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Subdivided into GENERAL (including *Technical Articles, Editorials, Letters to the Editor, Current News* and *Book Reviews*); AUTHORS; ENGINEERING LITERATURE, and CONTRACT PRICES

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Engineering News

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A Train-Order Signal Controlled by the Train Dispatcher

There are many cases where it is desirable that a train-dispatcher should be able to operate train-order signals along his division, and this applies especially to electric railways as there are operators at comparatively few points along these lines. Some special signal systems have been devised to meet these conditions, and we describe below a signal of this kind which is operated in connection with a telephone train-dispatching system. The signal is of the semaphore type, with operating mechanism, selective apparatus and telephone equipment contained in a box on the post. Fig. 1 shows

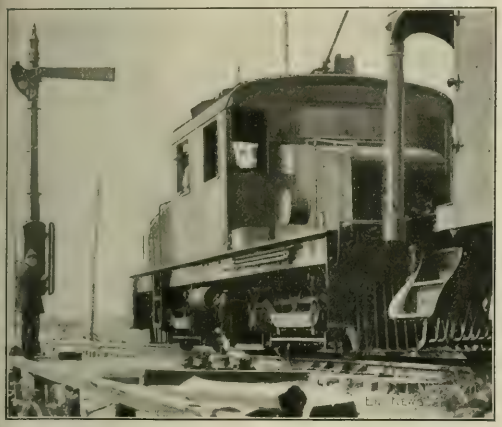


FIG. 1. ELECTRIC SEMAPHORE SIGNAL OPERATED BY TRAIN DISPATCHER: PIEDMONT & NORTHERN RY.

(The train has been stopped by the signal and the conductor is communicating with the train-dispatcher by telephone).

one of the signals on the Piedmont & Northern Electric Ry.; the signal has been set at the "stop" position by the train dispatcher in order to stop the train, and the conductor is at the telephone receiving instructions from the dispatcher.

The selector is one of the important features of this signal system, as it enables the dispatcher to operate any one signal at will. The selector is bridged directly across the telephone circuit and when the dispatcher wishes to throw any particular semaphore to the "stop" position, he operates a selector key. This sends out a number of direct-current impulses upon the line which operate a particular selector and no other. When this selector operates, it closes a circuit which bridges the semaphore-slot magnet across the telephone line, thus furnishing current to this piece of apparatus and energizing it. This, in turn, operates the semaphore. No local battery is required at the signal, all the current necessary being furnished from the signaling battery at the dispatcher's office. The selector is of the Western Electric type, which is used in connection with semaphore signals on a number of railways and which has a very low current consumption.

When the semaphore blade reaches a position approximately within 5° of the horizontal, it trips a special mechanism, and sends an "answer-back" signal to the office, giving a distinctive sound which informs the dispatcher that the particular semaphore has moved to the "stop" position. A train approaching the signal is of course, stopped and the conductor goes to the tele-

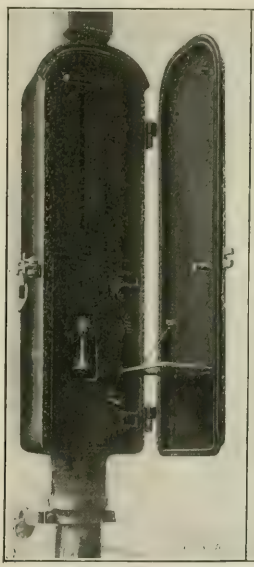


FIG. 2. TELEPHONE BOX OPEN ON SIGNAL POST

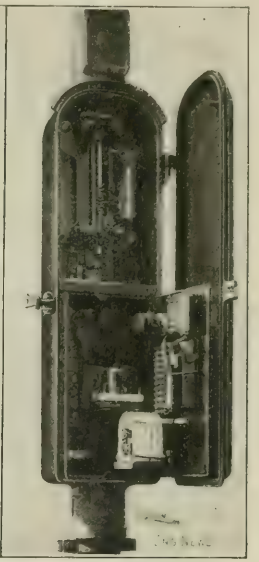


FIG. 3. MECHANISM BOX ON SIGNAL POST

phone to communicate with the dispatcher. When the conductor has received his orders, he sets the signal at its "clear" position, ready for future use. The signal mechanism is a simple electric slot, manually restored, and the dispatcher cannot clear a signal after having set it at the "stop" position.

The cast-iron box on the signal post has two doors, the outer one only being opened for ordinary use. When this is opened, as shown in Fig. 2, it exposes only the telephone receiver and transmitter, the generator handle, and the handle for restoring the semaphore arm to the

"clear" position. At the same time a shelf on the inside of the outer door drops into position, as shown, for the use of the conductor in writing the train-order with one hand while holding the telephone in the other. When the inner door is opened, as in Fig. 3, the apparatus is accessible for inspection and repair. The outer door is fitted with a gasket so that the box is weatherproof, and it can be opened only by a proper key. The telephone apparatus is weather-proofed, in order to withstand moisture, and all interior woodwork is treated with oil. The wiring and the design of the apparatus conform to good signal practice. All terminals are equipped with screws or lock nuts and are arranged conveniently for maintenance.

This selectively operated signal has been installed on the Piedmont & Northern Electric Ry., the Washington & Old Dominion Ry., and the Ogden Rapid Transit Ry. All of these are electric lines, but the system has an additional field in that it is applicable to steam railways, operating auxiliary train-order signals in connection with the telephone train-dispatching system now being introduced so extensively on steam railways. On divisions where night traffic is light and there are no night operators, the system can be used to supplement the day operators, as it enables the dispatcher to operate the signals and so get in touch with train crews at any desired point. This signal is manufactured jointly by the Western Electric Co. and the Union Switch & Signal Co., of New York, and we are indebted to the former company for photographs and other information.

Some Points in the Design and Construction of Reinforced Concrete*

By E. P. Wells.†

It is strange, at this present day, how many engineers and architects still adhere to the old specification of coarse grinding, consequently requiring aëration of the cement. It has been my lot only this week to come across a specification where it was stated the cement had to be spread on a floor for 21 days before being used. Those of us who are well acquainted with the present-day cement, and also its fine grinding, know how deleterious this is when great crushing strength is required. I think I have said, on more than one occasion at this Institute, that if cement is to be kept up to its full strength it is absolutely necessary that when it is received on the site of the works it should be stored in air-tight wooden bins; and if this is done cement may be kept for many years and be just as good after the lapse of time as it was when freshly made, whereas if the cement be stored in sacks, and even a very small amount of moist air plays upon them, then the cement is rapidly hydrated and caked in the sack.

In a great many works that I have seen where failures have taken place, the failures have been very largely attributable to shuttering and strutting. I have in mind cases of beams deflecting two or three inches after the concrete has been filled into the mold, this being due entirely to the strutting sinking into the soft ground underneath. In several cases this has caused what appeared like shear cracks at each abutment, though the work afterwards stood the test load satisfactorily. Still, such cracks made the beam look unsightly, and there could not have been the same adhesion between the concrete and steel, owing to this settlement, as if the boxes had remained perfectly true and level during the whole time the concrete was being put in and until the same were struck.

I know of one case of a failure taking place entirely owing to the strutting sinking into the ground, the sinking taking place over more than a week. The concrete, therefore, never had the least chance of getting a fair adhesion to the steel, but was constantly being drawn away from it by this settlement of the strutting, so much so that when the strutting was removed the whole structure came down with a run.

It is always advisable, if there is any doubt at all about the ground, to have the latter tested beforehand, and it is far better to increase the sole-plates to double the size required, so as to prevent any possible chance of settlement, than to have an insufficient area with consequent settlement and trouble taking place.

Not only does the settlement cause a reverse camber of the beam, but also gives a fall in the floors the wrong way, and it needs extra expense all around to make good such defective work.

In this country, as a rule, water is almost invariably obtained from what is called a domestic source, namely, water supplied by large public companies who are extremely careful in what is sold to the public. Such being so, it is very rarely in England that one has to use water that does not come from the public supply, but there are cases where it is advisable carefully to examine the same before it is used. There are some places where the water is highly charged with gypsum compounds, and such being the case, it behooves one to see that there is no likelihood of failure taking place owing to an excess of this compound.

In the South of France, in Algeria, and in a great many districts waters are highly charged with gypsum, and so bad is this in places that concrete is absolutely dissolved and disrupted in less than two or three years. Whenever there is any doubt as to the quality of the water to be employed an analysis should be made beforehand, and so prevent what might lead to a disaster.

In a great many years of practical experience I have come to the conclusion that even if there is a large deficiency of steel in the structure both in tension and compression, and the concrete is of an excellent quality, there is hardly any chance of failure taking place, but if the steel is up to and even in excess of the requirements asked for, and by any chance the concrete is poor, then if an excessive load be placed upon the structure, there is nothing to prevent it failing.

A great deal has been done by the London County Council School of Building in educating clerks of the works and others as to the method in which the practical part of reinforced-concrete construction should be carried out. They ought to go a step lower and take in hand laborers who are connected with the carrying out of the work, because until such time as they themselves understand, to even a very slight extent,

*Paper read before the Institute of Concrete Engineers, London, Eng.

†Engineer for concrete buildings, London, Eng.

what is required of them, so long will they be careless in doing the work they have to do.

The foremen employed must be instructed to keep a sharp lookout on all of their men, and not to allow laxity in any shape or form. If the men know that the foreman is up to all their so called tricks of the trade, then they will take good care that the work is carried out in an efficient manner, but if by any chance the foreman is careless his workmen will be the same; and it will, I think, very often be found that where anything serious takes place it is not only the men but the foremen and even the clerk of the works on the job who are answerable for this state of affairs.

Any foreman who persistently makes mistakes in the carrying out of the work, after the same has been pointed out to him, should be dismissed and not allowed to undertake any work of the kind in the future. It is only by making examples of men who do bad work that one can expect an improvement to take place in the industry in this country. Works executed abroad, as a rule, are carried out by men who seem to take a great interest in their work. Even the ordinary laborer knows what he has to do and does it, whereas in this country there are so many instances of scamping, not only in reinforced work but also in other branches of structural engineering, that it is only strict supervision in the past that practically made our work some of the best in the world, though I have very clear remembrances before me of seeing wooden rivets and other such things being done, and I daresay there are many in this room who have seen likewise. We do not hear of wood being put in for steel in reinforced concrete, that is to say, by the designer, but many accidents have proved that wood has been put in and has been the cause of the mischief.

A point to which it is advisable, I think, for me to call attention to is electrolysis. I have watched one work where this mischief occurred, and only about a couple of months ago I made a further examination and found that the mischief was still increasing. It is a moot point with some as to whether there is any electrolytic action or not, but personally I have very little doubt upon the subject, so that it behooves all designers and contractors to see that there is no possible chance of electric currents finding their way into the steel reinforcing, because, should they do so, I do not think there is any doubt whatever that it will mean the eventual disruption of the concrete. It only requires the exercise of care to put a stop to this and to be perfectly certain that all cables throughout the reinforced-concrete work are properly insulated, and that there are no stray currents wandering about the work.

I think a great many of my hearers will agree with me in regard to the calculations of reinforced-concrete work that a great deal too much mathematics has been imported into the subject and that common sense has had to take a back seat.

If we were dealing with two materials, both of which were absolutely constant—that is to say, the concrete constant within a month after it was made in strength as the steel is immediately after it is rolled—then it would be possible to go in for mathematical formulas of a high order; but where you have a material—i.e., concrete—the strength of which, if all portions are good, is increasing day by day, and in some cases attaining a strength of three, four, or more times that which it was originally calculated for, how is it possible in these ways to formulate any formulas which are even moderately correct? It is far better to use more common sense and simplify or formulate empirical rules which you know are absolutely safe in their application. It is no good trying to extract the square root of two—it is useless. I have seen cases where the stresses have been worked out to five places of decimals, and it could all have been done by mental arithmetic, and the result would have been so close that it was really not worth while troubling about.

I see cases constantly where rods are put into work varied in diameter to 32ds of an inch. That is not at all necessary. It wastes time on the work, and in a great many cases a wrong rod goes into the wrong place. It is far better to adhere in all cases to commercial sizes, never advancing beyond 16ths of an inch and if possible advancing only by 1/8ths, as by that means the size of the rod is clear to the naked eye and does not require a caliper to be put upon it to find out whether it is $^{21}/_{32}$ or $^{22}/_{32}$. Such reinforcements as these simply show how designers lack common sense and bring the work into disrepute. Exactly the same thing takes place with calculations submitted for approval. A mass of figures will be carried out into millions where the whole lot can be simplified by reduction into tens or hundreds, and the elimination of anything beyond two places of decimals. The simpler calculations are made, the less liability there is of errors creeping in, and if an error does creep in, then it is much easier to discover; but where a whole foolscap page of figures is used to arrive at a result, it means in a great many cases simply disaster, as well as being also a waste of time and expense with a view to possibly saving a pennyworth of steel.

I have always been a great enemy to the complicated calculations, as I do not think they are at all necessary. It only brings to mind the largest building that has ever been constructed in London. I am now speaking of as long ago as about five-and-twenty years. In an arch rib there was a deficiency in the center of the span of, I think, half an inch in a large sectional area of steel. To make up this deficiency in compression a bar 2 in. by 1/4 in. was riveted on, and this only for a length of two or three feet, thus making mathematics simply an absurdity, whereas no common-sense engineer would for the sake of half an inch in one hundred square inches ever think of doing anything so absurd.

The same applies to reinforced concrete. It is far better to work in all cases to commercial sizes of rods, even if there be a slight deficiency in sectional area, than to put in multiples of rods of all diameter so as to make up a given sectional area. This entails an enormous amount of work, not only upon the designer but also upon the foreman who has to take charge of the work, and upon everybody connected therewith, and it is of no practical value whatever. Therefore I should like to see in all rules made for reinforced concrete that common sense should enter more largely into the formulas that are given to the world.

A Proposed Standard Record of Street Traffic*

The Need for Traffic Records

Records of traffic on streets are of great importance and utility, as is known to all engineers connected with their construction, maintenance and use. The quantity and weight of traffic on a street or road has generally been one of conjecture and not based on actual count. A traffic regarded in small cities as numerous and heavy, is light traffic in larger ones; although in both places it passes over the same kind of pavement and is under other similar conditions. Although the engineers of the Department of Bridges and Roads of France, who have charge of construction and maintenance of streets and roads of that country, have, this 50 years, recorded traffic and reduced it to the quantity per meter of width, there has been comparatively little done in other countries. London, Berlin and a few other European cities have taken some records. In the United States it was not until 1885 that records were taken on a few streets of ten cities and more for the purpose of promoting a special class of pavement, then little used, than to determine the relation of quantity of traffic to wear, cost of maintenance of pavements and other important factors. Since 1900, records of various kinds have been made at a few places in several cities, as the importance and great cost of pavement and road construction and especially maintenance, have been recognized.

There is, as yet, no standard method for recording and comparing the traffic on different streets of a city, nor traffic on streets of one city with those of another. The object of this report is to suggest a uniform method of recording, analyzing and standardizing quantity and weight of traffic on streets and roads, and for reducing it to unit bases of quantity and of tons per yard of used traffic width of roadway per day, or per square yard of used roadway surface which is the same thing.

The two legitimate causes of wear and destruction of pavements are traffic and weather. In some cases where traffic is very light and the weather severe, the latter does the greater damage. Usually the traffic is a greater cause of wear than weather, but in every case traffic must be considered. Whether or not a pavement has been properly constructed with durable foundation and a wearing surface of any one of the many kinds in use and the pavement properly maintained or not, traffic records give very important data on which to base the selection of future pavements, to estimate the value of first construction and the cost of maintenance. Traffic records show the approximate cost of maintaining the kinds of pavements which add to the comfort and health of people using them or living near them. These records are also essential for handling traffic and effective city planning and administration. They show how to relieve traffic congestion by constructing new thoroughfares and their relative local uses, what streets must be widened; what streets can have their roadways made narrower to reduce cost of paving and cleaning and for beautifying them by parkways or otherwise.

This report is based on official traffic records of several European and American cities, made at various intervals during the past 39 years, supplemented by personal knowledge of many of the streets and experience in making actual traffic records. The various and widely divergent analytical records, made in the past few years at a few points in the United States, have been consulted. Most of these records have failed to state the width of the streets or roads and are defective in other respects. Many cannot be reduced to any unit basis for comparison with each other. Many have unnecessarily subdivided the vehicles into too many kinds, sizes, etc., by methods which are complicated and unnecessary for practical, general use.

Proper Traffic Records.

Traffic records should be based on a simple, accurate method of counting and recording traffic and reducing it to standard units of quantity and tonnage. The method should be such as to be quickly understood and applied. This report presents such a method with forms for practical use.

The period during which traffic should be counted is for 12 consecutive hours from 7 a.m. to 7 p.m. and during six consecutive or other different week-days. If average weather and what is known to be average traffic conditions are selected, then a record for only three consecutive week-days gives valuable information. No traffic should be counted in abnormal seasons of snow and ice, nor during continuous rainy, very cold or excessively hot days. The foregoing applies to all cities. Nevertheless, local special conditions on a few principal thoroughfares of cities, say above 500,000 inhabitants, sometimes require records of traffic during the 24 consecutive hours of each day for several days. The location where the traffic is counted must be at or near the center of a block and not at an intersection of two streets. The traffic is that which passes both ways along the street or road. It can well be counted from the sidewalk or

TRAFFIC ON DIFFERENT STREETS AND ROADS

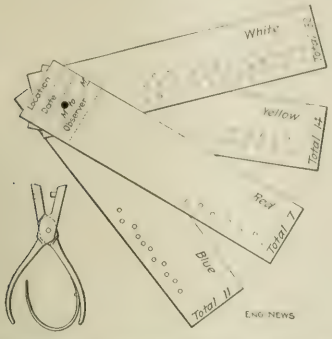
Place	Street	Totals on whole width of roadway		Total per yard effective width of roadway		Relative intensity of traffic
		Vehicles	Tons	Vehicles	Tons	
Paris	Rivoli St.	33,232	49,041	2767	4087	Sixth
Paris	Opera Av.	29,460	42,216	1789	2558	Sixth
Paris	Madeline Bl.	17,524	24,776	1019	1385	Sixth
Paris	Italiens Bl.	20,124	27,651	1093	1500	Sixth
Paris	St. Honore St.	16,598	22,952	1976	2732	Sixth
Berlin	Potsdam Pl.	14,221	39,656	1016	2832	Sixth
Berlin	Leipzig St.	9,506	26,139	720	1961	Sixth
Berlin	Friederichs Pl.	13,479	33,529	963	2395	Sixth
London	Strand	16,208	27,878	1430	2460	Sixth
London	Cheapside	11,019	18,953	1136	1954	Sixth
London	Gracechurch St.	12,148	20,894	1149	2154	Sixth
New York	5th Av. nr 58 St.	8,665	12,091	673	946	Fifth
New York	First Ave.	2,301	3,391	131	192	Third
New York	Bway. nr. Fkln.	3,277	3,554	266	288	Fourth
New York	Wall St	2,443	3,555	305	444	Fourth
New York (Queens)	Hillside Ave	1,304	1,529	157	184	Third
Bronx	White Plains Rd.	342	536	49	75	First
Washington	Fifteenth St.	4,687	6,456	335	461	Fourth
Washington	Ninth St.	1,965	2,478	123	155	Third
Chicago	State St.	6,048	(x)	430	(x)	Fourth
Chicago	Clark St.	4,691	7,728	335	552	Fourth
Chicago	Wabash Ave	3,791	8,643	237	590	Fourth
Chicago	Sheridan Rd	5,736	11,925	465	994	Fifth
Philadelphia	Broad St. N. Chest	6,176	11,154	165	697	Fifth
Philadelphia	Filbert St	5,185	8,102	576	900	Fifth
St. Louis	Locust St.	3,496	5,308	318	482	Fourth
St Louis	Broadway	3,150	4,976	197	311	Fourth
Buffalo	Main St	2,944	3,836	166	217	Third
Buffalo	Linwood Ave	697	1,541	50	129	Second
Boston	Tremont St.	5,410	7,380	676	923	Fifth
Boston	Kilby St.	3,503	4,555	455	591	Fourth
Newark, N. J.	Broad St	2,400	(x)	126	(x)	Third
Newark	Beach St	2,522	(x)	205	(x)	Fourth
Milwaukee	Shrewsbury Rd	184	770	07	154	Second
Milwaukee	Medford Rd	434	669	47	72	First
Massachusetts	Western Rd	961	1,260	161	210	Third
Rhode Island	E. Providence Rd.	163	172	77	112	Second

*From a report of the Committee on Traffic on Streets and Roads of the Municipal Engineers of New York City. Other reports of the Committee on Streets and Highways and Public Improvements, Issues Nos. 14, 1912

other convenient location, and best from a room with the window facing the street.

In order to determine the total traffic on a street or road and so tabulate it that the results can be reduced to standard bases, and do this at least possible expense and by simplest method, certain items or factors must be carefully noted as shown in the accompanying forms.

The *general classification* of vehicle traffic for practical results, is as follows: (1), *horse vehicles;* subdivided into one-horse, two-horse, three- or more horse; (2), *motor vehicles.*



SLIPS FOR RECORDING TRAFFIC COUNTS

(Form I. Report of Committe on Street and Road Traffic, American Society for Municipal Improvements; J. W. Howard, Chairman, New York City).

The vehicles and horses must both be considered in computing the weights, etc., of traffic from the quantities counted and recorded. This is because they both occupy space on a roadway and both help wear and injure the surface. Experience has shown that for general traffic counting and the reduction of the quantities of vehicles to tonnage of traffic, the average weight of all vehicles (empty and loaded) drawn by one horse can be taken as one ton (2000 lb.); by two horses as two tons; by three or more horses as four tons. In like manner the average of all motor-vehicles (loaded and empty) for transportation of persons and goods can be taken as 1¾ tons. All bicycles and ridden horses, because light and very few, are best omitted from street traffic records. If ridden horses are at all numerous on a park, suburban or country road, they are best recorded and estimated as one-horse vehicles. Unusual subdivision of vehicles into sizes and kinds, also street cars on their rails, and other data in special cases, can be recorded on separate slips. But this adds greatly to the difficulty of recording correctly and seldom furnishes any needed or practical information as far as streets themselves are concerned.

The forms for counting and recording traffic, hereto attached, are self-explanatory. They should be explained and distributed in advance to the traffic observers or recorders.

TRAFFIC COUNTING SLIPS (FORM I)—This consists, as shown, of sets of four cardboard slips, about 2x9 in. fastened together at the end; 12 sets are needed, one set being used for each hour. If traffic is very numerous, one or more extra sets can be used for one hour. Each set is marked for location where traffic is counted, name of observer, date, the hour represented by the set (as 7 a.m., to 8 a.m., etc.). There must be at least two observers for each location, to relieve each other at the end of each hour or two hours, because one recorder cannot work accurately for a longer period. An ordinary conductor's punch is needed and a hole is punched in a slip for each vehicle passing in either direction along the street in front of the recorder. One-horse vehicles are punched in the white cardboard, two-horse in the yellow, three- and more horse vehicles in the red; all motor vehicles are punched in the blue slips. The number of

FORM II. ONE-DAY TRAFFIC RECORD

12 hours from 7 a.m. to 7 p.m. Date 19 Day of week.....

City..... State.....

Location of observer, on.....St. (or Ave.) bet.....St. (or Ave.) and.....St. (or Ave.)

Width of roadway bet. curbs at place of observation.....yd.

Effective traffic width (1 yd. less than full width).....yd.

Kind of pavement; stone block.....; sheet asphalt.....; or.....;

Quality of surface of pavement; new and even.....; old and slightly uneven.....; very uneven.....;

Condition of surface of pavement; wet.....; dirty.....; clean.....;

Weather; rain.....; fog.....; dry.....; approx. temp.....°F.

Street-car rails present; single track.....; double track.....;

General kind of rail; flat with groove.....; L shape.....; T shape.....;

Average approximate speed of horse vehicles,.....mi. per hr.

Average approximate speed of motor vehicles,.....mi. per hr.

Remarks;.....

Between hours	No. horse vehicles: 1 horse	2 horse	3 or more horse	Total horse vehicles	Total motor vehicles	Total tons horse vehicles	Total tons motor vehicles	Total no. all vehicles	Total tons all vehicles	Total vehicles per yd. effective width	Total tons per yd. effective width
7 a.m. to 8 a.m.											
8 a.m. to 9 a.m.											
9 a.m. to 10 a.m.											
10 a.m. to 11 a.m.											
11 a.m. to 12 m..											
12 m. to 1 p.m.											
1 p.m. to 2 p.m..											
2 p.m. to 3 p.m..											
3 p.m. to 4 p.m.											
4 p.m. to 5 p.m..											
5 p.m. to 6 p.m....											
6 p.m. to 7 p.m..											
Totals for 12 hr..											

Note:

1 horse vehicles average—1 ton
2 horse vehicles average—2 tons
3 or more horse vehicles average— 4tons
Motor vehicles average—1¾ tons

Signatures of observers:

.....

.....

.....

.....

FORM III. FINAL CONSOLIDATED TRAFFIC RECORD

Period observed .....days of 12 hr. each, 7 a.m. to 7 p.m. Date. .19. Days of week.....

City. State.

Location of observer, on.....St. (or Ave.) bet.....St. (or Ave.) and .....St. (or Ave.)

Width of roadway bet. curbs at place of observation.....yd.

Effective width of roadway, ½ yd less than full width.....yd

Kind of pavement: stone block, sheet asphalt, of

Quality of surface of pavement: new and even.....; old and slightly uneven.....; very uneven.....

Condition of surface of pavement: wet, dry, dirty, clean

Weather: rain, fog, dry, approx. temp °F

Remarks:

Days	Total No. of vehicles: horse	Total No. of vehicles: motor	Total tons horse vehicles	Total tons motor vehicles	Total no. all vehicles	Total tons all vehicles	Total veh. per yd. effective width	Total tons per yd. effective width
1st day.....								
2nd day.....								
3rd day.....								
4th day.....								
5th day.....								
6th day.....								
Totals								
Year per day of 12 hr.								

Compiled by:

holes in each are not counted until after a recorder stops observing the traffic. He can count the holes when relieved by the other recorder or at the close of the day's work. On counting he should write on each slip the total number of holes in it.

ONE-DAY TRAFFIC RECORD (Form II)—This consists, as shown, of a consolidated record of the quantity of traffic during each of the 12 hours from 7 a.m., to 7 p.m., with totals and reductions to unit bases. It gives details of name of city, width of roadway, effective width used by traffic, which averages ½ yard less on each side or 1 yard less than the full width between curbs or edges of the street. The kind or quality of pavements, the weather and other needed facts are shown. This form reduces the one day's traffic to standard units which are the total vehicles and total tons of traffic on the whole street; also per yard of effective width of the street. This is the equivalent of number of vehicles and tons per square yard of used roadway surface.

CONSOLIDATED TRAFFIC RECORD (Form III)—This form, as shown, is compiled from records on several Forms II. It consists of a condensed statement covering the six or other number of days' traffic. It shows the data day by day, together with the final totals and the averages per day. These totals are reduced in quantity and tons to the standard units of yard of effective width (square yard) of roadway surface subjected to the traffic. These are the true bases for comparing the traffic of one street with another and for establishing the relation of different amounts of traffic to wear on pavements, cost of maintenance and many for other useful purposes.

Traffic records are seldom needed annually; but at long- or short-time intervals from five years or upward, to keep changes of traffic conditions and other necessities in cities, counties or states.

In connection with the foregoing description of how traffic can be simply and accurately recorded and reduced to standards of quantity and of tons per unit width of roadway, the accompanying actual records of traffic in various representative cities and on a few suburban and country roads, will aid in establishing a basis showing the various degrees of intensity of traffic; first, very light; second, light; third, moderate; fourth, heavy; fifth, very heavy; sixth, extra heavy.

These quantities are compiled and computed from old official and later traffic records and are excellent illustrations of quantities, tonnage and degrees of intensity of traffic per yard of effective width or used roadways. In a few cases the records were made in such different ways and without proper classification of vehicles, that the data, in such cases, are not complete. The traffic is the average of several days of 12 hours from 7 a.m. to 7 p.m. or in a very few cases, a close approximation.

As soon as cities, counties and states have recorded, tabulated and reduced the traffic on their roadways, on the standard bases and units set forth in this report, then they will have accumulated very valuable data for comparing the results between the streets and roads of the same and other places. This data will be of much assistance thereafter in economically and efficiently solving all problems connected with the construction and use of all arteries of public travel and transportation.

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Electricity-Supply Contracts of the New York Edison Co., New York City, with Gimbel Bros. (department store) and the Broadway Realty Co. (office building) have been held discriminatory by the Public Service Commission for the First District. In the case of the contract with Gimbel Bros. the Commission finds that the Edison company has been supplying electric current at a net cost of 2½c. per kw.-hr., when the published rate for such service was not less than 3c. This was accomplished by two contracts, in one of which the company agreed to supply electric current, in excess of a certain amount annually, for 3c., and in the other the Edison company agreed to rent from the firm space in its basement for a substation, and to pay therefor as rental, the difference between 2½c. per kw.-hr. and the price charged under the other contract for electricity.

The Edison company, it is held, should have contracted to pay the market value of the space rented, leaving the customer to pay the rate paid by every other consumer of the same class. The making of the rental dependent upon the quantity of current consumed in one building, reads the opinion, "could hardly fail to result in actual discrimination during some part, if not during the whole, of the time covered by the lease."

A Report on Locomotive Headlights by the Wisconsin Railroad Commission

The Railroad Commission of Wisconsin has made extended tests of certain headlights in order to determine whether they meet the requirements of the new state law, which specifies that locomotives (on railways over 50 miles in length) must be equipped with headlights of sufficient illuminating capacity to enable the enginemen to distinctly discern an object the size of a man at a distance of 800 ft. This law went into effect on July 1, 1912.

The report made by the Commission (under date of Dec. 4, 1912) states that the investigations covered the following headlights: 1, the standard type of oil headlight with 16-in. case, and the Bunn safety oil headlight with 16- and 18-in., lenses; 2, the Commercial acetylene headlight, with 18- and 27-in. reflectors; 3, the Pyle-National and American electric arc headlights. The Commission had in view the necessity of guarding the safety of operation of trains and the investigations were conducted, therefore, along two general lines: 1, to determine whether the light given by the headlight was sufficient to comply with the provisions of the law; 2, to determine whether the headlight might endanger the safety of operation of trains through interference with signal lights or in any other way.

The efficiency of the various headlights with respect to visibility of objects on the track was observed in a number of road tests, at which a large proportion of the observers were men in the employ of the various railways in the state. Later observations were made by the Commission's staff from the cabs of engines in regular service and while on their regular runs. The tests relating to safety of operation consisted of observations made on signal and switch lights, a large proportion of the observers being railway men in regular service. During these tests all observations were taken while the observers were stationary, and the results obtained revealed the necessity of making further examinations of the high-power headlights in regular operation with the train moving. Such examinations were made by the Commission's staff by riding upon engines equipped with these headlights while on their regular runs.

The following is a brief statement of the results of the studies made of the various lights, as presented in the Commission's report:

OIL HEADLIGHTS

Observations made at the road tests together with those made in actual operation, indicate that none of the oil headlights fulfill the requirements of the law.

ACETYLENE GAS HEADLIGHTS

Observations on the headlight having a 27-in. reflector were not conclusive, as the reflector was defective. The observations on the one having the 18-in. reflector indicated that the acetylene headlight equipped with a cluster of three burners (each having a capacity of ½ cu.ft. of gas per hour) and the 18-in. reflector fulfills the requirements. An acetylene light in regular service, having a double burner and a reflector that had been poorly maintained, did not give satisfactory results. Another in regular service, having the double burner and a well polished reflector, was much more satisfactory. It is believed that it will be necessary to maintain the reflector in a high degree of efficiency and to use the cluster of three burners in order to obtain satisfactory results with this type of light.

ELECTRIC HEADLIGHTS

Observations both at the road tests and in regular service indicate that the electric arc headlights mentioned fulfill the requirements of the law. There are some features, however, connected with the operation of arc headlights on locomotives, which should not pass unnoticed: (1) Liability of reflected light from the roundels of signals whose lights have become extinguished or have burned low, being mistaken for a clear indication; (2) Difficulty of distinguishing classification lights and engine numbers on locomotives equipped with arc headlights; (3) Dazzling effect on trainmen, flagmen and others who are required to perform their duties in the rays of these strong headlights.

As for the first item, observations made by the Commission's staff on electric headlights in actual service, with the engine moving continuously at usual speeds, demonstrate the fact that dangers from this source are not nearly so great as indicated by the earlier tests at which the observers were invariably stationary while the readings were being taken. While numerous phantom lights were detected in the regular service tests, they were not of such a nature as to cause serious confusion to the trainmen. It was also found that the position of the blades becomes visible, in general, before the phantom lights are seen, and that these phantom lights are much in the nature of mere flashes when the engine is running at the usual speeds. As for the second item, it is believed that some precautions should be taken to place classification lights and engine numbers at such a distance from the headlight that the latter may not materially interfere with correct reading of them.

As for the third item, it is believed that the arc lights should be switched off while the train is passing through large yards, as well as at other points when it may have a tendency to interfere with the performing of duty by yardmen, flagmen, etc., or to endanger their lives. An incandescent lamp should then be switched on, its illuminating capacity being sufficient to act as a marker for the engine and to give warning of its approach. This means should also be employed on engines carrying color signals or markers when it is necessary that the fact be made known to the crew of another train or to other interested parties. It can also be used in case there is any confusion of signal lights resulting from the high power of the headlight. It is believed, however, that the electric headlight does not endanger the operation of trains either on single or double track, provided precautions such as those above outlined are observed.

The investigations are not conclusive as to the use of the electric arc headlight on roads equipped with the disk type of signal. A brilliant reflection is cast by this light from a plain glass surface of the size used in front of the large disk for day indications. The small disk for night indications is located a few inches above this large glass surface, and it is possible that the brilliant reflection from the latter may interfere with the correct reading of the night indications. The lack of blades to serve as a check is another feature which differentiates this signal from the semaphore type. Careful tests should be made to determine this point before the attempt is made to operate electric arc headlights on a road thus equipped.

It should be borne in mind that these investigations have covered only the headlights named, though from some inconclusive observations it would appear that there are other types of power headlights now on the market that may be expected to give good results, both as to illuminating capacity and freedom from objections as regards the safety of train operation. There are also other makes of arc headlights which probably compare favorably with the two investigated, and to which the same objections might be raised as those above enumerated.

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The Raising of the Assuan Dam, described by F. H. Fowler in Engineering News, Sept. 30, 1909, p. 339, is now completed. Formal acceptance of the work by the Khedive of Egypt took place on Dec. 23, 1912.

Largest Working Force at Panama—Forty thousand, one hundred and fifty-nine persons were at work on the Canal and railroad at the close of November, the largest force in the Canal history. Of the total all excepting a few hundred women and children were men, and 5816 were white Americans. This condition is due mainly to the employment of 3499 men by the contractors on lock gates and similar work, and the development of the lock machinery erection under the Assistant Chief Engineer.

A comparison with the greatest force of past years follows:

Year	Month	Force
1907	October	31,967
1908	April	33,[illegible]
1909	October	35,[illegible]
1910	March	38,[illegible]
1911	December	3[illegible],[illegible]
1912	November	40,159

—"Canal Record," Dec. 11, 1912.

Reinforced-Concrete Ore Docks

SYNOPSIS—The ore traffic on the Great Lakes has many special and unusual features, among which are its great extent (30,000,000 to 40,000,000 tons annually) and the necessity of handling the greatest possible tonnage between the opening of navigation in the spring and its closing by ice early in the winter. Three special features are provided to meet these conditions of the traffic: 1, Large steamers carrying great quantities of ore, with special designs of hull and special hatchway construction (in the form of frequent narrow hatchways extending almost the full width of the deck) to facilitate loading and unloading. 2, Ore-loading docks at the shipping ports on the upper lakes, where ore is dumped from cars into pockets at such a height that it can be delivered by gravity to the vessels through a series of inclined spouts extending from the ore pockets to the ships' hatches. 3, Ore-unloading machinery at the receiving ports so that the vessels can be unloaded rapidly and started back for a new cargo. The article given below deals with the ore-loading docks, and particularly with modern docks of reinforced-concrete construction, which are an economical advance beyond the old timber type of dock. Elsewhere in this issue is a description of an ore-loading dock of steel construction.

The special features of the ore-shipping ports on Lake Superior and Lake Michigan are the docks or piers from which the ore is delivered to steamers and barges for transportation to receiving ports on the lower lakes. These piers have long and high superstructures, the upper part forming a series of pockets into which the ore is dumped from cars bringing it down from the mines on the iron range, and from which it is delivered to the ships by gravity through long inclined chutes. There are at present 27 of these ore docks at six American ports owned by eight railways and having a combined capacity of about 1,440,000 tons. The docks are utilized to store the ore only in readiness for the steamers. As navigation is stopped for four or five months in the winter, rapid loading is essential in order to enable the vessels to make as many trips as possible during the open season. For this reason great length of dock is important, to accommodate several vessels, while of equal importance are the facilities for discharging the ore into the vessels. The chutes are about 12 ft. apart, corresponding to the spacing of the hatches in the decks of the ships.

In the majority of these ore docks, the superstructure is of massive timber construction, and as the life of this averages only about eight years, the expense for maintenance and renewals is heavy. In addition, there is always risk of damage or destruction by fire, which might have serious results in delaying the ore traffic. Under these considerations and especially in view of the increasing cost due to the decreasing supply of suitable timber, attention has been given to the introduction of other materials of construction, which, while more expensive in first cost, would be ultimately economical owing to their more permanent character, longer life, very small fire risk and greatly reduced cost of maintenance. The available substitutes for timber are steel and concrete, and both of these have been adopted in ore piers of recent date. In this article we deal with concrete construction, but a steel ore dock is described elsewhere in this issue.

The reinforced-concrete ore dock of the Lake Superior & Ishpeming R.R., which is described in detail below, is the second built of this material, the Great Northern Ry. having built one in 1911. The two designs are essentially different, however. In the earlier one, the reinforcement consists of a limited amount of steel rods; in the later one, the steel reinforcement forms a self-supporting structure which was erected in advance of the concrete work. For purposes of comparison we give at the end of this article some particulars of the earlier structure.

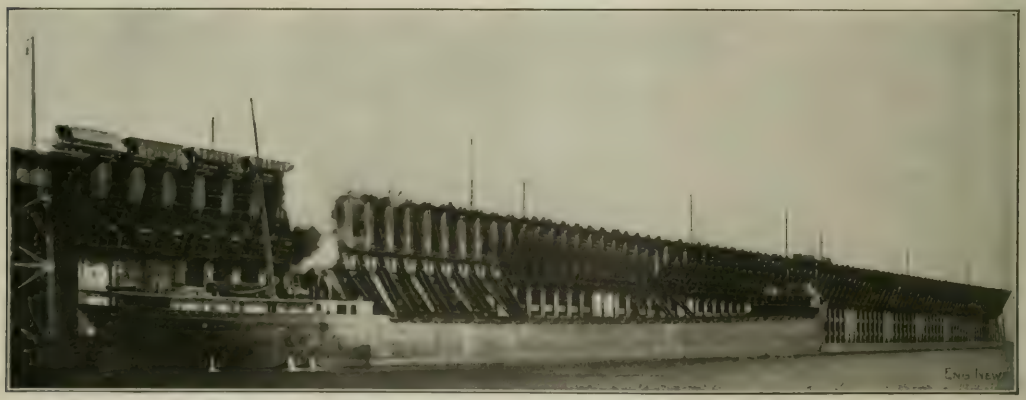


FIG. 1. REINFORCED-CONCRETE ORE DOCK AT MARQUETTE, MICH.: LAKE SUPERIOR & ISHPEMING RY.
(J. E. Jackson and R. C. Young, Designers. J. E. Greiner, Consulting Engineer.)

REINFORCED-CONCRETE ORE DOCK: LAKE SUPERIOR & ISHPEMING R.R.

This new ore dock was completed only recently, and is located at Presque Isle Bay, Marquette, Mich. As already noted, it has the special feature that its steel

reinforcement forms a self-supporting structure which was erected in advance of the concreting. The design was prepared by J. F. Jackson, Vice-President of the Wisconsin Bridge & Iron Co., Milwaukee, Wis., and the type of construction is very similar to that previously used by him for the supports of large ore bins at the stamp mills of the Ahmeek Mining Co., in Houghton County, Michigan. We are indebted to Mr. Jackson for information concerning this interesting ore dock.

The railway company had at Marquette a timber ore dock of ordinary construction which had been in service about 16 years, and in 1910 it became necessary to consider its replacement. The scarcity and increased cost of suitable timber, and the expense of maintenance and operation of the timber dock, led to an investigation of the relative costs of different forms of construction. Estimates showed that taking the first cost of a timber dock at 100%, that of a reinforced-concrete dock would be about 167% and that of a steel dock, 185%. Excluding the relative cost of operation, and including maintenace over a term of years, the cost on a long-term basis was found to be very much less for the reinforced-concrete dock than for either of the other types. Late in 1910, plans were prepared and the contracts for the structural steel and machinery were let on a percentage basis. A fee for engineering services was a separate consideration.

The new dock is 1200 ft. long (with 100 pockets on each side), 75 ft. high from water level to base of rails, and 54 ft. wide on the deck, which carries four lines of rails. The 200 ore pockets have each a capacity of 250 to 300 tons. There is an approach fill a mile in length about 600,000 cu.yd., on a grade of 1.5%; also an approach trestle 600 ft. long, and a tail trestle 60 ft. long, the latter extending beyond the end pockets of the dock proper. The completed dock is shown in Fig. 1, and the general cross-section, elevation and other details of construction are shown in Figs. 2 and 3. The dock has been in use for some months. It is located a little distance from the old timber ore dock.

Substructure

The entire area for the pier is inclosed with sheet-piling, composed of 12x12-in. Oregon fir timbers with 4x4-in. hardwood strips nailed on two sides to form a dovetailed tongue and groove, respectively. Inside and outside waling timbers are used, and the lines of sheeting are connected at intervals of 3 ft. by 1¼-in. tie-rods extending through the wales. Nearly 10,000 timber piles (30 to 45 ft. long) were then driven, having a penetration of about 20 ft. in the sandy bed of the lake. This work was done mainly by land pile-drivers (using steam pile-hammers) which traveled on tracks built on piles. A water-jet was used to assist the driving. The pile heads were cut off approximately at the water level by a railway pile-driver traveling on a track laid upon the piles. This had a revolving platform, and in the leads was fitted the vertical shaft of a 42-in. circular saw.

The space inclosed by the sheet-piling was then filled with dredged sand, after which a concrete slab deck was built, in the bottom of which are embedded the tie-rods of the sheeting. The slip on each side of the dock is dredged to a depth of about 24 ft. The concrete slab is a monolithic block, 60 ft. wide and 3 ft. thick, with a 9-ft. parapet wall on each side and with footings for the superstructure columns. It is reinforced longitudinally and transversely by old wire-rope hoisting cables, 1 to 1½ in. diameter, in long lengths. This was obtained

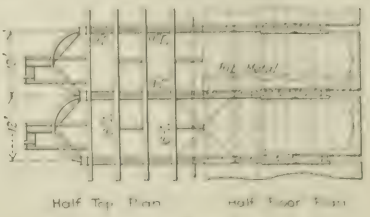


Fig. 3. Top Plan of Ore Dock

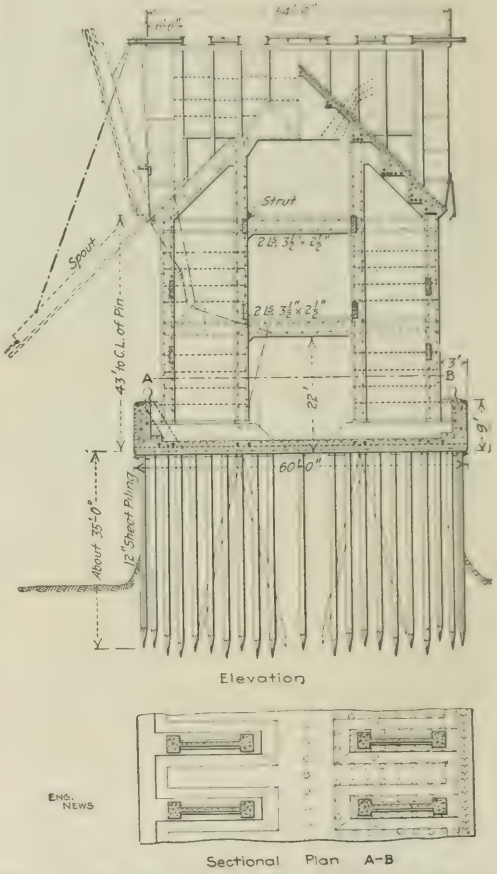


Fig. 2. Cross-Section and Bottom Plan of Reinforced-Concrete Ore Dock

from mines in the neighborhood at scrap prices. The total length of the slab is over 1500 ft. and in the 1200 ft. of the dock there are no expansion joints, although such joints are placed at each end, where the dock proper connects with the approach trestle and tail trestle. The

concrete (1:3:5) was deposited in place by revolving dump cars operated by cable on tracks of 2-ft. gage.

The whole foundation is very rigid, and no cracks of consequence have developed. The construction is so rigid and massive that the substructure is capable of withstanding very heavy bumps from large ships, and in the superstructure there is practically no vibration even when brakes are suddenly applied on the ore trains. An interesting feature of the dock-wall is the use of a steel facing-plate extending from the bottom of the concrete (6 in. below the water) to a height of 3 ft. above low water. This is intended to prevent the disintegration of concrete from freezing and abrasion by ice, at the water line, and government breakwaters in

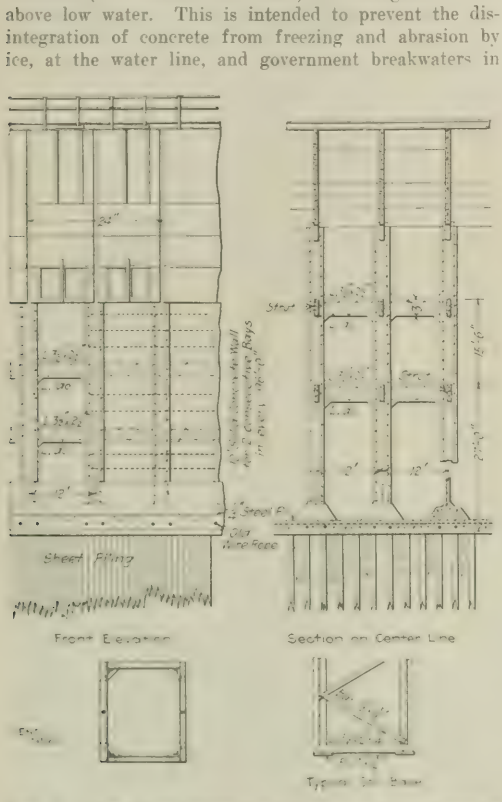


FIG. 4. PART ELEVATION AND LONGITUDINAL SECTION

the neighborhood, built only a few years ago, are said to show the need of protection of this sort.

SUPERSTRUCTURE

The superstructure is of reinforced concrete with a steel A-shaped floor for the pockets and concrete transverse partition walls between the pockets. The front wall of the pockets, however, is of steel; the front of each pocket is in semi-cylindrical form, which greatly reduces the liability of the ore to pack over the doorway, which is a trouble occurring in pockets having flat walls. After the completion of the substructure, the reinforcement of the columns, struts and partition walls of the pockets was erected, forming a self-supporting steel structure, as already noted. The semi-cylindrical front walls of the pockets and some other parts of the steelwork, were erected later.

There are four rows of columns, spaced as shown on the drawings, and connected by horizontal lines of longitudinal and transverse struts. The main columns of each bent are 28x36 in. section, and are connected in pairs by transverse 12-in. curtain walls. In certain panels, also, there are longitudinal curtain walls between the columns, forming towers which add to the longitudinal rigidity of the structure. Each column is reinforced by four angles 2½x2½x2¼ in., box laced. The columns and wall, which also carries load, were really figured as plain concrete carrying between 400 and 500 lb. per sq. in. The slight reinforcement shown was put in to prevent cracking and to form a positive means of tying the whole structure together both laterally and longitudinally. The general features of the work are shown by Figs. 2 and 3. The concrete bottom of the pockets forms a floor and is formed integrally with the longitudinal girders between the bents.

The complete self-supporting steel-skeleton structure formed by the reinforcement was erected complete (in advance of the concreting) by a traveler running on the concrete deck of the substructure and working back from the shore end. On this were two hoisting booms. The balance of the work was erected by a derrick-car on the overhead tracks. The steel angles had been punched with holes 4 ft. apart, to carry plugs which projected 2 in. from the steel and served as spacing blocks against which the forms were secured. This provided for ready and accurate placing of the forms, and insured a 2-in. thickness of concrete outside of the steel. All the form work was of wood. The forms were placed and the concrete poured in lifts of about 12 ft. The handling of the concrete and the design of the forms for use over again were large problems in themselves, and we are informed that in the design of a similar structure the concrete part would probably be modified in some respects to simplify the work.

Fig. 4. shows the concreting of the lower part and the steelwork of the pockets. Fig. 5 shows a partial elevation with the concreting completed. For about 100 ft. of the shore end, the concrete was handled in the cars mentioned in connection with the substructure work, the cars being hoisted by an elevator to the deck level and run to the desired point for dumping. After the concrete of this part of the dock had set, a traveling mixer plant was erected upon it, the front end of the traveler (with only a light load) being carried on a track supported by the steel reinforcing structure. The concrete (1:2:4) was discharged from the mixer into a chute carrying it to the forms.

DOORS, CHUTES AND OPERATING MACHINERY

Each pocket has two doors, 5 ft. wide and 3 ft. 8 in. high, emptying into the chute, as shown in Fig. 6. The chute is 35 ft. long, tapering in width from 8 ft. 6 in. at the upper end to 4 ft. 6 in. at the lower end, with a curved bottom throughout the whole length. Many ore chutes have been built with flat bottoms and straight sides, or with bends in the sides which caused the ore to stick or to flow over the sides. This chute was designed on the theory that soft iron ores flowing with

some velocity would act much the same as a stream of water, and the results in service seem to confirm this view. When both doors are open, the ore flows in the chute about a foot in depth, apparently faster in the center and with increasing velocity toward the end of the chute, and the ores do not stick or clog, and do not overflow the sides. The practical effect of this easy flow through the chute is to enable the operator to run ore to the far side of vessels 60 ft. or more in width,

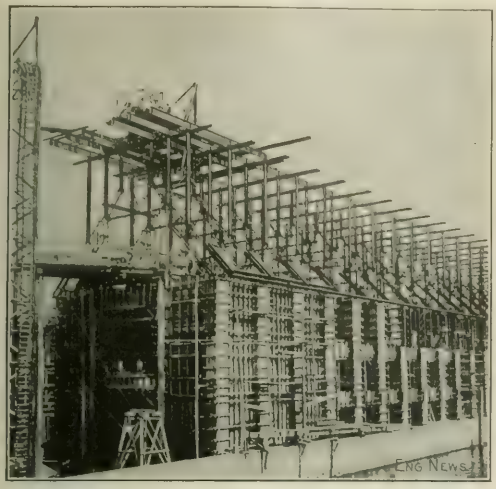


FIG. 5. CONCRETING THE SELF-SUPPORTING STEEL REINFORCEMENT OF ORE DOCK

and to trim the load perfectly. At many of the old docks an army of men is required to assist in their operation, because the ore does not flow freely from the pockets, but must be poked and "poled" to release it. Owing to the absence of sharp angles in the pockets, and the location and width of the doors, there is little of this work to be done in the new dock.

The design of the chutes themselves and of their operating machinery differs materially from designs previously used. It is believed that this is the first instance in which the chute winding cable, drums, counterweight cable and swinging counterweight are laid out in such a way that the chute (which weighs 8200 lb.) is perfectly balanced in every position. The hoists of each set of six adjacent chutes are operated through friction clutches from a 2-in. line shaft driven by a 15-hp. motor, and two or more hoists on one line shaft may be operated together. The time required to raise or lower a chute is only 20 sec. To move the chute, the operator must first relase and hold the automatic brake with the left hand, then hold the lever of the friction clutch in operating position with the right hand. The machinery is simple and reasonably fool-proof, and all moving parts are protected by safety coverings.

CONSTRUCTION AND OPERATION

Mr. Jackson and the engineers of the Wisconsin Bridge & Iron Co. were chiefly responsible for the superstructure, and the steelwork and machinery were built and erected by this company. The chutes were built under the Carter patent, and a number of patent claims have been allowed in certain features of the superstructure. The substructure was designed by R. C. Young, Chief Engineer of the Lake Superior & Ishpeming R.R. The railway company also furnished certain materials and did some parts of the work, including the large approach fill or embankment. The pile-driving and concrete work were done by the Raymond Concrete Pile Co. The dredging was done by the Zenith Dredge Co., a large part of the material being moved with a hydraulic dredge and deposited to fill swampy ground and to form the base of the approach embankment.

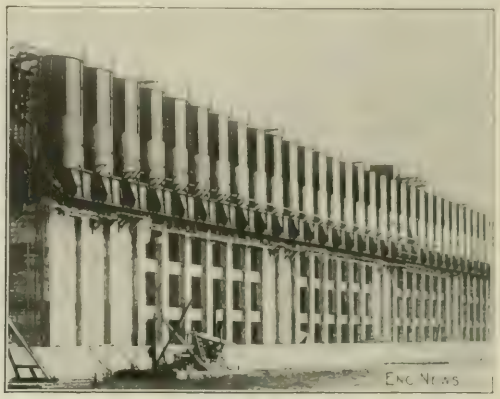


FIG. 6. PART ELEVATION OF ORE DOCK, SHOWING REINFORCED-CONCRETE BASE AND STEEL FRONTS OF ORE POCKETS

As to the operating cost, detailed records are not yet available, but we are informed that Mr. Young reports that it is probably only 25% to 33% of the operating cost for the old timber dock. Only a small amount of steelwork is exposed, so as to require painting, and the maintenance and depreciation costs should be very low.

REINFORCED-CONCRETE ORE DOCK; GREAT NORTHERN RAILWAY

This dock (mentioned in the first part of the article) was built in 1911 at Superior, Wis. It is about 1900 ft. long, with a deck 62 ft. wide and 75 ft. above the water. An A-shaped floor extending from the center line to the

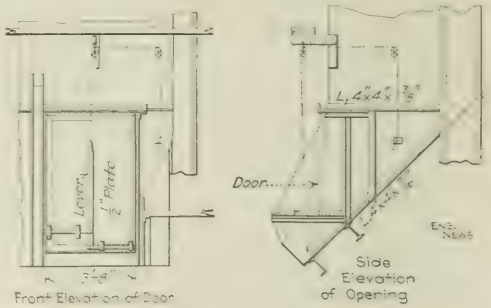


FIG. 7. DOOR OF ORE POCKETS

sides forms two longitudinal troughs which are divided by cross-walls so as to form 151 pockets on each side, in the usual arrangement. The pockets are 12 ft. long, each with a capacity of about 300 tons of ore. With its great length, six of the largest ore steamers can be loaded at one time.

The substructure consists of two lines of timber cribs (connected by crosstimbers), in each of which are driven seven rows of piles. Each line of cribbing is capped by a concrete slab 21 ft. wide and 3 to 8 ft. thick, upon which are the pedestals for the superstructure columns. These slabs are connected at intervals by transverse girders of reinforced concrete which support a filling or deck. Expansion joints with 2-in. filling are provided in these slabs at intervals of 120 ft. The superstructure has two rows of columns, spaced 44 ft. 7 in. between centers transversely and 12 ft. longitudinally. The columns extend to a height of 40 ft. above the water and those of each row are connected by two lines of horizontal struts, while in every tenth panel a concrete curtain wall is built between the columns, to give additional longitudinal rigidity. There is no transverse bracing between the columns.

In cross-section, the columns are 7 ft. by 2 ft. 9 in., reinforced only by a ⅞-in. square rod at each corner. Upon these columns is carried the steel framing of the partitions and front walls of the pockets, the partition framing being embedded in concrete walls. The track stringers of the deck and the I-beam purlins supporting the inclined floors of the bins are carried by the partition framing, so as to transmit all loads to the columns, there being no longitudinal girders between the columns. The inclined floor of the pockets is of creosoted fir timbers, with a wearing surface of 4-in. maple plank, both laid up and down the slopes, which has an angle of 47½°.

The face or outer wall of each pocket is of steel, semi-circular in plan; this arrangement practically prevents the arching of the ore which sometimes occurs over the door openings of pockets having flat walls. These openings are 5 ft. wide and 31 in. high, fitted with sliding steel doors which are raised by hand winches. The doors cannot be closed against a stream of ore, so that each pocket must be allowed to empty itself completely. The spouts are 34 ft. long, and taper in width from 5½ ft. at the upper end to 4 ft. at the lower end. To a bail on the lower end is attached a 5-in. flat-wire rope led to a drum on the upper deck. The drum is operated from a line shaft by a friction clutch; this shaft is divided into sections, each serving ten drums and driven by a 25-hp. motor. The power is sufficient to operate several spouts simultaneously. The spouts are raised and lowered by power, so that they are always under control.

❋

Bin Door for Ore Pockets

By R. B. Pearson*

A new type of bin door for ore docks, etc., of which I am the inventor, is described below. This door was developed to supply a demand for a large door that could be handled easily and could be closed against a head of ore in the bin when it was desired to "split a pocket" (or discharge only part of the contents) in trimming ship.

The drawings, Figs. 1 to 4, illustrate the action of the door. Fig. 1 shows the door in its normal position.

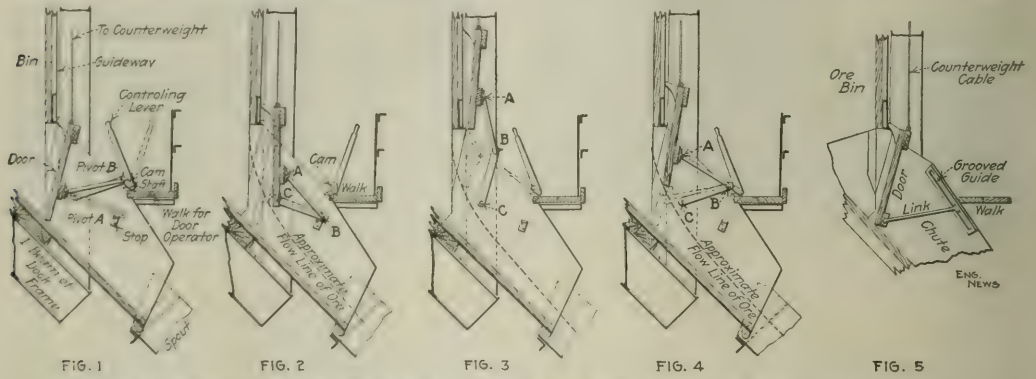


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

New Design of Bin-Door for Ore Docks. R. B. Pearson, Duluth, Minn., Inventor

(Fig. 1. Door closed and locked. Fig. 2. Door unlocked and forced open by flow of ore. Fig. 3. Door raised clear of opening. Fig. 4. Door closing and about to cut off the flow of ore. Fig. 5. Bin door on ore-dock No. 1 of the Duluth & Iron Range R.R., at Two Harbors, Minn.)

The door is guided at the top in a guideway attached to the bin, and the lower part of the door is free to swing, except as restricted by a simple link motion on each side. Each link motion consists of a strut and link pivoted together at one end, *B*, while the opposite end of the link is pivoted to the bin or side of chute, at *C*, and the opposite end of the strut is pivoted to the back of the door near one edge, at *A*.

The position or movement of the door can be controlled by shifting the pivot *B*, of the link motion. This is done by means of the cams or dogs on the cam shaft, which is supported by brackets on the side of the chute. When the door is closed and the pivot *B* is held well above the pivot *A* by the cam, the reaction resulting from the pressure of the ore against one side, and the strut against the other side of the door, will be downward and will hold the door closed. When it is desired to open the door, the cams are withdrawn from the path of the pivot *B* by means of the controlling lever, and this pivot then drops to the position shown by the dotted line in Fig. 1, so that it is well below pivot *A*, on the

*4601 London Road, Duluth, Minn.

door. The reaction resulting from the pressure of ore, and the strut in this position, will be upward, tending to raise the door clear of the flow of ore to the position shown in Fig. 2.

From here it can be raised by hand to the full height of opening, as shown in Fig. 3, the door being counterbalanced for this purpose. As soon as the door is raised to this position, the cams are again set to hold pivot *B* in the position to lock the door shut. Then in closing it will only be necessary to lower the door by hand,

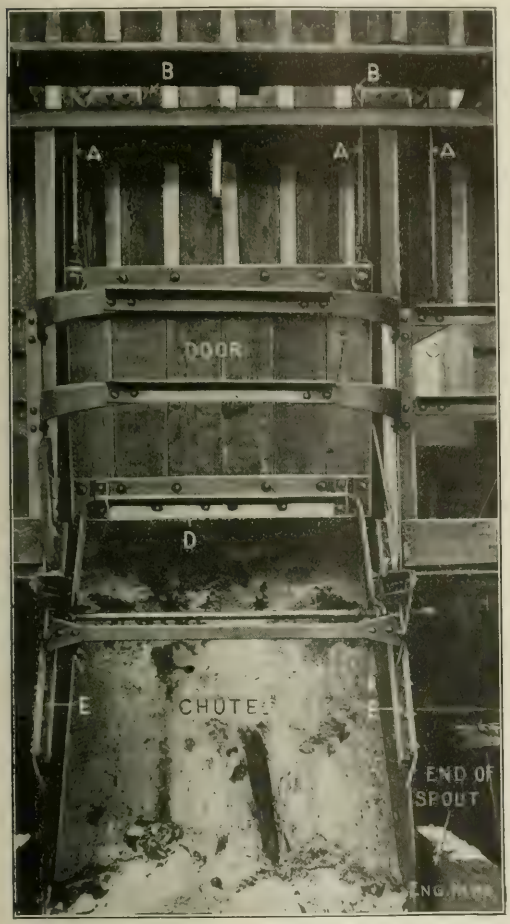


FIG. 6. BIN-DOOR ON ORE-DOCK NO. 1 OF THE DULUTH & IRON RANGE R.R.

pivot *B* following the arc of a circle until stopped by the cam as shown by the dotted line in Fig. 3. This position is shown more clearly in Fig. 4, and at about this point the lower edge of the door will enter any flow of ore in the chute. The resultant of the momentum of the ore and the thrust of the strut is then downward, forcing the door down through the ore to the closed position, the pivot *A* describing the arc of a circle about *B* as a center during this last portion of the door's travel. Should there be no flow of ore, the door, being counterbalanced, would be pushed all the way down by hand.

A modified form of this door has been placed on all pockets of the new dock No. 1 of the Duluth & Iron Range R.R. at Two Harbors, Minn., and gives good satisfaction in operation. In the form shown in the drawings (Figs. 1 to 4) I believe I have a much smoother acting door than that used by the D. & I. R. R.R. A detail of this latter door is covered by a patent recently issued to another person, which patent, however, has conceded priority to me (in interference) as to everything common to both patents.

[The patent granted to Mr. Pearson is No. 1,040,237, dated Oct. 1, 1912. The claim mentioned covers a "bin having an opening in one wall, a closure for said opening adapted for compound movement in a vertical and horizontal direction, a strut on said closure, and means associated with said strut adapted to control the path of travel of the free end thereof." In Figs. 5 and 6 we have shown the bin door of the ore dock of the Duluth & Iron Range R.R., from drawings and photographs sent us by Mr. Pearson. The door is hung in the same way, but instead of the jointed link previously described the link is a single piece; one end is pivoted to the bottom of the door, and the other end has a head sliding in grooved guides attached to the chute. The guide arrangement is covered by a patent granted to O. H. Dickerson, but it is claimed that this infringes the patent of Mr. Pearson, which is considered to cover the entire door action. The latter states that he has issued a restricted license to Mr. Dickerson for his modified form only. In Fig. 6, the counterweight cables *A*, attached to the door, pass over the pulleys *B* and are attached to the counterweight *C*. The bent bar *D* forms the link, with the ends of its two arms traveling in the inclined guides *E* on the sides of the chute. Descriptions of the Duluth & Iron Range R.R. ore-dock No. 1 and of other ore docks and ore-pocket doors are given in two separate articles elsewhere in this issue.—EDITOR.]

Steel Ore Dock: D. & I. R. R.R.

A large steel dock was built at Two Harbors, Minn., in 1911, by the Duluth & Iron Range R.R., to replace its timber dock No. 1 at that place. It is the second steel ore-dock built by this railway, the first one having been completed in 1908. The design for the new dock was made by W. A. Clark, Chief Engineer, and the construction is shown in Figs. 1 and 2. This dock is nearly 1400 ft. long, 74 ft. high from water level to rail level, and 52 ft. wide on the deck, which carries four tracks (two over each line of pockets). There are two rows of pockets, 112 in each row, with floors sloping from the center line (at the top) to the sides. The pockets are 12 ft. long, and about 35 ft. deep, separated by 12-in. concrete partition walls, and each pocket has a nominal capacity of 4150 cu.ft., or about 300 tons (or 67,200 tons in all). The substructure consists of two parallel reinforced-concrete slabs resting on rows of piles and connected by cross-girders. The entire space occupied by the dock is inclosed by an outer line of sheet-piling under the face of the concrete. Upon these slabs are the pedestals for the steel columns.

The superstructure has two lines of columns, spaced 37 ft. apart transversely, and 12 ft. longitudinally, with transverse bracing in each bent and longitudinal diagonal bracing between alternate pairs of bents. Each column is composed of an 18-in. I-beam (with web transfers to the center line of the dock), two 24-in. side plates riveted to the flanges, and four corner angles 4x4 in. on the edges of the plates. The columns support transverse A-frames of are covered with a wearing surface of 3-in. maple plank laid up and down the slope. The outer walls of the pockets are of 3x12-in. vertical plank spiked to timbers bolted against longitudinal 12-in. channels attached to the framing of the partitions. The dock extends 32 ft. beyond the pockets, so that a locomotive can bring its first car over the end pocket. The steelwork is painted with the Illinois Steel Co's. graphite paint.

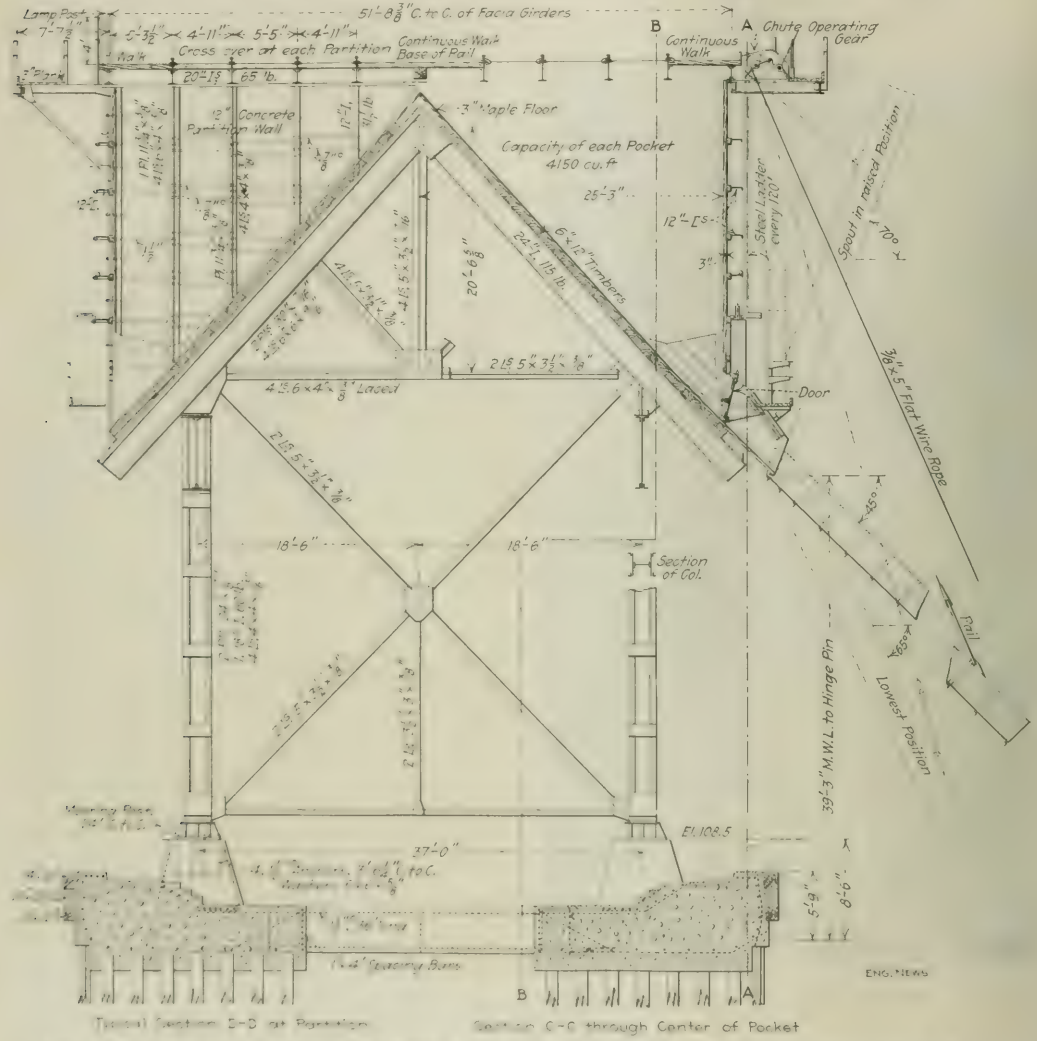


FIG. 1. CROSS-SECTIONS OF STEEL ORE-DOCK AT TWO HARBORS, MINN.; DULUTH & IRON RANGE R.R.

The A-frame girders carry vertical 12-in. I-beams which are connected by tie-rods and top angles, the entire vertical framing being embedded in the 12-in. concrete partition walls. On these walls rest lines of longitudinal 20-in. I-beams, upon the top of which are laid the track rails. The deck is carried by shelf-angles, on the webs of these I-beams. The floor of the pockets has a slope of

48° from the top to within 8 ft. of the doors, where it is reduced to 45°. Each pocket has a door opening 5 ft. wide and 3 ft. high. This is fitted with a vertically sliding door attached to a counterweight cable, which raises it, when the latching lug is released. The top of the door moves in guides, but the lower end has a swinging motion controlled by a link having one end pivoted to the bottom of the door and the other end sliding in an inclined guide on the discharge chute. This arrangement facilitates the closing of the door against a stream of running ore. The door mechanism is covered in part by a patent of O. H. Dickerson, of Detroit.

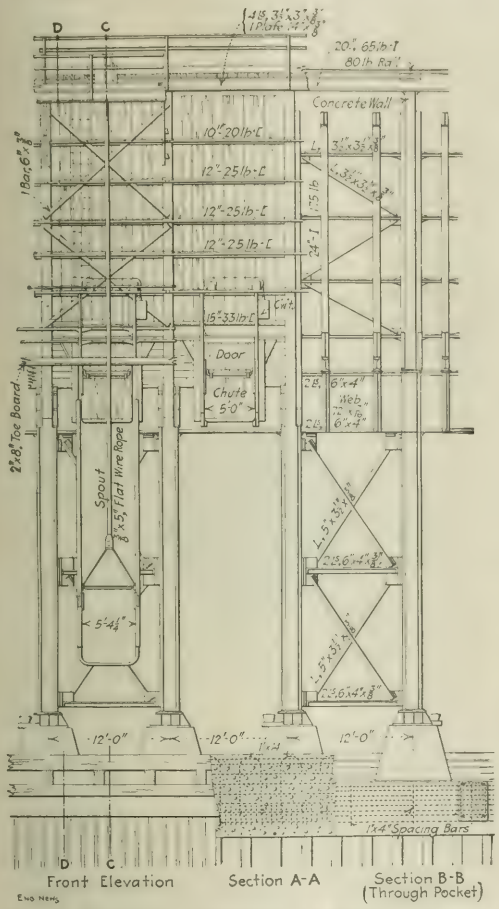


FIG. 2. SECTIONAL ELEVATION OF STEEL ORE-DOCK; DULUTH & IRON RANGE R.R.

The spout, hinged at the end of the discharge chute, is 34 ft. long, 5 ft. 4 in. wide, and 2 ft. 6 in. deep. At its outer end is a bail to which is attached a flat wire rope whose upper end is wound upon a drum operated from a shaft running along the top of the dock by means of a friction clutch. Each length of shaft carrying ten drums has its own electric motor, but only one spout is operated at one time. There is no counterweight to the spout. The substructure work was done by Whitney & Hill, of Superior, Wis., and the American Bridge Co. built and erected the superstructure.

COMPARISON OF STEEL, CONCRETE AND TIMBER FOR ORE-DOCKS

As to the relative economy of ore docks of steel (painted) and reinforced concrete, the officers of the Duluth & Iron Range R.R. believe that the comparison is favorable to the steel structure, the comparison presupposing two structures of equal strength and equally well fitted for the service. For the service required of these docks, rising 100 ft. above solid ground and subject to the strains due to moving trains, the dumping of ore and the impact of boats against the foundation, it is considered doubtful whether reinforced concrete is so suitable as the more elastic steel structure.

The life of a timber dock under modern conditions of service is limited to from 10 to 15 years, depending on the design, the severity of the service, and the amount which the owners are willing to spend for extraordinary repairs before rebuilding the entire structure. A life of 12 years is all that can ordinarily be figured safely for conditions on the D. & I. R. R.R. The life of the steel dock can, of course, only be estimated, but it is thought reasonable to believe it would not be less than 30 to 40 years. The modern steel dock can be constructed at a cost of $3800 to $4500 per pocket, exclusive of dredging, but including doors, spouts, hoisting machinery for the spouts, and electric lights. The cost varies considerably according to the design of these features and the local foundation conditions encountered, and it varies, of course, almost directly according to the capacity of the pocket. The cost of the timber dock under the same conditions will vary from $2400 to $3000 per pocket.

It is very difficult to compare the maintenance cost of the steel and timber docks because a large part of the maintenance is in connection with the doors, spouts,

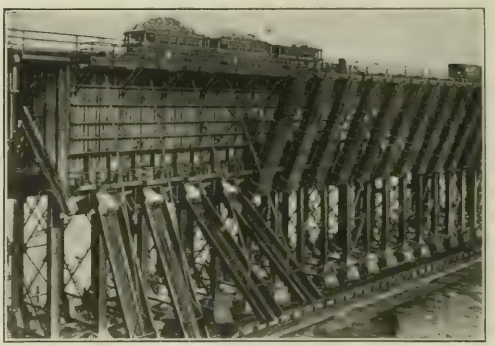


FIG. 3. SHORE END OF STEEL ORE-DOCK AT TWO HARBORS, MINN.; DULUTH & IRON RANGE R.R.

hoists, and the lining of the floor bins, and these costs are not kept separate from the other repairs. Comparison is difficult also, because of the different conditions of service upon different docks, the tendency always being to ship a greater proportion of ore over the more modern docks, which thus carry a heavier service. However, the figures of the D. & I. R. R.R. for the past three seasons, seem to indicate results favorable to the steel docks.

Progress in Military Explosives*

By Wilford J. Hawkins†

SYNOPSIS—A quarter century ago, there occurred in United States a marked revival of interest in military and naval matters. During the score of years following the Civil War the Nation had neglected its army and allowed its navy to become obsolete. There was sudden awakening to the fact that the Nation was wholly without means of defending itself in case of attack by a foreign foe. The work of building a new navy and providing both army and navy with modern weapons was actively undertaken; and great interest was taken by the engineering profession in this work. In recent years, however, partly as a result of a policy of secrecy concerning military matters which came into force about the time of the Spanish-American War, the engineering profession has been little in touch with the progress in military engineering. The paper here reprinted gives a birdseye view of the progress which has been made along these lines during the past twenty years in powders, projectiles, fuses and primers.

Powders

In comparing our ordnance of 20 years ago with that of today, one is struck with the revolutionary character of the changes. In this country, at least, it would seem as though the year 1892 marked the beginning of a new order of development in war material. Prior to that date, for 30 years or more, the changes in such materials had been slight, except for the development of brown prismatic powder and the partial development of built-up rifled cannon.

The transition period in Europe had its inception four or five years earlier. The initial impetus seems in all countries to have dated from the first experiments with smokeless powders or with the development of the small-bore high-power small arm or both. The keys to the new development were furnished by Schönbein and Böttger when they discovered nitrocellulose, or gun cotton, in 1846; and by A. Nobel in 1888, when he brought out a colloidal powder, "cordite."

The French appear to have been the first to introduce new high power propellants into their service, using a BN powder composed of nitrocellulose and barium nitrate or possibly of other ingredients, inasmuch as their early efforts were shrouded in a good deal of mystery and accompanied by several changes due to unexpected difficulties experienced with their early powders of this type. These powders were first used in the Lebel small arm and were not by any means smokeless or otherwise ideal. Concurrently, Von Lenk was endeavoring to use gun cotton alone as a propellant by braiding it into cords or ropes and winding these tightly on a wooden core. Some success attended these efforts and Germany did some serious work in developing the idea, but it was inevitable that such a scheme should fail, due to the not infrequent occurrence of erratic burning of an explosive in such a finely divided form. Many other devices were resorted to, all having the common object of slowing gun cotton in order to make it suitable for a propellant. The theory of granulation was well known and had long been applied in connection with black powders; the sphero-hexagonal grains of black powder, the varying sized irregular grains and the perforated cocoa, or brown prismatic powder all bear witness to this. Gen. Rodman, as is well known, was the leader of thought in this line by many years. To him, no doubt, we owe the early development of the multi-perforated smokeless-powder grain, as he proposed such a granulation for charcoal powders, and this idea was resurrected coincident with the early development of smokeless powder in this country.

To go back a step to the efforts to force gun cotton to burn progressively, it is interesting to note some of the other expedients tried before a colloidal powder was finally evolved. In England, efforts were made to press up gun cotton into hard pellets with a matrix of india rubber. The use of small compressed cubes surrounded with paraffin was also tested. Simultaneously, the Italians were struggling along the same line with their Fossano powder, in which gun cotton was distributed through a less explosive substance used as a matrix. Schultz's pyroxylin sporting powder was the most successful of any powders of the non-colloidal type and is in use to this day. He made up a vegetable cellulose by the treatment of finely divided wood, which was subsequently nitrated, giving a vegetable nitrocellulose. To this he added potassium nitrate, barium nitrate, vegetable gelatin, and water. Brugere's powder, although not nitrocellulose, is worthy of note among the early efforts to produce a stronger propellant than charcoal powder. His consisted of a mixture of ammonium picrate and potassium nitrate. It gave good results, but was not smokeless or as satisfactory in other respects as the later colloidal powders.



Fig. 1. End View of Smokeless-Powder Grain Indicating Results of Brittleness

In 1888, A. Nobel pointed the way to the practical solution of the problem by making a colloidal powder, "cordite." This powder was composed of nitroglycerin, gun cotton, and vaseline. Soon after, colloidal powders of nitrocellulose alone were produced, using acetone as the solvent because of the high nitration of the gun cotton used at that time.

Thus, in our earliest experiments in 1892 with smoke-

*From a paper in The Journal of the U. S. Artillery, September-October 1921.

†Captain, Coast Artillery Corps, U. S. A.; Ordnance Department.

less powders, we, in the United States, found ourselves handicapped in being about four years or more behind the times as regards smokeless powder, and even more laggard as to high explosive for shell fillers.

The smokeless-powder problem was first attacked amid considerable difficulties. In the first place, scientific research along these lines had not been made in this country and no native was conversant with the subject. Furthermore, the great domestic powder plants had been built for the manufacture of charcoal powders, and their owners were not as enthusiastic in developing the new propellant as they might otherwise have been. Another difficulty lay in deciding among a nitroglycerin-nitrocellulose, a pure nitrocellulose, and a BN-type powder. Nothing definite was known of any of them at that time in this country. No tests had been developed to determine the degree of stability possessed. That they might be responsible for a high rate of bore erosion, was not known until a year later. Furthermore, the shape of the pressure curve was not known, and many of our own early built-up guns had been designed for chase pressures incident to black-powder propellants.

At this point it may be of interest to consider the array of artillery then in use by our service. It consisted of the 15-in. smooth-bore gun, the 8-in. converted rifle, the 37-mm. Hotchkiss light field gun, the 1.65-in. Hotchkiss mountain gun, the 3.2-in. field gun, the 8-in., 10-in. and 12-in. built-up steel rifles then in the type-testing stage. It included also the 12-in. cast-iron steel-hooped rifled mortar, and the 12-in. steel rifled mortar, both then without carriages other than the model of 1890 undergoing test.

However, in the face of this transition state of all our seacoast guns and carriages, samples of smokeless powders were obtained abroad and tested in 1892. One sample was of German manufacture and the other of the French or BN type. These were tested in the new 12-in. steel breechloading rifle with astonishing results, so far as the experience of this country was concerned. For the same muzzle velocity, the weight of German powder to that of brown prismatic powder was one to three. The corresponding ratio for the BN powder was one to two. Furthermore, the maximum chamber pressures with the smokeless powders were less than with the brown powder. The difference was so great that the new powders were suspected of being capable of detonative action and attempts were accordingly made to detonate them with mercuric fulminate, but without success.

In this year also, the 0.30-caliber Krag rifle was adopted for our service, and that led to parallel efforts to obtain a smokeless powder for the small arms cartridge. In fact, the development of satisfactory powder for that arm was depended upon to point the way for the selection of a smokeless powder for cannon.

To this end samples of Wetteren, Troisdorf, Maxim and Houghton smokeless small-arms powders were obtained and sent to Frankford Arsenal for test and examination. An ordnance officer of experience was specially detailed to the Frankford Arsenal to conduct tests with smokeless powders and to develop the chemical laboratory work involved. The early tests of smokeless powders as to stability were, as compared with present practice, extremely abbreviated. They consisted largely in exposing the powders to varying degrees of heat, to moisture, and to storage conditions in the assembled cartridge. The potassium-iodide test was known and applied—150° F. and 15 min. being, respectively, the minimum temperatures and time required.

In the ensuing year (1893) a number of samples of smokeless small arms powder were received at Frankford Arsenal and tested—the Peyton, Leonard, du Pont, Axtell and Alters powders of domestic manufacture, and the Wetteren, Troisdorf, BNF, Swiss, Rifleite, S. R., and S. V. powders representing foreign manufacture. The Peyton powder was the only one of domestic manufacture worthy of note, and the standard of excellence was the Wetteren, with the Troisdorf also very highly esteemed.

Of smokeless powders for cannon, BN, German, U. S. Navy smokeless, Cordite, Troisdorf and Leonard powders were received and tested. The French BN powder was then in considerable favor as it contained no nitroglycerin, an ingredient even then much distrusted in this country. Firings with these powders were made in 12-in., 8-in., 5-in., 4.72-in., and 3.2-in. guns. Troisdorf, a nitrocellulose powder of German manufacture was also in considerable favor, as it gave uniform ballistics and was free from nitroglycerin. Cordite was not in favor, though it was known to have been adopted by England.

The subject of erosion in the bores of cannon first arose in this country at this time, and added another uncertainty to the already perplexing problem of selecting a suitable smokeless powder. It was thought that if erosion could not be avoided, the guns might be relined, an opinion which has since found expression in our practice.

The situation in 1894 was but little changed. Congress was insistent that a powder of domestic manufacture be adopted and every effort was made to stimulate the efforts of our own powder makers to produce a satisfactory powder. To this end, an ordnance officer was specially detailed at the works of the du Pont Company and provided with suitable ordnance at the works for testing the samples. The samples were slow of production as they had to be made up in small lots by hand in absence of any specially adapted machinery. Another officer was detailed on the Pacific coast to the Peyton company, and a proving ground produced at Benicia Arsenal.

In this year, the first ballistic specifications for smokeless cannon powders were drawn up:

Gun	Muzzle Velocity (ft. per sec.)	Maximum Chamber Pressure (lb. per sq. in.)
5-in. siege	1830 f.s.	31,360
7-in. siege	1085 f.s.	26,880
8-in steel rifle	2000 f.s.	33,600
10-in steel rifle	2025 f.s.	33,600

Various granulations were used, cord, strip, cube, and multiperforated. In the multiperforated, 19, 21 and 7 perforations were used.

In 1895 Peyton smokeless powder (nitroglycerin) began to be regularly used in loading 0.30-caliber small-arms cartridges, the service having been completely equipped with the new Krag rifles by May of that year.

In the two succeeding years experiments with cannon smokeless powders continued; and in 1897 the first smokeless powder was issued to our service for use in target practice with the 3.6-in. mortar. Contracts were also placed during this year with domestic firms for

Peyton, Rottweil, W. A., and nitroglycerin powders for 12-in. mortars, 10-in. and 8-in. guns. These contracts were divided among the California Powder Co., the American Ordinance, the Laflin & Rand and the du Pont companies. Also Peyton smokeless powder was definitely adopted and used throughout the year in loading 0.30-caliber small-arms cartridges for the Krag service magazine small arm. No further orders for charcoal powders were contemplated by the Chief of Ordnance.

As a sidelight on the status of artillery target practice in 1897, the following table of allowances published in a general order may be of interest.

Gun	Projectiles per Battery	Powder
3.2-inch field gun	15 Shrapnel 7 shell	IK
3.6-inch field mor	7 shrapnel 8 shell	Smokeless
8-inch M. L. Conv'd Rifle	10 chilled shot Butler or Eureka	Hexagonal
8-inch, B. L.	3 shots each.	
10-inch, steel	2 at 1725 and 1 at	Brown Prismatic
12-inch, rifles	2025 ft. per sec.	
12-inch B. L. mortar	3 shots	Black Moratr
10-inch, S. B	10 shots	Mammoth
15-inch, S. B	8 shots	Sphero-Hexagonal

(All shots at stationary targets.)

As germane to the subject of propellants, it may be stated that the Haskell multi-charge gun was tested at this time and found wanting; also that pneumatic guns were under test on the Pacific coast and that the Sims-Dudley dynamite guns were receiving consideration.

During 1898 and 1899 the situation as to smokeless powders continued about as before, the domestic manufacturers cited above being busy turning out their several types of smokeless powders in large quantities for the first time. A slight check to this work occurred in 1899 when all work of manufacturing smokeless powders was suspended on account of the destruction of an 8-in. and of a 10-in. rifle at Sandy Hook when smokeless powder manufactured in 1897 was being used. Upon investigation, however, confidence was again established in the smokeless powders under manufacture and the work resumed. The powder giving the destructive pressures was not of the type being manufactured and was found to have become brittle. This led to the present compression test of smokeless powders.

During the war of 1898, considerable newspaper agitation occurred on the subject of our defenseless condition as to a supply of smokeless powder; but this quieted down when it became known that all of our powder plants were doing their best to overcome the shortage.

The general trend of opinion was turning, during these years, toward the ultimate adoption of a pure nitrocellulose powder until, in 1900, that type was definitely decided upon for cannon. At this time, the rapid erosion of English guns under their "cordite" powder had become generally known, and that knowledge weighed heavily in making the above decision.

In 1900 sufficient confidence in our ability to make good common smokeless powder had been gained to warrant the placing of large additional orders with domestic manufacturers; but still the service had no smokeless powder except that for the 3.6-in. field mortar. In the ensuing year (1901), however, smokeless powder was also issued for the 3-in. 15-lb. D. S. gun; and, incidentally, it is interesting to note that moving targets were first used in our target practice that year.

To increase our knowledge of smokeless powders and of other ordnance material, two ordnance officers were sent to Europe in 1901 to investigate those subjects. Their visit had valuable results in many lines of ordnance work. New stability tests for smokeless powder were soon after put in use, so that by the end of 1901 the following tests were used additional to the potassium-iodide test: Vieille 110° test (discarded later), Wills' explosion test (discarded later), Troisdorf or German 135° test.

About this time also arose the suspicion that certain substances if present in the powder might mask the standard stability tests and thus render them useless. This matter was investigated and the use of certain ingredients forbidden.

It was in 1901 that we first demonstrated in this country the danger attendant upon the use of smokeless powder for saluting or blank-charge purposes, the demonstration consisting in the entirely unexpected destruction of a 3-in. 15-lb. D. S. gun. It was later learned that similar experiences had occurred abroad.

The great length of time requisite for the drying of smokeless powder, especially of the larger granulations, having been brought forcibly to the attention of the Ordnance Department, various schemes to expedite the process were suggested. The expedient of drying in hot water for the removal of solvents and later drying in air, was tested and discarded as the stability and ballistics obtained under this process were unsatisfactory.

The study of smokeless powder continued during the succeeding year and resulted in the addition of the 115° Ordnance Department test; also in the discovery of certain basic laws relating to nitrocellulose and to the colloid made therefrom; as for instance (1) that after a certain point smokeless powder deteriorates more rapidly when hermetically sealed than when in the open air, (2) that finshed powder is not as stable as the nitrocellulose from which it is made; etc.

Consideration was also given to the subject of strip or tubular powders instead of the multiperforated grains in order to make the powder charge more wieldy and less apt to clog the breech box in inserting. A serious objection to long tubular powders for such fagoting was found to lie in the intense blow-pipe action of the combustion gases emitted from the bores of the tubular powder. Strip powders were unsatisfactory, due to lack of progressivity.

By 1903, the manufacture of smokeless powder was fairly well understood and the manufacture of it progressed with greater confidence. That the resident inspectors (ordnance officers) were removed from station immediately at the works was due to this increased confidence, although the necessity for their relief was due to the scarcity of ordnance officers for other pressing work.

The cause of the development of critical pressures in the case of several powders of older manufacture was further investigated and, as a result, the powder specifications were changed so as to include a compression test and thus require a tough powder free from brittleness. The critical pressures occurred between 38,000 and 40,000 lb. per sq.in. The action at this point was such that for a very slight increase in the charge, a very great increase in the maximum chamber pressure would result. It was found that acetone as a colloiding agent was in some measure responsible for brittleness in the finished powder.

Although nitrocellulose powder had now been definitely decided upon for cannon, nitroglycerin powder was still used for the small arm propellant inasmuch as its keeping

qualities seemed to be much better, and inasmuch as it did not give excessive erosion when used with the 220-grain blunt-nosed bullet and the finally adopted muzzle velocity. This powder, therefore, continued to be used until the advent of the 150-grain sharp-pointed bullet in 1906.

This year (1903) all artillery practice was, for the first time, had with smokeless powder. In the following year (1904) the quality of brittleness was further investigated and many ballistic tests made in this connection. It was found that good nitrocellulose powder when heated continuously at 150° to 180° F. gave increased pressures and velocities up to a certain time, and that thereafter these qualities decreased. The reason for this phenomenon was not discovered, but it is, after all, a safe characteristic.

Some little discussion was also indulged in as to the danger of ether and air mixtures in service magazines. In certain proportions, the mixture was found to be explosive, but its presence was rendered unlikely by an improvement in the hermetic seal of the powder-storage cases.

In 1905, the specifications for the manufacture of nitrocellulose cannon powder were further improved. The stability tests were increased in severity and greater care in the purification of the gun cotton was required. The hygroscopicity of nitrocellulose smokeless powders was also investigated. It was at first believed that increased moisture in smokeless powder resided only on its surface as a condensation, but this was later disproved. If this theory had been correct, the increase in moisture for various granulations must have been proportional to their surface areas; whereas, experiment showed that increases in moisture in all granulations, large and small, approached a common maximum lying between 2½ and 3%.

The Joint Army and Navy Powder Board was first convened in 1906 for the purpose of further improving smokeless-powder specifications. This Board soon adopted the same specifications for both Army and Navy powders and made some minor improvements in the specifications adopted.

The serious accidents which occurred in the Navy due to flarebacks brought up this subject for serious consideration in regard to the seacoast artillery. Tests were made but it was soon demonstrated that, for guns mounted in open air, such phenomena would not occur. That combustible gases are present, however, was clearly shown by holding a lighted match at the mouth of a cartridge case extracted from a gun immediately after firing.

The adoption of the model of 1906 small-arms cartridge with its light pointed bullet led to difficulties with erosion in the 1903-model service rifle; and the greater part of the years 1906 and 1907 was spent in trying to meet this difficulty, more than 100 samples of powders being tested. The adoption of the present pyro, or nitocellulose powder finally resulted, thus terminating the history of nitroglycerin powders in our service. The new small-arms pyro powder gave very excellent results so that the accuracy life was increased from less than 1000 to more than 10,000 shots.

The Joint Army and Navy Powder Board continued its labors and the Army and Navy powder specifications were made identical. The influence of aldehyde in alcohol had always been much feared and the specifications had always prohibited its presence in the alcohol even in the minutest quantities. Upon investigation, however, it transpired that the substance, even if present in the alcohol to the extent of 5%, caused no decrease in the stability of the finished powder.

The great lengths of time required for the drying of smokeless powder, especially of the larger granulations, still engaged the attention of the authorities and quick drying powders were considered and tested, but with indecisive results.

During this year, the coast artillery service first received authority to reblend and weigh smokeless-powder charges for service practice, and thus arose the interesting discussions between the "blenders" and the "anti-blenders." Whatever may have been the ballistic result of blending, it is certain that it was justified by the awakening of increased interest in the Coast Artillery.

The Joint Army and Navy Powder Board was active in 1909 in still further improving the smokeless-powder specifications, especially as to the granulations best suited to the several service guns and mortars involved. Efforts were made to reduce the maximum pressures and thus to permit an increase in the muzzle velocity. The subject of bore fouling was also considered, with a view to reducing the amount and hardness of the deposit. In this year, the Army Powder Factory at Picatinny, N. J., was completed and the work of installing a small experimental plant for the manufacture of high explosives inaugurated.

In the three succeeding years, up to 1912, the situation in this country as to smokeless powder has remained practically *in statu quo*, except for minor improvements. These have consisted in changes looking toward the further stabilization of the powder, the cheapening of the product, and the acceleration of the methods of manufacture, especially as regards the matter of drying. The Army Powder Factory at Picatinny has proved a most useful adjunct in the improvement and cheapening of smokeless powder, furnishing as it does a large laboratory, so to speak, in which the Army may try out under ideal conditions the various expedients suggested from time to time. To this factory is due credit for having developed a powder for the 12-in. mortar applicable to all zones, a boon for which the Coast Artillery has reason to be thankful. To it also is due credit for having demonstrated what the cost of smokeless powder really is.

In 1911 our smokeless powder was attacked in the foreign press on the ground that it could not be safely fired when heated as high as 150° F., due to the multiperforated type of grain and the composition. This gage was promptly taken up and firings made with the powder preheated to 208° F., with no excessive pressures not accounted for by the usual temperature compensation.

The small-arms powder (pyro) has been further improved so that the accuracy life of the 1903 model service rifle approximates 15,000 shots. The addition of a new ingredient has resulted in decreasing the bore fouling and increasing the accuracy. In the last annual competition, held under the auspices of the National Board for the Promotion of Rifle Practice, for the selection of ammunition for the national match, the government-made ammunition took second place, losing first place by a margin of a small fraction of an inch on the mean radii.

To sum up, it appears that we started in on the development of a suitable smokeless powder in 1892, four or five years behind our European competitors, and by 1903 had

produced and issued a fairly satisfactory powder. From that date untill 1912 the work has been in the nature of minor improvement until at this writing our powder seems to have reached a degree of perfection scarcely excelled by that of any other nation. This is particularly true of all our powders manufactured subsequent to 1907. Striking evidence of this has been given by the destruction of the "Aquidaban" (cordite), the "Jena" (inferior nitrocellulose), the "Mikasa" (cordite), and the "Liberte" (inferior nitrocellulose). Two other explosions caused by the spontaneous decomposition of cordite have occurred, which happily were localized and did not destroy the ships—on H.M.S. "Revenge" and "Fox." Recent investigation of the French nitrocellolose powder indicates that inexcusable carelessness prevailed in that country in ponding temperature for "cordite." Consequently, gun erosion progresses much less rapidly with our nitrocellulose powder. (5) The chemical decomposition of our nitrocellulose powder in storage is at all times gradual and does not reach a critical stage beyond which the rate of decomposition is greatly accelerated and terminated by explosion. "Cordite," on the other hand, is treacherous in this respect, giving good stability tests perhaps for a number of years and then suddenly decomposing in a few months to a dangerous condition, usually terminating in explosion.

England has evidently realized some of the disadvantages of "cordite" in recent years as is evidenced by the change from "Mark I Cordite," containing 58% nitroglycerin, to "Cordite M. D.," containing but 30%.



FIG. 2. EVOLUTION OF U. S. ARTILLERY PROJECTILE IN EXTERIOR FORM
(A, 20-in. spherical; B, 16-in. ogival; C, 12-in. ogival shell with early cap; D, modern 12-in. shell with long-pointed cap)

the manufacture, storage, and reworking of their powders. In Germany, it is understood that nitrocellulose is used in the army, except for howitzers, but that a nitroglycerin powder specially stabilized (other than by mineral jelly) is in use in the navy. Russia uses a nitrocellulose powder while Italy and Spain use nitroglycerin powders, "ballistite."

We believe that nitrocellulose is superior to cordite or nitroglycerin powder for several reasons. (1) Nitrocellulose of a lower nitration is used and this permits of better purification and gives a more stable cellulose. (2) Nitrocellulose is insensible to ordinary shock at all temperatures, whereas at moderately high temperatures "cordite" exudes nitroglycerin and becomes sensitive to shock. (3) With the stabilizers now in use, our nitrocellulose powder may be expected to withstand a storage of 20 years as against our experience of 10 years or less for "cordite." (4) The temperature of explosion of our nitrocellulose powder is about 50° less than the corresIf it were not for the fact that a change from nitroglycerin to nitrocellulose powder entails an immense pecuniary expenditure in guns, magazines, ammunition hoists and the like, it is not improbable that many countries now using nitroglycerin powder would change to a nitrocellulose of low nitration like our own.

PROJECTILES

Twenty years of progress in the manufacture of steel projectiles in this country covers very nearly the entire subject. The first attempts in the manufacture of forged-steel shell in this country seem to have been made by the Midvale Steel Co. in 1885 in connection with early experiments to determine the best material for 8-in. seacoast shell. These were used in connection with tests of high-explosive shell fillers such as nitrogelatin. The earliest orders for service steel projectiles of 8-in., 10-in. and 12-in. calibers were placed in the early nineties and were small. They were mostly placed with the Midvale Steel

Co., yet with that company in the first year under our consideration we find but one small order for 12-in. mortar shells.

In these early times, special alloy steels and the treatment of such steels was, in this country, an unopened subject. Also at this time high-explosive shell fillers in this country were primitive in the extreme. Various attempts had been made to use dynamite, nitroglycerin and nitrogelatin with but indifferent success, and with the not infrequent destruction of the guns used in the tests.

The Winslow high-explosive shell is perhaps the most ingenious device of this sort tested. In it, the ingredients necessary for the production of nitroglycerin were inclosed in separate glass bottles, and there was provided a firing pin protruding to the rear through the base of the projectile so that it would be forced into the shell and break the glass bottles upon the explosion of the propelling charge. It was supposed that nitroglycerin would be formed during the flight of the projectile. A time fuse of the old plug type was used. It was found that these projectiles seldom exploded and that when they did it was with a low order.

Various other high-explosive projectiles were tested. Garrick's nitroglycerin shell appeared in 1885 as a forerunner of the Isham shell of later years. The Ordnance Department also tested a shell of this type, but desisted after the destruction of a gun.

being tested abroad for this purpose prior to 1895 and found as satisfactory as picric acid. The nitro-cresols were also tested abroad, the "ecrasite" use by the Austrians being of this class and bearing the same chemical relation to cresol that picric acid bears to phenol. In France prior to 1886 various mixtures of picric acid and oxygen carriers were used as shell fillers under the name of "melinite." But following Turpin's patent picric acid alone was used under the old name. In England also picric acid was used under the name of "lyddite," so named because the experiments with it had taken place near Lydd.

It was soon found that picric acid alone was unsatisfactory, due to its tendency to form sensitive metallic picrates; so thereafter recourse was had to its chemically less active salts, such as potassium picrate and ammonium picrate.

Having described the general situation at the beginning of the period 1892-1912, we may trace the progress in that period. One of the early orders for seacoast steel shell was placed with the Midvale Steel Co. in 1892 and that company seems to have been remarkably successful in the manufacture of armor-piercing projectiles. In the following year, other orders for large-caliber steel shell were given the same company under specifications requiring the use of the Holzer process.

In 1896, "emmensite" was tested as a shell filler with

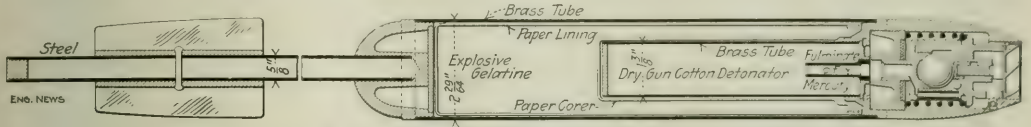


FIG. 3. THE SIMS-DUDLEY DYNAMITE SHELL OF 1899

The controlling idea, at that time, seemed to be to convey the largest possible quantity of the highest possible explosive to the target in the lightest possible envelope. The benefits to be derived from confinement in a strong envelope to develop the full force of the explosive, or the possibility of obtaining penetration and a delayed detonation, seem not to have been considered. Neither was attention given to providing a sufficient quantity of metal in the envelope to provide an ample number of effective fragments delivered at the highest attainable velocity by virtue of strongly confining the detonation.

It is interesting to note that it was only shortly prior to 1892 that the Butler obturating sabot gave place to the copper rotating band placed above the base of the shell as we know it today.

In Europe the matter of shell fillers seems to have been better understood. In 1885 E. Turpin, an Englishman, patented the use of picric acid as a shell filler, Sprengel having shown in 1883 that this material could be detonated. The salts of picric acid had also been proposed for use in powders as early as 1869 by Designolle, Brugere and Abel. Designolle's powder, consisting of potassium picrate, potassium nitrate, and charcoal, was for some time used by the French as a shell filler. In the same year (1869) Brugere and Abel simultaneously recommended a mixture of ammonium picrate and potassium nitrate. Later on, all of the picrates were investigated as to their suitability as shell fillers, ammonium picrate fairly satisfactory results. This explosive was of the picric-acid type with an addition of potassium or ammonium nitrate. Its stability was not considered satisfactory. At this time and until 1897 the subject of high explosives was handled by the Board of Ordnance and Fortification under the well known authority, Gen. Abbot. Experiments followed, in 1899, with the Gathmann projectile, with the Isham projectile carrying nitroglycerin, with the Sims-Dudley dynamite shell, with "joveite," and with Tuttle's "thorite."

The Cathmann wet-guncotton shell was a failure, as was also the Isham shell, as it provided only for an outside explosion. "Thorite" was rather favorably considered for a time, on account of its safety and insensitiveness; but it was nearly impossible to completely detonate it and it was decidedly hygroscopic. "Joveite" was a complex mechanical mixture of carbonaceous matter, picric acid, ammonium nitrate, sodium nitrate, and sodium oxalate. It was not favorably considered for obvious reasons. "Thorite" was not so complex, being a mixture of paraffin, a hydrocarbon, and ammonium nitrate.

In the following three years (1900, 1901 and 1902) experiments continued with the Isham shell until it blew up a gun at the Sandy Hook Proving Ground.

About this time explosive "D" made its appearance, as did also Hudson Maxim's "maximite." Explosive "D" was adopted for service, and "maximite," picric acid, "rend rock No. 400," and "thorite" were favorably con-

sidered for service use. "Maximite" was a mixture of mono-nitro-naphthalene and picric acid, which is apparently a recrudescence of Street's nitro-picro-naphthalene patented abroad in 1897. Later experience with "maximite" showed that it was not sufficiently insensitive to uniformly withstand setback in the field gun, so it was discarded. "Thorite" was used to some extent in field shell during the Spanish War and gave fair results. Picric acid has also been used as a shell filler to some small extent, but its tendency to form sensitive metallic picrates has caused its discontinuance for that purpose.

As explosive "D" possessed nearly all of the properties of an ideal shell filler, it was definitely adopted as the standard high explosive for this purpose, and has given satisfaction.

During the past few years trinitrotoluol has come into prominence abroad as a shell filler. It has also been tested in this country with promising results. Its striking advantages are its cheapness, chemical stability, or inertia, and its certainty of detonation, combined with a high degree of insensitiveness to shock. It is very similar structurally to picric acid, or trinitrophenol, and to trinitrocresol. All three of these substances are more or less suitable for shell fillers.

In 1904 C. M. Wheaton proposed his shell filled with an anaesthetic. It was also in 1904 that tests were made with armor-piercing projectiles with caps and without. The capped projectiles were found much superior as to penetration, and they bit as well on oblique impact as did uncapped shell. The cap was therefore adopted, and capped cast-iron projectiles were issued for coast-artillery target practice in 1906, the old projectiles having been redesigned, and a cap attached by means of a threaded tenon.



FIG. 4. THE GATHMANN GUN COTTON SHELL OF 1899

Following the adoption of the sharp-pointed small-arm bullet in the 1906 model cartridge, experiments were made with sharp-pointed cannon projectiles of similar form, and it was found that as much as 10% additional range resulted from the use of this form for the same muzzle velocity. Accordingly, a change to this form of projectile is in progress.

The standard projectile has also been further modified by the use of wide, continuous rotating bands. Bands up to one-third of the caliber in width were found to materially increase the accuracy life of cannon, offsetting the results of erosion, and have been adopted. Tracers for night firing have likewise been added in late years, but this device has not yet been fully developed.

Little has been said on the subject under discussion from the steel maker's point of view for the reason that the manufacturers give out no information as to their several methods. It is believed, however, that most armor-piercing shells are made of alloy steel carrying nickel, chromium, or tungsten. This steel is, of course, heat-treated with a view to obtaining great physical strength combined with toughness. Roughly speaking, such heat-treatment usually consists in heating to a point above the absorption point of the steel and of quenching in oil. Subsequently the steel is heated again to a lower degree than before, the exact degree depending upon the compromise between physical strength and ductility decided upon by the steel maker.

To sum up, our progress in 20 years of projectile manufacture has been greatly to increase the ability to penetrate, to develop a first-class shell filler, to add wide continuous bands, to add armor-piercing caps, and to sharpen the point so as to materially decrease the value of the coefficient of form.

FUSES

At the beginning of the period covered by this paper, our fuses were very nearly in the same state as they had been during and since the Civil War. The time fuse consisted of a conical wooden plug holding compressed meal powder in an axial bore. The head of this column was provided with an igniting disk of meal powder treated with alcohol in order to increase the ease of ignition. Over all was pasted a paper disk upon which was written the rate of burning of the meal-powder column. To use this fuse, the artilleryman consulted his range table, taking out the time of flight, and then computed the length he must saw off from the small end of the plug fuse to obtain the desired point of burst. The plug was then driven into the fuse seat and the shell pushed down the bore so as to leave the fuse pointing toward the muzzle. The fuse was lighted by the heated gases which passed around the projectile through the windage between the shell and the bore. The maximum time of flight obtainable with such fuses was from 6 to 8 sec.

The Bormann fuse was also used. Its ignition was accomplished in the manner first described, but the meal-powder time train was continued in an annular groove in a pewter fuse body in a manner similar to that now used in the dial-type time fuses. This train was covered with a pewter disk graduated in seconds, which was punched at any desired point for the admission of the igniting flame from the propelling charge. Upon ignition, the train burned in both directions until the reinforcing charge was ignited. The combustion of the igniting, or reinforcing, charge ignited the black-powder shell filler.

The concussion fuse was also common. In this fuse,

the time-train stem was made so brittle that it would be broken by the concussion of the shell upon impact regardless of the part of the shell struck. The breaking of the time train admitted the flame to the shell filler at once.

The combination time-percussion fuse (15 sec. and 28 sec., 1891 model) had just appeared at the beginning of the period under consideration, but of detonating fuses we had none. The simple base-percussion fuse was also more or less a novelty at that time in this country.

The year 1892 found us engaged in making road tests with the 15- and 28-sec. combination fuses to test the safety of the plungers in this respect. The use of an aluminum body, or stock, for these fuses was also being next adopted and has since been used in our service in great quantities. This device entered into the 1894-model 15-sec. and 28-sec. Frankford Arsenal combination fuses.

At the time under consideration, there were two general types of time elements for fuses: one, the dial type similar to that now used with our 3-in. field-gun material, and the other, the spiral lead-inclosed time trains familiar to our service in the Frankford Arsenal 15-sec. and 28-sec. fuses. The former was apparently the German type and the latter a French idea. As we had purchased considerable material from the Hotchkiss company at that time, it is perhaps not unnatural that the spiral type should have been adopted. However, experience has proved it to be inferior to the dial type.

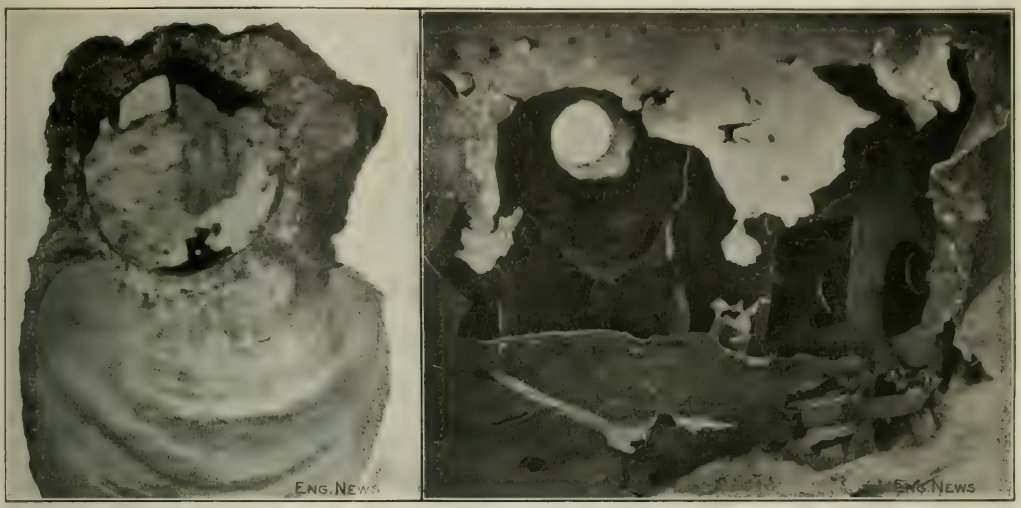


Fig. 5. At Front Fig. 6. In Rear

FIGS. 5 AND 6. EFFECT OF SERVICE 12-IN. PROJECTILE ON ARMOR PLATE

considered in order to convert the weight so saved into shrapnel balls. Five-inch and 7-in. common shrapnel were at this time being designed for the then new siege material of these calibers. Experiments were also made during this year with the Merriam base-percussion fuse. This fuse is particularly interesting as it embodied, at an early date, many features the importance of which was not apparently appreciated until several years later. The plunger restraining springs and the adjustable delay-nondelay device, are among the features referred to.

The earliest fuses manufactured at the Frankford Arsenal had plungers of the Hotchkiss type, in which the barbed firing pin was inclosed in a lead-filled plunger, the idea being that upon setback in the gun, the plunger would ride relatively backward over the barbed pin and expose the point of the firing pin in readiness for impact. This type of plunger was radically defective, inasmuch as this relative movement would occur gradually under the slight shocks incident to transportation, thus arming the plunger. This condition eventually led to a serious accident, after which the type was abandoned.

The ring-resistance type of plunger invented by W. J. Dungan, an employee at the Frankford Arsenal, was

The development and issue of the time fuses referred to, continued for several years; but it was not until about 1900 that serious efforts were made to develop a dial-type fuse at Frankford Arsenal.

In 1899 the matter of fuses seems to have been taken up in earnest and the "A," "17A20," "C," "M," and "W" fuses were developed. At the same time the development of detonating fuses received consideration. The "A," "C," "M," and "W" fuses are familiar to most of the artillery officers of our service as base-percussion fuses of different sizes appropriate for the various fuse seats and set-back conditions.

The detonating fuses were difficult to develop, for the reason that violent explosives must be carried in them in sufficient quantity to excite insensitive shell fillers, while at the same time the fuses must successfully withstand a high rate of impact retardation as well as bore acceleration. Fulminate of mercury was much distrusted, so the early development was along the line of a nonfulminate fuse. The work of developing a satisfactory detonating fuse was continued through 1899 and 1900 until in 1901 the type had been established.

The succeeding two years, 1902 and 1903, witnessed the

early development of centrifugal plungers and their adoption. This period also covered the earlier work with delay-action fuses, and the first steps in the development of the 1906-model dial-type combination fuse. In 1904, centrifugal plungers were further developed and certain old types of base percussion fuses became obsolescent. This year also marks serious attempts to



FIG. 7. PLUG TIME FUSES
[For Land Use (left); For Seacoast Use (right)]

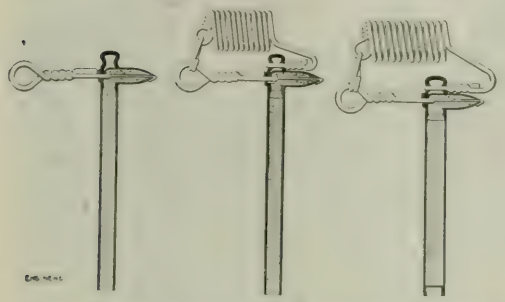


FIG. 9. EARLY MODELS OF U. S. FRICTION PRIMERS

develop a practical side-impact fuse for use in certain mortar shells which at that time were unsteady in flight. The attempts, however, did not lead to the adoption of a new type of fuse, though the devices tested were most ingenious.

In the following year, the present standard types of detonating fuses were approved for manufacture; i.e., the minor-, medium-, and major-caliber base-detonating fuses. The Hacherelle mechanical time fuse was also tested with poor results. Fuses of this type have in the last few years been brought to a fair state of perfection by the great ordinance corporations of Europe.

The 1906-model dial-type combination fuse appeared the following year, but was immediately succeeded by the 1907-model combination fuse with hooded venting, the type since standard in our service. During this year, 1906, the centrifugal plungers previously developed were abandoned, except for ordnance giving very low bore accelerations. The work of developing a 31-sec. dial-type combination fuse was inaugurated to provide a fuse for [illegible] in. and 6-in. siege material.

The Semple centrifugal plunger was tested during 1907 and 1908, being adopted in 1909, after numerous and prolonged tests. The years 1909 to 1911 have witnessed continuous efforts to develop a satisfactory high-explosive shrapnel for the several calibers of mobile artillery material, together with fuses suited to such projectiles. During this time, fuses have been designed and tested for balloon-gun projectiles and also for hand and rifle grenades.

Our progress in producing fuses has not been so rapid as it has been in Europe, due partly to the fact that we are not equipped so well as our friends across the water. In one country, there are five great ordnance-manufacturing establishments, each maintaining a permanent corps

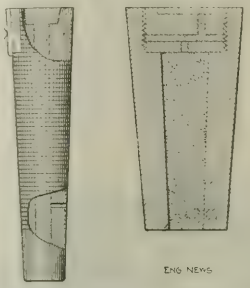


FIG. 8. THE BORMANN TIME FUSE

of the best obtainable specialists for experimental and research work alone. However, in spite of handicaps, our time, percussion, and detonating fuses do not compare unfavorably with those of similar foreign types.

PRIMERS

At the beginning of the period 1892-1912, we find but few primers in service, the radial-vent friction primer and the similar axial- and radial-vent electric primer, together with the obturating friction-screw primer for seacoast guns, representing the equipment.

In 1893 the friction primer for axial and radial vents received the safety wire coil connecting the body of the primer to the lanyard, so that the former would not be blown to the rear from an axial vent, as in the 3.2-in. field gun, and thus form a dangerous missile. In 1896 this safety wire was further improved. Some of these primers are shown in Fig. 9.

It was not until 1900 that the subject of primers was taken up seriously with a view radically to improving them. In this year, single-wire obturating electric primers were developed, and electric primers for 5-in. and 6-in. rapid-fire guns provided. This year also marked the first development of obturating electric friction primers without screw threads on the primer body.

The whole subject of primers was investigated in the succeeding four years and in 1904 the following primers were adopted: 110-grain percussion, 20-grain percussion, 110-grain igniting, 20-grain igniting, 20-grain saluting igniting.

It was during this year that the Horney firing mechanism for seacoast guns appeared, and that the development of a threadless combination electric friction primer for use with it was undertaken. In 1906 electric firing circuits were attached to the seacoast carriages, and by 1907 all of the primer seats in seacoast guns of 5-in. caliber and upward had been modified to receive the combination electric friction primer. During the years 1909, 1910 and 1911 further changes in the firing mechanism and primers have been considered and improvements of various kinds proposed and tested.

Reservoir Regulation for the Ottawa River

By Emile Low*

The subject of river regulation by storage reservoirs is now receiving much attention, and it is therefore of interest at this time to record what Canada is doing in this field. The reports of the Department of Public Works give much valuable information concerning the Ottawa River storage, construction work on which is now well advanced. The writer has abstracted such salient points from these reports as will give the readers of Engineering News some knowledge of the status of the work.

Origin of the Storage Scheme

During the extensive surveys made several years ago for the proposed Georgian Bay ship canal, it was found that no satisfactory scheme could be devised unless it included efficient regulation of the Ottawa River flow by storage of the spring floods, in order to reduce the fluctuations in the different reaches, to eliminate swift and dangerous currents, and to establish practically slack-water navigation.

Conditions on the upper Ottawa are very favorable to a partial control of the surplus waters to increase the low water flow.

The Ottawa drainage basin is 56,000 square miles in area; 10,000 of this lies south of the river, and 40,000 north of the same; 20,000 square miles of this latter, above Mattawa, forms the Timiskaming basin. The upper Ottawa basin contains Grand Lake Victoria, 40 square miles, and Quinze Expanse, 100 square miles. The outlet of Lake Timiskaming in a stretch of 15 miles descends 300 feet over rocky barriers that present wonderful visions of water power, all of which, however, has been disposed of by lease for the remainder of this century.

To the west of Lake Timiskaming is Lake Timigami, and to the east of Timiskaming is Lake Kipawa. The latter has a surface of 100 square miles and is 300 feet higher than Timiskaming. The flow of the Ottawa at Mattawa was 110,000 cu.ft. per second during the flood of May, 1909. The flow of the Ottawa River is a maximum in April each year during the period of melting snow.

After June, the river steadily falls. September, generally witnesses a low stage, but usually there are autumn rains that fill the subsoil of the basin and sometimes cause a rise of consequence. The ground water, coming out all winter from the swamps, serves to maintain the flow during January, February and March, when the frost covering stops all surface run-off.

Rainfall over the Ottawa in summer is even, and there are no steep hills to rapidly shed their load of water upon alluvial plains which have not sufficient slope to carry it away. Except then for the concentrated run-off in May and June, due to the accumulation of snow, there is no great flood, although autumn rains create local rises.

Reservoir Capacity

During the session of 1908-9 Parliament voted the sum of $65,000 to commence the construction of storage dams in the Ottawa valley, previously recommended by Mr. G. P. Brophy, superintendent of Ottawa River Works. Another sum of $20,000 was voted to continue the studies of the Ottawa River watershed.

As a result of these studies, it was decided to construct storage dams at the outlets of three large lakes on the Ottawa watershed, Timiskaming, Kipawa and Lakes Quinze and Expanse. The combined water surface of these three lakes has an area of some 370 sq. miles and it is possible to store in them by regulating their outlets over 6000 sq. mile feet of water, which instead of rushing to waste in the spring flood would be held in these reservoirs and gradually let out during the low water period.

Taking the low period at 150 days between October and March, it will then be possible ultimately to augment the low water flow at Ottawa for that period by 10,000 to 12,000 cu.ft. per second. Large as these reservoirs are, they will not be sufficient to exert the full control that is desired during years of extreme floods but further storage may be created by dams at the outlets of Lakes Turnback, Opasatika, Grand Lake Victoria, Birch, Barrière, Kakabonga, and several other lakes on the main stream or on the tributaries, which are now either under study, or will be investigated as soon as time and staff are available.

Cost of Storage Reservoir Dams

The three first reservoirs of the Ottawa River reserve system, the Timiskaming, the Kipawa and the Quinze, which are under construction, will have a storage capacity of 168,000,000,000 cubic feet of water.

While for a certain number of years it will not be possible to operate these reservoirs at their full capacity, on account of timber to be cut around the reservoirs for the high reserve stage contemplated, time required to settle some of the land damages, possible deficiency of inflow during low springs and other causes, it is confidently expected that the winter flow can be so regulated as to make room for over 100,000,000,000 cubic feet of water at the end of the winter in the three reservoirs mentioned. The great benefit to be derived from this conservation of surplus water in the way of mitigation of floods, regulation of flow for power purposes, raising the low level plain in the navigable stretches of the river, can be secured at an estimated total expenditure of, say:—

Timiskaming dam	$200,000
Kipawa River dam	38,000
Gordon Creek dam (Kipawa)	40,000
Quinze dam	300,000
Damages, surveys, etc.	150,000
Total	$728,000

These dams will all be concrete permanent structures, with the stop-log type of sluiceways, well adapted to conditions on the Ottawa River. They will not therefore require frequent renewal as would be the case with timber dams, and will require only small expense for maintenance.

Other reserve dams will also be built of concrete, except in cases where it will be impossible to transport cement to the dam sites at a reasonable cost. The figures show that great benefits will be derived for a relatively low expenditure by the construction of the first three reservoirs of the reserve project under study, and that this expenditure will be well justified. The ultimate object is to benefit navigation, but in their operation due regard has to be given to other legitimate interests.

*606 Ashland Ave., Buffalo, N. Y.

A Cotton Storage Shed of Economical Design*

By E. S. Pennebaker, Jr. †

The Mobile & Ohio R.R. has erected a large cotton-storage shed on its docks at Mobile, Ala., to provide for the protection of cargoes of export cotton from damage by bad weather. It is a timber structure 135x410 ft., covering a smooth concrete floor, and fronting the Mobile River.

The building was erected and thoroughly equipped by labor contract, the railway company furnishing all materials. The work was done under the supervision of the construction department and completed in approximately 60 working days at a cost of 22.2c. per sq.ft. of floor area, exclusive of fire line and lighting, or at a total cost of 27.5c. per sq.ft. of floor area. This structure covers a floor area of nearly 1 1/3 acres, and has a capacity of 7000 bales of compress cotton piled single tier. It is provided with ample fire protection, is lighted with tungsten lamps, and is served with track facilities which reduce to a minimum the cost of shipside delivery.

As will be seen from Fig. 1, the butterfly type of roof has been utilized to advantage. This permits the employment of low-pitch, shallow-truss construction, effects maximum economy in roof-framing, sheathing, and roof-covering, and affords ample clearance for cars on either side of the building. In addition, the high eaves afford excellent light along the outside bays, and provide much better light throughout the interior bays than is ordinarily secured in buildings of similar width and height, with few skylights. The employment of this type of roof also obviates the necessity of guttering, the roof drainage being taken care of through downspouts in the valleys and subdrains to the river. All timber is long-leaf yellow-pine.

A roof load of 30 lb. per sq.ft. was assumed, about 20 lb. less than the ordinary practice for structures of this type. This 20 lb. represents the snow and sleet load, which can safely be eliminated along the Gulf Coast. The various items which make up this loading are as follows:

	Lb. per sq.ft.
[illegible]	4.00
[illegible]	10.00
[illegible]	4.50
[illegible]	4.50
[illegible]	8.00
[illegible]	8.50
Total	30.00

* Abstract of a paper read at a meeting of the Western Society of Engineers, Chicago, Sept. 14.

† Engineering Department, Mobile & Ohio R.R., Mobile, Ala.

Roof

The roof is carried on trussed beams of built-up section bolted together. These beams (Fig. 2) have a span of 30 ft., and are tied together the full width of the building in series of four trusses each. These series-trusses are spaced 20 ft. on centers, this arrangement of column spacing giving a 7½-ft. overhang of the eaves on the sides of the shed, and a 5-ft. overhang at each end.

In order to eliminate waste ceiling height and reduce the height of columns to an economical minimum, the 4x12-in. purlins, in addition to performing their primary function, act as struts for the trussed-beams. The main compression members of the truss consist of four pieces 2x6 in., bolted together through the columns and through fillers over the purlins. One of these pieces is a rafter moved a few inches from the regular spacing and bolted to the beam to insure additional strength.

The use of a beam of this type and of the same depth as the rafters, was primarily necessary as a detail of the type of construction adopted. It also accomplished economy in material and facilitated erection. In addition, it aided in securing the prompt delivery of material for the building, the timbers being stock size, readily available for quick delivery and at a reasonable price.

The tension in the trussed-beams is carried by 1½-in. round steel rods, which support the purlins on cast-iron bearing knees, and are connected with clevis-nuts and cotters at the ends to ⅝-in. steel plates, which are supported by the 2x12-in. longitudinal girders. Turnbuckles afford a means of adjusting the tension in the rods after the roof is swung. The four spans in the series-truss are securely tied together and fastened at the ends of the outside bays by a combination of a square nut and heavy cast washer, where the rods pierce the outside longitudinal girder.

The truss depth, center of beam to center of tension rod, is 19 in. The 4x12-in. purlins, with the 2x12-in. girders, are spaced 10 ft. centers. The column spacing of 20 ft. longitudinally was adopted largely because the limiting length of the purlin and girder designed for a roof loading of 30 lb. per sq.ft. is approximately 20 ft. The rafters were arbitrarily spaced 2 ft. centers.

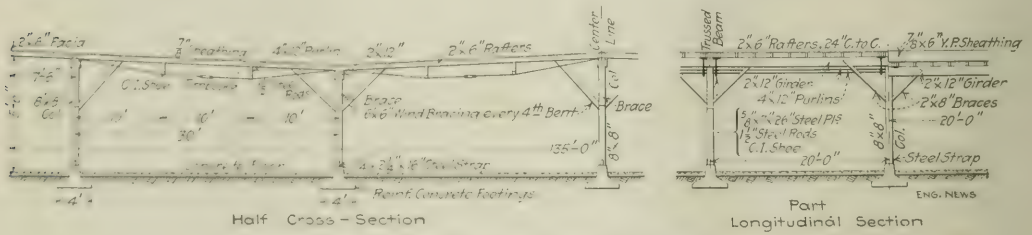


Fig. 1. Cotton Storage Shed: Mobile & Ohio R.R.

shed, it was thought best to adopt this size. Longitudinal 2x8-in. bracing is provided at every column, bolt-connected through the columns and through the two girders. Wind bracing of 6x6-in. timbers is provided at every fourth series-truss as shown in the cross-section in Fig. 1. Eave-ties, 2x8-in., have been placed at each of the outside columns on either side, the full length of the building.

The column footings are of slag concrete; 1 : 2½ : 5. They are designed for a safe crushing strength of 8 tons per sq.ft., and an allowable foundation pressure of slightly over ½ ton per sq.ft. The foundation is largely pumped-in river sand over clay and sand, and confined within timber bulkheads. As a precaution the bases of the footings (4 ft. square) were reinforced with ⅜-in steel rods arranged in two layers at right angles to each other, the rods in each spaced 6 in.

Floor

The concrete floor has proved to be economical and serviceable. It consists of a 4-in. slab of slag concrete (1 : 3 : 6,) with a 1-in. top of cement mortar, smoothly finished. The slab is cut into sections 10 ft. square to prevent cracking, and sufficient asphalt expansion joints

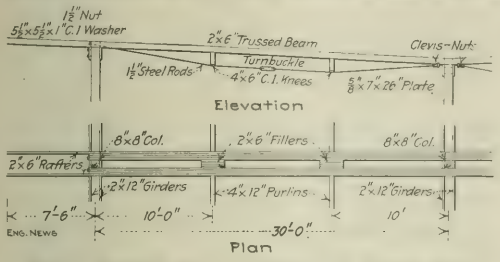


Fig. 2. Trussed Beam for Roof of Cotton Shed

are incorporated for safety. So far, the floor has stood well under very heavy trucking.

Roof Drainage

Galvanized iron downspouts, with roof-entrances capped with wire screens, are spaced 40 ft. apart along the two valleys of the shed. They are fastened to the columns with wrought-iron straps, and convey the drainage to vitrified-tile subdrains laid about 2 ft. below the concrete floor and carrying the water through the bulkhead to the river.

Fire Protection

The requirements of the Fire Underwriters for the protection of cotton-storage warehouses are unusually rigid, and the cost of fire protection is quite an item in a timber shed of this type. The building is equipped with a 4-in. fire line, supplied from the city mains, and tapped by six plugs. Each fire plug is equipped with hose supported on swinging bracket reels. In addition, there are 100 galvanized-iron fire buckets suspended from the columns for emergency use. One or two ships have been discovered on fire while loading cotton, and the fire line has rendered excellent service.

Lighting

During the busy shipping season, it is necessary for the steamers to work night and day taking on cargo. The lighting system includes tungsten lamps with Hubbell diffusive reflectors. A 100-watt tungsten light is suspended in the center of each one of the 84 bays, and the results obtained are satisfactory. Current is supplied by the city electric plant. Arc lamps are used along the pier fronting the shed.

Construction Cost

Detailed cost data were secured, and below are given a few of the unit costs covering material in place in the building; these indicate Gulf Coast costs. All common labor was negro labor. The figures do not include freight.

Reinforced-concrete footings for columns, $3.93 per cu.yd.; concrete floor (slag), 62.96c. per sq.yd.; lumber in place in superstructure, $20.73 per M.B.M.; steel rods, plates, etc., in place 4.61c. per lb.

Creosoted Wood Block Pavement Laid by City Day Labor in Minneapolis*

By Ellis R. Dutton†

The city of Minneapolis has at the present time over 1,000,000 sq.yd. of creosoted wood block pavement, laid by day labor.

In 1901, the city officials began investigating to find a better paving material. The sheet asphalt was unsatisfactory, being put in under a guarantee which was not lived up to, and holes remained in the paving for a whole season. The brick paving was too noisy and the sandstone blocks wore badly.

Quite a few people opposed creosoted wood block pavement, remembering the experience we had had with the old cedar blocks which had been used so extensively. Notwithstanding the opposition a street was paved in 1902, the city purchasing 4-in. southern yellow pine blocks treated with 12 lb. of "Kreodone" oil, which was a trade name for a better quality of creosote oil.

There were then laid 13,500 sq.yd. and the cost for the pavement, complete, was $2.79 per sq.yd., the city of Minneapolis doing all the work by day labor and purchasing the blocks at $1.95 per sq.yd., f.o.b. Minneapolis. These blocks were laid upon a 6-in. natural cement concrete foundation, over which was spread a 1-in. cushion of sand, upon which the blocks were laid at an angle with the curb of about 62°.

There were no cross expansion joints used, only a 1-in. joint on each side of the street next to and parallel with the curb. These joints as well as the joints between the blocks were filled with paving pitch, and the street was finished with a ¼-in. coating of sand to absorb the excess pitch on top of the blocks. In laying these blocks, we considered that it would be better to lay them at an angle with the curb instead of at right angles, both on account of the travel and also the expansion, and the correctness of the assumption has been proven by experience.

In the experimental blocks which were laid by the Forest Service, the creosoting company and the city of Minneapolis, observations made in 1912 prove

*Paper presented at the ninth annual convention of the American Road Builders' Association, Cincinnati, Ohio, Dec. 3-6, 1912.

†Assistant City Engineer, Minneapolis, Minn.

that it is better to lay the blocks at an angle of approximately 62° as that method shows less wear of the joints than any other. The pavement laid in 1902 has proved a complete success, as there have been practically no repairs on account of the blocks, and the wear has been only about ⅛-in. up to the present time.

This pavement looked so good and seemed to be so satisfactory, that in 1903 it was determined to lay more of this class of paving. Minneapolis is situated in a pine country and is one of the largest centers of pine lumber manufacture, so it was asked "Why not use our native Norway pine for the work?"

The matter was discussed and finally it was decided to use Norway pine, treated the same as the yellow pine. Accordingly, arrangements were made for the erection of a treating plant in Minneapolis, if the city would use 30,000 sq.yd. of creosoted Norway pine blocks. The price of this class of blocks was $1.64 per sq.yd., f.o.b. Minneapolis, using 12 lb. of "Kreodone" oil per cu.ft.

In the paving of Third Ave. South in 1903, there were left over from 1902 about 300 yards of the yellow pine blocks which were used in this street, and the remainder was Norway pine. In 1911, I took out some samples of these two classes of wood, which had received exactly the same travel and wear, and found that the yellow pine blocks showed a wear of ⅛-in. and the Norway pine blocks twice as much—¼-in. This was an actual comparative test of the two kinds of wood on the same street and under the same conditions.

In 1904 the price for blocks was $1.73 per sq.yd., f.o.b. Minneapolis, but there were proposals as low as $1.51 per sq.yd., using common commercial creosote oil. The engineers and the paving committee considered the higher priced blocks, treated with the best grade of oil, to be the better and cheaper. It was believed that the oil which contained the larger percentage of residue after distillation to 315° C. was the better. The cheaper oil showed 43% of residue and the best showed 70% of residue. The latter was used and there was much criticism made and much newspaper notoriety given the matter, but the wisdom of the purchase has been shown by experience.

The specifications of 1905 required an oil of a gravity of 1.09 at 20° C., and specified the fractional distillation percentages. These were the first specifications of the kind and they have been followed throughout the country ever since. The idea of specifying what is required should be adopted for all classes of paving and paving materials, as it places the contractors on an equal footing, and the municipality gets what it asks for provided the engineers know how to get it.

This brings up the question of inspection, and there is no class of paving that requires more rigid inspection than the creosoted blocks, and if it is possible to obtain a competent person to do the inspecting it is money well spent.

We raised the amount of oil per cubic foot to 16 lb. this year, as it was considered better to fill the wood more thoroughly and make the blocks more waterproof. This amount has not been changed since, though other cities have put in 20 lb. or more, which I think has caused other trouble.

We continued the use of Norway pine, tamarac and hemlock until 1911, when we returned to the yellow pine blocks which seemed to give the best results, especially on heavily traveled streets. We used a 3½-in. block on the lighter traffic streets. We have had no trouble with our creosoted block pavements, though on one particularly heavily traveled street the Norway pine blocks have worn about 2 in., and will soon have to be relaid.

On Jan. 1, 1912, we had a total of 968,000 sq.yd. of creosoted wood block paving, put in at a cost of $2,466,000, or an average of $2.52 per sq.yd. The prices have varied, as the prices of material varied, from $2.29 per sq.yd. in 1908 to $2.82 per sq.yd. in 1907. The price of the crushed limestone used in the concrete base averages about $1.75 per cu.yd. delivered on the street. The sand costs about 75c. per cu.yd., and portland cement has cost from 86½c. to $1.80 per bbl. delivered f.o.b. Minneapolis, depending on the year.

The cost of paving as given above includes the grading for the foundation, the laying of the concrete base, the paving blocks, pitch and all the labor connected with making a complete pavement. I have not heard of a city that gets as much for the money as we do. The city of Minneapolis does all of its public work by day labor and has done so for the past 12 years, with the exception of asphalt paving, which it could not do as it had no asphalt plant. The wages paid common labor in paving work have increased from $1.75 per day of 10 hours to $2.40 per day of 8 hours in 1912. The costs of skilled labor and teams have increased almost as much in proportion.

We have tried to eliminate the question of politics from the work, and have been partly successful, but the political question is the weak point in the day-labor system. All work is done under the direction of the City Engineer, but is ordered by the City Council through the various committees, such as water-works, sewer, paving, etc. All materials are advertised for and contracts awarded by the City Council. I think that as a general thing we get better work and better materials under this system than in much of the work done by the contract system.

To show the preference for the different kinds of paving, from 1902 to 1912, the following table is given:

Kind of Pavement.	Square Yards— Jan. 1, 1902	Jan. 1, 1912	Increase
Sheet asphalt	206,471	164,441	42,030*
Brick	171,144	390,869	219,725
Creosote blocks	.....	967,616	967,616
Granite blocks	156,994	403,915	246,921
Sandstone blocks	61,661	347,939	286,278
Macadam	129,305	335,159	205,854

* Decrease.

I think the people's preference for wood block paving has been largely on account of the success we have had, as we have had no "buckling," "bleeding" or other difficulties which have been experienced in other places.

There are several things necessary to properly construct a creosoted wood block pavement:

1—The proper kind and quality of wood.

2—The proper kind and quality of oil.

3—The proper amount of oil and treatment.

4—The blocks must be laid properly.

5—The joints must be filled properly.

6—The pavement must be cared for properly after construction.

I have touched on almost all of the points, and if they are looked after properly in a careful manner by competent persons, you will get the best pavement it is possible to obtain at the present time.

A Proposed Code of Ethics for Engineers

The committee appointed by the Council of the American Society of Mechanical Engineers to prepare a code of ethics for adoption by that society rendered a report on Dec. 9, with a draft of a proposed code, which it recommended should be submitted to the society's membership in advance of its adoption, to give opportunity for discussion and criticism.

In submitting its report to the Council, the committee urged that eventually such a code should be adopted by all the national engineering societies for the guidance of their members, and further, that since the same ethical standards and principles should be observed in all branches of the profession, eventually the societies should agree upon a uniform code.

In drafting the present code, the committee has endeavored to make it applicable to engineers generally and not to the special field of the mechanical engineer alone. The code follows:

A. General Principles

1. It is not assumed that this code shall define in detail the duties and obligations of engineers under all possible circumstances. It is an axiom that engineers in all their professional relations should be governed by principles of honor, honesty, strict fidelity to trusts imposed upon them and courteous behavior toward all. The following sections are framed to cover situations arising most frequently in engineers' work.

2. It is the duty of engineers to satisfy themselves to the best of their ability that the enterprises with which they become identified are of legitimate character. If an engineer after becoming associated with an enterprise finds it to be of questionable character, he should sever his connection with it as soon as practicable, avoiding in so doing reflections on his previous associates.

B. The Engineer's Relations to Client or Employer

3. The engineer should consider the protection of a client's or employer's interests his first obligation, and therefore should avoid every act contrary to this duty. If any other consideration, such as professional obligations or restrictions, interfere with his meeting the legitimate expectation of a client or employer, the engineer should so inform him.

4. An engineer cannot honorably accept compensation, financial or otherwise, from two or more parties having conflicting interests without the consent of all parties. The engineer, in whatever capacity, whether consulting, designing, installing or operating, must not accept commissions, directly or indirectly, from parties dealing with his client or employer.

5. An engineer called upon to decide on the use of inventions, apparatus or anything in which he has a financial interest, should make his status clearly understood by those employing him.

6. An engineer in independent practice may be employed by more than one party, when the interests of the several parties do not conflict; and it should be understood that he is not expected to devote his entire time to the work of one, but is free to carry out other engagements. A consulting engineer permanently retained by a party, should notify other prospective clients of this affiliation before entering into relations with them, if, in his opinion, the interests might conflict.

7. Before any consulting engineer takes over the work of another consulting engineer he should ask the client his reasons for desiring to change engineers and unless the consulting engineer is entirely satisfied that the client has good and sufficient reasons for making the change he should confer with the present incumbent before accepting the work.

8. Consultations should be encouraged in cases of doubt or unusual responsibility. The aim should be to give the client the advantage of collective skill. Discussions should be confidential. Consulting engineers should not say or do anything to impair confidence in the engineer in charge unless it is apparent that he is wholly incompetent or the interests of the profession so require.

9. Engineers acting as experts in legal and other cases, in making reports and testifying, should not depart from the true statement of results based on sound engineering principles. To base reports or testimony upon theories not so founded is unprofessional.

10. An engineer should make every effort to remedy dangerous defects in apparatus or structures or dangerous conditions of operation, and should immediately bring these to the attention of his client or employer. As failure of any engineering work reflects upon the whole profession, every engineer owes it to his professional associates as well as to himself that a reasonable degree of safety be provided in all work undertaken.

C. Ownership of Engineering Records and Data

11. It is desirable that an engineer undertaking for others work in connection with which he may make improvements, inventions, plans, designs or other records, should first enter into an agreement regarding their ownership.

12 If an engineer uses information which is not common knowledge or public property, but which he obtains from a client or employer, resulting in plans, designs or other records, these should be regarded as the property of his client or employer.

13. If a consulting engineer uses only his own knowledge, or information which by prior publication, or otherwise, is public property and obtains no engineering data from a client or employer, except performance specifications or routine information; then in the absence of an agreement to the contrary, the results in the form of inventions, plans, designs or other records should be regarded as the property of the engineer, and the client or employer should be entitled to their use only in the case for which the engineer was employed.

14. All work and results accomplished by an engineer in independent practice in the form of inventions, plans, designs or other records, which are outside of the field of engineering for which a client or employer has retained him, should be regarded as the engineer's property unless there is an agreement to the contrary.

15. When an engineer or manufacturer builds apparatus from designs supplied to him by a customer, the designs remain the property of the customer and should not be duplicated by the engineer or manufacturer for others without express permission. When the engineer or manufacturer and a customer jointly work out designs and plans or develop inventions, a clear understanding should be reached before the beginning of the work regarding the

respective rights or ownership in any inventions, designs or matters of similar character that may result.

16. Any engineering data or information which an engineer obtains from his client or employer, or which he creates as a result of such information, must be considered confidential by the engineer; and while he is justified in using such data or information in his own practice as forming part of his professional experience, its publication without express permision is improper.

17. Designs, data, records and notes made by an employee and referring exclusively to his employer's work, should be regarded as his employer's property.

18. A customer, in buying apparatus, does not acquire any right in its design, but only the use of the apparatus purchased. A client does not acquire any right to the plans made by a consulting engineer except for the specific case for which they were made, unless there is an agreement to the contrary.

D. The Engineer's Relations to the Public

19. The engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, to extend the general knowledge of engineering, and to discourage the appearance of untrue, unfair or exaggerated statements on engineering subjects in the press or elsewhere, especially if these statements may lead to, or as made for the purpose of, inducing the public to participate in unworthy enterprises.

20. Technical discussions and criticisms of engineering subjects should not be conducted in the public press, but before engineering societies or through technical publications.

21. It is desirable that the first technical descriptions of inventions or other engineering advances should not be made through the public press, but before engineering societies or through technical publications.

22. It is unprofessional to give an opinion on a subject without being fully informed as to all the facts relating thereto and as to the purposes for which the information is asked. The opinion should contain a full statement of the conditions under which it applies.

23. Engineers engaged in private practice should limit their advertising to professional cards and modest signs in conformity with the practice of other professions.

E. The Engineer's Relations to the Engineering Fraternity

24. The engineer should take an interest in and assist his fellow engineers by exchange of general information and experience, by instruction and similar aid, through the engineering societies, the engineering schools or other means. He should endeavor to protect all reputable engineers from misrepresentation.

25. The engineer should take care that credit for engineering work is attributed to those who, so far as his knowledge of the matter goes, are the real authors of such work.

26. Criticism of the work of one engineer by another should be based upon adequate knowledge of the facts, plainly stated. The success or failure of one member reflects credit or discredit on the whole profession.

27. The attitude of superiors toward subordinates should be that of helpfulness and encouragement. The attitude of subordinates to superiors should be one of loyalty and diligent support. The treatment of each by the other should be open and frank.

28. The attitude of an engineer toward contractors should be one of helpful coöperation. Tact and courtesy should be combined with firmness. An engineer should hold a judicial attitude toward both parties to a contract for whose execution he is responsible.

29. An engineer in responsible charge of work should not permit non-technical persons to over-rule his engineering judgment on purely engineering grounds.

F. Interpretation

30. If two or more engineers, members of this society, disagree as to the interpretation of this code, or as to the proper rules of conduct which should govern them in professional relations to each other, they may agree to refer the matter to a standing committee of the society on the interpretation of the code. Each party shall submit a statement of his position in writing, and the committee shall render a decision. A permanent record shall be made of the cases so submitted and decided.

31. Amendments or additions to this code may be made by the standing committee on interpretation of the code, subject to the approval of the Council.

Chas. Whiting Baker, *Chairman*
Chas. T. Main,
E. D. Meier,
Spencer Miller
C. R. Richards.
} *Committee on Code of Ethics*

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The Port of Para, Brazil, is very completely and interestingly described in the October, 1912, "Bulletin" of the Pan-American Union. Para is on the Para River, which belongs to the Amazon system, though not on the main outlet to the largest river bearing that name. It was established as a town as far back as 1700, and has taken its place as the largest rubber shipping port of the district. In 1910 the vessels entering the Port of Para numbered 1969 steamers and 1668 sailing vessels with a total tonnage of nearly 1,500,000 tons. The opening of the Madeira-Mamoré Ry. promises to add considerably to the use of the port.

In November, 1907, work was begun on a system of docks with accessory appliances, which provide permanent facilities for the present traffic of the city of Para, as well as for the traffic present and to come from that immense area known as the Amazon Valley, and although addition must later on be made to the docks as they exist now, yet the unit of improvement has been established and further expense should be nothing more than a duplication of that unit. The work is being carried on under an American corporation holding its concessions from the federal government of Brazil. To it is given a monopoly of the port services, construction, and operation of quays, warehouses, and other works at Para within a zone of 18 miles toward the ocean and 12 miles in the other direction, for a period of 65 years, and this period is to extend to 90 years after the completion of the second section of the work.

The main channel to the port has a depth of 30 ft., and a total width of about 400 ft. between chanel-line buoys. This leads up to the dock, which consists of about one mile of quay wall for ocean-going steamers where there is a depth of 30 ft. at low water of ordinary spring tides. In addition, there is 722 ft. of quay wall for river steamers with a depth of water of 12 ft. and 1500 ft. of quay wall for still smaller river steamers with a depth of water of 9 ft. 6 in. The quay walls are built of large concrete blocks. Back of the quay is a well paved platform or roadway on which are warehouses and freight handling machinery. Beyond the warehouses on the city side of the port works proper is a newly paved road about a mile long and 60ft. broad, making both a boulevard and, with the trees which are being planted, a future park.

In addition to the port works proper, the company is building a ship repairing depot with floating drydocks and necessary shops.

The first section of the port works was formally inaugurated in October, 1909, and work is now going on toward the final completion. The article in the bulletin is written by Albert Hale of the Pan-American Union staff.

A New Design of Centrifugal Dredging Pump

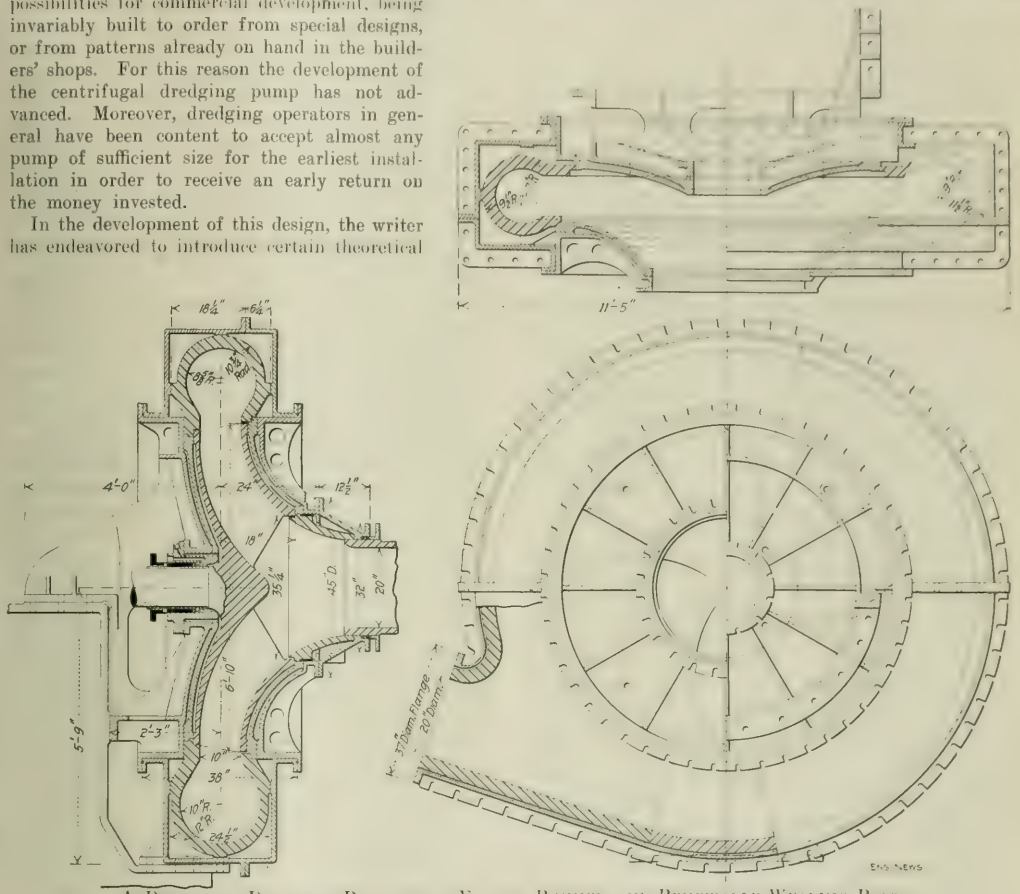
By H. S. New*

The development of the centrifugal pump for clear water during recent years has attained a very promising status, due in a measure to the fact that this service offers the best commercial field. Dredging pumps of this type are in a special class and offer extremely limited possibilities for commercial development, being invariably built to order from special designs, or from patterns already on hand in the builders' shops. For this reason the development of the centrifugal dredging pump has not advanced. Moreover, dredging operators in general have been content to accept almost any pump of sufficient size for the earliest installation in order to receive an early return on the money invested.

In the development of this design, the writer has endeavored to introduce certain theoretical elements without interfering with the practical features so necessary in a dredging pump. The aim was to produce a pump as near the volute type as possible, with the volute portion renewable and permitting of such alterations in its shape and design as experience would demand, without requiring a change in the exterior of the pump and its outside connections or fastenings. It is understood that the peripheral volute linings can be made of any metal desired and with a minimum of machine work.

A dredging pump must not only be an efficient power consumer, but it should permit of easy and quick renewals at low cost. It is the enormous wear on this type of pump and not the cost of driving that is the main feature of expense.

The service conditions met with in hydraulic dredging are so varied and the character of the materials handled so dissimilar, that a strictly theoretical design for this service would be useless, if not impossible. It therefore becomes necessary for the designer to be perfectly familiar with the conditions of service, and then to introduce as much of the theoretical in the design as knowledge of working conditions permits.



A Design of Dredging Pump with Volute Runner and Renewable Wearing Parts

The dredging pump of the present day is a single-stage, low-speed or high-speed type required to pass and propel material mixed with water, varying from silt, mud, sand, clay, roots, gravel, coral, small boulders to a miscellaneous assortment of foreign things often encountered during dredging operations. Some of the latter are a real menace, oftentimes causing instant destruction of the pump and loss of complete plant.

A dredging pump is required to propel material of specific gravity of 1.0, and above, through a winding pipe line the length of which may be anywhere from 500

*90 West St., New York City.

ft. or less, to 6000 ft., lifting it from depths of 30 to 40 ft. and discharging anywhere from zero to 50 ft. above the center of the pump. These conditions vary from hour to hour. It may thus be realized that a dredging pump can never be made to attain the efficiencies secured with the clear-water types, and simplicity in design and construction is imperative. Some parts will meet with considerably more wear than others, and even the same part at different stages of operations will work under entirely different conditions. For these reasons the writer has endeavored to produce a pump which will meet these peculiar conditions, the several parts being easily replaced and by members whose design may be altered in accordance with the lessons to be learned from the practical side. These alterations in the pump should not interfere with the operations of the plant to a greater extent than required for the change of substitution of parts. The largest pieces of the pump must be of weights and dimensions that permit handling by gear readily available for the purpose; a differential block and trolley beams are of invaluable assistance.

The design presented herewith is a development of a design of pump which met with extremely severe conditions on the New York State Barge Canal, and is now in successful operation there. The pump during one month handled 201,000 cu.yd. of stiff clay and large gravel through a pipe line 1000 ft. long, dredging at a maximum depth of 12 ft. and discharging 25 ft. above the water surface. The total number of hours during which the pump operated in the month was 520.5, making an average of about 283.5 yd. excavation per hour run. This pump, however, was not a volute type; the runner was 68 in. in diameter, used at 220 r.p.m.

The new pump (see accompanying figure) consists of a light exterior casing of cast iron inclosing the wearing parts of the pump proper. It will be seen that for the same casing we may alter the size of the pump, so to speak; that is, this particular design shows what is known as a 20-in. pump, but we can insert an entire new interior of smaller or larger size, making either a 24-in. or a 16- or 18-in. pump. It would seem absurd to have such a larger outer casing for the smaller size of pump, but if we had the large pump on hand, and desired to build a smaller dredge, it would be a very easy matter to design an interior of small size to suit the casing on hand, and by this means save money.

The outer casing is composed of the peripheral portion made in four parts, split in a horizontal plane through the center, and vertically through a plane at right angles to the shaft. The line of vertical division is towards the front, making these parts of unequal size. The covers are in circular pieces suitably ribbed and dished in form, carrying the liners which are bolted to them with taper bolts having no heads. The contact surfaces between liners and covers are made a minimum so that cost of machining may be reduced. The volute lining may, or may not, be bolted to the outside shell; if the bolts are used, taper bolts without heads and flush with the inside surface should be adopted and located where they will receive the least wear. It will be seen that the contact surfaces between the volute lining and shell are very small, and have the merit of minimum machining. The cover linings are shown in one piece, circular and dished, following the shape of the covers, the thickness and kind of material to be determined from the service and type of impeller. It is possible also to use an open impeller or runner if desired. The volute linings are in three pieces, one being a little over 90° in extent, another a complete half circle, while the third is of shape to conform with the discharge. A groove is cast in the ends of each volute lining where they butt together, and when set up in the pump, babbitt or other metal is run in the joints to insure a complete continuous inside surface to carry the dredged material.

The back cover is strongly formed to provide sufficient pads for bolting to the bedplate of the driving engine. The ribs have lightening holes available for convenience in bolting up during erection. Arrangement is also provided for attachment of tackle during the assembling. On the bottom section of the rear peripheral casing is a large pad for supporting and fastening the pump. Parts which have to be frequently taken apart are provided with slotted holes requiring only slacking of the nut on the bolt to permit the bolt to be quickly removed, also avoiding the danger of losing the nuts where the plain holes only are used. To the back cover is bolted a stuffing box carrying the gland through which the runner shaft passes; this stuffing box is fitted with a perforated bronze ring, and supplied with water under pressure. The front cover has bolted to it the tapered pipe carrying the suction liner, vanes or lugs extending on the inside and engaging similar vanes from the outside of the suction liner to keep the latter from turning. The front cover has also an internal gland for setting up packing on the outside of the suction liner; adjustment of this gland is made by bolts passing through bosses on the outside of the taper pipe. Inside the taper pipe and suction liner is a sliding pipe fitted with gland and packing, thus insuring a flexible connection to the dredge hull. Square packing is fitted in grooves turned in the flanges which match the flanges of the covers, similarly packing of this kind is provided in the cover liners where they bear against the volute linings. This style of packing might also be used where the volute linings bear against the sides of the outer casing for a good bolting cushion.

The impeller and shaft are cast in one piece. For the gland, a bronze sleeve is shrunk on the shaft, spare sleeves being kept on hand for replacement.

There are several details of construction not shown in the accompanying figure, and only the principal dimensions are given. The object has been to illustrate as near as possible a type of pump which might be termed "universal" in a sense; that is, the direction of discharge may be to right or left, the angle of discharge with slight alteration to patterns may be varied, also the size and shape of the lining may be varied without affecting the installation in the dredging plant. The cost of this pump will necessarily be slightly in excess of the general run of dredging pumps sold today but the cost per pound will be no more. The saving in a year will amount to the cost of several of the other types.

For any inclined to experiment with this pump, the volute lining could be made up of reinforced concrete in one piece without any great danger, as the writer has in mind where a pump was repaired with concrete until the spare part could be delivered.

EDITORIALS

A new use for steel plate has been found within the past few years, but it is not likely to make any great disturbance in the metal market. Dr. W. A. Lane, a noted surgeon of London, England, is given credit for introducing the use of vanadium-steel plates as reinforcements in setting fractures of the long bones. The process is thus described in the New York *Times*:

> Instead of treating fractures of the bone by the usual splint and extension methods, he cuts down to the seat of the fracture, bores holes in the ends of the bones and applies plates of vanadium steel, known as Lane's plates, which are screwed to the bones. He then closes the wound, applies a dressing, and then puts on the customary plaster cast. Sometimes these plates are left in place indefinitely, but sometimes it becomes necessary to remove them.

A member of the editorial staff of this journal, on visiting the well equipped hospital of the up-to-date construction camp of the U. S. Reclamation Service, at the site of the Arrowrock Dam, near Boise, Idaho, was told by the surgeon in charge that he had recently used steel plates after the general method described. The result was eminently successful, but the patient could not be easy-minded with a piece of steel screwed to his anatomical structure, and so the surgeon removed it—one of the cases of necessary removal mentioned in the foregoing quotation, but a necessity of the brain rather than of the bone.

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More Concerning the Everglades Drainage Work

Most of our readers will recall the articles published during the past year in this journal with reference to the work the State of Florida has attempted looking to the drainage of the Everglades, and our comments on the land sales which have been made in anticipation of this drainage work being completed.

According to an advertisement published in the *Everglade Magazine*, a journal published in Chicago devoted to the promotion of the Everglade reclamation, one of the large companies which has been selling land in the Everglades, has decided to undertake drainage work on its own account. The advertisement says:

> In view of persistent reports to the effect that the State's final drainage plan may be considerably delayed, the Everglades Sugar & Land Co. has decided to anticipate complete drainage of its own land and to that end has authorized a bond issue of $500,000, or approximately $20 per acre. It is the plan of the company to build dikes completely around its land, construct interior canals and a network of large laterals. The plans also call for the installation of enormous pumps with sufficient capacity to remove the excess rainfall should the outlet canals and the dikes of the State prove to be inadequate to accomplish this result by gravity.

It is fair to say, in justice to this company, that it has employed engineers to investigate and report upon the sufficiency of the general drainage plan adopted by the state. We can, of course, pass no opinion here upon the soundness of the company's plan; but at least its proposal is an indication of a desire to protect those who have purchased its lands.

Water-Supply Problems in Westchester Co., N. Y.

A continuous-performance water shortage in parts of Westchester County, N. Y., calls attention to what is alleged to be a double injustice. The City of New York, it is claimed, first appropriated nearly all the available sources of water-supply in the county named, and then, when the legislature made it compulsory for New York City to sell water to municipalities in Westchester County, succeeded in getting the price for water thus sold at wholesale fixed at the price charged private consumers at meter rates in New York City—which is $133 per 1,000,000 gal.

It is an ill wind that brings no one luck. The lucky ones in this case, it is alleged (New York City not caring to sell water to outsiders) are several private water companies in Westchester County, which have recently raised their water rates. But these water companies have had their own troubles with water shortages.

One rational solution of the whole problem would seem to be public ownership of all the water-works in the country, and the formation of a county water-supply system, owning and operating supply works only, leaving distribution systems to local ownership and operation. The county organization might then be able to secure amendatory legislation which would permit it to buy water from New York City at a fair price (whatever that might prove to be) instead of an arbitrary one. Failing that, it could, perhaps, provide a supply of its own. Still another plan, which has much in its favor, would be to put the whole matter of water-supply and water-rate adjustment under the control of the State Conservation Commission, successor to the Water Supply Commission.

First and last, there has been altogether too much political and private chicanery over water-supply sources for old New York, Brooklyn and Westchester County. The use of needed sources of supply for Brooklyn, on eastern Long Island, and for New York, in Dutchess County, were prohibited by the legislature, years ago, in the alleged interests of the country districts, but apparently with more desire to help out various private water-supply schemes. Whether the present legislative rate for water supplied by New York City to Westchester County communities was designed more to aid private water companies in that section than to protect New York City, we do not know.

Two things are certain, and these it is which justify discussion here of a situation which otherwise is mostly local: (1) The Conservation Commission or the up-state Public Service Commission should control these local conflicts over water-supplies and water rates, instead of the legislature; and (2) some, if not all, of the communities in Westchester County have been woefully deficient and negligent in making their plans for future water-supplies.

The Status of the Engineer

It is the custom of business firms at some time during the year to make an inventory of their assets, as it is commonly called, "take account of stock." They thus find where they stand and whether they have gone forward or backward during the year past. It seems appropriate for the engineering profession at the opening of a new year to undertake a similar investigation. Even though some engineers may object that it is unnecessary for them to inventory their assets, since they represent what mathematicians call a vanishing quantity, it is at least worth while to consider the profession's present condition and prospects.

And at the start it may be said that the outlook for engineering activity at the opening of the new year has seldom been more favorable. The enormous harvest of 1912 with high prices for farm products have laid a foundation for prosperous business which neither the vicissitudes of political change nor the exploits of high financiers seem able to shake. While the ominous shadow of a dark war cloud darkens the European situation and affects financial markets the world over, peace and tranquility prevail in our own favored land. Activity in engineering work, we need hardly say, is closely bound up with prosperous business conditions, particularly in the work of the civil engineer.

So far so good, but is the engineer justified in stopping at this point? Must he not if he is to make a true inventory, consider not merely the outlook for employment but the conditions under which he and the profession at large are carrying on their work? There is, we believe, substantial unanimity among all the members of the profession, in the higher ranks as well as in the lower, that present conditions leave much to be desired.

For one thing, to refer to a subject often mentioned in the pages of ENGINEERING NEWS, engineers should have a larger voice in the settlement of important public questions in which technical matters are concerned. Money is being wasted by the millions in the expenditures of the national government, of states and of cities, to say nothing of private corporations, for lack of competent engineering design and construction.

The engineer was long ago defined as the man who makes a dollar earn the most interest; but the engineering profession sees millions of dollars expended where they can earn no income, or only a very small one, where sound technical planning would have turned a loss into a profit. This condition is, in fact, a subject of frequent discussion among engineers. Some of the engineering societies have standing committees on the public relations of the engineer. Of many important public questions no correct solution is possible without the aid and advice of the informed and experienced expert engineer.

Unfortunately, the public has little understanding of this fact. It blindly gropes about, placing its trust on this politician, or that business man, or the other high financier. The public knows or thinks it knows men of this sort because it has heard them talked about in the newspapers, but the public knows little or nothing as to the names of the men who are the leaders in the engineering world today.

We are confident that many times the public would be glad to employ and to place its confidence in high-class engineers; but it does not know how to go about the work of selecting the real engineer from the pseudo-engineer.

Turning now to another sore spot of the engineering profession, it is a fact that the compensation of engineers, taking the profession as a whole, is inadequate to the responsibilities that they carry, and is far below that enjoyed by men who contribute far less to the world's welfare. Exceptions to this rule are found in the case of engineers who have abandoned purely technical work, and who hold high executive positions, or who are carrying on some line of business.

Of course, it must be recognized that the rewards to be gained by either salaries or fees by a man engaged in strictly professional work are never likely to compare with those enjoyed by a successful business man. In the medical profession, famous surgeons can command enormous fees as the price of saving the lives or limbs of wealthy patients; and in the legal profession, famous lawyers have no difficulty in collecting enormous fees from large corporations who find themselves in legal difficulties. But the man who approaches a consulting engineer is in no such frame of mind as the one who approaches the great surgeon with a plea that an effort be made to save his life, or the noted lawyer with the demand that an opponent be defeated in the courts no matter at what cost. In contrast with the fees of famous lawyers and physicians, it may be said that the engineer's fee is always weighed, measured, and parted with reluctantly by the client.

Besides this, there is to be reckoned with, the overcrowding of the profession, a chronic state which the United States shares in common with all other civilized countries, and which there is no prospect of changing.

There is, however, another point of view from which to look at these handicaps of the engineering profession—liabilities, if we may so term them in our inventory. Even though we cannot expect the client to approach the engineer willing to part with any amount of wealth to save his life or win his case, it is still not impossible that the public may yet come to have a better appreciation of the real value of high-class engineering service.

Again, while the profession is from one point of view overcrowded and there are a host of applicants for every engineering position paying a good salary, it is also true that the man who has the responsibility of selecting an engineer to take difficult and responsible work, either executive or technical, is very apt to find considerable difficulty in obtaining a man in whom he can place entire confidence. Perhaps there are in the entire ranks of the profession plenty of men able to give efficient service in every engineering position, but where shall one look to find them and how can their qualities be determined? In all the array of testing machines in our engineering laboratories, there is no machine which will infallibly weigh the abilities of engineers themselves.

We believe that three-quarters, if not nine-tenths, of the engineers in the profession who have thought of these matters believe that the profession itself ought to do something to better its status. As an indication of the direction in which men's minds are running, we print below a letter recently received in which the situation of the profession is squarely presented. We believe ENGINEERING NEWS can render no greater service to its readers than by having this letter before them and emphasizing the importance of its contents.

Sir—During recent years there has been considerable discussion about the status of the Civil Engineer and his compensation. Many remedies for existing conditions have been proposed, but excepting measures discussed by a few local engineering clubs, no concerted action to better these conditions has been attempted.

Both the expert at the head of the profession and the man at the opposite end of the line have suffered from a lack of knowledge and appreciation by the public of his work. In too large a percentage of cases today, the decision of the larger questions involved in the solution of great engineering problems—questions needing the best knowledge of our leading expert engineers—is made by boards of lawyers, doctors, merchants—in fact by anybody except the engineer.

Believing that some action should be taken in this matter, and that this action should be by the body most representative of the engineering profession in this country, the writer introduced the following resolutions at the annual meeting of the American Society of Civil Engineers last January.

That the President appoint a Committee of eight members to look into the conditions of employment of Civil Engineers throughout the country, the compensation they receive, the duration of employment, the expenses for which they are reimbursed by the employer, the expenses due to the work paid by the engineers themselves, the net yearly income, the prices charged for different classes of private work, and any other facts necessary to clearly set forth the problem. The report to set forth recommendations for action by the Society looking toward improving existing conditions and to include a report on the feasibility of this Society operating an employment bureau for its members covering all classes of engineering work. The Committee to consist of four employing engineers and four engineers holding subordinate positions. The Committee to be authorized to add to its membership and to fill vacancies. A preliminary report to be rendered in six months.

This resolution was referred to the Board of Direction which reported at the August Convention as follows:

(1) That it does not feel that it would be practicable or wise for the Society to operate an employment bureau for its members.

(2) That it feels that it would be of valuable interest to the Society to know the conditions of employment and the compensation of Civil Engineers throughout the country.

(3) That it, therefore, recommends to the Business Meeting of the convention that the matter be referred back to the Board with instructions to appoint a Committee to investigate the conditions of the employment, and the compensation of Civil Engineers throughout the country; to collect statistics and data in regard thereto, and to report the results of such investigation to the Society.

The Society approved the action of the Board; and the Committee for this work will soon be announced. As this matter affects vitally every member of the profession, both in and out of the Society, it seems wise to call attention to the work before this Committee through ENGINEERING NEWS.

It is not expected that any radical action will result from the report of this Committee, but rather that the facts in the case will be established, and that these facts will aid us to determine what action should be taken to bring about the desired results. For undoubtedly there is a long campaign before us before the public can be brought to grant the engineer the authority in engineering matters which should be his, and proper compensation for his services.

It seems desirable that engineers should generally interest themselves in this matter, should secure data for the Committee, should propose lines of action for bettering conditions, and subject all these measures to thorough discussion, both before the Society and in the engineering clubs and papers. To invite such discussion is the object of this letter. To this end a few lines of action are suggested.

1. The American Society should outline and publish sets of standards on engineering ethics, compensation for private work, salaries for various grades of engineering, and classes of allowable expenses for engineers employed upon various work.

These standards should be drawn up simply for reference, in order that the engineer may have a guide as to what the majority of engineers judge to be just and right, the same as he now has a guide in the Society's specifications for cement, etc. While no one would be obliged to adopt such standards, they would be a means of gradually eliminating some of the worst cases of low compensation, would aid engineers dealing with small cities and towns, and by their revision from time to time would furnish a means of increasing the compensation for the entire profession.

Disagreements over allowable expenses cause considerable friction in many engineering organizations. It would seem advantageous to have the Society establish classes of expenses, enumerating in detail for each class what is allowable. An employer offering employment could then specify so much salary and expenses as per Class A (or B, C, etc.) American Society Standard, thus making the term "expenses" perfectly definite.

We need a Code of Engineering Ethics published by some engineering body large enough to represent fairly the profession in this country. Many existing ideas relative to engineering practice seem to need revision.

2. Our present method of marketing engineering services of all grades is extremely crude, unbusinesslike and wasteful, and gives strong color to the often repeated statement that engineers are not fitted to be put in charge of large business matters. Some central body should be created where an engineer's qualifications and references may be kept on file and where employers may seek such services as they need, whether these employers be city authorities seeking expert advice or a chief of party looking for a good transit man.

3. Organized influence should be used to have disputes over purely engineering matters taken from the courts and referred to boards of engineers for arbitration.

4. Engineers as a body should investigate cases like that of the dismissal of C. G. Elliot from the Government service and then should actively aid the side of justice. Assuming the American Society to be the instrument used for this purpose, and if after investigation an engineer should be found guilty of unprofessional conduct or worse, then he should be expelled from the Society, but if not guilty the Society should actively support him.

In fact, we have arrived at a stage where concerted action on the *human* side of engineering is necessary. Some organization of engineers must soon take up this work. As the American Society of Civil Engineers is already in the field with a large membership and an effective organization, it would logically seem to be the proper body to undertake this work. If, however, it should decide that it is unwise for it to undertake such action, then a new organization is needed, and will undoubtedly develop.

PERCIVAL M. CHURCHILL.

Elmwood, Mass., Dec. 2, 1912.

Two or three of the specific matters considered by our correspondent in the letter above deserve special comment here. First, as to a proposed code of engineering ethics: It will be of interest to put on record here the fact that the American Institute of Electrical Engineers, after a long period of discussion and consideration, has formally adopted a code of ethics for the guidance of its members. The Boston Society of Civil Engineers, also has had a committee at work for several months on the preparation of a code for adoption by that Society, which code is, we believe, practically completed.

The American Society of Mechanical Engineers nearly a year ago appointed a committee to investigate and report as to whether it was advisable for that Society to formulate and adopt a code of ethics. The committee rendered a report favoring such action, and thereupon a second committee was appointed to prepare such a code. This committee reported to the Society's Council on Dec. 6, the code which it had drafted and which is based upon the code already adopted by the Institute of Electrical Engineers and that now pending before the Boston Society. Prior to the formal adoption of the code by the Mechanical Engineers' Society, it is to be printed and distributed to the members in the January issue of the Society' *Journal*, and will be open for discussion, criticism and amendment. It is printed on another page of this issue of ENGINEERING NEWS.

It may be said here that this committee in presenting its report especially recommended that in its opinion the different engineering societies should unite in the adoption of a standard code applicable to engineers in all branches of the profession. The drafting of the present code, it is hoped by the committee, may be a step in this direction.

With reference to the question, still more or less debated, as to whether it is any part of the duty of an engineering society to formulate a code of ethics, the committee urged that it is as much the function of an engineering society to place in the hands of its younger members at least, information as to what constitutes proper professional practice in the relation of engineers with each other and with the public as it is to furnish them with standards for their guidance in conducting their technical work.

This is a point often overlooked by older engineers in their consideration of this matter. It is true that the engineer of long experience and high professional standing needs no written code to guide him as to what is proper professional conduct. He has acquired this knowledge, unconsciously often, by his years of experience in contact with other members of the profession. The engineer young in years and experience lacks just this knowledge. He seldom errs through intention, but through ignorance.

In the second place we wish to direct special attention to our correspondent's proposal above that the National engineering societies should establish exchanges for the marketing of engineering services of every sort. We believe if this work is carried out as it might be and as it could be, it would be of greater value to the engineering profession in improving the status of its members than any other work which the engineering societies could possibly undertake. We will go further and say that it would be of greater importance and value to engineers than any and all the work which the societies are now doing, beneficial and important though that is.

As many of our readers will recall, in our issue of Aug. 17, 1911, (p. 210) we discussed this subject at much length and explained the general plan on which such an enterprise could be carried out with a certainty of success.

Let us make the situation definite. Within the past month there have come to us a number of applications from parties desiring to engage engineers for important and responsible positions. During the same time there have been as many or more inquiries from engineers desirous of securing positions. In not a single case, however, did it happen that an applicant had the special experience necessary for any of the positions for which candidates were desired.

This experience is, we need hardly say, not exceptional but typical. Every engineer of wide reputation is in constant receipt of letters from those who desire to secure professional employment and also of letters and inquiries from parties seeking engineers. It would be worth a great deal to hundreds of busy engineers if they were able to refer both classes of applicants to a high-class central bureau to which a man desiring a position could resort without the slightest loss of professional prestige, and to which the client or the employer desiring engineering services could go with confidence that he could there secure the special type of man he stands in need of.

Is not the position of the engineering profession, when one stops to consider, little short of absurd at the present time? Engineers complain because the public does not appreciate the difference between the high-class engineer and the amateur: between the engineer of education, experience, and intelligence, and the man who conceals a vast array of ignorance and incompetence behind a promising exterior and a valuable tongue. But how is the layman who desires to employ an engineer, to know where to find competent men of professional standing? Has the profession ever provided a place where those who desire engineering service could go, with confidence that high-class men could there be procured?

There is serious complaint in the engineering profession that engineering is becoming a commercialized business, that the independent engineer can no longer meet the competition of the big engineering companies which employ dozens or hundreds of engineers on a salary.

But the gravitation of engineering work to these big combinations is as natural a result as the fall of the apple to the ground. The public has little knowledge of engineering matters. All engineers look alike to it, and it is equally distrustful of all. It places its confidence in the big engineering combination because it feels that behind that combination there is capital and responsibility. The public knows how to find this concern, but it does not at all know how to find the independent engineer even though be could by his personal interest in the work give better results to the client than the big engineering combination.

There are many other matters that might be touched upon in discussing this need. We will mention at this time only one other, and that is the stimulus which would be given to the growth and standing of the engineering societies in the profession were such a plan successfully carried out.

With all that the national societies are doing for the profession and for their members, it cannot yet be said that they comprise anything like the proportion of the active membership in the profession that they should. Hundreds and thousands of engineers remain outside of the societies or drop out after holding membership for a time because they feel that what they receive is not worth what it costs. But if the national societies were to undertake such a work for the whole profession as is outlined above, it would be recognized by engineers of all classes that here was an achievement the value of which none could gainsay.

We believe, moreover, that such a plan as we here outline would have greater effect than any other possible action that the profession could take to secure an increase in compensation for engineers. We believe the public willing to pay a fair price for high-class engineering service when it can be assured that it is actually receiving it.

On the other hand, it is also true that to raise the compensation of engineers would enable them to do better work. If the engineer is to deal successfully with the large questions on which he alone is competent to pass judgment, he must be able to be a man among men; he must have a position of reasonable independence, financially and otherwise. And the converse proposition is equally true. It is only human nature to set a low value on that which costs us little. In order that the public shall properly appreciate the value of engineering service, it is necessary that the compensation of engineers shall be put upon a proper plane.

LETTERS TO THE EDITOR

The Lake with a Long Name

Sir—In your issue of Dec. 5 you say that the draftsmen plotting the surveys on the extension of the Grand Trunk Ry. system to Providence, R. I., were unable to spell the name of Lake Chaubunagungamaug. May I suggest that what the draftsmen really stumbled over was not the abbreviated name of this lake, which you give as above, but its full name, which is Chaugoggomauchaugchaubunagungamaug!!

I learned the name of this lake from an old inhabitant while I was engaged in the construction of a waterworks system for the town of Dudley, which adjoins the lake. The translation of this remarkable Indian name, as I recall it, is "the meeting of the three waters," referring to the three streams which feed the lake. While I would not take oath to the accuracy of this translation, I hardly think it could be contradicted, as there are few now living who could translate the Indian tongue in which it occurred.

J. H. SERRA.

15 Halsey St., Brooklyn, N. Y.

Nature and Conduct of the Slides in the Culebra Cut

Sir—After reading the article under the above title in the Nov. 28 issue, I am reminded of the story of the traveler who, driving up to a country inn, threw the lines into the hands of a small boy and thus addressed him:

"Diminutive specimen of primogeniture, expeditiously extricate yon equine quadruped from the vehicle, stabulate him, provide him with a sufficient quantity of suitable provender, and when Aurora shall gild the Oriental horizon, bring him forth and I will remunerate you munificently for your generous hospitality."

The boy, dumbfounded, rushed into the house, exclaiming, "Father, there is a Dutchman out there, that wants a glass of beer."

I had no idea it took so many words to describe an "everyday earth slide."

EMILE LOW.

606 Ashland Ave., Buffalo, N. Y.

Should a Pier Be Permitted in the North River for a Hudson River Bridge?

Sir—Mr. Lindenthal's letter to the New York *Times*, reprinted in this week's ENGINEERING NEWS, and your editorial comment thereon, are most interesting and timely.

ENGINEERING NEWS says that in the engineering profession one would look far today to find doubt that such a bridge as Mr. Lindenthal proposes is entirely feasible. Most engineers and especially bridge engineers would take the feasibility of the bridge for granted on Mr. Lindenthal's indorsement.

But the public is ignorant, suspicious and timid. The failure of the Quebec bridge, the widely published criticisms of the strength of the Blackwell's Island bridge, and the fact that Mr. Lindenthal's proposed North River bridge will exceed by more than 1000 ft. the clear span of the longest finished bridge will, taken altogether, not tend to create favorable public sentiment.

It may be taken for granted that Mr. Lindenthal is not advocating a 3000-ft. span for the everlasting glory of the bridge engineer, but has worked up a design for this enormous span because of the opposition of the War Department to piers in the river.

The present attitude of the War Department, backed up by some river interests and founded on an inherited Anglo-Saxon superstition in regard to the sacredness of waterways, is a formidable obstacle for bridge builders to overcome; but not so bad after all as it would be if the water in the Hudson River at the site of the proposed bridge were 1000 fathoms deep.

If Mr. Lindenthal could offer a cheaper bridge by putting one or two piers in the river, everybody who wants the bridge should help him get the piers.

Any craft or tow that is so unmanageable that it cannot avoid a stationary, visible obstacle like a bridge pier with a quarter of a mile or more of navigable water on each side of it, should be kept out of a busy crowded harbor in the interest of other vessels.

AUGUSTUS SMITH.

Ft. of West 5th St., Bayonne, N. J., Dec. 23, 1912.

Test of a Steel Overshot Water Wheel

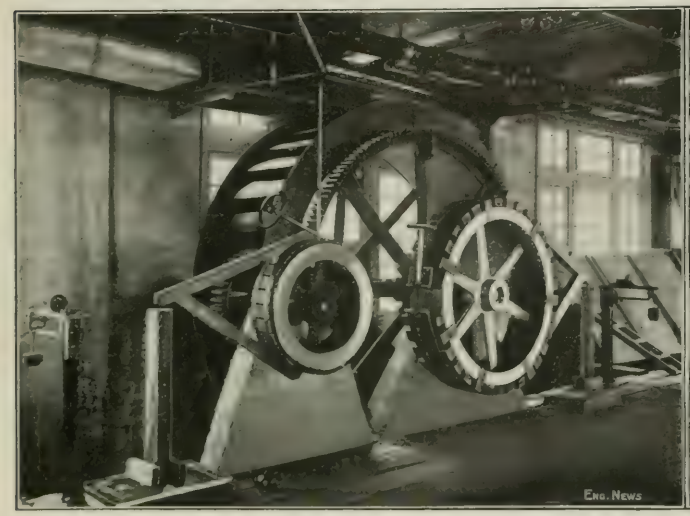
By C. R. Weidner. *

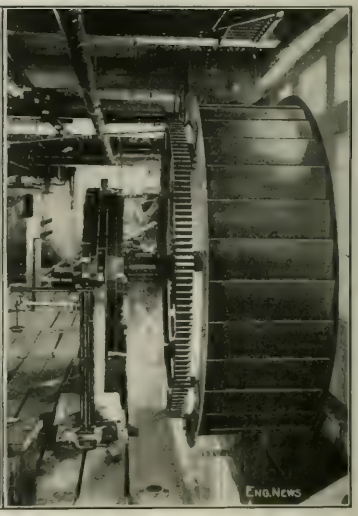
A series of tests on a 10-ft. steel overshot water wheel have recently been completed at the hydraulic laboratory of the University of Wisconsin, the results of which may be of interest to engineers who have occasion to develop small water powers.

A large number of American engineers consider the overshot water wheel as out of date—a relic of the past which has been replaced by the turbine, and for modern hydro-electric developments of large power there can be no question as to the superiority of the latter. The overshot wheel, however, is still capable of serving a distinct field, where the power to be developed is small and the speed of the machinery is slow and requires but little regulation. The fact that wheels of this type are still being installed in Germany and France, after careful engineering investigation, for small factories, pumping plants, and even for the development of electrical energy, may be taken as an indication of satisfactory and economical use of this type of motor.

The overshot wheel was formerly constructed of wood and a number of picturesque and interesting examples of this type of construction still remain in this country. In recent years, however, the wheel has been built entirely of steel and iron. Although the initial cost of a wooden wheel is less than one built of steel, the latter possesses certain advantages which makes it more desirable to install, notwithstanding the increased cost. Unless a wooden wheel be kept continually in operation, the constant swelling and drying of the wood soon causes all parts to get loose; the buckets leak and a considerable percentage of the available energy is wasted. In a steel wheel the buckets can be shaped more readily to accord with the design; a larger percentage of the total head is made available on account of the smaller thickness of the metal; and the friction in the bearings is decreased because a steel wheel is lighter than a wooden wheel well soaked with water. For these reasons the steel wheel is more efficient. Moreover, it is more durable, the cost of maintenance is less, and the parts are more readily assembled.

Fig. 1, shows an example of a steel overshot wheel of modern design—the wheel tested at the University of Wisconsin. Wheels of this type have been installed in various parts of the United States and South America. The buckets are formed by curved vanes attached to the cylindrical surface or inner circumference of the wheel, called the soling, and to the segmental circular housings on the sides. The vane thus forms the front or outer part of the bucket, the soling the back or inner side, and the housings form the sides. The buckets, soling, and rims are made of flanged steel riveted together. To the housings are bolted the radial arms, made of flat bar steel, which in turn are bolted to cast-iron center flanges keyed to the shaft. Power is usually taken from the wheel by means of gearing and is transmitted by shaft, belt, or rope drive. In some designs the segmental spur gearing is bolted to the arms of the wheel, as in Fig. 1, in others a gear wheel is keyed directly to the shaft. The manufacturers furnish either ball or roller bearings as specified.





Figs. 1 and 2. Front and Side Views of Overshot Steel Water Wheel Equipped for Testing: University of Wisconsin Hydraulic Laboratory

The advantages of the overshot wheel are: (1) high efficiency, (2) adaptability to varying discharge, (3) simplicity in construction, (4) reliability, (5) no interference of operation on account of clogging with débris or ice.

Of these advantages the first two are of the greater importance. The results of the experiments discussed below show high efficiencies under a wide range of operating conditions. Reliable tests of turbines have been

*Instructor in Hydraulic Engineering, University of Wisconsin, Madison, Wis.

reported yielding as high as 89% efficiency,* but it is rarely that this figure is attained in an actual installation. In the smaller plants especially, where an overshot wheel would be capable of competing with a turbine, it is doubtful whether the turbines operate with an average efficiency higher than 70%. It is, however, extremely difficult to make any comparison as to the efficiency of two types of motors, unless both have been tested under exactly similar conditions of operation. The installation of a turbine requires a technical analysis of the problem, and unless the turbine is set properly and selected for the particular conditions under which it is to operate, the efficiency will fall far below that of which it is capable when operating under the proper conditions. Very few of the small water powers developed receive the proper engineering supervision to promote a high degree of efficiency in their operation. The overshot wheel, on the other hand, suffers but little from a lack of proper design or selection, although to obtain the highest efficiencies of which the wheel is capable, it is not advisable to dispense with a technical analysis.

To engineers familiar with the variation in efficiency

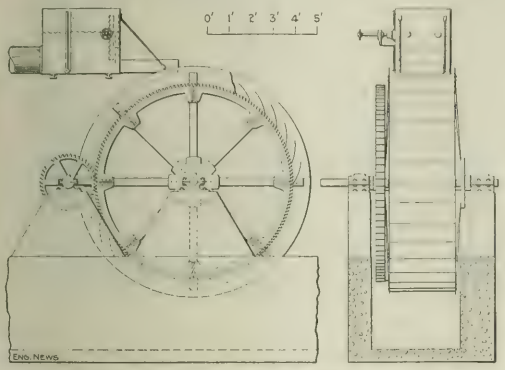


FIG. 3. CONSTRUCTION OF STEEL OVERSHOT WATER WHEEL IN UNIVERSITY OF WISCONSIN HYDRAULIC LABORATORY

of the turbine at part gate, a glance at the curves obtained from the Wisconsin experiments (Fig. 4) will be convincing as to the superiority of the overshot wheel, in respect to its adaptability to varying discharge. The experiments show that the range in the discharge may be as much as 400% with only a difference of 5% in the efficiency of the wheel. The other advantages cited are of minor importance, though in particular cases they may influence the choice of type of motor to be selected.

The limitations or disadvantages are; (1) an economical limit in respect to the head and discharge to be developed, (2) a limit in respect to the speed of the machinery to be operated, (3) a limit in respect to the variation in the water levels in the head and tail races, (4) larger space requirements than a turbine.

On account of the increase in the weight of the wheel, as the head or discharge is increased beyond a certain limit, the cost of the overshot wheel becomes so great that it can then no longer compete advantageously with the turbine. The economical field of the wheel, therefore, lies in developments which range approximately between 2 and 30 cu.ft. per sec. discharge, with heads varying from 10 to 10 ft., corresponding to a maximum development of about 75 hp. Within this field, the question whether to install a water wheel or turbine must be decided on the basis of the particular conditions of the power to be developed, the class of machinery to be operated, and the cost of installation. Only a rough approximation can be made as to the cost of the two types of motors, from the figures furnished by the manufacturers. In general it may be said, that the initial cost of an overshot wheel, up to a diameter of 16 ft., will be about twice that of a turbine of equal horsepower, and above that diameter a little more than twice the amount.

The peripheral velocity of the overshot wheel, when operating efficiently, varies approximately between 3 and 7 ft. per sec., depending on the diameter, discharge, and velocity of the entering water. Hence, there would be a practical limit to the speed of the machinery to be served, beyond which the loss of power through the necessary gearing would probably offset any gain in efficiency. It is, therefore, particularly adapted for the operation of slow-speed machinery, and should find a field of usefulness for the operation of small factories, the machinery on farms or country homes, and especially for pumping plants, where the pumps may be connected directly to the wheel shaft. For the operation of high-speed machinery, a loss of from 3 to 10% may be estimated to occur through the necessary gearing or belting.

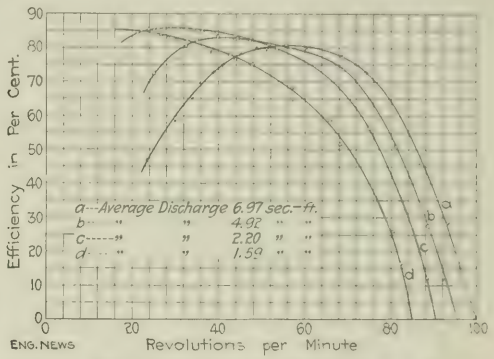


FIG. 4. EFFICIENCY-DISCHARGE CURVES OF A STEEL OVERSHOT WATER WHEEL
(Power Measured at Jack Shaft)

The principal application or use of water power at present is the development of electrical energy. In general the opinion is held, that only turbines on account of their high speed are applicable for this purpose. However, a number of electrical plants, operated with water wheels, have been built and are giving satisfactory service. The inertia of the heavy wheel and gearing provides a very uniform motion, and high efficiency at part load is a very desirable feature in electrical plants. It is a matter for the designing engineer to decide, which type of motor will give the highest total efficiency, for a plant of this kind.

*Trans. Am. Soc. C. E. Vol. LXVI, p. 306

The efficiency of the overshot wheel drops off quite rapidly if the bottom of the wheel is submerged, even though this is but a few inches; therefore, the wheel is poorly adapted to conditions where there is a considerable variation in the tail-water level. The turbine will operate almost as efficiently when submerged as when not submerged, and by use of the draft tube there is but little occasion to have it submerged. In this connection it should be noted, that in periods of flood, when the water wheel is likely to be submerged, there is an excess of water and as the wheel is particularly adapted for overload capacity, the extra power developed would probably make up for any decrease in efficiency.

Within these limitations the overshot wheel is capable of serving a field in water-power development, and of competing successfully with the turbine both in efficiency and cost of operation. The decision as to water wheel or turbine must be made after careful investigation of the particular conditions to be met with; each type of motor should receive equal consideration. The considerations which influence this choice are; (1) head and discharge available, and probable variation in these, (2) cost of the motor, including setting and foundation, (3) relation of motor cost to available capital for plant construction, (4) class of machinery to be served, and whether continuous or intermittent power supply is required.

Laboratory tests of a machine, when properly interpreted, undoubtedly have a great value, but it must be borne in mind, that any test so made represents results under the exact conditions of the test. The conditions under which the Wisconsin experiments were performed approached practical conditions very closely. The wheel tested was of a standard pattern taken from the stock of the manufacturers. The structural features are simple, and none of these features, of the wheel itself, were changed during the tests. Apart from the structural features of the wheel, the chief factors which influence the efficiency are the velocity of the entering water, the relation between this velocity and the peripheral velocity of the wheel, and the discharge. The results should, therefore, be readily duplicated in actual service, if the wheel is set properly, and they may be taken as a guide in the design and installation of this type of water wheel.

A summary of the conclusions reached in the experiments, the details of which will be published in a University bulletin,* is given below.

SUMMARY OF CONCLUSIONS FROM EXPERIMENTS

(1) The maximum efficiency obtained was 89% of the theoretical input delivered, at the wheel shaft or 86% at the jack shaft.

(2) The transmission loss, through the spur gear and pinion, including the friction in the bearings, reduced the efficiency of the wheel 3% at maximum efficiency of operation. Within the limited range of the experiments this loss increased with the speed and decreased with the horsepower transmitted.

(3) The efficiency of the wheel, other conditions remaining constant, increased with the decrease in the entrance velocity of the water. This statement is limited, however, by the fact that for maximum efficiency a definite relation exists between the peripheral velocity and the entrance velocity, so that a limit is reached when the entrance velocity equals or slightly exceeds the peripheral velocity.

(4) The variation in the discharge within reasonable limits, so that the coefficient of filling does not exceed approximately 0.50, has little if any effect on the efficiency of the wheel.

(5) For maximum efficiency of operation, the ratio of the peripheral velocity of the wheel to the velocity of the entering water is a constant, whose value is approximately 0.90.

(6) Submergence of the wheel in the tailwater causes a serious decrease in the efficiency. A submergence of 3 in. caused a loss of 6% at maximum efficiency of operation, which loss increased rapidly as the submergence was increased.

(7) For maximum efficiency, the point of impact of the water should lie as high in the wheel as possible. The point is regulated by the distance of the entrance spout or orifice from the wheel, and must be adjusted for each installation, otherwise a serious loss of energy occurs at entrance.

* Tests and Test Apparatus for Water Wheels, by C. R. Weidner. Bulletin of The University of Wisconsin, No. 329.

A Warehouse Telpherage System*

The arrangements for carrying merchandise into and out of the warehouse of M. A. Newmark & Co., Los Angeles, Calif., show an interesting attempt to reduce the cost of handling through the elimination of labor, breakage, and confusion, and by expediting receipts and deliveries. This firm is a large wholesale grocer and importer, receiving and delivering on an average 200 tons of goods daily, the goods consisting of a general miscellaneous line of every size package, box and barrel. With merchandise varying from a box of chewing gum to a hogshead of molasses, the handling problems were more complicated than with uniform freight.

This firm has recently erected a new reinforced-concrete warehouse, with four floors and basement, besides a mezzazine above the first floor. When designing the building, the handling problem was considered and a telpherage system was installed, together with two spiral chutes and four elevators.

The telpherage system comprises three motor-driven two-ton carrier cars (Fig. 1), traveling on the lower flange of an I-beam track. The carrier frame is suspended from two four-wheel trucks placed 7½ ft. apart. Only the forward truck is motor-driven, the maximum speed being 500 ft. per min. Both trucks are swiveled so that the carrier can round a curve of 10 ft. radius. On each side of each truck there is a current-collector shoe which bears on an angle-iron conductor running along each side of the I-beam track. Direct current at 500 volts is used and the contact between the shoe and the angle iron has proved so good that there has been no sparking. The hoisting motor on the trolley is gear-connected with the horizontal drum bars, one at each end of the carriage. Two hoisting ropes are suspended from each one of these bars and

* From information supplied by the Brown Hoisting Machinery Co., Cleveland, Ohio.

the loaded trucks are suspended on these four ropes. The maximum hoisting speed is 50 ft. per min., but this speed is seldom attained, owing to the short distance the load is raised. The load is held at any desired height by either of two brakes, a solenoid brake, which releases only when the hoist motor is driven by current, and a mechanical friction brake, which operates only on the downward travel of the load. Either one of these brakes is sufficient to carry a load of double the capacity of the carrier. The operator rides on a platform placed at the rear of the trolley and the two controllers, one for hoisting and one for trolley travel, are placed just in front of his seat.

The single-rail track is suspended from the ceiling in every gangway on the various floors (Fig. 1) and is provided with the necessary track switches, which are operated from the floor. Three of the four elevators are equipped with the I-beam tracks, which align with the track on each floor. The operator runs his trolley on the elevator and takes it to the different floors, running the elevator from his seat on the trolley. The elevator tracks and all switches are provided with safeay stops to prevent the trolley from running off the track.

The company uses four-ton automobile trucks for delivery service. These have special bodies, consisting of two similar sections, each 6 ft. 9 in. long by 5 ft. 8 in. wide. These body sections are detachable from the frame of the auto trucks so that they can be picked up by the trolley one at a time and carried into the warehouse. At the front of the building (Fig. 2) there are three I-beam tracks extending out over the street for a distance of 27 ft.; the auto trucks back up to the curb beneath these tracks and are loaded and unloaded by the trolleys. The tracks are covered with a canopy to protect the work during bad weather. During the rainy season, the auto trucks are equipped with special automobile tops, which open lengthwise of the truck, sufficient to allow the trolleys to pick up the bodies. These tops have a very simple lock device and are arranged so that they are very easily operated.

The body sections carry permanently attached two wheels in the middle and a small roller at each end, so that they can be pushed around the floor in the warehouse to be loaded direct from different piles of merchandise. The body sections can be locked into place on the trucks.

Practically all goods are received in carload shipments and railroad tracks run along the rear of the building. Just inside the building and parallel to the railroad track, is one of the telpher tracks. All goods are unloaded from the cars to hand trucks somewhat smaller than the automobile body sections, so that they can be easily worked through the car doors. The trolley carrier places an empty truck close to the car door and where it can be pushed into the car and loaded by four men. It is then pushed out and under the trolley track, the carrier picks it up and carries it to any part of the building. The two rear elevators are used almost exclusively for unloading freight, and this is usually done in the morning. Loads are carried to the storage department in less than two-thirds the time required by the old methods and with two less men.

In assembling orders for outside shipments and city delivery, both spiral chutes and the trolleys are used. When the orders are for small quantities, the goods are sent to the first floor through spiral chutes and the orders assembled there on automobile bodies. When the order is large, the goods are assembled on one of the body sections right at the storage departments and carried to the delivery entrance on the first floor by the trolleys. Very often the auto-truck bodies are loaded direct from a car shipment and placed on the first automobile truck that comes in, the goods being handled only once.

The loaded body sections are assembled on the first floor at the front of the building, awaiting arrival of the trucks. There are thus always loaded bodies waiting with goods checked ready to go out. When the trucks back up, the empty bodies, or loaded ones in some cases, are lifted off and replaced with others made up for deliveries. The average time of this exchange is 5 min., but it is expected that this will be cut to 4 min. The record time is 3 min. 10 sec. It is reported that the same loading could not be done within an hour, or an hour and a half for a truck arriving loaded.

The general system above described was designed by Leland S. Rosener, of San Francisco; the trolley carriers and track switches were designed, built and installed by the Brown Hoisting Machinery Co., of Cleveland, Ohio.



FIG. 1. AUTOMOBILE-BODY SECTIONS IN TRANSIT



FIG. 2. LOADED BODIES READY FOR TRUCKS

FIGS. 1 AND 2. WAREHOUSE TELPHERAGE SYSTEM OF M. A. NEWMARK & CO., LOS ANGELES

(Designed by L. S. Rosener, San Francisco.)

Methods of Tests for Concrete Materials*

The present report emphasizes the necessity for more rigid requirements for the acceptance of concrete materials and for routine tests of the materials and the concrete.

Tests of the individual materials are not sufficient for determining the quality of the concrete made from them. A certain sand may give satisfactory results with one brand of cement and prove a failure with another. A sand of a certain granulometric composition may require an entirely different proportioning with one coarse aggregate than with another or may be unsuited for use with it because of the sizes of the grains.

The Committee recommends that for all important structures, such as dams, conduits, and buildings, specimens of concrete be made up in advance of the actual work from materials which it is proposed to use in the work. These specimens should be made under laboratory conditions so as to obtain uniformity in mixing and storage, and with the same consistency which is to be used in the proposed structure. The specimens should be stored in moist atmosphere and compressive tests made at the age of 28 days and also at other periods if practicable. The final selection of the materials and the proportions to be adopted should be governed by the results of these tests.

The tests now in progress in different laboratories under the auspices of the Committee are expected to furnish data from which definite recommendations may be made as to the size and shape of the specimen. The Joint Committee on Concrete and Reinforced Concrete recommends cylinders 8 in. diameter by 16 in. high. Where it is impracticable to adopt this size, a 6-in. cube or a cylinder 6 in. in diameter and 6 in. high is tentatively suggested for use with aggregates under 1½ in. in size. It must be borne in mind that specimens of this shape may give from 10 to 20% higher strength than the same materials made into oblong cylinders or prisms.

Tests of materials for use in mortar or concrete may be divided into two general classes:

(1) Tests for acceptance.

(2) Tests for quality.

These two divisions frequently merge into each other because in many cases the special characteristics of a sand may render it unfit for certain work, although it may satisfactorily pass a standard test for acceptance.

The most important questions to be asked in regard to a material are: (*a*) Can it be used? (*b*) In what proportions must it be mixed with the other materials to produce the required qualities in mortar or concrete? (*c*) Can another material of the same class be substituted with greater economy?

For small structures and, in fact, frequently for larger ones where the sources of supply are limited, the all important question is a combination of the first two, namely, can a certain material—and this applies most frequently to the fine aggregate or sand—be used, and in what proportions to give the desired quality of concrete or mortar? For structures where the volume of the concrete is large so that the economy of the proportioning is paramount, or for small structures subjected to special conditions—such as the effect of sea water—the cement and aggregates should be thoroughly studied also and special tests made to determine the most economical or the qualifications for the work proposed.

Taking the matter of the selection of sand alone, an illustration of the poor quality that is frequently used in practice is found in the tests in the laboratory of one of the members of the Committee. Out of 37 samples of sand from different parts of the country made into 1 : 3 mortar, 12 were equal to or greater in strength than similar mortar of standard Ottawa sand; 5 were between 90 and 100% of standard sand; 6 were between 80 and 90%; 4 were between 70 and 80%; 6 were between 60 and 70%; 1 between 50 and 60%; 2 between 40 and 50%; and 1 between 30 and 40%. Such results as these indicate the absolute necessity for always testing sand that is used in concrete. For large and important structures, such as dams, tunnels, aqueducts, buildings, and other reinforced-concrete work, not only preliminary tests should be made but frequent tests at stated intervals to avoid the danger of inequalities in the supply.

Tests of Materials for Acceptance

Cement—The cement should meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials.

Fine Aggregate—Sand or other fine aggregate should always be tested. In ordinary cases where special characteristics are not required, the test for acceptance is the determination of the strength of mortar made up with the cement and fine aggregate to be used on the work in comparison with the strength of identical specimens made with standard sand. The results of this test also are an aid to the selection of the proportions which should be adopted.

Compression tests of mortar are the most reliable, but tensile tests may be employed when a compression machine is not available.

Selection of Sample—Take an average sample aggregating 20 lb. Ship in strong box or bag or barrel, so that laboratory will receive material in its natural condition. Ship in a separate package from the cement.

Quartering—Unless grains are of uniform size, separate from the large sample the quantity required for the test by quartering or other similar means.

Making Specimens—Mold a large enough quantity so that there will be at least four specimens each to test at 72 hours, 7 days, and 28 days, in proportions one part cement to three parts sand by dry weight. Bank sand should not be dried, since drying may affect the quality, but the percentage of moisture should be determined by test on another sample, and corrected for in making the weights. The consistency should be the same as that required for standard sand mortar. From 10 to 40% more water may be required for bank sands or artificial aggregates than for standard Ottawa sand to produce the same consistency.

Similar specimens of the same cement mixed at the same time under the same conditions should be made with standard Ottawa sand in the same proportions.

All temperatures of mixing and storage should be maintained at 70° F. During the first 24 hours the specimens

*Portion of Report of Committee on Specifications and Methods of Tests for Concrete Materials, National Association of Cement Users, presented at Annual Convention, Pittsburgh, Penn., Jan. 10-11, 1912.

should be stored in moist air and the remainder of the period in water.

The 72-hour test is the most severe and sand failing to attain the requirement at this age frequently reaches it at 7 or 28 days and can be accepted. If, however, the 72-hour briquettes break in the clips of the machine or if the specimens at this age show very low strength, say 25%, or below, of the strength of standard sand mortar, the sand should be considered dangerous to use on any important work of construction.

Requirements for Strength—The aim in concrete construction should be to obtain a sand which produces a 1 : 3 mortar equal in strength to a similar mortar of standard Ottawa sand. Sands producing mortars having a strength of less than 70% of standard sand mortar should be rejected.

Between these two limits the variations in strength should be taken into account in fixing the proportions of the mortar or concrete.

Other Tests—For work requiring special characteristics, the fine aggregate must be accepted not merely on passing the tests for strength, but other tests, such as the test for permeability, the effect of different brands of cement, the effect of frost action and the effect of fire. Characteristics of yield, density, chemical composition, granulometric composition, and amount of organic matter, are frequently required.

Coarse Aggregates—It is recommended that the quality of the coarse aggregate be determined from the preliminary tests of concrete made with the materials and in the proportions designed to be used in the work. Government tests made at the Structural Materials Laboratory in St. Louis under the direction of Richard L. Humphrey, clearly show that the hardness of the particles of coarse aggregate appreciably affect the strength of the concrete, so that greater stresses may be used in concrete when the stone is hard than when it is soft. In certain cases the chemical composition of the coarse aggregate may effect the strength and durability of the concrete.

Tests for Quality

Fine Aggregate—In addition to the tests for acceptance which have been discussed in the preceding paragraphs, many aggregates require special tests. Furthermore, various laboratories have adopted different classes of tests to use with aggregates which come to them for examination. This can be discussed best by a consideration of the practice in different laboratories.

During the past year this committee has been in communication with all of the laboratories of which they were able to learn, in an effort to gather as complete data as possible relative to the various tests for a sand now in use. Each laboratory was requested to furnish a complete description of their methods of testing sands—in most cases such descriptions were freely furnished. In all, 28 laboratories were communicated with and replies were received from 24; of these, 15 gave more or less complete descriptions of their tests.

The data in these replies were tabulated and listed and gave some very interesting information. It was found that some 26 different steps are taken in these laboratories for the determination of the suitability of a sand for use in concrete or mortar.

These steps are as shown in the following tabulation:

NUMBER OF LABORATORIES USING EACH TEST

	Test	Number of Laboratories
1	Examination of Deposit	4
2	Preparation of Sample	8
3	Tensile Test of Mortar	13
4	Compressive Test of Mortar	7
5	Compressive Test of Concrete	3
6	Per cent of Moisture	2
7	Per cent of Voids	17
8	Yield or Volume of Mixture	3
9	Density of Mortar and Concrete	2
10	Specific Gravity of Solid Particle	1
11	Specific Gravity of Sand	5
12	Weight per Cubic Foot	2
13	Granulometric Analysis	16
14	Uniformity Coefficient	1
15	Wet Screening	1
16	Silt Suspended in Water	1
17	Silt Washed Out	8
18	Loss on Ignition	5
19	Organic Matter by Agricultural Method	1
20	Chemical Analysis	5
21	Microscopical Examination	5
22	Absorption	1
23	Permeability	3
24	Effect of Different Cement	2
25	Freezing	1
26	Fire	1

[These tests are described in detail in the original report.—Ed.]

No doubt other tests of fine aggregate are in use which have not come to the notice of the Committee, but the very large range and lack of uniformity is illustrated by the outline given. No two of the laboratories used the same tests, and scarcely two of them carry out their tests in exactly the same manner, so that at present it is difficult or impossible to compare accurately the results obtained in one laboratory with those obtained in another.

Examination of the list shows that the popular tests for sand at the present time are granulometric analysis, tensile tests of mortar, and percentage of voids. Of these only one, the tensile test of mortar, belongs properly in the classification of tests for acceptance as discussed in preceding paragraphs of the report.

The problem before the engineer who is interested in proper methods of testing materials is to select and standardize such tests as will give the necessary data which will determine whether or not the sand is suitable for a particular use and, if suitable, in what proportions it should be used to produce desired qualities in the resulting mortar or concrete.

In the further study of this problem the Committee desires to enlist the active coöperation of all those who are interested in the subject, and shall appreciate any information or the results of any tests which may lead toward the solution.

Sanford E. Thompson, *Chairman*
Clovd M. Chapman,
William D. Fuller,
Russell S. Greenman,
Arthur N. Talbot.

Flashlight Railway Signals—It is reported that the Swedish State Railway authorities have decided to adopt flashlights on their signaling system. A trial installation was put into service on Liljeholmen Station, on the southern main line of the Swedish State Ry., at the end of last year, and was fitted on two distant signals, two home signals, and both starting signals for main line trains. The home signals have several arms to indicate the different train routes, as in the German signaling system. Flashlights were fitted to the top lamps governing the main line, but the lower lamps were lighted with steady lights. It is stated that the installation, which has been subjected to very varying and unsatisfactory conditions of weather, has worked satisfactorily. In consequence, the Swedish State Ry. authorities have now decided to adopt flashlights for two new types of signals, and the whole line between Stockholm Central Station and Saltskog will very shortly be equipped with them.—"The Engineer," of London, Eng.

Annual Convention of the American Society of Agricultural Engineers

The sixth annual meeting was held at the Great Northern Hotel, Chicago, Dec. 26 to 28. The attendance was fair, and it was stated that during the past year the membership had increased 40%. In the papers and discussions the teachers were most prominent, although the manufacturers were heard from also. In the presidential address, Prof. Riley (Cornell University) pointed out that while the Society is composed mainly of teachers and manufacturers, it is absolutely necessary to interest the farmers also, as the users of agricultural machinery, if good results are to attend the Society's work. They are the people who can criticize from actual experience and give specific information as to the results of the machinery in regard to durability and efficiency. During the proceedings, Prof. Riley referred to his work in organizing a New York State Rural Association for the special purpose of studying the efficiency of different machines for a term of years.

One group of papers related to tests of machinery, including "Tests of Corn Planters," by O. W. Sjorgren (University of Nebraska), and "The Draft of the Plow," by C. A. Ocock (University of Wisconsin). A paper on "The Testing of Gas Tractors," by L. W. Chase (University of Nebraska), was in close relation to a report by a special committee on rules for testing tractors of this class. A paper on "The Principles of Fuel-Oil Engines" was read by C. F. Hirshfeld (Cornell University), and a paper of a rather different class was on "Isolated Gas-Lighting Plants," by E. Becher (Atlantic Blau Gas Co.). Another group of papers related to questions of standards and included the following: "The Standardization Work of the Society of Automobile Engineers," by E. H. Ehrman (Chicago Screw Co.); "Standards in Agricultural Engineering," by J. B. Davidson (Iowa State College); "Standards in Agricultural Machinery," by J. A. King (Hart-Parr Tractor Co.); and "Standards in Gas Tractor Construction," by W. J. Brandon (Avery Co.). A third group related to education in agricultural engineering, and this led to considerable discussion on the general question and as to the proportion of time for work in the laboratory, the shop and the field. One speaker pointed out the necessity of a thorough instruction in the underlying principles rather than in mere details of mechanism. This group of papers included the following: "Laboratory Exercises in Farm Machinery," by Daniel Scoates; "The Designing of an Agricultural Engineering Building," by H. C. Ramsower (Ohio State University); and "The Relation Between Shop Work and General Lectures in Agricultural Engineering," by L. J. Hart (University of Georgia).

The officers for 1913 are as follows: President, L. W. Chase, University of Nebraska, Lincoln, Neb.; secretary, I. W. Dickerson, University of Illinois, Urbana, Ill. The next annual meeting will be held probably at Chicago.

A Proposal to Abandon the Commission Plan of City Government in Spokane, Wash., was defeated on Nov. 15, 1912, by a vote of 15,225 to 9418.

A Boiler Explosion in the shops of the Seaboard Air Line Ry., at Hamlet, N. C., on Dec. 5, killed one man. It is supposed that the water level fell in the boiler owing to a defective injector.

A Sewer Trench Cave-in occurred on Dec. 21 in the Westfield section of Queens Borough, New York City, and caused the death of one man. The trench was 12 ft. deep. The contractor for the work went into the trench to take some measurements, when the walls collapsed and buried him.

Panic in a Moving Picture Theater, at Barraques, Belgium, on Dec. 22, caused 13 deaths and injury to 50 other people. The cable accounts state that there were 700 people in the space built to accommodate 600, and that the fatalities were only indirectly due to the fire which caused the panic.

The Furness Liner "Florence" Was Wrecked off the coast of Newfoundland, on Dec. 20, and 22 of her crew of 27 were drowned. The boat was built in England in 1889, and had a displacement of about 1600 tons. She carried no passengers. A landing was attempted after the vessel went aground, but the high cliffs prevented.

The Steamer "Turrialba," owned by the United Fruit Co., ran aground, on Dec. 4, at the Brigantine Shoals, off the New Jersey coast and was pounded by heavy seas for some hours, losing her rudderpost and rudder, and having her propellers damaged. The "Turrialba" is a steel ship of 5000 tons displacement and was built in Belfast in 1909.

The boat was returning to New York from the West Indies when she got off her course during a storm. Prompt assistance was rendered by the adjacent life-saving stations and by the revenue cutter "Seneca," in response to wireless distress signals. The ship stayed water-tight in spite of the injuries to her steering gear and propellers and she was pulled off the shoal on Dec. 27, by three wrecking tugs.

A Minimum Wage for Women Employees has been established by the Public Service Corporation of New Jersey, and its subsidiary companies, which largely control the gas, electric lighting, and street railway business of the state. Out of its 10,000 employees some 300 are women, and the minimum sum which they will each receive after Jan. 1, is $9 per week. In making this announcement, the president of the company, T. N. McCarter, of Newark, N. J., stated that a careful investigation had been made to see what was required for the necessities of life with a small margin for ordinary comforts.

Land in the Catskills for Forestry Purposes to the extent of 100 acres has been given to the New York State College of Forestry, at Syracuse University, for use as a Forest Experiment Station. The gift was made by John R. Strong, a lawyer of New York City, who acquired it 25 years ago just after the heavy pine and hemlock on it had been cut off. Since then he has allowed no timber to be cut. The College of Forestry will put a forester on the tract and will use it for a summer school for its Sophomore class.

Willamette River Bridge Weight—Supplementing the description of the O. W. R. & N. bridge across the Willamette River at Portland, Ore., in our issue of Dec. 12, 1912, we give the weights of steel and machinery in the structure as follows:

	Tons
Approaches	1190
Fixed river spans (2)	4178
Lift span (both decks)	1594
Towers	789
Miscellaneous (trolley poles, hand rails, gas main)	342
Machinery and motors	484
Total	8587

The old "Steel Bridge" had a metal weight of 1200 tons. approaches included (W. P. Hardesty).

A Great Drydock for the Port of Boston, which has been under consideration by the Port Directors for some months, was assured, by their appropriation of $3,000,000 for its construction and supplementary work, at a meeting on Dec. 24. This supplementary work will include channel dredging and other harbor improvement in the line of extending existing piers and constructing new piers, to accommodate the largest vessels.

The drydock itself is planned to be about 1180 ft. long and 175 ft. wide, having for its foundation a ledge of solid rock about 1300 ft. long and varying in width from 200 ft. to 500 ft. It is of interest to note that this ledge has been in past years a stumbling block in the work of harbor improvement, affording a permanent obstacle in the way of desired pier extensions.

The action of the Port Directors was undoubtedly hastened by the receipt of an offer from a combination of steamship interests to unite in paying a sum of $50,000 annually for twenty years, amounting to a subsidy of $1,000,000. One of the obstacles in the way of constructing a big drydock is the fact that for the first few years its earnings are likely to be insufficient to meet fixed charges, but the above offer serves to reduce the risk in this case.

According to the note on this subject, appearing in the Boston "Transcript" of Dec. 24, there are 37 steamers regularly entering the port of New York, which cannot be drydocked there at all, and 89 regular steamers that cannot be handled by any commercial drydock at that place. Several of these big liners and some now building cannot be drydocked anywhere in the United States. As for Boston, this note goes on to say that its drydocking facilities, both naval and commercial, are decidedly inferior, not only to those of New York, but also to those of smaller ports of more recent commercial importance, such as Belfast, Glasgow, Southampton, Havre and even Quebec, whose shipping tonnage is only a small fraction of the tonnage of Boston. In all of these cities the shipping trade has been greatly stimulated by improvements in the docking and drydocking facilities, during recent years.

Cooling a Building by Roof-Watering is practiced in a Swiss spinning-mill ("Zentralblatt der Bauverwaltung," Dec. 7, 1912). Water is taken from a mountain brook and carried to a pipe running along over the ridge of the roof. Sprinkler heads 10 ft. apart distribute the water over the roof. At first the water was turned on only well along in the day, but this damaged the slate roof-covering by chilling it when warm. The present practice is to turn on the water early in the morning, keeping it on during the day, and no further damage has been noticed. The cooling effect is said to be very satisfactory.

Sewage-polluted Oysters are held responsible for 17 cases of typhoid fever and 83 cases of gastroenteritis out of 127 persons who ate oyster at a banquet at Goshen, N. Y., late in 1911. The total number of guests present at this banquet was about 155. The outbreak was investigated in detail by George W. Stiles, chief of the bacteriological laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Washington, who subsequently issued a bulletin on the subject. (See Bulletin 126, "Sewage Polluted Oysters as a Cause of Typhoid," etc., issued Sept. 21, 1912; copies of the bulletin may be obtained from the Superintendent of Documents, Washington, D. C., for 10c.). Dr. Stiles' summary of conclusions follows:

(1) There is undisputed evidence to show that infected oysters, clams, mussels, scallops, and other shellfish may cause typhoid fever and other gastrointestinal disturbances when consumed by susceptible individuals.

(2) The epidemics of typhoid fever, due to ingestion of polluted sea food, have in most instances been traced to shellfish floated in polluted water, although there is also evidence that oysters and other shellfish, grown in polluted water and directly consumed without transplanting for a time in pure waters, may be the source of typhoid infection.

(3) The investigations pertaining to the Minisink banquet, held at Goshen, N. Y., on Oct. 5, 1911, show conclusively that the "Rockaway" oysters served on this occasion were wholly responsible for the typhoid and gastroenteritis cases following this banquet.

(4) There were 17 well-defined cases of typhoid fever, with one death, and 83 cases of gastroenteritis (diarrhea) traced directly to eating "Rockaway" oysters from Jamaica Bay, floated at Indian Creek, near Canarsie, Long Island, N. Y.

(5) In addition to the typhoid and other intestinal disorders following the consumption of "Rockaway" oysters at the Minisink banquet, there were also 10 other cases of typhoid and 16 of diarrhea traced to eating "Rockaway" oysters, some of which came from the same lot furnished for the Minisink banquet.

(6) The bacteriological examination of water and shellfish collected from Jamaica Bay shows that this body of water is dangerously polluted; the laboratory data are substantiated by the sanitary inspection, which shows that millions of gallons of raw sewage discharge daily into this bay, and, in many instances, in close proximity to or directly over oyster beds.

(7) Typhoid bacilli were isolated in pure culture after 7 and 21 days from oysters, which had been floated at Inwood, Long Island, N. Y., on Oct. 1, 1911, and kept out of water in storage at 39° F. Organisms of the B. coli and B. paratyphosus groups were also isolated from oysters floated at Indian Creek, near Canarsie, L. I. They were probably the cause of the gastroenteritis cases following the Minisink banquet.

(8) This investigation comprises a complete study of all the factors which would materially contribute to typhoid infection. Each item of the menu served at the Minisink banquet was carefully considered, and the "Rockaway" oysters served were the only articles of food consumed by all of those who had typhoid or gastroenteritis following this banquet.

PERSONALS

Mr. W. L. Seddon, Chief Engineer of the Seaboard Air Line Ry., has been appointed Assistant to the President.

Mr. Lyman E. Cooley, M. Am. Soc. C. E., has been appointed Consulting Engineer for the Chicago Sanitary District, succeeding Mr. Isham Randolph, who has resigned.

Mr. L. S. Allen, Roadmaster of the Ann Arbor R.R. Owosso, Mich., has been promoted to be Engineer of Maintenance-of-Way, succeeding Mr. J. K. Howard, resigned.

Mr. Arthur Appleton has been appointed Eastern representative of the Toledo Bridge & Crane Co., Toledo, Ohio, with headquarters at 52 Broadway, New York City, succeeding E. H. L. Drollard.

Mr. A. D. MacTier, Assistant to the Vice-President of the Canadian Pacific Ry., at Montreal, Que., has been promoted to be General Manager of the Eastern lines, in charge of operation and maintenance.

Mr. W. D. Faucette, Jun. Am. Soc. C. E., who has been acting as chief clerk to the President of the Seaboard Air Line Ry., has been appointed Chief Engineer, to succeed Mr. W. L. Seddon, promoted, as noted elsewhere.

Mr. Ralph Budd, Chief Engineer of the Spokane, Portland & Seattle, and the Oregon Trunk Rys., Portland, Ore., has been appointed Assistant to the President of the Great Northern Ry., with headquarters at St. Paul, Minn.

Mr. John M. T. Rice, Assoc. M. Am. Soc. C. E., formerly Assistant Engineer of the Bureau of Water, Pittsburgh, Penn., has accepted a position with the Alabama Interstate Power Co., Birmingham, Ala., in charge of development work.

Mr. John T. Simpson, one of the organizers and for the past five years President of the American Concrete-Steel Co., Newark, N. J., has sold his interest in the company and opened an office as Consulting Engineer, at 1224 Essex Bldg., Newark.

Mr. J. E. Symons, former Master Mechanic of the Gulf, Colorado & Santa Fé Ry., at Cleburne, Tex., has been appointed Superintendent of Motive Power of the San Antonio & Aransas Pass Ry., San Antonio, Tex., succeeding Mr. G. W. Taylor.

Mr. William Stanley, F. Am. Inst. E. E., has been awarded the Edison Gold Medal of the American Institute of Electrical Engineers for 1912, "for meritorious achievements in invention and development of alternating-current systems and apparatus."

Mr. James H. Sturdevant, Division Engineer of the New York State Highway Department at Watertown, N. Y., has been appointed First Deputy Superintendent of Highways, subject to the approval of the State Highway Commission. The salary of this position is $3500 per annum.

Col. W. C. Gorgas, Assistant Surgeon-General, U. S. A., Chief Sanitary Officer of the Panama Canal Zone, and four of his assistants in the department of sanitation, at Panama, are to investigate and report upon the requirements for the proper sanitation of the city of Guayaquil, Ecuador.

Mr. George M. Yorke, M. Inst. E. E., Engineer of the Western Union Telegraph Co., has been appointed General Superintendent of Plant. Mr. York is a graduate of the Massachusetts Institute of Technology, and has been associated with the American Telephone & Telegraph Co. since 1893.

Mr. Isham Randolph, M. Am. Soc. C. E., has resigned his position as Consulting Engineer for the Chicago Sanitary District, after having been Chief Engineer and then Consulting Engineer for many years. He was Chief Engineer during the construction of the Chicago main drainage canal in the '90s.

Mr. John Morris Baird, formerly Bridge Engineer of the city of Seattle, Wash., and later of Kings County, has opened an office in the White Bldg., Seattle, as a consulting bridge and structural engineer. Mr. Baird was formerly with the American Bridge Co., with Purdy & Henderson, New York and Chicago, and with the bridge department of the city of New York.

Mr. Charles H. Ewing, formerly Superintendent of the Atlantic City R.R. Co., Camden, N. J., has been promoted to be General Superintendent. Mr. Fredrick M. Falck, former Superintendent of the Wilmington & Columbia division of the Philadelphia & Reading Ry., at Reading, Penn., has been appointed to succeed Mr. Ewing at Camden. Mr. W. F. Eckert succeeds Mr. Falck at Reading.

Mr. David E. McComb, M. Am. Soc. C. E., has been appointed Engineer of Bridges of the District of Columbia to succeed the late T. C. J. Baily, Jr., whose death was announced in these columns two weeks ago. Mr. McComb entered the service of the District in 1874, and three years later was appointed Superintendent of Sewers, a position which he held until 1908, when he resigned to take charge of paving, sewerage and drainage work for the city of Havana, Cuba. He resigned this position about a year ago. Recently he has been engaged on a special investigation for the Commissioners of the District of Columbia, looking into the desirability of establishing a municipal asphalt plant.

Mr. Benjamin F. Bush, M. Am. Inst. M. E., President of the Missouri Pacific Ry., has been elected President of all the so-called Gould railways, including the Missouri Pacific, the Denver & Rio Grande, the Iron Mountain, the Western Pacific, the Texas & Pacific and the International & Great Northern Rys., a system embracing 13,844 miles of track. Mr. J. M. Johnson, Vice-President of the Missouri Pacific Ry., will be Vice-President in charge of traffic of the entire system. Mr. Bush now becomes the chief executive of one of the largest railway systems in the world. Like President Rea, of the Pennsylvania R.R., he also began his railway career in the engineering department. Mr. Bush was born in Wellsboro, Penn., July 5, 1860, and received his education in the public schools and at the State Normal School, at Mansfield. Soon after his graduation he went to Wisconsin, where he entered the service of the Northern Pacific Ry. as a rodman. Five years later he was made Division Engineer on the Union Pacific R.R., in Idaho and Oregon. In 1889 he went to Seattle, Wash., and for seven years was Chief Engineer and General Superintendent of the Oregon Improvement Co.; later he was General Manager of the Northwestern Improvement Co., at Roslyn, Wash. His first service with the Gould lines began ten years ago as Fuel Agent of the Missouri Pacific Ry., at St. Louis, Mo. In 1907 he was made President of the Western Maryland Ry., was later Receiver, and after the reorganization of the company, was reëlected President. He was elected President of the Missouri Pacific Ry. in 1911, and President of the Denver & Rio Grande in 1912. Mr. Bush was a consulting engineer of the United States Geological Survey in 1900, and was appointed by President Roosevelt, a member of the advisory board on fuels and structural materials in 1907.

The University of Wisconsin announces a number of faculty changes, some of which have been previously noted in our columns. It has become the practice of the dean of the engineering department to send out annually a news letter to the alumni, from which we have taken the following extract: Prof. G. J. Davis, Jr., of the department of hydraulics, has resigned to become Dean of the engineering department of the University of Alabama. His place has been taken by Prof. C. I. Corps, who is a graduate of the University of Kansas, and who has been on the engineering faculty of that institution for several years. Mr. James Aston, '98, of the chemical engineering department, is now Professor of chemical engineering at the University of Cincinnati. Mr. A. H. Miller, '05, Instructor in mechanics, has recently resigned, and is now associated with the Globe Foundry Co., of Sheboygan, Wis. Mr. E. E. Parker, '07, Instructor in structural engineering, has been chosen City Engineer of Madison, Wis., and has resigned from the faculty. Mr. J. P. Schwada, '12, has been appointed Instructor in the department of structural engineering. Messrs. H. B. Sanford and C. R. Higson, of the department of electrical engineering, have resigned, the former to accept a position as Assistant Professor of electrical engineering at the Imperial Polytechnic Institute of Shanghai, China, and the latter to take up commercial work in Utah. Their places have been taken by L. E. Kelso, Missouri, '07, and H. L. Woolhiser, '12. Mr. W. J. Copp, '08, Instructor in machine design, has taken a position with the American Locomotive Co., and his place is being filled by P. H. Hyland, Purdue, '09, who was formerly with the mechanical department of the Pennsylvania R.R., at Ft. Wayne, Ind. Mr. J. A. Cutler, '09, has resigned as Instructor in topographical engineering, and S. D. Morris, of the University of Illinois, has been appointed in his place. Mr. O. W. Storey, '10, has been appointed Instructor in chemical engineering. Dean Turneaure and Prof. L. S. Smith are abroad for the present semester, making their headquarters at Munich, Germany. The Dean is making a study of engineering educational institutions and other matters relating to the engineering profession. Prof. Smith is investigating foreign practice in roads and pavements and other branches of municipal engineering.

OBITUARY

Eugene Smith, City Engineer of Hoboken, N. J., died at his home in that city, Dec. 24. He was 52 years old.

Isaac A. Hopper, Superintendent of Buildings of the City of New York, under Mayor McClellan, died Dec. 21, at his home in New York. He was 61 years old, and is survived by a widow and two sons.

Harry Mulford Rose, M. Am. Soc. M. E., a consulting mechanical engineer and exporter, died at his home in Elizabeth, N. J., Dec. 24. He was born at Albany, N. Y., Nov. 22, 1856. He had spent many years of his life in Mexico where he installed sugar-refining and coffee-milling machinery.

Erwin Graves, M. Am. Soc. M. E., Superintendent of the Camden Iron Works, Camden, N. J., died Dec. 13, at the Hahnneman Hospital, Philadelphia, Penn., after an illness of seven weeks. Mr. Graves was connected with R. D. Flood & Co., Philadelphia, for more than 30 years. He had been Superintendent of the Camden Iron Works since 1894. He is survived by a widow.

M. H. Dance, Assistant Engineer of Construction of the Illinois Central R.R., was killed at Centralia, Ill., Dec. 19. The motor car in which he was riding was struck and demolished by a locomotive. He was born in 1878 and began his service with the Illinois Central R.R., in 1901, as a masonry inspector. He was appointed Assistant Engineer of Construction in 1907, and at the time of his death was in charge of the construction of the new terminal buildings at Centralia.

W. M. Greene, a young civil engineering graduate of the University of Washington, employed by the Chicago, Milwaukee & Puget Sound Ry., at Deer Lodge, Mont., was instantly killed on Dec 17, by being struck by a train near Deer Lodge He was engaged in surveying a line over a bridge and stepped from one track to avoid a freight train, to be run down by a passenger train on the other track. He is survived by a widow.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Dec. 30-Jan. 6. Annual meeting at Cleveland, Ohio. Secy., L. O. Howard, Smithsonian Institution, Washington, D. C.

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Jan. 14. Annual meeting at New York City. Secy., W. R. Ingalls, 505 Pearl St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.
Jan. 14. Annual meeting in New York City. Secy., E. W. Stern, 103 Park Ave., New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 21-23. Annual convention at Chicago, Ill. Secy., F. J. Angier, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 21-23. Annual meeting at New York City. Secy., W. W. Macon, 29 West 39th St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28-30. Annual meeting at Montreal, Que. Secy., C. H. McLeod, 413 Dorchester St., West, Montreal.

Efficiency Society—The following tentative program has been outlined for the annual meeting of the Society in New York City, on Jan. 27-28: Symposiums on "Organization," "Management," "Efficiency in the Government Organization," "Industrial Relations," "Industrial Hygiene," and "Safety."

Illinois Society of Engineers and Surveyors—The annual meeting of the Society will be held in Chicago, Ill., on Jan. 22-24. The following are some of the subjects which will be discussed: "Concrete Paving for Country Roads," "Levee Construction by Pumping," "Park Development in Small Cities," "Garbage Disposal in the Smaller Cities," and "Floods in the Lower Mississippi Valley."

American Institute of Consulting Engineers—At the annual meeting of the Institute, on Jan. 14, in New York City, the following names will be voted on for three members of the Council to serve until January, 1916: Henry Holgate, of Montreal; Daniel Moran and Charles Sooysmith, of New York. The meeting will follow an informal dinner at the Engineers' Club. Secretary, E. W. Stern, 103 Park Ave., New York.

American Railway Engineering Association—The following nominations are announced for officers for the ensuing year: President, E. F. Wendt; Vice-President, Robert Trimble; Treasurer, G. H. Bremner; Secretary, E. H. Fritch; Directors (three directors, three-year term), H. S. Balliet, C. H. Ewing, J. V. Hanna, J. D. Isaacs, C. E. Lindsay, C. A. Morse, A. K. Shurtleff, Earl Stimson, J. G. Sullivan; Nominating Committee (five members), R. A. Begien, A. O. Cunningham, W. M. Dawley, A. E. Hale, R. L. Huntley, J. B. Jenkins, E. H. Lee, A. F. Robinson, H. R. Safford, C. A. Wilson.

American Institute of Architects—The result of the election of officers for 1913 at the annual convention of the Institute, on Dec. 10-12, was as follows: President, Walter Cook; Vice-Presidents, R. C. Sturgis and F. C. Baldwin; Secretary and Treasurer, Glenn Brown; Directors (for 3 years), B. L. Penner, C. G. LaFarge and H. VanB. Magonigle.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Pennsylvania—Philadelphia & Reading Ry. This company's plans to widen its trackway from Callowhill St. to the Terminal entrance, Philadelphia, Penn., is a widening of the elevated roadway from the train shed on the west side northward 12th St. to Cherry St. Legal steps have been instituted to obtain possession of properties on Arch St. and on 12th St., except that on the northeast corner, which must be removed to make way for the improvement. When the entire work is done the company will have four tracks instead of two, as now, from Callowhill St. to the Terminal entrance, and the latter will have a greatly increased trackage. William Hunter, Philadelphia, is Ch. Engr.

Virginia—Interstate R.R.—This company is contemplating the construction of an extension from Glamorgan, Va., to coal lands owned by the Pound River Coal Corporation in Wise County, eight miles. A. H. Reeder, Big Stone Gap, Va., is Gen. Mgr.

West Virginia—Surveys with all alignments, drawings, etc., have been completed by the Kanawha-Ohio Valley R.R. Promoting Co., for the construction of the proposed 74-mile railroad from Charleston to Parkersburg, W. Va. The promoter has the working maps with the cost of all bridges, tunnels, fills and cuts. K. B. Stevenson, Parkersburg, W. Va., is Pres. and Gen. Mgr.

North Carolina—Greensboro, Northern & Atlantic R.R.—This company has had surveys made and right-of-way has been obtained for the construction of its proposed 76-mile line. Walter Washbaugh, Charlottesville, Va., is Ch. Engr.

Alabama—Louis Hart, Gadsden, Ala., is interested in the construction of a line of railway between Gadsden and Centre, Ala. Surveys will be started soon.

Alabama—Finkbine Lumber Co.—This company is considering an extension of 10 additional miles to its line now being constructed from Wiggins to Stillmore, Miss., eight miles.

The construction of a railroad along the eastern shore of Mobile Bay from near Daphne to Bailey's Creek, is planned. Those interested include: Harry Pillans, E. G. Rickarby, T. W. Nicoll, E. D. Peppers, W. K. P. Wilson and James K. Glennon, of Mobile, Ala.; Dr. H. S. Greeno and F. A. Parker, of Fairhope, Ala., and E. Q. Norton, of Daphne, Ala.

Tennessee—Tennessee, Kentucky & Northern R.R.—This company has decided to construct an extension, it is reported, from Algood, Tenn., south to Sparta, Tenn., about 20 miles. Another extension is planned from Livingston, Tenn., to Rock Creek, Ky., about 40 miles. H. Adkins, Livingston, is Gen. Supt. and Ch. Engr.

Kentucky—Tennessee Central R.R.—This company is considering the construction of an extension from Hopkinsville, Ky., to Owensboro, Ky. L. F. Lonnbladh is Ch. Engr., Nashville, Tenn.

Ritter Lumber Co.—This company, with offices at Huntington, W. Va., will construct a railroad up Turkey Creek in Jackson County, Ky., in order to open up a 50,000-acre timber tract, which it intends to develop.

Sandy Valley & Elkhorn R.R.—This company will soon start work on an extension from Dunham to McRoberts, Ky. Surveys are being completed.

Indiana—Tennessee Central R.R.—This company has secured a franchise to enter Evansville, Ind., with the construction of an extension from Providence to Evansville. The company will build a bridge across the Ohio River, nine miles above Evansville.

Erie R.R.—This company is surveying from Bolivar to North Manchester, Ind., for the construction of a spur to connect the two towns. Work will probably begin soon. C. J. Rist, Huntington, Ind., is Div. Engr.

Chicago, Indianapolis & Louisville Ry.—This company is making surveys and preparing plans and specifications for the construction of a branch railroad from Switz City to Linton, Ind. A. S. Kent, Chicago, Ill., is Ch. Engr.

Wisconsin—Green Bay & Western R.R.—It is reported that Newman Erb and associates are considering the purchase of the line of this company. Extensions are contemplated from Independence or Whitehall, Wis., to St. Paul and Minneapolis, Minn. F. B. Seymour, Green Bay, Wis., is Gen. Mgr.

Minnesota—See item under Wisconsin: Green Bay & Western R.R.

Minnesota—Chicago, Milwaukee & St. Paul Ry.—Morris, Shepard & Dougherty, 801 Globe Bldg., St. Paul, Minn., will let subcontracts this month for the team and steam-shovel work on the contract awarded them by this company for work from Milan, Minn., to Milbank, S. D.

North Dakota—Fairmont & Veblen R.R.—This company has been organized to construct a 50-mile line in North Dakota and South Dakota, at an estimated cost of $600,000. The names of the promoters are not given.

Arkansas—St. Louis-Southwestern Ry.—This company is considering the construction of a line from Pine Bluff, Ark., to Sherrill crossing the Arkansas River on the free bridge to be built to Jefferson County. The new line will give an more direct route to Little Rock from Pine Bluff. F. H. Britton, St. Louis, Mo., is Pres.

✚St. Louis, Arkansas & Pacific Ry.—This company has awarded the contract to J. H. Rader, Harrison, Ark., for constructing 104 miles of line between Harrison and Bergman, Ark.

✚**Arkansas**—Ozark Land & Lumber Co.—This company has awarded the contract to the W. R. FELKER CONSTRUCTION CO., Rogers, Ark., for the construction of its line from Myers, Ark., to West Eagle, six miles. The company was organized in 1902 to develop timber lands in Benton, Washington and Madison Counties.

✚**Kansas City & Memphis R.R.**—This company has awarded the contract to the W. R. FELKER CONSTRUCTION CO., Rogers, Ark., for the construction of an extension of 35 miles, east to Huntsville.

The construction of a railroad from Pleasant Plains to either Batesville or Bald Knob is being considered. The Progressive Association of Pleasant Plains is interested.

Texas—Beaumont & Great Northern Ry.—This company is considering extending its line from the present northern terminus at Weldon to a connection with the Trinity & Brazos Valley Ry., at some point between Jewett and Flynn. William Carlisle, Atchison, Kan., is Pres.

Missouri, Kansas & Texas Ry.—This company is arranging to begin work soon on the improvements planned in the freight yards near Houston, Tex. A. M. Atcheson is Ch. Engr., Dallas, Tex.

Colorado—Colorado Midland Ry.—It is reported that one of the results of the receivership for this company will be the expenditure of $1,000,000 for improvements between Leadville & Colorado Springs, Colo. V. B. Wagner, Colorado Springs, Colo., is Ch. Engr.

✚**Washington**—Chicago, Milwaukee & Puget Sound Ry.—This company has awarded the contract to the ERICHSON CONSTRUCTION CO., New York Block, Seattle, Wash., for the construction of about 40 miles of line from Port Angeles south, at about $2,000,000.

California—San Pedro, Los Angeles & Salt Lake R.R.—This company will construct a new line from Daggert to San Bernardino, Calif. Arthur McGuire, Los Angeles, Calif., is Div. Engr.

Calaveras Copper Co.—This company is planning to construct a railroad 16 miles long, to cost $200,000, connecting the mines at Copperopolis, Calif., with the road leading into Stockton, Calif.

Southern Pacific Co.—This company, it is reported, has acquired the last right-of-way for a low-grade line over the Tehachapi Mountains, between Mojave and Kern City, Calif. The line, which will be begun immediately, calls for an expenditure of $10,000,000. W. Hood, San Francisco, is Ch. Engr.

Alaska—Tanana Valley R.R.—This company is having surveys made for the construction of an extension from Chatanika, Alaska, east to Cleary City, six miles. This work will be done by the forces of the company.

ELECTRIC RAILWAYS

Boston, Mass.—Plans are being prepared by the West End St. Ry. Co. for the extension of its lines in Boston. Edward Mahler, Boston, is Pur. Agt.

Ansonia, Conn.—The Connecticut Co. plans to extend its lines in Ansonia. J. K. Punderford, New Haven, is Gen. Mgr.

Canajoharie, N. Y.—The Little Falls & Johnstown R.R. Co. has applied to the Public Service Commission for permission to construct an electric railway to connect Canajoharie, Fort Plain and St. Johnsville. J. L. Hees is Pres.

Sterling, N. Y.—Charles M. Delling and associates are considering plans for the construction of an electric railway from Sterling to Fairhaven.

Seabright, N. J.—Plans are being prepared by the Monmouth County Electric Co. for the extension of its electric railway from Rumson to Seabright. William F. Hogan, Arbuckle Bldg., Brooklyn, N. Y., is Pres. and Gen. Mgr.

Gallitzin, Penn.—The Sugar Run & Portage Ry. Co. has applied to the Council for a franchise to construct and operate an electric railway through Gallitzin for its proposed line from South Fork to Altoona. Charles H. Morgan, Altoona, is Pres.

Washington, D. C.—The Virginia Terminal Co. has been incorporated to construct an electric railway in Washington. The incorporators are Henry A. Wardman, A. A. Thomas, Washington; J. G. Dudley and I. C. Taylor.

Richmond, Va.—The Richmond & Henrico Ry. Co. is making arrangements for the extension of its line into the east and west sections of Richmond. C. Sims Bailey, Richmond, is Gen. Mgr. and Ch. Engr.

Birmingham, Ala.—The Highland Land Co. has been granted a franchise to construct and operate an electric railway from Owenton to Tuxedo Park. Albert P. Bush, Mobile, is interested. Noted Dec. 26.

Fairhope, Ala.—The People's Ry. Co. has been incorporated to construct an electric railway from Fairhope to Robertsdale, about 14 miles. E. B. Gaston is interested.

Gadsden, Ala.—Preliminary surveys are being made for the construction of a proposed electric railway from Gadsden to Center. Louis Hart, Gadsden, is interested. Noted Nov. 28.

Memphis, Tenn.—The West Tennessee Traction Co. is making preliminary preparations for the construction of its proposed electric railway from Memphis to Arlington, about 25 miles. A. N. Bullitt, Memphis, is Ch. Engr.

Louisville, Ky.—The Louisville Ry. Co. is considering plans for the extension of its Market St. line on the Brownsville Road. T. J. Minary, 316 W. Jefferson St., Louisville, is Pres. and Gen. Mgr.

Terre Haute, Ind.—The Springfield & Central Illinois Traction Co. contemplates the extension of its lines through West Terre Haute.

Detroit, Mich.—The Detroit Electric Ry. Co. is making arrangements for double-tracking its line from Detroit to Mt. Clemens. Work will not be started until the spring. F. W. Brooks, 12 Woodward Ave., Detroit, is Gen. Mgr.

Lincoln, Ill.—The Council has granted a franchise to the Lincoln Ry. & Light Co. to extend its line on Eighth and State Sts. E. D. Blinn, Jr., Lincoln, is Gen. Mgr. and Pur. Agt. Noted Dec. 5.

Quincy, Ill.—Steps are being taken for the construction of an industrial belt line in Quincy. Estimated cost, $150,000. J. Henry Bastert, Pres. of the Chamber of Commerce, is interested.

Des Moines, Iowa—The Des Moines City Ry. Co. is considering plans for the general improvement of its system in Des Moines. William E. Ralston is Gen. Supt.

Keokuk, Iowa—The Keokuk, Nauvoo & Fort Madison Interurban Ry. Co. has completed surveys for the construction of an electric railway to connect Keokuk, Nauvoo, Carthage, Haullton and Fort Madison. R. E. Kirk, Minneapolis, Minn., is Ch. Engr.

Sheridan, Mont.—The construction of an electric railway in the vicinity of Sheridan is contemplated by the Waters Tunnel Co.

Fayetteville, Ark.—The City Council has granted a franchise to J. A. Connelly and W. Owens to construct and operate an electric railway in Fayetteville.

Little Rock, Ark.—The Arkansas Interurban Construction Co. will receive bids about Feb. 1 for the construction of its proposed electric railway from Little Rock to Hot Springs, about 56 miles. L. Garrett, Little Rock, is Gen. Mgr. Noted Dec. 26.

Beaumont, Tex.—The County Commissioners have granted a franchise to the Jefferson County Traction Co., to construct and operate an electric railway connecting Beaumont and Port Arthur. C. W. Kellogg, Jr., Dallas, is interested.

✦Dallas, Tex.—The Southern Traction Co. has awarded the contract for the construction of its proposed interurban railway from Dallas to Waco, and from Dallas to Corsicana, to the FRED A. JONES CO., Chronicle Bldg., Houston. Estimated cost $500,000. Noted Mar. 14.

Houston, Tex.—The South Texas Traction Co., which was recently organized, is making preliminary arrangements for the construction of a 25-mile electric railway through Harris County, connecting Houston and La Porte. H. T. Arnold, Houston, and Edward P. Allen, St. Louis, Mo., are interested.

Pocatello, Idaho—The City Council has been petitioned to grant a franchise to J. D. Browning, Pocatello, and L. R. Martineau, Salt Lake City, Utah, for the construction of an electric railway in Pocatello.

Salt Lake City, Utah—The Utah Ry. & Light Co. plans the extension of its Warm Springs line from Seventh North to Second West St. Joseph S. Wells, Salt Lake City, is Gen. Mgr.

Tillamook, Ore.—The construction of an electric railway from Banks to Tillamook, about 40 miles, is contemplated by the United Rys. Co. C. A. Coolidge, Portland, is Gen. Mgr.

Berkeley, Calif.—The San Francisco & Oakland Terminal Ry. Co. has applied for permission to exercise franchise rights previously granted by the city to construct and operate an electric railway in Berkeley.

Palo Alto, Calif.—The Peninsular Ry. Co. is planning the construction of an electric railway from Palo Alto to San Mateo. P. E. Chapin, San José, is Gen. Mgr.

San José, Calif.—The Peninsula Ry. Co. will reconstruct its electric line from San José to Glen Park. This will be one of the costlier pieces of electric railway in California, as the construction of at least 12 concrete bridges will be necessary. P. E. Chapin, San José, is Gen. Mgr.

Stanton, Calif.—The Pacific Electric Ry. Co. is preparing to double-track its line from Sterling to Huntington Beach. J. McMillan, Los Angeles, is Gen. Mgr.

Brantford, Ont.—The Brantford & Hamilton Electric Ry. Co. has applied for permission to construct and operate an electric railway from Brantford east to Hamilton. The company is a subsidiary of the Canadian Pacific Railway. [illegible] of which is Hamilton, Ont.

Sarnia, Ont.—The Huron Lake Shore Ry. Co. proposes to construct an electric railway from Sarnia to Stratford.

Calgary, Alta.—We are informed that the Calgary Municipal Ry. Co. is making preparations for double-tracking and extending some of its lines and constructing an extension of the present Tuxedo Park line. H. Mackenzie Cowper is Gen. Mgr. Noted Dec. 19.

Edmonton, Alta.—The Council has granted a franchise to the Edmonton Radial Ry. Co. to construct and operate a 3 ft. 6 in. belt line in Edmonton. Robert Leonard is Supt.

Prince Albert, Sask.—Plans are being prepared for the construction of an eight-mile electric railway in Prince Albert. Estimates are being made by H. S. Townsend, of the Stone & Webster Engineering Corporation, Boston, Mass.

LIGHT, HEAT AND POWER

Hill, N. H.—Frank R. Woodward has been granted permission by the Public Service Commission to construct and operate an electric system in Hill.

Stratham, N. H.—The Exeter & Hampton Electric Co. has applied for permission to construct and operate an electric light system in Stratham.

Bennington, Vt.—The Charles H. Tenny Co., 201 Devonshire St., Boston, Mass., is interested in the project for the development of water power in the vicinity of Bennington.

Edgartown, Mass.—Bids will be received by the County Commissioners until Jan. 10, for the installation of an electric system in the Dukes County court house. W. D. Harding is a member of the Comm.

Millbury, Mass.—The construction of a transformer station on Providence St., Millbury, is contemplated by the Worcester Consolidated St. Ry. Co. H. C. Page, Worcester, is Gen. Mgr.

Crescent Beach, Conn.—The Lyme Electric Co., Lyme, contemplates the installation of an electric-lighting system at Crescent Beach.

✦Cranford, N. J.—Thomas A. Sperry has awarded the contract for the construction of a power dam across the Rahway River, at Cranford, to the BARROWS-STEWART CO. The dam will be equipped with floodgates, to supply water to drive a turbine installed below the dam to furnish light and power for local use.

Franklin, Penn.—The power plant of the Citizens' Light & Power Co. at Franklin will be enlarged and improved. F. D. Shaffer, Oil City, is Gen. Mgr.

Mt. Pleasant, Penn.—The Mountain Power Co. has been granted a franchise to construct and operate an electric-light plant at Mt. Pleasant. Edward H. Wise, Wheeling, W. Va., is interested.

New Castle, Penn.—An election will soon be held to vote on the proposition to issue $200,000 in bonds for the construction of a municipal electric-light plant.

Sharon, Penn.—Plans are being prepared by G. Nicolls, Arch., Sharon, for the construction of a municipal electric light plant to cost $55,000. Noted Mar. 28.

Baltimore, Md.—The Consolidated Electric Light & Power Co. has had plans prepared for the construction of a boiler house at the foot of Leadenhall St., Baltimore, to cost approximately $50,000. Andrew Banks, Jr., Baltimore, is Pur. Agt.

Frederick, Md.—The city is considering plans for the improvement of the municipal electric-light plant.

Mt. Airy, Md.—Steps for the installation of an electric light plant are being taken by George W. Runkles and Emory Wagner.

Rockville, Md.—Permission has been granted to the Potomac Electric Power Co. to extend its transmission lines from Rockville to Gaithersburg. L. E. Sinclair, Washington, D. C., is Gen. Supt.

Lyons, Ga.—See item under Water Supply—Irrigation.

Alachua, Fla.—See item under Water Supply—Irrigation.

New Orleans, La.—Bids will be received by F. S. Shields, Secy. Sewerage and Water Bd., until noon, Feb. 18, for furnishing and installing a transmission line and power cables for the drainage system.

Morristown, Tenn.—The installation of an ornamental street-lighting system is under consideration.

Nashville, Tenn.—The Nashville St. Ry. & Light Co. is making preliminary arrangements for the construction of a substation on the Lebanon Turnpike. W. G. Cameron, Nashville, is Ch. Engr. Pwr. Station.

Sevierville, Tenn.—The construction of an electric-light plant, at Sevierville, as contemplated by McMahan Bros.

Monticello, Ky.—The Monticello Gas Co. has been incorporated to develop gas wells in Wayne County, Ky., and plans increasing its capitalization to $500,000 to finance the construction of a 10-in. pipe line from Monticello to Danville, Ky., by way of Somerset and Stanford. Ernest Porter is Ch. Engr.

Munfordville, Ky.—The Munfordville Electric Co. has been organized by local citizens and will establish an electric light plant.

Pineville, Ky.—The Continental Coal Co. is interested in a movement for the establishment of a $1,000,000 power plant at Pineville, for lighting that city, Middlesboro and other eastern Kentucky points.

Shelbyville, Ky.—An extensive heating system will be installed in the new Shelby County court house. Joseph & Joseph, Louisville, are Archs.

Somerset, Ky.—The Kentucky Utilities Co., Lexington, has authorized the United Wate, Light & Traction Co., which it recently purchased, to expend $75,000 for the construction of a new power plant at Somerset.

Cleveland, Ohio—The Hutzen Power Co., recently organized will need power equipment for its new power plant D. W. Gaskin and F. J. Peck are interested.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. of Pub. Serv., until Jan. 2, for furnishing fiber conduit and paper insulated cables for the municipal electric light plant.

Clyde, Ohio—See item under Water Supply—Irrigation.

Paulding, Ohio—The city is planning extensive improvements to its municipal electric-light and water plant. L. O. Farnsworth is Supt. of the plant.

Goshen, Ind.—We are officially advised that plans are being prepared for the reconstruction of the street-lighting system. Samuel F. Spohn is Mayor.

Logansport, Ind.—Improvements are planned to the municipal electric-light plant, including the installation of new equipment. J. H. Stewart is Supt. and Engr. of the plant.

New Albany, Ind.—The Chamber of Commerce of New Albany is interested in the construction of a pipe line from the natural-gas fields in Harrison County to New Albany.

Batavia, Ill.—The City Council is considering an expenditure of $7000 for the installation of new equipment in the municipal electric-light plant.

Dundee, Ill.—It has been decided by the Village Board to install an electric-light plant and system in West Dundee.

Pekin, Ill.—We are officially advised that the city has decided to install about 70 ornamental lamps for street-lighting purposes. Estimated cost, $11,000. E. L. Conklin is Pres. of the Commercial Club. Noted Dec. 19.

Raymond, Ill.—W. R. Adams, Taylorville, Ill., has applied for a franchise to construct and operate an electric-light system in Raymond.

✦Allouez, Wis.—The contract for constructing a new power plant for the Pittsburgh Coal Co., at Allouez, has been awarded to A. DAUPLAISE, Superior, at $60,000.

Fonddu Lac, Wis.—Bids are being received by the Committee on County Buildings for the installation of a new heating system in the Fond du Lac County court-house. M. Commo is Chn.

Kilbourne, Wis.—The installation of a considerable amount of additional equipment in the municipal electric-light plant is under consideration. David G. Howey is Supt. of the plant.

✦Port Washington, Wis.—The contract for remodeling the gas-producer plant of the Milwaukee Northern Electric Ry. Co., at Port Washington, has been awarded to the OPTENBERG IRON WORKS, Sheboygan.

Dyersville, Iowa—The Dyersville Light & Water Co. will construct a new electric-light plant if its franchise is renewed. H. F. Kremer, Dyersville, is Mgr.

Forest City, Iowa—Plans are being prepared by the Forest City Electric Light & Power Co. for extensive improvements to its plant, including the construction of a new power house, and installation of new equipment. F. Kellogg is Pres. and Mgr.

Boyd, Minn.—The citizens have voted $7500 of bonds for the installation of an electric-light system in Boyd.

Zumbrota, Minn.—Preliminary plans are being made by the Zumbrota Power Co. for the construction of a hydro-electric plant on the Zumbrota River. C. D. Denison, Zumbrota, is Mgr.

Garden City, Kan.—See item under Water Supply—Irrigation.

Topeka, Kan.—The citizens of North Topeka have petitioned the City Council to consider the extension of the ornamental street-lighting system to North Topeka.

Tecumseh, Neb.—The Town Board has granted a franchise to Edwin Bartels to construct and operate an electric-light plant at Tecumseh. Noted Dec. 26.

Pacific, Mo.—A franchise has been granted to the Pacific Electric Co. to construct and operate a new street-lighting system in Pacific. W. M. Thomas is Ch. Engr.

Benton, Ark.—Bacon & Davis, 115 Broadway, New York, N. Y., have been engaged as consulting engineers by the Garland Power & Development Co., in connection with the construction of its hydro-electric plant on the Ouachita River. The estimated cost of the plant and transmission system is $3,000,000. C. C. Cavanaugh, Little Rock, is Pres.

Cabot, Ark.—The construction of an electric-light and water plant at Cabot is contemplated by W. M. Hudson.

McGehee, Ark.—See item under Water Supply—Irrigation.

Bremond, Tex.—The Bremond Electric Light Co. is preparing to install an electric-light plant at Bremond.

Burnet, Tex.—The City Council has under consideration the proposition of ordering an election to vote bonds for the installation of an electric-light and power plant.

Gilmer, Tex.—The Albert Manuel Co., Dayton, Ohio, has purchased the plant of the Gilmer Light, Ice & Power Co. The new owner is planning considerable improvements to the property.

Paris, Tex.—The Texas Power & Light Co. which recently acquired the electric-light and power plant of the Paris Light & Power Co. will install new machinery and equipment and make other improvements to the present plant.

San Saba, Tex.—A franchise has been granted to the San Saba Electric Light Co. to construct and operate an electric-light plant and system in San Saba.

Waxahachie, Tex.—The Commercial Club is promoting the construction of an electric-light and power plant.

Johnstown, Colo.—The citizens have voted to grant a franchise to George H. Sethman to construct and operate an electric-light plant at Johnstown.

Safford, Ariz.—The Farmers Association, of Safford, has taken preliminary steps toward installing a central electric power station here and the construction of a system of transmission lines to irrigation pumping plants that are to be installed upon a large irrigation district that is to be formed near Safford.

Dixon, Calif.—The Pacific Gas & Electric Co. will spend $60,000 for improvements to its electric system in Dixon.

✦San Francisco, Calif.—The contract for the construction of a power plant, according to plans prepared by Charles P. Weeks, Mutual Bank Bldg., for the Union Iron Works, at 20th and Illinois Sts., has been awarded to THOMAS DAY'S SONS, Monadnock Bldg., at $35,000. Noted June 6 and Aug. 22.

Chesterville, Ont.—The Village Council contemplates the installation of an electric-light and power system. T. T. Shaw is Village Clk.

Parry Sound, Ont.—The Town Council is considering the installation of an electric-lighting system to cost $5500. E. E. Armstrong is Town Clk.

Woodstock, Ont.—The Woodstock & Brantford Gas Co. is making preliminary arrangements for the extension of its natural gas system. W. Sutton is Mgr.

Prince Albert, Sask.—Press reports are to the effect that the city is considering the proposition to expend $150,000 for the construction of an electric-light plant separate from the water and pumping plants.

BRIDGES

Salem, Mass.—The Board of Commissioners of Essex County is considering the construction of a new bridge to replace the present Rocks Bridge, over the Merrimac River, at Rocks Village. The estimated cost is $250,000.

Springfield, Mass.—The Springfield St. Ry. Co. is considering plans for the construction of a new bridge on St. James Ave. The estimated cost is $12,500. E. J. Dickson is M. Noted Dec. 12.

Springfield, Mass.—The Board of Aldermen is considering plans for the extension of Dwight and Water Sts., and the construction of a bridge on Dwight St. The estimated cost is $210,000. C. M. Slocum is City Engr.

✦New York, N. Y.—We are officially advised that the Dept. of Bridges, 21 Park Row, has awarded a contract to WILLIAM P. SEAVER, 32 Fifth Ave., at $817,380, for the construction of improvements to the Manhattan Plaza of the Manhattan Bridge. Bids were received on Dec. 19. Arthur J. D'Keefe is Comr. Noted Dec. 26.

Whitehall, N. Y.—Bids will be received until Jan. 13, by the State Highway Commission, Albany, for the construction of a bridge over South Bay, a branch of Lake Champlain, near Whitehall. The estimated cost is $50,000.

New Brunswick, N. J.—Bids will be received until Jan. 13, by the Board of Chosen Freeholders, for the construction of a steel and concrete bridge over Noes Creek, on Blazing Star Road.

Wilkes-Barre, Penn.—The Board of Commissioners of Luzerne County, is contemplating the construction of two reinforced-concrete bridges. The estimated cost is $20,000. Boyle & Howell, Kingston, Penn., are Engrs.-in-charge.

✦Baltimore, Md.—The Board of Awards has awarded a contract to the DAVID M. ANDREW CO., Equitable Bldg., Baltimore, at $16,150, for the construction of a masonry arch and retaining walls in connection with the Wymans Park Bridge.

Charleston, S. C.—The Charleston-Isle of Palm Traction Co. is arranging for the construction of a bridge over the Cooper River. The structure complete will be 5000 ft. long, and will have a bascule draw of 110 ft. It will be of reinforced concrete construction and will have accommodations for car tracks, roadway and pedestrian tramc. W. W. Fuller is Ch. Engr.

Birmingham, Ala.—Bids will be received until Jan. 6, by the City Council, for the construction of a reinforced concrete viaduct at 12th Ave. and 27th St. The structure will be 140 ft. long, and will be built over the tracks of the Frisco, Southern and Illinois Central railroads. Walter G. Kirkpatrick is City Engr. Noted Dec. 12.

Cleveland, Ohio—The Dept. of Public Service is considering the construction of two elevator bridges, costing about $500,000, to carry the tracks of the Lake Shore and Pennsylvania railroads over the river, replacing the old Lake Shore swing bridge with its center pier. The new bridges will each have a span of 200 ft., and the entire floor will be raised to the height of two tall towers, in elevator fashion, to permit tall masted boats to pass beneath. The Lake Shore bridge will be south of its present location, while the new Pennsylvania bridge will be on the present site of the Lake Shore bridge and at a lower level, to meet the grade of the Pennsylvania ore docks. W. J. Springborn is Dir. of Pub. Ser.

The Board of County Commissioners has decided on a plan for a new bridge over the Big Creek to replace the condemned Brooklyn-Brighton Bridge. The new bridge will start at west 25th St. and Selzer Ave., and will end at Pearl Road and Partside Ave. The estimated cost is $1,00,000. John F. Goldenbogen is Clk.

Cleveland, Ohio—Bids were received on Dec. 19, by the Director of Public Service, for the construction of a bridge over the Cuyahoga River, from Clark Ave. S. E. to S. W. H. Path & Son, Electric Bldg., Cleveland, at $223,450, were low bidders for the portion of the bridge over the land. The Phee Construction Co., Chicago, Ill., at $109,378, were low bidders for the portion over the river. The total length, including approaches, will be 7000 ft., while the bridge itself will be 4300 ft. F. Richards is Bridge Engr. Noted Nov. 28.

Toledo, Ohio—A resolution has been passed by the City Council, authorizing the Director of Public Service to advertise for bids for the removal of the present bridge over Swan Creek at St. Clair St. to a point at the old side-out of the Miami and Erie Canal. J. M. Babcock is City Clerk.

Indianapolis, Ind.—Bids will be received until 10 a.m., Jan. 14, by the Board of Commissioners of Marion County, for the construction of a reinforced concrete bridge, over Crooked Creek, on the Myers Road. William T. Patten is Audr.

Vincennes, Ind.—Bids will soon be received by the Board of Commissioners of Knox County, for the reconstruction of a 100-ft. span bridge, across the Duckee River, in lower Vincennes Township. John C. Scott is Audr.

Springfield, Ill.—The Board of County Commissioners has appropriated $6000 as the county's share toward the construction of a steel bridge across the Sangamon River, in Salisbury Township. Alvin S. Keyes is County Audr.

★Oshkosh, Wis.—Bids will be received until noon, Jan. 29, by the Board of Public Works, City Hall, for the construc-

tion of a new bridge across the Fox River, at West Algoma St. Bids will be received for the substructure, superstructure and approaches. The Scherzer Rolling Lift Bridge Co., Monadnock Block, Chicago, Ill., are Engrs.-in-charge. Noted Dec. 26.

Ida Grove, Iowa—The State Highway Commission is taking soundings in the Maple River preparatory to the acceptance of plans prepared for the new bridge, which will be erected across it. It will have a concrete arch, and with approaches, will be 400 ft. long.

Eldorado, Kan.—We are officially advised that bids will be received until noon, Jan. 7, by the County Clerk, for the construction of the Weidlein Bridge. It will have two reinforced-concrete girders. Noted Oct. 10.

Great Bend, Kan.—We are officially advised that bids will be received until noon, Jan. 10, by the County Clerk, for the construction of the Great Bend Bridge, across the Arkansas River. The structure will have ten 45-ft. reinforced-concrete girder spans. The estimated cost is $20,000. C. F. Younbein is County Clk. Noted Oct. 24.

McCook, Neb.—Bids will be received until Jan. 15, by the Board of Commissioners of Red Willow County, for the construction of the substructures and superstructures of all bridges to be erected in the county during 1913. C. K. Dutcher is County Clk.

Waynesville, Mo.—The County Court of Pulaski County has ordered the construction of a steel bridge across the Gasconade River, at Mayes Ford.

Denison, Tex.—The Red River Bridge Co. will construct a new and modern steel bridge across Red River, north of Denison. The proposed structure will consist of three spans, two being 280 ft. long, and one 100 ft. long. Provision will be made for accommodating the track of an interurban electric line upon the structure.

Littleton, Colo.—Bids will be received until Jan. 2, by the Board of Commissioners of Arapahoe County, for the construction of an I-beam bridge, over Little Dry Creek, on State Primary Road No. 3. Robert S. Brown is County Clk.

Middletown, Idaho—The City Council is considering the advisability of the construction of two bridges across Willow Creek. The estimated cost is $15,000.

Salt Lake City, Utah—Plans for the viaduct to be constructed by the Denver & Rio Grande R.R., at Fourth South St. will be approved by the City Engineer upon authorization of the City Commission. The bridge will be a steel and concrete structure, the abutments of concrete and the arch of steel construction. C. S. Thompson, Denver, Colo., is Supt. of Bridges, of the railroad. Noted Oct. 31.

+Tacoma, Wash.—We are officially advised that the Board of County Commissioners has awarded a contract to G. A. MARSH, Tacoma, at $8442, for the construction of three bridges on the Stillacoom-Tacoma Scenic Blvd. Bids were received on Dec. 21. W. A. Stewart is County Audr. Noted Dec. 12.

The City Commissioners are now considering the construction of a steel viaduct over the tracks of the Northern Pacific Ry. on South Tacoma Ave. The estimated cost is $40,000. W. C. Raleigh is City Engr.

Oakland, Calif.—We are officially advised that bids will be received until Jan. 6, by the City Council, for the construction of a new bridge, at Eighth St., over the Lazoon, which connects Lake Maritt with the estuary. It will be of steel and concrete. The estimated cost is $25,800. Noted Dec. 19.

+Santa Barbara, Calif.—The City Council has awarded a contract to J. M. WILLIAMSON, at $13,288, for the construction of a reinforced concrete bridge on the East Boulevard. Bids were received on Dec. 12. Eldon A. Garfield is City Engr. Noted Dec. 5.

Vancouver, B. C.—Bids will be received until Jan. 13, by the City Council, for the construction of the Georgia-Harris St. bridge. It will be of concrete and steel construction and will cost approximately $300,000. Noted Dec. 12.

WATER SUPPLY—IRRIGATION

Boston, Mass.—The following bids were received, Dec. 27, for the Supply Department for the pipe for the high-pressure fire service; the price includes the placing in piles of the pipe at the pipe yard. Amounts bid upon were: 100 tons of 8-in. Class C pipe & 12-in. 2400 tons each of 16-in. and 20-in. standard C. I. Pipe & Foundry Co. $22.31 per ton. Boston Iron Works $25.15. U. S. Cast Iron Pipe & Foundry Co. $25.50. Warren Pipe & Foundry Co. $30.50. No award. J. E. Mahan is Supt. of Dept. Noted Dec. 12.

Marlboro, Mass.—The Advancement Association is agitating the installation of a water system here.

Binghamton, N. Y.—According to press reports, the city contemplates the enlargement of a second filtration plant estimated to cost $125,000. M. Shepard is Supt. Water Dept. Noted Dec. 31.

+New York, N. Y.—We are officially advised that bids for furnishing 11 in. pumping equipment recently from the city of Kingston, N. Y., for the supply of Mount Pleasant, South Castle and Hurley, Ulster County, were received by the Board of Water Supply Dec. 23 as follows: William Harris Co. 71 West 23d st., New York, $10,000. Theodore L. Pratt & Co., 50 Church st., New York, $11,000. Carpenter & Lindsay Pattern Co., 1 Madison Ave. & Kerchoval Ave., 6 Church St., New York, $11,000. Noted Dec. 12.

Schenectady, N. Y.—According to press reports bids will be received by Fred W. Dunlap, Supt. of Water until Jan. 8, for furnishing 150 water meters. Noted Dec. 26.

Jersey City, N. J.—Press reports state that bids will be received by the Board of Street and Water Commissioners until 3 p.m. Jan. 6 for furnishing the necessary labor to lay the unpaved portions of Boulevard No. 2 E. to be in Cit.

★+Trenton, N. J.—We are officially advised that the contract to construct a water-purification plant here has been awarded to the J. S. ROGERS CO., Moorestown, N. J., at $326,906. Bids were opened by the City Commissioners, Oct. 25. Noted Nov. 14.

Canton, Penn.—We are officially advised that Henry W. Taylor, Consult. Engr., 100 State St., Albany, N. Y., has been retained by the Citizens Water Co. to investigate and report on water supply conditions.

Troy, Penn.—We are officially advised that Henry W. Taylor, Consult. Engr., 100 State St., Albany, N. Y., has been retained by the Borough Council to investigate and report on water supply conditions.

Rehoboth, Del.—An election will probably be called some time during the year to vote on a bond issue for the installation of a water system.

+Baltimore, Md.—A contract to furnish a 115-in. Venturi meter, with appurtenances, has been awarded to the BUILDERS' IRON FOUNDRY, Providence, R. I., at $5420. Bids were opened Dec. 11, by the Board of Awards. Noted Nov. 28.

Washington, D. C.—See item under Federal Government Work.

+Fairmont, W. Va.—We are officially advised that a contract to furnish a 4,000,000-gal. horizontal cross-compound Corliss high-duty pumping engine, for the water system, has been awarded to the EPPING-CARPENTER CO., 90 West St., New York.

Milton, W. Va.—Bids will be received by H. E. Jackson, City Recdr., until Jan. 3, for furnishing material and constructing a water system here. Plans were prepared by the Leete-Maupin Engineering Co., Huntington, W. Va.

Greensboro, N. C.—Bids will be received by the Board of City Commissioners until 2:30 p.m., Jan. 9, for the purchase of $10,000 bonds for improving the water and sewer systems, and $25,000 bonds for street improvement. T. J. Murphy is Mayor.

Lyons, Ga.—Bonds for $12,000 have been voted for improving the water system and the electric-light plant.

+Alachua, Fla.—According to press reports, a conract to install a water system and an electric-light plant here, has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at approximately $26,000.

Baton Rouge, La.—The Baton Rouge Water Works Co. contemplates the construction of a reinforced concrete reservoir. Bids will probably be asked this month. John H. Wood is Mgr.

Leitchfield, Ky.—The W. T. McCaskey Light & Power Co. will install a water system here. Plans are now being prepared and contracts for machinery will be placed in the near future.

Canton, Ohio—The Finance Committee of the City Council favors the expenditure of $10,500 for purchasing additional pumps and drilling new wells for the water system.

Clyde, Ohio—The Moore Engineering Co., Cleveland, Ohio, has been retained by the city to prepare plans and specifications for reconstructing and extending the water system and electric-light plant. Bonds for $30,000 were recently sold for this work. Noted Nov. 21.

East Liverpool, Ohio—An election will soon be called by B. L. Bennett, City Solicitor, to vote on a $250,000 bond issue for installing a mechanical filtration plant and making other improvements to the water system.

+Toledo, Ohio—We are officially advised that the contract to rebuild and enlarge a part of the high service pumping station, has been awarded to the A. BENTLEY & SONS CO., Toledo, at $26,445. The other bids were as follows: Henry J. Spirker Co., $27,114; Berrs Offut Co., $27,830; J. C. Le Duke Co., $30,390; Thomas Moylan, $34,990. Noted Dec. 19.

Toledo, Ohio—De Vore & McGormley, Consult. Engrs., Nasby Bldg., Toledo, are preparing plans for a one-story pumping station, 90x104 ft., for the city. Estimated cost, $200,000. J. R. Cowell is Dir. Pub. Ser.

Ann Arbor, Mich.—We are officially advised that bids for pumping five artesian wells were received by the Special Water Committee, Dec. 20, as follows: Hill Tripp Pump Co., Anderson, Ind., $8400; W. J. Harper, Wauseon, Ohio, $7350. Manley Osgood is City Engr. Noted Dec. 12.

Grand Rapids, Mich.—Press reports state that bonds for $100,000 have been voted for extending the water system. J. Schriver is City Clk.

Kalamazoo, Mich.—Bids will be received by C. L. Miller, City Clk., until Jan. 6, for furnishing about 500 tons of 4- to 12-in. c.-i. water pipe.

Olivet, Mich.—Surveys are being made for the installation of a water system here. An election will probably soon be called to vote on this proposition.

Ashton, Ill.—The City Council has passed an ordinance providing for the installation of a water system.

★Beardstown, Ill.—See item under Miscellaneous: Drainage Pumping Plant, Beardstown.

Chicago, Ill.—The Mayor has sent a message to the City Council urging the immediate development of high water pressure systems for different sections of the city. The necessary protection can be furnished these districts only by the installation of a high-pressure system operating independently from the present system. The cost of the entire system was given as $4,123,618.

Elgin, Ill.—The Water Department contemplates the construction of a standpipe estimated to cost, with other improvements, $50,000. C. L. Kuhn is Comr.

Antigo, Wis.—Arthur M. Morgan, Consult. Engr., 111 West Monroe St., Chicago, has been retained to appraise the value of the water system. The city will either buy the plant or install a new system.

Belle Plaine, Iowa—We are officially advised that Charles P. Chase, Consult. Engr., Clinton, Iowa, has been retained by the City Council to supervise the installation of an air lift or centrifugal pump, and extensions to the water system.

+Sioux City, Iowa—We are officially advised that the contract to construct a reinforced-concrete reservoir, 112 ft. in diameter and 32 ft. deep at the wall, and for enlarging the existing reservoir to the same dimensions, has been awarded to JENSEN & KRAGE, Sioux City, at $38,812. Bids were opened Dec. 14. Noted Dec. .

Valley Junction, Iowa—We are officially advised that Charles P. Chase, Consult. Engr., Clinton, Iowa, has been retained to prepare plans for a municipal water system and electric-light plant here.

Lake City, Minn.—Charles P. Chase, Consult. Engr., Clinton, Iowa, has submitted preliminary plans for reconstructing the water system here.

St. Paul, Minn.—Bids will be received by the Board of Park Commissioners until 2 p.m., Jan. 6, for constructing a water tank and tower at Phalen Park. G. T. Reddington is Secy.

Burlingame, Kan.—Bids will be received by the city until Jan. 9, for constructing a water system and filtration plant estimated to cost $56,000. Plans were prepared by A. J. Smith, Consult. Engr., Emporia, Kan. J. Pringle is Mayor. Noted Dec. 6.

Diller, Kan.—The city contemplates a bond issue of $5000 for completing the water system.

Garden City, Kan.—At an election held, Dec. 17, bonds for $40,000 were voted for installing a municipal water system and electric-light plant.

Humboldt, Kan.—We are officially advised that all bids received, Dec. 20, for extending the water intake, were rejected. The material will be purchased by the city, and the work done under the supervision of L. C. Willis, Consult. Engr. J. E. Wakefield is City Clk. Noted Dec. 5.

+Kansas City, Kan.—A contract to furnish a centrifugal pump of 15,000,000 gal. daily capacity, has been awarded to the BRAVO DOYLE CO., Pittsburgh, Penn., at $7335.

Billings, Mont.—Bids will be received by the Directors of the Lockwood Irrigation District until Jan. 6, for constructing the necessary pipe lines, distributing canals and pumping plants for the proposed irrigation system. E. D. Ford is Secy.

***Multa, Mont.**—See item under Federal Government Work.

Turon, Kan.—At a recent election, bonds for $20,000 were voted for installing a municipal water system and an electric-light plant here.

McIntosh, S. D.—Bonds for $12,000 have been sold for installing a water system here. B. H. Borresen, Watauga, S. D., is Consult. Engr., and John J. Flaherty, City Audr. Noted Sept. 26.

Cody, Wyo.—The Town Council has instructed the Town Engineer to investigate the efficiency of the water system and recommend improvements. It is planned to expend $30,000 for this work.

Heber Springs, Ark.—The Board of Public Improvements has retained Dickson & Watkins, Consult. Engrs., Little Rock, Ark., to prepare plans and specifications for water and sewer systems here.

+McGehee, Ark.—The contract to construct a water system and an electric-light plant here, according to plans prepared by the Missori Valley Engineering Co., has been awarded to T. C. BROOKS & SONS, Jackson, Mich., $34,189. Bids were opened Dec. 16. Noted Nov. 28.

Balmorhea, Tex.—The Mountcastle Irrigation Co. recently acquired about 5000 acres of land in addition to its other holdings near here and will extend its system of irrigation to cover the new tract.

Crystal City, Tex.—An election of taxpayers has been called for Jan. 11, to vote on the proposition of issuing $14,500 of bonds for the construction of a water system.

Garwood, Tex.—The Garwood Irrigation Co., which has its principal office at Hamilton, Ohio, will construct a system of irrigation near Garwood.

Montgomery, Tex.—The tax-payers have voted bonds for $10,000 for the installation of a water plant here.

Pleasanton, Tex.—The Atascosa Valley Irrigation Co. has been organized with principal offices here and a capital stock of $120,000, to construct a system of irrigation near Pleasanton. It is also establishing a new town called Coughran upon the 4000-acre tract of land, which is to be irrigated.

Sweetwater, Tex.—Thomas Trammell, Pres. of the local water company, announces that work will soon be started on the construction of a reservoir on Sweetwater Creek, seven miles southwest of here, and the laying of a pipe line to connect the proposed reservoir with the distributing system in the city.

Durant, Okla.—The taxpayers have adopted a resolution calling upon the city authorities to submit a proposition for the issuance of bonds in the sum of $80,000 for a water system.

Sapulpa, Okla.—Bonds for $75,000 have been voted for extending the water and sewer systems. For particulars, address the Mayor. Noted Dec. 26.

+Farmington, Wash.—The contract to construct a municipal water system here has been awarded to FOSTER & HINDLE, Spokane, Wash., at $7898. Bids were opened recently by the City Clerk. Noted Oct. 31.

Centralia, Wash.—Bids will probably be asked in March for constructing a gravity water system here. Stanley Macomber, Centralia, is Engr. Noted Nov. 7.

+Seattle, Wash.—The contract to construct a water main in Third St., and other streets, has been awarded to P. J. CLELLAN, Globe Block, Seattle, at $17,526. Noted Dec. 26.

Lafayette, Ore.—At a recent election, bonds for $ were voted for the installation of a municipal water here. Noted Dec. 26.

Portland, Ore.—Bids will be received by the Water Board until 4 p.m., Jan. 2, for furnishing the following: 10,125 corporation cocks from ¾ to 2 in.; 21,6 tons 30-in. cast pipe; 1312 tons 24-in.; 380 tons 16-in.; 1828 tons 8-in.; 310 tons 6-in.; 320,000 lb. pig lead; 30,000 ft. ½-in. galvanized wrought pipe; 3500 ft. ¾-in.; 2500 ft. 1-in.; 300 ft. 1¼-in.; 700 ft. 1½-in.; 500 ft. 2-in.; 110 gate valves from 6 to 30-in., and 250 fire hydrants. Frank T. Dodge is Supt.

Redlands, Calif.—The Directors of the Fontana Land & Water Co. have ordered that bids be asked for the construction of 26,000 ft. of irrigation laterals.

SEWERS

+Boston, Mass.—Bids for constructing sewers were received by the Board of Public Works, Dec. 20, as follows: Brainerd Road and Redford St., Brighton: WILLIAM L. DOLAN, $7231 (awarded contract); John J. Lane, $7277; Anthony Cefalo, $7637; Anthony Baruffaldi, $7817; McCarthy & Walsh, $8150; John McGourt & Co. $8345; Andrew M. Cusack, $8947; George J. Regan, $9223. In Northern Ave., South Boston: LOUIS BALDONI, $7821 (awarded contract); Antony Cefalo, $8128; Anthony Baruffaldi, $8906; McCarthy & Walsh, $9031; M. De Matteo, $9135; M. Russo, $9319; William L. Doolan, $10,648; Andrew M. Cusack, $11,740; George J. Regan, $12,539; D. E. Lynch, $13,611. Noted Dec. 19.

Oyster Bay (L. I.), N. Y.—At a special meeting of the Oyster Bay Citizens' League, a committee was appointed to investigate the proposition to install a sewer system here. E. A. Hegemand is a member.

+Syracuse, N. Y.—According to press reports, a contract has been awarded by the Board of Contract & Supply, to JAMES SWIFT, Syracuse, at $19,981, for constructing the Bellevue Ave. sewer system.

★Newark, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., Feb. 4, for constructing Section 7 of the main intercepting sewer, in compressed-air tunnel in the city of Newark. John S. Gibson is Clk.

Jenkintown, Penn.—Preliminary plans have been prepared for the installation of a sewer system here, to cost about $75,000.

North Braddock, Penn.—Bids will be received by the borough until 3 p.m., Jan. 3, for constructing terra cota sewers in Verona St. Plans and specifications are on file at the office of George F. Siefers, Boro. Engr.

Towanda, Penn.—The Borough Council has approved the plans and specifications prepared for the installation of a sewer system and sewage-disposal plant here. Estimated cost, $96,510.

★+Baltimore, Md.—According to press reports, the contract to construct storm sewers, Contract No. 24, has been awarded to B. F. SWEETEN & SON, Caroline and Madison Sts., Baltimore, at $166,194. Bids were opened by the Board of Awards, Dec. 18. Calvin W. Hendricks is Ch. Engr., Sewerage Comn. Noted Dec. 5.

★+The contract to lay house connections across footways in Districts 19 and 21, Contract 105, has been awarded to WILLIAM McCARTHY & CO., 121 Pearl St., Baltimore, at $37,834. Bids were opened by the Board of Awards, Dec. 18. Noted Dec. 12.

Martinsburg, W. Va.—The city contemplates the construction of a sewer system, with a sewage disposal plant on Turcararo Creek. Estimated cost, $215,000.

Greensboro, N. C.—See item under Water Supply—Irrigation.

Arcadia, Fla.—Bids will be received by the Board of Bond Trustees until noon, Jan. 15, for constructing a sewer system for the city. Plans and specifications are on file at the office of the City Engineer. J. L. Jones is Secy.-Treas.

Laurel, Miss.—We are officially advised that plans have been completed by Charles P. Chase, Consult. Engr., Clinton, Iowa, for the construction of six miles of sanitary sewers here.

+New Orleans, La.—Bids for Contract 50 D, constructing a lined and covered canal and siphon under the Carondelet Navigation Canal were received by the Sewerage and Water Board, Nov. 19, as follows: MITCHELL-BORNE CO., LTD., 323 Saratoga St., New Orleans, $497,049 (awarded contract); Jefferson Construction Co., Perrin Bldg., New Orleans, $594,923.

+Bids were received at the same time for Contract 48 D, excavating open drainage canals, Upper Protection, Claibourne, Florida Walk, Marigny Ave. and Broad St., ETTA CONTRACTING CO., 826 Perdido St., New Orleans, $91,959 (awarded contract); Southern Dredging Co., Mobile, Ala., $100,374; Hampton Reynolds, 7823 Birch St., New Orleans, $103,516; General Contracting Co., 1023 Hibernia Bank Bldg., New Orleans, $119,598; John Riess, Hibernia Bank Bldg., $119,929; W. J. Comerford, 120 North Peters St., New Orleans, $131,824. Noted Oct. 24.

Louisville, Ky.—Specifications have been completed for constructing sewers in 32nd, Green, West, Eleventh and Tenth Sts. Roy W. Burke is Asst. City Engr.

Columbiana, Ohio—At a special election recently held, bonds for $25,000 were voted to install a sewer system and sewage disposal plant.

Columbus, Ohio—The Commissioners have made surveys for the East Columbus Sewerage District No. 1, which includes parts of Mifflin, Marion and Truro Townships. A sewage disposal plant will be constructed near Alum Creek. Estimated cost, $20,000.

Shaker Heights, Ohio—Bids will be received by Carl A. Palmer, Village Clk., First National Bank Bldg., until noon, Jan. 20, for constructing sewers.

†Steubenville, Ohio.—A contract to construct a sewer in Summit Ave. has been awarded to J. O. BATES, Steubenville, at $6012.

Toledo, Ohio.—The State Board of Health has disapproved of the present method of disposing of sewage at Wildwood between Glendale Ave. and Delaware Creek. Plans for a new system have been submitted by property owners.

Elkhart, Ind.—We are officially advised that bids will be received by B. I. Bixler, City Clk., until 10 a.m., Jan. 8, for constructing sewers in the 13th District. Estimated cost, $8550.

Jeffersonville, Ind.—According to press reports, bids will be received by the Common Council until Jan. 4 for constructing sanitary sewers. E. W. Rauth is City Clk.

Lansing, Mich.—The City Engineer has been instructed by the City Council to prepare plans for the construction of sewers in Beech and Christiancy Sts.

Abingdon, Ill.—Bids will probably be asked by the Board of Local Improvements early in the spring, for the construction of a sanitary sewer system. A. L. Richey, Galesburg, Ill., is Consult. Engr.

Bloomington, Ill.—Bids will be received by the city until Jan. 2, for constructing sewers in Prairie, Clay and Vail Sts.

†Clinton, Iowa.—We are officially advised that the contract to construct sanitary sewers in Sewer District No. 5, has been awarded to THOMAS CAREY & SONS, Clinton, at $20,296. Bids were opened by C. J. Bousche, City Clk., Dec. 2. Noted Dec. 19.

Stillwater, Minn.—Plans have been prepared by L. W. Classe, City Engr., for the construction of sewers in various streets.

Yates Center, Kan.—Bids will be received by L. R. Wallace, City Clk., until Jan. 14, for constructing a sewer system here, estimated to cost $80,000. Plans were prepared by Worley & Black, Consult. Engrs., Reliance Bldg., Kansas City, Mo.

Sioux City, S. D.—Plans and specifications have been placed on file at the office of the City Engineer for the construction of lateral sewers to be connected with the main trunk sewers. Walter C. Leyse is City Audr. Noted Nov. 14.

Richmond, Mo.—Bids will probably be asked about Jan. 20, for construction of vitrified pipe sewers here, according to plans prepared by Worley & Black, Consult. Engrs., Reliance Bldg., Kansas City, Mo. Estimated cost $18,000. Noted Nov. 7.

St. Louis, Mo.—Bids will be received by the city until noon, Jan. 7, for constructing a sewer in the Rocky Branch Joint Sewer District. Plans, specifications and form of contract may be obtained at the office of the Board of Public Improvements and the Sewer Commissioner. Maxine Reber is Pres. of the Bd. According to press reports, $369,000 has been appropriated for this work.

Springfield, Mo.—C. E. Phillips, City Engr., is preparing plans for the proposed nine sewer districts provided for in the recent bond issue of $76,000.

Heber Springs, Ark.—See item under Water Supply—Irrigation.

Dallas, Tex.—The City Commission has adopted plans for extending the sanitary sewer system into congested sections of the city. Approximately $50,000 will be expended in this work.

Freeport, Tex.—The Freeport Development Co. is preparing to construct a system of sewers here.

Houston, Tex.—Bids will be received by Dan C. Smith, until noon Jan. 14, for constructing storm sewers in the Fourth Ward. The work includes approximately 12,000 ft. of 6-in. to 9-ft. sewers, 16 manholes, and 140 catch-basins. H. B. Rice is Mayor. Plans are on file at the office of F. L. Dormant, City Engr.

Jacksonville, Tex.—A survey of the city is being made with a view to installing a sewer system during the spring. Estimated cost $35,000 to $40,000.

Polytechnic, Tex.—Bonds for $15,000 have been voted for completing the sewer system. Noted Nov. 28.

Sapulpa, Okla.—Bonds for $25,000 are being sold for constructing sewers here. J. G. Anderson is City Clk.

Denver, Colo.—The Board of Public Works has adopted plans and specifications for the construction of sewers in Subdistrict No. 14. S. B. Bradley is Pres.

Nogales, Ariz.—Bids will be received about Jan. 15, for constructing a sewer system here, according to plans prepared by Frank A. Lattimer, Consult. Engr., Higgins Bldg., Los Angeles. Estimated cost, $50,000. L. W. Mix is Mayor. Noted Nov. 21.

Tempe, Ariz.—The City Commission will soon call an election to vote on a proposition to install a sewer system here.

†Coquille, Ore.—We are officially advised that the contract to construct vitrified clay pipe sewers in District No. 1 has been awarded to [illegible] at [illegible]. Bids were opened Dec. 16. P. M. Hall-Lewis [illegible].

Portland, Ore.—[illegible] Board [illegible] Jan. 7 [illegible] Sewer [illegible] Bids will be received [illegible] Noted Dec. 12.

Hanford, Calif.—[illegible] will probably be [illegible] about two [illegible] construction of a [illegible] which [illegible] are now [illegible] petitions.

Pasadena, Calif.—[illegible] Engineering [illegible] Bids will be received [illegible] Clerk of the Board [illegible] Ave. tract and were accepted by [illegible] the [illegible] Ave. sewer will be connected with the outfall by means of a pumping plant. The cost will be $17,000, exclusive of pump.

Santa Monica, Calif.—The J. D. Keen Co., Dudley Bldg., Santa Monica, submitted the lowest bid at $9800 for constructing lateral sewers to connect with main No. 5, at Santa Monica. The other bids were: E. Yeaco, Higgins Bldg., $11,960; John Sutalo, 476 Bell St., Los Angeles, $12,850.

Edmonton, Alta.—The City Engineer has prepared estimates for extending the sewer system to the exhibition grounds, with an outlet into the Rut Creek sewer. Cost, $20,000.

Kelowna, B. C.—A bylaw has been passed at Kelowna, providing $40,000 for completing the sewer system.

GARBAGE

Buffalo, N. Y.—The city is considering the erection of a municipal plant for garbage and refuse disposal after the present five-year private contract expires. F. G. Ward is Comr. Pub. Wks.

Schenectady, N. Y.—The Common Council is considering issuing $100,000 of bonds for the construction of a garbage disposal plant.

Washington, Penn.—Bids will be received until Jan. 20, by John Griffiths, Boro. Clk., for the construction of a 20-ton garbage incinerator.

Cleveland, Ohio—The city will improve its garbage disposal plant at a cost of $50,000.

Seattle, Wash.—The city is considering the purchase of equipment and apparatus for the collection and disposal of garbage. Estimated cost, $50,000.

Berkeley, Calif.—The following bids were opened by the City Council, Dec. 17, for the construction of the proposed garbage incinerator plant: Destructor Co., New York, $86,500; Universal Engineering Co., San Francisco, Calif., (1) $74,431; $82,107; and $68,827; Dixon Engineering & Construction Co., Toledo, Ohio, $65,000; Refuse Disposal Co., San Francisco, $61,250.

STREETS AND ROADS

Harperwell, Me.—Bids will be received until Jan. 4, by the Board of Selectmen, for the construction of a road, the work to include about 2100 cu.yd., of ledge excavation, and 1400 cu.yd. concrete masonry. Edward M. Pierce is Chn.

Waterbury, Conn.—The Board of Public Works has recommended that wood blocks be used for the new pavements on parts of East Main, Bank, South Main and Grand Sts., and Exchange Place: between 15,000 and 20,000 sq.yd. will be required. The Board has recommended vitrified brick for a section of Meadow St., between Field and Bank Sts. About 4000 sq.yd. will be required. William H. Sandland is Clk. of the Board, and Robert A. Cairns is City Engr.

Buffalo, N. Y.—Bids will be received until 11 a.m., Jan. 2, by the Dept. of Public Works for repaving portions of Jackson, Washington, Mortimer and Elk Sts., and Delavan Ave. Francis G. Ward is Comr.

New York, N. Y. (Borough of Queens)—The following are low bids received by the President of the Borough for various street improvements: Hastings Paving Co., at $17,446, for grading and laying sidewalks on Jackson Ave., Corona; same company, at $14,834, for paving Raddle St., Long Island City, with asphalt; at $4926, for paving the Boulevard, Long Island City, with asphalt block; and at $6375, for paving a section of Prospect St., Long Island City, with asphalt; J. P. Claner, at $44,670, for paving a part of Cypress Ave., Evergreen, with improved granite blocks.

New York, N. Y.—Bids will be received until 11 a.m., Jan. 21, by the Board of Water Supply, 165 Broadway, for surfacing with vitrified brick block, the highways around the Ashokan Reservoir, in the towns of Olive, Marbletown, Hurley, Woodstock and Kingston, Ulster County, under Contract No. 134. Charles Strauss is Pres. Bd.

Syracuse, N. Y.—Bids for paving North Franklin St., from the Erie Canal to Noxon St., have been received by the Board of Contract and Supply as follows: Warner-Quinlan Co. bid $10,705 for vitrified block and $1,147 for asphalt. Guy B. Dickinson bid $10,765 for vitrified block and $10,207 for asphalt. F. J. Baker's bid was $10,583 for vitrified block and $10,056 for asphalt. J. J. Halloran is Secy. of the Bd.

†Hackensack, N. J.—A contract has been awarded by the Board of Freeholders to ERNEST ABRAHAMS, Hackensack, at $59,122, for the improvement of the Anderson Ave. Road. Noted Dec 19.

Jersey City, N. J.—Bids will be received until 2 p.m., Jan. 6, by the Board of Street and Water Commissioners, for the improvement of Van Wagenen Ave., from Stuyvesant to Sip Aves., and for necessary repairs to asphalt pavements in various streets. Edward B. See is Clk.

Pittsburgh, Penn.—Bids will be received until 10 a.m., Jan. 10, by the City Controller, for street improvements as follows: Grading, curbing and paving with block-stone portions of B. Kirkpatrick and Reynolds Sts.; for grading, curbing and paving with asphalt on Antietam and Lloyd Sts.; grading, curbing and paving with brick on Cowley St., Decision, Jordan, Anton, Hurd and O'Neil Alleys; for grading, curbing and paving Mary St., from South 20th to South 21st St., paving with blockstone and brick, a section of Rockland Ave., a section of Lilac St. with asphalt and brick, and for [illegible] with blockstone South 11th, South 12th, Sarah and Brandt Sts. Joseph G. Armstrong is Dir. of Public Service.

†Baltimore, Md.—A contract has been awarded by the Board of Awards to PATRICK F. REDDINGTON & SONS, 321 St. Paul St., Baltimore, at $35,687, for about 9750 sq.yd. of granite block paving under Contract No. 42. R. Keith Compton is Chn. Noted Dec 12.

We are officially advised that bids will be received about the third week in January, for approximately $500,000 of street paving, consisting of sheet asphalt, bituminous macadam, granite block, vitrified block and bituminous concrete. The work will be divided into contracts ranging from $50,000 to $125,000. H. K. McKay is Ch. Engr.

Greensboro, N. C.—See item under Water Supply Irrigation.

Spartanburg, S. C.—Bids will be received until Jan. 13, by the Superintendent of Streets, for paving various streets and laying cement sidewalks, at an estimated cost of $30,000. J. H. Shores is Supt.

Brooksville, Fla.—Bids will be received until Jan. 14, by the Town Council for about 10,000 sq.yd. vitrified brick pavement on various streets, for which the sum of $19,950 is available. Noted Dec. 12.

✚Ocala, Fla.—The City Council has awarded a contract to the ALABAMA PAVING CO., Birmingham, Ala., for four blocks of vitrified brick paving. H. C. Sistrunck is City Clk. Noted Nov. 7.

Birmingham, Ala.—Bids will be received about Jan. 16, by the City Council, for approximately 25,000 sq.yd. of granite block paving in various alleys.

The City Commission is considering the paving of Maiden Lane, Sycamore and 19th Sts., at an estimated cost of $80,000. Walter J. Kirkpatrick is City Engr.

✚Natchez, Miss.—We are officially advised that the Board of Supervisors of Adams County has awarded a contract to the GARRETSON-BREWER CONSTRUCTION CO., Jackson, Miss., at $89,834, for the construction of about 60 miles of road. Worthington Lensbritler bid $150,000, P. W. Mulvihill bid $161,000. John T. Jenkins is Chancery Clk.

Louisville, Ky.—The City Engineer has announced that bids for street improvements in Louisville during 1913 will be asked in the near future. The specifications call for asphalt paving. David R. Lyman is City Engr.

✚Columbus, Ohio—The State Highway Commissioner has awarded the following contracts for state highway improvements: The Bridgetown and Ferguson Road, Hamilton County, 1.4 miles brick paving, to TIPPER & SON, Peru, Ind., at $27,680. The Wapakoneta & St. John Road, Auglaize County, 4½ miles waterbound macadam, to LOUIS PICKERING, Bellefontaine, Ohio, at $13,500. The Upper Sandusky and Findlay Road, Wyandot County, 2.65 miles waterbound macadam, to the National Lime & Stone Co., Carey, Ohio, at $12,495. James R. Marker is Comr. Noted Dec. 12.

Indiana—Bids for road improvements in Indiana will be received as follows:

Jan. 6, at Franklin, by Commissioners of Johnson County, for construction of a gravel road in Minevah Township. H. L. Knox is Audr.

Jan. 6, at Delphi, by Commissioners of Carroll County, for construction and completion of highways in Carroll County. M. G. Haun is Audr.

Jan. 6, at Connersville, by Commissioners of Fayette County, for construction of the D. W. Moore et al. Road. Jasper C. Kennedy is Audr.

Jan. 7, at Anderson, by Commissioners of Madison County, for improvement of county highways. Joel B. Bonefiel is Audr.

Jan. 7, at Portland, by Commissioners of Jay County, for improving roads in Wabash and Jefferson Townships. John Bonifas is Audr.

Jan. 7, at Winamac, by Commissioners of Pulaski County, for construction of the William Moyer Road. Jacob Nice is a Comr.

Jan. 9, at Martinsville, by Commissioners of Morgan and Johnson Counties, for construction of the Elburn Brown et al. Road. J. S. Whitaker is Audr.

✚Jeffersonville, Ind.—A contract has been awarded by the Commissioners of Clark County, to MARTIN F. O'NEIL, Jeffersonville, at $32,000, for the construction of four gravel roads. George W. Stoner is Audr.

✚South Bend, Ind.—A contract has been awarded by the Board of Commissioners of St. Joseph County to PRETTYMAN & HAINES, Knox, Ind., at $22,456, for the construction of 15 miles of gravel road in Lincoln Township.

Detroit, Mich.—Bids will be received until 10 a.m., Jan. 7, by the Department of Public Works, for approximately 1,000,000 paving brick, to be delivered within the year at such times and places as the department may direct. J. J. Haarer is Comr.

Peoria, Ill.—The Board of Local Improvements has decided to pave Seventh Ave. with brick; the work will be let in two contracts; the first will be 24 ft. wide, from Union Hill to Second St., at an estimated cost of $26,400, and the second will be 30 ft. wide, extending from Second St. to Western Ave., at an estimated cost of $12,087. College St., from Garfield to University, will also be paved, at an estimated cost of $9586. L. D. Jeffries is City Engr.

Quincy, Ill.—A resolution has been passed by the Board of Local Improvements authorizing the paving of South Ottawa St. early next year, at an estimated cost of $142,400. George L. Fransworth is City Engr.

Corning, Iowa—We are officially advised that bids will soon be asked for 22,469 sq.yd. street paving, 845 sq.yd. concrete alley paving and 16,127 lin.ft. combined curb and gutter. It is the intention to begin construction work as soon as weather conditions permit. W. C. Chubb is City Clk. Theo. S. DeLay, Creston, Iowa, is Engr.-in-charge.

Okmulgee, Okla.—We are officially advised that bids will be received until Jan. 6, by the City Commissioners, for approximately 10,000 sq.yd. bituminous concrete paving in Street Improvement Dist. No. 3. L. H. D. Cook is Comr. of Finance.

Tucson, Ariz.—The City Engineer has been instructed by the City Council to prepare plans for the improvement of Tyndall Ave., from Speedway to Ninth St., and for Eighth St., from Fourth Ave. to the eastern city limits. W. H. Thompson is City Engr

Seattle, Wash.—Bids for paving Fifth Ave. were received by the Board of Public Works as follows: F. McLellan, $74,723; McGuire & Moon, $77,943; P. J. McHugh, $82,414; D. H. Traphagen, $81,705; Commercial Construction Co., $89,318; T. Ryan & Co., $78,691; Stillwell Bros., $100,226; Gilles De Flong, at $79,916; Krogh & Jessen, $87,014; Sloane Bros., at $81,008. Arthur H. Dimock is City Engr.

Wenatchee, Wash. The four low bidders for pav... Wenatchee Ave. with wood block, vitrified brick or ... block, were as follows: J. J. McNeil, $112,470 for wood block and vitrified brick; $112,965 for wood block and vitrified block; Atlas Construction Co., $116,531, for wood and vitrified brick; $116,969 for vitrified block; Spokane Asphalt & Macadam Co., $117,349, for vitrified brick, and $247,000 for wood block; Inland Empire Bitulithic Paving Co., $119,731, for vitrified brick and $120,445 for vitrified block.

Imperial, Calif. The following bids were received by the Board of Trustees for the improvement of various streets by the Johnson-Shea Co., Riverside, were the low bidders at $120,-337. H. H. Peterson of Imperial, bid $127,335. The itemized bids were: Johnson-Shea Co., 3c. per sq.ft. for grading; 35c. per lin.ft. for cement curb; 24c. per sq.ft. for Class A paving; 20c. per sq.ft. for Class B paving. H. H. Peterson, 4c. for grading; 35c. for curb; 24c. and 22c. for paving. The estimated quantities of work to be done are as follows: 55,007 sq.ft. of grading, 254,892 sq.ft. of Class A paving, 187,660 sq.ft. of Class B paving; 14,108.2 lin.ft. of cement curb. I. B. Funk is City Engr.

✚Los Angeles, Calif.—J. M. MONTGOMERY, Alhambra, has been awarded the contract for improving approximately 6.23 miles of the Telegraph-Laguna and South Pasadena Road at 20c. per cu.yd. for excavating; 8c. per lin.ft. for shaping roadbed; 80c. per ton for placing oil macadam; $11 per cu.yd. for Class A concrete; 5c. per lb. for steel, $2.50 per lin.ft. for concrete pipe, $1.40 per lin.ft. for corrugated pipe, 50c. per lin.ft. for standard-guard fence. Total, $25,537. The estimated quantities are as follows: 8200 cu.yd. of excavating; 32,740 lin.ft. of shaping roadbed; 33,100 tons of oiled macadam; 151.6 cu.yd. of class A concrete; 3926 lb. of steel rods; 36 lin.ft. of 30-in. reinforced concrete pipe; 246 lin.ft. of 24-in. corrugated iron pipe; 600 lin.ft. of standard guard fence. Noted Dec. 19.

✚J. M. MONTGOMERY, Alhambra, has been awarded the contract for improving Avenue 64, from Pasadena Ave. to the north city limits, at $16,960. Erroneously noted, Dec. 26, as $810,959.

✚Los Angeles, Calif.—A contract has been awarded by the Board of Public Works to the BARBER ASPHALT PAVING CO., at $74,564, for improving Sunset Blvd., from Normandale Ave. to Hollywood Blvd.; the FAIRCHILD-GILMORE-WILTON CO. was awarded a contract at $55,664, for the improvement of Alhambra Ave., from Mission Road to the eastern city limits. Homer Hamlin is City Engr.

National City, Calif.—A. F. Harstoman, Oakland, Wm. Harstoman and W. R. Gulck, Los Angeles, are planning the subdivision of a 20-acre tract on National Ave., from Sixteenth to Eighteenth St. About $15,000 will be expended on grading and street work. The contract will be awarded to the Knight & Hyde Construction Co., San Diego.

Ventura, Calif.—The Board of Supervisors of Ventura County has ordered surveys made for a system of highways in the county, aggregating about 200 miles. The roadways will be 16 ft. wide, graded and surfaced to a depth of 6 in., with either gravel or crushed rock.

INDUSTRIAL WORKS

Framingham, Mass.—The A. & A. Rubber Co., manufacturer of rubber goods, will build an addition to its factory at Framingham. The building will be 60x100 ft.

✚Salem, Mass.—The contract for the weave shed to be built on East Gardner St. for the Naumkeag Steam Cotton Co. has been awarded to the NEW ENGLAND CONCRETE CONSTRUCTION CO., 201 Devonshire St., Boston. It will be 42x120 ft., to cost $80,000. Lockwood, Greene & Co., 60 Federal St., Boston, are the Archs. John T. Brooks is Pres.

Springfield, Mass.—The Chandler Co., manufacturer of metal goods, will occupy a factory on Napier St., to be built by W. D. Kinsman. The building will be 42x77 ft., two stories, and is estimated to cost $12,000.

Springfield, Mass.—Oscar Jurist will build a mattress factory at 53 Osgood St., Springfield. The building will be of brick, 53x75 ft., three stories and basement, and will be equipped with a freight elevator.

✚Webster, Mass.—The contract for the factory building for the Stevens Linen Works has been awarded to the FISKE CARTER CONSTRUCTION CO. It will be of brick, mill construction, 70x290 ft., two stories. T. Main, 201 Devonshire St., Boston, is Engr.

Bridgeport, Conn.—Plans have been completed and estimates are being received for an addition at the plant of the La Resista Corset Co., at Bridgeport. The building will be 50x140 ft., three stories high, of brick and heavy mill construction. The Fletcher Engineering Co., 1087 Broad St., Bridgeport, is in charge of the work.

Cos Cob, Conn.—The plush and fur fabric plant of the Mianus Mfg. Co., at Cos Cob, will be increased by the addition of a new four-story mill.

New Britain, Conn.—The Russell & Erwin Mfg. Co. will build a seven-story factory as an addition to its plant at New Britain.

Brooklyn, N. Y.—The Greenpoint Sash & Door Co., 206 Norman Ave., Brooklyn, is having plans prepared by Farber & Murick, Archs., 1028 Gates Ave., for the construction of a two-story, 110x60-ft. planing mill. The estimated cost is $12,000.

✚Buffalo, N. Y.—The J. P. Devine Co., manufacturer of vacuum drying apparatus, will build a manufacturing plant at Clinton St. and the Erie R.R., from plans by Wood & Bradney, Archs., Mutual Life Bldg. It will consist of a machine shop and erecting building, 90x200 ft.; a boiler house and an office building, brick and steel construction. Contract for the structural steel work has been let to the LACKAWANNA BRIDGE CO.

The Buffalo Standard Ink Corporation, Buffalo, has been incorporated at $20,000, and will build and equip a plant for the manufacture of inks. E. Earle Root, C. M. Root, and H. H. Betcher are directors.

A site has ben purchased at Military Road and the New York Central and Delaware, Lackawanna & Western railroads, by Taylor & Crate, manufacturers and dealers in hardwood lumber, to build a lumber mill and woodworking plant.

The Lackawanna Steel Co., Buffalo, has had plans completed to increase the present capacity of its openhearth plant by 150,000 tons. Four additional 60-ton openhearth furnaces will be erected at its No. 2 plant.

The Empire Radiator Co., Buffalo, has been incorporated at $1,000,000, and will merge with the Electrolytic Products Co., now located at Elmwood and Hertel Aves. The plant will be enlarged and equipped for the manufacture of automobile radiators to be made by a new electrolytic process and heating systems for dwellings, offices and public buildings. Edward B. Green, Du S. Morgan Bldg., is Pres.

An addition, 146x66 ft., will be made to the plant of the Buffalo Pitts Co., at Carolina and Fourth Sts., and the Erie Canal.

Glens Falls, N. Y.—The Warren Box Co. has plans completed for a factory, 50x130 ft., two stories and basement, brick construction, which will be built on Warren St. O. V. Vlitterdorf is Pres.

Utica, N. Y.—The West End Brewing Co. will build an addition to its brewery, 130x90 ft., from plans which are being drawn by Agne, Rushmere & Jennison, Archs., Arcade Bldg.

Dickerson Run, Penn.—Plans are being prepared by engineers of the Pittsburgh & Lake Erie R.R., for the railroad shops and power house to be built at Dickerson Run, by the company. The power house will be 60x70 ft., the roundhouse, 100x60 ft., and the machine shops, 60x130 ft. A storage building may also be erected. Details of the work will be ready in the spring. G. H. Sales, Pittsburgh, is Supt. of Bridges and Bldgs.

Duncannon, Penn.—It is reported that the Lebanon Valley Iron & Steel Co. will erect two additional rolling mills at its plant at East Lebanon, and two at Duncannon.

Richmond, Va.—The Anglo-American Tobacco Co., recently incorporated in New York with $500,000 capital stock, will erect a large factory at Richmond for the manufacture of cigars exclusively. J. E. M. Walker, Richmond, is Vice-Pres. and Gen. Mgr.

Greenville, S. C.—Press reports state that the Piedmont & Northern Ry. Co. will soon ask bids for the construction of a roundhouse and shops at Greenville for the Greenville, Spartanburg & Anderson division of the road. Thomas E. Lee, Greenville, S. C., is Ch. Engr.

Augusta, Ga.—The Riverside Mills will erect an additional mill and warehouse, which with the new equipment will cost from $100,000 to $150,000.

Thunderbolt, Ga.—The Baton Aëro Co. has purchased a site and will erect a plant for the manufacture of aëroplanes. Matthew A. Baton, Springfield, Mo., is Mgr.

Gadsden, Ala.—The Gadsden Pipe & Fittings Co., manufacturer of iron soil pipe and fittings, will rebuild its plant, which was recently destroyed by fire at a loss of $15,000.

Gulfport, Miss.—The Clyde Engineering & Machinery Works has been organized with $15,000 capital stock, and will establish a plant to manufacture machinery. J. C. Rogers, Robert Wallbillich and W. H. Tippin are interested.

+Cleveland, Ohio—G. A. Wheller, 804 Breitmeyer Bldg., Detroit, Mich., has awarded the general contract for the new brewery, two-story and basement, 60x107 and 200x107 ft., for the Pilsen Brewing Co., Vadav Snadjar, Pres., Clark Ave. and [illegible] St., to the ANDERS CONSTRUCTION CO., 411 [illegible] N. W. Cleveland Engr. Cost $100,000.

Lancaster, Ohio—A factory and warehouse will be erected at Lancaster by the Star Builders' Supply & Mfg. Co. The building will be 80x160 ft.

Logan, Ohio—Fire destroyed the furniture manufacturing plant of the Snider Mfg. Co., at Logan, causing a loss of $[illegible]. It will be rebuilt.

Marietta, Ohio—The Phoenix Mill Co. proposes to rebuild its plant at Marietta, Ohio, which was recently destroyed by fire.

Mt. Vernon, Ohio—Press reports state that the Pittsburgh Plate Glass Co. is considering plans for the construction of an addition to its plant at Mt. Vernon, Ohio.

Shadyside, Ohio—Plans are being prepared by the Ohio Valley Lumber Co. for the reconstruction of its plant at Shadyside, Ohio, which was recently destroyed by fire.

Toledo, Ohio—Leander & Heath, 1442 Nicholas Bldg., Toledo, are preparing plans for a reinforcement factory, 100x145 ft., for the Toledo Scale Co. & Tool Co. H. J. Hinde, 1536 Jeffrey Place, Columbus, is Engr.

Marion, Ind.—The Lundell-Smith Device Co. has been incorporated at $[illegible] to manufacture railway safety [illegible]. Marion, Ind., is Pres.

+Detroit, Mich.—Yerkes & Yerkes, 301 Palmer Bldg., Detroit, Mich., are preparing plans for the following concrete factories: [illegible] Co., 1 story, 50x[illegible] ft.; [illegible] Co., 1 story, 50x[illegible] ft.; [illegible] Co., 1 story, 50x[illegible] ft.; [illegible] & Hilo, 2[illegible] stories, 50x[illegible] ft.; [illegible] & Co., 1 story, 50x[illegible] ft.; [illegible] & Co., 1 story, 50x[illegible] ft.; [illegible] & Co., 1 story

Alexandria, Ont.—The Schell Foundry & Machine Co. is having plans prepared for an addition to its plant.

Guelph, Ont.—The Stewart Sheaf Loader Co. has had plans drawn for a factory building to be erected early next spring.

Kingston, Ont.—The Canada Creosoting Co. has been incorporated with a capital of $250,000, and will establish a plant for the manufacture of paving blocks. E. B. Beckman, Sterling Bank Chambers, Toronto, Ont., may be addressed.

Peterbourgh, Ont.—Incorporation papers have been filed here by the Peterborough Machine & Lubricator Co., Ltd. Capital, $600,000. The company will establish a plant for the manufacture of motors, engines, etc. Edgerton R. Wilson and Alexander Gillespie are among the provisional directors.

Toronto, Ont.—The Northern Electric & Mfg. Co., Ltd., will erect a factory and warehouse on Simcoe St. at a cost of $100,000. It will be of steel, cement, brick and concrete construction. M. S. Pierce, 112 Bay St., is Dist. Engr.

The Gurney Foundry Co. will add a core room to its present plant. It will be one-story, brick and steel construction, slate, felt and gravel roof, concrete floors and steel rolling doors. It will cost $40,000. Chapman & McGiffin, 59 Yonge St., are Archs.

Articles of incorporation have been granted the McKinnon Motor Vehicles, Ltd., with a capital stock of $100,000, to manufacture automobiles. Donald J. McKinnon, Thomas S. Blues and Gordon B. Mansfield are provisional directors.

Windsor, Ont.—The Baxter Hardware Co., Ltd., has been incorporated, capitalized at $40,000, to manufacture hardware specialties, for which a plant will be built and equipped. Charles S. Baxter, E. Baxter, David M. Roddy, are among the directors.

Coquitlam, B. C.—The Haynes Ornamental Cement & Staff Works will erect a new plant, at a cost of $200,000, the main building of which will be three stories, 50x200 ft.

FEDERAL GOVERNMENT WORK

Road, Walks, Etc.—Fort Totten, N. Y.—Bids will be received until 2 p.m., Jan. 15, by the Quartermaster, U. S. Army, for the construction of macadam roads, cement walks and other improvements at Fort Totten. For further information, the Quartermaster may be addressed.

★Dredging—New York, N. Y.—Bids will be received until noon, Jan. 31, by Col. William T. Roessell, Corps Engrs., U. S. A., Army Bldg., 39 Whitehall St., New York, for dredging in South and Hackensack Rivers, N. J.

Water Towers—Washington, D. C.—Bids will be received by the District Commissioners until 2 p.m., Jan. 3, for furnishing, delivering and erecting three steel water towers for the use of the Water Department. Specifications and form of proposal may be obtained from the Purchasing Agent. Cuno H. Rudolph is Chn.

★Removing Wreck—Norfolk, Va.—Bids will be received until noon, Jan. 28, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs. U. S. A., Norfolk, for the removal of the iron barge "Florida," sunk in Hampton Roads, Va.

Post Office—Cedartown, Ga.—Bids will be received until 3 p.m., Jan. 31, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches), of the U. S. post office at Cedartown.

Jetty Work—Jacksonville, Fla.—Bids will be received until noon, Jan. 23, by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for furnishing the material and raising the jetty at the entrance to St. Johns River, Fla.

Post Office—Cullman, Ala.—Bids were received as follows, Dec. 23, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Cullman: (a) Limestone; (b) sandstone; W. A. Schlosser & Co., Cullman, (a) $54,359; (b) $55,359; James Devault, Canton, Ohio, (a) $49,000; (b) $50,500; Algernon Blair, Montgomery, Ala., (a) $52,280; (b) $55,000; George W. Stiles Construction Co., Chicago, Ill., (a) $50,800; (b) $55,000; King Lumber Co., Charlottesville, Va., (a) $48,800; (b) $50,000; Newport Contracting & Engineering Co., Newport News, Va., (a) $51,436; (b) $56,436; Mississippi Valley Construction Co., St. Louis, Mo., (a) $48,749; Rogers & Kaiser, Chicago, Ill., (a) $46,796; (b) $48,189; Wise Granite Co., Richmond, Va., (a) $56,450; (b) $57,450.

Post Office—Crowley, La.—Bids were received as follows, Dec. 23, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Crowley: (a) Limestone; (b) sandstone; Daniel T. McCarthy, Philadelphia, Penn., (a) $46,900; (b) $47,900; Newport Contracting & Engineering Co., Newport News, Va., (a) $48,395; (b) $50,395; George W. Stiles Construction Co., Chicago, Ill., (a) $48,710; (b) $50,710; Wise Granite Co., Richmond, Va., (a) $49,900; (b) $50,900; King Lumber Co., Charlottesville, Va., (a) $51,500; (b) $54,000; Algernon Blair, Montgomery, Ala., (a) $51,665; (b) $54,400. Noted Oct. 31.

Buildings—New Orleans, La.—Bids were received by Maj. Edward H. Schulz, Corps Engrs., U. S. A., Custom House, New Orleans, for furnishing plant, labor and materials and constructing buildings at Burrwood, Southwest Pass, Mississippi River, La. The bids follow: Eskald & Alexander, New Orleans, $33,900; Lionel F. Favret, New Orleans, $40,286; John Lugenbuhl, New Orleans, $40,497.

★Dredge—Cincinnati, Ohio—Bids were received, Dec. 18, by Lieut.-Col. H. Jervey, Corps Engrs., U. S. A., Cincinnati, for constructing and delivering the steel and iron hull dipper dredge "Cincinnati." The bids follow: Marion-Osgood Co., Marion, Ohio, $97,850; M. A. Sweeney Shipyard & Foundry Co., Jeffersonville, Ind., $63,490; Marion Steam Shovel Co., Marion, $60,000 on own specifications.

Lumber—Detroit, Mich.—Bids were received as follows, Dec. 16, by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, for furnishing and delivering about 3,100,000 ft. B.M. of fir timber at St. Mary's Falls Canal, Mich.: McCormick Lumber Co., McCormick, Wash., $10 per M. ft.; Northwest Lumber Agency, Tacoma, Wash., $10.40; Foster Lumber Co., Tacoma, $10.73; Lumber Manufacturers' Agency, Tacoma, Wash., $10.74; Charles M. McCormick Mfg. Co., Tacoma, Wash.; Common Wilkinson Co., Seattle, Wash.; Pacific Coast Lumber & Shingle Co., Tacoma, Wash.; Fort Plain, N. Y., $10.95; Nebraska Bridge & Supply Co., Omaha, Neb., $11; Newhall Lumber Co., Tacoma, Wash.; Larson Lumber Co., Seattle, $11.50; Tacoma & Eastern Lumber Co., Tacoma, $11.90; C. Line & Son, Portland, Ore., $11.95; Tacoma Mill Co., Tacoma, $12; Edmonds Lumber Co., Edmonds, Wash., $12; Douglass Fir Sales Co., Portland, Ore., $12.50; Berthold & Jennings Lumber Co., St. Louis, Mo., $12.50; Fir Tree Lumber Co., Tacoma, $12.50; The Mershon Lumber Co., Chicago, Ill., $13; H. B. Waite Lumber Co., Minneapolis, $13.50; J. K. Jones, Chicago, Ill., $13.90; W. C. Rodgers, Hannibal, Miss., $15.75.

✚Cell Work—Leavenworth, Kan.—The Superintendent, Dept. of Justice, Washington, D. C., has awarded the contract for steel for cell work for the main east cell wing, U. S. Penitentiary, Leavenworth, to the McCLINTIC-MARSHALL CONSTRUCTION CO., Pottstown, Penn., at $21,523. Bids were opened Nov. 26 and rejected as being decided to purchase the material in the open market. This course proved unsatisfactory, and the contract was finally awarded to the above company. List of bidders noted Dec. 5.

★Hydraulic and Electrical Apparatus—Malta, Mont.—Bids will be received at the office of the U. S. Reclamation Service, Los Angeles, Calif., until 2 p.m., Jan. 22, for furnishing hydraulic and electrical apparatus for St. Mary Storage Unit, Milk River Project, Montana. For particulars address U. S. Reclamation Service, 905 Federal Bldg., Los Angeles, or Washington, D. C. A. P. Davis is Act. Dir.

SEWERS

Post Office—Clarksville, Tex.—Bids were received as follows, on Dec. 25, by Oscar Wenderoth, Supery. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post office at Clarksville: (a) Limestone; (b) sandstone: George A. Shaul, Seneca, Neb., (a) (b) $51,388; T. Lovell Sons, Enid, Okla., (a) $52,929; (b) $54,169; King Lumber Co., Charlottesville, Va., (a) $49,500; (b) $51,500; Newport Engineering & Contracting Co., Newport News, Va., (a) $43,324; Mississippi Valley Construction Co., St. Louis, Mo., (a) $49,624; (b) $49,924. Noted Nov. 21.

★Channel Work—Galveston, Tex.—Bids were received, Dec. 11, by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, for constructing a pile and brush fence along Galveston Channel. The bids follow: (a) 4500 lin.ft.; (b) totals: Charles Clarke & Co., Galveston, (a) $2.42; (b) $10,890; Charles Funk, Galveston, (a) $2.65; (b) $11,925; Isaac Heffron, Galveston, (a) $2.09½; (b) $9427.50; Charles L. Ryals, Galveston, (a) $3.60; (b) $16,200.

Dredging—Texas City, Tex.—Bids were opened, Dec. 18, by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, Tex., for dredging in Texas City Channel, about 578,000 cu.yd. The lowest bid was submitted by the Bowers Southern Dredging Co., Galveston, at 13.5c. per cu.yd.

Lumber—Seattle, Wash.—Bids will be received at the office of the Depot Quartermaster, U. S. A., Seattle, until 11 a.m., Jan. 20, for furnishing at Seattle or Tacoma, Wash., or other Puget Sound ports, Portland, Ore., or other Pacific coast ports accessible to vessels of deep draft and for Manila, P. I., 3,317,737 ft. B.M., lumber for the Philippine Islands. For further information address the depot quartermaster, Seattle.

Steel Bars—Panama—Bids will be received by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for steel reinforcing bars, journal bearings, steel wire, etc., under Circular 753.

Magazine Buildings—Hawaii—Bids were received, Dec. 21, for the construction of five magazine buildings in connection with the Naval Magazine at Pearl Harbor, H. T.: Spalding Construction Co., Portland, Ore., $89,140; Penn Bridge Co., Washington, D. C., $88,740; W. N. Concannon Co., San Francisco, Calif., $85,980; Lord-Young Engineering Co., Honolulu, Hawaii, $79,600.

Oil Storage Tanks—Hawaii—Bids will be received until Jan. 25, by the Bureau Yards and Docks, Navy Dept., Washington, D. C., for three steel oil storage tanks at the naval station, Pearl Harbor, under Specification No. 1920. Estimated cost, $56,000.

★Steel and Rivets—Philippine Islands—Bids will be received by the Purchasing Agent, Bureau of Supply, Manila, P. I., until 8 a.m., Jan. 15, and at the office of the Insular Purchasing Agent, Bureau of Insular Affairs, Room 1530, 17 Battery Place, New York, N. Y., until 7 p.m., Jan. 14, for all the fabricated steel and field rivets for various bridges for the Government of the Philippine Islands. For details see advertisement in this issue.

MISCELLANEOUS

Drydock—Boston, Mass.—The Directors of the Port of Boston, Dec. 24, appropriated $3,000,000 for the construction of a drydock. It will be 1180 ft. long, with a depth of 30 ft. at the sills, 100 ft. wide at the locks and 175 ft. wide within.

★✚Subway—Boston, Mass.—Bids were received by the Boston Transit Commission, Dec. 24, for building Sect. 4 of the Boylston St. Subway, extending from about 160 ft. east of Exeter St. to about 85 ft. east of Berkeley St., a distance of about 1790 lin.ft. The bids follow: H. NAWN CONSTRUCTION CO., Boston, $743,700 (awarded contract). Other bids were: Patrick McGovern & Co., Boston, $750,050; Coleman Bros., Chelsea, $751,100; Coughlan & Shells Co., Boston, $761,275.

✚Rock Removal—Boston, Mass.—Bids were received, Dec. 26, by the Massachusetts Harbor and Land Commissioners for removal of ledges and boulders in Harbor Cove, Gloucester. The contract has been awarded to the EASTERN DREDGING Co., 247 Atlantic Ave., Boston, at $18.90 per cu.yd. The only other bidder was Gilbert H. Harris, at $20.65. Wm. F. Williams, State House, is Ch. Engr.

Stable—Stamford, Conn.—Wm. F. Ziegler, Stamford, will erect a stable of cut granite, 9x178 ft., to cost $75,000. Plans were prepared by W. F. Knowles, Arch., 1170 Broadway, New York.

Barn—Albion, N. Y.—The lowest bid has been submitted by George . Harris, Albion, for the construction of a new barn, wagon shed and horse barn for the Western House of Refuge for Women, Albion.

Motordrome—Garden City (L. I.), N. Y.—The New York Motor Speedway Association has filed incorporation papers. A lease of the aviation field at Garden City has been concluded. A two-mile track will be built for automobile races, and a grandstand, to seat 75,000 people, will be erected. G. E. Tarbell, of Fish & Marvin, real estate brokers, 527 Fifth Ave., New York, is interested.

Drainage—Medina, N. Y.—The time for receiving bids for the Tonawanda Oak Orchard Swamp drainage work has been extended until Jan. 17. M. A. Bowen is Secy. Comn. in charge of the work.

✦Stables—New York, N. Y.—The general contract has been awarded to C. MURPHY & SONS, 764 11th Ave., New York, for alterations to the stable of PAUL VIANO, 39 Beekman St., New York, at $19,000.

Dock System—New York, N. Y.—The Board of Estimate and Apportionment voted, Dec. 19, to spend the necessary amount for a municipal dock system. In the property which the city may take over are the plants of the Bush Terminal Co. and the New York Dock Co., the estimated value of which is $50,000,000. Acquisition of other property by condemnation or otherwise is expected to cost $50,000,000. Another $50,000,000 would be expended in building docks and an electric railway along the water front. Negotiations for the property are expected to extend over several years. City officials will begin at once to appraise and obtain options on the land which extends from the Brooklyn Bridge to a point near Bay Ridge.

Fountain—New York, N. Y.—The city has approved the site for the proposed fountain provided for in the will of the late Joseph Pulitzer. Estimated cost, $50,000.

Barge Canal Terminal—Plattsburg, N. Y.—The State Canal Board has approved plans and specifications for the construction of a barge canal terminal at Plattsburg.

Park Work—Newark, N. J.—The Board of Chosen Freeholders of Essex County is considering an issue of $350,000 of bonds for the extension of parks and their maintenance.

Engine House—Newark, N. J.—The following low bids were received by the Common Council for the erection of a new building for No. 9 engine house, Summer Ave.: Mason and carpentry work, William G. Sharwell & Co., Newark, $22,796; plumbing and heating, Samuel F. Wilson, Newark, $3952; iron and steel, Goeller Iron Works, Newark, $1690; electrical work, McGowan & McCabe, Newark, $840; steel lockers, Merritt & Co., $185.

Tower House—Trenton, N. J.—The Pennsylvania R.R. Co. will erect a new tower house between the State St. and Chestnut Ave. bridges.

✦Pier Work—Philadelphia, Penn.—The Philadelphia & Reading Ry. Co. has awarded the contract to L. F. SHOEMAKER & CO., Philadelphia, for the structural steel work in connection with the new pier at 38 South Wharves.

✦Drainage—Tallahassee, Fla.—Bids were received, Dec. 16, by the Trustees of the Internal Improvement Fund and the Board of Drainage Commissioners, Tallahassee, for work in connection with the Everglades Drainage Canal. The contract has been awarded to the NATIONAL CONSTRUCTION CO., Birmingham, Ala., at 7.65c. per cu.yd. without classification. This work will involve the construction of Canal A, 42½ miles in length, 75 ft. average bottom width, 11 ft. average depth, excavation 7,100,000 cu.yd. of earth and 65,000 cu.yd. rock; or Canal B, of 42½ miles long, 45 ft. average bottom width, excavation about 4,600,000 cu.yd. earth and 400,000 cu.yd. of rock. F. C. Elliott is Acting Ch. Drainage Engr. On Canal A, the company bid 6.5c. per cu.yd. for earth excavation; and 20c. for rock; on Canal B, 6.5c. and 20c.; without classification, 7.65c. for Canal A and 7.81c. for Canal B. Other bidders were: Hillsboro Dredging Co., Tampa, Fla., Canal A, earth, 9.9c.; rock, 24.8c.; without classification, no bid; Canal B, 9.4c.; 24.2c.; and no bid; Furst-Clark Construction Co., Baltimore, Md., Canal A, 7.9c.; 40c.; and no bid; Canal B, 8c.; 40c.; and no bid; Miami Engineering & Construction Co., Miami, Fla., Canal A, 9.25c.; 30c.; and no bid; Canal B, 8.75c.; 27.5c.; and no bid.

Wharf—New Orleans, La.—Bids will be received until Jan. 8, by the Board of Port Commissioners for the construction of the proposed Frisco Lines wharf from Louisa to Lesseps Sts. Estimated cost $500,000.

Levee—Hickman, Ky.—The Mobile & Ohio R.R. Co. will construct a levee at Hickman. B. A. Wood, Mobile, Ala., is Engr.

Fence—Columbus, Ohio—Bids will be received until noon, Jan. 15, by A. P. Sandles, Secy. State Bd. of Agriculture, State House, Columbus, for 1720 ft. of race-track fence and 1851 ft. of ground enclosure fence.

Drainage Work—Greenville, Ohio—The Commissioners of Darke County, Greenville, have sold $62,000 of bonds for the construction of drainage work.

Subway—Lorain, Ohio—Plans are nearing completion and will soon be submitted to the city by the Baltimore & Ohio R.R. Co. for the construction of the East 28th St. Subway.

Asphalt—Indianapolis, Ind.—The Board of Public Works will receive bids until 10 a.m. Jan. 2 for 500 tons of asphalt for the city asphalt repair plant.

✦Drainage Pumping Plant—Bridgeview, Ill.—Bids will be received until 2 p.m. Jan. 7 by the Commissioners of Cool Creek Drainage and Levee District, Schuyler County, Ill., for pumping plant and auxiliary work. Guy L. Shaw is Secy. Plans, specifications and bond required can be had from the Secy. or advertising for this item.

Drainage—Mattoon, Ill.—Plans are being prepared for the construction of a drainage system in the northwestern part of the city.

✦Ore Dock—Ashland, Wis.—The Chicago & Northwestern Ry. Co., it is reported, has awarded the contract to M. J. PEPPARD and the BARNETT & MCQUESTEN CO., Minneapolis, Minn., for constructing an ore dock at Ashland to cost about $250,000.

Drainage—Fountain City, Wis.—Bids will be received until Jan. 14, by the Commissioners of the Trempealeau Drainage District of Trempealeau and Buffalo Counties, for drainage work in the district. Henry Roettiger is Secy.

Ore Docks—Two Harbors, Wis.—The Duluth & Iron Range R.R. Co. will enlarge its ore docks at Two Harbors.

Ditches—Edina, Minn.—Bids were received and rejected Dec. 14, by C. B. Yancey, Village Recdr., for constructing the Wind Ditch, and also the Wiltgen Ditch. Abbott & Budd, 425 Kasota Block, Minneapolis, Minn., are Engrs.

✦Ditch—St. Peter, Minn.—W. H. Holz, County Audr., received bids, Dec. 21, for reconstructing ditch No. 3, involving 89,523 cu.yd. The contract was awarded to CHARLES A. ANDERSON, and MARTIN SANDEM, at $14,090.

Dump Boat—St. Louis, Mo.—Bids will be received until noon, Jan. 7, by the Board of Public Improvements, for the construction of a wood hull scavenger dump boat. William T. Findly is Secy.

Bath-House—St. Louis, Mo.—Bids will be received until noon, Jan 14, by the Board of Public Improvements, for the erection of Public Bath-house No. 3. Estimated cost, $37,000.

Drainage Pumping Station—Little Rock, Ark.—Bids will be received by the Fourche Drainage District until Jan. 9, for erecting and furnishing the main pumping station of the Fourche Drainage District. Lund & Hill, 201 West 2d St., Little Rock, are Engrs.

Subway—Fort Worth, Tex.—Plans are in progress for the construction of a subway under the tracks of a number of railroads here. The city's part of the cost of the work will be about $200,000. It is proposed that the railroads shall pay for the construction of the subway itself and the city for the cost of the approaches and damage to abutting property. The contracts for the work will be submitted to the city commission by the railroads interested on Jan. 14.

Park Work—Sapulpa, Okla.—The citizens have voted $100,000 of bonds for park work. I. G. Anderson is City Clk.

✦Excavation—Salt Lake City, Utah—P. J. Moran, Salt Lake City, has submitted the lowest bid at 15c. per cu.yd. for excavating 70,000 cu.yd. of earth for the new state capitol building. Other bidders were: O. B. Brinted, 21c. per cu.yd.; Joseph Mellen, 23c.; Heman Brothers, 29c; John Hold, 37½c.; Enoch Smith, 50c.

✦Wharf—Los Angeles, Calif.—The Board of Public Works has awarded the contract to SNARE & TRIEST, 143 Liberty St., New York, for constructing 2520 ft. of reinforced concrete wharf for Huntington Fill, at $444,777. List of bidders noted Dec. 26.

Pier—Oakland, Calif.—The San Francisco, Oakland & San José Terminal Ry. Co. contemplates the construction of a six-track pier from Oakland's shore line to the Key Route mole, a distance of 3½ miles, at an approximate expense of $2,000,000. The plans call for the construction of a spur and side track from the six-track pier to the district bordering on the municipal wharves, and an enlargement of the present train sheds and present mole facilities, constructing a greater train shed. The total expenditure for the work will be over $7,000,000.

Engine House, Fire Apparatus—Pasadena, Calif.—The city contemplates spending $11,500 for a site and erection of an engine house; $11,000 for an automobile aërial truck; $16,000 for a combination wagon and pumping engine; $3000 for 3000 ft. of hose; $16,000 for three 80-hp. hose wagons; $9000 for three 40-hp. tractors; $3000 for one 40-hp. tractor; $1500 for new equipment and $800 for gasoline tanks.

Wharf—Sacramento, Calif.—The Vallejo & Northern Yolo Ry. Co. has applied for a franchise to construct a wharf, to cost $50,000, along the Reed orchard property, opposite Sacramento.

Harbor—San Francisco, Calif.—It is reported that a syndicate of Chicago packers will construct a harbor in San Francisco Bay, 14 miles from San Fancisco. T. E. Wilson, Vice-Pres., Morris & Co., Chicago, Ill., is interested.

Seawall—Philipsburg, Que.—A 200-ft. seawall will be constructed on the shore of Missisquoi Bay. A. H. Borden is Secy.-Treas., Philipsburg.

Wharf Extension—Ottawa, Ont.—Bids will be received until 4 p.m., Jan. 7, by R. C. Desrochers, Secy., Dept. Pub. Wks., Ottawa, for the construction of an extension to the wharf at Providence Bay, Manitoulin Island, Algoma District, Ont.

Hopper Scows—Ottawa, Ont.—Bids will be received until 4 p.m., Jan. 7, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for the construction of six 300 cu.yd. steel hopper scows.

Vessel—Ottawa, Ont.—Bids will be received until noon, Jan. 15, by G. J. Desbarats, Deputy Minister of the Naval Service, for the construction of a schooner.

Wharf—Windsor, Ont.—Bids will be received until 4 p.m., Jan. 13, by R. C. Desrochers, Secy., Dept. Pub. Wks., Ottawa, Ont., for the construction of a wharf at Windsor. Plans, specifications and form of contract can be seen and forms of proposal obtained at Ottawa and at the offices of H. J. Lamb, Esq. Dist. Engr., Windsor; and J. G. Sing, Esq., Dist. Engr., Confederation Life Bldg., Toronto, Ont.

Lock, Dam, Etc.—New Glasgow, N. S.—Bids will be received until 4 p.m., Jan. 20, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a lock, dam, regulation sluices and approach piers and the excavation of a raceway and channel in the East River, near New Glasgow. Plans, specification and form of proposal, etc., can be seen at the department and at the offices of J. L. Michaud, Dist. Engr., Merchants Bank Bldg., Montreal; A. R. Decary, Dist. Engr., Post Office, Quebec; F. G. Goodspeed, Dist. Engr., St. John, N. B.; C. E. W. Dodwell, Dist. Engr., Halifax, N. S., and an application to the Postmaster, New Glasgow, N. S.

BUILDINGS

+Boston, Mass.—The Paine Furniture Co. has awarded a contract to JAMES STEWART & CO., 30 Church St., New York, N. Y., for the construction of a new building. It will be located on the extension of Arlington St., and will be 10 stories high, 300x100 ft.

Boston, Mass.—Bids will be received by the Schoolhouse Commission, until Jan. 14, for the erection of an elementary school in the Emerson District East Boston. Chas. Logue, 120 Boylston St., is Chn. of the Com.

Pittsfield, Mass.—The city has been notified by the New York Central & Hudson River R.R. that its directors have authorized the erection of a union passenger station. It will be 144x75 ft., with an annex 176 ft. long. The estimated cost is $100,000. D. R. Carpenter, New York, N. Y., is Engr. of Structures.

Middletown, Conn.—C. V. Snedetur, Jr., Arch., 527 Fifth Ave., has been commissioned by a Connecticut syndicate, to prepare plans for a six-story fireproof hotel, 125x75 ft., to be erected in Middletown. The estimated cost is $250,000.

+New Haven, Conn.—The contract for alterations to the Hotel Garde, at Meadow St. and Columbus Ave., has been awarded to the DAVID H. CLARK CO., 166-178 Brewery St., New Haven. A six-story addition and a power house will be built. The improvements are estimated to cost $250,000. Dudley St. Clair Donnelly, 98 State St., New London, Conn., is the Arch.

Brooklyn, N. Y.—We are officially advised that the following bids were received, on Dec. 23, by the Department of Education, Park Ave. and 59th St., Manhattan, for the construction of the Flushing High School, in the Borough of Brooklyn: Richard E. Henningham, 1 Madison Ave., Boro. Manhattan, $380,485; Durkin & Laas, 103 Park Ave., Boro. Manhattan, $403,000; P. J. Brenner & Son, 624 Madison Ave., Boro. Manhattan, $403,330; Charles Wille, 1293 Second Ave., Boro. Manhattan, $429,000; James McArthur & Co., $434,000; Peter Cleary, $407,000; Thomas McKeown, Inc., 103 Park Ave., Boro. Manhattan, $410,000; T. A. Clarke Co., $422,700. C. B. J. Snyder is Supt.

+Geneva, N. Y.—We are officially advised that the City Council has awarded a contract to R. R. SCHNIREL, Geneva, at $77,500, for the construction of a new city hall and jail. Bids were received on Dec. 23. Noted Dec. 26.

Ithaca, N. Y.—The Board of Trustees of Cornell University has announced plans for the construction of a $325,000 addition to Lincoln Hall, the college of Civil Engineering.

New York, N. Y.—Plans have been filed by F. M. Andrews & Co., Archs., 1 Madison Ave., for the construction of a 37-story office building on the site of the recently destroyed Equitable Bldg., on Broadway, between Pine and Cedar Sts. The Thompson-Starrett Co., 49 Wall St., has the contract for the construction. The estimated cost is $8,000,000.

Plans have been filed by Gaston Ajello, Arch., 1 West 34th St., for the construction of a 12-story apartment house, 84x60 ft., to be erected at 305 West 72nd St., for the Anthony Campagna Construction Co., 601 West 115th St. The estimated cost is $300,000. Noted Oct. 17.

Plans have been filed by George & Edward Blum, Archs., 505 Fifth Ave., for the construction of a 12-story apartment, at West End Ave. and 98th St., for T. J. McLaughlin Sons, 845 Amsterdam Ave. The estimated cost is $500,000. Noted Dec. 12.

Plans have been filed by J. Riley Gordon, Arch., 507 Fifth Ave., for the construction of a 12-story fireproof hotel on 51st St., near Fifth Ave. It will be of limestone, granite and terra-cotta, 85x42 ft. The 33 West 51st St. Co. is the owner. The estimated cost is $300,000.

Bids are being received by the Adlon Construction Co., 501 Fifth Ave., for the construction of a 12-story apartment and store building, to be erected at 58 Seventh Ave. George & Edward Blum, 505 Fifth Ave., are the Archs.

The Emmay Realty Co., Pinehurst Ave. and 180th St., has purchased a plot, 117x160 ft., on the northeast corner of Riverside Drive and 160th St., upon which it will erect a 12-story apartment house.

Schwartz & Gross, Archs., 347 Fifth Ave., have completed plans for the construction of a six-story tenement at 181st St. and Pinehurst Ave., for the Comfort Realty Co., 8 West 39th St. The estimated cost is $225,000.

Plans have been filed by Samuel Sass, Arch., 32 Union Square, for the construction of a six-story apartment, at 163rd St. and Fort Washington Ave., for the Riverside Viaduct Realty Co., 419 West 119th St. The estimated cost is $200,000.

(Borough of Queens)—The Loose-Wiles Co., of Kansas City, Mo., and Boston, Mass., has had plans prepared for a nine-story bakery building on a plot 200x430x382 ft., on Thompson Ave., Queens Pl. and Orton St. It will be of reinforced concrete. The site was recently leased by the company from the Degnon Realty & Terminal Improvement Co. The cost is estimated at $1,000,000.

+Schenectady, N. Y.—The city of Schenectady has awarded general contract to BROWN & LOWE, for additions and alterations to be made to public school building on Robinson St. The structure will be 188x66 ft., three stories high.

Bayonne, N. J.—Plans are being prepared for the construction of an armory at Broadway between 33rd and 34th Sts., for the Fourth Regiment, National Guard, New Jersey. The estimated cost is $10,000.

+Elizabeth, N. J.—The general contract has been awarded to the GORDON LUMBER & WRECKING VO., Elizabeth, for the construction of the theater, on Elizabeth Ave., for the Fifth Ave. Amusement Co., 41 Canal St., New York.

Newark, N. J.—Hermas Schneder and Waldo Genund will erect a 12-story, 80x200 ft., hotel at Plaza Park. The estimated cost is $500,000.

Smiths Landing, N. J.—The Board of Supervisors has had plans prepared by S. Hudson Vaughn, Atlantic City, N. J., for the construction of an almshouse at Smith's Landing. The estimated cost is $75,000.

Trenton, N. J.—The Bell Telephone Co. will erect a four-story exchange building at 216-18 State St., Trenton. J. T. Windrim is Arch., Commonwealth Bldg., Philadelphia, Penn.

+Erie, Penn.—The contract for the construction of the four-story telephone building, for the Bell Telephone Co., of Philadelphia, has been awarded to HENRY SHENK CO., Erie, Penn.

+The contract has been awarded to GEORGE & BORST, Philadelphia, for the construction of an additional building at the University of Pennsylvania.

Pittsburgh, Penn.—The Dollar Savings Fund & Trust Co., of Allegheny, will erect a 10-story bank building, at Federal and Stobo Sts. The estimated cost is $100,000.

+Baltimore, Md.—The contract has been awarded to SANFORD & BROOKS CO., 24 Commerce St., for the construction of a five-story steel and brick building, at Aliceanna and Chester Sts., for the Canton Co.

+Jessups, Md.—The contract for the construction of alterations and additions to the House of Correction has been awarded to the L. SCOTT CONSTRUCTION CO., Marietta, Ohio, at $68,300. Noted Dec. 19.

Greenville, N. C.—Bids will be received until Jan. 7, by the Building Committee of the Greenville Banking & Trust Co., for the construction of a bank building. Benton & Moore are Archs., Wilson, N. C.

Aiken, S. C.—Plans have been prepared by G. Lloyd Preacher, Augusta, Ga., for the construction of an opera house and addition to the Olwell Hotel, for the Aiken Theater Co. The estimated cost is $50,000.

Atlanta, Ga.—Bids have been rejected and plans are being revised for the construction of the Y. M. C. A. building. Shattuck & Hussey, 907 La Salle St., Chicago, Ill., and A. Ten Eyck Brown, Atlanta, are Archs. Noted Nov. 28.

The Fitzhugh Knox Co., Candler Bldg., will erect a six-story apartment house, at 45 West Cain St. The estimated cost is $100,000.

Savannah, Ga.—The Savannah Trust Co. has had plans prepared by Wallin & Young, Archs., Savannah, Ga., for the construction of 26-story office and bank building, 60x180 ft. Noted Sept. 5.

Bids will be received until Feb. 1, by Mobray & Uffinger, Archs., 56 Liberty St., New York, for the construction of a bank building, for the Hibernia Bank. The estimated cost is $100,000.

+Birmingham, Ala.—A contract has been awarded to the BERGONDAHL-BASS CO., Chicago, Ill., for the construction of a 25-story bank building at Second Ave. and 21st St., for the Jefferson County Savings Bank. Noted Nov. 14.

Plans have been prepared by D. O. Whilden, Birmingham, Ala., for the construction of a three-story apartment house at Highland Ave. and 21st St., for Mrs. Rebecca P. Anderson. The estimated cost is $100,000.

Chattanooga, Tenn.—The University of Chattanooga contemplates expending $200,000 for college buildings. John H. Race is Pres.

+Bowling Green, Ohio—The general contract for the construction of the administration building for the Bowling Green State Normal College, has been awarded to the STEINLE CONSTRUCTION CO., Fremont, Ohio, at about $135,827. Noted Nov. 21.

Columbus, Ohio—Frank L. Packard, Columbus, has been commissioned to prepare plans for the construction of a memorial hall in Columbus ,to cost approximately $250,000.

Canton, Ohio—Plans are being prepared for the construction of a three-story court house of brick and stone. Richards, McCarty & Bulford, Columbus, Ohio, are the Archs.

Norwalk, Ohio—Bids will be received by the Board of County Commissioners of Huron County, Gardiner Block, oNrwalk, until 10 a.m., Jan. 7, for the construction of a Childrens' Home for Huron County. Plans and specifications are on file at the office of the County Auditor, Norwalk.

Dayton, Ohio—John S. McIntyre is having plans prepared for the construction of a four-story mercantile building of concrete and steel, at Second and Main Sts. The estimated cost is $150,000.

The Allyn Engineering Co., Cincinati, is preparing plans for the construction of an eight-story hotel at Second and Ludlow Sts., for the Miami Hotel Co. The estimated cost of the structure is $1,000,000. F. B. Rike is interested.

**+The contract for the construction of a five-story warehouse on Walnut St., for the Union Storage Co., 101 Bainbridge St., has been awarded to the FERRO CONCRETE CONSTRUCTION CO., Cincinati. Schenck & Williams, 591 Arcade Bldg., Dayton, are the Archs. Noted Dec. 19.

Toledo, Ohio—J. C. Huber, Jr., is preparing plans for the construction of a new church for St. Stephen's Parish. The estimated cost of the structure is $50,000.

Mills, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., have been commissioned to prepare plans for the construction of a 10-story department store building for the Fifty Associates. The estimated cost is $1,000,000.

Bids will be received by E. M. Gee, Board of Education Bldg., Toledo, until Jan. 9, for the construction of a three-story and basement school to be known as the Waite School. The estimated cost is $250,000.

Terre Haute, Ind.—Plans are being prepared for the erection of a six-story interurban station for the Terre Haute, Indianapolis & Eastern Traction Co. It will be of brick and will cost approximately $100,000. H. E. Smith, Terre Haute, is the Ch. Engr.

David Stott is planning the erection of a 10-story hotel building at Michigan and Wayne Sts. The estimated cost is $1,000,000.

Detroit, Mich.—Plans have been prepared for the construction of a club house for the Detroit Athletic Club. The estimated cost is $750,000.

Kalamazoo, Mich.—W. C. Jones, 30 North LaSalle St., Chicago, Ill., has been commissioned to prepare plans for the constrction of a two-story and basement edifice for the First Church of Christ, Scientist, Kalamazoo. The estimated cost is $65,000.

+Bloomington, Ill.—The contract for the construction of a passenger station for the Chicago & Alton R.R. has been awarded to D. B. DONELSON, Milwaukee, Wis. The estimated cost is $80,000.

Chicago, Ill.—Christian Londelius has acquired a site on Wabash Ave. between 59th and 60th Sts., and will erect an apartment [illegible] to cost approximately $170,000.

Spiegel's Home Furnishing Co. has leased the property at Wabash and Monroe Sts., and will erect a business building to cost about $[illegible].

Pekin, Ill.—Bids will be received by the Board of Education, until Jan. 15, for the construction of a school of brick, to cost approximately $110,000. Hewett & Emerson, Peoria, Ill., are the Archs. J. C. Aydelott is Chmn. of the Bldg. Comm.

Milwaukee, Wis.—The Builders' Investment Co. has purchased a site at Marshall and Biddle Sts., and will erect an apartment house to cost about $150,000.

Plans are being prepared for the construction of an apartment house at Juneau Place and Biddle St., for Patrick Cudahy. The estimated cost is $300,000. Crane & Barkhausen, Milwaukee, are the Archs.

Cedar Rapids, Iowa—Press reports state that the American Trust Co. is having plans prepared for the construction of a 10-story building on the Solomon Corner.

Des Moines, Iowa—The Des Moines Hospital Assn. is planning to erect a Homeopathic Hospital in Des Moines to cost about $100,000.

Minneapolis, Minn.—The Board of Education has taken out a permit to erect a three-story addition to the North High School, to cost approximately $225,000.

Plans have been filed for the construction of a five-story addition to the warehouse of Jenney, Semple & Co., at 213 First St., South. The estimated cost is $120,000.

Topeka, Kan.—Press reports state that the construction of a Masonic Temple, at 10th and Harrison Sts., is under consideration. The estimated cost is $250,000.

Omaha, Neb.—The erection of a business building on 11th St., for the Roobe & Runyan Co., is under consideration. The estimated cost is $200,000.

Dallas, Tex.—The various railroads entering Dallas will erect a union depot to cost about $5,000,000. Jarvis Hunt, Chicago, Ill., is the Arch.

+Seattle, Wash.—A contract has been awarded by George W. Fisher to T. STRAUSZER & SONS, at $108,000, for the erection of a three-story building on Third Ave. It will be [illegible] ft., with steel frame. Bebb & Mendel, Denny Bldg., are Archs.

W. G. Norris, of the Norris Safe & Lock Co., 309 Third St., has announced his intention of building a 10-story office and store building on a triangular site bounded by Third Ave. South, Washington St., and Prefontaine Place. It will be of steel and concrete construction, and cost approximately $500,000. Mr. Norris states that actual construction will not begin for some time.

Portland, Ore.—Press reports state that the Montana Electric Co., Butte, Mont., is considering the erection of a jobbing house in Portland, at an estimated cost of $200,000. H. W. Turner is Pres.

The New Homeopathic Hospital will erect a five-story U-shaped building to cost $350,000. Wm. H. Ladd is one of the directors.

Fresno, Calif.—A [illegible]-story office building will be erected at Mariposa and J. Sts by the Fresno Estate Co. It will be [illegible]x150 ft., of steel frame construction, with brick walls and concrete floors. Three electric elevators will be installed. The estimated cost is $275,000. George W. Kelham, San Francisco, is Arch.

H. H. Brix will erect a five-story brick and steel building, [illegible] adjoining the Fisk Bldg.

[illegible] the erection of a [illegible]-story club house [illegible].

Fullerton, Calif.—[illegible] contract for the erection of a one-story and basement building for the Fullerton Hospital Association. The structure will be 84x34 ft., with a wing 37x40 ft., of reinforced-concrete construction, hollow tile partitions, composition flooring, and equipped with all modern hospital devices. Charles F. Shattuck, Mason Bldg., Los Angeles, is Arch. As soon as the building is completed, another wing will be erected on the site of the present hospital.

Longbeach, Calif.—Barnett & Moore will erect a five-story building, to cost $150,000, at the corner of Ocean Front and [illegible].

Los Angeles, Calif.—Walker & Vawter, Mercantile Bldg., are completing the finishing drawings for the new buildings to be erected on Hope St. for the Girls' Institute, which include a nine-story and basement central auditorium, 112x165 ft., with [illegible] and the basement of dormitory building, [illegible] ft., [illegible] and the other for servants' quarters on the rear [illegible] ft., gravel roof gardens. 112x18 ft. The buildings [illegible] concrete construction, with cement plastered exterior and artificial stone trim, composition roofing, pine trim, metal [illegible] and [illegible] plate and art glass windows, metal frames and sash, elevators, steam heat, vacuum cleaning system, etc. A complete [illegible] plant will be installed.

The Klaus Co., 716 Union League Bldg., was the lowest bidder at $21,911 for the erection of a [illegible] reinforced concrete [illegible] Mfg. Co., at Fifth and Gless Sts. The Los Angeles Planing Mill Co. bid $15,232. Thornton Fitzhugh, Pacific Electric Bldg., is Arch.

The following [illegible] contract [illegible] Wright & Callender [illegible] been granted a permit for the erection of a nine-story and basement reinforced-concrete loft building at [illegible] Broadway, for A. I. Chesney. The cost will be $[illegible].

Robert M. Taylor, Douglas Bldg., has been commissioned to prepare plans for a four-story brick store and hotel building, to be erected on West Sixth St. for [illegible]. The building will be 100x120 ft., with a roof [illegible] ft.

Smith & Stahlmuth, 550 South Fair Oaks Ave., Pasadena, were low bidders at $16,970, for construction of a machine shop on the grounds of the County Hospital, and at $21,500 for construction of the library building. The Willard Slater Co., at $51,500, was low bidder for erection of the psychopathic ward at the County Hospital. Each building will have concrete frame, floors and walls. Plans were drawn by George Low, County Supt. of Bldgs. Noted Dec. 8.

Plans are being prepared for a six-story or higher lodge building, to be erected on Hope St., for the Knights of Columbus, at an estimated cost of $100,000. A. C. Martin, Higgins Bldg., is Arch.

The Whitcomb Co., 422 Consolidated Realty Bldg., Los Angeles, will erect a 14-story and basement steel frame office building on Sixth St., adjoining the Consolidated Realty Bldg. Thornton Fitzhugh, Pacific Electric Bldg., is the Arch.

+THE DAVIDSON CONSTRUCTION CO., Union Oil Bldg. has been awarded the contract for the construction of seven-story reinforced concrete warehouse on Arapahoe St. for the Fidelity Storage & Moving Co. It will be 50x100 ft. and will cost $45,000. Mayberry & Parker, P. E. Bldg., Archs. Noted Dec. 12.

Oakland, Calif.—Plans have been prepared by E. W. Hartmann, Arch., for a five-story apartment house, costing about $125,000, to be erected at 22d St. and Broadway, for John W. Mitchell, of Chicago.

Oakland, Calif.—The following bids were received by the Board of Education for the construction of the Peralta Heights School and the shop building at the Polytechnic High School: Peralta School, Moore & Burlingame, $47,675; C. Christensen, $39,650; W. G. Thornally, Jr., $40,184; Carnahan & Mulford, $39,761; Boyd & Kerr, $41,93; Stockholm & Allyn, $40,437; W. W. Anderson, $39,900. Shop Building, Polytechnic High School. McLeran & Peterson, $81,579; Moore & Burlingame, $89,800; W. W. Anderson, $79,500; Van Sant Houghton Co., $83,588; Williams Bros. & Henderson, $78,912; C. Christensen, $81,534; Carnahan & Mulford, $79,881; O. B. Ackerman & Son, $89,583; Lange & Bergstrom, $81,500.

Ocean Park, Calif.—Stineman & Kramer will erect a six-story and basement hotel building at Marine and Front Sts. It will be 51x87 ft., containing 100 guest rooms. The construction will be of reinforced concrete, plastered exterior with colored tile inlays. Frank T. Kegley, Consolidated Realty Bldg., Los Angeles, is Arch.

Plans have been prepared by the McGibbon-Frary Co., Los Angeles Investment Bldg., Los Angeles, for a seven-story store and hotel building, to be erected for G. M. Jones. It will be 80x180 ft., of reinforced-concrete construction, and is estimated to cost $100,000.

San Diego, Calif.—WELCH & WRIGHT, of San Diego and Portland, Ore., were awarded the general contract for the construction of the Washington school building, at $113,000. B. F. Hulse, 137 South Rose St., Los Angeles, will probably be awarded the contract for the heating system. The building will be of concrete construction. T. C. Kistner prepared plans.

+A. T. SPENCE, San Francisco, was awarded the contract for the construction of a three-story brick exchange and office building on University Ave., for the Pacific Telegraph & Telephone Co. It will have pressed brick exterior, composition roof, modern equipment, and will cost $90,000.

San Francisco, Calif.—Houghton Sawyer, Arch., Shreve Bldg., has plans nearly completed for the Burlingame Court Apartment House, a nine-story and basement building, which will be erected on Sacramento St. There will be a complete steel frame, with exterior walls faced with pressed brick and terra cotta. The building will cost $350,000.

San Francisco, Calif.—Charles S. Kaiser, Arch., Mechanics' Institute Bldg., has been commissioned to prepare plans for an eight-story and basement commercial building, which is to be erected for the fruit interests in Sacramento. A site, 60x160 ft., has been secured at the corner of 4th and J Sts. Construction will be of reinforced concrete, and will be fireproof throughout.

The Roman Catholic Church is planning the erection of a $75,000 edifice on Bush St., West of Chatham Place. B. D. Brouchoud is Arch.

Plans have been completed by Ward & Blohme, Alaska Commercial Bldg., for Machinery Hall, the largest of the Panama-Pacific Exposition buildings. Working drawings have received the approval of the Director of Construction. The building will be 360x800 ft. The roof will be supported by wooden arches of 75-ft. span. The average height of the building will be 100 ft.

W. D. Shea, Arch., 244 Kearny St., has been selected by the members of the Building Committee of the Young Men's Institute to prepare plans for the new $150,000 structure, which will be erected on Oak St. The site has a frontage of 89 ft., and a depth of 120 ft. The new building will be three stories high, with a basement. It will have a steel frame. Noted Dec. 12.

Frederick H. Meyer, Arch., Bankers' Investment Bldg., has awarded a general contract for the four-story and basement brick and steel structure, which is to be erected by the York Realty Co., to V. FRANZ, at $75,000.

The following bids were opened by the Board of Public Works for the construction of a two-story and basement reinforced concrete hospital building for the Infirm Poor at the Relief Home Tract: Monson Bros. $58,600; Karl Eberhardt, $55,250; F. Rolandi, $52,635; W. W. Anderson & Co., $52,430; J. W. Carr, $49,799; Commary-Peterson Co., $51,996; Robert Trost, $50,722; Frank Gallagher, $53,750; Carnahan & Mulford, $49,545; W. A. Newsom, $51,400; J. L. McLaughlin, $45,286; Wold & Kohn, $55,600; M. M. Finlayson, $48,975; R. W. Moller, $48,680.

Venice, Calif.—The Phoenix Building & Realty Co. is preparing plans for a five-story office building, which it will erect on Pier Ave., at an estimated cost of $75,000.

+Yuma, Calif.—A contract has been awarded by E. F. Stoughtell to CHARLES OLCESTER, Yuma, at approximately $45,000, for erection of a four-story brick business building, 80x160 ft. R. B. Young & Son, Lankershim Bldg., Los Angeles, are Archs.

Victoria, B. C.—The Manufacturers' Harbor Terminals, Ltd., Montreal, will erect five D-shaped buildings at Victoria, each to cost about $500,000. They will be six stories high.

Engineering News

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The Cape Cod Canal

No engineering undertaking in the United States has a longer history than the Cape Cod Canal. Few indeed have been more thoroughly investigated, surveyed and reported upon—and so invariably recommended as feasible—than this eight-mile waterway through the sand hills of the Massachusetts coast. Perhaps no other artificial waterway in America of equal magnitude could bring about greater saving in lives and property which at present are paid in annual toll by wrecks on the Cape Cod coast.

Cape Cod is a hook-shaped peninsula projecting some 30 miles to the east of the mainland of Massachusetts and partly inclosing an arm of the ocean variously known as Massachusetts Bay, Cape Cod Bay, or, in the immediate vicinity of the canal entrance, as Barnstable Bay. This bay is protected by the cape on the south and east, but open to the north, and as most of the winter storms blow from the northeast, sailing vessels and tows

On the south side of the peninsula, at the base of the hook, is Buzzards Bay, which is almost land locked and forms an expansive and magnificent harbor. From Buzzards Bay the passage into Long Island Sound is easy and can be made in all kinds of weather without danger. A canal through the base of the hooked peninsula, from Barnstable to Buzzards Bay, will therefore make possible an inland waterway from Boston, Mass., to New York City and points south, except for the short but exposed stretch of open water between Boston and the Barnstable Bay entrance of the canal.

The country through which the canal prism passes, from the low salt marshes west of the town of Sandwich to the Scussett River, across a low dividing ridge, and down the valley of the Monumet River to deep water in Buzzards Bay, is a most remarkable physical formation. It has every appearance that nature intended a waterway at this place, or that there had some time existed a channel there.

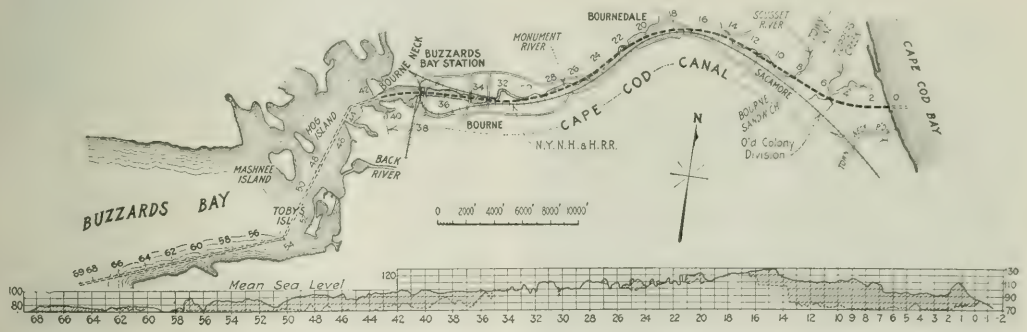


FIG. 1. PLAN AND PROFILE OF THE CAPE COD CANAL. PROFILE SHOWS PROGRESS OF EXCAVATION TO NOV. 1, 1912

of barges caught by a gale west and north of the point of the cape are almost certain to be driven upon the low sandy shore within the arm of the hook. Outside the cape are dangerous shoals, which, combined with rough and foggy weather, often make this part of the coast extremely hazardous during the fall and winter. Barge tows are often compelled to wait several days before attempting to round the cape.

The total tonnage of vessels rounding Cape Cod annually is estimated to be 25,000,000, and the passengers carried 500,000. The canal will shorten the distance between Boston and New York by 66 miles. The actual time saved coasting vessels will be in much greater proportion during rough weather by avoiding the now necessary delays. The saving in insurance for vessels using the canal will also be considerable.

The valley of the Monumet River is low and broad and is of an alluvial formation, consisting of sand and gravel mixed with large and small boulders. The direction of the valley is nearly northeast and southwest. The tide flows up the Monumet River for three miles and the headwaters of this stream nearly overlap the headwaters of the Scussett River, which flows into Barnstable Bay.

The ridge dividing the headwaters of the two rivers is only three-quarters of a mile wide and but 29 ft. above mean sea level. The width of the valley is about 650 ft. at its narrowest point and expands gradually toward each end. The hills rise on either side of the valley in gradual slopes to heights of from 60 to 180 ft.

Except for the narrow dividing ridge, the canal prism excavation required the removal of but little material except between the high-water level and the bottom of the

canal. There is no physical obstacle to a canal as deep as may be desired, and the width may be made at least 600 ft. The material excavated is chiefly sand, with underlying strata of hardpan in some places. Through the salt marshes at the eastern end, the material is of a peaty nature but not difficult to dredge. The boulders are too few to offer any serious trouble.

The tides in Buzzards Bay have a mean rise and fall of 4.11 ft., and in Barnstable Bay of 9.17 ft. The times of high and low water in the two bays are different; the high water is nearly 3½ hours, and the low water 4½ hours, earlier in Buzzards Bay than in Barnstable Bay. The durations of rise and fall in Barnstable Bay are nearly equal, but differ in Buzzards Bay by about 1½ hours, the rise being rapid and the fall delayed.



FIG. 2. VIEW OF THE BUZZARDS BAY ENTRANCE TO THE CAPE COD CANAL



FIG. 4. LOOKING EAST THROUGH CAPE COD CANAL CUT NEAR SAGAMORE

Low water occurs in Buzzards Bay soon after high water in Barnstable Bay, while high water in the former occurs after the tide has risen considerably in Barnstable Bay. The maximum difference in sea level in the two bays may be about 8 ft. Hence all the early plans for the canal contemplated the use of locks.

The slope of the surface of the water through the canal for the maximum difference in sea level in the two bays corresponds to a velocity of current of 6 ft. per sec., or 4 mi. per hr. Curves in the canal alignment will reduce this velocity and the flow will, of course, be maximum for very short periods only. For the canal of the cross-section now building there will be a current due to mean tide differences of about 2½ miles per hour, which will flow northerly when it is low tide in Barnstable Bay, and southerly when it is high tide there. The maximum current is little greater than that of the Mississippi River or of the Ganges Canal in India, and it is not anticipated that any seriously destructive effect on the canal banks will result; at least no more erosive action is expected than from the ordinary wash of steamers' screws.

The length of the canal from shore line to shore line is eight miles; from the 30 ft. depth contour in Barnstable Bay to the same depth in Buzzards Bay is 13 miles. The minimum width of the bottom is to be 100 ft.; the Barnstable Bay approach channel will be 300 ft. wide, and the Buzzards Bay approach channel 250 ft. wide. The canal will have a depth of mean low water of 25 ft. The banks through the sand will have a slope of 1 on 3, and



FIG. 3. CAPE COD CANAL CUT AT DEEPEST PLACE

in soft or exposed places will be rip-rapped from 6 ft. vertically below low water to 6 ft. above high water. It was the original intention to place rip-rap on practically all the banks, but this has been deemed unnecessary.

The only engineering work aside from the excavation of the channel has been the construction of a 3000-ft. breakwater to protect the eastern terminus of the canal and the relocation and rebuilding of several miles of the Old Colony R. R. (now a part of the New York, New Haven & Hartford R. R. system) and several public highways. The railway work included the construction of a 160-ft. span bascule lift drawbridge and the road construction of two highway drawbridges of similar type. The foundations of all the bridges are constructed on the basis that the canal may have an ultimate depth of 34 ft.

Fig. 1 shows a plan and profile of the canal. The profile shows the progress of excavation to Nov. 1, 1912. The accompanying views show the state of the work at the beginning of the present fall and winter season. The work is continued throughout the winter months with a somewhat reduced force. Dredging in Barnstable Bay is continuous throughout the winter months, but Buzzards Bay often freezes over in very cold weather.

It is readily seen that the construction of the Cape Cod Canal involves no engineering problems not met with in the excavation of any ditch. It is not an enterprise of great magnitude, as the whole amount of material re-

moved will not exceed 17,000,000 cu.yd.; yet it possesses a great deal of interest, due in no small measure to the vicissitudes of fortune the project of constructing the canal has passed through in the 300 years of its history. The officials of the present company have prepared a brief synopsis of the progress made in this time which, however, is by no means complete. It is as follows:

CHRONOLOGY OF THE CAPE COD CANAL

1602 Cape Cod discovered by Bartholomew Gosnold
1605 De Monts, a Frenchman, cruised around Cape called it "Malebarre."
1620 Arrival of Pilgrims
1623 Miles Standish inspecting coast south of Plymouth
1627 Standish trading at Manomet with Dutch from New Amsterdam. Boats within three miles of each other. Small canal talked of.
1676 Samuel Sewell examined canal route for "a passage from the South sea to the north."
1697 General Court Massachusetts appoints a committee to view the place for a passage from Barnstable Bay to Manomet Bay.
1717 Captain Cyprian Southack describes a free water connection across the Cape Colony of Massachusetts. Individual examinations for shallow canal until
1776 General Washington ordered Thomas Machin to survey the route which would "give greater security to navigation and against the enemy." Also James Bowdoin and Wm. Sever appointed a committee to investigate subject.
1780 Gen. Henry Knox using influence to have government build canal.
1791 John Hills and James Winthrop make survey.
1798 James Sullivan and others petition legislature to build.
1803 Committee appointed by legislature to interest people in project.
1808 Gallatin, Secretary of Treasury, advocated it as "useful in time of war."
1812 Isthmus used by small boats to avoid capture by enemy.
1818 Israel Thorndike and Thomas H. Perkins employed Laommi Baldwin to survey route. 5,000 ships rounding cape.
U. S. Senate made survey for a canal sufficient to admit vessels of war.
1824 U. S. under resolution of Senator Lloyd ordered Major Perault to make survey. Various army officers reported route practicable.
1825 Further surveys made under government orders until 1827.
1828 Government Board reports on canal 36 ft. wide, 8 ft. deep, to cost $669,522.
1844 Lieut. G. S. Blake, U.S.N. Survey.
1860 Renewed interest by Massachusetts and government. Surveys by Brig. Gen. J. G. Totten, Prof. A. D. Bache, Supt. Coast and Geodetic Survey, Comdr. C. H. Davis U.S.N. and Lieut. J. Wilkinson, U.S.N. Report on 18-ft. canal to cost $10,000,000.
1870 Charter to Cape Cod Ship Canal Co., to Alpheus A. Hardy and others. Maj. Gen. J. G. Foster, U.S.A., examining route under orders. Reports on practicability of 23-ft. canal without locks.
1870 Senator Chandler introduces Bill in Congress to pay for breakwater.
1880 Charter granted to Cape Cod Canal Co. Henry M. Whitney and others interested. Some work done but project abandoned.
1882 Gen. G. K. Warren, U.S.A. Engrs., reports to government on canal and cost of approaches.
1883 Cape Cod Ship Canal Co., authorized, William Seward, Samuel Fessenden and others interested. Funds advanced by Quincy A. Shaw. Company made contract with F. A. Lockwood. Excavated over one million yards and failed.
1890 Property assigned to Colonel Thomas L. Livermore by F. A. Lockwood.
1891 Charter granted to E. L. Corthell and others in the name of Massachusetts Maritime Canal Co. This charter lapsed.
1898 De Witt C. Flanagan of New York became interested.
1899 June 1, Charter to the Boston, Cape Cod and New York Canal Co. under which and its amendments present company is acting.
During the three successive years Mr. Flanagan, Gen. C. C. Dodge and associates advocated canal. Reports from the Engineers A. L. Rives and E. L. Corthell.
1904 August Belmont and others became interested.
1906 Voluminous report under instructions from William Barclay Parsons, C.E., from C. S. Sims to F. D. Underwood.
1907 May 8, Approval by Joint Board of Railroad and Harbor and Land Commissioners of the present location of canal.
1909 June 22, work begun officially by Mr. Belmont at Bournedale.

From the synopsis given it can be seen that the present company began work after nearly forty years of successive failures of private companies to build a canal. After the elaborate state and government surveys of 1860, which contemplated a canal 20 ft. deep with locks at both ends, the scheme seems to have been dropped until private enterprise took it up, although a census of wrecks on Cape Cod was made from 1843 to 1869, by which it was found 1444 wrecks had occurred, causing an average annual loss of $500,000.

In 1870, the Massachusetts legislature granted an exclusive charter to a private company and this project was kept alive with varying fortunes until its charter expired in 1878. Clemens Herschel was chief engineer of this company, and the canal contemplated was 7.3 miles long, 18 ft. deep at low water and was to have been operated without locks. The estimated cost was $2,500,000.

In 1880 a charter was granted to the Cape Cod Canal Co., and again elaborate surveys were made and announcements issued that the work of construction was about to be pushed with great vigor. Of this enterprise George H. Titcomb was chief engineer. Work was actually begun in September, 1880, with considerable gusto, but by Oct. 20, we read that the Italian laborers were unpaid, with but two days provisions on hand, and were on the verge of riot.

The first really earnest endeavor to dig the canal was in 1883. At this time there was considerable competition for charters, one proposal being made by French capitalists. In July of that year the Cape Cod Ship Canal Co. came into existence and deposited the sum of $200,000 with the State of Massachusetts as a guarantee of good faith. George H. Titcomb was chief engineer and the contractor was A. D. Fox & Co., of Montreal, Que.

Work was begun auspiciously in October, 1883. On the 11th of the month a grand reception was tendered the chief engineer at Sandwich, in which 500 people and two brass bands participated. The state had specified that $25,000 must be expended in the first four months on construction, and the company appears to have endeavored to fulfill this condition. During the latter part of the month a force of 400 men was employed and work was continued at night by the use of electric lights.

In December, 1883, the contractor became involved in a controversy with the company and applied for a charter to construct the canal on his own responsibility. However, it was currently reported that he was acting in the interests of the Old Colony R.R. Co. to put an end to the project, and a charter was refused. The contract was then turned over to F. A. Lockwood, and C. M. Thompson became chief engineer. Work was carried on continuously for several years, although with constantly diminishing industry. Most of this excavation was by dredging and amounted in all to about 1,000,000 cu.yd.

A note in our columns in 1887 stated: "It is reported that one mile of the Cape Cod Canal is finished. Considering that this canal was originally chartered in 1670—more than two hundred years ago—progress has been very gratifying, but the Panama Canal may yet be the first to be open for traffic."

The work under Lockwood dragged along until 1890, when the construction company was assigned by Lockwood to Thomas L. Livermore, manager of the famous Calumet & Hecla mines. In June, 1890, all work was abandoned. A year later the Boston, Cape Cod & New York Canal Co., was incorporated with a capital of $5,000,000. The state refused a charter until the company should deposit $500,000 with the state treasury. Of this sum $100,000 was to be forfeited for non-performance of the work; installments of $100,000 each were to be returned to the company at certain stages of progress. The company failed to deposit the necessary fund and the scheme dropped back into the hands of the old company.

During the ten years which intervened between this attempt to obtain a charter and the final granting of a charter to the Boston, Cape Cod & New York Canal Co., in 1899, various other schemes were launched under the names of the Bass River Canal Co., the Old Colony & Interior Construction Co., and the Massachusetts Maritime Canal Co., all of which got no further than more surveys, reports and plans. The old scheme to construct the canal farther east on the cape, between Yarmouth and Dennis was also revived by a proposed Massachusetts

Ship Canal Co. A bill was introduced in the Massachusetts legislature in 1897 which proposed to construct the canal by convict labor.

The Boston, Cape Cod and New York Canal Co. was chartered in 1899 with a capital stock of $6,000,000. The application of the company to issue its $6,000,000 of stock and a $6,000,000 bond issue before the construction of the canal was begun was denied by the Massachusetts River and Harbor Commissioners. The company did obtain permission to issue bonds for $140,000 to cover preliminary expenses of engineering upon the deposit of $200,000 with the state treasury, and once more elaborate surveys, plans and profiles were made. It is under the charter of this company and amendments made later that the present company, headed by August Belmont, of New York City, has undertaken the work.

Work was officially begun by Mr. Belmont on June 22, 1909, and has progressed without interruption to date. The original agreement was to have the canal completed in the fall of 1912, but an extension of time has been granted, within which at the present rate of progress the work will be done.

On Nov. 1, 1912, the breakwater near Sandwich, which will contain 350,000 tons of stone, was 88% completed. Of the 16,329,000 cu.yd. of excavation required, one-half, or 8,179,850 cu.yd., has been removed. Divided into divisions, the Buzzards Bay channel was 73% completed, the canal prism 43% completed and the Barnstable Bay channel was 33% completed. Of the 200,000 tons of riprap necessary for lining the slopes, 23% was in place. There were at this time four steam-shovels and a 16-in. suction dredge at work inland; two dipper dredges in Barnstable Bay and three dipper dredges in Buzzards Bay, all in service.

The construction work is done through the Cape Cod Construction Co., of which William Barclay Parsons, of New York, is Chief Engineer, Eugene Klapp, of New York, Deputy Chief Engineer, and Charles T. Waring is Resident Engineer, at Sandwich, Mass. The Resident Engineer until March, 1912, was H. W. Durham, who resigned to become Chief Engineer of the Bureau of Highways, Borough of Manhattan, New York City.

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The Repeal of the Tarsney Law, at the last session of Congress, was commented on by Walter Cook, President of the American Institute of Architects, in his address at the recent annual convention of the Institute as follows:

The Tarsney Act, authorizing the designing of our government buildings by architects, has been repealed; and for the moment these great monuments of our country have been handed over to an official factory, to be turned out by the yard; for whatever the talent and the ability of the Supervising Architect of the Treasury, this is what must of necessity result.

Nothing of this sort has ever happened in any civilized country, so far as I know, unless our own unhappy experiment of years ago may be considered an exception. It is quite unnecessary for me to speak of the so-called arguments which were employed in urging this repeal—the plea of an economy which has, we believe, been shown not to exist, and certain others which displayed an almost ludicrous ignorance of the whole subject. But if any of our special guests of this year—sculptors, painters or authors—are unacquainted with them, we hope they will, without delay, read certain of the official documents which have been published. And they will certainly appreciate the logical sequence of this repeal—the establishment shortly of a special department of the government for the manufacture of all sculpture and decorative paintings, followed rapidly by still another, whose duty shall be to turn out all odes, sonnets or lyric verse which may be needed to celebrate the achievements of our enlightened Republic.

However, we are hopeful and optimistic; we have faith in the sober second thought of our representatives in Congress; and we look forward with confidence to legislation in the near future, which will not simply re-enact the Tarsney Act—for it had its imperfections—but will give us something even better for our country and its art.

County and Township Organization of Highway Work*

By A. N. Johnson†

Preliminary Assumptions—The mileage of roads cared for is assumed to be from 75 to 100, of which approximately 75% are earth roads; the bridges and culverts are in the care of the road organization. It is also assumed that the town officials do not have charge of the maintenance or construction of sections of heavily traveled through roads, but that these form a part of a system under the maintenance of a State Highway Department.

The Town Road Commissioner — The entire responsibility for the work in the town should be in the hands of one commissioner. He should be elected for a term of three years, his pay should be a fixed percentage (about 10%) of the regular road and bridge levy of the town, but in no case less than $200 per year or exceeding $500.

His duties should be administrative only and require but one or two days time a month on an average. There should be one fixed day each month when he may be found at a designated office in the town, on which days contracts should be let and other business transacted. The commissioner should be required by law to let all contracts for road and bridge work after public advertisements and at public lettings, and upon properly prepared plans and specifications. He should also be required to purchase all supplies amounting to more than a certain maximum in any month by advertisement and public letting of contract. He should be custodian of the town road funds. He should have full charge of all road work in the town, make all contracts for road work and for bridges for the township and should be obliged to employ or appoint a road superintendent who would be responsible only to him. The road superintendent should be employed by the year on a monthly wage basis, being required to give his entire time to road work. He should be custodian of the equipment owned by the town and be responsible for its care and upkeep. He should have authority to hire such men and teams as may be necessary, subject only to approval of the town road commissioner.

Provisions should also be made by law for the proper engineering supervision of any work done in the town which requires technical skill not to be expected of the commissioner or of the road superintendent.

The Working Force—The various classes of work that ought to be done in a township can be so arranged that a regular force of employees can be kept busy throughout those months of the year when weather conditions permit construction work. This force may be large or small, depending upon the condition of the roads in the town and the amount of traffic, and consequently the amount of maintenance necessary; but whether it be large or small, it should be maintained as nearly as possible throughout the construction season so as to take full advantage of the expertness and experience which the men will obtain in doing the class of work required of them.

Several kinds of road work necessary in a town can be done about as well at one time of the year as another.

*Abstract of paper read at convention of American Road Builders' Association, Dec. 3, 1912.

†State Engineer, Illinois Highway Commission.

while other kinds ought to be done at certain seasons in the year as explained later in more detail.

Road Machinery—Some kinds of machinery that could be economically used in a larger geographical unit cannot be economically used in a town, since depreciation during a long period of inactivity will more than make up for the economies in their use for a short time.

County and Town Co-operation—To have available such engineering supervision and such equipment as are not practical for very small units, a larger organization than the town unit seems necessary—such as one for the county, and there should be a county highway engineer appointed by the county board to have general charge of all road and bridge work requiring engineering supervision. The county should own such expensive machinery like rollers, spreading machines for bituminous materials and concrete mixers, as might be efficiently employed on roads requiring such apparatus. This equipment should be under the immediate supervision of the county engineer and assigned by him for use in the different towns. Predetermined fixed per diem charges sufficient to operate and maintain this equipment should be ascertained by the county engineer and paid by the towns using the machinery.

The county engineer should draw and approve all plans for roads and bridges in the county exclusive of those upon the main system of roads, which are under direct control of a state highway department. The general specifications for all bridges should be furnished by this state department and followed by the county engineer in his designs for individual bridges.

The smaller concrete bridges that require only from 100 to 150 cu.yd. of concrete, could well be constructed by day labor under the immediate direction of the county engineer, the county to furnish on such work, a concrete mixer, special collapsible forms, where such can be used, and an inspector to superintend the work, this portion of the construction to fall upon the county; the cost of all labor and materials to be furnished by the town. The initiative for such work should be taken by the town commissioner.

Construction Work on Roads—All grading and shaping of earth roads should be done early in the season—beginning as soon as they have settled sufficiently to permit the use of proper machinery. The road superintendent should act as foreman, and be in immediate charge of the construction work and give his time continuously to it. The most approved and efficient methods should be employed—using a grader drawn by some sort of a power tractor; the work should be planned so as to inconvenience the public as little as possible.

If heavy grading, as in cuts or embankments, must be done, the work should be laid out and grade established by a competent engineer, and the road superintendent should then work to the grade so established, using teams and scrapers; and such work should be done as early in the season as practical, so as to permit the newly made embankments to be compacted before the winter season comes on. All such work can be conveniently done by day labor with the regular force employed in road work.

Construction of Hard Roads—Hard roads should be built by contract. Plans and specifications for the work should be prepared by a competent engineer and the construction should be caried out under suitable inspection by the engineer, or an inspector approved by him. The contracts should be let in early spring with provision for the completion of bituminous construction before the temperature drops below 60°.

Construction Work on Culverts—After the necessary earthwork on the roads has been completed, the force should take up the construction and repair of culverts. This work can be conveniently done in midsummer and early fall. At this time the streams are usually low and the work will be least interrupted.

In many instances the town might well adopt a general type of concrete culvert, thereby permitting the use of forms repeatedly, and making it unnecessary for the town force to become familiar with more than one general type of construction.

Construction of Bridges—The construction of all bridges or culverts having a span of 6 ft. or greater should be in accordance with general specifications established by the state highway department. The plans and specifications should be prepared during the winter, and the contracts let in the early spring. The construction of the bridges should be carried out under the supervision of an inspector and the approval of a competent engineer.

Maintenance of Earth Roads—After the earth road work has been completed in the early summer, a certain amount of grading will be necessary in order to maintain the proper shape to the roads during settlement. Such work can usually be done by teams and a light grader, and arrangements should be made by the town road superintendent to follow up new work to maintain the surface and general shape of the roads until the roadway has become thoroughly compacted.

In addition to the maintenance work which can be done with a small grader, there will be a large amount of maintenance work to be done by means of the split log or other similar forms of drag. Inasmuch as the dragging must usually be done throughout the town within a period of a few hours, if the work is to be done while the soil is in proper condition, it will be necessary for the road superintendent to have men who live in various parts of the township employed for this purpose with the understanding that they will drag certain sections of road immediately upon receipt of notice from the superintendent.

A perfect system of drainage on all roads is important throughout the year. It is particularly desirable to have the roads enter the winter-and-spring period without obstructions to drainage anywhere. Late in the fall, all culverts should be cleaned out, weeds and grass removed from the ends and the ditches along the roads throughout carefully cleared and opened so as to insure a free flow of water to the culverts and outlets.

Patrolling Roads—The road superintendent should patrol the main traveled roads in the town at least once a week. All of the roads in the town except possibly a few infrequently traveled byroads, should be patrolled once a month. Special inspection trips may be necessary to sections reported as being in improper condition.

Franchises for Rights of Way—No franchise for rights-of-way within the public highways should be at the disposal of so small a unit as the town, but this authority could well be extended under proper limitations, to the county boards. Franchises for electric railroads within the limits of a highway should be prohibited by law except within the limits of incorporated villages and cities.

Reminiscences of an Electric-Railway Engineer*

By S. W. Huff†

I have been given the subject of street-railroad development. This is a broad subject and if I feel a disinclination to follow a strictly technical discussion of it, I am equally disinclined to follow a strictly historical discussion of it on your account as well as my own. I have thought, however, that I might perchance be able to interest you in some of the early incidents of street-railway development with which I came personally in contact.

It has been something over twenty years since, as it were, I broke in upon Sibley College. I had had a college course and after teaching two years, one of which was in a mechanical school, I conceived the very prevalent idea at that time that "electricity was the coming thing," and having had the usual experience in bell and burglar-alarm wiring, I decided that I wanted to learn electricity and that Cornell was the place to learn it.

After a correspondence with Dr. Thurston, in which I explained that my previous college work would not fit in with the requirements for the regular course in mechanical engineering and that I had neither time nor money to spend in getting up back work, he consented to allow me to register as a special in Mechanic Arts and select my work.

We men of that period did not have present advantages, yet the personality of the instruction, which after all is a very important factor, was strong and deep and progressive, and the equipment was good for the period, probably surpassing any other similar institution.

With a Pioneer Road

At the beginning of the summer vacation of 1890 my attention was called to the fact that the operators of the pioneer electric railroad in Richmond, Va., had announced to the city authorities that after a thorough test, they were forced to admit that electricity as a means of propelling cars was a failure and they wanted time in which to provide some other means for the operation of their cars. I knew that the road had but a short time before been turned over by the Sprague company, and was of necessity an interesting point of operation at that time. Accordingly I went to Richmond and applied for work.

The superintendent had but recently taken charge, having previously been in charge of a small steam dummy line and was utterly ignorant of electrical work. Mr. Mason, one of the Sprague experts, who afterward upon the organization of a street-railway department by the Westinghouse company, became its chief engineer, was there trying to get the road in operating condition. He told me that things were in wretched condition, but if I wanted to learn that was the place above all others, as anything that could happen anywhere was happening there every day.

When I offered my services to the superintendent I had to admit that I had just come from college, in fact hoped to go back there again in the fall, and he could not see how I could be of any service. I insisted, however, that he must need laborers, and that I was willing to tackle laboring work in order to get in. But while a negro would have been readily employed, he was very loath to take me. By insistence, however, I finally succeeded in being enrolled as a laborer at a dollar a day and went to work the next morning.

(Much to my regret when I became general manager of the combined railway and lighting properties in Richmond some twelve years later, I was forced to dispense with the services of this old superintendent. He had been unable to learn, but with native ability in other directions had been able up to that time to first *run* and then *run away* anybody who had become connected with the company that was capable of helping in its development. Just here I will say that somewhere in this broad land there is some practical old fellow laying for you and sooner or later you will meet him, and have either to unhorse him or be unhorsed by him.)

But to return to my story; it was a very few months after the Sprague company had completed its experiments in Richmond, and turned the road over to the local company. So that although I cannot claim to have been present at the birth of this electric street car, I was present at the time it began to crawl and had a share in its nursing.

The period of experiment had spoiled everybody. It had been a period of hope and despair. If a man made a round trip with a car, he might reasonably expect an overcoat or a suit of clothes as a bonus. The men in the shop had become equally spoiled, and would do only that work which was absolutely required of them. Those who wanted to do honest work had little encouragement.

I was placed under one of the walking bosses out in the car barn. After completing a minor piece of work that had been assigned us, he ordered me to come along with him and after walking around for some time I stopped to look at something, and he ordered me to come on, with the remark that if we did not keep walking and keep out of the way the general foreman would come along and give us something to do. I suggested that probably this was the reason he was called a *walking boss.*

With 40 cars equipped and turned over by the Sprague company, the regular schedule called for only 13, and it was with the greatest difficulty and most strenuous work on the part of Mr. Mason that we could keep 13 out on the road. There had been times in which there were only one or two cars in operation. The cars had been used for horse-railway service. The motors were rated at 7½ hp., two of them to a car. The grades were as high as 10%, one of 9% being on a curve.

The motor then being operated was known as the Sprague No. 5. It was a flat two-pole type with four field coils and designed to operate on a 24-in. wheel. The motors had been designed originally for single reduction, but Mr. Sprague found that the speed was too great and an intermediate pinion and gear were cast together and mounted on a stud set into the frame. The pinion engaged with a shell gear, making a double reduction motor, and reduced the speed approximately four to one over the original design. The connections between the wheels and body of the car were

*Condensed from an address before the students of Sibley College, Cornell University, printed in the "Sibley Journal" for October.

†President, Brooklyn & Coney Island R.R., New York City.

what were known as gears, simply a pedestal bearing. The motor was mounted on the axle as at the present time, but the nose attachment hung from the car body by means of a bolt through the cross sill; that was before the day of street-car trucks.

The armature had a commutator on each end so connected that there was but one brush on each commutator, and that on the top of the motor so it would be readily reached. Up to that time carbon brushes were unknown and copper brushes were used, set at a very considerable angle. You can imagine the result of a rough commutator running in the reverse direction against these brushes. A man was kept on the corner in front of the shop and every time a car made a round trip, first one and then the other motor was cut out and the car was run backward and forward while he filed the commutator with a coarse file.

The four field cores formed a part of the frame of the motor, and were set in this frame with bolts and dowel pins. The field coils required constant rewinding, and in putting them together again it was usually necessary for us to drive them up with a sledge hammer. I never understood why we had so much trouble in putting them together until years afterward when Mr. Sprague referred to the fact that one of the troubles of the early experiments was by reason of their not having used jigs for making their motor parts. These parts were consequently not interchangeable; we had been interchanging them with a sledge hammer.

Each field was wound in three sections, making it possible to vary the speed of the motor by varying the combinations of these fields. As I recall it, the resistance at that time was only used at starting.

The armature cores were of the smooth solid-core type, with the armature windings wound in by hand between fibre wedges at the corners and insulated paper in between. It took five armature winders to keep the 13 cars running—in fact we considered ourselves fortunate to keep the required number of cars running regardless of the amount of help or the expense involved.

After getting away from my walking boss and spending several weeks in the pit and machine shop, I got in touch with a man in the armature room who was a civil engineer by profession, but had yielded to the persuasive call of electricity, and was tiding over a period of hard luck by winding armatures. He offered to teach me how to wind if I could get in the armature room. The other man refused to teach any one, as they confidently expected to confine the business to their immediate group. The old superintendent, with an eye to business and the wages he was paying me, agreed to let me go in, but was very much horrified the next day to find me winding an armature, as he had expected me to spend several months sweeping the floor and *"learning the business"* before I began to wind. But my friend persuaded him to let me keep on. He told me, however, that if that armature did not run, down would go my house. The armature did run but down went the bearings a few days after it started and stripped the armature. So I do not know how long it would have run if it had been allowed a natural life.

During the summer, the Sprague No. 6 motor was brought out, and a few of them were installed upon this line with very much better results. The old equipment not only suffered from poor general construction but was too small, which resulted in the constant burning out of armature and fields. No. 6 was a 15-hp. motor, making the equipment of each car 30 hp.

Other Early Developments

At this time the overhead construction was somewhat similar to that of the present time, although I was told that the first construction consisted of rods on the curves rather than wires with pull-offs at intervals.

The Daft company was at this time operating a two-car line on the main street of Ithaca with two overhead trolley wires, and a little truck running on top of these wires taking and returning the current. The truck was connected by a flexible connector to a switch under the hood of the car, and when the motormen met at the turnout in the middle of the street they exchanged trolleys, so that each truck ran backward and forward up to this turnout.

The Thomson-Houston company, the other principal company, was operating the Soldiers' Home & Eckington road out of Washington. The Westinghouse company had not then entered the field. The Sprague and the Thomson-Houston companies were radically different in their systems of distribution and car equipment. The Thomson-Houston company put up no feeders, but varied the size of its trolley as more or less carrying capacity was required, the trolley being larger toward the power house and smaller at a distance from the power house; the Sprague system used a uniform size of trolley wire, and fed this trolley by feeders as at the present time.

There was much discussion at this time as to the relative desirability of the two systems, from which you can readily understand what a feeble comprehension we had at that period of the gigantic part electric traction was to play in the transportation of the future. Think of the feeder capacity of today at many localities in our cities being concentrated in one trolley wire and what the size of that wire would be.

The Sprague people used a system of commutated fields and a controller switch to vary the speed of the motor, while the Thomson-Houston Co. varied the speed entirely by resistance. This resistance consisted of a series of plates insulated from each other, and over the edge of which moved a connecting arm actuated by a cable operated from the front platform by a crank handle very much similar to the present brake handle.

In Manufacturing

The whole country was enthusiastic over the possibilities of electric development, and the so called practical men who had come in contact with electrical work, although very remotely, were greatly in demand. Richmond mechanical circles had early gotten the fever. An inventor who had been molding commutator sections and trolley wheels for the Sprague road, conceived the idea of substituting three fields for each of the fields in Sprague's original No. 5 motor, making 12 in all, and passing a countershaft through the space between the three fields, thus doing away with the stud attachment for reducing the speed of the Sprague motor. He built one motor of this description, put it on a car and with a party of small capitalists on board undertook to operate around a curve on a 9% grade. Naturally the car spun the wheels, as any other single-motor car would

have done under similar conditions. The inventor exclaimed upon the wonderful power of his motor as demonstrated by its ability to spin the wheels, and forthwith a company was organized to build electric motors for street railways and other purposes.

This practical mechanic felt some need of scientific assistance in this work, and about the middle of the summer I was offered the position of electrical engineer of this promising company at a salary of $13.50 per week, which I readily accepted. The company had acquired the use of a 50-hp. waterwheel to which they had attached a 220-volt generator and begun the sale of current in this city. To further this use of current, it was to manufacture motors for sale to its patrons, and I began upon the design of these motors first.

I had not up to that time reached motor designing in my course in Cornell, and I had the toughest job that I have ever tackled. I purchased all the books I could find on the subject of motor and generator design, which were very few at that time, and waded into them on hot summer nights. I was not very well prepared to understand what I was reading, and I became firmly convinced that the authors for the most part were using mathematics that they themselves did not know how to apply.

All the time I was trying to find out how to design the motors, the foreman of the machine shop (we had a very well equipped small shop) was calling for drawings and bills of material. Finally I got a stationary motor started in the shop, which by trial windings I succeeded in getting to run fairly well. But things were moving so fast that the inventor was unwilling to stop at small things, and insisted upon taking a contract to build railway motors and equip a street railroad upon which there were several grades as high as 18%, this with a capitalization of the company of $10,000, only a portion of which had been paid in.

I demurred at this, but the inventor assured the board that he had millions in his mind, and only needed an aggressive policy to realize it. He said that I was disposed to hold back and intimated that this was due largely to the fact that I did not know how to go ahead, which was very true. On the board were several good business men who sided with me, but the majority felt that no matter how impossible it might seem, the magic word electricity was sufficient to carry the enterprise through, and I was out-voted and invited to resign.

Years afterward I met one of the directors who voted against me, and he was bemoaning the loss of his money in the company and reproaching himself for not having followed my advice in the matter. I assured him that he need not reproach himself on that account, as he would have as surely lost his money if he had followed me and not as by acting contrary to it, as it was only a question of time under either policy. The experience of this company is but an illustration of the many visionary electrical companies that were organized about that time, and the reckless manner in which they were handled.

The fall term at Cornell had already passed and I returned with the beginning of the winter term. I found that the class had been going over, in motor and generator design, very much the same work I had been doing in Richmond, but not under the same pressure. With a little assistance from instructors who were interested in the practical work I had been doing, I took my place in the class and enjoyed the work of the winter term immensely.

Although the facilities at Cornell were, we claimed, much ahead of similar institutions, they were limited as compared with what is enjoyed at the present day. In order to make tests of motors or generators, it was necessary for us to find sufficient pairs of wires on the switchboard in the dynamo room connecting with the instrument room of the physical laboratory, and a large portion of the squad engaged in the tests were located in this isolated room reading instruments, and it was not for several days after the tests, when the formulas and constants had been applied, that we really knew what the readings were or what we had been doing. The day of portable instruments and facilities for rapid testing had not yet arrived. To those of us who had had some experience in practical operation, this proceedure was tantalizing.

It was a period of rapid development and an intensely interesting one. Students were not following well beaten paths, but with discoveries on all sides were rushing headlong into an unknown field, ably led and stimulated by an enthusiastic corps of instructors and professors. I remember that I saw carbon brushes in use for the first time during that winter, and learned that armature reaction (which had but recently been discovered) played an important part in the motor and generator designs of that period.

The fact that the electric cars of that period as a rule carried all their weight on driving wheels, and the further fact that the uniform rotary pull of the motor was less liable to slip wheels than the irregular pull of a locomotive, had impressed every one with the wonderful climbing power of electrically propelled cars. There was much discussion as to whether the current passing down from the wheels into the rail did not have much to do with this. In some cases locomotives were fitted with generators, passing current down into the rail to increase the traction of the locomotive. I remember that quite an elaborate series of experiments were made at the university during that year to demonstrate what effect this flow of current would have; it was concluded that it was negligible.

When the spring vacation arrived, as I was not to get a degree (being a special student), as the remainder of the class were to apply themselves largely to experiments for the preparation of a thesis, and as my money and time were limited, I decided it would be a good plan to strike out and try and get a job before the market was flooded with the electrical engineers who were to come out in June.

Accordingly after much effort I secured a position with the Baxter Electric Motor Co., at Baltimore, Md., at $50 per month. (I mention these liberal retainers so you may not become discouraged when you secure your first positions.) This company had been one of the pioneers in the manufacture and installation of arc-light-circuit motors, and Mr. Baxter was one of the best known electric designers of that day. Some time before this he had published the design of a motor to be installed in each wheel of a car. The motor was never built; he had discovered that the commutation of a

large two-pole machine was very difficult, and he had taken the somewhat extreme position of designing a street-railway motor with eight poles in order to get a single reduction motor.

We claimed that this was the first single-reduction street-car motor built, and I am inclined to think the claim was justified. Up to that time cast iron was used almost exclusively for pole pieces and frames, the permeability of cast steel not having then been discovered; in order to make this motor light, the pole pieces and field cores as well as the armature cores were built up of soft iron sheet.

An experimental motor was exhibited to a group of capitalists, after which a champagne and terrapin supper was served, and the company launched upon its career with a large board of directors composed almost entirely of millionaires. In the early days it was thought that electrical enterprises could not be handled on the same business basis as other enterprises, as it was felt that capitalists did not understand anything about electricity.

Upon reaching the Baxter factory I found a magnificent shop building extending the entire length of a city block, together with much yard space, with the unassembled parts of fifty car equipments scattered over the floor, and not a man in the shop who had any street-railway experience. (I had gotten my employment upon the strength of my Richmond experience and not upon my Cornell training, as at that period and for many years afterward those in authority were very much afraid of college-trained men.)

Within ten days I was put in charge of the electrical department of the factory with some fifty electricians under me, but at the same pay of $50 per month, while many of the men under me were getting much more. They found that I was a college man and felt that a college man ought to be glad of a chance to work at any price.

We had orders for car equipments at something like $5000 per car and an equal amount of stock in the roads, and there were high hopes for great profits. When the first equipment was assembled it ran beautifully—until I put on a heavy load, when the motors would flash over at the commutators. The inventor and I thrashed over the situation, and decided there was something the matter with the brush holders. I tried every thinkable experiment in that direction without much improvement. Then I took the potential between the commutator bars around the commutator, and found that the difference between bars was very high, and that there was a very narrow space of low potential. I then went to work to trim the pole pieces with a view of widening out the space of low potential and succeeded to some extent in this.

The inventor and myself soon realized that the main trouble was that in designing an *eight-pole* machine a sufficiently large commutator had not been provided. In fact, as I remember, there were only about 17 bars between the brushes, which made an abnormally high potential between bars. The floor was full of armatures and the superintendent and inventor insisted that the capitalists behind the enterprise would not stand for redesigning of the armature at that time, that they could not understand, and that we must make it work as it was.

After making every improvement we could think of without a redesign, we laid off a large part of the men in the shop, and I went out on the road with some of the equipments. You can imagine the joy of the expert riding on the platform and keeping himself forever braced for fear of being thrown over the dashboard when the motor short-circuited and the car bucked.

We usually took three men to operate the car, one man to clean the commutator while the others ran the car. There was only a short line operating in Baltimore at that time, and these motors were experimented with on this line as well as on lines in Richmond, Washington and other places. After several months of experiment we prevailed upon the management to allow us to redesign the motor, and we put on a commutator a third larger. After that we got fairly good results with the motor, although there were mechanical defects that were serious, notably the slight clearance between armature and fields, which the inventor had fixed at $\frac{1}{64}$ in. This he insisted could not be increased or his calculations would be thrown out. Of course the armature got down on the poles and cut the bands off. I remember once sitting on the floor of a car in Washington, D. C., pulling out the band wire as the car ran until I had a large pile beside me. The passengers always viewed these experiments with remarkably good nature, and appeared to be considerably interested in the proceedings.

Things had been moving rapidly and no sooner had the single reduction motor been reached than several inventors went straight at the designing of a gearless motor. The Baxter company built one which I tested with fairly good results on our experimental track in the yard, but it was never put out on the road. The Short people, who were then prominent in the manufacture of motors, built one or more that were in service for a while, but not with very much success.

In Railway Operation

The Baxter company becoming inactive, and being offered a title and better salary to manage the little electric road in Raleigh, N. C., I accepted and had my first transportation experience. Two years later, upon the reorganization of the Baxter company, I returned as general superintendent. I timed and priced several equipments through the shop, and got the shop generally on a basis for aggressive commercial work.

By this time cast steel was being used for cores and polepieces with good results and, although the Baxter motor was a reasonably good one, it was necessarily expensive because of its mode of construction. Just at this time due to the severe competition between Westinghouse and the General Electric companies, which which were then the principal builders, the price of motors dropped to a very low figure, probably lower than they are today. In view of this I was forced to advise the capitalists, who were about to refinance the Baxter company, that the prospects for speedy returns upon new money invested in the company were not very good. Accordingly they decided to close up their electrical business, organize a land company and split up the land upon which their car tracks were located

into building lots. This real estate deal more than paid back the money they had sunk in electrical experiments. So far as I know this is only one of the numerous early electrical companies that went to the wall (and they nearly all did) by which the promoters did not lose their money.

Car equipments were being rapidly whipped into commercial shape. The Westinghouse company had brought out its "12-A" and "49" motors, and the General Electric company had brought out its "G. E. 800" and its "G. E. 1000," all of the present closed type. Mr. Potter (of the General Electric Co.) had developed the "K type" of magnetic-blowout series-parallel car controller, which has been the only manual type that has stood the test of continued usage successfully.

The problem of light-car operation in cities seemed practically solved and engineers were looking to the electrification of steam roads and of heavier service. The New York, New Haven & Hartford had equipped its Nantasket Beach branch electrically and was handling heavy service successfully. A company was organized to build a high-speed heavy-service line between Baltimore and Washington, a distance of 40 miles, to compete with the two existing steam lines. Upon becoming electrical and mechanical engineer of this company I had before me some of the most interesting problems of that period.

The question of long-distance transmission was a serious one. A line supplied from high-tension alternating-current through rotary converters was being operated out of Lowell, Mass., but it was considered highly experimental, and neither our advisers or the engineers of the electrical companies would recommend it strongly for our requirements. The General Electric company suggested the use of a three-wire system, one pair of motors of a four-motor equipment being operated on a positive trolley and the other pair on a negative trolley, the track being the neutral wire. After much discussion this plan was adopted by the board. But due to the claim of the company that its patents gave it exclusive use of this system, the question was again opened to give the Westinghouse company a chance. After much discussion, the booster system was finally adopted, although the financial panic of 1896 prevented its ever being put into use.

The letting of contracts of importance at that date was surrounded by so much wire pulling and influence of all kinds that it was very difficult for a young engineer to hold his own against the conflicting influences. I soon recognized that, aside from the important mechanical questions involved in the design of power houses for this road, sooner or later I would find the pressure too strong for me to stand alone, and it would be the better part of wisdom to call in a consulting engineer, who not only could help me with the design and letting of contracts, but whose reputation would assist in withstanding the pressure. Accordingly I got Prof. Carpenter to agree to act as consulting engineer for the company.

We took up in detail each item of machinery required in the power houses, and let the contracts separately, and I got about the best year of post-graduate work that a fellow could get at that time.

I must relate one incident to illustrate the fact that at that period (1896) college professors, as well as college-trained men, were looked upon with skepticism by those in contact with railroad matters.

A very successful agent for one of the most prominent street-railway engine builders of that period was located in Baltimore, and had confidently expected to get the contract. Matters had been delayed; he was becoming impatient and finally rushed into the office very much exercised and told me that he had just heard that a man by the name of Carpenter, a college professor, had been called in as consulting engineer, and intimated that he might withdraw his bid if his engine was to be passed upon by such theoretical people. The next day he came in with quite a different manner, and handed me a telegram, saying, "What do you think of that as a throw down for a man who has been selling engines for years and thought he was at the head of his profession?" The telegram was from the proprietor and designer of his engine company and read:

> Prof. Carpenter is all right, but you need somebody there who knows something about engines. I will be down on the night train.

The next work of special interest for operating engineers was the harmonizing and rounding into shape of the various equipment that came in from the various small roads as they began to be consolidated into the city systems of today. I remember, as electrical and mechanical engineer of the United Railways of Baltimore, that besides having under my charge almost every type of motor and car that had been built in this country, there were nine power houses, no two of which had the same type of engine equipment; about everything in the shape of generators and boilers that had been built was represented. The operation of the turbine plant of today is simple as compared with the difficulty in keeping this heterogeneous collection running and hitched up to the trolley wire.

I could spend much time in speaking of the development of cars, tracks, trolleys, etc. The development of today has been reached after many tedious steps and much waste of time and money, and many things which today would seem to us absurd were undertaken then with the greatest earnestness and enthusiasm.

I recall the anxiety with which we bonded the rail joints with a piece of iron telegraph wire, and made this fast to a small iron messenger ground wire, this wire being grounded carefully at frequent intervals. We were very anxious to get good contact with the earth, and I remember my own surprise when I discovered that the road ran about as well with the ground wire disconnected.

The builders of the Sprague road in Richmond drove a number of iron bars in the ground and connected the track with them, and some of them are there today; no wonder the expert who undertook to make a ground-potential and current-flow map of Richmond for electrolysis-cure purposes almost lost his mind in the attempt.

Those of you who take up electric traction have before you an intensely interesting prospect. You may not have the inspiration of the rapid development of an infant industry, yet even now this is not an old industry and there is unlimited work for well-trained earnest men and the day of your greatest opportunity

is but beginning. The day of the so called "practical" man in engineering work is rapidly passing, and the man of good training coupled with other requirements comes rapidly to the front.

Handling Men

There are some who look upon technical work, and even engineering, as but a stepping stone to what seems to you a broader field—a field of contact with men and affairs—a field in which you can multiply the efforts of your brains by the hands of many. I would urge you not to be in too great a hurry to rush into this field. If you have executive ability it will develop, and for successful work in this broader field, you need a fair experience with details. The requirements of the future will be more and more exacting, and you will save time by laying your foundations well and mastering fully the details which later you will require performed by others.

I do not believe any of you can handle men successfully and get the best results out of them without having a genuine interest in their welfare. You may have to stand firm against unjust demands and even pass through bloody strikes in order to maintain reasonable control over the operations of the property entrusted to your care. But if you are to get results with men and for men, you must not let these experiences, which are but incidents, imbitter you or cause you to lose your interest in the welfare of those whose labor you direct.

It is difficult to lay down any fast and hard rule for handling men. The ability seems to be inborn. I once heard a most successful track man say that a lazy man made the best kind of foreman, because a lazy man "fairly loved to see other men work." I don't believe great physical energy is essential in directing the work of large bodies of men, in fact, the over-energetic man who takes hold nervously and wants to do everything himself is seldom a success in organizing or handling men. Yet I don't believe a man who is mentally lazy will ever be a success in handling others. Freedom from physical exertion or, as one gets higher up in the scale, from details of administration, should only create greater activity in the mind, so that one may stimulate those under him to do their best.

Study and develop the individuality of your men, and don't try to fit men into a ready-made organization, but fit your organization to the individuality of your men. It is easier to adapt your organization to your men than to find men to fit a set organization.

Don't attempt to mislead the men under you as to your own ability. They are very much better judges of that than the men above you, and if there is one essential in winning and holding the confidence of the men under you, it is honesty toward them and justice in your dealings with them.

Relations with the Public

Those of you who select electric-traction work will find an ample opportunity to develop the best that is in you in your efforts to meet the necessities of operation, and at the same time meet the requirements of the people and the municipal authorities. Yet no matter how unpromising the prospects may appear at times, an abiding faith in the justice of your cause, and a determination to make your case appear as it really is, will win in the end. If you have absolute faith in the justice of your cause, take it to the people and keep it there until it is recognized.

I don't mean by this that every popular clamor of the times is just or should be heeded. There are times when you have to stem popular clamor, but you can rest assured if you are right it will turn with you in the end. I had a forcible illustration of this some years ago. I lived in a suburban municipality, and had just passed through a very bitter street-car strike in which the destruction of my house and family had been threatened. The house, by the way, that I lived in belonged to the mayor of the town, and when it was threatened with destruction by fire you can imagine how promptly he got busy. The people of the community showed a sympathetic and neighborly spirit which I much appreciated, and at a meeting of their improvement association, I thanked them for their kindness and promised them that the very slow and inefficient car service that they then had would be greatly improved.

Some months afterward we re-equipped the line with new four-motor cars, and cut the running time in half—that is, getting the people to the city in just half the time. Under the old, slow service they had been able to sight a car out of a certain window, take their time to go to the corner, and after exchanging greetings with their neighbors, take the car and make a leisurely trip to town. Under the new service, it was necessary for the crew to waste no time, with the result that probably half the people missed their car the first morning and a large per cent. of them for some time afterward. The motormen who had previously been on that line were naturally averse to doing double the work, and I had to make some changes in crews in order to run the service, which further added to the complication.

The result was that within a few days I had a perfect storm around my ears. Men whom I knew intimately and in whose judgment I had great faith, called me up and protested against the service most indignantly, and there seemed little abatement of this dissatisfaction. I was satisfied that the service was infinitely better, but the protest was so bitter that I was almost on the verge of returning to the old schedule, when I talked the matter over with a newspaper friend of mine, and he suggested that I let him write an article, referring to this new and rapid service, but intimating that the town itself was most too slow to appreciate the service. This he did in a very adroit way. The criticism stopped, and in a few months the town had taken on new life and was enthusiastic over its service. Bonds were floated for the improvement of sidewalks, the building of new houses went ahead rapidly, and shortly it was necessary to double the service in order to accomodate the travel.

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The Pearl Harbor Drydock at Honolulu, H. I., will be ready early in 1915, according to statements of the Navy Department. This date is later than that originally fixed, on account of changes in plan to accommodate vessels of 1000 ft., the limit of the Panama Canal locks, and on account also of the difficulties experienced in finding a suitable foundation in the coral rock. An attempt was made to utilize this coral rock as the aggregate for the concrete of the walls of the dock, but the concrete so made did not prove strong enough so it was finally decided after experiments to use parts of the coral sand and rock with a large amount of aggregate obtained from the Pacific Coast of the United States.

Automatic Block Signals for Single Track; C., I. & L. Ry.

The use of the block system on single-track railways is increasing, and its use involves the special problem of protection against opposing movements as well as following movements. The Chicago, Indianapolis & Louisville Ry. (the Monon Route) has completed an extensive installation of this kind, which is described below. The particulars are taken in part from a paper in the 1912 "Proceedings" of the Indiana Engineering Society, by E. G. Stradling, Signal Engineer of the railway, this being supplemented by information furnished us by the General Railway Signal Co., of Rochester, N. Y., which supplied and installed the equipment. During the latter part of 1910, the railway management decided to install an automatic block-signal system between Hammond, Ind. (at the northern or Chicago end of the line) and Indianapolis. The distance is about 163 miles, and there are about 340 signal blades in this district. Construction was commenced in July, 1911, and completed in March, 1912. The estimated cost was about $1100 per mile, including everything in connection with the automatic block signals and also the necessary alterations at the interlocking plants.



FIG. 1. STANDARD ARRANGEMENT OF AUTOMATIC BLOCK SIGNALS AT EACH END OF PASSING SIDINGS



FIG. 3. HOME SIGNALS ON SEPARATE POSTS
(With brackets and stub posts on account of a siding between the track governed and the signal post.)

SIGNALS

The two-position type of semaphore signal was adopted, though the signal mechanisms are so arranged that they can be altered so as to operate three-position signals. The semaphore blade moves from its horizontal position through an arc of 90° in counter-clockwise direction in the upper right-hand quadrant. The vertical position means "proceed," in all cases. The horizontal position means "stop" only when the semaphore is a home signal. For the distant signal the horizontal position means "proceed under control." The home and distant signals are distinguished from each other by the color and shape of the semaphore blades; the home signal being red with a square end, while the distant signal is yellow with a fishtail end.

LOCATION OF SIGNALS

The road being single track, it was decided that the signals should be located near the switches to the passing tracks. Therefore, at each end of each passing track there are placed two home signals, the two signals being on opposite sides of the track so as to govern trains in each direction. This standard arrangement is shown in Fig. 1, which represents the signals at the north end of the passing track at Sheridan, Ind. In the foreground is the switch, with its switchstand in advance of the signal. The cable running from the box on the post to the short pole at the left is the connection from the pole line to the signal. The signal at the right, governing movements from this point to the stretch of single track beyond, is shown in the "clear" or "proceed" position. Consequently, the signal at the left indicates "stop," which position is indicated also by the corresponding distant signal.

Fig. 2 shows a special bracket-post arrangement of signals at Horton, Ind. This is made necessary by close proximity to the station, so that a signal post on the left-hand side would interfere with the receiving and discharging of mail pouches at the mail crane shown just beyond the road crossing. At some points where a sid-



FIG. 2. BOTH HOME SIGNALS ON A BRACKET POST
(A post at the left side of the track would interfere with the use of the mail crane.)

ing intervenes between the signal and the main track, the signal posts are placed on opposite sides of the track, but each has a bracket arm with stub post and lamp to indicate the siding. This is shown in Fig. 3, which represents the installation at Rensselaer, Ind. Attention may be called to the crossing signs shown in Figs. 2 and 3. These are of the design required by the Indiana Railway Commission, having the word "Danger" in red letters on the board at the top of the sign.

In order to regulate the approach of trains to a passing track, a distant signal is located approximately half a mile from each end of the passing track. Fig. 4 shows the distant signal south of Horton, which is in the "clear" position, indicating that the home signal at the entrance of the passing siding (the left-hand blade in Fig. 2) is also at the "clear" position. A train receiving a "caution" signal, by the arm being horizontal, will reduce speed and arrive at the switch at the passing track under control, so that it can stop at the home signal and there meet an opposing train standing on the main track, the standing train having been stopped by the outgoing home signal. All that remains is for the train arriving last to enter the siding so that the other or opposing train may proceed.

In order to prevent two trains from leaving adjacent sidings simultaneously and meeting at some point between them, a set of intermediate home signals is placed between sidings. These signals are staggered on opposite sides of the track and about 3000 ft. apart, so that they will stop any two opposing trains by that distance. Fig. 5 shows an intermediate signal south of Monon (and between Monon and Guernsey). The signal governs northbound trains, and is set at the "stop" position against such trains as there is a southbound train in the section. It will be noted that all signals are numbered, those governing northbound trains having even numbers, while those governing southbound trains have odd numbers.

For following movements it was necessary to carry the control of each outgoing home signal some 3000 ft. beyond the next home signal. The overlap of 6000 ft. is necessary as a margin of safety.

Special Signal Arrangements

As in most problems of this character, there are some special cases. At Hammond, there is a long, narrow yard, and in order to make it safe for a yard engine to enter the main track, an electric lock was placed on the switch. This lock is controlled by the block system, and a train on the main track having passed the last stop signal will set the switch lock so that the switch cannot be opened.

Between South Hammond and Munster, the distance is so short that the distant signals in each case were placed on the outgoing signal, and the overlap carried into the next block. This eliminates the need of intermediate signals, but places a handicap on using Munster as a meeting point for trains.

At the junction at Monon it was necessary to arrange the signals to take care of trains for the Louisville line. This is done by having a set of signals selected by the position of the switch which is used by the Louisville trains. At Indianapolis, there is such a short distance between the north end of the yards and the passing track at the State-Fair grounds that the distant signals in this case were carried back and placed on the same poles as the intermediate signals.

Block and Interlocking Signals

One of the chief problems which arose was to operate the block signals through the interlocking plants. There are ten interlocking plants in this district and no two of them alike. It was necessary to mark the signals in some way so as to distinguish them from the block signals. Therefore, each home signal at an interlocking plant must have at least two home signal blades. The top blade on the pole is arranged so that it is both an in-



Fig. 4. Distant Signal

(Indicating position of home signal at the next passing siding. The signal indicates "Clear.")



Fig. 5. Intermediate Signal Between Passing Sidings

(The signal governs movements in opposition to the train shown, and is at the "stop" position as an opposing train is in the block section.)



Fig. 6. Three-arm Home Signal

(Governing approach to an interlocking plant and passing siding in rear of the train.)

terlocking signal and a block signal. The lower blade is known as a calling-on signal and is used to get a train over the derails when for some reason the block system prevents the top arm from being used.

At some of the interlocking plants a passing track is connected to the plant and handled by it. In such cases, the home signal regulating trains approaching the switch has three blades, as shown in Fig. 6, which represents the three-arm home signal at the Westfield interlocking plant. The top arm (semi-automatic) governs the main-track or high-speed route; the second-arm governs trains for the passing siding or diverging route; the third or bottom arm is the calling-on signal mentioned above.

By altering the interlocking plants so as to use upper-quadrant signals, a uniform type of signals was secured at all points. No new interlocking plants were installed in connection with the block-signal equipment, but the ten existing plants were overhauled, the mechanical work being performed by the railway company's forces and the route locking and electric work being handled by the signal company. A number of the home signals were slotted and route-locking installed at each of the mechanically operated interlocking plants.

Traffic Results of Block-System Operation

The installation of block signals has two important objects: 1, increased safety of traffic; 2, increased facilities or traffic capacity. In regard to the results of the automatic signal installation described above, we are informed that although these signals have been in service considerably less than a year, the freight trains are making much better time than they did under the manual-block system. This is due to the fact that now the trains can be run closer together with equal safety, which increases the traffic capacity on single track lines. There has not been any material increase in the number of trains hauled, but the fact that the trains can make so much better time than previously has made a considerable reduction in the overtime paid to the train crews, which previously accumulated on account of time lost while they were waiting on sidings. It may be noted also that with the installation of the automatic signals there was a decrease in the number of telegraph operators previously employed to operate the manual-block signals.

Protective Coatings for Railway Bridge Floors*

By A. W. Carpenter†

In the preservation of steel railway bridges from corrosion, the parts which offer the most difficulty are the tops of transverse floor members such as floor beams and transverse floor troughs, especially on bridges subject to the brine drippings from refrigerator cars. Quick drying is a very desirable quality for coatings for these parts, and considerable body is needed to resist abrasion and other mechanical damage.

Tar-Cement Coating

A coating possessing these qualities is one of coal-tar or coal-tar and portland cement, the preservative qualities of which are excellent. The tar, or tar and cement mixture is applied hot with mops, and the immediate hardening process is due to cooling and not to drying, as the term is applied to paint. Refined coal-gas tar should be used, not water-gas tar. The surface to be coated must be clean and dry to insure adherence and protection. Where a priming coat of paint can be applied, it is recommended but is not essential.

The mixture of tar and cement is preferable for locations subject to the heat of the sun, as the cement hardens the coating, thereby increasing its resistance to flowing, and its alkaline nature should neutralize any acid in the tar. We have prepared this coating by first heating the tar in a kettle and then sifting into it from one-half to an equal volume of portland cement and boiling the mixture one or two hours before application. This coating has given excellent results on plane surfaces, but in many instances has failed to protect the rivet heads, which have been found to be specially difficult to protect in the difficult location under consideration.

Whether the use of a larger proportion of cement in the mixture would cause the coating to hold better on the rivet heads is not known, as little experimenting with different proportions of cement and tar has been done. On the flat surfaces of the floor beam and trough tops and on the vertical sides of troughs filled with ballast this coating has protected well for several years, except where burned by hot coals from locomotives or removed by mechanical means. This coating has been used for several years on the floor troughs of the Park Ave. viaduct, in New York City, a four-track structure 1¼ miles long. The coating is applied as the troughs are opened for the renewals, it being possible to clean and coat a trough and replace the ballast during the same day. The life of ties on this viaduct is about four years, for which period the coating promises to protect the steel. No refrigerator cars are operated over the viaduct, but there is considerable deflection in the floor, which is a probable cause of the short life of plain coatings previously applied.

The quick drying or hardening of the coating, and the heavy body, combined with its close adherence to the metal and the excellent preservative qualities, make it far superior to the paint coatings previously used, which would not protect longer than two years. A wash of neat cement grout, to be applied on top of the tar and cement coating has been suggested, and should assist in hardening the surface of the coating and in increasing its efficiency. The use of graveled surface roofing felt over the coating on top surfaces is being tried, as it protects the coating greatly from mechanical injury.

Cement-Mortar Coating

Our experiments with the tar and cement mixture and various other coatings included cement-mortar protection. The latter has proved the most successful for the tops of floor beams and troughs. It has been applied by mixing a stiff mortar of 1 part portland cement to 2 parts sand, and plastering this on the tops of the beams (after painting) to such a thickness as to cover the rivet heads at least ¼ in. A reinforcement of poultry netting in the mortar layer has been specified for each case, but generally omitted in the application. The top of this mortar layer has in some cases been covered with roofing felt, mopped in place with roofing pitch, the felt bending over the edges of the mortar to shed water. In other cases the felt has been omitted, but it should be applied, for waterproofing the mortar slab, the better protection of the tops of the rivet heads (which can generally have only a thin coating of mortar), and the general binding together of the mortar surface to prevent it from cracking.

The first service experiment with the mortar coating was made on the tops of the troughs of a double-track floor in 1908. The tops of these troughs had suffered considerably by corrosion in spite of frequent painting. The troughs have less than the desired strength, for which reason they are to be replaced shortly, and consequently the deflection of the floor is quite marked. In spite of this deflection the mortar coating, covered with roofing felt, has held intact to date, except where injured by track tools and by rails dropping on it in distributing new rails. In another case the mortar protection applied without wire reinforcement and both with and without felt covering, is intact and in perfect condition after one year in service. This is on the very stiff floor beams of an open-floor bridge.

Protecting Other Parts of Bridge Floors

The tops of the floor beams and troughs are not the only parts attacked by brine drippings, although perhaps the most susceptible generally, owing to the more exposed position. The bottom flanges and webs of the floor beams of open-floor bridges suffer also, although in less degree, being considerably protected by the deck and the top flanges. The top and bottom flanges of stringers and deck girders and the tops of lateral members suffer nearly as badly as the tops of floor beams. The mortar protection can be applied

*Abstract of a paper read at the annual meeting of the Maintenance-of-Way Master Painters Association, at Chicago, 1912.

†Engineer of Structures, New York Central & Hudson River R.R., New York, N. Y.

to the bottom flanges, where such a thickness can be used that the felt covering should not be required, and the surface can be sloped so as to drain quickly. Web surfaces have generally not been found to suffer so severely as flanges and it should be possible to protect them by paint without great difficulty.

The tops of stringers and deck girders carrying timber decks do not seem to offer favorable application for the mortar protection, which would have to be applied between the ties. We have been experimenting to a small extent with the tar and cement mixture on these. The use of galvanized iron or steel or of zinc sheet metal for a top flange covering on stringers and deck girders between the painted metal proper of the flanges and the ties has been suggested.

A Large Cantilever Bridge in China

A cantilever bridge just completed crossing the Yellow River near Tsinanfu on the line of the Tientsin-Pukow River is remarkable in having not only an interesting cantilever span but also a very great total length of bridge, 4100 ft. It was built during the last three years by the Maschinenfabrik Augsburg-Nürnburg, of Germany. A brief general description given in *The Far Eastern Review*, of October, 1912, supplies the following data.

The bridge consists of nine spans of 300 ft. each, and a three-span cantilever structure comprising anchor arms of 420 ft. and a cantilever span of 540 ft. Eight of the approach spans are on the north bank and one on the south bank. The bridge is intended to carry ultimately two railway tracks (standard gage), but at present only one is laid, being placed in the center of the width of the bridge with footways along each side. The trusses are proportioned for only one track, and, when the other track is required duplicate trusses are to be added outside of the present ones, suitably connected to the old trusses. The railway loading for which the structure is designed is medium heavy, according to American standards.

The approach spans and the anchor spans were built on falsework, but the cantilever span was built by cantilever erection. The depth of the river, its very rapid current, the soft bottom and the variable river regimen combined to put falsework out of consideration for the channel span. For the same reasons the piers were difficult to construct, and represent as notable an element of the structure as the steelwork.

The low-water width of the river is about 1300 ft., but in flood times the water spreads out over the total width between the high-water dikes; the north dike is about a mile and a half from the river bank, while the south dike is close to the river. The flood discharge of the river is estimated at over 100,000 cu.ft. per sec., and the velocity of the current is nearly 15 ft. per sec. The region is entirely alluvial. The stream is notable for its shifting character. It has occupied its present bed less than a century, this being the location of an old stream whose bottom was found in the pier excavation to be about 55 ft. below the present low-water level. This bottom is hard, tough clay, above which is the alluvial deposit of the present river, a soft soil, the upper portion of which is constantly shifting.

The piers are concrete with stone facing, founded on reinforced-concrete piles (90 to 240 per pier), driven in open cylinders or coffer-dams (except the river piers). The general elevation of bottom of piles is 55 to 65 ft. below low-water level. The outer rows of piles were driven on a batter. The river piers were sunk as pneumatic caissons. The south main pier of the cantilever portion of the bridge, which is in the deepest part of the channel, was sunk to a depth of over 80 ft. below low-water level, or about 65 ft. below the river bottom. In the course of the sinking of this pier flood and freezing interfered considerably with the work. At one time the river was frozen from bank to bank solid enough to carry wagon traffic for a period of six weeks. Piles were driven in all piers except this one.



CANTILEVER SPAN OF YELLOW RIVER BRIDGE AT TSINANFU, CHINA, ON TIENTSIN-PUKOW RY.
(Closure of suspended span, October, 1912. The channel span is 540 ft. c. to c., consisting of 90-ft. cantilever arms and a 360-ft. suspended span.)

The superstructure consists of trusses of subdivided Warren type, with parallel chords, except that the top chord of the cantilever portion is up-curved toward the main piers to get extra depth. The roadway over the bridge is level on the cantilever span, while on the other spans it rises 0.67% toward the stream. Rail-level at mid-channel is 44 ft. above low-water level. The trusses are spaced 31 ft. As already noted, they are proportioned for the load of one track only and the second track when installed is to be provided for by building reinforcing trusses just outside the existing trusses. In that case brackets will be added outside of the trusses to carry the footways, which are now laid between the trusses, alongside the single track.

The proportioning of the cantilever span is rather unusual. Each cantilever arm is one-sixth of the span length; the suspended span, therefore, is two-thirds the cantilever span length, or 360 ft. This approximates to the proportion of greatest economy, and yet does not give an excessive length of suspended span.

Construction of the bridge was begun in August, 1909. The closure of the suspended span was made Oct. 9, 1912. The cost of the bridge is stated as 10,000,000 to 12,000,000 marks.

Reinforced-Concrete Elevated Sidewalks, East St. Louis, Ill.

By E. R. Rodenberg*

Before East St. Louis had adequate levees it was subject to annual inundation by the waters of the Mississippi River and Cahokia Creek. To overcome this the grades of the streets in the business section were raised above high water by filling between retaining walls of limestone masonry and paving with brick or granite blocks on this fill. The walls were set under the curb and no filling placed in the sidewalks space. This necessitated the construction of elevated sidewalks. Heretofore such sidewalks were constructed of wood or of "granitoid" arches between steel I-beams with one end resting on the retaining wall and the other end on columns or foundation walls of buildings. These columns were 18x18 in. in section and the maximum spacing being 8 ft., c. to c. they occupied a great deal of useful space and were very unsightly in appearance. When the wooden sidewalks on both sides of East Broadway from Fifth St. to Tenth St. became dilapidated and in need of renewal, City Engineer E. F. Harper recommended that reinforced-concrete sidewalks be constructed in place of the usual arch and steel-beam construction. The sidewalk shown in the accompanying sketch was designed by the City Engineer, assisted by the writer, approved by the Board of Local Improvements, ordered to be built by the City Council and is now under construction.

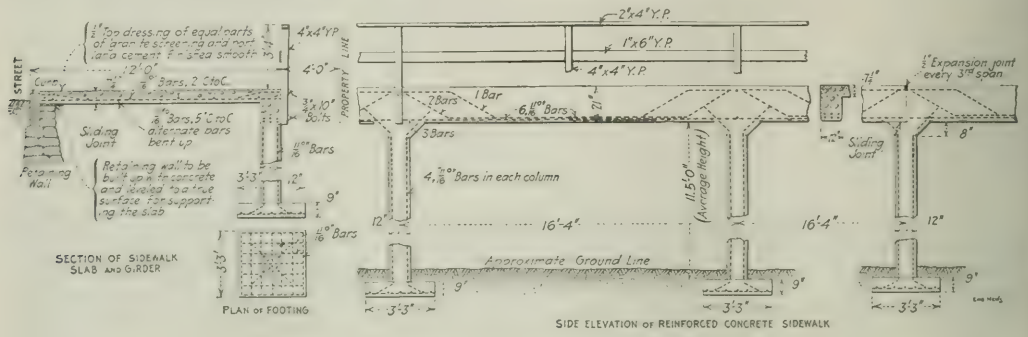
In the design a live load of 300 lb. per sq.ft. was used and all reinforcing bars are of the same cross-section to simplify placing the steel and avoid errors. A 1:2:4 concrete was used with a top dressing of equal parts of portland cement and granite screenings.

Although the space between the curb face and the property line is 16 ft., the walks are made only 12 ft. wide leaving a 4-ft. space in which the property owner may either place sidewalks lights or pave solid as he desires when constructing a building on his property. Openings, such as manholes for the delivery of coal to the basements, are placed as desired by the property owners, who furnish the cast-iron frames and covers.

The spacing of the columns is arranged so that the design can be used as a standard and three spans can be constructed in front of a 50-ft. lot without the columns encroaching upon the adjoining property. This is only important on work done by private contract with a property owner. As the work on Broadway is being paid for by special assessment under the Local Improvement Act of Illinois, no particular attention has been given to property lines in placing the columns.

A ½-in. expansion joint and a sliding joint have been placed at every fourth column. The joint between the slab and retaining wall is a sliding joint for the full length of the walk. The expansion joint extends entirely through the slab and girder and the upper 1½ in. is tapered, being ¾ in. at the top, and is calked with oakum and then filled with asphalt.

A 2x4-in. wood hand-rail supported by 4x4-in. wood posts 8 ft. 2 in. c. to c., is placed in front of vacant property and also where the buildings are set back from the property line. In the latter case openings are provided in the railing to permit entrance to the property. The posts are each fastened to the girder by two ¾-in. bolts embedded in the concrete.



Details of Elevated Sidewalks at East St. Louis, Ill.

The prices paid are as follows: Concrete $10.99 per cu.yd., steel in place $2.40 per 100 lb., excavation and backfill $0.62 per cu.yd., timber for railing, $51.02 per M. ft. B.M. The Murphy Construction Co., of East St. Louis, is the contractor.

*Assistant City Engineer, East St. Louis, Ill.

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A Practical Question in the Technic of Water Bacteriology

While engineers seldom attempt to make bacterial examinations of water, yet they, in common with others having to do with public water-supplies, frequently find it necessary to interpret bacterial analyses. It will surprise many such engineers to know that two methods of bacterial incubation are now in use which are liable to give such highly different results that the mere totals of bacterial counts may mean little, in some cases, unless the incubation method used is known, and also unless the would-be interpreter is able to weigh the significance of variations resulting from the use of the two methods.

Without going into technical details, it may be explained that since the bacteria in water are too minute to be counted directly, even with a powerful microscope, it is necessary, if they be counted at all, to raise a whole crop of them on some favorable culture medium and count them by colonies instead of by individuals. To this end a tiny but known portion of water is deposited on a small plate of culture media and the plate thus "sown" is

placed in an incubator and kept there under constant temperature for a certain time. The plate is then removed and the number of colonies is counted. Each colony is taken to represent a single germ in the original sample. The results thus obtained are only approximate, but they serve as an index which is of value for comparative purposes—provided the methods employed conform, for each count, to a suitable standard.

Such a standard, in this case, involves uniformity of culture media and of temperature and time of incubation. Variations in any one of these materially affect the bacterial counts.

When, some thirty years ago, Robert Koch laid the foundations for modern water bacteriology, he employed gelatin as a culture medium. That medium is still in use, notwithstanding the marvelous advances in water bacteriology since that day. Other media have also been adopted, each with its advantages for varying kinds of samples to be examined, and particularly for different classes of bacteria to be counted.

In 1905, a committee on standard methods of water analysis, appointed some years before by the American Public Health Association, submitted a final report in which, among other things, it recommended that the standard culture medium for determining total numbers of bacteria in water should be nutrient gelatin, and that the standard for incubation period should be 48 hours at a temperature of 20° C. In 1911, the committee submitted a revised report (published in book form in 1912), in which, for the standard just given, it substituted agar as a culture medium, with an incubation period of 24 hours at 37° C. This change met with strong disapproval from many water bacteriologists.

At the recent meeting of the American Public Health Association, the pros and cons of the two standards were reviewed by Prof. George C. Whipple (Harvard University and 103 Park Ave., New York City). As a result of this and the discussion which followed, the following resolution was passed:

"Resolved that in the opinion of the Laboratory Section of the American Public Health Association, ordinary routine examinations of water for sanitary purposes, and in the control of purification plants for the present should include the determination of the number of bacteria developing at 20° and at 37°, and a presumptive test for B. coli in lactose bile."

The question of standards at issue is of particular interest to managers of water-purification plants. To learn the opinions of the latter, Professor Whipple wrote to about "twenty of the leading filter operators" of the country. Of the 18 who replied, eleven preferred the 20° gelatin count, four the 37° agar count, and three wished to test the methods side by side before expressnig an opinion.

The evidence from filter operators reviewed by Mr. Whipple in his paper is presented under the three heads, (1) convenience and (2) precision of the two tests, and (3) relative values of results under the two methods, as a guide in operating filters.

Convenience—Under this head the 37° agar method seems to have the weight of evidence on its side, some of the leading reasons being (a) the greater ease and accuracy of maintaining 37° as compared with 20° C., (b) the reduction of the incubation period by half, (c) and the fact that the higher temperature is required for B. Coli. tests, thus making it feasible to use one incubator for this and for the total count.

Precision—As reflecting the sanitary character of the water the evidence for and against the 37° agar count is conflicting.

Surprisingly few comparative data are available. Broadly, gelatin counts at 20° C. are much higher than the agar counts at 37°, the difference generally being decidedly more marked in polluted than in unpolluted waters. In addition, the relative differences are subject to seasonal variations.

(3) As a Guide in the Operation of Filter Plants—The principal objections of filter operators to the 37° count were that to change from 20° after it has been used a number of years would introduce unnecessary confusion [and evidently of far more importance—Ed.]; the 37° count would give such low results for many different effluents (often zero) that it would fail "to show slight differences in the operation of the plant." The 37° count might indicate a perfectly filtered and the 20° count an imperfectly filtered water. All this might matter little if the ratios between the counts at different temperatures were constant, but they are not.

Quoting now a brief paragraph from Mr. Whipple's paper, which also bears on the 37° count as a guide to filter operations:

"Another objection raised to the 37° count is that at present we do not know how to interpret the results. It is generally considered that filter effluents should contain less than 100 bacteria per cc., as shown by gelatin count. Who knows what would be the equivalent of this with the 37° count?"

General Conclusions—Mr. Whipple's conclusion is as follows:

"All things considered, it would appear to be unwise to change abruptly at this time from the 20° to the 37° count, as a guide in the operation of water-filtration plants. Before this is done, extended comparisons of the two methods should be made at many places and the data carefully analyzed to determine whether or not the change is advisable. Another reason against changing at this time is the possibility of using synthetic media in the future. All media composed of variable ingredients are unsatisfactory and bacteriologists are looking forward to the employment of media more definite in composition. Should such a change occur in the near future, it would be better to adhere to present methods until that comes about.

"It is recognized, of course, that the bacterial count has other uses than in connection with filter plants, and that for some of these uses the 37° count is undoubtedly superior to the 20° count. It is better, for example, for studying the purification of sewage, the contamination of shell fish, and for the analysis of milk. Possibly it would be wise not to have a single standard method for all of these purposes. At any rate it would appear to be advisable for the present, at least, to employ both the 20° and the 37° counts whenever practicable. This will require extra work, but if it is carried on systematically for a year, the data should be sufficient for determining whether the 20° count or the 37° count is most useful, or whether both should be constantly employed. Our laboratory section, through its committees, can confer no more useful service than to undertake such an investigation."

An Industrial Locomotive Driven by a Crude Oil Engine

Some interesting engineering problems were involved in an order placed several months ago with the C. W. Hunt Co., of West New Brighton, N. Y., for a locomotive for haulage service in the nitrate mining industry at Iquique, Chili. The preliminary design of this car was worked out by Messrs. Charles Wallace Hunt and Charles C. King, President and Chief Engineer respectively of the C. W. Hunt Co. Neither of these two gentlemen lived to see the locomotive completed but it is impressive evidence of their foresight and engineering ability, that the final design differed in no great degree from that indicated in their first skeleton drawings.

The conditions to be met were peculiar in several respects. The supply of bituminous coal in this region is very limited and its price ranges from $10 to $12 a ton. Water is also scarce and what there is available has a large content of mineral salts. The track for which the locomotive was desired is a narrow one (30-in. gage) and has many sharp curves. The grades are heavy, requiring a large tractive effort in the locomotive. Crude oil is plentiful in the neighborhood and can be obtained for about three cents a gallon.

The excessive cost of coal and the scarcity of water, together with its undesirability for use in a boiler, precluded the possibility of using a steam-engine drive and the abundance and cheapness of crude oil led to the idea of using a crude-oil engine for the motive power. The fact that a high tractive effort was required of the locomotive made it necessary that each wheel should be a driving wheel, and because of the narrow track gage and many sharp turns (necessitating the use of a very short wheel base or distance between wheel centers on each truck) it was evidently impossible to place any motor equipment directly on the axles, for lack of space.

After consideration of these controlling factors, it was finally decided to build a car in which a crude-oil engine would be used to drive a generator supplying current to two motors, the same being in turn direct connected to the four axles through drive chains and gears. It was thought that this arrangement would provide for all the requirements of the service at a moderate expense, and as a matter of fact the locomotive which was designed on this basis, and the important features of which are shown in Fig. 1 and described in the following paragraphs, did prove satisfactory and is in successful operation in Chili at this time.

Structural Features of the Locomotive

General Dimensions—The car is box-shaped, as shown, and is 25 ft. long, 10 ft. 9 in. high and 7 ft. 7 in. wide over the running board. Fully equipped, its weight is about 22 tons.

Framework—The frame is of structural shapes throughout, assembled according to standard practice and using the ordinary connections and rivet spacings. Twelve-inch, 30-lb. channels form the sides and 12-in. 20.5-lb. channels form the ends of the frame proper and between these the stationary upper parts of the two trucks are riveted. The bumpers of steel-sheathed timber are bolted to the end members. The engine and generator are supported on pairs of 5-in., 6.5-lb. channels so placed that the bed bolts pass between pairs of channels. Gusset plates at the corners, and the cross channels and truck housings, included between the side channels, provide against any possibility of twisting of the frame.

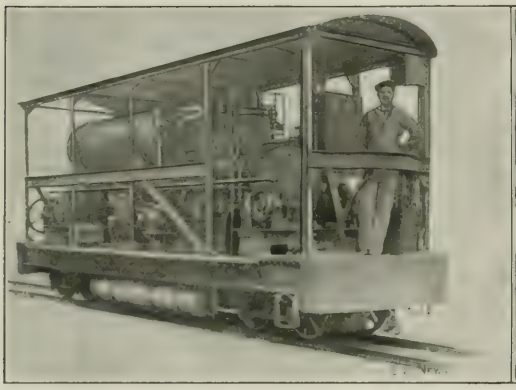


Fig. 1. Locomotive Driven by Crude-oil Engine for a Chilian Nitrate Railway

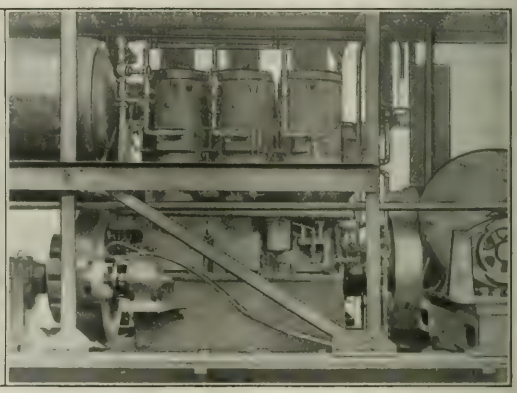


Fig. 2. Three-cylinder Crude-oil Engine Mounted on Locomotive

(The C. W. Hunt Co., West New Brighton, N. Y., Builders.)

The floor of the car is about 2 ft. 9 in. above the rails, and from the floor project ten upright angle posts $3 \times 2\frac{1}{2} \times \frac{5}{16}$ in., 7 ft. 4 in. high, which support the curved canopy of No. 18 black sheet iron and provide a convenient means for supporting air-tanks, switchboard and other auxiliary equipment. A 6-in. channel railing runs all around the car except for the openings at the front end, left for the operator's convenience.

Engine—The motive power is supplied by a Meitz & Weiss vertical 3-cylinder, 2-cycle internal-combustion engine of 75-hp. rating, operating on crude oil. A view of the engine is shown in Fig. 2. The cylinders are 10 in. in diameter and 12 in. stroke. Ignition is effected by the hot-ball method. Compressed air is used to inject the fuel into the chamber at the end of the compression stroke and provision is made for feeding the steam, which is

generated in the water jacket, into the combustion chamber along with the air supply.

The engine is connected to the generator through a flexible coupling whose construction is shown in Fig. 3. This coupling takes care of small discrepancies in the alignment of the engine and generator shafts and allows each shaft to run true in its own bearings and also permits of a slight degree of longitudinal play for each shaft, which is very desirable.

A special feature of this engine is the automatic compressed-air starting device. This consists of a chain-driven valve which provides a passage for the compressed air into the three cylinders in proper sequence in whatever position the engine may be previous to starting. The air is furnished by a small compressor attached to the rear cylinder and operated directly from an eccentric on the main shaft of the engine. This compressor automatically maintains a constant pressure of 175 lb. per sq.in. on the air-storage tank back of the engine.

Electrical Machinery—The generator used is a 40-kw. Westinghouse multipolar direct-current machine supplying current at 125 volts when operating at its normal speed of 340 r.p.m. The current is delivered to two Westinghouse direct-current motors of 25-hp. rating, and each motor is connected to the two axles of its truck through a chain belt and speed-reducing gears operating in an air-tight, oil filled gear case.

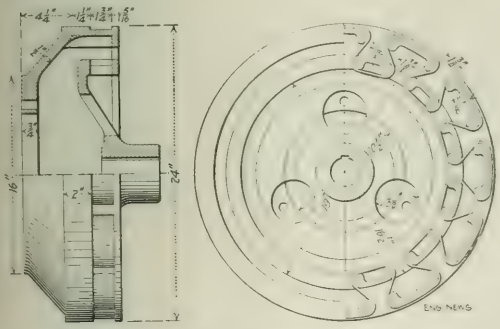


Fig. 3. Flexible Coupling between Oil Engine and Generator

Auxiliary Equipment—A switchboard is provided directly in front of the engine and on it are placed the usual meter and switch arrangements for taking readings of current and voltage on the electrical units.

The controller furnished is of a special series-parallel reversing type in which series-parallel contacts are made on an auxiliary drum. This arrangement allows the motors to be put directly across the line in either series or parallel relation without the use of external resistance, and it provides for nine speeds forward and reverse, allowing of starting, stopping and reversing at will.

The brakes were especially designed for this service and are of the hand-operated post type, in which contracting brake blocks are applied to the outer periphery of 10-in. brake wheels, one on each motor shaft. These blocks are lined with special mineral-tanned leather designed to resist high temperatures successfully.

Dust-proof roller bearings are used for the axles and these proved to be so nearly frictionless that the completed car weighing 22 tons can be easily pushed along a level track by one man, before the chain-drive belts are attached.

Three metal storage tanks 8 ft. 6 in. long and 15 in. in diameter, are placed under the locomotive frame. About twice as much of jacket water as of fuel oil is required in a given time by this engine, so two of these tanks contain water and the other oil. The capacity of each tank is about 78 gal., a supply sufficient for more than ten hours operation at full power.

Operating Characteristics

One of the objects in choosing the system above described was to obtain an engine which could run at a constant speed for maximum efficiency, the desired variation of speed of the car being obtained solely through the controller. This constant speed operation of the engine is obtained by means of a throttling governor, and tests of the entire unit showed a drop from 125 volts at no load to 115 volts at full load, or 8 per cent., which represents the speed regulation of the engine.

The special advantages obtained by the use of the chain belt and gear drive from the motors to the axles are as follows: (1) It allows the use of a short truck with only 34 in. between wheel centers, so that the locomotive can operate on very sharp curves; (2) it keeps the motors above the locomotive floor where they are readily accessible for inspection and repairs and are protected to a large extent from moisture and dust; (3) it permits a rotating speed reduction from motor to axle of four to one, giving the desired low operating speed to the car (8 mi. per hr. maximum) with use of a standard type of motor; and (4) it provides a positive drive for each axle so that every wheel is a drive wheel and so that the entire weight of the locomotive is rendered available for tractive effort.

Allowing a value of 0.2 as the coefficient of friction between wheels and rails, since the whole weight of the locomotive is available for traction, the maximum tractive effort before the wheels slip is 22 tons $\times$ 0.2 or 4.4 tons. At 8 mi. per hr. (the maximum operating speed) assuming that 50 hp. is applied to the axles, since the engine and generator have ample capacity to drive the motors up to their full rating, the tractive effort is about 2300 lb.

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The Planning of a Residence District has been made the subject of a competition by the City Club of Chicago, which has offered $600 in prizes for the best plans. The assumed site is a level quarter-section of land (2640 ft. square), about eight miles from the center of the city, having no trees or buildings, and not subdivided. It is surrounded by the straight streets of property subdivided in the usual rectangular or gridiron plan, and has street-car lines on three sides. The purpose is to show the best methods of subdivision, the best disposition of space for parks and recreation centers, the best width and arrangement of roads, the most convenient location of stores and public or semi-public buildings and grounds, the most desirable provisions for house yards and gardens, and the proper density of population to be provided for. Each competitor will submit a plan and a bird's-eye perspective view. With these there must be a statement as to the number and sizes of lots, the number of families, the length of sewers, the area of street and sidewalk paving, and the percentages of total area occupied by streets and by public spaces. The arrangements for the competition are in the hands of George E. Hooker, civic secretary, City Club, Chicago.

Selling Water by Current Meter Measurement

By J. C. Allison*

SYNOPSIS—The measurement of water used for irrigation purposes by some means which shall be accurate, practicable and economically feasible has long been a problem. The difficulties of this problem were increased in the Imperial Valley, California, by the large volume of silt carried by the water, while at the same time the necessity for accurate measurement was increased by the value of water in that marvelous valley, where irrigation is practiced every month in the year. This article outlines the irrigation system of the California Development Co., tells about the Mutual Water Cos., relates the silt and other difficulties and finally describes the use of current meters for water measurements and the current-meter rating flume of the company at Calexico.

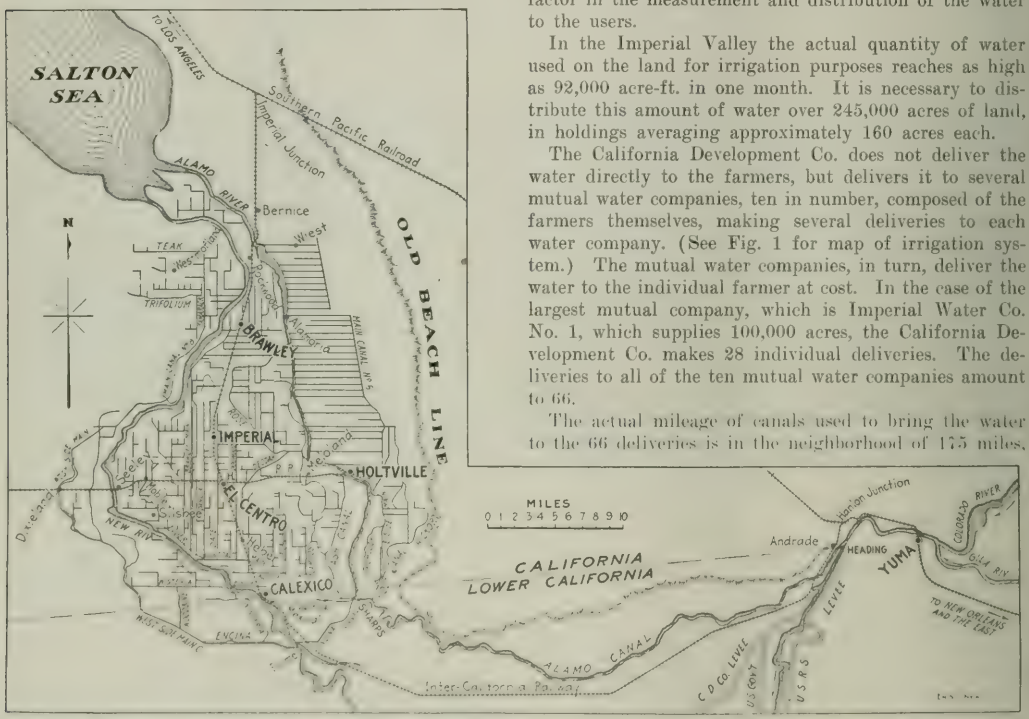


Fig. 1. Map of the Irrigation System of the California Development Co., Imperial Valley, California

Irrigation managers and engineers are realizing more and more fully the necessity of strict accounting for water, not only to promote its conservation and to insure its use with the greatest benefit, but also to make a profit. Many private irrigation projects have failed simply on account of inaccurate and wasteful methods in selling and delivering water, their chief source of revenue.

The accurate measurement of water in general is no small problem, inasmuch as the weir and orifice formulas now in general use in engineering practice are not absolutely accurate, and are not accurate at all unless used under conditions similar to those on which the equations were derived. When there is added to this the silt problem, the successful use of structures as measuring devices for the distribution of large quantities of water becomes impossible.

The Colorado River, from which Imperial Valley derives its water-supply by means of the California Development Co., carries as high as 2% by volume of suspended matter. By the time the water reaches the farmers' deliveries in the Valley, the water still carries in suspension in the neighborhood of 1 to 1½% of silt. Not only is this silt problem the greatest item in the maintenance of the system, but it also crops out as the greatest factor in the measurement and distribution of the water to the users.

In the Imperial Valley the actual quantity of water used on the land for irrigation purposes reaches as high as 92,000 acre-ft. in one month. It is necessary to distribute this amount of water over 245,000 acres of land, in holdings averaging approximately 160 acres each.

The California Development Co. does not deliver the water directly to the farmers, but delivers it to several mutual water companies, ten in number, composed of the farmers themselves, making several deliveries to each water company. (See Fig. 1 for map of irrigation system.) The mutual water companies, in turn, deliver the water to the individual farmer at cost. In the case of the largest mutual company, which is Imperial Water Co. No. 1, which supplies 100,000 acres, the California Development Co. makes 28 individual deliveries. The deliveries to all of the ten mutual water companies amount to 66.

The actual mileage of canals used to bring the water to the 66 deliveries is in the neighborhood of 175 miles, and the various distributing systems from these deliveries aggregate approximately 750 miles of canals. This latter figure does not include the mileage of head ditches and drainage ditches which the farmers own and utilize for the irrigation of their individual farms.

The irrigation season in the Imperial Valley includes the whole twelve months of the year, so that the canals are never dry. Instead of receiving their water according to schedule, the farmers are accustomed to receiving it on application after 24 hours notice. To give this kind of service in a satisfactory way, and still conserve the supply of water so as to prevent its waste, accurate measurement

*Assistant General Manager and Chief Engineer California Development Co., Calexico, Calif.

from point to point is absolutely necessary. Where the whole operation of the system depends upon the revenues derived from the sale of the water, accurate accounting for the water is also absolutely necessary.

The weir and orifice coefficient which has been arrived at by hydraulic engineers, and the resulting formula in general use for the measurement of water through openings and over weirs, require that the design of the structure, and the conditions under which the water is measured through the structure, be definitely known. It has been found here to be absolutely impossible to hold to any such formula for any individual structure, even those built originally in strict conformity with the design necessary for the proper application of the formula. This condition is due to the continual change in the condition of the channel directly above and below the structure, due to the silt deposits. For instance, the proper application of any of the weir formulas demands a lower contraction, or lip, for the water to fall over. The formulas also demand that there be a free access of air underneath the overpour. These two things in themselves are impossible, since the lip, and the consequent quieting of the water above the structure, affords an excellent berth for the deposition of silt. In the smaller structures, especially, we soon have the bot-



FIG. 2. VIEW SHOWING DEPOSIT OF SILT ABOVE SMALL STRUCTURE IN THE IMPERIAL VALLEY IRRIGATION SYSTEM

tom grade of the channel on the upstream side of the structure at the same elevation as the top of the lip, hence, not only doing away with the lower contraction of the structure, but also destroying the bottom grade and carrying capacity of the canal above.

In building the irrigation system of Imperial Valley, the structures were built principally of wood, and very little attention, if any, was paid to the part these structures would have to play in the accurate measurement of water through them. In the case of the weirs that were constructed with the necessary contraction, it was found that the silt accumulated above them to such an extent that it did away with the lower lip of the weir by lodging against it, causing the filling up of the canal behind it. The lower contraction, therefore, became a menace, and the weir was soon abandoned and an undershot opening substituted where possible. From this on, the structures were all built with a view to cheap maintenance, but the formula was still retained for the measurement of water.

As is well known to the readers of the ENGINEERING NEWS, the Imperial Valley in 1905, 1906 and 1907, passed through a series of unfortunate experiences, due to the incomplete control of the heading at the intake on the Colorado River, through which the river broke. This was stopped by the Southern Pacific Co., after which time the affairs of the California Development Co. passed into the hands of H. T. Cory, as general manager, and F. C. Herrmann as chief engineer. The revenues from water delivered did not meet the current expenses, consequently these gentlemen soon recognized the inefficient method of measuring and distributing water as one of the many necessary subjects for improvement. As a remedy they started to calibrate each of the large structures with current meters. From the calibrations a set of tables was made for each opening in each gate.

On Dec. 13, 1909, the California Development Co. was placed in the hands of W. H. Holabird, as receiver, and the bankrupt system became dependent upon the revenues from the sale of water alone. It became more necessary than ever to account for each acre-foot of water sold and delivered to the farmers.

In correcting the method of measurement of the water to the farmers, it was first determined that the calibration tables previously proposed would not serve for the same openings for any length of time, since the continual shifting of the silt deposits above and below the openings changed the conditions entirely under which the openings had been calibrated. This is illustrated by Fig. 2, which is reproduced from a photograph taken from a point above one of the small structures with the water out of the ditch. When this opening was calibrated the canal was clear above, with no obstruction in the flow of the water delivered through the gate.

It was next determined that there was no practical solution of the drift problem as related to the large structures. In spite of the care with which the drift was removed, there were always likely to be sticks half submerged, located in the bottom or on the sides of the submerged opening, which could not be detected on account of the muddy condition of the water. This accumulation of drift would either decrease the size of the opening which the position of the gate indicated, or else it would lodge in the bottom so as to prevent the proper setting of the gate below, thus causing the appearance of a smaller opening than actually existed.

After months of experimenting it was finally decided that current meters would have to be resorted to entirely, if a proper measurement of water was to be had.

In coming to this decision due consideration was given to the extraordinary expense, in a project of this magnitude, of establishing a system wherein the daily use of current meters on each delivery became necessary. It necessitated the employment of hydrographers with considerable engineering training, in the place of the usual "zanjeros" or water tenders, and this called for the payment of larger salaries. It became necessary that a considerable amount of money be invested in current meters, since the main measuring stations necessary for the distribution of the water numbered 66, requiring some 25 or 30 separate meters, on account of the long distance between stations. With the current meter there was necessary the extra equipment of first-class stop watches, etc. Metering bridges had to be installed at stations where the canals were of uniform section, and metering flumes where the canal bottoms were irregular.

A larger force of hydrographers was needed than "zanjeros," who had previously been employed, since

less ground could be covered in one day by hydrographers than was originally covered by the "zanjeros," owing to the extra time needed to make the meter measurements with the instruments. Water-level gages had to be established in a great many instances, so as to register the fluctuations in a rating station, or the rating flumes, from hour to hour.

A rating station was established at the California Development Co. headquarters in Calexico, for rating cur-

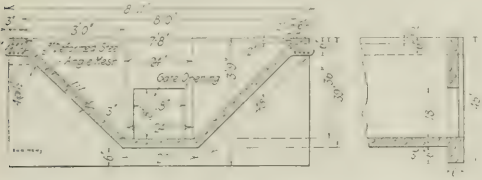


FIG. 3. RATING FLUME FOR CURRENT METERS, CALIFORNIA DEVELOPMENT CO., CALEXICO, CALIF.

rent meters, at a cost of $1360. Briefly described, the rating station consists of a reinforced-concrete flume 170 ft. in length and 3 ft. in depth, both inside measurements. The section of this flume differs from the section of the flume used by the U. S. Reclamation Service, or by the U. S. Bureau of Standards, or by the Canadian Government, as installed under the direction of the Irrigation Office in the vicinity of Galgary, Alberta. All of these flumes were built with a rectangular section. In the case of the Canadian station the tank was 6 ft. wide, and 5½ ft. deep, a section this large being used to eliminate any following movement of the water in running the meter through the tank. The same result was attained at the Calexico Station, with less expense, by using a section in the form of a trapezoid, the bottom width being 24 in., the top width 7 ft. 0.08 in., and the side slopes 1 to 1 (see Fig. 3).

In experimenting with a smaller station, previously installed, it was found that one of the main causes of error in rating meters was due to the fact that in cases where the meter was pulled through the water by hand, the speed at which the instrument was drawn, in rating for any particular velocity, was so variable, even with the greatest of care by the operator drawing the meter, that the object of determining the number of revolutions in a specified time for a certain velocity was defeated. In the final platting of the curve from which to calculate the meter equation, the points for different velocities were so variable in position that it was difficult to establish a true line through them.

At the new station, therefore, a motor car (Fig. 4) was designed, thus eliminating the main personal equation in rating meters. As yet the two additional personal equations, namely, that of recording the time and the revolutions of the meter, are still contended with, inasmuch as we have not established the automatic method used in some of the other stations for recording time and revolutions. These two factors, however, do not seem to impair the correct rating, provided the operator uses due diligence in counting and observing the revolutions and in counting the time with the stop watch, within the known distance in which the meter is drawn. As an aid in making the record, however, an automobile marker is used at either end of the flume, so as to be able to confine the record of time and revolutions in a definitely known distance.

A Price electric meter is employed uniformly on the system, the rod being used at stations where the depth and velocities are small, the cable attachment where the depth and velocities are excessive.

On account of the silt in the water the wearing parts of the meter need more attention than is the case where the meters are used in clear water, and for the same reason the instruments are also rated more frequently. In the organization perfected it is the duty of the watermaster, through his assistants, to re-rate each meter at least once every month, and oftener where the meter is used under unfavorable conditions. After the meter is rated at the headquarters station, the curve is platted, the equation calculated, and a revised table prepared for the use of the hydrographer using the meter.

In spite of the extra expense incurred in the establishment of the plant, the saving in revenues instituted thereby and the perfecting of the distribution of the water more than warrants the change.

The results for eleven months ending May 31, 1912, as compared with the same period of time ending May 31, 1911, is best shown by the auditor's statement. The total cost of distributing the water during the eleven months ending May 31, 1911, amounted to $16,930. This expense included the watermaster, superintendents and zanjeros salaries, repairs to telephone lines, and in fact all expenses which are chargeable to the operation accounts which come under the classification "Distribution of Water."

Assuming that the conditions would have remained the same, that is, if we had continued the use of the weir measurement only, the expense of the eleven months ending May 31, 1912, would have been practically the same as for the preceding period. However, our records show that the total expense for distributing water during the eleven months ending May 31, 1912, aggregated $21,353. The increase in expense, amounting to approximately



FIG. 4. RATING CURRENT METERS FROM MOTOR CAR, AT CALEXICO, CALIF.

$4400, was therefore due to the changes in the measurement of water from the weir method to the meter method.

During the eleven months ending May 31, 1912, the difference between the current meter and the headgate measurements made a net increase in revenue, due to the meter measurement, of $14,700. Deducting from this amount the increase in expense of $4400, leaves a net increase in favor of the meter measurement of approximately $10,300.

The greatest of all among the problems to be solved was the difficulty in bringing about the change in measurement of water to the satisfaction of the farmers, since the new method of measurement would entirely revolutionize the method which had been employed for over eight years. In spite of all this evidence of extra expense and extra trouble, meaning, perhaps, extended lawsuits with the mutual companies, Receiver Holabird backed the judgment of his engineers with his necessary support, and after due notice to all of the companies the meter measurements were put into effect July 1, 1911.

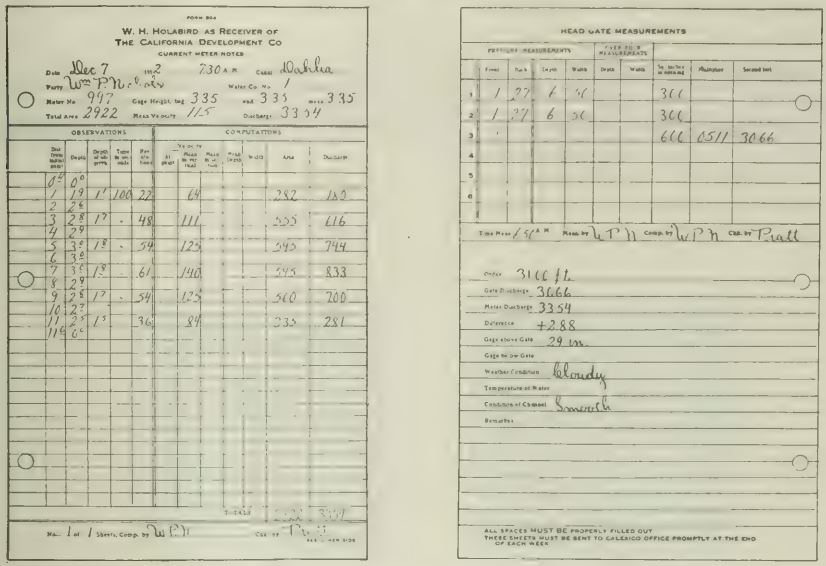
At first the water companies all rebelled, as was natural, since the meter exposed the errors in the measurement through the structures due to leaks, faulty use of formulas, etc., thereby giving less water to the company and the individual farmer on the same order, than had previously been given. In other words, in place of delivering 10 cu.ft. per sec. of water, on an order for 7 ft., the meters checked the errors involved and measured to the company or farmer the exact quantity of water delivered.

However, after several months of experimenting and checking, by the various engineers acting as superintendents of the mutual water companies, our methods were finally conceded to be as nearly accurate as is possible to attain in the distribution of large quantities of water, and the justice of the meter system was finally conceded. In the case of the largest water company, that is, Imperial Water Co. No. 1, R. S. Carberry, superintendent, went to the trouble and expense of installing an adjustable Cippoletti weir, adjustable to such an extent that he could remove the same from the water except at times when he needed its use, thus preventing silting above the structure. At this weir he required the checking of all the meters belonging to the California Development Co. which were to be used in measuring water to Imperial Water Co. No. 1.

After a careful rating of the meters at the Calexico station, and checking them against the weir station, the results showed that all of the meters would register within 1½% of the amount which the weir would measure in a stream runing about 40 cu.ft. per sec. With this demonstration of the correctness of our methods, the water companies finally conceded to our demands.

In order to bring the accounting for the water in the watermaster's office to a point wherein practically all of the waste could be eliminated, if necessary, a system was devised which resembles, more than anything else, the system used by railroads in train dispatching.

The time required to divert a quantity of water through a given canal, from one point to another, was definitely determined. With this as a basis each hydrographer was given a definite time in the day for the turning of his water and for measuring the same. In measuring his water, he was not only required to measure it with the meter in a careful manner, but was called upon also to check his work, in a rough way, by the use of the gate measurement. Later in the day he was required to return to the station and remeasure the same, so as to have a definite record of any fluctuations which might occur. A sample sheet from the hydrographer's daily water statement, for both the gate and the meter, is here reproduced as Fig. 5.


W. H. HOLABIRD AS RECEIVER OF
THE CALIFORNIA DEVELOPMENT CO
CURRENT METER NOTES

HEAD GATE MEASUREMENTS

Fig. 5. Sample Sheet of Hydrographer's Meter and Gate Measurement of Individual Irrigation Water Delivery

With this definite method of keeping track of the water, the watermaster, from his desk at the Calexico headquarters, can dispatch the various heads of water needed from day to day, to fill the fluctuating orders of the water companies, without waste of water, and without danger of drought or flood to the users. It was only in this manner that a 24-hour system of continuous deliveries could

be made, since the dispatching of water through 175 miles of main carrying canal requires a definite knowledge of the behavior of the water in each instance.

From the telephone communications from station to station, the watermaster is able to receive his orders from the mutual companies, instruct his hydrographers as to the carrying out of the orders, and from this make a daily report in such a complete manner as to account for practically every foot of water delivered into the headgate from the Colorado River, after the seepage and evaporation allowances have been made.

The watermaster's daily record is made up on a form sheet 11x17 in. in size. In the upper right-hand corner provision is made for recording gage heights above and below the main diversion gate and also the discharge through the gate. The body of the sheet provides for entries of the amounts of water diverted into the four main and the 18 sub-main canals; for deliveries from these canals to the various mutual companies and to each of the (about 65) canals of each of these companies; for amounts ordered for each of the smaller canals; for waste; and finally for actual and percentage losses. The lower part of the sheet gives further records for the main diversion from the river.

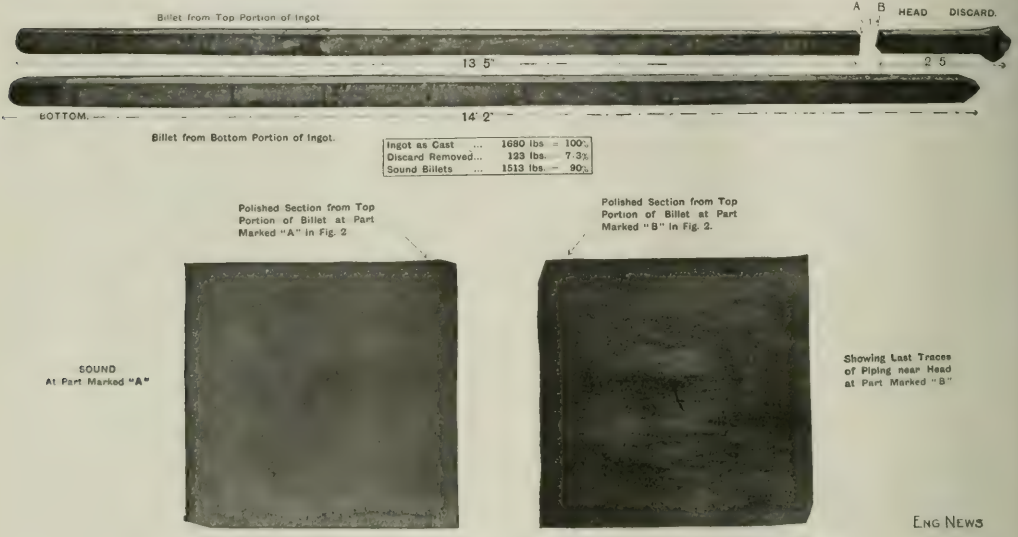
A majority of the irrigation projects in the Southwest have the silt problem to contend with. The experience of the California Development Co., narrated in this article, will, I trust, be of some use to the engineers of these projects, especially since the time is fast approaching when the accounting for every foot of water available in the rivers in the Southwest will become necessary. It has been principally due to the strict measurement and accounting for the water delivered to the farmers of the Imperial Valley that the California Development Co., under its receiver, has been able to deliver water at 50c. per acre-ft., with a 10% allowance for seepage and evaporation, on a 24-hours notice basis, and still operate the once bankrupt company at a profit. This is forcibly illustrated by the fact that the receiver has overcome a deficit of some $5000 per month, and is now making a net revenue in excess of $16,000 per month.

The Hadfield Top-heating Method of Eliminating Pipe in Ingots

The method of producing pipeless ingots worked out by Sir R. A. Hadfield, described in ENGINEERING NEWS, Nov. 21, 1912, p. 955, has proved highly successful, according to information received from the inventor. He states:

> We have already made 15,000 tons of ingots by this system, and to the best of my knowledge I am correct in stating that in this large lot we have not had a single waster ingot, which is a remarkable record.

As further illustration of the thorough elimination of pipes by the particular form of top-heating which he employs,* a new photograph showing the product of a Hadfield ingot of 1680 lb. is reproduced herewith. The text explanations on the picture give the data as to weight and discard. The complete disappearance of pipe 30 in. from the head of the billet is shown by the two cross-sections.



BILLETS FROM 11-IN. HADFIELD INGOT, SHOWING OVER 90% SOUND METAL

Very High Ocean Waves are reported in a recent press dispatch from Portland, Ore., which, in part, reads as follows:

> Unusual damage done by waves was reported by William Dahlgren, keeper of Tillamook Rock lighthouse, south of the Columbia River.
>
> A storm that swept the coast, Oct. 18 and 19, carried away a large portion of the west end of the rock foundation, and waves invaded the top of the tall lighthouse, putting out the lights and filling the trumpet of the fog signals with rocks. The focal plane of the light, 132 ft. above high water, was broken.
>
> The siren, which was filled with rocks, is 114 ft. above the high-water mark. None of the lighthouse employees was injured.

[We trust the refractive index is still intact.—Ed. Eng. News.]

*Top-heating for preventing piping of the ingot is not new. Hadfield uses a sand mold for the upper part of the ingot, an insulating layer of slag on the metal, a layer of charcoal over this, and an air-blast directed down on the charcoal to burn it.

The Ethical Relation between the Draftsman and the Mechanical Engineer*

By F. R. Hutton, Sc.D.†

The engineer is dependent on the draftsman, but the latter must return to the engineer the loyalty which is his *noblesse oblige* by reason of that dependence. He must put his knowledge and skill at the service of his professional chief without mental reservations or withholding of his talents.

But here possibilities of serious trouble may arise in the relations of draftsman and engineer. I am assuming the normal case where the engineer is the older and more experienced and able man: and where by virtue of these conditions he is the employer and the draftsman is the employee.

It may easily happen, however, that the draftsman may be the abler man, and may have sounder judgment and wider experience than the engineer. Suppose in such a case the engineer makes a blunder, an error in his arithmetic, a misreading of some law of physical science; a wrong decision in balancing alternatives. What course should the subordinate draftsman take?

Plainly, he should, first, in a tactful way, call his chief's attention to the error. Not by the name of *error* or *blunder,* but by some such formula as:

"Mr. Blank, I cannot get the same result that you do for the cross-section of this member. Have I made assumptions different from yours? 'Kent's Pocket Book' gives the formula as follows," etc.

"If he will hear thee" (to use the biblical phrase) "thou hast gained thy brother." But perhaps he will *not* hear thee, and because of obstinacy or pride of position, or for graft, or under compulsion from higher authorities, he persists in the error. In such a case there are four alternative courses open to the draftsman:

(1) It may be a trifling detail, where the failure will not reflect upon your professional competency. You may possibly be wrong in your judgment, and it is not of great consequence anyway. Only money loss will be entailed by failure. If this is the case, then shrug your shoulders, reserve the right to say, "I told you so," with its great mental comfort, and go ahead.

(2) The money loss by failure will be considerable: it will be so great as to involve a reflection on your competency and your future earning capacity as a careful and experienced draftsman. Here there are the usual two alternatives. The one is to resign, stating your reasons in your letter of resignation; and "shake off the very dust from off your feet!" This should always be done if the failure due to the error will cause loss of life or injury to persons. The other alternative is to make your protest in writing, and go on with your work. A copy of the written protest may be filed with the Society of Engineers or Draftsmen under your name, to be produced only in case your reputation is involved in the failure of the structure or the dam, and so that the blame may be laid on its responsible designer. To resign, however, is usually the better course, because after such a letter of protest has passed, the bond between draftsman and engineer is so shattered that they cannot work together to advantage.

This brings me to a further problem in the relation of draftsman to engineer. Who is entitled to the credit for success in a structure or a machine: the man who had only a general oversight and control while the draftsman furnished all the details which enable success to be attained; or may the draftsman claim the credit for himself?

The shortest answer is that he who must take the blame for errors and failure is entitled to the credit for success. Usually when the final drawings are signed by the highest authority in matters of design, such a signature entitles the signer to responsibility in both directions. If there was something wrong, he made it his by signing; if it was something fine and original, he made it his by that signature. Responsibility never ceases till it reaches the top. With the professional right to alter or change or veto the drawings goes the right to credit or to blame. If the draftsman signs drawings without professional revision from above, he is the engineer, whatever his title.

Finally, what are the relations of the draftsman to his engineer as respects a proprietary right in the design and drawings which he creates as the craftsman for the engineer? It is the same I think as the relation of the engineer to the corporation for which he labors; it is the same as their relations respecting patents or inventions which originate in their work.

The matter may appear in a wide range of variants:

(1) May the draftsman take blueprints from his drawings or those of his colleagues working with him, and carry these away as his own property, when he leaves that employing engineer or corporation? These are, perhaps, memoranda of his own computations; they will enhance his value to any engineer working with him, because they embody successful solutions of past problems. Are such blueprints his?

(2) Suppose he bought his own print-paper and did the printing at home on Sundays or in over-time, so that the employer could not claim that because they were done in time for which *he* paid therefore they could not be claimed by the draftsman.

(3) Suppose that instead of being embodied in drawings, this same information, tables of sizes and proportions, design data and standards were in note-books; may the draftsman copy these and carry such priceless information with him to his next place, perhaps to a rival competitive concern?

(4) Can an improvement in a process, or a new process or an improved design or new mechanical motion be patented by the draftsman who is working on the problems of the engineer and be used to hold up his employer until the parties can agree as to terms of use or sale?

The accepted answer, emphasized by decisions of courts and embodied in standards of professional ethics is that as between engineer and draftsman such patents, notes and drawings belong to the engineer; and as between engineer and an employing corporation or firm or individual, they belong to the *employer,* and are not to be taken away with the employee.

The reasons back of this practice include the following:

(1) The shop furnished the plant—rent, heat, light and tools—where these ideas were conceived.

(2) The shop presented the problem. Without these

*Extract from an address before the American Society of Engineer Draftsmen, Dec. 19, 1912.

†Consulting engineer, 257 West 86th St., New York City.

the invention or design would never have been created.

(3) The shop furnished antecedent knowledge and acquired experience which molded the creation.

(4) The shop furnished experimentation, actual or precedent, which gave the creation its practical or commercial shape.

(5) For many creations the shop furnished or will furnish manufacturing facilities which the inventor would have to struggle to obtain elsewhere.

(6) For many creations, the shop furnishes the selling or marketing facilities of its commercial organization.

If, however, the invention is entirely outside the employer's business, this principle does not apply; or if it is one he cannot use, then the inventor or designer is like any outside person. Or, the draftsman or engineer may contract to give shop or manufacturing rights to the employing shop while retaining the right to sell or license to outside parties interested.

Closely interwoven with this is the "trade secret" question, where the employer confides knowledge of immense commercial importance to his engineer and draftsman. In European practice, which has also some vogue in America, the engineer and draftsman agree by signed instrument not to enter another concern in the same line of production for five years after leaving his confidential relation. Five years will render much of the knowledge obsolete, or the first concern will not suffer much from the chase of another five years behind it.

And this brings me finally to the conclusion of the whole matter. The relation of the engineer and draftsman is a reciprocal one, and may be summed up in the epigram which we call "The Golden Rule": "Do unto the engineer as ye would that the engineer should do unto you"; or "Put yourself in his place," and do as you would that your draftsman should do to you. Nothing is more traitorous than to receive money from a competitor as the price of betraying to him the brains of your engineer.

⁂

Grade Reduction on Street Railways

By Carl H. Reeves*

SYNOPSIS—The growth of the business section of the city of Seattle, Wash., was hampered by the existence of high and steep hills which gave very unfavorable grades for streets. In view of the rapid growth and great commercial development of the city, the authorities adopted the radical process of removing the higher parts of the hills and using the material to fill in the valleys, thus entirely changing the topography of certain sections of the city.. The excavation was done in part by machinery and in part by hydraulic grading, as has been described in Engineering News. *As several of the streets affected were occupied by street-car lines (electric and cable) the street railway company had to undertake the lowering of its tracks to the new grades and at the same time to continue to handle its traffic. This difficult and very interesting work is described in detail in the accompanying article, prepared for us by the engineer who was in direct charge of the work. Similar reduction in grades and summit elevations has been undertaken in Portland, Ore., and Pittsburgh, Penn., but the city of Seattle was the pioneer in work of this kind.*

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In order to meet the needs of a rapidly growing city, in regard to reasonable grades for street traffic in the central business district, the engineering department of the city of Seattle has had some gigantic engineering problems to meet, in modifying the topographic conditions. It need only be stated here that these were met and solved under the leadership of R. H. Thomson, then City Engineer, in a very creditable manner and to the satisfaction of the citizens of this city. In this extensive grade reduction work,† property owners were put to great expense in meeting the changed conditions due to radical changes in street grades, but it is a fact of record that this great change was made upon ma-

*Field Engineer, Puget Sound Traction Light & Power Co., Seattle, Wash.

†Engineering News, Nov. 12, 1908, and Mar. 31, 1910.

jority petition of the property owners immediately interested.

The Puget Sound Traction, Light & Power Co. operated a street-railway system in Seattle by virtue of franchises granted it by the City Council, and these franchises require the company to care for its portion of the streets as follows:

"Whenever and to whatever extent the grade of any of the streets over which the lines of said tracks shall

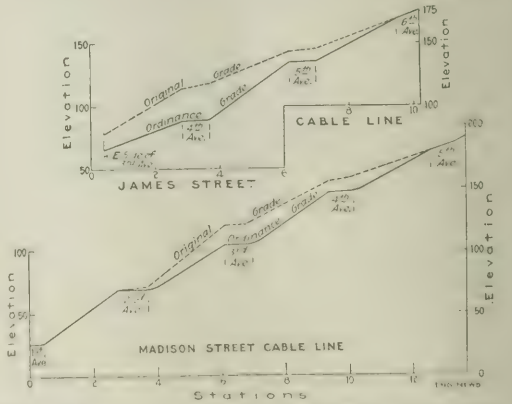


Fig. 1. Profiles of the Old and New Grades of the Cable Railway Lines on James St. and Madison St., Seattle, Wash.
(These two lines are parallel and about four blocks apart).

extend, shall be changed by said city, said track shall be so adjusted and changed as to conform to said grade so established, said adjustment and change in all things to be made at the cost and expense of the owner or owners of said track."

The company has had some extremely difficult prob-

lems to solve in connection with the regrades to be considered in this article. Aside from the cost, which was by no means small, the problem of maintaining service for the accommodation of the traveling public required very careful planning and detailed execution. The lines affected by regrading operations were the following: A, the Virginia St. line in the Denny Hill regrade district; B, the 3d Ave. line, the Yesler Way, James St. and Madison St. cable lines in the combined 3d, 4th and 5th Ave. districts; C, the Jackson St., and South Seattle lines in the Jackson St. district; D, the Main St. line and Madison St. cable line in the 12th Ave. district; E, the track embraced in the Pine St., district; and F, the Eastlake line in the Howell St. district.

The Virgina St., 3d Ave., and Main St. lines being electrically operated, and having adjacent streets with trackage facilities unaffected by the regrading, were abandoned temporarily and the traffic was handled over other lines. This arrangement, however, could not be made in the case of the Jackson St., South Seattle, and Eastlake lines passing through the Pine St. and Howell St. regrade districts, nor on the cable lines.

When the work in the Jackson St. district progressed to a point where operation on the existing tracks was a hindrance to the contractor on the work, the company secured temporary permits from the city for relocations during the further progress of the regrade. In addition to removing the existing tracks on Jackson St. between 6th Ave. South and 12th Ave. South, and 4th Ave. South and Seattle Boulevard between Jackson and Plummer Sts., the company was obliged to build 4200 lin.ft. of double track to carry the traffic around this work. Similar conditions existed on the Eastlake line, where 1200 lin.ft. of double track was constructed in a temporary location. Other tracks in the Pine St. regrade district, being merely transfer storage tracks, were abandoned during the filling.

Owing to the fact that the 12th Ave. regrade project was coincident with the company's electrification of its Madison St. cable line between Broadway and 21st Ave., it was possible to transfer traffic from one street to another so as to accommodate the contractor as well as the public. In this district East Pike St. was the first to be filled. Tracks were laid on this fill, and those on East Pine St., one block to the north, were removed. East Pine St. was then filled, East Madison St. being the last street occupied by a street railway to be brought to the new grade. This having been done all tracks were replaced and traffic resumed as before.

The problem of caring for traffic on the cable lines affected by the various regrades was really the most complicated portion of these undertakings. This article will therefore deal principally with this phase of the work. The 3d Ave. regrade contract, which was the first to affect our cable lines, was let Aug. 8, 1905, and reported completed June 28, 1907. This required the readjustment of all cable lines for two blocks, one block on each side of 3d Ave. The work was started at Yesler Way (occupied by a cable line) and proceeded northerly, cross-

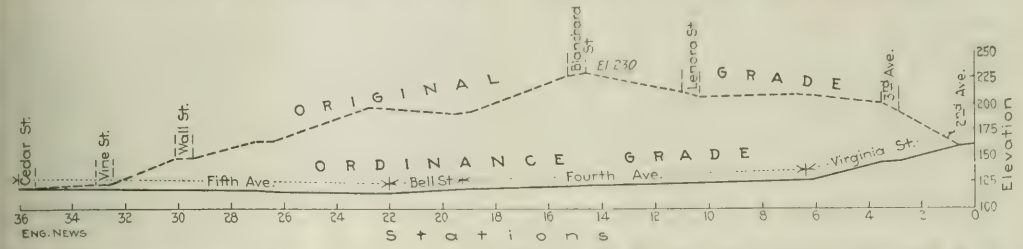


Fig. 2. Profile of the Old and New Grades of the Virginia St. Electric Railway Line, Seattle, Wash.

ing the cable lines on James St. and Madison St. The cut at Yesler Way and 3d Ave. approximated 5 ft., that at James St., 13 ft., and that at Madison St., 16 ft. Fig. 1 shows the old and new profiles of the James St. and Madison St. cable lines, these streets being parallel and four blocks apart. The Yesler Way cable line was the easiest to handle. The 4th and 5th Ave. regrades caused considerable work on this line but very little change in grade



Fig. 3. Lowering the James St. Cable Line, Seattle, Wash.

(The top of the grade in the foreground is at the intersection of Third Ave. The left-hand track is at the new grade. The right-hand track has to be lowered 10 ft.)

was required, as both of these streets go under Yesler Way, which necessitated the construcion of viaducts. The profiles in Fig. 2 show the old and new grades of the Virginia St. electric line which was abandoned during the Denny Hill regrade work. The maximum cut on this line was about 108 ft., at the intersection of Blanchard St. and 4th Ave. On the Jackson St. line the maximum

cut was approximately 90 ft., with fills on Seattle Boulevard of 27 ft. and under.* The 3d, 4th, 5th and 12th Ave. regrades were steam-shovel projects. The Jackson St. and others were done by hydraulic grading and the Denny Hill regrade was a combined hydraulic and steam-shovel project. Under the terms of the street railway company's franchises the following quantities of earth were paid for by the company:

	Cu. yd.
Virginia St.	140,810
Jackson St.	96,650
Pine St.	30,485
Third St.	22,285
Twelfth St.	13,501
Fourth St.	9,515
Fifth St.	2,058
Total	317,304

Changing Grades on the James St. and Madison St. Cable Lines

The cable lines were all carried on cribbing during the regrading work, as shown by the accompanying views. The profiles in Fig. 1 show the changes of grade on two parallel stretches of the James St. and Madison St. lines, which lines are four blocks apart. Prior to the regrade



Fig. 4. James St. Cable Line Supported on Cribs across 3d Ave. during the Excavation for Regrading

work on 3d Ave., the James St. line operated over a grade of 18.5%, a temporary grade of 19% having been maintained between 3d and 4th Aves. during the progress of the work. Fig. 3 shows the manner of handling the tracks on James St., and gives a fair idea of the method of cribbing used. It shows the north (left) track at 3d Ave. lowered practically to the new grade, with the south (right) track on the cribbing still to be lowered about 10 ft.

This lowering was done in stages after the close of service each night and before operation was resumed the following morning. A lowering of 5 ft. in a track during one shift of about four hours was the best record made. Beveled shims were placed under the shoulders of the yokes to maintain the grade in all positions. Fig. 4 is looking south on 3d Ave., showing a view of the cable tracks at James St., and the regrade work in progress between Jefferson and James Sts.

*The profile of this line, with the new and old grades, was shown in our issue of Nov. 12, 1908.—Editor.

The most difficult piece of cable track to handle during this regrade was on Madison St., with a cut of 16 ft. at 3d Ave. (Fig. 1). Six nights were required to bring these tracks to grade at that point. The men on the day shifts handled all ditching, secondary cribbing, and placing of timber for the night crews. Prior to the regrade, Madison St. cable line was operating over a 20.4% grade between Second and Third Aves. It is now a grade of 16.7%. A temporary grade of 19.9% was maintained during this work between 3d and 4th Aves. Fig. 5 shows the regrading work in progress at the intersection of Madison St. and 3d Ave. The men at the left are standing at approximately the new grade. The tracks are on cribbing, ready to be lowered, the ends of the cable yokes resting on the top timbers.

The regrade on 3d Ave. reduced an 8% grade from 2d Ave. to the alley east of 3d Ave. to 4%, and increased it to a permanent 10% grade east of that point. The 3d Ave. regrade was followed very shortly by the 4th Ave. regrade, and the latter by the 5th Ave. regrade. This removed the temporary grades previously mentioned between 3d and 4th Aves. on James and Madison Sts. The



Fig. 5. Lowering the Madison St. Cable Line, Seattle, Wash.

(The car is standing just beyond the intersection of Third Ave. The street has been excavated, and the tracks are supported on cribs built on the new grade line and are ready to be lowered.)

Madison St. line at 4th Ave. was readily handled, as the cut was but 9 ft. This placed Madison St. on its permanent grade between 2d and 5th Aves., which is shown in Fig. 1.

The conditions at James St. were much more complicated. With a cut of 27 ft. it was impossible to handle this track at the intersection of 4th Ave. as it had been previously handled at 3d Ave. Cribbing was used between 3d and 5th Aves. with the exception of the intersection of 4th Ave., where frame bents were sunk to the finished grade, allowing the 4th Ave. tracks to be operated beneath those of James St., as shown in Fig. 6. This view, however, shows the structure after the earth was removed by the steam shovel, which is seen working in the background. Owing to the great distance that it was necessary to lower these cable tracks, it was not considered safe to proceed as in the former cases, so a permit was secured from the Department of Public Utilities to close this line during the process of lowering. This was possible on the James St. cable, owing to the fact that the

line is but 3700 ft. long and connects with a distributing point at its outer terminus. The distributing point was moved four blocks to the north, connecting with the Madison St. cable line at that point so as to accommodate the public.



FIG. 6. THE JAMES ST. CABLE LINE SUPPORTED BY TRESTLE BENTS (INSTEAD OF CRIBBING) AT 4TH AVE. TO PERMIT OF TRAFFIC OPERATION ON THE 4TH AVE. LINE

(The track on the trestle is at the original grade and is to be lowered to the grade of the track beneath. The building marked A is shown also in Fig. 8, which is a view of another stage of work in the same place.)

A 15-day shutdown was necessary to bring these tracks to the permanent grade. They were lowered as shown in Fig. 8. Here the right-hand track and one section of the left-hand track have been lowered, and the men on the cribs are lowering the adjacent section. The frame bents at 4th Ave. were removed and replaced with cribbing and then the tracks were cut, and lowered in sections.

When this work was completed a temporary grade was maintained at 20% and 21% up to 5th Ave. This has since been placed on a permanent grade in connection with the regrading of 5th Ave.

METHODS OF PROCEDURE

The organization on the work was composed of a day crew and a night crew; each consisted of one bridge foreman, one sub-foreman with 12 men and one track foreman with 15 men. These crews were duplicated for night work. All of the work was done by company force, except the removal of the earth after it had been thrown from our right-of-way by our men. The hauling away was done under contract with the contractor at work on the street.

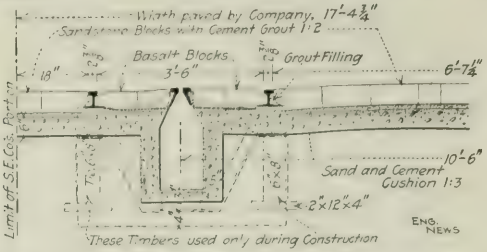


FIG. 7. HALF CROSS-SECTION OF THE CABLE-RAILWAY CONSTRUCTION ON JAMES ST., SEATTLE, WASH.

(This shows the yokes and concrete of the conduit, and also the paving in the width of street, which the railway company is required to pave.)

The cable line construction was all on cast-iron or built-up yokes, spaced in most cases 5 ft. apart. Cribbing was placed under each alternate yoke, the intermediate yokes being dug out and changed, as the old yokes were rather light; and as the permanent work was to be in paved street with concrete base, heavier yokes were put in throughout the district. The digging out and placing of cribbing at alternate yokes was done largely by the day crews; they prepared everything as near as possible for the night crews to take up the work, new yokes being placed at the alternate points as before mentioned. Throughout this district, where the rail was of a light



FIG. 8. LOWERING THE JAMES ST. CABLE LINE ACROSS 4TH AVE., SEATTLE, WASH.

(Owing to the great change in grade at this point traffic was suspended and the tracks were cut, as shown at the left. The men on the cribs are lowering the last section with jacks. The Fourth Ave. tracks may be seen just beyond the spade in the middle of the view. This crossing is the same one shown in Fig. 6, and the building marked A appears in both views.)

section, new 60-lb. rail was placed before any raising or lowering was started.

We usually took from 80 to 100 ft. of single track at a stretch for one setting of the jacks, and lowered from 6 to 8 in. and in rare cases, 12 in. The question of the amount of lowering depended somewhat upon the vertical curves at the street intersections, where it was necessary at frequent intervals to cut the rail. An average of six jacks was used on each section. We had no curves to handle, other than the vertical curves mentioned, and the principal difficulty in lowering these was the possible change in shortening or lengthening of the track. The rails, joints and slot rails were in good alignment and surface after this handling, considering the work, as we renewed all the yokes and light rail before attempting any lowering. Of course these tracks were not placed to permanent line and grade until the very last thing, when we were ready to lay the concrete and put in the paving. There was no settlement of our cable tracks, for the reason that all of these were in excavated portions of the street. All of our electric tracks, as mentioned already, were removed from the regrade district. When they were replaced on fills they were not placed in paving, and in fact very little of the electric track in those filled districts mentioned has been paved even to date.

In most cases the contractors on the street removed all the earth between our tracks and the property line that it was safe to remove before we did any work on the tracks themselves. The earth was then thrown out (as previously mentioned) at the alternate yokes and pits dug in which to place the cribbing. (See Fig. 5). The procedure was then as described above. After all excavating had been completed and the tracks lowered to approximately the permanent grade, grade stakes were set for all four rails along the tracks in the portion to be paved; and on the two outside stakes line was also established one foot from the gage of the rail. Of course the tracks in this position had very little support aside from the small blocks under the shoulders of the yokes holding them in position. The tracks were then placed to line and grade and forms set for concreting. Fig. 7 shows the concrete section on these cable lines. After this concreting was completed, the paving (of whatever nature) was placed.

The only material variation from the methods described was the using of frame bents at the intersection of James St. and 4th Ave. where the cut was excessive, as mentioned already.

Traffic Operation During Changes

The average headway on the cars of our cable lines was 2½ min. on the Madison St. cable, and 3 min. on both James St. and Yesler Way, with a shortening of about a minute during the rush hours. The speed of our cables at the time of this regrade work was 11.3 m.p.h. for Madison St., 9.4 m.p.h. for James St., and 11.1 m.p.h. for Yesler Way.

The principal precautions taken to insure safe movement of cars were in the nature of keeping track-walkers or watchmen on the work. It was their special duty to keep all bolts properly tightened, and all shims and wedges in place; and in case of any irregularity which they could not care for, to get into immediate touch with the office or call upon other men working on the job to set things right. There was but one derailment during all this work; that was on Madison St., and did not result in anything serious. The only other accident that we had was caused by the breaking of a sewer at 4th Ave. and Madison St. during a heavy storm which washed out several of the crib bents. This caused a delay in the service of but a few hours until the cribbing and track were in shape again for operating.

❖ ❖

New Sewage Treatment and Disposal Standards

In our issue of Dec. 19, 1912 (p. 1159) we published a brief editorial summary of the Eighth Report of the Royal Commission on Sewage Disposal,* which report is devoted wholly to standards for effluents from sewage treatment works and to a standard for sewage disposal without treatment. We now abstract the report at some length, as follows. Interested readers are referred to the report itself.

First of all, the Commission proposes the repeal of the British law which for 36 years has virtually demanded that all sewage discharged into non-tidal waters must be purified to a high degree, quite regardless of all local conditions. In place of this Quixotic requirement, which was never generally enforced, but which caused the waste of millions of pounds sterling needed for other purposes—the Commission recommends standards which may be applied, modified or entirely set aside, in accordance with all the governing local conditions affecting natural drainage districts in general and individual towns or sewage disposal systems in particular.

The one inflexible thing about the standards is that the discharge of sewage into a stream shall not create a nuisance as regards "smell, over-development of gray algal growths, accumulation of putrefying sewage solids and detriment to fish life." Extended studies by members and officers of the Commission have shown that suspended solids and oxygen consumed in five days afford satisfactory chemical tests upon which to predicate the likelihood of a nuisance. Where the dilution is small, as is so frequently the case in England, both these tests are advised, but where it is relatively large, the oxygen consumed determination may be omitted and the permissible amount of solids may be increased by degrees until even the solids may be disregarded, unless local conditions demand such minor removal as can be effected by screening or detritus tanks.

The standards set up are based, first of all, upon experiments and observations which showed that when water from the dry-weather flow of a stream takes up no more than 0.4 part per 100,000 of dissolved oxygen in

*The report proper comprises less than twenty pages and is published in London at only 3d or about 6c. by Wyman & Sons, Fetter Lane, E. C., London, England. Probably 1d. extra would be charged for postage to the United States. We are not yet able to state the price of the appendix, but it is likely to be several shillings. Those who wish to order direct can best make remittances by international money order.

five days at a temperature of 65° F.* the stream "will ordinarily be free from signs of pollution." In order to apply this limiting figure in practice it is necessary to take into account the oxygen absorbing powers of both the stream which is to receive an effluent, and the effluent itself, as well as the relative volumes of the stream and the effluent. Taking 0.4 as the limiting figure, we have:

$$\frac{x + y}{z + 1} = 0.4$$

where x = parts of dissolved oxygen taken up per 100,000 parts of effluent; y = the same for the river above the outfall; and z = the dilution (proportion of river water to effluent).

Applying this to an effluent which absorbs 0.1 part of dissolved oxygen in five days, and is discharged into a stream having ten times the volume of the effluent, we have:

$$x + \frac{(0.1 \times 10)}{10 + 1} = 0.4$$

which becomes

$$x + 1 = 4.4$$

and $x = 3.4$ parts of dissolved oxygen.

To permit a different effluent standard for each works would result in difficult central administrative problems, an unequal distribution of burden on each community in a drainage area, and "would go further in the direction of differentiation than is necessary to insure economy." It was therefore decided to have only a few standards and to have each of those conform approximately to the "degrees of purification attainable in practice by different systems of treatment properly supervised." Three "methods of sewage treatment" arranged in ascending order of efficiency and (broadly) of cost, were chosen and standards worked out to conform to these. In addition a standard was provided for sewage discharge without treatment. The three methods were: (1) "Simple settlement or septic tank treatment," and, (2) "settlement with the aid of chemical precipitation," each of which is an "incomplete system," and (3) "complete systems, including biological treatment of the liquor in artificially constructed filters or on land."

Before corresponding standards could be formulated, it was necessary to decide what should be considered a standard diluting water. From actual studies of rivers the following gradations of river quality and of parts of per 100,000 oxygen absorbed in five days were found to correspond: Very clean, 0.1; clean, 0.2; fairly clean, 0.3; doubtful, 0.5; bad, 1.0. It was decided to take a "clean" river, or one absorbing 0.2 parts of oxygen, as a normal stream for standard framing purposes.

Taking up next a standard for towns or works where the available dilution is small, and therefore a "complete treatment" is necessary, the Commission recalls the fact that in its fifth report it insisted on the importance of limiting the suspended solids in the effluent from "complete treatment" works and laid down 3 parts of solids per 100,000 as that limit—a standard which had "been commonly attained" at "a number of places." This standard is retained. In the fifth report also a dissolved oxygen standard of 1.5 parts per 100,000 taken up in five days, was recommended, but this was after the effluent had been passed through filter paper. Later investigations having shown that here are serious "practical difficulties in the way of removing suspended solids in a uniform manner, either by filter paper or otherwise," the Commission concluded that the "dissolved oxygen absorption test should be applied to the effluent as discharged, i.e., with its suspended matters."

After taking into account results obtained in practice at various works, the Commission decided upon and recommended a dissolved oxygen standard of 2.0 parts per 100,000 which, after allowing "for the oxygen taken up by the solids, is slightly more stringent than that previously suggested by us." Quoting a bit from the report:

> An effluent, which takes up 2.0 parts of dissolved oxygen in five days, will need some dilution if nuisance is not to be caused. The minimum degree of dilution required for safety can be ascertained by applying the formula on the lines already indicated, thus:
>
> $$\frac{2 + (0.2 \times z)}{z + 1} = 0.4, \text{ or } z = 8$$
>
> We think it may safely be assumed that the great majority of effluents are diluted by more than eight times their volume of river water.

It should be remembered that this standard of 3 parts of suspended matter and 2 parts of dissolved oxygen applies to conditions demanding sewage works for "complete treatment." It is recommended as a "normal standard," to be of general and uniform application except where a proper central authority [still to be created de novo or designated from existing government departments—Ed.] grants an application for a lower standard, on the one hand, or, on the other, sets up a "specially stringent standard" to meet exceptional conditions—chiefly very small dilutions. The Commission wisely leaves such stringent standards for determination to suit the needs of each particular case.

Under no circumstances, the Commission says with emphasis, is meeting a standard, no matter how stringent, to be *"held to justify the use for drinking purposes of streams receiving those effluents without subsequent treatment by the water-works authority."* [Italics ours. —Ed.]

Claims for "Relaxation of Normal Standards," the Commission states, may be entertained:

> (a) When it can be shown that the particular river water is of such quality and volume that when mixed with a sewage or sewage liquor of known or calculated strength and volume it does not or would not take up more than 0.4 parts per 100,000 of dissolved oxygen in five days; and
>
> (b) When there is reason to suppose or when it can be shown that the river will receive no further pollution until it has recovered itself so far as not to take up in five days an amount of dissolved oxygen much in excess of that which it took up before receiving the first discharge.

Since the main effect of "incomplete systems of treatment" is to reduce the suspended solids in sewage, dissolved oxygen is omitted from the "relaxed standards," leaving the diluting river water to provide this. But though dissolved oyxgen does not appear in these standards, it was used in the studies on which they are based.

Making use of the 0.4 parts per 100,000 limiting figure of dissolved oxygen, and "taking as a basis the rate of absorption of atmospheric oxygen by water and the rate of de-oxygenation of the admixture of various sewage liquids," the Commission states that it has "calculated the number of dilutions which would be required in order that the dissolved oxygen content of the mixtures should not fall below a certain figure." It has also noted the "effects produced at different seasons and under different conditions," by the discharge of "partially purified and unpurified sewage" into streams. Among the "different

*This was taken as a standard rather than the four-hour permanganate test because the five-day test corresponds more closely with observed conditions in streams, is more delicate, and is essentially a bacteriological test.

conditions" observed were depth and velocity of stream flow. Tables and text are used to show how the Commission deduced its "relaxed standards," which it has based upon actual tests with different classes of effluents and sewages and different grades of diluting water. In some of the tests depths of river water in feet were observed and also the length of time required for the "sewage liquors" and the river water to mix.

After working out to exact figures the necessary dilutions for different classes of effluent, the Commission chose three general classes of effluent, corresponding to the reductions in suspended solids, which may be expected from two kinds of tank treatment and no treatment at all, as stated more specifically in the summary of the report given further on.

As to the administration of the recommended standards, the Commission suggests that the normal standard should be fixed by "Statute or by Order" [departmental order?—Ed.]. Continuing, the report states:

> Compliance with this standard should be obligatory in regard to all discharges of sewage into non-tidal waters, and should be enforced by the Rivers Boards as a matter of routine, except in cases where it is shown to the satisfaction of the Central Authority that in view of local circumstances it is expedient to prescribe either an easier or a more stringent standard. In such cases the Central Authority should be empowered to approve special standards to be enforced by the Rivers Boards in the place of the general standard.
>
> The Central Authority will naturally pay special attention to waters, which are to be used for potable purposes, and, in the case of such waters, any application for the alteration of the general standard would be closely scrutinized.

The Commission considers the drinking water question so vitally important that it repeats the conclusions on that subject which it published in its Fifth Report. These may be briefly summarized as follows:

The Rivers Pollution Prevention Act of 1876 [rigid as it was—Ed.] was not designed to compel the purification of sewage to such a degree that the stream receiving it would afford a safe water-supply without filtration. The various systems of sewage treatment in use do not produce bacterially safe sewage effluents, as has been shown by exhaustive studies made for the Commission, and while those effluents might be rendered "fairly pure, bacteriologically," by further treatment the cost "would be serious." Furthermore, "a false sense of security" would result from such further treatment "unless, at the same time, storm overflows on sewers were abolished," since the discharges from such overflows "are frequently more impure, bacteriologically, than the normal crude sewage." The practicability of the abolition of storm overflows is doubtful, and even if a separate system of sewers were built it would be necessary to purify the storm sewage as well as the sanitary sewage to protect water-supplies if the sanitary sewage were to be purified for that purpose. The cost of separating storm and sanitary sewage, and of treating both so as to render the effluents bacteriologically safe "would in most cases be practically prohibitive"; and "even if this additional burden were placed on local authorities, the water of rivers would still generally require to be treated before it could be safely distributed for drinking purposes." The closing paragraph of the Commission's excerpt from its fifth report we reprint in full:

> Apart from the question of drinking waters we find no evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of our knowledge, we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure.
>
> We do not now suggest that the general standard should apply automatically to tidal waters as in the case of non-tidal waters, but we think that the principle which we have recommended in regard to special standards for streams might usefully be applied to tidal waters, where a standard is considered necessary.

Perhaps we should interject, that in an earlier report the Commission advised the formation of Rivers Boards for all the natural drainage areas of England (a few such boards have been in existence for many years) and that it also advised the creation of a Central Authority (which we presume might or might not be the present Local Government Board) to have general jurisdiction of the whole matter of sewage disposal. The Rivers Boards would deal directly with local authorities. This general plan is still favored by the Commission in its present report. As to how Rivers Boards should proceed in bringing local authorities to a compliance with whatever standards may govern in a given drainage area, we note that first of all it is assumed that they will "proceed by degrees," beginning with the larger towns. To quote:

> As a rule the areas draining into the head waters of a river are not densely populated, and consequently the pollutions derived from them, though they may be relatively large as compared with the volume of the small tributaries into which they discharge, occur at comparatively wide intervals, and do but little damage of a lasting character to the main stream. On the other hand, the pollutions arising from the larger centers of population, which are generally situated on the middle and lower reaches of a river, are not only more lasting in their effect, but owing to the extent of the requisite purification works, take longer to remedy.
>
> We think, therefore, that the Rivers Board might be well advised to turn their attention first to securing compliance with the standard by the larger towns whose works were as yet inefficient. The smaller communities might meanwhile employ this period of grace either in making provision for a scheme of sewerage and sewage disposal, which would be adequate for their increasing requirements, or, if their population were stationary or diminishing, in adopting some system of dry conservancy which would materially lessen the amount of pollution which entered the river.

Coming now to the close of the report, we reprint the Commission's own summary of its conclusions (the explanatory title being our own), as follows:

STANDARDS FOR SEWAGE EFFLUENTS TO BE DISCHARGED INTO NON-TIDAL WATERS, WITH CORRESPONDING STREAM DILUTIONS WHERE PARTIAL TREATMENT OR NO TREATMENT IS REQUIRED

(a) The law should be altered so that a person discharging sewage matter into a stream shall not be deemed to have committed an offense under the Rivers Pollution Prevention Act, 1876, if the sewage matter is discharged in a form which satisfies the requirements of the prescribed standard.

(b) The standard should be either the general standard or a special standard, which will be higher or lower than the general standard as local circumstances require or permit.

(c) An effluent, in order to comply with the general standard, must not contain as discharged more than 3 parts per 100,000 of suspended matter, and with its suspended matters included must not take up at 65° F. (18.3° C.) more than 2.0 parts per 100,000 of dissolved oxygen in five days. This general standard should be prescribed either by statute or by order of the central authority, and should be subject to modifications by that authority after an interval of not less than ten years.

(d) In fixing any special standard the dilution afforded by the stream is the chief factor to be considered. If the dilution is very low it may be necessary for the Central Authority, either on their own initiative or on application by the River Board, to prescribe a specially stringent standard, which should also reman in force for a period of not less than ten years.

(e) If the dilution is very great the standard may, with the approval of the Central Authority, be relaxed or suspended altogether. Our experience leads us to think that as a general rule, if the dilution, while not falling below 150 volumes, does not exceed 300, the dissolved oxygen absorption test may be omitted, and the standard for suspended solids fixed at six parts per 100,000. To comply with this test no treatment beyond chemical precipitation would ordinarily be needed. If the dilution, while not falling below 300 volumes, does not exceed 500, the standard for suspended solids may be further relaxed to 15 parts per 100,000. For this purpose tank treatment without chemicals would generally suffice if the tanks were properly worked and regularly cleansed. These relaxed standards should be subject to revision at periods to be fixed by the Central Authority, and the periods should be shorter than those prescribed for the general or for the more stringent standards.

(f) With a dilution of over 500 volumes all tests might be dispensed with and crude sewage discharged, subject to such conditions as to the provision of screens or detritus tanks as might appear necessary to the Central Authority.

EDITORIALS

A cousin to that famous (or infamous) worm that for years has been eating the life out of steel rails, has been found, or is in process of being found, in the form of an insect that destroys cast-iron pipe! Breaks in water mains at Syracuse, N. Y., according to the *Journal* of that city, showed the cast iron softened so that it could be cut like lead. A water-pipe manufacturer, whether the one who made the pipe does not appear, is said to have written to a Syracuse official advancing the theory that some minute insects, which frequented the water there (at Atlantic City, N. J.) exuded an acid secretion, which in conjunction with the salts in the water, set up an electrolytic action and softened the pipe. Perhaps this is the case at Syracuse.

It is further stated that some of the Syracuse pipe has been turned over to the Chemical Department of Syracuse University for investigation. Ought it not to have gone to the Department of Biology, Division of Entomology? Or, perchance to the Division of Parasitology, since, whatever the form of life, this cast-iron pipe eater is unquestionably a parasite.

The Latest Concrete Failure

The failure of the reinforced-concrete garage in Detroit, described elsewhere in this issue, is another of those catastrophes which could easily have been predicted from the elements that went into the building. Consider what they were: an architect quite ignorant of structural design, the designer a commercial firm whose responsibility ended with the sale of the steel, the contractor a mere renting agent of equipment, a building department incompetent to guarantee observance of its own code, and finally a contract between owner and builder which encouraged cheap material and methods. Is it any wonder that the building had numerous members designed with too low a factor of safety, that the concrete was weak, that the methods of construction were improper and that death and loss were the ultimate end of the project?

Competent engineers can learn nothing from the failure that will aid them in future design. The errors which marked the design and construction have long since been set down as errors; the fatal consequence of disregard of good practice only emphasizes what was already known. The important lesson from the failure is that these errors were the natural result of the system under which the garage was built.

As long as architects turn over structural design to steel salesmen, and steel salesmen design structures which they do not follow beyond the drafting room and paying-teller's window; as long as contractors play with concrete framework as though it were a concrete sidewalk which cannot fall down, so long will honest concrete men be kept busy explaining that a certain failure was due to ignorance and negligence.

The concrete trade press has called this collapse "another workmanship failure." That is an incomplete characterization. The responsibility is just as heavy on the architect and the designer, even if the structure as designed would have stood forever if built by an honest and competent contractor. In the concrete business more than in any other branch of engineering, the engineer must design with an eye toward the construction and must have always before him a clause which should be in capital letters in every code of engineering ethics—"It is unprofessional for an engineer to sell a design the execution of which he cannot supervise."

Finally, the failure shows up clearly the futility of half measures in revising building laws. Detroit apparently is justly proud of its new building code, which is administered by well paid political appointees; perhaps now its citizens will understand that a few engineers might be of value to execute the law.

Selling Irrigation Water by Current Meters

A notable departure in the measurement and sale of water for irrigation is described on pp. 66 to 70 of this issue. It is the daily use of some 25 to 30 current meters on the 66 main-line delivery canals through which the California Development Co. supplies water to 245,000 acres of land in the Imperial Valley, Southern California. This use has necessitated the establishment of 66 meter stations and a meter-rating station, and requires the employment of a considerable force of hydrographers in place of the usual zanjeros.

Conditions pertaining to the Imperial Valley and to the large size of its irrigation system are in large part responsible for this departure in irrigation-water measurement, as may be learned from the article already mentioned, but the use of current meters and of other accurate engineering devices on irrigation works is sure to grow, and with it will come a demand for more hydrographers and engineers.

Two significant facts brought out by the article deserve attention: (1) the overcoming of the opposition to the use of current meters on the part of the mutual water companies and of the farmers which compose them, and (2) the part which the more accurate measurement of the water and also the more perfect control of its distribution has played in putting a once bankrupt property on a paying basis.

The New British Standards for Sewage Treatment and Disposal

To the brief editorial summary of the new British standards for sewage disposal into fresh-water streams, which appeared in our issue of Dec. 19, 1912 (p. 1159), we now add a somewhat extended abstract (pp. 76-78) of the report. While for use in this country the standards may require modification to adapt them to a considerable range of different governing conditions, they reserve careful consideration here because they are based on sound principles of sanitary science and public economy; they are closely correlated with the results obtainable from widely used and well approved methods of sewage treatment; they recognize the fact that no

one standard will suffice; they accept dilution as one of the governing factors of sewage disposal, and acknowledge that when the dilution is sufficient no treatment is necessary; they make freedom from nuisance or offense to the nose and eyes the ultimate standard for sewage disposal; they place the burden of health defense against sewage pollution on water purification—in short, the British standards deserve consideration here because they are based on the sort of everyday Anglo-Saxon common-sense that is bound to appeal to any and all persons possessing that quality on both sides the Atlantic.

The Engineer as a Guardian of Public Credit

The old idea that the engineer is a purely technical man who has no business to discuss or interfere in questions of economics, finance and commerce, was brought forward again by George Clinton, of Buffalo, in the recent Rivers and Harbors Congress at Washington. According to newspaper reports of Mr. Clinton's speech, he said: "Congress is a hundred times better informed than the engineers as to the necessity of waterway improvements. Engineers lose sight of the great economic principle involved, that the projects are not only meant to meet existing needs, but are also for the development and building up of traffic."

If Mr. Clinton's advice were sound and if Congress were to pay no heed to the advice of engineers, but listen solely to the promoters of waterway enterprises, the road to national bankruptcy would be a very short and steep one. The Government has in fact expended a good many million dollars on waterways in the hope that traffic would be developed on them, but the waterways remain unused.

It seems almost needless to say in the columns of this journal that it is as much the duty of the engineer who investigates a project to estimate and weigh its future commercial probabilities in order to make proper provision for them as it is his duty to make measurements, drawings and designs, select necessary machinery, and conduct the technical part of the work.

With all due respect to the abilities of members of the House of Representatives and the Senate, it may well be asked what proportion of them ever had any training or experience in the scientific investigation and estimation of industry, commerce or traffic? Fully three-fourths of the members of Congress are lawyers. If they were placed on the witness stand before a judge, they would almost without exception disclaim any expert knowledge in connection with industrial matters or matters of economics and traffic. An engineer dealing with large transportation problems must possess some degree of expert knowledge in this field to be competent for his task.

Fortunately for the country, the Congressmen themselves understand better the value of engineering advice than does Mr. Clinton. They fully appreciate that while the delegations of waterway promoters from this and that and the other district are each seeking appropriations for their own pet schemes without regard to the larger interests involved, the government engineers deal with the questions submitted to them from an unbiased standpoint, and with an expert understanding of technical and industrial conditions which is an essential to safe judgment.

Revelations Concerning New York State Highway Work

As most of our readers are aware, New York has embarked upon the largest venture in state highway construction of any state in the Union. It has already expended on the construction of improved roads the money raised some five years ago by a $50,000,000 bond issue, and at the last election in November an additional bond issue of $50,000,000 was approved by popular vote.

ENGINEERING NEWS has voiced the sentiment, held we know, by most conservative engineers, that the financing of this road work by the issue of long-term bonds, which will not become due until long after the roads built with it are worn out, is an economic crime.

But the State of New York is not only building roads with borrowed money which future generations will have to repay. It has permitted inefficiency and wastefulness and dishonesty to creep in in the expenditure of this borrowed money.

We need not take space now to rehearse in detail the scandals in connection with some of the early work done on the New York State roads. Part of the failures in that early road work were due to placing incompetent men in charge; part of them were due to the fact that even the ablest engineers were a good deal at sea at that time as to what sort of a road could be built which would stand automobile wear, and part of the troubles were due to common graft.

As the result of these unfortunate experiences, an act was passed in the administration of Governor Hughes, placing the state highway work under control of a non-partisan commission. It was hoped that under this commission there might be built up an efficient, non-political engineering organization, which should expend the state's money on good-road construction in the most economical and efficient manner possible. The prospect appeared brighter at that time that highway construction in New York might be placed upon a sound and economic basis than under any previous administration.

Unfortunately, as we believed and still believe, Governor Dix, when he assumed office two years ago, immediately promoted legislation abolishing the non-partisan highway commission and substituting a commission composed of the State Superintendent of Highways, the State Engineer and the State Superintendent of Public Works.

To lay a groundwork for advocating this proposed change, the Hughes commission and its engineers were charged with inefficiency and incompetency. The fact that many highways were rapidly going to pieces under heavy automobile wear gave sufficient color to these charges to make them pass muster, and the legislature made the change which the Governor recommended.

Had Governor Dix selected for appointment as Superintendent of State Highways an engineer of high standing and experience, with rugged ideas of what constitutes professional honesty and sufficient backbone to hold his own against opposition, New York might still have had honest and efficient conduct of its state highway work.

Instead of pursuing this course, however, Governor Dix appointed to this important office, charged with responsibility for the execution of many million dollars' worth of work, Wm. H. Catlin, a man nearly 70 years of age, possessed of neither engineering knowledge or experience, whose previous business life had been spent as a farmer and real estate dealer. In the fall of 1911, however, Mr.

Catlin's death occurred and C. Gordon Reel, Assoc. M. Am. Soc. C. E., who had been Deputy Superintendent of Highways, was appointed Superintendent.

At various times and from various sources during the past year or two there have appeared reports that the New York highway construction was being carried on with little regard to sound engineering principles. Statements definite enough for publication, however, have been lacking. The New York *Sun*, however, in its issue of Jan. 2, published a letter written by Superintendent of Highways Reel to Governor Dix, on Sept. 9 last, in which Mr. Reel makes definite categorical statements as to the methods which have been pursued in the conduct of the state highway work.

According to the *Sun*, Mr. Reel went to Governor Dix last summer and declared that he did not propose to be held responsible for the manner in which the state's road work was being conducted. After explaining the situation in detail, Governor Dix requested Mr. Reel to put his statements in writing, and the result was the letter which the *Sun* prints.

The gist of Mr. Reel's letter is that the specifications for much of the New York highway work have been so drawn as to require the use of materials furnished by certain concerns at a price much in excess of the cost at which equally good materials could be obtained in the open market.

It was proposed, for example, to use a patented reinforcement in certain concrete roads which were being constructed. The cost of this reinforcement was 4½c. per sq.ft. at the factory, whereas an equally good or better reinforcement obtainable in the open market could be had at a cost of 1.3c. per sq.ft. This would make a difference in the cost of a 16-ft. road of over $2800 per mile. Mr. Reel also states that 3000 ft. of this expensive construction which was actually used on a roadway in Saratoga County proved a failure. Had the Division Engineers in the state service adopted this expensive reinforcement in their designs to the extent to which their instructions from their superiors originally required, Mr. Reel estimates that the additional cost to the state would have been over a quarter of a million dollars.

Mr. Reel next reviews the department's experience with the so called "rocmac" construction. He states that the specifications for 16 roads, aggregating over 65 miles, were changed in the office of the Chief Engineer to require "rocmac," this change being made after the specifications had been drafted by the Superintendent, the Chief Engineer and six Division Engineers in conference. We quote as follows from Mr. Reel's letter:

> Rocmac has been sold at varying prices, 20 cents, 22 cents and 28 cents, the highest price being 30 cents per gallon. As soon as the 65 miles was specified the price became 45 cents per gallon. At this extra price of 15 cents for the specified mileage, the extra cost to the State would be (allowing for the difference between the Imperial gallon and the U. S. gallon) $53,310.
>
> The whole rocmac proposition created a scandal throughout the state and of the 13 roads specified, supplementary agreements were etered into on nine roads, substituting 7- and 9-in. asphalt bituminous construction for the rocmac for 45.8 miles and at a saving of $15,550.
>
> The four roads, which were allowed to remain rocmac have given endless trouble. The specifications are not practicable and one of these was recently changed to another type of construction.

Mr. Reel then narrates the department's experience with the so called "dolarway" construction. He states that strong influences were exerted by men in high authority in the department to have this construction specified for about 300 miles of road, which were put under contract in June and September last. This construction consists of covering a concrete road with a thin coating of bituminous material. Mr. Reel states that the prices charged for the material were 10c. *per sq.yd.* for the material delivered in tanks and 11c. per sq.yd. in barrels. Allowing 0.4 gal. of the material per square yard of coating, this would be equivalent to a price for the material of 25c. per gal. in tanks and 27½c. per gal. in barrels. Another manufacturer of bituminous products, however, offered to supply bituminous materials, which Mr. Reel states were identical with this high priced material, at 6½c. per gal. in tanks and 8½c. in barrels. The state is now using this cheaper material, although, according to Mr. Reel, men of prominence in the department are still making strenuous endeavors to have the more expensive materials used.

Mr. Reel then takes up the so called "Hassam pavement," which consists substantially of building a concrete roadway by covering the road with broken stone and then filling the interstices between the broken stone with grout. Mr. Reel states that the State Highway Commission decided to use about 10 miles of this pavement as an experiment, and in the contract letting last April it was specified for a road 5.6 miles long in Chenango County and one 5 miles long in Schoharie County. We quote *verbatim* from Mr. Reel's letter as follows:

> The total royalty at 85 cents per square yard amounted to $85,052. Subsequently the Hassam company reduced its price to 25 cents per square yard and has now reduced it to 10 cents per square yard. At this latter price, 10 cents per square yard, I think their pavement is available and we will use a considerable amount of it.

Mr. Reel quotes further examples where bituminous materials were sold to contractors for state road construction at 9c. per gal., but for repair work done by the state with its own forces the same material was charged to the state at 13c. per gal. He also states that he found upon inspection that certain roads where these bituminous materials were being used were failures.

In connection with Mr. Reel's letter, it is of interest to note that Governor William Sulzer, who assumed office on Jan. 1, in reappointing Duncan W. Peck State Superintendent of Public Works, informed him that notwithstanding the law which makes him a member of the State Highway Commission, he should have nothing to do with the state highway work. Mr. Sulzer is also quoted by the *Sun* as saying: "I have no hesitancy about saying that State Engineer Bensel has all he can do with engineering and surveying. Neither will he have any more to do with state highways, either in building them or maintaining them. My message will give the people the key to what I propose to do about state highways."

Reference to this matter in Governor Sulzer's message to the Legislature was as follows:

> In the near future I shall communicate to you some further views by way of recommendations regarding the building and maintenance of good roads and the complete reorganization of the Department of Highways into the Department of Good Roads, having a single responsible experienced and competent head with full powers to do the work required along safer, and better and more comprehensive lines, in order to promote greater economy and a higher degree of efficiency in the future building and maintenance of good roads.

In his annual report just issued, State Engineer Bensel himself says:

> It is my opinion the method of organization should be

changed and the Highway Commission put in control of the work as a commission, or that it be placed under a single head. So much work is put on the State Engineer that it is not possible for him to attend to the work required in the Department of Highways.

It should also be said that Governor Sulzer has declared his intention to appoint an investigating commission with power to inquire into the conduct of state work in various departments, and it is understood that the conduct of the state highway work is one of the matters which the investigators will take up.

We have deemed it important to put the above facts on record for the defense of the engineering profession.

If and where the New York highway work proves a disappointment to the taxpayers of the state, the blame need not be laid at the door of the engineering profession. That profession will not stand for incompetency or graft. We believe the rank and file of the engineers on the New York state highway work desire to build the best roads which can be built for the money expended, and have no sympathy with attempts to divert the state's road funds to furnish exorbitant profits to private concerns.

New York, as we have said, has embarked upon the largest experiment in state highway construction of any state in the Union; but it has allowed politics to dominate the work and the natural result has followed. The taxpayers and voters of New York have themselves to blame in that they have permitted this great public work to come under control of a political organization and have thereby opened the door wide to inefficiency and worse in the connection with the expenditure of a hundred million dollars.

It is refreshing to turn from New York's work in state highway construction to the work in Massachusetts. The amount of money which Massachusetts has spent in state road building is a mere trifle compared with the millions that New York has appropriated; but the work in Massachusetts is a model which is studied by road builders from all over the United States, whereas a large part of New York's road work is chiefly notable as a monumental illustration of how not to do it.

As most of the readers of ENGINEERING NEWS know, the Massachusetts highway work has been from the outset in charge of a commission made up of three prominent citizens who have carried on the work on business principles without regard to politics. It is of interest in this connection to quote the following extracts from an address given by Col. Wm. D. Sohier, Chairman of the Massachusetts Highway Commission, before the American Road Congress at Atlantic City last October:

> The primary need in any state highway law is that the taxpayers' money shall be spent by men who know something about the business of road building. In such a law you need more than anything else tenure of office, and nobody in office who is not competent and trained for his work.
>
> The best asset in the Massachusetts Road Department today is the men we have educated and trained. Our engineers are men who have graduated from some technical school and who are when they graduate not worth very much. We hire them for $900 to $1200 a year and in two or three years they really know something about road building.
>
> It is nonsense to talk about getting expert advice and expert knowledge without being willing to pay what it is worth. Our experience in Massachusetts is that various other States are coming in and saying to our men whom we have educated, "you are worth more money to us than you are to them. Come out West."
>
> They took some of our engineers to New York, and they stayed there until there was a political change in administration and now they are back with us!
>
> The man does not live who can do what the New York Highway Commission set out to do and that is start in at once, with no organization, and spend $5,000,000 the first year on road construction and spend it economically. In Massachusetts we have had an organized highway force a good many years, yet it would be somewhat of an undertaking for us to organize next year a sufficient force to spend a million dollars rather than half a million dollars and secure with it as good results on each mile as we now secure when spending the half million dollars.
>
> When the New York State Highway Commission [appointed by Gov. Hughes] went into office, they found that the State of New York had already spent $18,000,000 in constructing state roads, and $3,000,000 was needed to put these roads back into good condition, although none of them were more than four years old and some were only one year old.
>
> A road as a piece of property is at all times a liability, and if you do not keep it up, its construction has done the state, and the country, and the good-roads movement more harm than can be done in any other way. If the men who are interested in highway construction will get together and formulate a plan by which road building shall cease to be political and be placed in charge of experts, they will do more real good than can be done in any other way. Roadbuilding under the Massachusetts Highway Commission has nothing to do with politics. I don't know the politics of more than two of the engineers out of seventy-five.

We earnestly commend Colonel Sohier's remarks above quoted to the attention of Governor Sulzer and the New York Legislature. Massachusetts adopted more than a quarter of a century ago the commission plan of conducting the great engineering works which the state has carried out; the members of the commissions have been appointed by the Governor and have been almost invariably men of high standing and reputation for business ability and integrity.

As a result, the engineering works carried out under state control in Massachusetts have been almost without exception completed without scandal and the state funds have been expended in an economical and efficient manner.

New York also has adopted the commission plan for the conduct of many of its great works, and where the commissions have been made up of capable and honest men, good and honest work has invariably been secured.

The State of Maine is about to expend $2,000,000 on highway construction and the State Board of Trade has secured advice from an expert of the Federal Office of Public Roads as to the proper organization to control this expenditure. The expert advised that the highway system in Maine be placed in the hands of a highway commission to be composed of three members appointed by the Governor and Council, the original appointees to serve three, two and one years, respectively, and thereafter each commissioner to serve three years; the commissioners so appointed to receive a salary of $500 per annum and actual expenses when traveling on official business.

In dealing with the New York highway situation, it is the future that is important rather than the past. Whatever waste or worse has occurred in the expenditure of the first $50,000,000 of New York's road fund is now chiefly important as a guide what to do (and what not to do) with the second $50,000,000. The desideratum is a non-political organization under which competent engineers can be secured for the work and sound engineering methods can be adopted. If Governor Sulzer will create such an organization, there is good reason to hope that succeeding Governors, even though of a different political party, may realize that it would be good politics, as well as an act in the public interest, to leave such an organization undisturbed.

LETTERS TO THE EDITOR

Recent Thefts of Surveying Instruments in New York City

Sir—It may be of interest to the engineering profession in general to publish the following in a prominent place in the next issue of your publication, and thereby put everyone concerned on guard.

Since Sept. 1 of this year there have been numerous thefts of surveying instruments reported to our firm, and we keep a record of such stolen instruments with a view of locating or retrieving the same if offered for sale or repair.

In the last two or three months there has been a regular epidemic of thefts. There have been reported as stolen one level and five transits of various makes, from different offices in various parts of New York City. In each case the method of procedure has been exactly the same. The instrument was removed from the box and unscrewed from the running or sliding board, the latter replaced in the box and the empty box left standing in its usual place. For this reason it has been in most cases impossible to establish the exact date of the theft, as generally there had been no occasion to use the instrument for some weeks, and the theft was not discovered until the instrument was again wanted for use on another job.

From the foregoing it would seem that the same person has been the offender in each case. The various losses have been reported to the police, but as yet no results have been produced by this method.

We consider it our duty to issue this warning to engineers in general to prevent further losses, and we hope that the culprit will be speedily apprehended.

KOLESCH & CO.

138 Fulton St., New York City,
Dec. 23, 1912.

Increased Flow of Springs Just before Rains

Sir—During the last summer and fall I have been studying the Scioto River watershed to the northwest of Columbus, and while so engaged I encountered a phenomenon regarding most of the springs in that section.

A large number of the springs on the west side of the Scioto River fluctuate with the amount of water in the ground. That is, in very dry weather the flow is less than in a wet season, as would be expected, but the thing that struck me as most remarkable was the fact that most of the springs increased their flow before a rain. Some of the springs increased in flow as much as 100% and this for a period of from 1 to 48 hr. previous to any sign of rain.

This fact was first called to my attention by one of the axmen in the party predicting rain when the sky gave every indication of continued fair weather. On questioning him as to his reason, he said that the Quarry Spring was flowing strong, which was a sure sign of rain in 48 hr. I at first passed it without thought, but it was again brought to my attention by some of the oldest inhabitants.

Quarry Spring flows from the side of a rocky point. A small basin has been formed by hand and a 2-in. pipe arranged for the overflow from the basin. In very dry weather the pipe has a capacity of about twice the flow of the spring. Generally this spring will increase its flow before a rain, commencing sometimes 48 hr. before any indication of rain. I do not say that it will increase its flow before every rain, but that it generally does so. The variation of flow of this spring is based on the time required to fill a bucket at the end of the pipe.

There are numerous instances of a similar character covering a strip of country extending 10 miles along the west bank of the Scioto River. My conclusion was that every time there was a decrease in the air pressure the spring increased in flow and that this same decrease in air pressure caused the rain—the latter effect following the lower barometer more slowly.

Evidently the source of the springs is at a considerable distance from the outlet, so that the same atmospheric conditions do not exist at the source as at the outlet.

The driven wells in this vicinity generally give cloudy water before a rain, but the reason I have suggested for the increase in spring flow will not explain the cloudy water from wells.

S. P. BAIRD.

315 Ninth Ave., Columbus, Ohio,
Dec. 15, 1912.

The Sheet-Pile Cut-off on the Port Angeles Dam

Sir—The writer was much interested in the descriptions of the accident to the dam at Port Angeles, Wash., appearing in your issues of Dec. 5 and Dec. 26, 1912. To the writer it appears more than probable that the unfortunate location of the steel sheet-piling at a point 8 ft. down stream from the downstream toe was largely responsible for the failure.

Although it is not so stated in the article, it is possible that it was intended to unite the sheet-piling to the body of the structure by a heavy concrete apron. Even so, it was the height of folly and ignorance to raise the head on the dam while the structure was in such an incomplete condition.

Through a gravel bed, such as appears to have underlain this dam, a flow of water is constantly in process. When a dam is placed on such a bed of gravel the danger is that the head of water in the pond back of the dam will so increase the velocity of the water flowing through the gravel that when it issues from the river bed below the downstream toe it will have sufficient velocity to carry away the particles of gravel and thus undermine the foundation of the structure. Cut-off walls, sheet-piling rear aprons and fore aprons are used to increase the resistance to this flow by forcing the water to take a longer path through the gravel, thus increasing the

friction head and lowering the velocity at exit below the danger point.

In the case of the Port Angeles Dam, the driving of the sheet-piling below the downstream toe had the same effect as the partial closing of a sluice gate; the velocity through the remaining opening or openings was greatly increased. Or to put it differently: The area of discharge before sinking the sheet-piling comprised the entire cross-section of the gravel bed at this point plus the horizontal area from this point to the downstream toe multiplied by the percentage of voids in the gravel. Through driving the sheet-piling this area of discharge was decreased by about one-half the area of the sheet-piling driven. The effect of this was greatly to increase the velocity of the water issuing from the horizontal area of the gravel bed between the sheet-piling and the downstream toe. The foundation was considered dangerous before; it was doubly so after the addition of the sheet-piling in its chosen location.

Had steel sheet-piling been driven at or near the upstream face of the dam to impervious strata; or failing in this, had it been driven to the greatest practicable depth and impervious fore and rear aprons added of sufficient length to force the water from the pond to take a path through the gravel equal to, say, 600 ft. before it could appear in the river below the dam, the velocity of the water would have been so reduced through friction that it could not move the gravel. Even if there had been a cut-off to an impervious layer, the dam should have had a fore apron to protect the gravel below the dam from the overflow.

The method of construction seems to have been a bit peculiar in that the superstructure of a dam to be under a head of over 100 ft. was constructed before even investigating the necessary depth of cut-off. It is possible, however, that this may have been justified by the expediency of construction.

JOEL D. JUSTIN.

Harrisburg, Penn.,
Dec. 31, 1912.

The Work of the International Association for Testing Materials

Sir—I only read the articles in ENGINEERING NEWS, of Sept. 19 last, on the Sixth Congress of the International Association for Testing Materials, after my return from America. Although very well satisfied with the thoroughness and correctness of your report of the proceedings of the congress, I was much pained by the editorial in that issue on the results attained by the congress—an editorial which, as a man well acquainted with the work of the association, I may say does it much injustice.

The editorial declares that the work accomplished by the last congress is very poor, and that this shows the futility of the association and its congresses. Does the writer really believe that the discussions on the notched-bar test, on the constancy of volume, on the testing of plastic mortars and many other subjects, as well as the work of the association which went before, on which the discussions were based, are useless because they did not lead to any positive resolutions? Does it signify nothing that through the handling of these questions by the association, the specialists in various countries are forced to regard these testing methods of their own, which are sanctioned through use, from the other standpoints, and to examine them? And does the international experience on certain objects, which the association in dealing with them systematically gathers, not serve the best interests of each country?

The object of the association is above all that of reconciling, by its work, the contrary views on methods of testing, the differences of some specifications and to unify them.

The policy followed by the association consists in actively working for this unification by the proposal of certain standards in the committees, by having the same examined by leading testing laboratories of all countries and by national societies. But the association does not confine its work, as the writer opines, by passively waiting until certain truths have established themselves in the whole world, so that the association only requires to put the seal of its consent upon them without further trouble.

This preparation is long and difficult, but it brings useful work with it, which only finds its last visible expression in a final conclusion.

The uniform methods recommended by the Brussels congress for testing metals, alloys, hydraulic cements, wood, and pipes of clay, stone and cement, which are recognized throughout Europe, but which are unfortunately little known in America, were the first great results of much arduous work.

At the last congress, resolutions on uniform nomenclature were agreed upon, a result of great value, although underestimated by the writer of the article, and it is to be hoped that further important resolutions on unified methods and on principles of specifications, as the result of continuous work, will be arrived at in the near future .

Those who know the difficulties bound up with international unifications will acknowledge the fact that they cannot be arrived at in a short time.

The testing of materials is not a purely theoretical question, but involves tasks with which the industrial conditions of the various countries are closely connected. The difficulties which already exist through this, for the unifying of the methods of testing, are further aggravated in the unification of specifications as, for instance, for iron and steel. It is to entirely mistake the range of the question and its connection with the unequal conditions of production in different countries, should the obstacles which stand in the way of the satisfactory solution of this task be considered of so little importance that the association could have easily solved them. It would be grossly unjust to condemn the efficacy and usefulness of the association because it has not as yet succeeded in establishing international specifications, which must, however, offer more weight of reason for general recognition than any existing national standards.

But even the apparently negative resolution of the congress on this question is no deadlock, but is an inducement to the carrying on of the preparatory work of enlightenment, which, as has been shown, must precede the solution of this difficult problem and which must be undertaken by an international body.

Besides this, the value of the international association lies not merely in its attempts at unifying the methods for testing and specifications, but also in the useful impulse which is given by it, as the central point of research

work of the whole world, to all countries, even to the most progressive and leading ones. The most valuable idea for which America, among others, has to thank the international association was that of the foundation of the American society. The great impulse to the practical utilization of metallography given by Osmond at Stockholm, or the impulse to the testing of hardness given by Brinell at Budapest, or the example of the model laboratory at Brussels, demonstrating to the world the application of the newest methods of testing metals—to mention only a few points of the earlier congresses—such impulses gave to the congresses an importance which really cannot be replaced by the technical press, however developed.

The last two congresses were also rich in fresh impulses and opened up new vistas of work for the near future.

I believe that the writer of the article, in spite of his intention to speak the whole truth about the association, has overlooked many good points of its work and of its congresses, though he has at the same time acknowledged the great value of the congress papers and the importance of the personal intercourse between first-class experts of the world brought about by the congress. He placed, on the other hand, certain deficiencies in too bright a light, deficiencies, such as the organization of some committees, which are about to be obviated.

Ernst Reitler,
General Secretary, International Association for Testing Materials.

Nordbahnstrasse 50,
Vienna, Austria.
Nov. 15, 1912.

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Selling Stock in a Railway Automatic Stop Company

Sir: The attention of the management of this company has been called to a bulletin, No. 16, issued under date of Dec. 9, 1912, by the International Signal Co., of 104 West 42d St., New York City., addressed to the stockholders of that company, the first paragraph of which bulletin reads as follows:

> It gives us great pleasure to announce that the officials of the Delaware, Lackawanna & Western R.R. have closed an agreement with us to make such an installation of our new automatic train stop on that great system as will comply with the requirements of the Block Signal and Train Control Board of the Interstate Commerce Commission; and we are now hard at work getting new machines built to make this installation.

The bulletin closes with an appeal to the stockholders to buy some of the treasury stock of the company, and attached is a blank to be used in subscribing to the stock.

The information contained in the first paragraph of said circular, as also throughout the entire circular, is grossly misleading as to the arrangement the above named Signal company has made with the D. L. & W. R.R. Co. Briefly stated, this arrangement is as follows:

After an examination of the mechanism of their device, as shown in a model in the office of the Signal company, this company on Nov. 2 by letter authorized the Signal company to install one of its signals on a branch line of our road, the mechanism for the test to be put on a single engine; this to be done solely at the expense of the Signal company, the railway company's officials and employees to render the necessary assistance in making the installation and in conducting tests. Up to this date the apparatus for the single signal has not been furnished, we being advised that the Signal company is busy in its shops making up parts for the apparatus and does not expect to have it completed ready for installation before Jan. 1.

This information is given to the public as, from inquiries which our company has had from different sources, it is evident the Signal company is securing subscriptions to stock from railway employees, based on the misrepresentations contained in its bulletin above referred to.

G. J. Ray,
Chief Engineer, Delaware, Lackawanna & Western R.R.
New York, Dec. 18, 1912.

[A proof of the above letter was submitted to the International Signal Co., to give opportunity to present its side of the case in the same issue in which the above letter was printed. Its reply follows.—Ed.]

Sir—We desire to thank you for calling our attention to the letter of G. J. Ray, Chief Engineer of the Delaware, Lackawanna & Western R.R., regarding our selling of Treasury Stock to our stockholders.

Briefly, our Bulletin No. 16 was mailed *only* to stockholders of this company, and *not* to "railroad employees" (unless they were also stockholders), nor at all to the general public. As will be noted from the number of the Bulletin, it has been the practice of the company to keep in touch with its widely scattered stockholders through bulletins issued from time to time, telling of the vicissitudes, good, bad and indifferent, of our corporation; and as was intended, and as we construe it, our Bulletin sets forth that the installation on the Lackawanna is purely for testing purposes, and its success or failure has no binding action of any kind on that railroad, and we certainly do not agree with any opinion that it was misleading.

We would like to call attention to the facts that only Treasury Stock, and *not* personal stock, was offered for subscription, and that every cent of the proceeds from its sale goes directly into the company treasury for a working capital, and not into the pocket of any individual; that even the Treasury Stock is offered only to present stockholders, practically all of whom have been stockholders for over six years and have been kept informed of company conditions; and that this Bulletin specifically states that the subscriptions are being solicited for the very purpose of making this *testing installation* and supervising the tests thereof.

The International Signal Co.,
By Jean F. Webb, Jr.,
Secretary.

104 West 42d St.,
New York City.
Jan. 2, 1913.

NOTES AND QUERIES

In the article by A. C. Arend, entitled "Investigation of a Compound for Producing Dustless Concrete Floors" (Engineering News, Dec. 19, 1912), the following correction should be noted in Table II (p. 1099). The loads recorded were total loads applied in each instance on 4 sq.in. (not lb. per sq.in. as printed) and the total load on the iron-mixed cubes equals 91% of that on the neat cubes (not 197 as printed).

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In the article in the issue of Jan. 2, 1913, entitled "Progress in Military Explosives," the cuts in Figs. 7 and 8 (p. 24) were inadvertently interchanged.

Failure of a Reinforced-Concrete Building, Detroit, Mich.

On Nov. 15, 1912, a three-story reinforced-concrete garage in course of construction in Detroit, Mich., collapsed while concrete was being laid, and carried down a number of workmen in the ruins. Three men were killed and a number of others were injured in the wreck. We have refrained from commenting on the disaster until

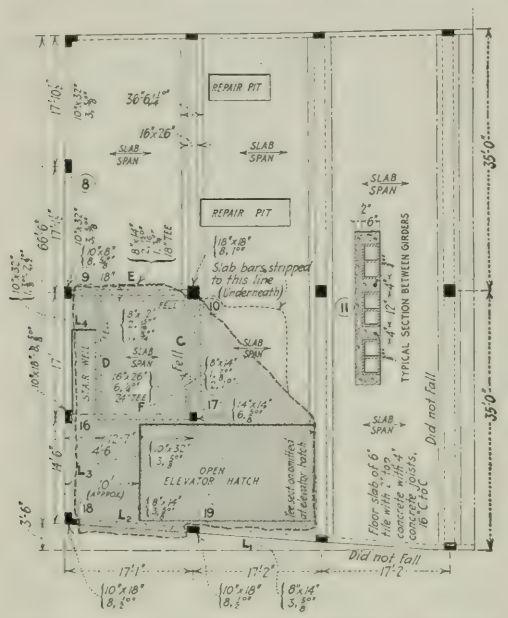


Fig. 1. Plan of Portion of Second-floor Framing Cowhey Building

after the coroner's inquest had been completed and, also, until a thorough investigation could be made of the design and the construction of the building. We give below the facts brought out by the inquest and by our own investigation.

The building in question was being built for S. E. Cowhey, near the corner of Larned and St. Antoine Sts., to be used as a garage and automobile repair shop. The general design was made by Frank L. Malby, a local architect with no particular experience in reinforced-concrete construction, and his drawings were turned over to the Gabriel Reinforcement Co., a local concern, for the structural design. This company made the drawings from which the material was ordered and according to which the building was put up. The contract was let to M. B. Everham, a local builder, under a peculiar form of contract, the details of which are not all available. It appears, however, to have been a form of force-account, with the additional bonus to the contractor of all the building material left after completion. In effect, the contractor did little less than to furnish equipment, the general supervision of the work being in the hands of a hired superintendent, who, it seems, resigned before the end of the work, leaving the supervision to the hoisting engineer on the job.

The plans were submitted to the Building Department of the City of Detroit, but this office, though working under an excellent code, is not provided with sufficient technical force to pass upon reinforced-concrete design. Consequently the approval of the department was merely formal. We are informed that there is no one in the department competent to design a reinforced-concrete structure.

The building was a three-story and basement structure, 120 ft. deep, 70 ft. wide at the street front, and 66 ft. 6 in. wide at the back alley.

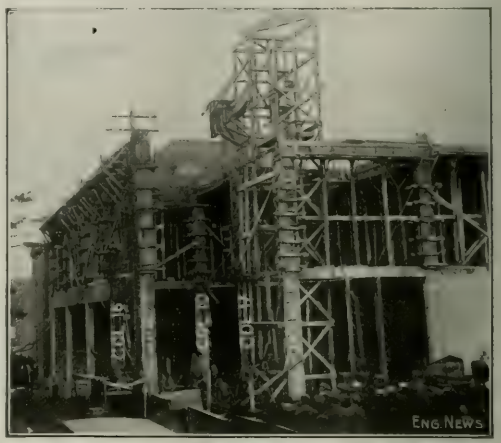


Fig. 2. View Looking Toward Side of Building Immediately after the Collapse

The layout was of the ordinary beam-and-column type, carrying tile-and-concrete floors of varying spans. The columns were rectangular in section, reinforced with straight "Gabriel ovoid" bars, and rested on square pedestals on good footings. Most of the beams were of T-section (with exceptions as noted below), reinforced with "ovoid" bars in the bottom, turned up to give tensile value over supports and tied together with the typical "Gabriel" loops, as stirrups. The slabs were of the tile-and-concrete type shown in the detail on Fig. 1. Brick curtain walls formed the main showing faces. It is not clear whether the third floor was supposed to be the roof



Fig. 3. Looking Toward Break between Columns 9 and 10

(Beam L 4 broken off after failure of rest of structure.)

or a working floor, but that is not material at this time.

The concrete work was started last Fall, and on Oct. 15 the casting of the second floor was completed. The work then proceeded so that on Nov. 15, 1912, the third floor in the rear of the building was being deposited, when, after a brief warning by cracking supports and sagging girders, the month-old second floor collapsed with the disastrous results noted. The drawing in Fig. 1 shows the rear bays of the building and indicates in the hatched area the portion of the second floor that fell. Fig. 2 is a view taken immediately after the collapse, looking toward the corner that failed.

Looking now at Fig. 1, it will be seen that the members which fell on the second floor were beams *C*, *D*, *E*, *F* and L_2, together with the slabs held up between these beams. No column failed, but in every case the above-noted beams pulled out of their respective columns. For the sake of safety the tottering column 16, with connecting beams, were torn down after the accident, leaving the break at column 9, beam L_4, as shown in Fig. 3. In most of the breaks between beams and columns there was no evidence of any reinforcing connection between the two members other than an inch or two intrusion of the beam rods into the column. These pulled out, leaving holes in the columns.



FIG. 4. VIEW OF BREAK AT TOP OF COLUMN 17

At the time of the failure, the third floor, being deposited, was supported by the second floor on struts taken from under that floor. The second floor itself was not held except by its own strength and by occasional posts of no particular strength. In addition to the dead load of the floors themselves the structure was also subject to the shock and vibration of the concrete elevator which was located in the elevator hatch at the side of the building, as shown in Fig. 2. The framework for this elevator was connected to the concrete forms.

A combination of bad practices was evidently the cause of the failure. The original architect apparently had nothing to do with the building, except to provide general plans; the structural designers did not follow their design beyond their office; the city did not pass on the design; the contractor did nothing more than to furnish equipment, and the final superintendent was not competent to supervise reinforced-concrete work. So much for the human agencies. The physical constituents of the building were equally bad; the design is decidedly weak in parts, and the concrete, though supposedly the 1:2:4 gravel mixture required by the city building ordinance, was so weak that it could be broken by the hand one month after the collapse. It was testified at the coroner's inquest that samples of the concrete taken from the building broke in compression at from 400 to 500 lb. per sq.in. This weakness is partly due to poor mixing and insufficient cement, though low temperatures may have had something to do with it. Weather-bureau records show temperatures as low as 25° F. on Nov. 1 to 3, two weeks after the second-floor concrete was placed.

In the design, attention is called to beam *D*, an 8x12-in. prismatic section, reinforced with 1.84 sq.in. of steel. At the time of failure it is probable that the concrete in this beam was stressed in compression up to 1500 lb. per sq.in. The structural designers claim that this beam was built with a T-section, but the drawings do not call for such form. The concrete in beam *C* was also stressed far above the design unit value of 650 lb. per sq.in. allowed by the code. At the same time the lack of connection between beam and column (a fault of construction, apparently, rather than design), added to the weakness of the frame. The slabs proper seem to be within safe limits of design.

The coroner's jury, on Dec. 18, brought in a verdict of negligence against the Gabriel Reinforcement Co., which was responsible for the design, and M. B. Everham, the contractor who was supposed to be in charge of the work.

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American Electric-railway statistics have been compiled and published in the "Electric Railway Journal" of Dec. 7, 1912. Of all the figures there shown, we have reprinted below only the totals for the various groups of states and the country as a whole. It is stated that, in the compilation, effort was made to confine the figures to operating companies and that intercorporate relationships were taken into account with proper allowances for duplications. The table represents the condition at the end of the calendar year 1911.

	Number Companies	Miles Track	Cars	Capital Stock Outstanding	Funded Debt Outstanding
New England States	121	6,035 79	15,792	$214,102,800	$152,586,543
Eastern States	497	12,395 40	34,684	832,926,963	1,019,654,702
Central States	315	14,570 30	25,844	679,069,110	789,332,393
Southern States	90	1,991 07	4,005	172,031,620	138,240,400
Western States	186	6,035 93	11,132	535,055,660	324,520,500
All States	1,209	41,028 49	91,457	$2,433,186,153	$2,424,334,538

A Drawbridge Stalled by an Unusual Accident

A failure in the machinery of the swing span of the Delaware, Lackawanna & Western R.R. over the Passaic River at Newark, N. J., on the morning of Dec. 3, interrupted traffic for about three-quarters of an hour. The failure occurred about 8:30 a.m., near the close of the morning rush-hour traffic, but delayed a large number of trains. The accident was caused by a peculiar breakage of parts in the operating machinery. A description of

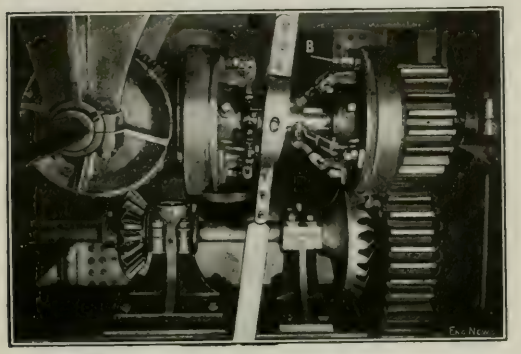


FIG. 1. FRICTION CLUTCH ON MOTOR SHAFT OF D. L. & W. R.R. PASSAIC RIVER BRIDGE, NEWARK, N. J.

(Bolt B broke Dec. 3, and was thrown between pinion and equalizer gear of swinging motion, resulting in fracture of a $6\frac{7}{8}$-in. rack-pinion shaft.)

the accident has been furnished us by G. J. Ray, Chief Engineer of the railway company.

This drawbridge is a double-deck swing, having two tracks on the upper deck and one track on the lower deck. It weighs about 1000 tons. The structural arrangement is unusual in that the bridge is of the pure center-bearing type and has wedge bearings on the center pier under the middle point of each truss, which re-

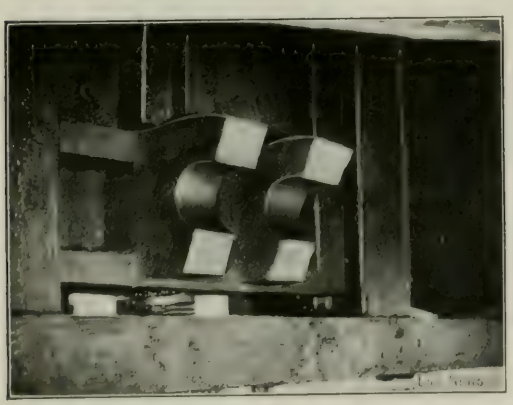


FIG. 3. BROKEN LUGS OF WEDGE-OPERATING NUT, PASSAIC RIVER BRIDGE

lieve the center bearing when the bridge is closed. The swinging motion is actuated by two pinions on vertical shafts meshing with a circular internal gear laid on the masonry pier. The two wedges are each driven by a vertically traveling nut, which is connected to the wedge by an inclined link exerting outward pressure by toggle action as the nut goes down when the screw is turned.

All this machinery is operated by a single electric motor located under the floor of the bridge near the center. The motor shaft, transverse to the center line of the bridge, carries a duplex friction clutch of the ordinary cone frictio n type, so arranged that either one side of the clutch or the other may be connected up to the shaft. One side of this clutch is coupled to a pinion (see Fig. 1) meshing with a differential gear on a shaft con-

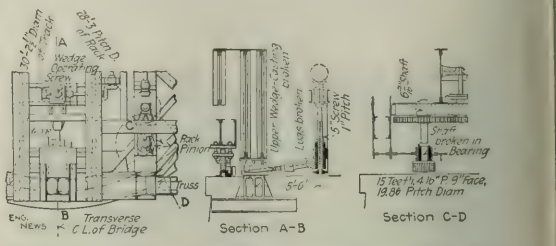


FIG. 2. PART PLAN AND SECTIONS OF OPERATING MACHINERY, D. L. & W. R.R. PASSAIC RIVER BRIDGE

necting with the swinging-motion pinions, shown in the part plan, Fig. 2. The other side of the clutch is connected by shafting and gearing to the screws which operate the two wedges, also shown in Fig. 2. From this wedge shafting are also driven two longitudinal shafts leading to the end lifts.

The break which started the accident occurred in the friction clutch on the side which drives the swinging motion. This clutch is shown in the photograph reproduced as Fig. 1 herewith. The bolt marked *B*, one of four bolts fastening the link bracket to the follower block, broke while the bridge was being closed after passing a vessel. Apparently the link and bracket with part of the bolt flew out and, in striking some part of the structure or machinery, bent the bolt and broke off the link. In this action the bolt was thrown between the pinion and differential gear of the swinging motion, at the right in Fig. 1. While the jamming of the bolt between pinion and gear effectively blocked the motor, the whole momentum of the swinging bridge was at the other end of the drive, acting upon the two rack-pinions, and the $6\frac{7}{8}$-in. shaft of one of these pinions broke in the bearing just over the pinion.

Immediate inspection showed the broken follower bolt, but did not reveal the break of the pinion shaft, as this was concealed in the bearing. The bolt and follower link of the clutch were replaced, and to test and adjust them the bridge was swung a short distance. In this operation the pinion whose shaft was broken fell out and was caught between the upper wedge and the masonry; it sheared off the upper wedge casting and broke off the lugs of the nut operating the wedge (see Figs. 2 and 3). Notwithstanding this serious breakage, the bridge was finally closed with only three-quarters of an hour delay to traffic.

It is proposed, as a future precaution, to secure the clutch-follower bolts in such a way that if broken they will not be thrown out.

Partial Wreck of the Sangamon River Bridge by a Derailed Train: Wabash R. R.

Early in December a part of the bridge carrying the Wabash R.R. over the Sangamon River at Decatur, Ill., was wrecked by a derailed train under unusual conditions, and particulars of the accident have been furnished by courtesy of the railway company's officers.

This structure consists of a steel trestle 525 ft. long, built in 1892; its height is from 35 to 45 ft. At one end of the trestle there are three steel 125-ft. pin-connected deck spans. These are somewhat light and are at present carried on falsework. The steel trestle is of more recent construction and fairly strong. At the present time, a great many new ties are being placed on the bridge, as it is proposed to put a gantletted track across it, as double track has been provided on each side of the bridge. On account of the volume of traffic, there is very little time available for the men to work on the bridge, and consequently every opportunity is taken between trains in order that the work may be kept in progress.

On the day when the accident happened, an engine with a heavy train of coal cars crossed the bridge and got out of sight, and immediately the bridge men started to tear up the rails in order to remove the old ties and replace them with new ones. The freight train was stalled after going some distance, and the rear flagman went back of the train to protect it. The bridge man had a flag out to protect the bridge and warn trains that work was in progress upon it. The conductor of the train gave the engineman a signal to back the train in order to get a fresh start, and in doing this the train was backed onto that part of the steel trestle from which the rails and some of the ties had been removed. The caboose crossed this opened portion of the bridge, but the heavy steel coal cars bunched the ties and fell through the trestle. Altogether 100 ft. of stringers and floor-beams were bent and damaged, but the posts remained standing, though they were badly twisted at the point of floor-beam connections.

About 100 ft. of the trestle was wrecked and nine steel hopper-bottom coal cars fell to the ground. No other damage was done to the trestle. It is of interest to note that though the trestle is 525 ft. long, it was moved longitudinally a distance of 18 in., the thrust being so great that the cap-stones were moved bodily from the foundations. The longitudinal bracing remained intact, showing it was amply strong to take this tremendous thrust.

The work required in resuming traffic was very simple. Most of the work and time consumed was in getting the wrecked cars out of the way. This was done with a wrecking crane. Immediately on receipt of the information concerning the wreck, four large gangs of bridge men were sent so as to be ready to start work at daylight. At one end of the gap a pile-driver started to drive the necessary piling and other work necessary for a trestle. At the other end, which happened to be on hard ground, bents were framed and a trestle was constructed. A very heavy wind was blowing at the time, which made the work all the more difficult to accomplish. It took 36 hr. to close the gap so that trains could operate over the new trestle. In all, about 200 men were employed in clearing up the wreck, shoveling away the coal, taking away the steel stringers that were in the way, and doing the necessary work incidental to constructing a temporary trestle.

Conferences on the Maintenance and Operation of Irrigation Work.

Conferences of local managers of irrigation canals and of employees of the U. S. Reclamation Service were held at various points in the West during 1912. Notes on the conferences at Bozeman, Mont., and Boise, Idaho, were printed in our issues of Nov. 7 and 14, 1912. Brief mention of three later conferences follow.

North Yakima, Wash.—This meeting was held on Oct. 31. The need of special training on the part of irrigation managers was emphasized. Stress was laid upon the desirability of delivering water on the rotation rather than the continuous flow plan, since the latter is liable to give too small a volume and head and to lead to waste.

Corvallis, Ore.—This conference was held on Nov. 6-7, at the Agricultural College, with the principal members of the faculty in attendance. Prof. J. A. Rexell explained a simple system of farm records and urged upon the farmer the necessity of keeping an account of his profits and losses.

Berkeley, Calif.—The next of these conferences was held at Berkeley, on Nov. 12-13, again with members of a college faculty present. It was agreed that water used for irrigation should be so delivered that the payment would be made for a corresponding proportionate amount of the total of the deliveries. In the Imperial Valley, Southern California, water payments are on a measurement basis. Irrigation is carried on under large heads of 5 cu.ft. per sec. or more, but the applications of water are light, a depth of about 2½ in. at a time being required for alfalfa. The seepage losses are less than 10%, probably due to the lining of the canals with silt.

The evaporation from Salton Sea is proving to be less than was anticipated, probably 5½ to 6 ft. in depth per year.

Drainage of irrigated lands in California is a general need. Many of the irrigation companies provide drains with their irrigation ditches.

A large number of pumping plants are being built in California at a first cost of $25 per acre of land irrigated. This is low, but the maintenance, operating and depreciation charges are from $5 to $10 per acre-ft. of water raised 50 ft.

In leveling land for irrigation in California expenditures of $35 to $60 per acre are justified to get the land as level as possible and to provide irrigation checks which will permit irrigation to be carried on at three acres per hour, under a head of 10 to 15 sec.-ft.

Finally, the opinion was expressed at Berkeley, that the most efficient irrigation manager is usually a man with experience in the management of large corporations.

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Indictments Against Railway Officers for Manslaughter on account of railway accidents have recently been found in Connecticut and in Indiana. In Connecticut a Vice-President, the General Manager and the Superintendent of the New York, New Haven & Hartford R.R., were indicted on account of the deaths which occurred in the wreck of the Springfield Express at Westport, in October.

In Indiana, on account of the wreck on the Cincinnati, Hamilton & Dayton R.R., on Nov. 13, in which 16 persons lost their lives when a passenger train ran into an open switch, indictments have been found against the Directors and the President, two Vice-Presidents, General Manager, General Superintendent, Division Superintendent, and also against the engineer and brakeman of the freight train for which the switch was opened.

The Explosion of a Compressed-air Tank, at Quincy, Mass., on Jan. 1, caused the death of two men who were making repairs on the tank. The accident occurred in a granite yard and the tank was part of the compressed-air storage system from which pneumatic drills and hammers were operated. At the time of the failure the repairs on the tank had been completed and the air was being let in to test its tightness.

A Fall of Earth imprisoned nine workers in the East Lehigh mines, at Tamaqua, Penn., on Dec. 31, and they were not rescued until 35 hr. later. During this time one of the miners died from the lack of food and fresh air, and two of the others were removed in a collapsed condition. The available account of the accident is not clear as to its cause, but the statement is made that a rush of water from some abandoned workings caused the earth movement.

A Digester Exploded at the plant of the Laurentide Paper Co., Grand Mere, Que., on Dec. 22, killing four and injuring two of the employees in the sulphide mill. The digester was a large brick-lined boiler in which the chipped wood was reduced to pulp by cooking with steam and sulphurous acid. It had been regularly inspected previous to the accident, according to press accounts, and was apparently in good condition.

An Example of Rapid Coal-loading was given recently at the Curtis Bay (Baltimore) pier of the Baltimore & Ohio R.R., when 7473 tons of coal were transferred in 3¾ hr. from cars to the steamer "Newton," owned by the Federal Coal & Coke Co., of Boston. This is equivalent to about 1993 tons per hr., a marked increase over the previous record at the same place, of 1816 tons per hr., established on Oct. 11, with a slightly larger total tonnage.

A Bridge Failure and Train Wreck on the Chesapeake & Ohio R.R., near Huntington, W. Va., on Jan. 1, killed seven and injured six others among the train crew and ironworkers, who were on the bridge at the time of its collapse. The bridge was being double-tracked and false work had been erected to give additional strength during these alterations. The wrecked train was a westbound freight, and just previous to the accident a passenger train also westbound had passed safely over the bridge but, according to press accounts, its passage had caused the structure to sway and tremble considerably.

A Snow Slide, at Fernie, B. C., on Dec. 30, killed six men and injured six others, employees of the Crow's Nest Pass Coal Co., who own and operate the Coal Creek Mines. The dead and injured were reported as working in a carpenter shop in the path of the slide and press accounts state that there was no warning given of the approach of the slide.

It is worthy of note that, on Apr. 29, 1903, a land-slide of large proportions, occurred at Frank, Alta., only 30 miles from the scene of the above accident. This land-slide involved the displacement of a large section of Turtle Mountain and caused the death of 66 people, besides burying a number of houses and some valuable mining machinery.

A High Wind Struck New York City on Jan. 3, accompanied by a drop in temperature and a lowering of the barometer. The wind velocity, as measured by the U. S. Weather Bureau, at its station on the Whitehall Building, varied from 80 to 87 miles an hour from 2 to 3:30 p.m., and for a very short period a value of 90 mi. per hr. was recorded. This latter figure has only been exceeded in recent years by the record established on Feb. 22, 1912, and noted in our issue of Feb. 29, 1912, when a velocity of 96 mi. per hr. was noted. The barometer fell to 28.61 in. during the storm of Jan. 3, establishing a new record for New York, as the lowest pressure previously noted was 28.81 in.

An Underground River was pierced, on Dec. 23, by the advance heading of the tunnel, which is being driven through the Cote d'Or Mountains, in France. The new tunnel is being driven on a cutoff which will shorten the line and lower the elevation of the main railway line from Paris to Italy by way of Lausanne, Switzerland, and the Simplon Tunnel. The stream of water pierced by the advance heading was of such volume and pressure that the workmen in the tunnel barely escaped with their lives. Cable dispatches from Berne, on Dec. 28, stated that the flow from the tunnel had increased in volume since it was first pierced and had swelled the rivers in the vicinity to a dangerous extent. Unless the flow is from an underground reservoir so that it will in time exhaust itself, it is believed that the tunnel will have to be abandoned.

An Aërodynamical-laboratory Commission of 19 members has been appointed by President Taft to investigate the need and possibilities of such an institution as was recommended by Capt. W. I. Chambers, Chief Officer of the naval aviation corps (see Eng. News, Dec. 26, 1912, p. 1201). The Commission comprises the following: R. S. Woodward, president of the Carnegie Institute of Washington (Chairman); C. D. Walcott, secretary of the Smithsonian Institution; S. W. Stratton, director of the U. S. Bureau of Standards; Prof. W. J. Humphreys, consulting physicist of the U. S. Weather Bureau; Gen. James Allen, chief signal officer of the U. S. Army; Maj. Samuel Reber, signal officer of the Eastern District, U. S. Army; Capt. W. I. Chambers, in charge of aviation, U. S. Navy;, Naval Constructor D. W. Taylor, in charge of model basin, U. S. Navy; M. B. Sellers, Aëronautical Society, New York City; H. A. W. Wood, vice-president of the Aëro Club of America; B. J. Arnold, Aëro Club of Chicago; Prof. W. F. Durand, Leland Stanford University; Prof. Richard MacLauren, president of the Massachusetts Institute Technology; C. M. Manly, New York City; Harold M. Sewall, Bath, Me.; Hon. Herbert Parsons, New York City; Col. Frederick N. Smith, Peoria, Ill.; Hon. Frank W. Rollins, New Hampshire, and as recorder of the Commission; Dr. A. F. Zahn, secretary of the Aëro Club of Washington, D. C.

A Municipal Asphalt Plant for the District of Columbia is again advocated in a report sent by the Commissioners to the House of Representatives. Acting under a special appropriation of the last Congress, David E. McComb, now Engineer of Bridges of the District, has been making an exhaustive study into the question of municipal asphalt plants and has just presented a report in which he thoroughly endorses the project and recommends the appropriation of $90,000 to build the plant. His figures showing the saving of such a plant are as follows.,

Using lake pitch asphalt	Contract price	Price with municipal asphalt plant (estimated)
Standard asphalt pavement, sq.yd..	$1.7142	$1.4028
Standard asphalt surface, sq.yd....	0.6550	0.4609
Standard asphalt binder on resurface work, cu.ft.....	0.2940	0.2023
Standard asphalt surface on minor repair work, cu.ft.....	0.5840	0.5003
Standard asphalt binder on minor repair work, cu.ft.....	0.4440	0.3953
Using any brand of asphalt conforming with specifications for asphalt		
Standard asphalt surface on minor repair work, cu ft.....	0.5540	0.4184
Standard asphalt binder on minor repair work, cu.ft.....	0.4340	0.3701

The Coal Production for the United States for the year 1912, has been estimated by E. W. Parker, of the U. S. Geological Survey, at 550,000,000 short tons, surpassing the previous high record of 1910 by about 10%. This estimate is based largely on information received by correspondence with coal operators and on records of shipments over some of the more important roads. A decrease in the production of anthracite is expected on account of the seven weeks' cessation of work in the spring of the year.

PERSONALS

Mr. R. Bowen, General Sales Manager of the Epping-Carpenter Co., Pittsburgh, Penn., has been appointed General Manager.

Mr. V. F. Drugan has been promoted to be Assistant Division Engineer of the Philadelphia division of the Baltimore & Ohio R.R.

Mr. Ivy L. Lee, in charge of the publicity bureau of the Pennsylvania R.R., in 1908 and 1909, has been appointed executive assistant to President Samuel Rea.

Mr. I. Paul Jones, a civil engineer, of San Francisco, Calif., has joined the staff of Judd & Co., Auditors and Efficiency Engineers, 140 Nassau St., New York City.

Mr. Roy S. Lanphear has resigned as Manager and Chemist of the Plainfield, N. J., sewage-disposal plant to become Chief Chemist of the Worcester, Mass., sewage-disposal plant.

Mr. M. C. Kennedy, Vice-President and General Superintendent of the Cumberland Valley R.R., Chambersburg, Penn., has been elected President, succeeding Mr. James McCrea.

Mr. Samuel Rea, M. Am. Soc. C. E., President of the Pennsylvania R.R., has been elected a director of the New York, New Haven & Hartford R.R., succeeding Mr. James McCrea.

Mr. H. W. McMaster, formerly Receiver and General Manager of the Wabash Terminal Ry., has been appointed General Manager of the Wheeling & Lake Erie R.R., at Cleveland, Ohio.

Mr. G. F. Eberly, formerly with the engineering construction corps at the Sand Patch tunnel of the Baltimore & Ohio R.R., has been appointed Assistant Division Engineer of the Newark division.

Mr. T. W. Kennedy, Superintendent of the Chicago, Milwaukee & St. Paul Ry., at Eau Claire, Wis., has been promoted to be Assistant to the General Manager, with headquarters at St. Paul, Minn.

Mr. R. E. Brooks, formerly of the Abbey-Brooks Co., Newark, N. J., has been appointed District Manager for the Koehring Machine Co., Milwaukee, Wis., with office at 50 Church St., New York City.

Mr. R. J. Middleton, Assistant Engineer on the Chicago, Milwaukee & St. Paul Ry., has been appointed Engineer of Track Elevation, in charge of the track elevation work on Bloomingdale Road, Chicago.

Mr. D. E. Douty has resigned his position with the U. S. Bureau of Standards, Washington, D. C., to become General Manager of the United States Conditioning & Testing Co., 340 Hudson St., New York City.

Mr. Beaudric L. Howell has entered partnership with his father, Mr. David J. Howell, M. Am. Soc. C. E., under the firm name of David J. Howell & Son, with offices in the Union Trust Bldg., Washington, D. C.

Mr. Gilbert S. Walker, M. Am. Soc. M. E., Assistant Inspecting Engineer for the Isthmian Canal Commission, Washington, D. C., will hereafter be in charge of a New York City office of the Commission, at 24 State St.

Mr. Charles T. Main, M. Am. Soc. C. E., Consulting Engineer, Boston, Mass., has been elected a term member of the corporation of the Massachusetts Institute of Technology. Mr. Main is a member of the class of 1890.

Mr. G. L. Peck, General Manager of the Pennsylvania R.R. Lines West of Pittsburgh, has been elected Vice-President, in charge of transportation. Mr. Peck entered the service of the Pennsylvania R.R., in 1874, as a telegraph operator.

Mr. John M. Van Gelder, Assistant Engineer, Board of Water Supply of the City of New York, has resigned to become County Engineer of Bergen County, N. J. Mr. Van Gelder was formerly with Westinghouse, Church, Kerr & Co., New York City.

Mr. Grant Hall, Assistant General Manager of the western lines of the Canadian Pacific Ry., has been promoted to be General Manager, succeeding to a part of the duties of Vice-President George Bury, whose title has been Vice-President and General Manager.

Mr. J. G. Code, formerly General Superintendent of the Wheeling & Lake Erie R.R., has been appointed General Manager of the Wabash-Pittsburgh Terminal Ry., with headquarters at Pittsburgh, Penn., succeeding Mr. H. W. McMaster, resigned, as noted elsewhere.

Mr. A. R. Merrick, formerly Superintendent of the Pere Marquette R.R., at Saginaw, Mich., has been appointed General Superintendent of the Western Maryland Ry., with headquarters at Baltimore, Md., succeeding to the duties of Mr. J. A. Shepherd, General Manager, resigned.

Mr. William O'Herin, Superintendent of Machinery & Equipment, Missouri, Kansas & Texas R.R., Parsons, Kan., has been promoted to be Assistant to the General Manager. He is succeeded as Superintendent of Machinery & Equipment by W. L. Kellogg, as noted in our issue of Nov. 28.

Mr. W. J. Tollerton, Mechanical Superintendent of the Chicago, Rock Island & Pacific Ry., has been appointed General Mechanical Superintendent with full charge of the mechanical department. This follows the resignation of T. Rumney, Assistant Second Vice-President, who has been at the head of this department.

Mr. H. W. Sheridan, former Superintendent of the Southern Pacific Ry., at Sacramento, Calif., has been appointed General Superintendent of the Louisiana Western R.R. and Morgan's Louisiana & Texas R.R. & Steamship Co., subsidiaries of the Southern Pacific Ry., at New Orleans, La., succeeding Mr. W. M. Hobbs, resigned.

Mr. Cass Gilbert, Architect, of New York City, has been elected a term member of the corporation of the Massachusetts Institute of Technology. Mr. Gilbert is a past-president of the American Institute of Architects, and is the designer of the Woolworth Building and other famous structures in New York City. He graduated in the class of 1880.

Messrs. W. G. Ross, Farquhar Robertson and Lieut.-Col. E. A. Labelle have been appointed members of the Montreal, Que., Harbor Commission. Mr. Ross is the Managing Director of the Montreal Street Rys.; Mr. Robertson is the head of the firm of Farquhar Robertson, Ltd., coal merchants; and Lieut.-Col. Labelle is General Manager of the St. Lawrence Flour Mills, Ltd.

Mr. F. W. Abbot, M. Am. Soc. C. E., has resigned as Construction Manager of the Electric Bond & Share Co., and as Vice-president and Construction Manager of the Yadkin River Power Co., New York City, to become Construction Manager of the Ebro Irrigation & Power Co., which is incorporated by the F. S. Pearson Engineering Corporation to construct two hydro-electric power plants on the Ebro River in Spain.

Mr. E. O. Reeder, Chief Engineer of the Chicago, Milwaukee & Puget Sound Ry., has been appointed Assistant Chief Engineer of the Chicago, Milwaukee & St. Paul Ry. Mr. Reeder's title is changed to fit the reorganization of the Pacific coast extension of the railway, which has hitherto been conducted as a separate organization. Mr. Charles F. Loweth, M. Am. Soc. C. E., is Chief Engineer of the entire Chicago, Milwaukee & St. Paul Ry. system, of which the Chicago, Milwaukee & Puget Sound Ry. is now a part.

Mr. Joseph D. Evans has resigned as Chief Engineer of the Montreal (Que.) Tramways Co. to become Construction Manager of the Electric Bond & Share Co., New York City, succeeding Mr. F. W. Abbot, resigned, as noted elsewhere. Mr. Evans studied civil engineering at the Massachusetts Institute of Technology and was later engaged in surveys for the proposed Nicaraguan Canal and later in preliminary work for the Panama Canal. For a number of years he was engaged in railway construction in South America . On return to this country he entered into electric railway construction and hydro-electric power development until 1911, when he accepted the position of Chief Engineer of the Montreal Tramways Co.

Mr. W. F. Wells, M. Am. Inst. E. E., formerly General Superintendent of the Edison Electric Illuminating Co., Brooklyn, N. Y., has been promoted to be General Manager, succeeding Mr. W. W. Freeman, Assoc. Am. Inst. E. E., resigned. After several years' work as a stenographer and secretary, Mr. Wells decided to study electrical enginering and took a special course at Rutgers College, New Brunswick, N. J., where he graduated with the class of 1892. His service with the Edison Electric Illuminating Co., of Brooklyn, began in August, 1892, as a draftsman. In 1894 he was made Electrical Superintendent. In April, 1897, he resigned this position and went to New York as Assistant General Manager of the Manhattan Electric Light Co., in charge of the technical departments. When this company was absorbed by the New York Edison Co., Mr. Wells became a District Superintendent of the latter company, and later had charge of the first installation of rotary converters, transformers, etc., for 6600-volt transmission. He was made General Superintendent of the Edison Electric Illuminating Co., of Brooklyn, in 1905.

Mr. Benjamin McKeen, M. Am. Soc. C. E., recently General Manager of the Vandalia R.R., St. Louis, Mo., has been appointed General Manager of the Pennsylvania R.R. Lines West of Pittsburgh, succeeding Mr. C. L. Peck, elected Vice-President, as noted elsewhere. Mr. McKeen is a native of Terre Haute, Ind., and graduated from the Rose Polytechnic Institute in 1885. His railway service began as a draftsman in the office of the Superintendent of Motive Power of the Terre Haute & Indianapolis R.R., which afterward became part of the Vandalia R.R. After a year in the drafting room he entered the field enginering corps as a rodman. He was promoted to be Resident Engineer on Construction of the Terre Haute & Logansport R.R., and was later engineer of Maintenance-of-Way of this division of the Terre Haute & Indianapolis R.R. In 1894 he changed to the operating department as Superintendent of the Peoria division; since then he has held important positions in the operating departments of the Vandalia R.R., and the Pennsylvania R.R. Lines West of Pittsburgh. Mr. McKeen has been General Manager of the Vandalia R.R. since 1903.

Messrs. S. G. Pollard, M. Am. Soc. M. E., and J. W. Ellms announce the formation of the partnership of Pollard & Ellms, Consulting Engineers, 603 Miles Greenwood Bldg., Cincinnati, Ohio. Mr. Pollard is a graduate in mechanical engineering of Cornell University, and for a number of years was connected with the Holley Manufacturing Co. and the Snow Steam Pump Works, at Buffalo, N. Y. More recently he was Mechanical Engineer for the state board, which had charge of the construction of the Cincinnati, Ohio, waterworks and water-purification plant. After the completion of this work Mr. Pollard was Superintendent until recently, when he resigned to devote his whole time to consultation work. Mr. Ellms received his technical education at the Massachusetts Institute of Technology and for a number of years was Assistant Chemist for the Massachusetts State

Board of Health; and Chemist of the Brooklyn, N. Y., health department. He was a member of the engineering staffs in the design and construction of the Louisville, Ky., and Cincinnati water-filtration plants. For the past five years he has been Superintendent of the Cincinnati water-purification plant. Mr. Ellms will continue in this position and devote only a part of his time to the new firm.

OBITUARY

Morris Morton, a young engineer employed by the Sperry Gyroscope Co., New York City, committed suicide on Dec. 29. He had recently suffered from an attack of appendicitis.

Julian Thornley, M. Am. Soc. C. E., committed suicide in the Masonic Hall Bldg., New York City, Dec. 28. He was 44 years old and was formerly an engineer with the New York State Water Supply Commission.

Frank P. Shepard, a member of the firm of Morris & Shepard, railway contractors, died at his home in St. Paul, Minn., Dec. 25, from pneumonia. He was a son of Mr. D. C. Shepard, M. Am. Soc. C. E., of St. Paul.

Oliver M. Weand, of the firm of McMullen, Weand & McDermott, Contractors, New York City, died at Reading, Penn., Jan. 2. Mr. Weand's firm was contractor for the Hartford, Conn., masonry arch bridge, described in our issue of Oct. 22, 1908.

William L. Bailie, a retired Chief Engineer of the United States Navy, died at the Naval Hospital, Washington, D. C., Dec. 27. He entered the navy during the Civil War, in 1863. In 1885 he was retired from active service because of injuries received in the line of duty. For a number of years he was engaged in scientific work for the U. S. Fish Commission, and in 1892 was made Director of the department of mechanics' arts, science and technology, at the Drexel Institute, Philadelphia, Penn. He was advanced to the grade of Chief Engineer and retired by Act of Congress in 1906.

Roswell Miller, Chairman of the Board of Directors of the Chicago, Milwaukee & St. Paul Ry., was found dead in bed at his home in New York City, on Jan. 3. Except for servants, he was alone in the house at the time, his family being at his country home at Millbrook, N. Y. The day before he had spent at his office as usual. Mr. Miller was born in Hartford, Penn., Oct. 28, 1843. When 18 years old he was a soldier in the Union Army, was promoted to First Lieutenant, and saw service in many battles in the Civil War. Following the war he was actively engaged in the building of the Cairo & Vincennes R.R., of which he became General Superintendent. He was associated with the development and consolidation of many railways in the Middle West, becoming General Manager of the Chicago, Milwaukee & St. Paul Ry., in 1885, and President in 1888. He retired from the active management of the company in 1899.

Robert Forsyth, for many years President and Chief Engineer of the Union Iron Works, San Francisco, Calif., died at his home in that city on Dec. 18, aged 66 years. Mr. Forsyth went to the West coast in 1870 as Chief Engineer of the steamship "Prince Alfred." At that time he joined the staff of the Pacific Mail Co. After several more years of sea service he was made Assistant Superintending Engineer of the company. Later he was appointed Engineer of the Risdon Iron Works, and in 1886 he became Engineer-in-Chief of the Union Iron Works. During the period Mr. Forsyth was Chief Engineer and President of the company no less than 23 government vessels were built, of which the battleship "Oregon" is probably the most famous. In 1906 he resigned his office to enter practice as a consulting marine engineer and naval architect. He was a member of the Society of Naval Architects and Marine Engineers and of the Pacific Union Club of San Francisco.

George Edward Gray, one of the oldest members of the American Society of Civil Engineers, and whose engineering experience dated back to the days of the Erie Canal construction, died at his home in Rome, N. Y., Jan. 1, aged 94 years. He was born at Verona, N. Y., Sept. 12, 1818. He studied civil engineering under one of profession's earliest disciples in this country, Peletiah Rawson. His first important work was on the New York State canals and the New York & Harlem R.R. He was Chief Engineer of the New York Central & Hudson River R.R. from 1853 to 1865—a period which marked many changes in railway construction and operation. Under his direction the New York Central & Hudson River R.R. was the first to build all wrought-iron bridges, the forerunners of the modern steel structures. Several railway bridges of cast-and wrought-iron members combined had been constructed on the Whipple truss and other designs, but these had begun to prove unsatisfactory owing to heavier loads and faster speeds with the greater shock and vibration. Under Mr. Gray's supervision a single-track bridge of 30-ft. span, proportioned to a load of 1 ton per lin.ft., was erected at Schenectady, N. Y., and tested to destruction. It was through his persistent efforts that the railway officials were led to adopt the higher-priced wrought-iron structures. From 1865 to 1871, Mr. Gray was consulting engineer of the Central Pacific R.R., which was built from San Francisco east to meet the Union Pacific R.R., forming the first transcontinental railway. From 1871 to 1885, he was Chief Engineer of the Southern Pacific Ry. and of various other railways which came to form part of the Southern Pacific system. Mr. Gray was elected a member of the American Society of Civil Engineers in 1873, and an honorary member in 1894. He was also a member of the Institution of Civil Engineers of Great Britain. For many years he made his home in California and was a trustee of the Leland Stanford, Jr., University.

ENGINEERING SOCIETIES

COMING MEETINGS

MINING AND METALLURGICAL SOCIETY OF AMERICA.
Jan. 14. Annual meeting at New York City. Secy., W. R. Ingalls, 505 Pearl St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.
Jan. 14. Annual meeting in New York City. Secy., E. W. Stern, 103 Park Ave., New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.
Jan. 14. Annual meeting in New York City. Secy., J. R. Wemlinger, 11 Broadway, New York.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 15-16. Annual meeting in New York City. Secy., C. W. Hunt, 220 West 57th St., New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 21-23. Annual convention at Chicago, Ill. Secy., F. J. Angier, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 21-23. Annual meeting at New York City. Secy., W. W. Macon, 29 West 39th St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28-30. Annual meeting at Montreal, Que. Secy., C. H. McLeod, 413 Dorchester St., West, Montreal.

American Society of Civil Engineers—At the Dec. 3 meeting of the Board of Directors, it was resolved that the providing of a luncheon on the first day of the annual meeting is not advisable. The Board also appointed as a committee to take charge of the arrangements for the next annual meeting, Messrs. G. W. Tillson, H. S. Tuttle and C. W. Hunt.

Association of American Portland Cement Manufacturers—At the annual meeting of the Association, in New York City, Dec. 9-12, the following officers were elected for the ensuing year: President, J. B. Lober; Vice-president, R. S. Sinclair, Treasurer, W. H. Harding; Secretary, P. H. Wilson.

American Wood Preservers Association—The following are among the papers to be presented at the 9th annual convention of the Association, at Chicago, Ill., on Jan. 21-23: "Comparison of Zinc Chloride with Coal-tar Creosote for Preserving Cross-ties," by H. F. Weiss; "Timber for Creosoted Block Paving," by H. G. Davis; "Laying Wood Block Pavement," by H. S. Loud; "Natural and Artificial Seasoning of Douglas Fir for Treatment," by F. D. Beal.

Engineers Society of Western Pennsylvania—"Recent Progress in Applied Chemistry and in Engineering" is the title of an address to be given by James O. Handy, at the annual meeting of the Society, at Pittsburgh, Penn., on Jan. 21.

American Society of Engineering Contractors—The 4th annual meeting of the Society will be held in New York, on Jan. 14, at which time the following papers will be given: "Legal Hints to Contractors," by W. L. Bowman; and "Fire, Its Effects and Its Prevention," by E. F. Croker.

Iowa Association of Cement Users—The following papers are among those on the program of the 9th annual convention at Mason City, on Jan. 7-10: "Concrete Fence Posts," by H. Rettinghouse. "The Keokuk Dam," by J. E. Griffith; "Concrete Pavement," by F. P. Wilson; and "Small Concrete Houses," by L. R. Ferguson.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

New Jersey—Pennsylvania R.R.—This company has acquired the necessary property in Milltown, N. J., and vicinity, for its proposed new line for freight traffic from Trenton, N. J., to Waverly, N. J. Notices of vacation have been made effective Apr. 1, when the company will commence construction. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

Pennsylvania—Pennsylvania R.R.—This company has awarded the contract to A. L. ANDERSON & BRO., Altoona, Penn., for improvements on its Cresson Division, at about $150,000. Noted Dec. 26.

Maryland—Baltimore & Ohio R.R.—This company is considering the construction of a cut-off, about six miles in length, from near Lansdowne, Md., to Hanover, Md. This will shorten the express route between Baltimore and Washington.

North Carolina—Virginia & Eastern Carolina Ry.—This company has completed surveys for its proposed 64-mile line from Henderson, N. C., to Wilson, N. C. Contracts will probably be awarded in March. J. C. Cruikshank, Spring Hope, N. C., is Ch. Engr. Noted Dec. 19.

South Carolina—South Carolina Western Ry.—This company is having the final survey made for the construction of its proposed extension from Florence to Alleson's, about 30 miles. W. R. Bonsal, Hamlet, N. C., is Pres.

Alabama—Mobile & Eastern Shore Ry.—The railroad proposed by James K. Glennon and associates, of Mobile, Ala., to be built from Montrose Park to Point Clear, Ala., 10 miles, will be named as above. The line will require the construction of two bridges.

Ohio—Ohio River & Northern R.R.—Permission was granted by the Ohio Public Utilities Commission, Dec. 30, to the Ohio River & Northern R.R. Co., to issue $1,000,000 in capital stock and $2,500,000 in bonds. The money is to be used in constructing an extension from Youngstown, Ohio, into Pittsburgh, Penn.

Indiana—Pennsylvania Lines West of Pittsburgh—This company will construct a branch line from Muncie to Hagerstown, Ind. B. V. Sommerville, Pittsburgh, Penn., is Principal Asst. Engr.

Grand Trunk Ry.—This company, H. R. Safford, Ch. Engr., Montreal, Que., is considering the construction of a new branch line to connect Elkhart, Ind., with Adamsville, Ind., the several lakes in that region, and its main line at Edwardsburg, Ind. The proposed new line will extend from Edwardsburg to Adamsville, thence directly to Elkhart, in all about 15 miles in length.

Illinois—Burlington Belt Line—See item under Iowa.

Iowa—Burlington Belt Line—This company has been organized by residents of Burlington, Iowa, to construct from Burlington, Iowa, southeast to Beardstown, Ill., about 65 miles.

Nebraska—Midland Continental R.R.—This company, already incorporated in South Dakota, has filed articles of incorporation in Nebraska. The proposed line of the company will cross the entire state. The directors of the company are Herbert S. Duncombe, Joseph D. Small, W. E. Jenkins, E. J. Molin, E. G. McGilton and Frank H. Gaines, of Omaha, Neb. Noted Dec. 26.

Montana—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company will lay rails into Montana. Its Ambrose line will be extended about 50 miles into Valley County, Mont., and another extension from Plaza, N. D., to a point near Goodall, Mont., has been approved. G. M. Huss, Minneapolis, Minn., is Asst. Engr.

Missouri—Moberly, Huntsville & Randolph Springs Ry.—This company has been incorporated with a capital of $500,000 to construct a line from Randolph Springs, Mo., east to Moberly in Randolph County, 12 miles. Among the directors are: C. H. Dameron, W. T. Dameron, G. P. Dameron and W. M. Evans, all of Huntsville, Mo.

Missouri—Shelby County R.R.—Construction work on the proposed Leonard branch of this company will probably begin in the spring. J. C. Houck, Shelbyville, Mo., is Gen. Mgr.

Arkansas—Pine Bluff, Sheridan & Southern R.R.—This company, at present completing a 16-mile extension out of Sheridan, Ark., is considering, it is reported, a further extension from Sheridan to Little Rock, a distance of 27 miles. E. S. McCarty, New Madrid, Mo., is Pres.

Arkansas—Mount Ida, Ouachita Valley & Hot Springs Ry.—This company is considering the construction of a 40-mile extension from Mount Ida, Ark., east to Hot Springs, Ark. This is in addition to the work now under way from Mount Ida, Ark., south to a connection with the St. Louis, Iron Mountain & Southern Ry., at North Caddo Gap, a distance of 10 miles. G. Cox, Mount Ida, is Pres.

Texas—San Antonio, Fredericksburg & Northern Ry.—This company is preparing to file its charter for the construction of its proposed line from Fredericksburg to the Guadalupe River, about 24 miles. R. A. Love, San Antonio, Tex., is interested.

Texas—Asherton & Gulf Ry.—According to press reports this company will extend its line from Asherton Junction to Aransas Pass, 140 miles. The road now operates from Asherton Junction to Asherton. Asher Richardson, Asherton, Tex., is Pres. and Gen. Mgr.

Oklahoma—Missouri, Kansas & Texas Ry.—This company is considering, it is reported, taking over the Clinton & Oklahoma Western R.R., a 50-mile line, operating from Clinton to Strong City, Okla. S. B. Fisher, St. Louis, Mo., is Ch. Engr.

Colorado—Denver, Colorado Springs & Pueblo R.R.—This company has been incorporated to construct a railroad between Denver, Colorado Springs and Pueblo, Colo.

Nevada—Southern Pacific Co.—This company has been surveying for the construction of a branch line north from Basalt over Cortez Mountain, and down Smokey Valley to a connection with the main line at a point west of Palisade, Nev. W. Hood, San Francisco, Calif., is Ch. Engr. Noted Oct. 31.

Washington—Chicago, Milwaukee & Puget Sound Ry.—Subcontracts for the construction of 40 miles of railway from Fort Angeles to Olympia, Wash., for this company, will be let shortly. The Erickson Construction Co., New York Bldg., Seattle, Wash., secured the general contract at about $2,000,000. Noted Jan. 2.

Great Northern Ry.—This company is surveying for its proposed line on the east bank of the Columbia River, between Wenatchee and Pasco, Wash., a distance of 100 miles. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Washington—Oregon-Washington RR. & Navigation Co.—This company will spend about $1,000,000 improving the district bounded by Monroe and Center Sts. and the Spokane River, and Front Ave., by grading, filling, constructing additional trackage, etc., and a depot. F. L. Pitman, Spokane, Wash., is Ch. Engr. of Const.

Oregon—Pacific & Eastern Ry.—This company will extend the eastern portion of the line, a distance of six miles further into the timber along the right-of-way toward Bend, Ore., providing that the assurance is given that an adequate mill is built and operated at that end of the line. The construction of the additional six miles of railroad will entail an expenditure of $250,000. The sawmill necessary to operate in the timber to the best advantage will cost in the neighborhood of $100,000 more.

ELECTRIC RAILWAYS

Danbury, Conn.—The construction of a street railway from Danbury to New Milford is under consideration. Saunders & Jones, Danbury, are interested.

Wyomissing, Penn.—Permission has been granted to the Reading Transit Co. to extend its line on Pennsylvania Ave., through Wyomissing. H. G. Louser, Lebanon, is Pres.

Charlotte, N. C.—The Charlotte Electric Ry. Co. is planning to double-track its line on Central Ave. Z. V. Taylor, Charlotte, is Pres. and Gen. Mgr.

St. Augustine, Fla.—The St. Johns Light & Power Co. has been granted a franchise to construct an extension to its Rivera St. line in St. Augustine. This line will eventually connect Jacksonville and St. Augustine. T. R. Osmond, St. Augustine, is Gen. Mgr.

Birmingham, Ala.—The Kelly Co. has made a considerable change in its plans for its proposed electric railway in Birmingham. A new franchise will have to be obtained before construction can be started. Noted Aug. 15.

Shreveport, La.—A franchise has been granted to the Louisiana-Texas Traction Co. to construct and operate an electric railway from Shreveport, La., to Longview, Tex. A. B. Blevins, Jefferson, is interested.

Nashville, Tenn.—The Nashville Traction Co. has been organized to construct and operate an electric interurban railway in the vicinity of Nashville. Walter Palmer, Russell Alger and Henry Ledyard are interested.

Taylorsville, Ky.—The Taylorsville, Louisville & Jeffersontown Traction Co. has been organized at Taylorsville, by I. F. Jewell, Rowland Cox and others, for the construction of a trolley line from Taylorsville to Jeffersontown, Ky. Surveys are now being made.

Columbus, Ohio—The Columbus Ry. & Light Co. has been granted a franchise to extend its Leonard Ave. line in Columbus. L. G. White, Columbus, is Gen. Supt.

Kokomo, Ind.—The Indiana Rys. & Light Co. has taken over the Kokomo, Marion & Western Traction Co., the Kokomo, Frankfort & Western Traction Co., and the Kokomo Public Utilities Co. The new owner contemplates the extension of the different lines into several counties in Indiana. George J. Marott, L. J. Kirkpatrick, Lee Hall and T. C. Reynolds are interested.

Martinsville, Ind.—The Capital Circuit Traction Co. contemplates the construction of an electric railway through Martinsville. The company proposes to build an electric line encircling Indianapolis and towns within a radius of 30 miles.

Terre Haute, Ind.—The Southern Interurban Co. has been incorporated to construct and operate an electric railway in Indiana. W. L. T. Rawlins and S. B. Boggs are interested.

Lancaster, Wis.—The Chicago Short Line Ry. Co. proposes to construct an electric belt line through Grant County, and plans to build a line to connect Lancaster, Wis., and Stockton, Ill. Joseph T. Bennett, Lancaster, is Pres.

Fairmont, N. D.—The Fairmont & Veblen Ry. Co. has been incorporated to construct and operate an interurban railway from Fairmont, N. D., to Veblen, S. D., about 50 miles. The incoporators are Julius Roshall and C. A. Paulson, of Minneapolis, Minn., and George H. Andersen and P. S. Hanson, of Veblen, S. D.

St Joseph, Mo.—The Council has granted a franchise to the Kansas City, Clay County & St. Joseph Ry. Co. to construct and operate an electric railway through St. Joseph.

Austin, Tex.—T. K. Smith, of Indianapolis, Ind., and associates, are promoting the construction of an interurban electric railway from Austin to Fredericksburg, about 75 miles. The route of the proposed road is via Johnson City, and is through a territory that is now without railroad transportation facilities.

Cleburne, Tex.—Daniel Hewett has acquired a controlling interest in the street railway system of Cleburne and will extend the lines and make other improvements to the property.

Dallas, Tex.—The Stone & Webster Engineering Corporation expects to begin the construction of its proposed interurban electric line, that is to run from Dallas to Terrell, Tex., about Mar. 1, and to complete it within 15 months after that date. This line will be about 30 miles long. M. M. Phinney, representative of the Stone & Webster syndicate, announces that practically everything in connection with the right of way for the proposed line has been settled.

It is announced by J. W. Crotty, Vice-Pres. and Gen. Mgr. of the Eastern Texas Traction Co., that contracts for right of way and franchises for the construction of that company's interurban electric line from Greenville through Wolfe City to Bonham have been entered into and that financial arrangements for the construction of the proposed road have been made.

+Denison, Tex.—The Texas Traction Co. has awarded a contract to the STANDARD CONSTRUCTION CO., Dallas, for the reconstruction of its main line in Denison.

The Field Engineering Co. will soon start surveys for the proposed electric railway to be built from Denison, Tex., to Durant, Okla., by John R. Cullinan, St. Louis, Mo., and associates. Noted Dec. 5.

+El Paso, Tex.—The Rio Grande Valley Traction Co. has awarded the contract to the STONE & WEBSTER ENGINEERING CORPORATION, of Boston, Mass., for the construction of its interurban electric line, which is to run from El Paso down the valley of the Rio Grande to Ysleta.

Houston, Tex.—It is planned by the Houston Electric Ry. Co. to extend its line on Lyons Ave., from Odin Ave. to the Houston Harbor addition, about 2½ miles. David Daly is Gen. Mgr.

Sherman, Tex.—The Texas Traction Co. announces that it will extend its Sherman electric railway system from Lamar St., in that city, to the St. Vincent's sanitarium.

Checotah, Okla.—The construction of an electric railway from Checotah to Wainwright is contemplated by C. N. Haskell, of Muskogee.

Tulsa, Okla.—The Consolidated Electric Ry. Co. is making preliminary arrangements for the construction of an electric railway from Tulsa to Sapulpa and Muskogee. A. A. Small is Pres. Noted Nov. 28.

Salt Lake City, Utah—The Utah Interurban Electric Co. has applied to the County Commissioners for a franchise to construct an electric railway throughout the county. This line will connect Salt Lake City, Pleasant Grove, Provo, Springfield and Spanish Fork. W. C. Orem, Salt Lake City, is Pres. Noted Dec. 5.

Asotin, Wash.—F. L. Strum, South Bend, Ore., has applied to the Council for a franchise to construct and operate an electric railway in Asotin. The proposed line will connect Lewiston and Clarkston.

Seattle, Wash.—The City Council has granted permission to the Puget Sound Traction, Light & Power Co. to reconstruct its Madison Ave. line from Broadway to Pike St. Estimated cost, $125,000. L. H. Bean, Tacoma, is Mgr. Noted Dec. 12.

Vancouver, Wash.—The City Council has granted a franchise to the Northwestern Electric Co. to construct and operate an electric railway in Vancouver.

Copperopolis, Calif.—The Calaveras Copper Co. is planning the construction of an electric railway to connect its mines with another line to Stockton. The line will be about 16 miles long and will cost approximately $200,000. J. H. Trerise is Supt.

Davis, Calif.—The Sacramento Valley Electric Ry. Co. contemplates the construction of an electric railway from Davis to Winters, about 12 miles, and from Corning to Paskenta, about 24 miles. C. L. Donohue, Woodland is Pres.

Fresno, Calif.—An interurban railroad about 45 miles in length extending from Fresno to Hoda, will be constructed. It will cost about $200,000. Walter M. Willett, P. M. Burr and William Hall, of San Francisco, and S. Christensen, J. B. Rogers and L. J. Coffey, of Modesto, Calif. are interested in the project.

Los Angeles, Calif.—Bids will be received until 2 p.m., Jan. 10, by the Board of Public Works for furnishing materials and for construction of an electric street railway on San Pedro St. between Allso and Ninth Sts. H. B. Ferris is Secy. Noted Dec. 5.

The City Council has granted a franchise for a period of 21 years to Emmet H. Wilson, to construct and operate an electric railway on Vernon Ave., from Dalton St. to the western city limits.

Madera, Calif.—J. S. Harker of Coarse Gold, Calif., is interested in a project to construct an electric road from Madera to Yosemite Valley. He proposes to store the waters of the North Fork watersheds and utilize them for developing electrical power for such a railroad.

Riverside, Calif.—The Board of Supervisors has granted a franchise to the Pacific Electric Ry. Co. to construct and operate an extension to its Magnolia Ave. line. J. McMillan, Los Angeles is Gen. Mgr.

San Francisco, Calif.—The Board of Supervisors are considering constructing a municipal double-tracked street railroad in Van Ness Ave., from Market to Bay Sts.

Tampico, Mex.—S. Pearson & Son, Ltd., who have a concession for the construction of an interurban electric line from Tampico to La Barra, six miles, and the building of a system of street railways in this city, will soon begin construction work.

LIGHT, HEAT AND POWER

Glens Falls, N. Y.—The Glens Falls Gas & Electric Co. has let general contract to the W. A. BURNHAM CO., for con-

+Glens Falls, N. Y.—The Glens Falls Gas & Electric Co. has let general contract to the W. A. BURNHAM CO., for construction of an addition to its gas plant to cost, with equipment, $20,000.

Asbury Park, N. J.—The Beach Commission is considering plans for an expenditure of $10,000 for the installation of a new lighting system on the boardwalk and beach front.

Farrell, Penn.—The installation of an ornamental streetlighting system on Broadway and Haywood St. is contemplated by the Farrell Improvement Co. James L. Freeble is Gen. Mgr.

Seaford, Del.—The South Delaware Gas Co. is considering plans for the extension of its gas mains from Seaford, Del., to Federalsburg, Md.

Marion, Va.—A site has been purchased at Marion by the Appalachian Power Co., of Bluefield, W. Va., for the construction of a substation.

Palatka, Fla.—The Board of Trade has appointed a committee to investigate the feasibility of installing a municipal electric-light plant. A. M. Leach is a member of the committee.

Shreveport, La.—The Shreveport Traction Co. will install additional equipment in its electric power plant here. W. A. Sullivan, Shreveport, is Gen. Mgr. and Pur. Agt.

Hardinsburg, Ky.—W. T. Halliday, of Chicago, Ill., is planning the erection of an electric-light plant at Hardinsburg. Application for a franchise will be made shortly.

Hazard, Ky.—E. A. Pollard and James Williams, of London, Ky., are considering plans for the establishment of an electric-light plant at Hazard.

Barberton, Ohio—Plans are being prepared for the construction of a municipal electric-light plant. Estimated cost, $200,000. Address the City Clerk for details. Noted Aug. 8.

Cincinnati, Ohio—The Columbia Gas & Electric Co., Cincinnati, is considering the erection of a large central station. A. B. Leach is Pres.

Churubusco, Ind.—Frank T. Schultz, of Columbia City, has applied to the City Council of Churubusco, for a franchise to construct and operate an electric-light plant here.

Linton, Ind.—Bids are being received by the Linton Gas Co. for laying about 28 miles of high-pressure gas mains and for the construction of a gas-manufacturing plant.

+Ann Arbor, Mich.—We are officially advised that the contract for the installation of a lighting and heating plant at the University of Michigan has been awarded to JAMES STEWART & CO., Fisher Bldg., Chicago, Ill. Noted Dec. 12.

Benton Harbor, Mich.—The local gas company contemplates the construction of a gas plant in Benton Harbor, to cost $50,000.

Spring Lake, Mich.—The Muskegon Interurban Ry. Co. is preparing plans for the construction of a substation at Spring Lake.

East Moline, Ill.—The Water and Light Committee has been instructed to investigate the feasibility of installing a municipal electric-light plant.

Kilbourne, Wis.—We are officially advised that bids will be received about Feb. 1 for the installation of additional equipment in the municipal electric-light plant. David G. Howey is Supt. of the plant. Noted Jan. 2.

Little Chute, Wis.—The installation of an electric-light plant in connection with its establishment is contemplated by the Valley Mill & Mercantile Co.

Clintonville, Iowa—We are officially advised that bids will be received early next spring for the installation of new equipment in the municipal electric-light plant. George C. Stewart is Supt. of the plant. Noted Dec. 26.

Marcus, Iowa—We are officially advised that plans are being prepared for the construction of an electric-light plant at Marcus, to be built by K. C. Gaynor, of Iowa City. Estimated cost, $15,000. Noted Dec. 26.

Murray, Iowa—A franchise has been granted to Gilbert Johnson to construct and operate an electric-light plant at Murray.

Sutherland, Iowa—It has been proposed to construct an electric-light system in Sutherland. The City Council is considering the proposition.

Winfield, Iowa—Ora Vaught, of Wapello, has been granted a franchise to construct and operate an electric-light plant in Winfield.

Annandale, Minn.—The Annandale Electric Light & Power Co. has been granted a franchise to construct and operate an electric-light plant in Annandale.

Boyd, Minn.—We are officially advised that bids will be received until Jan. 21 for the installation of an electric-light system in Boyd. Estimated cost, $7000. A. J. Manke is Village Recdr. Noted Jan. 2.

Shakopee, Minn.—The Minneapolis General Electric Co. has been granted permission to construct a high-tension transmission line between Minneapolis and Shakopee.

Garden City, Kan.—Bonds to the amount of $40,000 have been voted for the construction of a municipal electric-light plant. J. F. Crocker is City Clk.

Kingman, Kan.—See item under Water Supply—Irrigation.

Scott, Kan.—See item under Water Supply—Irrigation.

✚Topeka, Kan.—The Atchison, Topeka & Santa Fé R.R. Co. has awarded the contract for the installation of a heating system in its round-house at Topeka, to JOHNSON & BECK, at $10,000.

Lincoln, Neb.—Bids will be received by Roscoe C. Ozman, City Clk., until noon, Jan. 23, for furnishing one 500-hp. water-tube boiler, one chain grate stoker for 500-hp. boiler and one chain grate stoker for 200-hp. boiler.

Schuyler, Neb.—Considerable improvement to the municipal electric-light plant, including the installation of additional equipment, are planned.

Atkins, Ark.—The installation of an electric-light plant to supply electricity for a street-lighting system in Atkins, is contemplated by the Atkins Lumber Co.

Kensett, Ark.—U. S. Bratton, Little Rock, and associates are considering the construction of a dam and hydro-electric plant on the Red River, to supply electricity to Kensett and neighboring towns.

Corpus Christi, Tex.—Charles C. Bruce, Philadelphia, Penn., has been granted a franchise for a period of 50 years to construct and operate a gas plant and distributing system in Corpus Christi.

Granbury, Tex.—The citizens are considering the proposition to issue bonds for the construction of an electric-light plant. Address the Mayor for particulars.

Greenville, Tex.—The Cypress Blade Oil Co. will pipe natural gas into Greenville and construct a gas-distributing system here. A. M. White, of Winnsboro, is Gen. Mgr.

Rockdale, Tex.—J. C. Dumont, Engr., and associates, have been investigating the lignite deposits here with a view of installing a large hydro-electric plant and the construction of an extensive system of power-transmission lines throughout this territory.

Cushing, Okla.—H. Askin and Frank Overlees are considering plans for the installation of an electric-light plant at Cushing.

Clayton, N. M.—Plans are being prepared for the reconstruction of the municipal electric-light plant, which was recently destroyed by fire.

Salmon, Idaho—The Lemhi Power Co. is preparing for the construction of a power plant and the erection of about 12 miles of transmission lines.

Raymond, Wash.—Plans are being prepared by the Twin City Electric Co. to reconstruct its entire system in Raymond. A. Welch, Fenton Bldg., Portland, Ore., is Vice-Pres. and Mgr.

Seattle, Wash.—The Bryant Lumber Co. will build a new boiler house at its plant, 3200 Fremont Ave., Seattle.

Wapato, Wash.—The capacity of the power house of the Pacific Light & Power Co., at Wapato, will be increased by 5000 hp. D. F. McGee is Ch. Engr.

Long Beach, Calif.—The Southern California Edison Co. is preparing to enlarge its steam auxiliary generating plant on the ocean front at Long Beach. A second unit is to be installed and an addition to the present building, doubling its present capacity, will be constructed.

Los Angeles, Calif.—Bids will be received by the Board of Public Works, until Jan. 31, for furnishing 230 steel transmission towers for carrying 110,000-volt transmission line.

Los Angeles, Calif.—The following bids were received by the Board of Public Works for furnishing structural steel for the San Francisquito power house: Security Construction Co., at $14,280, f.o.b. Pittsburgh; Llewellyn Iron Works, $17,235, f.o.b. Los Angeles; Hugh G. Purcell, $13,000, f.o.b. Pittsburgh, Baker Iron Works, $22,125, f.o.b. Los Angeles; Fulton Engine Works, $22,850, f.o.b. Los Angeles. Noted Aug. 8.

Monrovia, Calif.—The city plans to extend the ornamental street-lighting system.

Redlands, Calif.—Bids will be received by R. W. Thomas, City Clk., until Feb. 5, for the construction of an electric power plant in connection with the municipal water system. F. E. Trask, Union Oil Bldg., Los Angeles, is Consult. Engr.

✚Humboldt, Sask.—The contract for furnishing engines and boilers for the new power plant at Humboldt, has been awarded to E. LEONARD & SONS, at $8750. Noted Nov. 21.

New Westminster, B. C.—The British Columbia Electric Ry. Co. will build a new power-distributing station at New Westminster. J. B. Ingersoll, Vancouver, is Elec. Engr.

Victoria, B. C.—See item under Water Supply—Irrigation.

BRIDGES

✚Boston, Mass.—We are officially advised that the State Highway Commission has awarded a contract to the UNITED CONSTRUCTION CO., Albany, N. Y., at $9000, for the construction of the substructure of a bridge across the Deerfield River, between Buckland and Charlemont. Bids were received on Dec. 31. Arthur W. Dean is Ch. Engr. Noted Dec. 26.

Falmouth, Mass.—The Town Council will soon erect a bridge across Earl Pond at Woods Hill which will be of stone and steel, 31½ ft., with a draw span of 40 ft. Plans will be ready by Jan. 20. F. C. Wales, 1150 Tremont Bldg., Boston, is Engr.-in-charge.

✚Oswego, N. Y.—The New York Central & Hudson River R.R. has awarded a contract to the PHOENIX BRIDGE CO., Boston, Mass., at $152,366, for the construction of the superstructure of a bridge across the Oswego River.

✚Cranford, N. J.—Sperry & Hutchinson Co. has awarded a contract to the BARROWS-STEWART CO., 17 Battery Place, New York, N. Y., for the construction of a reinforced-concrete bridge across the Rahway River at Cranford. Oakley & Son, Elizabeth, N. J., are Engrs.-in-charge.

New Brunswick, N. J.—Bids will be received until 2 p.m., Jan. 13, by the Board of Chosen Freeholders, for the construction of a concrete and steel bridge over Noes Creek, on the Blazing Star Road. Peter H. S. Hendricks is Dir.

Ocean City, N. J.—The Ocean City Auto Bridge Co. has extended the time of receiving bids for the construction of a trestle and highway bridge, from Ocean City to Somers Point, from Jan. 4 to 11 p.m. Jan. 11. The structure will be 6000 ft. long. R. L. Goff is Engr.-in-charge. Noted Dec. 19.

Toms River, N. J.—The Island Heights & Sea Side Park Bridge Co. has commissioned Arthur C. King, Consulting Engrs., Toms River, to prepare plans and supervise the construction of a bridge at Washington St.

✚Sheridan, Penn.—The Pennsylvania R.R. has awarded a contract to the AMERICAN BRIDGE CO., 30 Church St., New York, N. Y., for the construction of a new double track bridge at Sheridan, where the line crosses the Conemaugh River, not far from Johnstown. The bridge will require 6600 tons of material. It replaces an old single-track wooden structure used by the road on the north bank of the river at that point and will be one of the most important bridge improvements on the lines East for some time. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

Point Pleasant, Ala.—The Mobile & Eastern Shore Ry. will construct two new bridges in connection with its proposed line from Montrose Park to Point Pleasant. James K. Glennon, Mobile, is a Dir.

Harrodsburg, Ky.—The Board of Commissioners of Mercer County has been authorized to receive bids for the construction of a bridge across the Salt River on the Providence Turnpike.

✚Cleveland, Ohio—We are officially advised that the Director of Public Service has awarded contracts for the construction of a bridge over the Cuyahoga River, from Clark Ave. S. E. to S. W., as follows: Superstructure, to the C. H. HATH & SON CONSTRUCTION CO., Cleveland, at $223,450; the river span to the PHEE CONSTRUCTION & ENGINEERING CO., Chicago, Ill., at $109,378. Bids were received on Dec. 19. F. Richards is Bridge Engr. Noted Nov. 28 and Jan. 2.

Columbus, Ohio—The City Council is considering the petition of the Toledo & Ohio Central Ry. to erect a viaduct over Parsons Ave. J. A. Stocker, Columbus, is Ch. Engr.

Toledo, Ohio—Bids will be received until Jan. 20, by the Board of Public Works, for the construction of a bridge across the Maumee River, from Ash St. on the east, to Consaul St. on the West. The work includes the removal of the old Cherry St. bridge to Ash St., and the construction of a new steel span and approaches. The estimated cost is $185,000. T. R. Coswell is Dir. of Pub. Ser. Noted Nov. 28 and Dec. 12.

✚Rushville, Ill.—We are officially advised that the Board of County Commissioners has awarded a contract to E. E. BUCK, Springfield, at $4800, for the construction of the Star Bridge. Other bidders were: Miller & Borcherding, $5195; Blodgett Construction Co., $6995; Stites Steel Bridge & Iron Co., $5100; East St. Louis Bridge Co., $5200; Illinois Steel Bridge Co., $5095. Bids were received on Dec. 28. Isaac Lewis is County Clk. Noted Dec. 26.

Manitowac, Wis.—The City Council is considering the lengthening of the Eighth St. bridge. The estimated cost is $25,000. L. K. Pitz is City Engr.

Dallas, Tex.—The City Commission has taken steps toward the construction of a viaduct on Merlin St. over the tracks of the Atchison, Topeka & Santa R.R. The cost of the structure will be between $80,000 and $100,000 and will be borne jointly by the city and the railroad.

Fort Worth, Tex.—Brenneke & Fay, consulting engineers, St. Louis, Mo., have completed plans for the construction of bridges at Samuels Ave. and Riverside Ave. The structures will be of the girder type. The estimated cost is $150,000. F. J. Von Neuben is City Engr.

✚Tulsa, Okla.—The St. Louis & San Francisco R.R. has awarded a contract to E. G. FISKE, Tulsa, at $100,000, for the reconstruction of the bridge over the Arkansas River at Tulsa. Nine additional concrete piers will be erected and on these a steel girder bridge will be built. Noted June 20.

Ogden, Utah—It is reported that contracts will soon be let by the Ogden & Logan Rapid Transit Co., for the construction of five steel bridges on its Hermitage-Huntsville extension. Joseph A. West, Ogden, is Ch. Engr.

Ogden, Utah—The Salt Lake & Ogden Ry. is considering plans with the city for the erection of a steel bridge over the Weber River, near 33d St.

Seattle, Wash.—Plans have been completed by the City Engineer for the construction of a reinforced-concrete viaduct on Thorndyke St. The estimated cost is $185,000. Arthur H. Dimock is City Engr. Noted Nov. 14.

Longbeach, Calif.—The City Council has passed resolutions providing for the construction of a bridge over Cerritos Creek. E. P. Dewey is City Engr.

Redding, Calif.—The City Trustees are considering the advisability of combining with the Board of County Supervisors in the construction of a bridge over the Sacramento River at Market St.

Montreal, Que.—The Canadian Northern Ry. has made application to Parliament for the permission to construct a bridge over the St. Lawrence River at Montreal. This will be erected so that its line may be extended to Point Levis. H. K. Wicksteed, Toronto, Ont., is Ch. Engr.

Brilliant, B. C.—The Provincial Government of British Columbia has appropriated $20,000 as its share toward the construction of a bridge at Brilliant. The estimated cost is $60,000.

North Vancouver, B. C.—The City Council has decided to build a reinforced-concrete bridge at Capilano, connecting th Marine Drive and Robson Road. The estimated cost is $50,000

Vancouver, B. C.—An agreement has been reached between the City Council and officials of the Great Northern Ry., by which the company will build two bridges a year over the city streets. The structures will be of steel and concrete, 70 ft. long. J. A. Bohland, St. Paul, Minn., is Bridge Engr.

WATER SUPPLY—IRRIGATION

North Bennington, Vt.—The town contemplates the installation of a water system estimated to cost $140.000.

Brookline, Mass.—An appropriation of $250,000 has been recommended in order to augment the water supply. The system of filtering the water at Charles River will be extended. Fayette F. Forbes is Supt. W.-Wks.

Chester, Mass.—James L. Tighe, Consult. Engr., Holyoke, Mass., has made an investigation and filed his recommendations with the Water Commissioners, regarding the enlargement and improvement of the water system at the Horn Reservoir. Three different methods are suggested entailing an expenditure of from $12,000 to $18,000. Noted Oct. 24.

Worcester, Mass.—The Committee on Water, of the City Council, has recommended the appropriation of $200,000, for the construction of larger pipe lines to the reservoirs. It is intended to lay 48-in. pipe to the Holden Reservoir, and 36-in. pipe to the Lynde Reservoir. George W. Batchelder is Chn. Water Comrs.

Providence, R. I.—Bids will soon be asked for, for installing a new centrifugal electric pump and for a reciprocating steam pump with a daily capacity of 30,000,000 gal. at the Pettaconsett station. W. F. Slade is Comr. of Public Works.

Albion, N. Y.—Mayor William B. Dye and Daniel W. Hanley, Village Trustee, have been appointed to consult with the representatives of the Albion Water Co., with a view to purchasing the water system of that company. If negotiations are not successful, the village will install a new, municipal system, and bids for construction work will probably be asked early in the spring. Noted Dec. 26.

★Brockport, N. Y.—Bids will be received by Louis B. Shay, Village Clk., until 8 p.m., Jan. 21, for constructing a water system. The contract includes the following: 5000 tons of 6- to 14-in. standard c.-i. bell and spigot pipe, 30 tons special castings; 135 fire hydrants; 142 gate valves and boxes; 22 miles of pipe laid; brick pumping station and chimney, pump well and intake; concrete reservoir, etc. Plans and specifications are on file at the office of the Village Clerk, and at the office of Witmer & Brown, Consult. Engrs., Chapin Block, Buffalo, N. Y. Noted Dec. 26.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until Jan. 13, for furnishing and laying water mains and appurtenances in portions of Cypress Ave., Brooklyn and Queens.

Sodus, N. Y.—Bids for constructing a water system here, were received by the Water Commissioners, Dec. 27, as follows: Martin Stewart, $36,000; J. V. Johnson Co., $32,000; A. F. Nims, $37,310; Allen Pope, $24,268; Alfred Caffey, $30,770; A. A. Dancy, $31,739; M. Applegate & Son, $28,395; Frank George, $28,599; Wayne Construction Co., Newark, N. Y., without pipe, $19,169; Newark Construction Co. Newark, N. Y., without pipe, $23,640; C. R. Lewis, without pipe, $20,110; Fishette Bros., $31,238; Samuel Baum, $34,425; Reliance Sewer Construction Co., $37,090; S. V. R. Malcolm & Sons Co., $39,223. The contract includes six miles of 4-, 6- and 8-in. c.i. pipe lines, a pumping plant and a storage reservoir. W. A. Lafler, Rochester, is Consult. Engr. Noted Dec. 12.

White Plains, N. Y.—Bids will be received by the Board of Village Trustees until 8 p.m., Jan. 14, for the purchase of $8000 of water bonds.

Farrell, Penn.—It is proposed to issue bonds for $125,000 for the installation of a municipal water system. The matter will be brought up at an early meeting of the Borough Council.

Greenville, Penn.—We are officially advised that the Greenville Water Co. has retained Chester & Fleming, Hydraul. Engrs., Pittsburgh, Penn., to prepare plans and specifications for a storage dam, and several miles of pipe lines. Bids for construction will probably be asked about May 1.

Troy, Penn.—Henry W. Taylor, Consult. Engr., 100 State St., Albany, N. Y., is preparing plans for a filtration plant at the reservoir. H. K. Mitchell is Boro. Secy.

Washington, D. C.—Bids were received as follows, Dec. 30, by the Commissioners of the District of Columbia, for the construction of a pump-house and lodge at Eighteenth St., and Minnesota Ave., Anacostia, D. C.: Wm. Rothwell & Sons, $11,896; Arthur L. Smith & Co., $11,994; W. H. McCray, $12,837; W. E. Mooney, $11,189; Burgess & Parsons, $11,900; Arthur M. Poynton, $12,100; Skinker & Garrett, $12,245; H. J. Montgomery, $12,131. All of Washington, D. C. Noted Dec. 26.

Lillington, N. C.—An election will be called some time this month to vote on a bond issue of $15,000 for constructing water and sewer systems.

Raleigh, N. C.—The Board of Aldermen has declined the offer of the Wake Water Co. to sell its plant to the city, at $263,000. It is probable that a municipal system will be installed. J. N. Hazlehurst, Atlanta, Ga., is Consult. Engr. Noted Dec. 26.

Louisville, Ala.—Bonds for $5000 have been voted for the installation of a water system here. For particulars address the Town Clerk.

Nashville, Tenn.—It is estimated that it will cost $150,000 to repair the broken walls of the reservoir. Rudolph Hering, 170 Broadway, New York, is Consult. Engr. Noted Dec. 5.

Bromley, Ky.—The Ludlow Water Co., Ludlow, Ky., is considering an application from Bromley for the extension of its pipe lines to that community.

Winchester, Ky.—According to press reports, the City Council is having plans prepared for extending the pipe lines to the river, four miles distant, and for extending the distributing system.

Frankfort, Ohio—We are officially advised that at a meeting of the City Council, to be held Jan. 13, an engineer will probably be employed to prepare plans for the proposed municipal water system. J. G. Bell is Town Clk. Noted Dec. 19.

★Steubenville, Ohio—Bids will be received by James Gavin, Dir. Pub. Ser., at the Water Works Office, until noon, Jan. 28, for the design and construction of a 6,000,000-gal. compound, condensing, vertical, crank and flywheel pumping engine, according to plans prepared by Chester & Fleming, Consult. Engrs., Pittsburgh, Penn.

✝Toledo, Ohio—We are officially advised that the contract to furnish 1500 tons of c.-i. pipe and castings, has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Chicago, Ill., at $25.20 per ton for pipe, and $55 per ton for castings. Bids were opened by J. R. Cowell, Dir. Pub. Ser., Dec. 27. Noted Dec. 26.

Youngstown, Ohio—An ordinance has been passed providing for the purchase of property for the construction of a reservoir in the Milton Basin. S. S. Davis is Pres. of Council.

Richmond, Ind.—According to press reports, bids will be received until Jan. 16, by the Board of Public Works for a franchise to furnish water to the city for a period of 25 years. B. A. Bescher is City Clk..

Saline, Mich.—The W. J. Sherman Co. has completed plans for the installation of a water system here, estimated to cost $30,000. Bids for construction work will probably soon be asked. A. J. Warren is Village Clk. Noted Dec. 26.

Ashton, Ill.—An election will probably soon be called to vote on a bond issue of $45,000 for the construction of a water system. R. J. Dean is Town Clk. Noted Jan. 2.

★✝Chicago, Ill.—A contract to furnish and erect at the Lake View pumping station, a vertical triple-expansion crank and flywheel pumping engine of 25,000,000 gal. daily capacity, and reërecting an old pumping engine, has been awarded to the BETHLEHEM STEEL CO., South Bethlehem, Penn., at $118,000. Bids were opened by the Department of Public Works, Oct. 30. Noted Nov. 14.

Grafton, Ill.—The town contemplates the installation of a water system. W. H. Journey is Mayor.

Milwaukee, Wis.—According to press reports, the City Council has directed the Commissioner of Public Works to advertise for bids for the new water intake at Linwood Ave. Estimated cost, $750,000. Noted Dec. 5.

Oshkosh, Wis.—W. E. Miller, of the Wisconsin R.R. Commission, is appraising the plant of the Oshkosh Water Works Co., with a view to its purchase by the city.

Prairie du Sac, Wis.—A special election has been called for Jan. 14, to vote on a bond issue of $30,000, for installing a water system. R. G. Walter and J. F. Mead, of the Southern Power Co., have been appointed to assist the Village Board in preparing estimates and plans. Noted Dec. 5.

Clinton, Iowa—According to press reports, Charles P. Chase, Consult. Engr., Clinton, has been retained to prepare plans for a water system here.

Rendlyn, Iowa—The town contemplates the installation of a water system. An election will probably be called some time this month to vote on the project.

Waverly, Iowa—The village contemplates the installation of a water system, estimated to cost $6000.

Minneapolis, Minn.—We are officially advised that bids for furnishing water works supplies for the year 1913 were received by the Purchasing Agent, Dec. 30, as follows: water valves, (a) 4-in.; (b) 6-in.; (c) 12-in.; (d) 24-in.: Rensselaer Valve Co., Troy, N. Y., (a) $10.65; (b) $17.50; (c) $32; (d) $183.40. Kennedy Valve Co., New York, (a) $10.45; (b) $16.60; (c) $30.60; (d) $190.20. Roe-Stephens Mfg. Co., Detroit, Mich., (a) $10.50; (b) $15.50; (c) $32; (d) $175. J. B. Clow & Sons, Chicago, Ill., (a) $10.70; (b) $16.70; (c) $31.50; (d) $205. Central Supply Co., Minneapolis, Minn., (a) $12.35; (b) $20.40; (c) $36.75; (d) $197.40. R. D. Wood & Co., Philadelphia, Penn., (a) $11; (b) $16; (c) $28; (d) $145. Darling Pump Mfg. Co., Williamsport, Penn., (a) $12.85; (b) $19.20; (c) $35.20; (d) $200. Kellogg-Mackay Co., Minneapolis, Minn., (a) $10.75; (b) $18.50; (c) $33; (d) $180. Pittsburgh Valve & Foundry Co., Pittsburgh, Penn., (a) $9.60; (b) $15.50; (c) $31.50; (d) $190. Coffin Valve Co., Boston, Mass., (a) $10 (b) $15.25; (c) $30; (d) $175. Hydrants: Darling Pump & Mfg. Co., Williamsport, Penn., $45. Kennedy Valve Mfg. Co., New York, $34.25. Central Supply Co., Minneapolis, Minn., $36.50. R. D. Wood & Co., Philadelphia, Penn., $38.75. Kellogg-Mackay Co., Minneapolis, Minn., $33.75. J. B. Clow & Sons, Chicago, Ill., $33.45. Columbia Iron Works Co., Chattanooga, Tenn., $32.85. Rensselaer Valve Co., Troy, N. Y., $43.75. Western Valve Co., Chicago, Ill., $36. Coffin Valve Co., Boston, Mass., $30.25. c.i. water pipe: (a) 6- and 8-in.; (b) 12-, 16- and 24-in.: R. D. Wood & Co., Philadelphia, Penn., (a) $28.40; (b) $27.90. American Cast Iron Pipe & Foundry Co., Birmingham, Ala., (a) $28.50; (b) $28.50. U. S. Cast Iron Pipe & Foundry Co., Chicago, Ill., (a) $27.85; (b) $27.85. Special castings: Union Iron Works, Minneapolis, Minn., $51. Crown Iron Works, Minneapolis, Minn., $49. Camden Iron Works, Camden, N. J., $51.50. U. S. Cast Iron Pipe & Foundry Co., Chicago, Ill., $57. E. R. Dutton is Asst. City Engr.

✝St. Paul, Minn.—We are officially advised that the contract to furnish about 100 tons of c.i. water pipe, has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Chicago, Ill., at $27.85. Total, $27,223. The other bids were: Clavnorgan Pipe & Foundry Co., $27,508. American Cast Iron Pipe Co., $28,379. R. D. Wood & Co., $30,096. Massillon Iron & Steel Co., $28,092. Bids were opened by the Water Board, Dec. 31. Noted Dec. 26.

Virginia, Minn.—The city contemplates a bond issue of $500,000, for purchasing and improving the plant of the Virginia Water Co.

Burlingame, Kan.—We are officially advised that bids will be received by N. J. Griffin, City Clk., until 1 p.m., Jan. 9, for consructing a water system. The contract includes furnishing and installing c-i. pipe and castings, valves and hydrants, filter house, pump house, settling basin, pole line, clear water well, dam and machinery foundations, pumping machinery, filter equipment, elevated tank and tower with foundations. Plans and specifications are on file at the office of the City Clerk. Estimated cost, $56,000. Plans were prepared by A. J. Smith, Consult. Engr., Emporia, Kan. Noted Dec. 5.

Garden City, Kan.—According to press reports, bonds for $40,000 have been voted for installing a water system and an electric light plant here. J. F. Crocker is Town Clk.

Jewell, Kan.—The town contemplates a bond issue of $10,-000 for installing a municipal water system. For particulars address the Mayor.

Kingman, Kan.—Bonds for $45,000 have been voted for installing a municipal water system and electric-light plant here.

Scott, Kan.—We are officially advised that bonds for $40,-000 have been voted for installing a water system and electric light plant here. O. D. Card is City Clk. Noted Dec. 19.

Gaublin, S. D.—According to press reports, bids will be received by the City Commissioners until Jan. 26, for installing a new water system. The plans, as prepared by Edmunds & Morgen, Consult. Engrs., provide for wooden and iron mains.

New Rockford, N. D.—We are officially advised that F. E. Carson, Fargo, N. D., has been granted a franchise to install a water system and an electric light plant here. George M. Pike is Mayor. Noted Dec. 12.

Lander, Wyo.—C. M. Sturgis and R. C. Barnett, Engrs., Kansas City Life Bldg., Kansas City, Mo., are preparing plans for an irrigation project in Fremont County, for the Louis Lake Conservation Co. The system will irrigate 38,000 acres, and will require nine miles of 6-in. steel or wooden pipe, a main dam, 45 ft. high and 450 ft. long, on Popo Agie River, and a reinforced-concrete reservoir on Louis Lake, to be 40 ft. high and 50 ft. wide.

Chester, Mont.—Bids for constructing a water system here, were received, Dec. 19, as follows: L. W. Schruth, Fargo, N. D., $20,400; Demars Construction Co., Portland, Ore., $19,-250; Western Construction Co., Lewistown, Idaho, $19,108; Lindstrom Co., Butte, Mont., $19,500; W. D. Lovell, Minneapolis, Minn., $18,805; C. A. Cochrane, Spokane, Wash., $18,460. Plans were prepared by C. H. Green, City Engr. Noted Nov. 21.

Fayetteville, Ark.—Press reports state that bids will be received by the Board of Water Commissioners until Jan. 10, for constructing a brick and concrete reservoir of 900,000 gal. capacity. B. F. Campbell is Secy.

Anahuac, Tex.—We are officially advised that the only bid received by the Trinity River Irrigation District, Dec. 27, for constructing a lock and dam, was rejected, and the contract has been readvertised. John Wootin is Secy. Noted Dec. 12.

Beaumont, Tex.—W. C. Teter has applied to the Commissioners of Jefferson County for a franchise to install water mains in Jefferson County, within a radius of 10 miles from the court house.

Brownwood, Tex.—The city plans to install a new reservoir with a capacity of 2,000,000 gal., and a complete new filtration plant. Mark E. Raysdale is City Engr.

Jacksonville, Tex.—Nagel & Petersen, Consult. Engrs., Muskogee, Okla., have been retained by the city to make surveys for extending the water mains. Estimated cost, $10,000. J. E. McFarland is Mayor.

✚Ponca, Okla.—A contract to improve the water system here has been awarded to CHARLES HALSTEAD, Breckenridge, Mo., at $5945. Plans were prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo.

Deming, N. M.—C. E. Miesee, of Chicago and associates have purchased the holdings of the Deming Land and Power Co. here. Included in this transaction is a contract for the development of 9500 acres of state land ten miles east of Deming, which work involves the expenditure of approximately $1,000,000. Wells will be bored upon the land and pumping plants installed. These pumps will probably be operated by electrical energy. The company contemplates installing a central power station upon the land and from this it will build transmission lines over the property.

Tucson, Ariz.—W. H. Thomson, City Engr., is preparing plans and specifications for improvements and extensions to the water system, estimated to cost $100,000. A bond issue will soon be called to vote on this project. Noted Dec. 19.

✚Farmington, Wash.—The contract to construct about two miles of water mains here has been awarded to FOSTER & TRIMBLE, Spokane, Wash., at $10,000. Noted Oct. 31.

Friday Harbor, Wash.—The city will issue bonds for $14,000 for the construction of a new municipal water system.

Milwaukee, Ore.—According to press reports, bonds for $20,000 have been voted for installing a water system here. This bond issue was defeated at the election held in October. D. P. Matthews is Village Recdr. Noted Oct. 17.

Salem, Ore.—At the annual meeting of the State Board of Health a report was submitted by Louis C. Kelsey, Consult. Engr., Selling Bldg., of Portland, for supplying 13 towns and cities of the Upper Willamette Valley and the State institutions with a supply of water from Clear Lake, at an estimated cost of between $3,900,000 and $4,800,000. The 13 municipalities which the proposed pipe line would touch are: Springfield, Eugene, Creswell, Junction City, Halsey, Coburg, Harrisburg, Albany, Brownsville, Jefferson, Independence, Turner and Salem.

Riverside, Calif.—An election has been called by the Common Council for Jan. 14, to vote on a bond issue of $1,160,000, for purchasing the water systems of the Riverside Water Co., the Riverside Artesia Water Co., and H. P. Kyes. Of the total bond issue, $785,000 will be used for purchasing the systems, and $275,000 for extension and improvements. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Dec. 12.

Riverside, Calif.—The Superior Mutual Water Co. has filed articles of incorporation with $600,000 capital stock, to serve water users in the Elsinore Valley. The incorporators are Charles E. Waite, F. S. Castleman, Charles E. Johnson and D. W. Harvey, of Riverside.

Turlock, Calif.—According to press reports, bids will be received by the Directors of the Turlock Irrigation District, until Jan. 31, for constructing 18 dams in the Davis Reservoir. Burton Smith, Turlock, is Engr.

Regina, Sask.—Bids will be received by A. W. Poole, until Jan. 29, for supplying and erecting a 5,000,000-gal. turbine pump and compound vertical condensing engine.

Victoria, B. C.—Bids will be received by W. Galt, City Pur. Agent, until Jan. 27, for furnishing hydrants, valves, castings, lead pipe, brick, vitrified sewer pipe, portland cement, cluster light globes, tungsten lamps and carbons as required.

Port Arthur, Ont.—Bids will be received by J. J. Hackney, Comr. Utilities, Corporation Offices, Port Arthur, until Feb. 3, for furnishing lapwelded steel pipe, specials and flexible joints; also for supplying and delivering valves. Specifications are on file at the office of the City Engineer.

SEWERS

✚Providence, R. I.—Contracts for constructing sewers were awarded by the Board of Contract and Supply, Jan. 2, as follows: To F. E. SHAW, Providence, in Agnes, Troy and McDonough Sts., $15,880; Branch Ave. and Woodland Road, $6214; Irving Ave., $1164; Downing and Whitmarsh Sts., $1224; Eaton St. and Academy Ave., $6364; to ANTONIO AIELLO, Providence, sewers in Grape and Marietta Sts. and River Ave., $1685; to CHARLES CRANKSHAW, Providence, sewers in Eaton and Dunford Sts., at $11,795.

Buffalo, N. Y.—The City Council has ordered the construction of a 12-in. tile sewer in Prenatt St., 12- and 10-in. sewers in Vermont St. and Kerns Ave. Francis G. Ward is Comr. Pub. Wks.

New York, N. Y.—The lowest bid received by Maurice E. Connolly, Pres. Boro. of Queens, Dec. 30, for constructing the main outlet trunk sewer for the Corona District, was submitted by Peace Bros., 20 Main St., Flushing, N. Y., at $255,-290. Noted Dec. 26.

Oyster Bay (L. I.), **N. Y.**—We are officially advised that E. Morgan Griffen, E. A. Hegeman and S. Y. Boyles are the committee chosen by the Oyster Bay Citizens League to investigate the advisability of installing a sewage disposal plant here. Hans R. Jacobsen, Consult. Engr., Randall Block, Oyster Bay, is technical adviser to the committee. Noted Jan. 2.

Camden, N. J.—The City Council has passed an ordinance providing for the construction of sewers in 24th St., from Mickle St. to Mariton Ave., in Morgan St. from Sixth to Fillmore St., and in Fillmore St., from Morgan to Fairview St.

Chambersburg, Penn.—The City Council has adopted an ordinance providing for the extension of the sewer system to the Chambersburg silk mills.

✚Philadelphia, Penn.—We are officially advised that contracts for constructing sewers have been awarded by the Board of Public Works, as follows: Cobbs Creek intercepting sewer extension, to JOSEPH LAPOLLA, at $32,000; Lincoln Ave. extension, to EMILIO PASCUZZI, at $13,000; Mill Creek sewer at 43d St. and Woodland Ave., to ROBERT HIGGINS, at $25,000. Bids were opened Dec. 23. George S. Webster is Ch. Engr. and Survey. Noted Dec. 19.

Pittsburgh, Penn.—Bids will be received at the office of the City Controller until 10 a.m., Jan. 10, for constructing sewers in Album St., Bradish St., Graphic St., and others.

Reading, Penn.—The City Council is considering two plans for extending the sewer system so as to include the third of the city not now served by it. The work will probably be taken up during the spring.

★Somerset, Penn.—Bids will be received by the Commissioners of Somerset County until Jan. 29, for the construction of a sewage disposal plant on the County Home Farm, two miles east of Somerset, according to plans and specifications prepared by Clyde Potts, Consult. Engr., 30 Church St., New York.

Newark, Del.—The Sewer Committee has retained T. Chalkley Hatton, Consult. Engr., Wilmington, Del., to prepare plans for a sewer system here. Joseph H. Hossinger is Mayor. Noted Aug. 22.

★Baltimore, Md.—Bids will be received until 11 a.m., Jan. 22, by the Board of Awards, at the office of the City Register, City Hall, for constructing sanitary lateral sewers in District No. 6, Sanitary Contract No. 107. Calvin W. Hendrick is Chief Engr. of the Sewerage Commission. For details, see advertisement in this issue.

Manassas, Va.—Harry Stevens, Consult. Engr., Union Trust Bldg., Washington, D. C., is preparing plans for the installation of a sewer system here. The contract includes the construction of from five to six miles of sewers, and a complete sewage disposal plant. Bids will probably be asked in the spring. Noted Dec. 5.

Fort Thomas, Ky.—The City Trustees have ordered a survey made for the installation of a septic tank sewer system in the Highlands District.

Lexington, Ky.—We are officially advised that bids will probably be asked during the spring for extending the northern main sewer, and installing a sewage disposal plant. John J. Vance is Secy. to Mayor. Noted Dec. 12.

Louisville, Ky.—Bids will be received by the Board of Public Works, until Jan. 17, for constructing sewers in 32nd St., from Garland to Bismark St., in Madison, from 24th to 29th St., in Green, from Seventh to Eleventh St., in West.

from Green to Madison St., in Eleventh, from Green to Madison St., and in Tenth, from Green to Madison St. Roy W. Burke is Asst. City Engr. Noted Jan. 2.

Bids will be received by the Board of Public Works, about Jan. 20, for constructing a trunk sewer from L St. to Central

Geneva, Ohio—The City Engineer is preparing plans for the construction of the East Main St. sewer. W. E. Morgan is City Clk.

Kent, Ohio—The Village Engineer has been instructed to prepare an estimate of the cost of constructing a complete new sewer system and sewage disposal plant here. Plans and specifications for the system have been completed.

Toledo, Ohio—The City Council has passed an ordinance authorizing a bond issue of $22,000 for draining the marsh in North Toledo, and installing sewers.

Escanaba, Mich.—The City Council has adopted the plans prepared by T. Chalkley Hatton, Consult. Engr., Wilmington, Del., for the construction of a main trunk sewer and a sewage disposal plant here. Noted Nov. 14.

Chicago, Ill.—Bids will be received by the Department of Public Works until 11 a.m., Jan. 13, for furnishing and delivering sewer pipe to the Bureau of Sewers during the term ending Dec. 31, 1913. L. E. McGann is Comr.

De Kalb, Ill.—The Board of Local Improvements has adopted a resolution providing for the construction of a sewer system to cost about $150,000. Plans for a system to comprise about 14 miles of 8- to 24-in. vitrified pipe sanitary sewers, have been completed by A. R. Russel, City Engr. Noted Dec. 12.

Fulton, Ill.—E. O. Hills, Engr., is revising plans and specifications for the proposed sewer system here. Estimated cost, $30,000. Noted Dec. 19.

New London, Wis.—Bids will be received at the office of the City Clerk until 8 p.m., Jan. 21, for the construction of a sewer in Division St., between Quincy and Pine Sts. C. D. Hemmy is Chn. Bd. Pub. Wks. Plans and specifications are on file at the office of the City Clerk.

Luverne, Minn.—The City Council has adopted a resolution for the construction of a sewer in Freeman Ave., from Barck to Adams Ave. Plans are on file at the office of C. C. Appleby, City Recdr.

Shakopee, Minn.—The Oscar Claussen Engineering Co. is preparing plans for the construction of sewers as petitioned for, in the First Ward.

Topeka, Kan.—The residents of Auburndale, a suburb of Topeka, have petitioned the City Commissioners for a sewer system. The main sewer would be about three miles long, and the system, as estimated by A. R. Young, City Engr., would cost about $14,000.

Lincoln, Neb.—The City Council has approved the plans of Adna Dobson, City Engr., for constructing sanitary sewers in Districts 124 and 127. Bids will probably soon be asked. Plans are also being prepared by the City Engineer for constructing sanitary sewers in District 95.

Madison, Neb.—The City Council has adopted the plans of the W. K. Palmer Co., 919 Baltimore Ave., Kansas City, Mo., for the construction of trunk sewers and septic tanks here. Estimated cost, $16,000. Bids for this work will probably be asked in about two months. F. J. Danken is City Clk. Noted Oct. 31.

Missoula, Mont.—The City Council has accepted the plans prepared by Swearingen & McCulloh, Consult. Engrs., Great Falls, Mont., for a sanitary sewer system in South Missoula. The system comprises about 20 miles of sewers. Fred Buck is City Engr. Noted June 27

Hannibal, Mo.—The City Council has approved plans and specifications prepared by B. F. Smiley, City Engr., for the construction of Sewer District No. 100.

Maplewood, Mo.—An ordinance has been passed by the City Council, providing for the construction of sewers in Manchester Ave., between Big Bend Road and the city limits of St. Louis. Estimated cost, $15,000.

Houston, Tex.—Bids will be received, by Dan C. Smith, City Secy., until noon, Jan. 20, for furnishing material and constructing storm sewers in the First and Sixth Wards. The contract includes 1600 ft. of 4-ft., 1173 ft. of 5-ft., 1833 ft. of 6-ft. sewer, 16 manholes, 50 catch basins and 1600 lin.ft. catch basin connections. F. L. Dormant is City Engr. Noted Dec. 19.

Lufkin, Tex.—H. W. Cardwell, who was granted the franchise to install a sewer system here, plans to construct a system to cost about $15,000. Noted Dec. 19.

Pecos, Tex.—An election has been called for Jan. 21, to vote on a bond issue of $35,000 for constructing a sanitary sewer system. Noted Dec. 19.

San Antonio, Tex.—The City Council has ordered a survey made of sections in the city that are without sewers with a view to extending the present system to those portions.

+Tulsa, Okla.—A contract to construct sanitary sewers in Sewer Districts 73 and 74, has been awarded by the City Commissioners, to the WELLS FRANKLIN CONSTRUCTION CO., Surety Bldg., Muskogee, Okla., at $5258.

Boise, Idaho—C. C. Stevenson, City Engr., has submitted preliminary plans and estimates to the City Council for the construction of a storm sewer district to include Idaho, 12th and O'Farrell Sts. and Harrison Blvd. Estimated cost, $100,000. Noted Aug. 15.

+Pocatello, Idaho—The contract to construct 22,630 ft. of lateral sewers, 51 manholes, six combined manholes and flush tanks, and a septic tank, has been awarded by the City Council, to the JAMES KENNEDY CONSTRUCTION CO., Salt Lake City, Utah, at $58,623. Bids were opened Dec. 19. Noted Nov. 28.

Los Angeles, Calif.—Bids will be received by the Supervisors of Los Angeles County until 2 p.m., Jan. 20, for constructing a sewer at the Los Angeles County until 2 p.m., Jan. 20, for constructing a sewer at the Los Angeles County hospital.

Santa Monica, Calif.—The bids received for constructing a sewage disposal plant at the National Soldiers' Home, have been rejected, and plans and specifications are being revised. The lowest bid received was submhitted by the J. D. Kneen Contracting Co., at $24,800. Noted Dec. 5.

Edmonton, Alta.—Bids will be received by A. J. Latornell, City Engr., until Jan. 18, for constructing a trunk sewer. The contract includes the following: Contract 3, 4050 lin.ft. 8-ft. sewer; 2200 lin.ft. 6-ft. 6-in. sewer; 1950 lin.ft. 4-ft. sewer; and accessories. Contract 4, 6300 lin.ft. 4-ft. sewer, and accessories. Contract 5, 1200 lin.ft. 6-ft. sewer; 4650 lin.ft. 5-ft. sewer; 1620 lin.ft. 4-ft. 6-in. sewer; and accessories. Contract 6, 1400 lin.ft. 6-ft. sewer; 2050 lin.ft. 5-ft. sewer; 3750 lin.ft. 4-ft. 6-in. sewer; 3400 lin.ft. 4-ft. sewer; and accessories. Contract 7, 4050 lin.ft. 4ft. sewer; 3500 lin.ft. 5-ft. sewer; and accessories. Contract 8, 4700 lin.ft. 6-ft. sewer; 4700 lin.ft. 5-ft. sewer; 2450 lin.ft. 4-ft. sewer; and accessories. Noted Jan. 2 and Dec. 26.

GARBAGE

Boston, Mass.—Bids will be received until Jan. 14, by the Public Works Department, for removing offal, dirt, refuse, etc., in all districts of the city for the year 1913. L. K. Rourke is Comr.

Bids will be received by the Public Works Department until Jan. 16 for furnishing single and double teams in all the districts of the city for the year 1913.

+Newark, N. J.—Bids were received by the Board of Street and Water Commissioners, Dec. 18, for the collection, removal and disposal of ashes, rubbish, material, paper and garbage, for a period of three or five years, from Jan. 1, 1913. The contract has been awarded to JOSEPH MARRONE, New York, for the three-year term, under the present system of collection from the back yards and areaways, at $584,248.

Charleston, S. C.—The contract will probably be let in January or February for street sweeping and sprinkling apparatus, steel dump carts and wagons. J. H. Dingle is City Engr.

Detroit, Mich.—Bids will be received by the Department of Public Works, until Feb. 4, for furnishing material, erecting and putting in operation an incinerating plant, to have a capacity to destroy 100 tons of garbage, rubbish, ashes, etc., in 24 hours.

+Saskatoon, Sask.—The contract has been awarded to HEENAN & FROUDE OF CANADA, LTD., Board of Trade Bldg., Montreal, Que., for constructing the proposed incinerator, at about $58,100.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Jan. 14 by the Department of Public Works for repairing asphalt pavements in the city streets during the current year. L. K. Rourke is Comr.

Gilbertville, Mass.—Furnace Road is to be macadamized at an estimated cost of $9000, of which $3000 has been appropriated by the State Highway Commission. The balance will be paid by the town of Gilbertville.

+Lawrence, Mass.—A contract has been awarded by the Commissioners of Essex County to JOS. WAGENBACH & SON, Lawrence, at $47,492, for construction of the Lawrence and Methuen Blvd. This was the lowest of 10 bids submitted.

Pittsfield, Mass.—A resolution was passed at a recent town meeting authorizing the reconstruction of 2½ miles of state highway.

Salem, Mass.—Bridge St. is to be widened and improved at an estimated cost of $120,000. The work will be done under the direction of the State Highway Commission. Wm. D. Sohier is Chn.

Southbridge, Mass.—The Board of Selectmen has decided to pave various streets of the town, and bids are being asked on vitrified brick, cobble stone and wood-block paving.

Greenwich, Conn.—At a recent special meeting of the taxpayers of the town, it was voted to spend $100,000 annually for the next six years in constructing 50 miles of permanent pavement.

+Buffalo, N. Y.—The City Council has directed the Department of Public Works to award contracts as follows: To the GERMAN ROCK ASPHALT CEMENT CO. for paving Reservation St. with asphalt, at $8690; and at $13,440, for paving Sterling Ave. with asphalt. The paving of Ulmer Ave. and the repaving of Triangle St. have also been ordered. Francis G. Ward is Comr.

+Baltimore, Md.—A contract has been awarded by the State Roads Commission to J. R. FRANCIS, Mifflintown, Penn., for the construction of about 4½ miles of road between McHenry and Accident, Md. O. E. Weller is Chn.

Warwood, W. Va.—Bids will be received until 7 p.m., Jan. 10, by the Town Recorder for grading and macadamizing Main St., from 23d St. to the north corporation line, a distance of approximately 3100 lin.ft. Chas. B. Miller is Recdr. C. H. Dowler is Mayor.

Johnson City, Tenn.—Bids will be received until 7 p.m., Jan. 16, by the City Commissioners for the excavation of about 4000 cu.yd. on Locust St., and the construction of approximately 14,540 ft. of curb and gutter, including grading, in Dists. 17, 18, 19, 20. Geo. W. Cooke is Comr. W. R. Pouder is Recdr.

Lookout Mountain, Tenn.—We are officially advised that bids will be asked in the early spring for about one-half mile of heavy grading and general repairs to various streets. John H. Wheelock is Comr. and Treas.

Louisville, Ky.—The Board of Public Works will ask for bids about Feb. 1 on $175,000 of street work planned for 1913. The improvements consist of the reconstruction of Third St. from Main to Broadway with asphalt; reconstruction of Main from Fourth to Fifth with asphalt or brick; reconstruction of Walnut from 18th to 22nd; Chestnut from 21st to 24th, High from 31st to 32nd; Oak from Swann to Logan; Oak from Brook to Third; Oak from Fourth to Seventh; Oak from Tenth to 11th; Market from 23rd to 26th Noted Jan 2.

The Board of Public Works is considering paving Fourth Ave. from Market to Jefferson Sts. with wood block. West Broadway is to be repaved with asphalt, forming the entrance to Western Park.

Canton, Ohio—The City Council has adopted a resolution declaring it necessary to repave West Tuscarawas St., from the Square to Harrison Ave., and providing that bids be asked on vitrified block, creosoted block, sheet asphalt and Medina stone. The estimated cost is $115,512 for sheet asphalt or Medina stone, or $80,000 for brick. P. H. Weber is City Engr. Noted Dec. 5.

Cincinnati, Ohio—Bids will be received until noon, Jan. 17, by the Commissioners of Hamilton County, for improving the Gum Run Road from Zion Road to the East Miami River Road, Miami Township. Stanley Struble is Pres. Alfred Reinhardt is Clk.

Rockville, Ind.—Bids will be received until 1:30 p.m., Jan. 17, by Commissioners of Park County for construction of the Kerr Road, Raccoon Township. James E. Elder is Audr.

Terre Haute, Ind.—The Board of Public Works will shortly ask for bids for street improvements as follows: Seven blocks on North 14th St., six blocks on Wabash St., six on Poplar St., and two blocks on South Sixth St. Bids will be asked on various kinds of paving, the property owners to make the selection. O. Miller is Clk.

Freeport, Ill.—The City Engineer has prepared plans for paving Washington St. with brick, and concrete curb and gutter for a distance of about half a mile. Approximately 7000 sq.yd. of paving will be placed on Ordway, Lemon and Nursery Sts. C. Hepner is City Engr.

Rockford, Ill.—Bids will be received about Feb. 1, by the Board of Local Improvements, for approximately 20,000 sq.yd. of block paving on State St. with concrete curb and gutter. Edwin Main is City Engr.

Rock Island, Ill.—The Board of Local Improvements is considering paving 25th St., from Ninth to 13th Aves., at an estimated cost of $12,275.

Waukegan, Ill.—The Board of Local Improvements has passed resolutions authorizing street improvements at an estimated cost of $93,800. The proposed improvements include the paving of Washington St. from West St. to the city limits with brick to cost about $47,400; Ash St. from Grand Ave. to Seward, Julian from North to Ash St., Hickory St. from Grand Ave. to Julian, Seward from Ash to Williams St. to be paved with asphaltic concrete at $35,800; St. James St. from Glen Rock to Clayton, creosoted wood block paving at $10,600.

+Des Moines, Iowa—A contract has been awarded by the City Council to the TURNER IMPROVEMENT CO., at $1.59 per sq.yd., for paving Euclid Ave., from Sixth to 12th Sts., with brick. John Budd is City Engr.

Iowa City, Iowa—Bids were received by the City Council for about seven blocks of brick paving on East College and Cemetery Sts., from Barry & Bradley, at $16,615, and from William Horrabin, at $17,890. L. C. Watkins is City Engr.

Minneapolis, Minn.—Bids will be received until 11 a.m., Jan. 13, by the Commisisoners of Hennepin County, for approximately 6080 lin.ft. of grading under Contract No. 1, Sections 1 and 12, town of Minnetrista. A. P. Erickson is County Audr.

St. Paul, Minn.—The City Council is considering the paving of University Ave. with creosoted wood blocks from Dale St. to the city limits, at an estimated cost of $250,000. It is also proposed to pave Snelling Ave., from Grand to University, and Prior from University to Selby. Oscar Claussen is City Engr.

Greenville, Tex.—Bids will be received the latter part of January for approximately 125,000 sq.yd. of paving to cost about $250,000. Estimates will be received on various kinds of paving.

Houston, Tex—Bids will be received until noon, Jan 13, by the City Secretary for grading and paving sections of Louisiana St as follows: From Congress Ave to Capitol Ave, with creosoted wood-block pavement; from Capitol Ave to Pease Ave, with Texaco asphalt; and from Pease to Berry Ave, with bitulithic. D. C. Smith, Jr., is City Secy. H. B. Rice is Mayor.

Port Lavaca, Tex.—The taxpayers of Precincts 1 and 2 of Calhoun County have voted favorably upon the question of a bond issue of $135,000 for road construction. The proceeds from the sale of these bonds will build about 45 miles of highway, which will connect with the roads now building in Victoria County.

Waco, Tex.—The City Council has authorized an election of the tax-payer to vote on the question of a bond issue of $100,000 for street improvements.

Phoenix, Ariz.—Bids will be received until 5 p.m., Jan. 13, by the City Council for 24,000 sq.yd. of bitulithic pavement and 9000 lin.ft. curb and gutter. V. A. Thompson is Supt. of Streets. Frank Thomas is City Recdr.

+Los Angeles—A contract has been awarded to D. D. CHAPMAN, at $15,772, for improving Compton Ave., from 20th to 27th St. The lowest bids were $1.45 per lin.ft. for grading and graveling complete; 13c. per sq.ft. for macadamized; 32c. per lin.ft. for cement curb; 14c. per sq.ft. for concrete gutter; 35c. per sq.ft. for vitrified block gutter; 11c. per sq.ft. for sidewalk.

+The Holmes Walton Co., Grand Bldg., has awarded a contract to W. W. CRANDALL, for the improvement of about eight miles of streets in its new tract near La Canada. The work consists of grading, graveling and constructing cement curbs and sidewalks. E. T. Wright, Pacific Electric Bldg., is Engr. in Charge.

+A contract has been awarded to the FAIRCHILD-GILMORE-WILTON CO., Los Angeles, at $8887, for improving approximately 416 lin.ft. of San Fernando St.

+San Diego, Calif.—Contracts for street improvements have been awarded as follows: To FORD & STOUT, Bradbury Bldg., Los Angeles, at $26,755 for Washington St.; at $5442 for Fifth St., and at $4755 for improving Hawk St.

Chula Vista, Calif.—The Board of Trustees has ordered paving on National and Third Aves., and E St., at an estimated cost of $25,000.

San Francisco, Calif.—The Board of Public Works has granted permission to improve the following streets under private contract; Broad St. from Plymouth to Capital Ave., the crossing of Douglas and Elizabeth Sts., Treat Ave. from its southerly termination to Army St., Anza St. from 14th to 15th Aves., 25th Ave. from Balboa to Carillo St., 24th Ave. from Kirkham to Lawton St., Magnolia Ave. from Buchanan to Webster St.

Assiniboia, Man.—The Municipality is planning the improvement of Portage Ave. at an estimated cost of $17,000. Frank Ness, Kirkfield P. O., Man., is Secy. and Treas.

INDUSTRIAL WORKS

Cambridge, Mass.—The plant of the Mead-Morrison Mfg. Co., was damaged by fire, Dec. 27. Loss $100,000. The plant will probably be rebuilt immediately.

+Ipswich, Mass.—We are officially advised that the Dustbane Mfg. Co. has awarded the contract for its new factory to WILLIAM W. BANCROFT, Hamilton, Mass. The building will be one story and basement, 56x105 ft., the first floor to be of reinforced concrete. Burtis S. Brown, 88 Broad St., Boston, is Consult. Engr.

Lawrence, Mass.—The plant of the Lawrence Boiler Works was destroyed by fire recently. Plans have been made for rebuilding the entire plant at an estimated cost of about $10,000.

+Ludlow, Mass.—The contract for the construction of the factory for the Ludlow Mfg. Co. has been awarded to the J. W. BISHOP CO., 683 Atlantic Ave., Boston. The building will be of brick, five stories, 122x559 ft. Charles T. Main, 201 Devonshire St., Boston, Engr.

North Adams, Mass.—According to press reports, the Hoosac Cotton Co., North Adams, has announced plans for a new mill which will be built as soon as the new power plants of the Deerfield Valley are completed. The present plans call for an expenditure of about $900,000.

Pittsfield, Mass.—The Triumph Voting Machine Co., will erect a two-story addition, 18x60 ft., to its plant on Columbus Ave., Pittsfield.

The General Electric Co., has purchased a tract of land covering 40,000 sq.ft. adjoining its plant at Pittsfield, and will erect additional factory buildings.

+Taunton, Mass.—The Household Stove Mfg. Co. whose factory was burned recently has awarded a contract to R. E. WARNER for the erection of two brick buildings—one to be one story 150x210 ft., the other 200x77 ft. three stories.

Worcester, Mass.—Bids are being received for the structural steel of the superstructure of the building to be erected by the Worcester Presed Steel Co., at Greendale. The building will be two stories, 90x100 ft. William D. Thompson, State Mutual Bldg., is Engr. Noted Nov. 28.

Central Falls, R. I.—The Pawtucket Hosiery Co. has purchased a site at Central Falls, and will erect a two-story factory, 100x100 ft.

Providence, R. I.—The Blackstone Glazed Paper Co. has purchased a strip of land on North Bend St., and ground will be broken in a few weeks for a new wooden structure, 360x80 ft.

The Darthmouth Mfg. Co., will erect an addition to its No. 1 mill, to be 443x30 ft., one story, of brick and steel.

+New Britain, Conn.—From the plans of F. P. Sheldon & Sons, Providence, R. I. the contract has been awarded to the B. H. HIBBARD CO., 140 Main St., for the new factory on Corbin Ave. near Black Rock Bridge, for the Hart & Hutchinson Co. It will be 75x496 ft. one story high, of heavy mill construction. A brick boiler house 28x32 ft. will also be built. Noted Dec. 26.

New Haven, Conn.—The Semon Ice Cream Co. has purchased a site at 132 Bristol St., for a modern ice-cream factory, and is planning the erection of a building about three stories high and 50x150 ft. John Semon, 218 Park St., New Haven, is Pres.

+Brooklyn, N. Y.—John C. Wiarda & Co., manufacturer of chemicals and acids, 259 Green St., has awarded a contract to CHATTERTAN & WARWICK, 108 South Eighth St., for the rebuilding of the plant at Front, Pollock and Webster Sts. The plant will consist of ten buildings, including an office building, 50x50 ft.; three storage buildings, 50x100 ft.; shop, 50x100 ft.; boiler house, 38x50 ft.; foundry, 50x100 ft.; stable, 30x80 ft., acid works, 50x100 ft., and combustible shop, 50x35 ft. A. Ulbrick, 373 Fulton St., is the arch. Noted Sept. 19.

Brooklyn, N. Y.—Plans have been filed by Richard von Lehn, Jr., 2701 Avenue B, for the erection of a two-story, brick factory, on Sixth St., near Third Ave., for the manufacture of bathing suits. It will be 90x80 ft., and will cost $20,000.

Niagara Falls, N. Y.—The Niagara Falls Furnace Co., recently incorporated with a capital stock of $50,000, has had plans prepared for a plant, comprising two buildings, to be erected on a site just purchased in the new industrial section at the north end of the city. A. V. Davidson, Kittanning, Penn., W. R. Taylor, Aspinwall, Penn., and E. T. Williams, Niagara Falls, are the incorporators.

Oswego, N. Y.—The Oswego Textile Co., Inc., has filed incorporation papers with a capital stock of $25,000, and will establish and equip a plant for the manufacture of knit goods. J. A. Shufelt and A. C. Coon, of Oswego, and W. H. Spanswick, of Fultan, are the incorporators.

Silver Springs, N. Y.—The manufacturing plant of the Brown & Kearney Co., which was partially destroyed by fire with a loss of $25,000, is to be rebuilt at once.

Aldine, N. J.—Bids are being received by the Watson-Stillman Co., 50 Church St. New York, N. Y., for the con-

struction of a two-story machine shop, 120x100 ft., at Aldine. The estimated cost is $50,000. F. A. Waldron, 37 Wall St., New York, is Engr.-in-charge.

Grenloch, N. J.—The Bateman Mfg. Co., is having plans prepared by Henry L. Reinhold, arch., 1309 Walnut St., Philadelphia, Penn., for the construction of a four-story brass foundry, 100x50 ft. The estimated cost is $25,000.

Jersey City, N. J.—The C. F. Mueller Co., manufacturer of macaroni, Jersey City, is having plans prepared by F. P. Sheldon & Sons. Archs., 141 Broadway, New York, N. Y., for the construction of a five-story factory, 150x50 ft. The estimated cost is $75,000.

Newark, N. J.—The J. H. Ladew Co., Plank Road, manufacturer of leather products, will erect three new one-story additions to its plant, 40x150 ft., 37x58 ft., and 14x36 ft., respectively. The improvement is estimated to cost about $10,000.

Philadelphia, Penn.—C. H. Masland & Sons, carpet manufacturers, Frankford and Westmoreland Sts., are having plans prepared for a four-story factory, 150x100 ft., at their plant. The estimated cost is $50,000. William Steel & Sons Co., 1600 Arch St., is the arch.

Pittsburgh, Penn.—The United Oil Co., Adams St., is having plans pepared by Irvin & Witheron, Engrs., Keystone Bldg., for the construction of a two-story brick and reinforced-concrete factory, 119x100 ft. The estimated cost is $50,000.

Bluefield, W. Va.—The Bailey Lumber Co. will erect a new plant under the supervision of its vice-pres., G. McCue, at a cost of $25,000. It will be of mill construction, 53x280 ft., two stories in front and three in rear, and equipped with Universal rip saw, band saw and cutting boxes. E. R. Bailey, Lock Box 336, is Pres.

+Burlington, N. C.—The Keystone Finishing Mills has awarded a contract to T. G. NICHOLSON, Burlington, at about $5000, for the erection of a two-story brick addition, 90x60 ft. The equipment will be furnished by the PHILADELPHIA DYEING MACHINE CO., Philadelphia, Penn.

Shreveport, La.—The Caddo Lubricant Co. will erect a plant for the manufacture of lubricating oil.

Chattanooga, Tenn.—Press reports state that the Dayton Motor Truck Co., Dayton, Ohio, will establish a branch factory at Chattanooga. A. E. Ausman is representative.

Nashville, Tenn.—The White Star Iron Works, recently organized with $25,000 capital stock, will equip a plant for the manufacture of iron goods. E. Y. Chapman, H. A. Starr and L. C. Orr are the incorporators.

Louisville, Ky.—The Speedway Tire Co. has been organized with $250,000 capital stock, and will erect a plant to manufacture automobile tires. H. L. Lewman is Pres. of the company. G. W. Greene is Mgr., and will purchase equipment for the factory.

Pineville, Ky.—The Cumberland Motor Co. has been incorporated by H. J. Gibson and H. L. Pitman with $50,000 capital, and will equip a factory to manufacture a patented spring motor. The machinery required includes automatic gear-cutting machines, lathes, scrapers, screw machines, drills and spring coilers.

Canton, Ohio—The Canton Foundry & Machine Co., Canton, will soon receive bids for the erection of a one-story foundry, 62x145 ft.

Cincinnati, Ohio—The Corcoran Bros. Co., Cincinnati, lamp manufacturer, has taken out a permit to erect a four-story concrete, brick and steel plant on Reading Road, at Dandridge St. E. L. Baldwin & Co. are archs. Cost, $15,000.

Cleveland, Ohio—The S. F. K. Steel Barrell Co., Cleveland, is receiving bids for the erection of a factory, 55x110 ft. The building will be two stories high. S. B. Merry, 319 West St. N. W., is Mgr.

The Cleveland Electric R.R. Co., Cleveland, has been authorized by the City Council to erect a garage at Scovill Ave., S. E. and East 14th St. Cost, $10,000.

The city of Cleveland, Ohio, is planning to erect municipal machine shops for the repair and maintenance of automobile fire apparatus.

The Bourne-Fuller Co., range and stove manufacturer, Cleveland, will build a new factory addition, 170x300 ft.

East Palestine,Ohio—The Auto Owners Auto Tire Co., East Palestine, has been incorporated by C. J. Davis, T. Britton and others, to erect a factory to make automobile tires.

Lima, Ohio—The Ohio Steel Foundries Co., Lima, has applied to the Secretary of State for authority to increase its capital stock from $400,000 to $600,000. The increase will mean an enlargement of the present plant which now employs 350 men. An addition, 100x100 ft., is to be erected.

Auburn, Ind.—The Auburn Automobile Co., Auburn, will erect a two-story factory, 60x80 ft.

Boonville, Ind.—John G. Doelker & Sons Co., Owensboro, Ky., is considering the establishment of a harness and saddlery plant at Boonville.

Clay City, Ind.—The Modern Concrete Mfg. Co., Clay City, recently organized, will erect a factory to manufacture hollow building blocks, fence posts of concrete, etc.

Huntington, Ind.—The Majestic Furnace Co., Huntington, will erect an addition to its foundry, one story, 50x100 ft.

Detroit, Mich.—Morgan & Wright, Detroit, will erect a machine shop, 174x257 ft. The building will be three stories high.

Grand Rapids, Mich.—The Johnson Furniture Co. is planning the construction of a five-story factory at Grand Rapids, for the manufacture of furniture.

Menominee, Mich.—E. M. Gyms and A. M. Thomas, Fond du Lac, Wis., are considering establishing a factory at Menominee, for the manufacture of overalls.

Chicago Heights, Ill.—The Universal Wrench & Tool Co., Chicago Heights, has secured a site of five acres at Chicago Heights. A factory, 75x300 ft., will be erected.

Winona, Minn.—The Minnesota Harness Co. will construct a three-story addition, 25x140 ft., to its factory.

Pawnee City, Neb.—The Haarmen Vinegar & Pickle Co. will erect an additional factory building. It will be a three-story structure, 60x90 ft.

Hearne, Tex.—The Houston & Texas Central R.R. will double the capacity of its machine shops at Hearne. Its yard facilities will also be enlarged.

Lavernia, Tex.—The Lavernia Farmers Gin Co. will erect a cotton gin at Lavernia. Frank Koepp, William Englehardt and C. C. Pickow are interested.

Tuleta, Tex.—O. L. Taylor, Devine, Tex., will construct a cotton gin at Tuleta.

Denver, Colo.—The Bayley-Underhill Manufacturing Co. has had plans prepared for the construction of a large overall factory at 20th and Arapahoe Sts. It will be a five-story structure, 50x150 ft., of reinforced concrete and steel. The estimated cost is $75,000. Willison & Falis are the Archs.

Blaine, Wash.—The Blaine Farm Products Co. is being organized with a capital of $25,000, for the purpose of building a cannery.

Leavenworth, Wash.—The Kellogg Lumber Co., Leavenworth, plans to build a new lumber mill and box factory. The estimated cost is $100,000.

Seattle, Wash.—C. C. Wolford, of the firm of Wolford & Wolford, is having plans prepared for the construction of a garage and repair shop in Seattle, to cost approximately $100,000.

Spokane, Wash.—The Armstrong Machinery Co., Spokane, has had plans prepared for the construction of a new foundry for making a semisteel castings.

Toppenish, Wash.—The Northern Pacific Ry. Co. will build a new roundhouse at Toppenish.

Bandon, Ore.—George Geisendorf and E. E. Johnson will build a new box factory at Bandon, to cost approximately $10,100.

Lincoln, Ore.—The Lincoln Canning Co. has been incorporated with a capital of $25,000, for the purpose of erecting a cannery.

Whalem, Ore.—The Wheeler Lumber Co., Whalem, is planning the erection of a large dry kiln.

Fresno, Calif.—D. S. Ewing and L. O. Everts, Fresno, are planning the erection of a commercial garage and machine shop on I St., Fresno. The building will be 75x100 ft., and will cost approximately $13,000.

Lincoln, Calif—The Placer County Fruit Growers, recently incorporated, will build a cannery at Lincoln, to cost about $50,000. A. Sereva is Pres.

Los Angeles, Calif.—Hoxie & Gooloe, San Francisco Bldg., Los Angeles, are preparing plans for the construction of a one-story ice-making plant, of brick, on Slauson Ave. The estimated cost is $13,500.

The San Francisco Cornice Co., San Francisco, will erect a large manufacturing plant on Keller St., Los Angeles.

E. S. Butterfield, Los Angeles, is having plans prepared for the construction of a commercial garage and machine shop, 100x120 ft., on Boyd Ave. Train & Williams, Exchange Bldg., Los Angeles, are the Archs.

Oakland, Calif.—The J. C. Westphal Mill, known as the Bay City Flour Co., Oakland, has been purchased by R. D. Holmes. About $500,000 will be expended in making improvements and additions to the plant.

San Diego, Calif.—The plant of the Standard Iron Works Co., 23d St., San Diego, which was recently destroyed by fire with a loss of about $50,000, will be rebuilt at once.

The Magic City Mfg. Co. will erect a canning plant in San Diego. E. D. Shackleford is interested.

San Diego, Calif.—P. A. Snapp, recently of Denver, Colo., and N. J. Anderson, of Coffeyville, Kan., have leased about 50 acres of shale beds in Rose Cañon, near San Diego, where they will erect a factory for the manufacture of brick, tile, piping and paving blocks. The first section of the factory will cost about $35,000.

San Francisco, Calif.—The San Francisco Disposal Co., San Francisco, has applied for a permit to construct a plant for rendering tallow and other substances, at Evans Ave. and Keith St. It will be of reinforced concrete and steel. Charles Turner is Pres. and Mgr.

San Francisco, Calif.—Plans are being prepared for the construction of a five-story and basement factory of reinforced concrete on Mission St., for the Gantner & Mattern Co. George William Kelham, Crocker Bldg., is the Arch.

Niagara Falls, Ont.—The Visor Knitting Co., Niagara Falls, N. Y., will build and equip a branch plant here for the manufacture of wool and worsted sweater coats.

Sandwich, Ont.—The United States Steel Corporation, Pittsburgh, Penn., has secured a site at Sandwich, opposite Detroit, and is considering the erection of a $20,000,000 steel plant.

Thoroid, Ont.—The Window Glass Machinery Co., Cayuga, Ont., will erect a branch factory in Thoroid. Pilkington Bros., St. Helens, Eng., are the owners of the company.

Toronto, Ont.—The A. B. Ormsby Co. has purchased a site at King and Dufferin Sts., and will erect a plant for the manufacture of metal window frames, at a cost of $150,000.

The Cowan Co., Ltd., manufacturers of chocolate, cocoa, etc., has taken out a permit for the erection of a new factory on Sterling Road, near Dundas St., to cost $89,700.

Edmonton, Alta.—The Acme Brick Co., whose plant is located six miles west of Edmonton, will make additions and improvements at a cost of $250,000. The daily capacity will be increased from 75,000 to 250,000.

Winnipeg, Man.—The Stover Gas Machine Co. will erect a plant for the manufacture of soda and gasoline pressure tanks and allied lines. The company may be addressed in care of the Winnipeg Industrial Bureau.

FEDERAL GOVERNMENT WORK

Post Office—Biddeford, Maine.—Bids will be received until 3 p.m., Jan. 30, by the Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post-office in Biddeford. Oscar Wenderoth is Supervy. Arch.

Bridge—Portsmouth, N. H.—Bids were received as follows, Jan. 4, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a combined railway and highway bridge at the navy yard, Portsmouth: Item (1), substructure and superstructure complete; (2) substructure complete; (3) superstructure complete: (4) amount per cu.yd. for use of granite blocks belonging to the government: Penn Bridge Co., Washington, D. C.: (3) $34,400; C. M. Leach, P. O. Box 2285, Boston, Mass., (1) $123,983; (2) $84,000; (3) $41,000; (4) $3; Snare & Triest, 143 Liberty St., New York, N. Y., (1) $109,700. Noted under Bridges Dec. 19.

+Magazine—Hingham, Mass.—The contract has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a magazine at the U. S. Naval Magazine at Hingham, to J. B. ROWEN, Moorestown, N. J., at $12,350. Bids were opened Nov. 30.

Electric Elevators—New York, N. Y.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m. Jan. 25, for the installation of three electric passenger elevators in connection with the reconstruction of the U. S. Barge office at New York.

Dredging—Philadelphia, Penn.—Bids were received as follows, Dec. 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the Philadelphia, Navy Yard: Rickards Dredging Co., Real Estate Trust Bldg., Philadelphia, Penn., $9640; American Dredging Co., 308 Chestnut St., Philadelphia, $9750; August Nelson, 178 Donaldson Ave., Rutherford, N. J., $11,900.

Dam Parts—Pitsburgh, Penn.—Bids were received as follows, Dec. 19, by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., Pitsburgh, for delivering wicket irons, horses, props, service bridges, and poiree trestles for Dams Nos. 7, 8 and 19, Ohio River: (a) 1,005,870 lb. of wicket irons; (b) 727,416 lb. horses; (c) 648,728 lb. props; (d) 570,450 lb. service bridges and poiree trestles: Lawrence D. Weaning, Cleveland, Ohio, (b) 7c. per lb.; Heppenstall Forge & Knife Co., Pittsburgh, Penn., (b) 5.75c.; (c) 3.95c.; Pittsburgh Trolley & Forge Co., Pittsburgh, (a) 2.9975c.; Penn Bridge Co., Beaver Falls, Penn., (a) 3.6c.; (b) 5.45c.; (c) 4.95c.; (d) 3.8c.; Independent Bridge Co., Pittsburgh, (a) 3.46c.; (d) 4.76c.

+Gun Forgings—Washington, D. C.—Contracts have been awrded as follows by the Chief of Ordnance, U. S. N., Washington, for 15 sets of 14-in. nickel-steel gun forgings: For seven sets to the BETHLEHEM STEEL CO., South Bethlehem, Penn., for eight sets to the Midvale Steel Co., Philadelphia, Penn. Bids were opened Dec. 18. Noted Dec. 26.

Steel Forgings—Washington, D. C.—Bids will be received until noon, Jan. 10, by William Crozier, Ch. Ordnance Dept., Washington, for two sets of steel forgings for 14-in. guns, Model 1910.

Radio Station Equipment—Washington, D. C.—Bids were received, Dec. 28, by the Disbursing Officer, U. S. A., Washington, for furnishing one 5-kw. radio station equipment: F. Lowenstein, 115 Nassau St., New York, $5000; 120 days; National Electric Signaling Co., Farmers' Bank Bldg., Pittsburgh, $10,000; 150 days; Marconi Wireless Telegraph Co. of America, 27 William St., New York, $3375; 10 days; Wireless Specialty Apparatus Co., 81 New St., New York, $3595 and $3295 if Sebit wave meter is omitted; 90 to 100 days; Telefunken Wireless Telegraph Co. of the U. S., 111 Broadway, New York, $6175; 90 days; De Forest & C. Electric & Mfg. Co., 90 West St., New York, $3905; 60 days.

Light Vessels—Washington, D. C.—Bids will be received until 2 p.m., Feb. 1, by the Bureau of Light Houses, Dept. of Commerce and Labor, Washington, for furnishing material and labor necessary for the construction, equipment and delivery of two steel light vessels, Nos. 96 and 98.

+Submarines—Washington, D. C.—The Secretary of the Navy Washington, D. C., has divided equally between the ELECTRIC BOAT CO., New York, and the LAKE TORPEDO BOAT CO., Bridgeport, Conn., the contract for the construction of eight submarine torpedo boats at a cost of approximately $500,000 each. Four are to be built on the Atlantic Coast and four on the Pacific Coast. Bids were opened Dec. 6. Noted Dec. 12.

Wire, Steel Angles, Etc.—Washington, D. C.—Bids will be received until Jan. 14 by the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards and naval stations supplies as follows: Washington, D. C., Schedule 5067, 1000 lb. of soft copper wire; Shedule 5078, 5400 lb. structural steel angles, 36,700 lb. boiler plates. Brooklyn, N. Y., Schedule 5080, 1140 lb. handdrawn brass bar, miscellaneous medium bronze plates, 3560 lb. medium bronze shapes; Schedule 5081, 50M ft. Idaho soft pine, 6M ft. special mahogany. Norfolk, Va., schedule 5084, six clippings, six riveting and six scaling pneumatic hammers.

Post Office—Morgantown, W. Va.—Bids were received as follows, on Jan. 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Morgantown, W. Va.: (a) Limestone; (b) sandstone; George W. Stiles Construction Co., Chicago, Ill., (a) $97,867; (b) $103,867; Guernsey O'Meara Co., Philadelphia, (a) $97,995; Moore & Danner, Kokomo, Ind., (a) $98,800; Lazzell & Boyd, Morgantown, W. Va., (a) $117,000; King Lumber Co., Charlottesville, Va., (a) $103,000; (b) $110,000; William H. Fissell, New York, (a) $103,762; (b) $113,762; Interurban General Construction Co., New York, (a) $96,340; (b) $97,400; David T. Riffle, Pittsburgh, Penn., (a) $108,317; (b) $110,817; James Devault, Canton, Ohio, (a) $96,500; (b) $99,000; John G. Unkefer & Co., Mercervy, Ohio, (a) $95,393; (b) $98,393; Conners Bros. Co., Lowell, Mass., (a) $98,538; (b) $105,000; J. E. & A. L. Pennock, Philadelphia, Penn., (a) $105,800; (b) $109,000; McGarvey Blair, Waynesboro, Penn., (a) $99,998; (b) $100,998. Noted Oct. 31.

Alterations to Dredge—Jacksonville, Fla.—Bids will be received until noon, Jan. 30, by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for alterations to the dredge "Jacksonville."

Shore Protection Work—Rock Island, Ill.—Bids were opened Dec. 18, by the U. S. Engineer, Rock Island, for shore protection work and the repair of dams between (a) Clayton, Iowa, and Cassville, Wis.; (b) Rock River and Fairport, Iowa; and (c) Keokuk, Iowa, and Canton, Mo. The lowest bidders follow: (a) Kirchner Contracting Co., Dubuque, Iowa; (b) Builders' Sand & Gravel Co., Davenport, Iowa; (c) A. W. Fetter, Quincy, Ill. The total amount available for the work is $175,750.

+Post Office—Fort Madison, Iowa.—Oscar Wenderoth, Supery, Arch., Treasury Dept., Washington, D. C., has awarded contract to MOORE & DANNER, Kokomo, Ind., for the construction of the post-office at Fort Madison, Iowa, at $62,775. Noted Dec. 26.

+Cement—Fort Leavenworth, Kan.—The contract for furnishing 10,000 bbl. of Sunflower brand cement at Fort Leavenworth has been awarded to the KANSAS CEMENT & MATERIAL CO., Kansas City, Mo., at $1.56 per bbl. in cloth. Bids were opened Dec. 2 by the Constructing Quartermaster, U. S. Military Prison at Fort Leavenworth. List of bidders noted Dec. 19.

Buildings—San Francisco, Calif.—Bids were received as follows: Jan. 6, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. Sub-Treasury at San Francisco: Christensen Bros., Oakland, Calif., $472,600. William H. Maxwell, Phoenix, Ariz., $425,485. J. H. Wiese, Omaha, Neb., $411,320. H. A. Klyce, San Francisco, $485,000. Grant Fee, San Francisco, $384,300. F. Rolandi, San Francisco, $479,073. Lang & Bergstrom, San Francisco, $447,825. Campbell Building Co., of Utah, Salt Lake City, Utah, $404,698. Louis A. Hicks Co., San Francisco, $447,500. Eugene Schuler, Watertown, N. Dak., $397,500. Sound Construction & Engineering Co., Seattle, Wash., $417,488. King Lumber Co., Charlottesville, Va., $444,000. Conners Bros. Co., Lowell, Mass., $404,437. Franklin M. Gordon & Co., San Francisco, $405,325. Lindgren & Co., San Francisco, $397,100.

MISCELLANEOUS

Subway—Boston, Mass.—A report has been made to the Legislature by the Transit Commission on a subway from Archer Sq. South Boston, to Cadman Sq. Dorchester. The route suggested is via Boston St., Columbia Rd. Hancock, Bowdoin and Washington Sts. Edmund S. Davis is Ch. Engr. Conn.

Drydock—Boston, Mass.—The Directors of the Port of Boston are having plans prepared for the construction of the proposed 1180-ft. drydock in South Boston, near the new Commonwealth piers. Frank W. Hodgdon is Ch. Engr. Noted Jan. 2.

★Hearings on Subway Contracts—New York, N. Y.—The Public Service Commission for the First District will hold public hearings on the form of contracts containing terms and conditions to govern joint construction by the city, and by the Interborough Rapid Transit Co. and by the New York Municipal Railway Corporation, of certain rapid transit railroads embraced in the Dual System, and operation by those companies, respectively, of the portions of said lines allotted to each in conjunction with existing rapid transit roads now operated by each. The hearings will be held on Jan. 14, in Room 2305, No. 154 Nassau St., New York, as follows: On the New York Municipal Railway Corporation contract at 10 a.m.; on the Interborough Rapid Transit Co. contract at 2 p.m. Copies of the proposed contracts are for sale at $1 each. William R. Willcox is Chn.

Fire Houses—New York, N. Y.—All bids opened Dec. 31 by Joseph Johnson, Fire Comr., Boro. Manhattan, have been rejected as excessive.

Hearings on Elevated Extensions—New York, N. Y.—Public hearings will be held by the Public Service Commission on the terms and conditions of the certificates proposed to be issued to the Interborough Rapid Transit Co., the Manhattan Ry. Co., and the New York Municipal Ry. Corporation (Brooklyn Rapid Transit Co.), granting the rights to construct and operate certain extensions to and additional tracks upon existing elevated railroads embraced in the Dual System of rapid transit, as follows: Jan. 17, at 10 a.m., Interborough Rapid Transit Co.: Cedtificate for elevated extensions. Jan. 17, at 10 a.m., Manhattan Ry. Co.: Certificate for additional tracks on elevated railroads. Jan. 17, at 2 p.m., New York Municipal Ry. Corporation; Certificate for additional tracks on elevated railroads. Jan. 18, at 10 a.m., New York Municipal Ry. Corporation: Certificate for extension of elevated railroads. All the above hearings will be held at the office of the Commission in Room 305, Tribune Bldg., No. 154 Nassau St., New York. Travis H. Whitney is Secy.

Stadium—Syracuse, N. Y.—The New York State Fair Commission has passed on plans for a stadium, to be constructed at Syracuse. Estimated cost, $300,000.

Pier and Docks—Camden, N. J.—The city is considering the construction of a recreation pier and docks at Spruce and Walnut Sts.

Coaling Station—Port Reading, N. J.—The Port Reading R.R. Co., Reading Terminal, Philadelphia, will erect a coaling station at Port Reading, 66x473x38 ft., of steel and wood.

Shipyard Enlargement—Philadelphia, Penn.—Preparations are being made by the William Cramp & Sons Ship & Engine Building Co., Philadelphia, to enlarge its shipyard. Estimated cost, $2,000,000.

Play Grounds—Philadelphia, Penn.—The Board of Recreation has awarded the contract to the SAC & ABBOTT CONSTRUCTION CO., Hale Bldg., Philadelphia, for constructing playgrounds at Wayne Ave. and Logan St. to cost $16,000.

Retaining Wall—Pittsburgh, Penn.—Bids will be received until Jan. 10, by the City Controller for constructing a concrete retaining wall on Brownsville Ave. J. G. Armstrong is Dir. Dept. Pub. Wks.

★Jetty Construction—Wilmington, Del.—Bids will be received until 11 a.m., Feb. 3, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for petty construction at the mouth of the Mispillion River, Del.

★Locomotive—Washington, D. C.—Bids will be received by the Department of the Interior, Washington, D. C., until 2

p.m., Jan. 27, for furnishing and delivering one locomotive and dependencies, carriage free, at the Government Hospital for the Insane, Washington, D. C., in accordance with specifications, copies of which may be obtained upon application to the Chief Clerk of the Department. Lewis C. Laylin is Asst. Secy.

Docks—Pensacola, Fla.—The citizens have voted to issue $400,000 of bonds for the construction of municipal docks and a belt-line railroad.

Drainage Pumping Equipment—Toledo, Ohio—The City Board of Control, Dec. 24, awarded to the POWER EQUIPMENT CO., a contract for pumping equipment to drain North Toledo Marsh, at $9506.

Docks—Toledo, Ohio—The Toledo & Ohio Central Ry. Co. has had plans prepared for the construction of new docks at Toledo. J. A. Stocker, Columbus, Ohio, is Ch. Engr.

Coal Storage Plant—Superior, Wis.—The entire soft-coal equipment of the coal dock of the Lehigh Valley Coal Co's. tower slip plant is being razed. It is understood that a hard-coal storage plant is contemplated. Emil Emmert is Supt.

Ditch Work—Des Moines, Iowa—Bids will be received until 8 p.m., Feb. 3, by the County Auditor, Des Moines, for work on Drainage Ditch No. 12.

+Tile—Webster City, Iowa—The contract has been awarded to the LEHIGH CLAY PRODUCTS CO. for furnishing the tile for the Phillips point ditch No. 138, at 13,986. The contract for labor was awarded to C. Haugsted, Nevada, Iowa, at $12,500.

Ditch—Minneapolis, Minn.—Bids will be received until Jan. 16 by A. P. Erickson, County Audr., Minneapolis, for constructing Judicial Ditch No. 20, to be 5¼ miles long and to traverse parts of Hennepin, Wright and Carver Counties, reclaiming 14,000 acres. Estimated cost, $10,000. Noted Dec. 26.

★Earthwork—Nebraska—There is earthwork to let in Nebraska and Kansas, made up of team, steam shovel, drag line and grader work, wagon and traction engine hauling. Large or small jobs are ready now or in the spring. Payments will be made monthly in cash. Outfit for which work is wanted should be stated. Address P. 21, Engineering News.

+Ditch—Paragould, Ark.—The contract, it is reported, has been awarded to WILLS & SONS for constructing a ditch about eight miles long, at about $25,000. Bids were received by the Village Creek Drainage District.

Drainage District—Bryan, Tex.—The Commissioners' Court of Brazos County has been petitioned to establish a drainage district in the southern part of the county.

Drainage—Angleton, Tex.—Bonds for $130,000 have been issued in Drainage District No. 8 of Brazoria County for the purpose of constructing a system of drainage canals and ditches.

Baseball Park—Tacoma, Wash.—A new baseball park will be laid out by the Tacoma Baseball Association. J. J. McGinnity is Pres.

+Pier—Hermose Beach, Calif.—The contract has been awarded to the MERSEREAU BRIDGE & CONSTRUCTION CO., Pacific Electric Bldg., Los Angeles, Calif., for the construction of the proposed pleasure pier, at $56,390. Bids were opened Dec. 20 by the city.

Dock Work—Longbeach, Calif.—An extension to the municipal dock has been authorized.

Tunnel—Los Angeles, Calif.—The Special Tunnel Committee of the City Council has recommended the construction of two single-bore tunnels in First and Second Sts.

Levee Work—Sacramento, Calif.—Property owners in the southern part of the city are considering the construction of a levee. Estimated cost, $10,000. The work will be in charge of Albert Givan, City Engr.

Bath house—San Francisco, Calif.—The lowest bid received by the Playgrounds Commissioners for the construction of a one-story reinforced concrete bath-house at the North Beack Playgrounds, Powell and Lombard Sts. has been submitted by Carnahan & Mulford, San Francisco, at $13,389.

+Wharf—Big Bay Point, Ont.—The contract for the construction of a wharf with a stone approach at Big Bay Point has been awarded to H. HICKEY, Petersborough, Ont.

+Breakwater—Port Arthur, Ont.—The contract has been awarded to the THUNDER BAY CONTRACTING CO., Port Arthur, for constructing a breakwater at the south end of the city.

Dredging—Vancouver, B. C.—Bids will be received until Jan. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for all dredging required at False Creek, Vancouver.

Locks and Dam—Quebec, Que.—Bids will be received until Feb. 10, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing two locks and a dam in Quebec Harbor, Quebec.

BUILDINGS

Springfield, Mass.—Henry R. Johnson will build a six-story brick commercial building on Market St. It will be of brick mill construction, 66x75 ft., with an ell 25x25 ft., five stories high. The plans are being prepared by the Samuel M. Green Co., Inc., Springfield.

Stamford, Conn.—The Suburban Club is planning the erection of a club house on Main St., which will cost about $60,000. Peabody & Stearns, 53 State St., Boston, Mass., are the Archs., and L. J. Curtis, Schuyler Merritt and A. J. Hatch, Stamford, are the building committee.

Malone, N. Y.—A theater building, 54x90 ft., to be known as the Star Theater, is to be erected in Malone by F. A. Gilroy, of Ogdensburgh. G. Wilson, Ogdensburgh, is the Arch.

Troy, N. Y.—F. F. Proctor is considering sites for the construction of a new theater, to cost approximately $200,000.

Watertown, N. Y.—J. Dewey, Arch., is preparing plans for a Masonic Temple building, 68x130 ft., five stories high, brick and terra cotta, to be erected on Washington St. The estimated cost is $150,000.

White Plains, N. Y.—The Gedney Farm Co. has been incorporated here with a capital of $1,500,000, for the purpose of constructing a hotel. A site has already been secured, and the general contract will be let in January. The incorporators are Robert E. Farley, Dorman T. Connet, William L. Rumsey, L. Ward Prince and C. Halsey Mitchell.

Bayonne, N. J.—Guilbert & Bettelle, Archs., 665 Broad St., are receiving bids for the construction of a three-story, 77x140-ft. addition to Public School No. 6. The estimated cost is $150,000. Noted Sept. 26.

+Bound Brook, N. J.—The contract for the construction of two railroad stations at Bound Brook, for the C. R.R. of New Jersey has been awarded to the MERRICK FIREPROOFING CO., 1 Broadway, New York.

Camden, N. J.—Bids will be received about Jan. 25, by Moffett & Stewart, Archs., Jessup Bldg., for the construction of a two-story and basement, 120x130-ft. school building. The estimated cost is $90,000.

+Elizabeth, N. J.—The contract for the construction of the building on North Broad St., for the Public Service Corporation, has been awarded to the DAVID HENRY BUILDING CO., Newark, N. J.

Bids will be readvertised for the construction of a school building at Lyons Farms, for the Union Township Board of Education. Jacob Wind, Jr., is Arch., Elizabeth, N. J. The estimated cost is $40,000. Noted Nov. 28.

Irvington, N. J.—Bids will be received until 8 p.m., Jan. 9, by William A. Sherman, Secy. Bd. of Education, Irvington, N. J., for the construction of a school building on Augusta St. Joseph B. Allen is Arch., 11 Sanford St., Irvington, N. J. Noted Oct. 31.

Newark, N. J.—Plans have been prepared by Charles L. Steinbrenner, Arch., 118 Market St., for the construction of a two-story and basement brick department store, for Louis Rothstein. The estimated cost is $40,000.

Newark, N. J.—R. D. Argue, Secy. Board of Education, will receive bids about Jan. 15 for the construction of a three-story, 70x165-ft. school building, on Central Ave. The estimated cost is $70,000. E. F. Gilbert is Arch., City Hall.

+Pleasantville, N. J.—The contract for the construction of the almshouse at Pleasantville, has been awarded to JOHN W. EMERY, at $75,000.

Carlisle, Penn.—The Carlisle School Board has purchased a site at Mooreland Ave. and Graham St., for the construction of a high school. The estimated cost is $100,000.

+Harrisburg, Penn.—The contract for the construction of the building on Cedar St., for the Elliott-Fisher Co., has been awarded to JOHN W. WICKERSHAM, Lancaster, Penn.

Johnstown, Penn.—Bids will be received until Jan. 10, by Seymour & Paul A. Davis, Archs., 1713 Sansom St., Philadelphia, for the construction of a Y. M. C. A. building at Johnstown. Noted Dec. 12.

+Philadelphia, Penn.—Contracts for the construction of two school buildings have been awarded to CRAMP & CO., Philadelphia, one to be erected at 27th and Clearfield St., at $200,000, and another at 56th and Christian Sts., at $200,840.

Plans are being prepared by Zantzinger, Borie & Medary, Archs., Philadelphia, for the construction of a 37-story office building, 82x116 ft., at Broad and Locust Sts., for John H. McFadden. The estimated cost is $3,000,000.

**+The contract for the construction of the theater at Franklin and Clearfield Sts., for the Philadelphia Film Exchange, has been awarded to SAMUEL SCHULTZ, 920 E. Moyamensing Ave.

Plans are being prepared by H. L. Reinhold, 1309 Walnut St., for the construction of a ten-story, 40x130-ft. apartment house for Thomas W. Barlow, 122 South 13th St. The estimated cost is $100,000.

Plans have been prepared by Shukert & Sloan, Archs., for the construction of a four-story apartment house, at Broad and Thompson Sts., for Kahn & Greenbaum.

Plans have been prepared by George I. Lovatt, 416 Walnut St., for the construction of the St. Joseph's Polish Roman Catholic Church, 86x152 ft., of stone construction. The estimated cost is $125,000.

Magaziner & Potter, Archs., have prepared plans for the construction of a surgical ward building at Broad St. and Olney Ave. The estimated cost is $100,000.

Pittsburgh, Penn.—Alden & Harlow, Archs., Farmer's Bank Bldg., are receiving bids for remodeling the Allegheny County court house, to conform to the new grades of the hump cut. The estimated cost is $200,000. Noted Oct. 24.

The Union R.R. will erect an office building in Linden Ave., East Pittsburgh. J. A. Ralston is Mech. Engr., Pittsburgh.

Scranton, Penn.—The Scranton Life Insurance Co. will erect a 12-story office building at Adams Ave. and Spruce St. The estimated cost is $500,000.

Yardley, Penn.—The Philadelphia & Reading Ry. Co. is contemplating the erection of a new passenger station at Yardley. Wm. Hunter is Ch. Engr., Philadelphia, Penn.

Annapolis, Md.—Bids will be received until Jan. 9, by the City Armory and Convention Hall Commission for State of Maryland, for the construction of an armory at Annapolis. Baldwin & Pennington, are Archs., 330 N. Charles St., Baltimore, Md. The estimated cost is $40,000.

Baltimore, Md.—The lowest bidder for the construction of the addition to School No. 99 was the Singer-Pentz Co., 600 Equitable Bldg., Baltimore, Md., at $54,000.

Towson, Md.—J. Rush Marshall, 1410 11th St. N. W., Washington, D. C., has been selected by the Building Committee to prepare plans for the construction of the State Normal School Building, estimated to cost $600,000, the amount appropriated by the Legislature. J. Charles Linthicum, Chn. of the State Normal School.

+Washington, D. C.—The National Capitol Press will erect a seven-story brick and steel building at 511 11th St. N. W., and have awarded the contract to the BOYLE-ROBERTSON CONSTRUCTION CO.

+The contract for the construction of the Normal School has been awarded to GEORGE E. WYNE, Munsey Bldg., at $170,024.

Washington, D. C.—The National Geographical Society 16th and M. Sts., N. W., will erect an office building on 16th St. The estimated cost is $150,000. C. J. Bell is Chn. of the Finance Com.

The lowest bidder for the construction of the Normal School building was James L. Parsons, 610 Union Trust Bldg., Washington, at $202,000.

Staunton, Va.—Shattuck & Hussey, Archs., 907 La Salle St., Chicago, Ill., are preparing plans for the construction of a Y. M. C. A. building, at Staunton The estimated cost is $60,000.

+Charleston, W. Va.—The contract has been awarded to W. A. ABBITT, for the construction of a hotel on McFarland St., for the Holly Hotel Co., of Charleston.

Parkersburg, W. Va.—The Board of Education will erect a high school, estimated to cost $300,000. I. B. Bush is Supt., Bd. of Education.

Summersville, W. Va.—Bids will be received until 10 a.m., Jan. 20, by W. G. Brown, Secy. Bd. of Directors of Nicholas County High School, for the construction of a high school at Summersville. H. Rus Warne is Arch., Charleston, W. Va.

+Columbia, S. C.—The contract for the construction of the jail on Lincoln St. has been awarded to W. B. SUMMERSETT, Columbia, at $40,000. Noted Dec. 12.

+Florence, S. C.—The First Methodist Episcopal Church South, has awarded the contract to T. BAKER HAYNESWORTH, Florence, at $45,167, for the construction of a church edifice.

Cordele, Ga.—J. F. Gray, of the Railroad Commission, is planning the improvement of Cordele's passenger station. The estimated cost is $50,000.

Lakeland, Fla.—Bids will be received until 10 a.m., Jan. 20, by C. M. Clayton, First National Bank, of Lakeland, for the construction of a five-story and basement hotel, for Kibbler Bros. McIver & Mackay are Archs., Ocala, Fla. Noted Dec. 26.

Birmingham, Ala.—The Birmingham Paper Co. will erect a six-story building on First Ave., adjoining the Chamber of Commerce.

DeKalb, Miss.—P. J. Krouse, Arch., Meridian, Miss., has prepared plans for the construction of a court house, for Kemper County. The estimated cost is $50,000.

+Meridian, Miss.—The contract has been awarded to C. H. DABBS, Meridian, at $117,005, for the construction of a city hall and jail building.

+Lake Charles, La.—The contract has been awarded to REINHARDT & DONOVAN, Lake Charles, at $58,850, for the construction of a church edifice. Favrot & Livandais, 809 Gravier St., are Archs.

New Orleans, La.—The B. P. O. E. Lodge No. 30 will erect a ten-story lodge building. The estimated cost is $200,000.

+Johnson City, Tenn.—Bids for the construction of the high school on Science Hill have been received as follows: CURTIS BROS., Johnson City, Tenn., $47,945, awarded contract; L. A. Galyou & Co., Knoxville, $50,900. Noted Dec. 5.

+Nashville, Tenn.—The contract for the construction of a $150,000 building has been awarded by the Baptist Publishing House of Nashville, Tenn., to the SHELDON CONSTRUCTION CO., St. Louis, Mo.

Louisville, Ky.—The Standard Sanitary Mfg. Co. is having plans prepared for the construction of an eight-story warehouse at Seventh and Shipp Sts. The estimated cost is $60,000.

Akron, Ohio—Plans are being prepared for the construction of a seven-story and basement warehouse for the Union Fireproof Storage Co. Patterson & Davidson, 53 West Jackson Blvd., Chicago, Ill., are the Archs.

Alliance, Ohio—The Alliance Bank Co. contemplates the erection of a seven-story and basement bank and office building, of brick, reinforced concrete and steel. The estimated cost is $125,000.

Plans are being prepared for the construction of an edifice, on North Cleveland Ave., for the First Church of Christ, Scientist. The estimated cost is $50,000.

Bellaire, Ohio—Plans have been prepared for the construction of a city hospital building, to cost about $60,000.

Cincinnati, Ohio—The Cincinnati & Suburban Bell Telephone Co. has filed plans for a new building at Fourth Ave. and Hammond St., to cost about $500,000.

Plans have been prepared for the construction of a 50-room addition to the Christ Hospital, Cincinnati. Tietig & Lee, Cincinnati, are the Archs.

Cleveland, Ohio—Plans are being prepared for the construction of a two-story and basement school of reinforced concrete and brick at East 23d and Chesterfield Sts. The estimated cost is $80,000. F. S. Barnum, Board of Education Bldg., is the Arch.

The Board of Education has ordered plans for the construction of a two-story and basement school of reinforced concrete and steel at East 79th St. and Hough Ave. The estimated cost is $90,000. F. S. Barnum, Board of Education Bldg., is the Arch.

F. S. Barnum, Board of Education Bldg., has been commissioned to prepare plans for the construction of a three-story and basement grade school, of reinforced concrete, steel and brick, on East 43d St., near Woodland Ave. The estimated cost is $120,000.

Columbus, Ohio—Plans have been prepared for the construction of an edifice for the Holy Rosary Church, on East Main St. The estimated cost is $60,000.

Dayton, Ohio—The Dayton, Xenia & Springfield Traction Co. will erect a one- and two-story Interurban Terminal and office building in Dayton. The estimated cost is $50,000. Theis & Theis, Bollinger Bldg., are the Archs. T. A. Fernelding, 208 South Ludlow St., Dayton, is Gen. Mgr.

Lima, Ohio—The bids for the completion of the Lima State Hospital, which were received Dec. 20, have been rejected, and the work will be readvertised. Frank L. Packard, Hayden Bldg., Columbus, Ohio, is the Arch. Noted Dec. 5.

+Norwalk, Ohio—The Commissioners of Huron County have awarded the general contract for the construction of a new court house to GEORGE KRATT, Lorain, Ohio, at about $80,722. Nov. 28.

Norwood, Ohio—Plans are being prepared for the construction of a motion picture theater at Mills and Main Aves., Norwood, for the Plaza Co. S. S. Godley is the Arch. A. C. Dinglestedt is interested. The estimated cost of the structure is $60,00.

Springfield, Ohio—Plans have been prepared and bids will be received until Jan. 15, for the construction of an annex to the Springfield High School. The estimated cost of the structure is $100,000. Reed & Heckenlively are the Archs.

Steubenville, Ohio—Bids are being received for the construction of a one- and two-story church of brick for the Westminister Presbyterian Congregation, Steubenville. The estimated cost is $50,000. Vrydaugh & Wolf are the Archs.

Trinidad, Ohio—Press reports state that bids will be received by the Board of County Commissioners, until Jan. 15, for the erection of a courthouse. I. H. & W. M. Rapp & Co., Masonic Bldg., are the Archs.

Youngstown, Ohio—Plans are being prepared for the construction of a four-story addition, 75x150 ft., to the store building of John Stambaugh, Youngstown. The estimated cost is $50,000. Albert Kahn and E. Wilby, Trussed Concrete Bldg., Detroit, Mich., are the Archs.

Youngstown, Ohio—Plans are being prepared for the construction of a warehouse for the Mauser Warehouse Co., Youngstown. The estimated cost is $450,000. F. E. Devidson, 53 West Jackson Blvd., Chicago, Ill., is the Arch.

Clinton, Ind.—The School Board is having plans prepared for the construction of a new high school on the Opera House Block.

+Crawfordsville, Ind.—The contract for the construction of a new Y. M. C. A. building has been awarded to W. D. CARNE & SON, at $60,000. Noted Nov. 28.

Evansville, Ind.—The Acme Hotel Co., Evansville, is having plans prepared for the construction of an eight-story hotel, of brick, at Sycamour and Second Sts.

Detroit, Mich.—Patterson & Davidson, 53 West Jackson Blvd., Chicago, Ill., have been commissioned to prepare plans for the construction of an eight-story warehouse, 100x100 ft., for Leonard's Reliable Storage Co., Detroit, Mich. The estimated cost is $100,000.

Beloit, Wis.—Bids are being received for the construction of a Masonic Temple. E. O. Powers is Secy. of the Beloit Masonic Temple Assn. The estimated cost of the structure is $50,000. Leenhauts & Guthrie, Milwaukee, are the Archs.

Green Bay, Wis.—Press reports state that plans are being prepared for the construction of an addition to St. Vincent's Hospital. George Helmic, Springfield, Ill., is the Arch. The estimated cost is $40,000.

Milwaukee, Wis.—William O'Connor is planning the erection of a three-story store and apartment building at 12th and Wells Sts. The estimated cost is $100,000.

Mineral Point, Wis.—Plans are being prepared and bids will be asked, about Jan. 15, for the construction of a municipal building and auditorium which will cost approximately $40,000.

Superior, Wis.—Plans have been prepared for the construction of an office and store building at 13th and Tower Sts., for the S. Y. Josephs Co. It will be a two-story and basement structure, 50x140 ft., and will cost about $50,000. John O. Bach is the Arch.

Des Moines, Iowa—Plans have been prepared for the construction of a theater to be known as the Empress, on Eighth St., near Locust Ave., for Elbert & Getchell. The estimated cost is $150,000. Proudfoot, Bird & Rawson are the Archs.

Keokuk, Iowa—The School Board has voted to issue bonds for $50,000, for the purpose of erecting a school building for the aGrfield District.

St. Paul, Minn.—Press reports state that the plans for the new business building for Gordon & Ferguson have been completed. The estimated cost of the structure is $400,000. Noted Nov. 21.

St. Paul, Minn.—Press reports state that the construction of a store building on the Cathedral site, for Marshall Field & Co., Chicago, Ill., is under consideration. The estimated cost is $800,000.

Bismarck, N. D.—Plans are being prepared for the construction of an auditorium, which is to cost about $45,000. A. Van Horn, Bismarck, is the Arch.

Grand Forks, N. D.—Press reports state that the County Commissioners have accepted the plans prepared by Beuchner & Orth, St. Paul, Minn., for the construction of the new courthouse.

Chillicothe, Mo.—The city will ask for $30,000 additional appropriation from congress, with which to erect its proposed federal building and post office. The sum of $65,000 is now available.

Missoula, Mont.—Press reports state that the Chicago, Milwaukee & Puget Sound Ry. is having plans prepared for the erection of a station at Missoula, to cost approximately $750,000. E. O. Reed, Seattle, Wash., is the Ch. Engr.

Kansas City, Mo.—The Board of Education has secured a site at Pacific and Holmes Sts., and will erect a new school building. The estimated cost is $125,000.

Maude G. Allen has acquired a site at 3705 Washington Ave. and will erect a five-story apartment house to cost approximately $60,000.

Kansas City, Mo.—Louis Oppenstein has had plans prepared for the erection of a theater building at 13th and Wal-

nut Sts., to be known as the Globe Theater. The estimated cost is $150,000.

St. Louis, Mo.—The Burnes Estate will erect a three-story hotel at High and Morgan Sts., to cost about $60,000. The Larone Realty Co. will erect an apartment house at Westminster Pl. and Laurel St., to cost approximately $90,000.

St. Louis, Mo.—The Landay Real Estate Co. is having plans prepared for the construction of a six-story hotel for bachelors. The estimated cost is $300,000. Clymer & Drischler are the Archs.

St. Louis, Mo.—Plans are being prepared for the construction of an 18-story hotel, 100x125 ft., at 12th and Olive Sts., for George Hallen. The estimated cost is $1,000,000. W. H. Ittner, Ninth and Locust Sts., is the Arch.

J. L. Landay, 4509 Olive St., is preparing plans for the construction of a six-story apartment building at Taylor and Olive Sts. The estimated cost is $300,000. Clymer & Drischler, Wainwright Bldg., are the Archs.

Dallas, Tex.—Plans are nearing completion, and bids will soon be asked for the construction of a municipal building at Harwood, Commerce and Main Sts. C. D. Hill & Co. are the Archs.

El Paso, Tex.—The construction of additional barracks, at Fort Bliss, to cost approximately $450,000 is under consideration.

Falfurrias, Tex.—Atlee B. Ayers, San Antonio, Tex., has been commissioned to prepare plans for the construction of the new courthouse at Falfurrias. The estimated cost is $80,000.

Houston, Tex.—Bids are being received for the construction of a six-story and basement building on Main St., for S. H. Kress & Co. Noted Oct. 31.

+Temple, Tex.—The contract for the construction of a passenger station for the Missouri, Kansas & Texas Ry., has been awarded to H. D. McCOY, Cleburne, Tex. The estimated cost is $60,000.

Colorado Springs, Colo.—Press reports state that bids will be received by the Trustees of the Myron Stration Home, 117 East Pikes Peak St., until Jan. 21, for the construction of two dormitories, a superintendent's residence and 10 cottages. The estimated cost is $210,000. William Lloyd is Secy. of the Trustees.

Denver, Colo.—The Trackage & Storage Co. has purchased a site at Blake St. and 28th St., and will erect a warehouse to cost approximately $300,000.

Seattle, Wash.—Crawford & Conover are planning the erection of a 10-story building, exclusively for retail trade, on Third Ave., between Pike and Pine Sts. The structure will have a white terra cotta front, and cost about $125,000. John Graham is preparing the plans.

Plans have been prepared for a two-story brick church, to be erected at Columbia St. and Broadway, for the Westminister Presbyterian Church. It will be 56x103 ft., and cost approximately $50,000. David J. Meyers, Central Bldg., is Arch.

The congregation of Chevra Bekur Cholum has commissioned B. Marcus Priteca, Arch., Empire Bldg., to prepare plans for a new brick synagogue, to be erected at 17th Ave. and Yesler Way, at a cost of $40,000.

Spokane, Wash.—All bids for the erection of the new Davenport Hotel were rejected, and new bids will be asked. Its estimated cost is $2,000,000. Cutter & Malmgren are Archs. Noted Oct. 3.

Tacoma, Wash.—Plans are being prepared for a $50,000 club house, to be erected on Day Island, for the Tacoma Motor Club. C. F. W. Lundberg, Provident Bldg., is Arch.

F. S. Harmon & Co. will erect a warehouse, of concrete and mill construction, to cost $45,000.

Portland, Ore.—Plans are being drawn for a 14-story hotel, to be erected at Sixth and Morrison Sts., at an estimated cost of $1,500,000. Day Bros., Spokane, Wash., and Edw. Boyce, Portland, are owners.

+Los Angeles, Calif.—A contract has been awarded to DAWSON & DE PLANTY, Pacific Electric Bldg., at $99,735, for construction of a four-story brick warehouse, on Alameda St., for D. O. Charzadal. The building will be 126x150 ft., with a wing 126x150 ft. Edward S. Cobb, Central Bldg., is Arch. Noted Nov. 14.

The Southwest Museum Assn. has plans completed for its new building to be erected on the Arroyo Seco, near Sycamore Grove. The building will be two stories, 136x30 ft., with a tower 35 ft. square and 100 ft. high, the five stories of which will be used for offices and library. The construction will be of reinforced concrete, plastered exterior and tile roof, concrete retaining walls and steps. Hunt & Burns, Laughlin Bldg., are Archs. Noted Nov. 28.

The Knickerbocker Building Co. has applied for a permit to erect a 12-story loft and club building on South Olive St. It will be of reinforced concrete construction, and will cost $125,000.

The Methodist Hospital of Southern California has been organized for the purpose of raising a fund to erect a hospital at 2826 South Hope St., the site of the present Methodist Hospital. Plans have been drawn for three buildings, and the estimated cost is $250,000.

John Parkinson, of the firm of Parkinson & Bergstrom, Security Building, is contemplating erecting a 12-story and basement steel frame hotel building, at the southwest corner of Sixth and Figueroa Sts.

The California Hospital Co. South Hope St., will erect a group of reinforced-concrete buildings to replace the present frame ones. Dr. Lyndes is Mgr.

J. H. Call, Merchants' Trust Bldg., is having plans prepared for a three-story and basement hotel, to be erected on South Hope St. A. E. Featherstonhaugh, Ferguson Bldg., is Arch.

Mrs. Frances Zahn and A. W. Ross are planning the erection of a four-story brick apartment house on Hope St., near Fourth. F. W. Tyler, Hibernian Bldg., is Arch.

The sum of $75,000 has been voted for the erection of two gymnasium buildings for the Santa Monica Polytechnic High School. They will have concrete foundations, brick exterior facings and clay tile roofs. Allison & Allison are Archs.

Pasadena, Calif.—The Pasadena Athletic Club has been incorporated, and will erect a club house on its site on Worcester Ave., at an estimated cost of $100,000. Plans will be prepared at once. Leo Owen is Secy.

Porterville, Calif.—This city contemplates erecting a high school building, to cost not less than $50,000. H. F. Brey is Chn. of the Com.

Richmond, Calif.—Plans are being prepared for a five- or six-story reinforced-concrete business building, to be erected by the Nichols Estate, on MacDonald Ave. It will cost approximately $60,000.

Sacramento, Calif.—The Phoenix Mill Co. will erect a five-story building at 12th and B Sts., to cost about $100,000.

Press reports state that the local lodges of Odd Fellows have purchased a site at Ninth and E Sts., at a cost of $60,000, and will erect a handsome lodge building thereon.

Miller, Opel & Torbitt, Archs., Springfield, Mo., have been commissioned to prepare plans for the Missouri State Building at the San Diego exposition.

The Pacific Building Co. will erect a 10-story office building at Fourth and C Sts., San Diego.

McFadden & Buxton will erect an arcade, to cost $40,000, in the four-story building running through from Fourth to Fifth Sts., between B and C Sts.

The C. C. Moore Engineering Co. is planning to erect a four-story office building at First and Mission Sts.

Bids were received as follows by the Panama-Pacific Exposition Co. for erection of Machinery Hall: W. W. Anderson Co., $509,900; Spilho-Freeze & Peterson, $519,999; Neil A. McLean, $527,000; Commary-Peterson Co., $649,209; P. T. Quinn, $569,000; Lange & Bergstrom, $516,499; Mose Fisher, $542,000; Lindgren Co., $569,000; McLaren & Peterson, $599,000 Fred P. & L. F. Fisher, $593,616. Noted Jan. 2.

The Panama-Pacific Exposition Co. contemplates spending $1,000,000 for a building to contain exhibits from the 58 counties of California. C. C. Moore is Pres.

Santa Rosa, Calif.—Plans are being prepared for a new city hall building. It will be of brick and steel construction, and the exterior will be faced with cement plaster. L. M. Turton, Napa, Calif., is Arch.

South Pasadena, Calif.—A high school, to cost $70,000, will be erected in South Pasadena. Norman F. Marsh, Broadway Central Bldg., Los Angeles, is the Arch.

Whittier, Calif.—Fred C. Nelles, Supt. Whittier State Normal School, states that $80,000 will be spent for improvements to the institution to include equipment and buildings.

Montreal, Que.—Plans have been completed for the new Drummond building, to be erected at St. Catherine and Peel Sts. It will be ten stories, of fireproof construction, and cost about $600,000. H. S. Stone is preparing the plans for the Island Realty Co.

London, Ont.—Plans will be prepared for a new seminary, home and college for the Redemptorist Fathers school, to cost about $500,000. A site has been purchased and construction work will be begun in the spring. Bishop Fallon, London, Ont., has charge.

Toronto, Ont.—The Sun Life Assurance Co. of Canada plans to erect a ten-story building at Dorchester St. and Dominion Sq., in which it will establish its head offices. The structure will be of gray granite, and is estimated to cost $500,000. Darling & Pearson, Montreal and Toronto, are Archs.

Prince Albert, Sask.—J. S. Woodward and the Bradshaw Agencies are planning to erect a five-story business block on Central Ave., costing about $175,000.

FOREIGN

+Telegraph Line—Ecuador—A contract has been awarded to MANUEL S. REINA by the government for the construction of a telegraph line from Quevedo to Palenque.

Railway Construction—Russia—The Committee for New Railways, St. Petersburg, is considering plans for the construction of a railway from Vorozhba to Orsha, and from Moghiler to Lgor.

INDUSTRIAL NOTE

The New White Companies held their organizing meetings Jan. 6 and announced the following exceptionally strong boards of directors and officers:

Of The J. G. White Engineering Corporation the directors are: Harry Bronner, of Hallgarten & Company; James Brown, of Brown Brothers & Company; C. Brown, of Redmond & Company; Douglas Campbell, of Campbell, Harding & Pratt; Geo. C. Clark Jr., of Clark, Dodge & Company; Barayard Dominick, Jr., of Dominick & Dominick; A. G. Hodenpyl of Hodenpyl, Hardy & Company; T. W. Lamont, of J. P. Morgan & Company; Capt. Marion McMillin, of Emerson McMillin & Company J. H. Pardee, President The J. G. White Management Corporation; E. N. Potter, of Potter, Choate & Prentice; Frederic H. Ecker, Vice-President J. G. White & Company, Inc.; Chas. H. Sabin, Vice-President Guaranty Trust Company; Frederic Strauss, of J. & W. Seligman & Company; Moses Taylor, of Kean Taylor & Company; George H. Walbridge of Bonbright & Company; E. N. Chilson, and C. E. Bailey. And the officers are: J. G. White, Chairman Finance Committee; Gano Dunn, President; E. G. Williams, A. S. Crane, H. A. Lardner, Vice-Presidents; H. S. Collette, Secretary and R. T. Marchant, Treasurer.

Of The J. G. White Management Corporation announces as directors Cecil Barret, of Spencer Trask & Company; F. Q. Brown, of Redmond & Company; F. M. Chandler, of Chandler Brothers & Company, Philadelphia; Arthur Coppell, of Maitland Coppell & Company; Gano Dunn President The J. G. White Engineering Corporation; George B. Hands, of Hodenpool, Hardy & Company; R. G. Hutchins, Jr., Vice-President National Bank of Commerce; R. L. Montgomery, of Montgomery, Clothier & Tyler, Philadelphia; John T. Pratt, of Campbell, Harding & Pratt; Frederick Strauss, of J. & W. Seligman & Company; H. R. Tobey, of N. W. Halsey & Company and J. G. White, President J. G. White & Company, Inc. And the officers are: J. H. Pardee, President; F. H. Reed and S. L. Seldon, Vice-Presidents, and T. W. Moffat, Secretary and Treasurer.

The parent organization, J. G. White & Company, Inc., controls the new companies and will continue as an active financing and owning company.

Engineering News

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A Very Heavy Motor-drawn Truck

The Borough Development Co., of Brooklyn, N. Y., has recently put into service a very heavy motor-drawn truck, which is used in hauling ashes from various industrial plants, through the streets of Brooklyn to the docks, where the ashes are loaded on barges. A view of this truck is shown in the accompanying halftone. It consists of a steel body of 20 cu.yd. capacity, mounted on a truck provided with rear axles and wheels only, the front portion being provided with a king pin, which fits into the corresponding socket above the rear axle of a specially designed tractor. This tractor is known as the Martin Tractor, and is manufactured by the Knox Automobile Co., of Springfield, Mass.

The Martin tractor is a three-wheeled motor device, which may be attached to any two or four-wheeled vehicle and used as the propelling power for that vehicle, the combination making a five- or seven-wheeled truck. With proper provision, of course, the tractor may be used as the locomotive to draw a train of wagons. In some of its uses the body to be drawn is provided with a readily detachable king-pin device, so that the tractor may be run under the wagon, the wagon taken to the place desired, and the tractor then be run out to be used for whatever service required. In one city, for instance, a coal company has employed one tractor with a number of coal-truck bodies in delivering the coal. In this case the truck is drawn to the place where the coal is to be delivered, the tractor run back to the yard for other service, while the coal is being unloaded. In the case of the ash truck shown in the accompanying view, however, at present only one body is in use, and the vehicle acts as a unit. The tractor in question is provided with a 50-hp. motor, a single rubber-tired steering wheel to provide easy maneuvering, and two traction wheels 40 in. in diameter, and fitted each with a 6-in. steel tire. The rear wheels of the truck proper are 54 in. in diameter, and are provided each with a 7-in. steel tire. The tractor is geared down to a speed of 8 mi. per hr. under the maximum load.

As noted above, the truck body has a capacity of 20 cu.yd. Recent measurements in New York City show that the average weight of the ashes there is about 1090 lb. per cu.yd., so that when the truck is fully loaded with average ashes, its weight, exclusive of its own weight, will be about 10½ tons. The distribution of this weight upon the four wheels under the wagon is not given, but from the general appearance of the truck it would seem that the rear two wheels take more than one-half of the total load. If this is so, the load upon each of the 7-in. tires must be in excess of 4 tons. The manufacturer of the tractor states that the truck has carried as high as 15 tons load, though the owner of the truck states that it is not used in practice for loads greater than 10 tons. So far it has been making daily trips on the paved streets of Brooklyn without any damage to the pavements.



An Ash Truck of 20 cu.yd. Capacity
(Total weight when loaded with ashes, about 15 tons)

Municipal Bridge Approach, St. Louis

By S. W. Bowen*

SYNOPSIS—The Municipal Bridge, "or Free Bridge," now approaching completion, is the fourth bridge to be built across the Mississippi River at St. Louis. It is specially notable for the great length of its truss span (668 ft.) and for having a double deck, with railway on the lower deck (at the bottom chord level) and highway and electric railway on the upper deck. The article given below describes the viaduct approach for railway and street connections at the St. Louis end of the bridge, together with the methods of construction. Articles by the same author, in our issue of March 16, 1911, and Feb. 8, 1912, have described the substructure and superstructure of the river spans.

The west or city approach to the Municipal Bridge over the Mississippi River at St. Louis, is built to accommodate both railway and highway traffic. The railway deck (which connects with the lower deck of the bridge) carries two tracks. The highway portion (which connects with the upper deck of the bridge) consists of a 30-ft. paved roadway and two 6-ft. sidewalks; in the roadway are two electric-railway tracks. The general plan, Fig. 1, shows that shortly after leaving the river spans, the highway deck swings to the south until it clears the railway deck. The two decks are then carried side by side to Broadway, where they diverge, the highway structure coming to the ground at 7th and Papin Sts., and the railway at 8th and Gratiot Sts. From 8th to 23d Sts. it is proposed to run the railway tracks on the surface of Gratiot St., which lies along the south side of the railway yards in Mill Creek Valley. It is probable that 7th St. will be widened to give a better entrance to the highway approach.

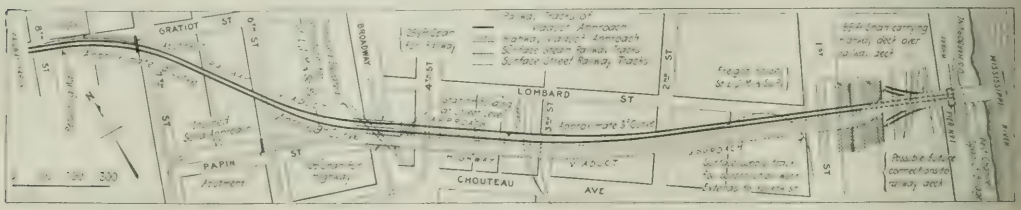


Fig. 1. Plan of West or City Approach to the Municipal Bridge, St. Louis, Mo.

Between 4th St. and Broadway there is a station building, with waiting rooms, etc., and stairways leading to the railway and highway levels. At this point provision has been made for a future 20-ft. roadway, leading to the south and ending at the east side of 4th St. This is intended to accommodate wagon traffic from the southern part of the city if it should be of sufficient volume to warrant the construction of an independent approach. As Mill Creek Valley is the main railway artery of the city, provision has been made for a future connection between the railway structure and these tracks, the connection diverging to the northwest at 7th St.

For the approach, the maximum grade on the highway is 3.443%, while that on the railway is 1.385%. The total length of the approach is about half a mile. The alignment is shown in Fig. 1. The portion of the city through which the approach passes is old and very thickly settled. A right-of-way 100 ft. wide was cut through the blocks to accommodate the structure, which in general has a total width of about 69 ft. At Broadway where the tracks are spread to allow for the station platform, the total width is considerably greater.

The approach consists of a steel superstructure of the plate-girder type, with columns supported on concrete pedestal piers. The roadway is to be paved with creosoted-wood blocks, laid on a reinforced-concrete slab supported on I-beam stringers. The sidewalk slabs will be of reinforced concrete. The railings are of steel. The railway deck will have 90-lb. rails on 8x10-in. creosoted ties.

Foundations and Subsurface Conditions

The distance from ground surface to bedrock varies considerably. At Pier I (the west pier of the bridge), rock lies about 50 ft. below the curb. From this point it rises gradually until between 2d and 3d Sts. its depth is only about 15 ft. It then dips to the west, and at 6th St. is at least 60 ft. below the curb. The rock is overlaid by a stratum of sand of varying thickness and fineness, with streaks of clay. The greater part of the upper material is fill, varying in depth to a maximum of about 15 ft. This fill is made up of earth, bricks, stones and rubbish, and most of it has been in place 50 years or more.

The material down to bedrock was investigated by means of wash borings and as a result it was decided to carry all foundations through the filled ground to the underlying material. Comparative estimates were made of the cost of the following types of foundations: concrete pedestals on reinforced-concrete piles, plain concrete pedestals, plain concrete shafts (or piers) extending to the rock, and concrete pedestals with reinforced-concrete footings. All the concrete pedestals were assumed to extend through the filled material or to about 1 ft. below the bottom of the cellars.

No tests were made of the bearing power of the soil or of the supporting power of the reinforced-concrete piles. But from a careful consideration of the results of the borings, of excavations and pile-driving in the immediate vicinity, and of tests of soil and piles previously made

*Principal Assistant Engineer, Brenneke & Fay, St. Louis, Mo.

under similar conditions, it was decided to use 25 tons per pile, and one ton per sq.ft. in bearing on the filled soil, or two tons per sq.ft. on the underlying material. It was also decided to use piles 25 ft. long and about 1 ft. in circumference, which would make the skin friction about 500 lb. per sq.ft.

It was found that the plain concrete pedestals and the concrete pedestals with reinforced-concrete footings were

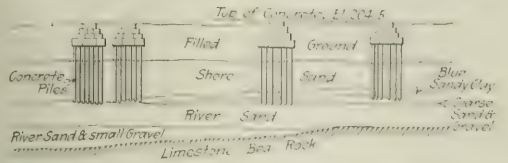
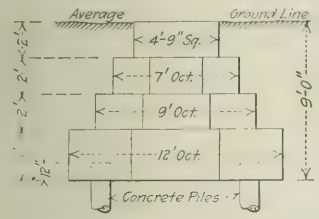


FIG. 2. PART PROFILE, SHOWING STRATA, WITH CONCRETE PILES AND PEDESTALS

not economical, owing to the depths to which it was necessary to carry them, and to the low-bearing value used on the soil. Under the loading used, the plain concrete shafts extending to the rock were found to be more economical than the pile foundations, to a depth of about 35 ft., assuming that no unusually soft strata were found, which would cause difficult excavation. The concrete shafts to rock are, of course, more economical for heavy loads than for light ones. In comparing the various types of foundations, the six piers of one tower were considered



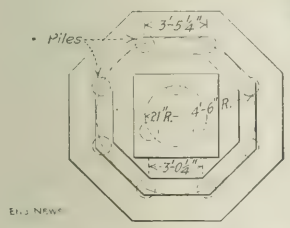


FIG. 3. TYPICAL PEDESTAL PIER FOR COLUMNS OF VIADUCT

of these points, owing to a stratum of fine water-bearing sand overlying the rock at these points. The stratum was encountered when sinking the first shaft of bents 15 and 29, and after attempting unsuccessfully to put down the open shaft, it was abandoned and piles were later driven to rock. Fig. 2 is a portion of the profile, showing the strata, with concrete piles and pedestals. Fig. 3 is a detail of one of the pedestals.

COMPARATIVE ESTIMATE OF COST OF FOUNDATIONS

The estimated cost of these two types of foundation for tower No. 15-16 is given in Table I. In this case the average depth of rock below the ground surface, as taken from the boring sheet, was about 31 ft. The yardage cost of concrete includes cost of forms, and that of excavation includes sheeting, shoring and pumping.

TABLE I.—COMPARATIVE ESTIMATE OF COST OF FOUNDATIONS FOR TOWER NO. 15-16

	Concrete Shafts		Concrete Piles	
Concrete, cu yd	302.3 @ $5.70	$1725	127.8 @ $5.70	$728
Excavation, cu yd	325.5 @ 1.75	570	216 @ 0.60	130
Reinforcement piles, lin ft	.....		1550 @ 1.10	705
Total for 6 piers		$2295		$1563

MANUFACTURING AND DRIVING CONCRETE PILES

The specifications called for piles of the pre-molded type. The length, superficial area and percentage of reinforcement were specified, but the cross-section and the taper were left to the contractor. It was also specified that the piles must season at least 30 days before driving and that they were to be driven by means of a steam hammer.

Pile-making was started late in the fall of 1911, and continued with some interruptions (due to cold weather) until the last of December, when it was stopped for the winter. The piles were of octagonal cross-section, 14 in. short diameter, 25 ft. long over the point. They were

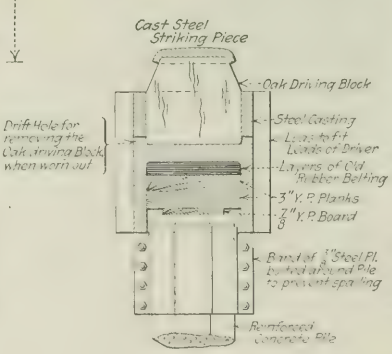


FIG. 4. CAP USED IN DRIVING CONCRETE PILES

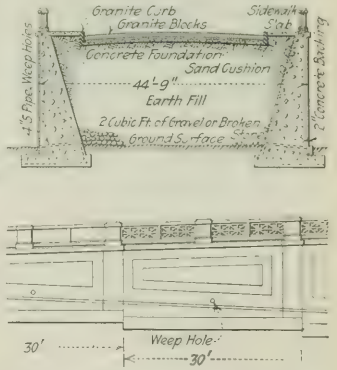


FIG. 5. CROSS-SECTION AND PART ELEVATION OF APPROACH FILL

together. It was not thought advisable to use concrete shafts (to rock) and pile foundations in the same tower, because of the probability of unequal settlement and consequent straining of the superstructure.

It was intended originally to use pile foundations for Bents 1 to 13, inclusive, and for those west of bent 30; and to use concrete shafts sunk to rock for bents 14 to 30 inclusive. During construction it was found necessary to use pile foundations in place of concrete shafts at four

reinforced with six ⅝-in. round longitudinal bars, wound with a spiral of No. 9 wire on 4-in. pitch. This pitch was reduced to 1 in. for about 18 in. at the head of the pile. At the point the six bars were drawn together and wired. The total reinforcement amounts to 1⅛% of the volume of the pile. A 1:2:4 mix was used, with gravel ¾ in. diameter and under for the coarse aggregate. The heads of the piles were made richer by the addition of about a quarter sack of cement to the last barrow of con-

crete. This, and the closer pitch of the wire spiral at this point, was intended to make the head of the pile tougher and better able to stand hard driving.

In fabricating the reinforcing units, the bars were fastened to wooden collars mounted on a 4-in. pipe mandrel supported on two frames about 26 ft. apart. The wire for the spiral was mounted on a reel and one end of the wire attached to one end of the bars. The mandrel was then turned slowly by a handle and the wire wound onto the bars. After the winding was completed, the spiral was wired to the bars at short intervals, the collars were removed, and the mandrel slipped out. The bars were then wired together at the point, and the reinforcement was ready to suspend in the form. A rather wet mix was used, care being taken to work the concrete into all corners, and to keep the gravel back from the surface. The forms were set side by side, 25 forms being set up each time. Concrete was brought from the mixer in barrows. Usually 25 piles were molded in a day. After setting two or three days, depending on the weather, the side forms were removed, leaving the piles resting on the bottom of the forms, an extra set of which was provided. As soon as the piles could be safely handled, they were rolled aside and left to season. The 50 forms and 50 extra bottoms were used throughout the work.

In spite of the hard driving, little injury was done to the piles; as subsequent excavation proved. Aside from eight piles which broke in driving, due to the setting of the concrete having been retarded by cold, the only injury done was the spalling of the heads. Most of the heads were uninjured after sustaining upward of 2000 blows of a No. 2 Vulcan steam hammer. In all, 767 piles were driven, including the eight which were broken. In these broken piles it was found that the outer concrete (to a depth of about 2 in.) had set up hard, inclosing a core of green concrete. The remaining piles of the same batches were set aside and left to season until warmer weather, when they were driven without difficulty. Samples of the green concrete from the cores of the broken piles set up hard on being left for two or three days in a warm room.

The piles made in warmer weather did not spall as

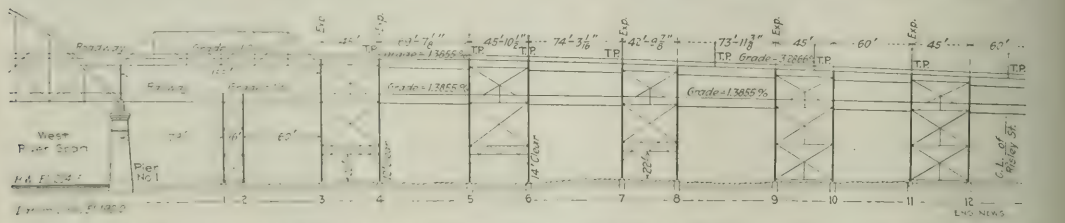


Fig. 6. Part Longitudinal Elevation of Viaduct Approach to the Municipal Bridge; St. Louis, Mo.

Pile-driving began late in January, 1912, and continued until the early part of June, with occasional layoffs due to bad weather and other causes. At first some difficulty was experienced in driving, owing to the hardness of the material near Pier I, where work was started. A cushion composed of layers of rubber belting was placed on top of the pile to absorb the shock. The driving head was arranged as shown in Fig. 4. It was found that as long as the blow could be concentrated at the center of the pile head, there was but little injury to the pile. When, however, the driving block became cupped, the blow was delivered on the circumference of the pile head, with the result that the head of the pile spalled, leaving the bars exposed. In some cases the reinforcement became bent and the head of the pile had to be cut off, and a new start was made. During the hardest driving a ⅜-in. steel band, about 15 in. wide, was bolted around the pile head, to prevent spalling; this was very effective.

The driving for the first 300 ft. was exceedingly hard. Many obstructions were encountered. In one place piles had to be driven through an old macadam roadway, which had been filled from time to time until a thickness of several feet was reached. The piles east of 1st St. came to a practical refusal, sometimes at several feet above the proposed elevation. In many cases piles stood 10 to 80 blows to the last inch. West of 1st St., softer material was encountered, and most of the remaining piles drove to the desired elevation, bringing up at from 4 to 20 blows to the last inch. In order to facilitate the handling of the driver, the piles were driven before excavating, except when they were driven in cellars. The piles were driven below ground surface by means of a follower having a steel band on the lower end, which slipped over the pile head and tended to prevent it from spalling.

The piles made in warmer weather did not spall as easily as those made during the winter, probably due to better setting of the concrete. Toward the last, the band and the rubber cushion were dispensed with and only a piece of pine plank was used beween the top of the pile and the driving blocks inside of the cast driving head. The total number of full working days of ten hours was 85, making an average of about nine piles per day, while the maximum number was 18. This was good work considering the amount of cribbing and moving that had to be done. When piles had to be cut off, the concrete was broken away from the bars by means of a chisel bar and sledge. The bars were then cut with a hacksaw, or cold chisel and sledge, and the pile head knocked off.

The piles for each pier were arranged in concentric circles and the courses of the concrete pedestals were made octagonal, as shown in Fig. 3. With this arrangement any desired number of piles could be used, and an excess avoided. In general, piles were spaced about 3 ft. c. to c.

Concrete Shafts on Bedrock

The concrete shafts extending to rock were made 7 ft. square, this being considered the minimum size in which the men could work to advantage. The first few feet of excavation was thrown out with shovels, then a lining of 2-in. planks was placed, the inside dimensions of the

lining being the size of the finished shaft. This lining or open caisson was sunk by excavating the material underneath it and weighting it so that it would follow down.

The excavated material was taken out by means of 1-yd. buckets which were handled by a derrick so placed that it could reach the six pits of each tower. When soft material was encountered, sheet-piling of 2-in. plank was resorted to. This served to hold back the material, except when the water-bearing sand was encountered. This sand was very much like quicksand and after making an attempt to get through it and down to rock by sheet-piling, it was decided that it would be cheaper to adopt pile foundations for these particular bents, as mentioned above. On reaching rock, it was cleaned off and in one pit of each bent a drill hole about 3 ft. deep was put down to test the rock. No ledges were encountered, however, and the shafts were concreted. The plank lining was left in place, as it was found cheaper to abandon the lining than to remove it and fill the additional space with concrete.

Locating Piers and Setting Anchor Bolts

All piers are located with reference to the center lines of the structure on tangent, or to these tangents produced. The center line of the river spans was first produced through the freight yards and freight sheds lying between Pier 1, and the west line of 1st St., and was continued as far west as the first point of intersection. The other tangents were tied in with the center line of the river spans. At the intersection of these tangents with each bent a hub was set, the angle between the bent and tangent turned off, and hubs or marks on curb or walls were placed on the bent lines.

The distances between centers of bents along the tangents were repeatedly measured by means of a 100-ft. steel base-line tape, which had been compared with the tape used at the bridge shop for laying out the steel work. A spring balance was used to give a uniform tension on the tape, and correction was made for temperature. Some difficulty was experienced in carrying the measurements through the freight sheds and yards, owing to numerous obstructions. Measurements were repeated until those between bent centers agreed to $\frac{1}{16}$ in. after all corrections were made.

Hubs were then placed at the site of each pier center and referenced, so that they could be readily replaced. These lines were used for locating piles, limits of excavations and pier forms. They were then checked and used to locate the anchor bolts, which were set in the usual manner by wooden templates located by transit and chalk lines. Each group of bolts was provided with an anchorage which served to properly space the bolts at the bottom, and to keep them vertical. The distance between centers of adjoining piers was checked from the centers marked on the anchor-bolt templates before the bolts were concreted in, and again after concreting was finished.

Retaining-walls

The highway structure from 6th to 7th Sts. is carried on an earth fill inclosed by retaining-walls of the semi-gravity type, Fig. 5. These walls are surmounted by reinforced-concrete railings of somewhat elaborate design. The walls are paneled and pilastered for appearance sake. The railway approach from 7th to 8th St. is carried in a similar manner, but has a retaining-wall along the south side only, the embankment sloping to Gratiot St. on the north. There is no railing on this wall, and the paneling is omitted except for the abutment, which faces 7th St. The coping and pilasters were also omitted on the railway wall.

The walls were constructed in alternate sections. The length of each section of highway walls is 30 ft. c. to c. of pilasters, and the length of each section of railway wall is 25 ft. Expansion joints occur between each two sections of walls. These are merely tongue-and-groove joints, with several thicknesses of tar-paper to form a compressible joint.

The mix for the walls and piers was 1:2½:5, and for the railings 1:2:4. Gravel was used for the coarse aggregate in all cases. Owing to the fact that the highway retaining-walls are contiguous to important streets, special pains were taken to get a good finish on the walls and railings. The forms for the walls were made of 2-in. dressed lumber with 4x6-in. studs. The faces for the exposed surface of the concrete were carefully dressed to remove all lips and ridges, the forms were wet down before concreting started, and all cracks were carefully puttied up flush with the boards, to prevent leakage, and board streaks. The concrete was handled from the mixer to the work by means of a movable stiff-leg derrick, carrying a 1-yd. bottom-dump bucket. A rather wet mix was used, and the concrete worked away from the forms with a spading fork, which allowed the mortar to flow between the tines to the face of the wall, while the coarse aggregate was held back.

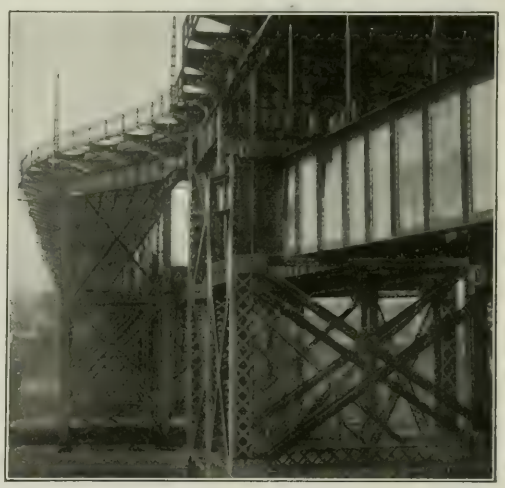


Fig. 7. View of Bridge Approach

[Showing offset of highway deck (connecting with upper deck of bridge) to a position alongside the railway deck (from lower deck of bridge)].

As soon as the forms were removed, the exposed surfaces of the work were painted with a thin grout of neat cement, and rubbed down with carborundum blocks. The

surplus grout was then washed off with a hose, and the process repeated, if necessary, until all rough places had been rubbed down and all pinholes and other small cavities filled. By this means, a very uniform and pleasing finish was obtained, which would not flake or skin off, as the grout was rubbed into the pores of the wall and there was no excess on the surface.

The railing, with the exception of the posts, was cast on the ground, erected and grouted into place. Forms for the various portions of the railings were made in a shop, and were painted with a paraffin oil. The forms were made collapsible, so that the sides, ends and cores could be readily removed, leaving the members resting on the form bottoms. The railing was given a trowel finish on all faces that could be reached, and after the forms were removed, the surfaces were gone over (where necessary) with carborundum blocks. In erecting the railings, the forms for the posts were set up around reinforcing rods, which had been built into the wall and projected nearly to the tops of the posts. The foot rails were placed, then the panels and hand rail. The railing was lined up from a transit line, the posts were concreted, and the joints in the railing were grouted and pointed up. An expansion joint was provided at each railing post, similar to those in the walls.

ruling length of spans is 45 ft. for the towers, and 75 ft. for the clear spans. Expansion joints are provided at each tower. The structure is designed for Cooper's E-60 loading on the railway tracks, and for 35-ton electric cars and an 18-ton road-roller on the roadway. The sidewalks are designed for a live load of 100 lb. per sq.ft. Carbon steel is used throughout. The unit stresses used in designing are the same as those used in the design of the carbon-steel portion of the river spans.*

The arrangement of the columns was complicated by the surface tracks, and by the proposed track elevation of the St. L., I. Mtn. & So. R.R. at Broadway. The required clearance over this proposed elevated structure also determined the grades on the approach and the depth of the floor system of the truss spans over Broadway. As indicated on the cross-section Fig. 8, the north railway stringer is riveted to the floor-beam directly over the column on top of which the floor-beam rests. The other end of this floor-beam is riveted to the web of the center column. The distance from the north to the middle column of the bent is determined by the spacing

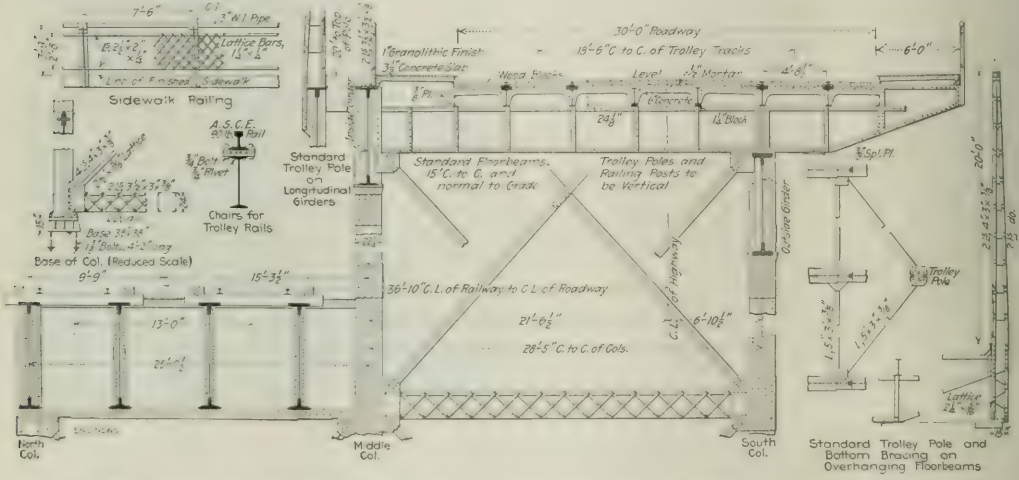


FIG. 8. TYPICAL SECTION OF COMBINED RAILWAY AND HIGHWAY APPROACH TO THE MUNICIPAL BRIDGE: ST. LOUIS, MO.

STEEL SUPERSTRUCTURE

The superstructure consists in general of steel girder spans on braced towers. Just west of Pier 1 there is a 155-ft. riveted span carrying the highway over the railway turnouts which are provided to take care of possible future railway connections from the north and south. Fig. 6 shows the typical construction and also the truss span noted above. Fig. 7 is an end view of the offset of the highway deck to its position beside the railway deck on the approach. Another riveted truss span carries the highway and railway structures over Broadway. All other spans are of the deck plate-girder type. The of the tracks and the necessary clearance between the cars on the south track, and the middle column.

The street-car rails are supported on 15-in. I-beam stringers, with fiber pads (shown on the detail) to reduce the impact. These stringers rest on transverse riveted floor-beams, having cantilever extensions to carry the south sidewalk. The floor-beams in turn are supported on longitudinal riveted girders, which frame into the middle and south columns of the bent. The north trolley rail of the south track is directly over the south column, and the entire sidewalk on that side and a portion of the roadway is carried on the cantilever end of the floor-beams.

The columns are of a modified H-section, having a built I-shaped web or diaphragm, and two built channels,

*Engineering News, Feb. 8, 1912

with the flanges turned in and laced. The columns are composed entirely of plates and angles. With the exception of the horizontal struts, all tower bracing and knee braces consist of four angles arranged in the shape of an I, and laced. The columns rest on cast-iron bases from 15 to 18 in. high, set on a bed of mortar on the piers, in the same manner as a cap stone. The anchor bolts (four in each pier) in general extend through these castings and the base plates of the columns. In some few cases where the base castings are unusually large, the anchor bolts extend only through the bedplates of the castings, and separate bolts are used to secure the columns to the castings.

The heaviest member in the structure is the south longitudinal highway girder spanning 4th St. This girder is 90 ft. long c. to c. of bents, 8 ft. 6½ in. deep over the flange angles, and weighs 42 tons. The web plate is ½ in. thick and each flange is composed of two angles 8x8x1



Fig. 9. Four Erection Travelers on the Municipal Bridge

(Two on the lower or railway deck, and two on the upper or highway deck).

in., three cover plates 20x⅞ in., and two 20x⅛ in. The stiffeners are 6x3½x$\frac{7}{16}$-in. angles. The west end of this girder is riveted to the transverse girders of bent No. 31. This transverse member has a span of 38 ft. ½ in. c. to c. of columns, and is chiefly remarkable for its depth, 12 ft. 2¼ in. over flanges. The web plate is ½ in. thick, and each flange is composed of two angles 8x8x$1\frac{5}{16}$ in. The unusual depth is due to the fact that the top flange is in the plane of the bottoms of the I-beam stringers, thus taking the place of the regular floor-beam, while the bottom flange is sufficiently below the bottom flange of the 90-ft. longitudinal girder to allow the latter to be riveted to the web of the former.

Erection of the Superstructure

The steel-work was erected by means of two mule travelers, one on the railway and the other on the highway deck, as shown in Fig. 9. These were assisted by the locomotive crane working on the surface tracks mentioned above. The railway traveler was the one used previously for placing the falsework bents and railway-floor system of the river spans. To suit the conditions met with in erecting the approach, it was remodeled by adding 10 ft. to the length of each boom and lowering the engine deck, which (for the river spans) had been high enough above the track to allow material cars to be passed under the traveler from the rear. On the approach, all the material was picked up from the ground in front of the travelers. This made it possible to place the engine decks close to the track, thus making the traveler more stable. Each traveler was equipped with two steel masts and booms and was operated by two steam hoisting engines. The booms of the railway traveler were 80 ft. and those of the highway traveler 50 ft. in length, with 10-ft. extensions on the highway booms for runner lines.

The railway traveler worked in advance, and placed most of the columns and bracing and the material for the railway (lower) deck. The highway traveler was

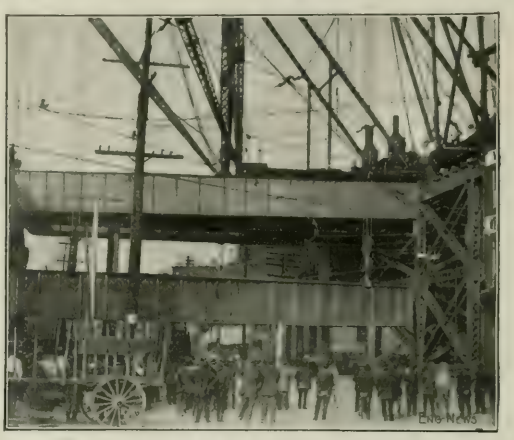


Fig. 10. Travelers Erecting 90-ft. 42-ton Girders Over 4th. St.; St. Louis, Mo.

erected on the upper deck of the river spans, and erected the 155-ft. riveted span extending from Pier 1 to bent 3. The falsework for this span was supported on the girders of the railway deck below. The top laterals and such other members as would have interfered with the passage of the traveler were handled by an auxiliary boom rigged on the rear end of the highway traveler. After completing the erection of the riveted span, this traveler followed up the railway traveler, and placed the highway-deck material, and such other members as had not been placed by the other traveler. The locomotive crane was provided with a 60-ft. boom. The cast column bases east of 4th St. and some of the columns and bracing were set by this crane. West of 4th St., the cast-column bases had to be set by hand, using a timber tripod equipped with chain blocks, and handled by a crew of five or six men.

When 4th St. was reached, a timber bent (framed for the purpose) was set upon the west side of the street, and the four railway girders placed in position, with their west ends cantilevered some 20 ft. beyond the bent. The railway traveler then advanced on the girders far enough to be able to raise the transverse girders of bent No. 31, and bolt them to the ends of the railway

girders. The columns and bracing of bent 31 were next placed in position, and the girders lowered slightly on the blocking until the transverse girders could be bolted to the columns. The next step was to erect the remainder of tower 31-32, which was done to afford a secure anchorage for the railway traveler, while raising the forward end of the 90-ft. 42-ton highway girder (described above). This girder was first picked up by the traveler (using both booms), moved out across the street into a position about parallel to its final position and left on blocking.

The traveler was then moved ahead, lashed down, and the north boom anchored to the steelwork of tower 31-32 to give greater stability to the traveler while making the heavy side lift. The south boom of the traveler raised the west end of the girder, and the east end was handled by the highway traveler, which had a direct forward lift. The load was about equally divided between the two travelers. The portion of the load raised by the highway traveler was divided between the two booms by evening beams attached by heavy dogs to the flanges of the girder. The erection of this girder is shown in Fig. 10. The riveted truss spans over Broadway were erected on timber falsework in the usual manner.

The total amount of steel and cast iron in the approach, exclusive of the railway structure west of Broadway, is about 7225 tons. All riveting was done with pneumatic hammers. The total number of field rivets is about 133,000, or about 18 per ton of metal. The estimated weight of the railway structure west of Broadway is about 810 tons, making a total for the approach of 8035 tons.

Contractors' Plants

The plant of the foundation contractor consisted of a movable stiff-leg derrick with a 50-ft. timber boom; this was used for handling the earth from the excavations, placing the forms for the walls, and placing concrete. There were also two mixers of ½-yd. capacity, and a pile-driver so constructed that the leads could be lowered (by revolving them about a horizontal axis) when the driver was being moved under wires, etc. The equipment of the superstructure contractor consisted of the two viaduct travelers described above, a derrick car, and a locomotive crane for unloading and handling material; also two air compressors with the usual equipment of receivers, pneumatic riveters, etc. The Missouri Valley Bridge & Iron Co., of Leavenworth, Kan., had the contract for the foundations, and the American Bridge Co. furnished and erected the superstructure, which was fabricated at the Gary plant.* The former company was represented on the ground by Jerome Wilhelm, who resigned about the middle of January, 1912, to take a position with another company. He was succeeded by S. W. Crocker. The American Bridge Co.'s work was in charge of Paul Johnson, assistant engineer, and Chas. Webster, general foreman.

Owing to difficulty in acquiring certain portions of the right-of-way for the railway approach west of Broadway, this portion of the structure was not contracted for until Sept. 3, 1912, when the foundation contract was awarded to Fruin & Colnon, of St. Louis, and the metal work of the superstructure to the American Bridge Co. The foundation work for this portion of the approach is now under way.

*Engineering News, Aug. 8, 1912.

Total Cost of Approach

The cost of the highway retaining-walls and foundations and railway foundations from Pier 1 to the point of divergence of the two structures just west of Broadway, is given in the first part of Table II. This cost is based on the actual quantities, and the unit prices bid by the contractor.

The amount of the American Bridge Co.'s contract for the first portion of the structure, as described above, is $127,297, with a unit price of 3c. per lb. for additions or deductions. For the remainder of the railway structure, its contract price is $50,227; the unit price for additions or deductions in this case being 3.1c. per lb. The total cost of the approach, from actual contract prices and from estimates of certain portions, is given at the end of the table. The cost of the land for the right-of-way is approximate, for the reason that exceptions to the findings of the commissioners in condemnation have been filed by several property holders, which may make the final award by the courts in excess of the amount here given. The summary does not include the cost of the railway on the surface of Gratiot St., from 8th to 23d Sts.

TABLE II COST OF WEST APPROACH, ST. LOUIS BRIDGE

Section I.					
Piling	18,975	lin.ft.	@	$0.92	$17,457
Excavation	4,667 3	cu.yd.	@	1.55	7,234
Earth fill	3,150	cu.yd.	@	0 60	1,890
Concrete (piers)	2,921 5	cu.yd.	@	4.70	13,745
Concrete (ret. walls)	1,771 4	cu.yd.	@	5 10	9,033
Railings	545.5	lin.ft.	@	3.00	1,636
Anchorages	15,611	lb.	@	0 04	624
Trolley pole casings	3,040	lb	@	0.04	122
Reinforcing steel	13,060	lb.	@	0.03	392
Total					$52,155
Section II.					
Piling	5,975 lin ft		@	1 25	7 469
Grading	400 cu.yd.		@	0 50	200
Excavation	1,150 cu.yd.		@	1 00	1,150
Earth fill	5,650 cu yd		@	0 25	1,412
Concrete (piers)	384 cu.yd		@	6 50	2,496
Concrete (ret. walls)	1,155 4	cu yd	@	7 00	8,050
Anchorages	3,650 lb		@	0 04	146
Reinforcing steel	7,300 lb		@	0 04	292
Total					$21,215
Summary					
Substructure (1st contract, actual cost)					52,155
Substructure (2nd contract, estimated)					21,215
Superstructure; metalwork (1st contract)					127,297
Superstructure; metalwork (2nd contract)					50,227
Paving for highway approach (estimated)					66,000
Track work for railway approach (estimated)					28,000
Station buildings (estimated)					26,000
Right of way					561,530
Total exclusive of engineers' fees					$1,232,424
Or in round numbers, say					1,250,000

Engineers

The approach, with the exception of the substructure, was designed by Boller, Hodge & Baird, of New York, the consulting engineers of the work. Local matters are in charge of Brenneke & Fay, resident engineers, of St. Louis. This firm also designed the foundations and retaining-walls, subject to the approval of the consulting engineers. The writer, as principal assistant engineer for Brenneke & Fay, supervised the work of construction, and the preparation of the substructure plans. He wishes to express his appreciation of the careful work of his assistants: C. S. Johnson, A. R. Ross, W. R. Johnson and R. D. Spradling, who laid out and inspected the work in the field, and L. H. Faidley and P. F. Michael, who prepared the substructure plans.

Engineering Progress in the U. S. Navy*

By C. W. Dyson†

In preparing an article under this heading, the ground to be covered is of such large extent that, in the greater part, nothing but the merest notice of improvements can be given, and only the most important points of progress will be detailed. The first and most important point of all, as reacting upon the general efficiency of the Navy as a reliable and economical fighting force, is the choice of propelling machinery for heavy vessels of moderate speed.

In the selection of the type of machinery to be used in the above class of vessels, the following points must be taken into consideration:

(1) General character of the service which the vessel will be called upon to perform, whether she must keep the sea for long periods, cruising at speeds very much lower than her maximum speeds, or whether she will be called upon for very little slow cruising, but must be held in readiness for dashes at high speed from a base to any threatened point.

(2) Greatest economy to be realized at the conditions under which she will be called upon to operate. This factor is important, not only from the standpoint of financial saving in reduced fuel cost, but, in the greater ease of fuel supply due to the decreased demands.

(3) Fuel capacity required by the demands of the service to which the vessel may be subjected.

(4) Ease of upkeep of the machinery, and degree to which the vessel, so far as machinery repairs are concerned, can be made self-supporting.

(5) Reliability of machinery when driven at high powers.

(6) Minimum weight and space required for the propelling machinery.

(7) Efficiency of propellers for maneuvering.

(8) Minimum obtainable vibration of hull due to machinery in operation.

(9) Effect of vertical position of center of gravity of the machinery upon the time of roll of the vessel, in fixing the quality of the vessel as a gun platform.

The question of costs of the different types of machinery will not be considered in comparing the relative advantages of the types, and the relative values of turbine reduction gear, electric propulsion and internal-combustion engines for propulsion will not be dealt with, because they are still more or less in the trial stage and sufficient data are not yet available to allow of a fair comparison.

Eliminating these three latter methods of propelling naval vessels restricts the choice of machinery for this purpose to the three following methods:

(a) By means of reciprocating engines.

(b) By means of steam turbines, impulse, reaction, or a combination of the two.

(c) By means of various combinations of reciprocating engines with turbines.

RECIPROCATING VS. TURBINE ENGINES

Maximum Economy and Fuel Capacity.—Formerly, the favorite method of comparing the relative economies of propulsion of reciprocating engines and turbines was by comparing the water per shaft horsepower of the turbines with the water per indicated horsepower of the reciprocator, in this comparison all mention of the large difference between the indicated horsepower required in the one case and the shaft horsepower in the other being carefully neglected. The method of comparison in use today is the commercial one of "pounds of fuel per knot" at different speeds.

From a study of the operating characteristics of battleships driven by each class of engine, the following conclusions seem justified, under present economic conditions and engine design practice:

Should the duties of a vessel be such that she is required to steam for long periods and long distances at speeds much lower than her designed maximum speed, a less fuel expenditure per day will be required, and consequently a greater cruising radius will be obtained and less frequent recoaling necessitated, should reciprocating engines be fitted rather than turbines for propelling purposes.

Should the vessel operate from a fixed base, only doing sufficient cruising to insure that the machinery is kept in efficient condition in readiness for forced runs to any threatened point, the value of fuel economy at low speeds becomes minimized and, where the maximum speed of the vessel does not exceed 21 to 22 knots, either turbines or reciprocating engines may be used, the choice being dependent upon other factors than economies, which are practically equal at these speeds.

In other words, for the conditions (2) and (3), under which the American battleship fleet operates, the reciprocating engine is preferable to the turbine as a propelling engine. The Navy Department is, however, thoroughly alive to the advantages to be gained by adopting rotary in place of reciprocating motion in the main propelling machinery of the heavy vessels of the fleet, and, while recognizing the present advantages held by the reciprocating engine in the matter of economy at low fractions of designed power, holds itself ready to discard the reciprocating engine as soon as the turbine designers can demonstrate by actual performance that their claims as to equality of economy at low powers with the older machine have been realized. It was with this object in view that the department decided to install impulse turbines in the "Nevada," and not because the engineers of the department were "wobbling," as has been charged.

Ease of Upkeep of Machinery.—The claim is frequently made by the turbine advocates that while the reciprocating engine, when new, is undoubtedly more economical than the turbine at small fractions of designed power, this advantage is soon lost in active service, due to excessive wear of piston and valve rings causing large losses through heavy leakage of steam, and that on the other hand, the turbines, not being subject to such frictional wear, retain their original economy indefinitely. Practical experience with both types of engine in actual service comes very far from justifying this conclusion. In fact, with intelligent supervision, the reciprocating engine, particularly since forced lubrication has been applied, holds its superiority continuously.

When reciprocating-engine vessels visit the navy yards for their regular overhaul, the work to be done on the main engines is practically nil, as the machine shops and foundries of the battleships are of ample capacity to take care of all repairs that may be necessary except such as the fitting of a new cylinder or the repair of a fractured bedplate. The above remarks apply only, however, to ships fitted with forced lubrication, where the wear of bearings and journals has been practically eliminated.

When we turn to the turbine engines, however, the case is quite the opposite. Fully 99% of the troubles that occur with this type of engine are internal troubles, and consist of erosion of blades and nozzles, stripping of blading, heavy corrosion of rotors, diaphragms and turbine wheels, causing destruction of balance. All of these troubles require a perfectly smooth haven in which to make repairs, and the majority of them require dock-yard facilities.

Evidence of experience leads, then, to the conclusion that a battleship fitted with reciprocating engines for propelling purposes is much less apt to be forced off her station by necessary repairs to her engines than is one fitted with turbine engines.

Reliability of Machinery When Driven at High Powers.—From the nature of the two machines, it would appear to be safe to decide this condition as being distinctly in favor of the turbines, as this type of engine is completely free from all reciprocating parts held together by bolts and nuts. Experience with the "Delaware's" engines, however, lead to the conclusion that where proper care is taken to lock all nuts securely, and to effectively protect the engines against the shocks of reversal of direction of motion, the reciprocating engine can, even in this respect, be regarded as nearly on a par with the turbine in reliability.

The full-power 24-hour run of the "Delaware," made without preparation immediately after her arrival home from Chili, demonstrates this reliability of the present type of battleship engines very thoroughly. As stated, without any preliminary preparation of engines or machinery, the vessel put to sea, and upon getting well clear of the land a full-power run of four hours was started, during which time the vessel averaged 21.86 knots per hr. Without intermission the vessel continued on for 20 hr. longer, averaging for the full 24 hr. a speed of 21.3 knots, the ship automatically slowing down as the fires became dirty and the personnel fatigued. Upon the completion of the trial a radiogram was received from the commanding officer of the vessel reporting that not the slightest disarrangement had occurred to either the main engines or the auxiliary machinery, and that she was ready for immediate service.

Condition for Minimum Weight and Space Required for the Propelling Machinery.—As already shown, the total heat units required to be absorbed by the boilers, both for Parsons turbines and for reciprocating engines, with battleships of the speed and power that now exist, is practically the same in both cases at full power. This indicates that, for existing conditions, nothing can be saved in the boiler-room weights

*Abstract of a paper before the Society of Naval Architects and Marine Engineers at the annual meeting in New York City, November, 1912.

†Captain, U. S. Navy.

or space by adopting turbines, as the same boiler power is required in the two cases

In the engine rooms, for these powers, however, the reciprocating engine has a decided advantage in both weight and space required, but this advantage would disappear should the necessary power to be developed be increased considerably above what is now asked for, and the advantage would rest with the turbine. Should such an increase of power be called for in future designs, or should the ordinary cruising speed be made considerably higher than now used, the Navy Department would undoubtedly abandon the reciprocating engine and adopt one of its rotary rivals for the propulsion of its capital ships.

Efficiency of Propellers for Maneuvering—The relation of the backing powers of the vessel as compared with the maximum full power ahead, and the time required from full speed ahead until the vessel is dead in the water, is taken as a comparative measure of this condition. When all boilers are in use, which in the case of the "Delaware" occurs at 25,000 indicated horsepower for the main engine in the ahead motion, and for the "Salem" at 14,000 shaft horsepower for the main engine in the ahead motion, the maximum backing powers can be obtained. In the case of the "Delaware" this maximum backing power amounts to 89.2% of the ahead power, while in the turbine vessel "Salem" it amounts to only 41.9%. That is, at these points, the backing power of the "Delaware" is 2.13 times as great as that of the "Salem," both being expressed as fractions of the ahead power. At the maximum powers developed by the engines of the two vessels, the ratio of the percentage backing powers becomes: "Delaware" = 2.27 "Salem."

These results are further corroborated by the backing tests of the "Delaware" and the "Utah" upon their preliminary acceptance trials, where, with the "Delaware" going ahead at 21 knots and the "Utah" at 20, the times taken to bring the vessels dead in the water were, for the "Delaware," 1 min. 52 sec.; "Utah," 4 min. 44 sec. Backing power divided by ahead power is, for the "Delaware" 87.5%, for the "Utah" 35.7%. These results are still further corroborated by the destroyers, which can easily steam ahead at 16 knots under one boiler, but when called upon to maneuver invariably, as a matter of safety, start a second boiler.

Minimum Vibration of Hull; Steadiness of Hull as a Gun Platform as Affected by Machinery—In judging these points it seems only fair to base the decision upon the results of target practice of the vessels in service. If this is done, the decision could be given to the reciprocating type of machinery, as the "Delaware" has just won the championship of the battleship fleet, with the "Colorado," another reciprocating-engined vessel, standing second on the list. From these results it appears reasonable to state that, with well balanced reciprocating engines, no ill effects on gun fire should be expected.

Basing the choice between reciprocating engines and turbines, for battleship propulsion under existing conditions of speed and power, upon the above comparison of relative advantages of the two types, the advantage appears to rest most decidedly with the reciprocating engines, and the Navy Department has ruled accordingly.

COMBINATION SYSTEMS

In the search for economy of propulsion through a wide range of speeds, various combinations of reciprocating engines and turbines have been proposed, both by the Bureau of Steam Engineering and by the shipbuilders, but only one of the systems has as yet been authorized, and that one is for destroyers. It has not yet been tried out in service, but preliminary shop tests show a good gain in economy of the main propelling engines at cruising speeds. This system, as applied to the destroyers, depends entirely for its gain upon the greater efficiency of the reciprocating engine at the higher steam pressures over the efficiency of high-pressure turbines of the reaction type and the high-pressure nozzles of the impulse type of turbines, no advantage being gained from increased efficiency of propellers, as the reciprocating engines are on the same shafts as the turbines.

From some points of view this combination is undesirable, and the gain in service must be considerable to justify its retention. With the other combination systems proposed, calculations indicate that if the propulsive efficiency counted upon can be obtained these systems will all be very much more efficient than either a straight turbine or straight reciprocating-engine drive at maximum power, will hold a big advantage over the straight turbine drive through all ranges of powers, and will hold its advantage over the straight reciprocating-engine drive until a minimum speed of about 11 knots is reached when the efficiencies become equal. The "if" exists, however, and is caused by the danger of the currents thrown to the rear by the big reciprocating-engine screws seriously affecting the rate of feed and direction of flow of water to the turbine propellers. In addition, there may possibly be another source of loss due to heavy leakage of steam through the large change valves which must be fitted to control the paths of flow of the exhaust steam from the reciprocating engines.

In all of these systems, to adapt them to naval requirements, it is necessary to exhaust from the low-pressure cylinders of the reciprocating engines at a pressure of not less than 25 lb. absolute, when this engine is operating at full power, and to bypass as few of the stages of the turbine as possible in order to obtain an increased economy of propulsion through a large range of powers.

IMPROVEMENTS IN ENGINE DESIGN

The Parsons turbine as it exists in our vessels today is, with very few exceptions, the same as the turbines of this type which were fitted in the initial turbine vessel, the "Chester." The only improvements which have been made consist of changes in blade angles, particularly in the low-pressure stages, an increase in the number of rows of blades in these same stages, and the fitting of nozzles for the admission of auxiliary exhaust steam at several different locations along the steam path.

With the impulse turbine, however, the advance over the original naval turbines of this type, those of the scout "Salem," has been rapid. The number of stages has been very much increased, both in battleship and in destroyer turbines, a drum construction has been adopted for the lower-pressure stages, steam balance for propeller thrusts has been provided, cruising nozzles for low fractional powers have been fitted, and nozzles for utilization of auxiliary exhaust are now supplied as in the Parsons turbines.

That these changes in turbines of the impulse type have been accompanied by increase in economy has been thoroughly demonstrated by experience with the machinery of the destroyers, the economy of the impulse turbine showing up nearly, if not fully, as good as that of the reaction type. No opportunity has as yet been offered to obtain a measure of this economy increase with the battleship types of impulse turbine, nor will such opportunity occur until the "Nevada" is ready for trial.

The steps taken in recent years toward increasing the economy and reducing the weight of reciprocating engines have been: increasing of the steam pressure at the engine, improvement in design of engine framing, increasing of piston speed, use of a slight degree of superheat, reduction of cylinder clearances, decreasing of frictional losses through the steam ports, provision of positive circulation of steam through the steam jackets, reduction of back pressure in the low-pressure cylinders, increasing of the ratio between low-pressure and high-pressure cylinders with consequent increased ratio of expansion of steam, and also the application of forced lubrication to all journals, crosshead guides, eccentrics and thrust-bearings.

The following progress has been made in both reciprocating- and turbine-engine systems: Condensing apparatus has been improved, resulting in higher vacuum; rational designs of feed-water heaters have been introduced, based on the amount of water to be heated and the amount of auxiliary exhaust steam available for heating purposes, instead of on the old rule-of-thumb method of allowing a fixed number of horsepower per square foot of heating surface; steam-piping design has been based on the actual rate of flow of steam through the pipes as determined by tests in service; feed-pipe losses have been reduced to a minimum; evaporators and other auxiliaries have been improved; high-speed, electric-driven, forced-draft fans for battleships, and turbine-driven fans for destroyers have been adopted and finally oil fuel has been adopted to a certain extent for both battleships and destroyers.

Considering the above changes in detail, the steam pressures at the main engines have increased since 1895 from 150-lb. gage to 265-lb. gage in the high-pressure valve chest, resulting in a decrease in the size of engine cylinders and in the size of steam piping for equal units of power.

Since the design of the "Oregon's" engines was laid down, there has been a gradual increase in piston speeds used, from 900 ft. per min. in that class of boat to 1000 ft. per min. in the "Delaware" class. This increase of piston speed has been followed by a decrease in the weight of moving parts and has aided in holding down the weight and height of the engine, although the stroke has been increased from 42 in. to 48 in.

In the use of superheated steam the Bureau of Steam Engineering (Navy Department) has been rather conservative. There are at present seven vessels in the naval service fitted for superheat, the maximum degree of superheat obtained at the boilers being 85° F., which reduces to about 60° F. at

the engines. These figures are for full-power conditions and an increase in economy of about 6% is estimated to be obtained. At 12 knots, the cruising speed, the saving by the use of superheat hardly exceeds 3%. The first experiences with the vessels fitted with superheat were far from satisfactory, due to the rapid deterioration of the valves in the steam lines. These valves had cast-steel bodies and cast-steel valve disks with monel metal seats. The erosion and corrosion of the valve disks were very extensive, and in a short period of service it became necessary to replace the cast-steel valve disks with disks of monel metal. This substitution has been satisfactory and no further trouble has been experienced.

Reduction of clearance, decrease of frictional resistances of steam through the steam ports and reduced back pressures in the low-pressure cylinders have all resulted from a change in the design of engine cylinders and valve chests.

In the last ten years, the ratio of low-pressure to high-pressure cylinders for triple-expansion engines, has been increased from about 7:1 to 10:1, including clearances. This increase in ratio had been used previously in remodeling the engines of the "Cincinnati" and "Raleigh," with most excellent results. A serious mistake was made, however, in counting too much on the increased expansion obtained by fitting a smaller high-pressure cylinder than that originally installed, the steam pressure having been increased. The new high-pressure cylinder was made 24 in. in diameter and the ratio of low-pressure to high-pressure cylinder changed to about 11½:1. While the economy obtained with these engines was most excellent, the high-pressure cylinders were entirely too small and the engines have never developed the expected power.

By the adoption of forced lubrication for the main propelling engines, the engine friction has been enormously reduced. All the journals are oil borne so that no metal-to-metal contact occurs. The result has been that the amount of adjustment and overhaul of the main engines has been decreased to a very large extent, and the men who would have been used for this overhaul work can now be used on the auxiliary machinery to good advantage. This decrease in wear of the bearings, and the cushion provided by the oil, has resulted in a much better maintenance of alignment of the engines, has reduced shocks on the machinery and has reduced vibration due to these shocks. In addition, there is considerable saving in oil at ordinary speeds. At high speeds there still exists a heavy loss of oil, due to splashing on the cylinder heads and also to loss by evaporation from the hot surface of the lower heads. When first fitted, the forced lubrication gave trouble, due to oil being drawn through the low-pressure piston-rod stuffing-boxes. In order to remedy this defect, stuffing-boxes fitted with steam seals have been supplied, and later reports indicate that where the steam seal is properly fitted no trouble of this kind now exists.

With the advent of the turbine for marine propulsion, if the full benefit of the new machine was to be realized, a high vacuum in the condensers became imperative. In order to obtain such vacuums, the Parsons company originated the vacuum augmentor, and this addition to the condensing plant is used extensively in the naval service. In some vessels in the service, in place of the ordinary air pump with augmentor, air pumps of the dual type, as manufactured by Weir, have been fitted, while in other vessels both wet- and dry-air pumps have been used. Of these systems, that with augmentors and also the dual type appear to give the greatest satisfaction in service, and in addition require less weight and space than the wet and dry system.

The improvements in design of feed heaters, steam pipes and feed pipes naturally followed on the measurements of water consumptions of the machinery taken during the acceptance trials of the vessels. These measurements placed in the hands of the Bureau of Steam Engineering data of great value, and that bureau has attempted to use the full value of it in proportioning these important items. For instance, the feed heaters of the "Delaware" were, for lack of data, proportioned on the basis of so many i.hp. per sq.ft. of heating surface, and the two heaters combined have a total heating surface of 2100 sq.ft. In her sister ship, the "Utah," the same degree of feed heating is obtained with heaters having a total surface of only 512 sq.ft.

In the search for economy, the Bureau of Steam Engineering has adhered strenuously to the use of feed heaters with auxiliary exhaust steam as the heating medium, using any excess of exhaust in the low-pressure turbines or the second receivers of triple-expansion reciprocating engines. This utilization of the auxiliary exhaust has not been to the taste of the turbine manufacturers who prefer to use all of this steam in the turbines, depending for feed heat upon that derived from steam drains discharging into the feed tanks.

The improvements in evaporators consist mainly in the adoption of double effect connecting and in throwing open the gates to other than the standard bureau design, although these are not the only changes from former practice. Evaporator feed heaters using the vapor from the evaporators as a heating medium have been fitted, and vapor pipes, better designed for the amount they have to carry, are installed.

Until the adoption of electric-driven blowers for battleships and other large vessels and of turbine-driven blowers for destroyers and small vessels, the successful outcome of any heavy forced-draft run was always endangered by the unreliability of the blowers. Since the adoption of these types of blowers this danger of breakdown has been almost entirely eliminated, and, so far as the destroyers are concerned, the blowers may be classed as one of the most, if not the most, reliable of the auxiliaries fitted.

OIL FUEL FOR DESTROYERS AND BATTLESHIPS

In deciding to adopt oil fuel for use on battleships and destroyers, the Navy Department took into account the following advantages which are to be gained by its adoption: Less fuel is required for any given radius of action; consequently less percentage of displacement and less bunker capacity are required for the fuel; boiler efficiencies are increased; fire-room force is decreased; deterioration of boilers is decreased, due to maintenance of more even temperatures; high power can be maintained for indefinite periods; there is less deterioration of the ship's structure because of the absence of water and ashes in the bilges; greater cleanliness is obtainable; the fuel supply can be more easily replenished both in port and at sea; less floor space is required for the development of a given power; and the steam supply can be more easily controlled.

In opposition to these undoubted advantages the following disadvantages exist; that fuel oil is less widely distributed over the earth than coal, that its unit cost is greater than that of coal, and that its storage involves greater danger of fire than attaches to the storage of coal. The reply to the first objection is that in time of war a fleet operating far from a base would depend upon fuel ships, anyhow, for replenishing her bunkers and that oil can be carried in bulk as well as coal. Also, the bases where stores of oil can be kept on hand are as easily established as are bases for coal, and such oil bases would have, in case of danger of capture by an enemy, the additional advantage of being much more easily destroyed, together with their stores of fuel, than are coal bases. The second objection, that of excess cost of oil over that of coal, is more than counterbalanced by the advantages above stated. Finally, the third objection, that of danger from ignition of the ship's store of oil fuel, is very thoroughly guarded against by storing the oil in compartments remote from the boiler rooms and situated well below the water line of the vessel.

Upon deciding on the adoption of oil as a fuel for the naval service, the Bureau of Steam Engineering examined carefully all the systems for burning oil that now exist and finally decided upon that of mechanical atomization of the oil as the one most suitable for naval use. In this system, the oil is pumped through heaters to the burners within which it is given a whirling motion. The small central core of oil, discharging through the tip orifice with this whirling motion, the oil flies off and forms a cone of fine mist. This oil mist mixes thoroughly in the furnace with air which passes into the furnace through a cone register surrounding the burner, the register having adjustable openings and guide vanes so that the amount of air to each burner may be regulated and the direction of flow of this air be made slightly oblique to the axis of the cone of oil.

The success of the system depends almost entirely upon the proper handling of the air. Improper air regulation will produce a series of rapid explosions of oil in the furnaces with consequent destruction of their brick linings. With proper handling, the oil burns almost noiselessly, and the amount of smoke produced can be held under control.

In the first battleships fitted with oil fuel, the oil was only fitted as an auxiliary fuel and was intended to be used as an aid in keeping up steam when the coal should be so low as to be remote from the fire rooms and so require excessive trimming. The results obtained with this mixed system are not to be rated as good nor were good results expected, as the furnace volumes of coal-burning boilers are too small to permit efficient burning of oil. Furthermore, when burning the oil and coal in combination, it is impossible to so regulate the air supply that each fuel will obtain the proper amount. This results in excessive production of smoke and no increase in steam production over coal alone.

Block Signals and Interlocking Plants on the Chicago Great Western R. R.

The recent extensive improvement work on the Chicago Great Western R.R. includes the installation of automatic block signals on the Eastern Division from Chicago (Forest Park) to Oelwein Ia. (236 miles), and on the Northern Division from St. Paul to Randolph, 33 miles. The installation includes both double-track and single-track signalling. The length of the block sections ranges from one to five miles, varying with the traffic and local conditions. The apparatus was purchased from different companies, and was installed by the signal department of the railway. For information regarding the work we are indebted to Joseph Beaumont, Signal Engineer of the Chicago Great Western Ry.

Block Signals

The signals are of the semaphore type, with arms 4 ft. long and 9 in. wide, mounted on steel posts about 25 ft. high, having the mechanism in a box forming the base of the post. The signals normally indicate "clear," and the arms move in the upper right-hand quadrant, which arrangement is now becoming general practice. For double-track equipment, the arms have three positions, and there are no separate home and distant signals, as each signal serves as the distant signal for the one in advance. The positions and indications of the signals on double-track are as follows: horizontal ("stop"); inclined upward 45° ("proceed under control, next signal is at the stop position"); vertical ("proceed"). At night the signals show red, yellow and green lights, respectively, for the above indications.

For single-track equipment, the home signal has two indications only: "stop" and "proceed"; but a distant signal is placed 2000 to 3500 ft. before it, so as to advise enginemen of the position of the home signal and enable them to get their trains under control in case it is necessary to stop at the latter. The home signals show a red or green light, and the distant signals a yellow or green light. An exception to this arrangement is where the block is very short. In such cases, the previous signal is of the three-position type, serving as both home and distant signal, as in the double-track equipment described above.

The home signals are located at both ends of the passing sidings, and intermediate home signals are located along the block section where the distance is sufficient to require them. The home signals have square-end blades painted red, and the distant signals have forked-end blades painted yellow. All blades have the reverse side painted black.

Fig. 1 shows the signal equipment on double track near Maywood, Ill. The signal at the right is of the standard type, but the one at the left has a bracket with stub post representing the side-track which lies between the main track and the signal. Fig. 2 shows the home-signal equipment on single track, this being at the west end of the passing siding at Durango, Ia. Fig. 3 shows the single-track distant signal west of Budd, Ia., governing eastbound trains. Each signal has a 16-cell primary battery, and current for each track circuit is supplied by three gravity batteries. The concrete pedestal foundations for the signal posts are in three sections. They were manufactured at a division yard, thus avoiding small jobs of concreting along the track. The pedestals were distributed by cars, with other supplies, and were handled by the derrick car used for placing the concrete chambers for the batteries.



Fig. 1. Automatic Block Signals for Double Track, at Maywood, Ill.; Chicago, Great Western R.R. Joseph Beaumont, Signal Engineer

(The bracket and stub on the post at the left are on account of the side track between the main track and the signal.)



Fig. 2. Automatic Block Signal for Single Track, at the West End of Passing Track, Durango, Ia.; Chicago Great Western R.R.

Signal Control by Track Circuits

While the system by which the signals are controlled automatically through track circuits is familiar to many of our readers, there may be others to whom it is not clear. For the benefit of the latter, we give the two diagrams in Fig. 4, which are redrawn from similar diagrams in the instruction pamphlet of the Signal Department of the C. G. W. Ry. The following description is slightly condensed from that in the pamphlet mentioned.

The operation of automatic block signals is regulated or controlled by train movements through the operation of relays connected to the track circuits. A battery is connected to one end, and a relay to the other end of each track section

as shown in Fig. 1, the path of current being indicated by arrows. The various signal circuits are opened or closed by the relay contacts, which are so arranged in combination with the signal-control wire as to apply energy when conditions are safe for a train movement. The signal arm is so counterweighted that whenever the signal circuits are de-energized it will go to (and remain in) the horizontal or "stop" position. It will only assume a vertical ("proceed") position when the track is clear, the track circuits are unoccupied, and all relay contacts are closed in the track sections over which the signal governs train movements.

Each signal is operated from the "stop" to the "proceed" position by a small electric motor which is controlled by a circuit connected through the relay contacts. When the block is unobstructed, an electric current will cause the motor to rotate and put the signal at the "proceed" position. When a train passes the signal and enters the block, the wheels



FIG. 3. AUTOMATIC DISTANT SIGNAL AT BUDD, IA.; CHICAGO GREAT WESTERN R.R.

and axles of the engine and car short-circuit the current flowing through the rails of the track, shunting the relay out of the circuit, as shown in Fig. 4. This opens the line circuit controlling the signal, disengaging the electric motor from the semaphore arm, which, being released immediately assumes the horizontal ("stop") position by gravity under the influence of the counterweight. The circuit remains open until the last pair of wheels has passed out of the block. Thus the signal indicates "stop" until the block is again clear and safe for an additional movement.

All switches in main tracks or leading to the main track in automatic signal territory are provided with circuit controllers, connected with the switch point as an operating medium, with wires bonded to the main track rails. If the switch point is moved from the main-track rail, the controller will short-circuit the track battery, thus shunting the relay out of the circuit and causing the signal arm to assume the horizontal position.

The rails of side tracks are so connected electrically to the main track circuit that a car or engine at the end of the side track close enough to the main line to foul a main track movement, will shunt the relay out of the circuit in the same manner as if the cars were on the main line. Thus, any movement fouling the main track will cause the inbound signal at each end of a block to assume the "stop" position. A broken rail or the removal of a rail from the track will open the circuit, thus causing the relay contacts to open, and putting the signal at "stop."

SWITCH INDICATORS AND LOCKS

At the switches of crossovers on double-track and at main-track switches located a considerable distance from the block signals, switch-indicators are installed to protect movements through the switches. The indicators are installed to protect movements through the switches. The indicator has a small box mounted on a short iron post close to the switchstand, and shows a miniature semaphore arm moving over a disk. When a train is on the main track in the block in which the switch is situated,

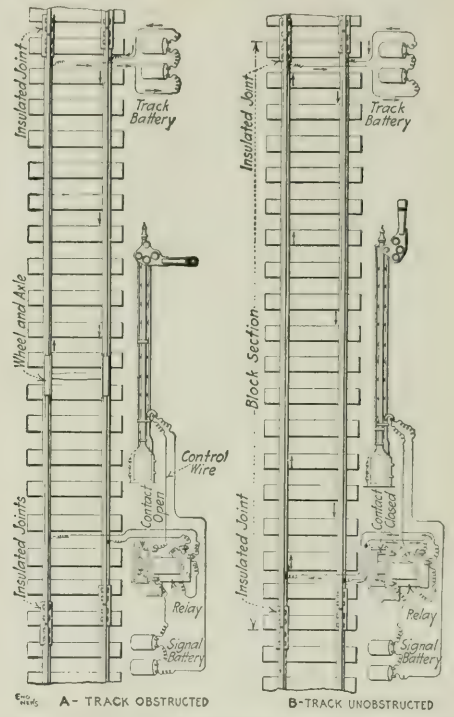


FIG. 4. DIAGRAM OF APPARATUS AND TRACK CIRCUITS FOR AUTOMATIC BLOCK SYSTEM

the arm of the indicator is horizontal ("danger"), showing that the switch must not be opened. If the arm is vertical, indicating that the main track is clear within the block limits, the switch may be opened. The movement of the switch then automatically sets the block signals at the "stop" position, so as to prevent trains from entering the section, and thus making it safe for another train to enter the section from the siding (and run to the end of the block section) or to cross from one main track to the other.

Some of the important crossovers have their switches equipped with electric locks so arranged that the switch cannot be operated unless the block section is clear. A train entering the block sets the switch-lock automatically. However, switching movements need not be delayed until after the train has passed out of the block, as

a release circuit just beyond the switch provides for the release of the lock as soon as the train has passed the switch.

Train-staff Block System

At several points on this road, and on tracks which it uses jointly with other lines, the traffic is operated under the protection of the train-staff block system. This provides for two or more consecutive following movements, or trains in the same direction, before any train movement is made in the opposite direction over the section thus controlled. But each following train must wait until the preceding train has passed out of the block before it can obtain the necessary authority to proceed.

Interlocking Plants

Interlocking plants at grade crossings with other railways include the mechanical, electrical and low-pressure pneumatic systems. In the first case, the various switches, signals and derails are operated by pipe connections, although in some few cases the signals are operated by wire. Where these plants are located in districts equipped with block signals, additional protection is provided by a combination of electric circuits and annunciators, electric slots, indicators and locks. These are so arranged as to give three functions: 1, to announce automatically the approach of a train; 2, to indicate to the signalman the condition of the track circuits through the limits of interlocking (showing whether or not the track is occupied), and 3, to automatically lock-up the route after a train has entered the limits, so that no opposing route can be cleared. Interlocking home signals operated by pipe connections are equipped with electric slot devices, so arranged that the semaphore arm will assume the "stop" position automatically when a train has passed the signal and entered the block. When the electric lock has locked up a route, the position of the switches can be changed only by a slow process which is purposely arranged with a view to requiring the signalman to consider his actions and thus preventing him from making a false move due to haste or impulse.

At electric interlocking plants, the motors for the signals and switches are operated by current from a generator driven by a gasoline engine; a storage battery of suitable capacity is in connection with this, and for small plants 60 amp.-hr. capacity is sufficient. A current of 110 volts is used generally. Each switch and signal motor is connected with the source of power through the necessary circuit-controllers and protective apparatus. The advantage of the electric system is that signals and switches can be operated at distances which would be impracticable with mechanical connections, while at the same time there is great ease of control. In the low-pressure pneumatic interlocking plant, the compressed air is used at 25 lb. pressure for transmission and 6 lb. for operating the apparatus.

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Cars for Disinfecting the Clothing and baggage of passengers who have been exposed to infectious diseases have been put into service on the Italian State Railways, according to the November, 1912, issue of "Rivista Tecnica della Ferrovie," describing apparatus, one a steam stove system and the other designed for the sterilization by the use of formalin. Italians." Already two cars have been built, but it is expected that four more will soon be put into the southern part of Italy. Each car is completely equipped with two sets of Each car is complete in itself, and is intended to be attached to a train coming out of a suspected or infected district.

Estimating the Cost of Garbage and Refuse Collection and Haulage in Chicago*

On July 15, 1912, the city council of Chicago passed an ordinance, directing the Civil Service Commission to make an investigation of the physical needs of the various wards of the city and of the systems and methods in use for the purpose of determining equitable ward appropriations for street and alley cleaning and refuse collection and removal. This work is done by the Bureau of Streets, Department of Public Works.

The city is divided into 35 wards. At the beginning of each year the council appropriates the money to be used in each ward for all operations of the Bureau of Streets.

The municipal refuse problem may be properly separated into four divisions: House separation, house collection, hauling and final disposition. Each division of the problem is so important that they should all be studied together and each weighed carefully in determining the final solution. Up to the present time the greatest study has been given to final disposition, yet this feature of the problem, as far as affecting the finances of the city, is of the least importance. Heretofore the whole problem has usually been handled as a condition to be met, rather than a problem to be solved. Collection and haul are the most important phases of the problem.

The city ordinance provides that rubbish and ashes shall be separated from garbage by the householders, and each kept in separate receptacles. Ashes and rubbish are collected together by wagons of 5 cu.yd. capacity and are dumped into large clay holes or into low marsh land.

In order to determine the costs of collection and the factors affecting it, study has been made as to time of collection, number of collections made each day by various teamsters, the service rendered, the rate of haul in miles per hour, location of dumps and the coöperation given the city's employees by the people served.

The peak quantity of garbage to be collected comes in the August and September canning season. Rubbish peak comes in the winter months.

The following tendencies have been found to control the expenditure necessary to care for these activities:

(a) Character of district.
(b) Population.
(c) Distribution of population.
(d) Location of dumps.
(e) Time required to collect.
(f) Time required to haul.
(g) Length of hauls.

A close study of Chicago conditions for the past several years show that a general law has been followed throughout the entire city in the matter of growth, and that set cycles of growth have obtained in the majority of districts in the past. While these cycles are changing, they are changing at a known rate, and this rate may be determined by studying the conditions for the past five years. The quantity of garbage and rubbish collected for each month of each year expressed in terms of percentage based upon January of that year, indicates that the quantity collected by months for any given district follows well-established cycles peculiar to that particular district.

These tendencies and cycles for a given district for the years 1908-1912 having been determined, it was comparatively easy to estimate what percentage of the January collection for 1913 may be expected in February of 1913. Carrying the same cycle through for March, the percentage for March was determined and so on. By getting the percentages between the Januaries of the various years by the same method, the quantity of garbage and rubbish that would probably be collected in January of 1913, was determined. As a further check upon this estimate, the percentage of garbage collected in one year over the percentage collected in another has been compiled for the past five years for each ward in the city.

As a still further check upon these estimates, the physical characteristics of the wards have been studied very carefully by investigators, engineers, and by others familiar with the conditions of each section of the city, and estimates made as to the increase or decrease that may be expected in the various wards in 1913.

Based upon conditions found to exist among efficient teamsters, the following units have been determined and used in formulating estimates. The average time required for

*Condensed from a statement sent to the technical press by E. H. Caufield, Efficiency Engineer, Chicago Civil Service Commission, Chicago, Ill.

dumping has been taken as 25 minutes, the average rate of haul during the summer months at 3 mi. per hr., and the average haul during the winter months at 2½ mi. per hr. In some of the outlying wards where it is very difficult to haul a load during certain months of the year, the number of months during which the men are allowed to make speed of 2½ mi. per hr. has been increased. Many writers upon the subject assume that a loaded team will make four miles per hour, but investigation of conditions existing here does not bear out these assumptions.

After studying the conditions very carefully in each ward of the city, it has been found that for the entire city the average time required for the collection of one load of rubbish averaged 1.7 hours in summer and 2.19 hours in winter.

The house collection of garbage is made by wagons equipped with steel tanks having a capacity of about 2½ tons of garbage. Each ward is divided into garbage districts and collections are made from each district by one driver according to the density and character of population. Under ordinary conditions it requires an average of approximately 3 hr. and 55 min. to collect a full load. Usually the greater number of garbage collectors collect one load per day and the remaining time is spent either in going to and from the loading station or disposal plant, or in waiting at the loading station.

All garbage which is collected from the north and west parts of the city is delivered either to the Chicago Ave. loading station or to the Oakley Ave. loading station, each of which is located on the north branch of the Chicago River. The garbage is transported by barge to the reduction plant at 39th and Iron Sts. The garbage delivered to these two stations in 1911 constituted 56% of the total garbage collected. For the first eight months of 1912 the cost of operation, maintenance and lighterage chargeable against garbage delivered at Oakley Avenue Station has averaged 75c. per ton, and at Chicago Avenue Loading Station, 64c. per ton.

To best comply with the ordinance regarding boxes in which to collect the garbage of the city, the city has used sheet steel tanks. These metal tanks are supplied with iron covers, attached by hinges with a common rod at the center of the top of the box. These tanks are loaded very heavily at times and receive considerable rough usage, both at the loading stations and at the reduction plant. The use that they receive on the barges in being transported from the loading stations to the reduction plant is especially deteriorating to the tank. The superimposed boxes rest directly on the boxes in the lower tiers and this has considerable to do with destroying the metal covers. Garbage contains considerable acid of various kinds, which has a tendency to remove the paint and destroy the metal. Many of the covers are completely gone and are being replaced from time to time.

With the rapid growth of the motor-truck industry, many questions have arisen as to the adaptability of motor trucks to the needs of various city departments. The Commission has made inquiries of municipalities and motor-truck companies regarding the adaptability of their product to the class of work which is done by the city. The "Engineering Magazine" published an article on the cost of operating motor trucks in the October, 1912, issue. The following table appeared in this article, showing the increase of operation with the increase in tonnage:

Size	Fixed charges	Increment per mile
1000 lb.	5.07	0.0886
3 ton	5.33	0.0860
5 ton	5.60	0.1253
6 ton	6.00	0.1540
7 ton	6.10	0.1718
12½-ton train	7.40	0.2070

The cost per day of the operation of a motor truck is equal to the fixed charges plus the miles per day times the cost per mile. This table indicates that the heavier the truck the smaller the cost of operation per ton capacity. It is very evident that the cost of hauling per ton mile by this method is considerably less than the cost per ton mile of hauling by team providing the truck can be kept in continual operation and in performing the work to which it is best adapted. There is no doubt that teams and wagons constitute the cheapest method of collecting garbage, rubbish and street dirt. Teams, however, constitute a more expensive method of removing garbage from the center of collection to the disposal plant, especially where the haul is any considerable distance, as exists in most sections of th city. In "Engineering and Contracting," for Feb. 22, 1911, an article on the adaptability of motor trucks to contractor's uses appeared, contemplating especially the haulage of heavy materials, such as crushed stone, cement and lumber. These materials, however, differ very little from the material which the Bureau of Streets is required to handle as regards their bulkiness and weight. The motor tractor especially described in this paper is one so designed that it may replace the front wheels of an ordinary wagon and in this way furnish the motive power, as well as the front running gear. An apparatus required to make this change consists simply of a knee jack to raise the front of the wagon while the change is being made. With the adoption of a change of this kind, definite time schedules can be arranged for garbage, rubbish and street dirt collection or refuse wagons for a given district to deliver to a central station or yard.

There are a number of methods of garbage disposal carried on in different parts of the country, depending mainly upon the conditions existing. The following are the principal ones: (1) Reduction. (2) Incineration; (3) Land fills

The advantages and disadvantages of reduction are as follows:

Advantages:

(1) Garbage changed into a product of commercial value and the addition of an industry to the community.

Disadvantages:

(1) Uneconomical for the city on account of the length of haul to a central reduction plant. For many sections of the city the haul is excessive and expensive.

(2) Labor employed must have considerable experience and skill.

(3) Large first cost of plant and high maintenance charges.

(4) Separate collection of garbage and rubbish required.

(5) Two separate systems of refuse disposal.

The advantages and disadvantages of incineration of garbage areas follow:

(1) Complete destruction of germs, organic matter and offensive gases of all municipal wastes.

(2) The reduction of length of haul, as small incinerators can be operated more economically than small reduction plants and can be established locally to meet the needs of local sections.

(3) Unskilled labor can be largely employed in the operation.

(4) No separation of refuse required.

Disadvantages:

(1) Is expensive, as there are no byproducts to help pay operating expenses.

(2) Unless experienced firemen are employed, results are not satisfactory or efficient.

Owing to the remoteness of certain sections of the city from the central garbage-disposal plant, the separation of refuse, as defined by the city ordinance, has been impractical and uneconomical. In these districts all house refuse has been collected together and has been disposed of in either low swampy lands or in clay holes. Up to the present time this method of disposal has met with very little objection. However, the time when this method will not meet the conditions of these localities is close at hand. The geographical locations of these districts and the character of population within them will make it practically impossible to economically obtain the proper separation of garbage from the other forms of house refuse, or to dispose of garbage at a central disposal plant. It will be necessary within a short period of time to devise some method of disposing of refuse in these districts in local plants.

A combination plant in which the salable portion of the refuse collected can be sorted and the balance destroyed by fire is, no doubt, the most practical, and will meet the needs of these districts in the most economical manner. It may be that some revenue may be obtained from the power that might be generated. However, this featurc has been given no consideration and the economy of this method is based on reducing the time spent in long hauls and unproductive work and the sanitation of the whole locality.

The number of pounds of garbage to be collected has been estimated in the same manner as has the number of loads of rubbish. It has been assumed that various wards having the same character of population and having the same general conditions should collect the same number of pounds of garbage per load. Keeping these facts in mind, the number of pounds of garbage per load to be expected for 1913 has been averaged over these various wards and over the various years. After having estimated the number of pounds per load to be hauled, the number of loads per month is directly obtainable.

Using the time of collection, the rate of haul under varying conditions, the distance to be hauled to the point of disposal, and scale of labor and teams, a standard cost of collection and hauling has been determined, and estimates made [a large detailed table giving many data by wards is omitted, since it is chiefly of local value.—Ed.].

The investigation described above was made by the Chicago Civil Service Commission under the direction of Major James Miles, examiner in charge, and J. L. Jacobs, engineer in charge, F. H. Cenfield and A. B. Segur, Engineers of the Efficiency Division.

Allowance for Evaporation from Reservoir Surfaces

By Gen. H. M. Chittenden*

In a recent investigation of the water-supply capable of being derived, by the aid of storage reservoirs, from a certain watershed, the writer was impressed with what seemed to him the rather careless method adopted by engineers of standing in making allowance for the evaporation from reservoir surfaces. The rule almost invariably adopted is to estimate the gross yield from the watershed including the reservoir area, on the basis of the land run-off and then deduct the assumed evaporation from the reservoir surface. Since the run-off from the reservoir area is 100 per cent. of the rainfall, and from other portions of the watershed only a small fraction of this, the correct method would evidently be to figure the run-off from the watershed exclusive of the reservoir area, add to it the run-off (= rainfall) on the reservoir itself and then deduct the surface evaporation. With the reservoir area very small compared with the watershed area, the error involved in the usual method is relatively quite small, and as it is invariably on the side of safety there is ordinarily no objection to its use. Where, however, water is scarce and supplies are figured somewhat to a nicety, it seems worth while to eliminate this error from the estimates. In a case recently considered by the writer the error of the usual method amounted to about 2,000,000 gal. daily, as an annual average. Of course, in actual operation, the error would be eliminated anyway, and the advisability of correcting it in the estimates depends upon the accuracy with which it is desired to compute them.

For the purpose of expressing these relations in algebraic terms

Let A represent the area of any watershed, including reservoir area.

Let a represent the reservoir area in the same square unit.

Let R represent the average depth of rainfall on the watershed for any period in lineal units.

Let r represent the average depth of run-off assumed for the watershed for the same period.

Let E represent the assumed depth of evaporation for the same period.

Then the algebraic expressions for the yield from the watershed by the two methods will be as follows:

(1) $Ar - aE$

(2) $(A - a)r + a(R - E) = Ar - aE + a(R - r)$

As $a(R - r)$ is always positive, (1) is always less than (2) by the value of this third term.

The first form of (2) given above illustrates one of the common phenomena of nature. It is manifest that the larger a is compared with A, and the larger E is compared with R the smaller will be the value of (2) and that it may actually be negative. Take, for example, the great natural reservoir, Lake Superior, whose area (a) is very nearly 0.1 A. In the dry hot term of later summer when R is small and r relatively smaller still, and E ordinarily much greater than R, the first term of the expression may become very small and the second term negative and very large, so that the algebraic sum may be a negative quantity. In fact this is what actually happens. As is well known, the surface of this great reservoir falls in mid-summer with a rapidity which cannot be accounted for by the discharge at its outlet.

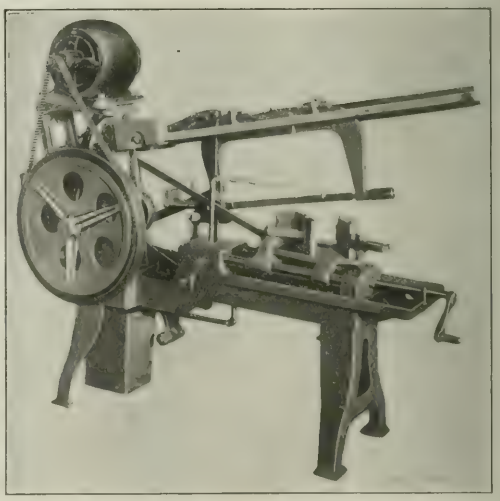
It is scarcely necessary to point out that, in localities where evaporation and rainfall are practically equal, evaporation from the reservoir surface may be left out of consideration, provided the reservoir area is excluded from the run-off estimates; also that the reservoir area will be a source of loss whenever E is greater than R, and a source of gain whenever it is less.

An anticipated criticism in regard to r will be considered. It may be said that r should represent the average run-off, taking into consideration the 100% run-off on the reservoir area. If this were done, then expression (1) would give a correct result. But it is scarcely ever done, r being always assumed as the land run-off unaffected by the reservoir area.

*President Port of Seattle Commissioners Central Building, Seattle, Wash.

A High-Speed Hacksaw Driven by Electric Motor

The power hacksaw shown in the accompanying cut is so constructed that the length of stroke is automatically adjusted by the size of the stock being cut, so that practically the entire blade is in service at each stroke. An



An Improved Type of Power Hacksaw

automatic lubricating system, a gage for limiting the depth of cut, a swivel vise for angle cutting, and a device for raising the saw blade on the back stroke are some of the special features of this machine.

A Crocker-Wheeler ½-hp., 220-volt, direct-current motor, with variable speed control, drives the saw through a chain belt and gears. The motor speed is capable of variation from 550 to 1100 r.p.m., giving a speed variation of from 50 to 100 strokes per min. for the saw. The saw is made by E. E. Atkins & Co., of Indianapolis.

Maintenance Engineering in Railroad Work*

The chief enemy of the maintenance engineer is water in some form or other. Drainage should not be forgotten in the early stages of an engineering work. Do not dip a road to get under a railway, or a railway to get under a road, without some thought as to the possibility of draining the depression proposed.

In dealing with steel bridge floors there are three courses open to the designer: (1) To make the floor as open as possible, with no place for water to lodge, and every facility for its getting away quickly; (2) to protect the steelwork floor so thoroughly that water cannot get to it; (3) a compromise course. Even the worst drained bridge, however, does not suffer so much as one over a railway, with a floor so designed that steam and gases from locomotives cannot escape freely.

When a structure fails, it is important that a correct diagnosis should be made. Otherwise the treatment may be all wrong, and may lead to large expenditure, when something quite simple and inexpensive would have met the evil equally well.

One instance is recalled where an intelligent inspector, climbing among the girders of a viaduct 140 ft. high, found that there were signs of movement where the girders rested on the piers. The first thing to find out was whether the girders were moving on the pier, or the pier moving under the girders; and observations extending over some time were necessary to settle this point. There was then no doubt that it was the pier that was moving, and getting increasingly out of plumb. Fortunately, the next pier was an unusually massive one, and it was possible with a system of tie rods attached near the base of it to get hold of the faulty pier near the top, and entirely stop the movement. From the date of the first observations to the tightening up of the tie rods, there had been a movement of 1¼ in.

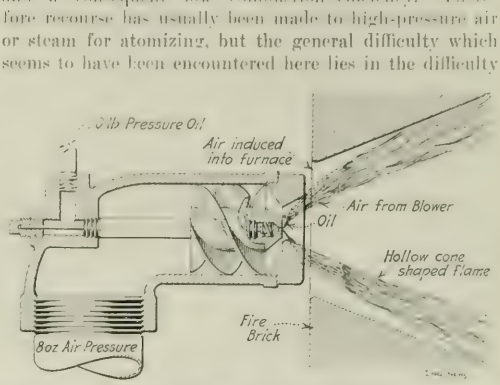
Similarly, if one is called upon to deal with an abutment which is bulging and out of plumb, the first thing to find out is, to what the failure is due; is it, for instance, the result of (1) bad foundations? (2) of colliery workings (and old workings which nobody knows much about are sometimes very troublesome)? (3) of excessive pressure from swelling clay or defective drainage behind? or (4) of imperfect building and want of proper bond, or sufficient section in the wall itself? The treatment will entirely depend on the diagnosis. For instance, it would simply be waste of money to rebuild or reface if colliery workings were the cause of the trouble, unless indeed the settlement due to them had quite ceased.

In the design of new works the consideration of the likelihood of future alteration has a bearing on the materials to be used. If it is likely to come soon, one does not build with the same solidity adopted if the structure is to be one of real permanence. In designing bridge work, some of our predecessors in days gone by have added large margins to the calculated strengths of their structures, remembering the effect of corrosion and the tendency to increase the weights of locomotives, etc. We are now reaping the benefit of this liberal policy; for had things been calculated more closely, our maintenance expenditure would now be largely increased.

*Abstract of article in the "Journal" of the Junior Institution of Engineers, London, England, by A. Clifford Swales, Secretary.

A Design of Fuel-Oil Burner Atomizing Oil at High Pressure with Air Under Low Pressure

The design of fuel-oil burner shown in the accompanying figure has been arranged in an attempt to increase the efficiency of oil combustion for boiler and metallurgical furnaces. A characteristic of many low-pressure oil burners has been their ineffective atomization of the oil and a consequent low combustion efficiency. Therefore recourse has usually been made to high-pressure air or steam for atomizing, but the general difficulty which seems to have been encountered here lies in the difficulty



A Fuel-oil Burner Using Oil at High Pressure and Air at Low Pressure.
(Designed by H. B. Stilz, Philadelphia).

of thorough mixture of the oil particles with the proper amount of air on account of the high velocity of the former.

This design shown comprises an inner nozzle through which oil is forced at 50 lb. pressure. At the end of the passageway in this nozzle is a small orifice and within the passage is placed a spindle bearing a spiral fin, which is claimed to cause the oil on delivery to rotate and spread out in a cone-shaped film. Around the inner nozzle above mentioned is a casing through which air passes, and within this casing is a larger spindle also with a spiral fin, which it is claimed gives the air a whirling motion as it passes out. By the velocity of the air in a radial direction from the burner axis, a certain amount of suction seems to be produced which draws the oil particles into the current of air. This, it is claimed, results in the desired intimate mixture and atomization. The shape of the issuing flame is controlled by the shape of the bell mouth of the outer orifice.

It is reported that competitive tests, conducted in 1912, at the plant of the Link Belt Co. in Nicetown, Pa., showed that this type of burner required only some 31% of the amount of fuel of high-pressure burners in use. Sizes have been made to give a capacity range of from under 1 gal. of oil per hour to over 400.

This design is the work of H. B. Stilz, 1938 N. Marvine St., Philadelphia, Penn., from whom this information has been obtained. The device is protected by broad patent claims.

A butter-tub cover lodged in a sewer pipe joint at Hutchinson, Kan., according to reports, and cut off the flow of sewage as completely as if it had been a valve placed there for the purpose.

Suggested Salary Schedule for New York City Engineering Employees

The Board of Estimate and Apportionment of New York City, which has final decision on all appropriations in the city budget, recently appointed a committee of its members to standardize the salaries of positions in the municipal civil service. As the city has several thousand engineering employees this committee requested the society, known as The Municipal Engineers of the City of New York, composed of about 600 engineers in the city service, representing 22 departments or bureaus, to suggest a uniform classification of grades and a schedule of salaries for each grade.

The society delegated this work to a committee of its prominent members. The committee has given the subject several months of deliberation and has just rendered its final report, which has been tabled until the February meeting, for further discussion. From the results of the discussion at the meeting of the society held Dec. 23, there appears to be a division of opinion which will test the fundamental objects of the society as a professional organization.

An abstract of the report submitted by the society's committee, for transmission to the Board of Estimate and Apportionment, is as follows:

EXISTING SALARY SCHEDULES

The positions in the New York City engineering service are at present graded according to limits of salaries; the limits are fixed as follows, the amount given in each case being the minimum salary for the grade:

Grade	A,	$300	per annum
"	B,	600	" "
"	C,	1200	" "
"	D,	1800	" "
"	E,	2400	" "

Practically, grades A and B are useless, for no engineering positions are paid so small a salary as $600.

For the inspection service, the grades are as follows:

Grade	1,	$900	per annum
"	2,	1200	" "
"	3,	1500	" "
"	4,	1800	" "
"	5,	2100	" "
"	6,	3000	" "

Here "grade" is really used to comprise in each instance a group of grades. This is a somewhat perverted use of the word, and has led to or permitted the numerous irregular salaries found upon the city payrolls.

Appointments from open competitive lists, as well as from promotion lists, are made to positions of the same title at different rates of compensation and in different grades in the various departments, for work of the same market value. Unnecessary promotion examinations are thus required, due to arbitrary and illogical grading.

SUGGESTED NEW SALARY SCHEDULE

REVISED NOMENCLATURE—The first recommendation is a suitable nomenclature, as a means for adequately expressing the suggestions as to standardization of salaries and grades. In the following definitions an endeavor has been made to conform closely to present practice of the Municipal Civil Service Commission.

CLASS—A distinction based partly on method of appointment and partly on general nature of service rendered; there are four classes: Exempt, Competitive, Noncompetitive and Labor.

TITLE—The name of a rank or of a position, as Rodman, Inspector, Engineer, Draftsman, Mechanical Engineer, Chief Engineer.

RATING—The mark or the order of standing on a list resulting from an examination.

POSITION—A place or office in an organization having certain duties or functions, determined by those in authority; there may be one, a few or many of a kind in an organization. Position is solely an organization unit. A position may have different salaries from time to time, that is, the incumbent may be in different grades. For example, a young man may be put in a position of responsibility, in a minimum grade, but with increased value of services due to experience and greater efficiency may be advanced to a higher grade, while still performing the same set of duties. Positions should be designated by titles, as brief as practicable, suggesting clearly the functions or duties of the employee, for example: Rodman, Electrical Engineer, Designer, Section Engineer, Deputy Chief Engineer; wherever practicable these titles should coincide with those of the civil service ranks.

RANK—A term indicating in a general way the relative importance of various kinds of positions, but not necessarily descriptive of the special duties of a position of the given kind in a specific organization; for example: Axeman, Rodman, Draftsman, Assistant Engineer, Engineer.

GRADE—A distinction governed only by annual rate of salary. There are two or more grades in each rank, but for each grade only one salary, fixed and uniform for all departments and bureaus. The grades are numbered consecutively from the lowest to the highest, in one series.

GROUP—A set of grades within which advancement is without examination. For promotion from one group to a higher group or for entrance to a group an examination is required. In some ranks there is but one group, and consequently no group designation is needed; in ranks demanding more, the groups are designated A, B, etc., in ascending order.

DEPARTMENT—For the purposes of this report only, includes "bureau," "board," "commission" and other similar divisions of the city government.

PROPOSED RANKS AND GRADES—In standardizing the engineering and other branches of the city service, sharp distinction must be made between organization, which covers the selecting and arranging of the number, titles and rates of pay for the various positions required by the different departments, and grading of the positions by ranks and salaries for purposes of municipal accounting and civil service regulation. No recommendations are made in detail along the lines of organization. Recommendations are made for grading positions in the engineering and inspection services under titles and rates of pay; for general rules to be applied to entrance, advancement in salary and promotion in said services; and for a method making the standardized schedule effective. Simplicity in civil service classification and grading is most desirable, for administrative, economical and moral reasons. To this end ranks and grades should be few.

A grade will always indicate a definite salary, whatever the employee's title, in all branches of the service.

This continuous numbering of grades indicates clearly the relative money values put upon different kinds of service and makes plainer an employee's steady advancement in compensation as he progresses in experience and fitness.

Positions such as architect, chemist, bacteriologist and others requiring technical knowledge, of each of which there are a small number, shall be subject to the same grouping, grading and rules governing advancement as are Rodman, Instrumentman, Assistant Engineer and Engineer.

The maximum salaries for Instrumentman, Draftsman and Junior Engineer, are identical, and employees in any of these ranks are eligible to the rank of Assistant Engineer, but only upon passing the proper examination, and after necessary length of service.

The minimum rate of advancement is intended to be as indicated in the above table from Grade 1 to and including Grade 9. It is intended to assure steady progress, certain conditions having been satisfied, pursuant to a general resolution or similar action of the appointing power, covering routine cases. This plan should simplify procedure, especially in the larger organizations, and should give the employee a more denite basis of expectation as to his income. Many private concerns have a similar practice.

This completes the suggested schedule of salaries, but the committee went further and recommended rules and

SUGGESTED STANDARD GRADES FOR SALARIES UP TO $5000 PER ANNUM

(For all ranks)

Grade	1	2	3	4	5	6	7	8	9	10	Increment
Salary	$750	$900	$1 050	$1 200	$1 350	$1 500	$1 650	$1 800	$1 950	$2 100	$150
Grade	11	12	13	14	15	16	17				Increment
Salary	$2 400	$2 700	$3 000	$3 500	$4 000	$4 500	$5 000				$500 and 500

SUGGESTED SCHEDULE OF SALARIES AND GRADES FOR THE ENGINEERING SERVICE

Rank and Group	Grade	Salary
Axeman	1	$750 first year
	2	900 second and subsequent years.
Rodman	3	$1 050 first year
	4	1 200 second and subsequent years.
Instrumentman	5	$1 350 first year
	6	1 500 second year
	7	1 650 third and fourth years
	8	1 800 fifth and sixth years
	9	1 950 seventh and subsequent years
Junior Draftsman	3	$1 050 first year
	4	1 200 second and subsequent years.
Draftsman	5	$1 350 first year
	6	1 500 second year
	7	1 650 third and fourth years
	8	1 800 fifth and sixth years
	9	1 950 seventh and subsequent years.
Chief Draftsman	10	$2 100
	11	2 400
Junior Engineer	5	$1 350 first year
	6	1 500 second year
	7	1 650 third and fourth years
	8	1 800 fifth and sixth years
	9	1 950 seventh and subsequent years.
Assistant Engineer	10	$2 100
	11	2 400
	12	2 700
Engineer, Group A	13	$3 000
	14	3 500
	15	4 000
	16	4 500
	17	5 000
Engineer, Group B	Ungraded	$6 000 and upward

SUGGESTED STANDARD SCHEDULE FOR INSPECTORS ON ENGINEERING WORK

Rank and Group	Grade	Annual Salary	
Inspector	3	$1 050	
Group A	4	1 200	Increase at the end of the second year in this group to Grade 4.
Group B	5	$1 350	
	6	1 500	Increase at the end of third year in this group to Grade 6.
Group C	7	$1 650	
	8	1 800	
	9	1 950	Increase at the end of third year in this group to Grade 8; increase at the end of sixth year to Grade 9.
Chief Inspector	10	$2 100	
	11	2 400	
	12	2 700	
	13	3 000	

regulations to govern appointments and promotion. These rules apply to engineering grades not in the inspection service and provide that all appointments below the rank of engineer shall be made at the minimum grade for each position; advancement in salary shall be made according to length of service, subject to a satisfactory service record; advancement shall be made only after a year's service in the next lower grade, but exception is made where there is a vacancy in the higher grade; promotion examinations are to be held at stated intervals and any employee of the lower rank may enter irrespective of his length of service, but shall not be eligible for promotion until after at least six months' service in the lower rank; positions in the higher ranks are to be filled so far as possible by promotion; below grade 11 open competitive examinations are to be combined with promotion examinations, but persons on the promotion list shall have preference for appointment over those on the competitive list; for ranks above grade 12 the competitive examination for original appointment shall consist of two parts, the first part to be of general character and limited to engineering principles, while the second part shall be directed to the work of the department in which the vacancy exists, and only those passing the first part shall be eligible for the second part, the rating of the second part to be the final rating; candidates for promotion shall be required to pass only the second part of the examination and their rating shall be the mean of that obtained in the examination and that deemed by the Civil Service Commission to represent their experience and efficiency as shown by their civil-service record and the reports of their superior engineer officers; preferred lists for other departments need not be used when promotion lists are available by the department in which the vacancy occurs unless requested by the appointing power; service in any grade beyond the term fixed for that grade shall be so construed as to give the employee the same privilege for advancement as if the service had been rendered in the next higher grade or grades. For ungraded positions no further examination should be held or only special examination to meet the special requirements of the case.

The committee recommends a wider range of choice from the eligible lists for the higher grades: for grade 13 and higher the choice should be extended to include any one of the five highest on the eligible list. The certified eligible lists should be so classified as to indicate the men having special fitness along certain branches of engineering.

DISCUSSION.—Those who spoke in opposition to this report at the meeting on Dec. 23, claimed that the proposed schedule of salaries has a lower maximum for the positions of instrumentman, draftsman and junior engineer than those prevailing under the present schedule; that the adoption of the proposed schedule would in effect produce a 15% reduction in the highest salaries of these positions, whereas this was an opportunity to recommend a general increase in salaries. The older, more experienced and higher salaried members of the society, who largely composed the committee, believed that the proposed schedule is the fairest to the profession as a whole. They have endeavored to equalize grades and salaries for the same kind of service, with the least possible injury to individuals, though some hardship of this kind is inevitable; and at the same time keep the total expenditure of the city for its engineering services approximately the same.

The committee believes the question is one which involves the dignity of the society and of the engineering profession, and are opposed to making a direct application for a higher rate of compensation for the lower positions than is already the average for those positions.

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Road Funds from Motor Vehicles in Massachusetts—For the fiscal year ending the first of December, there were registered in Massachusetts upward of 60,000 motor vehicles, including cars, trucks and cycles, and their estimated value is over $90,000,000. In the taxation of these cars the sum yielded was over $1,500,000. The fees paid by the motor-car owners amounted to $614,665 and the fines were $29,108. This makes a total of $2,143,773 that motor-vehicle owners have paid toward state and municipal expenses. How much of the taxes has been used for road work there is no means of determining, but the $643,773 paid in fees and fines all goes to the purposes of the State Highway Commission, and after the expenses of the automobile department are paid is used on the roads.

The figures for the fiscal year just ended show an increase of about 29% in the number of automobiles that have been registered over last year, the actual increase is 11,225 cars. The increase in revenue from fees and fines is $139,580. There were registered 50,132 cars, which represent as nearly as can be estimated the actual number of machines used in the state. Included in the total car registrations were 4040 commercial vehicles, the increase in these being almost 100%.

The preponderance of the small car is interesting, fully 40% of all the cars registered being in the 20- to 30-hp. division, where the fee is $10 per car. Only about 25% of all the cars registered were above 30 hp. The small number of very high-powered machines is striking, only about 1% of the total being cars of 50 hp. and above. About 8% of the registrations were commercial motor vehicles. There are 66,546 persons licensed to drive automobiles, or nearly one motorist to every 50 of the state's entire population.—[Boston "Evening Transcript"].

Stone Crushing and Screening, Fairmount, Ill.

By K. E. Casparis*

SYNOPSIS—Plants for the production of crushed stone have had a notable development in this country, owing to the very great demand for such material for blast-furnace flux, concrete, road making, railway ballasting, etc. Two features of this development are (1) *the great capacity of the crushers in regard to size of stone handled (thus reducing the labor and cost of quarry work), and* (2) *the extensive use of machinery and mechanical appliances to reduce the labor cost and labor troubles of the entire plant. The article given below describes a plant which produces stone for blast-furnace and cement-mill use exclusively. The crushers are of the roll type, and skips (automatically loaded) deliver the crushed stone to the sizing screens. The plant presents a number of special features in its mechanical equipment. Descriptions of large stone-crushing plants and large crushers of the gyratory, roll and jaw types will be found in* ENGINEERING NEWS *of June 4, 1908, Oct. 21, 1909, Jan. 12, 1911, and Feb. 22, 1912.*

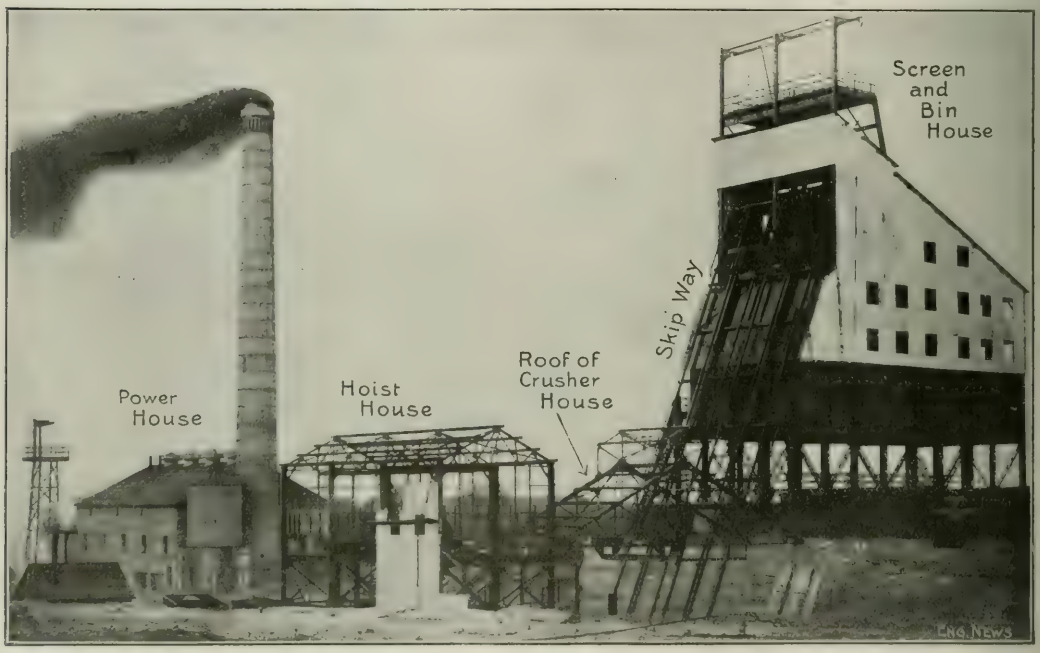


FIG. 1. STONE CRUSHING AND SCREENING PLANT (WITH ROLL CRUSHERS) AT FAIRMOUNT, ILL.
(Casparis Stone Co., Columbus, Ohio, owner.)

The quarry of the Casparis Stone Co., at Fairmount, Ill., has always been operated exclusively for furnishing limestone to the United States Steel Corporation, to be used as flux in the furnaces of the Illinois Steel Co. and the Indiana Steel Co. at South Chicago, Ill., Joliet, Ill., and Gary, Ind.; and also for mixing with slag at the mills of the Universal Portland Cement Co., at Bullington, Ind. The material consists of a high-grade calcite.

Operations started in 1898. At that time the crushing plant was equipped with a No. 6 Gates breaker, which was soon after replaced by a No. 7½. The latter continued in service until 1904, when a new plant, including a No. 9 Gates breaker, was installed. This has been operated continuously both day and night, until the present year. The No. 9 plant is equipped with hoists, continuous bucket elevator, screens, etc., such as are commonly installed for similar purposes. The present plant, described in this article, is installed with a view to securing the best possible operating efficiency not only in the crushing operations themselves, but also in enabling larger blocks to be handled in the quarry and the quarrying costs thereby reduced. This plant was put in operation during 1912.

QUARRY WORK AND PLANT

The deposit of calcite has an average thickness of only 20 ft., and it is covered with about 12 ft. of earth. Stripping is done with steam shovels. The unusual depth of the overburden as compared with the thickness of deposit makes it especially important to reduce cost at this point, and everything possible has been done to that end. The shovels used are of the Marion type,

* General Manager, Casparis Stone Co., Columbus, Ohio.

ranging in size from 60 to 100 tons. All stripping are dumped back into that part of the quarry from which the stone has been taken, the material being conveyed away for this purpose by 6 and 8 yd. side-dump cars hauled by light locomotives.

In drilling operations, the deep-well method has been applied. The blasting is done in single trains, with electric firing. The shattered stone is loaded with steam shovels of the type above mentioned. It is occasionally necessary to reduce large pieces of rock by "dobeying." During cold weather it is found difficult by ordinary means to prevent the dynamite from freezing, and W. O. Taylor, Vice-President and General Manager of the Casparis Stone Co., conceived the idea of making a dynamite carrier on the principle of the "thermos" bottle. With each of these he succeeded in keeping the dynamite 24 hr. without freezing, even when the weather got to 20° below zero. The use of the new carrier proved, in fact, so successful that a separate company has been formed to take over its manufacture and sale.

The stone is loaded in 8-yd. (12-ton) side-dump cars, eight of which are coupled in a train and hauled distances varying from 500 to 5000 ft. to the new crushing plant by 35-ton Vulcan locomotives. The haul is approximately on level track. At the crushing plant the arrangements have been so made that cars can come in from either direction or can be run through the plant.

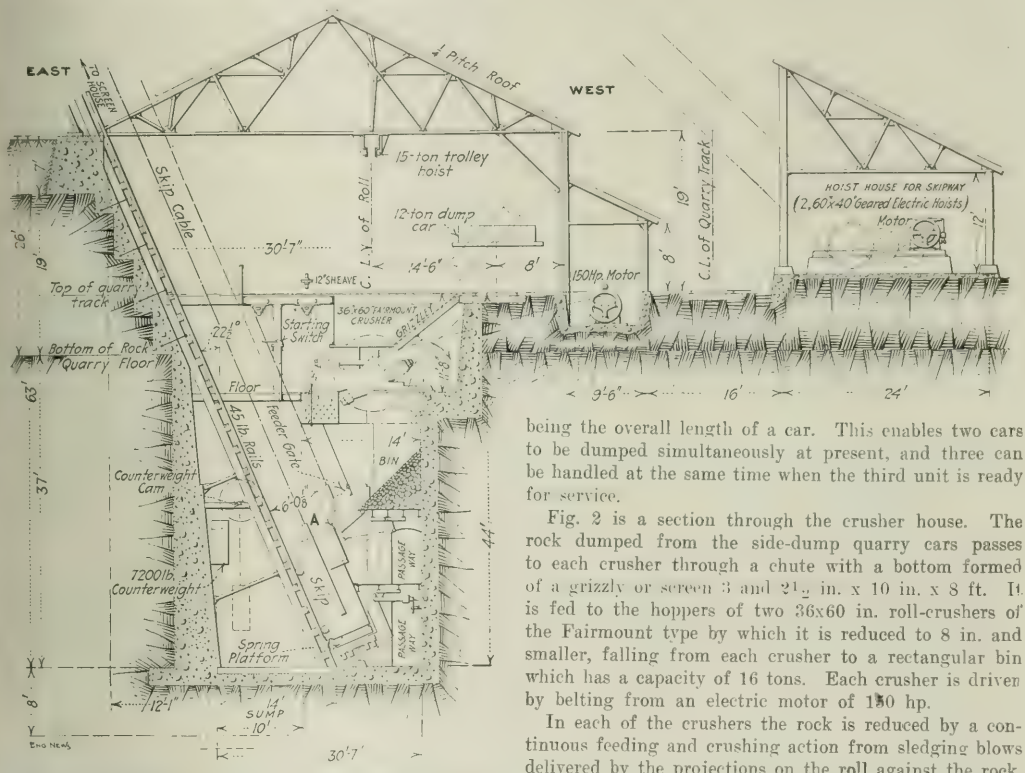


FIG. 2. CROSS-SECTION THROUGH CRUSHER HOUSE; SHOWING ROLL CRUSHERS, SKIPWAY TO SCREEN HOUSE, AND HOISTING PLANT FOR OPERATING THE SKIPWAY CABLES

NEW CRUSHING PLANT

The new plant consists mainly of a crusher house and a screen and bin house, with an inclined skipway from the pit below the crushers to the bin above the screens. At present there are two units, as shown in Fig. 1, but the foundations have been placed for a third set of crushers and the necessary extension of the buildings. The units are spaced 16 ft. 3 in. c. to c., this being the overall length of a car. This enables two cars to be dumped simultaneously at present, and three can be handled at the same time when the third unit is ready for service.

Fig. 2 is a section through the crusher house. The rock dumped from the side-dump quarry cars passes to each crusher through a chute with a bottom formed of a grizzly or screen 3 and 2½ in. x 10 in. x 8 ft. It is fed to the hoppers of two 36x60 in. roll-crushers of the Fairmount type by which it is reduced to 8 in. and smaller, falling from each crusher to a rectangular bin which has a capacity of 16 tons. Each crusher is driven by belting from an electric motor of 150 hp.

In each of the crushers the rock is reduced by a continuous feeding and crushing action from sledging blows delivered by the projections on the roll against the rock, which is held against the anvil block. These successive continuous crushing blows produce a gripping action upon the smaller pieces of rock in the charge delivered to the crusher, crushing them by pressure with a clean sharp break. Each piece drops lower on the anvil block, following each blow, until it leaves the machine. After the smaller pieces in the charge of rock delivered to the crusher have been crushed and passed through the machine, the large pieces (which are automatically rejected until the last) are first sledged and turned over to present new surfaces for crushing until they are broken into sizes small enough for the gripping, crushing action mentioned.

The operation of crushing has the effect of clearing the crusher from fine material before the large pieces add their quota of crushed material to the product. This

avoids choking and effects a uniform feed of crushed material delivered by the machine. The action also has a further advantage. Thus, should any pieces be sent to the machine too large to be crushed, the tendency of the operation of the machine is to clear the hopper of the remaining rock in the charge delivered to the crusher so as to make it a simple and easy matter to remove or turn over the very large pieces of rock. In this way it is not necessary to dig out the entire charge, as may be the case with jaw and gyratory crushers.

Handling the Crushed Stone

The capacity of these crushers and the large amount of stone to be handled opened an entirely new problem in the stone-crushing industry. The Casparis Co. being unwilling to adopt in a plant of this magnitude the old methods of handling stone, suggested the use of skips. The problem of thus handling stone in a practical and economical manner was solved by the Allis-Chalmers Co.'s engineers in an original manner. Each

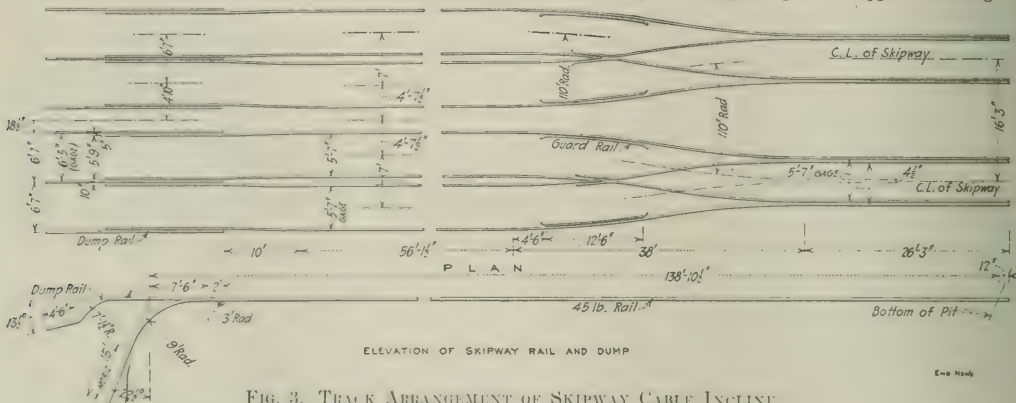


Fig. 3. Track Arrangement of Skipway Cable Incline

pit or bin into which the crushed rock is discharged opens towards a skipway inclined away from the crushers at an angle of 22½° from the vertical. The stone from each crusher is elevated by two skips operated by cable and working in balance, except for the weight of the material being hoisted.

Each skip in its descent to the loading position (Fig. 2) engages a latch *A* on the bin gate, causing it to open downward. The gate, however, is so proportioned that no stone is discharged into the skip until the latter has reached its proper loading position. The bin gate is held open by the weight of the skip until there has been discharged into it from the bin its normal load of eight tons of crushed stone.

During the time that the skip receives its load it rests against a spring-supported platform at the bottom of the skipway. This platform serves a double purpose: 1. it absorbs the shock of the descending skip, and 2. when the skip is started the springs exert an upward pressure upon it momentarily, thus greatly assisting in the starting of the hoist motor. The plant is so designed that the latch holding the bin gate can be automatically tripped by raising the counterweight attached to the spring platform, or it may be manually released by an operator pulling on a rope.

As the descending skip approaches the bottom of its travel, the loaded skip approaches the top of its travel, and both skips are stopped simultaneously. The stopping of the hoist which operates the two skips is effected by means of a standard traveling-limit switch, connected to the drum shaft of the hoist. This is so designed that near the end of the travel the proper amount of resistance is exerted to slow down the motor, and, at a predetermined position, the solenoid-operated main line switches are opened by breaking the circuit through the traveling-limit switch.

This switch has as its principal movable element a nut traveling in guides, this nut being directed in its travel by the rotation of a screw. The screw rotates in opposite directions with the reversals of the hoist, causing the nut to travel in opposite directions, thereby stopping the skips at each of the predetermined limits of travel. When the skip at the bottom of the incline has received its proper load of stone from the bin, the latch holding the bin gate open is tripped, allowing the gate to be closed by its counterweight. During the last movement of the bin gate, just before closing, a clip on the cable of the counterweight engages with an electric switch which starts the hoist. After the skip has reached the limit of its travel, the hoist is stopped by the traveling-limit switch, and the above operation is repeated for the alternate skip as soon as it has been filled with stone.

There is one hoist and a pair of skips for each crusher. Each hoist is driven by a 125-hp. three-phase, 60-cycle, 550-volt, induction motor, which is geared to the hoist and fitted with solenoid brakes. The motor runs at 560 r.p.m., and the hoist has a rope speed of 200 ft. per min., equivalent to about 13 r.p.m. for the drum shaft. Fig. 3 shows the arrangement of the skipway tracks, and the lower and upper ends of the skipway are shown in Figs. 2 and 4 respectively. It will be seen by Fig. 3 that each skipway has two sets of rails forming separate gantletted tracks with centers 4½ in. apart, the track gage being 5 ft. 7 in. In approaching the top of the incline the tracks swing apart by curves of 110 ft. radius and are then parallel, with centers 7 ft. apart. At the head of the incline the track rails become horizontal, and on these run the front wheels of the skip. The rear wheels have double treads, and at this point

the outer (smaller) treads engage with inclined dump-rails, up which they ride; in this way the skip is tilted and discharges its contents into the bin. This is shown in Fig. 4.

When the special electric switch above the bin gate is actuated by the closing of the gate, a secondary circuit is closed which energizes the solenoid of the main-line reversing switches to the hoist when these switches close, current is admitted to the motor and at the same time the solenoid attached to the brake is energized, thereby releasing the brake. The hoist motor is of the wound-motor type, with slip rings and variable resistance. The closing of the contactors which automatically cut out resistance is at first prevented by the heavy rush of current action on a series relay. As the motor accelerates and the current value decreases, each step of resistance is automatically cut out, there being five steps in all. As the nut on the limit switch, referred to above, approaches one end of its travel it first open

the hoist are provided at each end of the travel of the nut above mentioned. The control switches at both ends are closed except when the nut is in its final position at one end or the other. Current, however, can only be admitted to one side of the main-line reversing

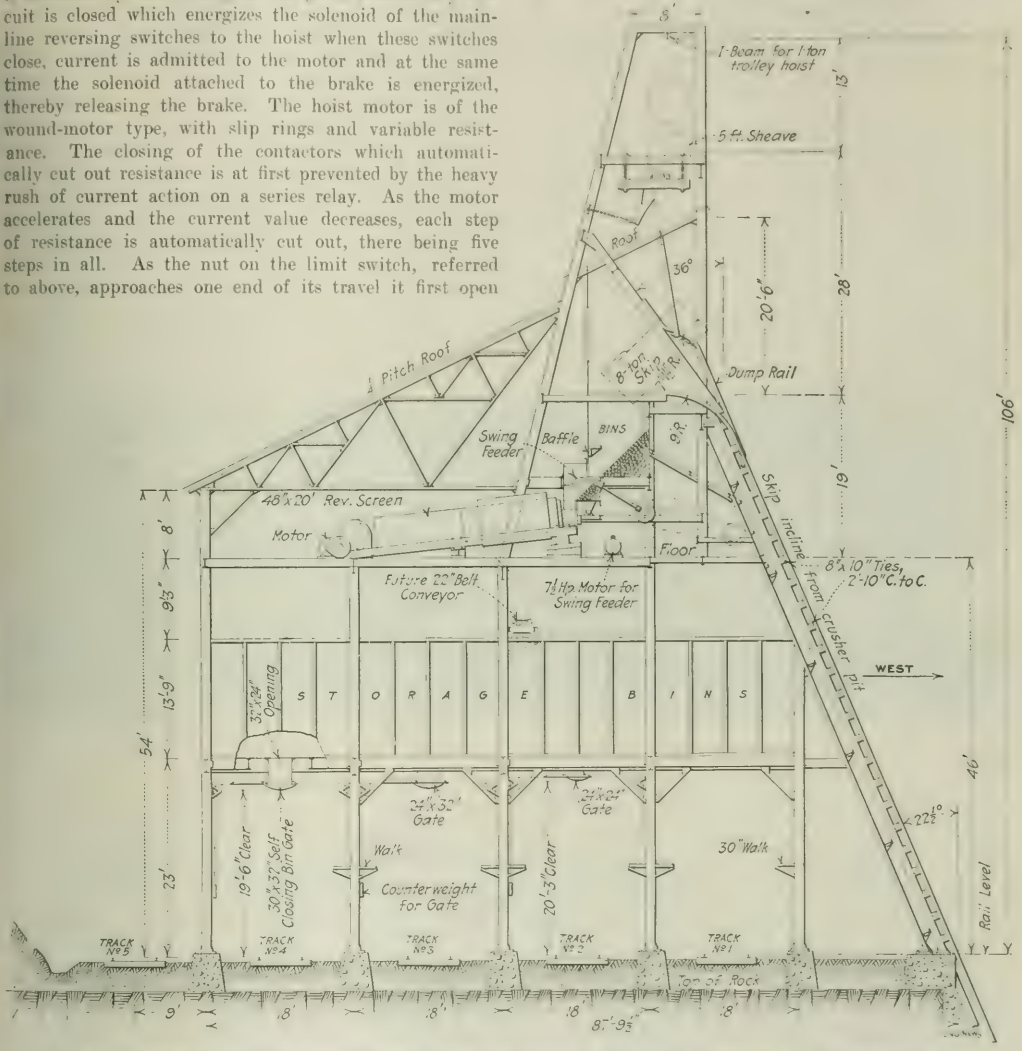


Fig. 4. Cross-section through Screen House: Showing Skipway, Screens and Storage Bins

a secondary contact which causes all the resistance switches to open, thereby throwing full resistance into the circuit of the rotor of the hoist motor.

In actual practice this switch opens when the switch is about 10 ft. below its dumping position. Due to the resistance inserted in the rotor circuit, the hoist slows down and is stopped at a predetermined position by the opening of a second switch (finger contact). One switch for cutting in resistance and one switch for stopping switches through the special control reversing switch which is operated by the closing of the bin gate.

Screens and Storage Bins

At the top of the skipway the crushed stone is discharged to bins with an aggregate capacity of 120 tons, as shown in Fig. 4. From these it is fed through Gates automatic swing feeders to four 4x20-ft. revolving screens, inclined 1½ in. per foot. Each screen with its charge of

stone weighs about 15 tons. These screens separate the material into 1½ in. to 5 in., and oversize (which last is 8 in.). The 1½-in. and finer stone goes to the portland cement mills. The material from 1½ in. to 5 in. is used for flux in the blast furnaces. The oversize stone is used in open-hearth furnaces, and a part of it is sent to the cement plant, where it is crushed in No. 6 Gates crushers. At certain seasons of the year the dust must be screened from the 1½-in. size in order to prevent the material from freezing in the cars.

From the trommels or screens the stone falls directly into bins for the different sizes. These bins are of the box type, the stone forming its own hopper. The bin gates are of the radial opening pattern, made exceptionally large and heavy on account of the size of product to be discharged. Railway cars are run underneath the bins on four tracks, a fifth track being provided as a run-around for bringing in empty cars. The total weight of stone when all the bins are level full is about 1200 tons, taking the weight of the stone at 100 lb. per cu.ft.

The power plant consists of four Heine water-tube boilers and one 600-kw. Parsons turbine-alternator, with steam and motor-driven exciters. The plant was designed and machinery furnished by the Allis-Chalmers Co., of Milwaukee, Wis.; and the structural steel work was designed and furnished by the North Works (Chicago) of the Illinois Steel Co. The plant was erected and started under the supervision of the writer.

A 100-Ton Coal Car: Norfolk & Western Ry.

A radical development in freight-car design and capacity has been made recently by the Norfolk & Western Ry. in introducing a coal car of the enormous capacity of 90 tons and equipped with a special design of six-wheel trucks to distribute the load and keep the wheel loads within limits. While the nominal capacity is 90 tons, the car is designed to carry 10% overload, and on an experimental trip it has actually carried 200,600 lb. of Pocahontas coal. A view of the car is shown in Fig. 1, while the general construction design of the car and its trucks is shown in Fig. 2. Cars of such capacity could be used economically, of course, only in some special service, and this car was designed with special reference to operation between the Pocahontas coal-fields and the Lambert's Point deep-water terminal of the Norfolk & Western Ry., near Norfolk, Va., where the car would be handled by a car-dumping machine.

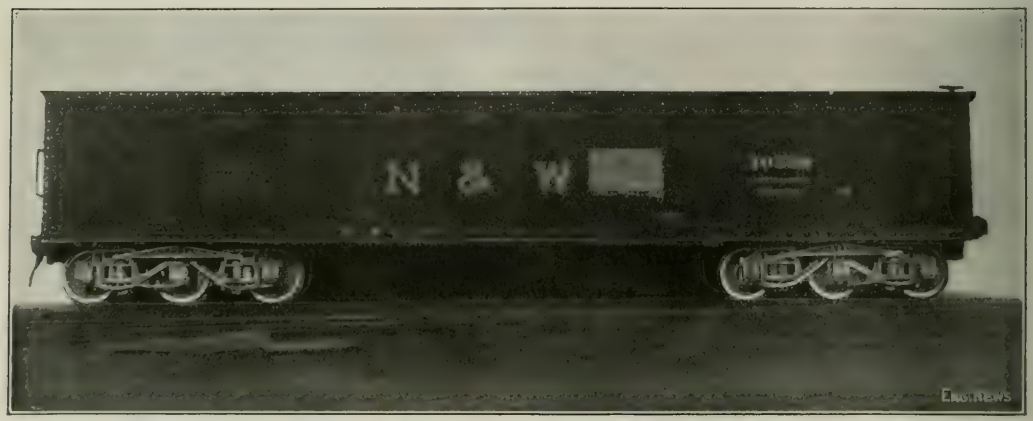


FIG. 1. COAL CAR OF 100-TONS CARRYING CAPACITY, WITH SIX-WHEEL TRUCKS; NORFOLK & WESTERN RY.
(John A. Pilcher, Mechanical Engineer. W. H. Lewis, Superintendent of Motive Power.)

100-TON COAL CAR: NORFOLK & WESTERN RY.

Length over end sills	46 ft. 10¾ in.
Width over top angles of sides	10 ft. 4½ in.
Height of top angles from rails	10 ft. 4½ in.
Length inside	45 ft. 6¾ in.
Width inside	9 ft. 6 in.
Depth inside	6 ft. 6½ in.
Distance between truck centers	32 ft. 10 in.
Truck wheelbase	9 ft. 0 in.
Wheels, diameter	2 ft. 9 in.
Weight, body	35,100 lb.
Weight, two trucks	29,800 lb.
Weight, total	65,200 lb.
Capacity, nominal	180,000 lb.
Capacity, actual (10% overload)	200,000 lb.
Cubic capacity, level full	2,829 cu.ft.
Cubic capacity, heaped 30	3,380 cu.ft.

The car is of the flat-bottom gondola type, with drop doors. The sides form plate-girders and the center sill or girder is composed of two heavy channels. The general dimensions and weights are given in the accompanying table, but it is expected that the weights of both the body and the trucks can be reduced by revision of the designs after experience with this first car. The truck is of special design, known as the Lewis truck, and is a six-wheel truck without pedestals. The wheels are of

The Assets of Iowa Cities early in 1912 according to the fifth annual report of the State Department of Finance and Municipal Accounts, totaled $21,825,702. Divided into 13 groups and rearranged from greatest to least, these assets were as follows:

Water works	$ 851,211
City parks	5,570,140
City hospitals	2,748,921
Parkways	1,197,519
Municipal buildings and land	1,722,815
Fire department land, buildings, apparatus, etc.	1,275,135
City electric light works	1,150,206
Cemeteries	441,506
Equipment of streets and alleys	319,882
Hospitals, docks, wharves, etc.	237,501
Police department buildings, apparatus and equipment	196,501
Equipment and furniture	135,877
Miscellaneous [illegible]	23,513

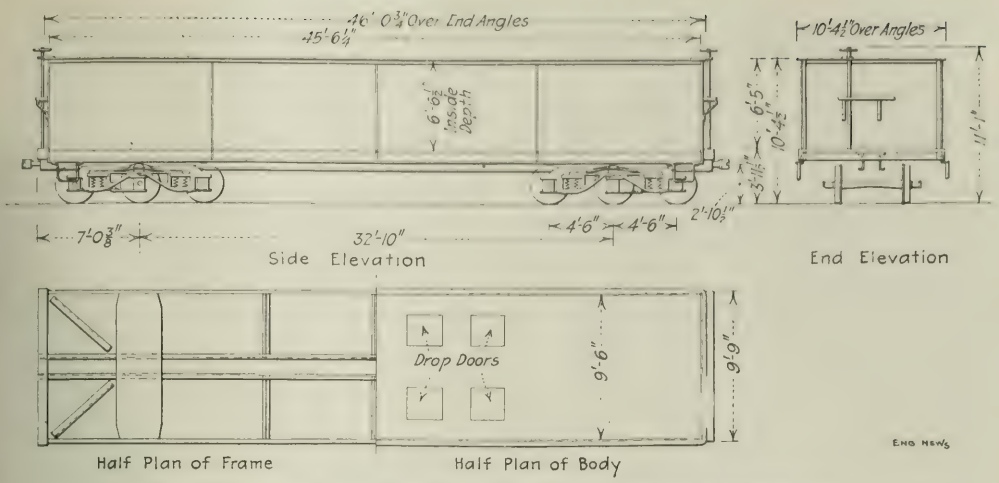


FIG. 2. GENERAL DESIGN OF 100-TON COAL CAR; NORFOLK & WESTERN RY.

forged steel. The frame is articulated over the middle axle-box, which arrangement allows ample movement of the axles to take care of any vertical irregularities in the track. This is clearly shown in Fig. 3, in which the cast-steel beam which carries the side-bearing has been removed from its seats on the bolsters (over the nests of springs). The springs are so located that the side frames themselves become equalizers and properly distribute the loads between the wheels. When carrying the load of 200,600 lb., mentioned above, the axle loads were 44,300 lb.

A patent for this truck has been granted to two of the officials of the mechanical department of the Norfolk & Western Ry.: John A. Pilcher, Mechanical Engineer, and W. H. Lewis, Superintendent of Motive Power. For photographs and other information we are indebted to Mr. Lewis.

Daily Fluctuations in Sewage Flows was the subject of a brief paper submitted to the Institution of Civil Engineers by William Fairley (Vol. clxxxix. Session 1911-1912. Part iii). Flows were observed for districts having populations ranging from 650 to 65,000, and per capita water consumptions varying from about 15 to 37 U. S. gal. per day. The author, after having presented a series of diagrams and explanatory text, summarized his conclusions regarding both the effect of subsoil water and the differences between day and night flow as follows:

From the foregoing remarks it would appear that, while the quantity of subsoil water finding access to a system of sewers has a certain effect, still, if not excessive, it does not materially alter the fluctuation in flow. This fluctuation is directly proportional to the length of outfall sewer and the ruling gradients of the sewers of the district. The flatter the gradients and the longer the outfall sewer the higher will be the percentage of night flow, and the more equal will be the flow during the 24 hours, the difference between the minimum and maximum rates of flow being reduced.

In a rural district where the points of contribution are widely scattered, the night flow may not fall below 50% of the maximum rate of flow.

Generally speaking, in an urban district with no exceptional length of outfall sewer and fair gradients in the collecting sewers, the night flow will be about one-third of the maximum rate of flow.

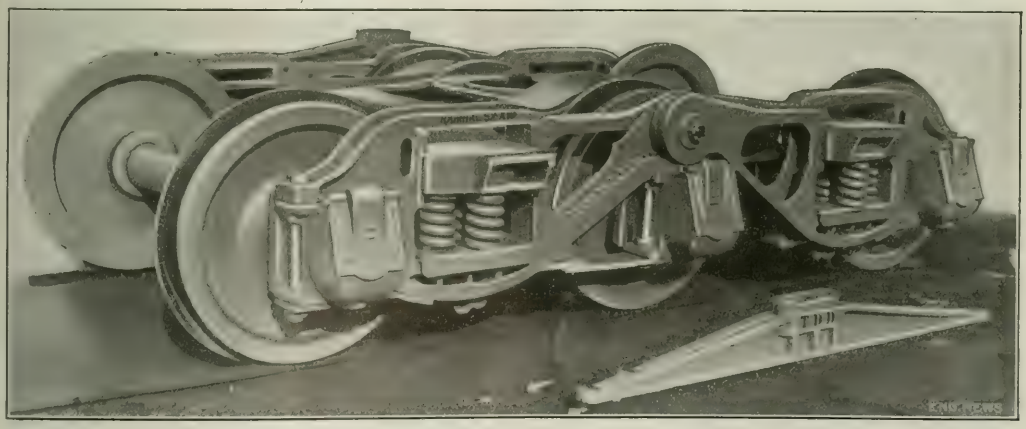


FIG. 3. SIX-WHEEL TRUCK WITH ARTICULATED FRAMES (AND NO PEDESTALS), FOR 100-TON COAL CAR; NORFOLK & WESTERN RY.

(The cast-steel beam carrying the side bearing has been removed to show the frame articulation. When in place this rests on the seats at the ends of the bolsters, over the springs.)

The Design and Specifications for the Arrowrock Dam, U. S. Reclamation Service

In our issue of June 6, 1912, p. 1062, we published an extensive article by C. H. Paul, Construction Engineer, U. S. Reclamation Service, describing the Arrowrock Dam project. Since that article was published the Reclamation Service has issued the specifications (Specifications No. 224) under which the dam had been designed and is to be constructed. As this is to be the highest masonry dam in the world, a description of it is necessarily interesting, but aside from this distinguishing feature there are others which make it especially notable. Among these are the methods of construction by force account, the use of sand-cement, the use of vertical contraction joints in the dam's structure, and the precautions taken to observe any leakage under the dam after construction. We give below portions of the specifications and some of the drawings showing the design of the dam. Readers are referred to the previously noted article for views and drawings of the dam site as well as for information regarding the preparatory work there.

The Arrowrock Dam will store water in the Arrowrock reservoir for the Boise project of the U. S. Reclamation Service. It will be located in the cañon of the Boise River, about 20 miles above the city of Boise, Idaho. The dam project consists of one 350-ft. masonry dam with a concrete masonry spillway. The dam will be of the gravity type, curved in plan, and will be built of concrete. It will be about 1050 ft. long on top, and its maximum height will be about 350 ft. above the deepest part of the excavation. The lowest portion of the foundation will be about 80 to 90 ft. below the present bed of the river. The spillway will consist of a concrete weir about 400 ft. long, discharging into a channel, to be cut into the hillside. This channel will convey the water around the north end of the dam and will discharge into Deer Creek below. The diversion works will consist of two crib coffer-dams across the Boise River and a tunnel about 490 ft. long, with a cross-sectional area of about 670 sq.ft., and a capacity of about 20,000 sec.ft.

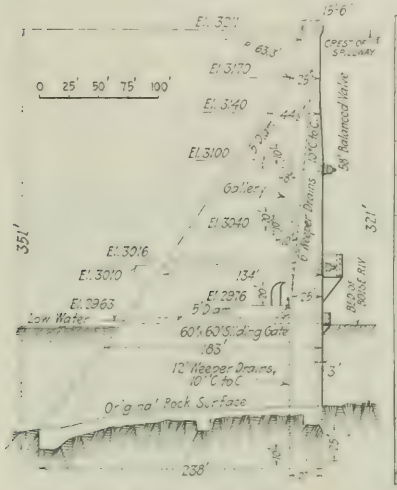


Fig. 1. Typical Section

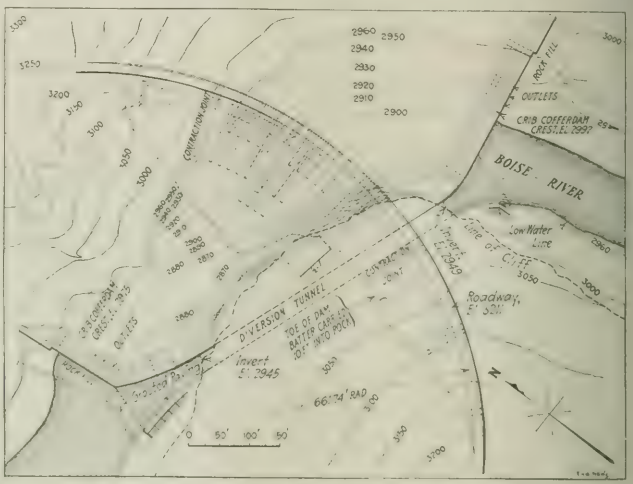


Fig. 2. Plan

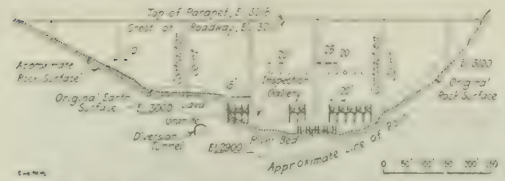


Fig. 3. Developed Front Elevation

Figs. 1-3. Details of the Arrowrock Dam, U. S. Reclamation Service.

Organization of Construction Force

The work is to be done on force account by the Reclamation Service. It will be noted that the peculiarity of the method of organization is that the government engineers are divided into two forces—a construction force, which corresponds to the contractor, and an engineering force, which corresponds to the engineer on ordinary contract work. The paragraphs of the specification describing the work are as follows:

The Director of the Reclamation Service, through the supervising and construction engineers and superintendent of construction will purchase all materials, equipment and supplies and will employ all labor necessary for the construction and completion of the dam and its appurtenant features. A scale of wages shall be fixed from time to time by the supervising engineer, after having received suitable written recommendations covering such scale of wages from the construction engineer and superintendent of construction. The supervising engineer shall divide the organization as would be done if the work were to be performed by contract, into the engineering division, under the direction of the construction engineer, and the construction division, under the direction of the superintendent of construction.

The duties of the engineering division shall be similar to those of the engineering force on contract work; the principal duties of this division being to make estimates and designs for the works and to see that the works are built in accordance with the plans and specifications, and this division will be held strictly responsible for this feature of the work. This division shall also give the construction division such help as may be necessary in getting out designs and estimates

for the construction plant. For the purpose of executing his duties, the construction engineer shall organize office and field engineering corps that shall report directly to him. All work, other than clerical, in connection with the construction, maintenance and operation of the Arrowrock R.R. [a government road built for purposes of construction], the power house at the Boise River Diversion Dam and the transmission line leading therefrom to Arrowrock shall be under the charge of the construction engineer.

The duties of the construction division shall be similar to those of the construction force on contract work; the principal duties of this division being to provide methods and plans for actually executing and building the works and to construct the work. This division will be held particularly responsible for the progress and cost of the work. In any work on designs and estimates for the construction plant that, under contract work, would be done by the contractor's engineering forces, the construction division shall be assisted as much as may be necessary by the engineering division. The superintendent of construction shall select his foremen and principal assistants, who shall report to him, and he will be held responsible for the efficiency of the entire construction force. He shall detail one man as cost keeper, who shall obtain from the clerical and engineering forces all data necessary for compiling the reqired reports of costs. At the end of each calendar month the cost keeper shall furnish the construction engineer (with a copy to the supervising engineer) a detailed statement, certified by the superintendent of construction of all costs, including estimated apportionment of general expenses, depreciation, unit costs of work done, etc.

The supervising engineer's office at Boise shall handle all advertisements, purchases and vouchers covering materials and supplies for use in the construction of the dam, and the chief clerk of the supervising engineer's office shall be responsible for all clerical work. He shall conduct the clerical work in such a manner as to relieve the engineering and construction divisions from the necessity of occupying their time with clerical matters. Pay rolls shall be made up in the supervising engineer's office, based on time books certified by the superintendent of construction and transmitted from Arrowrock, and the fiscal agent at Boise will pay all employees, including those receiving time checks.

Cement

A sand-cement, made up of approximately one-half portland cement and one-half sand ground together, will be used in the main section of the dam. Portland cement will be used in the minor works around the dam. The specifications in this regard read as follows:

> Upon the delivery of portland cement at the dam site, it shall be reground with granite or other suitable material to form sand-cement, which shall be used throughout the dam, spillway weir and lining, in the same manner as portland cement, unless otherwise specifically ordered by the engineer. The term "sand-cement" signifies the product of regrinding portland cement with suitable blending material in proportions fixed by the chief engineer, and these proportions shall be one part sand to one part cement by weight unless otherwise directed.

Design of Dam Section

Fig. 1 herewith shows the cross-section of the dam; Fig. 2 a plan, and Fig. 3, a developed front elevation. All necessary dimensions are noted on the drawings, so they will not be referred to in the text. It should be observed that the design is a normal gravity type, and is extraordinary only in its height. There are, however, two novel features provided: (1) An inspection gallery (Fig. 3) running through the whole section and providing opportunity for inspection of possible leakage, and (2) the contraction joints, which are provided in the section at intervals of about 150 ft. The contraction joints are made normal to the dam faces and are formed against vertical transverse bulkheads. Each face is coated with acceptable materials to prevent adhesion to the masonry on the other side of the joint. In order to minimize contraction, the concrete in these joints is to be placed in cold weather, February or March.

Foundations

The excavation for the dam is described in the specifications as follows:

> The material in the river channel consists mainly of river sand, gravel and boulders, and constitutes the greater part of the material to be excavated for dam foundation. On the south side of the river, the excavation will consist of stripping the dam site of a shallow covering of loose material and cutting suitable foundation in the rock. The work on the north abutment will consist mainly of removing a mass of seamy rock and large boulders embedded in loose rock and loam, and of cutting a suitable foundation in the ledge rock. Rock shall be excavated to a sufficient depth to secure a foundation on sound ledge rock free from open seams or other objectionable defects. It is the intention to build the masonry against the sides of these rock excavations.
>
> After the rock foundation for the dam has been prepared all further work on said foundation shall be designated as special preparations of rock foundation of dam. This special preparation shall be measured and estimated under the following classes: (1) Areas receiving special preparations. Portions or the whole of the foundation of the dam may be designated for special preparation and in all areas thus designated for special preparation and in all areas thus designated seams and cavities shall be traced as far as directed by the engineer by drilling holes or by other improved means. All such seams and cavities shall then be filled with concrete, mortar or grout. Whenever directed by the engineer, grout shall be pumped under pressures required by him through hose or pipe of at least 2 in. in diameter. (2) Pressure grouting and drilling drainage holes and main grout holes. In addition to the drilling and pressure grouting that may be required as noted in the previous paragraph, grout and drainage holes shall be drilled as shown on the drawing or as directed by the engineer, and after a portion of the masonry in the dam has been placed, grout under suitable pressure shall be pumped into the grout holes as directed by the engineer.

Concrete for Dam

The specifications read:

> It is planned to build the main body of the dam of concrete consisting of about 1 part sand-cement, 2½ parts sand, 5 parts gravel and 3 or 4 parts cobblestones, in which large rock and boulders of various sizes will be embedded. These proportions may be varied to suit conditions.
>
> In this designation cobblestones are considered as sound, clean gravel or broken rock of such size as will pass a grizzly having bars set about 6 in. apart, and be retained on a grizzly having bars set 3 in. apart. . . . Embedded rock is defined as follows: In all mass concrete having a thickness of 15 in. or more, sound and clean cobblestones or rock fragments of a size that can be lifted and handled by one man, shall be incorporated in the concrete. The proportion of such rocks shall be as nearly uniform throughout as practicable. No rock shall be laid in actual contact with an adjacent one or within 2 in. of the forms. In the main body of the dam, there shall be placed hard, sound, clean and durable rocks of derrick size, carefully shaken to position in fresh beds of concrete. Whenever possible, smaller rocks shall be embedded in the concrete between the large rocks. The object is to obtain, especially in the main body of the dam, a monolithic mass of stone and concrete containing as large a proportion of rock and as impervious to water as it is practicable to secure.

Forms

It should be noted that the specifications say: "All exposed faces of concrete work shall be molded against steel forms, or, if timber forms are used, against lagging that has been sized to uniform thickness and placed so as to prevent leaking of the fluid concrete."

Other Features of the Project

In addition to the dam there are to be constructed a spillway, a tunnel, and two coffer-dams. The spillway consists of a spillway weir about 400 ft. long over which the waste water spills into a spillway trench, made by excavating and lining a trench with reinforced concrete. The coffer-dam consists of timber cribs filled with loam, sand, gravel and rock. The diversion tunnel is located in

rock for its entire length, and is to be lined with concrete on the bottom and sides and with timber above the springing lines of the arch.

PERSONNEL

The present personnel of the engineering forces is as follows: F. H. Newell, Director, U. S. Reclamation Service; A. P. Davis, Chief Engineer, U. S. Reclamation Service; F. E. Weymouth, Supervising Engineer, Arrowrock Dam, and C. H. Paul, Construction Engineer, Arrowrock Dam.

Construction Features of the Elephant Butte Dam, U. S. Reclamation Service

The U. S. Reclamation Service has issued under date of August, 1912, Specification No. 227 for the construction of the Elephant Butte Dam on the Rio Grande Project, New Mexico-Texas. The following extracts from that specification and the accompanying drawings well illustrate the design and proposed construction of the dam and its allied projects:

General Description—The work to be done under these specifications is the construction by Government forces of a storage dam, and its appurtenant features, across the Rio Grande, at Elephant Butte, New Mexico. This dam, together with a dike about 1¼ miles northwest of the dam, will form a reservoir having a capacity of 2,600,000 acre-ft. The dam will be of gravity type, straight in plan, built of concrete in which will be embedded rough stones of various sizes up to about 4 cu.yd. each.

(a) The section of the dam will be in accordance with Fig. 1.

(b) The top of the dam will be 200 ft. above the original river bed. It will be about 1200 ft. in length, with a roadway along the top.

(c) The faces of the dam below the coping will be of concrete built in place with the use of sectional forms.

Rock Excavation for Foundation—Excavation shall be made to a sufficient depth to secure a foundation on sound ledge rock, free from open seams or other objectionable defects. It is the intention to build the masonry against the side of these rock excavations. To preserve the rock outside the lines of the excavation in the soundest possible condition and to obtain over the whole foundation a rock surface free from open seams or cracks, unusual precautions will be required in excavating. Blasting may be done to the extent directed, with explosives of such moderate power and in such positions as will neither crack nor damage the rock outside of the prescribed limits of the excavation, and whenever, in the opinion of the engineer, further blasting is liable to injure the rock upon or against which the masonry is to be built, the use of explosives shall be discontinued and the excavation of the rock continued by wedging and barring, or other approved methods.

A cutoff trench will be required at the heel for the whole length of the dam. This cutoff trench will have nearly vertical sides.

Preparation of Rock Foundation—The surfaces of the rock foundations shall be left sufficiently rough to bond well with the masonry and shall be cut to rough benches or steps, unless naturally so stepped. Care must be taken not to open or break the ledge rock unnecessarily. Before laying the masonry on or against the ledge rock, the latter shall be scrupulously freed from all dirt, gravel, scale, loose fragments, and other objectionable substances. Streams of water, air or steam under sufficient pressure, still [illegible] and other objectionable materials shall be used to accomplish this cleaning. Strong jets shall be used to remove thoroughly ice or snow, if any be found on the foundation when it is desired to lay masonry. All springs shall be piped and grouted or carried outside the dam. After cleaning and before concrete is laid on or against the foundation the water shall be removed from the depressions so that the surface can be inspected to determine whether seams or other defects exist. All seams and cavities showing on the face and the floor of excavation where masonry is to be placed shall be carefully scraped and cleaned out and filled with rich concrete or mortar rammed in under pressure.

(b) All holes that were drilled in river bed at the time when soundings were made to select a location for dam, and that penetrate the actual foundation of the dam, shall be grouted.

(c) In the center of the cutoff trench a row of holes shall be drilled as shown on Fig. 4, which holes shall be grouted after the concrete above shall have been carried up to a convenient elevation not less than 20 ft. above the base of the dam.

(d) Under the longitudinal gallery of the dam two rows of holes shall be drilled as shown in Fig. 4, that will eventually be made to extend up to the floor of this gallery. Care shall be taken in order to prevent any line of weakness between drainage holes to place large rocks in the concrete between them. These holes are meant to act as drainage holes, permitting the water that leaks into them to drain into the gallery. A similar set of holes shall be provided above the gallery, as shown in drawings.

(e) If after the completion of the dam it should prove that the discharge of one or a number of these holes (that terminate in floor of gallery) is excessive and the discharge continues to increase, it may then be proper to close up such holes by pumping into them grout under pressure.

(f) Whenever in excavating the abutments thick strata of shale or similar material liable to decompose on exposure to air are encountered, drifts generally parallel to the axis of the dam shall be driven along these seams until a safe distance from points of possible exposure is reached. These drifts shall be at once thoroughly washed and cleaned and immediately refilled with concrete. Grout should be pumped in especially around the top so as to entirely fill the opening.

Cement—All portland cement shall pass the U. S. Government standard specifications. The same care must be observed in the unloading, storing and safe keeping of this material, and for the return of the full number of sacks to the railroad station in serviceable condition, as would apply on construction under contract. Cement sacks must be carefully handled so that they are not torn or damaged; they must be completely emptied and shaken out and returned to the storehouse to be bundled and shipped back to the factory. Upon the delivery of the portland cement at the dam site, it shall be reground with sandstone or other suitable material to form sand-cement, which shall be used throughout the dam in the same manner as portland cement is ordinarily used. Hereafter in these specifications the term "cement" will signify the product of regrinding portland cement with suitable blending material in the proportions fixed by the chief engineer. All sand-cement shall be inspected and tested before being used in this work.

Concrete in Body of Dam—Concrete shall consist of an intimate mixture of river sand taken from the excavation for the dam, run of crusher rock and cement, in proportions to be determined by frequent mechanical analysis of the ingredients; approximately a 1:3:6 mixture when everything in the crusher run below ¾-in. size is considered as sand, and is added to the river sand to make the three parts. The rock furnished the crusher shall be taken from the sandstone quarries along the railroad, and must be sound, hard and clean.

Concrete Upstream from Drainage Holes—This concrete is to consist of a mixture so carefully proportioned as to have the greatest impermeability possible. The proportions are to be determined by mechanical analysis of the ingredients available and by experiments on samples taken from large batches.

Stones for Masonry—Stones for embedding in concrete shall be sound, free from seams and cracks, clean, hard, of irregular shapes, without long thing projections, and of various sizes up to the largest which can be economically quarried, transported and handled. They shall be thoroughly cleaned before being brought on the dam by washing with water under pressure from a nozzle, by the use of brushes, or otherwise, and shall be clean when placed in the concrete. Hammers or other tools shall be used, if necessary, to remove objectionable materials adhering to any stone. Stones shall be wet at the time of placing in the work.

Masonry, Placing—Wet concrete in sufficient quantities shall be deposited in low places in the work, and large stones shall be lowered into it immediately as close together as possible, but leaving room to thoroughly fill the spaces between them with concrete. The concrete shall be carried to the work in bottom-dumping buckets, or as otherwise directed. The stones after placing shall be joggled with a bar so as to settle well into the concrete, and the concrete shall be worked with suitable tools to force the escape of entrained air or surplus water, and insure the filling with con-

crete of all spaces around the large stones. In placing large stones, care shall be taken to secure as good bonding, both horizontally and vertically, as practicable with this class of masonry. Wherever convenient, smaller stones shall be embedded in the concrete between the large stones. The object is to obtain a monolithic mass of stone and concrete, containing as large a proportion of stone as economical. Wherever a concrete surface must be left long enough to permit the concrete to set, the surface must be left as rough as possible by means of large rocks partially embedded. No concrete shall be placed in the dam except in the presence of an authorized inspector.

The late winter, preferably in the month of February, and shall never be brought higher than the adjacent sections.

Racking.—The top of the masonry under construction shall be kept at all times approximately level between contraction joints or such other limits as required, except that the downstream side shall be generally higher than the upstream side. Pinnacles for landing platforms and similar purposes shall not be built. Where racking is permitted the slopes shall not be steeper than 1 to 1, and the face shall be as irregular as possible. Small spall dams shall be built to prevent the concrete from running down the face of the rack. The trowel work on the spall dams is the only trowel work which will

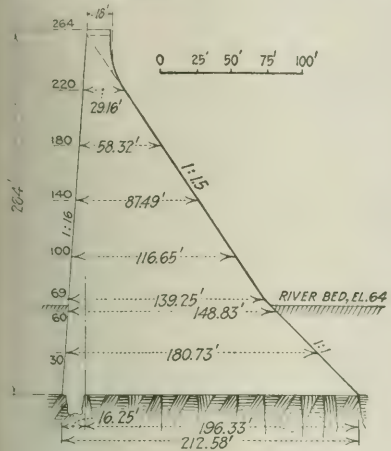


FIG. 1- CROSS-SECTION

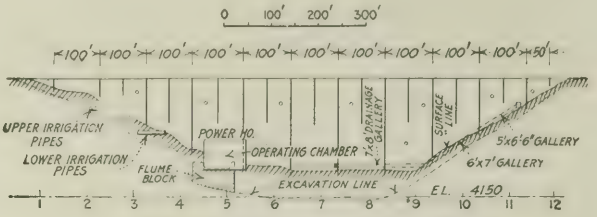
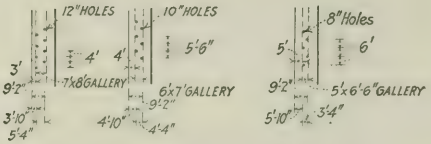


FIG. 2- ELEVATION SHOWING EXPANSION JOINTS



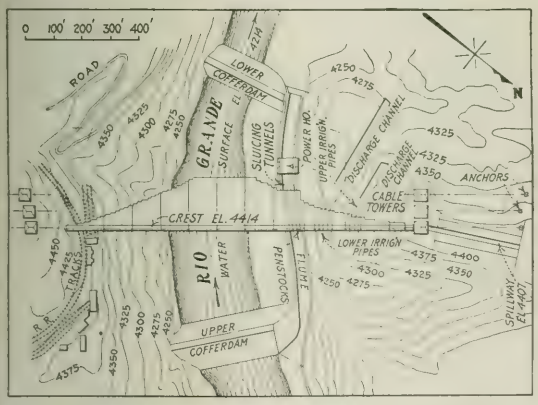


FIG. 3- PLAN OF DAM AND SPILLWAY

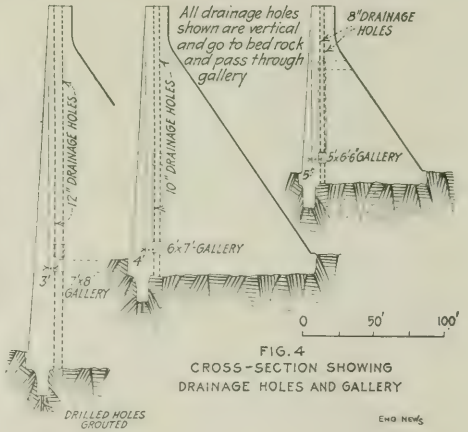


FIG. 4
CROSS-SECTION SHOWING
DRAINAGE HOLES AND GALLERY

THE ELEPHANT BUTTE DAM, U. S. RECLAMATION SERVICE

Contraction Joints.—At such intervals and depths as shown in the drawings or directed, contraction joints, normal to the dam axis, shall be formed of masonry built against forms. Each such face shall be coated with acceptable material to prevent adhesion to the masonry on the other side of the joint. The contraction joints will divide the dam into sections, and as the work progresses, alternate sections shall be carried ahead of the intervening ones. Derricks or other hoisting and conveying apparatus may, when the masonry is of acceptable strength, be placed on such higher sections for use in placing masonry in lower sections. One or more of these sections may be maintained at a lower elevation than the adjacent ones, as an additional safeguard against damage by flood.

Filling Vertical Slots.—In order to minimize contraction, the sections marked by asterisks on Fig. 3, shall be built in

be required or expected in connection with cyclopean masonry. When trowel work is necessary it shall be done with mortar of such consistency as to give a tight joint.

Depositing Masonry under Water.—Concrete or other masonry shall be deposited under water only when unavoidable, and extreme care must then be used in its deposition. No water shall be allowed to rise against any masonry until the mortar shall have had at least 24 hours in which to set.

Work in Freezing Weather.—When masonry is laid in freezing weather, precautions shall be taken for removing ice and frost from the materials, for protecting the newly laid masonry from freezing, and for heating the materials when necessary to prevent freezing. Covering for the newly laid masonry and such additional appliances and materials as may be required therefor, including steam pipes for keep-

ing the air warm beneath the covering, shall be provided in advance.

Protection of Masonry—Until a sufficient time has elapsed for the setting of the concrete, it will not be permitted to erect derricks or other machinery upon the surfaces of masonry, nor to build centering or forms, nor to land or store stones or other heavy objects, nor to walk or work on such surfaces. Care should be exercised to avoid disturbing stones in any way after they have been set.

Defective Masonry—Masonry damaged by freezing or by alternate freezing and thawing, or from any other cause, or any masonry which shall be found defective at any time before the completion of the dam, shall be removed and rebuilt. Whenever a stone that has been set has its bond broken it shall be taken up and reset.

Protecting Exposed Faces—The facing of the dam and all other masonry which is to be permanently exposed to view shall be effectively protected from injury or disfigurement by the falling of stones, tools, mortar or other objects until the completion of the work.

Masonry to be Kept Moist—Concrete or other masonry shall be kept moist for at least two weeks or until covered.

Grout, Mixing and Using—Apparatus for mixing and placing grout shall be of a type that has been successfully used and shall be equal in efficiency to a machine having for its essential part an air-tight chamber in which the grout is mechanically stirred, and from which it is forced by air pressure into the voids. Whenever it is known in advance that grout is to be used in any place, pipes, through which the grout may be forced, shall be set as the work progresses. In other cases, suitable holes shall be drilled. Holes to test the efficiency of the filling shall be made if necessary. If it is discovered that any voids have not been thoroughly filled by the first application of grout, the process shall be repeated until satisfactory results are obtained.

Special Finish of Concrete Surfaces—Except concrete surfaces for which special finish is required, the exposed faces of copings of wing walls, culverts and other structures, shall have a smooth finish, or by other acceptable means; wherever such surfaces are not cast against forms, they shall be screeded, troweled and rubbed to a smooth finish, by men skilled in such work. Such faces shall be of even texture and color.

Exposed Faces—Care shall be taken to avoid discolorations or marks on surfaces to be exposed to view, and such surfaces as are bounded by angles or grooves, shall be formed by placing concrete continuously until the completion of each such surface. In depositing concrete, the coarse aggregates shall be carefully spaded away from faces to be exposed, except in places for which other directions are given. If any voids or other imperfections are found upon removing the forms, molds or centers, such faults shall be corrected immediately by filling with mortar or otherwise, even to the extent of taking down and replacing unsatisfactory concrete.

Special Surfaces of Forms—In order to secure the smoothest practicable finished surfaces, wherever the concrete is part of a waterway, and elsewhere if required, the centering, if not entirely of metal construction shall be faced with sheet steel not lighter than No. 23 gage, weighing 1.12 lb. per sq.ft., or with other suitable material. The plates shall be carefully selected and shall be put on the forms without wrinkles. The surface of forms, against which concrete is to be deposited, shall be cleaned and coated with soap, mineral oil or other suitable substance to prevent adhesion of the concrete. Where the form is built of separable panels, the sheet metal shall be carried over all straight edges, having been bent to a sharp corner over a straight steel edge. Suitable and effective devices shall be used to hold adjacent edges or ends of panels or other forms tight together and in accurate alignment. Metal covering will not be required on any special forms, which are to be used but once. The surfaces of all such forms, however, shall be tight and smooth. In the waterway they shall produce concrete surfaces equal to those made upon metal forms.

Supports for Forms—Small rods to hold the forms will be allowed in the structures, provided proper means be used to take out a portion of each of the rods nearest the surface at least 2 in. in length. All holes left after removal of the rods shall be filled immediately and completely with cement mortar, and the surface left smooth and in good condition.

Wetting and Placing Forms—Wooden forms shall be wetted thoroughly just before placing concrete, so as to prevent [illegible] drying of the surface of the concrete by absorption. Where forms are placed in successive units for continuous surfaces, care shall be exercised to fit the forms tightly over completed surfaces so as to prevent leakage from the concrete.

Large-Scale Tests of Plain Sedimentation of Sewage, London, England

Plain sedimentation of sewage instead of chemical precipitation has been tried with promising results at one of the large sewage-treatment plants of the London County Council. The following slightly condensed statement is from a recently revised pamphlet edition of the "Main Drainage of London," by Sir Maurice Fitzmaurice, chief engineer of the London County Council:

The main drainage committee conducted experiments at Barking during the months of May, June, July and August, 1911, with the object of finding out how the effluent would be affected if lime and iron were not added to the sewage, and if some alterations were made in the times and method of cleaning out and removing the sludge from the precipitation channels. The usual interval between the successive cleaning out, or the "channel hours" of any one channel, is 60 hours. A shorter interval, viz., 30 hours, was adopted during these experiments so as to compare with the longer interval usually adopted. The general result of the experiments was that, as regards matters in suspension, almost the same purification was obtained without chemicals by reducing the channel hours to 30, as is at present obtained with the use of chemicals and with 60 channel hours. During the whole period in 1911, while these experiments were being carried on, no complaint was received as regards the condition of the Thames, notwithstanding that the summer of 1911 was exceptionally hot, and the amount of river water coming down was exceptionally small.

The experiments have been continued in the present year (1912) during the months of June, July and August, and the results obtained corroborate generally those obtained in 1911. The Port of London authority takes from time to time samples of the effluent discharged into the river, and during the months the experiments were being carried on they made no complaint as regards the quality of the effluent. In fact, the reports of that authority on the effluent during the experimental periods were of a more satisfactory character than either before or after, when the station was being run in the ordinary way.

The chemicals themselves add considerably to the amount of sludge that has to be dealt with, and it is possible that, owing to chemical combination, the bulk of the sludge may be increased by more than the amount of chemicals used.

If the use of chemicals were altogether discarded a very large saving in working expenses would result. The saving would not, however, amount to as much as the discarded chemicals would have cost, as the expense of increasing the flushing staff so as to reduce the channel hours from 60 to 30 has to be taken into account.

I cannot say exactly what the net saving would be, as the costs of lime and iron vary from year to year, but there is no doubt that, considering both outfall works, it would amount to betwen £15,000 and £20,000 a year [$73,000 to $97,000.—Ed.].

The results of the experiments made in 1911 were given in detail in a report presented to the Main Drainage Committee on Nov. 23, 1911, and the results of the experiments made this year will be presented in a detailed report later on. I am strongly of opinion that one of the outfall works, at all events, should be run completely without chemicals for one year after the termination of the present contracts for chemicals; and from the data thus obtained it may be found advisable ultimately to discard altogether the use of chemicals for precipitation.

❋

A Reduction in Electric-power Rates has been made by the Ontario Hydro-electric Commission to the municipalities which purchase energy through this commission (which supplies them over its own transmission lines from a Niagara Falls plant). The new rates mean a decrease of some $100,000 gross income over the present figures. The total connected load of the system is now about 34,000 hp. It is claimed that the new rates are more than sufficient to cover the various charges together with proper sinking-fund installments. There was a yearly surplus of $62,000 at the end of Oct. 31, which sum is only $10,000 less than the whole sinking-fund charges for the first year. It was not planned to burden the pioneer purchasers of energy with sinking-fund and depreciation charges until the year 1914; but before reducing the rates as above noted, deductions for that purpose were made.

EDITORIALS

A Recent Test of a Flat Slab Floor

At the recent annual convention of the National Association of Cement Users, a paper describing some stress deformation tests on reinforced-concrete flat-slab floors was read by an engineer who has specialized in extensometer measurements on buildings under load. We had hoped from the title of the paper that some further light would be thrown on the subject of flat-slab concrete floors by the tests, and looked forward to publishing the results for the benefit of our readers. On reading the paper, however, we note that while the author undoubtedly has acquired from the tests a considerable knowledge of the behavior of such floor slabs, his published report deals mainly with some general deductions and leaves much to be desired concerning the details of the construction and the test results.

The prevailing ignorance regarding flat-slab design is very great and every test which is made should have the fullest description and the widest publicity, if the profession is to gain the knowledge it needs. This knowledge is particularly needed in the amount of steel to be used in the reinforcing of flat slabs, which amount now varies apparently without reason, and with the taste and fancy of the designer. This particular paper specifically avoids detailed description of the amount of the steel reinforcing in the floors tested, on the very reasonable grounds that the company which designed the building and paid for the tests did not care to give out that information for the benefit of its competitors. One could wish that the company had assumed a broader view of its duty toward the profession, but certainly there can be no quarrel with the attitude it did take. The rights of property are indisputable. But as several correspondents have inquired as to our possible reprinting of the paper, we take this opportunity of explaining why we do not think such reprinting worth while. We have the utmost confidence in the author's analysis of results, but engineers who are interested in flat-slab design want actual figures and full data. Anything less is unsatisfactory.

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The Street Cleaning and Garbage Collection Efficiency Studies of the Chicago Civil Service Commission

To be timed by a stop watch in order to determine what percentage of your working day you spend in dodging vehicles must seem like an infraction of both personal and political liberty to a street cleaner under the block or patrol system. Such timing is just what was done in Chicago in 1912 by the engineers of the Efficiency Division of the local Civil Service Commission. Horrible to relate, it is only a small part of what these efficiency engineers did in their efforts to establish standards for street cleaning and for garbage and refuse collection. They studied average speeds of garbage and refuse wagons in going to unloading places and average time taken in loading, besides traffic density, street widths and kinds of pavements being cleaned.

The object of these studies was almost as novel, in city administration, as the studies themselves. It was to secure data on which to base budget estimates and apportionments for the yearly appropriations for street cleaning and for garbage and refuse collection and disposal. Standards were set, not only for the work a man or a team ought to do in a time unit, but also for such things as frequency of cleaning different classes of streets. Knowing these things and the area of streets for street-cleaning work, and the density and character of population for garbage and refuse collection, goes far toward changing the making of appropriations from a guessing game to a scientific procedure—a change doubly needed at Chicago, with its antiquated and politically bad system of making appropriations and administrating work by wards.

Particularly notable is the fact that these studies were made by a civil service commission, and that the Chicago Civil Service Commission has an Efficiency Division, with a staff of engineers, for making just such studies.

Heretofore the work of civil service commissions has been confined almost wholly to (1) the task of seeing that men were selected for employment or promotion with some regard to fitness for the work they were supposed to do, instead of on account of political qualifications; and (2) to seeing that once in office they stayed there until removed by death or physical disability—except in rare cases, when such commissions have taken just action against employees who have indulged in too much political activity.

As a result, the most that civil service has done in the majority of American cities has been to insure security of tenure and promotion by orderly procedure. These achievements are good so far as security of tenure does not result too largely in keeping men in office whether they render poor or good service, nor make promotion a matter of seniority rather than merit.

What has been needed in the civil service has been checks on the efficiency of the men protected by it. While the work outlined above as having been done in Chicago (described in part more fully elsewhere in this issue) appears to have been conceived and executed as a temporary measure for budget-making purposes (an excellent reason, too), those parts of it which apply to human efficiency might well be made a permanent feature of the work of the Chicago and other civil service commissions.

Finally, these unique studies at Chicago deserve to be considered in conjunction with the work-quantity unit-cost budget system, which is to be tried in 1913 for the Borough of Richmond, New York City, described and commented on at some length in our issue of Dec. 26, 1912. The world moves and the engineer is coming into his own.

Limiting the Size of Motor Trucks

The manufacturers of motor vehicles are getting considerably exercised over some proposed state laws regulating the weight and tires of motor trucks. In New York State, for instance, certain of the highway protective interests have suggested a law which will proportion the width of the tire to the load carried and limit the latter. One suggestion provides for an increasing scale starting at vehicles having ½-in. tires to carry a maximum load on one axle of 1200 lb., and rising to those having 10-in. tires, with a maximum load on one axle of 8000 lb., the latter to be the largest loading allowed on any country highway, though no restriction is placed on the loading for city streets.

This proposition is strenuously opposed by the manufacturers, who maintain that such a law is unconstitutional, and that the state is bound to build and to maintain highways for any traffic its citizens want to send over it. Of course, these same manufacturers would never pursue this argument to its absurd limit, but would agree to stop with loads just outside the possible maximum for their own trucks. Manifestly, there must be a limit to the load for which road builders can design. Where is this limit?

The loadings which railway tracks and bridges have to carry are continually increasing, and maintenance men have grumblingly to keep step and to design their permanent structures for the occasional maximum. The economics of railroading demand a certain maximum loading. The owner carefully figures that the gain in revenue from heavier units will more than offset the increased cost not only of those units, but of the roadbed on which they run.

In highway work the problem is quite different. Possibly a 15-ton truck is more economical for some user who only pays the average tax rate for the construction and maintenance for the road on which that truck runs, but is it fair to the thousands of other users who do not benefit by the economies of that large truck to be made to pay the excess cost and maintenance of the roads that that truck requires? The street railway has to pay for the construction and maintenance of the roadway between and contiguous to its tracks. Why should the motor-truck owner get the same privilege free?

The matter has not reached a dangerous stage, for it is probable that the damage to roads by high-speed, high-powered passenger cars is now far greater than any damage which may result from heavy loading. The time is rapidly coming when this will not hold. Witness for instance the 15-ton truck described on the first page of this issue. This truck will carry 20 cu.yd., which may readily mean 20 tons of certain types of material, and there is no doubt that a motor could be designed to draw such a load. This ponderous load moving at a fair rate of speed (8 m. per hr. for the one noted) along a country highway is destructive of the fabric and structure of that highway and its possible crossing of the usual country bridge is a positive menace to life and property. City streets are not designed for any such strain. Anyone who has seen footprints plainly marked on an asphalt pavement during the heat of the summer can readily imagine the effect of a 7-in. tire loaded up to 6, 7 or possibly 10 tons. Certainly the taxpayers of the city are not required to provide a roadway for such a vehicle, merely to benefit the few whose interest is served.

Undoubtedly roads will have to be built from now on with a view to automobile traffic, because the automobile for pleasure and commerce has become a necessity. Doubtless, also, a certain amount of the benefit from the use of the automobile is so distributed that the whole body of taxpayers should shoulder the added cost of the roads it demands. There is, however, a limit where this equable distribution stops and where the added benefit accrues only to certain individuals, and beyond this point those who dance should pay the fiddler. The usual horsepower or cylinder-bore automobile taxes are an attempt to meet this cost, but in the case of the extraordinarily heavy trucks no tax could posibly pay for the increase. Here, then, limitation in weight is the only remedy the state has.

There is a tendency in the opponents of these weight-limit laws to consider them directed against all motor trucks. For instance, a recent editorial in the Boston *Transcript* voices this sentiment as well as the railway analogy fallacy which is noted above:

> When traffic increases on railroads it is the practice of progressive management to build additional trackage and stronger bridges, put on bigger locomotives and cars. The motor truck is a method of merchandise transportation the possibilities of which have scarcely been touched; yet sufficient experience has been gained to show that it has a field of its own and to prove that in the immediate future a vast amount of traffic of this kind will pass over all the main inter-city thoroughfares. And provision must be made for it. The limit of twelve tons for vehicle and load that will be favored by the [Massachusetts State] Highway Commission in a bill would just about admit the five- and six-ton capacity trucks now in common use; it would bar out the heavier trucks such as those of ten tons capacity that are being used elsewhere. That is not a business-like proposition; it is as if the city said to the Boston Elevated: "You cannot carry any more passengers because the subways are not large enough and we don't propose to build any more."

As yet there is no reason to believe that the extraordinarily heavy trucks will prove of great advantage to any but a few users and for the present, at least, it certainly would be inadvisable to levy upon the whole people for the benefit of those few. The problem before the framers of any new law directed against heavy vehicles is to find what is the limit that typical good roads and bridges of today can stand and to prohibit any weight that is in excess. Such a restriction would probably not affect 10% of the motor trucks in use and would certainly not circumscribe their usefulness as a method of transportation.

Indicting Railway Officials as a Remedy for Accidents

Everyone has heard of the joke of *Punch*, the English comic journal, which proposed many years ago, in the early days of the railway era, that as a safeguard against railway collisions a director of the railway company should be tied to the front of each locomotive.

The joke of half a century ago becomes a serious reality in the United States today, where grand juries in Connecticut and in Indiana have recently returned indictments for manslaughter against the officers of railway companies on account of deaths in two recent railway accidents. In Connecticut the Vice-President and chief operating officers of the New York, New Haven & Hartford R.R. were indicted for the accident at Westport. In Indiana all the directors, the President and all the operating officials of the Cincinnati, Hamilton & Day-

ton R.R. were indicted for a recent wreck on the road where a freight brakeman forgot to close a switch.

It is true, no doubt, that these indictments are brought in response to a public demand that somebody, somewhere shall receive punishment for these accidents, and it is argued in defense of these indictments that they will tend to make railway officers realize more keenly their responsibility for the safety of those whose lives are in their care.

We do not for a moment believe, however, that such extreme measures are needed to impress upon railway officers the measure of their responsibility. At the present day particularly, railway officers everywhere are studying with the greatest care all questions affecting safety in railway operation.

Far from being callous and indifferent to the risk involved in railway operation, it is a fact that among railway officers themselves the percentage of casualty in train wrecks is far higher than with the average traveler. It would be easy to name half a dozen railway accidents within the last 15 years in which Presidents, Vice-Presidents, General Managers, or other chief officers of railway companies have lost their lives. The death of Samuel Spencer, President of the Southern Ry., a few years ago in a rear collision on his own road is, perhaps, the most notable illustration. In fact, railway officers in attaching their private cars to the rear of passenger trains, as is commonly done, are voluntarily doing what *Punch* proposed so many years ago, that is, taking the place of greatest danger.

There can be no doubt, therefore, that railway officers, for the protection of their own lives as well as the lives of millions of passengers and thousands of employees, earnestly desire to do everything possible to attain a high degree of safety in railway operation. To indict for manslaughter, directors, presidents and officials of the operating department whenever an accident occurs on the lines under their charge would give them no keener realization of responsibility than they now have.

It will, of course, be admitted that where definite and direct responsibility for an accident can be traced to an individual, whether he be a brakeman or a railway president, some sound argument may be made in support of an indictment. But what reason or wisdom is there in indicting President Daniel Willard, of the Baltimore & Ohio, because on one of the subsidiary lines of that great system a careless freight brakeman forgot to close a switch after letting his train onto a side-track and so caused the wreck of a passenger train shortly afterward?

If it serves the ends of justice to indict President Willard for manslaughter occurring under such circumstances, we do not see why it would not be equally just to indict President Taft for embezzlement because of a theft of government funds by some subordinate custom-house official.

As many of our readers will doubtless recall, this is not the first time when high officials of a railway have been indicted because of deaths in a train accident. A score of years ago a collision occurred in the Park Ave. tunnel above Grand Central Station in New York City; and in the fire which followed the collision, a dozen or so employees of the car department were burned to death. The directors of the New York, New Haven & Hartford R.R. were indicted afterward on the ground that they had failed to provide their cars with a safe system of steam heating. When the cases came to trial, however, it was found impossible to trace definite responsibility to any of the directors and the suits were dropped. Similar results will doubtless be the eventual outcome in the cases discussed above. Such an ultimate result, however, does not by any means justify the bringing of the indictment in the first place. If the principle were established that railway directors and railway officers were liable to indictment for every accident occurring on the lines under their charge, it would very shortly be impossible to induce competent and responsible men who cared for their reputation to accept such positions. It is of great public importance, however, that just this class of men shall hold these positions. We cannot have safety, and efficiency, and economy in the railway service unless men of this sort are in charge. Let it not be thought either that it is an easy matter to find this sort of men for such positions. Men competent to carry such responsibilities are at a premium everywhere.

Surely the safety of the traveling public will not be increased if we make conditions in the railway business such that the only class of men who will care to hold responsible positions will be those for whom the stain on their personal reputation involved in an indictment in a court of law is a matter of no consequence.

Let it be clearly understood that in what we have said we are not opposing the fixing of responsibility for accidents of any sort and the administering of proper punishment to those found responsible, not as a matter of public revenge, but as a stimulus to others to use greater care in future. What we do protest against is the misuse of the machinery of justice to appease public clamor, led on by sensational journalism, that "some man higher up" shall be sacrificed.

Far Reaching Decision Respecting the Use of the Chicago Drainage Canal

The denial by the Secretary of War of the application of the Sanitary District of Chicago for authority to withdraw 10,000 cu.ft. per sec. from Lake Michigan in place of the 4167 ft. authorized by a previous Secretary, which we print in full elsewhere in this issue, seems to leave Chicago only two alternatives. Either it must fight the question out in Congress, and if successful there, which is very doubtful, it must then fight it out again in a probable arbitration proceeding between the United States and Canada, with possibilities of a fight with navigation and other interests in the courts as well. Otherwise Chicago must, at an early date, begin the construction of a plant to purify its sewage, at least partially, before discharging it into the drainage canal, and this plant must eventually become one of the largest sewage-treatment plants in the world.

The necessity for purifying its sewage arises not alone from the doubt whether the city will be permitted to permanently divert from Lake Michigan even the amount of water it is now taking, but because the towns and cities along the course of the Illinois River will be apt to begin litigation if Chicago sends its sewage past their doors diluted with a smaller proportion of water than that agreed upon when the state legislation authorizing the construction of the sanitary canal was enacted.

LETTERS TO THE EDITOR

Piers for a North River Bridge at New York City Would Effect No Saving in Cost over a Single Span

Sir—The views of Mr. Augustus Smith, published in your issue of Jan. 2, 1913, on the subject of piers in the Hudson River at New York City (also called the North River) for a bridge across that stream are shared by many persons not informed as to the peculiar geological character of that river. The belief that one or more piers in that river would greatly cheapen the construction of a bridge is erroneous, and a word of explanation would seem to be in order.

The bed of the North River consists of a submerged rocky irregular trough or cañon, with an average width of a mile, and along its middle, from 250 to over 300 ft. deep from the water surface to rock. This trough is filled with mud, called euphoniously silt. The water in the middle of the river is 40 to 60 ft. deep. The river bottom is so soft that a diver cannot stand on it. At the depth of 90 ft. from the water surface, which is that of the Pennsylvania R.R.'s tunnels, the silt is still in a half liquid condition. The silt gradually thickens with increasing depth, and becomes a blue clay mixed with gravel overlying the rock. Bridge piers would have to be founded on that rock formation, which is about 100 ft. deeper than the deepest bridge foundations so far built.

To avoid confusion of terms it should be explained that the so called pierhead line is the line along each shore to which the landing piers for ships are built out at right angle to the river, with foundations mostly on long piles. The width of the river between these pierhead lines is from 3000 to 4000 ft., and the Government will not allow any bridge piers in that width.

Assuming now, for illustration, a bridge over this width with two spans each, say, 1500 ft. clear (or 1600 ft. on centers of piers), then the cheapest plan would be that for a cantilever bridge in which the two middle spans would be flanked with anchor spans, one over each shore, four spans in all. Each middle span would consist of a cantilever arm 800 ft. long, supporting one end of an independent truss, also 800 ft. long, the other end of the truss resting on a pier in the middle of the river. This symmetrical arrangement would give the smallest middle pier, as it would get the load from each middle span for a length of only 400 ft., or 800 ft. in all. Assume further this pier to be on top only 150x30 ft., and to rest on a foundation, say, 270 ft. below water. Allow 20 tons per sq.ft. pressure upon the foundation without allowing for the displacement of water, which gives the safer dimensions. More could not safely be allowed for a foundation which could not be ocularly inspected. A size of foundation is thus obtained, which, together with the pier would cost, at a low estimate, six million dollars. Piers may be built for less, but should not be built if absolute safety is to be paramount. A pier with a greater depth would, of course, cost more. Six million dollars will buy 40,000 tons of nickel steel, which, added to the amount of steel and cost of the cantilever structure, is more than enough to build a suspension bridge of the same capacity with a 3000-ft. span. Similarly, with two deep piers, no considerable economy could be discovered in the total cost of structure.

Therefore, one or two piers in this river do not cheapen the cost of a bridge. The economy leans to the side of a suspension bridge with a single span between pierhead lines. It is this fact that caused the writer to acquiesce many years ago in the decision of the War Department that the bridge shall, in the interest of unobstructed navigation, have a single span from pierhead line to pierhead line.

There is need of warning against a common error. That is, estimating the cost of construction too low, and with insufficient allowance for contingencies and delays, interest during construction, cost of administration and right of way, and the connections and approaches without which a bridge is not complete. It produces false notions of what such a large work really costs and as to the amount of money which must be provided. That has happened thus far with every engineering work of unprecedented magnitude.

Gustav Lindenthal.

68 William St., New York.
Jan. 7, 1913.

Effect of Cocoanut Oil and of Sugar on Concrete

Sir—I would like to know if any of your readers have had any difficulty in getting good results from concrete work in or around sugar refineries. I have had it disintegrate when I have used special care in mixing, placing and covering with damp cloths until set, and again I have obtained good results with the same material and mixture but with conditions which seemed less favorable. Laboratory experiments when I have added various percentages of sugar with cement and with cement and sand give such conflicting results that I am at a loss to know what the causes are which have affected my results.

F. E. P.

Brooklyn, N. Y., Dec. 16, 1912.

Sir—Will you advise me if you know of any material that can be incorporated with concrete that will make it oil-proof and protect it against the destructive action of animal and vegetable oils?

I am building a reinforced-concrete warehouse for the storage of cocoanut oil and by careful tests I have found that the destructive action of the oil in converting the lime of the portland cement into lime soap is very rapid. By subjecting a sample of hardened concrete to the action of oil for two weeks, the deterioation is very noticeable.

If either you or any of your readers can suggest a practicable remedy for protecting the concrete, I shall be

obliged. Several protecting paints to be applied to the surface have been suggested by the various manufacturers, but these are open to the objection that the abrasion of the surface due to rough usage would remove the paint and expose the floor to the destructive action of the oil.

WM. COPELAND FURBER.

Philadelphia, Dec. 16, 1912.

[The destructive effect of vegetable and mineral oils on concrete has been frequently noted, but we do not know of any protective measures that have been successful. The possible destructive effect of sugar is new to us; if any reader can throw any light on the subject, the information would be welcome.—ED.]

Upward Water Pressure on the "Reversed Dam"

Sir—In your issue of Dec. 19, 1912, p. 1142, a "reversed dam" is described by Frank C. Osborn. In considering the pressures exerted on this dam Mr. Osborn ignores a force or set of forces of enormous magnitude and importance. The force referred to is the upward pressure of water underneath the horizontal slab of this dam. If this force should reach anything like its full possible value, the resultant would be upward, and the dam would float away. The stability of this dam depends solely upon its being perfectly glued to a foundation of a solid rock—147 ft. wide in the direction of the stream and without seam in any direction, in the example analyzed in the article—glued or cemented so that no water whatever can ever penetrate beneath the horizontal slab.

In view of the periodic failures of dams by reason of water pressure beneath them lifting them off their foundation, it would be a bold spirit indeed who would attempt a dam of any magnitude along the lines of this one. He should be compared with the great military geniuses in his disregard for human life. Such a one ought to be compelled to reside just a little downstream from his structure.

It is to be fervently hoped that the always self abasing and willing profession of engineering will not be compelled to shoulder the responsibility of a series of disasters that dams of this sort would no doubt inaugurate.

The writer feels intensely serious about this matter, so much so, in fact, that he desires this letter to be considered as a warning, from the minority, perhaps, but a constantly growing minority. It is by no means the universal opinion of the profession that under pressure on dams does not exist or can be ignored. Books and specialists have not yet caught up with this advance, but they will be forced to it in time. It is to be hoped that there have been enough horrors already to supply the necessary material to effect this conversion.

EDWARD GODFREY.

Monongahela Bank Bldg.,
Pittsburgh, Penn., Dec. 24, 1912.

[The above letter was submitted to Mr. Osborn and he has replied as follows:]

Sir—If Mr. Godfrey had read the article a little more carefully he would have noted that the spirit of it was to illustrate a novel idea in dam construction, to indicate a simple, direct and compact method of calculation for obtaining the foundation pressures, and more particularly to call attention to the peculiar results obtained in the comparative calculations for the factor of safety against overturning.

He would have discovered also that the question of upward pressure on the base was not ignored, but, on the contrary, that complete calculations are given for foundation pressures and for overturning under the heading "Backwater Pressure."

It may be a possible theoretical assumption that the full hydrostatic head would act over every foot of the foundation from heel to toe, but this implies an entirely unobstructed entrance for water, no point of contact between the dam and its foundation, no drainage system and the positive prevention of any escape of water at the toe. If it is possible to provide such a preventative at the toe then it must also be possible to provide such a one at the heel and thus avoid any upward pressure whatever.

This question has, however, been most thoroughly and ably discussed before the American Society of Civil Engineers during the past year and was not considered pertinent to the article in question.

Mr. Godfrey is in error when he says it is necessary that no water whatever be permitted under the base of the reversed dam. This is proved by the calculations above referred to, which show stability under a very considerable head acting uniformly over the entire base. Further calculations will show, for a full static head at the heel and zero pressure at the toe, a substantial downward resultant, a moderate pressure at the toe and a tension at the heel so slight as to be easily provided for. It is apparent that if additional weight is desired the thickness of the base can be readily increased, or loose material superposed.

FRANK C. OSBORN.

Cleveland, Ohio, Jan. 6, 1913.

Effect of Moisture on the Strength of Concrete: An Explanation of Concrete Drain Tile Failures

Sir—A study of the existing literature on mortars and concretes seems to indicate that the factors affecting their strength are fairly well understood. Many reports are available of exhaustive investigations as to the variations in the strength of concrete resulting from varying proportions of aggregate, age and quality of cement, varying sizes and quality of aggregate, different methods of mixing and curing, different methods of testing, and of various impurities in the mixing water or aggregate.

To make the assertion that after it has set the amount of moisture present in a portland-cement concrete has an effect upon its strength of sufficient amount to be of practical importance in some uses of concrete, and that this fact is not recognized in concrete literature may astonish, yet investigations recently made seem to indicate that such is the case. When we consider, however, that only within the past two years has it become an established fact that concrete expands and contracts with changes in the amount of moisture present just as wood does, it does not seem altogether impossible that we have been overlooking such a simple thing as the fact that the

presence of water materially affects the strength of concrete.

Several failures of concrete drain tile in the state of Iowa have caused concern, and various ways of testing tile have been proposed. But not infrequently large numbers of concrete drain tile fail after being laid and covered, notwithstanding the fact that every joint is tested before laying and withstands a larger load than they are subjected to in the ditch. The significant fact about the failures is that they all seem to occur within a few hours after laying, but not immediately after covering. All joints that withstand the earth pressure for, say, twelve hours, prove to be permanently safe, even though the depth of covering is afterward increased. It was thought that the explanation of this action might be that the tile are tested in a fairly dry condition and that the moisture which soon saturates the walls after the tile are laid in some way has a weakening effect. It was at first thought that the weakening must be due to some sort of chemical action.

To learn whether or not this is the explanation, experiments were begun in the testing laboratory of the College of Applied Science, State University of Iowa, about a year ago. It was soon proved that a 1:3 portland-cement mortar cured in air under conditions similar to those commonly obtained in the manufacture of cement drain tile, was weakened from 40 to 50% by being soaked in water. It was farther proved that this weakening resulted at once, that is, the full weakening effect came about just as soon as the specimens were saturated with water. This fact seemed to indicate that the cause was physical and not chemical.

Many questions immediately arose. How does this weakening vary with different mixtures, with different cements, with different methods of curing? Is the percentage of weakening proportional to the moisture content? Can the mortar be repeatedly weakened and strengthened by repeated wetting and drying? A series of experiments is under way for the purpose of answering some or all of these questions and the results will be published when obtained. The mere fact, however, that a dry mortar may be weakened 50% by the introduction of pure water seems of sufficient importance to warrant its publication at this time. While it is true that a greater part of the concrete made is used in large masses with a sufficient factor of safety to cover such variations, yet the fact remains that if the factor of safety is based upon a strength obtained experimentally upon a dry concrete, it may be reduced 50% by a wetting of the structure. Furthermore, in cases where concrete is used in thin walls subject to bending without reinforcement, such as in drain tile, this weakening may actually cause failure as in the instances cited.

It has long been recognized that the strength of wood varies with the moisture content and tables of ultimate strengths of wood are always based upon a known percentage of moisture present. In view of the above facts, is it not equally important that reports of tests of strength of concretes and mortars contain a statement of the condition of the specimens with respect to moisture content?

Sherman M. Woodward,
Frederick C. Young.

Iowa City, Iowa,
Jan. 2, 1913.

Feathering Paddle Wheels for Self-Propelling Dredges

Sir—On p. 286 of your issue of Aug. 15, 1912 appears a description of the feathering paddle wheel to be used on the dredges "H. F. Taber" and "Robert McGregor," now building for the Arkansas River, and designed in the office of the Chief of Engineers, U. S. Army, at Washington.

You were pleased to quote a portion of what the writer stated in an article on "The Most Economical Type of Boat for Operation on Western Rivers," which appeared in your issue of May 5, 1910, p. 512. The quotation was confined, however, to the latter part of the paragraph in which it occurred, and omitted the items favoring the use of such wheels on our river boats.

I have many times expressed a hope for the trial of such wheels on our river boats, where the service gave any promise of possible satisfactory operating results. Such boats as the Arkansas dredges provide excellent conditions for an experimental installation of such wheels, but unfortunately use the propelling machinery to such a limited extent that they do not determine what result might be found under commercial operation.

It is to be regretted, moreover, that more wisdom was not shown in the Washington office, so that the really most desirable concomitant of the feathering wheel use might have been preserved. I refer to the increased piston speed of propelling engine that can be obtained by the use of such a wheel. This is entirely lost by the designer of these dredges. Similar boats built by the army engineers, but with the usual radial wheel, operate under probably 300 ft. per min. piston speed. The average piston speed of the Western River boat is less than 300 ft. per min. It is this slow piston speed which is most detrimental to fuel economy, and its possible increase, by the use of a feathering wheel, that which makes the installation of such a wheel on one of our river boats advisable. Yet this great advantage is entirely thrown away by the Arkansas-dredge designers when they adopt a stroke of 4 ft. for the propelling engines. The "Detroit III" is securing practically 500 ft. of piston speed, and there is no reason why these Arkansas dredge boats should not have had a similar advantage.

The Washington office also shows great lack of complete information in the design of the cylinder frames for these two dredges. The use of such steel frames on our river boats has developed a decided tendency to crystallize at certain points, and this might be emphasized in the construction shown. The elevation of the inboard end of the frames to some 4 ft. above the deck line should have been avoided; the placing of these frames in parallel, the small angle of some 30° shown as the limit of rudder movement, all point to an uncertain knowledge of proper practice.

Perhaps one of the most peculiar things which has otherwise come to my attention in connection with the design of these dredges, is that of the chimney weighing some three times that which would be accepted practice or thought necessary, accompanied with emphatic assurances of a purpose to preserve lightness.

Jno. M. Sweeney.
Mechanical Engineer.

1636 Monadnock Block, Chicago,
Dec. 9, 1912.

Limiting the Use of the Chicago Drainage Canal*

SYNOPSIS—The sewage of a part of Chicago and of some outlying territory has been diverted from Lake Michigan and is disposed of by the dilution method by turning it southward through a large canal which, with diluting water from Lake Michigan, discharges into the Des Plaines River, thence by way of the Illinois River into the Mississippi. Federal authority to divert water from the lake was not secured until the canal was about ready for use, 14 years ago, and was then obtained from the Secretary of War, subject to amendment at his discretion and to possible Congressional action. The present Secretary of War now denies an application to increase the amount diverted, on the grounds that since he is convinced that further diversion would interfere with navigation by lowering the level of the Great Lakes, he would not be warranted in sanctioning the increase without authorization from Congress, however much the water may be needed; that the facts presented show no imperative need; and that an existing treaty between the United States and Canada is a further reason why no administrative officer should grant such an application against Canadian protest.

The Sanitary District of Chicago applies to the War Department for permission to increase the amount of water it is authorized to withdraw from Lake Michigan from 4167 cu.ft. per sec., the amount now authorized, to 10,000 cu.ft. per sec.

The Chicago Drainage Canal was opened in January, 1900. It reverses the flow of the Chicago River, which formerly emptied into Lake Michigan, and as a result a portion of the waters of that lake, instead of following their former course through Lakes Huron, Erie and Ontario into the St. Lawrence, are now carried across the watershed into the Illinois River, and through that to the Mississippi and the Gulf of Mexico. The canal thus serves as a system of drainage for the city of Chicago, carrying the sewage of that city southward to the Mississippi, and thus protects the water supply of that city, which is taken from Lake Michigan.

Permission to divert water from Lake Michigan was first granted by my predecessor, Secretary Alger, on May 8, 1899. He permitted a flowage of 5000 cu.ft. per sec., but his permit contained the following conditions:

1. That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final action, and that this permit shall be subject to such action as may be taken by Congress.
2. That if, at any time, it becomes apparent that the current created by such drainage works in the south and main branches of Chicago River be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its south branch.

Subsequently, during the administration of Secretary Root, the amount of the current permitted to be taken was modified or restricted until Dec. 5, 1901, when it was fixed at the amount now permitted, and these permits contained the condition: "that the permission herein given shall be subject to such modifications as in the opinion of the Secretary of War the public interests may from time to time require."

On Mar. 14, 1907, an application made for permission to divert an additional 4000 cu.ft. per sec. for the purpose of reversing the current of the Calumet River and flowing that river also through the canal to drain the southern portion of Chicago was denied by Secretary Taft in an opinion in which he referred once more to the desirability of submitting "this question of capital and national importance to the Congress of the United States."

It is clear that even under the conditions heretofore manifested on these applications, the proposition to divert the water of Lake Michigan into another watershed has not been entertained without hesitation and careful restriction by my predecessors. The propriety of obtaining congressional sanction for the project has been pointed out from the beginning; and the form in which the permit has been granted even for the moderate amount of diversion permitted, has been so phrased as to indicate that the permission was predicated upon the absence of any substantial injury to commerce.

The sanitary canal has never received the direct sanction of Congress. It was built solely under the authority of the State of Illinois, as given in its 1889 general act for creating sanitary districts. And although pursuant to the suggestion of my predecessors the question of the propriety of its diversion of water from Lake Michigan was presented urgently in the reports of the Chief of Engineers for the years 1899 and 1900 as transmitted to Congress, no action upon the question has ever been taken by that body.

In the argument before me it was urged that the present canal represented the growth and development of a national policy expressed in two acts of Congress, 1822 and 1827, which authorized the construction of a canal "to connect the Illinois River with Lake Michigan," thus connecting the two watersheds. (Acts of Mar. 30, 1822, and Mar. 2, 1827). But these statutes authorized a canal for the purpose of navigation and not sanitation. (Missouri vs. Illinois, 200 U. S., 526). The Illinois and Michigan Canal, actually constructed under their authority, derived its water for navigation purposes from the Calumet, Des Plaines and Chicago Rivers, and not from the Lakes. And although in the latter part of its existence it was used to a very slight extent to help purify the waters of the Chicago River and thus sanitate the city of Chicago, such a purpose could not have been dreamed of at the time its construction was authorized by Congress, 90 years ago. I cannot see that its authorization and construction offer the slightest congressional sanction for the great canal now under discussion, which was not even contemplated until much more than half a century later.

Even at the time when the present canal was constructed and opened it is very evident that its ultimate possible effect upon the navigation of the Great Lakes was not clearly realized by those interested in that navigation. The evidence before me indicates that the withdrawal of water from Lake Michigan, at Chicago, would require about five years to produce its full effect upon the level of the Great Lakes (see report of International Waterways Commission on Chicago Drainage Canal, p. 7), and that this effect would be still further obscured by periodic oscillations in the lake levels. These facts may easily explain any inaction on the part of the Nation and their representatives to this withdrawal of water and make it clear that any argument of implied acquiescence must be scrutinized with unusual care.

In this respect the situation is now very different. The present application was opposed by representatives of 23 cities and 6 states interested in harbors and commerce upon the Great Lakes, notably the cities of Duluth, Milwaukee, Toledo, Cleveland and Buffalo. It was opposed by representatives of the navigation interests engaged on the Chicago River as well as on the Great Lakes, and by the official representatives of the Canadian government as well as private Canadian interests engaged in the navigation of the Lakes and the St. Lawrence River, including representatives of the cities of Kingston and Montreal.

A very careful consideration of the voluminous evidence and statements submitted, as well as a consideration of the reports of other commissions and boards of engineers who have investigated the subject, leaves no doubt in my mind that the withdrawal of 10,000 cu.ft. per sec. would substantially interfere with the navigable capacity of the Great Lakes and their connecting rivers. The Chief of Engineers, whose statutory authority in passing upon this application is concurrent with and independent of my own, and whose opinion upon such a question of scientific conclusion must be given especial weight, so states in his recommendation. His conclusions are corroborated by the authority of other boards of investigation, notably the report of the International Waterways Commission of Jan. 4, 1907.

Careful observations and calculations conducted under the offices of the United States Lake Survey and reported through the Chief of Engineers, covering observations for the last 46 years, indicate that a withdrawal of 10,000 cu.ft. per sec. would reduce levels at various places as follows:

	In.
Lakes Huron and Michigan	6.9
Lake St. Clair	6.3
Lake Erie	5.4
Lake Ontario	4.5
St. Lawrence River, at Rapide Plat	4.8 +

The foregoing effects would be produced at mean lake levels; the lowering effects would be much greater at low-

*Decision in full of Henry L. Stimson, Secretary of War, dated Jan. 8, 1913.

water periods—the precise time when any additional shortage would be most keenly felt. This reduction would create substantial injury in all of the American harbors of the Great Lakes and in the St. Marys, St. Clair and Detroit Rivers. It would produce equal injury in Canadian harbors on the Great Lakes, and a still greater injury on the lower St. Lawrence, the Canadian officials claiming a probable lowering effect of 12 in. at Montreal at low water.

The United States has improved about 106 harbors and rivers on the Great Lakes affected by this diversion and has spent on such improvements over $90,000,000. The Canadian government has improved over 50 harbors on Georgian Bay and Lakes Huron, St. Clair and Ontario. By treaty, American vessels are accorded equal rights of navigation with Canadian vessels in all these waters, including the St. Lawrence River. The reduction of the water in these harbors and channels would diminish to just that extent the amount of these improvements, and would nullify to just that extent the effects of the moneys which have been appropriated for that purpose by the respective governments. Connecting various portions of these waterways are the two canals at the Sault Ste. Marie, the Welland Canal, and a number of canals on the St. Lawrence River. The available depth of water over one or all sills of each of these canals would be affected, and in some cases reconstruction might even be made necessary.

The enormous lake traffic which uses these harbors and these rivers is increasing with great rapidity, both in gross volume and in the size and average draft of the vessels employed therein. The Chief of Engineers reports that to lower the water surface 6 in. would reduce the permissible load of one of the large modern vessels by from 300 to 550 tons, with a consequent loss of from $3600 to $7500 in freights for such vessel per season. The International Waterways Commission reported that it would be a conservative estimate which would make the loss to the navigation interests resulting from a reduction of 6 in. in the depth of water as $1,500,000 per annum, or a sum which, capitalized at 4% would amount to a loss of $37,500,000 (see third progress report of International Waterways Commission of Dec. 1, 1907, p. 24). The lowest careful estimate of injury to American vessels alone is reported by the Chief of Engineers as $1,000,000 per year.

The argument was made before me that, owing to the well known fact that the levels of the lake vary, owing to winds and change of barometric pressure, by amounts even greater than the reduction, which would be caused by this canal, therefore, the proposed reduction is of no consequence. This argument is well disposed of in the report of the International Waterways Commission of Jan. 4, 1907, on page 8, as follows:

> It is evident that the average level of the lake may be lowered considerably without the change becoming immediately apparent, and that fact has been used as an argument to prove that the lowering caused by the Chicago Drainage Canal is of no consequence to those interested in navigation. Since they cannot see it they will not know it and will not feel it. The argument is fallacious. It is true that they cannot see it immediately, but they will soon feel it and will know it through the most costly means of acquiring knowledge—the injury to their material interests. The oscillations will remain the same as before, but low water will fall lower and high water will rise less high. The average draft of vessels must be diminished by the amount that the average level is lowered unless the depth be restored by remedial works.
>
> In a word, every drop of water taken out of Chicago necessarily tends to nullify costly improvements made under direct authority of Congress throughout the Great Lakes, and a withdrawal of the amount now applied for would nullify such expenditures to the amount of many millions of dollars, as well as inflict an even greater loss upon the navigation interests using such waters.
>
> On the other hand, the demand for the diversion of this water at Chicago is based solely upon the needs of that city for sanitation. There is evolved in this case no issue of conflicting claims of navigation. The Chief of Engineers reports that so far as the interests of navigation alone are concerned, even if we should eventually construct a deep waterway from the Great Lakes to the Mississippi over the route of the sanitary canal, the maximum amount of water to be diverted from Lake Michigan need actually be not over 1000 ft. per sec., or less than a quarter of the amount already being used for sanitary purposes in the canal. This estimate is confirmed by the report of the special board of engineers on the deep waterway from Lockport, Ill., to the mouth of the Illinois River, dated Jan. 23, 1911. It is also confirmed by the practical experience of the great Manchester Ship Canal in England. From the standpoint of navigation alone in such a waterway too great a diversion of water would be a distinct injury rather than a benefit. It would increase the velocity of the current and increase the danger of overflow and damage to adjacent lands.

We have, therefore, presented in this case claims of entirely different characters and jurisdictions—the claim of sanitation on the one side and of navigation on the other; the vital interest of a single community on the one side and the broad interest of the commerce of the nation on the other.

The discretion given to the Secretary of War under Sec. 9 and 10 of the act of 1899 is very broad, but I have very grave doubts as to whether it was intended to authorize him to grant a permit which would inflict a substantial injury upon commerce in order to benefit sanitation. The entire purpose and scope of that legislation was to make him the guardian of the commercial interests of the nation represented in their waterways. And while he sometimes under that statute must decide that the interests of one class of transportation are less important and must yield to the conflicting interests of another class, I have considerable doubt whether it was intended to give him authority to sacrifice substantial interests of navigation to entirely different claims over which he normally has no jurisdiction whatever.

But however that may be, and without resting my decision upon the question of my legal authority, I am quite clear as a matter of discretion that under the facts presented by this case no further diversion of water should be permitted at Chicago without the direct sanction of the Congress of the United States. I do not for one moment minimize the importance of preserving the health of the great city of Chicago; but when a method of doing this is proposed, which will materially injure a most important class of the commerce of the nation and which will also seriously affect the interests of a foreign power, it should not be done without the deliberate consideration and authority of the representatives of the entire nation. The growth of Chicago is phenomenal and its representatives are quite unwilling to put any final limit to the demand which may be made upon the waters of Lake Michigan for its sanitation under the system now in use. I have before me the report in 1911 of the president of the sanitary district, in which he says:

> I am of the opinion that the presumption that our water-supply is to be limited to 10,000 cu.ft. per sec., or 600,000 cut.ft. per min., is gratuitous and mischievous and should not be voiced by the officials of this district. I believe that we should have the volume requisite to our needs as they appear and are justified.

It is therefore quite conceivable that compliance with their sanitary needs according to this method of sanitation may eventually materially change this great natural watercourse now existing through the Lakes. The weighing of the sanitation and possibly the health of one locality over against the commerce of the rest of the nation and the consideration of our relations and obligations to Canada in respect to a great international waterway are not matters of mere technical or scientific deduction. They are broad questions of national policy. They are quite different in character, for example, from the question of fixing the proper location of a pierhead line or the height or width of a drawbridge over a navigable stream—fair samples of the class of questions which come to the Secretary of War for decision under the above-mentioned act of 1899. While the researches and opinions of experts in the respective fields are necessary and useful as an assistance toward reaching a fair and proper policy, the final determination of that policy should belong not to an administrative officer but rather to those bodies to whom we are accustomed to entrust the making of our laws and treaties.

In my view of the proper exercise of my discretion in this matter the foregoing considerations are sufficient for a decision of this case. Having reached the conclusion that the proposed diversion of the waters of Lake Michigan would substantially injure the interests of navigation on the Great Lakes, which it is my legal duty to protect, it would clearly follow that the present application should be denied.

I have carefully examined, however, the evidence which both sides have introduced bearing upon the sanitary needs of the city of Chicago, and my conclusion is in no way shaken. I am not persuaded that the amount of water applied for is necessary to a proper sanitation of the city of Chicago. The evidence indicates that at bottom the issue comes down to the question of cost. Other adequate systems of sewage disposal are possible and are in use throughout the world.

The problem that confronts Chicago is not different in kind, but simply larger and more pressing than that which confronts all of the other cities on the Great Lakes, in which nearly 3,000,000 people of this country are living. The urban population of those cities, like that of Chicago, is rapidly increasing, and a method of disposition of their sewage which will not injure the potable character of the water of the Lakes must sooner or later be found for them all. The

evidence before me satisfies me that it would be possible in one of several ways to at least so purify the sewage of Chicago as to require very much less water for its dilution than is now required by it in its unpurified condition.

A recent report of the engineer of the sanitary commission [meaning Drainage Canal?—Ed.] (Oct. 12, 1911) proposes eventually to use some such method, but proposes to postpone its installation for a number of years to come, relying upon the present more wasteful method in the meanwhile. It is manifest that so long as the city is permitted to increase the amount of water which it may take from the Lakes, there will be a very strong temptation placed upon it to postpone a more scientific and possibly more expensive method of disposing of its sewage.

This is particularly true in view of the fact that by so doing it may still further diminish its expenses by utilizing the water diverted from the Lakes for water power at Lockport, Ill. But it must be remembered that for every unit of horsepower realized by this water at Lockport four units of similar horsepower would be produced at Niagara, where the natural conditions are so much more favorable. Without, therefore, going more into detail in a discussion of this question, I feel clear that no such case of necessity has been presented by the evidence before me as would justify the proposed injury to the many varied interests in the great waterways of our lakes and their appurtenant rivers.

It remains only to consider certain special arguments that have been pressed upon me. It has been urged that the levels of the lakes, even if lowered, could be restored by compensating works. To a certain extent that is true. But the very nature of this consideration offers another illustration of the importance of having the whole question passed upon by Congress. Such compensating works can only be constructed by the authority of Congress and at very considerable cost. It is not a matter which is in the hands of the Secretary of War. Permission to divert water which will at one and the same time nullify the effect of past appropriations and make necessary similar expenditures in the future, should be granted only with the express consent of the body in whose hands the making of such appropriations and the authorization of such works rest.

Furthermore, in most cases such compensating works could only be constructed with the joint consent of our neighbor Canada. The United States Government alone would be unable, even if it were willing to spend its own funds, to compensate for the damage done through the lowering of these levels unless Canada were willing to join in constructing the portion of such works which would necessarily stand upon Canadian soil.

The question, therefore, becomes not merely national, but international, and this leads me to the consideration of the arguments which were urged by both sides in reference to the treaty with Great Britain in respect to Canada of Jan. 11, 1909. A careful consideration of that treaty fails to indicate to me that it is in any way controlling upon the questions now before me. It gives to the citizens of both countries certain mutual rights of navigation in the waters of the Great Lakes and their connecting rivers; but beyond that the question of the right to this diversion at Chicago seems to me to have been carefully excluded. The applicants for the permit have urged upon me that Art. 8 of the treaty gives a preference to the uses of water of the lakes for domestic and sanitary purposes over the uses of such water for navigation. Art. 8, however, applies only to future cases brought before the International Joint Commission; and furthermore I am clearly of the opinion that the domestic and sanitary purposes referred to in that article were intended to be the "ordinary" uses of such waters for domestic and sanitary purposes referred to in Art. 3. It would be quite contrary to our own national policy to give such a preference to an extraordinary sanitary use of such a character as to create a substantial injury to navigation.

The matter has been before our own Supreme Court in the case of the United States vs. the Rio Grande Dam & Irrigation Co. (174 U. S., 690). In that case the Supreme Court held that a company which proposed to take the water of the Rio Grande River for the purpose, among others, "of supplying water to cities and towns for domestic and municipal purposes" could be prevented from so doing when the result would be a substantial injury to the navigability of the Rio Grande River farther down. In its opinion the court said:

> The question always is one of fact, whether such appropriation substantially interferes with the navigable capacity within the limits where navigation is a recognized fact. In the course of the argument this suggestion was made, and it seems to us not unworthy of note, as illustrating this thought. The Hudson River runs within the limits of the State of New York. It is a navigable stream and a part of the navigable waters of the United States, so far at least as from Albany southward. One of the streams which flows into it and contributes to the volume of its waters is the Croton River, a non-navigable stream. Its waters are taken by the State of New York for domestic uses in the city of New York. Unquestionably the State of New York has a right to appropriate its water, and the United States may not question such appropriation, unless thereby the navigability of the Hudson be disturbed. On the other hand, if the State of New York should, even at a place above the limits of navigability, by appropriation for any domestic purposes, diminish the volume of waters, which, flowing into the Hudson, make it a navigable stream, to such an extent as to destroy its navigability, undoubtedly the jurisdiction of the National Government would arise and its power to restrain such appropriation be unquestioned; and within the purview of this section (act of Sept. 19, 1890, ch. 907) it would become the right of the Attorney General to institute proceedings to restrain such appropriation.

The treaty, however, contains provisions in its Art. 10 by which "any questions or matters of difference arising between the high contracting parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada, either in relation to each other or to their respective inhabitants, may be referred for decision" to an international joint commission established by the said treaty. The hearing before me brought forth the fact that the Government of Canada regards the proposal contained in this application as one which affects the material interests of that country. The establishment by formal treaty between the two countries of a tribunal with jurisdiction to decide just such questions seems to me to afford an additional reason against the assumption of jurisdiction to decide the question by an administrative officer of one of those countries.

In short, after a careful consideration of all the facts presented, I have reached the following conclusions:

(1) That the diversion of 10,000 cu.ft. per sec. from Lake Michigan, as applied for in this petition, would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers.

(2) That that being so, it would not be appropriate for me, without express congressional sanction, to permit such a diversion, however clearly demanded by the local interests of the sanitation of Chicago.

(3) That on the facts here presented no such case of local permanent necessity is made evident.

(4) That the provisions of the Canadian treaty for a settlement by joint commission of "questions or matters of difference" between the United States and Canada offer a further reason why no administrative officer should authorize a further diversion of water, manifestly so injurious to Canada, against Canadian protest.

The prayer of the petition is therefore denied.

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The Use of Steam Turbine Driven Centrifugal Pump Units to carry the peak of the load in water-works pumping stations is exemplified in the new water-works of Youngstown, Ohio. We are informed that contracts were let on Dec. 14 for two 7,500,000-gal. pumping units for the new pumping station at Youngstown. One contract was for a triple-expansion reciprocating pump, let to the William Tod Co., of Youngstown, at a price of $72,110, for a pump with a guaranteed duty of 163,000,000 ft.-lb. A contract was also let to the Kerr Turbine, with a guaranteed duty for the unit of 80,000,000 ft.-lb. The contract price for this unit was $9989.

The Gatun Dam Sluice Gates—The first of the sluice gates for the spillway at Gatun Dam was placed in position on Dec. 12, and two others were placed on the following day.

These gates weigh 44 tons each, with seals and bearings attached. They are built up of structural steel and are 47 ft. 10¼ in. in length and 19 ft. high. They fit into steel-lined grooves in concrete piers, and only ⅛ in. play is allowed in each groove. On account of this small margin, the size of the gates, and the nicety required in their construction, it was thought that there might be difficulty in dropping them into place without removing the end rollers, rocker bearings, and the sealing devices. But no difficulty was experienced, although it developed that the play in one of the grooves was only ⅛ in.

Fourteen gates are required for Gatun Spillway, and they have already been erected at a point a little north of the Division Office, a distance by rail of about one mile and a half from the spillway. They are carried from the erecting grounds to the spillway on a single flat car, upon which they are loaded upright by two locomotive cranes In the construction of the piers between which the gates operate, a high trestle was built, and upon this the cars containing the gates were pushed out over the weirs which they close The cranes then lifted them from the cars, and lowered them slowly while men steered them into the grooves. The first gate was placed in about an hour, and the second and third in a few minutes each.—"Canal Record," Dec. 18.

NOTES FROM THE ENGINEERING SCHOOLS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY—A fund of 15,000, to be known as the "Ellen H. Richards Fund for Sanitary Research," has been raised by friends of Mrs. Richards. It is hoped to increase the fund from time to time; the income is to be used for fellowships to advanced students who shall be competent to pursue sanitary research, for the employment of research assistants, or in such other ways as may best promote the cause of the chemistry of sanitation. Mrs. Richards was a graduate of this institution, and instructor in sanitary chemistry from 1884 up to her death in 1911.

COLORADO AGRICULTURAL COLLEGE—A new hydraulic laboratory is being constructed jointly by the experiment station of this institution and the U. S. Office of Experiment Stations, Department of Agriculture. It is believed by the designers that the present methods of estimating the flow along streams or ditches are based on data which are not wholly applicable to present-day conditions in irrigation work, and the function of this laboratory will particularly be to show the proper corrections of older data.

This laboratory, it is reported, will cost $10,000. There is to be, first, a large main reservoir of concrete, with a capacity of ½ acre-ft. of water. The release from this reservoir is through a large headgate on one side and the flow is through a flume to the testing tanks. There are several of the latter in order to facilitate the experiments. The contents of these tanks have been measured carefully so that the exact capacity of each may be accurately known. The results of experiments may be published by either state or federal authorities.

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The Tank Steamer "Rosecrans" Went on the Rocks of Peacock Spit at the mouth of the Columbia River, near Astoria, Ore., on Jan. 7, and was lost with 33 of her crew.

The Bursting of a Compressed-air Pipe at the Brooklyn end of the Manhattan Bridge, New York City, on Jan. 7, precipitated two workmen from a scaffold to the street, 40 ft. below, causing them serious injury. The injured were members of a gang of painters, who were working on the pipe line at the time of the accident.

The Collapse of Two Buildings, at Rome, Italy, on Jan. 8, caused the death of 10 people and the injury of as many more. It is stated in press dispatches that the foundations of the National Industrial Museum were weakened by excavation work nearby, and when this structure collapsed it carried down with it an adjoining apartment house.

An Explosion in the New York Subway Extension, at 103d St. and Lexington Ave., New York City, on Jan. 9, killed one and injured four of the tunnel workers. A blast missed fire when it was attempted to set it off with the battery and then exploded shortly afterward when the men went near to find why the charge did not go off.

The Steamer "Uranium" Ran Aground at the entrance to Halifax harbor, Nova Scotia, on Jan. 12, during a thick fog, and three hours later transferred her passengers, to the number of 839, to rescue steamers sent to her aid. The vessel struck on a sloping shore with her bow on the rocks and her stern in deep water. She was making her first trip as the pioneer ship of a new transatlantic line.

A High Flood, in the Ohio River, did damage amounting to a million dollars last week, at Pittsburgh, the water there reaching a stage of 31.3 ft., the fourth highest on record. The U. S. Weather Bureau, on Jan. 12, reported conditions as follows:

The crest of the principal flood in the Ohio River is between Cincinnati and Louisville. As a result of continued rains for 18 hours, the second rainy period within a week, the river is again in flood in its upper reaches, but the second flood wave will not be so severe as the first one was.

A stage of 62 or 63 ft. is indicated for Cincinnati on Tuesday, and on the same day it is expected that the flood stage at Paducah, Ky., 43 ft. will be reached. The flood stage at Cairo, Ill., 45 ft., is indicated for Wednesday.

Panama Canal Excavation during December totaled 2,815,816 cu.yd., a daily average of 122,632 cu.yd. for each of the 25 working days. Rainfall for the month was 6.51 in. The amount of concrete laid in December was 62,907 cu.yd. and 196,426 cu.yd. of fill were placed in dams.

St. Paul's Cathedral, in London, is in danger of undermining from a projected new subway and station, according to a report by Sir Francis Fox, the eminent British engineer, made to the Dean and Chapter of St. Paul's, on Dec. 30, 1912. After describing his examination of the edifice, Sir Francis says: "The Cathedral is overloaded; it is actually moving and cracking, and now a proposal is brought forward, which can in no way contribute to its safety, but may at no distant date, bring about serious injury. I am of the opinion that this covered way and station should on no account be permitted in such close proximity to the Cathedral."

The London County Council must now decide if the work will be continued in the face of such advice.

The Guyandot River Bridge Wreck, near Huntington, W. Va., on Jan. 1, 1913, is covered by an account in the "Railway Age Gazette," of Jan. 10, credited to an officer of the Chesapeake & Ohio Ry. According to this, three 150-ft. iron single-track spans were being replaced by double-track steel spans, and work was in progress on the middle one. The floor of this span was supported on pile falsework, the old trusses having been taken down and the new trusses not yet erected. The river was 8 ft. above low-water, and the current swifter than at any time since the piles had been driven. Rock is about 20 ft. below low water, and the piles went to rock through overlying sand. There had been no settlement prior to the accident. The train before the wrecked one, an hour earlier, passed over without indications that anything was wrong, although the bridge gang watched for signs of settlement. The next train, a westbound freight, moving slowly across the bridge, was wrecked by settlement of the upstream side of the falsework; the engine and one car turned over and fell into the river, carrying down the falsework. The engineman of the train and six bridgemen were killed. The division supervisor of bridges and buildings had examined the bridge before the wrecked freight crossed, and pronounced it safe. Undermining of the piles is supposed to have caused the accident. Timber is floated down the Guyandot, and some logs may have lodged against the bottoms of the piles and caused scour.

Three Transatlantic Liners Went Aground in New York Harbor during the week just past, owing to the difficulty of navigating in the prevalent heavy fogs. On Jan. 4 the Hamburg-American liner "Amerika" out-bound, ran aground on the eastern edge of the channel off Bay Ridge, in Brooklyn. On Jan. 7, the White Star steamer "Adriatic," also outbound, attempted to anchor near Bedlow's Island to wait for the fog to disperse, but could not find anchorage and drifted aground just south of Governor's Island, off Van Brunt St., Brooklyn. On Jan. 9 the Red Star steamship "Kroonland" went aground on the edge of the Ambrose Channel somewhat farther out of the harbor than the other two. All of the ships were able to get away at high tide and proceeded on their voyages.

Electric Traction on 450 miles of main-line track of the Chicago, Milwaukee & Puget Sound R.R. or between Harlowtown, Mont., and Avery, Idaho, is contemplated according to reports (unofficial) from the U. S. Department of the Interior. It appears that a 50-year grant has been made to the Great Falls Power Co., of Montana, to transmit power over the public domain. The company already has its transmission line built, under a termless revocable permit, serving mines at Butte and Anaconda, and all classes of power consumers, but the railroad company is reported unwilling to have proceeded with its work under the older permit. The rental charge for the right-of-way during the first ten years will be five mills per 1000 kw.-hr.

This power company also supplies the Butte, Anaconda & Pacific Ry., which operates about 30 miles of single-track line with a 2400-volt direct-current line. (See Eng. News, Aug. 15, 1912). As 16 miles of this road is jointly operated with the C. M. & P. S. R.R., it is possible that the entire system of the latter may be similar—though that fact has not been announced.

A Derailment on the Chicago Elevated Loop, in the business district of Chicago, which forms the terminal for all the elevated railway lines, occurred on Jan. 8, and resulted

in a car falling from the structure. A three-car train of the Chicago & Oak Park Elevated R.R., had just turned the right-angle curve from Van Buren St. to Fifth Ave. (going north on Fifth Ave.) when the rear car left the rails and after bumping over the ties for a short distance it fell from the structure into the street.

The accident occurred in the early morning when traffic was light. Only two passengers were in the rear car and when this was derailed they had time to run forward to the next car before the other fell. The forward truck of the derailed car remained upon the structure. It has been suggested that as this was a light trail car (without motors) it might have been subjected to exceptional shock and vibration in rounding the curve at high speed. This is the more likely for the reason that the curve is intersected by another curve in the opposite direction, this being a junction of two lines at right angles, so that the angle of the crossing frogs is very flat. The guard timbers are extended as nearly to the intersection as possible, and the damage to them begins just beyond the frog, indicating that the truck was derailed at the crossing-frog and jumped the guard-timber while still on the curve, the wheels being in such position that the guard could not guide them into position. On the tangent the guard timbers were torn and splintered, and the ends of some of the ties broken off by the car in falling over.

There has been some complaint in the past at the speed at which trains frequently pass these sharp curves on the four corners of the loop. These curves are of 90- and 95-ft. radius. At two of the corners there are junctions with grade crossings on the curves, and as no superelevation can be introduced the motion is felt very distinctly by the passengers in the trains. These grade crossings, also, with their flat-angled crossing frogs, make very rough-riding track and cause considerable noise and jar in the trains. The speed is supposed to be limited to 8 m. p. h., but it is suggested that this should be reduced to 6 m. p. h. As every train passes all these corners (there being no through routes) the wear on the track is very severe, and the opportunities for maintenance and renewal work are limited. The city has ordered an investigation as to the cause of the accident, including the condition of both the track and the rolling stock.

Possible Danger to the Water-Supply of New York City is given as a reason for the denial of an application to locate a tuberculosis hospital for Westchester County in the Croton drainage area. The application was denied by the State Department of Health after two hearings, at which a number of sanitary engineers and others appeared both for and against the location. The hospital was to have been placed on a farm of 277 acres, through which flowed two brooks, which empty into the Croton Reservoir. Commenting on the denial of the application, it is stated in the monthly bulletin of the New York State Department of Health for Nov. 12, that:

> While undoubtedly it would be possible to dispose of the sewage from an institution of this kind so that it would not be a menace to the water-supply, this involves expert and efficient management. Having in mind the effect of political control over the management of such institutions, the Commissioner held that there can be no positive assurance that the sewage-disposal plant would always be operated so that no contamination of the New York water-supply would result, and therefore he was unable to assume the responsibility of approving the site in question. Other sites are available where these dangers do not exist, and the Commissioner felt obliged to deny the application of the Board of Supervisors.

PERSONALS

Mr. Charles H. Baldwin, Manager of the National Meter Co., Boston, Mass., has been elected President of the Franklin Savings Bank of Boston.

Mr. A. D. Furlong, General Superintendent and Electrical Engineer of the Springfield (Ill.) Consolidated Ry., has been appointed General Manager.

Mr. Lloyd B. Jones has been appointed Assistant Engineer of Motive Power of the Pennsylvania R.R. Lines West of Pittsburgh, with headquarters at Toledo, Ohio.

Mr. C. W. Akers, Trainmaster of the Seaboard Air Line Ry., at Plant City, Fla., has been appointed Superintendent of the Norfolk Southern R.R., at New Bern, N. C.

Messrs. Christopher H. Bierbaum and William M. Dollar, Ms. Am. Soc. M. E., announce the formation of Bierbaum-Dollar, Inc., with offices at 1142 Prudential Bldg., Buffalo, N. Y.

Mr. J. Bruce Ismay, President of the International Mercantile Marine Co., which controls the White Star Line, owners of the ill-fated "Titanic," has resigned, effective June 30.

Mr. Herman Hall, Division Engineer of the Louisiana Southern Ry., has been promoted to be General Superintendent, at New Orleans, La., succeeding Mr. W. H. De France, resigned.

Mr. A. L. Grandy has been appointed Chief Engineer of the Perre Marquette R.R., with headquarters at Detroit, Mich. Mr. Grandy was formerly Division Engineer at Saginaw, Mich.

Mr. R. C. Harris, Division Engineer of the Pennsylvania R.R. Lines West of Pittsburgh, at Akron, Ohio, has been promoted to be Supervising Engineer, attached to the staff of the General Superintendent at Columbus, Ohio.

Mr. G. C. Wilhelmi has announced the dissolution of the partnership of Wilhelmi & Smith, Cleveland, Ohio. Mr. Wilhelmi has opened an office at 810 Columbia Bldg., Cleveland, as a contractor and builder of engineering structures.

Mr. L. J. Ferritor, formerly Division Superintendent of the Chicago & Alton R.R., at Bloomington, Ill., has been appointed Superintendent of the Scranton division of the Delaware, Lackawanna & Western R.R., at Scranton, Penn.

Mr. J. J. McCullough, recently Inspector of Terminals of the Northern Pacific Ry., St. Paul, Minn., has been promoted to be Superintendent of the Puget Sound division, which includes the terminals at both Seattle and Tacoma, Wash.

Mr. C. S. Sheldon, Assoc. M. Am. Soc. C. E., recently First Assistant Engineer of the Cincinnati, Hamilton & Dayton Ry., Cincinnati, Ohio, has been appointed Engineer of Bridges and Structures of the Pere Marquette R.R., with headquarters at Detroit, Mich.

Mr. M. J. Kennelly, recently Division Superintendent of the Chicago, Rock Island & Pacific Ry., has been appointed General Manager of the Kansas City, Mexico & Orient Ry., succeeding Mr. Edward Dickinson. His headquarters will be at Kansas City, Mo.

Dr. Henry M. Payne, formerly Professor of mining engineering at the West Virginia University, and recently Mining and Metallurgical Expert with Stephen T. Williams & Staff, Inc., 50 Church St., New York City, has been appointed Chief of Staff of the company.

Mr. Harry A. Hyman has become associated with Mr. Marshall W. Brown, Assoc. Am. Soc. C. E., as Manager of the Waterproofing & Construction Co., 35 Wall St., New York City. Mr. Brown will continue his private practice as a consulting construction engineer.

Mr. John H. O'Neil, formerly connected with the American Museum of Natural History, New York City, and a graduate in sanitary engineering of the Massachusetts Institute of Technology, has been appointed Sanitary Engineer of the Louisiana State Board of Health.

Mr. H. E. Newcomet, Division Engineer of the Cleveland & Pittsburgh division of the Pennsylvania R.R. Lines West of Pittsburgh, at Cleveland, Ohio, has been appointed Superintendent of the Louisville division, with office at Louisville, Ky., succeeding Mr. F. J. Kron, promoted.

Mr. F. D. Batchellor, Division Engineer of Maintenance-of-Way, of the Baltimore & Ohio Southwestern Ry., at Seymour, Ind., has been promoted to be Assistant to the General Superintendent of the Baltimore & Ohio Southwestern and the Cincinnati, Hamilton & Dayton Rys., at Cincinnati, Ohio.

Mr. J. W. Eber, M. Am. Soc. C. E., has been promoted from the position of General Superintendent to that of General Manager of the Toronto, Hamilton & Buffalo Ry., at Hamilton, Ont. Mr. Eber was formerly Division Engineer and Division Superintendent of the New York Central & Hudson River R.R.

Mr. Franklin K. Lane, of California, a member of the Interstate Commerce Commission since 1905, has been elected by the commission, Chairman, for a term of one year. Mr. Lane is a Canadian by birth and a lawyer by profession. From 1897 to 1902, he was corporation counsel for the city of San Francisco, Calif.

Mr. A. Hussey, Assoc. Am. Inst. E. E., Supervisor of Transmission, in charge of the construction and maintenance of all the transmission facilities of the electric zone of the New York Central & Hudson River R.R., has resigned to become Acting Superintendent of Distribution of the Edison Electric Illuminating Co., of Brooklyn, N. Y.

Mr. H. A. Cassil, Division Engineer of the Cincinnati, Hamilton & Dayton Ry., at Indianapolis, Ind., has been appointed Division Engineer of the Baltimore & Ohio Southwestern Ry., at Seymour, Ind., succeeding Mr. F. D. Batchellor, promoted as noted elsewhere. Mr. H. F. Passel, Division Engineer of the Cincinnati, Hamilton & Dayton Ry., at Dayton, Ohio, succeeds Mr. Cassil at Indianapolis.

Mr. C. M. Garland, Assoc. Am. Soc. M. E., recently Engineer in charge of the gas-producer department of the Camden Iron Works, Camden, N. J., has become associated with the firm of Woodmansee, Davidson & Sessions, Consulting Engineers, First National Bank Bldg., Chicago, Ill. In addition to its present line of work the firm will take up consultation work in the design and operation of gas-plant and gas-power installations.

Mr. E. G. Connette, Assoc. Am. Inst. E. E., former Transportation Engineer of the Public Service Commission of the First District of New York, and recently Vice-President of the International Traction Co., Buffalo, N. Y., has been elected President of the International Railway Co., of Buffalo, succeeding Mr. Thomas Penny, resigned. Mr. Connette was formerly General Manager of the Worcester (Mass.) Consolidated Street Railway Co.

Mr. Charles H. Ewing, whose appointment as General Superintendent of the Philadelphia & Reading Ry., was noted in our issue of Jan. 2, began his railway career in the engineering department of this railway as a rodman in 1883. He was Chief Engineer of the Central New England R.R., now a part of the New York, New Haven & Hartford R.R., from 1894 to 1902. Afterward he was Division Engineer and Engineer of Maintenance-of-Way of the Philadelphia & Reading Ry.

Mr. Gano Dunn, F. Am. Inst. E. E., who has been Vice-President of J. G. White & Co., New York City, in charge of the engineering department, has been elected President of the J. G. White Engineering Corporation, a subsidiary of J. G. White & Co., Inc., which will handle the engineering and construction work. The operating department of J. G. White & Co. will be known as the J. G. White Management Corporation. Mr. J. G. White, M. Am. Soc. C. E., remains the President of the parent company.

Mr. Seely Dunn has been appointed Division Engineer of the United Fruit Co., with headquarters at New Orleans, La. Mr. Dunn's railway experience began in 1884 with the Louisville & Nashville R.R., as a stenographer. After passing through the several grades in the operating department to that of Division Superintendent, he became Vice-President and General Manager of several projected railway lines. His new position will consist chiefly of directing the improvements in the United Fruit Co.'s railway lines in Central American countries.

Mr. R. S. Parsons, M. Am. Soc. C. E., Superintendent of the New York division of the Erie R.R., at Jersey City, N. J., has been promoted to be Assistant General Manager of the lines east of Buffalo and Salamanca, with headquarters in New York City. Mr. Parsons graduated from Rutgers' College, in 1895, and has since been in service of the Erie R.R. He served in various positions in the engineering department, and for four years, 1901-1905, he was Engineer of Maintenance-of-Way. He has been Superintendent in the operating department since 1905.

Mr. C. S. Sergeant, Vice-President of the Boston Elevated Ry. Co., who has been chief of the bureau of operation of the company, has been made chief of the bureau of elevated and subway construction, succeeding the late George A. Kimball, M. Am. Soc. C. E. The Second Vice-President, Mr. Matthew C. Brush, has been made head of the department of transportation, power, inspection and employment; and Mr. C. Hile has become head of the department of maintenance, which includes mechanical and electrical engineering, maintenance of way, rolling stock, shops, wires and conduits, buildings and stores.

Mr. A. M. Schoyer, General Superintendent of the Northwestern system of the Pennsylvania R.R. Lines West of Pittsburgh, at Pittsburgh, Penn., has been promoted to be General Manager of the Vandalia R.R., at St. Louis, Mo., succeeding Mr. Benjamin McKeen, M. Am. Soc. C. E., promoted, as noted in our issue of last week. Mr. Schoyer entered the service of the Pennsylvania R.R., in 1872, at the age of 13 years as a messenger boy. He rose through the grades of telegraph operator, chief operator, train dispatcher, chief train dispatcher, to Superintendent of Telegraph of the Lines West of Pittsburgh, in 1892. In 1899, he became Superintendent of the Eastern division at Allegheny, Penn., and since 1902, he has been General Superintendent of the Northwest system.

OBITUARY

Samuel Barclay Charters, Jr., Assoc. Am. Inst. E. E., Assistant Professor of electrical engineering at Leland Stanford, Jr., University, in California, died at the home of his father in Pittsburgh, Penn., Dec. 29. A widow and young son survive him.

Eben Smith Wheeler, M. Am. Soc. C. E., United States Assistant Engineer at Detroit, Mich., died at his home in that city, Jan. 5. He was born in Wayne County, Penn., Aug. 27, 1839. He graduated in civil engineering at the University of Michigan in 1867. He at once entered the engineering service of the government and spent his entire lifetime as a civil engineer assistant to officers of the Corps of Engineers of the United States Army. His principal work was in connection with the Sault Ste. Marie Canal construction and as Chief Engineer of the Nicaragua Canal Commission of 1887. Mr. Wheeler was also connected for many years with the surveys of the Great Lakes.

ENGINEERING SOCIETIES

COMING MEETINGS

KANSAS ENGINEERING SOCIETY.
Jan. 21-22. Annual meeting at Topeka, Kansas. Secy., T. J. Strickler, Topeka, Kansas.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 21-23. Annual convention at Chicago, Ill. Secy., F. J. Angier, B. & O. R.R., Baltimore, Md.

OHIO ENGINEERING SOCIETY.
Jan, 21-23. Annual meeting at Columbus, O. Secy., C. J. Knisely, New Philadelphia, Ohio.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 21-23. Annual meeting at New York City. Secy., W. W. Macon, 29 West 39th St., New York.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 22-24. Annual meeting at Chicago, Ill. Secy. E. E. R. Tratman, 1144 Monadnock Block, Chicago, Ill.

INDIANA ENGINEERING SOCIETY.
Jan. 23-25. Annual meeting at Indianapolis, Ind. Secy., Charles Brossmann, Union Trust Building, Indianapolis, Ind.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 23-25. Annual meeting at Washington, D. C. Secy., T. R. Maul, 4213 Westminster Ave., Philadelphia, Penn

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28-30. Annual meeting at Montreal, Que. Secy., C. H. McLeod, 413 Dorchester St., West, Montreal.

NORTH DAKOTA SOCIETY OF ENGINEERS.
Feb. 13-14. Annual meeting at Bismarck, N. D. Secy., E. F. Chandler, University, N. D.

Central Railway Club—The following officers for 1913 were elected at the annual meeting of the club, on Jan. 9: President, W. F. Jones; Vice-Presidents, W. Elmer, H. C. Manchester, E. J. Devans; Executive Members, E. M. Tewkesbury, G. A. Bowman, E. P. Mooney. H. D. Vought was reappointed Secretary-Treasurer.

Western Society of Engineers—The society held its annual meeting, at Chicago, Jan. 8 and 9. At the annual dinner, held Jan. 8, at the Sherman Hotel, the principal addresses were by D. Emory R. Johnson (University of Pennsylvania) on "The Commercial Phases of the Panama Canal," and Charles H. Wacker, on "The Chicago Plan Commission." On Jan. 8, there was an excursion to the new Northwest power station of the Commonwealth Edison Co., where two vertical turbo-generator sets of 20,000 kw. each are now in operation, while the station is planned for a total development of 240,000 kw. A special train on the C. & N. W. Ry. was run up to the junction with the company's elevated third-rail railway, and was then hauled over this line to the power station by an electric locomotive. It is said that this was the first electrically hauled steam-railway train operated in Chicago. On Jan. 9, there was an excursion by the C. & A. R.R. to the plant of the Corn Products Refining Co., at Argo, 13 miles from Chicago. In the evening there was an informal meeting and entertainment at the Society's rooms. The officers for 1913 are as follows: President, Albert Reichmann (American Bridge Co.); Vice-Presidents, A. Bement, B. E. Grant and John F. Hayford; Treasurer, C. R. Dart; Secretary, J. H. Warder.

For the meetings on Jan. 20 and Jan. 27, the papers announced are "Concrete Roadways," by E. N. Hines (Detroit), and "The Regulation and Enforcement of Public Utility Laws," by Alfred Erleson (Wisconsin Railway Commission).

ENGINEERING LITERATURE

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EDITORIAL

An Engineer in "Fine Feathers"

Mr. Eugene Walter, we believe, has achieved considerable fame and no little lucre as a delineator of some of those phases of modern life which permit of dramatic presentation, and, as his characters and his episodes are taken from life, in the course of time it was to be expected that he would draw upon that field in which it is our pleasure and privilege to labor. From the current dramatic news we note that that time has arrived, and that the failure of a concrete dam with its attendant human frailties has been dramatized. So, although dramatic criticism is not precisely our metier, we consider a proper retaliation permissible.

The play referred to is entitled "Fine Feathers." It depicts through four acts the vicissitudes of an inspecting engineer (called a "chemist" in the play—and working for $25 per week), who, on account of the importunities of a luxury-loving wife, allows himself to be bribed into accepting for a huge dam an inferior cement, which will not pass the specifications. The tainted money only brings unhappiness, and in the end the dam fails, many people are killed, and the unfortunate man commits suicide.

The morals of the play are unimpeachable, but we do object to the crucial incident upon which the play is based. As realism is Mr. Walter's forte, we could wish that he had carried it to a legitimate limit. Passing over the obvious fact that $25 a week chemists do not have the say as to what cement shall be used on a large work—and it was a large work, a very large work, for the bribing contractor saved $200,000 by the use of the inferior cement—we present for our engineering readers the following analysis of the specious reasoning that convinced the reluctant hero to his fall. "Ordinary cement," argues his tempter, in effect "will easily last a hundred years. Such public works as this dam are rarely allowed to stand for twenty-five. Obviously, it is a great waste of money and a mistake of the supervising engineer to demand this expensive material for a structure that will be torn down before it is worn out. My cheaper cement will certainly last this quarter century. Let it through and it will be worth $40,000 to you." And this "chemist" is supposed to be a man of fundamental honesty who needed some potent argument to dissuade him from the straight path.

We wish Mr. Walter would forward us at once for publication the methods of tests or observations by which one can tell that one cement will form a concrete that disappears in 25 years, and that another will be good for a century.

After all, it is of small consequence, since men and their motives are the true subject of the dramatist's art; he can juggle facts as his fancy directs. Stage realism is an artificial sort of thing at best, only it is so rarely that we may wander in this particular field of criticism that we cannot let the opportunity pass.

REVIEWS

Roof Design and Construction

Reviewed by A. W. CARPENTER*

A TREATISE ON THE DESIGN AND CONSTRUCTION OF ROOFS—By N. Clifford Ricker, B. S., M. Arch., D. Arch.; Professor of Architecture, University of Illinois; President, Illinois Board of Examiners of Architects. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9¼ in.; pp. xiii + 419; 644 text figures. $5, net (21 -, net).

According to the reviewer's interpretation of the author's preface, this book is intended primarily for the use of architectural students in preparing themselves for examination for license to practice. It covers the usual design of roofs, including definitions of parts, loads, methods of determining stresses and the determination of stresses in about all the known forms of roofs, proportioning of sections, calculation of dimensions, detailing and determination of weight.

Twenty-four examples of stresses in different forms of trusses and arches are worked out by graphic statics. These include the ordinary triangular forms, mansard, crescent and cantilever trusses, three-hinged arches and combination trusses and arches. In one chapter, 70 typical forms of roof trusses with accompanying stress diagrams are shown. While graphostatics is the method principally employed for the determination of stresses, the method of moments is also explained.

A chapter is devoted to the determination of the apex lengths of truss members, and another to the stability of walls and pressure on foundations. Axial stresses and shear are explained, but not the theory of bending and of resistances to bending in beams. Formulas for the strength and stiffness of beams are given. The formulas based on the maximum allowable deflection are unusual and commendable. The ton is employed as the unit of weight, which the

*Engineer of Structures, New York Central & Hudson River R.R., New York City.

author thinks renders the application of the formulas briefer and simpler.

Tables for proportioning members are provided. These are based on the working strength of different forms at usual uniform values per square inch of section. They cover the usual members, such as rods, channels and angles in pairs, latticed channels, wooden posts, rivets and pins. These tables make it possible to dispense with much of the customary reference to the hand-books of steel mills, but such reference is still required for the bending properties of steel shapes. A wooden roof and several types of steel roofs are worked out in detail for the dimensions of members, the details of joints and connections and the weights.

The reviewer would commend the book for the treatment of graphostatics; the multitude of examples and of types thus treated; the advocating of less severe conditions than the combining of maximum wind and snow-load stresses; the consideration of the stability of walls against wind loads and the pressure on foundations due to such loads; the introduction of stiffness as a fundamental factor in proportioning beams; the general clear and complete treatment.

The reviewer would find fault with the following: The form of splices for timber advocated are the short halved-and-bolted splice for compression and the steel fishplate splice for tension; these are unquestionably good splices if properly made but the difficulties of workmanship are not stated and apparently are not appreciated. In the formulas for proportioning the tension splices, no account of the bending in bolts is taken—a very serious omission. The use of single angles for the truss members is pronounced bad practice, and the use of such members is carefully excluded from all the examples. While admitting the preference of double angles for members, the reviewer believes their use may be extravagant where single angles provide sufficient or excess strength. Since such members have been successfully employed in railroad bridges they should not be barred from roof trusses. The analysis of stresses in the example of an octagonal hip roof with lantern seems to neglect the thrusts due to the hip rafters and the axial wind stresses. The chapter on lengths of truss members involves much repetition of exceedingly elementary work. In treating the pressure on foundation due to combined vertical and wind loads the point of application of the horizontal force is taken at the top of the foundation, whereas in treating the steel columns the point of application is taken half way to the knee brace connection. The examples of footings 1.5 to 2 ft. deep are impractical for cold climates where they should extend below frost and be more nearly double the depth mentioned. The reviewer never before heard of proportioning a beam for the maximum bending moment and then increasing the section to compensate for the portion of the web required to resist the shear, as is done in an example, and he cannot agree to the statement that longitudinal shear occurs only in wooden beams, and he does not understand why logarithm tables should be recommended for labor- and time-saving where a slide rule is obviously the practical tool. The longitudinal component described in inclined beams with vertical end supports does not exist for vertical loads within the span.

The book is essentially academic and largely elementary. the detail designs illustrated being painfully so. One trouble with the designs is the fanatical adherence to clip-angle additions to all angle connections which, together with the taboo on single-angle members, makes the trusses ugly and extravagant of material.

The tables of working strength of two-angle struts give different values according to the method of connection. For unequal-leg angles three sets of values are given, these being, respectively, for the cases of: (1) Narrow leg riveted, (2) wide leg riveted, (3) both legs riveted (clip-angle connections). The relative values assigned are in the proportions of about 40:60:95; that is, a double-angle strut with the wide legs of angles connected to the gusset would be allowed to carry $^{60}/_{40}$ as much load if clip-angles were added to connect the other legs. The reviewer believes these proportions entirely erroneous and to lead to unnecessary expense. On the other hand the author freely employs members as thin as $\frac{5}{8}$ in. It seems too bad that better and more consistent practice in proportioning and detailing is not presented in this book, which will no doubt form the guide for many young architects and engineers.

There are a multitude of minor errors of all kinds throughout the book.

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The new quarters of the Ohio State Board of Health are described and illustrated with the floor plans and halftones in the December "Bulletin" of the Board. Two floors of the Hartman Building, Columbus, Ohio, are used.

The Entropy Temperature Diagram

Reviewed by L. S. MARKS*

CALCULATIONS ON THE ENTROPY-TEMPERATURE CHART—By W. J. Crawford, D. Sc., Lecturer in Mechanical Engineering, The Municipal and Technical Institute, Belfast; author of "Graphic Statics." London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth; 5x8 in.; pp. viii + 74; 52 text illustrations.

The general character and scope of this book are sufficiently indicated in the following extracts from its preface:

My object in writing this little book is to show students who are not very well up in thermodynamics how to make use of the entropy-temperature chart. For this purpose I have treated the matter as simply as possible, and have not insisted on a first-rate knowledge of the principles underlying entropy as the indispensable outfit for the purpose in hand. * * * * *

It is much better to teach a student how to make calculations on the chart than to be eternally drilling him in the abstract mathmetical principles involved. * * *

My hope is that this little volume will be of use to those who would like to learn how to use the chart but who have never been able to find the information in a sufficiently simple form. Therefore, I have introduced a large number of examples, and have worked many of these out at length.

The author lives up to his promise, but proceeds further in his use of the entropy temperature diagram than is likely to be of any service to such students as those whom he has in mind. It is not easy to understand why the book is devoted exclusively to the entropy-temperature chart and fails to make any mention of the essentially similar, but much more useful entropy-total heat, or Mollier chart. Like so many English works of its class, it appears to be suggested by and aimed at the examinations of the British Board of Education.

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ENGINEERING AND METALLURGICAL BOOKS, 1907-1911—A Full Title Catalog, Arranged under Subject Headings, of All British and American Books on Engineering, Metallurgy and Allied Topics, Published During the Five Years 1907-1911, with Their English and American Prices and Publishers' Names. By R. A. Peddie, Author of "Metallurgical Bibliography, 1901-1906," "National Bibliographies," etc., and Joint Editor of "The English Catalogue of Books, 1801-1836." New York: D. Van Nostrand Co. Cloth; 5x7½ in.; pp. ix + 244. $1.50, net.

A bibliography of good engineering or of good metallurgical books, with brief but pithy descriptive and critical notes, would be a real boon to the earnest searcher for technical data and information. The book before us is far from being such a work. As the author states, this bibliography is a "full title catalog" only—based on publishers' statements. He further states that he has brought together "all the discoverable titles," including many books that the publishers "had failed to notify the public they had published." Our readers who are familiar with present and ever increasing flood of mediocre (and worse) technical books, on even the most minute subjects, may wish more of the list had been undiscoverable.

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GASOLINE ENGINES: THEIR OPERATION, USE AND CARE—A Comprehensive, Simple and Practical Work Treating of Gasoline Engines for Stationary, Marine or Vehicle Use. Containing also a Complete Table of Motor Troubles and Remedies and a Full Glossary of Technical Terms Used in Connection with Gasoline Engines. By A. Hyatt Verrill. New York: The Norman W. Henley Publishing Co. Cloth; 5x7½ in.; pp. 275; 152 text illustrations. $1.50.

The difference between 2-cycle and 4-cycle gasoline engines, as to structural features and operating characteristics, is brought out by the author in language which has evidently been made as simple and non-technical as possible in order to reach that large number of gasoline motor operators and repair-shop men whose knowledge of technical terms is limited. Such technical words as it was impossible to avoid using are explained in a glossary at the end of the book.

The feature of the book is a list of common gasoline motor troubles, causes and remedies, but a good deal of attention is paid to the subject of valve operation and to timing, cooling, and ignition systems and a number of practical suggestions for motor repair work are given.

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DIARY OF A ROUND-HOUSE FOREMAN. By T. S. Reilly, Late Associate Editor of "Railway Review." New York: The Norman W. Henley Publishing Co. Cloth; 5x7½ in.; pp. 158. $1.50.

The author has succeeded admirably well in telling the story of a young mechanical engineer's start in the railway service and the reasons for his subsequent success. Any engineer who has or expects to have an executive position

*Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

where he will be called upon to direct the work of laborers, skilled or unskilled, will find many useful hints and valuable suggestions. Aside from these, the "diary" is so entertaining that one may read it merely for pleasure and be well repaid.

❋

Translation of a German Work on Explosives

Reviewed by CLARENCE HALL*

EXPLOSIVES—A Synoptic and Critical Treatment of the Literature of the Subject as Gathered from Various Sources. By Dr. H. Brunswig. Translated and Annotated by Charles E. Munroe, Ph. D., LL.D., and Alton L. Kibler, M. S., Ph.D., George Washington University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5¼x8¼ in.; pp. xv + 350. $3. net.

The author treats of the literature of explosives as gathered from reliable sources and considers the application of physical chemistry to the technique of explosives. Many references are made to the experiments and scientific researches of Berthelot and Abel; also to the more recent investigations of van't Hoff, le Chatelier, Bichel, Sarran, Will, and Nernst.

The presentation of the detailed results of many experimental tests in connection with the conclusions drawn therefrom is in striking contrast to the procedure followed in the English literature of explosives in which the experimental proof is often omitted. As a whole the book may be considered a valuable contribution to the literature of explosives and a reliable book of reference. A few discrepancies are noted and certain statements made not in accordance with the facts. Fortunately the translators were thoroughly familiar with the subject at hand and the annotations made by them add materially to the value of the work.

The conditions governing explosive reactions are treated: (1) In respect to thermo-chemical laws; (2) the characteristic sensitiveness of different explosive systems; and (3) the initiation of the reaction by means of flame, impact, detonators, and the transmission of an impulse (influence).

It is stated in the discussion of Table 4 "Energy Content of an Explosive System Expressed as Heat of Explosion (Calories)" that the heats of explosion, as expressed for the technically important explosives, do not show the comparative worth of explosives in practice, but that the heats of explosion may be regarded as a measure of relative efficiency in the case of those explosives standing near each other in the table because their technical use is similar.

The reviewer takes exception to this statement because it has been shown in mining practice that the efficiency of even those explosives whose technical use is similar cannot be measured by the heats of explosion. As an example, the first two explosives given in the table show that explosive gelatin has a value of 4% more than nitroglycerin. This relation is not consistent with general practice. In shooting oil wells or in other similar work explosive gelatin has not been found as efficient or as economical in replacing nitroglycerin, but the many advantages of explosive gelatin with respect to increased safety in transportation and handling more than compensates for the increased expense involved in its use. In the table 75% nitroglycerin dynamite and 40% nitroglycerin dynamite is given the same value: namely, 79%; and picric acid is given a value of 49% as compared to 41% for black blasting powder. It is evident from the results of tests made by the reviewer† that the relation of efficiency given in this table is not applicable to the technical use of explosives. The heats of explosion represent the potential energy or the maximum work that an explosive can theoretically accomplish. But as the useful work resulting from the use of explosives is a small percentage of the theoretical maximum, and as it varies considerably with the different types of explosives, knowledge of the potential energy of explosives is of little value to the user of explosives. Furthermore, the useful work resulting from explosives depends on the material to be blasted and the method of application. On account of the varying conditions in blasting, certain characteristics of an explosive may be of much importance in certain classes of work, and of little or no importance in others.

The initial velocity and rate of propagation of explosive reactions as influenced by temperature, pressure, and catalytic influences are given for inflammable gas mixtures and explosive compounds. The different methods and kinds of apparatus used in determining the velocity of explosive reactions are described. The steel bomb used by P. Vielle in determining the velocity of the combustion of various powders, Dixon's device for determining the velocity of the explosive wave of gaseous mixtures, and Mettegang's recorder similar to that used by the U. S. Bureau of Mines for determining the rate of detonation of explosives, are mentioned.

In treating the subject of pressure in explosive transformations the significance of the rate of detonation, as determined for a few inflammable gas mixtures and explosives when compared with results obtained by empirical methods for measuring their brisance (shattering effect), would indicate that there does not exist a close agreement between the rate of detonation of a given explosive and the brisant effect produced by its explosion. However, it is the opinion of the reviewer that from the results of physical tests made and observations in actual mining operations in the United States a very close agreement does exist between the rate of detonation of commercial explosives and the shattering effects produced. Furthermore, it has been found that the rate of detonation is the govering factor in selecting explosives suitable for the work. Thus, in hard rock blasting operations in which a shattering effect is desired, the explosive reaction should be quick and explosives having a high rate of detonation are selected. The higher the rate of detonation of commercial explosives the less the amount of heat loss by the products of combustion through radiation and conduction, and accordingly the more violent the effect it will exert.

The well known empirical tests are described for determining the brisance of explosives, such as small lead blocks and Trauzl lead blocks which are used by the U. S. Bureau of Mines for determining the disruptive effect of explosives. The lead plate tests for determining the relative strength of detonators could have been omitted with advantage. This test has been frequently described in textbooks on explosions. It consists of exploding the detonator on a lead plate which rests on an iron ring. The strength of the detonator is measured by the deformation or the penetration of the block and the fine radiating marks produced upon the surface of the plates. Tests recently completed by the U. S. Bureau of Mines show that this test does not indicate the relative effectiveness of different grades of detonators in initiating the explosive reaction of the commercial explosives used in this country.

A chapter is devoted to the temperature of explosion and also one to the gases evolved on explosive reactions. The method used in France and Spain is given for calculating the theoretical temperature of explosion from the data obtained from the analysis of the original explosive and that of the resulting products, also the method of direct determination by firing an explosive in a calorimetric bomb. However, nothing new is presented governing the specific heats of the products of explosion at high temperatures and, accordingly, the temperature to which the heat of explosion will raise the products of combustion cannot yet be accurately determined. The influence of the density of loading upon the composition of the gases resulting from the explosion of explosive compounds is considered and typical analyses of the gases from the explosion of nitrocellulose and picric acid under varying pressures are given.

In considering the subject of explosions by influence the author states it is still an open question whether the phenomenon is due to the rapidly increasing pressure of gases developed with great velocity or simply a phenomenon accompanying the high temperature. Attention is called to the late investigations which indicate the formation of a wave movement that originates in the sudden disturbance of equilibrium and communicates to the surrounding medium. The application of the phenomena as shown in the practical use of explosives is of special interest.

In the chapter on the flame of an explosive it is shown that the degree of safety of an explosive toward fire damp and coal dust in blasting work depends principally on the character of the flame accompanying its explosion. A description is given of the experimental mine station in Gelsenkirchen and Bichel's apparatus for determining the length and duration of the flame of an explosive. The characteristics of explosives, including igniters, fuse and detonators, are cited, and their practical significance with respect to the density, hygroscopicity and stability.

The book closes with a chapter on Blasting Explosives. The methods of manufacturing the more important commercial explosives, such as nitroglycerin, nitrocellulose, nitrated aromatic compounds, dynamites, black blasting powder, and permitted explosives are given; also the foreign regulations are cited with reference to the manufacture of explosives and suggestions given concerning the handling, application and destruction of explosives.

*Expert in charge of Explosives Section, U. S. Bureau of Mines, Experiment Station, Pittsburgh, Penn.

†See U. S. Bureau of Mines Bulletin 48.

New Editions of Tillson's Pavements and Spalding's Roads and Pavements

STREET PAVEMENTS AND PAVING MATERIALS—A Manual of City Pavements: The Methods and Materials of Their Construction. By George W. Tillson, C. E., Consulting Engineer to the Borough President of Brooklyn, City of New York. Second edition, revised and enlarged. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9¼ in.; pp. xii + 651; 97 text figures. $4. net (17/- net).

A TEXT-BOOK ON ROADS AND PAVEMENTS—By Frederick P. Spalding, Professor of Civil Engineering, University of Missouri; M. Am. Soc. C. E. Fourth edition, revised and enlarged. New York: John Wiley & Sons. London: Chapman & Hall Ltd. Cloth; 5x7 in.; xii + 408; 51 text figures. $2. net (8/6. net).

In noticing Mr. Tillson's "Pavements in our issue of Jan. 10, 1901 (p. 32), we gave it such commendation as left nothing further of the kind to be said of a subsequent edition, except as regards the thoroughness of revision. As to the latter, the author seems to have been uncommonly faithful, particularly in major particulars. Frequent references are made to the recent proceedings of the Association for Standardizing Specifications and of the American Society for Municipal Improvements, and statistical and other data for 1912 are found at various points in the new edition.

Two new chapters appear: "Concrete Pavements" and "The Protection of Pavements." Of the 30 pages on concrete pavements over half are occupied by a reprint of the American Society of Civil Engineers' specifications for portland cement, and much of what is left consists of extracts from the specifications and trade circulars of promoters of proprietary concrete pavements. The chapter (28 pages) on protecting pavements, while also composed largely of reprinted matter, is a valuable addition to the book. The new edition contains 119 pages more than did the first one, including the space occupied by 37 additional illustrations.

For the benefit of the younger readers of these columns it may be stated that Mr. Tillson writes from a long experience as engineer in charge of paving work in Brooklyn, and later in Manhattan borough, New York City. Engineering literature would gain if more engineers would give the profession the value of their world-wide investigations and their personal experiences in their special fields of work, as has been done so unstintingly by Mr. Tillson.

Prof. Spalding produced a small textbook on both roads and pavements as far back as 1894, and has performed the duty of revision now for the fourth time. His revision of 1908, which was largely a rewriting, was so well done that Samuel Whinery, reviewing the third edition in our issue of Dec. 17, 1908, characterized the volume as the best elementary textbook on roads and pavements yet produced—although earlier in the review he called attention to the almost inevitable limitations of new editions of technical books.

In the present edition the author has added chapters on bituminous macadam and concrete pavements and has "considerably modified" the chapters on brick, asphalt and wood pavements, effecting a gain of 68 pages, or 20% in space. Considering the breadth of his field and his space limits, the author continues to do well in his endeavor to cover roads and pavements in a single volume.

The full table of contents goes a very small ways in justifying the omission of an index.

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An Elementary Text on Mechanism

Reviewed by JOHN J. FLATHER*

MECHANISM—By Robert McArdle Keown, B.S., Assistant Professor of Machine Design, University of Wisconsin. New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. 169, 168 text figures. $2. net.

This work has been written as a college textbook and is intended to cover an elementary treatment of the subject extending throughout one-half year of study which embraces one lecture, one recitation and four hours' drafting work per week.

After a brief discussion of motions and velocities in general, the subject of linkages is presented. This is followed by a study of cams, gearing, and intermittent motions. Numerous problems are given at the end of each chapter, those which relate to the drafting room work are presented with especial reference to the needs of the student and are accompanied with all necessary instructions for laying out the mechanism. This feature ought to save considerable time on the part of both student and instructor.

It is to be regretted that on the first page of the book, the greatest authority on the subject of Kinematics should have his name spelled "Realeaux." This is followed by a rather loose statement relating to the design of machines in which it is stated that "the general outline is sketched without any regard to the detailed proportions of the individual part, and from this sketch or skeleton, acceleration of each of the moving parts can usually be accurately determined." Of course the author intends to say that the general outline may be sketched and the displacement and velocities determined if certain dimensions or proportions be given; without taking into account all the various dimensions of a piece.

The present reviewer would prefer to retain the use of the words "instantaneous center" as given by Reuleaux, rather than use the word "centro" which the author has adopted, even though the latter be briefer.

In the chapter on Cams the author devotes some 28 pages to the consideration of this subject, in which the principal types are represented very concisely and clearly. Under Gearing there appears the unusual discussion of friction gearing, involute and cycloidal, bevel and worm gears, with a description of the methods used in developing and cutting same. Elliptical gears are rather briefly treated and epicyclic trains are omitted entirely.

A perusal of the book indicates that it has been prepared with especial reference to the needs of the author's classes as a preparation for the more advanced work in machine design. The subject matter is essentially the same as that Gearing there appears the usual discussion of friction treatise of this character prepared for a special purpose, it is to be expected that many of the topics included should be discussed only briefly and that some rather important parts of the subject should be omitted entirely. However, the arrangement and method of treatment of the topics presented ought to produce excellent results if accompanied by the exercises required to be worked out in the drafting room.

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A TEXT-BOOK OF PHYSICS—Contributors, A. Wilmer Duff, E. Percival Lewis, Charles E. Mendenhall, Albert P. Carman, R. K. McClung and William Hallock. Edited by A. Wilmer Duff, D. Sc., Professor of Physics, Worcester Polytechnic Institute, Worcester, Mass., Third edition, revised. Philadelphia: P. Blackiston's Son & Co. Cloth; 5½x8½ in.; pp. 686; 595 text illustrations.

The third edition shows many changes over the second and decided contrast with the first. The type is new and the division of text between large and small type (to show essential from only desirable parts of a course) is modified. There is some space saved in remaking the illustrations together with an improvement in appearance—though the old figures were not bad. In the second edition a section on "Wave Motion" by E. P. Lewis of the University of California replaced that by William Hallock of Columbia University. In this third edition, a section on "Heat" by C. E. Mendenhall of the University of Wisconsin replaces that by K. E. Guthe of the University of Iowa; "Electricity and Magnetism" by A. W. Goodspeed of the University of Pennsylvania and "Electro-magnetic Induction" by A. P. Carman of the University of Illinois, are covered by the latter author in a section, "Electricity and Magnetism."

The order of presentation has been changed, from mechanics, heat, wave motion, sound, light, electricity and magnetism, electro-magnetic induction, gaseous conduction and radioactivity, to mechanics, wave motion, heat, electricity and magnetism, gaseous conduction and radioactivity, sound, light. The changes seem to have been well considered and carefully made so that the book retains its previous balance and usefulness as a teaching text.

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STATE ROADS COMMISSION OF MARYLAND—Reports for 1908, 1909, 1910 and 1911. (E. E. Goslin, Secretary, Baltimore, Md.) Cloth; 6⅜x10¼ in.; pp. 183; 12 page plates and one folding map.

The major part of this volume is occupied by the report of W. W. Crosby, chief engineer to the commission. Valuable tables of cost are presented by Mr. Crosby and also a system of road accounting designed for general use throughout the country. The chief engineer politely, but emphatically, criticises the Commission for laying out far more road construction than was warranted by the funds at its command, for adopting methods not approved by him, and for permitting the chairman of the commission to usurp the functions of its chief engineer, virtually making of the latter a consulting engineer. Attention is also called to the underpay of the engineering force, which (perhaps combined with the attitude of the commission in other matters) led no less than 60 engineers to resign their positions within a few years. Since the report was made the chief engineer has also resigned.

*Professor of Mechanical Engineering, University of Minnesota, Minneapolis, Minn.

New Highway Literature

Reviewed by A. W. DEAN*

HANDBOOK FOR HIGHWAY ENGINEERS—Part I. Theory of Design. Part II. Practice of Design and Construction. By Wilson G. Harger, C. E., First Assistant Engineer, New York State Department of Highways, Assoc. M. Am. Soc. C. E., and Edmund A. Bonney, Chief Draftsman, Division No. 5, New York State Department of Highways. New York and London: McGraw-Hill Book Co. Leather; 4x7 in.; pp. 493; 74 text figures, 67 tables. $3, net.

MODERN ROAD CONSTRUCTION—A Practical Treatise for the Use of Engineers, Students, Members of Local Authorities, Etc. By Francis Wood, M. Inst. C. E., F. G. S., Borough Surveyor of Fulham [England]; Author of "Practical Sanitary Engineering." London: Charles Griffin & Co., Ltd. Philadelphia, Penn.: J. B. Lippincott Co. Cloth; 5¼x8 in.; pp. xi + 137; two folding plates and 25 text figures. $1.50, net.

ROADS, PATHS AND BRIDGES—By Logan Waller Page, Director, United States Office of Public Roads; President, American Association for Highway Improvement; M. Am. Soc. C. E. New York: Sturgis & Walton Co. Cloth; 5x7½ in.; pp. 263; illustrated. 75c., net; postpaid, 84c.

The authors of the new highway handbook state in their preface that the purpose of the book is to collect in a compact and convenient form information ordinarily required in the field and office practice of road design and construction. A careful persual of the book shows it to be a compilation of data and tables, interspersed with information gained through the observation and experience of the authors on New York state highway work.

The first chapter discusses grades and alignments, giving tables showing maximum grades and widths constructed in states and countries that have adopted maximum or ruling grades. This is followed by a chapter devoted to different types of cross-sections. The authors here give illustrations representing standard cross-sections, principally of New York and Massachusetts, with a discussion of conditions governing the selection of proper width and section.

Drainage is treated in the third chapter, run-off, velocity and flowage tables and formula being given, together with plates showing standard reinforced culverts and small bridges, with accompanying tables of quantities and material entering into their construction as compiled by the New York State highway department, also data and tables concerning steel bars and other reinforcements.

The average road engineer would be somewhat confused in studying the chapter on foundations, as the authors do not differentiate between the foundation and the first course of road surface or crust. A short chapter is devoted to top courses. The authors state that "any discussion at this time of the methods of construction of the newer types of surfacing would be of little permanent value. . . . . Any conclusions which may be adopted are liable to be modified by further observation. . . . ." Some concise data and some positive statements are given, however, covering different types of surface, and giving some costs and results which the authors state in a concluding paragraph are only approximate and comparative.

A short chapter is devoted to qualities and physical characteristics of materials used in road construction. The subject is treated briefly and rather incompletely.

Part two of the book opens with a chapter on surveying practice, followed by a chapter on office practice. Both chapters are very clear and show in detail engineering field and office methods of designing work, calculating curves and quantities preparatory to make final specifications.

Cost data and estimates (many of which were contributed by one of the authors in 1911, to the "Engineering News") are given in much detail in Chapter 10. These data cover many of the details of state road construction, and, as the authors state, they must, although valuable, be used with discretion.

Chapter 11 consists of notes on construction, being essentially a chapter of directions and information for field inspectors. New York State specifications are given in Chapter 12, covering various materials and methods used by the New York state highway department.

The authors have also caused to be inserted in the book various tables, such as sines, tangents, logarithms, etc., commonly used in calculations.

One cannot but be impressed many times when reading the book with the fact that the experience of the authors was somewhat local. Two particular instances might be cited. The authors at one place state that vitrified clay pipe should never be placed under the roadbed proper unless incased in concrete. This advice is perfectly proper in the predominating soils of New York State, whereas in other soils double-strength vitrified clay pipe is perfectly satisfactory. The authors also classify broken stone as No. 1, 2, 3, etc. This is misleading, as the classification used in New York is different from that in some other states.

Notwithstanding the above criticisms, the book is one of value to road engineers and particularly to engineers employed on state highway work in the State of New York as a text and reference book.

In "Modern Road Construction," the author, as he states in his preface, has given in a concise and not too highly technical form, the leading characteristics and details of modern roads as observed by him in his experience in road construction. After a general introduction and a discussion of the wear on different types of roads due to natural causes and as affected by traffic, the author devotes the greater portion of the book to bituminous road construction.

This discussion is made up principally of notes taken by the author on road construction, repair and maintenance over quite a period of years, and as the notes are largely a result of his own practical experience and observation, the highway engineer will find them of considerable value. The author goes into considerable detail in describing bitumen and its application to road construction, not only as a blanket treatment, but also when incorporated in the road surface. Several pages are devoted to tests and analyses of bitumen and to comparisons of the results obtained by the use of different kinds of bitumens in road construction. A few pages are devoted to costs, but the cost data in the book can hardly be utilized by American engineers, as insufficient data are given of the rate paid per hour for labor and of the cost of material.

In the appendices are given typical specifications for constructing streets of macadam and wood pavement, and the specifications of the road board of England for surface tarring, and surfacing with pitch-grouted macadam, also extracts from the road board's specifications for tar and pitch. The book is well indexed, and is very clearly worded, making it interesting and very convenient for reference.

The layman or farmer will find in Mr. Page's "Roads, Paths and Bridges," a large amount of valuable information, set forth in an unusually clear manner, and made doubly interesting by many illustrations. The book opens with a brief history of road building and comments on road legislation. The author describes methods of construction and maintenance of the various types of roads and paths that are adapted to rural communities, with suggestions and advice governing the selection of materials and treatment of roadsides. A chapter on modern road problems treats briefly of the effect of automobile traffic and the use of oils and other dust layers. Culverts and bridges are treated by the author, the information given being of a descriptive rather than a technical nature.

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MECHANICAL ENGINEERING LABORATORY MANUAL—By Earl B. Smith, M. E.; Assistant Professor of Experimental Mechanical Engineering, Drexel Institute. Second Edition. Philadelphia: The Drexel Institute Press. Cloth; 6x9¼ in.; pp. iv + 92; 17 text figures. $2, postpaid.

This book is one of that already large and ever increasing number, which are built up from teachers' mimeographed syllabi, altered to make them as general as possible and still be definite enough to fit the detailed instruction given at one institution and, in this case, to the laboratory equipment of a given period. The author has recognized the difficulty of making such a manual of wide service. Presumably the book has been published chiefly to meet local demands—supplemented perhaps by a lesser call from other teachers.

The text covers most of what is generally taught to third-year students of mechanical and electrical engineering in the mechanical-power laboratory. It is designed to give them a ready familiarity with steam engines and boilers, piping systems, traps, separators, condensers, gages, calorimeters, indicators, dynamometers, gas engines, governors, carbureters, hydraulic motors, pumps, rams, orifices, weirs, meters, etc. Tests of working conditions, operating characteristics and efficiency of performance for all such machinery are planned with hints on the preparation of proper reports.

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The use of steel conduits for carrying all sorts of electric service wires is increasing in all kinds of building construction and naturally practice has ranged variously between the use of too small diameters for easy pulling in and use of extravagantly large sizes. To show the desirable intermediate sizes for any case the National Electrical Contractors' Association has prepared charts and tables giving the necessary data in detail.

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*Chief Engineer, Massachusetts Highway Commission, 15 Ashburton Place, Boston, Mass.

The charts show cross-sections of all sizes of conduit with various arrangements of conductors in place; the external diameter of conduit and carrying capacity of wires is also shown. The complete set of charts shows proper sizes of conduit for one-, two-, three- and four-wire systems; combination of duplex wires in sizes Nos. 10, 12 and 14; combinations of up to 90 single wires in No. 14; combinations of up to 150 fixture wires in Nos. 16 and 18, and combinations of up to 50 pairs of telephone wires. Each chart is mounted on heavy cardboard with an eyelet for hanging. They can be obtained from W. H. Morton, Secretary of the National Electrical Contractors' Association, 41 Martin Bldg., Utica, N. Y., at $2.25 per set.

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A Second Edition of the American Civil Engineers' Pocket Book

AMERICAN CIVIL ENGINEERS' POCKET BOOK.—Mansfield Merriman, Editor-in-Chief. Second edition, enlarged. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Montreal: Renouf Publishing Co. Morocco; 4x7¾ in.; pp. viii + 1473; 1200 text illustrations; 500 tables. $5, net. (21s., net).

That the first edition of the new engineering handbook prepared two years ago under Prof. Merriman's supervision* is now in its second edition and its 15th thousand demonstrates that the work was received eagerly and favorably. Such a reception, of course, warrants patient and careful efforts at revision, to correct errors and weak spots and to keep abreast of new developments. The future growth of the handbook will therefore be watched with interest by all who depend on such useful aids, which is to say all engineers.

The revision for the present second edition represents a change in some elements of the original plan, but leaves the bulk of the text unaltered. A chapter on Thermodynamics and Electricity, and a chapter on Highways and Streets, have been added, the latter being by Prof. A. H. Blanchard and the former by Prof. G. A. Goodenough and F. M. Farmer. Through these additions, two of the other chapters were improved by confining them to more circumscribed subjects; e.g., Railroads is now no longer burdened by mixture with Roads.

A certain amount has also been done in the way of minor revision. However, of the several comments made in our review of the first edition, a large proportion still apply, and (it is hardly necessary to add) the general description and characterization hold unchanged.

The two new chapters were placed at the end of the book, following "Physics, Meteorology, Weights and Measures." Section 13, while headed "Steam and Electric Engineering," deals in the former subject only with thermodynamics, of which Prof. Goodenough presents a very good summary. The Editor prefaces the section with a cautionary statement, that the section is "for civil engineers whose knowledge of the subjects is limited." Whether readers of this class will draw much instruction from even this edition's explanation of entropy will be for the future to show. They will welcome the notes on engine performance, but will miss other matter on engines. The restriction of the section to thermodynamics means, of course, that engines and pumps, etc., are not described. Under the heading "Electricity" the information is excellently practical, and it will throughout give sound and simple notions of electrical fundamentals, apparatus and fitting. A little further filing down may be helpful; to cite one of the most trivial illustrations, the statement relating to "Osmium, osram and zirconium lamps, . . . in which the filaments are of the metals indicated," may deserve to have "mazda" included.

Prof. Blanchard's chapter on streets and roads gives the impression of being fully uptodate and closely fitted to the probable demands of the reader of the pocketbook. All phases of the subject are covered, down to maintenance methods, construction plant and street cleaning. By the addition of this chapter the book has been notably improved.

The full evolution of such a handbook, as this one is the work of many years, not one or two and calls for the most scrupulous accuracy. To an author it may seem trifling indeed that two different figures are given for the weight of ashes to the use of the book, who looks up its figures for the purpose of earthwork calculations, such a discrepancy may mean everything. Perhaps in that case the fact that before reaching that point he has been misled by the index heading "Ashes" into scrutinizing a table containing somewhat of such lumber will seem like adding insult to injury.

*The first edition was fully reviewed in our issue of Feb. 16, 1911, pp. 19-22.

With many thousands of items making up the sum-total of the book, a patient fine-combing process, lasting over a long time, must be depended on for gradual elimination of error. The result will warrant such patience.

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Spring Valley's Reply in the Hetch Hetchy Controversy

THE FUTURE WATER-SUPPLY OF SAN FRANCISCO FROM THE CONSERVATION AND USE OF ITS PRESENT RESOURCES—Report to the Honorable the Secretary of the Interior and the Advisory Board of Engineers of the United States Army. San Francisco: [Spring Valley Water Co.]. Cloth; 8½x11¼ in.; pp. x + 506; illustrated.

REPORT ON THE WATER-SUPPLY SYSTEM OF THE SPRING VALLEY WATER CO., San Francisco, Calif.—By H. M. Chittenden, Brigadier General, U. S. A. (Ret.), M. Am. Soc. C. E., and A. O. Powell, M. A. Soc. C. E. San Francisco: [Spring Valley Water Co.]. Cloth; 8½x11¼ in.; pp. 44; illustrated.

The latest addition to the already long list of reports and legal documents on the attempts of San Francisco to achieve municipal ownership of water-works and on its yearly conflicts over water rates takes the form of two handsome volumes of interesting reports to the Secretary of the Interior. Like the large report by John R. Freeman and others, noted briefly on p. 937 of our issue of Nov. 14, 1912, and abstracted at length in our issue of Dec. 26, 1912, the volumes before us are the product of the controversy over San Francisco's project to introduce a gravity water-supply from the headwaters of the Tuolumne River. This scheme involves the flooding of the Hetch Hetchy Valley, a cliff-surrounded mountain meadow, lying in the Yosemite National Park, some 20 or 25 miles from the Yosemite Valley; hence the jurisdiction of the Secretary of the Interior. The park defenders, as well as those who oppose the Hetch Hetchy project for commercial reasons, claim that there are plenty of other available sources of water-supply for San Francisco. Strongest among these claimants, naturally enough, is the Spring Valley Water Co., which supplies water to San Francisco.

The company just named was asked by the Secretary of the Interior, on May 28, 1912, to submit information on the adequacy of the property of the company to supply San Francisco with an ample water-supply in the future. This the company did under date of Oct. 31, 1912, in the form of a main report by F. C. Herrmann, its chief engineer, and numerous supplementary reports.

Briefly, Mr. Herrmann claims that his company "has secured water resources for the people of San Francisco that when completely developed will safely produce year in and year out 210 M. G. D., or over five and one-half times the present needs of the city. In addition to this, other sources have been secured, which may be depended upon to supply 42 M. G. D., for use within the proposed metropolitan district, making a grand total of 252 M. G. D."

The two volumes before us are devoted to engineering and geological data to support this thesis, with sections here and there aimed at criticisms of the company's supply. Among the reports included in the larger volume are these: Hermann Schussler, for many years chief engineer of the Spring Valley Water Co., on the present works and proposed extensions of the company; Wm. B. Mulholland and J. B. Lippincott, of Los Angeles, on underground waters; Geo. G. Anderson, of Denver, on rainfall and runoff; Prof. J. C. Branner, of Stanford University, and Prof. A. C. Lawson, of the University of California, on geological questions, particularly those pertaining to underground supplies; L. J. Le Conte, of Berkeley, Calif., on testing models of dams; and T. W. Espy, an engineer of the company, on theoretical phases of stream and weir discharge computations and on evaporation. The reports of Messrs. Mulholland, Lippincott, Branner and Lawson deal with alleged "erroneous conclusions," drawn by John R. Freeman regarding the underground sources of supply held by the company.

The smaller of the two volumes, by Gen. Chittenden and Mr. Powell, contains a review of the reports in the larger volume, with which are interspersed various criticisms of the Freeman report, mentioned at the beginning of this notice.

We do not envy Secretary Fisher's task of weighing the evidence presented in these and in Mr. Freeman's report, together with the testimony put in by the Turlock and Modesto irrigation districts as to their rights in the Tuolumne River, and also the protestations of a group of men scattered from the Pacific to the Atlantic that to "dam Hetch Hetchy" would be one of the greatest desecrations of natural beauty ever perpetrated. Fortunately he has able engineering aids in the Board of Advisory Engineers (of the U. S. Army) appointed for that purpose. He also has a reputation for keen judg-

ment and rare impartiality—which is the only point of agreement among the four parties engaged in the Hetch Hetchy controversy.

PUBLICATIONS RECEIVED

AMERICAN MINE ACCOUNTING. Methods and Forms Employed by Leading Mining Companies. By W. H. Charlton, P. A., Member, Lake Superior Mining Institute, New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. viii + 367; 250 text figures. $5, net.

BIOGRAPHY OF GEORG VON REICHENBACH.—By Walther von Dyck. München (Germany): Deutsches Museum. Stiff paper; 10x14½ in.; pp. 140; 75 illustrations and 8 plates.

A splendidly illustrated and printed biography of Georg von Reichenbach, the early engineer, scientist and instrument maker. It is based on original material in the new Deutsche Museum; the author appears to have spared no pains to present his subject adequately.

THE "BUILDING AGE" HANDY ESTIMATE BLANKS—Compiled by Arthur W. Joslin, author of "Estimating the Cost of Building." New York: David Williams Co. Paper; 7½x10 in. Single copies, 25c.; per dozen, $2.50.

Tabular forms for making up estimates of the cost of buildings.

DESIGN OF POLYPHASE GENERATORS AND MOTORS—By Henry M. Hobart, M. Inst. C. E., Consulting Engineer, General Electric Co. New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. viii + 265; 125 text figures. $3, net.

ECONOMICAL IRRIGATION BY PUMPING—Bulletin 127 of the American Well Works, Aurora, Ill. Paper; 7½x10¾ in.; pp. 72; illustrated.

Primarily a trade catalog, this pamphlet contains various tabular and other data of possible use to engineers and irrigators.

THE ELEMENTS OF HEATING AND VENTILATION—A Textbook for Students, Engineers and Architects. By Arthur M. Greene, Jr., Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute; Some time Junior Dean, School of Engineering, University of Missouri. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9¼ in.; pp. vi + 324; 223 text illustrations. $2.50.

THE ELEMENTS OF MACHINE DESIGN—Part II, Chiefly on Engine Details. By W. Cawthorne Unwin, F. R. S., L. L. D., Formerly Professor of Engineering at the Central echnical College, and Professor of Hydraulic and Mechanical Engineering at the Royal Indian Engineering College, and A. L. Mellanby, D. Sc., Professor of Engineering at the Royal Technical College, Glasgow. New and revised edition. New York, Bombay and Calcutta: Longmans, Green & Co. Cloth; 5½x9 in.; pp. xxiii + 422; 311 illustrations in text. $2.50

ELEVATOR SHAFT CONSTRUCTION or Practical Suggestions for the Installation of Electric Elevators in Buildings—By H. Robert Ulmer. Assisted by Albert Bolton. With Introductory Note by Reginald Pelham Bolton. New York: The William T. Comstock Co. Cloth; 6½x10 in.; pp. 174; 63 plates; $3.

This is a book for the architect. It discusses and gives data on the layout of elevator shafts as to dimensions and clearances, and treats of shaft doors and elevator signal systems. A form of specification for elevators and elevator equipment is given, and the New York regulations for elevators are reprinted.

EXPERIMENTAL WIRELESS STATIONS, Their Theory, Design, Construction and Operation—A complete account of sharply tuned modern wireless installations for experimental purposes, which comply with the new wireless law. By Philip E. Edelman, author of "Inventions and Patents," "Simple Experiments in Chemistry," "An Experimental Quenched Arc System," "How to Comply with the New Wireless Law." Minneapolis, Minn.: Published by the author, at 2432 Lyndale Ave. South. Cloth; 5¾x8 in.; pp. 220; 80 illustrations. $2.

EXPERMENTS UPON THE DISINFECTION OF SEWAGE AND THE EFFLUENTS FROM SEWAGE FILTERS—By H. W. Clark and Stephen DeM. Gage. [Reprinted from the Forty-third Annual Report of the Massachusetts State Board of Health]. Boston: The Board. Paper; 5½x9 in.; pp. 28.

HEIZUNGS-, LUFTUNGS- UND DAMPFKRAFTANLAGEN in den Vereinigten Staaten von Amerika—By Arthur K. Ohmes, Consulting Engineer. München und Berlin: R. Oldenbourg. Cloth; 6½x9⅜ in.; pp. vii + 182; 119 text illustrations and 8 tables. 6 marks.

Consists of revised and extended reprints of articles published in "Gesundheit-Ingenieur" during the past few years, describing the heating and ventilating plants designed by the late Alfred R. Wolff for a number of important buildings in the United States, mostly in New York City. Included in the list of buildings are the Hotel St. Regis, the New Theater, the Metropolitan Art Museum and the United Engineering Societies Building, New York City; the store of Gimbel Brothers, Philadelphia, and the State Capitol at Hartford, Conn.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS, Especially Devoted to the Interests of the Architectural, Mechanical, Engineering, Contracting, Electrical, Railroad, Iron, Steel, Hardware, Mining, Mill, Quarrying, Exporting and Kindred Industries. Twenty-first Annual Edition. New York: Samuel E. Hendricks Co., 74 Lafayette St. Cloth; 7½x10½ in.; pp. 1574. $10.

HILFSTABELLEN ZUR BERECHNUNG VON WARMWASSERHEIZUNGEN—By H. Recknagel, Diplom-Ingenieur. München and Berlin: R. Oldenbourg. Stiff paper; 5½x13½ in.; pp. 28; 4.50 marks.

Gives tables of heat radiation per square foot for various water and room temperatures and various kinds of radiation surface, pipe capacity in heat and water units, and similar tables for hot-water heating computations.

INDEX TO THE STRATIGRAPHY OF NORTH AMERICA—By Bailey Willis. Professional Paper 71, U. S. Geological Survey, Washington, D. C. Paper; 9x11½ in.; pp. 894; 19 text illustrations and one geologic map of North America, in separate portfolio.

IRON AND STEEL CONSTRUCTIONAL WORK—A Concise Handbook with Examples for Practical Application. Vol. III, The Broadway Series of Engineering Handbooks. By Karl Schindler. Translated from the German and adapted to English Practice by Chas. Salter. New York: D. Van Nostrand Co. London: Scott, Greenwood & Son. Cloth; 4½x7½ in.; pp. xii + 140; 115 text illustrations. $1.25, net.

The structural engineer concerned with framework of buildings will be interested in this book, as giving a German's view of steel structural work through English spectacles. The treatment is descriptive and elementary, not to say superficial. It is not likely to supply the American engineer with any direct working material or data, but may tend to broaden his way of handling routine structural problems.

IRRIGATION: ITS PRINCIPLES AND PRACTICE AS A BRANCH OF ENGINEERING—By Sir Hanbury Brown, K. C. M. G., M. Inst. C. E. Second edition, revised. New York: D. Van Nostrand Co. Cloth; 5⅜x9¼ in.; pp. xv + 301; 68 text figures and several plates. $5, net.

ISOSTASY, A REJOINDER TO THE ARTICLE BY HARMON LEWIS—By John F. Hayford. Reprinted for private circulation from the "Journal of Geology," Vol. XX, No. 6, September-October, 1912. Paper; 6¾x9¾ in.; pp. 17.

KARSTGEBIETE UND IHRE WASSERKRAEFTE—Eine Studie aus Oeffentlichen Vorträgen des Verfassers über die Ausnützung und Verwertung der Wasserkräfte in den Karstländern der Ost.-Ung. Monarchie. By Theodor Schenkel, Behördlich Autorisierter Zivil-Ingenieur U. St. Beeid. Sachverständiger. Wien and Leipzig: A. Hartleben. Cloth; 7x10½ in.; pp. 91; 125 illustrations. Marks 8; American price, $3.20, net.

The power possibilities of certain streams in southeastern Austria are discussed. The region abounds in caves and fissures, the course of the streams is broken by underground portions, and the distribution of surface flow through the year has irregularities markedly different from those of normal streams.

METHODS FOR THE ANALYSIS OF IRON AND STEEL, USED IN LABORATORIES OF THE AMERICAN ROLLING MILL CO., MIDDLETOWN, OHIO—Middletown, Ohio: The American Rolling Mill Co., Research Department. Cloth; 6x9½ in.; pp. 62; illustrated. [We understand that a limited number of copies of this book are available, to those particularly interested.—Ed.].

METHODS OF MEASURING ELECTRICAL RESISTANCE—Edwin F. Northrup, Ph. D., M. A. I. E. E. New York and London: McGraw-Hill Book Co. Cloth; 6x9½ in.; pp. xiii + 389; 1505 text illustrations. $4, net.

MODERN SANITARY ENGINEERING. Part I, House Drainage—By Gilbert Thomson, M. A., F. R. S. E., M. Inst. C. E., Lecturer on Sanitary Engineering in the Royal Technical College, Glasgow. New York: D. Van Nostrand Co. Cloth; 5½x8¾ in.; pp. xv + 266; 110 text illustrations. $3, net.

MUNICIPAL WATER SUPPLIES OF COLORADO—By Clement C. Williams, C. E., Assistant Professor of Civil Engineering. Bulletin of the University of Colorado, Vol. XII. No. 5. Boulder, Colo.: The University. Paper; 6x9 in.; pp. 56; illustrated.

The essential features of a public water-supply are stated and the various elements of water-works are given. Then follow descriptions of the water-works of Colorado municipalities of 500 population and upward and a table of the rates charged in 49 cities.

THE NEW BUILDING ESTIMATOR—A Practical Guide to Estimating the Cost of Labor and Material in Building Construction, from Excavation to Finish; with Various Practical Examples of Work Presented in Detail and with Labor Figured Chiefly in Hours and Quantities. A Handbook for Architects, Builders, Contractors, Appraisers, Engineers, Superintendents and Draftsmen—By William Arthur. Eleventh edition, revised and enlarged. New York: David Williams Co. Flexible leather; 4½x7 in.; pp. 713; illustrated. $3, postpaid.

PRACTICAL MATHEMATICS, Being the Essentials of Arithmetic, Geometry, Algebra and Trigonometry. Part III, Algebra with Applications—By Claude Irwin Palmer, Assistant Professor of Mathematics, Armour Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 4½x7¼ in.; pp. xi + 178; 31 text figures. 75c., net.

PROBLEMS IN ENGINEERING WITH SOLUTIONS—Being Questions and Answers Reprinted from the Assistants' and Students' Section of the "Surveyor and Municipal and County Engineer." First series. Edited by Sydney G. Turner, Assoc. M. Inst. C. E. London: St. Bride's Press, Ltd. Cloth; 5x7½ in.; pp. 186; numerous illustrations. $2, net (5 -, net).

A collection of many kinds of problems, and answers to them, apparently from the "Question and Answers" columns of a technical paper. Though grouped to an approximate subject classification, the problems will not be found to cover with any pretense at completeness the subjects indicated by the group headings. However, many readers may find themselves helped over one or another doubt by studying this book as an auxiliary to their textbooks. But many

others will be disappointed in the book, as some chapters (e.g., that on building construction) are entirely bare of information and can make no pretense of satisfying their title.

PROCEEDINGS OF THE THIRTY-FIFTH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION, Held at Seattle, Wash., June 10-13, 1912. Four volumes. New York: Executive Committe of the Association, 29 W. 39th St. Cloth; 6x9½ in.; pp. 1921; illustrated.

RAIL CORRUGATION—Interim Report of Special Committee Appointed to Inquire into the Phenomena of Corrugation on Tramway Rails. Bradford (England): The Municipal Tramways Association, Inc.; 20 pages and folding plates.

REFRACTORIES AND FURNACES: Properties, Preparation and Application of Materials Used in the Construction and Operation of Furnaces—By F. T. Havard, E. M., Associate Professor of Metallurgy, University of Wisconsin; Consulting Metallurgist to Goldsmith Bros. Smelting & Refining Co. New York and London: McGraw-Hill Book Co. Cloth; 6x9½ in.; pp. viii + 356; 123 illustrations. $4, net.

REPORT OF THE FOREST SERVICE OF THE U. S. DEPARTMENT OF AGRICULTURE FOR 1912—By Henry S. Graves, Forester. Washington, D. C.: Pub. Doc. Paper; 6x9 in.; pp. 95.

REPORT ON THE INVESTIGATION OF THE CHICAGO TELEPHONE CO., Submitted to the Committee on Gas, Oil and Electric Light of the City Council, Chicago, Ill. (Hon. Anton J. Cermak, Chairman)—By Prof. Edward W. Bemis. Chicago: The Committee. Paper; 6x9 in.; pp. 127.

REPORT ON KNIGHT'S LANDING CUT PROJECT TO THE KNIGHT'S LANDING RIDGE COMMITTEE—By Haviland & Tibbetts, Civil Engineers, San Francisco, Calif. Paper; 5½x9 in.; pp. 111; 19 diagrams and 8 folding maps.

A study of flood control and land drainage in a portion of the valley of the Sacramento River, California. The proposed cut through a ridge built up by the overflow of Cache Creek would carry flood water from the Colusa Basin and afford quick drainage of the unleveed portion of the basin. Of alternative locations for the cut, one would involve 3,135,200 cu.yd. of excavation at an estimated cost of $436,000 and the other 4,556,300 cu.yd. at a cost of $566,143. The district includes 94,500 acres, of which 65,500 is leveed and 29,000 unleveed land. Hydrographic data are included in the report.

RETRACEMENT SURVEYS AS AFFECTED BY COURT DECISIONS WITH FIELD PROCEDURE—By N. B. Sweitzer, Assoc. M. Am. Soc. C. E., Neligh, Neb. Paper; 6½x9 in.; pp. 39. $1.

Evidently based on a paper by the author before the American Society of Civil Engineers (see "Transactions," December, for original and discussions). The subject covered is the resurveying of the former public lands of the United States, which were supposed to have been once divided by monuments into township sections and quarter sections.

SHOULD PUBLIC SERVICE PROPERTIES BE DEPRECIATED TO OBTAIN FAIR VALUE IN RATE OR REGULATION CASES?—A Report to St. Louis Public Service Commission. By James E. Allison, Commissioner and Chief Engineer of the Commission. Cardboard; 5½x9 in.; pp. 50; 19 curve sheets.

The author answers as follows the question asked by his title: "The conclusion seems clear then that in all ordinary cases of heretofore unregulated properties we cannot justly depreciate to obtain Fair Value unless we admit the justice of ex post facto laws or equivalent regulation, or unless we interpret Fair Value to mean Market Value and not Just Amount." A number of depreciation diagrams are given.

SMOLEY'S TABLES—Parallel Tables of Logarithms and Squares, Diagram for Solving Right Triangles, Angles and Logarithmic Functions Corresponding to Given Bevels, Common Logarithms of Numbers, and Tables of Logarithmic and Natural Trigonometric Functions and Other Tables, for Engineers, Architects and Students. By Constantine Smoley, C. E., Principal, School of Civil Engineering, International Correspondence Schools. Seventh edition, revised and enlarged. New York and London: McGraw-Hill Book Co. Leather; 4½x7¼ in.; pp. 174; illustrated. $3.50, net.

SOME PRINCIPLES AND FACTS THAT SHOULD BE CONSIDERED IN MAKING RATES FOR ELECTRICAL UTILITIES—By Halford Erickson, Member, Railroad Commission of Wisconsin. (A Paper Presented at the 18th Annual Convention of the Ohio Electric Light Association, at Cedar Point, Ohio, July 16-19, 1912). Paper; 6¼x9½ in.; pp. 36. Inc.

SPECIFICATIONS FOR AND MEASUREMENT OF STANDARD SIEVES (Circular 39, Bureau of Standards. (S. W. Stratton, Director). Washington, D. C.: Pub. Doc. Paper; 7x10 in.; pp. 14.

A brief but concise treatise on the manufacture and testing of sieves with instructions as to methods of having such test made by the Bureau.

STANDARDS AND TESTS FOR SEWAGE AND SEWAGE EFFLUENTS DISCHARGING INTO RIVERS AND STREAMS. Vol. I, Fourth Report of the Royal Commission on Sewage Disposal. London: Wyman & Sons, Ltd., Fetter Lane, E. C. Paper; 8x13 in.; pp. 1. 3 pence.

A brief editorial summary of this report, with editorial comment appeared in "Engineering News" for Dec. 12, 1912, and a detailed abstract in the issue following.

STANDARD SPECIFICATIONS FOR CAST-IRON WATER PIPE AND SPECIAL CASTINGS, Adopted May 12, 1908, by the American Water Works Association. [Reprinted by the United States Cast Iron Pipe & Foundry Co. New York City.] Paper; 5¼x9 in.; pp. 32. Illustrated.

STATE BOARD OF HEALTH OF MASSACHUSETTS—A Brief History of Its Organization and Its Work, 1869-1912. Secretary, Mark W. Richardson, M. D. Boston: The Board. Paper; 5½x9 in.; pp. 76. Illustrated.

STATISTICS OF CITIES AND TOWNS OF IOWA—Fifth Annual Report of the State Department of Finance and Municipal Accounts, for Fiscal Year Ending Mar. 31, 1912. (John L. Bleakly, Auditor of State, Des Moines, Iowa). Paper, 6x9 in.; pp. xiii — 235.

STEAM BOILERS—Prepared in the Extension Division of the University of Wisconsin by E. M. Shealy, Assistant Professor of Steam Engineering. New York and London: McGraw-Hill Book Co. Cloth; 6x9½ in.; pp. xiv + 356; 185 text illustrations. $2.50, net.

STRENGTH OF MATERIALS—A Text Book for Secondary Technical Schools. By Mansfield Merriman, Member of International Association for Testing Materials. Sixth edition, revised and reset. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x7½ in.; pp. vi + 169; 54 text figures. $1, net.

The chief feature of improvement in this revised edition is a new chapter on combined stresses. This addition gives proper recognition to the extensive practical bearings of combined-stress calculations. The subject being very generally neglected in the actual practice of designers, the new chapter should help toward improving practice. The formulas are stated simply.

A STUDY OF TROLLEY LIGHT FREIGHT SERVICE AND PHILADELPHIA MARKETS IN THEIR BEARING ON THE COST OF FARM PRODUCE—By Clyde Lyndon King, Ph. D., Wharton School of Finance and Commerce, University of Pennsylvania. Made under direction of Rudolph Blankenburg, Mayor of Philadelphia. Philadelphia: Department of Public Works, Room 216, City Hall. Paper; 6x9 in.; pp. 58; 1 map.

SUMMARY REPORT OF THE MINES BRANCH OF THE DEPARTMENT OF MINES, CANADA, FOR 1911. (Robert Rogers, Minister of Mines). Ottawa: Pub. Doc. Paper; 6½x10 in.; pp. 208; 16 plate illustrations and 6 folding diagrams.

THE TESTING OF CLAY REFRACTORIES, WITH SPECIAL REFERENCE TO THEIR LOAD-CARRYING CAPACITY AT FURNACE TEMPERATURES—By A. V. Bleininger, Ceramic Chemist, and G. H. Brown, Assistant Ceramic Chemist, Bureau of Standards, Department of Commerce and Labor, Washington, D. C. [Technologic Papers of the Bureau of Standards, No. 7]. Paper; 7x10 in.; pp. 78; 30 illustrations.

A TEXTBOOK ON SEWAGE DISPOSAL IN THE UNITED KINGDOM—By Henry Lemmoin-Cannon, P. A. S. I., Author of "The Sanitary Inspector's Guide," "Modern Sewage Disposal: A Popular Handbook." London: St. Bride's Press. Cloth; 5½x9 in.; pp. xx + 320; 52 text figures. 7/6, net.

TUNNELING: A PRACTICAL TREATISE—By Charles Prelini, C. E.; Author of "Earth and Rock Excavation," "Dredges and Dredging," "Earth Slopes, Retaining Walls and Dams"; Professor of Civil Engineering, Manhattan College, New York. Sixth edition, revised and enlarged. New York: D. Van Nostrand Co. Cloth; 6x9¼ in.; pp. xix + 349; 167 text illustrations. $3, net.

The re-edition of "Tunneling" shows considerable revision and improvement. The several short descriptions of the actual work on numerous tunnels, and the group of drawings of tunnel shields, are the most valuable elements of the book. Attention is due also to a chapter on accidents and repairs to tunnels during and after construction, and a following chapter on relining tunnels.

TYPHOID FEVER IN NEW YORK CITY, Together with a Discussion of the Methods Found Serviceable in Studying Its Occurrence—By Charles F. Bolduan, M. D., Assistant to the General Medical Officer, Department of Health of the City of New York. Being No. 3 of the Monograph Series. New York: The Department. Paper; 6x9 in.; pp. 52; illustrated.

"WATER SUPPLY" AND "DRAINAGE" SYSTEMATIZED AND SIMPLIFIED—By C. E. Housden, Late Superintending Engineer, Public Works Department, India, and Sanitary Engineer to the Governments of Burma and Eastern Bengal and Assam. London, New York, Bombay and Calcutta: Longmans, Green & Co. Cloth; 4¾x7¼ in.; pp. 28; two folding plates. 60c., net.

WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED—A Practical Treatise Embracing Complete and Detailed Explanations of the Theory and Practice of Modern Ratio Apparatus and Its Present Day Applications, Together with a Chapter on the Possibilities of Its Future Development. By Alfred P. Morgan, Editor, Mechanical and Electrical Department of the "Boy's Magazine," author of "Wireless Telegraph Construction for Amateurs." New York: The Norman W. Henley Publishing Co. Cloth; 5x7½ in.; pp. 154; 156 illustrations. $1.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY—Department of the Interior; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6x9 in.

Nos. 281, 288, 290, 291 and 304: Surface Water Supply of the United States, 1910 and 1911. Part I—North Atlantic Coast. By C. C. Babb, C. C. Covert and R. H. Bolster. Part IV—St. Lawrence River Basin. By C. C. Covert and R. H. Bolster. Part IX—Colorado River Basin. By W. B. Freeman, E. C. La Rue and H. D. Padgett. Part X—The Great Basin. By E. C. La Rue, F. F. Henshaw and E. A. Porter. Part XI—Pacific Coast in California. By W. B. Clapp, F. F. Henshaw and H. D. McGlashan. Prepared under the direction of M. O. Leighton. Pp. 305, 3 plates; 98, 3 plates; 233, 4 plates; 264, 3 plates, and 218, 4 plates, respectively.

No. 290, Gazetteer of Surface Waters of California. Part II, San Joaquin River Basin. Prepared under the direction of John C. Hoyt. By R. D. Wood.

No. 298, Water Resources of California. Part I—Stream Measurements in River Basin. By H. D. McGlashan and F. F. Henshaw. Part II—Stream Measurements in San Joaquin River Basin. By H. D. McGlashan and H. J. Dean. Prepared under the direction of John C. Hoyt. Pp. 111 and 439, respectively.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

✚**Pennsylvania**—Philadelphia & Reading Ry.—This company has awarded the contract to CHARLES F. KING & CO., Pottsville, Penn., for the grading and masonry in connection with four-tracking on the New York branch of the Philadelphia & Reading Ry. Co.

West Virginia—Welsh Colony R.R.—This company has been chartered to own, improve and operate a railroad from Arvondale Junction, on the Baltimore & Ohio R.R. in Randolph County, to Arvon or Penbro, in Webster County, connecting with a railroad which may be constructed. The incorporators are Matthew Perkins, Samuel Davies, John P. Williams and D. S. Thomas, of Shenandoah, Penn., and Enoch Jones, of William Penn., Penn.

Florida—Pine Springs, R.R.—This company is planning to construct about 10 miles of line between Welborn and White Springs, through level country. The directors are Cale Danley, Pres. and Gen. Mgr.; W. I. Phillips, Vice Pres.; Nathan Johnson, Secy. and Treas.; J. C. West, A. B. Small, C. M. Marsh and Paul Marx. This was formerly the Florida & Georgia R.R.

Alabama—Gulf, Florida & Alabama Ry.—This company is considering extending its line from the present northern terminus at Local, Ala., to a connection with the Southern Ry. at Pine Hill, Ala., 70 miles. The work will comprise about 20 miles of heavy steam-shovel work, the remainder consisting of grading that will be handled by teams and station men. A steel bridge over the Alabama River, involving about 600 ft. of river spans, included in which will be a draw span, with 1200 to 1500 ft. of approaching trestle, will be constructed.

Tennessee—Tennessee, Kentucky & Northern R.R.—Bids for the construction of the proposed extension of this company south to Sparta, Tenn., and north to Rock Creek, Ky., 77 miles in all, will be opened Apr. 1. H. Adkins, Livingston, Tenn., is Ch. Engr. Noted Jan. 2.

Kentucky—Caney R.R.—This company, located at Prestonburg, Ky., has been incorporated to build a 12-mile line from Beaver Creek to a point on the Big Sandy River in Floyd County. It is reported that the Chesapeake & Ohio Ry. will finance the road. The incorporators of the new company are: James Salisbury, M. C. Flannigan, W. F. Hite and others.

✚**Ohio**—Ashland & Western Ry.—This company has awarded the general contract to the WEST VIRGINIA & OHIO CONSTRUCTION CO., Ashland, for constructing an extension from Ashland, Ohio, north via Wellington to Lorain, Ohio. The work involves about 300,000 cu.yd. of earth, 270,000 cu.yd. of borrow and 12,000 cu.yd. of concrete. The extension is being built under the name of the Lorain, Ashland & Southern Ry.

Ohio—Lake Erie & Youghiogheny R.R.—This company, with a capital of $3,000,000 has been incorporated to construct a railroad to connect Youngstown and Conneaut, Ohio. The incorporators are A. W. Jones, John H. Ruhlman, W. H. Ruhlman, George J. Chapman and George M. Brown, all of Youngstown, Ohio. The incorporators have secured permission from the State Public Utility Commission to issue bonds and will begin work at once on the preliminaries of roadbed construction, and actual work of road building will be started as soon as the weather permits.

The road will be a passenger as well as an ore-carrying line and will be operated by either gasoline or electric equipment, although the road has been incorporated as a steam railroad.

Ohio—Cleveland, Cincinnati, Chicago & St. Louis Ry.—This company, according to press reports, is considering the construction of a branch line. As planned, the branch will leave the main line at Wellington, Ohio, run southeast through Ashland, Ohio, and connect with the main line again at Mount Gilead, Ohio.

Indiana—Pennsylvania Lines West of Pittsburgh—This company is planning to double-track its main line between Muncie, Ind., and Chicago, Ill.

Michigan—Detroit, Bay City & Western R.R.—This company is considering the extension of its line from Akron, Mich., north to Sebewaring, Mich. W. N. Boyd, Bay City, Mich., is Ch. Engr.

Illinois—Caseville Ry.—This company has been incorporated to construct a line of railroad from a point at or near Caseville to East St. Louis, Ill. The principal offices of the company will be at Belleville, Ill. The incorporators are Joseph E. Gundlach, A. H. Bear, Louis Opp, W. M. Hopp, all of Belleville.

Illinois—Illinois Central R.R.—This company, it is reported, is considering the construction of a branch line from Freeport, Ill., to Beloit, Wis. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

North Dakota—Northern Pacific Ry.—This company is considering the extension of its north branch to the Knife River country, and probably to the Killdeer Mountains. W. L. Darling, St. Paul, Minn., is Ch. Engr.

South Dakota—Chicago, Milwaukee & Puget Sound Ry.—This company, it is reported, will extend its line from Faith, Meade County, to Rapid City, S. D.

✚**Montana**—Great Northern Ry.—This company has awarded the contract to A. GUTHRIE & CO., St. Paul, Minn., for constructing the Libby cutoff, which is to reopen main line service through Kallspel, Mont., and the ranch and timber region west, to Libby, in Lincoln County.

Missouri—Cape Girardeau & Chester R.R.—This company has been bought by J. H. Byrd and associates. It has a mileage of about 106 miles. It is reported that the road will be extended into the Bonne Terre section, one of the largest zinc-producing regions of southeastern Missouri.

✚Missouri, Kansas & Texas Ry.—This company has awarded the contract to A. M. CLOPTON, Elgin, Tex., for widening banks, open cuts and ditches, on the line from Waco to Smithville, Tex., in connection with the reconstruction of the line between Waco and Smithville.

Paris & Mt. Pleasant R.R.—This company is planning to construct a line from Paris, Tex., to Atoka, Okla., and the Lehigh coal fields, after completing the extension to Mt. Pleasant. H. P. Mobberly, Paris, Tex., is Ch. Engr.

Asherton & Gulf R.R.—This company, it is reported, has awarded the contract for the construction of an extension from Asherton, northwest to Carrizo Springs, a distance of 10 miles. Asher Richardson is Pres. and Gen. Mgr., Asherton. Noted Jan. 9.

Texas—San Antonio, Fredericksburg & Northern Ry.—This company has been chartered to construct a standard gage railroad between Fredericksburg and Waring, Tex., where connection will be made with the San Antonio & Aransas Pass R.R., and an entrance obtained to San Antonio, Tex., over the latter road. Noted Jan. 9.

Colorado—Denver, Laramie & Northwestern R.R.—This company will soon begin work on the construction of its proposed extension from Greeley to Severance, Colo. J. L. Terry, Denver, Colo., is Supt. Noted Dec. 12.

Arizona—United Verde & Pacific Ry.—This company has received permission to issue $450,000 of bonds for the construction of a line from Verde tunnel to Clarkdale. C. V. Hopkins, Jedome, Ariz., is Ch. Engr.

✚**Washington**—Northern Pacific Ry.—This company has awarded the contract to GUTHRIE, McDOUGAL & CO., St. Paul, Minn., for double-tracking 25 miles of its line between Lester on the west side and Easton on the east side of the Stampede Tunnel, at $750,000. The old track will be abandoned where the track rounds the edge of a cliff by cutting across the cañon with a steel bridge 165 ft. high and 1200 ft. long, making a reduction of 2.28 miles. W. L. Darling, St. Paul, Minn., is Ch. Engr. Noted Nov. 21.

Toppenish, Fort Simcoe & Western R.R.—This company will resume work in the spring on the construction of its line to White Swan, a distance of 20 miles.

California—Southern Pacific Co.—This company will broad-gage its line between Keeler and Owens, Calif. W. Hood, San Francisco, is Ch. Engr.

California—Angel's Flight Ry.—This company has filed an amended application with the State Railroad Commission for authority to purchase the Angel's Flight Ry. in Los Angeles. The company desires to issue $100,000 of bonds and to use $40,000 of the proceeds in payment for the purchase of the property and the remaining $60,000 for such extensions of the railway as may be decided upon.

California—Ocean Shore R.R.—Officials of this company have taken up the matter of bonding the road for $1,200,000 to complete the line from Tunitas to Santa Cruz, and announce that it will probably raise $800,000 more with which to put the entire line in the best of condition. This matter has been taken up informally with the Railroad Commission, and the company's engineers are working out the details of construction.

San Diego, Riverside & Los Angeles R.R.—The State Railroad Commission has granted permission to this company to issue bonds for $2,500,000. The company was recently organized for the purpose of building a standard steam railroad to connect San Diego and Los Angeles, via Escondido. It is proposed to begin construction in San Diego and to build as far as Escondido. It is estimated that this will cost $3,306,000. Noted Dec. 5.

Canada—Canada & Gulf Terminal R.R.—This company is planning a 223-mile line from Ste. Flavie on the Intercolonial R.R. to Gaspe Bay at the end of Gaspe Peninsula, where a port open all the year round will be created. M. J. O'Brien, Montreal, Que., is Pres.

Ontario—Huron Lake Shore R.R.—This company is applying to the Canadian Government for incorporation to construct from Sarnia, Ont., northeast through the counties of Lambton, Huron, Bruce and Grey, to Meaford. W. B. Converse, Montreal, Que., is solicitor for the applicants.

Alberta—Calgary, Edmonton & Fort McMurray R.R.—This company has made application to the Canadian Government to construct the following lines: From Calgary, Alta., north via Edmonton, passing east of Lac La Biche to Fort McMurray, and following the Athabasca River to Chipewyan, thence west of Slave River, passing through to near Fort Smith to Fort Resolution on Great Slave Lake; from Fort Smith southwest to Fort Vermilion, thence south on the west side of Peace River to Peace River Landing, and southwest to Dunvegan; from a point on the Red Deer River north of the 52d parallel to Red Deer. Christie, Greene & Hill, Ottawa, Ont., are solicitors for the applicants.

ELECTRIC RAILWAYS

Holbrook, Mass.—Plans are being prepared by the Bristol & Norfolk St. Ry. Co., for the extension of its line in Holbrook. F. J. Williams, Randolph, Mass., is Supt. and Pur. Agt.

Norwood, Mass.—The Sharon, Canton & Norwood St. R.R. Co. has been purchased by a new company, which proposes to extend the line to Taunton. M. A. Cavanaugh, of Boston, is interested.

Elmira, N. Y.—The Elmira Water, Light & R.R. Co. is considering plans for the construction of an extension to its line from Elmira to the Morrow plant. H. M. Beardsley, Elmira, is Gen. Mgr.

New York, N. Y.—See item under Railways: New York.

Phoenixville, Penn.—The Pottstown & Reading St. Ry. Co. is preparing plans for the extension of three of its lines in Phoenixville. Harry F. Swinehart, Pottstown, is Gen. Mgr. and Supt.

Pittsburgh, Penn.—Surveys have been completed by the Pittsburgh, Steubenville & Wheeling St. Ry. Co. for its proposed line to connect Pittsburgh, Avella, Independence, Bethany, West Liberty, Fulton and Wheeling. Construction will not be started until the spring. W. H. Hildebrand, Pittsburgh, is Pres.

Fairmont, W. Va.—The Monongahela Valley Traction Co. proposes to make two extensions to its lines, one from Gypsy to Lumberport, and another from O'Neill to three miles west. J. O. Watson, Fairmont, is Gen. Mgr.

Newbern, N. C.—Press reports state that the Newbern-Ghent St. Ry. Co. is considering plans for some extensions to its line in Newbern. C. J. McCarthy is interested.

Wilmington, N. C.—The New Hanover Transit Co. has authorized Walter G. McRae to make surveys for its proposed electric railway from Wilmington to Carolina Beach, about 13 miles. A. W. Bates is Pres.

Spartanburg, S. C.—The South Carolina Light, Power & Ry. Co. has acquired the property of the local street railway, light and power company. The new owners contemplate extensions and improvements, funds for which are provided for under a $5,000,000 bond issue. A. B. Leach & Co., New York, N. Y., are interested.

Athens, Ga.—A company of local capitalists is being organized for the construction of a new street railway in Athens. Address the Mayor for particulars.

Decatur, Ga.—The Georgia Ry. & Power Co. is making preliminary arrangements for the construction of an extension of its line from Decatur to Stone Mountain, about 16 miles.

Fairburn, Ga.—The Fairburn & Atlantic Ry. Co. is preparing to convert its 10 mile railway from gasoline to electric operation. L. W. Roberts, Atlanta, is Ch. Engr.

Pensacola, Fla.—The citizens have voted $100,000 in bonds for the construction of an electric belt railway to connect the municipal wharves. L. E. Thornton is City Engr.

New Orleans, La.—The New Orleans Ry. & Light Co. is considering plans for the construction of a two-mile extension to its Claiborne line. J. R. McGivney, New Orleans, is Pur. Agt.

Jackson, Tenn.—The Jackson Ry. & Light Co. is considering plans for the extension of its line to Winter's Grove. John Wisdom, Jackson, is Gen. Supt. and Pur. Agt.

Paducah, Ky.—It has been announced by H. C. Rhodes, Pres. of the Kentucky Southwestern Electric Ry., Light, Heat & Power Co., that the company would soon be ready to start work on the construction of its proposed line from Paducah to Murray. Noted Feb. 22, 1912.

Russell, Ky.—The Ohio Valley Electric Ry. Co., operating a system at Ashland, Ky., is considering the extension of its line to Russell. W. W. Magoon, Ashland, is Gen. Mgr.

Taylorsville, Ky.—The Taylorsville, Louisville & Jeffersontown Ry. Co. has about completed surveys for its proposed interurban railway, to connect Taylorsville and Jefferstown. Rowland Cox is interested. Noted Jan. 9.

Youngstown, Ohio—The Lake Erie & Youghiogheny R.R. Co. has been incorporated to construct and operate an electric railway from Youngstown to Conneaut. George J. Chapman, A. W. Jones, John H. Ruhlman, and George M. Brown, all of Youngstown, are the incorporators.

Coloma, Mich.—The Berton Harbor-St. Joe Ry. & Light Co. is making surveys and expects to start work early this spring on the construction of its electric railway from Coloma to Hartford. Estimated cost, $150,000. H. C. Mason, Berton Harbor, is Gen. Mgr.

Saginaw, Mich.—The Saginaw-Bay City Ry. Co. is making preliminary arrangements for the extension of several of its lines in Saginaw. John A. Cleveland, Saginaw, is Gen. Mgr.

Ashmore, Ill.—The City Council has granted a franchise to the Central Illinois Traction Co. to construct and operate an electric railway in Ashmore.

Belleville, Ill.—The Caseyville Ry. Co. has been organized for the construction of an interurban railway from Caseyville to East St. Louis. A. Gundlach, J. E. Gundlach, Louis Oppenheimer and William M. Hoppe, all of Belleville, are interested.

Fergus Falls, Minn.—The construction of an electric railway in Fergus Falls, is contemplated by S. O. Bridston and associates.

Minneapolis, Minn.—The Electric Short Line R.R. Co. is making preliminary arrangements for the construction of its proposed electric railway from Minneapolis through Dawson. Earle D. Lyon is Pres.

St. Paul, Minn.—Press reports state that the Twin City Rapid Transit Co. has decided to construct an extension in St. Paul from the Agricultural College to the Belt Line bridge. W. J. Hield, Minneapolis, is Gen. Mgr.

St. Joseph, Mo.—The City Council has granted a franchise to the St. Joseph Ry. Light Heat & Power Co. to construct and operate an electric railway on Eighth St. J. H. Van Brunt, St. Joseph, is Vice-Pres. and Gen. Mgr.

St. Louis, Mo.—Press reports state that the St. Louis Kansas City Electric Ry. Co. has awarded the contract for the construction and equipment of its line from St. Louis to Kansas City, to the NATIONAL CONTRACTING CORPORATION, Norfolk, Va. The contract for grading the line was awarded to GRIFFITH & McMURRAY, Kansas City. Noted Dec. 5.

Bryan, Tex.—Surveys have been made and contract will be let some time in January by the Bryan-College Interurban Ry. Co. for the construction of its proposed line from Bryan down the valley of the Brazos River, about 35 miles. O. E. Gammill, Bryan, is Gen. Mgr.

Fredericksburg, Tex.—The San Antonio, Fredericksburg & Northern Ry. Co. has been organized for the purpose of constructing an electric railway from Waring to Fredericksburg. H. N. Jones, Foster Crane, R. A. Love and Frank Richards are interested.

Gainesville, Tex.—The Gainesville, Whitesboro & Sherman Ry. Co. has been purchased by T. F. MacMiller, of Chicago, Ill. The new owner is planning the completion of the electric line to Sherman.

Marlin, Tex.—It is reported that E. P. Turner, of Dallas, is interested in the construction of an electric railway from Marlin to Temple, about 40 miles.

Smithville, Tex.—The Ten Thousand Club of Smithville is taking steps toward the organization of a company to construct an interurban electric railway from Smithville to Austin and from Smithville to Rockport.

Tulsa, Okla.—Preliminary plans are being considered by the Tulsa St. Ry. Co. for the extension of its line through East Tulsa to the Bellview addition. The estimated cost of the improvements contemplated is $100,000. C. H. Bosler, Dayton, Ohio, is Pres. and Gen. Mgr.

Salt Lake City, Utah—The Salt Lake & Utah R.R. Co. is making preliminary arrangements for the construction of its proposed electric railway from Salt Lake City to Payson, about 62 miles. A. J. Orem & Co., Salt Lake City, is interested.

Tacoma, Wash—The Tacoma Ry. & Power Co. is considering plans for the extension of its line across the new bridge which will be completed during January. L. H. Bean, Tacoma, is Mgr.

Tunitas, Calif.—The Ocean Shore R.R. Co. has completed surveys for the extension of its line from Tunitas to the center of the timber, about 10 miles. Lee H. Landis, San Francisco, is Gen. Mgr. and Pur. Agt.

Quebec, Que.—It is announced by the Quebec Rapid Transit Co. that the construction of an electric line to connect Quebec, Beauport, Lorette, St. Ambroise, Cap Rouge and Isle of Orleans, will be started early this spring.

Moose Jaw, Sask.—Press reports are to the effect that plans are being prepared for the construction of an electric railway from Moose Jaw to Regina. The Board of Trade is interested.

LIGHT, HEAT AND POWER

Rockland, Maine—Hollis M. Shaw has completed construction of a concrete dam at Hills Mills in Union, Maine, which will develop 1000 hp., and will erect a power house to transmit power to Rockland. The improvements will cost $100,000.

Fall River, Mass.—We are officially advised that the Fall River Electric Light Co. is making preliminary arrangements for the installation of new equipment in its power plant at Hathaway St. Estimated cost, $200,000. Philip Cabot is Vice-Pres. Noted Nov. 28.

New Haven, Conn.—The United Illuminating Co., of New Haven, Conn., will increase its capital from $2,000,000 to $2,500,000, and will expend the $500,000 in improving and increasing the capacity of its plants here and in Bridgeport and extending service to surrounding towns. G. L. Clock, New New Haven, is Ch. Engr.

Albany, N. Y.—See item under Miscellaneous: Canal Terminal, etc., Albany.

✚Brooklyn, N. Y.—We are officially advised that the contract for the installation of electrical equipment in public school No. 175, Boro. of Brooklyn, has been awarded to T. FREDERICK JACKSON, INC., 94 John St., New York, at $10,369. Bids were received by C. B. J. Snyder, Supt. of School Bldgs., Dec. 30.

White Plains, N. Y.—The construction of a municipal electric-light plant at White Plains is being agitated. E. H. P. Squier is a member of the Village Bd.

North Arlington, N. J.—The Lighting Committee of the Borough Council has been instructed to acquire information relative to the installation of an electric street-lighting system through the Public Service Electric Co.

Bernville, Penn.—The Bernville Light, Heat & Power Co. has applied for permission to construct an electric-light plant at Bernville, to supply electricity for lighting and commercial purposes. Allison C. Harrison and William Kalbach are interested.

Livermore, Penn.—The City Council is considering the proposition to issue bonds for the construction of an electric-light plant.

Smiths Ferry, Penn.—Press reports state that the construction of an electric-power plant on Beaver Creek, near Smiths Ferry, is contemplated by the East Liverpool Traction & Light Co. and the Ohio River Passenger Ry. Co. Estimated cost, $2,000,000.

✚Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. has awarded the contract for the construction of a boiler house on Heath St., to DIETRICH BROS., Pleasant and Davis Sts., Baltimore. Noted Jan. 2.

Rome, Ga.—Plans are being prepared by Solomon & Norcross, Consult. Engrs., Atlanta, for the construction of a municipal electric-light plant at Rome. Estimated cost, $16,000. Noted Dec. 12.

Jacksonville, Fla.—See item under Water Supply—Irrigation.

Greeneville, Tenn.—The Tennessee Eastern Electric Co., of Greeneville, is about ready to install machinery at its water-power plant on the Nolachuckey River, near Greeneville. The work of building a dam across the stream is well under way.

Nashville, Tenn.—The Nashville Traction Co. will expend $4,000,000 for improvements, extensions and for the erection of an electric-light and power plant. Walter O. Parker is interested.

Hartford, Ky.—An extensive heating plant will be installed in the proposed new school building at Hartford. C. C. Weber, Cincinnati, Ohio, is Arch. Address the School Board for details.

Paducah, Ky.—The Board of Public works of Paducah will purchase a new dynamo for the municipal lighting plant, as well as make other improvements on the plant. An appropriation of $16,500 for this purpose has been recommended.

Middlebury, Ind.—The construction of an electric-light plant in connection with their flour mill at Middlebury, is contemplated by Pidgeon Bros. Construction will not be started until the spring.

Walkerton, Ind.—The city is considering plans for the installation of new additional equipment in the municipal electric-light plant next spring. A. L. Freyer is Supt. of the plant.

Belvidere, Ill.—It is reported that the Northern Utilities Co. is considering plans for the construction of a power plant at Belvidere. H. Caird is Supt.

Bushnell, Ill.—The City Council has appointed a committee to investigate the feasibility of installing a municipal electric-light plant. John M. Brant and C. C. Chain are members of the Com.

Clinton, Ill.—The installation of an ornamental street-lighting system on several streets in Clinton, is being considered by the Board of Local Improvements.

Milwaukee, Wis.—The municipal lighting plant, which has been contemplated by the city for some time, may now be constructed as a result of a decision of the State Supreme Court, which allows the municipality to go ahead as planned. The city has provided a bond issue of $100,000 and $300,000 in mortgage certificates for the work of construction at a site acquired on Davidson St., between Mineral and Walker Sts. The plant will supply the city buildings, pumping stations, and street lights.

Dallas, Iowa—Plans are being prepared by the Consolidated Coal Co., 139 West Van Buren St., Chicago, Ill., for the construction of an electric-power plant near Dallas, to supply electricity for the operation of its mines.

Holstein, Iowa—The construction of an electric-light plant at Holstein is under consideration.

Webster City, Iowa—Preliminary arrangements are being made for the installation of an ornamental street-lighting system in the business district. R. J. Mullins is Supt. of the municipal electric-light plant.

Monticello, Minn.—Plans are being prepared by the Monticello Electric Light & Power Co. for the construction of an electric-light plant and the installation of an ornamental street-lighting system in Monticello. E. M. Ruede, Kansas City, Kan., is interested, Noted Nov. 28.

Canton, Kan.—It has been proposed to install an electric-light plant in Canton, to cost from $10,000 to $12,000. The city is considering the proposition. T. N. Frantz is City Clk.

De Soto, Kan.—Bids will soon be received for the construction of a municipal electric-light plant. Estimated cost, $5000. Jerome Runyon, De Soto, is Consult. Engr.

Doniphan, Neb.—See item under Water Supply—Irrigation.

Louisville, Neb.—The Platte Electric Light & Power Co. has been organized to construct and operate an electric-light plant at Louisville. Estimated cost, $200,000. Contract will probably be let about May 1. James Stander, Louisville, is Secy.

Rich Hill, Mo.—We are officially advised that bids will be received by the city until Jan. 21, for the construction of a municipal electric-light plant. Estimated cost, $15,000. Plans have been prepared by Rollins & Westover, Kansas City, Mo. Noted Oct. 10.

Helena, Ark.—The installation of an ornamental street-lighting system in the business district is under consideration.

Eagle Pass, Tex.—The Texas Light & Power Co., which recently purchased the local electric-light and water-works plants at Eagle Pass, will enlarge the electric-power station here and construct a transmission line to the Indio ranch, a distance of 45 miles, where power will be used to operate pumps for irrigating 6000 acres of land. The company is also making plans to build other power transmission lines for the purpose of operating irrigation pumping plants and to furnish light and power for the towns of Cometa and Carrizo Springs.

Ennis, Tex.—F. A. Price, of Taylor, Tex., is arranging to install a gas-manufacturing plant and lay a distributing system here.

Italy, Tex.—The Texas Light & Power Co. has purchased the electric light plant here from the Italy Water Co. The City Council has granted the new company a 50-year franchise to operate the plant. It will make improvements and enlargements upon the property.

Collinsville, Okla.—See item under Water Supply—Irrigation.

Soper, Okla.—The construction of an electric-light plant at Soper is contemplated by J. W. Whitehead, of Soper, and L. Stokes, of Forney.

Stonewall, Okla.—At a recent election the citizens voted to install a municipal electric-light plant.

Bruneau, Idaho—Press reports are to the effect that the Great Shoshone & Twin Falls Water Power Co. contemplates the construction of a power plant at Bruneau. Lee W. Glass is Supt.

Globe, Ariz.—The Copper Reef Mining Co. will install a new electric-power station here and build transmission lines from San Carlos to its mine, a distance of about 12 miles. The company will also install an aërial tramway upon its property.

Astoria, Ore.—The Pacific Gas & Light Co. will reconstruct its gas plant in this city. The pipes are to be changed over, a new purifying apparatus will be installed, as well as new boilers, scrubbers and wash boxes.

Hood River, Ore.—The Pacific Power & Light Co. will erect a new power plant to develop between 7000 and 8000 hp. on the site of the present plant in Hood River. The cost of the new plant will be at least $750,000.

Glendora, Calif.—The electors voted bonds to the amount of $37,000, for the purchase of the properties of the Glendora Light & Power Co. Extensions and improvements will be made at once. Floyd G. Dessery, Hibernian Bldg., Los Angeles, is City Engineer. Noted Dec. 5.

Halfmoon Bay, Calif.—The Halfmoon Bay Light & Power Co. have asked the County Supervisors for a franchise to extend their lines southward from Halfmoon Bay to the southern boundary of the county. J. J. Gomes is Pres. and Mgr.

Holtville, Calif.—The Holtville Power Co. contemplates an expenditure of $150,000 for the improvement and extension of its system. C. E. Paris, El Centro, is Gen. Supt.

+Los Angeles, Calif.—The contract for the construction of an addition to the present power plant at the County Hospital has been awarded by the Board of County Supervisors, to SMITH-STAHLHUTH CO., at $16,970.

Los Angeles, Calif.—The City Council has instructed the city attorney to prepare an ordinance for the installation of ornamental lights on Seventh St., between Alameda and Hoover Sts., a distance of 47 city blocks.

+Redlands, Calif.—The contract for the installation of an ornamental street-lighting system at Redlands has been awarded to the SOUTHWEST ELECTRIC CO., at $9668.

Sacramento, Calif.—Bids will be received by E. F. Pfund, County Clk., 910 Sixth St., until Jan. 21, for the installation of electric-light fixtures in the County Court House at Sacramento.

Stockton, Calif.—A franchise has been granted to the Oro Electric Corporation to operate in this city, and plans are in preparation for the installation of a system, to cost $100,000. J. W. Goodwin is Pres.

Clinton, Ont.—A by-law has been passed appropriating $35,000 for the installation of a hydro-power and electric-lighting system. Bids will be received shortly by D. L. McPherson.

Niagara Falls, Ont.—The Ontario Power Co. has been granted permission to enlarge its power plant and install two additional units of 13,500 hp. each. Noted Nov. 28.

Sarnia, Ont.—The city will install a complete hydro-power and lighting system, to cost about $100,000. Address the Mayor for details.

Prince Albert, Sask.—We are officially advised that the city is preparing plans for the construction of an electric-light plant separate from the water and pumping plants. Estimated cost, $150,000. F. A. Creighton is City Engr. and C. O. Davidson is City Clk. Noted Jan. 2.

Rosthern, Sask.—The citizens are considering the proposition to appropriate funds for the installation of a municipal electric-light plant.

Yellow Grass, Sask.—The construction of an electric-light and power plant is being considered by the town.

Dauphin, Man.—Chipman & Power, Mail Bldg., Toronto, Ont., are preparing plans for a new power house for Dauphin. John A. Garby, Town Clk., of Dauphin, will call for bids very shortly.

New Westminster, B. C.—Plans are being prepared by W. J. Duncan, for the construction of a new gas plant, to have a capacity of 20,000 cu.ft. per day, and for 21 miles of gas mains. Bids will be received about Mar. 1.

BRIDGES

Falmouth, Mass.—We are officially advised that bids will be received until Feb. 8, by F. C. Wales, Consulting Engr., 1150 Tremont Bldg., Boston, for the construction of a steel draw bridge, with abutments and retaining walls, at Woods Hole, Falmouth. It will have a draw span of 31½ ft. clear and will be 40 ft. wide. Noted Jan. 9.

New Bedford, Mass.—Plans are being revised by the Board of County Commissioners for the proposed new highway bridge across the Acushnet River, between New Bedford and Acushnet. Bids were received for this work on Dec. 17 but all bids were above the appropriation of $30,000. Noted Dec. 5.

Albany, N. Y.—See item under Miscellaneous: Canal Terminal, Etc., Albany, N. Y.

Pottsville, Penn.—Bids will be received until Jan. 20, by the County Controllers, for the construction of a new trestle on the Lehigh Valley R.R. at Spring Garden. Henry C. Pelton, 8 West 38th St., New York, N. Y., is the Engr.-in-charge.

Reading, Penn.—The Board of County Commissioners will soon ask for bids for the building of a concrete and steel bridge at Kempton.

Wilkes-Barre, Penn.—Bids will be received shortly, by the Board of County Commissioners, for the construction of a new bridge on the Susquehanna River at Nanticoke. A sum of $280,000 has been appropriated for the undertaking.

Wheeling, W. Va.—The City Council is having plans prepared for the construction of a new bridge to be built across Caldwells Run at the foot of Moyston St., in South Wheeling. Charles Cook is City Engr.

+Tallulah, La.—We are officially advised that the Parish Police Jury has awarded a contract to the HAAS-SKINNER ENGINEERING CO., Dallas, Tex., at $5500, for the construction of two bridges, one across Roundaway Bayou, eight miles south of Tallulah, and one across Bull Calf Bayou, seven miles north of Waverly. Bids were received on Jan. 2. W. H. Harvey is Secy. Noted Dec. 19.

Sparta, Tenn.—The Tennessee, Kentucky & Northern R.R. will construct eight steel bridges on its new line from Sparta to Rock Creek. George A. Clark is Pres.

Cincinnati, Ohio—The Board of County Commissioners has approved plans prepared for the construction of a concrete culvert on Shawnee Run, near Wooster Pike. Bids will be received shortly. The estimated cost is $21,162. Albert Reinhardt is Clk.

Cleveland, Ohio—We are officially advised that legislation is being perfected and bids will be received during the spring, by the Board of County Commissioners, for the construction of a new bridge over Big Creek to replace the condemned Brooklyn-Brighton Bridge. The new bridge will start at West 25th St. and Selzer Ave., and will end at Pearl Road and Parkside Ave. The estimated cost is $700,000. John F. Goldenbogen is County Clk. Noted Jan. 2.

+Tuscarawas, Ohio—The Board of County Commissioners has awarded a contract to GEORGE J. BOCK & SON, Coshocton, at $12,186, for the construction of a concrete substructure of a bridge to be built over the Tuscarawas River, near the town of Tuscarawas. Bids were received on Dec. 30. W. C. Shott is Audr. Noted Nov. 21.

Youngstown, Ohio—The City Council Committee has decided to recommend a viaduct in Oak St., to extend from the intersection of Penn Ave. to East Rayen Ave., at a point about 500 ft. east of Watt St., with an approach from Summit Ave. to Ryan Ave. The plans for the East Federal St. bridge, which will eliminate the Himrod Ave. crossing, were also agreed upon. The approach in East Federal St. will extend due east over Crab Creek, with a span from there to the intersection of Himrod Ave. and Wilson Ave., which is about half way between the present bridge approach and Himrod Ave. Frank Lillie is City Engr.

+Ligonier, Ind.—We are officially advised that the Board of Commissioners of Noble County has awarded a contract to FREDERICK PERRY, Logansport, at $13,915, for the construction of a 90-ft. span reinforced concrete arch bridge, over the Elkhart River, at Ligonier. Other bids were: George Quinlan, Chicago, Ill., County Plan (a) $16,870, (b) $16,730, (c) $16,730; Burke Bros., New Castle, own plan, $11,449; National Concrete Co., Indianapolis, own plan, $13,266; Elkhart Bridge Co., Elkhart, County plan, $13,877; steel bridge, $10,977; Doty Bros., Milford, $14,990. Bids were received on Jan. 8. A. W. Grosvenor, 310 Bank Block, Fort Wayne, is Engr.-in-charge. Noted Dec. 19.

Vincennes, Ind.—The Boards of Commissioners of Knox and Gibson Counties have ordered the construction of a bridge over the White River, at Hazleton.

Chicago, Ill.—The City Council has authorized the construction of the following bridges over the Chicago and Calumet Rivers: Twelfth St., estimated cost $480,000; Lake St. double deck bridge, estimated cost $430,000; Wood St. bridge, estimated cost $175,000; South California Ave. bridge, estimated cost $200,000; Fuller St. bridge, estimated cost $175,000; North Central Park Ave. bridge, $19,000; North 40th Ave. bridge, $9000; North 48th Ave. bridge, $9000; Irving Park Blvd. bridge, $68,000; Madison St. bridge, estimated cost $330,000; Webster Ave. bridge, estimated cost $250,000; 106th St. bridge, estimated cost $250,000; Belmont Ave. bridge, estimated cost $250,000. L. E. McGann is Commr. of Pub. Wks.

Peoria, Ill.—The Chicago, Rock Island & Pacific R.R. has notified the City Council that it has accepted the plans prepared by Hendrick & Cochrane, Engrs., Kansas City, Mo., for the construction of a viaduct at Bridge St. J. B. Berry, Chicago, is Ch. Engr.

Des Moines, Iowa—The Board of County Supervisors has decided to spend $30,000 during the coming year for the construction of permanent bridges. James B. Uhl is Superv.

+Wichita, Kan.—The Board of County Commissioners has awarded contracts for bridge construction as follows: to the MISSOURI VALLEY BRIDGE & IRON CO., St. Louis, Mo., at $5149, for a bridge in Valley Center Township; to the WICHITA CONSTRUCTION CO., Wichita, at $4625, for a bridge in Park Township. Noted Nov. 28.

Albany, Mo—The Board of Commissioners of Gentry County has decided to construct a steel span bridge, 100 ft. long. John B. Ray is Engr.-in-charge.

Chillicothe, Mo.—The City Council has passed a resolution instructing the Chicago, Burlington & Quincy R.R. and the Wabash R.R. to reconstruct a steel bridge over the tracks at the foot of Locust St.

Waynesville, Mo.—We are officially advised that bids will be received about May 1, by the County Court of Pulaski County, for the construction of a steel bridge across the Gasconade River, at Mayes Ford. Noted Jan. 2.

Spokane, Wash.—The Northern Pacific Ry. has asked the approval of the department of public works of plans for a $25,800 detour viaduct, which is to handle the Sprague Ave. and Division St. traffic during the construction of the grade separation work at this point in connection with the general grade separation plan. The temporary viaduct, to the cost of which both the Northern Pacific Ry. and the Washington Water Power Co. are to contribute, will begin at the intersection of Riverside Ave. and Division St., continue northeast on Riverside Ave. to the point where the alley between Riverside and Main Aves., intersect, then turn north, carrying the roadway and streetcar tracks over the Northern Pacific freight sheds and right of way. The viaduct is to run north on Hilliard St. at this point as far as Sprague Ave., turning east on Sprague and continuing to Spokane St. J. D. Koren, Spokane, is Div. Engr.

San Francisco, Calif.—We are officially advised that the preliminary work of making borings and tests for the construction of a new railway and highway bridge across Suisun Bay, at Chipps Island, for the Oakland, Antioch & Eastern Ry., are now being made. Plans will be ready in about 60 days. The estimated cost is $1,600,000. Waddell & Harrington, 1012 Baltimore Ave., Kansas City, Mo., are the Engrs.-in-charge. Noted Nov. 7.

Kincardine, Ont.—Bids will be received until Jan. 27, by the County Clerk, for the construction of a center pier for the Southampton Bridge, across the Sangreen River. P. A. Malcomson is Clk.

Toronto, Ont.—The citizens have voted to construct a viaduct at Bloor St. to provide a right of way for the Civic streetcar service. The estimated cost is $2,500,000. R. C. Harris is City Engr.

WATER SUPPLY—IRRIGATION

New Durham, N. H.—The South Eastern New Hampshire Water Supply Co. will ask a charter from the State Legislature to install a gravity water system to serve Portsmouth, Dover, Rochester, Somersworth, Farmington, Salmon Falls, and possibly Newmarket, Newfield and Exeter. The supply will be obtained from Merry Meetin Lake, in New Durham. Dudley & Sawyer, Manchester, are Consult. Engrs.

Rochester, N. H.—F. B. Preston, Mayor, has recommended to the City Council the installation of a larger water main from Round Pond, to connect with the main below the reservoir, and the construction of a new gatehouse at Round Pond.

Boston, Mass.—Bids will be received by the Supply Department until Jan. 27, for supplying 55,000 lb. of composition castings, 1,125,000 lb. of miscellaneous iron castings, and 35 tons of 4-in., 150 tons of 6-in., 600 tons of 8-in., 650 tons of 10-in., 900 tons of 12-in., 700 tons of 16-in., and 80 tons of 30-in. c.-i. water pipe, also 50 tons of special castings. J. Edward Mullen, Tremont Bldg., is Supt.

+Providence, R. I.—A contract to furnish hydrants and water gates for the water-works was awarded by the Board of Contract and Supply, Jan. 2, to the COUGHLIN VALVE CO., Boston, Mass., at $12,563.

+Freeport (L. I.), N. Y.—According to press reports, a contract to extend the water and light plants has been awarded to the WILLIAM M. SHEEHAN & CO., at $17,970. Plans were prepared by William R. Smith, Engr.

New York, N. Y.—We are officially advised that the date for receiving bids for the construction of the Jerome Park Filters, Boroughs of Manhattan and the Bronx, has been postponed until 2 p.m., Jan. 23. The contract includes about 800,000 cu.yd. of excavation and about 350,000 cu.yd. of concrete masonry, with piping, valves, strainer system, operating tables, apparatus for handling and applying chemicals, etc. The bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity. Noted Dec. 5.

Bids will be received by the Board of Health until Jan. 17, for furnishing and delivering, as required, pipe, fittings, stop cocks, valves and miscellaneous plumbers' and steamfitters' supplies and hardware, to the hospitals of the Department of Health, during the year 1913.

West Winfield, N. Y.—The Conservation Commission has approved the maps and plans submitted by the village for the installation of a water system. The system is estimated to cost $33,000. W. G. Stone, Mann Bldg., Utica, N. Y., is Consult. Engr.. Noted Nov. 7.

Garfield, N. J.—The Borough Council contemplates enlarging its plant, and connecting it with the system of the Acquackanonk Water Co. Anton L. Petersen is Engr.

Hawthorne, N. J.—According to press reports, H. J. Harder, Boro. Engr., has completed preliminary plans for a water system here, estimated to cost $100,000. The plans include a pumping station and a reservoir.

+New Brunswick, N. J.—Bids for constructing a mechanical filtration plant of 6,000,000 gal. daily capacity, were received by the Water Commissioners, Dec. 30, as follows: Pittsburgh Filter Mfg. Co., Pittsburgh, $124,575; Norwood Engineering Co., Florence, Mass., $136,675; Roberts Filter Mfg. Co., Darby, Philadelphia, $123,258; Nicola Filtering Co., Pittsburgh, $137,260; New York Continental Jewell Filtration Co., New York, $119,725; John W. Danforth Co., Buffalo, $108,000. Plans were prepared by George W. Fuller, Consult. Engr., 170 Broadway, New York. Noted Dec 26.

Ramsey, N. J.—We are officially advised that bids will be received by the Borough Council until 8 p.m., Feb. 4, for constructing a complete water system. The contract involves about 11 miles of c.-i. water mains, from 4 to 10 in., a pumping plant, pumps, a caisson well and a 1,000,000-gal. reservoir. Henry R. Parvin is Boro. Clk.

Pittsburgh, Penn.—Bids will be received by the Department of Public Works until 10 a.m., Jan. 20, for furnishing and installing boilers and appurtenances in the Brilliant Pumping Station, Contract 13A; and for furnishing and installing coal-handling machinery in the Brilliant Pumping Station, Contract 13B. Specifications may be obtained in the Contract Offices, 432 Oliver Bldg. Joseph G. Armstrong is Dir.

Rankin, Penn.—We are officially advised that Chester & Fleming, Consult. Engrs., Pittsburgh, have been retained to investigate and report on the water system, with a view to rebuilding.

Westernport, Md.—According to press reports, bids are being received by Brady Bros., 12 Welsh St., Frostburg, Md., for furnishing 10,000 ft. of 10-in. c.-i. pipe. Brady Bros were recently awarded a contract to install a water system at Westernport. Noted Oct. 24.

Washington, D. C.—The following bids were received at the office of the Commissioners of the District of Columbia, Jan. 3, for furnishing, delivering, and erecting three steel Water Towers for use of the water department: Des Moines Bridge & Iron Co., Pittsburgh, Penn., $12,930; alternate, $14,030 and $12,100; Chicago Brass & Iron Works, 105th and Throop Sts., Chicago, Ill., (A) $14,150; (B) $16,200.

Graham, Va.—The town contemplates extensions and improvements to the water system. J. M. Smith is Mayor.

Wheeling, W. Va.—Bids will be received at the office of the County Auditor, until Jan. 20, for laying about one mile of water main, with the necessary hydrants, valves and boxes, in Warren Township.

Durham, N. C.—Gilbert C. White, Consult. Engr., Charlotte, N. C., is making investigations for a new water supply.

Gastonia, N. C.—We are officially advised that bonds for $40,000 are for sale here, the proceeds to be used for extending the water system. James E. Rankin is Town Clk. Noted Dec. 19.

Goldsboro, N. C.—Gilbert C. White, Consult. Engr., Charlotte, N. C., is preparing plans and specifications for an electrical pumping station and a filtration plant for the water system here.

Raleigh, N. C.—According to press reports, the Board of Aldermen has asked the General Assembly for the authority to issue bonds for $400,000 for acquiring a municipal water system. J. N. Hazlehurst, Atlanta, Ga., is Consult. Engr. Noted Dec. 26.

Charleston, S. C.—Bids will be received by the Street Department until 7 p.m., Jan. 30, for furnishing and delivering iron castings for the year 1913. Specifications will be furnished on application. J. H. Tingle is City Engr.

Jacksonville, Fla.—The Lake Worth Light, Water & Ice Co. is being incorporated here to supply water and light to the surrounding towns and territory.

Madison, Fla.—Bonds for $5000 have been voted for laying water mains. For particulars, address the Mayor.

✦Biloxi, Miss.—Contracts have been awarded by the City Council as follows: Constructing new reservoir and pump house, to GILES HARKNESS, Biloxi, at $1597; laying pipe, to the COOPER-GREER CO., Biloxi, at $2887. E. L. Castanera is Supt. W.-Wks. Noted Dec. 19.

Shreveport, La.—According to press reports, an election has been called for Feb. 4, to vote on a bond issue of $300,000, for the purchase of the lands surrounding Cross Lake. It is intended to use the territory for a reservoir for the water system. J. H. Eastham is Mayor.

Cleveland, Ohio—The Water Department has decided to construct the West Side Tunnel for the water system, by direct labor. It is estimated that the work can be done in this way at a cost of $900,000; the lowest bid received from a contractor was $1,062,800. The tunnel will be about four miles long, extending from Wedgewater Park shore to the new intake crib. Noted Dec. 12.

Glendale, Ohio—John W. Hill & Sons, Consult Engrs., Cincinnati, Ohio, are preparing plans for raising the standpipe and laying additional mains. Estimated cost, $7000. Bids will probably be asked in March or April.

Kenmore, Ohio—The Payne Engineering Co., Second National Bank Bldg., Akron, Ohio, is preparing plans for a water system here.

Willoughby, Ohio—Bids will be received by the Board of Public Affairs until Feb. 22, for furnishing material and constructing a 1,000,000-gal. mechanical water purification plant, according to plans prepared by Burgess & Long, Consult. Engrs., Columbus, Ohio. F. P. Saxton is Clk. of Bd.

Montpelier, Ind.—The only bid received by the City Council, Dec. 26, for the franchise to maintain and operate a water and light plant for a period of 15 years, was submitted by Charles McCauley, Montpelier. Noted Dec. 19.

Grand Rapids, Mich.—We are officially advised that bonds for $100,000 have been sold for extending the water mains. L. D. Cutcheon is Mgr. Bd. Pub. Wks. Noted Jan. 2.

✦Kalamazoo, Mich.—We are officially advised that the contract to furnish about 500 tons of 4- to 12-in. c.-i. water pipe has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Chicago, Ill., at $9122. The other bids were: McWane & Rice, $9138; Massillon Iron & Steel Co., $9208; American Cast Iron Pipe Co., $9755; James B. Clow & Sons, $9224; R. D. Wood & Co., $9994. Noted Jan. 2.

Carpentersville, Ill.—According to press reports, bonds for $18,000 have been voted for installing a water system here. Noted Dec. 26.

Chicago, Ill.—Bids will be received by the Department of Public Works, until 11 a.m., Jan. 17, for furnishing and delivering hydrant and stop valve castings to the water-works shops, 2304 South Ashland Ave. Bids will be received by the Department of Public Works until 11 a.m., Jan. 20, for furnishing and delivering at the meter shop, 1330 Indiana Ave., 75 ⅝-in., 300 ¾-in., 200 1-in. and 200 2-in., disk water meters. L. E. McGann is Comr. Pub. Wks.

Moline, Ill.—The Engineering Department is preparing plans for constructing water mains and sewers in the district bounded by 34th and 55th Sts., Eleventh Ave. and the river.

La Crosse, Wis.—The lowest bid received by the Board of Public Works, for laying a pipe line to the new wells, was submitted by the J. W. Turner Improvement Co., Des Moines, Iowa, at $17,899.

Boyd, Minn.—Bids will be received by A. J. Mattke, Village Clk., until 7:30 p.m., Jan. 21, for extending the water system. The contract includes building a cement block addition to the present water-works building, laying c.-i. mains, specials, hydrants, etc. Plans and specifications may be obtained from the Village Clerk, or from Earle D. Jackson, Consult. Engr., St. Paul, Minn.

Mount Iron, Minn.—Bids will be received until Jan. 28 by the Village Council, for $50,000 water bonds. George Eilertsen is Village Recdr.

Shakopee, Minn.—Bonds for $10,000 have been sold for extending the water system. Bids will probably soon be asked for construction work. H. P. Marx is Chn. Water Comn. Noted Nov. 21.

Mulberry, Kan.—Bonds for $45,000 have been voted for the installation of a water system and an electric-light plant here. Bids will probably soon be asked for construction work, from plans prepared by E. T. Archer & Co., Consult. Engrs., New England Bldg., Kansas City, Mo. H. L. Gees is City Clk. Noted Nov. 28.

Doniphan, Neb.—We are officially advised that bids will be received by the Board of Trustees until 1 p.m., Jan. 16, for constructing a complete water system and electric-light plant. Estimated cost, $15,000. Plans and specifications are on file at the office of L. G. Scudder, Village Clk., and at the office of Charles F. Sturtevant, Consult. Engr., Holdrege, Neb. Noted Dec. 12.

Grand Island, Neb.—The date of receiving bids for the proposed three deep wells has been extended to 8 p.m., Feb 5. H. E. Clifford is City Clk. Noted Dec 26.

Lincoln, Neb.—Bids will be received by Roscoe C. Ozman City Clk., until noon, Jan. 23, for furnishing and erecting a 500-hp. water-tube boiler, one chain grate stoker for a 500 hp. boiler, and one for a 250-hp. boiler.

McIntosh, S. D.—We are officially advised that bids will probably be asked about Mar. 1, for constructing a steel tower and tank, and three blocks of water mains. Estimated cost, $8000. John J. Flaherty is City Audr. Noted Jan. 2

✦Billings, Mont.—We are officially advised that the contract to construct the necessary pipe lines, distributing canals and pumping plants for the proposed irrigation system of the Lockwood Irrigation District, has been awarded to G. S. WELSOHNS, Stillwater, Minn., at $81,000. Bids were opened Jan. 6. E. D. Ford is Secy. Noted Jan. 2.

Billings, Mont.—According to press reports, an election will soon be called to vote on a bond issue of $600,000 for the installation of a municipal water system.

Drexel, Mo.—E. T. Archer & Co., Consult. Engrs., New England Bldg., Kansas City, Mo., have prepared preliminary plans for the installation of a water system here. An election will soon be called to vote on a bond issue of $40,000 for this work.

Maryville, Mo.—The city, which recently purchased the plant of the Maryville Water Co., contemplates an expenditure of $30,000, for extensions and improvements to the system. Noted Oct. 31.

Big Springs, Tex.—The city has issued bonds for $50,000 for the installation of a water system. Noted Nov. 28.

Denison, Tex.—The city contemplates a bond issue of $40,000 for the installation of a filtration plant for the water system. A. W. Acheson is Mayor.

Granbury, Tex.—Preliminary plans have been prepared for extending the water system. Estimated cost, $15,000. J. B. Ross is Mayor.

✦Grandfalls, Tex.—The Consolidated Reservoir Co. has awarded a contract to J. J. WHEAT, Grandfalls, for the construction of an extension to its irrigation canal. The company will also construct several storage reservoirs.

Collinsville, Okla.—Bonds for $40,000 have been voted for municipal improvements. It is intended to expend $20,000 for improving the water system and the electric-light plant, $5000 for a sewage disposal plant, and the remainder for street work, etc. W. F. Keller is Engr. Noted Dec. 26.

Guthrie, Okla.—The City Commissioners contemplate drilling an artesian well, 2000 ft. deep, in one of the city parks. Bids will probably soon be asked.

Sapulpa, Okla.—We are officially advised that bids will be received until Feb. 1, for $75,000 water and sewer bonds. The bonds were issued for extending the water and sewer systems, changing from electric to steam power, and riprapping Dam 3. H. K. Howard is City Engr. S. J. Smith is Mayor. Noted Jan. 2.

✦Phoenix, Ariz.—A contract has been awarded to the GRANT BROS. CONSTRUCTION CO., Security Bldg., Los Angeles, Calif., for widening the Grand Canal, for the Salt River Valley Water Users' Association, at 13½c. per cu.yd. for excavation. About 25,000 cu.yd. will be moved.

Centralia, Wash.—We are officially advised that the city will install a municipal water system, the supply to be obtained from the North Fork of the Newaukee River, 16 miles from the city. Estimated cost, $170,000. Bids will probably be asked the latter part of March. Stanley Macomber is City Engr. Noted Nov. 7.

✦Farmington, Wash.—The contract to construct a water system here has been awarded to FOSTER & TRIMBLE, Spokane, Wash., at $7892. Noted Oct. 31.

✦Hood River, Ore.—The contract to construct Divisions 1, 3 and 4 of the water system has been awarded to the RELIANCE CONSTRUCTION CO., Portland, Ore., at $44,021. Bids were opened Dec. 23, by H. L. Howe, City Recdr. Plans were prepared by Newell, Gasset & Walsh, Consult. Engrs., Portland. Noted Oct. 10.

Burbank, Calif.—An election will soon be called to vote on a bond issue of $50,000, for the installation of a municipal water system.

✦Fullerton, Calif.—The contract to construct a water system here has been awarded to E. D. VINCENT, Oakland, Calif., at $45,000. Plans were prepared by Sloan & Robson, Consult. Engrs., Nevada Bank Bldg., San Francisco. Bids were opened Dec. 9. Noted Dec. 5.

✦Longbeach, Calif.—A contract has been awarded to the LAYNE & BOWLER CO., 900 Santa Fé Ave., Los Angeles, at $8000, by the Southern California Edison Co., for sinking a well and constructing a derrick at the plant of the company.

Los Angeles, Calif.—Bids for constructing a water tank at the Los Angeles County Farm were received by the Board of Supervisors of Los Angeles County, Dec. 30, as follows: Llewellyn Iron Works, $10,975; Western Boiler & Steel Co., $11,600; Security Construction Co., $9533. Noted Dec. 26.

Redlands, Calif.—Bids will be received by the City Trustees until 1 p.m., Feb. 5, for furnishing and installing a power plant capable of furnishing 600 hp. for the municipal water system. George S. Hinckley is City Engr.

San Francisco, Calif.—According to press reports, bids will be received by the Panama-Pacific Exposition Committee until Jan. 28, for installing a high-pressure system and a water service system at the exposition grounds. The contract includes about 9½ miles of 6- to 16-in. pipe line and 180 hydrants.

Santa Barbara, Calif.—The city contemplates an expenditure of $38,000 for constructing a tunnel for the water system.

+Venice, Calif.—A contract to furnish pipe to the Water Department has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., San Francisco, Calif., at $36.50 per ton for 8-in. c.-i. pipe.

Watts, Calif.—We are officially advised that the town will install a municipal water system, estimated to cost $50,000. The supply will be obtained from wells 250 ft. deep. J. S. Lange, Plumbing Inspector, and the City Engineer are preparing plans. Noted Dec. 12.

SEWERS

Nashua, N. H.—William H Barry, Mayor, has recommended to the City Council the extension of the Lake St. sewer. G. P. Winn is City Engr.

Fitchburg, Mass.—It is expected that bids will be asked early in the spring for the remainder of the improvements to the sewer system. David H. Hartwell is Engr. for Sewer Comrs. Metcalf & Eddy, 20 Beacon St., Boston, are Consult. Engrs.

Hazardville, Conn.—Surveys will probably soon be started for the installation of a sewer system here. Frank Rosenberger is a member of the Bd. of Selectmen.

Orange, Conn.—An election will probably soon be held to vote on an appropriation for installing a sewer system in the Davin Rock District.

Albany, N. Y.—Stephen B. Vernon, previously connected with the Intercepting Sewer Board of Syracuse, N. Y., has been appointed engineer in charge of the proposed new sewer system here, which is estimated to cost $1,000,000. Hering & Gregory, 170 Broadway, New York, are Consult. Engrs. Noted Dec. 26.

Freeport, (L. I.) N. Y.—The State Health Department has approved the plans prepared by Alexander Potter, Consult. Engr., 50 Church St., New York, for the construction of a sewer system and a sewage disposal plant here. The plans provide for a pumping plant equipped with three centrifugal pumps having a total capacity of 5,500,000 gal., and a disposal plant to consist of a settling tank, intermittent sand filters and auxiliary sludge beds. Noted Dec. 26.

Lawrence, (L. I.) N. Y.—The Board of Trustees has had plans prepared for the installation of a sewer system and a sewage disposal plant in the Bannister Creek Valley. Since the plans were completed, it has been suggested that the system might be installed at less cost if Inwood, Cedarhurst and Woodmere be included in the system, with one disposal plant situated on the Jamaica Shore. An election will soon be called to vote on the proposition. Hobart Porter is Village Pres.

New York, N. Y.—According to press reports, the bids received by Maurice E. Connolly, Pres. Boro., of Queens, Dec. 30, for constructing the main outlet trunk sewer for the Corona District, have been rejected. The contract will probably be readvertised. Noted Jan. 9.

Syracuse, N. Y.—Bids will be received by the Board of Contract and Supply until 1:30 p.m., Jan. 20, for furnishing material and laying 12- and 15-in. pipe sewer in various streets. Plans and specifications are on file at the office of the Board. George J. Metz is City Clk.

Fairview, N. J.—The town contemplates the installation of a sewage disposal plant.

Secaucus, N. J.—At the election held Dec. 31, the citizens voted for the installation of a sewer system for the Clarendon Section. Plans for this system have been prepared by Sebastian Maulbeck, Boro. Engr. Noted Dec. 19.

Tenafly, N. J.—We are officially advised that bids will be probably be asked in May or June for constructing sewer main, laterals, pumping station and a sewage disposal plant. Estimated cost, $215,000. Watson G. Clark is City Engr. F. L. Colver is Mayor. Noted Dec. 12.

Carbondale, Penn.—Bids will be asked some time during the spring for the construction of a sanitary sewer system and a sewage disposal plant here. The system comprises about seven miles of sewers. R. J. Gillis is Boro. Engr. Noted Nov. 21.

Catonsville, Penn.—The plans submitted by Robert B. Morse, Engr., State Dept. of Health, for a sewer system here, provide for about 18 miles of sewers, and four disposal plants, one temporary. Estimated cost, $106,000. Noted Dec. 26.

Jenkintown, Penn.—Bonds for $75,000 have been voted for installing a sewer system here. J. K. Leatherman is Town Clk. Noted Jan. 2.

+North Braddock, Penn.—We are officially advised that the contract to construct brick sewers in Verona St. has been awarded to PHILLIPS & GEORGE, North Braddock. Bids were opened Jan 3. George F. Slefers is Boro. Engr. Noted Jan. 2.

+West Newton, Penn.—We are officially advised that the contract to construct sanitary sewers in various streets has been awarded to P. PHILLIPS & SON, McKeesport, Penn. Bids were opened Dec. 15. Noted Dec. 12.

+Washington, D. C.—A contract to construct sewers in the valley of Broad Branch, and in Military Road, between Rock Creek Church Road and Piney Branch Road, has been awarded to the W. F. BRENIZER CO., Washington, at $6787. Noted Dec. 12.

+Louisville, Ky.—Bids will be received by the Board of Public Works until 2 p.m., Jan. 17, for constructing the following sewers: Section 2, 24-in. Sewer Contract No. 5, Section 2, Main or 21-in. Sewer Contract No. 6, Section 2, Green St. Sewer Contract No. 7, 11th & West St. Sewer Contract No. 8, 9th, Jefferson and Madison St. Sewers Contract No. 10. The estimated amount of work to be performed and materials furnished is as follows: 540 lin.ft. 36-in. sewer, average cut 15 ft. 520 lin.ft. 33-in. sewer, average cut 12 ft. 1850 lin.ft. 30-in. sewer, average cut 10 ft. 390 lin.ft. 27-in. sewer, average cut 8 ft. 1440 lin.ft. 24-in. sewer, average cut 9 ft. 400 lin.ft. 20-in. sewer, average cut 6 ft. 2010 lin.ft. 18-in. sewer, average cut 10 ft. 3540 lin.ft. 15-in. sewer, average cut 9 ft. 250 vertical ft. of man-holes. Noted Jan. 7.

+Bremen, Ohio—We are officially advised that the contract to construct sewers in Storm Water Sewer District No. 2, will probably be awarded to WILLIAM STRACHAN, Lancaster, Ohio, at $9963. The other bids received were: Henderson & Houston, Logan, Ohio, $10,058; Adams Bros. Cont. Co., Zanesville, Ohio, $13,150; Karns & Vandenbach, Franklin, Penn., $11,894; H. E. Miller, Cols, Ohio, $10,033; Kohbarger & Hoyts, Marion, Ohio, $11,136. Bids were opened by E. T. Furvis, City Clk., Jan. 6. Noted Dec. 19.

Celina, Ohio—The W. J. Sherman Co., Toledo, Ohio, is completing plans and specifications for the construction of sanitary and storm sewers here.

Cleveland, Ohio—Bids will be received at the office of W. J. Springborn, Dir. Pub. Ser., until noon, Jan. 23, for constructing sewers in Arkansas Ave., Behrwald Ave., Cotes Ave., Proctor Court, and various other streets. Plans and specifications are on file at the office of the Chief Engineer, Room 305, City Hall.

Fostoria, Ohio—The City Council has instructed the City Engineer to prepare plans for improving the sewage disposal plant to comply with the recent order of the State Board of Health.

Piqua, Ohio—Plans are being prepared for constructing about 3000 ft. of 4-ft. concrete storm sewer in Water St. Albert Schroeder is City Engr.

Put-in-Bay, Ohio—Bids will be received by E. H. Ritter, Village Clk., until 7 p.m., Jan. 16, for constructing sewers in Sewer District No. 2.

St. Clairsville, Ohio—All bids received, Dec. 23, by E. Campbell, Audr. Belmont County, for constructing nine sewers with concrete heads, encased in concrete, and four concrete or rubblestone culverts, were rejected. Noted Dec. 19.

Troy, Ohio—We are officially advised that bids will be received by G. B. Hatfield, Dir. Pub. Ser., until noon, Feb. 4, for constructing six miles of sanitary sewer. Alva W. Scott is City Engr.

+Elkhart, Ind.—We are officially advised that the contract to construct the 13th District Sewer has been awarded to the NORTHERN CONSTRUCTION CO., Elkhart, at $6254. Bids were opened by B. I. Bixler, City Clk., Jan. 8. Noted Jan. 2.

Fort Wayne, Ind.—Frank Randall, City Engr., has prepared plans and specifications for the construction of two sanitary sewers, about 4½ miles long, to serve northwest Bloomingdale.

South Bend, Ind.—Bids will probably soon be asked by the Board of Public Works for constructing about ¾ mile of 24-in. vitrified pipe sewer in Eddy St., two miles of 15- to 24-in. concrete and vitrified pipe sewer in Mishawaka Ave., and for a 12-ft. reinforced concrete storm and sanitary sewer at Bowman Creek. W. S. Moore is City Engr.

Champaign, Ill.—D. M. Sizer, City Engr., is preparing plans for the Fountain Head Sewer. Estimated cost, $10,000. W. Coughlan is Mayor.

Moline, Ill.—See item under Water Supply—Irrigation.

Wilmington, Ill.—Plans and specifications have been completed for a sewer system here, estimated to cost $30,800. W. H. Carter is Secy. Bd. Local Impvts.

Belmond, Iowa—M. Tschirgi & Sons, Consult. Engrs., Cedar Rapids, Iowa, have prepared plans for the construction of two miles of sewers and a septic tank here. Bids will probably soon be asked.

+Manning, Iowa—We are officially advised that the contract to construct a sewer system here has been awarded to ARTHUR A. DOBSON, Lincoln, Neb., at $18,873. Bids were opened by M. Brunneir, City Clk., Jan. 6. P. A. Edquist, Omaha, Neb., is Consult. Engr. Noted Dec. 5.

Hibbing, Minn.—According to press reports, bids will be received until Jan. 21, for constructing an outlet to the sewer south of Brookston.

Salina, Kan.—J. H. Dousman, Consult. Engr., Kansas City, Mo., is preparing plans and specifications for the construction of a sewage disposal plant here. Paul Wakenhut is City Engr.

Richmond, Mo.—According to press reports, bids will be received by the City Council until Jan. 20, for constructing a system of vitrified pipe sewers, estimated to cost $15,000. Worley & Black, Kansas City, Mo., are Consult. Engrs. Noted Nov. 7.

Little Rock, Ark.—Bids will be received by the Board of Public Affairs until noon, Jan. 20, for constructing sewers, according to plans and specifications on file at the office of the Superintendent of the Board. Fred A. Isgrig is Clk.

+Calvert, Tex.—We are officially advised that contracts for installing a sewer system here have been awarded by the city as follows: Furnishing pipe to the SAN ANTONIO SEWER PIPE CO., San Antonio, Tex., at $1450; to the FOUNTAIN SHAW ENGINEERING CO., trenching, $1808; CALVERT LUMBER CO., furnishing brick, $8.25 per M.; cement, $1.95; STARZ & SONS, Cedar Rapids, Iowa, flush tank, siphons, $18.80 each; ENTERPRISE IRON WORKS, manhole covers and frames, $2.33; TEXAS ROLLING MILLS, reinforcing steel, $2.10 per hundred; HARTWELL IRON WORKS, Houston, cast pipe, $2.15; SMITH & WHITNEY, Dallas, gate valves, $4, $6.25, $8. Noted Dec. 19.

+Enfaula, Okla.—The contract to construct a sewer system here has been awarded to the McHENRY CONSTRUCTION CO., Little Rock, Ark., at $67,250. Noted Aug. 5.

Spokane, Wash.—Bids for constructing the Fifth Ward subtrunk sewer were received by the Board of Public Works,

Jan. 2, as follows: G. Burgle, $12,200; Raible & Hukkela, $12,348; J. L. Wood, $11,078; DeCamp & Cheatham, $11,430; Nick Thompson, $11,598; O. H. Stratton, $12,100; Scott & Hicks Construction Co., $12,349; J. W. Baylor, $13,800; J. C. Broad, $12,365; Fife Bros., $12,844; P. L. Lanigon, $13,117.

Portland, Ore.—The lowest bid received by the Board of Public Works, Dec. 27, for constructing the East Glisen St. extension of the East Stark St. sewer, was submitted by Gleibish & Joplin, Portland, at $156,167. Three other bids were: Consolidated Contract Co., $159,731; Jeffrey & Buffton, $158,230; James Kennedy Construction Co., $159,850.

We are officially advised, in connection with the bids on the third section of the East Stark St. trunk sewer, that owing to the fact that a state law had been passed limiting hours of labor on public work, in the interim between the preparation of the engineer's estimate and the reception of the bids, all the bids exceeded the city's estimate. Bids will probably be readvertised unless some legal proceedings should delay the work. This sewer will consist of about 12,000 ft. of concrete sewer ranging from 33 to 87 in. in diameter, besides a large amount of pipe sewer, manholes and other appurtenances. T. M. Hurlburt is City Engr. Noted Jan. 2.

Alhambra, Calif.—We are officially advised that bids will be received until Jan. 18, for constructing storm sewers. Estimated cost, $15,000. Olmstead & Gillelen, Wright & Callender Bldg., Los Angeles, Calif., are Consult Engrs. O. M. Caulk is City Clk. Noted Nov. 21.

Oceanside, Calif.—The City Engineer has prepared estimates and surveys for a sanitary sewer to serve 40 blocks. Estimated cost, $20,000.

Ontario, Calif.—Bids will be received by the Board of Trustees until 7 p.m., Jan. 20, for constructing an outfall sewer from Mailand and Plum Aves., to Dessau and Sultana Sts., and along Sultana St. R. C. Brackenridge is City Clk.

Richmond, Calif.—W. S. Farley, City Engr., is preparing plans for a main outfall sewer, which later is to serve the district recently annexed by the city.

Winnipeg, Kan.—H. N. Ruttan, Engr., 223 James Ave., is preparing plans for extensions to the sewer system, estimated to cost $50,000. Bids will probably soon be asked.

Edmonton, Alta.—The date of receiving bids for the proposed trunk sewer has been extended to Jan. 29. The contract includes the following: Contract 3, 4050 lin.ft. 8-ft. sewer; 2200 lin.ft. 6-ft. 6-in. sewer; 1950 lin.ft. 4-ft. sewer; and accessories. Contract 4, 6300 lin.ft. 4-ft. sewer, and accessories. Contract 5, 1200 lin.ft. 6-ft. sewer; 4650 lin.ft. 5-ft. sewer; 1620 lin.ft. 4-ft. 6-in. sewer; and accessories. Contract 6, 1400 lin.ft. 6-ft. sewer, 2050 lin.ft. 5-ft. sewer; 3750 lin.ft. 4-ft. 6-in. sewer; 3400 lin.ft. 4-ft. sewer; and accessories. Contract 7, 4050 lin.ft. 4-ft. sewer; 3500 lin.ft. 5-ft. sewer; and accessories. Contract 8, 4700 lin.ft. 6-ft. sewer; 4700 lin.ft. 5-ft. sewer; 2450 lin.ft. 4-ft. sewer; and accessories Noted Jan 9.

★**Toronto, Ont.**—Bids will be received by H. C. Hocken, Mayor and Chn. Bd. of Control, until noon, Jan. 21, for constructing the Earlscourt Outlet; Western Section, which consists of laying 2246 ft. of 6 ft. x 8 ft. 10 in. culver-shaped sewer. Specifications are on file at the office of Engineering News, 505 Pearl St., New York, N. Y.

STREETS AND ROADS

✚**Lawrence, Mass.**—Bids received by the Commissioners of Essex County for construction of the Lawrence-Methuen Blvd. were as follows: James M. Gurdy, Lawrence, $49,984; T. A. Manahan, South Hamilton, $55,228; James A. Gaffey, Medford, $71,892; JOSEPH WAGENBACH & SONS, Lawrence, $47,492 (awarded contract); Connors Bros. Co., Lowell, $53,850; Richard F. Hudson, Melrose, $57,484; J. J. Evans, Lowell, $49,957; M. O'Mahoney Estate, Lawrence, $50,289; W. J. Carroll, Lawrence, $51,763. Noted Jan. 9.

✚**Hartford, Conn.**—Contracts for state road work, bids for which were received by the State Highway Commissioner, Dec. 31, have been awarded as follows:

Town of Cheshire, 1145 lin.ft. of macadam construction on the Meriden and Waterbury Turnpike, to LEONARDO SUZIO, Meriden, Conn., macadam, $2.20 per lin.ft.; telford, $2.80 per lin.ft.; rubble drain, $1 per lin.ft.; concrete walls, $7.50 cu.yd.; masonry walls, $5.25 per cu.yd.; dry rubble walls, $4 per cu.yd.

Town of Bolton, 791 lin.ft. of graded construction on the Willimantic-Hartford Turnpike, to PIERSEN ENGINEERING & CONSTRUCTION CO., Bristol, Conn., $750 for the grading, 80c. per lin.ft. extra for telford, $1.50 per lin.ft. for rubble drain, $8 per cu.yd. for concrete walls, $7 per cu.yd. for masonry walls, $5 per cu.yd. for dry rubble walls.

Town of Tolland, 3653 lin.ft. graded construction, to the A. VITO CONSTRUCTION CO., Thompson, Conn., $8500 for the grading, $1 per lin.ft. extra for telford, $1.25 per lin.ft. for rubble drain, 75c. per sq.yd. for cobble gutters, $10 per cu.yd. for concrete walls, $8 per cu.yd. for masonry walls, $6 per cu.yd. for dry rubble walls.

Town of Bloomfield, 2845 lin.ft. macadam construction on the Simsbury Road, including a 6-ft. span concrete culvert, to ROBERT G. MILLER, Bloomfield, Conn., $2.45 per lin.ft. for the macadam, $3 per lin.ft. for telford, $3.50 per lin.ft. for rubble drain, $5 per cu.yd. for concrete walls.

Town of Beacon Falls, 1st Section, 1640 lin.ft. gravel construction on the River Road to E. N. CLARKE, Milford, Conn., 79c. per lin.ft. for gravel, $1.79 for telford, $1 per lin.ft. for rubble drain, $7 per cu.yd. for concrete walls, $6 per cu.yd. for masonry walls, $5 per cu.yd. for dry rubble walls; 2d section, 2350 lin.ft. gravel construction on the River Road, to FRANCONI & BENEDETTA, Litchfield, Con.., $1.30 per lin.ft. for gravel, $2.20 per lin.ft. for telford, $1.25 per lin.ft. for rubble drain, $9 per cu.yd. for concrete walls, $5 per cu.yd. for masonry walls, $4 per cu.yd. for dry rubble walls.

Town of Southington, 1st Section, 9630 lin.ft. graded construction on the Waterbury-Meriden Turnpike, including a 14-ft. concrete slab culvert, to the A. C. STEINBERG, JR., CONSTRUCTION CO., West Hartford, Conn., $9900 for the grading; telford, 75c. per lin.ft. extra; rubble drain, $1.25 per per sq.yd.; concrete walls, $8 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $4 per cu.yd.; 2d section, 9153 lin.ft. macadam construction on the same turnpike, to LEONARDO SUZIO, Meriden, Conn., macadam, $2.20 per lin.ft.; telford, $2.80 per lin.ft.; rubble drain, $1 per lin.ft.; cobble gutters, 65c. per sq.yd.; concrete walls, $7.50 per cu.yd.; masonry walls, $5.25 per cu.yd.; dry rubble walls, $4 per cu.yd.

Town of Orange, a section of macadam construction on the Derby-Milford Turnpike, to the B. D. PIERCE, JR., CO., Bridgeport, Conn., macadam, $2.31 per lin.ft.; telford, $3.25 per lin.ft.; rubble drain, $1 per lin.ft.; cobble gutters, 75c. per sq.yd.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd.; dry rubble walls, $6 per cu.yd.

Town of Waterbury, a section of graded construction on the Cheshire Road, to FRANCONI & BENEDETTA, Litchfield, Conn., grading, $11,600; telford, 95c. per lin.ft. extra; rubble drain, $1.20 per lin.ft.; concrete walls, $9 per cu.yd.; masonry walls, $5 per cu.yd.; dry rubble walls, $4 per cu.yd.

Contracts also have been awarded for road work, bids for which were received several days ago as follows:

Town of Morris, 2750 lin.ft. of graded construction on Peck Hill, to E. G. PARDEE, Bethany, Conn., $4800 for the grading; telford, 75c. per lin.ft. extra; rubble drain, $1.25 per lin.ft.; concrete walls, $7 per cu.yd.; masonry walls, $4.50 per cu.yd.; dry rubble walls, $3.50 per cu.yd.

Town of Cornwall, 7850 lin.ft. graded construction on the River Road to the GOODMAN & TRUMBULL CO., Litchfield, Conn., grading, $11,234; telford, 90c. per lin.ft. extra; rubble drain, $1.25 per lin.ft.; concrete walls, $9 per cu.yd.; masonry walls, $5 per cu.yd.; dry rubble walls, $4.50 per cu.yd.

Town of Litchfield, 4726 lin.ft. graded construction on the Torrington Road, to FRANCONI & MAGGONI, Litchfield, Conn., $4950 for the grading, 90c. per lin.ft. extra for telford, $1 per lin.ft. for rubble drain.

Town of Woodbridge, 6000 lin.ft. gravel construction on the Seymour Road, to R. D. DALEY & CO., New Haven, Conn., gravel, $1.80 per lin.ft.; telford, $2.80 per lin.ft.; rubble drain, $2.50 per lin.ft.; concrete, masonry and dry rubble walls, each $10 per cu.yd.

Buffalo, N. Y.—Bids will be received until 11 a.m., Jan. 17, by the Department of Public Works, for the following street improvements: For paving Cumberland Ave., from Cazenovia to Milford Sts.; repaving Cottage St., from College to Hudson St., and repaving Triangle St., from Abbott Road to South Park Ave. Francis G. Ward is Comr.

New York, N. Y.—Bids will be received until noon, Jan. 17, by the Commissioner of Docks and Ferries, Pier "A," foot of Battery Place, North River, for repairing the asphalt paving on the Marginal St., North, East and Harlem Rivers. Calvin Tomkins is Comr.

Bids will be received until 3 p.m., Jan. 16, by the Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., for repairing sheet asphalt and asphalt block roadway pavements in the Boro. of Manhattan, as directed during 1913. Chas. B. Stover is Pres.

✚**Syracuse, N. Y.**—Contracts for street improvement have been awarded by the Board of Contract and Supply as follows: For paving West Newell St., from Midland Ave. to Onondaga Creek, with asphalt, to the WARNER-QUINLAN CO., at $20,478. East Matson St., east from South Salina St., with asphalt, to C. T. HOOKWAY, at $4844; for resurfacing Onondaga Ave., from Onondaga St. to Stolp Ave., to the WARNER-QUINLAN CO., at $7726; for paving Madison St., from Irving Ave. to Almond St., with asphalt, to GUY E. DICKINSON, at $12,383. All bids for paving Beverly Road from Stolp Ave to Crossett St. were rejected as excessive. J. J. Halloran is Secy of the Bd.

Jersey City, N. J.—Bids have been received by the Board of Street and Water Commissioners, for the improvement of Mercer St., from Stuyvesant to De Kalb Aves., and Cuberly Place, from Van Reypen St., to its easterly terminus. Edward B. See is Clk.

Turtle Creek, Penn.—Bids will be received until 8 p.m., Feb. 6, by the Borough Council, for the improvement of various streets of the borough. The work will include 108,000 cu.yd. of embankment; 30,000 cu.yd. of dredging; 32,000 sq.yd. vitrified block paving; 17,000 sq.yd. of brick repaving; 13,000 sq.yd. of slag paving; 40,000 lin.ft. of concrete curb and gutter; 28,000 lin.ft. of curb reset. Harrop, Hopkins and Taylor, 900 Lewis Blk., Pittsburgh, Penn., are Engrs.-in-Charge.

Bradentown, Fla.—Bids will be received until Jan. 23, by the Commissioner of Public Works for 37,000 sq.yd. of bituminous concrete, asphaltic concrete or asphaltic macadam paving on various streets. O. A. Spencer is Comr. The H. S. Jaudon Engineering Co., Savannah, Ga., is Engr. in Charge.

Clearwater, Fla.—Bids will be received until Jan. 21 by the Town Council for vitrified brick, asphalt and bitulithic paving on various streets, also storm sewers and combined curb and gutter. R. T. Daniels is Town Clk.

Jacksonville, Fla.—Bids will be received until 3 p.m., Feb. 10, by the Committee on Public Works, of the Board of Bond Trustees, for the construction of approximately 98,826 sq.yd. of pavement on a concrete base, on various streets of the city. H. Gaillard is Chn. Com. on Pub. Wks.

✚**Mobile, Ala.**—A contract for hauling material to surface St. Stephens Road has been awarded by the Board of Revenue and Road Commissioners to A. E. PERRY, Montgomery, Ala., at $17,615. Other bidders were: S. R. Christy, $18,600; Seabry & Pringle, $19,645. W. J. Bradford, $24,748; Jett Bros. Contracting Co., $25,625.

Dayton, Ky.—The city is preparing to issue $20,000 of bonds to provide funds for the repaving of Fairfield Ave. with vitrified brick.

Canton, Ohio—Bids will be received until Jan. 21 by the Director of Public Service for paving with vitrified block and otherwise improving portions of West Eighth, North Dewalt, East Lake, East South and Cassilly Sts., Dueber, Linden, Aultman and Harrison Aves. Walter S. Ruff is Dir. P. H. Weber is City Engr.

Cincinnati, Ohio—The Board of Commissioners of Hamilton County is considering the improvement of the Mill Road, at an estimated cost of $21,683, and of the Springfield Road, from the Blue Rock to the Colerain Pikes, at an estimated cost of $16,367. Stanley Struble is Pres. Albert Reinhardt is Clk.

Cleveland, Ohio—Bids will be received until noon, Jan. 22, by the Director of Public Service, for grading, draining, curbing and paving with brick, portions of various streets of the city. W. J. Springborn is Dir. W. H. Kirby is Secy.

We are officially advised that all bids received Dec. 28 by the Commissioners of Cuyahoga County for the improvement of Gardner Road, from East Lake Road to Lake Erie were rejected, and the work will be readvertised. John F. Goldenbogen is Clk. Noted Dec. 5.

Sidney, Ohio—Bids will be received in February for about 60,000 sq.yd. paving at an estimated cost of $150,000. Brick, bitulithic, asphalt, asphalt block, bituminous concrete or other standard pavement will be considered. D. H. Warner is Dir. of Public Service. The Smith-Boulay Co., Toledo, Ohio, Engrs.-in-Charge.

✚Uhrichsville, Ohio—A contract has been awarded by the City Council to JOHN L. WEST, Uhrichsville, at $21,463, for grading, draining, curbing and paving Trenton Ave. H. O. Snyder is City Clk. Paul R. Murray is City Engr. Noted Dec. 19.

Jeffersonville, Ind.—Bids will be received until 10 a.m., Feb. 3, by the Commissioners of Clark County, for the construction of a crushed rock or macadam road on the old Plank Road. G. W. Stoner is County Audr.

Madison, Ind.—Bids will be received until 2 p.m., Feb. 4, by the Commissioners of Jefferson County, for paving in Shelby Township. A. M. Taff is Audr.

Rockford, Ill.—Bids will be received until 1:30 p.m., Jan. 22, by the Board of Local Improvements, for the construction of approximately 14,000 sq.yd. of brick pavement on State and Charles Sts. W. W. Bennett is Pres. of Bd. Noted Jan. 9.

Grundy Center, Iowa—The City Council has passed a resolution authorizing the paving of 12 blocks of streets, to include those around the Court House Sq., two business blocks, and from Main St. to the railway station. Bids will be asked on various kinds of paving, the Council later determining the kind to be used.

Denison, Tex.—The City Council has passed an ordinance declaring it necessary to pave Austin Ave., from Chestnut to Woodard St., with brick. Bids will soon be asked. E. E. Davis is Supt. of Paving.

✚Houston, Tex.—Contracts have been awarded by the City Council to the CREOSOTED WOOD BLOCK PAVING CO., New Orleans, La., at $75,000, for creosoted wood block paving, and to OCKANDER BROS., Waco, Tex., at $19,000, for Hassam, on portions of Leeland Ave., La Branch and Fannin Sts. D. C. Smith, Jr., is City Secy. Noted Dec. 5.

San Angelo, Tex.—The City Council has instructed the City Engineer to advertise for bids for approximately 40,000 sq.yd. of paving on various residence streets.

Collinsville, Okla.—See item under Water Supply—Irrigation.

McAlester, Okla.—The City Council has rejected as excessive the two bids received for paving in the Second Ward. W. P. Halliday is City Engr. J. M. Gannaway is Clk.

✚Seattle, Wash.—A contract has been awarded by the Board of Public Works to LEWIS, WILEY & MORRIS, at $141,589, for grading and filling Alki Ave. Arthur H. Dimock is City Engr.

✚Wenatchee, Wash.—The City Council has awarded a contract to J. J. McNERNY, Wenatchee, at $112,965, for paving Wenatchee Ave. with wood block. Noted Jan. 2.

The Atlas Construction Co. was low bidder, at $10,217, for paving First St. with asphalt on a 5-in. concrete base.

Bakersfield, Calif.—The City Trustees have ordered the improvement of Chester Ave., from 16th to 22d Aves. The work will consist of grading, asphalt paving on concrete base, cement curb and gutter, and concrete culverts with boiler plate covers.

✚Los Angeles, Calif.—The Board of Public Works has awarded a contract to the W. F. HEWITT CO., at $14,4999, for the improvement of East Seventh St.

Santa Monica, Calif.—The J. D. Kneen Co., Dudley Blk., was low bidder at $26,415, and will probably be awarded the contract for the improvement of Ocean Front Promenade. The work consists of 1900 lin.ft. of cement sidewalk 20 ft. wide, and a pile bulkhead.

INDUSTRIAL WORKS

Hartford, Conn.—The Wingford Printing & Engraving Co will build a new plant on property recently purchased, between Park and Hamilton Sts. The Fletcher Engineering Co., 1087 Broad St., Bridgeport, Conn., is preparing plans.

New Britain, Conn.—Several additions are planned at the plant of P & F Corbin, manufacturers of locks and building hardware, of which John T. STEVENS RDLF FWYPPP 3J hardware, one of which will be the addition of three stories to a present four-story building, 60x216 ft.

New Haven, Conn.—Plans have been completed and estimates are being received for a new building on James St., for the National Folding Box & Paper Co. The structure will be four stories high, of brick, mill construction, 100x250 ft., and will be connected with the present factory by a bridge. Noted Dec. 5.

South Manchester, Conn.—The J. T. Robertson Co., soap manufacturer, is planning an addition to its plant on Hilliard St. It will be of brick, two stories high and about 20x110 ft.

Brooklyn, N. Y.—Julius Kayser & Co. manufacturers of gloves, Traffic Place, has had plans prepared for a new seven-story factory to be operated in conjunction with its silk spinning plant. The new building will be erected on Reed Ave., between De Kalb and Willoughby Aves. It will be 26x110 ft., of brick. The estimated cost is $150,000.

Buffalo, N. Y.—Green & Wicks, Archs., 110 Franklin St., are receiving bids for the construction of a three-story factory, 100x50 ft., for the Barcalo Mfg. Co., manufacturer of beds.

Niagara Falls, N. Y.—The Niagara Falls Furnace Co. has been incorporated at $50,000, and is having plans prepared for the establishment of a plant in Niagara Falls, for the manufacture of domestic furnaces.

North Tonawanda, N. Y.—The Niagara Radiator & Boiler Co. will erect a building, 600x100 ft., to be used as a stock house, and for the extension of its boiler and equipment departments. The company will also build an addition to its boiler foundry, 100x200 ft. E. C. Andrews is Gen. Mgr.

Oswego, N. Y.—Plans are being prepared by Linn Kinne, Arch., U. C. N. Bank Bldg., Utica, for a two-story brick addition, 62x120 ft., to the Oswego Machine Works. Neal Gray is Gen. Mgr.

Perth Amboy, N. J.—Bids are being received by Abel Hanson, State and Gordon Sts., for the construction of a two-story, 234x45-ft. porcelain factory. The estimated cost is $20,000. Jensen & Brooks, 196 Smith St., are the Archs.

✚Trenton, N. J.—The De Lion Tire & Rubber Co., Trenton, N. J., has awarded a contract to the LEWEN ENGINEERING CO., 104 West 42d St., New York, N. Y., for the construction of a two-story factory, 245x60 ft. Freeman & Hassleman, 39 West 38th St., New York, N. Y., are the Archs.

Erie, Penn.—The Union Iron Works is contemplating the erection of an addition to its foundry on Raspberry St., between 14th and 15th Sts. A permit for a structure, 100x75 ft., of brick, steel and concrete, has been received by the company. The estimated cost is $12,000.

Marcus Hook, Penn.—The Union Petroleum Co., Keystone Bldg., Philadelphia, is having plans prepared for the reconstruction of its plant, which was totally destroyed by fire last August. The improvements include, besides several factories, the construction of a large pier and bulkhead.

Pittsburgh, Penn.—The Ritchey-Wirtz Co., Greenwood Ave., Dayton, Ohio, is contemplating the erection of a five-story factory, of brick and steel, in Pitsburgh. The estimated cost is $35,000.

Baltimore, Md.—Dietrich Bros., structural iron workers, have had plans prepared for a new plant to be erected in Baltimore, which will cost $500,000, according to plans the present plant, which takes in an entire city block on North St., between Bath and Pleasant Sts., will be abandoned. Work upon the new buildings is expected to be started soon. Already plans for three large shops, to measure 70x300 ft., have been prepared. Machinery and devices for handling large orders of structural steel will be installed. When the new buildings are completed the capacity of the plant will be four times that of the present one.

Westminster, Md.—The Westminster Metal & Foundry Co. is having plans prepared for an additional one-story foundry, to be erected at its plant.

Keyser, W. Va.—The W. B. Woolf Milling Co. has purchased the property of the Keyser Milling Co., and will rebuild the mill. The capital stock will probably be increased later, and other industries added.

Lexington, N. C.—The Lexington Board of Trade, George W. Montcastle and H. B. Varner are planning to organize a company, with a capital stock of $1,000,000, to erect a cotton mill. A site of 150 acres is under consideration, and the first building to be erected will have an equipment of 25,000 spindles and 700 looms.

Maysville, N. C.—The Maysville Cotton Mills Co. has been organized with $100,000 capital stock, and will spend $50,000 in erecting buildings and installing 5000 spindles with accompanying machinery.

Wilmington, N. C.—The Eagle Iron Works, recently incorporated with $125,000 capital stock, has taken a five-year lease on a shop at Front and Hanover Sts., and will manufacture rotary engines. M. M. Parker, Jr., is Pres.; J. W. Curtis, Vice-Pres. and Gen. Mgr., and J. M. Hines is Secy. and Treas.

Americus, Ga.—The Southern Art Metal Co. will shortly ask bids on the materials and equipment for the new plant it will erect. C. C. Hawkins, J. W. Hightower and John Sheffield are directors. L. W. Rose is Mgr.

Athens, Ga. The Southern Mfg. Co., manufacturer of rope and canton flannel from waste, is contemplating the erection of an additional mill, accommodating 20,000 spindles and 400 looms, at an estimated cost of $500,000. The company's present equipment includes 12,232 ring spindles, and 9302 woolen spindles.

Akron, Ohio—The International Harvester Co., Akron, will rebuild its factory at Akron, recently destroyed by fire.

Canton, Ohio—The Crossley-Miller Engineering Co., 411 City National Bank Bldg., Canton, is preparing plans for a two-story factory, 80x200 ft., of reinforced concrete. Cost, $50,000.

Cincinnati, Ohio—The Lippincott Co., Cincinnati, has engaged Sheblessy & Stegner, Cincinnati, to prepare plans for the erection of its proposed new factory on Main St. It will be six stories, 70x200 ft., of concrete. Estimated cost, $150,000.

Stewart & Stewart, Archs., Cincinnati, are preparing plans for a light manufacturing plant on Reading Road, Cincinnati, for the Kentucky Motor Car Sales Co. It will be two stories and basement. Cost, $28,000.

Hamilton, Ohio Articles of incorporation have been forwarded for the George Automatic Roller Bearing Co., Hamilton, for $550,000, to erect a manufacturing plant at that place. The incorporators are C. E. Helster, George T. Reiss, S. M. Goodman, and C. R. Greer, of Hamilton, and Walter H. Miller and Edwards Ritchie, of Cincinnati, Ohio. The factory will be erected in the spring.

Howell, Ind. The Louisville & Nashville R.R. Co., with general offices in Louisville, Ky., has plans for the construction of large shops at Howell, Ind. The estimated cost of the work is $200,000.

Bettendorf, Iowa—The Bettendorf Axle Co., Bettendorf, contemplates the erection of additions to its plant.

✦Charles City, Iowa—The contract for the erection of a new plant for the Charles City Gas Engine Co., has been awarded to E. B. C. WRIGHT.

Marshalltown, Iowa—The Marshall Vinegar Co., Marshalltown, plans to construct extensive additions to its plant.

Minot, N. D.—The Northern Briquetting Co., Minot, will build a new plant for the manufacture of briquettes. The estimated cost is $100,000.

Big Timber, Mont.—Harry Raiff and E. A. Lewis, both of Columbus, Mont., have organized a company with a capital of $25,000, and will convert the old flour mill at Big Timber, into a modern flour milling plant. About $10,000 will be expended.

Puyallup, Wash.—The column and box factory of the Holland-Cook Mfg. Co., which was recently destroyed by fire, with a loss of about $30,000, will be rebuilt. T. S. Holland is Vice-Pres.

Portland, Ore.—The Oregon Door Co., Portland, is having plans prepared for the construction of an addition to its plant, to cost approximately $30,000.

Sacramento, Calif.—The Phoenix Milling Co., Sacramento, is having plans prepared for the construction of a large milling plant, to be erected at 12th and B Sts., Sacramento. The estimated cost is $100,000.

Torrance, Calif.—The Acme Brass Foundry will erect a new plant in Torrance, near Los Angeles.

Montreal, Que.—E. L. Baugh & Co., 23 Royal Insurance Bldg., will erect an ice plant, costing $32,000, at Cote St. and Papi Road. It will be 150x125 ft., one story, of brick and stone construction.

Dunnville, Ont.—The Canadian Engines Co., manufacturer of gas and gasoline engines, is having plans prepared for an extensive addition to its plant.

Hamilton, Ont.—The Canada Steel Goods Co. will erect an addition to its present plant, at a cost of $40,000. The erection of the building will be begun at once, and equipment will be purchased later. Arthur Hatch is mgr.

London, Ont.—The Dennis Wire & Iron Works Co., Ltd., 266 Dundas St., is planning the erection of a new structural-steel plant, to cost $25,000. E. R. Dennis is mgr.

The Guelph Tool Co. has secured a site, and will erect a factory costing $50,000, for the manufacture of various kinds of hardware tools. T. S. Hobbs is mgr.

Owen Sound, Ont.—F. V. Samwell, Guelph, Ont., has completed negotiations for the establishment of a $150,000 rolling mill in Owen Sound. Construction work will begin in about six weeks, and complete equipment will be required.

FEDERAL GOVERNMENT WORK

Electric Elevator—Portland, Maine—Bids were received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., Jan. 6, for the installation of an electric passenger elevator in the U. S. post-office at Portland, as follows: Otis Elevator Co., Washington, D. C., $6464; Faunt Le Roy Elevator Co., Baltimore, Md., $7678; Portland Co., Portland, Maine, $6336; and Albro-Clem Elevator Co., Seventh St. and Glenwood Ave., Philadelphia, Penn., $5336. Noted Dec. 26 under Light, Heat and Power.

Pier Headhouse—Boston, Mass.—The Directors of the Port of Boston, Jan. 9, approved plans of Henry F. Keyes, Arch., for a pier headhouse, to be erected at the end of Commonwealth Pier No. 5. It will cost $300,000, and will be 360x100 ft. and 80 ft. high, of artificial stone or limestone, with a concrete base.

Seawall—New York, N. Y.—Bids will be received at the Office of the Commissioner of Immigration, Ellis Island, New York Harbor, until 2:30 p.m., Feb. 3, for the construction of a section of concrete and stone seawall along southwesterly face of Ellis Island (main island) under "Seawall Contract No. 1." For plans and specifications apply to William Williams, Comr. of Immigration, New York.

✦Dredging—Philadelphia, Penn.—The contract for dredging at the Philadelphia Navy Yard has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., to tht AMERICAN DREDGING CO., 308 Chestnut St., Philadelphia, at about $9750. Bids were opened Dec. 28. List of bidders noted Jan. 9.

Harbor Work—Baltimore, Md.—The improvement of Baltimore Harbor to provide an available width of 1000 ft. in the channel of the approach at Yorkspit, Chesapeake Bay, at an estimated cost of $305,250 for first construction and $20,000 annually for maintenance, has been recommended to the House by the War Department.

Grading—Washington, D. C.—Bids will be received until 11 a.m., Feb. 8, by the Bureau of Yards and Docks, Navy Department, for about 26,000 cu.yd. grading at the Navy Yard, Puget Sound, Wash., for which the sum of $10,000 is available. H. R. Stanford is Ch. of Bureau.

Cranes—Washington, D. C.—Bids were received as follows, Jan. 8, by the Commissioners of the District of Columbia, for two three-motor electrically driven five-ton, 70-ft. span cranes with runways: Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., $16,500; Manning, Maxwell & Moore, New York, N. Y., $15,849.

Ordnance—Washington, D. C.—Bids were received as follows Jan. 10, by the Chief of Ordnance, U. S. A., Washington, for furnishing two sets of forgings for 14-in. guns, Model 1910. Bethlehem Steel Co., South Bethlehem, Penn., gunsteel 24¼c. per lb., forged steel "C", 34½c.; Midvale Steel Co., Philadelphia, Penn., same prices.

✦Gun Forgings—Washington, D. C.—The contract for furnishing forgings for 14-in. guns, bids opened by the Ordnance Department, U. S. A., Washington, has been awarded to the BETHLEHEM STEEL CO., South Bethlehem, Penn., at 21c., for gun forgings and 36c. for nickel forgings.

✦Fence Wire—Washington, D. C.—The contract for furnishing the District of Columbia with certain fence wire has been awarded to the PITTSBURGH STEEL CO., Pittsburgh, Penn., at 75c. and 52.5c. per rod.

Removal of Wreck—Norfolk, Va.—Bids will be received until noon, Feb. 10, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for the removal of the steel Italian bark "Rosalia D'Ail," sunk in Hampton Roads, Va.

Manila Rope—Wilmington, N. C.—Bids will be received by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, until noon, Feb. 1, for furnishing manila rope.

Post Office—Bowling Green, Ohio—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Feb. 17, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the U. S. post office at Bowling Green.

Excavating Pit.—Sault Ste. Marie, Mich.—Bids were opened Dec. 31, by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, Mich., for excavating a pit for the fourth lock, St. Mary's Falls Canal, Sault Ste. Marie. The lowest bid was submitted by the MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., at $288,140.

Drainage—Storm Lake, Iowa—The County Commissioners, Storm Lake, have established Drainage District No. 45. George McCulloch is Engr.

Ditch—Albert Lea, Minn.—The construction of Ditch No. 25 has been recommended by the viewers. Address the County Commissioners at Albert Lea.

Post Office—Topeka, Kan.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Feb. 19, for the construction, including plumbing, gas piping, heating apparatus, electric conduits, and wiring interior lighting, main lift and approaches, of the U. S. post office and court house at Topeka.

Electric Elevator—Sioux Falls, S. D.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m. Feb. 3, for the installation of an electric passenger elevator and hydraulic lift in the U. S. post-office and court-house at Sioux Falls.

✦Railroad Spur, Etc.—Fort D. A. Russell, Wyo.—The contract has been awarded to HASTINGS, YOUNG & DUMIN, Cheyenne, Wyo., for constructing a railroad spur and sidings, track scale and scale house, at Fort D. A. Russell, at $46,600. Bids were opened Dec. 18, on modified plans and specifications. The original bids were opened by the Constructing Quartermaster, U. S. A., Nov. 25, and rejected. Noted Dec. 12.

✦✦Canal—Malta, Mont.—The Secretary of the Interior has authorized the Reclamation Service to award the following contracts for the construction of about 46 miles of the Vandalia south canal, Milk River Irrigation Project: To J. E. HILTON, Billings, Mont., Schedules 1 and 3, involving the excavation of approximately 583,550 cu.yd. of material, contract price, $118,150; to CHARLES WILHITE, Boise, Idaho, Schedule 4, involving the excavation of about 302,050 cu.yd. of material, contract price, $51,700. The work is situated on the south side of Milk River adjacent to the main line of the Great Northern Railway and in the vicinity of Vandalia, Tampico, Glasgow and Nashua, Mont.

Sand—Dallas, Tex.—Bids will be received until noon, Feb. 6, by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, for furnishing sand for guard lock, Sabine-Neches Canal, Tex.

✦Dike—Galveston, Tex.—The U. S. Government has awarded the contract to ISAAC HEFFRON, Galveston, for constructing a brush and pile dike from the Federal Quarantine Station in Galveston Harbor to the junction of the Texas City and Galveston Channels, at $9427.

Post Office—Paris, Tex.—Bids were received as follows, on Jan. 8, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office building at Paris: (a) Limestone; (b) sandstone: Bailey-Marsh Co., Minneapolis, Minn., (a) $94,277; William H. Maxwell, Phoenix, Ariz., (a) $96,770; Newport Contracting & Engineering Co., Newport News, Va., (a) $94,645; (b) $99,645; Wise Granite Co., Richmond, Va., $101,800; (b) $106,000; Mississippi Valley Construction Co, St. Louis, Mo., (a) $95,832; King Lumber Co., Charlottesville, Va., (a) $109,000; (b) $115,000. Noted Dec. 5.

✦Officers' Quarters—Bremerton, Wash.—The contract for the construction of two sets of officers' quarters at the navy yard, Puget Sound, Wash., has been awarded to CARLSON & SON, Seattle, Wash., at $13,485.

Bulkhead—Tacoma, Wash.—The city will construct a bulkhead to protect the piers of the Puyallup Bridge.

✦Ferryboat Hull—San Francisco, Calif.—The contract has been awarded to the NEW YORK SHIPBUILDING CO., Camden, N. J., for the construction of the hull of one of the largest ferryboats in the country. The boat will be built for the Southern Pacific Co., and will ply between San Francisco and Oakland, Calif. The vessel will be 292 ft. long; breadth of beam, 75 ft. 4 in.; depth of hold, 17 ft. The hull will be built and "knocked down" and will be shipped to San Francisco by rail.

Magazine—Vallejo, Calif.—Bids were received as follows, Jan. 11, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of one steel-frame corrugated steel covered magazine building at the U. S. naval magazine, Mare Island, Calif.: Gutleben Bros., San Francisco, Calif., $8450; Penn Bridge Co., Washington, D. C., $9740; Judson Mfg. Co., San Francisco, $8990; W. N. Concannon, San Francisco, Calif., $9366.

Hopper Scows—Ottawa, Ont.—Bids will be received until 4 p.m., Jan. 27, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for the construction of two steel hopper scows of 500 yd. capacity each.

✦Structural Steel—Hawaii—The contract for furnishing the structural steel, etc., for a pump well at the naval station, Pearl Harbor, H. T., bids opened Dec. 28, has been awarded to the RITER-CONLEY MFG. CO., Pittsburgh, Penn., at $9075.

Lumber—Panama—Bids will be received until 10:30 a.m., Jan. 27, by Maj. E. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing lumber under Circular 754.

MISCELLANEOUS

Tunnel—Fall River, Mass.—Plans have been completed by engineers of the New York, New Haven & Hartford R.R. for the underground tunnel to be built here. It will be one mile long. Work will be started in the early spring. Edw. Gagel is Ch. Engr., New Haven, Conn.

Greenhouse—Woods Hole, Mass.—The contract has been awarded to R. L. WILSON, Concord, Mass., for constructing a greenhouse, to cost $12,000.

Fire Station—New Haven, Conn.—Plans have been completed by C. F. Townsend, 55 Church St., New Haven, for a fire station on Water St. Bids will be received at once. The structure will be of brick, two stories and basement, 40x80 ft., with an ell 42x30 ft., for the paint, machine and blacksmith shops. The main building will contain the apparatus room on the first floor and sleeping rooms, etc., on the second floor.

Canal Terminal, Etc.—Albany, N. Y.—Duncan W. Peck, State Supt. of Pub. Wks., has awarded the contract for the Utica terminal to ALBERT M. BANKER, of Gloversville, N. Y., at $557,104. The work of constructing locks and dams at Seneca Falls and Waterloo was also awarded, LARKIN & SANGSTER, of Lockport, N. Y., securing Contract C, providing for the construction of locks, dam, etc., at Seneca Falls, at $1,187,047, and M. A. CLEVELAND SONS CO., of Brockport, N. Y., securing Contract E, providing for the construction of a lock, dam, etc., at Waterloo, N. Y., at $347,216.

On Feb. 4, D. W. Peck, State Supt. Pub. Wks., will receive bids on additional work amounting to approximately $2,775,000. This work includes Contracts 92 and 94, for the erection of power plants and installation of electrical equipment and machinery for operating Barge Canal locks at many points along the line of the new canal; Contract 42-A for completing the construction of the canal in the vicinity of Utica and Contracts 87 and 102, for bridges over the Canal at Rocky Rift Dam in Montgomery County and at Howland's Ave. in Cayuga County.

Drainage Channel Excavation—Batavia, N. Y.—Bids will be received until Jan. 17 at the Hotel Richmond, Batavia, by the Commissioners for approximately 1,000,000 cu.yd. of drainage channel excavation in Tonawanda-Oak Orchard swamps, counties of Genessee and Orleans. This is an extension of date from Jan. 3. Noted Dec. 19.

Stable—Brooklyn, N. Y.—W. A. Shaw, 543 La Fayette Ave., Brooklyn, will erect a stable, to cost $25,000. Benjamin Driesler, 153 Remsen St., Brooklyn, is Arch.

Bulkhead and Dredging—Lawrence (L. I.), N. Y.—Bids will be received by the Cullaloo Park Co., Lawrence, for the construction of approximately 2000 lin.ft. bulkhead and 29,000 cu.yd. dredging for canal. Plans and specifications can be secured on the payment of $10 at the office of Cyril E. Marshall, Engr., Marbridge Bldg., New York, where bids will be received until noon, Jan. 21.

Dredging—New York, N. Y.—Bids will be received until Jan. 17 by Calvin Tompkins, Comr. of Docks, for furnishing material and dredging under Contract No. 1360 as follows: 300,000 cu.yd. in the North River, Boro. Manhattan, 80,000 cu.yd. East and Harlem Rivers, Boros. Manhattan, Brooklyn and Queens; 15,000 cu.yd. East and Harlem Rivers, Boros. Manhattan and Bronx; 20,000 cu.yd. East River, Boro. Brooklyn, and in South Brooklyn and Boro. Richmond.

Bath-house—Yonkers, N. Y.—The city is considering the construction of a bath-house to cost $15,000.

Stadium—Princeton, N. J.—Princeton University is planning to construct a football stadium, to cost $300,000.

Subway—Pittsburgh, Penn.—The Pittsburgh Subway Co. secured a franchise from the city, Jan. 6. As planned, the subway proposed will cost $50,000,000.

Dredging—Wilmington, Del.—Bids will be received by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, until Feb. 8, for dredging Raccoon Creek, N. J.

+Piers—Norfolk, Va.—The contract has been awarded to the SANFORD & BROOKS CO., Commerce and Water Sts., Baltimore, by the Norfolk & Washington Steamship Co. Daniel J. Calahan, Gen. Mgr., foot of Seventh St. S. W., Washington, D. C., to erect two piers and a warehouse, located at foot of Front St., one pier to be 111 ft. long, and one to be 100 ft. Plans are prepared and supervision will be under Gwathmet Engineering Co.

Dredging—Jacksonville, Fla.—Bids were received Dec. 30 by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for dredging in channel, Clearwater Harbor to Tampa Bay. The lowest bid was the Hillsboro Dredging Co., Tampa, as follows: 5239 cu.yd. rock, $1.65; 17,865 cu.yd. soft material, 15½c. total. $11,413.3. Other bidders were: Home Dredging Co., Mobile, Ala., $24,539, and Southern Dredging Co., Mobile, $30,709.

Pier or Roadway—St. Petersburg, Fla.—Bids will be received by the City Council until Jan. 23 for the construction of a pier or roadway from the sand fill and breakwater on Second Ave. N. eastward into Tampa Bay.

Levee Enlargement—Clarksdale, Miss.—Bids will be received until Jan. 17 by the Board of Levee Commissioners at Clarksdale, for about 1,225,000 cu.yd. of levee enlargement work, suitable for 70-in. shovel and dump cars. T. G. Dabney is Ch. Engr., Clarksdale.

Levee Work—New Orleans, La.—Fifteen bids were opened, Dec. 27, by the Orleans Levee Board, New Orleans, for contracts aggregating a total cost on the Stanton to Boka Levee. The lowest bid was submitted by the General Contracting Co., at [illegible]

Wharf—New Orleans, La.—Bids will be received until 7:30 p.m., Jan. 22, by the Board of Commissioners of the Port of New Orleans, for the construction of the Pauline St. wharf. W. A. Kernaghan is Pres.

Drainage—Selmer, Tenn.—Surveys will be made soon by E. G. Buck and L. B. Withers, Engrs., Jackson, Tenn., for the construction of a drainage system in White Oak District in McNairy and Hardin Counties.

Ditch—Morganfield, Ky.—The Fiscal Court of Union County, Morganfield, is preparing to construct a ditch, which will drain 8000 acres. A cut to the Ohio River will be made.

Ditch—Reed, Ky.—Ohio County, Ky., will build a ditch, to cost $20,000, from a point near Reed, to the Green River, a distance of four miles. Address the Fiscal Court at Hartford, Ky.

Ditch—Boonville, Ind.—Special Judge Wm. Curtis has decided that the large Honna Totten ditch through Warrick and Spencer Counties should be built. This will be the largest drain to be constructed in the state.

+Ditches—Linton, Ind.—Contracts have been awarded to C. HYATT and WILLIAM ENGLAND, Washington, Ind., for constructing 45 miles of ditches.

Mausoleum—South Bend, Ind.—The St. Joseph County Mausoleum Co., 414 Jefferson Bldg., South Bend., will construct a one-story mausoleum, 60x125 ft.

Cement—Detroit, Mich.—The County Road Commissioners of Wayne County have opened bids for 1,000,000 bbl. of cement. The Wyandotte Portland Cement Co. was the low bidder.

Dam—Ludington, Mich.—The Citizens' Committee of Ludington will incorporate a company to have a capital of $25,000, for the purpose of rebuilding the dam at Hamlin Lake. Plans for the dam, estimated to cost $17,000, have been submitted by Prof. A. E. Phillips, Armour Institute, Chicago, Ill. George W. Clarke, City Engr., Ludington, has submitted a plan for a dam estimated to cost $14,000. The company will be known as the Lake Hamlin Resort Association.

Harbor Work—Chicago, Ill.—The City Council has appropriated $1,000,000 for the construction of an inner-harbor, contingent on a bond issue for the amount. L. E. McGann is Comr. Pub. Wks.

Field House—Chicago, Ill.—The West Chicago Park Commissioners will erect a two-story field house, 200x126 ft. G. A. Augler is Secy.

Cleaning Canal—Lockport, Ill.—The Commissioners of the Illinois and Michigan Canal, Lockport, have estimated the cost of cleaning out the canal from Lockport to the mouth of the Hennepin Canal, with other improvements, at $500,000.

Drainage—Pittsfield, Ill.—Bids were received Dec. 27 by Sny Island Levee District, of Pike, Adams and Calhoun Counties, at Pittsfield, for removing an old spoil bank, deposited by a dipper dredge, requiring the removal of approximately 100,000 cu.yd. The contract has been awarded to R. J. PHELPS, Carbon Cliff, Ill., at 12c. per cu.yd.

+Ditch—Tuscola, Ill.—Bids were received Dec. 19, by the Commissioners of Hayes Branch Drainage District, Douglas County, at Modern Woodmen Hall, Tuscola, for the excavation of an open ditch. The contract has been awarded to CHARLES R. LEWIS, Champaign, Ill., at 11.45c. The work will involve 157,900 cu.yd.

Retaining Wall—Portage, Wis.—The Portage Hosiery Co., Portage, will construct a retaining wall.

Drain—Sioux City, Iowa—The County Board of Supervisors is considering the construction of a tile drain, to cost $60,000. E. E. Tosmer, Sioux City, is County Audr.

Ditch—Bemidji, Minn.—Surveys are being made for the construction of Ditch No. 14.

Ditch—Blue Earth, Minn.—Bids will be received until 11 a.m., Jan. 14, by the County Auditor, Blue Earth, for constructing Judicial Ditch No. 5. J. L. Herring is County Audr.

+Ditches—International Falls, Minn.—The contract has been awarded to the NORTHERN MINNESOTA DRAINAGE CO., Crookston, Minn., for digging Judicial Ditches Nos. 1, 3 and 6.

+Retaining Wall—Two Harbors, Minn.—The contract has been awarded to WHITNEY BROS., Superior, Wis., by the Duluth & Iron Range R.R. Co., for constructing a concrete retaining wall along the shore bank of No. 1 Dock, at Two Harbors.

Oil Tank—Bonesteel, S. D.—The Chicago & Northwestern Ry. will erect a 50,000-gallon oil tank at Bonesteel.

Gymnasium—Webster Groves, Mo.—The Congregational Church, Webster Groves, is considering the construction of a two-story gymnasium to cost $20,000. W. H. Goodloe is a member of the Building Committee.

Drainage—Newport, Ark.—The Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., has filed the report for Grubbs Drainage District of Jackson and Pomsett Counties. The cost is estimated at $500,000.

Ditch and Levee Work—Piggott, Ark.—Bids will be received until Jan. 22 by the Board of Directors, Central Clay Drainage District, for constructing ditches and levees, approximately 6,160,000 cu.yd. ditch excavation and 480,000 cu.yd. levee embankment. J. E. Rhyne, Corning, is Engr.

Levee Work—Texarkana, Ark.—The Morgan Engineering Co., Goodwyn Institute, Memphis, Tenn., has estimated the cost of proposed work in Lenco District No. 3 of Miller County, at $200,000. Contract will probably be awarded in the spring.

Dredges—Matagorda, Tex.—The Matagorda Mud & Shell Co. will install dredges upon large oyster shell banks, which it has purchased near Matagorda. The shell will be used by railroads for ballasting and also for construction of highways. The incorporators of the company are George T. Sargent, W. E. McNabb, of Matagorda, and J. C. Lewis, of Markham, Tex.

Dock—Tacoma, Wash.—The Chicago, Milwaukee & Puget Sound Ry. Co. will extend its dock at Tacoma. The work will be done by day labor. Estimated cost, $100,000.

Tunnels—Los Angeles, Calif.—The City Council has authorized the commencement of proceedings for the construction of the proposed tunnels. Homer Hamlin, City Engr., was instructed to prepare and present to the Council plans and specifications for the tunnels, also the necessary ordinances for the construction of tunnels. The proposed plans and specifications will be for a single-bore tunnel at First St. and a single-bore tunnel at Second St. The First St. tunnel will extend from a point between Broadway and Hill St. to Fremont Ave.; the Second St. tunnel will extend from Hill St. to Figueroa St. Noted Jan. 9.

Wharf—San Diego, Calif—The Buchanan Lumber Co. will spend a large sum for building a wharf on the 600-ft water front at the foot of 28th St.

Ferry Annex—San Francisco, Calif.—Plans are being prepared by L. E. Dutton, Arch., Chronicle Bldg., San Francisco, for the construction of the proposed ferry annex.

Seawall—San Francisco, Calif.—The following bids were received Dec. 30, by the State Board of Harbor Commissioners, for the construction of Sections 9A and 9B of the seawall: Section 9A: F. Rolandi, $485,000; Pacific Construction Co., $420,582; Healy-Tibbitts Construction Co., $297,673; San Francisco Bridge Co., $328,000; Daniel Contracting Co., $275,700; Section 9B: Pacific Construction Co., $321,100; F. Rolandi, $402,000; Healy-Tibbitts Construction Co., $295,000; Mercers-Fraser Co., $305,600; San Francisco Bridge Co., $277,522; Thompson Bridge Co., $308,000; Daniel Contracting Co., $220,000.

BUILDINGS

✚Boston, Mass.—The J. W. BISHOP CO., of Worcester, has been awarded the contract for the erection of a new storage warehouse in Charlestown for the Terminal Wharf & Warehouse Co. It will be three stories high 135x8... ft., with a one-story extension.

Thomas F. Pedrick is Chm. of ... mittee which is considering the construction of two ...ings to the State House. Robert D. Andrews, William Chapman, and R. C. Sturgis, 120 Boylston St., are the Archs.

The city is considering the construction of a new municipal building in Roxbury, at Dudley and Vine Sts. Edward Sheehan, Tremont Bldg., is the Arch.

Woonsocket, R. I.—The City Council has appropriated the sum of $115,000, to be used for the erection of a new high school. Noted Sept. 5.

Bristol, Conn.—A site for a new theater has been purchased by Sherman E. Pike, of Hartford, Conn., at the corner of Church and Laurel Sts. It is planned to erect a building 65x130 ft., two stories high, of brick and steel, fireproof construction.

New Haven, Conn.—The Board of Education will receive bids until Jan. 10, for a 16-room school, on Derby Ave. It will be of brick, with concrete trim Brown & Van Beren, 421 Exchange Bldg., are the Archs.

Brooklyn, N. Y.—The New York Telephone Co., 15 Dey St., Manhattan, is contemplating the construction of a six-story telephone building, 75x100 ft., at South Brooklyn. The estimated cost is $150,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, Manhattan, are the Archs.

Gloversville, N. Y.—The Young Men's Christian Association will soon have plans prepared for the construction of a new building, estimated to cost $50,000 C. J. Holden, 18 Carpenter St., is the Arch.

Ilion, N. Y.—Fuller & Robinson, Archs., Albany, have completed plans and are receiving bids for a public school building to be erected on Otsego St. by the city. A. D. Richardson is Chm. of the Bldg. Com. The estimated cost is $75,000.

New York, N. Y.—Palmer, Hornbostle & Jones, Archs., 63 William St., are preparing plans for the construction of alterations to the one-story banking house at 33 Wall St., for the Mechanics & Metals National Bank. The estimated cost is $200,000.

Bids are being received by Carrere & Hastings, Archs., 225 Fifth Ave., for the residence which Henry C. Frick, Pittsburgh, Penn., will erect on Fifth Ave., between 70th and 71st Sts. The estimated cost is $4,000,000.

Plans have been completed by Charles B. Myers, Arch., 1 Union Square, for the construction of a six-story apartment house on 124th St., near Amsterdam Ave., for the Martha Building Co., 960 Prospect Ave. The estimated cost is $70,000.

Plans have been completed by Robert T. Lyons, Arch., 505 Fifth Ave., for the construction of a six-story apartment house on 138th St., between St. Nicholas and Edgecombe Aves., for the Charter Construction Co., 505 Fifth Ave. The estimated cost is $110,000.

Plans have been filed by Robert N. Cleverdon, Arch., 4 East 42d St., for the construction of alterations to the two-story stone edifice of the University Heights Presbyterian Church. C. P. Bliss, 2204 Andrews Ave., is Chm. The estimated cost is $65,000. Noted Dec. 14.

Howard L. Young, Arch., 1204 Broadway, is preparing plans for the construction of a six-story apartment house to be erected at Fort Washington Ave. and 161st St., for the Melvin Construction Co., 171 Broadway.

(Boro The Bronx)—Gregory B. Webb, Arch., 104 West 42d St., Manhattan has completed plans for the construction of an eight-story warehouse to be erected at Third Ave. and 140th St., for the A. P. Dienst Co., Third Ave. and 140th St.

(Boro. The Bronx)—Plans have been filed by J. C. Cocker, Arch., 2017 Fifth Ave., for the construction of a two-story brick, store and office building, 126x82 ft., for H. V. Singhi, 121 Kingsbridge Road. The estimated cost is $75,000.

★We are officially advised that bids were received as follows by the State Hospital Commission, Albany, on Jan. 8, for the construction of the Nurses' Home, Manhattan State Hospital, Wards Island: A. L. Guidone & Co., 162 East 23d St., $87,000; Werner Bartell Co., New York City, $109,873; Carston Co., New York City, $100,400; A. Pasquini, 1123 Broadway, $89,640; Nial Bros., Troy, N. Y., $101,690; P. F. Kinney Co., New York City, $89,600; W. H. Egan, 423 East 11th St., $93,178; Thomas J. Buckley Co., 103 Park Ave., $83,847; P. Keeler Building Co., Albany, $83,333; T. Ford Co., Rochester, $82,000; J. Whitaway, Woodhaven, $102,725; Wills & Marvin, 1170 Broadway, $98,499. Noted Dec. 19.

Thomas W. Lamb, Arch., 501 Fifth Ave., is preparing plans for the construction of a four-story theater and office building, to be erected at Broadway and 47th St., for the Sutphen Estate. John S. Sutphen, 311 West 72d St.

Plans have been completed by George F. Pelham, Arch., 507 Fifth Ave., for the construction of a six-story apartment house at 160th St. and Fort Washington Ave., for the Saranac Construction Co., 3785 Broadway. The estimated cost is $175,000. Noted Nov. 28.

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a six-story apartment house, 112x92 ft., on 181st St., near Broadway, for the Alexander Grant Co., 701 West 178th St. The estimated cost is $225,000.

(Boro The Bronx) Louis E. Jallade, Arch., 37 Liberty St., Manhattan, has been selected as the architect for the new Y. M. C. A. building, to be erected at 161st St. and Washington Ave., by the Young Men's Christian Association of the Bronx. The estimated cost is $400,000.

Yorktown, N. Y.—Plans are being prepared by the State Architect, Capitol, Albany, for the erection of the Mohansic State Hospital at Yorktown. The estimated cost of the plant is $335,000. Bids will be received about March 1 by the State Hospital Commission.

Atlantic City, N. J.—Plans are being prepared by Bertram Ireland, Arch., Bartlett Bldg., for the construction of a six-story and basement apartment house. The estimated cost is $150,000.

Camden, N. J.—Bids are being received by Clyde S. Adams, Arch., 1233 Arch. St., Philadelphia, Penn., for the construction of a three-story school building. The estimated cost is $100,000.

Newark, N. J.—Plans are being prepared by A. W. Johnson, 105 West 40th St., New York, for the construction of a seven-story brick office building and theater, on Market St., between Halsey and Washington Sts., for F. F. Proctor, 88 Park Place.

Bids are being received by William E. Lehmen, 738 Broad St., Arch., for the construction of a two-story theater at Branford Place and Halsey St., for Weingarten Bros. Realty Co., 405 High St. The estimated cost is $175,000.

Paterson, N. J.—Bids will be received until Feb. 28, by W. T. Fanning, Clot Bldg., for an addition to the Little Sisters of the Poor Home for the Aged, on Dey St. The estimated cost is $60,000.

Red Bank, N. J.—Plans have been prepared by Warrington G. Lawrence, Arch., 225 Fifth Ave., New York, for the construction of a one-story brick and stone bank building, 51x90 ft., at Wallace and Broad Sts., for the First National Bank, of Redbank. The estimated cost is $60,000.

Allentown, Penn.—The City has decided to erect three market houses, estimated to cost $50,000. Charles W. Rinn is Mayor, Allentown, Penn.

The County Commissioners of Lehigh County have completed plans for a three-story stone and brick court house, 98x190 ft., at Fifth and Hamilton Sts. The estimated cost is $500,000. Robert S. Rathbun is Arch., Commonwealth Bldg., Allentown, Penn.

Plans have been prepared by J. M. Grimley & Co., for the construction of a four-story building at 730 Hamilton St., Allentown. The estimated cost is $100,000.

Apollo, Penn.—Bids will be received until 3 p.m., Feb. 3, by C. H. Truly, Secy. Bd. of Education, for the construction of a high school at Apollo. John T. Simpson is Arch., Essex Bldg., Newark, N. J.

Beaver Falls, Penn.—John J. Paff, Beaver Falls, will erect a three-story brick theater. The estimated cost is $40,000. Carlisle & Sharrer are Archs., Pittsburgh, Penn.

Crafton, Penn.—Chartiers Council, Knights of Columbus, will remodel the Episcopal Church of the Nativity, into a club house. The estimated cost is $60,000.

Olyphant, Penn.—F. H. Davis, Arch., Scranton, Penn., is preparing plans for the construction of an addition to the high school. The estimated cost is $50,000.

Philadelphia, Penn.—Samuel Sternberger has purchased a site at 18th and Vine Sts., on which he will erect a ten-story commercial building. The estimated cost is $250,000.

Pittsburgh, Penn.—Rutan & Russell, Archs., 812 Magee Bldg., are preparing plans for the construction of an eight-story brick and steel building on Thackeray Ave., for the Republic Bank Note Co. The estimated cost is $200,000.

Pottsville, Penn.—Plans have been prepared by K. W. Johnson, Arch., New York, for the construction of a theater at Market and Logan Sts., for a local corporation headed by Charles Haussmann.

Wilkinsburg, Penn.—Plans are being prepared by A. C. Shand, Engr., Broad St. Station, Philadelphia, for the construction of a passenger station, at South Ave., Wilkinsburg. The estimated cost is $93,000.

Baltimore, Md.—Plans have been prepared by Oliver Wight, 1008 Munsey Bldg., Baltimore, for the construction of a warehouse at 401 North Calvert St.

Washington, D. C.—Woodward & Lothrop, Inc., will erect an eight-story building, 50x103 ft., at 1007 F St. The estimated cost is $450,000.

✚The contract for the construction of the building at Pennsylvania Ave. and 19th St., for the Department of Commerce and Labor, has been awarded to GEORGE A. FULLER CO., Munsey Bldg., Washington. Noted Nov. 7.

Chesterfield, Va.—The Fonticello Mineral Springs Corporation, Inc., will erect a sanatorium. The estimated cost is $200,000. John Garland Pollard is Pres., Richmond, Va.

Norfolk, Va.—The Norfolk & Washington Steamboat Co. has awarded a contract to the SANFORD & BROOKS CO., Baltimore, Md., for the construction of a warehouse, at the foot of Front St.

Richmond, Va.—Carneal & Johnston, Archs., Richmond, have prepared plans for the construction of three buildings, for Richmond College. The estimated cost is $225,000.

✚The contract has been awarded to R. F. RICHARDSON & SON, Norfolk, Va., for the construction of a ten-story building, to be used for the Chamber of Commerce and Manufacturers' exhibit. The estimated cost is $190,000.

Sewance, Va.—The University of the South will erect a building in memory of the late Maj. Archibald Butt. The estimated cost is $250,000.

Huntington, W. Va.—The Board of Education will erect a school building at 12th Ave. and Seventh St.

Charlotte, N. C.—The Masonic orders will erect a temple on South Tyron St. The estimated cost is $100,000. John M Scott is Chm. of the Com.

The Y. W. C. A. will erect a building at Charlotte. The estimated cost is $60,000.

Greenwood, S. C.—Bids will be received until Jan. 20, by Archs. A. Ten Eyck Brown, Atlanta, Ga., and L. D. Proffitt, Spartansburg, S. C., for the construction of a six-story brick office building, 107x40 ft., at Greenwood.

Athens, Ga.—Bids will be received until Feb. 4, by T. Wright, Clk. Bd. of Commissioners of Roads and Revenues, Clark County, for the construction of a three-story and basement court house. A. Ten Eyck Brown is Arch., 607 Forsyth Bldg., Atlanta, Ga. Noted Dec. 5.

Memphis, Tenn.—Bids will be received until Feb. 15, for the construction of a four-story building at Main St. and Butler Ave., for the Atkins Saw Co. The estimated cost is $65,000.

Nashville, Tenn.—The Knapp Memorial Committee will erect a school building at Peabody College. The estimated cost is $150,000.

Lexington, Ky.—The lowest bidder for the construction of the 15-story bank and office building for the Fayette National Bank was George A. Fuller Co., Munsey Bldg., Washington, D. C. Noted Nov. 14.

Akron, Ohio—Frank Selzer, Akron, is interested in a company which will erect a four-story garage, 120x163 ft., in Akron. The estimated cost is $45,000. F. W. Haglochm is the Arch.

Columbus, Ohio—The Board of Education has rejected all bids received for the construction of the Crestview School, and the work will be readvertised.

Dayton, Ohio—Plans have been prepared for the construction of a one-story edifice on Monument Ave., for the First Baptist Congregation. The estimated cost is $125,000. Schenck & Williams, Ludlow Arcade Bldg., Dayton, are the Archs.

Dayton, Ohio—The Board of Education will receive bids until Jan. 23, for the construction of a three-story addition, 167x156 ft., to a high school. The estimated cost is $200,000. E. J. Mountstephen, 27 McIntire Bldg., is the Arch.

✚Newark, Ohio—The contract for the construction of lodge and office building for the Masonic Temple Co., Newark, has been awarded to HANDSBY & SON, Zanesville, Ohio, at $65,000. Noted Dec. 12.

Jamestown, Ind.—Bids will soon be asked for the construction of a high school in Jamestown. An appropriation of $40,000 has been made for the purpose.

Milroy, Ind.—The School Trustees are preparing plans and specifications for the construction of a ne whigh school to replace the one recently destroyed by fire. The estimated cost is $40,000.

Muncie, Ind.—The School Board has ordered plans prepared for the construction of a new high school. The estimated cost of the structure is $200,000. Dr. H. M. Winans is Pres. of the Bd.

Shelbyville, Ind.—The New York Central Lines has purchased a site covering about six acres, near Shelbyville, and will erect a new freight depot. Plans are being prepared and bids will soon be asked.

Detroit, Mich.—The B. F. Goodrich Co., Akron, Ohio, has purchased a site at 964 Woodward Ave., and will erect a six-story mercantile building, to cost approximately $100,000.

Detroit, Mich.—Arthur Schlessinger will erect a two-story store and apartment building at Woodward Ave. and Glynn Court, to cost about $40,000. Baxter, O'Dell & Halpin are the Archs.

The directors of the Chicago Golf Club have voted a bond issue for $100,000, for the purpose of building a club house to replace the one which was destroyed by fire last fall.

Grand Rapids, Mich.—The Y. M. C. A. contemplates the erection of a new building, to cost approximately $200,000.

Lansing, Mich.—Bids will be received by the Board of Education until Feb. 15, for the construction of a grade school building.

Milwaukee, Wis.—Martin Tullgren & Sons have purchased a site at Biddle and Marshall Sts., and will erect an apartment building to cost approximately $125,000.

Davenport, Iowa—Plans have been prepared for the construction of a theater at Third and Ripley Sts., for a company in which Thomas J. Walsh and D. H. Lane are interested. The estimated cost is $120,000.

Crookston, Minn.—Plans are being prepared for the construction of a new high school, which will cost approximately $115,000.

Coffeyville, Kan.—The contract for the construction of a bank building for the First National Bank, of Coffeyville, has been awarded to H. E. McVART C. A. Henderson, Kellogg Bldg., is the Arch. Noted Dec. 26.

Greeley, Neb.—Press reports state that bids will be received by the County Commissioners, until Feb. 4, for the construction of a four-story court house. The estimated cost is $65,000. Berlinghof & Davis, Security Mutual Bldg., Lincoln, Neb., are the Archs.

Dallas, Tex.—Press reports state that bids will be received by J. B. Winslett, City Secy., until Jan. 31, for the construction of a municipal building at Harwood, Commerce and Main Sts. C. D. Hill & Co., 723 Wilson Bldg., are the Archs. Noted Jan. 9.

Denver, Colo.—The Colorado National Bank has had plans prepared for the construction of a bank and office building at Champa and 17th St.

Salt Lake City, Utah—The Deseret National Bank has purchased a site at First South and Main Sts., and will erect a 14-story bank and office building, to cost approximately $1,000,000.

✚Salt Lake City, Utah—The contract for the construction of the Utah State Capitol at Salt Lake City has been awarded to JAMES STEWART & CO., St. Louis, Mo., at $1,010,000. Noted Dec. 12.

Eugene, Ore.—C. K. Cole, Chihuahua, Mex., is having plans prepared for a new hotel to be erected on Olive St. The building will probably be eight stories.

Portland, Ore.—The University Club has purchased a site at Sixth and Jefferson Sts., and will erect a four-story club house, at an estimated cost of $125,000, including the furnishings. Whitehouse & Fouilhoux are Archs.

Portland, Ore.—The Pacific Telephone & Telegraph Co. has had plans completed for the new central office building to be erected at Park and Oak Sts. The ultimate height of the building will be 14 stories, 11 of which will be erected now. It will be fireproof throughout, with complete steel frame, reinforced concrete floors and exterior brick walls. The cost of the present structure will be about $400,000, the equipment will cost about $300,000, and to bring the conduits and cables into the new building will require $20,000 more.

Los Angeles, Calif.—A site has been secured at Eighth and Spring Sts. upon which the Home Builders' Co. will erect a 14-story building, costing from $700,000 to $800,000. J. Martyn Haenke is Arch.

Bakersfield, Calif.—T. B. Rice, owner of the Hotel Manchester, will add three stories to the building at a cost of about $45,000.

Los Angeles, Calif.—Bids will be received until 2 p.m., Jan. 27, by the Board of County Supervisors for the erection of two ward buildings, a dining room and kitchen, commissary building and a stable, at the County Farm. The wards will be 51x146 ft. each, two stories, and the stable will be in two parts, one 36x100 ft. and the other 73x36 ft., all to be of brick, two stories high.

Plans are being prepared for a new business block to be erected for Mrs. R. B. Young, on Seventh, between Flower and Figueroa Sts. It will be of steel and brick, 108x90 ft., and from eight to 14 stories high. R. B. Young & Son, Lankershim Bldg., are Archs.

The Hopper-McFarland-Duncan Co., 502 Story Bldg., will erect a hotel and store building on Figueroa St., near Seventh. J. Martyn Haenke, 417 Central Bldg., is Arch.

Oakland, Calif.—Plans are being completed for another new school to be located on 13th Ave., to cost $70,000. J. J. Donovan is City Arch.

San Diego, Calif.—J. W. Sefton, Jr., is having plans prepared for a four-story hotel and business building to be erected on F St., between Sixth and Seventh Sts. It will be 100x200 ft., and is estimated to cost $200,000. W. S. Hebbard is Arch.

✚San Francisco, Calif.—A contract has been awarded to KNOWLES & REICHLEY, 180 Jessie St., at $52,250, for the construction of a five-story rooming house on O'Farrell St., for Dr. C. F. Buckley. The M. J. Lyon Co., 127 Montgomery St., is Arch.

The American Can Co., Mills Bldg., has awarded a contract for the construction of a three-story reinforced concrete warehouse to be erected at 19th and Treat Aves., to the CLINTON FIREPROOFING CO., at $80,000. A contract for the piling was awarded to the RAYMOND PILING CO., at $15,000.

San Francisco, Calif.—A permit has been granted to Jos. N. Kowalsky for the erection of an eight-story hotel on Mission St., to cost $55,000.

A. W. Maltby will erect a seven-story hotel and store building on Ellis, west of Mason Sts. It will be 52x100 ft., of modern construction, with exterior facings of cement plaster. The estimated cost is $75,000. Albert Farr, Foxcroft Bldg., is Arch.

✚ A contract has been awarded by the Panama-Pacific Exposition Co., for the erection of Machinery Hall to the W. W. ANDERSON CO., at $509,900. Bids erroneously noted under Sacramento Jan. 9. C. C. Moore is Pres.

Stockton, Calif.—The Home Builders' Investment & Security Co. will erect an apartment house at Flora and El Dorado Sts., costing about $75,000.

Montreal, Que.—A permit has been granted to George Marcil & Co for the erection of a 10-story office building on Victoria Sq., adjoining the Imperial Bank Bldg. It will cost about $750,000.

Hamilton, Ont.—Press reports state the Canadian-Northern Ry. Co. has two sites in Hamilton under consideration, upon one of which it will shortly begin the erection of a new hotel.

Toronto, Ont.—Michael Shea, Buffalo, N. Y., and Toronto, has secured a site, and will erect a popular-price theater in Toronto. The structure will have a seating capacity of about 3000, and is estimated to cost $750,000.

Port Arthur, Ont.—Bids will be received until Jan. 22, by the Department of Public Works, Ottawa, for the erection of an armory at Port Arthur, to cost $100,000. Specifications are at the office of City Clk., Port Arthur; H. E. Matthews, Superv. Arch., Winnipeg, Man., or at Dept., Ottawa. R. C. Desrochers is Secy. Dept. of Pub. Wks.

St. Thomas, Ont.—A site has been leased, and plans will be prepared at once for the erection of a Y. M. C. A. building, costing $50,000.

Prince Albert, Sask.—Plans are being prepared for a new $300,000 hotel to be erected by the Marquis Hotel Co., on Central Ave. It will be of structural steel, reinforced concrete and terra cotta construction. Creighton & Crowther are Archs.

✚Calgary, Alta.—A contract has been awarded to BURCH & HOFFMAN, 180 Ellis St., San Francisco, Calif., on a percentage basis for the construction of a 12-story office building for Buffalo, New York and Toronto capitalists. The structure will be 100x165 ft., and 134 ft. high. It will be of fireproof construction throughout steel frame, reinforced-concrete walls faced with Alberta stone and metal interior trim. The foundation, frame and walls are designed for a 16-story building, but only 12 will be erected now. The estimated cost is $325,000. Peter McDuffie, Toronto, is Arch and Engr. in charge.

Engineering News

VOLUME 69 JANUARY 23, 1913 NUMBER 4

Completion of the Rebuilt Assuan Dam

We have already briefly noted the formal acceptance, on Dec. 23, 1912, of the rebuilt Assuan Dam across the River Nile, in Egypt.* It will be recalled that the old dam was constructed to make more effective the irrigation of the land in districts contiguous to the Nile. This was work on which the prosperity of the whole country depended, since the land had fallen desolate through the decay of the great ancient irrigation works—a decline which was only slightly improved by attempts of the ruler, Mehemet Ali, to convert part of the country from basin to perennial irrigation on a large scale and to introduce cotton growing. The proposal to create this dam, of course, aroused a popular clamor stimulated by the archæologists. As a concession to this sentiment, the Egyptian government decided that the water level of the projected reservoir should not be raised more than 350 ft. above the sea. This limited the reservoir capacity to 35,300 million cubic feet, but the designer, Sir Wm. Willcocks, devised a dam which he believed would allow the crest to be raised safely 19 ft. 9½ in. at a future date, if such a step should finally be permitted. The work was commenced in 1898 and completed in 1902, a year ahead of time, with Messrs. John Aird & Co. as contractors.

The dam was built of the red Assuan granite, laid in portland-cement mortar. One part of the length is of solid gravity section and the other of "pierced" section, to permit the rapid discharge of the silt-bearing flood waters before the burden could be deposited in the reservoir.

It was found, shortly after the first dam was put into use, that the development of the irrigated land could not go forward as desired with original height. After much study it was finally decided to raise the water level 23 ft. more, which was done by raising the masonry crest 16.4 ft. and thickening the dam 16.4 ft. In this way the capacity was increased to 81,190 million cubic feet, at an estimated cost of $6,000,000.†



DOWNSTREAM SIDE OF THE REBUILT ASSUAN DAM, NEARING COMPLETION
(From London "Engineering," Dec. 20, 1912.)

As shown in our previous article, the work of reconstructing the dam comprised three main operations; (1) thickening the present dam by the addition of a masonry reinforcement on the downstream face, (2) bonding this new work homogeneously with the original dam, (3) building the whole structure up to a desired height and making necessary changes in the locks and navigation channel of the Nile. The new masonry, which was built up in front of the old, was supported from 2 to 6 in. away from the latter by 1¼-in. steel rods a meter apart. This space was divided up into bays or compartments in which

*See Eng. News, Sept. 30, 1909, for a description of work then in progress. For articles on the old Assuan Dam, see Eng. News, Dec. 28, 1899, p. 418; Sept. 26, 1901, p. 221; Aug. 15, 1902, p. 106.

†See an article entitled "Egyptian Irrigation and the Assuan Dam," in London "Engineering," Dec. 20, 1912, for a history of the project connected with this development. From that article the progress of the work between 1909 and date has here been summarized.

perforated pipes were left for the introduction of cement grout when the temperature of the old and new masses of masonry should become equalized so that they could be bonded without danger of temperature stresses.

The grouting was begun in November, 1909, on parts finished two years before, and the work was completed in the season of 1911-12. The mixers were driven by portable engines and the grout put into the spaces by flexible piping. No trouble was experienced in the work, except that the men had to be trained to it, and it took longer than was expected.

The sluice openings in the new section are slightly higher than in the old one. The sides and floor, however, in both sections are flush. Thirty of the lower



FIG. 2. UPSTREAM ENTRANCE TO THE ASSUAN DAM LOCKS
(From London "Engineering," Dec. 20, 1912)

sluices in the old dam had been lined with cast iron to expedite the work, but in the new section no such lining was employed. In the original dam no spillway was provided, but this has been done in the reconstruction. In that length of the dam where there are no sluices, the arched spillways are carried through the crest wall, as shown in Figs. 1 and 2.

The heightening of the dam entailed raising the walls of Lock No. 1 by 16.4 ft.; No. 2, 13.1 ft.; No. 3, 13.1 ft.; No. 4, 19.7 ft., and adding a new lock (No. 5) at the lower end of the flight. New gates had to be provided for Lock No. 1, and the old gates were shifted.

The gates used here are an unusual single-leaf sliding type. Each is suspended from a carriage running on a roller track at 90° to the lock, partly carried on the lock wall and partly on a bascule bridge. In the land side of the lock wall is a recess into which the gate is run when lifted out of its pockets. The upper locks are now very deep and the highest gates have to be 78 ft. 9 in. from top to bottom, for a width of opening only 32 ft. 2 in. The other gates of the channel, however, are 59 ft., 52 ft. 6 in., 45 ft. 11 in. and 36 ft. 1 in., respectively.

The old No. 1 gate was moved into No. 3 recess (Lock No. 2) and the old No. 2 gate was cut down for recess No. 1 (Lock No. 3). Old No. 3 gate was removed to No. 5 recess without alteration, and No. 4 gate was placed in No. 6 recess. The old No. 5 gate, which was 26 ft. 3 in. in height, was dismantled and used in the reconstruction work.

To transfer all of these gates it was necessary to stop traffic in the locks from December, 1909, to December, 1910. The No. 5 gate, which weighed 12 tons, was removed from its recess, divided in two parts and taken to the upstream end of the locks, where it was floated to the entrance and here used to dam back the autumn floods (Fig. 3), its height being increased by balks. After this gate was secured in place, those which had to be removed to new positions were run out on their bascules, jacked up and disconnected from the carriage and after being fitted with their new appurtenances were lowered upon two special trucks carrying cup centers. One track was laid on an arc so that the gate could be swung around 90° and pointed down the lock. When this position had been reached the tracks were relaid as a single tangent down the lock and each gate was pushed along 175 yd. When a lock sill was reached the track was run ahead into the



FIG. 3. REMOVING THE TEMPORARY GATE AT THE LOCK ENTRANCE OF THE ASSUAN DAM NAVIGATION CHANNEL
(Photograph from Underwood & Underwood, New York City)

next lock on piled timbers, which were gradually removed when the gate was clear of the sill and the track and gate lowered to the new level. When the proper recess was reached for each gate this process was reversed and the gate was fitted to its carriage on the bascule. The tallest gate thus transported weighed 92 tons and was steadied at the top by guy ropes.

❋

How to Make Three Billion Dollars Look Like Thirty Dollars was shown by the Treasury Department the other day when it sent out word that Uncle Sam had $3,350,727,580 in circulation on Jan. 2, 1913, but added that estimating the population of Continental United States at 96,496,000, this was a per capita average of $34.72. Those who had less than that amount in their pocket at that time should remember that the statement covered money in bank reserves and in the treasuries of corporations as well as the contents of private pocketbooks and purses.

The Proposed Port of Richmond, Calif., in San Francisco Bay

A new port in San Francisco Bay is proposed in a recently printed report made to the Council of the City of Richmond, Calif., by the firm of Haviland & Tibbetts, engineers, of San Francisco. This report is printed in a 230-pp. book, with numerous drawings and illustrations. The City of Richmond is a comparatively new settlement, having been founded in 1900, and is located northeast of San Francisco across the bay. It is the terminus of two large railroads, and the seat of a number of extensive manufacturing interests. Apparently its future growth promises to be very rapid. With a view toward the increased commerce expected after the opening of the Panama Canal, the city has started this investigation toward the establishment of a large port, which can compete with the numerous other enormous port projects now incubating on the Pacific Coast.

The report takes up in general harbor and terminal developments now existing and proposed in San Francisco Bay, and then given a general description of Richmond, of the topographical features first, and the commercial development next, and finally outlines the proposed harbor improvements. The recommendations of the engineers in brief are as follows:

An ultimate development to be reached in a number of years is first proposed. In this it is recommended that a comprehensive plan be at once adopted for the orderly development of the harbor, as generally provided by the government plan, in order that all work performed may be a useful and integral part of the final scheme. This plan provides for the construction of a bulkhead wharf and eleven deep-water piers, 160x750 ft., separated by 300-ft. slips, all in the outer division of the harbor. Twenty-one piers, each 160x600 ft. and separated by 300-ft. slips, are provided along the interior basin. All the harbor is to be designed for 30 ft. of water at low tide. A belt-line railway and a 50-ft. highway are provided around the harbor passing along the rear edge of all wharves. It is further proposed that the city acquire all the submerged lands which were reclaimed by the dredging of the harbor, and reclaim and develop such land for manufacturing and industrial purposes. This project as outlined will provide the city with about 600 acres of reclaimed land for industrial and manufacturing purposes, and with a total of about 9.8 miles of waterfront, which it is estimated is sufficient to provide for an annual commerce nearly equal to that of San Francisco at present. The ultimate cost of this entire project is estimated to be over $18,000,000.

A development which can be immediately started is next proposed. This recommends that wharf construction be commenced simultaneously at both outer and inner ends of the proposed government harbor. The outer wharf when complete is to consist of a bulkhead wharf about 800 ft. long and 90 ft. wide. The outer 550 ft. of this is to be constructed at the present time. It is to be designed for the accommodation of deep-water ships, and as a convenient port of call for river traffic. An inner wharf 535 ft. long is also proposed. It is noteworthy that both wharves are designed to be of permanent and substantial construction, fireproof throughout, and of pleasing architectural appearance. Mechanical freight-handling devices have also been designed.

The engineers recommend that the city should immediately acquire sufficient submerged land around the edges of the government project to receive the material dredged from the channel. It should also acquire submerged land for rights-of-way for the government dike and training wall, and should cede this land to the government prior to the beginning of construction. The total amount of land required for both these purposes is about 802 acres. An estimate of this immediate project is about $729,000.

The report is now in the hands of the City Council of Richmond, but no action upon it has been taken as yet.

❋

Electric Traction on Steam Roads entering the city of Melbourne, Australia, has been estimated upon by various manufacturers about the world in response to invitations sent out six months ago, and the compiled figures have recently been printed in English technical journals. In 1908 the question of this substitution of electricity for steam was reported on by Charles Merz, but the local railway commissioners did not feel convinced that electrification would pay or that estimates of traffic increase would be realized. However, the estimates have now been exceeded. In 1908 there were 70,000,000 suburban passengers, and in this year there will be 90,000,000. In 1917, after electrification, it is estimated that there will be 150,000,000.

In the earlier report the direct-current system was recommended in preference to single-phase, and the commissioners have felt that today the direct-current system at higher voltage, employing an overhead wire, compares still more favorably with the single-phase. But as between $10,000,000 and $15,000,000 is involved in the conversion of some 300 miles of track, the government decided to secure complete alternative proposals on both systems, the specifications being drawn up by their engineers, Messrs. Merz & McLellan. Pains were taken, it is claimed, to see that the rival schemes were really comparable.

The cost of converting the suburban lines amounts to $11,750,000 and $15,300,000, respectively, for direct and single phase systems on the basis of the best tenders for each scheme. This includes items of capital expenditure affected by the different systems, such as steam raising plants, buildings of power house, repair shops, etc., are not included. The details are as in the following table:

	Direct-current system	Single-phase system
Power plant	$1,345,535	$1,440,220
High tension transmission	839,315	656,915
Substations	1,893,025	209,525
Electrical way equipment	2,811,400	2,059,580
Alterations to works and way	121,750	1,032,160
Rolling stock	4,736,160	9,886,720
Total	$11,747,185	$15,285,120

In comparing annual cost of operation under the two systems, only items were included in the report, which vary according to the system employed. These are shown in the following:

	Direct-current system	Single-phase system
Variable power house charges	$248,500	$292,000
Inspection and maintenance of lines, substations and tracks	168,485	110,800
Maintenance rolling stock	334,000	609,500
Interest on capital	469,885	611,405
Total	$1,270,870	$1,623,705

It was recognized that the single-phase system has proved more desirable for longer country lines in sparce territory. Therefore, the comparisons which were compiled of cost for the Melbourne-Bendigo line, which has a route length of 100 miles. The figures were $4,291,000 for the direct-current and $4,355,000 for the single-phase system, respectively.

These figures have been variously attacked as not being directly comparable. For instance, experience on the Brighton Ry. (single-phase) has led to the claims that (1) the figure for altering telephone and telegraph wires is $500,000 too heavy, and that the cost of the 500 single-phase motor-car equipments is much too high; in regard to operating costs, it is contended that (1) the Brighton experience indicates that the direct current losses due to converter substations would more than offset the increased energy consumption of the single-phase motors and (2) the maintenance of the direct-current overhead lines would be far greater than the single-phase on account of the heavier currents drawn.

Construction of the Calumet-Sag Canal

By E. J. Kelly*

SYNOPSIS—The Chicago main drainage canal, opened on Jan. 2, 1900, was built for the disposal of the city's sewage by dilution and for the elimination of sewage-pollution of the city's water supply, and incidentally with a view to its possibilities as an inland waterway. With the development of population in the outlying districts it has been necessary to provide for bringing the sewage of these districts to the main canal by means of branches having connections with Lake Michigan to give the necessary water for dilution. The North-Shore Channel is completed and in service. The Calumet Channel was put under construction during 1912, and this work is described in the article below. The main drainage canal was of importance not only as an engineering work but also on account of the numerous types and elaborate equipment of the plants for excavating and removing the material. The Calumet Channel being smaller, requires less extensive plant, but it is worth noting that much of the excavation is being done with drag-line scraper-bucket excavators, a type of machine practically unknown when the main canal was built. It is of interest to note also that some of these excavators are operated by electricity instead of by steam.

The construction of the east and west ends of the canal is facilitated by the fact that the ground is fairly high and dry, but the middle portion lies in a swamp some 5½ miles long and varying in width from ¼ to ½ mile. This renders the excavation of this portion somewhat more difficult, presenting the problem of handling a large amount of surface water at practically all times while the work is under way.

Materials to be Excavated

The material to be removed has been classified under the two general heads of "glacial drift" and "solid rock," and unit prices are paid on this basis. Glacial drift is as described as comprising "all material that overlies the solid, stratified limestone rock in its original bed." Solid rock comprises "all stratified limestone found in its original bed." The general character of the material encountered at the east and west ends of the canal differs widely from that found in the portion through the swamps. In the former, black soil is found, 2 to 4 ft.

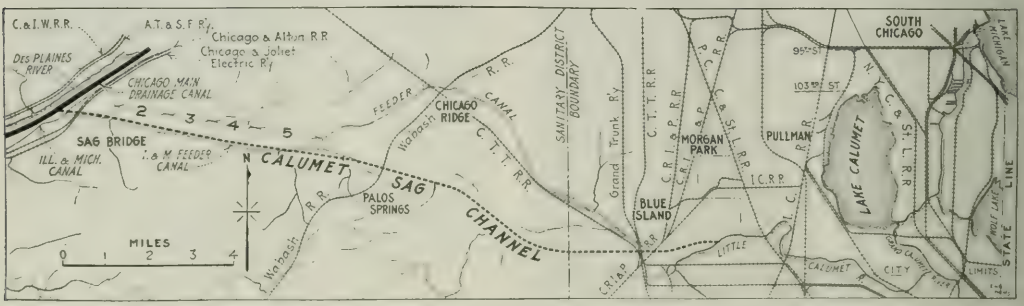


Fig. 1. Map of the Calumet-Sag Drainage Canal: Sanitary District of Chicago

The Calumet-Sag Canal or drainage channel is now being constructed by the Sanitary District of Chicago to connect the Little Calumet River (and Lake Michigan) with the Chicago Main Drainage Canal. The purpose of this new canal is to intercept the sewage of that part of the Sanitary District lying south of 87th St., which now enters Lake Michigan through the Calumet River, and to divert it westward into the Main Drainage Canal. The canal bears westerly from the mouth of Stony Creek through a natural valley for a distance of about 16 miles, passing through the city of Blue Island, Ill., and entering the main canal at Sag Bridge, as shown in Fig. 1.† The total estimated cost of the entire project, including some work of improving the Little Calumet River, constructing controlling works, pumping station, intercepting sewers, etc., is $11,000,000.

*Division Engineer Sanitary District of Chicago, American Trust Bldg., Chicago.

†The Calumet-Sag Canal and the sewage-disposal problem of the Calumet section of the Chicago Sanitary District have been dealt with in our issues of July 22, 1909, June 16, 1910; Feb. 22, 1911, and Nov. 3, 1911.—Editor.

The material to be excavated is found to be from 2 to 6 ft. deep, followed by sandy clay varying in depth from 2 to 6 ft., below this is encountered hard, white clay, gravel, boulders, some sea shells and other calcareous deposits, to a depth of 3 to 5 ft. and usually just overlying the solid rock. In some cases, however, a thin layer of shell limestone, or ledge rock is found overlying the solid rock. The average rock cut at the west end varies from 15 to 25 ft. while at the east end the borings indicate a rock cut somewhat less than this. The average total depth of the excavation is about 40 ft. Through the swampy portion, extensive peat beds and decayed vegetable matter are encountered, extending from the surface to a depth of 3 to 15 ft. below this a layer of silty clay of very unstable character (known locally as "bull liver"), varying in depth from 3 to 8 ft., is usually found; and underneath this a stratum of very hard clay, cemented gravel, and boulders, generally overlies the solid rock. Through the swamp the rock cutting varies from about 15 ft. to nothing, and the average total depth of excavation is about 35 ft.

Cross-Section

On account of the marked difference in the character of material encountered, two different types of channel sec-

tion are to be constructed, the "rock section" and the "earth section." These are shown in Fig. 2. Each is capable of carrying 2,000 cu.ft. of water per second, with a depth of 20 ft. and an available fall of about 3 ft. from Lake Michigan to the main drainage canal at Sag. & Michigan Canal, while that of the east half is carried east into the Little Calumet River. These ditches are connected with the channel at frequent intervals by cross-ditches, concrete outfalls being provided at their outlets.

At the present time four contract sections are under

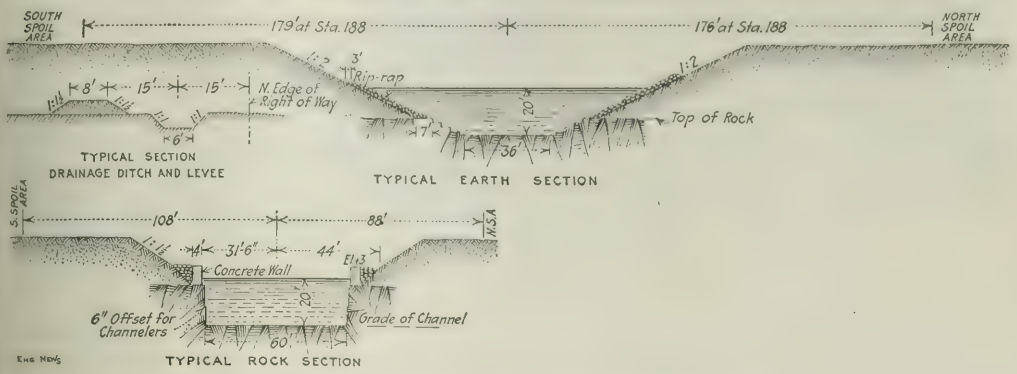


FIG. 2. TYPICAL CROSS-SECTIONS OF THE CALUMET-SAG CANAL

(In earth sections, where rock is above El.15, it will be excavated 2 ft. (measured horizontally) outside the theoretical prism, and this 2-ft. space will be filled with rip-rap.)

Where the rock cutting exceeds 15 ft. the "rock section" becomes the more economical. This section is 60 ft. wide on the bottom, with vertical channeled rock sides, and concrete walls on both sides of the channel extending 5 ft. above the proposed water surface. The wall, which is shown in section in Fig. 3, may be made with the rear face battered or stepped, at the option of the contractor. In either case, payment will be made for the actual amount of concrete measured in place. The expansion joints are 50 ft. apart, with a 4-in. weeper or drain through the bottom of the wall midway between the joints. The earth is sloped back from the wall to the ground surface and the space behind the wall is backfilled with rock. Where the rock cutting is less than 15 ft. the "earth section" is used. This section is 36 ft. wide on the bottom and about 190 ft. wide at the ground surface, with the side slopes in both rock and earth excavated to an inclination of 1 on 2.

Rip-rap, composed of broken stone excavated from the channel, is hand-placed on both slopes from the rock surface up to an elevation 3 ft. above the proposed water surface. On the "rock section," berms are provided from 30 to 50 ft. wide, while on the "earth section" the north berm is 50 ft. wide and the south berm from 90 to 100 ft. wide. The larger south berm is to permit a future enlargement of the channel without rehandling spoil. The material excavated is deposited on both sides of the channel. The spoil area extends from the berm to the right-of-way line, with the exception of a narrow strip about 40 ft. wide along both the north and south sides of the right of way, which is reserved for a collateral drainage ditch. The spoil areas on each side of the channel vary in width from 200 to 1200 ft., the wider areas being required through the swampy portion.

The drainage ditches along the edges of the right of way are designed primarily to intercept and carry off surface drainage during construction. The drainage from the west half of the work is carried west into the Illinois

construction: Sections Nos. 2, 3, 4 and 5, whose location is shown in Fig. 1.

CONSTRUCTION WORK ON SECTION NO. 2.

Section 2 is a "rock section" 6754 ft. long, and comprises the excavation of 221,000 cu.yd. of glacial drift and 351,000 cu.yd. of solid rock; the channeling of 313,000 sq.ft. of rock face, and the construction of 6400 cu.yd. of concrete retaining wall. The contractor is the Winston Bros. Co., of Minneapolis, Minn., and is doing this work at the following prices: glacial drift excavation, 22c. per cu.yd.; rock excavation, 65c. per cu.yd.; channeling, 20c. per sq.ft.; concrete retaining wall, $7 per cu.yd.

Work on this section was commenced April 2, 1912, the drainage ditch along the north edge of the right of

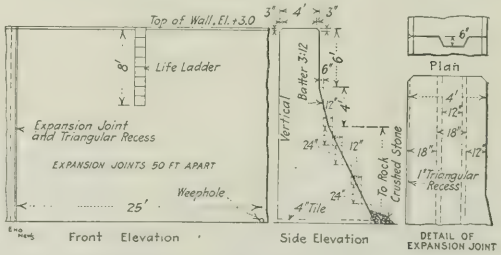


FIG. 3. CROSS-SECTION OF RETAINING WALLS ON THE ROCK SECTION OF THE CALUMET-SAG CANAL

(The battering or stepping of the rear face is optional with the contractor.)

way being the first work done. This ditch is shown in Fig. 4. Teams, scrapers, and a drag-line excavator were employed. The drainage ditch along the south edge of the right of way had already been excavated by the Sanitary District to afford an outlet for drainage from work already in progress farther east.

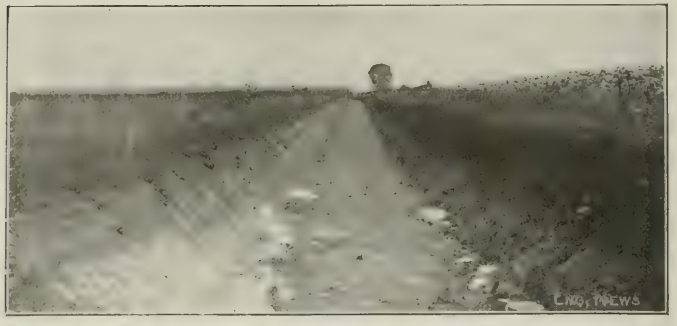


FIG. 4. DITCH FOR DRAINING THE SITE OF THE CALUMET-SAG CANAL: SECTION NO. 2
(The spoil bank at the right is that of the canal.)

The excavation of glacial drift in the channel proper is being done with a Bucyrus drag-line excavator, moving along the berms. The machine is equipped with an 85-ft. steel boom and with both Bucyrus and Page 2½-yd. buckets (Fig. 5). The cut averages about 8 ft. The black dirt is stored separately on the south berm, the intention being to later remove it for use in the Chicago parks, while the remainder of the glacial drift is being deposited on both sides of the channel in the spoil areas provided. This machine has averaged about 50,000 cu.yd. per month, working one daily shift of 10 hr. The average force employed was about 10 men.

After the rock surface was cleared, the work of cutting the vertical rock faces of the prism was commenced, two Ingersoll-Rand steam channelers being employed on each side of the channel. The average total height of the rock faces will be about 26 ft. and is divided into three lifts, the top lift being about 6 ft. and the other two lifts about 10 ft. each. The channeling of the top lift cost about 35c. per sq.ft., as against a contract price of 20c. This high cost was due to the nonuniformity and poor quality of the rock encountered, and the shallow depth of the cut, which required frequent moving of the channelers. The remainder of the faces being channeled in two lifts of 10 ft. each and through sounder rock, the machines are expected to work much more economically. Two additional channelers were later employed, as it was found that the four originally installed were of insufficient capacity to keep the channeling in advance of the drilling and blasting. Fig. 6 shows the channelers at work on each side, and also the pumping plant, beyond which is the dump track on the spoil bank.

Drilling is being accomplished by means of two Ingersoll-Rand steam drills, each having its own boiler and mounted on trucks as shown in Fig. 7. The blasted rock is loaded on 4-yd. dump cars by means of a 70-ton Bucyrus steam-shovel and hauled to the spoil area by small locomotives in 11-car trains. Present progress averages 800 cu.yd. of rock per day. Fig. 8 shows the rock after being blasted to a depth of 10 ft. The channelers, drills and pump may be seen in advance, and the dump track is in position on the rock surface. The total estimated value of this contract is $365,070, and the work is required to to be completed by Oct. 1, 1915.

CONSTRUCTION WORK ON SECTION NO. 3

Section 3 lies immediately east of Section 2, and is 5397 ft. long. It is a "rock section," except at the extreme east end, where the change in character of the material necessitates a change to the "earth section" before mentioned. This section comprises the excavation of 335,000 cu.yd. of glacial drift and 220,000 cu.yd. of solid rock; the channeling of 182,000 sq.ft. of rock face, the construction of 3400 cu.yd of concrete retaining wall, and the placing of 5000 sq.yd. of rip-rap slopes. The contractor, S. R. H. Robinson & Son Contracting Co., of St. Louis, Mo., is doing this work for the following prices:



FIG. 5. DRAG-LINE SCRAPER-BUCKET EXCAVATOR ON THE CALUMET-SAG CANAL



FIG. 6. CHANNELING THE SIDES OF THE ROCK EXCAVATION FOR THE CALUMET-SAG CANAL: SECTION NO. 2
(There are two channelers on each side. On the right is a drainage pump, with the spoil bank, and dump track behind it.)



Fig. 7. Steam Drills on the Calumet-Sag Excavation

glacial drift excavation, 29c. per cu.yd.; rock excavation, 69c. per cu.yd.; channeling, 25c. per sq.ft.; concrete retaining wall, $4.95 per cu.yd.; rip-rap slope, $1 per sq.yd.

Work under this contract was commenced March 22, 1912. After erecting a labor camp and performing other preliminary work, excavation was started on the north drainage ditch, this work being performed by hand. The south drainage ditch had already been constructed by the Sanitary District, a 40-ft. ditch 5 ft. deep, having been excavated by means of a floating dredge following the course of an old feeder channel of the Illinois & Michigan Canal. A Lidgerwood steam drag-line excavator with a 100-ft. boom and 2½-yd. Page bucket is being employed to excavate the glacial drift from the channel proper, the machine moving along one berm to the end of the section and then back along the other berm. Thus the material is deposited on the spoil banks on both sides of the channel.

The excavation of the glacial drift immediately overlying the rock to a depth of 5 or 6 ft. is attended with the greatest difficulty. The material is composed of a cemented rock and gravel. It has been found necessary to form powder holes by driving bull points into this layer and then blasting, after which the material is removed by the drag-line excavator. No work on rock has been done as yet on this section. The total estimated value of this contract is $365,855, and the work is required to be completed by Oct. 1, 1915.

Construction Work on Section No. 4.

Section 4 lies immediately east of Section 3. It is an "earth section" 5377 ft. long, and comprises the excavation of 780,000 cu.yd. of glacial drift and 121,000 cu.yd. of rock, and the construction of 37,000 sq.yd. of rip-rap slope. The contractor, Thomas J. Forschner, Lemont, Ill., is doing this work at the following prices: glacial drift excavation, 25c. per cu.yd.; rock excavation, 77c.; rip-rap slope, 50c. per sq.yd. Work under this contract was commenced in September, 1911, when hand excavation of the north drainage ditch was started. The south drainage ditch (10 ft. wide) was excavated by means of a floating dredge. The total estimated value of this section is $314,506, and the work is required to be completed by Aug. 1, 1915.

The excavation of the channel proper was commenced early last year, a Marion self-propelling steam drag-line excavator with 100-ft. steel boom being employed. This machine is equipped with a 3½-yd. and a 6-yd. Marion bucket, the larger bucket being used for the excavation of the peat and other light material found near the surface. An interesting feature of this machine is the placing of hydraulic jacks under each corner. These jacks automatically keep the swinging parts of the machine level through all positions, and have been found to operate very successfully. Their value lies in the saving of time necessary to keep track level and the reduction in the wear and tear of the machine. The output of the excavator for the last five months has averaged 60,000 cu.yd. per month, working two 10-hr. shifts per day and employing an average force of about 12 men per shift. Up to the present time no work on rock excavation or rip-rap slopes has been done on Section 4.

Construction Work on Section No. 5

Section 5 lies immediately east of Section 4. It is an "earth section" 8127 ft. long, and comprises the excavation of 1,070,000 cu.yd. of glacial drift and 141,000 cu.yd. of rock; the construction of 69,000 sq.yd. of rip-rap slope, 4800 lin.ft. of roadway, 1000 cu.yd. of miscellaneous concrete work, 900 cu.ft. of concrete cylinders, and the erection of two fixed highway bridges. The contractor, Green & Sons Co., of Chicago, are doing this work at the following prices: glacial drift excavation, 24c. per cu.yd.; rock excavation, 70c.; rip-rap slopes, $1 per sq.yd.; roadway construction, $1 per lin.ft.; No. 1 concrete, $10, and No. 2 concrete, $7 per cu.yd.; concrete cylinders, 60c. per cu.ft.; and $3000 each for the two highway bridges.

Work under this contract was commenced about July



Fig. 8. Rock after Blasting (10-ft. Drill Holes); Calumet-Sag Canal

1, but up to November operations had been confined to preliminary work such as drainage ditches, stripping and storing of black dirt, camp construction, etc. Two Lidgerwood drag-line excavators with 100-ft. steel booms and 2½-yd. Page buckets are now being erected. These machines will be electrically operated, a transmission line 15 miles long having been built to furnish power to various points along the channel. A feature of this section is the use of Cippoletti or notch weirs for the concrete outfall and spillway at Milk Creek, a stream entering from the south, with a maximum flow of about 350 cu.ft. per sec. By this design it is the intention to obviate difficulties to navigation caused by cross-currents in the channel, and also to prevent excessive velocities and scouring in the creek. The total estimated value of this contract is $444,990 and work is required to be completed by Oct. 1, 1915.

Railway Crossing of Canal

The Wabash R. R. is engaged in straightening its line across the swamps between the towns of Worth and Palos. This work involves the relocating of the Wabash R. R. crossing of the Calumet-Sag Channel to a point about 1600 ft. west of the present crossing. The bridge and approach embankments are to be built by the railway company, but the Sanitary District has agreed to repay it the expense incurred in building the bridge. Work on the fill is now in progress, and the bridge will probably be built before that section of the canal is let, thus requiring the construction of the channel under the completed bridge. This, and all bridges over the channel, will have a clearance of 16.5 ft. and a clear middle span of 60 ft. The contractor doing this work for the Wabash R.R. is John Marsch, of Chicago.

Future Work

Section 1, the most westerly section which will connect the Calumet-Sag Channel with the Main Drainage Canal, will be a "rock section," and this will probably be the last work let. The sections through the city of Blue Island will also be "rock sections" having a concrete wall on both sides. This portion of the canal presents many difficulties in the way of crossing railways, streets and sewers, and the care which must be observed in blasting. All excavated material will have to be transported and leveled off in the spoil areas provided. The channel lies practically through the business section of the town.

In addition to the work now under contract, the Sanitary District is engaged in excavating a drainage ditch, known as the North Diversion Ditch. This work is preliminary to letting contracts for the construction of the channel through the middle portion, the purpose of this ditch being to provide an outlet for drainage from the swamps. This work is being performed with a floating Marion dredge equipped with a 10-ft. boom and a 1¼-yd. dipper. Cemented-gravel, which requires shooting, is being encountered, making progress slow.

The work of preparing plans and specifications for the construction of additional sections is well under way, and contracts will be let as rapidly as conditions will permit. The great difficulty lies in acquiring the right of way, the Sanitary District policy being to purchase this by mutual agreement wherever possible. This method has been found to be more satisfactory eventually than that of condemnation.

Camps and Labor

An item of interest to contractors is the difficulty that has been encountered in engaging and holding common labor. This scarcity has necessitated the payment of higher wages and the maintenance and operation of camps and commissaries at a loss. The labor is mostly Austrian and Italian. Camps are equipped with shower baths and all possible conveniences. Water for camps and for the work is supplied by reservoirs constructed on the south bluffs, these reservoirs being filled by pumping from wells and by rain water. By this means a gravity flow under a head of from 50 to 60 ft. is available at all times. Coal and other material is hauled by wagon from Worth, Ill., on the Wabash R.R., or Lambert, Ill., on the Chicago & Alton R.R., over roads which are fair in good weather and bad in wet weather. The longest haul is about three miles. The canal and right of way are patrolled by Sanitary District police, and rules requiring order and a sanitary condition of the camps, etc., are rigidly enforced.

❖

The Urban Population on American Rivers used for public water-supplies after filtration, was tabulated by Allen Hazen, and a few comparative figures for European cities given in a report on water purification submitted to the city of Ottawa, Ont., in November, 1912, as follows:

Place	River	Drainage area above city sq.miles	Urban population 1910 Census, Total	Urban population 1910 Census, per square mile
Albany	Hudson	8,240	468,117	57
Atlanta	Chattahochee	1,560	5,925	4
Binghamton	Susquehanna	2,279	18,926	8
Chattanooga	Tennessee	21,418	113,351	5
Chester	Delaware	10,450	2,210,018	211
Cincinnati	Ohio	72,400	2,116,912	29
Elmira	Chemung	2,107	31,231	15
Grand Rapids	Grand	4,800	67,692	14
Harrisburg	Susquehanna	24,030	626,497	26
Indianapolis	White	1,820	67,678	37
Knoxville	Tennessee	9,530	77,005	8
Lawrence	Merrimac	4,634	364,858	79
Louisville	Ohio	91,000	2,989,458	33
Minneapolis	Mississippi	19,585	25,204	1
Paterson	Passaic	773	24,905	32
Philadelphia	Delaware	8,186	325,147	40
Philadelphia	Schuylkill	1,915	220,176	120
Pittsburgh	Allegheny	11,400	259,966	23
Pittsburgh	Monongahela	7,600	235,072	31
Poughkeepsie	Hudson	11,600	637,015	55
Toledo	Maumee	6,723	148,380	22
Washington	Potomac	11,476	100,950	9
Youngstown	Mahoning	967	34,525	36
Ottawa	Ottawa	34,623	20,839	0.6

In Europe, where the population is much more dense than in the United States and Canada, water has been taken from the rivers for purification, and the amount of sewage which rivers receive, has often been very much greater than it has been in most of the American rivers. For example:

City	River	Drainage area sq.miles	Population in large cities* Total	Population in large cities* per sq.mile
Bremen	Weser	15,100	679,196	45
Rotterdam	Rhine	75,000	5,892,705	79
Altona	Elbe	52,000	6,556,500	128

* These figures are not comparable with the American ones because they only include cities of over 100,000 inhabitants each. The data are not readily available for smaller cities. If these could be added the totals would be greatly increased.

In England, London takes most of its water from two rivers, the Thames and the Lea. The Thames above the intakes has a catchment area of 3548 sq.miles, with a population in 1891 of 1,055,115 or nearly 300 per sq.mile. There were seven cities with more than 10,000 inhabitants each and a combined population of 183,328 or 52 per sq.mile. The Lea, with a catchment area of 460 sq.miles, had a population at the same date of 189,287 or 412 per sq.mile, with one city with 30,005 inhabitants or 65 per sq. mile.

These figures are important in showing the successful purification and use of water from rivers with very much greater urban population and pollution, in some cases more than a hundred times as great as on the Ottawa River. [The total population on the Ottawa drainage area is only three per square mile—Ed.].

Drawbridges over Rivers Having Limited Navigation*

By C. E. SMITH†

The Missouri Pacific Ry. crosses a number of navigable rivers and maintains 30 movable bridges. The spans vary in length from a 36-ft. deck-plate girder bascule bridge to a swing span 440 ft. in length. The amount of navigation varies with the locality and with the season of the year. Some of the bridges have never been opened for boats since their construction; some are opened only a few times each year, while others are opened once (and sometimes oftener) each day during favorable stages of water and not at all for months during low-water periods.

On most of these rivers the navigation is notable by its absence, and in no case is there sufficient to afford any comparison between the tonnage passing under a bridge by boat and that passing over the bridge by rail. The latter is always many times, and frequently thousands of times, as great as the former. Notwithstanding the preponderance of rail traffic, however, the boat traffic gets the preference, and where there is necessity of delaying either a train or a boat the federal government has ruled that the boat must be given the preference, even though that might mean the stopping of the train.

A few months ago a boat approached one of the bridges a few minutes before the schedule time of a fast mail-train, which had been reported to the drawtender as being on time. The drawtender realized that he might not be able to open the bridge, pass the boat and close the bridge without delaying the mail train, so he waited until after the train had passed before opening the draw. The boat suffered a total delay of about 10 min. Complaint was lodged with the federal attorney, who took the matter up with the legal department of the railway company. It was ruled that the only condition under which it would be permissible to hold a boat to permit a train to cross would arise when the train was so close to the bridge that it could not be stopped before crossing.

The most important of the federal laws with reference to movable bridges is the Act of March 23, 1906, sometimes referred to as the General Bridge Act. In addition to the general laws governing movable bridges over navigable rivers, the War Department issues rules and regulations to govern the openings of bridges, these varying as may be necessary to meet local conditions.

What Is a Navigable River?

The question naturally suggests itself: "What is a navigable river"? The federal laws do not afford an answer and there is no competent general ruling in existence, nor does it seem possible that there can be given a satisfactory definition. Particular streams or parts of streams have been and may be declared navigable by Acts of Congress, by rulings of the War Department or by courts of competent jurisdiction. A definition given by a U. S. Engineer officer is as follows:

"A navigable stream is one which in a state of nature carries or is capable of carrying commerce in the manner in which commerce is usually carried."

The writer has concluded that the following general definition is as good as any; but in applying it to any particular case the rule of reason must be observed:

"A navigable river is one that has been declared navigable by competent authority, or that is in fact navigable at any time by any boat or raft."

All rivers that are designated as navigable are not navigable in fact, nor does the War Department require the construction of movable bridges over all so called navigable rivers. A notable example of this is the Kaw River, which joins the Missouri River at Kansas City, Kan. The Kaw has been declared a navigable river, the Government has established harbor lines for quite a distance above its mouth and has ordered the reconstruction of a large number of bridges to provide increased height, width and depth of foundations, the latter to do away with the necessity for protecting former piers with riprap.

In a distance of five miles above its mouth the Kaw is crossed by 15 bridges none of which have movable spans. With a few exceptions, the clearance of the steelwork will be only a few feet above high-water level, effectually preventing navigation at high water, which would otherwise be prevented by the swift current. At extreme low water the clearance under the bridges is about 30 ft. and the depth of water hardly sufficient to float a small barge. An occasional sand barge uses the river at occasional favorable stages and that constitutes the navigation. The jurisdiction of the War Department over the river is absolute, however, and the reconstruction of bridges now under way to comply with Government requirements will cost several millions of dollars.

The example is cited here simply to call attention to the reasonableness of the U. S. Engineers in not demanding movable bridges to accommodate a small amount of navigation. In fact the result of the writer's negotiations indicates the uniform reasonableness of these engineers in their interpretation of the laws and rules relating to navigable rivers.

Arrangements for Opening Drawbridges

Although theoretically it is the duty of the railway to maintain watchmen and turning machinery at each of its movable bridges and to be always ready to open a bridge at a moment's notice, it is practically unnecessary to bear such expense continuously at bridges that are seldom or never opened. At such points it is customary to lay the rails continuous over the bridge, to set the end wedges (in a swing bridge) so that the draw will not tip under traffic, and to dispense with watchmen. When such bridges must be opened it is customary for the boat owner or master to notify the section gang or nearest local agent, who arrange to open the bridge or to secure the necessary help. The relations between the railway company and the boatmen at such places have invariably been harmonious, as such relations usually promote the interests of both parties.

Occasionally, however, a boat owner approaches a drawbridge over such a steam with the apparent expectation of immediate attention, though his may be the first boat at that point in years and his arrival unexpected. His presence is usually discovered by the section gang or by a crew on a passing train, in which latter case the sectionmen are sent to investigate. The opening of the bridge soon follows. In such cases there is usually a claim for damages for the delay to the boat, and the railway company settles outside of court if the boat owner can be prevailed upon to see his loss (if any) in a reasonable light. An unreasonably large claim for one day's delay at a bridge that had not been opened previously for six years is now being adjusted.

Another fruitful source of complaint is the presence of stubs of old falsework piling in the channel. These are sometimes left in by the contractor cutting the piles off at extreme low water, assuming that boats cannot use the river until the water is deep enough over the pile stubs to float the boats, or by breaking the piles off, presumably at the bottom of the river but frequently higher; or they are the remaining stubs of piles that may have been swept away by flood and driftwood, or portions of some former bridge. It is practically certain that sooner or later a boat will hit them and they will result in delay or damage or both, with resulting claims. It is the practice of the writer in all cases to insist on the pulling of all false-work piles and former pile piers that stand in navigable channels, and this requirement is clearly set forth in the specifications and carefully watched.

It occasionally happens that navigation develops in a stream over which a bridge with fixed spans has been maintained for many years. In many cases such bridges must be reconstructed as movable bridges, but in others the necessity for permitting boats to pass occurs so seldom that when the design of the bridge permits, the most economical solution is the occasional temporary raising or removal of a span by means of a derrick car. There are many bridges that have been opened in this manner for years.

At bridges that are seldom opened, but where watchmen are maintained, it is difficult to maintain discipline on account of the monotony. The watchmen frequently leave the bridge between trains for shooting or fishing trips, with consequent delays to boats and subsequent complaints.

Drawbridges over Shifting Channels

It is, under the law, clearly the duty of the railway company to maintain channels under movable spans or to maintain movable spans over channels. It frequently happens, after a movable bridge has been constructed over the then channel, especially in a stream subject to quick rise, swift flow and shifting of sandy bottom, that the former channel under the movable span will fill up and a new channel be formed under one of the fixed approach spans. When this takes place it becomes a very nice problem to determine what course to pursue.

In the construction of the Illinois Central R.R. bridge over

*Abstract of a paper on "Bridges over Navigable Rivers," in Bulletin No. 150 (October, 1912) of the American Railway Engineering Association (Chicago). Decriptions of some methods of providing temporarily for navigation at drawbridges under construction, which are given in this paper, appear on pp. 153-5, of this issue.

†Bridge Engineer, Missouri Pacific Ry., St. Louis, Mo.

the Missouri River near Omaha, Neb., the channel moved out from under the original draw span while it was under construction. The company immediately arranged for the construction of a second draw span, duplicate of the first, to span the remainder of the river, so there are now four draw openings. For a somewhat similar reason the bridge of the St. Louis Southwestern Ry. over the Arkansas River, near Pine Bluff, Ark., has two draw spans.*

The problem of maintaining a movable span over the channel has been simplified by the recent development of the vertical-lift bridge. With this type of bridge it is practicable to cross a river with a number of simple spans of equal length on ordinary piers. The towers, counterweights and lifting mechanism are first applied to the span over the channel. At any later date, the lifting apparatus may be moved to lift any other span under which the channel may be, and the cost of the change will be only nominal as compared to the cost of changing any other type of movable bridge for a similar purpose. A bridge designed with this idea has recently been completed across the Arkansas River between Fort Smith and Van Buren, Ark. There are nine spans 196 ft. in length.

Location of Drawbridges

When a proposed bridge is to replace a former bridge which has been easily passed by boats and in regard to which there have been no complaints from the river interests, the approval of the U. S. Engineer Officer is usually merely a matter of form. Where boats have had difficulty in passing through the opening, or where there have been complaints for other reasons, or in the case of a bridge in a new location, the Engineer Officer either corresponds with the interested parties or holds a public hearing to determine what provision must be made for navigation. The width of opening and location of channel are matters, the determination of which frequently takes many conferences and much time.

From the standpoint both of the railway company and of the War Department it is most desirable that a movable bridge be located in the longest possible straight reach of the river, but conditions frequently impel the railway to choose a less desirable location. Where a bridge is located near or at a bend in the river, the boat owners and the War Department usually demand a larger opening than would be demanded in a straight reach. Two drawbridges were constructed over the Black River in Arkansas in 1911. The bridge near the mouth has a 267-ft. draw-span, providing openings 118 ft. wide in the clear, which is ample on account of the straight river; the other bridge, about 100 miles from the mouth, has a 440-ft. draw-span providing openings about 200 ft. wide in the clear, which is necessary on account of being located in a sharp bend.

Maintaining Navigation during Construction

The rights of navigation must be respected during the construction or reconstruction of a bridge and it is the duty of the railway to maintain navigation or to pay damages that are incurred by private parties if the channel be obstructed. Each case must be handled on its merits, controlled by local conditions such as actual and relative amounts of rail and boat traffic. In the case of very heavy traffic lines it is preferable (where practicable) to change alignment when such bridges are reconstructed, in order to avoid interference with either class of traffic. In congested districts this is frequently impossible and it becomes necessary to reconstruct in the former location under traffic. On light traffic lines interference with trains can be avoided without much increase in cost, so that the extra cost of changing the location is seldom warranted and it is most economical to reconstruct in the former location under traffic.

The writer has heard of instances of navigable rivers being declared closed for specified periods by the Chief of Engineers or Secretary of War or by Congress, but it is the invariable practice at the present time to refuse permission to close the channel even for a short period. It might be possible to secure the passage of an Act of Congress closing a river to navigation during a specified period for the reconstruction of a bridge, but it would probably be against the recommendation of the War Department and consequently would require more powerful political influence than most railways can command or would care to use for such a purpose if available.

It becomes practically necessary to work out a method of reconstruction that will not obstruct navigation or to pay the damages that are incurred by private interests. The U. S. Engineer Officer will usually make arrangements, if possible, to keep government boats away from the bridge, if request be made, for a reasonable period, but this is not always possible. It has been the uniform experience of the writer that the Engineer Officers are ready to make reasonable sacrifices where practicable, to avoid interference with the bridge construction.

Contractor's Responsibility in Keeping Navigation Open

It was the practice of many railways in the past (and the practice still obtains on some roads) to compel the contractor to work out a method of taking care of navigation and to make him responsible for any damages arising out of delays or injuries to boats during construction. This practice was objectionable for several reasons. Bidders would not familiarize themselves sufficiently with local conditions to be able to make a close estimate of the probable cost to which they would be put in caring for navigation; consequently a sum based on a guess would be added to the bid. In case the sum was too large, the railway would pay for more than it was getting; if too small, the contractor would soon find it out and would make every effort to keep within his estimate, with consequent delays to boats and dissatisfaction among their owners.

It is well to realize that the railway company must pay for the delays to navigation or for the means to avoid delays, and that it is better to pay the actual amount in either case than to gamble on it by getting an estimate. It is not difficult to write the specifications covering any specific case in such a manner that the contractor will not be subjected to a hardship or forced to take an unreasonable profit.

In the Southwest it is practically impossible to predict the amount of navigation that will be carried on during the reconstruction of a bridge. Of course every effort is made to carry out the work during expected periods of low water, but after five years' experience with rivers in the Southwest it appears to the writer that there is no certain period of low water. The rivers are almost certain to be high from November to July and are frequently high from July to November; in fact, during some years there are no well-defined low-water periods. If the river reaches a sufficiently low stage, however, navigation will cease entirely. On the other hand, the uncertainty of the low-water period and the fact that frequently the stage of a river throughout an entire year is sufficient for navigation, make it necessary to provide for navigation during construction.

It is sometimes possible, where a portion of a river is used by only a few boats, to make amicable arrangements with the owners, possibly by the payment of relatively small sums, so that the company will be safe in closing the channel. Such a course, however, is invariably followed by an immediate increase in the number and importance of the boats using the river. The writer has been forced to the conclusion that there is no method of stimulating navigation over any portion of a river so effective as the construction or reconstruction of a bridge.

Practice on the Missouri Pacific Ry.

There are many ways of taking care of navigation during construction, each case presenting an entirely different problem, the solution of which depends on local conditions. On the Missouri Pacific Ry. it is the practice to let separate contracts for substructure, fabrication and erection of each bridge.

It is the invariable practice of the writer to design the substructure of the new bridge in such a manner that, whether it be a new location or renewal, the foundation can be put in and completed without stopping navigation. Provision is then made in the specifications that the contractor's work must be carried on in such a way as not to interfere with boats and he is held to strict compliance with that provision. Considerable contraction of the channel is usually possible during construction for the reason that the boats are much narrower than the channel, the greater permanent width being required to provide for free passage under all conditions.

The method of erection that will be followed is worked out and described in detail in the specifications. Erection is usually let on a tonnage basis, the price including putting in and taking out the falsework. If any special arrangement of falsework is necessary, such as the installation of a girder span on pile piers, the bidders are requested to name a price for making the special arrangement. Bidders are also requested to name a unit price for each time the bridge must be opened during erection to permit the passage of a boat. The specifications also provide that during erection the contractor's work must be carried on in such a manner as not to interfere with boats. Since the above method of handling has been adopted very little trouble has been experienced in taking care of navigation.

*The Arkansas River bridge near Pine Bluff, Ark., has two swing spans, providing four channels 222 ft. c. to c. of piers; these swing spans are separated by two fixed spans 253 ft. c. to c. of piers.

Providing for Navigation During the Erection of Drawbridges

In a paper on "Bridges Over Navigable Rivers,"* by C. E. Smith, Bridge Engineer of the Missouri Pacific Ry., attention is called to the necessity of providing a temporary opening during the construction of a drawbridge, even when the navigation is extremely limited. In describing the construction of a number of river bridges on the Missouri Pacific Ry., particulars are given of the means provided for taking care of occasional vessels and this information we have abstracted below.

Tensas River Bridge

The old bridge over the Tensas River, near Clayton, La., consisted of a 150-ft. Howe truss draw-span with pile trestle approaches. The new bridge consists of a 150-ft. deck plate-girder disk-bearing draw-span and four 75-ft. deck girder approach spans, on concrete piers and abutments.

The four approach spans were placed by gallows frames resting on the ends of the piers. The girders (on cars) were run out under the frames, raised off the cars and the cars pulled away. The rails, ties and trestle in the way of the girders were then removed, the girders lowered to place and track connected up.

The draw-span girders were each shipped in three pieces, to be spliced in the field. Each section was placed in a manner similar to that used for the approach spans, the old pivot pier being used for falsework under the north splice, and falsework being placed under the south splice. During the placing of the sections of the draw-span girders the floor system of the truss-span was cut away and the trusses left in place. After the girders were in place the trusses were thrown into the river, floated out to the bank and dismantled there. The arrangement is shown in Fig. 1.

For the greater part of the time during the erection of the new draw span the water in the river was so low that no large boats could navigate and such small boats as could navigate could pass under the bridge. For that reason no special effort was made to effect a quick change from the old to the new span. The first turning of the new span was accomplished in about two weeks after the last turning of the old span. Near the completion of the erection the water rose to a point that permitted a boat to reach the bridge before the new draw span was ready to turn. The slight delay to the boat resulted in a claim for damages of $75, which was easily settled.

*This is published in Bulletin No. 150 (October, 1912) of the American Railway Engineering Association (Chicago), and an abstract of it is given on pp. 151-2 of this issue.

Black River Bridge

The old bridge over the Black River, near Paroquet, Ala., consisted of a combination fixed span 103 ft. 6 in. long and a Phoenix draw-span 206 ft. 6 in. long, on pile piers with trestle approaches. This was replaced (on the same center line) by a 267-ft. draw-span with concrete piers, and a 60-ft. deck plate-girder span with trestle approaches. Fig. 2 shows the method of erection and the temporary lift span.

The specifications for erection provided that the expense of caring for navigation would be borne by the railway. It was calculated that the falsework could be placed, the old span taken down and the new span erected and adjusted ready for turning in about six weeks. A canvass among the owners of boats that passed through the bridge indicated that their claims for damages for that length of time would certainly amount to from $15,000 to $20,000, and would probably greatly exceed that sum, as other boats would be drawn by the opportunity.

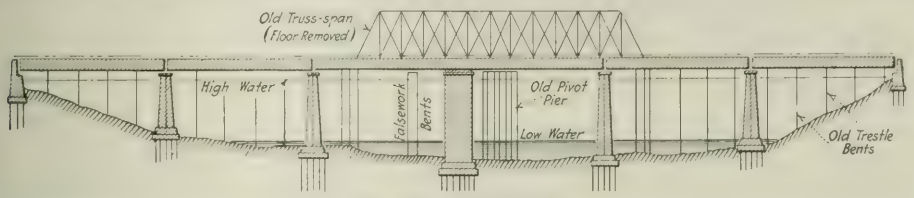


Fig. 1. Reconstruction of Drawbridge over the Tensas River (Louisiana): Missouri Pacific Ry.
(The new piers, girder fixed spans and girder draw-span are shown in hatched lines. The trusses of the old draw-span are in place, but with the floor removed to admit the new span.)

The large claims that could be foreseen caused the decision to install between the old and new east piers a second-hand deck plate-girder lift-span with timber towers and old rail counterweights. This was installed ready for operation before the old draw was placed out of service. The completion of the falsework, taking down the old span, and erecting the new draw span, including riveting and adjustment of machinery, out to the temporary lift bridge were carried out at leisure without any interference with boats.

At an opportune time, the lift-span was taken down and the new draw-span extended to the shore pier. During the latter operation the river was blocked a few days, which constituted the only time the river was blocked during the reconstruction of the bridge. In spite of all these precautions, however, claim for damage due to delay was filed by the owner of a boat which arrived at the bridge during the final extension of the draw-span.

White River Bridge

The old bridge over the White River, near Augusta, Ark., consisted of a 162-ft. pin-connected through-truss span, a 267-ft. rim-bearing draw-span of the same type, and two 65-ft. deck-girder approach spans. The new bridge has riveted truss spans of the same lengths as above, and two 60-ft. girder spans, the shortening of the girder spans being due to the enlargement of the piers. Fig. 3 shows the old draw-span with three panels removed to admit a temporary girder span, which could be removed when necessary by a derrick-car on the track laid on the new fixed span.

The experience in attempting to adjust claims from

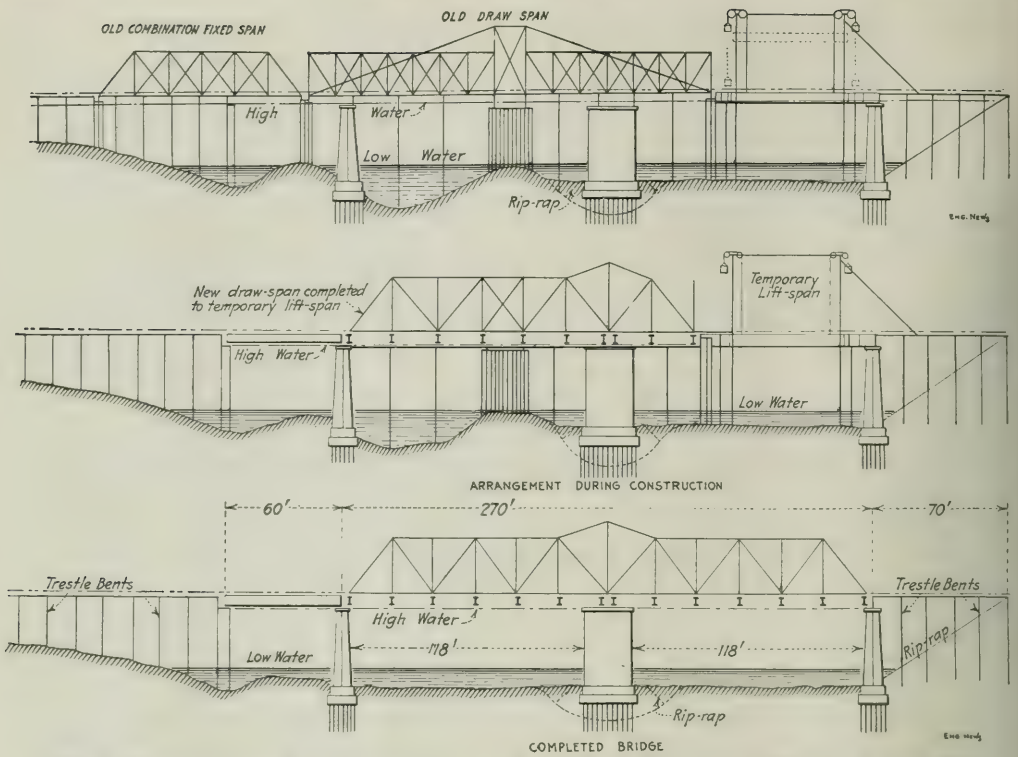


FIG. 2. RECONSTRUCTION OF DRAWBRIDGE OVER THE BLACK RIVER (ARKANSAS): MISSOURI PACIFIC RY.
(The old draw-span was shortened at one end to admit a vertical-lift girder span for a temporary opening.)

boat owners for the closing of the Black River (as described above) indicated that it would be best to make provision for navigation continuously during erection. The contractor was awarded a unit price per ton for the erection of the steel, a lump sum for installing a temporary deck-girder lift-span, and a fixed price for each time he had to open the bridge.

Towers and counterweights were not installed, but arrangements were made to lift the entire span out by the erector's derrick-car, which would move back with the span. Although no trouble had been experienced at Black River, it was seen that on account of the limited amount of lift that could practically be provided at reasonable expense on temporary supports, the arrival of a large boat at extreme high-water might find the lift span in its highest position too low, and it was to avoid such a contingency that the span was handled with a derrick-car at White River.

An opening 50 ft. wide was left in the east draw channel, just west of the rest pier, and a heavy pile bent was driven for the support of the temporary girders to be used for spanning that opening. Heavy pile bents were also constructed on each side of the pivot pier for the support of a deck-girder span over that pier to facilitate the reconstruction of the coping course.

When everything was in readiness, a quick change was made by removing two panels of the old draw span at the east end, and installing the temporary girder span over the channel. This change consumed about two days and no boats were delayed. The dismantling of the old span, reconstruction of the pivot pier and erection of the new span out to the temporary channel was carried out carefully with the realization that unusual speed was not necessary.

The draw was erected and riveted with the exception of the two east panels, after which another quick move

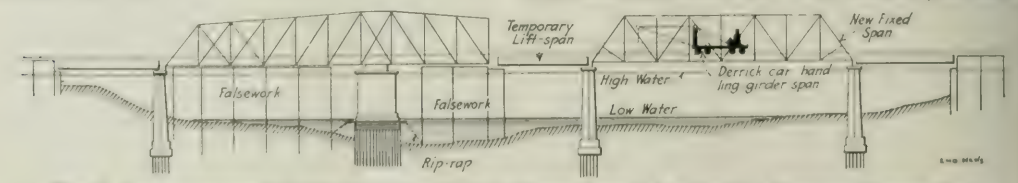


FIG. 3. RECONSTRUCTION OF DRAWBRIDGE OVER THE WHITE RIVER (ARKANSAS): MISSOURI PACIFIC RY.
(The old draw-span was shortened at one end for a temporary opening with a girder span, which could be lifted out by a derrick car and run back into the adjacent fixed truss span.)

was made in the removal of the temporary plate-girder span and completion of the erection of the draw span, which was ready for turning a few days after the deck-girder span was removed.

The installation of the temporary deck plate-girder span cost about $400. Each opening of this span during erection cost the railway company $10. For a period of about five years this bridge had been opened from five to ten times per month. During the erection of the new draw it was necessary to open the bridge nearly every day, a remarkable, but easily explained, increase in traffic.

The Status of the Engineering Profession

SYNOPSIS—The following papers were read at the meeting of the American Institute of Consulting Engineers, New York City, Dec. 18, 1912.

By L. B. Stillwell*

The history of those practical arts with which the engineer is concerned generally embraces, first, discovery, then invention, then commercial application. As an engineering art grows older, three tendencies which affect the work and relations of the engineer become manifest:

First—In certain large undertakings, such, for example, as railroad building and operation, great corporations are formed, and these soon employ engineering staffs.

Second—The art tends toward standardization. What at first was known only to a few becomes more or less common knowledge, and the need of specialists of the highest class is less obvious and less acutely felt, although perhaps not less real.

Third—The variety of engineering specialities associated in the construction problems presented by large and complex undertakings compels the coöperation of groups of specialists, and this situation leads to the formation of engineering corporations and partnerships, which, in turn, is frequently the first step toward a combination of the functions of the engineer, the contractor and the financier.

Obviously each of these three tendencies operates to limit the activities of the consulting engineer and to diminish his numbers, by substituting, as in railroad work, permanently retained engineering staffs; by diminishing his apparent usefulness because of the standardization of engineering practice, and by tempting him, first, to association in order to deal most effectively with complex problems, and then into the fields of contracting and financing in order to insure continuous occupation and increased remuneration for himself and his associates.

The characteristic American disregard for precedent; the equally characteristic American lack of respect for authority and special knowledge, and, I think it would not be unjust to say, the narrow and short-sighted view of directors and executive officers of some of our great corporations, have largely prevented the general adoption in this country of the practice of retaining consulting engineers after the period of active construction has passed. Time does not permit me to discuss the question whether the British practice of retaining consulting engineers to advise the management of a going concern, such as a railroad in full operation, is or is not, on the whole, wiser than the general practice in this country of getting rid of consulting advisers at the earliest possible date as construction approaches completion and thereafter placing full and undivided responsibility upon the operating staff. In this connection I may point out that, while the standardization of an art tends to make less obvious the value of the advisory service of the specialist, the increasing difficulty of effecting further improvement and economy as perfection is approached, argues on the other hand with increasing weight in favor of supplementing the efforts of the operating staff by the frequent criticism and suggestion of the most competent specialists.

To the three tendencies affecting the work and relations of the consulting engineer as a given art develops through discovery and invention to the stage of commercial application, frankness demands that we add a fourth, namely, the cumulative effect upon the opinions and the practice of executive officers and directors of those mistakes and misunderstandings which are practically inevitable in the progress of complex constructive undertakings carried through to completion, in many cases, by groups of men who perhaps are brought together in close working relations for the first time.

Too many real and serious mistakes are made by the incompetent or reckless engineer. In a much greater number of instances, mistakes between the banker, the executive and the engineer are responsible for disappointment and sometimes failure. In my opinion, there are perhaps no more important objects to be sought by this Institute than the elimination of the incompetent or reckless engineer and the prevention of those misunderstandings for which the engineer is sometimes in whole or in part responsible, but which more frequently is due to a lack of coördination of the activities of the banker, promoter and engineer, for which the engineer is not primarily responsible.

There are two specific phases of this very important subject, which I especially hope to hear discussed:

(1) What should be the attitude of this Institute as regards the competition from manufacturers and contractors which the consulting engineer encounters in the practice of his profession? Is the consulting engineer in what I may call an adult art a middleman who should be eliminated?

I ask this question in all seriousness. I have given the matter much thought and study and am not so sure but that, as in many cases of important projects in the past and today, the answer should be in the affirmative.

(2) The problem of eliminating, or at least restricting, the incompetent or careless engineer who brings discredit upon the profession. In this connection I think we should consider the question whether any practicable plan can be devised which, in apparently flagrant cases, would enable the Institute to protect the profession by

*Consulting Electrical Engineer, 1 Broadway, New York City.

disinterested and authoritive investigation, which should result either in placing responsibility for a financial wreck, in the case of a great engineering undertaking, directly upon the engineer, or absolving him from such apparent responsibility and placing it where it belongs.

In my own line of work, and more particularly in power transmision, it is a fact that the very best of projects must sometimes go begging because the bankers in this community and those in Boston and elsewhere have been deeply impressed by a number of bad failures. Someone is to blame for this condition.

Some of the engineers connected with these cases have said to me that they wish the facts could be known, as they were being blamed for something for which they were not responsible. I wish that a court might be brought about by this Institute with adequate powers and resources. Suppose an engineer has been connected with a large enterprise which has proved a financial failure. Suppose he is not to blame and could establish that fact. Might it not be possible that we could afford him or his client an opportunity to have this question investigated and the responsibility determined?

On the other hand, I believe that some engineers have been inexcusably careless in their estimates. There are some men relatively prominent in this field, who, I think, have been directly responsible for failures due to hasty and inaccurate estimates, and I feel that they should feel the responsibility and suffer the punishment which follows it. I do not know how this can be worked out; I have jotted it down without much thought, but I feel that there should be some way of fixing responsibility in these cases. We are all more or less blamed for some of these failures, for which somebody else may be solely responsible, and I think this responsibility should be definitely fixed in every case of failure.

In this connection another thought: I think in enlarging its membership, this Institute would do well to go farther than most societies in investigating the standing of applicants for membership. For instance, the applicant for the grade of Fellow in the American Institute of Electrical Engineers must have been in the active practice of his profession for at least ten years, but it is not taken into consideration whether, during that time, his record shows that he has acted wisely or not. In our Society a man should be obliged to produce evidence in the form of letters from his clients, or otherwise, not only to show that he has practiced his profession for a specified number of years, but to show that his work has been well done.

As regards competition from manufacturers, the consulting engineer whose work lies in the electrical field has encountered, in recent years, increasing and very serious competition from manufacturers of mechanical and electrical equipment, who undertake frequently to perform for prospective purchasers of their apparatus, important engineering service, for which no charge whatever is made.

At the meeting of this Society on Jan. 16, 1912, C. C. Schneider gave us a most interesting account of a somewhat similar situation which some years ago confronted the consulting engineer whose specialty is the design of bridges, and he told us how practice in this department of engineering effort had been improved. Upon the same occasion I called attention to the competition to which the electrical and mechanical engineers are subjected by the existing unfair and, I think, improper practice of companies manufacturing electrical and mechanical equipment, and that statement I shall not repeat this evening, except to repeat the suggestion which I then made regarding the possible remedy, namely:

(1) The American Institute of Consulting Engineers, the American Institute of Electrical Engineers, and our other national engineering societies whose members undertake work of this character, should adopt a schedule of minimum charges so far as the service rendered can be classified.

(3) The companies manufacturing electrical apparatus, in furnishing estimates, plans and specifications relating to aggregations of apparatus constituting plant or equipment, should regard themselves as consulting engineers, and invariably should exact for the service rendered at least the minimum charge recommended for its membership by the engineering societies.

(3) Consulting engineers who secure from manufacturing companies such estimates, plans and specifications as I have referred to, should pay the manufacturing companies for them just as any unprofessional inquirer would pay under the plan suggested.

By Samuel Whinery*

The practical questions we are considering tonight have a deeper significance, and a more important bearing upon engineering than might at first appear. When I speak of engineering, I refer to the broader definition of the word, which includes civil, mechanical, mining and electrical engineering and architecture.

Engineering is commonly spoken of as a profession. Possibly the strongest claim that can be truthfully made is that it is a quasi-profession, since it has no legal existence. But we like to speak of it as a profession and to believe that it is so, and we assume, for present purposes, that it is entitled by sufferance to be so called.

But whatever opinion we may hold on this point, the careful observer of present tendencies in engineering, industrial and commercial matters cannot fail to be impressed with the feeling that engineering, as a profession, is passing through a critical and dangerous period.

I speak now of *engineering as a profession.* The principles and practice of engineering will, of course, continue to grow in power and influence in the world. They must, necesarily, be always in the van of material human progress. The engineer, whatever may be his status before the public, or whatever may be his relations to his fellow engineers, and to other potent human agencies, will continue to exert a controlling influence in the material world. But the status of the engineer in the future will depend largely upon whether engineering shall develop into a well-defined profession or into a mere trade or vocation.

This question of the future status of the engineer is a fundamental one that must be answered before we can intelligently discuss such secondary topics as our relations to one another and to the public. If engineering is merely a trade or craft, it must take its chances in the hustle and competition of business like other crafts or trades.

The meaning of the phrase "a profession" is not as clearly and sharply defined as we could wish. The world

*Consulting Engineer, 95 Liberty St., New York City.

has, in a measure, outgrown its original signification. Nor is it easy to frame a definition that satisfactorily fits the modern idea of a profession. Some of its characteristics are, however, well understood. One of these is that a profession is a vocation founded upon specialized educational training, the purpose of which is to supply disinterested counsel and service to others for a direct and definite compensation, wholly apart from expectation of other business gains.

Thus, the engineer who acts in a strictly professional capacity is bound to give his best service to his client, influenced by disinterested motives only, for a stated compensation, and wholly free from any expectation of ulterior or incidental gain that may result through the adoption of his advice or plans. To put it more briefly still, the professional function necessarily assumes the absolute divorcement of engineering from commercialism in all matters involving the engineer's relation to his clients and to the public.

This principle is recognized in other professions. The doctor may not engage in the manufacture and commercial sale of pills and at the same time practice medicine and prescribe his product for his patients. The lawyer may not, theoretically at least, accept a case on a contingent fee. In like manner the professional engineer may not prescribe or recommend devices, construction or enterprise in the commercial success of which he has a personal interest.

It is the violation of this principle which now threatens the destruction of the profession. There is today a strong tendency to combine the professional and the commercial aspects of engineering. So combined, they become simply a learned trade, having no more claim to professional standing than the business of the skillful and scientific plumber, who commonly designs as well as sells his product.

The large number and the notable successes of so called "engineering firms" and "corporations" that undertake important public enterprises from their inception to their operation, through all the stages of exploitation, design, financing, construction and operation, offer the most convincing evidence of the drift of the times toward the commercialism of engineering. The large number of able engineers whose main vocation is contracting, but who, at the same time, assume to maintain a professional practice and standing, is another very significant sign of the times.

We need not here discuss the intrinsic merits or demerits of these combinations, and we certainly have no desire or disposition to criticize those engaged in them. We need not even express an opinion as to whether these developments are or are not in the interests of the public or make for true progress in the world's development. We are simply considering their relation to engineering as a profession.

If, upon the whole, it shall develop that by such a combination of engineering and commercialism, public or private projects can be carried through more cheaply, conveniently and satisfactorily, and with equally good ultimate results, than by the separate employment of independent engineers, there can be no doubt of the final outcome. *Engineering as a profession* will cease to exist, and engineering knowledge, skill and ability will become simply one of the valuable commercial assets of business organizations.

If, on the other hand, it shall be developed, and the fact becomes appreciated by the public, that to secure the best results in public or industrial enterprises, the services of the independent, disinterested, professional engineer are essential, there is a possibility that engineering as a profession may not only be maintained, but, in time, placed upon a clearly defined and permanent basis. But such a professional status can never be attained unless engineers themselves desire it, and make a united effort to bring it about.

Among those here tonight, it is safe to assume that all believe in the possibility, as well as the necessity, of a profession of engineering, though we may differ as to its present status and the measures that are necessary to insure its permanence and usefulness.

While it is useful to discuss special incidents or phases of the present situation, the writer is impressed with the belief that something more elemental and radical is essential. In the first place, it is necessary that the boundaries and limits of the profession shall be distinctly marked out. There must be some way of distinguishing between those who belong to it and those who do not.

In this respect the profession of engineering is now anomalous. In naw, medicine and the ministry it is required that there shall be some public, formal recognition and record of a man's right to admission as a member of the profession, involving also the power to terminate that right. This is wholly absent in the engineering profession. Any man, regardless of his competence or incompetence, or of his moral character, may hang out his sign as an engineer, put a profesional card in the engineering papers and pose before the public as a member in good standing. So long as he does not violate the civil or criminal laws or trespass upon the accepted rules of morality that apply to all men in common, neither the state nor the profession can exercise any control over him. The public can only judge of his character and professional ability by his general reputation, just as it would in the case of an ordinary mechanic. There exists at present no power or authority, either in the state or the profession, to dispute his pretension or to publicly brand him as an imposter, and anyone bold or rash enough to properly characterize him may be prosecuted for slander. There is, in short, no such legal offence as engineering malpractice.

It may be said that membership in reputable engineering societies is a sufficient passport to good standing in the profession, and the reserved right to expel an unworthy member is a sufficient safeguard for the protection of the public. But admission to such a society is not a public notice in the official sense; and it is a rather singular and impressive fact that no man has ever, so far as I am aware, been expelled from any one of the leading engineering societies for incompetence or unprofessional conduct. Among so large a membership as these societies possess, it would be surprising if no one had ever merited such expulsion. The absence of such cases is doubtless due, not to any lack of a disposition to act, but to the fact that no positive, authoritative and comprehensive code of practice and ethics has been formulated upon which a conviction could be based.

The simple, cold fact is that, beyond vague impressions in the mind of the public and a fond fiction in our own minds, there is no adequate public or legal recognition of the *profession* of engineering. It is true that

our engineering schools confer various engineering titles upon their graduates, which certify to their scholastic attainments, but can do nothing more, particularly since a degree in a profession that has no legal standing cannot be regarded as carrying much weight.

If the situation here outlined be even measurably correct, the conclusion seems inevitable that the first and most important thing necessary to establish and maintain a profession of engineering is the public, legal recognition of the existence of such a profession and some measure of official control of its membership by the state.

Following or in connection with this, there must be a sufficient degree of organization or solidarity within the profession itself to secure coherence and general unity of action. In other words, there must be adequate internal control of the profession. One of the most important functions of this internal control will be to establish comprehensive standards of professional conduct, including the relation of its members to each other, to clients and to the public. Such a "Code of Ethics" may almost be said to be absolutely essential to the successful existence and usefulness of any profession. Whether formally reduced to writing, or existing by common consent, or the outgrowth of traditional accretion, every one of the professions has its code of ethics developed to a greater or less extent. It will, I think, be conceded, however, that among engineers such ethical rules of conduct are more unformulated, less clearly defined and more loosely applied in any other profession.

It is largely because of this condition that we are now discussing questions of detail, the answers to which should proceed, as a matter of course, from fundamental "Thou shalts" and "Thou shall nots" having the force and authority of a professional Decalogue.

If, for instance, it were accepted as a fundamental dictum that the engineer cannot both design a structure and become the contractor for its construction, nor have any indirect or contingent material interest in the enterprise beyond the performance of his professional duty and the collection of his professional compensation, a whole brood of troublesome questions of detail would almost settle themselves. Among other cases, engineers who undertake to carry out public works from their A to their Z, would be promptly disqualified as members of the profession, and their employees, in whatever capacity, would necessarily share their fate.

If it were definitely accepted and ordained that a man cannot pursue the business of contracting and, at the same time, practice as a professional engineer, another class of troublesome questions would be easily and definitely disposed of.

These illustrations are used without expressing any opinion as to the wisdom of adopting such edicts, and with no intention of casting disrespect upon those who would be affected by their adoption. We are not now discussing the wisdom, equity or propriety of these or other possible provisions of a proper code of ethics for engineers. These are matters for the profession at large to carefully consider and determine. I am here arguing only the proposition that *a* code of ethics is necessary to establish certain standards for professional conduct. It must be obvious, however, that, if engineering is to be established and maintained on a professional basis, there must be a well-defined demarcation between professional duty and incidental or contingent business interest.

It must also be obvious that whatever rules of conduct and practice a profession may consider necessary for the benefit and protection of the public, and for its own control and preservation, they must be adopted, promulgated and enforced in such a manner as to attract the attention and command the respect and obedience of its members.

It may doubtless be truly said that engineers, as a rule, do not wilfully violate well established rules of professional conduct. But how few such rules are well established and known to all? How few of them have been formulated at all? It is trite to say that, where there is no law, there can be no violation of law, and a law not backed up by enforcible penalties is a dead letter. Until engineers shall have enacted positive and clearly defined rules and standards of conduct, the present state of uncertainty, confusion and unsatisfactory conditions will continue.

In line with those thoughts, it is the writer's feeling that the only way to deal satisfactorily with these individual questions that come up under the head of Professional Relations, is to begin at the foundation and build up systematically a real profession of engineering. He conceives that the two most important steps to be taken would be:

First: To secure the legal recognition of engineering as a profession and the enactment of such statutory provisions as may be necessary for its maintenance.

Second: The authoritative adoption and enforcement, within the profession, of a comprehensive code of ethical rules and standards of professional conduct.

Until something like this is done, our discussion of professional relations may be able and interesting, and our conclusions wise and just, but, in the absence of any adequate authority and power, within or without the profession, to enforce these conclusions, they are likely to be futile.

I do not desire to appear in the role of a pessimist or alarmist in this matter. I am aware that many of my fellow engineers will consider the views here expressed as radical and unwarranted by the present situation. I may even be wrong in assuming that the great body of American engineers desire or think necessary any radical change in the present and prospective conditions of engineering. I know that there are not a few who believe that whatever changes are essential or good for the profession will come about through some process of crystallization or natural evolution. I do not find anything in the past history of the profession, in this country, at least, to warrant such a belief or to encourage such a hope. History and experience teaches us that real advancement in ethics, sociology or civil government can only be achieved by united and determined effort.

In view of all this, it seems to me that the time has come when engineers must give these matters careful and weighty thought, decide what it is desirable and proper to do, and take whatever action is called for without delay.

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Electrical-engineering Students in the technical schools of this country in 1912 numbered 8921, according to a compilation of statistics in the "Electrical World," Nov. 23, 1912. In that year 1496 graduated, bringing the total number of graduates during the past six years up to 18,318. The statistics for the six years past are shown below.

	1907	1908	1909	1910	1911	1912
Number of students	8929	9651	8670	9041	9515	8921
Number of graduates	1358	1501	1473	1545	1614	1496

Codes of Ethics for Engineers

Apropos of the proposed code of ethics recommended for adoption by the American Society of Mechanical Engineers and printed in our issue of Jan. 2, a correspondent calls our attention to the fact that codes of ethics have previously been adopted by the American Institute of Consulting Engineers and by the Pacific Association of Consulting Engineers. The former was printed in full in ENGINEERING NEWS of June 29, 1911, p. 795, and the latter in ENGINEERING NEWS of Mar. 14, 1912, p. 489.

The American Institute of Chemical Engineers has now before it for consideration a code of ethics drafted by a committee of the Institute. We reprint this code as follows:

Purpose of the Code:

To define the rules of professional conduct and ethics for the members of the Institute.

The Institute expects of its members:

1. That in all their relations, they shall be guided by the highest principles of honor.

2. The upholding before the public at all times of the dignity of the chemical profession generally and the reputation of the Institute, protecting its members from misrepresentation.

3. Personal helpfulness and fraternity between its members and toward the profession generally.

4. The avoidance and discouragement of sensationalism, exaggeration and unwarranted statements. In making the first publication concerning inventions or other chemical advances, they should not be made through the public press, but through chemical societies and technical publications.

5. The refusal to undertake for compensation, work which he believes will be unprofitable to a client without first advising said client as to the improbability of successful results.

6. The upholding of the principle that unreasonably low charges for professional work tends toward inferior and unreliable work, especially if such charges are set at a low figure for advertising purposes.

7. The refusal to lend their names to any questionable enterprise.

8. Conservatism in all estimates, reports, testimony, etc., especially in connection with the promotion of business enterprises.

9. That they shall not engage in any occupation which is obviously contrary to law or public welfare.

10. When a chemical engineer undertakes for others work in connection with which he may make improvements, inventions, plans, designs or other records, he should enter into a written agreement with regard to their ownership; and when it is subsequently found that such an agreement does not cover a point at issue, the following rules shall apply:

a. If a chemical engineer uses information which is not common knowledge or public property, but which he obtains from a client or employer, the results in the form of plans, designs or other records shall not be regarded as his property, but the property of his client or employer.

b. If a chemical engineer uses only his own knowledge or information or data, which by prior publication or otherwise are public property, and obtains no chemical engineering data from a client or employer except performance specifications or routine information, then the results in the form in inventions, plans, designs or other records should be regarded as the property of the engineer and the client or employer should be entitled to their use only in the case for which the engineer was retained.

c. All work and results accomplished by the chemical engineer in the form of inventions, plans, designs or other records, or outside of the field for which a client or employer has retained him, should be regarded as the chemical engineer's property.

d. When a chemical engineer participates in the building of apparatus from designs supplied him by a client, the designs remain the property of the client and should not be duplicated by the engineer or anyone representing him for others without express permission.

e. Chemical engineering data or information which a chemical engineer obtains from his client or employer or which he creates as a result of such information must be considered confidential by the engineer; and while he is justified in using such data or information in his own practice as forming part of his professional experience, its publication without express permission is improper.

f. Designs, data, records and notes made by an employee and referring to his employer's work, should be regarded as his employer's property.

g. A client does not acquire any exclusive right to plans or apparatus made or constructed by a consulting chemical engineer except for the specific case for which they were made.

11. A chemical engineer cannot honorably accept compensation, financial or otherwise, from more than one interested party, without the consent of all parties; and whether consulting, designing, installing or operating, must not accept compensation directly or indirectly from parties dealing with his client or employer.

When called upon to decide on the use of inventions, apparatus, processes, etc., in which he has a financial interest, he should make his status in the matter clearly understood before engagement.

12. The chemical engineer should endeavor at all times to give credit for work to those who, so far as his knowledge goes, are the real authors of such work.

13. Undignified, sensational or misleading advertising should be discouraged.

14. Contracts made by chemical engineers should be subject to the Code of Ethics.

For the administration of this Code of Ethics, a Committee on Ethics shall be appointed by the president holding office at the time of the adoption of this Code, to consist of five members; one appointed for five years, another for four years, another for three years, another for two years, another for one year, and thereafter, the president then holding office shall appoint one member annually to serve for five years and also fill such vacancies as may occur for the unexpired term. Three of these members shall be over forty-five years of age. The Committee shall elect its own chairman. The Committee on Ethics shall investigate all complaints submitted to them bearing upon the professional conduct of any member, and after a fair opportunity to be heard has been given to the member involved, shall report its findings to the Council, whose action shall be final.

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Vaccine for Immunization Against Typhoid Fever is to be supplied free of charge to local health officials throughout Ohio, by the Hygienic Laboratories of the State Department of Health, on application to Dr. T. R. Brown, bacteriologist in charge of the laboratory. Further information on the subject is quoted from a recent bulletin of the Ohio State Board of Health as follows:

It must be definitely understood that the vaccine is not to be used as a therapeutic or curative agent, but solely as a preventive measure. The treatment consists of three injections 10 days apart given subcutaneously with a sterile hypodermic syringe. The first two injections consist of 0.5 cc. each containing approximately 500,000,000 dead microorganisms. The last injection of 1 cc. of approximately 1,000,000,000 micro-organisms. Subsequent to the first injection quite frequently a little discomfort such as headache, loss of appetite, etc., is felt for a short period of time. The subsequent injections usually produce little effect. If the injection is given properly there should be very little local reaction around the point where the needle is introduced.

The vaccine has been used in certain sections of the state rather extensively during the last few months, but its cost has in a measure prohibited it being used in large numbers of indigent cases, and it is particularly for the purpose of supplying this class of people that the State Board of Health has undertaken this very important work.

Track Elevation at Cincinnati, Ohio, is expected to make considerable progress during 1913. In November, 1910, a bond issue of $800,000 was approved by popular vote to pay the city's proportion of cost for the elimination of grade crossings. It is proposed to eliminate four crossings with these funds: Ludlow Ave. and the B. & O. R.R.; Hopple St. and the B. & O. R.R.; Rockwood and Delta crossings both of Eastern Ave. and the P., C., C. & St. L. R.R. Of these, Ludlow Ave. and Hopple St. are to have reinforced-concrete viaducts; the two crossings of Eastern Ave. and the P., C., C. & St. L. R.R. are subways, the railway being elevated. The Ludlow Ave. viaduct is now under construction and is about 40% completed. Plans have been made for the Hopple St. viaduct, but are being revised and work will probably commence on the structure early next summer. Work on the Rockwood crossing wil commence in the spring, and it is hoped to commence work on the Delta crossing also some time this year. Plans are also being made for the elimination of the crossing of Erie Ave. and the Indiana Division of the P., C., C. & St. L. R.R. in Madisonville. In this case the street will be carried over the railway tracks.

Operation of an English Producer Gas Supply Works

A paper entitled "The Generation and Distribution of Producer Gas in South Staffordshire" was presented before the British Institution of Civil Engineers, Dec. 10, 1912, by H. A. Humphrey. The following extracts have been taken from abstracts of the paper in the London *Times'* Engineering Supplement, Dec. 11, and *Engineering*, Dec. 13, 1912:

The South Staffordshire Mond Gas (Power and Heating) Co. was the first example of a company which gave, under Parliamentary powers, a supply of producer gas for public purposes. As finally passed by Parliament the Mond Gas Bill contained clauses prohibiting the sale of gas for domestic purposes or for illumination.

Area—The area covered was 123 sq.mi. in extent, and it included six corporations, 16 urban district councils, and three rural district councils, while there were 100 miles of railway, 106 miles of canals, and more than 2000 works which used heat or power.

In some respects the area of supply was not an ideal one. The works which required a supply of gas were sometimes clustered together, but there were barren spaces intervening, and frequently considerable lengths of main had to be laid in order to serve individual consumers. Competition from more favorably situated districts had considerably diminished what were once the principal trades, and the district was less a coal and iron producing center than formerly, although about three million tons of coal were still raised yearly, and some first-class steel and iron works had an important output.

Generating Station—It was decided ultimately that one centrally situated generating station would be best, and that the supply should be carried first to the northern portion of the area. Accordingly, a suitable site of about 40 acres, adjacent to railway and canal, was secured at Dudley Port, Tipton.

The unit of plant adopted was based on a capacity for gasifying 140 tons of coal daily, and consisted of eight Mond producers (one being a spare), together with the necessary plant for cooling, cleaning and compressing the gas; plant for the recovery of sulphate of ammonia and tar; and the machinery, comprising steam boilers, circulating pumps, electric-generating plant, motors and fans. The first unit of plant was started in February, 1905, and additions to the plant, now being made, would increase the present output by about 80%.

From the time that the public supply was first begun, in May, 1905, until the present date, there had not been a single stoppage of the gas supply from the station, and pressure had been maintained in the trunk mains throughout the whole period. Only twice had the gas supply been cut off from individual districts; the first occasion was to put in an enlarged main, and the second to couple up to another trunk main. In each case the stoppage was only for two hours.

Boilers and Producers—For each ton of coal gasified more than two tons of steam had to be supplied with the blast entering the fire-grate of the producer, and, although more than half the steam required was obtained from the system of recuperation by circulating water which was employed in the Mond producer plant, yet a considerable balance of steam had to be made up. It was usual, therefore, to drive the greater part of the machinery by steam, and in the present instance steam was raised for this purpose at 120 lb. pressure, and after passing through the various engines and pumps, where it did work, the exhaust steam was collected and mixed with the air supply to the producers. It was desirable that the boilers used should be capable of burning fine dust and small coal, which it was proposed to screen from the bulk supplied to the producers, and for this purpose the boilers had to be capable of working with forced draft. In order to equalize the station load as much as possible, the boilers were to be pushed during those portions of each 24 hours when the gas supplied to customers was comparatively small in quantity; and for part of each day coal firing and gas firing were to be carried on simultaneously.

A test lasting 10 hours with gas firing alone had shown a heat efficiency, as between calorific value of gas and heat in steam generated, of 79.1%.

The steam from the boilers was led to the various parts of the plant by ring mains so that each steam-driven machine could be supplied through at least two separate lines of mains.

Since there is no gas storage as in ordinary illuminating works, the output of gas depends at all times upon the quantity of air forced through the producers. There are three blowers of the Roots type (two working and one spare), each being capable of delivering 6000 cu.ft. of free air per minute at a pressure of 28 in. of water gage when running at a speed of 100 r.p.m. These positive-pressure blowers can run under a wide variation of speed, but there is a limit below which it is not safe to attempt to run, for fear of stopping. If, therefore, the demand for air is reduced below a certain quantity, further regulation is obtained by allowing some of the air to escape into the atmosphere.

The eight Mond producers installed at Dudley Port had a diameter of 10 ft. measured inside the brick lining. Each producer was rated at 20 tons of coal per 24 hours, but the actual capacity depended partly on the quality of the fuel. With the slack used at present a producer could readily be worked at 50% above the rated output, and for considerable periods.

Recovery Works—The gas on leaving the producer passes through the superheaters, which are used as heat interchangers to raise the temperature of the incoming blast, and then enters the gas-collecting mains, each of which receives a supply from four producers. Each of the two mechanical washers is fitted with three electrically driven dashers for throwing up large quantities of spray, with the double object of cooling the gas by evaporating some of the water for raising steam and washing out the solid particles of dust carried over from the producers.

After the first cleaning and cooling the gas passes upward through one of the lead acid-towers where it meets the downcoming current of acid liquors. The ammonia in the gas is combined with the free sulphuric acid, forming soluble sulphate of ammonia. From the acid tower the gas passes through two, and sometimes three, gas-cooling towers in series to reduce the water vapor to a minimum. There are three steam-driven gas compressors, two being normally in operation. Each has a capacity of 9400 cu.ft. of free gas per minute, and, when supplied with steam at 120 lb. and running at 80 r.p.m., will compress this amount to a gage pressure of 10 lb.

No water escapes from any part of the plant until it has passed through a settling tank, 70x50 ft., in area, so that the flow is slow enough to enable all sediment to be deposited, while surface tar is prevented from leaving by partitions. The tar, collected from various parts of the plant and especially from the settling tanks, is run into tar eggs, from which it is blown to a tar-collecting plant. It contains 30% to 40% of water, to get rid of which it is run into large vertical vessels with steam coils and raised to a temperature of 80° C. while stirred.

Plant Pipes and Valves—A number of cross-connecting pipes and valves are required for the plant. Some of these valves are fitted in mains 5 ft. 6 in. in diameter, and it is a matter of great importance that the design of these valves should be such that they can be readily operated, in spite of deposits of tar and hard carbon, which may have formed during a long period of idleness. A hinged quadrant plate, carrying a toothed rack, can be operated by a chain and wheel, which rotates a pinion geared to the rack. This plate is pierced by a hole of the required diameter, which can be brought to coincide with the bore of the pipe, while, by rotating the quadrant plate, the solid portion can be used to blank off the pipe. The flanges between which the quadrant plate is movable can be forced apart by strong setscrews, and poke holes are provided so that carbon deposits may be cleared off the quadrant plate. By this means the plate can be freed so that it is moved easily from one position to another, and can then be gripped again in its new position.

Mains—For safety against subsidence, and in order to reduce to the minimum the number of joints at which leakage might occur, steel pipes appeared desirable for the distributing mains, but their probable life required consideration. Stated briefly, the conclusion arrived at was that in all cases where steel pipes had had a comparatively short life there had been some special and preventable cause. The mere coating of pipes with such material as Dr. Angus Smith's solution is quite insufficient to protect them, and a thick coating of bituminous material, strengthened by layers of Hessian cloth, was recommended and adopted. Eight years is perhaps not a very long term of experience, but as steel pipes which have been laid for this period have been examined and show absolutely no signs of any attack, there is every reason to believe that the system adopted will prove entirely satisfactory.

For the larger trunk mains the cheapest pipes obtainable were the Mephan-Ferguson locking-bar pipes. One of these pipes, 28 ft. long, can be made in about 20 minutes. The

thickness of locking-bar pipes is ⅜ in. for 36-in mains, ⅝ in. for 3-in. mains, and ¼ in. for mains of 30 in. to 18 in. in diameter. All pipes supplied to the company were tested hydraulically to 300 lb. per sq.in., and only a very small percentage of pipes showed any leakage. About 13 miles of locking-bar pipes have been laid in South Staffordshire and have given satisfaction. For mains having diameters between 15 in. and 4 in., inclusive, lap-welded steel pipes, having their ends screwed with a vanishing thread and joined by a collar with a similar screw thread, have been used with success. When the joints are screwed up with a graphite compound they become absolutely tight. Up to the middle of September, 1912, the length of mains laid was 29.45 miles.

Originally the steel mains were coated once with asphalt, then wrapped round with Hessian cloth, and afterward again coated with asphalt, the result being to produce a coating ¼ in. thick. Pure Trinidad asphalt was first used, but owing to its expense a cheaper substitute was subsequently employed, made of pitch, bitumen, sand, and creosote oil, these constituents being mixed in the proportions necessary to give the necessary elasticity and freedom from brittleness. The mixture is applied hot, first over the pipe, and then over the Hessian wrapping.

The provision for draining the mains has to be more extensive than in the case of an illuminating-gas supply, and cast-iron drainage boxes are inserted at numerous points, determined by the lowest levels and inclines. The tarry water which collects in these boxes is emptied periodically, either by the pressure of the gas or by pumping. This work entails the use of a horse-drawn cart fitted with a pump.

The pressure chosen for the South Staffordshire mains was 7 lb. per sq.in. at the compressors, and this was fixed partly because all the steam used to drive the compressors could be utilized, along with the exhaust steam from the pumps, etc., for heating the blast for the producers; but the author is convinced that in the future higher pressures, up to 60 lb. per sq.in., will be used.

For most purposes it is necessary to reduce the pressure of the gas used in a consumer's works to a few inches of water gage, and for this purpose a pressure reducer and regulator is fitted at the entry to each consumer's premises, so as to insure a supply at a lower and constant pressure. Wherever the quantity of gas supplied is sufficient to warrant the expense a small gas holder is provided, the rise and fall of which is operated by the high-pressure supply, so as to maintain the gas in the holder at a constant pressure.

Operation—A large number of fuels have been used successfully in the producers in the course of seven years, but the fuel which is employed almost exclusively at the present time has an average calorific value of 11,600 B.t.u. per pound of coal. About 3300 tons of coal were being gasified per month in the first half of 1912, and the monthly outut of byproducts was approximately 120 tons of sulphate and 280 tons of tar. These figures have since increased.

The maximum output of gas in a typical week reached 368,700 cu.ft. per hr., all this being supplied to outside consumers, while the minimum taken by consumers was 195,000 cu.ft. per hr. The peak of the load has since reached 1,000,000 cu.ft. per hr.; in fact, the plant has gasified at the rate of 200 tons per day, although only designed for 140.

A very constant calorific value is maintained, due to the large size of the producers, with their big store of internal heat, and to the fact that the producer blast is always maintained saturated to the same degree.

The commencement of the gas supply occurred about the time when suction producer plants were beginning to be employed largely. It is, however, a fact worthy of record that practically every gas producer situated near the company's mains has been shut down, the owners finding it more advantageous to take supplies from the gas mains. From this cause 45 producer-gas plants have been thrown idle, 20 of these being suction plants and 25 pressure plants.

The blowers, cleaning fans and gas compressors are run for six weeks continuously day and night, and are then changed over for examination or overhauling. The gas engines are run continuously for a similar period, except that once each week there is a short stoppage of about one hour, while the ignition plugs are cleaned. The circulating pumps are run for three weeks continuously, when they are stopped for removing any tar from the valves. Most of the electric motors run continuously for much longer periods, and are only stopped when examination shows that there is some defect. The gas producers run continuously for two years, and then in rotation each producer is put out for examination; only slight repairs have ever been found necessary. Also every two years the superheaters are cleaned out, the dust and carbon deposit being removed; and in starting again care is taken to make hotter fires than usual, so that the superheaters shall be heated before any sticky carbon deposits can be formed upon their surface. The mechanical washers run three years before closing down for repairs, and one of the two gas-collecting mains is cleaned each Bank Holiday, so that each main is cleaned about every six months. The acid towers run two years in succession, and are then changed over so that any repairs to the lead work can be made. During the seven years of operation it has not been found necessary to change over the gas-cooling and air-heating towers. Steam boilers run for three months at a time, and are then cleaned, and the sulphate evaporators work for one year before the lead steam coils need repair. These evaporators require to be relined with lead every three years.

Results—The paid-up capital of the company at the end of the year 1911 was $2,120,015, which included $462,255 of debenture stock carrying interest at 5%. The expenditure might be divided, roughly, as $1,474,365, spent on Parliamentary expenses and central-station plant, and $645,650 on the distribution mains, etc. The capital spent on the gas mains was a large portion of the total, and this was accounted for by the fact that the mains were far in excess of the requirements of the first unit of plant erected. The additional plant now to be added, to increase the output by 80%, was estimated to cost only $175,000, and larger additions could be made before the gas mains would be working at their maximum capacity.

The cost per 1000 cu.ft. of gas manufactured, including general charges and debenture interest, less the amount realized by byproducts, was 2.574c. per 1000 cu.ft. The estimated cost was 1.6174c. with debenture interest. For the year 1911 there was a gross trading profit of $44,280.

The promoters of the company expected to obtain better prices for the gas than those realized, but partly because of the advent of the suction producer plant, and also owing to the difficulties of introducing an entirely new thing requiring new methods and new experience for its proper use, the schedule of prices has had to be lowered in order to render the supply more attractive to consumers. It soon became apparent that the only way to make real progress was to train an efficient staff who could undertake investigations in each individual case, and, where necessary, design the furnaces or other plant required, prepare working drawings and estimates, undertake the supervision of the building work, and, finally, start the plant and train men to work it.

The present scheme provided a supply for manufacturing works only, but if in future undertakings of this nature Parliament could remove the prohibition against supplying for domestic purposes, a powerful inducement would be offered to private companies or municipal bodies to embark on a supply of cheap fuel gas. Granted that there were difficulties in supplying areas where the streets were already congested with pipes, as in large cities, yet a beginning might be made in every "garden city" and in many of the smaller towns. As the average price at which Mond producer gas was now sold was only 3.50c. per 1000 cu.ft., and as the heating value of the gas was one-quarter of that of town gas, the supply was equivalent to lighting gas at about 14c. per 1000 cu.ft.

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A Joint Outlet Sewer from Pasadena, Calif., to the Pacific Ocean, with branch lines as needed to connect the 17 cities and towns in the San Gabriel Valley, is under consideration by a voluntary body named the Trunk Line Outfall Sewer Commission. W. J. Carr, City Attorney of Pasadena, assisted by William Hazlet, of South Pasadena, is drafting a legislative bill to authorize the project. It is stated that engineers Olmsted & Gillelen, of Los Angeles, have made a report on the project. The utilization of treated sewage for irrigation purposes is talked of as a possible large source of revenue. The project, it may be inferred, is at yet in an early tentative stage.

The Economic Prizes for 1912, offered by Messrs. Hart, Schaffner & Marx, of Chicago, have been awarded as follows:

Class A. The first prize of $1000 to Albert H. Leake, 170 Glengrove Ave., Eglinton, Ont., Canada, Inspector of Technical Education for Ontario, for a paper entitled "Industrial Education, Its Problems, Methods and Dangers."

The second prize of $500 to Harry Edwin Smith, A. B., A. M., Depauw University, 1906, Ph.D., Cornell University, 1912, Instructor in Economics, Cornell University, Ithaca, N. Y., for a paper entitled "The United States Federal Internal Tax History from 1861 to 1871."

Honorable Mention to Glover D. Hancock, A. B., William Jewell College, 1898, A. M., 1899, Ph.D., University of Wisconsin, 1908, Professor of Economics and Political Science, Washington and Lee University, Lexington, Virginia, for a paepr entitled "History of the National Banking System in the United States."

Class B. No papers were deemed worthy of award.

FIELD AND OFFICE

A Portable Plant for Mixing and Distributing Concrete

The distribution of concrete to the forms by means of inclined chutes or spouts from stationary elevating towers is now a very general practice, but we illustrate herewith a recent modification in which the tower and the concrete mixer are portable so that one plant can serve work covering a considerable length or area.

The plant is shown in the accompanying cut. It consisted of a standard-gage flat car equipped with a 1-yd. concrete mixer *A*, an elevator tower *B*, and a hoist house *C*, with electric motor for operating the mixer and elevator hoist. The tower was about 50 ft. high, and was placed at one end of the car, with guides so arranged that the skip *D* could travel past the end of the car and be in a position low enough for charging by gravity from the mixer. The skip was of 30 cu.ft. capacity, and delivered its contents automatically into a two-way discharge hopper *E*, placed in the tower. From this the concrete was delivered to the distributing chutes. Below one side of the car was a charging skip *F*, which was long enough to receive the contents of a Koppel 1½-yd. steel dump car, of the type shown at *G*. This skip was raised to deliver the material to the fixed charging hopper *H*, from which it was charged into the mixer. The dump cars ran on a double-track narrow-gage industrial track extending from the portable mixer plant to a double-track standard-gage siding; this siding had three cars of bank slag on one track, while on the other track were two cars of sand and one car of cement. The double-track narrow-gage line, with a switch at each end, extended between these two lines of railway cars, and on it were operated six of the dump cars. The bank slag and sand were loaded first into Lightbody unloaders, the correct amount for one batch being put in each. The narrow-gage car was then moved to receive the bank slag first, then the cement, and finally the sand. It was then pushed up to the loading or charging skip *F*, and dumped, as described above.



A Portable Concreting Plant, with Mixer and Elevator Tower Mounted on a Flat Car

When it was desired to move the plant, the chutes were disconnected and a locomotive shifted it to the desired position. The chutes to the forms were again connected, and concreting was resumed. This saved the trouble of dismantling and reërecting the tower as soon as all work within its radius of action had been completed. The trestle which carried the chutes had to be moved with each move of the mixer plant. The work extended over a length of nearly 900 ft., and the plant was located at six different points during the progress of the work.

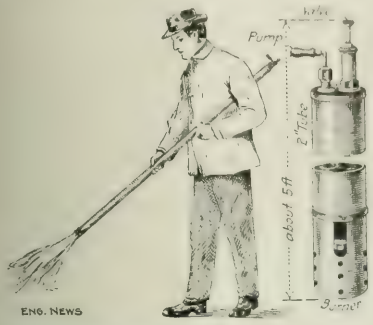
This plant was used in the construction of foundations and retaining walls for a new furnace for the Brier Hill Steel Co., of Youngstown, Ohio, and was designed in accordance with the ideas of B. R. Shover, Superintendent. The plant was purchased from the E. J. McHarg Co., of Binghamton, N. Y., which sublet the contract for the tower and skips to the Acme Equipment & Engineering Co., of Cleveland, Ohio. Mr. Shover states that the total amount of concrete was about 25,000 cu.yd. As much as 48 cu.yd. of concrete per hour was placed with this plant, while for several days the work averaged over 300 cu.yd. per day. A plant of this type is considered to be especially adapted to concrete work on railway construction or improvement.

A Gasoline Torch for Thawing Pipes and Melting Snow at Switches

In clearing snow and ice from switches, frogs and interlocking plants, the Chicago Great Western Ry. has had satisfactory results with a hot blast gasoline torch, particulars of which have been furnished us by C. G. Delo, Engineer of Maintenance of Way. This device consists of a 2-in. tube of heavy brass, about 5 ft. long, fitted with a burner at one end and with a gasoline valve and pressure pump at the other end. A controlling valve on the inside regulates the flow of fuel, so that the

torch can be used in any position. With the air pressure and the special burner there is much greater heat and volume of flame than in any ordinary gasoline torch; the flame has a length about 12 in., but its size can be regulated by means of the valve. It will burn equally well whether the torch is pointed upward or downward. The tube holds about 3 qt. of gasoline, or sufficient for three hours' use. The weight is about 7 lb.

The device is shown in the accompanying cut. It is applicable to various other purposes, such as thawing



GASOLINE TORCH FOR THAWING PIPES, MELTING SNOW, ETC.

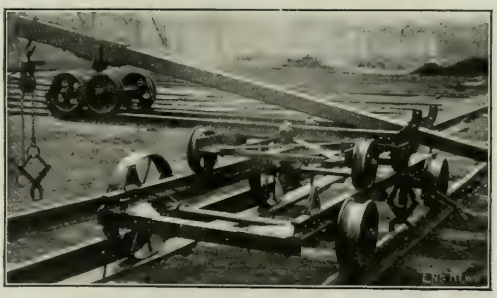
frozen water pipes and hydrants, taking the frost out of the ground for excavations, burning weeds, burning off paint, heating metal surfaces, etc. For foundry work, it is said to be superior to the ordinary blow torch for skin drying and baking sand molds. This hot-blast tubular torch is made by the Turner Brass Works, Sycamore, Ill., and is handled also by the Specialty Sales Co., 1307 Norwood St., Chicago.

A Rail-handling Machine for Rail Renewal

In rail-renewal work a large number of men are required, as a rule, to handle and place the rails, but several railways are now using a machine for handling the rails, thus effecting a considerable reduction in labor force and cost. This machine, which is shown in the accompanying cut, is built by the Q. & C. Co., of Chicago and New York. It consists essentially of three superimposed trucks. The bottom truck has a pair of longitudinal sills consisting of steel rails, upon which travel the double-flanged wheels of the second truck. This latter has a pair of rails at right angles to the track and extending some distance beyond it upon one side. Upon this transverse track rides a small truck with four double-flanged wheels, bearing the pivoted fulcrum support of a long lever whose short end carries a chain with rail tongs. As the fulcrum is pivoted on the truck the lever can be swung around in a horizontal plane to any desired position.

The machine is mounted upon four wheels; two of these are double-flanged wheels which ride on the line of rails which have not been changed or which have been relaid; the other two are flat-tired wheels which run on planks laid inside the line of the rails which are being renewed. The old rail may be pushed out of place, or the rail tongs may be attached to the rail, which is then raised by the lever, and the top truck is run out on the projecting track to deposit the rail on the roadbed. The tongs are then attached to a new rail, and the lever truck is run back to bring the rail in position over the ties. The rail is then lowered, being shifted longitudinally or "heeled" against the adjacent rail as required by moving the middle truck upon its rails. A rail-clamp, operated by a hand lever, is provided to hold the machine in position. This is shown between the double-flanged wheels. The machine is easily pushed along the track by three men, and it can be removed from the track quickly when necessary to let a train pass.

On the Mobile & Ohio R.R., it is stated by Sam Cheatham, roadmaster, only six men are required to handle 85-lb. rails with this machine, while otherwise 12 men would be required to carry the rails with rail-tongs. In rail renewals, a gang of 24 to 25 men with the machine is used, while to lay the same number of rails per day without the machine a gang of 32 to 35 men is used. For the Queen & Crescent Route, W. J. Edwards, roadmaster, has reported that seven men with the machine can lay as much rail as 12 men with the ordinary rail-tongs, provided that care is taken in distributing the new rails along the roadbed. With the machine the work is done more easily and causes much less strain upon the men. On high banks, where the rail is at some distance from the ends of the ties, these rails may have to be rolled up the slope to a position where the machine can reach them, but ordinarily this is not necessary. On the Kingston & Pembroke Ry. (Canada), we are informed by J. A. Irvine, engineer, formerly 14 men were used to pick up the new rail from the side of the track, carry it into place and heel it against the rail previously placed. With the machine, only eight men are now used, thus saving six men. The eight men at the machine are distributed as follows: 3 men on the lever to



RAIL-HANDLING CAR FOR USE IN RAIL RENEWALS

lift the rail; 2 men (one each end of the rail) to hold it from swinging when lifted up by the machine and to place it against the rail previously laid; 1 man to clamp the rail tongs to the middle of the rail, and 2 men to bring forward and place the boards on which the two flat-tired wheels of the machine run. The progress of the machine is dependent on how fast the spiking and fastening of the joints is kept up as the machine moves ahead. The saving on this road is from five to six men per day at $2 each.

Night Soil Incinerating Furnace at a Contractor's Camp

By Arthur W. Tidd*

The new 500-million-gallons-daily Catskill water-system for New York City, now being built by the Board of Water Supply, necessitates that construction work shall be carried on from the Ashokan Reservoir in the Catskill Mountains to New York City, a distance of approximately 100 miles. Throughout the whole length of the line a sanitary control is exercised, under the supervision of sanitary experts employed by the Board of Water Supply, over the housing and living of the laborers employed on the work and the disposal of all wastes.



Fig. 1. Combined Night-soil Incinerating Plant and Closets, Hill View Construction Camp, New York City Board of Water Supply

Clauses are inserted in the specifications of each contract placing upon the contractor the duty of carrying out the provisions required for proper sanitation and specifying in many cases just what these provisions shall be. One of these is the provision that buildings for the sanitary necessities of all persons employed on the work shall be provided, and that all excreta shall be incinerated daily.

The incinerating furnace and accompanying equipment used on Contract 30, the Hill View Reservoir, are described in this article. Camp Hill View is located on nine acres of leased land adjoining the site purchased by the city for Hill View Reservoir. The camp is in the city of Yonkers and just north of the northern limit of New York City. The contractor is the Keystone State Construction Co. Fig. 1 shows a view of the incinerator house, and Fig. 2 shows a plan and section of the house and details of the incinerator.

For the use of the laborers on the work, pan closets, with doors, well built, but light enough to be readily moved about as needed, are provided. The pans are made of heavy galvanized iron about 15x18 in. by 8 in. deep, one to each closet.

For the camp the four corners of the incinerator house are partitioned off into independent closets, entered only from the outside, two for the men having six seats each, two for the women having two seats each. The galvanized pans are used here also, being removed from the back of the closets on the inside of the building as indicated in cross-section of the building shown in Fig. 2.

The incinerator house is 16x27 ft. 4 in. in plan, of wood, with a concrete floor, Amatite roofing, well lighted, ventilated and screened. The furnace is of the grate-bar type, although old 60-lb. steel rails from the work are cut up to make the grates instead of using the commercial grate-bar. It is 5 ft. 4 in. by 9 ft. in plan, 4 ft. high, built of brick, and has two ovens with hinged flat sheet-iron covers opening into a tight stack through which all gases and smoke pass off. Below each oven is an ordinary firebox in which a soft-coal fire is maintained until incineration is complete.

The pans are collected by wagon daily from the closets around the work by one man, who takes out the used pan, leaves an empty one in its place and cleans out whatever mud and rubbish has collected on the floor of the closet. Sawdust from a sawmill operated on the work is sprinkled about ½ in. deep over the bottom of the pan. The pans in the incinerator house are emptied daily, cleaned and replaced. The pans are emptied into the ovens just as they come from the closets, no materials of any kind being added to aid destruction. The small amount of ash remaining from the preceding day's run is sufficient to prevent the semi-liquid mass from working down through between the rails. After the ovens have been charged, the fires are started and maintained until incineration is complete, from 6 to 12 hr. being required for a full charge, depending upon the percentage of liquid matter. The pans, after having been emptied, are washed with a stream of water and turned upside down to dry. They may be seen at the left of the

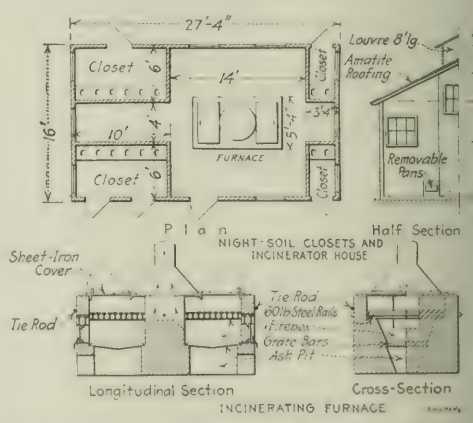


Fig. 2. Plan and Details of Combined Night-soil Incinerating Plant and Closets for Hill View Construction Camp

building in Fig. 1, washed and ready to be distributed. A garden hose and nozzle with city pressure is used for washing purposes. The two 6-seat toilets, the furnace and the floor of the building are also thoroughly washed down with the hose each day. One man who, except in the busiest season of the year also makes the collections around the work, charges the furnace, cleans the pans and building and starts the fires.

* Assistant Engineer, New York City Board of Water Supply, 215 Kimball Ave., Yonkers, N. Y.

About two tons of soft coal per month are burned, and it is noticed that the best economy is obtained by using as large a proportion as possible of the large pieces of coal. The rails will last about six months under average summer conditions. All the excremental matter is incinerated in the furnace. The waste water from kitchens, wash houses, etc., is discharged into a sewer, and the garbage, empty cans and general camp rubbish, which are also collected daily, are burned in a large Woodruff pit.

The contractor's force ranges from about 200 in the winter to 700 in the summer, practically all living in the camp in the winter and from 400 to 500 in the summer. There are some 16 closets on the work and in the summer about 30 pans are incinerated daily. Thirty pans taxes the capacity of the ovens to the limit, but the firebox is of ample size.

The first furnace of this general type to be used on the Board of Water Supply work was in 1909, when several small ones were put into service on Contracts 17 and 18 (American Pipe & Construction Co., contractors), in accordance with the ideas of David Whitmer, managing engineer for the contractors, and David S. Flynn, M. D., of the sanitary bureau of the Board of Water Supply. Ordinary grate-bars were used at first, but they were short-lived, and after experimenting with many different commercial bars old steel rails were given a trial. They have proved to be eminently satisfactory. The design of the building originated with L. C. Brink, of the Pittsburg Contracting Co.

The large double furnace described in this paper, operated without a watertight oven, was a development resulting from the ideas of Henry Delaplaine, chief engineer of the Keystone State Construction Co., contractors on Contract 30; Chas. E. Wells, division engineer for the Board of Water Supply, and David S. Flynn, M. D. It was built in May, 1910. Wood was used at first for fuel, and the firebox was practically equal in area to the oven, but the results were not altogether satisfactory, and the firebox was then rebuilt for burning coal, as shown in the drawings, with the reduced grate area for concentrating the bed of coals, and the sides widening out above to the full area of the oven.

The Stock System of a Structural Shop

By F. Tissington*

One of the most important features in any bridge or structural works is the handling, manufacturing and dispatching of contracts expeditiously. Many contracts are let on a time basis, and frequently the price is a secondary consideration to time of delivery. It is, therefore, imperative for the works to adopt any schemes that will enable them to carry out work in the shortest time possible.

The passage of any contract through the shops can be subdivided into several stages; as a rule the stage occupying the largest portion of the time available is that caused by waiting for the material. Therefore it is a great advantage to be able to say at a minute's notice what stock material is available for a particular job, so that a fairly close estimate may be made of the time required to carry out the particular work asked for.

*Chief Draftsman, MacKinnon, Holmes & Co., Ltd., Sherbrooke, Que.

Most of the larger works can afford to run an elaborate stock system, costing quite a large amount of money in the aggregate, but perhaps only amounting to a small percentage on the annual turnover. But it is impossible for the smaller works to attempt a similar scheme, as the standing charges for running the system would be excessive. In this article the writer proposes to describe a stock-keeping system which is neither elaborate nor expensive, yet has answered the purpose exceedingly well, and as far as can be judged has brought about various economies besides doing away with a good deal of worry and trouble.

At the works in question the stock yard is not covered in, and with heavy falls of snow in the winter months it was found quite impossible (before the stock system was started) to say what stock was available. During the summer months the practice had been for one of the staff to take a rough stock list for a particular job. Work going through in the ordinary way would possibly be held up for an odd bar or two in order to complete the job, and this meant buying from somebody else at an enhanced price or waiting for the ordinary delivery from the mill.

Most systems either have too much or too little red tape, and it is usually difficult to strike the happy medium. It was therefore decided not to make any hard-and-fast rules until the scheme had been tried out, but no alterations were to be made in the original scheme except after consultation with the other people concerned.

The Stock Card-record

The material handled consisted principally of I-beams, channels, angles, plates; there were also small quantities of rounds, tees, and small flats. The I-beams and channels running into rather a lot of weight per foot in most cases, and being of comparatively small value in short lengths owing to the few chances of using them up again, it was decided to treat them more carefully than the plates, angles, etc., as the short ends of the latter easily work up into cleats, gussets, and packings, almost down to the last inch.

The following limits were therefore made in keeping the stock:

I-beams and channels.....all lengths;
angles.....15 ft. long and over;
tees.....15 ft. long and over;
universal mill plates and small flats...
...10 ft. long and over;
sheared plates.....stock sizes only.

The whole scheme depended on starting with an accurate stock list of what was in the yard within the range of the limits fixed. This was obtained at the annual stock-taking without incurring additional expense. The entries were made on cards (printed on both sides) set out as shown in Fig. 1.

It will be noticed that, at the head of the card, space is left for the insertion of any stock material that may be on order but not yet delivered. As soon as such material arrives, the entry is crossed out on the top portion of the card and carried below the heavy line into the columns indicating that this material is actually in the yard.

A second card may be used for the balances left over after the stock bars are once cut. This keeps the first

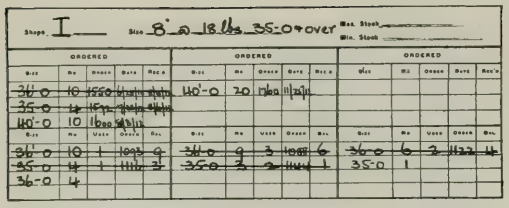


FIG. 1. STOCK CARD
(Back has same ruling, but no head)

card clear of anything except ordered lengths, and it is therefore possible to tell more rapidly what stock there is of a certain section. On this second card there is no need for the insertion of the lines for ordered material, and therefore the whole space can be taken up with the columns required for material in stock.

It was found with beams and channels that a subdivision after the following manner was useful:

First card: Ordered lengths 35 ft. and upwards.
Second card: Lengths from 20 ft. to 34 ft. 11 in.
Third card: Lengths from 5 ft. to 19 ft. 11 in.
Fourth card: All lengths under 5 ft.

By means of these subdivisions it was possible to pick out a length very quickly to cut from.

After the scheme had been in operation a short time it was found that quite a large stock of short lengths of beams and channels which had been looked upon principally as scrap was being used up, and thus quite a considerable saving was effected.

THE CUTTING-LIST CARD

BEAMS AND CHANNELS—The drafting room was made responsible for the cutting up of the beams and channels. A cutting-list form as shown in Fig. 2 was used.

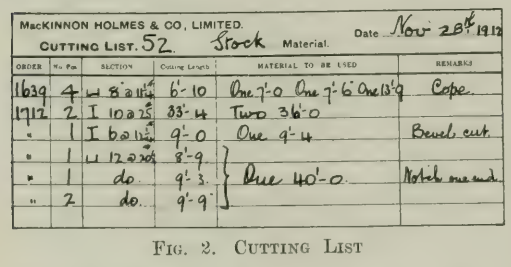


FIG. 2. CUTTING LIST

This was entered up from the bill of material. The cutting lists were numbered in sequence, the number being quoted on the material bill.

No changes from the cutting list were allowed to be made in the shop unless the foreman obtained permission from the drafting room, as otherwise a bar might be substituted which had been put aside for another order.

As far as possible current contracts were worked in together, so as to cut up stock bars to best advantage.

The cutting lists are issued in triplicate by the office to the foreman; one copy for his own use and reference, the second for the yard man looking up the stock, and the third to the man working the saw.

On the cutting lists were noted any special bevel cuts, coping, etc., so that the saw operator asked for markings for a bar calling for special cuts other than square. This relieved the foreman of a considerable amount of worry and trouble, and enabled him to get his stock bars in and cut up ready for the markers by the time the templates were made.

ANGLES AND PLATES—The foreman made out the other lists (for angles, plates, tees, etc.) for the man handling the stock; the men operating the shears and angle cutter made up the cutting lists as they went on by simply stating how many stock bars or plates were used for a particular contract and giving the balances left over.

THE OFFICE AND SHOP PROCEDURE

Briefly the operation of the scheme is as follows:

On receipt of an order the drawings and bills of material are prepared in the usual way, and if any I-beams or channels are included in the job a cutting list is made for them. This list states the lengths required, what stock bars they are to be cut from, and what special cuts are to be made. The man in the drafting office who prepares this list makes an entry in pencil on the stock card against the particular lengths proposed to be used; this is done in pencil to avoid making alterations in case the bars cannot be turned up and changes have to be made, and at the same time to obviate any risk of using the same bar for two different contracts.

The whole of the lists and drawings are then sent to the foreman, and he issues the stock-man's list in plenty of time to allow him to keep the men at the machines supplied with material. When all the material has been sent in, the list is returned to the foreman. The machine men then proceed to do their part, note any alterations made, and on completion of the work covered by each list they hand this list back to the foreman.

Returning these lists to the foreman keeps him acquainted with the progress of this part of the work. As soon as he has looked it over, one of the copies is sent back to the office marked completed, and then the pencil entries on the stock cards are put in permanently with ink, any alterations necessary being made as noted on the lists.

Cutting lists for angles and plates are also sent daily to the office of work completed, and these are entered up as soon as received. Thus it is possible to tell at any time exactly what stock is available to make a new job.

This scheme has been in operation now for about six months. Although some little trouble was experienced at first, owing to the men in the shop not recognizing the need for accuracy, very little trouble is being found at the present time. Only occasionally is there any need for changing cutting lists.

It is, of course, possible that this idea would not suit all works, but with slight modifications to suit existing circumstances the author has no doubt about the efficiency and economy to be obtained by the use of such a system.

Shop Painting of Steelwork

Defective shop painting of bridge and structural steel was criticized recently by a committee of the American Railway Bridge and Building Association (see ENGINEERING NEWS, Nov. 21, 1912, p. 968). Similar criticism and suggestions for better methods of procedure were given before the Maintenance-of-Way Master Painters' Association by O. F. Dalstrom (Bridge Dept., C.

& N. W. Ry., Chicago, Ill.). Extracts from his paper follow:

It is practicable to dispense with shop painting when the rolling, fabrication and erection are all completed within a short period, and provided the painters follow close behind the erectors. This would apply to small bridges, viaducts, signal towers, and the structural steel that enters into the construction of freight sheds, shop buildings and yard equipment. But in all large structures the fabrication and erection cover such an extended period that the shop coat is imperative.

The objections to shop painting can be grouped as follows: painting on improperly prepared surfaces; painting under improper atmospheric conditions; painting done by unskilled workmen, frequently without competent supervision; difficulty of maintaining thorough inspection of other shop work, concealed by the paint; difficulty of handling freshly painted material.

When the steel comes from the mills it is covered with mill scale, much of which clings to it through the entire process of fabrication. By the time it has reached the paint shop there will be found in addition, rust, oil, grease, dirt and usually moisture. It is not practicable to maintain a dry surface in damp weather, and paint applied under such conditions can have no strong adhesion to the metal. The film of moisture would be inclosed under the paint, the resulting corrosion further loosening and breaking the continuity of the protective coating. Very cold weather is not favorable for obtaining a uniform and unbroken coat. Exposure to the hot sun tends to produce blisters, and (in the presence of moisture) to cause peeling.

The surfaces to be painted should be dry and warm, and the painted material should be protected from the weather, from extreme cold, and from the direct action of the sun until the paint is well dried. The plant which has no well equipped paint shop protected from the weather, is not prepared to do good shop painting. The quality of the work will vary with the weather conditions and there can be no uniformity in the results. It may be urged that the same objection applies to painting in the field. But the field painting is done during the most favorable seasons, and it is under the supervision of the company's own foreman.

It is the usual thing to find the paint applied in the shops by men who are unskilled in the work, and the foreman, very probably, is a man without the training necessary to handle the work properly. The shop manager seldom criticizes the quality of the work. The inspector will not bother the painters if they keep away from the steel until he has completed the inspection of the shop work. Accordingly, scant consideration is given to the condition of the surfaces to be painted, atmospheric conditions are disregarded, and the paint is manipulated with thinners and driers in order to cover the most surface in the least time.

A loading gang approaches freshly painted steel very gingerly, as such material has a habit of slipping off the hooks, racing along the skids, and skewing out of adjustment in loading. The simplest way to dispose of this difficulty would be to wait till the paint is dry, but this is not always possible. The shop is usually under instructions to ship as fast as the material is ready; or the paint shop may be congested with accumulating material. If the painting is done in a roomy yard, the material can be left where it is painted until it is to be loaded; but this brings us back to the objection to painting outdoors.

To correct the questionable practices at the shop, practical methods will be worked out when the railways and the inspection companies coöperate with the shop managers to bring this neglected part of the maintenance schedule up to the standard of the construction work. But the initiative must be taken by the railways, and when proper shop painting is one of the requirements the shops will meet it in a practical way.

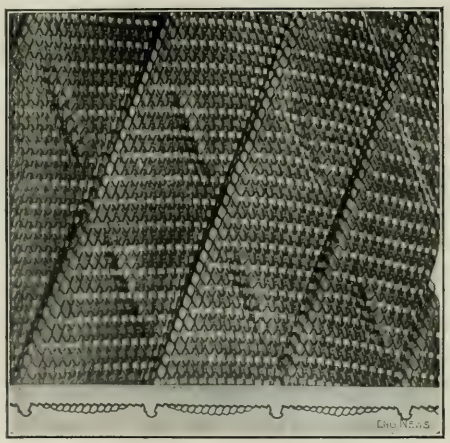
The railways should supply the paint direct to the shop, ready to apply. This would do away with the incentive to slight the quality or the quantity; and it would leave no opportunity for the painters to manipulate the paint with thinners and driers, in order to make better time. The painting should be under the direction of a master painter, who should report directly to the proper official of the engineering department and be responsible for results in all the work coming under his direction. He would make it his business to know what was being done at the shops; and (working directly with the engineer) would be able to bring the necessary pressure to bear on shop managers to correct abuses he might find. This would be done through the agency of the shop inspectors.

The procedure would be simple. Give the shop inspector explicit and thorough instructions as to how this part of the work is to be executed. Have it plainly understood that this work will be passed upon in the field by men competent to decide and report whether the work at the shop was up to the requirements. Hold the inspectors responsible for any defective work that gets through. We should then find inspectors giving the same attention to the painting that they now give to the machine work. They would require surfaces to be clean and dry. They would not permit painting under unfavorable weather conditions. They would insist on competent and trustworthy foremen on the painting, as on the machine work.

The shop manager, finding that this work must be up to a certain standard before it will be accepted, would place the right kind of a foreman in charge of the work and give him competent workmen. With the right kind of men in the paint shop there would be less annoyance from obliterated shipping marks, and other troubles originating with incompetent workmen would disappear.

Metal Lath with Integral Furring Strips

The use of metal lath in building construction has increased very rapidly in recent years, but in connection with this it has been necessary to use a metal furring strip over the wood supports in order to secure a perfect key or bond of the plaster at these points. This led to the development of metal lath having the furring strips as an integral part of the lath, and in the first designs these were V-shaped ribs of solid metal left in the expanded metal sheet. This construction had the disadvantage that the ribs would be plastered on one side only,



Metal Lath, with Ribs Forming Integral Furring Strips

except where back plastering could be done. In a recent development the ribs have the same mesh as the rest of the sheet, so that they become filled with the plaster. The ribs are ½ in. thick and 12 in. apart, running diagonally across the sheet at the same angle as that of the mesh. The size of the sheet is 22x96 in., and the ribs are so formed that those of adjacent sheets will mesh and automatically regulate the amount of lap. The ribs form stiffeners, and it is stated that in building solid partitions it was found that this particular kind of lath could be used successfully with supporting channels spaced 32 in. c. to c. The plasterer could apply the mortar as easily as with the ordinary spacing of 12 or 16 in. for the sup-

ports, while in back plastering the decreased number of supports was a great advantage. For ceiling work with supports spaced 12 in. apart there was no trouble from sagging when applying the plaster. This new form of expanded-metal lath is being introduced by the Northwestern Expanded Metal Co., of Chicago, and has been given the trade name of "Kno-Fur."

While metal lath is a distinctly modern article in building construction, it actually dates back to 1839, when a patent was granted for such lath consisting of punched or perforated metal sheets. This style of lath, and also metal strips in place of wood strips, was used to a limited extent, but the development of metal lath as a commercial product followed the invention of expanded-metal in 1885.

Performance and Power Consumption of a 2½-cu.yd. Electric Shovel

By C. E. Hogle.*

The U. S. Reclamation Service is now engaged upon the construction of a dam across the Carson River at Lahontan, Nev. for the purpose of impounding water for use on the Truckee-Carson Irrigation Project.

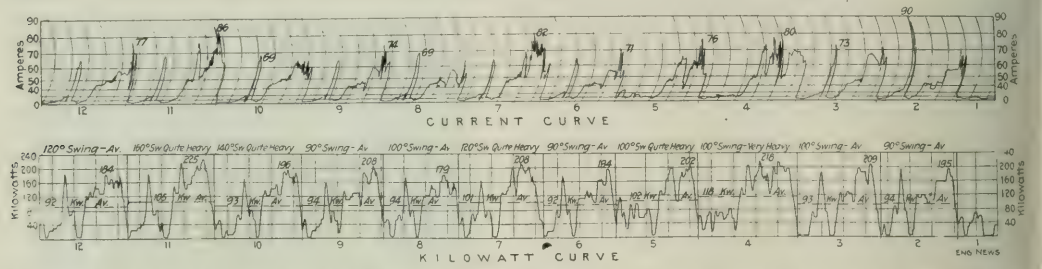
On account of the magnitude of this work and the high price of fuel, an hydro-electric plant of 1250-kv.-a. capacity has been installed just below the dam site. This plant is supplied with water from the existing canal which diverts water from the Truckee River and discharges it into the Carson River. It supplies practically all power for the construction of the dam as well as for all of the excavating machinery.

As the larger portion of the dam is gravel fill, an electric shovel (Bucyrus) with a 2½-cu.yd. dipper was purchased for excavating the gravel and an electric dragline excavator for stripping the gravel pit of the upper layer of sand and silt.

The construction of the electric shovel is practically the same as a steam shovel, except that the power is supplied by electric motors. The car body and house are mounted on M.C.B. standard trucks, the driving axles of which are supplied with split propelling sprockets. In the rear end of the house and directly behind the switchboard are located the three 90-kv.a., single-phase transformers which step down the line voltage from 2300 to 440, for which voltage the motors are wound. The primary side of the transformers on the shovel was connected to the 2300-volt distributing system by about 700 ft. of triple conductor 2300-volt flexible cable, armored with D-shape steel tape. This cable was laid on the ground and dragged along as the shovel moved up, thus allowing the shovel to move some 700 ft. without changing the taps on the 2300-volt line. This triple conductor armored cable is used largely by the Reclamation Service, for both 2300-volt and 440-volt work, and has given most excellent service. It is dragged around over rocks, through mud and water, and requires little protection. It is absolutely safe and is perfectly weatherproof.

When power is available at 15,000, 20,000 or 30,000 volts, this scheme could be used very nicely, by mounting high-tension outdoor-type step-down transformers and switching equipment on a sled or truck, and connecting the secondary side of these portable transformers to the shovel transformers by means of this 2300-volt armored cable.

The hoisting machinery is geared to a 115-hp. (intermittent rating) 440-volt, three-phase, 60-cycle, variable-speed induction motor, having a full-load speed of 680 r.p.m., the gear ratio from motor to drum being approximately 15 to 1. The propelling of the car is also accomplished with the hoist motor.



Current and Power Curves for an Electric Shovel Loading a Six-car Train; Lahontan Tests of the U. S. Reclamation Service

The swinging machinery is geared to a 50-hp. (intermittent rating) 440-volt, three-phase, 60-cycle, variable-speed induction motor, having a full-load speed of 680 r.p.m., the gear ratio from motor to drum being approximately 40 to 1.

The thrust motor, which is attached to the boom, is a 50-hp. (intermittent rating) 440-volt, three-phase, 60-cycle, enclosed-type, variable-speed induction motor, having a full-load speed of 680 r.p.m. This motor is geared to the shipper shaft through an intermediate shaft, the total gear ratio being approximately 10 to 1. On this intermediate shaft there is mounted an air-operated friction clutch. In addition, the intermediate shaft is also provided with a brake, operated by an air cylinder. The controlling air valve for this cylinder is connected to the motor-controller drum in such a manner that when the controller handle is on the off position the brake is set, and *vice versa*. This arrangement makes it possible to hold the dipper handle in any position with the current off the motor.

There is also a 2-hp., 440-volt, three-phase, 60-cycle, 1700-r.p.m. constant-speed induction mitor, direct-con

*Engineer, U. S. Reclamation Service, 605 Federal Bldg., Los Angeles, Calif.

ELECTRIC SHOVEL TEST U. S. RECLAMATION SERVICE; TRUCKEE-CARSON PROJECT

Lahontan, Nevada, Oct. 14, 1912.

No. train	No. cycles	Cubic yards	Time in minutes required to load trains	Cycles per minute	Maximum peak per train Amperes on 2300 v.	kilowatts	Highest average kws. per cycle	Power consumed loading trains kw.-hr.
9	12	24	4 08	2 94	88	226	112	6 22
10	12	24	4 57	2 62	97	259	132	7 68
11	12	24	4 75	2 52	87	236	120	6 75
12	12	24	4 00	3 00	90	225	118	6 10
13	11	22	4 00	2 75	99	252	102	7 12
14	12	24	4 50	2 67	90	238	126	6 15
Totals and averages	71	142	25 90	2 75				6 72

Total time elapsed from start of train No. 9 to end of train No. 14. . . . . 45 5 min.
Total time of loading trains . . . . . 25 9 min.
Total time of delays, moving up, waiting for cars, etc. . . . . 19 6 min.
Digging and loading period is 57% of total time.
Delays, moving up, etc. is 43% of total time.
On the above basis the amount of gravel excavated per 8-hr. day is 1500 cu.yd. of loose gravel.
Total power consumed by six trains is 42 96 kw.-hr. or 7 16 kw.-hr. per train.
Total number of trains per 8-hr. day = 63.3.
Power consumed by shovel per 8 hour day = 453 kw.-hr.
Power consumed per cu.yd. of loose gravel = 0.302 kw.-hr.

nected to an air compressor which furnishes air to the friction brake on the hoisting drum, the emergency brake on the swing motor and the air-operated friction clutch and brake on the intermediate shaft.

The control of the hoist and swing motors is accomplished by means of master controllers, circuit breakers, solenoid-operated switches, jamming relays, current relays, and acceleration switches, so connected and interconnected that the operation of the motors is within the control of the operator so long as he does not try to operate the master controllers too quickly. Should this latter occur, or should the motors become stalled, the operation then becomes automatic and the switches are operated in the proper sequence by the current-limit devices. The thrust motor is operated by a reversible drum controller similar to the street-railway type, which is mounted on a platform attached to the boom. In addition to the acceleration resistance in the rotor winding of this motor, there is also a fixed resistance in this circuit which gives the motor drooping-curve characteristics and protects it from injury in case it becomes stalled.

The levers for operating the master controllers on the hoisting and swinging motors are very similar to, and are located in practically the same position as the operating levers on steam shovels. It has been observed that steam-shovel men, with a very little instruction, become excellent operators of these electric shovels.

In order to get some definite data regarding the performance and power consumption of this shovel, a test was made at Lahontan, Nev., on the morning of Oct. 14, 1912. A polyphase recording watthour meter, a polyphase curve-tracing wattmeter, a curve-tracing ammeter and a voltmeter were installed in the 2300-volt circuit supplying the shovel. The speed of the paper in the curve-tracing ammeter was 10¾ in. per minute, while the speed of the paper in the curve-tracing wattmeter was 11 in. per minute. The different operations of th eshovel are noted by a separate observer, who signaled to the instrument observers and also timed the different operations with a stop-watch.

The shovel was working in a gravel bank 10 to 12 ft. deep, and the clear lift of the dipper was 16 ft. The conditions of the work were not favorable to making a test for determining the maximum excavating capacity of the shovel. Only two six-car trains could be spared for the test, and no attempt was made to adjust the train length to the material to be excavated. The shovel has, however, been operated at very nearly four cycles per minute.

The tests lasted throughout six trains of six cars each and current and wattmeter curves were taken throughout the whole time covered by these six trains, thus giving a complete record of every operation. Only the curves for train No. 12 are shown in the accompanying figures. During the test of train No. 12 the voltage varied between 2360 and 1960.

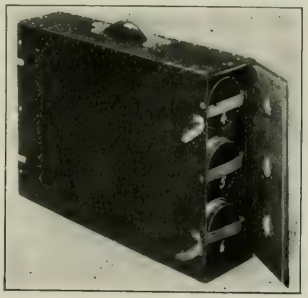
The data derived from these tests are grouped in the accompanying table.

A Nonfreezing Carrier for Dynamite

Dynamite in cold weather is troublesome and dangerous, as it freezes at about 40° F., and will not explode when frozen. It is, therefore, necessary to keep the dynamite magazines warm and to thaw any cartridges which become chilled. There are numerous designs of safely heated storage houses for explosives, and various devices for thawing dynamite; but in severe weather dynamite may be frozen between the time it is taken from the magazine and the time when it is used.

The use of frozen or partly frozen dynamite is exceedingly dangerous because a frozen cartridge or portion of a cartridge may remain unexploded when the rest of the charge is set off and may afterward explode when struck by a workman's pick or a drill or steam shovel.

A nonfreezing carrier for dynamite cartridges between the magazine and the place of use, made on the principle of the well known "Thermos" bottle, is now being introduced. The carrier is shown in the accompanying cut.



NONFREEZING CARRIER FOR DYNAMITE
(W. O. Taylor, Columbus, Ohio, inventor.)

When dynamite is placed inside of the bottles or "tubes," and the corks are firmly inserted in the ends, the dynamite will remain unfrozen within the carrier for at least 12 hours, even when the carriers is exposed during the entire period to a temperature of 12° to 25° below zero. The carrier is safe because no spark or flame can come in contact with the explosive while contained in the carrier. In a test at a quarry at Fairmount, Ill., the carrier was exposed for 18 hours to a temperature of 15° to 20° below zero, and the dynamite contained in it was then found to be unfrozen and ready for use.

Preliminary to charging, the carrier is placed in a room where the temperature is 65° F. or higher, and the corks are withdrawn from the tubes for at least five min-

utes. The dynamite is then placed in the tubes before the carrier is exposed to any lower temperature. After the corks are inserted in the tubes, the carrier may be taken on the work and the explosive will remain unfrozen for at least 12 hours, as noted. After the carrier is charged, the corks must remain in the tubes until the dynamite is required for use.

If it is desired at any time to use only a part of the dynamite contained in one tube, the cork is removed and the amount desired is taken out; the cork is immediately replaced, and the dynamite remaining in the tube will be ready for use later. If the dynamite remains in the tubes long enough to become frozen during very cold weather, it is only necessary to empty the tubes and allow the carrier to remain in a temperature of not less than 65°, with corks drawn, for five minutes, when it will be ready to recharge. But the dynamite must be thoroughly thawed before replacing in the carrier.

The largest size manufactured at present contains six tubes, three in each end of the carrier, as shown in the cut. Each tube will hold seven dynamite cartridges 1¼ in. diameter and 8 in. long. This carrier is 26½ in. long, 19 in. high and 7 in. wide, weighing 30 lb., exclusive of the dynamite.

This device was invented by W. O. Taylor, Vice-President of the Casparis Stone Co., of Columbus, Ohio, as a result of experience in the operation of this company's quarries. It is being introduced by the Dynamite Temperature Carrier Co., 200 Fifth Ave., New York, N. Y., and for information we are indebted to Geo. E. Hunter, Vice-President of this latter company.

❋

Examination Questions in Electrical Engineering

The following questions were given in an examination for the position of teacher of electrical engineering in the Evening High Schools of New York City, held on Jan. 2, 1913, at the headquarters of the Department of Education, 500 Park Ave., New York City. These questions were written from memory immediately after leaving the examination and, while not identical in wording with the original questions, they are so in meaning. The time allowed for the examination was four hours. The value of each question is indicated in parentheses following the question:

1. Describe the construction of the Clark cell and tell how it would be used in calibrating a voltmeter with a 150-volt scale. (10)

2. Describe the method of determining insulation resistance by direct deflection. What is a good value for the insulation resistance of an underground cable? (10)

3. The terminal voltage of a shunt generator is lower at full load than at no load. Explain all the factors which combine to produce this effect. (8)

4. Explain the principle of the Edison three-wire distributing system and tell what advantages it has over the two-wire system. Show how to operate a three-wire system from a regular two-wire generator. (10)

5. (a) What is the action of the equalizer in connection with the operation of compound-wound generators in parallel? (6)

(b) Explain why the speed of a shunt motor is lower at full load than at no load. (4)

6. Explain the structural features of two different types of three-phase motors and tell to what uses each type is best adapted. (10)

7. Show why closing the primary circuit of a transformer does not short-circuit the generator. (10)

8. Show how to operate a two-phase motor from a three-phase line. Find the amperes per phase in a three-phase commercial motor of 20 hp., 500 volts, 80% power factor. (12)

9. Explain how to proceed to connect two three-phase generators in parallel. What action would tend to throw them out of synchronism and how would this be prevented? (10)

10. Explain the method of phase splitting devised by Tesla for making single-phase motors self-starting. (10)

Proportioning the Shell Plating of Tanks

Under the heading, "A New Point in Tank Design," J. T. Maguire, in ENGINEERING NEWS of Dec. 19, 1912, made a suggestion for saving metal in the design of tanks, standpipes, etc. He argued that the vertical joint in one ring is strengthened by the adjoining unspliced metal of the rings immediately above and below, and that for this reason a ring whose joint has 70% efficiency should be proportioned as though it had an 85% joint (the mean of 100% and 70%). Some comment on this subject follows.

H. W. Alrich, 4 Irving Place, New York, says:

> Permit me to commend your comment, and to add a little of my own. If the point that Mr. Maguire undertakes to discuss is new to him, one must believe that he is delving for the first time into the principles of steel-tank construction. As a matter of fact, the relation of the rivets in the horizontal seams to adjacent vertical joints in the several courses of plating was understood in the days of 70 years ago, when large tanks were built of segmental cast-iron plates bolted together. It is also a fact that in the design of very large steel tanks, such as are required for gas holders, the rivets in the horizontal seams are considered in their proper relation to the splices of the vertical joints.
>
> It is difficult to believe that anyone having such visions of the economy to be effected by designing a tank as Mr. Maguire suggests was ever connected with the construction of steel tanks of any considerable size, or ever had the opportunity to observe the elastic behavior of such a tank under hydrostatic pressure. In a paper read before the American Gas Institute in 1910, on tank construction, the writer analyzed (pp. 33 to 35) the elastic deformation which occurs in large tanks. Fig. 9, on p. 34 of that paper, was developed from theory, and also demonstrated by observations to correctly represent the behavior of a very large steel tank under hydrostatic pressure.

The illustration in question shows the shell expansion to be restrained at the top by the circular stiffening girder and at the bottom by the attachment to the tank floor, and to have maximum value at some point in the lower half of the tank.

P. L. Reed, Washington, D. C., supports Mr. Maguire's argument, and remarks:

> The analysis does not undertake to show where initial failure takes place, but does imply that the tank will not fail by the failure of one ring alone, which seems justified by experience. It simply attempts to prove that continuous rings on either side of a spliced ring can take such a portion of the normal stress in the latter, by means of shear through the horizontal riveted joints, as to give a uniform factor of safety for the combined section composed of alternate continuous and spliced plates.
>
> There is nothing intrinsically absurd in this theory, even when carried to the extreme of omitting all vertical rivets in alternate rings and (after substituting solder for watertightness) assuming that the tank will resist half the full load of water as is suggested in your comment; nor for that matter in substituting solder for all vertical riveting, though Mr. Maguire makes no such claim.

Mr. Maguire also writes to further support his theory. Referring to our comment (see issue of Dec. 19, p. 1153, 3d column), he considers the last paragraph of that comment to be a strong argument in favor of his theory, i.e., if the circumferential elongation of the two adjoining rings is the same for the solid metal of one and the riveted seam of the other, the former must be carrying some of the other ring's stress at that point:

> If we assume a joint-efficiency of 70% (see Fig. 1), and base the design of each individual strake on this assumption, we realize that the metal between rivet holes in vertical joints is stressed to 100% of the allowable stress, and the elongation of this metal corresponds with the stress. In other words the distance x on the plate A is considerably

greater [?] than the same distance x on the plates immediately above and below plate A. But if any tendency toward undue elongation in plate A is overcome by the transference of stress to the adjoining plates, through the rivets in the longitudinal seams, then the strength of the combination is the average of the alternate plates.

The failure of tanks by individual strakes instead of as a whole unit might be accounted for by the improper spacing of rivets in longitudinal seams (developing abnormal stresses), or a number of other reasons, all outside of the present discussion.

It is not consistent with reason, in the opinion of the writer, to imagine that the tank would be equally strong with vertical joints immediately over one another as it would be with staggered joints.

As regards the ability of a tank to resist a pressure of

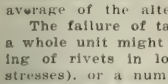


FIG. 1

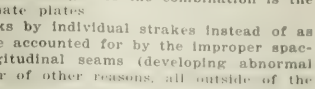


FIG. 2

fluid due to being half filled, with every alternate joint of zero efficiency, but watertight, the writer firmly believes that a tank properly designed as far as rivet-spacing and similar details is concerned would have this required strength.

In proof of his views, Mr. Maguire gives the following further considerations, illustrated by Fig. 2, which represents the tank surface developed into a plane. The plates A and B may have no connection along C, yet the tension P, due to the pressure in the tank, could be of considerable amount without causing failure, the tension being transferred from A to B by way of the longitudinal riveting to the adjoining plates, which is obvious. If this is true for a joint C of zero efficiency, it would apply still more in the actual case, where C has, say, 70% efficiency.

This illustration seems to ignore the fact that the water pressure is normal to the plate, and will bulge out the edges at C. We suggest that study of Fig. 2 be amplified by considering the water pressure normal to the plate, as is actually is, in addition to retaining the tensile forces P shown in the sketch.

The entire case is worth having the reader's careful study. It is an interesting case of distinguishing between designing to suit the actual distribution of stresses and calculating the stresses to go where the design provides metal to take them.

NOTES

An Early Fireproof Shutter—Outside sliding sash were used to some extent in buildings of two or three centuries ago, according to recent correspondence in "Zentralblatt der Bauverwaltung." Projecting stone sill and lintel courses, extending one side of the window a distance equal to the width of the opening, and grooved in the facing surfaces to take the sash, have been found in Scotch buildings. In a German castle ruin such grooves have also been found, and still in place within them stone shutter slabs. It is thought that one reason for using these stone shutters was the desire to protect against entrance of firebrands thrown by an attacking enemy.

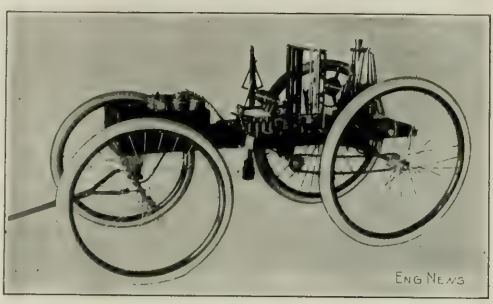
Another Tank Question—The discussion on tank design in this issue raises two further questions:

1. Should the doubling of metal at the horizontal seams be credited to the shell strength?
2. Is the plate-thickness of a given ring to be proportioned for the hydrostatic head at the bottom of that ring or at midheight of the ring?

We regard the two questions as being connected. The lower part of a ring is strengthened by the excess metal at the lap and also by the excess strength in the upper part of the ring next below. The textbooks on tank design usually either dodge the question of designing the shell for middle or bottom of ring, or they recommend designing for the bottom. In practice, shell plates are sometimes designed for the pressure at middle of ring.

A Mechanical Surveyor—An automatic level-man and profile draftsman has been invented and patented by M. J. Dykeman. It is an instrument which only needs to be hauled over the route whose profile is wanted, and not only turns out a profile drawn to scale and stationed, but also deposits at suitable intervals along the line properly-marked stakes. This mechanical surveyor is shown by the halftone below. It is made by the Dykeman Surveyor Co., of Detroit, Mich.

The working parts of the instrument are mounted on a light road-vehicle body, fitted with pneumatic-tired wheels for smooth riding. A drive from the rear axle moves a strip of profile-paper over two drums, and also moves a pencil, whose direction of travel is transverse to the motion of the paper. When the vehicle is drawn along, the strip of paper moves horizontally with a speed proportional to the velocity of the vehicle, and the pencil moves vertically over the paper. The rate of movement of the pencil is controlled by a pendulum, which by means of a cam affects the train of friction disks driving the pencil; the result is that the pencil moves vertically at a speed proportional to the vertical ascent or descent of the vehicle, i.e., proportional to the product of vehicle speed and roadway gradient. By the same means, the



A NEW SURVEYING INSTRUMENT FOR MAKING PROFILES AND SETTING STAKES AUTOMATICALLY

speed of travel of the paper is so controlled as to represent at all times the horizontal component of the vehicle's motion. A station mark is automatically stamped on the paper at suitable intervals.

A stake-setting device is placed directly behind the profile recorder and, like it, is driven by a chain and sprocket connection to the rear axle. By means of a 60-lb. spring and a trigger, controlled by the station marker, a small steel stake is projected into the ground simultaneously with the marking of the station on the profile sheet.

A Self-locking Car Seal.—A new car seal requiring no tools to apply it is manufactured by the International Seal & Lock Co. of Hastings, Mich. It is being used to some extent by railroads and by large shippers, and has also been applied by insurance companies to the sealing of sprinkler valves. The seal consists of a flat ribbon of sheet iron at one end of which there is fixed a small hollow button containing a spring-lock mechanism. By slipping the free end of the sealing strip into a slit in this button the lock is sprung, engaging a hole in the end of the strip. When the seal is once applied it cannot be removed without mutilating it.

For large users these seals are put up in 5000 lots and cost $3 per thousand, but they are also sold to smaller users in 1000 and 2000 lots at $4 per thousand. They are furnished embossed with any combination of 16 or 17 letters desired, numbered consecutively, and strung on wire, 100 in a bunch.

Long-time Tests of cement briquettes are reported by Prof. Isami Hiroi, of the Tokyo Imperial University, Japan, in the "Proceedings of the American Society of Civil Engineers," December, 1912, page 1717 (a paper to be read Feb. 19, 1913). The briquettes tested were made about 15 years ago, in sufficient quantity so that a record of 50-year performance could be kept. The results now reported cover a period of 14 years, which, so far as we know, is the longest period over which such tests have been made.

The first set of tests was made on 1:3 sand-cement briquettes, with a coarse beach sand in one group and standard sand somewhat finer in the other. One-third of the briquettes

were stored for the entire period of 14 years in open air in a shed; one-third in fresh water which was renewed every week, and one-third in sea water also renewed once every week. Each briquette was made in the standard form and kept in a moist closet for 24 hours before being put in its final medium. Five briquettes were tested for each type, and the results given are the averages of the five. The strengths with coarse and standard sand were found to be so nearly alike that the mean results were taken in plotting the curves, which are given in the paper. The strength attained by the use of finer sand came considerably lower. The paper states:

It will be seen, as might have been anticipated, that the mortar attains the greatest strength in air and the least in sea water, the mean comparative ratio of strength attained being nearly as follows:

Air	1.00
Fresh water	0.56
Sea water	0.45

The curves of strength thus traced are approximately hyperbolic and are expressed in equations in the original paper, plotting between time and strength. These mortars showed a fairly uniform increase in strength and attained their greatest strength in about six to ten years, beyond which, although they still continue (through occasional ups and downs) to increase in strength, the rate of increase is inconsiderable.

A second set of tests was made on neat-cement briquettes, and the results are entirely different. Those kept in sea water attained their greatest strength in about two to ten months, after which they rapidly declined, in some cases completely losing their strength in four or five years. The neat-cement briquettes in fresh water and in air did not show so decided a deterioration, but reached their maximum at about four years, after which they commenced to decline in strength. These figures show the decided superiority in the long run of the use of a 1:3 sand mortar over neat cement.

A similar set of experiments using hydraulic lime instead of cement in the sea-water tests showed a complete disintegration of the briquettes in about a year.

In a third series of tests briquettes were kept immersed in fresh water for two months before they were finally placed in sea water, in partial reproduction of the conditions which obtain with concrete blocks used in sea water. In these tests the increase of strength is not as rapid as in the case of briquettes immersed directly in sea water, but the rise is more steady and continues much longer. In these tests also the neat-cement briquettes reached their mixmum in about two years, after which the rate of decline of strength commenced.

Blueprint Rack—Racks for blueprints of current work, of the general type illustrated by the view herewith, are coming into use in many drafting rooms and engineering offices. They keep the prints flat, and make a large number of drawings accessible almost instantly. The one shown is used by J. L. Sheppard, Jr., Construction Superintendent at Newark, Ohio, for the New England Engineering Co. The rack is used for subdividing a large set of blueprints used on a power-house contract. Mr. Sheppard says:



The prints bearing on the same part of the work are assembled in one holder, thus obviating the necessity of having numerous prints in the field when information is desired from only one or more. A complete set of prints is assembled in one holder for office use. The holders are made preferably from some light wood, such as white pine or cedar, with a cross-section of 1¼ x¼ in., the blueprints being clamped between the two strips with ⅜x1-in. machine screws with wing nuts.

The Construction of Concrete Tennis Courts is described as follows, in the "Universal Bulletin" for January, 1913:

A court near Cadillac, Mich., is about 66x98 ft. in size, giving a margin outside the court limits of 5 ft. on all sides. The court has a total thickness of 5 in. and consists of a 4-in. base of 1:2½:5 concrete, a 1-in. top of 1:2 cement mortar and a sand foundation, tiled along two sides for drainage.

In constructing the court the general principles governing first-class sidewalk construction were followed. A joint was placed at each court and service line, and across the court at the net line. This divided the court into a number of large slabs each of which was reinforced with wire mesh. The play lines were formed by placing 1½-in. wooden strips between the slabs at the time of construction, the strips being afterward removed and the space filled with white cement mortar, thus marking the lines permanently. The top coat of the court proper was colored green to reduce the reflection of light.

Several years ago the Duluth Boat Club, Duluth, Minn., placed concrete over three of its tennis courts on a filled-in dock. The courts were formerly surfaced with clay, but concrete replaced this because the clay had to be renewed each season. The courts were laid on a fill 4 ft. above the water level of the surrounding harbor. The combined width of the three courts is 150 ft. and the length 100 ft. For convenience in laying, the concrete was put down in strips about 10 ft. wide and 150 ft. long. These strips were divided into three sections, each equal to the width of a court, or 50 ft. Expansion joints extending the full length of the courts were thus provided for. The total thickness of the slab was 4 in., consisting of a 3¼-concrete base and a ¾-in. top or wearing surface of cement mortar.

A Heavy-service Weight Block.—Three interesting features appear in the new type of weight block manufactured by the W. W. Patterson Co., of Pittsburgh, Pa. The construction of



A Quadruple Weight Block, Arranged for Quick Replacing of Sheaves

the block is such that a sheave can be replaced at any time without removing the weight castings. The bolt heads and the sheave pin cotter being countersunk, there is nothing on the block that can foul on the side of a building or elsewhere that it may be used. Finally the new becket attachment provided allows of the quick removal of the twist or "wind" in the becket line.

The block shown in the cut has a double swivel hook, forged from 3¾ in. round stock and safe for a working load of 25 tons. The weight of the block complete is 1030 lbs.

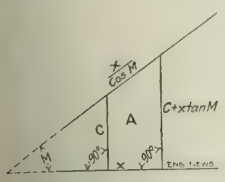
Food Supplies for Construction Camps.—A. H. Bromley in a letter to the "Engineering and Mining Journal" gives the following data of interest to contractors and engineers who have to maintain construction camps in the wilds:

The following list was compiled by a Canadian Pacific Ry. engineer from several years' store sheets, and represents the daily ration per man, in construction camps. The bacon and flour may be a little high, but much depends upon work being done, working temperature and cook's ability. If tinned meat be taken, the bacon can be reduced. Beside the supplies in the list, a little lard was used in the cooking, for which no allowance is made. The total of the above ration is 4.32 lb. Other supplies on a per diem basis were: Soap, 0.05 lb.; candles, 0.01 lb.

DAILY RATION

	lb.		lb.
Flour	1.25	Salt	0.10
Bacon and ham	1.40	Mustard and pepper	0.01
Beans	0.47	Currants	0.03
Dried fruit	0.20	Raisins	0.01
Sugar	0.40	Oatmeal	0.15
Tea	0.04	Rice	0.05
Coffee	0.08	Tomatoes or vegetables	0.04
Baking powder	0.06	Syrup	0.03

Lots Between Non-parallel Lines—It is often necessary to lay out property in equal-sized lots (or more generally in lots of specified area, between front and rear lines not parallel with each other. B. S. Dinsmore, New Kensington, Penn., who has often had this problem to handle, worked out the necessary formulas for it as follows: In the sketch the lines making an angle with each other are the front and rear lines; between them are to be run lines at right angles to the front line, inclosing lots of specified areas.



Let A represent the desired area, M the angle between the lines, x the base (unknown), C the known altitude, and C + x tan M the other altitude (unknown). The area is

$$A = \frac{x\,(2\,C + x \tan M)}{2}$$

Solving this quadratic equation gives,

$$x = \sqrt{\frac{2\,A}{\tan M} + \frac{C^2}{\tan^2 M}} - \frac{C}{\tan M}$$

For the first lot at the corner of the triangle the formula may be worked out separately or it may be deduced from the above by putting C = 0, in either case giving the result

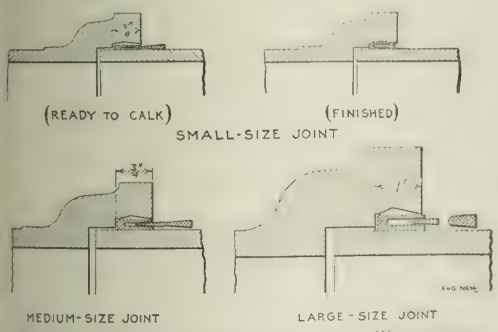
$$x = \sqrt{\frac{2\,A}{\tan}}$$

When working toward the corner instead of away from it, i.e., when the unknown altitude is less than the known altitude, certain signs in the formula will be changed, the result being,

$$x = \frac{C}{\tan M} - \sqrt{\frac{C^2}{\tan^2 M} - \frac{2\,A}{\tan M}}$$

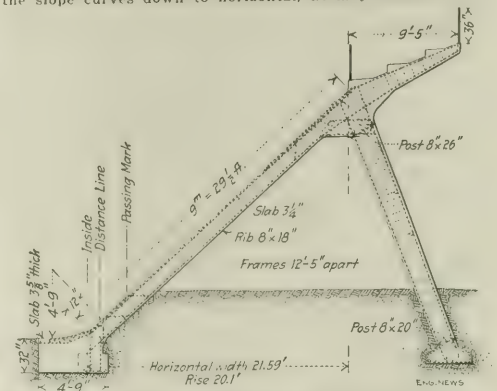
A New Lead Pipe-Joint—The various troubles in making the standard poured lead joint in cast-iron pipe lines are overcome by a wedged lead joint brought out recently by a Frenchman, L. Billé, of 37 Grande Rue, Nogent-sur-Marne, France. The sketch herewith, showing three forms of the joint as applied to bell-and-spigot pipe, illustrates its nature.

The lead wedge rings may, of course, be applied to sleeve joints on steel or cast-iron pipe as readily as to bell joints. The sketches explain themselves. The small-size type, having a single wedge, is to be used for pipe 2 to 6 in. diameter; the medium-size type, with two-taper wedge, as recommended for bell joints of 7-in. to 22-in. pipe and for sleeve joints on pipe up to 48 in.; the large size, using two short wedges in series, is for bell-joint pipe above 22-in. diameter and for sleeve-joint pipe above 48-in. diameter. These joints have been tested to high pressures successfully. The city of Paris is soon to lay a water main with Billé joints, it is reported. The inventor claims a saving of 8% to 15% over poured lead joints.



Billé's Pipe Joint, Made with Lead Wedge-rings

Dimensions of a Cycling Oval—A bicycle-racing saucer-shaped track of reinforced concrete recently built near Zürich, Switzerland, has a length of one-third kilometer (1093.3 ft.), measured 12 in. from the inner edge and a width of 29½ ft. on the slope. The middle part of each side is straight for a length of 119 ft., the ends are circular with radius 86 ft., and the joining portions are transition curves varying in radius of inside edge from 455 ft. to 86 ft., for a length of 157 ft. The track is 201 ft. wide and 440 ft. long, inside of inner edge. The banking was computed on the basis of 30 mi. per hr. average and 55 mi. per hr. maximum speed, but a small banking is also carried along the stretches. To reduce the longitudinal slope of the outer part in rising up to the banks at the turns, the inner line of the turns is depressed 3 ft. below the inner line of the stretches; a line 6 ft. from the inner edge of track is level throughout. The banking is 5.1 ft. on the stretches, and 20.1 ft. on the end curves, making the inclinations 18% and 90%, respectively. At the turns the track is widened by about 3 ft. inward from the inner edge, and here the slope curves down to horizontal, as may be seen in the section sketch. A small part of the track rests directly on the ground; in this portion 7 in. of broken stone leveled off with 2-in. concrete serves as the foundation for a 3¼-in. reinforced-concrete slab, edged by 12x20-in. reinforced-concrete beams. The rest of the track (except the turns) is formed of a 3¼-in. slab on reinforced-concrete cross-frames set into the fill. The turns are of similar construction without fill, and carry seat banks on a cantilever projection at the upper side, as shown by sectional sketch. A 1-in. wearing surface of 1:3 cement mortar tops off the slab. A full description of the track is given in "Schweizerische Bauzeitung" of Dec. 7, 1912.



Section of Reinforced-concrete Cycling Track on Bank

A Diagram for Area of Railway Culvert Openings

By T. J. Wright, Jr.*

I am pleased to send you herewith a blueprint of a diagram for the graphical solution of the Wentworth formula for determining area of culvert opening required to carry run-off from any given area up to 1,000,000 acres. We have found that this saves considerable time and it may possibly be of interest to those of your readers who are working in districts where the formula is applicable.

The Wentworth formula† is in use by the Norfolk & Western Ry. on that part of the line lying between the

*Engineering Department, Piedmont & Northern Lines, Charlotte, N. C.

†The Wentworth formula: $a = d^{\frac{3}{4}}$, where a is the sectional area of the waterway, in square feet, and d is the drainage area, in acres. This formula was derived in connection with work on the Norfolk & Western Ry., and is especially fitted to the conditions in the southeastern states. In cases of less rainfall, or if the ground be quite flat, the author states that the two-thirds power of the drainage area is too great for the square feet of area needed in the waterway. In the observations of Mr. Wentworth, 60% of the resulting area may be taken as the lower limit.

slopes of the Blue Ridge and the Ohio River, and owing to the fact that its use has been limited to this section (or others of similar topography) no rainfall or run-off factors have been necessary. It is discussed by Mr. Churchill, Chief Engineer of the N. & W. Ry., and by Mr. Wentworth, on pp. 35 and 143 of Bulletin 108, American Railway Engineering Association. It is discussed also on p. 492 of Part 3, Vol. 12, of the 1911 *Proceedings* of the Association.

I recently figured openings required for five streams at points between Greenville and Spartanburg, S. C. I used the Wentworth formula and checked the results by assuming a run-off of 100 cu.ft. per sec. per sq.mi., with a mean velocity of the stream of 5 ft. per sec. These assumptions are warranted, I think, by the U. S. Geological Survey report on the Pacolet River flood of 1903. (Water Supply and Irrigation Paper No. 96.) The results were as given in the accompanying table. It has been my experience in general, that the formula gives reliable results in the hilly country of the Virginias and in the Piedmont district of the Carolinas. In every case, however, consideration must be given to local conditions.

TABLE OF COMPARATIVE COMPUTATIONS OF CULVERT OPENINGS

	Area drained		Opening required., sq.ft.	
	Sq.mi.	Acres	Wentworth Formula	Assumed Data
Fair Forest Creek	12	7,680	390	240
North Tiger River	47	30,080	960	940
Middle Tiger River	54	34,560	1050	1080
South Tiger River	74	47,360	1300	1480
Enoree River.....	59	37,760	1130	1180

Example of Use of Diagram—Find the area of culvert required to drain 440 acres. Enter the diagram at bottom at 4.4, and follow the vertical line to intersection with diagonal line marked 100-1000 acres (440 being between these limits). Thence follow the horizontal line to the border, which will be found to reach point 5.8. Since the result must lie between 21.5 and 100 sq.ft., the required area of culvert opening is 58 sq.ft. For 4400 acres, enter the diagram as before, but follow the vertical line to the diagonal line marked 1000-10,000 acres; thence follow the horizontal line, and the result is 269 sq.ft.

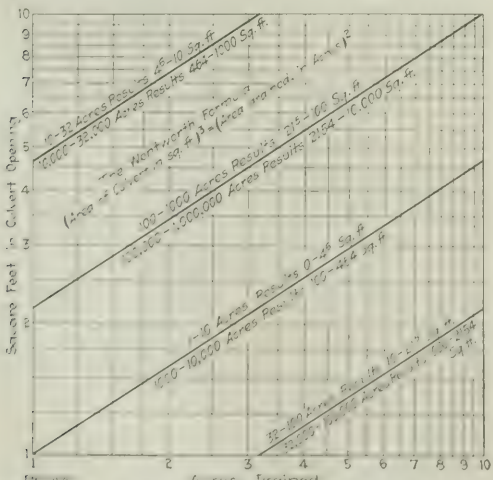


DIAGRAM FOR DETERMINING THE AREA OF RAILWAY CULVERTS
(Based on the Wentworth Formula)

Standard Sizes of Conduits for Electric Conductors

The use of steel-pipe conduits for the protection of all sorts of electric-service wires in building construction is greatly increasing. Practice is known to vary, from the use of smaller sizes than desirable for ease of drawing in, to the use of extravagantly large diameters. To establish a standard practice in the use of sizes neither over-economical nor extravagant, the National Electrical Contractors' Association has adopted tables and charts of sizes of conduit which it recommends for general use.

The tables show in condensed space all proper sizes from that for one No. 14 wire up to four 500,000 circ.-mil. and three 2,000,000-circ.-mil. conductors. There are also data for three-wire convertible systems, single-wire combinations, signal and telephone circuits. The charts show full-size cross-sections of conduit with the various conductors in place. The several charts are mounted on heavy board for hanging, and are sold by W. H. Morton, Secretary of the National Electrical Contractors' Association, 41 Martin Bldg., Utica, N. Y. We have reprinted in the accompanying table (copyrighted and used by permission) the association's data on ordinary and telephone systems.

STANDARD SIZE OF CONDUITS FOR THE INSTALLATION OF WIRES AND CABLES

(As adopted and recommended by the National Electrical Contractors' Association of the United States. Copyrighted and used by permission).

Conduit sizes based on the use of not more than three 90° elbows in runs taking up to and including No. 10 wires; and two elbows for wires larger than No. 10. Wire No. 8 and larger are stranded.

NUMBER OF WIRES IN SYSTEM

Size B. & S.	Cap'y Amps.	One wire in a conduit Size conduit,in. Int'l.	Ext'l.	Two wires in a conduit Size conduit,in. Int'l.	Ext'l.	Three wires in a conduit Size conduit,in. Int'l.	Ext'l.	Four wires in a conduit Size cond., in. Int'l.	Ext'l.
14	12	½	0.84	½	0 84	½	0.84	½	1 05
12	17	½	0.84	½	1.05	½	1.05	½	1.05
10	24	½	0.84	½	1.05	½	1.05	1	1.31
8	33	½	0.84	1	1.31	1	1.31	1	1.31
6	46	½	0.84	1	1.31	1¼	1.66	1¼	1.66
5	54	½	1.05	1¼	1.66	1¼	1.66	1¼	1.66
4	65	½	1.05	1¼	1.66	1¼	1.66	1¼	1.9
3	76	½	1.05	1¼	1.66	1¼	1.66	1½	1.9
2	90	½	1.05	1¼	1.66	1½	1.9	1½	1.9
1	107	½	1.05	1½	1.9	1½	1.9	2	2.37
0	127	1	1.31	1½	1 9	2	2.37	2	2.37
00	150	1	1.31	2	2.37	2	2.37	2½	2 87
000	177	1	1.31	2	2.37	2	2.37	2½	2 87
0000	210	1¼	1 66	2	2 37	2½	2.87	2½	2 87
Circ. mils.									
250,000	235	1¼	1.66	2½	2.87	2½	2 87	3	3.5
300,000	270	1¼	1.66	2½	2 87	2½	2 87	3	3 5
400,000	330	1¼	1 66	3	3 5	3	3.5	3½	4 0
500,000	390	1½	1 9	3	3.5	3	3.5	3½	4.0
600,000	450	1½	1.9	3	3 5	3½	4.0		
700,000	500	2	2.37	3½	4.0	3½	4 0		
800,000	550	2	2.37	3½	4 0	4	4 5		
900,000	600	2	2.37	3½	4 0	4	4 5		
1,000,000	650	2	2.37	4	4.5.	4	4.5		
1,250,000	750	2½	2 87	4½	4 5	4½	5 0		
1,500,000	850	2½	2 87	4½	5.0	5	5.56		
1,750,000	950	3	3.5	5	5 56	5	5.56		
2,000,000	1050	3	3.5	5	5.56	6	6.62		
Duplex Wire									
14	12	½	0 84	½	1 05	1	1.31	1	1 31
12	17	½	0 84	½	1.05	1	1 31	1¼	1 66
10	24	½	1.05	1	1.31	1¼	1.66	1¼	1 66

Example—To ascertain the size of conduit for three No. 1-0 wire, follow down the wire column to No. 1-0 and then across to the section headed "Three wires in a conduit" and it will be seen that 2½ inch conduit is the size to use and that the external diameter is 2 87 inches.

TELEPHONE CIRCUITS

Note—The permissible wires of the telephone companies of various cities differ as to thickness of insulation, therefore the following tables give both light and heavy insulation and the headings give the trade names of the wires used.

Based on not more than two 90° elbows

No. 20 braided and twisted pair, switchboard or desk instrument wire.

No. of pairs	Size conduit, in. Inter'l	Exter'l
5 pair...	½	0 84
10 pair	½	1 05
15 pair	1	1 31
25 pair	1¼	1 66
35 pair	1½	1 9
50 pair.....	2	2.37

No. 19 braided and twisted pair, standard ⅓" insulation telephone wire

No. of pairs	Size conduit, in. Inter'l	Exter'l
3 pair.	½	0 84
6 pair	½	1 05
10 pair	1	1 31
16 pair	1¼	1 66
25 pair.....	1½	1 9
35 pair	2	2 37

EDITORIALS

Proposed Amendments of the Patent Laws

It is extremely doubtful whether at the present short session of Congress, with an impending change in the political complexion of the government, any legislation will be enacted affecting the United States patent system. It is a fact, however, that numerous bills are pending before Congress and have been pushed more or less actively before the House Committee on Patents, which, if they were made law, would work serious injustice and harm to American inventors. On the other hand, there are many features in the present patent system and in the administration of the patent law which need revision, both in the interest of the public and in the interest of adequate encouragement to the development of new inventions.

The use of patents as a foundation for industrial combinations has provoked a great amount of public opposition. There is danger that this opposition may bring about sweeping alterations in the patent system which would greatly hamper engineering and industrial progress. Resolutions have been adopted by the governing board of the American Institute of Electrical Engineers and are pending before other engineering societies which propose that the whole matter of patent-law revision should be referred by Congress to a commission, "to be made up of unbiased, independent, non-partisan men of such national standing as will command the respect of the whole country. Such a commission would hold public hearings and make a thorough and careful study of the American patent situation and would make a report and recommendations to Congress for such changes, if any, as might appear to it expedient."

This is without doubt the sane and sensible way of dealing with this difficult question. If Congress enacts any legislation whatever on the patent situation at this session, it is to be hoped that it may take this form.

⁂

A Low Record Death Rate for New York City

A total of 73,008 deaths in a single city in one year seems appalling until it is known that the city was New York, with a population sufficiently above the five million to bring the rate per 1000 down to the remarkably low figure of 14.11. There are possibilities, of course, that the population estimate is too high or that the death registration was incomplete, but there seems to be reasonable basis for confidence in both. This confidence is increased when it is noted that the total number of deaths in 1912 was 2418 less than in 1911, and much less than the average for the ten years 1902-11; that there were heavy reductions over the average for 1902-11, in all the communicable diseases, in mortality from diarrhœal diseases under five years of age, and in infant mortality; and that in the large non-communicable class the only increases in 1912, were in deaths from cancer, homicide and organic heart disease—the latter being offset by a decline in deaths from apoplexy and diseases of the arteries.

It is particularly gratifying to note that the typhoid-fever death rate for 1912 was 34% less than the average for the previous decade and that the infant-mortality rate for the year was only 105 per 1000 reported births, the lowest ever recorded.

Record death rates are also reported for Boston, Philadelphia, Washington, Toronto and the states of New York and Connecticut. After allowing for favorable weather conditions in 1912, a goodly part of this decline may still be credited to concerted human agencies.

In our issue of Nov. 10, 1910 (p. 516), we discussed "The Declining Death Rate and the Engineer." We were not able, of course, to say just what part the engineer had played in bringing the death rate of the registration area of the United States down to 15 per 1000 for the year 1909, and the rates for England and Wales to 14.5, and of London to 14 for the same year. But we could say with confidence that the engineer had played an important part in reducing typhoid fever and that there were further possibilities for him in the reduction of deaths from accident, and from various other causes, as well as in the reduction of the general death rate.

Finally, we may call attention to the fact that the low death rate of 1912 for New York city, has fallen under the administration of a health officer who is at least a near-engineer, Ernst J. Lederle, a sanitary chemist, long associated with health work in New York City, and once before during this decennial of falling death rates rates, health commissioner of New York.

⁂

Concerning Railway Drawbridges

The interesting paper in this issue by C. E. Smith, on railway drawbridges over rivers having limited navigation, presents some facts which are worth further study. The principal one of these facts to which we wish to direct attention is that in the eyes of the law traffic by water has superior rights to traffic by land. Just why this should be is a little difficult to say. The probability is that since the water highway was in its natural state unhindered by any bridges crossing it, the law assumes that the users of the water highway have a perpetual right to its free and unhindered navigation. The law assumes apparently that this right is of the same nature as a property right and hence that it cannot be taken away or infringed by those who use the bridge across the stream no matter how numerous they may be or how large are the property interests involved.

This theory of the law, of course, harks back to the time when the water highways were the chief avenues of through traffic and when such crude bridges as crossed them were few in number and carried for the most part merely local traffic.

To say that this ancient theory of the law leads to gross absurdities is to put the case very mildly. It is for one thing a contradiction of that other principle of law, well recognized to be a sound guide in most matters—the principle of the greatest good to the greatest number.

If a man from Mars were to visit our planet he would be vastly surprised to see the entire traffic on a busy trunk-line railway brought to a standstill at a certain point in order to allow the opening of a drawbridge and the passage through it of some old scow loaded, perhaps, with manure or some similar cheap bulk freight. The scow may come along just at a time when the rush of suburban traffic is heaviest in the morning or evening hours. It makes no difference; ten thousand passengers must suffer delay rather than the scow owner.

At another city the man from Mars would find a bridge set at a height requiring all traffic across it—railway trains, street cars, loaded trucks, foot passengers—to climb up 10 or 20 ft. of extra height, necessitating steep grades on the approaches, rather than compel the owners of a few boats navigating beneath the bridge to so construct their craft as to be able to pass under it with less head room.

He would see, as narrated in the cases cited by Mr. Smith, a railway constructing a bridge across a stream on which boats pass up or down barely once in a week. But because the boat has a vested right and can mulct the railway for every obstruction that may be placed in the way of its free passige, the man from Mars would see boats coming past there every day on a chance that some obstruction to their passage as a result of the construction work might give them foundation for a damage claim against the railway company.

Perhaps it may seem like tilting at a windmill to propose disturbing a vested right of such long standing; but we believe the only reason why this vested right has endured so long is because the public has no appreciation of the fact that its maintenance is contrary to the public interest, and, in fact, results in an enormous public injury.

It is a fact that every drawbridge opening in a railway line costs the railway a large sum to construct and to maintain it. The draw span and its machinery must be, above all things, reliable; it may be opened for the passage of vessels only once a week or once a month, but its construction must be such that so far as human ingenuity and vigilance can contrive, the bridge will be absolutely certain to close and open when the necessity arises. All this costs money, not only in the original construction, but in maintenance and inspection and in attendance, for every drawbridge requires attendants and unless traffic on the stream which it crosses is confined to the daylight hours, there must be two or even three shifts of attendants to be on hand whenever necessity for opening the bridge may arise.

Again, every drawbridge is a potential cause of serious disaster. Some of the worst railway wrecks on record have been due to trains plunging into an open draw. Every drawbridge should be provided with a thorough system of signaling and interlocking for the protection of the traveling public. This must all be inspected and maintained in perfect order at all times.

The public is oblivious to all this because it fancies that the burden which is involved rests upon the railway companies. The public forgets that the railway has in the long run to obtain the money for each and every expense that it incurs by collecting it from travelers and shippers. In the long run the cost of building and operating drawbridges, as well as the necessary risk involved in their use, must be borne by the public.

The case is, in fact, exactly the same as if the railways were owned by the government. Whenever the public awakens to the idea that in considering the relative rights of transportation by land and by water where the two routes conflict, the principle of the greatest good to the greatest number should govern and not the principle of vested rights—when that comes to be realized we shall see a change in our present laws governing drawbridge construction and operation.

We are not, of course, urging by any means that all drawbridges should be made fixed spans, or that railways over rivers or street bridges across them should be allowed to unreasonably obstruct the waterways beneath, even though the land traffic may be hundreds or thousands of times as great as the water traffic. What we do urge is that the law should be so modified that common sense and reason may take the place of the present principle of vested rights.

As a result of the recent agitation to revive inland navigation, there have been cases in the West where railway bridges across streams in which a boat had not run for years have been obliged to have parts temporarily removed because of the whim of some enthusiast who wanted to run a boat up a channel long since abandoned.

There are cases where a railway could well afford to carry on, free of charge, the entire transportation work done by a river steamboat rather than incur the expense of building and operating a drawspan.

There are other cases where a drawbridge opening originally made to accommodate a considerable water traffic, now accommodates so few vessels that restrictions as to the time of its opening would save delays to many thousands of passengers every year and a large amount of money to the railway company by reducing the hindrance to traffic movement.

The Control of Banking over Industry

The proceedings of the so called Money Trust Investigating Committee of Congress have served to direct public attention recently to some very important problems in connection with finance, economics, industry and trade. It is not inappropriate, we believe, that some of these matters should be discussed in the columns of an engineering journal inasmuch as a very large proportion of our industrial and transportation enterprises are administered by engineers. In all construction work the financing is a preliminary stage, which must be passed through before the engineer can undertake his work. Upon the way in which this financing is done the character of the engineering work very largely depends.

More than this, the problem of public control by legislative process or executive action is not only dominant in connection with common carriers and all the so called public-utility corporations, but is being largely extended in connection with manufacturing enterprise of various sorts. And this public control has to be effected to a large extent through engineers.

One does not have to view the money-trust agitation with a prejudice excited by flaming headlines in sensa-

tional newspapers in order to realize that there are some very serious and important problems for American business men and American citizens to solve, if we are really to maintain that freedom of opportunity and that square deal which have been held up as ideals by leaders of public thought.

All well informed business men understand that the business of banking, properly conducted, renders a great and a necessary service to the business community. It is well recognized, also, that a certain amount of concentration of banking capital is essential to handle the large-scale financial operations which are a necessary accompaniment of the large-scale industrial and transportation units of the present day. But when the man who is by general consent the most prominent figure at the financial center of the United States frankly admits that consolidation of banking capital has gone about far enough and that this consolidation at its present stage, if administered by bad or incompetent men might wreck the country, it is surely time for thinking men to inquire as to the conditions under which we are living and working.

It is certain that the public receives with no satisfaction these revelations of vast power, and of the huge profits which are being made by these past masters of finance. Notwithstanding the assurances that conditions are all right because the men who are in control are good men, the public is without doubt exceedingly skeptical as to whether these men are good enough to wield such great powers. It is exceedingly skeptical as to whether the huge profits which are flowing into the vaults of a few Wall Street banking houses as a tribute paid by the industries in fifty states of the Union and a world-wide commerce do not represent a return out of all proportion to the service rendered.

It must be clearly understood that the present concentration of power in the hands of a few Wall St. financiers is one of the penalties the public has to pay for the carnival of consolidation which went on in the early years of the 20th century. Whether the results of that consolidation were good or evil, we need not now stop to discuss. We need only direct attention to the fact that when a banking firm had financed the purchase of 20, or 40, or more mills engaged in an industry and established a central organization for carrying on their operations, the banking firm was obliged to undertake more or less responsibility for the conduct of the organization. The public which had bought the stocks and bonds largely on the strength of the banker's reputation looked to the banker to see that the promised returns on these securities were obtained. Almost automatically, therefore, the banker came into control of a property of which in many cases he owned comparatively little. It was the banking firm, naturally, which sought the proxies of the stockholders and could obtain them far more readily than anyone else. It was the banking firm, therefore, which selected the board of directors of the new trust and who not seldom instructed this board what officers it should choose and what policies it should pursue.

If anyone thinks that this was on the whole a great benefit to American industry, it would be well for him to contemplate the long list of bankruptcies and receiverships which followed in the train of that financial carnival of 1900 to 1906. If this be not sufficiently convincing, he is invited to review the situation in which American industry finds itself today. Is it any wonder that wealth gravitates into the hands of a few men? What other result could be expected when unlimited powers have been placed in their hands?

One is amazed, perhaps, at the enormous volume of the deposits held by a few great banks at the financial center. Seven of them have combined deposits of $1,400,000,000. Whence come these enormous sums of money? Does anyone imagine that this huge volume of deposits is concentrated in these banks as a result of open competition with their business rivals? Is the service rendered by these banks to their customers so superior, is the personality of their officers so attractive, or what is the reason that so large a proportion of the total banking capital of the United States is concentrated in the hands of a half dozen great institutions located at this financial center?

There is no great difficulty in solving the mystery when it is perceived that a large proportion of these deposits are under the banker's own control. The directors which he places in office fully understand where their companies' surplus funds are to be concentrated.

Why do those who seek to establish new enterprises in the smaller cities of the country find it necessary to come to New York and go hat in hand to the bond houses in order to obtain capital? Is it not, in part at least, because the capital, which thirty years ago the local mill, or shop, or factory used to deposit in its own local bank, is now kept at the financial center, where the people who control the organization that owns what was formerly the local mill or factory can use it for their own purposes?

This, however, is only the beginning. If truth must be told, it is probable that the enormous profits scooped in so easily by the high-finance manipulators of ten years ago have permanently spoiled them, so that they are no longer satisfied with the legitimate profit to be gained by legitimate banking. What corporation nowadays attempts to obtain money by offering its own stock and bonds to its stockholders and to the public when it desires to obtain additional capital? Where would there be any opportunity for profits to the bankers if this plan of financing were followed? The corporation may be in ever so good a position financially, the financial operation may be nothing more than exchanging new notes for old, or new bonds for old ones; it must, nevertheless, be done through the bankers.

We are well aware that there are arguments in favor of such a course in many instances, and it may even be that there is in some cases a certain amount of competition between some of the smaller banking houses for such financial business. But where a banking house controls a corporation, names its directors, and does its financing, who is to say how large a slice out of the corporation's treasury should be awarded to the banking house as its commission? One does not require a long memory to recall some famous (or infamous) instances of this sort of robbery of investors which filled the honest men and honest bankers of Wall Street (for there are many such there) with high indignation.

And we may say here parenthetically that if one wishes to hear a scathing arraignment of the "money trust" situation it is not necessary to go to the halls of Congress, nor to Texas, nor to Arkansas, nor Nebraska. One can obtain far more definite knowledge as to the real evils in connection with concentrated financial control from

men of high reputation for honesty and probity, who have done business in Wall St. for many years, and who know from first-hand knowledge how the game is played.

There is a comparatively recent Wall Street invention which has never been the subject of a patent, but which as a profit-yielding machine to the banking fraternity beats anything in the entire range of mechanical engineering. This invention is known as the short term note.

Its use on a large scale for corporation financing began about half a dozen years ago. At that time it was alleged that the public would no longer subscribe for additional stock issues and would only purchase bonds at a rate of interest higher than it seemed advisable for the companies to pay as a fixed charge. It was at that time declared, very likely in entire honesty, that instead of selling bonds at perhaps 5% or even 5½% to run for a period of ten years or more, it was better for corporations to provide for their immediate financial necessities by issuing notes for short terms, and before these notes came due it was argued that interest rates would go down and the bond market would improve so that the financial necessities of the companies could be provided for on better terms.

That was half a dozen years ago, but the short-term note is with us yet. In fact, some hundreds of millions of dollars of the obligations of corporations controlled in Wall St. is represented by short-term notes. Corporations not subject to Wall St. control are able to sell bonds, at a higher rate of interest, it is true, than prevailed in the '90's, but so far as can be seen, this higher rate of interest is likely to be with us for years to come and perhaps for many years to come.

Whenever these short-term notes become due, the company raises the money to pay them by issuing another lot of short-term notes, selling them to the banker, of course, who sells them to the public and reaps his commission on the transaction.

It will be seen by this wonderfully simple invention that instead of securing one commission on an issue of bonds which may run for 10, or 20, or 50 years before maturity, the invention of the short-term note enables the banker to exact a percentage on the debt of the corporations he controls every one, or two, or three years, whenever their issues of short-term notes fall due.

There are other ramifications in connection with the concentration of control of which it would be difficult to cite specific instances in print, but which are well known to many who hold executive positions in connection with industrial and transportation enterprises. It is, of course, evident that when the same interest controls a railway and also controls an industrial plant, or a dozen industrial plants from which that railway makes large purchases, it is to be expected that the railway patronage will go to those plants rather than to their competitors. It may even be for the interest of the directing power that the manufacturing company shall make large profits and the railway company small ones, or the reverse may be the case.

Probably the distinguished financiers who testified before the Pujo Committee would claim that the men who wield this enormous power are such good men that nothing of this unfairness ever enters their minds. Those who hold high executive positions in some of our corporations might tell a different story of the secrets of all hearts were revealed; but it is at least indisputable that this concentration of control which we are discussing makes a possible a most serious limitation in the field of equal opportunity in the not unthinkable case that bad men might come to wield this enormous power.

Much more might be said with respect to this matter; but there is another equally serious aspect of banking consolidation which deserves consideration. Not alone has the progress of consolidation of banking concentrated banking capital in New York, but the exploits of high finance in banking circles have in a large degree spoiled the banking fraternity for the pursuit of legitimate and conservative banking and have led bankers everywhere to emulate the methods of the Wall St. promoter. In an address delivered by John Harsen Rhoades, himself a Wall St. banker, before the New York City Finance Forum last month the following incident is recorded:

> Let me tell you another story: Just previous to the panic of 1907 my firm, a borrower of money from a large trust company, was informed that the rate on the loan had been raised to 50%. The collateral consisted of gilt-edged bonds, and the loan had been standing for some time. Knowing one of its officers—as a matter of fact—a personal friend, I called upon him, and among other things said: "Is not my credit sufficiently good to warrant a lower rate than 50%? You are a lender of money with a service to perform. Do you think it just to bleed me?"
>
> He replied: "I agree that such rates seem extortionate; but we are not facing a theory but a condition, and it is the duty of an officer of this company to its stockholders to take advantage of every opening that presents itself."
>
> Now, gentlemen, from his standpoint he was not dishonest, nor was he doing wrong. He was merely taking advantage of his opportunities. The fault lies where? Not with him, but with his conception of his duty to his stockholders versus service to the public and with a banking system that invited him to do as he did.

This incident related by Mr. Rhoades, it seems to us, emphasizes the wrong position in which the banking business stands today. Under a proper banking system the ideal should not be the rolling up of 20%, or 40%, or 100% dividends for the holders of bank stock in the manner for which Wall St. has set a precedent.

It is argued that the bank has a right to take any rate of interest which the borrower is willing to pay, and that the law of supply and demand should govern. The flaw in this argument lies in the fact that to a large extent the supply is in the control of the lender, and that by creating a condition of apparent scarcity he can make the rate of interest depend upon the borrower's *necessities* and not at all upon the relation between supply and demand.

It is surely a higher conception of the banker to consider him as a semipublic official, intrusted by the community with a reservoir of capital and credit, and with the judicial responsibility upon him of treating with absolute fairness and impartiality all the interests in the community. Such a bank and such a banker renders a community an enormous public service, but the banks and bankers which aim to be the masters instead of the servants of the public can bring a community or a nation to disaster.

As to what remedies are available for the condition of affairs which we set forth, we shall not at this time discuss. That the situation is one exceedingly difficult to better by any sort of governmental control will be admitted by all who have given careful study to the matter.

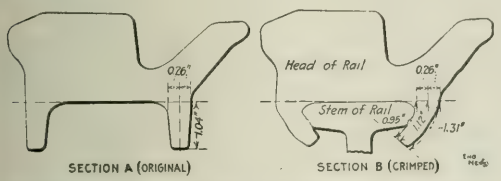
The first step, however, is to understand the situation which at present exists, and the obstacles which stand in the way of that equality of opportunity which the public demands, and properly demands, should prevail.

LETTERS TO THE EDITOR

Compound Rails on Chicago Street Railways

Sir—In ENGINEERING NEWS of Sept. 28, 1911, and Feb. 1, 1912, the writer gave some details in relation to the first mile of compound rails of the Romapac system* installed in Chicago. Since the latter date, three more miles have been laid for the Chicago City Ry. Co. and the Chicago Railways Co., and further tests have been made of the completed rail.

The basis of the system is the crimping of the flanges of the channel-shaped head section onto the bulb of the base section in such a manner as to convert the depending flanges of the former into springs. This is effected by causing a cold flowing of the metal under the pressure of the crimping rollers until the tension strains developed in first bending the flanges are converted, in the outer portion of the flanges, into compression strains, which give a spring grip that resists a shearing stress of over 36 tons to the foot. Measurements of the change effected in the cross-section of the flanges by this process have been taken by R. W. Hunt & Co., and are given in the following report:



SECTIONS OF HEAD OF ROMAPAC COMPOUND RAIL BEFORE AND AFTER BEING CRIMPED TO THE LOWER PORTION OF THE RAIL

The section termed *A* (shown in the cut) was an original section of which the flanges were not crimped. The section *B* was one consisting of both the head and the base section, in which the head section had been formed to the base section, in the track. The lengths of the flanges were measured and are given in the table.

Length inside of flange before crimping	1.04 in.
Length inside of flange after crimping	0.95 in.
Length center of flange before crimping	1.04 in.
Length center of flange after crimping	1.12 in.
Length outside of flange before crimping	1.04 in.
Length outside of flange after crimping	1.31 in.
Permanent contraction inside of flange	0.09 in.
Permanent elongation center of flange	0.08 in.
Permanent elongation outside of flange	0.27 in.
Per cent. of contraction inside of flange	8.65%
Per cent. of elongation center of flange	7.69%
Per cent. of elongation outside of flange	26.0 %

The writer believes that the above are the first published data on the cold deformation of rail steel and the conversion of the energy of deformation into a form of potential energy akin to that of a spring.

WM. A. DEL MAR,
Electrical Engineer.

70 E. 45th St., New York, N. Y.
Jan. 3, 1913.

*Described also in our issue of May 24, 1906.

[One effect of the crimping of the flanges is to cause the rail head to buckle or bend transversely, as noted in our issue of Nov. 28, 1912. Editor.]

The Code of Ethics Drafted for the American Society of Mechanical Engineers

Sir—The proposed code of ethics for engineers, published in your issue of Jan. 2, is the best which I have ever seen. It is short and comprehensive. The committee has done the profession an important service in drafting this code, and I hope it will receive proper consideration by the various engineering societies.

ALBERT J. HIMES.

Cleveland, Ohio., Jan. 10, 1913.

The Status of the Engineer

Sir—I have read with interest your valuable editorial in the issue of Jan. 2, on the "Status of the Engineer," wherein you review this very important subject and "take stock" of the standing of the profession not only as to its inner shortcomings and merits, but, what is very much more to the point, its standing before the public. As I view it, the inner troubles are largely in the hands of the engineer body itself to cure and may be briefly stated as, (1) lack of homogeneity and team work, (2) little regard for ethics, (3) a very decided tendency toward commercialism as to services.

Now, let us examine the standing of the engineer before the public. This, as you say, leaves much to be desired. Engineers should have more voice in the settlement of important public questions, yet they are seldom heard as individuals, and then with but scant interest. Men who are aggressive and active in this profession, seem to lose these qualities before the public. Is it a constitutional want of some element in the technical mind, or is it a matter of training? My personal belief is that it is largely due to the conditions under which young men begin and continue work through their engineering life; the individual is suppressed as a part of some large organization, and if in later life independent practice is reached, the suppression has become a habit. Whatever the cause, individual initiative in public and business matters is but seldom found among engineers. It would seem, then, that local and, possibly in some instances, national engineering bodies must be looked to to make an impression on the public mind, and to raise the profession above its present status.

In order that this may be done comprehensively, it is advisable as a first step, to take up and provide a cure for what I have designated as the inner troubles. Never can the profession take its proper place before the public until it presents a united front as a homogeneous body with unalterably fixed ideas as to right and wrong. It

must have full knowledge of what it has a right to expect from or to give to the public and its clients, not in any sense as a labor organization, but as a body of men actuated by high principles of right and justice. It must protect the public, in so far as it can, from improper practice, and must sustain honest efficiency.

The starting point is a uniform code of ethics for the whole profession. Having adopted such a code, its enforcement by local and national societies should be taken up under such wise regulations as may be established for this purpose.

In order that such a code should be thoroughly understood and looked upon as an asset of the profession, our engineering schools should instill its principles into their students, as thoroughly as any other branch of the course, and during every year of the curriculum.

In addition to the code of ethics, such other standards and regulations as to practice as stated by Percival M. Churchill in his excellen letter, printed with your editorial of Jan. 2, would go a long way toward solidifying the engineer body and prevent some of its most unfortunate troubles.

In a few years, conditions of work under such a system as outlined above, would unquestionably bring about an improved status of the profession, not only within itself, but before the public. At the present time the profession is drifting without clearly defined ideas or standards. The overburden of young men taking up engineering work, is making the situation increasingly difficult, as competition for work does not tend to professionalism but to commercialism. Prompt action is necessary and the times demand it.

G. B. HAZLEHURST.

Catonsville, Md., Jan. 13, 1913.

The Question of Impact on Bridge Substructures

Sir—In designing a railway bridge, proper allowance for "impact" is invariably made in the computations of stresses in the main members. The same care is taken in designing a tower or a bent carrying such a bridge.

The impact stress is sometimes figured by one of several formulas known to and generally accepted by bridge engineers; and sometimes it is determined by taking certain percentages of the live-load stresses. Some text-books attempt to discuss the subject and try to arrive at a mathematical conclusion, though none as yet has been able to present a theoretical formula which may be substituted for the empirical formulas now in use. Engineers of wide repute study the question from time to time and inform the engineering profession of their experiments and conclusions. Engineering associations appoint committees, solely for the purpose of investigating the important question of impact. In the absence of a correct theoretical formula, the engineering profession seems to be well satisfied with the data at hand, taking refuge in the statement that in this matter experience is in advance of theory.

But all these formulas, reports, conclusions and recommendations concern only the superstructure. The writer does not recollect any source of information which treats of the impact effect upon the substructure and the foundations. It is true that there are cases in which the dynamic effect of a moving train upon the substructure, especially upon the foundations, is practically a negligible quantity. Yet there are many cases when this force cannot be very well overlooked.

There are several different ways in which the effect of the impact stress upon the substructure or foundations may be considered. Take the case of a low pier on pile foundations, supporting two adjacent trusses or girders of such spans as to give a considerable amount of impact reaction. In determining the number of piles under this pier the end reactions of the trusses or girders resting on it form one of the important forces. The impact, of course, contributes considerably to the reactions; and it is very evident that in computing the number of piles this portion of the reactions cannot be omitted. On the other hand, the direct impact on top of the pier cannot be taken in full in the same computations.

The case of a pier is not much different from that of a tower as regards the relation between impact and dead-load; and if we agree to determine the amount of impact stress by a formula in which the dead-load is one of the factors, the problem may be partly solved, although not for all cases. Taking the formula $I = \frac{L^2}{L+D}$, in which I is the impact reaction, L the live-load reaction and D the dead-load reaction, the most logical procedure would be to modify the expression by changing it into $I' = \frac{L^2}{L+D+M}$, in which I' is the impact reaction on top of foundation area, L and D live- and dead-load reactions, respectively, and M the weight of masonry.

The same reasoning would be applicable to abutments without wings, were it not for the effect of the impact directly on top of the ballast wall. The analysis of this impact stress is rather difficult, for the reason that several indeterminate elements enter into the problem, such as the speed of the train, time in which the impact stress is generated, curvature of the track, etc.

Again, the effect of impact upon the wings of an abutment and upon the foundation area of these wings may require careful consideration; especially so with T and U abutments, as in the case of T-abutments the tail-wall is directly under the track and in the case of U-abutments the wing-walls as a whole are nearer the track.

When the pier or abutment is so high that the weight of masonry is very large compared with the live-load reaction, the effect of impact upon the foundation area becomes an insignificant quantity. This can easily be seen from the preceding formula, in which the larger the value for the dead-load reaction D, the smaller the result for the impact reaction I. It is rational also to conclude that when such a solid mass of masonry like a high pier or high abutment is subjected to dynamic load, the impact effect would naturally decrease with the height of the pier or abutment and almost vanish at its base.

C. M. LUTHER.

Toronto, Ont.,
Dec. 28, 1912.

This space was intended for an interesting inquiry, but we find that the author signed it "A Subscriber," without giving his name. The old rule is that no notice may be taken of anonymous communications, the rule is still good, but especially so in the case of letters with the above signature.

The Present Status of the New York State Barge Canal

The greater part of the annual report of John A Bensel, State Engineer and Surveyor of the State of New York, for the fiscal year ending Sept. 30, 1912, is devoted to a discussion of the past work on and future necessities of the Barge Canal, which has been in course of construction for the last eight years. In the main the report is a statement of the inadequacy of the $121,800,000 appropriated by the state for the full completion of the canal and its accessories. The leading portions of the report follow:

There has been much speculation as to when the Barge Canal will be completed and whether or not, when completed the cost of the improvement would be within the original appropriations of $101,000,000 for the improvement of the Erie, Champlain and Oswego canals, and of $7,000,000 for the improvement of the Cayuga and Seneca Canal. I deem it my duty as State Engineer and Surveyor to place before the Legislature and the people of the state a statement setting forth what to my mind is the exact status of this underaking, such judgment being based on the progress made to the end of the fiscal year Sept. 30, 1912.

From an examination of the status of the work it is apparent that the construction of the Barge Canal is progressing at a rapid rate, in that to Oct. 1, 1912, there had been placed under contract work to the amount of $77,029,116, and there had been completed work amounting to $50,684,369. The construction work is more than 60% completed, and more than 50% of the work completed to date has been done during 1911 and 1912.

Plans for the work remaining to be placed under contract are practically completed, and such work as is included therein will be awarded at an early date, such as to permit the completion of the entire Barge Canal system and have this extensive waterway ready for navigation probably in the year 1915.

ERIE, CHAMPLAIN AND OSWEGO CANALS

PROGRESS OF WORK—At the rate with which the work is being and has been progressed, there was every reason to believe that the Champlain Canal would have been entirely completed and ready for navigation in the year 1913, but owing to the failure on the part of certain contractors performing work on this portion of the canal it has been necessary for the Canal Board to cancel certain contracts and to readvertise for the uncompleted portions of such work. The best to be expected is that this portion of the Barge Canal system may be completed in 1914.

There is every reason to believe that the Barge Canal between the Hudson River and the city of Oswego on Lake Ontario, the terminus of the Oswego Canal, will be completed and in readiness for navigation in 1914.

The progress of the work on that portion of the canal west of the junction of the Oswego and Erie canals at Three River Point is such as to warrant the expectation of having this section of the system completed in 1915, thereby placing that portion of the Barge Canal, including the Erie, Champlain and Oswego Canals, in condition for navigation during the season of 1915.

To Oct. 1, 1912, many of the Barge Canal contracts had been completed and certain sections of the improved canal used as a part of the canal system. Upon the resumption of navigation in the spring of 1913 there will be completed approximately 140 miles of the improved Barge Canal.

FINANCIAL—After having made an investigation of the possible cost for constructing a Barge Canal, a report was submitted to the Legislature in 1901 by the then State Engineer, setting forth the estimated cost of construcion along the various routes as then contemplated. In 1903 the then State Engineer, in answer to certain questions contained in a resolution adopted by the Assembly on Feb. 10, 1903, submitted certain data in which the total estimated cost of the Barge Canal project was fixed at $100,562,993, based upon the prices for labor and material governing at the time of making such report. With this information at hand the Legislature of 1903 authorized the issuance of bonds to the amount of $101,000,000 for carrying out the work, which, having been submitted to the people, was approved at the Fall election of that year.

It should be borne in mind that the prices of labor and materials have increased to a considerable extent since the enactment of the Barge Canal law; that the size of the locks has been increased by widening from 28 to 45 ft. that the grade has been lowered by legislative enactment between Tonawanda and Lockport and the rock cut at Lockport widened; that this work was done without additional appropriation but has added to the cost of construction approximately $4,500,000; and further, that recent legislative enactment now requires certain increased fixed charges, such as bonds and liability insurance, which of course must eventually be paid by the state, as they are included in the bids received for the various contracts.

To offset a portion of this added burden the appropriation of 1903 has been relieved to date of the construction of the canal from Tonawanda to Buffalo, the construction of the Troy dam, and a slight decrease in the expense of the work east of Lockport, due to changing the grade of the canal, the saving as a result of which items is estimated at $3,500,000.

It is my opinion that the cost of the actual construction as contemplated in 1903 and the cost of engineering in the preparation of plans and specifications and the supervision of construction appertaining to this improvement will be performed within the estimated amount for such items, but that the whole project as contemplated by Chapter 147 of the Laws of 1903 and amendatory acts cannot be completed within the original appropriation of $101,000,000. The principal excess in the cost of this undertaking is in connection with the appropriation of lands and structures, together with damage to water powers and riparian rights, for which items the allotment in the 1903 estimate appears to have been greatly deficient.

Summarizing the cost estimates of 1903 and 1912 we find:

	1903	1912
Total estimated cost of construction	$77,572,906	*$83,293,872
Railroad bridges	4,042,765	4,401,173
Engineering, administration and contingencies, Comptroller, and Superintendent of Public Works, etc.	11,793,273	9,500,000
	$93,408,944	$97,195,045
Increased cost, due to burden added without additional appropriation		4,500,000
		$92,695,045

*Includes certain work covered in 1903 contingent item.

This estimate of $97,195,045 does not include the item of $3,445,000 for the estimated cost of constructing bridges at points where there are existing bridges over the present canal, inasmuch as the question as to who shall defray the expense of such construction has not as yet been definitely determined. Deducting from the total estimate for 1912, as stated above, the items of increase in expense by reason of additional burdens, amounting to $4,500,000, placed upon the Barge Canal appropriation by reason of legislative enactment without providing for additional appropriations, it will make the present estimated cost of construction within the 1903 estimate covering the same territory.

From these figures it is therefore apparent that there is approximately $3,800,000 available with which to make payments in settlement an account of the appropriation of lands and water-power rights. The total estimated cost of the right-of-way in 1903 was $4,712,114, and it was estimated that the state would realize from the sale of abandoned lands the sum of $1,966,391, leaving a balance estimated for the payment of land damages of $2,745,723. The 1903 estimate included an item of $188,500 for paying riparian damages to property owners along the Oswego river, it being held the estimated cost of lands would be sufficient for the payment of riparian damages at other points. The total net estimated cost, therefore, of lands and water-power rights in 1903 was $2,944,223, after deducting the estimated return from the sale of abandoned canal lands.

In view of the uncertainty as to the position to be taken by the courts in the consideration of claims for damages on account of water-power appropriation, no attempt has been made to estimate the probable amount necessary to settle such claims. Inasmuch as a great many settlements have been made by the Special Examiner and Appraiser of awards made by the Board of Claims and the Court of Claims on account of appropriation of lands and buildings, such settlements of awards have been taken into consideration and by a comparison in connection with adjacent property which has been appropriated for canal purposes and for which settlements have not been made, a conservative estimate of the cost of lands necessary for Barge canal construction is placed at least $8,000,000, this figure not including any item on account of water-power settlements.

The State Comptroller has already made disbursements on account of Barge Canal construction, approximating $58,000,000. During the coming year a greater number of the large

contracts will be completed and it will be necessary for the state to make final payment. In addition to this the expenses of the different departments for administration, etc., must be met and the awards made by the Board of Claims and settlement agreements made by the Special Examiner and Appraiser must be paid.

It would, therefore, seem that within the course of the next two years, unless some action is taken by the Legislature, a condition will exist wherein the total appropriation of $101,000,000 will have been exhausted and the state will be under further obligations for expense for which there will be no funds available for payment. I, therefore, recommend to the Legislature the careful consideration of the enactment of some legislation to the end that funds shall be available when the same shall become necessary with which to meet this additional expense above the $101,000,000 heretofore authorized, which excess in expenses is due principally to the increase in the cost of lands and waters taken for Barge Canal purposes above the estimate of 1903.

CAYUGA AND SENECA CANAL

Chapter 391, Laws of 1909, appropriated the sum of $7,000,000 for the improvement of the Cayuga and Seneca Canal. This act provided for the improvement of this canal to Barge Canal dimensions the same as those for the Erie, Oswego and Champlain Canals. The work embraced in the Cayuga and Seneca improvement will be completed at such time as to permit of the navigation of this part of the Barge Canal system upon the completion of the Erie Canal system, namely, in 1915.

TROY DAM

The attention of the Legislature was called in my report for the year 1911 to certain conditions governing in connection with the construction of a dam across the Hudson River in the vicinity of Troy, which dam will be the key to the Barge Canal system of the State of New York.

Your honorable body is undoubtedly familiar with the steps taken by the former Canal Board toward canceling leases for the use of surplus waters at the site of the present dam and of the action on the part of the Federal authorities in assuming jurisdiction over the upper waters of the Hudson River and of the construction of a dam at the point in question. Accordingly the Federal authorities proceeded with the preparation of plans and specifications for a dam and lock to be constructed in the vicinity of Troy, approximately 1400 ft. above the site of the present dam. Proposals were invited for carrying on this work in accordance with the plans prepared, but no bid was received which approximated the estimate of the army engineers close enough to warrant the award of such contract. As a result, the United States government has determined to proceed with the construction of this dam with their own forces.

It is important that the Troy dam shall be completed as soon as the Barge Canal is completed in order to permit boats of Barge Canal dimensions to be locked through from the upper pool to the Hudson River below the Troy dam.

At the site of the Troy dam it will be possible to install a power development plant of considerable size, and there will be available for sale a large amount of power. This dam being within the bounds of New York State, it would appear just and proper that any revenue derived therefrom should properly be paid into the treasury of the State of New York, and furthermore, that the State of New York should have control over the structures at the entrance to the Barge Canal system.

I would, therefore, recommend for your careful consideration the questions arising in connection with the Troy dam situation, to the end that, if so deemed advisable, the necessary steps may be taken and an endeavor be made to return to the control of the state of New York the construction of and jurisdiction over the Troy dam, together with the disposal of power appurtenant to the site of the structure.

BARGE CANAL TERMINALS

Chapter [illegible] of the laws of 1911 authorized the issuing of bonds in the amount of $19,800,000 for the purpose of constructing terminals for the Barge Canal system throughout the state. This act was approved by the people in November, 1911.

To the end that the various localities might be provided with terminals which would conform to the plans for the Barge Canal terminals and at the same time meet the commercial demands of the [illegible] public hearings and meetings personally conducted by me have been held in the various ports where terminals are to be located, to the end that the desires of the people with respect to the location of terminals might be obtained.

To the end of the present fiscal year location plans for Barge Canal terminals for the following localities have been approved by the Canal Board: Ithaca, Albany, Little Falls, Utica, Gowanus Bay (South Brooklyn), Schuylerville, Schenectady, Rome, Lockport, Mechanicville, Fonda, Fort Edward, Greenpoint (North Brooklyn), Amsterdam, Erie Basin (Buffalo), Herkimer, Ilion, Troy, Constantia, Syracuse, Cleveland, Watkins, Port of Call (New York City) and Dresden.

Contracts have been entered into providing for the construction of terminals at the following localities: Ithaca, Albany, Little Falls, Mechanicville, Fort Edward, Schenectady and Herkimer.

The construction work on the terminals will be progressed with all possible speed.

Annual Meeting of the American Society of Civil Engineers

Several live subjects came up for discussion before the annual meeting of the American Society of Civil Engineers, held in the society house in New York City, on Jan. 15, 1913. By custom, the annual meeting is devoted to business proceedings and to the reception and discussion of special committee reports, no individual papers being presented. At last week's meeting both the committee reports and the society business discussed contained matter of considerable importance. The second report of the joint committee on concrete and reinforced concrete was presented (but not discussed). The other technical committees, generally speaking, reported progress only; in doing so several of them which have been standing for a number of years illustrated anew the fact that in this society things move slowly.

Under the head of society business, several active professional questions were brought up for discussion, such as codes of ethics for engineers, engineering employment and rates of compensation, the formation of an engineering employment exchange based on a broad plan, the International Engineering Congress at San Francisco in 1915, further centralization of the society control (if such be possible), and, last but not least, ways and means of increasing the interest of the semimonthly meetings of the society.

The election of new members of the nominating committee and the officers of the society resulted as follows

Nominating Committee: S. W. Hoag (New York, N. Y.), Charles T. Main (Boston, Mass.), Edward A. Fisher (Rochester, N. Y.), Richard Khuen (Pittsburgh, Penn.), J. B. Berry (Chicago, Ill.), Frank M. Kerr (New Orleans, La.), and William Mulholland (Los Angeles, Calif.).

New Officers: President, Prof. George F. Swain, of Boston, Mass.; Vice-Presidents, J. Waldo Smith, of New York City, and C. H. Rust, of Victoria, B. C.; Treasurer, John F. Wallace, of New York City; Members of the Board of Direction, Henry W. Hodge and James H. Edwards, of New York City, Leonard Metcalf, of Boston, Mass., Henry R. Leonard, of Philadelphia, Penn., Edward H. Conner, of Leavenworth, Kan., and Samuel H. Hedges, Seattle, Wash.

The society prizes for the year ending July, 1912, were awarded as follows: The Norman Medal to W. S. Kinnear for a paper on the Detroit River tunnel; the Rowland prize to Eugene Klapp and W. J. Douglas for a paper on the Minneapolis River bridge, and the Collingwood prize to W. W. Clifford for a paper on reinforced-concrete standpipes.

Business Proceedings

Passing over the report of the Board of Direction and of the several officials, all of which showed the society to be in a very flourishing condition, the first matter of interest was the action on the request of last year to appoint a committee to investigate the conditions of engineering employment and compensation.

Engineering Employment and Compensation—The Board of Direction has approved the proposal that such a committee be appointed. The following have been named as members of this committee: Alfred Noble, S. L. F. Deyo, D. C. Jackson, W. V. Judson, G. W. Tillson, C. F. Loweth, and J. A. Bensel.

A further development in the same subject was agitated through a letter by P. M. Churchill (Boston, Mass.), who submitted a motion asking that the Board of Direction confer with other engineering societies with a view to determining whether it is possible to establish an exchange for marketing engineering services, and that in case of a favorable decision a committee be appointed to consider the subject. This motion, unfortunately, was brought up near the close of the session. Whether partly on this account or because the meeting was not interested in the subject-matter of the motion, it was promptly passed over without discussion, by reference to the Board of Direction.

Code of Ethics—This subject was also brought up by P. M. Churchill. He advocated (by letter) that, in view of the fact that a standard code of ethics is greatly needed, the society should consider the adoption of the code recently drawn up by a committee of the American Society of Mechanical Engineers but not yet acted on by that organization (the code was printed in Eng. News., Jan. 2, 1913, p. 29). He proposed an intricate scheme by which action on this code and revision of the code could be secured without the appointment of a committee, through a letter ballot for opinion and suggestion as to revision, and a second letter ballot for adoption by sections.

This subject was also passed without discussion, being referred to the Board of Direction.

Method of Society Control—The Board of Direction presented a brief special report in which it advocated redistricting the society. At present the election of the nominating committee and of directors is carried on according to geographical districts, which theoretically are laid out to have approximately equal shares of the membership and to be representative of different territorial interests. There are at present seven such districts.

The Board of Direction proposed that the redistricting should be made so as to create a total of thirteen districts and that instead of two directors for districts there should be only one, elected as at present for two years, with the result that only half the total number of districts would elect a director in any given year. Inasmuch as the proposed change would require the constitution to be amended, the Board suggested that the subject be fully discussed by the meeting.

Besides an active discussion, this subject produced a pretty complex parliamentary tangle. The latter is well indicated by the series of votes as follows: First it was voted that the special report of the Board be approved and that an amendment as proposed be submitted to the society for vote. After some discussion it was then voted, quite without regard to the prior vote, that the plan to amend the constitution as proposed by the Board is desirable, but that consideration should be given to abolition of geographical restrictions from the election of officers. It was then separately moved to drop all mention of geographical divisions from the constitution, *but this motion was voted down almost unanimously.* It was finally voted that the whole matter be referred back to the Board of Direction, and that the Board be asked to recommend an amendment or series of amendments suited to the case. This conflicting set of motions evidently leaves the subject pretty much where it was before.

The discussion of the entire matter was quite active. Its chief result was to show that a certain number of members are in favor of dropping the scheme of division into geographical districts and regard this arrangement as being mere red tape, while a certain number of others strongly believe in the district plan as protecting the interest of the members living at a distance from New York. Speaking for the former party were G. S. Williams, R. L. Humphrey, S. Whinery, among others. The other party was represented by Prof. A. N. Talbot, N. P. Lewis, H. B. Seaman, and others.

Several auxiliary matters were injected. One of these was the matter of securing an adequately attended meeting of the nominating committee, and it was proposed that to secure a full attendance the members of the nominating committee be paid their traveling expenses to either the annual meeting or the summer convention of the society. It was also suggested that the members of the Board of Direction might be paid salaries, in the same way as the officers of a corporation are paid. These expenses-and-salary suggestions were made with direct reference to the fact, shown by the financial report, that the society's income exceeds its expenses by about $30,000 per year.

Other Business—A letter of E. W. Clarke, addressed to the Board of Direction, made the suggestion that the practice of reading papers at the semi-monthly meetings of the society be discontinued, on the grounds that this reading is a bore and that there is little discussion, the evening of the meeting being valuable chiefly for the social coming together of the members. As a means of making the meetings interesting he suggested that lantern slides of construction work in progress be presented, or other entertainment of an engineering character be offered, and that for the rest the gathering being treated as a social meeting. To carry out his suggestion he offered a motion that it be suggested to the Board of Direction that the Board take steps to find out whether engineering entertainment suitable for the meeting can be obtained.

A number of speakers, discussing the letter, actively seconded the proposal to inject a little more activity into the meetings. An amendment was offered to the effect that a committee be appointed to investigate the entire subject of handling the programs, considering even such questions as paying authors of papers, securing papers through direct invitation, etc. It was further moved that a committee of five be appointed to consider the entire subject of improving methods of presentation of papers. This motion was finally adopted.

H. M. Wilson called attention to the fact that this annual meeting overtaxed the capacity of the society house and that the inadequate facilities were alleged as the reason why a lunch is not provided there for the

members on the first day of the annual meeting. In view of these facts he moved that the Board of Direction be requested to consider plans for increasing the capacity of the society house to make it adequate for the annual meeting and the like. This motion was carried.

It was also voted that the Board of Direction be instructed to employ the best talent available to determine how the acoustics of the meeting hall might be improved.

Secretary Charles Warren Hunt reported the preliminary arrangements toward organizing the International Engineering Congress, which is to be held in San Francisco in 1915, at the time of the Panama-Pacific Exposition. The original suggestion for such a congress came from the Pacific Coast engineers, who proposed that the congress be conducted by the several national engineering societies jointly, each society conducting that part pertaining to its own work. The first final outcome was a financing plan which called for a local contribution of $10,000 and society contributions as follows: American Society of Civil Engineers, $9000; American Institute of Electrical Engineers, $9000; American Society of Mechanical Engineers, $5000; American Institute of Mining Engineers, $5000; Society of Naval Architects & Marine Engineers, $2000; a total of $40,000. However, the electrical society has to contribute heavily toward conducting the International Electrical Congress at the time, and on this account their contribution to the Engineering Congress is reduced to $3500. The organization and management is to be in the hands of a committee of 30, made up of delegates from the different societies (including in each case the president and secretary, *ex-officio*) and having the remaining representation of Pacific Coast members.

Technical Proceedings

The most important item of the technical program was the second report of the society's delegation on the Joint Committee on Concrete and Reinforced Concrete. The report, presented in printed form, was introduced briefly by R. L. Humphrey.

While the report is far too bulky for reprinting here (it covers 52 pages of the regular "Transactions" sizes), the following is a brief summary of the main points in which the new report differs from the first report rendered four years ago (January, 1909).

New Features of Concrete Report—A historical introduction and bibliography is added. An express caution is added that the report is not to be regarded as a specification, but may be used as a basis for a specification. Under the heading of Destructive Agencies the relation of *electrolytic disintegration* to the durability of concrete is stated quite fully in accordance with the most recent experimental conclusions. The qualities of *fine aggregates* are stated more fully; something is added on *high-carbon* [illegible]. The section on *Proportioning Concrete* is a little amplified. For *mixing* a definite minimum length of mixing period is recommended, although no figure is given for this minimum. The desirability of [illegible] is discussed. Time of [illegible] is a little amplified. How to prevent [illegible] is made the subject of a few paragraphs [illegible] differently from those in the former report. The [illegible] of concrete to be deposited under different conditions are somewhat modified. [illegible] ratio of 8 is recommended to compute deflection where the former report stated 8 to 12, and different ratios are given for concrete of different normal strengths. A little more detailed specification of *T-beam proportions*, and stricter fixing of assumption for continuous or *constrained beams* or slabs, are provided. Slabs having *reinforcement in more than one direction* are honored by two paragraphs of discussion, containing numerous cautionary statements. More conservative statements are made on *bond strength*. A considerably revised discussion of *diagonal tension* and *shear* is presented. Several new features are found in the section on *Columns*, an important one being the omission of structural-steel reinforcement as one of the classifications. A table of *mean compressive strengths* of concretes having different kinds of stone and different proportions of mixture is given, with the recommendation that these values should be the maximum ultimate strengths on which designing should be based. The recommended *unit-stresses* for shear and diagonal tension are modified.

As already remarked, there was no discussion on the report.

Engineering Education—On this subject Desmond Fitzgerald presented an informal progress report. It appears that the committee is waiting for the Carnegie Foundation to make the necessary investigation on which a report may be based.

Steel Columns—A. L. Bowman reported progress for this committee. The full program of tests laid out by the committee is to be carried through by the U. S. Bureau of Standards, beginning shortly. The tests have been postponed by delay in getting ready the new testing-machine, but the machine is now in operation and about half of the test material has been purchased.

Bearing Value of Soils—The Board of Direction has decided to appoint a special committee on bearing value of different soils for foundations. The committee has not yet been completely made up.

Valuation of Public Utilities—F. P. Stearns, Boston, Mass., reported progress for the committee appointed to formulate principles to govern the valuation of public utilities.

Bituminous Material for Road Construction—The committee reported through W. W. Crosby. Essentially its report was a report of progress, but a number of suggestions and fragmentary recommendations were made. The committee defined bitumen in the same definition as used by the American Society for Testing Materials, the criterion being solubility in carbon disulphide. It also defines bituminous materials as materials containing bitumen. It may later fix limits for the maximum amount of distillate in tar up to 170° C. (different limits for different conditions of origin and use), limits for free carbon in tar for superficial treatment, etc. In addition to its definition of bituminous surfaces, etc., the committee presented a definition for bituminous-concrete pavement, the definition involving the mixing method of preparation. On the question of seal coats for mixture-method pavements the committee recommended further investigation. It renewed its recommendation of a year ago for drawing up a standard method of recording costs.

The report of the committee was not discussed, but the report was received and the committee continued. This same remark also applies to the reports of the other committees above noted.

The Portland Cement Specification of Lackawanna R.R.

As a result of an extended investigation the Delaware, Lackawanna & Western R.R. has decided to adopt a specification for the purchase of portland cement, which differs in some important features from the standard specifications adopted by the United States Government or by the American Society for Testing Materials. As announced in ENGINEERING NEWS, June 13, 1912, p. 1111, the main divergence is in the matter of soundness tests, for which the Lackawanna has adopted the "autoclave" boiling-pressure test, described in our previous article, instead of the ordinary boiling test prescribed by the usual standards. The full text of the specification, adopted Jan. 1, 1913, is as follows:

Definition

1. The cement shall be the product obtained by finely pulverizing clinker produced by calcining to incipient fusion, an intimate mixture of properly proportioned argillaceous and calcareous substances, with only such additions subsequent to calcining as may be necessary to control certain properties. Such additions shall not exceed 3%, by weight, of the calcined product.

Specific Gravity

2. The specific gravity of the cement shall not be less than 3.10.

Fineness

3. 95% of the cement, by weight, shall pass through the No. 100 sieve, and 80% of the cement, by weight, shall pass through the No. 200 sieve.

Time of Setting

4. The cement shall not acquire its initial set in less than 1 hour and must have acquired its final set within ten hours.

Soundness—Force Autoclave Test

5. Three neat briquettes to be made up in the usual manner and allowed to remain in the damp closet for 24 hours. At the expiration of that time, the briquettes are to be removed from the molds and placed in the autoclave, sufficient water being added to partly or wholly cover the briquettes. The autoclave is then closed, the burners being of sufficient size to raise the pressure to 295 lb. in not more than 1 hour. The pressure of 295 lb. shall be maintained for 1 hour longer, or a total time of 2 hours. The pressure is then to be gradually released, the briquettes taken out and placed in the moist closet, where they shall be allowed to remain for 1 hour. At the end of that time they are to be broken in the standard cement-testing machine in the usual manner. The average tensile strength of the three briquettes taken from the autoclave must show a tensile strength of not less than 500 lb. per sq.in. They must also show an increase of not less than 25% over the average tensile strength of three briquettes broken at the end of 24 hours. A bar of neat cement, 6 in. long by 1 in. square, shall be made up at the same time the briquettes are made. This expansion bar to remain in the moist closet for 24 hours and to be removed along with the briquettes and tested with the briquettes in the autoclave, as indicated above. After one hour in the moist closet, this expansion bar shall not show an expansion greater than ½%.

Tensile Strength

6. The minimum requirements for tensile strength for briquettes 1 in. square in section shall be within the following:

Age	Strength
Neat Cement	
24 hours in moist air	200 lb.
7 days (1 day in moist air, 6 days in water)	500 lb.
28 days (1 day in moist air, 27 days in water)	600 lb.
One Part Cement, Three Parts Sand	
7 days (1 day in moist air, 6 days in water)	250 lb.
28 days (1 day in moist air, 27 days in water)	375 lb.

The average of the tensile strengths developed at each age by the briquettes in any set made from one sample is to be considered the tensile strength of the sample at that age. Any results that are manifestly faulty will not be included. The sand briquettes will be thoroughly tamped in the molds by using an iron die to fit inside the sand briquette mold, this die to be struck a number of blows with a wooden mallet.

Composition

7. In the finished cement, the following limits shall not be exceeded:

[Limits shown in table at top of next column]

	Per Cent
Loss on ignition for 20 minutes	1
Insoluble residue	1
Sulphuric anhydride (SO_3)	1.75
Magnesia (MgO)	4

8. The insoluble residue shall be determined on a 1-gram sample which is digested on the steam bath in hydrochloric acid of approximately 1.035 specific gravity until the cement is dissolved. The residue is filtered, washed with hot water, and the filterer paper contents digested on the steam bath in a 5% solution of sodium carbonate. The residue is then filtered, washed with hot water, then with hydrochloric acid, approximately of 1.035 specific gravity, and finally with hot water, then ignited and weighed. The quantity so obtained is insoluble residue.

Inspection

9. All cement which is used by the above named company, or any contractors doing work for the above named company, must be sampled at the mill. The inspector will take a sample from each and every car and properly seal the cars with the company's seals.

In no case must cement be shipped from any mill without the company's inspector being present. Should it be necessary at any time to ship cement without inspection at the mill, but which inspection will be made at point of destination, the shipper must so notify the chemist and engineer of tests, and receive special orders from him for the shipping of the cement.

The inspector must have access to all parts of the mill, either day or night, when any contract is being filled for the company.

The shipper must furnish the office of the chemist and engineer of tests with analysis and physical tests showing results obtained upon the bin from which shipments are made.

Samples taken from every car will be sent to the laboratory for further test and inspection. Any sample which fails to meet any or all of the above requirements will be condemned and returned to the shipper, who must pay freight charges in both directions.

Samples of cement obtained from cars which continue to show a lower result at the end of the 28-day sand test than is shown in the 7-day sand test will be sufficient cause for the canceling of any contract which at that time may be in force.

The following tabulation shows the main divergent items between the above specification and that adopted by the American Society for Testing Materials. The comparison is made by the editors of ENGINEERING NEWS and is not a part of the above specification.

	Lackawanna	Am. Soc. T. M.
Fineness—Through 100 mesh	95%	92%
Through 200 mesh	80%	75%
Initial set	<1 hr.	<30 min.
Soundness	Autoclave	Air and Boiling
Tensile strength:		
Neat—24 hr.	200 lb. per sq.in.	175 lb. per sq.in.
1:3—7 days	250 lb. per sq.in.	200 lb. per sq.in.
1:3—28 days	375 lb. per sq.in.	275 lb. per sq.in.

❖

Reduced Gas Rates will become effective throughout northern New Jersey on and after May 1, as the result of conferences between the Public Service Gas Co. and the State Board of Public Utility Commissioners. For many weeks the Commission has been studying the investment and operating expenses of the Passaic Division of the Public Service Gas Co., and recently rendered a decision that a rate of 90c. per 1000 cu.ft. for this district would be reasonable. The valuation of the company's property and business was placed at $5,775,000, compared with $12,000,042, as claimed by the company. The difference is partly in the items of special franchises, which were rejected. A contention that the evaluation should not fall below the par value of securities issued, in a merger of six companies dating before the present company's lease, was also rejected.

The company accepted the order of the commission fixing the price at 90c., but reserved the right to test at its convenience the legality and constitutionality of the Board's principles of valuation.

The Commission also recommended that the price of gas be reduced from $1 to 90c. throughout the entire area served by the company in the state and this recommendation was accepted by the company pending the termination of litigation of principles of the valuation. The device of the company to adjudicate the difference in principles of valuation, was commended by the Commission.

Drainage Area and Population of the Ohio River Valley and Pollution of the Ohio River

By A. H. Horton*

The drainage basin of the Ohio River comprises parts of 14 states, not one of which lies wholly within the basin. Table I gives the area and percentage of the total area of each state within the basin; also the rural, urban and total population, and the percentage each is of the total in each state.† It is of interest to note that the percentage of each state's total area and the percentage of each state's total population within the basin agree quite closely, with the exception of the State of Illinois.

Table II gives the area, rural, urban and total population and the percentage each is of the total in the basin for different points along the Ohio River.

An examination of Table No. II will convince any one of the necessity of treating the Ohio River water before using it for a municipal water-supply.

The International Waterways Commission, under date of Jan. 4, 1907, states that "the latest conclusions of sanitary engineers as to the amount of dilution which is required to make sewage inoffensive are that a dilution of 3⅓ cu.ft. per sec. per 1000 persons connected with the sewers is as low a figure as it is now possible to state." At the Ohio-Pennsylvania state line the minimum flow of the Ohio River in 1908 was approximately 1100 sec.-ft. At the present time probably not all towns of 2500 population and over in the Ohio Valley are provided with sewers. The percentage of urban population in towns between 2500 and 5000 population is small, for in Ohio and Kentucky the urban population in cities between these limits is but 12 and 9%, respectively, of the total urban in each state; towns of 5000 population or over generally have more or less complete sewer systems. Perhaps not more than 75% of the population in sewered towns are provided with sewers, depending upon how rigidly the municipal authorities enforce the laws which most cities have that sewer connections must be made. It is not thought necessary, however, in this brief discussion to enter into modifying details, as the reader may use whatever coefficients he thinks advisable to reduce the data to actual conditions. Assuming, therefore, that all the urban population is connected with sewers, since it will not be so very long before this will be practically true, the flow at the Ohio-Pennsylvania state line should be 1626 times 3⅓, or 5420 sec.-ft.; the minimum flow of the Ohio River in 1908 at the point under consideration was, therefore, only one-fifth of that required to make the sewage in the river inoffensive.

Above the mouth of the Little Miami River (intake of Cincinnati water-works) the urban population is 2,524,000; the minimum flow at this point in 1908 was approximately 5000 sec.-ft. The amount required for proper dilution is 8400 sec.-ft. At Evansville, Ind., the minimum flow in 1908 was approximately 8000 sec.-ft.; the urban population above this point is 3,762,000. The flow required is 12,500 sec.-ft.

The above figures, with the assumption as stated, show that at no point on the Ohio River is the minimum flow sufficient to render the sewage that enters the river inoffensive. Under the conditions that prevail at ordinary low-water stages perhaps little of the sewage from the State of Pennsylvania arrives as far down the river as Cincinnati or Evansville. But if a long continued

*District Engineer, U. S. Geological Survey, Newport, Ky.

†Urban population, as defined by the 1910 Census, is the population in towns of 2500 or over.

Population data in Tables Nos. I and II were taken from the 1910 Census. Areas were taken from Rand & McNally's Atlas, 1908. Population and area were worked up by counties. The distribution of the rural population was assumed to be proportional to each county's area where the outline of any drainage area passed through a county; in such counties the actual location of the urban population was determined so as to exclude towns and cities outside of the basin.

TABLE I. AREA AND POPULATION OF THE OHIO RIVER DRAINAGE BASIN BY STATES

State	Area: In Ohio Basin, sq.mi	Area: Percentage of entire state	Population: Rural	Population: Percentage of total rural in state	Population: Urban	Population: Percentage of total urban in state	Population: Total	Percentage of total in state
Alabama	6,842	13.3	249,742	14.1	32,835	8.9	282,577	13 2
Georgia	1,516	2 6	45,565	2.2	...	0	45,565	1 8
Illinois	11,395	20 3	451,234	20 9	136,484	3 9	587,718	10.4
Indiana	29,292	81 6	1,311,466	84 2	860,091	75 3	2,171,557	80 5
Kentucky	38,859	97 1	1,676,905	96 9	544,215	98 1	2,221,120	97.1
Maryland	422	4.3	12,867	2.0	...	0	12,867	1.0
Mississippi	397	0.9	12,241	0 8	...	0	12,241	0.7
New York	1,889	4 0	71,499	3.7	51,832	0.7	123,331	1.4
North Carolina	6,105	12.6	209,372	11.1	21,580	6.8	230,952	10.5
Ohio	29,030	71.2	1,502,985	71.5	1,549,379	58 1	3,052,364	64 0
Pennsylvania	15,310	34 0	1,210,103	39 9	1,380,122	29 8	2,590,225	33 8
Tennessee	33,659	80.6	1,346,605	77 2	276,305	62.7	1,622,910	74 5
Virginia	7,222	18 0	306,089	19 3	23,627	5.0	329,716	15 9
West Virginia	21,083	85 7	907,269	91 5	211,177	92 6	1,118,446	91 6
Total	203,021	34.6	9,313,942	37.6	5,087,647	22 2	14,401,589	30 2

Note. The percentages in the line of totals are percentages of the totals of all the 14 states.

TABLE II. AREA AND POPULATION OF THE OHIO RIVER DRAINAGE BASIN ABOVE DIFFERENT POINTS ON THE OHIO RIVER

	Distance below Pittsburgh, miles	Area: Sq.mi	Area: Percentage of total	Population: Rural	Population: Percentage of total rural	Population: Urban	Population: Percentage of total urban	Population: Total	Percentage of total in basin
1	0	19,004	9 3	1,221,258	13 1	1,258,203	24 7	2,479,461	17.2
2	49	23,408	11 5	1,552,489	16 7	1,625,855	32 0	3,178,344	22.1
3	90	24,803	12 2	1,677,900	18 0	1,688,264	33 2	3,366,164	23.4
4	Parkersburg.... 184	35,188	17 3	2,207,388	23 7	2,026,865	39 8	4,234,253	29.4
5	[illegible] 184	37,667	18 5	2,305,939	24 8	2,044,707	40 2	4,350,646	30.2
6	[illegible] 317	60,432	29 7	3,252,581	34 9	2,192,674	43 1	5,455,255	37.8
7	[illegible] 491	70,252	34.6	3,713,144	39 9	2,524,303	49 6	6,237,447	43 3
8	[illegible] 486	75,799	37 4	4,067,844	43 0	3,009,411	60 3	7,077,234	49 1
9	[illegible] 530	77,119	40 1	4,244,057	46 1	3,374,654	66 4	7,668,092	53 2
10	[illegible] 602	90,254	44 6	4,671,302	50 2	3,453,720	68 0	8,125,062	56.4
11	[illegible] 727	105,629	52 2	5,448,186	57 4	3,701,947	74 0	9,110,133	63 3
12	[illegible] 846	147,[illegible]	68 [illegible]	6,811,869	73 1	4,662,123	91 7	11,473,932	79.6
13	[illegible] 974	[illegible]	99 [illegible]	9,266,554	99 5	5,054,586	99 4	14,321,140	99 5
14	Mouth [illegible]	[illegible]	100 0	9,313,942	100.0	5,087,647	100 0	14,401,589	100.0

Note. Nos. 1 [illegible] Pittsburgh, Nos. 3, 4, 10, 11 and 14 do not include the population of Wheeling, Parkersburg, Louisville, Evansville and Paducah respectively. No. 9 includes the Ohio and Miami Rivers. No. 14 includes the Cumberland and Tenn. Rivers.

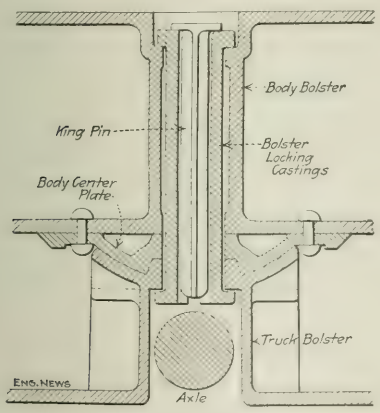
drought be followed by a general rain which causes a rise of 5 to 10 ft. in the river and the dams in the river to be lowered, an immense amount of sewage and filth of every description along the entire length of the river would be swept into and down the river. Under such conditions it might be possible that even the flow of the river at the increased stage would be insufficient to produce the prescribed amount of dilution. After all, the question is not one of dilution to make the sewage inoffensive, but whether or not the untreated Ohio River water is suitable for a municipal water-supply; and no one, after examining Table II and reading the above discussion, would be willing to claim that the conclusions were not justified and to recommend the raw Ohio River water as a suitable water-supply for any town.

The need of legislation to control and limit the pollution of the Ohio River and tributaries is at once apparent and should be undertaken without delay. Legislation affecting so many states can only be prescribed by the federal government, for it is easily discernible that the problem is beyond the power of any one state, and that it would be practically impossible for a combination or association composed of all or part of the states in the Ohio River basin to arrive at any definite concerted action.

❋

A Simple Device for Locking Passenger Car Bodies to Trucks

One of the causes of casualties in railway wrecks with ordinary passenger coaches is the ease with which the car body is pushed off the trucks and telescoped. Constant increase in the size and weight of car bodies has increased this tendency where the car bodies are held on



DEVICE FOR LOCKING CAR BODIES TO TRUCKS; GRAND TRUNK RY.

the trucks in the standard way with center plate and plain king bolt. The steel underframe of the modern car is sufficiently strong to stand heavy shock or impact with the buffing devices now commonly used, and if the car bodies are prevented from lifting and riding the platforms of adjoining cars, the danger of telescoping is greatly diminished.

With this end in view the Grand Trunk Ry. has recently adopted a simple device which is being applied to a number of new cars, and will hereafter be standard on all passenger equipment on the Grand Trunk Ry. lines. This device, shown in the accompanying illustration, consists of a steel key and ribbed pin in place of the ordinary, plain king bolt. The key is made of two sections of a hollow steel cylinder with flanges top and bottom. The flanges lock the truck frame to the car-body bolster, and the key is held in place by the ribbed king bolt, which is dropped into the cylindrical space within the key. This device does not interfere in any way with the free and flexible movement of the trucks, as provision has been made to give sufficient clearance, and the key may be removed with little more difficulty than an ordinary king bolt.

The locking device is the invention of J. Coleman, Superintendent of the Car Department, Grand Trunk Ry., to whom we are indebted for the foregoing description.

❋

In a Rear End Collision on the Midland Ry., near Birmingham, England, on Jan. 13, two persons were killed and 40 injured.

Six Million Packages Were Handled by the Parcels Post during the first week after its installation, according to press reports.

Two Tunnel Explosions occurred at Chicago, on Jan. 14 and 15, in a branch water-supply tunnel, at about 72d St. and Cottage Grove Ave. Pockets of natural gas are considered as the cause of both accidents. The first occurred about 11:30 p.m., and three men were badly burned. The second occurred about 5 a.m., killing one man and injuring eight more. The tunnel is to supply Jackson Park and Washington Park. It extends from a pumping station at 58th St. and Cottage Grove Ave. to 73d St. and Drexel Ave., where it will connect with the Southwest tunnel of the city's water-supply system. It is expected to be completed next summer.

A Suit for Electrolytic Damage to a concrete building has been brought in the court of Lehigh County, Penn., by the Arbogast & Bastian Co., owner of a packing house in Allentown, Penn., against the Lehigh Valley Transit Co., which owns an electric power house within a few yards of the packing house. Suit has been brought to recover damages to the sum of $300,000 for the alleged damage to the building by stray electric currents from the power house. This is the building which was described extensively in "Engineering News," June 8, 1911, p. 684 and 1912, p. 149.

A Joint Water-Supply for the cities and towns of the Willamette Valley, Oregon, has been reported on for the State Board of Health by L. C. Kelsey, of Portland. It is estimated that a supply could be brought from Clear Lake, at the head of the Willamette River, for about $4,000,000. The pipeline would be 116 miles long, from 44 to 36 in. in diameter and would have a capacity, at its upper end, of 30,000,000 gal. Ten or dozen towns and a number of state institutions would be supplied. These towns include Salem, the state capital, which is now supplied privately with water from a gravel bar in the Willamette River. State and municipal cooperation is proposed, but it appears that an issue of state bonds for this purpose might require a constitutional amendment, which could not be voted on until 1914.

A Very Large Mine Hoisting Engine is to be built for the Inverness Railway & Coal Co., of Cape Breton, Canada, by the Nordberg Manufacturing Co., of Milwaukee, Wis. The two cylinders are 34 in. in diameter with a 72-in. stroke, and the hoist has two drums, each equipped with clutches and post brakes enabling either drum to be operated independently. The hoist is designed to be able to lift the following load: A train of 12 mine cars, each of which weighs 1150 lb. and contains one long ton of coal. This train of cars has to be hauled up an incline 10,000 ft. in length, which has a slope of 16° at the surface and 35° at the bottom. The maximum stress on the hoisting cable is about 41,000 lb. The order was secured by the Nordberg Co. in competition with both German and English bidders.

A Very Large Reinforced-concrete Arch Bridge is being designed for the Chur-Arosa Ry., in Switzerland, to be known as the Langwiesen viaduct. It will have a main arch of 328.1 ft. calculated span, which will give a clear opening between skewbacks of 315 ft. This will be, if built as designed, somewhat smaller than the present largest concrete arch, the 328-ft. span across the Tiber. The bridge is being designed by E. Züblin & Co., Basel, Switzerland, under specifications approximately equivalent to those of the Swiss Reinforced-Concrete Committee.

The Mildness of the Present Winter in the eastern part of the United States in indicated by the fact that the Hudson River is still open for navigation to Albany. With the exception of the winter of 1889-90, when the river was not closed at all, but remained open from Mar. 10, 1889, to Dec. 2, 1890, this is the latest date the river has remained open in its history. Complete records dating back to 1824, are on record in the State Engineer's office, at Albany, and unofficial records before that time confirm the above statements. Only three times since 1824 has the closing of the river run over into the new year: in 1825, Jan. 5; in 1829, Jan. 14, and in 1882, Jan. 2. Generally navigation is stopped by Dec. 15. These data are based on the records of the New York State Engineer and Surveyor, and do not entirely agree with those of the U. S. Weather Bureau.

Severe Storms on the Atlantic during January, have done great damage to shipping. The Cunard liner "Mauretania" reached New York on Jan. 19, two days overdue. Her promenade deck shield was destroyed and her bridge damaged by a big wave on Jan. 15.

The steamship "El Dorado," of the Morgan Line, which sailed from Baltimore, Md., on Jan. 1, with a cargo of steel rails, for Galveston, Tex., has not been heard from and is thought to have gone down with her crew of 39 men in the storm of Jan. 3.

The Lamport & Holt Line Steamer "Veronese," sailing from Glasgow to Brazil, was wrecked off the coast of Portugal on Jan. 16.

The British steamer "Snowdon Range," which sailed from Philadelphia, on Nov. 23, bound for Leith, Scotland, docked at Queenstown on Jan. 14, after losing her rudder and drifting for seven weeks. The boat was sighted by the Dominion Liner "Welshman," about 500 miles out from Queenstown and towed into that port.

A Concrete Pile Test—In our issue of Dec. 19, 1912, page 1181, we noted the test of a very large reinforced-concrete column before a delegation from the National Association of Cement Users in the laboratory of the U. S. Bureau of Standards at Pittsburgh. On account of the very low ultimate value which this column reached, there has been considerable interest in the test, but it has not been generally understood that the test was in the nature of a spectacle for the visiting engineers rather than a complete investigation of the strength of a concrete column. As noted in our previous issue, the column was the largest reinforced-concrete column ever tested, being 30 in. in outside diameter with a 27-in. core within a helix reinforcement, which gave a total core area of 572.55 sq.in. The failing load was close to 2,000,000 lb., which in itself indicates the extraordinary size of the column as well as the value of the test as a spectacle. For the benefit of those who are in doubt as to the strength of the column, we would say that it was only 25 days old when tested, and that the concrete had not been protected from the time it was cast until it was broken, during which time the weather was closely approximately freezing. It is estimated from tests on other concrete made at about the same time that the value of the concrete at this age would hardly have exceeded 1400 lb. per sq.in. ultimate. No very complete log of the test was taken, but, as we stated before, the first sign of distress, which was the beginning of the spalling of the outside concrete, occurred at about 1500 lb. per sq.in. and the total load carried was 1,950,000, or about 3400 lb. per sq.in. core area.

Another Derailment of the Chicago Elevated Loop occurred Jan. 15, under very similar circumstances to that of the accident recorded in our issue of Jan. 16. As noted in the former article, two of the right-angle curves on the loop (with radii of 90 and 95 ft.) are intersected by grade crossings, making a complicated track arrangement and involving [illegible] of that angle and the absence of superelevation on the curves. In the first accident, the rear rail car of a train was derailed at the crossing on the curve turning the corner from Van Buren St. into Fifth Ave. In the second accident the head car (a motor car) of a train of the North-western Elevated Ry. was derailed at the crossing on the curve turning the corner from Wabash Ave. into Van Buren St. Fortunately the train was running slowly, partly as the result of orders issued after the first accident. There was no great damage, but the tracks were blocked for some time, and South Side trains were unable to enter or leave the loop. It is proposed now to still further reduce the speed to 5 m. p. h. at the curves, and the management has suggested the use of steel girders as guard rails, extending some 4 ft. above the ties. These cou'd not be used at the crossings, however, and it is not clear how they would be attached to the structure. The main longitudinal girders are under the track, and apparently the only available supports are the tops of the columns carrying the transverse girders.

A Suspension Bridge of 2700-ft. span over the Mersey River, at Liverpool, England, was proposed by L. H. Chase, in a paper recently read before the Liverpool Engineering Society. The main dimensions of the proposed structure are given as follows, in the London "Times," Engineering Supplement, of Dec. 26: Main span, 2700 ft. long; towers, 500 ft. high; height above high-water mark, 200 ft.; depth of girders, 50 ft.; weight of girders, 2100 tons; width between girders, 50 ft.; width between towers 300 ft.; and weight of cables (410 sq.in. in each), 6400 tons. The total cost, exclusive of land and legal expenses, he thought should not exceed £825,000 (about $4,000,000).

The bridge is proposed only for automobile and street-car traffic. Instead of making long approaches on each shore a spiral incline was proposed, the spiral having an external diameter of 300 ft. and internal diameter of 200 ft., with a building occupying the space inside the helix.

United States Patents Expire with Foreign Patents notwithstanding the Brussels treaty of 1900, according to a decision of the U. S. Supreme Court announced on Jan. 20, 1913 (see note beginning "The Cameron Septic Tank Process Patent," immediately below.)

The Cameron Septic Tank Process Patent Expired in November, 1909, with the original British patent, according to a decision by the U. S. Supreme Court, announced Jan. 20, 1913, in a suit between the Cameron Septic Tank Co., of Chicago, and the city of Knoxville, Iowa. The company named maintained that the life of the patent (U. S. No. 634,423, to Cameron, Commin and Martin, Oct. 3, 1899) was extended to the full term of 17 years by an agreement covering all such cases reached on Dec. 15, 1900, by the International Conference for the Protection of Industrial Property, and subsequently ratified by the U. S. Senate (see "Eng. News," Oct. 14, 1909, p. 414, for a detailed statement of the company's claims, as made by H. D. Wyllie).

Presumably this decision will result in the termination of the suit brought in 1912 by the Cameron Septic Tank Co. against the city of Winchester, Ky., for infringement of the Cameron process patent on account of the construction by that city of an Imhoff or Emscher tank after designs by Chas. E. Collins, of Philadelphia.

There is now pending before the U. S. Court of Claims a suit brought by the Cameron Septic Tank Co. for the payment of royalties by the United States on account of septic tanks built by the War Department. The government, we understand, maintains that the Cameron patent, at least as regards the tanks built by it, is invalid, notwithstanding the decision of the U. S. Supreme Court affirming the process claims (but denying the apparatus claims), in the suit brought by the company against the village of Saratoga Springs, N. Y. (See "Eng. News," Jan. 23, 1908, pp. 88-91, for this decision; also Mar. 28, 1907, pp. 347-51, for decision of the lower court which declared the whole patent void, "for want of patentable invention"). So far as we can learn, no award for damages or royalties has ever been made in the Saratoga Springs case, although the court appointed a master to report on the subject as long ago as Feb. 20, 1908.

PERSONALS

Mr. U. E. Gillen, Superintendent of the Grand Trunk Ry., at Montreal, Que., has been promoted to be General Superintendent of the Western lines.

Mr. C. G. Bowker, Superintendent of the Grand Trunk Ry., at St. Thomas, Ont., has been promoted to be General Superintendent of the Eastern lines.

Mr. D. Crombie, Assistant to the Vice-President of the Grand Trunk Ry., at Montreal, Que., has been promoted to be General Superintendent of Transportation.

Mr. H. E. Whittenberger, formerly Superintendent of the Grand Trunk Ry., at Toronto, Ont., has been promoted to be

General Superintendent of the Ontario lines, the Toronto terminals and the Barrie division.

Mr. W. R. Cameron has resigned as City Engineer of Cairo, Ill. According to newspaper reports Mr. Cameron resigned because local political influences interfered with the proper performance of his work. He has accepted a position in St. Louis, Mo.

Mr. J. W. Knightlinger, recently Trainmaster of the Southern Pacific Ry., at Roseville, Calif., has been appointed Assistant Superintendent of the Louisiana Western R.R. and Morgan's Louisiana & Texas R.R. & Steamship Co., at New Orleans, La.

Mr. S. P. Waldron, M. Am. Soc. C. E., of New York City, has been appointed Contracting Manager of the Boston, Mass., office of the American Bridge Co., of New York, succeeding the late H. J. Kattell. Mr. Waldron's headquarters will be in the John Hancock Bldg., 120 Franklin St., Boston, Mass.

Mr. A. P. Prendergast, Division Superintendent of Motive Power of the Baltimore & Ohio Southwestern R.R., at Cincinnati, Ohio, has been transferred to Baltimore, Md., with the title of Superintendent of Motive Power of the entire eastern system, reporting directly to the General Manager of the eastern lines.

Mr. E. W. Sylvester, of Albany, N. Y., has been appointed Superintendent of Public Works, of Poughkeepsie, N. Y. Mr. Sylvester has been at different times First Assistant Engineer, New York State Highway Department, Assistant Engineer, New York State Barge Canal and the Albany city engineering department.

Mr. M. M. Worthington, a civil engineer, has been appointed City Manager of Sumter, S. C., succeeding Mr. Wm. F. Robertson, who was appointed as noted in our issue of Nov. 28, but resigned a short time later to accept a position in engineering work. Mr. Worthington has been with the Atlantic Coast Line R.R.

Mr. Walter G. Fox, formerly Engineer in charge of construction of the extension of the Mexican Southern Ry., has been appointed one of the Directors of Engineering and Construction of the Ferrocarril al Curaray, a new line being built by the government of Ecuador. Mr. Fox will have his headquarters at Ambato, Ecuador.

Dr. R. E. Doolittle, who has been acting Chief of the Bureau of Chemistry, U. S. Department of Agriculture, since the resignation of Dr. Harvey W. Wiley, has returned to his former position as Chemist for the appraisers, Customs Service, New York City. Dr. Carl Alsberg has been appointed Chief of the Bureau of Chemistry.

Mr. A. M. Lupfer, M. Am. Soc. C. E., of Spokane, Wash., has been appointed Chief Engineer of the Spokane, Portland & Seattle, the Oregon Trunk and the Spokane & Inland Empire Rys., with headquarters at Portland, Ore., succeeding Mr. Ralph Budd, resigned, as noted in our issue of Jan. 2. Mr. Lupfer was Chief Engineer of Spokane & Inland Empire Ry., three years ago.

Mr. M. J. McCarthy, formerly Assistant Superintendent of Motive Power of the Cleveland, Cincinnati, Chicago & St. Louis Ry., at Beech Grove, Ind., has been appointed Superintendent of Motive Power of the Baltimore & Ohio Southwestern R.R. and the Cincinnati, Hamilton & Dayton Ry., at Cincinnati, Ohio, succeeding Mr. A. P. Prendergast, transferred as noted elsewhere. According to the new organization of the Baltimore & Ohio R.R. mechanical department, Mr. McCarthy will report directly to the General Manager of the western lines.

Mr. S. Bruce McConnell, Assoc. M. Can. Soc. C. E., formerly Assistant Division Engineer of the Canadian Pacific Ry., at Montreal, Que., has been promoted to be Assistant Engineer. His headquarters will remain at Montreal. Mr. McConnell entered the railway service in 1898 as a transitman on location of the Midland Ry. of Nova Scotia. Later he was transitman and Resident Engineer on construction of the Great Northern Ry. of Canada, and Resident Engineer of a railway in Cuba. He joined the engineering staff of the Canadian Pacific in 1902, as Assistant Engineer in charge of yard construction at North Bay, Ont.

Mr. C. E. Allen, Assoc. Am. Inst. E. E., has been appointed Assistant Manager of the detail and supply department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn. Mr. Allen graduated from the Virginia Polytechnic Institute in 1901. After graduation he entered the employ of the General Electric Co., at Schenectady, N. Y., as an apprentice. While with the General Electric Co., Mr. Allen was engaged for several years in transformer design, and he is the inventor of the distributed core type of transformer now made by the company. Mr. Allen entered the employ of the Westinghouse Electric & Manufacturing Co. in 1909, as the head of the transformer division of the detail and supply department.

Mr. F. W. Cappelen, M. Am. Soc. C. E., Chief Engineer and General Manager of the Decarie Incinerator Co., Minneapolis, Minn., has been made City Engineer of Minneapolis, succeeding Mr. Andrew Rinker. Mr. Cappelen is a Norwegian by birth. He was educated at the technical school at Orebro, Sweden, and the Polytechnicum, at Dresden, Germany, studying seven years in all. In 1880 he entered the service of the Northern Pacific Ry. as a draftsman, and a year later he was made Assistant Engineer in charge of location and construction work. For two years, 1884 to 1886, he was Bridge Engineer of the St. Paul & Northern Pacific Ry., at Minneapolis. From 1886 to 1892 he was Engineer of Bridges and Buildings of the city of Minneapolis; during this period he designed and built three large iron bridges over the Mississippi River. Mr. Cappelen was City Engineer of Minneapolis in 1892 and 1893.

Mr. Charles H. Moore, M. Am. Soc. C. E., has resigned as Principal Assistant Engineer of the Erie R.R., to accept the position of Director of Engineering and Construction of the Ferrocarril al Curaray, a railway being built by the government of Ecuador. Mr. Moore will remain in this country, his headquarters being at 33 Broadway, New York City, except when making an annual inspection of the work in Ecuador. Mr. Moore is a native of Baltimore, Md., and graduated from Lafayette College in 1884. He entered the railway service four years later as a rodman with the New York, Lake Erie & Western R.R. In 1890 he was made Resident Engineer of the Northern R.R. of New Jersey, and a year later Assistant Engineer of the New York, Lake Erie & Western R.R. Except for a year, 1893-94, when he was Assistant Engineer of the Quaker City & Northeastern Construction Co., of Philadelphia, Penn., Mr. Moore has been continuously in the service of the Erie R.R. He has been Consulting Engineer for the republic of Ecuador for a number of years.

The Pennsylvania R.R. has announced the following changes in the engineering department: Mr. W. R. Hillary, Division Engineer of the Lines West of Pittsburgh, Northwest system, has been promoted to be Supervising Engineer of the Central system, with headquarters at Toledo, Ohio; Mr. M. P. Tucker, Jr., has been appointed Division Engineer of the Akron division, Central system, at Akron, Ohio, vice Mr. R. C. Harris, promoted as noted in our issue of last week; Mr. A. C. Watson has been appointed Division Engineer of the Zanesville division, Central system, at Zanesville, Ohio, succeeding Mr. Tucker; Mr. J. A. Rothrock has been appointed Assistant Division Engineer at Zanesville, succeeding Mr. E. H. Kersting, transferred; Mr. R. C. Miller has been appointed Division Engineer of the Toledo division, Central system, with office at Toledo, Ohio, succeeding Mr. G. R. Barry, transferred to Logansport, Ind.; and Mr. R. R. Metheany, Jr., has been appointed Division Engineer of the Marietta division, Central system, at Cambridge, Ohio, succeeding Mr. S. W. Hodgin, transferred to Richmond, Ind.

OBITUARY

John Towne, formerly Contracting Manager of the American Bridge Co., for Maine, died at his home in Springfield, Mass., Jan. 12, aged 74 years. He was for many years Contracting Engineer of the Berlin Iron Bridge Co., of East Berlin, Conn.

John S. Spengler, Assistant Engineer of the Chicago Harbor and Subway Commission, and formerly Assistant City Engineer of Chicago, died Jan. 11. He was born at Bethlehem, Penn., in 1866, and began his engineering experience in railway work. He was at one time Assistant City Engineer at Memphis, Tenn., then an assistant engineer on the construction of the Chicago drainage canal, and then became connected with the Department of Public Works, in Chicago. He was a graduate of Lehigh University.

Francis Blake, inventor of the Blake transmitter, which had much to do in the development of telephony, died at his home in Weston, Mass., Jan. 19. He was born at Needham, Mass., on Christmas day, 1850. His education was received in the public schools of Brookline, Mass. For 13 years he served as a field officer of the United States Coast Survey. His invention of the Blake telephone transmitter in 1878, and of

other electrical devices proved remunerative. At the time of his death he was a director of the American Telephone & Telegraph Co., and of the American Bell Telephone Co.

Prof. George A. Koenig, M. Am. Inst. M. E., oldest member of the faculty of the Michigan College of Mines, died in Philadelphia, Penn., Jan. 14, at the home of his son. He was born in Germany in 1844 and educated in Germany and Switzerland. He was a graduate of Polytechnic School of Karlsrühe, of the University of Heidelberg, of the University of Berlin and of the famous Mining Academy of Freiburg, in Saxony. He came to the United States in 1868 as a chemist, later going to Mexico to make examination of gold mines. In 1872 he was appointed Assistant Professor of chemistry and mineralogy at the University of Pennsylvania, where he remained until 1892; since then he had been Professor of chemistry at the Michigan College of Mines. Prof. Koenig was the discoverer of a number of the rarer metals. He was the inventor of metallurgical processes and the author of several books and contributions on chemistry, metallurgy and mineralogy. He was a member of many learned and professional societies.

William Green Raoul, former President of the Mexican National R.R., died at his home in Atlanta, Ga., Jan. 17. He was born in Louisiana on July 4, 1843. At the outbreak of the Civil War he enlisted in the Confederate Artillery. Later he became a captain in the Confederate Railway Bureau and had charge of car construction and the transportation of army supplies. His war experience in railway work proved to be the opening to a long and distinguished career as a railway official. Following the war he was a partner of the Southern Car Works in Louisiana. He moved to Georgia in 1871, and was a contractor in railway construction work. He entered the operating service of the Southwestern R.R., in 1874, as Assistant Roadmaster, was soon promoted to Superintendent, and in 1876 was made General Superintendent of the Montgomery & Eufala R.R. Later he was Vice-President and President of the Central of Georgia Ry. He was President of the Mexican National R.R., the Texas Mexican Ry. and the National R.R. of Mexico, from 1877 to 1904.

William Oliver Webber, M. Am. Soc. M. E., Consulting Engineer, of Boston, Mass., died at his home in Brookline, Mass., early in January. He was born in Springfield, Mass., on Jan. 4, 1856, the son of Col. Samuel Webber, who was also a well known engineer. His grandfather, Samuel Webber, D. D., was a former president of Harvard University. Mr. Webber was educated in the public schools of Manchester and Portsmouth, N. H., and studied engineering in his father's office. His first important engineering work was with the Chicago, Burlington & Quincy R.R., and the Allen-Pope Car Wheel Co., of Pullman, Ill. In 1882 he went to Lawrence, Mass., as Superintendent and owner of the Lawrence Machine Co. For a short time he was connected with the Erie City Iron Works, Erie, Penn. Mr. Webber established himself as a consulting mechanical and hydraulic engineer at Boston, about 25 years ago. He was early identified with the grade-crossing elimination work undertaken by the State of Massachusetts and was a member of the first state commission appointed to investigate the engineering features of the work. He will be remembered by the readers of "Engineering News" as a contributor on mechanical engineering subjects. He also made extensive studies of tidal power, and established an experimental plant at South Thomaston, Maine, which was described in our issue of Dec. 6, 1906. Mr. Webber was married in 1880 to Miss Ellen Porter Battles, who, with three daughters survives him.

Dr. Thaddeus S. C. Lowe, scientist and inventor, chiefly known for his invention of gas-manufacturing apparatus, died at his home in Pasadena, Calif., Jan. 16. He was born at Jefferson, N. H., Aug. 20, 1832. His education was received in the public schools. He early became interested in chemistry and natural science and in 1856 constructed balloons for studying atmospheric phenomena. He invented numerous inventions [illegible] and the possibility of making ice without [illegible] made up to [illegible] and [illegible] to the South Carolina coast in nine hours. At the beginning of the Civil War he entered the service of the United States Government as Chief of the Aëronautic Corps, which was organized under [illegible] after the close of the war he turned his inventive genius to the more useful arts of industry and developed a [illegible] for [illegible] and [illegible] for [illegible] metallurgical furnace for gas and petroleum fuel, water-gas [illegible] and [illegible] In 1885 he [illegible] achieved added distinction by the invention of the Lowe Coke Oven system for producing simultaneously gas and metallurgical coke known as "Lowe anthracite." Dr. Lowe also gained fame as the builder of the Mount Lowe Ry. and the Lowe Observatory in the Sierra Madre Mts., in California.

ENGINEERING SOCIETIES

COMING MEETINGS

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 22-24. Annual meeting at Chicago, Ill. Secy. E. E. R. Tratman, 1144 Monadnock Block, Chicago, Ill.

INDIANA ENGINEERING SOCIETY.
Jan. 23-25. Annual meeting at Indianapolis, Ind. Secy., Charles Brossmann, Union Trust Building, Indianapolis, Ind.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 23-25. Annual meeting at Washington, D. C. Secy., T. R. Maul, 4213 Westminster Ave., Philadelphia, Penn.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28-30. Annual meeting at Montreal, Que. Secy., C. H. McLeod, 413 Dorchester St., West, Montreal.

NORTH DAKOTA SOCIETY OF ENGINEERS.
Feb. 13-14. Annual meeting at Bismarck, N. D. Secy., E. F. Chandler, University, N. D.

MINNESOTA SURVEYORS AND ENGINEERING SOCIETY.
Feb. 11-13. Annual convention at St. Paul, Minn. Secy., Charles A. Forbes, 91 Kent St., St. Paul, Minn.

IOWA ENGINEERING SOCIETY.
Feb. 19-21. Annual meeting at Sioux City, Iowa. Secy., S. M. Woodward, Iowa City, Iowa.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.
Feb. 25-26. Annual meeting at Indianapolis, Ind. Secy., W. F. King, Indianapolis, Ind.

ILLINOIS WATER SUPPLY ASSOCIATION.
March 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
March 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

Indiana Engineering Society—The annual convention of the Society occurs, on Jan. 23-25, at Indianapolis, Ind., with headquarters at the Denison Hotel. The following are among the more important papers on the program: "The Engineer in Accident Prevention," by M. W. Mix; "The Value of an Apprenticeship Course to the Manufacturer and the Apprentice," by H. S. Dickerson; "The Indianapolis Experimental Sewage Disposal Plant," by H. W. Klausmann; "State Aid for Roads," by J. T. Voshell; "A Study of the Artistic Treatment of Concrete Bridges," by John Mueller; and "An Ordinance for Reinforced-concrete Buildings," by W. K. Hatt.

Engineers Society of Western Pennsylvania—At the annual banquet of the Society at Pittsburgh, Penn., on Jan. 27, the speakers will be F. Hopkinson Smith and Charles M. Schwab, and John A. Brashear will serve as toastmaster.

American Institute of Consulting Engineers—The annual meeting of the Institute was held in New York City, on Jan. 14, at which time Henry Holgate, Daniel E. Moran and Charles Sooysmith were elected Members of the Council, for three years, and F. A. Molitor, for one year. Following the business meeting the Institute was addressed by Prof. George F. Swain, President-elect of the American Society of Civil Engineers, on the subject of "Education." Messrs. Rudolph Hering, T. A. Bingham, Gardner S. Williams and Frank J. Sprague participated in the discussion.

Oklahoma Engineering Society—The officers elected for the ensuing year, at the annual meeting of the Society in Oklahoma City, on Jan. 7, were as follows: President, C. M. Lawrence; Vice-Presidents, W. L. Benham, S. A. Joyner, and W. C. Burke; and Secretary-Treasurer, H. V. Hinckley.

Engineers Society of Western New York—The following officers for 1913 were elected at the annual meeting of the Society, Jan. 4: President, H. B. Aberson; Vice-Presidents, F. N. Speyer and J. G. Ullman; Secretary, E. G. Speyer; Treasurer, T. J. Rogers; and Directors, G. T. Roberts, S. M. B. Kielland and G. A. Ricker.

Pacific Northwest Society of Engineers—At the annual meeting of the Society, at Seattle, Wash., on Jan. 4, the following officers for 1913 were elected: President, R. H. Ober; Vice-Presidents, Marvin Chase, Joseph Jacobs and S. B. Hill; Secretary, J. H. Jackson; Treasurer, W. N. Chase, and Directors, J. D. Blackwell, J. C. Jeffrey, D. W. McMorris, Milnor Roberts, J. J. Cryderman, A. H. Fuller, G. A. Kyle and R. H. Thomson.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Massachusetts—Plans for the construction of a four-track line from the South Station to the North Station, making a direct connection between the New York, New Haven & Hartford R.R. and the Boston & Maine R.R. and abolishing the North Station, it is stated, have been practically completed. This means that the New Haven and the Boston & Maine in Boston must be electrified. The project involves an expenditure of at least $50,000,000. New Haven officials are said to have conferred with the Boston Transit Commission with regard to providing for underground tunnels and entrances under Dewey Sq., between the proposed railroad tunnel and the Park St.-South-Boston-Dorchester tube, now under construction.

New York—Liberty & Callicoon R.R.—The Public Service Commission has authorized this company to construct a railroad from Liberty, N. Y., to Jeffersonville, N. Y., about 14 miles. Estimated cost, $500,000. Charles B. Ward, Liberty, N. Y., is an incorporator.

★**New York**—The Public Service Commission has authorized the advertisement of the first contract for rapid transit construction work in the Boro. of Queens. This contract is for the construction of Section No. 2 of the Astoria, Woodside and Corona Rapid Transit R.R. Bids will be opened Jan. 28. Plans for rapid transit in Queens call for two elevated railroads to be built from the Queensboro Bridge connecting with the Steinway Tunnel extension. One of these roads will be a two- and three-track elevated line north through Debevoise Ave. to Ditmars Ave., Astoria. The other will be a two- and three-track elevated line through Queens Boulevard, Greenpoint Ave., and Roosevelt Ave. to Prime St., Corona.

Pennsylvania—Beech Creek R.R.—This company has made application to the State Forestry Commission, Harrisburg, Penn., for a right-of-way through the Hopkins State Forest Reserve from Keating to Queen's Run.

✚Philadelphia & Reading Ry.—This company has awarded the contract to P. E. BRENDLINGER, Arcade Bldg., Philadelphia, for the grading and masonry for third-track work on the New York Branch between Skillman and Hopewell.

Montour R.R.—Papers were filed at Harrisburg, Penn., for the merger of the Montour, North Star & Mifflin, and Pittsburgh & Moon Run R.R. companies under the name of the Montour R.R. Co. The capital is $1,500,000. Erie and Pittsburgh people are interested.

Pennsylvania R.R.—This company has authorized the construction of three double-track tunnels of the Allegheny Valley R.R., ranging in length from 2500 to 3500 ft., and costing approximately $1,500,000. The tracks of the Allegheny Valley R.R. follow the course of the Allegheny River, and between Kiskiminetas Junction and Oil City, a distance of 105 miles, there are three sharp bends in the stream. To obviate these and straighten the line, which will shorten the distance between Oil City and Pittsburgh 14 miles, a realignment of the tracks in connection with the tunnels will be necessary. Alex. C. Shand is Ch. Engr., Pittsburgh, Penn.

Eastern Midland R.R.—This company was granted a charter, Jan. 10, to construct a 40-mile line from Matamoras to Delaware Water Gap. Capital, $400,000. Among the incorporators are H. C. Miller, McKeesport, Pres.; R. M. Wilson, Aspinwall; A. B. Thornburg and H. O. Hovis, Aspinwall; C. W. Helman, Homestead; Ray Lowe, A. A. Adams, C. G. Hinds and W. W. Bald, Pittsburgh; C. R. Turton, Aspinwall; Byron Trimble, Pittsburgh; H. B. Rhine and Herbert Hunt, Bellevue, Penn.

North Carolina—Pembroke, Red Springs & Northern R.R.—This company, it is reported, has authorized the construction of an extension to Raeford. W. J. Johnson is Pres.

Georgia—Americus, Tifton & Atlantic R.R.—This company has made preliminary surveys for the construction of its proposed 110-mile line from Americus to Milltown, Ga. I. W. Myers, Tifton, Ga., is Pres. John W. Greer, Tifton, is Secy.

Louisiana—New Orleans, Southern & Grande Isle Ry.—This company is planning to construct a branch from about 20 miles south of New Orleans, La., to Grande Isle, about 30 miles. C. E. A. Carr, New Orleans, is Gen. Mgr.

Kentucky—Louisville & Nashville R.R.—This company is planning to construct a second track from Lebanon Junction to Elizabethtown, Ky.

★**Wisconsin**—Bids are wanted for building and equipping about eight miles of single-track railroad complete with sidetracks, switches, terminals, buildings, etc. Details can be obtained by writing P. 106, Engineering News, as to yardage, equipment, plans and specifications, and payments. Estimated cost, $75,000. The work is in central Wisconsin, easily accessible.

Montana—Great Falls & Teton County Ry.—This company will construct an extension to Bynum. The company is now constructing from Power to Choteau, Mont. Surveys for the extension have been completed, and construction contracts will probably be let at once.

Missouri—Cape Girardeau Northern R.R.—This company, capitalized at $2,500,000, was chartered Jan. 11. The company, with offices at the National Bank of Commerce Bldg., St. Louis, Mo., proposes to construct a 10-mile line, connecting Flat River and Farmington, Mo. The incorporators are J. H. Byrd, A. R. Byrd, Jr., George W. Simmons, G. H. Walker and Albert T. West, all of St. Louis, Mo.

Arkansas—Fort Smith, Subiaco & Eastern Ry.—This company is planning an extension to Dardanelle, Ark., about 25 miles. Henry Stroup, Paris, Ark., is Gen. Mgr.

Texas—Marshall & East Texas R.R.—Three routes for the proposed extension of the Beaumont & Great Northern R.R. from Weldon to Waco have been surveyed and a decision will soon be made. The Beaumont & Great Northern was purchased recently by the Missouri, Kansas & Texas Ry. Co. It runs from Weldon to Livingston, 49 miles. Construction on the extension from Weldon to Waco will be started within the next few weks, it is stated. This proposed extension will be about 125 miles long. The Beaumont & Great Northern will also be extended from Livingston southeast to Beaumont, about 80 miles, giving the Missouri, Kansas & Texas Ry. a new northwest and southeast line across the state for several hundred miles. The Texas Central division of the system runs from Waco northwest to Rotan, 167 miles.

Texas—Marshall & East Texas R.R.—This company is considering the extension of its line from Winnsboro to Mount Pleasant, Tex., about 25 miles. R. J. Lockwood, Marshall, Tex., is Ch. Engr.

Missouri, Kansas & Texas Ry.—This company, it is reported, will spend $2,000,000 in Texas during this year for extensions and betterments, including reballasting the entire main line, relaying about 170 miles of track with 85-lb. rails, building passing tracks, installing new bridges, culverts, etc., reducing grades and curves. A. M. Acheson, Dallas, Tex., is Ch. Engr.

Oklahoma—Oklahoma, New Mexico & Pacific R.R.—This company has applied for a charter for the construction of its proposed line from Ardmore to Lawton, Okla. Capital, $2,500,000. G. L. Reeder, Guthrie, Okla., is in charge of the survey being made.

Oklahoma—Clinton & Oklahoma Western Ry.—This company is planning to construct an extension from Clinton east to Chicasha, Okla., about 75 miles, to connect with the Oklahoma Central R.R. T. J. Nance, Clinton, Okla., is Vice-Pres. and Gen. Mgr.

Oklahoma Central Ry.—This company is planning to construct an extension from Lehigh, Okla., to McAlester, Okla., at which place it connects with the Santa Fé, Rock Island and the Missouri, Kansas & Texas railroads. W. G. Choate, Chickasha, Okla., is Gen. Mgr.

Colorado—Montezuma & Western Ry.—This company contemplates the construction of the Argentine Tunnel and about 40 miles of narrow-gage track in the spring. This is to open up the mining camp of Montezuma. The road will be from Silver Plume, Colo., via Argentine Tunnel to Montezuma and Dillon, Colo. E. A. Hopkins is Engr., Equitable Bldg., Denver, Colo.

✚**Idaho**—Oregon Short Line R.R.—This company has awarded the contract for the construction of the Mountain Home cutoff to the UTAH CONSTRUCTION CO., Ogden, Utah. The proposed line shortens the distance from Salt Lake City to Boise, Idaho, 94 miles.

Idaho Northern Ry.—This company, it is reported, has been purchased by the Oregon Short Line R.R. Co. The road now operates between Nampa, Murphy and Emmet, Idaho. An extension to the Payette Lakes will be completed by the new company.

Oregon—Portland, Eugene & Eastern Ry.—This company is preparing to award the contract for the construction of its line from Portland, Ore., 40 miles south.

California—Central California R.R.—This company has completed surveys for its proposed extension from San Juan to Hollister, Calif. E. U. Lee, Ch. Engr., San Juan Portland Cement Co., San Juan, Calif., is in charge.

Canada—Canadian Pacific Ry.—The Minister of Railways has approved route maps of route revision in the second-track work between Calgary, Alta., and Vancouver, B. C., west of Calgary, 21 miles, Ross Peak to Mill Creek, B. C., 20 miles and Chase to Salmon Arm, B. C., 25 miles.

Alberta—Athabasca & Grande Prairie Ry.—This company is completing arrangements to apply to Parliament for incorporation to construct a line from some point at or near the junction of the Salmon and Athabasca River, Alberta, in a northwesterly direction to a point at or near the Junction of the Smokey and the Muskeg Rivers, thence in a northerly direction to Dunvegan, passing through Grande Prairie at a point on the westerly side of Bear Lake.

✚**British Columbia**—Canadian Northern Ry.—This company has awarded the contract to the NORTHERN CONSTRUCTION CO., for constructing its Lulu Island branch. The proposed line will cross the north arm of the Fraser River a short distance below New Westminster, B. C., and extend almost the length of Lulu Island to Steveston, B. C., adjacent to the British Columbian electric line.

Honduras—Truxillo R.R.—This company is having surveys made for the construction of a line to extend from the Port of Truxillo to Tegueigalpa. A partial survey for that portion of the road from Truxillo to Juticalpa, 200 miles, has been completed. Victor Camora, New Orleans, La., has the concession from the government of Honduras for the railroad.

ELECTRIC RAILWAYS

Fitchburg, Mass.—The Fitchburg & Leominster St. Ry. Co. is making [illegible] for the extension of its electric railway to Ashby and Ashburnham, about 12 miles. W. W. Watson, Fitchburg, is Pres. and Gen. Mgr.

New York, N. Y.—Bids will be received by the Public Service Commission for the First District, 154 Nassau St., until noon, Jan. 25, for the construction of a rapid transit line to be built in the Bronx. The line will be an elevated line and be an extension of the Astoria, Woodside and Corona rapid transit route.

Ridgefield Park, N. J.—A 50-year franchise has been granted to the Public Service Corporation for the construction of an electric railway. The company plans to build through Ridgefield Park to Bogota and Teaneck. R. E. Danforth, Newark, is Gen. Mgr.

Woodbridge, N. J.—The Public Service Corporation will extend its electric railway system from Woodbridge to the Borough of Roosevelt. R. E. Danforth, Newark, is Gen. Mgr.

California, Penn.—The Pittsburgh Rys. Co. is planning the extension of its Charleroi branch from California to Roscoe. P. N. Jones, Pittsburgh, is Gen. Supt.

Leighton, Penn.—The Lehigh Valley Transit Co. is considering plans for the extension of its line from Slatington to Leighton, about 13 miles. R. P. Stevens, Allentown, is Pres. and Gen. Mgr.

Phoenix, Penn.—The Phoenixville, Valley Forge & Strafford St. Ry. Co. is planning the construction of an extension to its line from Phoenixville to Cromby, Royersford and Collegeville.

Wilmington, Del.—The Southern & Traction Co., a five-mile line connecting Wilmington and New Castle, has been acquired by the Wilmington, New Castle & Delaware R.R. Co. The new owner, it is reported, will establish a storage-battery car service and do away with the overhead wires.

Hagerstown, Md.—The Hagerstown, Greencastle & Mercersburg Electric Ry. Co. has been organized for the construction of the Maryland section of the proposed line from Hagerstown, Md., to Mercersburg, Penn., about 23 miles. A. R. Shaster is Secy.

Avondale, W. Va.—The Welsh Colony R.R. Co. has been incorporated to construct and operate an interurban electric railway from Avondale to Pendro. M. Perkins, D. S. Thomas, John P. Williams and S. Davies are interested.

Fairmont, W. Va.—The Fairmont & Mannington Traction Co. is making surveys for its proposed line from Annabelle to Mannington, about two miles. J. O. Watson, Fairmont, is interested.

Morgantown, W. Va.—The South Morgantown Traction Co. is planning the extension of its South Park line to the Sabraton Mills. C. D. Willey, Clarksburg, is Gen. Mgr.

Wilmington, N. C.—Surveys are being made by Walter G. McRae for the construction of an electric railway from Wilmington to Carolina Beach, about 13 miles, to be built by the New Hanover Transit Co. A. W. Pate is Pres.

Waycross, Ga.—The Waycross St. & Suburban Ry. Co. is considering plans for the extension of its line from Waycross to Hebardsville. A. B. Coryell, Waycross, is Gen. Supt. and Purch. Agt.

Hastings, Fla.—The Interurban R.R. Co. has applied for franchises for the construction of an electric railway from Hastings to Palatka, about 10 miles. C. A. Dupont is Pres. and H. A. Woodbridge is Vice-Pres.

Birmingham, Ala.—The Tidewater Power Co. is interested in the construction of an electric railway from Birmingham to the Warrior River, about 25 miles, to connect with a steamboat line.

The Tidewater Development Co. has applied for a franchise to construct and operate two crosstown lines covering about [illegible].

The Birmingham Ry., Light & Power Co. is making arrangements for the extension of four of its lines in Birmingham. The Owenton line will be extended to Tuxedo, the East Lake line to Roebuck Springs, the Ave. F line to the Elmwood Cemetery, and the Gate City line to Irondale. A. H. Ford, Birmingham, is Pres. and Gen. Mgr.

Birmingham, Ala.—The Birmingham, Ensley & Bessemer Ry. Co. has applied to the City Council for a franchise to extend its lines in Birmingham.

Baton Rouge, La.—Preliminary arrangements are being made by the Baton Rouge Electric Co. for the construction of an electric street railway on Florida St. and the East Boulevard to South Baton Rouge. William A. Buttrick, Baton Rouge, is Local Mgr. Noted Dec. 26.

Lake Charles, La.—The Louisiana Traction & Power Co. is making arrangements for extending its interurban electric line from Lafayette to Alexandria. This company is [illegible] for the purchase of the lines of the [illegible] to Alexandria. T. H. Morrell, Lake Charles, is Local Mgr.

Lynchburg, Tenn.—Plans are being prepared by the Standard Power Co., Manchester, Tenn., for the construction of an electric railway from Tullahoma to Lynchburg. Surveys [illegible] are completed.

Murfreesboro, Tenn.—It is reported that the Murfreesboro Electric Co. is considering the construction of a line to Smyrna, La Vergne, Rutherford and Eagleville. J. L. Pierce, Murfreesboro, is Local Mgr.

Russell, Ky.—The Ohio Valley Electric Ry. Co. is making arrangements for the construction of the line authorized to Russell about four years ago. It is proposed to [illegible] Mayo Lick.

Pekin, Ill.—Plans are being prepared by W. A. Harris and Associates for the construction of the electric railway to Delavan.

Springfield, Ill.—Plans are being prepared by the Springfield Consolidated Ry. Co. for double tracking the Mount Pleasant line. A. A. Anderson, Springfield, is Gen. Mgr. and Pur. Agt.

Lincoln, Neb.—The Omaha, Lincoln & Beatrice Interurban Co. has applied for permission to issue $2,250,000 in bonds for the construction of a 50-mile extension to its line. The proposed route connects Lincoln, University Place, Bethany, Waverly, Greenwood, Ashland and South Omaha. H. S. Norton, Lincoln, is Secy.

Butte, Mont.—The City Council has granted a franchise to the Butte Electric Ry. Co. to extend its lines in the southwestern section of Butte. J. S. Wathey, Butte, is Supt. Noted Dec. 12.

Moberly, Mo.—The Moberly, Huntsville & Randolph Springs Ry. Co. has been incorporated to construct an interurban electric railway to connect Moberly, Huntsville and Randolph Springs, about 12 miles. C. H. Dameron, W. T. Dameron and W. M. Evans, all of Huntsville, are interested.

Dardanelle, Ark.—The Fort Smith, Subiaco & Eastern R.R. Co. is considering plans for the extension of its line either from Subiaco to Dardanelle, about 32 miles, or from Scranton to Dardanelle, about 26 miles.

Palestine, Tex.—The Dallas, Corsicana & Palestine Ry. Co. has been granted a franchise by the City Council for the occupancy of certain streets with its proposed line of railway.

San Antonio, Tex.—The San Antonio & Austin Interurban Ry. Co. has been organized for the purpose of constructing and operating an interurban electric railway between San Antonio and Austin, a distance of about 85 miles. The directors are Vories P. Brown, W. B. Tuttle, Jesse B. Oppenheimer, Sam C. Bell, all of San Antonio; G. H. Henne of New Braunfels, C. L. Hopkins, of San Marcos and A. J. Eilers, of Austin.

Colorado Springs, Colo.—The proposition to construct an electric railway from Colorado Springs to Greely, by way of Denver, is being promoted. Preliminary surveys have been made. The estimated cost of the line is $3,000,000. Frank P. Read, Denver, is the promoter.

Lewiston, Idaho—F. M. Strum, of Wahpeton, N. D., has been granted a franchise by the City Council to construct and operate an electric railway in Lewiston. The line will eventually be extended to Clarkston.

Walla Walla, Wash.—The Walla Walla Valley Ry. Co. is considering plans for the extension of its line from Walla Walla to Vincent, about 10 miles. C. S. Walters, Walla Walla, is Gen. Mgr.

Medford, Ore.—The construction of a 10-mile electric railway in Medford is planned by the M. C. Minney Realty Co., of Oakland, Calif. A. A. Davis, Medford, is interested.

Hollister, Calif.—The Central California Traction Co., is making arrangements for the construction of an extension of its line from San Juan to Hollister. H. A. Mitchell, San Francisco, is Gen. Mgr.

Pacific Grove, Calif.—The Monterey & Pacific Grove Ry. Co. has been granted a franchise to construct, maintain and operate an electric railroad in and upon the streets and highways of the city of Pacific Grove.

San Francisco, Calif.—The Board of Supervisors are making preliminary arrangements for the construction of a municipal electric railway on Van Ness Ave., from Market to Bay Sts. Noted Jan. 9.

Winnipeg, Man.—The Winnipeg Electric Ry. Co. is considering plans for the construction of an electric railway from Winnipeg to Portage la Prairie. Wilford Phillips, Winnipeg, is Gen. Mgr. and Ch. Engr.

LIGHT, HEAT AND POWER

Boston, Mass.—Bids will be received by the School House Committee until Jan. 28 for the installation of an electric system in the Public Latin School Annex. Charles Logue, 120 Boylston St., is Chn. of the Com.

Hartford, Conn.—The Hartford Electric Light Co. has voted to expend $600,000 for improvements to its plant and system. R. W. Rollins, Hartford, is Gen. Mgr.

Arcade, N. Y.—Bonds for $9500 have been sold for the purpose of installing new equipment in the municipal electric-light plant. Noted Dec. 19.

†Brooklyn, N. Y.—We are officially advised that the contract for the installation of the electrical equipment in public school No. 28, Boro. Brooklyn, has been awarded to T. FREDERICK JACKSON, INC., 94 John St., New York, at $6243. Bids were received Jan. 13 by C. B. J. Snyder, Supt. of School Bldgs.

†Geneva, N. Y.—The city has awarded the contract for the construction of a power plant in connection with the town hall to R. B. SCHNITZEL at $77,500.

Jamestown, N. Y.—The installation of additional equipment in the municipal electric-light plant is being considered by the Board of Lighting Commissioners.

Monticello, N. Y.—Press reports are to the effect that the New York & New Jersey Power Co. is preparing plans for the construction of a power plant and dam on the Neversink River near Monticello. The estimated cost of the project is $3,000,00. Carl C. Giles is Mgr.

Orange, N. J.—The Common Council has ordered the Building Committee to prepare estimates for the extension of the municipal lighting system to include service for all public schools and buildings.

†Trenton, N. J.—The Pennsylvania R.R. Co. has awarded the contract for the construction of a new power plant on Stacy St. to FRED R. PARKER.

Moorefield, W. Va.—An election will be held Feb. 1 to vote on the proposition to issue bonds for the construction of a municipal electric-light plant. John I. Cupples is Mayor.

Parkersburg, W. Va.—G. L. Cabot has applied to the City

Council for a franchise to construct and operate a gas distributing system in Parkersburg.

Williamstown, W. Va.—S. D. Camden and associates are considering plans for the installation of an electric-light system in Williamstown.

Wilson, N. C.—The citizens are considering the proposition to issue $160,000 in bonds a part of which is to be used to enlarge the municipal electric-light plant. Easton & Moore, Wilson, are Consult. Engrs.

Jonesboro, Ga.—The citizens are considering the proposition to issue $10,000 of bonds for the construction of a municipal electric-light plant.

Waveland, Miss.—Preliminary arrangements are being made by the city for the installation of an electric-light system. Address the Mayor for particulars.

Napoleonville, La.—The citizens will hold an election, Feb. 18 to vote on the proposition to issue bonds for the construction of a municipal electric-light plant. For details address the Mayor.

Covington, Ky.—The Covington Industrial Club has under consideration the construction of a tenement power plant. Joseph Luhn is Chn. of the Com. which has the project in charge.

Elizabethtown, Ky.—The construction of a water-power plant is projected by the Tygart Valley Water Power & Electric Co., which has been organized at Elizabethtown. W. W. Carter, George Snider and D. H. Hall are interested.

Hopkinsville, Ky.—The Kentucky Public Service Co., of Hopkinsville, has announced plans for the construction of a new lighting plant to take the place of the one now in use. It will cost $100,000. New steam turbines, engines, dynamos, etc., will be required. The company has plants at Frankfort, Bowling Green and Owensboro, Ky., and Clarksville, Tenn., which will be similarly improved. The local manager in each city should be addressed for information.

Lexington, Ky.—The Kentucky Natural Gas Co. contemplates the construction of a gas pipe line from Lexington to Paris.

Louisville, Ky.—H. M. Byllesby & Co., of Chicago, Ill., who have been negotiating for a natural gas franchise in Louisville, are having a survey made for the construction of a pipeline from the West Virginia fields to Louisville.

Munfordville, Ky.—Bids will be received by the Munfordville Electric Light Co., about Feb. 1 for the construction of an electric-light plant. J. O. Bright, Munfordville, is Engr.-in-Charge. Noted Jan. 2.

Paducah, Ky.—The Board of Public Works has asked for an appropriation to be used for the installation of an ornamental street-lighting system in the down-town district.

Williamstown, Ky.—The installation of an electric-light plant and street-lighting system in Williamstown, is being considered by J. M. Riley.

Cincinnati, Ohio—Plans have been prepared by Tietig & Lee, Archs., for the installation of a heating and power plant in the new tubercular hospital to be built by the Hospital Commission of Cincinnati.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. of Pub. Serv. until Feb. 3 for furnishing surface condensers for the municipal electric-light plant. Estimated cost, $60,000.

Kenton, Ohio—Extensive improvements to its plant are contemplated by the Hardin-Wyandotte Lighting Co. P. M. Magley is Mgr.

Steubenville, Ohio—The City Council has decided to construct a municipal electric-light plant. Estimated cost, $250,000.

Toledo, Ohio—Press reports state that the construction of an electric plant to be operated by steam, is contemplated by the Crawford interests of New York. The plant will cost $500,000 and will be located near Toledo. W. P. Wallace and Eugene Rheinfrank are interested.

Bluffton, Ind.—The City Council has decided to retain the municipal electric-light plant and make extensive improvements. Frank S. Smith is Mayor. Noted Nov. 28.

Goshen, Ind.—The contract for the improvement of the municipal electric-light plant will be awarded by the city about Mar. 1. Plans are also being prepared for the reconstruction of the street-lighting system. Noted Jan. 2.

Huntington, Ind.—Milo Freightner, Mayor, has recommended the installation of a municipal electric-light plant. The proposition to consolidate the county lighting plant with the proposed new municipal electric-light plant is being considered by the Common Council.

Laporte, Ind.—John H. Sullivan, of Chicago, Ill., has been granted a franchise by the County Commissioners to construct and operate transmission lines throughout the county. Plans are being prepared for the construction of a power plant to supply electricity for these proposed lines.

Belleville, Mich.—The construction of a power plant and dam at Belleville, is contemplated by the Eastern Michigan Edison Co. The plant when complete will develop 3300-hp. and will cost about $450,000. J. W. Brennan, 18 Washington Ave., Detroit, is Pur. Agt.

Bloomington, Mich.—L. E. Hawks, Chicago, Ill., is interested in the project to construct an electric-light and power plant at Bloomington.

Clayton, Mich.—At a recent election the citizens voted to construct an electric-light plant. Bids will soon be received for the work.

Kalamazoo, Mich.—Press reports state that bids are being received by the city for the installation of new equipment in the municipal electric-light plant. Bonds for $150,000 were voted recently for the purpose.

Alton, Ill.—Press reports state that the Alton Gas & Electric Co. will expend $40,000 for the construction of a new power plant. C. F. Hewitt, East St. Louis, is Gen. Supt.

Colfax, Ill.—The Village Board has been petitioned by the Central Illinois Utilities Co., Watseka, for a franchise to operate an electric-light plant at Coalfax.

De Kalb, Ill.—The City Lighting Committee and the City Council are considering plans for the installation of an ornamental lighting system in the business district.

Eau Claire, Wis.—The Common Council has prepared specifications for the installation of a new street-lighting system.

†Fond du Lac, Wis.—The Board of County Supervisors has awarded the contract for the installation of a heating plant in the county court house to AHRENS-McCOY, Fond du Lac, at $5288. Noted Jan. 2.

Wayland, Iowa—The Council has granted a franchise for a period of 25 years to D. D. Bentzinger to construct and operate an electric light system in Wayland.

Canton, Kan.—Bids will be received about Feb. 20 for the construction of a municipal electric-light plant at Canton. The Alamo Engine & Supply Co., Omaha, Neb., is Consult. Engr. Estimated cost, $10,000. T. N. Frantz is City Clk. Noted Jan. 16.

Mulberry, Kan.—Bonds for $30,000 have been voted for the installation of a municipal electric-light plant.

Heber, Ark.—U. S. Bratton, of Little Rock, is interested in the construction of a hydro-electric plant and power dam on the Little Red River, near Heber Springs. Bids will be received about Apr. 1. The estimated cost of the dam is $250,000 and of the plant $150,000. C. V. Smith, of Leslie, Ark., is Consult. Engr.

Sulphur Springs, Ark.—See item under Water Supply—Irrigation.

†Corpus Christi, Tex.—We are officially advised that the Corpus Christi Gas Co. has awarded the contract for the erection of a 100,000-cu.ft. two-lift gas holder to the STACEY MFG. CO., Cincinnati, Ohio. The contract for laying about 14 miles of cast-iron mains and fittings has been awarded to the WALKER MFG. & SUPPLY CO., Detroit, Mich. H. M. Wallace is Pres. Noted Oct. 10.

†Dallas, Tex.—The contract for the installation of an ornamental street-lighting system on Main and Commerce Sts. has been awarded to the DALLAS ELECTRIC LIGHT & POWER CO., Dallas.

Eastland, Tex.—The local electric-light plant, owned by A. A. Abney, which was recently destroyed by fire, will be rebuilt immediately.

Giddings, Tex.—The local electric-light plant has been purchased by the Giddings Cotton Oil Co. The new owner will enlarge and improve the property.

Denver, Colo.—The Denver City Tramway Co. is making preliminary arrangements for the construction of a power sub-station at Delaware and Cortland Sts. Estimated cost, $40,000.

Boise, Idaho—The city will soon receive bids for the installation of an ornamental street-lighting system.

Spokane, Wash.—The Washington Mill Co. is planning to install a power plant in connection with its establishment, to cost $35,000.

Tacoma, Wash.—Plans are being prepared for the installation of a new heating plant in the National Realty Bldg., to cost $10,000. F. H. Godfrey is Constr. Engr.

Eugene, Ore.—The Oregon Electric Ry. Co. will build a 30,000-h.p. hydro-electric plant at Clear Lake, near Eugene. C. A. Coolidge, Portland, is Gen. Mgr.

†Fresno, Calif.—The Fresno, Hanford & Summit Lake R.R. Co. has awarded the contract for the construction of a 3000-hp. power plant at Fresno, to the GENERAL ELECTRIC CO., Schenectady, N. Y., at $100,000.

Ontario, Calif.—Bids will be received by R. O. Brackenridge, City Clk., until Feb. 3, for the installation of a municipal fire-alarm system.

Riverside, Calif.—Plans and an efficiency report have been prepared for the installation of a municipal electric-light plant at Riverside. Plans call for an expenditure of $429,112 for a hydro-electric plant, $100,351 for steam reserve plant and $200,000 for alternate oil engine plant of 2000-kw. capacity. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs.

Cote St. Paul, Que.—The Montreal Light, Heat & Power Co. is planning to start work early this spring on the construction of a new gas plant at Cote St. Paul, to add 12,000,000 cu.ft. of gas to the daily capacity, and to cost, $200,000. J. S. Norris, Montreal, is Gen. Mgr.

Toronto, Ont.—We are officially advised that the Hydro-Electric Power Commission will receive bids sometime in March for the construction of about 125 miles of double circuit transmission line at 110,000 volts and equipping substations for transforming 20,000-hp. from the line to 13,200 volts. J. J. Galey is Ch. Engr.

Winnipeg, Man.—Bids will soon be received by M. Peterson, Secy., for the installation of additional equipment and the extension of the McPhillips St. substation. J. G. Glassco, 54 King St., is Engr.

Weyburn, Sask.—An expenditure of $35,000 has been authorized for the improvement and extension of the municipal electric-light plant.

Vancouver, B. C.—The City Council has passed an ordinance providing for the construction of a municipal electric-light plant in West Vancouver.

San Luis Potosi, Mex.—The City Council has the proposition of installing a municipal electric-light plant under consideration.

BRIDGES

Boston, Mass.—The Directors of the Port of Boston have approved plans prepared for the construction of a viaduct from the street level to the second story of the Commonwealth Pier Bldg. The estimated cost is $200,000. F. W. Hodgdon is Ch. Engr.

Boston, Mass.—The Boston & Maine R.R. proposes the rehabilitation of the Central Massachusetts R.R. to allow the running of trains direct from North Station to New York, and has appropriated $267,000 for rebuilding 25 to 30 bridges between North Cambridge and Bondsville, Mass. The majority of the new bridges will be of steel construction. A. B. Corttrell, Boston, is Ch. Engr.

Leominster, Mass.—The City Council is considering plans for the construction of a reinforced-concrete bridge, over Monoosnock Brook, at Whitney St., R. I. Whipple & Co., Worcester, are the Engrs.-in-charge.

Watertown, N. Y.—The City Bridge Commission has submitted a report favoring Court St. as the location of a new bridge over the Black River. The plan of the Commission is to provide for the elimination of the Court St. grade crossing and furnish a new bridge at the same time. An overhead or double-deck bridge is recommended. The lower deck will cost about $50,000, while the overhead structure, with approaches, will cost $200,000, of which the New York Central R.R. will pay $11,000, the state $50,000 and the city $50,000. Earl W. Sayles is City Engr.

✚Whitehall, N. Y.—The State Highway Commission has awarded a contract to the OWEGO BRIDGE CO., Owego, at $44,431, for the construction of a bridge over South Bay, a branch of Lake Champlain, near Whitehall. Bids were received Jan. 13. Other bids were: Roger Kennedy, Middletown, $46,891; Richard Hopkins, Troy, $49,316. Noted Jan. 2.

Belmar, N. J.—The New York & Long Branch R.R. will build a new steel bridge over the Shark River. The Belmar Board of Trade has requested the company to erect a draw span. G. V. Sneden, Long Branch, is Engr. M. W.

Cape May, N. J.—Col. Edwin A. Stevens, State Road Comr., Trenton, has advised local officials that he will draw an act, providing for the construction of a bridge between Somers Point and Besley's Point with state aid. The proposed structure will continue the Ocean Boulevard along the shore. The estimated cost is $300,000.

Ocean City, N. J.—The only bid received by the Ocean City Auto Bridge Co., on Jan. 11, for the construction of a trestle and highway bridge, from Ocean City to Somers Point, was that of the Sutton & Corson Co., of Philadelphia, and the Hill Dredging Co., combined at $184,663. The structure, with approaches, will be 6000 ft. long. Bids were received Jan. 11. Noted Jan. 9.

✚Red Bank, N. J.—The New York & Long Branch R.R. has awarded a contract for a 1600-ft. span, steel and concrete bridge over the North Shrewsbury River, to JESSE L. HOLLAND, Seabright, N. J., at $250,000. G. V. Sneden, Long Branch, is Engr. M. W.

Media, Penn.—The War Department, Washington, D. C., has approved the plans prepared by the Board of County Commissioners for the construction of a new bridge over the Chester River at Fifth St., Chester.

✚Pittsburgh, Penn.—Bids will be received until 10 a.m., Feb. 3, by the City Controller, Municipal Hall, for the construction of a substructure, consisting of concrete abutments, piers and pedestals, for the Bloomfield Bridge. Joseph G. Armstrong is Dir. of Pub. Wks.

The Art Commission has approved plans prepared for the construction of the Haights Run Bridge. It will be a concrete structure, with a main span of 193 ft., and will cost $150,000. Joseph G. Armstrong is Dir. of Pub. Wks.

Floyd C. H., Va.—We are officially advised that bids will be received until noon, Jan. 27, by the Board of County Commissioners, for the construction of an 87-ft. concrete span bridge over Burks Fork, and also for an 87-ft. concrete span bridge over the South fork of the Roanoke River.

Gate City, Va.—We are officially advised that bids will be received until noon, Jan. 28, by the Board of County Commissioners, for the construction of a concrete bridge, consisting of two 150-ft. spans, across the Clinch River.

Clearwater, Fla.—The Board of County Commissioners is contemplating the construction of a bridge over Whitcomb Bayou at Tarpon Springs. The estimated cost is $6000.

Bristol, Tenn.—The County Court of Sullivan County has appropriated funds for the erection of three steel bridges as follows: One over the Holston River, at Kingsport, to cost $20,000; another over the same river on the Weaver Turnpike, and a third at Shady Ford, on the road to Mountain City. The estimated cost of the three is $40,000.

Chattanooga, Tenn.—The question of getting with the Birmingham & Chattanooga R.R., in building a bridge across the Tennessee River at the neck of Moccasin Bend, or of paying the railroad company an annual rental of $25,000, for the surface use of the bridge, is now under the consideration of the County Court. Decision will be made early next month.

Lexington, Ky.—The city is considering the construction of a viaduct from Main St. to High St., at Merino St., and also a viaduct on West Main and Cox Sts. W. R. McCorkle is Comr. of Pub. Wks.

Paducah, Ky.—The City Council is considering an appropriation of $50,000, to be used for the construction of the following improvements: Erection of a concrete bridge on Sixth St.; the building of a reinforced-concrete viaduct at the Tennessee St. crossing of the Illinois Central R.R., and the construction of a subway on Jefferson St. L. A. Washington is City Engr.

Cleveland, Ohio—The City Engineering Department has applied to the Council for an appropriation of $50,000 to be used in widening the span of the Main Ave. bridge. Robert Hoffman is City Engr.

Massillon, Ohio—The Board of County Commissioners has decided to construct a steel viaduct on Columbus Road. The structure will be 116 ft. long and will cost $50,000.

✚Indianapolis, Ind.—The Pennsylvania Lines West of Pittsburgh have awarded a contract to the RITTER-CONLEY CO., Pittsburgh, Penn., for the construction of a four-track railroad bridge at Indianapolis.

✚Indianapolis, Ind.—We are officially advised that the Board of County Commissioners has awarded a contract to the CLEARY-KEURT CONSTRUCTION CO., Indianapolis, at $28,492, for the construction of a reinforced concrete bridge, over Crooked Creek, on the Myers Road. Bids were received Jan. 14. William T. Patten is Audr. Noted Jan. 2.

Kokomo, Ind.—The Commissioners of Howard County are preparing plans for the construction of a concrete arch bridge across the Wildcat River at the foot of Washington St., and to remove the iron bridge at that point to the foot of Lafountain St.

Richmond, Ind.—The Board of Public Works has voted to confer with the Board of County Commissioners on the project of removing the Main St. bridge, erecting it at a point south of its present location, and in its place erecting a concrete arch across the Whitewater River.

Rockville, Ind.—The Board of County Commissioners has decided upon the location of a new bridge at Strong's Ford, and also for a new structure at Armiesburg.

Wabash, Ind.—The Board of County Commissioners will soon receive bids for the construction of a concrete and steel bridge, over the Mississinewa River. The estimated cost is $9000.

Havana, Ill.—The Senate Committee on Commerce has reported the bill giving the Chicago, Peoria & St. Louis R.R. permission to construct a bridge across the Illinois River, at or near Havana. C. R. Westcott, Springfield, is Gen. Supt.

Milwaukee, Wis.—The War Dept., Washington, D. C., has approved plans prepared by the City Council, for the construction of a bridge over the Milwaukee River, at Buffalo St. The plans call for a two leaf bascule type, with a span of 130 ft. E. A. Pinney is Supt. of Bridges. Noted Dec. 5.

✚Thief River Falls, Minn.—We are officially advised that the Board of County Commissioners has awarded a contract to the MINNEAPOLIS BRIDGE CO., Minneapolis, Minn., at $9200, for the construction of a steel bridge over the Thief River, at Thief River Falls. Bids were received Jan. 8. A. H. Fasel is County Audr. Noted Dec. 19.

✚Eldorado, Kan.—The Board of County Commissioners has awarded a contract to McKENZIE & WILLIAMS, Webb City, Mo., at $6889, for the construction of the Weidlen Bridge over the Walnut River. Bids were received Jan. 7. Noted Jan. 2.

✚Great Bend, Kan.—We are officially advised that the Board of County Commissioners has awarded a contract to the KANSAS CONSTRUCTION CO., Wichita, Kan., at $24,800, for the construction of the Great Bend Bridge, across the Arkansas River. The structure will have ten 45-ft. reinforced concrete girder spans. Bids were received Jan. 10. C. D. Younkin is County Clk. Noted Jan. 2.

Schuyler, Neb.—Bids will be received until Jan. 28, by the County Clerk, for the construction of all county bridges during the year. Edward F. Vrzak is County Clk.

✚York, Neb.—We are officially advised that the Board of County Commissioners has awarded a contract to the WESTERN BRIDGE & CONSTRUCTION CO., Omaha, Neb., for the construction of all bridges in the county during the year 1913. Bids were received Jan. 7. H. F. Chapin is County Clk.

Galveston, Tex.—Bids will be received until 11 a.m., Jan. 27, by the County Auditor, for the construction of the Dickinson Bayou Bridge over Dickinson Bayou on the road from Dickinson to Alta Loma. John M. Murch is Audr.

✚Oakland, Calif.—We are officially advised that the City Council has awarded a contract to the ROSS CONSTRUCTION CO., Sacramento, Calif., at $25,714, for the construction of a new bridge at Eighth St., over the Lagoon, which connects Lake Merritt with the estuary. It will be of steel and concrete. Other bidders were: Ernest H. Sundborg, $28,434; Contra Costa Construction Co., $27,490; Foster Vogt Co., $29,897; Healey-Tibbitts Construction Co., $30,750; Coast Improvement Co., $27,500. Bids were received Jan. 6. Percy F. Brown is City Engr. Noted Jan. 2.

Pasadena, Calif.—The Board of County Supervisors is contemplating the construction of a concrete bridge across the Arroyo Seco, above Devils Gate. The estimated cost is $7863.

San Diego, Calif.—The Panama-California Exposition Society has been granted permission to construct a reinforced concrete bridge on Laurel St., at the entrance to the fair grounds. The estimated cost is $146,000.

Cainsville, Ont.—The Grand Trunk Ry. has been authorized to construct bridge No. 18, at mileage 73.21, from Black Rock on the middle division of its line, near Cainesville.

Ramsay, Ont.—The Canadian Pacific R.R. has been authorized to construct a bridge over the Pogamasing River, near Ramsay.

St. Catherines, Ont.—The Niagara, St. Cathrines & Toronto Ry. will replace the timber trestle at Ten Mile Creek, with a steel swing bridge.

Quebec, Que.—Bids will be received until Jan. 27 by the Provincial Government Roads Dept., Parliament Bldg., for the construction of all small and large bridges on the road between St. Augustin, County Portneuf and Charlemazne, County L'Assomption. B. Michand is Deputy Minister.

Vancouver, B. C.—We are officially advised that bids will be received until 2 p.m., Jan. 30, by the City Clerk, City Hall, for the construction of the Georgia-Harris St. viaduct. Plans and specifications may be obtained at the office of C. A. P. Turner, Engr.-in-charge, 424 Vancouver Block. It will be of concrete and steel construction and will cost approximately $300,000. William McQueen is City Clk. Noted Jan. 2.

Vancouver, B. C.—The Dominion Government Dept. of Public Works, Ottawa, Ont., is contemplating the construction of a bridge over Seymour Narrows. R. C. Desrochers, Ottawa, is Secy.

WATER SUPPLY—IRRIGATION

Agawam, Mass.—The town contemplates a bond issue of $100,000 for extending and improving its water system.

Boston, Mass.—Bids will be received by the Supply Department until Feb. 19, for furnishing six 6-in., 101 8-in., 106

12-in., and 120 16-in. valves for the high pressure fire service. J. Edward Mullen, Tremont Bldg., is Supt.

L. K. Rourke, Commr. Pub. Wks., has advertised for bids for seven miles of water pipe for the high-pressure water system. About Feb. 1 plans will be ready for the underground pumping station for the system to be constructed between the Common and Public Gardens. Estimated cost of station, $80,000.

✚The contract to furnish 7000 tons c.-i. pipe for the high-pressure fire service has been awarded to the STANDARD CAST IRON PIPE & FOUNDRY CO., at $22.35 per ton. J. E. Mullen is Supt. Supply Dept. Noted Dec. 12.

Providence, R. I.—The City Council has appointed a special committee to investigate and report on method of increasing the city's water supply, and has appropriated $10,000 for expenses of the committee. Otis Clapp is City Engr.

✚**New Britain, Conn.**—The contract to furnish c.-i. water pipe for the year 1913 has been awarded to R. D. WOOD & CO., Philadelphia, Penn., at the following prices, f.o.b. New Britain: (a) 1000 ft. of 4-in. pipe, $300; (b) 10,000 ft. of 6-in., $4032; (c) 3000 ft. of 8-in., $1890; total, $6222. Other bids were as follows: U. S. Cast Iron Pipe & Foundry Co., New York. (a) $295; (b) $4064; (c) $1905; total, $6264; Standard Pipe & Foundry Co., Bristol, Penn., (a) $315; (b) $4352; (c) $2022; total, $6670.

Albion, N. Y.—The town has offered to pay $8,500 to the Albion Water Co., for its plant. Bonds for $130,000 were recently voted for acquiring a municipal water system. William B. Dye is Mayor. Noted Jan. 9.

Binghamton, N. Y.—We are officially advised that plans have not been prepared yet for the proposed filtration plant, but it is hoped that it will be installed during the coming spring. It is estimated that the plant will cost about $125,-000. M. Stoppard is Supt. Water Dept. Noted Jan. 2.

✚**Brooklyn, N. Y.**—We are officially advised that the contract to furnish, deliver and lay water mains and appurtenances in Cypress Ave., from Myrtle Ave. to Troutman St., has been awarded to JOHN CORNWELL, Jr., New York, at $40,585. Bids were opened by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, Jan. 16.

★**New York, N. Y.**—Bids will be received by the Board of Water Supply, 165 Broadway, New York, until 11 a.m., Feb. 11, for Contract 146, furnishing and delivering valves, hydraulic cylinders, piping and appurtenances for the city tunnel of the Catskill Aqueduct in the city of New York. Charles Strauss is Pres.

Asbury Park, N. J.—A mass meeting will be held Jan. 28, to discuss the water situation here. A report has been made by T. Chalkley Hatton, Consult. Engr., Wilmington, Del., recommending an expenditure of $700,000 for a system. The proposed improvements include two reservoirs, each with a capacity of 13,000,000 gal.

★✚**Atlantic City, N. J.**—Contracts have been awarded by the Water Department, as follows: For furnishing 1206 tons of 6- to 24-in. pipe and 5,000 ft. of special castings, to the U. S. CAST IRON PIPE & FOUNDRY CO., Philadelphia, Penn.; furnishing 112 6- to 24-in. valves and 20 24- and 20-in. gear cases, to the RENSSELEAR VALVE CO., 180 Broadway, New York. Bids were opened Dec. 19. Noted Dec. 12.

Hawthorne, N. J.—The borough contemplates the installation of a water system. A Water Advising Committee has been appointed to do the preliminary work.

Ramsey, N. J.—Bids will be received by the Borough Council until Feb. 4, for constructing a complete water system to include about 11 miles of 4- to 10-in. c.-i. water mains, a 1,000,000-gal. reservoir, a pumping plant and caisson wall. Henry R. Parvin is Boro. Clk.

Contesville, Penn.—The Borough Council will soon call an election to vote on the installation of a new water system, the supply to be obtained from Rock Run. Estimated cost, $185,000.

Halifax, Penn.—The Halifax Water Co. has increased its debt by $15,000 for improving its system.

Springdale, Penn.—We are officially advised that Chester & Fleming, Hydraul. Engrs., Pittsburgh, Penn., are supervising the installation of a new water-works for the American Glue Co. The plant will have a capacity of 3,000,000 gal., and will consist of a well system and new pump station equipped with direct-acting steam pumps.

Tarentum, Penn.—The Borough Council has instructed W. A. Gibson, Boro. Secy., to communicate with Dr. Samuel T. Dixon, State Health Commissioner, urging the early approval of plans for the new municipal water works, at Tarentum. The voters approved a bond issue of $100,000 for this work two years ago, but the work has been delayed on account of technicalities. Leo Hudson, McKeesport, Penn., is Consult. Engr. Noted Nov. 14.

Tunnelton, W. Va.—We are officially advised that the W. J. Sherman Co., The Nasby, Toledo, Ohio, has been retained by the village to prepare plans and specifications for a municipal water system.

Raleigh, N. C.—According to press reports, the Board of Aldermen has refused the offer of the Wake Water Co. to sell its plant to the city for $263,000. It is probable that a new municipal system will be installed. J. N. Hazlehurst, Atlanta, Ga., is Consult. Engr. Noted Dec. 26.

Yazoo City, Miss.—According to press reports, bids will be received by the Public Service Commission until Feb. 15, for furnishing water meters during the year 1913. James S. Butler is Supt.

Baton Rouge, La.—Bids will be received by the Baton Rouge Water Co. until noon, Feb. 20, for constructing a reinforced concrete reservoir 59x120 ft. and 20 ft. deep, to have a capacity of 1,000,000 gal. The following material will be required: 725 cu.yd. crushed stone or gravel, 363 cu.yd. sand, 1292 bbl. portland cement, 130 bbl. hydrated lime, 208,-960 lb. reinforcing steel, 12 ventilators, two manhole covers, two 10-in. pipe collars, four 16-in. pipe collars, four 10-in. pipe hangers, two valve stem hangers and 30 ⅝-in. round rods, 3 ft. 4 in. long. John H. Wood is Secy. Noted Jan. 2.

✚**East View, Ohio**—The contract to construct a 10-in. water main in Kinsman Road has been awarded to the LAUESE CO., Columbia Bldg., Cleveland, Ohio, at $26,515. Bids were opened by A. A. Smith, Village Clk., Dec. 20. Noted Dec. 5.

Fostoria, Ohio—The City Council is considering a resolution authorizing Charles Latchaw, City Engr., to prepare plans and specifications for increasing the water supply.

Hamilton, Ohio—The City Council has authorized the Director of Public Service to have plans prepared for increasing the capacity of the water system from 3,000,000 to 10,-000,000 gal. per day.

New Berlin, Ohio—Bids will be received by the Village Council at the office of E. L. Garmon, Mayor, until noon, Feb. 4, for the construction of a water system. The contract involves the following: 11,250 ft. of 4- to 8-in. pipe, 22 fire hydrants, seven 7-in. valves and valve boxes, three tons special castings, one elevated steel tank of 50,000 gal. capacity, on a tower 104 ft. high, one triplex pump and motor, of 360,000 gal. daily capacity, with concrete foundation, and one brick pumping station. Plans and specifications are on file at the office of the Mayor. W. A. Hess is Clk.

Rockport, Ohio—Bids will be received by Fred Feuchter, Clk. Bd. of Affairs, until noon, Feb. 3, for constructing water mains in Harrington Road, according to plans and specifications on file at the office of the clerk, and at the office of the William H. Evers Engineering Co., The Arcade, Cleveland.

Shaker Heights, Ohio—Bids will be received by Carl A. Palmer, Village Clk., until noon, Feb. 10, for constructing water mains. Plans and specifications are on file at the offices of the Village Clerk and the Village Engineer.

Woodsfield, Ohio—We are officially advised that the W. J. Sherman Co., The Nasby, Toledo, Ohio, has been retained by the Woodsfield Water Co. to prepare plans and specifications for a mechanical filtration plant here.

Howell, Ind.—The Louisville & Nashville R.R. contemplates the construction of a new water station at Howell, estimated to cost $20,000. John W. Logsdon, Evansville, is Div. Supt.

Princeton, Ind.—The Princeton Water Co. contemplates extending its system to obtain additional pressure for fire protection.

Washington, Ind.—The city contemplates purchasing the plant of the Washington Water, Light & Power Co. H. F. O'Neall is City Engr.

Adrian, Mich.—An election has been called for Feb. 12, to vote on an expenditure of $2000, for securing an appraisal of the plant of the Adrian Water Co. John Mawdsley is City Clk. Noted Dec. 5.

✚**Detroit, Mich.**—We are officially advised that a contract to furnish 3827 tons of c.i. water pipe has been awarded to the AMERICAN CAR & FOUNDRY CO., Detroit, at $26 per ton for 6-in. and $25.75 per ton for 8-, 12-, 16-, 24- and 42-in. Bids were opened by the Board of Public Works, Jan. 3. Noted Dec. 19.

Bloomington, Ill.—The Board of Local Improvements has approved the plans prepared for the 12-in. water main, to be laid in East Washington St., from East to McClun St. Estimated cost, $8438.

Chicago Heights, Ill.—Allen L. Fox, City Engr., is preparing plans for laying 5000 ft. of 4-, 6- and 14-in. watermains.

✚**La Crosse, Wis.**—The contract to lay a pipe line to the new wells has been awarded to the J. W. TURNER IMPROVEMENT CO., Des Moines, Iowa, at $17,899. Noted Jan. 16.

Des Moines, Iowa—Preliminary plans are being prepared for a new system for the Polk County Almshouse. J. E. Backman is Chn. of Building Com.

Marshalltown, Iowa—W. Steiner, City Engr., is preparing plans for extending the water and sewer systems. Estimated cost, $25,000. D. Lamb is Supt. Pub. Wks.

Gibbon, Minn.—The town contemplates the installation of a water system. C. W. Carlson is Town Recdr.

Ironton, Minn.—The village contemplates the installation of a new water system.

Morgan, Minn.—According to press reports, plans have been completed for the installation of a water system here, estimated to cost $12,435. An election will probably soon be called to vote on this project.

Taylors Falls, Minn.—L. P. Wolff, Consult. Engr., St. Paul, Minn., is preparing plans for the installation of a water system here.

✚**Burlingame, Kan.**—We are officially advised that contricts for installing a water system and filtration plant here have been awarded as follows: Pipe and special castings, to BASH & GRAY, Joplin, Mo., at $21,482; valves and hydrants, pumps and motors, to E. J. MERKLE & CO., Kansas City, Mo., at $1478 and $1866; Contract 3 and 4, to the TONKAWA CONSTRUCTION CO., Tonkawa, Okla., at $8190 and $9960; filter, to the NEW YORK CONTINENTAL JEWELL FILTRATION CO., New York, at $3250; tank and tower, to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, at $3200. Bids were opened by N. J. Griffin, City Clk., Jan. 9. Noted Jan. 9.

Jewell, Kan.—Bonds for $40,000 have been voted for the Installation of a water system here. O. E. White is City Clk.

Oswego, Kan.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., have completed plans for a filtration plant of 1,000,000 gal. capacity, concrete settling basin, and a steel tower and tank here. Estimated cost, $25,000. An election will soon be called to vote on a bond issue. Noted Nov. 21.

Broken Bow, Neb.—According to press reports, bids are being received by the City Clerk for improvements to the water system, estimated to cost $6000. Noted Dec. 19.

Cook, Neb.—Bids will probably be asked about Mar. 15, for constructing a water system and an electric-light plant here. Plans have been prepared by the Alamo Engine & Supply Co., 1122 Farnam St., Omaha. L. H. Frank is Village Clk.

Homer, Neb.—Plans are being prepared by the Des Moines Bridge & Iron Works for a water system here, estimated to cost $12,000.

Chamberlain, S. D.—The County Commissioners contemplate an expenditure of $10,000 for drilling four artesian wells

Midland, S. D.—According to press reports, plans are being prepared by the Dakota Engineering Co., Mitchell, S. D., for a municipal water system here. Noted Sept. 12

Rawlins, Wyo.—We are officially advised that bids for improving the water system were received by L. Junggquist, City Clk., Dec. 27, as follows: (a) Furnishing and laying 3000 ft. of 10-in. lap-welded steel pipe and 4150 ft. of 6-in. c.-l. of 10-in. lap-welded steel pipe and 4150 ft. of 6-in. c.-l. pipe, (c) furnishing and erecting a 3,000,000 gal. steel reservoir, complete, Schenck-Newell Engineering Co., Basin, Wyo., (a) $14,500, (c) $8950, Peter Kiewit & Sons' Co., Omaha, Neb., (a) $21,500, W. H. Inman, Laramie, Wyo., (a) $21,500, Marshall Bros., Las Animas, Colo., (a) $21,500, Marshall Bros., Las Animas, Colo., (a) $21,500, Drake, Williams, Mount & Co., Omaha, Neb., (c) $24,000, Drake, Williams, Mount & Co., Omaha, Neb., (c) $8675, J. S. Schwartz, Colorado Springs, Colo., (a) $15,400, (c) $8675, J. S. Schwartz, Colorado Springs, Colo., (a) $7175, Fritz Chicago Bridge & Iron Works, Chicago, Ill., (c) $7175, Fritz Chicago Bridge & Iron Works, Chicago, Ill., (c) $8790, J. N. A. M. Larry, Rawlins, Wyo., (a) $17,415, (c) $8790, J. N. A. M. Larry, Rawlins, Wyo., (a) $17,415, (c) $8632, Minneapolis Jacobbucci, Rawlins, Wyo., (a) $14,554, (c) $8632, Minneapolis Steel & Machinery Co., Denver, Colo., (c) $8750; Hendry & Bolthoff Mfg. & Supply Co., Denver, Colo., (c) $8750; Hendry & Steel & Machinery Co., Denver, Colo., (c) $8124, Des Moines Bridge Bolthoff Mfg. & Supply Co., Denver, Colo., (c) $8750; Hendry & Steel & Machinery Co., Denver, Colo., (c) $8124, Des Moines Bridge & Iron Works, Des Moines, Iowa, (c) $7500, Mackay & Geddis, & Iron Works, Des Moines, Iowa, (c) $7500, Mackay & Geddis, & Boiler Works, Williams, Mount & Co., Omaha, Neb., (c) $8675, Bennett Hardware Co., Denver, Colo., (c) $14,332, (c) $8575, Bennett Hardware Co., Denver, Colo., (c) $14,332, (c) $8575, Bennett Hardware Co., Denver, Colo., (c) $14,332, (c) $8575, Bennett Hardware Co., Rawlins, Wyo., (a) $15,300, Omaha Structural Steel Works, Rawlins, Wyo., (a) $15,300, Omaha Structural Steel Works, Omaha, Neb., (a) $15,300, Omaha Structural Steel Works, (c) $8670. Noted Dec. 19

Billings, Mont.—We are officially advised that an election has been called for Mar. 25, to vote on a bond issue of $575,000 for the installation of a complete new water system here. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs.

Livingston, Mont.—We are officially advised that plans are being prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., for a complete water system here, including a filtration plant. An election will be called here, including a filtration plant. An election will be called as soon as plans are completed, which will probably be within a month.

Parnguild, Ark.—According to press reports, plans are being prepared for extending the water system. E. L. McKinley is City Clk.

Sulphur Springs, Ark.—Albert C. Moore, Consult. Engr., Joplin, Mo., is preparing plans for the installation of a water system and an electric-light plant here. Estimated cost, $40,000.

✦Vashnne, Tex.—We are officially advised that the contract to construct a lock and dam for the Trinity River Irrigation District has been awarded to C. R. CUMMINGS, Wallisville, Tex., at $55,850. The only other bid received was that submitted by Charles Clark & Co., Galveston, at $60,400. Noted Jan. 9.

Bryan, Tex.—Bonds have been voted for the installation of a water system here. W. W. Harris is Mayor.

Bryan, Tex.—Bids will be received by George Wecker, City Secy., until Jan. 30, for constructing two water towers of 100,000 and 150,000 gal. capacity.

Denison, Tex.—The City Council contemplates the installation of a filtration plant for the water system. An election will probably soon be called to vote on a bond issue.

Eagle Pass, Tex.—The Rio Grande Irrigation Co. will construct a system of irrigation near here and install a pumping plant. The incorporators are: L. C. de Bona, B. C. de Bona, J. L. Matthews and others.

Fort Worth, Tex.—The City Commission has under consideration the proposition of issuing $261,000 of additional bonds for the completion of the West Fork Reservoir, which will greatly augment the municipal water supply.

Madisonville, Tex.—It is proposed to install a water system here, to cost about $16,000. An election will soon be called to vote on a bond issue.

Malone, Tex.—Clayton Rogers, who recently obtained control of the Malone Water Co., will install a pumping plant and other equipment.

Durant, Okla.—We are officially advised that an election will probably soon be called to vote on a bond issue of $80,000 for extending the water system and the sanitary sewer system. W. P. Bamford is City Engr. A. Neely is Mayor. Noted Jan. 2.

Deming, N. M.—The Home Plot Co. will install 100 electric pumping plants on a tract of land near here. Each plant will be capable of irrigating 20 acres.

Thatcher, Ariz.—The Thatcher Water Co. has been organized to install a water system here.

Milton, Ore.—We are officially advised that the bond issue of $15,000 for the proposed water system failed to carry at the election. Another election will probably soon be called. L. L. Cook is Business Mgr. Noted Nov. 7.

Portland, Ore.—The lowest bids received by the Water Board, Jan. 2, for furnishing supplies were as follows: Eureka Foundry Co., furnishing 1000 ft. of 12-in. C. I. C. pipe; Pacific Foundry Co., furnishing 1000 ft. of 12-in. C. I. C. pipe; Portland Foundry, furnishing hydrants; Ludlow Valve Co., $9750, valves; M. L. Ells, $10,000. Noted Jan. 2.

San Diego, Calif.—Bids will be received by the Department of Public Works and Motor, until Feb. 3, for furnishing [illegible] pipe and fittings. P. E. Woods is Supt. Noted Dec. 26.

Brantford, Ont.—The Board of Water Commissioners contemplates calling [illegible] water system estimated to cost $[illegible]. T. H. Lockwood is [illegible].

Brighton, Ont.—The town contemplates the installation of a water system estimated to cost $[illegible]. T. C. Lockwood is City Clk.

Nayolato, Mexico.—[illegible] has begun the construction of what will be the largest [illegible] in Mexico. The dam will be built [illegible] miles from here and will hold back a large [illegible] of water. From this reservoir a main canal [illegible] feet long will carry the water to the [illegible] and the main canal will have a [illegible] feet wide. The irrigation system will supply water for irrigating approximately 1,000,000 acres of land.

SEWERS

Boston, Mass.—Bids will be received by the Board of Public Works until Jan. 27, for constructing sewers in Spring, Baker and Gardner Sts., West Roxbury District. L. K. Rourke is Comr.

Brooklyn, N. Y.—The Board of Estimate has voted the preliminary authorization of the Classon Ave. system of relief sewers, which is planned to serve the Heights, Bedford, Prospect Heights, Flatbush, Williamsburg and Bushwick. Estimated cost, $2,500,000.

Newburgh, N. Y.—According to press reports, bids are being received by the City Clerk for constructing a sewer in Fullerton Ave., between Third St. and Gidney Ave. Estimated cost, $15,700.

New York, N. Y.—Bids will be received by Cyrus C. Miller, Pres., Boro. The Bronx, until Jan. 27, for constructing sewers in portions of St. Lawrence, Beacon and Commonwealth Aves.

Newark, N. J.—Bids will be received by the Board of Street and Water Commissioners until Jan. 23, for furnishing 41,000 lin.ft. of 4- and 6-in. vitrified all-glazed sewer pipe and 900 specials, for the use of the House Sewer Connection Department during the year 1913. Morris R. Sherrerd is Ch. Engr. of Bd.

✦Newark, N. J.—The contract to construct a sewer in Broad St., from Clay to State St., has been awarded to HARRISON CRAIG, Newark, at $6691.

✦Princeton, N. J.—Bids will be received by the Board of Trustees of Princeton University, until 3 p.m., Feb. 5, for constructing an outfall sewer and sewage purification plant, consisting of settling tanks, sprinkling and sand filter beds. Plans and specifications may be obtained at the office of G. C. Wintringer, Secy. of Business Administration.

Spring Lake, N. J.—Bids will be received by the Mayor and Borough Council until 8 p.m., Feb. 10, for constructing a sewer outlet at the foot of Brighton Ave. E. V. Patterson is Boro. Clk.

Union, N. J.—The Common Council has adopted plans prepared for the construction of sewers in the Fifth Ward.

Darby, Penn.—The State Commissioner of Health has ordered that sewerage disposal plants be built to serve the various boroughs and townships, in order that the pollution of streams may cease. Tentative plans provide for three disposal plants and four trunk line sewers, estimated to cost $1,500,000.

Catonsville, Md.—Bids will be asked some time during the spring for the construction of a sanitary sewer system and a sewage disposal plant here. The system comprises about seven miles of sewers. R. J. Gillis is Boro. Engr. Noted incorrectly, Jan. 16, as Catonsville, Penn.

Huntington, W. Va.—Bids will be received by the Board of Commissioners until 1:30 p.m., Jan. 30, for the construction of 12- and 15-in. lateral sewers in First, Hagan and Smith Sts., and Second Ave. L. A. Pollock is Comr. of Streets.

Charleston, S. C.—Bids will be received by the Street Department until 7 p.m., Jan. 30, for furnishing, delivering and laying terra cotta pipe during the year 1913. Specifications may be had on application. J. H. Dingle is City Engr.

Cornelia, Ga.—The town contemplates the installation of a sewer system estimated to cost $5000. For particulars, address the Mayor.

✦Arcadia, Fla.—We are officially advised that the contract to construct a sewer system here has been awarded to the SEARCEY CONSTRUCTION CO., Greenville, Ala., at $7224. The other bids were: J. B. McCrary Co., $12,450; W. B. Williams, $13,750; I. C. Mishler, $14,657; Bryan & Co., $16,340; Parker & Calow, $29,890. Bids were opened Jan. 16. Noted Jan. 2.

Birmingham, Ala.—The Board of Commissioners has approved plans for the construction of sewers in various streets. Estimated cost, about $16,000. H. S. Ryall is City Clk.

Tuskegee, Ala.—Walter G. Franz, Consult. Engr., Cincinnati, Ohio, is preparing plans and specifications for a sanitary sewer system for the Tuskegee Institute. Bids will be asked about Feb. 1.

Paducah, Ky.—See item under Bridges.

Arlington Heights, Ohio—Bids will be received by A. J. Orth, Village Clk., until noon, Feb. 17, for constructing sanitary sewers in various streets, according to plans and specifications on file at the office of the clerk.

Bellaire, Ohio—See item under Streets and Roads.

Burton, Ohio—See item under Streets and Roads.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Jan. 30, for constructing main and lateral sewers and drains, with appurtenances, according to plans and specifications obtainable at the office of the Chief Engineer.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Jan. 30, for constructing sewers in various streets, according to plans and specifications on file at the office of the Chief Engineer, City Hall.

Columbiana, Ohio—Bids will be received about Mar. 1, for constructing a sewer system and a sewage disposal plant. Bonds for $25,000 were recently voted for this work. H. A. Inman is Town Clk. Noted Jan. 2.

New Berlin, Ohio—Bids will be received by the Village Council, at the office of E. L. Garmon, Mayor, until noon, Feb. 4, for constructing sanitary sewers and a sewage disposal plant. The contract involves the construction of 13,250 ft. of 8- to 15-in. vitrified pipe sewers. W. A. Hess is Clk.

Niles, Ohio—Bids will be received by C. Caldwell, Dir. Pub. Ser., until noon, Jan. 27, for constructing storm sewers.

Shaker Heights, Ohio—Bids will be received by Carl A. Palmer, Village Clk., until noon, Feb. 10, for constructing

sewers. Plans and specifications are on file at the offices of the Village Clerk and the Village Engineer. Noted Jan. 2.

Sidney, Ohio—D. H. Warner, Dir. Pub. Ser., has been authorized to prepare plans for constructing from 15- to 24-in. storm sewers in various streets.

Kokomo, Ind.—The Board of Public Works has passed a resolution for the construction of sewers in Firman, Washington and Hoffer Sts. Bids will soon be asked. B. Havens is City Clk.

Ann Arbor, Mich.—Bids will be received by R. Granger, City Clk., about Mar. 1, for constructing one mile of 8-in. vitrified pipe sanitary sewer, and two miles of 12- to 20-in. vitrified pipe storm sewers. M. Osgood is City Engr.

Detroit, Mich.—The Park Commissioners contemplate an appropriation of $40,000 for the construction of a sewer system for Belle Isle.

Berwyn, Ill.—Bids will be received by the Board of Local Improvements until 8 p.m., Feb. 11, for constructing a brick sewer, with manholes, catch basins, house and catch-basin slants, street connections, and connections with laterals. Estimated cost, $92,445. Plans and specifications are on file at the office of Arthur R. Wolfe, New York Life Bldg., Chicago, Ill. Walter V. Aikman is Secy. of Bd. Noted Nov. 28.

Bradley, Ill.—We are officially advised that bids will be received at the Village Hall until 7:30 p.m., Jan. 30, for constructing a sewer system estimated to cost $47,548. C. A. Voorhees is Pres. Bd. Local Impvts. Noted Oct. 31

Dixon, Ill.—Bids will be asked in March for constructing 5800 ft. of 8- to 15-in. sewer. Charles F. Nesbit is City Engr.

Elgin, Ill.—The City Council has passed the ordinance appropriating $45,000 for the construction of a sewer in State St. M. H. Brightman is City Engr. Noted Dec. 19.

Rockford, Ill.—The Board of Local Improvements is having plans prepared for the construction of a sewer system for the West End. Estimated cost, $30,000.

Marshalltown, Iowa.—See item under Water Supply—Irrigation.

Springfield, Minn.—A resolution has been adopted authorizing the construction of sewers in Jackson St., South Jefferson St., and various others. H. Langmack is Village Recdr.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until noon, Jan. 24, for constructing the Clifton Heights Joint District Sewer, and for constructing sewers in Clifton Heights Joint Sewer District No. 2. The contract includes the following: 588 ft. of 54-in., 355 ft. of 52-in., 732 ft. of 28x42-in., 340 ft. of 26x39-in., and 627 ft. of 32x48-in. inside diameter brick and portland cement mortar sewers; 210 ft. of 27-in., 410 ft. of 24-in., 340 ft. of 21-in., 440 ft. of 18-in., 240 ft. of 15-in., 3790 ft. of 12-in. vitrified clay pipe sewers. Plans and specifications are on file at the office of the Board of Public Improvements. Maxime Reber is Pres.

Pecos, Tex.—The city contemplates a bond issue of $55,000 for the installation of a complete sewer system. Noted Dec. 19.

Temple, Tex.—We are officially advised that an appraisement is being made of the privately owned sewer system, and plans and specifications are being prepared for its extension and improvement when acquired by the city. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Dec. 12.

Nogales, Ariz.—We are officially advised that bids will be received until Feb. 15, for the construction of a sewer system here, according to plans prepared by H. Gordon Glore, Town Engr. Estimated cost, $45,000. L. W. Mix is Mayor. Noted Jan. 2.

Hanford, Calif.—The Board of Trustees has instructed the City Clerk to advertise for bids for the construction of the proposed sewer system and sewage disposal plant. Estimated cost, $80,000.

✦Los Angeles, Calif.—We are officially advised that the contract to construct the Arroyo de la Brea storm sewer has been awarded to HOLT & JEFFREY, Los Angeles, at $538,844. Bids were opened Jan. 6, by the Board of Public Works. Noted Dec. 12.

John Balch was the lowest bidder at $33,983, for constructing a sewer in Santa Cruz St., between Pacific and Grand Aves. Other bids were B. C. Nicols and F. S. Tomich, $34,527; W. W. Hendricks, $38,000; Peter Jamcich, $38,562; John Radich, $38,960; S. M. Kerns, $39,700.

San Diego, Calif.—An appropriation of $25,000 has been made for the construction of sewers. Bids will probably soon be asked. A. E. Dodson is Supt. of Sewers.

Simcoe, Ont.—Bids will be received by the city until Mar. 1, for constructing a sewer system here, according to plans and specifications prepared by Chipman & Powers, Consult. Engrs., Mail Bldg., Toronto. Estimated cost, $70,000. W. C. McCall is City Clk.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Jan. 27 by the Department of Public Works for repairing artificial stone sidewalks during 1913. L. K. Rourke is Comr.

✦Hartford, Conn.—The contract for the construction of about 14,764 lin.ft. of graded road on the Westbrook-Centerbrook Turnpike has been awarded by the State Highway Commission to F. ARRIGONI & BRO., Middletown, Conn., at the following prices: Grading, $12,999; telford, $1.50 per lin.ft., extra; rubble drain, $1.75 per lin.ft.; masonry or dry rubble wall, $6 per cu.yd. J. H. McDonald is Comr.

✦Buffalo, N. Y.—The City Council has directed the Department of Public Works to award a contract to the ERIE CONTRACTING CO., at $9500, for paving a portion of Pries Ave. with brick.

The Council has also ordered the paving of Champlain and Tousey Sts., and the repaving of Eagle St. from Pine to Jefferson with asphalt. Francis G. Ward is Comr.

The City Council has instructed the Commissioner of Public Works to advertise for bids for paving Saybrook Place with brick or asphalt, and for repaving Military Road with asphalt, from Grant St. to the Delaware, Lackawanna & Western R.R. the roadways to be 40 ft. wide.

Hailey, N. Y.—The taxpayers of the village have voted to pave the E. Ellis Square at a cost of not more than $7500.

✦Ilion, N. Y.—The Village Board has awarded a contract to the WARREN BROS. PAVING CO. at $2.18 per sq.yd., for paving East River and West Sts. with bitulithic.

Bids will be received until 8 p.m., Jan. 23, by the Board for paving West Clark and West North Sts.

Syracuse, N. Y.—Bids will be received until 1:30 p.m., Jan. 27, by the Board of Contract and Supply, for grading Dudley St., from Stolp Ave. to Crossett St. George J. Metz is City Clk.

✦Flemington, N. J.—The Hunterdon County Board of Freeholders has awarded a contract to M. IRVING DEMAREST, Sewaren, N. J., for the construction of a macadam road between High Bridge and Califon, a distance of about three miles, at a cost of $43,085.

✦Jersey City, N. J.—We are officially advised that the Board of Street and Water Commissioners has awarded a contract to WM. VAN KIETHEN, Penn St., Jersey City, at 88½% of the estimated cost for improving Van Wagenen from Stuyvesant to Sip Aves. Edward B. See is Clk. Noted Jan. 2.

Williamsport, Penn.—The Highway Committee has requested an appropriation of $15,000, for street paving during 1913. Ordinances have been passed for the paving of Hepburn, Bennett, Sixth and West Edwin Sts., and the City Engineer will advertise for bids for paving Hepburn St. as soon as the survey is completed. S. Stabler is City Engr.

Washington, D. C.—Bids will be received until 2 p.m., Jan. 27, by the Commissioners of the District of Columbia for grading certain streets, aggregating about 47,000 cu.yd. C. H. Rudolph, John A. Johnston and William V. Judson are Comrs.

✦Birmingham, Ala.—We are officially advised that the City Council has awarded a contract to DUNN & LALLANDE BROS., Birmingham, for approximately 20,000 sq.yd. of granite block paving in various alleys at $1.05 per sq.yd., with 4-in. gravel foundation, or $1.15 per sq.yd. for a 4-in. concrete foundation. Walter F. Kirkpatrick is City Engr.

Gadsden, Ala.—The City Council has instructed the City Engineer to prepare plans for paving Forest Ave., from Sixth to 12th Sts. with tar and gravel on a concrete foundation, at an estimated cost of $20,000. Chas. L. Marsh is City Engr.

Natchez, Miss.—The contract recently awarded to the Garretson-Brewer Construction Co., Jackson, Miss., for the construction of 60 miles of road has been rescinded, and new bids will be received in February, by the Board of Supervisors of Adams County. The sum of $150,000 is available for the purpose. John T. Jenkins is Chancery Clk. Noted Jan. 2.

Louisville, Ky.—Bids will be received until Feb. 11, by the Board of Public Works, for all of the street work planned for 1913. The estimated cost is $263,000. There will be seven contracts, covering asphalt, vitrified block and wood block. The seventh contract is for sidewalks, which are to be of granitoid. The total yardage is as follows: Asphalt, 46,295; vitrified block, $49,690; wood block, 2350; brick in alleys, 3570, and granitoid sidewalks, 6740. About $132,000 is paid by the city, the remainder of the expense being borne by the property owners. Roger McGrath is Secy. of the Bd.

Bellaire, Ohio—Bids will be received until noon, Jan. 24, by the Director of Public Service for street improvements as follows: Grading, paving and constructing necessary drains, culverts and retaining walls on 44th St., from Franklin St. to Pine Alley, and Pine Alley, from 44th to 45th Sts., paving Guernsey St., from 19th to 23d Sts., constructing sewers in portions of Washington Ave., Boundary and Hamilton Sts. Marie Gaertner is Clk.

✦Bryan, Ohio—We are officially advised that a contract has been awarded by the Village Council to E. A. FRESHWATER & SONS, Cleveland, Ohio, at $58,360, for paving West High, Mulberry and Centre Sts. with Metropolitan brick, cement filler and concrete curb and gutter. The Engineers' estimate was $59,473. Other bidders using same materials were: Lambert Bros. & Wirt, Delaware, Ohio, at $57,976; the T. J. Mulligan Co., Lima, Ohio, at $64,340; J. O. Shoup & Co., Dayton, Ohio, at $59,304; H. S. Enck, Lima, Ohio, at $58,325. The Smith & Boulay Co., Toledo, Ohio, is Engr. in Charge. John A. Neill is Village Clk. Noted Dec. 19.

Burton, Ohio—Bids will be received until noon, Feb. 3, by the City Clerk for the following street improvements: 7326 sq.yd. of concrete pavement with tar top, 3500 lin.ft. concrete curb, 1800 cu.ft. excavation, and 1500 lin.ft. sewer pipe. A. C. Brown is Clk. E. A. Fiedler, Chardon, Ohio, is City Engr.

Chardon, Ohio—Bids will be received until noon Jan. 31 by the Board of Public Service for the construction of 6950 sq.yd. of brick pavement at an estimated cost of $20,000. E. A. Fiedler is City Engr.

Cincinnati, Ohio—The Commissioners of Hamilton County have instructed the County Engineer to prepare plans for the improvement of 5¾ miles of Batavia Pike at an estimated cost of $55,566, and of Rapid Run Pike, from the city limits to Neeb Road, at an estimated cost of $12,184. Clinton Cowen is County Engr.

Niles, Ohio—Bids will be received until noon Jan. 27 by the Board of Control for paving with vitrified brick North Main St. from the Erie R.R. to the north corporation line. J. E. Tregaskis is Clk.

Ravenna, Ohio—Bids will be received until noon, Feb. 3, by the Director of Service for the improvement of Cleveland Ave. and North Chestnut St. from the Erie R.R. track to the north corporation line by grading, draining, curbing, paving and all other necessary improvements. The work includes 10,210 sq.yd. of pavement, 6965 lin.ft. curbing; 4500 sq.yd. sidewalks relaid, 4000 cu.yd. excavation, etc. W. H. Linton is Dir. Pub. Ser.

Shaker Heights, Ohio—Bids will be received until noon Feb. 10 by the Village Clerk for paving with brick, asphalt, macadam or concrete and laying sidewalks in sections of the following streets: Southington, Endicott, Wicklow, Leighton, Drummond, Litchfield, Attleboro, Devonshire, Fontenary, Coventry, Elham, Warrington, Weymouth, Huntington, Drexmore and Woodbury Roads. C. A. Palmer is Clk.

Washington C. H., Ohio—Bids will be received until noon, Feb. 1, by the Director of Public Service for improving Pearl St. from Rawlinge to Gregg St. by grading, curbing and paving with hardburned paving brick. C. E. Mark is Dir.

Indiana—Bids for road improvements in Indiana will be received as follows:

Feb. 3, at Rushville, by Commissioners of Rush County for construction of a macadam road in Rushville Township. Allen R. Holden is Audr.

Feb. 3, at Jeffersonville, by Commissioners of Clark County, for construction of a macadam road in Jeffersonville Township. George W. Stoner is Audr.

Feb. 4, at Marion, by Commissioners of Grant County, for the improvemetn of county roads. E. H. Kimball is Audr.

Feb. 4, at Bloomington, by Commissioners of Monroe County, for construction of the Fred Owens et al. Road, Richland Township. W. F. Kinser is Audr.

Feb. 4, at Crawfordsville, by Commissioners of Montgomery County, for the construction of gravel roads in Brown, Franklin, Union and Scott Townships. B. B. Engle is Audr.

Feb. 4, at Winamac, by Commissioners of Pulaski County, for construction of a road on line between Van Buren and Indian Creek Townships. W. E. Munchenburg is Audr.

Feb. 4, at Paoli, by Commissioners of Orange County, for construction of a gravel road in French Lick, Northwest, Paoli and Orangeville Townships. Ed. A. Palmer is Audr.

Feb. 13, at Martinsville, by Commissioners of Morgan and Johnson Counties, for the construction of the Elburn Brown et al. Road. J. S. Whitaker is Audr.

Cannelton, Ind.—Bids will be received until noon, Feb. 4, by Commissioners of Perry County for the construction of approximately 18.25 miles of macadam roads in Troy Township. The estimated cost is $69,664. Charles D. Patrick is Audr.

Greencastle, Ind.—Bids will be received until 10 a.m., Feb. 3, by the Commissioners of Putnam County, for the construction of macadam roads as follows: The Brackney Road, 2684 ft.; the McKeehan Road, 5305 ft.; the Browning Road, 3853 ft., and the Dick Road, 6618 ft., in Greencastle and Marion Townships. James E. Houck is Audr.

Kentland, Ind.—Bids will be received until 1 p.m., Feb. 3, by the Commissioners of Newton County for the construction of a macadam road on the line between Jefferson and Grant Townships. Samuel R. Sizelove is Audr.

Portland, Ind.—Bids will be received until 10 a.m., Feb. 4, by the Commissioners of Jay Country for the construction of a crushed stone road in Bearcreek Township, petitioned for by E. T. Haffner and others. John Bonifas is Audr.

Vincennes, Ind.—Bids will be received until 2 p.m., Feb. 3, by the Commissioners of Knox County, for the construction of gravel roads as follows: 10,647 ft. of the Downey Road, Washington Township; 7381 ft. of the Auleitner Road, Vincennes Township, 8058 ft. of the Martin Fox et al. Road, Washington Township, and 5400 ft. of the Carl Schmidt Road, Vincennes Township. John T. Scott is Audr.

Mount Clemens, Mich.—Plans will be prepared by the City Engineer for about 20,000 sq.yd. of paving on various streets at an estimated cost of $42,000. Bids will be asked about Mar. 1 on various kinds of paving, and 6000 cu.yd. of excavation. John Irwin is City Engr.

Peoria, Ill.—The Board of Local Improvements has decided to pave South Adams St., from Oak to Cedar, with creosoted wood block, as a majority of the property owners favored that paving. Through Ave. is to be paved with brick, from Knoxville to Wisconsin Sts., at an estimated cost of $22,947, or $[illegible] per front ft. L. D. Jeffries is City Engr.

Quincy, Ill.—The Board of Local Improvements has passed a resolution declaring it necessary to pave 16th St., from Maine to Broadway, with vitrified brick, at an estimated cost of $[illegible]. W. P. Bischoff is City Engr.

Rock Island, Ill.—The Board of Local Improvements has decided to pave 18th Ave., from 17th to 30th Sts., with brick, at an estimated cost of $[illegible]. The improvements will include stone curbing and installing six drain or catch basins. Wallace Trefehler is City Engr.

Clinton, Iowa.—We are officially advised that bids as follow[illegible] received by the City Council for paving Seconq [illegible] to Bozard St. with vitrified block: [illegible] Carey & Sons, Clinton, Iowa, $105,023; J. S. McLaughlin & [illegible] Rock Island, Ill., $105,[illegible]; Roberts & Ridge, Sterling, Ill., $105,428; John Fey, Davenport, Iowa, $105,416; James J. [illegible] & Sons, Cedar Rapids, Iowa, $107,068. The quantities required include [illegible] sq.yd. of vitrified brick to be laid on concrete and [illegible] sq.yd. of [illegible] to be laid on [illegible] Feb. 11 be the City Council will receive bids for the construction of approximately [illegible] of vitrified brick paving, [illegible] to City Engr. C. J. [illegible]

Omaha, Neb.—[illegible] sewers, [illegible] miles of [illegible] new [illegible]

Houston, Tex.—[illegible] of 18,500 lin.ft. of [illegible] sewers, [illegible] per ft., C. E. [illegible] Construction Co., 39.4c. [illegible] & Paine at [illegible]

✦Okmulgee, Okla.—[illegible] Council [illegible] Muskogee, Okla., at $22,686 for approximately 10,000 sq.yd. of Bermudez asphalt paving. The same company bid $21,736 for Gilsonite. L. P. McCormack's bid was $22,687 for Gilsonite. L. H. D. Cook is Comr. of Finance. Noted Jan. 2.

Tacoma, Wash.—The Commissioner of Public Works has declared it necessary to construct 40 miles of new sidewalks in Tacoma during 1913. They will be of cement, and the estimated cost is $100,000. W. C. Raleigh is City Engr.

✦Colton, Calif.—We are officially advised that the City Trustees have awarded a contract for paving Eighth, I and J Sts. to GEORGE PAGNESSA, Los Angeles, at $29,723. Other bidders were: Fairchild-Gilmore-Wilton Co., $31,928; Los Angeles Paving Co., $34,021; Highway Construction Co., $32,477. Charles H. Wondries is City Engr.

Glendale, Calif.—Bids will be received until 7:30 p.m., Jan. 27, by the City Clerk, for improving portions of Doran, Dryden and Campbell Sts. and Central Ave. The approximate quantities are as follows: 7500 lin.ft. grading, 281,500 sq.ft. oiling, 7440 lin.ft. cement curb, 7440 lin.ft. cement sidewalks, 5 ft. wide, and 15 corrugated iron culverts, averaging 80 ft. long, and from 24 to 42-in. in diameter. G. B. Woodbury is City Clk.

Los Angeles, Calif.—The Cudahy Walnut Lands Co. will spend approximately $300,000 in street work on its recently acquired 500 acres of land near Huntington Park.
LIGHT, HEAT & POWER

Orange, Calif.—We are officially advised that bids will be received until Jan. 27 by the City Council for paving 2040 lin.ft. of North Glassell St. with asphalt surface on a concrete base. The estimated cost is $14,361. C. W. Hallman is City Clk. C. C. Bonebrake is City Engr.

Pasadena, Calif.—The city will improve Lake and Oak Knoll Aves., from California St. to the south city limits. The work will consis of 172,450 sq.ft. of asphalt paving on 4-in. cement base, 14,830 sq.ft. vitrified brick paving, 440 sq.ft. gutters, 141 lin.ft. curbs, and 43,615 sq.ft. asphalt paving on concrete base. Proceedings have been commenced for similar work on about five blocks of Hillcrest Ave., Oak Knoll and on Raymond Ave., between Dayton and Glenarm Sts., a distance of about 11 blocks. S. J. Van Ornum is City Engr.

San Diego, Calif.—The City Council has ordered the grading of Sixth St. from B St. to the City Park, and the construction of concrete curbs, sidewalks and vitrified sewer laterals. The grading of Monroe Ave. from Maryland St. to University Heights, and from Arch to Connecticut Sts., and the construction of cement pipe culverts, also for grading and paving Abbott St. from Newport to Long Beach Ave. with decomposed granite, and the construction of cement curbs and culverts.

✦Venice, Calif.—BRAUN, BRYANT & AUSTIN were awarded the contract at $8766 for the paving of Royal Court and Thornton Place, and the construction of cement sidewalks, curbs and sewer laterals.

JOHN D. MARSH, Wilson Bldg., Los Angeles, was awarded the contract at $11,996 for the grading and paving and construction of cement sidewalks and curbs on Vista del Mar, Montgomery and Fowler Aves.

Fort William, Ont.—The City Council is planning street improvements at an estimated cost of $10,500. A. J. McNaughton is City Clk.

Edmonton, Alta.—Press reports state that the Board of Commissioners of Edmonton is planning the construction of 30 miles of street paving, and about 50 miles of sidewalks during 1913. William Short, K. C., is Mayor.

✦South Vancouver, B. C.—A contract has been awarded by the City Council to V. L. McADAM & CO., Vancouver, at $227,148, for paving Westminster Road with creosoted wooden block.

INDUSTRIAL WORKS

Great Barrington, Vt.—Fire totally destroyed the sawmill of Thomas & Palmer, Jan. 12, causing a loss of $30,000 on buildings and machinery. The plant will be rebuilt at once, and equipped with electrically operated machinery.

Boston, Mass.—The Board of Port Directors is having plans made for a 500,000-bu. grain elevator, to be erected adjoining Commonwealth Pier No. 5, now under construction. Gen. Hugh Bancroft is Chm. of Bd. Frank W. Hodgson is Ch. Engr.

Hudson, Mass.—Thomas F. Mahoney has had plans drawn for a new shoe factory to be five stories high and 350 ft. long, of concrete and steel.

Somerville, Mass.—The Gulf Refining Co., 110 State St., Boston, will build a distributing station on Allen St., Somerville. There will be three buildings: a garage, 30x50 ft.; a stable, 30x100 ft.; a warehouse, 30x32 ft. Cost, $40,000. A. B. Carll, American House, Boston, is Supt. of Construction.

Auburn, R. I.—The Hope Foundry, Warren, R. I., will build a plant at Auburn, R. I., and remove to that place. Estimated cost, $30,000. John E. Costello is Mgr. and Supt.

Central Falls, R. I.—Plans are being prepared for rebuilding the Newell Brass Foundry, at Central Falls. The three buildings now in use will be demolished, and it is expected that one larger foundry will be built to replace them.

✦Providence, R. I.—The Revere Rubber Co. of Providence, R. I., has awarded the contract for the erection of a two-story addition to its plant to the CRUISE & SMILEY CONSTRUCTION CO., Pawtucket, R. I.

Bridgeport, Conn.—The American Graetzin Light Co., of Germany, is negotiating for a factory at Bridgeport, to manufacture its lights in this country.

Bristol, Conn.—The New Departure Mfg. Co. has decided to raise the office and factory building on North Main St. two additional stories, making a five-story structure instead of three as was originally intended. The building is 62x216 ft., of steel and reinforced concrete. W. P. Crabtree, New Britain, is Arch.

New Britain, Conn.—Several additions are planned at the plant of P. & F. Corbin, one of which will be the addition of three stories to a present four-story building, 60x216 ft.

New Haven, Conn.—Plans have been completed and estimates are being received for a new building on James St., for the National Folding Box & Paper Co. The structure will be four stories high, of brick mill construction, 100x250 ft., and will be connected with the present factory by a bridge.

South Manchester, Conn.—The J. T. Robertson Co., soap manufacturer, is planning an addition to its plant on Hilliard St. It will be of brick, two stories high and about 30x140 ft.

+Brooklyn, N. Y.—The Royal Lace Paper Co., 850 Lorimer St., has awarded a contract to JULIUS STRAUSS, 153 Remsen St., for the construction of a three-story factory, 75x72 ft. The estimated cost is $12,000. P. Tillwin & Son, 385 Fulton St., are the Archs.

Buffalo, N. Y.—The Ferguson Steel & Iron Co. has been incorporated with a capital stock of $100,000, and will build a shop for the fabrication of structural steel. The directors include James E. Ferguson, John W. Robinson and Charles Kennedy.

New York, N. Y.—Plans are being prepared for a twelve-story factory, which the U. T. Hungerford Brass & Copper Co., 497 Pearl St., will erect at 486 to 492 Pearl St. It will be 94x137 ft., of brick.

North Tonawanda, N. Y.—The Niagara Radiator & Boiler Co. will erect a building, 600x100 ft., to be used as a stock house, and for the extension of its boiler and equipment departments. The company will also build an addition to its boiler foundry, 100x200 ft. E. C. Andrews is Gen. Mgr.

Rochester, N. Y.—The Erdle Perforating Co., 279 Mill St., has had plans prepared for a new factory, 75x300 ft., of brick, which it will build on York St.

The Rochester Brass & Aluminum Co. has purchased property on Marrietta St., upon which it will erect a foundry and a two-story machine shop.

Jersey City, N. J.—The Central R.R. of New Jersey has received permits for the erection of a new boiler and power plant to cost $100,000, and new roundhouse and repair shops to cost $150,000, at Jersey City. J. O. Osgood, 143 Liberty St., New York, N. Y., is Ch. Engr.

+Newark, N. J.—The Atha Tool Co., Chapel St. and Albert Ave., has awarded a contract to SAMMON BROS., Arlington, for the construction of a one- and two-story factory and shop building, 169x94x168 ft. Fred A. Phelps, 9 Clinton St., is the Arch.

Harrisburg, Penn.—Bids are now being received by the Moorhead Knitting Co., for the construction of a three-story factory, 150x50 ft. Weaver & Stewart, Commonwealth Trust Bldg., are the Archs.

Lancaster, Penn.—Bids are being received by Stehle & Co., silk manufacturer, 84 Green St., New York, N. Y., for the construction of a one-story silk mill in Lancaster. The estimated cost is $10,000. C. H. Urban, Woolworth Bldg., Lancaster, is the Arch.

+Philadelphia, Penn.—The American Engineering Co., Cumberland and Aramingo Sts., has awarded a contract to GEORGE KESSLER, Drexel Bldg., for the construction of a two-story machine shop, 130x60 ft. The estimated cost is $35,000. Ballinger & Perrott, 1211 Arch St., are the Archs.

Bids are being received by George W. Graves, Arch., Rowland Bldg., Detroit, Mich., for the construction of a two-story factory, 350x100 ft., in Philadelphia, for the Richmond Radiator Co., 1480 Broadway, New York, N. Y.

The William Steele & Sons Co., 1600 Arch St., has been granted permits to erect for the Electro-Dental Mfg. Co., at 33d and Arch Sts., a $173,000 factory and a $10,000 power plant. The former building will be a five-story structure, 277x65 ft., of reinforced concrete and brick. The boiler and engine house will be 34x66 ft., one story high, of brick.

Pittsburgh, Penn.—The Pittsburgh Screw & Bolt Co. has obtained a permit to erect a steel structural shop, 798x332 ft., at its plant on Preble Ave. The estimated cost is $40,000.

South Bethlehem, Penn.—Bids are being received by Charles E. Lehr, Ch. Engr., Bethlehem Steel Co., for the construction of a four-story pattern shop, 200x62 ft.

Baltimore, Md.—The Hamburger, Wolf & Caroll Co., underwear manufacturers, Bayard and Carroll Sts., whose plant was recently destroyed by fire, is having plans prepared for its reconstruction. The estimated cost is $75,000.

The American Tobacco Co., Barre and Charles Sts., is having plans prepared for a five-story factory, 398x265 ft. Theodore Wells Pietsch, American Bldg., is the Arch.

Plans are being prepared by John Freund, Jr., Arch., 508 Hoffman Bldg., for the construction of a factory, 120x85 ft., of brick and concrete, for the International Bedding Co., 337 Guilford Ave.

Charlestown, W. Va.—George B. Burnhard, Syracuse, N. Y., is organizing a company to manufacture a patented cast-iron heating boiler. The capital stock will be $100,000.

Jacksonville, Fla.—The Automatic Vacuum Street Sweeper Co., Valdosta, Ga., is considering the establishment of a plant at Jacksonville, to manufacture a patented street sweeper invented by Fred A. Bishop, Valdosta. The company is capitalized at $1,000,000. G. E. Montgomery is Sales Mgr.

Gadsden, Ala.—The Alabama Automatic Threading Shuttle Mfg. Co. will establish a plant for the manufacture of its product. W. H. Portner is Pres.

New Orleans, La.—The New Orleans Railway & Light Co. is planning the erection of car-building and repair shops.

Chattanooga, Tenn.—The Mountain City Mill Co. will erect a grain elevator at a cost of $75,000. It will have a capacity of 250,000 bu. The Baxter Engineering Co., Buffalo, Tenn., is in charge of the work.

Memphis, Tenn.—The Tennessee Cellulose & Mfg. Co. has been incorporated with $500,000 capital stock, and will establish a plant to manufacture Kraft book, magazine and printing paper.

Nashville, Tenn.—The Tennessee Seaton Wheel Co. has been organized with $25,000 capital stock as a subsidiary of the Seaton Wheel Co., and will manufacture Seaton wheels at various places in Tennessee. J. R. Tubs, S. S. Lord, F. S. Wheeler are among those interested.

Midway, Ky.—Cogar & Co. are preparing to build a stock feed mill for which power and special equipment will be required.

Akron, Ohio.—The Mohawk Rubber Co., Akron, has taken over the plant of the Stein Double Cushion Tire & Rubber Co. The present capacity will be doubled and a new building will be erected. R. M. Fillmore is Pres.

Cleveland, Ohio.—The Parish & Bingham Co., Cleveland, manufacturer of sheet-metal products, has secured a site at Madison Ave. N. W. and West 106th St., and will erect a new plant. James Scott, Pittsburgh, Penn., is Pres.

Hamilton, Ohio.—The George Automatic Roller Bearing Co. has been incorporated at Hamilton, with $500,000 capital, by C. E. Heister, George T. Reiss, S. M. Goodman and others. The company will erect a factory at Hamilton in the spring.

+French Lick, Ind.—The contract has been awarded to H. W. KLAUSMAN, Indianapolis, Ind., for constructing a bottling plant for the French Lick Springs Hotel Co., French Lick. The building will be 75x200 ft., five stories high.

Buchanan, Mich.—The Lee & Porter Mfg. Co., Buchanan, will erect a frame addition to its plant for making automobile axles. The new structure will be 32x80 ft., with concrete foundation.

Chicago, Ill.—The Budlong Pickle Co., 5226 Lincoln Ave., Chicago, will erect an addition to its factory, 120x155 ft., of brick and stone. Postle & Fisher, Chicago, are Archs.

+Neenah, Wis.—The contract for erecting a large addition to the Lakeside Paper Co.'s plant here has been awarded to WALTER BLAKE, Appleton, Wis. Cost, $45,000.

Milwaukee, Wis.—The Milwaukee Lithographing Co. has secured a permit to erect a new plant at 22d and Sycamore Sts. Cost, $30,000. J. A. Davis is Pres. and Gen. Mgr.

St. Louis, Mo.—Bids are being received for the construction of a five-story factory, 150x150 ft., at Sarah St. and Forest Park Ave., St. Louis, for the Ford Motor Car Co., Detroit, Mich. It will be of reinforced concrete and will cost approximately $150,000. Clymer & Drischler, 105 North Sixth St., are the Archs.

Pine Bluff, Ark.—The Arkansas Short Leaf Lumber Co., Pine Bluff, a branch of the Long Bell Lumber Co., Kansas City, Mo., will erect a hardwood mill near its lumber mill in Pine Bluff. It will have a daily capacity of about 60,000 ft.

Bishop, Tex.—F. Z. Bishop and associates will establish an ice plant and a cotton gin at Bishop.

Bryan, Tex.—L. M. Hewett and associates are interested in a project to erect a brick-making plant at Bryan, with a daily capacity of 100,000 bricks.

Bryan, Tex.—The St. Joe Creamery Co., Bryan, has been incorporated with a capital of $30,000, for the purpose of constructing a creamery. The incorporators are: P. H. Hensarling, W. J. Coulter and G. B. Hensarling.

Caldwell, Tex.—The Caldwell Cotton Seed Oil Co., Caldwell, has increased its capital from $20,000 to $40,000, and will make improvements to its plant.

Coughran, Tex.—John Wiseman and associates have acquired a site and will construct a cotton-seed oil mill and cotton gin at Coughran.

Houston, Tex.—The Gulf Bag & Paper Co., recently organized with a capital of $50,0400, will construct a bag-manufacturing plant.

Nacogdoches, Tex.—The Hoya Lumber Co., recently organized, will erect a lumber mill at Hoya Switch, located on the Texas & New Orleans R.R., about four miles south of Nacogdoches. It will have a daily capacity of about 25,000 ft.

The Armour Packing Co., Chicago, Ill., will erect a cold-storage plant at Nacogdoches, which will cost about $25,000.

+Galveston, Tex.—The contract for the construction of a bottling works plant for the Galveston Brewing Co. has been awarded to the LISLE-DUNNING CONSTRUCTION CO., Oklahoma City, Okla. The estimated cost is $100,000.

Cœur d'Alene, Idaho—Henry L. Karrick has purchased the holdings of the Lane Lumber Co., and will remodel the plant and install new equipment.

Nampa, Idaho—The Wilson Orchard Co., the Nampa Apple Orchard Co., the Burkland Apple Orchard Co., the Eagle Heights Orchard Co., and the Commercial Orchard Tracts Co., all of which own acreage on Eagle Heights, Nampa, have decided to incorporate with a capital stock of $25,000, and to erect a fruit-canning and cold-storage plant at Nampa.

Bellingham, Wash.—The Whatcom Falls Mill Co., Bellingham, will expend about $20,000 in making alterations and repairs to its plant.

Bremerton, Wash.—L. Y. Stayton, Tacoma, Wash., is planning the erection of a plant at Bremerton, for the manufacture of concrete sewer pipe.

Bridgeport, Wash.—A. N. Thompson and E. Lovett, Bridgeport, Wash., have purchased a site and will construct a box factory. A small sawmill will be operated in connection.

Centralia, Wash.—W. A. Perkins, Seattle, Wash., is interested in the organization of a company with a capital of $2,000,000, which will construct an automobile factory in Centralia. The proposed structure will cost about $250,000.

Hillyard, Wash.—The Chamber of Commerce plans to promote a company with a capital of about $15,000, to erect a box factory at Hillyard. S. L. Americus is Chn. of the Committee-in-Charge.

Leavenworth, Wash.—The Lamb-Davis Lumber Co., Leavenworth, will improve and enlarge its sawmill and box factory. About $25,000 will be expended. F. C. Riggs is Mgr.

Little Falls, Wash.—The Standard Clay Co., Little Falls, will rebuild its clay plant, which was recently destroyed by fire. The estimated cost of the new structure is $100,000.

North Yakima, Wash.—The Yakima Glazed Cement Pipe Co., North Yakima, has been incorporated with a capital of

$1[illegible] by W. M. Walter and George W. Hopp. The company will erect a plant at North Yakima for the manufacture of its specialty.

Port Townsend, Wash. The Puget Sound Mill Co., Port Townsend, plans to make extensive repairs and alterations to its plant. New equipment will be installed.

Seattle, Wash.—The Seattle Can Co., First Ave., South Seattle, is planning the erection of a can factory in the Duwamish Valley, Wash. C. M. Bogle is Pres.

Press reports state that the Kelly-Springfield Motor Truck Co., Springfield, Ohio, will build an automobile factory and distributing plant at Seattle.

Gardiner, Ore.—W. P. Reed, Gardiner, will erect a sawmill with a capacity of about 75,000 ft., at the outlet of Tsiltcoos Lake, near Gardiner.

La Grande, Ore.—The Oregon-Washington R.R. & Navigation Co. will build new car repair shops at La Grande.

Emeryville, Calif.—The Griffin-Skelley Co. plans to enlarge the capacity of its canning plant. About $18,000 will be expended.

Livermore, Calif.—The Coast Mfg. & Supply Co. will construct a large plant at Livermore, for the manufacture of fuse. A. H. Merritt is Vice-Pres. and Gen. Mgr.

Lookout, Calif.—The Lookout Development Co. has been organized to build a creamery and cheese factory at Lookout. J. J. Potter, G. R. Brown and George Revalkes are interested.

✦**Los Angeles, Calif.**—The contract for the construction of additions to the baking plant of the Bradford Baking Co., 401 Ave. 20, has been awarded to G. J. RAMSEY, of the Pioneer Truck Co., 201 North Main St. Train & Williams, Exchange Bldg., are the Archs. Noted Dec. 12.

San Bernardino, Calif.—The Atchison, Topeka & Santa Fé Ry. will enlarge its shops at San Bernardino, to the extent of about $1,500,000.

San Diego, Calif.—Joseph N. J. Abt, San Diego, has purchased a site on 12th St. and will erect a plant to be known as the Abt Bottling Works.

Armour & Co., Chicago, Ill., have acquired a site at Seventh and K Sts., San Diego, and will erect a large cold-storage plant.

Taft, Calif.—The Traders' Oil Co., Taft, is planning the construction of a topping plant with a daily capacity of about 150 bbl. The estimated cost is $10,000.

Hamilton, Ont.—The Eversharp Pencil Co., St. Paul, Minn., is seeking a site for the erection of a Canadian factory. H. C. Carson is representative. H. L. Frost, care Frost Wire Fence Co., Sherman Ave., North, Hamilton, is interested.

Harriston, Ont.—The Harriston Furniture Co. is planning an addition to its factory. It will be two stories, 60x80 ft., of cement, brick and stone construction, fireproof. Freight elevators and factory machinery will be required. H. Leighton is Mgr.

Toronto, Ont.—Rolph & Clark, Ltd., lithographers, will erect a new factory, costing about $160,000. It will be of brick construction, 2½ stories high.

Medicine Hat, Alta.—The Hunt Engineering Co., Kansas City, Mo., is planning the erection of a cement plant at Medicine Hat. It will have a daily capacity of 2000 bbl., and cost about $1,000,000.

Vancouver, B. C.—The American Can Co., Chicago, Ill., is planning the erection of a Canadian branch at Vancouver. A site has been leased on Railroad St., and it is expected to have the plant in operation by May 1. F. D. Kendal, Portland, Ore., is western Mgr.

St. Boniface, Man.—The Manitoba Rolling Mills Co., whose plant was recently damaged by fire to the extent of $200,000, will rebuild and purchase new equipment as soon as possible.

Winnipeg, Man.—The Winnipeg Steam Heating Co. will erect a new plant at an estimated cost of $4,000,000. Construction work will begin soon, and complete new equipment will be purchased. C. M. Black, 306 McArthur Bldg., is Mgr.

Winnipeg, Man.—The Strong-Scott Mfg. Co., 774 Dufferin Ave., manufacturer of flour-milling machinery, is considering an addition to its plant. E. H. Franke is Mgr.

Sydney, N. S.—Plans are being prepared for a plant for the Cross Fertilizer Co., Ltd. It will be one-story, 350x100 ft. The equipment to be installed includes dissolving dens, overhead railway and conveyer, and disintegrating machine. The plant will have an annual capacity of 10,000 tons of mixed fertilizer.

FEDERAL GOVERNMENT WORK

Crane—Portsmouth, N. H.—Bids will be received until [illegible] by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one 15-ton locomotive crane, delivered and erected at the navy yard, Portsmouth.

Dredging—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for dredging Entrance Cut No. 1.

Dredging—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for dredging [illegible] Cut No. 2.

Dredging—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for dredging [illegible] Cut No. 3.

Dredging—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for dredging [illegible] Cut No. 4.

Dredging—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for dredging [illegible] Cut No. 5.

Jetty Work—[illegible] Bids will be received until [illegible] by Maj. H. E. Eastwood, Corps Engrs., U. S. A., Wilmington, for [illegible] jetty work at the mouth of the Shallotte River.

Motor Vehicles—Washington, D. C.—The Post Office Department will ask for bids for [illegible] motor vehicles.

Road Oil—Washington, D. C.—Bids will be received until 2 p.m., Jan. 24, by the Commissioners of the District of Columbia, for furnishing and delivering 100,000 gal. of emulsifying road oil for use in the surface division.

✦**Pump House**—Washington, D. C.—The Commissioners of the District of Columbia have awarded the contract for the construction of a pump house and lodge at Anacostia, D. C., to W. E. MOONEY, Washington, D. C., at $11,189.

Mechanical Equipment—Washington, D. C.—Bids were received, Jan. 14, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for mechanical equipment, inside finish, and elevator plant for the new Bureau of Engraving and Printing Building, Washington, D. C.: Mechanical equipment: Hanley-Casey Co., Chicago, Ill., $305,940; Standard Engineering Co., Washington, D. C., $299,500; S. Faith & Co., Philadelphia, Penn., $292,897; Thompson-Starrett Co., New York, $293,000; Hoben & Doyle, Philadelphia, $358,500; Evans-Almirall Co., New York, $323,541; W. G. Cornell & Co., Washington, D. C., $296,977; Daniel T. McCarthy, Philadelphia, $352,156; John W. Danforth & Co., Buffalo, N. Y., $314,829. Interior finish: J. Henry Miller, Baltimore, Md., $397,713; P. J. Gormley Co., Washington, D. C., $377,589; John Gill & Son, Washington, D. C., $445,000. Elevator plant: Portland Elevator Co., Portland, Maine, $89,134; Otis Elevator Co., Washington, D. C., $84,844.

Building—Fort Monroe, Va.—Bids will be received until 11 a.m., Feb. 10, by Maj. H. L. Pettus, Q. M. Corps, U. S. A., Fort Monroe, for constructing an alteration to the post hospital at Fort Monroe.

✦**Gas Buoys**—Norfolk, Va.—The contract has been awarded to the SAFETY CAR HEATING & LIGHTING CO., New York, for furnishing seven Pintsch type gas buoys and appurtenances for lighting Norfolk Harbor, Fifth Light House District, at $12,455.

★**Dredging**—Norfolk, Va.—Bids will be received until noon, Jan. 20, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for dredging in the James River, Va.

✦**Piling**—Wilmington, N. C.—The following bid has been submitted to Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for about 1000 tons of steel sheet piling for Lock and Dam No. 1, Cape Fear River, King's Bluff, N. C.: Lackawanna Steel Co., Buffalo, N. Y., $49,584.

Dredging—Wilmington, N. C.—Bids were received Jan. 11, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for dredging in Pamlico and Tar Rivers: (a) 392,000 cu.yd.; (b) 194,000 cu.yd.; (c) totals: Packard Dredging Co., Philadelphia, (a) 12½c., (b) 20c., (c) $88,244; Hillsboro Dredging Co., Tampa, Fla., (a) 13.2c., (b) 22c., (c) $95,024; W. H. French, Norfolk, Va., (b) 13.7c., (c) $26,750; Norfolk Dredging Co., Norfolk, (a) 11.9c., (c) $46,394; River & Harbor Improvements Co., Philadelphia, (a) 17.4c., (c) $68,536; SEtandard Engineering Co., New York, (a) 16⅝c., (c) $64,190; Atlantic Gulf & Pacific Co., New York, (a) 15.4c., (c) $60,696; Maryland Dredging & Contracting Co., Baltimore, (a) 12¾c., (b) 12¾c., (c) $75,195.

Light-House—Charleston, S. C.—The Interstate and Foreign Commerce Committee of the House of Representatives, Washington, D. C., has recommended that $125,000 be appropriated for the purchase of a site and the erection of a light-house at Charleston.

Post Office—Augusta, Ga.—Bids will be received until 3 p.m., Feb. 20, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office and courthouse at Augusta.

Riprap—Memphis, Tenn.—Bids will be received until noon, Jan. 31, by Maj. E. M. Markham, Corps Engrs., U. S. A., Mississippi River Comn., First and Second Districts, Custom House, Memphis, for furnishing and loading 10,000 cu.yd. of riprap stone on government barges.

Lock and Dam—Nashville, Tenn.—The following bid was opened, Dec. 23, by Maj. H. Burgess, Corps Engrs., U. S. A., Nashville, Tenn., for constructing Lock D, Cumberland River: Mansfield Engineering Co., Indianapolis, Ind., at $269,270.

Post Office—Wooster, Ohio—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office at Wooster, at $59,939. Noted Nov. 14.

Post Office—Frankfort, Ind.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Mar. 1, for the construction, including plumbing, gas piping, heating apparatus, electric conduits, and wiring, interior lighting fixtures and approaches of the U. S. post office at Frankfort.

Post Office—Abilene, Kan.—Bids were received as follows, on Jan. 7, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Abilene, Kan.: (a) Limestone; (b) sandstone: George A. Shaul, Seneca, Kan., (a) $60,940; (b) same; Joseph B. Betts, Kansas City, Mo., (a) $65,110; (b) same; Rogers & Kaiser, Chicago, Ill., (a) $65,439; (b) $67,439; George W. Stiles Construction Co., Chicago, Ill., (a) $65,855; (b) $68,855; William O'Neil & Son Co., Faribault, Minn., (a) $66,585; W. D. Lovell, Minneapolis, Minn., (a) $66,600; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $67,338; (b) $67,838; King Lumber Co., Charlottesville, Va., $67,800; (b) $72,000; Mississippi Construction Co., St. Louis, Mo., (a) $67,949; (b) $69,949; J. H. Wiese, Omaha, Neb., (a) $67,970; General Construction Co., Milwaukee, Wis. (a) $68,448; (b) $70,488; Northern Construction Co., Milwaukee, Wis., (a) $69,900; (b) $72,250; William Maxwell, Phoenix, Ariz., (a) $71,745.

Post Office—Ottawa, Kan.—Bids were received as follows, on Jan. 18, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Ottawa, Kan.: (a) Limestone; (b) sandstone: King Lumber Co., Charlottesville, Va., (a) $63,000; (b) $68,000; General Construction Co., Milwaukee, Wis., (a) $58,740; (b) $60,850; Rogers & Kaiser, Chicago, Ill., (a) $56,418, (b) $59,558. Mississippi Valley Construction Co., St. Louis, Mo., (a) $65,796; (b) $[illegible]. Northern Construction Co., Milwaukee, Wis., (a) $58,350 (b) $61,286. Tom Lovell & Sons, Enid, Okla., (a)

$55,193; (b) $58,129; V. E. Taylor, Huntington, W. Va., (a) $62,500; (b) $62,900. F. H. Latimer & Son, Kansas City, Mo., (a) $60,890; W. D. Lovell, Minneapolis, Minn., (a) $59,845; V. Bauer & Son, Horton, Kan., (a) $51,980, (b) $50,500. J. B. Betts, Kansas City, (a) $65,807, (b) same. Alexander & Beeler, Ottawa, Kan., (a) $64,663; William O'Neill & Son Co., Fairbault, Minn., (a) $61,931; George A. Shaul, Seneca, Kan., (a) $60,321; (b) same; William H. Maxwell, Phoenix, Ariz., (a) $61,630; George W. Stiles Construction Co., Chicago, Ill., (a) $58,600; (b) $65,000; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $62,419; (b) $64,419; D. T. McCarthy, Philadelphia, Penn., (a) $61,900; (b) $63,000; J. H. Wiese, Omaha, Neb., (a) $59,723. Noted Dec. 12.

Post Office—Salina, Kan.—Bids were received as follows, on Jan. 17, by Oscar Wenderoth, Superv. Arch., Treasury Department, Washington, D. C., for the construction of a post office at Salina; Hiram Lloyd Building & Construction Co., St. Louis, Mo., $57,043; King Lumber Co., Charlottesville, Va., $59,950; Northern Construction Co., Milwaukee, Wis., $59,950; George A. Shaul, Seneca, Kan., $62,816; William H. Maxwell, Phoenix, Ariz., $63,477; General Construction Co., $65,468. Noted Dec. 12.

Earthwork—Malta, Mont.—We are officially advised that bids for earthwork on the Dodson North Canal, Mill River Project, were received by the U. S. Reclamation Service, Jan. 10, as follows: Maney Bros. & Co., Boise, Idaho, $51,075; Carleson Chindahl & Co., Spokane, Wash., $60,700.

★**Revetment**—Mokane, Mo.—Bids will be received until noon, Feb. 17, by Maj. Herbert Deakyne, Corps Engrs., U. S. A., Kansas City, Mo., for constructing about 12,000 ft. of standard revetment on the Missouri River, 262 miles below Kansas City and one mile out from Mokane.

Revetment—New Haven, Mo.—Bids will be received until noon, Feb. 17, by Maj. Herbert Deakyne, Corps Engrs., U. S. A., Kansas City, Mo., for constructing about 12,000 ft. of standard revetment on the Missouri River, about 302 miles below Kansas City, and two miles above New Haven, Mo.

Post Office—Clarksville, Tex.—Bids were received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., on Dec. 26, for the construction of the U. S. post office at Clarksville, as follows: (a) limestone; (b) sandstone: Geo. A. Shane, Seneca, Kan., (a) $51,388, (b) $51,388; Tom Lovells Sons, Enid, Okla., (a) $52,929, (b) $54,169; Newport Constr. Eng. Co., Newport News, Va., (a) $49,324; King Lumber Co., Charlottesville, Va., (a) $49,500, (b) $51,500; Mississippi Valley Constr. Co., St. Louis, Mo., (a) $49,664, (b) $49,624. Noted Nov. 21.

Post Office—Pocatello, Idaho—Bide will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Feb. 28, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, and lighting fixtures, of the U. S. post office and court house at Pocatello. It will be a three-story and basement structure.

Buildings—Bremerton, Wash.—Bids will be received until 11 a.m., Feb. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for hospital buildings at the naval hospital reservation, Puget Sound, Bremerton.

✚**Magazine**—Hawaii—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of five magazine buildings at Pearl Harbor, H. T., to the LORD-YOUNG ENGINEERING CO., Honolulu, H. T., at $79,600.

MISCELLANEOUS

Tunnel—Fall River, Mass.—Plans have been completed by engineers of the New York, New Haven & Hartford R.R. for the underground tunnel to be built here. It will be one mile long. Work will be started in the early spring. Edw. Gagel is Ch. Engr., New Haven, Conn.

Greenhouse—Woods Hole, Mass.—The contract has been awarded to R. L. WILSON, Concord, Mass., for constructing a greenhouse, to cost $12,000.

Fire Station—New Haven, Conn.—Plans have been completed by C. F. Townsend, 55 Church St., New Haven, for a fire station on Water St. Bids will be received at once. The structure will be of brick, two stories and basement, 40x80 ft., with an ell 42x30 ft., for the paint, machine and blacksmith shops. The main building will contain the apparatus room on the first floor and sleeping rooms, etc., on the second floor.

Canal Terminal, Etc.—Albany, N. Y.—Duncan W. Peck, State Supt. of Pub. Wks., has awarded the contract for the Utica terminal to ALBERT M. BANKER, of Gloversville, N. Y., at $557,104. The work of constructing locks and dams at Seneca Falls and Waterloo was also awarded, LARKIN & SANGSTER, of Lockport, N. Y., securing Contract C, providing for the construction of locks, dam, etc., at Seneca Falls, at $1,187,047, and M. A. CLEVELAND SONS CO., of Brockport, N. Y., securing Contract E, providing for the construction of a lock dam, etc., at Waterloo, N. Y., at $347,216.

On Feb. 4, D. W. Peck, State Supt. Pub. Wks., will receive bids on additional work amounting to approximately $2,775,000. This work includes Contracts 92 and 94, for the erection of power plants and installation of electrical equipment and machinery for operating Barge Canal locks at many points along the line of the new canal; Contract 42-A for completing the construction of the canal in the vicinity of Utica and Contracts 87 and 102, for bridges over the Canal at Rocky Rift Dam in Montgomery County and at Howland's Ave. in Cayuga County.

Drainage Channel Excavation—Batavia, N. Y.—Bids will be received until Jan. 17 at the Hotel Richmond, Batavia, by the Commissioners for approximately 1,000,000 cu.yd. of drainage channel excavation in Tonawanda-Oak Orchard swamps, counties of Genesee and Orleans. This is an extension of date from Jan. 3. Noted Dec. 19.

Bath-house—Yonkers, N. Y.—The city is considering the construction of a bath-house, to cost $15,000.

Stadium—Princeton, N. J.—Princeton University is planning to construct a football stadium, to cost $300,000.

Pier—Philadelphia, Penn.—The Merchants' & Miners' Transportation Co., Philadelphia, will construct a 300-ft. pier, 68 ft. wide. Estimated cost $65,000.

Subway—Pittsburgh, Penn.—The Pittsburgh Subway Co. secured a franchise from the city, Jan. 6. As planned, the subway proposed will cost $20,000,000.

Dredging—Wilmington, Del.—Bids will be received by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, until Feb. 8, for dredging Raccoon Creek, N. J.

✚**Piers**—Norfolk, Va.—The contract has been awarded to the SANFORD & BROOKS CO., Commerce and Water Sts., Baltimore, by the Norfolk & Washington Steamship Co., Daniel J. Calahan, Gen. Mgr., foot of Seventh St. S. W., Washington, D. C., to erect two piers and a warehouse, located at foot of Ront St., one pier to be 111 ft. long, and one to be 100 ft. Plans are prepared and supervision will be under Gwathmey Engineering Co.

Dredging—Jacksonville, Fla.—Bids were received Dec. 30 by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for dredging in channel, Clearwater Harbor to Tampa Bay. The lowest bid was the Hillsboro Dredging Co., Tampa, as follows: 5239 cu.ft. rock, $1.65; 17,865 cu.yd. soft material, 15½c.; total, $11,413. Other bidders were: Home Dredging Co., Mobile, Ala., $24,539, and Southern Dredging Co., Mobile, $30,709.

Pier on Roadway—St. Petersburg, Fla.—Bids will be received by the City Council until Jan. 23, for the construction of a pier or roadway from the sand fill and breakwater on Second Ave. N. eastward into Tampa Bay.

Levee Work—New Orleans, La.—Fifteen bids were opened, Dec. 27, by the Orleans Levee Board, New Orleans, for constructing a revetment on the Stanton to Beka Levee. The lowest bid was submitted by the General Contracting Co., at 84c. per lin.ft.

✚**Levee**—Shreveport, La.—The Caddo Levee Board, Jan. 8, awarded the contract to MICHAEL HUNT, Shreveport, to construct 85,000 cu.yd. of the Brown Levee, at 14.2c. per cu.yd. Eleven bids were submitted.

Levee Work—Shreveport, La.—Bids will be received until noon, Mar. 5, by the Board of Commissioners of Caddo Levee District, Shreveport, for bank protection work in Caddo Parish. W. A. Kerley is Secy.

Drainage—Selmer, Tenn.—Surveys will be made soon by E. G. Buck and L. B. Withers, Engrs., Jackson, Tenn., for the construction of a drainage system in White Oak District in McNairy and Hardin Counties.

Ditch—Morganfield, Ky.—The Fiscal Court of Union County, Morganfield, is preparing to construct a ditch, which will drain 8000 acres. A cut to the Ohio River will be made.

Ditch—Reed, Ky.—Ohio County, Ky., will build a ditch, to cost $20,000, from a point near Reed, to the Green River, a distance of four miles. Address the Fiscal Court at Hartford, Ky.

Ditch—Canton,Ohio—Bids will be received until 10 a.m., Feb. 3, by the Board of Stark County Commissioners, Canton, for the construction of the Shaub Ditch in Plain Township. J. H. McConnell is County Audr.

Mausoleum—Clyde, Ohio—Bids will be asked soon by the American Mausoleum Co., Clyde, for the construction of a mausoleum of granite for the Butler, Penn., Mausoleum Co., to cost $45,000.

✚**Channel Work**—Lowellville, Ohio—The Pittsburgh & Lake Erie Ry. Co. has awarded the contract to H. A. and R. L. CULBERTSON, Youngstown, Ohio, for making changes in the channel of the Mahoning River at Lowellville.

Ditch—Boonville, Ind.—Special Judge Wm. Curtis has decided that the large Honna Totten ditch through Warrick and Spencer Counties should be built. This will be the largest drain to be constructed in the state.

Park—Danville, Ind.—The Town Council of Danville, is preparing to ask for bids for the improvement of a pleasure park. Separate bids will be asked for landscaping, for roads, for shelter house, dam, retaining walls, bathing-house and beach and amusement facilities.

✚**Ditches**—Linton, Ind.—Contracts have been awarded to C. HYATT and WILLIAM ENGLAND, Washington, Ind., for constructing 45 miles of ditches.

Drain—Logansport, Ind.—Bids will be received until noon, Jan. 25, by A. B. Ireland, Comr. of Drainage, Logansport, for the construction of the John H. Plotner Ditch.

Mausoleum—South Bend, Ind.—The St. Joseph County Mausoleum Co., 414 Jefferson Bldg., South Bend, will construct a one-story mausoleum, 60x125 ft.

Cement—Detroit, Mich.—The County Road Commissioners of Wayne County have opened bids for 1,000,000 bbl. of cement. The Wyandotte Portland Cement Co. was the low bidder.

Dam—Ludington, Mich.—The Citizens' Committee of Ludington will incorporate a company to have a capital of $25,000, for the purpose of rebuilding the dam at Hamlin Lake. Plans for the dam, estimated to cost $17,000, have been submitted by Prof. A. E. Phillips, Armour Institute, Chicago, Ill. George W. Clarke, City Engr., Ludington, has submitted a plan for a dam estimated to cost $14,000. The company will be known as the Lake Hamlin Resort Association.

Harbor Work—Chicago, Ill.—The City Council has appropriated $1,000,000 for the construction of an inner-harbor, contingent on a bond issue for the amount. L. E. McGann is Comr. Pub. Wks.

Field House—Chicago, Ill.—The West Chicago Park Commissioners will erect a two-story field house, 200x126 ft. G. A. Mugler is Secy.

★**Drainage Work**—East Alton, Ill.—Bids were received and rejected, Jan. 11, by the Commissioners of the Wood River Drainage and Levee District, East Alton, for doing all clearing, grubbing and excavation of new channels, building of levees and other embankments, ditch-

.ng, building of culverts, laying of drain tile, bank and channel protection work and all other work aside from the building of railroad bridges, connected with making the improvement along the stream known as Wood River, situated in Township 5 North, Range 9 West, Madison County, Ill., as contemplated and set forth in the plans and specifications therefor, as now filed in the County Court of Madison County, at Edwardsville, Ill.—Estimate of work: 55 acres of clearing, grading, etc.; 443,000 cu.yd. excavation, earthwork and embankments; 300 lin.ft. 12-in. tile for culverts; 450 lin.ft. 18-in. tile for culverts; 440 cu.yd. concrete headwalls, culverts, etc.; 7000 lb. iron for valves and valve seats; 3500 sq.yd. willow mattress, complete; 16,000 sq.yd. rip rap for channel protection; 1000 lin.ft. 12-in. drain tile, average cut, 4 ft. Notice bids will be received until 2 p.m. Jan. 28.

+Drainage—Lewistown, Ill.—The county has awarded the contract to KELSO & WALLACE, Lewistown, for improvements to Otter Creek Drainage District, at about $27,000. Bids were opened Jan. 6.

Cleaning Canal—Lockport, Ill.—The Commissioners of the Illinois and Michigan Canal, Lockport, have estimated the cost of cleaning out the canal from Lockport to the mouth of the Hennepin Canal, with other improvements, at $500,000.

Levee Work—Mound City, Ill.—Bids will be asked soon by the city for raising and strengthening levees. Estimated cost, $40,000. M. F. Brownell is Mayor.

Drainage—Pittsfield, Ill.—Bids were received Dec. 27, by Sny Island Levee District, of Pike, Adams and Calhoun Counties, at Pittsfield, for removing an old spoil bank, deposited by a dipper dredge, requiring the removal of approximately 100,000 cu.yd. The contract has been awarded to R. J. PHELPS, Carbon Cliff, Ill., at 12c. per cu.yd.

+Ditch—Tuscola, Ill.—Bids were received Dec. 19, by the Commissioners of Hayes Branch Drainage District, Douglas County, at Modern Woodmen Hall, Tuscola, for the excavation of an open ditch. The contract has been awarded to CHARLES R. LEWIS, Champaign, Ill., at 11.45c. The work will involve 157,900 cu.yd.

Retaining Wall—Portage, Wis.—The Portage Hosiery Co., Portage, will construct a retaining wall.

Ditch—Eldora, Iowa—The Hardin County Supervisors have decided to construct a ditch for Silver Creek district, to cost $26,000. It will drain 13,000 acres.

★Ditch—Garner, Iowa—Bids be received by W. L. Fitkin, County Audr., Garner, until noon, Feb. 1, for the labor and materials necessary for the construction of Drainage Ditch No. 26.

Drain—Sioux City, Iowa—The County Board of Supervisors is considering the construction of a tile drain, to cost $60,000. E. E. Tosmer, Sioux City, is County Audr.

Ditch—Bemidji, Minn.—Surveys are being made for the construction of Ditch No. 14.

Ditch—Blue Earth, Minn.—Bids will be received until Jan. 30, by J. L. Herring, County Audr., Blue Earth, for constructing Judicial Ditch No. 4, requiring approximately 82,525 ft. of tile, from 6 to 20 in. Estimated cost, $22,792.

Ditch—Glencoe, Minn.—Bids will be received until Feb. 7, by F. D. Stocking, County Audr., Glencoe, for constructing Tile Ditch No. 25.

+Ditches—International Falls, Minn.—The contract has been awarded to the NORTHERN MINNESOTA DRAINAGE CO., Crookston, Minn., for digging Judicial Ditches Nos. 1, 3 and 6.

+Retaining Wall—Two Harbors, Minn.—The contract has been awarded to WHITNEY BROS., Superior, Wis., by the Duluth & Iron Range R.R. Co., for constructing a concrete retaining wall along the shore bank of No. 1 Dock, at Two Harbors.

Oil Tank—Rapeseed, S. D.—The Chicago & Northwestern Ry. will erect a 50,000-gal oil tank at Rapeseed.

Flood Protection, Etc.—Kansas City, Mo.—The citizens, Jan. 7, voted to issue $750,000 of bonds for flood protection and dikes. L. R. Ash is City Engr.

Gymnasium—Webster Groves, Mo.—The Congregational Church, Webster Groves is considering the construction of a gymnasium, to cost $20,000. W. H. Goodloe is a member of the Building Committee.

Drainage—Newport, Ark.—The Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., has filed the report for Grubbs Drainage District of Jackson and Pomsett Counties. The cost is estimated at $50,000.

Levee Work—Tennessee, Ark.—The Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., has estimated the cost of proposed work in Lenoe District No. 3 of Miller County, at $50,000. Contract will probably be awarded in the spring.

+Ditches—[illegible] Tex.—Bids were received Jan. 6, by H. M. Powell, City Engr., for Drainage District No. 6 [illegible] ditches, involving about 330,000 cu.yd. The contract has been awarded to the Alamo Contracting Co., Houston, Tex.

+Ditch—Galveston, Tex.—The contract has been awarded to the [illegible] Contracting Co., Houston, Tex., for constructing ditches for Drainage District No. 2 at about $30,000.

Dredges—Matagorda, Tex.—The Matagorda Mud & Shell Co. will install dredges [illegible] Shell Co., which is now engaged in [illegible] The shell will be used in the construction of [illegible] Gulf Intracoastal Waterway. The [illegible] Gulf Intracoastal W. T. Wood, of Matagorda, [illegible] Co., of Matagorda, Tex.

Dock—Tampa, Wash.—The Chicago, Milwaukee & Puget Sound Ry. will extend its dock at Tampa. The work will be done by the Isbey Contracting Co., Tacoma.

Dock—Tampa, Wash.—Plans have been completed for the extension of the new municipal dock. The plans include a coal storage plant.

Light and Fog Signal Building—Portland, Ore.—Bids will be received until 2 p.m., Feb. 3, by the Lighthouse Inspector, Portland, for furnishing material and labor necessary for the construction, erection and delivery of a light and fog signal building at Point Wilson, Wash.

Tunnels—Los Angeles, Calif.—The City Council has authorized the commencement of proceedings for the construction of the proposed tunnels. Homer Hamlin, City Engr., was instructed to prepare and present to the Council plans and specifications for the tunnels, also the necessary ordinances for the construction of tunnels. The proposed plans and specifications will be for a single-bore tunnel at First St. and a single-bore tunnel at Second St. The First St. tunnel will extend from a point between Broadway and Hill St. to Fremont Ave.; the Second St. tunnel will extend from Hill St. to Figueros St. Noted Jan. 9.

+Boat Landing—Oakland, Calif.—The Park Directors have awarded the contract to SORENSON BROS., Oakland, for constructing an ornamental boat landing at Lake Merritt, at $17,500.

Pier—San Francisco, Calif.—The Harbor Board has approved plans and specifications for the construction of Pier 41 at the foot of Stockton St. The new pier is to be 1080 ft. in length on one side and 880 ft. on the other; 200 ft. wide, with a spur track on each side; concrete pillars, supported by wooden piling, will be ten feet apart. The pier is to be built at an angle with the seawall, and will act as a breakwater for other docks. It is to be an open wharf, without roof, for handling heavy and bulky articles.

+Seawall—San Francisco, Calif.—The contract has been awarded by the Board of State Harbor Commissioners to the DANIEL CONTRACTING CO., for constructing Section 9A and Section 9B of the seawall, at $275,700, and $220,000 respectively. List of bidders noted Jan. 16.

Wharf—Yarmouth, N. S.—The Canadian Pacific Ry. Co., will construct a 520-ft. wharf. F. L. Ellingwood, Montreal, Que., is Supt. Bldg. Construction.

Dredging—Quebec, Que.—Bids will be received until 2 p.m., Jan. 31, by the Quebec Harbor Commission, for the removal of from 2,500,000 to 5,000,000 cu.yd. of materials, chiefly sand, to a depth of from 35 to 47 ft. below low water. Raoul Renault is Secy.-Treas.

Flood Protection Work—Brantford, Ont.—The citizens have voted to raise $15,000 for flood protection work. T. Harry Jones is City Engr.

Drydock—Midland, Ont.—The by-law granting a bonus to the Midland Drydock Co. carried Jan. 6. The drydock company will commence work at once on the construction of a floating dock to cost about $250,000, and capable of lifting the largest steamers on the great lakes.

Quay Wall, Rock—New Westminster, B. C.—Bids will be received until 5 p.m., Jan. 27, by W. A. Duncan, City Clk., for the construction of 1782 ft. of cedar pile quay wall and for 30,000 tons of quarry-run rock. A. O. Powell is Harbor Engr., 511-14 Westminster Trust Bldg., New Westminster.

BUILDINGS

Boston, Mass.—The Boston City Club has had plans prepared for the construction of an eight-story club house at Somerset St. and Ashburton Place. The estimated cost is $200,000. Newhall & Blevins, 9 Park St., are the Archs.

Bids will be again received for the construction of the Emerson School, Prescott St., East Boston, as the lowest bid ($76,650) was in excess of the amount appropriated. Chas. Logue, 120 Boylston St., is Chn. School House Comn.

Holyoke, Mass.—Eisenwein & Johnson, Archs., Buffalo, N. Y., are preparing plans for a modern fireproof hotel, to be built at Maple and Suffolk Sts., for the Holyoke Hotel Co. The building will cost about $200,000, and will be 110x122 ft. Thomas S. Childs is Pres. and Morton Hull is Secy.

+Cambridge, Mass.—The contract for the construction of the Widener Memorial Library at Howard University has been awarded to GEORGE F. PAYNE & CO., Philadelphia, Penn., at $1,250,000. The structure will be of brick and limestone, 270x260 ft.

Haverhill, Mass.—Mayor Moulton has requested the Legislature for authority to borrow $300,000 for the erection of two new school buildings, one a 30-room building, the other a 16-room building.

+Worcester, Mass.—The following awards have been made for the Carnegie Libraries: For Greendale and at South Worcester, to the CENTRAL BUILDING CO., of 58 Front St., and at Quinsigamond, to JOHN J. POWER, 1 Granite St. The Archs. are, for Greendale library, the L. W. Briggs Co.; for South Worcester, Henry D. Whitfield, of New York, N. Y., and for Quinsigamond, the Fuller & Delano Co.

F. W. Dean, Arch., Boston, Mass., is preparing plans for a two-story Doctors' and Dentists' office building, to be erected on Pearl St. Maurice Y. Ready, of Worcester, is at the head of the project.

+Stoneham, Mass.—The contract for a state armory here has been awarded to E. A. PEABODY & SON, Lawrence, Mass. The building will be of brick, with concrete and stone trimmings, and is estimated to cost $55,000. Henry L. Rourke, Lowell, Mass., is the Arch.

Hartford, Conn.—The Board of Contract and Supply has received the following bids for the construction of an extension to the Municipal Building at Main and Arch Sts.: Packard Johnson Hartford, (a) complete building, $1,060,720; (b) complete building except granite face work $840,720; Tidewater Building Co., New York, N. Y., (a) $972,339; (b) $775,229; Commons Brothers Co., Lowell, Mass., (a) $980,293; (b) $760,293; Norcross Brothers Co., Worcester, Mass., (a) $940,500; (b) $718,220; P. J. Carlin Construction Co., New York, N. Y., (a) $884,000; (b) $681,000. The following bids were also received for furnishing and placing the granite face work: The Woodbury Granite Co., Hardwick, Vt., $215,666; the New England Granite Works, Westerly, R. I., $197,-

000. The bids have been referred to the Municipal Building Commission and to the architects, Davis & Brooks, 19 Pearl St., Hartford. Noted Dec. 26.

The Hartford Electric Light Co. is planning the erection of a five-story building on Pearl St. The building will be about 130 ft. front and 100 ft. deep. Allen & Collins, Boston, Mass., are the Archs.

F. C. Walz, Arch., 247 Putnam St., has completed plans and bids are being received for a four-story brick apartment block on Collins St., between Myrtle and Edwards Sts. It will be 104 ft. on Collins St., 82 ft. on Edwards St., and 75 ft. on Myrtle St.

Waterville, Conn.—The Sprague School which was recently destroyed by fire will be rebuilt as soon as the plans can be completed by Freney & Jackson, Archs., 51 Leavenworth St., Waterbury. The new building will be of brick, two stories high, and will cost about $60,000. E. W. Wight is Chm. of the building committee.

Providence, R. I.—Bids will be received until Jan. 31, by the Young Men's Christian Association, for the construction of a 12-story building on Westminster St. The estimated cost is $350,000. Shattuck & Hussey, Chicago, Ill., are the Archs. Noted Oct. 24.

Buffalo, N. Y.—Plans are being prepared by the Lackawanna Steel Co. for a club house for the use of its 7000 employes, to be erected at its plant in Lackawanna City, on the shore of Lake Erie, just south of Buffalo. It will be modeled after modern Y. M. C. A. buildings.

+Buffalo, N. Y.—The City Council has awarded a contract to METZ BROS., Builders' Exchange, at $599,235, for the construction of the Masten Park High School, at Masten Park. It will be a four-story structure, of brick and steel.

Plans have been prepared by Esenwein & Johnson, Archs., Ellicott Square Bldg., and bids will shortly be received for the construction of a three-story lodge, of brick and steel, for the Order of Orioles, East Eagle and Main Sts. The estimated cost is $75,000.

New York, N. Y.—Plans have been filed by E. H. Janos and A. W. Cordes, Archs., 124 West 45th St., for the construction of a three-story hospital on Lafayette St., between Bond St. and Shinbone Alley, for the Women's League for Animals, 325 Lafayette St. It will be 114x32 ft. The estimated cost is $50,000.

Tracy, Swartwout & Litchfield, Archs., 244 Fifth Ave., have filed plans for the construction of alterations to the Webster Hotel at 38 West 45th St., in order to make it into an office building for George W. Stetson. The estimated cost is $50,000.

Brody, Adler & Koch, 38 West 32d St., contemplate the erection of a 6-story office and loft building at 6-8 West 32d St. The architect will soon be selected.

Lawlor & Haase, Archs., 69 Wall St., are preparing plans for a working girls' home on 120th St., between Amsterdam and Morningside Aves., for Mrs. Susan Devin. It will be five stories high, 100x75 ft., of brick.

Plans have been completed by Cook & Welch, Archs., 3 West 29th St., and bids will soon be received by them, for the construction of a three-story brick and stone Carnegie Library, to be erected at 535 West 179th St., for the New York Public Library, Bryant Park. The estimated cost is $85,000.

The Realty Holding Co., 907 Broadway, has purchased the plot at the northwest corner of Broadway and 145th St., upon which it is contemplating the construction of a 12-story apartment house.

(Boro. The Bronx)—The McAvoy & Koester Construction Co., 926 East 167th St., is having plans prepared by the Kreymborg Architectural Record Co., 1330 Wilkins Ave., for the construction of a five-story apartment house on Mohegan Ave., near 175th St.

(Boro. The Bronx)—Plans are being prepared by C. B. Muyers, Arch., 1 Union Square, for the construction of a six-story, brick and limestone apartment house, 92x60 ft., on East 167th St., near Tiffany St., for Mrs. Sophy Gruenstein, care of B. Gruenstein, 230 Grand St. The estimated cost is $65,000.

+Atlantic City, N. J.—The contract for the construction of the theater at Atlantic City, has been awarded to IRWIN & LEIGHTON, 126 North 12th. St. Noted Dec. 19.

Bayonne, N. J.—The City Council has voted to purchase an entire central block for the establishment of a civic center. The plans include the erection of a city hall and fire headquarters.

Bayonne, N. J.—The Y. M. C. A. will erect a brick building at Broadway and 38th St. The estimated cost is $100,000. John Monroe, 854 Ave. A, and A. Herman Kern, 907 Broadway, are interested.

Elizabeth, N. J.—F. F. Proctor Jr., is planning the erection of a four-story office building on Broad St., near the Proctor Broad St. theater. The estimated cost is $40,000.

Irvington, N. J.—The lowest bidder for the construction of the school building on Augusta St., was the B. & W. Concrete Co., Ordway Bldg., Newark, at $41,582. Noted Jan. 9.

+Madison, N. J.—The general contract for the construction of the dormitory, for the Drew Theological Seminary has been awarded to H. H. VOUGHT & CO., 340 Madison Ave., New York, N. Y. Noted Sept. 26.

Metuchen, N. J.—At a special election, the citizens voted favorably on a proposition to acquire a site for the erection of a school at Highland Park.

Newark, N. J.—Plans are being prepared by Edward V. Warren, Arch., for the construction of a four-story apartment house at Second and Summer Aves., for Henry Kolodin. The estimated cost is $65,000.

Paterson, N. J.—Plans have been prepared for the construction of an apartment house on Van Houten St., for Collier & Stein. The estimated cost is $125,000.

Plans are being prepared by William T. Fanning, Arch., Paterson, for the construction of an office building at Main and Van Houten Sts., for the A. J. Van Winkle Hardware Co.

The City Council contemplates erecting a municipal building at North 10th St. and Belle Ave. Lambertus Touw is Mayor.

Sea Isle City, N. J.—Bids will be received until Jan. 27, by the Board of Education, for the construction of a three-story school building at Sea Isle City. Earle M. Henderson is Arch., Ocean City, N. J.

+Smith's Landing, N. J.—The general contract for the construction of the almshouse at Smith's Landing has been awarded to JOHN W. EMERY, 1524 Sansom St., Philadelphia, Penn. Noted Jan. 2.

Trenton, N. J.—The Pennsylvania R.R. is having plans prepared for the construction of a freight station at Trenton.

Westwood, N. J.—Bids will be received until Jan. 24, by J. E. Ackerman, Clk. Bd. of Education, for the construction of the Westwood High School, Third Ave. and Mill St. John T. Rowland, Jr., and Frank Enrich, Jr., are Archs., 95 Sip Ave., Jersey City.

+Confluence, Penn.—The contract has been awarded to the SOUTH PENN BUILDING CO., Uniontown, Penn., for the construction of a three-story brick and concrete storage building for the Confluence Cold Storage Co. The estimated cost is $40,000.

Johnstown, Penn.—Plans are being prepared by W. G. Eckles, Arch., Lawrence Trust Bldg., New Castle, Penn., for the construction of four additional stories to the Capital Hotel, Johnstown. The estimated cost is $50,000.

Latrobe, Penn.—Plans are being prepared by A. P. Cooper, Arch., Uniontown, Penn., for the construction of the high school, at Latrobe. The estimated cost is $125,000.

Philadelphia, Penn.—The Board of Education has appropriated $200,000, for the construction of a school building.

The Penn. R.R. Co. has purchased a site along Filbert St., from 15th to 20th St. for the construction of a railroad terminal. A. S. Vogt is Mech. Engr., Philadelphia.

Plans have been prepared by A. E. Westover, Arch., 607 Keith Bldg., for the construction of a theater at 60th. and Locust Sts., for the Garden Realty Co. The estimated cost is $175,000.

Plans have been prepared by the Reading Ry., for the construction of a terminal building and additional trackage at 1127 Arch St. for the Philadelphia & Reading Ry. The estimated cost is $750,000. W. H. Hunter is Ch. Engr.

The Congressional Committee on Public Buildings and Grounds is planning the erection of a Custom House along the riverfront.

The Democratic Association is planning the erection of a club house at Broad and Walnut Sts. The estimated cost is $250,000.

+Pittsburgh, Penn.—Contracts for the construction of an addition to the school building at Margaretta and Beatty Sts., have been awarded as follows: General contract, GOLDEN & CRICK, 3512 Fifth Ave.; stone work, P. H. McCANN; electric work, MORGENSTERN ELECTRIC CO., 325 Second Ave.

Pittsburgh, Penn.—Pittsburgh Aerie No. 76, Fraternal Order of Eagles, will erect a four-story clubhouse of brick and stone on the site of the present building. The estimated cost is $45,000.

Pittsburgh, Penn.—Plans are being prepared by F. K. Helmle, Arch., Brooklyn, N. Y., for the construction of an 18-story hotel on Smithfield St., between Second and Third Aves., for the Iron City Hotel Co.

+The contract for the construction of a three-story office building at Smithfield St. and Oliver Ave., for the Hawkins Estate has been awarded to the JAMES L. STUART CO., Oliver Bldg.

Pittsburg, Penn.—Janssen & Abbott, Archs., Renshaw Bldg., are preparing plans for the construction of a six-story, 30x100-ft. building at Fifth Ave. and Market St., for F. F. Nicola, Farmers' Bank Bldg. The estimated cost is $85,000.

Plans are being prepared by Charles Bickel, Arch., May Bldg., for the construction of a three-story hotel on Grant St., for Kaskel Solomon. The estimated cost is $60,000.

Williamsport, Penn.—Plans are being prepared by E. E. Joralemon, Arch., 547 Franklin St., Buffalo, N. Y., for the construction of a four-story high school building, 143x143 ft., at West Third and Susquehanna Sts., for the Williamsport School District. The estimated cost is $200,000.

Annapolis, Md.—The lowest bidder for the construction of the armory for the City Armory and Convention Hall Commission was D. M. ANDREW CO., Mt. Vernon Ave. and 26th. St. Baltimore, Md., at $43,485.

+Baltimore, Md.—The Board of Awards, City Hall, awarded the contract for the construction of the addition to School 99, to the SINGER-PENTZ CONSTRUCTION CO., Equitable Bldg., Baltimore at $53,852. Noted Jan. 9.

We are officially advised that plans are being prepared by Cram, Goodhue & Ferguson, Archs., 2 West 47th St., New York, N. Y., for the construction of a cathedral for the Trustees of the Foundation of the Protestant Episcopal Cathedral. The final cost is estimated at $10,000,000.

+Lynchburg, Va.—The contract has been awarded to METZGER & WELLS, Heed Bldg., Philadelphia, Penn., for the construction of a ten-story bank and office building, 48x128 ft. for the People's National Bank. Noted Sept. 12.

Norfolk, Va.—Bids are being received by Ferguson, Calrow & Taylor, Archs., 1024 Royster Bldg., Norfolk, for the construction of a terminal arcade building, for the Ferries Co.

Clarksburg, W. Va.—Plans are being prepared by W. B. Ittner, Arch., Ninth and Locust Sts., St. Louis, Mo., for the construction of a three-story school building at Clarkesburg. The estimated cost is $140,000.

Charlestown, S. C.—Plans are being prepared by Meyer J. Sturm, Arch., 116 S. Michigan Ave., Chicago, for the construction of a three-story and basement ward building for St. Francis Xavier Hospital. The estimated cost is $40,000.

Birmingham, Ala.—The Knights of Columbus will erect a council building. The estimated cost is $75,000.

Bids will be received until Feb. 1, by the Jefferson County Commissioners for the construction of an addition to the courthouse. The estimated cost is $50,000. H. B. Wheelock, is Arch., Birmingham.

Plans are being prepared by A. Von Herbulis, Arch., Kellogg Bldg., Washington, D. C., for the construction of a high school, and rectory, for St. Paul's Parish. The estimated cost is $200,000.

+De Kalb, Miss.—The contract has been awarded to HANCOCK & McARTHUR, for the construction of a courthouse at about $40,000. Noted Jan. 9.

Bellaire, Ohio—Press reports state that all bids which were received Jan. 3, for the construction of the city hospital have been rejected. The plans are being revised. F. L. Packard, New Hayden Bldg., Columbus is the Arch. Noted Jan. 9.

Canton, Ohio—The Beckans Realty Co., is having plans prepared for the construction of a two-story theater building to cost approximately $60,000. C. Howard Crane, 1920 Ford Bldg., Detroit, Mich., is the Arch.

Cleveland, Ohio—Jacob Babin, has ecquired a site at Prospect Ave. S. E. and East Fourth St., and will erect an eight- or 10-story mercantile building to cost approximately $150,000.

Mt. Vernon, Ohio—Plans have been completed for the construction of a new jail at Mt. Vernon. The estimated cost is $50,000. Marriot, Allen & Hall are the Archs.

Newark, Ohio—Plans are nearing completion and bids will soon be asked for the construction of the new city hospital in Newark. F. L. Packard, New Hayden Bldg., Columbus, is the Arch.

Indianapolis, Ind.—Plans have been completed and bids are being received for remodeling and enlarging the Union Station.

Plans have been approved and bids will be received until Jan. 28, for the construction of a 12-story addition to the Hotel Claypool. William E. Russ, Dayton, Ohio, is the Arch. Henry W. Lawrence is the owner.

Logansport, Ind.—Herbert L. Bass & Co., Indianapolis, Ind., have been selected to draw plans for the construction of the new high school building at Logansport. The estimated cost is $175,000.

Detroit, Mich.—Plans are being prepared for the construction of a 12-story store building on the north side of Cadillac Square, for the Gregory, Mayer & Thom Co. The estimated cost of the structure is $250,000.

Grand Rapids, Mich.—Edward Lowe, 1013 Michigan Trust Bldg., Grand Rapids, contemplates the erection of a 10-story and basement office building on the site of the old Porter Block. The estimated cost is $200,000.

Plans are being prepared for the construction of a four-story and basement Masonic Temple. The estimated cost is $250,000. William E. Elliott, Ionia and Louis Sts., is Chn. Bldg. Com.

Muskegon, Mich.—The Elks contemplate the erection of a lodge building in Muskegon, to cost approximately $150,000.

+Pontiac, Mich.—The Board of Education has awarded the general contract for the construction of the new high school to W. H. ISGRIGG & SON, Greensburg, Ind., at $155,692. Perkins, Fellows & Hamilton, 6 North Clark St., Chicago, Ill., are the Archs.

Keokuk, Iowa—The Keokuk lodges of Masons are negotiating for the purchase of a site for a five-story and basement temple, to cost approximately $90,000.

Waterloo, Iowa—C. O. Lamson has commissioned Marshall & Fox, Chicago, Ill., to prepare plans for the construction of an eight-story hotel at Fifth and Commercial Sts., Waterloo, to be known as the Hotel Russell-Lamson.

St. Paul, Minn.—G. Summers & Co. will erect a warehouse at Woodward Ave. and Grove St., to cost approximately $120,000.

+Lexington, Neb.—The contract for the construction of the county court house at Lexington has been awarded to the FALLS CITY CONSTRUCTION CO., Louisville, Ky., at $90,130. W. F. Gernandt, Fairbury, is the Arch. Noted Dec. 12.

Chinook, Mont.—The County Commissioners have commissioned George Shanley, Great Falls, Mont., to prepare plans for the construction of the new court house. The estimated cost is $70,000.

St. Louis, Mo.—The Scruggs, Vandervoort & Barney Dry Goods Co. plans to erect a 12-story building on Locust St. The estimated cost is $200,000.

St. Louis, Mo.—Press reports state that the Monward Realty Co. has had plans prepared and will erect a 19-story building at Broadway and Olive St. The estimated cost is $2,000,000.

Dallas, Tex.—The Dallas Dry Goods Co. contemplates the erection of a 10-story building at Lamar and Monroe Sts. [illegible]

Denison, Tex.—Plans for the new high school have been submitted to the School Board. The estimated cost is $100,000. A. O. Watson, Austin, Tex., is the Arch.

Waco, Tex.—[illegible] has purchased a site at Eighth and [illegible] and will erect a fireproof hotel.

Little Rock, Ark.—[illegible] is interested in a project [illegible] Main and Center Sts. [illegible]

Little Rock, Ark.—Press reports state that the Southern Trust Co. is interested in the proposition to build a new 15-story [illegible] Louisiana and Center Sts. for which [illegible]

Astoria, Ore.—The [illegible] Astoria Seaside Park will [illegible] a [illegible] It will be of reinforced concrete construction with glazed brick and terra cotta [illegible] The seats will be constructed to stand two additional seasons [illegible]

+Portland, Ore.—[illegible] has been awarded by the [illegible] for the [illegible] to be erected by the Northwestern Electric Co. on Morrison St. between [illegible] and Seventh Aves. Its estimated cost is $75,000. Noted Dec. 12.

T. B. Wilcox is planning the erection of a 12-story office building at West Park and Washington Sts. for the exclusive use of physicians. It will be 50x100 ft., of steel and terra-cotta construction, and is estimated to cost $350,000. Whidden & Lewis are Archs.

Coronado Beach, Calif.—Bids were received as follows on the general contract for the Coronado high school: The Wuester Construction Co., San Diego, at $64,800, John Campbell at $66,250, the W. M. Simpson Construction Co. at $74,828, the John Simpson Co. at $83,679, Brenner & Decew at $84,950, Cline & O'Brien at $110,766. Quayle Bros. & Creesy, Savoy Theater Bldg., San Diego, are Archs.

Fresno, Calif.—E. F. Lacour and R. L. Felchin will erect a six-story reinforced-concrete apartment house on Tulare St., between M and N Sts., to cost approximately $75,000.

Los Angeles, Calif.—Edgar H. Door 1811 South Main St., is preparing plans for a four-story and basement brick apartment building to be erected at 16th and Courtland Sts. for R. H. Raphael and George Cohn. It will be 130x130 ft., with concrete foundations, pressed brick facing, art stone trimmings, tile and marble entrance. Estimated cost, $100,000.

+A contract has been awarded by Alexander Meyer, 214 South Broadway, to the BARBER-BRADLEY CONSTRUCTION CO., 1824 East 15th St., at $50,000 for the construction of an eight-story reinforced concrete store and loft building at South Main and South Spring Sts. Norman F. Barber and J. F. Blee are Archs.

The Egan School of Dramatic Arts is having plans prepared for a three-story fireproof theater, 100x120 ft. to be erected at Figueroa and Pico Sts. It will have steel frame, hollow tile partitions, blue brick exterior with terra cotta and stone trimmings. Morgan, Walls & Morgan, Story Bldg., are Archs.

H. V. Bard is having plans prepared for a four-story apartment house to be built on Hartford Ave., between Fourth and Fifth Sts. It will have 108 rooms. The construction will be of brick, concrete foundation. Leonard L. Jones, F. W. Hellman Bldg., is Arch.

A. L. Hill, 2373 West 22d St., is planning to build a five-story hotel at West Sixth and Lake Sts., containing 183 rooms. It will be 96x148 ft., with concrete foundation and steel frame. It will cost about $125,000. J. W. Chalmers, Mason Bldg., is Arch.

Train & Williams, Exchange Bldg., are completing plans for a five-story and basement reinforced-concrete apartment building to be erected at Ninth and Alvarado Sts., for F. L. Aulten.

+The Merchants' Fireproof Building Co. has awarded a contract to the RAYMOND STONE CO., 781 Lyon St., at $64,800, for the granite work in the office building it is erecting at Sixth and Spring Sts. WEYMOUTH CROWELL, Story Bldg., was awarded a contract at $35,700 for construction of the concrete foundation and footings for the same building. William Curlett & Son, Title Insurance Bldg., are Archs.

John C. Austin and W. C. Pennell, Wright & Callender Bldg., are preparing plans for an 11-story and basement hotel to be erected on West Sixth St., between Flower and Figueroa Sts., for Alex. Mackiegan and E. C. Ellis, Story Bldg. The construction will be of reinforced concrete.

The Louis Philips Estate has decided to erect a modern store and hotel building on its property at Spring and Franklin Sts., which is 120x218 ft. There will be stores and lobby on the first floor, and 500 rooms with private and general baths in the upper stories. The building will be of Class B construction. The cost is estimated at $500,000. Plans are now under consideration and the architect will be announced shortly.

The Hill Street Lot Co., Eugene Overton, Secy., Wright & Callender Bldg., is having plans prepared for a 10-story loft building on Hill between Second and Third Sts. It will be 58x165 ft., of reinforced-concrete construction. Austin & Powell are Archs.

Train & Williams, Exchange Bldg., have prepared plans for the erection of a two-story and basement brick store and hall building at 1024-1032 South Grand Ave., for A. T. Wells, of Pasadena. It will have concrete foundation, 89x154 ft., and the construction will be structural steel.

The Whitcomb Investment Co., Consolidated Realty Bldg., has completed arrangements for the erection of a 14-story office building on West Sixth between Hill and Olive Sts. for the Building Owners' Co. It will be of reinforced-concrete construction and contain 325 offices, each with a fireproof vault. Thornton Fitzhugh, Pacific Electric Bldg., is Arch.

Plans have been completed for a seven-story loft building to be erected at 946 South Broadway for J. Kahn, George Mosbacher and others. It will be 50x85 ft., with reinforced-concrete frame, walls and floors. S. Tilden Norton, Title Insurance Bldg., is Arch.

+Oakland, Calif.—Contracts have been awarded by the Board of Education to O. B. ACKERMAN & SON, First National Bank Bldg., at $67,000 and $87,000 respectively for the construction of a two-story brick school on Park and Division Sts., and a one-story reinforced concrete school at College and Shafter Sts. J. J. Donovan, Security Bank Bldg., is City Arch.

Sacramento, Calif.—The Wells-Fargo Express Co. is planning the erection of a new depot and office at a cost of $100,000. It will be located north of I St., between Second and Fifth Sts., and will be two stories, 200x60 ft.

+San Diego, Calif.—A contract has been awarded to the F. C. PENGSTROM CO., Los Angeles, at approximately $175,000, for the erection of a 10-story concrete building at 907 Fifth St., for Nathan Watts. Noted Dec. 12.

San Diego, Calif.—Plans for the California State Building of the San Diego Exposition are being prepared by H. G. Goodhue, 2 W. 47th St., New York, N. Y. The structure is estimated to cost $250,000.

The Southern Title Guarantee Co. is planning to erect a six-story office building on Third St., near D St. It will be of reinforced concrete construction throughout. W. S. Hebbard, Grant Bldg., is Arch.

+San Francisco, Calif.—The Pierce Arrow Motor Car Co. has awarded a contract to J. D. HANNAH at $100,000 for the erection of a four-story concrete garage on Geary St. John Galen Howard is Arch.

Engineering News

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A Famous English Chain Suspension Bridge

A chain suspension bridge, which is of interest from its engineering features and its picturesque location, is the Clifton Bridge, which spans the River Avon, at Bristol, England. The river flows mainly through a rolling country, but at Clifton (a suburb of the city) it pierces a high rocky ridge by a gorge having vertical cliffs upon one side and steep wooded slopes on the other. The bridge is carried by chains composed of eye-bars. It has a span of 702 ft. 3 in. c. to c. of towers, and its floor is 245 ft. above high water; the height at low water is considerably greater, as the river has a phenomenal tidal range of 30 to 38 ft. The site is only a short distance below the entrance to the docks, and as there is a very sharp bend in the river, the channel has been widened, a roadway being cut in the solid rock on the west side, while on the east side a heavy retaining wall has been built, as shown beyond the large steamer in Fig. 1. There is a railway also on each side of the river, piercing the rocky points by tunnels as shown. Fig. 1 is a view of the bridge from the river, and shows how the steep slope at the right is terraced by means of heavy stone retaining walls. Fig. 2 is a view from the higher ground along the east end of the bridge.

The idea of spanning the river at this point was conceived in the 18th century by an alderman named Vick, who by his will left $5000 toward the enterprise. This fund remained invested for some eighty years, when it had grown to about $40,000. Private and other subscriptions brought the amount up to $160,000, when actual construction was commenced. In 1829, designs for a suspension bridge were submitted by Isambard Kingdom Brunel, but these were not accepted. In 1813, however, another design of his was accepted. The first stone was cut with some ceremony by Lady Elton, in 1831, and the foundation stone for the first abutment was laid Aug. 27, 1836. A cable was stretched across the gorge Sept. 26, 1836, and venturesome people were hauled across in a basket suspended from the cable, a small fee being charged for the trip. The Clifton (or east) abutment is of no great size, but owing to the slope on the west side the Leigh (or west) abutment is a bold and striking mass of stone masonry, as may be seen from the accompanying views. This latter abutment was completed in 1840, and then the towers were built, but the work was abandoned in 1853, owing to lack of funds to undertake the superstructure.



FIG. 1. THE CLIFTON SUSPENSION BRIDGE, OVER THE RIVER AVON, AT BRISTOL, ENGLAND
(Span, 702 ft. Height above high water, 245 ft.)

The superstructure finally erected (and now in place) was not built for this site. By a curious coincidence it was the work of the same engineer, although he had nothing to do with its removal to Bristol, this being undertaken after his death. In 1842, Mr. Brunel had built the Hungerford suspension bridge over the River Thames, at London (Charing Cross), but in 1861 (two years after his death), it was decided to remove this to make way for a new structure. It was then suggested that it could be utilized at Bristol. In that year, the present Clifton Suspension Bridge Co. was formed, and purchased the chains and other work of the Hungerford bridge. The material was transported to Bristol and reërected on the towers of the Clifton Bridge. Eight wire cables carried a platform upon which the chains were put to-



Fig. 2. The Clifton Suspension Bridge

gether, the bars being taken out by a car or platform suspended from another cable. This bridge was opened on Dec. 8, 1864. Its total cost was about $500,000.

The towers are of rough-faced gray granite, pierced with openings to reduce the weight, and having the corners beveled or chamfered. The towers have a decided curved taper to the upper part (which is of dressed stone and incloses the saddle chambers), and the whole appearance is very massive. The height of the towers above the abutments is about 70 ft. The chains are anchored 70 ft. deep in the solid rock. At about 200 ft. from the tower each chain passes over a fixed saddle bolted to the wall of the anchorage tunnel and then extends at an angle of 45° to the anchor plate and chamber.

The chains are composed of eye-bars packed side by side on pins, there being 4200 bars for the two chains. These bars are 1 in. thick, and 7 in. deep in the body. The length of the bars at the middle of the chains (where they are nearly horizontal) is 24 ft.; as the inclination of the chain increases, the length of bars is increased, so that the horizontal projected length is 24 ft. throughout. In effect, each of the two chains is composed of three [illegible] one above the other, and staggered so that the connecting pins have a uniform spacing of 8 ft., as shown in the sketch in Fig. 3. This is the spacing of the vertical suspension rods which are attached to the pins. There are 132 of these rods, 1⅜ in. diameter, and ranging in length from 3 ft. to 60 ft. Each bar is in two parts, the larger one being attached to the chain pin, and the shorter one to a pin fitted to pin-plates riveted to the top chord of the stiffening girder. The two parts have threaded ends and are connected by long threaded sleeves. The sectional area of the chains is about 140 sq. in. at the center of the span and 189 sq. in. at the piers.

The stiffening girders are wrought-iron plate girders 3 ft. deep, the upper part separating the roadway from the sidewalks. The transverse floor beams extend beyond the girders so as to support the sidewalks. Additional stiffness is afforded by lattice girders 57 in. deep, which serve as railings at the outer edges of the sidewalks. The width of the bridge is 31 ft., and the floor has a camber of 18 in. at the middle of the span. The total weight is between 1400 and 1500 tons. The heaviest load allowed for any vehicle crossing the bridge is 7 tons. For inspection and painting the floor system there is a box extending across the full width of the bridge and suspended from frames attached to trolleys with grooved wheels which ride on top of the hand-rails. There are no wind guys, and the bridge has been observed to swing as much as 18 in. in very stormy weather, such as in southeasterly gales.

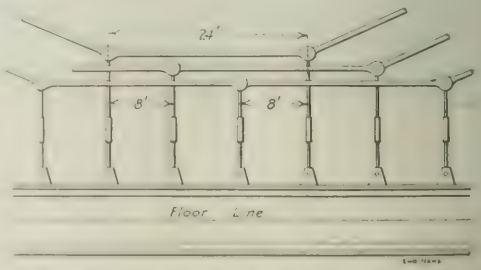


Fig. 3. Arrangement of Chains and Suspenders on the Clifton Bridge

The designer and engineer of the bridge, Isambard Kingdom Brunel, was famous both as a railway engineer (notably for the construction of the Great Western Ry. system of 7-ft. gage) and as the designer of the famous early steamers, "Great Western," "Great Britain" and "Great Eastern," the first two of which sailed from the port of Bristol. He died in 1859. The present consulting engineer of the bridge company is H. Howard Humphrey, of London, and the resident inspector or engineer is Thomas Stevens.

British Opinion on Railway Automatic Stops

By H. Raynar Wilson*

The attention which the subject of automatic train control is again receiving in America, coupled with inquiries from America as to British experience in this direction, prompts the writer to review briefly the situation as it appears to one versed in the conditions in England and having some acquaintance with the altogether different situation to be faced in the United States.

Except on the electrically operated railways in London, automatic train control is not only absent from British railroads, but it has never been tried in regular work. There are reasons for this, but before giving them it should be noted that we have what we consider is the equivalent—locomotive cab-signals.

The repetition in the locomotive cab of the signals shown at the side of the track is a very old idea. In Great Britain cab-signals have always been advocated because of the frequency of fogs in the winter months, the density, inconvenience and danger of which can only be appreciated by those who have experienced them. Innumerable ideas have been submitted, and some tested, but all the earlier ones were abandoned for one cause or another. While many had mechanical defects, they all had one dangerous weakness—they failed to give "clear" indications as well as "danger"; the non-receipt of a "danger" signal, owing to the failure of some part of the apparatus, might lead to an engineer assuming that a "clear" fixed signal was turned, if only it could be seen.

Up to about seven years ago there was only one system that in any way approached the ideal. This was the apparatus designed by W. S. Boult whereby electrically actuated pointers were deflected to the right or to the left, thereby indicating "clear" or "danger," by means of induced currents picked up as the locomotive passed over certain magnetic fields which were varied to suit the condition of the fixed signals. This system, which was in actual work for some time on a leading English main line, gave other indications than these, but it is to be feared that the cost was too great. Probably, however, the characteristic objection of British railway officials to trying any new idea was principally against its further use. Anyway, Mr. Boult told the writer only a few weeks ago that he had dropped the subject.

Two other cab-signal systems have since been introduced and both are in actual work on main lines of railway. One of these, known as the "Audible," is in use on the Great Western Ry., and, experimentally, on the Midland. The other, called the "Raven," is to be found on the North Eastern Ry.

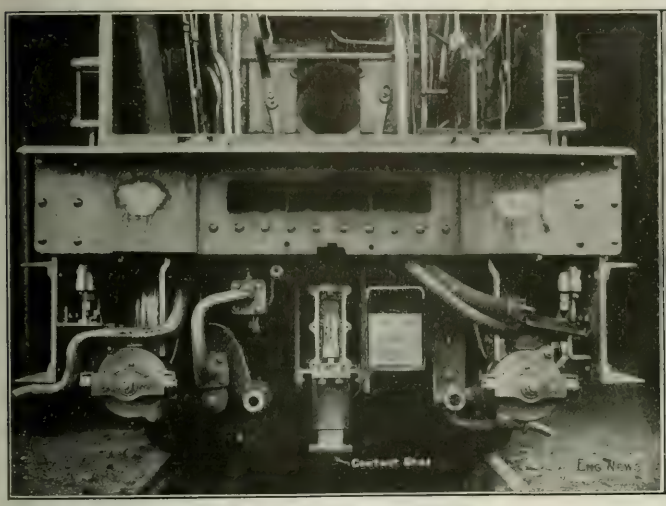


Fig. 1. "Audible" System



Fig. 2. "Raven" System

Figs. 1 and 2. British Locomotive Cab-Signal Contact Shoes

The "Audible" system was described and illustrated on p. 36 of the first report of the United States Block Signal and Train Control Board; it was mentioned on p. 22 of the second report, and on p. 19 of the third, but a brief further description is desirable.* Fixed on the track at the advance ("distant") signal is a metallic ramp and on the engine is a corresponding shoe (Fig. 1) which, when lifted, opens a local circuit and causes a whistle to be blown. The ramp can be electrically connected to a battery in the signal-tower and is switched in by the lever that works the advance signal, or, if the latter is not provided, then by a special lever so interlocked that the stop ("home") signal for the same direction must have been "cleared" before the ramp is switched in. A diagram of the electrical connections is given in Fig. 3, from which it will be seen that if the ramp is "dead" the raising of the shoe causes a whistle to be blown. If, however, the ramp is in the cabin-battery circuit, the shoe picks up current which, through the

*96, Hurlingham Road, London, S. W. England.

*The earlier arrangements were described in Eng. News., May 2, 1907.—Ed.

relays, restrains the whistle and sounds a bell. A whistle therefore signifies "caution" and a bell indicates "clear." To guard against the ill-effects of frost there has been attached to the shoe a flexible pipe from the steam-heat supply. On the Great Western there are 35 engines fitted with the apparatus, seven of which have also an automatic brake application and there are 199 signaling ramps. On the Midland there are, I believe, two engines fitted and about a dozen ramps.

The "Raven" system was also mentioned in the first report of the U. S. Block Signal and Train Control Board, but not in respect to its present form. The whole Richmond branch track of the North Eastern Ry. and all the locomotives running thereon are equipped. This system also has on the locomotive a shoe (Fig. 2) which is raised by a ramp on the track but, different from the "Audible" system, there are at least three, and sometimes four or more, ramps. There is a bell, but no whistle. There is also a visual indicator, which is deflected when a "clear" signal is given and which is, in addition, made to show which way the switch is set when a junction is being approached. A normally dead ramp is placed, say, 450 ft. before an advance signal is reached. When the contact runs over this ramp (*A* in Fig. 4) the bell is started and it continues ringing until a second ramp is reached at the advance signal itself (*B* in Fig. 3, and *B* in Fig. 4). This ramp is electrically connected to the levers $H_1 H_2$ working the stop ("home") signals, and levers $A_1 A_2$ working the advance signals, which latter, in accordance with British practice, are placed in advance of the junction and allow the signalman to let a train, for which the line ahead is not clear, to get that much further on its road and yet be under the protection of the home. Unless these levers H_1 and A_1 are at "clear" for a train to proceed along line No. 1, or H_2 and A_2 at "clear" for No. 2 line, the second ramp is also dead. Whenever the shoe is raised by a ramp the bell stops ringing but, if the ramp is not connected the bell starts ringing again immediately the shoe falls as it leaves the ramp. If, however, the levers in the proper set at "clear" the ramp is connected and, when the shoe goes over, the main semaphore coils are energized, holding the bell and preventing its ringing even although the shoe has again fallen.

The engine driver, then, gets a warning, by means of the bell ringing at the first ramp, that he is approaching an advance signal and in 450 ft. or so, by the bell stopping, that he is at it. If the bell does not again sound he knows that the line is "clear," but if it resumes ringing it is an indication that the signals are against him and the man, therefore, gets his train under control, prepared to stop, on ramp *D*, at the stop signal. Between the ramp at the advance and that at the stop signal is an intermediate ramp *C* which is provided to intimate to an engine driver, who may be feeling his way in a dense fog, whether any change has been made since he passed the distant. The needle of the visual indication must be deflected when the bell does not resume ringing. When the engine gets to the final signal, the driver gets another ramp *E* or *E'*, according as to whether he is on No. 1 line or on No. 2. The line in the diagram, Fig. 4, runs from right to left and the signals point from the track.

These, then, are the only two cab-signals in use in Great Britain and, as they give every satisfaction, it is necessary to note why their use, or the use of some similar system, has not been extended. The main reason is that, owing principally to smoke-abatement legislation and the use of gas stoves and electricity, there has been much less fog during recent years. Moreover, the present system of fog-signaling by means of the sectionmen putting torpedoes on the rail when the signal is against a train, although antiquated and inconsistent (inconsistent in that a "clear" signal is given by the withdrawal of the torpedo) is well handled and it finds work for the sectionmen who would otherwise have to go home, as they are not allowed to work on the line during fog. Another factor is that it is almost essential that any cab-signal system should be universally adopted, if at all. The practice of running the trains of one company over the tracks of another is so widely in force that uniformity is almost vital. The engines of some English companies are ubiquitous. The Midland trains, for instance, travel on at least twenty other companies' lines. Consequently, if one company adopted cab-signal system A, and another had system B, and a third C, it is possible that some companies would have to have at least three systems fitted to their locomotives.

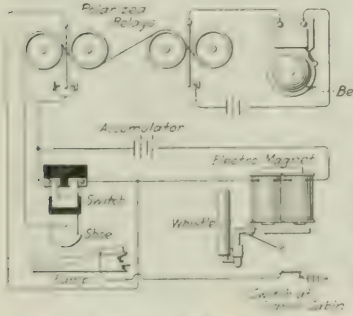


FIG. 3. DIAGRAM OF LOCOMOTIVE CIRCUITS; "AUDIBLE" CAB-SIGNAL SYSTEM

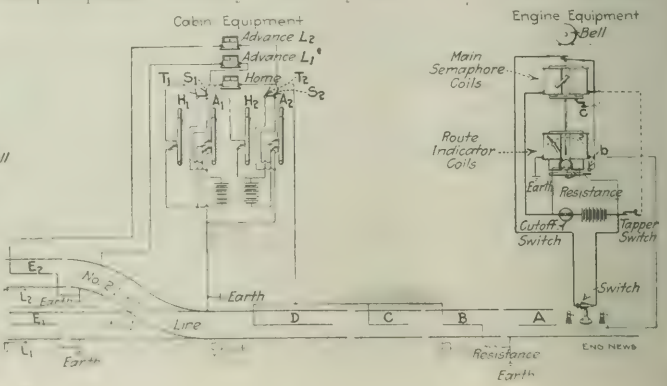


FIG. 4. LOCOMOTIVE AND TRACK CIRCUITS; "RAVEN" CAB-SIGNAL SYSTEM

So, for the present, British railways are simply "marking time" and awaiting events. In the meantime there is a growing fear among the officials, perhaps not yet pronounced, that something ought to be done in the way of fitting cab-signals to locomotives. But this is not so much for use during fog, but as an aid to the engineer in all weathers. There have been several cases where signals have been mis-read and a driver has taken the signals governing one track as applicable to him and ignored his own. Cab-signals in such a case would have warned him of his error. The writer has also recently advocated cab-signals for places where speed has to be reduced—not only at curves, drawbridges, etc., but also where there is a junction that allows for unlimited speed in one direction and restricted speed in the other.. When



FIG. 5. ADVANCE-SIGNAL TRACK RAMP; "RAVEN" CAB-SIGNAL SYSTEM

the signals for the latter road were lowered, the cab-signal caution would be given; if the signals were adverse, the stop warning would be sounded in the usual way.

If, then, cab-signals have made such little progress in Great Britain, need it be wondered that automatic train control has made no progress? While there are few objections to cab-signals, there are numerous weighty ones against automatic control. There is, first, our comparative freedom from accident; secondly, the experience of the U. S. Block Signal and Train Control Board shows that a perfect system is hard to attain. Then, if it should be found there still are points that the Board has not yet dealt with, e. g., shall the controlling apparatus be at the distant or at the home signal; if at the latter, may not that be too late, and if at the distant, may not that be too soon? A third opposing factor, peculiar to Great Britain, is our light, unbraked freight wagon. Get a train of a hundred of these going down a steep grade and let the engine brakes be suddenly applied and there would be a wreck. Other objections might be named, but these are enough. Automatic train control is, therefore, unknown in Great Britain and likely to remain so.

In conclusion, the writer would like to suggest that instead of searching for a perfect control apparatus, American railroads might be satisfied to try a cab-signal. The conditions to be complied with are similar and many of the objections to automatic control are eliminated. I admit that a cab-signal will not pull up a train if the engine driver had fallen dead but, surely and fortunately, that is such a rare event that it need not enter into consideration. A cab-signal will awaken a man that is asleep, and pull together one dozing or with wits "wool-gathering," and under all conditions would be of great assistance to the engine driver. As applied on some parts of the Great Western Ry., distant signals are dispensed with and the engineman gets an intimation as to how the stop signal is by a ramp fixed the regulation distance out—about 2100 ft. from the stop signal.

The writer's experience in America has shown that the climatic conditions there, while very trying, can be overcome and that, instead of wasting time and energy in endeavoring to find a perfect automatic control, American railway companies would be wise to take the easier middle course and try a cab-signal to which, later, if necessary, train control could probably be added.

Fuller particulars of the "Audible" system may be obtained from Messrs. McKenzie & Holland, Ltd., 58 Victoria St., Westminster, London, S. W., and of the "Raven" system from Vincent L. Raven, chief mechanical engineer, North Eastern Ry., Darlington, England.



The Public Service Commission of New York (First District), charged with supervision of utilities in New York City, in its sixth annual report presented to the legislature, on Jan. 13, gives the following figures, showing the amazing volume of earnings from the street traffic and lighting systems of New York City:

In the year 1911-12, the public in New York City paid for street-railway transportation $83,684,799. This is equivalent to about $16 per capita. For gas and electricity for a year the public paid $60,581,760—equal to about $12 per capita. This makes a grand total of $144,266,539 paid in the city of New York in one year for local transportation, gas and electricity.

The total number of passengers carried on street and electric railroads (including subways and elevated lines) was 1,680,914,025, an increase of 77,000,000 passengers over the preceding year, and an increase of 365,000,000 over the year 1907-08, the first year of the Commission. These railroads used 1666 miles of track and operated 11,688 passenger cars. More than 126 miles of track have been added during the life of the Commission.

The total capitalization, including capital stock and funded debts outstanding, of all companies subject to the jurisdiction of the Commission amounts to $1,104,993,683, of which $691,373,872 applies to street and electric railways, $210,952,600 to gas companies and $136,968,751 to electric light and power companies.

The number of gas consumers is 1,286,717, an increase of about 50,000 over the preceding year, and of 201,231 over the year 1908. The gas manufactured amounted to 43,297,216,000 cu.ft. In the same period the electricity generated amounted to 589,778,573 kilowatt-hours.

The Commission also has in charge the extension of the proposed transit subway system. The city of New York up to Dec. 31, 1912, had expended for rapid transit within the city $87,808,238. Of this total, $55,625,231 was spent upon the existing subway and $32,183,006 has so far been paid out under contracts for the construction of new subways for the dual system, namely, the Lexington Ave. and Centre St. loop subways, in Manhattan, and the Fourth Ave. subway, in Brooklyn.

It is estimated that the city will expend about $160,000,000, and the two companies between them about as much more in the construction and equipment of the dual system, the total expenditure being estimated at about $325,000,000. When completed the dual system will have three times the mileage of the existing lines.

The total construction work under contract on the subway system on Dec. 31, 1912, was $71,214,127.

Presidents of Four National Engineering Societies

For the 20th consecutive year we present to our readers portraits of the Presidents of the four great national engineering societies, and we print below biographies of each of them, prepared in each case by some personal friend who is himself a well known engineer.

It is noteworthy that this year three out of the four Presidents of the national engineering societies are engaged in the work of engineering education. This is the first time in its history that the American Society of Civil Engineers has chosen a Professor of engineering as its President. In the American Society of Mechanical Engineers the only other engineering professors elected to the Presidency have been its first President, the late R. H. Thurston of Cornell, elected in 1880, F. R. Hutton of Columbia, in 1907 and Alex. C. Humphreys of Stevens, elected last year.

In the Institute of Mining Engineers and of Electrical Engineers the number of past Presidents chosen from the ranks of the engineering professors is somewhat larger.

While Professors Swain and Goss and Kemp have each won enviable eminence for their work in engineering education, it is also true that the professional work of each outside of college walls has been of even greater importance in giving them the distinction which has resulted in their being honored with the highest office within the gift of their professional associates.

Geo. F. Swain, President of the American Society of Civil Engineers

By C. Frank Allen*

The American Society of Civil Engineers in choosing its President this year has, for the first time, elected a professor of engineering, for Professor Swain has attained, on the whole, greater distinction as an engineering educator than in the practice of his profession. His selection as President, however, would have been amply justified either by his standing as an engineer outside of his teaching work or because of his faithful and effective work within the Society.

George Fillmore Swain was born Mar. 2, 1857, in San Francisco. His ancestors, however, came from New England, and of these the Swains and Starbucks were among the best known families of Nantucket in its prime, when whale fishery not only bred sturdiness of character, but also brought prosperity with its many adventures. His father was a prominent citizen of San Francisco, and was one of its leading merchants. He served as President of the Chamber of Commerce, and was appointed Superintendent of the Branch Mint there during Lincoln's administration. His work at the Mint called for and developed a mathematical ability which was unusual and the son's success in this direction had some root both in inheritance and in example.

Young Swain received his preparation for college at a military school, and the effect of the discipline which goes with such a school may well have had an important influence in fixing habits of mind and action which were elements in his later success. He became a student at the Massachusetts Institute of Technology at the early age of 16, led his class in scholarship and served as adjutant of the military battalion.

The thorough training characteristic of that institution in its turn could not do otherwise than serve to further develop the habits of thoroughness and of character already fairly established. Among the studies pursued there, the non-professional course in logic, taught at that time by Prof. George H. Howison, inspired in young Swain a taste for study along that line, and the reading done in this direction he has valued highly as an important part of his training. He also acquired a fondness for Shakespeare and this in connection with his logic certainly helped not only to clear thought, but habits of clear expression which a training in mathematics and science sometimes fails to secure.

His teacher in civil engineering was Prof. John B. Henck, a fine mathematician, a strict and clear teacher who demanded and received good work from his pupils and did more than any other member of the early faculty of "Tech" to fix the high standards of this institution. His influence on Professor Swain's later teaching must have been very great.

In 1877, Swain received his degree of "Bachelor of Science" in the course of "Civil and Topographical Engineering." Not satisfied with this, he spent three years abroad, primarily for the study of civil engineering, in which he did fine work, but with the added advantage to him of acquiring a breadth of view and experience in life, a wide acquaintance with men of various training, and an opportunity to travel, which together formed probably the most valuable feature of his life abroad, and which cannot be acquired from travel alone.

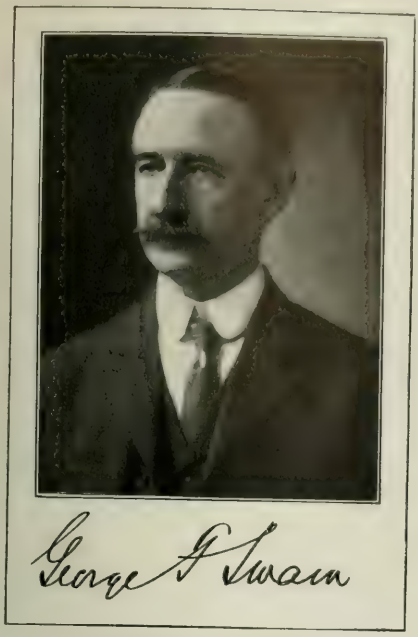
He studied at the Royal Polytechnicum at Berlin under such able masters as Winkler, Goering and Hagen, specializing in bridges and structures, railroads, and hydraulics, subjects valuable quite as much for training as for knowledge of the work covered. Advanced degrees there were then restricted to those who were to enter government service, so that he received no degree, but the substance he secured.

On his return to this country in 1880, he was employed as a special agent of the Census in investigating water power in connection with manufacturing interests, his field being the Atlantic slope. He also spent some time in hydraulic work in the Offices of Locks and Canals at Lowell, and of the Essex Co. at Lawrence.

His water-power work was done under Gen. Francis A. Walker, Superintendent of the Census, who shortly afterward became President of the Massachusetts Institute of Technology. He promptly recognized Swain's ability by appointing him instructor in civil engineering. Early promotion followed to the position of assistant professor in 1883 and a few years later, in 1887, he became full professor in charge of the Department of Civil Engineering. Later the course in Sanitary Engineering, newly introduced, also came under his direction.

Although placed in charge of the Department of Civil Engineering at an early age (for conservative Boston), his success justified his appointment, and a remarkable development followed; when he became acting head of

*[illegible] of Civil and Topographical Engineering, Massachusetts Institute of Technology, Boston, Mass.



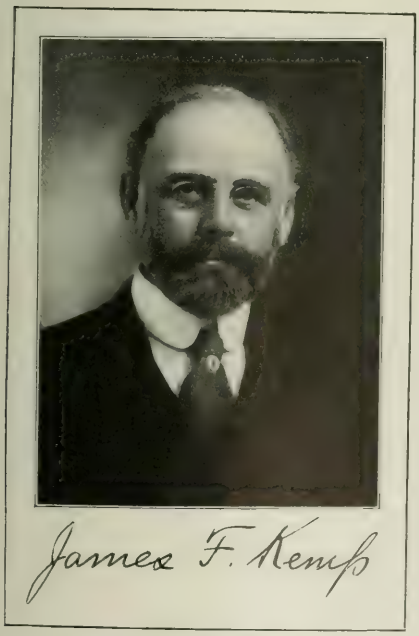
George F. Swain

PRESIDENT OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS



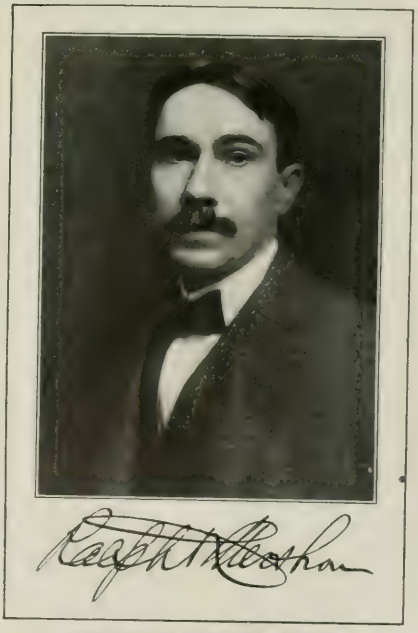
W. F. M. Goss.

PRESIDENT OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS



James F. Kemp

PRESIDENT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS



Ralph W. Pope

PRESIDENT OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

the department in 1887, he was the only full professor; there were three instructors and one assistant. In 1909 there were in the department twenty all told; ten of these were members of the faculty. In 1887 there was no department library worthy of the name; in 1909 it had become probably the best working library of civil engineering in the country, and it was due to his enthusiasm and judgment that this was accomplished.

While at Technology he served for a time as secretary of the Society of Arts, connected with it, and was also for two years secretary of the Technology Alumni Association.

In 1909, Prof. Swain was offered and accepted the Gordon McKay Professorship of Civil Engineering in the Graduate School of Applied Science, Harvard University. An important consideration in his acceptance was his expressed belief that this graduate school marked an advance in the status of engineering, putting it on the same basis as law and medicine, the schools of which for some time had been on a graduate basis at Harvard.

As a teacher, his standards have been high. He has demanded from his students not only diligence and attention, but beyond that has insisted upon clear thinking on their part. His work has been very thorough, of a high grade, and enforced by a steady drill in the principles of the subject. Here acquirement or an understanding of the subject in hand has been secondary to clear thinking along the line of work. He taught many subjects at the Institute in the early days, the important course in hydraulics being for several years in his charge. Later he confined his attention almost exclusively to structures, which he taught not only to undergraduate students, but also to the graduates, and he is best known in connection with this line of work.

In 1893, men engaged in teaching engineering in the United States and Canada organized the Society for the Promotion of Engineering Education. Prof. Swain was the second President of this Society, in which he took for many years an active part. His attitude toward the work of teaching was well defined in his presidential address on "The Profession of Engineering Teaching," in which he called attention to the necessity that professors of engineering should cultivate the teaching side, however attractive the engineering side may be. His reputation among the teachers of this country has placed him in the first rank.

He has been for a number of years one of the Board of Judges to select names for the Hall of Fame of New York University, and this university, in 1906, conferred upon him the honorary degree of LL.D. In 1908 he was appointed by President Roosevelt a member of the Inland Waterways Commission, and also of the Conservation Commission. This followed the hearings of a Congressional Committee upon the proposed Appalachian Forest Reserve, at which Prof. Swain took an important part.

His publications include notes on "Hydraulics" and also on "Structures" for the use of his classes, which have not been given general circulation. The *Journal* of the Franklin Institute for 1883 contains articles from him on "Mohr's Graphical Theory of Earth Pressures" and on the "Applications of Virtual Velocities to the Determination of the Deflection and Stresses of Frames"; in 1887 he contributed a paper to the American Society of Civil Engineers on the "Calculation of Stresses in Bridges for Concentrated Loads," a feature of which was the use of "Influence Lines." The two last mentioned papers have had a very material effect upon present practice in structural computations and investigations. He has been active in contributing to various society papers, and many official reports have been made by him, sometimes individually, sometimes as one of a board.

As an engineer, and as an official in connection with engineering work, he has had a large and successful experience. His first opportunity came in 1887, at the time of the failure of the Bussey Bridge, near Forest Hills, Boston. At the investigation which followed, the quality of his training and his ability to analyze the causes of the accident so impressed the Railroad Commission that he was appointed the first expert engineer of the Commission under a law newly passed, an office which he has continuously and satisfactorily filled and now holds; an office for which he is well fitted and which has yielded him a rare experience. The necessary changes and reforms in railroad-bridge practice in the state were secured quietly and with avoidance of ostentatious publicity.

In 1894, the Boston Transit Commission was organized to construct the Boston subways; Prof. Swain was one of the first commissioners appointed, and is now the sole remaining member of the original board. The work was without precedent in this country, was well carried out, and within the original estimates. The tunnel under Boston Harbor to East Boston was a part of the work of this Commission, as was also the Charlestown Bridge. At the present time the expenditure under this Commission has been in excess of $18,000,000.

In connection with architectural construction, he was employed upon the large extension of the State House at Boston, and upon many other works, some of which offered unusual problems. He has been consulting and designing engineer for a number of bridges, movable as well as fixed, an unusual case being the reconstruction of the old chain suspension bridge at Newburyport as a stiffened cable suspension bridge with a hinge at the center, and with reinforced-concrete towers.

He has served upon a number of Commissions to fix the method of eliminating grade crossings of highways with steam railroads, those at Worcester, Taunton, Newton and Waltham being among the most important. He was a member of the Commission to revise the building laws of Boston. He has also frequently been called upon as an expert in court cases, not only in Massachusetts, but elsewhere.

Quite recently Prof. Swain served as expert for the Commission on validation of the assets and liabilities of the New York, New Haven & Hartford R.R. This involved appraisals of properties and securities held by the railroads, a physical valuation, a consideration of economic problems, and a critical examination of books. This has been followed by similar valuations of other roads, both large and small. As late as 1912 he served the Chicago Elevated Railways as their expert in a valuation of their properties. Altogether these valuations sum up to many hundreds of millions of dollars.

He has been a member of many engineering societies, among them the Boston Society of Civil Engineers, of which he has been President; the American Society of Mechanical Engineers, the Institution of Civil Engi-

neers of Great Britain, the Canadian Society of Civil Engineers, the Society of Engineers of Hannover, Germany, the American Railway Engineering Association, the American Society for Testing Materials, the New England Water-Works Association, the New England Railroad Club, the American Academy of Arts and Sciences, and the American Association for the Advancement of Science, of which he has been a Vice-President.

He has long been a pronounced believer in the advantage to engineers of associating more largely with business and professional men not engineers. His presidential address to the Boston Society of Engineers dealt with this subject; and consistently he is a member in Boston of the Union Club, a general social organization; the St. Botolph Club, where literary or similar qualification is necessary; and the Commercial Club, whose name indicates its business character.

Prof. Swain has a fine library, is fond of reading along varied lines, and reads German and French freely, not only for engineering purposes, but for their literature. He has been twice married, first to Katherine K. Wheeler, and second to Mary H. Lord, of Salem, who is pleasantly known to many members of the Society.

His success may be attributed in part to inherited ability and fine environment, at home and at school, both here and abroad; a training extended beyond that secured by most of his fellows; an orderly habit in his work and economy of effort, avoiding waste; a faculty for clear thought and clear expression; a remarkable capacity for hard, rapid and concentrated work, together with an appreciation of short cuts and effective methods.

Prof. Swain long since remarked that activity in the Society should precede rather than follow election to office. By his own standard, he qualifies well. Aside from papers and discussions in 1893, he translated from the German a paper for the Society on "Railway Signaling"; he was, back in 1887, a member of the Committee on Compressive Strength of Cements, was Chairman for some time of the Committee on Tests of Cements dating from 1897, and was also a member of the Committee on Columns appointed after the failure of the Quebec Bridge. Some of this committee work combined well with similar committee work of the Committees [illegible] of the Society for the Testing of Materials, and the Committee on Masonry of the American Railway Association. He has served as a Director of the American Society of Civil Engineers, and later as its Vice-President, and has been an influential member of its board of government. He made a most excellent presiding officer for the Boston Society of Civil Engineers, and for the Society for the Promotion of Engineering Education, and he is therefore, by experience and natural qualifications, unusually well qualified to assume the duties of President of the American Society of Civil Engineers.

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Timber for the Fenders of the Panama Canal [illegible] preservative before it is installed. In all 551,312 ft. b. m., in [illegible] it is proposed to treat the timber [illegible] At the time the decision was made to use creosote, it was not [illegible] that the cost of handling timber for this purpose [illegible] Timber can be treated [illegible]

W. F. M. Goss, President of the American Society of Mechanical Engineers

By G. M. Basford*

In electing Dr. W. F. M. Goss as its President, the American Society of Mechanical Engineers honors him, but also brings honor to itself because of his accomplishments in engineering.

Dr. Goss was born in Barnstable, Mass., in 1859. At the Massachusetts Institute of Technology, in 1877, he entered the then recently established mechanic arts course, and two years later began the development of a similar course in mechanic arts at Purdue University, Lafayette, Ind. He began with a class of five students. For ten years he was occupied in building up this course and in preparing for a larger development at Purdue. As Professor of Practical Mechanics he became an important factor in influencing the introduction of new methods in technical education throughout the middle West. This was pioneer work in a period when a Professor of Practical Mechanics could exert great influence over thought in the educational world. When he began there was no college west of the Allegheny Mountains giving systematic courses in shop practice. From this small beginning, Dr. Goss developed the reputation of Purdue as a school of engineering, to a point which gave the university and himself an international reputation. He approached the education of engineers as a modern problem, which to a large extent explains his great success.

The lesson of Goss and Purdue is an important one for engineering educators to learn. His achievement at Purdue with what seem to have been entirely inadequate resources is certainly a most remarkable one. What he lacked at first in facilities he more than made up by the definiteness of his methods. Then he acquired the desired facilities and used them effectively.

He has always had the confidence of many men in high positions in engineering, manufacturing and transportation fields. This confidence was based upon his personality, his ability and his sound judgment. Thus he established and maintained close contact with problems of engineers. His opinions and advice are sought in many phases of engineering development, particularly in railroad lines. It is given to few educators to stand as close to leading men in his field of endeavor as Dr. Goss does to the railroad men. They claim him as their own.

In building up his educational methods he used research work most effectively. While his efforts were well balanced, the most important results were obtained through investigations concerning the locomotive and other railroad problems. The confidence and high esteem in which he is held by railroad officials is indicated by the location at Purdue of the official experimental testing equipment of the Master Car Builders' Association.

Until the building at Purdue of the first stationary locomotive-testing plant, all data upon the performance of the locomotive had been taken in road service and were of very limited value, really of no scientific value. This was because in road service it is impossible to obtain uniform or stable conditions, and such conditions are essential in scientific research. By use of this testing

*Assistant to President American Locomotive Co., 30 Church St., New York City.

plant from which data could be taken from a locomotive as from a stationary-engine plant, with well trained assistants and his students, he brought out facts which were of great value and which began the development of scientific knowledge of the locomotive, resulting in changing the problem of locomotive design from one based upon judgment and experience, to one based upon scientific principles. The valuable work now being done on the Altoona testing plant of the Pennsylvania R.R., and that done by other progressive students of the locomotive would undoubtedly have been greatly delayed if Goss had not built his Purdue testing plant when he did.

From the Purdue plant came the first exact data concerning relation between combustion and grate areas of locomotives, concerning the capacity of the locomotive boiler at varying rates of combustion, the dynamic effect of counter-balance weights, the relative values of high- and low-steam pressures, the effectiveness and economy of superheated steam, and many other important subjects. The researches in high-steam pressures and superheated steam were conducted for the Carnegie Institution of Washington, and the results were published by the Institution.

The *Proceedings* of the American Society of Mechanical Engineers, of which Dr. Goss has been a member for many years; the records of the Master Mechanics' and Master Car Builders' Associations, and other railroad organizations, contain reports of his research work which in themselves constitute a great achievement. His best known books are those on "Locomotive Performance" and "Locomotive Sparks."

Dr. Goss does not end his research with the experiments themselves, but combines conscientious, thorough investigation with a remarkably clear-minded, judicial study of the results and conservative judgment as to their exact value and usefulness. He has a rare faculty of sorting out from a bewildering maze of figures those which lead to practical conclusions, and he always puts the results of his work in concise and perfectly definite form for engineers to use.

His observations of European engineering development, resulting from several extended trips abroad, are exceedingly important from an engineering standpoint, which renders them all the more valuable from an educational standpoint.

In 1888 he was given the degree of Master of Arts by Wabash College, and in 1904 he was honored with the degree of Doctor of Engineering by the University of Illinois. He was further honored by appointment on the National Advisory Board on Fuels and Structural Materials and was a member of the Jury of Awards in the Transportation Department of the World's Fair at Chicago.

In 1907 he was appointed Dean of the College of Engineering of the University of Illinois and made a member of the council of that university, charged with the administration of university affairs. For about twenty years he had been engaged in the development of advanced engineering work at Purdue, and he is now contributing to a further development in the same direction in a larger field. To him is intrusted the problem of bringing the College of Engineering up to its place in the high standard which has been set by the University of Illinois for its future development.

He undertakes this as in itself an engineering problem. He desires his professors to be the highest authorities in their various fields, believing that, if their opinion and advice are sought for by men of affairs, they will be the better teachers. He is making great progress in this direction. As a side light on his plans and the support he receives, he has doubled the salary account of the College of Engineering in five years. He is building up a strong teaching staff. He has plans on a large scale for activities of the engineering experiment station of the University and for the dissemination of engineering information.

His work has always been largely a personal one in that he has not been unduly bound by traditions or precedent, and he has been singularly free from fear of criticism. Few men have had as large a share in the progress of technical education as he has had, and few have made as strong an impress upon it. He is far sighted, enthusiastic and keenly alive to the demands which may reasonably be made upon the college and to its opportunities for service and advancement. Those characteristics which make him successful as an educator and administrator promise a successful, progressive administration as President of the American Society of Mechanical Engineers.

James Furman Kemp, President, American Institute of Mining Engineers

By Frank D. Adams*

There is probably no one who is more widely known among the mining fraternity of the North American continent than J. F. Kemp, and there is certainly no one who is more highly esteemed or whose name calls forth more widespread expressions of respect and admiration.

He was born at New York, in 1859. During his preliminary years at school, his purely academic studies were supplemented by much outdoor training, received during summers spent in hunting, fishing and in other woodland crafts, which has proved of much service to him in his subsequent career. He entered Amherst College and was there drawn to the study of geology by Prof. B. K. Emerson. The contagious enthusiasm of Prof. Emerson has exercised a most important and widespread influence on North American geology, for in addition to the many valuable contributions made to the science by Prof. Emerson himself, he has inspired an extraordinary number of young men with a love for this science who, leaving his class-room, have risen to prominence in every branch of geological studies and now occupy many of the most important positions in geology and in mining in the country.

On graduating from Amherst in 1881, Mr. Kemp, attracted by the great reputation of Dr. J. S. Newberry, of the Columbia School of Mines, who was at that time almost the only teacher of economic geology in the United States, entered Columbia as a student in the course of Mining Engineering and completed his course for the degree of Engineer of Mines in 1884. While following this course he gave special attention to the subject of practical geology and, during his summers, visited several of the great mining camps in the Lake Superior

*Dean of the Faculty of Applied Science, McGill University, Montreal, Can.

region and in Colorado. Upon graduation, he secured a position with the Rand Drill Co., but later returned to Columbia, where for a time he acted as assistant to Prof. Newberry. He subsequently went to the University of Munich for graduate study, but returned to America in 1886 to become instructor in geology at Cornell University. He was promoted to the position of assistant professor at that university in 1888. In 1891, however, Prof. Newberry's health had failed, and Prof. Kemp was called to Columbia as adjunct professor of geology. In the following year he was appointed to the full professorship in that science, and has been the head of the Department of Geology at Columbia University since that time. Under his able leadership and administration, Columbia has been one of the greatest centers of geological study in the United States, attracting a large number of students, not only from all parts of the United States itself, but from many foreign countries. The original staff of one professor with an assistant at the time of Prof. Kemp's appointment, has grown with the increase of the number of students and now consists of four professors, a curator and three assistants.

Throughout his career Dr. Kemp has paid especial attention to the application of geology to mining, and especially the relation of that science to ore deposits. His book on the ore deposits of the United States and Canada is used as a text in every mining school in North America. In pursuing his varied studies, Dr. Kemp has traveled very extensively and made special investigations in all the mining regions of the United States; he has also made three visits to Mexico and many to the Dominion of Canada, and has visited most of the more important mining districts of Europe. is work on the iron ores of the Adirondack Mountains may be especially mentioned, as well as the numerous and very important contributions which he has made to our knowledge of the development of ore deposits in contact zones and elsewhere, through the action of magmatic waters. His views upon the rôle played by magmatic waters in volcanic action have received a very brilliant and striking confirmation from the recent researches at Hawaii of Dr. A. L. Day, of the Carnegie Institute, the results of which have just been announced at the last meeting of the Geological Society of America at New Haven. His papers, published in various scientific journals and magazines, number over one hundred titles. Prof. Kemp received the degree of Doctor of Science, *honoris causa*, from Amherst on the occasion of the 25th anniversary of his graduation.

Dr. Kemp is a member of the National Academy of Sciences, of the Philosophical Society of Philadelphia, and has been President of the New York Academy of Sciences. He has been Vice-President of the Geological Society of America and has served the nine incorporators of the American Institute of Mining Engineers, of which he is now President. He is a corresponding member of the Academy of Sciences of Christiania, Norway; of the Geological Society of Stockholm, of the Canadian Mining Institute and of the Sociedad Antonio Alzate of Mexico.

In addition to the distinctions which Dr. Kemp has enjoyed as an investigator, he is noted as an excellent and inspiring teacher. His former students are to be found occupying important positions in every mining center in North America. In the course of an after-dinner speech some years ago, a well known mining engineer, in proposing Dr. Kemp's health, referred to this fact, remarking that although the West might be "wild and woolly," he had never seen a part of it which was "un-Kemp-t." All of these students without exception, look back to their association with him at Columbia as one of the most fortunate incidents in their lives.

Dr. Kemp's charm of personality and manner is known to all, and his confreres hope that he may long be spared to illuminate the problems of American mining geology by the wealth of his knowledge and experience.

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Ralph Davenport Mershon, President of the American Institute of Electrical Engineers

By G. A. Wardlaw*

In the early eighties, George Westinghouse, with characteristic foresight, discerned the great future of the alternating current. He, having pinned his faith to it, was always alert in finding the brightest minds to help develop his ideas. Under his direction, Stanley and Shallenberger were hard at work at Pittsburgh, perfecting the alternating-current system. About 1884 he acquired the Gaulard and Gibbs patents on series transformers, and then began to manufacture alternating-current machinery on a commercial scale.

Electrical engineering was becoming both fascinating and fashionable. The scientific schools were promptly abreast of the times, the practical training of embryo electrical engineers being carried on with such apparatus as the schools were able to get at that time. The electrical tree had taken deep root in a receptive and nourishing soil and was growing apace in trunk and branches. Coincident with the beginning of the manufacture of commercial alternating-current machinery in America was the founding of the American Institute of Electrical Engineers in 1884, with Norvin Green as its first president. The telephone, the electric railway, the central lighting station, the electric industrial motor and alternating-current power transmission were all pushing forward rapidly.

At that time, too, Tesla was independently working out his own ideas, spurred on, no doubt, by the stories from Pittsburgh of the ingenuity and industry of the small group of electrical engineers in the research laboratory of the enterprising Westinghouse company. It was a lively race between Tesla and Stanley and Shallenberger, both sides working along the same lines and both eager to be the first to startle the world with a commercially efficient alternating-current induction motor. Tesla won by a narrow margin, describing his polyphase induction motor, operating with a rotating magnetic field, before a meeting of the Institute on May 16, 1888. The announcement of the development of the Shallenberger alternating-current energy meter followed almost immediately. Shortly after that, the Westinghouse company acquired the rights of the Tesla patents, thereby completing the final link in the alternating-current chain.

While the early experimental work with alternating-

*Editor of the "Electrical Record," 114 Liberty St., New York City.

current machinery was being carried on in the Westinghouse laboratories, a number of youthful aspirants to engineering fame were being trained at several of the college scientific schools. A kindly fate had decreed that their paths should converge at Pittsburgh, whither 'tis pleasing to fancy they were lured by the enterprise of Westinghouse and the work of Stanley and Shallenberger. Thither came E. W. T. Gray from Dartmouth, Charlie Young from Princeton, Billy Blunt from Lehigh, Calvert Townley from Yale, Philip Barton from Cornell, Lewis B. Stillwell from Lehigh, Charles F. Scott from Johns Hopkins and Ralph D. Mershon from Ohio State.

All these young engineers were members of the Amber Club, now famous in song and story in that part of western Pennsylvania. They lived together in a rented house, one of them acting as steward, being graciously permitted in this way to test his ability as an engineer by trying to "do for one dollar what any blunderer could do for two." The professional work of this group of fast developing engineers was carried on in the Westinghouse shops under the inspiration of the talented Stanley and Shallenberger; possessing ability, capacity, endurance, enthusiasm, and youth, there was no holding them back. They discussed their work at night, compared notes, debated and argued. Consciously or unconsciously they influenced one another to an unusual degree. No man in that club, it is reported, was without opinion and conviction on the engineering, political and economic questions of the day.

Of this rather remarkable group of young engineers (all of whom have since occupied positions of unusual trust and responsibility, and one of whom, Charlie Young, like the gentle and heroic Shallenberger, gave all that he had to give, his life, in the interest of his profession), three were graciously gifted with more than ordinary imagination. These three had the sort of imagination that loses none of its creative qualities when alloyed with that other rare quality, common sense. As sensible, shrewd, creative engineers, they had no alternative but to climb to the top of their profession and to win, within the next twenty years, the highest honor that the profession in this country has in its power to bestow—the presidency of the American Institute.

Here, then, were three youthful engineers from different scientific schools, all at work in the same shops, all living in the same club at the same time, all creating alternating-current apparatus of increasing importance in the development of alternating-current power transmission throughout the world. All were destined to sail widely diverging courses in later years and then, not to have their ways converge again but, strangely enough, to become captains, and, in one decade, to guide the American electrical ship of state, the American Institute of Electrical Engineers, through the turbulent seas and buffeting winds that always beset such craft. The three clubmates whom the Institute has thus honored in the last ten years are: Charles F. Scott, inventor of the two-phase-three-phase transformer, president in 1902-03; Lewis B. Stillwell, inventor of the Stillwell regulator, president in 1909-10; and Ralph D. Mershon, inventor of the six-phase rotary converter and the compensating voltmeter, president in 1912-13.

It was in 1891 that Mershon went to the Westinghouse company after being graduated at the Ohio State University and serving there for one year as assistant instructor of electrical engineering, at that time he was 22 years of age. Like some of the young engineers at Pittsburgh, he acquired experience in all the important departments, including patent experimental work, commercial work and selling. To him was assigned the designing of the transformers for which the Westinghouse company received the gold medal at the World's Columbian Exposition in 1893. He also designed the transformers for the Pomona plant in California, the first commercial high-tension transmission system in the world. The then high potential of 10,000 volts was used.

Several years later, he was at Telluride, Colo., investigating, for the Telluride Power Transmission and the Westinghouse companies, the phenomena that occur between conductors at high voltages. This investigation was carried out on a transmission line about two and a half miles long. Original methods were devised by Mershon for doing this work, and special apparatus was designed and built by him by means of which quantitative measurements were made up to 72,000 volts. At the completion of the quantitative work, the pressure was carried up to 133,000 volts, at that time by far the highest voltage that had ever been impressed on an outdoor line. He made a masterly report on the results obtained and submitted it to the Westinghouse company, with which it has ever been a highly treasured document.

It was while doing this work that Mershon showed the sort of stuff he is made of. Those who worked with him in that bleak country say that ailing or well—and he was ailing most of the time—he stuck to his hard task. The climate did not treat him kindly; the snow was deep and treacherous; the food was rough and, to him, indigestible; the work was protracted and arduous. Day after day he struggled, half sick, through the deep snow, loaded down with heavy coils of wire and no less heavy instruments. And night after night he doggedly analyzed his data and formulated his conclusions. This detail is mentioned, not as a matter of sentimental heroics, but to give some idea of the man's grit. Pluck is one of his most pronounced characteristics, as the following story bears witness.

A man now holding an important executive position with a large corporation was a member of the Amber Club with Mershon. In talking about club matters only a few days ago, this man said:

> Some of the happiest days of my life were spent in that rickety old club house in East Liberty. Every member had pronounced characteristics. There wasn't a commonplace man in the lot, and I always thought the most interesting personality was bound up in Mershon, of Zanesville. To test his metal we older men used to try to "put things over on him," as the saying goes. When he said he didn't feel well we craftily tried to take advantage of his physical weakness and get him to change front on certain fundamental engineering and economic questions. No matter how sick he felt he never flinched. With back to the wall, he always fought us to a standstill. Then we let him alone, and shifted our attack to some other member with less of the hickory and more of the willow in his makeup. Frankly, there were some things about Mershon that I did not particularly care for. But admire him, I had to, in spite of myself. To put it figuratively, I didn't like the color he was dyed, but, by heck! color or no color, he was all wool and a yard wide. There was no make-believe about him; I have never met a man with a more rigid sense of duty.

Mershon secured leave of absence from the Westinghouse company in 1897-98, to act as chief engineer of the Colorado Electric Power Co. during the designing and installating of their electric-power system, which generates current by steam at Cañon City and transmits pow-

at 25,000 volts a distance of 25 miles to Cripple Creek, where it is used for mining. From 1898 to 1900 he was engineer of the New York office of the Westinghouse Electric & Manufacturing Co., but during the latter year he resigned to enter upon private practice as a consulting electrical and mechanical engineer in New York City, with a branch office in Montreal, Canada.

Some of the more important pieces of engineering work accomplished by him since entering practice as a consulting engineer are: the reconstruction and enlargement of the waterwheel, generating, transforming and transmitting equipment of the Montreal & St. Lawrence Light & Power Co. (now a part of the Montreal Light, Heat & Power Co.), transmitting 20,000 hp. at 25,000 volts to Montreal, a distance of 17 miles; the design and supervision of the first transmission plant of the Shawinigan Water & Power Co., transmitting power at 50,000 volts a distance of 85 miles to the same city; the design and installation of the substation equipments of the Montreal Street Ry. Co., having an aggregate capacity of about 12,000 hp., for utilizing power transmitted to Montreal from various hydraulic plants; the design and supervision of the transmission plant of the Niagara, Lockport & Ontario Power Co., for transmitting power at 60,000 volts from Niagara Falls to various points in New York State.

In 1905, and for several years thereafter, he was retained on the work of the Victoria Falls Power Co., in connection with the installation of their steam stations near Johannesburg, South Africa, for supplying power to the gold mines of the Witwatersrand, and in connection with the proposed transmission of power from Victoria Falls on the Zambesi River, Rhodesia, to the Rand, for operation in connection with these steam stations. He was the only American engineer so retained.

When Scott became president of the American Institute, in 1902, he did not forget the old days in Pittsburgh and the later ones in Colorado. He knew on whom to call for pushing through one of his most important projects to a successful and practically useful conclusion; Mershon was induced to undertake the hard job of chairman of the newly formed High-Tension Transmission Committee, the most important committee from an engineering standpoint in Scott's active and progressive administration. Now Scott made no mistake. Mershon planned a series of papers and discussions on high-tension transmission that the Institute has always been proud of. He went about it in his customary way, arranging all details, even to the editing of the papers and discussions. He was after something definite and he got it. These results, embodied in about 800 pages of the Institute *Transactions* were considered so valuable that a publisher of technical books arranged to republish them in book form, giving the Institute a small royalty on sales. The demand for this book has been so large that not only has the prestige of the Institute been much enhanced, but its treasury has been materially enriched by the royalties. No member ever served the Institute more faithfully or more unselfishly than did Mershon during the seven years that he was chairman of its High-Tension Transmission Committee.

There was a little opposition to the course of this committee from some who thought the time and money spent in a futile way. But the illustrious Scott stood staunch and one of them actually became the enthusiastic chairman of the high-tension committee of another society, where he copied Mershon's methods. But the members of the Institute at large did not need to be thus converted. They realized the nature of the work, its value, and the great accomplishments. They gave Mershon the best they had to give in return—the office of president during 1912-13.

He is a member of the American Societies of Mechanical and Civil Engineers, of the Canadian Society of Civil Engineers, the American Electrochemical Society, the Franklin Institute, the American Association for the Advancement of Science, and he is president of the Inventors' Guild.

Enough has been said here to show what sort of man the present head of the American Institute is. His most characteristic traits are perhaps his steadfastness under adverse conditions and his persistent individuality. He is versatile, but with all his versatility he is thorough—a rare combination. In him there is a touch of Ben Franklin, of whom it has been said he was an excellent printer, but he used his trade only as a means. The development of his mind and his manhood went on above it. Printing with him was not an end of life; if it had been, someone else would have built the kite that exchanged the first kiss with electricity. So with Mershon, if he had devoted his life solely to engineering, someone else would have had to labor to produce his many notable contributions to our knowledge. Better than any other man, it seems to the writer, Mershon squares with the definition which says: "An engineer is a compound of common sense and mathematics. If he has not enough mathematics, his lot in life will be hard; if he has not enough common sense, God pity him." Here is a man, now in his forty-fifth year, who is so well fortified with the fundamentals of mathematics that he has not tasted this particular form of hardship. If, according to the latter part of this definition, absence of common sense is a cause of pity, no pity need be wasted on him for, to those who really know him, he is the embodiment of native shrewdness and unusual common sense.

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Forestry in the Owens Valley on land acquired in connection with the Los Angeles Aqueduct and the new water-supply for Los Angeles has included the planting of 170,000 black locust trees up to July, 1912, and in addition the planting of 1½ tons of walnuts in nurseries. It has been found that the eastern black walnut and the California walnut, which grows in the north part of California, will both flourish in the Owens Valley. The report states:

> The lumber obtained from these trees is of value for ornamental finishing and furniture. The northern California walnut has the dark walnut color, but with a reddish rather than a brown tint. The black locust also grows very rapidly in Owens Valley and makes a high-grade hardwood, suitable for fence posts, railroad ties, wagon work, and many other uses where a hard, tough wood is desired. The moist bottom lands in the valley will support the growth of these trees, and it is believed that the city should develop extensive forestry interests on these areas.

The Highway Work in Louisiana, done by the Highway Department of the Board of State Engineers during 1912, aggregated 127.4 miles, of which 100.75 miles were built by contract and 26.63 miles by convict labor. The total cost was $199,931, of which $29,945 was for the convict camps, $101,099 by the parishes (for contract work) and $68,887 by the state (for contract work). The contract work included 88.75 miles of earth roads, 8 miles of shell roads and 4 miles of petrolithic roads, the average cost per mile being $1380, $2949 and $3911 respectively. The earth roads built by convicts averaged $1124 per mile. The road work done under this department from Jan. 1, 1908, to Jan. 1, 1913, has aggregated 299.3 miles, of which 125.2 miles were built by contract and 174.1 miles by convicts. The above figures are from a statement furnished to us by C. C. Sandoz, Secretary of the Louisiana State Highway Department.

Grouting a Bank Revetment with Molten Slag

The Wheeling & Lake Erie R.R. is doing some interesting work in the revetting of embankments along the Ohio River, and in grouting the revetment with molten slag (and cement grout in some places). For particulars of this work we are indebted to W. L. Robbock, Chief Engineer of the railway.



Fig. 1. Embankment Revetted with Molten Slag

The embankment where this revetment was built extended for a length of about 3500 ft. at both Brilliant and Rush Run, which points are some five miles distant from each other. The height of the embankment at both these places is about 30 ft. The original single track was on a more or less side-hill cut, and the construction of the second track necessitated the widening out of this embankment on the side next the river. This widening was started by dumping heavy mill refuse together with clay and ordinary slag. As this filling progressed it became necessary to protect the slopes with revetment. This was done by placing heavy mill slag along the face of the slope, building it up in the form of a wall at an inclination of about 1 on 1, a trench being dug at the foot of this wall to provide a toe hold.

The pressure from the hill on the opposite side of the track seemed to have a serious effect on this embankment, particularly in wet weather. This was especially noticeable in the alignment of the old track. This pressure caused the revetment work to bulge and get very much out of line, and in two bends in the river, the revetment work was pushed out at the bottom—due to the scouring of the river. In addition to these failures it was found that the slag lumps, although of about two-man size, were not sufficient to resist the force of the river current or of the ice floes in the winter.

To obviate further difficulties it was decided to use molten slag as a coating over this revetment work and also for the purpose of reinforcing it at the bottom. The slope was increased to 1½ on 1 and at points where the river was low and the bottom of the wall was exposed, an additional trench was dug, heaping the earth on the one side to stop the hot slag from going into the river. This method proved extremely satisfactory, as the slag could be handled in quantities varying between 500 and 600 cu.yd. per day, hauling it a distance of about two miles, and handling in the neighborhood of 60 ladles (the average contents of each ladle being about 9 cu.yd.). These ladles were tipped by steam power and could be poured slowly so as to regulate the flow of the slag, thus building up the wall on a uniform slope. (Fig. 1.)

At other places along this embankment, where both slag and stone revetment was used, a cement-gun was employed to grout the voids in the revetment, using a mixture of 5 parts clean, sharp sand and 1 part cement. This material was delivered at the rate of about 15 cu.yd. per day, which covered on an average of 1050 sq.ft. of revetment. This work has so far proved satisfactory, although somewhat more expensive than using the molten slag. The purpose for which both these methods were employed was principally to provide a comparatively smooth surface for the revetment, so as to offer less resistance to the water, and to bond the comparatively small units together in order to offer a greater resistance against the pressure of the hill side. Weep holes were provided at intervals of about 20 ft., both horizontally and vertically.

The economy in using the hot slag protection at the rate of 600 cu.yd. per day (24 hr.), at a total cost of $100, can hardly be questioned. The work done by the cement-gun cost on an average about $6 per cu.yd. of material placed.



Fig. 2. Embankment Revetted with Slag Blocks and Partly Grouted with Molten Slag



Fig. 3. Embankment Revetted with Stone and Partly Grouted with Cement

Air Measurement by Pitot Tubes*

SYNOPSIS—For a long time, the measurement of air currents, by means of the pitot tube, has been handicapped by great uncertainty as to the proper shape of the tube and the correct size and placing of orifices. In this article are given the shape and dimensions of a pitot tube, which has been found to be accurate over a wide range of values, together with the methods of calibrating orifices and of checking the accuracy of readings. Mention is also made of an inclined gasoline manometer, which was found to give accurate readings at low pressures, and a number of practical points are noted in connection with the use of the pitot tube in the testing of centrifugal blower fans.

The importance of mechanical draft from an engineering standpoint and its range of application in industry, have been growing steadily for the past twenty years. During this time many tests have been made to determine the laws governing the flow of air in pipes and much has been accomplished in the direction of improving the design of centrifugal blowers and of piping systems for handling air currents.

As a result of these investigations it has been established that Bernoulli's Theorem for the flow of liquids holds, with certain modifications, for the flow of air, and also it has been proved that the volume of air delivered from a fan varies directly as the velocity of the fan, that the difference in total head or pressure, between the intake and the outlet sides of the fan, varies as the square of the fan velocity, and finally that the power consumption of a fan varies directly as the cube of the fan speed.

However, in spite of the fact that these general laws have been established, there is still very great need for further experimental work, particularly in connection with a study of the causes and effects of eddy currents and of means for eliminating these power-wasting phenomena. An absolute necessity for carrying on tests of this kind is some reliable pressure-measuring device which, beside giving accurate readings, is conveniently portable and can be used for taking observations at different points in the air current. The following abstract of Mr. Treat's paper describes a form of pitot tube which he has found convenient and accurate for pressure measurements in fan-testing work, and shows also a number of the difficulties encountered in this work and his methods for overcoming them.

* Abstract of a paper by C. H. Treat, presented before the American Society of Mechanical Engineers at the annual convention in New York City, December, 1912.

Apparatus Used in Testing Fans

For the many occasions where measurements are required of the volume of air from a fan, or of the pressure and volume, better and more accurate methods are often desired, than have been commonly used. The engineer frequently needs something better than the ordinary anemometer to determine the velocity head, and a rubber tube connected to a water gage to get the static head. This is especially the case in fan-testing work where the volume varies from nothing with closed gate to a maximum with free discharge, for the measuring apparatus must be accurate through this wide range. Although the pitot tube has long been known and used there is still much doubt of its accuracy and distrust of its results obtained by it, and this is due in some cases to a lack of information as to what forms of pitot tube can *not* be used.

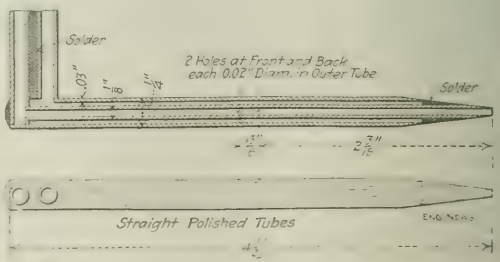


Fig. 1. Standard Pitot Tube for Air-measurement Work

In Fig. 1 is shown the standard form of pitot tube which was adopted for these tests and which has been successfully employed on similar work for a number of years. Used in connection with suitable pressure-measuring gages, this device has proved particularly well adapted for measuring both pressure and volume. It has been found to be simple, reliable, and accurate, and to be easily arranged for fan-testing.

In this tube, the static orifices, which in older pitot tube work have been the main source of errors, were clean holes 0.02 in. in diameter, in ¼-in. tubing, ½ in. thick, and they gave static readings accurate to within

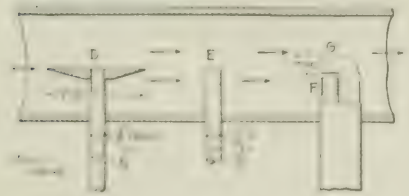


Fig. 2. Other Forms of Static Orifice

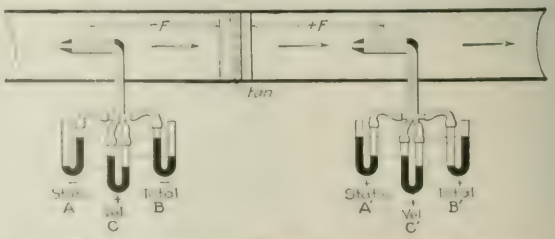


Fig. 3. Arrangement of Manometers for Reading Impact Velocity and Static Pressures

less than 1% of the corresponding velocity head. A hole $\frac{1}{8}$ in. in diameter in this tubing gave readings considerably off, while a 2½-in. slot, $\frac{1}{8}$ in. wide, in slightly larger tubing gave static readings as much as 14% too high. A $\frac{5}{8}$-in. slot 0.01 in. wide in the $1\frac{1}{4}$-in. tube seemed to give good results, with or without an inner tube, as did the large slots if an inner tube fitting the outer to within 0.01 in. on each side. Wire cloth over the large slots appeared to give good results. However,

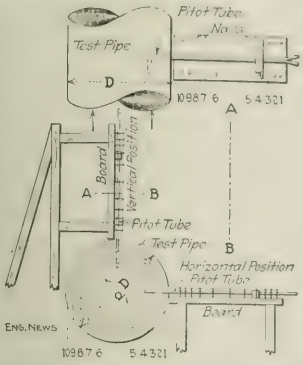


FIG. 4. ARRANGEMENT OF PITOT TUBE FOR MEASURING PRESSURES IN VARIOUS PARTS OF A PIPE

these other forms of orifice were not checked and rechecked to the same extent as the 0.02-in. holes.

Some of the older forms of static orifice are shown in Fig. 2. That marked *D* was fairly accurate, but required to be set with the plate exactly parallel to the direction of flow and this was often impossible to determine, because of eddy currents or of a whirling motion of the air current. The 0.02-in. static openings above described gave accurate results when 5° out of parallel with the direction of flow. The orifice marked *E*, a tube $\frac{5}{16}$ in. in diameter, held perpendicular to the line of flow, gave static readings too small by over 50% of the corresponding velocity reading, while that marked *F* gave readings too small by 65% of the true velocity reading.

The apparatus shown in Fig. 4 was devised for the purpose of obtaining readings of the velocity head in different parts of the pipe, so that some idea could be obtained as to the velocities in different parts of the pipe, and thereby as to the effect of friction in retarding the flow of the air.

When the air is discharged into a pipe by a fan both static and velocity heads measured from atmospheric are positive and their sum is indicated in Fig. 3 by the reading in impact manometer *B'*. When air is drawn from a pipe by a fan the static head is negative with respect to atmospheric pressure, while the velocity head is positive. The sum of the two is indicated in Fig. 3 by the reading in impact manometer *B*. The manometer arrangement used in this investigation for tests on suction is shown in Fig. 5 and that for tests on discharge is shown in Fig. 6.

The tests were made in the fan-testing room of the American Blower Company, at Detroit, Mich., using a small turbine fan for supplying the forced draft. Fig. 7 shows a view of this room and of the apparatus used in the investigation. Pipes of different diameters were used to check the accuracy of the pitot tube readings and a gasometer for measuring the volume of air displaced provided an additional check. A third check was secured by measuring the same air currents simultaneously and at the same location with two or three pitot tubes.

CALIBRATION OF PITOT TUBE ORIFICES

In deciding how to prove experimentally the correctness of the pitot tube orifices preference was given to the

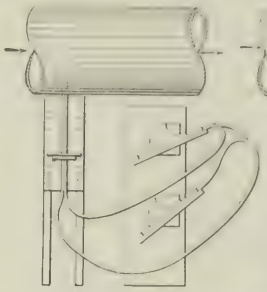


FIG. 5. CONNECTIONS OF MANOMETERS FOR MEASURING SUCTION PRESSURES

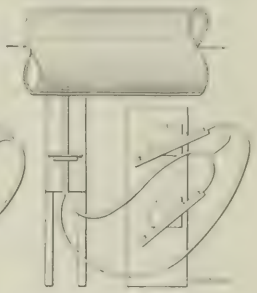


FIG. 6. CONNECTIONS OF MANOMETERS FOR MEASURING DISCHARGE PRESSURES

method which seemed most simple and accurate and which promised to be the best check on work already done. The accuracy of the impact orifice cannot be proved by means of a jet of air because the only practical means for determining the velocity at any point in the jet is by the use of the pitot tube. It would scarcely do to test the tube by means of a carrier such as a locomotive

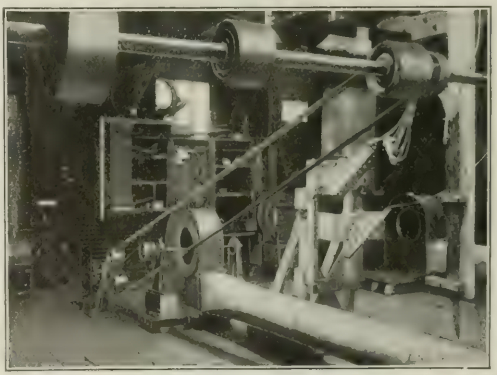


FIG. 7. VIEW OF THE FAN-TESTING ROOM AND APPARATUS

because of changing air currents. But by attaching the impact tip to the end of a slender hollow arm rotating about a shaft, uniform motion may be obtained in air having motion due only to the passage of the slender arm through it. This motion was found by tests to cause a reduction of from 2 to 5% in the readings of impact

head and to eliminate this error the device was placed on the fan shaft near the intake side and the fan allowed to discharge enough to draw the air, which was disturbed by one passage of the slender arm, away in time so that the next passage of the arm through the same part of its path was made through air undisturbed by the first passage. That is, the fan caused the air to have a motion at right angles to the direction of travel of the arm and tip instead of with it. The proper rate of flow for the best results was determined by blowing smoke into the fan intake.

The device used for calibrating the pitot tube orifices is shown in Fig. 8. The process as explained above consisted in rotating the various tips at the end of a slender arm and in noting the speed of rotation and the pressures at the axis. The arm was of brass tubing $\frac{3}{16}$ in. and $\frac{3}{8}$ in. in diameter, sweated together. Stay wires

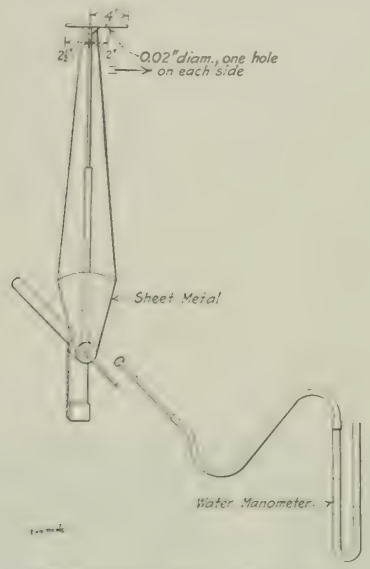


FIG. 8. APPARATUS FOR CALIBRATING PITOT-TUBE ORIFICES

[illegible] and, as shown, to give it rigidity, and the tubing was fastened to the fan shaft by a setscrew in the collar to which the tube was attached. The different tips to be tested were soldered to the outer end of this tube and to the cross brass. A small air-tight connection was effected at the axis by a [illegible] brass tube projecting from the radial arm and along the axis. Around this small tube there was a ring of [illegible] candle wick, against which the cone end of a larger tube was pressed, care being taken to press only hard enough to make the joint air-tight. The arm was counter-weighted as shown.

The fan shaft was driven by an automatic engine [illegible] other loads on the circuit was steady and uniform. Pressures were read on a vertical water manometer of large cross-section, using [illegible] in. inside diameter for most of the work and for those with a small head an inclined reading manometer was employed. Temperature and humidity readings were taken in the room close to the calibrating apparatus. The ¼-in. tips, used in all tests except the last four, projected forward from the arm about 4 in. and backward about 2½ in. The static orifices in the sides were located about 2 in. forward of the arm. This rotating-arm method was the one used for calibrating not only the impact orifice but the static orifice as well.

An effect which tends to vitiate the accuracy of the calibration tests unless a correction is made to offset it, is the centrifugal force acting on the air confined in the tube. This tends to suck air in at the axis and to force it outward against the impact or static pressure at the tip orifices. For an inelastic fluid the computation of this centrifugal force is fairly simple but air, being elastic, that portion nearer to the shaft presses, due to this centrifugal force, on the air further out in the tube, compressing it slightly. Therefore, the outer portion of the air in the tube is slightly more dense than the inner and this varying density makes it necessary to employ calculus to determine the difference in pressure at the two ends of the calibrating tube, due to centrifugal force.

In the calibration work the first tests were made on the impact orifices with the fan drawing away the disturbed air. Of these the ones with gate open full were affected only very slightly, if at all, by the air motion due to the rotating arm, this point being determined as above stated by testing with smoke. The air travel toward the inlet was probably never anywhere more than 300 ft. per min. With the discharge restricted there was, however, some motion of the air with the arm so the tests with full discharge deserved more consideration than those with partial discharge.

Another minor source of trouble was the tendency of the stuffing box to heat the air in the tubes slightly. This was largely overcome by the free use of soft grease on the wicking, also by reducing the pressure of the outer cone end tube, shown in Fig. 8, as much as possible consistent with maintaining the joint air-tight. Between tests fresh cool air was allowed to replace the warmed air in the tube but the results may have been affected very slightly by the air in the tube being a little warmer than that in the room. An increase of 10 degrees in the temperature in one test, without change of moisture content of the air in the arm, changed the computed centrifugal head from 4.905 in. at room temperature to 4.825 in.

Later tests were made on the impact orifice, without the fan to draw the disturbed air away. These served to show the comparison between a flat impact tip $\frac{1}{16}$ in. diameter, with a hole in the center $\frac{1}{16}$ in. in diameter, and the standard orifice, also between a ¼-in. open brass tube, with its end filed square, and the standard orifice. Some readings were taken with the back end of the tip open, using four forms of opening. One test was made to determine about what air motion the arm set up for these runs, because nearly everyone interested in pitot-tube work sooner or later wants to know what value this suction has. It evidently depends for one thing on the shape of the orifice.

In calibrating the impact orifice we have only the pressure due to impact to deal with, as the atmospheric pressure in the room is on both the tip and the pressure-

measuring instrument. The device above described and shown in Fig. 8 for calibrating orifices provides a simple means for comparing the pressure computed from the relative velocity of tip to air by the relation $V = \sqrt{2gh}$, with the pressure actually resulting from this velocity. The calibration tests show the impact or total reading to be accurate probably to within 1% in the above relation.

For computation of the centrifugal head for the static tests the pressure at the axis is below atmospheric, if the pressure at the tip is atmospheric, and the mean density in the arm is slightly less than for the impact runs, since for them the pressure at the axis is nearly atmospheric. The first tests on the static orifices were with a form of orifice, believed to be particularly accurate. The orifices were simply holes 0.02 in. in diameter, drilled through the tubing, which was about 0.03 in. thick. These holes were clean and had their outer edges square and it was found that they were small enough so that the static-head readings were independent of the inner tube in every way.

Tests were then made with a slotted static orifice. The outer tube was about 0.4 in. in diameter, its inside diameter being about 0.28 in. With no inner tube the results were poor even with this thick tube. With an inner tube central and fitting the outer to within about 0.015 in., the result was fairly good, but when the inner tube was made 0.02 in. smaller in diameter, the result was poor again. It is very interesting to know that when fine-mesh wire cloth was wrapped around the tube outside the slots, the results were good and agree with those from the small drilled holes. By comparison with the standard static orifice in air flowing in a pipe, the results were found to be considerably worse with a thin outer tube than with a thick one using the same inner tube. It was found in this way that an instrument with 2¼-in. slots, $\frac{1}{16}$ in. wide in ⅜-in. tubing $\frac{1}{32}$ in thick and with a $\frac{7}{32}$-in. inner tube gave static-pressure readings 14% of the velocity pressure too high and that holes $\frac{1}{16}$ in. in diameter in the ¼-in. regular tip $\frac{1}{32}$ in. thick also gave poor results.

Theoretical and Practical Considerations in Fan Testing

The calibration tests on different forms of impact and of static orifices developed the fact that, in using the pitot tube in air-pressure measurement, there is no difficulty in getting correct readings of impact or total head. Considerable latitude was found to be allowable in choosing the form of impact orifice without affecting the accuracy of results. The form of impact orifice most carefully checked, however, was that shown in Fig. 1. The most frequent source of error was shown in the same way to be due to incorrect readings of static pressure. It was found that the static orifice had to conform closely to certain fixed dimensions if at all accurate readings were to be obtained.

The pitot-tube arrangements shown in Fig. 5 and 6 were those used in fan testing. In Fig. 4 is shown the manometer arrangements necessary to give readings of the three heads, impact or total, velocity and static. By using the pitot tube shown in Fig. 1 where impact and static pressures are measured at practically the same point, the connections shown in Fig. 4 give accurate readings of velocity head in manometers C and C' because the pressures other than that due to velocity cancel each other. The possibility of the pressure changing between the times of reading static and impact pressures independently is avoided and there is no subtraction to be made. The difference in static pressure between the point of reading in the pipe and atmospheric pressure in the room is read in manometer tubes A and A' and the corresponding difference in impact or total pressures is read in tubes B and B'. To read correctly either impact, velocity or static pressures the pitot-tube tip should point as nearly as possible straight into the air current.

The common pressure-measuring apparatus is satisfactory for pressures above 1 in. water gage and, for pressures from 1 in. to 2 or 3 ft. of water, manometers are reliable and convenient. Various forms of apparatus are used for measuring pressures of 1 in. or less and probably as simple and reliable a means as any is furnished by an inclined manometer containing gasoline instead of water. The tubes for this manometer should be of the same size, perfectly straight and parallel inside. When so made they can be easily used when inclined as much as 20 in. slant for 1 in. vertical reading with very accurate results. Water, however, is not a satisfactory fluid in a manometer inclined more than three to one and gasoline is recommended instead, as it is not only very active but comes accurately to the same form of surface.

The back plate is set by leveling by the bubbles in the manometer tubes and then the tubes are swung up to the angle required to give a good reading, 20, 10 or 5 to 1. In fan testing for velocity reading at different restrictions two or three slants may be used to cover the wide range in pressure and it is very convenient to cover this wide range with the one gage by the simple device of changing the angle. Good care is necessary to get the angle correct for 20 to 1 and great care for 40 to 1. At 40 to 1 slant for ½ in. velocity reading the velocity is 384 ft., for 0.49-in. reading the velocity is 380 ft., showing that with the slant gage, velocities as low as 500 or even 400 ft. per min. may be measured satisfactorily. With skill and care the hook gage gives good results if the pressures do not fluctuate. In air-measuring work the pressures usually fluctuate slightly even when care is taken to get the fan speed as constant as possible. It is desirable to be able to take the readings under these conditions, and this may be done by setting the zero-point of the measuring slide at the mean lower level, and at the instant the level comes opposite this point, reading at the upper level.

The spacing board for the pitot tube should be placed so that the tube crosses the test pipe centrally. Inclining manometers are shown for pressure measuring, but other instruments for this purpose may be used if preferred. After connecting try out the lines of tubing by noting if the liquid lowers in the manometers after pressure has been applied and make sure that the connections are not clogged. Use care to prevent liquid from being drawn from the gages into the tubing.

For a fan test the area of the test pipe should be made the same as the area of the outlet or inlet connections. Well fitted soldered pipe should be used for the test as an ordinary test pipe, unsoldered and carelessly fitted to the fan, may leak 5% or more of the air handled at ½ gate, or even at ⅝ gate, lowering the pressure correspondingly.

It is very essential to determine the relation between the volume, the pressures and the power required as the resistance changes. For this purpose it is usual to gate down the outlet for an outlet test or the inlet for the inlet test, using round orifices in thin flat plate. No air should escape except through the orifices. It is usually ample to test with gates 0, ¼, ⅜, ½, ⅝, ¾ and once the area of the orifice. Occasionally a ⅛ gate is useful. For some tests the ⅜ and ⅞ gates may be omitted. The area of the gate divided by the area of the test pipe is the ratio of opening or the equivalent orifice.

The coefficient of efflux is larger for a conical outlet than for an orifice of the same area and is probably greater for a large gate than for a small one on the same test pipe. However, a gate, say ¾, is very nearly a fixed measure of resistance. Even if it were not there would be no inaccuracy due to this cause as the final curves are ordinarily used, for the required ratio of opening is found from the required ratio of pressures. The ratio of gate area to full area is often very useful, so that it is wise to use ratio of opening for abscissa in final curves.

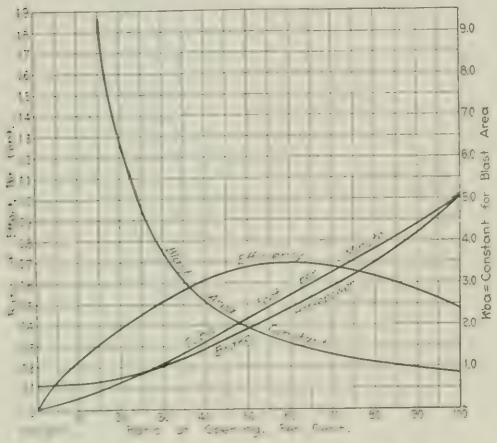


Fig. 9. Characteristic Curves of a Fan Test

In making fan tests the speed may not be constant at all times. To correct to a common speed we have relations between speed and pressure and power that have been fully verified by test. These relations (under the same conditions of resistance to air flow, density of air, and only the speed [illegible]) are as follows: (1) The volume of air discharged by the fan varies directly as the r.p.m.; (2) the pressures produced vary directly as the square of the r.p.m.; and (3) the horsepower required to drive it varies directly as the cube of the fan r.p.m.

In working up a fan test, a correction for friction in the test pipe must be made to show what the fan alone is really doing. The friction pressure or pressure to overcome this friction may be 10 or 15% of the total at wide open gate and 3 to 4% at ½ gate. For ordinary round galvanized pipe a simple and quick way to find this friction is from the formula

$$F = \frac{\text{velocity}^2}{10{,}000} \times \frac{L}{D}$$

Where F = friction in inches of water, L = length, and D = diameter of round pipe. It is easier to remember that the length of the pipe in which friction pressure equals velocity pressure is 40 diameters. This rule is applicable to air under ordinary conditions of temperature, pressure and humidity and values by it check closely with those given by Kent. For smooth, straight pipe, instead of 40 diameters it may be 60 or more, and for rough bended pipe the figure will be less than 40. It is interesting to note that 0.0067, the coefficient of air friction in ordinary piping is given as the coefficient of skin friction for water of rather rough surface.

It is important to have a standard weight of air at which fan performances may be compared. The density, while ordinarily a small factor, affects the results considerably, if extremes are great, as with heated air or with cold out-door air. It affects the velocity pressure, the total pressure and the horsepower. As correction to a standard involves some labor it is desirable to choose for a standard a mean weight so that the original data will be close enough without correction in many cases, or so that the conditions may be kept such as will give standard weight. Another reason for using the mean or ordinary weight is that such data as taken may be compared with previous tests, also that ordinary rough uncorrected tests may be compared with standard tests.

As fan tests are apt to be conducted indoors with warmed air the weight on the average for the year in the United States will not be far from 0.0715 lb. per cu.ft. This in fact is the average weight for a large number of tests extending over a number of years. To correct to standard air, multiply the velocity pressure, total pressure and the horsepower of the actual test by $\frac{0.0715}{wt.\ 1\ cu.ft.}$. The velocity will be the same as though found at the actual velocity pressure, but the static and total pressure change as the density, changing the air horsepower and the actual horsepower in proportion.

A fan discharging under constant conditions as to speed and resistance, will maintain a constant head and a constant velocity of discharge with changing density. In a pipe system supplied by a fan running at a constant speed, all the resistance may be classed as friction of various kinds. The impeller sets up heads, due to centrifugal force and to motion imparted to the air, which total head is resisted by internal and pipe frictions. Density of the fluid does not affect these heads, and the net head for one density will be the head for all. The velocity will be the same for all from the law of falling bodies. From this it follows that the volume discharged from a fan is the same at all densities, other conditions being the same. This is probably true of all fluids, since the coefficient of friction seems to be the same.

A thoroughly good way of making the results of a fan test available and useful is to plot characteristic curves as in Fig. 9. The original readings are first corrected to one common speed, if the speed has varied through the test, as it is likely to do from belt slip. These data at a common speed are then plotted on a preliminary curve sheet similar to the curve sheet in Fig. 10, but with the ratio of opening instead of r.p.m. plotted as abscissa. On this sheet correction can be made to standard weight

air and for pipe friction. This preliminary set of curves will usually show up a mistake in observation or in computation. From this curve sheet practically any fan problem may be solved for fans of that kind. Of course the other fans of the same line must be kept in proportion to the one tested to get the proper result.

Bernouilli's theorem states that the sum of all the pressures of a fluid at one section of a system of smooth piping equals the sum of all the pressures at any other section, pipe friction being cared for by the difference in friction pressures. If a fluid motor be introduced between the two sections where pressures are taken it will create a difference in pressure. This difference in pressure times the fluid passing through the motor times the constants for heaviness of fluid, area, etc., gives the horsepower produced by the motor, or given to it if power is being taken from the fluid. But for the pressure caused by the motor, the sums of pressure of the two sections would be equal.

It is quite usual in buying and selling fans to understand that a certain effect on discharge shall be produced, that is, a certain volume and pressure in the discharge pipe. When the work for which the fan is sold is to be done on the discharge side the inevitable friction loss in drawing air through the inlet is not to be included. It is not wanted although, as in the case of some single-inlet fans, it may be a very appreciable factor. Large inlets reduce it.

A cone on the outlet will not increase the efficiency of a fan but will decrease the power required, that is, the same volume of air will be moved through the same resistance by less power, the speed being a little slower.

The velocity is least at the surface of the pipe because of skin friction. In a square pipe the mean of the velocities and of the pressures taken at the center of a large number of equal squares into which the pipe is divided, is the average velocity and pressure in the pipe. In the case of a round pipe, divide into equal annular areas, and for each read at a point where the area inside equals the area outside. Since the velocity changes as the square root of the velocity water-gage reading, the velocities should be computed for each unit area and these values averaged. The error is small, however, if the velocity be computed from the average of the velocity pressures, being usually less than 1% from this cause.

There are usually irregularities of flow in air entering a pipe and if it is the discharge from a fan the irregularities may be considerable; in an inlet pipe there will be less, and in a cone inlet there will be considerable less irregularity of flow. The irregularity becomes less away from the pipe inlet and in 8 to 12 diameters in the case of fan discharge and in straight pipe good pitot tube readings may be taken. For accurate measurement it is recommended that both vertical and horizontal readings across the pipe be taken rather than either alone, especially if there has been a bend in the pipe or if the pipe is the discharge from a fan.

In so far as Mr. Treat's paper furnishes information as to a simple and successful pressure-measuring device for use on air currents, it is worthy of attention from all engineers in any way interested in such work. There are at present far too many indeterminate factors in the design of both fans and piping systems and the only way to attack these problems in a thorough and scientific manner is with some such testing device as is above described, which is both convenient and accurate.

The desired object, in most cases where forced draft is used, is to move a certain volume of air from one place to another at as small expense as possible. This may be done by producing an air current of large cross-section, moving at low velocity, or by producing a high velocity in an air current of small cross-section. The former method requires the use of larger fans and larger piping, each of which entails more expense and takes up more valuable space than would high velocity apparatus, and for these reasons the latter method is in most cases preferable.

The following points in air work are too little understood and should be the subjects of extensive investigation in order that they may assume the important place to which they are entitled, in the design of forced-draft systems, (1) the effects of slant and curve of fan blades at different speeds, (2) the effect of the form of case, on fan efficiency, (3) the conditions affecting pipe friction, (4) the effects of difference of temperature between the air inside and that surrounding the pipe, and (5) the

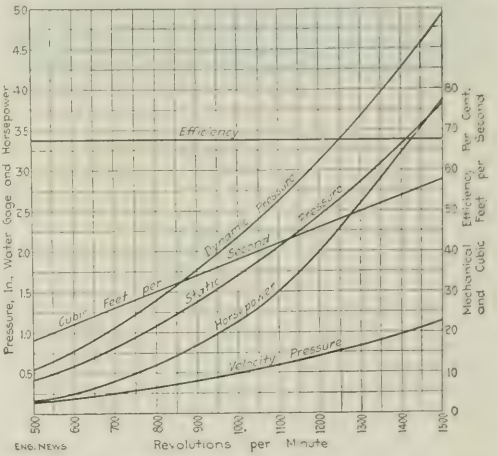


Fig. 10. Preliminary Curves of a Fan Test

effect of the temperature and velocity of the air current in determining the proper placing of outlets, bends or branches.

All of these points are largely affected by the velocity of the air current and it is to be hoped that the development of a good pressure-measuring device will stimulate the increased study of these problems, which their importance warrants, and which is essential to the further improvement of forced-draft apparatus.



A Summer School of Town Planning under the auspices of the University of London was held in August, 1912, and will be held again from Aug. 2 to 16, 1913, at the Hampstead Garden Suburb, England. Lectures will be given and an opportunity will be afforded to study a town-planning project in the vicinity—a 400-acre extension scheme to the Hampstead Garden Suburb has recently been brought before the Local Government under the Town Planning Act of 1909. The summer school is designed for municipal engineers and architects. Its secretary is J. S. Rathbone, the Institute, Hampstead Garden Suburb, London, N. W., England.

A Temporary Drawbridge of the Horizontal Rolling Type

In the renewal of drawbridges on city streets it is usually necessary to provide temporary accommodation for street traffic, and an unusual way of effecting this at the Oneida St. crossing of the Milwaukee River, in Milwaukee, Wis., is described below.

In May, 1911, the Common Council authorized the sale of bonds for the construction of a bascule bridge at Oneida St., as the existing swing bridge was too narrow to accommodate the increasing traffic at this point. As this crossing of the river is within the business district, it was considered necessary to provide some accommodation for traffic during the construction of the new bridge. This was accomplished by the installation of a temporary bridge for pedestrians only, vehicles being directed to other bridges a short distance on either side.

The clear width of channel of the permanent bridge is 80 ft. The temporary open channel was 60 ft. wide, and this was crossed by a riveted through-truss span 91 ft. long, having one end counterbalanced and mounted on wheels running on a track laid upon a pile trestle. For information and drawings of this interesting rolling drawbridge we are indebted to J. C. Pinney, Jr., Superintendent of Bridges and Public Buildings, Milwaukee, Wis. The bridge was designed and constructed under the supervision of his predecessor, L. J. Krug.

The general design is shown in Fig. 1, in which the bridge is rolled back in position to open the channel. The arrangement of the structure and its approaches, and their relation to the permanent bridge, are shown in Fig. 2. The bridge was located north of the permanent site, and beyond the street line, being approached by a short lateral walk at each end. The pile trestle (at the west end) panel of the truss had the diagonal member omitted.



Fig. 1. Temporary Rolling Drawbridge (for Foot Passengers) over the Milwaukee River, Milwaukee, Wis.

(Used during the construction of the Oneida St. bascule bridge)

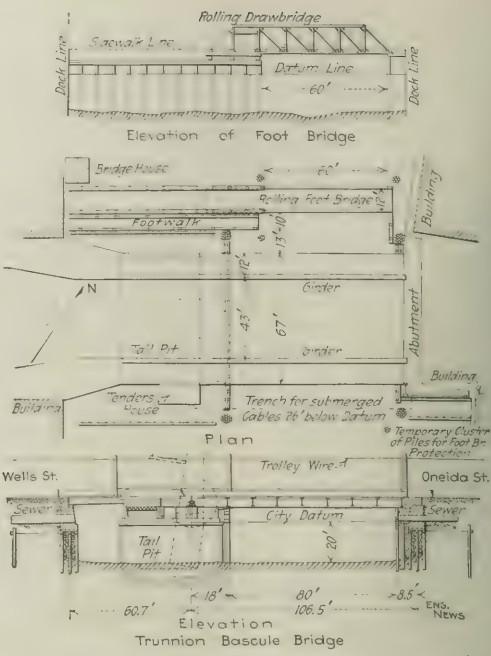


Fig. 2. Plan and Elevation, Showing Temporary Rolling Bridge and Permanent Bascule Bridge at the Oneida St. Crossing of the Milwaukee River, Milwaukee, Wis.

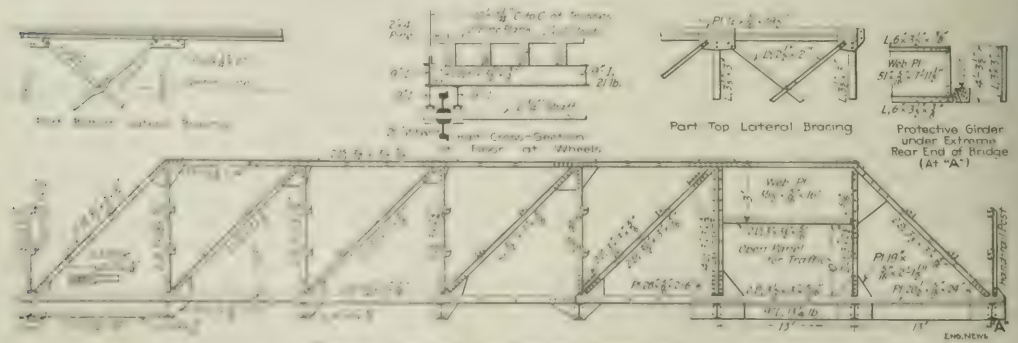


Fig. 3. Details of Rolling Truss Span

and at the other side an 8-ft. walk level with the floor of the bridge (Fig. 4). When the bridge was opened for navigation, access to the walks was prevented by gates. When the bridge was open for passengers, they walked through one of the panels of the truss in passing from the walk to the bridge. To permit this, the rear (west end) panel of the truss has the diagonal member omitted, the stress being provided for by a 36-in. web plate in the top chord, as shown in Fig. 3. At the east end, passengers stepped on and off the bridge in the usual way, as will be seen from the plan.

The bridge was designed for an assumed live load of 100 lb. per sq.ft. The trusses of the rolling span had seven panels of 13 ft., the length over all being 92 ft. 3 in.; width, 10 ft. 7¼ in. c. to c. of trusses, and depth 13 ft. c. to c. of chords. The trusses were built entirely of angles and plates, as shown in Fig. 3, and the connections are made by gusset plates of large size. The reason for the open panel at the rear of the truss has been noted above.

The floor beams were 9-in. I-beams carrying joists 2x10-in. with a deck of 2-in. pine plank and 2x4-in. foot-

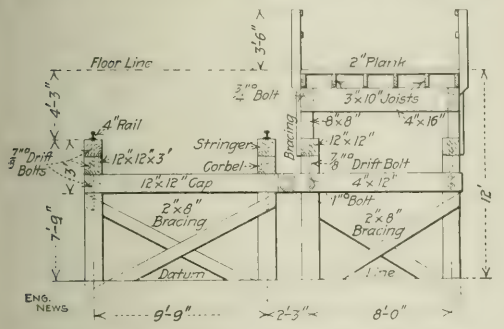


FIG. 4. SUBSTRUCTURE AND TRACK FOR ROLLING DRAWBRIDGE

guards. On each side were two hand rails of angles 2½x2 in., attached to lugs. At the forward or free end of the bridge, the two floor beams of the first panel were connected by bottom angles, serving to stiffen the bottom chords in this panel. At the heel or rolling end of the bridge are 9-in. channels, placed directly under the bottom chord angles of the two end panels. Beneath these and the floor beams were two pair of 9-in. longitudinal I-beams or sill beams, to which were attached the axle boxes of the six 20-in. cast-steel flanged wheels. This construction is shown in Fig. 3. At the extreme rear end of the bridge, beneath the floor, was a transverse protective girder acting as a stop. All field connections were bolted, to facilitate both erection and removal. The members were all marked, and when the bridge was taken down the parts were all stored, so that it will be available for use at some other time if necessary.

The trestle had four-pile bents, the inner piles 2 ft. 3 in. between centers and the outer ones 9 ft. 9 in. distant for the track side and 8 ft. for the fixed walk side. The track piles had caps 12x12 in., with corbels 3 ft. long supporting the stringers, on which were laid the rails. The sidewalk piles had stringers laid directly upon them, with 8x8-in. posts to which were bolted cross timbers supporting the floor joists. This construction is shown in Fig. 4.

The rear end of the bridge was carried by six 20-in. flanged cast-steel wheels with 4-in. cylindrical tread, running on a track 9 ft. 9 in. c. to c. of rails. As shown in Fig. 5, one of the axles was driven by gearing from a 25-hp. 500-volt series-wound direct-current motor, this being the motor which operated the old swing bridge. The motor speed was about 1200 r.p.m., which was reduced by the gearing to about 214 r.p.m. on the axle, giving a speed of travel of about 112 ft. per min. It actually required from 15 to 60 sec. to open or close the span. The weight of the truss span was about 24,000 lb., and about 30,000 lb. of counterweight was required, but considerably more than this was used.

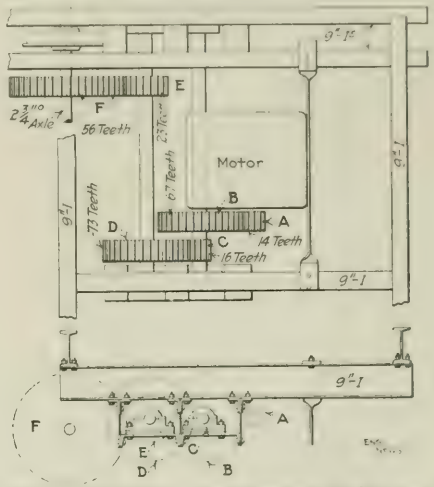


FIG. 5. MACHINERY ARRANGEMENT OF ROLLING DRAWBRIDGE

The bridge was built by the city's department forces, and the total cost of the work was as follows:

CONSTRUCTION

(A: Contract Work)	
Steel trusses and bracing	$580 00
Piling	691 20
Lumber	332 12
Machinery and structural steel	358 53
Paint	24 00
Total contract work	$1985 85
(B. Day Labor:)	
Carpenters	839 00
Ironworkers	293 22
Painters	47 40
Total day labor work	1179 72
Total cost of construction	3165 57

REMOVAL

Carpenters	58 00
Ironworkers	55 12
Laborers	65 25
Time of tug for towing to yard	10 00
Total cost of removal	188 37
Total cost of bridge erected, removed and stored in yard	$3353 81

Rolling Stock for Spanish railways is so much in demand that the home factories can not guarantee deliveries under 12 months. In consequence it is reported that the government is intended to remove all duties on such stock for a period, in order to admit foreign cars.

The Proposed Extension of the Grand Trunk Railway System in New England

Much space has been given in the newspapers during the past two months to the proposed agreement between the New York, New Haven & Hartford R.R. and the Grand Trunk Ry., to cease competition in New England. The abandonment by the Grand Trunk Co. of construction work on the Providence extension and of its other plans for extension in New England first called general attention to this agreement and started a campaign of



FIG. 1. MAP OF GRAND TRUNK RY. LINES TO NEW ENGLAND SEAPORTS AND PROPOSED EXTENSIONS

investigation against the New Haven Company which may have important results.

It is of interest, therefore, at this time to see what the work was which the Grand Trunk Co. had under way and projected. The accompanying map, Fig. 1, shows these extensions.

From Montreal the company has for many years had its own lines to Portland, Me., and to New London, Conn.; the latter by the Central Vermont R.R., which is controlled by the Grand Trunk Ry. From Montreal to Boston a through route is obtained by connection with the Boston & Maine R.R. at White River Junction.

The proposed extensions included the following lines: 1, from White River Junction to Boston, about 120 miles, practically paralleling the present Boston & Maine R.R. route; 2, from Palmer, Mass., to Providence, R.I., about [illegible] miles, of which [illegible] miles had been placed under construction [illegible] with a branch from Dudley to Worcester); 3, from Boston to a connection with the Providence extension. All this new work was in the hands of a separate organization, the Southern New England R. R. Co., the president of which is F. H. Prouty, [illegible] president also of the Central Vermont R.R.). For information we are indebted to Mr. Fitzhugh and to H. C. Estep, engineer of construction.

The surveys had been made for the line from White River Junction to Boston (through Nashua, N. H.), and the Massachusetts portion had been authorized by the state legislature. Should the New Hampshire legislature fail to authorize the northern portion, however, it was planned to relocate the line entirely within the state of Massachusetts, connecting with the Central Vermont R.R. at Northfield, near the Vermont boundary. This is indicated by the line of crosses on Fig. 1. Profiles of the existing lines from Portland to Montreal and Boston to Montreal were given in our issue of Dec. 21, 1911.

The Palmer & Providence line is the only one upon which extensive construction work has been done. A map and profile of the line are shown in Figs. 2 and 3. The total length is about 75 miles, exclusive of a 10-mile freight line to the water front at Providence. The length in Massachusetts is about 58 miles, with 7½ miles of sidings. In Rhode Island, however, the length of main line is 27 miles, while the sidings aggregate 38 miles. The line was planned to serve many mills and factories.

From Palmer, Mass., where the Central Vermont R.R. crosses the Boston & Albany R.R., the new line parallels the latter road up the west side of the Quabaug River, crossing this valley near West Brimfield and then looping down on the east side. Near Fiskdale it strikes the valley of the Quinnebaug River and follows this nearly to the state line, where the river runs south while the railway turns eastward through Dudley and Webster and makes a wide loop around the north and east sides of Lake Chaubunagungamaug. Thence it continues east to Blackstone and Woonsocket, where it turns southeast along the Blackstone river.

From Blackstone, the line follows the east side of the river to Albion, and then the west side. It parallels the N. Y., N. H. & H. R.R. The main passenger line tra-

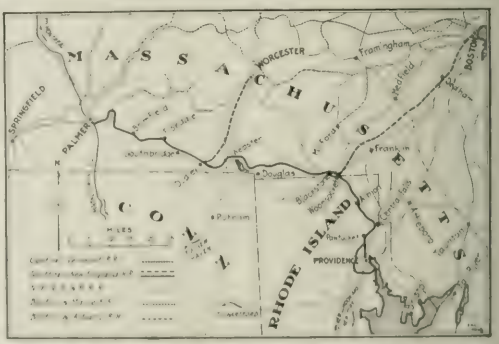


FIG. 2. MAP OF THE PALMER, PROVIDENCE & BOSTON EXTENSION OF THE GRAND TRUNK RY.

verses the city of Providence, and connects with the N. Y., N. H. & H. R.R. at a short distance from the Union Station. A freight line ten miles long swings around the city to a terminal on Narragansett Bay at Fields Point, where the company has a long lease of lands and wharves, with 900 ft. of water front. It will be seen from the map that the new line practically parallels different

lines of the N. Y., N. H. & H. R.R., and this applies also to the branches to Boston and Worcester.

The terminal elevations are 320 ft. at Palmer and 25 ft. at Providence (Union Station). There are three main summits. The first is at West Mountain (9½ miles from Palmer, near Brimfield), where the elevation is 705 ft. above sea level. The other two are in the neighborhood of Webster and the lake; at 31½ miles from Palmer is a summit of 545 ft., while at 41 miles (Mt. Daniel) is the maximum summit of 740 ft. elevation. The maximum grades are 1%, equated 0.04% per degree of curvature, with a maximum curvature of 6°. Transition curves are used, and the superelevation is calculated for a speed of 40 m.p.h. The line was to be of first-class construction, and was laid out to avoid all grade crossings, of both railways and highways.

The longest steel structure was to be a viaduct 1252 ft. long, carrying the railway over the Quabaug River (at a height of 115 ft.), the state highway and the Boston & Albany R.R. At North Webster (36 miles) is a structure 1052 ft. long which crosses the French River at a height of 55 ft.

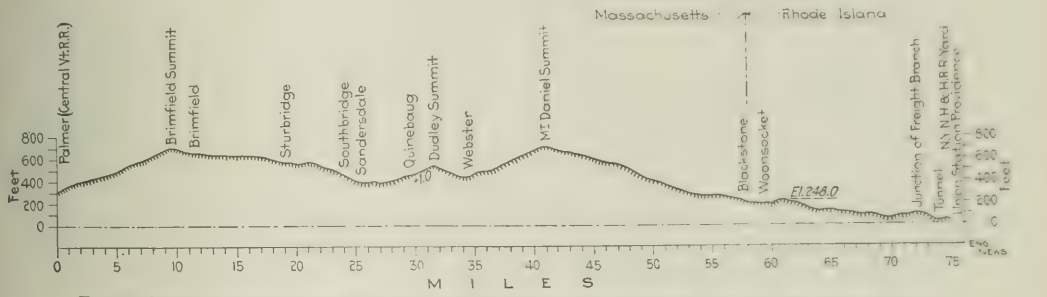


FIG. 3. PROFILE OF THE GRAND TRUNK RY. EXTENSION FROM PALMER, MASS., TO PROVIDENCE, R. I.

There was to be only one tunnel on the line, in Providence, 2400 ft. long, carrying the passenger line under the State House hill and terminating at Jewett St., near the Union Station. The freight line around Providence is for a large part of the distance depressed below the street level.

Charters had been secured for a 36-mile extention of this line from Blackstone to Boston (at South Boston), and for a 27-mile branch from Dudley to Worcester. The Grand Trunk Co. also proposed to operate steamers between Providence and New York and had placed orders for two steamers for this service, to be named the "Narragansett" and the "Manhattan", each having a capacity of 500 passengers and 500 tons of freight.

It should be said that these extensions of the Grand Trunk system were fought by the New York, New Haven & Hartford Co. by every influence at its command and there was some surveying for retaliatory lines by the New Haven as well as much bluffing.

The agreement, or rather offer, by the New Haven Co., which it is claimed led to the suspension of work on these extensions was a general proposal for trackage rights with facilities for through routing and through billing, which it was claimed would give the Grand Trunk, if the agreement were carried out, as good facilities for business in Boston and Providence as it could obtain with its own lines.

A Unit to Supplant "Horse Power"

The unit of power input, the myriawatt, recommended before the recent convention of the American Institute of Electrical Engineers (see ENGINEERING NEWS, July 4, 1912), by Mr. H. G. Stott, as desirable for expressing the power output of boilers, or the rate of steam energy input of engines in service, has been recommended to the American Institute of Electrical Engineers and the American Society of Mechanical Engineers jointly by the Standards Committee of the former and a special committee of the latter. It is proposed as a new unit to be used in dealing with the performance of steam boilers, steam engines, gas engines, steam and water turbines, etc., and as the unit of thermal or mechanical power. It is also recommended that these two societies discontinue the use of the term "boiler horsepower." According to this practice, for instance, the rating of the steam turbine generating unit would be according to its input in myriawatts and output in kilowatts. The myriawatt is about 2% larger than the accepted definition of boiler horsepower, and is equivalent to 10 kw.

Resuscitation Apparatus—Since the importation of the first resuscitation machines ("pulmotors") by the U. S. Bureau of Mines, as noted in "Engineering News," Apr. 6, 1911, some 250 have been purchased for gas- and electric-supply companies and are in use in some 100 cities where they have been made free to the public for emergency service. According to a bulletin of H. M. Byllesby & Co., of Chicago, 11 machines were purchased in 1912, and every gas property under the management of that concern was equipped with the device. In something less than a year in which these machines had been used, 24 lives had been saved; these were mostly cases of gas poisoning, but two persons were revived from the effects of morphine, two after serious surgical operations, and one after electric shock. In one case first breath was induced in an infant.

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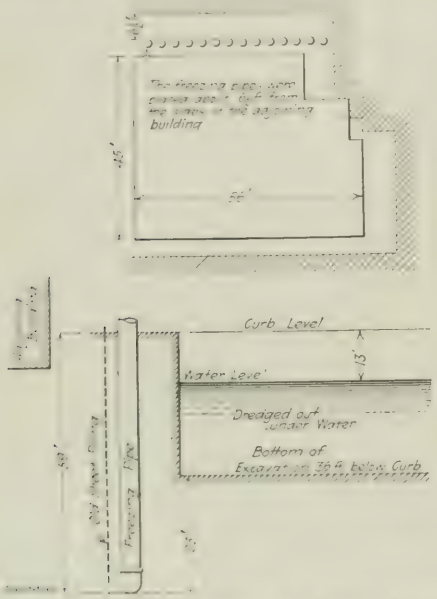
Sieves and Sieve Cloth will be tested by the U. S. Bureau of Standards, Washington, D. C., according to information appearing in Circular No. 39 of the Bureau. The fees for this work are graded as follows:

(a) Test and certification of any sieve conforming to the specifications of the Bureau of Standards	$2.00
(b) Test and report of any sieve which is rejected for mesh outside the tolerances	1.00
(c) Test and report of any sieve which passes specifications as to mesh, but is rejected for average diameter of wires	2.00
(d) Test and report of any sieve not conforming to other parts of the specifications or purchased on any other specifications	2.00
(e) Test and report of the mesh of warp wires of a piece of sieve cloth, per lin.ft.	0.60
(f) Test and report of the mesh of shoot wires of a piece of sieve cloth, per lin.ft.	0.60
(g) Determination of the average diameter of a number of wires in each direction in a piece of sieve cloth	
(h) A discount of 10% on the fees above under (a) to (d), inclusive, will be allowed when sieves are submitted in lots of five or more at a time.	

A Building Foundation Constructed by the Freezing Process

What is claimed to be the first use of the freezing process in constructing a building foundation is described by Maurice Deutsch in the following. Mr. Deutsch gathered the information during a recent visit to Europe, where he took occasion to study the latest methods of application of the freezing process for various purposes, particularly for shaftsinking. The work on the building foundation described below was done several years ago, but has not previously been reported in print.

In designing the substructure of a department store for R. Herzog, in Berlin, it was necessary to provide for a deep cellar where machinery was to be located. The [illegible] shown in the accompanying sketch, it is approxi-



Plan and Vertical Section of a Berlin Building Foundation Constructed under the Freezing Process

[illegible] square 56x56 ft. The building is four stories in height, but provision was made in construction for increasing this height later. The subsoil is a bed quicksand extending to a considerable depth. Ground-water level is about 13 ft. below curb at the site, and the foundations of the adjoining buildings are about 10 ft. below curb. The cellar excavation had to be carried about 36 ft. below curb, or more than 30 ft. below water and 25 ft. below the foundations of adjoining buildings.

Work was begun by excavating inside of a sheet-pile inclosure. When [illegible] ft. below water-level, material from under adjoining buildings started to boil up into the excavation, and several of these buildings settled and cracked. Work was abandoned, then a contract which [illegible] in the application of the freezing process was called upon to construct the foundations. The contractor undertook to complete the work within a stipulated time for a fixed price.

Freezing pipes 5 in. in diameter and about $\frac{5}{16}$ in. in wall thickness were sunk vertically around the site about 3 ft. on centers, on a line about 6½ ft. from the adjoining buildings. The pipes could not be located exactly on a straight line, as the sheet-piling driven by the previous contractor was not always either vertical or in a straight line. The pipes were sunk to 59 ft. below curb level, or about 23 ft. below the bottom of the proposed excavation. The pipes were closed at the bottom and inside of each was set a 1-in. brine pipe open at the bottom. The brine pipes were connected to a supply header at the top, and the 5-in. pipes were connected to a drain header. The system was supplied from a brine pump and a refrigerating plant. The brine passed down through the 1-in. pipes, up through the inclosing 5-in. pipe and back into the drain header, which returned it to the brine tank. The liquid was pumped through the 1-in. pipes at a velocity of about 11½ ft. per min. Valves fitted in the supply main and in the collecting main, and valves in the connections of the individual pipes to these mains, permitted making any necessary tests for tightness of the individual pipes.

About four weeks after the brine was started flowing the ground was frozen a sufficient distance for the contractor to begin excavation. Work proceeded by dredging inside of the lot to a depth of 36 ft. below curb. At no time did any inflow of material under the frozen wall take place. When the excavation was completed to the desired depth the floor was covered with a thick bed of concrete, placed under water. Then the site was pumped out and the foundation completed.

The work was done at a much lower cost than it could have been done for by the pneumatic-caisson process.

⁂

The Profitable Limit of a Five-Cent Street-Railway Fare*

By Henry G. Bradlee†

In the 1911 report of our Committee on Rates and Fares, we indicated that it is possible to figure accurately the distance which overhead, trolley, surface, street railway cars may be operated with profit for a 5c. fare, provided four factors with reference to a company's business are shown, and we included in our report certain curves by which such calculations can be readily made.

The four items which we mentioned are as follows: (1) The total cost per car mile of operating expenses, taxes, depreciation and obsolescence. (2) The average number of 5c. fare passengers carried per one-half round trip. (3) The investment made in the company's property for each $1 of gross business. (4) The percentage return on the company's investment which must be earned to attract capital freely to the business.

Since our last year's report was completed, I have endeavored to secure information from street-railway systems covering the above items. In securing this information, I have modified the items somewhat by transferring taxes, depreciation and obsolescence from the first item to the fourth. The first item, therefore, covers the total cost per car mile of operating expenses exclusive of taxes, depreciation and obsolescence. The fourth item covers the percentage return on the company's investment which must be earned to provide for taxes, depreciation and obsolescence and to attract capital freely to the business.

In presenting the information which I have collected, it perhaps will be somewhat clearer if I consider each one of these four items separately.

*From a letter written to F. R. Ford for incorporation in the report for 1912 of the Committee on Rates and Fares of the American Electric Railway Association.

†Stone & Webster, 147 Milk St., Boston, Mass.

(1) THE TOTAL COST PER CAR MILE OF OPERATING EXPENSES

Operating expenses per car mile for those companies from which the other data could also be secured are as the accompanying table.

These figures indicate that operating expenses per car mile are not materially affected by the mere size of the road. In general, the small companies may be said to have slightly lower operating expenses per car mile than the large companies, but some of the large companies operate on a very low basis and some of the small operate on a high basis. If these companies were retabulated with reference to their geographical location, it would appear that the companies in the southeastern section of the country in general operate at a lower cost per car mile than those in the northern section or those in the extreme western section.

(2) THE AVERAGE NUMBER OF FIVE-CENT-FARE PASSENGERS PER HALF ROUND TRIP

From the figures in the accompanying table (Col. 4), it appears that the larger companies carry a greater number of passengers per half round trip than the smaller companies. The reason for this is evident. In the larger cities it is possible, to a certain extent, to vary the number of cars operated on each line from hour to hour so that the number of cars operating at any one time is approximately proportioned to the amount of traffic. In smaller cities this is usually impractical because a line which can handle its rush-hour business on a 10- or 15-minute headway cannot ordinarily reduce this headway during hours of light travel without strong objections from the traveling public.

If we consider the larger cities only, it appears that 25 five-cent-fare passengers per half trip is about as high as any road can hope to average. That we are not likely to exceed this number of passengers with the present type of car is quite evident when we consider that this figure is the average number of paying passengers per half trip covering the entire day's operation, including hours of light travel, as well as those of heavy travel, and that it does not include transfer passengers who must also be accommodated on the cars. Assuming that 25 five-cent-fare passengers is the maximum which we can hope to carry on an average per half trip, it is evident that our maximum receipts per half trip will be $1.25, and that this is the limiting factor in determining the distance which the car may be profitably operated.

(3) INVESTMENT IN PROPERTY FOR $1 OF GROSS BUSINESS

The word "investment" is intended here to cover all costs incident to the production or replacement of a property and its business.

The figures obtained showing the ratio between investment and gross earnings are as in Column 2 of the accompanying table.

These figures must, necessarily, be considered approximate because they are in all cases obtained from appraisals made after the completion of the property and at a time when the actual cost of construction was not available. All the figures are, however, based on appraisals made by competent engineers of long experience, and I think may be accepted as approximately correct. The appraisals of companies (1), (2) and (3) were made at a time when these properties were not properly equipped to handle their full gross business and give adequate and first-class service. The valuations of these cases are, therefore, low, and had the physical properties been adequate for the business handled, I think that investment per dollar of gross business would have undoubtedly been as high as $4 in each case.

Taking the average of all of the companies given in the above table, I find an average investment of $3.92 per $1 of gross earnings.

It would appear from the figures that the average investment per dollar of gross business is practically the same in smaller companies as in the larger. It is, of course, true that the average investment per mile is much greater in large cities than in small. It is also true that the gross earnings per mile of track are much greater in large cities than in small, and these two factors, apparently, offset each other when comparisons are made between the total investment and the total gross earnings.

(4) PERCENTAGE RETURN ON INVESTMENT NECESSARY TO PROVIDE FOR TAXES, DEPRECIATION, OBSOLESCENCE AND TO ATTRACT CAPITAL FREELY TO THE BUSINESS

It is hardly practical to obtain definite data for this fourth item, but I think it may be possible to arrive at figures which we will all agree are reasonable.

In the matter of depreciation and obsolescence, opinions of engineers and operators differ as to details, but they agree fairly well in that at least 3% of the investment, over and above ordinary maintenance charges, should be set aside to provide for replacement of property due to depreciation, obsolescence and other causes.

I think that 1½% of the value of the physical property may be said to fairly represent the average amount paid in taxes.

The return on the company's investment, which must be earned to attract capital freely to the business is not so easy to determine. In the older communities, where conditions are more stable, an investment would, no doubt, be freely made for a lower return than would be expected in the newer and more rapidly growing sections. Considering average conditions throughout the country, however, it seems to me that a street-railway company should be able to earn 8% on its investment, if it is to secure freely the capital necessary to develop its business. It might be well to point out in this connection that the securing of new capital is, in this country, an exceedingly important part of the business of a street-railway company. The cities throughout the United States are growing at an exceedingly rapid rate and new capital must be continuously obtained if a community is to be properly served. In a group of companies scattered all over the country, with which I am familiar, the investment required has doubled on the average once in about seven years.

We have then a total of at least 12½% on the company's investment which should be earned to provide for taxes, depreciation and obsolescence and to attract capital freely to the business.

(5) THE MAXIMUM LENGTH OF HALF TRIP IN MILES FOR PROFITABLE OPERATION

Taking the above figures and applying them as indicated in our 1911 report, we arrive at the accompanying figures as the maximum length of half trip in miles for profitable operation:

These figures indicate that passengers may be profitably carried a longer distance in the large cities for a 5c. fare than in the small cities. This is due to the fact that in the large cities the number of passengers carried per half trip and, consequently, the receipts per half trip are greater than in the small cities. It would appear, however, that even in the large cities a distance of 3½ to 4 miles in the maximum length of half trip for profitable operation, if we assume, as above, that 12½% should be earned to provide for taxes, depreciation and obsolescence and a reasonable return on the capital invested.

As a matter of fact, there are, of course, a considerable number of the larger cities in which the length of half trip would average over 3½-4 miles, and it is evident that in the cities where this condition exists, the companies are either operating under exceptionally favorable conditions as to investment or low operating expenses per car mile, or, they are not earning 8% on their investment after setting aside 3% for depreciation and obsolescence. The truth is that there are very few street railways in the country which are today earning 8% on their investment and setting aside 3% for depreciation and obsolescence, after paying all operating expenses and taxes.

OPERATING DATA OF 20 STREET RAILWAYS

Company.	Dollars invested per dollar of gross.	Cents Operating expenses per car mile.	Passengers per ½ round trip 5-ct. fare.	Max. length half trip for profitable operation miles.
Annual gross receipts over $1,000,000				
1	3.15	14.96	22.40	4.54
2	3.25	18.33	22.80	3.69
3	4.40	18.50	25.40	3.09
4	4.00	19.60	24.40	3.11
5	3.30	16.30	17.00	3.06
6	3.90	19.00	15.60	2.10
7	5.55	19.90	22.20	1.71
8	3.03	14.22	17.50	3.82
9	4.97	15.00	27.00	3.40
Annual gross receipts over $750,000 and less than $1,000,000				
10	3.00	18.40	13.20	2.24
Annual gross receipts over $500,000 and less than $750,000				
11	3.90	18.30	14.40	2.02
12	3.00	12.60	13.00	3.22
Annual gross receipts over $250,000 and less than $500,000				
13	3.80	18.60	15.30	2.16
14	4.40	12.00	13.40	2.51
15	4.20	13.70	8.70	1.51
16	4.40	13.70	7.40	1.21
Annual gross receipts less than $250,000				
17	3.70	17.70	19.00	2.88
18	4.50	15.20	17.00	2.44
19	3.70	14.80	12.60	2.28
20	4.20	12.70	6.60	1.23

Rapid Construction*

An instance of rapid power-plant construction is shown in the extension of the existing Jordan steam station of the Utah Light & Ry. Co., at Salt Lake City.

The original station† was designed and built by the same engineers in 1910 and consisted of an 8500-kw. single-unit steam-turbine station designed to act as an adjunct to various hydro-electric plants operating in the vicinity and also to form the nucleus for such steam generating equipment as might be later required to serve Salt Lake City. The operating conditions covering the original plant were as follows: (1) Wyoming coal was to be used, carrying about 11,700 B.t.u. per lb.; (2) ample condensing water was available, but unsuitable for boiler feed; (3) feed water was to be purchased at comparatively low cost; (4) operation was not to be continuous at first.

The new work, which consists of an extension to the old station, comprises in general a brick and steel building approximately 100x60 ft. The building walls rest on a pile-and-concrete base composed of 36-ft. piles overlaid with about 3 ft. of concrete. Condenser intake and overflow flumes are formed in the foundations. The boiler room consists of a steel-frame structure, supporting overhead coal bunker, with brick walls, concrete-slab floors and roof. The turbine room is similarly constructed, the only steel, however, being in the crane rails, floor-beams and roof trusses.

The new boiler equipment consists of six water-tube (Stirling) boilers, with mechanical stokers; natural draft is furnished by a reinforced stack 11½ ft. in diameter 225 ft. high. Piping is designed with welded flanges for high-pressure work and cast-steel fittings and valve bodies.

It was not necessary to store coal in large quantities, so the coal- and ash-handling equipment is comparatively simple. [illegible] bucket conveyor up to the top of the boiler house, where it discharges on a horizontal belt by which it is distributed through the length of the bunker over the boilers. Ashes are dumped from ash pits into side-dump cars, which run on an industrial railroad in the boiler-room basement, are lifted to ground level by an elevator and run out by hand to dump on adjacent land which is being filled. Good natural illumination of the boiler room is provided by skylights placed just beneath the coal bunkers.

The new generator equipment consists of one Westinghouse-Parsons turbine, 8500-kw., 3600-r.p.m., three-phase, 4400-volt unit. A Leblanc condenser‡ is placed directly beneath it in the turbine foundation, the condenser having turbine-driven air and circulating pumps. The main generator is provided with the usual air ducts for ventilation and is excited by a turbine-driven set of 100-kw. capacity. The switching apparatus is contained in concrete cells and the ring type of bus is used to secure the desired flexibility in switching operations.

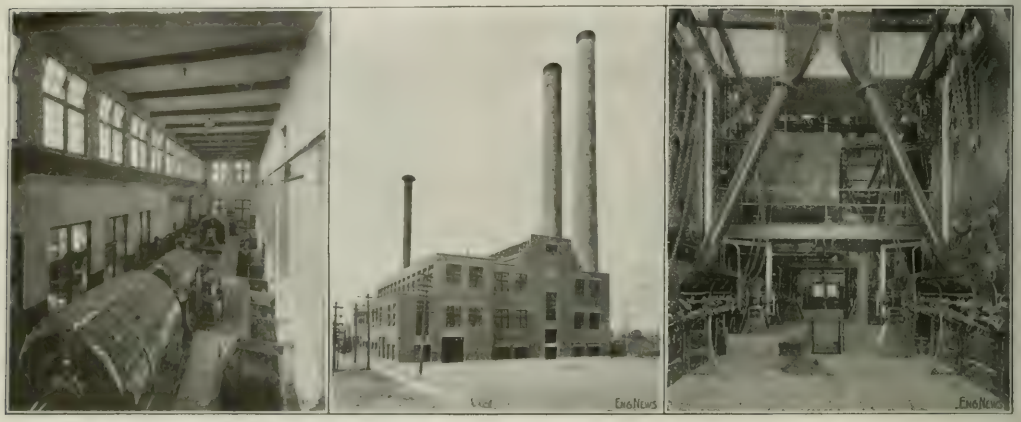


FIG. 1. THE JORDAN STATION OF THE UTAH LIGHT & RY. CO., SALT LAKE CITY
(Extensions for Unit 2 in foreground.)

The record of construction is graphically shown by Fig. 2, and may be thus summarized:

March 27, 1912. Authorization received to design and build an extension to the original station, increasing its capacity 100%.

Apr. 1. Five days after authorization sufficient progress had been made so that the main generator unit, the boilers, condenser, stack, heater, stokers and piles had been purchased. Inquiries for steel had been sent out and contracts were let for steel on Apr. 3.

Apr. 6. Ten days after authorization the field organization arrived in Salt Lake City and excavation was at once started. Construction office, storeroom and cement sheds were built.

Apr. 19. Twenty-three days after authorization, the first piles were received and driving was begun, the stack foundations being finished on May 20.

May 9. Forty-three days after authorization, stack brick work was started together with concrete building-foundation work. On May 19, brick building walls were begun; on May 21, boiler-foundation piers were started and on May 28 steel framing for boiler-room floor was begun.

May 27. Sixty-one days after authorization, the boilers began to arrive and sheet piling for condensing water intake and overflow flumes was started.

July 8. One hundred and three days after authorization, piping erection was commenced.

July 10. One hundred and five days after authorization, steam end of main generating unit arrived and was unloaded

*[illegible]

†Described in Eng. News, Jan. 26, 1911.

‡Described in "Engineering News," Aug. 19, 1909.

and put in position, condenser having been released and placed about a week previously.

Aug. 1. One hundred and twenty-six days after authorization all structural work was finished including brick walls, floors and roof, three boilers had been erected and tested and five out of the six stokers erected.

Aug. 6. One hundred and thirty-one days after authorization, main generator arrived and was placed on foundations; auxiliary work, wiring up and miscellaneous work went rapidly forward until Aug. 26 152 days after authorization the station was put under commercial load.

It is believed by the constructing engineers that this record has never been exceeded when the size of the station and its location is considered.

subject before it was dismissed. At the request of the Department, the Stanley Works very kindly consented to repeat the tests in the presence of a representative of the Department. The writer was assigned to this work.

Although these tests at New Britain were entirely satisfactory, the proposition of putting out fires with a combustible material, such as sawdust, seemed to be so unusual that it was felt desirable to conduct a more extended series of tests. Especially was it desired to learn the effect of varying the size of the tank, the depth of the lacquer and the kind.

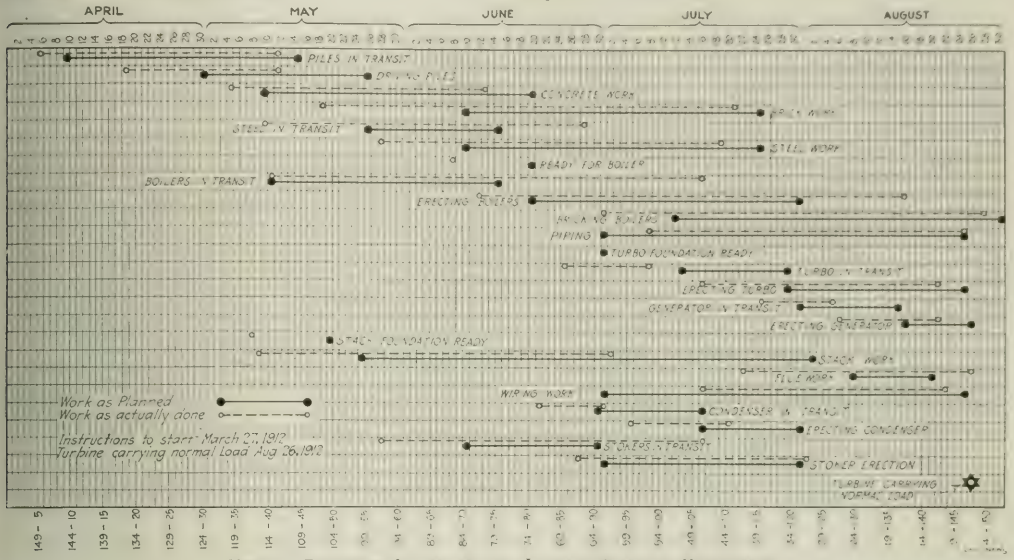


FIG. 2. PROGRESS DIAGRAM FOR JORDAN STATION EXTENSION

The work was designed and constructed by Westinghouse, Church, Kerr & Co., under the direction of O. A. Honnold, Electrical Engineer of the Utah Light & Railway Co.

Extinguishing Fires with Sawdust*

BY EDWIN A. BARRIER†

In the latter part of July last, word was received from the Stanley Works, New Britain, Conn., through the Manufacturers' Mutual Fire Insurance Co's. office, that experiments had been conducted at that plant on the extinguishing of fires in burning lacquer by means of sawdust, and that the results had been very satisfactory. A report was also sent covering in detail two tests which had been made.

The low cost of the material used, the simplicity, which makes its use more nearly resemble the fire pail than anything that has been previously suggested, the entire absence of any automatic device likely to fail to work at time of fire, and the fact that no special training would be necessary to enable the operatives to efficiently use the sawdust seemed to justify careful consideration of the

Three tanks were accordingly obtained, built of sheet steel reinforced with angle irons. The largest was made 60 in. long, 30 in. wide and 16 in. deep; the middle tank 48 in. long, 14 in. wide and 16 in. deep, and the smallest 30 in. long, 12 in. wide and 16 in. deep. The joints were made tight with silicate of soda cement. Both soft- and hard-wood sawdust was obtained from a local sawmill. The soft-wood sawdust was probably a mixture of pine and spruce, and the hard-wood apparently mostly oak. One barrel of sawdust was thoroughly dried to note the effect, if any, of moisture. It was thought possible if sodium carbonate were mixed with the sawdust that the formation of carbon dioxide by the decomposition of the bicarbonate by heat might be of help in extinguishing the fire. A bushel of soft-wood sawdust was accordingly mixed with 10 lb. of commercial bicarbonate of soda and used in the cases mentioned below. An ample supply of sand was also provided.

Commercial lacquer, as used in their respective plants, was obtained from the General Electric Co. at Lynn and the Stanley Works at New Britain. From their general appearance and odor, it is certain that they both were amyl-acetate-pyroxylin lacquers with the usual thinners, such as wood alcohol, benzine, etc.

The tests were conducted at Woburn, Mass., at the farm of L. F. Baldwin, on Friday, Nov. 15, 1912. The tanks were placed out in the open, well away from

*From a report made to the Factory Mutual Laboratories (under the direction of the inspection department, Associated Factory Mutual Fire Insurance Companies).

†Chemical Engineer, Factory Mutual Laboratories, 31 Milk St., Boston, Mass.

any buildings. The weather conditions were fair, although the sky was overcast. The wind blew from the northwest at a velocity of from some 14 to 19 miles per hour.

The sawdust was applied by means of a snow shovel having a steel blade 11 in. wide and 15 in. long, and provided with a handle 4 ft. long. The fires were all extinguished by the writer except in one case. [From the log of the 16 tests the following typical cases have been taken.—ED.]

TEST NO. 1.—Small Tank Containing 2 in. of Stanley Lacquer.

Time	Remarks
[illegible]	Fire started.
2:21:03	Sawdust applied.
2:21:28	Fire extinguished with 2½ shovels of soft-wood sawdust in 25 sec.

TEST NO. 3—Small Tank Containing 5 in. of Stanley Lacquer, Left From Previous Tests After Sawdust Had Been Removed From the Surface.

2:40:00	Fire started.
2:41:18	Sawdust applied.
2:41:53	Fire extinguished with two shovels of dry soft sawdust in 35 sec.
	In this test some of the lacquer which had leaked out on to the ground ignited near the tank, but was readily extinguished with a small amount of sawdust in about 10 sec.

TEST NO. 4—Small Tank Containing 4 in. of Lacquer Left From the Previous Tests After Sawdust Had Been Removed From the Surface.

2:50:00	Fire started.
2:51:19	Sawdust applied.
2:51:29	Fire extinguished with ¼ shovel of mixture of bicarbonate of soda and sawdust in 10 sec.

TEST NO. 6—Small Tank With 3 in. of Stanley Lacquer Left From Previous Tests, After Sawdust Had Been Removed From the Surface.

2:58:00	Fire started.
2:59:03	Sand applied.
3:00:58	Fire extinguished with nine shovels of dry sand in 1 min. 55 sec. The tank was over half full of sand before the last flame disappeared.

TEST NO. 9—Soft Pine Platform 5 ft. 2 in. Square Provided With Rim Raised 2 in. on All Four Sides; About 2 gal. of G. E. Lacquer Uniformly Spread Over the Surface.

3:30:00	Fire started.
3:30:45	Sawdust applied.
3:31:38	Fire extinguished with three shovels of soft-wood sawdust in 53 sec.

[illegible] Platform As in Test No. 9, With About 2 gal. of G. E. Lacquer Spread over the Surface.

3:35:00	Fire started.
3:35:36	Extinguisher applied.
[illegible]	Fire [illegible] by means of a 3-gal chemical extinguisher, but with some difficulty, in 56 sec. In this test if the stream from the extinguisher had not been carefully sprayed, or if the platform had not been provided with a rim, it is probable that the force of the stream would have spread the lacquer all over the ground.

[illegible] Tank Containing [illegible] of G. E. Lacquer [illegible] After Sawdust Has Been Removed From the Surface.

[illegible] started.
[illegible] with two shovels of hard-wood [illegible]

[illegible] Tank Containing [illegible] Gasoline.

[illegible] started.
[illegible] with [illegible] shovels of sawdust in 25 sec.

TEST NO. 16—Middle Tank Containing 2¾ in. Gasoline.

4:40:00	Fire started.
4:40:50	Dry sand applied.
	Four shovels of sand were used, but as they had absolutely no effect, the fire was finally extinguished with eight shovels of sawdust in about 56 sec.

CONCLUSIONS

In view of these tests, the following conclusions appear warranted.

(1) Sawdust, if spread over the surface, will readily and successfully extinguish fires of inflammable liquids, particularly lacquer, when contained in moderate-sized tanks, or small fires in these liquids on the floor. Fires in gasoline in up to the middle-sized tanks, were extinguished without difficulty, but there may be some question as to whether sawdust would have worked equally well in larger tanks.

The efficiency of sawdust is undoubtedly due to its blanketing action in floating for a time upon the surface of the liquid and excluding air. Its efficiency would be greater on viscous liquids than on thin liquids, since it would float more readily on the former. Sawdust itself is not very easily ignited and it burns without flame; the embers are not sufficient to re-ignite the lacquer.

(2) The character of the sawdust, whether from soft or hard wood, appears to be of little or no importance.

(3) The amount of moisture contained in the sawdust is apparently not a factor. The dry sawdust which was used in some of the tests was prepared in order to represent the condition in which sawdust might be found after having been stored in a heated mill for some time. This material, however, was evidently as efficient as the untreated sawdust.

(4) The depth of lacquer in the small tank was of no importance.

In the largest tank, on the other hand, it is quite possible that with greater depths than those tried, it might have been much more difficult to extinguish the fires. Tests at greater depths were not tried on account of the large quantity of lacquer required. This is not as important as might seem at first thought, because the average lacquer tanks in mutual-insurance mills are about the same size as the smallest of those employed in these tests.

(5) Sand is not satisfactory for extinguishing fires in lacquer tanks because being heavy it sinks to the bottom and does not have the blanketing action of sawdust.

(6) The sawdust can best be applied by means of a long handled and light, but substantial, shovel with a large blade. The long handle is necessary since in some cases the fires are too hot to work at close range.

(7) The admixture of sodium bicarbonate very much increases the efficiency of the sawdust, as shown both by the shortened time and decreased amount of material necessary to extinguish the fire. The effect of the carbon dioxide was clearly noticeable in the tests in that the flames occasionally made an effort to shoot sidewise and up from under the blanket of gas. The bicarbonate will decrease possible danger from the presence of sawdust in mills. It would be very difficult, if not impossible, to ignite the bicarbonate-sawdust mixture by a carelessly thrown match, etc.

Difficulty arose from the caking of the bicarbonate [illegible] could be easily overcome by the addition of 10% by weight of iron ore.

The Relation of a Pure Water-Supply to Chronic Intestinal Tract Infection*

BY NICHOLAS S. HILL, JR.† AND LEON R. WHITCOMB‡

One of the common if not the most common result of chronic intestinal-tract infection is auto-intoxication. It is not the purpose of the authors to present a history of auto-intoxication, but rather to outline its effect upon the body and to suggest that one cause of auto-intoxication may be the constant drinking of impure water. If this hypothesis is true, then we have found one rational explanation for the increased human resistivity following the substitution of a pure water for a polluted water and, therefore, the cause for the decrease in the general death rate following such a change.

The symptomology of auto-intoxication which is presented here is drawn largely from the works of Metchnikoff, Dr. A. Combe, of the University of Lausanne, Switzerland, and Dr. C. A. Herter, of Columbia University, New York City.

AUTO-INTOXICATION AND ITS EFFECT ON THE GENERAL HEALTH

Dr. Combe defines intestinal auto-intoxication as the toxaemia caused by qualitative or quantitative alterations in a normal digestion. By normal digestion is meant the digestion of a normal man produced by the enzymes or the bacteria in the stomach and intestines. Auto-intoxication may also be defined as a toxaemia caused by poisonous substances, which are formed through the influence of the vital processes of the body. Such substances are termed "toxic substances" or "toxic compounds."

Certain classes of bacteria perform a legitimate function in the process of digestion, and while their presence may not be absolutely necessary, yet under normal conditions their presence is at least not detrimental. Under certain conditions, however, the bacterial action is extended to the production of hydrogen sulphide, lactic, butyric, propionic acids, indol, skatol, phenol, paracresol and other substances derived from the processes of fermentation and putrefaction. These compounds may be produced by the introduction of bacteria not normal to the intestines, but which, when planted there, gain a firm lodgment and carry on the work of putrefaction. The toxic compounds may also be increased by an increase in the number of bacteria normal to the intestine. In fact, any bacterial condition in which the number, varieties and microbic associations overbalance those influences provided by nature to prevent the formation of toxic substances detrimental to the human organism may produce auto-intoxication.

The substances introduced as food into the alimentary canal, which are most susceptible to putrefaction are the highly nitrogenous compounds. It is the aromatic bodies produced by the action of bacteria upon these proteid matters, which cause auto-intoxication. These products, some of them but slightly poisonous individually and in the quantities normally present, when present in excessive quantities produce the most deleterious effects upon the human system. Fortunately, the body is capable of gradually accustoming itself to the presence of these toxic substances and even organizes means of defense against them.

The ability of the human organism to adjust itself to the presence of toxic substances derived from the intestines is limited, and it may be overcome by the formation of excessive quantities of the toxic compounds. It is also impaired by other means, such as a severe cold, by overwork, or by some disturbance of the nervous system. It also varies greatly with the individual.

In order to reach the large intentine, bacteria admitted in food to the mouth must pass through the stomach, and, under usual conditions, remain in the stomach for a period of time. Here they are subjected to the action of the stomach fluids, which are acidified with hydrochloric acid. Since most vegetative forms of bacteria are destroyed by hydrochloric acid, only a small per cent. of the number of bacteria entering the mouth ever reach the intestines under normal conditions. If, by some derangement of the digestive system, the stomach contents become weakly acid or alkaline, increased numbers of bacteria are permitted to enter the intestines directly. Liquids such as milk or water, for example, dilute the stomach juices and also pass through the stomach rapidly. Thus it is possible even in the normal condition of the stomach for large numbers of bacteria to pass into the intestines.

When the bacterium reaches the intestine, it must begin at once a battle royal for supremacy over other varieties of bacteria. It must align itself with one of two groups the putrefactive group, or the lactic acid producing group. Some bacteria, however, are capable of joining either group and will align themselves with the group which appears to predominate. For example, B. coli is capable of living aerobically and producing acid or of living anaerobically and aiding in the putrefactive processes.

When the acid-producing bacteria predominate in the intestine, and the contents of the intestine are therefore acid, there is little opportunity for auto-intoxication, since the toxins causing the disturbance can only be produced under strictly anaerobic, putrefactive conditions. It is, therefore, only with these latter effects that we are interested in this discussion. If, for any reason, the putrefactive organisms predominate in the intestines, toxic substances, such as indol, skatol, putrescin, cadaverin, methyl mercaptan, may be formed.

If unprevented, these toxines, together with the bacteria themselves, will enter the portal vein and eventually the circulatory system. Under normal conditions, however, they do not reach the major circulatory system [being repelled or neutralized by various agencies outlined in the paper.—Ed.] No one of these agencies necessarily performs the entire work of destroying the toxines, but each does a part. When one defense begins to fail, the others are forced for a time into greater activity, ... finally the antitoxic glands become altered and fail to contribute the necessary amount of antitoxin to the blood. It is then possible for the poisonous compounds to pass unchanged from the intestinal tract into the major circulatory system where they produce various symptoms of disease, according to their nature and quantity. They may effect: (1) the heart; (2) the arterial blood pressure; (3) the respiratory system; (4) the nervous system; (5) the general nutrition; (6) the urinary system.

THE RELATION BETWEEN IMPURE WATER AND AUTO-INTOXICATION

Thus far, we have only hinted at the relation between impure water and intestinal tract infection, one of the most important results of which is auto-intoxication. We have stated that among other causes of the breakdown of the defensive organs of the alimentary system is that due to a large increase in the putrefactive bacteria entering the intestine in the food.—[Finality has not been reached but] as a general thing, the authorities consulted concur in the belief that the anaerobic bacteria are chiefly concerned and that the anaerobic bacteria most prominently mentioned have been of the spore forming variety, included in which are the B. aerogenes capsulatus, B. enteriditis sporogenes, B. putrificus, B. anaerobicus alcaligenes.

In considering the possible effect of polluted water in intestinal tract infections, it must be remembered that the secretion of the gastric juices is most active at the time that freshly digested food is in the stomach and, therefore, while uncooked food may be the most potent factor in the introduction of foreign bacteria into the digestive tract, the bacteria thus ingested are subjected to the maximum disinfection produced by the gastric juices. When the stomach is idle, the production of gastric juices is very slight and it is under these conditions that water is regularly and frequently taken. It is to be remembered that liquids, and particularly water, pass more rapidly from the stomach to the lower intestines than do solids and, therefore, the time element, which is an important factor in the destruction of foreign bacteria, is materially lessened, and, lastly, that the percentage of water present in the intestines materially influences the character of the bacterial action in the intestine.

If, therefore, the supply of putrefactive bacteria through the agency of water is constant, though small in number, and the diet of the person inbibing impure water is favorable to the putrefactive bacteria, it is not unreasonable to assume that these small numbers will in time, or under accidental conditions, produce anaerobic putrefaction and eventually intestinal tract infections and the resultant auto-intoxication.

So long as bacteria which are concerned in chronic intestinal tract infections are evacuated, so long will these bacteria be present in greater or lesser quantities in sewage-polluted water, and we have a repetition of the same phenomena, which are present in the causation of typhoid fever and other acute gastro-intestinal disturbances. As a matter of fact, those bacteria which have been most prominently mentioned in connection with chronic intestinal-tract

*Condensed from a paper read before the American Public Health Association, Washington, D. C., September, 1912. The paper, in full or in abstract, will presumably be published in the Journal of the Association.

†Consulting Engineer, 100 William St., New York City.

‡Chief Chemist and Bacteriologist, Laboratory of Nicholas S. Hill, Jr., 100 William St., New York City.

infections, and which are generally of the spore-forming variety, have frequently been isolated from the water-supplies of various cities.

Nearly everyone in the medical world today is more or less familiar with the theorem formulated by Hazen and the so called Mills-Reincke phenomenon. Hiram F. Mills, member of the Massachusetts State Board of Health, and Chief Engineer of the Locks and Canals on Merrimac River, observed that shortly after the introduction of a filtered and purified water-supply in Lawrence, there was a marked decrease, not merely in the death rate from typhoid fever, but also from other diseases. At the same time Dr. J. J. Reincke, Health Officer of Hamburg, Germany, observed a similar effect on the death rate of his city following the installation of a purer water-supply. From these observations, together with observations made by him in the cities of Troy and Albany, Allen Hazen evolved a theorem which he states as follows: "Where one death from typhoid fever has been avoided from the use of better water, a certain number of deaths, probably two or three, from other causes, have been avoided."

Prof. W. T. Sedgwick and J. S. MacNutt have made further studies of the Mills-Reincke phenomenon. In addition to the cities above cited, they examined the death rates of Lowell and Binghamton, and found that following the introduction of a purer water-supply in these cities, there was a decrease in the number of deaths due, not only to typhoid fever, but to other causes. They found that the decrease in death rate was particularly noticeable in such diseases as diarrhœa, cholera infantum, other gastro intestinal diseases, pneumonia, pulmonary tuberculosis and bronchitis. Furthermore, they noted an apparent improvement in the general health of the community, not traceable to the reduction in these diseases.

Of the diseases just mentioned, it will probably be admitted that the causative factor in the production of diarrhœa, cholera infantum, pneumonia and pulmonary tuberculosis may be bacterial. We will venture to state that most gastro-intestinal diseases have their origin through the agency of bacteria. It will also be admitted by most that typhoid, cholera, diarrhœa, cholera infantum, dysentery and other acute gastro-intestinal diseases may be water borne. There are some who claim that pulmonary tuberculosis may be conveyed through the medium of water. So far as this paper is concerned, however, the most interesting fact here presented is that all of the acute gastro-intestinal diseases have, at one time or another, been attributed to water. If this be so, why may not chronic intestinal tract infections be water borne?

Two hypotheses have been suggested to explain the improvement in the general health here, aside from those diseases which are known to be specifically water borne. One credits the reduced death rate to the greater human resistivity following a reduction of the organic matter, or filth, in a water-supply, but it has never been definitely shown that filth per se, minus infection, will produce disease. Filth may be deleterious and harmful and tend to reduce the vital resistance of the body, but the amount of organic matter or filth, which may be present in a drinking water, which is inoffensive to the taste and smell, is so small that its pathological significance is minimized, if not eradicated.

The other hypothesis is that the improvement is due solely to the elimination of [illegible] which may be causative of disease, but whose etiological significance is not now known. We know that the elimination of specific bacteria, which [illegible] typhoid and cholera. It may be that the removal of many other bacteria not now [illegible] may be attributable for the reduction in the general death rate as noted. As a matter of fact, the flora of the intestinal tract or the human faeces, and the results of these [illegible] the pathogenicity of these bacteria is not known and the extent of [illegible] the virulence of some is not properly appreciated. In fact, the consensus of opinion of the writers of the present day is that the species of bacteria present in the intestines of man is very limited.

[illegible] carried on [illegible] various species of bacteria which have been isolated from the [illegible] and the faeces of these [illegible] a table which we present with this paper [omitted here—Ed.].

A study of this table [illegible] that a year seldom passes without establishing the direct connection between a specific disease and a bacterium formerly unconnected with [illegible] of the bacteria [illegible] have passed the [illegible] stage.

The authors believe that the reduction in the general death rate, following the introduction of pure water, which has been noted, can be attributed to a reduction in bacteria rather than to a reduction of filth. The correctness of this view is supported by a consideration of the relation of bacteria to intestinal-tract infections, which may not of necessity be acute, as in the case of diarrhœa, dysentery, enteritis and typhoid, but which may develop a condition of toxaemia, which affects the general health tone and thereby increases susceptibility to other diseases, not alone those at present associated with bacteria, but those unassociated with them as well.

That there are many cases of intestinal-tract infection at the present time, which pass unheeded and unnoticed, is the consensus of opinion of a number of eminent scientists and physicians who have made a special study of these infections. Chief among the results of chronic infection is the so called auto-intoxication, which is another name for many forms of indigestion or derangement of the processes of digestion.

It has been found when careful studies have been made that more people are suffering from intestinal-tract infection and auto-intoxication than is usually supposed, and we believe, if a careful investigation of the subject were made, it would be found that many people in our congested communities are suffering from this disturbance. When a person is suffering from impaired digestion, affected heart, a diseased condition of the kidneys, or a nervous breakdown, conditions which are often the result of auto-intoxication that person must naturally be in a much more susceptible condition toward other diseases. Moreover, the problem of the prevention of disease has only been partially solved when the infections of chlera infantum, dysentery and typhoid fever are broadly checked by modern sanitary measures. There still remains the more elusive task of preventing the recurrence of the severe chronic infections in the digestive tract. The acute infections like dysentery and typhoid are so numerous and obtrusive in their manifestations that it is impossible to overlook them, but chronic infections are obscure in their manifestations and seldom are found in epidemic form. Hence, they pass unnoticed. The injurious effects of the chronic infections are none the less real.

It is not the intention of the authors to ride a hobby or to insist upon a theory to the exclusion of other theories. We have had entirely too much of this in modern sanitation, but it seems wrong to assume that various morbid manifestations are inevitable or inherited. The effects of chronic poisoning of gastro-enteric origin are understood by few persons, for it must not be forgotten that in addition to reduced physical resistivity, these enterogenic intoxications of the nervous system may be extremely detrimental to character and contribute to complicate and mar the finer human relations. They entail a severe economic loss to the communities in which they occur through the partial failure of performance resulting from the reduced efficiency of the individual suffering therefrom.

It would seem that a proper regard for the inestimable benefits to be achieved by any process which will aid in the reduction of chronic intestinal-tract infections will add to the significance to be attached to the reduction in the general death rate following the introduction of such a process, and a proper regard for these infections will tend to minimize the tendency to over-value results achieved by such a process as shown by an individual study of the reduction in a specific disease, such as typhoid. The time has come when the sanitarian should judge of the value of a process, not by the reduction in the death rate along specific lines alone, but also by its effect on the general health tone of the community. A proper appreciation of the importance of the enterogenic intoxications will certainly tend to eliminate the preponderating value placed upon the prevention of epidemics, one might say almost to the exclusion of a consideration of deleterious endemic conditions.

NEW WORK FOR THE SANITARIAN

The sanitarian has been so eminently successful in the prevention of epidemics that he should now turn his attention to the chronic affections which so seriously impair the usefulness and comfort of a great portion of our population. It is chiefly for the purpose of focusing attention in this direction that this paper is presented, though the theory outlined suggests a rational explanation for the "Hazen Theorem."

[Following the original paper there was a lengthy table of "Bacteria of the Intestinal Tract," giving names, whether cultures or [illegible] and citing authorities; also a long list of references to books and articles on intestinal bacteria.—Ed.]

EDITORIALS

There is a story with a moral to it in the annual report of the Panama Railroad Co. just issued. It will be remembered that all the capital stock of this company is owned by the United States Government. The company's directors are all officers of the army or navy or connected with the Panama canal work. The report states:

A serious strike among marine firemen, oilers, water tenders, sailors and petty officers in New York Harbor developed about the close of the fiscal year, that threatened to completely tie up the Panama Railroad Steamship Line. As it was inadvisable that a Government-owned line employ strike-breakers, our ships were all manned for one round voyage by enlisted men from United States war vessels then in New York. Our sailing dates were thereby protected, serious loss to the company averted, and great inconvenience and discomfort to the officials and employees of the Commission and railroad on the Isthmus, through lack of communication and supplies, prevented.

It will be recalled that when the French nation was brought to a crisis by a strike of all the employees on the Government railways, the Government met the situation by ordering all the employees to undertake military service, and continue the railway operation as enlisted men.

More Discussion of the Status of the Engineering Profession

Evidence that the subject discussed in the leading editorial in our issue of Jan. 2, "The Status of the Engineering Profession," is uppermost in the minds of engineers holding high positions in the profession, as well as those in the lower ranks, is furnished by the remarkable discussion which took place at the December meeting of the American Institute of Consulting Engineers. The announced subject for the meeting, we believe, was the relations between the engineer and the contractor, but those who took part in the discussion devoted their chief attention to the broader subject, the status of the engineer.

The papers by Lewis B. Stillwell and Samuel Whinery, which were read at that meeting, were printed in our last week's issue, and have been read with interest, we doubt not, by a majority of our readers. When an engineer of the long experience and high standing of Mr. Whinery expresses the opinion that if certain present tendencies are allowed to continue unchecked, engineering as a profession will cease to exist, it is certainly time that engineers gave careful study to the conditions under which they are carrying on their work.

Similarly, when so eminent a consulting engineer as Mr. Stillwell asks the question in all seriousness whether the consulting engineer in a standardized industry is not a middleman who should be eliminated, there can be no doubt that the status of the engineering profession is a matter deserving grave consideration.

It is distinctly a hopeful sign, however, that these serious questions are being taken up in earnest by men at the head of the profession. It is to them that the younger engineers look, and properly look, for leadership and counsel. The extent of the dissatisfaction among the younger members of the profession, and in fact among men no longer young who are working under unsatisfactory conditions, is increasingly evident. The strong movement to bring about legislation restricting the practice of engineering is one evidence of the current dissatisfaction. Another hint as to the agitation which is going is furnished by a letter before us, received recently from a prominent engineer in the West. We quote from its contents as follows:

Engineers have labored hard for years to establish their standing as professional men, and today people understand that we are highly educated, and that we should be ranked as the equal in intelligence of physicians, surgeons, lawyers, ministers and editors. It has been a long, hard pull from the mechanic class to the position in which we now stand in the public mind, but recent events have alarmed me, and it looks as if we are soon to experience a severe shock.

I have been informed that within the past few weeks the American Federation of Labor has granted a charter to a civil engineers' union near New York, and is considering an application from a body of young engineering graduates in Chicago, who are organizing a similar union. Two young fellows have been in to see me about it and went out with their ears burning. They had the nerve to think I might join them and wanted me to be the first President.

These boys told me that if the unions are organized and a string can be formed across the country, they will insist upon all the plans and details bearing the union stamp; and if they do not, then union workmen will not do the work of manufacturing or erecting structures on which union engineers have not been employed as designers.

They say that no man objects to paying a dollar an hour to bricklayers who cannot read and write, but $75 per month is considered good pay for men who supervise the work of the bricklayers and are held responsible for the work being done right.

They say the engineering schools still advertise for students and send articles to daily papers telling of the high pay given to engineers, etc., so that thousands of boys go to engineering schools who would otherwise have learned a trade.

If to some engineers in active and successful practice, the formation of trade unions in engineering seems an impossibility, it may be well to reflect on the fact that other occupations in which executive ability and originality are both requisite have already been unionized. The strike of the reporters and sub-editors of New York City newspapers published in foreign languages during the present month is an illustration of the extent to which the trade-union movement has already been carried.

We shall not attempt, at this time, to discuss the proposition of transferring the engineering profession into a trade union. We may remark, however, that so far as the fixing of standard rates of fees for professional work is concerned, action of that sort has already been taken by some of the engineering societies composed of men of the highest standing in the profession. It is, perhaps, no very long step from such measures to the adoption of standard rates of compensation for employees working for salaries or wages in the drawing office, the shop, or the field. It is perhaps worth serious consideration whether some action of this sort might not be taken which would forestall any movement for organizing trade

unions among those working in various subordinate branches of engineering.

There is a great public need at the present day in all branches of industry for men who have the natural ability and technical training to be competent as leaders. We do not believe that the best apprenticeship for such leadership during the early years of work will be gained through membership in a trade union.

The Perils of Navigation on the Hudson Bay Route

Many of our readers will recall that immediately after the "Titanic" disaster last summer, we called attention to its significance as an object lesson with respect to the dangers of navigation on the proposed Hudson Bay route to Europe. We then showed in detail the perilous ice conditions which steamers attempting to enter Hudson Bay during the short period of navigation, from about the middle of July to the middle of September, must encounter. Not only is there danger from icebergs, but from heavy Arctic field ice and from fog, which is present over these far northern seas during a large part of the short summer.

Dangers of this sort are to be met much farther south, on the Canadian transatlantic route to St. Lawrence ports. A recent issue of the *Toronto Globe* says:

> L. C. Webster, a member of the Montreal Harbor Commission, addressing the Toronto Canadian Club a few days ago, told his audience that the insurance charges on line steamships navigating the St. Lawrence are very much higher than those on ocean steamships resorting to United States ports, and that the rates imposed on tramp steamships are higher still, so much so that these vessels have been driven entirely off the route.

The *Globe* urges the establishment of a Canadian marine-insurance company and a better system of pilotting for the St. Lawrence. The latter is very likely needed; but the fact cannot be denied that there are many dangers in navigating the ocean route terminating in the Gulf of St. Lawrence, and that these dangers must necessarily be represented by increased rates of insurance. If one were to plot upon a chart the marine disasters which have occurred during the past dozen years along and near the St. Lawrence route, the showing would not be encouraging to those who argue for lower rates of insurance there.*

But if marine-insurance rates are so high as to divert tramp steamships from the St. Lawrence route to United States ports, what rate would marine underwriters fix to compensate them for the risks to tramp steamships which should attempt to enter Hudson Bay to take part in the [illegible] during the few weeks of the year when navigation is possible?

We have just received the report of the Department of Naval Service of the Canadian Government for the last fiscal year, and find in it a notable account of the work of the marine survey on Hudson Bay and Strait.

The vessel employed for the survey of the Canadian Government service was the "Minto," with two schooners and the sailing vessel "Beatrice" [illegible] Nova Scotia on July 10, 1911, to go up the coast of Labrador and pass through Hudson Strait to Port Nelson and Port Churchill, in the southern part of Hudson Bay. The account of the voyage reads much more like the story of Peary's voyage in the "Roosevelt," in search of the North Pole, than like the log of any voyage for commercial purposes.

The vessels proceeded up the Labrador coast, experiencing much fog and heavy weather, and passing many scattered icebergs. On July 25, about 25 miles off Cape Mugford, Labrador, in lat. 58°, the vessels encountered field ice in such quantities that the captain of the "Beatrice" refused to proceed and finally turned back, leaving the "Minto" with the two schooners to go on alone. We quote extracts from the report as follows:

> It is impossible to state how far this ice extended off shore, but from aloft no clear water could be seen ahead or to the eastward. . . . . During the following night a field of very heavy Arctic ice was encountered and we lay to until daylight, not caring to risk entering it. On July 27, we were off Cape Chidley. At 4:30 a.m., the tow line was parted by fouling a large pan of ice, although the "Minto" was speeding very slowly. . . . . At 4 a.m., on July 26, we entered another flow of Arctic ice, probably from Gabriel Strait. On clearing this ice the speed was increased about 8 knots until noon. This also proved to be Arctic ice, some very large pans closely packed together in places. Fair leads could be picked out from the masthead, but there was no clear water visible. At about 1:30 p.m. we glanced off a large pan, which it was impossible to avoid and the starboard anchor caught, tearing away the hawsepipe and considerably damaging the plates nearby. On examination it was found that the hawsepipe was completely shattered and must be removed. An old iron door was used for a patch, the most was made of everything available. At this time one of the schooners was reported to be damaged and taking water fast. The fore foot had been carried away by ice. The schooner was brought alongside and cleared of water by steam pumps. A spare foresail was then stretched under the bow and drawn up as tightly as possible on either side when quantities of ashes were thrown into the sail from the "Minto" and the suction produced by the leak almost stopped it in a few hours. This was most satisfactory, as the situation began to look serious. The engineers worked all day at repairs. The ship drifted about 12 miles to the northwest in 24 hours and we were surrounded again by Arctic ice in very large pans, and in fact small icebergs.
>
> Monday, July 31 heavy ice was drifting past. The crew was engaged in trimming coal aft to bring the ship up as much as possible in better shape for the ice. Aug. 1 the damaged schooner was beached in Wakeham Bay and the damage was repaired as well as possible with the tools and material at hand.
>
> On Aug. 3, about midnight, we ran into a field of Arctic ice, which had come down from Fox Channel. The weather was very thick and the ice closely packed so we made fast to a large pan, as it was impossible to pick out any leads through which we might make a safe passage. On Aug. 4, the fog was very dense and we were hove to all day, not considering



TWO SCHOONERS OF THE CANADIAN GOVERNMENT HUDSON BAY SURVEY EXPEDITION IN HUDSON STRAITS. JULY 28, 1911

*[illegible]

it safe to make a move under the conditions. At sundown, the fog lifted, we were lucky enough to completely clear the ice before the fog closed in again. This was the last ice met with, for which I was very thankful. We arrived at Port Churchill on Aug. 7. While crossing Hudson Bay the weather was fine, but foggy.

This is the official report to the Canadian Government describing the seas through which vessels will have to pass if the commercial navigation of the Hudson Bay route is ever to take place. The perils of such navigation to such small vessels as engage in whaling, fishing or Government explorations in these latitudes are evident enough; but the peril would be even greater to the far larger vessels which would be required if grain were to be carried to Europe by this route in the quantities necessary to justify the building of the Hudson Bay Ry.

And as we have shown above, this peril, measured in dollars and cents by the marine underwriters in the form of insurance would inevitably be so heavy as to more than offset the claimed commercial advantages of the Hudson Bay route, on the strength of which the Canadian Government is attempting to build the Hudson Bay Ry.

❖

Overloading the Interstate Commerce Commission

Everybody knows that in carrying on any industry, if a workman is given more to do than he can perform in a given time, he must slight some of the work. The same thing is true of the man higher up, all along the scale from foreman to president. If a man is given a larger number of responsibilities than he can properly discharge, he will have to slight some of them. One of the reasons why many of the great industrial combinations are breaking down and failing to obtain the efficient and economic operation which was prophesied for them when they were organized, is that the task of looking after all the varied activities of such a huge affair proves too great for the capacity of even extraordinary men.

Everybody recognizes, as we have said, this situation in private business; but when it comes to public business our lawmakers have the habit of loading a public official with responsibilities without a thought as to whether he has any spare time which he can give to these new tasks. Mayors of cities and governors of states are placed on all sorts of boards and commissions *ex-officio* until they would require 49 days in each week, instead of 7, were they to really discharge all these duties in something more than a perfunctory way.

About the most glaring example at the present time of this tendency to overload public officials is found in the Interstate Commerce Commission. This body of seven men, according to its annual report just issued, received during the past year 6550 complaints of informal nature which had to be taken up with carriers by correspondence and an adjustment reached if possible. It received 6009 applications from carriers for leave to refund to patrons money collected in accordance with tariffs which for one reason or another were unlawful. It received nearly 2000 applications for relief from provisions of the fourth section of the Act. There were 189 proceedings instituted before the Commission to suspend the operation of tariffs which had been filed but had not taken effect. There were 755 formal complaints filed with the Commission during the year. The Commission conducted during the year 1154 hearings, at which about 125,000 pages of testimony were taken. The Commission has of its own motion undertaken investigation of the rates of express companies, and it has now in progress investigation on substitution of tonnage in transit, allowances for terminal railroads, weighing of freight, issuing of passes, bills of lading, private cars, rates on anthracite coal, etc. The Commission conducts a tariff bureau with which 108,000 tariff publications were filed during the year. The Commission has charge of suits brought for infringement of the Interstate Commerce law, under which 93 indictments were returned during the year, and many pages of its annual report are devoted to a review of various litigation in which the Commission is taking an interest as representing the public.

Uniform systems of accounts for railways, electric railways, express companies, pipe lines, sleeping-car companies, telephone, telegraph and cable companies, water carriers and gas and electric corporations have been prepared by the Commission. The Commission carries on examinations of accounts of the various concerns under its jurisdiction, and undertakes disciplinary measures where its system of uniform accounts is not followed. The Commission further collects the statistics of the railways of the United States, has charge of the investigation of railway accidents, the enforcement of the laws relating to safety appliances, the use of locomotive ash pans, the hours of service of employees, and the inspection of locomotive boilers.

It will be admitted, without question, that these responsibilities are quite enough to lay upon the shoulders of any seven men, no matter how great their capabilities for work. The end, however, is not yet. Congress, in its anxiety to regulate every act of the railways from least to greatest, has acquired the habit of tacking on to each new proposed law a section placing responsibility for its enforcement upon the Interstate Commerce Commission. For example, the Adamson Bill, which passed the House of Representatives on Dec. 5 and is now before the Senate, requires the Commission to undertake the valuation of the property of all the railways of the United States, by means of an inventory "to be made by such engineers, experts and other assistants as may be necessary." Another bill now pending in the House of Representatives forbids the use on any railway, after Jan. 1, 1915, of any car in passenger service "not made of steel with vestibule platforms and all modern appliances," whatever the latter may mean. The Interstate Commerce Commission is to be charged with the enforcement of this law and is given authority to suspend its enforcement in cases where it may deem wise. Another pending bill requires all common carriers to equip their locomotives with headlights "of not less than 1500 candlepower, measured without the aid of a reflector." The Interstate Commerce Commission is likewise given authority to enforce and suspend the operation of this law in its discretion. A resolution, introduced into the House on Dec. 10, requests the Commission" to investigate the management of repair shops of railroads throughout the United States in respect to their efficiency in all their branches, and report its finding to the House." The same resolution also orders the Commission "to investigate the management of railroads in the United States with respect to car shortages and car storages and the manner of manipulation of the same."

These are but samples of the many schemes now under

consideration by would-be reformers in Congress and elsewhere, which propose to further increase the burdens and responsibilities laid upon the Interstate Commerce Commission. As we remarked above, when a man or set of men is overloaded with responsibilities, some of his work must suffer. The Interstate Commerce Commission already has laid upon it a far greater amount of work than it can efficiently perform.

It is not the personal welfare of the members of the Interstate Commerce Commission that makes its overloading a matter of greatest importance. We as a nation have embarked on the largest experiment ever undertaken in Governmental regulation of public utilities. It is important that this experiment shall succeed; for if it does not succeed, indications multiply that we shall be driven to the far more radical experiment of Government ownership and operation.

But in order that Governmental regulation shall succeed, it must be governed by the same business principles that control the administration of any private business. It is just as necessary that the Interstate Commerce Commission shall do efficient work as it is that efficiency shall prevail in the railway repair shops; and neither the Commission nor the repair shop can operate with good efficiency when congested with work beyond their capacity.

LETTERS TO THE EDITOR

The Cape Cod Canal

Sir—In your issue of Jan. 9, 1913, in the article on the Cape Cod Canal, I find this statement,

> From Buzzards Bay the passage into Long Island Sound is easy and can be made in all kinds of weather without danger.

It is a well known fact that Point Judith, R. I., is a terror to coastwise shipping. Between 1880 and 1903 there were 1016 marine disasters on the Atlantic coast between Cape Cod and Long Island Sound, 458 of which occurred between the entrance to Buzzards Bay and the eastern entrance to Long Island Sound.

The Cape Cod Canal will save the trip around Cape Cod, but "in all kinds of weather" the trip around "Pint Jude" is anything but pleasant and is not "without danger."

RALPH F. RHODES.

Newport, R. I.,
Jan. 10, 1913.

[We are aware that rough seas are often met with around Point Judith, which not infrequently give serious trouble to navigators of barges and schooners. What the writer had in mind was vessels of a more seaworthy type, which can go around Point Judith in safety, when rounding Cape Cod would be highly dangerous.—ED.]

Effect of Moisture on the Strength of Concrete

Sir—Referring to the letter on "Effect of Moisture on the Strength of Concrete," in ENGINEERING NEWS, Jan. 16, 1913, p. 127, I wish to state that I have received permission from some experts to make public some bare facts relating to experiments performed by me in 1908. This communication is read by them and approved before being sent to you and I am grateful that this much is permitted.

We made a number of blocks of concrete from one batch. They were in the form of cubes 2 in. thick, with embedded bars. In some blocks the bars were round and smooth and in others they were square and twisted. One-third of the slabs were placed in the roof of a small shed where the interior was never wet and where the temperature was practically that of any unheated building with thin walls of boards, with cracks between. One-third of the slabs were placed in a room where they were never wet and where the temperature possibly was never less than 125° F., generally somewhat higher. One-third were suspended in water. The steel projected only from one end and the slabs were suspended by wires attached to the projecting ends of the steel.

Pulling tests were made at the end of 3, 6, 9, 12, and 18 months. Further details I am not permitted to give but the conclusions reached were as follows:

1st. Deformed bars of almost any type are preferable to plain bars when same are not bent at the ends or are not supplied with plates or other means for mechanical anchorage. I have never used plain bars since that time in my designs.

2nd. Concrete constantly exposed to a drying action shows much less bend, or adhesion, than concrete placed where it is alternately wet and dry. Concrete floors should be frequently scrubbed and concrete ceilings can be sprinkled with advantage from time to time. If a coat of watertight paint is applied to a ceiling, then the floor above should be wet often to keep the concrete from becoming too dry. A practice lately mentioned of putting steam pipes in concrete floors should be condemned.

3rd. The adhesion of concrete to steel is weakened by continued submergence and the use of high stresses (especially high bond stresses) in thin reservoir and tank walls is not good practice.

4th. Concrete used for reinforced-concrete tank walls should be of the very best and hardest stone procurable.

I hope some professor of engineering will duplicate the foregoing described tests in the college laboratory and make the results public.

ERNEST MCCULLOUGH.

Monadnock Block, Chicago, Ill., Jan. 18, 1913.

Bituminous Filler vs. Cement Grout for Brick Pavements

Sir—In an editorial comment on my letter published in your issue of Dec. 26, 1912, you state that the "Association of Paving Brick Manufacturers is emphatic in its preference for a grout filler for brick-block pavement and

requires the use of grout in its standard specifications." A leaflet recently published by the Western Association of Paving Brick Manufacturers has caused some question in my mind as to whether this preference is as emphatic as your comment would indicate. The leaflet describes a new form of brick-block pavement which will be placed on the market this coming year and which is especially adapted to bituminous filler. The block is to be wire cut and not repressed, 3x4x8½ in. in size, laid with a 4x8½-in. face up. This block has square horizontal edges, although the vertical edges are slightly rounded and lugs are formed by the die on one longitudinal face. After laying and rolling, the brick are to receive a coat of bituminous filler squeezed into all joints and enough left on the surface to form a coating about ⅜ in. thick, after being properly sanded. The rough wire-cut surface offers a good chance for bond between the filler and the brick. The blocks are to be made of the same quality of shale and the same degree of vitrifaction as the present brick block.

The advantages gained are decrease in cost of manufacture, a decrease in the number of brick and brick material per square yard of pavement, the elimination of expansion troubles and a smooth, noiseless, nonslippery pavement. It is, of course, possible to use a cement-grout filler with these brick but in that case, some of the above advantages would not obtain. In all fairness it must be said that both the bituminous and cement-grout filler have objections but those to the cement are inherent in the grout while the chief objection to pitch filler may be overcome, I believe, by changing the present form of block. In theory, cement grout has many good qualities, but in practical application to the paving on a busy street in a large city, where the weather and traffic conditions, the expansion, cuts for service pipes and conduits, street-railway traffic, etc., annul a great many of these advantages.

I believe the majority of municipal engineers and the brick manufacturers as well are not entirely satisfied with the cement-grouted brick pavement as it has been possible to lay it and it seems to me that this new form of brick with a bituminous filler has wonderful possibilities.

CLARK R. MANDIGO, Asst. City Engineer.

Kansas City, Mo., Jan. 10, 1913.

Internal Water-Pressure in Hollow Dams

Sir—In Mr. Bilderbeck's recent article on "Protection for Hollow Reinforced Concrete Dams" (Nov. 21, 1912, p. 948), some rather strange statements are made about the effect of holes in the upstream deck.

Let us investigate his section of a triangle 40 ft. wide, 20 ft. high, withstanding a head of 30 ft. (Fig. 1 herewith). As a rough approximation, assume the masonry to weigh 30,000 lb. per lin.ft. The horizontal thrust of the water is 25,000 lb., the weight of water above the dam is 25,000 lb., giving W_1 = 35,000 lb. and a resultant R_1 of 60,000 lb. at a slope of 1 in 2.2.

When a large hole is broken in the upstream deck (Fig. 2), the horizontal thrust remains at 25,000 lb., but the weight of water above the base becomes 50,000 lb., giving W_2 = 56,000 lb. and resultant R_2 = 84,000 lb. at a slope of 1 in 3.2. The hole is a decided improvement. It is assumed, of course, that the dam was designed with an eye to possible large holes and properly reinforced.

Now let us examine the effect of uplift. Despite the apparent perfection of the latest cut-off scheme, water pressure under the dam is not at all impossible. Perhaps the drains become plugged, perhaps an inclined porous layer leads underneath the trench up to the center of the base. Assume an uplift head of 15 ft. acting over the central 20 ft. and decreasing to zero at either end, a force of 28,000 lb. In Fig. 1, the water pressure becomes W_3 = 25,000 lb. and the resultant R_3 = 37,000 lb. at a slope of 1 in 1.1. In Fig. 2, the water pressure is W_4 = 32,000 lb., with a resultant R_4 = 58,000 lb. at a slope of 1 in 2.1.

Thus it appears that, far from being a source of danger, the large hole was really an act of Divine Providence to save the dam from sliding.

Now having discovered the value of an occasional hole, the next step is to remove the upstream deck altogether,

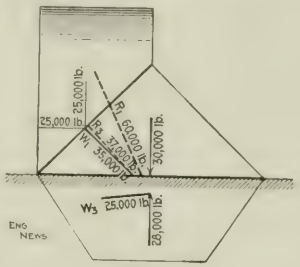


FIG. 1

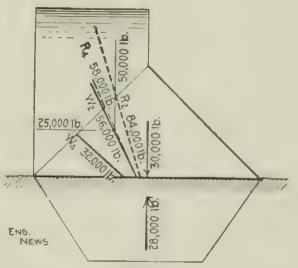


FIG. 2

or, in cold countries, all below the ice line. Such a dam would be stronger than one of the hollow empty type and its additional safety would cost nothing, as the saving in deck would pay for the steel required in the buttresses and base.

D. STAIRS.

Care of The Acadia Sugar Refining Co., Ltd.

Halifax, N. S., Nov. 29, 1912.

[Mr. Bilderbeck replies to these comments as follows]:

Sir—Referring to the above letter, there seems to be a disagreement due, I believe, to a misunderstanding.

The statement made in the writer's article of Nov. 21, 1912, relative to the effect of breaking a large hole in the upstream face of a dam is as follows:

Now suppose the upstream slab breaks, so as to fill the enclosure with water, an upward hydrostatic pressure will exist on the downstream slab of 25,000 lb., and the sliding pressure will be the same as in normal conditions.

Mr. Stairs deducts this 25,000 lb. upward pressure from the total weight of the water on the base slab. The pressure on the base slab has nothing whatever to do with the failure of the downstream slab due to the pressure on it as this dam is ordinarily constructed. To prevent possible failure the downstream slab would have to be designed for the same loads as the opposite side, with additional means of clamping the slab to the buttresses. In practice this is not done, and if it were the cost would be in many cases prohibitive.

A large percent of the concrete dams of the above type have weep-holes in the bottom slab to lessen the possibility of upward pressure on the bottom of the slab. In dams of this type, water in the enclosure would reach the bottom of the base slab, equalize its own weight on the top of the slab, and cause the structure to overturn or float out of place.

In the article of Nov. 21 mention was made only of the dams as they are being built, and as is practicable to build them. It is granted without argument that a hollow structure could be built that would withstand all possible conditions with a large factor of safety. However, there are three conditions that would determine the efficiency of a design: utility, safety, and cost. Any one or two of the three must not be developed regardless of the others.

Referring to the infiltration chamber mentioned, attention is invited to the fact that when the material forming the foundation under a dam is so impervious that only small veins of water reach the bottom of the slab there will be no danger of a pressure being distributed over a distance of 20 ft. as assumed. If it spreads 20 ft. between the slab and its foundation under the pressure assumed, why not 5 or 6 more and reach a condition of no pressure?

The upstream slab of the dam could be omitted, in part at least, as suggested, but it is thought the difficulties of safe construction would more than offset the advantages. It would be as necesary to prevent the upward pressure on the bottom of the base slab as in any type of dam. It would be as advisable to prevent the impact being carried directly into the masonry as in the general type of dam. All the suggested improvements mentioned in the article of Nov. 21 would be needed in this type of dam as much as in any.

The writer wishes to thank Mr. Stairs for his opinion on hollow concrete dams, not, however, for the acrimony in his manner of stating the opinion, but in spite of it.

G. L. Bilderbeck, Ass't Engineer,
Conn. Rivers, Harbor, and Bridges Commission.
New London, Conn., Jan. 13, 1913.

NOTES AND QUERIES

Duluth Ore Docks. In the description of the steel ore [illegible] on page 15 of our issue of [illegible] was given as Detroit. This should have been Duluth. Miss Mc Dockerty [illegible] Assistant Engineer of the Duluth & Iron Range R.R. In regard to the ore dock of the Great Northern [illegible] on page 11 of the same issue it is [illegible] that it will be considered rather as a plain concrete structure [illegible] concrete pockets [illegible] the pockets of this dock are of steel, while in the ore dock of the Lake Superior & Ishpeming R.R. (page 9 of the same issue) these parts are of reinforced concrete, formed integrally with the supporting columns.

Annual Convention of the American Wood Preservers Association

The ninth annual convention was held Jan. 21 to 23 at the Sherman Hotel, Chicago. The attendance was larger than usual, and the character of the proceedings indicated a growing recognition of the importance of the association and its work. At the morning meeting on Jan. 21, the President, E. A. Sterling (Philadelphia), read the annual presidential address, reviewing some of the activities and possibilities of the association. The report of the Secretary, E. J. Angier (Baltimore), showed a cash balance of $1124 and a membership of 177, both figures representing a marked advance over the previous year. It referred also to the present practice of the association in sending out bulletins containing notes of articles published in the technical and trade papers which relate to timber and timber preservation. An amusing but instructive address of welcome was delivered by Bolling A. Johnson (Editor of the *Lumber World Review*), who pointed out that lumber men in general are beginning to recognize the practical relation of wood-preservation to the lumber industry. He thought that the trade papers could help this by publishing more information in regard to wood preserving. Mr. Johnson also voiced a warning to the effect that many lumbermen regard the association as too scientific or technical to affect the commercial side of the question, and stated that the manager of one preservation plant said he did not intend to attend the meeting, as it would be composed only of "a lot of high-brows." The association should seek to correct such ideas, and the more publicity it gives to its work the better it will be for the association itself, for the wood-preserving industry, for timber conservation, and for the lumber trade in general.

The officers elected for 1913 are as follows: President, A. E. Larkin (Republic Creosoting Co.), Minneapolis, Minn.; Vice-President, J. H. Waterman (C., B. & Q. R.R.), Galesburg, Ill.; E. B. Fulks (American Creosoting Co.), Louisville, Ky., and Geo. E. Rex (A., T. & S. F. R.R.), Topeka, Kan.; Secretary and Treasurer, F. J. Angier, B. & O. R.R., Baltimore, Md. The next meeting will be held at New Orleans, La., in January, 1914.

Wood-Block Paving

A paper on "Timber for Creosoted Block Paving," by H. G. Davis (Chicago), discussed the suitability and comparative merits of different woods available in the central states, and suggested that tamarack, hemlock and maple are quite as good as the long-leaf yellow pine, which is so generally assumed to be superior to any other. We shall publish an abstract of this paper in a later issue. A paper on "Yellow-Pine Block Pavement," by H. L. Collier (St. Louis), presented this as best meeting requirements as to sanitation, efficiency, economy and durability. He suggested, however, that special care should be taken in making the concrete base, and preferred a mortar bed (1:3) to a sand bed for the blocks. The mortar should be mixed and laid dry, struck off with a

template and then sprinkled just in advance of the pavers. A still better plan is to use a coating of hot pitch or asphalt mixed with 10% (by weight) of portland cement. At the curbs there should be expansion joints 1 in. or 1½ in. wide for 30- or 50-ft. streets. As to the timber, he considered that sap-wood and heart-wood when treated have equal wearing properties, and that specifying a certain percentage of heart-wood only serves to add to the cost. The methods of constructing the curbing and concrete base and laying the paving was described in a paper on "Laying Wood-Block Pavement," by H. S. Loud (New York). He pointed out that a sand bed gives a real cushion effect, but advocated a mortar bed on grades, especially on street-car tracks. In foreign practice, however, the concrete base is finished to a smooth surface and the blocks are laid directly upon it. As to the timber, he stated that long-leaf yellow pine and southern black gum have been standard for streets of heavy traffic; tamarack and Norway pine have been used in the West, and North Carolina pine is coming into favor in the East for streets of moderate traffic and with heavy grades. This last wears uniformly and permits crushed stone to be rolled into the surface, making it less slippery than long-leaf pine.

Zinc-chloride, Creosote Oil and Crude Oil

A paper on "Comparison of Zinc-Chloride and Creosote," by Howard F. Weiss, showed a decrease in the number of ties treated annually with zinc-chloride and an increase in those treated with creosote, for the five years 1907-1911. His conclusions were as follows: 1, both are effective and there is little choice as far as annual charges are concerned; 2, creosoted ties generally cost more than burnettised ties, the cost of treatment being two or three times as great; 3, creosoted ties average a longer life, and therefore require less frequent renewals and disturbance of the roadbed; 4, if the price of creosote advances it may result in stimulating the use of the zinc-chloride process. Mr. Goltra, in a lengthy discussion, stated that the real reason for the increase of creosoting has been the exploitation of the empty-cell process for which so much has been claimed, and which is being used extensively. Of the 16,510,700 ties creosoted in 1911, he estimated that 14,000,000 were treated by this empty-cell process, the ultimate value of which is questioned. Mr. Waterman stated that 550 burnettised red-oak ties laid in 1900, gave 12 years service, and on inspection in 1912 only 18 had to be removed on account of decay. Of burnettised pine ties on 15 miles of railway in Colorado, 97% gave 12 years service. These had tie-plates only on curves, while all the oak ties had tie-plates. Both lines carry heavy traffic and very heavy engines. He considered that 50% of the ties would give 20 years service. Mr. Buehler thought that creosoting plants in this country do work as good as that of any foreign plants, and that our creosoted ties would show as long a life if equally well protected and watched. Mr. Goltra had argued in favor of crude oil as a preservative, and referred to the long life of oil-soaked timbers in the oil fields. It was pointed out, however, that to lay ties in track is a very different matter. Mr. Buehler mentioned a case where ties in a siding were kept soaked with oil dripping from cars. But as soon as this siding ceased to be used for tank cars, the ties began to show signs of decay.

Two papers related specifically to coal-tar creosote. One of these, by L. B. Shipley, was a review of some laboratory tests on: 1, the distillation of oils; 2, the comparative volatility of oils, and 3, the extraction of oils from treated wood. Other tests to be conducted include: 4, the volatilization of oil from treated wood; 5, the leaching of oil from treated wood, and 6, the antiseptic values of different oils. The second paper, by E. A. Sterling, dealt with the production and supply of creosote oil, and showed that only a small proportion of the necessary supply is of home production, for the reason that creosote is not made to meet the demand, but is a resultant from distillation carried on to recover by-products. Of 78,000,000 gal. consumed in this country in 1912, 75% was imported. In view of the commercial conditions, other preservatives should receive careful consideration; these might include, crude-oil, water-gas creosote, and refined tar in combination with creosote. It would be profitable also to study the methods of treatment, and eliminate a heavy impregnation where (on account of mechanical wear or other causes) a lighter treatment would suffice. In a paper on "The Preliminary Treatment of Timber to Insure Satisfactory Impregnation with Creosote," David Allerton suggested a difficulty in raising the temperature to the required height in the interior of large sticks.

Miscellaneous

In a paper on "The Requirements of Successful Timber Treatment," Herman von Schrenk said the requirements were: 1, sound timber; 2, proper seasoning; 3, good preservative; 4, proper injection; 5, proper handling of the treated material. He protested against the tendency to conduct the treatment in accordance with any demands which may be made by the customer, as this results in dissatisfaction which reacts on the entire industry. Two papers dealt with the treatment of Douglas fir, and two more with treatment of wood for floors and freight cars. For freight-car floors, where the effect of mechanical wear is greater than that of decay, a zinc-chloride or light creosote treatment was considered more advisable than heavy creosoting. The use of machines for boring and adzing ties was discussed in a paper by J. A. Lounsbury (Rockford, Ill.), referring to machines of a class described in Engineering News of Oct. 19, 1911. The piecework system of handling ties and timbers at treating plants was advocated by W. W. Eldridge (C., B. & Q. R.R.), and A. M. Smith (Argenta, Ark.) stated that he had found no machines so satisfactory as hand labor. In a paper on "Sap in Relation to the Properties of Wood," S. J. Record explained that there is more sap in growing wood in winter than in summer, contrary to common opinion. In the discussion on this paper, Mr. Weiss referred to a number of prejudices against certain woods which investigation has proved to be unfounded: 1, wood cut in summer does not contain more water than winter-cut wood, but the reason it is more liable to decay is that the wood pores or cells are more open, and the conditions for fungus growth are more favorable; 2, wood is not weakened by sap stains or by the soda-dip to prevent these stains; 3, wood turpentine (distilled) is not inferior to gum-turpentine; 4, bleeding for turpentine does not weaken the timber; 5, red-hickory is not a useless timber, and as a result of investigation it has been used extensively for pick-handles.

Recent Development of Gas Power in Europe*

By H. J. Freyn†

SYNOPSIS—A notable summary of European progress in gas and oil engines was a feature of the recent annual meeting of the American Society of Mechanical Engineers. The retiring Chairman of the Gas Power Section of the Society, Mr. H. J. Freyn, Consulting Engineer of the Allis-Chalmers Co., spent several months abroad last year studying European practice in gas- and oil-engine design. His address summarized the results of his studies, and makes clear the extent to which gas and oil engines have supplanted the steam engine on the Continent of Europe.

The development of the internal-combustion engine in Europe during the last year has been very marked and great strides were made, especially by the Diesel engine. The unparalleled progress of this prime mover, due primarily to the expiration of the basic Diesel patents, created a wave of enthusiasm, the crest of which swept Europe only a short time ago. To the careful observer, however, signs of an ebbing of this wave are apparent and more sober, more healthy views are gaining ground.

OIL ENGINES

LARGE DIESEL ENGINES—Without desiring to detract from the importance of the Diesel engine, investigation has proved to me that my warning against over-enthusiasm sounded about a year ago on a similar occasion was fully warranted.

In particular, I was disappointed to find that the achievements with large Diesel engines, above 1000 hp., do not altogether coincide with the optimistic reports which have appeared in the technical press of the world during the past year or two. It is not certain that the large Diesel engine will be an undisputed commercial success abroad, since the price of natural fuel oils is steadily increasing, thus largely limiting such engines to the use of tar oil.

The horizontal double-acting four-cycle M. A. N. Diesel engine in twin tandem arrangement of 1600-2000 b.hp., which I had the privilege of examining at Halle, a. S., is a splendid piece of machinery and operates apparently very satisfactorily on tar oil with a small addition of ignition oil. It is claimed that such an engine can be sold in Germany for from $30 to $32.50 per horsepower, against $35 per horsepower for a steam plant. It would be expected, however, that the repair and maintenance cost would be much higher than for a steam plant and even higher than for present gas engines, on account of the high pressures and temperatures which are essential with the Diesel working principle and because of carbonization at partial loads which can be prevented only by scrupulous cleanliness. In countries where the price of coal is high, this engine type may have some importance, and a number of such engines of even larger unit capacity than mentioned have been sold in France and Russia, where fuel conditions are favorable for this type.

SMALL AND MEDIUM SIZED DIESEL ENGINES—The Diesel engine in sizes of from 40 or 50 hp. in single-cylinder units up to about 600 hp. in four-cylinder units plays a vastly more important part abroad. It has unquestionably come to [illegible] which places [illegible] the corresponding steam or gasoline plant as far as reliability and cost of operation are concerned and far ahead of its competitor from the standpoint of fuel economy. It is amazing to note how many manufacturers of gas and steam engines abroad have taken up the manufacture of Diesel engines, because they found that the sale of suction gas-producer plants and smaller steam engines had fallen off alarmingly during the last few years.

[illegible] In general, the single-cylinder Diesel engine has not functioned the former, as compared to [illegible] and operation, especially owing to [illegible] It is certain that, generally speaking, complication of any mechanical contrivance increases with increasing efficiency. This engine is always ready to be put in service at a moment's notice and has no standby losses; it does not require upkeep and attendance of boilers or gas producers and its cost compared with that of steam or gas plant is reasonable. It can be installed in the basements of buildings below occupied dwellings, whereas in Europe boilers are not permitted in such places. One of the greatest advantages which cannot easily be expressed in figures, but is of vast importance to the consumer, is the fact that the actual fuel consumption of Diesel engines, taken over long periods of operation, does not materially exceed the guaranteed figures, whereas in gas-producer and steam plants this excess is quite considerable. A few months ago a German technical periodical contained an article showing that the actual fuel consumption during a period of one whole year was for certain Diesel engine plants only 14 per cent. higher than the guaranteed figures given by the manufacturer, whereas it averaged 120 per cent. more in high-class steam locomobile plants. In this comparison 27 installations containing units of 50 to 80 hp. were investigated, 12 of which were locomobile plants, whereas 15 contained Diesel engines. In a Diesel plant the human element, the skill of the operator must have much less influence upon the fuel economy than in a steam or producer-gas plant where everything depends upon the efficiency and intelligence of fireman and producer attendant.

While the Diesel engine is originally a vertical engine, the last two or three years have witnessed a remarkable development of the horizontal Diesel engine. With few exceptions the manufacturers of vertical Diesel engines have branched out to build horizontal engines as well for purely commercial reasons. Experience shows that the fuel consumption is only very little, if any, higher than that of vertical engines, but the horizontal type is decidedly preferred by the customer, not only on account of its lower cost, but particularly owing to its greater simplicity and better accessibility. Especially the horizontal Diesel engine with Lietzenmayer's open fuel injection nozzle offers these advantages in their full measure. The open nozzle is simpler, can be easier taken care of by unskilled attendants, gives better results when burning heavy oils and is less sensitive in its action than the so called closed injection nozzle of the original Diesel engine. The horizontal open-nozzle oil engine has the additional advantage that certain essential accessories, such as the starting gear and the fuel pump, can be designed much simpler than for the other type. Many engines of the former type are in very successful service, using all kinds of fuels and installed for various purposes, for instance, for power transmission, for operating flour mills, for lighting factories, sanitariums, office buildings, department stores and for electricity works.

The only difficulty of which some users of small and medium Diesel engines sometimes still complain is caused by the discharge valves of the air compressors for fuel injection, and although these difficulties have been greatly reduced, numerous efforts are being made to materialize the dream of the "compressorless" Diesel engine. I had the privilege of seeing a 12-hp. experimental engine of this type in operation, which seemed to give good results, since an oil consumption of only 0.48 to 0.5 lb. per b.hp.-hour is claimed, but it is not certain that this principle, which has been tried many times before, would be applicable for larger engines.

MARINE ENGINES OF THE DIESEL TYPE—In view of the great importance of the Diesel engine for ship propulsion, there is little wonder that great effort is directed by many manufacturers to the design and construction of an engine which, while having nearly the same excellent fuel economy as the stationary engine, will also meet the severe requirements of simplicity, reliability and reduced first cost. That the last condition is not yet fulfilled is shown by the fact that, according to authentic information, the cost of an 800-hp., four-cylinder, two-cycle marine engine recently built was 50% higher than anticipated and 150% higher than for a corresponding steam-engine equipment. I was nowhere able to find the 10,000- and 15,000-hp. Diesel-engine ships of which I had read, and even enthusiasts do not believe that our modern leviathans will be propelled by Diesel engines.

The largest single Diesel-engine unit propelling any ship afloat develops not over 2000 hp., and there still remain many obstacles to be overcome before the single-acting multicylinder, four- or two-cycle Diesel engine on board ship is supplanted by the double-acting engine. Vertical engines

*Presidential address at the Annual Meeting of the Gas Power Section of the American Society of Mechanical Engineers.

†Consulting Engineer, Allis-Chalmers Co., West Allis, Wis.

of the latter type are still in the experimental stage, and their future does not appear very promising on account of the serious mechanical complications of scavenging pumps and multiplicity of scavenging valves in each cylinder head.

The lack of simplicity in these designs has prompted experiments with the so called "valveless" two-cycle type, which presumably will become the large marine Diesel engine of the future. One valveless two-cycle experimental engine of 260 hp. is claimed to have shown an economy as good as that of a regular two-cycle engine with scavenging valves. The mean effective pressure obtained reached 125 lb. per sq.in., which is truly remarkable in view of the extremely simple scavenging method employed.

THE JUNKERS OIL ENGINE—Among the valveless, two-cycle engines, the Junkers oil engine has attracted a great deal of attention. It has reciprocal pistons, a three-throw crankshaft, and differs essentially from the regular type. An advantage is the excellence of the form of combustion space which, from a thermodynamic point of view, at least, gives it the distinction of being the best oil engine. Practical experience alone will tell whether its unusual design and certain mechanical disadvantages will be offset by this advantageous feature. One of the foremost authorities in Europe very graphically characterized the Junkers engine as an oil engine built around a given perfect combustion chamber in contradistinction to all other Diesel engines where it is attempted to provide a satisfactory combustion space in an existing engine. Only a few smaller engines, mostly for marine propulsion and of the twin- or three-cylinder vertical type have been built abroad. The tandem arrangement of cylinders which results in the same number of crank efforts realized in ordinary single-cylinder, double-acting, two-cycle engines has so far been applied only on two 800-hp. three-cylinder vertical engines to be fitted in a vessel of one of the largest steamship companies. Aside of two experimental engines in Prof. Junkers' famous laboratory, no horizontal engines of this type have been built and opinions abroad are much divided concerning the future of the stationary, horizontal, tandem Junkers engine.

CONDITIONS AFFECTING THE DEVELOPMENT OF THE DIESEL ENGINE—If conditions in Europe are not altogether favorable for the development of the large Diesel engine, they are much less so in this country. The misapprehension frequently prevails that the Diesel engine must have a wonderful field of usefulness in countries where crude oil is produced in very large quantities, but such is not the case. The price of oil fuel in any locality must be considered in connection with the prevailing coal price to determine whether a Diesel engine installation is economically efficient or wasteful. Cheap oil fuel will favor the Diesel engine only where coal is very expensive, as on the Pacific Coast, whereas high oil and low coal prices will exclude it from any part of the country where such conditions exist. Considering that the total cost of producing power is made up of a number of items, as interest on the money invested and depreciation of the plant, cost of fuel, cost of attendance, maintenance and repairs, cost of supplies, etc., it is evident that in Europe where fuel prices are from two or three times higher, while labor is only one-half to one-third of what they are in our country, the item of fuel cost constitutes a very high percentage of the total cost of power, particularly since the other items, such as interest and depreciation, attendance and repairs are actually much lower and thus form a still smaller percentage of the total cost.

With us conditions are practically reversed: Our fuel cost is not only lower and our labor cost much higher than in Europe, but, morever, the quality of our mechanical labor is not as excellent, and thus the fuel cost plays a much less important role in the total cost of power than the items into which labor largely enters, whereas the lower standard of manufacture, and especially of maintenance, favors the use of simple although less economical machinery.

To what importance the use of coal-tar oil has grown on the Continent can be judged from the fact that France has to rely on this Diesel-engine fuel almost exclusively on account of the very high import duty on natural oils. In Germany a number of collieries have combined to form a company for the utilization of tar which operates a large factory at Meiderich, where, at present, over 300,000 tons of tar a year is distilled, producing over 80,000 tons of tar oil. This is contracted for in larger quantities at a price of approximately $12.50 per ton (5c. per gallon). With the tremendous increase in demand, it is expected that before long this one factory alone will have a capacity for handling one million tons of tar per year, producing 300,000 tons of tar oil.

It is estimated that the total world production of coal-tar oil is even now in the neighborhood of 1,000,000 tons per annum, and since the recognition that coal is too valuable a fuel to be wasted in our present-day furnaces is spreading more and more, the number of by-product coke oven and producer gas-producer plants will steadily increase, especially in our country, so that the total production of tar oil is certain soon to double and treble, adding to our supply of natural liquid fuels an artificial product which will by legitimate competition check the advance in the price of the former.

The heat value of tar oil is over 17,000 B.t.u. per lb., and its consumption in the Diesel engine is, therefore, not very much higher than that of natural oil, varying now from 0.49 to 0.46 lb. per b.hp.-hour, according to the size of the engine.

The operation of medium size Diesel engines on tar oil, especially of those above 50 hp. per cylinder and with open fuel-injection nozzle is satisfactory. For smaller engines the addition of a so called ignition oil is necessary, which somewhat complicates these engines.

GAS TURBINES

Renewed activity is noticeable abroad in the matter of designing an adequate gas turbine. The foremost authorities are convinced that the gas turbine will soon come to stay and, in view of the universal tendency toward high-speed rotative machinery, the statement would seem warranted that when the gas and oil turbine does come it will revolutionize power production in the large steel centers and wherever natural fuel oils abound in this country. A large experimental gas turbine in Germany is operating splendidly, mechanically speaking, although the problem of satisfactory thermal efficiency still remains to be solved.

INDUSTRIAL WASTE GASES

The use of the so called "industrial waste gases" has progressed considerably. The four most prominent manufacturers in Germany alone are now building large gas engines for blast furnace and steel works at the rate of 120 per year, and a number of twin tandem engines of 5000 b.hp. operating very satisfactorily on rich coke-oven gas can now be seen in German coking plants.

The splendid results obtained with gas blowing engines in Germany have prevented the turbo-blower from getting a firm foothold in that country, although its use in France, England and Russia is steadily increasing. Blast-furnace gas engines for blowing and electric-power purposes and even for operating rolling mills are today the standard equipment for old and new plants, even where the coal price is fully as low in our Pittsburgh district. Within the last two years the use of coke-oven gas for producing electric power by gas engines has greatly increased, and after overcoming the many earlier difficulties the coke-oven gas engine is today just as safe and reliable as the blast-furnace gas engine. These difficulties arose principally from overrating the engines, and from sulphur in the coke-oven gas. Since the reasons for the trouble were recognized, the causes, or their consequences, are now avoided, so that in a number of plants sulphur of considerably over one grain per cubic foot of gas is very successfully handled in coke-oven gas engines if the proper very simple precautions are taken.

DETAILS OF CONSTRUCTION

In regard to the detail construction of the modern German gas engine a few remarks may be of interest. The most prominent gas-engine builders are now governing their engines on a simple combination quantity-quality regulation principle. The valve gear has been much simplified by all manufacturers, and gas-engine prices are, generally speaking, lower than they ever were before. The gas cylinders, after a few unsatisfactory attempts to use cast steel, are invariably made of cast iron, and with the exception of a few types are cast in one piece with integral water jacket. They are often provided with hard cast-iron liners. The cracking of gas cylinders is now much reduced by proper design, selected material and better pouring methods. Experience has taught that the life of a gas cylinder can be materially increased if the water jackets are thoroughly cleaned from all scale and muddy deposit at regular intervals of from four to eight weeks, depending upon the character of the cooling water used. It was found by experiment that the average temperature of the cylinder wall increases at an amazing rate with even a very thin layer of scale forming in the water jacket, and in certain plants with hard cooling water, acid and wire brushes are resorted to from time to time to take the accumulated scale off the cylinder walls.

Gas cylinders on electric engines crack more frequently than on blowing engines because the former carry much higher loads than the latter, and because electric engines are usually shut down oftener. It was found that frequent shutting down and starting of gas engines shortened the life of

the cylinders materially if the engines were allowed to cool off too much during shutdowns.

The average life of a gas-engine cylinder in the large steel plants in Germany is pretty generally reckoned to be from five to six years. This is accepted as a matter of course, and the expense incurred by replacement is simply distributed over this number of years in the cost figures.

The cost of producing electric power in German blast furnace and steel plants is about $2.70 per thousand kilowatt hours, comprising $1.25 value of the raw blast-furnace gas and including cost of gas cleaning, cost of labor, repairs, and supplies of all kinds, but without interest and depreciation on the money invested. This figure applies on an annual output of about 100,000,000 kw.-hours, and a use factor of approximately 60.

The gas-engine pistons are generally ribless cast-iron castings, although for large engines cast steel is used. One concern has recently introduced for blast-furnace gas engines solid, noncooled, forged-steel pistons of one piece.

The piston rods are now usually made of openhearth steel of about 100,000 lb. tensile strength, uncambered, and their diameter is approximately 26% of the diameter of the gas cylinders. A variety of piston-rod coupling designs is used, but the threaded connection enjoys the best reputation. It is noteworthy that crossheads are made of forged nickel steel.

No uniformity of design can be claimed for piston-rod packings, but they invariably consist of single or double sectional cast-iron packing rings pressed against the rod by garter springs and separated by solid one-piece rings forming from 12 to 14 chambers. It is universally claimed that the clearances of the ring sections must be reduced to the possible minimum. So called fire rings are sometimes used, but several builders object to such solid rings.

The exhaust valves are made of forged steel or of "Durana" metal, and are now almost exclusively of the noncooled mushroom type. Some builders, however, still prefer water-cooled exhaust valves for coke-oven gas engines.

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A Study of Malaria in Alabama is reported on by R. H. [illegible], P. S. Public Health Service in Public Health Reports for Dec. 27, 1912. At the end of the report, which covers a number of pages, the following conclusions are given:

All forms of malarial fevers prevail in the state of Alabama.

Morbidity reports indicate that in September, 1912, about 1 person for every 50 population suffered an attack of malarial fever and [illegible] cent [illegible] of [illegible] to [illegible].

The types of infection, in the order of prevalence are [illegible].

The [illegible] type of malarial infection is proportionately greater in the colored race than in the white.

The Flood of January 9, 1913, at Pittsburgh, Penn.

By Kenneth C. Grant*

On Jan. 9, the fourth greatest flood in 48 years visited Pittsburgh, reaching a gage height of 31.3 ft., or 9.3 ft. above the "danger line" of 22 ft. The direct losses due to this flood in the city of Pittsburgh alone amount to considerably over $1,000,000. Heavy losses were also sustained by various communities on the rivers above and below the city.

Since Mar. 18, 1865, when a stage of 31.4 ft. was recorded, the rivers at Pittsburgh have been higher than the recent flood only three times, namely: Feb. 6, 1884, 33.3 ft.; Mar. 1, 1902, 32.4 ft.; Mar. 15, 1907, 35.5 ft. On Feb. 18, 1891, the same stage, 31.3 ft., was reached. It is the first time that a January flood has ever crossed the 30-ft. stage at Pittsburgh, although in January, 1862 and 1904, the rivers rose to 30 ft.

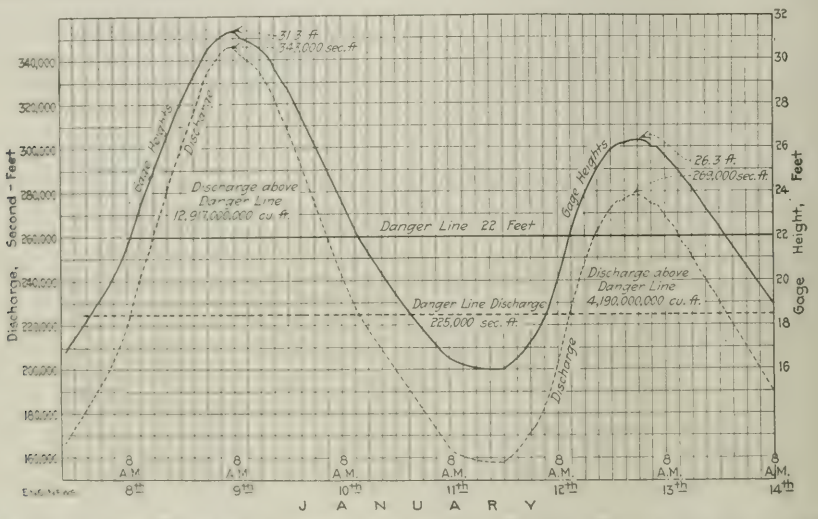


Fig. 1. Gage Height and Volume of Discharge of the Ohio River at Pittsburgh during the Flood of Jan. 8 to Jan. 14, 1913.

The recent flood, therefore, ranks with the great floods of Pittsburgh and, as such, deserves description. It is also of particular interest because of the exhaustive studies and report which have recently been completed by the Flood Commission of Pittsburgh, and the attention that has thereby been drawn to the flood problem of this region.

The flood was caused by a warm rain of no very great intensity at any particular point, but fairly uniformly distributed over the entire drainage area above Pittsburgh, the total precipitation for Jan. 6 to 9, inclusive, averaging about 2 in., and nowhere falling below 1 in. The maximum rainfall, so far as present records show, occurred at Rowlesburg, W. Va., on the Cheat River Basin, and amounted to 2.5 in. The principal rainfall occurred during the 24 hours preceding 8 a.m. on Jan. 8.

The drainage area to the north and northeast above

*Consulting Engineer, Arrott Bldg., Pittsburgh, Penn.

Pittsburgh had a depth of snow on the ground averaging from about 1 in. at Pittsburgh to 5 in. in the northern Allegheny Basin. With the exception of scattered drifts in the mountainous section to the east, there was practically no snow on the Monongahela Basin. The high temperature that prevailed preceding the flood melted all this snow, and it ran off with the first part of the rainstorm.

The rainfall recorded on the morning of Jan. 7 at the stations reporting directly to the local forecaster of the U. S. Weather Bureau at Pittsburgh, and the weather indications of continued precipitation, caused a prediction of a stage of over 20 ft. by the morning of the 8th. This prediction was proved correct by the stage at Pittsburgh crossing the 20-ft. mark about 4:30 a.m. on the 8th. The rivers continued to rise rapidly, averaging about 6 in. per hour. The danger line of 22 ft. was crossed shortly before 9 a.m.

The continuance of the rain through the 24 hours preceding 8 a.m. on the 8th and the rainfall and river stages reported from the various stations at that time formed the basis of an estimate by the local forecaster of the Weather Bureau that there would be a stage of 31.5 ft. at Pittsburgh on the morning of the 9th. As a precaution, this estimate was increased to 32 ft., and warnings were sent out to the flooded districts and the river interests to prepare for a flood of that height. The rivers continued steadily rising until 7 a.m. on the 9th, when the maximum of 31.3 ft. was reached. The flood continued at this stage for about an hour and then began to fall gradually, at first only about 0.1 ft. per hour. At 4 p.m. on the 9th it had receded to 30 ft., but it did not fall below the 22-ft. stage until 12 noon on the 10th, having been above this stage for 51 hours, and above the 30-ft. stage for about 16 hours.

By 8 a.m. on the 11th the stage had fallen to 16.5 ft., from which point it gradually receded to 16 ft. during that day. At about 7:30 p.m., however, the rivers began to rise again, and at 10:30 a.m. on the 12th, or 47 hours after the water had fallen below the danger line, they had again risen above the 22-ft. stage. This second rise continued until midnight of the 12th, when the crest of 26.3 ft. was reached, 88 hours after the crest of the first flood. The water continued at this level for about three hours and then gradually receded, the 22-ft. stage not being reached until about 9:30 p.m. on the 13th, so that this second flood was above the danger line for 35 hours.

The second flood was caused by a rain which fell during the 48 hours preceding 8 a.m. on the 12th. There was no snow on the ground, but a high rate of run-off resulted from its saturated condition. The rainfall was heaviest on the upper Monongahela Basin. The maximum, according to records thus far available, occurred at Fairmont, W. Va., 127 miles south of Pittsburgh, where 2.47 in. was recorded. The greater part of the Monongahela Basin in West Virginia received over 2 in. The rainfall gradually decreased in amount northward, although a considerable portion of the middle Allegheny Basin received over 1½ in., the maximum recorded on this basin being 1.78 in., at Parker, 85 miles above Pittsburgh. The Allegheny Basin from Warren northward received something under 1 in.

The discharge of the combined Allegheny and Monongahela at a 22-ft. stage at Pittsburgh is about 225,000 sec.-ft. The discharge at the crest of the first flood reached about 346,000 sec.-ft. The total volume of this first flood wave above the 22-ft. stage was about 12,917,000,000 cu.ft. The discharge at the crest of the second flood was about 278,000 sec.-ft., and the total volume of this flood wave above the danger line was about 4,190,000,000 cu.ft. The total volume of the two flood waves above the danger line therefore amounted to about 17,107,000,000 cu.ft.



FIG. 2. RIGHT BANK OF ALLEGHENY RIVER LOOKING UPSTREAM, JAN. 9

The first and higher crest was caused by a fairly high stage in all the tributaries, due to the uniform distribution of the rainfall. The Allegheny River was a more important contributor to this crest than the Monongahela, largely on account of the high stage reached by the Clarion, which came within 0.6 ft. of record height, and delivered its flood waters at Pittsburgh just about at peak time. The Allegheny at Kittanning, 46 miles above Pittsburgh, and 40 miles below the mouth of the Clarion, rose to 25.3 ft., or to within 4 ft. of record stage. At Freeport, 30 miles above Pittsburgh, it was within 4.3 ft. of record stage, although the Kiskiminetas River, which enters just above this point, was 10.6 ft. below record stage at Avonmore. Compared with many of its past performances, the Kiskiminetas was of relatively small importance in causing this flood, the main offenders on the Allegheny being the tributaries entering from the east along its middle course, particularly the Clarion.

On the Monongahela Basin, the Youghiogheny River, usually a leading factor in Pittsburgh floods, rose to only 16.7 ft. at West Newton, or 11.5 ft. below record stage. The Monongahela at Lock No. 4, 41 miles above Pitts-

burgh, rose to 30.4 ft., or 11.6 ft. below its maximum, at 10 p.m. on the 8th, but this crest did not reach Pittsburgh until several hours after the flood peak had begun to subside. The West Fork at Enterprise was 17.4 ft. below record stage, the Tygart Valley River at Fetterman, 14 ft., and the Cheat River at Rowlesburg, 13.5 ft. Taken as a whole, therefore, the Monongahela was a less important factor than the Allegheny in causing the first crest of this flood.

The second and lower crest, however, was caused mainly by the Monongahela River, which, on the evening of January 12, reached about the same stage at Lock No. 4 as on the 8th, while the Allegheny at Freeport only came within about 6 ft. of its earlier crest. The West Fork River, at Enterprise, on the morning of the 12th, reached a stage about 2 ft. higher than in the first flood, and was the main factor in producing this second high stage at Lock No. 4, as none of the other main tributaries above this point had so high a crest as in the preceding flood. The Youghiogheny, at West Newton, was 3.4 ft. lower than during the first rise. All the gages on the Allegheny Basin recorded a lower stage than in the first rise, particularly in the northern section, where the rainfall was lightest.

The occurrence of these two floods in January, and with so short an interval between, is another significant warning of the menace of possible floods in the future that will far exceed all past records as to height and damage. If the precipitation causing the first crest had been in the form of snow, and had thus remained on the ground until the arrival of the rainfall causing the second crest, these two floods would have been combined, and much higher stages would have resulted at all points.

A providential deliverance from such a catastrophe occurred in 1910. The winter of 1909-1910 had been one of unusual severity, with a number of extraordinary snowfalls, a total of nearly 10 ft. having been recorded at some parts of the basins. An unprecedentedly large amount of this snow still lay on the ground at the end of February. If one of the usual heavy warm rains of March had then occurred, Pittsburgh would unquestionably have had a flood approaching the 40-ft. stage, 1.5 ft. above the record flood of 1907. Fortunately, however, March, 1910, had an unprecedentedly light rainfall, the average over the drainage area above Pittsburgh being considerably under 1 in., and this scattered through the month in ineffectual showers. The temperature, moreover, was unusually high for that time of year, and the heavy blanket of snow melted off gradually without causing flood stages.

Damage

At the crest of the first flood, nearly 700 acres of low land within the city limits were submerged to a maximum depth of 11 ft. Over eight miles of main railroad tracks were covered to a maximum depth of 11 ft., about four miles of street-car tracks to maximum depth of 7 ft., and about 15 miles of streets and alleys to a maximum depth of 9 ft. Federal St., the principal business street on the North Side, which has recently been raised, was not flooded. If the street had been at its old grade, there would have been about 2½ ft. of water on it at the crest of the flood. On the Pittsburgh side of the Allegheny, this street was covered to a depth of nearly 2 ft. in the lower section between Penn Ave. and Duquesne Way. Street-car traffic was blocked and passengers had to be transferred with wagons and motor trucks. All business was suspended on the north side of this street. The higher sidewalk on the south side enabled pedestrian traffic to continue, although it was seriously delayed by numerous blockades.



Fig. 3. A North Side Street in Pittsburgh on Jan. 9

Street-car traffic throughout the city and outlying towns was seriously interrupted. In some cases re-routing was possible; in others, all operations were discontinued until the water subsided. All passenger trains on the Bessemer & Lake Erie, Pittsburgh & Western, and Buffalo, Rochester & Pittsburgh railroads were obliged to use the Water St. station of the Baltimore & Ohio, the tracks and station in the North Side being flooded on the 8th. The Pittsburgh & Lake Erie tracks on the South Side were covered in places to a depth of 6 ft., many passenger and freight cars on the sidings being half submerged. As a result of this tying-up of traffic, thousands were unable to reach their work on time on the 9th, and some not at all. In a large portion of the North Side the only method of travel was in boats, the water being 8 ft. deep in many of the streets. A number of motor-boat ferries were in operation, one route extending for about a mile.

All river traffic was tied up by the high water. Ship-

ments of coal by river were suspended on the 7th and not resumed until the 15th. A special trip of the new steamer "City of Parkersburg," to inaugurate a better passenger and packet freight service on the Ohio, had to be postponed from the 6th to the 16th.

The cellars of all buildings in the lower portions of the city were flooded. The timely warning sent out by the Weather Bureau allowed suitable preparations to be made and much damage was thus avoided. Flood barriers were erected at all openings, pumps put in operation, and merchandise stored in cellars and basements removed to the sidewalks or to upper stories. The residents in these lower sections were put to great suffering and inconvenience. Furniture and household goods had to be moved to upper stories, and the ground floors and basements were uninhabitable for several days. Food and fuel supplies were cut off, and these had to be furnished by the police department and local charity organizations, who did most effective work with a small fleet of boats.

The majority of industrial plants along the river



FIG. 4. A VIEW IN FEDERAL ST., NORTH OF PENN. AVE., JAN. 9

banks had to shut down, and many thousand men were thrown out of work for periods of from several days to over a week. One plant employing 3000 men had to suspend operations and a number of those shut down employ more than 2000. The loss to these wage-earners was very considerable and will be severely felt.

The new Union bridge, under construction across the Allegheny, near the mouth, narrowly escaped destruction. The north span was nearly completed, and by working night and day under very adverse weather conditions, the truss was connected up at midnight of the 8th, and the huge traveler moved to a point of safety over the channel pier. The wisdom of this precaution was shown when the entire falsework under the span was carried away during the flood. At the new bridge of the Pittsburgh & Shawmut R.R., under construction across the Allegheny at Mahoning, 58 miles above Pittsburgh, the falsework was carried away by the flood on the morning of the 8th. The truss fell into the river, causing a loss of about $30,000 and a delay of several months in the completion of the work.

The damage along the rivers above Pittsburgh was considerable. Manufacturing plants were shut down, residences and clubhouses flooded, and street-car and railroad traffic interrupted. Streets in some outlying towns were under 10 ft. of water. Many residents were marooned in the second stories of their homes. Business was at a standstill, and there was much suffering from scanty supplies of food and fuel. The aggregate loss was very considerable and it will be several weeks before all traces of the flood are removed.

The flood of Feb. 16, 1908, which reached a gage height of 30.7 ft., was above the danger mark for about 52 hours, or approximately the same length of time as the first crest of the recent flood, which, however, was 0.6 ft. higher. A careful canvass of the flooded districts immediately after this 1908 flood led to an estimate of about $840,000 direct loss within the city limits. Newspaper reports place the damage in the recent flood at over $1,000,000, and this is conservative, as the second flood of 26.3 ft. again placed the low districts under water and prolonged the time that some of the industrial plants were out of commission.

THE FLOOD ALONG THE OHIO RIVER

The flood did great destruction in its passage down the Ohio. All industrial plants along the lower lands bordering the river were inundated and many thousands of men temporarily thrown out of work. Railroad and trolley lines were blocked and traffic seriously interrupted. Many men were thrown out of work at the mines owing to the impossibility of obtaining cars.

The flood crest arrived at Wheeling, W. Va., 90 miles below Pittsburgh, at midnight on the 9th, when a stage of 44.6 ft., or 8.5 ft. below the record stage, was reached. This crest was 8.6 ft. above the danger line and drove over 600 families from their homes or to the second stories. Thousands of men are employed at the various plants along the river front, and at the mines on the Ohio side. The majority of these were thrown out of work for several days. Street-car and railroad traffic was at a standstill.

At Cincinnati, 468 miles below Pittsburgh, the danger line of 50 ft. was crossed on the night of Jan. 10, and during the 11th the rising waters began to flood the houses and buildings in the lower sections and to block traffic. Over 3000 families were driven from their homes, and school houses and churches were thrown open and filled with refugees. Rowboats and launches plied the streets, carrying the flood victims to places of safety and bringing food and fuel to the sufferers. The city appropriated $20,000 as a relief fund and the police and the charity organizations coöperated in caring for the needy. Commission merchants and warehouse owners along the river front suffered heavy losses. In some buildings the water was up to the second stories. The Panhandle and the Louisville & Nashville freight houses were half submerged. The Grand Central Station was put out of commission when the 54-ft. stage was crossed on the 11th, and all trains to that station had to be rerouted into the city.

The highest stage, 62.2 ft., was not reached until Jan. 15. This is 12.2 ft. above the danger line, and 8.9 ft. below the record stage of 1884. The river fell very slowly, and on the 20th, 10 days after it had crossed the danger line of 50 ft., it was still 51.6 ft. It is estimated that the damage from this flood at Cincinnati will be nearly $2,000,000.

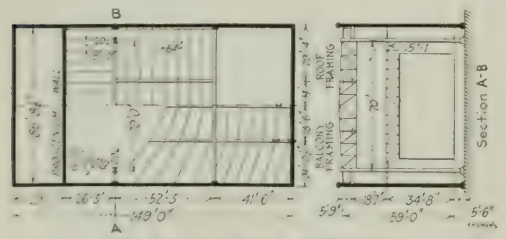
Similar conditions obtained in practically every Ohio River city and town. In the outlying districts, many hundred square miles of bottom lands were flooded from 3 to 20 ft. deep and in numerous cases livestock was cut off and drowned. The total loss along the Ohio Valley will foot up to many million dollars.

Failure of a Theater Building, New York City

The larger part of the roof of the Orpheum Theater, a large vaudeville house under construction at 3d Ave. and 87th St., New York City, collapsed on Jan. 22, at about 5:20 p.m., just after some 200 workmen had left the interior of the building. The falling roof carried down with it into the cellar the cantilevered balcony and the orchestra floor, completely wrecking the auditorium of the theater, but fortunately there was no one in that portion of the building at the time, so no one was injured in the collapse.

The accompanying sketch will give some idea of the construction of the building and the nature of the collapse. The main portion of the theater, 87x149 ft. in plan, comprises the stage and auditorium. There is a main floor carried on columns from the cellar, a balcony mainly carried on cantilever trusses extending back into a rear truss and columns, and a reinforced-concrete slab roof spanning beams between trusses, which in turn frame into two main transverse trusses. The stage is separated from the auditorium by a brick proscenium wall with the proscenium opening formed by a transverse truss resting on the brick wall.

It will be noted from the roof-framing plan on the cut that the load of the short-span concrete slabs is carried through beams and trusses to two main trusses. One of these, at the rear of the auditorium, about 87 ft. long, spans the entire width of the building and rests on brick pilasters built out from the side walls. The other, nearer the stage, was 70 ft. long and spanned between two steel columns set some 8 ft. in from the walls and extending up from the footings of the building. That portion of the roof between this latter truss and the stage was carried on the truss and on the proscenium wall.



PLANS AND SECTION OF THEATER

The 70-ft. truss is 8 ft. deep at the column and 9 ft. 3 in. at the center, with a horizontal bottom chord. The [illegible] are of I-section, made up of two 6x4x⅞-in. angles with a 12x⅜-in. center plate. They are 64 ft. 6 in. in total length and were designed to [illegible] at the level of the top of the proscenium truss and opposite the 70-ft. truss. The framing of the proscenium truss consisted of a light beam to the adjacent brick wall and a 15-in. I-beam extending over the 27-ft. distance to the proscenium wall. The connection of the balcony fascia girder to the columns was very [illegible] and of no structural value as a stiffener. The least radius of gyration of the column is about 5½ in., so that assuming a [illegible] the greatest value of $\frac{l}{r}$ [illegible]

brace omitted, $\frac{l}{r}$ for the column would reach 256. The footings of the columns and walls were on concrete base to solid rock.

At the time of the accident all of the brickwork had been completed, the steelwork was all in with the exception of some minor framing around the stage boxes, and the concrete roof had all been completed. The workmen were engaged in the plastering and other decoration of the auditorium. No eye witness has come forward as yet with an account of the accident, so what occurred can only be inferred from examination of the ruins.

The collapsed portion embraces all of the area between the proscenium wall and the 87-ft. truss and within that area the destruction is complete. The four walls are still standing apparently undamaged, the 87-ft. truss is slightly twisted and at the connection to the longitudinal trusses its vertical posts are torn out, but it is still in place. The proscenium wall was bulged to such an extent that the building department required its removal. The two columns are down, lying in the auditorium, but that space is entirely covered as with a blanket by the concrete and plaster of the roof and balcony, so that the precise position and condition of the steelwork cannot be determined until after the removal of the débris.

In view of the condition of the building it is difficult to form an opinion as to the cause of the collapse. The building is to be carefully inspected by official and private engineers during the uncovering of the wreckage; after this inspection has been made and the accordance between design and construction noted, a more complete study of the accident can be made.

The building was designed by Thomas W. Lamb, Architect, for Loew's Theater Enterprises. The steelwork was designed and built by the National Bridge Works. The general contract was held by Fleischman Bros. All these parties are of New York City. The theater was one of a number of similar ones being built in New York for the same company and designed by the same architect. It was to have a capacity of over 2000.

Partial Failure of Reservoir Lining, Johnson City, Tenn.

BY D. R. BEESON*

A portion of the concrete lining of a new reservoir just put in service for the water-supply of Johnson City, Tenn., blew out on Jan. 10 and allowed the contents of the reservoir to escape. No one was injured in the accident nor was any property other than the reservoir proper damaged by the outflowing water.

The new reservoir is to be used for emergency storage, being a part of the new city water-supply system from a set of springs 13 miles away from town. It is located on a ridge south of the city at an elevation about 145 ft. higher than the general level of the residence section of the city. As shown in Fig. 1, it is 200 ft. square on top and 20 ft. deep, with sloping sides on a 1¼ to 1 slope. When full to the overflow, 1 ft. below the rim, it has a capacity of 4,000,000 gal. The bottom and sides of the reservoir were lined with concrete, 8 in. thick, reinforced with ⅝-in. twisted rods 18 in. c. to c. both ways. The engineers say that the lining was for the purpose of

* Johnson City, Tenn.

waterproofing only and not figured to resist any strain due to water pressure, and that the reinforcement was to prevent expansion cracks and not to add strength to the concrete. The lining was not waterproofed. Where the side lining joined the floor and in other places where new

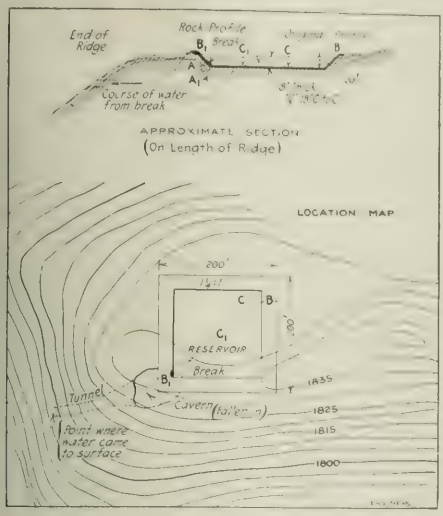


FIG. 1. PLAN AND SECTION THROUGH RESERVOIR

concrete was joined to old in the course of construction, there was no effort made to secure a bond between the two except by the reinforcing. Consequently, in many places, these joints show very pronounced cracks.

The concrete was mixed 1 : 2 : 4 with a standard cement, good coarse sand and broken limestone. The limestone was secured from the excavation for the reservoir. at the joints. Forms for the sloping sides were of wood, spiked to stakes driven into the ground. These stakes were supposed to be driven down beyond the concrete as the work progressed, but some of them, at least, were left in the concrete and may be seen projecting out of the slab on the under side of the break.

Johnson City is located in the eastern part of Tennessee on a formation named, by the U. S. Geological Survey, the Knox Dolomite. The rock of this formation is a blue limestone and weathers very easily on account of the solubility of its component materials and the whole area covered by it has been considerably bent and shaken in prehistoric times, so that the rocks are much broken and characterized by many fissures and caverns. The soil is the red clay of eastern Tennessee and western Virginia, which washes and slides very readily.

The floor of the reservoir was built for the most part on rock bottom, of the sort described above. At the corner of the reservoir, where the break occurred, the rock seemed to run out abruptly and the construction was on natural earth. The rim of the reservoir is above natural grade, making it necessary to back the sides with an earth fill of height varying from nothing to about 6 or 8 ft. A rock profile is very difficult to determine in this formation, as the strata are characterized by many projecting points and large boulders. At the side of the reservoir marked *B* (Fig. 1) the rock cut was deep enough to place the floor on fairly solid rock, but toward the broken corner it was laid on earth as before mentioned. In excavating for this corner a point of rock appeared that had to be blasted off. This was afterward proved to be a boulder of about 8 cu.yd., and after the accident was found to have dropped about 8 ft. from its original position to a ledge of limestone underneath. In Fig. 1 the position of this boulder before and after the break is shown at *A* and *A1*. Two caverns, *C* and *C1* (Fig. 1), in the limestone rock were discovered in the course of excavating for the floor. These were filled with concrete,



FIG. 2. VIEW OF RESERVOIR, SHOWING BREAK IN FAR CORNER

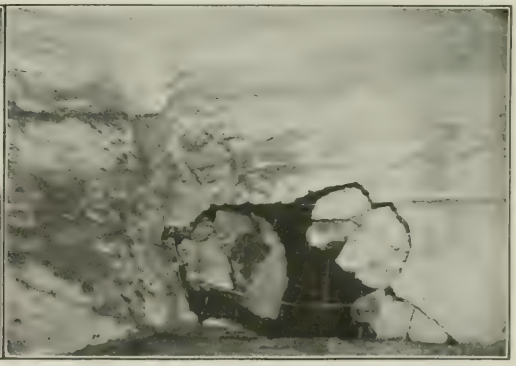


FIG. 3. NEAR VIEW OF BREAK TAKEN EIGHT DAYS AFTER OCCURRENCE.
(Cracks in concrete lining appeared after the initial break)

At the corner where the break occurred the concrete seems good and not affected by the freezing weather in which some of it was laid. The thickness of the concrete at this point is about 7 in. The reinforcing had been lap-jointed here and all five inclined rods shown in the break were lapped opposite each other horizontally. None of the reinforcing was broken, the ends being pulled apart 22 cu.yd. being used therefor. No cavern was apparent under the corner which broke.

Water from the city main was turned into the reservoir at 11:30 a.m. on Jan. 8, 1912, and the break occurred at 2 a.m., Jan. 10. The reservoir had filled to a depth of 17 ft. Instead of discharging at the surface of the ground immediately outside the break, the water took

an underground course and came to the surface nearly 200 ft. away, as shown on Fig. 1, on the slope or nose of the ridge. After the accident there was a hole or cavern directly under the break extending 35 ft. straight down and running back 30 ft. under the floor of the reservoir. The surface had fallen in pretty badly for a space about 30 ft. each way at this corner of the reservoir. The hole showed earth bottom so it is impossible to state at this time the distance down to solid rock. Approximate outline of this hole or cavern is shown on Fig. 1. This hole may have been an open cavern before the accident or it may have been filled with earth. Ledges of rock can be seen at both sides of it about 10 or 15 ft. below floor level, but none is apparent back under the floor or in the channel taken by the water. The rock visible in this hole does not show the lines of stratification, being very much weathered, but a railroad cut near-by shows the strata pitching about 50° from the horizontal.

The photographs illustrating this article were taken eight days after the accident and show the concrete at the broken corner sagged down by its own weight and badly cracked, but the day after the trouble occurred the concrete was in place as built and showed no strain or tension cracks whatever, although the earth had all been washed from under it. The break in the concrete, 8 ft. wide by 6 ft. high, was the only sign of failure in the lining.

As to the probable cause of the break, it seems evident that the reservoir leaked through the bad joint in the concrete, where the side joins the floor, and that the leaking water made for itself a tunnel in the clay soil coming to the surface. The pressure of the water on the unsupported concrete lining over the reservoir end of this tunnel probably broke the lining and gave egress to the water stored in the reservoir. The cavern under the broken corner was probably excavated by the big stream of water after the concrete broke, though some part of it may have been there before. There are no proofs as yet discovered that there was a cavern at this point in the natural formation, and if there was it must have been well below the floor of the reservoir, or the boulder mentioned above could not have remained in place over it.

No plan for repairing the reservoir has as yet been adopted, but the engineering firm that had the work in charge has recommended that the hole or cavern under the break be filled and the damaged corner rebuilt where it was originally.

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The New Subways under construction and projected in New York City on a cooperative contract between the city and street railway corporations of New York and Brooklyn, may be definitely assured to the city by the time this issue of Engineering News reaches our readers, or may be indefinitely postponed. It is impossible at the time of going to press to predict which result will occur.

There are undoubtedly honest differences of opinion between those who have given most careful study to the subject as to whether these contracts for the dual subway should be signed by the city authorities. On the other hand the majority of business men interested in the city's welfare who have given careful study to the subject appear to be convinced that the pending contracts are as good as the city could hope to secure, and that under existing conditions it is of great importance to the city that the contracts should be concluded.

A Building Collapse occurred at McKinney, Tex., on Jan. 2, followed by a fire and resulted in the loss of eight lives. About 15 other persons were injured. The killed and injured were in a four-story building occupied as a department store. An adjoining building used for storage purposes collapsed first, according to press accounts, and caused the cave-in of the first-mentioned structure.

A Rear-end Collision on the 3rd Ave. "L," New York City, on Jan. 25, involved the death of one man and injury to 17 other persons. The first train was stopped between stations by a track repair gang and was struck at almost full speed by the second train, which was following it closely. The back end of the last car in the stationary train and the front end of the first car in the moving train were telescoped and lifted from the tracks, projecting several feet out over the street from the "L" structure. A short-circuit in the wrecked motorman's box on the rear train started a fire that further damaged the two cars. The accident occurred at about 3:30 p.m., and held up traffic on the street cars until 6:30 p.m., and on the elevated line until 8 p.m.

Portland Cement Production in 1912 is estimated by the U. S. Geological Survey to be approximately 81,941,998 bbl., an estimate which is believed to be within 1½% of the correct figure. This is an increase of 4.3% over the 78,528,637 bbl. production in 1911.

Nine Bids for a Mechanical Filtration Plant to treat the Croton water supply, New York City, were received on Jan. 23. The bids ranged from $5,672,145 to $6,752,500 (see p. 48 of "Construction News" section for details). No award has yet been made.

The Biggest Battleship Afloat was launched in England, at Newcastle-on-Tyne, on Jan. 22. This boat is the Brazilian superdreadnaught "Rio de Janeiro," having a displacement of 27,500 tons and an armament of fourteen 12-in. and twenty 6-in. guns. She is designed for a speed of 22 knots an hour.

A battleship of equal displacement is building for the United States at the Fore River Yards, Quincy, Mass., and will be known as the "Nevada." Another battleship of 31,500 tons displacement, the "Pennsylvania," is projected, but no work has started on her.

The Awarding of Medals by the American Museum of Safety took place on the evening of Jan. 22, at the United Engineering Societies Building, in New York City. The "Scientific American Medal" for the most efficient safety device invented in the past three years was awarded to F. F. Morris, of the Draeger Oxygen Apparatus Co., makers of the pulmotor. The "Traveler's Medal" went to the New York Edison Co., for work in the line of safeguarding their power-plant employees, and was received by John W. Leib for the company. Frederick Patterson received for the National Cash Register Co., the "Seaman Medal," for the promotion of industrial hygiene and sanitation and the mitigation of occupational diseases.

The feature of the evening was the awarding to Thomas A. Edison of the "Rathenau Medal," recently placed at the Museum's disposal by the Allgemeine Electricitaäts Gesellschaft, of Berlin. This is the first annual award of the medal and was for the invention of a safety electric mine lamp. Mrs. Edison received the medal because of the inventor's enforced absence.

Following the several awards announcement was made of the establishment of an E. H. Harriman Memorial Medal to be awarded annually to the American steam railway making the best record in accident prevention and industrial hygiene, affecting both the public and its own personnel.

PERSONALS

Dr. C. E. Dutton has been appointed Health Commissioner of Minneapolis, Minn., succeeding Dr. P. M. Hall.

Mr. Herman F. Doeleman has opened offices at 614 American Bldg., Baltimore, Md., as a consulting structural engineer in steel and concrete.

Mr. J. O. Ely, formerly Assistant Engineer of the Louisville & Nashville R.R., at Knoxville, Tenn., has been appointed Roadmaster of the Lexington & Eastern division.

Mr. E. H. Fitzhugh has resigned as President of the Central Vermont R.R., at Montreal, Que. He is succeeded by Mr. E. J. Chamberlin, President of the Grand Trunk Ry., of which the Central Vermont R.R. is a subsidiary.

Mr. M. T. Clements, of Superior, Wis., has been appointed Engineer in charge of grade separation, Northern Pacific Ry., at Spokane, Wash. The work will require an expenditure of $3,500,000 and is to be completed in three years.

Mr. F. L. C. Bond, Assoc. M. Can. Soc. C. E., Resident Engineer, Eastern division of the Grand Trunk Ry., Montreal, Que., has been promoted to be Division Engineer of the Eastern division. His headquarters will remain at Montreal.

Mr. E. F. McCrea, formerly Division Engineer of the Pennsylvania R.R. Lines West of Pittsburgh, at Toledo, Ohio, has

been transferred to a similar position on the Cleveland & Pittsburgh division, with headquarters at Cleveland, Ohio.

Mr. E. G. Johnston, formerly Assistant Engineer, Pennsylvania R.R. Lines West of Pittsburgh, Southwest system, at Indianapolis, Ind., has been promoted to be Assistant Division Engineer of the Eastern division of the Northwest system, at Pittsburgh, Penn.

Mr. Philip Lacey, City Engineer of Bessemer, Ala., has resigned to become a member of the staff of Mr. James N. Hazlehurst, M. Am. Soc. C. E., Consulting Engineer, of Atlanta, Ga. Mr. Lacey will have charge of paving and sewer work in Tampa, Fla.

Col. George W. Goethals, M. Am. Soc. C. E., Chairman and Chief Engineer of the Isthmian Canal Commission, was the guest of honor at a dinner given by the Lehigh University Club of New York, at the Hotel Astor, Jan. 27. Besides members of the club a number of prominent engineers were invited guests.

Mr. Ralph Budd, whose appointment as Assistant to the President of the Great Northern Ry. was noted in our issue of Jan. 2, will have charge of the construction of the new Minneapolis, Minn., passenger station of the Great Northern Ry., and of the extensive terminal improvements underway in St. Paul and Minneapolis.

Mr. Mott Sawyer, formerly Superintendent of the Bellingham Bay & British Columbia R.R., has been appointed Superintendent of the Columbia division of the Chicago, Milwaukee & St. Paul Ry., at Malden, Wash. The Bellingham Bay & British Columbia R.R. was recently purchased by the Chicago, Milwaukee & St. Paul Ry.

Mr. Julian B. Beaty, Secretary to the Borough President, Borough of Manhattan, New York City, has been appointed Superintendent of Public Buildings of the Borough of Manhattan at a salary of $3000 per annum. Mr. Beaty was at one time secretary to ex-President Cleveland, and for a short time, to Governor Woodrow Wilson, of New Jersey, President-elect.

Mr. Arthur B. Recknagle, of the United States Forest Service, in charge of District No. 3, New Mexico, has been appointed Professor of Forestry at Cornell University. Prof. Recknagle is a native of Brooklyn, N. Y., and a graduate of Yale University and of the Forestry School at Yale, class of 1906. He has served continuously in the U. S. Forest Service with the exception of a year spent in European study.

Dr. Alvah H. Doty, former Health Officer of the Port of New York, has been appointed Medical Director of the Employees' Benefit Fund Committee of the American Telephone & Telegraph Co., the Western Union Telegraph Co., and the Western Electric Co. It will be among the Medical Director's chief duties to look after the sanitary conditions in the offices and shops of the three companies and to instruct employees in hygiene and sanitation.

Mr. George G. Powell, Assoc. M. Can. Soc. C. E., Deputy City Engineer of Toronto, Ont., has declined an offer to become Public Works Commissioner of Prince Albert, Sask., at a salary of $6000 per annum. Mr. Powell's salary at Toronto is $4000 per annum. The recent City Engineer of Toronto, Mr. C. H. Rust, M. Can. Soc. C. E., resigned to accept a similar position at Victoria, B. C., at a salary of $6500 per annum, as noted in our issue of May 2, 1912.

Mr. Alfred K. Chittenden, Forester of the United States Indian Service, Department of the Interior, has been appointed Director of the Engineering Experiment Station and Lecturer on timber and timber resources at the College of Engineering of the University of Illinois. Mr. Chittenden is a native of New Haven, Conn., and a graduate of Sheffield Scientific School, Yale University, class of 1900, and of the Yale Forestry School in 1902. After a year's study in Europe he entered the U. S. Forest Service in 1903. In 1911 he was appointed Forester in the Indian Service.

Mr. Frank F. Fowle, M. Am. Inst. E. E., has resigned as Associate Editor of the "Electrical World" to resume his practice as a consulting electrical engineer, with offices at 68 Maiden Lane, New York City. Mr. Fowle graduated in electrical engineering at the Massachusetts Institute of Technology in 1899. For a number of years he was with the engineering and railway departments of the American Telephone & Telegraph Co., in New York City, and with the operating department of the same company in Chicago, Ill. From 1908 to 1912 he was a consulting engineer with offices in Chicago, Ill.

Mr. John B. Dickson, formerly General Agent of the Erie R.R., at Chicago, Ill., has been promoted to be Superintendent of the New York division, succeeding Mr. R. S. Parsons, M. Am. Soc. C. E., promoted as noted in our issue of Jan. 16. Mr. Dickson entered the railway service in 1882, at the age of 20 years, in the maintenance of way department of the Cleveland & Pittsburgh division of the Pennsylvania R.R. Lines West of Pittsburgh. In 1887, he was promoted to a Supervisor. In 1892 he was appointed Roadmaster of the Galena division of the Chicago & Northwestern Ry. After 10 years' service with this railway he was appointed Assistant Engineer of Maintenance of Way of the Baltimore & Ohio R.R. Three years later he was promoted to Chief Engineer of Maintenance-of-Way, which position he held until he entered the operating department of the Erie R.R. a few years ago.

Mr. William B. Wood, recently Superintendent of the Cleveland & Pittsburgh division of the Pennsylvania R.R., at Cleveland, Ohio, has been promoted to be Superintendent of the Eastern division of the Northwest system of the Pennsylvania R.R. Lines West of Pittsburgh, with headquarters at Allegheny, Penn. Mr. Wood is a graduate of Sheffield Scientific School, Yale University, class of 1897, and began his railway work in the chief engineer's office of the Pittsburgh, Cincinnati, Chicago & St. Louis R.R., in October, 1897. Two years later he was promoted to be Assistant Engineer of the Cleveland & Pittsburgh division of the Pennsylvania R.R. Lines West of Pittsburgh, and on Jan. 1, 1901, he became Engineer of Maintenance-of-Way of the Cincinnati & Muskingum Valley R.R. A short time later he returned to the Cleveland & Pittsburgh division in the same capacity and after two years' service was transferred to the operating department as Superintendent of the Cleveland, Akron & Cincinnati Ry. He was made Superintendent of the Cleveland & Pittsburgh Division about a year ago.

Mr. W. D. Faucette, whose appointment as Chief Engineer of the Seaboard Air Line Ry. was noted in our issue of Jan. 2, is a graduate of the Agricultural and Mechanical College of North Carolina. He entered the railway service in 1901 as an engineering inspector with the Seaboard Air Line Ry., at Savannah, Ga., and in 1903 was promoted to be Assistant Engineer at Savannah. The following year he was placed in charge of the Assistant Engineer's office at Savannah, having supervision of the engineering work south and west of Columbia, S. C. In 1906 Mr. Faucette was promoted to be Assistant Engineer attached to the Chief Engineer's Office at Portsmouth, Va. Four years later he went to New York City as Chief Clerk to the President. In September, 1912, he returned to Norfolk, Va., as Chief Clerk to the new President, Mr. W. J. Harahan, M. Am. Soc. C. E., who had been Vice-President and Chief Engineer of the Erie R.R. Mr. Faucette's recent appointment as Chief Engineer of the Seaboard Air Line Ry. makes him one of the youngest chief engineers of a great railway system.

Mr. A. R. Whaley, General Superintendent of the Electric Division of the New York Central & Hudson River R.R., New York City, has been elected Vice-President of the New York, New Haven & Hartford R.R., in charge of operation, succeeding Mr. H. J. Horn, who will give his entire attention to the operating department of the Boston & Maine R.R., of which he is also Vice-President. Mr. Whaley was born at Rock Island, Ill., in 1861. In 1877, at 16 years of age, he became a freight brakeman on the Providence & Worcester R.R. He passed through the various grades of baggageman, conductor, stationmaster, trainmaster, yardmaster and general yardmaster until 1899, when he was promoted to be Superintendent of the Worcester division of the New York, New Haven & Hartford R.R., which had absorbed the Providence & Worcester R.R. Later he was made Superintendent of the railway's most important division, with headquarters in New York City. In 1907, Mr. Whaley became General Superintendent of the electric zone of the New York Central & Hudson River R.R. and Manager of the Grand Central terminal. Under his supervision the train service to and from the Grand Central has been continued uninterruptedly during the entire reconstruction of the tracks, terminal and station building. It has been said that for the past six years he has supervised the traffic of 750 trains a day with an average delay of less than a minute a train.

OBITUARY

Michael Horan, City Engineer of Peru, Ind., died in that city, Jan. 18. For a number of years he also served as County Surveyor.

John MacGregor, Assoc. Am. Soc. C. E., Engineer of the United States Fidelity & Guaranty Co., Baltimore, Md., died in that city, Jan. 21.

Walter Chess, President of the Expanded Metal Engineering Co., New York City, died Jan. 19, aged 73 years. He was also Vice-President of the Consolidated Expanded Metal Co., of Pittsburgh, Penn.

Erwin Graves, M. Am. Soc. M. E., whose death was noted in our issue of Jan. 2, was born near Tiffin, Ohio, Aug. 19, 1850. He was educated in the public schools of Tiffin, never attending an engineering school. For about two years following the completion of his high-school course he was engaged in railway surveys, and later he was associated with J. D. Cook, a civil engineer of Sandusky, Ohio, who built the city's water-works. Mr. Graves was afterward appointed Superintendent of the water-works and in time became City Engineer also. From Sandusky, Mr. Graves went to Quincy, Ill., where he constructed the city water-works. After about two years in Quincy he went to Atlantic City, N. J., to enter the employ of R. D. Wood & Co., where his first work was also the construction of water-works. In 1885 he became connected with the Camden Iron Works, at Camden, N. J., which is controlled by R. D. Wood & Co., of Philadelphia. He was Assistant Superintendent of the Camden Iron Works until December, 1890, when he resigned. In 1894 he returned to Camden as Superintendent of the works and remained in this position until his death on Dec. 13, last. He became a member of the American Society of Mechanical Engineers in 1890, and was for many years a member of the Engineers' Club of Philadelphia.

William Gaston Hamilton, M. Am. Soc. C. E., former Mechanical Engineer and General Manager of the Atlantic & Great Western Ry., and for many years a well known engineer, died at his home in New York City, Jan. 23. He was one of the two surviving grandsons of Alexander Hamilton, Military Secretary to George Washington during the American Revolution and afterward first Secretary of the United States Treasury. Mr. Hamilton was born in New York City, Sept. 15, 1832. He attended private schools and prepared to enter Columbia University. He early showed a strong inclination for mechanics and at 18 years of age he decided to abandon school work to follow mechanical engineering; this was at a period when the opportunities of mechanical engineering were just beginning to be recognized—the early days of railways, steamboats and industrial machinery—but long before the days of schools of engineering. He began as an apprentice in the machine shops of H. R. Dunham & Co., New York City, and worked through various departments. While with this firm he made the drawings for the engines of the steamship "Henry Clay," which was exhibited at the first World's Fair, in London, England, in 1854. Later he became Vice-President and Chief Engineer of Breese, Kneeland & Co., owners of the Jersey City Locomotive Works, at that time among the largest locomotive works in the country. Eventually Mr. Hamilton became President of the company. From this position he succeeded to that of General Manager and Mechanical Engineer of the Atlantic & Great Western Ry. He founded the Ramapo Wheel & Foundry Co., at Ramapo, N. Y., which for many years was a famous manufactory of car wheels. He was President of the Hamilton Steeled Wheel Co., of Philadelphia, Penn., and for several years was Consulting Mechanical Engineer of the Pennsylvania R.R. In 1886 he retired from the active practice of his profession, although he remained a director of the Mexican Telegraph Co. and of the Central & South American Telegraph Co. He was a member of many clubs and societies and took an active interest in many philanthropic organizations. He was elected a member [illegible] and was therefore one of the society's oldest members. He is survived [illegible]

ENGINEERING SOCIETIES

[illegible]

[illegible] Chandler, University, N. D.

[illegible]

IDAHO SOCIETY OF ENGINEERS.
Feb. 21-22. Annual meeting at Weiser, Idaho. Secy., I. F. Shaffner, Boise, Idaho.

ASSOCIATION FOR STANDARDIZING PAVING SPECIFICATIONS.
Feb. 24. Annual meeting at Pittsburgh, Penn. Secy., J. B. Mittell, 5917 Winthrop Ave., Chicago, Ill.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.
Feb. 25-26. Annual meeting at Indianapolis, Ind. Secy., W. F. King, Indianapolis, Ind.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 26-28. Midwinter Convention in New York City. Secy., F. L. Hutchinson, 33 W. 39 St. New York, N. Y.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Mar. 3-5. Annual meeting at Chicago, Ill. Secy., W. P. Blair, 824 Engineers Bldg., Cleveland, Ohio.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

Minnesota Surveyors and Engineers Society—At the annual meeting, to be held at the Ryan Hotel, St. Paul, Minn., Feb. 11 to 13, there will be papers covering a variety of subjects. The high dam in the Mississippi River, at Fort Snelling, will be described by Capt. G. W. Freeman, U. S. Engineers, and A. F. Meyer, consulting engineer, and a visit will be paid to the works of this dam. Other papers include the following: "Bank Erosion and Protection on Streams," W. F. Brooks; "Ore Docks," Max Toltz; "Concrete Roads and Pavements," O. B. Leland and T. F. McGilvray; "Collection and Disposal of Municipal Wastes," Geo. H. Herrold; "Drainage on Northern Minnesota," W. R. Hoag.

Municipal Engineers of the City of New York—At the annual meeting of the society on Jan. 22, Alfred D. Flinn, Department Engineer, Board of Water Supply, was elected president for the coming year.

Geological Society of America—Following are the officers of the Society for the year 1913: President, E. H. Smith; Vice-presidents, J. F. Kemp, R. D. Salisbury and C. D. Walcott; Secretary, E. O. Hovey; and Treasurer, W. B. Clark.

Society of American Bacteriologists—The following officers for the ensuing year were elected by the Society at its annual meeting in New York City, on Jan. 2: President, Prof. C. E. A. Winslow; Vice-president, Prof. C. E. Marshall, and Secretary-Treasurer, Dr. A. P. Hitchens.

New York Railroad Club—Following the election of W. J. Harahan to the presidency of the Seaboard Air Line, necessitating his change of residence to Norfolk, Va., and his resignation from office of President of the Club, the election of Eugene Chamberlain to fill the vacancy is announced. The Vice-presidents are George Wildin, C. W. Huntington and F. C. Syze.

Engineers Club of St. Louis—The program of the Club for 1913 as announced, contains a number of interesting papers, among them the following: Jan. 8, "Unit Methods of Reinforced Concrete Construction," by J. E. Conzelman; Feb. 5, "Lubricating Properties and Other Characteristics of Cup Greases," by Prof. A. L. Westcott; Feb. 19, "Smoke Abatement," by W. A. Hoffman; Apr. 2, "Oscillations and Surges in High Potential Transmission," by A. S. Langsdorf; and Apr. 16, "Water Meter Performance in St Louis," by F. L. Bock.

Maine Society of Civil Engineers—The annual meeting of the Society will be held at Augusta, Maine, on Feb. 10-11, at which time a paper will be read by Edward G. Lee on "The Use of the Pitometer." The Secretary of the Society is Frank E. Pressey, 487 Union St., Bangor, Maine.

National Association of Corporation Schools—The first annual convention of the Association was held in New York City on Jan. 24, attended by about 100 delegates from leading corporations in various parts of the country, interested in vocational training of employees. The morning session was largely taken up with the details of forming an organization and this work proceeded in the afternoon session when a temporary constitution was adopted and the following officers elected for the ensuing year: President, Arthur Williams, and Vice-presidents, E. St. Elmo Lewis and Dr. C. P. Steinmetz.

Papers were read at the afternoon session by H. C. Gantt, F. C. Henderschott and C. P. Steinmetz, describing various phases of vocational training work in different lines, and in the evening a banquet was held at Delmonico's, at which the delegates were addressed by President-elect Williams and Vice-president-elect Lewis, of the Association, and by Chancellor Brown, of New York University.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Massachusetts—Boston & Maine R.R.—This company is considering the construction of a four-track system between Boston and Haverill, via Lawrence. A. B. Corthell, Boston, is Ch. Engr.

Pennsylvania—Baltimore & Ohio R.R.—This company is surveying through Franklin County to the west of Waynesboro and through the east end of Greencastle for a new line from Cherry Run to Chambersburg or Shippensburg to connect there with a branch of the Philadelphia & Reading Ry. F. L. Stuart, Baltimore, Md., is Ch. Engr.

Maryland—Baltimore & Virginia Ry.—This company will probably award contracts soon for constructing a section of its line. The plans call for building from Baltimore, south through Anne Arundel and Calvert Counties to Drum Point, on the Patuxent River. Part of the grading has been finished for tracklaying, and some track has been laid. The plans include putting up trestles, terminal docks and shop buildings. H. M. Thompson, Baltimore, is interested.

Maryland—The Bond Lumber Co., Bond, Md., it is reported, is considering the construction of a railroad from Bond, Md., to Confluence, Penn., about 25 miles, along the Savage and Youghiogheny Rivers.

Virginia—Southern Ry.—This company will make improvements to its line from Richmond to West Point, Va., 39 miles. B. Herman, Washington, D. C., is Ch. Engr. M. W.

West Virginia—Red Creek R. R.—This company has been chartered with a capital of $40,000. The incorporators are R. B. Norsburgh, D. G. Wilson, E. M. Bechtel, L. R. Harvey and A. J. Armstrong, all of Hendricks, W. Va.

West Virginia—Morgantown & Wheeling Ry.—This company, recently organized, has acquired the Morgantown & Dunkard Valley R.R. Co. and proposes to extend its line from Cassville via Blacksville to Elm Grove and Wheeling, W. Va., a distance of about 73 miles. J. Ami Martin is Gen. Mgr.

Georgia—W. E. Aycock, Moultrie, Ga., is interested in the construction of a railroad from Moultrie to Meigs, Ga., about 25 miles. Surveys have been completed.

Florida—Port St. Joe Dock & Terminal Ry.—This company, it is reported, will build a line 12 miles long. L. H. Dimmitt is Vice-Pres. and Gen. Mgr.

Alabama—Gadsden, Bellevue & Lookout Mountain R.R.—Construction work, it is reported, will be started on this railroad as soon as arrangements can be completed for an entrance to Gadsden, and that the line will be built from that city to Noccalula Falls. U. J. Virgin, New Orleans, La., is Pres.

Tennessee—Kentucky, Tennessee & Alabama R.R.—Surveys are being made, it is reported, by this company, for its proposed line. The company was promoted as the Appalachian R.R. and proposed to construct from Williamsburg, Ky., to Chattanooga, Tenn., 183 miles, with branches and connecting lines to Knoxville, Harriman, Nashville and Birmingham. Estimated cost of construction, from $5,000,000 to $6,000,000. H. F. Lee is Pres., East Tennessee National Bank Bldg., Knoxville, Tenn. A. C. Olney, of Birmingham, Ala., is Ch. Engr.

Kentucky—Caney Ry.—This company has filed articles of incorporation with the Secretary of State. The proposed line will connect with the Chesapeake & Ohio Ry. at a point near the mouth of Middle Creek of the Big Sandy River in Floyd County, and extend to Beaver Creek, a distance of 12 miles. The construction of the road will begin at once. The incorporators are: James Salisbury, B. F. Combs, M. Flannigan, W. F. Hite, W. P. McVay, W. W. Brown, R. Flannigan. Noted Jan. 16.

Ohio—Erie & Youngstown R.R.—The Public Service Commission has approved the application of the Lake Erie & Youngstown R.R. Co. to issue $4,500,000 in first mortgage bonds, and the same amount in capital stock, to finance the construction of a new railroad from Youngstown to Conneaut Harbor. Of the stock issue $300,000 is for promotion fees. Noted Dec. 12.

✚**Indiana**—Chicago, Terre Haute & Southeastern Ry.—This company has awarded the contract to the CROWLEY-SALISBURY CONSTRUCTION CO., Davenport, Iowa, for constructing a branch to the coal fields in the southern part of Indiana.

Michigan—Grand Rapids & Northwestern Ry.—This company will construct its line this year. It will be 95 miles in length.

Illinois—Chicago Great Western Ry.—This company has made surveys for the construction of a line from Bolton to Freeport, Ill. L. C. Fritch, Chicago, Ill., is Ch. Engr.

Wisconsin—Chicago & Wisconsin Valley Ry.—This company expects to complete the Portage, Madison and Prairie du Sac line this year. The construction work has been transferred to the WISCONSIN CONSTRUCTION CO. J. E. Jones is Vice-Pres. and Gen. Mgr., Portage, Wis.

Chicago & Northwestern Ry.—This company will lay out switching yards midway between Racine and Kenosha, Wis. Ten miles of switch track will be laid.

North Dakota—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company has awarded the contract to FOLEY BROS., WELCH & STEWART, St. Paul, Minn., for constructing an extension from Ambrose, N. D., to a point in Montana, 75 miles west.

Missouri—The construction of a railroad from St. Joseph, Mo., northeast to Calnesville, Mo., about 75 miles, is proposed. A survey is now being made. C. F. Enright, St. Joseph, Mo., is interested.

Texas—San Antonio, Uvalde & Gulf R.R.—This company has filed an amendment to its charter, increasing its capital stock from $230,000 to $280,000. The stockholders authorized a branch line from Campellton to Mathis, about 50 miles. An extension will also be made from Fowlerton to some point on the Rio Grande. E. R. Breaker, Pleasanton, Tex., is Ch. Engr.

El Paso & Southwestern R.R.—This company, which recently extended its line into Tucson, Ariz., it is reported, will build into Los Angeles, Calif. F. B. King, Douglas, Ariz., is Supt.

Texas—Asherton & Gulf R.R.—This company, it is reported, has awarded the contract for the construction of an extension from Artesia Wells on the International & Great Northern Ry. to Corrizo Springs, 10 miles. W. McComb, Asherton, Tex., is Secy.

Texas—Estacado & Gulf R.R.—This company, which was bought recently by L. C. Eastland, of Oklahoma City, Okla., has been reorganized. Improvements will be made. L. C. Eastland is Pres.

Oklahoma—Atchison, Topeka & Santa Fé Ry.—A bill was introduced in the House of Representatives, Jan. 11, authorizing this company to reconstruct its line through the Chilocco Indian Reservation, Oklahoma. C. A. Morse, Topeka, Kan., is Ch. Engr.

New Mexico—It is announced by Phelps, Dodge & Co., who recently acquired extensive copper mines in the Burro Mountain district of New Mexico, that they will soon begin the construction of a railroad from Whitewater to the mines. The proposed new line will connect at Whitewater with the Atchison, Topeka & Santa Fé Ry., and traffic arrangements have been made with the latter road to handle the traffic of the new line to Deming. The preliminary surveys for the proposed road that is to run from Whitewater to Tyron have been made. Walter Douglas, Bisbee, Ariz., is interested.

Idaho—Oregon Short Line R.R.—This company has purchased the Idaho Northern Ry., in operation between Nampa and Murphy, and will build an extension to the line a distance of 100 miles to the south, and north to the Salmon River, down that stream to Snake River, and west to Lewiston, Idaho. Noted Jan. 23.

Nevada—Nevada Copper Belt R.R.—This company is considering the construction of an extension from its terminal at Ludwig.

Arizona—A railroad will be constructed from Clarksville to Phoenix, about 100 miles. The line will run to the east of Humboldt. Address the Secretary of the Commercial Club of Phoenix.

Washington—McCoy-Loggie Timber Co.—This company, it is reported, will build a logging road up North Fork, about six miles, connecting with the Northern Pacific Ry. near Saxon. The cost of the line will be about $100,000. Eugene Loggie is Mgr.

California—Atchison, Topeka & Santa Fé Ry.—This company, it is reported, will double-track its line from Los Angeles to San Diego, Calif. All wooden trestles will be replaced by concrete structures. G. W. Harris, Los Angeles, Calif., is Ch. Engr. Coast Lines.

Canada—North Ry.—This company, incorporated in Quebec in 1906 as the North Eastern Ry., is applying for a Canadian charter, and for an extension of time to build from the east shore of Lake Temiskaming near Ville Marie, east, passing the southern bays of Lakes Des Quinze, Victoria and Kakebonga to the city of Quebec, and to build extensions as follows: From the main line to Ottawa and from Montreal to Quebec; from Quebec and Montreal to the boundaries of the states of Maine, New Hampshire and Vermont, and also to build a bridge across, or a tunnel under the St. Lawrence River for railway and other traffic. Pringle & Guthrie, Ottawa, are solicitors.

Canada—Canadian Central & Labrador Ry.—This company has applied to the Canadian Parliament for incorporation to construct from Cochrane, Ont., northeast, to a point at or near Cape St. Lewis on the Atlantic Coast, with a branch to a point near the mouth of the Hamilton River, Que., and a branch to the city of Quebec, Que. Smith & Johnston, Ottawa, are solicitors.

Manitoba—Canadian Pacific Ry.—This company awarded contracts, Jan. 17, for 807 miles of new line, to be constructed in western Canada this year. The following secured portions of the work: JANSE BROS., BOOMER & HUGHES, Calgary, Alta., for 375 miles; E. PETERSON, Omaha, Neb.; WELCH & STEWART, J. D. McARTHUR, and GEORGE WEBSTER, for the remainder.

✚**Alberta**—Grand Trunk Pacific Ry.—This company has awarded the contract to the BATES & ROGERS CONSTRUCTION CO., Spokane, Wash., and Chicago, Ill., for the construction of all bridges and tunnel lining on the line between Prince Rupert, B. C., and Edmonton, Alta. The cost is estimated at $2,000,000.

ELECTRIC RAILWAYS

Milford, Conn.—Plans are being considered by the Connecticut Co. for double-tracking its line in Milford. J. K. Punderford, New Haven, is Gen. Mgr.

Albany, N. Y.—The United Traction Co. is preparing plans for the construction of an extension of its Arbor Hill line on Livingston Ave. to North Lake Ave. in West Albany. Edgar S. Fassett, Albany, is Gen. Mgr.

Canajoharie, N. Y.—The Little Falls & Johnstown Ry. Co. is making preliminary arrangements for the construction of an electric railway from St. Johnsville to Canajoharie. The line will consist of a main line, 28 miles long and an eight-mile branch. Estimated cost, $1,845,000. J. L. Hees, Gloversville, is Pres.

Lestershire, N. Y.—The Binghamton Ry. Co. is considering plans for the extension of a branch line from Main St. in Lestershire to Johnson Park. J. P. E. Clark, Binghamton, is Gen. Mgr. and Pur. Agt.

★New York (Boro. of Queens), **N. Y.**—Bids will be received by the Public Service Commission for the First District, 154 Nassau St., until Feb. 7, for the construction of Section 3 of the Woodside, Astoria & Corona Rapid Transit R.R. The work includes a two- and three-track elevated railroad to Queens Boulevard, Greenpoint Ave., Skillman Ave. and Roosevelt Ave., between the Queensboro Bridge Approach and Sycamore Ave., Corona, including two express and eight local stations.

Koppel, Penn.—Press reports are to the effect that the Pittsburgh, Harmony, Butler & New Castle St. Ry. Co. is making preliminary arrangements for the extension of its line from Elwood City to Beaver Falls, by way of Koppel. Harry Etheridge, Pittsburgh, is Supt. and Elec. Engr.

Matomoras, Penn.—The Eastern Midland R.R. Co. has been incorporated to construct and operate an interurban railway from Matomoras, Penn., to the Delaware Water Gap. The incorporators are H. C. Miller, R. M. Wilson, A. B. Thornburg, E. C. Hayes and C. R. Barton.

Nesquehoning, Penn.—The extension of the local street railway from Nesquehoning to Summit Hill is being agitated.

Warren, Penn.—Press reports state that the Warren St. Ry. Co. will be ready to start construction work early this spring on the proposed electric railway from Warren to Youngsville. D. A. Wheelock, Warren, is Ch. Engr. Noted Nov. 7.

Newell, W. Va.—The Newell St. Ry. Co. has applied to the City Council for a franchise to double-track and extend its lines in Newell. F. B. Lawrence, Newell, is Gen. Mgr. and Pur. Agt.

Wheeling, W. Va.—Press reports state that the Wheeling & Morgantown Electric Ry. Co. is making preliminary arrangements for the construction of an electric railway from Wheeling to Morgantown, about 73 miles. J. M. Martin is Gen. Mgr.

Jackson, Ga.—The Georgia Ry. & Electric Co. is making preliminary arrangements for the extension of its line from Snapping Shoals to Jackson. W. H. Glenn, Electric & Gas Bldg., Atlanta, is Gen. Mgr. Rys.

Jacksonville, Fla.—The Florida Interurban Ry. & Tunnel Co. will soon be ready to start work on the construction of its proposed line from St. Augustine to Jacksonville. Right-of-way has been secured and franchises obtained. M. W. Bates, Jacksonville, is Pres. Noted Nov. 28.

Birmingham, Ala.—The Kelly Co. has been granted a franchise to construct and operate an electric railway in Birmingham, according to its revised plans. Noted Jan. 9.

Gadsden, Ala.—Preliminary arrangements are being made and work will soon be started by the Gadsden, Belleville & Lookout Mountain Ry. Co. for the construction of an electric railway from Gadsden to Noccalula Falls. U. J. Virgin, New Orleans, La., is Pres.

Mobile, Ala.—The Mobile & Baldwin County R.R. Co. has been incorporated to construct and operate an interurban railway to connect Mobile, Bay Minette and Pensacola. The incorporators are John P. Lowell, W. P. Miller, J. R. Cross and E. H. Miller.

Laurel, Miss.—Preliminary arrangements are being made and construction will soon be started by the Laurel Light & Railway Co. on its proposed electric interurban railway from Laurel to Ellisville. Noted Dec. 5.

St. Elmo, Tenn.—The City Council has granted a franchise to the Chattanooga Ry. & Light Co. for operating and extending its railways in St. Elmo. W. E. Basham, Chattanooga, is Mgr.

Maysville, Ky.—Plans are being prepared by the Maysville [illegible] Corporation, for the extension of its line to [illegible] suburbs of Maysville.

Cincinnati, Ohio—The Cincinnati Traction Co. is considering plans for the expenditure of $1,000,000 for the extension of its lines in Cincinnati. E. H. Berry, Traction Bldg., Cincinnati, is Pres.

Martins Ferry, Ohio—The Wheeling Traction Co. is consid[illegible] Wheeling, W. Va., is [illegible]

Alton, Ill.—The Alton & Eastern Ry. Co. has been incorporated [illegible] operate an electric railway in Madi[illegible] The incorporators are L. C. Hanson, [illegible]

Burlington, Iowa—[illegible]

Clinton, Iowa—The [illegible] Co. [illegible] in the [illegible]

Iowa City, Iowa—The reorganization of the Iowa City Electric Ry. Co. under the name of the Mississippi Valley Electric Co. has been completed. The new company plans the extension of its street railway service in Iowa City. J. O. Schulz, Iowa City, is Pres.

Tekamah, Neb.—Franklin Everett, Lyons, Neb., is promoting the construction of an electric railway from Tekamah to Decatur, about 18 miles.

Brazil, N. D.—Preliminary arrangements are being made by the Brazil, Devil's Lake & Minneapolis Ry. Co. for the construction of an interurban railway to connect Brazil, Devil's Lake and Minneapolis, Minn. A. B. Fox, Brazil, is interested. Noted Dec. 26.

St. Louis, Mo.—The Missouri Public Utilities Co. has been organized for the purpose of constructing an electric interurban railway in southeast Missouri. Hugo Wurdack, Wright Bldg., St. Louis, is interested.

Sherman, Tex.—T. F. Macmiller has applied to the City Council for a franchise to construct and operate an electric railway on certain streets in Sherman. This is part of a proposed line from Sherman to Gainesville. Noted Nov. 28.

Temple, Tex.—E. P. Turner, Dallas, Tex., is promoting the construction of an electric railway from Martin to Temple.

Price, Utah—The Buckhorn Land Co. is considering plans for the construction of electric railway from Price to the northern section of Emery County, where the company is developing waters for irrigation purposes.

Buckskin, Nev.—Preliminary surveys are being made by the Nevada Copper Belt R.R. Co. for the construction of an extension from Ludwig to Buckskin, about six miles.

Kelso, Wash.—The Commissioners of Cowlitz County have granted a franchise to the Washington-Oregon Corporation to construct and operate an electric railway from Kelso to Castle Rock.

Port Townsend, Wash.—The construction of an electric railway in Port Townsend is contemplated by W. B. Webb and associates.

Grants Pass, Ore.—The Grants Pass & Crescent City Ry. Co. is making preliminary arrangements and will soon be ready to receive bids for the construction of an interurban railway from Grants Pass, Ore., to Crescent City, Calif., about 100 miles. J. F. Reddy, Grants Pass, is interested.

Alameda, Calif.—D. J. Hanlon is contemplating spending between $70,000 and $80,000 for the construction of a marine railway on the property adjoining the shipbuilding plant of the United Engineering Co.

Fresno, Calif.—Preparations are being made by the Visalia Electric R.R. Co. for the extension of its line from Orosi to Fresno. F. W. Webster, Fresno, is Gen. Mgr.

Huntington Park, Calif.—The Board of Trustees has granted a franchise to Victor G. Kleinberger to construct and operate an electric railway in Huntington Park.

✚Los Angeles, Calif.—We are officially advised that the contract for furnishing materials and for constructing an electric street railway on San Pedro St., from Aliso to Ninth St., has been awarded by the city to the PACIFIC ELECTRIC RY. CO., at $246,575. Bids were received by H. B. Ferris, Secy. Bd. of Pub. Wks., Jan. 10. Noted Jan. 9.

Orange, Calif.—The Pacific Electric Ry. Co. has been granted a 50-year franchise to construct and operate an electric railroad over and along certain highways in Orange. J. McMillan, Los Angeles, is Gen. Mgr.

San Luis Potosi, Mex.—The local street railway systems in the cities of San Luis Potosi, Leon, Guanajuato, Torreon and Tampico, have been acquired by Hoogwhinkel, Anthony, Brown & Co., London, England. The new owners contemplate the reconstruction of all the lines.

Brandon, Man.—The City Council has applied to the Manitoba Legislature for permission to construct an electric railway to connect Brandon with surrounding towns. R. E. Speakman is City Engr.

LIGHT, HEAT AND POWER

Rochester, N. H.—The City Council has appointed a committee to investigate and make a report of the feasibility of installing a municipal electric-light plant.

Newfane, Vt.—Albert Phillips will install an electric-light plant in Newfane if sufficient patronage is assured.

Boston, Mass.—The installation of a new lighting system on Broadway in South Boston, is being considered by the South Boston Citizens' Association. Estimated cost $15,000

✚Millbury, Mass.—The Worcester Consolidated St. Ry. Co. has awarded the contract for the installation of a steam economizer in the Millbury power plant, to the GENERAL ELECTRIC CO., Schenectady, N. Y., at $20,000.

Providence, R. I.—Plans are being prepared by the Electrical and Gas Engineer for the installation of 4000 new ornamental lamps for street-lighting purposes.

✚New Britain, Conn.—The New Britain Gas Light Co. has awarded the contract for the construction of a gas purifying plant in connection with its present plant, to JOHN W. ALDEN & SON. Noted Dec. 19.

✚Waterbury, Conn.—The American Brass Co. has awarded the general contract for the construction of a power plant at its Waterbury branch, to CHATFIELD & CHATFIELD, INC., 93 Lincoln St., Waterbury. Noted Oct. 10.

✚Freeport, (L. I.) N. Y.—The contract for the improvement and extension of the municipal electric-light plant has been awarded by the Village Board of Trustees, to WILLIAM J. SULLIVAN & CO., 111 Liberty St., New York, N. Y., at [illegible]

Marathon, N. Y.—The Municipal Water and Light Commission is considering plans for the installation of new equipment in the municipal electric-light plant.

New York, N. Y.—Bids will be received by George McAneny, Pres. Boro. of Manhattan, until 2 p.m. Feb. 10, for the installation of the heating and ventilating systems, using the [illegible] and boilers specified, and all work incidental thereto, in the children's court building, to be located at 137 to 143 East 22d St., Boro. of Manhattan.

New York, N. Y.—Bids will be received by Michael J. Drummond, Comr. of Pub. Charities, until 2 p.m., Feb. 5, for providing all the labor and materials required for the inspection and maintenance of electrical apparatus in the Boroughs of Manhattan, The Bronx, Brooklyn, Queens and Richmond.

Rochester, N. Y.—The Clark Paper Mfg. Co. will construct a new power plant in connection with its establishment on Dewey Ave., Rochester. F. A. Brockett is Arch.

Scranton, Penn.—The Scranton Electric Co. is making preliminary arrangements for the construction of a three-story boiler house. Duncan T. Campbell, Scranton, is Gen. Mgr.

+St. Charles, Va.—The Bewley-Darst Coal Co. has awarded the contract for the construction of an electric-power plant and about 50 miles of transmission lines to the ELECTRIC TRANSMISSION CO., at about $300,000. Noted Sept. 26.

Huntington, W. Va.—The Tri-State Power & Milling Co., recently organized, proposes to construct a hydro-electric plant capable of supplying electricity in West Virginia, Kentucky and Ohio. R. W. Kline, Salem, Va., H. M. Fox, Roanoke, Va., and A. D. Buxh, Huntington, are interested.

Elizabeth City, N. C.—The city is making arrangements for the construction of a municipal electric-light and water plant.

Waveland, Miss.—At a recent meeting of the Board of Aldermen, it was decided to install an ornamental street-lighting system throughout the city.

+Donaldsonville, La.—The Light and Water Commission has awarded the contract for the construction of a new power plant to R. L. STEWART, Donaldsonville, at $8000. Noted Aug. 22.

Lafayette, La.—Plans are being prepared for the installation of new equipment in the municipal electric-light plant and for changing the system from direct to alternating current. Estimated cost, $40,000.

Bristol, Tenn.—A company is being organized under the name of the Electric Transmission Co. for the purpose of constructing an electric-power plant near Bristol. Estimated cost, $2,000,000. B. L. Dulvaney is interested.

Dunlap, Tenn.—The city is considering the installation of a municipal electric-light plant.

Vine Grove, Ky.—Bids will soon be received by W. A. Burkhart for the construction of an electric-light plant which he proposes to erect at Vine Grove.

Cincinnati, Ohio.—Plans are being prepared by Stewart & Stewart Archs., for the construction of an electric-light and power plant for the Kentucky Motor Sales Co. Estimated cost, $30,000.

Cincinnati, Ohio.—Press reports state that the Union Gas & Electric Co. contemplates the construction of a new generating plant, to take the place of the Plum St. plant. Estimated cost, $2,500,000. James C. Ernst is Vice-Pres.

Cleveland, Ohio.—Bids will be received by W. J. Springborn, Dir. of Pub. Serv., until noon, Jan. 31, for furnishing and erecting the structural work for the municipal electric-light plant.

Coshocton, Ohio.—The Coshocton Light & Heating Co. has decided to construct an extensive addition to its power plant, to cost $60,000. S. E. Holderman, Coshocton, is Supt.

Richmond, Ind.—It has been decided by the Board of Public Works to expend $65,000 for the improvement of the municipal electric-light plant. The work includes the installation of new equipment.

Frankfort, Mich.—We are officially advised that bids will soon be received by the Benzie County Power Co. for the construction of a hydro-electric plant near Frankfort. S. B. Wiggins, 269 Engineering Bldg., Ann Arbor, is Consult. Engr.

Bryant, Ill.—A franchise has been granted by the Village Board to the Canton Gas & Light Co. to construct and operate an electric-light system in Bryan. E. H. Negley, Canton, Ill., is Mgr.

Galva, Ill.—The construction of an electric-light plant in Galva is contemplated by the Hayes Pump & Corn Planter Co. The proposition is being considered by the City Council.

Thomasboro, Ill.—The installation of an electric-light system is contemplated by the Village Board.

Tuscola, Ill.—The County Council will hold a meeting to discuss the installation of a county electric-light plant to supply electricity for county buildings. Fred C. Rahn is Chn. of Bd. of County Supervisors.

Ames, Iowa—At an election to be held Feb. 10 the citizens will vote on the proposition to issue $25,000 of bonds for the construction of a municipal electric-light plant.

Iowa Falls, Iowa—The Iowa River Light & Power Co. has received an extension of time on its franchise for the construction of an electric-light plant at Iowa Falls.

Sioux City, Iowa—Bids will soon be received by the city for the installation of new equipment in the municipal electric-light plant.

Argyle, Minn.—The installation of an ornamental street-lighting system in Argyle is being agitated by the Business Men's Association.

Westbrook, Minn.—L. P. Pederson and Bert Milligan are interested in the installation of an electric-light plant in Westbrook.

Fort Scott, Kan.—The City Council is considering plans for the construction of a municipal electric-light plant.

Parsons, Kan.—An election will be held Feb. 11 to vote on the proposition to issue $75,000 in bonds for the construction of a municipal electric-light plant.

Devil's Lake, N. D.—Bids will be received by the city until Feb. 10 for the installation of an ornamental street-lighting system.

Kansas City, Mo.—The proposition to issue bonds for the construction of a municipal electric-light plant is under consideration.

Dallas, Tex.—The City Commission will submit to a vote of the citizens at an election, to be held in April, the proposition to install a municipal electric-light plant at Dallas. Leon M. Taylor, City Engr., has estimated the cost at $[illegible].

Greenville, Tex.—The local gas plant has been purchased by J. R. Cullinans, of St. Louis, Mo. The new owner plans to enlarge the plant and extend the distributing system.

Cushing, Okla.—The Cushing Electric Light & Power Co. is making arrangements for the construction of an electric-light plant to furnish electricity to Cushing and Earlsboro. H. Askin is in charge of the work. Noted Jan. 9.

Hinton, Okla.—Bonds for $10,000 have been voted for the purpose of installing an electric-light system in Hinton.

+Stonewall, Okla.—The Town Council has awarded the contract for the construction of an electric-light plant and system to DON A. TOLBERT, Ada, Okla. Noted Jan. 16.

Salt Lake City, Utah—The Utah Gas & Coke Co. contemplates an expenditure of $150,000 for the improvement of its gas manufacturing plant and the laying of about 12 miles of new mains. J. C. D. Clark is Gen. Mgr.

Hood River, Ore.—The Pacific Power & Light Co. contemplates the construction of a hydro-electric plant at Hood River to develop between 7000- and 8000-hp.

Portland, Ore.—The Northwestern Electric Co. will erect an auxiliary steam plant for the generation of electricity on Albina Ave. The company will spend more than a quarter of a million dollars on improvements in the shape of substantial brick structures on the property.

Portland, Ore.—The Mayor is agitating the construction of a municipal electric-light system.

Fresno, Calif.—Plans are being prepared by J. G. White & Co., New York, N. Y., for the construction of a 5000-hp. hydro-electric plant on the Tule River for the San Joaquin Light & Power Co.

Lindsay, Calif.—The Tulare County Power Co., of Lindsay, has applied to the State Railroad Commission for permission to issue bonds for $500,000, to be used for further extensions and development work.

Los Angeles, Calif.—The Southern California Edison Co. will spend $2,500,000 for improvements. It will spend approximately $1,500,000 on its Longbeach plant, and the balance will be used for stations in Los Angeles, construction of new substations, enlargement of the distributing system and general improvements throughout the entire system. W. A. Brackenridge, Los Angeles, is Gen. Mgr.

Newport Beach, Calif.—Bids will be received by the city until Feb. 3, for the construction of a municipal electric-light system, to cost about $25,000.

Redding, Calif.—The Northern California Power Co. contemplates an expenditure of $225,000, for constructing the Dry Burney Creek storage reservoir, for doubling the capacity of its power plant at Kilarc and for enlarging its South Cow Creek power plant. The Dry Burney Creek reservoir will cost about $130,000, the Kilarc plant project, about $35,000 and the improvement at South Cow Creek, about $30,000.

Sacramento, Calif.—The Great Western Power Co. has applied for permission to issue $4,000,000 of bonds for the completion of the Big Bend Power Dam, on the Feather River at Big Meadows.

San Francisco, Calif.—The Pacific Gas & Electric Co., 445 Sutter St., have taken out a permit for the construction of a one-story steel frame and brick steam plant on Meacham Place. Estimated cost, $15,000. John A. Britton, San Francisco, is Gen. Mgr.

St. Charles, Man.—Bids will soon be received for the construction and equipment of a new electric-light plant.

Moose Jaw, Sask.—Bids will be received by A. W. Mayberry, Ch. Comr., until Feb. 10, for the installation of a steam turbine and generator in the municipal electric-light plant.

Duncans, B. C.—Dutcher, DuCane & Co., Rogers Bldg., Vancouver, have prepared plans for the construction of a hydro-electric plant at Duncans. Estimated cost, $45,000.

+Kamloops, B. C.—The city has awarded the contract for the construction of a municipal power plant to C. C. MOORE, Mutual Life Bldg., Seattle, Wash.

BRIDGES

Rockport, Maine—Bids are being received by E. H. Powers, Chn. of Selectmen, for furnishing plans and constructing a bridge, either girder or suspension, to have a 42-ft. span, 18 ft. wide.

Van Buren, Maine—The Van Buren Bridge Co. has applied to the government for permission to construct a toll bridge over the St. John River between Van Buren and the parish of St. Leonard. The company is capitalized at $250,000. Allan E. Hammond is interested.

+New Bedford, Mass.—The contract to construct a bridge across the Acushnet River between New Bedford and Fairhaven, has been awarded to WILLIAM H. ELLIS, 18 Tremont St., Boston, at approximately $25,000. Noted Jan. 16.

South Norwalk, Conn.—It is proposed to widen the Wall St. Bridge at an estimated cost of from $50,000 to $100,000. Samuel W. Hoyt, Jr., is City Engr.

+Albany, N. Y.—The contract to construct a bridge over Great South Bay has been awarded by the State Highway Commission, to the OWEGO BRIDGE CO., Owego, N. Y., at $44,431. Noted Sept. 12.

Herkimer, N. Y.—Bids will be received by the Town Superintendent of Highways, German Flatts, until 1 p.m., Feb. 3, for constructing a bridge over Steele's Creek, at Main St., Ilion, N. Y., and a bridge over Fulmer Creek on Main St., Mohawk, N. Y. Plans were prepared by Wilbur J. Watson & Co., Consult. Engrs.

Oswego, N. Y.—Press reports state that the Concrete Steel Engineering Co., 17 Park Row, New York, New York, is preparing plans for the construction of a concrete and steel bridge over the Oswego River, between Oswego and Bolney. Estimated cost, from $50,000 to $75,000.

+Ocean City, N. J.—According to press reports, the Ocean City Auto Bridge Co. has awarded a contract to the SUTTON

& CORSON CO., Philadelphia, and the HILL DREDGING CO., combined, to construct the proposed wooden bridge across Great Egg Harbor Bay, between Ocean City and Somers Point. Contract price, $184,663. Noted Jan. 23.

Passaic, N. J.—Garwood Ferguson, County Engr., has prepared a report for the Board of Freeholders, recommending the construction of a new bridge at the foot of Eighth St. Estimated cost, $55,000.

Toms River, N. J.—We are officially advised that bids will be received about Mar. 15, by the Island Heights and Sea Side Park Bridge Co., for the construction of two timber trestles and one earth fill across Barnegat Bay. Estimated cost, $85,000. Arthur C. King, Toms River, is Consult. Engr. J. P. Everham is Secy. Noted Jan. 9.

Etna, Penn.—Bids will be received by J. C. Armstrong, Boro. Clk., until 5 p.m., Feb. 10, for furnishing and erecting a plate girder bridge with concrete abutments, over Pine Creek, on Butler St.

Mocanaqua, Penn.—The Commissioners of Luzerne County, Wilkes-Barre, Penn., will probably soon ask bids for the construction of a reinforced-concrete arch bridge between Mocanaqua and Shickshinny. Estimated cost, $20,000. Plans have been prepared by Boyle & Howell, Consult. Engrs., Bank Bldg., Kingston, Penn.

New Castle, Penn.—The County Commissioners and the city authorities contemplate the construction of a viaduct at Gardner Ave., to eliminate the grade crossing there. Estimated cost, $200,000.

Pittsburgh, Penn.—Bids will be received at the office of the City Controller until 10 a.m., Feb. 3, for constructing the concrete abutments, piers and pedestals for the Bloomfield Bridge. Plans may be obtained at the office of the Department of Public Works.

Ridgway, Penn.—Bids will be received by G. F. Greiner, Secy. of Town Council, until 7:30 p.m., Feb. 10, for constructing a reinforced-concrete arch bridge over Elk Creek at Depot St. Plans and specifications are on file at the office of F. W. Ward, Boro. Engr.

Towanda, Penn.—Bids will be received by the Commissioners of Bradford County, until 2 p.m., Feb. 20, for rebuilding the bridge across the Susquehanna River, at Towanda, consisting of four steel pans, 220 ft. each, with 35-ft. roadway, and sidewalks; also the bridge across the Susquehanna River at Athens, consisting of three steel spans, 183 ft. each, with 35-ft. roadway, and sidewalks. David A. Keefe, Athens, is Ch. Engr.

West View, Penn.—See item under Sewers.

Dover, Del.—Bids will be received by the Levy Court of Kent County until noon, Feb. 11, for removing the Martins Bridge over the Leipsic River. James T. Truax is Pres.

Annapolis, Md.—The city, county and state officials plan to construct a concrete bridge across the Severn River, to replace the county bridge and the railroad bridge now in use. William L. Marcy is Chn. State Roads Com.

Baltimore, Md.—The Pennsylvania R.R. Co. has asked permission to construct an ornamental concrete bridge near Western Cemetery, over Gwynn's Falls.

Washington, D. C.—The District Commissioners contemplate an appropriation of $60,000 for installing a draw in the bridge over the Anacostia River at Pennsylvania Ave.

Huntington, W. Va.—Press reports state that plans are under way and a contract is about to be awarded for the construction of a steel railway bridge across the Ohio River, and building 35 miles of railroad to be known as the Huntington & Northern Ry., and connecting the Baltimore & Ohio R.R. and Hamilton & Dayton Ry. The estimated cost of the work is $3,000,000, and the contract will probably be awarded to the United States Engineering & Construction Co. Edward B. Garretson, Cincinnati, Ohio, is interested.

New Orleans, La.—Bids will be received until Feb. 11, by the Parish Police Jury for the construction of a steel bridge across the Amite River at the point known as Joors Bridge.

Cincinnati, Ohio—The Business Men's Club is interested with the Park Committee in securing the erection of a new [illegible] to the Ideal Way entrance to Eden Park.

Dayton, Ohio—Plans and specifications have been completed for the concrete bridge over Mad River, on Keowee St., and bids will be asked in March. The bridge is to be a three-span structure, 235 ft. long, and will cost approximately [illegible]. Noted Nov. 28

Defiance, Ohio—Bids will be received about May 10 by the [illegible] for the construction of [illegible] bridge across the Maumee River. The contract for the superstructure has been awarded to The Toledo Bridge & [illegible]. The contract is for about 1,100 tons, 16 to 15 [illegible] feet in the middle of the river, at an estimated cost [illegible]. H. T. Bloom is Chn. B. F. Wirth is [illegible].

Toledo, Ohio—Bids will soon be asked by the Director of Public Service for the construction of a bridge at Sumner St. [illegible] will be [illegible] to cost about [illegible] Plans with [illegible] are now in the [illegible] Engr. Noted Jan. 16.

Edwardsville, Ill.—The [illegible] Co. is [illegible] plans preparatory to [illegible] bridge across the Mississippi River at [illegible] Noted Jan. 16.

✦Topeka, Kans.—The [illegible] for the construction of a [illegible] bridge across the Kaw River, and [illegible] Noted Jan. 16.

Omaha, Neb.—[illegible] for the construction of the Douglas [illegible] Plans for the [illegible] Noted Jan. 16.

San Angelo, Tex.—The [illegible] to be received by [illegible] Feb. 7 for the construction of a [illegible] across the South Concho River at South Chadbourne St., San Angelo, have been accepted by the County Commissioners. It will be about 500 ft. long and will cost approximately $60,000. Bids will soon be asked.

✦Norman, Okla.—The contract for the construction of a bridge over the South Canadian River, has been awarded to the KANSAS CITY BRIDGE CO., at $38,000. Noted Aug. 8.

✦Ogden, Utah—We are officially advised that the Ogden & Logan Rapid Transit Co. has awarded the contract for the construction of five steel bridges on its Hermitage-Huntsville extension, to J. J. BURKE & CO., Salt Lake City, Utah. Joseph A. West, Ogden, is the Ch. Engr. Joseph A. West, Ogden ,is the Ch. Engr. Noted Jan. 9.

Phœnix, Ariz.—An appropriation of $70,000 has been made for the construction of two bridges, one across the Gila River and the other across the San Carlos River.

Klamath Falls, Ore.—The Klamath County Court is considering the construction of a 65-ft. steel span bridge across the Lost River, at a point about 12 miles south of Klamath Falls. The structure will replace the Wikon Bridge, near the Lost River division dam.

Princeton, Calif.—The County Supervisors plan to build a bridge across the Sacramento River at Princeton. The estimated cost is $90,000.

Redding, Calif.—The City Trustees and the State Engineer have selected the site and have made arrangements to call for plans and specifications for the construction of a highway bridge over the Sacramento River at Redding. Noted Jan. 16.

Willows, Calif.—Plans have been submitted to the Supervisors for the construction of six new county bridges, three south of Willows and three in Newville County. A bond issue for $450,000 was voted last year for the purpose. L. C. Stiles is the County Engr.

WATER SUPPLY—IRRIGATION

Auburn, Maine—The Water Department contemplates an expenditure of $10,000 for improving the water system. The work will be done by day labor. F. G. Bisbee is City Engr.

Blandford, Mass.—It is proposed to establish a reservoir on Prospect Hill, to be supplied by water from the Mountain View Reservoir. H. K. Herrick, Blandford, is interested.

Boston, Mass.—Bids will be received by J. Edward Mullen, Supt. of Supplies, until Feb. 4, for furnishing about 100,000 lb. Type No. 1, and about 1,270,000 lb. Type No. 2 c.-i. special castings, and 642 6- to 16-in. valves, for the high-pressure fire service.

Boston, Mass.—The Fire Commissioner has recommended the extension of the high-pressure water mains through Massachusetts Ave., to give fire protection to the City Hospital.

Chatham, N. Y.—According to press reports, the village has voted to purchase the plant of the Chatham Water Works Co., for $90,000. Noted Dec. 5.

Cortland, N. Y.—The Board of Public Works has plans under preparation for the construction of a pump house and the installation of the necessary equipment, also for laying about 1000 ft. of 16-in. water main. E. L. Becker is Supt.

New York, N. Y.—We are officially advised that bids for constructing the Jerome Park filters, Boroughs of Manhattan and Bronx, were received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, Jan. 23, as follows: Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, Penn., $5,139,015; Oscar Daniels Co., 38 Park Row, New York, N. Y., $6,160,410; T. A. Gillespie Co., 50 Church St., New York, N. Y., $6,752,500; E. E. Smith Co., 71 Broadway, New York, N. Y., $6,619,960; Luke A. Burke Sons Co., 25 West 42d St., New York, N. Y., $5,672,145; Carter Construction Co., 42 Broadway, New York, N. Y., $5,885,875; Cogan & Co., 280 Broadway, New York, N. Y., $5,934,955; Booth & Flinn, 1942 Forbes St., Pittsburgh, Penn., $6,094,855; McArthur Bros. Co.-Mason Hangers Co., 11 Pine St., New York, N. Y., $5,783,170. Noted Jan. 16.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Feb. 3, for furnishing and delivering c.-i. pipe, special castings, valves and double nozzle fire hydrants.

Bids will be received by the Board of Water Supply until 11 a.m., Feb. 18, for furnishing and delivering bronze shaft caps and appurtenances for the city tunnel of the Catskill Aqueduct, in New York City. Charles Strauss is Pres.

Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Feb. 6, for furnishing and delivering c.-i. special castings and valve box castings, Boroughs of Manhattan and The Bronx.

✦Sodus, N. Y. The contract to construct a water system here has been awarded to FISCHETTE BROS., Clyde, N. Y., at $31,238. Bids were opened by the Water Commissioners, Dec. 27. W. A. Lafler, Rochester, is Consult. Engr. Noted Jan. 9.

✦Atlantic City, N. J. Bids will be received by the Board of Commissioners until 2:30 p.m., Feb. 13, for laying a 24-in. and 20-in. c.-i. water main in Arctic Ave., from Missouri Ave. to Maine Ave., with lateral mains on intersecting streets. Specifications are on file at the office of the Water Department. Harry Bacharach is Comr.

Hawthorne, N. J.—The Borough Council has applied to the State Water Supply Commission for permission to install a water system. Noted Jan. 23.

Manhall, Penn.—Bids will be received by the Borough Secretary until 8 p.m., Feb. 4, for laying a 6-in. c.-i. water main in Whitaker Way, and furnishing four fire hydrants, two gate valves and one regulator, in accordance with plans and specifications on file with the Secretary.

Williamsport, Md.—Alfred M. Quick, Consult. Engr., Baltimore, Md., is making a preliminary survey with a view to the installation of a water system here. William Stake is interested.

✦Milton, W. Va. The contract to construct a water system here has been awarded to J. L. STEWART & SONS, Milton.

at $7417. Bids were opened Jan. 3. Plans were prepared by the Leete-Maupin Engineering Co., Huntington W. Va.

Gastonia, N. C.—The owners of the Loray Mills will build a 100,000-gal. water tank to protect the village and the mills from fire.

Lillington, N. C.—Bonds for $15,000 were voted, Jan. 15, for installing water and sewer systems. Noted Dec. 26.

✚Camden, S. C.—According to press reports, the contract to construct a water system and an auxiliary light plant here, has been awarded to TUCKER & LANTON, Charlotte, N. C., at $125,000. Bids were opened Dec. 19. Gilbert C. White, Charlotte, N. C., is Consult. Engr. Noted Nov. 21.

Greer, S. C.—An election has been called for Feb. 1 to vote on a bond issue of $35,000, for the installation of a water system. John D. Wood is Mayor.

Mullins, S. C.—The town contemplates a bond issue of $60,000, for installing water and sewer systems.

★★Rock Hill, S. C.—Contracts for installing a water system here have been awarded as follows: Valves, etc., to R. D. WOOD & CO., Philadelphia, Penn., at $631; pipe line, to HOWARD NEELY, Franklin, Tenn., at $8700 for iron, $5700 for wood; reservoir, etc., to CASE & COTHRAN, Atlanta, Ga., at $23,365. Bids were opened Jan. 21. Noted Dec. 26.

Tallahassee, Fla.—An election will probably be called some time in April to vote on a bond issue of $40,000, for extending the water system and paving various streets.

Birmingham, Ala.—The Birmingham Water Works Co. contemplates the addition of eight filtration tanks on Shades Mountain. Each tank will have a daily capacity of 500,000 gal.

Laurel, Miss.—We are officially advised that plans are being prepared for the extensions to the water and sewer systems estimated to cost $45,000. H. W. Bell is City Engr. Noted Dec. 12.

Covington, Ky.—According to press reports, bonds for $200,000 are for sale here for constructing water mains in South Covington. H. G. Meiners is City Engr. Noted Dec. 12.

Louisville, Ky.—Brinton B. Davis, Consult. Engr., Louisville, is preparing plans for the construction of a reservoir at the county poor farm. Bids will probably soon be asked.

Akron, Ohio—Bids will be received by the Board of Control until noon, Jan. 30, for furnishing 600 ft. of 24-in. intake pipe, also for furnishing corporation and curb cocks and curb boxes. R. M. Pillmore is Dir. Pub. Ser.

Columbus, Ohio—Bids will be received by Samuel A. Kinnear, Dir. Pub. Ser., until Feb. 4, for furnishing 300 valves, ranging from 4 to 20 in., 1500 ¾-in. corporation cocks, 1500 ¾-in. curb cocks, 1500 service boxes, 100,000 lb. of pig lead, 120,000 lb. of lead pipe, 1500 tons of c.-i. pipe, and 90 tons of special castings.

Frankfort, Ohio—The W. J. Sherman Co., The Nasby, Toledo, Ohio, has been retained to prepare plans for a municipal water system here. J. G. Bell is Town Clk. Noted Jan. 9.

Geneva, Ohio—Cummings & Downer, Consult. Engrs., Painesville, Ohio, are preparing plans for the proposed reinforced-concrete dam on Grand River. Estimated cost, $10,000. J. R. Trunkey is Mayor. Noted Nov. 28.

✚Shaker Heights, Ohio—We are officially advised that contracts for constructing water mains and sewers were awarded by the village, Feb. 10, as follows: Eight water mains and four sewers, to G. C. WILHELMI, Cleveland, at $11,991 and $6332, respectively; one sewer and water main, to W. B. SMITH, Cleveland, at $3089 and $1689, respectively; four sewers, to O. P. & M. J. SWERINGEN, Cleveland, at $17,147. Noted Jan. 23.

Bloomington, Ill.—The City Council has passed an ordinance providing for laying about two miles of 16- and 20-in. c.-i. water mains in Division, Seminary and Washington Sts. Estimated cost, $30,000. Elmer Folsom is City Engr. Noted Jan. 23.

✚Chicago, Ill.—A contract to furnish and erect a 15-ton Gantry crane at the Lake View Pumping Station, has been awarded to the TOLEDO BRIDGE & CRANE CO., Toledo, Ohio, at $6500.

✚Chicago, Ill.—We are officially advised that contracts have been awarded to the AMERICAN BRAKE SHOE & FOUNDRY CO., McCormick Bldg., as follows: on Jan. 17, furnishing and delivering hydrant and stop valve castings to the water-works shops, at $29.85 per ton; Jan. 20, furnishing and delivering disk water meters, at $24,910. Noted Jan. 16.

Decatur, Ill.—Bids will be received by the City Council until 10 a.m., Feb. 11, for constructing a filtration plant, according to plans and specifications prepared by W. G. Clark, Consult. Engr., Spitzer Bldg., Toledo, Ohio. Albert Leach is City Clk.

Jacksonville, Ill.—Thomas Worthington, B. Haskell and O. D. Bleakley have been granted authority by the Secretary of State, to open stock subscriptions for the Jacksonville Water Supply Co. The concern is capitalized at $35,000, and intends to supply water to Jacksonville and neighboring towns.

Moline, Ill.—The city plans to lay about ten miles of water mains and sewers in the territory east of 34th St. to the city limits, and from the river to Eleventh Ave. Bids will probably soon be asked. Lyle Payton is City Engr. Noted Jan. 16.

Antigo, Wis.—Arthur M. Morgan, 111 West Monroe St., Chicago, Ill., has been retained by the City Council to appraise the value of the privately-owned water plant. The city proposes to either purchase the present plant or install a new system. Noted Oct. 24.

Hudson, Wis.—Bids will be received by A. Karras, Town Clk., until 8 p.m., Feb. 3, for furnishing and delivering 10,000 ft. of 1½-in. black standard pipe, with couplings.

Council Bluffs, Iowa—Bids will probably soon be asked for relining three reservoirs. The work will involve about 1200 cu.yd. of reinforced concrete. S. L. Etnyre is Supt. Water Dept.

Knoxville, Iowa—The City Council is planning to rebuild the entire water system. The present plant includes two pumping stations, three miles of mains connecting the distributing system with the creek station and the standpipe will be abandoned, torn down or removed to other location at a cost of approximately $30,000.

Pisgah, Iowa—Bids will be received about Mar. 1 for constructing a water system here, estimated to cost $6000. Plans were prepared by the Alamo Engine & Supply Co., Omaha, Neb. Noted Dec. 26.

Gibbon, Minn.—Bids will be received by C. W. Carlson, Village Clk., until 7 p.m. Mar. 3, for furnishing material and laying water mains, according to specifications on file at the office of the clerk. Noted Jan. 23.

✚Minneapolis, Minn.—We are officially advised that contracts have been awarded by the city as follows: 3000 tons c.-i. pipe, U. S. CAST IRON PIPE & FOUNDRY CO., at $23.55 per ton, delivered f.o.b. Addyston, Ohio; 200 hydrants, to COLUMBIA IRON WORKS CO., Chattanooga, Tenn., at $32.85 each, delivered f.o.b. Minneapolis; 200 tons special castings, to CROWN IRON WORKS, Minneapolis, at $49 per ton, delivered f.o.b. Minneapolis; to RENSSELAER MFG. CO., Troy, N. Y., 6-in. valves, $10.65 each, 24-in. valves, $183.40 each, f.o.b. Minneapolis; to J. B. CLOW & SON, Chicago, Ill., 8-in. valves, $16.70 each, 12-in. valves, $31.50 each, f.o.b. Minneapolis. Bids were received Dec. 30, and the contracts awarded Jan. 17. Noted Jan. 9.

Shakopee, Minn.—Bids will be received until Feb. 7, for constructing a water system here, according to plans prepared by the Oscar Claussen Engineering Co., St. Paul, Minn. Estimated cost, $6000. H. P. Marx is Chn. Water Comm. Noted Jan. 16.

Frontenac, Kan.—Bids will be received by the City Council at the office of the City Clerk until 7:30 p.m., Feb. 2, for constructing a water main on West McKay St., from the present terminus to the city limits.

✚Doniphan, Neb.—The contract to construct a water system here has been awarded to the J. B. KATZ CONSTRUCTION CO., Omaha, Neb., at approximately $15,000. Bids were opened by the Board of Trustees, Jan. 16. Charles F. Sturtevant, Holdrege, Neb., is Consult. Engr. Noted Jan. 16.

South Sioux City (Sioux post office), **Neb.**—Plans are being prepared for the installation of a water system here. Bonds for $25,000 were recently voted.

Canova, S. D.—The Town Council will probably soon call an election to vote on the proposition to install a water system here.

Drexel, Mo.—An election will probably soon be called to vote on a bond issue of $40,000, for the installation of a water system here. Preliminary plans for a system have been completed by E. T. Archer & Co., Consult. Engrs., New England Bldg., Kansas City, Mo.

Jefferson City, Mo.—We are officially advised that Chester & Fleming, Consult. Engrs., Pittsburgh, Penn., are preparing plans and specifications for the installation of new pumping machinery for the water system here. Bids will soon be asked by the engineers, to be received at their office in the Union Bank Bldg., Pittsburgh.

Plattsburgh, Mo.—The town contemplates the installation of water and sewer systems estimated to cost $23,000.

Springfield, Mo.—The Springfield Water Co. contemplates extending its mains to Elfindale, at a cost of $5000. R. L. Pate is Mgr.

Crystal City, Tex.—Bonds for $14,500 have been voted for the installation of a water system here. W. B. Guilledean is Mayor. Noted Jan. 2.

Houston, Tex.—The State Land Co., which was recently organized here with a capital stock of $500,000, will construct a system of irrigation in South Texas. The incorporators are: J. H. Thompson, J. F. Sadler and Jonathan Lane.

Longview, Tex.—The city contemplates the installation of a water system to replace the private plant now in operation. An election will probably soon be called to vote on a bond issue of $100,000. M. L. Cunningham is City Atty.

Malone, Tex.—According to press reports, bids will be received by Clayton Rogers until Feb. 1, for extending the water system. The contract includes a power house, an 80-ft. g.-i. tower and an 80-ft. reservoir. Plans have been prepared by the McCall-Moore Engineering Co. Noted Jan. 23.

Paint Rock, Tex.—The Concho Waterworks Co. will install a water plant and lay a distributing system here. J. W. Norman, D. B. Stone and J. B. Wade are the stockholders in the company.

Pyote, Tex.—The Consolidated Reservoir Co. has taken over the Grand Fals and Big Valley Irrigation systems near here and has started the construction of a water-storage reservoir. The two systems will be combined and extended so as to irrigate about 80,000 acres of land.

Rockdale, Tex.—The City Council has ordered an election of taxpayers to be held Feb. 25 to vote on the proposition of issuing $30,000 of bonds for purchasing the privately owned water plant and making extensions and improvements.

San Angelo, Tex.—N. G. Simpson is preparing to construct a system of irrigation near here to water from 50,000 to 100,000 acres of land.

San Antonio, Tex.—The City Council will probably soon call an election to vote on the question of purchasing the plant of the San Antonio Water Supply Co.

Guthrie, Okla.—The engineers of the Atchison, Topeka & Santa Fé R.R. are surveying a site one mile east of Guthrie, where the company intends to establish a reservoir which will cover 200 acres.

Guthrie, Okla.—Bids will be received by C. S. Petty, Secy. Park Comrs., until 2 p.m., Feb. 4, for drilling an artesian well, maximum depth 3000 ft. Noted Jan. 16.

✚Purcell, Okla.—A contract to improve the water system has been awarded to W. J. KENNEDY, Oklahoma City, Okla., at $23,000.

✚Denver, Colo.—The contract to complete the Antero Irrigation System has been awarded to JOSEPH OSNER, Denver, at approximately $100,000. The contract includes raising the Antero dam 6 ft., and repairing 75 miles of high-line ditch, and other work.

Deming, N. M.—The Rio Mimbres Irrigation Co. is preparing to construct a system of irrigation on its land, ten miles northwest of Deming. E. H. Vickford is Mgr.

Rupert, Idaho—W. S. Harer, Boise, Idaho, is preparing plans for the installation of a water system here, estimated to cost $25,000.

Fallon, Nev.—It is proposed to construct two additional reservoirs for the Truckee-Carson Project. A. Griffin is District Mgr. Noted Dec. 26.

Phoenix, Ariz.—The Southern Pacific Co. is preparing to develop a water supply, five miles north of here. The water will be brought to the shops of the company through a 6-in. pipeline.

Phoenix, Ariz.—The Salt River Valley Water Users' Association will ask bids in about 30 days for the construction of a reinforced-concrete conduit, estimated to cost $75,000. Charles A. Van der Veer, Water Users' Bldg., is interested.

Tucson, Ariz.—We are officially advised that the proposed improvements to the water system include a 4,000,000-gal. reservoir, 15,000 ft. of 12-in., and 8000 ft. of 8-in. pipe line, five hydrants, and the necessary valves and fittings. The work will probably not be started before the summer. W. H. Thomson is City Engr. Noted Jan. 9.

Carpinteria, Calif.—A company is being organized by C. B. Franklin, W. E. Beckstead, John, E. and B. Ballard, and others, to construct an irrigation system to irrigate 2000 acres of land. The estimated cost of the system is $45,000.

Davis, Calif.—R. T. Stone, Davis, has been granted permission to divert water from the Sacramento River at a point 12 miles below Sacramento to irrigate 128,000 acres of land. The project will cost about $3,000,000. It is the plan to convey water from the river by canals already constructed to Kobe, and thence by canals to be constructed to a series of lifts to a point about two miles east of Winters, Calif.

Los Angeles, Calif.—Bids are being received by F. G. Dessery, Engr., for the Patterson Ranch Co., in Ventura County, for the construction of an irrigation system on Tapo Ranch. The work will require 7070 lin.ft. of 12-in. cement concrete pipe, 4440 lin.ft. of 18-in. cement concrete pipe, six reinforced-concrete boxes, four 18-in. Keller-Thomason gate valves, five 12-in. Keller-Thomason gate valves, and 7600 lin.ft. trench.

Otis, Calif.—Patton & Longley Co., South Hill St., Los Angeles, have acquired a tract of land near Otis, Calif., and will install an irrigation system, to cost about $500,000.

Red Bluff, Calif.—The Antelope Creek & Red Bluff Water Co. contemplates an expenditure of $15,000 for improving its plant. The company furnishes water to Red Bluff and surrounding country.

Red Bluff, Calif.—John G. Miller, R. L. Douglas and Norman R. Smith are interested in an irrigation project for Northern California. A reservoir will be formed by a dam in the Cottonwood Creek, 120 ft. high and 200 ft. long, from which the water will be conveyed in two flumes each 6 ft. wide and 4 ft. deep.

Riverside, Calif.—We are officially advised that bonds for $1,160,000 were voted, Jan. 14, for purchasing the three privately owned water systems. It is planned to expend $342,000 for combining the three present systems and making extensions into territory not served or inadequately served by the present systems. A. P. Campbell is City Engr. William L. Peters is Mayor. Noted Jan. 9.

Victoria, B. C.—Bids will be received by W. Galt, City Pur. Agent, until Feb. 10, for furnishing 13,000 ft. of 6-in. and 8-in. water pipe.

Brantford, Ont.—T. H. Jones, City Engr., is preparing plans for extending the water system. Estimated cost, $50,000. Bids for construction will soon be asked. Noted Jan. 23.

RAILWAYS

SEWERS

✚Northampton, Mass.—The Sewer Commissioners have awarded the contract to furnish pipe used during 1913, to WALKER BROS., Boston, Mass., at 72%.

Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Pres. Boro. Brooklyn, until 11 a.m., Feb. 5, for furnishing all labor and material required for laying sewers in various streets.

Cooperstown, N. Y.—The Board of Village Trustees has authorized Charles S. Lee, Engr. to make surveys and map out a complete sewer system for the village in accordance with the recommendation of the State Health Department.

✚✚Larchmont, N. Y.—The contract to construct sewers here has been awarded to MICHAEL FLECTCO, Larchmont, at $14,000. Bids were opened by the Board of Trustees, Jan. 15. Noted Dec. 26.

Oswego, N. Y.—We are officially advised that bids will be received at the office of David L. Long, Mayor, until noon, Feb. 10, for [illegible]. Plans have been completed for constructing sanitary and storm water sewers on both sides of the [illegible] disposal plants. Charles H. Cooper is City Consulting Engr.

West New York, N. J.—Bids will be received by Isaac L. Wolfe, Town Clk., until 8 p.m., Feb. 4, for constructing a [illegible].

Collingdale, Penn.—Bids will probably soon be asked for [illegible] sewer system here. Bonds for $50,000 have been sold for this purpose.

Reading, Penn.—The [illegible] Council has approved the [illegible] of the Commissioners in passing the $200,000 sewer loan bill. From this appropriation it is planned to construct sewers in [illegible] parts of the city not served by the present system. Noted Jan. 9.

West View, Penn.—According to press reports, bonds for $70,000 have been voted for sewer extensions, street improvement and bridge construction. Howard Donaldson is Boro. Clk.

✚Petersburg, Va.—The contract to furnish all pipe to be used during 1913 for extending the sewer system has been awarded to R. E. BRUNET & CO., Petersburg. The pipe will range in size from 6- to 24-in.

Lillington, N. C.—See item under Water Supply—Irrigation.

✚Newbern, N. C.—We are officially advised that the contract to construct about 4000 ft. of 6- to 24-in. sanitary sewers has been awarded to FRANK HACKNEY, Newbern, at $5033. Bids were opened Jan. 7, by F. T. Patterson, City Clk. Noted Dec. 19.

✚Wilmington, N. C.—The contract to construct about 36 miles of vitrified, concrete and c.i. sewers, from 8- to 24-in. in diameter, has been awarded to MARTIN & MILLER, Passaic, N. J., at $134,494. Bids were opened Jan. 14. Noted Dec. 26.

Greer, S. C.—An election has been called for Feb. 4, to vote on a bond issue of $17,000 for constructing a sewer system. John D. Wood is Mayor.

Mullins, S. C.—Press reports state that the town contemplates the installation of a sewer and water system estimated to cost $60,000. An election will soon be called to vote on a bond issue.

✚Spartanburg, S. C.—The contract to construct sewers here has been awarded to BERGHAUS & FERRY, Orangeburg, S. C., at approximately $20,000. Bids were opened Jan. 13. Noted Dec. 26.

✚Ocilla, Ga.—The contract to install a sewer system here has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at approximately $16,000. Noted Dec. 12.

✚Spartanburg, S. C.—We are officially advised that the contract to construct sewers here has been awarded to BURGHOUSE & FAIREY, Orangeburg, S. C., at $20,000. Bids were opened Jan. 13. Noted Dec. 26.

Sarasota, Fla.—The Board of Public Works has sold bonds for $15,000 for sewer construction.

Tampa, Fla.—The Board of Public Works has ordered plans and specifications prepared for storm sewers to drain a section of Hyde Park. Estimated cost, $40,000.

Laurel, Miss.—See item under Water Supply—Irrigation.

✚New Orleans, La.—A contract to furnish and erect mechanical draft apparatus has been awarded by the Sewerage and Water Board, to the AMERICAN BLOWER CO., Detroit, Mich., at $8260.

✚✚Louisville, Ky.—The Board of Public Works has awarded the following sewer contracts: To L. R. FIGG CO., Louisville, Madison, Green and 11th St. sewers, $8469, $7208 and $4217, respectively; to L. W. HANCOCK, Louisville, 33d St. sewer, $12,176; and to EDWARD R. LARSON, Louisville, West St. sewer, $5096. Bids were opened Jan. 17. Noted Jan. 16. Bids will be asked about Feb. 18, by the Board of Public Works for constructing sewers. David R. Lyman is City Engr.

Ashland, Ohio—Bids will be received by F. Edwards, Dir. Pub. Ser., until Feb. 1, for constructing the South Highland relief sewer. The contract calls for 3000 ft. of 36-in. brick or segment block sewer.

✚Bremen, Ohio—A contract to construct about 16,500 ft. of sewers here has been awarded to WILLIAM STRACHAN, Lancaster, Ohio, at $9963. Bids were opened Jan. 6. Noted Dec. 19.

Celina, Ohio—The Village Council has accepted plans for a complete sanitary and storm water sewer to cost approximately $200,000. W. J. Sherman Co., The Nasby, Toledo, Ohio, are Consult. Engr. Noted Jan. 16.

Cleveland, Ohio—Bids will be received at the office of W. J. Springborn, Dir. Pub. Ser., until noon, Feb. 6, for constructing sewers in 12 streets. Plans and specifications are on file at the office of the Chief Engineer, Room 305, City Hall.

Linden Heights, Ohio—We are officially advised that bids will be received by the Village Council about Feb. 4, for constructing about four miles of vitrified pipe sewers. D. A. Shade is Village Clk. R. K. Schlafly, Asst. Prof. Civil Engineering, Ohio State University, Columbus, is interested.

Lowellville, Ohio—The Improvement Committee of the Village Council is securing preliminary estimates of the cost of installing storm and sanitary sewer systems.

New Philadelphia, Ohio—Bids will be received by the Director of Public Service until noon, Jan. 30, for furnishing material and constructing a storm sewer. T. L. Aughinbaugh is Clk.

Shaker Heights, Ohio—See item under Water Supply—Irrigation.

Troy, Ohio—Resolutions have been adopted by the City Council declaring it necessary to construct sewers in the district south of Miami and Erie Canal Sts.

Youngstown, Ohio—Bids will be received by the Director of Public Service until Feb. 5, for constructing sewers in portions of Blaine Ave., Morgan and Empire Sts., and the Idora Hill District. W. H. McMillin is Clk.

Anderson, Ind.—Plans and specifications have been ordered, and bids will probably soon be asked for making the Green Branch drain a closed sewer. Estimated cost, $[illegible].

Bloomingdale, Ind.—The Board of Public Works has adopted resolutions for the construction of two sanitary sewers, about 25,000 ft. long. Plans have been prepared by Frank M. Randall, City Engr.

Evansville, Ind.—The Board of Public Works has passed a resolution for constructing a sewer in Oregon St., and for opening Sixth St. Estimated cost, $8000.

Escanaba, Mich.—The proposition to issue bonds for $117,000 for the installation of a complete sanitary sewer system and a sewage disposal plant was defeated at the election, Jan. 20. Noted Jan. 9.

De Kalb, Ill.—We are officially advised that bids will probably be asked in the early spring for constructing about 16 miles of vitrified pipe sewer, from 8 to 24 in., and a sewage disposal plant. Estimated cost, $150,000. A. R. Russell is City Engr. Noted Jan. 9.

East Dundee, Ill.—The Village Board contemplates the installation of a sewer system, estimated to cost $18,000.

Moline, Ill.—See item under Water Supply—Irrigation.

Ripon, Wis.—Bids will be received by the Board of Public Works until Mar. 1, for constructing 3300 ft. of sewers. J. W. Pierce is City Clk.

Sibley, Iowa—Preliminary plans have been submitted to the Town Council for a complete sewer system, estimated to cost $22,000.

Minneapolis, Minn.—We are officially advised that bids will be received by the city until Feb. 4, for furnishing sewer brick, vitrified clay pipe, vitrified paving brick and special castings. K. E. Alexander is Pur. Agt. Ellis R. Dutton is Asst. City Engr.

Shakopee, Minn.—We are officially advised that bids will be received at the office of C. Theodore Weiland, Jr., City Clk., until 8 p.m., Feb. 7, for constructing a sanitary outlet sewer, extensions to the sanitary sewer system and extensions to the water system. Plans and specifications are on file at the office of the City Clerk, and at the office of the Claussen Engineering Co., American Bank Bldg., St. Paul, Minn. Noted Jan. 9.

✚Yates Center, Kan.—The contract to construct a sewer system and a sewage disposal plant here has been awarded to the INTER-MOUNTAIN BRIDGE & CONSTRUCTION CO., Tecumseh, Neb., at approximately $74,295. Bids were opened Jan. 14. Worley & Black, Reliance Bldg., Kansas City, Mo., are Consult. Engrs. Noted Jan. 2.

✚Livingston, Mont.—A contract to construct a sewer from Main to Second St., has been awarded to LINDSTROM & OREN, Billings, Mont., at approximately $59,600.

Missoula, Mont.—We are officially advised that the proposition to install a sanitary sewer system in South Missoula, was defeated at a recent election. Noted Jan. 9.

Plattsburg, Mo.—See item under Water Supply—Irrigation.

Maplewood, Mo.—According to press reports, bids will be received by the City Council until Feb. 11, for constructing sewers in Manchester Ave., between Big Bend Road and the city limits of St. Louis. Estimated cost, $15,000. Noted Jan. 9.

Richmond, Mo.—We are officially advised that bids will probably be asked about Feb. 15, for constructing the proposed sewers here, according to plans and specifications prepared by Worley & Black, Consult. Engrs., Kansas City, Mo. R. E. Brown is City Clk. Noted incorrectly, Jan. 16.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until noon, Feb. 4, for Letting No. 10,788, constructing sewers in Harlem Creek Sewer District No. 9, and Letting No. 10,789, constructing sewers in Dale Ave., Sewer District No. 2. The contract calls for laying about 12,500 ft. of 12- to 27-in. vitrified clay pipe sewers. Maxime Reber is Pres.

We are officially advised that bids will be received until noon, Feb. 18, for constructing the Rocky Branch Joint District Sewer. The bids received on this contract, Jan. 7, were rejected. Plans, specifications and form of contract may be obtained at the office of the Board of Public Improvements, and at the office of C. E. Moreno, Sewer Comr. Noted Jan. 2.

✚Houston, Tex.—The City Council has awarded the contract for constructing storm sewers in the Fourth Ward to HORTON & HORTON, Houston, at $269,720. Bids were received Jan. 13. Noted Jan. 2.

Henryetta, Okla.—The City Council is making arrangements for the installation of a sewer system to cost about $25,000. An election will soon be called to vote on bonds.

Tulsa, Okla.—The City Commissioners have accepted the report of T. C. Hughes, City Engr., recommending the construction of a storm sewer to care for the water in the ravine in the Hackathorn Addition.

Loveland, Colo.—The City Council has approved the plans and specifications prepared by A. E. Sprague, City Engr., for the new sewer district in the McKee Addition.

Kellogg, Idaho—C. H. Green & Co., Consult. Engrs., Spokane, Wash., are preparing plans and specifications for the construction of a sewer system here.

Bisbee, Ariz.—The City Council contemplates extending the sewer system up Tombstone Canyon. Estimated cost, $15,000.

Alhambra, Calif.—The Board of Trustees received on Jan. 18, the following bids for the construction of storm sewers: Andrew Halloway, Pasadena, $23,000; John Radich, Los Angeles, $32,400. Noted Jan. 16.

✚Bakersfield, Calif.—The contract for the construction of a sewer system in Bakersfield, has been awarded to T. J. SHEA, 1800 South Oxford St., Los Angeles, at $177,369. Bids were received Jan. 6, by the Board of Trustees. Noted Dec. 12.

Berkeley, Calif.—Plans have been prepared by J. J. Jessup, City Engr., for the construction of a sewer system. Estimated cost, $475,000.

Gridley, Calif.—Plans have been prepared by the City Engineer for the installation of a sewer system. Noted Dec. 19.

✚Los Angeles, Calif.—The contract for constructing a sewer in Santa Cruz St., between Pacific and Grand Aves., has been awarded to JOHN BALCH, 606 West 54th St., Los Angeles, at $33,983. Noted Jan. 23.

Pasadena, Calif.—The City Council has ordered the construction of a storm drain on the east side. Estimated cost, $35,000. J. S. Van Ornum is City Engr.

Santa Monica, Calif.—Bids will be received by Maj. E. E. Moore, for the installation of a sewage-disposal plant at the National Soldier's Home. Estimated cost, $20,000. Noted Jan. 2.

STREETS AND ROADS

Providence, R. I.—Bids will be received until 2 p.m., Feb. 3, by the Board of Contract and Supply for furnishing and delivering 300,000 improved granite paving blocks, 250,000 ordinary granite paving blocks and 10,000 lin.ft. straight granite curbing. Joseph H. Gainer is Mayor and Chn. of the Com.

New York, N. Y.—Bids will be received until 2 p.m., Feb. 5, by the President of the Borough of Manhattan for repairing sheet asphalt pavements in Section No. 3 of the Boro., bounded by 42d St., North River, 72d St. and East River during 1913. George McAneny is Pres.

Bids will be received until 10:30 a.m., Feb. 4, by the Fire Commissioner, 157-159 East 67th St., for repairing asphalt floors in quarters of the various companies in the Boroughs of Manhattan, the Bronx, Richmond, Brooklyn and Queens. Joseph Johnson is Comr.

(Boro. the Bronx)—Bids will be received until 10:30 a.m., Feb. 6, by the President of the Boro. Municipal Bldg., 177th St. and Third Ave., for repairing asphalt block paving and setting curb where necessary during 1913. Cyrus C. Miller is Pres.

West View, Penn.—See item under Sewers.

✚Spartanburg, S. C.—We are officially advised that a contract has been awarded to ROSE & KERLIN, Atlanta, Ga., at about $35,000, for the construction of concrete sidewalks at 83c. per sq.yd.

Bids will be received until 4 p.m., Feb. 3, by the Superintendent of Streets and Sewers for paving various streets at an estimated cost of $50,000. J. H. Shores is Supt. Noted Jan. 2.

Tupelo, Miss.—We are officially advised that bids will be received until Feb. 3, by the Good Roads Commission of Lee County, for the construction of approximately 43,000 sq.yd. gravel streets in the city of Tupelo, and about 75,000 cu.yd. grading on the county roads of the Third District. Landon G. Smith is Engr.

Kentucky—The commercial clubs of Danville, Middlesboro and Mount Vernon, Ky., have originated a plan for the Federal government to reconstruct the old "Wilderness Road," from Louisville to Cumberland Gap, Tenn., at an estimated cost of $400,000.

Lexington, Ky.—The Bristol-to-Lexington Highway Association has been organized to plan the construction of a public highway from Lexington to Bristol, Tenn. Jackson Morris, Lexington, Ky., is Vice-Pres.

Louisville, Ky.—Bids will be received until Feb. 11 by the Board of Public Works for all street improvements to be made during 1913. There will be six lettings for street paving. Noted Jan. 23. Plans and specifications on file at office of Engineering News.

Bellevue, Ohio—Bids will be received until Feb. 11 by the City Council for paving Monroe St. with brick or bituminous concrete.

✚Canton, Ohio—A contract has been awarded by the Commissioners of Stark County to URBAN & CLEMENTS, at $23,870, for paving the Massillon-Millersburg Road, from the corporation line of Massillon for a distance of 1.14 miles.

Columbus, Ohio—Bids will be received until Feb. 11 by the Director of Public Service for improving the following streets: Deming Ave., from Blake to Arcadia Aves.; Engler St., from Pearl to Fourth St.; Kossuth St., from High to Bank St.; Maynard Ave., from Indianola Ave. to Summit St.; Medary Ave., from Deming to Arcadia Ave.; 19th St., from Eryden Road to Main St.; Ninth St., from Broad to Gay St.; Poplar Ave., from Neil to Michigan Ave.; Summit St., from Hudson St. to Indianola Blvd.; Walters St., from Fifth to Leona Aves. S. A. Kinnear is Dir. Paul B. Kemper is Clk.

Lockland, Ohio—Bids will be received by the Village Council until Feb. 24, for the improvement of Wyoming Ave., from Wayne Ave. to the west corporation line of the Village of Reading, by paving with brick and constructing concrete curb and gutter and sidewalks. Frank Reed is Village Clk.

Evansville, Ind.—See item under Sewers.

✚Indianapolis, Ind.—A contract has been awarded by the Board of Public Works to the MARION COUNTY CONSTRUCTION CO., for the construction of an asphalt pavement on Division St., from Oliver to River Aves. Charles A. Schrader is Pres. of the Bd.

Wabash, Ind.—Bids will be received until 11 a.m., Feb. 6, by Commissioners of Wabash County for construction of the Engelman Road on the line between Wabash and Miami Counties. D. Showalter is Audr. of Wabash County.

Grand Rapids, Mich.—Plans have been prepared for paving Franklin St., from Division to Eastern Ave., at an estimated cost of $54,000, for brick, or $47,000 for asphalt macadam. Bids will be asked in the early spring.

Mount Clemens, Mich.—Bids will be received until noon, Feb. 4, by the Road Commissioners of Macomb County for the construction of 16 miles of road. W. J. Lehner is County Road Engr. Wm. P. Rosso is Chn. of the Comrs.

Joliet, Ill.—The Board of Local Improvements has passed a resolution authorizing the paving of Eastern Ave., from Cass St. to Third Ave. with bituminous concrete at an estimated cost of $14,150. Wm. S. Welch is Clk. of Bd. H. A. Stevens is City Engr.

+Rockford, Ill.—We are officially advised that the Board of Local Improvements has awarded a contract to A. E. RUTLEDGE, Rockford, for the construction of about 14,000 sq.yd. of brick pavement on State and Charles Sts. W. W. Bennett is Mayor. Noted Jan. 16.

Corning, Iowa—We are officially advised that bids will be received until 7:30 p.m., Feb. 11, by the City Council for about 22,000 sq.yd. paving, 16,127 sq.ft. combined curb and gutter and 845 sq.yd. concrete alley paving in parts of the following streets: Adams, Seventh, Eighth and Tenth Sts., Davis, Loomis and Grove Aves. Bids will be received on vitrified brick, bituminous concrete, asphaltic concrete and bitulithic paving, the kind to be selected when bids are considered. W. C. Chubb is City Clk. The S. De Lay, Creston, Iowa, is Engr. in Charge. Noted Jan. 2.

Minneapolis, Minn.—See item under Miscellaneous: Cresote Blocks. Minneapolis.

St. Louis, Mo.—We are officially advised that bids will be received until noon, Feb. 11, by the Board of Public Improvements for approximately $400,000 worth of street improvements as follows: Improving Delor St., from Virginia to Alaska Ave., by grading, curbing and paving with asphaltic cement on a concrete base; for grading, curbing and paving Labadie Ave., from Union Blvd. to Abner Place, with aspahltic cement on a concrete base; improving Cora Ave., from Natural Bridge Ave. to Margaretta Ave. by grading, curbing and paving with bitulithic on a concrete base. For improving Bowman Ave., from Simpson to Elizabeth Ave., by grading, curbing and laying a roadway pavement consisting of a telford base, a course of macadam covered with residuum oil, and a surface of Tarvia-X, Tarvia-pedo gravel and sand; for grading, curbing and paving Lexington Ave., from Taylor to Cora Ave., with vitrified brick on a concrete base; for grading, curbing and paving Prairie Ave., from Cozens to Easton Ave., with vitrified brick on a concrete base; for grading, curbing and paving with vitrified brick on a concrete base, Virginia Ave., from Cherokee to Utah Sts.; for improving Residuum Ave., from a line 133 ft. south of Bailey Ave. to the intersection of Kossuth Ave. and 25th St., by grading, curbing and paving with vitrified brick on a concrete base; for improving 22d St., from Angelica St. to Glasgow Ave., by grading, curbing and paving with vitrified brick on a concrete base; reconstructing Penrose St., from 20th St. to Florissant Ave. by removing old pavement and curbing, setting new granite curbing and paving with vitrified brick on a concrete base. Maxime Rebert is Pres. of the Board. W. T. Findly is Secy.

+Springfield, Mo.—A contract has been awarded by the Road Commissioners of Greene County to D. G. HENDRIX, Brookline, Mo., at $17,080, for construction of the Springfield and Brookline Macadamized Road. The road is eight miles long.

+Marshall, Tex.—A contract has been awarded by the City Secretary to the DOLARWAY PAVING CO., 95 Liberty St., New York, for 12,000 sq.yd. of Dolarway paving on various streets. H. S. Rice is City Secy. Noted Dec. 19.

+Sweetwater, Tex.—The City Council has awarded a contract to MOXELEY & CO., Sweetwater, at approximately $50,000, for the construction of more than 40,000 sq.yd. of asphalt paving on a concrete base.

Cleveland, Okla.—The City Council has decided to pave Broadway with vitrified brick, and the work will begin as soon as possible. The Benham Engineering Co., 812-14 American National Bank Bldg., Oklahoma City, Okla., is Engr. in Charge.

Bakersfield, Calif.—The Board of Supervisors of Kern County has appointed a highway commission, which, with the aid of engineers, will plan a system of county highways at an estimated cost of $3,000,000. C. E. Getchell, A. J. Woody and J. L. Evans are Comrs.

Corona, Calif.—The Board of Trustees is asking bids for the improvement of approximately 3½ miles of streets. The work includes oil macadam paving, concrete curbs and gutters. M. Terpenning is City Clk.

El Centro, Calif.—The City Trustees have ordered the paving of Broadway, Main, State, Fifth and Sixth Sts. Bitulithic on a 5-in. hydraulic pressure cement base will be used, and [illegible] will be constructed.

+Fresno, Calif.—The City Trustees have awarded a contract to the RANSOME-CRUMMEY CO. at 13c. per sq.ft., for [illegible] The total cost will be [illegible] There is Supt. of Paving.

+Pasadena, Calif.—The City Council has awarded a contract to [illegible] 346 Spring St., at $9927, for the improvement of [illegible]

Sacramento, Calif.—The following low bids were received [illegible] for constructing portions of [illegible] but no contracts will be awarded until funds are available to make cash payments. Fairbanks & [illegible] at $2,856.50, for grading, culverts and [illegible] gravel over miles on Meadowview Road; the [illegible] Contracting Co., San Francisco, at $5,290.50, for [illegible] concrete base on 0.1 mile in San Luis Obispo County; S. P. Boyle, San Francisco, at $41,720, for [illegible] between Redwood and San Mateo & Santa Barbara, at [illegible] on concrete base in Butte County.

San Diego, Calif.—[illegible] has plans will be ready to [illegible] boulevard 150 ft. wide, extending from India St. to the state highway at Del Mar. D. W. Cotton, Supt. of [illegible]

Sanger, Calif.—[illegible] the construction of the [illegible] Street [illegible]

+Santa Barbara, Calif.—[illegible] awarded to [illegible] at [illegible] for [illegible] at [illegible] The improvement includes [illegible] and sewer [illegible]

Montreal, Que.—A macadam roadway estimated to cost $19,000, is planned for the municipality of Greenville Park. The work will begin as soon as plans can be completed and the contract awarded. F. Hornby is Secy. and Treas.

London, Ont.—The City Council is having plans prepared for the construction of a boulevard around the city. It will be several miles in length. Emery B. Hamilton is Comr.

INDUSTRIAL WORKS

+Portland, Maine—The Portland Shoe Mfg. Co., 154 Middle St., has awarded the contract for the erection of a new building to N. E. RODIN CO., 80 Union St., Portland. The new building will be of brick, six stories high, 60x103 ft. George Burnham, 120 Exchange St., Portland, is Arch. in charge of the work.

Springfield, Mass.—The Stoddard Motor Co. plans the construction of an addition to its garage. The new building will be 60x65 ft., two stories, of brick and steel.

+Central Falls, R. I.—The contract for the new factory for the Pawtucket Hosiery Co. on Dexter St. has been awarded to the HUMES CONSTRUCTION CO., 76 Dorrance St., Providence, R. I. The building will be two stories, brick, mill construction, 100x108 ft.

Newport, R. I.—The Common Sense Gum Co. is having plans drawn for an addition to its factory.

+Bridgeport, Conn.—From plans drawn by the Fletcher Engineering Co., 1087 Broad St., contracts have been awarded by the Salts Textile Mfg. Co., for a one-story weave shed and a three-story mill building at the plant on Kossuth St. The contractors are SCHWARZ BROS., mason work; DOWLING & BOTTOMLEY CO., carpenter work; and EASTERN BRIDGE & STRUCTURAL CO., Worcester, Mass., steel work. The structures will be of brick and steel with concrete roofs, and are estimated to cost $50,000.

Danielson, Conn.—The Connecticut Mills Co. is negotiating for a piece of property opposite its plant, upon which it proposes to build a yarn mill.

Waterbury, Conn.—Armour & Co. are planning to build a new three-story packing plant on Sperry St., Waterbury. Plans are now being prepared at the main office of the company in Chicago, Ill.

Waterbury, Conn.—The Scoville Mfg. Co. will build a new casting shop at the plant on Hamilton Ave. It will be 125x160 ft., of brick and steel.

Buffalo, N. Y.—The Ferguson Steel & Iron Co., has been incorporated with a capital stock of $100,000, and will build a shop for the fabrication of structural steel. The directors include James E. Ferguson, John W. Robinson and Charles Kennedy.

Elbridge, N. Y.—The Dynamo Electric Co. has increased its capital to $200,000, and is having plans prepared for the construction of a new plant at Syracuse.

Newburgh, N. Y.—Swift & Co., meat packers, will erect a modern plant on the site of its present buildings at Front and First Sts. The structures will be of brick and concrete, and will cost $200,000. B. C. Burger is Mgr.

Poughkeepsie, N. Y.—James H. Ackley contemplates the erection of a new factory for the manufacture of cut glass, at Roosevelt Ave. and Main Road. It will be 225x200 ft.

+Rochester, N. Y.—The Kawald Co. has awarded a contract to the COLUMBIAN STEEL BAR CO., New York, N. Y., for the construction of a four-story brick and concrete factory, 125x65 ft. The estimated cost is $50,000.

Rochester N. Y.—The Clark Paper Mfg. Co., has awarded contracts for the construction of a manufacturing building, three stories high, 113x63 ft., and a one-story power house, to be erected at its plant. Frederick A. Brockett, Cutler Bldg., is the Arch.

Atlantic City, N. J.—Bids are being received by Peuckert & Wunder, Archs. Philadelphia, Penn., for the construction of a bottling plant, of brick and steel, for the Moerlein Brewing Co., at Massachusetts and Mediterranean Aves.

Camden, N. J.—Bids are being received by Ballinger & Perrot, Archs., 1211 Arch St., Philadelphia, Penn., for the construction of a plant for the Camden Dyeing & Finishing Works, River Ave. It will be 46x86 ft., with a boiler house, 17x32 ft., of brick and wood construction, with a steel chimney 50 ft. high.

Elizabeth, N. J.—The Diehl Mfg. Co., manufacturers of electrical apparatus, Elizabethport, has purchased 12 acres of land on Newark Ave., Elizabeth, upon which will be constructed a new plant in the spring.

The Smidth Co., Jersey City, has acquired 22 acres of land at Elizabeth, on which it will erect a factory costing $40,000, for the manufacture of machinery for concrete products.

Jersey City, N. J.—The American Sugar Refining Co., Essex St., will erect a five-story brick addition to its sugar refining and syrup manufacturing plant, to cost $29,000. The company will also make improvements and additions to its present structures to cost about $4000.

Newark, N. J.—The Barclay Corset Co., will erect a seven-story factory, of reinforced concrete, 50x110 ft., and costing $75,000. John T. Simpson is the Arch.

The Balbach Smelting & Refining Co., Newark, will expend about $20,000 for the erection of a steel factory building at its Bay plant. It will be 110x208 ft., from plans by George E. Fulton, Arch. Plans for a one-story steel structure, 64x85 ft., and for a melting furnace have also been drawn.

The Schalk Brewery, Inc., Lewis St., will make alterations and improvements in its plant to cost $20,000. A permit for the work has been issued.

New Brunswick, N. J.—The Twentieth Century Steel Co. has secured an option on property along the Pennsylvania R.R. in New Brunswick on which it will erect a new plant. The main building will be 275x125 ft.

Philadelphia, Penn.—The John W. Kershaw Co., manufacturer of turkish towels, 25th St., has awarded a contract

for the construction of a new mill, 150x54 ft., three stories high. The estimated cost of the building and equipment is $110,000.

Trotter (Leisenring post-office), **Penn.**—The H. C. Fricke Coke Co. is receiving bids for the erection of a brick and steel boiler house at its plant in Trotter. The structure will be 118x43x57 ft.

Baltimore, Md.—As a site for a new plant, the Patapsco Iron Works, 303 South Woodyear St., has purchased ground at Wicomico and Hamburg Sts., and will erect a steel frame structure, with equipment for structural steel work. The estimated cost is $10,000.

Munden, Va.—The Norfolk Southern Ry. has secured a site of 40 acres at Munden, and will build shops and roundhouses at an estimated cost of $500,000. F. L. Nicholson, Norfolk, Va., is Ch. Engr.

Roanoke, Va.—Press reports state that the Virginia Bridge & Iron Co. will enlarge its plant.

Raleigh, N. C.—The Union Metallic Cartridge Co., Bridgeport, Conn., has purchased a site two miles southeast of Raleigh, and will immediately erect a plant to manufacture detonating powder, discontinuing its Canadian factory.

Baton Rouge, La.—The Standard Oil Co. will spend about $1,500,000 in enlarging and improving its plant at Baton Rouge, the sum of $500,000 to be used in erecting a plant to manufacture lubricating oils.

South Pittsburg, Tenn.—A stock company is being organized to establish a broom factory and canning plant combined. It is understood that the promoters have a building under consideration and plans will soon be perfected.

Carthage, Ohio—Bert L. Baldwin & Co., Archs., Perin Bldg., Cincinnati, Ohio, are receiving bids for factory buildings for the Tool Steel Gear & Pinion Co., Carthage, C. E. Sawtelle, Gen. Mgr.

Cincinnati, Ohio—Plans have been completed for the new factory building for the Ohio Knife Co., at South Cumminsville. Bert L. Baldwin & Co., Perin Bldg., Engrs.

Cleveland, Ohio—The Cleveland Galvanizing Works, 3924 Cooper Ave., Cleveland, will soon award contracts for the erection of a four-story factory. H. H. Hodell is Pres.

Hamilton, Ohio—The George Automatic Roller Bearing Co., Hamilton, recently incorporated, will erect a factory in the spring. Capital, $550,000. G. T. Reiss, S. M. Goodman, C. R. Greer, all of Hamilton are incorporators.

Richmond, Ohio—The Scharf Gearless Motor Co., Richmond, which was recently incorporated with a capital of $10,000 by G. W. Worden and others, is planning the erection of a plant for the manufacture of a new gearless motor.

Fort Wayne, Ind.—The Perfection Biscuit Co., Fort Wayne, will erect a four-story and basement factory, 60x120 ft. Estimated cost, $50,000. Richards, McCarty & Bulford, New Hartman Bldg., Columbus, Ohio, are Archs.

Detroit, Mich.—The Saginaw & Bay City R.R. is considering the erection of a one-story addition to its car barns, 60x160 ft. Estimated cost, $30,000. T. A. Cleveland, 134 South Washington St., Detroit, is Gen. Mgr.

Detroit, Mich.—Mildner & Eisen, 1018 Hammond Bldg., Detroit, have awarded the gentral contract for the three-story and basement factory, 40x60 ft., for W. H. Allen, 255 Lafayette Ave., Detroit., to LEONARD SCHOLL & SONS, 298 12th Ave. Cost, $20,000.

The Wolverine Motor Supplies Co., Detroit, Mich., has had plans prepared for the construction of a two-story, 74x84-ft. brick addition to its plant.

The Keeton Motor Car Co. has purchased the old plant of the Oliver Motor Car Co., and contemplates the erection of an additional factory on Lawton Ave. and the Grand Trunk Ry. Plans will be ready about Feb. 1.

Baxter, O'Dell & Co., Arch., 1024 Hammond Bldg., let contracts for the Haskell-Kales Co., on Lafayette Boulevard, as follows: Mason, W. S. POCOCK, 624 Hammond Bldg.; steel, WHITEHEAD & KALES IRON WORKS, Beecher and M. C. Ry.; cut stone, DETROIT ORNAMENTAL STONE CO., 165 Breckenridge Ave.; carpenter, JAS. J. MOYNES; roofing and sheet metal, J. D. CANDLER ROOFING CO., 177 High St.

The Linde Air Products Co., Buffalo, N. Y., has let the general contract for brick factory, to be erected on Hart Ave. and the Belt Line, Detroit, to the THEO. STARRET CO., 103 Park Ave., New York.

Dowagiac, Mich.—The Lee & Porter Mfg. Co., Dowagiac, is contemplating the erection of a 33x90-ft. frame addition to its plant. The company is preparing to manufacture axles.

Beloit, Wis.—The plant of Fairbanks, Morse & Co., Beloit, will be enlarged. Estimated cost, about $200,000.

The Besley Mfg. Co. is considering improvements and additions to its plant. Charles Munson is Supt.

The Berlin Machine Works contemplate a large addition to the plant at Third St., between Roosevelt Ave. and Barrett Court. Plans call for a 300x300-ft., two-story structure, costing approximately $250,000. P. B. Yates is Pres.

The Stewart-Warner Speedometer Corporation, recently formed by the absorption of the local Warner Co., by the Stewart-Clark people, of Chicago, contemplates additions and improvements at the local plant.

Milwaukee, Wis.—An addition to the plant of the Wrought Washer Co., on South Bay St., near Reynolds St., has been authorized by the Building Inspection Department. The site was recently acquired. The addition will cost $55,000.

Port Washington, Wis.—The factory of the Port Washington Brass Works, Port Washington, recently destroyed by fire, will be rebuilt at once.

Waukegan, Wis.—John D. Williams, Albert Leeland and E. C. True, all of Milwaukee, Wis., have acquired a site for the proposed plant of the Waukegan Motor Boat Co., of which they are the owners. Estimated cost, $55,000.

Clinton, Iowa—The Christie Engine Co. is being organized for the purpose of building a plant for the manufacture of engines.

Northfield, Minn.—Bids have been received and the contract will soon be awarded for the construction of a new foundry for the Northfield Iron Works. The estimated cost is $10,000. Noted Nov. 21

+Casper, Wyo.—Press reports state that the contract for the construction of a refinery for the Mid West Oil Co., at Casper, has been awarded to the HAMILTON IRON WORKS CO., Warren, Penn. The estimated cost is $250,000.

Corpus Christi, Tex.—Swift & Co., Chicago, Ill., contemplate the establishment of a cold-storage plant at Corpus Christi.

Franklin, Tex.—J. W. Guynes will build an ice plant at Franklin, with a daily capacity of six tons.

Kaufman, Tex.—The Kaufman Compress Co. will erect a large cotton compress at Kaufman.

Lewiston, Idaho—The Lewiston Orchards Producers Assn., Lewiston, is interested in the erection of a fruit dryer in Lewiston. The estimated cost is $15,000.

Anacortes, Wash.—The Reichert Cedar Co. is having plans prepared for the construction of a new planing mill at Anacortes. D. J. Reichert and R. H. Kihn are the owners.

Seattle, Wash.—The Callahan Mfg. Co., recently incorporated with a capital of $150,000, will build a plant for the manufacture of soap. J. Callahan is Pres. and G. C. Dietrich is Mgr.

The Sun Polishing Co., Seattle, will erect a new six-story plant, 60x120 ft., at Sixth Ave. and Pike St. E. H. Wells is Mgr.

Spokane, Wash.—The Inland Empire Paper Co., Spokane, will enlarge and improve its plant, at a cost of about $500,000. W. A. Brazeau is Mgr.

Tacoma, Wash.—The Nickerson & Macfarlane Machinery Co. will build a four-story machine shop on Dock St., Tacoma. About $20,000 will be expended for new equipment. C. C. Doud is Vice-Pres.

Tacoma, Wash.—The Crawford Air & Navigation Co., Puyallup, Wash., will erect a plant for the manufacture of airships on the tide flats of Tacoma.

Dinuba, Calif.—J. H. Thompson, Dinuba, is interested in a plan to establish a plant at Dinuba, for the manufacture of denatured alcohol.

El Segundo, Calif.—The Standard Oil Co., El Segundo, is planning the erection of a large addition to its refining plant.

Fresno, Calif.—The American Gasoline Co., Fresno, has purchased a site and will erect a distributing plant, to cost approximately $100,000.

Los Angeles, Calif.—The Commercial Engine Co., North Main St., is having plans prepared for the construction of a new factory, 96x160 ft., at Ninth St. and Santa Fé Ave.

The Pan-American Marble Co., Los Angeles, will erect a marble finishing plant in the Dominguez Harbor Tract. The estimated cost is $25,000.

Riverbank, Calif.—James E. Long and associates, Fresno, Calif., plan to erect a woodworking plant at Riverbank.

Sacramento, Calif.—The Western Pacific Ry. Co. has been granted a permit to construct car shops on land adjoining Whiskey Hill Road. The estimated cost is $86,250.

The Libby, McNeil & Libby Co., will erect a cannery at 31st and R Sts. The estimated cost is $180,000.

Tulare, Calif.—The American Union Oil Co., has been incorporated for the purpose of erecting a topping refinery with a daily capacity of about 1000 bbl.

Montreal, Que.—The Consolidated Milk Co. will equip a modern cold-storage and creamery plant on St. Viateur St., at a cost of $250,000. Neil Sangster, Ormstown, Que., is Pres.

Niagara Falls, Ont.—A site has been purchased, and a furnace factory is planned for the Niagara Falls Furnace Co. Two buildings will be erected. A. V. Davidson, Kittanning, Penn.; W. R. Taylor, Aspinwall, Penn., and E. T. Williams, Niagara Falls, Ont., are among those interested.

Sarnia, Ont.—The Doherty Mfg. Co., manufacturer of stoves, is having plans prepared for a new three-story addition, 40x100 ft. Construction will begin as soon as possible.

Calgary, Alta.—J. M. Bateson, whose woodworking plant was recently destroyed by fire, at a loss of $60,000, will rebuild and enlarge it.

New Westminster, B. C.—The Schaake Iron Works will build a new plant. H. Schaake is Mgr.

Revelstoke, B. C.—The Consolidated Mining & Smelting Co. plans to establish a new reduction plant for zinc ores at Revelstoke. It will cost about $5,000,000.

FEDERAL GOVERNMENT WORK

Foundry—Portsmouth, N. H.—Bids will be received until 11 a.m., Feb. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing an extension to the foundry at the navy yard, Portsmouth. H. R. Stanford is Ch. of Bureau.

+Buildings—Bostor., Mass.—The contract for constructing one set of officers' quarters at the U. S. Navy Yard, Boston, has been awarded to the CONNERS BROS. CO., 157 Plain St., Lowell, Mass., at $11,516.

Switchboard—Newport, R. I.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Feb. 21, for furnishing a direct current switchboard and station wiring at the naval torpedo station at Newport, R. I.

Wharf—Fort Terry, N. Y.—Bids will be received until 2 p.m., Jan. 31, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., Fort Terry, for constructing a wharf in Plum Gut Harbor, N. Y.

Rebuilding Lighthouse—Lewes, Del.—Bids will be received until Feb. 15, by T. J. Rout, inspector, Fourth Lighthouse District, 427 Post Office Bldg., Philadelphia, Penn., for rebuilding the Brandywine Shoal Light Station, Delaware Bay, located about 12½ nautical miles from Lewes. Bids were received on this work but did not prove satisfactory. Plans and specifications have not been changed.

Dredging—Wilmington, Del.—Bids will be received until 11 a.m., Feb. 14, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Appoquinimink River, Del.

Dredging—Wilmington, Del.—Bids will be received until 11 a.m., Feb. 20, by Maj. R. R. Raymond, Corps Engrs., U. S. A., for dredging Murderkill River, Del.

★**Dredging**—Wilmington, Del.—Bids will be received until 11 a.m., Feb. 21, by Maj. R. R. Raymond, Corps Engrs., U. S. A., for dredging Cooper Creek, N. J.

Highway Bridge—Annapolis, Md.—Bids were received as follows, Jan. 25, by the Bureau of Yards and Docks, Navy Department, Washington, for the construction of a highway bridge over Dorsey Creek, Naval Academy, Annapolis: Sanford & Broks Co., Baltimore, Md., $64,145; Baltimore Stone Co., 1505 Decatur St., Washington, D. C., part only, $3200; McLean Contracting Co., 1441 Fidelity Bldg., Baltimore, Md., $80,603; W. W. Lindsay & Co., 902 Harrison Bldg., Philadelphia, $61,000.

✚**Cranes**—Washington, D. C.—The contract for furnishing two electrically driven traveling yard-cranes for use in the Water Department, bids opened Jan. 8, has been awarded by the Commissioners of the District of Columbia to MANNING, MAXWELL & MOORE, 85 Liberty St., New York, at $15,849. Noted Jan. 16.

Wagons—Washington Barracks (Washington, D. C., post office), D. C.—Bids were received as follows, Jan. 21, by Maj. W. J. Barden, Corps Engrs., U. S. A., Washington Barracks, for furnishing: Item (1) 83 chess wagons: (2) 11 tool wagons; (3) 40 pontoon wagons: Kentucky Wagon Mfg. Co., Louisville, Ky., (1) $230.58 each; (2) $312.91; (3) $236.58; total, $27,437; if wood hubs are used, deduct $7 per wagon; A. Stripe & Bro. Co., Oshkosh, Wis., (1) $204.50; (3) $206.50; total, $21,263; Abbott & Downing Co., Concord, N. H., (1) $226.95; (2) $312.77; (3) $236.95; total, $27,446; Geo. B. Marx, New York, (1) $163.75; (2) $249; (3) $169.25; total, $19,825; Studebaker Corporation, South Bend, Ind., (1) $183.50; (2) $299.43; (3) $194.50; total, $22,630.

Post-Office—Grafton, W. Va.—Bids will be received until 3 p.m. Mar. 6, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, hydraulic mail lift, and approaches) of the U. S. post office at Grafton, W. Va.

Dikes—Savannah, Ga.—Bids were received Jan. 21, by Col. Dan. C. Kingman, Corps Engrs., U. S. A., Savannah, for constructing shore protection dikes in Savannah River, near Augusta. A. T. Twigg & Son, Augusta, at $44,187, have been recommended for acceptance.

✚**Dredging, Rock Excavation**—Jacksonville, Fla.—The contract for dredging in channel from Clearwater Harbor to Tampa Bay, Fla., has been awarded to the HILLSBORO DREDGING CO., Tampa, at $11,413. List of bidders noted Jan. 16.

Post Office—Red Oak, Iowa—Bids were received as follows, Jan. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office building at Red Oak: (a) Limestone; (b) sandstone: James Corgar, Racine, Wis., (a) $72,176; (b) $74,713; Rogers & Kaiser, Chicago, Ill., (a) $77,423; (b) $80,658; J. H. Wiese, Omaha, Neb., (a) $78,596; General Construction Co., Milwaukee, Wis., (a) $80,340; (b) $81,990; Bailey-Marsh Construction Co., Minneapolis, Minn., (a) $80,973; (b) $82,973; Moore & Danner, Kokomo, Ind., (a) $81,000; Mississippi Valley Construction Co., St. Louis, Mo., (a) $81,496, (b) $83,496; Harvell Mincapolis, Minn., (a) $82,780; R. Moore, Lafayette, Ind., (a) $82,825; (b) $86,365; Isaac N. Salyers, Estherville, Ia., $83,300; (b) $87,500; George A. Shaul, Seneca, Kan., (a) $84,713; (b) $86,713. Noted Dec. 19.

Steel—Fort Leavenworth, Kan.—Bids will be received until 10 a.m., Feb. 6, by Lieut.-Col. T. H. Slavens, Const. Q. M., U. S. A., U. S. military prison, Fort Leavenworth, for furnishing steel. Further information will be furnished upon application to the Constructing Quartermaster.

Post Office—Billings, Mont.—Bids were received as follows, Jan. 23, by the Supervising Architect, Treasury Dept., Washington, D. C., for the construction of a post-office at Billings: (a) Limestone; (b) sandstone: J. H. Wiese, Omaha, Neb., $109,748; (b) $115,530; King Lumber Co., Charlottesville, Va., (a) $190,800; (b) $118,000; W. H. Maxwell, Phoenix, Ariz., (a) $113,741; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $115,657; (b) $117,557; W. D. Lovell, Minneapolis, Minn., (a) $121,000; William O'Neil & Son Co., Faribault, Minn., (a) $121,407; Gagnon & Co., Billings, Mont., (a) $124,000, (b) $128,000; Palmberg & Mattison, Astoria, Ore., (a) $128,823; (b) $129,990; Piper Construction Co., Billings, (a) $130,000, (b) $141,272. Noted Dec. 26.

✚**Court House**—Linneus, Mo.—The contract for the construction of the court house at Linneus has been awarded to RAY & SON, Louisiana, Mo. It will be a three story structure of brick and stone, and will cost about $75,000. Noted Nov. 28.

Engines, Etc.—St. Louis, Mo.—Bids will be received until noon, Feb. 7, by Maj. Clark S. Smith, Corps Engrs., U. S. A., Secy., Mississippi River Comn., 1911 Leggett Bldg., St. Louis, for the construction and delivery of two screw engines and propelling machinery. Specifications, blank form of proposals etc., will be furnished on application.

Stone—Dallas, Tex.—Bids will be received until noon, Feb. 15, by Maj. T. H. Jackson, Corps Engrs., Dallas, for furnishing one-man stone and crushed rock or gravel for guard lock, Sabine-Neches Canal, Tex.

Cement—Dallas, Tex.—Bids will be received until noon, Feb. 17, by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, for furnishing about 9000 bbl. of American portland cement.

Post Office—Grand Junction, Colo.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Mar. 5, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the U. S. post office at Grand Junction.

Barges—Seattle, Wash.—Bids will be received until noon, Feb. 5, by Maj. T. B. Cavanaugh, Corps Engrs., U. S. A., 602 Burke Bldg., Seattle, for furnishing two flat-bottom wooden-hull barges.

✚**Magazine**—Vallejo, Calif.—The contract for the construction of a magazine at the U. S. Navy Yard, Mare Island, bids opened Jan. 11, has been awarded to GUTLEBEN BROS., San Francisco, Calif., at $8450. Noted Jan. 16.

Steel Oil Storage Tanks—Hawaii—Bids were received as follows, Jan. 25, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing steel oil-storage tanks at the U. S. Naval Station, Pearl Harbor, H. T.: W. N. Concannon Co., Monadnock Bldg., San Francisco, Calif., $61,785; Riter-Conley Mfg. Co., 55 Water St., Pittsburgh, Penn., $60,900; Treadwell Construction Co., Midland, Penn., $60,000; Chicago Bridge & Iron Co., 105th and Throop Sts., Chicago, Ill., $73,000; Petroleum Iron Works Co., Sharon, Penn., $63,717; Reeves Bros. Co., Alliance, Ohio, $67,920.

MISCELLANEOUS

Swimming Pool—Springfield, Mass.—Judson Strong, of this city, is heading a stock company which is planning building a public swimming pool, to cost $50,000.

✚**Stable**—Noroton, Conn.—J. W. BISHOP, 345 Fifth Ave., New York, has been awarded the contract for a stable of cut granite, 98x178 ft., for William F. Zeigler. The cost is estimated at $75,000. W. F. Knowles, 1170 Broadway, New York, is Arch. Noted Dec. 12.

Stable—Brooklyn, N. Y.—W. A. Shaw, 543 La Fayette Ave., Brooklyn, will erect a stable, to cost $25,000. Benjamin Driesler, 153 Remsen St., Brooklyn, is Arch.

Lumber—New York, N. Y.—Bids will be received until 10:30 a.m., Feb. 6, by Cyrus C. Miller, Pres. Boro. The Bronx, for furnishing and delivering lumber.

Sand—New York, N. Y.—Bids will be received until 3 p.m., Feb. 6, by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan, for furnishing and delivering cow bay sand.

Pier Work—New York, N. Y.—Bids will be received until noon, Jan. 31, by W. H. Edwards, Comr. of Street Cleaning, for furnishing all the labor and materials required for the construction of a covered dumping board and runway on pier at Lincoln Ave. and Harlem River, Boro. The Bronx, City of New York.

Fire Hydrants—New York, N. Y.—Bids will be received until 2 p.m., Feb. 3, by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, for furnishing and delivering double-nozzle fire hydrants.

Fountain—New York, N. Y.—Carrere & Hastings, of 225 Fifth Ave., New York, have been commissioned to prepare plans for the erection of a fountain in Central Park, at Central Park Place, south of the 59th St. entrance. The Estate of Joseph Pulitzer, 80 Broadway, is donor. Estimated cost, $50,000.

Dredging—New York, N. Y.—Bids will be received until Feb. 3, by Calvin Tomkins, Comr. of Docks, for dredging about 80,000 cu.yd. on the East and Harlem Rivers, Boros. Manhattan, Bronx and Queens.

Canal Work—Plattsburgh, N. Y.—Bids will be received until Feb. 18, by Duncan W. Peck, State Supt. Pub. Wks., Albany, N. Y., for dredging a channel and constructing a dock wall on Lake Champlain, at Plattsburgh Terminal, Contract No. 23.

Coal Dock—Duquesne, Penn.—The Carnegie Steel Co., Pittsburgh, Penn., will construct a large coal dock at Duquesne, to cost $250,000.

Wharf—Wilmington, Del.—The City Council is considering the construction of a concrete wharf at Church St. Estimated cost, $27,000.

Drainage—Starke, Fla.—Bids will be received until noon, Feb. 10, by the Board of Bradford County Commissioners, Starke, for the excavation of 200,000 cu.yd. of canals and ditches to drain 17,280 acres of land, known as East Starke Drainage District. The work is divided into three parts, and all bids must be submitted per cu.yd. W. T. Weeks is Clk.

Drainage—Tampa, Fla.—The Anna Maria Beach Co., is considering drainage work in connection with the development of its pleasure resort at Anna Maria Beach. G. Bean, Tampa, Fla., is Pres.

✚**Levee Work**—Clarksdale, Miss.—The contract for levee enlargement in Upper Yazoo Levee District has been awarded by the District Commissioners to E. A. STACY, Greenville, Miss., at the following prices: 375,000 cu.yd. of earthwork, 20c. per cu.yd.; 388,600 cu.yd. earthwork, at 26.3c., and 664,100 cu.yd. earthwork at 29.1c.

Levee Work—Greenville, Miss.—Bids will be received until Feb. 10 by W. J. Shackelford, Ch. Engr. Mississippi Levee District, Greenville, for Belzoni, Catfish Point and Eutaw enlargement work, about 120,000 cu.yd.

✚**Drainage Canal**—New Albany, Miss.—The Commissioners of Okonitie, Hatchie and Lappatubba Drainage Districts have awarded the contract to D. W. ROBINS, Tupelo, Miss., for constructing a 14-mile drainage canal.

✚**Revetment**—Donaldsonville, La.—The contract has been awarded to E. L. STEWART, Donaldsonville, for a concrete revetment on the riverfront from the Bayou Lafourche Dam to the head of Houma St.

Seawall—Mandeville, La.—The citizens are considering the construction of a seawall. Estimated cost, $26,000

Drainage—New Roads, La.—The Parish Jury of Pointe Coupee Parish, New Roads, is considering establishing the Slidell Drainage District.

Drainage—Shriver, La.—The Bayou Blue District of Upper Terrebonne Drainage District has voted to construct a gravity drainage system to reclaim 1000 acres of land

+Lock—Nashville, Tenn.—The contract has been awarded to the FOSTER-CREIGHTON-GOULD CO., Nashville, for constructing Lock D, Cumberland River.

Creek Work—Paducah, Ky.—The Fiscal Court is considering draining and widening Mayfield Creek. Estimated cost, $200,000.

+Drainage—Wickliffe, Ky.—The contract has been awarded to A. BENNETT by the Board of Drainage Commissioners of Ballard County for the drainage of Clanton Creek.

Breakwater—Cleveland, Ohio—The city is considering the construction of a breakwater along the lakefront, to cost $100,000.

Wharf—East Liverpool, Ohio—The Board of Public Service is considering the construction of a wharf, to cost about $20,000.

Car Ferries—Toledo, Ohio—The Ann Arbor R.R. Co. will add two new car ferries to its Lake Michigan fleet. W. D. Holliday, Toledo, Ohio, is Asst. to Pres.

Dredging—Indianapolis, Ind.—Bids will be received by the Park Commission until Feb. 14, for dredging Fall Creek, $150,000 cu.yd., to be used in constructing a boulevard along the north bank of the stream. Approximate cost, $35,000.

Ditch—Rensselaer, Ind.—Bids will be received until 2 p.m., Feb. 1, by M. B. Price, Supt. of Construction, Rensselaer, for constructing the J. A. Borntrager Ditch.

Roofing Creek—Kalamazoo, Mich.—Andrew Lenderink, City Engr., has submitted plans to the City Council for roofing over Portage Creek. Estimated cost, $100,000.

Ditch—Prairie View, Ill.—Bids will be received until 2 p.m., Jan. 31, by the Drainage Commissioners of Drainage District No. 2 town of Vernon, Lake County, Ill., at Priest's Hotel, Prairie View, Ill., for the excavation of about 60,000 cu.yd. of earth for open drainage ditch. M. C. Decker, North Chicago, Ill., is Atty.

Dock—Ashland, Wis.—The city is considering the construction of a new dock, to cost $50,000.

Chapel—Beloit, Wis.—Bids will be received until Jan. 31, for constructing a chapel in Beloit City Cemetery. E. M. Carey is Chn. Public Grounds Com. F. H. Kemp is Arch.

Motor Fire Apparatus—Oshkosh, Wis.—The Common Council has authorized the purchase of motor fire apparatus. Bids have been called for on a six-cylinder, 80-hp., and four-cylinder, 50-hp. machine, to carry 2000 ft. of 2½-in. hose, four 6-gal. and two 3-gal. chemicals, six men, ladders, etc. John Mulva is Mayor.

+Drainage Ditches—Trempealeau, Wis.—The contract has been awarded to the LA CROSSE DREDGING CO., for constructing drainage ditches and laterals for Trempealeau Drainage District, at 8½c. per cu.yd. Bids were received Jan. 14.

Drain—Guthrie Center, Iowa—Bids will be received until Feb. 4, by the County Supervisors for furnishing and laying 6000 ft. 24- and 3000 ft. 22-in. double strength vitrified drain tile, 11,200 ft. 18-, 16-, 20- and 14-in. vitrified drain tile, and 9000 ft. 12-, 10-, 8- and 6-in. hard-burned drain tile, for Guthrie County Drainage District No. 7. W. M. Wells is County Audr.

Drainage District—Oskaloosa, Iowa—The Commissioners of Hardin County are considering the establishment of a new drainage district. Estimated cost, $26,000.

+Drains—Storm Lake, Iowa—Bids were received Jan. 14 by W. W. Bennett, County Audr., for constructing drains in District No. 45. The contract has been awarded to the NEWELL CEMENT TILE CO., Newell, Iowa, at about $10,000.

+Ditch—Blue Earth, Minn.—The contract has been awarded to CHARLES CHESNUT, Delavan, Minn., by Jesse L. Herring, County Audr., for constructing Judicial Ditch No. 5, at $12,335. H. W. Holly, Winnebago, Minn., is Engr.

Ditch Work—Duluth, Minn.—The Duluth & Iron Range R.R. has petitioned the Commissioners of Saint Louis County, Duluth, to establish a public ditch near Wallace and to enlarge the drainage ditch of the Duluth, Missabe & Northern R.R. near White Face River. The work will require 30 miles of ditches for the improvement of its road. W. A. Clark, Duluth, Minn., is Ch. Engr.

+Dock—Duluth, Minn.—The contract has been awarded by the Berwind Fuel Co. to the J. M. DODGE CO., Chicago, Ill., for the construction of a coal dock at Duluth. Estimated cost, $500,000.

Ditch—International Falls, Minn.—Bids will be received until 11 a.m., Feb. 20, by L. H. Slocum, County Audr., International Falls, for constructing Ditch No. 4, Koochicking County. Estimated cost, about $21,500; also until 10 a.m., Feb. 20, for Ditch No. 8, to cost $35,000; and until 10:30 a.m., Feb. 20, for Ditch No. 5, to cost $29,600.

Cement—Minneapolis, Minn.—Bids will be received until Jan. 31 by K. E. Alexander, Jur. Agt. for 65,000 bbl. of portland cement for paving work.

Creosote Blocks—Minneapolis, Minn.—Bids will be received until Feb. 5 by K. E. Alexander, Pur. Agt., for 175,000 sq.yd. of creosote paving blocks.

Cement—Minneapolis, Minn.—Bids will be received until Jan. 31, by K. E. Alexander, Pur. Agt., for 25,000 bbl. of portland cement.

Ditch—Minneapolis, Minn.—The county is considering the construction of Public Ditch No. 24. A. F. Erickson, Minneapolis, is County Audr.

Ditch—Wakonda, S. D.—Bids will be received until Feb. 5, by the County Auditor of Clay County for the construction of Clay Creek Ditch.

Ditch—Billings, Mont.—The Gotharz Engineering Co., Billings, is making surveys for the enlargement of Cove Ditch.

+Ditch—Richmond, Mo.—The contract has been awarded to A. A. MUTTI, Rolfe, by the Crooked River Drainage District for constructing about 5.5 miles of main ditch and 1.5 miles of levee. Bids were opened Jan. 11. Brooks & Jacobs, Shukert Bldg., Kansas City, Mo., are Engrs.

+Bulkhead—Anahuac, Tex.—The Commissioners of Trinity River Irrigation District, Jan. 9, awarded the contract to C. R. CUMMINGS, Houston, Tex., for the construction of a bulkhead across Trinity Bay, at $59,400.

+Dredging—Hampshire, Tex.—The BOWERS SOUTHERN DREDGING CO., Galveston, Tex., has the contract for dredging the larger canals of the proposed drainage system, to be constructed in District No. 3 of Jefferson County. The contract for digging the smaller ditches has been let to the LAKE ARTHUR DREDGING CO. The system will drain about 45,000 acres of land.

Dike—South Bend, Wash.—The Commissioners of Pacific County, South Bend, Jan. 10, appropriated $20,000 for constructing the Palix Dike.

+Dock—Tacoma, Wash.—The Alaska-Pacific Steamship Co., Tacoma, will construct a dock, to cost $75,000. CORNELL BROS. have been awarded the contract.

+Fire Apparatus—Alhambra, Calif.—The WEBB MOTOR FIRE APPARATUS CO. has been awarded the contract for furnishing the city motor fire apparatus, to cost $14,200.

Wharf—Martinez, Calif.—The Board of Trustees, Jan. 8, received plans for the construction of a new municipal wharf, prepared by J. C. Arnold, Engr. The wharf will be 1300 ft. long and 80 ft. wide.

Harbor Work—Oakland, Calif.—The city contemplates spending $405,000 for harbor improvements this year.

+Ferryboat—San Francisco, Calif.—The Southern Pacific Co. has awarded the contract to the NEW JERSEY SHIP BUILDING WORKS, for constructing a steel ferryboat, at $98,000.

Pier—San Francisco, Calif.—The Harbor Board has approved plans of Carl Uhlig, Asst. Engr., for Pier 41, to be constructed at the foot of Stockton St. It will be 1080 ft. long on one side, 880 ft. on other side and 200 ft. wide.

Harbor Work—San José, Calif.—The citizens have voted to annex a section of land extending from the northern city limits to tide water, 200 ft. wide, 11 miles in length, to a point about four miles northwest of Alviso. A channel is proposed up the mouth of the Guadalupe River. The War Department will be asked to pass upon the feasibility of a harbor and to appropriate $100,000 for the work.

Filling—Tunitas, Calif.—The Ocean Shore R.R., F. W. Bradley, Pres., contemplates filling in the gap between Tunitas and Smith Creek, at a cost of $1,200,000.

+Bulkhead—Venice, Calif.—MUNOZ & MUNOZ, Lissner Bldg., Los Angeles, were awarded the contract at $24,873, for constructing the bulkhead on Ocean Front Walk, between Dorothy and Clark Aves.

+Dam—Grandmere, Que.—The contract has been awarded to the TALBOT ENGINEERING CO., Dayton, Ohio, for the construction of a dam across the St. Maurice River, Canada. This contract involves an expenditure of $2,500,000, and will require two years for completion.

+Grain Elevator—Montreal, Que.—The contract has been awarded to the JOHN S. METCALF CO., LTD., 54 St. Francis Xavier St., Montreal, by the Harbor Commissioners, for a 1,500,000-bu. addition to Harbor Commissioners' Elevator No. 1. It will be of reinforced concrete and steel, and will cost approximately $700,000. This will make the capacity of the elevator 2,500,000 bu., as compared with 2,600,000 bu. capacity in the new Elevator No. 2, recently completed by the above contractors.

+Stable—Montreal, Que.—The contract has been awarded to R. RYAN, 697 Atwater Ave., Montreal, by the George Hall Coal Co., of Canada, Ltd., 126 St. Peter St., Montreal, for constructing a two-story brick stable, at about $10,000.

Grain Elevator—Fort William, Ont.—Bids will be received until 5 p.m., Jan. 30, by James Murphy, Pres. Fort William Commercial Chambers, Ltd., for the erection of a grain elevator. Wirth Corson & Smithley, Murray Block, Fort William, are Assoc. Archs.

Wharf—Sarnia, Ont.—Plans have been prepared by the engineers of the Department of Public Works, Ottawa, for the construction of a wharf at Sarnia, about 600 ft. long. R. C. Desrochers is Secy., Ottawa.

Drydock Shipbuilding Plant—Sault Ste. Marie, Ont.—According to press reports, work on the proposed drydock and shipbuilding plant at Sault Ste. Marie will begin Apr. 1. The contract, it is stated, will be awarded to Pethick Bros., Ltd., London, England.

Dock—Toronto, Ont.—The Richelleu & Ontario Navigation Co., 46 Yonge St., Toronto, is considering the construction of a dock, to cost $1,000,000.

+Barn—Brandon, Man.—The contract for the erection of the new horse barn, required by the government experimental farm at Brandon has been awarded to the BRANDON CONSTRUCTION CO.

✦Fire Apparatus—Winnipeg, Man.—Contracts have been awarded to the DARVEN MOTOR TRUCK CO., and to the BOYCE CARRIAGE CO., 325 Elgin Ave., Winnipeg, for furnishing two motor hose-wagons, at $11,165.

Wharf—Kaslo, B. C.—The Canadian Government and the Canadian Pacific Ry. have decided on a plan for wharf facilities at Kaslo. It was agreed to have the government build a wharf 800 ft. in length from the present site of the Kaslo & Slocan depot in an easterly direction, at a cost of $20,000. A heavy cut will be made in the bank, and the ground will be used to raise the depot site 9 ft. higher than at present, clearing high water. Tracks will be laid between the wharf and the bank and a slip for the transfer of cars will be built at the end of the wharf. It is understood that the work will start at once while the water is low. The cost of the work will approximate $70,000.

Dredging—Vancouver, B. C.—The time for receiving bids for dredging False Creek has been extended to Feb. 17. Bids will be received by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont. Bids were to have been opened Jan. 31.

Ferry—North Vancouver, B. C.—The City Council is considering the construction of a ferry. Estimated cost, $140,000. Austin Brown is Clk.

✦Breakwater—Victoria, B. C.—The contract for the construction of a breakwater at Victoria has been awarded by R. C. Desrochers, Secy. Dept. Pub. Wks., to SIR JOHN JACKSON, Ltd., Montreal, Que.

Elevators—Alberta—According to press reports, in order to make more perfect provision for handling the farmers' grain in the province of Alberta, the provincial government of Alberta will guarantee the bonds of the Grain Growers' Grain Co., Winnipeg, Man., to the extent of $1,000,000. In return the company, it is stated, has agreed to erect 60 grain elevators in the province during the year.

BUILDINGS

Attleboro, Mass.—The Attleboro Lodge, B. P. O. E., is about to construct a three-story building for its headquarters. The estimated cost is $175,000. John J. Coady is Chn. Com.

Boston, Mass.—Plans for the new building for the Boston City Club on Ashburton St., have been approved by the building committee as prepared by Newhall & Bevins, Archs. The structure will be of brick and marble, and will cost $200,000. James W. Rollins is Chm. of Bldg. Committee.

Boston, Mass.—The Department of Public Buildings is planning the construction of a new municipal building in Charlestown. The estimated cost is $125,000. Manus J. Fish is Supt

The City Council has ordered the construction of a new police station to replace Station 6, on Broadway, South Boston. The estimated cost is $80,000.

Lynn, Mass.—Bids will soon be received by the Board of Education for the construction of a two-story school on Myrtle St. The estimated cost is $60,000. Noted Nov. 28.

Norwood, Mass.—An appropriation of $57,000 has been made for a school house in the Balch District. John Gilhooly, Frank G. Allen, A. N. Ambrose and James W. Conger are the building committee in charge.

Pittsfield, Mass.—The plans being prepared by the Boston & Albany R.R. for a new station in this city, are nearing completion. The building will be 60x144 ft., two stories high, with a one-story extension, 60x176 ft., for baggage and express. The cost is estimated at $400,000.

✦Springfield, Mass.—The following bids were received for the general contract on the building for the Water Department on Colton St.: J. F. Walls & Son, $52,460; E. T. Davis & Son, $51,596; Gagnier Bros., $49,769; A. E. Stevens Co., $49,500; Michael Maloney, $49,500; D. J. Donahue, $48,570; FRED T. LEY & CO., Springfield, $48,262 (awarded contract); T. P. Morrissey, $47,900; W. H. Falvey & Son, $47,000. The building will be of brick, mill construction, 50x140 ft., three stories high. H. L. Sprague is the Arch. Noted Nov. 28 and Jan. 9

Springfield, Mass.—Henry R. Johnson will erect a six-story business block on Market St Samuel M. Green & Co. Archs., Springfield, have completed the plans which provide for a building, 66x75 ft., with an ell 25 ft. square, of brick, with concrete or sandstone trim.

Springfield, Mass. The Central Labor Union has had plans prepared for a new labor temple which will cost $75,000

Springfield, Mass.—The owners of the Worthy Hotel have announced plans for tearing down the adjoining MacIntosh Bldg. and erecting an eight-story addition to the hotel. William M Kimball is Mgr.

Springfield, Mass. Bids will soon be received by the Stutz and Merrick Co for the construction of a five-story warehouse 90x120 ft. of brick and steel. It will be erected on Chestnut St. McClintock & Craig are the Archs.

Webster, Mass. The Parish of St Joseph R C. has decided to build a new stone church estimated to cost $150,000

Worcester, Mass. Frost & Chamberlain, Archs. Springfield are preparing plans for the proposed addition to the Classical High School. The cost is estimated at $185,000

Worcester, Mass. Maurice F Reidy will soon erect a seven-story business block on Pearl St. It will be of brick and stone construction. Francis W Dean, 53 State St Boston, is the Arch

Worcester, Mass. Plans are being prepared by Harry Prescott Graves Arch Lowell, for a six-story fireproof building to be erected by the H H Bigelow estate. The building will be of brick and steel and will contain a theater and banquet hall

Enfield, Conn. The town has appropriated $45,000 for erection of a new eight room school building. Francis P Leary is a member of the school board.

Hartford, Conn.—The Hartford Electric Light Co. is having plans prepared for the construction of a seven-story office building on Pearl St. It will be 130x110 ft., and will cost $200,000.

✦New Haven, Conn.—From the plans of Brown & Von Beren, Archs., 865 Chapel St., New Haven, the general contract for a new 16-room, brick, school house, on Derby Ave., has been awarded to the DAVID H. CLARK CO. 166 Brewery St., New Haven at $79,971. Other bids were as follows: James H. Hogan, $81,500; The Spery & Treat Co., $85,628; The Torrington Building Co., Torrington, $86,026; Charles W. Murdock, $87,091; Charles E. Anger, $87,500; Daniel G. Carmichael, $93,761 and John N. Leonard & Co., $94,448.

Waterbury, Conn.—The City Hall Commission has selected Prof. Warren D. Laird, of the University of Pennsylvania, as advisory architect for the new municipal buildings to be erected at Grand and Field Sts. A group of three structures consisting of a City Hall, a Police Department Building and a Central Fire Station will be erected. The advisory architect will prepare sketches and specifications, upon which competitive plans will be received later. The estimated cost is $100,000. Noted Aug. 1.

Plans are being prepared by the architects of Armour & Co., meat packers, Union Stock Yards, Chicago, Ill., for the construction of a three-story storage warehouse on Sperry St.

Windsor, Conn.—The Trustees of the Loomis Institute have accepted the plans of Murphy & Dana, Archs., 331 Madison Ave., New York, N. Y., for the school buildings to be erected this year. The plans call for a school building, a power house, a refectory, a headmaster's house and six domitories.

Buffalo, N. Y.—The Roman Catholic Church of the Sacred Heart, Rev. William H. Bernet, pastor, having sold its church and school property on Seneca St., has purchased a site 200x200 ft., on Emslie St., between Clinton and Howard Sts., and will erect a new church edifice, to cost approximately $100,000.

New York, N. Y.—Plans have been filed by C. H. Cullen, Arch., 25 East 26th St., for the construction of a six-story warehouse, 71x51 ft., at Ninth Ave. and Little West 12th St., for Vincent Astor, 28 West 26th St. The estimated cost is $88,000.

Plans have been filed by George F. Pelham, Arch., 507 Fifth Ave., for the construction of a six-story apartment house, at Fort Washington Ave. and 160th St., for the Saranac Construction Co., 3785 Broadway. The estimated cost is $175,000. Noted Jan. 16.

Plans have been filed by Schwarz & Gross, Archs., 347 Fifth Ave., for the construction of a six-story apartment house on 181st St., near Broadway, for the Alexander Grant Co., 701 West 178th St. The estimated cost is $225,000.

Goldwin, Starrett & Van Vleck, Archs., 45 East 17th St., have filed plans for the construction of alterations to the building now located at 4 to 22 West 35th St. James McCreery & Co., West 34th St., will be the occupant. The estimated cost is $60,000.

Plans have been filed by Valentine & Kissam, Archs., 346 Fourth Ave., for the construction of a seven-story hotel at 121 East 29th St., for F. L. Morrian, Tarrytown, N. Y. The estimated cost is $100,000.

L. & M. Goldsticker, 182 Fulton St., are having plans prepared by Charles Frederick Rose, Arch., 1 Madison Ave., for the construction of a 12-story loft and office building on the Southeast corner of Fulton and Church Sts. The estimated cost is $300,000.

Bids will be received until 2 p.m., Feb. 10, by the Department of Public Works, 21 Park Row, for the construction of the Childrens Court Building, at 139 East 22d St., Manhattan.

✦Delano & Aldrich, Archs., 4 East 39th St., have awarded a contract to C. T. WILLS, INC., 286 Fifth Ave., for the construction of a six-story, brick and stone, medical college building, for the Flower Hospital, Ave. A and 63d St.

✦Amos R. E. Pinchot, 60 Broadway, has awarded a contract to the HASCO BUILDING CO., 17 Madison Ave., for the construction of an 11-story warehouse, 100x100 ft., at 18 West 61st St. Walter Haefili, 17 Madison Ave., is the Arch.

The Wesley Realty Co., 2245 Broadway, is considering the erection of a nine-story apartment house, 102x56 ft., at 163 West 81st St.

William Sommer, 910 Sixth Ave., contemplates the erection of a 12-story loft building, 100x67 ft., at 242 West 54th St. An architect will soon be selected.

(Boro. the Bronx)—Bids are being received by Albro & Lindenberg, Archs., 2 West 47th St., Manhattan, for the erection of a one-story, brick and granite bank building, at 375 East 149th St., for the Corn Exchange Bank.

Rochester, N. Y.—McKenzie, Voorhees & Gmelin, Archs., 1123 Broadway, New York, N. Y., are preparing plans and will receive bids for a three-story addition to the telephone exchange building of the New York Telephone Co. It will be of stone, brick, terra cotta and steel.

Sloan, N. Y.—Bids are being received by the Village Board for the construction of a three-story and basement, brick, school, 103x62 ft. The estimated cost is $40,000. W. S. Brickell, Ellicott Square Bldg., Buffalo, is the Arch.

Syracuse, N. Y. C. W. Snow & Co., wholesale druggists, are having plans prepared by Russell & King, Archs., for a four-story warehouse, 55x125 ft., to be erected on West Willow St. The estimated cost is $50,000.

Utica, N. Y. Stein & Feilheimer, Archs., 7 East 42d St., New York, N. Y., have completed plans and will receive bids for a passenger station, baggage and express building, to be erected by the New York Central R.R. It will be 201x192 ft., three stories high, with an annex 586x36 ft. The estimated cost is $500,000

Belvidere, N. J.—We are officially advised that F. W. Salmon, County Engineer, Netcong, is preparing plans for the construction of a new county jail for Warren County

Jersey City, N. J.—Plans have been prepared by Wortman & Braun, Archs., 114 East 28th St., New York, N. Y., for the construction of a five-story apartment house, 98x94 ft., to be erected at Hudson Blvd. and Glenwood Ave., for the Glenwood Realty Co., 49 Liberty St., New York. The estimated cost is $161,000.

+Newark, N. J.—The Third Presbyterian Church, Abington and Clifton Aves., has awarded a contract to J. B. ROBERTS & CO., 1 Madison Ave., New York, N. Y., for the construction of a church and two-story Sunday school, 167x94 ft. The estimated cost is $75,000. Cady & Gregory, 6 West 22d St., New York, N. Y., are the Archs. Dr. Robert Scott Inglis, 30 Walnut St., is Pastor. Noted Dec. 5.

Newark, N. J.—The Public Service Corporation of New Jersey has announced plans for the construction of a new trolley terminal to be erected on Park Place extending back to Pine St., with outlets to North Canal and East Park St. It will be a six-story structure, irregular in shape, 180x285x230 ft., and will be constructed with a subway and the two lower floors for trolley operations. The upper floors will be used as general offices. The estimated cost of the entire undertaking is $4,000,000. Martin Schrieber, Engr. M. W., Public Service Bldg., is in charge.

Newark, N. J.—H. W. Barclay has had plans prepared by John T. Simpson, Consult. Engr., 27 Clinton St., for the construction of an eight-story loft building, 110x55 ft., of reinforced concrete. The structure will be erected on Summit St.

New Brunswick, N. J.—Plans are being prepared by the State Architect for the construction of a three-story building at the State College farm. The estimated cost is $100,000.

West Hoboken, N. J.—Plans are being prepared by Leo Feinen, Arch., 3697 Bloyd, Jersey City, for the construction of a two-story stone and brick bank building, at Summit Ave. and Plank Road, for the National Bank of North Hudson. The estimated cost is $50,000.

Allegheny, Penn.—The First National Bank of Allegheny contemplates the erection of a one-story brick and stone building, at Federal St. and Park Way. The estimated cost is $75,000.

+Alexander, Penn.—The contract for the construction of the new school building for the Episcopal High School has been awarded to the PAGE CONSTRUCTION CO., Hibbs Bldg., Washington, D. C.

Altoona, Penn.—The Pennsylvania R. R. Co. contemplates erecting an office building and station on the site of the Logan House.

Butler, Penn.—C. C. & A. L. Thayer, Archs., Lawrence Savings & Trust Bldg., New Castle, are preparing plans for the construction of a four-story, 80x140-ft. Y. M. C. A. building. The estimated cost is $100,000.

+Charleroi, Penn.—The general contract for the construction of the school has been awarded by the Board of Education to the GEORGE M. HALL CONSTRUCTION CO., Homestead, Penn.

+Harrisburg, Penn.—The contract has been awarded to JOHN MYERS, Harrisburg, for the construction of a four-story brick lodge building for the Eagles, at Sixth and Cumberland Sts. C. Harry Kain, Arcade Bldg., is Arch.

Johnstown, Penn.—The Johnstown Board of Education will receive bids about Feb. 11, for the construction of a three-story school building. J. E. Lucas, Arch., Fairfield Ave., Johnstown, is preparing the plans.

Kutztown, Penn.—Bids will be received until 5 p.m., Feb. 3, by Ruhe & Lange, Archs., Allentown, Penn., for the construction of a library building for the Keystone State Normal School, Kutztown. The estimated cost is $90,000.

+Meadville, Penn.—The contract for the construction of a masonic temple here has been awarded to J. A. NIXON & CO., Titusville, at $51,000. Noted Dec. 5.

Mt. Carmel, Penn.—Bids will be received until Feb. 24, by Mt. Carmel Borough School District, for the construction of a two-story 120x140-ft. school. The estimated cost is $75,000. Clyde Adams, 1233 Arch St., Philadelphia, is Arch.

New Kensington, Penn.—Charles S. Rieger, Arch., Germania Savings Bank Bldg., Pitsburgh, is receiving bids for the construction of the New Kensington High School.

Oakbourne, Penn.—Bissell & Sinkler, Archs., 805 Bailey Bldg., Philadelphia, are preparing plans for a dormitory at the Epileptic Hospital. The estimated cost is $50,000.

Philadelphia, Penn.—Plans are being prepared for the construction of an eight-story warehouse at 23d and Arch Sts., for E. M. Harris.

+The contract for remodeling the building at Seventh and Market Sts., for the Finance Co. of Pennsylvania, has been awarded to GEORGE HOGG.

The Board of Education will erect an administration building at Arch St. west of 15th St. The estimated cost is $500,000. Edwin Wolf is Chn. of the Finance Com.

+The Bell Telephone Co. has awarded the contract to F. W. VAN LOON, Denckla Bldg., for the construction of a three-story telephone exchange building at 26 West Chelten Ave., Germantown.

Pittsburgh, Penn.—M. Nirdlinger, Arch., Diamond Bank Bldg., has prepared plans for the construction of a five-story brick mercantile building at 220 Fifth Ave., for the Holmes Estate, care of Real Estate Trust Co., Pittsburgh.

+The contract for the brick masonry work on the theater to be erected in Center Ave., for T. B. Moreland, has been awarded to G. A. RIFFLE & CO., by W. B. Bennett, 742 Negley Ave. Noted Nov. 28.

The Dollar Savings Fund & Trust Co., North Side, will erect a seven-story building. The estimated cost is $100,000. Edward Stotz, Monongahela Bank Bldg., is Arch.

Pittsburgh, Penn.—The Bedell Co., of New York, will erect a six-story mercantile building on Fifth Ave., between Wood and Market Sts.

George Bippus, Arch., Main St., Northside, is preparing plans for the construction of a three-story, 100x100-ft. storage building.

+Sayre, Penn.—The general contract for the construction of the new hospital building at Sayre, for the Robert Packer Hospital, has been awarded to PULFORD & DEMUSIA, Elmira, N. Y.

Plans are being prepared by Pierce & Bickford, Archs., 118 Lake St., Elmira, N. Y., for the construction of a school at Sayre. The estimated cost is $40,000. Grant Hutchinson, Jr. Chn. Bldg. Com.

Scranton, Penn.—Scranton Lodge 123, B. P. O. E., will erect a lodge building. Thomas H. Mitnes is Professional Advisor. The estimated cost is $85,000.

Wilmington, Del.—The I. E. Du Pont de Nemours Powder Co., Wilmington, contemplates erecting a theater, 150x130 ft., at Market, Orange, Tenth and Eleventh Sts.

Baltimore, Md.—The Board of Trustees of the Enoch Pratt Free Library contemplates erecting a central library at Cathedral and Mulberry Sts. The estimated cost is $750,000.

+Baltimore, Md.—The contract for the construction of the warehouse at 116 West Lombard St., for John E. Hurst & Co., has been awarded to WEST CONSTRUCTION CO., Knickerbocker Bldg., Baltimore. Noted Dec. 26.

Owings Mill, Md.—Ellicott & Emmart, Archs., Union Trust Bldg., Baltimore, are preparing plans for the construction of a school for the Maryland Asylum and Training School for Feeble Minded. The estimated cost is $100,000.

Washington, D. C.—Plans have been prepared by Arthur B. Heaton, Arch., 1319 F St., N. W., for the construction of an addition to the building adjoining Hubbard Memorial Hall, for the National Geographic Society. The estimated cost is $125,000.

Charlottesville, Va.—Plans are being prepared by Ferguson, Cairow & Taylor, Archs., Law Bldg., Norfolk, Va., for the construction of a building, for the University of Virginia. The estimated cost is $40,000.

Richmond, Va.—Plans have been prepared by Carneal & Johnston, Archs., Richmond, for the construction of an academic building for Richmond College. The estimated cost is $100,000. Noted Jan. 16.

+The contract has been awarded to R. M. ANDERSON & CO., for the construction of a four-story warehouse at Franklin and Governor Sts. for the B. W. Wilson Paper Co. Herbert L. Cain is Arch., Richmond, Va.

Tazewell, Va.—Bids will be received until Feb. 15, by C. W. Greever, Clk., Tazewell County Commissioners, for remodeling the court house. Andrew J. Bryan is Arch., Louisville, Ky.

+Greenwood, S. C.—The contract for the construction of the Oregon Hotel, has been awarded to the SMITH CONTRACTING CO., Athens, Ga., at $93,000. Noted Dec. 19.

Atlanta, Ga.—Plans have been prepared for the construction of a 24-story building on Peachtree and James Sts. The estimated cost is $500,000. George M. McKenzie is interested.

Plans have been prepared by C. E. Frazier, Candler Bldg., Atlanta, for the construction of a three-story, 120x75-ft. lodge building, for Red Men's Wigwam Association. The estimated cost is $90,000.

Macon, Ga.—The Board of Education will receive bids until Mar. 1, by T. D. Tinsley, Chn., Board of Education, for the construction of a high school, 200x160 ft., at Orange St. and Cotton Ave. The estimated cost is $100,000.

Macon, Ga.—Plans have been prepared for the construction of a brick and reinforced concrete hotel on the site of the Brown House by Claude M. Stubbs, Proprietor. The estimated cost is $250,000.

+Bradentown, Fla.—Contracts for the construction of the court house at Bradentown have been awarded as follows: General contract, FALLS CITY CONSTRUCTION CO., Louisville, Ky.; steel, to the SOUTHERN IRON & STEEL CO., Birmingham, Ala.; reinforcing steel, J. T. RYERSON & SON, 72 West Adams St., Chicago.

St. Petersburg, Fla.—The City Council contemplates erecting a library. The estimated cost is $40,000.

Birmingham, Ala.—The American Finance & Bond Co. will erect an apartment house at Highland Ave. and Iroquois St. The estimated cost is $100,000. George W. Pratt is Pres.

+Birmingham, Ala.—The general contract for the construction of the 25-story bank and office building for the Jefferson County Savings Bank, has been awarded to F. W. MARKS CONSTRUCTION CO., Birmingham. Noted Jan. 2.

+A contract has been awarded to F. W. MARKS CONSTRUCTION CO., for the construction of a 2-story hotel for the Roden Hotel Co. Noted Sept. 26.

+Mobile, Ala.—The contract for 500 tons of fabricated structural steel to be used in the construction of the City Bank & Trust Co. building, has been awarded to JONES & LAUGHLIN STEEL CO., Pittsburgh, Penn. Noted Dec. 5.

Hattiesburg, Miss.—Plans are being prepared for the construction of an administration building for the Mississippi Woman's College. J. L. Johnson, Jr., is Pres. The estimated cost is $50,000.

+New Iberia, La.—The contract for the construction of the Hotel Frederick has been awarded to C. E. REYNOLDS, Nolan & Torre, Hennen Bldg., New Orleans, La., are Archs.

New Orleans, La.—Bids will be received until Feb. 15, by Andry & Bendernagle, New Orleans, for the construction of buildings for the Catholic Home for Incurables. The estimated cost is $300,000.

Pineville, La.—Plans are being prepared by Wm. Drago, 931 Canal St., New Orleans, La., for two additional buildings at Louisiana Hospital for Insane. The estimated cost is $70,000.

Knoxville, Tenn.—The National Conservation Exposition will erect an exposition building on the exposition grounds.

Memphis, Tenn.—The congregation of the Park Ave. Christian Church will erect an edifice at Park Ave. and Gay St. The estimated cost is $40,000. J. L. Keevil is Pastor.

Nashville, Tenn.—Plans have been prepared by J. E. R. Carpenter, Arch., 1 Madison Ave., New York, N. Y., for the construction of an addition to the Hermitage Hotel. The estimated cost is $200,000.

★✚**Conduit**—Baltimore, Md.—Bids were received by the Board of Awards, Dec. 4, for Contract No. 3, constructing a steel pipe conduit in connection with the Gunpowder Supply Improvements. Ezra B. Whitman is Water Engr. The bids were as follows: (A) MASON-HILTON & CO., 17 Battery Pl., New York (awarded contract); (B) Singer-Pentz Co., Baltimore; (C) James Ferry & Sons, Inc., Baltimore; (D) Snare & Triest Co., New York. (E) S. M. Neff Co., New York; (F) Ryan & Reilly Co., Baltimore; (G) Concrete & Foundation Co., New York; (H) Lane Bros. Co., Baltimore; (I) Elkans-Tufts Construction Co., Baltimore; (J) Whiting-Turner Construction Co., Baltimore; (K) King-Ganey Contracting Co., New York:

STEEL PIPE CONDUIT, BALTIMORE, MD.

	A	B	C	D	E	F	G	H	I	J	K
8000 cu.yd. earth excavation	$0 85	$0 75	$2 00	$0.90	$0.80	$1.50	$1.80	$0.50	$1.50	$1 35	$2 00
6000 cu.yd. rock excavation	2 40	2 25	3 00	2 60	2.75	2.40	2.60	2 00	2 50	2 90	2 00
20,000 ft. B.M. sheeting or bracing left in trench	30 00	39 00	30 00	40 00	50.00	25.00	40.00	50 00	40 00	40 00	0 50
3700 cu.yd. backfill	0 50	0 50	0 25	0 60	0 50	0 90	0.40	0 35	0.75	0 60	1 00
500 cu.yd. topsoil removed and replaced on slopes	1 05	1.50	1.00	1 40	1 00	2 25	000	0 75	1 50	1 00	1 25
2464 lin.ft. steel pipe in place	25 00	28 70	27 00	26 50	25 00	25 20	29 00	31 60	25.33	27.00	39 00
4630 cu.yd. 1:3:6 concrete in casing	7 10	6 60	6 00	7 20	7 50	7.50	7 25	8 25	2 00	9.00	8 50
Reinforced bridge, etc., Shanghai Creek, lump sum	3000	3594	3200	6700	6000	4500	5000	4200	5000	4724	2500
Reinforced bridge, etc., Towson Run, lump sum	4800	5000	5000	9000	8500	8000	6900	6648	5500	7280	5000
160 cu.yd. 1:2½:5 concrete in casing adjacent to bridges and meter vault	8 00	7 23	10 00	9 20	8 00	9 00	7.55	8 50	13.00	9 20	9.00
11,730 lb. steel reinforcing bars in 1:2½:5 concrete	0 04	0 03½	0 05	0.04	0.04	0 04	0 04	0 03½	0.06	0 04	0 05
75,500 sq.ft. cement mortar lining, unreinforced	0 18	0.13	0.15	0 15	0.25	0.25	0.21	0 30	0.15	0.27	0 20
76,750 sq.ft. cement mortar lining, reinforced	0.27	0 27	0 27	0 23	0.25	0.50	0 31	0 40	0 18	0 27	0 25
Placing venturi meter tube, lump sum	700	2000	1000	1200	500	1500	500	3000	1000	500	2000
1720 sq.ft. reinforced lining in meter tube	0.40	0.35	0.50	0 46	0.35	0.70	0.50	0.35	0.25	0.27	0.30
52 lin.ft. terra cotta pipe, drain	0 30	1 00	1 00	1 00	0 30	0.50	1.00	0 50	1 00	3.50	0 50
Totals with Item 12 reinforced	$143,190	$146,755	$153,956	$156,161	$158,816	$164,187	$ 68,547	$173,716	$174,325	$165,364	$186,684
Totals with Item 12 reinforced	$150,323	$167,663	$163,354	$162,488	$159,129	$183,687	$176,485	$181,766	$176,815	$175,702	$190,772

Danville, Ky.—The Board of Trustees of Caldwell College, Danville, has announced that new buildings will be erected. The estimated cost is $150,000. John C. Acheson is Pres.

✚**Lexington, Ky.**—Contracts for the construction of the 15-story bank and office building for the Fayette National Bank have been awarded as follows: General contract, GEORGE A. FULLER CO., Munsey Bldg., Washington, D. C.; structural steel to the NOELKE & RICHARDS IRON CO., 180 East Palmer St., Indianapolis, Ind.

Louisville, Ky.—The Seelbach Realty Co. will erect a ten-story addition to the Seelbach Hotel. J. L. Smyser, is Pres.

✚**Murray, Ky.**—The contract for the construction of the Calloway County court-house, at Murray, has been awarded to the FALLS CITY CONSTRUCTION CO., Realty Bldg., Louisville. Noted Dec. 19.

Pineville, Ky.—R. F. Graf & Sons, Archs., Knoxville, Tenn., have prepared plans for the construction of a high school at Pineville. The estimated cost is $40,000.

Shelbyville, Ky.—Bids will be received about Feb. 15, by Joseph & Joseph, Archs., Commercial Bldg., Louisville, Ky., for the construction of a two-story and basement court house for the Shelby County Fiscal Court. The estimated cost is $100,000.

Cleveland, Ohio—Plans are being prepared for the construction of an edifice on West 65th St., for St. Coleman's R. C. Church. The estimated cost is $175,000. E. J. Schneider, Cuyahoga Bldg., is the Arch.

Delaware, Ohio—Plans are being prepared for the construction of an eight-room school to cost approximately $50,000.

Girard, Ohio—A site has been purchased for the new school for Girard. The estimated cost of the structure is $60,000. Kling & Zenk, Youngstown, Ohio, are the Archs.

Dallas, Tex.—The Dallas Dry Goods Co has selected Brickey & Brickey, Archs., to prepare plans for the erection of the new 10-story building at Lamar and Monroe Sts. The estimated cost of the structure is $300,000. John R. Cavanaugh is Pres. Noted Jan. 23.

Denver, Colo.—Bids are being received for the construction of a two-story addition to the Kelserhof Hotel. The estimated cost is $10,000.

✚**Lima, Ohio**—The contract for the construction of a bank and office building for the Allen County Savings Bank, on Market St., has been awarded to the STILES CONSTRUCTION CO., Chicago, Ill., at $95,000.

Steubenville, Ohio—The People's National Bank plans to build an eight-story bank and office building. L. L. Grimes is Cashier.

Huntington, Ind.—Plans are being prepared and bids will soon be asked for the construction of a high school at Huntington, to cost about $150,000. Z. T. Duncan is Secy. of the School Bd.

Indianapolis, Ind.—The School Board is having plans prepared for the construction of a new school on Park Ave. and North St.

Jamestown, Ind.—The School Board will soon ask bids for the construction of a high school at Jamestown, to cost approximately $40,000.

✚**Kalamazoo, Mich.**—The contract for the construction of the new Masonic Temple has been awarded to H. L. VANDERHORST, at $130,000. It will be a six-story structure.

Chicago, Ill.—Sol Cohen is having plans prepared for the construction of a three-story store and theater on Milwaukee Ave. The estimated cost is $60,000.

Joliet, Ill.—Plans are being prepared for the construction of an edifice to cost about $50,000, for the First Presbyterian Church.

✚**Beloit, Wis.**—The contract for the construction of a Masonic Temple has been awarded to SCHEINBERG BROS. The estimated cost is $50,000. Noted Jan. 2.

Milwaukee, Wis.—Plans are being prepared for the construction of a three-story addition of brick and stone, to the club house of the Knights of Columbus, at Grand Ave. and 15th St. The estimated cost is $60,000.

Bids are being received by Leiser & Holst, Archs., for the construction of a new church for the Lutheran congregation. The estimated cost is $55,000.

Racine, Wis.—Morris Fox is having plans prepared for the construction of a new hotel building to cost approximately $50,000.

Waterloo, Iowa—Press reports state that the erection of an edifice at Wellington and Sixth Sts., for the Brethern Church, is under consideration. The estimated cost is $60,000.

Fulfurrias, Tex.—Press reports state that the citizens have voted in favor of issuing bonds for $80,000 for the purpose of erecting the new court house. Noted Jan. 9.

San Antonio, Tex.—Charles B. Kelsey is having plans prepared for the construction of a seven-story business building of steel and concrete. It will cost between $150,000 and $175,000.

Bartlesville, Okla.—Press reports state that the County Commissioners are receiving bids for the construction of a court house at East Third and Delaware Sts. The estimated cost is $115,000.

✚**Trinidad, Colo.**—The contract for the construction of the court house has been awarded to W. G. RUPP, Trinidad, at $85,063. I. H. & W. M. Rapp & Co., Masonic Bldg., are the Archs.

Boise, Idaho—Two wings will be added to the state capitol at Boise. The estimated cost is $750,000.

Salt Lake City, Utah—C. N. Strevell, James H. Paterson and associates plan to erect a warehouse on the block bounded by South Temple and First South Sts., and Second West and Third West Sts. The estimated cost is between $400,000 and $500,000.

Phoenix, Ariz.—Plans are being considered for the erection of a new edifice for the Trinity Church. The estimated cost is $100,000.

Charles Korrick plans to build a business block at First and Washington Sts., to cost approximately $100,000.

Wenatchee, Wash.—J. E. Ferguson will erect a two-story theater costing $50,000 at Wenatchee and Palouse Sts.

Reeves Bros. plan to erect a two-story business block at Wenatchee and First Sts. It is estimated to cost $50,000.

Portland, Ore.—Morgan, Fliedner & Boyce Co. will erect an 8-story brick building costing about $500,000 on Seventh and Washington Sts.

Portland, Ore.—The Ford Motor Car Co. will erect a 3-story steel and concrete garage, office and warehouse at E. 11th and Division Sts., to cost $250,000.

Chico, Calif.—B. Cussick and W. J. O'Connor plan to erect a $150,000 hotel at Second St. and Broadway.

✚**Long Beach, Calif.**—A contract has been awarded to C. J. HAGGIS, at $55,000, for the erection of a three-story hotel at Ocean Front and Locust Aves., for Job Barnett and R. M. Moore. It will be 50x162 ft., concrete foundation, enameled brick facing, and artificial stone trimmings. Kysor & Biggar, Los Angeles, are Archs.

A. L. Reed, 236 West Ocean Ave., is drawing plans for a three-story apartment house to be erected at 44 Atlantic Ave., for Mrs. Edwin Greble, 1131 South Orange Ave., Pasadena. It will be 94x142 ft., containing 62 apartments, and will cost $50,000.

Modesto, Calif.—The local lodge, B. P. O. E., plans the erection of a three-story building on Tenth St. It will be 50x100 ft., with pressed brick facing. The ground floor will be used for business purposes, there will be lodge and banquet rooms on the second floor, and apartments in the third story. John Tully, Modesto, has the plans.

Oakland, Calif. Snyder & Carlson will erect a $200,000 12-story store and office building at Broadway and Telegraph Ave., Oakland. Benj. McDougall, San Francisco, is the Arch.

Oakland, Calif. W. R. Brackett and George J. Croll will erect a 2-story reinforced concrete hotel at 16th and Wood Sts. to cost $10,000.

Sacramento, Calif.—The sum of $180,000 is available for the construction of a new school on the block bounded by U. V. 11th and 12th Sts. Willis Polk & Co., Merchants' Exchange Bldg., San Francisco, have been appointed Superv. Archs.

★**Sewers**—Louisville, Ky.—Bids for constructing sewers were received by the Board of Public Works, Nov. 29, as follows: (A) James Perry & Sons, 38 Hawthorne Ave., Pittsburgh, Penn.; (B) Henry Bickel Co., Louisville, Ky.; (C) W. M. Mitchell; (D) J. H. Cahill:

SEWERS, LOUISVILLE, KY.

Sewer in 32d St

	A Type D	A Type C	A Type B	A Type E	B Type B	D Type B
20 cu.yd. excavation below masonry	$2 00	$2 00	$2 00	$2 00	$1 00	$2 00
20 cu.yd. gravel refill	2 00	2 00	2 00	2 00	1 00	2 00
10 cu.yd. Class A concrete	12 00	12 00	12 00	12 00	6 50	12 00
10 cu.yd. Class B concrete	11 00	11 00	11 00		4 50	5 00
10 cu.yd. brick masonry in bulkheads	15 00	15 00	15 00	15 00	9 00	10 00
75 vert.ft. manholes	4 50	4 50	4 50	4 50	4 00	5 00
75 lin.ft. 20-in. sewer	3 00	3 00	3 00	3 00	1 80	6 85
2935 lin.ft. 60-in. sewer	10 45	10 90	11 00	12 20	13 15	16 75
150 lin.ft. 6-in. sewer connecting exist. hous. sewers	1 00	1 00	1 00	1 00	1 25	75
980 lin.ft. 6-in. drop inlets	1 00	1 00	1 00	1 00	95	1 75
7 lin.ft. 20-in. drop inlets	4 50	4 50	4 50	3 00	4 00	4 50
196 6-in. slants	60	60	50	60	1 00	50
17 15-in. slants	1 50	1 50	1 50	2 50	1 00	1 50
4 20-in. slants	2 50	2 50	2 50	3 00	7 00	2 50
2 20x15-in. Y's	3 00	3 00	3 00	3 00	7 50	7 50
196 6-in. bends	50	50	50	50	60	45
2 20-in. bends	3 00	3 00	2 50	2 00	2 75	3 25
Totals	$33,110	$34,431	$34,665		$41,951	$52,475

SEWERS, LOUISVILLE, KY.

Sewer in 23d St

	A Type D	A Type B	A Type C	B Type B	C Type C	C Type B
20 cu.yd. earth excavation below masonry	$2 00	$2 00	$2 00	$1 00	$2 00	$2 00
20 cu.yd. gravel refill	2 00	2 00	2 00	1 00	2 50	2 50
10 cu.yd. Class A concrete	12 00	12 00	12 00	6 50		12 10
10 cu.yd. Class B concrete	11 00	11 00	11 00	4 50		5 00
145 vert.ft. typical manholes	4 50	4 50	4 50	4 00		6 80
387 lin.ft. 57-in. sewer	9 20	9 50	10 50	12 50	21 50	21 50
335 lin.ft. 60-in. sewer	10 80	10 80	11 50	14 00	21 50	21 50
670 lin.ft. 63-in. sewer	11 30	11 70	13 00	14 00	21 50	21 50
856 lin.ft. 66-in. sewer	14 80	15 00	16 40	18 00	21 50	21 50
282 lin.ft. 69-in. sewer	19 80	20 00	21 00	20 50	21 50	21 50
1560 lin.ft. 6-in drop inlets	1 00	1 00	1 00	95	50	50
9 lin.ft. 15-in. drop inlets	2 00	4 00	4 00	3 75	1 75	1 80
24 lin.ft. 18-in. drop inlets	4 00	6 00	6 00	4 25	2 00	2 00
170 6-in. slants	0 75	0 30	0 70	1 00	0 50	0 50
5 12-in. slants	1 00	1 00	1 00	2 50	1 75	1 50
13 15-in. slants	1 50	2 00	1 50	4 00	2 80	1 60
7 18-in. slants	2 00	2 50	2 00	5 00	3 00	2 50
2 30-in. slants	3 00	10 00	10 00	16 00	15 00	3 50
170 6-in. bends	0 60	0 40	0 60	0 60	0 50	0 50
5 12-in. bends	1 00	0 70	1 00	1 60	3 00	3 00
2 15-in. bends	2 00	1 00	2 00	2 10	3 00	3 00
9 18-in. bends	3 00	2 00	3 00	2 75	3 00	3 00
Totals	$35,779	$36,467	$39,544	$42,828		$56,644

San Diego, Calif.—The Sacramento Valley Association contemplates the erection of a building costing about $150,000 on the San Diego Exposition grounds. Newton Cleveland, H. O. Miller and H. H. Dunning comprise the building committee.

Construction work will shortly begin on the Electrical, the Mining and the Machinery Buildings of the Exposition. They will form part of a group to be of permanent construction, and will be of Spanish Colonial architecture. Bertram G. Goodhue, 2 W. 47th St., New York, is Consulting Arch.

San Francisco, Calif.—Isaac Liebes will erect a 10-story store and office building at Sutter and Market Sts. Havens & Toepke are the Archs.

San Francisco, Calif.—Frank J. Klimm will erect a six-story reinforced concrete apartment house on Ellis St. Estimated cost $55,000. David Salfield, Clunie Bldg., is Arch.

✚The Realty & Rebuilding Co. has awarded a contract to MACDONALD & KAHN, Rialto Bldg., for the construction of a four-story reinforced concrete apartment house on Eddy St. from the plans of Miller and Colmesnil, Lick Bldg., amount $155,000.

The California Academy of Sciences will erect a $500,000 museum either in Golden Gate Park or in the new Civic Center. The present address of the Association is 343 Sansome St.

The Lexington Realty Co. is having plans prepared for a brick and steel apartment house on Sutter St. It is estimated to cost $125,000. C. T. Ryland, 357 Polk St., is Arch.

The University of California will spend $400,000 to build and equip a university hospital.

W. H. Weeks, 75 Post St. is completing working drawings for a seven-story and basement hotel building to be erected on Ellis St., for Charles C. Judson & Co. Estimated cost $75,000. The exterior of the building will be faced with pressed brick.

The Hop Woe Society will erect a four-story and basement reinforced-concrete store and office building on Stockton St. Estimated cost, $40,000. Frye & Schastey, Monadnock Bldg., are the Archs.

Arthur G. Scholz, Phelan Bldg., is completing plans for the five-story and basement apartment house to be erected at Geary and Larkin Sts., for Patrick J. Garland. The estimated cost is about $125,000. The exterior will be faced with pressed brick.

S. C. and S. G. Buckbee will erect a six-story apartment house on Jones St., at a cost of $70,000. The exterior will be faced with pressed brick. There will be elevator service and a vacuum cleaning system. Miller & Colmesnill, Lick Bldg., are Archs.

The following bids were received by the Board of Public Works for the construction of the new Hospital for the Infirm Poor to be erected on the Relief Home Tract: Commercy Pearson Co., $19,962; James L. McLaughlin, $19,600; M. M. Pindaxson, $18,675; Wold & Kohn, $52,800; Robert Trost, $19,472; R. W. Moller, $18,650.

San Mateo, Calif.—The San Mateo Polo Club plans to erect a $75,000 club house at Hillsborough. G. H. Howard is a director of the club.

Santa Monica, Calif.—Plans are being completed for the erection of a three-story store and apartment house on Pier Ave., for Henry Klein and Adolph Schwartz. It will be 42x90 ft., with concrete foundation and brick walls. S. Tilden Norton, Title Insurance Bldg., Los Angeles, is Arch.

Santa Paula, Calif.—Davis & Drown will erect a one-story business building, containing five stores, on Main St. It will be 90x75 ft., pressed brick paving. The estimated cost is $75,000.

Venice, Calif.—Dana Burke is having plans drawn for a two- and three-story hotel and café to be erected at Vicente Terrace and Ocean Ave., near the Ocean Front. The hotel portion will contain 100 rooms, and the café will extend over the water on a concrete pier.

✚**Venice, Calif.**—D. D. Smith has awarded a contract to the FIREPROOF CONSTRUCTION CO., at $45,000 for the construction of a three-story brick apartment building at Ocean Front and Paloma Sts.

Woodland, Calif.—James Flannigan, Sacramento, Calif., and H. H. Gable and others, of Woodland, will erect a 4-story hotel to cost $300,000.

Prince Albert, Sask.—Bids wil be received between Feb. 1 and 28, for the erection of the Mechanics' Institute. It will be four-story, cement foundation, structural steel and brick construction, and will cost about $60,000. Creighton & Crowther, Central Ave., are Archs.

Edmonton, Alta.—The Bank of British North America, whose main office is at Montreal, will have plans drawn at once for a 10-story office building to be erected at Edmonton in the spring.

Edmonton, Alta.—Charles Carey is having plans prepared for an eight-story business and apartment building, to be erected in the spring. It will be 50x150 ft. The estimated cost is $145,000.

Vancouver, B. C.—Bids will soon be asked for the construction of a six-story apartment house on Chilco St., for J. A. Russell, 837 Hastings St., West. It will be of concrete construction, and is estimated to cost about $200,000. H. B. Watson, 16 Hastings, St., East, is Arch.

Vancouver, B. C.—C. C. Muller will erect a five-story apartment house on Robson St., near Thurlow, to cost $100,000.

Victoria, B. C.—R. T. Elliott will erect an office building in Victoria to cost about $175,000. Jesse H. Warren, Victoria, is Arch.

The Albion Trust Co. will erect a 14-story office building at Government and Wharf Sts. It is estimated to cost $1,000,000. H. S. Griffith, Vancouver, B. C., is Arch.

Victoria, B. C.—Alvo von Alvensleben, Ltd., will erect an 8-story building near the corner of Fort St. and Douglas St., at an estimated cost of between $250,000 and $300,000. Yelland & Reilly are the Archs.

Filters—New York, N. Y.—Bids for constructing the Jerome Park Filters were received by the Department of Water Supply, Gas and Electricity, Jan. 23, as follows: (A) Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, Penn.; (B) Oscar Daniels Co., 38 Park Row, New York; (C) T. A. Gillespie Co., 50 Church St., New York; (D) McArthur Bros. Co., Mason Hanger Co., 11 Pine St., New York; (E) Luke A. Burke Sons Co., 25 West 42d St., New York; (F) Carter Construction Co., 42 Broadway, New York; (G) Cogan & Co., 280 Broadway, New York; (H) Booth & Flinn, 1942 Forbes St., Pittsburgh, Penn.; (I) E. E. Smith Co., 71 Broadway, New York:

JEROME PARK FILTERS, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H	I
494,000 cu.yd. earth excavation, general	$0 74	$0 70	$1 80	$0 72	$0 60	$0 75	$0 75	$0 75	$1.10
50,000 cu.yd. earth excavation in trenches and foundations	0 84	1 80	2 00	1 96	0 95	1 25	1 00	0 75	2 25
254,000 c. yd. rock excavation	0 98	1 50	2 50	1.45	1.90	1 10	1.75	1.50	1 10
160 cu.yd. masonry excavation of dividing wall	50 00	22 00	17 50	43 50	30 00	40 00	35.00	30.00	1 10
250 cu.yd. masonry excavation of gate chambers	50 00	15.00	17.50	17.40	24 00	30 00	12.50	20.00	7 50
350,000 cu.yd. rolling of embankments and foundations	0 15	0 05	0 20	0 36	0 30	0 10	0 20	0.50	0.30
50,000 c. yd. loam and seeding	2 20	1.65	1.75	2 32	2 00	2.00	3 00	3.00	3.00
40,000 cu.yd. puddle	3 20	3 00	3 20	3 19	3 50	4.75	2 75	2.75	4.00
152,000 lin.ft. tile drains over vaulting	0 06	0 10	0 04	0 06	0 09	0 03	0 05	0 04	0 03
9500 cu.yd. broken stone for filling	2 00	0 80	1.25	1.74	1.25	1.50	1 00	2.75	1.80
118,000 cu.yd. concrete in foundation and floors	6 50	7 00	7.00	6.16	6.00	6.50	6.25	7.55	8.25
122,000 cu.yd. concrete in piers and vaulting	7 90	10.00	9 00	8.00	8.25	8.75	9.50	7.40	10.50
74,000 cu.yd. concrete in walls	6 50	9.00	8 00	6.16	7.50	7.50	7 00	7.20	8 00
32,000 cu.yd. reinforced concrete in special vaulting	10 60	12 25	17.50	12.50	11.00	12.50	11 00	16.50	11.75
20 cu.yd. reinforced concrete in thin sections	40.00	25 00	35 00	21.75	50.00	40.00	10.00	20.00	27.50
11,000 sq.yd. special surfacing of concrete	0 90	0 30	0.50	0.58	0.45	1.50	0 75	1.00	0.15
5000 bbl. additional portland cement	2 20	1 50	0.70	2 10	1.60	1.60	1.50	1.60	2.25
5,000,000 ft. steel reinforcement	0 0295	0 04	0.035	0.35	0 04	0.03	0 03	0.035	0.035
13,800 lin.ft. vitrified pipe sewers and drains	1 00	0 90	0.75	0 94	1.00	1.00	0.80	0.80	2 00
Manifolds, tanks and special straight pipe	65,000	76,400	120,000	71,050	59,000	90,000	52,000	70,000	33,000
Filter equipment, item 21a, lump sum*	1,045,000	1,402,400	1,226,000	1,417,000	1,300,000	1,454,145	1,521,330	1,402,400	1,402,400
Filter equipment, item 21aa, lump sum	1,043,000	1,400,000	1,264,000	1,415,000	1,290,000	1,451,625	1,518,750	1,400,000	1,400,000
Filter equipment, item 21b, lump sum		1,369,500	1,173,000	1,352,000	1,200,000	1,430,100	1,485,962	1,369,500	1,369,500
Filter equipment, item 21bb, lump sum		1,367,500	1,211,000	1,350,000	1,250,000	1,417,500	1,435,975	1,367,500	1,367,000
Filter equipment, item 21c, lump sum		1,397,000	1,165,500	1,381,000	1,350,000	1,448,475	1,515,525	1,397,000	1,397,000
Filter equipment, item 21cc, lump sum		1,375,125	1,106,500	1,354,000	1,320,000	1,425,031	1,492,546	1,375,625	1,375,625
1000 tons c.i. bell and spigot straight pipe	39 00	55.00	45 00	50 00	40 00	50 00	40.00	50.00	45 00
250 tons c.i. special pipe and castings	85 00	100.00	90 00	100.00	65.00	90 00	90.00	70.00	100.00
Pipe connections at Gate Chamber No. 11, lump sum	2,500	2,500	2,250	2,175	2,500	5,000	2,600	1,350	1,750
Sluice gates, lump sum	82,000	80,000	85,000	101,500	73,000	80,000	103,000	85,000	130,000
162,000 lb. gate valves, lump sum	0 09	0 09	0.10	0.13	0.12	0.10	0 10	0.08	0.11
300,000 lb. setting metal work furnished by city	0 03	0.017	0 02	0 03	0.02	0 01	0 03	0 03	0 025
Meter, lump sum	8,900	9,000	8,000	12,433	10,000	10,000	7,500	8,500	7,500
8 M. ft. B.M. timber and lumber	100 00	100.00	65 00	72.50	50.00	90 00	50.00	80.00	120 00
300,000 lb. miscellaneous w.i. and steel work	0 08	0.10	0.07	0.07	0.06	0 06	0.06	0.06	0 2250
480,000 lb. miscellaneous c.i. work	0 05	0.05	0.05	0.06	0.06	0.05	0 05	0.06	0.07
4400 lb. bronze	0 60	0.60	0.60	0.72	1.00	1 50	0 65	0.40	0.70
6000 lin.ft. pipe railing	0 85	0.70	0.80	1.09	2.00	0.80	0.75	1.00	0 65
3000 lin.ft. stair treads	0 50	0.50	0.50	0.72	0.30	0 80	0.75	0.50	0.50
3000 sq.yd. granite block pavement	4 00	3.00	4.50	5.07	4.50	3 50	1.50	5 00	4 50
8000 sq.yd. telford pavement	1 50	0 80	1.70	1.81	5 00	1 00	0.75	1.50	1.75
4000 s. yd. macadam walks	0 75	0 40	0 90	0.72	3.75	0 90	0.65	0 40	1.40
1800 lin.ft. curbs	0.75	1 00	0 90	1 45	2 75	0 80	0 75	1 00	1.35
300 c. yd. gutter	0 60	0 50	0 90	0 72	2 50	2.75	0 50	1 30	1.00
23,000 sq.yd. sodding	0 25	0 20	0 20	0 30	0 25	0 35	0 40	0 15	0 30
4000 lin. ft. vitrified clay ducts	0 15	0 12	0 12	0 19	1.00	0 18	0 08	0.15	0.11
Engineers' office, lump sum	6,000	2,000	4,500	5,000	3,500	10,000	7,500	3,500	22,500
	$6,139,015	$6,160,410	$6,752,500	$5,783,170	$5,672,145	$5,885,875	$5,934,955	$6,094,855	$6,619,960

*Item 21a. With this type the filters are washed with air and water forced through separate systems. The positive head is used in filtration, i.e., the head due to the depth of water above the bottom of the filter tank.

Item 21aa. This type is the same as the previous one, but provides for the use in filtration of a "negative head." That is to say, the operating head would be the head in the tank, plus such suction as might be created by lowering the water in the filtered water reservoir.

Item 21b. With this type, the filters are washed by water and air, but not through separate systems; only one strainer system will be provided for both water and air. Positive head used in filtration.

Item 21bb. This type is the same as the preceding one, but providing for the use of "negative head" in filtration.

Item 21c. With this type the washing is done by water alone at a comparatively high velocity. Positive head used in filtration.

Item 21cc. This system is identical with 21c., but the use of "negative head" in filtration is provided for.

Wharf—Los Angeles, Calif.—Bids for constructing 2520 ft. of reinforced-concrete wharf for Huntington Fill, were received by the Board of Public Works, Dec. 16, as follows: (A) SNARE & PRIEST, 147 Lilac Pl., New York (awarded contract); (B) Somers & Lund, Los Angeles; (C) Russell-Greene-Ewell Co., Los Angeles. The item bids follow:

WHARF, LOS ANGELES, CALIF.

	A	B	C
1,222,000 lb. steel cylinders	$0 044	$0 055	$0 053
1,400,000 lb. steel reinforced rods	0 04	0 048	0 04
14,250 sq.ft. 18-in. concrete piles	1 85	1 42	2 10
17,220 sq.ft. 18-in. concrete piles	1 80	2 07	2 05
30,500 sq.ft. concrete sheet piles	2 05	2 35	2 00
80 cu.yd. Class A concrete	14 00	17 00	10 00
5 cu.yd. Class B concrete	13 00	13 65	9 00
1 cu.yd. Class C concrete	6 70	7 20	7 00
Miscellaneous concrete work	6 00	1 00	0 50
20,000 lb. iron railing	1 50	1 90	1 10
6,000 sq.ft. roofing (slate)	1 00	1 75	1 10
105 cu.yd. dry rock	5 00	7 00	1 00
24,000 lin.ft. creosoted pile piling	1 30	1 70	1 40
24,000 lin.ft. creosoted 12-in. piles	1 20	1 55	1 10
24,300 cu.yd. creosoted 3-in. plank decking	0 70	0 55	0 60
17,300 cu.ft. piles in cofferdams	0 44	0 52	0 60
46,000 cu.ft. piles untreated	0 34	0 41	0 40
11,000 sq.ft. asphalt pavement	0 19	0 20	0 16
Totals	$444 700	$556,203	$447,450

INDUSTRIAL NOTES

The Wheeler Condenser & Engineering Co., Carteret, N. J., announces that it has acquired the American license to build the turbo air pumps of the A. E. G. type, as manufactured in Europe by the Allgemeine Electricitaets Gesellschaft. This pump is of the rotary water jet type for motor or steam turbine drive.

The Lansing Co., Lansing, Mich., recently purchased an eight-story building at 288 West St., New York, and will remove from 202 North Moore St., carrying a full line of trucks, barrows, concrete machinery, carts and scrapers.

The Epping-Carpenter Co., Pittsburgh, Penn., manufacturer of pumping machinery, has opened a district sales office at 131 State St., Boston, Mass. James J. Hart is in charge. A branch office has also been established at 728 Monadnock Bldg., Chicago, Ill., in charge of R. E. Burke.

Stacge & Bennett, Watertown, N. Y., consulting civil, steam and electrical engineers have moved their offices from the Smith Bldg., to the Charlebois Bldg., Watertown.

The Universal Crusher Co., Cedar Rapids, Iowa, maker of the original Velton Universal Crusher, has taken over the sale and control of the line of crushers heretofore manufactured and sold by the Eureka Stone & Ore Crusher Co., of Cedar Rapids. The Universal Co. will continue to manufacture both lines at the Eureka plant.

The Contracting Firm of James Stewart & Co., with offices at 30 Church St., New York, has been incorporated with a capital stock of $3,750,000, divided into $1,000,000 7% cumulative first preferred, $1,500,000 7% cumulative second preferred and participating, and $1,25,000 common. The officers of the new company will be A. M. Stewart, Pres.; J. C. Stewart, Vice-Pres. and Western Manager; Charles F. Transom, Third Vice-Pres. and Ch. Engr.; W. A. Rowan, Treas., and J. B. A. Fosbugh, Secy. The firm of James Stewart & Co. was established in 1845 in Ottawa, Can., by James Stewart, of Aberdeenshire, Scotland. In 1865 its headquarters were moved to St. Louis. The general office was changed in 1909 to New York City with district offices in St. Louis, Chicago, Pittsburgh, Montreal, Salt Lake City, New Orleans, Houston and San Francisco. The operations of the company include the construction of public and state buildings, office buildings, hotels, banks, manufacturing plants, dock work and grain elevators. The present booked business of the company amounts to about $20,000,000.

CONTRACT PRICES

+Subway—Boston, Mass.—Bids were received Dec. 24, by the Boston Transit Commission, for constructing Section 4 of the Boylston St. subway, as follows: (A) W. H. Reeves & Co., 95 Milk St., Boston; (B) Coughlan & Sheils Co., 13 Tremont St., Boston; (C) Coleman Bros., Pearl and Marginal Sts., Chelsea, Mass.; (D) P. McGovern & Co., 6 Beacon St., Boston; (E) HUGH NAWN CONTRACTING CO., 82 Salvin St., Roxbury, Mass. (awarded contract). The item bids were as follows:

SUBWAY, SECTION 4, BOSTON, MASS.

	A	B	C	D	E
90,000 cu.yd. earth excavation, above invert	$4 80	$3 90	$3 67	$3 50	$3 50
7000 cu.yd. earth excavation, below invert	7 60	4 25	5 00	3 00	1 00
50 cu.yd. masonry removed in walls and foundations	10 00	18 00	10 00	5 00	10 00
6500 sq.yd. masonry removed concrete base	5 00	0 50	0 70	0 80	0 70
23,000 cu.yd. concrete masonry	10 00	9 50	9 00	10 00	11 00
7000 cu.yd. gravel concrete masonry	8 00	6 00	7 00	10 00	5 00
2000 cu.yd. concrete masonry, mortar under flanges of beams	10 00	10 00	16 00	20 00	15 00
100 cu.yd. brick masonry	20 00	18 00	20 00	18 00	20 00
50 lin.ft. 6 to 10-in. vitrified pipe, laid	0 90	0 50	1 00	0 50	1 00
1400 lin.ft., 12 to 20-in. vitrified pipe, laid	1 50	0 50	1 00	1 00	1 00
700 lin.ft. 22 to 30-in. vitrified pipe, laid	2 00	1 00	2 00	1 50	1 50
3000 lin.ft. 4 to 8-in. vitrified pipe, laid for underdrain	1 00	0 50	1 00	0 50	0 50
1000 tons reinforcing rods, less than 6 in.	15 00	12 00	10 00	12 00	7 00
400 tons structural steel, more than 6 in.	20 00	18 00	16 00	20 00	12 00
225 tons steel sheet piling	70 00	50 00	60 00	75 00	60 00
20,000 sq.yd. cement plaster	0 50	0 50	0 50	0 30	0 40
40,000 sq.yd. textile and asphalt waterproofing	0 50	0 50	0 50	0 40	0 55
20,000 sq.yd. tarred felt and pitch waterproofing	0 40	0 30	0 30	0 30	0 40
125,000 lin.ft. spruce piles	0 25	0 30	0 30	0 27	0 25
1000 sq.yd. crude parafine applied to piles, per sq.yd.	0 20	0 20	0 30	0 10	0 10
Other work and risks not included by other items (lump sum)	5,000	5,000	10,000	100	4,000
Totals	$927,945	$761,275	$751,100	$750,050	$743,700

+Bridge—Cleveland, Ohio—Bids for constructing a steel bridge on concrete piers and pile foundation, 4300 ft. long and 7000 ft. with approaches, over the Cuyahoga River, at Clark Ave., were received by the Director of Public Service, Dec. 19, as follows: (A) C. H. PATH & SON CONSTRUCTION CO., Cleveland (awarded contract on substructure); (B) PHEE CONSTRUCTION & ENGINEERING CO., Chicago (awarded contract on superstructure); (C) Great Lakes Dock & Dredge Co., Cleveland; (D) Carland & Hecker, Cleveland; (E) W. Kupper Construction Co., Cleveland; (F) Hezlop-Sinclair, Cleveland; (G) Masters & Mullen, Cleveland; (H) W. S. Cooper Co., Cleveland; (I) R. P. Hurnett, Cleveland; (J) Mettler-Gloyd Co., Cleveland; (K) Duquesne Contracting Co., Pittsburgh; (L) J. Connelly Construction Co., Cleveland; (M) James Duff Construction Co., Cleveland; (O) Charles H. Strong & Son, Cleveland; (P) American Construction Co., Cleveland. The item bids follow:

SUPERSTRUCTURE, CLARK AVE. BRIDGE, CLEVELAND, OHIO

	A	O	P	B	C
Cofferdam (lump sum)	$24,950 00	$11,500 00	$43,000 00	$8,960 00	$22,500 00
14,500 cu.yd. foundation excavation	1 75	0 80	1 00	1 00	1 00
5,050 cu.yd. concrete 1:3:6	7 00	5 80	7 00	5 75	6 80
2,750 cu.yd. concrete 1:2½:5	8 25	7 10	12 00	6 17	7 60
60,000 ft. foundation piles, plumb	0 40	0 30	0 45	0 35	0 39
4,600 ft. foundation piles, battered	0 50	0 40	0 60	0 38	0 44
6,300 ft. pier protection piles	0 40	0 48	0 38	0 40	0 40
100,000 lb. metal reinforcement	0 05	0 02½	0 05	0 02½	0 03
3,000 lb. anchor bolts	0 05	0 05	0 10	0 03½	0 04
7,000 lb. pier protection bolts, washers and wire cable	0 06	0 03	0 10	0 04	0 04
25 M ft. B.M. pier protection lumber	60 00	60 00	70 00	80 00	80 00
Canal diversion (lump sum)	5,000 00	350 00	700 00	500 00	277 00
4 test piles	20 00	100 00	200 00	75 00	307 00
Totals	$174,282	$111,389	$210,254	$109,378	$149,589

SUBSTRUCTURE, CLARK AVE. BRIDGE, CLEVELAND, OHIO.

	A	B	C	D	E	F	G	H	I	J	K	L	M
19,800 cu.yd. foundation excav.	$1 25	$1 07	$1 77	$1 00	$1 00	$1 25	$0 97	$1 40	$1 00	$2 30	$2 25	$1 50	$2 50
43,400 cu.yd. grading	0 40	0 80	0 45	0 50	0 60	0 60	0 95	0 60	0 95	0 90	0 65	1 04	0 75
6,180 cu.yd. concrete 1:3:6	6 50	5 92	6 15	6 00	6 50	7 25	5 35	6 79	7 00	6 55	8 00	7 72	6 00
7,300 cu.yd. concrete 1:2½:5	7 00	6 18	6 55	6 25	7 25	7 50	6 50	7 17	7 40	7 20	8 50	9 50	9 50
300 cu.yd. concrete 1:2¼	7 50	10 23	7 00	8 00	8 50	8 00	10 00	9 85	9 00	7 80	12 00	10 00	16 00
145,000 ft timber piles	0 28	0 33	0 33	0 35	0 40	0 35	0 36	0 34	0 43	0 336	0 40	0 40	0 34
32,000 ft. concrete piles	1 20	0 93	1 05	2 00	1 40	1 25	1 25	1 70	1 25	1 10	1 25	1 65	1 87
122,000 lb. metal reinforcement	0 05	0 02½	0 04	0 03	0 03	0 05	0 03	0 03½	0 02½	0 02½	0 04	0 03	0 03
15,000 lb. anchor bolts	0 05	0 03½	0 07	0 05	0 06	0 05	0 09	0 05	0 05	0 06	0 06	0 10	0 10
35 M ft. lumber	50 00	50 00	65 00	1 00	45 00	50 00	80 00	70 00	50 00	45 00	50 00	75 00	60 00
8 test piles	20 00	50 00	350 00	2 50	140 00	35 00	2400 00	200 00	350 00	350 00	250 00	250 00	250 00
4-in. drains	0 50	0 50	0 20	0 25	0 25	0 10	0 15	0 20	0 30	2 00	1 00	0 25	0 50
Totals	$223,450	$224,069	$234,977	$245,850	$251,570	$252,387	$263,257	$263,812	$272,051	$272,150	$295,500	$315,510	$328,480

INDUSTRIAL NOTES

Brazil is also to have improved automobile highways. The Empreza Autoviaria Paulista has been granted permission by the government to construct a road between São Paulo and Santos, Brazil. Reports state that the company has floated a loan for this purpose, netting $450,000 or $500 a thousand coffee planters are interested in the vast territory lying between the two points to be connected, and the construction of this road will render an automobile almost a necessity to each of these planters.

Joseph T. Ryerson & Son, of Chicago, announce that Edward T. Hendee has been appointed Secretary in charge of railway sales, with headquarters in New York, succeeding Gilbert H. Pearsall, who has resigned to engage in business for himself.

The Pennsylvania Railroad System, comprising all the lines from New York at one end and Chicago and St. Louis at the other, has recently requested from freight car builders bids with a view to the purchase of 12,300 new freight cars, involving an expenditure of about $16,000,000.

Of the foregoing cars, 10,000 will be additions to the System's equipment, while 2300 will represent replacements. The replacements and additions will represent a net increase in the carrying capacity of the company of 516,000 tons.

The Lines East will utilize 5000 of the steel gondola cars, 1300 wooden side gondola cars, and 1000 refrigerator cars. The Lines West of Pittsburgh will use 2000 steel gondola, 1000 wooden side gondola, 500 refrigerator, and 500 box cars. The foregoing purchases will be in addition to orders placed in 1912, for a total of about $20,000,000 worth of freight cars, comprising 9875 additions to equipment and 8000 replacements. During the four years, 1909 to 1912 inclusive, the Company added to its freight equipment a net increase in carying capacity of 1,389,370 tons.

With the cars now to be added, the Pennsylvania System will have provided for the use of the shipping public, about 275,000 freight cars.

The purpose of the new equipment now to be ordered is that shippers may have equipment available without delay for the normal increase in traffic to be expected on the Pennsylvania Railroad System.

A Freight Subway—The Hudson National Freight Terminal Co., incorporated with a capital of $300,000,000, plans to install subways to facilitate the direct handling of freight coming to and going out of the city. It is proposed to have direct connections with the railroads, steamships, and the State Canal. A charter is asked to build and operate a four-track subway in Hudson St., from Chambers to 14th St., to Eleventh Ave. to 72d St., with spurs to the Hudson River, to be used by all the railroads; also to lease from the city all that unimproved river front from 38th to 42d St., and to construct river piers in order to accommodate all vessels engaged in foreign or domestic commerce, to have direct connections with the railroads running out on the river piers, to receive and deliver their freight direct, also running from their own car floats direct to their own terminals, and to all warehouses, factories and the market terminals, wholesale and retail, to be located at points in the subway, convenient to the public in every part of the city, in order that all market supplies may be shipped direct by the farmers, in better conditions, at lower prices to the consumers. The proposed plan of the company practically collects all the railroad traffic at one point and releases about twenty Hudson-Riper piers below 14th St., and is intended to be a relief to the congested and dangerous conditions of West St. and Twelfth Ave. The Hudson National Freight Terminal Co. propose to build to order all warehouses, railroad and market terminals and lease for a long term of years at the very lowest rates, making all direct subway and railroad connections, at the time of construction. Clarence Garretson is given as Pres. of the company.

The Hess Flume Co., 2166-76 15th St., Denver, Colo., has purchased the patents of the Maginnis flumes, covering both the Maginnis Standard Flume and the Smooth Interior Flume, together with the business, stock and good-will of P. Maginnis, Kimball, Neb. The Hess company will manufacture both the Hess and Maginnis flumes at its factories in Denver and Canton, Ohio. The infringement suit brought by Mr. Maginnis against the Hinman Hydraulic Mfg. Co., of Denver, will be continued by the Hess Flume Co.

Louis Scotti, of Madrid, Spain, now visiting in Boston, reports that automobile roads in Spain are being rapidly improved. The government has appropriated about $10,000,000 for road improvements, and within the past year, some 37,000 miles of highway have been put into fine condition for motoring.

New Steel Plant in Canada—The Steel Corporation late in 1912 announced its intention of building an iron and steel manufacturing plant in Canada, the location of which will be not far from Detroit, and at a point where is can receive raw materials and ship finished products by water as well as by rail. No details have yet been published with regard to this plant, but it is reported that work will be begun early in 1913. The site has already been purchased.

An Ambitious Scheme for Railway Improvements has been broached, but as yet no official announcement has been made of the project, and it may never be put through. This concerns the improvement of the Pennsylvania R.R., including the four-tracking of the 1.w-grade freight line from Harrisburg to Trenton Junction and the four-tracking of the Cumberland Valley R.R., an allied br.nch of the Pennsylvania, from Harrisburg to Chambersburg, and the establishment of a Junction point at Newville, a few miles west of Carlisle, from which a four-track road can be run straight west to Pittsburgh along the lines of the old South Penn survey, lopping off nearly 70 miles from the circuitous main line West between Harrisburg and Pittsburgh.

Charles M. Schwab has purchased, in conjunction with French bankers and steel men, iron-ore property containing 100,000,000 tons of ore in sight at Coquimbo, Chile, near the Bay of Cruz Grande, known as the Tofo Iron Mines. Mr. Schwab is described as the owner of the Swedish ore, which up to this time he has considered the best. It assays 67% of iron and contains very little phosphorus and sulphur.

The addition of this Chilean ore to the Bethlehem company will increase its output about 60%, and to provide for it additional construction to the plant costing $6,000,000 has been planned. A fleet of steamers for transportation of the ore to the Bethlehem plant is to be built, with not less than ten of from 15,000 to 20,000 tons capacity. The ships will use the Panama Canal.

The property is under the jurisdiction of the government of Chile, but French capitalists held concessions on the property with the consent of the French government. Associated in the purchase with Mr. Schwab are George S. Gandjean, president of the Banque Française; Marquis Chasseloup, Loubat, of the Rothschild; A. Armond, director of the Creusot Steel Co.; Albert Enriques, of London, and H. Grosdider, of Paris.

Plans for a New Trolley Terminal, which is designed to relieve the present traffic congestion at Broad and Market Sts., Newark, N. J., have been submitted by the Public Service Corporation of New Jersey. The terminal will front on Park Place, extend back to Pine St., with outlets to North Canal and East Park Sts., will be six stories high, and contain a three-level system of entrance and exit for trolleys and passengers. No trolley lines will enter or leave the structure on the street level, and it is planned to bring lines from the west throughout subway into the building on a sub-level, and lines from the east, north and south by way of Mulberry St. on to the company's property at grade and have them ascend a trestle, crossing Pine St. overhead and into the terminal building proper on what may be called the second floor. The subway to the terminal from the westward is regarded as one of its most important features. It is also one of the most costly, and was decided upon only after careful study had demonstrated that no other plan could be devised that would afford real relief and escape the criticism of being a makeshift proposition such as would be the case if an attempt were made to simply transplant existing congested conditions to some other point.

It is designed to have the westward entrance to the terminal actually begin on Washington St., at a point north of the Morris Canal. The company will have a private right of way extending from Washington St. through to Halsey St., including the old church edifice adjoining the Young Men's Christian Association building and facing Cedar St. The plans call for cars to turn from the north and south off Washington St. into this private right of way, and dip into the subway on a 4% grade, crossing underneath the surface of Halsey St., the subway following the line of Cedar St., crossing Broad St. and continuing beneath the apex of Military Park and Park Place, into the terminal building basement.

The new arrangement of trackage will in no way affect or diminish the present traffic facilities on either Broad or Market Sts., but the means of the proposed underground routes the congestion at the "Four Corners," Market and Broad Sts., will be materially reduced, as a large percentage of the cars will pass that point underground, the Broad St. cars going under at Park Place and at Lafayette Sts., and the Market St. cars at Mulberry St. and at Washington St. The other cars will continue to cross at grade. The curve of the tracks at the "Four Corners," which allows cars from the Market St. depot to run north on Broad St., will be discontinued, the Pennsylvania R.R. depot service being supplied through the underground system entering at Mulberry and Market Sts. The cost of the entire undertaking, as estimated by Public Service officials, is $4,000,000. The financeering has been satisfactorily accounted for and all that is needed for the beginning of construction work is the necessary legislation from both the city and the state. Thomas F. McCarter is President of the Public Service Corporation, and Martin Schreiber, Engr. of Maintenance of Way, Public Service Bldg., Newark, N. J., is in charge of the undertaking.

EXAMINATIONS

Electrical Assistant—Washington, D. C.—The United States Civil Service Commission announces an open competitive examination for electrical assistant, for men only, on Feb. 26. From the list of those passing this examination, certification will be made to fill vacancies in this position at $1080 per annum in the Signal Service at Large, War Dept., on vacancies requiring similar qualifications in any branch of the service. Subjects of examination and their relative weights are: Practical questions in electrical science, 40; practical questions in construction and installation of electrical instruments, 30; training, experience and fitness, 50. Applicants should be familiar with the practical side of electricity as applied to telegraph, telephone and kindred engineering, and have had experience in the installation and equipment of telephones, storage batteries, motor generators and other electrical apparatus. Applicants must be 20 years of age or over on the date of the examination, and must be actual residents of the state or territory from which they make application for at least one year previous to the examination. Persons who meet the requirements and desire this examination should apply at once to the U. S. Civil Service Commission, Washington, D. C., for Form 1312.

Engineer of Water Works Design—The Municipal Civil Service Commission of Chicago, Ill., City Hall, announces an examination to be held Feb. 3, 4 and 5, for the position of Engineer of Water Works Design, Class B, Grade 4, salary $3600. Subjects of Examination: Duties, mathematics, report, efficiency, seniority. Eligible: Persons in the engineering service whose official grade under the new duties engineering classification is Grade III or above, and those whose official grade under the old compensation classification is Grade 6 or above, and those persons in the classified service who have been performing duties and drawing compensation of such grades in the service of the city and have been employed as indicated above for six months immediately preceding this examination, and at the time of this examination are actually employed in the city service or are on leave of absence or eligible for reinstatement. Eligible: Persons in the engineering service whose official grade under the new duties engineering classification is Grade III or above, and those whose official grade under the old compensation classification is Grade 6 or above, and those persons in the classified service who have been performing duties and drawing compensation of such grades in the service of the city and have been employed as indicated above for six months immediately preceding this examination, and at the time of this examination are actually employed in the city service or are on leave of absence or eligible for reinstatement.

Sanborn Map Expert—The Municipal Civil Service Commission, City Hall, Chicago, Ill., announces an examination to be held Feb. 4, for the position of Sanborn Map Expert, Class B, Grade 3, Salary, $1800. Subjects of Examination: Special subject, mathematics, report, experience. Duties: Has charge of the Sanborn division, Bureau of Maps and Plats; supervises posting of Sanborn atlases; makes record of building permits; appears before department heads and Council committees and explains information contained in Sanborn records; makes building surveys and notes in the field when necessary.

★**Intercepting Sewer System**—New Bedford, Mass.—Bids for constructing the substructure of the screen house sewer and sea wall, according to plans prepared by William F. Williams, Engr., New Bedford, were received by the city, Dec. 18, as follows: (A) Frank Gammino, 233 Federal St., Providence, R. I.; (B) J. W. Bishop Co., 417 Butler Exchange, Providence, R. I.; (C) C. E. Trumbull & Co., 1121 Tremont Bldg., Boston; (D) Joseph Long & Co., 29 Blossom St., Leominster, Mass.:

SUBSTRUCTURE OF SCREEN HOUSE SEWER AND SEA WALL, NEW BEDFORD, MASS.
(Intercepting Sewer System)

	A	B	C	D
3900 cu.yd. earth excavation	$1.50	$3.41	$1.75	$2.90
250 cu.yd. rock excavation	4.00	2.50	5.00	7.00
2100 cu.yd. masonry in sewer house	9.00	9.60	10.00	13.80
2100 cu.yd. concrete masonry in sewer, manholes and overflow	9.00	9.60	10.00	10.80
129,000 lb. steel reinforcing in sewer and sewer house	0.025	0.03	0.05	0.045
12,000 lb. steel beams, Angles, channels, Z-bars	0.07	0.05	0.08	0.07
14,000 ft. lumber left in place	20.00	20.00	20.00	20.00
375 cu.yd. rubble masonry in sea wall	11.00	10.70	9.00	10.50
1300 sq.ft. brick lining in boiler room	0.30	0.42	0.30	0.60
Totals	$41,111	$54,191	$52,470	$66,536

CATALOG NOTICES

The Berger Mfg. Co., Canton, Ohio. Catalog. Concrete reinforcing and furring plates. Illustrated, 82 pages, 6x9 in.

Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 34F. Design and construction of Class G "Chicago Pneumatic" compressors. Illustrated, 28 pages, 6x9 in.

International Praeposit. Safety explosive. Illustrated, 4x9 in.

The T. L. Smith Co., Milwaukee, Wis. Catalog No. 250. Rock, ore and gravel handling machinery. Illustrated, 40 pages, 6x9 in.

Toch Bros., 320 Fifth Ave., New York. Booklet. "Toxement," for waterproofing cement construction. Illustrated, 16 pages, 3½x6 in.

The Alexander Milburn Co., 1420-26 W. Baltimore St., Baltimore, Md. Catalog. Oxy-acetylene welding and cutting apparatus. Illustrated, 32 pages, 6x9 in.

American Sheet & Tin Plate Co., Pittsburgh, Penn. Pamphlet. "Better Buildings." Illustrated, 62 pages, 6x9 in.

General Electric Co., Schenectady, N. Y. Bulletin No. A1080. Electricity in excavation and construction work. Illustrated, 28 pages, 8x10½ in. Bulletin No. 4850C. Edison Mazda lamps for standard lighting service. Illustrated, 26 pages, 8x10½ in.

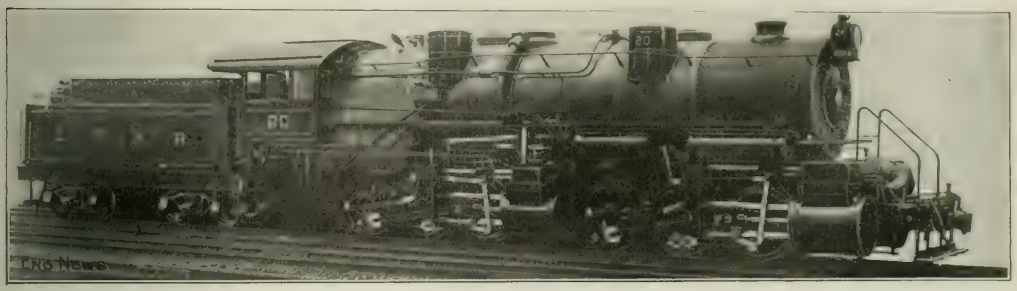
Lackawanna Steel Co., Lackawanna, N. Y. Bulletin No. 105. Steel sheet piling. Illustrated, 28 pages, 8x10½ in.

Engineering News

VOLUME 69 FEBRUARY 6 1913 NUMBER 6

A Heavy Switching Locomotive with Side Sandboxes

On very large locomotives with numerous driving wheels, and especially on Mallet duplex engines, the ordinary sandbox on top of the boiler hardly affords sufficient capacity of sand, as the large boilers leave little height available for the sandbox. For engines in yard and shifting service two sandboxes are commonly used. In some recent Mallet locomotives these boxes are placed on each side of the boiler, so that a much larger box can be used. This arrangement, with two boxes (for the rear or high-pressure group of drivers only), has been applied to large locomotives of the 0-8-8-0 class for the Pennsylvania R.R. The accompanying cut shows an engine of the 0-6-6-0 class having four sandboxes arranged as above described, and serving both groups of driving wheels. The engine



MALLET SHIFTING LOCOMOTIVE WITH FOUR SANDBOXES MOUNTED AT THE SIDES OF THE BOILER; LAKE TERMINAL R.R.
(Baldwin Locomotive Works, Builders)

illustrated is one used at Lorain, Ohio, by the Lake Terminal R.R., its principal duty being to push trains of loaded ore cars from the ore docks on the lake front to the mills of the National Tube Co. The work is severe, and with the size of boiler required, the distance between the boiler and the clearance limits was too small for a sandbox of adequate capacity. To secure capacity for the required amount of sand, four boxes were placed at the sides of the boiler, as shown, thus enabling large and deep boxes to be used. Each box is fitted with the Leach sanding device. It may be noted, also, that the size of the boiler necessitated placing the bell at one side instead of upon the top of the barrel. In this country the sandbox is placed almost universally upon the boiler, and one box (except on yard engines) serves all the wheels. In European practice, sandboxes are placed usually upon the frames. Very generally they form an extension of the splashers or hoods which cover the tops of the driving wheels, as the engines have the cab floor and running board placed below the tops of the wheels, instead of above them, as in this country. Sandboxes supported by the frames and placed directly in front of the driving wheels, have been tried on a few American engines, but with unsatisfactory results, the sand becoming cold and moist so that it would not flow as freely as when warmed by the heat from the boiler.

The 0-6-6-0 engine shown is of interest on account of the special character of its service. As stated already, it is employed to push trains of loaded ore cars from the ore-receiving docks to the steel mills at Lorain, Ohio. The standard train consists of 21 cars, with a total weight of 1638 tons. While the run is short, the operating conditions are severe. Directly after starting, the engine has to pass a curve of 7° 48′ on a grade of 1.23%, and on straight track there is a maximum grade of 1.65%. The boiler is very large, but has neither superheater nor feedwater heater. The high-pressure steam is taken from a low dome by outside pipes, and the steam distribution of all the cylinders is effected by balanced slide-valves operated by Walchaerts valve gear. The engine was built by the Baldwin Locomotive Works, and its main dimensions are shown in the accompanying table.

175-TON MALLET SHIFTING LOCOMOTIVE: LAKE TERMINAL R.R.

Class	0-6-6-0
Fuel	Soft coal
Driving wheels (42)	4 ft 7 in.
Journals	10½x12 and 10x12 in
Wheelbase, each group	10 ft. 0 in.
Wheelbase, total	29 ft. 8 in.
Wheelbase, engine and tender	62 ft. 3 in
Length over engine	50 ft. 0 in
Weight, all on driving wheels	350,000 lb
Weight of tender, loaded	130,000 lb.
Cylinders (4)	24x32 in. and 37x32 in.
Boiler, straight-top; diameter	7 ft. 0 in.
Boiler, height to center line	10 ft. 9 in
Barrel plates	⅝ in.
Firebox, radial-stay; size	9 ft. 10 in.x8 ft.
Firebox, depth, front and back	6 ft. 6 in. and 6 ft. 4 in.
Firebox plates; (side, back and crown)	⅜ in
Firebox tube-plate	½ in
Tubes, steel; No. 437; diameter	2¼ in
Tubes, length	21 ft. 0 in
Heating surface, tubes	5380 sq.ft
Heating surface, firebox	230 sq.ft
Heating surface, firebrick arch tubes	30 sq.ft
Heating surface, total	5640 sq.ft
Grate area	78.3 sq.ft
Height to top of smokestack	14 ft. 8½ in
Water in tender	7000 gal
Coal in tender	12 tons
Tractive effort (working compound)	82,500 lb.

Lightning Protection of Buildings*

By ERNST J BERG†

In looking over recent articles dealing with lightning and lightning protection one is struck by the prominence given to protection of electric transmission lines and electric apparatus, while practically no contributions have been made to the subject of protection of buildings since the famous work by Sir Oliver Lodge years ago. Yet the protection of buildings unquestionably is as important as the protection of transmission lines and there are thousands of people interested in protecting their homes to every one interested in a transmission line.

To people living in cities the subject is, however, of little or no interest. Experience has shown that the extensive networks of wires, metal roofs, etc., are usually ample for protection. The man living in the country, however, is very much concerned, as experience has shown that in certain localities at least it is indeed tempting providence not to have some lightning-rod scheme.

While little is known about the source of the electric energy, fortunately, due mainly to the researches of Sir Oliver Lodge, a fair amount of knowledge exists about the nature of its discharge—of lightning itself. Lodge first suggested that there are at least two distinct kinds of discharges; one which is relatively quiet and which results from the gradual breaking down of the air between the object struck and the charged cloud; the other which is a violent secondary discharge caused by a primary discharge in the vicinity.

The first kind follows the well known laws familiar to the electrical engineer—laws that deal with more or less permanent conditions. The nature of the discharge is governed by the resistance, inductance and capacity of the path. The path itself is almost certain to be the rod on account of the conducting streamers above it.

The second kind is more complex and the laws that it follows are less thoroughly understood. There is no conducting path above the rods because there may have been no potential difference between them and the surrounding air before the discharge. Thus the rods may well be missed and the discharge enter any portion of the roof and find its way to ground through the building. To guard against these it would seem that the entire roof should be of metal, or at least largely covered by a metal network.

Professor Fleming has compared the first with the slow combustion of gun powder placed in a room and carefully lighted, the second with detonating powder.

Electrical Constants of Lightning Rods

It is generally rescognized that a lightning discharge is oscillating and that the oscillations are of high frequency, perhaps from 100,000 to several million cycles per second. At these frequencies the electric constants of conductors are very different from those normally.

In the passing of high frequency currents, energy is expended as heat at the surface of the conductor and as electric radiations in the surrounding space.

The object of the lightning rod is to form a path for the discharge, a path offering much less obstruction than any path through the building. If the ohmic resistance were all important this could well be done by using a very large copper rod, but at these very high frequencies the inductive obstruction, or impedance, is measured in tens or even hundreds of ohms, whereas the ohmic resistance may be but a small fraction of an ohm.

Electric Characteristics of Lightning

The greatest number of lightning discharges takes place inside of clouds or between adjacent clouds. These discharges involve usually rather moderate voltages, as has been shown by Steinmetz, but while very interesting are hardly within the scope of this paper. The knowledge of the nature of lightning discharges from cloud to earth is, however, of the greatest importance in studying the efficiency of lightning rods.

Unquestionably such discharges take place not only at moderate voltages, but also at voltages which are exceedingly high; this latter being the case when the charged cloud is separated from earth by a layer of more or less dry, moisture free air.

Under these conditions the distribution of potential may be quite uniform, and the air as a limiting case may be charged to its breakdown point all through its mass, when the potential difference may be exceedingly great, perhaps hundreds of millions of volts. The maximum value of the discharge current may also be very great, reaching several thousand if not hundreds of thousands of amperes, as may be judged from the consideration of the following simple and apparently conservative case.

An area on the surface of the earth 100 ft. square is subjected to the discharge of a cloud or part of a cloud, also 100 ft. square, at a distance of 1000 ft. In this case the capacity is approximately 0.000027 microfarads, a very small capacity indeed, something like that of the smallest Leyden jar. If the electric stress as assumed were uniformly distributed throughout the air space separating cloud and earth, and if the disruptive strength of air is 30,000 volts per cm., a potential of 912 million volts would exist between cloud and earth just before the stroke. The electric charge, that is, the amount of electricity stored, would be 0.025 coulombs, a very small value when considered by itself. The energy stored would, however, be great on account of the high difference of potential. It would be 11,200 kw.-sec., corresponding to the energy of almost a pound of dynamite. This energy must be expended in heat and electric radiation, partly in the stroke before it reaches the rod, partly in the circuit of the rod. The higher the frequency the greater is the relative amount radiated. With a small copper rod the energy radiated at one million cycles is perhaps 50 times as great as that converted to heat in the rod. With a small iron rod, however, the two quantities are not much different. Thus the iron rod will convert more energy to heat and yet only slightly more impede the discharge. The number of oscillations of the current in the iron rod is therefore less than with copper, and the discharge less violent.

While in every discharge almost an infinite number of frequencies undoubtedly are represented, it is probable that one is preponderating. Were it permissible to consider that the frequency in the discharge after it reaches the rod is governed only by the electrical constants of the rod, the wave length would be somewhat more than four times the height of the rod. This would mean with an ordinary dwelling, having a rod of say 50 ft., about 5,000,000 cycles. If on the other hand the effect of the rod is hardly noticeable and the frequency is governed by the distance between cloud and earth, the frequency will be much lower, say 250,000 cycles, with a distance of 2000 ft between the cloud and earth.

In the first case the drop in potential per foot is about two million volts, in the second case only nine thousand volts. The first case, I believe, gives an idea of the conditions of a secondary stroke. It is of very high frequency and may be the result of the discharge of the air immediately surrounding the rod rather than the entire air between cloud and earth. The discharge area is in this case difficult to estimate; it may be quite limited or it may be quite great.

Assuming again an area of 100 ft. square and calculating the voltage and capacity, it is found that the capacity is increased in the same proportion as the voltage is decreased; therefore the charge and maximum value of the current remains unchanged. The maximum value of the current would be, say, 750,000 amp., and the drop per foot of rod about 2,000,000 volts.

It is evident that such discharge would jump several feet in the air rather than travel 1 ft. in the conductor. (The drop in potential of 2,000,000 volts per ft. corresponds to 2 ft. striking distance between parallel planes and perhaps 10 ft. distance between projecting masses of metal).

The second case, I believe, is approached when a lightning discharge takes place from cloud to rod after a conducting path has been prepared by means of streamers. It is the first, the quiet type of lightning mentioned in the beginning of the paper.

Thus is seen how a single lightning rod may be expected to take care of low frequency discharge from cloud to earth, but is entirely inadequate to cope with a violent secondary discharge, even if perchance it hit the rod instead of the building proper.

Were this illustration then at all representative it would mean that one lightning rod, while offering some protection, is entirely inadequate to cope with the situation. If the building were grounded by 10 rods the condition would be much improved. The maximum drop per foot would then correspond to a moderate air space and the lightning discharge would probably be confined to the system of rods.

Before discussing the approximations involved in this elementary discussion it may be well to see the effect of a larger cloud, or perhaps better a larger section of a cloud discharging through the rods. If the areas were doubled, twice as many rods would be required for the same amount of pro-

*Condensed from a paper before the Illinois State Electric Association, Oct. 24, 1912.

†Professor of Electrical Engineering, University of Illinois.

tection. If the areas were the same, but the cloud were only one-half as far above the building, the voltage would be lower, but the capacity greater, and the conditions in the original assumption would apply.

Principal Uncertainties in Theory

The principal uncertainty of this theory lies in the estimate of voltage and frequency. Regarding the voltage, it is not likely that even in perfectly dry air the electric stress is uniformly distributed throughout the space; it is probably higher at the cloud and at the building than in the column of air separating them. The effect of this would be to lower the potential and therefore the charge and energy involved. It is probable that, as stated previously, in discharges in clouds and between clouds the potential may be only moderate because it is likely that the discharge takes place from drop to drop at rather low values. In the case of the discharge to ground, however, this suggestion does not seem reasonable, when the lightning strikes through clear air. Furthermore, unless the voltage is extremely high the energy discharged could not be great enough to do what is frequently done

Regarding the frequency, a great deal has already been said. It seems reasonable that discharges take place at frequencies as low as 100,000 cycles and as high as several millions. While with the former considerably more energy is likely to be involved, it seems reasonable to expect that a rod is of very considerable protection, whereas with the latter a very large number of rods would be required.

Conclusions and Answers

What conclusions can then be drawn regarding the best method of protection; what answers can be given to the questions often asked?

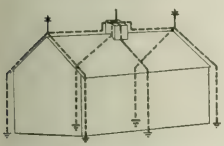


FIG. 1. SATISFACTORY ARRANGEMENT

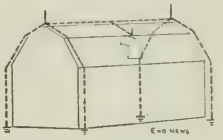


FIG. 2. UNDESIRABLE ARRANGEMENT

FIGS. 1 AND 2. LIGHTNING RODS ON SMALL BUILDINGS

"Is there any real advantage in the installation of lightning rods or do they draw lightning and thereby add to the danger?" Experience seems to have settled beyond reasonable doubt that if properly installed, lightning rods afford considerable protection. A large number of instances might be quoted, but suffice it here to mention only one near at hand. Before equipping the University of Illinois buildings with rods, three fires were caused by lightning; since that time, though the number of buildings has been greatly increased, there has been no damage from lightning.

Any lightning rod "draws" lightning if by that expression is meant that it prepares under certain conditions an easier path for the lightning discharge than would be the case if it were not there. The conducting streamers issuing from the rod tend to equalize the potential between earth and cloud and thus diminish the severity of a stroke and possibly prevent it altogether. Yet it may also be argued that unless there are many such streamers the rod cannot always cope with the situation and a stroke may result from them. This feature is dealt with later under another heading.

"Can a building be perfectly protected from lightning?" The answer must be no, except perhaps in the case of a thoroughly grounded all-metal building.

"How much protection does a lightning rod afford?" Unquestionably some if properly installed, but it may make matters worse in some cases. Assume for instance that a large building is equipped with a high, but broken, rod or a rod having poor joints or a high resistance to ground, say several hundred ohms, which undoubtedly sometimes is the case. Such a rod could serve the function of equalizing the potential between cloud and earth almost as effectively as a good rod, and were there only a sufficient number of them it is conceivable that the neutralization of potential would be so complete as to make a flash discharge practically impossible. A building having one rod only, however, is considered at present. The rod is assumed as projecting considerably above the building. If the electric tension is great, unquestionably streamers are emitted, the air above the rod is made fairly conductive and thus the discharge is invited.

The question is then: "How can such a rod take care of a discharge?" It has been shown how the discharge current frequently is very large and while the ohmic resistance of the rod is practically immaterial as long as it is at all reasonable, it must not approach or exceed the normal value of the impedance. In a rod, say, 30 ft. long, the ohmic resistance of even the smallest practical iron conductor is a fraction of an ohm only and the impedance is perhaps 30 to 75 ohms, depending upon the height and frequency of the discharge. It is easily seen that a poor joint may have many times this resistance; therefore, when the discharge encouraged by the streamers from the defective rod strikes the building it finds the rod entirely inadequate to cope with the situation. The voltage drop in the rod is so great that it is far easier for the current to split up in a number of paths and enter through the building than to confine itself to the rod.

An apparent paradox thus exists. The rod should have good joints, should have good ground connection, and should be mechanically secure against breaking; although the shape of the rod, its metal or general dimensions, are rather immaterial.

"How many rods should be used?" The answer is, the more the better. The protection afforded ought to be, roughly speaking, proportional to the number of earthed rods. Half a dozen ground connections to a house 100 ft. by 50 ft. seems nothing out of the way.

How should they be placed? They should always be placed outside of the building and it is indeed a question whether the vertical part of the system, that is, the rod proper, should not be some little distance from the wall and possibly even insulated therefrom. The rods should be a considerable distance from gas pipes, stove pipes, water pipes and balconies or places where persons might be during a storm.

A small house might be protected as shown in Fig. 1. There are five or six ground connections, one at each corner and one or two from the chimney. A horizontal rod follows the ridge of the roof and is connected to earth by the several ground connections.

Heated gases coming from a chimney are apparently themselves good conductors, or more probable are instrumental in collecting and forming a path of charged particles constituting good conductor for lightning discharges It seems conservative, therefore, to have a metal conductor crossing over the chimney opening. Such a conductor should be made of copper on account of the chemical effect of fuel gases on iron.

Two small spires each having many points are shown. These are unquestionably of some advantage in that through them there is a continuous equalization of the potential between cloud and earth. It seems, however, as if their height should be conservative. A projection of a few feet seems quite enough. To be effective in their office these spires should have several points; but the expense of using platinum or something similar seems hardly warranted, because the amount of current radiated from the points is insignificant before the "brush discharge" begins, and when such discharge takes place it matters little whether the points are rough or sharp.

Each tower or other projection of a building should have direct ground connection, though connected with the other lightning-rod system.

In Fig. 2 is shown what in my opinion is an unsatisfactory arrangement of rods. A small dormer is supposedly protected by an independent short rod connected by a long wire to the main system. It seems unlikely that the discharge would travel many feet to reach the main rod when by striking through the building it can reach ground in most cases with greater ease. The attic room, supposedly protected, is in my opinion endangered by the rod. Protection would, however, result if the dormer rod were directly grounded.

Metal gutters should be connected to the lightning-rod system and should be connected at their lower extreme to ground.

A high factory or power-plant chimney needs good protection; two or three rod do not seem too many and the opening of the chimney should be crowned by some simple copper-rod construction.

"What kind of material should be used?" In cities, where after all the damage by lightning is small, there is always more or less fuel gas and soot in the air and copper seems best. But I can see no electrical advantage in having a stranded cable—a solid rod is as efficient. There is a very slight advantage in a flat ribbon, but the advantage is very small and the mechanical difficulties with a ribbon are greater than with a rod.

In the country, galvanized-iron rods seem best for two

reasons: (1) They are cheaper; (2) their electrical constants are, if anything, better than those of copper. Again an apparent paradox is met. It has been said that the material, size and shape of the rod was rather immaterial and yet now iron rods are recommended. The reason is that the first statement applied to the ability of the rod to discharge the current with the least drop of potential, whereas other factors also enter—factors which, to be sure, are of a secondary importance.

The old idea that the rod carries the electric charge to earth and that that is the end of it is fallacious. The earth is one plate of the condenser, the cloud the other, and whatever energy is stored between them has to be consumed in some way. It is done by heating the rod and by sending out electric radiations. The higher the resistance of the rod the greater is the energy converted to heat, and thus the smaller the number of oscillations of the discharge current necessary to dissipate the energy. Iron has considerably higher effective resistance than copper, and thus has an advantage.

Perhaps the point will be clearer by stating that as far as impeding the flow of the current is concerned the ohmic resistance of the rod is immaterial as long as it is at all reasonable. As far as affecting the duration of the discharge is concerned, however, the higher the resistance the shorter is the time and the less violent is the disturbance. [The resistance should not be concentrated, as at joints, for this would concentrate the energy and destroy the rod.—Ed.].

Lodge's experiments and theory show conclusively that there is no advantage in copper over iron. Copper may have mechanical advantages under certain conditions, for instance in cities where the atmosphere is charged with soot and a varety of fumes. Galvanized iron has the advantage of cheapness, with a possible electrical superiority.

"What should be the shape and size of the rods?" While flat conductors have a very slight advantage, it appears too small to be considered seriously. A round wire or a pipe can conveniently be handled and seems therefore preferable. In the installation of the rods, sharp bends should be avoided as much as possible. There is little or no advantage in using large expensive copper conductors or cables; a size mechanically satisfactory is likely to serve all electrical purposes. Expensive sharp points offer little advantage over ordinary rather blunt points. The rods may advantageously terminate in a number of points projecting only a short distance above the part to be protected.

"How should ground connections be made?" They should be of low resistance, and therefore the rods should preferably terminate in moist soil. "Salting" the ground may be an advantage, but the experience with such grounds is not sufficient to warrant its adoption unless an occasional inspection is made. In many cases excellent connection can be made by driving a galvanized gas pipe a few feet in the ground.

"Should water, steam and gas pipes in the building be connected to the rods and grounded?" This is debatable. On the whole it would seem most conservative to leave them alone, especially the gas pipes. The water pipes, which are always grounded, may, however, advantageously be connected to the lightning-rod system under ground.

"Is it dangerous to stand in a draft during a thunderstorm?" A building having its windows and doors open certainly affords a chance for the entrance of air, perhaps ionized air made conducting by a previous discharge. It is, therefore, safer to keep the house closed during a violent storm.

"Is it safe to stand near a lightning rod?" From the preceding discussion this seems hardly safe. It is well to keep away not only from the rod, but from chimneys, kitchen ranges, metal pipes, etc.

It is finally of interest to draw attention to the fact that the damage by lightning in cities is relatively small and that so far the modern sky scraper with its vast amount of steel appears to be lightning proof.

In conclusion, I wish to emphasize the fact that after all we know little about lightning. I have tried to incorporate the experience of many investigators and observers and am particularly indebted to Sir Oliver Lodge's numerous writings and experiments on this subject.

Supporting an Electric Railroad on the Edge of a Side Hill

By Walter Loring Webb*

A vexing engineering problem was recently solved in Oil City, Penn., by a method which is probably unique in engineering practice. Colbert Ave. runs along a side-hill slope, which drops down steeply to the tracks of the Pennsylvania R.R., beyond which is the Allegheny River. For a considerable distance the street is about 50 ft. above the railroad and the slope in many places is at or beyond the slope of repose. The street-railway track of the Citizens Traction Co. has been placed at the outside edge of the slope. Immediately following every heavy rainstorm and especially in the spring, when the frost is coming out, there is always a loosening of the soil on the edge of the bank and the railroad has been compelled to use cribbing of poles and old ties to support the outside of their track. Even this cribbing would settle as the surface soil gradually gave way and it was a constant source of expense to even maintain the cribbing and keep up the track to grade. The outer rail especially would settle, causing an outward lurch to the cars which was so alarming that it discouraged traffic. Even if there was never any real danger, the discouragement of traffic and the constant expense required for maintenance justified a considerable expenditure to make the track firm and unyielding.

Naturally, retaining walls were considered. The steep-

*Chief Civil Engineer, Day & Zimmermann, Philadelphia, Penn.

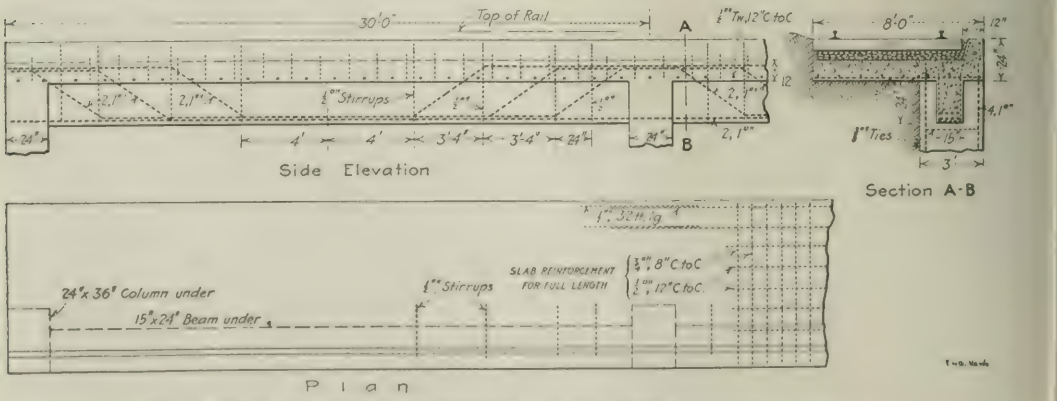


Fig. 1. Details of Reinforced-concrete Slab to Carry Railroad on Side Hill

ness of the side slope would have made it a very difficult problem to support the exposed earth surface while a wall was being constructed, especially if traffic were maintained on the very edge of the slope. A preliminary estimate on the cost of two stretches of retaining wall, one 60 ft. long and the other 120 ft. long, was between $1000 and $5000.

The method adopted has apparently solved the difficulty, has made a stable track and was done at a cost about one-fourth of the estimated cost of the retaining walls. It was argued that if the edge of the slope could be thoroughly supported and the soil underneath protected from frost and weather, the structure would be



FIG. 2. VIEW OF ONE OF THE SLABS DURING CONSTRUCTION

indefinitely solid. A concrete slab 8 ft. wide was built under the track (Fig. 1). Near the outer edge a girder with a depth of 3 ft. and which acted, in conjunction with the slab, as a T-beam, was designed to support the heaviest load of traffic on a span of 30 ft. Two slabs were placed, one of them 60 ft. long and another 120 ft. long, at a place a few hundred feet further on. On the 120-ft. stretch there were five piers 30 ft. apart under the girders; on the 60-ft. stretch there were three piers. The pier pits were dug to a depth varying from 11 to 14 ft. and reached a firm shale several feet below the original surface over which there had been a filling of several feet. The original design called for piers 2x3 ft., but since the pits as dug were not much larger, it was considered preferable to fill them entirely with concrete, thus making a more perfect bond with the soil, saving the use of forms and saving the necessity of backfilling and its tamping. All of the concrete was thoroughly reinforced with steel, the reinforcement being well shown in the view in Fig. 2.

One of the elements of economy in the cost was the lack of necessity for forms. The concrete for the girder was laid in a mere trench. No forms were required for the bottom of the slab nor for its up-hill vertical side. A line of planks 2 ft. high was placed on the down-hill side as shown in Fig. 2, and this was the only planking required, except where a rain-water culvert ran under the slab. Of course, a plank was needed for the inner side of the curb, which was placed after the slab was complete and hard.

Although the soil supported the concrete during construction, it is expected that the soil may shrink away on the down-hill side and thus bring into play the strength of the girder. It is not expected that there will be any appreciable settling or yielding of the soil under the up-hill side of the slab. Even if this should occur to some extent no harm will be done. Considering the slab as a beam lying on its side and having a depth of 8 ft., its strength is enormous and evidently the entire slab would move as a unit if any earth sliding should occur which could move it at all.

It was suggested that the piers might have been extended the entire width of the slab and another girder placed under the up-hill side of the slab. Although this would have made a trestle of the entire structure, which would harmlessly permit the soil to fall away from under it for the entire width of the structure, such a complete failure of the hillside is hardly conceivable. It would have added about 60% to the cost of the work and it was considered needless.

Although the two structures have been in place only since November and it will require a year or two to demonstrate the efficiency of the method, there is every indication that the problem has been solved and that two exceptionally costly retaining walls have been avoided.

The work was done for the Citizens Traction Co., of Oil City, by the Operating Managers, Day & Zimmermann, the work being under the direct charge of the writer.

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The Ban Placed On Common Drinking Cups and Common Towels by a number of state boards of health has now been made universal throughout the United States so far as interstate traffic is concerned by an order of Franklin MacVeagh, Secretary of the Treasury, dated Dec. 19, 1912, and addressed to medical officers of the U. S. Public Health Service, and to state and local health authorities:

> Common carriers shall not provide in cars, vehicles, vessels or conveyances operated in interstate traffic, or in depots, waiting rooms or other places used by passengers traveling from one state or territory or the District of Columbia to another state or territory or the District of Columbia, any drinking cups, glass or vessel for common use: Provided, That this regulation shall not be held to preclude the use of drinking cups, glasses or vessels which are thoroughly cleaned by washing in boiling water after use by each individual, nor shall it be held to preclude the use of sanitary devices for individual use only.
>
> Common carriers shall not provide in cars, vehicles, vessels or conveyances operated in interstate traffic, or in depots, waiting rooms or other places used by passengers traveling from one state or territory or the District of Columbia to another state or territory or the District of Columbia, any towel for use by more than one person: Provided, that towels may be used again after having been sterilized with boiling water.

Experience with Wood-Stave Pipe in Irrigation

By R. K. Tiffany*

SYNOPSIS—The author gives instructive experiences with wood pipe, mostly composed of staves, used for irrigation purposes on the Sunnyside Unit, Yakima Project of the U. S. Reclamation Service, in Washington. Both wire-wound and banded pipe are reported on. Emphasis is laid on the importance of using a protective coating to cover pipe, joints and collars for pipe laid in dry soil and not kept filled throughout the year. A considerable portion of the article is devoted to leaks in a 55-in. stave pipe, under 190 ft. head, laid beneath a river. Several small leaks in the pipe caused the cutting of the steel bands by the escape of silt-bearing water. After the bands had been cut, the water pressure broke through the end of the unsupported stave. Methods of repair are described.

Owing to its low first cost, the facility with which it may be handled and laid by unskilled labor, the ease with which connections and taps of all kinds may be made, and the belief that its life will equal, or exceed, that of comparatively light gage steel pipe, which is its only competitor in large portions of the arid West, wood pipe has been very popular with many irrigation engineers and large quantities of it have been installed during the last ten years of rapid irrigation development. Unfortunately, but little has been published concerning the various uses of this pipe under the conditions which prevail in the irrigated districts. The following notes are, therefore, submitted with the hope that they may be of interest to irrigation engineers and may result in bringing out some of the experiences of others along the same lines.

The pipes mentioned are all in use at the present time on the Sunnyside Unit, Yakima Project of the U. S. Reclamation Service and were laid by the Reclamation Service, or its predecessor in interest. The irrigation season on this unit extends from Apr. 1 to Nov. 1, and during that time all the pipes mentioned are kept continuously full of water. With the exception of the Mabton pressure pipe, no effort is made to keep the pipes full during the winter season. The Mabton pipe is kept filled by means of a gasoline engine and pump installed at the river crossing for that purpose.

The climate from Nov. 1 to Apr. 1 is cool, with from 4 to 6 in. of precipitation, mostly in the form of rain, and sometimes from four to eight weeks of foggy or misty weather. As a consequence, the pipes do not become entirely dry during the winter, but, on the contrary, the wood is usually found to be moist at any time during the winter, with the exception of a short distance at either end of the pipe line. While the degree of moisture is perhaps not as great as could be desired for the preservation of the pipe, it seems to be sufficient to keep the pipe in fairly good condition, as evidenced by the fact that the decay, in those cases where it has been troublesome, has invariably started from the outside. A few typical installations will be described, with description of surrounding conditions, the behavior of the pipe, and conclusions which have been drawn as the result of our experience.

*Project Manager Yakima Project, U. S. Reclamation Service, Sunnyside, Wash.

Pipe for Lateral Turnouts from Main Canal—In 1893 the Irrigation Co. installed some 40 or 50 pipe headings or turnouts for diverting water from the main canal into lateral ditches. These turnouts were from 18 to 30 ft. long, with a wooden bulkhead and gate at the end next to the canal. They were buried from 4 to 8 ft. below the surface and covered with a puddled backfill of very fine volcanic ash. The pipes were bored from Washington fir, spirally wound with flat iron bands, joined with steel collars and coated with a very heavy coat of asphalt and sawdust. These pipes were removed in the winter of 1911-12, after 18 or 19 years of use, to be replaced by concrete turnouts of larger capacity. The pipes were found to be, almost invariably, in very good condition, with the exception of the two ends, which were occasionally found to be partly decayed. The steel collars were in very good condition, showing very little damage from rust, and the ends of the pipe contained within the collars were, almost invariably, in good order. While these pipes were empty at least five months of every year, the soil surrounding them remained constantly damp and the interior of the pipe never became really dry. The pressure on these pipes in no case exceeded 2 or 3 ft.

Pipe No. 1 was a 4-in. wood-stave, wire-wound pipe, 2000 ft. in length, laid in 1902, to carry water from a concrete reservoir to the headquarters buildings and grounds of the Irrigation Co. at Zillah. This pipe was built with inserted joints, laid at a depth of from 2 to 3 ft. in a very dry volcanic ash. The head varied from 6 ft. at the upper end to about 60 ft. at the lower end. The coating was very thin and light, having more the appearance of ink than that of a good pipe covering. This pipe was kept full of water from the time of installation for about two years, at which time it began to leak and was thereafter emptied during the winter. At the end of four years it was so badly decayed that it became necessary to replace the entire line. It was replaced by a wood-stave pipe, wire-wound, with inserted joints, very similar to the first, but with a very good asphalt coating. The latter pipe has now been in use six years, being full during seven months of each year and empty during the remaining five months. It is in very good order and there are no leaks of any consequence.

Pipe No. 2 is a 13-in. bored pipe of fir, spirally wound with flat iron bands joined with steel collars, and the whole covered with a very good asphalt coating. This pipe, 2200 ft. in length, was laid in 1903 in soil similar to the above, with a covering of 2 to 2½ ft. The maximum head is 25 ft., the minimum 4 ft., and the average about 12 ft. It has been running full for seven months of every year since it was installed in 1903 and when recently inspected, the wood was firm and solid, the bands under the asphalt coating were bright and the collars were evidently in first-class condition. There was no evidence of leakage or decay at any point in this pipe. The material in which it is laid is volcanic ash and the land immediately above the pipe has been irrigated every year since the pipe was laid, the crops being orchard and alfalfa.

Pipe No. 3 is a 14-in. wood-stave pipe, wire-wound, with wooden collars also wire-wound, with a fairly good coating of asphaltum. The length is 5200 ft. This pipe was laid in very dry, sandy soil in the spring of 1908 at a depth of about 2½ ft. No water was carried during the first year and during the three years following the first 800 ft. of this pipe ran less than one-third full. The maximum head is 60 ft., the minimum 4 ft., the average about 15 ft.

In the spring of 1912 it became necessary for the first time to carry a full head in the pipe and the first 800 ft. was found to be so decayed as to be entirely worthless and was taken up and replaced with new pipe. On the balance of the pipe many collars were found to be leaking badly. These were replaced or repaired with wedges, the balance of the pipe being apparently in good condition. In some cases the water was found to be issuing in a jet between the staves of the collar and the staves of the pipe with sufficient velocity that the wires had been cut entirely in two, making it necessary to reband the pipe for a short distance from the joint. The wooden collars, so far as experience on this project goes, have been found to be a source of weakness.

Pipe No. 4 is a 22-in., machine-banded wood-stave pipe, 2300 ft. in length, laid not less than 2 ft. underground in soil similar to the above. The maximum head is 80 ft., the minimum 4 ft., the average about 35 ft. It was laid in the fall of 1906 and it has been giving continuous service since that time for seven months of each year. It has a very good coating of asphalt and has given no trouble, except from occasional leaks at the wooden collars. The collars on this pipe consist of staves about 6 in. long, with two to four steel bands at each collar, provision being made for adjusting the collars by thread and nut on one end of each band. The pipe is apparently in good condition except at the collars, where there have been several leaks, and it has been necessary to renew a number of collars.

The above described pipe and conditions are typical for installations of machine-banded wood-stave pipe in this valley. So far as we have ventured to draw any conclusions, they are substantially as follows:

The one great essential of continuous service from wood-stave pipe that is not kept filled throughout the year is a thorough and complete coating of asphalt on the outside. This coating must cover, not only the body of the pipe, but also all joints, collars or other fittings.

Wooden collars for joints have not given as good results as metallic collars. It has been difficult to secure a tight fit with the wooden collars and the additional thickness of the shell at this point and the break in continuity makes complete saturation of the joints impossible. The result is that decay starts at the joints and from there spreads until a leak develops. Leaks are rapidly enlarged by erosion, especially if the water carries silt or sand in any considerable quantities.

With a good heavy coating of asphalt, and the pipe running full throughout the irrigation season, it appears that absorption of water from the pipe by the surrounding soil is prevented; and well laid pipe under such conditions will probably last 20 years, possibly much longer. With a pipe with poor coating, or empty during a portion of the dry season, decay is very rapid.

Mabton Pressure Pipe—This pipe is two miles in length and 55 in. in diameter, carrying approximately 100 cu.ft. per sec., and is of the usual type of continuous-stave wood pipe. The staves are 5½ in. wide, 2½ in. thick; cut to true circle and radial lines, with butt joints made of galvanized-iron tongue driven to a tight fit in slots in the ends of the staves. The maximum head is 190 ft., the minimum 40 ft., the average about 100 ft. Of the total length, about 500 ft. of the pipe is at a depth of from 3 to 6 ft. under the bed of the Yakima River. Fifteen hundred feet of this line, including the portion under the river, has a diameter of 48 in. About 2000 ft. is uncovered, lying on the surface of rocky ground or in rock-cut. The balance of the pipe is covered with soil to a depth of not less than 2 ft., the material varying from volcanic ash to coarse gravel or sand.

There is very little vegetable matter in the soil used for backfilling and, during the greater part of the year, practically no moisture, excepting that which may come from leaks in the pipe. During the winter, however, there is a sufficient rain and snowfall to dampen the ground to a depth of 2 or 3 ft., or possibly more, in loose backfill surrounding the pipe. During at least seven months of the year the soil of the backfill is perfectly dry and, of course, absorbs whatever moisture there may be present in the outer shell of the pipe.

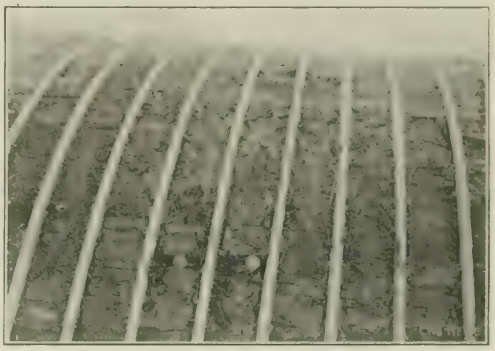


Fig. 1. Exterior of 55-in. Wood-stave Irrigation Pipe, Four Years after Construction.

(This pipe was covered to a depth of 2 ft. with a soil consisting of fine volcanic ash. The coins shown on the pipe are nickels.)

As might be expected, that portion of the pipe lying under the bed of the river is in very good condition and shows no evidence of decay. The exposed portion of the pipe was painted with a red-oxide paint and is now in very good condition, only a slight decay showing at some of the butt joints where there is some slight leakage. The covered portion of the pipe is in fairly good condition, but there are a great many staves which have decayed to a depth of ¾ in. to 1 in. (See Fig. 1.)

Considering our experience with this pipe and the smaller pipe on this project, it would appear that no wood pipe should be used in dry soil of this character without a good protective coating.

Break in Mabton Pipe Line—The following description of a rather unusual accident and its repair in the above described pipe line may be of interest to those

who are operating or who contemplate the construction of a similar pipes.

The presence of a serious leak in the Mabton pipe was first discovered during the winter of 1910-11, when we undertook to fill the pipe by pumping. The pumping plant installed at the river for the purpose of keeping this pipe full of water consists of a 20-hp. gas engine and a rotary pump with a rated capacity of 450 gal. per min. against a 200-ft. head. Some weeks after the close of the irrigation season of 1910 this pump was started and

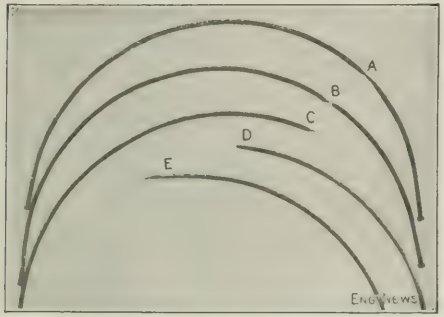


FIG. 2. HOW 5/8-IN. STEEL BANDS WERE SEVERED BY EROSIVE ACTION OF SILT-BEARING WATER UNDER 190-FT. PRESSURE

(These bands were on a 55-in. pipe under 190-ft. pressure, laid beneath a river to convey water for irrigation. See Fig. 3 for view on a larger scale).

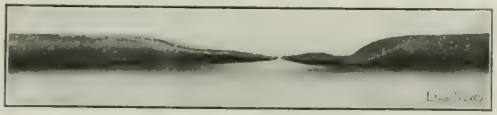


FIG. 3. ENLARGED VIEW OF ONE OF THE SEVERED STEEL BANDS SHOWN IN FIG. 2

water pumped into the pipe until a pressure of about 40 lb. was reached, after which it was impossible to raise the water in the pipe, and it seemed apparent that there was a leakage at that head equal to the capacity of the pump. The entire length of the pipe was carefully patrolled, but no leak could be found on either side of the river, and the conclusion was finally reached that the leak must be under the river. In fact, a buzzing sound, which was apparently caused by escaping water, could be heard from a boat at various points over the pipe; but this sound could not be located, nor was there any evidence of a stream of water sufficiently large to make any disturbance on the surface. Nothing further was done at that time.

The leak was next heard of on the morning of July 29, when the patrolman noticed a drop in the water at the outlet of the Mabton pressure pipe, and on investigation found that a break had occurred in the pipe under the middle of the river crossing at a depth of 8 or 10 ft. under water, from which it was found that about 7½ cu.ft. per sec. of water was escaping.

On Aug. 2 a similar break took place at a point about 75 ft. south of the first, the two together discharging about 12 or 15 cu.ft. per sec. of water.

By sounding with rods and the use of a water telescope, it was ascertained that each leak was small in area and purely local, and not more than two or three bands were broken at each point, but by this time at least one smaller leak had developed and it seemed advisable to take steps to provide a temporary supply of water for the lands under the Mabton Canal in case the breaks should become so large or numerous as to cut off the water-supply entirely.

Accordingly, a trestle was built across the river and 600 ft. of 24-in. wood-stave pipe rushed to the ground for the purpose of providing a temporary crossing if found necessary. Water service, however, was continued through the pipe and as the leaks did not increase appreciably, the pipe was continued in service until Oct. 1, when steps were taken to effect, if possible, a permanent repair.

The service of a diver were secured and it was found that the two large leaks were very similar in character, being roughly triangular in shape, with an area of 16 to 24 sq.in. each. Each break had occurred at the end of a stave and at each point two of the steel bands were found to be entirely severed and a third almost entirely severed by the erosive action of the water and the silt and sand which it carried. A third smaller leak which was found apparently shows the beginning stage of the larger leaks. At this third leak a small hole was eroded at the end of a stave, the water apparently following around the metal tongue and a band being already slightly eroded, and had this not been repaired in time it seems probable that a break similar to the other two would have occurred in the near future. It appears that the erosion cut one or more bands, and the end of the stave was then broken off by the water pressure. Figs. 2 and 3 are views of the severed bands.

The breaks were repaired by placing plates of ⅜-in. steel inside and outside of the pipe at each break, the inner plate having its smallest dimension equal to the largest dimension of the opening in the pipe, both plates being curved to fit the pipe, with rubber gaskets between the plate and the staves. These plates were drawn together by a ¾-in. bolt through their centers. New bands were placed where the old ones had been destroyed, passing over the outer plate and then cinched up as tight as possible.

After the job was finished and before the diver had left, a full head of water was turned into the pipe again and the pipe carefully sounded and inspected throughout its entire length. Under the river, at one of the places repaired, a very small leak appeared, but this was entirely stopped by placing several sacks of sawdust and alfalfa meal in the pipe through a manhole at the north end of the river crossing, and then turning in a small head of water.

The entire cost of the repairs made by the diver, including all labor and material, was $1260. The greater portion of the time was spent in removing the material from around the pipe, so as to be able to get at the band connections and to get a sufficient room to work in placing the patches. Several plans were tried for removing the material from around the pipe, but it finally became necessary to install a 6-in. sand pump on a scow, which was brought up the river from Prosser. The gasoline pumping engine from the pump house was moved

aboard the scow to drive the pump and the diver handled the suction hose, and by this means the material was removed very rapidly after the pumping plant was once in operation.

It is a noticeable fact that these three leaks all occurred in the upper third of the pipe and I have also noticed that there are numerous very small leaks in the upper third of the exposed portion of the pipe south of tf the river, and practically none in the lower two-thirds of the pipe. This may be due to the fact that the velocity through the pipe up to the present time has been only 2 to 4 ft. per sec., and throughout the length of the pipe a certain amount of fine silt has been deposited on the sides and bottom. This would, of course, have a tendency to fill all small leaks in the sides and bottom, but probably not those in the top. It is, therefore, proposed to feed into the pipe from time to time a few sacks of fine sawdust, bran, alfalfa meal, or something of a similar character for the purpose of plugging any small leaks before erosion sets in.

An 18-in. manhole has been placed near the river margin at each side of the crossing and it is believed that similar leaks may be stopped, should they occur in the future, by pumping the water from the pipe under the river and making repairs on the inside of the pipe. It appears that repair may be made in this way, provided the leaks are discovered before any bands have been destroyed, and with our experience of the past year, we should be able to anticipate and prevent any serious breaks.

Sheet-Pile Cut-off for the Protection of Levee Foundations

By C. O. Sherrill*

The readers of Engineering News are, no doubt, familiar with the principal conditions under which levees are built, the most notable of which is that their location is governed by other conditions than the suitability of foundation or materials for their construction. Unlike most other engineering structures, no extensive preparation of foundation is usually possible on account of the extent of the work and the relatively small amount of money available; the earth found in front of the levee must be used for construction, even though known to be wholly unsuited for the purpose.

When a levee is thus built of inferior porous material, the usual method of strengthening it is to increase the area of cross-section. For defects in the levee proper, this increase of section by the addition of earth is usually best because it is the cheapest means of adding strength; but if leaks develop deep down in the foundation and show up as sand boils as far inland as 600 ft. from the levee, no satisfactory remedy has been found.

A leaky levee of small section may also be protected by concrete revetment, especially where the levee is subject to wave wash. This method has been used for several years by the Fourth District, Mississippi River Commission, with entirely satisfactory results. On the river face of the levee, a weak concrete without reinforcement is laid with its toe resting on a vertical curb extended for 3 ft. below the base (Fig. 2). This revetment has been found to be an effective remedy against wave wash and seepage.

Sand boils are large springs often 6 or 8 in. in diameter, out of which water and sand flow under the pressure of the water on the river side of the levee, whose surface is from 10 to 20 ft. above the base. These sand boils are harmless unless they carry a large quantity of sand, but when the flow of sand becomes excessive, indicating rapid erosion of the base, they are a constant menace to the safety of the levees and require immediate attention to prevent disaster. A large percentage of crevasses, except where due to overtopping, have been caused by sand boils, which appear to be the result of filaments of water flowing in horizontal porous strata until they unite in one stream and burst through to the surface at the point of least resistance. To cut off this underground flow, muck ditches have been used, but with indifferent success, because of the prohibitive cost of digging to a sufficient depth and the impossibility of securing good clay filling in the vicinity. To overcome the difficulty, the Fourth District, Mississippi River Commission, is now having 5000 lin.ft. of levee at White Oak Lake, 35 miles below Vicksburg, on the west bank of the Mississippi, protected by means of dove-tailed sheet-piling (Fig. 1) driven 20 ft. deep at a point on the levee 4 ft. above the river toe. About 5000 ft. of levee at Grand Bay, 10 miles north of Baton Rouge, La., will be protected in the same manner. If the sheet-piling at these two localities proves successful during the next high water, this method of protection

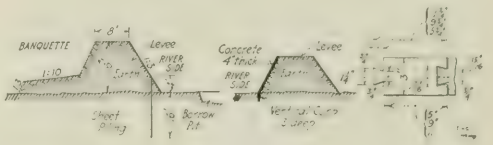


Fig. 1 Fig. 2 Fig. 3

will be extensively used on the Mississippi River Levees in future.

The sheet-piling used is of No. 1 common heart cypress and it cost, machined, as shown in Fig. 3, $29.50 per M. delivered on U. S. barges at Plaquemine, La. Heart cypress was selected as it lasts indefinitely in damp earth; pine would be easier to drive, not being so brittle, but does not last so well. The dove-tailed section gives a water-tight joint when the timber is expanded to a close fit in the damp earth.

The contract for driving the piling was let to J. B. Alexander, New Orleans, La., at $1.87 per lin.ft. of levee protected, or $0.0935 per sq.ft. of piling. The work advanced slowly at first, on account of breakdowns, but at present an average of 200 piles are driven per day.

Some doubt was felt as to the possibility of driving piling only 3 in. thick to a depth of 20 ft. on account of the small area of cross-section. It has been found that a single pile 3x6 in. cross-section has not enough strength to resist the blows from an 1850-lb. hammer, so the plan of threading two piles together and driving this double pile was tried successfully. An average of 55 blows is given each double pile. A small number of piles have been broken or split, but in general about 6 in. of brooming of the end of the piles is the only injury from driving. The driving is comparatively easy except in strata of compact sand.

*Captain, Corps of Engineers, U. S. A., Mississippi River Commission, Fourth District, New Orleans, La.

The V-Notch Weir Method of Measuring Water*

By D. Robert Yarnall†

Attempts to measure accurately and to record automatically the flow of water through pipes or channels have been made from time to time with varying results as to accuracy and convenience. This paper will attempt to show results obtained by the simple and practical V-notch method of measurement, which though not new, seems now to be meeting with marked success, both abroad and in America, in power plant measuring problems. Tests of the accuracy of this method of measurement have recently been made in America and the data collected are here presented to show the degree of accuracy attainable.

The instrument employed in the tests is the Lea V-notch recorder. An apparatus which depends on the laws governing the flow of water through weirs. These laws have been found to work with extraordinary accuracy but it is only comparatively recently that they have been turned to

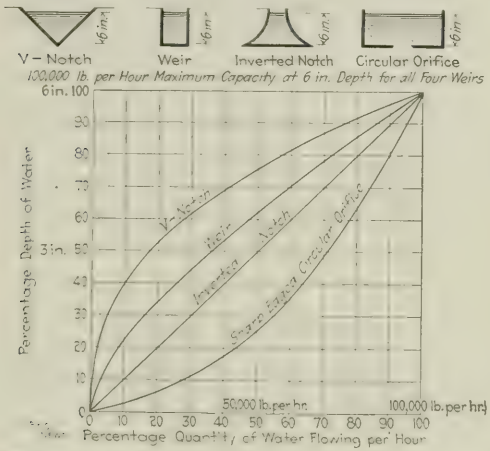


Fig. 1. Curves Showing Comparative Accuracy of Different Types of Weirs under Different Rates of Flow

account in measuring the widely varying rates of flow, both hot and cold, met with in power plants.

The most common forms of weir are the plain horizontal sill and the sharp edged rectangular notch. The former of these has the full width of the stream or channel and is without end contraction, the formula used in connection with it being that of Francis:

cubic feet per second = 3.33 (L – 0.2 H) H^1.5

where

L = The width of the weir in feet.

H = The head of water passing over it in feet.

The latter is a sharp edged rectangular notch of less width than the channel or stream and therefore has end contraction. The formula used in this case is:

cubic feet per second = 3.33 (L – 0.1 H) H^1.5

where

L and H are the same as before.

C = a constant which depends on the ratio of the width of the weir to the width of the channel.

Although these two formulas give a fair degree of accuracy, there is another in which the accuracy is very nearly 100 per cent. This is Prof. James Thomson's formula for the sharp edged V-notch weir:

cubic feet per minute = 0.595 H^2.5

where

H = The height of the notch in inches, the angle of the notch being 90°.

Table I gives the flow of water through 90° V-notches for each inch of head, up to and including 15 in., calculated by Thomson's formula.

TABLE I. FLOW THROUGH 90° V-NOTCH WEIRS

Depth in notch, in.	Flow per hour, lb.	Depth in notch, in.	Flow per hour, lb.
1	1,140	9	277,960
2	6,480	10	361,740
3	17,830	11	459,030
4	36,610	12	568,720
5	63,940	13	694,710
6	100,860	14	836,110
7	148,290	15	993,510
8	207,060		

The section of the flow through the V-notch is at all times the same shape, though the area may vary, and this constancy of form tends to simplify the formula and make it accurate. This form of notch is also especially adapted for measuring smaller quantities of water than the rectangular wiers, as shown by the curves in Fig. 1 which give a comparison of the accuracy of the different types of wiers at different rates of flow. Another property of the notch is that its angle may be less than 90° without impairing its efficiency, which enables it to be used to measure very small quantities of water.

It was for these reasons, as well as for its accuracy, that the V-notch was adopted for use in connection with the Lea recorder, a sectional view of which is shown in Fig. 2. It will be seen that a float spindle, rigidly attached to a float which rides on the surface of the water flowing over the V-notch, passes up through the bottom of the instrument case. A rack on this spindle engages a small pinion upon the axis of a drum revolving between centers. Upon the body of the drum is a screw thread, shown in Fig. 3, the contour of which is the "curve of flow" for the V-notch in connection with which the recorder is used, and as the flow through the notch increases rapidly with the depth, the pitch of the screw increases in the same proportion. Above this drum as shown in Fig. 4 is a horizontal slider bar, supported on small pivoted rollers and carrying an arm, at the upper end of which is a pen or pencil point in contact with a paper chart upon a clock-driven recording drum, which revolves once in 24 hours. As the float rises or falls the drum spiral is rotated, and its motion is imparted to the slider bar and pen arm by means of a saddle arm projecting from the latter and engaging at its lower end with the screw thread. On the body of the spiral drum is a graduated scale adjacent to the screw thread and computed in pounds per hour. It is thus seen that the drum serves the double purpose of rectifying the motion of the pen so that it moves equal distances for equal increments in the rate of flow, and of providing a magnified scale for making an accurate observation of the rate of flow at any moment.

The apparatus has the following advantages:

a. It is simple and hence dependable.

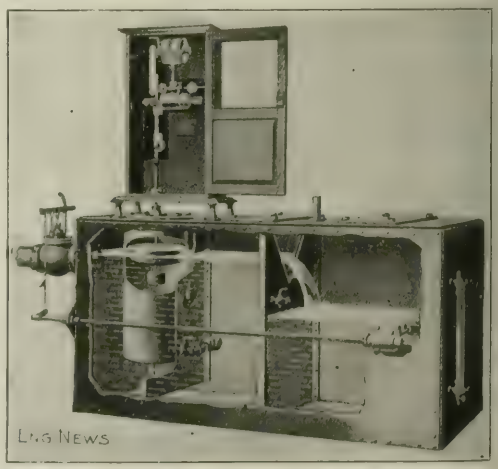


Fig. 2. Sectional View of V-Notch Weir Meter with Lea Recording Mechanism

*From a paper read before the American Society of Mechanical Engineers at its annual meeting in New York City, December 1912.

†Mechanical Engineer Yarnall-Waring Co., 1109 Locust St., Philadelphia, Penn.



FIG. 3. RECORDER DRUM, SHOWING GRADUATED CURVE OF FLOW

b. Its operation is continuous.

c. There are no moving parts in contact with the flow except the float, which is in a chamber by itself and not in the path of the flow.

d. Collections of sediment and deposits of scale do not affect the accuracy.

e. Owing to change of density of the liquid being measured, due to changes in temperature, the float which actuates the recorder is immersed more or less, depending upon this change of density, and the recorder and the float are so constructed that they compensate automatically for these changes in temperature over a wide range.

f. By making the tank of ample proportions a considerable interval of time takes place between changes in the head on the weir, so that the recording apparatus has a

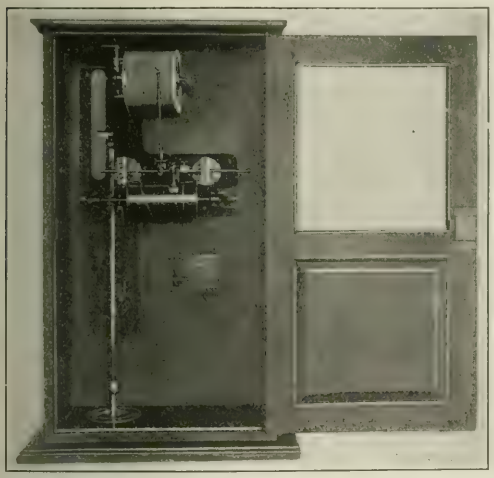


FIG. 4. ENLARGED VIEW OF LEA RECORDING MECHANISM

chance to adjust itself to changes in the rate of flow, thus giving a chart very easy to measure with the planimeter.

g. It is always placed on suction side of pump, hence it is available at all times for inspection, cleaning and repairs.

Like the Venturi meter and the Pitot tube, the V-notch recorder is a continuous flow meter, but unlike these it is not dependent for its accuracy on velocity changes, and hence its record is not subject to the fluctuations due to sudden changes of velocity head observed in these meters while measuring rapidly changing rates of flow. Perhaps the greatest advantage of this method of measurement is found, however, in the way by which it may be checked independently of the recording mechanism. The operator may construct alongside of his recorder an independent hook gage or use the graduated vertical scale and pointer on the extended float rod in the instrument, and can observe from time to time the number of inches head on the weir. By substituting these values in Thomson's formula, the rates of flow as shown on the recorder chart may be checked quickly and accurately. Thus the operator need not depend upon the recorded result until he is sure that it agrees with the figured result from his hook gage readings. It is believed, therefore, that the V-notch with its tank is the most satisfactory testing set that could be devised for measuring water under varying conditions of temperature, continuity of flow, and rate of flow.

The tests mentioned in the opening paragraph of the paper were made at Dartmouth College, Philadelphia and New York City. At the first location there were two tests, one in the winter and one in the summer, conducted by the engineers of the college, Messrs. R. D. Kimball Co. The graphic charts of these two tests are shown in Fig. 5, where the top chart shows the record of the winter test, the middle chart that of the summer test, while the record of the Philadelphia test is given the lowest chart.

The winter test at Dartmouth College was made at the normal running load and took care of all the natural fluctuations in the returns from the heating system, which was being taxed to its utmost by an outside temperature only slightly above zero. These fluctuations were due in part to poor control of the return water from the heating pipes at the new Gymnasium, and in part to the small water-storage capacity of the receiver. The summer test was later run with the same apparatus as the first test, but the rate

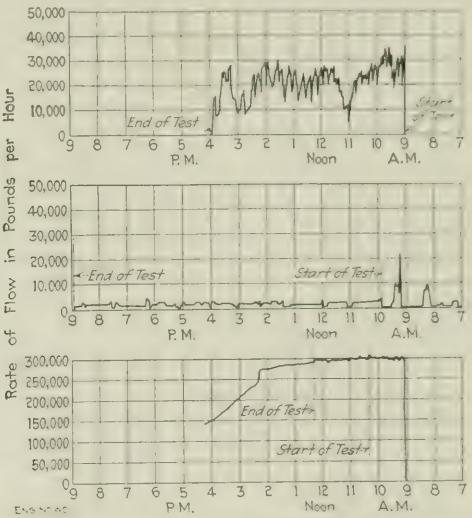


FIG. 5. RECORDS OF TESTS ON V-NOTCH WEIR METERS

of flow and amount of fluctuation were greatly reduced because the Gymnasium heating system was out of service. The Philadelphia test was made with water of considerably lower temperature and much higher rate of flow. Also in this case the amount of fluctuation was comparatively negligible. The tests at New York were of longer duration and employed a meter of the larger capacity used.

In Table II is shown the comparison of the principal data obtained in these three sets of observations and from this table it is apparent that the V-notch weir method of measurement, using the Lea recording mechanism, can be depended upon to within about 1%, even in extreme cases of fluctuating character of flow and changing temperature.

TABLE II. RESULTS OF TESTS ON V-NOTCH WEIR METERS

Location	Dartmouth Col		Phila	New York City				
Date (1912)	3-23	8-2	8 9	4-19	4 20	4 22	4 23	4 24
Duration of test (hr.)	6 25	10 2	1 96	5	8	13	8	8
	Var	Var	Var					
Temperature of water (F)	160°-195°	160°-195°	72°-74°					
Corrected weight of water by tank (lb.)	143,841	41,625	598,867	291,065	266,009	557,974	352,725	352,725
Corrected weight of water by meter (lb.)	145,538	4,1395 7	602,270	280,525	267,260	557,775	351,501	352,231
Error of meter (lb.)	+1697	—229 3	+3403	—1440	+1251	—199	—1224	[illegible]
% error of meter	+1.18	—0.55	+0.9	—0.49	+0.46	—0 03	—0 34	[illegible] 14

— =low reading. + =high reading.

Annual Convention of the Illinois Society of Engineers and Surveyors

The 28th annual meeting was held Jan. 22 to 24, at the Great Northern Hotel, Chicago, with the President, J. A. Harman, in the chair. The attendance was good, and there was such a long list of papers that it was necessary to read some of these by title. The entertainments included the annual dinner (on the subscription plan) and excursions to four points of interest: 1, the Chicago Ave. pumping station of the water-works system; 2, the pumping and sewage-testing and experimental plant of the Sanitary District of Chicago at 39th St.; 3, the new Milwaukee Ave. viaduct, which has plate girder, truss and reinforced-concrete spans, and, 4, the boulevard system of the South Park Commission, showing different kinds of paving, public playgrounds and ornamental concrete work. At one of the meetings, papers were presented describing the several works to be visited. A short address was made also by Wm. C. Fraser, President of the Minnesota Surveyors and Engineers Society. At the dinner an address was made by S. S. Greeley (a Past President of the Society and one of the pioneers among Chicago surveyors), and a lecture on "City Planning" was delivered by Geo. C. Hooker, Civic Secretary of the City Club. This was accompanied by a number of lantern slides illustrative of work and conditions in this country and abroad.

The address of the President, J. A. Harman, was of a rather unusual character, taking for its subject the weakness of our present educational system (from the public schools to the universities and technical colleges) in preparing youth for the actualities of commercial life. He contended that the word "education" has come to be considered as "book learning" and that as now practiced, it fails to give an adequate idea of or preparation for future responsibilities. Manual-training systems are largely "playing at work," which is one reason why the interest in them is comparatively small. He suggested that the time should be devoted partly to general education, partly to the competitive production of something useful, and partly to pleasure and recreation. The report of the Secretary, E. E. R. Tratman, showed a membership of about 230 and a cash balance of about $1100.

Water-supply and Sewerage—The report of the Committee on Water-works, presented by D. H. Maury, reviewed some of the developments in the pumping, storage and purification of water, and a paper by Paul Hansen (Chief Engineer of the Illinois State Water Survey) discussed the advantages of expert control over the operation of public water supplies and sewage-purification works. The pumping stations of the Chicago water-supply system were described by H. S. Baker. Diagrams of rainfall records of Illinois were submitted by G. C. Habermeyer (Urbana), and in relation to these was a report by M. W. Hayes (St. Louis, Mo.) on a phenomenal rainfall at Alton, Ill., in July, 1912; this record was 9.22 in. for a fall of very short duration. The sewage-testing plant of the Sanitary District of Chicago was described by Langdon Pearse, but nothing was said as to the relation of these investigations to the future policy of the Sanitary District as affected by the recent decision of the Secretary of War, denying permission for an increased supply of water from Lake Michigan to the drainage canal. An interesting paper by S. A. Greeley (Winnetka) discussed the subject of garbage collection and disposal for cities of the smaller class. Illinois has 30 cities of over 10,000 population (exclusive of Chicago). The three important matters to be considered are the house treatment, the collection and the disposal. The reduction system of disposal is not generally in use in cities of less than 100,000, although one at Vincennes, Ind., serves a population of 15,000. Other methods are burial, feeding to pigs and burning. The last is the best for cities of 20,000 to 30,000, while the others may be satisfactory in the smallest cities. The cleaning of a small septic tank that had become clogged and foul through neglect was described by L. Z. Jones, City Engineer of Galva, Ill.

Surveying—The meeting was rather notable for the amount of attention given to the subject of surveys and surveying instruments, and the exhibits also included an extensive display of such instruments. A paper by D. D. Scott (Rochester, N. Y.), dealt with a new precise Y-level. Some recent improvements in engineering instruments were described by E. E. R. Tratman (Engineering News). The methods of making topographic surveys for drainage district were dealt with in a paper by W. A. Birket (Peoria), and a paper by A. L. Webster (Wheaton) described river surveys made on the ice on account of the swampy condition of the country making it almost impossible to do the work in any other way. The methods of surveying for partition of lands were discussed by E. P. Montblanc (Chicago). The report of the Committee on Surveying touched upon the vexed question of the county surveyor; his qualifications, and his duties, as they are and as they should or might be. The land surveyor, as distinct from the engineer or engineering surveyor, is far from being extinct, and he seems to have greater political ability and activity than the engineer. In an address, S. S. Greeley (Chicago) a pioneer surveyor of wide experience and high repute (whose experience dates back to the time when there was very much more work in surveying than in engineering), humorously characterized the surveyor as "an engineer in an incomplete state of development."

Land Drainage—This is another subject of very live interest in the central West, and one which always receives a good share of attention at such meetings as this. In addition to papers noted above which related more or less to the subject, there was a paper by C. A. Sheppard (Edwardsville) on "Drainage Projects in Southwestern Illinois," and reports were made by committees on drainage and drainage legislation. Somewhat related to this subject also was a paper on "The Floods in the Mississippi River," by A. C. Dabney (Memphis, Tenn.), which presented a review of information given by the author in Engineering News a few months ago.

Roads and Streets—Nearly every kind of paving received attention during the part of the meeting devoted to this subject. These included brick, concrete, stone, wood-block and bituminous paving, for city streets, park roadways and country highways. Apart from papers relating to paving proper, there was a paper by A. N. Johnson (State Highway Engineer) on the work of the Illinois State Highway Commission; another on "Modern Road Machinery and Its Work," by T. R. Agg (Springfield, Ill.), and a third on "Cost Data for Paving Construction," by W. W. Kerch (Granite City). A topic

suggested for discussion was, "How to make concrete sidewalks that will last," but nobody seemed disposed to offer suggestions as to this.

MISCELLANEOUS—Four papers dealt with structural design and construction work. These included "The Track Elevation Work of the Chicago & Alton R.R. at Joliet, Ill.," by R. A. Cook (C. & A. R.R.); "Specifications and Design-Standards for Reinforced-Concrete Structures," by E. McCullough; "The Milwaukee Ave. Viaduct," by L. K. Sherman, and "Novel Construction of Concrete Foundations," by W. G. Kirchoffer. This novel method (for soft ground) consisted in building the work in sections which were sunk to place by their own weight, requiring only a minimum of form work. The possibilities of "Park Development in Small Cities" were presented by A. E. Nelson, and Prof. H. H. Stoek (University of Illinois) outlined the coöperative work on mining in Illinois which is being done through the joint service of the U. S. Geological Survey, the U. S. Bureau of Mines, and the Illinois Geological Survey.

OFFICERS—The officers for 1913 are as follows: President, L. K. Sherman, Chicago; Vice-President, J. J. Harman, Peoria, Ill.; Secretary, E. E. R. Tratman, Wheaton, Ill. The next meeting will be held at Peoria, Ill., in January, 1914.

Annual Meeting of the American Society of Heating and Ventilating Engineers

The 19th annual meeting of the American Society of Heating and Ventilating Engineers was held at the Engineering Societies' Building, in New York City, on Jan. 21, 22 and 23. There were five sessions for the presentation of papers, reports, etc., in addition to a banquet and various excursions for the guests.

The following officers were elected by a count of letter ballots: President, J. F. Hale, of Camden, N. J.; Vice-Presidents, E. F. Capron, of Chicago, and A. B. Franklin, of Boston; Treasurer, J. A. Donnelly, of New York.

By a change in the organization no secretary was elected, the office now being appointive. A "council" also replaces the "board of governors."

Various committee reports were received, such as the committees on compulsory legislation, standards of ventilation, heating guarantees, tests, and various conferences. Throughout the meetings, there was an evident desire on the part of some members that these reports should result in "standards of performance," or "recommended practice," etc. Some members, on the other hand, wished to postpone action always to some distant convention, or to have some committee continue to deliberate. The net result was a succession of parliamentary tangles, which used up time that was needed for engineering discussion.

Of all these reports that which aroused the most interest probably was the one on compulsory legislation for heating and ventilating. The chairman of this, Prof. J. D. Hoffman, of Lincoln, Neb., made a brief progress report by mail, showing how the committee was at work in its endeavor to prepare a model bill which they might recommend for passage in any states that were discussing the advisability of compulsory ventilation and heating. The committee divided the model law into two parts, one to provide for schools, hospitals and amusement places, etc., and the other particularly drawn to meet conditions in factories, etc. A tentative draft was submitted on the first division only.

Several speakers deplored the years of delay in the various committees on this subject, and asked that the present one push its work more vigorously so that within the next few months a model law would be in shape for recommendation to all inquirers. In the discussion of the merits of the specific recommendations, there was criticism of imposing any rigid requirements for sick rooms, humidity figures for factories, etc.

A committee on a ventilation standard for motion-picture theaters brought in a model law which they desired the society to adopt for recommendation in all instances where advice was sought as to the requirements which should be imposed on these amusement enterprises. The ordinance embodied certain minimum requirements, such as a floor area of 4.3 sq.ft. per occupant exclusive of aisles, entrances, etc.; 80 cu.ft. of air space per occupant for the hall; a positive supply of outside air, furnishing at least 15 cu.ft. per min. per occupant; a temperature between 62 and 70° F., except when no heating should be needed; a maintenance of temperature and ventilation without drafts; an exhaust ventilation of 60, 90 or 120 cu.ft. per min. from the picture-machine booth, depending on whether one, two or three machines were installed; and a fireproof vent pipe from the machine booth. Gas radiators were prohibited from installation in the theater. The report was received and ordered printed as information.

By request, a committee was appointed to bring in for discussion a recommendation of methods of using an anemometer in front of an air register. Finally it was agreed that where an anemometer had to be used (in spite of its notorious unreliability) the air-vent opening should be divided into eight equal areas, up to 10 in. square, and half-minute readings taken at the center of each area. When the eight areas exceeded the 10-in. limit, 12 equal areas were to be used. The average velocity was to be taken as the average reading—deducting in the process any negative readings from the total. For figuring volume the net area of the register was to be used except where the anemometer is held two inches away from the openings.

The presidential address of John R. Allen was read by Vice-President J. F. Hale, Prof. Allen being engaged in work at Constantinople. The address bore the title "Developments and Present Problems in Heating and Ventilation." It described the advance of present practice from a mechanics' art to an engineering science, and then led on to mention of the data which were available and those which were desirable but not in hand.

F. I. Cooper, of Boston, in the paper "Improved Air Conditions in a Residence," described the equipment placed in a Back Bay attic, which warmed, washed and ozonized the air which was fed to a few rooms. The work was attempted on the advice of physicians and was carried out with available only electric current and water under pressure.

The paper, "Downward Ventilation in a Schoolhouse," by C. E. Beery, of Rockford, Ill., described a heating and ventilating system where steam coils were suspended from the ceiling and warm fresh air was discharged from a duct head in the center of the room just below the plane

of the steam coils. The foul-air exits were in the corners at the floor. The author claimed that this design (patented) secured a temperature range of 1° F. throughout the room in the breathing zone, complete absence of drafts and cross-currents, improvement in work of teachers and pupils.

F. K. Chew, of New York, presented the paper, "An Analysis of a Combination Heating System," which was a description of hot-water and hot-air equipment in a converted farm house. The author put this material together that the society proceedings might show a complete record of all current methods of heating and ventilation.

The paper entitled "Design of Indirect Heating Systems With Respect to Maximum Economy and Operation," by F. L. Bucey and W. H. Carrier, of the Buffalo Forge Co., Buffalo, N. Y., presented a study of the economic balance between first cost and operating expense of a hot-blast heating system. They found that current practice resulted in much too high velocities through the coils and ducts causing too heavy an expenditure of power to result in a maximum economy over all. Starting with certain practical assumptions, they mathematically derived a basis for laying out a heating and ventilating system so as to obtain any desired economic results. They found that the most economical system was secured when the installation was proportioned so that the annual cost of power due to frictional resistance through the heater amounted to 28.6% of the annual interest and depreciation on the first cost of the heater regardless of variations in depth of heater, temperature rise, or steam pressure. They found the most economical velocity through ducts when the annual cost of power due to the pipe resistance was one-third the annual allowance for interest and depreciation, which was noted to be about 25% on the original cost of installation. The lower velocities brought about by these conditions required the use of larger fans to operate at higher efficiency. Considering the entire heating and ventilating system, the annual cost of power was held to be placed practically at 30% of the total annual allowance for interest and depreciation. Assuming that this allowance was 20%, as an average, they found 6% on the first cost as the most economical yearly rate ordinarily to be allowed for power.

In the discussion the point was raised as to the effect on this theory when the exhaust steam from the fan engine was used to heat the air blown through the coils. The authors admitted that in such cases the cost of engine power was often practically negligible, and that their conclusions would not hold then.

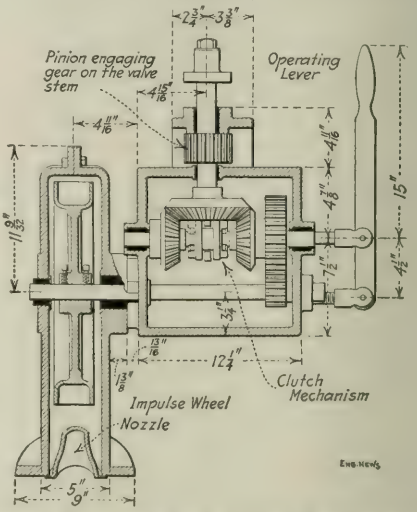
Under the title, "Ozone and Its Applications," M. W. Franklin, of Schenectady, N. Y., gave an informal presentation of facts in an interesting and entertaining way. The speaker did not claim that ozone was to supplant ventilation, but that there were certain instances where it was a very valuable adjunct, as where there were certain odors which ventilation did not satisfactorily remove, or only transferred from one vicinity to another. Use of ozonated air was shown to oxidize the odoriferous particles satisfactorily. A number of specific cases of work of this character were cited—glue factories, paint works, rendering plants, and rooms where offensive human emanations were encountered.

A New Valve-Operating Device

The Water-Works Department of the District of Columbia has recently adopted for use on all important valves throughout its system, a new hydraulic valve operator, manufactured by the Self-Operating Valve Co., of Washington, D. C.

One man can open or close the largest valve where this machine is attached, and the time required is from three to five minutes. Under the old system of manual operation, several men were required to open or close a large valve and the time required was from half an hour to an hour. Electric motors have been tried in this service and found an improvement on the manual operation, but in most cases the conditions of the service are such as to make electric motors subject to short-circuits and generally unreliable.

The hydraulic operator shown in the accompanying cut is simply a water motor driven by water from the main



Sectional Elevation of a New Hydraulic-valve Operator, Showing Reversing-clutch Mechanism
(Self Operating Valve Co., Washington, D. C., manufacturers)

and connected, through gearing, to the valve stem. The operating lever shown enables the motor to be stopped, started or reversed at will. By means of a clutch the device may be allowed to get up speed before it is thrown into mesh with the operating screw, if that is found desirable in cases where the gate is rusted or otherwise clogged. A limit-device is arranged to stop the water-supply to the motor when the gate has reached the end of its travel in opening or closing.

Among the advantages claimed for this device by the makers are its simplicity and durability, its speed of operation, and the fact that it takes up no more room than the valve alone, and will work equally well whether submerged or not.

The device is supplied either separate from the valve, in which case it may be easily and quickly attached to any form of gate valve already installed, or it can be obtained attached to any desired make of gate valve, supplying a complete self-operating valve ready for installation.

A Novel German Air Filter

By Otto E. Trautmann*

It is well known that with large and high-speed electric generators, air cooling is often resorted to in order to prevent injury from over-heating, and to keep down ratios of weight to output.

Since the air in the vicinity of a power plant is not particularly clean, much coal and metal dust is often blown into the machine windings, causing danger of short-circuits and making the cleaning of the machine a frequent necessity.

In Europe hardly a power plant is now erected without being equipped with air filters for the cooling air of the generators. These filters generally consist of strong cloth (specially woven for the purpose) which is stretched over frames of wood or iron. These frames are set in a zigzag fashion after the manner usually adopted in air-filter arrangement to allow sufficient surface for the passage of the air but, at best, are hard to keep clean and necessitate duplicate units or use of unfiltered air during cleaning.

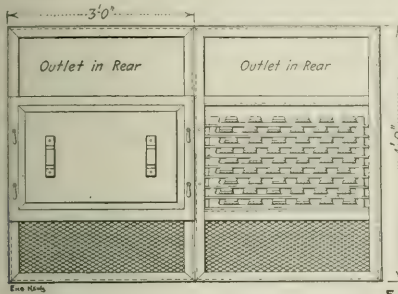


FIG. 1. ELEVATIONS OF A 140,000-CU.FT. AIR FILTER
(Bollinger cotton-rope type)

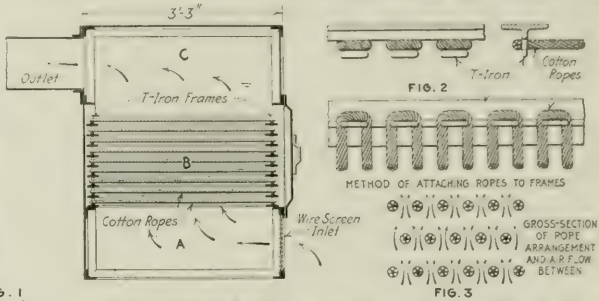
The former power superintendent of the City of Charlottenburg, Germany, Mr. Bollinger, has designed a new type of filter whose advantages lie in compactness and ease of cleaning. This filter consists of single sections which are now manufactured in three standard sizes, each for 100,000, 140,000 and 175,000 cu.ft. of air per hr. These sections are built up to meet the capacity required and to suit the space available.

Fig. 1 shows the dimensions for two sections each of 140,000 cu.ft., and is fairly typical of other capacities, except as to size. The filtering elements are set in a housing of angles and sheet iron, comprising three compartments: (1) the air inlet, "A"; (2) the frame box, "B", and (3) the air outlet, "C." In the frame box are placed 20 to 25 frames, of small iron T-bars; each frame is equipped with cotton ropes strung very close to each other, giving but a small air passage between. Details of the method of attaching these ropes to the T-irons is shown in Fig. 2. These frames are put into position so that the spaces of the upper frame between the ropes are always vertically over the ropes of the next lower one, that is, staggered as shown in Fig. 3, forcing the air to change its direction of flow repeatedly while passing through.

A slot for a sliding damper is provided so that it is possible to shut one section off at a time for cleaning. After shutting a section off by the damper the cover of the frame box is removed, when each rope frame can be withdrawn and cleaned.

It is generally the practice to use two sections as shown in Fig. 1, and a spare set of rope frames. Then one section has to do all the filtering during a minimum time only—the interval required in which to remove the clogged frames and to insert the clean ones in their place. This requires but a few minutes and throws extra load on the remaining frames for such a short time as to be practically negligible. The air inlet is covered with a wire-mesh screen for protection, while the air outlet or outlets are generally connected together into some sort of chamber from which ducts are run to desired points.

So far as the writer knows this system has been limited to use in power plants, and it is not positively known how successfully it could be applied in heating and ventilating work where air is filtered for breathing. However, the success attending its operation in Europe for power stations seems to show that in positions of limited space this device might also be made to answer the requirements of heating and ventilating installations.



FIGS. 2 AND 3. ATTACHMENT OF COTTON ROPES IN BOLLINGER AIR FILTER AND DIAGRAMMATIC CROSS-SECTION OF A SECTION

*349 W. 57th St., New York City.

The Complexity of Business done by the great German electrical manufacturing concern, the Allgemeine Elektricitäts Gesellschaft, is shown in a summary of the annual report printed in the "A. E. G. Journal" for December, 1912. Out of the business profits, a dividend of 14% will be distributed after setting aside 3,000,000 M. as a contribution to the reserve fund which now is increased to half the amount of the share capital.

The machines and transformers delivered from the Berlin factory numbered 118,205 and showed a horsepower output of 2,529,000. Among these machines were large three-phase generators for waterpower units up to 15,000 hp. and generators for coupling to Diesel motors up to 6000 hp. In the manufacture of steam turbines the speed limit was pushed up to 3000 r.p.m. for three-phase sets under full guarantee. There were 312 turbines put out having an output of 735,650 hp. The largest units constructed were for 20,000 hp.

The company also makes or directly controls concerns which make arc and incandescent lamps, arc-lamp carbons, mercury-vapor lamps, electric clocks, workmen's time registers, electrical instruments, tachometers for power-driven vehicles, typewriters, heating and cooking apparatus, porcelain fittings, ozone equipment, railway ticket-printing machines, electric wires and cables, enamel-insulated wire, pneumatic tires and hard- and soft-rubber articles, pleasure and commercial automobiles, motor boats and motors, airships and flying machines, rotary air compressors, etc. The company also participates in the formation of gas and electric-supply companies about Germany. The total number of employees amounts to 70,162.

The Oil Industry of California

The development of the oil resources and the oil industry of California is one of the remarkable features in the mineral industries of the United States. The oil available in the California field is from 30 to 50% of the total oil resources of the country according to the estimate of the U. S. Geological Survey, given in Table I.

TABLE I. OIL RESOURCES OF THE UNITED STATES.

Oil Fields	Million Barrels Minimum	Maximum
Appalachian	2,000	5,000
Lima-Indiana	1,000	3,000
Illinois	350	1,000
Mid-continent	400	1,000
Gulf	250	1,000
California	5,000	8,500
Minor fields	1,000	5,000
Total	10,000	24,500

As in the development of other natural resources, there has been lack of system and enormous waste, and although there is a movement to introduce improved methods, this is really only the commencement of work which should have been undertaken and carried into effect long ago. An interesting report on the oil situation in California was made some months ago to the Commercial Club of San Francisco by a committee on fuel resources,* and from this report we have compiled the accompanying article.

Oil Fields and Oil Production

The order of development of the present oil fields in California, and their production for the year 1911 are given in Table II, but most of the fields were known and experimented with for several years before the commercial development commenced. Table III shows the estimated area and production, from a table by F. A. Bell, of the U. S. Geological Survey, and Table IV shows the varying rate of daily production per well in some of the fields.

In regard to the total capacity of the oil fields, the report states that it is fashionable to talk of the unlimited oil resources of California, but that compared to the coal resources of Great Britain they are pitifully small. With an annual coal output of 25,000,000 tons and taking 3½ bbl. of oil equivalent to a ton of coal, the output of the latter would have to be 800 million barrels or ten times the present annual output. Ten years of such production would exhaust the oil resources of California, while Great Britain has coal resources estimated sufficient for 450 years at the present rate of production. Such a comparison is considered sufficient to justify the demand for the strictest conservation of California oil. The annual production of California oil (in thousands of barrels), has been approximately as follows:

1875	3	1888	690	1900	4,324
1880	41	1890	307	1905	33,427
1885	325	1895	1208	1910	73,070

Notes on Some of the Principal Oil Fields

Ventura—The first work in developing the oil industry was done by Josiah Stanford and his associates in Ventura County in 1864, their attention having been attracted by the seepage of oil from the exposed oil-sands at the foot of the southern slope of Sulphur Mountain. Tunnels 60 to 3000 ft. long have been driven into the face of the mountain to intercept the oil strata, the flow being by gravity to tanks near the mouths of the tunnels. Some of these are still producing oil in a small way. The first oil well in this field was drilled in 1866, but it was not until 1883 that the industry was fairly started. The oil is of superior quality for refining purposes, and at that time its use for fuel was not thought of. The production also was very limited, especially with the methods of drilling then in use. The development of modern well-drilling is a matter of the last decade, and is still progressing in an effort to meet problems that confront the industry.

In 1884, the necessity for a more extensive use of California oil was pressing upon the producers. With a view of creating an additional market the Union Oil Co. borrowed an old locomotive from the A., T. & S. F. Ry., and fitted it with oil-burning equipment. After months of experimental work, success was reached, and this opened a new era in the oil industry. It is said that this was the first oil-burning locomotive in the world, but we believe it had predecessors in Russia. In 1885 a 4-in. pipe line was laid from the Ventura County oil fields to the coast, and two steamers (each of 7500 bbl. capacity) were put in service between Ventura and Pacific coast points, especially San Francisco Bay.

Orange County—The Whittier-Fulton district did not become active until the value of fuel oil had been demonstrated, but it is now considered one of the best producing sections. Most of the product, however, is used locally. The Union Oil Co. has a pipe line of 15,000 bbl. daily capacity to tidewater at San Pedro, and the Standard Oil Co. has a 6-in. pipe line (20,000 bbl. capacity) to its new refinery at El Segundo, near Redondo Beach. As a whole, the fields in southern California are not regarded as of any such importance as those of the San Joaquin Valley.

Los Angeles—This is still an important factor and is one of the prime causes of the growth of Los Angeles, having given to that city a supply of fuel at its door.

Kern River—The area is about 12 sq.mi., and the large production did not begin until 1901-02. This field has been threatened seriously by water. The production has passed its maximum, and probably will diminish from year to year. An 8-in. pipe line to Point Richmond (on San Francisco Bay) was laid by the Standard Oil Co. in 1904-05; it is 280 miles long, and has a daily capacity of 15,000 to 20,000 bbl. The Associated Oil Co. now has a parallel 8-in. line to Port Costa, on San Francisco Bay.

Coalinga—Shallow wells were drilled at first, but in 1906-07 the Union Oil Co. drilled two wells 900 ft. and 1100 ft. deep, while in 1907 another firm struck 10 ft. of oil-sand at a depth of 300 to 400 ft.; this was the first strike of importance. Until the discovery of the Midway field, the Coalinga ranked as the most important. The Standard Oil Co. serves it by a branch pipe from Mendota, on its Kern River pipe line, and the Independent Oil Producers Agency has a pipe line south to Port Harford. The Associated Oil Co. has a branch from the Kern River line, and also a 6-in. pipe line from Coalinga to Monterey Bay.

McKittrick—The development of this field has progressed rapidly since 1900. The oil was transported by rail until 1908, when the Standard Oil Co. built an 8-in. pipe line to its main line at Kern. In 1909, the Producers Transportation Co. completed its pipe line to Port Harford and, in 1910, the Associated Oil Co. opened a line to this field.

*M. L. Requa, Chairman; F. W. Bradley, Mining Engineer; Walter Stadler, Geologist.

Sunset—Various attempts have been made here since 1889, but nothing of importance was accomplished before 1902; the field had then a checkered career until 1908, when production increased rapidly.

Midway—This was the sensation of the years 1910 and 1911, its production increasing from 2,231,530 bbl. in 1909 to 11,148,925 and 21,584,610 bbl. in the later years, respectively. The character of the oil is largely refining oil, but the water conditions are the most serious of any field, with the possible exception of the Kern field.

Santa Maria—This field, on the coast, was first developed systematically by the Western Union Oil Co. In 1904 the Hartnell gusher was opened by the Union Oil Co., and this was the largest producer in the history of the oil industry until the striking of the Lakeview gusher in the Midway field.

Estimate of Resources and Production

The U. S. Geological Survey estimates 850 sq.mi. as the total oil-bearing area of California. Other estimates are 700 and 560 sq.mi. The oil-producing area is confined entirely to the district south of Coalinga, and for much of the territory north of that point geologists offer little hope of future production. Recent developments on Belridge and Lost Hills have in a measure closed the gap between Coalinga and McKittrick, and it is possible that oil may be discovered over a majority of the intervening territory. But much of this may be at depths too great for profitable production at present prices and, in fact, there are large areas fairly well known to be underlaid with oil which cannot be commercially profitable until the oil reaches a price of about $1 per bbl. at the well. Indications point to the area between Coalinga and Bakersfield as being by far the most important oil territory of the state.

Estimates of production are based upon the hypothesis that a foot of oil sand over one acre will produce a given number of barrels—generally assumed as approximately 500 bbl. per acre-foot of oil sand. This is a fairly conservative assumption, based upon the voids in sand, and is an estimate of the extraction of a small part of the contents. It has been proved beyond question that oil sands vary in saturation in the same well (when separated in some instances by but two or three feet of intervening impervious formation) from nothing to probably complete saturation. The factor of extraction assumed, however, is so small that it allows for such variation, and while we may have 100 ft. of oil sand, of which but 25 ft. may be productive, the saturation of that 25 ft. may be so great as to give a production equivalent to 500 bbl. per acre-foot over the entire 100 ft. This is the first great assumption in calculating the probable production of California oil fields.

To maintain the present production of 78,000,000 bbl. per annum, it will probably be necessary to bring in annually new wells of a capacity of 15,000,000 or 16,000,000 bbl. at least. This is based upon a 20% decrease in the annual production, which must be supplied by new wells to take the place of the decreased production of old wells. The figure is an arbitrary one, probably not exact, but it is believed to be fairly within reason. If the average new well produced 40,000 bbl. per annum, or 150 bbl. per day, it will take approximately 400 wells drilled annually to maintain present production. The figure given of 150 bbl. per day is an extremely liberal one.

If we assume the average cost per well at $20,000, it will require annually the investment of $8,000,000 to drill the 400 wells necessary to maintain production; or, stating it another way, a charge of 11c. per bbl. of oil produced will be necessary to offset decline due to diminished production per well. If we assume $40,000 as the cost per well, a figure that will ultimately be reached, this charge becomes 22c. based on present production.

COST OF PRODUCTION

It is becoming more and more apparent that past estimates on the part of oil producers of California as to the cost of production have not been sufficiently high. Interest on capital, amortization of capital, cost per barrel for drilling to maintain production, depreciation of surface equipment, have in many cases not entered into the calculations in figuring cost of production. The figures herewith for a property of a depth of approximately 2500 ft. will give a fair idea of actual cost of operation:

	Cost per bbl.
Pumping	$0.032
Pulling	0.0155
Bailing and cleaning	0.0126
Maintenance and repairs, including redrilling	0.10
Cost of drilling to maintain production	0.15
Amortization fund	0.08
Total cost per barrel	$0.3901

These cost figures vary and are less for properties with shallow wells, and also less for properties such as some in the Midway field, where the production per well is large. Taking the state as a whole, however, and for territory of this depth, the figures are believed to be fairly representative. In addition to this, there are unquestionably large areas in California where the cost of production, due to various causes (principally to increased depth or heavy-gravity oil) will cause production to be more expensive than herewith indicated. There is undoubtedly territory that will, at some future time, produce oil where the actual cost of production will approximate 50c. to 75c., and possibly in excess of $1 a barrel. In order that satisfactory profit may be realized, and by satisfactory profit is meant a profit commensurate with the hazards of the business, it is quite evident that prices for oil must be materially in excess of those now obtaining.

Conservation of the Oil Resources

The report mentioned states that the factors menacing the California oil resources may be summarized as follows, in the order of their importance: 1, influx of water to the oil formation; 2, competitive drilling; 3, unsatisfactory control of production, permitting an unnecessarily large production, with consequent loss through evaporation and seepage; 4, undetermined disposition of government lands.

1. Water—Within the past few years the entrance of water into the oil fields has assumed a somewhat alarming aspect in some of the fields, and if the life of any field is cut short it will be due probably to this cause rather than to exhaustion of the oil. This water (upon which the oil may have been floating) may be an indication of the exhaustion of the oil, or it may come from other causes. Whether water necessarily accompanies oil is a debatable question, but it occurs in all the California fields, and the cementing of the well to exclude water is a difficult problem. In most cases the water can be controlled in this way, but it is not being done effectively. The remedy proposed in the report is to levy a special tax in each field, the money to be expended in that field under the direction of the State Mining Bureau in properly shutting off the water. All estimates of life and production of the oil fields may be nullified by the inflow of water, although some operators consider that the oil is simply driven to other parts of the field and is eventually recovered from wells at its edge.

Top water overlies the oil sands, and can be excluded by proper cementing of the wells. Bottom water underlies the oil sands, and if it is in the same stratum as the sands (and has the oil floating upon it) it cannot be prevented, as the exhaustion of the oil permits the water to rise and gradually drown first the deeper wells and then the shallower wells, until the field is flooded. If it is in strata underlying the oil sands, it can be kept out by not drilling into these strata, or by promptly and effectively plugging wells which do penetrate them. Intermediate water is inclosed in the formation and lies between an upper and lower stratum of oil-bearing sand. Trouble

TABLE II. OIL FIELDS OF CALIFORNIA

Field	Date of Development	Production in 1911 (1000 bbl.)
Ventura County (coast)	1864	459
Orange County (Whittier dist.)	late '70s	1,154
Los Angeles City (coast)	1892	137
Coalinga (valley)	1897	17,830
Kern River (valley)	1899	12,161
Salt Lake (coast)	1902	2,795
McKittrick (valley)	1900	5,373
Santa Maria (coast)	1901	6,228
Summerland (coast)	1903	4,026
Midway (valley)	1909	20,967

TABLE III. ESTIMATED AREA, PRODUCTION AND FUTURE SUPPLY OF CALIFORNIA OIL FIELDS.

Fields	Area acres	Production to Jan. 1, 12 million bbl.	Remaining supply million bbl.
Coalinga	30,000	98	1027
Lost Hills and Belridge	4,000		150
McKittrick	2,400	30	100
Midway-Sunset	40,000	60	1440
Kern River	6,000	144	446
Santa Barbara	6,800	40	131
Whittier (Orange Co.) and all east of Los Angeles	5,000	39	411
Salt Lake and all west of Los Angeles	2,000	38	34
Miscellaneous (incl. Ventura)	3,000	13	54
Total	99,200	462	3793

TABLE IV. VARIATIONS IN FLOW OF OIL WELLS IN CALIFORNIA

(Bbl. per well per day).

Oil Fields	1903	1905	1907	1909	1911
Kern River	82	63	40	32	24
Coalinga	72	124	99	86	68
McKittrick	73	79	102	116	84
Sunset	44	28	47	48	78
Midway				83	132
Santa Maria	104) 91	291	291	171	119

from it can be minimized by drilling only the upper stratum first, and after its exhaustion, drilling the lower stratum, allowing the intermediate water to flood the upper one and possibly carry the unextracted oil to a higher level so that it may be recovered. Edge water is that on the edge of the oil field, along the strike of the formation, and its inflow is not preventable.

2. COMPETITIVE DRILLING.—The existing method of drilling wells along the property lines makes it hopeless to secure any united curtailment of production, since adjacent companies are forced to continue production, for if either one stopped, the wells of the other would draw oil from the former's property. The report states that line drilling is done to get oil from adjacent property. If one company drills in a corner of four adjoining properties, each of the other three must drill a well or lose a certain quantity of its oil. The remedy suggested is to induce or compel the companies to drill from the center of the property outward. This would be economical in keeping the wells as near as possible to the power plant, and when the price of oil is low the production could be reduced without fear of having the property drained by the wells of an adjacent company.

3. CONTROL OF PRODUCTION.—The marketing of oil, and especially fuel oil, must usually be done by a few large companies, according to the report. Under the practice of contracting the oil for a period of years it is almost impossible for small concerns to enter the marketing field, and consumers will not jeopardize their business by contracting with these small concerns. The business necessitates a large expenditure for pipe lines, distributing stations and ships, so that it is impossible for the small producer to market his oil himself. The law [illegible] permit of pooling agreements, but the report suggests that the large marketing companies should be permitted to make agreements and price regulations (subject to government supervision), so that production may be controlled.

4. DISPOSITION OF GOVERNMENT LANDS.—The United States government has in California a large amount of oil-bearing land that is withdrawn from entry, and this is a desirable situation since there is no present market for the oil in this teritory. The method of disposing of the lands has yet to be worked out, but indications point to a leasing system. The report states that this should be as free from government control as possible, although the government might exercise police powers as to shutting off water from the wells and also require a standard system of accounting. It would be very unwise to place all of this land on the market at one time.

Swimming Pool in the New Gymnasium of the Rensselaer Polytechnic Institute, Troy, N. Y.*

The Class of '87 of the Rensselaer Polytechnic Institute gave, last year, $150,000 to the Trustees of the Institute for the construction of a new gymnasium. This has just been finished. It contains rooms for general gymnastic exercise, basketball, indoor baseball practice, wrestling and fencing, a squash court, four bowling alleys, shower baths, and a room with 800 lockers. It contains also a carefully designed and constructed swimming pool. As such pools quite often leak, sometimes to such an extent that they have to be relined and made smaller, a description of this one, which represents the best modern practice, should be of interest.

The pool is placed in the basement of the gymnasium in a room 97 ft. long, 40 ft. wide, and 18 ft. 6 in. high. There is a gallery, hung from the ceiling, around the four sides of the room. The side walls are covered with white tile, 3x6 in. in size, from the floor to the under side of the white marble slabs which form the floor of the gallery. The floor around the pool is of terrazzo. The room is well lighted by windows opening on two sides on the gallery floor level; it is also lighted by electricity.

The pool is 75 ft. long and 30 ft. wide with a depth of 8 ft. at one end and 4 ft. at the other. It is tiled on the bottom and sides including the scum gutters, with ¾ in. square white ceramic tile laid in cement.

The pool was constructed as follows: A bed of clean ashes, 12 in. thick, was placed on the clay foundation. On this was placed a layer of concrete 4 in. thick. Above this came a waterproofing course consisting of a heavy liquid asphalt into which, while hot, a layer of tarred felt, weighing 15 lb. per 100 sq.ft., was imbedded. This was followed by alternating layers of felt and asphalt until five layers of felt and six moppings of asphalt were applied. All the felt was bedded into the asphalt while the latter was hot, and each layer of felt was completely covered by asphalt. A bed of concrete, 12 in. thick, reinforced with galvanized wire cloth, was laid on the felt. The wire was No. 3 of 3x3-in. mesh and the sheets of wire were turned over and locked to each other over the entire bed of the pool. Near the sides of this 12 in. bed of concrete twisted steel bars 10 ft. long of ½ in. square cross section, spaced 12 in. c. to c., were imbedded. Seven feet of the length of these bars was imbedded in the 12-in. course and the bars were turned up so that 3 ft. of their length was in concrete side walls, which were carried up from the 12-in. bed. This was done all around the pool

*From information furnished by the architects.

and at the four corners these bars were curved in basket form. The bars hold the bed and side walls together and materially help to form a tight pool. The top of this bed and the side walls were then covered with heavy liquid asphalt and five layers of felt and moppings of asphalt were applied as described above for the waterproofing beneath. An additional layer of felt and asphalt was applied at all angles of the pool.

The sides of the pool were then lined with a brick wall 8 in. thick and the bottom was covered with a layer of concrete 4 in. thick which closely fitted against the wall. All interstices between the brick wall and the waterproofing behind it were filled with grout. This is important. No interstices should be left to exert pressure behind the lining of the pool when the water is drawn off. A pool constructed in New York some years ago had the slabs of marble lining it thrown out by the water pressure behind them when the water was let out of the pool. Water in interstices behind the lining cannot escape as quickly as the water in the pool and pressure behind the lining under considerable head may result.

The bottom and sides of the pool were then lined with ¾-in. square white ceramic tile laid in cement mortar.

The scum gutter, shown in section in the figure, extends all the way around the pool. It carries off any scum and also any excess of water in the pool. It is drained by twelve 3-in. pipes at equal intervals around the pool. The ends of these pipes are covered with strainers in the bottom of the gutter. There is also a 4-in. overflow pipe at one end of the pool, with a strainer placed about ½ in. above the bottom of the gutter. Cleanouts are provided for all these overflows.

Provision is made for draining any water which may percolate through the upper layer of waterproofing under the bottom of the pool by means of a 4-in. pipe which leads to a waterproofed manhole outside the pool in the machinery room. A float is provided to indicate the presence of water in this manhole. Such water may then be pumped out. The object is to prevent upward water pressure under the bottom when the pool is empty.

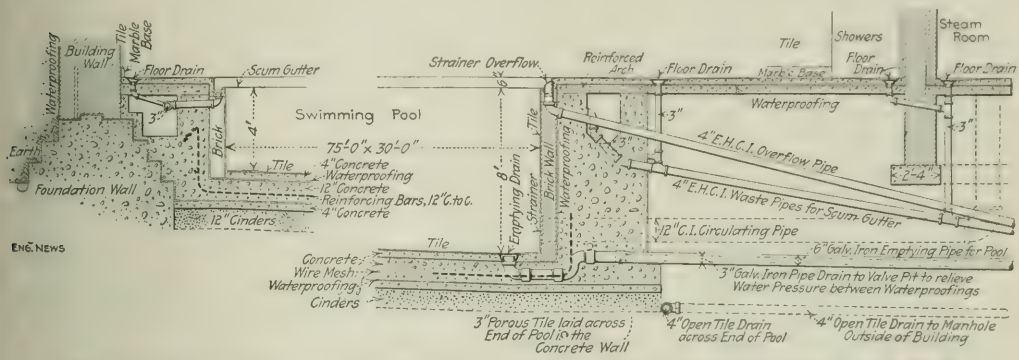
The water is filtered by mechanical filters before it enters the pool. It passes from a heater, where the temperature is automatically kept constant to the filters and thence to the pool. Two inch brass pipes carry it from the heater to two points of discharge; one on each side of the pool near the shallow end. A 12-in. cast-iron circulating pipe extends from the deep end of the pool near the bottom to the machinery room. This acts as a sump for an electric pump which forces the water through the heater and filters back to the pool.

Any water on the terrazzo floor surrounding the pool is drained away from the scum gutters to strainers connected with pipes which carry it to the scum gutter drainage system independently of the scum gutters. This keeps any dirty water on the floor from being swept into the pool.

Eight shower baths and a steam room are placed at one end of the room containing the pool.

The pool has been kept full of water for about a month and no leakage has resulted.

Messrs. Lawlor & Haase, 69 Wall St., New York City, are the architects of the building. The steam heating and filter systems were designed by Prof. Arthur M. Greene, and the electrical equipment by Dr. W. L. Robb, both of the Institute faculty. Dr. D. A. Sargent of Harvard University was consulted during the preparation of the plans, and additions to the equipment have been made by Mr. P. B. Samson, who was appointed Professor of Physical Training during the construction.



DETAILS OF CONSTRUCTION OF SWIMMING POOL, RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.

⁂

Gas-pressure Regulations have been fixed for the Boroughs of Brooklyn and Queens, New York City, by the Public Service Commission for the First District of the state. One ward embracing Coney Island, the famous amusement resort, is not covered, action being postponed here until the summer conditions can be studied. The orders adopted here are similar in form and substance to those adopted for Boroughs of Manhattan, Bronx and Richmond, after a study of the gas-supply service there (see "Engineering News," Oct. 31, 1912).

It is provided that the companies shall install by Aug. 1, 1913, recording pressure gages so located that no consumer shall be more than 3800 ft. distant from one, and that there shall be at least one in each square mile. After Dec 1, 1913, the companies must maintain a minimum pressure of 2-in. water column on two consecutive days except in certain wards, and except where the service comes from a main located previous to the date of the order in an ungraded street or in a street not opened by the city, in which case a minimum pressure of 1½ in. is allowed until Dec. 1, 1915. The maximum pressure for this territory is 6 in. on two consecutive days. The maximum daily pressure variations are fixed for after Dec. 1, 1913, at 3-in. water column on two consecutive days, 2½ in. after Dec. 1, 1914, and 2 in. after Dec. 1, 1915. The maximum momentary pressure variation must not exceed 0.8 in. after Sept. 1, 1915, and the maximum pulsating pressure variation for after Nov. 1, 1913, is fixed at the same value, and reduced to 0.5 in. for after May 1, 1914.

Joint Committee on Concrete and Reinforced Concrete; Abstract of Second Report

On June 17, 1904, delegates or special committees on concrete from four technical societies met and formed the Joint Committee on Concrete and Reinforced Concrete, with the object of studying and reporting upon the making and use of concrete, especially reinforced concrete. The societies thus coöperating were: the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering and Maintenance-of-Way Association, and Association of American Portland Cement Manufacturers. In 1909 the Joint Committee rendered a report. Critical discussion of this report followed. For the past two years the Joint Committee has been considering changes in the report, and on Nov. 20, 1912, the revised or second report was adopted by the committee. The first public presentation of the new report was made to the American Society of Civil Engineers on Jan. 15, 1913.

The report comprises:

a. An account of the Joint Committee's work.
b. A historical review of cement and concrete.
c. Technical discussion of concrete and its use.
d. Recommended working stresses.
e. The cement specifications of the American Society for Testing Materials.
f. The steel specifications of the American Railway Engineering Association.
g. Formulas for designing reinforced-concrete beams and columns, based on straight-line stress-distribution, and identical with what all modern textbooks on the subject give.

Below we reproduce about one-third of the full report; we omit a, b, e and f, and give extracts only of c; d is given nearly in full, and g in full.

In reporting the meeting of the American Society of Civil Engineers (p. 182, issue of Jan. 23, 1913) we enumerated the chief points in which the second report of the Joint Committee differs from the first report. The changes are numerous, but none of them appear to be radical.

Since the appearance of the first Progress Report, in 1909, many experiments have been conducted by some of the technical institutions and by private and corporate interests, and through these and through longer experience in construction by its members and others, the Committee is now able to make some perfecting modifications of its former report and to add some entirely new material.

While the report deals with every kind of stress to which concrete is subjected, and includes all ordinary conditions of proportioning and handling, it does not go into all types of construction or all the applications to which concrete and reinforced concrete may be put.

This report is what the word implies, and nothing more; it is not a "specification," but may be used as a basis for specifications.

RESPONSIBILITY AND SUPERVISION

The design of reinforced-concrete structures should receive at least the same careful consideration as those of steel, and only engineers with sufficient experience and good judgment should be intrusted with such work.

The computations should include all minor details, which are sometimes of the utmost importance. The design should show clearly the size and position of the reinforcement, and should provide for proper connections between the component parts, so that these cannot be displaced. As the connections between reinforced-concrete members are frequently a source of weakness the design should include a detailed study of such connections, accompanied by computations to prove their strength.

The construction of buildings in large cities is regulated by ordinances or building laws, and the work is inspected by municipal authorities. For reinforced-concrete work, however, the limited supervision which municipal inspectors are able to give is not sufficient. Therefore, means for more adequate supervision and inspection should be provided. The engineer who prepares the design and specifications should have the supervision of the execution of the work.

The Committee recommends the following rules for structures of reinforced concrete for the purpose of fixing the responsibility and providing for adequate supervision during construction:

(a) Before work is commenced, complete plans shall be prepared, accompanied by specifications, stress computations and descriptions showing the general arrangement and all details. The plans shall show the size, length, dimensions for points of bending, and exact position of all reinforcement, including stirrups, ties, hooping and splicing. The computations shall give the loads assumed separately, such as dead and live loads, wind and impact, if any, and the resulting stresses.

(b) The specifications shall state the qualities of the materials to be used for making the concrete, and the manner in which they are to be proportioned.

(c) The strength which the concrete is expected to attain after a definite period shall be stated in the specifications.

(d) The drawings and specifications shall be signed by the engineer and the contractor.

(e) Plans and specifications for all public structures should be approved by a legally authorized State or City official, and copies of such plans and specifications placed on file in his office.

(f) The approval of plans and specifications by other authorities shall not relieve the engineer or the contractor of responsibility.

(g) Inspection during construction shall be made by competent inspectors employed by and under the supervision of the engineer, and shall cover the following: 1. The materials. 2. The correct construction and erection of the forms and the supports. 3. The sizes, shapes and arrangement of the reinforcement. 4. The proportioning, mixing and placing of the concrete. 5. The strength of the concrete, by tests of standard testpieces made on the work. 6. Whether the concrete is sufficiently hardened before the forms and supports are removed. 7. Prevention of injury to any part of the structure by and after the removal of the forms. 8. Comparison of dimensions of all parts of the finished structure with the plans.

(h) Load tests on portions of the finished structure shall be made where there is reasonable suspicion that the work has not been properly performed, or that, through influences of some kind, the strength has been impaired. Loading shall be carried to such a point that one and three-quarters times the calculated working stresses in critical parts are reached, and such loads shall cause no injurious permanent deformations. Load tests shall not be made until after 60 days of hardening.

DESTRUCTIVE AGENCIES

(a) **Corrosion of Metal Reinforcement**—Tests and experience indicate that steel sufficiently embedded in good concrete is well protected against corrosion, no matter whether located above or below water level. It is recommended that such protection be not less than 1 in. in thickness. If the concrete is porous, so as to be readily permeable by water, as when the concrete is laid with a very dry consistency, the metal may corrode on account of the presence of moisture and air.

(b) **Electrolysis**—The most recent experimental data available on this subject seem to show that while reinforced-concrete structures may, under certain conditions, be injured by the flow of electric current in either direction between the reinforcing material and the concrete, such injury is generally to be expected only where voltages are considerably higher than those which usually occur in concrete structures in practice. If the iron be positive, trouble may manifest itself by corrosion of the iron accompanied by cracking of the concrete, and, if the iron be negative, there may be a softening of the concrete near the surface of the iron, resulting in a destruction of the bond. The former or anode effect decreases much more rapidly than the voltage, and almost if not quite disappears at voltages that are most likely to be encountered in practice. The cathode effect, on the other hand, takes place even on very low voltages, and is therefore more important from a practical standpoint than that of the anode.

Structures containing salt or calcium chloride, even in very small quantitites, are very much more susceptible to the effects of electric currents than normal concrete, both the anode and cathode effects progressing much more rapidly in the presence of chlorine.

There is great weight of evidence to show that normal reinforced-concrete structures free from salt are in very little danger under most practical conditions, while non-reinforced concrete structures are practically immune from electrolysis troubles.

The results of experiments now in progress may yield more conclusive information on this subject

(c) **Sea Water**—The data available concerning the effect of sea water on concrete or reinforced concrete are limited and inconclusive. To effect the best resistance to sea water, the concrete must be proportioned, mixed and placed so as to prevent the penetration of sea water into the mass or through the joints. The concrete should be kept from exposure to sea water until it is thoroughly hard and impervious.

(d) **Acids**—Concrete of first-class quality, thoroughly hardened, is affected appreciably only by strong acids which seriously injure other materials.

(e) **Oils**—When concrete is properly made and the surface is carefully finished and hardened, it resists the action of such mineral oils as petroleum and ordinary engine oils. Oils which contain fatty acids produce injurious effects, forming compounds with the lime which result in a disintegration of the concrete in contact with them.

(f) **Alkalies**—The action of alkalies on concrete is problematical. In the reclamation of arid land, where the soil is heavily charged with alkaline salts, it has been found that concrete, stone, brick, iron and other materials are injured under certain conditions. Such destructive action can be prevented by the use of a protective coating, and is mimimized by securing a dense concrete.

MATERIALS

Cement—Only portland cement is suitable for reinforced concrete. The cement should meet the requirements of the Standard Methods of Testing and the Specifications for Cement, the result of the joint labors of special committees of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, and others.

Aggregates—Extreme care should be exercised in selecting the aggregates for mortar and concrete, and careful tests made of the materials for the purpose of determining their qualities and the grading necessary to secure maximum density* or a minimum percentage of voids.

(a) Fine Aggregate—This should consist of sand, crushed stone, or gravel screenings, graded from fine to coarse, and passing when dry a screen having holes ¼ in. in diameter; it is preferable that it be of silicious material, and should be clean, coarse, free from dust, soft particles, vegetable loam or other deleterious matter; and not more than 6% should pass a sieve having 100 meshes per lin.in. Fine aggregates should always be tested.

Fine aggregate should be of such quality that mortar composed of one part portland cement and three parts fine aggregate by weight, when made into briquettes, will show a tensile strength at least equal to the strength of 1:3 mortar of the same consistency made with the same cement and standard Ottawa sand.† If the aggregate be of poorer quality, the proportion of cement in the mortar should be increased to secure the desired strength.

If the strength developed by the aggregate in the 1:3 mortar is less than 70% of the strength of the Ottawa sand mortar, the material should be rejected. To avoid the removal of any coating on the grains, which may affect the strength, bank sands should not be dried before being made into mortar, but should contain natural moisture. The percentage of moisture may be determined on a separate sample for correcting weight. From 10 to 40% more water may be required in mixing bank or artificial sands than for standard Ottawa sand to produce the same consistency.

(b) Coarse Aggregate—This should consist of crushed stone or gravel which is retained on a screen having holes ¼ in. in diameter, and graded from the smallest to the largest particles; it should be clean, hard, durable and free from all deleterious matter. Aggregates containing dust and soft, flat or elongated particles, should be excluded from important structures..

The maximum size of the coarse aggregate is governed by the character of the construction.

For reinforced concrete and for small masses of unreinforced concrete, the aggregate must be small enough to produce with the mortar a homogeneous concrete of viscous consistency which will pass readily between and easily surround the reinforcement and fill all parts of the forms.

For concrete in large masses, the size of the coarse aggregate may be increased, as a large aggregate produces a stronger concrete than a fine one, although it should be noted that the danger of separation from the mortar becomes greater as the size of the coarse aggregate increases.

Cinder concrete should not be used for reinforced-concrete structures. It may be allowable in mass for very light loads or for fire protection purposes. The cinders used should be composed of hard, clean, vitreous clinker, free from sulphides, unburned coal or ashes.

Metal Reinforcement—The Committee recommends, as a suitable material for reinforcement, steel filling the requirements for structural steel reinforcement of the specifications adopted by the American Railway Engineering Association. Where little bending or shaping is required, and also for reinforcement for shrinkage and temperature stresses, material filling the requirements of the specifications adopted by the American Railway Engineering Association for high-carbon steel may be used, adopting the same unit-stress as hereinafter recommended for structural-grade material.

For the reinforcement of slabs, small beams or minor details, or for reinforcement for shrinkage and temperature stresses, wire drawn from bars of the grade of rivet steel may be used, with the unit-stresses hereinafter recommended.

The reinforcement should be free from excessive rust, scale or coatings of any character which would tend to reduce or destroy the bond.

PREPARING AND PLACING

Proportions—For reinforced-concrete construction, one part of cement to a total of six parts of fine and coarse aggregates measured separately should generally be used. For columns, richer mixtures are generally preferable, and in massive masonry or rubble concrete, a mixture of 1:9 or even 1:12 may be used. These proportions should be determined by the strength or the wearing qualities required in the construction at the critical period of its use.

Removal of Forms—So many conditions affect the hardening of concrete that the proper time for the removal of the forms should be decided by some competent and responsible person, especially where the atmospheric conditions are unfavorable.

It may be stated in a general way that forms should remain in place longer for reinforced concrete than for plain or massive concrete, and that forms for floors, beams and similar horizontal structures should remain in place much longer than for vertical walls.

When the concrete gives a distinctive ring under the blow of a hammer, it is generally an indication that it has hardened sufficiently to permit the removal of the forms with safety. If, however, the temperature is such that there is any possibility that the concrete is frozen, this test is not a safe reliance, as frozen concrete may appear to be very hard.

DETAILS

Shrinkage and Temperature Changes—Shrinkage of concrete, due to hardening and contraction from temperature changes, causes cracks the size of which depends on the extent of the mass. The resulting stresses are important in monolithic construction, and should be considered carefully by the designer; they cannot be counteracted successfully, but the effects can be minimized.

Large cracks, produced by quick hardening or wide ranges of temperature, can be broken up to some extent into small cracks by placing reinforcement in the concrete; in long continuous lengths of concrete, it is better to provide shrinkage joints at points in the structure where they will do little or no harm. Reinforcement is of assistance, and permits longer distances between shrinkage joints than when no reinforcement is used.

Small masses or thin bodies of concrete should not be joined to larger or thicker masses without providing for shrinkage at such points. Fillets similar to those used in metal castings, but of larger dimensions, for gradually reducing from the thicker to the thinner body, are of advantage.

Shrinkage cracks are likely to occur at points where fresh concrete is joined to that which is set, and hence, in placing the concrete, construction joints should be made on horizontal and vertical lines, and, if possible, at points where joints would naturally occur in dimension-stone masonry.

Fireproofing—Experience, together with the results of tests thus far made, indicates that concrete, on account of its low rate of heat conductivity and the fact that it is incombustible, may be used safely for fireproofing purposes. The dehydration of concrete probably begins at about 500° F., and is completed at about 900° F., but experience indicates that the volatilization of the water absorbs heat from the surrounding mass, which, together with the resistance of the air cells, tends to increase the heat resistance of the concrete, so that the process of dehydration is very much re-

*A convenient coefficient of density is the ratio of the sum of the volumes of materials contained in a unit volume to the total unit volume.

†A natural sand obtained at Ottawa, Ill., passing a screen having 20 meshes and retained on a screen having 30 meshes per lin.in.; prepared and furnished by the Ottawa Silica Company, for 2 cents per lb., f.o.b. cars, Ottawa, Ill., under the direction of the Special Committee on Uniform Tests of Cement of the American Society of Civil Engineers.

tarded. The concrete that is actually affected by fire remains in position and affords protection to the concrete beneath it. For ordinary conditions, it is recommended that the metal in girders and columns be protected by a minimum of 2 in. of concrete; that the metal in beams be protected by a minimum of 1½ in. of concrete; and that the metal in floor slabs be protected by a minimum of 1 in. of concrete.

It is recommended that, in monolithic concrete columns, the concrete to a depth of 1½ in. be considered as protective covering, and not included in the effective section.

It is recommended that the corners of columns, girders and beams be beveled or rounded, as a sharp corner is more seriously affected by fire than a round one.

DESIGN OF MASSIVE CONCRETE

In the design of massive or plain concrete, no account should be taken of the tensile strength of the material, and sections should usually be proportioned so as to avoid tensile stresses, except in slight amounts to resist indirect stresses.

Massive concrete is suitable for dams, retaining walls, and piers and short columns in which the ratio of length to least width is relatively small. Under ordinary conditions, this ratio should not exceed six. It is also suitable for arches of moderate span, where the conditions as to foundations are favorable.

DESIGN OF REINFORCED CONCRETE

Lengths of Beams and Columns—The span length for beams and slabs shall be taken as the distance from center to center of supports, but need not be taken to exceed the clear span plus the depth of beam or slab. Brackets shall not be considered as reducing the clear span in the sense here intended.

The length of columns shall be taken as the maximum unsupported length.

Internal Stresses—As a basis for calculations relating to the strength of structures, the following assumptions are recommended:

1. Calculations will be made with reference to working stresses and safe loads, rather than with reference to ultimate strength and ultimate loads.
2. A plane section before bending remains plane after bending.
3. The modulus of elasticity of concrete in compression, within the usual limits of working stresses, is constant. The distribution of compressive stresses in beams, therefore, is rectilinear.
4. In calculating the moment of resistance of beams, the tensile stresses in the concrete are neglected.
5. Perfect adhesion is assumed between concrete and reinforcement. Under compressive stresses, the two materials, therefore, are stressed in proportion to their moduli of elasticity.
6. The ratio of the modulus of elasticity of steel to the modulus of elasticity of concrete is taken at 15, except as modified in Chapter VII, Section 8.
7. Initial stress in the reinforcement, due to contraction or expansion in the concrete, is neglected.

It is recognized that some of the assumptions given herein are not entirely borne out by experimental data. They are given in the interest of simplicity and uniformity, and variations from exact conditions are taken into account in the selection of formulas and working stresses.

Deflection of Beams—This is affected by the tensile strength developed throughout the length of the beam. For calculations of deflections, a value of 8 for the ratio of the moduli will give results corresponding approximately with the actual conditions.

T-Beams—In beam-and-slab construction, an effective bond should be provided at the junction of the beam and slab. Where the principal slab reinforcement is parallel to the beam, transverse reinforcement should be used extending into the beam and well into the slab.

Where adequate bond and shearing resistance between slab and beam is provided, the slab may be considered as a flange of the beam, and its effective width shall be determined by the following rules. It will not be necessary to reduce the width of the beam due to overlapping of the flanges of the web shall not exceed three times the thickness of the slab.

In the design of T-beams acting as continuous beams, due consideration should be given to the compression area at the supports.

Beams should be so used as to provide for the purpose of providing additional compression area of concrete [illegible] of beams and slabs that [illegible] of the slab and [illegible] of beams [illegible] the beam [illegible] the [illegible] and the [illegible] of the beam [illegible] and the [illegible] is placed and [illegible] the horizontal reinforcement will probably be controlling factors in design.

Floor Slabs—Floor slabs should be designed and reinforced as continuous over the supports. If the length of the slab exceeds one and five-tenth times its width, the entire load should be carried by transverse reinforcement. Square slabs may well be reinforced in both directions.*

The continuous flat slab with multiple-way reinforcement is a type of construction used quite extensively, and has recognized advantages for special conditions, as in the case of warehouses with large, open, floor space. At present, a considerable difference of opinion exists among engineers as to the formulas and constants which should be used, but experience and tests are accumulating data which it is hoped will in the near future permit the formulation of the principles of design for this form of construction.

The loads carried to beams by slabs which are reinforced in two directions will not be uniformly distributed to the supporting beam, and its distribution will depend on the relative stiffness of the slab and the supporting beam. The distribution under ordinary conditions of construction may be expected to be that in which the load on the beam varies in accordance with the ordinates of a parabola having its vertex at the middle of the span. For any given design, the probable distribution should be ascertained, and the moments in the beam calculated accordingly.

Continuous Beams and Slabs—When the beam or slab is continuous over its supports, reinforcement should be fully provided at points of negative moment, and the stresses in concrete recommended farther below should not be exceeded. In computing the positive and negative moments in beams and slabs continuous over several supports, due to uniformly distributed loads, the following rules are recommended:

(a) That for floor slabs, the bending moments at center and at support be taken at $\frac{wl^2}{12}$ for both dead- and live-loads, where w represents the load per linear foot and l the span length.

(b) That for beams, the bending moment at center and at support for interior spans be taken at $\frac{wl^2}{12}$, and for end spans it be taken at $\frac{wl^2}{10}$ for center and adjoining support, for both dead- and live-loads.

(c) In the case of beams and slabs continuous for two spans only, the bending moment at the central support should be taken as $\frac{wl^2}{8}$ and near the middle of the span as $\frac{wl^2}{10}$.

(d) At the ends of continuous beams, the amount of negative moment which will be developed will depend on the condition of restraint or fixedness, and this will depend on the form of construction used. There will usually be some restraint, and there is likely to be considerable. Provision should be made for the negative bending moment, but, as its amount will depend on the form of construction, the coefficient cannot be specified here, and must be left to the judgment of the designer.

For spans of unusual length, more exact calculations should be made. Special consideration is also required in the case of concentrated loads.

Even if the center of the span is designed for a greater bending moment than is called for by a or b, the negative moment at the support should not be taken as less than the values there given.

Bond Strength, and Spacing of Reinforcement—Adequate bond strength should be provided. The formula hereinafter given for bond stresses in beams is for straight longitudinal bars. In beams in which a portion of the rein-

*The exact distribution of load on square and rectangular slabs, supported on four sides and reinforced in both directions, cannot readily be determined. The following method of calculation is recognized as faulty, but it is offered as a tentative method which will give results on the safe side. The distribution of load is first to be determined by the formula:

$$r = \frac{l^4}{l^4 + b^4}$$

in which r = proportion of load carried by the transverse reinforcement, l = length, and b = breadth of slab. For various ratios of $\frac{l}{b}$ the values of r are as follows:

$\frac{l}{b}$	r
1	0.50
1.1	0.59
1.2	0.67
1.3	0.75
1.4	0.80
1.5	0.83

Using the values above specified, each set of reinforcement is to be calculated in the same manner as slabs having supports on two sides only, but the total amount of reinforcement thus determined may be reduced 25%, by gradually increasing the rod spacing from the third-point to the edge of the slab.

forcement is bent up near the end, the bond stress at places in both the straight bars and the bent bars will be considerably greater than for all the bars straight, and the stress at some point may be several times as much as that found by considering the stress to be uniformly distributed along the bar. In restrained and cantilever beams, full tensile stress exists in the reinforcing bars at the point of support, and the bars must be anchored in the support sufficiently to develop this stress.

In case of anchorage of bars, an additional length of bar must be provided beyond that found on the assumption of uniform bond stress, for the reason that, before the bond resistance at the end of the bar can be developed, the bar may have begun to slip at another point, and "running" resistance is less than the resistance before slip begins.

Where high bond resistance is required, the deformed bar is a suitable means of supplying the necessary strength; but it should be recognized that, even with a deformed bar, initial slip occurs at early loads, and that the ultimate loads obtained in the usual tests for bond resistance may be misleading. Adequate bond strength throughout the length of a bar is preferable to end anchorage, but, as an additional safeguard, such anchorage may properly be used in special cases. Anchorage furnished by short bends at a right angle is less effective than hooks consisting of turns through 180°.

The lateral spacing of parallel bars should not be less than three diameters, from center to center, nor should the distance from the side of the beam to the center of the nearest bar be less than two diameters. The clear spacing between two layers of bars should not be less than 1 in. The use of more than two layers is to be discouraged, unless the layers are tied together by adequate metal connections, particularly at and near points where bars are bent up or bent down.

Diagonal Tension and Shear—When a reinforced-concrete beam is subjected to flexural action, diagonal tensile stresses are set up. If, in a beam not having web reinforcement, these stresses exceed the tensile strength of the concrete, failure of the beam will ensue. When web reinforcement, made up of stirrups, or of diagonal bars secured to the longitudinal reinforcement, or of longitudinal reinforcing bars bent up at several points, is used, new conditions prevail; but even in this case, at the beginning of loading, the diagonal tension developed is taken principally by the concrete, the deformations which are developed in the concrete permitting but little stress to be taken by the web reinforcement. When the resistance of the concrete to the diagonal tension is overcome at any point in the depth of the beam, greater stress is at once set up in the web reinforcement.

For the composite structure of reinforced-concrete beams, an analysis of the web stresses, and particularly of the diagonal tensile stresses, is very complex; and when the variations due to a change from no horizontal tensile stress in the concrete at the remotest fiber to the presence of horizontal tensile stress at some point below the neutral axis are considered, the problem becomes more complex and indefinite. Under these circumstances, in designing, recourse is had to the use of the calculated vertical shearing stress as a means of comparing or measuring the diagonal tensile stresses developed, it being understood that the vertical shearing stress is not the numerical equivalent of the diagonal tensile stress, and even that there is not a constant ratio between them. It is here recommended that the maximum vertical shearing stress in a section be used as the means of comparison of the resistance to diagonal tensile stress developed in the concrete in beams not having web reinforcement.

Even after the concrete has reached its limit of resistance to diagonal tension, if the beam has web reinforcement, conditions of beam action will continue to prevail, at least through the compression area, and the web reinforcement will be called on to resist only a part of the web stresses. From experiments with beams, it is concluded that it is safe practice to use only two-thirds of the external vertical shear in making calculations of the stresses that come on stirrups, diagonal web pieces and bent-up bars, and it is here recommended for calculations in designing that two-thirds of the external vertical shear be taken as producing stresses in web reinforcement.

Experiments bearing on the design of details of web reinforcement are not yet complete enough to allow more than general and tentative recommendations to be made. It is well established, however, that vertical members attached to or looped about horizontal members, inclined members secured to horizontal members in such a way as to insure against slip, and the bending of a part of the longitudinal reinforcement at an angle, will increase the strength of a beam against failure by diagonal tension, and that a well-designed and well-distributed web reinforcement may, under the best conditions, increase the total vertical shear carried to a value as much as three times that obtained when the bars are all horizontal and no web reinforcement is used. Where vertical stirrups are used without being secured to the longitudinal reinforcement, the force transmitted between longitudinal bar and stirrup must not be greater than can be taken through the concrete, and care must be taken to provide for the larger bond stress developed in the longitudinal bars with this construction than exists in the absence of stirrups. Sufficient bond resistance between the concrete and the stirrups or diagonals must be provided. Where the longitudinal bars are bent up, the points of bending of the several bars should be distributed along a portion of the length of the beam in such a way as to give efficient web reinforcement over the portion of the length of the beam in which it is needed. The higher resistance to diagonal tension failures given by unit frames having the stirrups and bent-up bars securely connected together both longitudinally and laterally is worthy of recognition. It is necessary that a limit be placed on the amount of shear which may be allowed in a beam; for when web reinforcement sufficiently efficient to give very high web resistance is used, at the higher stresses the concrete in the beam becomes checked in such a way as to endanger its durability as well as its strength.

The section to be taken as the critical section in the calculation of shearing stresses will generally be the one having the maximum vertical shear, though experiments show that the section at which diagonal tension failures occur is not just at a support, even though the shear at the latter point be much greater.

The longitudinal spacing of stirrups or diagonal members, or the distribution of the points of bending of adjacent bent-up bars, should not exceed three-fourths the depth of the beam.

It is important that adequate bond strength or anchorage be provided to develop fully the assumed strength of all web reinforcement.

It should be noted that it is on the tension side of a beam that diagonal tension develops in a critical way, and that the proper connection must always be made between stirrups or other web reinforcement and the longitudinal tension reinforcement, whether the latter is on the lower side of the beam or on its upper side. Where negative moment exists, as is the case near the supports in a continuous beam, web reinforcement, to be effective, must be looped over, or wrapped around, or be connected with, the longitudinal tension reinforcing bars at the top of the beam, in the same way as is necessary at the bottom of the beam at sections where the bending moment is positive and the tension reinforcing bars are at the bottom of the beam.

Inasmuch as the smaller the longitudinal deformations in the horizontal reinforcement are, the less the tendency for the formation of diagonal cracks, a beam will be strengthened against diagonal tension failure by arranging and proportioning the horizontal reinforcement so that the unit-stresses at points of large shear shall be relatively low.

Where pure shearing stress occurs, or shearing stress combined with but a small amount of tensile stress in the concrete, as when a concentrated load rests on a slab, or other forms of punching shear are produced, or in the case of compression pieces, the element of tension will not need consideration, and the permissible limit of the shearing stress will be higher than the allowable limit when this stress is used as a means of comparing diagonal tensile stress.

Columns—By columns are meant compression members of which the ratio of unsupported length to least width exceeds about six, and which are provided with reinforcement of one of the forms hereafter described.

It is recommended that the ratio of unsupported length of column to its least width be limited to 15.

The effective area of the column shall be taken as the area within the protective covering; or, in the case of hooped columns or columns reinforced with structural shapes, it shall be taken as the area within the hooping or structural shapes.

Columns may be reinforced by longitudinal bars, by bands, hoops or spirals, together with longitudinal bars, or by structural forms which in themselves are sufficiently rigid to act as columns. The general effect of closely spaced hooping is greatly to increase the "toughness" of the column and its ultimate strength, but hooping has little effect on its behavior within the limit of elasticity. It thus renders the concrete a safer and more reliable material, and should permit the use of a somewhat higher working stress. The beneficial effects of "toughening" are adequately provided by a moderate amount of hooping, a larger amount serving

mainly to increase the ultimate strength and the possible deformation before ultimate failure.

Composite columns of structural steel and concrete in which the steel forms a column by itself, should be designed with caution. To classify this type as a concrete column reinforced with structural steel is hardly permissible, as the steel will generally take the greater part of the load. When this type of column is used, the concrete should not be relied on to tie the steel units together or to transmit stresses from one unit to another. The units should be adequately tied together by tie-plates or lattice bars, which, together with other details, such as splices, etc., should be designed in conformity with standard practice for structural steel. The concrete may exert a beneficial effect in restraining the steel from lateral deflection, and also in increasing the carrying capacity of the column. The proportion of load to be carried by the concrete will depend on the form of the column and the method of construction. Generally, for high percentages of steel, the concrete will develop relatively low unit-stresses, and caution should be used in placing dependence on the concrete.

The following recommendations are made for the relative working stresses in the concrete for the several types of columns:

(a) Columns with longitudinal reinforcement only, to the extent of not less than 1% and not more than 4%: the unit-stress recommended for axial compression in "Working Stresses."
(b) Columns with reinforcement of bands, hoops or spirals, as hereinafter specified: stresses 20% higher than given for (a), provided the ratio of the unsupported length of the column to the diameter of the hooped core is not more than 8.
(c) Columns reinforced with not less than 1% and not more than 4% of longitudinal bars, and with bands, hoops, or spirals, as hereinafter specified: stresses 45% higher than given for (a), provided the ratio of the unsupported length of the column to the diameter of the hooped core is not more than 8.

The foregoing recommendations are based on the following conditions:

In all cases, longitudinal reinforcement is assumed to carry its proportion of stress. The hoops or bands are not to be counted on directly as adding to the strength of the column.

Bars composing longitudinal reinforcement shall be straight, and shall have sufficient lateral support to be securely held in place until the concrete has set.

Where hooping is used, the total amount of such reinforcement shall be not less than 1% of the volume of the column enclosed. The clear spacing of such hooping shall be not greater than one-sixth of the diameter of the enclosed column, and preferably not greater than one-tenth, and in no case more than 2½ in. Hooping is to be circular, and the ends of bands must be united in such a way as to develop their full strength. Adequate means must be provided to hold bands or hoops in place so as to form a column, the core of which shall be straight and well centered. The strength of hooped columns depends very much on the ratio of length to diameter of hooped core, and the strength due to hooping decreases rapidly as this ratio increases beyond five. The working stresses recommended are for hooped columns with a length of not more than eight diameters of the hooped core.

Bending stresses due to eccentric loads and lateral forces must be provided for by increasing the section until the maximum stress does not exceed the values above specified; and, where tension is possible in the longitudinal bars, adequate connection between the ends of the bars must be provided to take this tension.

Reinforcing for Shrinkage and Temperature Stresses—To be most effective, reinforcement (in amount generally not [illegible] which will develop a high bond resistance should be placed near the exposed surface and be well distributed.

General Assumptions [illegible] recommended for static loads. Proper allowances for vibration and impact are to be made [illegible] sary to produce an equivalent static load before applying the [illegible]

[illegible] the [illegible] to be assumed [illegible] the working stresses [illegible] specific allowance for such features of construction as [illegible] [illegible] of the same [illegible] [illegible] [illegible]

Suggested Formulas for Reinforced-Concrete Construction

(a) STANDARD NOTATION

1. Rectangular Beams.

The following notation is recommended:

f_s = Tensile unit-stress in steel,
f_c = Compressive unit-stress in concrete,
E_s = Modulus of elasticity of steel,
E_c = Modulus of elasticity of concrete,
$n = \frac{E_s}{E_c}$,
M = Moment of resistance, or bending moment in general,
A = Steel area,
b = Breadth of beam,
d = Depth of beam to center of steel,
k = Ratio of depth of neutral axis to effective depth d,
z = Depth of resultant compression below top,
j = Ratio of lever arm of resisting couple to depth d,
jd = d — z = Arm of resisting couple,
p = Steel ratio (not percentage).

2. T-Beams.

b = Width of flange,
b′ = Width of stem,
t = Thickness of flange.

3. Beams Reinforced for Compression.

A′ = Area of compressive steel,
p′ = Steel ratio for compressive steel,
f'_s = Compressive unit-stress in steel,
C = Total compressive stress in concrete,
C′ = Total compressive stress in steel,
d′ = Depth to center of compressive steel,
z = Depth to resultant of C and C′.

4. Shear and Bond.

V = Total shear,
v = Shearing unit-stress,
u = Bond stress per unit area of bar,
o = Circumference or perimeter of bar,
Σ_o = Sum of the perimeters of all bars.

5. Columns.

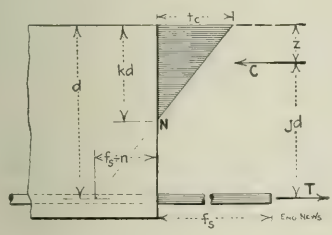
A = Total net area,
A_s = Area of longitudinal steel,
A_c = Area of concrete,
P = Total safe load.

(b) FORMULAS

1. RECTANGULAR BEAMS.

Position of neutral axis,

$$k = \sqrt{2pn + (pn)^2} - pn \qquad (1)$$



Arm of resisting couple,

$$j = 1 - \tfrac{1}{3}k \qquad (2)$$

(For f_s = 15,000 to 16,000, and f_c = 600 to 650, k may be taken at $\frac{3}{8}$.)

Fiber stresses,

$$f_s = \frac{M}{Ajd} = \frac{M}{pjbd^2} \qquad (3)$$

$$f_c = \frac{2M}{jkbd^2} = \frac{2pf_s}{jk} \qquad (4)$$

Steel ratio, for balanced reinforcement,

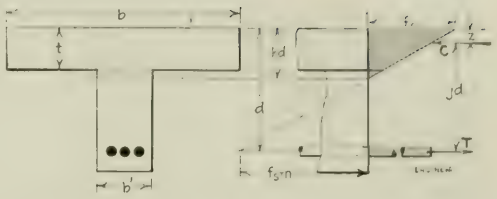
$$p = \frac{1}{2}\frac{f_s}{f_c}\left(\frac{1}{\frac{f_s}{nf_c} + 1}\right) \qquad (5)$$

2. T-BEAMS.

Case I. When the neutral axis lies in the flange: Use the formulas for rectangular beams.

Case II. When the neutral axis lies in the stem.

The following formulas neglect the compression in the stem:



Position of neutral axis,

$$kd = \frac{2ndA + bt^2}{2nA + 2bt} \qquad (6)$$

Position of resultant compression,

$$z = \frac{3kd - 2t}{2kd - t}\frac{t}{3} \qquad (7)$$

Arm of resisting couple,

$$jd = d - z \qquad (8)$$

Fiber stresses,

$$f_s = \frac{M}{Ajd} \qquad (9)$$

$$f_c = \frac{Mkd}{bt\left(kd - \frac{1}{2}t\right)jd} = \frac{f_s}{n}\frac{k}{1-k} \qquad (10)$$

(For approximate results, the formulas for rectangular beams may be used.)

The following formulas take into account the compression in the stem; they are recommended where the flange is small compared with the stem:

Position of neutral axis,

$$kd = \sqrt{\frac{2ndA + (b - b')t^2}{b'} + \left(\frac{nA + (b - b')t}{b'}\right)^2} - \frac{nA + (b - b')t}{b'} \qquad (11)$$

Position of resultant compression,

$$z = \frac{\left(kdt^2 - \frac{2}{3}t^3\right)b + \left[(kd - t)^3\left(t + \frac{1}{3}(kd - t)\right)\right]b'}{t(2kd - t)b + (kd - t)^2 b'} \qquad (12)$$

Arm of resisting couple,

$$jd = d - z \qquad (13)$$

Fiber stresses,

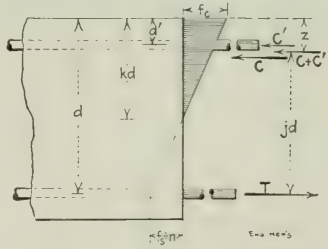
$$f_s = \frac{M}{Ajd} \qquad (14)$$

$$f_c = \frac{2Mkd}{[(2kd - t)bt + (kd - t)^2 b']jd} \qquad (15)$$

3. BEAMS REINFORCED FOR COMPRESSION.

Position of neutral axis,

$$k = \sqrt{2n\left(p + p'\frac{d'}{d}\right) + n^2(p + p')^2} - n(p + p') \qquad (16)$$



Position of resultant compression,

$$z = \frac{\frac{1}{3}k^3d + 2p'nd'\left(k - \frac{d'}{d}\right)}{k^2 + 2p'n\left(k - \frac{d'}{d}\right)} \qquad (17)$$

Arm of resisting couple,

$$jd = d - z \qquad (18)$$

Fiber stresses,

$$f_c = \frac{6M}{bd^2\left[3k - k^2 + \frac{6p'n}{k}\left(k - \frac{d'}{d}\right)\left(1 - \frac{d'}{d}\right)\right]} \qquad (19)$$

$$f_s = \frac{M}{pjbd^2} = nf_c\frac{1-k}{k} \qquad (20)$$

$$f'_s = nf_c\frac{k - \frac{d'}{d}}{k} \qquad (21)$$

4. SHEAR, BOND, AND WEB REINFORCEMENT.

In the following formula, Σ_0 refers only to the bars constituting the tension reinforcement at the section in question, and jd is the lever arm of the resisting couple at the section.

For rectangular beams,

$$v = \frac{V}{bjd} \tag{22}$$

$$u = \frac{V}{jd\Sigma_0} \tag{23}$$

(For approximate results, j may be taken at $\frac{7}{8}$.)

The stress in web reinforcement may be estimated by the following formulas:

Vertical web reinforcement.

$$P = \frac{Vs}{jd} \tag{24}$$

Web reinforcement inclined at 45° (not bent-up bars).

$$P = 0.7\,\frac{Vs}{jd} \tag{25}$$

in which P = stress in single reinforcing member, V = amount of total shear assumed as carried by the reinforcement, and s = horizontal spacing of the reinforcing members.

The same formulas apply to beams reinforced for compression as regards shear and bond stress for tensile steel.

For T-beams,

$$v = \frac{V}{b'jd} \tag{26}$$

$$u = \frac{V}{jd\Sigma_0} \tag{27}$$

(For approximate results, j may be taken at $\frac{7}{8}$.)

COLUMNS.

Total safe load,

$$P = f_c(A_c + nA_{st}) = f_c A\,(1 + (n - 1)\,p) \tag{28}$$

Unit stresses,

$$f_c = \frac{P}{A\,(1 + (n - 1)\,p)} \tag{29}$$

$$f_s = nf_c \tag{30}$$

*

The Emergency Use of Hypochlorite Water Disinfection at Philadelphia

BY FRANCIS D. WEST*

During the latter part of November, 1911, at a time when the Schuylkill River was very badly polluted, a break occurred in two of the filtered-water mains; as a result it was necessary for a time to pump water directly from the Schuylkill River to supply about 50,000 consumers. In spite of warnings to boil the water, an epidemic of typhoid fever broke out and over 300 cases resulted.

This epidemic, unfortunate as it was, caused the authorities to take such precautions that, following a second break, they succeeded in taking care of the situation in such a manner that not a single case of typhoid fever for the five weeks following has been directly attributable to the water.

The second break occurred about midnight of Oct. 25, about 100 yd. from the auxiliary pumping station of the Upper Roxborough Filter plant. The pipe cracked at a point where new earth had been placed over and under it, following the bad break of 1911. The break was repaired in 20 hr. Meanwhile it was necessary to turn unfiltered water into the district. The precautions taken were so thorough and complete in every detail that they may well be copied by other cities finding themselves in a difficult predicament. They were as follows:

(1) A dilute solution of hypochlorite about sixty parts per million* of bleach (chloride of lime) corresponding to about 1.1 part of available chlorine @36%, was set up at the pumping station. The bleach was applied at the pump wells and consequently no water that had not been treated reached the consumer.

(2) Circulars printed for the purpose warning the people to boil the water were distributed by daybreak of Oct. 26.

(2) Posters were fastened to telegraph poles, displayed in store windows and similar places.

(4) The Bell and Keystone Telephone Companies notified all their subscribers—about 13,000.

(5) Announcement of the danger was made by all the newspapers.

(6) Special delivery letters were sent to all ministers in the district, requesting that they make announcement from the pulpit. Similar announcement was made at the schools.

(7) All fountains and public or semi-public water-supplies were shut off.

(8) Bacterial tests were made the day of the break and were followed by a thorough sampling of the district. This has continued since and a study of the results will be found further on.

(9) When the repairs had been completed and filtered water again turned into the mains, bleach was added at the filtered-water basin to thoroughly disinfect the pipes and pipe deposits.

(10) All fire plugs or hydrants were flushed out with the idea of stirring up and getting rid of all pathogenic bacteria as soon as possible.

The area receiving Schuylkill River water from the Upper Roxborough plant comprises a part of Wards 21, 22, 38 and 42, which comprise a part of the 5th and 6th districts, consisting of Germantown, Chestnut Hill, Roxborough and Manayunk, with a population of about 50,000, using in the neighborhood of 20,000,000 gal. of water a day.

Table I shows the cases of typhoid fever in the 21, 22, 28 and 42 Wards for a corresponding period of 1911 and 1912, as well as the cases in the entire city during the same time. The total number of cases for the four wards was practically the same in 1911 and 1912, and represents what might be called the normal for this time of the year. The water used in these wards comes from Lower as well as from Upper Roxborough filter plant.

TABLE I.—TYPHOID FEVER CASES IN THE FOUR WARDS AND IN THE WHOLE CITY.

	1911		1912	
Week ending	4 Wards	City	4 Wards	City
Oct. 26	1	31	1	30
Nov. 2	2	20	1	18
Nov. 9	3	21	1	10
Nov. 16	1	20	3	19
Nov. 23	0	23	2	22
Nov. 30	0	16	3	23
Total	10	131	11	122

The bacteriological results are interesting and instructive and are given somewhat at length in Tables II, III and IV. They bring out two things: First, the effect of large doses of bleach on badly polluted water and second, the length of time it took to flush out the bacteria introduced with the raw water (see particularly, Table IV., bacterial counts from dead-end samples).

TABLE II.—CONDITION OF SCHUYLKILL RIVER AT TIME OF BREAK.

Date.	Shawmont Sluice Bacteria per c.c.	Turbidity	Belmont intake
Oct. 24	220,000	700	140,000
Oct. 25	130,000	180	120,000
Oct. 26a	6,000	50	58,000
Oct. 27a	7,000	36	28,000

a Treated with bleach.

*Director of Public Health and Charities of Philadelphia. Presented before the Engineers' Club of Philadelphia, Pa.

*For the first two days, a dosage of one part per million was given, thereafter as follows:

The untreated water at Shawmont had a count in excess of that at the Belmont intake due to the dilution of Wissahickon Creek which enters the Schuylkill below Shawmont.

The count was about 70,000 on the 26th and 40,000 on the 27th. At this the efficiency of the treatment at the pump wells was 91% for the 26th and 82% for the 27th.

TABLE III—CONDITION OF WATER ON REACHING VARIOUS TESTING POINTS.

Bacteria per c.c. on Gelatin at 20° C

Date.	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Oct. 26.		1400a	510		28*	...
Oct. 27.	5	1600a	10	2200a	17*	....
Oct. 28.	2	1800	4	190	100	...
Oct. 29.	5	370*	100	120	.	. .
Oct. 30.	.	810	82	60	6A	.
Oct. 31.	8	230A	140	100	6	180
Nov. 1.	5	140	38A	92	4	89
Nov. 2.	4	150*	35A	61	4	88
Nov. 3.	2			49*	.	....
Nov. 4.	5			26	3	.
Nov. 5.	8	52	14A	.	. .	49
Nov. 6.	8		..		.	..
Nov. 7.	6	19	4	. .	16	14
Nov. 9.	11	16	4	. .	10	7
Nov. 12.	2	12	14	..	8	13
Nov. 14.	4	14	4	..	5	2
Nov. 16.	4	6	5	....	2	5

No. 1 = Upper Roxborough Filtered Water Basin.
No. 2 = Tap at Mt. Airy Pumping Station.
No. 3 = Germantown above Chelton Ave.
No. 4 = 5th District Office.
No. 5 = 5214 Germantown Ave.
No. 6 = Mt. Airy Public School.

a = B.Coli present in 1 c.c.
* = B.Coli present in 10 c.c
A = atypical Coli in 10 c.c.

ALL OTHER TESTS COLI ABSENT in 1 and 10 c.c.

At Mt. Airy Pumping Station (abandoned) the line is used but little and the water was turbid for four days and the count remained high until Nov. 7.

At Germantown and Chelton Aves. where the mains are used extensively the water was turbid but one day following which the count dropped to rise again due to stirring up of deposits in the pipes. The water at that point had a count of 14 per c.c. by Nov. 5.

The efficiency of the bleach at the Mt. Airy Pumping Station was 98% on the 26th and 96% on the 27th and at 5th District Office for the 27th it was 97%.

It will be noticed, then, that at a point where considerable water is used, although the count dropped by the third day it became higher and did not run consistently low until 10 days after.

The results from 5214 Germantown Ave., supplied by Lower Roxborough, but located near the border line between the two plants, shows the effect of the water backing up from Upper Roxborough during the first few days. By Oct. 30 the count was 6 per c.c. and after this it remained low.

TABLE IV—CONDITION OF WATER AT VARIOUS DEAD ENDS.

Bacteria per c.c.

	Source.	Oct. 30	Nov. 4	Nov. 15
	5th District.			
1	6808 Ridge Ave	4	6	4
2	6936 Ridge Ave.	6	8	6
3	9156 Ridge Ave	81	85	contam.
4	302 Lamonte St	55	12	2
5	6247 Lawnton St	130	100	12
6	632 Leverington St	45	48	8
7	511 E. Connaroe St	22	28	6
8	260 Sumac St	250	54	19
9	279 E. Rochelle St	220	92	8
10	506 E. Roxborough St	58	9	4
11	Vicarous and Osborne St	42	13	7
12	5200 Ridge Ave	32	17	4
13	5501 Ridge Ave	32	16	4
	6th District			
14	Carpenter N. E. Emlen St	6	2	4
15	McCallum N.W. of Carpenter St.	7	10	4
16	Germantown N.W. Johnson St	19	12	4
17	Morton N.W. of Johnson St	320	24	6
18	Germantown N.W. Allen's Lane	85	20	8
19	Gowen S.W. Stenton St	230	94	15
20	Mermaid S.W. of Stenton St	280	81	4
21	Mt. Pleasant S.W. of Emlen St.	180	45	11
22	Willow Grove & Township Line	250	57	3
23	Upsal and Jefferson St	180	38	5
24	Stenton S.W. of New St	41	21	5
25	Highland S.W. of 30th St	160	56	4
26	3719 Emlen St.	64	20	5
27	Greene N.W. of Carpenter St.	33	9	28

Tests for B. Coli communis Oct. 30 all negative 1 and 10 c.c., Nov. 4 all negative 1 c.c. Upsal and Jefferson positive on 10 c.c. and 506 E. Roxborough and 5200 Ridge Ave. atypical on 10 c.c. Nov. 15 all negative on 1 c.c. and 10 c.c.

The filtered water basin on each of these dates had a bacteria count of 5 per c.c.

Samples 1, 2, 14 and 15 were low on each date, it is thought that no turbid water reached these points. Nos. 8, 9, 17, 19, 20 and 22 are the most interesting. These show a drop from an average of 260 on Oct. 30 to 67 on Nov. 4 and 7 on Nov. 15.

Omitting Nos. 1, 2, 14 and 15 the other 23 have an average of 122 on Oct. 30, of 36 on Nov. 4 and 7 on Nov. 15

B. Coli Communis.

Omitting the tests of the first two days when the water was turbid and not filtered, we have the following results:

Total test of 1 and 10 c.c. = 133
Total positive tests of 1 c.c. = 0
Total tests of 10 c.c. positive = 3 = 2.3%
Total tests 10 c.c. atypical = 7 = 5.3%

It is very evident from these results that the bleach thoroughly disinfected the water.

By Nov. 17 is was stated by the writer that he believed the water to be entirely safe to drink. Samples tested since that date have had counts as low as 0 per c.c. and B. coli has been absent from all tests.

On Nov. 26, one month from the time of the break, the Bureau of Health notified the consumers that the water could be used with out danger.

The hypochlorite treatment has been continued.

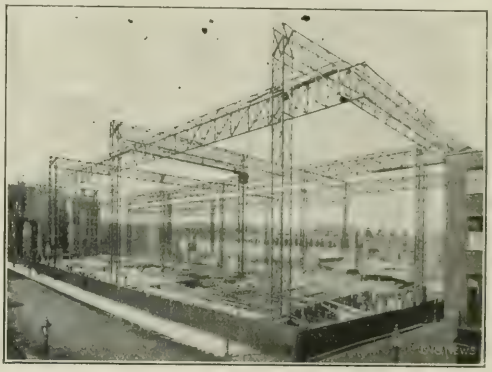
The strength of the bleach used at Upper Roxborough was as follows:

Oct. 26 and 27, 3 parts per million (powder); Oct. 28, 29 and 30, 2½ parts. Oct. 31 to Nov. 11, 2 parts; Nov. 11 to date (Dec. 2) ½ part.

All the filter plants in Philadelphia have been adding bleach to water in the filtered water basins as an added precaution for over a year.

Steel Frame and Traveling Crane for Building Erection

The novel framework shown in the accompanying halftone is now being used in the erection of H. M. Stationery office, in London, Eng., a new reinforced-concrete structure. It is an adaptation of the common shipyard crane for the first time applied to building work on a large scale. The new building occupies the major portion of an entire city block, with outside dimensions of 106, 189, 377 and



STEEL FRAME CARRYING TRAVELING CRANES FOR ERECTING AN ENGLISH BUILDING

323 ft. on its four sides, and will be, when completed, eight stories high. The frame shown covers this entire area and allows a clearance for the complete height of the building.

In design the frame comprises four transverse rows of columns across the narrow length of the lot and five rows along the wide length, the columns being connected longitudinally by box frames upon which electric cranes are run, and transversely by bracing frames which are raised above the elevation of the longitudinal frames to allow clearance for the traveling cranes. The whole structure is of riveted steel work. The positive control of the whole area and the freedom from the necessity of constantly changing the erection cranes to avoid the rising structure are considered sufficient reasons for the use of this erection frame, which involves a rather high first cost.

The view shown herewith is taken from *Concrete and Constructional Engineering*, of London, Eng.

Lessons from the Failure of a Weir and Sluices on Porous Foundations

By W. G. Bligh*

The principles which underlie the design of any hydraulic work founded on a porous sub-stratum have been explained *in extenso* in previous articles by the author in Engineering News†, so that further detailed explanation will be unnecessary and it will suffice to state that the stability of structures built on a porous foundation of

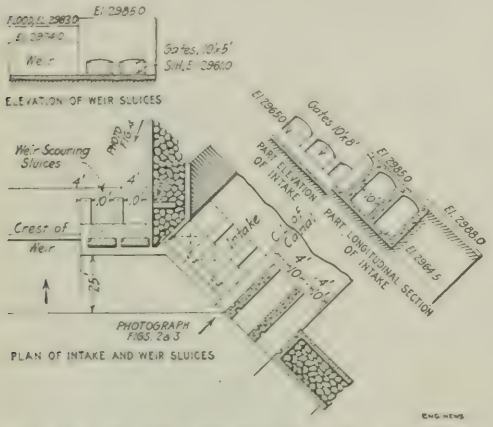


Fig. 1. Plan and Elevation of Weir and Intake, Which Failed

sand or boulders and subjected to the pressure of a head of water is dependent entirely on the ratio the length of the enforced percolation underneath the impervious superstructure bears to the head of water acting on the work. Symbolizing the former by the latter l and the latter by H the ratio $\frac{l}{H}$ or c is termed the "percolation factor."

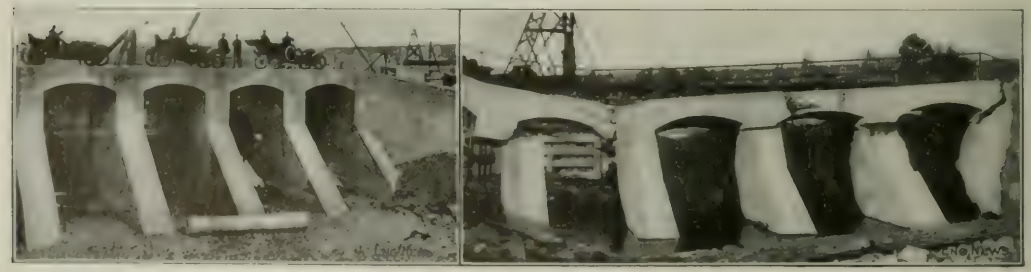
the undermining influence of the pressure of the water upheld. The ratio $\frac{1}{c}$ is termed either the "hydraulic gradient" or the "virtual slope." The values of percolation factors for the various materials adopted by the writer and given in the articles above alluded to are:

Very Fine Sand and Silt	18
Fine Sand	15
Coarse Sand	12
Sand and Gravel	9
Boulders and Gravel	4 to 6

The statistics referred to are based on the failures of works which originally, from ignorance of the principle involved, were designed with too short an effective base, or length of percolation, for safety. Thus, suppose a case where a work fails by undermining, or what is technically termed 'piping," in which the ascertained value of c is say 10. When repaired this structure is provided with an increased travel of percolation, raising the ratio $\frac{l}{H}$ or c to, say, 18, we are now enabled to deduce the fact that 10 is too small a value for the "percolation factor," while on the other hand 18 is certainly a safe value, though it may be wastefully large. Examination of other works similarly situated, as regards quality of the pervious substratum, enable a fairly correct value to be deduced and the real safe value for c may be found to be close to, say, 15. Based on this deduction from ascertained facts, any work can be designed with confidence as to its stability against undermining if its horizontal base width with its vertical depressions and sinuosities added in, i.e., l, equals $c \times H$. Under these circumstances any failure of a work on a porous foundation is often extremely valuable as furnishing an additional fact on which a reliable value for c can be deduced suitable for the particular description of sub-stratum in question.

Such a failure, from which some useful deductions may be made, recently occurred in an irrigation project which, for the present, shall be nameless. The details of the design, the collapse of a portion of the work and the lessons which may be learned from the collapse are given below.

The diversion works in question are located on a river which is split in two channels by an island, and both



Figs. 2 and 3. Views of Intake before and after Failure

The proper safe value of this factor is found, not by artificial experiments on a small scale, but by indisputable statistics which bear on the capacity of the various pervious materials which may compose a river bed to resist

channels are crossed by diversion weirs, connected by a riprapped embankment across the island. Each of the weirs is a little over 500 ft. in length and the embankment is 2000 ft. long. The canal takes off at one end of one of the weirs, Fig. 1, where are situated the weir scouring sluices, two openings 5x10 ft. each, and closely adjoining is the canal intake, consisting of five openings

*44 Dupont St., Toronto, Can.

†Engineering News, Dec. 29, 1910, p. 705; Correction, Jan. 12, 1911, p. 52; Apr. 13, 1911, p. 443.

each 8x10 ft. The full supply of the canal is 8 ft. deep, with a discharge of 1500 sec. ft.

The river is supposed to have a maximum discharge of 118,000 sec. ft., which will cause an afflux of about 9 ft. above the crest of the south weir. The principal levels are as follows:

Crest of south weir	El. 2971
Crest of north weir	2975
Low water level	2960
Flood afflux	2983
Sill of weir sluice	2961
Sill of intake sluice	2965

The maximum statical head acting on the weir occurs when the water upstream is at crest level and the chan-



FIG. 4. VIEW LOOKING UPSTREAM AT WEIR SLUICES AFTER FAILURE
(Position of view shown on Fig. 1)

nel below at low-water level, viz. 14 ft. (Fig. 6.) The maximum head acting on the intake occurs when the river is in full flood and the canal below empty and is then 18.5 ft. (Fig. 9.)

The materials of which the bed of the river is composed consist of boulders, gravel and sand. A safe value for the percolation factor c should, it is deemed, be not less than 6, consequently the requisite length of travel including any vertical depressions beneath the weir or the weir sluices should be $14 \times 6 = 84$ ft., while for the intake the value of l should be $18.5 \times 6 = 111$ ft.

On analysis it will be found that the weir proper falls short of this, but the other works were provided with a sufficient length of travel, provided the fore aprons had been made thick enough to withstand the uplift, which is taken from about the same location, shows its condition after the settlement of the foundation. Fig. 1 is a view of the weir sluiceways after the collapse.

ALIGNMENT OF WEIR SLUICES

With regard to the alignment of the work, the function of weir scouring sluices is to maintain a clear channel in front of the canal intake. To effect this it is requisite that the latter be situated close adjoining to the sluice ways and be aligned at right angles to the axis of the weir. A further necessary adjunct is the provision of a "divide" wall with deep foundations between the weir and the approach and escape channels of the sluices.

This wall protects the weir from the consequence of any disaster occurring to the sluices, which are always a vulnerable point, and further promotes scour by confining the channel. In these works no divide wall whatever had been provided, with the natural consequence that the failure of the weir sluices carried with it a considerable length, viz., 40 ft., of the weir itself.

The alignment of the canal head being at an angle of 135°, not 90° with the axis of the weir, neutralizes the useful effect of the scouring sluices. Reference to Fig. 1 will clearly show that a triangular spit of gravel or sand is bound to be deposited in front of the gates of the intake, the prevention of which is the essential function of the weir sluices; their value therefore, owing to this wrong alignment, is largely discounted.

WEIR PROPER

Figs. 5-7 are profiles of the weir at different locations. From these figures it is apparent that the weir body consists of a solid triangular mass of concrete which is provided with rear and fore aprons of like material. The levels of these aprons and that of the base of the structure itself were made to coincide with the bed of the river channel as it existed at the time of construction. Wherever a dam is founded on solid bedrock, the carrying down of the profile in this way is to be commended as being the most economical method. When, however, as in this case the bed of the river is composed of loose material which can easily be shifted either forward or sideways by the action of water in a high state of commotion, as would naturally occur below an overfall weir, such a procedure is open to strong objection. In every river bed, some part or parts of the water section are deeper than

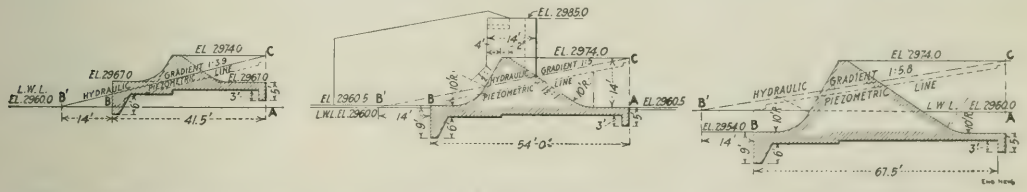


FIG. 5. MINIMUM SECTION FIG. 6. SECTION ADJOINING SLUICES FIG. 7. MAXIMUM SECTION

FIGS. 5 TO 7. SECTIONS OF MAIN WEIR, SHOWING HYDRAULIC GRADIENT AND PIEZOMETRIC LINE

very considerable. This they were by no means capable of doing, consequently with a comparatively low head they blew up and the fore aprons once destroyed, the length of travel of the percolation was reduced to a figure much below 84 ft., so that the works were immediately undermined and collapsed bodily.

Fig. 2 shows the intake before destruction and Fig. 3, the rest, forming a depressed channel which carries the greater part of the discharge. When, however, as is the case with an overfall weir, a level wall is built across the river, the volume passing over is practically the same at the ends of the crest as in the center, or wherever the deep channels exist.

These depressions therefore tend to become obliterated

below the weir as they undoubtedly are in the upper reach and this process of leveling up takes place at the expense of the higher parts which become gradually denuded. This being the case it is distinctly erroneous to design the foundations on the assumption that the river bed will remain unchanged in profile as if it were rock, after the weir is built and the conditions of flow radically altered. The proper procedure in all such cases is undoubtedly to level up the bed artificially by excavating the higher parts and with this material filling up the hollows, the latter being protected by deep curtain walls to retain the fill. On the platform thus formed the concrete weir wall with its complements, the rear and fore aprons, which are placed generally at low-water level, is built.

Thus inexpensive fill takes the place with perfect safety of a solid concrete mass. Many examples of this construction exist in river weirs in the United States while in Indian works light friable sand is made to do duty in the same manner, all that is essential is the provision of sufficiently deep protective curtain walls, in order to prevent any possible movement of the inclosed fill.

The hydrostatic conditions being the same right through, i.e., a maximum head of 14 ft., the length of travel of the enforced percolation should also be the same throughout. Examination of the profiles in Figs. 5-7 shows a considerable variation in base width and consequently also in the values of *c*.

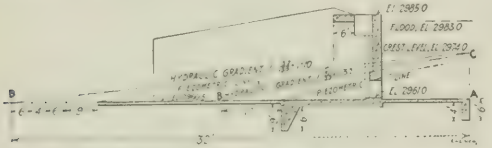


FIG. 8. CROSS-SECTION OF WEIR SLUICES, SHOWING HYDRAULIC GRADIENT AND PIEZOMETRIC LINE

Thus in Fig. 5 the hydraulic gradient works out to 1 in 3.9, in Fig. 6 to 1 in 5, and in Fig. 7 to 1 in 5.8. These grade lines are marked on each of the profiles, together with the parallel piezometric lines which demonstrate the height to which water would rise if piezometer pipes were inserted through the impervious base, and consequently the area contained between the piezometric line and the base represents the uplift in terms of the depth of water. If these graphical lines were drawn in on every design of a work subjected to uplift, mistakes such as are being chronicled would be impossible, for the reason that the extent of uplift and that of the virtual slope at once appeal to the eye. The piezometric line, which the writer was the first to introduce, when the base is only horizontal, coincides with the hydraulic gradient, but when vertical depressions occur in the base, it is stepped down at these points, and then the outline is lowered below the hydraulic grade line. Its application is most simple, and only requires a pencil, a parallel rule and a few grains of common sense to effect. Take any of the profiles, e.g. that in Fig. 5, it will be seen that there is a point of ingress for the percolating water, *A*, and a point of egress *B*, the distance between these is the horizontal measurement of the length of travel of the percolating fluid.

To obtain the hydraulic grade line graphically, the line *AB* has to be lengthened to *B*¹ to the extent of the sum of the vertical depressions below the base line. The percolating current has been proved by experiment to cling to the sides of the vertical obstructions, the length of travel being measured down one side and up the other, except in such cases where the vertical obstructions are closely adjacent. In Figs. 5-7 the point of ingress is at *A*, that of egress is at *B*, the end of the fore apron, at low-water level. The line *AB* is prolonged to B^1, BB^1 being made equal to 14 ft., which is the sum of the vertical components of the travel, viz.: 5 + 3 + 6 ft., the final one at the outside of the cut-off wall being omitted from consideration, as it varies in value in the different sections and if scour took place would be nonexistent. The effect of sheet piling below the fore curtain is also neglected. The line *AC* made equal to *H*, the head of 14 ft., is drawn vertically and CB^1 the hypothenuse of the triangle CB^1A is then the hydraulic gradient, which is $\frac{l}{H}$, or $\frac{55.5}{14} = 1$ in 3.9.

The piezometric line is formed as follows. In Fig. 5 the vertical depression 6, 3 and 5 ft., respectively, are marked out from *B* to B^1, in reverse order; from the points thus obtained lines parallel to CB^1 are drawn intersecting verticals drawn up from the reciprocal vertical depressions in the base line. The piezometric line is thus stepped down wherever a vertical step down or up occurs in the base, the depth of each step being obviously equal to the actual vertical travel divided by *c*. Thus the depth of the initial step at *C* will be $\frac{5}{3.9} = 1.2$ nearly, the next will be $\frac{3}{3.9} = 0.75$, and so on. The graphical procedure, however, avoids any such calculation, the same result being produced automatically by the method described.

In the maximum profile, Fig. 7, there is clearly great waste of expensive concrete whose place could well have been taken by protected boulder and gravel fill, whereas in Fig. 5 the whole profile lies above low-water level exposed to having its foundations eroded and deposited in the deep central channel, while its hydraulic grade is only 1 in 3.9 instead of 1 in 6. Its condition is therefore considered decidedly unsafe and it only requires a very low river or a high flood to bring about a catastrophe. The only hope lies in a thick deposit of silt taking place upstream, forming a natural impervious rear apron which will throw the ingress point of the line of percolating travel further back and so flatten out the hydraulic gradient to a safe ratio. This natural action of silt-laden water has saved many an ill designed work from inevitable destruction by undermining. It cannot, however, be depended upon and in this case unfortunately the river is not much of a silt bearer.

The outline of the profile of the weir is distinctly crude. It is that of a trapezium with a crest width of 2 ft., increasing in thickness in the ratio of $\frac{2}{1}$, whereas this slope should be more in the relation of $\frac{2}{3}$. There is, therefore, a surplusage of material which is wholly useless. Such a profile is only suitable for a hollow dam, similar to the Ambursen type, the weight of the material in which is insufficient to withstand the horizontal water moment without assistance. The additional weight required is obtained by sloping the back so as to cause it

to support a mass of water as well, and further insures a wide base. What is then suitable under totally different conditions becomes wasteful when applied to a solid dam. Where material would be of value is in the horizontal aprons which are alarmingly deficient in length. The rear apron requires widening to bring the hydraulic grade down to 1 in 6, while the fore apron has a width of only 12 ft. which undoubtedly requires supplementing, not however by an impervious floor, but large blocks of concrete laid with open joints, as was done in the case of the Granite Reef dam on the Salt River, Ariz.*

A properly designed solid weir under prevailing conditions would have a crest width of 6 ft. and a base width of about 13 ft., which will be just half the superficial area of this profile at a depth of 14 ft. The most suitable design, however, would probably be of the buttressed-slab or buttressed-arch type.

Weir Sluice

A section of the weir sluice is given in Fig. 8. The rear apron of the weir, the only commendable feature in that crude design, has been carried at a reduced thickness right across the rear of the weir sluice till it runs into that of the intake (Fig. 1). The latter is therefore practically devoid of a rear apron, two bays being without any such protection. Under these circumstances, inspection of Figs. 7, 8 and 9 will show, that under a head of 11 or of 9 ft., the uplift is greater beneath the canal intake than that acting on the weir sluices. The great advantage of a rear apron is apparent in these figures. It throws back the incidence of the point of ingress and the perpendicular of the triangle CAB^1, thus flattening the hydraulic grade and reducing the uplift. A line of deep sheet piling would have a similar effect, but in a boulder formation an impervious diaphragm is impossible of realization since even with the introduction of sheet-steel piling the presence below the surface of large boulders will cause the separation and bending of the piles, leaving gaps. For this reason the sheet piling which exists at the end of the fore apron of the weir has been omitted from consideration, as having no statical value. A fore apron or fore sheet piling has the opposite effect to the rear apron, as it tends to throw the point of egress farther outward, thus increasing the uplift.

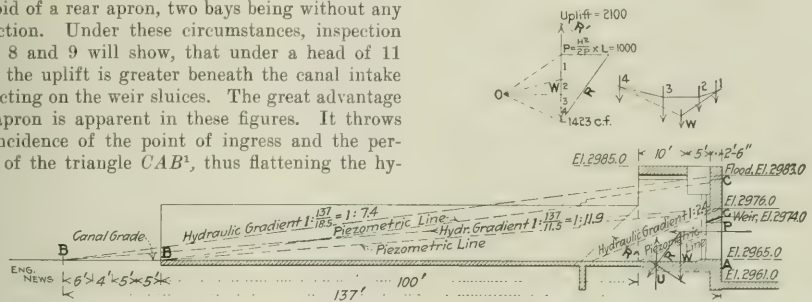


Fig. 9. Cross-section through Intake, Showing Hydraulic Gradient and Piezometric Line

Intake

With remarkable fatuity a fore apron 1 ft. thick no less than 100 ft. long had been added on to the intake. The fatal error was the immediate cause of the catastrophe, the uplift, even with a low head of 11 ft. or 9 ft., with water only at crest level, was far too great for a thin floor to stand and naturally it blew up with great force not only beyond the intake head but as far as could be seen the floor situated between the piers themselves was also upset. When this occurred the hydraulic gradient suddenly fell back from 1 in 12 to 1 in 2.4, a value of c which for the full flood levels is graphically delineated. If the fore apron, which was directly responsible for the disaster, had not been built the intake would still have failed by undermining, the percolation factor being in that case no higher a value than 3, while that of the weir sluice is 5.2. At full flood levels the hydraulic gradient would be as steep as 1 to 1, in the case of the intake.

Had a sufficiently wide rear apron been provided, which could be composed of a thick layer of clay, covered with riprap and the fore apron or floor rendered pervious, the work would have been perfectly safe. It is an extremely massive construction, the piers being 4 ft. in thickness of solid concrete. In cases where the foundation is porous, weight in a structure except as regards overturning moment, is of little value. It certainly has the property of retarding disintegration of the loose substratum, but failure must occur sooner or later by undermining, if the hydraulic gradient is too steep. The work is now a complete ruin and has been blown up to remove the gates.

Repairs

A new intake will be built at another site, as the river is wide enough at this part to allow plenty of space for the purpose. Weir sluices will be of no use and the

*Engineering News, Oct. 1, 1908, p. 366; Jan. 7, 1909, p. 1.

scouring will have to be accomplished through the intake itself, utilizing an escape head which is built lower down as outlet. The weir will be shortened by 40 ft., as it is proposed to build a south abutment at the point where the fracture took place.

Port Angeles Dam

The accounts of the accident to the dam at Port Angeles, Wash., contained in Engineering News, Dec. 5, and 26, 1912, are of interest as a demonstration of how little the principles governing the design of dams and weirs built on a porous foundation are understood.

The head of water upheld in this case is 100 ft. The length of travel is as follows: horizontal, 197 ft.; vertical, $2 \times 10 = 20$ ft. (around the sheet piling), or 217 ft. total. The head being 100 ft., the hydraulic gradient will be 1 in 2.17.

A percolation factor of a little over 2 is absurdly inadequate for gravel; it is considered that 6 is the very minimum allowable value. This increased length of travel can be easily provided by simply lengthening the rear apron of puddle or clay 323 ft. and also providing sheet piling 40 ft. deep underneath the dam. That in front of the dam is clearly of no use whatever, in fact, if effective it would be positively detrimental as increasing the uplift. The new length of travel would then be 600 ft. made up of 520 ft. horizontal and 80 ft. vertical travel. The profile of the wall could then be largely reduced in sectional area. The profile as it stands is wasteful and primitive. If a core wall reaching down to rock and forming a watertight connection with the same on all sides were built it would obviate any failure by undermining. The uplift, however, would be very great.

⁂

The Semi-centenary of Underground Rapid Transit railways was celebrated in London, on Jan. 10, of this year. Prior to 1863 and as far back as 1844, a number of the various railways entering London had stations within the city limits between which they operated a passenger service, but in every case the lines were merely the termini of the main railroads running out of the city. As early as 1846, however, the overcrowding of the London streets and the consequent difficulty and danger of locomotion began to be a matter for public discussion. New lines of streets were formed and fresh channels of communication opened, but the traffic continued to be greater than the service.

At length, in 1846, a parliamentary committee examined and reported upon a number of different projects to remedy the difficulty. About 20 schemes were submitted to this committee, most of which were merely intended to extend the existing roads. A few, however, proposed to lay new local lines either in what they termed railway streets, that is, new thoroughfares to be formed by wholesale demolition of buildings, or in open cuts which meant the conversion of streets into trenches, or on viaducts. One proposal, that by Charles Pearson, then the city solicitor of London, suggested that a new line be built into the crowded district of London as a shallow subway. This project was intended to have six tracks in the subway with an 80-ft. road above. Mr. Pearson's suggestion was not carried out, but he was engaged to work out a system of metropolitan subways somewhat on the same plan as the one which he suggested. As a result of his study, in 1859 parliamentary permission was obtained to build what afterward became the first underground rapid transit subway under the direction of the Metropolitan Ry. The first section of this road was opened on Jan. 10, 1863.

The subway was built as a single arch tunnel carrying four broad-gage tracks with multiple-car trains drawn by a steam locomotive. So great was the success of the short line first built that immediately thereafter plans were formulated for the construction of a much more extensive line, which eventually developed into the present Metropolitan District Ry. A view of one of the first trains and a short history of the railway appears in the "Engineer," of London, for Jan. 10, 1913.

Corrosion of Spikes in Ties Treated with Zinc-Chloride*

In the past 12 or 15 years the use of the zinc-chloride process for treating ties has extended to numerous railways covering the territory west of Chicago, and with this largely extended use of the process there have been instances where serious corrosion of spikes (and tie-plates also) has occurred. Such damage, however, is by no means general. On some roads, where such ties have been in use in large numbers for many years, there is no evidence of corrosion of track fastenings (either in hard-wood or soft-wood ties). On other roads, the corrosion appears in some localities, while in others it is absent.

The cause of the corrosion is not well understood. In the earlier days it was laid to the presence of free acid in the treating solution, and this may be responsible for cases of recent occurrence. The treatment of ties is now done more largely by contracts and, there may be more hasty methods of handling the ties, with possibly less attention to the purity of the solution. The remedy is adequate inspection at the treating plants by representatives of the railways.

In the Wellhouse process, a weak solution of glue and tannin or tannic acid is either mixed with the chloride or is applied later as a separate solution, in order to plug up the cells and prevent the entrance of moisture to leach out the zinc-chloride salt, which is easily soluble. It has been claimed that no corrosion of spikes has been noticeable where glue and tannin have been used. On some roads it has been noticed that while steel spikes have been appreciably corroded in zinc-treated ties, iron spikes have shown no evidence of corrosion.

The most widely prevailing opinion as to the cause of corrosion has reference to the seasoning of the ties after treatment. It is thought that if zinc-treated ties are immediately put into the track the spikes will corrode, but that if the ties are permitted to dry out, so that all the salt has solidified, there will be no appreciable corrosion. It is an interesting fact that in all cases of corrosion the action on the spike is most intense at the face of the tie. Others claim that the supposed greater activity of the corrosion in freshly treated ties is due to galvanic action, and that when once the solution in the tie becomes evaporated, the dry salt will not act upon the spike or other fastening. Contrary to this view is the fact that spikes in tracks at the doors of tie-treating cylinders, constantly exposed to the dripping of zinc-chloride for periods, as long as ten years, show no evidence of corrosion, while spikes in untreated ties in main track (in the same neighborhood) in service the same length of time, have become badly corroded. However this may be, it is in line with good practice to give treated ties time to season before putting them into the track, as the zinc-chloride, once solidified, is less liable to be leached out of the tie by the dampness of the ballast.

On electric railways the corrosion of spikes is more frequently met with than on steam railways, and it is thought, that it is more rapid in zinc-treated ties. It seems to be agreed that the corrosive action is caused by electrolysis from the currents which escape to the ground from the return circuit of the track. In the case of ties treated with a metallic salt the path to the ground would naturally be easier than through untreated ties. There is the question of a similar action on the spikes from the track circuits of electric block signals. Inquiry, however, fails to show that any case of spike corrosion can be traced to the signal circuits. It might be worth while to investigate whether the corrosion of spikes in steam railway tracks might not in some cases be caused by stray ground currents originating in an intersecting or parallel track of an electric railway.

On a railway system where corrosion of steel spikes in zinc-treated ties had occurred, experiments were undertaken to determine the relative corrosive effect on spikes driven in untreated ties, in ties treated with zinc-chloride and in ties treated with water. After seven years of service the spikes were pulled out and it was found that corrosion had taken place with all the spikes under the three test conditions, and that the differences were so slight that conclusions in favor of any one of the three seemed unwarrantable. On some roads where corrosion has occurred it has been found difficult to determine whether or not the corrosion in treated ties was more than in the untreated ones. This makes it certain that some other agency than zinc-chloride was responsible for at least some of the corrosion. On other roads, inspection has shown that corrosion of spikes on zinc-treated ties was caused by the brine drippings from refrigerator cars.

*From a report by W. M. Camp, published in the "Bulletin" of the Roadmasters and Maintenance-of-Way Association.

EDITORIALS

The semiannual INDEX to ENGINEERING NEWS, that for Vol. 68, July-December, 1912, is mailed with this issue. All subscribers who fail to receive a copy should notify this office as soon as possible.

The poor old horsepower, like the hound dog in the campaign song of last fall, is being kicked around in a most unfeeling way of late. As noted in these columns a week ago, the myriawatt (10,000 watts) is being blandly offered to the engineering public as altogether better than the horsepower. It's almost the same as a "boiler horsepower" anyway, say its sponsors, so why not shove the horsepower back out of sight?

And now comes the Bureau of Standards with a proposal to make the horsepower an even 746 watts—a proposal which is about equivalent to trimming the ears of the old hound to make him look like an uptodate bull dog. These would-be surgeons do not realize that the hound is too old to stand such an operation. The chances are after he had been trimmed he would not know where he was at and his old friends would have no further use for him.

Fortunately for the horsepower, like the hound dog, he has some staunch friends left, who will protest against his being kicked around. It will be a long time, we believe, before the term horsepower disappears from commercial usage. The electrical engineers can think in watts, and so probably can numbers of other engineers trained in the technical schools; but to the average man the horsepower has a concrete meaning which the watt cannot possibly have. There is no objection, of course, to the kilowatt or to the myriawatt, for that matter, if the natural process of evolution shall establish that new unit as a definite breed; but let us not imagine that by simply kicking the horsepower out of the back door he is going to disappear. Old hounds have a surprising vitality, and our guess is that he will be able to follow the trail for many a long day yet.

Engineer Members for the New York Public Service Commissions

The American Institute of Consulting Engineers deserves the approbation of the profession for the aggressive attitude it has taken in urging upon Governor Sulzer of New York that engineers should be selected to fill the existing vacancies in the New York Public Service Commission. A delegation of Institute members went to Albany, on Jan. 22, and interviewed Governor Sulzer and also left with him a letter setting forth the reasons why engineers should be selected for these positions.

Of even greater importance perhaps, because of its influence upon public opinion, is the fact that the Institute took measures to give proper publicity to its action. The New York daily papers of Jan. 30 and 31 gave prominent space to this appeal from the Institute representatives. The following quotation from the argument by the Institute's representatives before Governor Sulzer is well worth putting on record in these columns:

> At a recent meeting of the American Institute of Consulting Engineers the undersigned Committee was appointed to present the views of that Institute, and what are probably the views also of a majority of the engineering profession on the subject of appointments to the Public Service Commissions of this State.
>
> We have no personal or individual ambitions to serve and no candidates to present, but as citizens, however, and expressing the sentiment of a body of professional men who, more than any other understand the problems involved in the execution and management of great public works, we may be permitted an altruistic viewpoint, and speak for what we believe to be the best interests of the city and the State.
>
> * * * * *
>
> It is unnecessary to here go into the history of the changing activities of the New York Commission, but had it been constituted as above indicated [with able engineers among its members] the preparation of unworkable and costly plans for the so called Triborough System, now largely abandoned, for which not a single bid for operation was received, would not have occurred. The plans for so much of the original routing as constitute a part of the dual system under consideration have, because of the activities of engineers, already been changed so as to effect a saving of many millions of dollars. With a commission, thoroughly informed on questions of construction and transportation, rapid transit would already have been an accomplished fact on terms creditable and fair to both city and the transportation companies.
>
> The new commissioners, whether chosen because of experience in executive and business affairs, or legal attainments and knowledge of corporation law, or special railway experience, training and knowledge, or wide engineering experience should be men of such character and standing as to command not only your own, but the public's confidence.
>
> This committee believes that the best interests of the community will be conserved, and the maximum of credit accrue to your administration, if you establish the practice obtaining elsewhere of selecting for the Public Service Commissions, men of broad engineering experience, not because of their profession as engineers, but because the problems continually confronted are best solved by men of character and executive capacity who have had engineering training.
>
> There are ample precedents for your guidance. The National Government selected engineers for its Canal Commissions and an army engineer officer to supervise the Panama project in its entirety; Chicago employed an engineering board to settle its financial, constructive and operating transportation problems, and another board of three engineers to determine its rapid transit system; the Pennsylvania Terminals, costing $125,000,000, was supervised by an engineering commission, and the road's president is an engineer; the New York Central's Terminal improvements, of enormous cost, were largely determined by engineering boards, and in Massachusetts and elsewhere Public Service Commissions include engineers of standing. But whatever the character of the work, its supervision by men of the type of Goethals would be a public guarantee that energy, sanity and economy would characterize the work undertaken, and we wish to voice in some measure the belief that a change in the character of Public Service Commissions so as to comprise men equipped with engineering training is essential for the best results.
>
> The practice has often obtained for the Governor of a State to ask the advice of professional bodies from which candidates can be selected to fill appointive public offices. New York is the headquarters of engineering societies comprising an aggregate membership of over 20,000.
>
> We take the liberty of urging you, first, to make the appointments of such Commissioners absolutely independent of political or other pressure, and second, to appoint men of engineering training selected by you from a list of, say, a dozen men to be submitted on your invitation by the Presidents of the five National engineering societies in coöperation with

the Presidents of the Chamber of Commerce and the Merchants' Association.

Such aggressive action by the leaders of the profession is the proper procedure if engineers are to take the prominent position with respect to public affairs that the profession as a body believes they should hold. The organizations in other professions—architects, lawyers, physicians, teachers—are active in defending the interests of their members when issues are pending in state legislatures, in Congress or before public officials. There is no reason in the world why organizations of engineers should not be similarly active in support of the interests of the profession.

Moreover, such work is actually work for the public benefit and for good government, as well as for the interest of the profession. For it is well agreed that only by putting men with some understanding of technical matters in responsible charge of engineering works, can there be any assurance of obtaining good results.

Since the above was written, Governor Sulzer has appointed two judges to membership on these Commissions. Nevertheless, the strong presentation by the Institute of Consulting Engineers was well worth making. It is only by such widely published statements as to the value of expert engineers in public service that public opinion will become educated to understand the reason for some of the serious failures of popular government.

The Efficiency Society

Is the recently formed Efficiency Society, which held its first annual meeting in New York last week, to be classed as an engineering organization? Its principal officers are engineers and there was a sprinkling of engineers among the 80 or 100 persons in attendance at the sessions. We doubt, however, whether the organization can properly be classed as an engineering society.

In fact, so far as efficiency in relation to engineering work is concerned, it is difficult to see any reason justifying the establishment of a new society. A special section of the American Society of Mechanical Engineers has been organized devoted to the so-called science of management, which seems to fill all the necessary requirements, for the mechanical engineers at least. As for the engineers in other branches of the profession, the furor over the so called new science of management does not appear to have created any great excitement among them. It is well recognized that problems in connection with the organization and management of enterprise are a part of the engineer's job, but these problems [illegible] work of the civil and mining and electrical engineer began to be carried on on a large scale.

If, then, the Efficiency Society is to do a useful work, it must appeal to a much wider field than the manufac[illegible] with which engineers are concerned. Indications are, in fact, that the society is endeavoring to find itself by doing this very thing. Its president is the head of a national bank and while the majority of names on its list of directors are engineers, there are in[illegible] executives, sales officers and heads of publicity enterprises.

In the recent twoday meeting the program may be summarized by stating that the three sessions on the first day were devoted, respectively, to the subjects of organization, management and efficiency in government work; on the second day to industrial relations and industrial hygiene.

Confining our attention to the subjects dealt with at the first two sessions, it is undoubtedly true that we need to develop a more definite science of organization and of management. It is a question, however, whether the proceedings at these sessions shed any light upon these important problems. Some of the papers appeared more likely "to obfuscate the subject," in the colored brother's words.

For example, one of the papers had the high-sounding title, "Scientific Selection and Assignment of Men in the Creation of an Organization." The young woman author of this paper laid down the admirable general principles that the work each man should be given in an industry should be the sort of work for which he is physically and mentally adapted.

As many of our readers know, the work usually known as vocational guidance consists in aiding young men and young women on leaving school to intelligent selection of an occupation, and is being developed to an important extent in connection with philanthropic and educational agencies in some of our cities.

It was soon evident, however, that it was not at all this class of work that the young woman author of the paper had in mind. Her thesis was that the employment department of an industrial concern should be "in charge of expert character analysts, who interview, select and assign men applying for positions." What she meant by "expert character analysis" was further explained in the latter portion of the paper as follows:

> He who would become proficient in human analysis must, therefore, lay tribute upon biology, anthropology, physiology, anatomy, physiological psychology, history, political economy and sociology. He must also make for himself and secure from others the results of years of patient, painstaking, widely extended scientific research into the workings of the law of cause and effect, both in nature and human nature.
>
> It is a law of nature having universal application that the size, color, form, proportion, texture, consistency, and structure of an object indicate its function and use.
>
> We determine the difference between an orange and a shotgun through comparison of size, color, form, proportion, texture, consistency and structure.
>
> The same law is applicable without modification to human beings.
>
> It is obvious that size of body fits or unfits a man for a given kind of work. If the work requires covering great distances, the short, stout man is sorely handicapped because he is not built for easy locomotion. On the other hand, much stooping or bending is difficult for the tall, rangy-built man.
>
> Blondes and brunettes do not work in the same manner. They naturally incline to different lines of work. Generally speaking, blondes are speculative and optimistic; usually mild and good natured; often inventive; like to conceive the idea or plan for someone else to work out. They naturally incline to aggressive work, such as salesmanship, advertising and promotion.
>
> Brunettes incline to conservatism rather than speculation; often serious minded; sometimes inclined to gloominess; like to work out and perfect the plan which some other mind has conceived.

The above quotation sheds some light on what the author of the paper meant by "scientific character analysis"; but a much more illuminating explanation came when, in response to a request from the audience, the young woman consented to give an exhibition of her powers of character analysis. A volunteer from the audience was brought upon the stage and the young woman, first carefully examining his hand, explained the significance of the distance between the thumb and certain of the fingers, the flexibility of the hand, the length of

the fingers, etc. Then taking a view of the subject's features she proceeded, without questioning the subject in any way, to delineate his character and explain what sort of occupation he was best adapted for. The whole exhibition was strongly reminiscent of the acute character reading which was done by traveling phrenologists a quarter of a century ago. It seems well-nigh unbelievable that it should find a place in the proceedings of a so called scientific society at the present day.

Lest it be thought that we are giving undue prominence to this feature of the Efficiency Society's program, it should be noted that it was this which attracted chief attention on the part of the public and was heralded in large headlines by the daily papers as the principal event of the session.

*

Second Report of the "Joint Committee on Concrete and Reinforced Concrete"

While the "Joint Committee's" second report, presented at the recent annual meeting of the American Society of Civil Engineers, differs only in secondary detail from its first report, it has very much greater importance. To realize this it is only necessary to recall the history of the Joint Committee.

Beginning in 1904—or perhaps in reality somewhat earlier—the committee has been at work for eight and a half years; the final result is the present or second report. The first report, the product of five years' work, was the occasion of fundamental dissension within the committee, and was put forward concededly as a temporary measure, an introductory statement, a primer of the subject. Criticism apparently was expected, and it came, much of it rather sharp; the committee replied to it by stating that a mere progress report should not be expected to meet all demands. This explanation was given, for example, as a defense against the criticism that the report stated only known matters, but did not point out the doubtful or unknown matters, much less investigate them and thereby advance the art; and against the criticism that a mixture of textbook and specification matter did not satisfy the injunction "to investigate and report." Naturally the report had but a qualified standing. But the present report, coming forth as the mature product of over three years' redeliberation, is in a much different position.

We would point to the air of finality inherent in the second report. Nothing is said of tentative conclusions, of its being a progress report, of some phases having been laid aside for the present, of details still under study. No suggestion is made that the committee plans further work, or regards its duties as uncompleted, or has studies under way which will enable it to present new information in a third report. Thus the report stands forth as a real conclusion, the ultimate outcome of the committee's study of the subject. It will go before American engineers, and before our foreign brethren, as the crystallized professional opinion of this country on reinforced concrete (nominally, *concrete and* reinforced concrete; but see the contents of the report on this point).

That this makes the report a very important document indeed, will be apparent. Because it is so important, we have concluded (despite the very wide distribution which the report itself will enjoy) that an abstract of its leading features ought to be printed in ENGINEERING NEWS on the chance that a few additional persons might thus be reached. Such an abstract will be found on another page of this issue.

For study of the report, attention will be attracted by two elements: its positive statements, and the subjects omitted or ignored.

As to the first element, it will be found by the reader that the report is a sane, balanced, well-expressed, exposition of expert conclusions concerning a great number of questions arising in the use or contemplated use of reinforced concrete. Based on many long series of tests made at various places under different conditions and for different purposes, and based also on a decade's practice in reinforced-concrete construction throughout the United States, the positive part of the report takes front rank beyond all question, as a code of good practice in this field of construction.

That this second report contains only minor changes from the 1909 report, and that it agrees substantially with what has been established as good practice for some years past, proves not only that the committee did excellent work in its first period (i.e., prior to the first report), but also that reinforced-concrete engineers have been remarkably wideawake and prompt in following the experimental study of the subject and adapting their practice to the results of such study. The present report, therefore, confirms the conclusions of established practice and stamps the latter with authoritative approval.

The second element which is bound to engage the student's attention consists of the omissions of the report. No burning questions, points of doubt, subjects of criticism or suspicion, etc., appear to have representation in the report. The societies before whom the Joint Committee presents its findings will be bound to conclude that all is serene in the realm of concrete, that nothing requires further discussion or investigation. At the very least, as the committee does not report subjects of further study and, in the course of its text, makes note of practically no serious open questions, the societies must conclude that the committee did not find further questions worthy of its attention. Perhaps there will be critics of the report who will take issue with the Joint Committee on this. There may even be those who will say that the committee in reporting on removal of forms should not have omitted to point out that it advocates purely arbitrary opinion, that there is no scientific or other non-arbitrary method available, and that a test-method for deciding the time of striking centers is one of the crying needs of the art today.

Largely by the effect of omissions—for example omission of all reference to the disturbed feeling in some circles over surface disintegration and "decay" of concrete—the report has a smooth and even tone, to the degree of giving an optimistic impression. This is inevitable in part, if the report is to form a reassuring "basis for specifications." The correct modicum of doubt when referring to durability, or to effect of seawater; or a scientific disclaimer of certainty when recommending unit-stresses, etc., would not be compatible with fullest efficiency in molding the future specifications of the country. Yet there are plenty of other omitted points not under the same ban; as, the matter of a field test already

alluded to, a statement of limitations of knowledge on the agreement between structural concrete and testpieces, an opinion as to the relative homogeneity of concrete made and placed by different methods, and the like. Such omissions as the latter lead to the impression that in drawing the report the cold and plain-flavored bread of fact was buttered and spiced with a little enthusiasm, and with the wish to promote.

Now that the work of the Joint Committee is done, no further work having been reported necessary or in progress, its component committees will, we trust, request their discharge by the respective societies. No good can come of letting the subject of concrete and reinforced concrete float between heaven and earth in the custody of a committee indefinitely. The world has gravely done its share of the Joint Committee's work, by waiting nearly a decade for a final report, and it is entitled to end its waiting. Of course, this is the natural thing, and our mention of it here would be impertinent were it not for the fact that the American Society of Civil Engineers' committee (a component of the Joint Committee), which recently reported, *failed to ask for its discharge or for a specific continuance.* Is the Joint Committee to be as eternal as its subject? If so, we would advocate annual election on the same basis as governs election of officers of the societies.

LETTERS TO THE EDITOR

Purposes of Railway Signaling

Sir—I have read the articles on signaling on the C., I. & L. Ry. and the C. G. W. Ry., in your issues of Jan. 9 and 16, and have found both articles very interesting. The former article, with the summing up of the advantages of block signaling, made the better impression. In Fig. 1 of the latter article is shown a bracket post. This is not a good example of signaling, as the best practice requires the signal to be placed next to the track it governs. Placing it outside of the track and using a stub post is at best a makeshift. The diagrams in Fig. 4 of the same article show too much detail, with the result that it is difficult to trace the circuits, and the batteries and relays seem to be upside down. Some information as to the density of the traffic handled would have added to the value of the article. Signal systems accomplish two purposes: they provide "safety" and "facility," and both points should be brought out in a signal article.

H. M. Sperry,
General Railway Signal Co.

Rochester, N. Y., Jan. 29, 1913.

[The use of the bracket post in the case mentioned was due to the existence of a siding, and presumably there was not room between the siding and main track to permit of placing the signal in that position. As to the position of the batteries and relays, our readers undoubtedly recognized that these were shown only diagrammatically. We quite agree with Mr. Sperry that the operating results of signaling are fully as important and interesting as the design of signal plant. —Ed.]

Effect of Sugar on Concrete

Sir—In regard to the action of sugar and vegetable oils on concrete, mentioned in your issue of Jan. 16, 1913, the decomposing action in both cases is due to the $Ca(OH)_2$ which is split off during the hydrolysis of the silicates in the cement. In the case of oils, saponification ensues with formation of lime soap, while in the case of sugar a calcium saccharate is formed, which is soluble. The aluminates are likewise robbed of lime by sugar solutions, which result in a soft, weak, porous concrete. The remedy in each case is to reduce the amount of lime capable of being attacked. Canevazzi has reported on the successful use of puzzolana in concrete for resisting the attack of olive oil, and it is suggested that the use of tufa concrete as employed in the Los Angeles Aqueduct be employed in this case. It is further suggested that the concrete surface coming in contact with the oil be swabbed with hot paraffin and the surface then gone over with a blow torch in order to drive the paraffin into the pores. Abrasion and rough usage will not completely remove the film of paraffin and the oil will thus be kept out of contact with the $Ca(OH)_2$ in the cement.

A. J. Phillips.

U. S. Bureau of Standards,
Pittsburgh, Penn., Jan. 27, 1913.

Sir—Having spent several years as a mechanical engineer in and around sugar mills, I may be able to answer the question of F. E. P., whose letter appears in Engineering News, Jan. 16, 1913, p. 126. Your correspondent has failed to discover the probable action of sugar on concrete by laboratory tests because he has assumed that it was the sugar itself which causes the disintegration. I believe it is a fact that strong solutions of sugar and molasses do not injure concrete, and have heard it stated that the Romans mixed molasses with the other ingredients in making the concrete for their ancient structures. These strong solutions of sugar will not alter or putrefy, as is well known from the fact that sugar is used to cure perishable articles of food, but weak solutions of sugar have a very prompt manner of converting themselves into different compounds, several of which have marked acid reactions.

Around osmose presses in sugar factories, where the sugar is a weak solution, it is a common and in fact an inevitable occurrence to have the concrete floors disintegrate to a marked degree, sometimes in the short space of one campaign of 100 days and nights. Similarly, around a battery where the solution is thin a man will commonly wear out a pair of shoes in a few weeks on account of the action of the acid on the leather. I am afraid there is no way in which concrete can be made permanent in places

where weak sugar solutions come in contact with it until a good way has been discovered to make concrete acid proof.

BENJAMIN BROOKS.

1241 Holmes St.,
Kansas City, Mo., Jan. 20, 1913.

Is the Cameron Septic Tank Patent Dead or Alive?

Sir—Having noted in the press reports that the U. S. Supreme Court has not sustained our contention made in the so called Knoxville case [see ENG. NEWS, Jan. 23, 1913, p. 188], that the mere Treaty of Brussels made the 17-year term of our United States patent independent whether the foreign patents were for the same or a different invention, we believe your readers would be interested in the situation as it now stands. Our fundamental position has been, and is, that as a matter of fact none of the foreign patents cover the Septic *Process,* but merely certain *apparatus,* and it is therefore wholly inconsequent whether the foreign patents have expired or not, and our United States patent being for the *process,* is still in force and will continue so to the end of its 17-year term, Oct. 3, 1916. Thus the above mentioned decision in the Knoxville case, even if final, benefits only the one defendant in that city, the city of Knoxville, Iowa, and other infringers being in no way benefitted or relieved from liability to the end of the full 17 years' term. This fact was fully stated in an announcement made by us a year or so ago in a printed pamphlet on "The Septic Tank."

H. D. WYLLIE,
Manager, Cameron Septic Tank Co.

Monadnock Block, Chicago, Ill., Jan. 23, 1913.

Sir—On Jan. 20, the U. S. Supreme Court affirmed the decision rendered by the U. S. Circuit Court for the Southern District of Iowa in the case of Cameron Septic Tank Co. v. The City of Knoxville, and held that U. S. Patent No. 634,423 expired by limitation Nov. 8, 1909, with the expiration of a British patent granted Nov. 8, 1895, for a term of 14 years.

The claim is being generally made by the Cameron Septic Tank Co. that the effect of this decision is confined to the Knoxville case, just terminated after more than three years of litigation. It will be of interest to municipalities which have used sewage-treatment works wherein some septic action has occurred, and to the engineering world generally, to ascertain the facts in connection with this claim.

In this connection the following letter written by Wallace R. Lane, of Chicago, who argued the Knoxville case before the United States Supreme Court in behalf of the city of Knoxville, will be of interest:

Chicago, Illinois.

S. H. Crosby, Esq.,
Denver, Colorado.

Sir—Answering your letter of recent date, relative to the stipulation in the Knoxville case, I do not have before me, the statement of Geo. W. Fuller in his recent book on "Sewage Disposal," but call your attention to the stipulation made in the Knoxville case which reads:

That the allegation in the Plea to the effect that the invention patented in the United States Letters Patent, issued to Edwin [should be Donald—Ed.] Cameron, et als, on a process of and apparatus for treating sewage, No. 634,123, dated Oct. 3, 1899, set forth in said bill, had been previously patented in a foreign country by said patentee, to wit: in the United Kingdom of Great Britain, by Letters Patent, dated Nov. 8, 1895, and that the said last mentioned patent of Great Britain, expired on Nov. 8, 1909, being the expiration of the term for which it was granted, may be taken as true.

This stipulation between the parties, when taken in conjunction with the admission on the face of the Cameron et als patent No. 634,423, dated Oct. 3, 1899, that it was for certain new and useful improvements in the process of and apparatus for liquefying and purifying sewage (for which the patentees had received Letters Patent in England, No. 21,142, dated Nov. 8th, 1895, also in a large number of other countries), it seems to me, should dispose of any claim on the part of the Cameron Co. that the patent in the foreign country which has expired, was for any different or other invention than that of the United States patent, and it seems to me, such claim should not receive serious consideration by any other Court before whom the matter is presented.

In fact, in my opinion, such admissions as are made by the complainant in this case, and on the face of the patent, should be conclusive against the complainant company.

As there are numerous suits pending against various municipalities for the collection of royalties claimed under the Cameron patent, it is quite possible that the Cameron Septic Tank Co. may urge the claim referred to above in Court. It is particularly for this reason that I wish due publication to be given at this time to Mr. Lane's letter, which we [the Septic Process League—ED.] believe correctly states the legal aspects of the case.

S. H. CROSBY.

Foster Building, Denver, Colo., Jan. 27, 1913.

[In its decision of Jan. 20, 1913, the U. S. Supreme Court declared in unmistakable terms that the United States patent on the Cameron septic tank expired on Nov. 8, 1909, "with the British patent for the same invention." To sustain any claim to the contrary it would therefore seem to be necessary to get the Supreme Court to reverse its decision, either on a re-hearing of this case or by carrying some other case to the U. S. Supreme Court.—ED.]

Steamboats and Drawbridges

Sir—In the editorial on railway drawbridges in your issue of Jan. 23, you discuss why it is that the water traffic has the right-of-way instead of the railroad.

It is a common idea that, because the railroad traffic is so much greater and more important in these days of declining water commerce on rivers, the railroad should have the right-of-way. I do not believe it is at all because the water traffic was there first, but because of a very different reason which is well known to all men who have the handling and responsibility of steamboats. To arrange it any other way would endanger life and property.

Every boat has to be kept in motion to be under the control of its pilot. When he stops and floats, his boat is the sport of wind and current. In a wide stretch of the river he can wait a good while without the engines being in motion before anything begins to happen; he is comparatively like a sailor in the open sea. But as soon as a boat approaches the draw of a bridge, whether there is or is not a current, the case is different. The pilot's task becomes then the solution of delicate problems of current, wind, momentum, steering power and velocity through the water. All pilots know that they are perpetually combining forces into a resultant that means the wrecking or the safety of the boat.

When near or in the draw opening of a bridge, especially when the current is swift and perhaps a side wind

springs up, you will see the knees of the older pilots knocking together if on a large boat—for they have a keen appreciation of what is going to happen if the calculations are out or if the bridge fails to open as it should before they get too close to be able to save the boat by backing away.

There are bridges on the upper Mississippi River where the current at high water is as much as eight miles an hour. Now few boats going ahead at full speed upstream make much more than that; astern they go much slower and are also much less under command.

Imagine a big boat approaching a draw such as that from upstream and a railroad man undertaking to hold him up with a train; and consider the feelings of the pilot and such of the passengers as have any knowledge of the dangers of steamboating. The train can always stop. It cannot be blown from its course. It undergoes no danger by stopping and there are no currents to bear it down on a bridge and tear its side out against pier or abutment.

The steamboat, then, has the right-of-way because it is, compared with the train, much less under control, and because this is the only way to protect the passengers and crew.

M. MEIGS.

U. S. Civil Engineer, Keokuk, Iowa,
Jan. 26, 1913.

The San Francisco Water-Supply Hearing before the Secretary of the Interior

Sir—In your issue of Dec. 26, 1912, you print in connection with a review of John R. Freeman's report on the San Francisco water-supply a "Summary of Hearing before Secretary Fisher on the Hetch Hetchy Water-Supply," written for you by Mr. Freeman.

While having full regard for the large experience and great engineering ability of Mr. Freeman as manifested in that part of his report which resulted from his own investigations, I do not think it fair that his summary should be considered as complete, inasmuch as it does not mention many important statements brought out by questions of the Secretary of the Interior and others.

The Secretary secured the admission from Mr. Freeman that the figuring involved in his report on the Hetch Hetchy supply was not on a parity with the figuring involved in his report on the alternative sources of water-supply. It was made known, as the inquiry proceeded, that in relation to these alternative supplies Mr. Freeman had been content to use the figures of Messrs. Manson and Grunsky, while he had discarded the figuring of these engineers and had, indeed, shown a lack of confidence in their statements concerning the Hetch Hetchy project. It was also shown that a different unit basis had been used in figuring the costs for the Hetch Hetchy project and in connection with the one alternative source upon which engineering investigation of recognized adequacy was made—that of the Sacramento River, reported upon by Allen Hazen.

The result of these disclosures was to have the Secretary order Mr. Freeman to at once have all the figures put on a parity, so that fair comparisons might be made.

Nor has Mr. Freeman presented the fact that while, as he has said, the various engineers called by the City of San Francisco, with one exception, agreed that the Hetch Hetchy provided an admirable natural source for a municipal water-supply, one of them, Prof. Whipple, said very definitely that "the time is coming when all surface water-supplies will be filtered," and another, Mr. Hazen, showed that the claim as to the comparative softness of the Hetch Hetchy supply was not really important.

Surgeon-General Rupert Blue—who, it will be remembered, was opposed and denounced by the San Francisco officials when he was conducting his memorable campaign against bubonic plague in that city—disagreed with Mr. Freeman and his associates as to the propriety of sanitary reliance upon the purity of any surface source of water-supply when he definitely announced his preference for the filtered water of the Sacramento River rather than the unfiltered Hetch Hetchy water. He was not willing to "skate on thin ice" with the lives of a great urban population, in respect of its water-supply.

Secretary Fisher's searching questions as to the use of the power which might be developed from the impounded Hetch Hetchy water developed an interesting disposition on the part of Mr. Freeman, for he took the stand, as shown by my notes made at the moment, that it would not be wise for the City of San Francisco to develop this power and sell it to its citizens at cost, or to use it in promoting industrial advance. He believed that there should be a profit charged, which he said might be used in "municipal embellishment," and his given reason was that there should be no municipal interference with private corporate enterprises selling electric power.

I wish Mr. Freeman, for whose purely engineering conclusions I have great respect, had kept closer to the facts in his criticism of the opponents, whom he groups under the head of "nature lovers," and who he says "claimed that none of this land, dedicated to the whole of the American people, should be diverted so long as another source was available, regardless of cost." He does me the credit of saying that I did not go quite so far as to agree that the city ought to be "compelled to distill water from the Pacific Ocean," rather than have the Hetch Hetchy supply.

Now the truth is that I said many times in Mr. Freeman's hearing, and to him separately, and have before and since repeatedly put the statement in writing, that I believe, and the American Civic Association stands for the position, that San Francisco should have the Hetch Hetchy Valley, or any other property of the Federal Government, for the purposes of a municipal water-supply, if there is available to her no other practicable source of a water-supply. And this is the position that has been steadfastly maintained by a large majority of those who are questioning San Francisco's attitude in this matter.

The City of San Francisco has been at this proposition for eleven years. All its engineering findings up to the time when Mr. Freeman took charge are by him discarded as valueless, save as they affect the alternative supplies, his consideration of which was seemingly for the purpose of discovering not their practicability, but their impracticability. After all this lapse of time, after the expenditure of more than a million dollars, and after the use by the City of San Francisco of Mr. Freeman's genius on the proposition for about two years, the fact still remains, as brought out at the hearing in question, that no adequate and impartial investigation of all the available

sources of a water-supply for the city of San Francisco has yet been made.

The American Civic Association desires nothing but the greatest good to the greatest number in this matter. It will cheerfully second San Francisco's desires when and if those desires are fairly and honestly shown to be in accord with this principle. That the people of San Francisco have a great doubt as to the practicability of the scheme was rather conclusively shown in the election of Dec. 10, when the charter amendments relating to the progress of the Hetch Hetchy project were rejected by majorities approximating three to one.

J. HORACE MCFARLAND.
President American Civic Association.

Harrisburg, Penn., Jan. 13, 1913.

[In accordance with our custom in such cases, we submitted a proof of Mr. McFarland's letter to Mr. Freeman. The reply of the latter is printed below.—ED.]

Sir—I submit the following reply to Mr. McFarland's letter of Jan. 13:

Obviously, all of the interesting statements made in the five-day hearing could not be reported in the space given to this subject in your issue of Dec. 26. For example, early in the hearing I felt compelled to enter a protest against Mr. McFarland's unjust accusations and wrong statements regarding my presentation of the city's case. Apparently these gentlemen do not understand that an engineer may value and guard his reputation for truth and fairmindedness just as highly as fair words concerning his professional skill.

In the foregoing letter from Mr. McFarland the same spirit of unfair criticism is found in such phrases as "the secretary secured the admission," "result of these disclosures," and the remarks on my lack of confidence in the statements of the two former city engineers.

The facts regarding all of these matters were set forth with the utmost plainness in the reports as originally published. The one important difference was that I used the same price per day for common labor that prevails today on most similar large construction work in California and that which was actually paid on the Los Angeles aqueduct, while certain of the other engineers used the price paid to city laborers in San Francisco, in accordance with an ordinance which will probably be changed. Each engineer's estimate was published over his own signature and with the plainest kind of statement relative to his own unit costs. In my own reports these matters, as any fair-minded man familiar with engineering reports on public works must admit, were set forth with a minuteness of detail that is seldom published.

Mr. McFarland and his associate critics who were not engineers, and who were apparently unfamiliar with engineering estimates, in their comparison of unit costs failed to note that in the alternative projects contractor's profit and general overhead expenses and loading for administration were all lumped into the cost per yard or per foot, whereas in my estimates the "field cost" was first separately reckoned and a careful estimate made in detail for the "loading" or overhead costs, amounting in general to 40% and in some cases to much more.

The supplementary statements filed with the Secretary of the Interior since these hearings, in general, make the difference of cost in favor of the Hetch Hetchy project substantially as great as was originally claimed.

Mr. McFarland ingeniously states that his association stands for the position that San Francisco should have the Hetch Hetchy if there is available no other practicable source of water-supply, but evidently fails to consider that an excess of from twenty to thirty million dollars in the cost of alternative projects, as compared with the cost of the Hetch Hetchy, makes them practically unavailable.

Your space is too valuable to be taken up with such petty matters as these, or with going into details about the biased character of the letter ballot sent out by the Sierra Club regarding the Hetch Hetchy project.

JOHN R. FREEMAN.

Providence, R. I., Feb. 1, 1913.

[In the Hetch Hetchy controversy the city of San Francisco has had to contend with (1) the Spring Valley Water Co., (2) the Turlock and Modesto Irrigation Districts, (3) proponents of rival sources of water-supply, and (4) various associations and individuals who for convenience and sometimes with unmerited scorn have been classed together as "nature lovers," because they are united in opposing what they believe would be the destruction of a beautiful mountain meadow in one of our national parks—but what San Francisco claims would be the mere conversion of a part of a mountain meadow into a mountain lake, and would make the section accessible to the many instead of to the few.

In this controversy, the city, the water company, the irrigation districts and the would-be sellers of rival sources of water-supply have all been represented by engineers, including a number of the foremost hydraulic engineers of the United States. The subject has been vast and complex and involves millions of dollars of rival private commercial interests, as well as the future health and prosperity of San Francisco.

Under such circumstances it is not strange that the "nature lovers," being human, have shown a strong tendency to accept without question the engineering and other claims made by those whose commercial interests ally them against San Francisco and the Hetch Hetchy project, and an equally strong tendency to discredit the testimony put forward in behalf of San Francisco.

Mr. Freeman has touched upon a number of the points raised by Mr. McFarland. He has not, however, called attention to the fact that the San Francisco charter amendments, mentioned in the last paragraph of Mr. McFarland's letter, did not deal directly with the merits of the Hetch Hetchy project, but with such questions as authorizing a separate water-supply board and financing the project outside of the 15% debt limit. Moreover, these questions were tied in with other ones, such as creating a city public-utility commission. Finally, the civic associations of San Francisco united in advising that these and a number of other of the 37 charter amendments voted upon on Dec. 10 be defeated, but none of the arguments which they advanced contained a word against the Hetch Hetchy project.—ED.]

The Machinery Building of the Panama-Pacific Exposition, at San Francisco, Calif., which was put under construction on Jan. 1, 1913, will be the largest frame building in the world, according to its architect, Clarence Ward. It will require "8,000,000 cu.ft. of lumber," it is stated.

How to Repair the Nashville Masonry Reservoir

SYNOPSIS—Rudolph Hering concludes that further leaks into the shaly foundation of the Nashville reservoir, 150 ft. of the wall of which slid out on Nov. 4, may be prevented and the East Basin made safe at a cost of $35,110. Besides replacing the breached wall, it is recommended that the East Basin be given a cement-gun coat of mortar, and the floor of both basins be waterproofed by asphalt felt, protected by concrete, and that a waterproofed wedge be built at the junction of the wall and bottom, and a drain placed beneath this wedge. This done, similar reinforcement of the West Basin is recommended.

The failure of a portion of the wall of one basin of a water-works reservoir at Nashville, Tenn., on Nov. 4, 1912, was described and illustrated in our issue of Nov. 14, 1912, pp. 922-4.* A report reviewing the failure briefly and recommending measures for repair was submitted to the Board of Public Works of Nashville, under date of Jan. 15, 1913, by Rudolph Hering, of Hering & Gregory, New York City.

On Nov. 24, 1912, Mr. Hering visited Nashville upon invitation of George Reyer, superintendent of water-works. A few facts and opinions based on Mr. Hering's inspection of the damaged reservoir will be abstracted from the report to supplement the account of the failure published in our issue of Nov. 14, 1912. We shall then print the substance of that portion of the report which deals with proposed repairs to the reservoir.

The general design of the reservoir and its dimensions, the cross-section of the wall which failed and of the wall designed to replace the breach, and the details of the proposed lining, wedge and drains, are all shown by the line drawings reproduced herewith. The capacity of the reservoir was 50,000,000 gal., divided equally between the two basins. The water line was about 31 ft. above the bottom of the reservoir.

The reservoir was located on the top of a domeshaped hill. The outer parts of the walls were built of limestone, excavated from the site and the inner part was composed of concrete. Louisville natural cement was used throughout. The walls were founded upon "much jointed limestone beds, between many of which are thin layers of shale" (A. H. Purdue, state geologist of Tennessee). At many points, Mr. Hering says, the foundation course of the walls starts not more than a foot beneath the natural surface.

About 150 ft. of the outer wall of the reservoir was pushed outward (see plan). Mr. Hering describes and [illegible] on the break as follows:

[illegible] examination of the rock beneath showed that the [illegible] had been altered to clay at a number of points. It was further found that the failure was apparently due to a slip on a layer of the altered shale, which was about 4 ft. below the top of the rock upon which the wall had been placed. This was evident because about 4 ft. of bed rock adhered to the base and was moved out with it. That there had been a slip was shown also by the fact that the surface of parts of this clay layer was quite smooth, showing that the [illegible] had slipped upon it.

The material of the wall exposed at the breaks was fairly good. No disintegration appeared. The cement mortar was generally hard though here and there quite porous. In some cases it was stronger than the limestone, the latter breaking rather than the cement pulling off. In other cases it was rather soft and could be crumbled with the fingers. Some of the limestone in the wall is of excellent quality; some is poor, laminated and weathered. At some points it was evident that percolation through the wall had been going on for some time. It can be said that generally the masonry and core wall were good and built as average work was usually done at the time of its building, and were in a good condition.

The foundation courses were not found to be so well built. Mortar here and there was more scarce and the masonry was not as compact as in the upper parts. In other places, there were indications that mortar had been used plentifully, indicated by the fact that some of the foundation stones adhered to the rock layers better than the rock layers adhered to each other, and indicated by the fact that portions of the original rock moved out with the wall. The shale and clay layers in the original rock under the wall were quite frequent and varied from ⅛ in. to 5 or 6 in. in thickness.

Before the break occurred, water at the location of the subsequent break ran down freely on the front of the wall, into the natural ground beneath, and into and below the foundation, where it evidently soaked into the soft layers of clay or shale, which had been transformed into clay. This percolation was probably the final cause for removing the frictional resistance of those transformed layers. The percolating water had thoroughly saturated and softened them. They had become slippery like a lubricated surface.

The first rupture no doubt occurred at the central break, where the wall had been pushed out furthest, and the other breaks, one on each side, were consequential.

When the rupture occurred and the wall was pushed out, together with several feet of bed rock holding to it, the mass pushed out the rock layers in front sufficiently to cause a fold in the layers, which was quite apparent at the inspection. A thick clay layer located about 4 ft. below the bottom of the wall is probably the one which caused the initial slip.

There seems to be some doubt as to whether the entire floor of the reservoir was covered with Louisville cement concrete and if so, what the depth of concrete was. At the break it is evident that such a floor existed, but the depth may vary. At the places observed it was about 12 in. thick.

The walls have stood 23 years without significant, if any, settlement. They have a sufficient cross-section to store water to a depth of 31 ft. and are fairly well built, but they leak at numerous places and this leakage flows down their outer side and is liable to cause softening of the clay beneath the foundations and thus give rise to further slips. "There is no evidence of percolation through the bottom of the reservoir," Mr. Hering states, "but as such percolation is not improbable it should be assumed that it occurs."

After considering all the governing conditions, Mr. Hering concludes that the reservoir can be made safe by preventing further leakage into the natural foundation. This can be done, after closing the breach, by lining the inner walls and the bottom, and placing a waterproofed concrete wedge and a drain at the junction of the two. The nature of this work is explained as follows (see also the detailed drawings):

(1) In order to secure watertightness of the present walls they should receive a lining of cement mortar over the entire inside surface of the reservoir, applied by what is known as the cement gun. Wet cement mortar of a proper mixture is shot against the surface of the wall, after this has been thoroughly cleaned, first by thorough washing and scraping, then by sand blasting, which will make the adhesion of the cement complete. The density of this gun cement is very great, and it penetrates into all open crevices and covers every fine crack. An average thickness of about an inch is more than enough to make a wall entirely watertight. Details of application are given in the appended specifications.

(2) In order to make the floor of the reservoir watertight it should receive, after thorough cleaning, a layer of 5-ply asphalt felt [see detail]. Upon this layer, which secures the watertightness of the floor, there should be placed, to protect it, preserve it and keep it in place, a 4-in. layer of

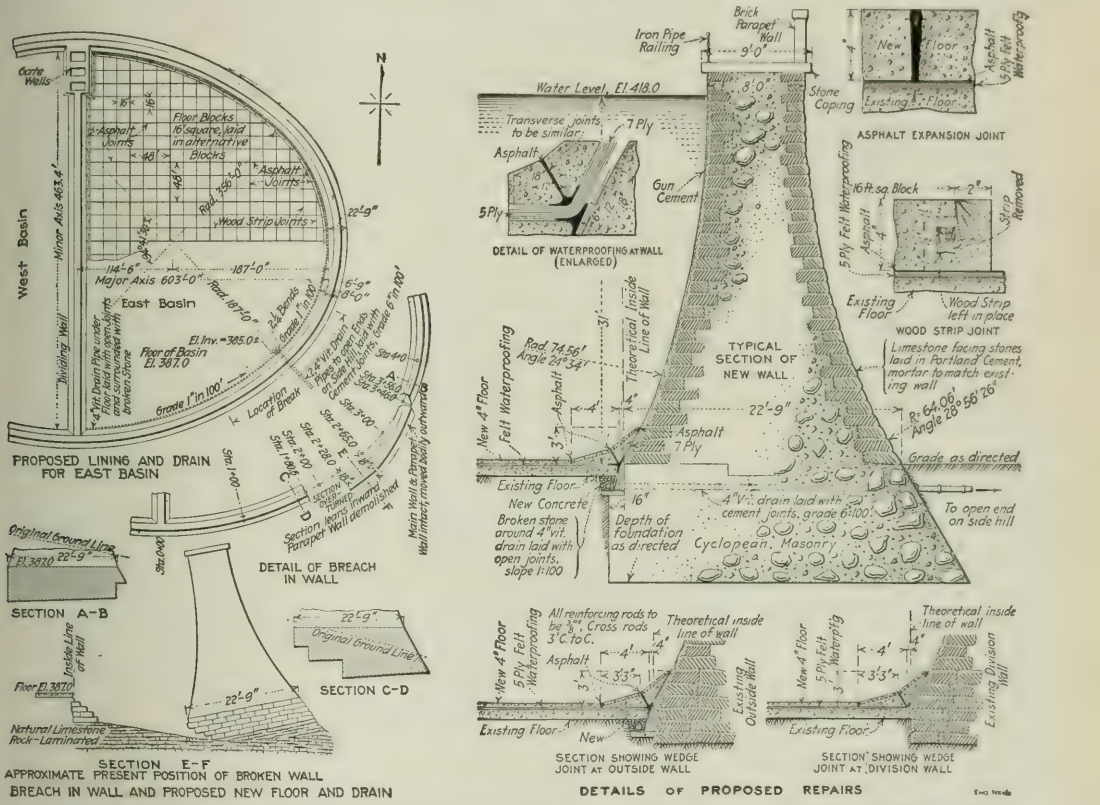
*See also Eng. N. vol. 15, 1886, p. 144 for description of original construction. Written by H. de B. Parsons.

portland cement concrete. This layer should be put down in 16-ft. squares, in a manner and jointed as indicated in the specifications and plans.

Dividing the concrete floor into 16-ft. squares has the purpose not only of obtaining better joints between the separate applications, but also of providing facilities for an expansion and contraction of the concrete, due chiefly to temperature changes.

(3) Having watertight walls and flooring, it becomes necessary to provide also for a thorough watertightness of the joint between the wall and the floor. This joint is liable to change in width, because there is a possibility of the walls settling slightly in the future, due to the altering of the shale layers. A settling, even the most insignificant, will produce a crack, and this would allow water under 31 ft. of head to penetrate and enter the clay layers. The width of the joint is also affected by contraction of the concrete of [see detail] on a slight grade around the entire inside of the reservoir, discharging with two outlets outside of the wall, so as to give assurance, either that the leakage within the reservoir, if there is any, is insignificant, or and mainly, that any leakage water will neither soak down into the clay strata beneath the walls and lubricate them, nor exercise any upward pressure within the wall, to reduce its weight, and, therefore, its stability.

This drain pipe will be a safe indicator of the watertightness of the reservoir. If either or both of the pipes do not discharge any water outside of the reservoir, its watertightness and the entire safety of the walls is demonstrated. If either or both show a flow of a constant but small amount of water, it indicates a small leakage, which should be observed and gaged to ascertain whether it is constant or increases. A constant small leakage does not indicate any danger. If such a leakage increases continuously and becomes



PLAN AND DETAILS OF BREAK IN MASONRY RESERVOIR, NASHVILLE, TENN., AND OF PROPOSED REPAIRS AND IMPROVEMENTS

the floor. Provision must, therefore, be made to allow for these probable vertical and horizontal movements in a manner to obviate the formation of any crack with consequent leakage.

This condition can be secured by placing at the inside foot of the wall a large wedge of concrete, the two sides being at an angle of 60 degrees from the horizontal, and both sides resting upon layers of waterproof materials, one upon the wall and the other upon the floor, so that any vertical movement of the wall or horizontal movement of the floor will correspondingly move the wedge upon the asphalt surfaces, and, therefore, avoid any tendency to cause a crack, either in the floor or at the wall [see detail.] The water pressure in the reservoir would continually tend to press the wedge against the adjoining surfaces, and not prevent its rising in case there is an expansion of the floor.

(4) Below the wedge it is proposed to lay a 4-in. drain pipe large, the reservoir in which it occurs should be emptied, and the location and cause ascertained and remedied. Had such means existed in the present reservoir, an examination and repairs could have been made in ample time and the break obviated. After the [East Basin has been repaired and reinforced] the West Basin should then be [reinforced] in the same manner, so as to prevent any slippage and break occurring in it, as [its] wall is also built upon the shale and clay strata, which underlie the entire reservoir, and which might in the future also cause a slippage as in the East Basin. Horizontal leakage now occurs to some extent through the wall of the West Basin below the present water level.

ESTIMATES OF COST

The following is an approximate estimate of the cost for making the repairs of the East Basin of the reservoir and of

giving it such additional treatment that it will in future be watertight:

ESTIMATED COST OF REPAIRING THE EAST BASIN AND OF RENDERING IT WATERTIGHT

Item	Unit	Quantity	Price	Amount
Earth excavation	cu.yd.	10,500	$0.40	$4,200
Rock and masonry excavation	cu.yd.	4,000	2.00	8,000
Concrete, Class A	cu.yd.	1,800	6.50	11,700
Concrete, Class B	cu.yd.	2,800	7.50	21,000
Concrete, Class C	cu.yd.	1,600	8.00	12,800
Brick parapet wall	lin.ft.	180	4.00	720
4-in. vitrified pipe	lin.ft.	1,000	0.20	200
Broken stone or gravel	cu.yd.	40	2.00	80
Cleaning walls	sq.yd.	5,100	0.10	510
Sand blasting of walls	sq.yd.	5,100	0.50	2,550
Pavement with cement mortar	cu.ft.	11,000	0.50	5,500
Asphalt waterproofing	lb.	30,000	0.03	900
Asphalt felt waterproofing	sq.yd.	12,350	1.00	12,350
Iron pipe railing	lin.ft.	200	1.00	200
Steel reinforcing rods	lb.	6,500	0.04	260
				$80,970
Engineering and contingencies, 15%				12,145
				$93,115

Concrete Class A includes the masonry in the foundation of the reservoir wall below elev. 387.0. Its composition is 1:3:5.

Concrete Class B includes the masonry in the reservoir wall above elev. 387.0. Its proportions are 1:2:4.

Concrete Class C includes the masonry in the floor of the reservoir, the wedge blocks, the foundation under the vitrified drain, and the replacing of the existing floor where removed. Its composition is 1:3:5.

Sand and broken stone are used in each of the three classes. Large stones may be added to Class A and Class B concrete, if so desired, in which case it shall constitute cyclopean masonry.

The original cost of the reservoir, as given in "The Manual of American Water-Works" for 1889-90, was $385,000, or about $7700 per 1,000,000 gal.

The Annual Meeting of the Indiana Engineering Society

The 33d annual convention was held in Indianapolis, Ind., Jan. 23-25, inclusive. This convention was a notable one in the interest shown and in the breadth and scope of the subjects discussed, which included not only engineering problems, but such public and social problems as the housing laws, greater safety in steam and electric-railway operation and workingmen's compensation laws.

On Thursday, Jan. 23, there was a special meeting of county surveyors. A temporary organization was effected, the purpose of which will be to obtain, by legislative action, uniformity in salaries paid to county surveyors, and to provide for a percentage fee to be paid them on the contract prices of roads and bridges built under their supervision. About 25 county surveyors were present; J. B. Short, of Fountain County, was elected president of the organization.

The first regular session of the society took place Thursday afternoon. In his presidential address DeWitt V. Moore, of Indianapolis, urged the society to use its influence for the construction of good roads; he also recommended that the society give attention and consideration to such problems as accident prevention, occupational diseases, housing reform, etc. He stated that the assumption of these burdens was a duty which engineers owe to their fellow men, who were, perhaps, in carrying out their daily labor, accomplishing the fulfillment of engineers' plans and designs.

Housing Reform—This subject was taken up in a paper read by Wilson B. Parker, an architect, of Indianapolis, entitled "The Housing Law in America." He emphasized the need of proper housing legislation to protect the health and morals of the poor in our great cities. The necessity of good fire escapes, sewerage, light and air shafts and the limitation of the space to be occupied on each lot by buildings were considered in detail. Mr. Parker's paper was illustrated by lantern slides showing disadvantageous conditions in Kansas City and Philadelphia.

Safety in Railway Operation—Prof. H. O. Garman, of Purdue University, chairman of the committee on steam railways, reported that but 22% of the railways of Indiana had been equipped with block signals before the state railway commission began to require their adoption; when the work recently ordered by the commission is completed there will be 64% of the railway mileage thus safeguarded. E. G. Stradling, of Lafayette, read a paper on the "New Automatic Block Signals of the Monon (Chicago, Indianapolis & Louisville) Ry." The operation of electric railways was treated by Alex Shane, of Columbus, Ohio, in a paper entitled "A Movement to Secure Greater Safety in the Operation of Electric Railways."

Mechanical Engineering—Friday morning's session was devoted to the consideration of mechanical engineering subjects. The mechanical equipment of the Severin Hotel, Indianapolis, was described by O. N. Mueller, of that city. J. S. Stoudt read a paper on "Automobile Starters.' The manufacturers' side of the problem of industrial accidents and workmen's compensation was discussed in a paper read by M. W. Mix, of the Dodge Manufacturing Co., Mishawaka, Ind. A paper on workmen's compensation was also read, by the president, Mr. Moore. "The Value of an Apprenticeship Course to the Manufacturer and the Apprentice," was the title of a paper read by H. S. Dickerson, of Lafayette, Ind. Prof. L. W. Wallace, of Purdue University, read a paper on the "Relative Resistance of New and Worn Car-Wheel Treads."

Sanitary Engineering—H. W. Klausmann, City Engineer of Indianapolis, presided over the Friday afternoon session. Papers were read, "A Sanitary Survey of the Wabash River," by J. A. Craven, of Indianapolis; "The Use of Hypochlorite of Lime in Water Purification," by Prof. C. N. Hilliard, of Purdue University; "The Hydraulic Laboratory at Purdue University," by Prof. R. L. Sackett; "The Indianapolis Experimental Sewage Disposal Plant, and Notes on Sewage Disposal in Other Cities of the United States," by H. W. Klausmann; "The Julietta, Ind., Sewage Disposal Plant," by Charles Brossmann, of Indianapolis," and "Observations and Recommendations as to the Methods of Conducting Drainage Works," by E. E. Watts, of Princeton, Ind.

Road Construction—Friday evening the members of the society and their guests enjoyed what was termed a "good-roads smoker," at which there were informal discussions of road building by James T. Voshell, Highway Engineer, U. S. Office of Public Roads, Capt. C. S. Tarleton, U. S. A. (retired), who spoke on Philippine roads librarian, of Indianapolis.

Concrete—The session on Saturday morning was presided over by D. B. Luten, of Indianapolis. Papers were read entitled, "Indiana's Concrete Aggregates," by C. D. Franks, of Chicago, Ill.; "A Study of the Artistic Treatment of Concrete Bridges," by John Mueller, of New Castle, Ind.; "The Tennessee Ave. Bridge, Ft. Wayne, Ind.," by A. W. Grosvenor, Ind.; "An Ordinance for Reinforced-Concrete Building Construction," by Prof. W. K. Hatt, of Purdue University.

Resolutions—The society adopted resolutions favoring the creation of a state highway commission and state aid for highway construction; a resolution was also adopted favoring a $10 per diem recompense for engineers on public work, or remuneration based on a percentage of the contract price.

Officers—The officers for 1913 are: President, H. O. Garman, Associate Professor of Civil Engineering, Purdue University, and Secretary, Charles Brossmann, 43 Union Trust Building, Indianapolis, Ind. The next meeting is to be held at Purdue University, Lafayette, Ind.

Mid-Year Conference of the American Electric Railway Association

Since the development of the mid-year conference of the American Electric Railway Association at headquarters in New York City, these meetings have developed to an importance barely second to that of the annual convention in the fall. In fact, so far as pushing the work of the Association goes, it is possible that more is actually accomplished because of the fewer general sessions and greater opportunity seized for committee work. Some 47 committee meetings were scheduled for the four days of the last conference, Jan. 29 to Feb. 1. At these committee meetings the work done since appointment at the close of the last fall convention was reviewed, or in some cases the organization was perfected so that scheduled work could be taken up. The morning and afternoon of the third day of the conference, Jan. 31, were given over to general sessions. At a banquet held with the allied manufacturers' association on Jan. 31, there were about 900 present.

At the first of the general sessions of this conference the report of the Committee on Proper Basis for Rates and Fares, as presented before the last convention, was discussed. In re-presenting the report, F. R. Ford, of New York City, supplemented it with a recommendation that the work of such a committee be continued on a permanent basis (1) with salaried officials or an organized department for collecting statistics on fares, and for coöperation with member companies, (2) for encouraging and sustaining desirable public relations along this line, (3) for the formulation of standard accounts and forms of studying railway costs and fares. These recommendations were later approved and referred to the executive committee of the Association.

C. N. Duffy, of Milwaukee, a member of the same committee, presented a paper on "The Effect of Load Factor on Cost of Electric Railway Passenger Service." In this he followed a method developed by the Wisconsin Railroad Commission in studying rates of fares. "Load factor" was defined as the number of passengers carried divided by the seating capacity of cars in operation. For studying the effect of load factor on total cost, the costs were divided into (1) expenses which exist without traffic, (2) expenses proportional to car traffic, (3) expenses proportional to number of passengers. The Wisconsin Commission has found, he reported, that the first of these comprised 82.4% of the total cost of service, and that the total cost per passenger decreased as the load factor increased. For a flat fare of 5c. per passenger, the maximum possible length of haul under ordinary conditions increased from 1.36 miles at 10% load factor to 4 miles at 40%, and 8.80 miles at 100%. The author held that low rates of fare during rush hours could not be justified, but that the cost of service and rate of fare could be reduced and length of haul could be increased, were it practicable to increase the load factor by spreading the traffic over a greater number of hours per day. Where operating expenses, depreciation, extraordinary contingencies, factors, investments, etc., were identical between two electric-railway systems, the reasonable length of haul was dependent upon load-factor conditions which had to be studied in determining fares.

W. J. Clarke, of the Traction Department, General Electric Co., Schenectady, N. Y., presented a paper filled with data on British tramways. He outlined the financial advantages which these municipal projects enjoyed in the matter of low, but rising, rates of interest, low wages ($6 to $8.75 for motormen and conductors after five years' service), etc. In spite of these advantages he found but 2637 miles of tramway lines—only as much as in New York or Pennsylvania. He held that both American and British roads over-estimated their net earnings and failed to provide adequate funds for obsolescence, made too long life allotments of equipment and too low rates of fare.

British tramways were also discussed by A. K. Baylor, of New York City, who described the rise of the municipal tramway in England as being due simultaneously to (1) expiration of the horse-car-line franchises in England, (2) the success of an electric-lighting department in Birmingham, (3) expansion of the idea of municipal control, and (4) tremendous development of electric traction in the United States. The low rates of fare he explained as being due to the prevalent small unit of money (penny), there being no coin in general circulation there corresponding to the American nickel.

R. B. Stearns, of Milwaukee, presented a paper on the use of the zone system of collecting fares. He had come to believe thoroughly in this arrangement and advocated collecting five cents for the zone originating traffic and an additional two cents for each zone outside the first district. He believed that a two-cent coin would be found admirably suited to such a system and advocated its issue from the mints.

C. S. Sergeant, of Boston, in describing the upgrowth of the electric-railway system of that metropolitan district, stated that in 1888 five or six horse railways were consolidated, the combined capital being 2.7 times the gross earnings. The average number of passengers per one-half round trip was then 22½, with an average length of passenger ride of 3.5 miles, and an average length of car trip of 4.8 miles. After electric traction was installed, in 1892, the number of passengers per half trip rose to 28, and in 1898 it still further increased to 29½. But after true rapid-transit facilities were provided, the average number of passengers (in 1903) dropped to 23, and gradually rose to 25 for one-half round trip in 1912. The drop was due to more trips and longer extensions of line. The permanent investment at the present time was six times the gross earnings, due to the cost of rapid-transit facilities. All these he mentioned as illustrating some of the points in the committee's report and in Mr. Duffy's discussion.

The second session on the same day was given up to a discussion of the recent report of the U. S. Railway Securities Commission. The first speaker was D. W. War-

ren, general counsel of the Bay State Street Railway Co., Boston, Mass. He noted that while electric railways were largely not interstate organizations, yet the remarks of the commission applied very well to their financial operations. He described the effects of the drastic Massachusetts anti-stock-watering statutes, which were annoying to an honest concern as well as one dishonest. He stated that it had been very difficult to obtain capital for transportation companies since the law had prohibited the issuing of stocks below market value. He cited, in this connection, the difficulties experienced by the Bell Telephone Co. and the Boston & Albany R.R. Lack of provision for bond discounts and working capital also came in for criticism.

The paper "Mistaken Popular Notions Concerning Public Service Corporations" was read by Frederick Strauss, of J. & W. Seligman & Co., of New York City, and a member of the Securities Commission. His contentions were that the so called "special privileges" were not privileges at all, but necessary rights without which these utilities could not be developed—such things as rights of eminent domain, perpetuity of life, limited liability of stockholders, and the right to act by majority vote. The element of monopoly he held was one of fact rather than of law and that while the law permitted or invited competition, public interest and economic conditions usually dictated a monopoly. He held also that the public was confusing "reasonable return" with mere "abstention from confiscation," which would not suffice to bring out capital needed for extensions, improvements and progress in services.

In discussing "watered stock," he claimed this was to be found in one form or another in the older countries. He commented on the ability of the great banks in Europe with enormous capital and surplus to carry on new projects until the earnings have reached the desired point where shares were sold to investors at a high premium. In this way, he said, the promoters reaped a large profit by sustaining the enterprises during infancy and finally the capital of the bank was freed for new ventures. In this country, the banks could not do this with their funds and the necessity for setting capital free at the earliest possible moment was the cause of the issue of so called "watered stock" and the advocacy of shares without par value.

O. T. Crosby, of Wilmington, Del., maintained that it was highly desirable that the academic side of the business should be studied, including just such questions as were treated in Mr. Strauss' paper. He believed that self-education and education of the public were necessary before the electric-railway industry was put on a proper financial basis. He held that proper representatives of the association should appear before every legislative body in the country, which was considering questions involving these utilities, and that they should plead general economic principles. He claimed that there were no precedents to govern the financing regulations which were to be imposed on these utilities; the industry was so bound that there was no basis for stating, for instance, whether 6% or, say, was confiscatory or not.

The discussion for a while turned on physical valuation, Prof. A. S. Ritchy, of Worcester, Mass., and C. G. Young, of New York City, maintaining that the term itself should have been defined when used, as by the Railroad Securities Commission, and that in making any valuation the use should be fundamentally considered. Mr. Young held that valuations were often of questionable service anyway. Prof. Ritchy deprecated the tendency to allow a return only on depreciated value of a property which had been in service a number of years.

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Specifications and Design Standards for Reinforced-Concrete Structures*

By Ernest McCullough†

Engineers should do more than they are at present doing, to post owners and architects on proper design and to expose faulty methods in reinforced-concrete work. In the first place, the average architect and owner rely too much upon the salesmen for steel companies for plans of reinforced-concrete buildings. They think the construction practically standardized, so that when competitive designs are submitted, all designers work on the same basis. A common requirement in specifications is that the building shall be designed to carry certain floor loads with a factor-of-safety of four. The owner may think that under this clause a floor to carry safely 100 lb. per sq.ft. will be apt to break under 400 lb. Many architects say that this means four times the dead-load plus the live-load the floor is expected to carry constantly. The engineer designs so that the fiber stress will be either one-fourth the ultimate strength, or the yield point of the material used. If he is an independent engineer he may use one-fourth the elastic limit of the steel; but if he is employed by a company selling material, and is furnishing the plans for nothing, he may use one-fourth the ultimate strength.

Examples of Faulty Methods in Design

The writer recently checked plans for a reinforced-concrete building where the architect had specified that the safe live-load on each floor was to be 125 lb. per sq.ft., with a factor of safety of four; no fiber stresses given in steel or concrete. He stated that when completed a panel on each floor would be selected at random and loaded with four times the combined dead- and live-loads, under which test it should deflect not to exceed $^1/_{360}$-th. of the span. Five plans were submitted and in three the steel fiber stress was 20,000 lb. per sq.in., in one it was 18,000 lb. and in the last it was 22,000 lb.; yet each designer stated in his bid that the steel stress was 16,000 lb. The concrete stress was stated to be 700 lb. per sq.in., and it was actually a trifle over 800 lb. in two designs, 900 lb. in two designs, and 1040 lb. in one design. In checking the plans, a ratio of deformation of 15 was used. It was found that some designers had used 8 and some 10, but not one used the ratio fixed by common custom, the action of a number of national societies and by the majority of building ordinances.

Nearly every beam in reinforced concrete is a T-beam, the stem being comparatively narrow and containing only enough concrete to protect the steel and take care of shear, assisted sometimes by stirrups. The flange or upper part of the beam, that takes all the bending compression, extends into the floor slab on either side of the beam. Assume such a beam 24 in. wide in the flange and 12 in. in the stem, with a span of 19 ft. c. to c. of beams. To obtain the load on the slab we deduct the stem thickness from the span, giving 18 ft., and multiply this by the load per lin.ft. (say 100 lb.); obtaining 1800 lb. total load. The bending moment will then be $1800 \times 19 = 34{,}200$ in.-lb. The writer knows from actual experience in checking "free" designs that many men will design as follows: The flange is 2 ft., so that load is $19 - 2 = 17 \times 100 = 1700$ lb. (taking the clear spa nbetween the flange edges). Using the same span the moment (1700×17) is 28,900 in.-lb. In this method, to save steel and thus obtain a contract, the load on the overhanging portions of the flanges is neglected in designing the floor slab, and a condition of perfect restraint is assumed, with no attention paid to any possible bending of the flanges. When such questionable methods are used in competitive designing, it is not strange that a disinterested engineer will find stresses running 10 to 20% higher than the specifications mentioned, although every designer claims to have followed the specifications. It might be thought that the steel salesman would

*Abstract of a paper presented at the annual meeting of the Illinois Society of Engineers and Surveyors in Chicago, Jan. 22-24, 1913.

†Consulting Engineer, Chicago.

try to put in more than enough steel. This he will do if he can arrange to have his steel specified to the exclusion of other steel, but if compelled to compete with other companies it is necessary to cut the steel to the lowest possible limit.

Relations of Steel and Concrete

The stresses should be so balanced that the steel and concrete will be balanced. Studies made to determine the economical proportions are not always satisfactory, for prices vary so greatly for all materials. The writer, however, plotted the result of a number of studies and found the following expression useful in fixing the amounts of steel and concrete. Let fc be unit concrete stress; fs, unit steel stress; n, ratio of deformation. Then $fc = fs \div 1.8\ n$. By fixing the stresses in accordance with the above expression the maximum economy will be obtained. For average prices of materials the economical stresses seem to be practically 500 lb. per sq.in. for concrete in compression and 15,000 lb. for steel in tension with $n = 15$. In spite of this it is not uncommon to see men using a concrete stress of 800 lb. and a steel stress of 20,000 lb.

A 1:2:4 concrete is assumed to have an ultimate strength not far from 2000 lb. per sq.in. in compression and the ratio of deformation is generally assumed to be 15. The safe fiber stress recommended by the Joint Committee is 650 lb. per sq.in. The writer, however, has examined test reports on concrete made in many parts of the United States and finds that such concrete seldom exhibits an ultimate strength exceeding 1800 lb., the strength being fixed by the character of the aggregate, modified by the care used in proportioning and mixing. Poor aggregate may often be used successfully provided the mixing is properly done, so the secret of making good concrete lies in proper mixing after due care has been taken to proportion the material.

Hand mixing should be positively prohibited for reinforced concrete and only batch mixers permitted, except when positive proportioning devices are attached to the mixers. The cement should be always added by weight and not by bulk, the sand and aggregate to be added by bulk, loose. As a rule a 1:2:4 concrete made near Chicago will be stronger than that made near Pittsburgh, owing to the difference in the stone used. The best way to prepare a specification is to state that the fiber stress of the concrete in compression shall not exceed one-third the ultimate strength shown by a test made on a cylinder 8 in. in diameter and 16 in. long, poured at the time the beam or slab is poured and stored under similar conditions to those under which the construction is cured; this strength to be shown at the end of 30 days.

The steel strength is governed by the yield point, which is something different from the elastic limit and should not be confused with it. Twisting steel cold does not raise the elastic limit, which may in fact be slightly lowered by the twisting, but it does raise the yield point considerably. When a steel is stressed past the yield point the dstruction of a reinforced-concrete structure is assured and failure begins. The unit fiber stress used in the steel should not exceed half the yield point for a medium openhearth steel having a yield point in the neighborhood of 33,000 lb. per sq.in., provided mechanical bond is provided. Without a mechanical bond the unit stress should not exceed 12,000 lb., for the adhesion is weakened by continued dryness, or long continued submergence, as in tanks. For steel having a yield point exceeding 40,000 lb. the unit fiber stress may be one-third the yield point, but should never under any circumstances exceed 18,000 lb. Without a mechanical bond, the steel stress should never exceed 12,000 lb., no matter how strong the steel. Rerolled steel may be used safely if it complies with the standard specifications of the steel manufacturers association.

Cement is a very uniform material when purchased from the larger companies, yet it is the almost universal practice to pay for cement testing, while steel is bought on faith. The man who neglects to have his steel tested is taking unjustifiable chances. The writer, if governed by small appropriations, would rather use cement without testing than steel without testing, provided that the cement is provided by a manufacturer of good reputation. The majority of men selling steel are merely brokers under contract to dispose of the product of mills rolling (not necessarily manufacturing) steel. In all specifications there should be a clause requiring that the steel weigh within 5% of the standard weights given in steel manufacturers' handbooks. Unfortunately much light steel is marketed.

Columns

In reinforced-concrete columns it is good practice to specify that the steel be set so that a cover of not less than 2 in. of concrete will be provided. This is for fire protection, and many engineers will not consider any of the concrete outside the steel as carrying load. Thus if the design requires a 12-in. column, the fire protection will cause the use of a column 16x16 in. The writer has never yet examined a competitive design in which the concrete outside the steel was excluded. In his own practice he adds one inch each way to the dimension of the column for fire protection, for it is hardly likely any fire will injure the concrete to a great depth. The steel, however, is set 2 in. from the faces. Concrete increases in strength with age and on an average-sized column a reduction in dimension of one inch each way after the expiration of one year will not make the column any weaker than it was the day it was first put in use.

Columns of the hooped variety always show signs of failure by the concrete peeling away from the steel, so for such columns it is necessary to consider only the concrete area inclosed within the inner face of the hooping. Competitive designers may use the full area of the concrete in computing the strength. The concrete stress for hooped columns being much higher than for columns vertically reinforced without hooping makes this sort of designing highly objectionable.

Improved Methods in Design

True economy and proper service in reinforced-concrete design can be obtained only by having the design prepared by a man paid for his work, and not tied to any steel or any system of reinforcement. The reputable companies, however, should not be prevented from helping the architect or engineer by giving him the benefit of their experience. So every specification should contain clauses giving design-standards, and competition should be permitted, provided the lowest bidder with his own design will consent to a checking of his design (he to pay for the checking).

These standards should be stated plainly in the specifications, and the writer recommends the following clauses:

> Parties wishing to submit competitive designs for this structure may do so provided said designs conform in every detail to the standard building specifications for reinforced-concrete structures adopted by the National Association of Cement Users, the floor loads being as follows. . . . .

In asking for plans it is not sufficient to require a factor of safety or to simply mention steel stresses. The factor of safety should not be mentioned. When steel stresses are given it is necessary also to fix the ratio of deformation. It is positively necessary to state the bending-moment coefficients and define the span lengths. When this is done the amount of steel to be placed over supports, as compared with the steel in the middle, must be mentioned, and the amounts should be equal if the middle positive coefficient is $1/_{13}$. The area of the concrete to be considered in column design must be fixed; also the percentage of live-load on each floor going to the columns.

These are a few of the things to be considered and the specifications mentioned above should be carefully studied to insure a design according to the intention of the architect, engineer or owner.

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Delay in Awarding the Mechanical Filtration Contract for the Croton Water-Supply, New York City, has been secured by the Bureau of Municipal Research and the Citizens' Union, of New York City, acting through Comptroller Wm .A. Prendergast, a member of the Board of Estimate and Apportionment. By agreement, the bids were opened on Jan. 23, with the understanding that the award would be postponed until the subject could be looked into further. A pamphlet of 129 pages, reviewing both the hold-up and the history of the preparation of the filtration plans, and also reprinting a report (June 10, 1912) of a board of engineering experts on the plans, has been published for general circulation by the Department of Water Supply (Park Row Building, New York City).

The detailed bids for this work were published on p. 48 of our Construction News section of Jan. 30, 1913. By a typographical error the total bid of the Keystone State Construction Co. (2 Rector St., New York City) was wrongly given, both in the table and in a brief news note on p. 236 of the same issue. The correct figure was $5,139,015, which was the lowest bid received. The lowest bid of the highest bidder was $6,752,500. The estimate of I. M. de Varona, chief engineer of the Department of Water Supply, was $5,916,700. The lowest bid was 13% lower than the engineer's estimate, and the highest bid (really the lowest bid of the highest bidder) was 14% higher than the engineer's estimate, while the average bid was only 1½% higher than the engineer's estimate. We expect to give some further details of the bids in our Construction News section for Feb. 13.

Following a Cattle-train Derailment near Cairnes, Queensland, Australia, a passenger express train ran into the wreckage and killed six and injured five other persons. It is said that this is the first serious accident on the Queensland railways in years.

A Collision Occurred on Feb. 2, between the Hamburg-American liner "Prinz Oskar" and the four-masted schooner "City of Georgetown," in which the former vessel was badly damaged and the latter was sunk. The scene of the accident was the Five Fathom Bank Light beyond the Delaware Breakwater. No lives were lost as a result of the collision.

The Proposed Lincoln Memorial Road from Washington, D. C., to Gettysburg, Penn., was effectually killed last week by the passage through Congress of a bill which authorized the appropriation of $2,000,000 for a Lincoln memorial in Washington, to take the form of a suitable building, statute and grounds in the river park, which will fit into the general development of the city plan recommended by the McKim Commission. The proposed road, which was very pertinaciously advocated by the federal road aid enthusiasts, was to be a broad boulevard between the national Capital and the Gettysburg battlefield, and was to be built and maintained by the federal government. Pres. Taft signed the bill on Feb. 1.

A Panic Broke Out in a moving-picture theater in New York City, on Feb. 2, when one of the films took fire. The operator extinguished the flame, but the audience of over a thousand fled in a wild panic in which two persons were killed and between 20 and 30 injured. The fatalities occurred at a short flight of steps leading from the theater to the side walk. People fell on the steps and others were crowded upon them until exit from the theater was entirely blocked. The dead were found at the bottom of this heap of persons.

PERSONALS N. R.

A Society for the Greater Development of the electrical industry at large has been incorporated in New York City under the name of the Society for Electrical Development. The aim of the society is to increase use of electricity, especially for light, heat and power. Four branches of the industry are represented by men from prominent concerns therein: (1) electric light and power companies, (2) manufacturers of electrical apparatus, (3) electric supply jobbers, (4) electrical contractors. H. L. Doherty has been elected President; J. M. Wakeman, General Manager; and P. F. Dodd, Secretary-Treasurer.

An Appeal from the Chicago Drainage Canal Decision rendered by Secretary of War Stimson, on Jan. 8, 1913, denying the application of the Trustees of the Sanitary District of Chicago for permission to increase the amount of water diverted from Lake Michigan to and through the Canal, seems likely. It has not been announced whether the appeal will be made to Congress, as suggested in the course of editorial comment, which accompanied our reprint of the decision in our issue of Jan. 13, or to the new Secretary of War, after Mar. 4. It seems likely, however, that the appeal may be to the latter. However this may be, the trustees do not seem to be willing to accept the decision of Secretary Stimson as final. Their conclusion seems to be based partly on legal points and partly on what the trustees believe to be important new evidence bearing upon the case.

We have received from Lyman E. Cooley, the recently appointed consulting engineer to the trustees of the Sanitary District, a statement bearing upon this subject which we condense as follows: After an interview with Gen. Wm. H. Bixby, Chief of Engineers, U. S. Army, Mr. Cooley wrote to the Secretary of War, on Dec. 30, 1912, requesting permission to withdraw or amend the application in question and stating that within two weeks the trustees of the Sanitary District would be able to present in full their reasons for the request. In an interview held subsequently, Secretary Stimson expressed unwillingness to reopen the case or to defer his decision, but stated that he would hold his findings for a few days and that meanwhile he would consider citations on certain legal propositions. On Dec. 31, a statement presented before the Senate Committee on Commerce (Apr. 16, 1912) on behalf of the case of Chicago was left at the Secretary's office. On Jan. 6, 1913, M. B. Madden interviewed the President and the Secretary of War with a view to having the decision deferred until the additional or supplementary matter could be presented. The matter was considered also at a cabinet meeting on Jan. 7, when further time for consideration was asked for by the Secretary of the Interior (Mr. Fisher) and by the Secretary of the Treasury (Mr. MacVeagh). The attorney of the Sanitary District of Chicago went to Washington to present statements prepared by him and by the consulting engineer, but on his arrival (Jan. 10) he was refused an interview and was told that no further briefs or arguments would be considered or would change the adverse decision which had already been rendered (Jan. 8). In his letter accompanying the unaccepted statements, the consulting engineer had explained that the officials of the Sanitary District were preparing additional matter in support of their application, which they considered important, and Mr. Cooley informs us that this matter is now undergoing revision and will be made public in the early future.

At the meeting of the Trustees of the Sanitary District, held on Jan. 23, a report was submitted by the Trustees' Special Commission on sewage disposal and water-power development ("Eng. News," Mar. 7, 1912). The main statements of the report were as follows:

After a careful investigation of the effect upon lake levels and the legal and legislative phases involved, your Commission does not believe that the government will ultimately prevent the utilization of the main drainage canal to the full purpose for which it was designed.

As the ultimate capacity of the main drainage channel is 14,000 cu.ft. per sec., and at the necessary legal rate of flow of 3½ cu.ft. per sec. per 1000 of tributary people the capacity of the canal will serve for a population of over 4,000,000, we advise that (pending the submission of the final report of this commission) no departure from the dilution method of sewage disposal, as provided for by law, should be contemplated by the Sanitary District, except for treatment of trade wastes and special effluents.

It is interesting to note that the International Waterways Commission, in its report of Jan. 4, 1907, on the Chicago Drainage Canal, recommend that the government of the United States "prohibit the diversion of more than 10,000 cu.ft. per sec. for the Chicago Drainage Canal." Secretary Stimson was far less liberal when he refused to allow an increase of the present diversion of 4157 ft.

PERSONALS

Mr. L. J. Houston, Jr., Assistant Chief Engineer of the Paving Commission of Baltimore, Md., has resigned.

Mr. Seton Porter, for the past eight years associated with Sanderson & Porter, Engineers and Contractors, New York City, has been admitted to membership in the firm.

Mr. Allen J. Saville, for the past three years Assistant City Engineer of Richmond, Va., has resigned to engage in private practice in partnership with Mr. Burton Marye, with offices in Richmond.

Mr. Lester W. Tucker, M. Am. Soc. C. E., formerly with Westinghouse, Church, Kerr & Co., New York City, has been appointed General Manager of the Brinson Ry. Co., with headquarters at Savannah, Ga.

Mr. Percy R. Todd, recently Vice-President, has been elected President of the Bangor & Aroostook R.R., in Maine. Mr. Todd was formerly Vice-President of the New York, New Haven & Hartford R.R., at New Haven, Conn.

Mr. E. C. Blundell, formerly Assistant Superintendent of the Chicago, Milwaukee & St. Paul Ry., at Eau Claire, Wis., has been promoted to be Superintendent of the Nebraska division at Omaha, Neb., succeeding Mr. J. R. Welch, transferred to St. James, Minn.

Mr. E. T. Adams, M. Am. Soc. M. E., former Manager and Chief Engineer of the gas and mill engine department of the Allis-Chalmers Co., Milwaukee, Wis., and recently President of the Wisconsin Engine Co., Milwaukee, has been appointed Chief Engineer of the Rumely Co., La Porte, Ind.

Mr. W. L. Saunders, M. Am. Soc. M. E., President of the Ingersoll-Rand Co., New York City, has been elected President of the International Harvester Corporation, recently organized to handle the foreign business of the International Harvester Co., of Philadelphia, Penn. Mr. Saunders will continue as President of the Ingersoll-Rand Co.

Mr. Robert I. Randolph, Assoc. M. Am. Soc. C. E., has resigned as Secretary of the Rivers and Lakes Commission of Illinois. He will continue to attend to such matters as may come before his department until a successor is chosen. The position will be filled by a civil-service examination, the announcement of which will be made later, and it is desired to obtain a civil engineer. The salary is $300 per month.

Mr. Fletcher M. Hamilton has been appointed State Mineralogist of California, succeeding Mr. W. H. Storms, who was summarily removed by Governor Johnson without other cause than that he was not in harmony with the administration. Mr. Hamilton is a graduate in mining engineering of the University of California, class of 1904. He has had practical

mining experience in California, Nevada, Montana and Mexico.

Mr. D. L. Bush, recently General Manager of the Chicago, Milwaukee & St. Paul Ry., has been elected Vice-President with headquarters at Chicago, Ill. Mr. Bush has passed through all the positions in operating department from night telegraph operator in a backwood's town to Superintendent, General Superintendent, and in 1909 to General Manager. He was born in 1855 and has been in the railway service since he was 17 years old.

Mr. Howard D. Bennett, Consulting Engineer, of Baltimore, Md., formerly in charge of the designing department of the Ellicott Machine Co., is now associated with the Skinner Ship Building & Dry Dock Co., of Baltimore, as Engineer in charge of the dredge department, which has recently been added to the company's business. Mr. Bennett will also continue his private practice as a consulting engineer.

Mr. Virgil G. Bogue, M. Am. Soc. C. E., former Chief Engineer of the Western Pacific Ry., has recently been engaged in an economic study of line improvement and double-tracking of the Canadian Pacific Ry. through the Selkirk and Rocky Mountains in British Columbia. Mr. A. W. Buel, M. Am. Soc. C. E., who has been associated with Mr. Bogue in this work, has returned to his consulting practice, at 15 William St., New York City, after an absence of three months.

Mr. E. Warren Ritchie, formerly with the Purdy Engineering Co., in charge of a large hydro-electric development in Costa Rica, has opened an office in Petersburg, Va., as a consulting engineer in hydro-electric and municipal engineering work. Mr. Ritchie is a graduate of the Massachusetts Institute of Technology, class of 1898. He had charge of the surveys in Havana, Cuba, upon which the present sewerage system is based. Mr. Ritchie also made the preliminary surveys for the Jamestown Exposition.

Mr. Charles H. Lee, Assoc. M. Am. Soc. C. E., for several years Assistant Engineer on the Los Angeles, Calif., water-supp y aqueduct, in charge of water-supply investigations in Owens Valley, has opened an office at 934 Union Oil Bldg., Los Angeles, as a consulting, civil and hydraulic engineer. Recently Mr. Lee has carried on underground water investigations in various parts of central and southern California for the State Conservation Commission, and has also served as Hydraulic Engineer for the Cuyamaca Water Co., of San Diego.

Mr. Richard S. Buck, M. Am. Soc. C. E., has retired from membership in the firm of Sanderson & Porter, Engineers and Contractors, New York City, to become Chief Engineer of the Dominion Bridge Co., Montreal, Que. Mr. Buck graduated from Rensselaer Polytechnic Institute in 1887. He was Resident Engineer during the construction of the famous Niagara River steel arch bridge; the Williamsburg bridge, East River, New York, was built under his supervision, and for a number of years he was Chief Engineer of the Department of Bridges of New York City.

Mr. E. H. McHenry, M. Am. Soc. C. E., who for the past two years has been Vice-President in charge of maintenance and construction of both the New York, New Haven & Hartford R.R. and the Boston & Maine R.R., will hereafter have charge of these departments of the New York, New Haven & Hartford R.R. only. Mr. H. J. Horn, whose retirement from the New Haven system was noted in our issue of last week, will have charge of these departments of the Boston & Maine R.R., as well as the operating department.

Mr. Miles Bronson, Superintendent of the Electric division of the New York Central & Hudson River R.R., has been promoted to be General Manager of the Grand Central terminal, New York City, in addition to his other duties, succeeding Mr. A. R. Whaley, resigned as noted in our issue of last week. Mr. Bronson was born in British India in 1875. His railway work began in 1890 in the law department of the Grand Trunk Ry. He has been private secretary to the President, Assistant to the President and Division Superintendent with the New York Central Lines.

Mr. H. B. Earling, formerly Assistant General Manager of the Chicago, Milwaukee & St. Paul Ry., has been elected Vice-President, with headquarters at Seattle, Wash., succeeding Mr. H. R. Williams, transferred to New York City. Mr. Earling entered the service of the Chicago, Milwaukee & St. Paul Ry. in 1878, as an agent and telegraph operator. He was promoted through the grades of assistant train dispatcher, chief train dispatcher, Trainmaster, Superintendent of Terminals, Division Superintendent, Assistant General Superintendent and General Superintendent to that of Assistant General Manager about a year ago.

Mr. E. D. Sewall, formerly Assistant to the President of the Chicago, Milwaukee & St. Paul Ry., has been elected Vice-President, with headquarters at Chicago, Ill. Mr. Sewall was born in Wilmington, Del., in 1855. At 16 years of age he entered the service of the Wicomico & Pocomoke R.R. as a rodman. In 1872 he went West and spent 10 years in the engineering departments of the Northern Pacific Ry., the Chicago & Canada Southern Ry., the St. Paul, Minneapolis & Manitoba Ry. and the St. Paul & Duluth R.R. From the engineering he changed to the transportation branch of the railway service as a clerk of the general freight department of the St. Paul & Pacific Ry., in 1881. Later he was Assistant Engineer and clerk to the General Superintendent of the St. Paul & Duluth R.R. For a few months in 1882, he was joint agent of the St. Paul & Duluth R.R. and the Chicago, Milwaukee & St. Paul Ry., at Stillwater, Minn.; and then for five years he was agent for the latter road at the same place. After nearly two years' experience as traveling lumber agent he was appointed, in 1889, commercial agent of the Chicago, Milwaukee & St. Paul Ry., at St. Paul, Minn. In 1895 he was appointed Assistant General Freight Agent of the Superior division, at Milwaukee, Wis.; and for four years, 1898 to 1902, he was Northwestern Agent at Minneapolis, Minn. Mr. Sewall was promoted to be Assistant General Superintendent of the Chicago, Milwaukee & St. Paul Ry. in 1902, and in 1906 was appointed Assistant to the President. He was Vice-President of the Chicago, Milwaukee, Puget Sound Ry., from 1909 to the recent consolidation of this road with the older company.

Mr. Edward E. McCall, a Supreme Court Justice of New York, has been appointed Chairman of the Public Service Commission, First District, of the State of New York, succeeding Mr. William R. Willcox, who has been Chairman since the establishment of the commission during Governor Hughe's administration. The Chairman of this Public Service Commission is the executive head of probably the largest engineering organization in the world, which is about to supervise the construction of subway and rapid transit lines in Greater New York to cost many millions of dollars. Mr. McCall graduated from New York University Law School in 1884, and practiced law in New York City until 1902, when he was elected a justice of the state supreme court.

Mr. W. W. Colpitts, M. Am. Soc. C. E., has resigned his position of Chief Engineer of the Kansas City, Mexico & Orient Ry., to become associated with W. H. Coverdale & Co., Consulting Engineers, New York City. He will, however, continue to be Chief Engineer of the company's lines in Mexico. Mr. Colpitts is a graduate in civil engineering of McGill University, class of 1899, and began his engineering experience as a draftsman in the office of the Chief Engineer of the Intercolonial Ry. He remained in the engineering departments of various Canadian railways until 1899, when he was appointed Chief Clerk in the office of the President of the Canadian Pacific Ry., at Montreal, Que. In 1900, he returned to engineering work as Assistant Engineer in the construction department. A year later he joined the enginering staff of the Kansas City, Mexico & Orient Ry. as Assistant Engineer and was promoted to be Division Engineer, and in 1909 to be Chief Engineer.

OBITUARY

Thomas J. O'Connor, a young civil engineering employee on the construction of the plant of the Air Turbine Co., Harrison, N. J., was killed, Jan. 31, by a fall from an erecting tower. Mr. O'Connor was a native of New Haven, Conn., and a recent graduate of Sheffield Scientific School, Yale University.

John Harlan Freeman, M. Am. Soc. M. E., a consulting mechanical engineer with offices at 45 Broadway, New York City, died at his home in Brooklyn, N. Y., Jan. 27. He was born in Michigan 45 years ago, and was a graduate of the Michigan Agricultural College. For a number of years he was in the U. S. Patent Office, Washington, D. C. He came to New York City in 1890.

A. H. Coon, of Kingston, Penn., for many years a well known contractor, died Jan. 31, at the age of 84 years. He was still active in local contract work after his 83d year. Mr. Coon was contractor for more than 40 complete waterworks. He was first to lay rails for street-car service in the State of Pennsylvania, which was on a line built in 1856, between Kingston and Wilkes-Barre.

Mrs. Lavinia Marston Swasey, wife of Ambrose Swasey, of Cleveland, Ohio, Past-President of the American Society of

Mechanical Engineers, died at her home in Cleveland, on Jan. 22, after a very brief illness. Mrs. Swasey was born at Hampton, N. H., July 28, 1842. She had been a resident of Cleveland for more than thirty years and had taken a prominent part in charitable and philanthropic work.

James B. Hammond, President of the Hammond Typewriter Co., and inventor of one of the first practical typewriters, died Jan. 26, at St. Augustine, Fla., while on a yatching trip. He was born in Boston, Mass., Apr. 23, 1839, and graduated from the University of Vermont in 1861. He studied for the ministry, served during the Civil War as a war correspondent for the New York "Tribune"; and after numerous experiments patented his typewriter in 1880. During the past few years he had been noted chiefly for his eccentricities.

Gaylord M. Beach, former Assistant General Manager of the Pittsburgh & Lake Erie R.R., died at his home in Pittsburgh, Penn., Jan. 28, aged 81 years. He was retired on a pension, two years ago, after 61 years of active railway service, begun in 1850 as a track laborer on the Sandusky, Mansfield & Newark R.R. From track laborer he was promoted to the position of foreman of construction gangs and laid many miles of railway track in the Middle West and South in the decade preceding the Civil War. He then became a conductor of freight and passenger trains, Fuel Agent and Assistant Roadmaster of the Cleveland, Columbus, Cincinnati & Indianapolis Ry., and in 1869 Superintendent of Construction of the Indianapolis & St. Louis Ry. For a short time he was Roadmaster of the Atlantic & Pacific R.R. and the South Pacific R.R. in Missouri. Following January, 1871, he served 8 years as Real Estate and Tax Agent of the Cleveland, Columbus, Cincinnati & Indianapolis R.R., and two years as Roadmaster of the Indianapolis division of the same railway. From 1880 to 1885 he was in charge of the engineering department of this railway, which was combined with the Indianapolis & St. Louis Ry. in 1882. From 1885 to 1889 he was General Manager of the combined railways. In 1890 Mr. Beach went to the Pittsburgh & Lake Erie R.R. as General Superintendent. Eight years later he was promoted to be Assistant General Manager. In 1900 he retired to the less active position of Special Agent at Pittsburgh.

ENGINEERING SOCIETIES

COMING MEETINGS

MAINE SOCIETY OF CIVIL ENGINEERS.
Feb. 10-11. Annual meeting at Augusta, Maine. Secy., F. E. Pressey, 487 Union St., Bangor, Maine.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS.
Feb. 11-12. Annual meeting at New Haven, Conn. Secy., J. F. Jackson, New Haven, Conn.

MINNESOTA SURVEYORS AND ENGINEERS SOCIETY.
Feb. 11-13. Annual convention at St. Paul, Minn. Secy., Charles A. Forbes, 91 Kent St., St. Paul, Minn.

OREGON SOCIETY OF ENGINEERS.
Feb. 12. Annual meeting at Portland, Ore. Secy., J. C. Stevens, 605 Spalding Bldg., Portland, Ore.

NORTH DAKOTA SOCIETY OF ENGINEERS.
Feb. 13-14. Annual meeting at Bismarck, N. D. Secy., E. F. Chandler, University, N. D.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
Feb. 19-20. Annual meeting at Boston, Mass. Secy., N. W. Gifford, Boston, Mass.

IOWA ENGINEERING SOCIETY.
Feb. 19-21. Annual meeting at Sioux City, Iowa. Secy., S. M. Woodward, Iowa City, Iowa.

IDAHO SOCIETY OF ENGINEERS.
Feb. 21-22. Annual meeting at Weiser, Idaho. Secy., I. F. Stadtner, Boise, Idaho.

ASSOCIATION FOR STANDARDIZING PAVING SPECIFICATIONS.
Feb. 24. Annual meeting at Pittsburgh, Pa. Secy., J. P. Hutsell, 5047 Winthrop Ave., Chicago, Ill.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.
Feb. 25-26. Annual meeting at Indianapolis, Ind. Secy., W. F. Ring, Indianapolis, Ind.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 26-28. Midwinter Convention at New York City. Secy., F. L. Hutchinson, 33 W. 39 St., New York, N. Y.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.
Feb. 27-28. Annual meeting at Indianapolis, Ind. Secy., A. L. Neereamer, Indianapolis, Ind.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Mar. 3-5. Annual meeting at Chicago, Ill. Secy., W. P. Blair, 824 Engineers Bldg., Cleveland, Ohio.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

Kansas Engineering Society—The feature of the annual meeting at Topeka, Kan., on Jan. 21-22, was an address by Hugh L. Cooper on "The Keokuk Dam." Among the other papers on the program were the following: "Construction Cost Data," by F. D. Hughes; and "The Value of Pure Water," by G. R. Jones.

The officers elected for the ensuing year were: President, J. M. Meade; vice-president, H. A. Rice; secretary-treasurer, T. J. Strickler; directors, R. V. Leeson, J. W. Mavity, Fred Hesser and H. A. Rowland.

Maine Society of Civil Engineers—At the annual meeting at Augusta, Maine, on Feb. 10-11, a paper will be read on "The Use of the Pitometer," by Edward G. Lee. Secretary, Frank E. Pressey, Bangor, Maine.

Connecticut Society of Civil Engineers—Among the papers on the program for the annual meeting at New Haven, Feb. 11-12, are the following: "Relation of the Engineer to Public Health," by F. H. Snow; "The Chemist and Physicist in Relation to the Engineer," by W. R. Whitney; "The Catskill Aqueduct of the New York City Water Supply," by Clarence Blakeslee; and "Electrification on the New York, New Haven & Hartford Railroad," by W. S. Murray.

American Institute of Electrical Engineers—It has been decided to have the midwinter convention of the Institute, in New York City, Feb. 26-28, a working convention, so no excursions or other special entertainment features have been planned, except the reception and dance at the Hotel Astor on the evening of Feb. 28.

An extensive technical program has been prepared, containing papers under the head of "Heating, Heat Measurements and Rating by Heat," "Methods of Determining Losses in Apparatus," "Methods of Testing Apparatus for Performance," "Miscellaneous Subjects Relating to Rating." Particular interest will center about the paper on "Temperature and Electrical Insulation," by C. P. Steinmetz and B. G. Lamme (Sub-committee on Revision of Rules) and that on "Method of Rating Electrical Apparatus," by W. L. Merrill, W. H. Powell and Charles Robbins (Sub-commitee on Rating). The morning session on Feb. 27 will open with an address by H. G. Stott on the use of the "myriawatt" and "myriawatt-hour" terms proposed by him at the last annual convention as substitutes for the boiler horsepower and boiler horsepower-hour.

Albany Society of Civil Engineers—The ninth annual meeting of the society was held at Keeler's Hotel, Albany, N. Y., Jan. 28. The report of the secretary aroused much enthusiasm and gave encouraging evidence of the growth and influence of the society. During the past year the membership has increased from 110 to 216, and includes many engineers prominent in the state barge canal and highway work and in the federal service. After a short business session the members proceeded to the banquet hall to enjoy their annual dinner. The toastmaster was Richard W. Sherman, Chief Engineer of the State Conservation Commission. Among the after-dinner speakers were Robert E. Horton, Consulting Hydraulic Engineer, of Albany, who was for many years in charge of the water resources branch of the U. S. Geological Survey in New York State; Arnold D. Chapman, Deputy State Engineer of New York; P. H. Partheslus, Senior Engineer Examiner of the New York State Civil Service Commission, of Troy, N. Y.; John A. O'Connor, Engineer of Terminals, New York State Barge Canal; C. C. Covert, District Engineer, U. S. Geological Survey in charge of water resources surveys, in New York State; F. R Lanigan, City Engineer, of Albany; A. C. Harper, Assistant Engineer, U. S. Engineer Office, Troy, N. Y., and Mortimer G. Barnes, Consulting Engineer of the New York State Barge Canal. The officers elected for the ensuing year are: President, William R. Hill, Consulting Engineer, of Albany; Secretary, Rupert Sturtevant, Assistant Engineer, New York State Barge Canal; Treasurer, E. H. Sargent, Assistant Engineer, State Conservation Commission.

Size	Price per block—Hollow wall tile	Size	Interior partition block
4x12x12-in.	$0.06	2x12x12-in.	$0.048
6x12x12-in.	0.084	3x12x12-in.	0.048
8x12x12-in.	0.102	4x12x12-in.	0.052
10x12x12-in.	0.12	6x12x12-in.	0.072
12x12x12-in.	0.15	8x12x12-in.	0.096

Sewer Pipe—There is no change in the condition of the market. Discounts applying to the eastern list, delivered in New York, are as follows: 3 to 24 in., inclusive, 73% for 27 to 30 in., 65%, and for 33 and 36 in., 60%. Factory discounts are quoted at 82½ for 3 to 24 in.; 74% for 27 to 30 in., and 69% for 33 and 36 in. At those discounts the net prices per foot are as follows:

SEWER PIPE, PER FOOT

Size	Delivered N. Y.	Factory	Size	Delivered N. Y.	Factory
3-in.	$0.065	$0.045	20-in.	$0.6075	$0.405
4-in.	0.065	0.045	21-in.	0.81	0.54
5-in.	0.108	0.072	22-in.	0.81	0.54
6-in.	0.108	0.072	24-in.	0.8775	0.585
8-in.	0.1485	0.099	27-in.	1.575	1.17
10-in.	0.216	0.144	30-in.	1.925	1.43
12-in.	0.27	0.18	33-in.	2.50	1.93
15-in.	0.3645	0.243	36-in.	2.80	2.17
18-in.	0.513	0.349			

Flue Linings—The discount from list, f.o.b. mill, is 85%. Delivered in New York, in small lots, prices are on a basis of 72%. Mill prices are as follows:

Size	Weight in lb.	Price per ft.	Size	Weight in lb.	Price per ft.
4½x 8½-in.	14	$0.04½	12x16-in.	45	0.15
4½x13 -in.	20	0.068	13x16-in.	38	0.128
6 x12 -in.	22	0.075	13x18-in.	57	0.18
7 x 7 -in.	15	0.053	14x16-in.	60	0.165
8½x 8½-in.	18	0.068	16x16-in.	65	0.24
8½x13 -in.	28	0.098	16x20-in.	80	0.30
8½x18 -in.	45	0.135	18x20-in.	75	0.30

MILL SUPPLIES

Shafting—The prices of shafting have been advanced, and while the demand is only nominal, cold-rolled shafting is quoted at 60% off list in carload lots, and 52% in less than carload lots. The following net prices per foot are based on a discount of 52%:

Diameter in inches	Cents per ft.	Diameter in inches	Cents per ft.
¾	4.30	2¼	32.50
1	7.00	2½	40.00
1¼	11.00	2¾	52.50
1½	14.20	3	58.00
1¾	19.50	3½	85.00
2	25.60		

Belting—The demand continues large and quotations are steady.

Discounts are unchanged as follows: Leather belting, extra heavy, 50 to 50 and 5%; heavy, 50 and 10 and 5 to 60%; medium, 60 and 10 to 60 and 10 and 5%; light, 60 and 10 and 10 to 70%; Standard, 70 to 70 and 10%.

Rubber belting, best grades, 40 and 10%. Standards, 50 and 10% to 60%. Competitive grades are 60, 10 and 10% to 70%.

The price of rubber belting is, as stated, unchanged from last month. The net prices may be found on page 311 of the issue of Nov. 7.

LEATHER BELTING, NET PRICE PER FOOT

Width inches	Extra heavy	Heavy	Light
1	$0.11	$0.10	$0.08
1½	0.17	0.14	0.11
2	0.23	0.19	0.15
2½	0.28	0.24	0.19
3	0.34	0.29	0.23
3½	0.40	0.34	0.27
4	0.46	0.38	0.31
5	0.57	0.48	0.38
6	0.68	0.58	0.46
7	0.80	0.67	0.54
8	0.91	0.77	0.61
9	1.03	0.86	0.69
10	1.14	0.96	0.77
11	1.21	1.06	0.84
12	1.37	1.15	0.92
14	1.60	1.34	1.07
16	1.82	1.54	1.22
18	2.05	1.73	1.38
20	2.28	1.92	1.58
22	2.51	2.11	1.68
24	2.74	2.30	1.84
26	2.96	2.50	1.99
30	3.42	2.88	2.30
36	4.10	3.46	2.76
48	5.47	4.61	3.67

Fire Hose—The demand is large, but prices continued unchanged as follows: Underwriters' cotton rubber-lined hose, 2-in. in diameter, 350 lb. pressure, in 50-ft. lengths complete with couplings is 65c. per lin.ft. Common hose, 2½-in. diameter, tested to 200 lb. pressure, is 35c. per lin.ft.

Cotton Waste—Prices are as follows in bales of 100 to 500 lb.: No. 1 white picked cotton waste, 9¾ c. per lb.; No. 3, 7¾c.; No. 1 colored, 5c.; No. 3 colored, 4¼c.

Chain Belting—Prices* continue unchanged. Quotations are as follows: From 3 hp. to 10 hp., 30-in. centers complete the two sprockets, $7@8 per horsepower. From 10 hp. to 25 hp., 36-in. centers complete, $5@6 per horsepower. For 25 hp. to 100 hp., 56-in. centers complete, $4@5 per horsepower. From 100 hp. to 500 hp., 72-in. centers complete, $3@4 per horsepower.

Lubricating Oils—Quotations continue without change, the following figures being named for 5-bbl. lots:

Neutral oils, filtered:

	Cents per gal.
*Cylinder, dark	26@ 27
*Cylinder, steam refined	14@ 22
Neutral oils, filtered:	
Stainless, white, 32 to 34 gravity	28@ 29
Lemons, 33 to 34 gravity	17@ 19
Dark, 32 gravity	15@ 18
Crank case oil	15@ 17

*Prices are according to test.

Packing—Prices vary within wide limit, according to the brands of various dealers, but in general, packing can be purchased at the following quotations: Asbestos, wick and rope, 13c. per lb.; sheet rubber, 11@13c.; pure gum rubber, 40@45c.; red sheet packing, 40@50c.; cotton packing, 16@25c.; Jute, 5@6c.; Russian packing, 9@10c.

LUMBER

Advancing tendencies have been the rule all along the line. Two reasons are ascribed for this: The increased demand and the difficulty, if not impossibility, of securing men to get out the material. The absence of snow in the North has had the effect of greatly curtailing operations in that section.

Spruce—Quotations are firm with a normal winter market. Yard prices in New York are as follows:

2x10-in. 3x10-in. 4x10-in. 2x12-in.	12 to 16 ft.	$34
3x12-in. 4x12-in.	12 to 16 ft.	$36

For 18 and 20 ft., $37; for all lengths over add 50c. for every additional foot.

Flooring—The market is firm with a good demand.

Quarter-sawed oak flooring, A1, is $88 per M. Selected white-oak or red-oak flooring is $50 per M., and common flooring, red or white, is $30 per M.

Maple flooring, ⅞x2¼-in., is $50 for clear; $45 for No. 1, and $28 for factory. Long-leaf yellow-pine flooring, ⅞x2½-in. face, is $60@65 for A heart rift, $50@55 for sap rift; $36 for No. 1 flat; $34 for No. 2, and $30 for No. 3.

Hemlock—Prices are quoted with no change.

Price per M., f.o.b. cars, New York:

	Length— 10 ft.	12 ft.	14 ft.	16 ft.
2x4-in.	$27	$25	$25	$27

Long Leaf Yellow Pine—All sizes are in good demand, with prices steady.

Prices per Thousand Feet in Yard, New York.

	Length— 20 ft. base	21 to 25 ft.	26 to 30 ft.	31 to 35 ft.
2in. thick and under by 8 in. wide and under	$36	$36	$36	$38
10 in. wide by 10 in. thick and under 12 in. wide	42	42	42	45
by 12 in. thick and under 14 in. wide	41	42	43	46
by 14 in. thick and under 16 in. wide	47	48	50	52
by 16 in. thick and under	50	52	54	60

Piling—In New York, the price of oak piling is 22@25c. per lin.ft. Oak piles, 14 in. in diameter, 2 ft. from butt with a 6-in. top, and 40 to 45 ft. long, are held at $10.50@11.50; 50 ft. long, 25c. per lin.ft. Pine piles, 25 ft. long, 12 in. in diameter, 2 ft. from butt, with a 7-in. top, held at 17c. per lin.ft., while those 25 ft. long are 16c. In general pine piles can be had at 16@17c.; oak piles, 55 to 60 ft., are quoted at 23c. per lin.ft.

Shingles—No large demand is noted and prices are steady. The suply is limited, but as poor weather conditions have now stopped the call for shingles, the market is able to keep firm.

The following prices are repeated from last month and are normal, because there is not enough business to establish a higher quotation: Cypress shingles, New York: 7x24-in., rived and shaved, $23.50@24 per M.; 21-in., promiscuous widths, rived and shaved, $8, 4-in. basis; 6x20-in., sawed, $12 per M.; 6x18-in., sawed, $8.50 per M.; 5x18-in., sawed, $7.50 per M.

Cross Ties—Prices are still at a high figure, and are quoted by G. S. Baxter & Co., 15 William St., New York, as follows:

	Cents each
7x9 in. by 8 ft. 6 in.	88
6x9 in. by 8 ft. nominal	83
6x8 in. by 8 ft.	76

Lighterage Limits—The free delivery or "Lighterage Limits" in New York City are as follows: In Manhattan, from a point opposite the Fort Lee ferry, south along the Hudson River around the Battery and north along the East and Harlem Rivers to the Jerome Ave. Bridge at 155th St. In New Jersey, south from Fort Lee ferry to Bayonne City, points on the north and east shores at Staten Island, between Bridge Creek (Arlington) and Clifton, both inclusive, and including Elm Park, Erastina and Shooters Island. In Brooklyn, from 69th St., Bay Ridge, north to Pot Cove, Astoria, Long Island City.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Connecticut—Central New England Ry.—This company has made application to the Public Service Commission to issue $2,500,000 of bonds for improvements, of this amount, the sum of $775,000 will be spent for double-tracking. W. J. Backes, Hartford, Conn., is Ch. Engr.

New York—Bids will be received until Feb. 7, by the Public Service Commission, for the construction of the first section of the proposed subway system in Queens Borough. This section will be elevated, and operated jointly by the Interborough Co. and the Brooklyn Rapid Transit Co

New York—Bids were opened as follows, Jan. 28, by the Public Service Commission for the construction of Sect. No. 2 of the Woodside, Astoria and Corona Rapid Transit R.R. of New York City; a two- and three-track elevated railroad in Second or Debevoise Ave., beginning 300 ft. south of Beebe Ave. and extending to a point about 330 ft. south of Ditmars Ave., including five local stations and one express station: Cooper & Evans, 220 Broadway, $850,000; Snare & Triest Co., 143 Liberty St., $893,000; Oscar Daniels Co., 38 Park Row, $933,000; E. E. Smith Cont. Co., 71 Broadway; $937,000; Peace Bros., 20 Main St., Flushing, L. I., N. Y., $940,000; Fraser, Brace & Co., 1328 Broadway, $945,743; Percy Litchfield, 23 Flatbush Ave., and Brooklyn, $948,270; Post & McCord and Tidewater Bldg. Co., 16 East 33d St., $991,000; Rogers & Hagerty, 152d St. and East River, $1,012,260; Terry & Tench Co., Lexington Ave. and 131st St., $1,030,000; Marble Arch Co. and Conners Bros. Co., 17 West 42d St., $1,040,000; Thomas J. Buckley Eng. Co., Inc., 103 Park Ave., $1,287,000.

Pennsylvania—Montour R.R.—Contracts will be awarded before the close of winter by this company for 40 miles of extensions. The road is owned by the Pittsburgh Coal Co. Estimated cost, about $400,000.

Cumberland Valley R.R.—This company, it is reported, is considering four-tracking its lines between Harrisburg and Chambersburg, Penn. J. H. Tonge, Pittsburgh, Penn., is Supt.

Maryland—Western Maryland Ry.—The Board of Directors of this company has authorized increased tracking facilities between Hagerstown and Cumberland, Md. Estimated cost, $300,000. H. R. Pratt, Baltimore, Md., is Ch. Engr.

Virginia—Southern Ry.—This company will soon award contracts for double-tracking north of Monroe, Va., to Amherst, Va. B. Herman is Ch. Engr., M. W., Washington, D. C.

West Virginia—Buckhannon & Northern R.R.—This company will extend its line from Rivesville to Belington and connect with the Western Maryland Ry. at that point.

Morgantown & Wheeling Ry.—This company will construct 65 miles of line from Cassville, via Pentress, and Blackville, W. Va., and Brave, Penn., including a tunnel 1200 ft. long. Samuel & C. L. Eakin, Wadestown, W. Va., are the Engrs. J. Ami Martin, Morgantown, is Gen. Mgr. Noted Jan. 30.

Huntington & Northern Ry.—According to press reports, plans are under way and the contract will be awarded soon for 35 miles of railroad to be known as the Huntington & Northern Ry. The United States Engineering & Construction Co. will probably receive the contract. Edward B. Garretson, Cincinnati, Ohio, is interested.

Georgia—Ocilla Southern R.R.—This company, it is reported, will construct an extension from Nashville to Waycross, Ga., about 55 miles. J. A. J. Henderson, Ocilla, Ga., is Ch. Engr.

Waycross & Western R.R.—This company is planning to increase its stock from $350,000 to $710,000, for continuing the line west of Waycross, Ga., and for equipment purchases.

Georgia—Moultrie Metter & Panama R.R. Work will start soon on the construction of this company's proposed line. W. E. Aycock, Moultrie, Ga., is interested. Noted Jan. 30.

Florida—Tampa & Gulf Coast R.R.—This company has been incorporated with a capital of $250,000. The construction of a line from Tampa, down to St. Petersburg, Fla., is proposed. J. Edgar Wall, Tampa, Fla., is Pres., and J. A. Taylor, Sec.

Alabama—Mobile & Baldwin County R.R.—This company is [illegible] to Alberta from Mobile, Ala. Mobile and Pensacola, Fla., via Bayou and Fairhope. The bridge will be constructed. P. A. Parker is Engr.

Mississippi—Mississippi Northwestern R.R.—This company has received its charter, and has been granted permission to construct a line from [illegible] to near Greenville, Miss. The incorporators are W. G. Seaver and W. [illegible], Pascagoula, Miss.; W. S. Burns, St. Louis, Mo.; M. [illegible], Boston, Mass.; Philadelphia, Penn.; S. S. Watson, New York, and [illegible], Vicksburg, Miss.

Tennessee—Tennessee Central Ry.—The contract for this [illegible] has been awarded to Speed Brown Bros. Co., Inc., of Knoxville, Tenn., to Cookeville, Tenn., to Cane Creek.

Kentucky—Louisville & Eastern Ry.—This company will construct a further extension up Line Fork Creek, about 20 miles. Contracts are to be awarded in about 60 days. John Mason, Jr., Louisville, Ky., is Engr.

✚**Indiana**—Wabash R.R.—A contract has been awarded to the Hanna-Nellis Co., for double-tracking about 48 miles of line for this company between Fort Wayne and Peru, Ind. A. O. Cunningham, St. Louis, Mo., is Ch. Engr.

Iowa—Chicago, Milwaukee & St. Paul Ry.—This company will spend $150,000 this year for 25 new sidings between Manila, Iowa, and Mitchell, S. D. Each will be 3000 ft. long. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Iowa—Chicago, Rock Island & Pacific Ry.—This company will double-track its line from West Liberty, Iowa, to Vinton, Iowa. J. B. Berry, Chicago, Ill., is Ch. Engr.

Iowa Southern Ry.—This company filed articles of incorporation, Jan. 17, for the construction of a line from Albia, Iowa, to the coal mines at Centerville, Iowa, about 25 miles. The incorporators are William Gardner, Richard Ashton, John Caldwell and Josiah Cleveland. The principal office of the company will be located at Des Moines, Iowa. Capital, $900,000.

Kansas—Coffeyville, Caney & Southeastern Ry.—See item under Oklahoma.

South Dakota—Great Northern Ry.—This company is considering the construction of a line from Sioux Falls, S. D., to Wheeler, S. D. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Montana—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company, it is reported, will spend $25,000,000 for constructing 725 miles of new lines, necessitating crossing the state of Montana. C. N. Kalb, Minneapolis, Minn., is Ch. Engr. Noted Jan. 9.

Arkansas—Memphis, Dallas & Gulf R.R.—Work will probably start at once on the proposed extension from near Murfreesboro to Hot Springs, Ark., about 50 miles. W. P. Hart, Nashville, Ark., is Ch. Engr.

Rock Island, Stuttgart & Southern Ry.—This company has been chartered to take over the Stuttgart & Rice Belt Ry. Improvements will be made. The following are the officers of the new company: Thomas S. Buzbee, Pres.; A. B. Copley, Vice-Pres.; George B. Pugh, Sec. and Treas. The capital is $300,000.

Oklahoma—Coffeyville, Caney & Southeastern R.R.—It is reported that arrangements have been concluded for financing the construction of this company's proposed line. The line, as planned, will be built from Coffeyville, Kan., through Nowata, Centralia and Vinita, Okla., to Siloam Springs, Ark.

Colorado—Plateau Valley R.R.—The projected Plateau Valley R.R., which is to be built this spring, will extend from Yeckel Junction to Collbran, a distance of 125 miles, and will cost $600,000. Bonds to the amount of $750,000 have been sold by Jacob Yeckel, Pres., and A. J. Halter, Vice-Pres. Work of construction will begin soon. Yeckel Junction is on the Denver & Rio Grande R.R., near Grand Junction, Colo.

Idaho—Twin Falls, Oakland & San Francisco Ry.—This company has been organized at Twin Falls, Idaho, and proposes to construct a line south from Twin Falls to Wells, Nev., where a connection will be made with the Western Pacific Ry.

Washington—Northern Pacific Ry.—This company will revise grades and curves and improve the roadbed on its line between Tacoma, Wash., and Sumas, B. C., known as the Sumas Branch. Estimated cost, $1,500,000. W. L. Darling, St. Paul, Minn., is Ch. Engr. Noted Sept. 12.

Oregon—Bandon & Oregon Eastern R.R.—This company, recently incorporated with $14,000,000 capital, has completed surveys for the construction of its proposed line. Work will start soon. The offices of the company are at Bandon. Noted Nov. 14.

British Columbia—Northern Pacific Ry.—See item under Washington

ELECTRIC RAILWAYS

Rockland, Maine—Plans are being considered by the Rockland, South Thomaston & St. George Ry. Co. for the extension of its electric railway this spring. Alfred S. Black, Rockland, is Pres. and Gen. Mgr.

Boston, Mass.—The Bay State St. Ry. Co. is considering plans for the extension of its County St. line in Boston, to Horton. H. E. Reynolds, Boston, is Asst. Gen. Mgr.

Cortland, N. Y.—The Cortland County Traction Co. is considering plans for the extension of its line on Railway Ave., to Oswego St. Edwin Dudley, Cortland, is Mgr.

Granville, N. Y.—A franchise has been granted to Thomas F. Haley to construct and operate an electric railway from Granville through North Granville to the Fort Ann line.

Rahway, N. J.—The Board of Public Utility Commissioners has granted the Elizabeth & Trenton Railway Co., permission to extend its electric railway system to a connect with that of the Public Service Corporation, between Rahway and Woodbridge. This connection will provide a through line for the company from Camden to Jersey City, via Elizabeth.

Erie, Penn.—Plans are being considered by the Erie Traction Co. for the extension of its electric railway from Erie to Corry. C. M. Hatch, Erie, is Gen. Mgr.

Lebanon, Penn.—Preliminary arrangements will soon be completed by the Ephrata & Lebanon Electric Ry. Co. for the completion of its line to Lebanon. Chester Shoff, Lancaster, is Supt. of Const. Noted Sept. 19.

Pottsville, Penn.—Press reports are to the effect that the Pottsville Union Traction Co. will expend about $1,000,000 for improving and extending its line. It is proposed to extend the line from Mauch Chunk. W. B. Rockwell, 43 Exchange Place, New York, N. Y., is Mgr.

Frostburg, Md.—The construction of an electric railway from Frostburg to Meyersdale and Johnstown, Penn., is under consideration by E. H. Wise, Charlestown, W. Va.

Hendersonville, N. C.—Press reports state that plans are being prepared for the extension of the traction line at Hendersonville. Charles A. Carlson, Philadelphia, Penn., is interested.

Newbern, N. C.—Plans are being considered by the Newbern-Ghent St. Ry. Co. for the extension of its line from Newbern to Pollocksville by way of Trenton. C. J. McCarthy is interested.

Jacksonville, Fla.—The Jacksonville Traction Co. is planning the extension of several of its lines in Jacksonville. Hardy Crom, Jacksonville, is Local Mgr. and Pur. Agt.

St. Augustine, Fla.—The St. Augustine Public Service Corporation has applied for a franchise to construct and operate an electric railway in St. Augustine.

Mobile, Ala.—Preliminary arrangements are being made by the Mobile & Baldwin County R.R. Co., for the construction of its proposed line from Mobile to Bay Minette. The line will eventually be extended to Pensacola. J. R. Cross, Fairhope, Ala., is interested. Noted Jan. 30.

Montgomery, Ala.—Plans are being prepared by the Montgomery Light & Traction Co. for the extension of its electric railway to Woodley Road and the new Country Club. W. J. Ginnavan, Montgomery, is Gen. Mgr. and Ch. Engr.

Jackson, Miss.—The construction of an interurban electric railway from Jackson to Canton is being agitated. Y. D. Lott, Jackson, is a promoter of the project.

Shreveport, La.—A. K. Clingman, Keithville, La., is interested in a project to construct an electric railway from Homer to Minden and Shreveport.

Memphis, Tenn.—The Memphis St. Ry. Co. will soon be ready to start construction of its proposed extension of two of its lines in Memphis. E. W. Ford, Memphis, is Gen. Supt.

East Liverpool, Ohio—The Tri-State Ry. & Electric Co. has applied to the City Council for a franchise to construct a loop in East Liverpool and double-track its Newell St. line. W. R. W. Griffin, East Liverpool, is Gen. Mgr.

Youngstown, Ohio—The Poland St. Ry. Co. has been incorporated to construct and operate an electric railway from Poland to Youngstown. The incorporators are J. W. Blackburn, E. Mason Wick, U. C. Dedford, John T. Harrington and G. E. Rose.

Laporte, Ind.—The Northern Indiana Ry. Co. is considering plans for the construction of a belt line in the west and north portions of Laporte. C. D. Emmons, South Bend, is Gen. Mgr.

Eau Claire, Wis.—Among the entensive improvements planned by the Chippewa Valley Ry., Light & Power Co. is the construction of an interurban electric railway from Eau Claire to Altoona. George B. Wheeler, Eau Claire, is Gen. Mgr. and Pur. Agt.

Wauwatosa, Wis.—The Milwaukee Electric Ry. Co. has been petitioned to extend its street car lines in the vicinity of the county buildings in Wauwatosa. Estimated cost, $20,000. R. B. Stearn, Milwaukee, is Gen. Mgr.

Minneapolis, Minn.—The Minneapolis St. Ry. Co. is preparing plans for the extension of its Cedar Ave., Western Ave. and Monroe St. lines in Minneapolis. Horace Lowry, Minneapolis, is Gen. Mgr.

Moberly, Mo.—The Moberly, Huntsville & Randolph Springs Ry. Co. has completed surveys for the construction of its proposed line to connect Moberly, Huntsville and Randolph Springs, about 12 miles. John J. Mundinger, Huntsville, Mo., is Ch. Engr. Noted Jan. 23.

Argenta, Ark.—The City Council has granted a franchise to J. W. Carpenter, Corsicana, Tex., Pres., of the Corsicana Transit Co., to construct and operate an electric railway in Argenta.

Little Rock, Ark.—The Little Rock Ry. & Electric Co. has been granted a franchise to extend its line to Biddle, a suburb of Little Rock. C. J. Griffith, Little Rock, is Gen. Supt. Noted Nov. 28.

✚El Paso, Tex.—The Stone & Webster Engineering Corporation of Boston, Mass., has awarded the contract for grading the proposed interurban electric railway that is to be constructed between El Paso and Fabens, a distance of 30 miles, traversing the valley of the Rio Grande, to DUDLEY & ORR, of El Paso. C. W. Kellogg is Gen. Mgr.

San Antonio, Tex.—The San Antonio Traction Co. is preparing plans for double-tracking several of its lines. W. B. Tuttle, San Antonio, is Vice-Pres. and Gen. Mgr.

Waco, Tex.—A company is being organized at Waco under the name of the Waco, Mooreville, & Temple Interurban Ry. Co. for the construction of an electric railway to connect Robinson, Bell Falls and Blevins. The Business Men's Club at Waco is interested.

Sapulpa, Okla.—Preliminary arrangements are being made for the construction of an electric railway from Sapulpa to Cushing. C. N. Haskell, Muskogee, is interested.

Pocatello, Idaho—The City Council has granted a franchise to L. R. Martineau and J. B. Browning, Salt Lake City, Utah, to construct and operate an electric railway in Pocatello. Noted Jan. 2.

Corona, Calif.—The Pacific Electric Ry. Co. is making arrangements for the extension of its Riverside-Arlington line to Corona, about nine miles. J. McMillan, Los Angeles, is Gen. Mgr.

Martinez, Calif.—Fred E. Brooks has applied for two franchises to construct and operate electric railways. One line will be constructed from Martinez to Bay Point and the other from Martinez to Walnut Creek, Danville, Haywards and Livermore.

San José, Calif. The San José R.R. have made applications for franchises to operate a line on West Santa Clara St., from the old to the new city limits, on East Santa Clara St., between Coyote Creek and Hale Ave. F. E. Chaplin, San José, is Gen. Mgr.

Ottawa, Ont. The Ottawa & Morrisburg Electric Ry. Co. is making preliminary arrangements for the construction of its proposed electric railway from Ottawa to Morrisburg. J. G. Kilt is Pres. Noted Dec. 12.

Permission has been granted to the Ottawa Electric Ry. Co. to extend its lines in South Ottawa, for about three miles. J. E. Hutcheson, Ottawa, is Supt. and Pur. Agt.

Port Colborne, Ont.—The Niagara Falls, Welland & Lake Erie Ry. Co. will soon be ready to start surveys for the construction of its proposed line from Port Erie to Port Colborne. C. J. Laughlin, Welland, is Gen. Mgr. Noted July 11.

Toronto, Ont.—Plans have been prepared by the Humber Valley Ry. Co. for double-tracking its line through the Humber Valley, from Lambton to the Humber River.

LIGHT, HEAT AND POWER

Burlington, Vt.—The proposition to issue $50,000 of bonds for the enlargement and improvement of the municipal electric-light plant is under consideration.

Brockton, Mass.—Plans are being prepared for the installation of an ornamental street-lighting system in the business district. A. H. Andrews is interested.

Brooklyn, N. Y.—We are officially advised that bids were received by C. B. J. Snyder, Supt. of School Bldg., Jan. 27, for the installation of electric equipment in public school No. 172 as follows: John T. Williams Co., $7099; T. Frederick Jackson, Inc., $7482; Conner Construction Co., $7750; J. & F. Electric Co., $7200.

New York, N. Y.—Bids will be received by Joseph Johnson, Fire Comr., 157 East 67th St., until 10:30 a.m., Feb. 10, for the installation of an incandescent electric-lighting system in quarters of Engine Co. No. 31, at Lafayette and White Sts., Boro. of Manhattan.

Lambertville, N. J.—The Lambertville Heat, Light & Power Co. has passed to the control of F. Stanley North, Bay Shore, L. I., and associates. The new owners plan for extensive improvements in the power plant and electric system. T. F. Artell is Mgr.

Mercerville, N. J.—The Public Service Electric Co. will install a distributing system at Hamilton Township, by way of Mercerville and Hamilton Square. Dudley Farrand, Newark, is Gen. Mgr.

Salem, N. J.—The Board of Public Utility Commissioners has approved of a plan for the consolidation of the Salem Electric Co. and the Gloucester Electric Co., with a new corporation name of the Electric Co. of New Jersey. The company is permitted to issue stock for $24,000, and bonds to the extent of $130,000, the proceeds to be used for improvements and additions to its properties.

South River, N. J.—In a report to the Board of Public Works, Superintendent Reid, of the municipal electric-light plant, recommends increasing the capacity of the plant to provide for increased demands. Estimated cost, $25,000.

Trenton, N. J.—The Board of Public Utility Commissioners has granted permission to the New Jersey Gas Co. to issue $48,000 in bonds for the extension and improvement of its plant and system.

Franklin, Penn.—The Franklin Electric Co. is taking steps toward the installation of an ornamental stree-lighting system in Franklin. B. F. Ott is Supt.

Philadelphia, Penn.—Ballinger & Perrott, Archs., have completed plans and are receiving bids for the construction of an addition to the power plant of the W. Charles Young Co., at 26th and Thompson Sts.

Kenova, W. Va.—Plans are being considered by the Ohio Valley Electric Co. for the construction of a transmission line from Kenova to Ashland and Ironton. Estimated cost, $20,000. J. F. Frasher, Wheeling, is Supt. and Gen. Mgr.

Wellsburg, W. Va.—Plans for the construction of a municipal electric-light plant are being considered by the City Council.

★Clayton, N. C.—Bids will be received by the Board of Commissioners until 3 p.m, Feb. 25 for the construction of a municipal electric-light plant. D. L. Barbour is Clk. and Gilbert C. White, Charlotte, is Engr. Noted Oct. 31.

Glen Alpine, N. C.—The construction of a hydro-electric plant across the Catawba River, near Glen Alpine, is contemplated by the North State Power Co.

Jonesboro, Ga.—At a recent election the citizens voted to issue $10,000 in bonds for the construction of a municipal electric-light plant. Noted Jan. 23.

Rochelle, Ga.—See item under Water Supply-Irrigation.

Arcadia, Fla.—Plans are being prepared by the Arcadia Electric Light & Telephone Co. for the installation of new equipment in its power plant. E. Scott, Arcadia, is Supt. and Mgr.

Tuscaloosa, Ala.—The construction of a gas plant and distributing system in Tuscaloosa is under consideration. Estimated cost, $75,000. H. B. Foster is interested.

Jackson, Miss.—The Jackson Ry. & Light Co. is planning to install an ornamental street-lighting system in Jackson. J. Abbott, Jackson, is Gen. Supt. and Elec. Engr.

Corydon, Ky.—A committee has been appointed to make arrangements for the construction of a municipal electric-light plant. Bonds for $8000 have been voted for the purpose. C. E. Harness is Clk. Noted Nov. 14.

Richmond, Ky.—The Dix River Power Co., is reported to have financed the construction of its water power project on Dix River by the sale of $4,000,000 of bonds. L. B. Herrington, of Richmond, Ky., is Pres. of the company and has

information regarding construction plans, which it is said will be executed at once. Noted July 18.

Clyde, Ohio—See item under Water Supply-Irrigation.

East Liverpool, Ohio—Plans are being prepared by Sidney B. Martin, Consult. Engr., Glanshaw Bldg., Pittsburgh, Penn., for the construction of a municipal electric-light plant. Estimated cost, $60,000.

Alexandria, Ind.—The Indiana General Service Cl., recently incorporated, will soon receive bids for the construction of an electric-light and power plant. C. L. Walling is interested.

Lawrenceburg, Ind.—Bids will be received by the Common Council until 7:30 p.m., Feb. 17, for the construction of a municipal electric-light plant. Frank Goble is City Clk. Paul H. White, Union Trust Bldg., Indianapolis, is Consult. Engr.

Williamsport, Ind.—The city contemplates the installation of new equipment in the municipal electric-light plant. Charles E. Brooks is City Clk.

Detroit, Mich.—Preliminary arrangements are being made for the installation of a power plant in connection with the Detroit General Hospital to supply electricity for the various buildings.

Montague, Mich.—Plans are being prepared by Wernette & Bradfield, Houseman Block, Grand Rapids, Mich., for the construction of a power plant for the White Lake Light & Power Co. at Montague. Estimated cost, $100,000.

Saginaw, Mich.—Plans are being prepared by the Van Lyle Co., Union Trust Bldg., Detroit, for the construction of a power plant, to be built for the Saginaw Wood Products Co., at Hess and Sheridan Sts. Estimated cost, $20,000.

Alton, Ill.—The Alton, Granite & St. Louis Traction Co. has purchased a site in Alton for its proposed power plant which will furnish electricity for its system on the East Side. C. F. Hewitt, East St. Louis, is Gen. Supt.

Arenzville, Ill.—Plans are being considered by the Central Illinois Public Service Co. for the construction of an electric-light plant at Arenzville.

Bardolph, Ill.—A franchise has been granted by the Village Board to the Central Illinois Public Service Co. to construct and operate an electric-light system in Bardolph.

Clinton, Ill.—Plans have been prepared for the installation of an ornamental street-lighting system in Clinton. Estimated cost, $18,000. L. W. Lemon is City Engr. and Chn. Bd. of Pub. Wks.

Springfield, Ill.—The installation of an ornamental street-lighting system on Adams St., from Tenth St. to Forest Park, is under consideration. John S. Schnepp is Mayor.

Marshalltown, Iowa—The Iowa Ry. & Light Co. is preparing plans for the installation of new equipment in its local power plant to provide for the increased demand of electricity.

Rockwell, Iowa—The installation of an electric-light system in Rockwell, is contemplated by C. C. Carhart, Sheffield, Iowa. A transmission line will be extended from Sheffield.

Toledo, Iowa—Extensive improvements are planned by the Iowa Ry. & Power Co. to its local plant. Estimated cost, $30,000.

Warroad, Minn.—Plans are being considered by the Village Council for the installation of a municipal electric-light plant.

Arcadia, Kan.—Bids will be received some time in February for the construction of an electric-light plant. Bonds for $7500 were recently voted for the purpose. E. T. Archer & Co., Kansas City, Mo., are Consult. Engrs. Noted Nov. 21.

Kingman, Kan.—Bonds for $45,000 have been sold for the installation of a municipal electric-light plant. Noted Jan. 9.

Miltonvale, Kan.—E. T. Archer & Co., New England Bldg., Kansas City, Mo., are preparing plans for the construction of an electric-light plant at Miltonvale. Estimated cost, $32,000.

Topeka, Kan.—Bids will be received by the State Board of Control until Feb. 8, for furnishing electric lamps to be installed in the state institutions. N. C. Bowman is Chn. of Bd.

Springdale, Ark.—The City Council is considering the proposition of A. C. Moore, of Joplin, Mo., for the construction of a municipal electric-light plant and water system.

Texhoma, Tex.—At a recent election bonds for $25,000 were voted for the construction of a municipal electric-light and water-works system.

Victoria, Tex.—The Victoria Electric Lighting Co. will install new machinery and make other improvements to its electric light and power plant here.

Belen, N. M.—Local capitalists are interested in the installation of an electric-light plant at Belen.

Cashmere, Wash.—The Town Council has decided to install an ornamental street-lighting system. The system will cover about three miles and will necessitate the use of 110 lamps.

Spokane, Wash.—The Spokane Gas Co. will expend $120,000 for the extension and improvement of its gas plant. A. N. Cantrill is Mgr.

Corvallis, Ore.—Plans are being prepared by the Corvallis & Eastern Ry. Co. to install new equipment in its power plant at Corvallis.

Milton, Ore.—It is reported that local capitalists are interested in the construction of a 7000-hp hydro-electric plant on the Walla Walla River, near Milton.

Azusa, Calif.—The Pacific Light & Power Co. will erect a power house to generate 5000 hp. opposite Mountain View resort on the Main River. Water will be taken out of Fish Fork, through a tunnel in spur of Pine Mountains to Main River, thence through the tunnel in spur of Rose Mountains to Iron Fork.

Covina, Calif.—The City Engineer is preparing plans for the installation of an ornamental street lighting system on various streets.

Redlands, Calif.—The Edison Electric Co. will build a high power line from Redlands to Yucaipa Valley. R. H. Ballard, Los Angeles is Mgr.

San Bernardino, Calif.—The Atchison, Topeka & Santa Fe R.R. Co. is planning to enlarge the capacity of its precooling and ice-making plant at San Bernardino. Estimated cost, $250,000. G. W. Harris, Los Angeles, is Ch. Engr.

San Francisco, Calif.—Frederick H. Meyer, Arch., Bankers' Investment Bldg., has completed plans and specifications for a one-story reinforced concrete sub-station which is to be erected by the Pacific Gas & Electric Co. on Townsend St. between First and Second Sts.

Tulare, Calif.—The Central California Gas Co. will enlarge and improve its plants at Tulare, Visalia and Porterville. The company will also lay distributing mains in Exeter and Lindsay.

Amqui, Que.—The City Council is planning the construction of a municipal electric-light plant.

Glace Bay, N. S.—The installation of additional equipment in the municipal electric-light plant is under consideration.

Sidney, N. S.—The Cape Breton Electric Co., Ltd., has been authorized to issue $100,000 of bonds for the extension and improvement of its plant and system. W. G. Ross, Sidney, is Gen. Supt. and Pur. Agt.

Sutherland, Sask.—See item under Water Supply—Irrigation.

Tepic, Mex.—Rafael Pardo and associates have revived the project of installing a large hydro-electric plant on the Santiago River in the state of Jalisco and the construction of a system of power transmission lines to Tepic and a number of other cities, towns and mining camps within a radius of 150 miles of the proposed power station. The application of Mr. Pardo and associates for a concession from the government for the project requests that they be given the right to use 30,000 liters of water per second of the Santiago River for the generating of electrical energy.

BRIDGES

Concord, N. H.—Plans are being prepared at the office of Frank A. Merrill, Div. Engr., for steel bridges to replace the wooden structures on the Suncook Branch of the Boston & Maine R.R., between Concord and Hooksett. Bids will be asked as soon as the plans are completed.

Hartford, Conn.—The New York, New Haven & Hartford R.R. Co. plans to rebuild a large proportion of the bridges on the line of the Central New England R.R. in Connecticut and in Dutchess County, the Central New England R.R. in and in Dutchess County, New York. Edward Gagel, New Haven, is Ch. Engr.

Norwalk, Conn.—Plans are being prepared for a new bridge over the Norwalk River at Cross St., the present structure being too light for the traffic now passing over it. Alfred Avison is First Selectman.

Edwards, N. Y.—The town contemplates the construction of a highway bridge across the Oswegatchie River from the Hoover property to the railroad grounds.

Lackawanna, N. Y.—It is proposed to construct two bridges on South Park Ave., at an estimated cost of $50,000. Robert H. Reed is Mayor.

Little Falls, N. Y.—Bids will be received by Duncan W. Peck, Supt. Pub. Wks., Albany, until Feb. 18, for constructing a lift bridge and a fixed bridge over the Erie Canal at Little Falls. Estimated cost, $124,471. Noted Dec. 19.

Harrisburg, Penn.—The city officials plan to ask the Commissioners of Dauphin County to provide for the construction of two bridges, one at Cumberland and one at Walnut St.

Pittston, Penn.—According to press reports, the city contemplates the construction of a concrete and iron bridge over the Susquehanna River, at Water St. Estimated cost, $3,000,000.

Baltimore, Md.—The Baltimore & Ohio R.R. contemplates the construction of a viaduct across the tracks at Lee St. F. L. Stuart is Ch. Engr. H. K. McCay is City Engr.

✚The Pennsylvania R.R. Co. has awarded a contract to CHARLES McDERMOTT, Pennsylvania Bldg., Philadelphia, to construct a four-track reinforced-concrete arch viaduct over Gwynn's Falls. The bridge will be 606 ft. long, to be composed of three 115-ft., one 75-ft., and one 50-ft. spans, and will require about 25,000 cu.yd. of concrete, and 800,000 lb. of reinforcing steel. Noted Jan. 30.

Lawrenceville, Va.—Bids will be received until Feb. 11 by the Clerk of the Circuit Court of Brunswick County, Lawrenceville, for construction of a bridge across Waqua Creek, near Rawlings, Va. It will be a standard 80-ft. span, the substructure to be the old masonry encased in concrete. P. St. John Wilson, Richmond, Va., is State Highway Comr. Noted Sept. 12.

Norfolk, Va.—The Bridge Committee of the City Council has authorized the City Engineer to secure information regarding plans and estimates for the proposed Berkley Bridge, and has appropriated $500 for the purpose. W. F. Brooke is City Engr.

Charlotte, N. C.—Press reports state that satisfactory plans have been completed for the East Morehead St. Bridge, and that bids will soon be asked. It will be a flat slab reinforced concrete structure, and is estimated to cost $12,000. Joseph Firth is City Engr. Noted Oct. 31 and Nov. 21.

✚**Birmingham, Ala.**—A contract has been awarded by the Southern Ry. Co. to JOHN W. ASHE, Chattanooga, Tenn., for construction of the Norwood Viaduct at 27th St. and 10th Ave. It will be of steel and concrete with sidewalks on each side, a wagon road and a double-track for the street railway. Noted Dec. 12 and Jan. 2.

Chatom, Ala.—Bids will be received until noon, Feb. 25, by the Board of Commissioners of Washington County, for the erection of two steel bridges, with concrete floors. W. S. Kellett, Montgomery, Ala., is State Highway Mgr.

Mobile, Ala.—The Mobile & Baldwin County R.R. Co. plans to construct four drawbridges between Baldwin County and Mobile, and two drawbridges between Fairhope and Pensacola. Martin H. Miller, Box 928, Mobile, is Vice-Pres. and Gen. Mgr.

Akron, Ohio—The Commissioners of Summit County are considering plans for the North Howard St. Bridge. It is estimated to cost $78,000. C. B. Brower is County Clk.

Toledo, Ohio—Bids will be received until noon, Feb. 17 by the Director of Public Service for the construction of the Summer St. Bridge over the tracks of the Lake Shore & Michigan Southern Ry. T. R. Cowell is Dir. Noted Oct. 31 and Jan. 30.

Milwaukee, Wis.—Bids will be received by the Commissioner of Public Works, about Feb. 28 for the construction of a double-leaf bascule bridge, approaches, foundations and abutments. The estimated cost is $175,000. J. C. Pinney is Supt. of Bridges. Noted Jan. 23.

+Oshkosh, Wis.—We are officially advised that the contract for the construction of the superstructure of the West Algoma St. Bridge over the Fox River, has been awarded to the Joliet Bridge & Iron Co., Joliet, Ill., at $86,440, and for the substructure, to FITZ SIMONS & CONNELL DREDGE & DOCK CO., at $93,523. Noted Dec. 26.

+Ida Grove, Iowa—The contract for the construction of a concrete bridge over the Maple River, has been awarded to the MARSH ENGINEERING CO., Des Moines, Iowa. The estimated cost is $12,000. Noted Jan. 2.

Montezuma, Iowa—Bids will be received by the County Auditor of Poweshie County until Feb. 12, for the construction of concrete bridges and culverts during the year 1913. W. C. McKee is the County Audr.

Seward, Neb.—Press reports state that the County Board of Supervisors will receive bids until Feb. 11 for the construction of all bridges during the year.

Eldorado, Kan.—Bids will be received by the County Commissioners until Feb. 12, for the construction of seven steel bridges.

+Jasper, Ark.—Press reports state that the contract for the construction of two bridges of steel, one at Harrison and Jasper Road and the other at the mouth of Big Creek at Harrison and Mt. Judea Road, has been awarded to the JOLIET BRIDGE & IRON CO., Joliet, Ill., at $25,970.

San Acacia, N. M.—The Commissioners of Sonorro County will receive bids for the construction of a bridge across the Rio Grande at San Acacia.

Tacoma, Wash.—The Oregon-Washington R.R. & Navigation Co., will construct a steel bridge in Tacoma. The estimated cost is $350,000.

Santa Ana, Calif.—The Board of Supervisors contemplates replacing the Olive Bridge with a 450-ft. concrete structure with about one mile of pile protection to guard against the encroachment of the river. The sum of $35,000 is available for the purpose.

+Kincardine, Ont.—We are officially advised that a contract has been awarded by the Commissioners of Bruce County to the HUNTER BRIDGE & BOILER CO., Kincardine, at $10,000, for the construction of the center pier for the Southampton Bridge across the Sangreen River. Robert McDowall, Owen Sound, Ont., is County Engr. P. A. Malcomson is County Clk. Noted Jan. 16.

New Westminster, B. C.—The Canadian Northern Ry. Co. plans the construction of a bridge over the right-of-way of the British Columbia Electric Ry. at New Westminster. M. H. McLeod, Winnipeg, Man., is Ch. Engr.

Vancouver, B. C.—The Burrard Bridge & Tunnel Co. is considering plans for constructing a steel bridge over the Second Narrows, at an estimated cost of $2,100,000. John Wolfe Barry is Consult. Engr.

WATER SUPPLY—IRRIGATION

Pembroke, N. H.—A committee has been appointed to secure the necessary legislation for the installation of a water system here. Arthur H. Dudley, Manchester, N. H., is Consult. Engr. E. T. Morrison is a member of the committee.

Boston, Mass.—Bids will be received by J. E. Mullen, Supt. of Supplies, until Feb. 19, for furnishing 642 six- to 16-inch valves for high pressure fire service.

Chatham, Mass.—Bids will be received until Feb. 17, for the purchase of $60,000 water bonds. Robert H. Smith is Village Clk. Noted Jan. 30.

Medford, Mass.—Bids will be received by the Sewer and Water Commissioners until Feb. 12, for furnishing 225 tons of c.-i. water pipe. Fred W. Gow is Chn.

Glens Falls, N. Y.—The city contemplates constructing a duplicate main from the Upper Junction to the centre of the city, and a new dam at the Wilkie Reservoir, repairing the Keenan Dam, and cleaning the Wilkie and Keenan Reservoirs. Estimated cost, $175,000.

★Jamestown, N. Y.—Bids will be received by the Board of Water Commissioners until noon, Feb. 17, for furnishing all labor and materials for constructing a 6,000,000-gal. pumping engine, reciprocating or turbine, according to specifications on file at the office of the Board.

Asbury Park, N. J.—We are officially advised that bids will be received by the City Council about Mar. 1, for constructing an addition to the pumping station, installing new equipment, and laying distributing mains. Estimated cost, $275,000. R. L. Savage is City Engr. Noted Jan. 23.

Atlantic City, N. J.—Specifications have been submitted to the City Commission for laying about one mile of c.-i. water main across the meadows. Estimated cost, $90,000.

★Belmar, N. J.—Bids will be received by the Borough Council until 1 p.m., Feb. 15, for furnishing all labor and material for installing about 4½ miles of 4- to 10-in. c.i. water mains, with the necessary valves, hydrants, specials, etc. Plans may be seen and specifications obtained at the office of Charles O. Hudnut, Boro. Clk., or at the office of Clyde Potts, Consult. Engt., 30 Church St., New York. Robert G. Poole is Mayor.

Laurel Springs, N. J.—The Clementon Spring Water Co. plans the construction of a new water tank, of the standpipe type. Seldon Twitchell is Pres.

Trenton, N. J.—Bids will soon be asked by the City Commissioners for low lift pumping machinery in connection with the new filtration plant, the contract for which was recently awarded. The Engineering Department is now considering what type of machinery to ask bids on. Noted Jan. 2.

+Trenton, N. J.—The contract to furnish all c.-i. water pipe to be used during the year 1913, has been awarded to the U. S. STANDARD CAST IRON PIPE CO., Burlington. The approximate quantities of pipe required, and the unit prices, are: 180 tons of 4-in., $26; 225 tons of 6-in., $24.50; 50 tons of 10-in., $24; 50 tons of 12-in., $24; 30 tons of fittings, $50 per net ton.

Farrell, Penn.—Bonds for $125,000 have been voted for the installation of a municipal water system. Noted Jan. 9.

+Baltimore, Md.—Bids will be received at the office of the City Register until 11 a.m., Feb. 12, for furnishing ten sluice gates and appurtenances at Loch Raven, Contract No. 8. The contract involves the following: Approximate quantities: Four 42x72-in. sluice gates with appurtenances; two 48-in. dia. sluice gates with appurtenances; four 24-in. dia. sluice gates with appurtenances. Additional items that may be required: 260 lin.ft. additional 3½-in. gate stems with couplings; 172 lin.ft. additional 2¼-in. gate stems; 24 additional guides for 3½-in. setms; 8 additional guides for 2¼-in. stems. Plans and specifications may be obtained at the office of Ezra B. Whitman, Water Engr., City Hall.

Pence Springs, Va.—The Pence Springs Water Co. has been incorporated with a capital stock of $75,000 to install a water system here.

Vinton, Va.—An election will probably soon be called to vote on a bond issue of $40,000 for installing water and sewer systems.

+Clayton, N. C.—Bids will be received by E. L. Hinton, Mayor, and the Board of Commissioners, until 3 p.m., Feb. 25, for installing a water system here. The contract involves; about four miles of 6-, 8-, and 10-in. water mains, with hydrants and valves, a fireproof building, power pumps, and a clear water basin. Plans and specifications are on file at the office of the Mayor, and at the office of Gilbert C. White, Consult. Engr., Charlotte, N. C.

+Newbern, N. C.—The contract to construct a fireproof building for the water and light plants, has been awarded to H. S. HANCOCK, Newbern, at $9800. Bids were opened by the Board of Aldermen, Jan. 7. Noted Dec. 26.

Rochelle, Ga.—The town contemplates installing a water system and an electric light plant. It has not been decided whether to install a municipal system or to grant a franchise to a private company. For particulars, address the Town Clerk.

Lafayette, La.—Bids will probably soon be asked for installing three boilers, a generator and an air compressor for the water and light plant. A. H. Traham is Mayor.

Paintsville, Ky.—George W. Atkinson, Louisa, Ky., has been granted a franchise to install and operate a water system here.

+Alliance, Ohio—According to press reports, a contract to construct a 6,000,000-gal. filtration plant and an earth storage dam, has been awarded to the PITT CONSTRUCTION CO., Pittsburgh, Penn., at approximately $67,000. Noted Dec. 12.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Feb. 11, for furnishing 75 fire hydrants, of the compressed type, with 6-in. inlet, and one 4½-in. steamer outlet. Specifications may be obtained at the office of the Director.

+Clyde, Ohio—The Board of Public Affairs has awarded a contract to the JOSEPH L. SHELDON ENGINEERING CO., Spitzen Bldg., Toledo, at $25,497, for extending, repairing and improving the water system and electric-light plant. Plans were prepared by the Moore Engineering Co., Cleveland. Noted Jan. 2.

Frankfort, Ohio—The W. J. Sherman Co., The Nasby, Toledo, Ohio, has been retained by the Town Council to prepare plans and specifications for the installation of a municipal water system here. J. G. Bell is Town Clk. Noted Jan. 9.

Jeffersontown, Ohio—See item under Buildings.

Wyoming, Ohio—Bonds for $16,000 have been sold for extending and improving the water system.

Youngstown, Ohio—Bids will probably soon be asked for constructing a dam for the Milton Reservoir. Veeder Heasley is Dir. Pub. Ser. Noted Jan. 9.

West Terre Haute, Ind.—Plans have been completed by W. R. Paige, Consult. Engr., Rose Dispensary Bldg., Terre Haute, for a water system for the West Terre Haute Water Co. Estimated cost, $15,000. J. C. Kelly is Pres. Noted Nov. 28.

Battle Creek, Mich.—The City Council has instructed the Board of Public Works to prepare plans and estimates for constructing a pumping station at Verona Wells.

Bay City, Mich.—Bonds for $6000 have been voted for improving the water system.

Detroit, Mich.—Plans are being prepared for constructing a purification plant for the water system. Estimated cost, $35,000. F. T. Bowles is Secy. Water Bd.

Grand Rapids, Mich.—Bids will probably soon be asked for laying additional water mains for fire protection. Estimated cost, $50,000. L. D. Cutcheon is Mgr. Bd. Pub. Wks. Noted Jan. 16.

Evanston, Ill.—We are officially advised that plans are being prepared by George W. Fuller, Consult. Engr., 170 Broadway, New York, for a filtration plant here. The plant will be of the sand-gravel type, with a daily capacity of 12,000,000 gal. Estimated cost, $180,000. J. H. Moore is Comr. Pub. Wks. Noted Dec. 26.

Paris, Ill.—The citizens contemplate a bond issue of $30,000 for the installation of a filtration plant. An election will probably soon be called to vote on the project.

Mukwonago, Wis.—Bonds for $14,000 have been sold for installing a water system here. Bids for construction will soon be asked.

Oshkosh, Wis.—A. T. Maltby, Consult. Engr., 20 West Jackson Blvd., Chicago, Ill., is preparing plans for a water

system and a filtration plant for the city. An appraisal of the plant of the Oshkosh Water Co. was recently completed. Noted Jan. 9.

Estherville, Iowa.—An election has been called for Feb. 17, to vote on a bond issue of $25,000 for installing a water system. Noted Dec. 26.

Deerwood, Minn.—An election will probably be called some time during the spring to vote on the installation of water and sewer systems.

Miltonvale, Kan.—E. T. Archer & Co., Consult. Engrs., Kansas City, Mo., are preparing plans for a water system here, and electric light plant, estimated to cost $32,000. S. G. Lacey is Town Clk.

Chamberlain, S. D.—Bonds for $10,000 have been voted by Brule County for boring four artesian wells to secure water for refilling Red Lake.

Charleston, Mo.—The City Council contemplates retaining an engineer to appraise the plant of the private water company, and to prepare plans for extensions to the water and sewer systems to cost about $55,000. An election will probably soon be called to vote on a bond issue. L. E. Haw is City Atty.

✚Little Rock, Ark.—We are officially advised that the contract to construct the concrete foundation of a pumping house, and install four pumps and motors, for the Fourche Drainage District, has been awarded to R. V. JONES, Finance Bldg., Kansas City, Mo., at $38,075. Bids were opened by the Directors, Jan. 9. Lund & Hill are Engrs. Noted Dec. 26.

✚Dallas, Tex.—The contract for the construction of a pumping station at Oak Cliff, has been awarded to LINDSAY & SMITH, Dallas, Tex., at $9751. Bids were opened Jan. 20.

Madisonville, Tex.—Bonds for $16,000 have been voted for the installation of a water system here. W. W. Sharpe is interested. Noted Jan. 23.

New Boston, Tex.—An election has been called for Feb. 25, to vote on a bond issue of $15,000 for installing a water system.

Spur, Tex.—An election has been called for Feb. 17, to vote on a bond issue of $25,000, for the installation of a water system.

Texhoma, Okla.—Tentative plans are being prepared for the installation of a water system and an electric light plant here. Bonds for $25,000 have been voted.

Tucson, Ariz.—The Tucson Farms Co. is constructing a system of irrigation in the Santa Cruz Valley near here, to cost about $750,000. About 6000 acres of land will be reclaimed, and it is proposed to install 30 pumps.

Seattle, Wash.—Bids for constructing a water main in East 60th St. were received by the Board of Public Works, Jan. 17, as follows: Erickson Bros., $19,650; E. J. Rounds Construction Co., $19,595; Dickens & Rightmire, $20,487; McQuaid & Moore, $20,856; Washington Construction Co., $18,809; Ferguson Colt Co., $20,221; John W. Johnson, $19,463; Krogh & Jensen, $20,479; International Dredging Co., $20,087; Jahn Construction Co., $20,072.

Long Beach, Calif.—The Board of Public Works has authorized an expenditure of from $4000 to $5000 for the installation of a compressor pump at the Bouten Wells. Bids will be asked immediately.

Los Angeles, Calif.—Work will commence immediately, by day labor, on the erection of a one-story reinforced concrete addition to the pumping plant of the city at Wilmington. It will be one-story high, 56x104 ft., with concrete foundation, reinforced concrete walls, steel truss roof. The work will be carried on under the supervision of the Bureau of Water Works & Supply, 636 South Hill St.

✚The contract to construct a water tank at the Los Angeles County Farm has been awarded to the SECURITY CONSTRUCTION CO., Union Oil Bldg., Los Angeles, at $9533. [illegible] Noted Jan. 16.

San Diego, Calif.—Bids will be received until 11 a.m. Feb. 12, by the Board of Directors of the San Ysidro Irrigation [illegible] San Diego County for the construction of a water system comprising four electric induction motors, two centrifugal pumps, pump house, five drive wells, 12,210 lin.ft. of 6-in. steel pipe 3670 ft. of 8-in. pipe, 2130 ft. of 12-in. 2400 ft. of O. D. casing, 2500 ft. 2-in. standard pipe, specials and fittings, of two cement-lined reservoirs of 186,000 and 204,000 gal. capacity. Josiah Poeton, San Ysidro, Calif., [illegible]

★**Hamilton, Ont.**—Bids will be received by S. H. Kent, City Clk., until 10 a.m., Feb. 18, for supplying 12-in. flanged pipe; high pressure, 12-in. bell and spigot pipe, high pressure; and 12-, 16- and 24-in. special castings for high and low pressure service. Plans and specifications may be obtained from [illegible] Engr.

Parkhill, Ont.—Bowman & Conners, Consult. Engrs., Berlin, Ont., have prepared plans for a water system here. Bids [illegible] will probably soon be asked.

Sarnia, Ont.—Willis Chipman, Consult. Engr., Mail Bldg., Toronto, has been instructed to prepare plans and submit improvements to the water system. Estimated cost, $240,- [illegible] Noted Nov. 21.

Sutherland, Sask.—Bids will be received by the Town Council for [illegible] water [illegible] pipe, [illegible] street, and laying sidewalks. McArthur, Murphy & Underwood [illegible] Engrs.

★**Esperanza, Mexico.**—Bids will be received at the office of the [illegible] Esperanza, Sonora, Mexico, until [illegible] for the excavation of about [illegible] cu.yds. of earth and rock, [illegible] from the Yaqui River, near Esperanza, involving the excavation of [illegible] cu.yds. of earth and rock, [illegible] of concrete lining, [illegible] of concrete channel lining, [illegible] of timber in the [illegible]

SEWERS

Boston, Mass.—Bids will be received by the Department of Public Works until Feb. 14, for constructing an underground sewage pumping plant in Sumner St., South Boston. L. K. Rourke is Comr.

✚**Boston, Mass.**—We are officially advised that bids for constructing sewers in Spring, Baker and Gardner Sts., West Roxbury, were received at the Board of Public Works, Jan. 27, as follows: WEST ROXBURY TRAP Rock CO., $36,848 (awarded contract); William J. Barry, $40,457; Antony Cefalo, $41,200; McCarthy & Walsh, $43,154; William L. Dolan, $43,449; M. Russo & Son, $60,252. Noted Jan. 23.

Fitchburg, Mass.—The Sewerage Commissioners have announced that bids will be asked about Apr. 1, for constructing the new sedimentation plant and filter system, and for laying another section of the trunk sewer. David A. Hartwell is Ch. Engr. Noted Jan. 16.

Lawrence, Mass.—The city contemplates the construction of a sewer system to serve the section west of Tower Hill. Estimated cost, $30,000.

Medford, Mass.—Bids will be received by the Sewer and Water Commissioners until Feb. 12, for furnishing 20,000 lin.ft. of vitrified salt glazed sewer pipe. Fred W. Gow is Chn.

New York, N. Y.—Bids will be received by Maurice E. Connolly, Pres. Boro. of Queens, until 11 a.m., Feb. 10, for the construction of a temporary dry weather flow sewer in the line of 43d St., from the pierhead line to the bulkhead line; a sewer and appurtenances in 43d St., from the bulkhead line of Fushing Bay to Ditmars Ave., a temporary grit and screening chamber in 43d St. and a sewer and appurtenances in Ditmas Ave. Bayshore Terrace), from 43d St. to 51st St., Second Ward of the Borough of Queens.

★**Belmar, N. J.**—Bids will be received by the Borough Council until 8 p.m., Feb. 15, for constructing about 4½ miles of 8- to 18-in. vitrified pipe sewers with manholes and the necessary appurtenances. Plans may be seen and specifications obtained at the office of Charles O. Hudnut, Boro. Clk., and at the office of Clyde Potts, Consult. Engr., 30 Church St.

Fairview, N. J.—At a recent election, the citizens voted in favor of installing a sewage disposal plant. Noted Jan. 16.

Morrisville, N. J.—The Borough Council has voted to install new water mains in certain streets.

Trenton, N. J.—Bids will be received by the Board of Commissioners until 2:30 p.m., Feb. 14, for constructing sewers in portions of various streets. Plans and specifications are on file at the office of the Engineer of Sewers. Frank Thompson is City Clk.

Trenton, N. J.—The Board of City Commissioners has passed an ordinance authorizing the construction of sewers in Roosevelt St., Wayne Ave., Calhoun St., and Harris Ave.

★**Beaver Falls, Penn.**—Bids will be received by the Borough Council until 8 p.m., Feb. 19, for constructing about 16 miles of 8- to 24-in. sanitary sewers. Plans and specifications are on file at the office of Dr. W. F. Rayle, Secy. of Council, at Beaver Falls, and at the office of Leo Hudson, Consult. Engr., McKeesport, Penn. Noted Nov. 14.

Lansdowne, Penn.—Bids will be received by the Borough Council until noon, Feb 7, for constructing about 5½ miles of sewers. A. F. Damon, Jr., is Boro. Engr.

Lansford, Penn.—The Town Council has adopted an ordinance for the issue of $6000 in bonds, for the construction of sewers.

Pittsburgh, Penn.—The City Council has passed ordinances for the construction of sewers in Wyman St., Phillips Ave. and other streets. William A. Magee is Mayor.

Warren, Penn.—Samuel Dixon, State Health Comr., has directed D. A. Wheelock, City Engr., to prepare plans for the installation of a sewer system and a sewage disposal plant.

★**Baltimore, Md.**—We are officially advised that bids for constructing sewers were received by the Board of Awards, Dec. 18, a sfollows: Sanitary Contract No. 106. William McCarthy & Co., Baltimore, Md., $37,834; James H. McQuade, Pittsburgh, Penn., $40,092; Gallagher, Boyle & Bryan, Baltimore, Md., $40,777; James Ferry & Son, Baltimore, Md., $45,-371. Storm-Water Contract No. 24. E. F. Sweeten & Son, Baltimore,Md., $166,194; Ryan & Reilly, Baltimore, Md., $187,244; William McCarthy & Co., Baltimore, Md., $198,735; James Ferry & Sons, Inc., Baltimore, Md., $200,814. Storm-Water Contract No. 25. James Ferry & Sons, Baltimore, Md., $279,990; Ryan & Reilly, Baltimore, Md., $283,562; Whiting Turner Construction Co., Baltimore, Md., $286,148. Calvin W. Hendrick is Ch. Engr., Sewerage Comn. Noted Dec. 12.

★✚**Baltimore, Md.**—The Board of Awards has awarded the contract for the construction of lateral sewers in district No. 8, Sanitary Contract No. 107, to FRANK BRUNO & CO., Newark, N. J., at $117,873. Noted Jan. 9.

Vinton, Va.—See item under Water Supply—Irrigation.

★**Clayton, N. C.**—Bids will be received by E. L. Hinton, Mayor, and the Board of Commissioners, until 3 p.m., Feb. 25, for constructing about three miles of 8- to 15-in. pipe sewers, with appurtenances. Plans and specifications are on file at the office of the Mayor, and at the office of Gilbert C. White, Consult. Engr., Charlotte, N. C.

Rocky Mount, N. C.—The city contemplates a bond issue of $44,000 for extending the sewer system. For particulars, address the Mayor.

Wilmington, N. C.—Martin & Miller, Passaic, N. J., have been released from their contract to construct about 36 miles of sewers here, owing to an error in preparing the bid. The contract will probably be awarded to the American Light & Water Co., Chicago, the next lowest bidder, at $151,000. Noted Jan. 30.

✚**Decatur, Ala.**—The contract to construct sewers in West Decatur has been awarded to the W. M. LEPTWICH CO., Nashville, Tenn., at $5634. Noted Nov. 28.

Covington, Ky.—An appropriation of $13,000 has been made for improving the sewer system.

Louisville, Ky.—Bids will be received by the Board of Public Works until Mar. 2, for constructing 1½ miles of sewers. Estimated cost, $60,000. The contract involves the construction of a number of small lateral connecting sewers in the district from Broadway to Oak and Preston to Shelby Sts. David R. Lyman is City Engr.

Louisville, Ky.—According to press reports, bids will be received by the Board of Public Works until Feb. 7, for constructing storm and sanitary sewers in South Louisville. Estimated cost, $25,000. David R. Lyman is City Engr.

Canal Dover, Ohio—R. Winthrop Pratt, Consult. Engr., 2048 East 82nd St., Cleveland, has been retained to prepare plans for the construction of intercepting sewers and a sewage treatment plant. George E. Arnold is City Engr.

Delaware, Ohio—Bids will be received by the Department of Public Service until about Mar. 1, for laying 6000 ft. of 8-in. tile sewer in West Central Ave. and Lake St. O. E. Martin is Clk.

Geneva, Ohio—Cummings & Downer, Consult, Engrs., Painesville, Ohio, are preparing plans for laying sanitary sewers in East Main, Chestnut, Eastwood, and Vine Sts. Approximately 1½ miles of sewers will be laid. Bids will be asked about Mar. 15. William E. Morgan is Village Clk.

Lakewood, Ohio—Bids will be received by J. W. Chrisford, Dir. Pub. Ser., until noon, Feb. 17, for furnishing labor and materials for laying sewers in portions of Harlan Ave., Merl Ave., Emerson Ave., and Jackson Ave.

✚Fort Wayne, Ind.—A contract to construct sewers in five streets has been awarded to ANTON RIEG, Fort Wayne, at approximately $7000.

Richmond, Ind.—We are officially advised that bids will be received by the Board of Public Works until Feb. 13, for constructing sewers in various streets. Estimated cost, $20,000. Fred R. Charles is City Engr. B. A. Bescher in City Clk. Noted Dec. 19.

South Bend, Ind.—According to press reports, bids will be received by the Board of Public Works until Mar. 11, for constructing the Bowman Creek sewer. Estimated cost, $100,000. W. S. Moore is City Engr. Noted Jan. 16.

Coldwater, Mich.—Cox, Norton & Co., Consult. Engrs., have completed plans and specifications for the installation of a sewer system here. The plans provide for about 10 miles of sewers.

Mount Clemens, Mich.—John W. Irwin, City Engr., is preparing plans for the construction of three trunk sewers, estimated to cost $50,000. Noted Dec. 12.

Muskegon, Mich.—The city contemplates the construction of a sanitary sewer in the South Side. Estimated cost, $14,000. B. H. Tellman is City Clk.

Byron, Ill.—The village contemplates the installation of a sewer system, estimtaed to cost $20,000. For particulars, address the Village Clerk.

Pontiac, Ill.—A. T. Maltby, Consult. Engr., 20 West Jackson Blvd., Chicago, is preparing plans for a sewer system here, estimated to cost $46,000.

Prairie du Chien, Wis.—We are officially advised that bids will be received by the City Clerk, until 7 p.m., Mar. 1, for constructing 27,520 ft. of vitrified pipe sewers, from 6 to 12 in. in diameter. Plans are on file at the office of the City Clerk, and at the office of W. G. Kirchoffer, Consult. Engr., Madison, Wis.

Racine, Wis.—An election has been called for Mar. 18, to vote on a bond isue of $18,000 for constructing sewers in various parts of the city.

Belmond, Iowa—Bids will be received by G. J. Byers, Town Clk., until 7 p.m., Feb. 11, for constructing 8313 ft. of 8- to 12-in. sewers, and settling tank. M. Tschirgi & Sons, Cedar Rapids, Iowa, are Consult. Engrs. Noted Jan. 16.

Clinton, Iowa—J. G. Thorne, City Engr., is preparing plans for sewer system in the southern part of the former town of Lyons, including the territory lying between Main and Commercial Sts. The plans will soon be submitted to the City Council.

Davenport, Iowa—Bids will probably soon be asked by the City Council for the construction of a sewer system in the 13th District. J. A. Ryan is City Engr. Noted Dec. 12.

Mason City, Iowa—The City Council is considering two plans for the installation of an intercepting sewer and a sewage disposal plant.

Deerwood, Minn.—See item under Water Supply—Irrigation.

Hibbing, Minn.—The lowest bids received by the City Council, Jan. 21, for constructing a sewer outlet south of Brookston, was submitted by P. McDonnell, Duluth, at $61,268. Noted Jan. 16.

Luverne, Minn.—Plans have been prepared for constructing sewers in West Park St. and Cedar St. C. C. Appleby is City Recdr.

Charleston, Mo.—See item under Water Supply—Irrigation.

Hannibal, Mo.—According to press reports, bids will be received by the City Council until Mar. 3, for constructing sewers. Estimated cost, $100,000. B. F. Smiley is City Engr. Noted Jan. 9.

Austin, Tex.—Bonds for $100,000 were voted Jan. 15, for purchasing the system of the Austin Sewerage Co. John O. Johnson is City Clk. Noted Dec. 26.

✚Corpus Christi, Tex.—A contract to construct a storm sewer in the business part of the city has been awarded to J. O. SEVERNS, Oklahoma City, Okla., at $13,787. The other bids were: Trueheart & Jackson, $13,883; Richland Concrete Co., $15,314; Sherman Concrete Co., $16,503.

Elgin, Tex.—The Ehlers Engineering Co., La Grange, Tex., has completed plans and specifications for the installation of a municipal sewer system here. Estimated cost, $15,000.

Pecos, Tex.—The O'Neill Engineering Co., Dallas, Tex., has completed surveys for the installation of a sewer system here. Bonds for $35,000 were recently voted for this improvement. Noted Jan. 23.

Portland, Ore.—Bids will probably be asked some time in March for constructing the Delaware Ave. trunk sewer. Estimated cost, $122,000. A. L. Barbur is City Audr.

Pasadena, Calif.—The City Council will advertise for bids early in February for the construction of the storm drain to extend from Woodbury Road to the county road at the intersection of Sierra Bonita and Colorado Sts. The plans have been completed by J. S. Van Ornum, City Engineer, and only the necessary preliminaries remain to be done. The cost will be $85,000.

San Diego, Calif.—The City Council is considering an appropriation of $100,000 for the construction of the City Heights Sewer System, and $80,000 for the Albatross St. Sewer.

San Francisco, Calif.—The following bids have been received by the Panama-Pacific Exposition Co. for the construction of sanitary and storm sewers on the exposition site: Sunset Construction Co., $32,000; Contra Costa Construction Co., $49,200; Pringle-Dunn Co., $31,000; Healy-Tibbetts Construction Co., $35,000; Hilmer and O'Connell, $43,500; Michael Murphy, $28,350; Edward Malley, $43,700.

Simcoe, Ont.—Bids will probably soon be asked for constructing the proposed sewer system. Estimated cost, $40,000. Willis Chipman, Mail Bldg., Toronto, is Consult. Engr.

Stratford, Ont.—Plans have been prepared for the construction of a vitrified tile trunk sewer, estimated to cost $28,000. B. R. Lang is Clk.

Sutherland, Sask.—See item under Water Supply-Irrigation.

STREETS AND ROADS

✚Boston, Mass.—The Department of Public Works has awarded a contract for repairing asphalt and bitulithic pavements during 1913 to the WARREN BROS. CONTRACTING CO., at $39,890. Other bidders were: F. S. & A. D. Gore Corporation, $40,310; Barber Asphalt Paving Co., $42,953; Michael Meehan, $42,880. The contract for the repairing of artificial stone sidewalks during 1913 was awarded to JERE J. SULLIVAN, at 11c. to 18c. per sq.yd. L. K. Rourke is Comr. of Pub. Wks.

Atlantic City, N. J.—Bids will be received until Feb. 13, by the City Commissioners for approximately 12,880 sq.yd. vitrified fire clay block, creosoted wood block or asphalt block pavement. J. B. Thompson is Dir. Dept. of Sts. J. W. Hackney is City Engr.

★Philadelphia, Penn.—Bids will be received until noon, Mar. 3, by the Department of Public Works, Bureau of Highways, for the completion of the Northeast Blvd., from Second St. to Rhawn St. Approximate quantities of the principal items are as follows: 402,729 cu.yd. grading, 445,700 sq.yd. bituminous macadam surfacing, 69,000 sq.yd. waterbound macadam surfacing, 59,000 sq.yd. vitrified brick gutters on 4-in. concrete foundation, 68,700 lin.ft. 8-in. steel protected concrete curb, 49,200 sq.yd. concrete sidewalks, 431,800 sq.yd. top soil and grass seeding, together with all incidental work. M. L. Cooke is Dir.

★Baltimore, Md.—Bids will be received until 11 a.m., Feb. 19, by the Board of Awards for paving various streets under Contracts Nos. 43, 45, 46, 47, 48, 49, 50 and 51. The approximate quantities of the principal items are as follows: Vitrified block, 41,860 sq.yd.; sheet asphalt, 30,050 sq.yd.; bituminous concrete, 7750 sq.yd.; granite block, 12,100 sq.yd. R. Keith Compton is Chn. J. Myers Hedian is Secy. Noted Jan. 2.

★Richmond, Va.—Bids will be received until noon, Feb. 17, by the Administrative Board, for the construction of approximately 16,000 sq.yd. of paving with asphalt blocks on Broad St., from Third to Jefferson Sts. Charles E. Bolling is City Engr.

Charleston, S. C.—The City Council is asking bids for approximately 30,000 sq.yd. paving on various streets, at an estimated cost of $100,000. J. H. Dingle is City Engr.

Bartow, Fla.—Bids will be received until noon, Apr. 7, by the Board of Commissioners of Polk County, for the construction of a macadamized road, from Eagle Lake, Polk County, northeast to Osceola County by way of Winter Haven, Florence Villa, etc. J. A. Johnson is Clk. of the Bd.

✚Bradentown, Fla.—We are officially advised that the Commissioner of Public Works has awarded a contract to the WEST CONSTRUCTION CO., Chattanooga, Tenn., at $1.69 per sq.yd for 37,000 sq.yd. of asphaltic concrete paving on various streets. The contract for combined curb and gutter was awarded to SHIRLEY, MATTESON & SHIRLEY, Bradentown, at 50c. per ft. S. Falkenbach is Res. Engr. Noted Jan. 16.

✚Clearwater, Fla.—A contract has been awarded by the Town Council to the GEORGIA ENGINEERING CO., Augusta, Ga., for about 32,000 sq.yd. vitrified brick paving and concrete curb and gutter. R. T. Daniels is Town Clk. Noted Jan. 16.

Opelika, Ala.—Bids will be received until Mar. 3, by the City Council, for about 40,000 sq.yd. of concrete sidewalks. S. S. Palmer is City Clk.

✚New Orleans, La.—A contract has been awarded by the Commissioners of the Port to the GRASSER CONSTRUCTION CO., at $45,866, for paving the river front from Thalia to Nuns St. with granite blocks on a concrete foundation.

Cincinnati, Ohio—Bids will be received until noon, Feb. 7, by the Director of Public Service, for the construction of concrete sidewalks in Sidewalk Dists. Nos. 1, 2, 3 and 4 during 1913. V. T. Price is Dir. M. J. Keefe is Clk.

Cleveland, Ohio—Bids will be received until noon, Feb. 12, by the Director of Public Service to grading, draining, curbing and paving with brick portions of 33 streets and avenues; for grading, draining, curbing and repaving Carnegie Ave., S. E., from East 55th to East 89th St., with brick, creosoted

wood block or sheet asphalt; and for grading, draining, curbing and paving Eagle Ave., S. E., from East Fourth to East Ninth St., with creosoted wood block, dressed block, Medina stone or granite block. W. J. Springborn is Dir. W. H. Kirby is Secy.

Bids for the paving of Madonna and Armitage Aves. and East 34th St., were rejected as excessive by the Director of Public Service.

Lakewood, Ohio—Bids will be received until noon, Feb. 17, by the Director of Public Service for grading, draining, curbing and paving with brick, the following streets: Ethel and Edward Sts., Wayne, Roycroft, Bonnie View and Winton Aves. J. W. Chrisford is Dir.

New Concord, Ohio—Bids will be received until noon, Feb. 14, by the Village Council for improving Main St. by grading, draining, curbing and paving with vitrified brick block on a sand cushion. W. G. McKinney is Village Clk.

✚**Springfield, Ohio**—A contract has been awarded by the Board of Control to McHUGH BROS., at $8314, for paving Jefferson St., from Fountain to Wittenberg Ave., with Athens block. Edward Seggerson is City Clk.

✚**Warren, Ohio**—A contract has been awarded by the Trustees of Newton Township to KENNEDY & WARREN, at $11,861, for the construction of the Duck Creek Road.

South Bend, Ind.—The Board of Public Works has received bids as follows for paving East Second St.: Rankert & Eggleston, $40,816 for asphalt; Grace Construction & Supply Co., Fort Wayne, Ind., $44.53⅞ for Trinidad lake sheet asphalt; C. H. Jeffress, South Bend, $42,582 for Metropolitan brick.

Mount Clemens, Mich.—We are officially advised that bids will be received early in March by the City Council for about 11,300 sq.yd. pavement on six different streets. The estimated cost is $21,000. John W. Irwin is City Engr. Noted Jan. 23.

Glencoe, Ill.—The Village Board has unanimously decided to pave about six miles of streets at an estimated cost of $200,000.

Lincoln, Ill.—The Board of Local Improvements has decided to pave the Public Sq. with creosoted wood block at an estimated cost of $24,543.

Appleton, Wis.—The City Council has decided to pave Drew, Franklin, North and Union Sts., during 1913.

Lincoln, Neb.—Bids have been received by the City Council for about 4500 sq.yd. of paving on G St., as follows: Abel & Roberts, $7.86 per sq.yd.; Burke-Cochrane Construction Co., $1.88 per sq.yd. for sheet asphalt; for paving 14th St., from B to Washington, with asphaltic concrete, Abel & Roberts bid $1.69 per sq.yd., and the Burke-Cochrane Co. $1.72. Adna Dobson is City Engr.

Lexington, Mo.—Bids will be received until 8 p.m., Mar. 3, by the City Council, for grading and paving with vitrified brick approximately 5474 sq.yd. on 20th St., from Maine St. to the Missouri Pacific Ry. Cleveland Wright is City Clk.

Galveston, Tex.—Bids will be received until noon, Feb. 13, by the Board of City Commissioners for improving Ave. J, from 14th to 24th Sts. Approximate quantities required are: 27,615 sq.yd. concrete pavement, 8532 sq.yd. vitrified brick pavement, 2228 lin.ft. concrete culverts, 5100 lin.ft. concrete coping, 1229 cu.yd. extra concrete and 1682 lin.ft. concrete bulkheads. A. T. Dickey is City Engr.

✚A contract has been awarded by the City Commissioners to R. J. VAUTRIN, at $9812, for paving the south side of Broadway, from 25th to 27th Sts., with concrete and vitrified brick.

✚**Houston, Tex.**—Contracts have been awarded by the City Council to the EUREKA CONSTRUCTION CO., at $1.79 per sq.yd., for paving Harrisburg Road, from Milby St. to the eastern city limits, and Louisiana St., from Capitol to Pease Aves., with Texaco asphalt, and to the TEXAS BITULITHIC CO., at $2.43 a sq.yd., for paving Louisiana St., from Pease to Berry Aves. with bitulithic. Noted Jan. 9.

The Council has decided to pave portions of Washington, La Branch and Burlington Sts., and has authorized the Mayor to advertise for bids. H. B. Rice is Mayor. D. C. Smith, Jr., is City Sec.

Corona, Calif.—THE JOHNSON-SHEA CO., Riverside, Calif., was awarded the contract at $20,957, for improving a portion of Washington St.

The same company was awarded a contract at $26,768, for improving sections of Fullerton, Clark and Willard Aves. M. Terpenning is City Clk.

✚**Inglewood, Calif.**—A contract has been awarded by the City Council to M. S. CUMMINGS, 1302 West 22d St., Los Angeles, at $17,771, for improving East Kelso St., from Grevillea to Prairie Ave.

✚**Los Angeles, Calif.**—The Board of Public Works has awarded contracts for street improvements as follows: To GEORGE H. OSWALD, at $146,082, for paving South Main St., from 36th Place to Manchester Ave., a distance of 3½ miles; to the FAIRCHILD-GILMORE-WILTON CO., at $4562, for improving Quincy St., from Hoover to Adams St., to T. E. SMITH, at $1847, for improving Ave. H from Midland to Carlotta Blvd. Hopper Hazelle is City Engr.

Redwood City, Calif.—The Supervisors of San Mateo County contemplate spending $1,200,000 for the construction of 150 miles of oiled and macadam roads.

✚**San Diego, Calif.**—A contract has been awarded by the City Council to JOHN A. BROWN, at $26,994, for improving Date St. from 30th to 32d Sts. Allen H. Wright is City Clk.

✚**San Francisco, Calif.**—A contract has been awarded by the Westside Park Commission to the PACIFIC PAVING CO., Merchants Bldg., at $[illegible] per sq.yd. of asphalt paving at the intersection of [illegible] Blvd. and Geary Blvd. George B. Gutterson is Engr. for Commission.

Sawtelle, Calif.—Bids will be received until 8 p.m., Feb. 17, by the City Council for [illegible] of about one-half mile and Bonita Ave. for about four blocks. The work includes grading, oil-macadam paving, concrete curbs and storm drains.

INDUSTRIAL WORKS

✚**Boston, Mass.**—The contract for a factory at Jamaica Plain, to be erected on Washington St., for Patrick Meehan, has been awarded to MICHAEL MEEHAN, 24 Oakdale St. It will be 55x165 ft., brick, two stories, to cost $36,000. Saml. J. Rantin, 1117 Columbus Ave., is Arch.

Haverhill, Mass.—Ernest N. Gilman and John H. Tilton, of Krankle & Tilton, have purchased a site on Locust St., and are having plans drawn for an eight-story shoe factory, 51x111 ft.

Holyoke, Mass.—Henry Taylor, formerly president of the New York & New England Paper Co., is negotiating for a site for a paper mill at Holyoke.

✚**Central Falls, R. I.**—The Waybossett Mfg. Co. has awarded a contract for building a one-story fireproof building, 80x180 ft., to the FRANK G. ROWLEY CO., Pawtucket, R. I.

South Manchester, Conn.—Plans are being drawn for the proposed addition to the factory of the J. P. Robertson Co., on Hilliard St.; building will be 30x140 ft., two stories, brick, mill construction. Walter Kidde, 140 Cedar St., New York, is Arch.

Batavia, N. Y.—Plans are being prepared by R. North, Arch., Prudential Bldg., Buffalo, for a cold-storage plant to be erected in Batavia for C. H. Teicher. The estimated cost is $50,000.

Brooklyn, N. Y.—Plans are being prepared by Dodge & Morrison, Archs., 133 Front St., New York, for a five-story bakery, 130x80 ft., to be erected for Drake Bros. Co., 1006 Wallabout Market, Brooklyn. The estimated cost is $125,000.

Bids will be received until 2:30 p.m., Feb. 13, by the Department of Public Charities, foot of East 26th St., Manhattan, for the construction of a one-story boiler house and laundry, 250x58 ft. Frank J. Helmle, 190 Montague St., is the Arch.

✚**Buffalo, N. Y.**—The American Radiator Co. has awarded a contract to F. S. MATHEUSON, Law Exchange Bldg., for the construction of an addition to its "Bond" plant, on Rano St. The estimated cost is $45,000.

Bids are being received by Green & Wicks, Archs., 110 Franklin St., for the construction of a one-story foundry, 300x300 ft., for the Otis Elevator Co., 281 Chicago St. Noted Nov. 21.

Dover Plains, N. Y.—The Dutchess County Hydrate Co. has been incorporated to take over the plant and property of the Dutchess County Lime Co., at Dover Plains. It is the intention of the new company to enlarge the old lime-manufacturing plant to three times its present capacity and to build a new hydrating plant. Richard K. Meade, 202 North Calvert St., Baltimore, Md., has been commissioned to prepare plans for the improvements and to act as Engr.-in-charge. The officers of the new company are: Paul M. Pierson, Scarborough-on-Hudson, Pres.; R. W. Soper, 115 Broadway, New York, N. Y., Vice-Pres. and Gen. Mgr.; H. C. Pierson, New York, N. Y., Secretary and Treasurer, and W. C. Smith, Dover Plains, Supt.

Long Island City (L. I.), N. Y.—The National Casket Co., 29 Ashland Place, has purchased property in Long Island City, and will erect a six-story factory, 200x100 ft.

New York, N. Y.—The Steiber Iron Works, Concord Ave. and St. Mary's St., Boro. The Bronx, contemplates the erection of a two-story, brick and stone factory, 100x50 ft., at Jackson Ave. and St. Mary's St.

Waycross, Ga.—The Standard Oil Co. has been granted a permit for improvements and additions to its Waycross plant. An 18,000-gal. tank will be built and the warehouse enlarged.

Tampa, Fla.—The Tampa Packing Co., recently organized, will erect a plant, costing $25,000, equipment for which will cost about $10,000. H. T. Lykes is Pres.

Birmingham, Ala.—Press reports state that the Southern Structural Steel Co., San Antonio, Tex., is considering the establishment of a plant at Birmingham to manufacture steel jails and portable cages. The estimated cost is $50,000.

New Orleans, La.—The Mills Preserving Co. has purchased a site at Poeyfarre and Constance Sts., and will soon begin the erection of a four-story factory. It will be of brick, with composition roof, with elevators, boilers and other modern equipment. Keenan & Weiss are Archs.

Knoxville, Tenn.—The Fulton Co., manufacturer of thermo-sensitive devices, has purchased a site of seven acres, and will build a foundry and office building.

Memphis, Tenn.—The American Snuff Co. has had plans prepared for an addition to its factory on Keel Ave., which will double its present output. The building will be of concrete, and cost $35,000.

Elizabethtown, Ky.—B. H. Alvey, who recently secured a patent on a new type of motor, plans to erect a factory for its manufacture.

Akron, Ohio—The International Harvester Co. has announced the purchase of a site on Hill and Center Sts., Akron, on which a five-story, 183x190-ft. factory, to cost $250,000, will be erected. Part of the auto plant recently destroyed will also be rebuilt.

Cincinnati, Ohio—The Herancourt Brewing Co., Cincinnati, is reported to be preparing to enlarge its bottling works.

Dayton, Ohio—The Dayton Paper Bottle Co., Dayton, will erect a plant. H. C. Long is Secy.

Sharon, Ohio—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. is preparing to construct a roundhouse at Sharon. Estimated cost, $150,000.

Laporte, Ind.—The Great Western Mfg. Co. is preparing plans and will ask for bids soon for the erection of a large two-story brick manufacturing building on Washington St.

✚**Detroit, Mich.**—Mildner & Elson, 1018 Hammond Bldg., Detroit, have awarded the following contracts for a three-story and basement factory, 40x60 ft., for W. H. Allen, 256 Lafayette Ave., Detroit: Structural iron, to ALBERT ROHUS, [illegible] Cass Ave.; masonry, to LEONARD SCHOLL & SONS [illegible]

12th Ave.; carpentry, to M. J. HEIDE, 42 Beresford St., all of Detroit.

✚Baxter, O'Dell & Halpin, 1021 Hammond Bldg., Detroit, have awarded the contract for the two-story factory addition, 40x128 ft., for Kales, Haskel Co., 445 Lafayette Ave., to W. S. POCOCK, 241 25th St., Detroit, at $20,000.

✚Varney & Winter, 604 Equity Bldg., Detroit, have awarded the following contracts for the three-story and basement factory, 51x150 ft., for J. C. Wilson Co., 15th and Warren Ave., Detroit: Masonry, to F. N. COOPER, 301 Penobscot Bldg.; carpentry, to HARCUS & CO., 774 Russel St.; steam heating and plumbing, to JOS. J. DOYLE CO., 51 Bates St. Cost, $40,000.

✚George V. Pottle, 708 Detroit Gas Co. Bldg., Detroit, has awarded the following contracts for the two-story and basement factory, 50x115 ft., for the White Star Refining Co. R. M. Connor, Secy., Pleasant Ave., Detroit: Masonry to LANNAN & LYNN, 2 Hannon Mills Bldg.; plumbing, to ROBERT ADDY, 1900 Fort St. West. Cost, $30,000.

✚Mildner & Eisen, 1018 Hammond Bldg., Detroit, have awarded the following contracts for the Modern Laundry Co. F. W. Enide, Jr., Mgr., 1160 Jefferson Ave. East: General contract, to BRYANT & DETWILER, 510 Hammond Bldg., Detroit; plumbing, to JOHNSON & LARSON, 12 Griswold St. Cost, $30,000.

Port Huron, Mich.—Smith, Hinchman & Grylls, Archs., Washington Arcade Bldg., Detroit, will receive bids soon for the erection of a brick and steel factory for C. E. Mueller & Co.

✚**Chicago, Ill.**—The contract has been awarded to M. F. POWERS, 30 North La Salle St., Chicago, for constructing a factory for F. E. Lammert. The structure will be two stories, 100x112 ft.

Cedar Falls, Iowa—The Waterloo & Cedar Falls Union Mill Co. is having plans prepared for the construction of a new mill. The estimated cost of the structure is $100,000.

Davenport, Iowa—The Purity Oats Co., recently organized, will expend about $150,000 for new buildings and equipment.

Minneapolis, Minn.—The Washburn-Crosby Co. will expend about $300,000 for the construction of additions to its plant.

Brownwood, Tex.—Walker Smith will build a new cold-storage plant to replace the one recently destroyed by fire.

Coleman, Tex.—The Coleman Vitrified Brick Co. plans to enlarge and improve its plant. It will have a daily capacity of about 60,000 bricks.

Kosse, Tex.—The Farmers Cotton Oil Co. will erect a cotton seed oil mill. W. C. Blaylock, L. F. Gibbs and J. B. Brothers are interested.

Hatch, N. M.—L. Clapp will build a new flour mill to replace the one recently destroyed by fire.

Phœnix, Ariz.—The Mesa Cotton Growers' Assoc., Phœnix, will construct large additions to its ginning plant, and will add a cotton seed oil plant.

Everett, Wash.—The Light Granite Co., Everett, has acquired a site on 41st St., and will equip plant to cut granite, at a cost if about $20,000. R. H. McKee is interested.

Tacoma, Wash.—The St. Louis Label Works, St. Louis, Mo., will establish a factory at Tacoma, for the manufacture of boxes, cartons and labels.

Albany, Ore.—The Corvallis & Eastern Ry. Co. plans to improve and enlarge its shops at Albany, and to install additional equipment.

Baker, Ore.—The Baker White Pine Lumber Co. will build a large sawmill and planing mill at Baker.

Kento, Ore.—The Pacific Fixture & Cabinet Co. will build a plant at Kenton for the manufacture of bar fixtures. The estimated cost is $75,000. William Okker is Vice-Pres.

Medford, Ore.—The Iola Portland Cement Co., Iola, Kan., contemplates the erection of a large cement plant in Rogue River Valley, near Medford, Ore.

Longbeach, Calif.—The American Potash Co., a consolidation of the Pacific Kelp Co., and the Coronado Chemical Co., plans to construct a plant for the manufacture of kelp products.

San Diego, Calif.—The San Diego Ice & Cold Storage Co. plans to make extensive improvements to its plant on Eighth St.

San Diego, Calif.—The Producers' Mutual Dairy Assn., San Diego, is having plans prepared for the construction of a three-story ice plant, 50x100 ft., of steel and concrete. Eugee M. Hoffman is the Arch.

Stockton, Calif.—The Holt Mfg. Co., San Leandro, Calif., plans to construct a foundry, at Stockton, which will increase its present capacity.

FEDERAL GOVERNMENT WORK

Post Office—Biddeford, Maine—Bids were received as follows, on Jan. 30, by Oscar Wenderoth, Superv. Arch., treasury Dept. Washington, D. C., for the construction of a post-office at Biddeford: (a), Limestone; (b) sandstone: Conners Bros. Co., Lowell, Mass., (a) $68,567; (b) $71,567; Interurban General Construction Co., New York, N. Y., (a) $72,000, (b) $73,700; F. W. Cunningham & Sons, Portland, Maine, (a) $73,387, (b) $78,647; C. M. Leach, Boston, Mass., (a) $73,983, (b) $74,983; Woodbury & Leighton, Boston, Mass., (a) $74,426; Mahoney Construction Co., Portland, Maine, (a) $76,784, (b) $78,584; King Lumber Co., Charlotte, Va., (a) $77,800, (b) $79,000.

Rochester, N. H.—Bids were received as follows, on Jan. 29, by Oscar Wenderoth, Superv. Arch., Treasury, Washington, D. C., for the construction of a post-office at Rochester, N. H.: (a) Limestone; (b) Sandstone; Interurban General Construction Co., New York, N. Y., (a) $66,827, (b) $68,077; W. H. Fissell & Co., New York N. Y., (a) $73,279; (b) $73,279; Westchester Engineering Co., New York, N. Y., (a) $71,085, (b) $74,085; C. M. Leach, Boston, Mass., (a) $69,983, (b) $71,000; Woodbury & Leighton, Boston, Mass., (a) $69,870. Noted Dec. 5.

✚**Headstones** Boston, Mass.—The contract has been awarded to the LEE MARBLE CO., Lee, Mass., by the U. S. government for 20,000 headstones for soldiers' graves, at $2.60 each.

Elevators New York, N. Y.—Bids were received as follows, Jan. 25, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for installing three electric passenger elevators in the Barge Office, New York: Otis Elevator Co., New York, $12,932; Kaestner & Hecht, Chicago, Ill., $13,790; A. B. See Electric Elevator Co., New York, $14,525; Wheeler-Mclowell Elevator Co., New York, $16,770. A. Kleckhefer Elevator Co., Milwaukee, Wis., $18,143.

Post Office—Bristol, Penn.—Bids will be received until 2 p.m., Feb. 26, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including mechanical equipment and approaches) of the U. S. post office at Bristol.

Lock Gates—Pittsburgh, Penn.—Bids will be received until noon, Feb. 25, by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., Pittsburgh, for furnishing and erecting four steel lock gates and furnishing and delivering four gate recess covers and four gate engine pit covers for Dams Nos. 7 and 9, Ohio River.

Dredging—Wilmington, Del.—Bids will be received until 11 a.m., Feb. 21, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging the entrance to Salem River, N. J.

Dredging Wilmington, Del.—Bids will be received until 11 a.m., Feb. 24, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Cohansey River, N J.

★**Removal of Wreck**—Norfolk, Va.—Bids will be received until noon, Feb. 28, by Lieut.-Col. E. Eveleth Wilson, Corps Engrs., U. S. A., Norfolk, for the removal of the steel whaleback wreck "Bangor," sunk in Hampton Roads.

★**Removing Wreck**—Norfolk, Va.—Bids were received as follows, Jan. 28, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for the removal of the iron barge "Florida," sunk in Hampton Roads, Va.; (a) for removing according to specifications—bodily; (b) for blowing up with dynamite and removing pieces, informal—not according to specifications: F. Staud Ximinez, City Dock, care of T. W. Trautwein, Annapolis, Md., (a) $18,860; Baxter Wrecking Co., 308 West St., New York, (a) $37,500; Merritt & Chapman Derrick & Wrecking Co.; 17 Battery Place, New York, (a) $31,750; Engene Boehm, Island House, Atlantic City, N. J., (b) $14,822; Johnston & Virden, Lewes, Del., (b) $13,765.

★★**Dredging**—Norfolk, Va.—Bids were received Jan. 20, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for dredging in the James River, Va. The contract has been awarded to the MARYLAND DREDGING & CONTRACTING CO., Fidelity Bldg., Baltimore, Md., at about $20,000.

Elkins, W. Va.—Bids were received as follows, Jan. 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Elkins, W. Va.: (a) Sandstone; (b) limestone: Interurban General Construction Co., New York, (a) $73,564; (b) $76,110; Wells Construction Co., Philadelphia, Penn., (a) $74,000; (b) $77,000; Volney E. Taylor, Huntington, W. Va., (a) $74,893; (b) $75,893; James Devault, Canton, Ohio, (a) $76,737; (b) $78,900; Westchester Engineering Co., New York, (a) $77,157; (b) $80,757; Wise Granite Co., Richmond, Va., (a) $79,800; (b) $84,000; Rogers & Kaiser, Chicago, Ill., (a) $80,783; (b) $84,900; Daniel T. McCarthy, Philadelphia, Penn., (a) $81,560; (b) $83,560; J. E. & A. L. Pennock, Philadelphia, (a) $81,600; (b) $84,700; W. H. Fisell & Co., New York, (a) $86,300; (b) $96,300; Olin Gerlach, Frostburg, Md., (a) $96,860. Noted Dec. 26.

Dredging—Charleston, S. C.—Bids will be received by Maj. G. P. Howell, Corps Engrs., U. S. A., until Feb. 26, for dredging Sampit bar and river, Winyah Bay.

Post Office—Cedartown, Ga.—Bids were received as follows on Jan. 31, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Cedartown: Daniel T. McCarthy, Philadelphia, $44,500; James Devault, Canton, Ohio, $45,327; King Lumber Co., Charlottesville, Va., $45,500; Newport Contracting & Engineering Co., Newport News, Va., $47,076; Mississippi Valley Construction Co., $47,480; Algernon Blair, Montgomery, Ala., $47,525; George Becking, Chattanooga, Tenn., $49,100; James F. Dupree & Son, Rome, Ga., $63,550.

Jetty Work—Jacksonville, Fla.—Bids were received as follows, Jan. 23, by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for furnishing the material and raising the jetty at the entrance to St. Johns River, Fla., requiring about 36,000 tons of stone: R. S. Sales, Savannah, Ga., $3.41 per ton; R. G. Ross, Jacksonville, $2.87; Johnston & Virden, Lewes, Del., $3.65.

Post Office—New Orleans, La.—Bids will be received until 3 p.m., Mar. 13, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the interior finish of the U. S. post office and court house at New Orleans.

Post Office—Bellefontaine, Ohio—Bids were received as follows on Jan. 30, by the Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Bellefontaine: (a) Limestone; (b) Sandstone: James Devault, Canton, Ohio, (a) $64,250, (b) $76,300; George W. Stiles Construction Co., Chicago, (a) $64,650, (b) $67,000; King Lumber Co., Charlottesville, Va., (a) $64,400, (b) $68,000; W. H. Fissell & Co., New York, (a) $67,000, (b) $77,000; Eugene & Easley, Bellefontaine, Ohio, $67,102, (b) $69,071; Thomas W. Cissell & Co., Washington, D. C., (a) $67,500, (b) $69,500; James Corse, Racine, Wis., (a) $64,500, (b) $65,740; John G. Unkefer & Co., Minerva, Ohio, (a) $62,375, (b) 65,500; Rogers & Kaiser, Chicago, Ill., (a) $63,446, (b) $65,387; Charles McCaul Co., Philadelphia, Penn., (a) $66,520, (b) $69,239; Central Construction Co., Louisville, Ky., (a) $65,898, (b) $66,500. Noted Dec. 26.

✚**Post Office**—Lorain, Ohio—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Lorain, to E. HENRY, Punxsutawney, Penn., at $91,000. Noted Dec. 26.

Post Office—Waukesha, Wis.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 15, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches of the U. S. post office at Waukesha.

Post Office—Denison, Iowa—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 17, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the U. S. post office at Denison.

Post Office—Brookings, S. D.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 14, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the U. S. post office at Brookings.

★**Steel Barges**—Kansas City, Mo.—Bids will be received until noon, Feb. 27, by Maj. Herbert Deakyne, Corps Engrs., U. S. A., Kansas City, for constructing and delivering 16 steel barges.

Post Office—Springfield, Mo.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 13, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches of the U. S. post office and court house at Springfield.

✚**Post Office**—Paris, Tex.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Paris, to the NEWPORT CONTRACTING AND ENGINEERING CO., Newport News, Va., at $94,645. Noted Dec. 5.

✚**Canal**—Denver, Colo.—A contract has been awarded by the Secretary of the Interior, Washington, D. C., to JOHN PALMGREN, for Schedule 2, West Canal extension, Uncompahgre Valley Irrigation Project, Colo., at $11,390. The work involves the excavation of 7600 cu.yd. of material, 800 ft., of tunnel and 10,000 ft. of timbering.

✚**Transmission Line**—Phoenix, Ariz.—A contract has been awarded by the Secretary of the Interior, Washington, D. C., to the CHICAGO STEEL PRODUCTS CO., Chicago, Ill., for furnishing steel tower tops and structural materials for the reconstruction of the Roosevelt-Mesa transmission line, Salt River Irrigation Project, Ariz., at a cost of $22,569. The change is made to give increased efficiency to the service, the new line to be constructed on the suspension plan. Contracts have also been awarded for the line material necessary to effect the change. Items 1, 2, 3 and 4, for insulators and suspension clamps have been awarded to PIERSON, REEDING & CO., of San Francisco, at $10,160 and to JOHN A. ROEBLING'S SONS CO., San Francisco, for items 5, 7, 10, 13, 14 and 16, covering guy clamps, thimbles, connectors, telegraph wires, steel ground wire and guy wire at $7206.

✚**Buildings**—San Francisco, Calif. — Oscar Wenderoth, Supperv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of the sub-treasury, San Francisco, to GRANT FEE, San Francisco, at $384,300. Noted Jan. 9.

Lumber—Panama—Bids were received, Jan. 27, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for 2,106,000 ft. B.M. of long-leaf yellow pine or Douglas fir: Chicago Lumber & Coal Co., St. Louis, Mo., $60,325; G. Ellas & Co., Buffalo, N. Y., $65,923; Great Southern Lumber Co., Bogaloosa, La., $62,152; Gress Mfg. Co., New York, $73,904; W. R. Grace & Co., San Francisco, Calif., $56,641 (Balboa delivery, Douglas fir); Long-Bell Lumber Co., Kansas City, Mo., $63,935; Rainwater Lumber Co., New Orleans, La., $60,491; D. L. Gillespie & Co., Pittsburgh, Penn., $59,503.

Structural Steel—Panama—Bids will soon be asked by the Isthmian Canal Commission, Washington, D. C., for furnishing structural steel for shed Pier No. 17. Maj. F. C. Boggs, Corps Engrs., U. S. A., Washington, is Gen. Pur. Officer.

★**Bulkhead**—Porto Rico—Bids will be received until 11 a.m., Mar. 18, at the office of the San Juan Harbor Board, San Juan, P. R., for the construction of 2750 lin.ft. of concrete bulkhead with backfilling and paving, or as much thereof as may be done for the sum of $375,000 U. S. currency. John A. Wilson is Chn.

MISCELLANEOUS

★**Rock Excavation**—Boston, Mass.—Bids will be received until noon, Feb. 15, by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston, for rock excavation in Beverly Harbor.

Fire Apparatus—[illegible] Mass.—The city is considering the purchase of a new automobile chemical and hose truck. E. R. [illegible] is M[illegible].

✚**Channel Work**—Dalton, N. Y.—Contracts have been awarded by the [illegible] opened Jan. 17, at the Hotel Richland, Pulaski, N. Y., for the following improvements: [illegible] approximately [illegible] cu.yd. of earth on the Oswegatchie River, and [illegible] cu.yd. of earth on Indian River;

★**Dredging**—Chicago, Ill.—Bids for dredging the east and west arms of the south fork of the south branch of the Chicago River, in the city of Chicago, are asked by the Sanitary District of Chicago. The work includes the dredging or excavation of approximately 130,000 cu.yd. scow measurement, of material.

Levees—Jerseyville, Ill.—Improvements to cost $54,000 have been ordered made in Nutwood Levees and Drainage District. Levees will be raised and eight miles of ditches will be cleaned.

Pavilion—Peoria, Ill.—Bids have been received as follows by the Park Board for constructing a pavilion at South Park: R. Iben, $21,760; W. G. Wall & Son, $21,852; John Voss, $22,400.

Piers and Walls—Milwaukee, Wis.—The city will construct piers to cost $44,000 to protect south shores from the ravages of the lake. F. P. Schumaker is Secy. Bd. Park Comrs. who will have charge of the work.

✚**Coal Docks**—Superior, Wis.—The contract for improvements to the Northwestern Fuel Co.'s dock No. 1, has been let to the HEYL-PATTERSON CONSTRUCTION CO., at $150,000. Work on the superstructure of the dock will commence Apr. 1. B. A. Galleher is Supt. The company has filed an amendment to its articles of incorporation increasing its capital stock from $3,000,000 to $5,000,000. The increase will provide for the improvements.

Ditch—Sioux City, Iowa—Bids will be received by the Supervisors of Woodbury County until Feb. 25 for the construction of the Little Sioux ditch and laterals in Little Sioux Drainage Dist. No. 2, about 482,696 cu.yd. E. E. Hosmer is County Audr.

✚**Ditch**—Blue Earth, Minn.—Bids were received Jan. 30, by J. L. Herring, County Audr., Blue Earth, for constructing Judicial Ditch No. 4, requiring approximately 82,525 ft. of tile, from 6 to 20 in. The bids follow: D. C. ARMSTRONG & CO., Sioux City, Iowa, $19,875 (awarded contract); Segley & Parrish, Worthington, Minn., $22,470; L. P. Axelsen, Clear Lake, Iowa, $24,776; Moeller Bros., $23,469; Davison & Gjellfeld, Forest City, Iowa, $20.839. Estimated cost $22,792.

Ditch—Edina, Minn.— All bids opened Jan. 11 for constructing Wind Ditch have been rejected. New bids will be asked in the spring. Abbot & Budd, 425 Kosota Block, Minneapolis, Minn., are Engrs.

Ditch—St. Paul, Minn.—Bids will be received until 10 a.m., Feb. 15, for completing state ditch No. 84, in Kittson County, Minn. It is estimated that the work will require 80,276.3 cu. yd. floating dredge work; 9381 cu.yd. scraper work; 17.3 miles road leveling; installing 11 corrugated culverts. Samuel G. Iverson is State Aud.

Drainage—Dumas, Ark.—The Cypress Creek Drainage District will issue $700,000 of additional bonds for the completion of four drainage canals. I. N. Moore is Pres.

✚**Ditch and Levee Work**—Piggott, Ark.—Contracts for ditch and levee work have been awarded as follows by Central Clay Drainage Dist. CLAY COUNTY DREDGE CO., Corning, 48,750 cu.yd., 7½c.; to J. H. KOLETZY, Cape Girardeau, Mo., 298,312 cu.yd., 6¼c.; STERNBERG & SON, Kansas City, Mo., 53,124 cu.yd., 7.15c., and NORTHERN CONSTRUCTION CO., Elkhart, Ind., 73,920 cu.yd., 15.4c.

✚**Stable**—Waxahachie, Tex.—The contract has been awarded to H. D. TIMMINS, Waxahachie, for constructing a stable on College St., two stories, 82x100 ft.; of brick.

Piles, Timber—Los Angeles, Calif.—Bids will be received by the Board of Public Works until 11 a.m., Feb. 10, for furnishing creosoted piles and timbers for the construction of Pier A and bulkheads at San Pedro.

Lumber—Oakland, Calif.—Walter J. Mathews, Architect, 927 Broadway, Oakland, has completed plans and specifications for the new bleachers at the Oakland Baseball Park. The work will require over 1,000,000 ft. of lumber and will cover an area of 1920x70 ft. The bleachers will be 20 ft. in height. The new park will cost over $150,000.

Freight Ferry Slip—San Francisco, Calif.—Bids have been received as follows by the Panama-Pacific Exposition Co., for constructing a ferry slip: Healy-Tibbitts Construction Co., 247 Market St., San Francisco, $39,340; Thompson Bridge Co., 40,410; Mercer-Fraser Co., $42,292; Hyde-Harjes Co., $44,783. Bids for the structural-steel aprons and hydraulic machinery will be opened at once.

✚**Pier**—San Francisco, Calif.—The State Board of Harbor Commissioners has awarded the contract to the THOMPSON BRIDGE CO., for constructing Pier 37, foot of Kearney St., at $475,200. The pier will be 1080 ft. long and 200 ft. wide.

★**Wall**—Toronto, Ont.—Bids will be received by the Chairman of the Board of Control, until noon, Feb. 18, for reinforced-concrete retaining wall at Coxwell Ave. Subway. Specification and proposal form may be obtained upon application at the office of the Railways, Bridges and Docks Sec., Dept. of Works, City Hall, Toronto.

Cement—Calgary, Alta.—Bids will be received until noon, Feb. 12, by J. M. Miller, City Clk., for furnishing 85,000 bbl. of portland cement.

BUILDINGS

Athol, Mass.—Bids will soon be received by Frank Wilcox & Co., Archs., 15 Beacon St., Boston, Mass., for the construction of a three-story business block, 90x110 ft., on Main St. The estimated cost is $85,000.

✚**Boston, Mass.**—The contract for the apartment and business block to be built on Huntington Ave., for Harry Coleman, has been awarded to COLEMAN & GILBERT, 319 Huntington Ave., at $90,000. It will be of brick, five stories high, 105x48 ft. F. A. Norcross, 46 Cornhill, is the Arch.

✚The contract for the Nurses Home, to be built at Newbury St. and Charlesgate West, has been awarded to SNIDER & DRUCKER, Kimball Bldg., at $250,000. It will be of brick and stone, six stories high, 123x80 ft. F. A. Norcross, 40 Cornhill, is the Arch.

✚The School House Commission, 120 Boylston St., has awarded a contract to the JOHN T. GRIFFEN CO., 319 Washington St., at $80,000, for the construction of a three-story annex to the Public Latin School.

The Wentworth Institute is having plans prepared by Peabody & Stearns, Archs., 53 State St., for the construction of a four-story trade building, 150x60 ft., at Huntington Ave. and Ruggles St., Roxbury. The estimated cost is $150,000.

The Congress St. Association is considering plans for the erection of an office building to cover the entire square, bounded by Congress, Hawes and Kilby Sts. and Exchange Place. The estimated cost is $1,300,000.

Springfield, Mass.—We are officially advised that bids will be received until Feb. 12, by McClintock & Craig, Archs., Springfield, for the construction of a five-story warehouse, 120x90 ft., of concrete and steel, for the Sturtevant-Merrick Co. It will be erected on Chestnut St. Noted Jan. 30.

We are officially advised that bids will be received until Feb. 10, by Samuel M. Green & Co., Archs., Springfield, for the construction of a six-story business block on Market St., for Henry R. Johnson. The estimated cost is $75,000. Noted Jan. 30.

Hartford, Conn.—We are officially advised that plans are being prepared by Allens & Collins, Archs., 40 Central St., Boston, Mass., for the construction of an office building for the Hartford Electric Light Co. It will be seven stories high, 130x110 ft., and will be erected on Pearl St. The estimated cost is $200,000. Noted Jan. 30.

New York, N. Y.—The Cotton Exchange has announced that owing to the uncertainty of subway plans, the construction of its proposed new 22-story building at William and Beaver Sts., has been postponed for one year. Donn Babrter, 25 East 26th St., is the Arch. Noted Nov. 14.

Plans have been filed by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., for the construction of a six-story public school, 205x99 ft., on Mangin St., near East Houston St. The estimated cost is $250,000.

Plans have been filed by Von Beren & La Velle, Archs., 507 Fifth Ave., for the construction of a 12-story loft building, 200x112 ft., on 55th St., near Ninth Ave., for Isaac Hopper, Inc., 231 West 125th St. The estimated cost is $60,000.

The New York Central & Hudson River R.R. is having plans prepared by Warren & Wetmore, Archs., 70 East 45th St., for the construction of a 2000-room hotel. It will be erected at Lexington Ave. and 42d St., in conjunction with the Grand Central Terminal.

The Fullerton Weaver Realty Co., 1 Madison Ave., has commissioned J. E. R. Carpenter, Arch., 1 Madison Ave., to prepare plans for a 12-story apartment house to be erected at Park Ave. and 66th St.

Plans have been filed by Herbert M. Baer, Arch., 655 Fifth Ave., for the construction of a 10-story apartment house at Lexington Ave. and 38th St., for the 138 East 38th St. Co., 27 William St. The estimated cost is $100,000.

Plans have been filed by Walter Haefili, Archs., 17 Madisor Ave., for the construction of an eight-story apartment house, 90x85 ft., to be erected at 105 East 53d St., for the Aeon Realty Co., 17 Madison Ave. The estimated cost is $300,000.

Plans are now being prepared for the construction of additional buildings at the Mount Sinai Hospital, Fifth Ave. and 100th St. The estimated cost is $1,350,000. George Blumenthal, 23 West 53d St., is Pres.

Plans have been filed by Frank A. Rooke, Arch., 489 Fifth Ave., for the construction of a five-story brick dairy building, 194x100 ft., to be erected at 166th St. and Webster Ave., for the Sheffield Farms-Slawson-Decker Co. The estimated cost is $200,000.

Plans are being prepared by Samuel Sars, Arch., 32 Union Square, for the construction of two 5-story apartment houses, to be erected at the junction of Nagel and Hillside Aves., for the Psaty Construction Co., 147 East 125th St. The estimated cost is $175,000.

Plans have been completed by J. C. Cocker, Arch., 2017 Fifth Ave., for a six-story apartment house to be erected on Northern Ave., near 181st St., for the Trosacks Realty Co., 40 East 22d St. The estimated cost is $175,000.

(Borough The Bronx)—Edwin C. George, Arch., 4185 Fulton Ave., Woodhaven, L. I., is preparing plans for a six-story apartment, 100x60 ft., to be erected on Prospect Ave., near 179th St., for Felix Amabile, 151 Taylor St., West New Brighton, S. I.

✚(Borough Queens)—We are officially advised that the Dept. of Education, Park Ave. and 59th St., Manhattan, has awarded a contract to the JAMES MacARTHUR CO., 11 Pine St., Manhattan, at $136,500, for the construction of Public School 71, Boro. of Queens. Bids were received on Jan. 27.

Elizabeth, N. J.—The Board of Education has voted to erect two new schools, one in the Elmora Section, and the other in the Schiller St. district. The new structures are estimated to cost together, $145,000.

Jersey City, N. J.—Following the destruction by fire of Public School No. 24, on Virginia Ave., with a loss of $75,000, the Board of Education has anounced that plans will be immediately prepared for a new and larger school on the same site.

Newark, N. J.—Macknet & Doremus, 798 Broad St., are having plans prepared by William C. Ely, Arch., for the construction of a five-story, brick, warehouse, 105x60 ft. The estimated cost is $50,000.

We are officially advised that bids have been received by H. W. Barclay, 819 South 12th St., for the construction of the eight-story Barclay Bldg., 110x55 ft., on Summit St. John T. Simpson, 27 Clinton St., is the Arch. Noted Jan. 30.

✚**Trenton, N. J.**—The Board of Education has awarded contracts as follows: for the construction of the new Franklin School, to SCOTT & DAY, at $119,000; for an addition to the Columbus School, to BURTON & BURTON. American Mechanics Bldg., at $55,938.

Harrisburg, Penn.—Mowbray & Uffinger, Archs., 5 Liberty St., New York, N. Y., are receiving bids for the construction of a bank and office building for Mechanics National Bank, Harrisburg. The estimated cost is $125,000.

Plans are being prepared by Zantzinger, Borie & Medary, Archs., Philadelphia, for the construction of a Y. W. C. A. building at Harrisburg. The estimated cost is $100,000

Lebanon, Penn.—Plans are being prepared by Mowbray & Uffinger, Archs., 56 Liberty St., New York, for the construction of a bank building for the First National Bank. The estimated cost is $80,000.

Mansfield, Penn.—Pierce & Bickford, Archs., 118 Lake St., Elmira, N. Y., are receiving bids for the construction of a two-story and basement school for the Mansfield Normal School. The estimated cost is $40,000.

New Kensington, Penn.—William E. Snaman, Arch., Empire Bldg., Pittsburgh, has prepared plans for a two-story brick building at Ninth and Fifth Aves., for the First National Bank.

North East, Penn.—Plans are being prepared by J. W. Yard & Son, Archs., 805 State St., Erie, Penn., for the construction of a two-story school building, 75x140 ft., for the Board of Education. The estimated cost is $60,000.

Oil City, Penn.—E. E. Bailey, Arch., Chambers Bldg., is receiving bids for the construction of a church edifice for the South Side Presbyterian Congregation. The estimated cost is $80,000.

Philadelphia, Penn.—James H. Windrim, Arch., Commonwealth Bldg., has prepared plans for the construction of a three-story, 129x187-ft. high school, at Girard College.

E. F. Durang & Son, Archs., 1200 Chestnut St., are preparing plans for the construction of a church, rectory, parochial school and convent, on Allegheny Ave. and 28th St., for Archbishop Prendergast. The estimated cost is $400,000.

The Board of Home Missions and Church Extension will erect a ten-story office building at 1026 Arch St. The estimated cost is $500,000. William H. Heisler, Manufacturers' National Bank, is Pres.

Stewardson & Page, Archs., 316 Walnut St., are preparing plans for the construction of a building at 34th and Walnut Sts., for the Graduate School of the University of Pennsylvania. The estimated cost is $300,000.

Bids will be received until Feb. 7, by F. Webber, Arch., Morris Block, for the construction of a store building and warehouse, 72x148 ft., on Seventh St. below Cherry, for S. P. Wetherill. The estimated cost is $200,000.

The Board of Directors of the Penn Mutual Life Insurance Co., will receive bids for the construction of a building at Sixth and Walnut Sts.

✦The contract for the construction of the school building at 22d and Ritner Sts., has been awarded to CHARLES McCAUL CO., Tenth and Sansom Sts.

The contract for the construction of the school building at Fifth and Medro Sts. has been awarded to CHARLES McCAUL CO., 10th and Sansom Sts.

✦The contract for the construction of an addition to the University of Pennsylvania Museum has been awarded to JACOB MYERS' SONS. The estimated cost is $300,000.

Pittsburgh, Penn.—The Board of Education will erect a high school and elementary school buildings. The estimated cost is $3,000,000.

Janssen & Abbott, Archs., Renshaw Bldg., are preparing plans for the construction of an eight-story store and apartment building at Federal and Moody Sts., Northside, for the Samuel W. Black Co. The estimated cost is $350,000.

The Rosenbaum Co. is having plans prepared for the construction of a 12-story department store on Sixth St. The estimated cost is $4,000,000.

A company headed by Morris Baer, former general manager for Kaufman Bros., will erect a 12-story department store on Smithfield St. The estimated cost is $5,000,000.

Wilkes-Barre, Penn.—The Lehigh Valley Coal Co. will erect an office building. The estimated cost is $200,000.

Wilkinsburg, Penn.—Janssen & Abbott, Archs., Renshaw Bldg., Pittsburgh, Penn., are receiving bids for various materials to be used in the construction of the building in Wilkinsburg, which they are erecting for Grant McCargo, 34th St. and Allegeny Valley R.R.

Baltimore, Md.—The Nobles of the Mystic Shrine of Baltimore, are planning to erect a home at Monument St. and Park Ave. The estimated cost is $300,000.

✦**Baltimore, Md.**—The National Bank of Baltimore has awarded the contract to EDWARD BRADY & SONS, 1113 Cathedral St., Baltimore, for an addition to the bank building.

Cumberland, Md.—The Bedford St. German Lutheran congregation will erect a two-story church at Columbia and Bedford Sts. The estimated cost is $80,000.

Frederick, Md.—Bids will be received until Feb. 15, by D. J. Markey, Chn. of the Frederick Armory Comn., for the construction of a stone and concrete armory. The estimated cost is $40,000. John B. Hanne is Arch., York, Penn.

Owings Mills, Md.—Bids will be received until 2 p.m. Feb. 12, by Frank W. Keating, M. D., Supt. Rosewood State Training School for the construction of a dormitory at the Rosewood State Training School.

✦**Hot Springs, Va.**—The contract for the construction of the Hot Springs Post Office has been awarded to GEORGE A. FULLER & CO., Washington, D. C. Bids are being received from sub-contractors.

Norfolk, Va.—The Anheuser Brewing Association will erect a seven-story warehouse, at Norfolk. The estimated cost is $[illegible]. Archs., St. Louis.

George W. Kramer, Arch., 1 Madison Ave., New York City, has prepared plans for the construction of an edifice at Colonial Ave. and 31st St., for the Park Place Baptists. The estimated cost is $[illegible].

Summerville, W. Va.—The Bd. of Supervising bids for Summerville County Court House has been extended to [illegible]. Plans [illegible] Office of the Supervising Architect, Washington, D. C. Thos. Ward [illegible] Law Bldg.

Charleston, S. C.—Bids will be received until Feb. 7, by McKim, Mead & White, Archs., 42 East 24th St., Philadelphia, Penn., for the construction of [illegible] for the Charleston Library Society.

✦**Greenwood, S. C.**—The contract for the construction of the [illegible] building for [illegible] has been awarded to W. [illegible] Co., [illegible] Ga.

Waycross, Ga.—Plans are being prepared for the construction of a seven-story brick and steel office building at Jane and Tebeau Sts., for J. R. and T. Bunn.

✦**Waycross, Ga.**—The Phoenix Hotel Co. has awarded the contract to V. C. PARKER & SON, for the construction of an addition to the hotel.

Birmingham, Ala.—The Southern Bell Telephone Co. will erect a 100x190-ft. warehouse on Sixth Ave., between 17th and 18th Sts. The estimated cost is $54,000. D. F. Turnbull is Mgr.

Montgomery, Ala.—Frederick Ausfield, Arch., has prepared plans for the construction of an 11-story hotel at Montgomery and Lee Sts., for the N. J. Bell estate. The estimated cost is $300,000.

Memphis, Tenn.—Plans have been prepared for the construction of an armory at Memphis. The estimated cost is $250,000. W. C. Duttlinger is Chn. of Armory Com.

Milligan, Tenn.—The Trustees of Milligan College will erect a dormitory. The estimated cost is $50,000.

Nashville, Tenn.—The Jesuits will erect buildings on a 200-acre tract of the Belle Meade land, known as the Red House Field. The estimated cost is $100,000.

East Liverpool, Ohio—The Board of Education will erect a school, to cost approximately $100,000. Peterson & Clark, Steubenville, Ohio, and C. M. Metch, East Liverpool, are the Archs.

Newark, Ohio—Bids will be received until Feb. 25, for the construction of the new city hospital. F. L. Packard, Hayden Bldg., Columbus, Ohio, is the Arch. Noted Jan. 23.

Detroit, Mich.—Plans are being prepared and bids will soon be received for the construction of a department store building on Michigan and Shelby Sts., for F. G. Clayton. The estimated cost is $500,000. Albert Kahn, Union Trust Bldg., is the Arch.

The Murphy Estate, Penobscot Bldg., plans to erect a tall office building at Congress and Shelby Sts.

Plymouth, Ind.—Plans are being prepared and bids will soon be asked for the construction of a Carnegie Library in Plymouth.

Grand Rapids, Mich.—Plans are being prepared for the construction of a six-story and basement hotel, 50x100 ft., for Charles H. Mehrtens. The estimated cost is $60,000. Robinson & Campau, 449 Housman Bldg., Grand Rapids, are the Archs.

Grand Rapids, Mich.—Plans are nearing completion for the new Pantlin Hotel, at Grand Rapids, and bids will soon be asked. The estimated cost is $1,000,000. Warren & Wetmore, 16 East 47th St., New York, N. Y., are the Archs. Clay Hollister is Pres.

Champaign, Ill.—Bids will be received by T. E. Smith, Chn. of the Bd. of Education, until 10 a.m., Feb. 27, for the construction of a new high school. Spencer & Temple, Champaign, are the Archs.

Chicago, Ill.—A permit has been granted for the construction of an eight-story hospital building for the Cook County Hospital. The estimated cost is $3,000,000. Paul Gehardt is the Arch.

Ex-Senator A. J. Beveridge, Indianapolis, Ind., will erect a six-story and basement building at Michigan Ave. and 16th St., Chicago, to be leased by the Goodyear Tire & Rubber Co. The estimated cost is $125,000.

Aberdeen, Wash.—Klaw & Erlanger and Chas. Frohman will erect a theater in Aberdeen to cost about $152,000. George K. McKenzie is their representative.

Spokane, Wash.—Patrick Welch will erect a large department store to cost $400,000 at Main Ave. and Howard St.

Portland, Ore.—The First M. E. Church will build a new church to cost $150,000 at 12th and Taylor Sts.

Longbeach, Calif.—The First Church of Christ, Scientist, will erect a new church on Elm Ave. near Fifth St. It will be one-story and basement, 90x140 ft. Elmer Grey, Wright & Callender Bldg., Los Angeles is Arch.

Los Angeles, Calif.—T. J. Douglas & Sons will erect a five-story and basement reinforced concrete apartment house on Burlington St., between Seventh and Orange Sts.

Albert C. Martin, Higgins Bldg., is preparing plans for a new building to be erected on Hope St., for the Knights of Columbus. The plans provide for a four-story and basement building 62x160 ft. It will have concrete foundation, structural steel frame, brick walls, terra cotta facing, marble and tile entrance and lobby, vacuum cleaning, elevator, plumbing and electric wiring. The cost is estimated at $75,000.

Oakland, Calif.—The County Supervisors have appropriated $1,000,000 for the erection of a county infirmary.

The Y. W. C. A. will erect an association building at 15th and Webster Sts. to cost $225,000. Miss Julia Morgan is Mgr.

The Supervising Architect of Oakland has completed the plans for two more of the new Oakland schools. One of these buildings will be one-story, and is to be erected at 54th and Market Sts. at a cost of $64,000. The other will be a two-story building and is to be erected at a cost of $84,000 on Grand Ave., between Perry and Santa Clara Sts. Bids for the first building will be received by the Board of Education until Feb. 10, and for the two-story structure until Feb. 17. Plans and specifications can be secured from the Supervising Architect, Security Bank Bldg., Oakland.

Orange, Calif.—Bids will be received until 3 p.m. Feb. 21 by the Board of Trustees for two buildings to be erected for the Orange Union High School District at a cost of $40,000. They will be of brick construction, plaster exterior, composition roof and pine finish, each two stories. Fred H. Eley Harvey-Eley Bldg., Santa Ana, is Archs.

Venice, Calif.—Albert H. Beach will erect a four-story and basement brick store and hotel building to cost $50,000 at Venice. W. S. Garrett, 405 Currier Bldg., Los Angeles, is the Arch.

Yosemite, Calif.—Frank A. Miller, Riverside, Calif., will erect a $250,000 hotel in Yosemite Valley and a $75,000 hotel at Glacier Point.

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Sewage Disposal Investigations at Cleveland

By R. Winthrop Pratt*

SYNOPSIS—Preparatory to the design of sewage-treatment works for Cleveland, Ohio, a series of tests is being made of various methods of treating the sewage. The causes leading up to the decision to treat the sewage and to make the tests before building the proposed works are outlined and then the testing station is described. The station includes grit chambers, screens and tanks for preliminary treatment; rapid filters or scrubbers, sprinkling filter, auxiliary settling tanks, and a disinfection plant for final treatment; tanks for dilution studies; sludge digestion tanks and sludge-drying beds, and an office and laboratory.

In Engineering News, of Mar. 28, 1912, J. M. Estep, assistant chief engineer, Department of Public Service, described the development of the Cleveland intercepting sewer system from the time when it was commenced in 1897. In the present article, therefore, the writer will but briefly discuss the present sewer system, taking up only those features which have special reference to the sewage-treatment problem.

On July 25, 1905, the city appointed a commission of experts, consisting of Rudolph Hering, George H. Benzenberg and Desmond FitzGerald to study the general question of improved water-supply and sewerage for the city. This commission, about six months later, submitted a report in which was recommended:

(1) The extension of the water-works tunnel to a point about four miles from the shore.

(2) The construction of an intercepting sewer system to collect the sewage from the entire city and discharge the same into Lake Erie, at a point about 10 miles east of the Cuyahoga River. This intercepting sewer was to be designed to carry twice the dry-weather flow from one million people, on the basis of 200 gal. per capita, or a total of 400 gal. per capita per day. This plan involved several overflows into the lake and river to take care of the discharge in excess of the above amount.

(3) The construction of a river flushing tunnel and pumping equipment for the purpose of pumping clean lake water into the river above all local pollution, was recommended by two members of the commission.

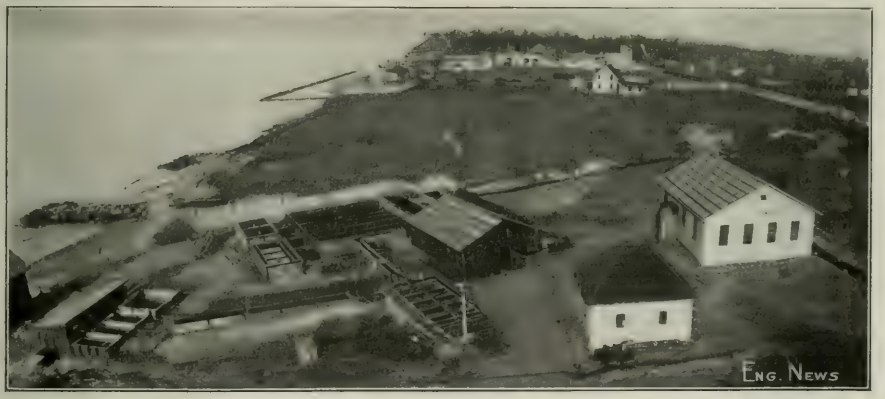


Fig. 1. General View of the Sewage Testing Station, Cleveland, Ohio, from the West

(Taken from the terminal basin tower at end of intercepting sewer. Shows proximity of houses in the background; laboratory building extreme right; screen house right center; grit chamber and tanks in center; filter house and filters at left; corner of Disinfection house extreme left.)

Present Conditions

Since 1896, the recommendations of the commission have in part been carried out and a new water-intake tunnel and crib have been constructed, the entire water-supply now being taken at a distance of four miles from the shore. About one-half of the intercepting sewer system has been completed at a cost of $2,528,575. A main outlet has been established at a point some eight miles east of the Cuyahoga River, it being found impracticable to go further east, without pumping, on account of

*Sanitary Engineer in Charge Sewage Disposal Investigations, Cleveland, Ohio.

*See Report of D. D. Jackson on Cleveland Water Supply, 1912.

the flat topography. That completed portion of the intercepting system which is tributary to the main outlet serves about 50% of the population and drains the territory in the northeastern part of the city. In addition there is a detached portion of the intercepting sewer which discharges into the lake at West 58th St.

The Main Interceptor is 13½ ft. in diameter and is laid on a grade of 2 ft. to the mile. On the shore of the lake at the terminus of this sewer, there has been constructed a Terminal Basin, which is in effect a combined grit chamber and storm-water overflow. This basin is 100 ft. long and 52 ft. wide. The usual depth of sewage in the basin is 2 ft. at the inlet and 6 ft. at the outlet end. The sewage before entering the Terminal Basin passes through two sets of coarse bar screens, having open spaces of 6 in. and 3½ in., respectively.

The dry-weather flow, and in fact also the wet-weather flow up to about 70,000,000 gal. per day, passes out over a weir 6.67 ft. long and into a 63-in. steel pipe laid below the bottom of the lake and extending 2650 ft. from the shore, where it discharges in about 35 ft. of water.

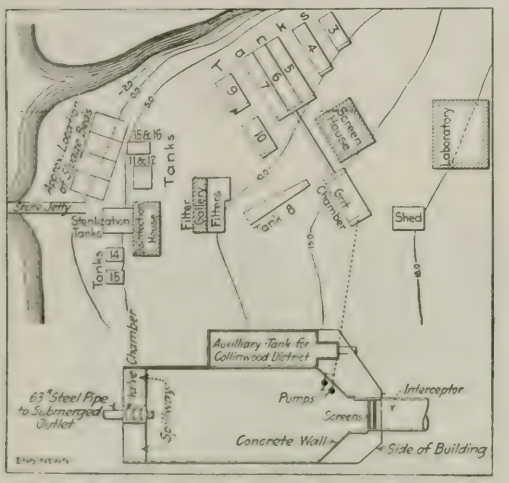


FIG. 2. GENERAL PLAN OF SEWAGE TESTING STATION AND TERMINAL BASIN, CLEVELAND, OHIO

No trouble has ever been occasioned by deposits in the outfall pipe.

The excess sewage during heavy storm flows passes out of the basin over an overflow weir 43 ft. long, onto the beach. The deposits in the tank consist largely of mud and sand and are removed at intervals by means of an electrically operated grab bucket; an unusually heavy flow, however, sometimes washes out these deposits onto the beach.

The Terminal Basin was originally not covered. On account of complaints from near-by neighbors, there has been built over it a steel-frame structure, which includes a tower 60 ft. high, through which the building is ventilated. The tower is placed directly over the screens.

Recent observations as to the quantity of sewage now being discharged at the main outlet, indicate an average dry-weather flow of about 40,000,000 gal., and this is increased three or four times during storms.

Since the discharge of sewage into Lake Erie at this point was begun there has been much complaint in regard to the pollution of bathing beaches and also complaint from summer communities located east of Cleveland, which desire to use the lake for water-supply purposes. The occasional pollution, from this outlet, of the lake water in the vicinity of the Cleveland intake is considered probable.

In connection with the pollution of the lake water at the intake crib, the writer would mention a condition which exists at Cleveland, and doubtless at other lake cities, although he does not wish to be considered as drawing any conclusions in the matter. Hovering around the two principal sewer outlets at Cleveland may be seen at any time large numbers of gulls. These feed on the solid matter in the sewage and splash in the foul water, and they also fly about the lake, sometimes circling around the water-intake crib and diving into the near-by waters. Seeing these gulls at both sewer outlet and water intake, and knowing that it would take but a few minutes to fly from one to the other, one is reminded of the "typhoid fly," which travels between out-house and kitchen. In order to remove the source of attraction for the gulls at the sewer outlet, it is simply necessary to clarify or remove the solid matter from the sewage entering the lake.

The gross nuisance existing in the Cuyahoga River, caused by the discharge into it of the sewage from fifty city sewers and also much manufacturing waste, has been complained of for many years; in fact, there are few if any streams in this country which are more foully contaminated than the Cuyahoga.* It has been quite definitely proven that the polluted water from the river is under certain conditions carried out to the water intake, four miles distant. The discharge of sewage into the lake at West 58th St., within the breakwater, causes severe pollution of the harbor water. To prevent conditions objectionable to sight, smell and comfort, as well as to furnish an additional safeguard to the city's water-supply, it is imperative that the pollution of the Cuyahoga River and of the harbor, cease.

PLANS FOR THE COMPLETION OF THE INTERCEPTING SEWER SYSTEM

In July, 1911, the city council, in order to relieve the gross pollution of the river and harbor, voted $1,000,000 to be used toward the completion of the intercepting-sewer system, in accordance with the original plan of discharging all of the city's sewage, untreated, at the main outlet. In view, however, of protests against the further pollution of the lake, it was decided not to use any of this appropriation until further study had been given to the question of whether any more untreated sewage should be discharged into the lake at the main outfall and also to the question of the feasibility of treatment works.

In January, 1912, the writer submitted a preliminary report relative to the local sewage-disposal problem (see ENG. NEWS, Feb. 8, 1912, for recommendations of report) in which he gave rough estimates of costs of various types of plants and suggested the possible advantage, if treatment works were to be installed, of treating at one or two separate plants the sewage from the portions of the city yet unprovided with main sewers, instead of concen-

*See Report of D. D. Jackson on Cleveland Water Supply, 1912.

trating all of the sewage flow at works on the lake shore near the present outfall, which location is near a high-class residence district. It was also pointed out that economies in sewer construction could be effected by such a plan.

As in any case the magnitude and cost of the treatment works would be great, it was recommended that there be first conducted actual tests of various types of screens, tanks and other devices before adopting a final plan. Accordingly, the city council voted $20,000 for the construction of a sewage-testing station which will be described further on.

Studies made subsequent to the above mentioned preliminary report, relative to the collection and disposal of the sewage now entering the Cuyahoga River, have shown that under the present conditions it is more feasible to depart from the original plan of draining the entire city to one outfall, and to collect the sewage from the southeasterly district (which is not yet provided with an interceptor) and possibly that from the southwesterly district, at a point south of the city limits and in the valley of the Cuyahoga River. A tract of land, covering some 200 acres, adjacent to the property on which is already located the city garbage plant, has been purchased for use as a site for sewage-treatment works. This can be reached without pumping. The sewage treated at this point would be 25 to 40% of the total output of the city, according to whether or not the southwesterly district is included, and would contain, in any case, considerable manufacturing sewage. The sewage from the southwesterly district can be either carried across the river in an inverted siphon to the interceptor leading to the southerly site, or it can be treated at an independent plant at some point on the west side of the river.

It has been decided, in brief, to treat the sewage already discharging through the main outfall, and to establish two other treatment plants, one on the west side of the river and the other south of the city. At these last two plants will be collected the sewage from those portions of the city not connected with the present main interceptor. In other words, little or no new territory will be made tributary to the present main outfall. It is expected that the treatment plant at the main outfall, as well as that on the west side, will comprise means for screening, sedimentation and disinfection only; while at the southerly plant a more thorough method of purification will be needed, at least when the Cuyahoga River is at its low stages.

The pollution of the Cuyahoga River was investigated by the State Board of Health, in June of the present year, with the result that the city was ordered.* after due hearing and with the approval of the Governor and Attorney General, to cease the pollution of the Cuyahoga River before July, 1915, and to install works or means for purifying or otherwise disposing of the sewage now entering said river. The City Council, in accordance with the state order, has already authorized the expenditure of $2,000,000 for this purpose, in addition to the $1,000,000 authorized in July, 1911.

*This order was issued under the Bense Act, so called, which empowers the State Board of Health to compel municipalities to provide for the purification of their sewage, and to issue bonds for this purpose in excess of the debt limit permitted by law for other purposes. See Eng. News, Apr. 9, 1908 (p. 396), for the Bense Act in full, and p. 400 of same issue for editorial comment; for decision of the Ohio State Supreme Court upholding the Act, see Eng. News, July 11, 1912 (p. 45).

The Sewage-Testing Station

This station (Figs. 1 and 2) is located on the shore of the lake adjacent to the terminal basin already described, on a seven-acre tract of land owned by the city. The various structures, which are arranged with a view to convenience in operation, cover an area of 200x150 ft. The topography is such that the screens, tanks and filters could be readily placed so that the sewage, after being once pumped into the grit chamber, may flow through these various devices by gravity.

Object of Tests.—One of the primary objects of the investigations is to secure a continuous record of the character and amount of sewage now being discharged, not only into the lake through the main outfall, but also into the river and harbor through the numerous sewers not yet intercepted. A general study of the character of the wastes from the principal factories in the city will also be made.

It is intended to install small experimental tanks and filters at the outlets of some of the main sewers in the river district in case it is found that this sewage differs materially in character from that now being discharged at the main outlet. Data thus obtained will be of special value in designing the southerly disposal plant. All analytical work, regardless of the source of the sewage being studied, will be done at the testing-station laboratory.

The main object of the tests and experiments at the main outfall is to determine the most economical method of clarifying the sewage so that it may be discharged into the lake without causing unsightly or objectionable conditions at any point. The clarification tests will comprise studies of various types of screens; plain shallow sedimentation tanks; plain deep sedimentation tanks; vertical flow tanks; two-story tanks; and septic tanks; also roughing or mechanical filters with provision for the settling of the wash water.

There are also to be worked out data relative to the feasibility and expense involved in disinfecting the clarified sewage so that all danger to bathing beaches and water-supplies may be practically eliminated. Data on the electrolytic production of chlorine will also be obtained, as the conditions at Cleveland, where salt is very cheap and where the city makes and sells electricity at a low figure, indicate that this process may prove to be of advantage.

The determination of the method of sludge disposal best suited to local conditions is, of course, one of the most important questions to be solved by the investigation, especially in view of the high-class residence property along the lake front for several miles on both sides of the main outfall. The character of the sludge produced by the various types of tanks will be carefully watched and sludge-drying tests, on sand beds on the shore of the lake, will be conducted. Then a heat dryer will be used to study the feasibility and possible advantages of drying the sludge and changing it into a condition in which it could be stored without offense and disposed of as a fertilizer ingredient in connection with products of the city garbage-reduction plant. Data on the burning and the destructive distillation of sludge will also be obtained.

Pumping Equipment.—To raise the sewage out of the main interceptor, for testing purposes, there have been installed a 6-in. and a 5-in. centrifugal pump, the suc-

tions of which are located in the flowing current of sewage a short distance below the coarse screens at the entrance to the terminal basin.

The 6-in. pump is of the vertical type, placed in the sewage and driven by a 15-hp. motor, belted with a ¼-turn belt to the upper end of the extended pump shaft, 12 ft. above the pump. The other pump is of the horizontal type, set upon the same base with and direct-connected to a 30-hp. motor. This excessively large motor is used because the city already owned it. Each pumping outfit is capable of raising 1,000,000 gal. or more per day from the flow level in the terminal basin to the experimental grit chamber, a vertical distance of 15 ft.

About 800,000 gal. of sewage per day will be used for testing purposes, but the amount treated will be varied from hour to hour to correspond to the variation in flow in the main sewer. In other words, it is proposed to treat at all times a fixed percentage of the total flow (up to 2 or 3 times the dry-weather flow) rather than to treat continuously a fixed quantity. This procedure will tend to eliminate inaccuracies in sludge-production data due

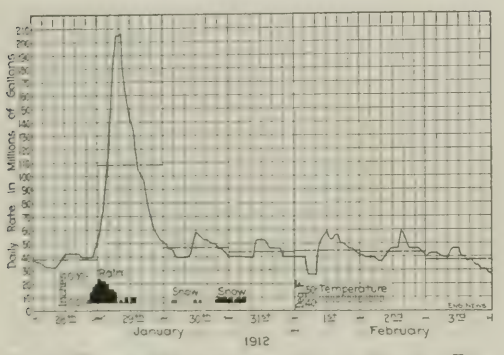


Fig. 3. Hourly Variations in Rate of Sewage Flow at Main Intercepting Sewer Outlet, Cleveland, Ohio, Jan. 26 to Feb. 3, Inclusive

to pumping too much weak night sewage and too little strong day sewage.

The average dry-weather flow is about 40,000,000 gal. per day, varying from a 30,000,000-gal. rate to a 50,000,000-gal. rate (see chart, Fig. 3), and it is intended to treat 1½% of this at all times. The speed of the motor and pump being constant, the hourly variations in rate of pumpage are obtained by opening or closing a relief valve located in the force main just above the pump, which valve allows the surplus sewage to fall back into the terminal basin. The attendant will, therefore, read, each hour, a gage indicating the flow in the main sewer (measured at the outfall weir of the terminal basin) and then turn the relief valve the requisite number of times to secure a pumpage of 1½%. Of course, during early storm flow, reaching a 200,000,000-gal. rate the same percentage cannot be treated.

Grit Chamber.—The grit chamber into which the sewage first enters is divided longitudinally into two parts, each of which is 5x16 ft. on plan, by 5 ft. deep at the upper end and 3 ft. at the lower end. The intention was to operate at first at a velocity of from 6 to 12 ft. per min. Since starting the tests it has been found that this velocity is too slow to prevent the deposition of objectionable organic matter. The grit chambers have therefore been remodeled and the velocity increased to about 30 ft. per min. The grit chamber will be used only at times of storm flow and will be by-passed ordinarily. A smaller grit chamber will be built for the dry-weather flow if this should prove desirable.

Distributing Flume.—This adjoins the lower end of the grit chamber and conveys the sewage to all of the tanks. The main flume, extending across the upper ends of Tanks 5, 6 and 7, together with the entrance channels built on to the upper ends of the remaining tanks, constitute a reservoir from which the sewage is drawn off through measuring weirs of different sizes, into the tanks themselves. The supply for the screen house is taken from the flume just below the grit chamber. The respective crests of all the weirs are set level, although the weirs are of various lengths. By this arrangement the rate of flow through each tank always bears the correct proportion to the total pumpage, which will be varied from hour to hour as above discussed.

Plain Sedimentation Tanks.—Tanks 3, 4, 7 and 8 are classed as sedimentation tanks. Nos. 3 and 4 are 25 and 15 ft. deep, respectively, the former being 7x20 ft. in plan, the latter 7x30 ft. (see Fig. 4 for details of Tank 3). They will receive about 100,000 gal. of sewage per day, representing about a 4-hour storage period. Both tanks have hopper bottoms, 7x10 ft. in plan, and separate sludge drains extending to the bottom of each hopper. The intention is to draw off the sludge regularly without draining the tanks. Tanks 3 and 4 will later be changed to vertical-flow tanks, the sewage to be discharged near the bottom and drawn off at the top, as in the Dortmund type of tank.

Tanks 7 and 8 are also of the hopper-bottom type, but shallower. They also will be operated on a 4-hour storage period. Tank 7 is 8x40 ft. in plan and 8 ft. deep to the bottom of the hoppers. Tank 8 is 40 ft. long and of unusual design (see lower part of Fig. 5). It is 4 ft. wide at the inlet end and 8 ft. wide at the outlet end. The bottom is formed into three hoppers, which are, respectively, 10 ft., 9 ft. and 8 ft. deep below the flow line. The tank was designed with the thought that the heavier solids would settle out first, and that the volume of sludge so deposited would be relatively greatest in amount at the influent end, hence the deeper space at the upper end. The lighter particles, which will be deposited later, under decreasing velocity of flow, will drop into the shallower portion of the tank.

Septic Tanks.—Tanks 5 and 6 are each 40x8 ft. in plan, with a flat or single-plane bottom, 8 ft. deep at the upper end and 9 ft. deep at the lower end. These tanks, while classed as septic tanks, will doubtless later be operated as plain sedimentation tanks on the basis of a 6- to 8-hour storage period.

Two-story or Emscher (Imhoff) Tanks.—Tanks 9 and 10 are of the straight-flow Imhoff type, each 10x20 ft. in plan, 25 ft. and 20 ft. deep, respectively (see Fig. 5). The inner flow channels are 20x7 ft., and are approximately 12 ft. and 8 ft. deep, respectively, representing a 3½-hr. and a 2½-hr. storage period when treating the proposed average quantity of 100,000 gal. per day.

Dilution Tanks, Auxiliary Settling Tanks and Sludge Digestion Tanks.—There are two dilution tanks, each 8x10 ft. by 6 ft. deep, for studying the pro-

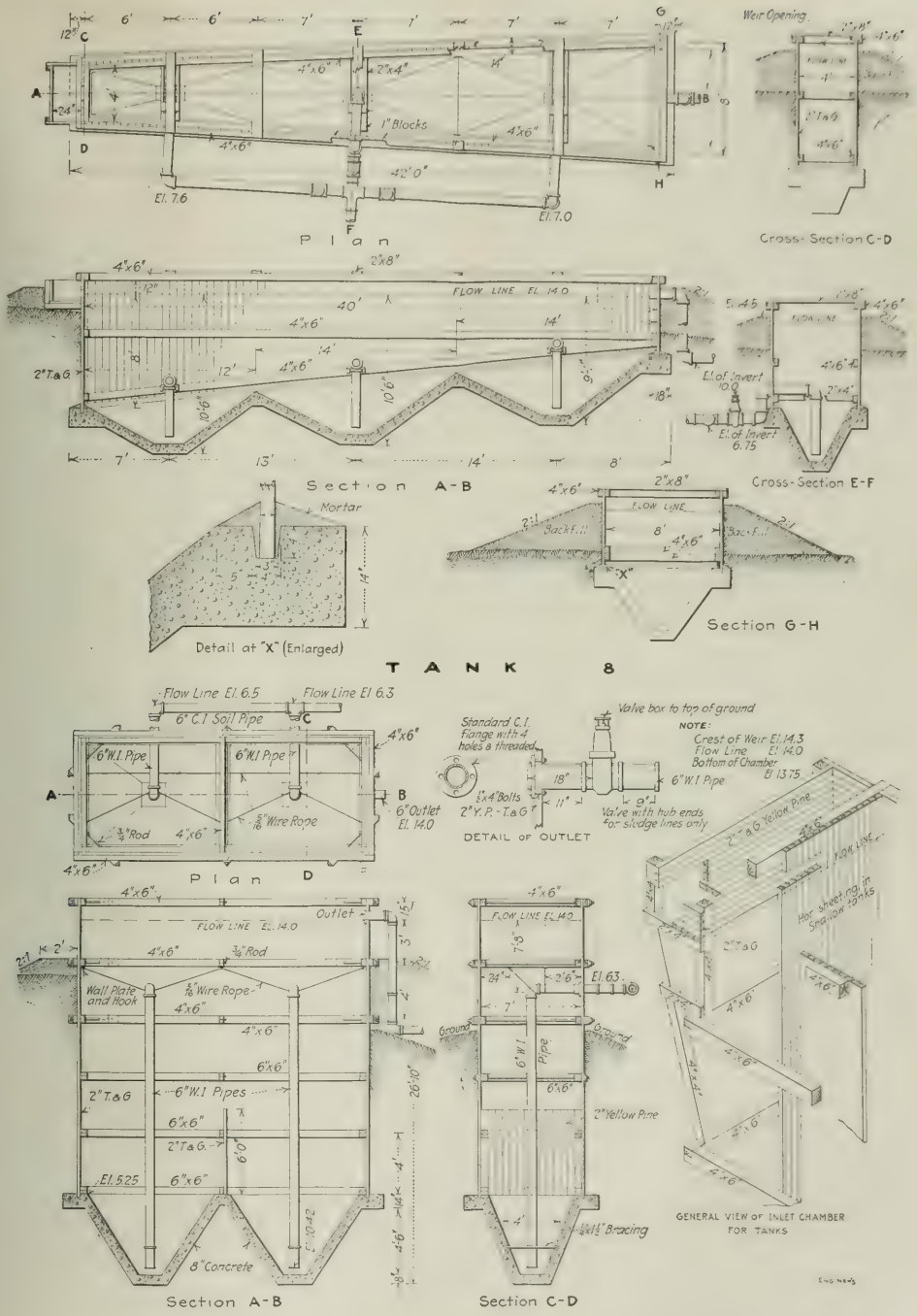
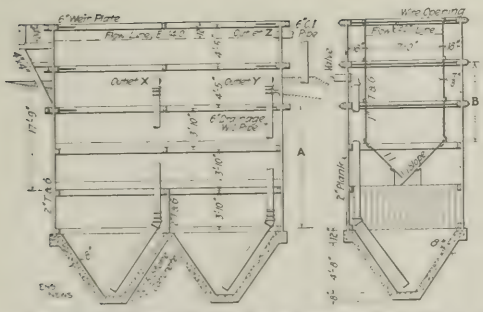


FIG. 4. PLAIN SEDIMENTATION TANKS 3 AND 8, CLEVELAND SEWAGE TESTING STATION

(Baffles for Tank 3 omitted.)



(Tanks 9 and 10 are of this general design. No. 9 is 15-25 ft. deep and No. 10 is 15-20 ft. deep. Dimensions of each are the same, except A and B.)

FIG. 5. EMSCHER OR IMHOFF TANKS, CLEVELAND SEWAGE TESTING STATION. (BAFFLES OMITTED)

portion of clean water necessary to inoffensively dilute the effluents from the several clarification processes. There are two auxiliary settling tanks, each 7x10 ft. by 15 ft., for clarifying the wash water from the mechanical filters or scrubbers and for settling the effluent from the sprinkling filter. The two sludge digestion tanks, each 7x7 ft. by 16 ft., are for digesting or decomposing the sludge from the several plain sedimentation tanks in order to enable a comparison to be made between sludge so treated and sludge from the two-story tanks.

GENERAL CONSTRUCTION OF TANKS—The tanks being for temporary use only are, with the exception of the grit chamber, constructed of 2-in. Norway pine tongued-and-grooved lumber, fastened to yellow pine 6x6-in. and 8x8-in. framing. Tanks 5, 6 and 7 have wooden bottoms, while all others have concrete bottoms. The deep tanks are mostly in clay soil, which tends to make them watertight. Tanks 3, 4 and 9, however, being located quite near to the creek bank, required a special waterproofing of from 4- to 8-ply tar paper and pitch. Some difficulty was also found in making the wooden-bottomed tanks tight. The grit chamber, made of square-edge 3-in. lumber, with 3-in. steel rods about 2 ft. c. to c. running vertically through it, gave no trouble.

The piping within the various tanks and also the lines which connect them to the filter and disinfection devices are cast-iron soil pipe, this being at the time of purchase much cheaper than wrought-iron pipe or cast-iron water pipe. The valves are all lightweight gate valves, made by Crane & Co., and are cheaper than ordinary water-gate valves.

Baffles were not placed on all the tanks during construction, the idea being to add baffles wherever they were found to be desirable. Since the plant was put in operation all tanks have been provided with two or three baffles each.

SCREENS AND SCREEN HOUSE—Tests are to be made on the efficiency of fine screens of various meshes. There are to be four screen boxes, each 2½x5 ft., with grooves for inserting different screens. About 25,000 gal. per day will be handled in each screen box. The screened sewage flows to Tanks 5 and 7, or it can be diverted directly to the disinfection house. A centrifugal machine has been provided for drying the screenings.

The screening devices are located in a 24x30-ft. wooden building, in which is also placed the boiler which heats the laboratory.

FILTER AND FILTER HOUSE—There have been installed one sprinkling filter and three rapid filters on scrubbers (see Fig. 6 for section). The sprinkling filter is a wooden box 12 ft. square, containing 6 ft. of slag. The sewage from one of the sedimentation tanks will be applied through one nozzle, located in the center. This filter will be dosed intermittently from a wooden dosing tank operated by 3-in. Miller siphon and located on the roof of the filter house.

The station was put in partial operation on Dec. 1, 1912, but the work was not established on a routine basis

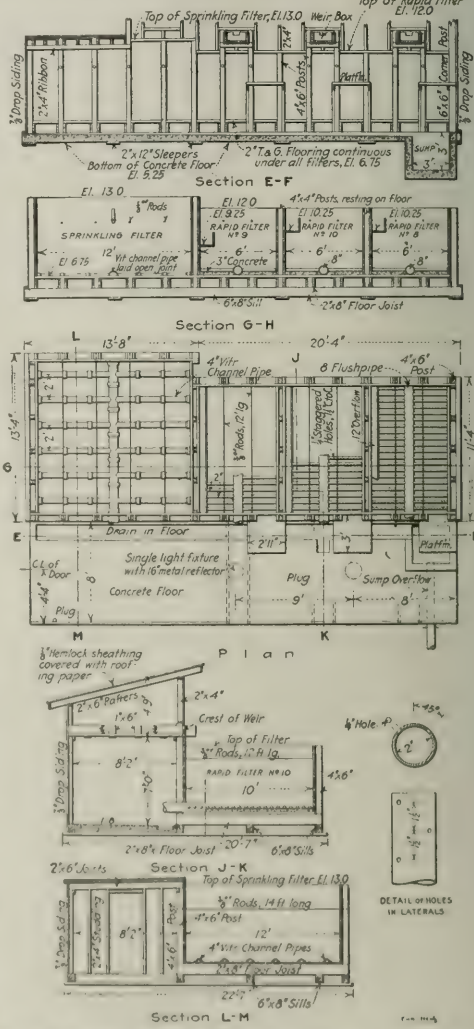


FIG. 6. SPRINKLING AND RAPID OR SCRUBBING FILTERS, CLEVELAND SEWAGE TESTING STATION

until about Jan. 1, 1913. It was expected (Jan. 27) that the disinfection work would be started by Feb. 1, 1913.

The rapid filters are made of watertight wooden boxes, each 10x6 ft. in plan and provided with such piping and fittings as are necessary to form a mechanical water filter. Two of the rapid filters will contain 3 ft. of fine gravel filtering material and the third will contain 2 ft. of material. The filters will be back-washed by water from the city main. The dirty wash water from the rapid filters will pass into a deep settling tank the effluent from which will be disinfected.

Along one side of the filter has been built the filter house in which are located the valves necessary for operating the filters. Here also is a hydraulic ram, placed on the effluent line from the sedimentation tank. This ram automatically raises the requisite amount of sewage into the dosing tank which supplies the sprinkling filter, thus saving repumping of this amount.

Disinfection House—This is a two-story, 16x32-ft., wooden structure, and contains all the devices for mixing

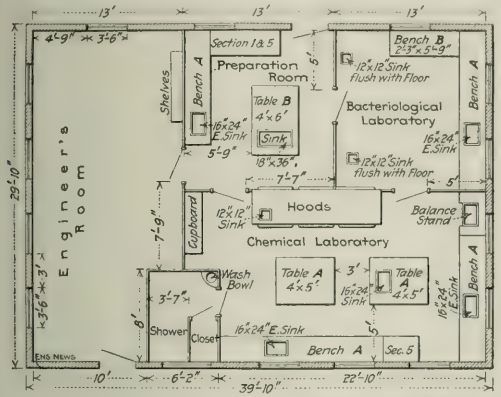


Fig. 7. Plan of Laboratory, Cleveland Sewage Testing Station

and applying disinfectant to the various tank effluents. On the lower floor are three chemical storage tanks; one of galvanized iron (to be painted with enamel paint), 8 ft. in diameter and 10 ft. deep; one of wood, 8 ft. in diameter and 10 ft. deep, and one of concrete, 4 ft. square in plan and 5½ ft. deep. The first two tanks are to be used for the storage of calcium hypochlorite, while the concrete tank will be filled with sodium hypochlorite. The three different materials, galvanized iron, wood and concrete were used in order to note the relative effect of the chlorine on them. On the lower floor is placed a large feed box or constant-level tank, which can be fed from either of the circular tanks. This box has six outlets, each with its adjustable orifice.

On the upper floor will be stored the calcium chloride, which will be introduced into the tanks from here. There is also a brine tank in which will be mixed the salt solution to feed the electrolytic cell which is to make the sodium hypochlorite. The cell is known as the "Dayton Cell," and will be placed immediately over the concrete tank.

Passing under the floor of the disinfection house and also under the orifice box are six 6-in. pipe lines leading from five tanks and from one filter. The sewage passing through each line will be treated with the disinfectant solution and then passed into a reaction tank, of which there are six, located just outside of the disinfection house. The tanks are each designed to hold about 20 minutes' flow of sewage and are highly baffled so as to insure a rapid (up and down) flow through the tank.

Sludge Treatment—There are four sand-sludge beds, each 10x20 ft. by 2½ ft. deep, placed at such elevation that the sludge from any tank can flow onto them. Each bed comprises an open wooden box filled with 20 in. of lake sand.

As mentioned above, it is proposed to study the drying of sludge in a direct heat dryer, either before or after partially drying it by some other process. The dryer will be constructed in accordance with designs made by W. J. Springborn, Director of Public Service of Cleveland, who has had extensive experience in the construction and operation of garbage-reduction and drying machinery. If it should be found that it is feasible to dry the sludge in this way, the dried material could probably be sold by the city for fertilizer base in connection with the products of the municipal garbage-reduction plant. No expectations are entertained, of course, of placing such a method on a money-making basis; but, as such a method would afford a sanitary means of disposing of sludge, especially where little land is available, it is desired to obtain figures on the net cost involved in handling the sludge in this way. It is expected to devote considerable time to making chemical analyses of the various sludges.

Some studies will be made of the burning and distillation of dried sludge and data on its fuel value will be obtained. The digestion or septic decomposition, in separate sludge tanks, of sludge drawn from some of the plain sedimentation tanks will be investigated by means of the sludge-digestion tanks above mentioned.

Laboratory—The laboratory building is a one-story, 30x40-ft. structure. It is divided (Fig. 7) into an engineer's office, chemical laboratory, bacteriological laboratory and preparation room. A very complete equipment has been provided as regards analytical apparatus, and this has been chosen with particular reference to making sludge analyses and disinfection studies, as well as standard analyses of sewage and effluents. The rooms are well supplied with water taps, gas cocks, sinks and drains. There is also a shower bath and a water closet. A large-sized hood, accessible from both laboratory rooms, has been installed. The building is well heated by steam generated in the boiler located in the screen house.

Proposed Schedule of Operation—The accompanying chart (Fig. 8) indicates in a brief and condensed manner the schedule which it is proposed to follow at the start (full lines) and also the systems which will probably be followed later (dotted lines). It is expected that various new problems will arise during the course of the tests and the necessary changes of schedule will be made to enable these problems to be taken up if they are considered of sufficient importance. The septic tanks have been installed chiefly to furnish comparative results and these will doubtless be operated as plain sedimentation tanks or used for other purposes later. The sprinkling filter, also, is to be operated in order to afford comparison between its efficiency, under the local conditions, and the efficiency of some of the other devices, rather than

with the expectation of adopting the sprinkling filter in the design of the permanent plant.

Modifications of the forms and dimensions of the various tanks will suggest themselves as the tests proceed. For example, it is probable that a shallower and less expensive form of Emscher (Imhoff) tank from which the sludge can be removed by compressed air (with the idea of obtaining a porous sludge) would be worthy of study.

PERSONNEL—The testing station is under the general direction of the Department of Public Service, of which W. J. Springborn is director, and Robert Hoffmann, chief engineer. The writer is engineer-in-charge of the station; H. B. Hommon is chief chemist and bacteriologist; G. B. Gascoigne, assistant chemist; E. G. Dyer, assistant

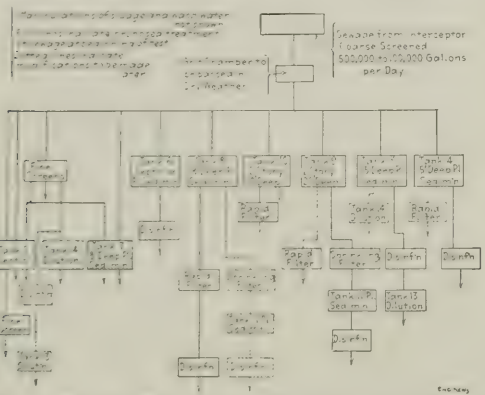


FIG. 8. GENERAL SCHEDULE OF OPERATIONS, CLEVELAND SEWAGE TESTING STATION

bacteriologist, and A. C. Lucas, assistant engineer. There are also a janitor for the laboratory and four attendants, whose duties are to collect samples and make flow observations. One attendant is on duty at all times.

⁂

Burned-clay Ballast for Electric Railways is suggested in connection with the construction of such lines in the province of Alberta, Canada. Gravel and sand are scarce and of high price in the district to be served, but as the subsoil is mainly clay it has been suggested that this might be burned for use as ballast. Such material has been used in the Western States by a number of steam railways, and there seems to be no reason why it should not be satisfactory on electric lines, provided that the clay is of suitable character, although we have no information as to its previous use on such lines. Perhaps some of our readers can refer to electric interurban railways, which have used this ballasting material and can give us some information regarding the methods, cost and results.

⁂

Canadian Railway Construction in 1911-12. During the year ending June 30, 1912, there were 2953 additional miles of railway put into operation in Canada, 1738 miles more were reported as ready for operation, and about 10,000 miles were under construction. The total railway mileage of Canada, exclusive sidings and double tracking, is given by the Railways and Canals Department as approximately 30,000 miles, representing a total investment in stocks and bonds [illegible] of $1,356,645,326, an average of $50,832 per mile. Dividends were paid equaling 4.04% of the total stock issue. The public has aided the construction of these railways to the extent that the total sum contributed in cash by the various federal, provincial and municipal authorities amounts to over $205,000,000, while land grants of 56,000,000 acres have been acquired by the railways. Railway bonds have been guaranteed by federal and provincial governments to the extent of $245,070,045. The number of railway employees was 156,901.

The Design of Hot Water Supply Systems to Minimize Corrosion

BY F. N. SPELLER*

In a paper on the "Durability of Welded Steel Pipe,"[1] reprinted and commented upon in ENGINEERING NEWS, Mar. 23, 1911, there was discussed the results of investigations on the relative corrosion of iron and steel in service, and the influence of the dissolved gases (oxygen and carbonic acid) in water and a scheme was suggested for rendering the water practically harmless by removing the air after heating. So far as the writer is aware, however, no system has yet been designed with this as the main object.

In the paper referred to, the writer pointed out, first, that the superiority claimed for "genuine" wrought-iron pipe had not been proven by comparative tests in service; on the contrary, the numerous cases which are on record (and which have been largely added to since that time), show conclusively that where both iron and steel have been used together in water lines, the wrought-iron pits just as badly as the steel under the same conditions. A number of such comparisons were compiled by the writer for the International Congress for Testing Materials last September.[2]

We need not again go into the cause of this pitting, which is now generally recognized to be due to galvanic action between impurities on the surface of the metal, especially mill scale and rust. The leading authorities now seem agreed that corrosion is practically independent of the composition of the metal, provided it is reasonably uniform (as the steel used for welded pipe must necessarily be if it welds without developing injurious defects).

In order to have continued corrosion, oxygen must be present in solution; the removal of this oxygen has been found to greatly lessen corrosion. In his recent report of researches along this line, Dr. W. H. Walker, Director of the Research Laboratory of the Massachusetts Institute of Technology, describes one of his experiments thus:[3]

> Two coils made up from pieces taken from the same length of pipe were each fed with water from the same source at the same temperature. In one case the water was heated to 85° C. in an open tank, while in the other the water was heated to the same temperature in a closed tank. The feed water contained on the average 5.85 c.c. of oxygen per liter, and passed through each coil at the rate of ½ gal. per min. After running 1750 hr., the coil fed with water heated in an open tank had lost 22 grams, while the soil fed with water heated in a closed tank had lost 155 grams. In neither case was the oxygen completely removed; if the water in the open tank had been gently boiled, corrosion in the coil fed with this water would have been completely prevented.

These results again indicate that the intensity of conditions have much more to do with corrosion than anything else; so much so that the same material used as a pipe in a hot-water heating system, where the water is practically free from oxygen and unchanged, should last 50 years or more, while in a closed hot-water supply system it may only last five or six years.

*Metallurgical Engineer, National Tube Co., Frick Bldg., Pittsburgh, Penn.

[1] Proceedings, American Society of Heating and Ventilating Engineers, 1911.

[2] "Comparative Service Obtained with Wrought Iron and Soft Steel Pipes as Water Lines in the United States," Proc., International Association for Testing Materials, 1912, XXIV, 4.

[3] "Engineering News," Dec. 21, 1911; "Journal of New England Water Works Association," March, 1912; "Journal of Industrial and Engineering Chemistry," July, 1912.

This principle of heating and freeing the water from dissolved oxygen, by which it seems possible to prolong the life of standard welded pipe several times, is surely worthy of careful consideration in designing piping systems which are subject to corrosion.

A recent investigation, undertaken by the writer with the assistance of some of his research staff, has developed interesting points in regard to the present practice of laying out hot-water supply systems. The influence of the arrangement of the piping on corrosion seems to be quite marked, depending on whether the gases are liberated before the water enters the distributing system or not, although the separation of these gases is only partially accomplished under the best conditions. Large installations were considered, such as hotels, large apartments and office buildings where, on account of the great quantity of hot water used, serious trouble would be most likely to occur.

The hot-water supply systems found in these buildings differ in many details, but may be divided into two classes, according to whether the main vertical distributing lines are supplied from a common horizontal main in the basement, or from a similar horizontal distributing main above the level of the highest fixture near the roof. These types of installations are illustrated, diagrammatically and without detail of any kind, in Figs. 1 and 2.

The underfed system is characterized by a number of independent risers and return-risers, each supplying a separate section of the building. These risers are rarely vented at the top and consequently the hot water is always supersaturated with air when the system is in continuous use. This is a good example of the closed type of heating so designed that it would be very difficult, if not entirely impracticable, to vent so as to remove the gases before the water is used.

The system illustrated by Fig. 2, on the other hand, is radically different in this respect and to a considerable extent, although not completely, allows the escape of dissolved gases to the atmosphere at the highest point before the water is distributed throughout the system and returns to the heater. Since all the water used passes up through one riser a vent must be provided, otherwise trouble due to the trapping of air in the upper lines would probably be experienced. It would seem to be a very simple matter to almost completely free the water from dissolved gases with such a system, by putting a simple air-separating device at the upper end of the main riser, as indicated at the point *A* in Fig. 2. To obtain the best results, the water should be heated to about 200° F., using an inter-cooler, if desired, to reduce the temperature after leaving the air-separating chamber.

The writer has discussed only general principles affecting the life of the piping system; the details necessary to carry out these principles in practice will, of course, require thought and expert knowledge of design on the part of practical engineers having to do with heating and plumbing.

With pure water, such as is supplied to New York City for example, the percentage of dissolved gases is proportionately high, so that the benefit to be expected from such treatment when thoroughly carried out and maintained would probably be very marked.

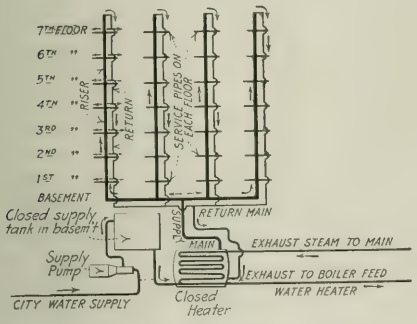


Fig. 1. Underfed Closed System

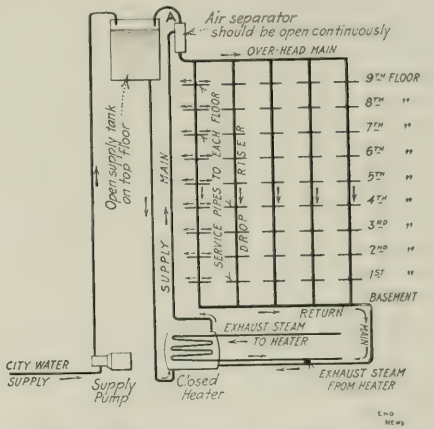


Fig. 2. Overhead Open System

Figs. 1 and 2. Two Types of Hot-water Supply Systems

Several cases investigated, where large systems of hot-water supply lines have suffered serious damage in six or eight years, have all occurred in buildings equipped with closed heating systems. So far, we have not found serious trouble in systems of the open type where any attention has been given to venting, although the significance of adequate venting of such systems does not seem to be appreciated by architects and engineers, for in some cases, where vents were provided, the practice was to keep them closed except when trouble with air-hammer was experienced.

Engineers and architects have perhaps hesitated to make changes in the closed system of heating without more practical evidence of a substantial character, the scientific study of corrosion being all new ground. The writer hopes to see a free discussion, on the part of those who have most experience in such work, so that the best system of design may be developed for such installations with due regard to prevention of corrosion.

The Hughes Terminal on the Delaware River at Philadelphia

By H. McL. Harding*

Delaware River Traffic—The Delaware River, on which this new terminal is to be located, carries more commerce than any other river in the United States. In 1910 the freight was 25,496,000 tons, having a value of $1,340,392,000. This commerce pays into the United States treasury approximately $20,000,000 annually. In 1911 the port of Philadelphia made a new commercial record—a greater number of vessels and a larger tonnage

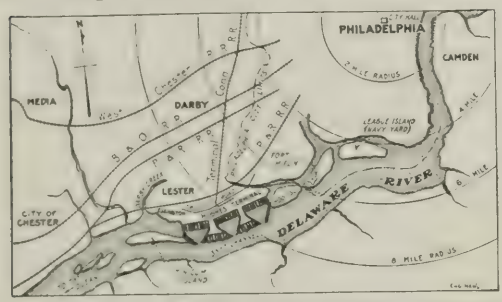


Fig. 1. Map of the Port of Philadelphia, Showing the Proposed Hughes Terminal

than in any previous year. The principal shipbuilding interests of the country are on the Delaware River.

In Philadelphia there is now little unoccupied space out of the 56,640 lin.ft. of water front. There is no effective coördination here between the rail and water lines, and this is especially true of the transshipment and transfer sheds, the warehouses and the industrial sections. The total volume of traffic handled at Philadelphia in the year 1911 by the three railways entering amounted to 32,562,000 tons; all the railway terminals are more or less congested.

Location of the Proposed Hughes Terminal—By an inspection of Fig. 1, the position of the Hughes Terminal in relation to the city of Philadelphia and the surrounding country is clearly indicated. It is contiguous to the boundary line of Philadelphia, and about eight miles from the City Hall; it is directly on the Delaware River, about 80 miles from the sea, and has an advantageous situation. The projected terminal is 105 miles nearer Panama than New York. It is nearer the great manufacturing centers of Philadelphia, Pittsburgh and Chicago than any other Eastern seaport terminal. There will be small taxes, and control of the township will rest with the terminal authorities.

Including the three adjoining counties and the smaller cities, there is a contributing population near-by of not less than 2,500,000; but the shippers and consignees in a greater population of many millions will use this terminal if the facilities are favorable, for contributing to this terminal will then be the rich states of Pennsylvania, Ohio, western New York, Indiana, Illinois and others.

The physical characteristics of the location show Tinicum Island, a low-lying stretch of land, and on a line between that and Hog Island (Fig. 1) another island, then very shallow water or a submerged bar and the Miflin Bar Dike of the government which cuts off the shallow water between the island and the mainland and the Delaware River.

The shallow body of water to the rear of these islands and bars averages 7 ft. mean low water and is called the Miflin Basin. It is mostly owned by the terminal. From the channel now being dredged by the government, and from the deepening of the center of the basin (Fig. 2) there will be material for the earthfilling of the initial development.

Acreage and Frontage—This new terminal will contain, south of the trolley road, about 2500 acres. This includes the shore land, the Miflin Basin, the islands in front, the whole of Tinicum Island and the submerged lands which are part of the Tinicum Island property. There will also be about 500 acres north of the trolley road.

In the first layout, as planned, there will be about 25,000 ft. of lineal frontage, or berthing capacity at one time for some 40 vessels 500 ft. long. There will be two piers, each 1000 ft. long. There is space for eight 1000-ft. piers within the basin. In future developments, each new basin will have practically the same lineal pier and quay length, the three basins would therefore have a lineal frontage of 60,000 ft.

There can be five river piers, with 10,000 ft. frontage, in front of the cotton area. Other river piers can give 24,000 ft. additional. Furthermore there can be developed a frontage upon both sides of Tinicum Island

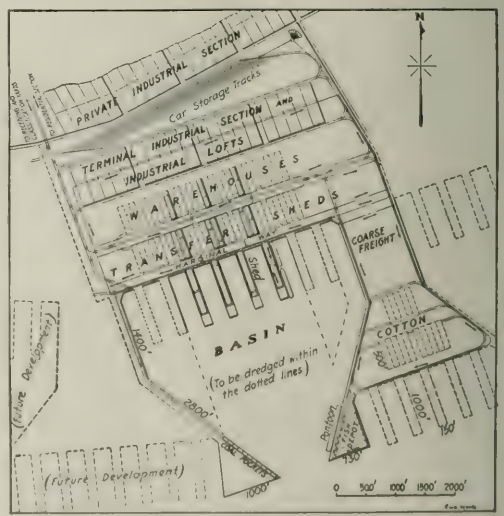


Fig. 2. Plan of Development; Hughes Terminal, Philadelphia

west of the terminal development proper. It will therefore be seen that there will be a surplus of frontage for many years to come.

It is estimated conservatively, by making use of the latest mechanical appliances, there should be an annual transferring capacity at the 20,000 lin.ft. of pier and quay walls of about four million tons.

The Waterway—There is at present a depth of 30

*Consulting Engineer Department of Docks and Ferries of the City of New York, 17 Battery Pl., New York City.

ft. in the channel, and appropriation has been made by the government to increase this to 35 ft., with a width of 800 to 1000 ft.

The river here is a mile and a quarter wide. There is water area for all terminal requirements, including anchorage and ship-turning space.

Railway Facilities—It is the intention to provide ample room in this terminal for trackage for all purposes, including team-track facilities, sidings and storage yards, receiving and classification yards, and perhaps a transfer station. In its final development there will be 60 miles of trackage. It is the purpose to transfer the freight, as far as practicable, directly to cars upon tracks behind each pier or quay. This may be from the ship's hold, from the deck, or from the pier side. Proper consideration will be given in this connection to customs regulations, assorting and distributing. In order to do this without rehandling, which would add some 15 to 20c. per ton to the cost of transference of miscellaneous freight, it is necessary to have placement for at least 300 cars in each one or two combined sections of the terminal. In the storage yards, to the north of the terminal, will be trackage for over 900 additional cars, and more trackage in other locations. Trackage is also provided for cars within and between the sheds and warehouses and between the warehouses and the industrial section. Space can readily be reserved still further to the north of and within the terminal grounds for classification and transfer yards.

Between each of the four lines of tracks serving the piers and quays are platforms, about 20 ft. wide. This enables the cars to be loaded or unloaded without "spotting." Many sidings will be so arranged, not only for local freight, but also for full carloads, and for the local team freight.

No successful terminal has proved to be too large, and all the available space here will sooner or later be urgently needed. It therefore seemed advisable for the tracks to pass through the lower story of the sheds. Another advantage of this is that the handling and transferring of the freight is done under cover, avoiding horizontal movements; the work can proceed during inclement weather, and the property be protected from damage and also from theft.

It is also proposed to extend the sidings through a portion of the lower story of the warehouses for similar reasons, and for the direct elevation of freight to the upper stories, but tracks are not to be extended within the pier-sheds or upon the piers, except possibly on special piers for the transference of bulk freight or cargoes of few marks. For miscellaneous or package freight service, it is not advisable that cars should pass upon the piers.

The railway franchises of the terminal, extending to the rear of the terminal lands and connecting with independent railroads, will serve all parts of the terminal and may be supplemented by overhead transfer tracks.

Internal Water Area—The basin will be an anchorage place for barges and lighters, and a temporary mooring place for even the longer vessels.

One slip has been indicated as dredged within the eastern portion of the basin, about 2600 ft. long and 300 ft. wide. The reason for this is that it seems to be excellently well adapted for special freight and for transference to the local industries by railway or transfer tracks. As there must be a location where certain classes of cargoes can be transferred directly between ships and lighters, the basin can be used for this purpose.

Marginal Way—A strip of land 200 ft. in width, in front of the transfer sheds and called the marginal way, is reserved for the common use of all the factories and the whole terminal, and for surface tracks and overhead runways.

Transshipment Sheds—These sheds in the basin section are upon the piers. Only two sheds will be constructed at first. These will be of one story, about 40 ft. high, 138 ft. wide and 800 ft. long, fully equipped with freight tiering and transferring machinery.

To the east of the basin will be other transit sheds in the future, 100 ft. wide and 500 ft. long, of the two-section type. These are chiefly for the transference and storage of cotton and similar material which, on account of fire risk, it is desirable to isolate.

Locations for some special commodities are shown on Fig. 2, but provisions have been made for other commodities such as tobacco, wool, ore, phosphates, lumber, fruit and for markets. Lumber and structural-steel yards will later be located west of the basin. There might well be storage warehouses for perishable freight and a market.

Transfer Sheds—To the rear of the marginal way are transfer sheds for transference to and from cars or drays, and for shorter-time storage than in warehouses. There are five groups of these sheds, with five sheds in each group, each shed being 500 ft. long and 100 ft. wide. Only four sheds will be erected and equipped in the beginning. These are one story in height, with elevated or auxiliary floors. The lower section is 14 ft. high and the upper section is 26 ft.

Warehouses—Toward the north of the transfer sheds, between them and the industrial section, will be located warehouses, of which only two need be constructed at first. They will be of reinforced concrete and will have sprinklers for fire protection. Each warehouse is 500 ft. long and 100 ft. wide, with a connecting wing, with fire walls and doors between wings. The walls will be designed for sufficient strength to sustain other stories. The lower section of these will be reserved for car tracks, car platforms and dray platforms. Above the car platforms will be openings so that freight can be taken to the upper floors.

Machinery—Later devices consist in overhead trackage and electric transferring and hoisting machinery. This conveying mechanism consists of a transfer-tractor which draws after itself from one to four trailers, each trailer supporting an electric hoist. This transfer-tractor constitutes the traveling-conveying mechanism, having a speed up to nine miles an hour, with its complement of trailers and six tons of freight.

Power House—A 1000-hp. central station will be located on the west side of the basin for supplying light and power. The lighting generators will furnish alternating current; there will be two 500-volt direct-current machines for power.

Use of the Terminal—The piers, pier-sheds and marginal way will be for the common use of the terminal. Certain transfer sheds will be rented exclusively to transportation companies rather than the piers or pier-sheds, and the terminal company will transfer freight between the vessel or the pier and the transfer shed; it can do it

at a less cost than the transportation company can handle it upon a pier alone.

Cost and Income—The initial investment expenditure would be about $2,900,000. The estimated gross income will be about $1,200,000, the expenses $580,000, and the net income $660,000.

Recommended Changes in Portland Cement Specifications

The Bureau of Science of the Philippine Islands has been investigating for five years the physical and chemical properties of portland cement and has published the results from time to time in the *Philippine Journal of Science.** These studies have recently been brought to an end and the final results published in the June, 1912, issue of the *Philippine Journal of Science.* While pressure of space forbids any complete résumé of the entire publication of these studies or even of the summary of them, which appears in the last report noted above, the final conclusions as to possible reform in cement specifications are interesting as indicating the general conclusions of the investigators, and they are given below. The complete report of the work can be obtained from the Bureau of Science, Manila, P. I. The studies were under the general direction of W. C. Reibling, Chief, Division of General Inorganic and Physical Chemistry.

The conclusions follow:

(1) The qualities in portland cement which we need are constancy in volume and setting properties, and reliability of strength, and it is of vital importance that this material both harden rapidly and maintain great strength. We believe that the enforcement of the following recommendations will increase the efficiency of the present standard cement specifications of the American Society for Testing Materials.

A. Concerning the constancy of volume:

(a) In order to secure the desired efficiency in portland cement, the manufacturer must be induced to burn his materials so that no seasoning is required to produce a sound cement.

(b) Failure to meet the requirements of the accelerated tests shall (in place of "need not" as now specified) be sufficient cause for rejection.

B. Concerning the specific gravity:

(a) In order to secure the best burning and proper storing, the specific gravity of the cement as received (i.e., dried but not ignited) shall not be less than 3.10 unless the loss by ignition is less than 2%.

(b) The clause "Should the test of cement as received fall below this requirement a second test may be made upon a sample ignited at a low red heat" should be omitted.

(c) The clause "A low specific gravity in conjunction with a high loss by ignition is positive proof of undesirable burning, adulteration or seasoning" should be substituted for the present paragraphs concerning the significance of the specific gravity.

C. Concerning the fineness:

(a) As the specifications now stand, there is little incentive to induce the manufacturer to grind to the degree of pulverization that modern improvements in grinding machinery has made practicable unless his cement is so poor that extreme fineness is necessary to enable it to pass the requirements for strength and soundness. Therefore:

(b) That the cement shall leave a residue of not more than 5% by weight on the No. 100, and not more than 20% on the No. 200 sieve.

(c) That the average of at least four briquettes representing at least two separate mixtures of the same sample shall be taken for each test, excluding any results which are manifestly faulty.

E. Concerning retests:

(a) Manufacturers should be impressed with the fact that these are minimum requirements; that ample provision already has been made in the specifications for lack of uniformity in testing as well as in real quality; and that a quality so superior should be demanded that, regardless of the variable factors, the ability of cement to pass all requirements shall be a certainty. Therefore:

(b) The results obtained from the original test shall be considered as final unless it becomes evident that serious error in sampling or testing has resulted in totally misrepresenting the quality of the cement. In other words, that "border-line" cements should be avoided as much as possible.

F. Concerning the practical significance of the above recommendations:

(a) Manufacturing conditions are such that we cannot hope to secure portland cement which contains no free lime. Also, it is realized that the proposed specifications are not perfect. However, we believe that the enforcement of the above recommendations will support and promote the best practice in grinding and burning, and, accordingly, secure greater uniformity and efficiency than the present specifications.

(b) Without the hearty, honest coöperation of both manufacturer and user little can be accomplished. The degree of fineness and burning are important financial considerations to the manufacturer, and the consumer should buy on a basis of quality.

(c) The testing of a great number of commercial portland cements from many parts of the world has convinced us of the feasibility of these recommendations from both economic and practical standpoints, and the results obtained have disproved all claims to the contrary. For instance, a certain manufacturer in America stated that owing to a long sea voyage he could not guarantee his cement to pass the 3.10 requirement for specific gravity. Our work showed conclusively that cement stored in good barrels undergoes very little change due to atmospheric influences and many cements imported from Europe and America show consistently a gravity above 3.10 and a low loss by ignition. These are the cements which, as stated in the Introduction of our work, show the most remarkable uniformity in physical properties.

(2) We desire to emphasize the importance of the calcium hydroxideaphenol microscopic test for free lime, as in every instance the physical and chemical properties of the different products examined demonstrated the accuracy and usefulness of this test. As stated, we believe that in the hands of an expert it gives more definite and reliable information regarding the constancy of strength and volume than the usual 28-day or even 3- or 6-month tests. However, there is one undesirable feature to this test; namely, that it requires considerable experience and ability correctly to interpret the significance of the phenolate crystals formed on the microscopic slide. Therefore, in order to make this test generally practicable and universally dependable, it must be simplified or made quantitative. Certainly, its possibilities and importance warrant much more extended research in this direction than we have had opportunity to accomplish.

Reinforced-concrete Trolley Poles are in use at Windsor, Ont., Canada, by the Windsor, Essex & Lake Shore Rapid Ry. They are for the span-wire suspension of a catenary system consisting of a $\frac{1}{2}$-in. standard messenger cable and No. 3-0 grooved trolley wire with hangers 10 ft. apart. The poles are 30 ft. long, set 8 ft. in the ground; those on tangents are 6 in. square at the base and are reinforced by five round steel rods $\frac{7}{8}$ in. in diameter, extending the entire length. Those on curves are 8 in. square at the top and 12 in. at the bottom, with seven steel rods. The corners of the poles are chamfered. The only trouble with these poles is that whenever a pole is leaning in the line of strain it soon gets badly out of line, owing probably to its weight. This could have been avoided by setting the poles in concrete, which was not done when they were placed originally. A. W. Westman, Superintendent, is of opinion that concrete poles, properly constructed and erected, would last longer and cost less per year per pole than either wood or steel poles.

*One of these reports was abstracted in "Engineering News," Dec. 2, 1909, p. 613.

The above recommendation provided for the possibility of a well burned cement with a low specific gravity provided the loss by ignition is not due to the absorption of volatile constituents; but our experience does not include such a possibility.

Building a Large Railway Embankment

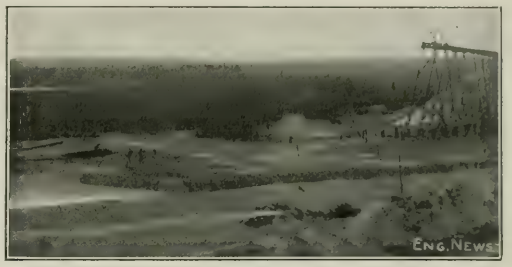
In connection with the construction of a large reinforced-concrete ore-dock recently built by the Lake Superior & Ishpeming Ry. Co., at Marquette, Mich. (described in our issue of Jan. 5), there was constructed an approach fill or embankment of approximately 600,000 cu.yd. This work contained several special features of interest. It was commenced Apr. 3, 1911, and finished Jan. 15, 1912. The total number of days worked, which means the number of shifts the crew was under pay, was 323. The total quantity of material moved by the steam shovel was 503,979 cu.yd., being an average of 1428 cu.yd. a day. The best monthly average was made in April, when 97,223 cu.yd. were moved in 50 shifts, making an average of 1944 cu.yd. per shift. The poorest monthly average was made in January, 1912, when 11,627 cu.yd. were moved in 12 shifts, an average of 969 yd. per shift. The work-train crew consisted of a conductor and two brakemen. The equipment consisted of a Bucyrus steam shovel, with a 3-yd. dipper, and 25 standard-gage side-dump cars of 5 and 6 cu.yd. capacity. The average haul was about 1½ miles. The material was sand, and the average face in the pit was about 10 ft.

The material was dumped from a temporary trestle consisting of two-post bents, the posts or legs being of round timbers with 8-in. tops. This trestle is shown in the accompanying cut. The caps and sills were made of old timbers, from 10x10 to 12x12 in., the sills being spliced to get the desired length. Each bent had sway-bracing consisting of small round poles. These bents were spaced about 20 ft. centers and braced longitudinally with round poles about 4-in. size at the top. One 8x16-in. stringer was used under each rail. The stringers were held in place by means of cleats spiked on top of the cap and bottom of stringer, so that the latter could be easily removed after the embankment was made. The remainder of the trestle was left in the embankment.

The trestle was not intended to carry any load except the empty dump cars, and the material was not dumped from the trestle but from the end of the embankment. The dumping was done by four men, two on each side, who knocked off the toggle chains of the cars with shovels having reinforced points, the cars being so loaded in the pit that half of the train would dump in each direction. The train of 25 cars was dumped in less than three minutes. It was then taken back to the pit, where the cars were righted by the pitman, six pitmen being employed at the shovel to take care of the extra work of righting the dump cars. The four dump men cast the earth into the center and tamped up the track while the train was gone to the pit, so that the next train would have a solid embankment to run on and would not strain the stringers. The dump men also took out the stringers (after the dump was made), in the intervals during the train's absence. This was done by digging down alongside of the stringer and rolling the stringer out while the bank was narrow. This work of taking out stringers was formerly done on Sundays, when it was necessary to get out the train crew and pull the stringers with the locomotive.

The main trouble in this method of dumping from a trestle is the danger of breaking the trestle legs and crowding them from under the cap. To prevent this, cleats were bolted to the tops of the trestle legs and extended up behind the caps. The trestle legs were supported and prevented from bending and breaking by means of ties made of six or eight strands of No. 9 binding wire about every 15 ft. in height. These ties were placed parallel to the slope of the end of the embankment, and extended from bent to bent. The natural method at first seemed to be to tie the top of each bent back to bottom of the next bent under the embankment. This method was not satisfactory, as the pressure of the settling earth would bend and break the tie wires.

The longest trestle legs used in this work were 50 ft. long, which brought the embankment to a height of 55 ft. From this point to the point at the beginning of the steel trestle, where the embankment was 70 ft. high, the bank was built across a swamp where the water was about 6 ft. deep. The base of this bank to a height of 23 ft. across the swamp was built by the Zenith Dredge Co., of Duluth, Minn., with a hydraulic dredge, the material being dredged from the harbor to form the slips at the dock. This hydraulically filled base is shown in the cut. To span an interval of swamp between the hard ground and the base put in by the hydraulic dredge, a water-jet was used to sluice material into place from the dump.



Building a Large Embankment by Pumping for the Base and Dumping from Cars for the Upper Part; Lake Superior & Ishpeming Ry.

Two men, using ordinary fire hose, washed the material ahead in troughs as it was dumped from the cars, so as to form a base upon which to build the temporary trestle. The troughs were of corrugated iron. By this method only three men were employed on the dump instead of four, and the work went on nearly as fast as usual. A part of the time the work was carried on at night, and the records show that fully as much work was accomplished at night as in the day time, with no additional expense.

In order to carry on the work without interruption while the hydraulic dredge work was in progress, sub-bents were jetted into the base fill which was in process of construction and the temporary trestle built on these. The accompanying cut shows the base built by the suction dredge with the slope maintained by means of levee boards. The discharge pipe is just in front of the post at the left of the cut. It also shows the temporary trestle and the sub-bents jetted into the base fill. All of the work was done by the company's forces under the engineering department. E. C. Watson, Roadmaster, had direct charge of the work. For information as to the work we are indebted to R. C. Young, Chief Engineer, Lake Superior & Ishpeming Ry.

Studies of Fish Life and Water Pollution*

By H. W. Clark† and George O. Adams‡

The effect of sewage, trade wastes and the effluents from sewage filters upon fish life has received little investigation in this country, although it is known, of course, in a general way that owing to increasing pollution, fish have disappeared from many streams in which they were formerly abundant. The effect of sewage pollution upon shellfish and the areas from which shellfish are taken has been investigated during the past 10 or 15 years chiefly because shellfish are likely to be the bearers of infectious diseases.

From a practical viewpoint, the question of fish life in streams and lakes in a settled community is one of the value of such life in a certain stream or lake compared with the cost of maintaining such freedom from pollution or such restriction in the use of streams as will allow the continuance of this life. It goes without saying that looked at in this way, the cost of preserving a stream in a condition that allowed fish life might be exceedingly large as compared with the value of the fish saved. This would be especially true in manufacturing districts, as in such places the streams are chiefly valuable for power and the carrying away of the waste products of the district more or less purified. Treating these wastes sufficiently to prevent the stream from becoming a nuisance, moreover, may not keep it sufficiently pure to encourage the life of fish within it and many streams seem fated to become sources of power and the carriers of wastes, and find their chief value when so used. Practically all that can be expected in many instances is that the sewage or wastes entering such streams shall at all times of the year be so purified before entrance or so diluted by the flow of water that the stream will not be a nuisance to the community through which it flows but rather a source of enjoyment to such community.

From a scientific standpoint there are a number of questions to be considered in this study of pollution and fish life, the most important being as follows: (1) The amount of pollution that a stream may receive without decreasing the dissolved oxygen of the water to such a degree that fish can no longer live in the water; (2) the effect of the various constituents of sewage and trade wastes upon fish and the effect of these various constituents upon fish even when a plentiful supply of dissolved oxygen remains in the water after receiving these wastes; (3) the amount of oxygen consumed by the fish themselves; and (4) the rate of absorption of oxygen by polluted waters.

At the Lawrence Experiment Station of the Massachusetts State Board of Health a series of investigations in regard to these questions has been carried on during the past year and the following paper describes a portion of these investigations. The experiments have been made largely in 5-gal. glass aquaria and some of the commonest fish of the region—shiners, suckers, chub and carp—have been used. Most of the cary and shiners have weighed from 1 and 2 oz. each, while the suckers have weighed from ¼ to ½ lb.

EFFECT OF SEWAGE

In the first experiments, the fish were immersed in undiluted Lawrence sewage, well aërated, and containing at the time of immersion from 50 to 100% of saturation of dissolved oxygen. Notwithstanding the presence of this dissolved oxygen, all the fish in these experiments apparently became crazed when immersed and died almost immediately, that is, within a few minutes after immersion.

EFFECT OF EFFLUENTS FROM SEWAGE FILTERS

Following this, experiments were made with the effluents from sand, contact and trickling filters and with mixtures of sewage and water, contact-filter effluents and water, and trickling-filter effluents and water (for analyses, see Table I). In this series of experiments a supply of dissolved oxygen was maintained when necessary by blowing air through the liquid used. The results were as follows:

(a) It was found that when water and sewage of the strength used were mixed in equal portions and this mixture kept aërated, fish life could exist almost indefinitely, but with a larger proportion of sewage the fish died within a few minutes, or at most, in an hour or two after their immersion. Even in the equal mixtures of sewage and water, a number of fish died quickly and only the stronger individuals survived, but such as did survive were kept in this mixture alive and well for 14 days, and apparently could have continued to live for an indefinite period. The sewage used was freed from matters in suspension before being mixed with the water.

(b) It was found that aërated effluents from contact and trickling filters in successful operation supported fish life for 14 days without any apparent discomfort to the fish immersed in these effluents.

EFFECT OF SEWAGE AND EFFLUENTS WHEN NONAERATED

Experiments were next made to determine the volume of water (tap water) necessary to mix with sewage and the effluents from trickling filters in order that fish life could be sustained under what might be called stagnant conditions, that is, sustained without the introduction of dissolved oxygen by aëration as in the previous experiments. After several trials it was found that but 10% of sewage could be mixed with 90% of water and the fish survive in good condition for 14 days. Increasing the sewage above this percentage invariably caused the exhaustion of the oxygen and the death of the fish within a few hours. It was found that only 25% of water was needed in 75% of the best trickling filter effluents in order that fish might live under these stagnant conditions for 14 days, this mixture always containing enough oxygen to support life, and the effluent present having apparently no harmful effect upon the fish. With the contact filter effluents equal mixtures were necessary, that is, 50% of the effluent to 50% of tap water.

LIMIT OF DISSOLVED OXYGEN

At the beginning of the last experiments described, that is, at the time of the immersion of the fish, the dissolved oxygen in the mixtures was 0.5 part per 100,000. During the experiment it became reduced in the water and effluent mixture to as low a point as 0.11 part per 100,000, and in the mixture of sewage and water, to 0.14 part per 100,000, but without any apparent discomfort to the fish in these mixtures.

The greatest consumption of oxygen by the organic matter present in such mixtures occurs in the first few hours, and it was found that if the initial supply of oxygen was great enough to last through this early period, the oxygen would then be increased by absorption from the air.

In a third experiment of this nature, where a mixture of equal portions of tap water and trickling filter effluent was made, the dissolved oxygen at the start was 0.80 part per 100,000, and was not reduced below 0.40 part per 100,000 during the 14 days of the experiment.

In further investigations in regard to the amount of dissolved oxygen that would sustain fish life, the following three experiments were made: Sewage of the strength shown in Table II was so mixed with water that three dilutions containing 5, 10 and 15%, respectively, of sewage were obtained. In these dilutions the dissolved oxygen was at first 0.88, 1.00 and 0.85 parts per 100,000. In each dilution fish were immersed and in each of the three dilutions they lived for one week without discomfort, that is, until the end of the experiment.

*A paper read before the International Congress of Applied Chemistry, New York City, September, 1912.

†Chief Chemist, Massachusetts State Board of Health

‡Assistant Chemist Massachusetts State Board of Health

TABLE I. ANALYSES OF SEWAGE FILTER EFFLUENTS, MIXTURES OF WATER AND SEWAGE AND MIXTURES OF WATER- AND SEWAGE FILTER EFFLUENTS USED IN STUDIES OF FISH LIFE AND WATER POLLUTION

(Parts per 100,000)

	Contact-filter effluent		Trickling-filter effluent		Equal mixture of water and sewage		Water and 10% sewage		Water and 75% trickling-filter effluent		Water and 50% trickling-filter effluent	
	At start	After 14 days	At start	After 14 days	At start	After 14 days	At start	After 14 days	At start	After 14 days	At start	After 14 days
Free ammonia	1 5500	2 8000	1 8000	2 8800	1 9000	2 8000	0 5500	0 6600	1 2000	1 8800	1 3000	1 2600
Albuminoid ammonia												
Total	0 6760	0 7880	0 2800	0 3480	0 2100	0 2280	0 0440	0 0620	0 0960	0 1720	0 1260	0 1000
In suspension	0 5340	0 7340	0 1800	0 1220	0 2400	0 1480		0 0300	0 0960	0 0820	0 0840	0 0720
Oxygen consumed	13 20	12 10	10 70	12 10	7 30	7 00	1 60	2 00	7 20	7 10	6 50	6 50
Nitrogen as												
Nitrates	0 03	0 01	2 01	2 12	0 02	0 02	0 06	0 06	2 09	1 81	0 67	0 50
Nitrites	0 0000	0 0000	0 0160	0 0600	0 0024	0 0180	0 0000	0 0036	0 0004	0 0380	0 0015	0 0340
Oxygen consumed	1 78	1 80	1 82	2 22	1 24	1 46	0 63	0 67	0 90	1 00	1 00	1 04
Solids in suspension												
Total					0 0	2 3			0 0	1 9		
Volatile					0 0	2 2			0 0	1 6		

The minimum amount of dissolved oxygen found during this period in each of these dilutions was 0.47, 0.28 and 0.15 part per 100,000, respectively.

TABLE II. ANALYSIS OF SEWAGE USED IN DILUTIONS CONTAINING 5, 10 AND 15% OF SEWAGE

(Parts per 100,000)

Ammonia			Kjeldahl Nitrogen			
Free	Albuminoid Total	Albuminoid in solution	Total	In solution	Chlorine	Oxygen consumed
5 80	0 86	0 35	1 38	0 79	12 40	1 40

EFFECT OF SAND-FILTER EFFLUENTS

In six experiments in which fish were immersed in well-purified, highly nitrified effluents from sand filters receiving sewage (see Table III for analyses), the three fish immersed in each experiment died in from three hours to three days after immersion. All of these effluents but one were clear but slightly acid, this acidity being due to insufficient base to combine with the nitric acid present. One effluent was alkaline, but contained considerable matter in suspension, this matter being largely silica and alumina. When this suspended matter was removed the fish lived in this effluent without any apparent discomfort for 14 days, or during the length of the experiment. Other acid effluents from sand filters when neutralized and filtered to remove precipitated $CaCO_3$ and $MgCO_3$, etc., supported fish life. The alkaline suspended matters at times separating from such effluents and from sewage, gathering at the outlet of the fish's gills and at the joints in their scales, gave the appearance of a fungus growth upon the fish.

TABLE III. ANALYSES OF EFFLUENTS FROM SAND FILTERS RECEIVING SEWAGE

(Parts per 100,000)

No.	Ammonia			Nitrogen as		Oxygen consumed	Alkalinity
	Free	Total albuminoid	Chlorine	Nitrates	Nitrites		
1	0.4800	0.0540	9.00	5.21	0.0024	0.23	—0.9
2	0.9600	0.0960	7.30	1.64	0.0032	0.51	—0.3
3	0.9600	0.0960	9.40	2.17	0.0120	0.54	1.0
4	0.0628	0.0194	9.00	4.62	0.0002	0.17	—0.2
5	1.0400	0.0460	7.10	6.13	0.0012	0.45	—1.5
6	0.2505	0.0290	7.00	1.64	0.0380	0.29	—0.2

EFFECT OF NITRATES, IRON, POTASSIUM CARBONATE, ETC.

It would seem without doubt that the alkaline suspended matter and the acidity of the effluents in the experiments just described were responsible for the death of the fish immersed in these effluents.

Fish immersed in water containing 5 parts of nitrogen as potassium nitrate lived without any apparent discomfort, and in water in which organic matter, etc., had been coagulated by the use of 1.5 grains of alum, they lived two weeks without discomfort.

In water treated with ferric sulphate they became covered with a fungus-like growth and died in a few days. The iron in solution may have been the cause, as apparently fish are extremely sensitive to iron salts, as will be shown later.

Free nitric acid in tap water in amounts equal to 0.7 part per 100,000 $CaCO_3$ was without effect.

Very small amounts of hydrochloric acid, equivalent to about 0.5 part per 100,000 alkalinity, caused the death of fish in a few hours.

When the experiments with nitric acid were made, it was found that the small fish used not only neutralized the acid but made the water alkaline. The water was acidified five times and each time was rendered alkaline by the fish present. In 12 days the fish experimented with had neutralized acid equal to 2.7 parts per 100,000 $CaCO_3$ in about 1500 c.c. of water, leaving a residual alkalinity of 1 part per 100,000.

"Free Ammonia" in sewage is supposed to consist in part of carbonate and it was found that from 5.5 to 7 parts of ammonia as carbonate in well aërated tap water was fatal to shiners and carp in from a few minutes to a few hours. Ammonia in the form of chloride up to 18 parts per 100,000 had no ill effect on the fish. When used in the form of ammonium hydrate, the ammonia was much more deadly, 2 parts per 100,000 killing shiners, carp and large suckers in 15 minutes. The fatal amount was probably slightly over 1 part per 100,000 as the fish experimented with were unaffected in water containing 0.94 part per 100,000 but died in water containing 1.3 parts per 100,000.

It should be noted in passing that the ammonium hydrate was soon changed in water to the less injurious carbonate by the free carbonic acid present and by carbonic acid given off by the life of the fish.

The effect of caustic and carbonate alkali was next tried. Pollution of this nature comes from a number of industrial processes and at times may be serious before sufficient dilution by the water in a stream takes place to render it harmless. It was found that from 25 to 30 parts per 100,000 $NaCO_3$ per 100,000 killed fish within a few hours. Seven parts of NaOH killed several fish in two hours and 9.6 parts per 100,000 killed two in ten minutes. In water containing 5.6 parts per 100,000, fish lived 24 hours.

It was noticed in this work that fish immersed in sodium carbonate solutions, rendered these solutions less poisonous to fish subsequently immersed in them, this being due probably to the change from carbonate to bicarbonate. As a proof of this, it was found that bicarbonate of soda was the least injurious form of alkali experimented with, fish living easily in water containing 120 parts per 100,000.

The effect of iron salts was next investigated, these salts being dissolved in distilled water to prevent precipitation such as would occur in tap water on account of the alkalinity of this tap water. Copperas equivalent to 0.128 part per 100,000 of iron killed fish in from 4 to 24 hours, one fish living without trouble in water containing 0.100 part per 100,000. In such dilute solutions, however, the iron gradually precipitates even when dissolved in distilled water.

In solutions of ferric sulphate fish died in from ½ to 3 hours when 0.1080 part iron per 100,000 was present, and in from 12 to 24 hours when as little as 0.0100 part per 100,000 was present.

CONSUMPTION OF OXYGEN BY FISH LIFE

The large amount of dissolved oxygen consumed by fish is little realized. In studying this point, the following experiments were made: Thirteen small fish weighing altogether 200 grams, were placed in a saltmouth gallon bottle filled with water, and the dissolved oxygen determined at the beginning and at the end of the experiment.

In a second experiment four fish weighing 340 grams were used. In all, nine experiments of this kind were made. Averaging these experiments it was found, speaking generally, that all the oxygen held in solution in a gallon of water at 60° F.—practically one part per 100,000—would be consumed or breathed in one hour by a weight of fish equal to 1 lb. This would mean that 1000 lb. of fish life would in about 15 days exhaust the dissolved oxygen in a layer of water 1 ft. deep and an acre in area, saturated at 60° F., assuming, of course, that dissolved oxygen was not added by absorption from the air. The oxygen consumed in this way remains in the water as CO_2, and hence the amount of CO_2 in surface waters sustaining fish life must be influenced to a considerable extent by the fish present.

SOLUTION AND DIFFUSION OF OXYGEN IN WATER.

There are few good data in regard to the rate of solution and diffusion of oxygen in water. E. A. Letts, in the "Journal of the Royal Sanitary Institute," Vol. XXXIII, No. 1, states that Dr. Adeny found that ten days were required to saturate with oxygen a sheet of water at a temperature of 15° C., 6 ft. in depth, and deprived of all atmospheric gases.

The following experiments made by us give some idea of the rate of aëration of a quiet, shallow sheet of water. In the first, a small fish, weighing 25 grams, was immersed in an aquarium holding 7 in. in depth of tap water. Experiments had shown that a fish of this size in this volume of water would reduce the dissolved oxygen primarily present about 0.26 part per 100,000 per day.

Table IV presents the amount of dissolved oxygen found in the water in the aquarium on different days during a period of 34 days, together with a column showing the amount of oxygen consumed by the fish during that period. From this table it will be seen that oxygen was absorbed by the water at about the same rate that it was consumed by the fish.

TABLE IV. DISSOLVED OXYGEN IN AQUARIUM WATER AND USED BY FISH WHILE IN AQUARIUM, IN PARTS PER 100,000

Days	Dissolved oxygen	
	In aquarium	Used by fish
1	0.37	0.26
2	0.40	0.52
3	0.45	0.78
5	0.22	1.04
14	0.49	3.18
22	0.40	5.48
29	0.50	7.08
34	0.31	8.58

In a second experiment the dissolved oxygen in an aquarium of tap water was reduced to 0.11 part per 100,000 by the fish in this aquarium. The fish were then removed and the aquarium allowed to stand in the laboratory open to the air, and determinations of disolved oxygen made from time to time. The results of these determinations are shown in Table V, and it will be noticed that practically seven days

were required for this water to again become saturated with oxygen

TABLE V. DISSOLVED OXYGEN IN AQUARIUM CONTAINING FISH AFTER 2 TO 10 DAYS

Days	Temperature, deg. F.	Dissolved oxygen: Parts per 100,000	Dissolved oxygen: Per cent saturation
2	68	0.38	41.3
3	65	0.72	74.7
4	64	0.76	79.2
5	66	0.80	85.0
6	67	0.88	94.5
7	70	0.94	104.0
10	65	1.00	105.0

During the last part of this experiment, "green growths" (Scenedesmus and Protococcus) made their appearance in this water.

LIBERATION OF OXYGEN BY "GREEN GROWTHS"

It is well known that organisms containing chlorophyll give off free oxygen when growing in the light. Water in which organisms are plentiful is frequently found to be supersaturated with disolved oxygen as the organisms take the C fro mthe CO_2 dissolved in the water, and liberate part of the oxygen. When the dissolved CO_2 is all absorbed the bicarbonates are attacked and CO_2 abstracted, leaving carbonates. This happened several times in experiments here. On testing for CO_2 with phenolphthalein, a pink color showed the presence of carbonates, while in the tap water used in the various experiments, the alkalinity was due to bicarbonates. In the experiments the "green growths" were largely Protococcus, Scenedesmus and smaller numbers of Monas. In one experiment an aquarium was filled with tap water and seeded with "green growth." The disolved oxygen and CO_2 at the start were 0.18 and 1.00 part per 100,000, respectively. At the end of seven days, they were 1.14 and 0 parts per 100,000, respectively.

In another experiment a small fish was put into a tightly stoppered gallon bottle full of water containing these "green growths." If oxygen had not been liberated by the organisms during this experiment, the oxygen primarily present would have been consumed by the fish in 38 hours. However, it lived eight days and at its death at the end of this period, dissolved oxygen was present in the water in greater volume than at the beginning of the experiment. The growth of organisms increased greatly during this period, and either the presence of these organisms or some body formed during their growth or decay, was injurious to the fish.

In a similar experiment made during cloudy weather when the oxygen-liberating power of the organisms was lowered, the fish present consumed the dissolved oxygen in four days.

In further experiments, not yet completed, upon the effect of such "green growths" on sewage, bottles of sewage were seeded with organisms, then aërated for 24 hours, and afterwards allowed to stand 24 hours with aëration. The average of 16 dissolved oxygen determinations then made showed 0.62 part per 100,000 of dissolved oxygen present in these sewages at the end of the period of aëration and 1.01 parts per 100,000 after the sewage had stood unaërated during an additional period of 24 hours; in other words, the "green growth" supplied not only all the dissolved oxygen consumed by the sewage during the period of standing, but, furthermore, increased the volume present 0.39 part per 100,000.

It is probable that the chlorophyll-bearing organisms take a greater part in overcoming sewage pollution in surface waters than is at present generally realized.

Merits of Different Woods for Street Paving*

BY H. G. DAVIS†

The success of a creosoted wood-block pavement depends principally upon four fundamental features: 1, the quality of the wood; 2, the characteristics of the oil used; 3, the method of treatment; 4, the construction of the pavement. While it is probably true that the first three are of equal importance and the fourth is of major importance, this paper has to deal with the first, or the quality of the wood selected for the pavement.

Failures of street pavements frequently are attributed to causes which have nothing to do with the failures. In the case of a street in Chicago where gum wood was used, the timber was condemned and struck from the specifications because of defects appearing which were attributed (probably without the slightest reason) to the wood itself. As another instance, the weeping or bleeding has been attributed universally to the nature of the oil, and few engineers have attempted to charge it to any other cause. About three years ago, the writer heard M. Rinker, City Engr. of Minneapolis, state that there had been no trouble from bleeding in some 700,000 sq.yd. of cresoted blocks laid in that city. Since then a change has been made in the timber specifications, while the oil is practically the same, and now there are complaints of bleeding. As usual this has been attributed to the oil and no one has suggested that the wood is in any way responsible for the condition.

In selecting a wood for paving purposes, three things should be taken into consideration; 1, its adaptability to the purpose; 2, its availability; and 3, the commercial conditions. By adaptability is meant both the probable service that will be given by the blocks, as well as the natural characteristics of the wood with respect to the manufacture of the blocks. It is, of course, necessary to select a wood which is sufficiently strong in texture to withstand the effects of the traffic and give a long life to the pavement. Engineers in this country have been making long-leaf yellow-pine the standard of perfection in a paving block, and this wood has been used in probably 75% of the creosoted block pavements laid prior to 1911. Then it was decided that a short-leaf pine might be used if of close growth. The change was a wise one, as the short-leaf pine, while not so strong a wood as the long leaf, is sufficiently strong for a paving block. There is a great deal of difference in the characteristics of the two woods: Long-leaf pine weighs 43.6 lb. per cu.ft. against 38 lb. for the short-leaf, and the specific gravity is 70 and 61 respectively.

The foregoing is cited to show that in selecting a wood for paving purposes it is not necessary to require one of the greatest possible strength to withstand the stress to which it will be subjected under traffic. In the Central West we have at least four woods which are suitable for paving purposes; southern yellow-pine, tamarack, hemlock and maple. The writer has had no opportunity to study the Norway pine. The one street paved in Chicago with gum is not considered a sufficiently conclusive experiment to warrant a definite opinion. Maple is the wood most easily treated, followed closely by tamarack and hemlock, all three greatly outclassing yellow-pine in this respect.

For the past ten years, Chicago has confined its wood-block pavements almost entirely to yellow-pine, and in fact all the streets laid prior to 1912 were yellow-pine with the exception of about 1500 yd. of gum and about 8000 yd. of street-car track paved with tamarack. In the past year we have laid a test intersection with maple and about two miles of tamarack. The yellow-pine has given excellent satisfaction on some of the heaviest traffic streets in the country.

About five years ago the Chicago Railways Co. used some tamarack blocks in paving its tracks on Dearborn St., north of Van Buren St. Although the construction of this pavement is open to considerable criticism, especially the treatment around the tie-rods, yet the pavement is in excellent condition and shows just as good results as have been obtained from yellow-pine blocks.

A little more than a year ago, our company furnished hard-maple blocks for the intersection of Madison St. and Fifth Ave. This is one of the heaviest traveled spots in Chicago, and it is estimated that the daily vehicle traffic is 8000 and 5000 on the two streets, respectively. These blocks do not show the slightest sign of wear. In fact, so satisfactory was the result that the Chicago Railways Co. specified maple when purchasing its entire supply for 1912. As to hemlock, I call attention to the results shown in the test pavement laid in Minneapolis under the supervision of the U. S. Government. In a seven-year test, hemlock shown only $\frac{1}{8}$ in. more wear than the long-leaf yellow-pine.

As to availability, it is necessary to be assured that the supply is sufficient to fill the demand, and in considering this phase of the subject it is well to look to the future. It is most important to take into consideration the commercial conditions surrounding the timber selected, for the pavement must be constructed as cheaply as possible, commensurate with the quality required. As an illustration, in Chicago, in 1912, every ordinance called for southern yellow-pine or woods equally good for paving purposes. Prices in the yellow-pine market went high early in 1912, and as a result wood-block pavements broke all records for high prices to the consumer and small profits to the manufacture. Tamarack was not affected, and we sold all we had. But while these prices were soaring we were vainly struggling with the city to permit us to deliver hard-maple, which could be purchased at a lower price than yellow-pine or tamarack.

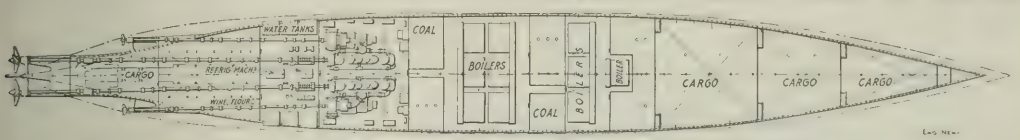
*Abstract of a paper read at the annual meeting of the American Wood Preservers' Association, at Chicago, Jan. 21-23.

†Manager of Paving Department, Chicago Creosoting Co., McCormick Bldg., Chicago.

A Transatlantic Steamship with Reciprocating Engines and Exhaust Turbines, the "Rochambeau"

The quadruple-screw steamship "Rochambeau" of the Compagnie Generale Transatlantique has recently been completed by the Société Anonyme des Chantier et Ateliers de St. Nazaire. This boat is of 17,000 tons gross register, and is propelled by two reciprocating engines on the inner shafts, exhausting into turbines in each wing, driving outer propellers. There are five decks, a central deckhouse over which is the boat-deck, and above this the bridge, captain's cabin, deck officers' quarters, and the wireless-telegraph station. The hull throughout is of open-hearth steel with a double bottom running the whole length of the ship and forming water-ballast tanks. The length of the boat between perpendiculars is 535 ft.; the extreme breadth is 63 ft. 7 in.; the mean loaded draft is 26 ft. 10 in.; the cargo capacity is given as 332,580 cu.ft. and the boat carries 274 officers and crew, 428 cabin passengers, 200 third-class, and 1248 steerage.

The double bottom consists of seven separate compartments, each of which can be filled and emptied independently. Those compartments under the forward stokehold are set apart for fresh water for the boilers, and have a capacity of about 7800 cu.ft. The compartments under the aft stokehold have a capacity of about 13,700 cu.ft. and contain fresh water for washing decks.



HOLD PLAN OF THE QUADRUPLE-SCREW STEAMSHIP "ROCHAMBEAU," SHOWING ENGINE AND BOILER LAYOUT

The ship is steered by steam gear of the usual type, mounted aft of the upper deck. The vessel is lighted throughout by 110-volt direct current from three generators, driven by vertical steam engines.

The main reciprocating engines are of a triple-expansion, four-cylinder type with a high-pressure cylinder diameter of 34.6 in.; the diameter of the intermediate-pressure cylinder is 50.8 in., and the low-pressure cylinder 57.5 in. The stroke is 39.4 in. The low-pressure cylinders are at each end of each engine; steam distribution to the high-pressure and intermediate cylinders is by piston valves in chests, side by side at the center of the engines. The low-pressure cylinder has slide valves in check at each end. All valves are operated by eccentrics and link motion. The crank shaft is 16.1 in. in diameter, carried in six bearings.

Each of the two wing-shaft turbines takes exhaust from the reciprocating engine on the same side of the ship. The turbine is mounted alongside of the reciprocating engine, an arrangement which is considered by the builders to be preferable to having two reciprocating engines exhausting into a single turbine.

The result of the trial trips is reported satisfactory. The stipulated speed of the contract was 17 knots with a coal consumption of 14,800 lb. per hr. for the main units only. The average speed actually attained was over 17½ knots with a coal consumption of only 14,100 lb. On the first run, at a speed of 17.65 knots, 13,222 hp. was developed. The high-speed propeller showed 111 r.p.m. and the low speed, 108.6. On a run at 17.78 knots these various figures were 13,398 hp., 113.2 and 108.2 r.p.m. respectively. The slip of the engine-driven propellers was 4.12% and of the turbine-driven 24%.

The turbines are of standard Parsons type, with a drum 67 in. in diameter carrying 48 rows of blades. There is an unbalanced thrust of the turbine rotors which is approximately equal to the propeller thrust in the opposite direction. The turbines are not used for maneuvering purposes so that no reverse sections are provided. This shortens the casing, making it practicable to construct top and bottom parts as single castings.

The engines are supplied with steam from nine boilers each with four furnaces working on a forced-draft system. The working pressure is 205 lb. per sq.in. The diameter of the boilers is 16 ft. 9 in., with a length of 11 ft. 6 in. and a total heating surface of 26,800 sq.ft.

Numerous illustrations of this boat with accompanying text are found in London *Engineering*, Nov. 22 and 29, 1912.

❖

The Government Stream Gaging Work—Before Major J. W. Powell, of the U. S. Geological Survey, had the matter of stream measurement taken up by that bureau, no systematic studies of the water resources of the United States were being made. The work inaugurated by him and continued under his successors, Chas. D. Walcott and Geo. Otis Smith, has borne good fruit. Engineers throughout the width and breadth of the land have constant occasion to refer to the results of these studies. And yet these studies are not as broad and extensive as they ought to be. They should, as you all know, be carried on on a much larger scale than at present.

The engineer, whose problem relates to the utilization of run-off waters, or to the protection of lands against inundation, or to the improvement of river channels, searches the records as far back as they go and wishes for more. He is bound to do this. He cannot at a moment's notice go afield and gather adequate reliable facts by an examination of the stream. Nature does not put the stream either into its extreme low stage nor yet into its maximum flood stage just to accommodate the engineer who wants knowledge of these extreme conditions.

For such information the records supplied by the U. S. Geological Survey are invaluable. A stream may be in maximum flood only once in a century. Shall the engineer conjecture what this may be, or will the nation make and maintain adequate provision to gather such data and have them ready and easily accessible when they are required? Such questions as this prompted the U. S. Geological Survey, under able leadership, to take up and to continue the work of measuring streams. And yet almost annually there is an attempt made in Congress to curtail, or to cut out altogether, the already inadequate annual allowance of some $150,000 or $200,000 for a continuance of the work of the Water Resources Branch of the U. S. Geological Survey. And the question is asked, and with some reason too, "What has the Geological Survey to do with stream gaging?

This bureau, under the Secretary of the Interior, has had the wisdom to recognize the importance of this work and has had the courage to take it up because there was no one else to do it, because there was no properly organized department of public works in our scheme of government. The Geological Survey deserves full credit for its foresight and should receive every needed assistance.

The Municipal Quay Wall, Oakland, California

By Thomas E. Risley*

One of the units of Oakland's comprehensive development of her water front is the quay wall. This wall (Fig. 1) is located on the southern side of the city, on what is known as Oakland Harbor, and is 2005 ft. in length.

The wall (Fig. 2) is of the gravity type, with a width of 22 ft. at the bottom and a height of 44 ft. The bottom is 33.2 ft. below mean low tide. From borings (Fig. 1) before the plans were drawn, it was determined that the hundred feet from the site of the work, in deep water. A pipe line, varying in length from 300 ft. to 900 ft. as the work progressed, delivered the water to a Hendy hydraulic giant fitted with a 1¾-in. nozzle, at the rate of 1500 gal. per min. at a pressure of 175 lb. per sq.in.—which was found in most instances to be a sufficient pressure to break down the bank. When very hard material was encountered a few light shots of powder were used to shake up the ground. After shooting it was found that the volume of water as supplied by the monitor was not sufficient to carry off the finely divided material so an auxiliary pump was rigged to supply the necessary quantity. From the face of the cut the material flowed back

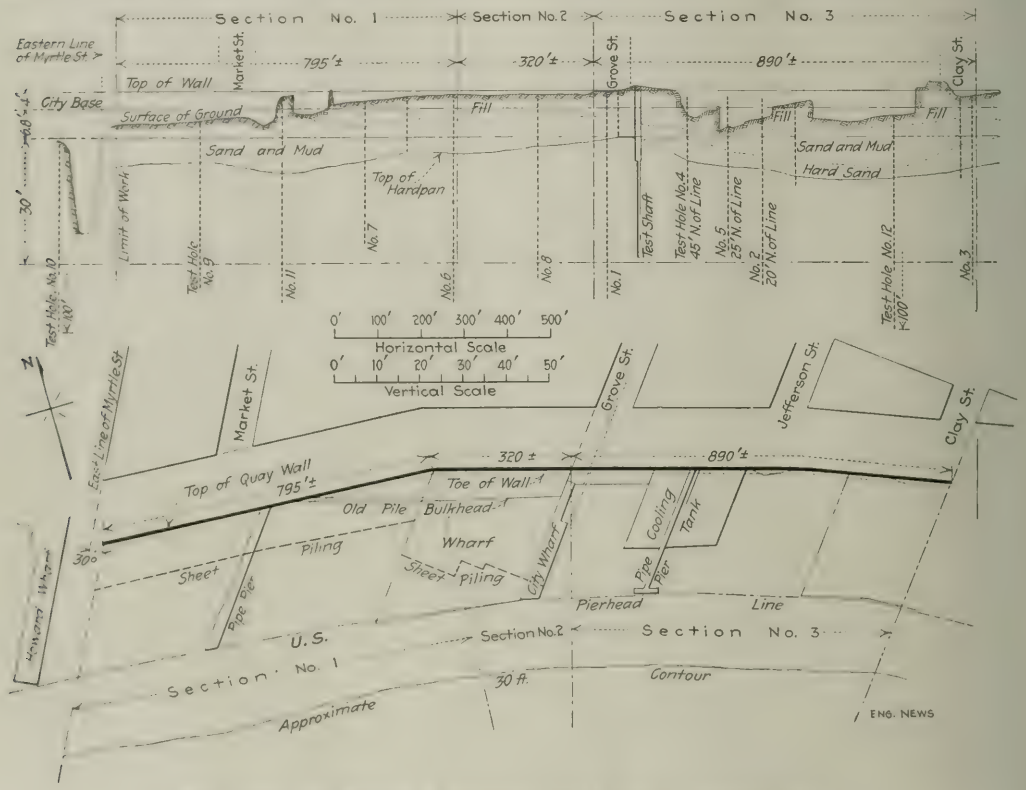


Fig. 1. Map and Profile of Municipal Quay Wall, Oakland, Calif.

foundation would be fine sand cemented with approximately 10% clay, firmly compacted. Excavation in the construction of the wall bore out this fact, so no other foundation was necessary.

Excavation. Before excavating, a row of standard sheet piling was driven on either side of the center line of the wall, 10 ft. apart. The excavating was performed by the application of the early California method of mining, namely, hydraulicking. The hydraulic plant consisted of a 6-in. discharge Krogh centrifugal pump, with a 10-in. intake, directly connected to a 300-hp., General Electric, 3-phase, 60-cycle, 220-volt induction motor, placed on a small barge and moored several

to a sump from which it was pumped out of the trench by an 8-in. pump driven by belt from a 75-hp. Westinghouse, 3-phase, 220-volt induction motor. The point of discharge was frequently 900 ft. from the sump.

After a depth of 20 ft. had been reached a second system of sheet-piling was used. This was placed on the neat lines of the bottom section of the wall and was driven only as the excavation proceeded. Sufficient bracing was used to keep it in place and to prevent the occurrence of slides.

When the excavation had reached a point within 2 or 3 ft. of grade a narrow trench was excavated along the center at grade in which was placed a sluice box 2 ft. wide, with sides 12 in. high. Into this box laborers shov-

*Assistant Engineer, Office of City Engineer, Oakland, Calif.

cled material—the monitor was turned into the box and the material washed to the sump. Owing to the fact that the grade of the entire wall is level, the work was divided into sections 160 ft. in length. Upon completion of the section the equipment was moved ahead and a

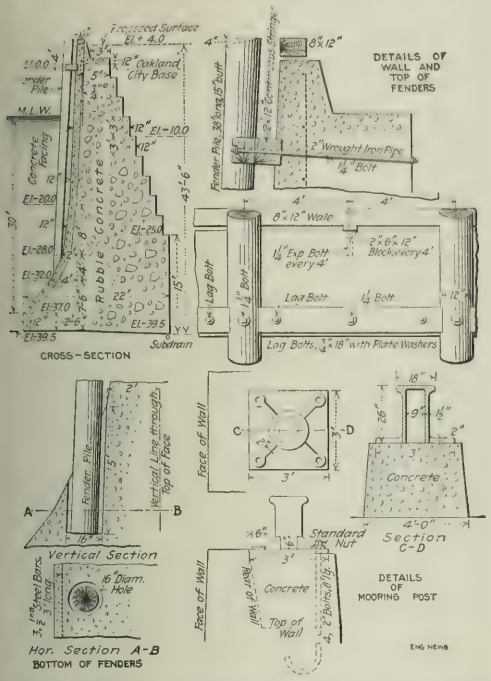


FIG. 2. SECTION OF OAKLAND QUAY WALL AND DETAILS OF FENDERS AND MOORING POSTS

small embankment of sacks filled with earth was placed across the trench separating the new sump and the completed trench.

CONCRETE WORK—After the removal of the excavating equipment there was placed over the trench a platform that carried a double track on which concrete was brought from the concrete-mixer plant in trains of 3 to 4 side-dump Koppel cars drawn by a horse. The concrete was dumped into a hopper to which was hung a 6-in. tube. The concrete was distributed by moving the discharge end to the position desired. As the concreting was in progress large rocks to the amount of about 25% by volume were deposited in the green concrete. Owing to the existence of braces in the trench it was found impossible to pour a single section of the wall monolithic (the limits of length of a section were 16 to 50 ft). The result was that each section was poured its full length to a height of 6 ft. (the braces being 6 ft. apart) then allowed to set 24 hr.—the braces removed and the sheeting braced against the wall—forms were then placed and the pouring continued.

To attain a key and bond between these horizontal layers care was taken to place large rocks, from 1 to 5 ft. long, on the top of the layer before the concrete had set. These were imbedded about one-half their thickness. Also 1 ft. from the rear of the wall were placed $\frac{3}{4}$-in. bars, 30 in. long, 12 in. c. to c. Before concrete was added to the layer the surface was thoroughly cleaned with a wire broom, then wet and sprinkled with neat cement. The result of this method of bonding has proven satisfactory.

The plans and specifications called for concrete of two grades—rubble concrete and facing concrete. The rubble concrete consisted of a mixture of one bag of cement (containing 94 lb.) and 9 cu.ft. of aggregate. The aggregate was composed of one part sand and two parts broken stone. It was of concrete of this composition that the bulk of the wall was constructed. The facing concrete consisted of a mixture of one bag of cement (containing 94 lb.), $2\frac{1}{2}$ cu.ft. of sand and 5 cu.ft. of rock. The broken stone in each case was $\frac{1}{4}$ in. to 2 in. in size. This richer mixture was used on the outside face to a thickness of 12 in. and a top capping 3 ft. deep. Considerable difficulty was encountered in placing the facing concrete. Great care was taken to insure that the full quantity was placed, with no intermixing of the two grades and still with no line of cleavage. The problem was finally solved at the expense of the contractor, in that he banked the richer grade against the form in excess quantity and allowed the leaner grade to flow to it until there remained a 12-in. section.

The different sections of the wall were keyed together by having a recess 3 ft. wide and 6 in. deep cast in the end of each section. This recess extended from the bottom to within 8 ft. of the top. On pouring the next section the concrete was poured into this recess, completing the key. No effort was made to cause the new section to bond to the old.



FIG. 3. VIEW OF PORTION OF OAKLAND QUAY WALL AFTER COMPLETION

(The material at the right is yet to be removed to a level 30 ft. below low tide.)

FENDERS AND OTHER DETAILS—The fender line (Fig 2) has been designed so that replacements may be readily made and at small cost. The fender piles, spaced 8 ft.

c. to c., are placed in sockets cast in the outward toe of the wall and fastened at the top by means of a 1¼-in. machine bolt that projects through the wall, being incased in a 2-in. pipe. Between the pile and wall and 3 ft. from the top there has been placed in a recess, 2 in. deep, a 12x12-in. continuous stringer. An ordinary chock has been placed between the piles.

On the top of the wall there is an 8x12-in. "backing piece" held up 2 in. by means of blocks. This "backing piece" is held in place by means of expansion bolts in holes cast in the concrete every 4 ft.

Cast-iron mooring bits, spaced 75 ft. apart, are bolted on the top of the wall, as shown in the detail in Fig. 2. The bolts were cast in the concrete.

A section of the completed quay wall is shown by the view, Fig. 2.

Back of the wall the city of Oakland has acquired a strip of land, 150 ft. wide, on which plans call for a section of the Belt Line Ry. (which will eventually circle the water front, of which Oakland has 20 miles), the necessary sheds, roadway and freight machinery.

Before the wall can be used it is necessary that some dredging be done. A depth of 30 ft. of the water at low tide will be attained, which is the depth of the channel in the harbor. This will open to the large manufacturing district to be benefited by this wall a deep-sea traffic.

The quay wall was designed by Perry F. Brown, city engineer, and built under the direction of the writer. The Healy Tibbitts Construction Co., of San Francisco, was the contractor.

A Proposed Union of International Associations

By E. L. Corthell*

Since 1843 there have been held about two thousand meetings of international associations, called assemblies, committees, conferences, congresses or conventions. They have embraced almost every subject in which mankind is interested; from peace to tobacco, from religion to anti-slavery, all the sciences, all branches of commerce and industry, sanitation, medicine, law and economics, all social and financial subjects, etc. A list of these international associations at the present time shows the existence of over five hundred organizations.

At first, and still so to some small extent, these congresses, reunions and conferences were ephemeral—dying at each meeting, resuscitated for a subsequent one, and without a permanent organization or domicile. We have an illustration of this at Chicago in 1893, where 43 international congresses were held during the world's fair; nearly all of these expired on adjournment, although many left important literary products—notably the Engineering Congress, embracing the civil, mechanical, mining, military and naval divisions, which published nine volumes of papers and proceedings.

With international attention to the subjects of these and other congresses persistently growing, it was a logical result that this interest should crystalize into permanent associations, upheld, promoted and subsidized by governments or professions, or by general subscription. After some years, usually the international interest and expenses became so extended that the holding of a congress, which was formerly the only feature, became a part only of a continuous activity in the subject. The congresses are still held in about three or five years (the Navigation Congress is held generally at triennial periods, while the Railway Congress is held at quintennial periods), but the intermediate years are fully occupied, by a permanent committee at some city, Brussels, Berne, Paris, Vienna, London, etc., in publishing the results of congresses, in preparation for them, or in current publications of interest and utility to a membership scattered over the whole world.

It is also a logical result of all of this international activity in the five hundred odd associations now existing that, in order to conduct the work more systematically and properly, there should have been formed a union of all these international associations for coöperation and, it may be said, standardization of congress work.

Brussels was selected as the domicile of this International Union, where the general government fosters, financially supports, and lends its moral and active assistance as well, to many international associations.

The union thus formed has become the exponent, guide and pivot of a large number of permanent international associations; the first world congress of this union was held in Brussels in May, 1910, and to it about a hundred international associations sent delegates. In preparation for this important congress the union published an extended general statement on the usefulness of international associations and a special statement on the various associations, the volume containing these statements embraced nearly 1500 pages. It is a logical result that this union should publish regularly for its affiliates, the various international associations, a journal entitled *La Vie Internationale*, which is the official mouthpiece.

There is to be held the coming year a second world congress of the union, which no doubt will have a much larger attendance and more affiliated associations than in 1910. The congress of 1913 will be held at Ghent, at which place and time will be held an international exposition, which is likely to exceed in size and interest that of 1910 at Brussels. It has been decided to hold the third congress in the United States in 1916. It is therefore of interest to the people of this country now to become acquainted with the objects and appreciate the importance of the union and its world congress.

The questions most in accord with our utilitarian conceptions are naturally, "What are the real practical uses of this congress? What ground does it cover? How does it aid and supplement existing international associations?"

These questions can easily be answered to the general satisfaction of all. At the outset it may be said that it goes afield of pure engineering. But as the engineer of the 20th century is, or ought to be, a man interested in worldwide subjects and one versatile in his aptitudes, actions and interests, the literary exponents of engineering must necessarily go afield of the strict definition of engineering. They must be interested in whatever concerns the welfare of mankind, whether it be in construction of means of transportation and satisfying the commercial wants of man, or in the study of man himself in his multifarious relations, or of the globe he lives on, its geodesy and geology, its relations with other worlds of the universe. They must include the study of man himself, his anatomy, physiology and hygiene, the sanitation of his

*Hildesheim, Bern, Switzerland

abodes, the cure of his diseases, the means of building up and developing his local, national and international life and relations, which look to peace and prosperity, enlightenment, good government and good laws. The time has come when scientists and practical men of affairs who are interested not only in their professions and businesses, but also in the human race, *per se*, should support a union of all the varied interests of mankind associated until now in separated international associations. A union, which in a business and practical way, seeks to establish coördination, coöperation, harmony in methods and uniformity even to standardizing the rules and regulations that govern all these associations and their recurrent meetings, should be of interest to and be supported by the engineer. One practical feature of great advantage to all international associations is the establishment of a medium for their promotion, by which they can know what each is aiming to do and is accomplishing by itself; thus each can learn from all others what its own defective methods are and can give to all the excellent qualities it possesses above others.

Among the features of the Union of International Congresses most important to the engineering profession are the purpose of and efforts for common international weights and measures, money, universal technical terms, common methods of investigations and uniformity in stating results and, eventually a universal technical language, of which Esperanto is an example, which in the future, when subjected to modifications and improvements which its exponents themselves suggest, may become the world tongue.

Whatever may be the object of an international association, and to be attained by international congresses or meetings from time to time, it will find that in other or perhaps many other associations and their congresses there are many features common to their own; questions also that formerly were discussed in, say, an international engineering congress, are also discussed in an international association for tests of materials, of navigation, of mines, of railways, of sanitation, of universal science, of statistics, applied chemistry, bibliography and documents, scientific and technical language, technical dictionaries, sociology, international geodesy, commercial education, international expositions, aëronautics, archives, libraries, stenography, pedagogy, international economy, architecture, even by the established bureaus of postal union, copyright, telegraphs, international peace, etc.

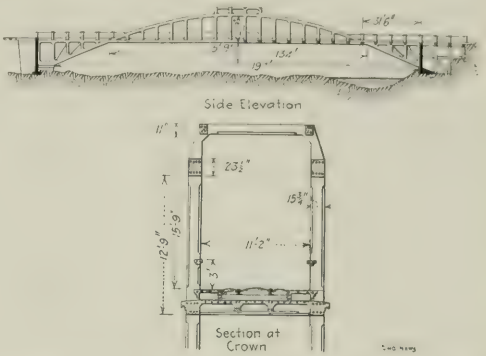
It can easily be seen that a committee might be formed from among the various associations united in the Union of International Associations and meeting annually, might take up special but related unsolved problems and report at the next meeting or congress, or through the monthly periodical of the union, keep the various associations *en rapport* with each other.

At the World Congress of Associations at Brussels in 1910, 132 international associations had become permanent affiliates of the union and met in general discussions of questions of common interest. It was then decided to be necessary to establish a permanent center for all associations. The object appealed to the Carnegie Endowment and it at once accorded an annual subvention of $15,000. This has been increased by dues of members (which are always associations), subsidies of governments and by subscriptions of private interested individuals.

As complementary to the annual meetings and triennial congresses the union has established for its work a permanent executive committee, a universal international library and an international museum, where may be found maps, exhibits of countries, publications, catalogs of all kinds, and a department of archives.

A Light Reinforced-Concrete Arch, La Mescla, France

An extremely light reinforced-concrete arch bridge has recently been completed across the Rivers Vars, in France, on an electric interurban line which runs from Nice to Digne. From articles in the foreign technical press, we have prepared the following brief description. A side elevation and section of the structure appear in the accompanying cut.



REINFORCED-CONCRETE ARCH BRIDGE NEAR LA MESCLA, FRANCE

The bridge has two no-hinged arch ribs, 197 ft. between faces of abutments and with a rise of 28.5 ft. The roadway is carried part way up the arch, as shown in the cut. This roadway, a 3-in. reinforced-concrete floor slab, is carried on two longitudinal fascia stringers, 15¾ in. square, reinforced with seven 1-in. rods, and two track stringers, each 6x10 in. in section and reinforced with four ⅜-in. rods. These stringers frame into 9¾x11¾-in. floor-beams, reinforced with four 1½-in. and two 1¼-in. rods and spaced about 8 ft. center to center. In line with these floor-beams are the vertical posts, which in the middle act as hangers and at the haunches as columns, carrying the roadway. At the haunches it will be noted that these columns are diagonally braced. The posts are 9¾x15¾ in. in section and carry four 1-in. rods. The arch ribs proper are 15¾ in. wide and 23½ in. deep throughout, reinforced with eight 1⅜-in. rods. Wind bracing is provided at the crown in the way of the framed structure shown there on the cut.

The abutments, it will be seen, are also structural members of reinforced concrete, but we are unable to give any further details of them than are shown in the illustration. A 1:1½:3 concrete was used.

The bridge is very similar in design and lightness to the present world's largest reinforced-concrete arch bridge across the Tiber at Rome (ENGINEERING NEWS, Nov. 30, 1911, p. 641), which was built by the same company, the well known European firm of Hennebique.

Boiler Explosions as Affected by Unsymmetrical Riveted Joints

An interesting pamphlet by S. H. Barraclough, A. J. Gibson, H. W. May and E. P. Norman, being a reprint from the 1911 *Proceedings* of the Engineering Association of New South Wales, is at hand, bearing the title given above. In it they relate some studies which were made on two locomotive boilers which had exploded in service, and under conditions which did not permit of the usual explanation, "abnormal conditions." In both cases the fractures were along double-riveted lap seams. In one case the fracture followed the course of the joint in such a manner as to be entirely covered by the protecting lap of the unaffected plate. In the second case the fracture was along the inner line of rivets.

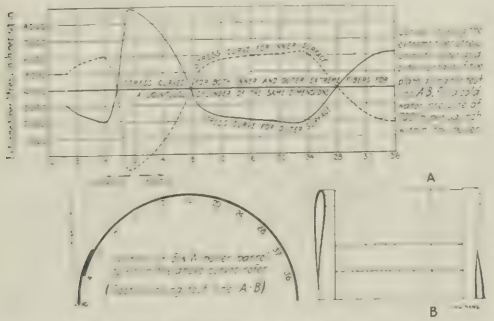


FIG. 1. LAP-JOINT STRESSES IN ONE PLATE OF A WATER-TUBE BOILER BARREL

A theoretical study of the stresses involved in such an unsymmetrical joint convinced the authors that, due to the bending moment of a couple introduced by the lap of the plates, the outside fiber stresses might rise to a tension of four times the direct stress on the inner side of the plate, and a compression of twice the direct stress on the outer side of the plate. To these initial stresses from pressure in the boiler would be added the stresses set up by variations of pressure in temperature that accompany normal working operations covered by the term "breathing."

The boiler plate in the first explosion mentioned was removed so that the corresponding joint on the other side of the boiler which did not fail could be studied. It was found that here the plate was fractured from end to end along the joint line and that the fracture had gone through the plate almost to the outer skin. While the plate was nearly severed throughout its entire length, the edges of the fracture were so close together that its surface could be [illegible] examination looked almost as [illegible]

In the case of the second boiler, the unaffected joint was examined and it was found that minute cracks had [illegible] which were known to have been punched. The punching [illegible] the rivet holes in the plate was [illegible] to be the cause of starting the fracture along the line of rivet [illegible] rather than along the protecting overlap of the unaffected plate as in the other case [illegible]

Later, experimental investigations were carried on with [illegible] boilers, to determine the extreme fiber stresses in the vicinity of unsymmetrical joints. An ingenious arrangement of fixed and swiveled mirrors was used, after the principles of the Marten's mirror extensometer, for the direct measurement of the extreme fiber strain. In the case of the isolated joints the modulus of elasticity of the material was known and permitted a close calculation of the actual stresses. In studying the strains in drum joints and dished ends, in place on boilers in service under changing conditions of pressure load, the actual modulus of elasticity could not be experimentally obtained, but had to be assumed at a reasonable figure, giving probable or approximate values for the stresses. In the case of the made-up joints, tension was applied in the usual way by machine. In the case of the drums and dished ends, hydrostatic pressure was employed to give the tension loading.

With the machine-pulled joints the ratio of maximum extreme fiber stress to the value of direct stress (that without eccentric effect of lapping) was found to be 3.9 —agreeing with the theoretical deductions. The value of compression ratio was found to be about two, also in agreement.

Tests on pulled joints with "joggled" plates (plates formed to the eccentric shape which common lap joints would assume under load) showed that the stress in the plates of a joggled lap joint did not approach a value more than twice the maximum fiber stress with a direct load. The authors, however, do not recommend "joggling," under all conditions, on account of the increased stresses set up in the already indeterminately stressed rivets, and on account of the variability of workmanship in the bending for "joggling."

The mirror method of making explorations of outer-fiber stress in the case of boilers in service, showed that the value of the stress did not rise to more than twice that of direct loading, but an explanation of this was found. On plotting the values of stresses along a plate away from a joint, a point of inflection was found also in the center of the plate opposite the (staggered) joints of the next longitudinal ring, showing that the practical construction of the boiler tends to stiffen the various parts and to modify the effect of lack of symmetry in the joints.

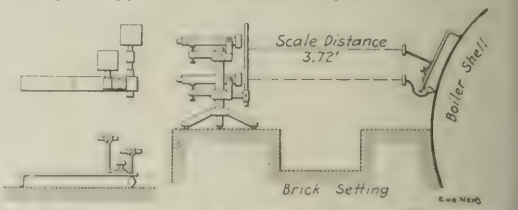


FIG. 2. MODIFICATIONS OF MARTEN'S MIRROR EXTENSOMETER USED IN MEASURING OUTER FIBER STRESSES IN BOILER PLATES

In the author's conclusion it is held that typical lap-joint failures are the result of extreme stress conditions present in this type of joint, and are due to lack of symmetry in design. The warning is given that in the inspection of boilers particular attention should be paid to parts where it is now known that bending actions can occur, and that the examination (with a hand type of stereoscopic microscope) should be most particular for pitting and incipient surface cracks. A further warning

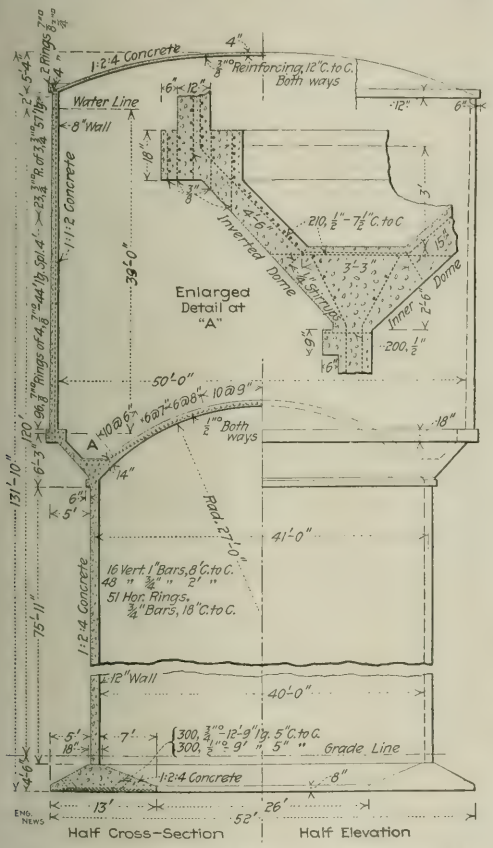
is given that where pitting has been noted its progress should be carefully watched, and should there be a line of pit marks the examination should be even more particular, as hidden cracks often run from one pit hole to another.

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A Large Reinforced-Concrete Elevated Tank

By L. J. Mensch*

A very large reinforced-concrete tank was completed by the writer a short time ago at Berlin, Ont., Canada. It forms a part of the new water-works system, the engineers for which are Bowman & Conner, of Berlin and Toronto.



Reinforced-concrete Tank for Water-works at Berlin, Ont.

Canada. This has a capacity of 600,000 U. S. gal., equal to 500,000 imp. gal. The accompanying cut shows the details of the design.

The tank is 50 ft. in diameter inside, with a height of 41 ft., or 39 ft. to the overflow level. It is supported by a reinforced-concrete shell 12 in. thick, 42 ft. outside diameter and about 80 ft. high, resting on a circular foundation 13 ft. wide. The inner and outer domes are proportioned so that the thrusts nearly balance. At the junction of the outer dome and shell of the tank, there exists a great outward thrust from the weight of the shell of the tank and of the roof, which necessitated the placing of a large amount of steel, and in order to secure the coöperation of the steel and the concrete there was provided a section of concrete at this junction of 18x30 in.

The reinforcing of the tank consisted of ⅞-in. and ¾-in. square bars of high-carbon steel, placed in two separate layers where the spacing was less than 4 in. At the junction of the two domes, a great excess of concrete was provided to take care of the thrust of the outer dome while the tank was empty or partially full. The reinforcing of the inner dome consisted of ½-in. rods placed 6 to 8 in. c. to c., which rods were provided to take care of stresses due to the elastic deformation; otherwise the dome is stressed in both directions in compression only, and would not require any reinforcing.

A mixture of concrete of 1:1:2 (or slightly richer) was used in all portions of the tank in direct contact with the water. All other concrete consisted of a 1:2:4 mixture. In order to prevent a leak at the junction of each day's work, due to carelessness in removing laitance or insufficient tamping of new concrete, a dam of No. 28 sheet steel, 6 in. wide, was embedded 3 in. in the concrete at the end of each day's work. These dams came in lengths of 82 ft., which is half the circumference of the tank.

The dome and frustum-shaped bottom shown in the accompanying cuts is an ideal design. Concrete being an ideal building material for compression, is strained to its best advantage in this type. The inner dome is under compression in every direction, and the frustum or inverted dome is in compression in one direction and in tension from water pressure in the other direction. At the junction of the inverted dome and the inner dome, the thrust from these two domes may be balanced by the adoption of proper inclinations and sizes of the domes. Or there may exist a tension in the ring by the thrust of the inner dome being greater than the thrust of the outer dome, or there may exist a compression by the thrust of the outer dome being greater than that of the inner dome. In most cases there is at this point a massive ring of concrete to take care of eventual changing conditions, for the tank empty, for the tank half full, or for the tank filled to its top.

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Coöperative Buying of food supplies is to be undertaken by the New York Railways Co. and the Interborough Rapid Transit Co. for its employees. On Jan. 30, a canvas was made of all the employees on the proposition of having the companies open such stores and the vote was very greatly in favor of the plan.

It is now announced that the car-house at 50th St. and 8th Ave., New York City, will be fitted up for the first store. If the demand warrants extension of the system, other stores will be located at the various distant car-houses or shops. It is planned to carry in these stores all classes of food stuffs not extremely perishable—including table groceries, canned goods, meat, potatoes, turnips, carrots, etc. Approximately 20,000 employees will be in a position to take advantage of this coöperative buying. All sales will be on a cash basis and no accounts of any kind will be carried; this is done in order to reduce the system to the simplest possible basis. There will be no deliveries. Only members of the family of an employee can buy at the stores, for the companies do not intend to enter into competition with existing stores in regular trade. The plan is promulgated to offset in part the high cost of living and to make the employees more contented with employment under these companies.

*Contracting Engineer, 138 N. LaSalle St., Chicago.

Modern Road-Making Machinery and Its Use*

By T. R. AGG†

The law establishing the labor system for maintaining the public highways in Illinois was enacted in 1879, and it enumerates the various implements that overseers may require to be furnished as follows: Spade, shovel, ax, hoe, plow, yoke of oxen or team of horses or mules, and a wagon or truck. This indicates about the equipment that was deemed necessary in those days for highway work. There are comparatively few kinds of construction work that are being done today in the manner in which they were done thirty years ago, nor are the same tools being used, and this applies to the processes and machinery used in road construction.

Plant for Earth Roads

There are certain kinds of machinery that have come into use in the construction and maintenance of earth roads, and are used more or less in other forms of road construction. One of the simplest, yet one of the most necessary, is a strong plow of suitable design. It should be sufficiently heavy to permit its being drawn with a tractor, and at the same time should be narrow enough to be drawn with teams when occasion demands. A plow having a long beam with shoes for regulating the depth and with a share not to exceed 10 in. wide will answer most requirements. Soils of a gravelly nature or hard-baked earth can be most readily broken with the "rooter" plow; this should weigh not less than 300 lb., and should have a short beam fitted with a shoe for regulating the depth of plowing.

There are many ways of moving material after it has been loosened, but the slip and wheel scrapers meet all ordinary conditions. For moving earth a distance not exceeding 100 ft., the slip scraper of 5 cu.ft. capacity is best, while the wheeled scraper should be used for distances of 100 to 1000 ft. As a snap team is necessary for economy in any case, it is advisable to use wheeled scrapers of 14 to 16 cu.ft. capacity, and there should be one scraper for each 100 ft. of haul for each gang.

If material is to be moved for general reshaping, a road grader of some kind will be used, and the tendency is to draw this with some sort of a tractor. The grader should be sufficiently strong to withstand the hard service of tractor grading, and it should be arranged with some device for independent steering because it is impossible to steer a heavy tractor with sufficient accuracy to do the proper work with the grader. For crowning up earth roads where much material must be moved, excellent results are being obtained with the elevating grader. It may be of a size to be drawn with a tractor, or it may be smaller and drawn with teams, but the tractor outfit is preferable on good soil. An objection often made to the elevating grader is that it leaves the road rough, due to clods of earth and sod being deposited on the roadway. The grader should not be expected to construct a finished job, but a small amount of subsequent work by a disk harrow and drag will leave the road in excellent condition. The use of steam and gasoline tractors for drawing road machinery, is rapidly becoming general.

The effect of traffic on an earth road is to flatten it and work the soil away from the traveled portion of the road toward the ditches. At least once a year, a little material must be drawn back toward the center of the roadway in order to maintain a proper cross-section. Several devices have been perfected for doing this work. The Monroe leveler is drawn by a tractor which travels in the middle of the road, and the leveler has wings which draw in the material from the side of the road, spreading it in the middle portion. One bad feature is that a ridge of loose earth is usually left in the middle of the road. If a drag and a roller follow the machine this fault is overcome and the road will be so shaped that the traffic will use the middle of the road instead of getting to one side. For light maintenance work, the most satisfactory device is the road-drag, of which a number of types have been developed.

[illegible] One item of expense in ordinary road maintenance, particularly in Mississippi Valley states, is the [illegible] These range from 12 to 36 in. in [illegible] the [illegible] of 12 to 24 in. predominate. Concrete is coming into general use for their construction, and [illegible] metal forms [illegible] Their use

*Abstract of a paper read at the annual meeting of the Illinois Society of Engineers and Surveyors, at Chicago, Jan. 23-24.

†Assistant Engineer, Illinois State Highway Commission, Springfield, Ill.

a great many types of these forms to be had, but that which will give a circular opening is perhaps to be preferred. The essential principle of all these forms is, of course, that when the concrete has set, the forms can be removed and used for another culvert. Not a few so called collapsible forms fail to collapse when desired and must be left in the culvert. A satisfactory homemade form for circular culverts can be made by building up 2x4-in. scantlings of the desired length around a disk, which has been cut to give a desired diameter to the culvert. The sticks are first strung on a wire run through holes at each end and bored through the 4-in. dimension. The scantlings are then rolled up around the disk and tied with a wire hoop and the wire through the holes removed. The closure is held slightly open by means of wedges, which are removed to permit the collapse of the form. These forms are very cheap and can be used a number of times, and while they do not give as smooth a finish to the inside of the culvert as the metal forms, they may often be used when it would hardly pay to purchase more expensive forms.

A concrete mixer, having a capacity of 3 or 4 cu.ft. per batch, is of advantage in small culvert work. While the continuous mixers in many cases are excellent machines, yet with the unskilled operation usual in road work it is believed that much better results in the long run will be obtained by the use of the batch mixer, and probably this principle holds true on even larger work.

Plant for Macadam Roads

In the construction of hard roads, the material is usually shipped in cars and hauled by wagon to the work. There is on the market a chute which is suspended from the side of the car and is large enough to hold a wagon load of material. The wagon is driven under the chute and the contents are dumped into it by tripping the door, thus securing a wagon load in a very short time. These chutes are of considerable economy where large quantities of material are being handled. The cost of shoveling material into the chutes is less than for shoveling into the wagon, because the opening into which the material is thrown is visible from any position in the car. The great economy in their use, however, is due to the fact that the team is not idle for any considerable length of time while the wagon is being loaded at the car.

It often times happens that the material is shipped and stored during the winter, and with the difficulty of securing cars during the construction season, this practice is becoming more general. When loading such material onto the wagons, a loading incline is essential. This consists of an inclined trough so arranged that the wagon can be drawn up under an apron at the upper end and the crushed stone or other material dragged up by means of a team and slip scraper and dumped into the wagons. While the cost of operation of such a loading device per cubic yard is about as great as the cost of shoveling the material into the wagon, yet the time of loading is much reduced, and there is a saving on the time of the teams. In some instances, the material is quarried and crushed near the site of the road. The machinery required includes a stone crusher of the desired capacity, a gasoline or steam engine for operating the crusher, and a screening plant and bins. The details of the arrangement of the machinery depend upon the class of work being done, but it is common to use a plant having a capacity of 75 to 100 tons of material in 10 hours, together with the necessary screens and bins. In two or three plants of about this capacity in Illinois, the cost of the crushed stone on wagons was 60c. per ton. This included all the cost of quarrying and crushing. The stone being rather a soft limestone and badly fissured in the ledge, the expense for blasting was small.

A macadam road should always be built with a roller. The accepted form for highway or street work is a three-wheel, self-propelled roller weighing from 10 to 12 tons. This is also suitable for rolling embankments in heavy grading work, although the weight might need to be varied with different classes of material to be compacted. If the roller is to be used on bituminous macadam work, it should be equipped with an apparatus for spraying water on the wheels. The weight should be so distributed between the front and rear rolls, that the weight per lin.in. on the front roll is not less than 75% nor more than 90% of the weight per inch of width on the rear roll. The machine should be hand-steered unless the weight is greater than 12 tons, and if mechanically steered, the steering apparatus should be independent of the man operating the roller. Steam, gasoline and oil motor rollers are being used and are giving satisfactory results, and there are classes of work and conditions under which each is most economical.

In the construction of waterbound-macadam or bituminous-macadam roads with a bonded lower course, a sprinkling wagon is a necessity. Any type of street sprinkling cart is adapted for this service, but should have 6-in. tires and the "race track" type of gear, that is, the tread of the front wheels narrower than the tread of the rear wheels, so that in effect, the wagon when drawn along the road has a surface bearing of 12 in. on each track. This is necessary, because the sprinkling wagon is used on the macadam at the time when it is in condition to be easily injured, and if the tires are narrow, serious damage will result. The spraying apparatus should be designed to throw the water directly down on the road surface, because the object of the sprinkler is to wash in the screenings and bonding material. The cart should have a pump for taking water from wells or ponds and should be equipped to force water into the steam-roller boiler for washing out.

In preparing macadam for rolling, excellent results are obtained by harrowing the stone after it is spread and just before rolling begins. The harrow should be heavily built, with teeth 1 or 1¼ in. in diameter, and the entire harrow should have a weight equal to about 10 lb. for each tooth. It should be so designed that when drawn the teeth will not follow each other, but will be well distributed across the width of the harrow. If a macadam outfit is doing any maintenance work, a scarafier is a necessary addition. This must have sufficient weight to insure that the picks will be held down into the surface which is being loosened, the picks must be susceptible of adjustment so that the surface may be loosened to any desired depth, it must be so arranged that there can by some variation in the width which is scarafied in one trip, and it should be arranged so that it can be steered independently of the movement of the tractor.

A complete macadam outfit then should contain the following tools: Roller, sprinkling wagon, plow, harrow, tool box, rooter plow, and the necessary small tools. Such an outfit will cost approximately $3100. Records kept in the work of the Illinois Highway Commission for six years and embracing 52 outfit seasons of operations, show that the average cost per outfit per season for maintenance is $61. This includes all repairs and replacement on all parts of the equipment mentioned above.

If materials for road construction are hauled long distances, a traction-engine outfit is necessary for economical work. The choice between the gasoline or oil tractor and the steam engine will depend very largely on the condition under which the machinery is to be operated. In general, it seems possible that there are decided advantages in the use of the gasoline tractor for this purpose. The cars which are used for hauling the material should be reversible so that it is unnecessary to turn the train around at the end of the trip. They should be of the dump-bottom type and arranged so that the load can be spread as dumped. The size of the unit should be such that the load including the wagon will not exceed 5 or 6 tons if the hauling is over roads similar to those in the state of Illinois. For the car of this weight, the wheels should be at least 8 in. broad and should be cambered to fit the crown of a finished road.

Experience in Illinois shows that hauling with such an outfit is cheaper than team hauling for the same distances, and that the economy increases with the length of the haul up to the maximum for which data have been obtained in the work of the commission. The cost per cubic yard for hauling crushed stone with the tractor outfit is about 60% that of team hauling for one mile, and about 40% for distances of three miles. This includes the pay of the operator for the engine (who is paid straight time regardless of the conditions of the weather and whether the job is running or not), the cost of the fireman (who is paid only for the days when the outfit works), the cost of fuel, oil and supplies for the steam engine, and the cost of maintenance. During the average season in Illinois from May 1 to Dec. 1, a tractor outfit can be used for hauling over earth roads only about 50% of the time. A hauling outfit costs approximately $4000, and in the work of the Commission, the cost of maintenance has been $100 per season.

Plant for Bituminous-macadam Paving

If an outfit of road-making machinery is to be used in the construction of bituminous macadam roads by the penetration method, in addition to the machinery already enumerated, there will also be required the machinery for spreading the bituminous compound on the road. The spreading may be done by hand-spreading cans, in which case there are two general types available. In one type, the slot through which the compound is poured is vertical; in the other, it is horizontal. There is a decided difference in the method of handling these two types of cans in pouring the compound, and experience indicates that the former permits more even distribution. Both types are made with arrangements for varying the width of the slot. This, however, is not a very important feature, because the operator will govern the quantity of the material spread very largely by judgment.

If the bituminous compound is to be spread by means of a distributing wagon, there are two general types available: The gravity distributing wagon, and the pressure distributing wagon. The former is suitable for a limited range of operation, and it can be used satisfactorily for spreading light oils for dust laying and similar work where a slight variation of bunching of the material as it leaves the machine is immaterial. For high-class bituminous macadam constructed by the penetration method, the gravity wagon does not give satisfactory results.

Of the pressure distributing wagons, there are two types. One (which may or may not be equipped with a heating apparatus) is designed so that the pressure in the wagon forces out the binder through a hose and nozzle and thus distributes it on the road surface. This seems to give very satisfactory results for certain class of binders, but not with viscous binders or those requiring high temperature for application. If solid asphaltic or tar binders are being distributed, the spray type of wagon is essential. These are of two general classes. One is arranged with a series of nozzles close to the road surface through which the bituminous material is forced by means of pressure produced by an auxiliary pump. A strip of roadway, the width of the spray apparatus, is covered at each trip with this machine. In the other type of machine (used by the Illinois Highway Commission), the binder is applied by means of a nozzle, which is carried by an operator walking behind the machine. The air pressure in the tank forces the material through the nozzle and a jet of steam forced into the binder at the orifice in the nozzle breaks the binder into fine spray.

In addition to the distributing wagon or cans for distributing the binder, there will also be needed tanks for heating the asphaltic binder. Some of the distributing wagons are fitted with heaters, but in general open-top heating kettles into which large pieces of solid binder can be placed are also needed. Along with these tanks, there will be required a certain amount of small apparatus such as asphalt cutters and various small tools. The cost of a bituminous outfit is $1000. Data collected upon 12 seasons of operation show that the cost of maintenance per outfit per season is $106.

Plant for Concrete Roads

The construction of concrete roads requires a complete outfit of machinery. There will be a steam or gasoline roller weighing about ten tons, and certain special machinery for the concrete. The mixer should be of the batch type and should load from in front and discharge from the rear. It should be self-propelled and for this class of work, experience shows that the steam-driven machine is more satisfactory than the gasoline machine. In country road work it will be found that the water-supply will require special attention. The water will be obtained from ponds, reservoirs or wells, and must be pumped to the mixer. This will necessitate a pumping outfit and a system of piping arranged alongside the road so that the hose from the mixer can be attached at any place. The pumping outfit should be of ample capacity, certainly capable of delivering three or four times the amount ordinarily required by the mixer itself, because in hot weather a large amount of water is necessary for wetting down the subgrade before the concrete is placed and for sprinkling the concrete behind the mixer.

In addition to the concrete apparatus, there will be required templets for striking the road surface. These usually consist of two 1-in., or 1¼-in. boards cut to the desired crown for the road and fastened to blocks parallel to each other and about 6 in. apart. They are drawn along the top of the forms at the edge of the concrete. For floating the surface after it has been struck off to the desired crown, a float made of a thin board of sufficient length to reach the entire width of the pavement and one foot on each side is bent to the crown of the finished pavement and held by means of ribs to which it is attached. This float is drawn with a combined forward and crosswise movement in such a way as to float the finished concrete and at the same time strike it down to the desired shape. There will also be required the ordinary tools used in concrete work, that is, wheelbarrows, shovels, picks, tampers and similar tools.

The cost of a complete concrete road outfit can be made anything desired, but the essentials for placing the concrete and furnishing the water-supply, including a mixer having a capacity of about 1000 sq.yd. of 6-in. pavement per day, with all auxiliary apparatus and tools, will cost about $2700.

The Panama Pacific International Exposition

By J. H. G. Wolf*

The opening of the Panama Canal, announced to be ready for traffic during the Fall months of the present year, is exacting more interest and attention generally than any event of political or social importance in years. That it will have a revolutionary effect upon certain lines of trade, and upon the welfare of certain countries fortunately situated with respect to particular trade routes, is confidently expected. The belief that such things will be realized in the case of California and the two other western states bordering upon the Pacific led, some years ago, to projecting a celebration in the form of an exposition to be held at San Francisco in 1915, the construction work on which is now under way.

The accompanying figure shows (1) the position of the site beside the Golden Gate and (2) a simplified plan of the exposition buildings and grounds.

The lines of development of the project have followed in a way past expositions, but have been varied here to take advantage of the site upon the Golden Gate Channel and to include developments of arts and sciences in the past decade having exhibition possibilities. There are the usual exhibition palaces, some 14 in number, designed to surround and flank a central court; there is a group of amusement concessions, in which it is aimed to furnish only the highest class of diversions; there are to be separate buildings for the Federal Government and the several states, and for foreign governments. There will also be aviation and drill fields and grounds for stock exhibits, etc.

Prominent architects and landscape engineers, particularly those who have had experience with past expositions, have united as an architectural commission in collaboration with local talent and a staff of colorists, sculptors and artists for two years or more developing the main plans. The general status of the enterprise can be summarized by noting the following progress as of Jan. 1, 1913:

(1) The site, 1.6 miles long and 0.5 mile wide, has been practically cleared, and the lowlands covering a part of the area have been filled with sand dredged from the bay; some seawalls have been built and others are under way.

(2) The Service Building, which will contain the administration, constructor and police departments, the first building upon the grounds, is about completed.

(3) Ground has been broken for Machinery Hall, which is to cover some eight acres and will be the first exhibition palace. It is to cost $600,000 and the contract has been let. The remaining exhibition palaces are all to be placed under contract during the present year, and all are to be finished by June, 1914, or *eight months before the opening* of the exposition (February, 1915).

(4) The matters covering the distinctly civil-engineering works—the docks and sewers, the gas, water and electric mains, the roads and streets, have been entrusted to a corps in the Division of Works. Plans covering these features are about completed and construction of the sewers is already under way. Bids are about to be advertised for 10 miles of special high-pressure water mains for fire protection (in connection with the harbor fire boats) and 20 miles of water mains for ordinary domestic service.

(5) Within 10 months after President Taft's invitation to foreign nations to participate, 27 governments signified their intention to exhibit and, of these, six (the first enumerated) have already selected sites for their buildings. The nations are:



1. Japan,	10. Santo Domingo,	19. Chile,
2. China,	11. Honduras,	20. Liberia,
3. Sweden,	12. Mexico,	21. Nicaragua,
4. Portugal,	13. Panama,	22. Cuba,
5. Canada,	14. Costa Rica,	23. Brazil.
6. Holland,	15. Peru,	24. France,
7. Guatemala,	16. Bolivia,	25. Great Britain,
8. Haiti,	17. Ecuador,	26. Germany.
9. Salvador,	18. Uruguay,	27. Spain,

The following 35 states and territories have prepared to participate, of which the first 23 are said to have selected sites for buildings:

1. New York,	13. Nevada,	25. Iowa,
2. Pennsylvania,	14. Missouri,	26. Kansas,
3. Nebraska,	15. Idaho,	27. Kentucky,
4. Arizona,	16. Kentucky,	28. Louisiana,
5. Illinois,	17. Montana,	29. Maryland,
6. Ohio,	18. West Virginia,	30. Massachusetts,
7. Utah,	19. Indiana,	31. New Mexico,
8. Washington,	20. Hawaii,	32. North Dakota.
9. Oregon,	21. Minnesota,	33. Texas,
10. New Jersey,	22. Philippines,	34. Oklahoma,
11. Colorado,	23. California,	35. South Carolina
12. South Dakota,	24. Georgia,	

(6) Applications for exhibition space are reported to amount to 2,000,000 sq.ft., and to have come from all parts of the world; applications for amusement concessions requiring the expenditure of several millions of dollars are filed, and it is probable that those accepted will run towards the reproduction of natural wonders, such as the Grand Cañon, the Panama Canal, and various objects of distinct historical interest and educational value.

San Francisco, while still staggering under the 1906 loss of a half billion dollars in property or business interests, is fulfilling the trust imposed by Congress. The

*1912 Mills Building, San Francisco, Calif.

citizens have subscribed (and are duly paying) $7,500,000; the city and the state have each bonded for $5,000,000, making in all a base fund of $17,500,000. To this must be added the expenditures of each of the 58 states and foreign governments for their individual exhibits (varying in amounts from $10,000 to $1,000,000, the announced intended expenditure of Japan).

The business organization of the fair is founded upon an incorporated company, called the Panama Pacific International Exposition Co., capitalized at $5,000,000, and governed by a board of directors of 50 prominent local men assisted by special city and state commissions. The members of the directors' executive committee and the controller constitute the cabinet of the president, which practically directs all affairs. The executive staff of the president consists of a director-in-chief, a director of exploitation, a director of works and a director of concessions and admissions. The president of the corporation, the man whose ability has contributed most to the present degree of success, is a well known engineer, Charles C. Moore.

Oregon State Irrigation Congress

[CONTRIBUTED]

The second annual Oregon State Irrigation Congress, which was recently held in Portland, Ore., was notable for the good attendance of practical irrigators, real farmers and experienced engineers.

The opening speech was by Jos. N. Teal, whose efforts in the line of conservation have been recognized throughout the United States. The report prepared by the State Conservation Commission, largely under his personal direction, is one of the most noteworthy documents of its kind.

Mr. Teal spoke of the necessity of coöperation between the state and federal government in future irrigation work, particularly on the larger projects. He also described the great opportunities in connection with the development of the Deschutes River, and outlined a tentative agreement that is being made with Secretary of the Interior Fisher in the matter of investigations on the Deschutes River.

The discussions at this conference were participated in by men of moderation and of sound sense. The control of the meeting was evidently in their hands, a condition so unlike that of many of the so called irrigation congresses elsewhere, that there has been general comment on it.

Practically all of the recent irrigation enterprises whose securities have been offered to Eastern purchasers have been financial failures largely due to the fact that the prime object of their organization was to secure the promoter's profits and a commission frequently as high as 20% on the sale of the securities. Many of them which possessed merit have failed because of the fact, which is now being generally appreciated, that it takes a long time to develop agriculture in a new country, and the interest charges and costs of operation and maintenance during this long time amount to a sum which not only takes away the profits, but eats into the principal.

With all of the relatively easy irrigation projects taken up, there appears to be very little outlook for future construction, excepting under some form of coöperation between the state and nation, or under the terms of the federal Reclamation Act.

There are millions of acres of arid land now reclaimed at large cost which are lying untilled. The owners or entrymen who control these do not have the capital or energy to utilize them or are hoping to sell out at large prices to homeseekers from the East. The lure to the Eastern man is cheap land, and with the prices asked, he cannot see where his profit comes in. Thus, there are few, if any, land sales being made to newcomers.

It is refreshing to find that the substantial men of the West are appreciating these facts. They know that the inflation of prices has been an injury to them and that they must cut down to bedrock and be prepared to share with the newcomer the benefits of increase in land values which are due to cultivation of the soil. It is seen to be not only fair, but also a matter of sound business sense, to admit freely the risks of irrigation investment, and the worthlessness of many of the existing irrigation stocks and bonds. It is also acknowledged to be unwise to permit the homeseeker to assume that irrigation is an easy way of acquiring wealth. He should be clearly informed of its difficulties and risks; that it is pioneering; that a large portion of the soil is liable to deteriorate under careless handling and that from 15% to 30% of the best lands have been ruined under existing systems by swamping or alkali; that plant and insect pests are liable to attack his crops, and that markets cannot be had at first for all of his produce. In other words, that he is taking a large risk and should be reasonably sure of the opportunity of correspondingly large profits.

At the same time it should be clearly shown that with the exercise of skill and good judgment, accompanied by reasonably hard work and self-denial, the rewards should be correspondingly great, and that the same amount of energy which is applied in other enterprises, accompanied by reasonably good fortune, will result in the majority of men obtaining a competence beyond their reasonable expectation elsewhere.

When other state and national conventions in the West get down to business on a foundation of this kind, it is believed that substantial and steady progress will result.

The Coal Production of Canada for the year 1911, is reported in a bulletin just published by the Department of Mines. From this it appears that 11,323,338 short tons were put out, compared with 12,909,155 tons in 1910, a falling off of about 12% due to labor troubles in Southern Alberta and Eastern British Columbia. The approximate selling value of the coal at the mines in 1911 was $2.34 per ton, compared with an average of $2.39 per ton in 1910. Nova Scotia in this year produced 62% of the total; British Columbia, 22%; Alberta, 13%, and Saskatchewan less than 2%. Of the total production, 75.6% was sold for consumption in Canada, 9.4% for export to the United States and 2.5% for export to other countries, with 3.4% used by colliery operators making coke and 9.19% used for colliery purposes and by workmen.

The Transit a Rival of the Hat Pin—The following letter appeared in the New York "Times," Jan. 28, 1912:

To the Editor of the New York "Times":

Cannot something be done to make surveyors cover the points of their tripods while they are carrying them on their shoulders? They invariably carry them on their shoulders with the points extending the full length of the legs in front of them.

The other day in walking down Broadway, while the sun was shining into the eyes of persons going south, on three separate and distinct occasions, within a distance of two blocks, I narrowly missed having my head punctured by surveyors going north with the points of the tripods exposed, as stated above.

The above danger to pedestrians can be obviated by the use of a leather cover for the points, as used by traveling photographers.

EDWARD SCHWAB.

International Cement Questions from a French Viewpoint

The wide differences existing between the cement experts and engineers of different countries were brought into sharp view at the Sixth Congress of the International Association for Testing Materials, held in New York last September. This was apparent in our report on the congress (see ENGINEERING NEWS, Sept. 12 and 19, 1912, pp. 502 and 513); by reference to that report it will be seen that the antagonism is chiefly between Germany and all other countries.

The situation is further illuminated in an account by the noted French cement man, R. Feret, given last October in an address before the Réunion des Membres Francais et Belges de l'Association Internationale pour l'Essai des Matériaux, at Paris, France. From a copy of the proceedings of the Réunion we quote some parts of this account in the following:

Mr. Candlot's proposal to eliminate the clauses of certain specifications which require an increase of strength from 7 to 28 days was lengthily discussed, although it is of interest only in a theoretic way to a certain number of foreign members, there being few specifications which require such increase of resistance. Nevertheless the meeting decided in favor of a committee for studying this question.

Then was discussed a communication of Mr. Poulsen, a Danish engineer, who at the Copenhagen congress had already presented an important paper on the behavior of cement in sea water and on puzzolanic additions. On the first occasion he dealt with researches on a special puzzolana, a diatomaceous earth known in Denmark as "moler." The paper concluded that it is useful to add this material (pulverized and dried) to cement, particularly in the case of work in sea water.

The subject was discussed at length, and the question of puzzolanic additions was treated broadly. In particular, recourse was again had to the argument, oft-repeatd but long ago refuted, that puzzolanic additions improve mortar only by mechanical action, through the effect of greater fineness of their particles, which fill up the interstices and render the mortar more compact. I have demonstrated repeatedly that if a particular cement has added to it in one case a fine puzzolanic material, in another case an inert sand pulverized to the same fineness, the former mixture is much superior to the latter, and in fact the latter is inferior to the original cement. The communication of Mr. Poulsen brought forward no proposition for a resolution, and the discussion remained platonic [sic].

In the second session the question of accelerated tests for constancy of volume of cement was first taken up. At prior reunions I have made reference to the existing differences on this subject, and you well know what animosity the German manufacturers have exhibited toward the Le Chatelier test; accordingly all of them came to New York with the fixed resolution to rescind the vote of the Copenhagen congress which recommended officially the Le Chatelier method as the normal accelerated test of constancy of volume.

On account of the well pronounced diversity of opinion there were numerous papers on this subject. The discussion could not be called lively, for the method fixed by the rules prevented all animosity; but it was long, and many speakers set forth their views on the subject. Most of them were Germans, and their arguments in all cases rested on the two same sets of experiments—that of ten cements which had not shown up well in various accelerated tests and yet during 16 years have behaved quite well under weather exposure; and the more recent experiment on several cements which, subjected to the Le Chatelier test in various laboratories, gave discordant results. I think it unnecessary to recall to you the refutation of these arguments, and the test results on the occasion of the Le Chatelier test.

Besides identical resolutions proposed by Mr. Gary and Mr. Martens, Mr. Robertson presented one asking simply for the creation of a committee to continue the study of the question. [He was part or all of the last portion of the German proposal [calling for the revocation of the Copenhagen resolution as a preliminary to referring the question to a new committee for study. I considered the phrasing of Mr. Robertson as going to the extreme on the adoption of a resolution which while recognizing the necessity of new study to perfect the test method adopted by the Copenhagen congress, should explicitly state that the New York congress could not logically (unless it had new, contradictory, test results) go back on a decision taken by a former congress as the result of long study by an international commission. This view was fully aired in a session of the council, which agreed with it unanimously, Mr. Martens included. Thereafter, in the session of the committee on resolutions, Mr. Gary abandoned the first part of his proposition, and I no longer had reason to maintain my motion. Therefore the committee was able to agree without great difficulty on a resolution which was subsequently adopted without comment by the session and by the full congress [practically the Robertson resolution. —Ed.].

After this long discussion the session took up the no less important problem brought forward by Mr. Müller in the name of the Association of German Manufacturers of Portland Cement, who requested the International Association to fix a maximum sulphuric-acid content for portland cement. Like a certain number of prior publications on the same subject, the report was based on a test made in Germany with two samples of cement, one German and the other French, used partly in natural condition, partly after adding gypsum in such proportion that the sulphuric-acid content was raised to 2½%. The examination of mortar immersed in sea water was claimed to be entirely in favor of the first cement, although this in its natural condition contained a sulphuric-acid percentage considerably higher than the second.

To these claims it was objected that it would be unsafe to base a conclusion on a single experiment, in which, moreover, the two products under comparison were profoundly unlike in other points (notably in fineness of grinding and in alumina content), which rather than the sulphuric-acid content might have been the principal reasons for the reported difference of behavior in sea water. For my part, while recognizing the great value of further researches, I considered it necessary to move the previous question by observing that the International Association should limit its activities to the standardization of test methods, an object in most cases involving sufficient difficulties, and to leave to every user the selection of specification figures.

This view, it appears, raised a very lively and extended discussion in the council. It was recognized that substantially this principle had been established since the beginnings of the Association, but that it had been partly abandoned later on in connection with certain questions relating to specifications for metals. To reaffirm the principle at the present time, even though in another line of tests, would tend to overthrow what had been built up by great labor. Facing this difficulty, I did not insist on my motion, and on the other hand the original motion also was dropped by its promoters; thereupon the resolutions committee had no difficulty in agreeing upon a motion [for appointing a committee to study the subject.—Ed.].

This is a very interesting matter for study, and its final settlement may entrain important consequences for practice. This can be seen if it is remembered that the present adoption of the proposition of the German manufacturers would have had the result of opening to their product certain markets, such as those of South America, from which they are excluded at present by excessive sulphuric-acid content. This discussion furnishes one of many counterarguments opposing certain scoffers who see in our congresses only pretexts for promenading and receptions, but no practical value.

The report of Mr. Schüle, chairman of committee 42, on uniform tests of hydraulic cement by prisms, and standard sand, gave an account of the work of this committee and sketched the state of the plastic-mortar question, without proposing a definite test method, the subject being not yet wholly cleared up. He indicated, however, some points on which the members of the committee were able to agree. The related question of standard sands came up, though this can hardly be settled until after the test method itself shall have been fixed. In the meantime it is agreed that different laboratories will compare the standard sand of each country with the German standard sand, which up to now is the only one produced regularly and under careful inspection.

In a communication on this subject Mr. Gary attacked the principle of plastic mortar, quoting test results showing considerable divergences arising through its use. However, Mr. Gary does not rigidly oppose a study of the question. He merely states that in Germany, tamped mortar gives complete satisfaction, so that no interest is taken in other methods. Mr. Schüle objected that the German operators perhaps had not the required amount of skill in mixing plastic mortar, which would account for the variable results.

There followed a discussion in which various special points of the subject were treated, for example the question of

whether it is desirable in figuring averages to reject the lowest observations. But as all were agreed that the tests should be continued the debate was not very animated, and the meeting adopted Mr. Schüle's motion [calling for continuation of the work of the committee and application of the method to the comparison of different standard spans.—Ed.].

It is to be remarked only that a German, Mr. Probst, declared himself an advocate of tests with plastic mortar, which aroused the protest of his countrymen.

Progress of the Commission Plan of City Government in 1912

The commission plan of city government was adopted by some sixty or more cities in 1912, compared with nearly a hundred the previous year. We give herewith a list of 63 cities which adopted the plan in 1912, as recorded by Clinton Rogers Woodruff, Secretary of the National Municipal League, Philadelphia, Penn. The list is followed by comments upon it from another reliable source and from a somewhat different viewpoint, after which there is given a summary of the progress of the commission plan from its adoption by Galveston, Tex., in 1901, to the close of the past year. It should be noted that all our figures are based on years of adoption and not the dates the plan went into effect.

LIST OF 63 CITIES REPORTED AS HAVING ADOPTED THE COMMISSION PLAN IN 1912

New England.....1	
Salem, Mass.	43,697
Middle Atlantic.....7	
Atlantic City, N. J.	46,150
Deal Beach, N. J.	273
Long Branch, N. J.	13,298
Longport, N. J.	118
Nutley, N. J.	6,009
Ridgefield Park, N. J.	966
Wildwood, N. J.	898
South Atlantic.....3	
Florence, S. C.	7,057
Sumter, S. C. (City Manager).	8,109
Tampa, Fla. (Advisory vote)	37,782
South Central.....12	
Sheffield, Ala.	4,865
Charleston, Miss.	1,834
Gulfport, Miss.	6,386
Jackson, Miss.	21,262
Meridian, Miss.	23,285
Hammond, La.	2,942
*New Iberia, La.	7,499
Natchitoches, La.	2,532
New Orleans, La.	339,075
Lebanon, Tenn.	3,659
Covington, Ky.	53,270
Lexington, Ky.	35,099
North Central.....8	
*St. Joseph, Mich.	5,936
Harvey, Ill.	7,227
Marseilles, Ill.	3,291
Portage, Wis.	5,440
Janesville, Wis.	13,894
Menominee, Wis.	5,036
Rice Lake, Wis.	3,968
Superior, Wis.	40,384
Northeastern.....16	
Ottumwa, Ia.	22,012
Duluth, Minn.	78,466
St. Paul, Minn.	214,744
Tower, Minn.	1,111
Arkansas City, Kan.	7,508
Great Bend, Kan.	4,622
Holton, Kan.	2,842
Junction City, Kan.	5,598
Manhattan, Kan.	5,722
Olathe, Kan.	3,272
Parsons, Kan.	12,463
Lincoln, Neb.	43,973
Nebraska City, Neb.	5,488
Madison, S. D.	3,137
*Watertown, S. D.	7,010
Polson, Mont.	not given
Southwestern.....10	
Bishop, Tex.	not given
Franklin, Tex.	not given
Frankston, Tex.	not given
McKinney, Tex.	4,714
Willis, Tex.	not given
Ada, Okla.	4,349
Collinsville, Okla.	1,324
Okmulgee, Okla.	4,176
Colorado City, Colo.	4,333
Durango, Colo.	4,686
Pacific.....6	
Everett, Wash.	24,814
Pasadena, Calif.	30,291
*San Bernardino, Calif.	12,779
San Mateo, Calif.	4,384
*Phoenix, Ariz.	11,134
Boise, Ida.	17,358

*See two paragraphs following this table.

A list of commission-governed cities is kept by The National Short Ballot Organization, which also collects the charters and organic laws under which cities are empowered to adopt the commission plan. The Organization has a standard for judging whether or not it shall include cities in its loose leaf "Digest of Short Ballot Charters."

H. S. Gibertson, assistant secretary of the Organization, has kindly sent us the following comments on the National Municipal League list:

Checking up your list, I would make the following comments: I am not informed as to the cities under 2000 population, since we do not consider cities of less size worth recording. Aside from this, I should question New Iberia, La.; St. Joseph, Mich.; Watertown, S. D.; San Bernardino, Calif., and Phœnix, Ariz. San Bernardino must be a mistake. As to Phœnix, Ariz., I know that they did adopt the commission plan of government, but the Governor refused to approve the charter on the ground that it was unconstitutional. They will have to draft an entirely new document before they can change their form of government.

A list of 206 cities, reported as having adopted the commission plan up to Dec. 31, 1911, was published in our issue of Apr. 1, 1912, p. 638. The reported adoptions by years are as follows: 1901, 1; 1905, 1; 1907, 9; 1908, 6; 1909, 29; 1910, 58; 1911, 95; 1912, 63. Doubtless the list is subject to corrections, but as it stands the total adoptions to date are 269. Although the accessions in 1912 were fewer than in 1911, they included New Orleans and St. Paul, with populations in 1910 of 339,075 and 214,744, respectively, each larger than any city which had previously adopted the plan. Altogether, eight cities of more than 100,000 population in 1910, and several which had nearly that then and probably equal or exceed it now, have adopted commission government.

A number of other large cities, including Boston, Pittsburgh, Los Angeles and Seattle, have one of the chief features of the commission plan, a small single-chambered city council, but these cities retain their mayor and also maintain a separation of executive and legislative functions.

Increasing the Service of Freight Cars*

By J. M. Daly†

The average movement for all freight cars on the Illinois Central R.R. in the busy season is 27 miles per day. This is equal to three hours moving in trains and 21 hours standing on sidings or 87% of the time on sidings and only 13% in movement.

The average time consumed by the shipper in loading cars is less than two days, and the average time consumed by the consignee in unloading is less than three days, Sundays included. The average number of loaded trips per car per month is 2.7, an average of 11 days being required to handle each load. This includes all cars, revenue and company freight cars loaded on our rails and loaded cars received for other roads. The car, in a busy season, averages per month as follows: 13 days loading and unloading; 3½ days moving in trains; 13½ days standing waiting movement, switching or repairs; total, 30 days.

If we could increase the daily average mileage from 27 to 35 miles per day, it would result in 183,960,000 increased miles with our present equipment. This divided by 27 miles per day is equal to one car 6,813,333 days at 45c. per day, or a saving of $3,065,999 in per diem paid for use of foreign cars. It is equal to the service or purchase of 18,666 additional cars. To this must be added the increased revenue that would be derived from the increased use of equipment.

I am dealing with the present methods employed and the lack of proper supervision obtained over the location, movement and use of equipment. We have approximately 65,000 freight cars on our road. Take all the reports furnished, and total cars reported are about 45,000 leaving 20,000 (or 30%) unaccounted for. The failure on the part of agents, yardmasters and others to account for so many cars each day forces the conclusion that most of them have been overlooked.

As 87% of the freight equipment on our line is standing at stations, yards and shops at all times, it devolves upon us to supervise the stations, yards and terminals with a view of expediting the movement of the equipment so delayed. To secure the results in this direction there is only one businesslike method to pursue, and that is to properly organize the terminals and yards so that the men in charge will know of every car they have and why they have it. Instead of knowing merely that they have 6000 cars on the terminal, they should know in detail why all of these cars are there, and what cars should not be there and why they are not moved.

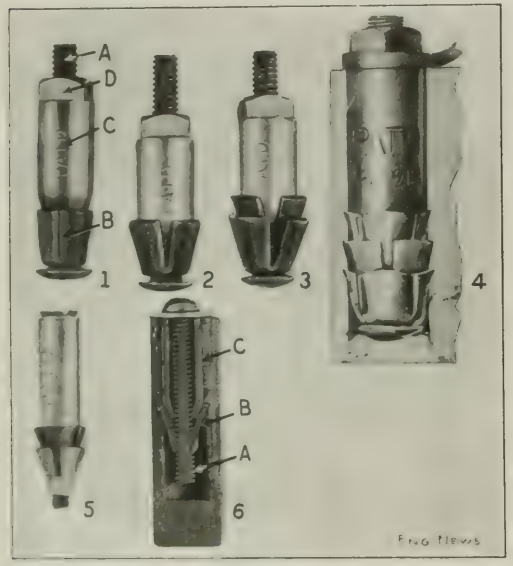
To obtain this result it is necessary to employ sufficient yard clerks to check the tracks assigned them in three or four hours in the morning, and then to devote the balance of the day to analyzing the check made and preparing data for the man in charge of the terminal.

*Abstract of a paper read at the annual meeting of operating officers of the Illinois Central R.R.

†General Superintendent of Transportation, Illinois Central R.R., Chicago.

A New Expansion Bolt

An expansion bolt now being introduced develops a positive hold and a longitudinal strain upon the material in which it is set, instead of depending upon a friction grip developed by expanding a sleeve radially against the wall of the bolt hole. The construction is shown clearly in the accompanying cut. Upon the bolt *A* is slipped a conical die-formed steel cup *B*, which is slit at the sides, so that in expanding it will spread out in the form of flanges. This cup rests on the bolt head, and following it is a sleeve *C* having one end tapered, while above this sleeve is the ordinary nut *D*. The cup and sleeve being in place, as shown at 1, the bolt is dropped into the hole, and the nut turned; the bolt head then faces the tapered end of the sleeve into the cup, thus spreading the latter, as shown at 2, so that its edges cut into the side of the hole. Where extra resistance is required two (or more) cups



A New Form of Expansion Bolt

may be used, as shown at 3. The sleeve may be of any desired length, according to the purpose for which the bolt is used; and where the work is very shallow the cup may be much shorter than is shown in the cut. When a strain is put on the bolt, it is resisted by a direct pull of the cup edges embedded in the material. This is shown by the sectional view, 4, which represents a bolt set in concrete and having three cups expanded.

The cut also shows the same appliance fitted to a screw, the cup in this case being threaded to form a nut. At 5, the device is shown with two cups expanded. The action is indicated by the sectional view at 6, from which it will be seen that as the screw A is turned, the expansion cup or nut *B* is drawn up against the tapered end of the sleeve *C*, thus spreading the cup so that its edges bite into the material. As there is no bursting action, the device can be used in thin material without fear of splitting it, the strain being mainly parallel with the pull on the bolt.

The device is made in 25 sizes to suit various sizes of bolts, (⅜ in. to 3¼ in.) and is made in both brass and steel. It is being used for such work as attaching electrical apparatus to switchboards, anchoring lamp posts to sidewalks, and securing chairs to concrete floors in theaters and grand-stands. For the latter work about 70,000 were used at the Polo Grounds in New York and 40,000 at base-ball grounds in Chicago. As the hole may be somewhat larger than the bolt without reducing the holding power of the expansion-cup, a certain amount of play is available in fitting the chairs to the bolts. They have been used also for attaching fixtures to ceilings, where each bolt has to sustain a load of about 500 lb. We are informed by Phillips, Lang & Co., contracting engineers, of Chicago, that they have used the device on bolts for attaching steel frames (for plaster partitions) to concrete bases, for anchoring rails to concrete (without ties), for setting wheel guards and steel door frames in brick walls, and for holding small high-speed motors both on wood sills and concrete foundations. They stated that this was the only expansion bolt which would successfully hold a motor set flat against a concrete wall.

The device is the invention of M. H. Paine, and is manufactured by the Paine Co., 1316 Corn Exchange Bank Building, Chicago. It is sold without bolts, thus saving the cost of freight on the latter.

❖

Painting Steel Passenger Coaches with baking enamels was noted in a paper reprinted in "Engineering News," Oct. 3, 1912. Since then the Hudson & Manhattan R.R., operating a tunnel system between New York City and points in New Jersey, has found success with baking enamel in repainting its rolling stock. This work is described in the "Electric Railway Journal," Jan. 25, 1913. In this case, since the cars are used almost exclusively in tunnel service, the exterior appearance of the coaches was not considered but the interior finish was desired carefully done.

After cleaning, the car is first heated to 200° with electric heaters strung between the stanchions in the car. The temperature is controlled by a man who watches, through a window, a thermometer inside the car, the current being turned off or on as needed. Windows and doors are closed tight and ventilators are covered with newspapers stuck to the roof with tar. The car is allowed to remain at 200° for one hour to drive off moisture and equalize surface expansion and contraction. The heat is then shut off, the car is cooled down to about 115° and the priming coat applied while the metal is hot. The temperature is again raised to 200° and the enamel baked for three hours. Second and third coats are baked at 140° for three hours, and the last coat for three hours at 130°. All coats except the first one are applied with the air in the car cooled to about 70°. The old enamel is scraped off by hand before painting to remove the bulk of the covering; the surface is then gone over with a standard varnish remover carefully applied so that all the old enamel is removed from the pores of the metal. To clean off traces of the varnish remover, the surface is rubbed with waste soaked in gasoline.

The costs are in general about equal to those of common high-grade painting. The best of materials have to be used, but a given volume of baking enamel covers about twice as much surface as the air-drying variety. The following table shows the cost in detail:

	Material	Labor
White Work		
Heat at 0.6c. per kw-hr		$3 60
Connecting heaters		1 00
Removing paint from ceiling		7 00
First ceiling coat, 1¼ qt	$1.38	1 25
Sanding same		0 75
Second ceiling coat, 1¼ qt.	1 38	1 25
Sanding same		0 60
Third ceiling coat, 2 qt	1 84	1 35
Fourth ceiling coat, 2 qt	1 84	1 35
	$6 44	$18 15
Green Work		
Removing paint from sides		$15 00
First coat green, 2¼ qt	$2 30	1 75
Sanding		0 80
Second coat green, 2 qt	1 84	1 80
Sanding		1 50
Third coat green, 4 qt	3 70	1 75
Sanding third coat		0 75
Fourth coat, 2¼ qt	2 30	2.00
	$10 14	$25 35

EDITORIALS

The Influence of Dissolved Oxygen on the Corrosion of Metals Immersed in Water

Engineers interested in the corrosion of iron and steel (and this includes a pretty large proportion of the profession) will do well to give careful attention to the contribution by F. N. Speller, which appears on page 294 of this issue. While Mr. Speller's contribution is primarily of interest to engineers responsible for the design of hot-water-supply systems, the data which it contains ought to be generally known and understood by engineers in many different lines of work.

The facts cited by Mr. Speller appear to abundantly demonstrate that the most active agent in causing the corrosion of iron or steel immersed in water is the air and other gases which are contained in solution in the water. It is quite generally understood by engineers that water containing a large amount of carbonic acid gas in solution is apt to cause an abnormal amount of corrosion, but it has been frequently supposed that this was because water charged with this gas became a weak acid. Mr. Speller makes it clear, however, that ordinary air dissolved in water can cause active and serious corrosion, especially if the water is heated.

It may be that the heating which disengages the gas from solution in the water leaves it in something like a nascent state, in which it attacks iron with especial activity. This appears to be the explanation why hot-water pipes in household plumbing corrode so much more rapidly than cold-water pipes. It is quite remarkable that the rate of corrosion appears to be proportional to the temperature of the water circulated and also to the amount of water passing through the pipes. Thus in a system for heating hot water for the supply of a hotel or apartment house, the corrosion is found to be several times as rapid as it is in the hot-water-supply pipes of an ordinary dwelling.

The practical lesson to be drawn from these facts is that provision should be made wherever possible for removing the dissolved air and other gases from water before it is circulated through pipes, boilers, etc., where these gases may do harm. By heating water to the boiling temperature in an open type of heater, the dissolved air and gases will be pretty thoroughly removed; and the life of the pipes through which the water has to pass should be materially increased by this simple precaution in design.

⁂

Lap Joints and Boiler Explosions

While it has been known for a long time, it has undoubtedly not been fully appreciated, that an unsymmetrical boiler-plate joint (well typified by the common riveted type) leads to abnormal plate stresses in the vicinity of the joint, due to the bending caused by the eccentric load. We have noted elsewhere in this issue some experiments which have shown in isolated lap joints, the tension stresses rising to four times the direct-load value. In practical cases of boiler plates in service, the stresses do not seem to rise above twice the direct-load value, due to the stiffness introduced by details of construction such as staggered joints of other longitudinal rings or plates. The danger of abnormal plate stresses at lap joints has been pointed out before and warnings have been made at various times, but it seems evident that, so far as the practical work of many designers and the instruction in technical schools goes, little heed has been paid to these warnings, so that they need to be repeated again and again until they are observed. On that ground, lack of great novelty in the paper abstracted elsewhere is excused by evident utility.

Another phenomenon which has been known and studied for some time, but considered to have little immediate and practical value, is that iron stressed beyond its elastic limit will corrode more rapidly than iron unstressed or stressed only within the elastic limit. Considering this action, together with the peculiar stresses in the neighborhood of lap joints, we have an explanation for the often observed phenomenon of concentration of pitting along joints and bends in boiler plates and fittings. Concentration of pitting effects then in a boiler, along any marked lines or after some definite fashion, may be taken to indicate there the presence of excessive stresses, leading perhaps to rupture. Thus the danger to be avoided multiplies, for deterioration is most rapid in those parts subjected to abnormal and unsuspected loads.

In the case of the New South Wales studies which we have noted elsewhere in this issue, incipient failures were found under conditions which could not be detected by the ordinary boiler examination, but were disclosed by the more searching investigation of those who knew that conditions were proper for such development. This seems to point out an inadequacy in the method of inspection in vogue. The recommendation made by the investigators mentioned that boiler inspectors should use a simple form of stereoscopic microscope is useful and worthy of serious consideration in this country.

⁂

A Safety Type of Locomotive Boiler

In the Literature Supplement of this issue there is reviewed the elaborate report, just published, which has been made by Dr. W. F. M. Goss on the notable tests of the Jacobs-Shupert locomotive boiler, carried out last spring at Coatesville, Penn. It seems to us that this report, and the matter to which it relates, has a public importance which puts it quite outside of the ordinary category of engineering reports upon patented inventions.

The Jacobs-Shupert type of boiler, which has already been fully described in the pages of ENGINEERING NEWS and which is now in extensive use on the Santa Fé R.R., where it was originally developed, eliminates stay-bolted surfaces from the sides and crown-sheet of the locomotive

boiler. Elaborate tests carried out by Prof. Goss, with the practical experience gained in service, have fully demonstrated the large advantage of this type of boiler, so far as safety is concerned, over the ordinary type of locomotive boiler, in which the firebox is surrounded and roofed over by stay-bolted surfaces.

As our readers know, the danger of locomotive-boiler explosions has been considered such that Congress has recently established a national system of inspection for locomotive boilers under the direction of the Interstate Commerce Commission. Probably three-fourths, if not nine-tenths, of the dangers in connection with locomotive boilers are due to the stay-bolted surfaces around the firebox. Under present labor conditions, there is difficulty in maintaining reliable and continuous inspection of locomotive stay-bolts, and such inspection, even when established, is a constant and considerable expense.

Under these conditions the development of a design of locomotive boiler which has equal efficiency and capacity with the present boilers and greatly reduces the dangers inseparable from stay-bolted surfaces, is an achievement of great importance to American railways and, for that matter, to the railways of the world.

A very good way to form an impartial judgment of the relative merits of a new device in comparison with an old one (the new device being assumed to have been thoroughly tested and its practicability and efficiency demonstrated) is to imagine that the new device or new form of construction had been developed first and become adopted as standard practice, and that the old device is then brought forward as an improvement.

The distinguishing feature of the Jacobs-Shupert boiler is the use of rolled plates to stay the inner and outer surfaces of the firebox instead of round bolts with screw threads cut for their whole length. If flanging and riveting machinery had been available in the early days of the locomotive, so that the plate-stay type of boiler had been first developed and come into universal use, one can imagine the difficulties which would have beset any inventor who came forward with a proposition to substitute in place of these plate stays, screwed stay-bolts. He would have been told that his device involved inherent elements of danger which made its adoption out of the question, and that the amount of labor involved in making and placing the screw stays and inspecting them during the boiler's life made his invention impossible from the commercial standpoint as well.

Concerning Government by Investigation

It would require a very industrious man, working overtime, to keep track of the investigations which are going on at the present time. He would be busy if he followed only those reported in the daily newspapers. It has come to be the fashion for every state legislature to appoint one or more investigating commissions. Congress [illegible] in a chronic and confirmed stage. [illegible] the New York Board of Aldermen has awakened from its former condition of innocuous desuetude and has sought itself into the limelight.

We have no protest to make against such investigating commissions; in fact, they are probably the best means of remedying evils in governmental matters where other means of cure have failed; but it is instructive to reflect, after all, as to how little the average investigating commission can accomplish. It can, indeed, if made up of men of the proper ability, arouse public opinion and put things on a better basis for the future; but it can do very little concerning the errors and worse than errors of the past, except in some flagrant cases to bring about the punishment of those who have been guilty of serious breaches of trust.

The old adage is as true in governmental matters as in any others, that prevention is far better than cure. It is far more important that the governmental business shall be so organized that it will be honestly and efficiently conducted than it is to allow a government enterprise or department to be organized on improper lines and then after its blunders and worse have become a public scandal, to appoint an investigating commission.

It seems worth while to emphasize this matter in connection with the principle which has been repeatedly urged in these columns that government work of importance whether carried on by a state, a city or the nation, should be put in charge of a commission of high-class men without regard to political affiliation. It is only by organizing our public works on such a plan that we can make sure of their being carried on by a permanent and competent staff of able engineers.

We have alluded so recently to the unfortunate experience on the New York State highway work, which is now under investigation, that it is needless to comment further on the situation there. It is worth putting on record though that in New York's sister state, Pennsylvania, which is also spending large amounts of state money on highway construction and has now pending a $50,000,000 bond issue for further work, the state highway department is also under fire, and the legislature is demanding an investigation.

In saying this we especially disclaim any intention to reflect upon the Pennsylvania highway department, for we have no information as to whether the state highway work in Pennsylvania has been in any way deserving of criticism. What we do wish to emphasize is that the very fact that the work is in charge of one man makes attack upon the work by members of the opposing political party almost inevitable. We are inclined to believe that this result would follow almost without exception, no matter who the man was who was placed in charge of the work.

Whatever the merits of the Pennsylvania controversy, there can be no doubt that an attack upon the state highway work already done is a most unfortunate way to start a campaign for a $50,000,000 bond issue for good roads in Pennsylvania. We believe those interests which are so industriously agitating for public expenditures upon road construction can do no greater public service than to couple with their demand for state appropriations for good roads the further demand that all such appropriations shall be spent under direction of a non-partisan commission of not less than three men which will carry on the work in an efficient manner without regard to political considerations.

If Massachusetts and other states can carry on public work with continuous economy and success under direction of an appointive commission of high-class men and without the need of sensational investigations every two or three years, it ought to be possible for New York and Pennsylvania to adopt an equally wise policy.

Why Not?

At the recent annual meeting of the American Society of Civil Engineers, held in the Society's house in New York City, two matters which impressed themselves forcibly on all those present at the meeting were in the first place that the auditorium in the Society's house is inadequate to accommodate the members present and enable them to hear what is going on. Probably not more than half the members present were able to hear the various speakers.

In the second place, it is well understood that what attracts three-quarters of those who come from a distance to attend the annual meeting is not the formal proceedings of the business meeting, but the opportunity to renew and extend mutual acquaintance with their fellow members. This opportunity is, to a large extent, lost because the Society's house is not large enough nor provided with the necessary conveniences to enable luncheon to be served to the membership at the close of the business session. The result is that as soon as the session is over, the members split up into small detachments and scatter to various hotels, restaurants and clubs.

It was the general appreciation of these conditions that led to the adoption of a motion at the recent annual meeting instructing the Board of Direction to consider the enlargement of the Society's house so that it would be of sufficient size to accommodate at luncheon the members present at the annual business meeting.

Is this a wise and efficient use of the funds accumulated from the dues paid by the Society's members? Does it not, on the other hand, seem almost the climax of inefficiency in the use of capital to expend $50,000 or $100,000 additional on the Society's building in order that *once a year* the house may serve to accommodate those present at the annual meeting? Is it an example of good engineering management in the economic use of capital to erect this costly building on this valuable real estate when it will lie idle 364 days out of 365?

There is, fortunately, a way by which the members who attend the annual meeting of the American Society of Civil Engineers can be accommodated in what is, we believe, without exception the best auditorium in New York City and can afterward meet each other at luncheon in the same building with ample provision for service. They can have these accommodations, moreover, at no other cost than a moderate rental.

We refer to the auditorium in the Engineering Societies' Building, which is now rented for large gatherings not only by the three national societies which joined in the erection of the building, but by numerous other engineering societies having headquarters in the building and elsewhere. As many of our readers know, there are in the same building spacious rooms for serving luncheon, which are frequently used by these other societies on the occasion of their annual meetings.

If there is any sound and sufficient reason why the American Society of Civil Engineers should not lease this auditorium and luncheon room for use at the time of its annual business meeting in New York, it has yet to be brought to our attention. The idea that the annual business meeting must be held in the Society's own house, purely as a matter of sentiment, can surely be dismissed at the present time. So may also the idea, which was more or less strenuously urged a dozen years ago, that the Society would lose something of its independence by sharing with other societies the use of an auditorium. Experience has demonstrated that the national engineering societies whose headquarters are located in the Engineering Society's Building are exactly as independent of each other in their organization and conduct as they were before they coöperated in its erection.

Great progress has been made in the past dozen years toward the establishment of coöperation between all the different national societies. Many prominent engineers hold membership in two or more of these national societies, and the list of those who have served on the governing boards of the different societies, if one looks back a half dozen years, reads like the "interlocking directorates" that are now attracting so much attention in the financial world.

Under these circumstances we believe the great majority of members of the American Society of Civil Engineers would approve the rental of the auditorium in the Engineering Societies' Building for the Society's annual meeting rather than have the Society incur a new burden of debt for enlarging its house.

Improving the Railway Freight Service

The efficiency of railway freight-car equipment is determined by the proportion of time which it spends in actually moving freight over the line, and the very low efficiency of such equipment on American railways is a recognized condition which appears to be too generally accepted as necessary and inevitable. Progressive operating officials realize that this is not the case, but the individual can do little to improve the conditions; what is needed is concerted action and coöperation, with active encouragement by the management or higher officials. The present low service-efficiency of the equipment is due to the fact that each car averages but a very short run and a very short time on the road daily, and a small ton-mileage per day. At a recent meeting of the operating officers of the Illinois Central R.R. this subject was dealt with forcibly in a paper by J. M. Daly, the Superintendent of Transportation, who discussed the actual conditions, their causes and the means of remedying the conditions.

From the brief abstract of the paper, which is presented elsewhere in this issue, it will be seen that the remedy suggested by Mr. Daly consists in closer checking of the movements of individual cars and closer supervision of the work at yards and terminals in order to reduce the present excessive proportion of time spent by cars standing idle instead of moving over the road. It was pointed out in the paper that the day is past when a yard-master could effectively manage his yard or terminal by personal work in the yard. At the present time he is (or rather he should be) an officer in control of the situation, and competent to realize that his work is not simply that of operating a yard, but rather that of operating a part of a railway system. Too many of these men aim simply at low cost of yard operation, with the result (as noted by Mr. Daly) that where they save in the pay-roll by discharging one or two yard clerks, they may cause the railroad a loss of a hundred times the amount in per-diem charges and also a loss in business, due to the absence of the checking done formerly by the yard clerks. These clerks are apt to be looked upon as a sort of necessary

evil, and little help or encouragement is afforded them by their immediate superiors, when in fact their work is of great importance to the efficient operation not only of the yard but of the railway as a whole. The paper goes into detail as to the proper checking by a large force of experienced and active yard clerks, but these details we need not consider. To press home the point, Mr. Daly states that a terminal having 6000 cars represents an investment of $6,000,000 in cars, about the same for tracks and facilities, and about the same for the lading in the cars, or say a total of $15,000,000 to $20,000,000. He asks: "Does not this justify the employment of the best men available, both at the head and in the ranks."

Under present conditions the actual movement of cars over the road averages but a few miles and a few hours per day. The great proportion of the time is spent standing idle on yard tracks while consignees are clamoring for their freight and shippers are clamoring for empty cars. Undoubtedly this is a very defective feature in railway operation and management, and it is one to which some efficiency system might well be applied in order to improve the service to the public and to enable the railways to get better service from their equipment. When freight cars average an effective travel of only 27 miles per day, and an actual running time of only three hours per day, as on the Illinois Central R. R., it is small wonder that there is endless complaint of the public at inefficiency on the part of the railways. The purchase of additional equipment is no adequate remedy, but serves to increase the confusion and delay and produces no real improvement in the freight-handling service, so that the investment is largely wasted.

It is unfortunate that the railways seem unable to realize the effect of these conditions, both upon the operating economy of the railways themselves and upon the relations between the railways and the public. Their higher officers, and particularly the men in power whose authorization and backing are needed, give apparently little heed to the demands or necessity for radical changes which will effect large improvements, but are largely content to devote their attention to matters of minor detail rather than to those of fundamental importance. Under such conditions there is little encouragement for the active operating officer who is anxious to improve the conditions, and little spur to rouse to activity the easy-going officer who is well content to let things remain as they are and have been. The indifference to this important matter cannot be due to lack of knowledge of the conditions, since these conditions have been set forth plainly and frequently by men in railway service as well as by outsiders, and they have been set forth in regard to individual railways as well as to the railway system as a whole For example, it may be questioned whether Mr. Daly's clear and definite presentation of the matter has had any wider effect, even on his own road, than a possible "punching-up" of yardmasters and minor officials, with only temporary effect.

In what has been said above we are not unmindful of the fact that there are active and progressive officials, many of them. But the fact remains that probably on no railway in the country is the freight movement nearly as rapid or efficient as it should be. This is not saying that new cars are not or may not be necessary. It is simply saying that the present cars are not worked to anything like their real efficiency. The problem of improving the freight service includes such factors as yard design and operation (both for division yards and terminals), industrial service to factories, etc., car interchange, the maintenance of cars in proper condition and the regulations relating to time limits, demurrage, etc., on cars while in the hands of shippers, consignees and foreign roads. But one of the most important is the service or performance of the cars, and it is this which requires much more attention than it now receives.

LETTERS TO THE EDITOR

The True Story of the Lake with a Long Name

Sir—The letters you published on Dec. 5 and Jan. 2, regarding the name of a lake near Webster, Mass., recall some notes I made in connection with the resurveying of the Connecticut-Massachusetts state boundary. All of the following versions of the lake name have appeared in print, some in the Hartford *Daily Times*, between Apr. 16 and 20, 1905, but the collection as such is original. If any engineer outside of the German empire has ever run out a longer name, I would like to hear from him.

The name is never printed with the syllables separated, but it is impossible to make sense of the word unless this is done and it really is proper to attach a certain meaning to the combinations, as it is a modest corruption of certain Indian names. J. Hammond Trumbull, in his "Indian Names in Connecticut," gives the spelling used by Elliott, "the Apostle to the Indians" (1668), as Chaubun-a-kong-ko-muck, meaning a boundary place and applied to a town near the pond. The pond itself was called Chaub na-kung-a-maug, i.e., "boundary fishing-place" or "fishing place at the boundary," the last syllable being a regular Algonkin termination meaning "fishing place." Chabenuck was a Massachusetts Indian word for "that which divides," a "bound mark," and this country lay between the Mohegan and Narragansett Indians. Manchaug was a village of Christian Indians in the Nipmuck country east of the lake and the name is still applied to a small pond in the vicinity.

The trouble started when a clerk in our office received a picture postal card bearing the legend "Greetings from Char-gogg-a-gogg-man-chaugg-maug" (9 g's out of 26 letters). A reporter happened to be passing by in the street when the man tried to pronounce it, and he rushed in to see what was the matter and scooped the poor fellow's obituary. Next day a constant reader assured the *Times* that the only reason the word stopped at "chaugg maug" was that the postal-card printer had no more g's

in his font. He quoted a name, which but for the linotype, would have stumped even the newspaper: Char-gogg-a-gogg-man-chaugg-a-gung-o-maug (11 g's in 36 letters).

Another old resident went him one better next day with Char-gogg-a-gogg-man-chaugg-a-gogg-chaub-un-a-gung-amaug (14 g's in 42 letters). The last 17 letters of this version (what a Webster man might call the last syllable) is the name which appears on the state topographical maps. The inter-state boundary map of 1822 uses exactly this spelling and Chandler and Thaxter used it in the survey of 1713 with only a slight difference, "Chab-un-a-gung-a-muog." It is sometimes corrupted into Chawyermothersgingerbread, but it is probably the generally accepted Indian name for the lake.

Now, however, comes another *pro bono publico* who not only sticks in two more g's, but attempts to gild the 37-letter pill by saying that it means "Pleasant Water." "Char-gogg-a-gogg-man-chaugg-a-gogg-a-gung-a-maug" might be pleasant as a gargle, but it is rather heavy for a beverage.

The only thoroughly consistent and really probable account of the whole matter is suggested by a letter writer who formerly lived at Webster, but who moved away so long ago that his brain has had time to clear itself of the storms of consonants which seeth through the minds of his fellow correspondents. By applying the integral calculus we find his version (or vision) of the name to have 55 letters, 20 of them g's. It means "Dead Man's Lake," he says, and, "some years ago the skeleton of a dead Indian was dug up on the banks. It was in a perfect state of preservation and is now in a museum in New York State"—town not given. "The Indian was 8 ft. 4 in. tall!"

The facts, undoubtedly, are that this was the ancient king of the pond; the identical Indian who first showed the lake to the white men. Stooping down to drink some of the pleasant water he choked. The water lost its way in his 8-ft. windpipe and he died. The white men, mistaking his dying gurgles for his untutored attempt to tell the name of the lake, wrote it down thus, "Char-gogg-a-gogg-au-gogg-o-gogg-man-chaugg-o-gogg-charb-un-a-gung-a-maug."

HENRY R. BUCK.

Hartford, Conn., Jan. 30, 1913.

The Status of the Engineer

Sir—Anent the discussion of the above subject now going on in ENGINEERING NEWS, it is to be regretted that persons taking part in the same consider it proper to take refuge under such *nom de plumes* as "Prominent Engineer." In order that their views may be of force, they should at least have moral courage enough to back them up with their real names.

The country is brim full of "Prominent Engineers," a sobriquet which is often assumed by engineers not so prominent, and if a person has the nerve (!!!) to send young fellows away with their ears burning, the reader should at least know who this redoubtable person is. The trouble with the great majority of engineers is they are too modest, at least for their own good.

EMILE LOW.

606 Ashland Ave., Buffalo, N. Y.
Jan. 30, 1913.

Increased Flow of Springs Just Before Rains

Sir—Allow me to suggest another explanation than that given by S. P. Baird, for the increased flow of springs preceding rains. Mr. Baird (see p. 83 of your issue of Jan. 9, 1913) has observed that the flow of some springs increases as much as 100% from 1 to 48 hours before a rain. He explains it on the theory of decrease in air pressure. Undoubtedly a decrease in air pressure will increase volumes of water on and near the surface, but the magnitude of this increase would be inappreciable. The increased flow depends upon the head, and this in turn upon the supply from the source of the spring. Perhaps an explanation is afforded in an analysis of the source.

The disposition of precipitation on the earth's surface is accomplished in three distinct ways: (1) surface run-off; (2) evaporation, including transpiration; (3) underground flow. For a certain area of average conditions the surface run-off is quite limited as to time, while evaporation and underground flow go on continuously. If evaporation is small, underground flow is large; what affects evaporation, therefore, affects underground flow in an inverse manner. But evaporation depends on a good many meteorological conditions, and is especially dependent on the relative humidity of the air. Other conditions being the same, evaporation decreases as relative humidity increases. As the latter increases toward 100% the former decreases toward zero, and underground flow approaches its maximum. But these are meteorological conditions conducive to rain in a day or two. Let us, therefore, rather try to explain the sequence of rain after decrease in air pressure by calling attention to the fact that the air is always engaging in an effort at maintaining equilibrium. If there has been an appreciable decrease in pressure over a certain area it usually means that heavier and colder air will sooner or later be rushing toward this area; relative humidity will rise to supersaturation and eventually we have condensation and consequent precipitation.

JOHN BERG.

220 South Michigan Ave., Chicago, Ill., Jan. 18, 1913.

Cost of Steel vs. Wood for River Barges

Sir—In your issue of Sept. 26, 1912, there appeared a criticism by John L. Taylor of my article in your issue of Aug. 29, 1912, on "Steel vs. Creosoted Wood for River Barges."

Mr. Taylor evidently thinks I was comparing the cost of wooden barges built in the early '90's with the cost of present day steel construction. He cites a case where the following bids were received in 1911 on two gravel barges 100x22x5 ft.

$2950 lowest bid on untreated wood.
4300 lowest bid on steel.

In my original article the following figures were used for barges 100x20 ft. by 4 ft. 7 in.

$1200 untreated wood.
4000 steel.

It will be noted that the cost for steel cited by Mr. Taylor supports the cost I used for the steel construction and also tends to indicate that my figure of $4000 was

conservative, in that it was a low price for a steel barge 100x20 ft. by 4 ft. 7 in. On the other hand the lowest bid received for untreated wood was $2950. This figure seems exceedingly high, for in 1910 the U. S. Boatyard at Stillwater, Minn., constructed untreated-wood barges 100x20 ft. by 4 ft. 7 in. for $1000 each; in 1909 the U. S. Boatyard at Fountain City, Wis., built similar barges of untreated wood for $1068 each. From the above it will be noted that the writers' figure of $1200 was conservative, for it is a high figure for an untreated-wood barge 100x20 ft. by 4 ft. 7 in. From the above it can be seen that a steel barge 100x20 ft. by 4 ft. 7 in. would cost three times as much as an untreated barge of the same size. In my original article attention was called to the fact that all costs of timber barges were based on government freight rates, and that for commercial comparison $10 per barge should be added to the yearly cost. However, when this item is added to the above actual costs the ratio still remains 1 to 3.

The following direct comparison of the lowest bids received on steel construction with the actual cost of similar barges built of creosoted wood is of interest. On Oct. 6, 1909, the U. S. Engineer Office at Vicksburg, Miss., received bids on steel barges 120x30x6 ft. These barges were afterwards built at the U. S. Dry Dock at Keokuk, Iowa, of open-tank creosoted Douglas fir. The bids received on steel and the actual cost of the creosoted wood construction are given below:

Bidder No.	Material	Price each	Total cost of 4 barges	
1	Steel	$11,873	$47,492	
2	Steel	12,500	50,000	
3	Steel	13,300	53,200	
4	Steel	15,939	63,756	
5	Steel	16,000	64,000	
6	Steel	10,750	43,000	lowest steel bid.
Open-tank creosoted Douglas fir		3,650	14,600	actual government cost.

It will be noted that the ratio of the actual government cost for open-tank creosoted wood to the lowest steel bid received is 1 to 2.95.

In 1911 the U. S. Engineer Office at Rock Island, Ill., received bids on 10 steel pontoons 38x14x3 ft. All bids were rejected and the pontoons built at the U. S. Dry Dock at Keokuk, Iowa, of open-tank creosoted yellow pine with flaring sides and concrete decks 38x14 ft. by 4 ft. 4 in. The bids for steel pontoons and the actual government cost were as follows:

Bidder No.	Point of delivery	Price each without 18-in. rope	Total cost of 10 pontoons	
2	Lockport, Ill.	$854	$41,170	lowest steel
3	Grafton, Ill.	1128	45,120	bid.
4	St. Louis, Mo.	1058	42,295	
1	St. Louis, Mo.	1121	50,820	
5	St. Louis, Mo.	1096	43,820	
Creosoted wood and concrete decks, Keokuk, Iowa.		313	12,529	actual cost.

It will be noted that the ratio of the actual government cost for open-tank creosoted wood with concrete decks to the lowest bid received on steel construction is 1 to 2.5.

In 1910 the U. S. Engineer Office at Rock Island, Ill., received prices on 10 steel barges 110x24x5 ft. The lowest bid received on barges built of steel and the actual cost of barges built of pressure creosoted Douglas fir at the U. S. Boatyard, Fountain City, Wis., in 1912 are as follows:

Bidder No.	Material	Price each	Total cost of 10 barges	
1	Steel	$ [illegible]	$ [illegible]	lowest steel
2	Steel	[illegible]	[illegible]	bid.
4	Steel	[illegible]	[illegible]	
Pressure creosoted Douglas fir		2,000	20,000	actual cost 1912

It will be noted that the ratio of the actual government cost for pressure creosoted wood to the lowest price received for steel construction is 1 to 2.25.

A. E. Hageboeck,
In Charge Creosoting Operations,
U. S. Engineer Office.

Rock Island, Ill., Dec. 1, 1912.

The Value of Foresight in Engineering

Sir—A long time ago—doesn't it seem so?—in Engineering News of Feb. 3, 1898, there was published an editorial with the alluring title "The Value of Foresight in Engineering." Its purport was that it was the duty of the engineer to look ahead in designing. One might even think from the article that it was fairly easy to do so. Is it so easy? For example, let us look backward and forward on a big job that our engineers began about a decade ago and that is now nearly done. I refer to the Panama Canal and the estimates of its traffic.

When the Isthmian Canal Commission of 1901 made its report, the probable traffic of the canal by 1914, a year that has now nearly rolled around, was estimated at 6,401,332 tons; a few months ago Prof. Emory R. Johnson (who made the first estimate) in his report on the proposed tolls for the canal put the estimate of traffic in 1914 at 10,500,000 tons. This shows clearly that forecasting the future is not at all easy, but very difficult. Still more difficult—if we take discrepancy as a measure of difficulty—does it appear if we take the estimates not of one man only but of several men. In the *Railroad Gazette* of Nov. 15, 1901, S. D. Webster, of St. Louis, gave some estimates of "outsiders" of the traffic of the canal ranging from the 300,000 tons by "those who have given the matter careful consideration" to the 8,000,000 tons of "most ardent promoters" and said that "Mr. Nimmo says, 500,000 tons." Mr. Webster himself used 4,000,000 tons as a "friendly" estimate. What a difference between 300,000 and 10,500,000!

Does not all this diversity of estimates of traffic, on the preparation of which lots of money was spent, go to show that forecasting the future is difficult?

A. P. C.

Nashville, Tenn., Jan. 27, 1913.

[Of course, forecasting the future is difficult (that is to say, it requires men of large ability and experience), but so is any important and intricate problem which the engineer has to solve difficult. If engineering work was so easy that any man who pursued a prescribed course of study could perform it perfectly, engineering would very soon become a skilled trade, not a profession.

What is of particular interest in our correspondent's letter, however, is that it illustrates most admirably the value and the importance of forecasting the future in engineering design, and, further, it shows how accurately it is possible by scientific methods to make such forecasts.

The quotations from the *Railroad Gazette* above should, of course, be left out of the account. Those were not estimates at all, but mere guesses, and are no more to be compared with Prof. Johnson's figures than one should compare the guess of a passer-by as to the cubic yards in a railway embankment to be built across a valley with the estimates of the engineers who make the survey for the line. Besides, some of the so called "esti-

mates" of future Panama Canal traffic circulated a dozen years ago were probably made to injure the canal enterprise.

The real comparison to be made, therefore, is of the first estimate of the canal traffic in 1914 made in 1899, which set its volume at 6,100,000 tons and the second estimate, made in 1912, based on statistics of the world's ocean traffic in 1910, which set the traffic of 1914 at 10,500,000 tons.

Assuming that the latter figure will be actually realized, it indicates that the estimate of 1899 erred somewhat on the side of conservatism, which is the sort of error an engineer prefers to make. To assume a parallel case: If an engineer for a projected railway line estimated its probable volume of traffic at a period 15 years in the future and the actual traffic proved to be about 50 per cent. in excess of his prediction, he would have done marvelously well.

It is, of course, recognized that any forecast of the future in the form of an estimate must be subjected to a large percentage of possible error. But so must a great many of the calculations which an engineer makes, even such supposedly accurate calculation as the stresses in a bridge truss.

The fact that a large percentage of error must be allowed for, however, is no argument against making the calculation or against its usefulness to the designer.—Ed.]

The Control of Banking over Industry

Sir—In your issue of Jan. 23 there are two articles which, while not intended to be so, might, I believe, very properly be considered together. One is the discussion by Messrs. Stillwell and Whinery on the "Status of the Engineering Profession." The other is your editorial on "The Control of Banking over Industry." Since Industry, either directly or indirectly, furnishes employment for the engineers, then, if Banking controls Industry, it necessarily follows that the bankers who control the banking must indirectly fix the status of the engineers.

Messrs. Stillwell and Whinery speak for a large number of engineers who regret that the engineering profession, as a whole, is not held in higher esteem, and wonder why. The answers, for there are doubtless many of them, are not simple, but it seems to me that your editorial gives a clue to at least one of them.

You say that it is "time for thinking men to inquire as to the conditions under which we are living and working." By all means, but, since the problems are so serious and important, let us be quite sure that we are thinking clearly and sanely. Let us really think; not merely think that we think. If we do think clearly and sanely, when we pursue our inquiries we shall find out a number of things which are not now visible to that public which "receives with no satisfaction these revelations of vast power and huge profits" which the bankers have acquired.

We shall see, I believe, first of all, the manifest injustice of placing these eminent gentlemen in the dual capacity of defendant and witness for the prosecution before an investigating committee which is itself both prosecutor and judge, in order to establish the preconceived proposition that certain alleged facts are evil in themselves or the result of evil conditions.

Referring specifically to your editorial; suppose the banking firm did "almost automatically" come into control of the property; was not the property both honestly and ably managed? If the common stock was issued largely on hope, was the public deceived or victimized when it fixed the selling price around $8 a share? And when, through the able management of the company, the price of the stock rose to above $90 a share, or, if that is considered too speculative, its present price of about $65, is the public, who is paying the bills for investigations without number, in need of either pity or protection?

If we "contemplate the long list of bankruptcies and receiverships" with an open mind and not with a "prejudice excited by flaming headlines" after due investigation, we shall see, I believe, that most of them occurred in companies that were less ably and, in many cases, less scrupulously managed, and among the companies that did not enter any combination and remained single and weak instead of recognizing the axiom that "in union there is strength."

You ask, "Whence come these enormous sums of money?" Do they not come primarily from the investors and depositors who place their money where they believe it will be both honestly and intelligently used? The gentlemen who testified before the Pujo Investigating Committee were entirely ready to admit that if this vast power got into the hands of bad or incompetent men the results might be disastrous; but the Committee utterly failed to show how such men could obtain control or how they could keep it if they did get it.

Credit is the most sensitive thing in the business world and it is a short memory that does not recall how quickly during 1906 and 1907 a run on a bank started on the slightest suspicion of either moral or financial weakness. The Carnegie Trust Co. and Mr. Morse's shipping combination, to mention only two instances, were institutions of no small financial strength which went to pieces when those in control were tried in the balance and found wanting.

You say that "probably the distinguished financiers who testified before the Pujo Committee would claim that the men who wield this enormous power are such good men that nothing of this unrighteous sort ever actually happens," and suggest the possibility that others holding high executive positions might tell a different story; but I believe it is also indisputable that, if there were a different story to be told, the Committee had as its counsel a man who was as able and willing to find it out as any counsel that any committee ever had.

These gentlemen who are alleged to form the "Money Trust" do wield enormous power and have made profits beyond the dreams of avarice; but that the power and profits are the result of anything but a fortuitous combination of great ability, unquestionable integrity and favorable opportunity is not yet an established fact. I believe it to be easily demonstrable that the profits bear a no greater proportion to the capital invested that have been repeatedly made during the same length of time in gold or oil or copper or even in New York real estate; and I have recently been told on the best of authority of a gentleman who enjoys an income of $80,000 a year derived from an original investment of $10,000 in a manufactured article in common use which, on a percentage

basis, makes the profits of even the most successful banks look small by comparison.

Now what has all this to do with the status of the engineering profession? Simply this, that the engineering profession will never be recognized as Messrs. Whinery, Stillwell and others wish it to be recognized, will never get the position that they want it to have until its members show their ability to think clearly and sanely and broadly on other matters than engineering alone.

At a dinner in New York a few nights ago, Col. Goethals was hailed, and I believe rightly so, as the greatest engineer of the present day. Will anybody say that it was his engineering skill alone that won him his fame? Was it not also his ability to think clearly and broadly and quickly on all the administrative and executive problems that were presented? We can not all be Col. Goethals, but we can all do our best to think clearly and broadly and sanely on the very pressing problems of the day and to help others to do so. When the engineering profession takes this kind of leadership, its status will be recognized without the aid of legal enactment.

ALEX. L. BRODHEAD.

Catasauqua, Penn., Jan. 31, 1913.

[Our correspondent asks the question, "Suppose the banking firm did 'almost automatically' come into control of the property, was not the property honestly and ably managed?"

In reply it may be said that the very essence of the criticism is that in too many cases the properties have not been honestly managed, but have been run for the benefit of the inside interests in control, with little regard to the interest of the real owners, the holders of the bonds and stocks.

We need not take space to enumerate specific instances. The financial history of the past dozen years is full of them. As for "the companies which did not enter into any combination and remained single and weak," there are also conspicuous instances of concerns which stood outside the combination and have proved their ability to compete with it and prosper to a greater degree than the combination.

Concerning the source of the enormous deposits in the banks, one important fact developed by the insurance investigation a few years ago was the huge amount of cash carried by the insurance companies in the shape of bank deposits which might have been invested for the benefit of policy holders.

We said in the editorial referred to that the banker as the trustee of the business communities' reservoir of capital and credit performs a most valuable public service, and one deserving ample compensation. It is when he uses this trust for his own undue profit or when he uses his great powers to break one concern and build up another which ought to have equal opportunities for success that he becomes an element of as great danger to the public welfare as those who attack property rights or preach the doctrine of anarchy.—ED.]

NOTES AND QUERIES

Erratum In the article on "Expanded Metal Lath" in our issue of Jan. 24 it was stated (p. 168) that for ceiling work there was no trouble with supports spaced 12 in. apart. This should have read 24 in. apart.

In our issue of Dec. 26, in the course of an article on "Use, Waste and Metering of Water in Chicago," the water consumption of Providence was given as 40 gal. per capita, on the authority of the report, which formed the basis of the article just named. Chas. G. Richardson, of Providence, R. I., writes us that the latest records of the Providence water department show the per capita consumption to be 65 gal. daily.

F. C. W., Sheridan, Wyo., writes: "Noncorrosive, corrugated iron pipe is being used a great deal for flumes and siphons, in the West. It has been suggested to extend its use to storm sewers instead of using vitrified sewer pipe. If engineers have used this iron pipe for storm sewers, it would be most interesting to learn with what success."

Elimination of Timbering in Rock Tunneling: A Proposal

BY JOHN F. O'ROURKE*

Rock tunneling for railways or other purposes is difficult and expensive when the rock does not possess sufficient solidity to prevent falling of the roof when unsupported. In such cases the roof must be timbered, i.e., held up by timber supports, varying in amount from simple conditions, when a few posts here and there will do, to conditions of "heavy" rock, when it is necessary to use close segmental arching of heavy timber from side to side. The cost of the timber, the expense of preparing the bearings for it in the rock, and the time lost in placing it are items in the additional expense of tunneling under these conditions. Anything that can be done to reduce or avoid the necessity for timbering is of the greatest importance in the art of tunneling.

The accompanying drawings show a new method of placing lining in a loose rock tunnel, which avoids the necessity for timbering and at the same time produces a tunnel structure equal, if not superior, to anything heretofore built or proposed. The cost of the lining built by this method is no greater and probably less than that built in the ordinary way. The method depends on the use of the O'Rourke interlocking concrete blocks which were described in ENGINEERING NEWS, Nov. 28, 1912, p. 1022. The shape of these blocks is such that they can be set in place and built into an arch without centering, and form a complete and secure arch as soon as keyed up. Thus they make it possible to keep the lining built in a fully supporting condition close up behind the working face, provided the individual operations are carried on in the order and manner described below.

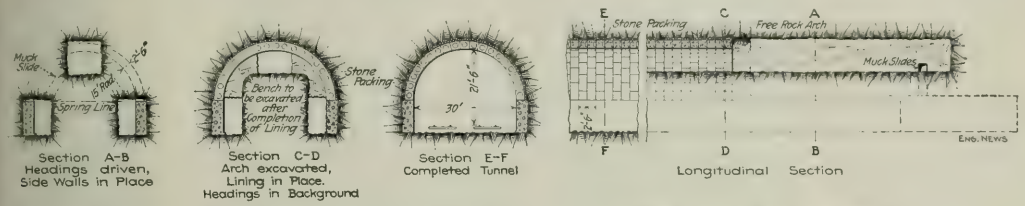
An important part of the economy in using this block method of lining is the avoidance of the additional excavation necessary for placing the timbering outside the lining; in the case of full timbering this amounts to 15% or more. Moreover, if side posts are not used to carry the timber arch, benches have to be prepared in the rock at the spring line. This operation, which is both slow and costly, is, of course, eliminated in the proposed method.

As illustrated in the drawings herewith, the method employs two side bottom headings driven at the grade of the bottom of the tunnel, and a center top heading driven along the top of the arch. The bottom headings are carried along in advance of the top heading, and the side walls are built up to the spring line. At intervals openings are made between the top and bottom headings

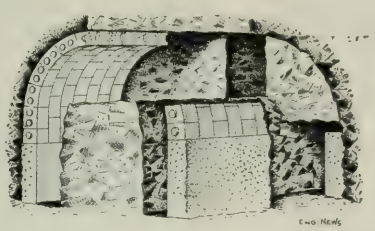
*President, O'Rourke Engineering Construction Co., 345 Fifth Ave., New York City.

for the disposal of the excavated material of the top heading through the bottom headings. Following the heading work, the rock between center and side headings along the roof is broken down, in lengths as short as the character of the rock demands, and the rings of lining blocks are erected immediately behind this excavation. As soon as each ring is erected, the packing between this ring and the overlying rock is done, so that the ring carries its part of the roof. Thus, except in the headings, the only unsupported roof is over the short length of arch excavation, which can always be kept so short that the roof will be stable without timbering.

In the case of very bad rock, short posts from the bench to the roof can be put in wherever necessary and the rock cleared away for each lining block separately. In this case, as each block is placed it would be supported with posts when necessary until the ring is completed, and the roof packing over it would be done as the erection of the ring goes on. When all the blocks of the ring are in



Sketches Showing Method of Tunneling in Heavy Ground without Timbering, Using Interlocking Concrete Blocks



place, the ring can take its load and the posts may be removed.

In the method of tunnel construction proposed in this article, the central core of the tunnel excavation is left in place, as the sketches show, until the lining is completed. Thus it affords a firm support during the difficult part of the operation; and the amount of excavation during the real tunneling portion of the work is greatly reduced since the removal of the bench is deferred and can be done later in the completed tunnel under the most favorable conditions.

As the muck from the top-heading excavation is removed through the bottom heading, a way is open for bringing in material and for carrying a traveler to erect the lining, free from interference with the work of excavation or with any of the other operations incidental to the tunneling. The traveler can be made as wide as the arch, and if necessary may be extended down into the side headings to the spring line, so that the entire arch is accessible from the traveler and the hoisting and setting machinery of the traveler can be designed to reach all the parts of the arch. An upward-projecting metal screen carried at the front of the traveler will protect the forward face of the concrete-block lining from any injury by the blasts required in removing the wedge of material between top and side headings.

The principal feature of the O'Rourke concrete block, as already described in Engineering News (Nov. 28, 1912, page 1022), is that each block has two or more projections on one side face with corresponding recesses in the opposite face, so spaced that the blocks in successive rings break joints and thus lock the rings together securely, the projections and recesses furthermore being of such length and depth as to leave an open joint space between faces of the blocks. The outer edges of all the joints are provided with moldings to reduce the size of the joints there and serve to retain a waterproofing preparation for preventing the entrance of water or other material from the outside. The blocks are placed without mortar at the time of setting, and the longitudinal joints are wedged so as to be capable of transmitting arch thrust even before the joints are filled. The subsequent joint filling may be done by any one of many different methods.

As the projections and recesses of these blocks fit together snugly, any one block, when set, is carried by the previous ring, and therefore centering or falsework is unnecessary. This is the feature utilized in the method proposed by the present article.

The manufacture of the blocks in advance at a plant outside of the tunnel gives greater economy than is possible when concrete is mixed and placed in forms inside the tunnel. At the same time a perfect concrete is insured by reason of the ease with which the individual blocks may be inspected and tested. Incidentally, all possible troubles from shrinkage of the concrete in drying are avoided, since the shrinkage of the individual blocks has already taken place before they are set in the tunnel.

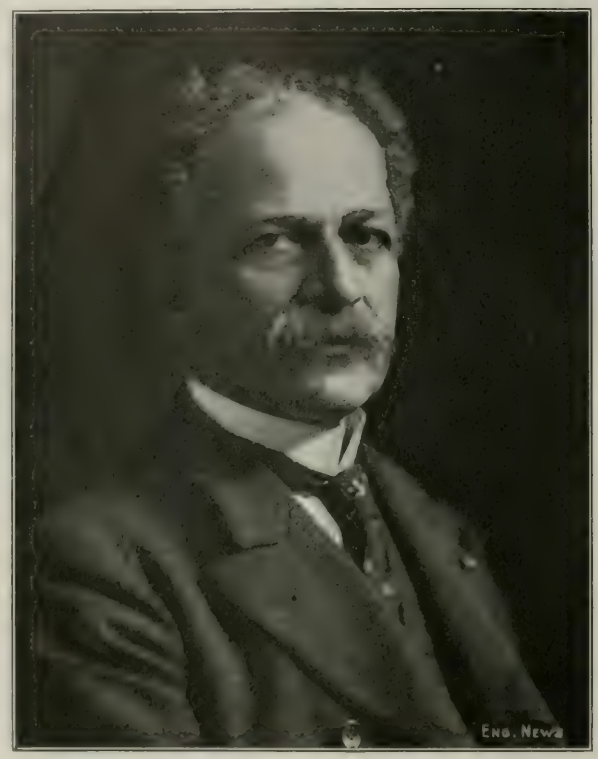
Tunnels in firm clay so large as to require a roof shield like those in Boston Harbor can be driven by the method described in this article without roof shield or timbering. The method would also be capable of use in softer material, or in sand, but here each individual case would have to be considered by itself, and at present only the general statement can be made that a reduction in amount of timbering and an increase of speed would be attainable by using this method.

It might be interesting to state that, in the writer's experience, tunnel timbering has cost his company approximately $100 per M. ft. b.m. in one case. In proposing very recently to build some rock tunnels, the bids for the tunnels timbered and lined in the usual way were higher by $65 per lin.ft. than for the same tunnels built without timbering by the help of the concrete-block lining as described.

D. McN. Stauffer

David McNeely Stauffer, a member of the editorial staff of ENGINEERING NEWS for nearly 25 years, died at his residence in Yonkers, N. Y., on Wednesday, Feb. 5, after an illness of many months' duration.

Mr. Stauffer was born in the village of Richland (now Borough of Mt. Joy), in Lancaster County, Penn., Mar. 24, 1845. His father, Jacob Stauffer, was a solicitor of patents and a naturalist of some fame, numbering among his friends such men as Asa Gray, Agassiz, and Joseph Henry. The Stauffer family was of Swiss origin and has been traced back to Thun, Switzerland. On his mother's side, D. McN. Stauffer was descended from the McNeely and Knox families, representatives of whom came to America from Scotland and Northern Ireland about 1720. Jacob Stauffer removed to Lancaster, Penn., in 1858, and his son David entered the secondary schools of that city. He graduated from the Lancaster High School in 1862, passing through the four classes in three years and in that period maintaining the head of his class. In accordance with an agreement between the city of Lancaster and the old Franklin and Marshall College, there located, the city was permitted to send one student a year to the college free of tuition fees. This scholarship went to the graduate of the High School who had maintained leadership of his class for his four-year term. In accordance with this, David McN. Stauffer was granted this scholarship.



Dav McN. Stauffer

But in those stirring days of the Civil War it was difficult for an active, energetic lad to fix his mind on studies. Although only 17 years old, David Stauffer enlisted, on Sept. 12, 1862, in the Second Pennsylvania Emergency Regiment, and was present at the battle of Antietam under Gen. Reynolds. At the end of the campaign he was discharged with the regiment and entered the Freshman class of Franklin and Marshall College.

On June 15, 1863, he again enlisted as Independent Battery I, Pennsylvania Light Artillery, under Capt. R. G. Navin. This battery was being organized at Camp Curtin, near Harrisburg, at a time when Lee's invasion of the North, which culminated at the battle of Gettysburg a fortnight later, was arousing all Pennsylvania. The battery did duty near Carlisle and was then sent to Philadelphia for a time to suppress expected riots, and finally to West Virginia. Mr. Stauffer was mustered out of the battery as a corporal, at Harrisburg, Penn., on the expiration of his six months' enlistment, Jan. 9, 1864.

On Feb. 5, 1864, he received, through the recommendation of Admiral David D. Porter, an appointment as master's mate in the U. S. Navy, taking the place of Vincent Porter, son of the admiral, whose death had just occurred. Mr. Stauffer was assigned to the U. S. gunboat "Alexandria," which was commanded by David Porter Rosenmiller, a cousin of the admiral. By virtue of being the only other line officer on board, Mr. Stauffer, although not yet 19 years old, at once became executive officer.

The "Alexandria" was ordered to join the First Division of the Mississippi River fleet, with headquarters off Donaldsonville, La. She was engaged here in fighting guerillas, chiefly along the coast, and entered upon the Red River campaign, but was sent back to her station owing to insufficient protection to her men.

On Apr. 1, 1865, Mr. Stauffer was promoted to the rank of Ensign, U. S. N., and from July 1 to Nov. 1 he was in command of the "Alexandria." In June he witnessed the surrender of Gen. Kirby Smith, the last Confederate commander to surrender. On Nov. 5, 1865, Mr. Stauffer was honorably discharged from the U. S. Navy with the "thanks of the Department for faithful and honorable service."

It was hardly to be expected that the youth of 21, who had carried responsibilities such as are usually borne only by men of mature years, had occupied positions of command and had lived for the better part of three years in the midst of war's excitement, would return to the quiet life of a student and finish his college course.

The active life of the civil engineer had much more attraction for him, and on the same day that he was discharged from the Navy he began work on the surveys for

the Columbia & Port Deposit R.R., in eastern Pennsylvania as a rodman under John A. Sheaff. He remained with the company until May 30, 1868, when he was appointed assistant engineer on surveys and construction for the Philadelphia & Reading R.R. On Aug. 12, 1869, at the age of 24, he was promoted to the position of division engineer, and put in charge of construction of the Allentown R.R.

The boom in railway construction which took place at the end of the Civil War had a collapse in 1870, and the Reading company suspended work on its extensions. Mr. Stauffer then took a position, on Aug. 3, 1870, as assistant engineer on the South St. Bridge, which the city of Philadelphia was then building over the Schuylkill River, with Strickland Kneass as chief engineer. At that time the use of compressed-air caissons for sinking foundations was unknown in this country, but had been practiced in France. Mr. Stauffer took up the study of French in order to post himself on what had been done in this field and be able to apply his knowledge to the construction of this bridge. At this time he wrote an article on "The Use of Compressed Air in Tubular Foundations," which was printed in the *Franklin Institute Journal* and was republished by the Institution of Civil Engineers of London. It was the first detailed description of compressed-air foundation work printed in the United States, and was used as a textbook for a time in some of the engineering schools.

The South St. Bridge cost $800,000, and its construction dragged along very unsatisfactorily owing to the difficulties of the work and the bankruptcy of the contractor. On June 27, 1874, Mr. Stauffer accepted a position as assistant chief engineer on what is now the Bound Brook Line of the Philadelphia & Reading R.R. between Philadelphia and New York, and was assigned to special charge of the Delaware River Bridge on that line. Meanwhile, the affairs of the South St. Bridge were still in suspense, and as the Bridge Commission would not accept Mr. Stauffer's resignation, he still retained charge, on full salary, of the adjustment of the Commission's differences with the contractor's estate until the final completion of the bridge in December, 1875.

On June 1, 1876, the Bound Brook Line being completed, Mr. Stauffer left the service of the Reading company and was for a time engaged in private work, making bridge plans for the Philadelphia Survey Department. In January, 1877, he was a candidate for city engineer of Philadelphia, but was beaten after a close fight. On Apr. 15, 1877, he entered the service of the Philadelphia Water Department as engineer in charge of construction. He built the Frankford reservoir and pumping stations and other important works, and also engaged in a certain amount of private engineering practice.

At the close of 1879, Mr. Stauffer ventured into the contracting field in partnership with R. A. Malone, a well known Pennsylvania contractor. The firm was awarded the contract for what proved to be one of the most difficult pieces of tunnel work that had at that time been undertaken, the Dorchester Bay Tunnel at Boston for the discharge of sewage. The tunnel was an inverted siphon about 9000 ft. long, with its bottom 180 ft. below sea level. One shaft was sunk through soft ground and quicksand almost its entire depth. The leakage through the rock roof into the tunnel was so great that the pumping plant was enormous and involved heavy expense.

The venture was a disastrous one for the contractors and would have been even more disastrous except for the discovery by Mr. Stauffer at the height of the difficulties that the seamy character of the rock through which the tunnel was to be driven was known to the city authorities, to some extent at least, but had not been made clear to the bidders on the contract. This led to a settlement which enabled the contractors to complete the work. By December, 1880, the tunnel was finished except the brick lining, and Mr. Stauffer, who had suffered several attacks of fever due to the conditions of living on the work, sold his interest in the contract to his partner.

Mr. Stauffer returned to Philadelphia and was for two years with the Philadelphia Bridge Works, owned by Cofrode & Saylor. He resigned his position in September, 1882, and removed to New York City, where he opened an office for private practice as an engineer, renting quarters in the Tribune Building from Geo. H. Frost, then publisher and sole proprietor of ENGINEERING NEWS. The acquaintance thus formed resulted in the purchase by Mr. Stauffer, in January, 1883, of a part interest in ENGINEERING NEWS, of which he became the editor. Of what Mr. Stauffer brought to the journal at that time, Mr. Frost himself has written in some unpublished reminiscences:

> The debut of Mr. Stauffer gave to the service of the paper a real engineer who was competent to decide upon the merits of engineering work of which we might be called upon to publish descriptions. Mr. Stauffer was well known and was already very popular where known; he was an expert draftsman and his industry in this line soon became apparent in the paper.

It was Mr. Stauffer's notable ability as an artist that first suggested to Mr. Frost the value of his services as an editor. Those who possess the back volumes of ENGINEERING NEWS for the years 1883 to 1887 will find there many sketches made by Mr. Stauffer. His work with pencil, pen and brush, in fact, although as an artist he was wholly self-taught, was all his life long a source of pleasure to himself and to his friends.

Until the advent of Arthur M. Wellington to the editorial staff in 1887, Mr. Stauffer was the editor-in-chief of ENGINEERING NEWS. With the coming of Mr. Wellington's forceful personality, Mr. Stauffer, with characteristic modesty, yielded the chief responsibility to his associate, though his conservative good judgment was a most valuable counterbalance to Mr. Wellington's enthusiasm.

His work as editor of ENGINEERING NEWS continued to some extent down to his final severance from the paper when he sold his interest in it some six years ago.

During the later years, however, numerous other interests made demands upon his time. In fact, while Mr. Stauffer, as may be gleaned from the above account, did conspicuously good work during his 18 years of activity as a civil engineer, his temperament was essentially that of the artist and literary man. At a comparatively early age he was even more widely known as an authority on antiquities and historical lore than as an engineer. He wrote himself of his work in this field:

> I was probably born a collector of "curios," commencing with coins and postage stamps. In 1876 I fell heir to the papers of a remote relative, who was a Chief Justice of the Superior Court of Pennsylvania and prominent in the Revolution. I found about two tons of papers stowed away and carefully preserved in his old house, and the "pickings" from this formed the nucleus for a valuable collection of Colonial

and Revolutionary autographic matter, numbering about 30,000 letters and documents. I then began gathering portraits to illustrate autograph letters; and about 1880 I commenced the private illustration of books, chiefly American and historical in character, by the insertion of portraits, views, letters and documents, and pen and ink and water-color drawings. A "History of Philadelphia," thus illustrated, now (1898) has about 18,000 prints, etc., inserted in it, and is said to be the most elaborately and profusely illustrated local history in the United States. In all about 40,000 prints, etc, are thus disposed of in my collection. Included is a "History of Engraving," illustrated by about 7000 examples of the work of 2800 different engravers, dating back to 1480, and including the etchings of many famous artists. There is also a unique collection of the works of American engravers and lithographers, covering the work of nearly 700 different men. Other items in my collection are old arms, rare china, rare books on America, etc.

I have made many of the illustrations for these books; and have designed about 50 book plates for friends; and am credited with being one of the first in America (1872) to introduce what is now called the "pictorial" style of book-plate.

In 1905 I wrote the first work ever published upon American engravers on copper and steel, accompanied by a descriptive list of about 3000 plates engraved by the earlier American engravers. This work was published by the Grolier Club, New York.

Without doubt Mr. Stauffer's collection of historical documents and relics was one of the most valuable and intelligently gathered in America. Begun in early life as a hobby and a relief from the active work of his profession, it became in later years an occupation which enlisted all his energies.

His Alma Mater, Franklin and Marshall College, gave him the degree of A.M. in 1881 and the degree of Doctor of Literature in 1904.

In March, 1891, Mr. Stauffer, as one of the editors of ENGINEERING NEWS, was invited to accompany the Warner Miller party to the Nicaragua Canal work. The party sailed from New York on the steamer "Aguan" and was shipwrecked on a coral reef in the Carribean Sea, near Roncador Island, on the voyage to Greytown. Among the members of the excursion party were the late G. Hilton Scribner, of Yonkers, N. Y., and his oldest daughter, Florence. The intimate associations in connection with the shipwreck and final rescue culminated in a romance and the marriage of Mr. Stauffer and Miss Scribner on Apr. 19, 1892. Their home in Yonkers has been the resort of a choice circle of friends and noted for its gracious hospitality.

The list of societies and clubs of which Mr. Stauffer was a member is a very long one, including not only the leading engineering societies, such as the American Society of Civil Engineers and the Institution of Civil Engineers of Great Britain, but famous historical societies and such bodies as the Loyal Legion. In the early volumes of the American Society *Transactions*, from 1876 to 1883 will be found some notable engineering papers from his pen.

Mr. Stauffer was always interested in public affairs as an engineer and a citizen. He was active in charitable and philanthropic works in Yonkers during the later years of his life.

He was appointed by Gov. [illegible] as one of the members of the Palisades Park Commission at its establishment, which has had for many years the work of preserving the Palisades on the Hudson River from destruction. Mr. Stauffer was long the Vice-President and Treasurer of this Commission, the members of which gave their services without compensation, and have performed a most important public work.

No review of Mr. Stauffer's life could be complete without reverent and loving mention of his fine personality. He was a man who made friends all his life long. The gentle art of making enemies was one accomplishment of which he never learned even the rudiments. His genial, sunny disposition and his wonderful fund of reminiscence and anecdote made him a center of attraction in every circle. Those who were attracted by his outward manner were held to him in bonds of friendship when they came to know him intimately and appreciate his sterling worth as a man.

❖

The Hudson River was finally closed to navigation on Feb. 6, after 317 days of open water, one of the longest periods on record.

A Broken Cross-head Guide on a locomotive drawing the Twentieth Century Limited of the Big Four Ry. was discovered when the train entered the station at Middletown, Ohio, in time to save a wreck. B. D. Butler, a member of "Engineering News" staff, at its Chicago office, was standing on the station platform at Middletown, waiting to take the train and caught a glimpse of the broken guide as the locomotive passed him. He ran up the platform and reached the locomotive just as the go-ahead signal was given and was unable to get the attention of engineer or fireman. He was fortunately able to reach the conductor and warn him before he train started.

Inductive Interference with Telephone lines by high-tension power lines is being studied by a joint committee authorized by the Railroad Commission of California. This committee is made up of representatives of the various transmission-line, electric-railroad and telephone companies in California, and of the Railroad Commission itself. It has undertaken a series of tests as a part of its investigation.

The Proper Method of Valuing Private Water-works for purchase by New York City is to be reported on by a committee appointed by Mayor Gaynor, as follows: Lawrence Godkin, Eugene H. Outerbridge and Nelson P. Lewis. The latter is chief engineer of the Board of Estimate and Apportionment. The companies involved supply various outlying sections of the city. What is wished of the committee is thus stated by Mayor Gaynor:

> What we particularly with your judgment upon is the method of valuing such companies for the purpose of taking them over by the city. The basis of such valuation needs to be considered and stated. For instance, it is easy to say that these companies are supplying water in sections of the city which are rapidly growing in population, and that, therefore, their net income will grow with the growth of population. But, on the other hand, we have to consider that all public-service corporations are subject to the State Legislature, and that it will be presumed that the Legislature would see that the rates were so regulated that not more than a proper return for the capital invested would be allowed. A variety of suggestions like this will occur to you as readily as to me.
>
> I have considerable anxiety about this matter and I shall be glad that you all serve on this commission, even at some inconvenience to yourselves.

New Slides in Culebra Cut, Panama Canal—On the afternoon of Jan. 16, the Cucuracha slide, located on the east bank of the canal again renewed its activity and by the morning of the 17th, the moving mass of material had completely covered all tracks in the canal, except one next the west bank, making five tracks in all covered and destroyed by the slide. A train of cars, standing at the two shovels which were excavating the toe of the slide, was caught by the rapidly moving material and two cars were derailed and buried. A new track was built around the toe of the slide and two steam shovels commenced digging the slide away before noon of the 17th.

This recent movement of the slide carried material to a greater distance across the canal than in any other case, except the original movement of the same slide in 1907. It is estimated that in all about 400,000 cu.yd. of material will have to be removed from this slide before the end of the present fiscal year.

On the night of January 19-20, the rock bluff, some 300 ft. in height, on the east bank of the canal, immediately south of Gold Hill, broke away at a distance of several hundred feet to the east of the canal, and a large part of the broken material moved into the canal, entirely covering all tracks to the east of the center line. The total amount of material in the broken rock portion is estimated at about 500,000 cu.yd.; but this bluff, which was quite flat on top, served to protect the movement into the cut of a clay top-covering

several feet in thickness, which lay to the eastward of it, some of which will now undoubtedly move into the cut, so that it is estimated that the probable effect of the break just described will be to add not less than 1,000,000 cu.yd. to the amount which will have to be removed from the cut by means of steam shovels.

Immediately south of the recent break is the "Purple Hill" by which the moving clay of the Cucuracha slide was divided in two, and which has served very effectually, on account of its superior height, to hold back a large amount of top-covering, which would otherwise have come into the canal. There are indications that the "Purple Hill" has been weakened on its north face by this break, and should this small hill break away and come into the cut, it would probably release an amount of moving material, which would aggregate between 500,000 and 1,000,000 cu.yd. additional to that previously described.

A new slide has recently developed in the east bank of the canal, about 1000 ft. north of the suspension bridge. The amount of material in motion is estimated at 125,000 cu.yd., the greater part of which consists of rock. ["Canal Record," Jan. 22].

According to newspaper dispatches, slides involving 3,000,000 cu.yd. were moving into the cut on Feb. 7. It was stated, however, that these would not delay the opening of the canal.

A Passenger Train Derailment on the Houston & Texas Central R.R., near College Station, Texas, on Feb. 1, involved the death of the engineer and fireman and injury to four other persons.

At a Grade Crossing on the West Jersey & Sea Shore R.R., near Absecom, N. J., on Feb. 6, an automobile truck was struck by an express train and demolished and three men on the truck were killed.

While Placing a Large Gate Valve for a 42-in. water main at Detroit, Mich., on Feb. 4, one of the supporting timbers failed, allowing the valve to fall into the trench. Three laborers were killed and six badly injured in the accident, according to press reports.

A Sawdust Explosion in the box factory of the H. H. Sheip Mfg. Co., of Philadelphia, Penn., on Feb. 5, injured six of the employees, one fatally. A bolt falling among the cutters on a sawdust grinding machine is reported to have caused a shower of sparks that served to ignite the particles of sawdust in the air. Explosions of similar nature are of common occurrence in coal mining and have occurred also in flour mills, candy factories and other industries producing inflammable dust.

A Collision on the Boston Elevated Railway on Feb. 4, resulted in injuries to four passengers. The accident occurred on a long curve on Commonwealth Ave., Allston, and was an indirect result of a tie-up on the line, caused by an earlier derailment. There was apparently some misunderstanding of the temporary emergency orders so that two trains, one carrying passengers and the other empty, came together. The claim was made that because of the curve, the two motormen were not aware that they were on the same track until too late to avoid a collision.

A Loan Collection of prints and books on early railroading is on exhibition at the New York Public Library, through the courtesy of the owner, William Barclay Parsons. The period covered is from the development of Trevithick's locomotive in 1804 to the commencement of the line between Manchester and Liverpool in 1830.

PERSONALS

Mr. G. A. Mitchell, hitherto Master of Bridges and Buildings of the Grand Trunk Ry., at Toronto, Ont., has been promoted to be Superintendent of Bridges and Buildings.

Mr. J. T. Gillick, formerly Superintendent of the Chicago, Milwaukee & St. Paul Ry., at Aberdeen, S. D., has been promoted to be Asistant to the General Manager, at Chicago, Ill.

Mr. W. E. Higgins, Assistant to the General Manager of the Lackawanna & Wyoming Valley R.R., has been made Acting Vice-President and General Manager, succeeding Mr. C. F. Conn, resigned.

Mr. R. G. England has become associated with Mr. William G. Fargo, M. Am. Soc. C. E., Civil and Hydraulic Engineer, Jackson, Mich., as a member of the firm to be known as the Fargo Engineering Co., of Jackson.

Mr. W. E. Costello, Superintendent of the Central Vermont Ry., at New London, Conn., has resigned to become Superintendent of the Houston & Texas Central R.R., at Ennis, Tex. He is succeeded at New London, by Mr. J. McCraw.

Mr. Edward C. Heald, M. Am. Soc. C. E., formerly Chief Structural Engineer, Office of the Supervising Architect, Treasury Department, Washington, D. C., has opened an office at 1516 H St., N. W., Washington, as a consulting engineer.

Mr. P. C. Hart, former General Superintendent of the Chicago, Milwaukee & Puget Sound Ry., at Seattle, Wash., is now General Manager of the Chicago, Milwaukee & St. Paul Ry lines east of the Missouri River, with offices at Chicago, Ill.

Mr. A. G. Holt, M. Am. Soc. C. E., formerly Division Engineer of the Chicago, Milwaukee & Puget Sound Ry., at Spokane, Wash., has been promoted to be Assistant Chief Engineer of the Chicago, Milwaukee & St. Paul Ry., with headquarters at Chicago, Ill.

Messrs. W. W. Huff, formerly Assistant Bridge Engineer of the Kansas City Terminal Ry., and E. B. Murray, formerly Chief Engineer of the Kaw Valley Drainage Board, announce the formation of the firm of Huff & Murray, Missouri Savings Bank Bldg., Kansas City, Mo.

Mr. John J. Lyons has been appointed Chief of the superintendent department of the Ceresit Waterproofing Co., Chicago, Ill. This is a newly established branch of the company, which will undertake to superintend waterproofing work done by contractors for architects or engineers.

Mr. Robert I. Randolph, Assoc. M. Am. Soc. C. E., whose resignation as Secretary of the Rivers and Lakes Commission of Illinois was announced in our issue of last week, has withdrawn his resignation, pending the reorganization of the commission under the new state administration.

Mr. Nathan B. Payne, Jun. Am. Soc. M. E., formerly Manager of the governor department of Manning, Maxwell & Moore, New York City, has been appointed Manager of Sales of the Davis-Bournonville Co., manufacturers of oxy-acetylene welding and cutting apparatus, New York City.

Mr. Clifford B. Moore, Assistant Engineer, Topographical Bureau of the Borough of Queens, New York City, has been promoted to Chief Engineer at a salary of $6000 per annum. Mr. Moore entered the city service in 1900 as a transitman with engineering staff of the Department of Finance.

Mr. Devoe P. Hodson, Municipal Court Judge at Buffalo, N. Y., has been appointed a member of the Public Service Commission of New York, Second District, at a salary of $15,000 per annum. Mr. Hodson's salary as Judge has been $3000 per annum. He succeeds Mr. John B. Olmstead, of Buffalo.

Mr. Shirley Baker, M. Am. Soc. C. E., for a number of years Manager of the pipe department of the Redwood Manufacturers Co., San Francisco, Calif., has been appointed Construction Engineer of the Panama-Pacific International Exposition, the plans for which are described on another page of this issue.

Mr. Samuel P. Senior, Assoc. M. Am. Soc. C. E., Engineer and Superintendent of the Bridgeport (Conn.) Hydraulic Co., has been promoted to be Vice-President and Chief Engineer. Mr. Senior graduated from Lehigh University in civil engineering in 1897. He was famous as a foot-ball player during his college days.

Prof. Thomas M. Roberts, Assoc. Am. Inst. E. E., has resigned his office as head of the electrical engineering department at Delaware College to become Chief Electrical Engineer of the Edison Storage Battery Co., Orange, N. J. Prof. Roberts was formerly Engineer at the Boston, Mass., office of the General Electric Co.

Mr. G. C. Jones, formerly General Manager of the Central Vermont Ry., has been made Vice-President in charge of construction, operation and maintenance, with headquarters at Montreal, Que. Mr. Jones was at different times General Superintendent of the Central Vermont Ry. and Division Superintendent of the Grand Trunk Ry

Mr. Willis Ranney, formerly of Bartlett & Ranney, San Antonio, Tex., sailed from New York City, Feb. 8, for Barcelona, Spain, where he will become a member of the engineering staff of the Ebro Irrigation & Power Co., under Mr. F. W. Abbott, M. Am. Soc. C. E., Construction Manager fir the F. S. Pearson Engineering Corporation

Mr. Walter E. Holland, Assoc. Am. Inst. E. E., Chief Electrical Engineer of the Edison Storage Battery Co., Orange, N. J., has resigned to become Research Engineer with the Anderson Electric Car Co., Detroit, Mich. Mr. Holland has been associated with the Edison companies for the past ten years. He is succeeded by Mr. Thomas M. Roberts, as noted elsewhere.

Mr. Leonard Goodwin, recently associated with the Boston office of Lockwood, Green & Co., Mechanical Engineers, Bos-

ton, Mass., has been appointed Manager of the Chicago office of the firm, in the First National Bank Bldg., Chicago, Ill. Mr. Harold V. Coes, formerly Manager at Chicago, has been transferred to the Boston office to assume charge of special work.

Mr. Arthur M. Shaw, M. Am. Soc. C. E., has resigned as Engineer and Resident Manager of the Phillips Land Co., New Orleans, La., to accept a similar position with the New Orleans Lake Shore Land Co. Prof. W. B. Gregory, M. Am. Soc. C. E., of Tulane University, is Consulting Mechanical Engineer for the company, whose offices are at 1003 Hibernia Bank Bldg., New Orleans, La.

Mr. Conrad D. Trubenbach, recently with the Public Service Commission of New York, First District, and formerly connected with the Pennsylvania R.R. East River tunnel work, has become associated with Mr. Daniel R. Bacon, Assoc. Am. Inst. E. E., Consulting Engineer, 30 Church St., New York City. Mr. Trubenbach was also connected at different periods with the New York Central & Hdson River R.R., on its marine development work in New York Harbor and with the Rapid Transit Commission of New York City.

Mr. M. A. Long, M. Am. Soc. C. E., Architect of the Baltimore & Ohio R.R., Baltimore, Md., has been appointed Assistant to the Chief Engineer of the entire Baltimore & Ohio R.R. System. Mr. Long is in his 38th year. He received a public school education at Dayton, Ohio, and studied architecture through correspondence courses. He obtained a position in the architectural and engineering department of the Baltimore & Ohio R.R. in 1899, and was rapidly promoted to the position of Architect of the company within five years. Mr. Long is also a member of the American Institute of Architects and is Vice-Chairman of the building committee of the American Railway Engineering Association.

Mr. F. A. Gaby, Assoc. Am. Inst. E. E., who has been Acting Chief Engineer of the Hydro-Electric Power Commission of Ontario since the resignation of Mr. P. W. Sothman, M. Am. Inst. E. E., last July, has been permanently appointed Chief Engineer. Mr. Gaby graduated from the University of Toronto in 1903, and after several years with the General Electric Co. of Canada, as Erecting and Supervising Engineer, he went to Winnipeg, Man., where he was Assistant Engineer on the work of preparing the designs and specifications for the municipal hydro-electric plant, described in our columns in the issue of July 4, 1912. Mr. Gaby has been with the Ontario Hydro-Electric Power Commission since 1907, and was appointed Assistant Chief Engineer in 1908.

Mr. W. H. Penfield, M. Am. Soc. C. E., formerly Assistant Chief Engineer of the Chicago, Milwaukee & St. Paul Ry., has been appointed Assistant to Vice-President David L. Bush, with headquarters at Chicago, Ill. Mr. Penfield began his engineering experience with the Buffalo, Rochester & Pittsburgh Ry., and was soon promoted to be Resident Engineer. He left this railway in 1899 to become Resident Engineer and later Locating Engineer of the Chicago, Milwaukee & St. Paul Ry. For three years, 1902-1905, he was engaged in location surveys for the Western Pacific Ry. in California, leaving this work in December, 1905, to join the engineering staff of the Chicago, Milwaukee & Puget Sound Ry. He was for several years Construction Engineer at Butte, Mont.; he was promoted to be Assistant Chief Engineer in 1911.

OBITUARY

Lloyd B. Fuller, a former Assistant City Engineer of Chicago, Ill., died at his home in that city, Jan. 29, aged 72 years.

A. J. Hanson, a pioneer Western railway contractor, died at his home at Monument, Colo., Feb. 2, from paralysis. He was 69 years old. Mr. Hanson went to Denver in 1869 and for many years was engaged on contracts for building early Colorado railways.

James V. Welch, a well known Western railway contractor, who graded many miles of track in Oregon, Washington and British Columbia, died Feb. 2 at Port Arthur, Ont., where he was at work on a contract to build a section of the Canadian Northern Ry. He was 52 years old.

Fred L. Weyerhaeuser, President of the Weyerhaeuser Engine Works, builders of steam and gasoline log engines, St. Paul, Minn., died at his home in South St. Paul, Feb. 4. He is said to have been a pioneer in the development of self-propelled geared log hauling apparatus. He was 58 years old and a native of St. Louis, Mo.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF MINING ENGINEERS.
Feb. 17-20. Annual meeting in New York City. Secy., Joseph Struthers, 25 W. 39th St., New York, N. Y.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
Feb. 19-20. Annual meeting at Boston, Mass. Secy., N. W. Gifford, Boston, Mass.

IOWA ENGINEERING SOCIETY.
Feb. 19-21. Annual meeting at Sioux City, Iowa. Secy., S. M. Woodward, Iowa City, Iowa.

IDAHO SOCIETY OF ENGINEERS.
Feb. 21-22. Annual meeting at Weiser, Idaho. Secy., I. F. Shaffner, Boise, Idaho.

ASSOCIATION FOR STANDARDIZING PAVING SPECIFICATIONS.
Feb. 24. Annual meeting at Pittsburgh, Penn. Secy., J. B. Hittell, 5917 Winthrop Ave., Chicago, Ill.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.
Feb. 25-26. Annual meeting at Indianapolis, Ind. Secy., W. F. King, Indianapolis, Ind.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 26-28. Midwinter Convention in New York City. Secy., F. L. Hutchinson, 33 W. 39 St. New York, N. Y.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.
Feb. 27-28. Annual meeting at Indianapolis, Ind. Secy., A. L. Neereamer, Indianapolis, Ind.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Mar. 3-5. Annual meeting at Chicago, Ill. Secy., W. P. Blair, 824 Engineers Bldg., Cleveland, Ohio.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

Indiana Sanitary and Water Supply Association—Several topics of broad engineering and public interest are to be discussed at the sixth annual meeting at Indianapolis, Ind., on Feb. 25-26, among them the following: "The Functions of a Technical Staff in Public Utility Regulation," "Industrial Contamination of the Public Water Supply," "Fire Waste and Fire Protection," and "Sewage Disposal."

The officers elected for 1913 are: President, F. C. Jordan; Vice-Presidents, D. R. Gwinn, H. E. Barnard, C. S. Woods, J. W. Elms and J. W. Peck; and Secretary-Treasurer, W. F. King.

American Institute of Mining Engineers—At the annual meeting, to be held at 29 West 39th St., New York City, Feb. 17-27, 1913, the principal item of the program will be a discussion of iron and steel, with main attention to metallurgy. An attempt will be made to bring out all available information on production of sound ingots. The iron and steel division begins its session at 10 a.m., Wednesday, Feb. 19, and will continue at 2 p.m., and possibly at 10 a.m. Thursday. The program includes the following papers, which will be available at the meeting in printed form:

J. R. Finlay, "Valuation of Iron Mines." Albert Sauveur, "Notes on Cast Iron." R. W. Hunt, "Comparison Notes on Steel Rail Rolling." H. M. Howe, "Why Does Lag Increase with Temperature from which Cooling Starts?" B. G. Klugh, "Microstructure of Sintered Material." F. L. Grammer, "Blast Furnace Slag Analyses for Twenty-four Hours." H. F. Miller, Jr., "Methods of Preparing Basic Openhearth Steel for Castings." B. Talbot, "The Production of Solid Steel Ingots." E. H. Dudley, "Piping and Segregation of Ingots of Steel and Ductility Tests for Openhearth Steel Rails." E. A. Beck, "The Use of Anti-Piping Thermit in Casting Ingots."

A general discussion of the subject of sound steel ingots, on behalf of both producers and consumers of steel, will be had, presented under the following topics:

1. Is the present method of getting rid of the pipe by cropping, a safe and reliable device for making sound steel?

2. Is it desirable to increase the amount of metal arbitrarily cropped off the top of an ingot, and, if so, what would be a fair excess price to pay for cropping off 20%.

3. Is it commercially practicable to make ingots without pipes or blow-holes, and what additional expense of manufacture would be justified to accomplish this result?

4. What process for making pipeless ingots seems the most promising of commercial success, and why?

The program of papers for the first technical session, 2 p.m. Tuesday, Feb. 18, has not been made public. In the sessions on iron and steel, the subject of sound ingots will be the first to be taken up.

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REVIEWS

British Works on Sewerage and Water-Supply

Reviewed by JOHN H. GREGORY*

THE MAIN DRAINAGE OF TOWNS—By F. Noel Taylor, C. E., Member of the Institute of Municipal Engineers; Author of "Civil Engineering Practice." Philadelphia, Penn.: J. B. Lippincott Co. London: Charles Griffin & Co., Ltd. Cloth; 6x9 in.; pp. xi+313; 350 text figures; 34 tables. $4.50, net.

"WATER SUPPLY" AND "DRAINAGE" SYSTEMATIZED AND SIMPLIFIED—By C. E. Housden, Late Superintending Engineer, Public Works Department, India, and Sanitary Engineer to the Governments of Burma and Eastern Bengal and Asam. London and New York: Longmans, Green & Co. Cloth; 5x7 in.; pp. 28; two folding plates. 60c., net.

The author treats mainly of the design and construction of sewers and sewage-disposal works. As the book has been written from the standpoint of an English engineer, English units and terms are used throughout.

In the first chapter the author considers Maps, Plans, Sections and Preliminary Arrangements and in the second and third chapters the Principles of Hydraulics and Hydrostatics and Practical Calculations.

Following these are chapters on Practical Construction, Forms of Sewers and Ventilation of Sewers. One chapter is devoted to Storm Overflows, Sea Outfall Manholes, Tank Sewers, Manholes, Lampholes, Flushing Tanks and Gullies, another to Pumping Sewage and still another to House Drainage

In Chapters X and XI the author considers the Theoretical Side of Sewage Disposal and Sewage Disposal Works. The last chapter is devoted to Special Construction. The four appendices contain brief descriptions of the Dublin and Glasgow Main Drainage Works, of Sewage Measuring Appliances and Pneumatic Ejectors.

From a mere casual inspection one would expect the book to contain a large amount of valuable information, but this expectation is not borne out after a careful examination and reading of the subject matter. Many subjects of little importance are treated at great length and in great detail while but little space is devoted to much more important subjects.

That the author has spent a large amount of time in the preparation of the book is evident, but it is greatly to be regretted that much of the subject matter is not well presented. The book contains many statements with which experienced engineers will not agree, others which are open to question and still others which are incorrect.

The author's treatment of the subject of hydraulics and hydrostatics is laborious and far from satisfactory. Some of it is extremely difficult to follow, as formulas are used without stating what the different symbols stand for. Again, some of the formulas are incorrect. In the formula for weirs the author states that the discharge is in cubic feet per minute, whereas the formula gives the discharge in cubic feet per second. He then proceeds to simplify the formula by algebraic reduction and in so doing makes another error, leaving the reader with an absolutely incorrect formula.

Further on the author presents a formula for determining the mean thickness of a wall to resist water pressure and works out a numerical example. The head of water taken is 10 ft. and the author reaches the startling result that a concrete wall having a thickness of only 18 in. is required. The error occurs in the numerical work, which is given in detail on the page. It seems almost inconceivable that such an evident error should have been passed over by the author.

The author is very positive in his views. In treating of the pressure on a vertical plane, which is subject to water pressure at different levels on opposite sides of the plane, the formula presented is incorrect. The correct formula is easily derived and can be found in any standard textbook on hydrostatics. The author then undertakes to use this formula for computing the resultant pressure on a submerged hinged gate set in the bottom of a vertical wall with water at different levels on the opposite sides of the wall. Not only is the author's numerical work wrong, but his theory also is wrong as he has computed (errors excepted) the resultant pressure on the wall and not on the gate. Perhaps enough has been said to let the reader judge for himself as to the value of the chapter on hydraulics and hydrostatics.

On the separate system he says: "That such a system does not work well is clearly evinced by the small amount of attention it has had. The author can find absolutely no recommendations for it. . . . ." In the very next sentence he somewhat qualifies his views on the separate system, admitting that it has some advantages, but a little later he makes the statement: "It is also generally recognized that the sewage from a separate system is more difficult to treat than that from a combined system." Many engineers hold different views.

The chapters on the theoretical side of sewage disposal and on sewage-disposal works are also unsatisfactory. In the 73 pages devoted to these subjects the reader will search in vain to find any reference to some of the methods of sewage treatment which have come to the front in the last few years. But little is said of the Dortmund tank and no mention whatsoever is made of the Hampton tank or of the Imhoff tank. Few data are presented which are of practical use.

In conclusion it may be said that the book should be read with great caution, especially by a young and inexperienced engineer. That there is something of value in the book cannot be denied, but it is equally true that there is much in the book which is of little or no value

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Mr. Housden, in his "'Water Supply' and 'Drainage' Systematized and Simplified," has supplemented his "The Precise Calculation of Pipe Drain and Sewer Dimensions," noticed in these columns for Apr. 18, 1912, p. 765. In the present book the author presents a very ingenious diagram from which, knowing the discharge, length and available head, and after having made a very simple numerical calculation, the proper size of pipe to give the required discharge can be determined. The digram gives directly the diameters of clean pipes by Unwin's formula, and by means of a correcting scale, the use of which is explained, there are also given the diameters of incrusted pipes and of pipes corresponding to various values of "n" in Kutter's formula.

The author also explains how the sizes of two types of open drains can be determined by numerical computations. The process by which he arrives at the desired result is, however, not easily followed. The author further explains how the diagram and computations can be applied to small water-supply and drainage projects.

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*Consulting Engineer and Sanitary Expert, 170 Broadway, New York City.

A New Type of Steam Engine

Reviewed by L. S. MARKS.*

THE UNA-FLOW STEAM ENGINE—By Prof. J. Stumpf, Technische Hochschule, Charlottenburg, Germany. New York: D. Van Nostrand Co. London: Constable & Co., Ltd. Cloth; 8x11 in.; pp. 284, 250 illustrations. $3.50, net.

Fifteen years ago the reciprocating steam engine seemed to be crystallizing into its final shape. So long a time had elapsed since any fundamentally new features had been introduced that it seemed probable that the improvements in the steam-engine would be quantitative rather than qualitative, until some revolutionary discovery should be made. In particular it seemed that the only practical way of combating the ancient evil of cylinder condensation was by the use of jacketing, compounding, and superheating. Since that time, it has been found that both jacketing and compounding were being carried too far, and we have settled down to a period of moderate jacketing, two-cylinder compounding, and of considerable superheating.

The newly developed una-flow engine appears to be able to obtain the economy of a first-class modern engine without the use of compounding or superheating, and with very moderate jacketing. It is a prophylactic rather than a remedial method of meeting the cylinder condensation evil. In addition, it appears to offer other advantages. That it has commended itself to many European engineers is indicated by the fact that at the end of July, 1911, there were engines of this type with a total output for a half-million horse-power working or in actual construction. Furthermore, the engines in operation included stationary, locomotive, marine, portable, rolling-mill, winding and other kinds of engines. A book dealing with these new developments cannot fail to be of interest to all engineers who have to consider the problems of the generation of power.

This new type of engine has been devised and constructed by Professor Stumpf and his book is necessarily an ex parte statement of the case. It is the kind of material that is more generally published in the proceedings of an engineering society, or in an engineering paper than in book form. The bulk of the material and its importance justify the method of publication. The nature of the material makes it difficult for the reviewer to take any attitude towards it other than that provoked by a paper presented to a society.

For the benefit of those who are not as yet familiar with this engine it may be explained that it differs from the usual type in having a ring of exhaust ports around the middle of the length of the cylinder, in the manner which has become familiar since the introduction of the two-cycle gas or oil engine. Since the exhaust ports are covered after about one-tenth of the return stroke, compression takes place for nine-tenths of the stroke. This necessitates large clearance in non-condensing engines, except where the initial pressure is very high; in condensing engines, on the other hand, the clearance may be quite small. By the use of the central exhaust, the cooling action of the exhaust steam as it goes out of the cylinder in the usual counter-flow engine is avoided, and the variation in temperature of the parts exposed to steam is diminished. To assist further in keeping each part of the cylinder at a constant temperature, the cylinder heads and that portion of the barrel exposed up to cut-off are jacketed.

Starting with this central idea, an engine has been developed and designed which shows many unexpected advantages and great adaptability to all kinds of service. These matters are fully expounded in the book, and in addition there is given a large number of excellent drawings of actual constructions on this principle, together with the tests of some of them.

As the author remarks in his preface, "Expounding ideas is one thing—converting one's fellow men to a sufficient degree to influence them to carry out the ideas in practice, is an entirely different and very much more difficult thing." The author has been fortunate enough to convince many European engineers in a comparatively short time—one cannot but think that his difficulties would have been much greater had he tried to persuade the engineer of an American railroad to buy and test out a locomotive built from his plans.

The titles of the chapters of the book indicate the diversity in the use of the engine. After an explanation of the general [illegible] features, the advantage of the engine in the reduction of back pressure is brought out, the desirable degree of jacketing is discussed; the decrease in leakage and clearance losses is shown; the methods of taking down for necessary steam-tight separations are illustrated; and the influence of clearance volume on steam consumption is worked out at considerable length. In addition, eight separate chapters deal with as many different services for which the engine has been used and show how it has been designed, constructed and applied to each kind of service.

This book suggests one other book of its general class, namely, that in which Diesel discussed his engine. The two books differ, however, in this important respect; that whereas Diesel's dealt almost exclusively with the theory of his machine and with developments and applications which he proposed to make, Stumpf's touches but very lightly on theory but gives the results of practical experience with the machine.

*Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

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A Study of Railway Rates

RAILROADS: RATES AND REGULATION—By Wm. Z. Ripley, Ph.D., Nathaniel Ropes, Professor of Economics in Harvard University. New York, London, Bombay and Calcutta: Longmans, Green & Co. Cloth; 6x8¾ in.; pp. xviii + 659; 41 maps and diagrams. $3, net.

As may be seen from the statement as to the size of the book and its number of pages in the heading above, this is a bulky volume. A good idea of its scope may be given by quoting the titles of some of its important chapters as follows: (I) The History of Transportation in the United States; (II) The Theory of Railroad Rates; (IV) Rate Making in Practice; (VI and VII) Discrimination; (VIII) Routing; (IX) Freight Classification; (XI) The Southern Basing Point System, Transcontinental Rates, Differentials, etc.; (XIII to XVIII) The Interstate Commerce Law of 1887, the History of Its Amendment and Execution with the various changes of the last half-dozen years; (XX) Conflict of Federal and State Authority.

The book represents an enormous amount of labor on the part of its author and contains a great amount of information on the subject of which it treats. Prof. Ripley is eminently qualified to write such a work from his experience as a teacher of economics, first at the Massachusetts Institute of Technology and in recent years at Harvard, together with his service as an expert for the U. S. Industrial Commission of 1901, and his extended studies of economic problems. The chief criticism we make of the book is to raise the broad question as to the practical usefulness of all this great mass of information to those who have to do with the actual fixing of railway rates, either as railway officers or in connection with governmental commissions.

Prof. Ripley himself confesses in his preface that he has used "an almost exuberant mass of illustrative material. Possibly, even, it may be alleged that in places so thick are the circumstantial trees of evidence that one can scarcely perceive the wood of principle."

If governmental control of rates is ever to bring order out of the present chaos, it would appear that we must have somewhat more of principle and method in the formation of railroad rates than has ever obtained; and in the determination of these governing principles, we shall not be helped much by the study of past history and past conditions. Neither must we consider alone what are present conditions, but we must look to the future. For example, one of the great problems in connection with railway rates at the present time is the amazing increase in the cost of handling freight in large city terminals and the equally amazing reduction in the cost of hauling over the road, when the train has once started on its journey.

Since rates must in the first place be based upon the cost of service, one might expect in a work of this sort to find some statement as to these costs and some reference to the proposals, already given consideration by railway officials, to make a separate charge for the terminal expenses of both passenger and freight traffic.

Prof. Ripley himself confesses in his preface that he has his bulky book, but he contents himself with what he well calls a rough estimate of fifty cents per ton for terminal cost with one-half cent additional per mile for movement expenses. As was shown in "Engineering News" some three years ago, under present-day conditions of trunk-line operation terminal costs in large cities are far in excess of the above amount, while the cost of haulage on the open road is far below it.

While the bulk of the book and the large space given to concrete examples may be criticised by the busy engineer or the over-worked railway commissioner who desires to make use of the book as a guide in his work, it is on the other hand true that the book is admirably adapted for use as a textbook and work of reference for students of economics. We recommend it also to students of engineering who desire to post themselves on the recent history of government railway regulation. In view of the amount of work which engineers are now called upon to perform in connection with

railway regulation, there can be no doubt that such educational training is of great practical value.

It is interesting in conclusion, as a significant illustration of how far we have traveled in modern economics since the "laissez faire" theory reigned supreme, 30 years or more ago, to have a professor in Harvard University express the opinion which we find set down in Mr. Ripley's preface as follows:

It is not unlikely, in my judgment, that the final solution of the so called Trust Problem in the United States, whether for good or ill, may ultimately contain as one important feature, the determination by governmental authority of reasonable prices for such prime necessities of life, as milk, ice, coal, sugar and oil, when produced under monopolistic conditions. This view is shared by my colleague, Professor Taussig, in his "Principles of Economics." It is also distinctly set forth by President Van Hise, of the University of Wisconsin, in his recent "Concentration and Control." When the seed of such an industrial policy is planted, as I believe it possible in time, the soil will have been richly prepared for its reception by our experience in the determination of reasonable charges for the services of railroads and other public utilities.

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On Drawing

Reviewed by ROSSITER R. POTTER*

THE THEORY OF ENGINEERING DRAWING—By Alphonse A. Adler, M. Am. Soc. M. E., Instructor in Mechanical Drawing and Designing, Polytechnic Institute, Brooklyn, N. Y. New York: D. Van Nostrand Co. Cloth; 5¾x9¼ in.; pp. xv + 312; 273 illustrations. $2, net.

ELEMENTS OF DRAWING—By George F. Blessing, M. E., Ph. D., Professor of Mechanical Engineering and in charge of Engineering, Swarthmore College; and Lewis A. Darling, E. in M. E., Engineering Department, Remy Electric Co., formerly Assistant Professors in Machine Design, Cornell University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9¼ in.; pp. xviii + 193; 151 text figures. $1.50, net.

THE PRINCIPLES OF PARALLEL PROJECTING-LINE DRAWING—Part I of "The Theory of Engineering Drawing." By Alphonse A. Adler, B. S., M. E.; Instructor in Mechanical Drawing and Designing, Polytechnic Institute, Brooklyn, N. Y. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. vi + 66; 48 text figures. $1, net.

The difference between the "Theory of Engineering Drawing" and other books on descriptive geometry arises chiefly from an effort to present the subject wrong end first. At it is explained in the preface, "the order of presentation is reversed" and the reader is asked to consider first some concrete object, in fact a box, instead of "that most abstract of all abstractions," the mathematical point. There is little question but that the box is considerably more concrete than the point, and it may have a more tangible interest at the start for the young student. However, this advantage is more than offset, in the reviewer's opinion, by an inseparable difficulty—namely, the greater complication in the projection of the box as compared with that of the point. This is especially true here since the author has chosen to start in with oblique projection. To present the descriptive geometry of oblique projection as an introduction to the study of the more usual orthographic variety seems certainly a reversed method of teaching.

After the three opening chapters devoted, respectively, to oblique projection, orthographic projection and axonometric projection, the book settles down as a more or less orthodox textbook on descriptive geometry. A lingering trace of insurgency is manifested in the presentation of the projection of the line before that of the point. There should be some advantage in the explanation of the elements of mechanical drawing in connection with the principles of descriptive geometry, as it may help to impress upon the student the connection between them.

A device worthy of note is the repetition on successive pages of the figures referred to in the text on both those pages. This avoids the awkward inconvenience of reading the other side. A possible danger to be avoided in this method is brought out on p. 66 where the drawing for Fig. 53 is reproduced by mistake and marked Fig. 50, which latter figure it was apparently intended to repeat from the previous page.

Part III presents the principles of perspective projection, and the following section deals with "Pictorial Effects of Illumination," a somewhat obscure title for shade lining, shades and shadows. The style of the text throughout the book is occasionally loose and often involved, and the wording is less simple than is desirable in a book of this sort.

The authors of "Elements of Drawing" are or have been members of the faculty of Cornell University and the work outlined is based on the drawing-room courses required of first-year engineering students of that institution. As compared with other college textbooks in elementary drawing, this volume has a large amount of space given to instruction and advice concerning the choice and use of drawing materials and instruments. Considering that the opinions given on the best form and type of each particular instrument will have all the weight and authority of a faculty utterance, it seems plain that the authors have been too positive in some of their statements

Some 35 pages are devoted to the subject of lettering. Freehand lettering is taught by the method of indicating the sequence of the separate penstrokes by means of numerals and the direction of each stroke by an arrow. About the same amount of space is devoted to freehand and isometric sketching, including the use of cross-section paper and paper with isometric ruling.

The models selected for illustration and as exercises for the student are the parts of a wood-turning speed lathe of the type commonly used for instruction in wood turning in engineering schools. The authors maintain that since the student will be taking his course in wood turning at the same time with his elementary drawing, he will take a more intelligent interest in these than in models of "the kindergarten type" or machine parts selected at random.

Under the title of "Principles of Parallel Projecting Line Drawing" there is published in a separate volume, Part I, of the same author's work on "The Theory of Engineering Drawing." It is intended as a text for preparatory schools or high schools. Oblique projection, orthographic projection and isometric, dimetric and trimetric projection are covered with the emphasis on the descriptive geometry involved rather than the technic or detailed method of making the drawings.

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A Contribution to the Art of Locomotive Design

TESTS OF A JACOBS-SHUPERT BOILER—A Report by W. F. M. Goss, Dean, College of Engineering, University of Illinois, Urbana, Ill. Coatesville, Penn.: Jacobs-Shupert United States Firebox Co. Cloth; 8x11 in.; pp. 171; 112 text figures.

Judged from its title alone, the book before us might be classed with so called trade literature, since it is a report upon tests of a patented type of locomotive boiler, made for the purpose of demonstrating its advantages over boilers of the ordinary construction. The tests were made, however, under the direction of an engineer who ranks among the highest authorities in the field of locomotive engineering. Furthermore, the book, as indicated by the dimensions given above, is a bulky volume and covers a much broader field than merely the report of the tests.

The first two chapters of the book are devoted to a brief historical review of locomotive boiler development. Then follows a chapter describing the Jacobs-Shupert boiler, which gives a very clear exposition of the distinguishing features of its design.

As many of our readers may recall, the Jacobs-Shupert boiler was described in this journal in the spring of 1909 when the first locomotive equipped with it was put into service on the Atchison, Topeka & Santa Fé R.R. About 150 locomotives equipped with this boiler are now in use on the Santa Fé, and its use is extending on other railways.

Professor Goss devotes an interesting chapter to the results of a five-day investigation into the condition of locomotive boilers equipped with this type of firebox, which had seen extended service on the Santa Fé. Next comes a description of the program of tests which were planned to enable a comparison to be made of the relative merits of the ordinary boiler and the Jacobs-Shupert boiler. The tests were most elaborate in their character. In fact, it is doubtful whether a more complete experimental investigation of the operation of locomotive boilers has even been carried out in the whole history of railway engineering.

The spectacular part of these tests was the attempt to explode each of the boilers by allowing the water level to fall until the crown sheet was dry. These tests were made on June 20 last in the presence of a large delegation of railway officers from the American Railway Master Mechanics Association and a crowd of spectators numbering several thousand. The general result of these low-water tests, as reported at the time, in these columns, was the the failure of the radial stay boiler when the water had dropped about 15 in. below the crown sheet. About half the crown sheet came down, the escaping steam lifted the rear end of the

*Assistant Superintendent, Blood Brothers Machine Co., Kalamazoo, Mich.; formerly Assistant Editor, "Engineering News."

boiler from its foundation, and scattered the brick work in which it was set in all directions over a radius of 150 ft.

In the Jacobs-Schupert boiler, on the other hand, the water continued to recede in the boiler until it had fallen nearly 40 in. below the crown sheet. The tubes, which were above water level, became overheated and sagged, and several collapsed; but notwithstanding the high temperature to which the firebox of the Jacobs-Schupert boiler was exposed it was practically uninjured by its severe treatment, and neither explosion nor collapse occurred.

Turning again to the other features of locomotive engineering treated in the volume before us, we may refer to chapters in the book discussing water circulation in locomotive boilers, the brick arch as a factor in boiler performance, and the relative value of firebox heating surface and tube heating surface. The latter subject, especially, is one on which authoritative data for the use of locomotive designers have long been much needed.

The concluding chapter gives a brief summary of all that has preceded, and enables the busy reader to obtain with the least expenditure of time a clear idea of the results which were obtained from this elaborate test, upon which many thousand dollars were expended.

High praise must be awarded to those in charge of the Jacobs-Schupert Boiler Co. for their enterprise in undertaking so elaborate and costly a series of tests to demonstrate the value of the important invention which they control. High praise must be awarded also to the distinguished author of the report for the care and completeness with which all the facts are stated, so that the expert engineer can study the data and form his own conclusions if he desires. At the same time Dr. Goss has clearly expressed his own opinions and conclusions, and his high reputation as a careful and impartial investigator will give these full weight of authority with engineers.

If there is any serious objection that can be made to the design of the Jacobs-Schupert boiler, it has never been brought to our attention. As for the inherent defects of the present type of locomotive boiler, their cataloging would make a lengthy list. It has long been recognized that in the design of stationary steam boilers stay-bolted surfaces are highly objectionable. But their use has continued with the locomotive boiler because no better method of construction has been developed. Certainly, then, the design of a locomotive boiler, which eliminates a large part of the stay-bolts, is a mechanical triumph of the highest rank.

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Precise Measurements

THE THEORY OF MEASUREMENTS. By A. de Forest Palmer, Ph. D., Associate Professor of Physics, Brown University. New York and London: McGraw-Hill Book Co. Cloth, 6¼x9¼ in.; pp. xi + 248; illustrated. $2.50 net.

Centering around the theory of least-square adjustment, or, in other words, around the theory of accidental errors, there is a large group of considerations on precision of measurement and transmission of error, which require study jointly. Prof. Palmer has done original thinking in expounding these matters and linking them together in a unified treatment. The subject is not restricted to adjusting series of observations and obtaining an index of the consistency of the individual observations, but covers also the criticism of measurement methods and selection (by calculation) of the methods best suited to the desired grade of results. The book leads up to this point, and shows by some interesting prob-

As a well planned and well written treatise for the [illegible] the book will be a permanent

As an engineer's book its position is not so assured, since it is written for the higher physics student and (in large meas-

however, bears also on engineering work, not only in geodetic

of determinations are involved, as, testing laboratory work,

accidental errors.

by another method be separated into parts, of which one can

other part remains fortuitous. This is suggested in the text, but is not emphasized.

Physical relations concerning which measurements are made are usually known from theory. Many observations in engineering are made before it is known that a definite relation exists between the initial and final quantities involved, and the results are expected to show whether a fixed relation exists. Graphical charting of results is most commonly used in this work. The procedure employed herein affords opportunity for much instructive discussion. The subject is discussed (but not exhaustively, nor sufficiently for the needs of the subject) in the final chapter of the book, entitled "Research." This is a particularly interesting chapter.

Covering least-square adjustment as well as the associated considerations, the book is of such broad scope as to merit a place in every scientific library, and in the libraries of many engineers.

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A British Metallurgy of Iron and Steel

Reviewed by WILLIAM CAMPBELL*

AN OUTLINE OF THE METALLURGY OF IRON AND STEEL. —By A. Humboldt Sexton, Emeritus Professor of Metallurgy, Royal Technical College, Glasgow; Past-President, West of Scotland Iron and Steel Institute, and J. S. G. Primrose, Lecturer on Metallurgy, Royal Technical College, Glasgow; Member of Iron and Steel Institute, London. Second Edition. Manchester: The Scientific Publishing Co. Cloth; 5½x8¾ in.; pp. xv + 572. 12/6, net.

This book is divided into 44 chapters and the subject matter is arranged in the manner usually found in textbooks on the metallurgy of iron and steel. First are given the physical and chemical properties of iron and its compounds, then the various ores and their occurrence are discussed in Part I. Under the heading of Part II—Iron, the properties, etc., of pig iron and its production in the blast furnace are dealt with in some detail, ending with a chapter on the foundry. Part III is devoted to malleable iron and puddling, while Part IV embraces steel: The crucible, bessemer and openhearth processes; the working and casting of mild steel; alloy steels; testing; rusting and protection; microstructure; heat treatment, and ends with an appendix of miscellaneous subjects.

Taken as a whole we are given a very clear outline of the subject, which is well written. As is to be expected, the book is from the British standpoint and necessarily British methods are those on which great stress is put. Where American methods or figures are given they are for the most part old. As examples of this, the following may be noted: The diagram of the iron and steel industry (p. 7) shows crucible steel as the product obtained by melting blister steel, whereas today in this country most crucible steel is made from "melting-bar," an openhearth product. The bloom from puddling is hammered, not squeezed. For blast-furnace gases a long column shows the purification of the liquids, but for the gases the use in gas engines does not appear on the diagram.

Under the heading of iron ores, the Lake deposits are just mentioned while the iron ores of Spain are given almost a page—though under Geographical Distribution analyses of ores from the Lake Superior region are given. The analyses are evidently old, for the Vermilion range is given as 65% iron, the Mesabi as 63 and the Marquette as 64½%.

Some space is devoted to the British ore supply; imports; fluctuations in British ore and pig-iron production; prices of British pig irons, May 26, 1911; fluctuations in price of Cleveland pig, 1875-1910, and so forth.

In the section on blast-furnace practice in the United States of America, there appears:

> The iron production of the United States is now so large and is spread over such a wide area, with such varying conditions, that the practice must vary considerably. Hematite pig is made in districts where ores free from phosphorus occur, in other localities foundry pig is made. Coke is the fuel almost always used, but anthracite and charcoal are used to a smaller extent. Raw coal, suitable for direct furnace use, occurs, but has not yet been utilized.

"American Bloomeries—Howe describes a hearth as still in use in the United States for the direct production of malleable iron," would read better "Howe described in 1891, etc." Under the heading of Carbon Content of Steels, page 223, hard rails are given as carbon 0.25 to 0.50%. Similar criticisms apply to the sections describing the various processes of steel making.

Discussing blister steel, mention is made of Arnold's work on the microscopic study of the Cementation Process, in which Fe_3C was thought to play an important part. This seems to [illegible] necessarily a fairly simple phenomenon.

The two sections of the book most open to criticism are

* Associate Professor of Metallurgy, Columbia University, New York City.

those dealing with microstructure and heat treatment. The method given for the preparation of specimens for microscopic examination is not the best. It is recommended to cut specimens ½-in. cube. In practice, it is generally better to have the thickness about half the width in order that the finished surface may be perfectly flat. For etching it is stated that picric acid in alcohol is very useful in some cases, especially when phosphorus is present. It seems the general opinion that picric acid is the best etching medium for general work. Again, it is recommended to wash the specimen with water, lime water and again with water or alcohol and finally dry with a current of air; whereas, the specimen ought to be given a final wash with alcohol to prevent rust and stain; also, mopping with a very soft linen handkerchief is much more convenient than an air current.

It is stated that when pure carbon steels with more than 1% carbon are very slowly cooled from 1000° C., a portion of the carbide is decomposed and an equivalent of carbon is set free in the form of annealing carbon. We know that high-carbon steel worked at a low temperature, cold rolled or in small sections often shows this; but the fact that we can get dead soft steel with no free carbon by heating to high temperatures and very slow cooling shows that such precipitation is the exception rather than the rule.

The iron-carbon diagram, on page 507, shows ferrite, graphite and cementite below Ar_1. According to the phase rule only two phases are in equilibrium, hence this cannot be the stable diagram. It would be much better to give the double-diagram showing the stable and metastable systems, following Heyn, Benedicks and the others. Surely Upton's diagram is at least worthy of mention.

Again, under the heading of quenching, on page 528, the best temperature for quenching any steel is given as just above the lower boundary line of the area of region III, which is the liquid + plus primary graphite, evidently a misprint for region IV. This would hold good for steels of 0.9% carbon or less, but above that, quenching ought to be done from just above the lower critical point, that is, Ac_1. We are also told that suitable tempering is often able to restore the requisite fine grain (in a brittle and coarse-grained steel). Surely tempering merely changes hardness, but never affects grain size.

In conclusion, while the book has many points to recommend it to the British student, as an elementary textbook, Stoughton's "Metallurgy of Iron and Steel" covers the ground and is more suitable for American readers. The make-up of the book is excellent, printing and binding are very good and the illustrations exceptionally clear.

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Factory Planning

ENGINEERING OF SHOPS AND FACTORIES—By Henry Grattan Tyrrell, C. E., Bridge and Structural Engineer; Author of "Concrete Bridges and Culverts," "Mill Buildings," "History of Bridge Engineering," "Artistic Bridge Design." New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. xvii + 399; 174 text illustrations. $4, net.

The author has been known more in connection with bridge and structural work than for work in factory planning. It will not surprise the reader therefore to discover that the present book is strongest on the structural design of factory buildings. It contains also some chapters on location and planning, and on certain items of equipment, such as heating and lighting, air washing, sewerage, etc. But in examining these chapters it becomes evident that the subjects are not the author's own, and that in compiling he has missed completeness and in many instances correctness. This no doubt reduces the value of the book. Yet the work forms an ample collection of suggestions, remarks, descriptions and data on various phases of factory planning, and as such it can prove useful and valuable on many occasions.

The author begins with the relation of the engineer to factory design, and gives standard rates of charging. He discusses questions of location and general layout, and gives in detail a report on a proposed bridge shop. The factors of the structural design, and the types and details of the design itself, are then entered into; here wood, steel and concrete as main materials, and the components such as foundations, floors, partitions and roofs, are treated. Certain special building types and special structures (bins, chimneys, tanks) are discussed separately. Individual chapters on heating, lighting, water-supply, fire protection, air washing, sewerage and cranes, follow; but as already noted these must be read with constant caution, and they are chiefly useful in a suggestive way. Some concluding chapters, giving (among other things) sample estimates, weight tables of steel sheds, and the inevitable discussion of "welfare" features, should also be noted.

The book is quite fully illustrated. The selection of illustrations is affected somewhat as is the text, the structural-steel field being greatly favored and many other subjects represented poorly in quantity or nature of illustrations. But the execution of the illustrative matter deserves commendation, being in most cases remarkably good, which comment applies also to the typography.

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An Exposition of Municipal Government and a Survey of Ten Commission Plan Cities

THE NEW CITY GOVERNMENT—A Discussion of Municipal Administration Based on a Survey of Ten Commission Governed Cities. By Henry Bruère, Director of the New York Bureau of Municipal Research. William Sheperdson, of the Staff of the Bureau of Municipal Research, Cooperating in the Collection and Tabulation of Material Respecting Commission Government. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. xiii + 438; 10 folding plates. $1.50, net. $1.62, postpaid.

Here are virtually two books woven into one; an exposition of what constitutes efficient municipal government and a report on a "survey" of ten commission governed cities. The "survey" was limited to two or three days spent in each city, but was made to yield more than might be expected from such brief visits by going around with an already prepared schedule of questions, to which answers were sought. The information thus obtained was supplemented by official documents, and the whole, it is to be supposed, was arranged and studied at comparative leisure.

The presentation and discussion of the data secured by the "survey" both gain and lose by being combined, and in some cases one might say mixed, with an exposition of the principles of municipal government as conceived by the New York Bureau of Municipal Research. For those who have no ideas of their own as to what efficient municipal government is, there may be a gain in this dual presentation of the results of the survey and of a theory of municipal administration. However, since the authors chose this dual plan, the results are to be judged accordingly, though it is, of course, permissible to say that the plan has great drawbacks for all except elementary students of the subject and, perhaps, for most of those.

The cities chosen for study were Cedar Rapids and Des Moines, Iowa; Kansas City, Topeka, and Wichita, Kan.; Dallas, Fort Worth, Galveston and Houston, Tex., and Huntington, W. Va. The population of these cities ranges from about 30,000 for Huntington to 92,000 for Dallas. The general plan of the "survey" was to use a score card for recording "two general groups of facts": (1) Those relating to streets, parks, homes, factories, public buildings and grade crossings, or "physical condition of the city," and (2) those relating to "common services," which include hotels, various recreation facilities, railroads, street cars, water and other utilities. So far as the book is concerned, the results of the "survey" are presented largely in the form of comparative tables. In addition, some descriptive text is given and comments and criticisms, of course, are also in the form of text.

After outlining "new standards of city government" the authors describe the general purpose and methods of the "survey." They next take up "the commission government movement," and, after that, the "efficiency movement." Then follow chapters on accounting and reporting methods, budget making, supply purchasing and store keeping, the administration of public works, the protection of persons and of property, the protection of life and health, civil service and related matters. All these chapters carry out to a greater or less degree the dual plan already mentioned of trying to outline the principles of municipal administration with the report of the "survey" of the ten cities. Two other chapters following somewhat the same general plan deal with attempts to make municipal government efficient by means of charter changes and with "citizen control and coöperation." An appendix outlines a plan for what is termed "representative health organization and work."

The book is strongest, as might be expected from the composition of the Bureau of Municipal Research and the sort of work it has done in the past, on its accounting and budget-making side, and in its dealings with some of the general problems of municipal efficiency. Next, perhaps, in strength is the section on health administration. Weakest of all is the discussion of public works and engineering. Waterworks are passed by with scarcely a mention, and do not appear to be given any place whatever in the index.

Since so large a part of the work of our municipalities is concerned with public works and engineering, it is obvious that for a really thorough-going "survey" of results obtained under the commission plan of government, or for that matter under any other plan, the coöperation of an engineer, would be advantageous. The book bears no evidence of such coöperation.

As the book stands, it contains many comparative data on the municipal organization of the ten cities studied, and apparently fewer data on actual achievements. These data are well presented in tabular, graphical and other forms, and many useful deductions and suggestions are based upon them. The viewpoint is that of the investigator rather than the administrator of municipal affairs, and of the accountant rather than the engineer. Strong emphasis is laid on service rendered to the citizens as a standard for judging the successes or failures of municipal government, and efficiency is the keynote throughout.

The net conclusions drawn from the "survey" is that commission government in the cities studied is an improvement over the forms which preceded it, but chiefly in organization, the placing of responsibility and giving an enlarged measure of popular control. "It is not a method," the authors say, "except as to election, recall, legislation," and "it does not make graft impossible because it does not in itself provide means for detecting graft in contracts, job loafing or padded payrolls"; and it "leaves practically unaffected 50 per cent. of official acts."

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Electrical Machinery Estimating

Reviewed by V. KARAPETOFF*

DIE VERANSCHLAGUNG ELEKTRISCHER LIGHT UND KRAFTANLAGEN unter Benutzung vorgedruckter Formulare. By B. Jacobi. München and Berlin: R. Oldenbourg. Cloth; 6½x10¾ in.; pp. vi + 207. 7 marks.

The book consists of 20 printed forms for estimating prices on various kinds of electrical machinery, apparatus and aggregates, delivered and installed. The following estimates comprise the book: Direct current generators with auxiliary apparatus; switchboards for a direct-current power house; alternating-current generators with auxiliary apparatus; switchboard for an alternating-current power-house; storage-battery with necessary connections and switchboard; direct-current boosters; protective apparatus against overvoltage; aërial transmission line; cable network; transformers with auxiliary apparatus; direct-current motors with starters, wiring and auxiliary apparatus; induction motors; distributing switchboards; electric lighting installation with incandescent and arc lamps; wiring for a lighting installation; rotary converters. The estimates are given in great detail, some forms comprising over 60 items.

In each estimate the author begins by specifying the principal pieces of machinery or apparatus, leaving blank spaces for the rating, the number of units, etc. Space is also left for specifying exactly the type of apparatus, for instance, series, shunt, or compound wound, hand-operated or motor-operated, etc. Then he enumerates the secondary parts, such as foundation-bolts, knobs, wire, porcelain tubes, then follow solder, tape and minor materials; also packing and freight, and finally the labor of installing. All items not specifically included are mentioned separately at the end of each estimate. No prices are given for the reason that each estimate form is suitable for widely different sizes and types of apparatus. The prices are supposed to be taken from available quotations and catalogs. In some cases the author gives a hint for estimating the cost of auxiliary apparatus. The purpose of the work is to make all estimates originating in an office uniform, to save time and to make sure that no important items have been omitted when the estimating engineer is pressed with work.

A valuable part of the book is the explanatory matter and the notes which are appended to each form. In these explanations the author is inclined to guide the contractor in the necessities of particular types or size of apparatus. In some places the author also briefly explains the function of various types of machines and apparatus, so that even a person not electrically trained can intelligently follow the estimates or can make use of them in a standardized case. Really, a book of this kind is a result of deep and mature engineering experience. It has been in use abroad for many years and the author has rendered a valuable service to the electrical profession by compiling these forms for estimating electrical contracts.

It is only natural that a work on electrical estimating should appear at a comparatively late date, first because the profession itself is a new one, and, secondly, because it is only a few years since safety regulations in electrical installations ceased to be changed to any extent. Now each country has a set of rules for electrical installations, similar to our Fire Underwriters' Rules and the Standardization Rules of the American Institute of Electrical Engineers. The existence of such rules makes it possible to use uniform specifications and estimates in standard cases. Mr. Jacobi's work will be useful for manufacturing, consulting, construction engineers, and contractors, and also to those who wish to become acquainted first-hand with the modern electrical practice, by reading the explanations which accompany the forms. For German readers these forms are available printed separately for office use. It is hoped that the book will be translated into English, or that a similar work will be published in this country for the use of American electricians. Like most German books, Jacobi's work is very carefully written, the explanations are clear, and the type and the general appearance of the book are quite satisfactory.

*Professor, Department of Electrical Engineering, Sibley College of Engineering, Cornell University, Ithaca, N. Y.

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THE FREEZING-POINT, BOILING-POINT AND CONDUCTIVITY METHODS—By Harry C. Jones, Professor of Physical Chemistry in The Johns Hopkins University. Second edition, completely revised. Easton, Penn.: The Chemical Publishing Co. Cloth; 5¼x8 in.; pp. vii + 75; 15 text figures. $1.

The time is fast passing when it is generally considered sufficient to study chemistry entirely from a chemical standpoint, physics only from a physical standpoint or mathematics from a purely mathematical standpoint. These three sciences are perhaps more fundamental than some of the others, and to a certain extent they are distinct, but they are nevertheless closely enough allied so that any study of either of them, which does not embrace an investigation of the bearing of the other two upon it, must necessarily be limited in scope.

Two of the most common and perhaps the most interesting effects observed, on the borderland between chemistry and physics, are the lowering of the freezing-point and raising of the boiling-point temperatures of a solvent, produced by a dissolved substance, and the change in conductivity of solutions of electrolytes at different stages of dilution. These effects are treated in this book in their relation to the laboratory study of physical chemistry, an effort being made to avoid the usual extremes of a too involved theoretical discussion, or of a mere description of the apparatus and directions as to the practical points involved in its use. The author has chosen what he considers the salient features of the problem, both theoretical and practical, and covered them clearly and simply. The mathematics used have been reduced to a simple form and explained thoroughly.

Those portions of the text in which the "ionization theory" is involved may be open to some difference of opinion in the present state of knowledge of that subject, however they are probably an element of strength rather than weakness in the book, as any opposition to this theory, which may be raised, will tend to bring us a step nearer to the actual truth of the matter. The "ionization theory," although it contains some weak spots, does appear to offer at least a partial explanation of many phenomena observed in this field of research.

A lamentable feature of the book (and by no means an uncommon failing in technical works) is the entire absence of any graphical representation of the relations involved in the problems covered by it. Through years of study of the subject, the author no doubt has these relations clearly and indelibly fixed in his own mind, and not necessarily in a graphical form, but to the large number of readers who could find interest and profit in the book, without having the same intimacy with the subject, these relations could be much better and more quickly explained by a few curves, than by pages of written matter, equations or statistics.

In regard to the above criticism it is only fair to say that the book gives a large number of references to other literature on the subject so that any one particularly interested in the problem can find more extended treatment of the various points of importance, elsewhere.

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THE MODERN GASOLINE AUTOMOBILE: ITS CONSTRUCTION, OPERATION, MAINTENANCE AND REPAIR.—A Practical, Comprehensive Treatise Defining All Principles Pertaining to Gasoline Automobiles and Their Component Parts. By Victor W. Page, M. E., Late Technical Editor of "The Automobile Journal." New York: The Norman W. Henley Publishing Co. Cloth; 5½x8¾ in.; pp. 693; 380 text illustrations; numerous charts. $2.50.

It has been said that the boys of the nineteenth century, or rather of the last three-quarters of it, derived most of their knowledge of mechanical engineering from the loco-

motive. It is almost needless to say that to the boys of the twentieth century the automobile has taken the place which the locomotive held fifty years ago. As a result of the enormous development of the automobile, the gasoline engine is better known to the present generation than the steam engine.

There has been a profusion of semi-popular books published upon the automobile, but most of these books have been of comparatively limited scope and quite elementary in their treatment. The book before us bears every evidence of having been compiled and written with painstaking care and with a thorough knowledge of the subject in every phase. As the title indicates, the author has confined himself to the gasoline automobile exclusively, omitting all mention of electric and steam driven machines, and no space is devoted to the historical matter which books of this sort usually contain. Little attention is given, too, to the variety of types of car and motive power which were quite common half a dozen years ago. The author has confined himself to the design, construction and operation of the motor cars built for either pleasure or commercial use at the present day, and he has treated this subject exhaustively.

While the book is written in nontechnical language, it goes into much detail with respect to questions of design and aims to cover the main variations in type which still exist in automobile details. The style of the author is clear, and the work is well arranged. The illustrations in the book deserve especial praise. The publisher's work on the book has also been extremely well done, and it is sold at a reasonable price.

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Differential Calculus

Reviewed by ARTHUR D. BUTTERFIELD*

THE A B C OF THE DIFFERENTIAL CALCULUS—By Wm. Dyson Wansbrough, Author of "The Portable Steam Engine: Its Construction and Management," "The Proportions and Movement of Slide Valves," "Modern Steam Boilers." Third edition. New York; D. Van Nostrand Co. London: The Technical Publishing Co., Ltd. Cloth; 5x7¼ in.; pp. xii+148; 30 text illustrations; $1.50, net.

The fact that this book has appeared in a third edition, with but slight changes, testifies to a demand for a simple presentation of the fundamentals of the differential calculus in a style as free from technicalities as possible.

The attempt of the author to present the fundamentals in a less rigorous way than usual has resulted in a large amount of unnecessary work in some cases, with several glaring inaccuracies. For instance, probably the most fundamental idea of the differential calculus is that if $f(x)$ and $F(x)$ are functions such that $f(a)=0$ and $F(a)=0$, then $\frac{f(a)}{F(a)} = \frac{0}{0}$ is meaningless, but $\lim_{x=a} \frac{f(x)}{F(x)}$ may be and usually is wholly definite. As a matter of convenience $\frac{f(a)}{F(a)} = 0$ is usually defined to mean simply $\lim_{x=a} \frac{f(x)}{F(x)}$. This idea the author has seemingly failed to grasp, and leads the reader, in the first chapters, through a maze of entanglements trying to explain that $\frac{0}{0}$ really means something; for he says, p. 11, "The assertion that $\frac{0}{0}$ can, under any circumstances, equal any real number or quantity, will require a good deal of proving before we can accept it. Nevertheless, this is a part of the task I have set myself for the next article."

Again, one blunder of more than ordinary importance is the statement that a convergent series is "a series whose terms diminish indefinitely" (foot-note, p. 52).

Nevertheless, the author's style is clear and easy, his illustrations well chosen and applied, and his reasoning easy to follow.

The author prefers the term "differential coefficient" to the more compact term "derivative," and uses the notation "differential coefficient$_n$" for the nth derivative instead of the more usual form $\frac{d^n y}{dx^n}$.

The first three chapters are devoted to fundamental ideas, the next six: to deducing the rules for differentiation, the tenth to successive differentiation, the eleventh to the graphical meaning of the derivative in rectangular coördinates, and the final chapter to maxima and minima. There are no problems other than those worked out and used in illustrations—a decided drawback even to the reader who seeks only the slightest knowledge of the subject.

*Professor of Mathematics, Worcester Polytechnic Institute, Worcester, Mass.

AN APPRECIATION OF TWO GREAT WORKERS IN HYDRAULICS—Giovanni Battista Venturi and Clemens Herschel. By Walter G. Kent. London: Blades, East & Blades. [Privately printed]. Cloth; 7x10 in.; pp. 34; illustrated.

This book is an excellent contribution to the history of engineering. In the literature of the profession there is, comparatively speaking, very little on record concerning the personality of the men who have been responsible for noteworthy achievements in engineering. One difficulty is, of course, that the world only wakes up to find out that a man has done something deserving of recognition after the man himself has passed away, as have those who knew him in his days of active life. Another difficulty is that in the rush and hurry of this Twentieth-Century life we are too busy making history to stop either to write or to read history.

It is all the more deserving of notice, therefore, when a man does take time from earning his bread and butter to write and publish books dealing with engineering history. Mr. Kent, the author of this book, is the manufacturer who has, under Mr. Herschel's patents, furnished Venturi meters to all other countries than North America. He went to great pains in his search for data regarding Venturi's life and history and only by long and persevering search did he succeed. The portraits in the book deserve special praise for their high artistic excellence. While the book is privately printed and not for general circulation, we hope that copies will be obtained and put on file in the principal engineering libraries.

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A Teaching Exposition of the Art of Electric Lighting

ELECTRIC LIGHTING AND MISCELLANEOUS APPLICATIONS OF ELECTRICITY—A Textbook for Technical Schools and Colleges. By William Suddards Franklin. New York: The Macmillan Co. London: Macmillan & Co., Ltd. Cloth; 6x9 in.; pp. 299; 200 text figures. $2.50, net.

The author has presented a teachers' exposition of the art of electric lighting, different from those texts which are already recognized as desirable standards in the instruction of technical students. He has, to a negligible extent, infringed on the territory so well covered by books like Prof. Crocker's two volumes on "Electric Lighting." It will be recalled that Prof. Crocker in his treatise started out with the history of electric lighting, following that up with a description of the present system of electric units previous to giving a classification of different systems of artificial lighting with electric current. It will be recalled also that he discussed the proper location of generating plants and the arrangement of buildings and machinery. A considerable portion of Prof. Crocker's treatise is given over to the mechanical engineering of power plants, comprising such items as steam engines, steam boilers, power-house piping, gas producers and gas engines, waterwheels and turbines, etc. Then he went into the design of electric-generating equipment, both electrically and mechanically, as the best way of leading up to the more purely electrical side of the art. The second volume of Prof. Crocker's treatise, as will be remembered, largely concerned itself with systems of distribution, discussions of alternating-current phenomena and apparatus, practical details of underground construction work, the construction and use of arc lamps, incandescent lamps, meters, etc.

Prof. Franklin's text is evidently prepared from a very different viewpoint, since he emphasizes, everywhere possible, the influence of economical considerations on design, giving only very minor space to descriptions of apparatus and expositions of design. At the start he outlines the items into which the cost of generating electric power may be divided, and in setting forth these classifications he takes data which have been made available by different engineers to illustrate his divisions. He has thus opened up immediately that field of discussion which the engineer must enter as soon as he undertakes practical work in the electric-lighting industry, particularly in this latter day when the reasonableness of rates and the actual cost of furnishing energy becomes so important in the relations of a company to its patrons and to public regulating commissions.

The theoretical elements of any schedule of rates are considered: items such as (1) a fixed charge to cover cost of metering, billing, etc.; (2) a minimum charge to cover investment behind readiness to serve, and (3) a charge for energy actually consumed. The author also emphasizes simplified schedules and shows the conditions under which simplification is possible even to the extreme of doing business under flat rate. Between the rate discussions and a summary of the financial and engineering operations of the

municipal electric-supply plant of Wellington, Conn., there are sandwiched in some very brief descriptions of electric-energy meters.

The second and third chapters comprise work on distribution and transmission—taking up theoretical discussions of circuits and some more important practical details, such as stresses in catenary sags, pole-line construction, insulators, etc. Chapters IV to VII, inclusive, are largely given over to what we would call nowadays "illuminating engineering." This includes the older fundamental ideas behind the art and science of photometry and the newer material on planning the illumination of specific exterior and interior locations. The absorption method of finding the amount of light and electric energy required for a given scheme of interior illumination has been employed to good advantage, giving the student at one and the same time a clear, easily grasped idea of the actions which go on, and a short easy method for finding the average value of illumination.

In the latter part of the book, Prof. Franklin has departed somewhat from electric lighting to include much matter of a general interest in teaching electrical engineering and of, perhaps, some remote connection with electric lighting. For instance, there is a chapter on "electrolysis and batteries," in which he gives a very readable and interesting review of the modern conception of electro-chemical theories. This leads up to descriptions of a few more important primary cells and to the lead and nickel-iron storage batteries. Finally, he compares the cost of securing current from primary batteries and mechanical generators, that the student may see how chemical generation must cost from $1.50 to $4 per kw.-hr. It is well that the student should realize such facts early in his study, and such specific analyses as here given should give a transferable impression.

There is a chapter on "miscellaneous applications," in which are found some very elementary descriptions of the theory of simple and multiplex telegraphy, submarine signaling, telephony (including the use of loading coils), railway signaling, etc. There are two appendices, one of which presents the subject of electric stresses much in the same way as is done in the author's previous books. A second appendix gives a number of problems which may be used with the various chapters.

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Mexican Cyanide Practice

Reviewed by F. W. TRAPHAGEN*

CYANIDE PRACTICE IN MEXICO—By Ferdinand McCann. San Francisco: Mining and Scientific Press. London: The Mining Magazine. Cloth; 6x9½ in.; pp. 194; 39 text illustrations. $2, postpaid.

The literature of the cyanide process has been greatly enriched by the recent issue of several books dealing with this subject, some of them taking up in great detail the practice followed in special localities. The book under review comes in the latter class, and, dealing with the practice in Mexico, where silver is almost always present in considerable quantity, and where the adaptation of the process to the treatment of gold-silver ores in which the silver is combined as sulphide, sulpharsenide or sulphantimonide, forms not readily amenable to simple cyanidation, has been successfully carried out, it will be welcomed by those interested in the treatment of [illegible] ores.

After a brief review of the history of the cyanide process and a general discussion of the various methods of treatment, the practice is described in detail as carried out at 11 different plants. In addition there are chapters on Cyanide Practice in Small Plants, Continuous Cyanide Treatment, Cyanidation in Pan-Amalgamation Mills without Change in the Machinery, Precipitation with Metallic Zinc, [illegible] of Cyanide Precipitates.

Descriptions of the various plants are very complete and [illegible] results of experiments of various machines and devices, consumption of chemicals and costs of operations cannot fail to be of great value to those concerned with the treatment of ores similar to the Mexican [illegible] to those [illegible] of [illegible].

[illegible] Mexican and South African practice. In Mexico, as well as in other parts of America, Chilian and Huntington mills are in very general use as intermediate or final crushers, while in South Africa stamps follow breakers and all fine crushing is done in tube mills. The logical practice would seem to be, except where battery amalgamation is required, to use breakers, rolls, or [illegible] without [illegible] to [illegible].

Classification, or rather sand-slime separation, is made in [illegible].

[illegible] of McCann and [illegible] Colorado School of Mines, Golden, Colo.

South Africa almost exclusively by means of cone-classifiers, more recently with the addition of the Caldecott diaphragm. In Mexico, mechanical classifiers are in general use, the drag-classifier, the Archimedean screw type or the Dorr scraper type being the forms preferred.

Filtration of slime in Africa is conducted with filter presses or more generally with vacuum filters, although decantation renders filtration unnecessary in many plants. In Mexico vacuum filters, pressure filters, with, occasionally, filters of the Merrill type are used.

The flow sheet of the Esperanza practice is very excellent and the "Data Relative to Various Cyanidation Plants," compiled by W. E. Hindry, contains in small compass a great amount of valuable information.

The metallurgists who have worked out the treatment of these Mexican ores have done a very valuable service and Mr. McCann is to be congratulated for his work in making available in compact form the result of these labors.

Unfortunately, there are a number of errors, mainly typographical, which have escaped the proof reader. Among many are the following: "stop-clock," page 130, "drip cork," page 129, 92,656 pesos instead of 2.656 pesos treatment cost on page 36. There is a redundancy in "decanted off," page 15.

Chemists and metallurgists generally will question the accuracy of the following statement and reaction: "Alkali, in the presence of oxygen, may dissolve zinc forming potassium zincate and hydrogen peroxide, according to the following reaction:

$$Zn + 2\ KOH + O_2 = K_2ZnO_2 + H_2O_2"$$

It is generally believed that the reaction was rather one of reduction:

$$Zn + 2\ KOH = K_2ZnO_2 + H_2$$

The reviewer wonders where McCann finds authority for the reaction as he gives it.

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Military and Tropical Hygiene

MILITARY HYGIENE AND SANITATION—By Col. Charles H. Melville, M. B. Edin., D. P. H.; Royal Army Medical Corps; Late Sanitary Officer, Army Headquarters, India. New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 5½x9 in.; pp. 418; numerous tables and diagrams. $3.50, net.

AIDS TO TROPICAL HYGIENE—By Major R. J. Blackham, D. P. H. (London): Divisional Sanitary Officer, First Division, Indian Army. New York: William Wood & Co. Cloth; 4¾x6½ in.; pp. vii + 192. $1.25, net.

If those portions of Colonel Melville's book which deal with the more strictly military phases of his subject are as good as those which have to do with sanitation, and we have no reason to doubt that they are, then he has produced an unusually good treatise. The volume is founded on lectures delivered by the author while Professor of Hygiene at the Royal Army Medical College, and is marked throughout with a rare combination of scientific knowledge and judgment with practical good sense.

Besides such topics as the physical condition and training of recruits, marching, and the food, rations, clothing and equipment of the soldier, the book deals at considerable length with sanitary organization, water-supply and purification, ventilation, removal and disposal of various wastes, the design and care of barracks and of less permanent military habitations, the prevention of infectious diseases, disinfection and the sanitation of the battlefield.

In general, subjects which have been treated over and again in other texts and which are not materially different in private and military sanitation, like plumbing, sewerage and sewage treatment, are briefly dismissed—a most praiseworthy feature of the book.

From the military viewpoint, the removal of sewage and of night soil is rightly considered as of greater importance than their disposal. For night soil and garbage, burning as near as reasonably may be to the point of origin is advocated. Feces and urine from persons known to be infected with typhoid fever, in the author's opinion, should be disinfected by boiling. Experience in India points to comparatively little danger of typhoid from water-supplies, up to the point of distribution to individual users, but the greatest care in distribution from tanks or water taps by human water carriers, particularly by Indian natives, is urged.

Hypochlorite water disinfection is not given the fullness of consideration or the value which it seems to merit, but the British are conservative in this respect. The author does not seem to hold the septic tank in high esteem, and does not even mention the Imhoff tank. The latter failure, again, is in line with British conservatism. We hasten to add, however, that no general accusation of British or other conservatism or backwardness would hold good against the author. He shows

a breadth of information and judgment alike, which is not common in British writers.

Colonel Melville's book as a whole deserves hearty commendation. We should suppose that it might be useful to army officers responsible for the health of soldiers, and the sanitation of camps in any part of the world, although it seems to be founded largely on East Indian conditions. The book also contains many practical suggestions and even specific data of possible use to any one in charge of engineering and construction camps, besides abounding with ideas that cannot fail to interest the student of general hygiene and sanitation.

Major Blackham, in his "Aids to Tropical Hygiene," has compressed into small compass a large amount of useful information. Both personal hygiene and general sanitation are treated. The chapters on water purification and sewage treatment betray a superficial knowledge of these subjects and contain a number of misleading statements. The section on the disposal of household refuse is brief and unsatisfactory.

All three of these subjects are treated with a brevity and shallowness that is in striking contrast with the three chapters on Insects and Disease, Animal Parasites and Prevention of Malaria. Considering the small size of the book these subjects are treated in great detail. It is questionable whether in a "Students Aids Series" there is occasion for going so minutely as has this author into the natural history of the various mosquitoes and flies described. If such detail is required it would seem to be better either to refer the students to larger and special treatises, if such exist, or else to add to this series a book dealing with these subjects alone.

Notwithstanding the foregoing criticisms, Major Blackham's little book has much to commend it. Particularly good is a folding sheet at the end of the book containing a tabular summary of "Tropical Diseases Indicating Preventive Measures."

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Radioactivity

Reviewed by CHARLES BASKERVILLE*

STUDIES IN RADIOACTIVITY—By W. H. Bragg, M. A., F. R. S., Cavendish Professor of Physics in the University of Leeds; formerly Elder Professor of Mathematics and Physics in the University of Adelaide. New York: The Macmillan Co.; London; Macmillan & Co., Ltd. Cloth; 6x9 in.; pp. 196; 70 text figures; $1.60, net.

All students of radiochemistry are familiar with the experimental investigations of Bragg and of Bragg and R. Kleeman on, mainly, the phenomena attending the passage of the alpha-, beta-, gamma- and X-rays through matter, as published in the "Philosophical Magazine" during the past eight years. Bragg and Kleeman first attacked certain questions in the study of radioactive transformations in 1904, and the interesting experiments performed by them and the conclusions which they arrived at therefrom have thrown light on the nature of the alpha-rays and on the laws of their absorption by matter, on the scattering of the beta-ray and its loss of energy, and on the nature and properties of the X- and gamma-rays.

In this volume Bragg deals with the subjects which he has investigated, in response to a request that he prepare an account of his experiments and conclusions. He has not, however, confined the book within the limits of his own enquiries, but has included the field in which his investigations have been conducted. While this field may be regarded as but a limited portion of the domain of radiochemistry, as pointed out by the author himself, yet the attempt to give a presentment of the important features of a special subject and to collate the things which most invite comparison has been successful, and the book will undoubtedly serve a useful purpose in conveniently supplying the results of special studies in an important field of radioactivity. It is divided into 17 chapters and includes a good index.

It must be borne in mind that the book deals exclusively with certain phases of the physical side of radioactivity. Consequently, considering that the chemical side is of equal importance, the general reader—in fact, all others than radiochemists and physicists who have specialized in radioactivity—will lay down the work with a feeling that he has only heard part—an intermediate part—of a serial; but it may be cordially recommended to the advanced student of chemistry and physics of the radio-elements.

The work is well printed on substantial paper. There are very few misprints.

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*Professor of Chemistry, College of the City of New York, New York City.

REINFORCED-CONCRETE CONSTRUCTION—Advanced Course, with Numerous Fully Worked Examples. By M. T. Cantell, Licentiate, R. I. B. A., Head of Architecture and Building Department, Municipal Technical College, Brighton. London: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth, 7x10 in.; pp. xi + 240, 251 illustrations, including 7 folding plates. $5.

English engineers are just beginning to realize that the design and construction of reinforced concrete is not a secret process known only to a certain limited guild, to which all general practitioners must turn when reinforced concrete is to be used. While the various "systems" still have a greater prestige in Great Britain than in any other country, the growing number of British books on reinforced concrete shows that there is a demand among engineers for more information as to design, which information, it is to be hoped, will be used in original designing rather than in checking. However, the comparative novelty of such books explains the elementary form that most of them take. Occasionally an English book on concrete is supertechnical; such a book, for instance, is Faber & Bowie's "Reinforced-concrete Design" (reviewed here on June 13, 1912, p. 1151), but in general they are devoted only to the most simple phases of concrete design.

The book before us is called an "Advanced Course," and follows a previous "Elementary Course," and yet it takes up only the simplest design and the stock forms of construction. It further follows the elementary types of text in numerous numerical examples which are used to illustrate the occasional general principles. An examination of the book, however, shows this to be a most admirable method of instruction, and one that could be profitably followed in other texts. The beginner can always more readily understand a specific example than a general formula.

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A German Treatise on Oil Engines

OELMOTOREN IN VIERTAKT- UND ZWEITAKTBAUART—By H. Haeder, Ingenieur. Vol. I, Bauarten, Wirkungsweise, Berechnung und Konstruktionseinzelheiten der Motoren und Motorenteile. Cloth; 4¾x8 in.; pp. xvi + 255; 460 text figures. Vol. II, Hauptmasse, Masstabellen, Diagramme, Versuchsergebnisse, Berechnungen, Gewichte, Preise, Aufgaben und Beispiele. Cloth; 9x8 in.; pp. viii + 108; numerous text figures, 58 plates. Wiesbaden: Otto Haeder, Vol. I, 5 marks. Vol. II, 13.50 marks. Complete, 18.50 marks.

An examination of these volumes impresses one at once how far Europe is in advance of this country in the design and construction of internal combustion engines. We note with regret, also, that it is likewise far in advance of this country in the extent to which publicity is given to the art of mechanical design. It would be easy to criticise these volumes by saying that they are to a considerable extent a compilation of matter, which has previously appeared in technical publications and in trade catalogs. The work is not to be compared, of course, it will be admitted, to the monumental treatise of Güldner on internal-combustion engines. On the other hand, it is also true that these volumes are filled with just the sort of information that the practical designer of oil engines desires to have. There is a profusion of detailed drawings of oil engines of many sizes and types and especially of their details. These drawings are in many cases quite fully dimensioned, and, while reduced to a comparatively small scale, they are still of great use to the designer.

It would be absolutely impossible to publish such a book in the United States, even if the oil-engine industry were advanced to as high a stage of perfection in this country as it is in Germany. There is a prevalent idea in this country that European manufacturing concerns are much more secretive in their policy than American concerns. There is this much foundation for the idea: It is generally much more difficult for an engineer to obtain access to a European engineering works than to a similar works in the United States, in Germany and France. On the other hand, the art of mechanical design is immensely stimulated and aided by the extensive publication of detailed drawings of machinery in technical journals, and in such books as the one before us. The American editor of a technical journal or the American writer of a technical treatise who attempts to secure from American manufacturers anything in the way of detailed drawings of the machines which they build invariably finds that he has run square against a stone wall.

We believe that this mistaken attitude of American manufacturers has very much to do with the backward state of mechanical-engineering design in this country as compared with Europe. The men in each establishment in America are working independently with no knowledge of what is being done by others in the same field except as it is picked up more or less surreptitiously. It is a fact that designing en-

gineers in many American shops make extensive use of foreign publications such as this before us, and must do so, indeed, if they are to keep at all up to date.

The recent development of the oil motor in Europe has been remarkable. In the United States the era of cheap gasoline has lasted so long that only a very few firms have bothered themselves at all over the design of motors burning kerosene or heavier oils. In Europe, however, there is a great variety of oil engines produced by many different manufacturers, in all sizes from small machines of a few horsepower up to the large Diesel engines of 1000 to 2000 hp. Their construction has become as well established an industry in Europe as has the production of ordinary steam engines in the United States. With the rapid increase in the consumption of gasoline in this country and the steady increase in its price, which is inevitable in the future, there is certain to be a great demand for successful oil engines in the United States. Careful study of European designs will enable American manufacturers to save the expenditure of much money in useless experiments.

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Studies of Aviation

Reviewed by WILLIAM McENTEE*

THE MECHANICS OF THE AEROPLANE—A Study of the Principles of Flight. By Captain Duchene. Translated from the French by John H. Ledeboer, B. A., Associate Fellow, Aëronautical Society; Editor "Aëronautics," Joint-Author of "The Aëroplane," and T. O'B. Hubbard, Secretary of the Aëronautical Society; Joint-Author of "The Aëroplane." New York, London, Bombay and Calcutta: Longmans, Green & Co. Cloth; 5½x9 in.; pp. x + 231; 91 text figures. $2.25, net.

STABILITY IN AVIATION—An Introduction to Dynamical Stability as Applied to the Motions of Aëroplanes. By G. H. Bryan, Sc. D., F. R. S.; Professor of Pure and Applied Mathematics in the University College of North Wales, formerly Fellow of Peterhouse, Cambridge. New York and London: The Macmillan Co. Cloth; 6x9 in.; pp. 192; 38 text figures. $2, net.

The author of "The Mechanics of the Aëroplane" is Captain of Engineers in the French Army. In 1911, according to the Translators' Preface, the French Academy of Sciences awarded him the Monthyon prize, in recognition of his production of the original of this "Study."

The book is designed to supply a demand for an explanation of the principles of mechanical flight in such form that an education in abstruse mathematics will not be required in order to read it intelligently. At the same time, it does not seek to convey the essential element of the subject in a way which can be said to be popular, or make an appeal to a wider circle of readers by sacrificing mathematical accuracy of statement in an attempt to convey in words facts which are best expressed in formulas. The author has, on the whole, succeeded in avoiding abstruse mathematics on the one hand and loose popular form on the other. The subject is presented so that it will readily be understood by the reader who has a good high-school education.

The volume is divided into four parts. Part I consists of 100 pages, dealing with flight, both horizontal and oblique, in still air. In Part II, 65 pages are devoted to the question of stability. Parts III and IV deal with the effect of the wind and with the screw propeller, respectively, taking together some 43 pages. At the end of the book are given 9 pages of tables which are useful for those making aërodynamic computations, and particularly so if conversions from the metric to the English system are involved.

On page 2 the statement is made, in discussing the subject of air pressures on inclined planes, that "the magnitude of the pressure is proportional to the square of the velocity." On the opposite page, it is stated that "the pressure is proportional to the velocity." This is apparently a slip by the author or translators.

It is perhaps unfortunate that the angle of incidence is expressed in terms of the natural sine instead of degrees. Though convenient for computations, it is confusing because of the more general use of the latter for this purpose. The author himself finds it necessary in many places throughout the book to state the angle in both forms.

On page 8, the aërodynamic constant, or pressure coefficient K, is stated to be characteristic of the "lifting efficiency" of a plane or curved surface, and it is therefore called throughout the book the "lifting efficiency." This is a curious confusion of the terms "efficiency" and "capacity." The "efficiency" of an aeroplane is greatest when the ratio of lift to drift is greatest. It does not necessarily follow that under this condition its weight-carrying capacity is also greatest.

This confusion of terms leads, in a lengthy discussion of the relations between weight, speed, angle of incidence and value of K, to what is called, on page 19, "at first sight . . . . the astonishing result that . . . . The aëroplane possessing the most inefficient planes will fly the fastest." Instead of changing the error producing name given to the constant K, the author remarks that the advantage is only apparent and that the increase in speed is obtained at an excessive cost in power. This part of the work could be recast to advantage.

With the exceptions noted, Part I is well presented.

Passing on to Part II, dealing with equilibrium and stability, one is struck by the assertion that it is erroneous to liken the equilibrium of an aëroplane to that of a boat, and still more so by the attempted proof of that assertion, the proof being based on the assumption that when equilibrium is disturbed the center of effort and direction of action of the supporting forces is such that their line of action passes through the center of gravity of the aëroplane in all cases. Under such circumstances, there could, of course, be no righting moment tending to right the machine. The proof, however, is a clear case of arguing in a circle. In a foot note, it is stated that this assertion applies only to transverse equilibrium. As a matter of fact, it is only true in the very exceptional case when the center of effort of the supporting forces coincides exactly with the center of gravity of the aëroplane. In the subsequent discussion of the subject, formulas are derived for longitudinal stability, which are exactly analogous to those used to express the stability of a ship.

The treatment of the propeller problem in the last part of the book is not very impressive. The formula

$$T = b\ V^2\ D^2,$$

giving the relation between thrust, speed of advance through the air, and diameter of the propeller required, is simple and can be used with excellent results, if the value of the constant b is taken with due regard to type and pitch ratio.

The statement on page 215 that a pitch ratio of 3.14 is desirable for efficiency is contrary to results of experiments both with air and water propellers, which agree in showing a pitch ratio of about 1.5 to be best.

The rather guarded opinion expressed as to the probable superior efficiency of 4-bladed as compared with 2-bladed propellers is also at variance with experimental results.

In "Stability in Aviation," Prof. Bryan is frankly a mathematician, working with the mathematician's tools in the field of aëronautics.

In a novel and interesting "Introduction and Summary," comprising the first 18 pages of the book, the author sets forth his reasons for undertaking the present work, as follows:

> In this book attention is concentrated on the mathematical aspect of the problem for several reasons. In the first place, there is no obvious alternative between developing the mathematical theory fairly thoroughly and leaving it altogether alone; any attempt at a via media would probably lead to erroneous conclusions. In the second place, the formulæ arrived at, even in the simplest cases, are such that it is difficult to see how they could be established without a mathematical theory. In the third place, there is probably no lack of competent workers interested in the practical and experimental side of aviation, and under these conditions it is evident that the balance between theory and practice can be improved by throwing as much weight as possible on the mathematical side of the scale. Lastly, it is hoped to advocate the claims of aëroplane equilibrium and stability as an educational subject suitable for study in our universities alongside with such branches of applied mathematics and mathematical physics as hydrodynamics, and particle and rigid dynamics.
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> And as if the forces at work on the theoretical side were in need of recruits, this is followed by an invitation to other mathematicians to join in the exploration of the new field, where it is promised that many problems await solution.
>
> There is no doubt that there is need of rigid theoretical investigations of the forces involved in the subject. Theorists should therefore be encouraged to extend their investigations to the mathematical limit, so to speak. If the conclusions arrived at agree with observed facts, they supply a logical explanation of them. If they do not agree with the facts, so much the worse for theory, and no harm has been done.
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> The author first deduces the six general equations of motion, as used in Rigid Dynamics. These are applied under various assumed conditions of equilibrium and disturbed equilibrium, the result being a maze of mathematics, in which a number of transformations and assumptions as to importance of neglected terms are necessary, in order to simplify the results sufficiently to make them capable of indicating any particular conclusion.

*Naval Constructor, U. S. N., Fore River Shipbuilding Co., Quincy, Mass.

The danger of the method is that in the process of simplification certain assumptions may be admitted which eventually lead to error. For example, on page 53, under what is called the "Principle of Independence of Height," it is concluded that "if an aëroplane is stable when the planes are on a level with the center of gravity, the stability is only very slightly affected by raising or lowering the planes."

This appears doubtful. On a "Wright" aëroplane a considerable initial transverse stability is obtained by placing the center of gravity of the machine with passengers about 12 in. below the center of support. If the center of gravity were raised 18 in., the aëroplane would certainly become initially unstable as concerns transverse inclinations.

The book as a whole appears to be equal to the best known previous work of the same class, published in English, that is Lanchester's "Aërodonetics" (London, 1908). The methods employed in the two are radically different, but the conclusions reached in each, on points of fundamental importance, are in substantial agreement. The present work may be said to have made some advance over the other, in that it takes account of the secondary and more rapid longitudinal oscillations of an aëroplane, and shows them theoretically to be of little importance.

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Applied Statics

Reviewed by AMASA TROWBRIDGE*

TEXTBOOK OF MECHANICS—By Louis A. Martin, Jr., Professor of Mechanics, Stevens Institute of Technology. Vol. IV, Applied Statics. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x7¾ in.; pp. xii+198; 141 text illustrations. $1.50, net. (6/6, net).

A small book for a very broad subject. In fact, so small that only an outline is given. The author's effort to make a "teachable" book has been crowned with success for, without a teacher, the student would certainly find the path of knowledge quite difficult in some places. The plan of the book is the same as in Volume III; the student is required to deduce his formulas with the least possible aid from the textbook. Without doubt, this is bound to make him think and to give him a more thorough understanding of the subject than would be gained by merely memorizing. The scheme is decidedly a good one.

The subject of Applied Statics is so broad that one could not expect to cover it in a small textbook. The author has selected what he considers the essentials and has treated them as fully as his space permitted. The free use of problems has enabled him to introduce many points not covered by the text, which the student is expected to dig out for himself. A set of review problems at the end of the book serves to connect the subject treated to the problems which an engineer might meet and which may be readily solved by the methods and formulas given in the text.

The author begins with a very concise chapter on Work and Energy. He introduces many machine elements, but confines the treatment to the "static" condition. He next gives a condensed discussion of Coplanar Forces as these are the basis of much of the work in Chapter III, which treats of two-dimensional structures. These are the forms of framed structures most frequently used. Then follows a chapter on Solid Statics, these being applied to the solution of the stresses in sheer legs and steam-shovel frames. Chapter V treats briefly of the Equilibrium of Ropes and Cables. Friction is introduced in Chapter VI, the treatment of the subject being mostly graphical. This is amplified by a consideration of the Forces Acting on Machine Members and Complete Machines. The final chapter deals with Resistance to Rolling.

Volume I of this series on Statics, was reviewed in these pages on July 12, 1906; Volume II, on Kinematics and Kinetics, Dec. 12, 1907; and Volume III, on Mechanics of Material, Nov. 16, 1911.

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MODERN PARK CEMETERIES—By Howard Evarts Weed, M. S., Landscape Architect. Chicago, Ill.: R. J. Haight. Cloth; 5x7½ in.; pp. 145; 21 text illustrations. $1.60, net.

Within brief compass the author has succeeded in giving a good, general idea, as well as some practical information, on the principles which should be followed in laying out and managing any cemetery and particularly those which depart from the old-time rigid geometrical lines and real-estate conception of providing as many salable lots as possible, and in place follow the principles governing good landscape work. The book contains, among other things, practical hints on grading, planting, lawn-making, and construction of roads. The latter subject is treated by Myron H. West, superintendent of Lincoln Park, Chicago. A few line drawings and a number of well selected and well produced halftone photographs add to the interest and value of the book.

*General Manager, Rhodes Mfg. Co., Hartford, Conn.

PUBLICATIONS RECEIVED

ALMANAC FOR 1913—Baltimore, Md.: The "Sun." Paper; 5x7 in.; pp. 256.

ALTERNATING-CURRENT MACHINERY—A Practical Treatise on Alternating-current Principles and Systems, Commercial Types of Alternators, Synchronous Motors, Transformers, Converters, Induction Motors, Switchboard and Station Appliances, etc. By William Esty, S. B., M. A., Head of Department of Electrical Engineering, Lehigh University. Chicago: American School of Correspondence. Cloth; 6¼x9¾ in.; pp. xii+467; 409 text illustrations. $3.

AMERICAN CITY GOVERNMENT: A SURVEY OF NEWER TENDENCIES—By Charles A. Beard, Associate Professor of Politics in Columbia University. New York: The Century Co. Cloth; 5¼x8¼ in.; pp. 420; 14 illustrations. $2, net.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION—Proceedings for 1912. [Secretary, Jos. W. Taylor, 390 Old Colony Building, Chicago.] Cloth; 6x9 in.; pp. 432; illustrated.

AMERICAN WATER WORKS ASSOCIATION—Proceedings for 1912. Troy, N. Y.: John M. Diven, Secy. Cloth; 6x9 in.; pp. 465; illustrated.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1911, with Subject Index—John M. Nickles. Bulletin 524, U. S. Geological Survey (George Otis Smith, Director). Washington, D. C.: Pub. Doc. Paper; 5¾x9¼ in.; pp. 162.

BOARD OF RAILROAD COMMISSIONERS OF IOWA—Report for 1911. Des Moines. Cloth; 6x9 in.; pp. 790.

THE CANE AS A WEAPON—By A. C. Cunningham, Civil Engineer, U. S. Navy. Washington, D. C.: The Army and Navy Register. Stiff paper; 4½x6 in.; pp. 55; illustrated. 50c.

CARE OF TUBERCULOSIS WAGE EARNERS IN GERMANY—Washington, D. C.: U. S. Bureau of Labor. Paper; 5⅞x9¼ in.; pp. 133.

CENSUS OF THE CANAL ZONE, Feb. 1, 1912—Taken by the Department of Civil Administration. Mount Hope, C. Z.: Isthmian Canal Press. Paper; 5½x8¾ in.; pp. 58.

CHEMICAL ARITHMETIC AND CALCULATION OF FURNACE CHARGES—By Regis Chauvenet, M. Am. Inst. Min. E. Philadelphia and London: J. B. Lippincott Co. Cloth; 6x9 in.; pp. xi+302; $4, net.

CLEAR LAKE WATER SUPPLY for State Institutions, Cities and Towns in Upper Willamette Valley—Report of Louis C. Kelsey (Portland, Ore.) to Oregon State Board of Health. Paper; 6x9 in.; pp. 39; illustrated.

A news note summarizing this report may be found on p. 187 of Eng. News of Jan. 23, 1913.

COMMISSIONER OF HEALTH OF VIRGINIA—Report of Ennion G. Williams, M. D. (Richmond, Va.), for 1912. Paper; 6x9 in.; pp. 200.

CONCENTRATING ORES BY FLOTATION—Being a Description and History of a Recent Metallurgical Development, Together with a Summary of Patents and Litigation. By Theodore J. Hoover, A. B., Leland Stanford, Jr., University; M. Inst. M. & M. London: The "Mining Magazine." San Francisco.: Mining & Scientific Press, Agents. Cloth; 6x9 in.; pp. 221; 55 text illustrations. $3.75.

CONTROL OF WATER CARRIERS BY RAILROADS AND BY SHIPPING CONSOLIDATIONS, PART IV—Report of Commissioner of Corporations Luther Conant, Jr. (Washington, D. C.), on Transportation by Water in the United States. Paper; 6x9 in.; pp. 101; illustrated.

COSTS OF PRODUCING POWER IN IOWA WITH IOWA COALS—By H. W. Wagner. Bulletin 29, Engineering Experiment Station, Ames, Iowa. Paper; 6x9 in.; pp. 36; illustrated.

THE ECONOMICS OF RAILROAD CONSTRUCTION—By Walter Loring Webb, M. Am. Soc. C. E., Assistant Professor of Civil Engineering (Railroad Engineering), University of Pennsylvania, 1893-1901. Second edition, thoroughly revised. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. viii+347; 34 text figures. $2.50 (10/6), net.

ELECTRICAL MACHINE DESIGN—The Design and Specification of Direct and Alternating Current Machinery. By Alexander Gray, Assistant Professor of Electrical Engineering, McGill University, Montreal, Can. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii+528; 317 text illustrations. $4, net.

ELECTRICITY IN INDIA—Being a History of the Tata Hydro-Electric Project, with Notes on the Mill Industry in Bombay and the Progress of Electric Drive in Indian Factories. Edited by S. M. Rutnagur. Bombay, India: "Indian Textile Journal." Paper; 6x9 in.; pp. 80; illustrated. Rs. 1-12.

ELECTROLYSIS FROM STRAY ELECTRIC CURRENTS—By Albert F. Ganz, Professor of Electrical Engineering, Stevens Institute of Technology, Hoboken, N. J. Reprinted from Proceedings American Water Works Association. Paper; 6x9 in.; pp. 40; illustrated.

ELEMENTS OF HEAT-POWER ENGINEERING—By C. F. Hirshfeld, M. M. E., Professor of Power Engineering, and Wm. N. Barnard, M. E., Professor of Steam Engineering, Sibley College, Cornell University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6—^ in.; pp. xiii+811; 480 text figures. $5 (21s.), net.

ELEMENTS OF WESTERN WATER LAW—By A. E. Chandler. Irrigation and Water Right Specialist; Assistant Professor, Irrigation Institutions, University of California; Secretary, American Engineering Corporation, San Francisco. San Francisco: Technical Publishing Co. Cloth; 5x9 in.; pp. 150. $2.

ESSENTIALS OF ELECTRICITY—A Textbook for Wiremen and the Electrical Trades. By W. H. Timbie, Head of Department of Applied Science, Wentworth Institute, Boston, Mass.; formerly Instructor in Industrial Electricity, Pratt Institute. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x7 in.; pp. xiii+271; 224 text figures. $1.25, net (5/6, net).

FOREST FIRES: Their Causes, Extent and Effects, with a Summary of Recorded Destruction and Loss—By Fred G. Plummer, Geographer. Bulletin 117, Forest Service, U. S. Department of Agriculture. Washington, D. C.: Pub. Doc. Paper; 6x9¼ in.; pp. 39; 1 plate and 6 text figures.

THE GASOLINE ENGINE ON THE FARM—A Practical, Comprehensive Treatise on the Construction, Repair, Management and Use of this Great Farm Power as Applied to All Farm Machinery and the Farmer's Work Indoors and Out. By Xeno W. Putnam. New York: The Norman W. Henley Publishing Co. Cloth; 5x8 in.; pp. 527; 179 text illustrations. $2.50.

GEOLOGY OF THE OIL AND GAS FIELDS OF WICHITA AND CLAY COUNTIES, TEXAS—By J. A. Udden, Geologist of the Bureau of Economic Geology and Technology, assisted by Drury McN. Phillips. Austin: The University of Texas. Paper; 5¾x9 in.; pp. 308; illustrated.

THE GOVERNMENT OF AMERICAN CITIES—By William Bennett Munro, Ph. D., Professor of Municipal Government, Harvard University. New York: The Macmillan Co. Cloth; 5¾x9 in.; pp. 401. $2, net

A HANDBOOK OF ENGLISH FOR ENGINEERS—By Wilbur Owen Sypherd, Professor of English in Delaware College. Chicago and New York: Scott, Foresman & Co. Flexible leather; 4x7 in.; pp. 314. $1.50.

HIGHWAY COMMISSIONER OF WASHINGTON—Report of W. J. Roberts (Olympia, Wash.) for 1911 and 1912. Paper; 6x9 in.; pp. 43; illustrated.

IRON AND STEEL INSTITUTE—Journal for 1912, No. 2, Vol. LXXXVI. London: The Institute (28 Victoria St.) and E. & F. N. Spon. New York: Spon & Chamberlain. Cloth; 5x9 in.; pp. 708; illustrated.

IRRIGATION, ITS PRINCIPLES AND PRACTICE AS A BRANCH OF ENGINEERING—By Sir Hanbury Brown, M. Inst. C. E. Second edition, revised. New York: D. Van Nostrand Co. Cloth; 5x9 in.; pp. xv+301; 68 text figures and several plates. $5, net.

Apparently the present edition of this work is substantially the same as the first one (the number of pages is identical), which was reviewed by F. W. Hound, in our issue of May 14, 1908.

ISTHMIAN CANAL COMMISSION—Report for 1912. Washington, D. C. Paper; 6x9 in.; pp. 640; illustrated.

LEAD AND ZINC OF OKLAHOMA—By L. C. Snider, Assistant Director, Oklahoma Geological Survey. Bulletin No. 9. Norman, Okla.: The Survey. Paper; 6x9 in.; pp. 97; illustrated.

THE "MECHANICAL WORLD" ELECTRICAL POCKET BOOK FOR 1913—Manchester and London: Emmott & Co., Ltd. Cloth; 4x6¼ in.; pp. 311; 98 text figures. Sixpence.

THE "MECHANICAL WORLD" POCKET DIARY AND YEAR BOOK FOR 1913—Manchester and London: Emmott & Co., Ltd. Cloth; 4x6¼ in.; pp. 439; 66 text figures. Sixpence.

MELTING POINTS OF FIRE BRICKS—By C. W. Kanolt, Assistant Physicist. Being No. 10, Technologic Papers of the Bureau of Standards (S. W. Stratton, Director). Washington, D. C.: Pub. Doc. Paper; 7x10 in.; pp. 17; illustrated.

THE METRIC SYSTEM IN ALL ITS DETAILS—Compared with the American Weights and Measures. By Henry G. Bayer. 26 tables of Equivalents. The Thermometers. New York: The Author, 232 Greenwich St. Cloth; 4x7 in.; illustrated. 85c.

A very complete exposition of the value of the metric system with a full set of conversion and multiple tables.

MINERAL FUELS—By Marius R. Campbell. Part II of Contributions to Economic Geology in 1910. Washington, D. C.: U. S. Geological Survey. Paper; 6x9 in.; pp. 663; illustrated.

MINERAL PRODUCTION OF CANADA FOR 1911—Ottawa: Department of Mines. Paper; 6½x10 in.; pp. 38.

MINERAL RESOURCES OF THE UNITED STATES FOR 1911—Part II, Nonmetals. Washington, D. C.: U. S. Geological Survey. Cloth; 6x9 in.; pp. 1224; illustrated.

MINING ENGINEERS' EXAMINATION AND REPORT BOOK—By Charles Janin, Consulting Mining Engineer. San Francisco, Calif.: Mining & Scientific Press. London: The "Mining Magazine." Part I, Flexible leather; 5x8 in.; pp. 94; illustrated. Part II, cardboard; 8x5 in.; pp. 57. [Fitted in envelope on back cover of Part I.] Complete, $2.50, postpaid, or Part II, 50c.

NATIONAL ELECTRIC LAMP ASSOCIATION—Abstract Bulletin of the Physical Laboratory. Cleveland: The Association. Paper; 6x9 in.; pp. 127. Illustrated.

THE NEW COMPETITION—An Examination of the Conditions Underlying the Radical Change That Is Taking Place in the Commercial and Industrial World—The Change from a Competitive to a Coöperative Basis. By Arthur Jerome Eddy, author of "The Law of Combinations." New York: D. Appleton & Co. Cloth; 5¼x8½ in.; pp. 374. $2, net. $2.14, postpaid.

NEW YORK STATE DEPARTMENT OF HEALTH—Report for 1911. Albany, N. Y.: Eugene H. Porter, M. D., Commissioner. Cloth; 6x9 in.; pp. 1232; illustrated.

OHIO ELECTRIC LIGHT ASSOCIATION—Proceedings for 1912. Greenville, Ohio: D. L. Gaskill, Secy. Cloth; 6x9 in.; pp. 206; illustrated.

OKLAHOMA GEOLOGICAL SURVEY—Part I. Director's Biennial Report to the Governor of Oklahoma, 1912. Part II. Mineral Production of Oklahoma, from 1901 to 1911. By D. W. Ohern, Director, Norman, Okla. Paper; 6x9 in.; pp. 47.

PEAT DEPOSITS OF OHIO: Their Origin, Formation and Uses—By Alfred Dachnowski. Columbus, Ohio: Geological Survey of Ohio. Cloth; 6x9 in.; pp. 424; illustrated.

POPULAR MECHANICS "SHOP NOTES FOR 1913"—Vol. IX. Chicago: Popular Mechanics Magazine. Stiff paper; 6½x9½ in.; pp. 224; 503 illustrations. 50c., postpaid. Set of nine volumes, $4.50.

PROCEEDINGS OF THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS—Edited by Thomas Cole, Assoc. M. Inst. C. E., Secretary of the Institution. Vol. XXXVIII. 1911-12. London: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½x8¾ in.; pp. xcviii+514; numerous illustrations and folding plates.

PROCEEDINGS OF THE TRAVELING ENGINEERS' ASSOCIATION, 1912—Edited by W. O. Thompson, Secretary, New York Central Car Shops, Buffalo, N. Y. Leather; 5¾x8¾ in.; pp. 469.

THE PROPOSED PATENT LAW REVISION—By Gilbert H. Montague. [Reprinted from the Harvard Law Review, Vol. XXVI, No. 2]. Cambridge: The Harvard Law Review Association. Paper; 6¾x10¾ in.; pp. 17.

PROVINCIAL BOARD OF HEALTH OF ONTARIO—Report for 1911. Toronto. Paper; 6x9 in.; pp. 165; illustrated.

PSYCHOLOGY AND INDUSTRIAL EFFICIENCY—By Hugo Münsterberg. Boston and New York: Houghton-Mifflin Co. Cloth; 5x8 in.; pp. 315. $1.50, net.

THE PUBLIC HEALTH ACT, and THE VACCINATION ACT—Toronto, Canada: Provincial Board of Health of Ontario. Paper; 6½x9¾ in.; pp. 70.

PUBLIC SERVICE COMMISSION OF NEW YORK, FIRST DISTRICT—Report for 1910. Statistics of Gas and Electric Corporations. Cloth; 5½x9 in.; pp. 664 and 760.

RAILROAD CONSTRUCTION—By Charles Lee Crandall, M. Am. Soc. C. E., Professor of Railroad Engineering, and Fred Asa Barnes, M. Am. Soc. C. E., Assistant Professor of Railroad Engineering, Cornell University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. viii+321; 79 illustrations. $3, net.

RATIONAL AND APPLIED MECHANICS—By Calvin Milton Woodward, Ex-Dean of School of Engineering and Architecture; Professor Emeritus of Mathematics and Applied Mechanics, Washington University, St. Louis, Mo. St. Louis: The Author, 3013 Hawthorne Boulevard, or Nixon-Jones Printing Co., 215 Pine St. Cloth; 6x9 in.; pp. viii+517; 486 text illustrations. $4.

RECEIPTS AND EXPENDITURES OF ORDINARY REVENUE FOR 1907 TO 1911—Boston, Mass.: Statistics Department. Paper; 9x12 in.; pp. 170.

RETAIL PRICES, 1890 TO JUNE, 1912—Bulletin of the United States Bureau of Labor, Whole Number 106: Part II: [Retail Prices and Cost of Living Series, No. 2: Part III]. Washington, D. C.: Pub. Doc. Paper; 6x9 in.; pp. 205.

SAW FILING AND MANAGEMENT OF SAWS—By Robert Grimshaw, M. E. Third edition, revised and enlarged. New York: The Norman W. Henley Publishing Co. Cloth; 4x6½ in.; pp. 133; 106 text illustrations. $1.

STATE BOARD OF HEALTH OF MASSACHUSETTS—Report for 1911. Boston. Cloth; 5½x9 in.; pp. 680; illustrated.

STATE BOARD OF HEALTH OF MICHIGAN—Report for 1911. Lansing. Cloth; 6x9 in.; pp. 118.

THE STOCK EXCHANGE FROM WITHIN—By W. C. Van Antwerp. Garden City and New York: Doubleday, Page & Co. Cloth; 5x8 in.; pp. 457. $1.50, net.

TRANSACTIONS OF THE INSTITUTION OF MINING AND METALLURGY. Session—1911-1912. London: E. & F. N. Spon. Ltd., and the Institution of Mining and Metallurgy. Paper; 5½x8½ in.; pp. 831; illustrated. 21 shillings.

TUBULAR STANDARDS FOR 1913—Pittsburgh, Penn.: National Tube Co. Flexible leather; 4x7 in.; pp. 565; 136 illustrations. $2.

While devoted chiefly to tables applicable to the tubular products made by the publishers, this volume also contains a considerable amount of matter relating to engineering work in which pipes and tubes are used. The book is similar in general scope and object to the well known handbooks published by manufacturers of structural steel, and will be useful in almost any drafting room.

WATER: ITS PURIFICATION AND USE IN THE INDUSTRIES—By William Wallace Christie, M. Am. Soc. C. E., Consulting Engineer; Editor, Mechanical Section of Foster's "Electrical Engineer's Pocketbook." New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. xi+219; 79 text illustrations. $2, net.

WESTERN CANADA IRRIGATION ASSOCIATION—Proceedings for 1912. Calgary, Alta.: Norman S. Rankin, Secy. Paper; 7x10 in.; pp. 198; illustrated.

WIDERSTAND EINBETONIERTEN EISENS GEGEN GLEITEN. EINFLUSS DER HAKEN—By C. Bach, K. Württ. Baudirektor, Professor des Maschineningenieurwesens, Vorstand des Ingenieurlaboratoriums und der Materialprüfungsanstalt an der K. Technischen Hochschule Stuttgart, und O. Graf, Ingenieur der Materialprüfungsanstalt. Berlin: Wilhelm Ernst & Sohn. Paper; 5x7 in.; pp. 31; 16 text illustrations. 1 mark.

WATER-SUPPLY PAPERS—Surface Water Supply of the United States. Washington, D. C.: U. S. Geological Survey. No. 283: Ohio River Basin, 1910. By A. H. Horton, M. R. Hall and H. J. Jackson. Pp. 158. No. 301: North Atlantic Coast, 1911. By C. C. Babb, C. C. Covert and R. H. Bolster. Pp. 221.

THE "WORLD" ALMANAC AND ENCYCLOPEDIA FOR 1913. New York: Press Publishing Co. Paper; 5x8 in.; pp. 896. Single copies, 25c. By mail, 35c.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Massachusetts—Boston & Providence Interurban Electric R.R. (Boston Elevated Ry.) This company, according to press reports, plans to construct a line from the Forest Hills terminal of the elevated road and run in a direct line to Providence. It will be railed for heavy trains. J. W. Corning is Elec. Engr., Boston, Mass.

MISCELLANEOUS

★★**New York**—The contract has been awarded, bids opened Jan. 28, to COOPER & EVANS, 220 Broadway, New York, by the Public Service Commission, for the construction of Sect. No. 2 of the Woodside, Astoria and Corona Rapid Transit R.R. of New York City; a two- and three-track elevated railroad in Second or Debevoise Ave., beginning 300 ft. south of Beebe Ave. and extending to a point about 330 ft. south of Ditmars Ave., including five local stations and one express station, at $850,000. List of bidders noted Feb. 6.

New York—Bids were opened Feb. 7 as follows by the Public Service Commission, 154 Nassau St., New York, for the construction of Section No. 3 of the Woodside, Astoria and Corona Rapid Transit R.R. of New York City, a two- and three-track elevated railroad in Queens Boulevard, Greenpoint Ave., Skillman Ave. and Roosevelt Ave., between the Queensboro Bridge Approach and Sycamore Ave., Corona, including two express and eight local stations: E. E. SMITH CONTRACTING CO., 71 Broadway New York, $2,063,588 (awarded contract); Snare & Triest Co., 143 Liberty St., New York, $2,204,740; Fraser, Brace & Co., New York $2,213,453; Frawley-Kaufman Co., New York, $2,222,408; Thomas J. Buckley Engineering Co., Inc., 103 Park Ave., New York, $2,295,896; Mulcahy & Gibson, $2,310,439; Oscar Daniels Co., 38 Park Row, New York, $2,333,855; Marble Arch Co. and Connors Bros. Co., 17 West 42d. St., New York, $2,359,342; Coleman Bros., $2,377,969; P. McGovern & Co., $2,453,030; Carter Construction Co., $2,887,741.

✚**Pennsylvania**—Pennsylvania R.R.—This company, Jan. 25, awarded contracts for the construction of three double-track tunnels on the Allegheny Valley Division, between Oil City and Kiskiminetа's Junction, involving an expenditure of $1,500,000. The railroad at present follows the sharp curves of the Allegheny River, and by the building of these tunnels and the realignment of tracks the distance between Oil City and Pittsburgh will be shortened 14 miles. The awards are as follows: At East Brady, tunnel 2600 ft., and at Woodhill tunnel 2878 ft. long, to ARTHUR McMULLIN, New York; 3350-ft. tunnel at Kennerdell, to JOHN A. KELLY CONSTRUCTION CO., Philadelphia, Penn. Noted Jan. 23.

✚**Virginia**—Richmond, Washington & Chesapeake Ry.—This company has awarded the contract to LANE BROS., CO., Altavista, Va., for constructing its line from Doswell to Sandy Point, Va., about 82 miles, at about $1,400,000

New River, Holston & Western R.R.—This company, it is reported, has been taken over by the Norfolk & Western Ry. An extension is contemplated. F. E. Bastian, Narrows, Va., is Gen. Supt.

Norfolk & Western Ry.—This company is planning to double-track its line from Norfolk, Va., to the Ohio River, 147 miles. C. S. Churchill, Roanoke, Va., is Ch. Engr.

West Virginia—Surveys have been made by C. P. Lewis, County Surv., Union, W. Va., and Wm. Echols, for the Tri-State Lumber Co., J. H. Rush, Uniontown, Penn., Pres., to build a railroad incline from Ray's Siding, on the Norfolk & Western Ry., to the summit of Pitts Mountain, 1100 ft., and from there down the south side of the mountain 3400 ft., to connect with a narrow gage railroad, about four miles long to be constructed into the John's Creek Valley in Craig County, Va.

North Carolina—Piedmont & Northern Lines—An extension is planned by the Piedmont & Northern Lines from Charlotte to Concord, N. C., about 22 miles. Thomas B. Lee, Charlotte, N. C., is Ch. Engr.

Durham & Southern R.R.—This company, it is reported, is making surveys for the construction of an extension from Dunn to Newton Grove, N. C., 18 miles. J. E. Stagg, Durham, N. C., is Vice-Pres.

The construction of a railroad from Elizabeth City, N. C., to Portsmouth, Va., via South Mills, is being considered. Length, about 40 miles. W. I. Halstead, Elizabeth City, is interested.

South Carolina—Greenville & Knoxville R.R.—This company has completed the survey for the construction of its proposed extension. J. R. Cothran, Greenville, S. C., is Ch. Engr.

Georgia—Brinson Ry.—This company, it is reported, plans to construct an extension beyond St. Clair, Ga. The company is now constructing to St. Clair. G. M. Brinson, Springfield, Ga., is Pres.

Alabama—Mobile & Eastern Shore Ry.—This company has been organized to construct a line from Montrose Park, Ala., to Point Clear, about 20 miles. J. K. Glennon, Mobile, Ala., is interested.

✚**Louisiana**—Orange & Northeastern R.R.—This company has awarded the contract to M. TANSEY for grading six miles of its line from Vinton, La., to a point connecting with the Gulf, Sabine & Red River R.R., north of Vinton.

Tennessee—Kentucky, Tennessee & Alabama Ry.—See item under Kentucky.

Kentucky—Kentucky, Tennessee & Alabama Ry.—This company is being promoted to connect Williamsburg, Ky., and Chattanooga, Tenn.

Kentucky—J. W. Johnson & Co., Jackson, Ky., who have purchased 30,000 acres of hardwood timber in Letcher County, Ky., will build a 20-mile railroad to connect with the Lexington & Eastern Ry. for the purpose of developing the property. At least one bridge will be erected.

✚**Ohio**—Lake Erie & Youngstown R.R.—This company has awarded the contract to the CALDWELL CONSTRUCTION CO., Youngstown, Ohio, for constructing its proposed line between Youngstown and Conneaut, Ohio. The contract includes 1,400,000 cu.yd. earth excavation, 360,000 cu.yd. rock excavation, five bridges, requiring about 4600 tons of steel and 18,700 cu.yd. of concrete masonry, one machine shop and equipment, one dock equipped, two roundhouses and turntable, telegraph service, water tanks, coal chutes, station buildings, etc. The grading, concrete and steel will probably be sublet. Noted Jan. 16.

Ohio—Cleveland Short Line Ry.—This company has been granted permission to increase its capital stock from $7,725,000 to $8,725,000, to provide for additional sidetracks and other construction work.

✚**Michigan**—Detroit, Bay City & Western R.R.—The BAY COUNTY CONSTRUCTION CO., Bay City, Mich., has been awarded the contract for an extension of this company's line from Akron, Mich., north to Sebewaing, Mich.

Kansas—Missouri Pacific Ry.—This company will improve its roadbed between Wichita and Yates Center, Kan., 98 miles. About $100,000 will be used widening the roadbed. J. R. Stephens, St. Louis, Mo., is Ch. Engr.

Wyoming—Chicago, Burlington & Quincy Ry.—This company has called for bids for the construction of its projected line between Powder River and Orin Junction, Wyo. The contract will probably be let soon.

Montana—Northern Pacific Ry.—This company plans to commence construction work early in the spring on its proposed extension to Chance, Mont.

Missouri—Moberly, Hunterville & Randolph Springs Ry.—This company will award contracts, it is reported, in April, for the construction of its proposed line from Moberly, Mo., to Huntsville & Randolph Springs, Mo., 12 miles. J. J. Munindger, Huntsville, Mo., is Ch. Engr.

Arkansas—The Board of Trade of Fayetteville, Ark., is interested in a plan to construct a railroad of 15 or 20 miles, to haul lumber from near Fayetteville to the St. Louis & San Francisco R.R.

✚**Arkansas**—J. H. Phillips Lumber Co.—This company has awarded the contract to BURKE BROS. & McNERNEY, Fort Smith, Ark., for grading, bridging, and track laying on 16 miles of railroad, commencing at a point at the station of Combs, Ark., and extending the first eight miles up a creek valley opening up an agricultural district.

Texas—Acme, Quanah & Pacific Ry.—This company, it is reported, will construct an extension from Roaring Springs, Motley County, Tex., to Roswell, N. M. John A. Knox, Savannah, Tex., is Ch. Engr.

Texas—Rio Grande & Eagle Pass R.R.—This company contemplates constructing an extension from Laredo down the Rio Grande Valley to a connection at Sam Fordyce, Tex., with a branch line of the St. Louis, Brownsville & Mexico Ry. The proposed extension will be about 125 miles long.

Gulf, Colorado & Santa Fé Ry.—This company will spend $1,500,000 for improvements during this year.

Arizona—Nacozari R.R.—This company contemplates extending its line 100 miles further south to reach the Promentorio mine owned by the Phelps-Dodge interests. E. O. Llano, Nacozari, Sonora, Mex., is Supt.

Southern Pacific Co.—This company plans to diverge its present main line to Los Angeles, at Red Rock, Ariz., through Box Cañon, thence on to Phoenix, and from Phoenix through the Yuma and Imperial Valleys to the main line at a point a short distance from the California state line. This will shorten the present distance to Los Angeles by about 100 miles. W. Hood, San Francisco, is Ch. Engr.

California—Atchison, Topeka & Santa Fé Ry.—This company will extend its line into the San Luis Rey Valley. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

California—California, Shasta & Eastern Ry.—This company contemplates the construction of a line from Bella Vista to Ingot, a distance of 13 miles.

Quebec—Canada & Gulf Terminal Ry.—This company has completed surveys for its extension from Matane, Que., east to Gaspe Basin, about 160 miles.

Ontario—Canadian Pacific Ry.—This company is considering double-tracking its main line between London and Woodstock, Ont. C. W. P. Ramsey is Engr. Const., Montreal, Que.

British Columbia—Northern Pacific Ry.—Bids are being received by this company for 20 miles of line from Victoria, B. C., to Union Bay. The work includes clearing, grubbing, bridging, etc. W. L. Darling, St. Paul, Minn., is Ch. Engr.

ELECTRIC RAILWAYS

Nashua, N. H.—The State Legislature is considering a bill for the extension of the charter of the Nashua & Hollis Electric Ry. Co. to provide for the construction of an electric railway from Nashua to Hollis.

Newport, N. H.—Plans are under consideration for the reorganization of the Newport & Sunapee Electric Ry. Co., for the construction of an electric railway from Newport to Lake Sunapee, about 10 miles.

Boston, Mass.—See item under Railways: Massachusetts. Boston & Providence Interurban Electric R.R.

★**New York, N. Y.**—See item under Railways: New York.

Patchogue, N. Y.—The Suffolk Traction Co. is considering the extension of its line from Patchogue to Sayville. A. R. Applegarth, Patchogue, is Ch. Engr.

Reading, Penn.—The Reading Transit Co. has completed surveys for the extension of its line from Meyerstown and Womelsdorf, about eight miles. H. G. Louser, Lebanon, is Pres.

Charleston, W. Va.—Press reports are to the effect that the Charleston Interurban Ry. Co. is planning the construction of an extension to its line from Charleston to Montgomery, W. Va. W. E. Clinton, Charleston, is Pres.

Point Marion, W. Va.—The West Virginia Traction & Electric Co. has applied to the City Council for a franchise to construct and operate an electric railway in Point Marion.

Princeton, W. Va.—The Princeton Power Co. is preparing plans for the construction of an electric railway from Princeton to Bluefield, about seven miles. S. J. Evans, Princeton, is Pres.

Wheeling, W. Va.—The West Virginia Traction & Electric Co. is considering plans for the reconstruction of its entire line from Wheeling to West Alexander. The work will include laying new rails, constructing a new concrete bridge and building a new track on Bow St. William Morris Imbrie & Co., 45 Broadway, New York, N. Y., are interested.

The Wheeling Traction Co. is considering plans for the extension of its line from Barton to St. Clairsville, about five miles. George O. Nagle, Wheeling, is Gen. Mgr.

Lexington, N. C.—A franchise for a period of 60 years has been granted to the North Carolina Public Service Co., to construct and operate an electric railway in Lexington. Bird S. Coler, 43 Cedar St., New York, N. Y., is Interested.

Ruskin, Fla.—The Ruskin-Morris Park Interurban R.R. Co. is considering plans for the construction of an interurban railway from Ruskin to Morris Park, about 20 miles. George Miller, of Ruskin, is interested.

Tampa, Fla.—The construction of an electric interurban railway from Tampa to St. Petersburg, about 45 miles, is contemplated by Alexander Shane, of Indianapolis, Ind.

Holly Springs, Miss.—Preliminary arrangements are being made by E. G. Hammer for the construction of an electric railway in Holly Springs. Noted July 18.

Donaldsonville, La.—Plans have been prepared by S. Wexler, of New Orleans, for the construction of an electric railway from Donaldsonville to White Castle and Napoleonville, about 16 miles. The City Council is considering the proposition.

Kenner, La.—The Orleans-Kenner Electric Ry. Co. is preparing plans for the construction of an electric railway from Kenner to Orleans Parish. A. S. Bowman, Hibernia Bank Bldg., New Orleans, La., is Pres.

Bristol, Tenn.—Plans are being prepared by James B. Cox, Knoxville and associates for the construction of an electric railway from Bristol to Johnson City.

Chattanooga, Tenn.—The Chattanooga Ry. & Light Co. has been granted a franchise for a period of 38 years to construct and extend its lines on various streets in Chattanooga. W. E. Bolleau, Chattanooga, is Gen. Mgr.

Lexington, Ky.—Plans have been prepared by the Kentucky Utilities Co. for the construction of an electric railway through Bath and Montgomery Counties in Kentucky. Noted Dec. 19.

Cincinnati, Ohio.—The Cincinnati Traction Co. is considering plans for the extension of its line to Bond Hill. Dana Stevens, Cincinnati, is Gen. Mgr.

Cleveland, Ohio—Plans are being considered by the Cleveland Ry. Co. for the expenditure of $516,000, for the reconstruction of 15 miles of track. C. H. Clark, Cleveland, is Engr. of Maintenance of Way.

✦**Youngstown, Ohio**—The Lake Erie & Youghiogheny R.R. Co. has awarded the contract for the construction of its proposed line from Youngstown to Connneaut to the CALDWELL CONSTRUCTION CO., Youngstown. Noted Jan. 16.

Youngstown, Ohio.—The City Council has granted a franchise for a period of 25 years to the Lake Erie & Youngstown Ry. Co. to construct and operate an electric railway in Youngstown. Noted Jan. 16.

Indianapolis, Ind.—The Indianapolis, Cincinnati Electric R.R. Co., recently incorporated, will soon receive bids for the construction of an electric railway from Connersville, Ind., to Harrison, Ohio. Leonard G. Wild, Fred G. Appel, Fred D. Reed and William M. Frazier are directors.

Albia, Iowa—The Iowa Southern Ry. Co. has been incorporated to construct and operate an electric railway from Albia to Centerville. The incorporators are William Gardner, John Caldwell, Joseph Cleveland and Richard Ashton.

Cedar Rapids, Iowa—The Cedar Rapids & Marion City Ry. Co. is making preparations for improving its system this spring. The improvements include the construction of about seven miles of new track. F. L. Dinsmore, Cedar Rapids, is Gen. Supt. and Pur. Agt.

Minneapolis, Minn.—The Twin City Rapid Transit Co. is making preliminary arrangements for the extension of its line on Seventh Ave. to the Lake Harriet district. Horace Lowery, Minneapolis, is Gen. Mgr.

Kansas City, Kan.—J. D. Waters, Bonner Springs, Kan., is interested in the construction of an electric railway from Kansas City to Bonner Springs, about 16 miles.

Little Rock, Ark.—The T. H. Bunch Coal Co. is considering plans for the construction of an electric railway on various streets in Little Rock. Horace Chamberlain and T. H. Bunch are interested.

Amarillo, Tex.—Henry L. Doherty & Co., of New York, N. Y., who recently purchased the street railway system and other holdings here of the Amarillo St. Ry. Co. will extend the lines and make other improvements to the property.

Austin, Tex.—Joseph A. Davidson, of Indianapolis, Ind., and associates who are promoting the construction of a system of interurban electric lines from Austin to Lockhart, Stowall, Bastrop, Smithville and San Antonio, embracing about 150 miles of track, announce that they are negotiating with London bankers to finance the project. Preliminary surveys of the proper-proposed lines will soon be started and an estimate made of the cost of construction.

Denton, Tex.—J. T. Witt and associates have been granted a franchise by the City Council for the construction of an interurban railway between Denton and the suburb of Cement City.

San Antonio, Tex.—Preliminary arrangements are being made by the San Antonio & Austin Interurban Ry. Co. for the construction of its proposed electric railway from San Antonio to Austin, about 85 miles. W. B. Tuttle, 305 East Houston St., San Antonio, is Engr.-in-Charge. Noted Jan. 23.

Tulsa, Okla.—Plans have been prepared by the Tulsa St. Ry. Co. for the improvement and extension of its lines, to cost about $60,000. C. H. Bosler, Dayton, Ohio, is Pres. and Gen. Mgr.

Phoenix, Ariz.—The Arizona Corporation Commission has ordered the Phoenix St. Ry. to completely reconstruct and equip its lines of street railway here. The present cars will be replaced by new and more modern equipment and the track will be relaid with heavy rails. The system will also be extended.

Port Townsend, Wash.—A franchise has been granted to W. B. Webb and associates to construct and operate an electric railway in Port Townsend. Noted Jan. 30.

Hood River, Ore.—A company is being organized in Hood River for the purpose of constructing an electric railway in Hood River and Hood River Heights.

Dinuba, Calif.—The Southern Pacific Co. will build an extension of the Visalia Electric road through the Woodlake district north through the Orosi foothills and thence through Dunigan Gap to Fresno.

Eureka, Calif.—Plans have been prepared by J. N. Lentell, of Eureka, for the construction of a 53-mile interurban electric railway through Humboldt County. Estimated cost, $1,259,000. R. R. Wilson is one of the promoters.

Fresno, Calif.—The Fresno-Handford-Summit Lake Ry. Co. has applied for permission to issue $1,250,000 in bonds, the proceeds of which to be used for the construction of an electric railway from Fresno to Centerville and Kingsburg, about 40 miles.

Sacramento, Calif.—The Sacramento Valley Electric Ry. to be constructed from Red Bluff, Calif., to Dixon will open bids for the construction of the road next month.

San Francisco, Calif.—Plans for the extension of the Geary St. Municipal Ry. from its present terminus along Market St., have been approved by the Board of Public Works. Estimated cost, $27,000. M. M. O'Shaughnessy is City Engr. Noted Nov. 7.

Santa Ana, Calif.—Plans are being prepared by the Pacific Electric Ry. Co. for the construction of an electric railway in Santa Ana. J. McMillan, Los Angeles, is Gen. Mgr.

Cobalt, Ont.—The Nipissing Central Ry. Co. is considering plans for the extension of its line from New Liskeard to North Temiskaming. S. B. Clement, North Bay, Ont., is Ch. Engr.

Ottawa, Ont.—The Ottawa, Rideau Lakes & Kingston Ry. Co. is being organized for the construction of an electric railway to connect Ottawa, Rideau Lakes and Kingston. About $250,000 has been contributed toward the construction. J. S. R. McCann, Kingston, Ont., is interested.

LIGHT, HEAT AND POWER

Fall River, Mass.—The Fall River Gas Works Co. is having plans prepared for a new coal-gas plant, to be erected on Bay and Birch Sts., to have a capacity of 10,000,000 ft. Estimated cost, $400,000.

Worcester, Mass.—The Worcester Gaslight Co. is to lay about nine miles of gas piping next month. The work includes laying 10,000 ft. of 16-in. pipe, 5000 ft. 12-in. pipe, and the balance 4- and 6-in. pipe. D. D. Barnum is Mgr.

New Haven, Conn.—The United Illuminating Co. is considering plans for additions and alterations to its power plant on Grand Ave. Bids will be received shortly. C. F. Townsend is Arch.

Waterbury, Conn.—The Connecticut Co. is planning an addition to its power house on West Main St. The structure will be of brick, two or three stories high, and 40x100 ft. D. S. Miller, New Haven, is Elec. Engr.

Cohoes, N. Y.—Press reports are to the effect that the Cohoes Co. has purchased a site on the Mohawk River, near Cohoes Falls, for the construction of a power plant to have a capacity of 25,000 hp. Estimated cost, $1,500,000. W. F. Parsons is Supt.

Hope, N. J.—Local citizens have formed an electric-lighting company to render service to the town. It is planned to install an electric plant, to be operated by power from the Moravian Mill.

Jersey City, N. J.—The Board of Freeholders plans the establishment of a municipal power plant for county lighting. The Board is considering the enlargement of the present electric-lighting plant in the County Court House, to render service for roads, parks and institutions. An electric storage plant is also contemplated for Court House night service.

Morristown, N. J.—The Morris County Traction Co., is considering the erection of a new central steam generating

plant at Morristown or vicinity. J. L. Desch, Morristown, is Ch. Engr.

J. W. Melick, Morristown, representing the Northern New Jersey Power Co., recently incorporated at Newark, plans for the erection of a hydroelectric power plant on the Black River, near Morristown, with distributing system to serve the Boroughs of Madison, Chatham and Summit. Propositions have been submitted to the Councils at Madison and Chatham, and are being considered by the Lighting Committees.

Altoona, Penn.—Plans for extensive improvements and extensions to its plant and system, are being considered by the Penn Central Light & Power Co. E. T. Penrose, Altoona, is Gen. Mgr.

Columbia, Penn.—The Janson Iron & Steel Co. contemplates the construction of an electric-light plant in connection with its establishment, to supply electricity for lighting its various buildings.

✦Newbern, N. C.—The contract for the construction of a new municipal electric-light plant has been awarded to H. S. HANCOCK, Newbern. Noted Dec. 26.

Rocky Mount, N. C.—The proposition to issue $12,000 in bonds for the installation of additional equipment in the municipal electric-light plant is under consideration. A. S. Lyon is Mgr. and Ch. Engr. of the plant.

Siler City, N. C.—A franchise has been granted to the Siler City Light & Telephone Co. to construct and operate an electric-light plant at Siler City.

Marksville, La.—It is proposed to issue $30,000 in bonds for the enlargement of the municipal electric-light plant and the installation of a water system.

Dresden, Tenn.—See item under Water Supply-Irrigation.

Nashville, Tenn.—The Nashville Ry. & Light Co., Nashville, will soon commence the construction of a subpower-house, which will cost about $8000, exclusive of the machinery to be installed.

Louisville, Ky.—The Seelbach Hotel Co. is making preliminary arrangements and will receive bids about Mar. 1 for the construction of a power and heating plant. Estimated cost, $75,000. Webster Gazlay, Louisville, is Engr.-in-Charge. Noted Nov. 28.

Owingsville, Ky.—The Kentucky Utilities Co., of Lexington, is arranging the purchase of the Owingsville electric-light plant and its enlargement and improvement. Similar action is to be taken at Eminence, Ky.

✦Cincinnati, Ohio—The contract for the installation of a heating plant in the new Hotel Gibson in Cincinnati, has been awarded to GEERING BROS., Cincinnati.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. of Pub. Ser., until Feb. 18, for furnishing transformers for the municipal electric-light plant.

Columbus, Ohio—The Finance Committee has approved the proposition to issue $30,000 in bonds for the extension of the municipal electric-lighting system to the newly annexed districts. S. A. Kinnear is Dir. of Pub. Serv.

East Liverpool, Ohio—Press reports are to the effect that the Tri-State Ry. & Electric Co. is considering an expenditure of $2,000,000 for the construction of a power plant at East Liverpool. W. R. W. Griffin, East Liverpool, is Gen. Mgr.

Findlay, Ohio—The construction of a municipal electric-light plant, to cost $70,000, has been recommended to the City Council.

Jeffersonville, Ind.—Additional boilers are to be installed in the power plant of the Jeffersonville reformatory if an appropriation for that purpose is approved by the State Legislature. D. C. Peyton is Supt.

Bay City, Mich.—Burns & McDonnell, Consult. Engrs., Kansas City, Mo., have estimated the cost of the reconstruction of the municipal electric-light plant at $36,750.

Dysart, Iowa—The citizens recently voted to issue $10,000 in bonds for the construction of a municipal electric-light plant.

Duluth, Minn.—Bids will be received by C. S. Palmer, City Clk., until Mar. 3, for $100,000 bonds, the proceeds to be used for the construction of an electric-light and water plant.

New Ulm, Minn.—The Oscar Claussen Engineering Co., St. Paul, is preparing plans for the construction of a municipal electric-light plant at New Ulm.

Blue Mound, Kan.—The construction of a municipal electric-light plant at Blue Mound is under consideration. Estimated cost, $6000. E. T. Archer & Co., Kansas City, Mo., are Engrs.

Fort Scott, Kan.—F. D. Martin, of Fort Scott, is preparing preliminary plans and estimates for the construction of a municipal electric-light plant. G. N. Sanford is City Clk. Noted Jan. 30.

Neosho Falls, Kan.—The construction of a municipal electric-light plant is being agitated.

✦White Cloud, Kan.—The construction of an electric-light plant at White Cloud has been awarded to the ALAMO EN-

Bassett, Neb.—See item under Water Supply—Irrigation.

Beaver City, Neb.—The citizens will hold an election soon to vote on the proposition to issue bonds for the construction of a municipal electric-light plant.

Omaha, Neb.—The Omaha Electric Light & Power Co. contemplates an expenditure of $375,000 for extensions and improvements to its system and the installation of new equipment in its power plant. H. A. Holdrege, Omaha, is Gen. Mgr.

Milnor, N. D.—Ole Hansen is interested in a project to install an electric-lighting system in Milnor.

Joplin, Mo.—The Board of Public Works is discussing plans for the enlargement of the municipal electric-light plant. It is proposed to issue $50,000 in bonds for the purpose.

✦Rich Hill, Mo.—The contract for the construction of a municipal electric-light plant at Rich Hill has been awarded to E. J. MERKLE, Kansas City, Mo., at $13,600. Bids were received Jan. 21. Noted Oct. 10 and Jan. 16.

St. Louis, Mo.—The Missouri Public Utilities Co., St. Louis is planning to erect an electric-light and power plant, to cost $500,000 in southwestern Missouri.

Wynne, Ark.—Bids will be received by the Board of Commissioners until Feb. 24 for the improvement of the municipal electric-light system. R. C. Houston & Co., Exchange Bldg., Memphis, Tenn., are Consult. Engrs.

Cuero, Tex.—The Guadalupe Water Power Co. is seeking authority from the state legislature to build five dams on the Guadalupe River, for the purpose of providing a water-storage supply to operate hydro-electric plants which it will install.

Ennis, Tex.—The Booster Club is promoting the installation of a gas plant and the construction of a distributing system here.

Houston, Tex.—The Houston Lighting & Power Co. will install two 600-hp. boilers at its power plant here. It will also install a generator to increase the capacity of the plant 5000kw. Among other machinery it will install is a 40-hp. electrically driven crane for handling heavy machinery.

Manor, Tex.—The installation of an electric-light system at Manor is contemplated by W. M. Allison.

Purcell, Okla.—The local electric-light plant and water system has been purchased by the Purcell Bank & Trust Co. The new owners contemplate the installation of new equipment and improvement of the plants.

Wanette, Okla.—The citizens are considering the installation of a municipal electric-light plant.

Tucumcari, N. M.—The Tucumcari Light & Power Co. will enlarge its electric-light and power plant here.

Centralia, Wash.—The Washington-Oregon Corporation has applied for permission to extend its transmission lines from Centralia to Dryad and Doty. H. C. Coffman is interested.

Ellensburg, Wash.—Plans are being prepared for the installation of new equipment and improvement of the municipal electric-light plant.

Kelso, Wash.—Preliminary arrangements are being made by the Washington-Oregon Corporation for the improvement of its local plant and system. Estimated cost, $10,000.

Baker, Ore.—An election will be held to vote on the proposition to issue $160,000 in bonds for the construction of a municipal electric-light plant.

Dinuba, Calif.—Bids are being received by A. Webber, Mgr. of the Dinuba Gas Co., for the construction of a new gas plant.

Los Angeles, Calif.—We are officially advised that bids were received Jan. 31, by the Board of Public Works, for furnishing 230 transmission towers for carrying 110,000-volt transmission line, as follows: Pierson, Reeding & Co.; Riter-Conley Mfg. Co. Noted Jan. 9.

Randsburg, Calif.—The Southern Sierras Power Co. is planning the extension of its power lines into the Randsburg district, and the construction of a new power plant on the Owens River. F. A. Worthley, Riverside, is Gen. Mgr.

Tropico, Calif.—The Southern California Gas Co. has been granted a franchise to construct a system of gas mains in the streets of Tropico.

Edmonton, Alta.—The installation of an ornamental street-lighting system, to cost approximately $186,050. has been recommended to the City Council.

BRIDGES

Manchester, N. H.—It is proposed to construct a bridge here, over the Merrimack River. Estimated cost, $150,000 to $200,000. Charles C. Hayes is Mayor.

Portsmouth, N. H.—The Boston & Maine R.R. Co., has had plans prepared for the construction of either a steel or a concrete bridge over the river here. A. Mountfort, Nashua, is Superv. of Bridges. Noted Oct. 17.

Boston, Mass.—We are officially advised that plans will probably be out before long for constructing a street via duct, 1200 ft. long, from the street level to the second-story of the Commonwealth Bldg. Cost, about $200,000. F. W. Hodgdon is Ch. Engr., Port of Boston. Noted Jan. 23.

★Providence, R. I.—Bids will be received by the Commissioners until noon, Feb. 24, for rebuilding the approaches of the Rhode Island Stone Bridge. Plans and specifications atare on file at the office of the Secretary of the Commission, at 434 Dexter St., Central Falls, and at the office of J. R. Worcester & Co., Consult. Engrs., 79 Milk St., Boston. Fred H. Jones is Secy.

The State Board of Public Works has asked an appropriation of $100,000 for constructing, repairing and reconstructing bridges on state highways.

Buffalo, N. Y.—Plans have been completed and adopted by the Grade Crossings Commission of Buffalo, and the New York Central, the Lackawanna, the Erie and the Grand Trunk railroads, for the construction of a steel viaduct over the tracks of the railroads, at Amherst, Austin and Tonawanda Sts. near the entrance to the International Bridge. The improvements wil cost $1,004,000.

Minetto, N. Y.—We are officially advised that bids will probably be asked about Apr. 15, for constructing a reinforced concrete bridge over the Oswego River at Minetto. The dimensions of the bridge have not as yet been decided. Plans are being prepared by the Concrete Steel Engineering Co., 17 Park Row, New York. Cost, from $50,000 to $75,000. Noted, Jan. 30, under Oswego, N. Y.

★Niagara Falls, N. Y.—Bids will be received by Harry K. Eckert, Supt. Commissioners of the State Reservation at Niagara, until noon, Mar. 1. For constructing relieving walls for present spandrel walls, new parapet railings, new sidewalks, etc., on bridges between the mainland and Goat Island, Niagara Fals, Niagara County, and completing the same on

or before June 1, 1913, pursuant to the provisions of Chapter 547 Laws of 1912. Plans may be seen and blank forms for proposals and specifications may be obtained at the office of the Supt. at Niagara Falls.

Watertown, N. Y.—A. T. Hardin, V.-Pres. of the New York Central R.R. has forwarded plans to the city officials, for the new overhead steel bridge at Court St., to be built jointly by the city, state and the railroad. The bridge is estimated to cost about $200,000. C. E. Buchholz is Chn. Bridge Comn. Noted Jan. 23.

Hopewell, N. J.—The Philadelphia & Reading Ry. Co., has made an offer to the Common Council to build a reinforced concrete bridge at Greenwood Ave., and open streets in connection therewith, provided the borough will share a portion of the expense.

Mount Holly, N. J.—The Board of Freeholders has instructed the County Engineer to prepare plans for a fixed bridge at Loveland's Thoroughfare, to replace the present draw span at that site.

Chester, Penn.—The State Water Commission and the War Department have approved the plans of the County Commissioners for the construction of a bridge over Chester River at Fifth St. The bridge will be about 175 ft. long, with a clear span about 80 ft. Noted Dec. 12.

✚North Braddock, Penn.—We are officially advised that the contract to construct a steel highway bridge over the tracks of the Pennsylvania R.R. at Overland St., has been awarded to the C. M. NEELD CONSTRUCTION CO., Oliver Bldg., Pittsburgh, at $16,663. The other bids were: Penn Bridge Co., $22,050; Capitol Construction Co., $19,490; Farris Bridge Co., $20,100. Bids were opened by the Borough Council, Nov. 29. George F. Seifers is Boro. Engr. Noted Nov. 28.

✚Philadelphia, Penn.—The Bureau of Highways has received the following bids for the construction of a bridge over the Pennsylvania R.R. tracks at 40th St., M. & J. B. McHUGH, $12,290; (awarded contract) American Paving & Construction Co., $12,900; William A. Mundy, $13,000; Steyer-March & Co., $14,775.

Pittsburgh, Penn.—Bids will be received by R. J. Cunningham, County Contr., until noon, Feb. 18, for filling the approaches of Bridge No. 4, over Pine Creek, South Branch, in Shaler Township.

Whitney, Penn.—The Pennsylvania R.R. Co., is preparing to build a bridge 450 ft. long over the tracks at Whitney, on the new trolley line from Hecla to Latrobe.

Georgetown, Del.—The Levy Court of Sussex County contemplates the construction of a drawbridge over the canal to be dug by the Government in Lewes and Rehoboth Hundred. Estimated cost, $30,000.

Wilmington, Del.—The Levy Court is considering various propositions for building a new bridge over the Christiana River, at Third St. The Court favors a bascule type of bridge; estimated to cost $275,000. Noted May 23.

Washington, D. C.—The District Commissioners contemplate an appropriation of $95,000, for completing the construction of a bridge across Rock Creek on the line of Q St.

Montgomery, Ala.—The Board of Revenue of Montgomery County is considering the erection of a steel bridge over the Tallapoosa River at Ware's Ferry, at an estimated cost of $25,000.

✚Clarksville, Tenn.—The Louisville & Nashville R.R. has awarded contract to the FOSTER-CREIGHTON-GOULD CO., Nashville, Tenn., for the erection of a steel viaduct on a concrete foundation across Commerce St. Its approximate cost is $50,000.

Cincinnati, Ohio—The Board of Trustees of the Cincinnati Southern Ry. has had plans prepared for altering the viaduct extending from the Southern Bridge to a point near Third and Front Sts. to conform with the standard clearance rules of the Cincinnati, New Orleans & Texas Pacific Ry., lessee of the Cincinati Southern. The cost of the improvements will be from $6000 to $8000. Curtis Dougherty is Chief Engr. of the C. N. O & T. P.

Cleveland, Ohio—Bids will be received by the Commissioners of Cuyaboga County until 11 a.m. Mar. 8 for the construction of bridge work per report No. 3068, Harvard Road, Brooklyn Township. Frank R. Lander is County Surv. John F. Goldenbogne is Clk.

Newport, Ind.—The Vermillion County Council has appropriated $40,000 for the construction of a new bridge across the Big Vermillion River. Bids will soon be asked.

Faribault, Minn.—Plans have been prepared for the construction of a viaduct to span the Cannon River and the tracks of the Chicago, Rock Island & Pacific Ry. and of the Chicago Great Western Ry. The estimated cost is $37,600. F. W. McKellip is the City Engr.

✚Manhattan, Kan.—The contract for the construction of a new concrete bridge across the Arkansas River at Manhattan, has been awarded to the KANSAS CONSTRUCTION CO., Wichita, at $24,800.

✚Denison, Tex.—The Red River Bridge Co., has awarded the contract for the construction of a new steel bridge across the Red River, north of Denison, to the MIDLAND BRIDGE CO., Kansas City, Mo., at about $60,000. Noted Jan. 2.

Eugene, Ore.—Bids will be received until Feb. 25, for the construction of the piers and abutments and placing the steel for the large steel bridge across the Willamette River at Ferry St.

Fall Brook, Ont.—Bids will be received until noon, Feb. 15 by the Council of Lanark County for the construction of five concrete piers and two abutments for a steel bridge over the Mississippi River at Juniasville, Drummond Township. Plans are on file with the County Clk., Perth, Ont. or with Engineer, Charleton Place, Ont. George Kerr, Fall Brook, Ont., is Chn. of the Roads & Bridges Com.

Ottawa, Ont.—The citizens of Pontiac County have filed a petition with the Minister of Public Works asking for the construction of a bridge across the Quinze River at the head of Lake Temiskaming, forming a highway between Ontario and Quebec. The bridge is estimated to cost $75,000.

St. Boniface, Man.—Bids will be received until Feb. 17 by the City Council for the construction of the substructure of a bridge over the Red River. M. B. Blair is City Engr. Noted Nov. 7.

Fredericton, N. B.—Bids will be received until noon, Feb. 26 by the Department of Public Works for the construction of the substructure and approaches of a bridge at Newcastle, N. B., over the Miramishi River, Northumberland County. John Morrissy is Ch. Comr.

WATER SUPPLY—IRRIGATION

★Hartford, Conn.—Bids will be received by the Board of Water Commissioners until 3 p.m., Feb. 20, for furnishing about 1500 tons of c.-i. pipe and about 108 tons of special castings. Caleb Mills Saville is Ch. Engr.

✚Brockport, N. Y.—Contracts for installing a water system here have been awarded as follows: Furnishing pipe and special castings, to the R. D. WOOD CO., Philadelphia, Penn., at $24.38 per ton for pipe, and 2½c. per lb. for castings; constructing a brick pumping station, chimney, pump, well and intake, to the J. VICTOR JOHNSON CO., Jamestown, N. Y., at $25,400; furnishing hydrants and valves, laying pipe, setting pumping machinery, constructing concrete reservoir and furnishing and erecting steel pressure filters, to FRANK GEORGE & CO., Batavia, N. Y., at $94,693. Bids were opened by the Board of Village Trustees, Jan. 21. Witmer & Brown, Chapin Block, Buffalo, N. Y., are Consult. Engrs. Noted Jan. 9.

Binghamton, N. Y.—According to press reports, plans are being prepared by the Norwood Engineering Co., Florence, Mass., for the construction of a filtration plant here. Estimated cost, $125,000. M. Stoppard is Supt. of Water. Noted Jan. 23.

Buffalo, N. Y.—Bids will be received by Francis G. Ward, Comr. Pub. Wks., until Feb. 15, for constructing and equipping underground valve house at the pumping station at the foot of Porter Ave.

✚New York, N. Y.—We are officially advised that contracts have been awarded by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, as follows: Furnishing double nose fire hydrants, to the KENNEDY VALVE MFG. CO., 57 Beekman St., New York, at $12,720; furnishing c.i. pipe and special castings, to the FLORENCE IRON WORKS, at $11,791; furnishing valves, to the A. P. SMITH MFG. CO., at $9600. Bids were opened Feb. 3. Noted Jan. 30.

Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Feb. 20, for hauling and laying water mains and appurtenances in Arden, Isham, West 151st, West 160th, West 176th, West 189th, West 119th, West 217th sts., Haven, Northern and Sevenths Aves., Park Terrace East and Riverside Drive, Boro. of Manhattan. Specifications are on file at the office of Engineering News. 505 Pearl St., New York.

Schenectady, N. Y.—Tentative plans have been prepared for the construction of a reservoir of two 15,000,000-gal. units, at Bevis Hill. Estimated cost, $200,000. Fred W. Bentley is Supt. of Water.

Atlantic City, N. J.—Bids will be received by the Board of Commissioners until Feb. 20, for furnishing 48-in. c.-i. water pipe and special castings, and for furnishing gate valves. Harry Bacharach is Comr.

★Atlantic City, N. J.—Bids will be received by the Board of Commissioners until 2:30 p.m., Feb. 14, for constructing a 24-in. and a 20-in. c.i. water main in Arctic Ave., from Missouri Ave. to Maine Ave., with lateral mains on intersecting Sts., and for furnishing gate valves. Specifications are on file at the office of the Water Department. Harry Bacharach is Comr.

Atlantic Highlands, N. J.—We are officially advised that bids will be received by the Department of Public Works, until Feb. 25, for sinking a well. Ralph W. Orebaugh is Supt.

Dover, N. J.—The Board of Water Commissioners has received the following bids for the installation of a new pumping plant, and power for operation: Dover, Rockaway & Port Oram Gas Co., pumping machinery, $6000; power for pumping water, 1.65c. per 1000 gal.; Eastern Pennsylvania Power Co., pumping machinery, $4100; power for pumping water 2c. per 1000 gal.

South Orange, N. J.—The Board of Public Utility Commissioners has granted the Commonwealth Water & Light Co. permission to install a 14-in. water pipe line in certain sections of the town.

Kane, Penn.—We are officially advised that the Spring Water Co. has retained Chester & Fleming, Hydraulic Engrs., Union Bank Bldg., Pittsburgh, Penn., to make a report on various methods of increasing the water supply.

Mount Joy, Penn.—The Borough Council contemplates the installation of a filtration plant, estimated to cost $15,000.

Ashland, Va.—The proposition to install water and sewer systems here, estimated to cost $50,000, was defeated at the bond election. Noted Dec. 1.

Bridgewater, Va.—An election has been called for Feb. 21, to vote on a bond issue of $25,000 for water and sewer systems. Otis W. Wine is Chn. Finance Com.

Roanoke, Va.—According to press reports, the Vinton-Roanoke Water Co., contemplates an expenditure of $15,000 for constructing a dam across Beaver Dam Creek.

Rockymount, Va.—J. L. Ludlow, Consult. Engr., Winston-Salem, N. C., is preparing plans for the installation of a water system here. Estimated cost, $50,000. C. S. Greer is Mayor.

Cherryville, N. C.—An election will probably soon be called to vote on a bond issue of $45,000 for installing a water system. For particulars, address the Mayor.

Durham, N. C.—An election will probably soon be called to vote on a bond issue for the installation of a water system here. Investigations to locate a supply have been completed by Gilbert C. White, Consult. Engr., Charlotte, N. C. Noted Jan. 16.

Valdosta, Ga.—The City Council contemplates an expenditure of $103,000, for improving the water and sewer systems and for paving streets.

Marksville, La.—The town contemplates a bond issue of $30,000 for installing a water system and enlarging the electric-light plant. T. T. Fields is Mayor.

✚Chattanooga, Tenn.—We are officially advised that the American Water Works & Guarantee Co., Pittsburgh, Penn., has awarded a contract to the EPPING-CARPENTER CO., Pittsburgh, for the construction of a 7,000,000-gal. vertical triple-expansion condensing pumping engine to be installed at the plant in Chattanooga.

Dresden, Tenn.—An election will probably soon be called to vote on a bond election of $25,000, for installing a water system and an electric-light plant.

Caldwell, Ohio—We are officially advised that the W. J. Sherman Co., The Nasby, Toledo, Ohio, has been retained by the village to prepare plans and specifications for the improvement of the municipal water system.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Feb. 14, for furnishing lead pipe for the use of the Water Department. Specifications may be obtained at the office of the Superintendent of the Water Department.

✚Columbus, Ohio—We are officially advised that contracts have been awarded by Samuel A. Kinnear, Dir. Pub. Ser., as follows: Furnishing 300 valves, from 4 to 20 in., to the BOURBON COPPER & BRASS WORKS, at $4000; furnishing 1500 tons c.-i. pipe, 90 tons castings, 100,000 lb. pig lead, 120,000 lb. lead pipe, 1500 corporation cocks, 1500 curb cocks, 1500 service boxes, to the WESTWATER SUPPLY CO., at approximately $13,000. P. B. Kemper is Clk. Pub. Ser. Dept. Noted Jan. 30.

Elyria, Ohio—The City Council contemplates an expenditure of $7500, for extending the water system.

Frankfort, Ohio—Bids will be received until Feb. 20, for purchasing $12,000 bonds, to be used in constructing a water system. Plans have been prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio. J. G. Bell is Town Clk. Noted Feb. 6.

Zanesville, Ohio—According to press reports, bids will be asked about Apr. 1, for the new well water system, estimated to cost $360,000. The work will be divided into three contracts: First, the wells; second, the buildings; third, the equipment. J. R. Tanner is City Engr. Noted Nov. 28.

Lebanon, Ind.—The City Council has authorized the City Engineer to prepare plans for the installation of a complete water system.

Lagansport, Ind.—The American District Steam Co., First National Bank Bldg., Chicago, Ill., is preparing plans for the proposed filtration plant here. Estimated cost, $60,000. William Pickett is City Clk. Noted Nov. 14.

Saline, Mich.—Bids will be received by the Common Council until 8:30 p.m., Feb. 21, for the construction of a water system, according to plans and specifications prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio, and on file at the office of A. J. Warren, Village Clk. Estimated cost, $30,000. Noted Jan. 9.

Moline, Ill.—We are officially advised that bids will be received by Martin R. Carlson, Pres. Bd. Local Imprvts., until Feb. 18, for constructing the 25th St. water main district. Estimated cost, $11,585. Lyle Payton is City Engr. Noted Jan. 30.

Virden, Ill.—The Water-Works Committee has submitted a report to the City Council recommending the construction of a reservoir, a concrete dam and a water tower. Estimated cost, $75,000.

Antigogo, Wis.—Arthur M. Morgan, Consult. Engr., 111 West Monroe St., Chicago, Ill., has submitted a report to the Board of Public Improvements appraising the value of the water system at $86,000, and estimating the cost of the necessary improvements at $40,000. Noted Jan. 30.

Boscobel, Wis.—According to press reports, bonds for $24,000 have been voted for the installation of a water system here.

Fond du Lac, Wis.—Bids will be received by the City Water Commission until Feb. 20, for constructing air lifts for six wells, and for furnishing and installing an air compressor capable of raising 4000 gal. of water per min. Estimated cost, $14,000. J. F. Ahern is Pres.

Kenosha, Wis.—The city contemplates the installation of a filtration plant, estimated to cost $150,000.

Marinette, Wis.—City officials are investigating water plants in various cities with a view to purchasing the local plant from a private corporation. The State Railway Commission has placed a valuation of $400,000 on the property. Improvements, including metering the system, will probably be made if the deal is consummated. A. L. Hillis is City Engr.

Carroll, Iowa—The City Council will probably soon ask bids for constructing sanitary sewers and subdrains in various streets. J. A. Dougherty is City Clk.

Council Bluffs, Iowa—We are officially advised that the Board of Public Works contemplates relining three reservoirs, but has not yet decided whether to ask bids, or do the work by day labor. The work will involve about 1200 cu.yd. reinforced concrete, and is estimated to cost between $9 and $10 per cu.yd. S. L. Etnyre is Supt. Water Dept. Noted Jan. 30.

Epworth, Iowa—The city contemplates improvements to its water system, estimated to cost $10,000. J. J. Hamilton is City Clk.

Waterford, Wis.—Bids will be received by the Village Board until 2 p.m., Feb. 15, for furnishing and erecting a steel water tower 112 ft. high, of 30,000 gal. capacity. A. G. Scheele is Village Clk.

Essex, Iowa—Preliminary plans are being prepared for extending and improving the water system.

Muscatine, Iowa—Bids will be received by the Board of Trustees until 9 a.m., Mar. 10, for furnishing all material, equipment and labor for constructing a distributing reservoir between Cook St. and Kindler Ave., and north of Lucas St. T. R. Fitzgerald is Secy. of Bd. Noted Dec. 5.

Duluth, Minn.—Bids will be received by C. S. Palmer, City Clk., until Mar. 3, for the purchase of $100,000 bonds for improving the water system and the electric light plant.

Fergus Falls, Minn.—The City Water and Light Commission has authorized the City Engineer to make a survey of three routes for the extension of the water system to the new power station to be built at Hoot Lake.

Minneapolis, Minn.—We are officially advised that bids will be received by K. E. Alexander, Pur. Agent, until Feb. 24, for furnishing 15,000 ft. of 50-in. steel pipe for the water system, according to specifications on file with the Agent. E. R. Dutton is Asst. City Engr.

Pine City, Minn.—Plans have been prepared by the Claussen Engineering Co., German American Bank Bldg., St. Paul, Minn., for the construction of a water system here, estimated to cost $20,000. Bids for construction will probably soon be asked.

✚Mulberry, Kan.—We are officially advised that the contract to install a water system and an electric-light plant here, according to plans and specifications prepared by E. T. Archer & Co., Consult. Engrs., New England Bldg., Kansas City, Mo., has been awarded to W. H. MILLER, Mulberry, at $40,045. Work will begin about the first of March. Noted Jan. 16.

Bassett, Neb.—We are officially advised that bids will be received by W. E. Buckendorf, Village Clk., until 9 a.m., Feb. 17, for installing a complete water system and electric-light plant, according to plans and specifications prepared by the Alamo Engine & Supply Co., Omaha, Neb. Estimated cost, $15,000. Noted Nov. 14.

Silver Creek, Neb.—The village contemplates the installation of a water system. F. E. Layton and A. A. Sanders are interested.

Maryville, Mo.—Bonds for $30,000 have been sold for extending the water system recently purchased from the Maryville Water Co. C. L. Gann is City Clk. Noted Jan. 16.

Sulphur Springs, Ark.—We are officially advised that bids will be asked about the end of March for installing a municipal water system and electric-light plant, estimated to cost $40,000. Plans have been prepared by Albert C. Moore, Consult. Engr., Independent Bldg., Joplin, Mo. Noted Jan. 23.

Wynne, Ark.—Bids will be received by the Board of Commissioners until 1:30 p.m., Feb. 24, for improving the water system, according to plans and specifications on file at the office of C. B. Bailey, Secy. of Bd., and at the office of R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn.

Paris, Tex.—Bonds for $40,000 have been voted for improving the water system. E. H. McCuistion is Mayor.

San Antonio, Tex.—The City Council has passed an ordinance providing for an election some time in March to vote on the proposition of issuing bonds for $2,500,000, of which $2,000,000 is to be used for the construction of a municipal water plant or the purchase of the existing privately owned plant. The remaining $500,000 will be used for the construction of an extension of the sewer system.

Denver, Colo.—The Dolores Reservoir Co. has filed plans with the State Engineer for a reservoir and irrigation system to serve about 75,000 acres of land in the southern part of the state. The reservoir will be built on the Dolores River, and will have a capacity of 11,000,000 gal. The dam will be 230 ft. high. H. F. Morgan, Cortez, is Pres.

Greeley, Colo.—Bids will be received by the City Clerk, until 5 p.m., Feb. 21, for construction of Distributing Reservoir No. 2, for the water system. The reservoir will be 232x 256x14 ft. deep, and will require about 1560 cu.yd. of concrete lining. Plans and specifications may be obtained at the office of O. F. Shattuck, City Engr.

Hazelton, Idaho—According to press reports, T. D. McDonough is receiving bids for furnishing 20,000 ft. of 6- and 12-in. water pipe.

Salt Lake City, Utah—The City Council has instructed the City Engineer to prepare plans for installing the first unit of the proposed plumbing station at Liberty Park. This unit is estimated to cost $14,625. C. F. Barrett is Supt. W.-Wks.

Glendale, Ariz.—The town contemplates an expenditure of $30,000, for extending the water system. V. E. Messenger is Town Clk.

Dayton, Ore.—We are officially advised that plans are being prepared for the rebuilding of the water system, at an estimated cost of $14,000. William F. Allison, Portland, Ore., is Consult. Engr. W. T. H. Tucker is City Recdr.

Newport, Ore.—Bonds for $10,000 have been voted for extending the water system. Noted Nov. 7.

Longbeach, Calif.—The Board of Public Works will soon advertise for bids for furnishing one carload of standard pipe for the Water Department.

Puente, Calif.—Bids will be received until noon, Feb. 15, by the Cross Land Co., H. W. Hellman Bldg., Los Angeles, for the construction of a 3,000,000-gal. concrete lined reservoir near Puente.

Vancouver, B. C.—Bids will be received by the City Clerk, about Feb. 15, for furnishing 10,560 ft. of 2- and 4-in., 107,000 ft. of 6-in., and 50,000 ft. of 8-in. steel water pipe.

SEWERS

Patchogue, (L. I.) N. Y.—The village contemplates the installation of a sewer system and a sewage disposal plant. Dr. Frank Overton is Village Health Officer.

West New York, N. J.—Bids will be received by the Town Council until 8 p.m., Feb. 18, for the reconstruction of a sewer in 12th St., from Jackson to Jefferson St. James L. Wolfe is Town Clk.

Atlantic City, N. J.—Bids will be received by the Board of Commissioners until Feb. 20, for extending the storm water system. The work to be done embraces the building of approximately 1210 ft. of reinforced concrete drains from 3 ft. 6 in. to 4 ft. wide; 6633 ft. of brick and concrete drains from 27 in. to 36 in. in diameter; 7172 ft. of terra cotta and concrete drains from 12 in. to 24 in. in diameter; 5200 ft. of terra cotta and c.i. inlet pipes from 10 in. to 12 in. in diameter, together with manholes, catchbasins, stormwater inlets and the necessary timber and pile foundations. J. B. Thompson is Dir. of Streets and Pub. Impvts.

Hopewell, N. J.—The Common Council contemplates the installation of a sewer system.

++Newark, N. J.—We are officially advised that the contract to construct Section 7 of the main intercepting sewer, compressed air tunnel, has been awarded by the Passaic Valley Sewerage Commissioners, to BOOTH & FLINN, Ltd., 1942 Forbes St., Pittsburgh, Penn., at $1,413,030, without metallic shields. The other bids were: Booth & Flinn, with metallic shields, $1,853,450; Dock Contractor Co., Hoboken, N. J., with shields, $3,131,777; without, $3,337,712; Charles A. Haskin, Boston, Mass., without shields, $2,117,400. Bids were opened Feb. 4. Noted Jan. 2.

Lansdowne, Penn.—We are officially advised that bids for constructing 5½ miles of terra cotta sewers here, were received by the Town Council, Feb. 7, as follows: E. M. Boland, $18,965; R. Shoemaker, $21,790; F. S. Buckius, $24,000; J. A. Shallanbarger, $28,960; Colonial Construction Co., $32,000; E. D. Garrett, $32,250; Garden State Construction Co., $32,481; Cantrell Construction Co., $35,270; Field, Charles A. Underwood, $37,500. Plans were prepared by the Garden State Construction Co., Goff Bldg., Camden, N. J. Noted Feb. 6.

Norristown, Penn.—Plans have been submitted to the State Department of Health for approval, for the installation of a sewage disposal plant here. Estimated cost $55,000.

North Charleroi, Penn.—The State Department of Health has approved the plans prepared by the Borough Council for extending and improving the sewer system. T. P. Sloan is Chn. Street Com.

Oil City, Penn.—The City Council contemplates the construction of 1½ miles of 6- and 10-in. sewers. Estimated cost, $7000. G. F. Roess is Town Engr.

Bridgewater, Va.—An election has been called for Feb. 21, to vote on a bond issue of $25,000 for installing sewer and water systems. Otis W. Wine is Chn. Finance Com.

Statesboro, Ga.—Bids will be received by W. B. Johnson, Countil Clk., until Mar. 10, for the purchase of $54,000 of bonds for a sewer system. Noted Dec. 12.

Valdosta, Ga.—See item under Water Supply—Irrigation.

Tampa, Fla.—Bids will be received by the Board of Public Works until 1 p.m., Feb. 18, for constructing reinforced concrete storm drains in Hyde Park. Estimated cost, $40,000. D. B. McKay is Chn. of Bd. Noted Jan. 30.

Tuskegee, Ala.—Bids will be received at the office of Walter G. Franz, Consult. Engr., Union Trust Bldg., Cincinnati, Ohio, until noon, Feb. 15, for constructing 4-, 6-, 8- and 10-in. vitrified tile sewers, with brick manholes, etc., at the Tuskegee Normal and Industrial Institute. Noted Jan. 23.

Lebanon, Tenn.—The Lebanon Business Men's Association is working for the installation of a sewer system here. Andrew B. Martin is Chn. Bd. City Comrs.

Louisville, Ky.—The Solomon-Norcross Co., Atlanta, Ga., has prepared plans for the installation of a sewage disposal plant at the Home of the Aged and Infirm. Estimated cost, $8750.

Ashland, Ohio—We are officially advised that all bids received by F. Edwards, Dir. Pub. Ser., Feb. 1, for constructing the South Highland relief sewer, were rejected as above the estimate. The contract, which consist of constructing about 3000 ft. of 36-in. brick or segment block sewer, will probably be readvertised. Noted Jan. 30.

Chardon, Ohio—See item under Streets and Roads.

Cleveland, Ohio—According to press reports, bids will be received by W. J. Springborn, Dir. Pub. Ser., until Feb. 13, for constructing sewers in portions of Cypress, Sophia and Stone Aves., and other streets.

Columbiana, Ohio—Press reports state that bids will be received by Harry A. Inman, City Clk., until Mar. 27, for the installation of a sewer system and a sewage disposal plant here. Bonds for $25,000 have been voted for this work, and the total cost is estimated at $45,000. Noted Jan. 23.

Conneaut, Ohio—The Board of Health has asked the City Council to arrange for the construction of sanitary sewers in Lake St. and in Deane Ave., from Harbor to Bay Sts.

+New Philadelphia, Ohio—We are officially advised that the contract to construct a storm sewer here has been awarded to WILLS & DICK, New Philadelphia, at $9703. The other bids were: Springer and Rogers, New Philadelphia, $10,655; Adams Bros. Contracting Co., Zanesville, $12,792; Van Meter Construction Co., New Philadelphia, $11,881; Adam Schwab, New Philadelphia, $9934; Nickles and Hoffman, Canton, $15,296. Bids were opened Jan. 30. Noted Jan. 30.

+Troy, Ohio—We are officially advised that bids for constructing six miles of sanitary sewers were received by G. E. Hargfield, Dir. Pub. Ser., Feb. 4, as follows: FIDLER & BROCK, Springfield, Ohio, $32,843 (awarded contract); Kohbarger & Hoyles, $43,099; W. J. Irwin & Co., $41,105; Shaper & Dill, $35,745; Sieverling & Fairbain, $41,422. Noted Jan. 16.

Youngstown, Ohio—The City Council has adopted a resolution declaring it necessary to construct a sanitary sewer in Madison Ave. between Michigan Ave. and Bryson St.

Lebanon, Ind.—The City Council has authorized the City Engineer to prepar eplans for a complete treatment of the city's sewerage.

South Bend, Ind.—The Board of Public Works has passed a resolution providing for the construction of a 60-in. trunk sewer in Michigan St., extending from Monroe St. to the bridge at LaSalle Ave., and emptying into the St. Joseph River. W. S. Moore is City Engr.

Champaign, Ill.—We are officially advised that bids will be received by the Board of Local Improvements until 2 p.m., Feb. 18, for constructing the Fountain Head storm water sewer. Plans and specifications were prepared by L. N. Sizer, City Engr. W. F. Woods is City Atty. Noted Jan. 16.

Chicago, Ill.—The Sub-Committee of the Council Committee on Streets and Alleys is considering a plan to reconstruct the sewer system in the downtown section of the city, at an estimated cost of $2,000,000. C. D. Hill is Engr. Bd. Local Impvts.

Elgin, Ill.—Bids will be received about May 1, for constructing sewers in various streets. Estimated cost, $75,000. M. H. Brightman is City Engr. Noted Jan. 23.

Kankakee, Ill.—The bids received by the Village Board, Jan. 30, for constructing the Bradley sanitary sewage will probably be rejected as too high. Estimated cost, $47,800.

Moline, Ill.—We are officially advised that bids will be received by Martin R. Carlson, Pres. Bd. Local Impvts., until Feb. 18, for constructing the 25th St. Sewer District. Estimated cost, $6736. Lyle Payton is City Engr. Noted Jan. 30.

Madison, Wis.—Alvord & Burdick, Consult. Engrs., 8 South Dearborn St., Chicago, are preparing plans for a sewage disposal plant at Madison. Estimated cost, $40,000.

New London, Wis.—Bids will be received by C. J. Thompson, City Clk., until Feb. 18, for constructing a sewer in Cook St., between Wyman and Door Sts.

Superior, Wis.—E. B. Banks, City Engr., has prepared plans for a sewer system for the Ninth Ward. Estimated cost, $31,000.

Carroll, Iowa—The City Council contemplates the construction of three miles of sewers.

Tipton, Iowa—We are officially advised that bids will be received by the city until Feb. 26, for constructing ten miles of 8- to 15-in. pipe sewers and accessories. Philip D. Ketelsen is City Clk. Plans and specifications were prepared by the Iowa Engineering Co., Clinton, Iowa. Noted Sept. 26.

Toledo, Iowa—According to press reports, bids will be received about Mar. 1, for constructing a sewerage disposal plant and about 1000 ft. of outlet sewer.

Greenleaf, Kan.—Bids will probably soon be asked for the installation of a sewer system here. Plans have been prepared by Bruce & Standevin, Consult. Engrs., Bee Bldg., Omaha, Neb.

Sidney, Neb.—We are officially advised that bids will be received by Leslie Newbaur, Village Clk., until 4 p.m., Feb. 28, for constructing a sewer system and a sewage disposal plant, according to plans and specifications prepared by Grant & Fulton, Consult. Engrs., Lincoln, Neb. Estimated cost, $20,720. Noted Sept. 12.

St. Joseph, Mo.—The Board of Public Works has appropriated $5000 for repairing the lower end of the Blacksnake Sewer.

Wynne, Ark.—Preliminary arrangements have been completed for installing a sewer system here, and bids for construction will probably soon be asked. C. M. Crain is Mayor.

+St. Louis, Mo.—Contracts for constructing sewers here have been awarded by the Board of Public Improvements, as follows: Clifton Heights Joint Sewer District No. 2, Section 2, to JOHN B. TURNER, Pierce Bldg., at $9569; Clifton Heights Sewer District No. 2, to P. McINTYRE, 1385 Union Ave., at $12,965. Noted Jan. 30.

Dallas, Tex.—The City Commission is advertising for bids for the construction of a 6-in. sanitary sewer in Exposition Ave., and in First Ave. and Second Ave. from Grand Ave. to Grady St. About 6253 ft. of sewer pipe will be required for the work.

Canyon City, Colo.—The City Council is organizing Sewer District No. 2, which will comprise the territory east of 11th St.

+Seattle, Wash.—The Board of Public Works has awarded a contract to the INTERNATIONAL DREDGING CO., Central Bldg., Seattle, at $80,031, for constructing sewers in Rainier Ave.

Alhambra, Calif.—Bids are being received by the City Clerk for constructing a storm sewer, consisting of the following approximate quantities: 300 ft. 8-in. pipe, 350 ft. 10-in. pipe, 388 ft. 22-in. pipe, 360 ft. 24-in. pipe, 640 ft. 27-in. pipe, 1462 ft. 30-in. pipe, 1696 ft. 33-in. pipe, 3688 ft. 42-in. pipe. Bids will be taken on both vitrified and concrete pipe. Plans and specifications may be obtained at the office of City Engineer. O. M. Caulk is City Clk.

+Hanford, Calif.—The contract to construct the sewer system here has been awarded to CHAMBERS & DEAFEY, Oakland, Calif., at $75,000. Plans and specifications were prepared by Sloan & Robson, Consult. Engrs., San Francisco. Noted Jan. 2.

Santa Monica, Calif.—Knapp & Woodard, Consult. Engrs., Consolidated Realty Bldg., Los Angeles, are receiving bids for constructing 18,700 lin.ft. of 8-in. sanitary sewer, 425 lin.ft. concrete box storm sewer, 1705 ft. 30-in. corrugated iron storm sewer, 19,700 ft. 2-in. gas mains, in the King C. Gillette Subdivision in Santa Monica.

STREETS AND ROADS

Niagara Falls, N. Y.—The Board of Public Works will shortly ask for bids for paving various streets at an estimated total cost of $264,785. Work will be begun in the spring.

Buttzville, N. J.—The Warren County Board of Freeholders

will macadamize the present public highway between Buttzville and Townsbury, a distance of about six miles.

Camden, N. J.—The City Council has passed an ordinance providing for the construction of vitrified brick paving, with 4-in. concrete foundation, on Seventh St., from York to Erie St.

Towson, Md.—Bids will be received until noon, Feb. 20, by the Highways Commission of Baltimore County, for the improvement of about 1.98 miles of the Black Rock Road from the end of the improved section to Mount Zion Church.

Valdosta, Ga.—See item under Water Supply—Irrigation.

Louisville, Ky.—Bids will be received until Feb. 18, by the Board of Public Works for the reconstruction of Broadway from 32d St. to Lincoln Court, a distance of approximately 2500 ft. The estimated cost is $28,000. Granite block will be used between the car tracks and the rest of the roadway will be of asphalt with vitrified brick gutters. Roger McGrath is Secy.

Burton, Ohio—We are officially advised that bids received on Feb. 3 for various street improvements were withdrawn, and new bids, with amended estimates will be received by the Village Clerk until noon, Feb. 20. A. C. Brown is Clk. E. A. Fiedler, Chardon, Ohio, is County Surv. Noted Jan. 23.

Canton, Ohio—Bids will be received until Mar. 3 by the Commissioners of Stark County for paving with brick approximately four miles of the Massillon-Wooster Pike, from West Brookfield to the Wayne County line.

+Chardon, Ohio—We are officially advised that the Board of Public Service has awarded a contract for various street improvements to GEORGE B. HERRING & SON, Cleveland, Ohio, at $16,118. Other bidders were: H. F. Green, Ravena, Ohio, $16,780; Gould & Maybach, Collinwood, Ohio, $17,107. The work includes 6950 sq.yd. vitrified brick block paving, sand filler on a slag or stone foundation, 2500 cu.yd. excavation, 4300 lin.ft. stone curb, 4300 ft. drain tile, 870 lin.ft. storm sewers and 9 catch basins. E. A. Fiedler is City Engr. Noted Jan. 23.

+Cincinnati, Ohio—A contract has been awarded by the Commissioners of Hamilton County to WM. HARREL & CO., at $9606, for improvement of the Gum Run Road, Miami Township. Stanley Struble is Pres. Noted Jan. 9.

The County Commissioners have ordered plans prepared for improving the Ohio Pike from the Bogart Road to the Clermont County line, at an estimated cost of $13,415.

Niles, Ohio—Bids will be received until noon, Feb. 18, by the Board of Control for paving portions of Church, Mechanic, Chestnut, Beaver and Cedar Sts. J. E. Tregaskis is Clk.

Norwalk, Ohio—Bids as follows were received by the Director of Public Service for paving portions of East Main St. and Woodlawn Ave.: (a) Pavement: George E. Scott & Co., Norwalk, Ohio, (a) $38,345, (b) $27,048; the Modern Construction Co., Fremont, Ohio, (a) $32,439; (b) $24,977; the Buckeye Engineering Co., (a) $30,693, (b) $23,229.

Youngstown, Ohio—Bids will be received until noon, Feb. 14, by the Director of Public Service, for paving Kyle St., from Pine St. to South Ave. W. H. McMillin is Clk.

Zanesville, Ohio—The City Council has passed an ordinance authorizing the paving of parts of Muskingum and Moxahala Aves., at an estimated cost of $45,395.

Indiana—Bids for road improvements in Indiana will be received as follows: Mar 3, at Kentland, by Commissioners of Newton County, for construction of a macadam road in Jefferson Township, and two gravel roads in McClelland Township. S. R. Sizelove is Audr.

Mar. 3, at Brookville, by Commissioners of Franklin County, for construction of a gravel road on line between Posey and Salt Creek Townships. Chas. G. Reifel is Audr.

Mar. 3, at Mount Vernon, by Commissioners of Posey County, for construction of a gravel road on line between Black and Lynn Townships. Joseph R. Haines is Audr.

+Cannelton, Ind.—We are officially advised that the Commissioners of Perry County have awarded a contract to FRANK R. PAULIN & CO., at $64,602, for the construction of approximately 18.25 miles of macadam roads in Troy Township. Other bidders were: Barnes & Barnes, $68,500; Beal & Bell, $68,362; Traylor & Kremp, $65,550; Von Fossen, Coleman & Noble Co., $63,500. W. H. Cost is County Engr. Chas. D. Patrick is Audr. Noted Jan. 23.

+Kentland, Ind.—We are officially advised that the Commissioners of Newton County have awarded a contract to EVANS & VAN NATTA, Fowler, Ind., at $14,845, for construction of a macadam road on the line between Jefferson and Grant Townships. Other bidders were: J. F. & A. H. Barnes, at $15,450; Alva E. Harriman, at $15,300. S. R. Sizelove is Audr. Noted Jan. 23.

New Albany, Ind.—The Board of Commissioners of Floyd County plans to reconstruct the Charleston and Green Valley Roads.

+Portland, Ind.—We are officially advised that the Commissioners of Jay County have awarded a contract to MARK W. JONES, Pennville, Ind., at $10,533, for construction of a crushed stone road in Bear Creek Township. Other bidders were: Smith & Mathys, $11,400; Wheat, Sisk & Sprinkle, $12,075; Teeters & Teeters, $11,494; Frank J. Wright, $14,300. John Bonifas is Audr. Noted Jan. 23.

Richmond, Ind.—We are officially advised that bids will be received until 10 a.m., Feb. 27, by the Board of Public Works for 16,200 sq.yd. brick paving on various streets at an estimated cost of $29,000. Fred R. Charles is City Engr.

+Wabash, Ind.—We are officially advised that the Commissioners of Wabash County have awarded a contract to SHAFER & BROWNING, Royal Center, Ind., at $16,800, for the construction of the Engelman Road. Other bidders were: C. J. McGreevey & Sons, at $17,376; Ora J. Simmons, at $18,000. D. Showalter is Audr. Noted Jan. 30.

Mount Clemens, Mich.—We are officially advised that no bids were received by the Commissioners of Macomb County for the construction of 16 miles of road, and the Commissioners will build the roads by day labor. George A. Dankers is Clk. of the Good Roads Com.

Glencoe, Ill.—We are officially advised that objections will probably be made and delays must ensue before bids can be asked for the proposed street paving, estimated to cost $190,000. Noted Feb. 6.

+Peoria, Ill.—The Board of Local Improvements has awarded a contract to CANTERBURY BROS., at $9315, for paving a portion of Windom St. Other bidders were: McElwee & Bushel, $9393; D. A. Myers, $9433; A. D. Thompson, $9433; John McAllister, $9542. L. D. Jeffries is City Engr.

Fresno, Calif.—The Ewing-McDaniel Co. is receiving bids for construction of concrete curbs, gutters and sidewalks in its new tract of Hazelwood. The estimated cost is $10,000.

Manhattan Beach, Calif.—This city will do $300,000 worth of street work. Knapp & Woodard, 741 Consolidated Realty Bldg., Los Angeles, are the Engrs.

+Orange, Calif.—We are officially advised that a contract has been awarded by the City Council to the LOS ANGELES PAVING CO., L. W. Hellman Bldg., Los Angeles, at $15,887, for asphalt paving on North Glassell St. Other bidders were: Barber Asphalt Paving Co., $16,856; Fairchild-Gilmore-Wilton Co., $16,391. C. C. Bonebrake is City Engr. Noted Jan. 23.

Riverside, Calif.—The Board of Supervisors of Riverside County has ordered the advertising of bids for construction of about 1.75 miles of macadam road west of Hemet.

+San Fernando, Calif.—F. B. GRIDLEY, Burbank, Calif., has been awarded the contract at $11,162, for improving McDougal St.

Venice, Calif.—Bids will be received by the Board of Trustees until 5 p.m., Feb. 17, for improving a portion of Westminster Ave., Electric Ave., Fourth Ave. and Washington Blvd. The work consists of grading and paving with cement concrete base with asphalt wearing surface, curbs, 5-ft. concrete sidewalks and 2-ft. vitrified block gutters on each side, 20-in. vitrified pipe storm drains, including all manholes, junction boxes and catch basins, and corrugated iron culverts, including manholes, catch basins and junction boxes. C. S. Thatcher is City Clk.

Saskatoon, Sask.—The City Council is considering the construction of approximately 45,000 sq.yd. of street paving at an estimated cost of $140,000. Andrew Leslie is City Clk.

INDUSTRIAL WORKS

+Augusta, Maine—The Schmick Handle & Lumber Co. has awarded a contract to A. CAREY & CO., Waterville, Maine, for the construction of a handle and sawmill, 100x200 ft., two stories, and a thimble mill, 32x160 ft., Augusta, Maine. The specifications call for concrete foundations and substructures of hard pine lumber. The company also contemplates the construction of a boiler house, warehouse and power house.

Boston, Mass.—The Ford Motor Co., Detroit, Mich., contemplates the construction of an assembling plant at Cottage Farm Bridge, Boston. Plans for the new building are being prepared by Philip R. Hovey, Arch., 50 State St., Boston.

Great Barrington, Mass.—Representatives of the Martin Tractor Engine Co., of Springfield, Mass., are negotiating for the purchase of a site for a branch factory at Great Barrington.

Holyoke, Mass.—Henry Taylor, formerly Pres. of the New York & New England Paper Co., is negotiating for a site for a paper mill at Holyoke.

Bridgeport, Conn.—The Blue Ribbon Auto & Carriage Co., Cannon St., is making arrangements to build a new factory at Fairfield and State Sts. Plans call for an el-shaped building probably three stories high, of brick, heavy mill construction. F. A. Cooper is Arch.

Meriden, Conn.—The J. H. Bergen Co. contemplates the construction of a foundry on Brittania St., for the manufacture of silver deposit ware. Walter H. Bradley is Pres. and Gen. Mgr.

Buffalo, N. Y.—The King Sewing Machine Co. has had plans completed for a one- and two-story foundry to be erected at its plant at Rano and Welland Sts. The estimated cost is $40,000. Noted Nov. 21.

+Laurel Hill (Flushing post-office), **N. Y.**—The Nichols Copper Co., 25 Broad St., New York, has awarded the contract for the foundation to JOHN K. TURTON, 39 West 32d St., New York, and for the steel superstructure to GRANT & RUHLING, 373 Fourth Ave., New York, for the construction of a smelting and furnace plant to be erected at Laurel Hill. The estimated cost is $100,000.

New York, N. Y.—Frank B. Hill, care of Frederick Hammond, Arch., 391 East 19th St., is having plans prepared for a four-story wagon works, 130x51 ft. The estimated cost is $60,000.

+Jersey City, N. J.—The American Chocolate Almond Co., 901 Jefferson St., has awarded a contract to DE RISO & AREVA, 322 Fifth St., Union, for the construction of a three-story brick factory, on the Paterson Plank Road, near Congress St. The estimated cost is $50,000.

Newark, N. J.—R. H. Nathan is having plans prepared by William E. Lehman, Arch., for a leather manufacturing plant, to replace his plant, recently destroyed by fire. The structure will be erected at 132 Frankfort St., and will be 80x90 ft. A new one-story brick boiler and engine room, 5x65 ft., will also be erected. The company is known as the Leather & Patent Cloth Novelty Co.

Conshohocken, Penn.—The Linde Products Co., Buffalo, N. Y., has received bids for the construction of a brick and concrete factory to be erected in Conshohocken.

Jeanette, Penn.—The Pennsylvania Rubber Co. is having plans prepared for the construction of a three-story addition to cover an area of 8000 sq.ft., and to cost in the neighborhood of $100,000.

Palmerton, Penn.—The New Jersey Zinc Co. has purchased a 12-acre tract of land near Allentown, and will erect a stone-crushing and hydrating plant on the property for use in the manufacture of its products at the Palmerton plant.

Philadelphia, Penn.—Bids are being received by the Harrison Safety Boiler Works, Allegheny Ave. and 17th St., for the construction of a one-story brick machine shop, at its plant.

Baltimore, Md.—John Freund, Jr., Arch., Hoffman Bldg., is preparing plans for the construction of buildings for the City Baking Co. The estimated cost is $80,000.

Macon, Ga.—The Georgia Realty & Mfg. Co. plans to erect three plants, costing $100,000 each, for the development of beauxite, raolin and fullers' earth deposits.

Tifton, Ga.—The Georgia Harrow & Implement Co. has been incorporated with $15,000 capital stock, and will establish a plant to manufacture farm implements. J. D. Cook, R. S. Short and J. H. Brown are among those interested.

Gadsden, Ala.—The Gadsden Car Works plans an addition to double its present capacity of 600 cars per month.

Lafayette, La.—The Southern Pacific Co. plans to erect new shops and roundhouses at Lafayette and Algiers, La., at an approximate cost of $250,000. Hiram W. Sheridan, New Orleans, La., is Gen. Supt.

Knoxville, Tenn.—W. P. Biddle, 110 East Vine St., will establish a plant to manufacture steel ranges.

Lewisburg, Tenn.—The Sunbeam Laundry will receive bids until Mar. 15 for the erection of a three-story concrete block building, 30x70 ft.

Memphis, Tenn.—The Tennessee Hoop Co. has decided to increase its capital stock from $25,000 to $100,000 and will enlarge its plant.

Mount Gilead, Ohio—The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, has had plans prepared and will erect a one-story, 44x150-ft. factory, for the manufacture of hydraulic presses.

Indianapolis, Ind.—The National Motor Vehicle Co., Indianapolis, Ind., is contemplating the erection of an 83x97-ft. three-story addition to its factory.

Springfield, Ohio—The Robbins & Meyers Co., has increased its capital stock from $50,000 to $1,000,000 for the purpose of making extensive additions and betterments to its plant. The company does a foundry business and manufactures electric motors and fans.

+Detroit, Mich.—G. W. Graves, 55 Rowland Bldg., Detroit, has awarded contracts as follows for a three-story factory, 200x200 ft., for Reuben Miller, Farmers' Bank Bldg., Pittsburgh, Penn., to be located in Detroit: Structural iron work, to H. B. LEWIS, Ferry Ave. and Roby Sts., Detroit; masonry, to GEO. D. NUTT, 608 Bamlet Bldg.; carpentry, to HARCUS & CO., 774 Russell St.; plumbing, to A. W. SCHULTZ, 815 Gratiot Ave., all of Detroit. Cost, $100,000.

+Kalamazoo, Mich.—D. J. Albertson, 305 East Main St., Kalamazoo, has awarded the general contract for the two-story factory building, 132x266 ft., for Wm. Shakespear, Jr., Rose and Water Sts., Kalamazoo, to the BEYERS CONSTRUCTION CO., care of the owners. Cost, $40,000.

+Chicago, Ill.—The Chicago White Lead Co., Chicago, has awarded the contract to WILLIAM ADAMS & CO., Chicago, for constructing its proposed factory. Estimated cost, $150,000.

The Schulze Baking Co. will erect a four-story and basement bakery to cost about $175,000 at 5424-58 South Wabash Ave., Chicago.

La Crosse, Wis.—Improvements contemplated by local manufacturers this year include an addition to the Rubber Mills Co.'s plant that will double its present capacity. Albert Funk is Sec. The National Gauge and Register Co. also contemplates a large factory addition for which plans have not yet been completed.

+Milwaukee, Wis.—The contract for a four-story steel and concrete addition 90x100 ft. to the Miller Brewing Co.'s plant at 42nd and State Sts., has been awarded to the UTLEY CONSTRUCTION CO.

Milwaukee, Wis. The Garage Equipment Mfg. Co., Milwaukee, is planning to rebuild its factory, which was recently destroyed by fire. Bids are being received for a one-story building, 100x93 ft.

Jefferson, Wis.—The Waverly Mfg. Co., manufacturer of the "Jefferson" motorcycle, Jefferson, is having plans prepared for the erection of a three-story addition to its plant.

Rexford, Mont.—The Kootenai Lumber Co., Kootenai, Mont., contemplates the erection of a saw mill at Rexford, Mont. W. H. Graham is the Mgr.

St. Louis, Mo.—The Schlueter Mfg. Co., St. Louis, has acquired a site and will erect an addition to its plant, to cost approximately $20,000.

Galveston, Tex.—The Galveston Commercial Assoc., is promoting the establishment of a large machine shop and plant for the manufacture of engines.

Independence, Ore. The Western Glass Co., Independence, has acquired a site covering about eight acres, and will erect a large glass factory. O. H. McClellan is Pres.

Portland, Ore.—The Ford Motor Car Co., Detroit, Mich., is having plans prepared for the construction of a three-story and basement factory at East 11th and Division Sts., Portland, Ore. The estimated cost is $200,000. Doyle, Patterson & Beach, Worcester Bldg., Portland, are the Archs.

Los Angeles, Calif. Nathan Blanchard, Los Angeles, is having plans prepared for the construction of a commercial and pleasure steamboat on East Fifth St., Los Angeles. John C. Austin and W. C. Pennell, Wright & Callender Bldg., Los Angeles, are the Archs.

Porterville, Calif. Frost Mercer, Visalia, Calif., is completing plans for the erection of a large addition to the power house at Porterville for the Southern California Edison Co.

San Pedro, Calif. The Olympia Cutting Mill Co. of South San Pedro, Los Angeles Co., Calif., recently incorporated with a capital of $50,000, is planning to erect a cutting mill at San Pedro. Lee Moorhead, M. W. Hellman & C. F. Hunsaker and C. W. Eberhardt are interested.

Santa Rosa, Calif. The Santa Rosa Steel Mfg. Co. Santa Rosa, Cal., has acquired a site at Third and E Sts., and will erect a factory.

Torrance, Calif.—W. D. Cottrell, Los Angeles, Calif., is having plans prepared for the construction of a factory at Torrance, near Los Angeles, for the manufacture of buttons. Irving J. Gill is the Arch.

Montreal, Que.—The Smart-Woods Co. plans alterations and additions to its bag factory on Mullins St. It will be three stories, of reinforced concrete, brick and mill construction. Ross & McDonald, 1 Belmont St., are Archs.

Blenheim, Ont.—The Blenheim Canning Co. will begin the erection of a new factory as soon as possible. It will cost $40,000. John Wall is Mgr.

Burlington, Ont.—The Vera Chemical Co. will erect a size factory. It will be four stories, 152x62 ft. Boilers, engines, belting and 70-ft. stacks will be required. Gladman & Gladman, Confederate Life Bldg., Toronto, Ont., are Archs. D. C. Davis is Supt.

Fort William, Ont.—The Western Terminal Elevator Co. plans to erect an addition to its elevator increasing its capacity by 1,000,000 bu. Work will be begun at once.

Guelph, Ont.—The International Sand, Lime, Brick & Machinery Co., Montreal, Que., has purchased a site near Guelph, and will erect a $90,000 plant for the manufacture of sand, lime, brick and artificial stone.

St. Catherines, Ont.—The Goodrich Rubber Co., Akron, Ohio, plans to establish a Canadian branch, which will, it is reported, give employment to about 1000 men.

Sarnia, Ont.—The Sarnia Bridge Co. plans to double the capacity of its plant. The firm's draftsmen are preparing the plans, and construction will begin in the early spring.

Sault Ste. Marie, Ont.—The improvements and enlargements to be made to the plant of the Lake Superior Corporation include additional furnaces, a new rail mill, a billet mill, an openhearth furnace, another battery of 11-0 coke ovens, extensions to the docks, additional blooming mills and another merchant mill. The estimated cost is $12,000,000. J. F. Taylor is vice-pres. and gen.mgr.

Sydney, N. S.—The Sydney Boot & Shoe Co., Ltd., has been organized with a capital stock of $100,000, and will erect a $50,000 factory. Electric dynamos and machinery will be required. George W. Murphy, Prince St., is Secy. and Treas.

FEDERAL GOVERNMENT WORK

Air Compressors—Newport, R. I.—Bids will be received until 11 a.m., Feb. 15, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing two 450 cu.ft. of free air per min. air compressors, one to be motor-driven, and the other steam-engine driven, supplied complete with accessories. Estimated cost, $6000. H. R. Stanford is Ch. of Bureau.

Armor—Washington, D. C.—Bids will be received until noon, Feb. 18, by the Bureau of Ordnance, Navy Dept., Washington, D. C., for furnishing armor for naval vessels. N. C. Twining is Ch. of Bureau.

Forgings—Washington, D. C.—Bids were received as follows by the Chief of Ordnance, U. S. A., Washington, Feb. 3, for furnishing four sets of steel forgings for 12-in. mortars, Model 1912, except trunnion hoops: Bethlehem Steel Co., South Bethlehem, Penn., 24.25c. per lb. for gun steel forgings, 34.5c. per lb. for forged steel C; first set 120 days, one set each 20 days thereafter; Midvale Steel Co., Philadelphia, Penn., 24.25c. for gun steel forgings and 34.5c. for forged steel C; first set 180 days, one each 30 days thereafter.

Vessels—Washington, D. C.—Bids were received as follows, Feb. 1, by the Commissioner of Lighthouses, Dept. of Commerce and Labor, Washington, D. C., for the construction of two steel light vessels, Nos. 96 and 98: Navy Department, Washington, D. C., $150,000 for both; Racine-Truscott Shell Boat Co., Muskegon, Mich., No. 96, delivered Buffalo, N. Y., $77,000; delivered Muskegon, $75,000; No. 98, delivered Detroit, $77,000; delivered Muskegon, $75,000; both, delivered Bucalo and Detroit, $143,000; delivered Muskegon, $139,700; Manitowoc Shipbuilding & Dry Dock Co., Manitowoc, Wis., No. 96, $85,000; No. 98, $85,000; both, $168,000, delivered Manitowoc.

Building Addition—Washington, D. C.—Bids were received as follows, Jan. 30, by the Commissioners of the District of Columbia, for the construction of an addition to the ward building and dining rooms of the Home for the Aged and Infirm, Blue Plains, D. C.: W. H. McCray, $22,000; Skinker & Garrel, $18,817; W. E. Mooney, $23,263; H. J. Montgomery, $22,032; McKay & Morris, $20,831;* Burgess & Parsons, $23,000;* Samuel P. Harbin, $23,033.* All bidders of Washington, D. C.

*Not including electrical work.

Dredging—Fort Screven, Ga.—All bids opened Jan. 15 for dredging near the government wharf at Fort Screven have been rejected.

Riprap—Memphis, Tenn.—Bids were received Jan. 31, by Maj. E. M. Markham, Corps Engrs., U. S. A., Mississippi River Comn., First and Second Districts, Custom House, Memphis, for furnishing and loading 10,000 cu.yd. of riprap stone on government barges. The bids follow: W. B. Arnold, Cape Girardeau, Mo., $1.05 per cu.yd.; C. C. Ruthmacher, Grand Tower, Ill., 95c.; C. B. Hoeller, Cape Girardeau, $1.33; J. B. Wiles, Helena, Ark., $1.67½. The contract will probably be awarded to C. C. Ruthmacher.

Steel Barges—Louisville, Ky.—Bids will be received until noon, Mar. 7, by Maj. J. C. Oaks, Corps Engrs., U. S. A., Louisville, for two steel barges.

Elevator—North Platte, Neb.—Bids will be received by Oscar Wenderoth, Supvy. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Feb. 27, for the installation complete of an elevator passenger cage in the U. S. post office and court house at North Platte, in accordance with the drawing and specification copies of which may be had at the discretion of the Supervising Architect.

+Dredging—Texas City, Tex.—The contract has been awarded to the BOWERS SOUTHERN DREDGING Co., Galveston, Tex., for dredging in Texas City Channel, about 578,000 cu.yd., at 13.5c. per cu.yd. Noted Jan. 2.

Crematory—Monterey, Calif.—Bids will be received until 11 a.m., Mar. 5, by Maj. F. A. Grant, Q. M., Corps, U. S. A., Presidio of Monterey, for the construction of a garbage crematory, complete.

Structural Steel—Panama—Bids will be received until 10 a.m., Feb. 25, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for structural steel under Canal Circular 759.

Structural Steel—Panama—Bids will be received until 10:30 a.m., Mar. 6, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Washington, D. C., for structural steel for administration building.

Coaling Plant—Panama—Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., will ask for bids soon for delivering and erecting coal-handling machinery and accessories necessary for two coaling plants, one at each terminus of the Isthmian Canal, to be furnished and erected, complete, ready for operation.

Locomotives—Hawaii—Bids will be received until 11 a.m., Mar. 1, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one narrow-gage and two standard-gage saddle-tank switching locomotives, for delivery at the naval station, Pearl Harbor, H. T.

MISCELLANEOUS

★**Road Oil**—Bridgeport, Conn.—Bids will be received until 1 p.m., Feb. 19, by the Board of Contract for furnishing and applying approximately 380,000 gal. of road oil. Separate bids are asked as follows: For furnishing oil; applying oil; furnishing and applying oil.

Barge Canal Work—Albany, N. Y.—Duncan W. Peck, Supt. Pub. Wks., received bids, Feb. 4, on five contracts for Barge Canal construction work. These included Contract No. 42-A for completing the construction of the canal near Utica; Contract No. 87, for the construction of a bridge over the Erie Canal, near Rocky Rift Dam, in Montgomery County, and Contract No. 102, for building the steel superstructure for the Howland's Alve. highway bridge in Cayuga County, and Contracts Nos. 92 and 94, for erecting and installing power plants, electrical equipment and machinery for operating over 20 locks along the line of the Barge Canal. Grant Smith & Co. and Locher, New York, submitted the lowest bid for the Utica work, their bid being $1,014,671, as compared with the engineer's estimate of the cost of the work of $1,033,037. The other bidders on this contract were: Buffalo Dredging Co., Buffalo, N. Y., $1,344,230; Furst & Talbott, Utica, N. Y., $1,135,632. For the Rocky Rift bridge, the P. B. McCaghey Co., of Little Falls, is low, its bid being $11,202, against the Engineer's estimate of $10,900. The others submitting bids for this work were: S. V. R. Malcolm & Sons, Medina, $12,025; Owego Bridge Co., Owego, $18,997. Lupfer & Remick, Buffalo, were the lowest bidders for the Howland Ave. highway bridge, at $25,993. Other bids were: Penn Bridge Co., Beaver Falls, Penn., $26,366; Owego Bridge Co., Owego, N. Y., $26,580; M. Fitzgerald, Hoosick Falls, $27,229. The engineer's estimate was $25,035. McArthur Bros. Co. and the Lord Electric Co., of New York, bidding jointly, submitted the lowest bids for Contracts Nos. 92 and 94, covering the electrical equipment of the Barge Canal locks, their bid for Contract No. 92 being $1,178,976, and for Contract No. 94, $433,380. The former bid is approximately $28,000 under the engineer's estimate of the cost of the work embraced in Contract No. 92, and the lowest bid for Contract No. 94 is over $25,000 under the engineer's estimate for that contract. Other bids were: On Contract No. 92, Buffalo Dredging Co., Buffalo, N. Y., $1,429,083; J. Livingston & Co., Inc., New York, $1,336,914; P. J. Carlin Construction Co., New York, $1,299,310; Lupfer & Remick, Buffalo, $1,306,837; Northeastern Construction Co., New York, $1,333,560; on Contract No. 94: Buffalo Dredging Co., Buffalo, $580,211; J. Livingston & Co., Inc., New York, $497,257; P. J. Carlin Construction Co., New York, $494,203; Northeastern Construction Co., New York, $484,279; Lupfer & Remick, Buffalo, $488,931. There were in all 22 bids received for the five contracts.

Dredging—New York, N. Y.—Bids were received as follows Feb. 3 by Calvin Tompkins, Comr. of Docks, for Contract No. 1360 Class 2, furnishing materials and dredging in the Boroughs of Manhattan, Brooklyn and Queens: R. G. Packard Co., 25c. per cu.yd.; P. Sanford Ross, Inc., 28.9c.

Seawall—Willets Point (L. I.), N. Y.—The Board of Estimate and Apportionment has appropriated $32,390, to rebuild the seawall along Willets Point Road.

Fire Station—Camden, N. J.—The Fire Committee of the Common Council has awarded a contract for the erection of a new fire station in the North Cramer Hill District, to J. W. DRAPER, at $11,500.

Jetties—Trenton, N. J.—Bids will be received by the Board of Managers of the Geological Survey at the office of Henry B. Kummel, State Geologist, until Feb. 27, for reinforced concrete jetties at Shark Inlet. C. C. Vermuele, 203 Broadway, New York, is Engr.

Piers—Baltimore, Md.—The Western Maryland R.R. Co., H. R. Pratt, Ch. Engr., Hillen Station, Baltimore, has purchased the remaining portion of Port Covington, a tract of 90 acres, at a cost of $800,000, and plans extensions of terminal facilities and the construction of freight piers, etc., together with elevators, and new trackage.

✚**Stable**—Baltimore, Md.—The Baugh Chemical Co. has awarded to CHARLES L. STOCKHAUSEN the contract to rebuild its stables on Clinton St. and 12th Ave., recently damaged by fire. The cost is estimated at $12,000.

✚**Tunnel**—Harpers Ferry, W. Va.—The Baltimore & Ohio R.R. Co. has awarded the contract to E. BRODY & SONS, Baltimore, for constructing a tunnel and fence between tracks at Harpers Ferry.

Tunnel—Wheeling, W. Va.—The Morgantown & Wheeling Ry. will construct a 1200-ft. tunnel at the divide between the waters of Dunkard and Wheeling Creeks. J. A. Martin is Gen. Mgr., Morgantown, W. Va.

Stables—Marion, Ala.—Mrs. B. M. Huey, Marion, will rebuild the stables recently burned. Estimated cost $20,000.

Drainage Work—Crenshaw, Miss.—Bids will be received until 2 p.m., Feb. 18, by the Commissioners of Drainage District No. 2, of Tunica, Quitman and Panola Counties for the following work, to be constructed according to the specifications of the engineers: 11,158 cu.yd. of embankment (levees), 61,014 cu.yd. of excavation (ditches). Bids will be accepted for the work as a whole or for either part thereof. The district is located near Crenshaw, Miss., on the Yazoo & Mississippi Valley R.R., about 48 miles south of Memphis, Tenn. The specifications, form of contract and other data can be seen either at the office of the Board of Commissioners, or of the Morgan Engineering Co., Memphis. Construction work on the levees must begin within two weeks, and on the ditches within two months after the sale of the bonds. The ground is now suitable for constructing the levee. The ditchwork can be done by a dredge, a drag-line excavator or teams.

Ditch—Canton, Ohio—Bids were received Feb. 3, by the Board of Stark County Commissioners, Canton, for the construction of the Shaub Ditch in Plain Township. All bids submitted were rejected as excessive. J. R. McConnell is County Audr.

✚**Ditches**—Rensselaer, Ind.—Bids were received Feb. 1, by M. M. Price, Supt. Const., Rensselaer for constructing the J. A. Borntorager Ditch. The contract has been awarded to C. H. STEINBURG & SONS, Rensselaer, at about $95,000.

✚**Ditch Work**—Lacon, Ill.—The contract has been awarded to TRIPP & DEVAULT, Greenview, Ill., for constructing a main ditch and two laterals for Crow Creek Drainage District, at $26,378. Bids were opened Jan. 25.

Dock—Ashland, Wis.—J. W. Day, City Engr., is preparing plans and specifications for the construction of a municipal dock to cost $50,000.

Harbor, Etc.—Milwaukee, Wis.—The city has appropriated $40,000, for harbor work, $50,000 for docks and dredging, and $65,000 for parks.

Grandstand—Milwaukee, Wis.—The Common Council has decided to erect a combination grandstand and public comfort station facing the Washington Park driving track and the inclosed athletic field. The stand will have a seating capacity of from 7000 to 8000 persons. Estimated cost $10,000.

✚**Drains**—Dakotah, Iowa—The contract for constructing Drains Nos. 47, 52 and 59, has been awarded to W. S. JOHNSTON, Fort Dodge, Iowa, at about $41,300.

✚**Drain**—Fort Dodge, Iowa—The contract has been awarded to W. S. JOHNSTON, Fort Dodge, for the construction of the joint drain for Humboldt and Webster Counties, at 6c. per cu.yd. Bids were opened Jan. 29.

Ditch—Sioux City, Iowa—The Woodbury County Supervisors, Sioux City, will receive bids until Feb. 22, for the construction of the Little Sioux Drainage Ditch and its laterals.

Ditch—Blue Earth, Minn.—Bids will be received until 11 a.m., Feb. 26, by J. L. Herring, County Audr., Blue Earth, for constructing Judicial Ditch No. 6. Estimated cost, $34,560.

Portland Cement—Minneapolis, Minn.—Bids were received Jan. 31 for 90,000 bbl of Portland cement, by the Purchasing Agent as follows: Universal Portland Cement Co., Chicago, Ill., $1.20 net, per bbl.; Lehigh Portland Cement Co., Mason City, Iowa, $1.22; N. W. States Portland Cement Co., Mason City, $1.29; N. W. Lime Co.; St. Paul, Minn., $1.32; Shevlin-Carpenter Co., Minneapolis, Minn., $1.24.

Ditch—Warren, Minn.—The County Commissioners have ordered the necessary surveys made for the construction of Judicial Ditch No. 28.

Drainage—Pine Bluff, Ark.—Bids will be received until Feb. 10 by the Board of Commissioners, of Waterloo Drainage Dist., Pine Bluff, for digging and excavating about 44 miles of drainage ditches.

Drainage Tunnel—Cripple Creek, Colo.—The sum of $100,000 has been subscribed for the construction of a new deep drainage tunnel to be constructed 500 ft. below the Roosevelt tunnel in the Cripple Creek District. A. F. Carlton, Cripple Creek, Colo., is interested.

✚**Dock**—Bellingham, Wash.—**The Inland Navigation Co.**, Seattle, Wash., has awarded the contract to J. M. RISSE, Bellingham, for constructing a **300x100 ft. frame dock and a** 80x90-ft. 1½-story warehouse, at about $35,000. Blackwell & Baker are **Arch., Northern Bank Bldg., Seattle.** Noted Dec. 26.

✚**Dike System**—Sumas, Wash.—The contract has been awarded to L. M. RICE & CO., 445 Granville St., Vancouver, B. C., for a dike and irrigation system at Sumas to cost $75,000.

✚**Dredges**—Los Angeles, Calif.—The contract has been awarded to the CRAIG SHIPBUILDING CO., Longbeach, Calif., by the California Delta Farms, Inc., of Los Angeles, for constructing a dredger to cost $100,000.

Wharf—Los Angeles, Calif. — The American-Hawaiian Steamship Co., R. D. Lapham, 205 South Broadway, Los Angeles, Agt., will construct a 1000-ft. wharf at Los Angeles Harbor.

Elevators—Los Angeles, Calif.—THE VAN EMON ELEVATOR CO. has been awarded a contract at about $22,000, for furnishing and installing the elevators in the 10-story Class A reinforced concrete office building being erected at San Diego for Nathan Watts. The F. O. Engstrum Co. is the general contractor. Briston & Lymann, San Diego, Calif., are the Arch.

Dredging—San Diego, Calif.—The bar channel at San Diego Harbor will be dredged to a depth of 35 ft. and the middle harbor to 32 ft. The estimated cost is $208,786.

Wharf—San Diego, Calif.—The American Union Fish Co., the San Diego Fish Co., and the Sandoval Fish Co., will jointly build a large wharf with a refrigerating plant and other modern appliances at the foot of E St.

Pier—Santa Monica, Calif.—The pier recently burned, owned by A. R. Fraser will be rebuilt. Estimated cost. $150,000.

Dike—Chilliwack, B. C.—The ratepayers of Upper Sumas Districts have endorsed a diking project which provides for the construction of various dikes, to cost about $250,000.

Wharf—Vancouver, B. C.—The Canadian Northern Ry. Co. has completed plans for constructing wharf and terminal yards at Union Bay at a cost of about $400,000. M. H. MacLeod, is Gen. Mgr. & Ch. Engr., Winnipeg, Man.

Equipment—Toronto, Ont.—Bids will be received until noon, Mar. 4, by the Chairman of the Board of Control for concrete mixers; grading machines; tar kettles; three-wheel road rollers; road roller (tandem); scarifiers; stone-crushing outfit complete, stationary; derricks, buckets, etc. H. C. Hocken is Mayor and Chn. Bd.

Retaining Wall—Toronto, Ont.—Bids will be received until noon, Feb. 18, by the Chairman of the Board of Control, for constructing a reinforced-concrete retaining wall at Coxwell Ave. Subway.

Broken Stone, Etc.—Ottawa, Ont.—Bids will be received until 4 p.m., Feb. 13, by the Secretary of the Board of Control for broken stone, brick, sand stone, setts, cement, plank and cedar, sand, vitrified clay pipe, refined asphalt, etc.

Canal—Esperanza, Mex.—Bids will be received until 1 p.m., Apr. 1, by Compania Constructora Richardson, S. A., Esperanza, Sonora, Mex., for the construction of about 2½ miles of canal with sluicing channel from the Yaqui River near Esperanza involving the excavation of 670,000 cu.m. of earth and 215,000 cu.m. of rock, and the placing of about 6500cu.m. of concrete channel lining. L. H. Taylor, is Ch. Engr.

CONTRACT PRICES

Filters—New York, N. Y.—The bids received for the Jerome Park Filters, which were published in the issue of Jan. 30, are republished below, owing to a mistake of $1,000,000 in the total bid of the Keystone State Construction Co., the lowest bidder. With this table is incorporated the average bids of all received. The bids were as follows: (A) Keystone State Construction Co., 2 Rector St., New York; (B) Oscar Daniels & Co., 35 Park Row, New York; (C) T. A. Gillespie Co., 50 Church St., New York; (D) McArthur Bros. Co. and the Mason & Hanger Co., 11 Pine St., New York; (E) Luke A. Burke & Sons Co., 25 West 42d St., New York; (F) Carter Construction Co., 42 Broadway, New York; (G) J. F. Cogan Co., 280 Broadway, New York; (H) Booth & Flinn, ltd., 1942 Forbes St., Pittsburgh, Penn.; (I) E. E. Smith Contracting Co., 71 Broadway, New York; (J) Average bid:

JEROME PARK FILTERS, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H	I	J
494,000 cu.yd. earth excavation, general	$0 74	$0 70	$1.80	$0 72	$0 60	$0 75	$0 70	$0 75	$1 10	$0 87
50,000 cu.yd. earth excavation in trenches and foundations	0 84	1.80	2.00	1.96	0.95	1 25	1 00	0.75	2.25	1.42
254,000 cu.yd. rock excavation	0 98	1.50	2 50	1 45	1 90	1.10	1 75	1 50	1 10	1 53
100 cu.yd. masonry excav. of dividing wall	50 00	22.00	17.50	43.50	30.00	40 00	35 00	30.00	10.00	30.89
250 cu.yd. masonry excav. of gate chambers	50.00	15.00	17.50	17.40	24.00	30 00	12 50	20.00	7.50	21.54
350,000 cu.yd. rolling of embankments and foundations	0 15	0.05	0.20	0.36	0 30	0 10	0 20	0 50	0.30	0 24
500 (1) cu.yd. loam and seeding	2 20	1.65	1.75	2.32	2 00	2 00	3 00	3 00	3.00	2 32
40,000 cu.yd. puddle	3.20	3.00	3.20	3.19	3 50	4 75	2.75	2 75	4.00	3 37
152,000 lin.ft. tile drains over vaulting	0 06	0.10	0.04	0.06	0 09	0 03	0 05	0 04	0.03	0 056
9500 cu.yd. broken stone for filling	2 00	0.80	1.25	1.74	1 25	1 50	1.00	2.75	1.80	1 57
118,000 cu.yd. concrete in foundation and floors	6 50	7.00	7 00	6.16	6 00	6 50	6.25	7.55	8.25	6 80
122,000 cu.yd. concrete in piers and vaulting	7 90	10.00	9 00	8 00	8.25	8 75	9 50	7 40	10.50	8.81
74,000 cu.yd. concrete in walls	6 50	9 00	8 00	6.16	7.50	7 50	7 00	7 20	8.00	7 43
32,000 cu.yd. reinforced concrete in special vaulting	10 60	12.25	17 50	12.50	11 00	12 50	11 00	16 50	11.75	12 84
20,000 cu.yd. reinforced concrete in thin sections	40 00	25 00	35 00	21.75	50 00	40 00	10 00	20 00	27 50	29 92
11,000 sq.yd. special surfacing of concrete	0 90	0 30	0 50	0 58	0.45	1 50	0.75	1.00	0.15	0 68
5000 bbl. additional portland cement	2 20	1 50	1 70	2.10	1 60	1 60	1 50	1 60	2 25	1 78
5,000,000 lb. steel reinforcement	0 0275	0 04	0 035	0 035	0 04	0 03	0 03	0 035	0 035	0 034
12,800 lin.ft. vit. pipe sewers and drains	1 00	0 90	0 75	0 94	1 00	1 00	0 80	0 80	2 00	1 02
Main drain, lump sum	65,000	70,000	120,000	71,050	50,000	90,000	52,000	70,000	33,000	70,718
Filter equipment, item 21a, lump sum	1,045,000	1,402,400	1,226,000	1,417,000	1,300,000	1,454,145	1,521,330	1,402,400	1,402,400	1,352,297
Filter equipment, item 21aa, lump sum	1,043,000	1,400,000	1,264,000	1,415,000	1,290,000	1,451,625	1,518,750	1,400,000	1,400,000	1,353,597
Filter equipment, item 21b, lump sum		1,369,500	1,173,000	1,352,000	1,200,000	1,430,100	1,485,963	1,396,500	1,369,500	1,343,695
Filter equipment, item 21bb, lump sum		1,367,500	1,211,000	1,350,000	1,250,000	1,417,500	1,435,975	1,367,500	1,367,500	1,345,872
Filter equipment, item 21c, lump sum		1,397,000	1,165,500	1,381,000	1,350,000	1,448,475	1,515,525	1,397,000	1,397,000	1,381,437
Filter equipment, item 21cc, lump sum		1,375,625	1,106,500	1,354,000	1,320,000	1,426,031	1,492,500	1,375,625	1,375,625	1,354,494
1000 tons cl. bell and spigot straight pipe	39 00	55 00	45 00	50 00	40 00	50 00	40 00	50 00	45 00	46 00
250 tons cl. special pipe and castings	85 00	100 00	90 00	100 00	65 00	90 00	90 00	70 00	100 00	87 78
Pipe connections at Gate Chamber No. 11, lump sum	2,500	2,500	2,250	2,175	2,500	5,000	2,600	1,350	1,750	2,514
Sluice gates, lump sum	82,000	80,000	85,000	101,500	73,000	80,000	103,000	85,000	130,000	91,056
162,000 lb. gate valves, lump sum	0 09	0 09	0 10	0 13	0 12	0 10	0 10	0 08	0 11	1 02
300,000 lb. setting metal furnished by city	0 04	0 017	0 02	0 03	0 03	0 02	0 01	0 03	0 025	0 25
Meter, lump sum	8,900	9,000	8,000	12,433	10,000	10,000	7,500	8,500	7,500	9,092
80 M. ft. B.M. timber and lumber	100 00	100 00	65 00	72 50	50 00	90 00	90 00	120 00	120 00	80 83
300,000 lb. misc. w.i. and steel work	0 08	0 10	0 07	0 07	0 06	0 06	0 06	0 06	0 0825	0 071
140,000 lb. miscellaneous cast work	0 05	0 05	0 05	0 06	0 06	0 05	0 05	0 06	0 07	0 056
4400 lb. bronze	0 60	0 60	0 60	0 72	1 00	1 50	0 65	0 10	0 70	0 75
6000 lb. pipe railings	0 85	0 70	0 80	1 09	2 00	0 80	0 75	1 00	0 65	0 96
2000 lb. cast iron grids	0 50	0 50	0 50	0 72	0 30	0 80	0 75	0 50	0 50	0 56
3000 sq.yd. granite block pavement	4 00	3 00	4 50	5 07	4 50	3 50	1 50	5 00	1 50	3 95
1000 sq.yd. setted pavement	1 50	0 80	1 75	1 81	3 00	1 00	0 75	1 50	1 75	1 76
1000 sq.yd. macadam walks	0 75	0 40	0 90	0 72	3 75	0 90	0 65	0 40	1 10	1 10
1000 lin.ft. curbs	0 75	1 00	0 90	1 45	2 75	0 80	0 75	1 00	1 35	1 19
1300 sq.yd. gutter	0 60	0 50	0 90	0 72	2 50	2 75	0 60	1 30	1 00	1 29
2500 sq.yd. walking	0 25	0 20	0 20	0 30	0 25	0 35	0 40	0 75	0 30	0 33
6000 lin.ft. vitrified clay ducts	0 15	0 12	0 12	0 19	1 00	0 18	0 08	0 15	0 14	0 23
Iron gate, valve, sump sum	6000.00	2000 00	4500 00	5800 00	3500 00	10,000 00	7500 00	3500 00	22,500 00	7256 00
Total 21a	$5,141,015	$6,195,310	$6,872,000	$5,850,170	$5,772,145	$5,922,520	$6,020,310	$6,120,755	$6,054,860	$6,058,454
Total 21aa	$5,139,015	$6,192,910	$6,910,000	$5,848,170	$5,762,145	$5,920,000	$6,017,730	$6,127,355	$6,052,460	$6,063,087
Total 21b		$6,162,410	$6,819,000	$5,785,170	$5,672,145	$5,898,475	$5,984,943	$6,000,855	$6,021,960	$6,140,120
Total 21bb		$6,160,410	$6,857,000	$5,783,170	$5,722,145	$5,885,975	$5,934,955	$6,004,855	$6,010,960	$6,142,298
Total 21c		$6,189,910	$6,811,500	$5,814,170	$5,822,145	$5,916,850	$6,011,505	$6,124,355	$6,049,460	$6,167,862
Total 21cc		$6,168,535	$6,772,500	$5,787,170	$5,792,145	$5,894,406	$5,991,526	$6,102,980	$6,028,085	$6,140,688

Item 21a. Water and sand type, the filters are washed with air and water forced through separate systems. The positive head is used in filtration, i.e., the head due to the pressure of water above the bottom of the filter tank.

Item 21aa. This type is the same as the preceding one, but provides for the use in filtration of a "negative head." That is to say, the operating head would be the result of the negative pressure created by lowering the water in the filtered water reservoir.

Item 21b. With this type, the filters are washed by water and air, but not through separate systems; only one strainer system will be provided for both water and air. Positive head used in filtration.

Item 21bb. This type is the same as the preceding one, but providing for the use of "negative head" in filtration.

Item 21c. With this type the washing is done by water alone at a comparatively high velocity. Positive head used in filtration.

Item 21cc. This type is identical with 21c., but the use of "negative head" in filtration is provided for.

BUILDINGS

Concord, N. H.—The State Board of Education is having plans prepared by Brainerd & Leeds, Archs., 89 Franklin St., Boston, Mass., for the construction of a two-story State Normal School. The estimated cost is $75,000.

Boston, Mass.—The State has awarded a contract to H. P. CONVERSE, 88 Broad St., at $300,000, for the construction of a three-story head house, 360x60 ft., to be erected on the Commonwealth Pier. Henry F. Keyes, 35 Congress St., is the Arch.

The United Christian Endeavor Societies, Tremont Temple, has commissioned Brainerd & Leeds, Archs., 89 Franklin St., to prepare plans for a three-story society building. The estimated cost is $100,000.

Springfield, Mass.—The United Realty Trust Co. has acquired property on Howard St., 105x144 ft., and on Worthington St., 92x183 ft. The company is planning the erection of modern business buildings on both tracts. Edward T. Davis, Joshua L. Brooks and James L. Dougherty are members of the company.

Bristol, Conn.—Plans have been completed and bids are being received for a theater building at Church and Laurel Sts., for Sherman E. Pike, of Hartford. The building will be of brick and Steel, 65x130 ft., two stories high. Berenson & Rosen, Hartford, Conn., are the Archs.

Stamford, Conn.—Bids are now being received by W. W. Rossi, Arch., Washington Bldg., for the construction of a new hotel, 130x85 ft., to be built by a Stamford syndicate. The estimated cost is $100,000.

Wallingford, Conn.—R. W. Foote, Arch., 215 Malley Bldg., New Haven, has completed plans for a 17-room brick school house for the Holy Trinity R. C. parish, of which the Rev. John Carroll is pastor.

Albany, N. Y.—A committee of citizens, Peter D. Kiernan, Chairman, 100 State St., has been organized to erect an industrial building, 70x400 ft., four stories high. The estimated cost is $200,000.

Buffalo, N. Y.—Bids will be received until 11 a.m., Feb. 21, by the Dept. of Public Works, for the construction of a new high school building, to be known as the Hutchinson Central High School. Francis G. Ward is Commr. of Pub. Wks.

The City Architect, Municipal Bldg., has prepared plans for shelter house, comfort station and subway, to be built by the city at Shelton Square and Main St. It will be of stone, brick and concrete, and will cost $40,000. Francis G. Ward is Commr. of Pub. Wks.

★**Elevated Railway**—New York, N. Y.—Bids for constructing Section No. 2 of the Woodside, Astoria and Corona Rapid Transit R.R. were received by the Public Service Commission, Jan. 28. The contract consists of constructing a two- and three-track elevated railroad in Second or Debevoise Ave., beginning 300 ft. south of Beebe Ave., and extending to a point about 330 ft. south of Ditmars Ave., including five local stations and one express station. The bids were as follows: (A) COOPER & EVANS, 220 Broadway (awarded contract); (B) Snare & Triest Co., 143 Liberty St.; (C) Oscar Daniels Co., 38 Park Row; (D) E. E. Smith Contracting Co., 71 Broadway; (E) Fraser Brace & Co., 1328 Broadway; (F) Peace Bros., 20 Main St., Flushing, N. Y.; (G) Percy Litchfield, 23 Flatbush Ave., Brooklyn, N. Y.; (H) Terry & Tench Co., Inc., Lexington Ave. and 131st St.; (I) Post & McCord and the Tidewater Building Co., 16 East 33d St.; (J) Rodgers & Hagerty, Inc., 152d St. and East River; (K) Marble Arch Co. and the Conners Bros. Co., 17 West 42d St.; (L) T. J. Buckley Engineering Co., Inc., 103 Park Ave.:

RAPID TRANSIT SYSTEM, ROUTES 36 AND 37, SECTION 2, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H	I	J	K	L
11,800 cu.yd. column excavation	$1.39	$2 70	$2 50	$1 00	$3 36	$1 60	$2 40	$2 74	$2 55	$2 31	$4 50	$8 00
7200 cu.yd. railroad duct excavation	1 19	1 80	2 00	0.60	1.54	1 40	2 10	2 79	1 62	2 01	3 00	6 00
5100 cu.yd. concrete masonry	7.25	6.50	7.50	6.00	7.25	7.50	8.00	7.35	8.67	8 50	9 00	10 00
10 cu.yd. brick masonry	15.00	15.00	15.00	11.00	20.00	15.00	15.00	12.60	17.71	18 00	20 00	25 00
2000 lin.ft. timber piles	0.50	0.80	0.40	0.40	0.30	0.50	0.50	0.53	0.44	0 50	0 60	3 00
2M. ft. B.M., timber foundations	60.00	75.00	50.00	50.00	60.00	75.00	50.00	45.00	75.90	50 00	80 00	200 00
525 lin.ft. 4-in. vitrified pipe	1.00	1.00	0.70	0.20	1.00	0.75	0.30	0.21	0.39	0 50	0 50	0 60
212,000 duct ft. railroad ducts	0.14	0.15	0.13	0.12	0.17	0.14½	0.15	0.12	0.19	0 15	0 20	0 90
11,460 tons riveted steel	60.70	62.00	64.45	69.00	62.25	67.20	65.60	68.00	67.29	70 00	66 50	70 00
370 tons steel beams and shapes	60.70	58.50	53.50	56.00	62.25	57.20	54.00	68.00	56.29	70 00	55 50	70 00
2 tons steel rods and bars	60.00	70.00	60.00	42.50	65.00	50.00	60.00	80.00	69 58	70 00	120 00	75 00
495 tons miscellaneous iron castings	50.00	60.00	55.00	60.00	55.00	50.00	62.00	69.00	70.22	66 50	100 00	70 00
20 tons c.i. hub and spigot pipe	50.00	75.00	60.00	70.00	70.00	100.00	62.00	80.00	65.80	100 00	120 00	70 00
5500 sq.yd. street surface restored	2.65	2.30	3.50	2.75	7.75	2.90	3.32	3.12	4.20	4 00	3 75	2 00
12,750 lin.ft. electric overhead trolley	0.69	0.40	1.25	0.45	1.00	1.00	0.50	0.53	0.95	1.00	2 60	2 00
Totals	$860,743	$893,265	$933,252	$936,782	$945,743	$946,469	$948,270	$981,003	$991,061	$1,012,260	$1,045,712	$1,287,165

Rapid Transit System—New York, N. Y.—Bids for constructing Section No. 3 of the Woodside, Astoria and Corona Rapid Transit R.R. of New York, were received by the Public Service Commission, Feb. 7. The contract includes a two and three-track elevated railroad in Queens Boulevard, Greenpoint Ave., Skillman Ave. and Roosevelt Ave., between the Queensboro Bridge Approach and Sycamore Ave., Corona, including two express and eight local stations. The bids were as follows: (A) E. E. Smith Contracting Co.; (B) The Snare & Triest Co.; (C) Fraser Brace & Co.; (D) Frawley-Kaufman Contracting Co., Inc.; (E) Thomas J. Buckley Engineering Co.; (F) Mulcahy & Gibson; (G) Oscar Daniels Co.; (H) Marble Arch Co. and Conners Bros. Co.; (I) Coleman Bros.; (J) P. McGovern & Co.; (K) Carter Construction Co.

RAPID TRANSIT SYSTEM, ROUTES 36 AND 37, SECTION 3, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H	I	J	K
40,000 cu.yd. column excavation	$1.75	$1.40	$1.70	$1.50	$1.50	$2.50	$2.00	$1.25	$1.50	$1.60	$1.75
14,000 cu.yd. railroad duct excavation	1.25	1.40	1.65	1.00	1.50	2.40	1.50	1.25	1.50	1.50	0.02
12,630 cu.yd. concrete masonry	6.00	7.00	6.95	6.00	7.25	7.00	7.75	8.50	8.00	7.50	7.00
39,200 cu.yd. reinforced concrete	7.20	8.60	8.25	9.00	10.25	13.14	10.50	13.00	13.00	11.00	11.50
19,000 sq.yd. natural cement finish	0.17½	0.60	0.15	0.75	1.00	0.25	1.20	1.10	0.75	0.50	0.60
31,000 sq.yd. mortar face finish	0.90	1.00	0.25	1.40	1.80	0.45	1.60	2.00	0.50	0.50	1.80
21,000 sq.ft. inlaid colored tile	1.60	0.90	1.35	1.20	1.00	1.75	1.40	1.50	1.25	1.25	1.37
29,000 sq.ft. granolithic surface finish (platform)	0.14	0.05	0.07	0.16	0.16	0.09½	0.70	0.10	0.15	0.15	0.30
250 lin.ft. concrete copings around stairwells	0.40	2.00	0.75	1.00	0.75	2.75	1.75	2.00	3.00	5.00	7.50
10 cu.yd. brick masonry	12.00	15.00	15.00	15.00	15.00	14.00	15.00	13.00	20.00	20.00	20.00
2000 lin.ft. timber piles	0.35	0.70	0.30	0.60	0.60	1.50	0.40	0.30	0.75	0.50	1.00
2 M. ft. timber foundations	50.00	60.00	60.00	100.00	75.00	60.00	0.60	90.00	100.00	50.00	100.00
18,400 sq.yd. waterproofing, 2-ply	0.50	0.50	0.50	0.80	0.40	0.45	0.70	0.60	0.60	0.75	1.00
1500 sq.yd. waterproofing, 4-ply	0.90	1.00	0.00	1.00	0.80	0.92	1.20	0.85	1.20	1.50	1.50
1300 lin.ft. vitrified pipe 4-in	0.30	0.80	0.50	0.75	0.70	0.25	0.60	0.50	0.75	0.35	0.80
1840 lin.ft. c.i. pipe and fittings, 3 in	0.55	0.70	0.61	0.60	0.80	0.68	1.00	0.50	1.00	1.00	0.90
4000 lin.ft. c.i. pipe and fittings, 4-in	0.70	0.80	0.93	0.60	0.90	0.75	1.25	0.75	1.00	1.25	1.00
470 lin.ft. c.i. pipe and fittings, 6-in	1.00	1.20	1.06	1.00	1.10	0.90	1.50	0.95	1.25	1.70	1.75
1300 lin.ft. c.i. pipe and fittings 8-in	2.00	1.50	1.43	1.25	1.50	1.05	1.75	1.60	2.00	2.00	2.00
40,700 duct ft. railroad ducts	0.12½	0.14	0.15	0.13	0.15	0.08½	0.15	0.14	0.15	0.14	1.25
21,930 tons riveted steel	60.00	62.50	66.00	63.00	62.00	59.75	60.50	60.00	63.00	69.00	66.00
800 tons steel beams and shapes	60.00	60.00	66.00	63.00	63.00	60.00	59.50	60.00	67.00	69.00	63 00
1050 tons steel rods and bars	48.00	60.00	62.50	70.00	66.00	40.00	75.00	660.0	55.00	70.00	60.00
50 tons miscellaneous iron castings	60.00	60.00	55.00	70.00	60.00	65.00	55.00	120.00	60.00	7 0.00	60.00
20 tons new c.i. hub and spigot pipe	70.00	70.00	70.00	80.00	70.00	75.00	75.00x	65.00	60.00	70.00	50.0
2200 lb. special wire forms	0.10	0.15	0.11	0.10	0.10	0.08	0.20	0.15	0.10	0.10	0 12
18,500 sq.yd. street surface restored	1.75	0.60	0.25	0.10	2.00	0.50	2.00	1.00	1.00	1.25	2.25
6850 lin.ft. w.i. electric conduits, ½-in	0.30	0.16	0.11	0.15	0.10	0.15	0.15	0.20	0.10	0.20	0.52
6500 lin.ft. w.i. electric conduits, 1¼-in	0.45	0.32	0.22	0.25	0.22	0.30	0.30	0.38	0.20	0.30	0.30
120 lin.ft. w.i. electric conduits, 1-in	0.35	0.25	0.16	0.25	0.15	0.25	0.20	0.28	0.20	0.35	0.30
GG22 each c.i. outlet boxes	0 75	1 00	0 50	2 00	1 50	1 00	1 25	1 75	1 00	1 50	1 50
102 each c.i. pull boxes	8.00	1.50	0.50	2.00	3.00	2.00	1.25	5.00	2.00	1.50	3.50
102 lin.ft. street surface railroads											
180 single track electric overhead trolley, railroad	2.00	1 00	0 50	1 00	1 00	0.00	1 75	1 00	1 00	5 00	1.00
5700 lin.ft. steel and iron stairways	2.25	2.50	1.50	1.25	2.50	2.90	4.00	2.40	2.90	3.00	1.00
1900 sq.ft. steel and iron stairways platforms	2.00	2.00	1 00	1.25	2.50	1.90	2.50	1.50	2.90	2.00	1.00
2700 sq.ft. 16 oz. copper flashing	0.40	0.40	0.40	0.40	0.60	1.00	0.50	0.50	0.50	0.25	0.75
2400 .in.ft. w.i. pipe, 3-in	0.40	0.75	0.30	0.50	0.60	0.75	0.65	1.00	0.50	0.35	0.50
Totals	$2,063,588	$2,204,740	$2,213,453	$2,222408,	$2,295,896	$2,310,438	$2,333,855	$2,359,342	$2,377,969	$2,453,030	$2,887,74

Ilion, N. Y.—Bids will be received until Feb. 20, by the Board of Education, for the construction of a three-story high school, 126x62 ft., with a wing, 50x39 ft. Fuller & Robinson, Albany, are the Archs. The estimated cost is $95,000.

Lockport, N. Y.—The County of Niagara will receive bids about Feb. 15, for an adition to the Court House. Chester R. Phelps is the Arch. The estimated cost is $75,000. A. C. Dwyer is Chn. Board of Pub. Wks.

✚**New York, N. Y.**—The Bradstreet Co., 346 Broadway, has awarded a contract to the CAULDWELL-WINGATE CO., 381 Fourth Ave., for the construction of a 12-story office and loft building, at the northwest corner of Lafayette and Howard Sts. The estimated cost is $450,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, are the Archs.

✚Charles Kaye, 1133 Broadway, has awarded the general contract for the construction of a 21-story loft building, at the southwest corner of Madison Ave. and 20th St., to CHARLES A. COWEN & CO., 1123 Broadway. Buchanan & Fox, 11 East 59th St., are the Archs. Noted Dec. 26.

Plans have been filed by Goldwin, Starrett & VanVleck, Archs., 45 East 17th St., for the construction of the department store to be erected at 38th St. and Fifth Ave., for Lord & Taylor, Fifth Ave. and 20th St. It will be ten stories high, 200x148 ft., and is owned by the J. H. & F. V. Burton Co., 384 Broadway. The estimated cost is $2,000,000.

Plans have been filed by W. R. Patterson, Arch., 13 Park Row, for the construction of a one-story asphalt plant, 142x84 ft., by the city, on Avenue A, between 90th and 91st St. The estimated cost is $117,000.

Plans have been filed by Trowbridge & Livingston, Archs., 527 Fifth Ave., for the erection of a five-story dwelling on Fifth Ave., near 60th St., for H. Havemeyer, 129 Front St. The estimated cost is $75,000.

Plans have been filed by C. B. Mayers, Arch., 1 Union Square West, for the construction of an apartment house at 520 West 124th St., for the Martha Building Co., 960 Prospect Ave. It will be six stories high, 100x87 ft. The estimated cost is $130,000.

Plans have been filed by Harold L. Young, Arch., 120 Broadway, for the erection of a six-story apartment house, 117x102 ft., at the northeast corner of Fort Washington Ave. and 161st St., for the Friedman Construction Co., 171 Broadway. The estimated cost is $275,000.

Syracuse, N. Y.—Brazer & Robb, Archs., 1133 Broadway, New York, N. Y., are preparing plans and will receive bids about Apr. 1, for a church edifice, 50x150 ft., of stone and steel, to be erected by the Trinity Church. The estimated cost is $65,000.

Newark, N. J.—Bids will soon be received by Arland W. Johnson, Arch., 105 West 40th St., New York, N. Y., for a new seven-story theater and office building for F. F. Proctor, 1493 Broadway, New York, N. Y. The estimated cost is $300,000.

The West Side Trust Co., 59 Springfield Ave., has commissioned Crow, Lewis & Wickenhoefer, Archs., 200 Fifth Ave., New York, N. Y., to prepare plans for a bank.

+Norfolk, Va.—The contract for the construction of the warehouse for the Anheuser Brewing Association has been awarded to the GILSONITE CONSTRUCTION CO., St. Louis, Mo. Noted Feb. 6.

+Roanoke, Va.—The structural steel contract has been awarded to the VIRGINIA BRIDGE & IRON CO., Roanoke, for the People's National Bank building. The estimated cost is $300,000.

+Staunton, Va.—The contract for the construction of the dining hall and dormitory at Staunton Military Academy has been awarded to STODDARD & CO.

Charlotte, N. C.—Plans have been prepared by Hook & Rogers, Archs., Charlotte, for the construction of a Y. W. C. A. building. Noted Jan. 16.

Durham, N. C.—The First National Bank, Durham, N. C., is contemplating the erection of a seven- or 10-story building. Gen. J. L. Carr is Pres.

Wake Forest, N. C.—The Trustees of Wake Forest College are preparing plans for the construction of a dormitory. The estimated cost is $40,000.

Raleigh, N. C.—The State Agricultural Society, of Raleigh, is planning the erection of a building at the fair grounds.

Charleston, S. C.—Bids will be received until Mar. 1, by W. C. Miller, Chn. Bldg. Com., Charleston Library Society, 414 People's Office Bldg., for the construction of a library on King St. McGoodwin & Hawley are Archs., 34 South 16th St., Philadelphia, Penn. Noted Feb. 6.

+Columbia, S. C.—The general contract for the construction of the Logan school has been awarded to W. R. HARBECK, St. Charles, S. C., at $58,292. Noted Aug. 1.

+The contract for the construction of the warehouse on Sixth Ave. and 17th St., for the Southern Bell Telephone & Telegraph Co., has been awarded to the FRED A. JONES BUILDING CO., Birmingham. Noted Feb. 6.

+Contracts for the construction of the 25-story bank building for the Jefferson County Savings Bank, have been awarded as follows: Steel frame, VIRGINIA BRIDGE & IRON CO., Roanoke, Va.; erection of steel frame, BERGENDAHL-BASS ENGINEERING & CONSTRUCTION CO., Chicago, Ill.; terra cotta, FEDERAL TERRA COTTA CO., Woodbridge, N. J.; fire proofing, NORTH BIRMINGHAM FIRE BRICK & PROOFING CO., Birmingham. Noted Jan. 30.

Columbia, S. C.—The City contemplates erecting a market house. The estimated cost is $40,00.

Athens, Ga.—Bids were received by A. Ten Eyck Brown, Arch., Atlanta, for the construction of the Clarke County courthouse as follows: King Lumber Co., $156,800; Miles & Bradt, $161,000; Griffin Cons. Co., $158,000; Wise Granite Co., $162,800; Melton Cons. Co., $155,515; Little-Cleckler Construction Co., $155,000, lowest bidder, L. R. Wright & Co., $152,500; Metzger & Wells, $167,000; T. S. Moudy & Co., $160,000; Donaldson & Pearson, $170,000; Jos. Trimby, $163,400; H. J. Carr & Co., $157,600. Noted Jan. 16.

Macon, Ga.—The Central of Georgia R.R. will erect a terminal station. The estimated cost is $1,500,000. F. F. Gaines is Mech. Supt., Savannah, Ga.

+Jacksonville, Fla.—The contract for the construction of the three-story building at Laura and Dubal Sts., for the Main St. Co. has been awarded to CHAMBERLAIN & GILLESPIE.

Miami, Fla.—The White Palace Hotel Co. is planning the erection of a $100,000 apartment hotel at Miami. George D. Smith is Mgr.

St. Petersburg, Fla.—Bonfoey & Elliott, Archs., are preparing plans for the erection of a hotel to be built at St. Petersburg, Fla. The estimated cost is $300,000.

+Tampa, Fla.—McGUCKEN & MILLER, Tampa, Fla., have been awarded the contract for the construction of the Elks' building. Noted Dec. 26.

Birmingham, Ala.—The American Finance & Bond Co., Birmingham, Ala., contemplates the erection of an apartment building. The estimated cost is $125,000.

Birmingham, Ala.—The Birmingham Paper Co. will erect a three-story addition, 150x175 ft., to be used as a warehouse. The estimated cost is $75,000.

Mobile, Ala.—The city has purchased a site on Spring Hill Ave., St. Francis and Wilkinson Sts., and will erect an auditorium and library. The estimated cost is $50,000.

+Memphis, Tenn.—A contract has been awarded to C. W. HOLMES, for the construction of a warehouse at Jefferson Ave. and Promenade, for S. Steinberg & Co.

Nashville, Tenn.—C. K. Colley, Arch., Nashville, has prepared plans for the construction of an armory and auditorium 200x300 ft. The estimated cost is $250,000

Danville, Ky.—Grant C. Miller, Arch., Chicago, Ill., is preparing plans for the construction of buildings at the Kentucky College for Women. The estimated cost is $250,000.

Louisville, Ky.—The Levi Tyler Land Co., Louisville, has announced that a reinforced-concrete theater will be erected on Jefferson St. between Third and Fourth Sts. Owen Tyler is Pres. J. J. Gaffney is Arch., Louisville. The estimated cost is $200,000.

Louisville, Ky.—Bids will be received until Apr. 15, by B. H. Farnsley, Louisville, for the construction of an apartment house, 150x124 ft. The estimated cost is $200,000. Brinton B. Davis, 1006 Inter-Southern Bldg., Louisville, is Arch. Plans are being prepared by Brinton B. Davis, Louisville, for the construction of a school at 26th and Date Sts., for the Board of Education. The estimated cost is $100,000.

Cincinnati, Ohio.—A permit has been issued for the erection of the new 13-story building for the Cincinnati & Suburban Bell Telephone Co. Harry Hake is the Arch. Noted Jan. 9.

Cleveland, Ohio.—Bids will be received by Charles W. Stage, Dir. Pub. Safety, 106 City Hall until noon Mar. 3, for the construction of an administration building, nurses' home, service building, laundry building and stable, for the City Hospital Group, Scranton Road S. W., Cleveland, Ohio. Myron B. Vorce and E. J. Willingdale, Garfield Bldg., are the Archs.

Columbus, Ohio—A proposition to remodel the Franklin County court house, at a cost of $250,000, is under consideration.

Anderson, Ind.—Plans are being prepared and bids will soon be asked for the construction of a new high school to replace the one recently destroyed by fire. The estimated cost is $180,000.

Indianapolis, Ind.—Plans have been prepared for remodeling and constructing an addition to the department store of L. S. Ayres. Vonnegut & Bohn, Indiana Trust Bldg., are the Archs. The estimated cost of the improvements is $120,000.

Laporte, Ind.—Press reports state that plans are being prepared for the construction of a five-story bank building at Main St. and Michigan Ave., for the Frst National Bank. E. C. Niles is Pres.

Jackson, Mich.—The Jackson City Club will erect a new club house, to cost approximately $75,000.

+Marshalltown, Iowa—The contract for the erection of an edifice for the Congregational Church at Fourth and Main Sts., has been awarded to C. F. REIMER & CO., Marshalltown. The estimated cost is $45,000. Patton, Holmes & Finn, 8 South Dearborn St., Chicago, Ill., are the Archs.

Aberdeen, S. D.—The erection of an addition to St. Luke's Hospital is under consideration. The estimated cost is $50,000.

Mobridge, S. D.—A. H. Brown contemplates the erection of a hotel, to cost about $60,000.

Minot, N. D.—Press reports state that Louis Emerson plans to erect a new theater at West Second and Main Sts., to cost about $45,000.

+Springfield, Mo.—The contract for the construction of a high school has been awarded to the J. B. EVANS CONSTRUCTION CO. The estimated cost is $100,000.

Helena, Ark.—The congregation of the First Methodist Church plans to erect an edifice to replace the one recently destroyed by fire. The estimated cost is $50,000.

Brawley, Calif.—Norman F. Marsh, Broadway Central Bldg., Los Angeles, has been commissioned to prepare plans for a $50,000 high-school building. It will be a two-story brick structure and will be known as the administration building, the first of four buildings to compose the high-school group, the others being the domestic arts, science and manual training buildings. It will be of brick construction with modern school conveniences. Noted Dec. 12.

Fresno, Calif.—Bids will be received until Feb. 17, by the Board of Trustees of Fresno, for the construction of a convention hall in accordance with plans and specifications prepared by C. K. Kirby Jr., Forsyth Bldg. W. H. Ryan is City Clk. Estimated cost, $40,000.

Los Angeles, Calif.—The Prudential Fireproof Building Co. will erect a steel-frame building at Eighth and Broadway. J. C. Austin and W. C. Pennel, Wright & Callender Bldg., are the Archs.

Edward D. Silent will erect a five-story building at 731-735 South Hill St. Hunt & Burns, Laughlin Bldg., are the Archs.

A 12-story steel-frame hotel building will be erected on Spring St. between Fourth and Fifth Sts. by a syndicate. Train & Williams, 226 Exchange Building, are the Archs.

Mrs. G. Kornblum, is having preliminary plans prepared for a four-story and basement brick apartment building to be erected on Benton Way. The cost will be $100,000.

E. T. Flaherty, I. W. Hellman Bldg., has prepared plans for a six-story reinforced concrete warehouse, 74x90 ft., to be erected at 1335 South Figueroa St. by the Bekins Van & Storage Co., 250 South Broadway.

+J. V. McNEIL, Citizens' National Bank Bldg., has been awarded the contract at $70,000 for the erection of the seven-story and basement loft building at 946 South Broadway for J. Kahn. It will be 50x85 ft., and will have reinforced concrete frame, walls and floors, S. Tilden Norton, Title Insurance Bldg., is the Arch.

Pasadena, Calif.—The Citizens Savings Bank will erect a seven-story and basement building at Colorado St. and Marengo, Ave.

Pasadena, Calif.—The Foss Designing & Building Co., 100 East Colorado St., has prepared the preliminary designs for the proposed Odd Fellows Temple to be erected at Fair Oaks Ave. and Green St. The building will be three stories, 50x98 ft.

San Francisco, Calif.—The Board of Public Works received bids as follows for removing the High School of Commerce from its present site on Grove St. to a site on Fell St. between Van Ness Ave. and Franklin St.: Sound Construction Co., $151,000; Grant Fee, $165,000; N. H. Pearson, $178,000.

The Franklin Realty Co. will erect a 4-story hotel building to cost about $90,000, on O'Farrell St., near Larkin St. A. Nordin, Mills Bldg., is the Arch.

A seven-story and basement hotel to cost $90,000 will be erected on Market St. near Second. John F. Haner, 3579 Nineteenth St. is the Arch.

The Realty & Rebuilding Co. will erect a four-story reinforced concrete building to cost $100,000 on the old Chutes block fronting on Fillmore St. between Turk and Eddy Sts. McDonald & Kahn are the Archs.

Permission has been granted by the Panama-Pacific International Exposition Co. to the National Association of Automobile Manufacturers to erect a motor Transportation Building on the 1915 exposition site. The building is designed by G. Albert Lansburg of San Francisco, and has been approved by the Architectural Commission. It is approximately 275 ft. front by 800 ft. deep, covering over five acres.

San Francisco, Calif.—John F. Haner, 3579 19th St., is preparing plans for a seven-story and basement hotel which will be erected on Market near Second St. The building will be 50x58 ft. Estimated cost $90,000. The exterior has been designed in Colonial style, and will be faced with pressed brick.

CONTRACT PRICE

★Intercepting Sewer—Newark, N. J.—Bids for constructing Section 7 of the main intercepting sewer, a compressed-air tunnel, were received by the Passaic Valley Sewerage Commissioners, Feb. 1, as follows: (A) Dock Contractor Co., Hoboken, N. J.; (B) Charles A. Haskin, Boston, Mass.; (C) BOOTH & FLINN, LTD., 1943 Forbes St., Pittsburgh, Penn. (awarded contract with out metallic shields):

INTERCEPTING SEWER, NEWARK, N. J.

With Metallic Shields

	A	C
4930 lin.ft. excavation in tunnel, for 135-in. concrete sewer, including furnishing and use of shields, c. i. plates, etc..	$211 39	$115 00
8800 lin.ft. excavation in tunnel for 141-in. concrete sewer, including furnishing and use of shields, c.i. plates, etc....	212 98	115 00
30,000 cu.yd. concrete masonry, in tunnels and shafts, and appurtenant work.....	7 00	9 00
300 cu.yd. brick masonry in shaft-manholes, and appurtenant work.....	18 00	15 00
Totals.....	$3,131,777	$1,853,450

INTERCEPTING SEWER, NEWARK, N. J.

Without Metallic Shields

	A	B	C
4930 lin.ft. excavation in tunnel for 135-in. concrete sewer, including furnishing and use of ¾-full reinforcement plates, etc.....	$218.52	$130 00	$81 00
8800 lin.ft. excavation in tunnel for 141-in. concrete sewer, including furnishing and use of ¾-full reinforcement plates, etc.	222.16	140 00	84 00
30,000 cu.yd. concrete masonry, in tunnels and shafts, and appurtenant work.....	10.00	8 00	9 00
300 cu.yd. brick masonry in shaft manholes, and appurtenant work.....	18.00	15.00	15 00
Totals.....	$3,337,712	$2,117,400	$1,413,030

GARBAGE

✚Boston, Mass.—Contracts have been awarded by the city as follows: For collecting and removing offal in the West Roxbury District for 1913, to the MUNICIPAL SUPPLEMENTARY SERVICE CO., at $2880; for removing ashes in the Brighton District for 1913, to JOS. McGREEVEY, at $10,740. Other bids were: A. J. & G. H. McMurtrie, $11,688; John J. Loonie, $15,000; John J. Lane, $19,200 J. H. McNamara, $19,800; for removing ashes in the Hyde Park District, to M. McGINNIS & CO., at $4788. Other bids were: Thos. H. Corrigan, $5880; J. F. Dooley, $6000; for collecting and removing offal in the Brighton District, to the NORTHERN CONSTRUCTION CO., at $8400. The only other bid was that of the P. J. Reid Corporation, at $10,980; for removing ashes in the East Boston District, to AGOSTINE DE STEFANO, at $10,800. Other bids were: Cerulli Greco, $11,988; Coleman Bros., $15,600; Chas Berman, $17,500. L. K. Rourke is Comr. Pub. Wks.

Roselle, N. J.—The Board of Health of Roselle, and of Roselle Park, are jointly considering the question of the installation of a garbage disposal plant for both boroughs, and have voted to investigate data and cost.

Petersburg, Va.—The city is considering the installation of a garbage crematory. Estimated cost, about $28,000.

Birmingham, Ala.—The city has under consideration the installation of an additional garbage crematory at Ensley.

Sandusky, Ohio—No bids were received Jan. 16, by the city for the collection of garbage. Dr. Henry Graefe is Health Officer.

Detroit, Mich.—Bids have been received as follows, by J. J. Haarer, Comr. Pub. Wks., for the construction of the new garbage incinerator: The Destructor Co., one-unit plant, $83,900; two-unit plant, $128,000; Dixon Engineering & Construction Co., one-unit plant, $100,000; H. W. Johns-Manville Co., one-unit plant, $90,848.53; W. E. Wood Co., one-unit plant, $100,000.

Chicago, Ill.—All bids submitted to the city, Oct. 22, for garbage disposal have finally been rejected. Revised plans and specifications will be prepared. L. E. McGann is Comr. Pub. Wks.

Los Angeles, Calif.—The Board of Public Works is considering building a garbage plant, to cost about $250,000.

Toronto, Ont.—Plans will be prepared at once, it is reported, for a new garbage disposal system for the city, to cost $1,000,000. R. C. Harris, Comr. of Pub. Wks., and the Mayor are in charge. Work is to be started as soon as plans can be prepared.

South Vancouver, B. C.—The Health Committee of the City Council has recommended the construction of two garbage incinerators. Estimated cost, $60,000.

FOREIGN

Harbor Works—Bulgaria—The Ministry of Railways, Sofia, Bulgaria, will soon award contracts for harbor works, to cost $924,635.

Parks—France—The city of Paris, France, Jan. 3, voted in favor of acquiring from the government the fortifications and adjacent military zone. It is planned to transform the tract into parks and recreation grounds.

INDUSTRIAL NOTES

The Madeira-Mamore Ry. which has been completed in South America will probably open up a larger territory to the world's commerce than any other railway of equal length. It is only 200 miles long, but is 1500 miles from the mouth of the Amazon, and 570 miles from the junction of the Amazon with the Madeira. For its entire length of 200 miles, the Madeira River, which is adjacent but seldom in sight from the line in the right of way, is a turbulent river, full of rapids and treacherous whirlpools. Portages are necessary almost all around this stretch, and for this it was the custom to bring rubber from the plantations at the foot and the wild rubber growing there, to the Amazon in native boats. By its construction, the state of Brazil, hitherto almost isolated, furnished an outlet and a wonderful area of perhaps 100,000 sq. m. is brought into close contact with the world's market. Just at present, most of the product from this section is rubber, but who can say with the better transportation facilities, that some of it at least will not be devoted to cattle raising? A great deal of this is virgin forest to be had almost for the asking. This railway has been a dream of long fulfillment. When railroad building in North America was in its infancy, the pioneers in South America projected a canal. In the early '70's an attempt was made to grade the line, and lay a road and about 1876 a contract was let and considerable work done, but the abandonment of the work was not the fault of engineers. The line is laid out on a regular 1-meter gage, with a maximum grade of 2% and few of them. The train service is unique; the southbound train running into the interior has the right of way, leaving Porto Zelho at 8 a.m. on Sundays, Tuesdays and Thursdays, arriving at Abuna at 5:30 p.m. the same day. The distance is about 100 miles. On the following day, it continues on its journey at 7:30 a.m., arriving at the terminus of the road at 3:15. The motive power includes nine Mogul engines, of 35 tons, and two consolidated engines of 50 tons. An old engine, called Col. Church, which was brought to the country in 1878 and lay in the swamps for 34 years is said when it was found to have a good sized tree growing in its funnel, the cab and fixtures missing, and the boiler jacket disappeared. It was rejuvenated, and made an entire trip on July 3, 1912.

Constructing such a road through the tropics is always difficult. Where it is 1500 miles from a base of supplies and a post station at that, the hardships are magnified. It was impossible to secure native labor and workmen had to be recruited from all parts of the earth. At first the mortality was excessive, averaging, the first year of construction, (1909) 125 deaths per thousand, with 4000 average employees. In 1910, this rate had been reduced to 90, in 1911 to 84, while last year the rate was 70 per thousand. Special pains were taken in the sanitary part of the establishment, there being ten resident physicians patrolling the line, and a well equipped hospital at Candelaria with three resident physicians.

The H. W. Johns-Manville Co., Madison Ave. and 41st. St., New York, N. Y., has opened a new branch office in the Dooly Block, Salt Lake City, Utah, to facilitate the handling of correspondence and orders.

The Manistee Iron Works, Manistee, Mich., has opened a branch office in the Hudson Terminal Bldg., 30 Church St., New York, N. Y. J. D. McRae is in charge.

Richard K. Meade, Mechanical and Industrial Engineer, has opened offices and laboratories at 202 North Calvert St., Baltimore, Md., and will make a specialty of the design and construction of lime and cement plants, and of reports on lime and cement properties.

The San Francisco Bridge Co., engineers and contractors, announces its removal to the tenth floor of the Nevada Bank Bldg., Market and Montgomery Sts., San Francisco, Calif.

The National Employment Exchange, 50 Church St., New York, N. Y., recently opened a new department to bring the technical employer and employee together. This department is in charge of C. H. Spalding, an engineer with several years' experience, who not only knows the vicissitudes of young engineers seeking jobs, but the attitude of employers toward such men.

EXAMINATIONS

Official Notice—The following official notice has been sent out by the United States Civil Service Commission:

"The United States Civil Service Commission has had numerous letters from persons who have been misled by advertisements of correspondence schools to the effect that thousands of appointments would be made to positions in the Parcel Post System No such increase in the service is contemplated, as the duties required in connection with the administration of the law will be performed by the regular employees of the Postal Service, and if any additional employees are required, they will be appointed to positions in the regular service. It is not contemplated that any examinations will be held especially for the Parcel Post System. By direction of the Commission. John C. Black, Pres."

CATALOG NOTICES

C. W. Hunt Co., West New Brighton, N. Y.—Catalog No. 12-9. Noiseless gravity bucket conveyor. Illustrated. 4 pages, 6x9 in.

Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 124. Pneumatic riveting, chipping, calking and stone hammers. Illustrated, 24 pages, 6x9 in.

Edgar Allen American Manganese Steel Co., McCormick Building, Chicago, Ill. Bulletin No. 55. Steam shovel and dipper dredge repair parts. Illustrated, 20 pages, 6x9 in.

Smooth-On Mfg. Co., Jersey City, N. J. Circular. Smooth-On iron cement for leaks in concrete. Illustrated.

Joseph Dixon Crucible Co., Jersey City, N. J. Catalog. Dixon's graphite productions. Illustrated, 104 pages, 6x9 in.

The Hess Flume Co., 2166-76 Fifteenth St., Denver, Colo. Folder. Hess improved metallic flume. Illustrated.

Chapman Engineering Co., Mount Vernon, Ohio. Catalog. Rotary gas producers. Illustrated, 24 pages, 8½x11 in.

Gurney Elevator Co., 62-64 W. 45th St., New York. Bulletin No. 4. Traction Elevators. Illustrated, 28 pages, 7x10 in. Bulletin No. 5. Engineering supplement to Bulletin No. 4. Illustrated, 28 pages, 7x10 in.

The Central Foundry Co., 90 West St., New York. Booklets. Soil pipe and fittings, universal pipe. Illustrated.

CONTRACTS TO BE LET

Bridge Repair Work

STATE OF NEW YORK
THE COMMISSIONERS OF THE STATE RESERVATION AT NIAGARA

Niagara Falls, N. Y., January 27, 1913.

NOTICE TO CONTRACTORS.

Sealed proposals will be received by the undersigned at their office in the Administration Building, Niagara Falls, N. Y., until 10 A. M., Saturday March 1st, 1913, at which place and hour they will be publicly opened and read:

For constructing relieving walls for present spandrel walls, new parapet railings, new sidewalks, etc., on Bridges between the mainland and Goat Island, Niagara Falls, Niagara County, N. Y., and completing the same on or before June 1, 1913, pursuant to the provisions of Chapter 547 Laws of 1912.

Plans may be seen and blank forms for proposals and specifications may be obtained at the office of the Superintendent of the State Reservation at Niagara Falls, N. Y.

Monthly estimates will be paid of ninety per centum of the amount of work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of New York or Albany, N. Y., issued by a national or State bank in good credit within the State and payable at sight to the Superintendent of the State Reservation at Niagara for ten per cent. of the amount of the proposal, the deposit of the successful bidder to be retained by the Superintendent as a guarantee of the execution of the contract under the terms and conditions of the proposal, and to be returned upon the proper execution and approval of the contract. The amount of bond for faithful performance of the contract will be forty percentum and the amount of labor bond required on execution of the contract will be twenty per centum of proposal. Each proposal must be addressed to the Superintendent of the State Reservation at Niagara, and must be endorsed on the envelope "For Constructing Goat Island Bridge."

The right is reserved to reject any or all bids.

Commissioners of the State Reservation at Niagara.

HARRY K. ECKERT,
Superintendent.

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Sewers

NOTICE TO CONTRACTORS.

Beaver Falls, Pa.

Sealed proposals will be received by the Borough Council for the construction of a System of Sanitary Sewers with Appurtenances, addressed to Borough Secretary, Dr. W. F. Rayle, Beaver Falls, Pa., and indorsed "Proposals for Constructing a System of Sanitary Sewers with Appurtenances" until 8:00 P. M., Eastern time, on the 19th day of February, 1913, in accordance with the plans and specifications on file in the office of the Secretary of Council in Beaver Falls and at the office of the Engineer at McKeesport, Pa., and from whom copies may be obtained.

The work to be done consists of laying approximately sixteen (16) miles of sanitary sewers with appurtenances, sewers varying in size from 8-inches to 24-inches in diameter.

Each proposal shall be properly signed and accompanied by certified check on a solvent bank, for an amount equal to $5,000.00 to be drawn payable to the order of the Treasurer of the Borough of Beaver Falls and which shall be forfeited if the successful bidder fails to enter into a contract with the Borough officials of Beaver Falls, Pa.

The successful bidder will be required to furnish bond satisfactory to the Borough Attorney within ten days (10) after due notice of the acceptance of his proposal for the full amount of his total bid.

The right is reserved to reject any and all bids.

THOMAS McKEE, President.
W. W. PIPER, Chairman, Sewer Committee,
DR. W. F. RAYLE, Secretary.

LEO HUDSON,
Consulting Engineer,
McKeesport, Pa.

Completion of Northeast Boulevard

DEPARTMENT OF PUBLIC WORKS, BUREAU OF HIGHWAYS AND STREET CLEANING, OFFICE, 232 CITY HALL

Philadelphia, Jan. 23, 1913.

Sealed proposals, endorsed, "Bids for The Completion of the Northeast Boulevard," and addressed to the undersigned, at the office above mentioned, will be received until 12 o'clock noon, on Monday, March 3rd, 1913, for the Completion of the Northeast Boulevard, from Second Street to Rhawn Street. Approximate quantities of principal items of work as follows:

402,729 cu. yds. Grading
445,700 sq. yds. Bituminous Macadam Surfacing
69,000 sq. yds. Water Bound Macadam Surfacing
59,000 sq. yds. Vitrified Brick Gutters on 4" Concrete foundation.
68,700 lin. ft. 8 inch Steel Protected Concrete Curb
49,200 sq. yds. Cement sidewalks
431,800 sq. yds. Top Soil and Grass Seeding

Together with all other work incidental thereto, including Sewers, Masonry, Vitrified Pipe, Manholes, Inlets, and Trees and Shrubs. The amount of money available for the work is $1,000,000.00.

A charge of $10.00 will be made for each set of Specifications and blue prints, which charge will be refunded upon the return on or before March 3, 1913, of the unused Specifications and plans in good condition, or upon the return of the Plans in case a bid is submitted.

Specifications and blank forms upon which bids must be made, can be obtained upon application at the office of the Bureau of Highways, Room 232, City Hall.

No bid will be considered unless accompanied by a certificate from the City Solicitor that the provisions of an ordinance requiring proposal bonds when the bids exceed in amount five hundred dollars, approved May 25, 1860 (p. 81 West), have been complied with.

The Director reserves to himself the right to reject any or all bids, as he may deem best for the interests of the city.

M. L. COOKE,
Director.

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Rhode Island Stone Bridge

TO CONTRACTORS

SEALED PROPOSALS for rebuilding approaches of the Rhode Island Stone Bridge will be received by the Commissioners to reconstruct and repair the Rhode Island Stone Bridge, at their office, Room 213 in the State House, in Providence, R. I., until 12 o'clock noon, on the 24th day of February, 1913.

Proposals shall be endorsed "Proposals for rebuilding approach spans of the Rhode Island Stone Bridge."

Plans and Specifications may be seen at the office of the Secretary of the Commission, 434 Dexter Street, Central Falls, R. I., or at the office of J. R. Worcester & Co., civil engineers, 79 Milk St., Boston, Mass.

Proposals shall state the price for each separate item of work. All proposals shall be made on the blanks furnished by the Commissioners for that purpose and hereto annexed.

Parties who shall bid on the work must furnish evidence of their ability to execute the same.

A certified check for one thousand ($1,000) dollars payable to the State of Rhode Island must accompany the bid as liquidated damages in case the party to whom the work is awarded fails to execute the contract and furnish the security required, as stipulated. Bids are to be made according to the plans for the work and according to the specifications thereto annexed.

Security will be required to the amount not less than one-third and not more than one-half the total amount of the contract.

The Commissioners reserve the right to reject any or all bids.

HENRY C. WILCOX,
HENRY C. ANTHONY,
IRVING P. HUDSON,
CLARENCE H. GREENE,
FRED H. JONES, Secretary,
Commissioners.

Engineering News

VOLUME 69 FEBRUARY 20, 1913 NUMBER 8

Yakima Indian Reservation Drainage Project

By James Wm. Martin*

SYNOPSIS—Over-use of water for irrigation having turned productive farms on the Yakima Indian Reservation, Washington, into swamps and barren alkali flats, a drainage system was constructed by the U. S. Indian Service. Interesting facts concerning the earlier and later irrigation works and regarding the design and construction of the drainage works are given, including cost figures for the latter.

The Yakima Indian Reservation is located near the central part of the State of Washington. Its eastern boundary is formed by the Yakima River, which flows in a southeasterly direction and discharges into the Columbia River at a point about 45 miles east of the southeast corner of the reservation.

The reservation was set aside by treaty in 1855 in order to bring together the major part of the more or less savage Indians of various tribes who were at that time roving promiscuously over the central part of the state. The treaty specifically declares it to be the government's intention to encourage and assist the Indian in every way possible along the lines of agriculture, even to the extent of establishing an agricultural and industrial school, a wagon and ploughmaker's shop, the appointment of a superintendent of farming, and two farmers, etc., etc. From the records it appears that from the date of the treaty, farming to a greater or less extent has been carried on and developed within this reservation, encouraged and assisted by the United States Indian Service.

The reservation comprises something over a million acres and varies in topography from high mountainous timbered and grazing lands on its western border to very rich irrigable smaller valleys bordering on the Atanum, Simcoe, Toppenish and Satus creeks, with an extensive area on which the drainage project was constructed, comprising about 130,000 acres of very rich land sloping about 10 ft. to the mile, in a southeasterly direction, and situated at an average altitude of about 850 ft. above sea level.

This body of land, measuring about 15 miles north and south, and extending west from the Yakima River for a distance of about 15 miles, is bounded on the east by the Yakima River, and is readily irrigable by gravity and easy pumping from that source. The annual precipitation is only some 8 in., most of which falls during the winter season.



Fig. 1. Drainage Canal of Yakima Indian Reservation, Washington, Near Outlet into Yakima River

This large body of irrigable land is bounded on the south by Toppenish Ridge, a low spur, at the north base of which flows Toppenish Creek, a small reservation stream which includes Simcoe Creek, and in all drains about 240 sq.mi., finally emptying into the Yakima River. It is bounded on the north by the Atanum Ridge, along the northern base of which flows Atanum Creek, and hemmed in to the west by the higher mountainous country forming the western part of the reservation. A portion of the reservation is shown by the map, Fig. 1. This land is very favorably located regarding transportation and market facilities, and is so situated as to be easily irrigated almost immediately after the canal leaves the river, thus eliminating the usual very expensive and generally undesirable long line of feed canal so often necessary in connection with irrigation projects of similar magnitude. A more or less extensive stratum of water-washed gravel underlies the whole area, being close to the surface at the upper or northern part, and at varying depths in the lower slopes.

For about a mile to the north of Toppenish Creek a

*Wright and Callender Building, Los Angeles, Calif.

strip exists where the soil is quite deep, acting as a submerged barrier to the free drainage of these gravels generally underlying the territory to the north.

Prior to the era of extended irrigation over the upper section of this body of land, the lower lands, along the north side of Toppenish Creek, were chosen by the Indian allottees and generally considered by the whites as the most desirable and productive on the reservation. I have been told by old residents that even on this lower belt within two or three miles from Toppenish Creek, in some cases in the earlier days, it was necessary to sink a well from 20 to 40 ft. in depth in order to get water. This is illustrative of the dryness of this territory prior to the period of more general irrigation on the higher parts of this body of land. As these lands became allotted, they were gradually cultivated through irrigation by a canal from theYakima River, built in the earlier days by the Indians without outside assistance. In the early 90's, the Yakima Indians, through the disposal of some tribal fishing grounds farther north on the Yakima River, became possessed of about $20,000 in cash, which it was decided to use for the benefit of those whose allottments were so located along the Yakima River as to require an expenditure for irrigation larger than they were able to afford. Acordingly there was constructed, in 1893, what is known as the Old Reservation or Irwin Canal, of 10 or 12 miles more or less in length, and with a capacity of about 150 sec.-ft. This canal was built under the supervision of a former Indian Agent by the name of Irwin. It tapped the Yakima River at a point about four miles downstream from the northeast corner of the reservation, and has been developed from time to time, so that at present it is capable of covering from 12,000 to 15,000 acres or more of very choice agricultural lands. A report from the Indian Agent in 1897 regarding this canal shows that in that year alone about 20 miles of extensions and laterals were constructed, also its capacity had been increased to approximately 300 sec.-ft., and the report further states that by further extension and lateral construction, it will be possible to cover about 50,000 acres of rich land.

This canal was constructed to serve lands from its headworks to the Toppenish Creek, and considering the conditions under which it was built and extended, has certainly performed a service most creditable. Prior to and subsequent to the construction of this canal, many smaller ditches have been taken out at various points along the Yakima River or its tributary sloughs and small creeks by Indian allottees and white lessees of Indian lands.

Beginning with about the year 1903, ten years after the start on the construction of the Irwin Canal, the chief engineer of the Indian Service, W. H. Code, was enabled by small annual congressional appropriations, to construct at a point farther up the river, just south of the northeast boundary of the reservation, substantial masonry headworks and a canal of about 650 sec.-ft. capacity, skirting the southern base of the Atanum Ridge, to cover the larger irrigable area. This canal and headworks were constructed in order to be easily capable of covering some 60,000 or 70,000 acres of land to the north and west of the land already covered by the Irwin Canal.

The Yakima River, draining a mountainous timbered territory, and being fed through the generally slow melting of accumulated snows, usually continues to flow at a flood stage of sufficient quantity to accommodate all the irrigable lands along its course until about the middle of June or the first of July of each year, after which time its flow quickly diminishes with the exception of occasional uncertain autumn floods brought about by heavy rains in the upper mountainous regions.

As the low-water stage of the Yakima River unfortunately occurs at the height of the irrigation season, a general water shortage has in the past been experienced throughout the valley at the most critical period of the crop-maturing season. This difficulty is now being overcome by the construction of storage reservoirs by the Reclamation Service, in the upper reaches of the Yakima River to augment the regular low-water flow.

This condition of low water in the past has been a very strong natural factor in causing the farmer to over-irrigate in the earlier part of the season when the water was plentiful, in the hope that by using a large amount of water when it was available he might be able to more strongly fortify his growing crops, usually alfalfa, against the ordinary later shortage with its attendant extremely dry, hot weather. Also, as the generally underlying free gravel exists either very close to or at the surface, especially on the upper part of this irrigable area of the reservation, more water is necessary for irrigation on this body of land than at other points in the Yakima Valley, where the soil is deeper and the underlying gravel does not exist.

At this point it seems proper to mention that the irrigation work of any magnitude on the Reservation to date has been constructed and developed from time to time through the aid of uncertain small congressional appropriations which necessarily enforced a policy demanding the best results for the time being at a minimum cost. Further, due to the gravelly nature of the territory, an appreciable mileage of the lateral canal system had to be constructed through occasional beds of loose gravel and as sufficient funds have never been available to make these canals water-tight, an appreciable seepage occurs. This, of course, is a factor in requiring more water than would otherwise be necessary, and it also adds to the amount of seepage to the lands situated at a lower altitude which thus became swamped and alkalied as the upper irrigation was developed. However, no matter what may be done to make the canals proof against seepage, the naturally loose soil with its favorable slope to the south and closely underlying extensive depth of a loose gravelly constant natural drain, will always be a factor to be taken into consideration in measuring the future irrigation water-supply needs for this area.

In the earlier days of limited irrigation, the underlying gravels were able without any noticeable detriment to the lower lands to dispose of such seepage as found its way from the upper parts of the reservation, but with the constant gradual development of this irrigated area (about 40,000 acres at present) the seepage, of necessity, rapidly increasing, became more than could be taken care of by the natural gravel outlet. This, consequently, caused a rapid rise in the water plane at the lower elevations, beginning near the Toppenish Creek, and gradually encroaching to the north from year to year as the irrigated area increased. This condition became so serious that in the year 1909 the water-logged and alkalied area had encroached far enough to the north to have made worthless an area covering about 40,000 acres of what had previously been as productive land as could be found any-

where under similar climatic conditions. Where previously prolific grain crops higher than a man's head were possible, with irrigation an absolute necessity, the same ground had become as barren as a floor through the new condition. On these now barren, alkalied and swampy areas, which formerly were cultivated ranches, can be seen deserted Indian homesteads, with their attendant typical Western corrals and sheds rapidly falling to pieces through abandonment and lack of use.

This area in the year 1909 covered a distance of approximately 20 miles along Toppenish Creek and extended back for a distance of from one to four miles. It had been studied and surveyed by the U. S. Reclamation Service at different periods prior to this time. Through the urgent appeals of some of the more advanced Indians and enterprising resident whites, this condition was quite forcibly brought to the attention of former Secretary of the Interior, Ballinger, who, after a full realization of the importance of quick action through a visit to the locality, with the coöperation of Senator Wesley L. Jones, obtained a reimbursible appropriation from Congress of $250,000, in the spring of 1910, to become immediately available for the relief of this precarious situation. Upon assurance of the appropriation, the writer was immediately detailed in May, 1910, by Chief Engineer of the Indian Service, W. H. Code, to proceed to the reservation and make surveys and test borings and compile all available necessary data for subsequent consideration in formulating definite plans for construction.

To give an idea of the condition of the affected territory at that date, it may be stated that in making the surveys through the previously cultivated and prosperous ranches, it was often necessary to wade waist deep in mud and water, and the horses occasionally became mired so that their backs were submerged in the bogs.

The test borings were carried along with the surveys in order to locate a line, if possible, where the bottom of a prospective drainage canal would tap the underlying gravel. It developed that a blanket of alluvial soil of appreciable depth of a volcanic ash and cinder nature existed for a distance of one or two miles from the creek, consequently the canal line was run farther to the north, favorable for successful drainage. Due to the natural where gravel conditions were found to be much more slope of the surface, it was found to be quite feasible to construct a main canal from the Yakima River practically due west, with laterals on the section lines about every two miles in a northerly direction. As the highways in this locality usually follow the section lines and the natural slope of the lands is to the south and west, the canals were laid out and constructed on the north and west sides of the section lines with a view to local connection possibilities whenever found necessary with the minimum number of highway crossings.

Further, as the irrigation canals for proper service will, of necessity, be located on the south and east sides of the section lines, the highways can be quite conveniently laid out between the two canals, allowing for a very profitable use of the spoil banks of the canals which happen in most cases to be naturally adaptable for favorable highway construction.

On the completion of the surveys and borings, a consulting board of engineers was convened on the ground, comprised as follows: W. H. Code, chief engineer U. S. Indian Service; D. C. Henny, consulting engineer U. S. Reclamation Service; C. H. Swigart, supervising engineer U. S. Reclamation Service; C. G. Elliott, drainage expert U. S. Agricultural Department, and the writer, with the results that definite lines for the canals were established, size of main canals and laterals adopted, and type of machines for prosecuting the work approved.

In earlier studies the widening and deepening of Toppenish Creek for use as a main drainage channel had been suggested, but due to gradient and annual flood conditions, it now appeared advisable to construct an independent drainage canal to provide for the new condition, parallel to and to the north of the creek, thus leaving the creek for the present in its natural condition to take care of its 240 sq.mi. of watershed as heretofore.

It appeared advisable to use a floating dipper dredge for the more swampy locations, and a drag-line excavator for the lands not so wet; starting at the western end with the floating dredge and working toward the Yakima River and starting at the Yakima River with the drag line and working west toward the dredge.

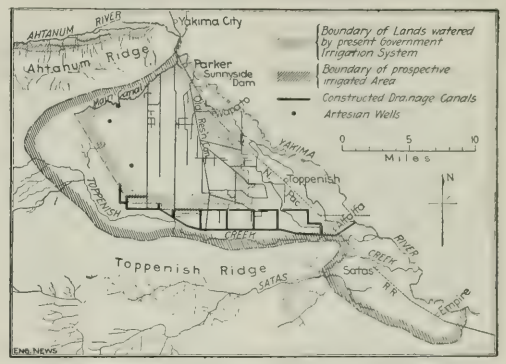


FIG. 2. MAP OF A PART OF THE YAKIMA INDIAN RESERVATION, WASHINGTON, SHOWING IRRIGATION AND DRAINAGE SYSTEMS

The main canal (see Fig. 1), 10 ft. bottom width and 9 ft. deep, was located from one to two miles and more north of and practically paralleling Toppenish Creek, where the gravel was nearer the surface than it was at locations which were closer to the creek.

As the yardage to be moved was large, probably some 2,000,000 cu.yd., it was considered desirable to take advantage of the experience gained with different excavating machines on the construction of the New York State Barge Canal. Consequently the writer was detailed East by direction of the chief engineer to investigate and report regarding the purchase of the most favorable machines for prosecuting the work. Due to urgent need for immediate action, it was considered desirable to purchase the necessary machinery and prosecute the work by our own forces rather than wait to take the time necessary for preliminaries, such as would have been required should it have been decided to do the work by contract.

Proposals for the drag-line excavator were called for, to be opened July 25, 1910, for a structural-steel drag-line excavator with 60-ft. boom, 1½-yd. bucket, the bucket to be stiff and strong, machine to be fitted with hardwood skids and provided with rollers and equal to or better than the Lidgerwood, Crawford, Browning or Marion

steam-shovel companies' standard makes, and to be fully guaranteed in every respect.

Proposals were also invited for a standard floating dipper dredge of 1 yd. capacity.

It was decided to purchase the Lidgerwood Crawford, Class B, excavator, for $8875, without engine house, it being decided to use a galvanized corrugated-iron house in place of the ordinary wood house furnished by the company, to minimize fire dangers.

It was also decided to purchase a Marion standard 40-ft. boom, 1-yd. dipper dredge, with bank spuds, operating on a hull 60 ft. by 18 ft. wide by 5½ ft. in depth, at a price of $5000 for the machinery complete f.o.b. Marion, Ohio.

As a local contractor had just finished some work on a drainage proposition, a short distance down the river, consequently having available a drag-line excavator of 40-ft. boom, and 1 yd. bucket capacity, the machine was leased and put to work on the construction of the laterals, with very satisfactory results.

The drainage results on this work have been satisfactory beyond what was anticipated by the most opti-

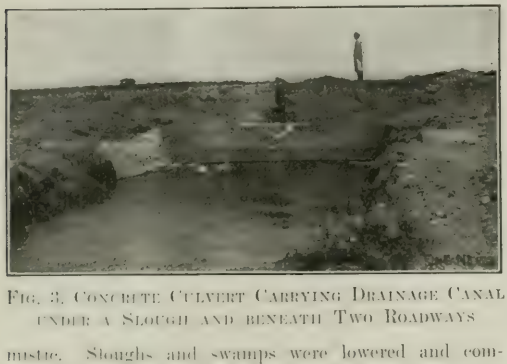


FIG. 3. CONCRETE CULVERT CARRYING DRAINAGE CANAL UNDER A SLOUGH AND BENEATH TWO ROADWAYS

mistic. Sloughs and swamps were lowered and completely dried 1½ miles from the ditch.

In laying the work out on the ground, C. G. Elliott, former drainage expert of the Agricultural Department, who was called in consultation, emphasized the importance of taking advantage of the intercepting features of the drainage canals to the extent of locating the canals where they might serve lands below as well as those above the ditch.

This feature was very noticeably prominent as the work progressed, for swamps, sloughs and the land in general for a mile below the canal were affected just as freely through the intercepting qualities of the canal as the lands above.

Due to appearances of the alkalied lands, very few had never lost of the early reclamation of the badly affected lands without persistent and continuous washing and treatment of some kind, but the reverse turned out to be the fact. Before the approach of the drainage canal some tracts were impassably boggy and covered with a black alkali to the extent of being absolutely devoid of of any vegetation whatever, but with the approach of the drainage ditch in the winter the land became dust dry, making irrigation necessary in the following spring, and a very creditable crop was raised the same year without any treatment beyond ordinary irrigation. Equally successful results were obtained with potatoes on a former berry tract that had been completely destroyed through the action of the alkali salts. The drainage system was the means of reclaiming lands that could not find purchasers at any price under the swampy alkali conditions, the reclaimed lands selling at prices varying from $50 to $200 and more per acre.

While it is hardly fair to judge what the permanent future flow may be from the present discharge, it is confidently expected that a good substantial permanent flow will result. The present total discharge is somewhere in the neighborhood of 200 cu.ft. per sec. from about 40 miles of drainage canal.

Fig. 3 shows a reinforced-concrete culvert carrying the main drainage canal under Wanity Slough and two roadways, Wanity Slough being an old reservation natural drainage slough emptying into Toppenish Creek and carrying too much water to be cared for by the drainage canal. This culvert has a clear opening 39 in. deep and 20 ft. wide, and has a length of 75 ft. Its total cost was $4039.

As the work was practically completed and the accounts balanced at the close of the fiscal year, it appears more convenient to give the cost and construction data to June 30, 1912.

A light highway bridge, similar to the one shown in Fig. 2, was used throughout and constructed at a total average cost of about $150.

The following are the detailed costs and construction data of the three machines:

Marion Dredge—1-yd. dipper dredge, 40-ft. boom. Limit of dump above water 15 to 18 ft. Limit of digging below water, 12 ft. Center of hull to center of dump, 35 to 40 ft. Size of hull, 60x18x5½ ft. About 24,000 ft. B. M. lumber required in construction of hull.

Cost of machinery f.o.b. Marion, Ohio, $5000. Cost complete with hull in working order about 8 miles haul from the railroad (exclusive of freight charges on machinery from Marion, Ohio, to Toppenish, Wash.), $10,034.

Started to excavate, Nov. 17, 1910, and worked steadily till Mar. 13, 1912, usually excavating in soft material with gravel subsoil and occasional streaks of hardpan. Results: gravel subsoil and occasional streaks of hardpan. Results:

Total cu.yd. excavated	502,911
Total lin.ft. of canal	57,944
Total 8-hr. shifts operating	823

		Cost of Work Total	Per cu.yd.
Field supervision, including clerical		$2,896 08	0 005
Labor operation		18,816 49	0 0374
Hardware, tools, etc.		1,138 50	0 0023
Repairs, shopwork, etc.		1,850 79	0 0037
Camp maintenance		960 00	0 0019
Coal, about $4.85 per ton delivered	$8224 00		
Cable	2368 00		
Oil, waste, etc.	784 00		
Carbide for lights	558 00	11,934.00	0 0236
		$37,595 86	0 0739

No depreciation charges have been added, but it is believed that from 1 to 1½c. per cu.yd. would cover this item.

Leased Machine—This machine was constructed by the Washington Iron Works, of Seattle, Wash. It had a 50-ft. boom, with 1 yd. channon bucket, operated by a 7x10¼-in. double engine. The machine was mounted on skids and hauled back by an independent engine mounted on the rear. It was started in September, 1910, and finished on expiration of lease, Apr. 15, 1912.

The material excavated comprised volcanic ash with occasional streaks of hardpan that required blasting, underlaid with loose gravel.

Total cu.yd. excavated	539,235
Total lin.ft. of canal	68,590
Total 8-hr. shifts operating	917

	Cost of Work Total	Per cu.yd.
Field supervision, including clerical	$3,275 76	0 0060
Labor operation, including $225.00 rent per mo	32,320 68	0 0602
Hardware, tools, etc.	1,502 53	0 0028
Repairs and shopwork	5,815 02	0 0108
Camp maintenance	1,386 05	0 0025
Coal, about $4.85 per ton delivered Cable Oil, waste, etc. Carbide for lights	14,151 60	0 0262
	$58,511 44	0 1085

Due to layout of canals, this machine moved empty about 2½ miles, which expense is included in above costs.

Lidgerwood Class B. Drag Line Excavator—This machine (Fig. 4) complete for operation on the ground about two miles haul from railroad, exclusive of railroad transportation from Chicago, cost $11,555.

The material excavated compressed volcanic ash soil with occasional streaks of hardpan, underlaid with loose gravel. The machine started to operate Oct. 1, 1910, and the data are given to June 20, 1912.



FIG. 4. LIDGERWOOD DRAG-LINE EXCAVATOR WORKING ON YAKIMA DRAINAGE CANAL

Total cu.yd. excavated	789,968
Total lin.ft. of canal	92,305
Total 8-hr. shifts operated	1,024

	Cost of work	
	Total	Per cu.yd.
Field supervision and clerical	$3,617.45	0.0046
Labor operation	27,562.65	0.0352
Hardware, tools, etc.	3,026.33	0.0038
Repairs and shopwork	10,007.33	0.0125
Camp maintenance	1,449.00	0.0018
Coal, Cable, Oil waste, etc., Carbide for lights	18,097.40	0.0229
	$63,760.16	0.0808

No depreciation has been charged in the above, but it is believed that about 1½c. per cu.yd. should cover this item.

This machine moved empty, a total distance of about 18 miles, which expense is included in the above costs.

As a matter of general interest the following is submitted as showing the total amounts expended from the original appropriation of $250,000 to June 30, 1912:

Inventory on hand	$22,555.90
General miscellaneous	1,867.07
Bills paid by Washington office	2,745.05
Excavation	159,867.46
Clearing	4,786.74
Miscellaneous culverts and drops	4,891.19
38 highway bridges	5,695.49
Fence moving and replacing	3,343.68
Engineering	14,462.97
	$220,215.55

It may be of interest to note that the total amount disbursed, including engineering, structures, clearing, fence moving and inventory, which covers all depreciation, added to the excavation, shows a cost of about 12c. per cu.yd. when applied wholly to the excavation.

The work was prosecuted under the direction of Former Chief Engineer of the U. S. Indian Service, W. H. Code, at present of the firm of Quinton & Code, Wright & Callender Building, Los Angeles, Calif., with the writer in charge in the field. A. L. Darr was assistant engineer in charge of surveys, and Hector Gillis was superintendent of construction.

A Trench Bottom Raised by the Load of Excavated Material on the Banks*

The accompanying views show a four-barrel brick outlet sewer at the foot of Morell St., Detroit, Mich., the completed portion of which was destroyed on Jan. 12 by a slip in the clay subsoil surrounding the unsheathed open trench. The four barrels of the sewer were of circular cross-section, made of two rings of brick, 5 ft. in inside diameter, and the invert was laid 14½ ft. below the street grade. When completed the sewer will extend from Jefferson Ave. to the Detroit River.

The character of the excavation is clearly illustrated in Fig. 1. The material excavated, consisting of about 5 ft. of ash and cinder fill, 2 ft. of clay fill, and the remainder a soft blue-clay subsoil, was thrown into piles about 15 ft. back from the trench opening. The weight of this superimposed material on the saturated clay subsoil caused a slip and consequent upheaval of the bottom of the trench, which destroyed the short section of sewer completed. The upheaval varied from 6 in. to 5 ft.

In Fig. 1, on the left, may be clearly seen a crack across the face of excavated material marking line of settlement. This settlement amounted to 12 or 15 in., and is more clearly shown in Fig. 2. From Fig. 1 the proximity to the work of the Jefferson Ave. street-railway tracks is apparent, and it is not unlikely that the jar of passing cars contributed materially to cause the slide.



FIG. 1. BRICK SEWER UNDER CONSTRUCTION, MORELL ST., DETROIT, MICH., SHOWING SECTION DESTROYED BY EARTH SLIDE



FIG. 2. CRACK IN EXCAVATED MATERIAL SHOWING SETTLEMENT OF 12 TO 15 INCHES

*From data furnished by W. I. Cathcart, 223 Atkinson Ave., Detroit, Mich.

An Electric Tractor for Hauling Freight Cars in City Streets, Pennsylvania, R.R.

In the accompanying cut is shown a view of the new electric tractor recently built in the Juniata shops of the Pennsylvania R.R. and tried out at Altoona, Penn. The tractor was built as a substitute for long strings of horses which have hitherto been used for freight-car hauling in the city streets, and its construction was undertaken only after extensive trials of commercial trucks and tractors had proved them inadequate for the special service. The principal dimensions of the tractor are as follows:

Length over couplers	23 ft.	Drawbar pull (normal)	8000 lb.
Wheel base	12 ft. 6 in.	Drawbar pull (max.)	21,500 lb.
Width over all	8 ft. 4 in.	Speed (normal)	6 m.p.h.
Weight	28,850 lb	Battery	80 cells Edison A-12-H
Width of tires	12 in.	Weight of battery	4350 lb.

The most remarkable feature of this tractor is that it drives, steers and brakes, on all four wheels. This development was made necessary on account of the short radius curves around which the tractor would be required to operate and the necessity of driving all four wheels in order to secure the necessary tractive effort. The wheels and driving mechanisms are located near the ends of the chassis and the battery box hangs in the center directly under the cab. The cab contains the air compressor, controlling apparatus, and steering wheel. Sloping hoods at each end of the cab cover the driving mechanisms.

The driving mechanism at each end is supported by the axle, and is held in position by radius rods. The motive power is furnished by two General Electric motors of approximately 20 hp. apiece. Each motor is connected through a set of herringbone gears to a countershaft, the employment of the herringbone gears necessitating the use of a special flexible coupling between the armature shaft and the herringbone pinion. Integral with the countershaft gear is a differential gear of special design, a new departure in differential construction wherein each side of the differential drives a section of the split countershaft and each section of the countershaft carries a universal pinion, which meshes with the driving gear that is bolted to the wheel casting. Through this system of gearing a reduction of about 40 to 1 is obtained. All gears are made of special steel, and heat treated. All rotating parts of the driving mechanism are carried on ball bearings.

The wheels, which are of the tangent-spoke type, are steel castings, weighing approximately 1200 lb. and are equipped with steel-base solid-rubber-block tires of such design that one section may be removed and replaced without disturbing any other section. Each wheel is carried on a steering knuckle, which is operated by a steering arm engaging with another arm on a longitudinal shaft, carried by the chassis. This longitudinal shaft is made in two sections, coupled at the center by means of an interrupted crank. From this coupling there are two connectors, which are attached to a system of planetary gearing driven by a large steering wheel in the center of the cab. This steering wheel is of the marine type and turns the tractor in the direction the top of the wheel is turned.



Side and End Views of Electric Tractor Built by the Pennsylvania R.R. for Hauling Freight Cars in City Streets

The four-wheel steering arrangement allows the tractor to turn in a circle of 20 ft. radius, the trailing wheels tracking with the forward wheels. This tracking feature allows the operator to devote his entire attention to the forward end of the tractor, since the trailing end will always clear anything that the front end has cleared.

On each side of the cab there is a lever connected to the controller, and also a motorman's brake valve. The controller lever allows the operator to drive from either side of the steering wheel. The lever is moved in the direction in which the tractor is to go, and a guard prevents the operator from going into reverse without first coming to a full stop. The brake valve controls the operation of the air-brake apparatus. This is of the automatic type, air being supplied to the main reservoir by a motor-driven air compressor. The application of air actuates a system of equalizing levers, which operates the internal expanding brakes carried by the wheels. Standard air-brake hose couplings allow the air to be used on the cars that are being shifted. This automatic air brake is supplemented by a hand brake, which may be used at any time, separately or in conjunction with the air brake.

An application of the brakes is utilized through a lever to bring the controller to the off position, thus making it impossible to use power while the brakes are on.

The normal drawbar pull of the tractor is 8000 lb. During one of the trials in the Juniata shop yard it pulled a locomotive and two cars with such surprising ease that it was decided to have the tractor and the locomotive push against each other to see what the tractor could do. With the throttle wide open, the locomotive failed to hold the tractor and was moved several feet. The locomotive used was a Class "R," rated at 21,500 lb. drawbar pull.

Maintenance Treatment of Smooth Pavements in St. Louis*

By W. L. HEMPELMANN†

Smooth pavements, in this paper, include asphalt, bitulithic and creosoted wood-block. Everyone interested in the maintenance of bituminous pavements is familiar with the asphalt patching gang, the equipment and the manner in which repairs are made. "Cutting out and plugging in" is the most common means of repairing an asphalt or bitulithic pavement. To do this properly and satisfactorily requires careful attention to details. The general procedure is to trim the joint properly paint it, and then tamp or roll the hot asphaltic top mixture into the prepared depression.

Careful examination of a pavement where such patching has been done, will frequently reveal the fact that the joint between the patch and the old pavement has not been sealed, due sometimes to a "dirty joint" but generally to carelessness on the part of the laborer in not painting every part of the exposed edge of the depression. This condition is easily observed when, after a rain, the sun has dried the surface of the pavement, while the patches are definitely outlined by a wet line. Another source of trouble comes from the pushing or displacement of patches because of the material used. The patching material should be as nearly as possible of the same consistency as the old pavement, so that when the summer's sun warms up the pavement the old and the new material may soften to the same degree. The folly of using a new street mix as patching material in an old pavement has been shown frequently.

A temperature variation of from 5 to 10° below zero to 120 or 130° F. in the summer's sun, on the surface of the pavement, presents a complex problem concerning the proper mixture to be used. Under slow-moving heavy loads in the summer, the material is apt to push or creep, bringing about a wavy or undulating condition of the surface, which is very "bumpy" to the automobilist. This condition can frequently be remedied by the use of surface heaters; the bumps or high places are softened and all the burned and soft material is scraped off, leaving a clean surface of the old material. Such burning should be continued until the burned area will require at least 1 in. of added material to restore the pavement to its proper surface and cross-section. It is well to cut a joint at the edge of the burned area (1 in. or 1½ in. deep) so that the edge of the old pavement may serve as a shoulder for the new material. The surface of such burned area should be made as rough as possible with a pick or the point of a hoe, so that the old material may mechanically hold the new material in place. The whole area should be liberally sprayed or sprinkled with an adhesive asphaltic cement, to bring about a better union between the old surface and the new material. This method is economical and when properly done, gives entire satisfaction. Our records show that this method of making repairs, including labor, material, roller and fuel, costs from 50 to 55c. per sq.yd., depending upon the conditions, while straight patching in the ordinary way costs from 75 to 95c. per sq.yd.

Here, again, it is absolutely necessary that the joint between the old and the new pavement be waterproof for the best results. The effect of an imperfect joint, or one not properly sealed, is best seen in the late fall or early spring of each year, when by alternately freezing and thawing, the moisture in the joint tends to entirely separate the patch from the rest of the pavement. Such a joint, once opened up during the winter, will not heal in the summer under traffic, the dust from the surface finding its way into these small crevices and preventing the amalgamation of the two mixtures.

In the case of bituminous mixtures having stone of the larger size this open surface condition (which permits moisture to freeze and thaw in the surface) materially aids in pitting the surface. Steel-tire traffic is much more detrimental on such a wet and open surface, as the steel grinds or crushes the surface rock much more readily. With mixed motor and steel-tired traffic, the suction created by the rapid motion of the motor cars tends to redistribute these fine particles. This can be plainly seen after a heavy shower, when the fine material from the surface can be found at the low point in the grade.

Surface Treatment to Prevent Wear

BITUMINOUS PAVING—Recognizing water as one of the worst enemies to smooth pavements, we have endeavored to waterproof our asphalt and bitulithic pavements by treating the surface. Flush-coating or squeegee-coating the last named pavements has generally been done as a matter of course, to seal the surface. Hand squeegee carts or pressure wagons to evenly distribute the bituminous material with a coating of sand are generally used. In recent years, the economy of flush-coating the bitulithic streets under contract maintenance is evidenced by the fact that a flush-coat gang is one of the regularly equipped maintenance gangs when repairs are begun after the winter. This thin coat on the surface performs a double duty. It tends to waterproof the surface, by filling all the surface voids, and with the sand it forms a thin cushion-coat on the surface, taking the wear off the pavement proper. In other words, we tend to build up the pavement by the judicious application of flush coats, instead of permitting the pavement to wear down under traffic. Under our traffic conditions, such a flush coat wears at least a year. Using tar at 7¼c. per gal., and applying it by means of pressure-wagons, our total flush-coat cost on bitulithic pavements last summer (including tar, sand, teams and labor) was about 2½c. per sq.yd.

In case of asphalt pavements, we applied the same reasoning. We have oiled some of our asphalt pavements and covered them with sand at a cost of about 1c. per sq.yd. for material, covering and applying. For an old pavement it was thought that the oil treatment would help keep out the water and at the same time tend to give new life to the bitumen. This thin cushion-coat on the surface plays an important part in the wear during the winter months, when the chains attached to the driving wheels of automobiles have a pounding effect in passing over the pavement. The thin layer on the surface largely takes care of this added wear.

WOOD-BLOCK PAVING—It has been the practice in St. Louis for the last three years to oil and sand the wood-block thoroughfares. This largely is a treatment for slipperiness, and was evolved gradually. Sand or sharp grit was first spread over the surface of such pavements. Most of the sand was soon found in the gutters, blown to the side by the rapidly moving motor cars and by the wind. The benefit from such a treatment was very short lived. Oiled-sand was then tried, the oil and sand being mixed in asphalt-mixing pans and spread over the surface from wagons. This was slow, expensive and unsatisfactory, since the sand had to be heated and dried to mix with the oil, and when this warm material was hauled to the street the bottom of the load was extremely soggy because of the oil which percolated through the sand and collected near the bottom. Spreading this soggy material uniformly was impossible. At the suggestion of J. C. Travilla, Street Commissioner, the oil was sprayed on the wood-block surface and then covered with sand. This method proved very satisfactory and was economical, costing about 1c. per sq.yd. for oil, sand and labor. For this work we apply about ⅛ gal per sq.yd., using a pressure wagon for distribution. Such a treatment lasts through the winter and largely helps to waterproof the surface.

*Abstract of a paper read at the annual meeting of the Illinois Society of Engineers and Surveyors at Chicago, Jan. 22-24.

†Engineer of Bituminous Roadways, Street Department, St. Louis, Mo.

The Fire Loss on the Pennsylvania R.R. system for 1912, is reported as being the lowest in the 34 years of the road's record, being $219,892, and resulting from 905 fires. The rate of loss is claimed to be very small as the property endangered ran into hundreds of millions. This reduction in loss is attributed to better organization and equipment of the company's fire-fighting forces. In 1908, the road's employees extinguished 274 fires out of a total of 1397 on railroad property. In 1909, the employees put out 321 from 929 total. In 1912, the employees attended to 454 out of 905.

Some Features of the 1913 Motor Truck Show in New York City

The annual exhibition of commercial motor vehicles in New York City, Jan. 20-25, brought out the largest display ever shown, requiring both Madison Square Garden and the Grand Central Palace for its accommodation. No fewer than 26 vehicle exhibitors and 180 exhibitors of accessory supplies were accommodated in the Garden, while 42 vehicle and 44 accessory exhibitors had displays at the Palace.

The number and size of the exhibits emphasize the rapid development of this branch of the automobile industry. Rapid advance has been made in motor-truck design during the past year and the vehicles impress one as having had their details much more carefully worked out than was the case a few years ago. Nine out of ten of the trucks, of all types and sizes, are equipped with chain drive, generally outside the chassis frame and exposed. A few makers, however, provide a sheet-metal casing for the chains and run them in an oil bath. Perhaps even a greater percentage of the cars are using double-tread drive wheels, even some of the comparatively light trucks being so equipped. Tires are of all kinds and sizes, but the solid tire seems to have generally won over the pneumatic. The number and variety of dumping-body designs indicates a heavy demand for this type of truck. The four-cylinder vertical motor is nearly universal on gasoline-motor trucks. There was a considerable number of exhibitors of electric trucks, both for heavy hauling and light delivery, and the increasing price of gasoline gives the makers of such vehicles much encouragement.

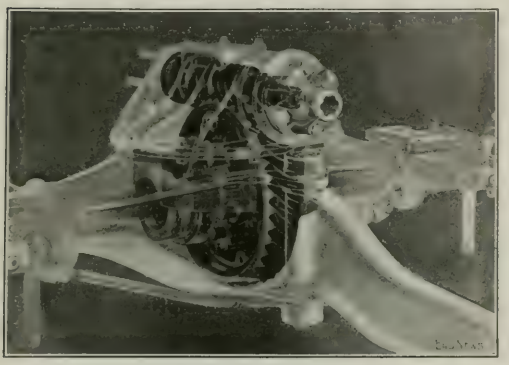


FIG. 1. PHANTOM SKETCH, SHOWING THE WORM-GEAR DRIVE ON PIERCE ARROW TRUCKS

WORM GEAR VERSUS CHAIN DRIVE—We have noted that the chain drive is nearly universal on motor trucks, but it is interesting to observe that several of the leading manufacturers also show worm-gear drive as a feature of their designs. In Fig. 1 is shown the worm-gear and differential arrangement in use on the Pierce-Arrow truck, and a similar method is employed in driving the Studebaker and the Blair trucks. The claims made for this type of drive are that it gives a large speed reduction in a small space, that it is more durable and efficient than the chain drive, and is free from the wear by dust, grit and sand of the open chain drive. The advantage of noiseless operation, so much emphasized on pleasure cars is, of course, of minor importance on commercial vehicles.

A TELESCOPING DUMPING DEVICE—There is a large variety of dumping mechanisms, running from the davit-crane principle of operation on the Alco to the hydraulic-lift equipment on the Pierce-Arrow and the toggle device on the Locomobile. A telescoping threaded-column arrangement appeared on several trucks, among them the Universal and Packard. The main features of this apparatus as exhibited on the Peerless truck are shown in Fig. 2. It consisted of a threaded rod turning in an internally and externally threaded tube, which in turn worked within a second tube internally threaded. The rod carried a bevel gear at *A*, driven from the engine shaft through a chain-and-sprocket and bevel-gear train. Pivots at *A* and *B* insured alignment of the rod and tube at all times. Raising and lowering were both positive drive and each movement occupied about 30 sec. The mechanism was entirely controlled from the driver's seat.

THE LATIL FRONT DRIVE—Attempts have been made in the past to perfect a rear drive with the motor located on the rear axle, but the Walter Motor Truck Co., of New York City, presented this year an innovation in American practice in the form of a front drive, having the front wheels driven direct from the motor through spur gears. The claims made for this drive are that several types of body can be used with it because the entire driving, steering and control mechanism is a complete unit, detachable, as shown in Fig. 3; that all machinery is both compact and accessible; that a saving in efficiency is obtained by the elimination of drive shafts and transmission gearing; and that skidding is obviated. The points which seem unfavorable to this arrangement are that the steering-gear problem, at no time a simple one, is complicated



FIG. 2. VIEW OF THE TELESCOPING DUMPING MECHANISM USED ON PEERLESS DUMPING-BODY TRUCKS

by the fact that the front wheels are also drive wheels. What is more important is that the concentrated weight on the rear wheels is not available for traction. Nevertheless the scheme claims eight years of commercial success in French practice and it is not beyond the range of possibility that in level districts, such as occur in many cities of the middle West, the system might be exploited with success.

A Sectional-block Detachable Tire—Although its principles are not entirely new, inasmuch as both sectional-block tires and detachable tires have been extensively used in previous years, the combination of these two ideas in the United States Standard Block and in the Goodyear Individual Block tires is novel and worthy of attention. The advantages of this type are that any single block may be quickly and easily detached and replaced without removing the wheel or disturbing any other block, the only tool required being a small wrench; that tire economy is effected by the ability to replace a section rather than a whole tire; and that tractive efficiency is improved by the sectional nature of the tires and by the staggering of sections.

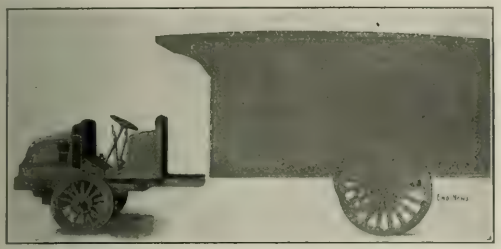


Fig. 3. Side View of the Latil Detachable Front Drive Used on the Walton Trucks

A Three-wheeled Truck—Another of the unusual types at the show was the three-wheeled Knox-Martin tractor, a view of which is given in Fig. 4. An illustration of this truck as used by the Borough Development Co., of Brooklyn, N. Y., appeared in the Jan. 16 issue of Engineering News. This design, like the one above referred to, aims to make use of the present horse-drawn vehicles which may have cheap steel tires, instead of costly rubber tires. The three-wheeled construction also adapts it to uneven roads.

A Motor-generator Starter and Lighter—One of the interesting accessory exhibits was an electric motor-generator starting and lighting arrangement for use on gasoline cars, which possesses several excellent features. The unit is direct-connected to the drive shaft just back of the engine and replaces the usual flywheel. It is in four sections, an aluminum case or frame supporting the field coils and attached to the engine frame, a rotating armature and commutator attached to the drive shaft and revolving in the case and around the field, a brush holder fastened to the case, and a protecting shield of aluminum also attached to the case. The weight of the armature is approximately the same as that of the usual flywheel and, due to the fact that it revolves outside of the field instead of inside as is usually the case, it has been possible to make its diameter and inertia about the same as those of a flywheel of the same weight. For starting, the device becomes a motor driven by the auxiliary storage battery, and for lighting, it serves as a generator, being arranged by means of an automatic regulator, to charge the battery at the required rate. This equipment was on exhibit by the U. S. Light & Heating Co., of New York City.

A Hood Seat—A saving in space on the chassis is obtained in the truck exhibited by the Speedwell Motor Car Co., of Dayton, Ohio, by combining the hood and seat in one piece. With this arrangement it becomes necessary to provide a ready means for getting at the motor, and this is accomplished by tilting the hood seat sideways on hinges, as shown in Fig. 5.

Friction and Hydraulic Drives—Two friction-disk drives were on exhibition at the Palace, the double-disk arrangement on the trucks of the Service Motor Car Co., of Wabash, Ind., and the single disk on the Best trucks, made by the Durant-Dart Carriage Co., Flint, Mich. For the lighter vehicles this system seems to have merit. Another interesting exhibit at the same place was the Manly hydraulic drive on the truck exhibited by the

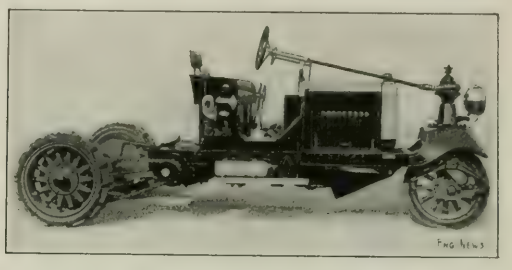


Fig. 4. The Knox-Martin Three-wheeled Truck



Fig. 5. Combined Hood and Seat Arrangement on the Speedwell Trucks

American-La France Fire Engine Co., Elmira, N. Y. The advantages of this are similar to those of the friction drive. Another form of hydraulic drive which accomplishes the same results, was described in the Oct. 31 issue of ENGINEERING NEWS.

OPPOSED TYPE MOTORS—Two-cylinder motors of the opposed type were shown in the Autocar and International Commercial trucks. This design, which was popular a few years ago, has now been very generally discarded in favor of the four-cylinder vertical type of motor.

SPRING WHEELS—An interesting form of flexible wheel was exhibited by the Seaton Wheel Co., of Nashville, Tenn. By the use of these wheels the riding qualities of the pneumatic tire are approximated in connection with the economy of the solid tire.

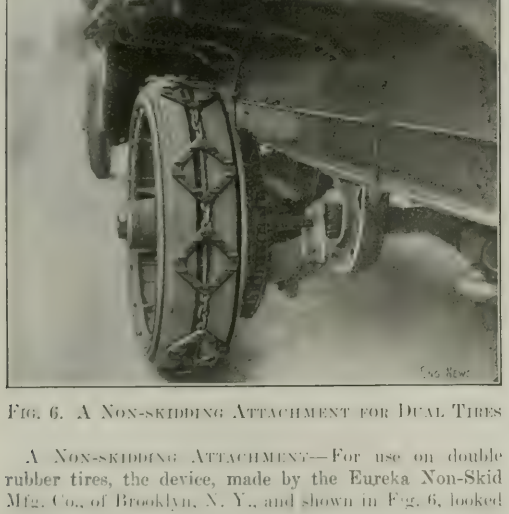


FIG. 6. A NON-SKIDDING ATTACHMENT FOR DUAL TIRES

A NON-SKIDDING ATTACHMENT—For use on double rubber tires, the device, made by the Eureka Non-Skid Mfg. Co., of Brooklyn, N. Y., and shown in Fig. 6, looked effective. Each of the plates presents eight contact points to the road surface aside from those offered by the connecting links.

STEEL WHEELS—Steel cast wheels, in which rim, spokes and hub are in one piece, were on exhibition by the Johnson Steel Wheels Corporation, of Boston, Mass., which claimed for them greater simplicity, increased strength and, for heavy trucks, decreased weight, over the standard wooden wheel.

A MOTOR "SPEEDER"—A device was shown by the Fudge Bros. Mfg. Co., of Marion, Ind., for improving the working of a motor, particularly in cold weather, by forcing a current of warm air into the intake pipe, proportional in volume to the amount of gasoline used. The air is warmed by being drawn through a coil around the exhaust pipe.

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A List of Testing Laboratories is to be compiled by the new Austrian government "Technische Versuchsamt" (Michelbeuerngasse 6, Vienna). Private and public testing laboratories throughout the world are hereby asked to send the "Versuchsamt" all pertinent information concerning their field of work, organization, commercial or educational affiliation, equipment, and extent of operations. Wm. EXNER, k. u. k. Wirklicher Geheimer Rat, is president of the "Versuchsamt."

Topographical Surveys for Drainage Districts*

By WALTER A. BIRKET†

Topographic surveys in connection with the reclamation of swamp and overflowed lands along the Mississippi and Illinois rivers are made for the following purposes: 1, the location of levees and main and lateral ditches, and the preparation of estimates of cost; 2, the assessment of benefits and damages.

For the location of the levee, detail topography should be taken along the river extending back 600 to 1000 ft. In most cases a ridge of higher land is found near the river, and sometimes the levee location can follow this the entire length of the river front. More often it approaches too near to or recedes too far from the river bank, and then it becomes necessary to cross to another ridge. The question then arises as to where the location should leave the ridge and where the crossing can best be made. If there are other ridges further from the river that appear to be higher, it is necessary to extend the topography to cover them, as the question will likely arise whether the additional land taken in by the location nearer the river will pay for the additional expense of building the higher or longer levee which would be necessary? With all the possible locations made on a topographical map, and the cost of each route estimated, it becomes a simple matter to choose the best route.

For the location of main and lateral drains, it is essential to know the elevation of all sloughs, ponds or other depressions in order that a ditch can be located and a grade established that will drain such places. It is also necessary to have the elevations along the line of the ditch so that an estimate of cost can be prepared, as it is seldom possible to make the best location (without the aid of a topographical map) except by running out several locations, and even then the best location is not always found. From a topographic map, with contours of 1 ft. intervals, it is a small matter to make an estimate on all possible locations, from which the most desirable route can be adopted. For the assessment of benefits, it is essential to know the elevation and extent of all ridges and depressions. The most practicable way to show these features is on a topographic map, with 1-ft. contours. It is also important to know the amount of timber, that part of the land which is prairie and that which is cultivated, and to be able to tell from the maps the amount of land in each tract that will not be reclaimed, if any.

Methods of Survey

The methods used in 1912 on a survey of 20,000 acres are described below. The levee had been constructed a number of years, so that the extra detail necessary for levee location was not required. The information necessary was for the assessment of benefits, the location of the interior drainage ditches, and the diversion of hill streams. The territory covered ranged from two to four miles wide, extending from the river levee to the bluffs, and about 12 miles north and south. A camp was established, with three 14x24-ft. tents. One tent was used for kitchen and dining, one for quartering the rodmen, and the third for the topographers, instrumentmen and draftsmen. The last was used also as the field office where the plotting was done.

There were two topography crews, each consisting of a topographer, an instrument man and three rodmen. A third crew (instrumentman and two rodmen) was organized to run base line. When this crew had finished all the base line that could be run from a given camp, it was disorganized, one rodman being put in each of the topography crews, while the instrumentman worked in the office computing and assisting the draftsman. The base line was run from north to south through the center of the district, using the regular stadia methods, except that no topography was taken. Azimuth was carried and checked by deflections right or left from the last line produced. The elevation of stations was carried by differences of elevation, as follows: The height of the telescope above the stakes was determined with a rod graduated in feet and tenths, or by bringing the point of the plumb bob to the top of the stakes, then swinging it over to a graduated leg of the instrument. The difference between the height of the instrument and the rod read on a station when the telescope is level is the difference of elevations of the two stations. As this difference is taken both forward and back from each station it furnishes a check on

*Abstract of a paper read at the annual meeting of the Illinois Society of Engineers and Surveyors, held at Chicago, Jan. 22-24.

†Harman Engineering Co., Peoria, Ill.

the work before leaving the station. The average of the two differences is used for the difference of elevation between the stations. No vertical angles were used between stations, and only on side shots when the rod could not be used direct.

The elevations of the base line stations were checked by direct levels with fore and back sights of 300 ft., as nearly as practicable. The distances along the base line were read by stadia and checked by chaining. The chained distances and direct levels were used as correct, in preference to the results obtained by the stadia and difference of elevation methods, providing they did not differ more than could be expected from the different methods used. Where the error was greater than allowable a second check was run. The method gave a base line in which there was little chance of errors, and in which none were found.

The two topography crews were started east and west from the base line. Each ran to the limits of the district (the levee on the west and the bluff on the east), then north half a mile and then back to the base line, making a circuit of about 4½ miles. These circuits were closed on the base line for azimuth and elevation. A tabulation of the circuit was made in which the error in azimuth and elevation was prorated throughout the circuit. This tabulation also included a traverse of the circuit, which was prorated to close. As the error in azimuth was prorated before the traverse was computed, the error in traverse was considered as due to errors in distance and was prorated on that basis. The error in departure was prorated in the east and west lines, and the error in latitude in the lines north and south.

The first lines east and west from the base line were run along a section line and the return lines along a quarter-section line, half a mile from the first line. The next lines were run along a section line one mile north of the first line to the limits of the district, then south half a mile to close on the first circuit. Errors in azimuth, elevation and traverse were corrected and prorated to the correct results for the station tied into. The circuits were run in this manner between the base line and the limits of the district along each section and quarter-section line, and closed on the base line and on the preceding circuit at the limits of the district alternately. This gave a base line north and south about the center of the district, which was checked and free from observable errors; also stadia lines east and west across the district at half-mile intervals, each one being closed back to the preceding circuit at the limits of the district, thus avoiding all chance of small errors accumulating. The allowable errors were 5 min. in azimuth and 0.2 ft. in elevation. We found no trouble in keeping within these limits.

Stadia Work

In open country the circuits were run along the section and quarter-section lines and a distance of a quarter-mile used between stadia stations. This was in order that a station would be near each 40-acre corner, making it possible for the topographer or instrument-man to make a search for monuments. Rodmen do not realize the importance of tying in monuments and, as a rule, make little if any search for them. Anyone who has sectionized a topographic may of a large area realizes that even if all the information available is plotted, such as monuments and fences, there is little enough from which to correctly plot the section lines. As the areas of fractional tracts within the district are computed to these lines as plotted, and ditch lines are located along them, it is very important to obtain all the information possible that will in any way influence the plotting of the section lines. It is time well spent to keep the work well squared up in such a way that an instrument station is near each 40-acre corner.

In timber it is seldom possible to get stations one-quarter mile apart. Sometimes half this distance can be taken and it will give the same results. Where even this is not practicable, if the stadia line is kept near the section or quarter-section line, the instrumentman in passing from one station to the next will pass the corners and can make a search for monuments. In timber country, or where there is a great deal of detail to be taken, it is not possible to cover the ground from lines half a mile apart. Then it is necessary to set spur stations from the main circuit from which to get the detail. To save the time necessary to set off a spur station, if the instrument is set up at a point from which the detail can be got, and oriented by means of the compass; the azimuth, distance and difference of elevation back to a station on the main circuit are read, and the detail then taken in the usual way. By using this method the instrumentman is able to pick the position from which the detail can be taken with the least amount of work. For spur stations, the location must be left to the rodman, or a special inspection made by the topographer. Results obtained by this method are as accurate as ordinary stadia or spur stations, but would not be if circuits were run by such methods as would permit errors to accumulate. By closing the circuits by traverse, using a chart from which the latitude and departure of each line was read, time is saved and the results are much better, as the errors can be prorated more nearly in their proper places than can be done by plotting. The errors found are errors in the circuits themselves and do not contain errors of plotting. By plotting the circuits by traverse there can be no accumulation of errors.

Sketching

Instead of sketching the work in the field book, as is common in topographic work, sketch sheets 8½x11 in. were used on a board which would take four of these sheets at one time. The board was rounded out to fit a man at the waist, and had a strap from the outside corners passing over the shoulders. This enabled the topographer to work on the board while standing, and also to compare the sketches with the territory while walking over it. The observations taken by the instrument man were recorded in a field-book and also plotted with a half-circle stadia protractor on the sketch sheets by the topographer. The sketches were made to a scale of 1 in. to 400 ft. (the same as the finished drawings). With the shots plotted on the sketch sheets in the field, it is possible to sketch a great deal of the work which would have to be taken by shots if less reliable sketches were used. Enough contours were drawn on the sketches so that they could be used as a guide for the finished maps.

When it is difficult to get the shots, the topographer is able to keep the elevations computed and plotted as fast as they are taken. When the work is done easily the topographer will not be able to keep up. In that case, when the station is worked out, it is necessary to stop and plot the shots before the instrument is moved to the next station. This takes but little time, and as soon as the work is plotted the instrumentman takes the book, goes to the next station and starts work. The topographer in going to the next station covers the territory between the circuit being run and the last preceding circuit, sketching the sloughs and swales that are not shown by actual shots, as it is not practicable to take shots at all the crooks and turns. If the topographer works between the line that is being run and the last preceding line, he is able to cover the territory well and keep the sketch up without delaying the instrumentman. The latter will be delayed by having to keep his own notes while the topographer is sketching, but this will be more than offset by the number of shots that will be saved by the sketch method, besides obtaining much more reliable work.

The advantages of this method are : 1, the work is plotted in the field, the sloughs and swales are followed out and are connected up properly; 2, the work is plotted from the balanced notes; 3, a draftsman who has never seen the territory can finish up the maps from notes and sketches and contour them correctly. The advantage over the plane-table is that the transit sets higher and therefore overlooks a great deal of vegetation that would have to be cut if a plane-table were used. Work can be done more rapidly with a transit than with a plane-table. With the sketch method it is not necessary to take more than 75% of the shots that would be necessary with the ordinary stadia method. Sometimes with the latter method the territory is not covered and sometimes it is covered twice, due to the instrumentman not being able always to tell the distance between the line he is running and the preceding line, when one or both lines are not straight, on account of timber and the necessity of running an irregular line in order to get the detail. With the sketch method, the topographer is able to tell at all times just how closely the territory is covered, and he can always scale from the nearest known property corner and tell where to look for the next one.

Cost

The cost of such a survey as described will vary with the local conditions and the time of year. A district with little timber or brush surveyed under ordinary weather conditions should be finished ready for tracing for from 12c. to 14c. per acre. A district with 50% of the territory covered with timber and brush, if surveyed under ordinary weather conditions, would cost from 14 to 17c. per acre, while for the same territory surveyed under adverse conditions the cost might run as high as 20c. per acre.

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A Federal Income Tax is made possible by the sixteenth amendment to the United States Constitution, ratified by the state of Wyoming, Feb. 3. This ratification completed the necessary three-fourths of the States.

A Problem in Beach Reclamation and a Prize for its Solution

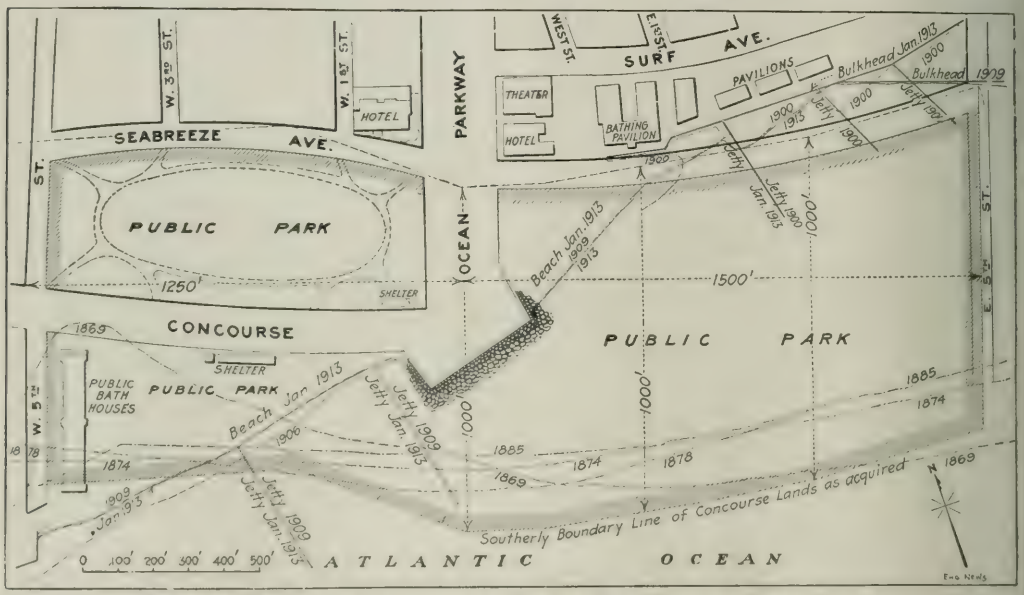
The accompanying plan shows a part of the famous Coney Island shore, in the Borough of Brooklyn, New York City. It is the only part of several miles of waterfront facing the open Atlantic Ocean and frequented by hundreds of thousands of people every summer, which is now the property of the city and is accessible to everyone. Located at the end of Ocean Parkway, one of the most popular automobile roadways in Greater New York, it is one of the most frequented parks in the city, during the hot weather, by all classes of people.

The plan shows the line of the beach between the years 1869 and 1912. By the unchecked natural process of coast erosion, the city has allowed about half of the beach to become washed away and submerged.

Through the generosity of Alfred T. White, of Brooklyn, N. Y., the Brooklyn Engineers' Club is enabled to offer prizes of $200 for the best plans for reclaiming this beach. While there is, of course, no assurance that the beach will be reclaimed, the problem itself will interest many engineers and perhaps lead them to study a phase of engineering work not often met with by the ordinary engineer, yet in many countries, notably in Holland and parts of England, a very important branch of engineering practice. All engineers are eligible to compete.

The end aimed at by the competition is to obtain the best possible suggestions for the restoration of the beach on its original lines within a reasonable time and in a manner to secure the greatest benefit to the public for the least expenditure by the city.

The committee to award the prizes consists of two engineers and one layman: the layman appointed by the Chairman of the Brooklyn Committee on City Plan, one of the engineers designated by the Chief Engineer of the Board of Estimate and Apportionment of the City of New York and one by the President of the Brooklyn Engineers' Club. The committee appointed is: Edward M. Bassett, chairman; William T. Donnelly, consulting engineer, of New York, and William G. Ford, consulting engineer, of Brooklyn, N. Y.



PLAN OF WATERFRONT BELONGING TO CITY OF NEW YORK AT CONEY ISLAND
(Showing shoreline 1869-1912. Sand beaches extend east and west each side of this property).

PRIZES OFFERED AND RULES TO GOVERN THE COMPETITION

(1) This contest is open to all engineers, whether they are members of the Brooklyn Engineers' Club or not.

(2) The prizes offered are as follows: First prize, $150: second prize, $50.

(3) Engineers desiring to compete for these prizes may notify this Committee in writing at the Brooklyn Engineers' Club, in which case they will be furnished with a printed copy of the rules governing the contest, together with a map showing the location and limits of the property under consideration.

(4) For the purpose of this award, the boundaries of the property in question, as shown on the accompanying map, are to be considered, irrespective of any legal question as to the title thereof.

(5) All competitors must submit a map of the property prepared to a scale of 100 ft. to the inch and such other detailed plans as are necessary in connection with specifications to clearly indicate and describe the method and construction proposed for the work, together with an estimate of its cost.

(6) The Committee will consider the relative merits of the plans according to the following general outline:

Permanence of construction.
Economy of cost.
Time required to effect the result.
Largest public use and benefit.
Completeness of the plans as shown by description, specifications or drawings.
Justifiability of the plans as shown by experience.

(7) All specifications and plans submitted to the Committee must be signed with a nom de plume and so as not to disclose the identity of the party submitting same, and this signature, together with the proper name of the engineer, must be inclosed in a sealed opaque envelope, superscribed with the same nom de plume on the outside of such envelope, to be delivered at the same time.

(8) The plans and specifications will be received and retained by the Committee for the purpose of award only, it being understood that they are to remain the property of the engineer submitting same.

(9) It is to be further understood that the Committee will exercise no authority and will have no influence relative to the use of any of the plans for the actual reclamation of the property referred to, by the city.

(10) All plans and specifications submitted for this contest must be in the hands of the Committee on or before May 15, 1913.

(11) The Committee of Award will report its findings to the Brooklyn Engineers' Club, on or before June 15, 1913.

(12) The plans and specifications which are awarded first and second prizes will be published in the "Proceedings" of the Brooklyn Engineers' Club, and honorable mention will be made of such others as are deemed to have special merit.

Railway Bridges on Track Elevation*

By Geo. H. Tinker†

NOISE—Some of the early bridges on track-elevation work, which carry trains over the streets, are objectionable on account of being quite noisy. At the Clifton Boulevard bridge, the rails rest directly upon the floor plate, held down by clips, and trains produce a roaring sound which can be heard for a long distance. In determining how this noise could be reduced, bridges of various types in different cities have been observed. In Pittsburgh, two bridges carry the Pennsylvania R.R., across Penn Ave. and 10th St., and it is remarkable how little noise is caused by trains crossing them. On both bridges there is a deep bed of ballast. In Chicago there are a number of bridges which apparently are of similar construction and yet the noise is quite pronounced. Probably there is not very much ballast. There is also much noise produced by street cars passing under the bridges. Where the beams of the floor are exposed beneath the bridge, and form air pockets, the passage of the car sets up a reverberation. Where the floor is heavy and there is considerable concrete, the noise is much less. Observations seem to indicate that if a bridge is constructed with a considerable depth of ballast the vibration of the rails and the parts of the bridge will be reduced. And further, that if a smooth under-surface of the bridge is obtained there will be very little opportunity for reverberation in the subway.

WATERPROOFING BRIDGE FLOORS—The dripping of water through the bridge floor upon the street is objectionable even when the amount of water passing is quite small, because the water collects lime, grease and rust, which, dripping upon passers-by, may ruin their clothes Therefore, it has become necessary, and is required by ordinance in some cases, that bridge floors should be waterproof. The accepted method of waterproofing a concrete slab in a bridge floor is to place upon it a ½-in. to 2-in. layer of some of the asphalt, coal-tar or petroleum-product gums, with which may or may not be included several layers of burlap or felt paper. A small surface covered with these substances will hold water indefinitely, but when spread over a large expanse of bridge floor, there are other difficulties to be met, and the greatest of these is the expansion and contraction from temperature. Asphalt itself, if its condition remains unchanged, is quite impervious to water, but if it contracts through cold, and cracks, the water will pass through the crack. It takes a very small crack to produce a leak which is objectionable in a bridge floor, and therefore it is necessary to have a substance which will expand and contract with the slab and not crack. This leads to the other extreme, that is, a substance so soft that when it becomes warm it will run. There are bridge floors in Chicago which leak asphalt.

Several substances are on the market for incorporation with the sand and cement to make impervious concrete. The theory is that they make the concrete so dense that water cannot percolate. Extravagant claims are made for some of these materials. A well-built slab of concrete is fully as impervious as a poorly-built slab with any style of waterproofing. The asphalt, coal-tar or petroleum-products used require protection against abrasion and damage from external causes. This requires a still greater thickness. Many bridge floors with a protection of brick on top of the asphalt have been fairly successful from a waterproofing standpoint, but the finished waterproofing adds about 6 in. additional thickness to the bridge floor, and it is thought that this could be better utilized by placing 6 in. of concrete on the floor.

In the bridges recently built in Cleveland by the N. Y., C. & St. L. R.R., no foreign waterproofing substance has been used. An attempt has been made to construct a concrete slab, which would be in itself as nearly waterproof as practicable. This has proved satisfactory. When the Cedar Ave. bridge floor was built, the ends of the bridge were dammed up, the trough so formed was filled with water and allowed to stand for several days. No water whatever came through at any point of the slab.

For successful waterproofing of the floor it is necessary to get rid of the water, which means that a drainage system must be provided of ample capacity to take care of all water that can collect upon the floor. This is a difficult matter, as the drainage system has to be carried some distance, to make a number of angles or bends, and eventually to reach the street gutter or sewer. The essential points in constructing a watertight floor slab are: 1, dense concrete (the denser the more impervious); 2, intelligent study and design in the location of expansion joints; 3, the provision of an ample drainage system; 4, careful workmanship and constant supervision during construction.

LOCOMOTIVES UNDER BRIDGES—With bridges over the tracks where the clearance is low, the blast from the engine has a very detrimental effect on the structure. In Chicago, it has been determined that where the clearance is about 18 ft., the steel will be worn away by the blast at the rate of about ¼ in. in ten years. That means that the flange of an I-beam would be so deteriorated in ten years that the beam would have to be replaced.

At the Detroit Ave. crossing of the N. Y., C. & St. L. R.R., the clearance is 16 ft. 3 in., which is the general rule in Cleveland. The I-beams are covered with concrete to a thickness of 1½ to 2 in.; it was found in the course of a few years that the engine blast eroded the concrete, so that in about five years there is a bare streak of steel over the center of the track. At the Adelbert Road and Cornell Road bridges it was decided to place cast-iron plates immediately over the center of the track. These plates are about ½ in. thick. The engine blast will not be as destructive as upon steel, and when the plates are destroyed they can be replaced with little trouble and expense. In Philadelphia, the Philadelphia & Reading R.R. placed a wooden ceiling under the steel bridges; this gave fair satisfaction for several years.

Our experience is that a concrete covering will be satisfactory for a few years, but where the head room is low (as is apt to be the case in cities) it will not protect the steel permanently. It must then be replaced, and to repair an old, worn surface of concrete is likely to prove a difficult and costly operation.

THICKNESS OF FLOOR—In some cities, there has been a tendency to design the work of grade elimination at the least possible expense. That means the lowest height for retaining walls, the least distance between the street and rail level, and the least thickness for bridge floors. This is unfortunate. While it is true that a bridge floor may be built quite thin, it is not satisfactory and leads to objectionable designs. Wherever the bridge floor consists of simply I-beams and steel plate, which is about as thin as a bridge floor can be made, there will be noise and leakage. In order to reduce both leakage and noise to a minimum, it is necessary to have a reasonably thick bridge floor. In recent designs in Cleveland about 4 to 4½ ft. has been adopted. With this thickness a very satisfactory floor can be made, and it is believed that the additional expense due to the increased height and length of approaches is offset by the greater length of the life of the structure, and by the greater satisfaction which it gives in use.

*Abstract of a paper in the Journal of the Cleveland Engineering Society, Cleveland, Ohio, November, 1912.

†Bridge Engineer, N. Y., C. & St. L. R.R., Cleveland ,Ohio.

Massachusetts Laws pertaining to the manufacture, distribution, and sale of gas and electricity and to incorporations engaged therein, have been studied for revision, consolidation, and rearrangement by the Gas and Electric Light Commissioners in conformance with an order of the Massachusetts Legislature of 1912. Their report, recently made, recommends the regulation of transmission companies as well as those distributing and selling power. The recommended codification would cover (1) formation, internal government, and relation of corporations to stockholders and creditors; (2) acquisition, financing and management of municipal plants; (3) use of streets for distribution; (4) public supervision and regulation of business of supply.

Among the special recommendations is one that, where a municipality acquires a previously existing private plant, cases of arbitration be referred to the reporting Commission rather than to a special commission. It is recommended that the law provide that a combined gas and electric company or a combination of either with a transmission company cannot be organized without the approval of this Board and after public hearing. The present statute prohibiting the consolidation of gas and electric-light companies, except to a limited extent, is held to be desirable. The report seems to recommend the granting of rights of eminent domain to high-tension transmission concerns. The Commissioners show how they have permitted the entrance of transmission companies into areas already supplied by local generating and distributing companies; this action is reported to have been stimulating to the service of local companies, and the terms imposed have prevented indiscriminate and wasteful competition.

Explosion-Proof Electric Equipment for Mining Service

The need for safe electric motors in mining is particularly felt in the coal regions where the presence of combustible gases and explosive mixtures is always a possibility. It is evident that if such apparatus is not in absolutely gas-tight cases and happen to be working in a combustible atmosphere, then there will be an accumulation of explosive mixtures in the cases to be ignited by any chance spark. A number of investigations of devices for rendering electric motors and switches safe for use in gaseous mines have been brought to a completion recently and the results are now available.

U. S. Bureau of Mines Investigations*

This series of studies was undertaken as one line in a more general series leading to the ascertaining of methods for lessening risks in the use of electricity in mining. A circular letter was sent to manufacturers of electric motors for mine service, stating that the Bureau proposed to make tests for motors designed for operation in the presence of methane. Five motors were submitted for test as a result, no two being protected in exactly the same manner. In conducting the experimental work on these motors an effort was made to produce conditions that would introduce the greatest elements of failure: (1) in each case some way was developed of producing sparking sufficient to ignite gas; (2) the motor casing was completely filled with explosive mixture; (3) the motor casing was surrounded with similar mixture.

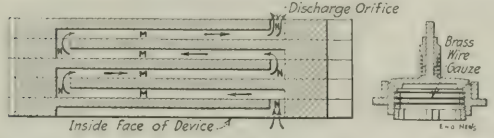


Fig. 1. Safety Devices for Electric Motors, Tested by U. S. Bureau of Mines: Types C and A

Several factors were controlled to suit the desired conditions; (1) ratio of gas to air in mixtures, (2) ignition point within the motor casing, (3) presence of coal dust within the motor casing. No effort was made to control the temperature of the mixtures outside the motor.

Four classes of protective attachments were shown in the sample motors submitted. The motors were all of a closed type, and the devices acted on the principle of the Davy safety lamp, in reducing the temperature of the products of internal explosion to such a point that they would not ignite the mixtures outside.

The first device ("Type A") consisted of three layers of gauze protected by a poppet valve. The motor used for testing was equipped with two such devices, one for each side of the casing at the commutator.

The second device ("Type B") consisted of two unprotected layers of gauze having an exposed area of approximately 4x5½ in. The motor submitted was provided with two such devices, one for each side of the casing covering the commutator.

The third scheme ("Type C") comprised five baffle-plates, so arranged to give a tortuous path for the products of explosion. The area of cross-section of the gas path was 1 sq.in. and the openings into and out of this were 1½ sq.in.

The fourth type ("D") consisted of two sets of plates, one of which was located at each end of the motor casing. Each contained 43 plates of sheet iron, $^1/_{25}$ in. (1 mm.) in thickness and spaced $^1/_{25}$ in. (1 mm.) apart by small pieces of the same material as the plates. These plates were in the shape of flat rings having an inside diameter of 11.4 in. (30 cm.) and an outside diameter of 15.7 in. (40 cm.). The total relief area of each set, at the inside edges of the plates, is 24 sq.in. and 34 sq.in. at the outside edges.

The fifth type of device ("E") consisted of two sets of gauze and baffle-plates, one of which was placed at each side of the motor casing at the commutator end. Each set consisted of five sheets of 30-mesh brass gauze, 4½x6 in., separated a distance of ¼ in. by bronze spacers, in each of which were 16 holes, 1½x1¾ in. These plates were inclosed in a bronze cover having a double baffle-plate at the outlet, and the whole was bolted to the motor casing by capscrews.

The device with unprotected gauze ("Type B") was rejected without test. Some weak point was shown in each device. In only four tests out of 191 did the first type of device prevent the passage of flames. Although few actual explosions resulted in the outside explosive mixtures, the margin of safety seemed too narrow; the successful operation of this type appeared to depend on the cooling of the expelled gases outside rather than within the device. The margin of safety was overstepped when the maximum heat was discharged at a comparatively low pressure, as when the gaseous mixture within the casing was exploded with the poppet valve open, a condition which might exist in practice to help the cooling of the motor. The third type was given a few tests because it was of rugged mechanical design, although failure was almost a certainty. The openings in the baffle-plates were so large that their cooling effect was negligible, and flames could easily pass. With gas in the motor casing, the space between the baffle-plates was also filled with the mixture, and the transmission of flame throughout the entire length of the passage between baffle-plates was helped.

The armature of the motor protected by the device of the fourth type carried a fan so as to cause a considerable circulation of air through the motor casing when the armature was revolved at high speed. Flames were discharged through the protective device in all tests in which the motor was running with the fan in place, but no outside flames were observed in any other test. Flames appeared at the inside edges of the plates from the burning of a fiery mixture not within the casing at the time of the explosion, but drawn by the fan. The failure of this type was due more to the severe conditions imposed by the motor's design than to imperfections in the device itself. It was considered impossible to build a device of reasonable size that would absorb the amount of heat produced by continuous operation (and after-burning) in a gaseous atmosphere.

With the fifth type of device no "punctures" occurred with gas alone, except in one test with one of the devices out of service, but it failed in tests where coal dust was sifted into the motor casing and the gas caused to explode inside. No flames issued through the protective

*See Bulletin 16, U. S. Bureau of Mines, Washington, D. C.

devices, but the coal dust was driven out and the explosion seemed to start from a point within this cloud after its expulsion. It indicates that probably the dust was raised to ignition temperature before it left the casing and on reaching the outer air burst into flame. The weak point of this type was considered to be the tendency to ignite coal dust, deposited in the openings of the baffle-plates outside the gauzes.

Concerning the design of true explosion-proof protective devices, H. H. Clark, of the U. S. Bureau of Mines, concludes the pamphlet as follows:

Explosion-proof protective devices should be so designed that flames cannot be driven through them by an explosion of gas within the casing of the motor to which they are connected. They should also be so designed that coal dust cannot enter them or, if allowed to enter, cannot be discharged while ignited. Such devices should be very rugged in mechanical design or they should be completely protected from injury. They should also be so constructed and applied to the motor that they cannot be detached from it without rendering the motor inoperative.

The casings of explosion-proof motors should be designed with the fewest possible number of openings. An ideal casing for this purpose would be one that had no openings whatever except those to which the protective devices were attached. The electrical conductors which enter such casings should be efficiently bushed with hard fiber or some other material that will make a strong and tight joint. If the amount of unoccupied space within the casing is made as small as possible the duty of the protective devices will be reduced to a minimum.

The factory tests to discover unprotected openings in the casings of explosion-proof motors should be as rigid and complete as any tests made upon the protective devices themselves. Several incidents that occurred during this investigation emphasized the importance of making such tests for tightness.

The most satisfactory form of protective device is one that is capable of absorbing a large amount of heat. In order to do this the device must be constructed of a metal that is a good conductor of heat. A considerable amount of metal should be used and it should be so disposed as to offer a large amount of heat-absorbing surface to the flames without being itself raised to an unsafe temperature. The total area of protected openings through the wall of the motor casing should be as large as is consistent mechanically. There are two reasons for this arrangement. First, it permits the use of more heat-absorbing material, and, second, it decreases the maximum pressure developed. The lower the pressure, the lower the temperature of the flame and the less heat is passed through the cooling devices in a given time. With a lower pressure the rate of flame propagation is slower; consequently, heat absorption is facilitated.

Use may be made of the fact that the advancing edge of the explosive wave is the most likely to be chilled because it passes through the coolest metal. If, then, the relatively cool dead gas produced by this means is passed through a comparatively long passage, like that between the baffle plates of the type E devices, subsequent flames will be cloaked with noncombustible gas and can cause no ignition.

Finally, the simpler and more rugged the design of such devices the better are they adapted for practical purposes. The devices should be so mounted as to render impossible the separation of plates or the rupture of gauzes. A splendid place for such devices would be entirely within the motor casing, with vent holes for the escaping gases.

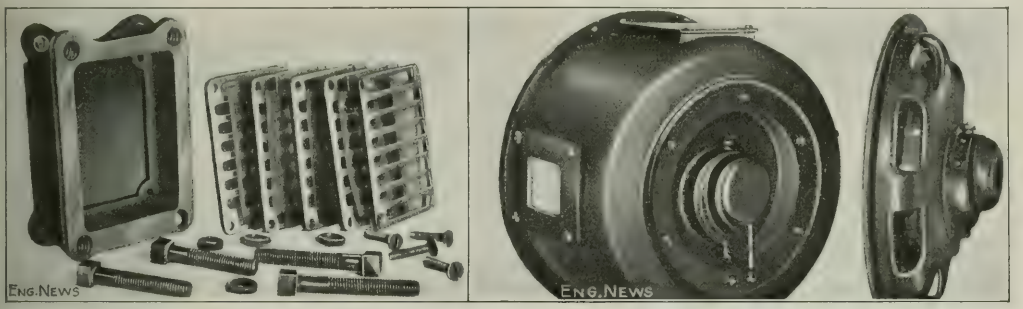


FIG. 2. SAFETY DEVICES FOR MINE MOTORS, TESTED BY THE U. S. BUREAU OF MINES: TYPES E AND D

WORK OF THE ALLGEMEINE ELEKTRICITÄTS GESELLSCHAFT

In the *A. E. G. Journal*, for December, 1912, is the abstract of a lecture by Bergassessor Lisse, of Kattowitz, on the occasion of the "Allgemeiner Bergmannstag" 1912, describing work in Europe. He states that two fundamental systems have been followed, one culminating in the principle of installing the electric motors and apparatus at such points in fiery mines as are free from firedamp, while the other consists in developing motors and apparatus with an explosion-proof frame. The first system, he says, has been adopted chiefly by mine owners and particularly in Austria, where in the Karwin district large pumping motors have been erected, protecting, not the motor, but the pump chamber against the entrance of firedamp. The chamber was made airtight from the water hole, while the connection with a crosscut is provided with three iron doors, the two outer ones of which open in an opposite direction to the inner one. Endeavors have been made wherever possible to withdraw the winch motors from the firedamp sections of the mine by placing them in a current of fresh air. In the Courle mine, near Carmen, the hoisting winches are placed at the lower end close to the opening of shafts, which are 94 ft. (120 m.) high in places.

Fundamental experiments for the development of explosions through motors and apparatus were carried out on the Gelsenkirchen-Bismarck experimental section.* These tests showed that three forms of construction were preferable in designing motors, transformers, starting apparatus and switch gears; (1) total inclosure, (2) laminated plates, (3) oil protection.

The totally inclosed type assumes a construction of casing that can withstand the pressure of explosion in event of ignition of firedamp mixtures inside. The

*"Tests For Determining Explosion-proof Qualities of Protected Motors," Bergassessor Beyling, "Gluckauf," 1906, Nos. 1 to 13; "Testing and Valuation of Protective Devices for Electric Apparatus," Dipl. Ing. Goetze, "Elektrotechnische Zeitschrift," 1906, p. 4; "Experiments with Fire-Damp and Protection of Electric Installations," Hoffman, "Zeitschrift Des Vereins Deutscher Ingenieure," Mar. 23, 1906, No. 12, p. 43.

second type follows the principle of the Davy lamp. In the third type, a convenient form of construction can be adopted for controlling switches and auxiliary apparatus, but with motors it is employed, as a rule, solely for the protection of slip rings. In the switches, the opening and closing of circuits is done under oil.

It is found that the plate-protection parts must be very carefully manufactured, as the effectiveness is completely destroyed by a single fault, such as one gap which is too large, or a hidden defect in the frame casting. It is found advisable to subject the finished motor to very careful testing before delivery.

Controllers are made for starting and reversing three-phase motors and up to 5000 volts, particularly for driving winches, pumps and rope railways underground. The contacts lie under oil contained in a tank which may be lowered for inspection of the drums and the fingers. A combination of high-tension switch and transformer is made for underground lighting. The cast-iron case of the upper part contains a maximum release in oil, and can be also provided with plate-protected openings.

A British Study of Explosion Prevention

A paper on "Safety Devices in Connection with Electrical Machinery and Apparatus for Coal Mines" was read by D. Bowen and W. E. French before the British Institute of Mining Engineers in London, on June 6, 1912, an abstract of which was printed in *London Electrician*, Dec. 20, 1912.

The first thing that they discussed is what is known as "pressure heaping" in a fully inclosed casing with communicating divisions. The explosion in one chamber forces the gases into the other and compresses them to upward of 1½ to 2 atmospheres and the explosion of the compressed gases is so violent that a greatly increased mechanical stress on the various parts is brought about. Numerous actual cases were cited.

In the experiments on safety devices at the Mining Department of the University of Leeds, the authors of the paper started out to verify the work of Goetze in 1906, some of whose statements they doubted. To overcome the transmission of flame from the interior explosive atmosphere to the exterior, the following suggested systems were taken up: (1) flange protection, (2) oil protection, (3) wire-gauze or perforated-plate protection, (4) plate protection, (5) tube protection, (6) labyrinth protection.

Flange protection is involved when the products of combustion are forced to leave through flange joints under high pressure and velocity in single thin and easily-cooled layers. Owing to their high pressure of exit and consequent rapid expansion to atmospheric pressure, cooling of the gases takes place due to this expansion alone and considerable cooling is effected by the passage of gases between wide flanges spaced a very small distance apart. Goetz reported that a ratio of 132 sq.in. cross-sectional flow per cubic foot volume of the apparatus (4.65 sq.in. per liter) secured safety, and that with closed cases for switches, resistances or motors, the small and narrow clearances between shafts and bearings or at lids and doors, etc., were not dangerous if not exceeding $^1/_{25}$ in.

The authors of this paper conducted tests similar in all respects to those of the German experimenters, and they found that Goetze's ratio did not necessarily secure safety. Unless unusually wide flanges were used, failure occurred with flange clearances of much less than $^1/_{25}$ in.; with a flange width of 0.55 in. and a gap equal to 0.006 in., failure occurred. In one case where the end covers were bolted on tightly to bring the flanges into contact, one bolt was inadvertently left loose; on the explosion of the inside mixture a flash of flame 3 in. long shot out of the apparatus at the small gap thus afforded.

In arranging wire-gauze protection, they found that several conditions must obtain; (1) there must be sufficient time for the absorption of the heat by the wire gauze, that is, the velocity of the gases must not be too great through the screen, (2) the metal of the gauze must be well distributed to possess the capacity of absorbing heat in available time, (3) the wire must not lose its mechanical properties due to stresses of explosion or melting. Steel possesses better thermal characteristics, but is easily attacked in mines, and brass or copper becomes preferable. Goetze has claimed that if a gauze surface was provided with at least 43.6 sq.in. per cubic foot of explosive mixture (1.54 sq.in. per liter) contained in the apparatus, then the apparatus was safe, and that where

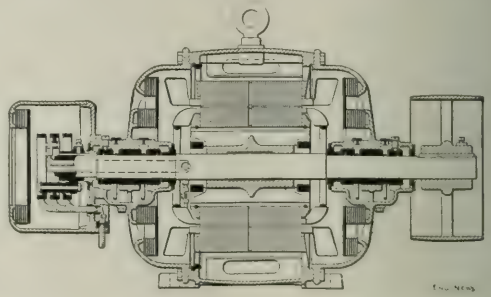


Fig. 3. Section of an Induction Mine Motor with Plate Protection
(Allgemeine Elektricitäts Gesellschaft, Berlin).

pressure heaping was set up, sufficient cooling and protective action could be secured by building into the apparatus several series of gauze partitions.

In the writers' experiments, apparatus fitted with 371 sq.in. per cubic foot volume of apparatus (13.1 sq.in. per liter) showed complete failure, and also with two, three and four layers of gauze in series. They encountered after-burning wherever it was possible to provide a constant flow of gaseous mixture into and out of the apparatus case.

In studying plate protection, the writers confirm the results of German tests that it was not safe to arrange the plates more than $^1/_{50}$ in. apart, and under this spacing absolute safety was obtained under every possible condition of tests. It was recommended that only such a number of plates with $^1/_{50}$ in. gap should be placed in parallel as to guarantee the necessary cross-sectional flow for easy ventilation. The effects of after-burning were noted only to a very small degree and the construction was found to lend itself to a better and stronger mechanical design. Plate protection by them is regarded as the most reliable. They believe that forced ventilation can readily be arranged for by adding fan vanes to the rotor or armature of an electric motor. The authors evidently did not follow out tests of motors equipped with

plate protection and fans, as did the U. S. Bureau of Mines, for they did not mention the serious after-burning of indrawn gas.

Goetze had held that the desired safety could not be obtained by forcing the gaseous products to travel along a long cooling path as through a tube because the number of tubes could not be confined within practical limits. The authors hold that all that is necessary is to furnish the apparatus with many narrow and long ducts packed into a comparatively small compass, though they suggest no specific design.

A somewhat similar solution which had been suggested was that of providing a labyrinth by arranging several metal sheets with the separating spaces connected in series by holes arranged alternately at the top and bottom of the plates; but the authors hold that ventilation of the appliance is impaired in this case and that the type is dangerous since pressure heaping and rupture is liable to occur, as the chamber is subdivided into a number of small interconnected spaces.

The writers agree with Goetze that the indiscriminate use of oil submersion for protection is not advisable. Certain precautions are recommended for oil switches: (1) The current densities at contact surfaces and the contact resistance should be low to prevent heating. Without this precaution, the oil decomposes or vaporizes, and if the oil level is close to the switch contact, flames may break through to the surface and fire any explosive mixture above; (2) the contact should be placed near the bottom of the oil tank; (3) the case should be of sound mechanical construction and supplied with flange protection for pressure release. The writers believe that the submersion of multicontact switches and drum controllers for use in starting and regulating machinery has proved a complete failure (in contrast with the A. E. G. apparatus noted), since a low-contact resistance between fingers and contact blocks is impossible.

The City's Side of Grade-Crossing Elimination*

By Robert Hoffman†

The changes made when abolishing grade crossings often make possible certain betterments in the railway, such as a better grade or a wider right-of-way, and the building of more tracks. The city, however, seldom obtains either a better street alignment or a better street grade. There is, of course, an indirect benefit on account of the safety and the ease of traffic over the streets.

PROPERTY DAMAGE AND IMPROVEMENT—On the other hand, considerable damage often results to property. Abutting land improved in reference to the original grade of the street may be left either considerably above or below the changed grade. This frequently involves a partial or total reconstruction of buildings, and in some cases the change in grade has been so great as to unfit the building for occupancy. The law provides that property so damaged shall be compensated to the amount of such damage, but should the buildings lose their tenants and business go elsewhere, it means that temporarily, at least, the entire section surrounding an undertaking of this kind is to some extent damaged. Vacant property may be left so far above the new grade of the street that no one cares to undertake the expense incident to building upon it. This brings about an unsightly appearance, in that frequently the side slopes of the property are left rough and unfinished, allowing mud and dirt to wash down upon the sidewalks. This unfavorable condition may be temporary, as there is always a possibility that the land may be improved.

It is to be regretted that when the work of eliminative grade crossings is undertaken the improvement of abutting property cannot be made simultaneously. The law, however, gives the city no power to enter upon private land in order to build retaining walls, grade side slopes, or change buildings that will interfere with the private rights of the owner. The changes must be confined to the limits of the roadway unless land necessary for walls or slopes is appropriated. Such appropriations would often delay the work, and are, therefore, undesirable where they can be avoided. In Cleveland, where it becomes necessary to build retaining walls or grade side slopes upon abutting property, the policy is to make the doing of this work one of the conditions of the damage settlement. In the early cases, the damage settlement was made, and the money paid to the property owner, who was allowed to do as he wished as regarded his property. Several cases arose where the property owner, though claiming that he would be obliged to build a retaining wall, or to grade his property and to plant grass or trees, failed to do this after having received his damage settlement. To prevent this, payment of money for damage settlements should only take place after the property owner has properly protected abutting land, and done what is necessary to prevent an undesirable condition from arising.

BRIDGES—The city is interested in the sightly appearance of the structures that are built, so far as they may be seen from the streets. Should the roadway be carried over the railway, the railings of the bridge should be neat in appearance, and it is desirable that no part of the structure should extend above the roadway, with the exception of the railings. Deck structures are, therefore, desirable wherever they can be obtained. The through-truss or through girder often fails to present as pleasing an appearance as an unobstructed roadway such as can be obtained by the deck structure.

Where the roadway goes underneath the railway, it was at first thought desirable that the roadway should be clear from all obstructions, and several of the earlier bridges built in connection with grade-crossing elimination were provided with clear spans extending between abutments placed at the side lines of the streets. This made necessary the construction of deep girders, considerably out of proportion to the clearance provided between the bottom of the same and the roadway underneath. In later structures, curb supports have been generally adopted, and as a consequence, the girders carrying the bridge have been made shallower and present a neater appearance.

Though theoretically it might seem a good principle that the roadway should be left free of permanent supports, there is hardly a case in the city where numerous temporary encumbrances have not been constructed at the curb lines in the immediate vicinity of such grade-crossing bridges. Reference is made to the many telegraph and trolley poles, water hydrants, trees and like obstructions. As there is seldom need for vehicles to stop alongside the curb underneath the bridge, there is really less argument in favor of a wide unobstructed roadway in such a location, than there would be in other portions of public streets. It can, therefore, be stated that for widths of over 40 ft. column supports at the curbs are not objectionable.

*Abstract of a paper in the Journal of the Cleveland Engineering Society, Cleveland, November, 1912.

†Chief Engineer, Department of Public Service, Cleveland, Ohio.

Improvement of the Illinois & Michigan Canal, from the Chicago River to the Illinois River, is being advocated, although the canal is now practically abandoned. Mr. Norman Fraser, President of the Chicago Portland Cement Co., has asserted that this condition is due largely to the failure of manufacturers and shippers to realize the advantages offered by this waterway. Last year some experimenal trips were made by this company between La Salle and Chicago, using an old barge and steamboat. The time occupied was about four days. There was no saving over the railway rate, owing to the small cargoes (186 and 200 tons) and the antiquated craft employed. It is estimated that with the canal cleaned out to a uniform depth of 7 ft., and with locks increased to 170x35 ft., it would be possible to operate modern craft handling 2000 tons and making the trip in 2½ days, or somewhat better than the present railway freight service. A fleet for such a cargo would consist of a steel power boat ($18,000) and five steel barges, 140x17 ft. ($15,000 each), all of 6-ft. draft. It is thought that with a steady volume of traffic and good terminal facilities the saving in cost of transportation (estimated at 5 mills per ton-mile) would warrant the investment. As to the improvement work, it is stated that $1,000,000 would suffice to rehabilitate the canal, which is owned by the State of Illinois.

FIELD AND OFFICE

A Pipe-laying Derrick and Power Backfiller for Trench Work

The great amount of trenching required in the construction of sewers, drains, water mains, etc., has led to the development of numerous machines and devices to facilitate and expedite work of this kind. Several forms of trench-excavating machines are in use,* and there are other devices used in connection with this work. We illustrate herewith two such devices, invented by F. J. Monahan for use in his contracting work; he is also the inventor of a trench-excavating machine (ENGINEERING NEWS, Mar. 16, 1911) and steel forms for concrete catch-basins and manholes. These various devices are now being manufactured and put on the market by Wm. Heggie, of Joliet, Ill.

PIPE-LAYING DERRICK—In laying sewer pipe and drain tile in trenches there is often much loss of time and breakage of material due to inefficient handling of the pipe, and this is especially the case where large and heavy pipes are being handled. Many contractors rig up home-made derricks, but Fig. 1 shows a simple portable device manufactured for this purpose, as noted above. It is shown at work immediately behind a trench-excavating machine. The cranked axle *A* is carried by a pair of wheels riding on planks laid at each side of the trench; upon this axle are mounted standards with bearings for the shaft of the drum *B*. A brace-frame *C* supports the derrick in position, and its legs are swung up clear of the ground when the derrick is to be moved. The wheels are 38 in. diameter and 6 ft. apart, and the axle and brace-frame are of 2-in. pipe. The rope drum is 25 in. long, and operated by a crank handle *D*, with a single pair of spur gears. To the end of the rope is attached a U-shaped pipe-hook *E*, and the descent of the load is controlled by a rope brake on the drum. The derrick weighs 150 lb., and has a capacity of 1 ton.

*"Engineering News," Feb. 23, Mar. 16 and Apr. 6, 1911.



FIG. 1. A LIGHT PIPE-LAYING DERRICK



FIG. 2. A POWER-OPERATED SCRAPER FOR BACKFILLING TRENCHES

POWER-OPERATED BACKFILLER—In backfilling trenches, a somewhat common practice is to hitch a horse to a rope attached to a scraper on the opposite side of the work, the scraper being hauled forward by the horse and moved back by hand for the next haul. A more rapid and effective method is to use a light hoisting engine to operate a scraper, as shown in Fig. 2. Here a 10-hp. engine and boiler are mounted on a frame carried by small flanged wheels on a short piece of portable track of 5½-ft. gage, but the machine may be mounted on traction wheels and may be made self-propelling. The scraper is a large flat board (with no pan), fitted with arms for attaching the chain bail, and having a wheel at the back for convenience in running it back from the trench. It is operated by two men at the handles, by which the scraper is tilted back to take its load and tilted forward to throw the material into the trench. A third man operates the engine. For filling a trench in soft and caving ground the rope was led through a snatch-block and attached to a drag scraper, operating this longitudinally so as to spread the caving material over the pipe already laid, and to trim out the bottom for the new pipe. It is stated that in ordinary backfill work one machine will do as much work as five or six scraper teams, with two or three men to each team, and that in a working shift of ten hours it has filled 200 ft. of 33 in. trench 12 ft. deep.

A Tamping Machine for Backfilling Trenches

The backfilling of trenches is a troublesome problem on work in paved streets, owing to the difficulty of getting the fill so thoroughly tamped that there will be no settlement of the paving when relaid over the trench. This problem is encountered by contractors and municipal authorities as well as by engineers, but with the class of labor commonly employed it is not easy to get the work done well or in the way specified.

To meet this difficulty, and at the same time to reduce the labor cost, a tamping machine has been introduced and has been used in a number of cases with satisfactory results. This machine is shown in the accompanying cuts, Fig. 1 being a side elevation and Fig. 2 an end elevation of the machine at work on a pipe trench. The machine consists of a truck carried by two 36-in. wheels (and supported at the rear by legs), upon which is a long frame or sweep, which is pivoted over the truck axle and is composed of a pair of 3-in. steel channels stiffened by truss rods. It is swung to and fro horizontally to cover the desired width. This frame carries a small gasoline engine at one end, while at the forward end is a train of gearing which gives a vertical reciprocating motion to a long bar or timber fitted with a tamping head. The wheels and the shoes on the rear legs have a vertical adjustment of about 8 in., so that the machine can be set level when working close to the curb, with one wheel and shoe on the sidewalk.

The vertical beam or lifter bar is of hardwood, faced on two sides with small steel channels which slide in the channel guides supported by diagonal braces from the frame. The lifting mechanism consists of two rolls placed on opposite sides of the lifter bar, geared together and driven from the engine by a belt. The front roll is pressed against the tamper by coiled springs, and a portion of the circumference of each roll is cut away so as to release the tamper automatically. Thus the tamper is gripped, raised and dropped once with each revolution of the rolls, the length of stroke being 2 ft. The number of strokes is from 50 to 60 per minute. When not in use, the tamper is held in the raised position by a pair of dogs or grips attached to the guides and held against the bar by springs. When it is desired to stop the tamper (while the engine is running), these dogs are released or thrown into action, and they then prevent the tamper from dropping at each revolution of the rolls; the rolls will then raise it to the full length of its travel, but as the size of the tamper bar is reduced near the bottom, the rolls lose their contact with the bar, which then remains held in the raised position by the dogs.

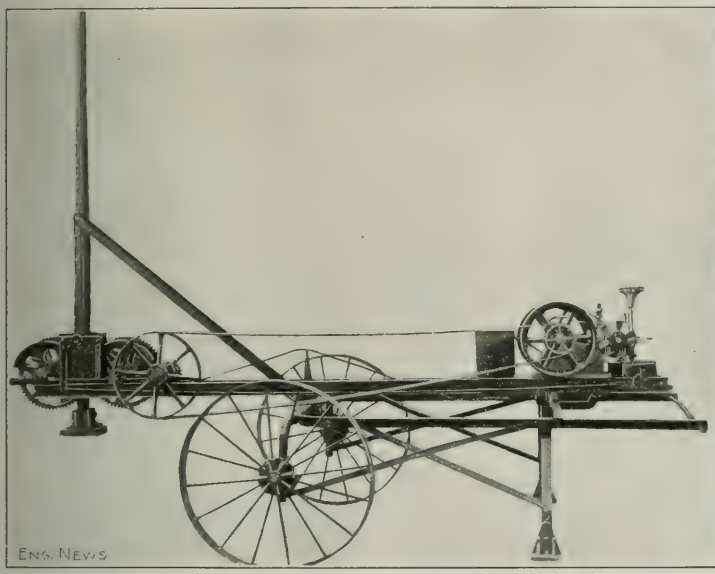


FIG. 1. POWER TAMPING MACHINE FOR TRENCH AND SURFACE WORK (Lourie Mfg. Co., Springfield, Ill., Builder).



FIG. 2. TAMPING MACHINE AT WORK ON A PIPE TRENCH

When equipped with a 10-ft. bar, the machine can tamp to a depth of 6 ft. below the surface, which is considered sufficient for trenches as deep as 9 ft., owing to the force of the blow. The tamping head is 8x9 in., weighing 80 to 90 lb. The bar may be made 16 ft. long, enabling the machine to work to a depth of 12 ft. For the greater lengths the weight of the tamping head is reduced, so the total weight will not exceed 100 lb., the head being made sometimes of steel plates and angles instead of a casting. On small trenches and on surface work where the footing is good the machine may be handled by one man, but ordinarily two men are used, one on each side. It is stated that for surface work, two men with the machine can tamp 1200 to 1500 sq.ft. per hour, making one pass. In a 30-in. trench work, they can tamp ten layers in 40 to 50 lin.ft., making one pass over each layer (1000 to 1250 sq.ft.). The weight of the machine is about 950 lb.

Five of these tamping machines have been used by the

McCrary Excavating Co., of Atlanta, Ga., which states that their work is far superior to hand tamping; it is found that all the earth taken out is put back, and even after very heavy rains there has been no settlement. In one case where a trench was being filled by hand labor there were 23 shovelers and 23 tamping men; a machine was put on this work, with two men to operate it and one man to level the fill in the trench. Thus, 20 men were eliminated and the work was done more effectively. In fact, on this one stretch the saving paid for the machine in a few days. At Wilmington, Del., a machine has been used in filling pipe trenches, and Alexander J. Taylor, City Engineer, has stated that it appeared to do the work for about six shovelers; in some cases where the pipe did not exceed 10 in. diameter all the excavated earth was put back, so that none had to be hauled away. The Central Indiana Gas Co. has used the machine, and the Minneapolis Gas Light Co. reports that the machine with two men does the work formerly requiring ten men. Five of these tamping machines have been used by G. M. Gest, of New York and Chicago, contractor for underground electric conduit work, and he has reported a saving of $8 per day per machine, as compared with hand work.

The machine is the invention of R. H. Staley, and is being manufactured and introduced by the Lourie Mfg. Co., of Springfield, Ill.

Erection Costs for a Double-track Railway Bridge

By M. A. O. Stilson*

The bridge whose erection costs are given in this article comprises three double-track through spans, each 154 ft. 6 in. long c. to c. The trusses are of lattice type. The piers are square to the track and trusses.

There were in place two old spans (single-track), which were taken out as the work progressed. For cutting apart they were blocked up on the falsework put in for the new spans. The grade of the new track was that of the old, the pier height above high-water allowing for the extra depth of the new floor-beams. The use of a derrick car enabled this work to go forward while the first new span was erected.

An overhead traveler (see Fig. 3) was used for the erection. It was assembled and raised from the old truss. The raising of a traveler becomes a simple and rapid task when old spans are in place to erect from, as the assembling can be in a position not far from the vertical, letting the upper frame of the traveler rest on the top chord of the old spans and finally pulling the small distance to a perpendicular with tackle just prior to joining the bents of the traveler. The traveler could also be raised from the flat floor of the falsework, by means of a jack-frame erected at the foot of the traveler legs. This takes nearly twice the time of the other method, and costs (a gang of 12 men can have a traveler framed and ready for use in three days with the help of a hoisting engine) about $300.

The piers of the new three-span bridge were so located that the masonry could be all completed, with the exception of a few bridge-seat stones to carry track stringers, before the arrival of the bridge steel, thus allowing the new shoes to be placed at once. A temporary trestle at the upstream side of the main line cared for the train movement, allowing the erection to proceed undisturbed by the traffic. Therefore, the falsework had to be proportioned for the trusses alone.

The height of the piers above mean low water was about 27 ft. The river bottom was a well washed gravel, into which a pile could be driven to a penetration of 5 ft. only with difficulty.

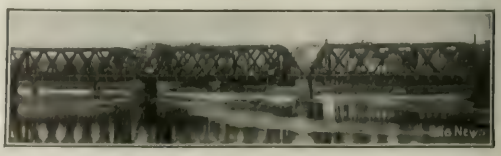
The sequence of operations in the erection of the bridge was as follows: (1) Ship equipment and materials to bridge site; (2) unload; (3) place hoister and compressor and house them; (4) put in falsework; (5) erect traveler and wreck old spans; (6) place and block floor-system and bottom chord, cambered; (7) erect web-members; (8) place end posts; (9) place top chord; (10) place bottom and top laterals, with portals and other small members, or release traveler to second span; (11) rivet up; (12) strike falsework and traveler; (13) load material and equipment.

Cost of Shipment.—The cost of shipment of equipment and material to the bridge site is an item varying in each case, and also depending on the terms of the contract with the company owning the bridge. If a railway company, the contract may include transportation and work-train service during erection, though these items are properly a part of the cost, no matter by whom paid. It is not unusual, however, for a charge of $25 per day to be incurred for a locomotive, flat-cars and crew, especially where the bridge members have had to be unloaded at a distance. The economy effected through the use of a derrick car capable of propelling itself and loaded flat-cars thus becomes apparent.

Cost of Unloading.—The unloading of the material and bridge members at the site or some adjacent point, while variable, will generally be covered by the expense of a derrick and hoister, its erection and a possible shift, if the ground available makes this necessary. In the present case the material for the three spans was unloaded in about three weeks, including delays, by a gang of eight men, one engineer and one foreman, about $200 per week for labor cost.

*23 Roseland Ave., Waterbury, Conn.





Figs. 1 and 2. Two Views of the Three-span Double-track Railway Bridge

Hoist—Placing the hoister, compressor and their boilers is comparatively a small item unless considerable falsework be necessary for support. In this case three bents of six piles each, capped and braced, with plank floor, were placed, and the power set, by 12 men and one foreman in four days, costing $200.

Falsework—The erection of the falsework, consisting of pile bents, capped and braced, floored with timbers parallel with the bridge and some plank, can go forward during the same period. The equipment of scow, pile hammer and hoister engine was able to drive 15 bents of 10 piles each (150 piles) in four days. The piles were delivered into the water above; they were of 25 to 27 ft. lengths, and were driven to a penetration of 5 ft. This gang consisted of one foreman, one engineer and four men, a labor cost of about $23 per day, according to rate of wages paid. The cost was, therefore, $92, or practically 62c. per pile in place. The piles cost 10c. per lin.ft. delivered above the work, or $2.50 to $2.70

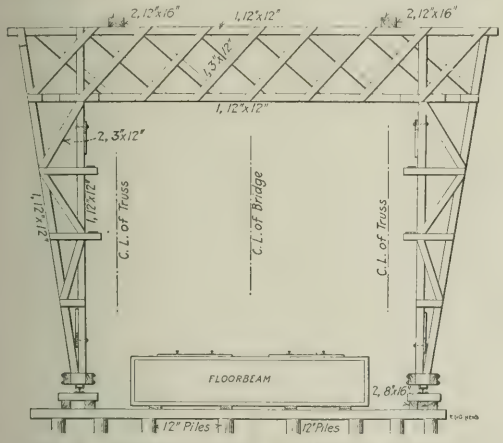


Fig. 3. Sketch of Bent of Wooden Traveler

apiece, making $482 the total cost of piles in place. (This figuring assumes that the equipment can leave the work in good condition, so as to be available at full value for other work.) Cutting off the piles, capping, boring and bracing, was completed in eight days by a gang consisting of one foreman and eight carpenters, at a cost for labor of $23.50 per day, or $188 total. This includes placing the timbers to carry the trusses, drifting them in place, and laying floor-plank and traveler track.

The labor cost of one span of falsework in place is thus $280. The cost of piling is $390, and of timber as follows:

30 caps 12x12 in. x 25 ft.	9,000 ft. B.M.	
12 saddles 12x12 in. x 8 ft	1,152	
50 stringers 12x12 in. x 25 ft	15,000	
120 braces 3x12 in. x 30 ft.	10,800	
80 blocks 8x8 in. x 8 ft.	3,411	
240 plank 2x12 in. x 12 ft	5,760	
Cost		
40 M at $30	$1200	
6 M at 25	150	
		$1350
Total Cost of Falsework		
lumber	$1350	
piles	390	
labor	280	
	$2020	

This gives $2020 cost of falsework of one span in place ready for setting steel. In the three-span bridge in question, the riveting of Span No. 1 was completed early enough to release the falsework for use under Span No. 3, except for piling.

Traveler—The erection of the traveler has been stated to cost about $150. It followed the placing of the falsework, using the old spans to erect from. The cost of the traveler itself was as follows:

1 foreman, $4	$ 4	
6 carpenters, $3	18	
4 days at	$22	$88
4 legs 12x12 in. x 48 ft.	2304 ft. B.M.	
4 batters 12x12 in. x 40 ft.	1920	
2 bott. chords 12x12 in. x 36 ft	864	
4 top chords 12x12 in. x 30 ft	1440	
4 top timbers 12x16 in. x 30 ft	1920	
16 braces 3x12 in. x 20 ft.	960	
24 braces 3x12 in. x 12 ft.	864	
4 diagonals 3x12 in. x 36 ft.	432	
4 sills 8x16 in. x 30 ft.	1280	
12 doz. ¾-in. bolts, etc., at 60 lb.		05. $36
4 flanged wheels, at 100 lb		03. 12
4 sets axles, bearings, etc., at 40 lb.		03. 5
Cost of traveler		
lumber, 10 M at $35	$350	
" 3 M. at 25	75	
hardware	54	
labor	88	
		$567

Removing Old Spans—The wrecking of the two old spans occupied one foreman with 12 men two weeks, the pieces of the members being taken away by the derrick car.

Erecting New Trusses—The floor-system of one span, including bottom chords, was put in place, blocked up, and bolted, by a gang consisting of two foremen, 18 men and one engineer in five days, assisted by a derrick car with one engineer, one foreman and eight men, who brought the bridge members from the storage yard in proper order.

The truss members and hanger posts were placed in two days, and the shoes, end posts, and top chords in two days, the pins being driven and the connections fitted up. The portals and lateral bracing, top and bottom, were placed in two days, fitted up ready for riveting.

The riveting was by pneumatic hammers acting under a pressure of 90 to 100 lb. from a Franklin air compressor. A gang consisted of four men, eight gangs being operated during the major portion of the work, with one foreman and one supply man. The riveting of the three spans was completed in 39 days, or an average of 13 days to a span. A total of 60,000 rivets were driven in the three spans, with an average of less than 3% cut out and redriven.

Striking and Loading—The striking of the falsework followed the riveting of its span. The material was then loaded for shipment. The equipment, including traveler, pile-driver, and scows with hoister, was then loaded, freeing the hoisting engine, air compressor with tank, pipe and boiler.

Appended hereto are tabulated the labor and lumber items, showing at a glance the approximate cost per span and per ton. In a bridge of three or more spans the progress of one span's erection so laps that of the succeeding one, under good management, that the inference that the erection cost of a single-span bridge is 33% would lead to some error, as several of the general charges would be unchanged for one-third the number of spans.

The assumption has been made that an equipment such as has been described was in the hands of the erection company. But since it would be proper to add a charge not only for depreciation, but for interest on the invested funds, a value on which to base such is also given, the

items of which are mostly estimated, although some are actual costs. A sketch of the traveler is also given. The traveler consisted of two bents suitably braced, supporting four timbers 12x16 in. x 30 ft., two over each truss, to carry the blocks of the main falls and smaller tackles.

Exclusive of the time taken to unload the bridge members at the site the erection of the bridge was completed in nine weeks from the arrival of the forces. This includes wrecking the two old spans.

ERECTION COST OF THREE-SPAN DOUBLE-TRACK RAILWAY BRIDGE.

First cost of equipment		
Air compressor	$800	
Tank and pipe	200	
3-drum hoister	1900	
8 coils rope	400	
Blocks, etc	550	
Pile-driver, scows and conductor	500	
Hammer, falls, etc	150	
2-drum hoister	1000	
Derrick car (est.)	4000	
Traveler	600	
Total	$10,100	
¼ year interest, 6%	$202	
¼ year depreciation, 10%	343	
		$545
⅓ for one span		$182
Labor cost of erecting span No. 3.		
Superintendent 30 days at $8	$240	
Foreman 38 days at $4	152	
Men 832 days at $3	2904	
Engineer 43 days at $3	150	
	$3446	
Unit cost (weight of span 587 tons)	$5.50 per ton	
Total erection cost of span No. 3		
Labor for erecting	$3446	
¼ cost erecting hoist	70	
¼ cost erecting traveler	50	
¼ cost unloading material, etc	200	
¼ interest and depreciation	182	
Total erection cost for 587 tons	$3948	
	$6.72 per ton	

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Novel Construction of Concrete Foundations*

By W. G. Kirchoffer†

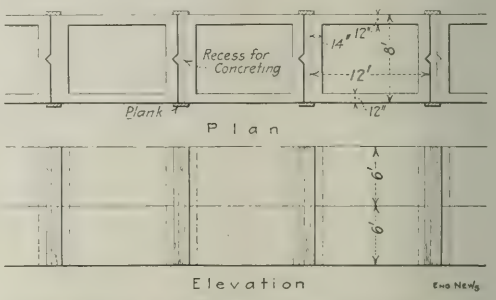
This refers to a method of constructing reservoir walls and foundations for small dams, bridges, etc., where the materials to be excavated are water-bearing sands and gravel, quicksand or other materials which will not be self-supporting and would require complicated or expensive sheeting and bracing.

For many years, large round wells and small storage reservoirs have been constructed of brick or stone masonry built upon a wooden or steel cutting shoe, the wall being carried up as its weight causes the shoe to sink with the excavation of the soft material. With reinforced concrete the trouble from cracking of the walls due to unequal settlement is largely eliminated. Simple and inexpensive forms may be used and the steel or wooden shoe omitted. I have made the forms of 1-in. matched flooring nailed vertically to horizontal ribs built of two thicknesses of 2-in. plank. The inside form braces itself and the outside form may be held by two rods or cables with turnbuckles.

When the surface material is solid for five or six feet the excavation usually precedes the starting of the wall. Then the forms and reinforcing materials are placed in the excavation and a ring of concrete is poured. This is usually allowed to set for a day before removing the forms or starting the excavation again. As the excavation is carried down, the walls will sink and the forms may be placed again at the top of the completed portion and again filled. This process can be carried on until the desired depth is reached. Where large quantities of water or quicksand are encountered, it will be necessary to use a power pump continually. Reservoirs built after this method were constructed successfully and economically at Marinette, Mich., and at Medford, Merrifield and Stevens Point, Wis. The materials excavated varied from water-bearing sand to boulder clay. The diameters were 35 and 50 ft. and the depths ranged from 15 to 25 ft.

The success of this method led to its use for the foundations of a concrete dam about 200 ft. long and 8 ft. high, upon the Kickapoo River at Viola, Wis., for the Viola Light & Power Co. On account of the size of the job and the remoteness of the place, it was necessary to do the work by force account and as cheaply as possible. For these reasons and because of the small amount of equipment available, the writer adopted the same method of construction for the foundation as he had used on the reservoirs, except that the forms were made to inclose a series of hollow rectangular blocks 12 ft long, 8 ft. wide, 6 ft. high and 1 ft. thick, as shown in the accompanying cut. These forms were of 2-in. plank, and built in a substantial manner so that they could be used several times. The concrete was reinforced with ½-in. round rods, spaced 1 ft. vertically and 3 ft. horizontally. The water in the river was from 1 to 3 ft. deep. The work was begun on the flats along the river and as excavation progressed the dirt was used for a cofferdam about the forms.

These rectangular sections were constructed end to end as they were sunk, and as soon as the top of one came close



Foundation for a Concrete Dam; Box Sections Sunk by Open Excavation

to the top of the water, another section was poured on top of it until a total depth of 12 ft. below the river level was reached. The material to be excavated was sand, gravel and clay, with some old logs and slabs. The openings between the blocks or sections were closed by pouring concrete in the V-shaped openings left at the ends. The space within the wall was filled with gravel, stone and clay. The whole foundation, including an apron in front of dam, was then covered with a slab of concrete 18 to 24 in. thick upon which the dam is to be constructed.

This method appears to be of much practical value where a full contractor's equipment is not available and work must be done at a minimum of cost and with inexperienced labor. It has the advantage of being cheap, it saves time, it eliminates many dangers of open excavation held by curbing and bracing, it is effective and the work is easily put in by men of little experience.

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Three Radical Innovations in a New Steelwork Specification

A specification issued recently by the American Bridge Co., intended to apply to the design and construction of steelwork for buildings, towers, etc. (but not bridges), contains some clauses likely to arouse much attention among structural engineers. The company will use this specification for all of its own structural designing, and aims to secure its use by other designers. Copies may be secured by those interested, on application to the American Bridge Company of New York, 30 Church St., New York City, or any of its district offices. We quote here the three most radically new items of the specification.

1. A New Column Formula.—The column formulas

*Abstract of a paper read at the special meeting of the Illinois Society of Engineers and Surveyors, at Chicago, Jan. 22 to 24.

†Consulting Engineer, Madison, Wis.

in use today, giving the permissible unit-stress p in terms of the length-ratio $l \div r$, are of three kinds:

a. Formulas of the Gordon type; e.g.,

$$p = \frac{15{,}000}{1 + \frac{l^2}{13{,}500\, r^2}}$$

b. Straight-line formulas; e.g., $p = 16{,}000 - 70\,\frac{l}{r}$.

c. Broken-line formulas composed of two straight lines; e.g., the formula $p = 16{,}000 - 70\,\frac{l}{r}$ limited by the formula $p = 14{,}000$ as upper limit.

The new structural specification of the American Bridge Co. prescribes a *three-segment* formula, as follows:

For $\frac{l}{r}$ up to 60,*

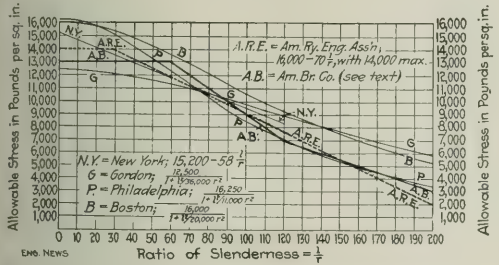
$$p = 13{,}000 \text{ lb. per sq.in.}$$

For $\frac{l}{r}$ from 60 to 120,

$$p = 19{,}000 - 100\,\frac{l}{r}$$

For $\frac{l}{r}$ from 120 to 200,

$$p = 13{,}000 - 50\,\frac{l}{r}$$



Some Well Known Column Formulas and the New Three-segment Formula

The third segment has half the slope of the middle segment. If the main formula (that of the middle segment) were continued beyond 120 it would give a unit-stress of zero for $\frac{l}{r} = 190$, whereas the upper-range formula as prescribed gives $p = 3500$.

This set of three formulas when plotted on the base $\frac{l}{r}$ follows the general course of formulas of the Gordon type, but in use it differs from such formulas quite materially in the region $\frac{l}{r} = 40$ to 80.

The application of the formula is affected by the following clause found in another part of the specification:

The effective or unsupported length of main compression members shall not exceed 120 times, and for secondary members 200 times, the least radius of gyration.

*This does not refer to short blocks, but only to compression members long enough to be classed as columns. The compression allowed by the specification for pieces other than columns is 16,000, which figure is also fixed as the bending unit-stress. Pin and rivet bearing is 24,000.

Thus the formula $p = 13{,}000 - 50\,\frac{l}{r}$ is to be used only for secondary members.

2. Proportioning Plate-girders by Section Modulus—According to common practice, the flange section of plate-girders is determined like that of trusses or lattice-girders; i.e., the external bending moment is divided by the distance between centers of gravity of the flanges or chords (which operation gives the total stress in the flange), and then each flange is proportioned for its stress by making the proper application of tensile or compressive unit-stresses to net or gross cross-sections, respectively. This practice is subject to slight variations, some engineers counting the web-plate as resisting part of the external bending moment, while others disregard the web in considering bending. The new American Bridge Co. specification substitutes an entirely different procedure, described in the following simple clause:*

Rolled I-beams and channels and built-up members used as beams and girders shall be proportioned by their moments of inertia.

We are informed that this refers to *gross* moment of inertia, i.e., computed from gross sections. It is intended to be used for finding the section modulus I/c; where the distances from neutral axis to the extreme fiber on tension and compression sides differ, the largest c is to be taken, and thus the least I/c obtained. This latter is then multiplied by the allowed bending unit-stress (generally 16,000), giving the moment value of the girder.

Plate-girders being usually symmetrical or nearly so, the results from the use of the method specified are expected to be about the same as those of the common method. The specification states that members shall preferably be of symmetrical section.

The plate-girder clause is affected by a provision that when the unsupported length of compression flange (l) exceeds 10 times its width (b), the unit-stress in this flange must not exceed $19{,}000 - 300\,\frac{l}{b}$; and l must never exceed 40 b.

3. A New Set of I-Beam Connections—The end-connection angles of I-beams and channels which have long been listed and shown in mill handbooks are replaced in the present specification by a new set, with the important feature that, for the larger beams, only one line of rivets is used in each angle-leg. All beams over 10 in. deep have 4x4x$\frac{7}{16}$-in. or 4x4x$\frac{1}{2}$-in. end-connection angles, with three rivets for 12-in. beams, four rivets for 15 and 18 (and 20), five rivets for 20 and 21, six rivets for 24, and seven rivets for 27-in. beams. Beams 8, 9 and 10 in. deep have 6x4x$\frac{3}{8}$-in. angles, with two rows of two rivets each in the beam leg; beams 5, 6 and 7 in. deep have also 6x4x$\frac{3}{8}$-in. angles, but with two rows of only one rivet each in the beam leg.

Together with a set of drawings and capacity tables of these connections, a set of rivet stresses is given for beam connections, which contains one item different from the stress allowance given elsewhere in the specification. The bearing value for "inclosed" condition (i.e., on a web gripped between two connection angles) is given as 30,000 lb. per sq.in. This applies to shop rivets only. It is stated that this high value, as against the 24,000 bearing value for shop rivets not "inclosed," is permitted "be-

*Based on unpublished tests, we are informed

cause of the increased efficiency due to friction and grip."

These connection angles are stated to have been designed for bearing and shear *without considering moment;* and the allowable reactions listed for them are stated to agree with tests made under ordinary conditions of use. Such tests have not been published, so far as we know.

Other Features—The specification has other items worth attention, but not radical in the sense of the three above cited. Such are: Loads include impact, *if any;* but no rule for impact is given. Wind during construction is to be taken at 30 lb. per sq.ft., but wind on the finished structure at 20 lb. Latticing of struts is to be proportioned for a shear equal to 2% of the strut load.

❋

An Improvement for the Micrometer-Microscope

By Wilmer Souder*

The precision now required in the manufacture and test of various commercial instruments and materials has made the microscope an absolute necessity in every research and testing laboratory; its use is so general and constant that any improvement in the accuracy of its results or reduction in the time required for making observations is worthy of consideration.

There are various types of micrometer-microscopes; however, those most generally used for extreme accuracy are equipped with movable cross-wires, or spider-lines, beneath the eyepiece, and these may be moved across the image by means of a graduated head or nut (usually graduated to 100 parts around its circumference) turning on a screw attached to the frame supporting the cross-wires.



New Micrometer-Microscope Scale

After calibrating the pitch of this screw, in terms of the magnifying power, distances may be determined by making settings of the spider-lines on opposite sides of the image. These settings are made by bringing the spider-lines up to the image on, say, the left side, and taking the reading on the graduated head, then rotating the graduated head until the line appears to touch on the right, taking a second reading. This is usually repeated on the right, finally returning to the left, to insure that the initial position of the object has not changed. In many cases four settings are made on each side. The difference between the averages of the right and left readings, plus the whole number of turns, multiplied by the proper factor (called "screw value") gives the desired distance.

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tween 0.004 and 0.005 in. The new scheme consists in using a gage to fit magnified images of objects ranging between these values.

The gage consists of two diverging lines replacing the single spider-line, and so set that they caliper the image of the wire just as the original line touched the image. The divergence is such that a wire calipered at the wider end has a diameter of 0.005 in., while one calipered at the narrower end has a diameter of 0.004 in. Now if the intervening positions can be read with sufficient accuracy, the diameter may be determined to any degree of accuracy. To facilitate in taking these readings, I ruled eleven auxiliary lines beside the two diverging lines. The entire scale is ruled on a piece of cover-glass 19x19 mm. Its general appearance is shown (magnified) by the accompanying figure. This is mounted upon the regular spider-line frame of the microscope. After calibrating the lines, it is then only necessary to read the point along the auxiliary scale at which the image is exactly calipered by the diverging lines. If we estimate to tenths of a division on the auxiliary scale, we estimate the diameter to 0.00001 in.

The proper divergence and distance between lines may be readily computed by simple trigonometric formulas for any magnifying power. The lines are best ruled with a diamond attached to the circular dividing engine. Lines for limits other than those given above may be readily ruled.

Such a device is now in use in the U. S. Bureau of Standards. Some of its demonstrated advantages are given below:

(1) The variation in results, due to different observers determining the same distances, are decreased, on an average, by more than 30%. This would seem to indicate that it is even more accurate than the old method. It must be remembered also that observers taking these readings were experienced in the use of the old system and that this was absolutely new to each.

(2) The proper allowance for the width of the lines is more easily made.

(3) One sets to both sides of the object at once, consequently variations due to unequal lighting are reduced.

(4) The time required for measurements is only 25% of the original time required.

❋

An Exponential Computer

By Louis Ross*

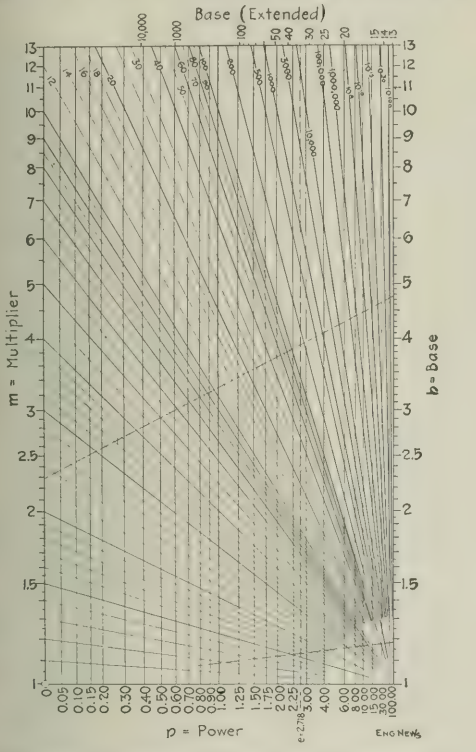
Many problems that the engineer meets in practice require the solution of equations with mixed or fractional exponents. Among these problems may be mentioned: flow over weirs, friction of water flowing in pipes or in open channels, friction between solids, wind and frictional resistance of moving bodies, belting problems in power transmission, the laws of moving gases and generally of the properties of steam and gases, laws of magnetic properties of metals, hysteresis losses, electrical transmission of energy. There is also the natural law of variation according to the $x = 2.718$ power, which enters into a large field of the physicist and electrical engineer. A large part of all experimental laws are most accurately expressed by exponential equations. The actuary and accountant have the compound-interest problem

[illegible]

[illegible] Sutter St. San Francisco, Calif.

to contend with. This list may be extended into wider ranges; in fact, nature has not made its laws follow our arbitrary integral exponent system; it is only the inconvenience of handling numbers with fractional exponents that has led the engineer to substitute for the exact laws other arbitrary approximate laws employing terms of simple integral powers.

The slide-rule handles primarily numbers having an exponent of 1, and by a double setting exponents of ½



EXPONENTIAL COMPUTING CHART, FOR SOLVING $n = mb^p$
(Designed and copyrighted by Louis Ross.)

and 2*. Outside the defined range no direct solution is possible. To fill the special needs of other exponents, special tables have been computed, and printed in the forms of handbooks giving powers especially used in a given field, as the $^3/_2$ power table, and the recent 1.7 power table issued to cover the magnetic field.

An Exponential Computer has recently been devised by the writer, which consists of a straight-line chart and a straight-edge, or better a fine hair-line drawn on a strip of transparent celluloid. This computer multiplies and divides, like an ordinary slide-rule, but in addition it gives at one setting any power, from 0 to infinity, or any root of any number; it will also, at one setting, multiply any number by any root or any power of any other number. Trigonometric or any other special functions can be handled by labeling one line on the chart with a scale of those functions.

*Log-log slide-rules handle fractional exponents. See Eng. News, July 8, 1909, p. 40.—Ed.

Expressed algebraically, the Exponential Computer will solve at one setting any unknown in the equation $n = mb^p$, and with two settings any unknown in the equation $x = m^y b^p$.

A reduced copy of this chart is given herewith. For the purpose of showing more clearly its construction and use, most of the intermediate coördinates have been omitted; the readings made in the worked examples are correspondingly crude.

Referring to the diagram, the left and right edges, labeled m = *multiplier* and b = *base*, respectively, carry logarithmic scales, and they are drawn any convenient distance (L) apart. The vertical lines are drawn at distances from the left represented by $L \frac{p}{p+1}$, where p is the power or exponent, indicated at the bottom. The base scale at the upper right corner is extended by folding it over the top marginal line.

The use of the diagram is based on the construction explained above, which is such that a line across the b and m scales cuts the vertical p line at the diagonal $n = mb^p$; i.e., any straight line across the diagram passes through the three points b, m and the intersection of p with the diagonal n.* Hence, pass a straight line across the diagram, and read whichever one of the four factors is unknown; two points being determined by the known factors, the third point solves the unknown.

EXAMPLES—Two positions of the straight-edge are represented by dotted lines in the illustration. The dotted line near the middle is cut by a dash in its left half, this intersection representing a reading of the formula $3.44 = 2.27 \times 4.76^{0.87}$. Any three of the elements of this formula serve for obtaining the line and the point where the fourth element may be read. Similarly, the dash in the right half of the dotted line marks the point which determines the relation $500 = 2.27 \times 4.76^{3.5}$.

The dotted line at the bottom of the sheet passes through $m = 1$, and solves equations of the type $n = b^p$. Thus, to find in how many years money will triple at 18% compound interest, the equation is $1.18^p = 3$. The dotted line passes through $b = 1.18$; where it cuts the diagonal $n = 3$, read $p = 6.6$ years. Likewise, to find how many years it will take money to increase 50% at the same rate, read on the same dotted line, at its intersection with $n = 1.5$, $p = 2.4$ years.

To make up a table of numbers raised to any particular power it is only necessary to draw a vertical through that power; pivot the straight-edge about $m = 1$ (lower-left corner), set its lower end on any number in the right-hand scale, and at the intersection of the straight-edge with the power vertical read the answer. Thus the power $e = 2.718$ has been indicated on the diagram by a vertical dash line. By its aid one reads on the lower dotted line $1.18^e = 1.6$.

The diagram has a pleasing mathematical finish in that it contains the full scope, from 0 to infinity, of each scale; and a still more pleasing practical aspect in that the most used range of powers and numbers is by far the most open and accurate. A scale of, say, tangents may be placed just above and parallel to the m scale, on the extension of the diagonals, for use as a multiplier; or below the base, if it is to be raised to any power.

The b and m scales need be extended to the value of 10 only; in the diagram they have been plotted to 13 to recover the space lost by the convergence of the lines in the lower right-hand corner.

The extended base (at the top, for $b = 13$ to 10,000) can be used only with $m = 1$. For any other value of m, first find b^p, then multiplying this by m, using the 1 line for this last multiplication.

*The proof can readily be derived by the interested

The "Rainy Day" Theory of Office-work

(A plea for more office men in the field office on construction.)

By "Construction Engineer"

Why is it that in the matter of keeping up the records in the field offices on construction the "rainy day" fallacy still obtains to such an extent?

The theory underlying this is that the work of cleaning up the hundred and one little odds and ends which accumulate rapidly and unceasingly on any job will be done by the field party on the days when outside work is impossible. As it works out in practice, however, all members of the field party have their minds centered on the construction work, which is the *live* part of the job, and they find that a strong effort is needed to concentrate on a page of notes. The result is that unless the head of the party supplies a constant stimulus to work, the men under him are apt to carry their responsibilities very lightly and to regard the day's work as a formality beginning at eight and ending at five. The head of the party always has plenty to do, however, and if he kept the rest steadily and intelligently at work all day long he could do none of his own pressing work. The result is that the men chafe at the confinement, their attention lags, and they soon become restless and noisy, simply because they are essentially out of their element. The day passes and little real progress is accomplished.

In the winter season there is a little better opportunity for organized effort under this theory, but even in that season it does not always work out. There is always some field work to be done, and vacations, overtime and holidays break into the working period. Usually the result is that winter slips away with much left undone in the way of cleaning up defective records and making notes and drawings systematic and accessible.

Why not provide in the original organization an office man whose business it shall be to see that the notes and records are in proper form and are kept up to date? You say that this would add to the cost of construction. Does it really do so? Consider what is very likely to happen on the usual job which lacks such an office man. Everything runs along smoothly during construction, and after two or three seasons the work draws to a close, and the final estimate is taken up. The notes are gone over and duplications appear, with too much difference to be ignored. Conflicting elevations bob up in the most unexpected places without explanation. Owing to the rush of daily routine, the little side notes were not jotted down, and their absence is now fatal. At the time the notes were taken everything, of course, was clear, but since that time it has grown cold and forgotten. The force has changed and probably no one is left who was on the job at that time and who might explain away the confusion. Under the circumstances the contractor must be given the benefit of the doubt. Little items of this kind here and there soon run up to a surprising amount of money, enough to account for a good part of the office man's salary had he been there to save just such losses.

Or, assume that at last the estimate is out (probably overdue even then) and the contractor's extra bills are taken up. One item in these is found to cover, say, $1500 worth of work which you are morally certain should not be allowed. On looking into the notes you find a couple of pages that cover the point, you feel sure, but unfortunately they have neither date nor heading. In this condition you are unable to prove your side of the case, and very likely the item will have to be allowed—an amount which would pay the salary of an office man for a year.

Surely there are good reasons for establishing the policy right at the start of keeping everything up to date in the field offices and providing the organization necessary to accomplish it. This arrangement will exert a wholesome effect on all who come within its influence, for, while habits of procrastination may often grow to large proportions unnoticed, it is just as easy to form habits of the very opposite character. Having provided the proper organization, let it be understood that things are not to be allowed to drift along and that all branches of the work must be kept up to date. There is a snap and go in the resulting atmosphere which all will feel, and the result will be increased efficiency.

❖

Current Observations With a Stadia Float

By B. L. G. Rees*

In conjunction with some protective bulkhead construction at the terminals of the Atlanta, Birmingham & Atlantic R.R., at Brunswick, Ga., it was necessary to make float observations at frequent intervals to determine the direction of the tidal currents across the location of the new entrance to the basin between the bulkheads to be constructed.

These terminals are located on the north shore of the East River about opposite where it joins the larger Turtle River, which flows into St. Simons Sound. The East River carries an abundance of fine light silt, particularly along the shallow shore water out of the main current. This silt is continuously moved about by the tides, and is readily deposited along the shores and where the current is retarded. After years of this silt deposit-

*Brunswick, Ga.: Resident Engineer for Barclay Parsons & Klapp.

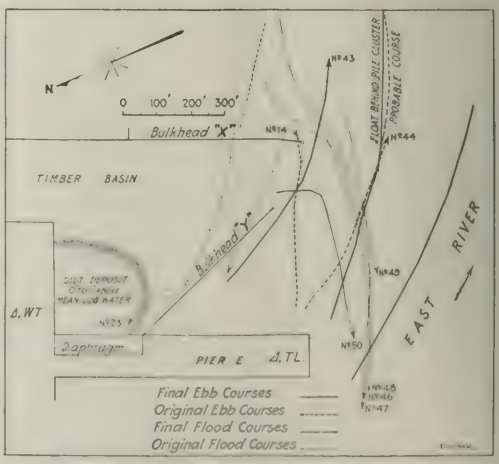


Fig. 1. Map of Area Covered by Current Observations, East River, Brunswick, Ga.

ing, the entrance and the basin at the terminal became so filled with silt that extensive dredging has recently been necessary to permit navigation. The new protective bulkhead construction completely closes this basin except for a width of 180 ft. between the bulkheads at the new entrance to the basin out near the current of the East River (see Fig. 1).

To be of greatest effect in clearing the basin of silt, the bulkheads were built with their outer ends on a line parallel to the average tidal current which carries the silt. Therefore it was necessary to make observations

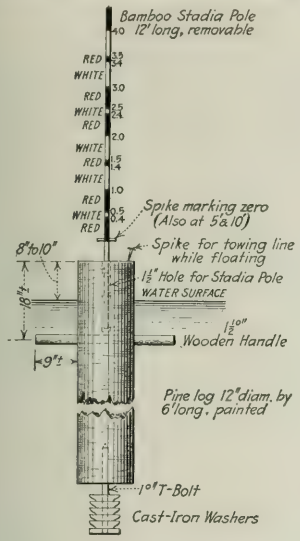


Fig. 2. Stadia Float and Rod

for determining the direction of the currents. As most descriptions of float observations are meager and lacking in practical details, special methods had to be devised for the work.

The controlling conditions were as folows: At the basin entrance the tide ordinarily ranges about 7.5 ft., producing a considerable current—about 2.5 nautical miles per hour in the main channel. The water surface is generally choppy and frequently is rough with unusual disturbances from the wash of steamers and tugs. The width of the rivers precluded the use of sighting-ranges; ranges were also out of consideration because the object of measurement was direction of currents rather than velocity. Only one instrumentman could be used, and therefore intersection methods were eliminated. The observations had to be taken when other work permitted, which meant that frequently the observations would have to be made in undesirable weather.

After some experiments a combination surface-and-submerged float was tried, but this was discarded because of complicated rigging, unsteadiness in surface disturbances and being difficult to handle with two men in a boat, on choppy water particularly. The float finally adopted and about to be described gave entire satisfaction with a long list of observations in all kinds of water disturbances.

The float is shown in detail in Fig. 2. It is made of a well seasoned white pine log from which the bark had been removed, about 6 ft. long and about 12 in. in diameter. It was thoroughly painted two coats of red lead. About 18 in. from the top a 1½-in. crossbar was driven through at right angles to the axis and made to project a foot on each side, to serve as a handle. Into the bottom end was driven a T-bolt holding cast-iron washers sufficient to submerge the float vertically until 8 in. to 10 in. remained above the water surface. Into the center of the top was bored a 1½-in. hole to form the socket for the stadia pole. For towing, a line was made fast under the handle, and while floating free this line was slipped over a spike driven into the top of the float log.

The stadia pole was the main feature of the complete float. It was made of a straight bamboo pole about 15 ft. long. Bamboo was selected for its strength combined with lightness and cylindrical form. The foot marks were painted alternately red and white enamel around the pole, while between 0.4 and 0.5 ft. points in each foot space there was painted a band of the other color to mark the half foot and serve as a gage in estimating the tenths. The zero-mark of the pole was made to be about 2 ft. above the water when the pole was in position in the socket of the float. The zero, 5-ft. and 10-ft. points were marked by 20-d. nails driven across the pole. Although this stadia rod reads only to tenths of a foot, the results are close enough for the practical purpose for which it was designed, when plotted on a scale of 100 ft. to an inch. Finer graduations for this work would only complicate the observations and would be useless on a float moving 1.5 ft. per sec. with the current and moving vertically with the surface disturbances.

The float proved to be very steady in rough water and was practically undisturbed by wind because of the light round pole which gave so little resistance compared to the submerged float. Serious disturbances were caused by counter under-currents around piers and piles, but it was seldom used in such areas.

The float was handled by one man from a motor boat. When being towed, the stadia pole was slipped from the socket in the float and laid on the deck. The line attached to the float under the crossbar was made fast to the forward cleat, allowing the float to come alongside well ahead of the propeller. Arrived at the point where a "run" of the float was to start, after the boat had stopped and the float had settled into a vertical position the pole was slipped back into place in the top of the float, the towing line dropped onto the spike in the top and the float swung into the current.

The observations were made from an elevated platform at the end of the long pier (*TL* in Fig. 1), which point was about on a line with the current direction across the approximate position of the entrance between the new bulkheads. A tide-gage was set where it could be read from the instrument at any time during the observations.

The observer set up at the station on the platform, oriented the instrument from the water tank (*WT* in Fig. 1) as zero, and attached a watch to the transit for noting the time of each stadia reading. The upper motion and the horizontal axis were clamped sufficiently to hold any set position. Using the vertical slow-motion screw the observer followed the stadia pole until simul-

FORM OF FIELD NOTES.
(Notes for observation No. 43, as shown on map Fig. 1.)

Lefthand Page						Righthand page
Date	Stadia	Hor. Angle	Time	Gage	Tide	Remarks
Oct. 26, '12	310	34°—40′	10:30A	4.9	Spring Ebb	Calm
43	310	42°—40′	:30½		H.W. 7:19	Bulkheads
Hadden,	350	57°—20′	:32		AM	Completed
Observer	410	69°—50′	:33½			
	490	78°—0′	:34½			
	540	80°—55′	:35			
	600	83°—0′	:36			
	710	84°—45′	:37			
	800	85°—35′	:38			
	910	85°—15′	10:39			Wind 112° 30′

44

taneous readings were made with both stadia wires. The stadia, time and horizontal angle were then noted. The tide-gage was read as often as necessary. This completed the field observation. After a little practice such observations were made at a rate a little better than a "shot" or reading to the minute. Readings on the float were continued until the distance was about 1000 ft., unless stopped for other reason.

Each run of the float or continuous set of observations was given a consecutive number, which served to identify it both in the field and on the plot. The date, weather, angle of the wind and observer's name then completed the field notes. The form of complete notes for one run of the float is shown in the table below, which is a copy of the notes taken for run No. 43 as shown plotted on Fig. 1. The angle of the wind was taken by swinging the telescope of the transit into the wind and noting the horizontal angle.

In the office the times of high and low water were computed from the tide tables, and from this time the hours and minutes of the quarters of the tide were figured, also adding the nature of the tide (spring or neap). The condition of the tide makes distinct differences in the current velocities and direction, for the same time after slack water.

The observations were then plotted by the usual methods for stadia surveys; then the number of the "run" was added (as shown in the small circles on Fig. 1), and the direction of the current was indicated by an arrow. The current velocities, while not precise, were reasonably accurate as determined by scaling a distance between known time points after the float was well started. The only method for accurate velocities would be by the use of a current meter.

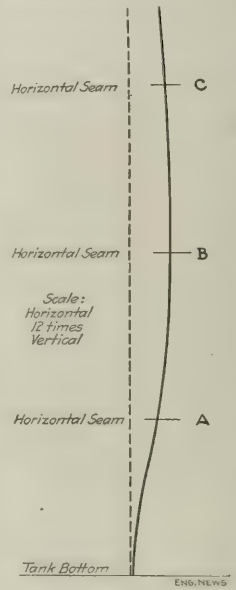
The map, Fig. 1, shows the area where over sixty "runs" as described have been observed during the past five months. The dotted lines are the plots of the typical currents before the diaphragm and bulkheads were constructed during the past summer. These currents show how and where the silt has been carried and deposited. They demonstrate clearly the need of protective bulkhead obstructions on lines to deflect these currents.

Construction work was completed about Nov. 1. The full [illegible] plots of observations made since the construction work was completed, show how successfully these currents have been deflected to clear the new entrance to the basin. About slack tide there are eddies formed across this entrance and any deposit will be slight and probably be scoured by the heavy tide. Around the outside of the entrance the line of demarkation between the clear water of the basin and the muddy water of the river is very definite.

Hardie Parsons & Klapp, 60 Wall St., New York, are engineers for this work, with the writer as resident engineer and G. Hadden as assistant engineer.

Tank Design. Behavior of a Large Gas-holder Tank

In connection with a further reference to the matter on tank design discussed on p. 170 of our Jan. 23 issue and p. 1153 of our Dec. 19 issue, an interesting statement on the distortion of a large tank is given in the following letter:



Sir—The further discussion of the proper design of steel tanks seems to require for its conclusion a comprehensive analysis of the elastic behavior of such a vessel under hydrostatic pressure.

Mr. Maguire's obvious error is that he conceives of the tank as being circumferentially elastic, but vertically inelastic. Its reasoning would require an assumption which conflicts with the established theories of the elasticity of metals and also with the known behavior of tanks under fluid pressure.

In order that our thoughts may be better directed to the problem, let there be assumed a steel tank 200 ft. in diameter and 45 ft. deep, such as would be used for a large gasholder. With the usual proportions, such a tank would have nine courses of plating in the height of the shell. These several courses would vary in height from about 4 ft. 6 in. at the bottom to about 6 ft. 6 in. at the top. The bottom course of plates is attached to the bottom of the tank by a heavy curb angle, which extends around the entire circumference. The top edge of the uppermost course is stiffened by a heavy curb, or in the case of a gas-holder by a circular girder. The thickness of the top course of plating is governed by practical considerations and is somewhat more than the stress conditions would require.

When the tank is acted upon by the hydrostatic pressure, there results a circumferential stretching of the metal which would be the same at all points from the top to the bottom, if it were possible to so proportion the tank plates that the unit-stress in the plating would be exactly the same at all points in a vertical plane. However, this is not the case. The bottom course of plating is restrained by its connection to the tank bottom and by the adhesion to the foundation, while the excess of metal, assisted by the top curb, or circular girder, reduces the expansion at the top to a very small increment.

Referring to the accompanying sketch, the heavy dotted line indicates the position of the tank wall before the application of pressure, and the heavy full line the position after distortion resulting from the pressure. The curve was deduced from observations made upon a very large steel tank, which contained some 15,000,000 gallons of water. It may be seen by inspection that the flexibility of the lowest course of plating in a vertical plane results in a diminution of the restraint of the tank bottom as the second course is approached, and that the maximum expansion is at or near the horizontal seam B. A computation of the circumferential stresses based upon the observed distortion of the plates indicated that the unit-stress at A was six times that at X, while the unit-stress at the upper edge B of the plate A-B was 55% greater than it was at the lower edge A.

I would suggest that Mr. Maguire develop his theory in connection with the above observed behavior of a large tank.

Yours very truly,

HERBERT W. ALBIGH.

Engineering Department, Consolidated Gas Co.

New York City, Feb. 4, 1913.

Unit Costs of Removal of City Refuse by contract in Washington, D. C., during 1912 were: Garbage, per ton, $1.44 unless per cu.yd., $0.30; miscellaneous refuse, per cu.yd., $0.14 [illegible] per bbl., $0.25; dead animals, each, $0.62.

NOTES

A Steam Shovel's Hard Job is well illustrated in the accompanying view sent us by Albert J. Himes, Engineer, Grade Elimination, New York, Chicago & St. Louis R.R. at Cleveland, Ohio. Mr. Himes writes:

The photograph shows an 8-ft. circular sewer encountered by a steam-shovel in excavating for the depression of the N. Y., C. & St. L. R.R. tracks at East 105th St., Cleveland. Through some misinformation the sewer was supposed to be about six feet lower, and the shovel coming upon it unexpectedly in the middle of the night, was obliged to break its way through the sewer or suspend work until the sewer



AN 8-FT. CONCRETE SEWER CUT THROUGH BY A STEAM SHOVEL

could be removed in some other way. The volume of flow through the sewer was exceedingly small and there was no objection to breaking through. This the steam shovel did successfully although the sewer was constructed of a first-class quality of concrete reinforced by 1½x⅜-in. flat bars 15 in. c. to c. placed transversely and five ½-in. round bars in the top placed parallel with its length. The shovel was a 70-ton, Bucyrus pattern.

Moving a Drag-line Excavator—After a drag-line excavator has been standing in one position for some time without being moved there is a tendency for the rollers to settle into the planks. This will make the moving of the excavator quite difficult and this condition is augmented by the collection of dirt and small pebbles beneath the rollers. It is also found in many instances that the planks will settle down at the point of contact with the rollers and the outer ends will raise, which practically necessitates starting the machine up hill when moving it. When an excavator is found in this condition it will be a very difficult job to pull it ahead with a steady pull of the cable, in fact the cables are likely to be snapped because of the tremendous strain put upon them.

The proper procedure, after the chock and braces have been removed and the bucket has secured a good hold in the material ahead, is to throw in the clutch and then to slowly open the throttle until a good strain is obtained upon the cables, when the clutch should be quickly thrown out. This will permit the machine to return to its former bearing and go a bit beyond. By again applying the strain on the cable at the proper moment the machine can be rocked back and forth on the rollers until the latter are clear of the rut where they had settled into the planks. The machine will then move forward easily. This method has been found very satisfactory and is a great saving both in time and in repairs over the method of pulling straight away.—["The Excavating Engineer," January, 1913].

Recent Developments in Surveying Instruments include a compass-testing device and a plane-table orienting device. These have been introduced in the topographic service of the U. S. Geological Survey, and were described by E. E. R. Tratman (Engineering News) in a paper dealing with modern designs of engineering instruments, which was read at the annual meeting of the Illinois Society of Engineers and Surveyors, at Chicago, Jan. 22-24. The compass device is for testing all compass needles before they are sent out for field work. It has been found, as a result of systematic tests, that many compass needles (even when received new from the maker) are deficient in magnetism. Under the new system, every compass owned by the Survey is numbered, and before it goes out for use it is tested with a standard compass. The deflection of the standard compass while swinging freely, caused by the needle under test when placed in a fixed direction and distance from it, is noted and recorded. A later test of the same needle will indicate its quality. If it is made of a poor grade of steel or is badly tempered, it will probably lose a large part of its magnetism. If the loss is excessive the needle will be replaced by a new one. After each test the needles are remagnetized by inserting them in a solenoid, after which a second test is made and recorded.

A simple device for orienting the plane-table without the use of compass needles was developed during 1912 and adopted for use in all areas where local conditions are such that variable declination may be expected. This is the D. H. Baldwin solar chart, being named after its inventor, who is a topographer of the Survey. It is based on the principle of a sun dial having a vertical gnomon or stylus. The paper chart used has on it all the data needed for laying off the proper angle for any hour of the day and for any day of any year in this century. Although on first sight the chart appears quite complicated, in practice it is found both simple and rapid. While the sun is visible the table can be oriented with it in less than the time required for a swinging compass needle to settle.

Adhesion of Old to New Concrete—A Paper by H. St. G. Robinson before the Institution of Civil Engineers in London, entitled "Experiments on the Adhesion of Old and New Concrete," set forth the results of a short set of experiments on this subject. The author tested a number of prisms of concrete as cantilevers and noted the relative efficiency of joints formed under different conditions. The standard prism to which all the others were compared was molded in one piece and four types of joints were tested, six specimens being prepared for each type. Assuming the solid prism to have an efficiency of 100%, the following were the results for the other series: (a) Face wetted only, 38.3%; (b) face roughened and wetted, 56.2%; (c) face roughened and grouted, 85.5%; (d) face treated with acid, 82%. The four types are described as follows: In "a" the faces of the seven days' old concrete which constituted the two separate parts of the prism were merely washed and well wetted prior to the imposition of new material. As these faces had been molded against the somewhat rough softwood board they were fairly open and coarse, and the somewhat high efficiency obtained with these joints is due to this roughness. In series "b" the faces were roughened with a chisel, all the loose material cleared away and the surface thoroughly wetted. In series "c" the faces were prepared first as in series "b," and then were washed over several times with a thick wash and a semiliquid cement grout, the new concrete being immediately applied. In series "d" the faces were thoroughly cleansed with water and treated with hydrochloric acid. After the acid had removed the cement to a sufficient depth to expose the aggregates and thus leave a very rough face, all traces of the acid were removed with stiff brushes and water, and the new concrete was then applied.

All the blocks were made at the same time; the artificial joints were made seven days later, and the whole set was tested 28 days after their manufacture.

Solving Quadratics by Slide-rule—A slide-rule solution for quadratic equations is given by R. W. Stewart, Engineer of Bridge Department in the City Engineer's office, Los Angeles, Calif. One of the commonest cases is that of computing tangent offsets to a circle, as in getting ordinates to an arch, and this case is taken as an example. If R is the radius of the circle, and a point on the tangent is distant x from the point of tangency, the offset y at point x to the circle is obtained from the semicircle rule:

$$y\ (2R - y) = x^2$$

which gives

$$y = \frac{x^2}{2R - y}$$

This expression can be handled by slide-rule, as follows:

Set the runner to x on the lower scale, which will give x^2 on the upper scale. Then, reading on upper scales only, shift the slide so as to make its index read y, the correct value of y being obtained when $2R - y$ appears on the slide at the runner. If greater accuracy is desired, set x^2 on the lower scale and find y here.

While this is a trial method, like the method used for extracting cube root on the slide rule, its simplicity is shown by the example quoted below.

[Continued on p. 374.]

Strength and Ductility of Iron, Steel and Bronzes at High Temperatures

The accompanying cuts show the results of two series of tests, Fig. 1 in tension and Fig. 2 in torsion, made under high-temperature conditions on some of the more common alloys by L. W. Spring and I. M. Bregowsky in the laboratory of the Crane Co., Chicago, Ill., makers of valves and steam fittings. The usual tests of such materials are made under conditions of normal temperature, say between 50° and 150° F., and do not tell what service the metals will give when hot. While the weakening effect of high temperatures has always been recognized, only few precise data have been available, particularly as regards bronzes. Such tests have been made necessary by the modern tendency in steam-engineering practice to increased boiler pressures and higher engine temperatures, due to the use of superheated steam, these advances making necessary the use of better valves and pipe-fittings.

In Table 1 are given the quantitative chemical analyses of the several alloys tested. A complete account of the

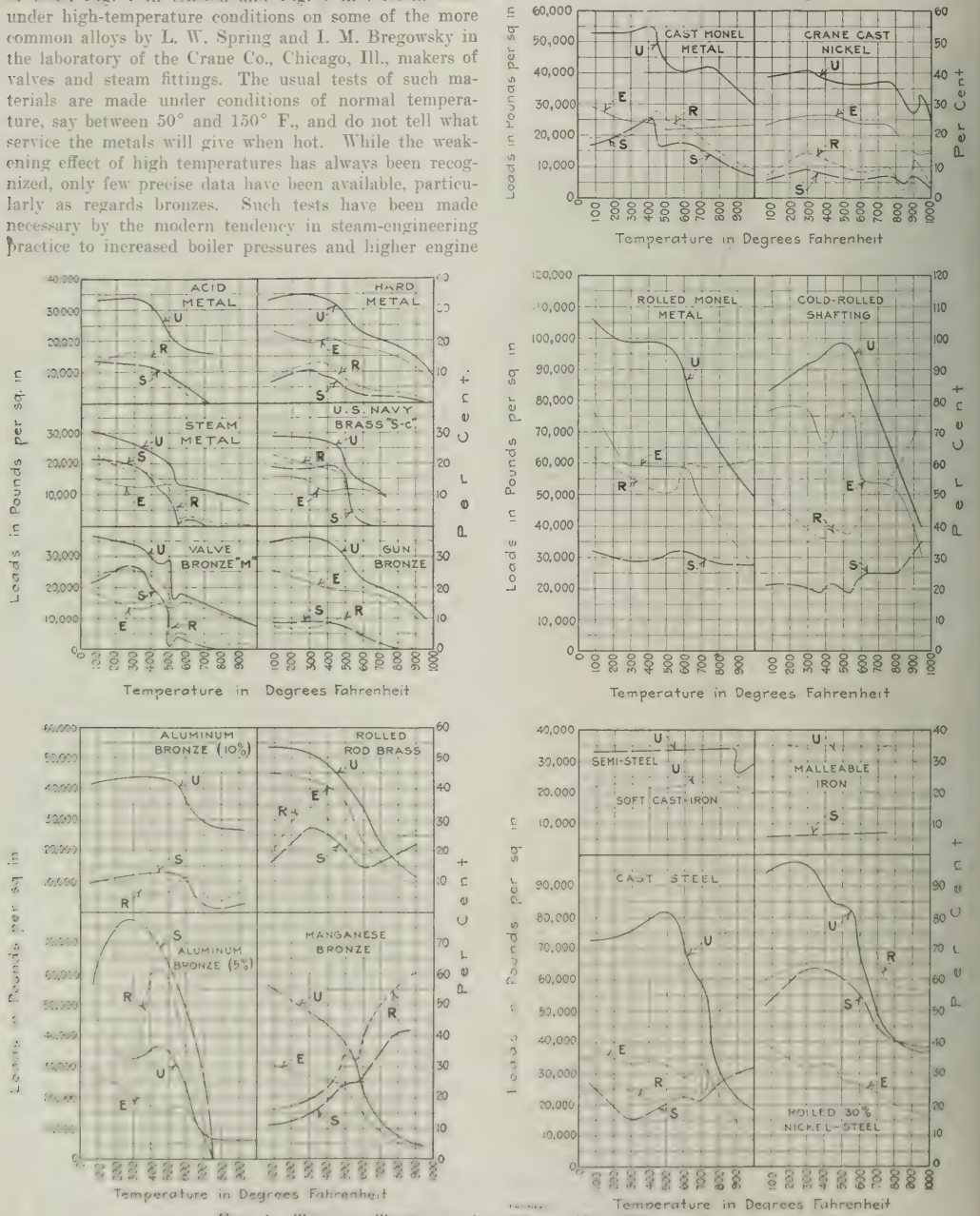


FIG. 1. TENSILE TESTS OF ALLOYS AT HIGH TEMPERATURES

(Tests by L. W. Spring and I. M. Bregowsky in the laboratory of the Crane Co., Chicago, Ill.)

U—Ultimate strength. S—Elongation.
E—Elastic limit. R—Reduction of area.

test methods and apparatus was given in a paper by Bregowsky and Spring read before the Sixth Congress of the International Association for Testing Materials at New York, September, 1912 (the paper was printed in Vol. 2, No. 13, of the *Proceedings* of the association). Another account, somewhat fuller in certain respects, but lacking the analyses, was given in the January, 1913, issue of *The Valve World* (Crane Co., publishers, Chicago, Ill.), under the title of "The Effect of High Temperatures on the Physical Properties of Some Alloys." The essential features of the tests were that the test-pieces were heated by means of an electric heating coil, that temperatures were measured by a thermometer or pyrometer placed in a hole bored longitudinally in the testpiece and extending to within a short distance of the test section, and finally that the materials tested were such as are in common commercial use rather than specially prepared alloys.

The curves are self-explanatory. They are of value mainly as an indication to the reader of the general course of the values for a given metal, and would rarely, if ever, be used for reading off accurate values of strength or ductility at a particular temperature.

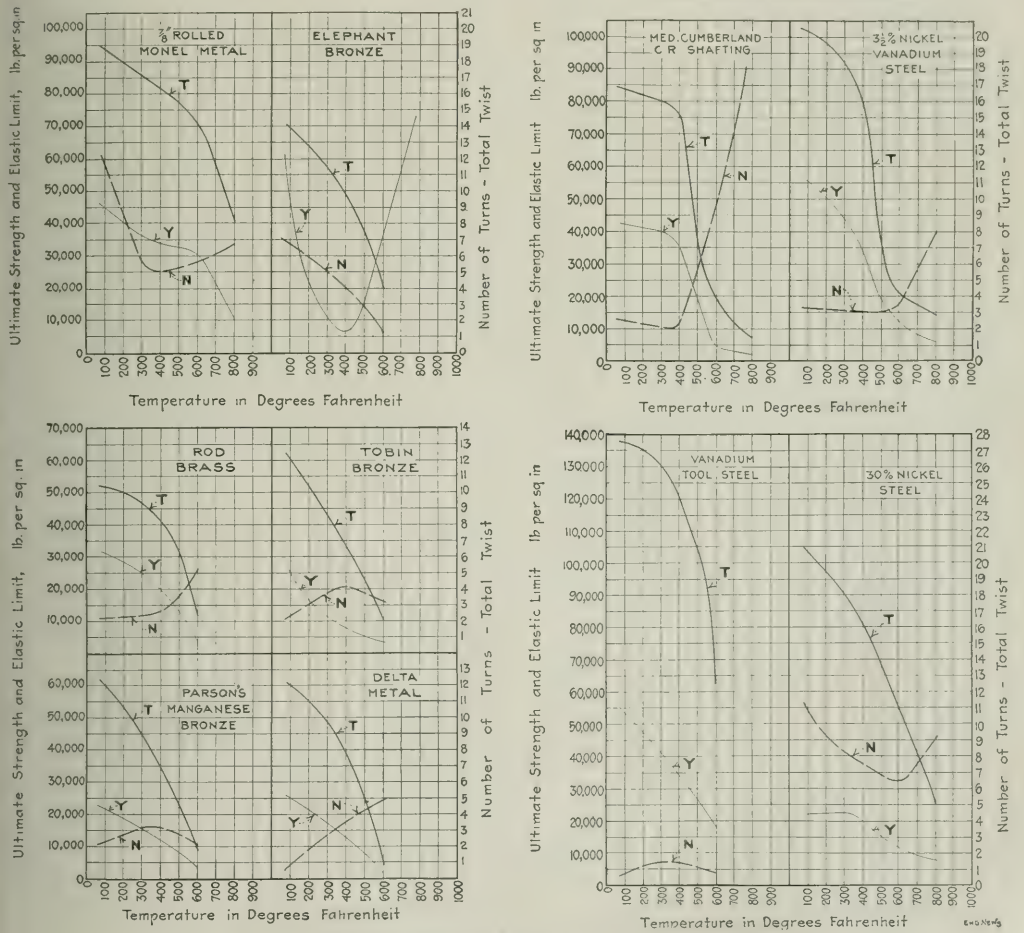


FIG. 2. TORSION TESTS OF ALLOYS AT HIGH TEMPERATURES

(Tests by L. W. Spring and I. M. Bregowsky in the laboratory of the Crane Co., Chicago, Ill.)

T—Ultimate strength, lb. per sq.in. torsional shear.
Y—Elastic limit, lb. per sq.in. torsional shear.
N—Number of turns total twist, at rupture.

TABLE 1 QUANTITATIVE ANALYSES OF ALLOYS USED IN HIGH TEMPERATURE TESTS (TESTS BY L. W. SPRING AND I. M. BREGOWSKY AT THE LABORATORY OF THE CRANE CO., CHICAGO, ILL.)

Analyses of metals used in tensile tests

Name	Percentages Cu	Zn	Sn	Ni	Fe	P	Pb	Mn	C	Al
Copper-tin bronze, "Hard Metal"	87.02	0.20	12.46		0.30	.....	0.06	....	..	..
Copper-tin bronze, "Acid Metal"	89.50		10.22	.....	0.38	0.035	tr	.	.	.
Brass, "Steam Metal"	86.19	5.03	5.69		0.20	.....	3.02	.	.	.
U. S. Navy brass, "S-C"	80.32	12.80	3.98		0.24		2.78	..		
U. S. Navy bronze—"M", "Valve-bronze"	86.92	3.62	7.72	.....	0.23		1.22	. .	.	.
U. S. Navy gun-bronze—"G"	87.60	1.31	10.40	.....	0.11	.....	0.39	.	.	
Aluminum-bronze 10%	88.86	0.15	0.48		0.75	.....	0.17	..	.	9.67
Rolled rod brass	62.30	34.84			0.15	.....	2.53			
Aluminum-bronze 5%	94.94		0.03		0.14		0.16	.....		4.90
Cast manganese-bronze	58.10	39.05	0.51		2.21	.....	tr	0.055	.	..
Cast nickel-steel	27.11	.....	0.08	64.79	5.46	.....	0.13	2.33	0.32	.
Rolled monel-metal	27.22	.....	.....	68.64	2.38			1.56	0.225	..

Name	Percentages Fe	Si	Mn	S	P	C	Ni	Gr.C.	C.C.
Cast-steel*						....			
Cold-rolled Bessemer shafting	98.842	0.031	0.80	0.108	0.079	0.14			
Cast-iron (Semi-steel) "Ferrosteel"	93.077	1.76	1.15	0.103	0.44	.....		3.0	0.47
Soft cast-iron	92.517	2.57	0.60	0.013	0.73	.....		3.31	0.17
Cupola malleable-iron	95.475	0.92	0.51	0.152	0.183	.....		2.96	tr
Cast-steel	98.755	0.22	0.61	0.068	0.045	0.302			
Rolled 30% nickel-steel	65.827	0.14	2.80	0.017	0.011	0.285	3.092		

Analyses of metals used in torsion tests

Name	Percentages Cu	Zn	Sn	Ni	Fe	P	Pb	Mn	C
Cast-rolled monel-metal	27.22		....	68.64	2.38	.....		1.56	0.225
Elephant (phosphor) bronze	95.52		3.87		0.16	0.307			
Rod brass	61.08	35.72	0.18		0.42	.....	2.34		
Tobin bronze	59.86	38.94	0.80		0.46	0.0015		.....	.....
Parson's manganese-bronze	59.58	38.08	0.64		1.22			0.34	.....
Delta metal	56.56	39.36	0.76		2.40	0.004			

Name	Percentages Fe	Si	Mn	S	P	C	Ni	Va	Cr
Vanadium tool-steel	98.115	0.16	0.32	0.034	0.014	0.722		0.145	0.49
30% nickel-steel	65.837	0.14	2.80	0.017	0.011	0.275	30.92		
Cumberland c.-r. shafting (medium)	98.932	0.12	0.51	0.05	0.013	0.375			
Cumberland cold-rolled shafting	98.435	0.024	0.50	0.11	0.101	0.83			
3½% nickel-vanadium-steel	95.279	0.132	0.45	0.042	0.032	0.365	3.25	0.45	
Openhearth manganese-steel	99.36	0.024	0.49	0.029	0.013	0.084			

*Commercial nickel

The ordinary solution of the above equation is in the regular quadratic form

$$y^2 - 2Ry = -x^2$$

or,

$$y = R - \sqrt{R^2 - x^2}$$

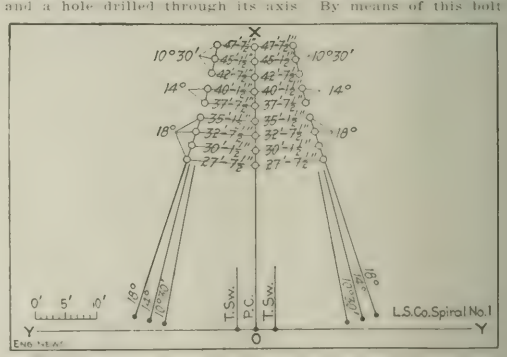
which equation can be deduced directly from a diagram of the case in hand. The use of this equation was compared with the slide-rule method in a particular case from practice.

It was required to compute the distances of the extrados of a circular arch below the crown, at a series of points 4 ft. apart, the arch having 40-ft. radius. These distances were needed to get the heights of the spandrel wall for computing the volume of the wall. Eight solutions of the problem had to be made, one for each point from 4 to 32 ft. from center of bridge. By the slide-rule method it was necessary to write down only two columns of figures, a column of x, and a column of the resulting y; if the values of x^2 should be wanted for further work they could be written down with practically no extra loss of time. Using an omnimeter—a circular slide-rule—the eight values in the example were obtained in 3 min. To get the result by the quadratic solution, five columns of figures had to be written, x, x^2, R, $R^2 - x^2$, and y; two columns involve subtraction, and two either squaring or extracting a square root. The time required for this solution is not stated except to say that it was considerably over the 3 min. required by the recommended method. In both cases the results were read to two decimal places (e.g., y = 11.43 ft. for x = 28 ft.).

The method is applicable without change to other examples involving quadratic equations. Very likely some degree of practice must be had before the eye can read simultaneous values of y and K — y at the two points on the slide.

The "Spiralgraph." W. T. Rossell, Jr., Asst. Engr. of Roadways, Cincinnati Traction Co., Cincinnati, Ohio, describes a new instrument which proves of great assistance in laying out spiraled street-railway curves. It is essentially a template giving the center of main curve, point of spiral, point of tangent, etc. By using two such templates (for the two ends of a curve), the layout can be tried with various spirals and various radii in the shortest possible time and without making a mark on the paper, and as soon as the best spiral-and-curve combination has been selected the centers and other determinative points can be marked through onto the drawing and thus the layout completed. The actual drawing of the transition curve may be done by a template cut to that particular curve on the scale used for the drawing.

The "spiralgraph" is shown diagramatically by the sketch herewith, representing the Lorain Steel Co.'s spiral No. 1 drawn (in the original) for a scale of ½ in. to 1 ft. The figure is supposed to show a rectangular sheet of celluloid or metal, on which the lines and figures indicated have been scribed with a sharp point. The circles indicate holes drilled through the sheet. They mark the centers of curves of various radii combined with various spirals, and also for each case the P. S. C.; the P. T. is in the middle, at the intersection of OX and YY, and to either side the position of toe of switch is marked. The open circles, which are the curve centers, are holes which receive a bolt with a very thin flat head and a hole drilled through its axis. By means of this bolt



two such templates can be pinned together and pivoted independently about the same center, providing for the two ends of a curve.

For curves not spiraled the holes on the line OX are used, the holes to right and left of axis OX indicate the centers of curves of the radii indicated in feet and inches, for a length of spiral whose total angle is indicated by the figure just outside (10° 30', 14°, 18°).

In using the instrument the two tangents between which the curve is to be laid out are drawn. Suppose a trial radius of 40 ft. 1½ in. is selected. Insert the small bolt through hole marked 40 ft. 1½ in. in both templates (right-hand hole in one, left-hand hole in the other), and set the axis YY of each template on one of the two tangents as laid out. Then prick the center of curve through the hole in the bolt, the P. S. C. through the hole at the end of line marked 14°, and if for a switch spiral the toe of the switch through the hole marked T. Sw.

It will be seen that a pair of templates (both alike) is required for each spiral. These "spiralgraphs" are used in the engineer's office of the Cincinnati Traction Co. It is claimed that accurate results can be obtained at a great saving of time.

EDITORIALS

The United States as a Shipbuilding Nation

There is a widespread popular impression in this country that the shipbuilding industry in the United States is trifling in importance compared with that of European nations. Probably few outside of those interested in the shipping business are aware that only two nations in the world, Great Britain and Germany, surpass the United States in the magnitude of their shipbuilding industry.

Tables from *Lloyd's Register,* published in London *Engineering* of Jan. 24, summarizing the statistics of shipbuilding in various countries of the world during the past fifteen years, show that in the year 1912 the tonnage of vessels of 100 tons gross measurement and upward launched in the United States was 284,223 tons. In the same year German shipbuilders launched vessels aggregating 375,317 tons, and French shipbuilders, who take the fourth place, launched only 110,000 tons. Of course, Great Britain is the chief shipbuilding country of the world. The total tonnage turned out of her shipyards in 1912 amounted to 1,738,514 tons, which was considerably more than the output of all other nations combined.

All the above figures, it should be said, are for merchant vessels alone. With war vessels included, the United States tonnage for 1912 was 349,500 tons. The relative position of the principal nations in shipbuilding is not changed by the inclusion of war vessels. With respect to the relative output of the United States and Germany, it should be noted that no longer ago than 1910 the present position of the two nations was reversed, the United States launching in that year vessels aggregating 331,318 tons and Germany only 159,303 tons.

It may be well to point out that American shipbuilding under present economic and industrial conditions is confined almost exclusively to the supply of vessels for coastwise and inland navigation and for the Navy. Under present economic and industrial conditions American shipbuilders appear to be unable to compete with their European rivals for vessels to operate in international trade. Of the output of the United States in 1912, the Lake shipyards launched 90,000 tons.

⁂

Two Ways of Obtaining Efficiency

The New York State Investigating Commission, which at Governor Sulzer's direction is overhauling the methods of work followed by various departments of the New York State government, has drafted a bill to create a new State Department of Efficiency and Economy. It is currently reported that the head of this commission is to have a salary of $12,000 a year and that a prominent politician is slated for this appointment as a balm for his disappointment because he did not receive a high place on the Public Service Commission.

Far be it from us to say one word in the way of any movement whatever which even aims to produce efficiency in governmental affairs. Better this than nothing. We are strongly impressed, however, that this is the wrong way to set about the production of genuine efficiency and that the error is a fundamental one, which is working serious harm in private business as well as in public business.

The right way to produce efficiency is to select men for responsible positions who are competent for their work. If Governor Sulzer, or any other Governor of New York or any other State, appoints at the head of State departments in charge of important public business, men whose political activity is the reason for their appointment and who know nothing about the work which they are supposed to supervise, a Commission on Efficiency and Economy, or one labeled with any other name of excellent sound, can do very little to help the situation.

What Chief Engineer of a large construction enterprise would be willing to take the responsibility for the work if the division engineers, and superintendents, and foremen under him were distinguished by various degrees of incompetence and he had to rely on a floating gang of accountants and cost-keeping experts and methodizers to show these men how to perform their work? What army in a campaign could win battles if its commanding generals were incompetent, even though a staff of inspecting generals were sent out by the War Department to tell the commanders wherein they fell short?

In saying this we are by no means denying that there is a certain field of usefulness for the so called "efficiency engineer" (a term to which we strongly object), provided he adds to his knowledge of methods of management and organization a large fund of common sense. We are far from denying that in some, or perhaps many, industrial plants, such an engineer can make valuable suggestions for improvement. In many concerns permeated with dry rot he may indeed work a real revolution in methods of production.

What we do protest against is the too prevalent idea that efficiency engineers or efficiency commissions can in any way obviate the necessity of having able men in important and responsible positions if efficiency is to be secured.

⁂

Cases Where Engineering Judgment Differs

All young engineers (and some old engineers) need to realize that of many engineering problems two or more perfectly correct solutions are possible. It happens not infrequently that the decision as to which solution will be accepted may depend more upon the temperament and taste of the engineer in responsible charge than it will upon the local circumstances and conditions.

One of the best illustrations of this fact is the differences in engineering practice of different countries. Take, for example, the typical differences in railway roll-

ing stock of England and the United States. English railway shops do things, and have been doing them successfully for many years, which many shopmen in this country would declare to be the extreme of bad practice. The converse is equally true.

Another example is the typical differences in bridge practice of the two countries. English bridge builders have a great fondness for bowstring trusses. Both English and Continental builders have no hesitation in adopting curved lines in their truss designs, while American builders stick closely to the rectilinear truss.

A remarkable illustration of how practice may diverge on opposite sides of the ocean is furnished by an article in *The Engineer*, of London, in its issue of Dec. 20, describing the new water-supply for the city of Leicester, England. This water-supply is collected in the Derwent Valley and is carried a distance of about 30 miles to the city of Leicester in two cast-iron mains 35½ in. in diameter. Where this pipe line crosses the Trent River the crossing is made by means of a bridge of 220 ft. clear span.

The puzzling question is why this line of conduits was carried over the stream on a bridge instead of laying the pipes beneath the river bed. The bridge was built especially for the pipe line, and carries nothing else save a footway. Instead of carrying the cast-iron mains across the bridge, 30-in. steel mains are substituted. They are supported on cast-iron rollers to allow free movement and a difficult and expensive bend had to be made at each end of the bridge to bring the pipe up out of the ground to the level of the bridge. The bridge is far from being an inexpensive one to construct, for it is supported on cylinder piers, which had to be carried down 22 ft. below water level, with the aid of compressed air, to reach a safe foundation. The river at this point is navigable and the bridge had to be placed 17 ft. above water level. This, of course, limits the height of vessels passing under it.

As far as one is able to judge from the published description, the conditions in all respects are such that any American engineer who had the responsibility of solving this problem would have, without question, placed his conduits underneath the river bed, instead of carrying them across overhead. Why the other solution was adopted by the English engineers is a question on which our contemporary's description sheds not a particle of light.

The same article, however, contains an even more difficult puzzle to the American engineer. It became necessary at a certain point to carry the conduit line across a single-track railway. Instead of tunneling through the embankment beneath the tracks, and laying the pipes there, the engineers constructed two enormous bends on each side of the railway, and built two high brick piers to carry the mains across over the track. This was rather a bold piece of engineering work, for the pipes are, according to the description and drawings, unsupported in any way, and the distance between the masonry piers is 33 ft. c. to c. It is true the railway was in a cutting at this point, so that a depression in the pipes would have been necessary to have passed under the railway, but the depression required would have been much less than the elevation which is necessary to carry the pipes overhead and give them proper clearance.

Perhaps the English engineers responsible for this design were concerned lest the load upon the pipes from the trains passing overhead, if the pipes had been carried underneath the track, might cause eventual fracture. An American engineer would have been far more concerned as to the stability of a 30-ft. span of pipe only 30-in. in diameter and carrying a load of water under heavy pressure. To make the whole matter still more puzzling, *The Engineer* says that this railway crossing is typical of the various brook crossings along the pipe line. We shall not attempt to fathom the mystery why the engineers who built this pipe line preferred to carry it overhead instead of underneath every brook and railway and river which it crosses. We merely present the fact as illustrating the principle that of many engineering problems more than one successful solution is possible.

We cannot refrain, however, from calling attention to the further fact that the whole matter is illustrative of a common and serious fault in engineering literature. We believe it is far more important to the engineer who reads engineering literature for its practical usefulness, to find out *why* a thing was done than *what* was done. Every piece of engineering work can be considered as made up of the solution of a number of problems. In order that an engineer shall reap the greatest benefit from the study of the work which other engineers have done, he must know what were the conditions which were involved in the problems that were solved and what were the reasons which governed the engineer in choosing one solution instead of another.

A New England Scheme for State Supervision of Railway Operation

It is pretty well known that Massachusetts led all the other states in the Union in the establishment of government supervision of railway operation through a State Railroad Commission. A conference of the Governors of the New England States, held in Boston, Jan. 25, may have ultimately as large results in the development of government control over railway operations as did the original Massachusetts Railroad Commission established 45 years ago, or as did the establishment six years ago, by Governor Hughes of New York, of the first State Public Service Commission.

Some months ago, when the agitation broke loose in New England over the projected alliance between the New Haven and Grand Trunk interests, we referred to the affair as a tempest in a teapot. We did this in view of the comparatively unimportant nature of the transaction which started the hubbub. We did not believe and do not believe that the extensions of the Grand Trunk system to Providence and Boston were of any such vast importance to New England commercial welfare as was claimed. In fact, if an absolutely impartial commission, having the public welfare as its sole object in view, had to pass upon the question whether public convenience and necessity demanded the investment of this additional amount of capital in railway lines in New England, we very much doubt whether the verdict would be an affirmative one.

It has become evident, however, from the continued agitation of the past three or four months, that the question at issue in New England is a larger one than the mere matter of bringing in to Boston and to Providence the Grand Trunk Ry. system as an independent

competitor. New England has suddenly aroused to the fact that its entire railway system is under the control of a single corporation, and an overwhelming indictment of this corporation's control and management has been rolled up from many quarters. To what extent this indictment is justified by the facts, we shall not at all attempt to say; but it is certain that from Maine to Connecticut, and from Rhode Island to Vermont a chorus of complaints has arisen. It is evident that the public is not by any means satisfied with the measure of state control over railway operations which the present railway commissions in the New England States exercise. There has been evidence, also, of a pretty widespread public demand that the State of Massachusetts should purchase the whole of or an interest in the New England railway lines, and this demand has been voiced not merely by the large and growing element of the population which is inclined toward socialist views, but by many usually conservative business men. It has been common enough to hear the remark, "I don't believe in state ownership of railroads, but I am in favor of state ownership of the New Haven R.R."

Of course, sober second thought indicates at once the enormous difficulties which would stand in the way of half a dozen states sharing in the ownership and control of a great railway system supplying the transportation requirements of them all.

It should also occur to many of the advocates of state ownership that if a private corporation, with every incentive to economy and unhampered by the laws and red tape inseparable from government ownership, can barely earn operating expenses (as is the case on a large proportion of New England railway mileage), then government ownership and operation of these railway lines would evidently place a heavy burden on the taxpayers to make up the deficiency.

It is not to be expected, either, that conservative New England would undertake to confiscate the railway lines within its borders; and to create an enormous public debt in order to purchase the whole or a part of these railway lines would hardly meet with popular approval.

It has been demonstrated, however, that there are difficulties in the exercise of control by the Railway Commission of a single state over a railway corporation operating lines in half a dozen states. There appears to be also an overwhelming sentiment among New England business men that a larger measure of public control should be exercised over the railways which serve them.

It was in recognition of this popular sentiment that a conference of New England governors was held at Boston, on Jan. 25. At this conference it was agreed that the governor of each state should appoint two citizens of his state to be members of a New England Railroad Conference, to consider and report on the best modes of developing and operating the New England railroad system. The New England Railroad Conference thus constituted is to consider a dozen or more subjects. One of them is defined as follows:

> The question of creating state directors representing the various New England States in the management of the railroad system and the general question of the participation of the public in the ownership or operation of transportation facilities and the form of such participation.

There has been some public discussion of this proposition already, and more is likely to be heard in the future. The proposal to represent the public interest in the efficient management of railways by having some members of the Board of Directors appointed by public authority is not entirely novel. Over 20 years ago it was suggested in a treatise on monopolies and their control, written by a member of the editorial staff of this journal. At even an earlier date it was in actual operation in the Union Pacific R.R. Co. For many years the financial interest of the United States in that railway was recognized through the appointment by the President of the United States of a member of the Board of Directors to represent the government's interest. It is our impression that the men who served as government directors of the Union Pacific in those days were men more distinguished for political activity than for their knowledge of railway finance and management. Unless we are greatly mistaken, the government directorship of the Union Pacific Co. became simply an opportunity for the President to provide a comfortable berth for some superannuated politician.

Of course it is easily among the possibilities that if it were attempted to effect government control of railways at present by appointing directors to represent the state or the federal government, these directors might either be amiable figureheads or active blackmailers.

This, however, is really no argument against the proposition. Exactly the same thing is true of the men who may be appointed as members of State Railway Commissions or Public Service Commissions. In other words, it is an absolute essential of successful state control of public utilities that the men selected to administer such control shall be in the first place honest, and in the second place competent. These two things are essential, no matter how much or how little authority these men may be given and regardless of the particular way in which the authority may be exercised.

It is universally agreed at the present day, even by the officers of public-utility companies, that public control over them has come to stay. The practical question is how may this control be most effectively exercised?

The present tendency in the public-service commissions where control has been most highly developed, as in the states of New York and Wisconsin, is toward the establishment of a system of inspection and supervision of the detailed operations of the various railway and other public-utility companies.

This is, in some respects, commendable, but there is a limit beyond which it is not wise to go. To attempt to inspect and supervise every department of railway operation by state officials has a tendency to harass staff and employees and create friction and irritation on both sides. Moreover the expense involved in such detailed supervision is so great as to make it of doubtful wisdom even if it were possible to carry it out in an ideal manner.

We have recently discussed the overloading of the Interstate Commerce Commission with a multitude of new duties. The same thing is being experienced by the State Public Service Commissions and will grow more serious as year by year new details of operation are committed to these commissions' control.

While in the theory of the public-service commission law the three, or five, or seven commissioners are supposed to personally exercise their large powers of control, they are actually merely the executive heads of a great organization of engineers, accountants, inspectors, etc.

There is danger that this system will tend to break

down by its own weight. We must not forget that there are limits to what such public supervision can accomplish.

The situation is not wholly unlike that existing in City Building Departments, which has been more than once discussed in these columns. We have pointed out the error in supposing that the force of municipal building inspectors in any city can so thoroughly supervise all the construction work going on as to make it unnecessary for the owners of buildings under construction to employ their own supervisors. We have shown that in no case must the inspection of the City Building Department be held to relieve the owner and architect of a building under construction from the primary responsibility that the construction is safe and properly carried out.

In like manner the supervision of a State Public Service Commission over the operations of a railway or a gas company ought not to extend to such details of inspection and supervision as to relieve the corporation itself and its officers and employees from its responsibility for furnishing good service at reasonable rates and devoting energy and efficiency to this work.

Bearing these things in mind, it is an interesting question whether the public demand for the further extension of government control over public utilities might not be better met by representation on the Board of Directors of public-utility corporations than by adding detailed duties to the present Public Service Commissions. There is no reason, so far as we can see, why the two methods of control might not exist together.

Of course, the objection to this method of control which will be at once heard will be that the directors appointed to represent the state would not represent the owners of the property, as do the directors elected by the stockholders. It would not be hard to recall many cases, however, where the interest of the owners of a corporation's bonds and stocks would have been better protected by state directors than by the directors put in office by the financial interest in control. If we could always have such men as Governor Hughes of New York at the head of our state governments, we fancy that the majority of holders of stocks and bonds would rather trust their interests in the hands of directors appointed by the governor than in the hands of the directors selected by the controlling financial interest at whose behest they fill out proxies year by year.

The selection of the directors who control the great life insurance companies, with their billions of dollars of accumulated capital, the property of a million stockholders scattered all over the country, is in the hands of a few men in New York City. It has been demonstrated to be a practical impossibility for the policyholders to exert any real voice in the selection of the men who control this enormous wealth. The same thing is true of most of the great railway and industrial corporations, with their stocks scattered in the hands of many thousand holders. A few men owning a very small part of the property can manage the whole as they please, and the stockholders are practically powerless to change the situation.

State control of public utilities through Public Service Commissions has been established primarily to protect the interests of the public. We believe state representation on the directorate of public-utility companies is equally needed to protect the stock and bondholders who are the owners of the property from spoliation at the hands of the interests in control.

Of course, we are speaking broadly, with full knowledge that many corporations are honestly managed, with full regard for the interests of those who hold the corporation's securities; but the exceptions to this have been so many and so flagrant in the past twenty years that no legislation looking to better administration of public utilities can ignore this aspect of the question.

It may be said, of course, that one, or two, or three state directors on the board of a corporation would be in a minority and could therefore always be out-voted by the directors elected in the ordinary way. It does not follow, however, that these directors would not serve a very useful purpose, provided, of course, that they were men of the requisite ability, force of character and honesty. At least, they would be in a position to give publicity to nefarious schemes concocted to defraud the stockholders or aimed against the public interest.

It is worthy of note that steps tending in this direction have already been taken in a number of different cities. In both Chicago and Philadelphia, the systems of street transportation are now under the joint control of representatives of the city and representatives of the owning companies. There have been a few instances also of joint ownership and joint control of such public utilities as water-works and gas-works by a private company and the city.

It is indeed worth consideration whether an extension of this principle may not eventually be made a means of exercising a certain amount of public control over a long list of industrial and commercial enterprises. In our banking system, for example, the federal government inspectors usually become aware of the looting of a bank by those who control it only after the event has taken place. This is a sample of a great deal of government supervision and inspection which only succeeds in locking the stable door after the horse has been stolen. There are strong arguments to be made, therefore, in favor of a government supervision, which can be exercised from the inside instead of the outside.

We fully appreciate the very great difficulties in carrying into effect the principle which we have outlined above. In the several states of New England, for example, it may be argued that the directors from each state should have a voice only over the railway operations within the limits of that state. In railway operations it often happens also that the interests of one locality will be opposed to those of another locality. Perhaps it was this reason which caused the governor of Maine to remain absent from the Boston conference. Maine would rather see the United States terminal of the Grand Trunk system remain at Portland than to have new terminals for Canadian traffic developed at Boston and Providence.

These and other difficulties will in all probability prevent the plan of controlling public utilities by state-appointed directors from coming into use for a long time in the future. We believe, nevertheless, that it deserves the consideration of candid and thoughtful men. Those who best understand the magnitude of the great forces which are tending toward social upheaval, realize that the only means by which this threatening wave can be made to spend its force without destruction is by taking radical steps (or steps that would have seemed radical a generation ago) for the betterment of conditions in our economic, industrial and political life whose evil results are admitted by all.

LETTERS TO THE EDITOR

Anti-typhoid Vaccination among U. S. Reclamation Service Engineers

SIR: Some thirty engineers and assistants of the U. S. Reclamation Service, on the Sun River Project, Montana, are being vaccinated against typhoid fever. Three doses were given, ten days apart. The first and second doses were of 0.5 c.c. of serum, containing approximately 500,000 dead typhoid germs. The third dose was of 1 c.c. and contained 1,000,000 organisms. The effects of the treatment are mild, a slight fever resulting for the next forty-eight hours after treatment, and the arm is lame and sore for about three days. The serum is furnished free by the Reclamation Service and is secured by them at the Army Medical School at Washington, D. C.

This vaccination is taken simply as a precautionary measure. This part of Montana is very healthful and typhoid fever is rare. It is probable that a large amount of construction will be in progress on the Project during the coming year and the various engineers and assistants will be located near large camps of men where it will be difficult to control sanitary conditions. The summer season is hot and dry and flies are very numerous around camps on the open prairie.

WALTER S. MERRILL.

U. S. Reclamation Service, Fort Shaw, Mont., Feb. 19, 1913.

Street Traffic Counts in Newark, N. J.

Sir—The City Plan Commission of Newark, N. J., has had traffice counts taken throughout the city along lines similar to those suggested in an article entitled, "A Proposed Standard Record of Street Traffic," which appeared in ENGINEERING NEWS of Jan. 2, 1913.

The results, in the case of Broad St., were somewhat at variance with those given in the aforesaid article, probably due to the fact that our count is much more recent. Market St., rather than Bridge St., is Newark's second busiest thoroughfare. Our results were as follows:

	Totals on whole width of roadway		Totals per yard effective width of roadway	
	Vehicles	Tons	Vehicles	Tons
Broad St.	4052	7505	188	348
Market St.	2277	4570	167	334

Considering the rapid growth in the use of motor trucks for transportation, would it not be wise to specify weights singly for runabouts, touring cars and motor trucks as well as for one-horse, two-horse and three- or more horse vehicles? The motor will very soon replace the horse almost entirely, and an average of 1.75 tons for all motor vehicles, as is suggested, will be unfair, especially upon streets which are located in manufacturing districts, as compared with a parkway for pleasure vehicles only.

HARLAND BARTHOLOMEW,
Asst. Engr. City Plan Commission.

Newark, N. J., Jan. 10, 1913.

Progress on the Richmond, Calif., Port Project

Sir—Since your receipt of the information upon which was based the article entitled "The Proposed Port of Richmond, Calif.," in your issue of Jan. 23, 1913, p. 145, the following progress in the project has been made:

Our report and plans were adopted by the city trustees on Sept. 23, 1912, and detailed contract and specifications for the highway and tunnel portions of the project were approved on Nov. 18, 1912. The matter was submitted to the electors on Nov. 19, 1912, under two segregations. The vote in favor of the tunnel and highway portion for a bond issue of $440,000 was approved by a vote of somewhat over 5 to 1. The vote on the second unit for $730,000 bonds, bonds for wharf construction, was approved by a vote approximately 8 to 1. The legality of the bonds has been passed upon and they are now offered for sale, the first unit of $350,000 on Feb. 10. We are now preparing detailed plans, with the expectation of starting construction work immediately.

HAVILAND & TIBBETTS,
BY FRED H. TIBBETTS.

San Francisco, Calif., Feb. 4, 1913.

The Clifton Suspension Bridge

Sir—In regard to the very interesting article on the Clifton suspension bridge (at Bristol, England) in your issue of Jan. 30, I am sending you some additional notes relating to this bridge. The $5000 bequeathed in 1753 by William Vick was to be kept until it had increased to $50,000, and it was then to be used for building a stone bridge. When the project was first started in 1829, Thomas Telford was the engineer, and his plans showed a suspension bridge in three spans, with two tall stone towers 400 ft. apart, c. to c., rising from the valley. His original estimate for the work, which was confirmed by Mr. Brunel, was $260,000. On account of difficulty from foundations on the west side, Mr. Brunel intended at first to put that tower 260 ft. further back, making a span of 960 ft., but in this he was overruled by the directors of the company, and an abutment of enormous size was therefore built further out toward the valley. The abutments are not at the same level, one being 3 ft. higher than the other, and the system of hangers is unsymmetrical on each side of the span center. During the first period of construction, in addition to building the abutments, anchorages in the solid rock were also prepared for the chains. Vertical shafts were sunk 233 ft. back from the tower centers, to intersect the anchor chambers (at a depth of 53 ft. below the surface), which are inclined at an angle of 45° with the horizontal. Prior to 1853, when work was abandoned, no less than $225,000 had been expended.

The Hungerford suspension bridge over the Thames at London (at Charing Cross), built during 1841-45, under the direction of Mr. Brunel, had a center span of 676½

ft. and side spans of 333 ft. It was 14 ft. wide and was for pedestrian travel only. The towers, in Italian style, were 22 ft. square, of brick masonry, rising to a height of 58 ft. above the roadway. The total cost of the bridge was $550,000. The chains consisted of two sets of links, one above the other, at each side of the bridge, the pins of one set being midway between those of the other. The floor suspenders were attached to triangular levers or crossheads, which in turn hung by two rods from the upper and lower chains, attaching to the pins in one case, and hanging on the other chain from the middle of the bars, producing bending therein.

In 1861, the old Hungerford bridge was bought by the Charing Cross Ry. in order that it might be replaced by a heavier structure leading to the new Charing Cross railway terminal, and the parts of the old bridge were therefore for sale. By a strange coincidence, negotiations were being conducted simultaneously by two sets of men for the completion of the Clifton bridge; John Hawkshaw was purchasing the old chains from the railway company at London, while W. H. Barlow was at the same time buying the piers, land and approaches from the trustees of the Clifton bridge. As each of these men is said to have known nothing of the other's doings, the work was carried on jointly by Hawkshaw and Barlow. The principal features of the Hungerford and Clifton bridges are given in the accompanying table:

HUNGERFORD AND CLIFTON SUSPENSION BRIDGES

	Hungerford	Clifton
Height of abutments above water	80 ft.	257 ft.
Span between tower centers	676½ ft.	702½ ft.
Chain deflection	50 ft.	70 ft.
Length of each link	24 ft.	24 ft.
Weight of each link	550 lb.	550 lb.
Diameter of connection pins	4¼ in.	4¼ in.
Total number of links	2600	3636
Total weight of links	715 tons	1000 tons
No. of links in center span	1280	1981
Weight of links in center span	352 tons	544 tons
Width of platform	14 ft.	31 ft.
Section of chains at center	296 sq.in.	440 sq.in.
Section of chain at towers	312 sq.in.	481 sq.in.

The land, towers, approaches and other completed work were bought for $10,000 and the old chains for $30,000. The Hungerford bridge was a narrow one for pedestrian travel only, while that at Clifton was designed for both foot passengers and vehicles. Both of these bridges were quite different in one respect from former bridges of the same class; the chains of others always had a uniform number of links, necessitating short couplings with a double number of joints. At Hungerford and Clifton, the number of links varies alternately, being 11 and 12 near the span center, and 12 and 13 near the piers, thus avoiding much extra expense for pins and couplings. The chains have the same angle of inclination at each side of the towers, and the floor is supported (as described in your article) from the successive connection pins of the three chains, thus avoiding the objectionable feature in the Hungerford bridge, of suspending them alternately on the middle of the tension bars, which caused heavy bending therein. The chains bear at the towers on 50 cast-steel rollers, 4 in. in diameter and 2 ft. long, supported on cast-iron roller plates 7 ft. wide and 14½ ft. long, thus allowing the saddles to move 18 in. each way. To support the third or upper cables on each side, other saddles were mounted on the original ones.

The method of stiffening the floor, as given and illustrated in official reports printed shortly after its completion, does not agree with that described in ENGINEERING NEWS of Jan. 30, for the reports stated that the stiffening members are lattice trusses 5 ft. deep, between the road and walks, and are similar to those at the outside of the footwalks, though heavier. Drawings show upper and lower chords composed of angles and plates connected by a system of diagonals 10½ in. apart, and supported at intervals of 2½ ft. by 3-in. vertical channels. The claim was also made that lattice trusses were a new feature, though they had been proposed several years before by P. W. Barlow. [Our description was correct, see note below.—EDITOR.] The floor-beams are 7½ ft. apart, 18 in. deep at the center, with lattice webs, and the chords have an area of only 4½ in. These floor-beams directly support the plank flooring, which is laid longitudinally and jointed with $2 \times \frac{3}{16}$-in. hoop-iron tongues.

The cost of the completed bridge was as follows: Original expenditure, $225,000; old chains from Hungerford bridge, $30,000; erection and completion of superstructure, including freight, etc., $135,000; total, $390,000. This does not include the $10,000 paid to the bridge company for the old completed work and land, nor any engineering fees.

H. G. TYRRELL.

Evanston, Ill., Feb. 4, 1913.

[In regard to the additional stiffening trusses referred to by our correspondent, these do not exist, as may be seen from the view in Fig. 1 (p. 192, Jan. 30), and as we know from personal acquaintance with the bridge. The lattice trusses are at the outer edges of the sidewalks. The suspenders or hangers are attached to plate girders, which separate the roadway from the sidewalks, but which extend only about 2 ft. above the floor. The proposed trusses were probably included in some of the preliminary designs.—EDITOR.]

NOTES AND QUERIES

In the article entitled "Concrete Dikes and Bank Protection on the Missouri River," by Maj. E. H. Schulz, U. S. A. ("Eng. News," Dec. 26, 1912), the final table of costs on p. 1200 contained some errors that make its reprinting in correct form desirable.

a. Willow Mattress.

757 cords brush @ $0.892	$675 87	
776 cu.yd. ballast @ $0.746	579 09	
555 cu.yd. spalls @ $0.702	389 70	
Wire strand, clips	204 43	
Towboat service	784 00	
Labor, superintendence and miscellaneous	2669 59	$5,302 68

b. Concrete paving.

1156 cu.yd. gravel @ $1.533	$1772 35	
Grading bank, 1000 lin.ft. @ $0.940607	916 07	
Reinforcement	749 32	
821¼ bbl. Portland cement @ $1.15	945 01	
Labor, superintendence and miscellaneous	1881 33	6,294.08

c. Flexible concrete blocks.

120 cu.yd. gravel @ $1.533	$183 96	
Reinforcement	221 65	
182 bbl. Portland cement @ $1.15	209 30	
Labor, etc. making blocks	636 00	
Labor, etc. placing blocks	685 12	1,936 03

Summary.

Weaving and ballasting mattress 1030 lin.ft. @ $5.1482	5,302 68
Concrete paving and grading, 1000 lin.ft. @ $6.294	6,294 08
Flexible concrete blocks in place	1,936 03
	$13,532 79

The note on the "Government Stream Gaging Work," on page 303 of our issue of Feb. 13, was taken from an address by C. E. Grunsky, before the San Francisco Association of Members of the American Society of Civil Engineers. Credit to this source was accidentally omitted in printing the item.

The Recent Derailments on the Chicago Elevated Loop

Two derailments on the loop line of the Chicago elevated railways, in the business district, were described in our issues of Jan. 16 and 23, and as a result of these accidents the Commissioner of Public Works appointed a board of investigation, composed of Wm. Artingstall, G. B. Robinson and S. Gold. They had the derailed car of the first accident examined by R. W. Hunt & Co., but as this car had been dismantled the examination was not of much value, although the wheels were found to be of proper gage, with full flanges and very little wear. The track conditions were examined by A. K. Shurtleff (C., R. I. & P. R.R.), whose report is noted below. The conclusions arrived at by the board were that the first accident was due to excessive speed of the train on the curve (95 ft. center-line radius), while the second was due to faulty position of the guard rail. We give below, in condensed form, the summary and recommendations of the report.

Report of Investigations

Derailment at Van Buren St. and Fifth Ave., Jan. 8—The rear truck of the last car left the track at the middle frog, and the train traveled approximately 250 ft. before being brought to a stop. The rear car probably hung for an instant on the cross-girder (projecting beyond the track girders), then uncoupled and fell to the street, front end first. The front truck was left standing on the track. The wheels and trucks were in good shape; the flanges were full and showed but little wear. The center bearings were dry and slightly rusty, where they should have been smooth and dry. The track was in good shape, having been relaid lately with 90-lb. rails. The frog was in fair shape and good for several months' wear; it has been replaced with a new frog since the accident.* Excessive speed while rounding the curve was responsible for the accident, and the motorman was reckless and violated the rules. Statements by three unbiased witnesses estimated the speed at 8 to 12 m.p.h. The conductor did all he could to stop the train as soon as he felt the first jar. The trainman was negligent in not being in his proper place, and in not pulling the emergency cord when he felt the first shock. The track plan at this point is shown in the accompanying cut.

Derailment at Wabash Ave. and Van Buren St., Jan. 15—The wheels of the rear truck left the track at the north frog of a new crossing that had been installed only two days.† The speed was moderate, and the car was stopped within 30 ft. from the point of derailment. Lack of sufficient clearance from back to back of wheel flange between the inside guard rails of the curve was the immediate cause of the accident. This lack of clearance was due to improper curvature of the frog guard. This error was reported to the railway company and has since been corrected.

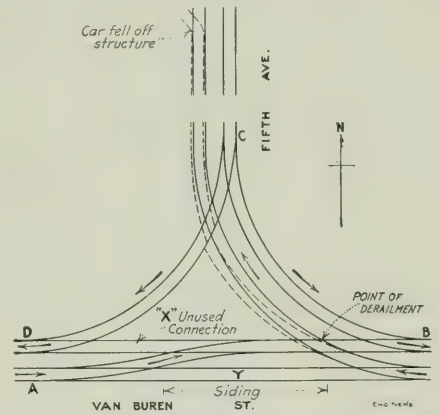
*The report of the railway company's engineer states that the crossing frog was of cast manganese construction (corresponding to 80-lb. rails) and very rigid, with the guard and running section cast in one piece. But although this was renewed, the report of Mr. Shurtleff (noted later) states that an inspection of this new crossing showed conditions of gage and guard-rail spacing that would tend to cause derailment, particularly at the west frog of the crossing.

†The situation is identical with that of the crossing shown in the cut, supposing the cut turned sideways so that Van Buren St. would correspond with Wabash Ave. (running north and south). The derailment was at the frog corresponding to that shown in the cut, but the car ran only a short distance into the triangular space between the tracks.

Recommendations—1. A maximum speed not to exceed 8 m.p.h. at all curves and crossings where it is not feasible to provide superelevation; 2, where there is superelevation, the maximum speed to be determined by the amount of superelevation and the degree of curve; 3, operation of motors in multiple to be forbidden while the train is on the curve; 4, targets to be placed on the tangent to indicate when the last car has cleared the curve; 5, special guard rails at all curves; 6, struts and ties to be provided to hold all running and guard rails in proper relation to each other.

Report of A. K. Shurtleff

The first part of this report discusses the action of wheels and trucks on curves, and the purpose of superelevation of rails, such superelevation being of necessity



Corner of the Elevated Loop in Chicago, Where a Derailment Occurred Jan. 8

1. The dotted lines show the path of the derailed truck.
2. Trains of the Oak Park and Northwestern lines run north on the outer track of the loop.
3. Trains of the Metropolitan line enter the inner track of the loop at A-B and leave it by the curve C-D.
4. Trains of the South Side line follow the inner track of the loop on curve C-B.
5. The two connecting portions of the track at X and Y are not used by trains.

omitted in this case owing to the track crossing. The most significant part of his report is abstracted below. This should be considered carefully by engineers of local lines having very sharp curves, and should lead them to examine the track conditions on their own lines.

One of the practical measures for guarding against these causes (of derailment) is the use of guard rails placed in such a position as to assist in guiding the wheels around the curve and draw the flange away from bearing hard against the outer rail. The guard rail that performs this duty is the one placed adjacent to the inside rail. Its function is to engage the back of the inside wheel at the time the flange of the outside wheel is against the running rail. To perform this function it is absolutely necessary that this guard rail be rigidly fixed so that its position with reference to the outside running rail is always maintained. The great tendency of track men is to maintain a given width of throat (or flangeway) between the guard rail and its adjacent running rail, overlooking the fact that the real function of these inside guard rails is to protect the wheel running on the opposite rail. A slightly tight gage of track in such cases renders the guard rail useless. Where inside guard rails are used adjacent to both track rails, it is necessary to place them so that the distance between the throatway sides of the rail heads is never greater than the minimum standard allowance back to back of wheels, otherwise there would be strong tendency to derailment.

The elevated railway has the two inside guard rails throughout the length of the curve under consideration, evidently recognizing its full value when properly used. The position of these guard rails with reference to the running rails which they are supposed to protect is a proper subject for criticism, particularly through the crossing on which the derailment occurred. The following conditions were found to exist (at the Wabash Ave. and Van Buren St. crossing):

1. Track gage narrow near the north end frog of the crossing and the guard rail adjacent to inside rail not properly performing its service.

2. Midway between north end frog and center frogs, both gage and guard rails about right.

3. At middle frogs, gage wide and guard rails probably too wide apart for proper clearance back to back of wheels.

4. Midway between center frogs and south end frogs both gage and guard rails were practically right.

5. At south end frog the inside guard rail was too close to outside track rail to prevent a strong tendency of wheel flange to strike the frog point and derail.

6. The two most dangerous points in this crossing as installed are at the center frogs and at the south end frog. With the guard rails apparently too far apart to properly clear the distance back to back of wheels and with the unbalanced centrifugal force throwing additional weight on the outside rail the tendency would be for the inside wheel to mount over the guard rail ,thus allowing the outer wheel to catch the middle frog point and derail the truck.

In this connection, the inspection of the crossing now in place where derailment of an Oak Park car occurred at 5th Ave. and Van Buren St. (see cut) shows conditions that tend to derailment, particularly at the west end frog of the crossing.

⁂

Hudson River Bridges and Tunnels at New York City are again considerably in the foreground through the activities of interstate bridge and tunnel commissions of New York and New Jersey. Henry W. Hodge and J. Vipond Davies as consulting engineers, Mr. Hodge working on bridge schemes and Mr. Davies on tunnel schemes. An earlier commission a few years ago advanced a project for a bridge at 179th St. (Manhattan), but borings showed that rock could not be found at any practicable depth; in fact, several borings did not discover rock.

At the present time the bridge proposal under consideration is for a location near 57th St., with a main span of 2800 ft. Borings are now being made to determine the character of foundation soil available. On the Manhattan shore at the pierhead line rock has been found at but little over 150 ft. below water. On the New Jersey side it is expected to lie at greater depth, probably 200 ft. or more, but still within practicable depth. A complete project for a 2800-ft. suspension bridge with 612-ft. steel towers and capacity for eight lines of track has been elaborated. This bridge is quite closely similar to the eyebar-chain suspension design of Gustav Lindenthal for the Manhattan Bridge and the Quebec Bridge, the stiffening truss being formed immediately below the suspension chain. Ground level on the New York side would be reached at Ninth Ave., while on the other shore the bridge would extend to the top of the Bergen Hill ridge. No cost estimates of any kind have been advanced, but an earlier estimate of $35,000,000 for a 3000-ft. suspension bridge is referred to. As this did not include real estate or damages, the total cost is certain to be much larger.

A tunnel project has been worked out for a more southerly location, reaching lower ground on the New Jersey shore. The best line is recommended as extending from Canal and Varick Sts., New York, to Provost and 13th Sts., Jersey City, the latter point being between the Erie Ry. and D., L. & W. R.R. terminals. With 3% and 3.7% end gradients, a tunnel length of about one mile results. Two tunnels, each for a single roadway, are estimated to cost $11,000,000, including real estate, etc.

The wagon traffic between New York and New Jersey over the present ferries amounts to about six million per year, or about 20,000 per day. This includes the ferries from Liberty St. (to Communipaw) north to 130th St. (to Edgewater).

A series of public meetings has been held recently in cities of northern New Jersey under the auspices of the New Jersey commissioners to explain the projects to the people and get an indication of the public demand for a crossing and the preference as between bridge and tunnel, with due regard to the fact that for the cost of one bridge a large number of tunnels at different locations could be built.

John Fritz

John Fritz, probably the most widely known and signally honored of American engineers and well-nigh the last survivor of his generation, died on Feb. 13 at his home in Bethlehem, Penn., in his 91st year.

It usually happens when a man thus far outlives his contemporaries that he becomes almost forgotten by the men in active life. But Uncle John Fritz, as he was affectionately known by engineers far and wide, had so kept in friendly touch with his professional brethren that the news of his death brings a sense of personal loss to a wide circle.

Few engineers have gained a wider and more deserved fame than this pioneer Pennsylvania ironmaster and engineer. A rugged constitution, a clean, temperate and well ordered life, a cheerful disposition and a clear conscience prolonged his years of active life as well as his serene old age far beyond the usual lot of man. His many friends are thankful that he was so long spared to enjoy those expressions of sincere esteem and affection which mankind so often neglects to bestow upon the living.

John Fritz was born Aug. 21, 1822, in Londonderry Township, Chester County, Penn. He was the oldest of seven children, three boys and four girls. Of his parents he says in his autobiography,* they were of "exemplary character, my father being a man of high moral standards, who fully impressed upon my mind the importance of absolute integrity, energy and economy; my mother was a true Christian woman." His father was a native of Hesse Cassel, Germany, who came to this country in 1802, with his father's family. John Fritz's mother was a native of Pennsylvania, born of Scotch-Irish Presbyterian parents.

John Fritz's boyhood days were spent on his father's farm, where, like most farmer's boys, he began to be an active worker between six and seven years of age. His schooling was, as he himself says, "sandwiched" in at such intervals as he could be spared, and at such intervals as the country schools of 1830-1840 offered opportunity. In 1838, when 16 years of age, he went to Parkesburg, Chester County, Penn., as an apprentice to learn the trades of blacksmithing and country machine work, such as repairing threshing machines for farmers and making renewals required by the primitive cotton and woolen mills of that day, or for grist and saw mills, blast furnaces and forge plants. Some five years later this business became dull, and as his father's work as a millwright compelled him to somewhat neglect the farm, John Fritz returned "to the plow and to his first love, the farm." But, he says, "the little knowledge I had gained of mechanics made me eager for more, so I made up my mind to take up the iron business as a calling."

Business revived to some extent in 1843, and in 1845 he was enabled to return to an occupation in which he always took the greatest pleasure. This early experience in iron making is delightfully described in the short autobiography which follows, so we will here pass over it, and briefly sketch his subsequent career.

In 1854, John Fritz went to Johnstown, Penn., where he rebuilt the rail mill of the Cambria Iron Co. In 1857 he built there the first three-high rail mill ever constructed, carrying out the work in the face of strong opposition both from the workmen and some of the own-

*Published by John Wiley & Sons, New York City, 1912.

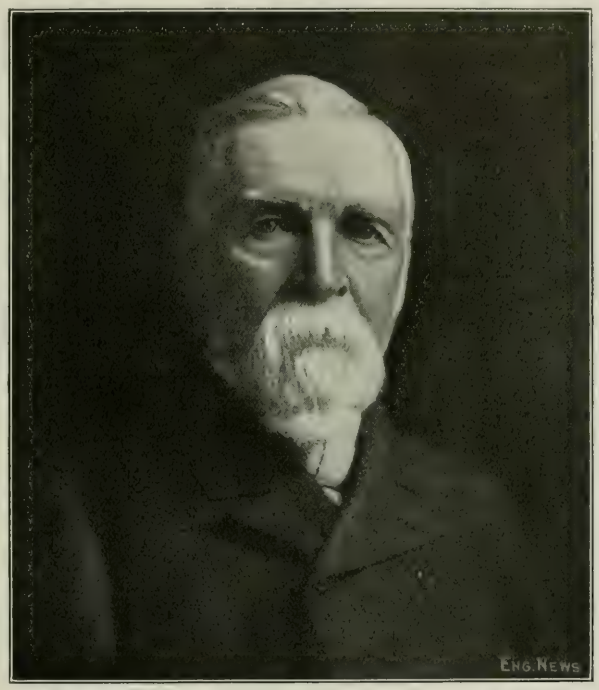
ers of the plant. In 1860, he was made General Superintendent of the then newly organized Bethlehem Iron Co. This position he held for 32 years, until he retired from active work for the company in 1892, at the age of 70 years. The iron mills of the company were built and started in operation under his direction in 1863, and the Bessemer steel works in 1873. In 1886 the Bethlehem works were the first to engage in the manufacture for the government of hydraulic-forged openhearth steel armor plate and forgings for heavy guns. A complete new plant was built under Mr. Fritz's directions for making, shaping and tempering the steel. The new works were the finest of their kind in the world, and included a 125-ton hammer, a 14,000-ton hydraulic forging press and a machine shop for finishing the heaviest gun forgings.

His retirement in 1892, however, did not mean retirement from the practice of engineering, for he retained all his mental activity until the last, and was long a consulting engineer and expert of the highest authority on iron and steel manufacture. In 1897 he was selected by the United States Armor Plate Board to make plans and estimates for a proposed government armor-plate works. In 1904 he was honorary expert on iron and steel at the Louisiana Purchase Exposition, St. Louis, Mo.

John Fritz was the recipient of so many honors that it would be difficult to mention them all. He was an honorary member and past-president of the American Society of Mechanical Engineers, an honorary member of the American Society of Civil Engineers, a past-president of the American Institute of Mining Engineers, an honorary member and past-vice-president of the Iron and Steel Institute of Great Britain and of the American Iron and Steel Institute. He held honorary degrees granted by Columbia University, University of Pennsylvania, Stevens Institute of Technology and Temple University. He was the recipient of the Bessemer Gold Mdal of the Iron and Steel Institute of Great Britain, of the John Fritz Gold Medal of the United Engineering Societies, and of the Elliott Cresson Gold Medal of the Franklin Institute.

Although himself denied the advantages of an education, he fully appreciated the value of technical training. He was a trustee of Lehigh University from its foundation in 1866 to the time of his death, with the exception of a few years, during which, at his own request, he was relieved from active participation in the affairs of the University; and he was ever liberal in his contributions for support of the institution. The Fritz Engineering Laboratory will long remain a monument not only of his generosity, but of his whole-hearted esteem for the work done by the University for many of his younger friends and assistants.

No account of the life of John Fritz would be complete without mention of the famous anniversary dinner given in his honor at Bethlehem, on Sept. 28, 1892, in commemoration of his 70th birthday. Few men either in public or private life have ever received a more enthusiastic and sincere compliment from friends and acquaintances from all parts of the country, from men distinguished in every branch of engineering and industry. A similar notable occasion was the John Fritz banquet, held in New York City, Oct. 31, 1902, to celebrate the foundation of the John Fritz Gold Medal of the United Engineering Societies.



John Fritz

A more graphic picture of John Fritz's life and character than we could possibly write is given in a brief autobiography, never before published, which we are able to present to our readers herewith. It was written by Uncle John, seven years ago, in response to a request from Dr. W. F. M. Goss, Dean of the College of Engineering, University of Illinois, and now President of the American Society of Mechanical Engineers. Dr. Goss had asked Mr. Fritz for some account of his life and work that might be a source of instruction and inspiration to the engineering student. We are indebted to Dean Goss's courtesy for the privilege of publishing Mr. Fritz's letter written in response to this request.

My dear sir—Yours of Feb. 16, making inquiry in regard to my application to business, is before me. This is rather a delicate question for me to answer, as I have at all times tried to avoid notoriety as much as possible, and I request you to give what I write as little publicity as possible, consistent with the purpose you want it for, which I suppose is for an example for students who will not give their studies proper attention. I will therefore give you a very brief outline of my rule of application to business, to which I attri-

bute my success—whatever it may have been.

I was apprenticed in the old-fashioned way, being bound out for a given number of years to learn blacksmithing and the country machine trade. In 1845 I left my home to try my fortune in the world, and went to Phoenixville in order to get work in the rolling mill, but was told that business was very dull, and that they had more men than they knew what to do with.

I there learned that a new mill was building at Norristown, and at once concluded to go there and see if I could get something to do. I went direct to the office and told the proprietors what I wanted, and was told that they had more men than they wanted; their mill was not completed, and if it were finished, times were so dull they would not start it.

I left the office, and in going back to the street, I walked through the mill and was looking at some of the machinery when one of the owners came into the mill and came up to me. I thought that he might order me out, but these thoughts were soon dispelled. He at once commenced to talk to me in a very pleasant manner.

After a pleasant talk, he asked me if I was used to hard work, to which I frankly answered, "Yes." Then he wanted to know where I was raised. I told him on a farm and what I had been doing. To all of his questions I gave him a prompt answer. He then said: "Young man, I like thy looks. Will thee remain until Monday?" I replied by saying that if there was any probability of my getting employment, I would be pleased to remain over Sunday. He then said that the manager was absent, but was expected to be at the works on Monday morning, and I should call about eight or nine o'clock.

I remained over, but it was both a long and an anxious period from Saturday evening until Monday morning in a strange place. At length the appointed time came around, and I was on hand promptly. In a short time Mr. Moore, accompanied by a large, fine-looking man, came near where I was standing and halted, and had a short conversation in an undertone. To me this was a most trying ordeal, as I supposed it was to determine my fate.

After the brief conversation, they walked up to where I was standing. Mr. Moore introduced the gentleman as John Griffin, the Manager. I confess that I had some dread of meeting him, as the word "Manager" at that day seemed to my simple mind to mean a supercilious kind of person who would hold one at a distance; but this was not the case. He was a fine-looking and affable gentleman. After some hesitation, I told him what I wanted. He asked what I had been doing and if I was afraid of hard work. I answered both questions in a manner that seemed satisfactory to him. He told me to come to work the next morning.

When I entered the mill the next day to go to work, I fully realized the fact that I was among entire strangers without friends or prestige, or compass to direct my course, with mind untrained for systematic work or study, and with but scant education. My thoughts naturally went back to the scenes of my boyhood days—to the old home where my kind parents and loving sisters and brothers remained. I now fully realized that I was enlisted in the army for the great battle of life, and made up my mind that I would faithfully do my duty in whatever position chance might place me, always keeping my eyes and ears open and my mouth shut. This is important. A man who is an habitual talker is an abominable nuisance about a plant, and no manager wants him.

In 1845 or 1846, then, I succeeded in getting a job—now called a situation—in the Norristown Iron Works as a country machinist, who at that day was not considered worth much. I started in at $1.25 per day, but my pay was soon raised to $1.50, that being the regular machinist rate of wages.

I was at the works with tools in hand when the bell rang. I idled no time away, and was ready and willing to do anything I was called on to do, and did it willingly, pleasantly, and with energy. The result was that when the mill was completed and put in operation, I was placed in charge of all the machinery in the plant, which to me was a great surprise.

Having previously made up my mind that the iron business would become a leading one, I was now placed in a most fine to get a very general knowledge of rolling mill practice—a very important branch of it. But I soon made up my mind that to be a success it was essential to learn all branches of it practically.

At that time puddling was the most important, the most difficult, and the most laborious of all branches of the business. But in face of all the difficulties it was clear to my mind that I should learn it. As my time was occupied during the day, it had to be learned in off hours, which meant at night. After having my supper, I used to return to the mill and work at the puddling furnace until ten o'clock—at times later—every night, Saturday and Sunday nights excepted. This was no child's play, but I was on hand every night that the mill ran until I was well posted in the art.

About this time, there was another great surprise for me. I was called to the office without knowing what it was for, and I confess even at this late day, I well remember that as I had never been sent for before, I went to the office with some fear that they were in some way dissatisfied with me. When I entered, I found both partners in their private room and both of them seemed in a pleasant mood.

Now this is especially for your boys, and they should commit it to memory and ever have it in mind.

Mr. Moore, the senior partner, said that the man (calling him by name) who had charge of the mill in the night time, was not giving satisfaction, and they had dismissed him and wanted me to take his place. I was amazed for a moment. After gathering myself together again, I said to them: "I do not want the position, and if I did, there are four other men (naming them) that are older than I and have been with you longer than I have." Two of them were nephews of Mr. Moore, and the other two were friends of both Mr. Moore and Mr. Hoover, the proprietors of the works.

Mr. Moore, who was the spokesman and a Friend, said: "John, if I were going to look for thee any time after thee got thy supper till ten or eleven o'clock, I should come to the mill; if for either of the others. I should look over the town, and we insist upon thee accepting the position. To us, it is very important to have a person there at night that we have full confidence in."

Consequently I accepted, though reluctantly, as I was fearful that it might in a measure interfere with my opportunity of gaining practical knowledge of the manufacture of iron. Fortunately, I had gained a good knowledge of the art of puddling, which to learn properly made it necessary to be at the furnace from the time the heat was charged until the metal was finished, taken out and rolled, which required some two hours.

In the course of some three or four weeks, having got things in quite good shape, I found it the very place in which to become well posted in all the different branches, as it was necessary for me to look carefully over them all.

In learning to puddle, I acquired the skill necessary to work a furnace properly, which assisted me very much in becoming a heater. Learning to roll was not at all difficult, for being a blacksmith, handling the tongs came naturally, besides I was not confined to any given length of time. I could take the tongs and roll for five minutes, more or less, as the opportunity occurred. But getting up the templates for the rolls at that time was quite another matter. Having but little experience and no books on the subjects, at least none that we knew of, we had to think them over thoroughly and experiment with them until they would work all right.

Having now graduated in all the branches in the mill, in the manufacture of bar iron, pipe iron, boiler plate, tank iron, band iron, nails, car axles, shafting, heavy rounds and squares, and about all kinds and sizes of iron that were there being manufactured, I concluded that the rail business, although in a most deplorable condition at that time, would eventually become a leading branch of the iron business, and made up my mind that it would be important to know something about that.

At this time there was a rail mill going to be built at Safe Harbor, near Lancaster, Pennsylvania, and the owners wanted me to go there to erect the machinery in the mill. This was just what I wanted to do. At once I had a talk on the subject with Mr. Moore and Mr. Hoover, and they both advised against it, saying they did not want me to leave them, and that I would not get the salary that I was getting with them. I said that that was true and that I did not expect it, my object being to learn something of rail manufacture, as I believed there was a great future in it, and they finally consented to let me go.

When I left Norristown, I went directly to Safe Harbor and put the machinery in place, and remained there some two years, being finally driven away by fever and ague. I then returned to Norristown to my old place.

When Mr. Reeves learned that I had left Safe Harbor, he sent for me to come and see him, and he wanted me to go to Phoenixville and take charge of the machinery and shops there, which I declined to do, saying that one of my objects in going to Safe Harbor was the hope that I might get some knowledge of blast-furnace practice, and I had failed in consequence of being driven away by chills and fever.

Mr. Reeves said: "Well, I have just leased the old furnace

on the Schuylkill River near Philadelphia, and am going to remodel, repair and get her in blast. How would you like to go there and take charge of the repairs and improvements and get her in blast?"

I told him it was just what I should like to do if Moore and Hoover would let me off. He said that he could not pay me the wages he offered me to go to Phoenixville, but could only pay about one-half. I told him that would be all right, as it was not money I was after so much as information and experience, and if Messrs. Moore and Hoover would let me off, I would accept his offer.

On my return to Norristown, I had a very full talk with Mr. Moore and Mr. Hoover on the subject, and told them frankly the conversation I had with Mr. Reeves, and said that if they were willing, I would accept Mr. Reeves's offer. They and all my friends said that I must be crazy to leave the position I had and accept one that they considered much inferior at a lower salary.

I then had a private talk with Mr. Moore, saying to him that I had now had practical experience in all branches of the manufacture of iron except the work of the blast furnace, which is the first of all, and that I could not be a thorough practical ironmaster without having a practical knowledge of the blast furnace. He said that the view which I took was quite correct, and consented to let me go after some work that I had on hand was completed, after that was finished he said he would be satisfied to let me go, and to this arrangement Mr. Hoover subsequently agreed.

I now took hold of the project of remodeling and rebuilding the furnace and getting it in blast. This was accomplished with complete success, and I remained with Mr. Reeves about two years. I then returned to Messrs. Moore and Hoover to make some improvements in their mill.

Having obtained a very general knowledge of the iron business, both in the mechanical and practical working of the same, and also in the conversion of pig iron to wrought, and putting it in shape for the market, I in company with others put up a foundry and machine shop, with the view of remodeling and building blast-furnace and rolling-mill machinery.

Before the shops were completed, Mr. David Reeves, in company with a few others, leased the Cambria Works at Johnstown, Pennsylvania, and insisted on my taking the position of general superintendent; and he having strong claims on me, I accepted the position—whether wisely or unwisely I have never been able to determine.

The plant was new, yet it was not possible to make a commercial success with it without many changes and betterments, which involved the remodeling and rebuilding of the whole plant. This I did, and at the expiration of six years of the most strenuous labor, I left the works with their acknowledged supremacy as the best rolling-mill plant in the world.

On the morning of July 5, 1860, I bade Cambria Iron Works people good-bye and arrived in Bethlehem the same evening; and on the morning of the sixth, I entered the employ of the Bethlehem Iron Co. and built the iron and steel plant, and later on erected the hydraulic forging plant, the machine shop, and the armor-plate plant and finishing shop.

I have written you many times more than I intended, but there is nothing in the sketch that will not be a benefit to the students if it can in some way be impressed on their minds.

Now a word about application to business. It has been my rule through life to be at the works every morning, Sundays excepted, winter and summer, at half past six, breakfast being over before I leave the house.

This gives me time, if anything has gone wrong in the night, to make arrangements for the repair men to go directly to whatever place they are needed, and to see that all the men are in their places. It is always better to say "Come boys" than "Go boys," and an hour in the morning is worth more than two in the afternoon.

At half past eleven, some of the principal foremen go to their dinner, and about half past twelve they return. Then I go to my dinner and return about two o'clock. I get my supper about half past six and return to the works at half past seven and remain until half past nine; then I go home and go to bed at ten o'clock sharp, unless something is going wrong at the works, and then I know no hours until it is righted.

One Monday morning about one o'clock, we had not finished what were called "Sunday repairs," and when we came to put them in place, the work would not go together, in consequence of what was called a "machinist fit." In repairs, the rule was "loose fits" so that everything could be put together quickly, but in this case the rule had not been strictly adhered to, and a part of the work had to be sent back to the shop to be loosened so that it would go in place.

I was waiting for the job to come back and was not in an amiable mood. The mill men were there waiting to get started. I noticed an Irishman standing leaning on his shovel, looking at me. After a little while he walked over to where I was standing and said to me: "Mr. Fritz, I was standing looking and thinking and wondering how long you have been in an iron works." I said to him: "Some thirty-odd years." He said, "I have been with you nineteen years, and you have been making time and half time ever since I have been with you."

I write this to show that men do not often hurt themselves by hard work and long hours if they take proper care of themselves.

In regard to vacations, I never had but one in my life, and that was after a severe attack of typhoid fever. I was then away for some ten days. I once had a very bad case of pneumonia, and having much to do at that time, I had a room fixed up away from the works and some of my best draftsmen in it with me. This was done by the doctor's advice to keep me away from the dust of the works.

Outside of fever and ague, typhoid fever, pneumonia, and an attack of erysipelas, the time I was away from the works on account of sickness would not average over one day in a year. This seems remarkable, as I was exposed to all kinds of temperatures—going from the hot furnaces out into the cold in winter, when the thermometer was down to ten. No matter how badly it stormed, I was at the works attending to my duties, and rarely took a cold.

My first work in the iron line was in 1838 at a charcoal furnace which made about 16 tons per week; the total production that year in the United States was 263,000 tons. This year (1905), at the rate it is now going, it is supposed that the production will exceed 20,000,000 tons.

I have not only been contemporary with the marvelous improvements that have taken place in the iron and steel industry, but have had much to do with their introduction and perfection.

In regard to the fifteen years you refer to, when I was building the Bethlehem gun-forging and armor-plate plant, one thing I did was to go abroad to see what they were doing on the other side of the water. I saw most of the large iron and steel and forging plants in England, Germany, Belgium and France, and was absent from home only about six weeks; and I think it was about the hardest work I ever did, except the building, organizing and getting the works started and the steel to stand the high physical test required by the government for the gun forgings and armor-plate.

It was my rule to make my own foremen, selecting them out of the men employed in the works, but when we came to select men to do work they had never seen, it was something of a task; but it was done and not one of the men selected to take charge had ever seen a plant for doing the kind of work he was called on to do.

The best and hardest and most difficult work of my life was done when I was between 65 and 73 years of age, yet many well-minded people are under the impression that men over 45 are quite useless. They seem to forget the fact that experience counts for much. An experienced man does his work better, faster and easier for himself and those around him than a novice, although a much younger man. A man with experience has confidence in himself, knows what he is doing, and does not hesitate. He goes ahead with the assurance that he is right.

My life has been an active one in the most laborious, exacting and important branch of manufacture in the domain of human activities, requiring courage, endurance, and a most varied talent. In August next (1906), I shall be 83 years old, and I am now hearty and active, both mentally and physically, and do not think that I am yet a proper subject for chloroform.

"John Fritz is a living proof of the results of individual and industrial liberty in a country endowed with boundless resources. . . . He is more to us than a man whom we love and respect, more than a friend to whom we wish many years of health and happiness: he is an example of the free spirit of American institutions, a beacon light warning the present and coming generations against permitting any invasion of the principle of the liberty of the citizen, which alone has made our beloved country great and free."—A tribute to John Fritz by the late Abram S. Hewitt, Oct. 31, 1902.

The Annual Meeting of the Connecticut Society of Civil Engineers

The 29th annual meeting of the Connecticut Society of Civil Engineers was held in New Haven, Conn., Feb. 11-12. The business session occupied the morning of Feb. 11, and the afternoon of that day and the morning of the next were devoted to the reading and discussing of papers. In addition to the day sessions, a banquet was held on the night of Feb. 11.

While the papers presented to the association were interesting, they were not of a controversial nature and did not bring forth much discussion. Inasmuch as most of them were upon subjects which have been fully treated in ENGINEERING NEWS, only brief reference to them will be given below.

The most interesting part of the meeting was the discussion on certain recommendations of the president, A. W. Sperry of New Haven. The president, in brief, recommended the appointment of a number of standing committees whose duty it would be to take up certain lines of endeavor, closely associated with the engineering profession, but which hitherto, in Connecticut at least, have not been considered the duty of an engineering association. The principal one of these recommendations was crystallized in a motion providing for a committee to be appointed by the Board of Direction to consider all bills before the Connecticut Legislature and after conference with the Board of Direction to take whatever action might seem best to benefit the engineering profession.

This motion immediately provoked considerable opposition. It seems that at present the State of Connecticut is in considerable political turmoil in regard to the administration of its highway commission. A Democratic governor, now holding office for his second term, has been unable to secure the confirmation by the Senate (Democratic now though Republican through his first term) of his own appointee to the office of highway commissioner, which office is still filled by the incumbent who has held office for some fifteen years. It happens that the contest for the office has degenerated into a political squabble in which the technical fitness of the various candidates has not been considered very much. For this reason a number of the more conservative members of the Society thought that it would be undignified for the Society to enter into the controversy in any way. Although the motion as put did not specifically refer to the highway commission matter, it was inferred by many members on the floor that this would be the construction put upon the motion by the citizens of the state who considered the matter at all.

The maker of the motion, however, referred to the confusion existing in the legislature regarding the organization of the highway department as well as all other departments in which engineering is concerned. There are now at least three bills before the Connecticut Legislature in which the engineering activities of the state are directly concerned. One of these provides for a state engineer's department somewhat similar to that in California, and another (toward which the activities of the commitee would be especially directed) organizes a highway commission to be headed by three members, "one to be a civil engineer, one an expert road builder, and one a practical road builder." Against such absurdities as this the committee would necessarily take action.

After some discussion the motion was passed with the instruction implied, if not specified, that the committee should act as a committee and not as representing the Connecticut Society of Civil Engineers. This was a concession to those who for some reason seemed to be afraid that the smut of politics would dirty the hands of the Society if the Society did not watch out.

Another motion provided that a committee should be appointed to investigate the subject of codes of engineering ethics and tables of engineering fees, and should make a digest of all such codes and tabulations which have been adopted by various engineering societies, such digest to appear in the next annual proceedings of the Society. This motion was more specifically directed toward the question of fees than that of ethics. It was felt that there it too much competitive bidding for engineering business and that it would be much to the advantage of every engineer if he could refer to some fixed table of proper charges in making his bid for work or in consultation with a possible client.

Other committees were appointed to take up the question of uniform building laws, water power, deed registration, etc.

PAPERS

The leading address the first day was by F. Herbert Snow, Chief Engineer, Department of Health, Pennsylvania, and was entitled a "10,000 Square Mile Sanitary Survey." Mr. Snow's address, which was most profusely illustrated by lantern slides, took up in minute detail sanitary study of the Allegheny River Valley. This included a study of the iron, coal, oil, gas industries of the region, with the effect of such industries upon the adjoining water courses and consequently upon the Allegheny River. The latter part of the address was devoted to the problem of the water supply of the metropolitan district of Pittsburgh, which is served now practically entirely from the Allegheny River.

Another address was delivered the same afternoon by Dr. W. R. Whitney, who is at the head of the research laboratory at the General Electric Co. at Schnectady. Dr. Whitney took the members on an imaginary trip through the various rooms of the large research laboratory of the company at Schenectady, and described as well as might be in the limited time afforded him the different problems which the chemists in that laboratory have before them.

On Feb. 12 the first paper was by Clarence Blakeslee, of the firm of C. W. Blakeslee & Sons, contractors, who held one of the large contracts on the new Catskill aqueduct. This illustrated lecture by Mr. Blakeslee described the new Catskill aqueduct of New York in general, and more specifically that portion of the aqueduct which Mr. Blakeslee's firm had under contract and which they recently completed.

The second address was by Charles R. Harte, of the New York, New Haven & Hartford Railroad Co., on a "Modern Electric Power Net Work, the Waterbury-New Britain System." This power net work comprises a combination of hydro-electric and steam electric plants spreading between the Housatonic River and Hartford, New Britain, Waterbury and outlying districts. It was one of the pioneer high-tension lines, being the first in the eastern part of this country to distribute current over

an 11,000-volt line. Mr. Harte's paper took up the hydro-electric plant and the line construction in particular.

The third paper of the day was by Wm. S. Murray, electrical engineer, New York, New Haven & Hartford Railroad, on the electrification of that railroad. His preliminary talk was mainly a defense of the use of the single-phase system by the New Haven road in contradistinction to the direct current which has been used on similar work by other railways. He said that undoubtedly the road had to undertake a great lot of pioneer work, but that the future seemed now to justify it. It would have been easier to have built a direct-current line, but such a line would not have admitted of the progress which it is hoped the present installation will allow.

OFFICERS

The following officers were elected for the ensuing year: President, Sheldon E. Minor (Greenwich); 1st Vice-Pres., George K. Crandall (New London); 2nd Vice-Pres., C. C. Elwell (New Haven). The secretary is J. Frederick Jackson of New Haven.

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Block Signaling and Train Control Report

SYNOPSIS.—A Board was appointed by the Interstate Commerce Commission in 1907 at the direction of Congress, to investigate the use and necessity of railway block signals. In 1908, the work was ordered continued by Congress and broadened to include the study of appliances and systems intended to promote the safety of railway operation. Annual progress reports have been made each year and recently the final report has been issued. A considerable portion is reprinted below, showing the general development and present status of block signals, automatic train stops, rails, ties, high-power headlights, car couplers, and automatic train-pipe connectors.*

STATISTICS

Since the organization of the board in July, 1907, 1146 devices and systems intended to promote the safety of railroad operation have been brought to the board's attention, and in 1047 cases complete plans have been furnished. All of these 1047 cases have been disposed of, opinions regarding the practicability and merit of the devices or systems having been transmitted to the proprietor in each case.

THE BLOCK SYSTEM

The block-signal system as used on the railways of the United States was one of the two principal subjects assigned to this board for investigation when it was appointed.

The mileage of road block signaled at the beginning of this year was 30% greater than on Jan. 1, 1908, as shown by the following comparison:

	1912 Miles	1908 Miles
Manual	56,074.8	47,875.7
Automatic	20,334.9	10,803.0
Total	76,409.7	58,678.7

In automatic signaling it will be seen the increase in these four years was almost 100%. The automatic system, superior in many respects to the manual, has in many cases been installed in place of the manual system.

Excepting this statement of mileage, there is nothing of importance to report under this head as having occurred since the last report. The five years' observations of the board may be summarized.

The desirability of using the block system as the only reasonably safe method of regulating the movements of railway trains, which had already been set forth by the Commission in several of its annual reports, was confirmed. The soundness of the principle that the block system is the one and only adequate method now known of spacing trains not only has the constantly renewed indorsement of the majority of prominent railroads, as evidenced by their action in extending its use, but there is a special and significant indorsement in its use on an increasing number of lines which are used only by freight trains. In using the space-interval system on such lines the railroads go further than the board or the Commission has yet proposed to go; and their action tends to disprove the notion that superficial or short-sighted motives, such as advertising, or a narrow consideration of nothing but prospective damage bills for passengers killed or injured, constitute the main reason for introducing the block system.

The simple manual block system under regulations was used on the Northern Pacific—the "A B C system"—increasing its safety without the addition of costly electrical apparatus, and simplifying and cheapening the operation by abolishing the timetable and its complicated rules. But the system was abandoned by the Northern Pacific. Besides the reason for abandonment given by the company, it seems proper to mention what appears to have been a powerful collateral reason, namely, the fact that in returning to the use of the timetable (with or without some manual block signaling carried on under the old regulations) the number of operators (and the amount of salaries paid) could be considerably reduced. A change has been made in the A B C system which has improved it. This is in the provision for moving trains in case of failure of the telegraph wire. Instead of an emergency timetable, to be put into use by the station operators in such a case, the simple train staff, with no electric locking from station to station, is provided. This is simpler, more easily understood, and safer than a timetable, and, we are informed, worked satisfactorily.

AUTOMATIC TRAIN STOPS

The automatic train stop, the investigation of which was one of the two chief purposes aimed at in the establishment of this board, continues to be a live subject. New data concerning it are being constantly evolved, and serious attention is being given it by competent engineers, so that both the science and the art are being developed along more practical lines than formerly. It is greatly to be regretted that the chief stimulus to these efforts lies in the recurring collisions due to causes that these devices are intended to prevent. The serious collision in the Hoosac Tunnel on the Boston & Maine R.R., near North Adams, Mass., on Feb. 20, 1912, resulting in the loss of four lives and thousands of dollars' worth of property, draws particular attention to the subject, for not only was that collision ascribed to the failure of the engineman to observe the fixed visual signals, but the locality in which it occurred is one where the use of automatic stops is peculiarly appropriate.

Inductive systems—that is, those in which electrical apparatus on the roadway acts upon electrical apparatus on the train by means of electrostatic or electromagnetic induction, and without any physical contact—continue to offer promise of success. An experimental installation of one such system is being tried in New York City.

In dealing with the mechanical-trip type of train stop the board recognizes as the only adequate standard for such devices that they be so designed as to detect their own failure; that is to say, to be in this respect as safe as electrical apparatus which is arranged on the so called "closed-circuit" principle. It insists that any mechanical trip, to be entirely satisfactory, should be so designed that the breakage or removal of the movable roadside member shall cause an application of the brakes. In a typical apparatus of this kind this object is accomplished by having a rigid roadside member so securely fastened to the track as to be as little susceptible to breakage or removal as a rail of the track itself. This rigid member acts upon the engine member of every train at every point of indication and causes an air-brake valve to be opened. This is the normal operation at the entrance of a train to each block section if the fixed visual signal is at "Stop" or if the block section is obstructed. If, however, the fixed signal is at "Proceed," or the route clear, the movable roadside member comes into operation to engage a member on the engine in such a manner as to prevent the escape of air from the brake pipe due to the previous opening of the valve by the fixed roadside member, or it in some

*See "Engineering News," Jan. 14, 1909.

other way forestalls or nullifies its action. Not only does such an arrangement place the mechanical trip within the class of "closed-circuit" devices, but it assures that each apparatus will be operated every time a train passes a signal or a point of indication, thus affording a complete check of its operative condition. In the mechanical-trip systems heretofore tested and those now in use, the engine device and the roadway device never engage except for the purpose of making an emergency stop or when periodically tested, being in this respect in the same category as life preservers and fire extinguishers.

A number of devices have been submitted to the board in which the design of electrical circuits and of the apparatus is apparently of equal merit with that in some devices of the same class which have been tested. The board has not deemed it desirable, however, to conduct tests of two systems embodying the same principle until it has completed at least one test of each of the following types of apparatus: (a) ground mechanical trip; (b) intermittent contact rail; (c) devices having insulated short-track sections and insulated wheels or axles; and (d) inductive electrical devices. The board has considered it important to have available the information and data obtained from the first test as a guide in future tests of similar devices.

The board greatly regrets that largely through the inability of proprietors of devices to provide proper installations it is not able to present with its final report any data covering tests and devices using insulated short sections of rail and insulated wheels and axles, or of inductive devices.

TRACK STRUCTURE

RAILS—In the use of steel rails prior to 1900, there were comparatively few rail fractures. During the past 10 years the breakage of rails has increased rapidly until now it is of very frequent occurrence. On some roads the number of broken rails found in a single day during the past winter was a matter of grave concern to the officers. It is probably owing to the use of the automatic block system and its track circuit, which in most cases detects broken rails, that more accidents of a serious nature have not resulted from these breakages.

It is of the greatest importance to discover the cause of these rail breakages. The Bureau of Standards in its investigations conducted for the Safety Appliance Division of the Interstate Commerce Commission has performed an excellent service, and this work, if continued, will no doubt contribute very materially to the solution of the problem. Of the number of things pointed out in the report of the Bureau of Standards two are conspicuous: (1) That by the present method of inspection faulty rails are passed for shipment from the mills, and (2) that rails are overloaded.

Since 1900, an effort has been made by the mills to hasten the metallurgical process, but the soundness of the metal has been decreased. One obvious method of improving the quality of rails would appear to be to take all the time needed to insure sound rails. Since 1900 cars and engines have greatly increased in weight. Simultaneously, high speeds have become more and more common. It requires only the briefest consideration to realize that the magnitude of rail shocks is directly proportional to the weight and to the square of the speed. Thus, if both the weight and the speed have been doubled, the intensity of the shock has been increased eight times.

It is true that the rail itself has also been increased in weight, rails weighing 100 lb. per yd. being now frequently used where formerly rails weighing from 60 to 80 lb. per yd. were used. As a standard 100-lb. rail has a strength of only about two and one-half times that of a 60-lb. rail and one and one-half times that of an 80-lb. rail, it is obvious that with the greater weights and speeds the rail load has increased quite out of proportion to the increase of rail strength. The importance of the rail problem is so great as to warrant [illegible] to it most careful and systematic investigation.

TIES AND ROADBED—The board has devoted considerable time to the investigation of various designs of ties in [illegible] for wood ties. The most that can be said for the many designs that have been submitted is that in general they indicate only in moderate degree an appreciation of the real problem to be solved.

The principal materials other than wood which have been used or suggested for railroad ties are steel, concrete, and combinations of these two materials. In this country the use of steel is slight as compared with foreign countries, but on a few roads, the Bessemer & Lake Erie in particular, the I-beam form of steel tie has been given a thorough trial. From the standpoint of strength, durability and adaptability to the use of proper track fastenings this form of steel tie can be said to be adequate. It furnishes a good support for vertical loads, and proper resistance for forces in compression, tension and bending. With stone ballast it holds the track in adjustment more satisfactorily than with light ballast. Projecting flanges have been used to secure greater resistance against displacement, and no reason is apparent why such flanges should not prove adequate.

Another prominent form of steel tie is the trough-shaped section, some having the opening of the trough downward and others upward. The dome or saucer-shaped section has also been used to some extent, particularly in Mexico. While moderate success has attended the use of the trough-shaped section with the opening upward, those forms with the opening downward have not met with such success that their use has been continued. This is apparently due to the working of the ties in the ballast, although in some kinds of ballast they have given satisfactory service.

Concrete ties are found in only a few experimental installations. These consist either of concrete, plain or reinforced, made in the same shape as wooden ties, or of solid blocks of concrete under each rail, opposite blocks being connected by metal tie bars which also take part in forming the track fastenings. Two installations of concrete ties were examined by the board, one on the Erie R.R., the other on an electric line near Buffalo. Those on the Erie, after several years' service on a branch line, were put into the main track, near Salamanca, but after a few months' trial they were removed and it is understood their use has been discontinued.

The examination of the concrete ties in use near Buffalo and Salamanca and of the steel ties on the Bessemer & Lake Erie indicates that when the track is ballasted with stone and is properly drained, the fear of a too rigid roadbed from the use of materials less elastic than wood is in large measure unfounded.

The use of concrete ties reinforced with steel must remain a question for the future, as no examples of this type are in use.

The fundamental defect in design, which is the most apparent, is failure to realize and appreciate the overturning moment due to the wheel flange pressure against the head of the rail. It is not sufficient that a tie should support the vertical loads and resist direct horizontal thrust and the tendency of the track to move laterally and longitudinally, but this overturning moment must be resisted. This requires that the tie must be a beam to resist bending so that the overturning stresses may be properly transmitted and resisted.

In order that the tie may properly support the stresses transmitted to it by the rail, a suitable fastening of the rails to the ties is most essential. The driven spike commonly used with wooden ties is, of course, impracticable for steel, concrete, or composite ties. The type of track fastening will necessarily vary not only with the material of the tie, but also with its form. A common defect found in many designs is the complication of the rail fastenings. Where bolts are used both the head and the nut should be accessible and the bolts should be capable of renewal without disturbing the ballast to any extent. In many designs of track structure an outside rail chair or brace is used to prevent the overturning of the rails. It is generally formed to fit the contour of the rail, and intended to act as a compression member only. The strength of the rail section itself when subjected to outward bending is more than sufficient to prevent overturning if the bottom flange of the rail is securely held down to the tie. Thus held, there would be no need to resort to outside braces.

A large number of designs presented indicate that the inventors are quite unfamiliar with the ballast and weather conditions encountered on many railroads, particularly in winter, as they make no provision for shimming. Under the action of frost the roadbed heaves, often to a considerable extent and frequently in a very uneven manner. The ties are frozen in the ground, and such undulations of surface are caused by the uneven freezing or heaving that the rails must be shimmed or blocked up above the surface of many of the ties in order to produce a rail surface sufficiently even to carry traffic safely. Under the conditions existing on a large proportion of the railroads in this country the means of adjustment of rail to tie must be such as to admit of this blocking up or shimming, though as the roadbed becomes older and better compacted and as stone ballast is introduced to a sufficient depth the necessity for so doing diminishes.

To provide adequately for shimming or for widening the gage appears to have been a difficult problem for inventors, as it involves the use of adjustable fastenings, with consequent chance for lost motion and change of adjustment. In turnouts and in main-track curves of less than a certain radius it is desirable to widen the gage of the track and

many designs of ties submitted make no provision for so doing.

Another factor having to do with both form and material is the question of insulation of the rails on the one side of the track from those on the other, where electric track circuits are used for signaling. The electric track circuit is coming more and more into use, and no design of tie can be deemed suitable for general use which does not adequately provide for insulation of the rails from the ties.

HEADLIGHTS

From a study of the devices submitted, the board believes that it is not practicable properly to control the direction of a headlight beam through the swiveling of the trucks or by any relation of the train or engine to the track upon which it is running, but that simple mechanical means may readily be designed to swing the headlight so that the engineman may, within limits, have complete control over the direction of the beam.

As a general conclusion regarding locomotive headlights, the board believes that a headlight should be considered either as simply a marker to indicate to stationmen and other persons concerned the approach of a train or, if it is to be used as more than a marker and is intended to be used for the detection of obstructions on the track at a sufficient distance to enable a train to be brought to a stop after they are sighted, the headlight should be a high-power light having both the direction and intensity of the beam controllable by the engineman. The control of the intensity of the beam by the engineman directly from the cab is regarded as a necessity, as when meeting or passing other trains and for preventing inmproper reading of fixed or classification signals. Perhaps the most common and the most weighty objection to the use of high-power headlights is that an engineman running in one direction is dazzled by the light of an engine coming toward him. To meet this objection it is deemed important that every high-power headlight should be so arranged that the engineman can occult it at will.

CAR COUPLERS

Since the passage of the sundry civil act of May 27, 1908, which directed the Commission to examine and report upon all systems or appliances intended to promote the safety of railway operation, the board has examined plans and specifications, as well as models, of numerous automatic car couplers. By reason of the requirements of uniformity and interchangeability to which such devices must conform, the inventors of car couplers are limited to a vertical-plane type of coupler which follows the contour lines prescribed by the Master Car Builders' Association, and their efforts must be confined to effecting improvements in design of the working parts of couplers of the M. C. B. type. The Federal safety-appliance law, which requires the use of couplers that will couple automatically by impact and which can be both coupled and uncoupled without the necessity of men going between the ends of the cars, together with the great increase in size and weight of trains within recent years, have rendered many of the earlier designs of the M. C. B. type of coupler unserviceable. To meet the new conditions, there has of necessity been a notable improvement in the mechanical design and construction of the working parts of couplers, while the type and contour lines prescribed by the Master Car Builders' Association have remained unchanged.

The knuckle-opening device is now in general use and is recognized as a necessary feature of the standard M. C. B. coupler. All M. C. B. couplers now manufactured embody some form of mechanism for automatically opening the knuckle. The use of a centering device is not so general, but the utility of some form of centering device is well recognized, and such devices are coming into use.

Most of the coupler designs that have been offered to the board for examination were considered impracticable, or inferior to couplers already in use. As an aid to inexperienced inventors, the board formulated the following desirable characteristics for automatic car couplers. They should:

(1) Conform to M. C. B. standard drawings and contour lines.

(2) Have a lock-set within the head of the coupler.

(3) Be so designed that they will not part when the knuckle pin is removed or broken.

(4) Be so designed that movement of the uncoupling means to unlock the coupler will open the knuckle.

(5) Be so designed that they will couple with each other with either or both knuckles open.

(6) Be so designed that the lock lift will not be more than 6 in.

(7) Have the fewest possible number of parts; and their operation must in no way depend upon the use of springs.

(8) Have the tail of the knuckle and the lock bearing so located that the axis of the drawbar will pass centrally through the engaging surfaces of the knuckle tail and the lock block, which must be of sufficient area to avoid excessive wear.

(9) Have the locking pin so designed that it will assume locking position freely by gravity, without being compelled to overcome friction or resistance from the unlocking means.

It is believed that the Master Car Builders' Association has the coupler problem fairly well in hand, and that couplers are now being furnished which meet the demands of safety as fully as can be expected owing to the restrictions of manufacture and in view of the exceptionally hard service to which such appliances are subjected.

AUTOMATIC CONNECTORS

The use of a practical device for automatically connecting the air-brake, steam-heat, and signal-pipe lines through a train is desirable, not alone from the standpoint of safety, but also because of economy and the saving of time in train operation.

The side-port and butt-face types of connectors cannot be used together, nor can the pin-and-funnel and wing types of gathering devices be used together. It is apparent, therefore, that until some one type has been decided upon by adequate authority and definitely adopted as standard, little progress in equipment for actual service can be hoped for. It is also true that because of the manifest impossibility of equipping all cars in service at the same time, any hose connector to be serviceable must be so constructed that it can be coupled to the couplings now in common use. The absence of such a provision in a connector is sufficient to prevent its adoption for general use. Another important question is the stopping of leaks and making light repairs. From an operating standpoint it is clearly impracticable to have an engine at hand for the purpose of separating cars whenever it becomes necessary to remove defective gaskets and insert new ones. Some means must be provided for doing such work while the connector heads are coupled together.

The connector designer must provide for additional requirements that are more severe than any which the car-coupler designer has to meet. Whatever form of gathering and registering device may be used with a connector, it is apparent that it must be capable of considerable distortion without destroying the ability of the connectors to register and lock in position when their faces are brought together. Not only for convenience and for obvious mechanical reasons, but also to make it possible to couple hand hose with the automatic connectors during the transition period, connectors should be located directly below the car coupler and in a vertical plane containing the center line of the coupler. To meet the requirements of the Master Car Builders' Association the center line of the conector head must not extend downward farther than 17½ in. below the horizontal center line of the drawbar. The central axis of the connector head must also be the center line of the air-brake port.

Some of the connectors which had been presented for examination possess theoretically good features which would seem to render them entirely practicable for general use. The usefulness of these theoretically good features, however, can only be determined by extensive tests of the connectors in which they are embodied, under the most severe working conditions which such devices are likely to meet in actual service. The board, therefore, arranged with the officers of the Great Northern Ry., for the equipment (with the Robinson connector) of 50 high-capacity cars. These cars are used in ore service on the Marcus division, on track having heavy grades and excessive curvature. The cars are heavily loaded in service and high brake-pipe pressure is used, so that the conditions are such as should afford a thorough test of the practicability of the connector for use in general railway service.

Owing to manufacturing difficulties encountered by the proprietors of the device the equipment was delayed far beyond the time of its expected completion, and the board is therefore unable in this report to present any details concerning the performance of this connector.

INSPECTIONS

In previous reports references have been made to inspections carried on by the board covering signaling practices, methods of operation, and conditions of roadway. These inspections have been continued. They have been made for the double purpose of (1) carrying on the investigation relating to block-signal systems and other devices intended to promote safety in railway travel, and (2) to set forth in a summary for the benefit of the officers of railroads any bad practices or unsafe conditions observed.

In signaling, many instances have been found where signals were out of order; portions of the track without track-circuit protection; signals improperly located amid surroundings which tend to create confusion in their observance; lack of sufficient tools, lanterns, and flags; giving of hand signals from interlocking towers; drawbridges without any kind of protection; and many cases where interlocking towers were found in filthy condition. In methods of operation, practices such as the handling of train orders in cramped quarters and amid confusing surroundings; allowing some trains to pass block signals in the stop position without stopping; practices connected with the flagging of trains, particularly trains which are not fully manned, thus requiring the flagman to perform services liable unduly to take his attention away from flagging, are some of the many defects or deficiences to which our attention has been called.

GENERAL CONDITIONS AFFECTING SAFETY

In discussing this subject it may be assumed at the outset that railroad officers and employees are as anxious to do everything in their power to promote safety as the public is to have safeguards provided, and that railroad officers and employees are not immune to the horrors of a terrible wreck. The railroad officer responsible for results does his utmost to meet the demands made on him. His first responsibility, as he sees it, is to provide earnings. It is but natural, therefore, that he has given chief attention to the conditions directly affecting the financial end of the business, and less attention to the conditions affecting safety. Safety he very much desires, but earnings he must have.

The public should squarely face its share in the responsibility for safety. The comfort and luxury which it now demands are costly. The high-speed train which was a special event 20 years ago is now a feature of the regular schedules. The American people cannot wait; they crowd the steps to get on a train and the aisles to get off. Comforts and luxuries are demanded without increase of expense to the traveler; not only that, but with a very general demand for a decrease in prices. Every added demand upon existing facilities and methods introduces sources of danger. As the demand does not diminish, it seems necessary that methods and facilities must improve if the standard of safety is to be maintained.

As regards methods, it may be said that on the large majority of American railroads excellence of administration is nullified by faulty organization, magnification of individual function to the detriment of team work, and by an almost entire absence of a definite system of broad training of subordinates for higher duties. These, and the shifting of responsibility from one officer or department to another, prevent the attainment of that high order of discipline and morale which must be had if carelessness is to be overcome and skill and painstaking loyalty govern the acts of the men on whom the public must depend for safety in travel. As has been observed in former reports, this condition is largely due to causes which have their roots in the conditions of society in America.

While the deficiencies noted above may explain, they can hardly excuse failure to take greater advantage of the facilities for promoting safety which already exist or are ready for final development by the railroads. The railways have been slow in installing the block system, long since demonstrated to be the prime requisite for safety against collision. The railroads have failed to investigate as fully as they should the availability of devices to supplement the block system as now used, and which if adopted would add directly to the safety secured by existing means. This question of neglect of definite measures affects the public also. The failure of the Government to require the installation of the block system is a definite feature of recent congressional history, there being more and stronger reasons to require this improvement than exist for the use of some other safety devices now required by law. Intelligent coöperation by the States and the Federal Government in establishing more uniform requirements for the operation of railroads would result in marked advancement and help to do away with the uncertainty felt by railroads as to their future.

CONCLUSIONS

In concluding its final report, the board summarizes the recommendations made in its several reports as follows:

(1) The compulsory adoption by all interstate railroads of the block system. That system has long since passed out of the experimental stage. As regards the manual block system this recommendation implies the careful selection and thorough training of the block signalmen and the constant, regular and thorough inspection of signal operation and methods. The automatic block system must be carefully and thoroughly installed and constantly inspected.

(2) The development of the automatic train stop has proceeded far enough to warrant the expectation that by its use greater safety can be secured in the operation of trains. Railroads should be given to understand that the automatic train stop must be developed by them as rapidly as possible.

(3) Railroad tracks should be properly inclosed and the laws against trespassing thereon enforced. Grade separation should be encouraged and in certain localities required.

(4) The payment of pensions by the railroad companies to their superannuated employees would do much toward creating loyalty and stability in railroad organizations.

(5) There should be more complete coöperation of the State and Federal Governments on the one hand and railroad companies on the other in order to bring about more stable conditions throughout the entire country. Piecemeal legislation should be brought together and harmonized into general enactments, comprehensive in character and based on the best standards of practice. The board recommends that the enforcement of this general legislation be intrusted to a body having powers similar in character to those now provided for and administered by the Railway Department of the British Board of Trade.

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The Commission Plan of Government was adopted by the city of Denver, Colo., on Feb. 14, by a large popular majority. The vote was on a series of amendments to the existing charter.

Panama Canal Excavation during January, totaled 2,612,020 cu.yd., a daily average of 100,642 cu.yd. for each of the 26 working days. The monthly rainfall was 2.82 in. The amount of concrete laid in January was 91,362 cu.yd. and 222,002 cu.yd. of fill were placed in dams.

The Water-Works Standpipe of the Cairo Water Co., Cairo, Ill., fell on Feb. 11, 1913. The Company has wired us the following infomation, at our request:

The standpipe was built in 1885. It was originally 150 ft. high, was later increased to 175 ft., and was 16 ft. in diameter. The standpipe did not collapse, but fell over and broke after falling. Our opinion is that on account of long continued high water the earth became so softened that the foundation was weakened.

According to "The Manual of American Water-Works," the Cairo works were built in 1885 and put in operation on Jan. 1, 1886, by Peter Herdic, under the name of the Cairo Water Co. The earlier issues of the "Manual" gave the surname of the constructing engineer as Ditmar, of Williamsport, Penn., and later issues stated that James H. Harlow & Co., Pittsburgh, Penn., were designing engineers. The contractors for the standpipe were Maittang & Son, Peoria, Ill. The standpipe must have been raised before 1897, since the "Manual" for that year gave its height as 175 ft. The water-supply of Cairo was pumped from the Ohio River.

We hope to give particulars of the failure in a later issue.

A Series of Lectures on Radioactivity is being arranged for March and April under the auspices of the Electrophysics Committee of the American Institute of Electrical Engineers. The lectures will be given in the Auditorium of the Engineering Societies Building, New York City, on the evenings of Mar. 18 and 25, and Apr. 1 and 8, and the lecturer will be Prof. Edwin P. Adams, of the Palmer Physical Laboratory, Princeton University.

The Alaska Railroad Commission, appointed by President Taft in August, 1912, to conduct an examination into the transportation question in the Territory of Alaska, from the engineering, financial and development standpoints, has made its report, the principal details of which are brought out in a special message to Congress from the President, under date of Feb. 6.

The Commission, consisting of Major J. J. Morrow, A. H. Brooks, L. M. Cox and C. M. Ingersoll, recommended as a result of their investigations that two independent railroad lines be constructed, one connecting the Yukon and Tanana River valleys with tidewater, by way of Cordova, Chitina and Fairbanks, and the other running from Seward around Cook Inlet and connecting with the Kuskokwim and Susitna River systems.

Cordova is indicated by the Commission as the logical and best terminal for the Bering River coal fields, and Seward occupies the same position with respect to the Matanuska field. The proposed terminals at Katalla and Controller Bay were deprecated as lacking in the essential factors of good harbor facilities and economy.

The two roads advocated would involve 733 miles of new construction at an estimated cost of $35,000,000, not including branch lines for local development, for which probable future growth the route has, however, been partly planned.

PERSONALS

Mr. W. S. MacCulloch has been appointed Assistant Engineer of the Grand Trunk Ry., at Montreal, Que.

Mr. Geo. W. Craig, Assoc. M. Am. Soc. C. E., has resigned as City Engineer of Omaha, Neb., to become City Engineer of Calgary, Alta.

Mr. W. B. Way, Assistant Superintendent of the Canadian Pacific Ry., at Montreal, Que., has been promoted to be Superintendent at Farnham, Que.

Mr. D. McCoe, Superintendent of Grade Separation, Grand Trunk Ry., Toronto, Ont., has been made Superintendent of Tracks of the Toronto terminals.

Mr. Henry Ferguson, formerly General Road Master of the Grand Trunk Ry., at Toronto, Ont., has been appointed Superintendent of Tracks of the Ontario division.

Mr. Charles Dorrance, Jr., M. Am. Inst. M. E., formerly Fuel Engineer of the Lehigh Coal & Navigation Co., has been promoted to be Chief Mining Engineer, having superintendence of the mining and mechanical departments.

Mr. Joseph Chidley, formerly Division Master Mechanic of the Lake Shore & Michigan Southern Ry., at Collinwood, Ohio, has been promoted to be Assistant Superintendent of Motive Power, with headquarters at Cleveland, Ohio.

Mr. B. R. Pollock, recently promoted to be General Manager of the New York, New Haven & Hartford R.R., has been made General Manager of the transportation department of the Boston & Maine R.R., with headquarters in Boston, Mass.

Mr. Julian Kendrick, M. Am. Soc. C. E., has resigned as Chief Engineer of the Rudolph S. Blome Co., of Chicago, Ill., and opened an office in the First National Bank Bldg., Birmingham, Ala., as a consulting, municipal and hydraulic engineer.

Mr. Thomas E. Collins, Assoc. M. Am. Soc. C. E., Assistant Engineer on the revaluation of the railways and canals, State of New Jersey, has been made city surveyor of Elizabeth, N. J., succeeding Mr. W. H. Luster, Jr., M. Am. Soc. C. E., resigned.

Mr. J. A. Shepherd, formerly General Manager of the Western Maryland Ry., has been appointed Superintendent of the Kansas City terminals of the Missouri Pacific Ry., with headquarters at Kansas City, Mo., succeeding Mr. J. A. Somerville.

Messrs. Robert D. Hennen and G. B. Hartley announce that they have formed a partnership under the firm name of the Monongahela Valley Engineering Co., with offices in Morgantown, W. Va. The firm will engage in both civil and mining engineering.

Mr. Henry L. Gray, M. Am. Soc. C. E., Chief Engineer of the Public Service Commission of the State of Washington, Olympia, Wash., has resigned. Mr. Gray will return to private practice, specializing in appraisal engineering, with offices at Seattle, Wash.

Mr. F. S. Burroughs, Assoc. M. Am. Soc. C. E., formerly Assistant Chief Engineer of the Public Service Commission of the State of Washington, has been appointed Chief Engineer, succeeding Mr. Henry L. Gray, M. Am. Soc. C. E., resigned, as noted elsewhere.

Mr. T. N. Jacob, M. Am. Soc. C. E., has been reappointed Chief Engineer of the East Side Levee and Sanitary District, East St. Louis, Ill., under the new organization of the board of trustees. The office of Consulting Engineer, formerly held by Mr. J. A. Ockerson, M. Am. Soc. C. E., has been abolished.

Mr. E. G. Hewson, formerly Resident Engineer of the Grand Trunk Ry., at Toronto, Ont., has been promoted to be Division Engineer of the Ontario division. The grade of Division Engineer is a new one in the Grand Trunk Ry. organization, which has hitherto had only a Chief Engineer and his staff of Assistant Engineers and Resident Engineers.

Mr. H. W. Beers, recently Chief Engineer of the Southern Ferro-Concrete Construction Co., Atlanta, Ga., has been elected Vice-President of the company. Mr. Beers is a graduate in civil engineering of the Massachusetts Institute of Technology, class of 1906, and has previously been Assistant Engineer and Resident Engineer of the company.

Mr. H. H. Althouse has resigned as Chief Engineer of the Erie R.R. Mr. Althouse has been connected with the Erie since 1899. From 1902 to June, 1912, he was Assistant Engineer at New York. After a short period as Principal Assistant Engineer of the Western lines, he was promoted to be Chief Engineer, August, 1912, succeeding Mr. W. J. Harahan, M. Am. Soc. C. E., now President of the Seaboard Air Line Ry.

Mr. Watson Townsend, Assistant Engineer of the Union Pacific R.R., at Omaha, Neb., has been made City Engineer of Omaha. Mr. Townsend has been in railway work in the Middle West since 1902, when he was a draftsman with the Minneapolis, St. Paul & Sault Ste. Marie Ry. For a short time he was Locating Engineer and later Assistant Engineer of Construction with the Great Northern Ry. He has been with the structural department of the Union Pacific R.R. since 1909. Mr. Townsend succeeds Mr. Geo. W. Craig, resigned, as noted elsewhere.

Mr. T. P. Artaud, Assoc. Am. Soc. M. E., formerly Superintendent of terminals and Purchasing Agent of the Hudson & Manhattan R. R., New York City, has been promoted to be Assistant General Manager, succeeding Mr. O. T. Boyd, resigned. Mr. Artaud became connected with the company during the construction of the Hudson River tunnels and has since steadily advanced through the various departments. In his present office he will have direct charge of the operation of the railway, power house and terminals, as well as act as supervisor of purchases.

Mr. H. W. Irwin has been appointed Assistant Superintendent of Equipment of the Bay State Street Rys., Boston, Mass., which is a system of nearly 1000 miles of track in Massachusetts, Rhode Island and New Hampshire. Mr. Irwin graduated from Purdue University in mechanical engineering in 1903. For a number of years he was with the General Electric Co., Schenectady, N. Y. He entered street railway work as General Manager of the Northern Electric Co., Fargo, N. D., returning to the East in 1909 to become Superintendent of instruction of car service employees for the Boston & Northern Street Ry. and the Old Colony Street Ry.

Mr. E. T. Munger has resigned as General Superintendent of the Hudson & Manhattan R.R., New York City. Mr. Munger graduated from the University of Wisconsin in 1892. He first entered railway work in 1895 as a foreman of construction of the Metropolitan West Side Elevated Ry., Chicago, Ill. In 1898 Mr. Munger was Engineer in charge of the construction of the storage-battery street car line of the Englewood & Chicago Ry., between Englewood and Blue Island, Ill. He again entered the service of the Metropolitan West Side Elevated Ry. in 1903 as Master Mechanic; later he was Superintendent of Motive Power of the company.

OBITUARY

George William Maynard, a prominent mining engineer, died at the home of his sister, Mrs. F. S. Matthews, in Boson, Mass., Feb. 13. He had been in poor health for several years. Mr. Maynard was the dean of the mining engineers of America; he was the oldest mining engineer graduated from the Columbia University, but before its first School of Mines had been established.

Mr. Maynard was born in Brooklyn, N. Y., June 12, 1839. He graduated from Columbia College, as it was then called, in 1859. After graduation he spent a year in the chemical laboratory of Columbia, and in 1860 went to Germany, where for a year he studied chemistry, physics and mineralogy at the University of Göttingen. While there he was a fellow student with J. Pierpont Morgan. Leaving Göttingen he spent a year at Clausthal in the Harz, studying mining and metallurgy in the Bergakademie there. In 1862 he received the degree of Master of Arts from Columbia.

Having completed his studies, Mr. Maynard began his professional practice with an engagement at the Connoree mines in County Wicklow, Ireland, where he remained a year. In 1864 he returned to New York City, where he established an engineering office and chemical laboratory. In April of that year he was called upon to make a professional examination of a mining property in Colorado, which was his first visit to the new mining regions of the Rocky Mountains. He was so much attracted by the possibilities there that in December, 1864, he returned to Colorado and established an engineering office and assay laboratory in Gilpin County, which was perhaps the first institution of that kind in that part of Colorado.

Mr. Maynard returned to New York City in the winter of 1867 and took charge of a sulphuric-acid works on Staten Island. In 1868 he was appointed Professor of mining and metallurgy at the Rensselaer Polytechnic Institute, Troy, N. Y., and occupied that chair until 1872, when the mining department of that institution was discontinued. In 1873 he went to London, England, which was his headquarters during the next six years. During this period he spent six months in Eastern Russia, erecting a copper reduction works for a British company at Voskrevsenky. During this period

he was Consulting Engineer for several iron and steel works in England and Wales, and in such capacity made, at Middlesbrough, the first demonstration in a large way of the Thomas-Gilchrist basic bessemer process of steel making. This brought him into very intimate relations with that lovable character, Sydney Gilchrist Thomas.

Mr. Maynard returned to New York City in 1879 for the purpose of introducing the Thomas-Gilchrist process in the United States, which he succeeded in doing by selling the patents to the Bessemer Co., afterward known as the Steel Patents Co. Subsequent to that time Mr. Maynard remained a resident of this country, save for such brief professional trips as took him abroad. He was engaged in active practice as Consulting Engineer up to the time of his last illness, visiting Nova Scotia, British Columbia, the Yukon, Mexico and Cuba in connection with his mining and metallurgical work.

Mr. Maynard was one of the charter members of the American Institute of Mining Engineers, and many years later he became one of the charter members of the Mining and Metallurgical Society of America. He was also a member of the American Museum of Natural History, the Metropolitan Museum of Art, and the Engineers' Club of New York.

During his early associations with the steel industry Mr. Maynard came closely into contact with many historic characters—Sydney Gilchrist Thomas, Andrew Carnegie, John Fritz and Alexander Lyman Holley, among others—and during his pioneering in the region west of the Rocky Mountains, both in the Northwest and in the Southwest, he had many interesting experiences, reminiscences of which always made absorbing stories when he told them to his friends (Abstract from the "Engineering and Mining Journal.")

ENGINEERING SOCIETIES

COMING MEETINGS

ASSOCIATION FOR STANDARDIZING PAVING SPECIFICATIONS.
Feb. 24. Annual meeting at Pittsburgh, Penn. Secy., J. B. Hittell, 5917 Winthrop Ave., Chicago, Ill.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.
Feb. 25-26. Annual meeting at Indianapolis, Ind. Secy., W. F. King, Indianapolis, Ind.

ONTARIO LAND SURVEYORS.
Feb. 25-27 Annual meeting at Toronto, Canada. Secy., L. V. Rorke, 701 Temple Bldg., Toronto, Canada.

AMERICAN CERAMIC SOCIETY.
Feb. 25-28. Annual meeting at Washington, D. C. Secy., Edward Orton, Jr., Raleigh Hotel, Washington, D. C.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 26-28. Midwinter Convention in New York City. Secy., F. L. Hutchinson, 33 W. 39 St. New York, N. Y.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.
Feb. 27-28. Annual meeting at Indianapolis, Ind. Secy., A. L. Neereamer, Indianapolis, Ind.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Mar. 3-5. Annual meeting at Chicago, Ill. Secy., W. P. Blair, 824 Engineers Bldg., Cleveland, Ohio.

VERMONT SOCIETY OF ENGINEERS
Mar. 10. Annual meeting at Burlington, Vt. Secy., G. A. Reed, Barre, Vt.

NEW ENGLAND RAILROAD CLUB.
Mar. 11. Annual meeting at Boston, Mass. Secy., W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.
Mar. 18-21. Annual convention at Chicago, Ill. Secy., E. H. Fitch, 900 S. Michigan Ave., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

AMERICAN CHEMICAL SOCIETY.
Mar. 25-28. Annual meeting in Milwaukee, Wis. Secy., C. L. Parsons, Box 505, Washington, D. C.

NATIONAL FIRE PROTECTION ASSOCIATION.
Mar. 26-27. Annual meeting in New York City. Secy., Ralph Sweetland, 141 Milk St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB.
Mar. 25. Annual meeting at Boston, Mass. Secy., H. A. Faulkner, 12 Pearl St., Boston, Mass.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Martin, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

American Ceramic Society—Among the papers on the program for the annual meeting in Washington, D. C., on Feb. 25-28, are the following: "Use of the Casting Process for Large Clay Wares," by C. J. Kirk. "The Brick Industry of Europe," by G. W. Conrad. "Pottery Firing by Pyrometry," by E. C. Stover. "The Melting Point of Refractory Materials," by C. W. Kanolt; "Properties of Portland Cement as Affected by Different Burning Temperatures," by P. H. Bates; and "Transverse Tests for Clays," by C. H. Kerr and R. J. Montgomery.

Illuminating Engineering Society—At the annual meeting in New York City, on Jan. 10, the following officers were elected for 1913: President, P. S. Millar; Vice-Presidents, J. W. Cowles (New England), W. J. Serrill (Philadelphia), H. S. Evans (Pittsburgh), and J. R. Cravath (Chicago); Secretary, J. D. Israel; Treasurer, L. B. Marks; and Directors, P. W. Cobb, C. O. Bond and W. C. Morris.

Mining and Metallurgical Society of America—The officers elected for the ensuing year, at the annual meeting in New York City, on Jan. 14, were as follows: President, H. M. Chance; Vice-President, J. R. Finlay; Secretary, W. R. Ingalls, and Councillors, R. A. F. Penrose, Jr., S. W. Mudd, C. W. Goodale and H. S. Munroe.

Plans have been proposed and approved by the governing councils of both organizations, for effecting a union of the Society with the American Institute of Mining Engineers. By the terms of the proposed combination the Society would become the Mining and Metallurgical Society of the American Institute of Mining Engineers, preserving its separate individuality and organization. No action has yet been taken in the matter by the membership of either society.

American Society of Mechanical Engineers—At a meeting in the Engineering Societies Building in New York City on Feb. 11, a paper was read by William T. Donnelly on "Port Facilities for Ships and Cargoes in the United States." The paper dealt almost entirely with conditions at the port of New York. Mr. Donnelly pointed out the essential differences between that and the majority of European ports and gave a very clear and interesting diagnosis of the present congested conditions along the water front of lower Manhattan. His paper explained the contest between railroad and shipping interests for terminal facilities, and also the efforts to relieve congestion by developments along the water front in South Brooklyn and in the Communipaw section of Jersey City. Some attention was given also to the proposed plan for an elevated freight railway along the west water front of lower Manhattan, an alternative plan for an elevated street for pedestrian traffic being suggested. The lecture closed with a series of slides illustrating the differences between the docking facilities and the loading and unloading machinery at European and American ports. H. McLain Harding, S. Sawyer and G. A. Orrok contributed to the discussion.

National Paving Brick Manufacturers' Association—The annual meeting of the Association will be held at Chicago, Ill., on Mar. 3-5, at which time papers will be read on "The Relation of the Trade Journal to Municipal Work," by S. T. Henry, and "The Psychology of Competition," by E. L. Middleton. The date of the meeting was arranged to partly coincide with the dates of the Clay Products Exhibition in Chicago.

Western Society of Engineers—At the meeting held at the Society's rooms, in Chicago, on Feb. 3, a project for a central railway terminal for both passenger and freight traffic was described by Jarvis Hunt. The proposed site is on land owned by various railways, but is traversed by the Chicago River, which would have to be diverted to a new channel. The track plan of the passenger station is peculiar in having separate groups of tracks for inbound and outbound trains, with loop connections, so that there would be no reverse movements. The discussion was chiefly upon matters of detail. The most important points brought out were: 1, the enormous area of land within the business center of the city, which is occupied by freight yards; and, 2, the scattered and inconvenient locations of the numerous freight houses.

A paper on "Railway Bridge Design in Europe and America," by Edward Godfrey, presented at the meeting of Feb. 10, compared the heavy loading for American locomotives (60,000, 64,000 and even 66,000 lb. per axle) with the much lighter loading of foreign locomotives (44,000 lb. maximum for the Prussian State Railways). The foreign practice of providing for periodical inspection was regarded favorably, but the details of design in some small bridges were criticised. Nothing was said, however, as to the design or workmanship on more important structures, except that it was stated that European regulations seem to fail to realize the weakness of hand-driven or field rivets as compared with power-driven or shop rivets.

Other papers listed for the February meetings are as follows: Feb. 17, "Topography of the Bed-Rock under Chicago," by R. Peattie; Feb. 24, "Synchronous Condensers," by L. B. Andrus. This latter meeting will be held jointly by the electrical section of the Society and the Chicago section of the American Institute of Electrical Engineers.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Maine—York & Oxford R.R.—This company has applied for a charter to construct a line from Sanford through several other towns to a connection with the Boston & Maine R.R. and the Maine Central Ry. Capital, $500,000.

Vermont—Southern Vermont Ry.—This company has filed plans for the construction of its proposed railroad from the Rockingham line to the Westminister line through Bellows Falls, Vt.

Massachusetts—Boston & Maine R.R.—The Railroad Commissioners, Feb. 7, authorized this company to issue $7,500,000 of bonds to make permanent additions and improvements and to defray certain indebtedness. A. B. Corthell, Boston, Mass., is Ch. Engr.

Massachusetts—Boston & Maine R.R.—This company plans to four-track the six miles of line between Wellington and Wakefield Junction.

New York—Erie, R.R.—This company is having surveys made for the construction of a cutoff on the main line between Sparowbush and Tusten, N. Y., 30 miles.

Pennsylvania—Western Allegheny Ry.—This company is considering the construction of an extension from its eastern terminus, Kaylor, Penn., to the Allegheny River, opposite Mahoning, where connection could be made with the Pittsburgh, Sbawmut & Northern Ry. G. M. Hughes, Kaylor, is Supt.

Pennsylvania—Pennsylvania R.R.—This company is considering the construction of a branch through Ten-Mile Valley of Greene County.

West Virginia—Trans-Appalachian Ry.—This company has been chartered to construct a line from Parkersburg, W. Va., to Covington, Va., via Marlinton, W. Va., about 150 miles. H. M. Lockridge, Huntersville, W. Va., is one of the incorporators.

The survey for the construction of the proposed railroad from Parkersburg, W. Va., to Charleston, W. Va., 74 miles, has been completed. K. B. Stephenson, Parkersburg, is interested.

North Carolina—Radford-Carolina R.R.—This company has started surveys for its proposed line from Radford, Va., to Mount Airy, N. C., 80 miles.

Florida—Birmingham, Columbus & St. Andrews Ry.—This company is considering, it is reported, the construction of an extension to Lynn Haven, Panama City and Bunker's Cone. A. D. Campbell, Chipley, Fla., is receiver for the company.

Alabama—Gulf, Florida & Alabama Ry.—This company has filed articles of incorporation in Alabama to construct an extension, north from Locality G. A. Berry, Pensacola, Fla., is Vice-Pres. and Ch. Engr. Noted Jan. 16.

Kentucky—Chesapeake & Ohio Ry.—This company has entered into an agreement with the Elkhorn Fuel Co. to construct a 20-mile line from Beaver Creek to Kentucky coal land. F. I. Cabell is Ch. Engr., C. & O. Ry., Richmond, Va. J. A. Clark, Fairmont, W. Va., is Pres. Elkhorn Fuel Co.

Kentucky—Cincinnati, Licking Valley & Virginia Ry.—This company has completed surveys for the construction of its line up the Licking River Valley. Construction work, it is reported, will soon begin. T. G. Stuart, Winchester, Ky., is interested. Noted June 20.

Lexington & Eastern Ry. (Louisville & Nashville, R.R.)—This company is surveying and securing rights-of-way for its proposed extension along Line Fork Creek, about 20 miles. J. H. Peyton, Louisville, is Ch. Engr. Const. Noted Feb. 6.

Ohio—Pittsburgh, Cincinnati, Chicago & St. Louis Ry.—This company made application to the Public Service Commission, Feb. 10, to issue $7,000,000 of bonds for improvements.

Michigan—Rapid R.R.—The State Railroad Commission has approved the application of this company to increase its capital stock. The company plans to double-track its line between Detroit and Port Huron, Mich. H. Bullen, Detroit, Mich., is Gen. Sut.

Illinois—Hooppole, Yorktown & Tampico R.R.—This company was granted incorporation papers, Feb. 10. The company plans to construct a railroad from Hooppole, Henry County, through Bureau County, to Tampico, Whiteside County. The incorporators are C. W. Groves, H. J. Rinzel, G. R. Mathis, James Tonkinson, all of Hooppole; R. H. Mathis, Prophetstown, Ill., and John H. Cooley and T. W. Mathis, Tampico, Ill. Capital, $100,000.

Iowa—Atchison, Topeka & Santa Fé Ry.—This company has completed surveys for the construction of a line across the state of Iowa to Quincy, Ill., necessitating the construction of a bridge over the Mississippi River at Keokuk, Iowa.

Kansas—The Atchison, Topeka & Santa Fé Ry. and Missouri Pacific Ry.—These companies, it is reported, have arranged to extend the Larned-Jetmore Branch of the former and the Larned-Conway Springs Branch of the latter. The plan as outlined is for the Missouri Pacific to connect with the Santa Fé branch at Larned, Kan. The Santa Fé branch will then be operated jointly as far west as Burdett. J. R. Stephens, St. Louis, Mo., is Ch. Engr. Missouri Pacific Ry. and C. F. W. Felt, Topeka, Kan., is Ch. Engr. of the A. T. & Santa Fé.

Nebraska—The construction of a railroad 30 miles long from Hemmingford, Neb., to Canton or Curley, Sioux County, is under consideration. Several merchants of Hemmingford and farmers and ranchmen along the proposed route are interested. K. L. Porter, Hemmingford, is in charge.

North Dakota—Great Northern Ry.—This company will soon commence construction on its proposed line from Crosby, N. D., southwest 24 miles in Divide County, ending at Ferile, and passing through Stady, Plummer and Tansem.

Texas—Gulf, Texas & Western Ry.—This company is planning to construct an extension of the line now under construction from Jacksboro to Salesville, Tex., about 23 miles, to Mineral Wells, Tex., eight miles further. P. E. Bock, Jermyn, Tex., is Gen. Supt.

Oklahoma—Beaver, Meade & Englewood Ry.—This company has been organized to construct a railroad connecting Beaver, Meade and Englewood. Length, about 75 miles. W. T. Quinn is Secy.

Nevada—Winnemucca Northern R.R.—This company will award grading contracts as soon as location surveys have been completed. The company's proposed line will run from Winnemucca, Nev., to Boise, Idaho. The work will involve about 40 miles of heavy work and 20 miles of rock work.

Arizona—Bagdad Copper Co.—This company is preparing to construct a railroad from Seligman to Bouse for the purpose of giving its copper mines a transportation outlet. Lewis A. Wright is Mgr.

✚**California**—San Francisco, Oakland & San Jose Terminal Ry.—This company has awarded a contract to TWOHY BROS., Spokane, Wash. and Portland, Ore., for the enlargement of terminal facilities at Oakland, Calif., the work calling for filling in the Key Route pier and providing for increased trackage facilities.

California—San Pedro, Los Angeles & Salt Lake R.R.—This company will construct a new line from Los Angeles to San Diego, Calif. It will be 130 miles long, and will cost $10,000,000. E. G. Tilton, Los Angeles, is Ch. Engr.

Alaska—Government ownership of railroads in Alaska with private operation under lease was urged Feb. 6, by President Taft in a special message to Congress. He recommends the construction by the government of two roads at an estimated cost of $35,000,000, to open up the coal fields of the territory.

✚**Manitoba**—Grand Trunk Pacific Ry.—This company has awarded the contract to the HYLAND NAVIGATION & TRADING CO., Winnipeg, Man., for the construction of its proposed line from Hartney to Brandon, Man., 50 miles.

ELECTRIC RAILWAYS

Farmington, Maine—The Farmington & Oakland Interurban Ry. Co. has applied for permission to construct an interurban railway from Farmington to Oakland.

Houlton, Maine—The Houlton St. Ry. Co. has been incorporated to construct and operate an electric railway in Houlton. The incorporators are I. G. Hersey and P. P. Burleigh, Houlton; A. R. Gould and H. N. Crandall, Presque Isle.

Sanford, Maine—The Atlantic Shore Electric Ry. Co. has increased its capital to provide funds for the extension and improvement of its line. L. H. McCray, Kennebunk, is Gen. Mgr. and Pur. Agt.

Sanford, Maine—The York & Oxford R.R. Co. is being organized to construct and operate an electric railway connecting Sanford, Alford, Waterloo, Limerick, Baldwin and Hiram.

Boston, Mass.—The Boston & Eastern Ry. Co. has been incorporated to construct and operate an electric railway from the Post-Office Square in Boston to Beverly. The incorporators are William H. Young, John H. Bickford, Charles Dayton and William G. Cove.

Oaklawn, R. I.—The construction of an electric railway from Oaklawn to Apponaug, about four miles, is contemplated by Charles B. Wescott and associates.

Utica, N. Y.—The Common Council has granted a franchise to the New York State Rys. Co. to construct and operate a double-track line on Genesee St. B. E. Wilson, Rochester, is Gen. Mgr.

Altoona, Penn.—The Altoona & Logan Valley Electric Ry. Co. has been petitioned by the Greenwood Cemetery Association to extend its lines in Altoona. S. S. Crane, Altoona, is Gen. Mgr.

Chambersburg, Penn.—The Chambersburg & Shippensburg Ry. Co. has been organized to construct and operate an electric railway from Chambersburg to Shippensburg. T. M. Mahon is Pres.

Charleston, W. Va.—The Charleston Interurban Ry. Co. is preparing plans for the extension of its line from Charleston to Montgomery, about 25 miles. Robert. W. Rockwell, Charleston, is Supt. and Pur. Agt.

Homestead, Fla.—Plans are being prepared by the Ocean Beach Realty Co. for the construction of an electric railway from Homestead to Palm Beach. Joseph A. McDonald, Miami, is Pres.

St. Augustine, Fla.—The City Council has granted a franchise to the St. Augustine Public Service Corporation to construct and operate an electric railway in St. Augustine. A. W. Corbett is Pres. Noted Feb. 6.

Cincinnati, Ohio—The Indianapolis & Cincinnati Electric Co. has been incorporated to construct and operate an electric railway from Rushville to Cincinnati. Charles L. Henry, Indianapolis, Ind., is Pres.

Jackson, Ohio—Press reports are to the effect that plans are being prepared for the construction of an electric railway from Jackson to Portsmouth, about 40 miles.

Ravenna, Ohio—The Cleveland, Alliance & Mahoning Valley Traction Co. is making preliminary arrangements for the extension of its line from Ravenna to Leavittsburg, about 21 miles. Charles Morley, Cleveland, is Pres.

Indianapolis, Ind.—Robert I. Todd, Pres. of the Indianapolis & Crawfordsville Interurban Ry. Co., announces that bids will soon be received for the construction of a double-track line west as far as the Speedway.

The officials of the Indianapolis & Interurban Ry. Co. announce that the contract for the construction of the 84 miles of road will be let in the spring. Henry L. Smith is Secy.

Laporte, Ind.—Local citizens are considering plans for the organization of a company to construct and operate an interurban railway from Laporte to Logansport.

Princeton, Ind.—The Evansville Public Service Co. is preparing plans to extend the Evansville and Princeton interurban line north to Owensville.

Tipton, Ind.—The Tipton & Frankfort Interurban R.R. Co., recently incorporated, will soon ask for bids for the construction of the road from Tipton to Frankfort, a distance of 21 miles.

Alton, Ill.—The Alton & Eastern Electric Ry. Co. is making arrangements in order to be able to start work this spring on the construction of its proposed lines east of Alton. A. J. Puritan, of East St. Louis, and O. C. Macey, of Alton, are interested.

Lerna, Ill.—The City Council has granted the Springfield & Central Illinois Traction Co. a franchise to construct and operate an electric railway through Lerna.

Peoria, Ill.—Plans are being prepared by the Peoria Ry. Co. for the extension of its South Adams St. line. R. W. Bailey, Peoria, is Gen. Supt.

Quincy, Ill.—The Tri-State Traction Co. has been incorporated to construct and operate an interurban line from Quincy to Hamilton. The incorporators are Henry F. Dayton, Quincy; John M. Hungate, Warsaw; C. T. Daugherty and E. W. Wood, of Warsaw.

Fergus Falls, Minn.—A company has been formed and is making preliminary arrangements for the construction of an electric railway in Fergus Falls. S. O. Bridston is interested. Noted Jan. 16.

Austin, Tex.—The Commissioners' Court of Travis County has granted the San Antonio & Austin Interurban Ry. Co. a franchise for the operation of cars over the bridge of the Colorado River in Austin for a term of 50 years. The construction of this line will soon be started, it is announced. The survey is now being made.

Greenville, Tex.—A. R. Nicholson and associates are making preliminary arrangements and will soon be ready to start work on the construction of its proposed line from Greenville to Blue Ridge.

La Porte, Tex.—The Bay Shore Rapid Transit Co. is making preliminary arrangements for the construction of its proposed electric line to connect Houston, La Porte, Velasco and Freeport. Samuel F. George, Dayton, Ohio, is interested. Noted Nov. 14.

Venus, Tex.—Steps are being taken to construct an interurban electric railway between Dallas and Venus. The promoters of the project will be given a franchise for the use of the streets of Venus for the proposed line.

Waco, Tex.—John J. Potts of Waco, and associates are promoting the construction of an interurban electric railway from Waco to Temple via Onaville, Mooresville and other towns. Another similar project is on foot, but the two proposed lines are to occupy different routes.

Seattle, Wash.—The Puget Sound Traction, Light & Power Co. has applied to the City Council of Seattle for permission to double-track its line on Meridan Ave. L. H. Bean, Tacoma, is Mgr.

Portland, Ore.—The Washington Electric Co. is making preliminary arrangements for the construction of its proposed electric railway from Portland, Ore., to Tacoma, Wash.

Los Angeles, Calif.—The City Council has granted a franchise for a period of 21 years to the Los Angeles Ry. Co. to construct and operate an electric line in the western section of the city. Howard Huntington, Los Angeles, is Vice Pres. and Gen. Mgr.

The construction of a double-track line on 13th and San Pedro Sts. is contemplated by Frank E. Gooch and associates.

Richmond, Calif.—The San Francisco-Oakland Terminal Ry. Co. is preparing plans for the construction of an electric railway on Standard Ave. in Richmond.

San Bernardino, Calif.—Bids will be received until Feb 20, by the Pacific Electric Ry. Co. for the construction of the new line from San Bernardino to Upland.

San Francisco, Calif.—The United Railroads of San Francisco is considering plans for the extension of its Bryant St. line to the wharf docks. E. D. Hibbs, 85 Second St., San Francisco, is Gen. Supt.

Willows, Calif.—The construction of an electric railway on Seventh and Walnut Sts. in Willows is contemplated by George E. Freeman and associates.

Lacombe, Alta.—The Lacombe & Blindman Valley Electric Ry. Co. is considering plans for the construction of an electric railway from Lacombe to Gull Lake and Rumsey, about 30 miles. L. E. Smith, Vice-Pres. Moose Jaw, is interested.

Moncton, N. B.—The Moncton Tramways, Electricity & Gas Co. is considering plans for the construction of a two-mile extension of its electric railway. J. L. Chalmers, Moncton, is Secy. and Treas.

Saskatoon, Sask.—The City Council is considering the proposition to issue bonds for $100,000 for the construction of a municipal electric railway system.

LIGHT, HEAT AND POWER

Greenfield, Vt.—The New England Power Co. will rebuild the dam at Munroe Bridge, which, when rebuilt, will be 253 ft. long.

Montpelier, Vt.—The Consolidated Lighting Co., has purchased the Molly Falls Light & Power Co. of Marshfield, Vt., and is planning the construction of a large reservoir and erection of a power house and also building a penstock 1½ miles long. These improvements are expected to develop 3000-hp. which will furnish manufacturing power for Montpelier and Barre.

Worcester, Mass.—The Worcester Electric Light Co. will increase the capacity of its plant by installing additional machinery and other improvements. Estimated cost $250,000.

New Haven, Conn.—The United Illuminating Co. is making preliminary arrangements for the extension of its transmission lines into Woodbridge. G. L. Clock, New Haven, is Ch. Engr.

Brooklyn, N. Y.—Bids will be received by C. B. J. Snyder, Supt. of School Bldgs. until Feb. 24 for the installation of an electric-lighting system in public school No. 172, Boro. of Brooklyn.

Edwards, N. Y.—A large dam will be built in the Spring at the foot of Cotton Rapids on the Oswegatchie River, near Edwards. An electric plant is planned which will develop 3000 hp. It is believed the promoters are the Watertown Electric Light & Power Co. J. B. Taylor and C. C. Burns, Watertown, N. Y. have the matter in charge.

New York, N. Y.—We are officially advised that bids were received as follows, on Feb. 10, by the Department of Public Works, 13 Park Row, for the installation of heating and ventilating apparatus in the new Childrens Court Bldg. at 139 East 22d St.: (a) Boilers, Titusville Iron Works; (b) Boilers, Oil City Boiler Works; (c) Boilers, Kewance Boiler Works; (d) American Boiler Co.; Baker & Smith, (a) $14,889; (b) $14,985; (c) $15,059; (d) $15,481; Grimshaw & Sturgis, Inc., (a) $14,553; (b) $14,553; (c) $14,553; (d) $15,104; Ruisser Co., (a) $14,186; (b) $14,186; (c) $14,186; (d) $15,186; R. J. McKinnon, (a) $16,200; (b) $16,150; (c) $16,100; (d) $16,500; Child & Scott Co., (a) $14,542; (b) $14,550; (c) $14,600; (d) $14,982; Evans & Merrill, (a) $14,710; (b) $14,760; (c) $14,959; (d) $15,403; Gillis & Georghegan, (a) $13,490; (b) $13,580; (c) $13,550; (d) $14,000; Philip & Paul, (a) $15,150; (b) $15,200; (c) $15,250; (d) $15,700; W. J. Oloany, (a) $22,500; (b) $22,500; (c) $22,600; (d) $22,900; Blake & Williams (a) $15,582; (b) $15,682; (c) $15,732; (d) $16,107; James Curran Mfg. Co., (a) $14,750; (b) $14,850; (c) $14,875; (d) $15,300; John Hankin & Bro., (a) $15,547; (b) $15,547; (c) $15,547; (d) $15,947; E. Rutzler & Co., (a) $15,167; (b) $15,167; (c) $15,227; (d) $15,593; John S. Dalton, (a) $14,587; (b) $14,592; (c) $14,662; (d) $15,023; John A. Scollay, (a) $14,556; (b) $14,686; (c) $14,750; (d) $15,157.

Westfield, N. Y.—The Lake Shore Electric Light & Power Co. Inc., has been incorporated to erect and equip a plant to generate and distribute electric current for power and lighting purposes. The directors are Eugene L. Falk and William M. Scott, Buffalo and L. I. Ottaway, Westfield.

Bordentown, N. J.—The Board of Public Utility Commissioners has granted the Bordentown Electric Co., permission to issue $50,000 of capital stock, to be used for extensions and improvements in its plant and system.

Freehold, N. J.—The Board of Public Utility Commissioners has granted permission to the Middlesex & Monmouth Electric Light, Heat & Power Co., for the construction of a new pole line, and high-tension system, on the Freehold-Matawan Turnpike.

Port Murray, N. J.—The installation of an electric-light plant in connection with its establishment is contemplated by the National Fireproofing Co.

Harrisburg, Penn.—A committee has been appointed by the City Council to take steps toward the installation of an ornamental street-lighting system in the business district.

Williamstown, Penn.—The Pennsylvania Gas Co. has been granted permission to construct a gas plant at Williamstown. A distributing system will be built to Lykens and Wiconisco. W. C. Miller, of Harrisburg, is interested.

Moorefield, W. Va.—The construction of a municipal electric-light plant is contemplated. Bonds have been voted for the purpose.

Elisabeth City, N. C.—See item under Water Supply—Irrigation.

Williston, Fla.—A franchise has been granted to the Williston Mfg. Co. to construct and operate an electric-light plant at Williston.

Kenton, Tenn.—See item under Water Supply—Irrigation.

Hazard, Ky.—J. E. Jones, Harbourville, Ky., and associates are considering plans for the installation of an electric system in Hazard.

Cleveland, Ohio—We are officially advised that bids were received by W. J. Springborn, Dir. Pub. Ser., Jan. 31 for furnishing the material and erecting the structural work on the municipal electric-light plant, as follows: McClintic-Marshall Construction Co., at $72,350. Riter Conley Mfg. Co., $66,415; Van Dorn Iron Works, $71,600; T. H. Brooks Co., $88,200. Thomas J. Clifford is City Contract Clk. Noted Jan 30.

Cleveland, Ohio—The lowest bid received Feb. 3 by W. J. Springborn, Dir. of Pub. Serv. for furnishing surface condenser for the municipal electric-light plant was that of the C. A. Wheeler Mfg. Co., at $52,500. Noted Jan. 23.

Dayton, Ohio—The contract for the installation of an electric-light and heating system in the new Reibold office building at Dayton, has been awarded to M. J. GIBBONS, Dayton, at about $45,000.

Findlay, Ohio—We are officially advised that the city will construct a distributing power plant to cost, $70,000. J. E. Edie is City Clk. Noted Feb. 13.

Piqua, Ohio—The Miami Light, Heat & Power Co. is preparing estimates of the cost of installing an ornamental lighting system on various streets of Piqua.

Evansville, Ind.—The Business Men's Association is promoting a project to construct a municipal electric-light plant, to cost $100,000.

Richmond, Ind.—Bids will soon be received by the City Council for the installation of new equipment in the municipal electric-light plant. Estimated cost, $50,000. Noted Jan. 30.

Bloomingdale, Mich.—M. C. Hawk has been granted a franchise to construct and operate an electric-light and power plant at Bloomingdale.

Detroit, Mich.—The City Controller has been petitioned by the Public Lighting Commission to appropriate $119,500 for the installation of new equipment in the municipal electric-light plant. An appropriation of $130,000 is asked for the installation of an ornamental lighting system in various sections of the city.

Hastings, Mich.—The proposition to issue $90,000 in bonds for the construction of a municipal electric-light plant is under consideration.

✚Kalamazoo, Mich.—The contract for furnishing and installing electrical equipment in the municipal electric-light plant has been awarded to the FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., at $62,500. Noted Jan. 23.

Decatur, Ill.—A company has been organized at Decatur for the construction of an electric-light plant. Frank L. Suffern is Pres.

Nokomis, Ill.—The City Council is considering plans for the construction of a municipal electric-light plant.

Perry, Ill.—The Central Illinois Public Service Co., of Mattoon, Ill., has applied for a franchise to construct and operate an electric-light plant at Perry.

✚Summit, Ill.—The contract for the construction of a substation and installation of an electric-lighting system in Summit, has been awarded to the W. A. JACKSON CO., Old Colony, Bldg., Chicago, Ill.

Milwaukee, Wis.—Bids are being received by the Trustees of the Asylum for Chronic Insane of Milwaukee County for the installation of a heating and electric system in the men's building of the institution. Richard Seidel is Secy.

Cedar Falls, Iowa—An election will be held on Feb. 24 to vote on the proposition to issue $50,000 in bonds for the construction of a municipal electric-light plant.

Early, Iowa—The construction of a municipal electric-light plant is under consideration.

Grove City, Minn.—The construction of an electric-light plant at Grove City is contemplated.

Waverly, Minn.—The construction of an electric-light plant at Waverly is being considered by the Central Minnesota Light & Power Co.

Warroad, Minn.—Bonds for $20,000 have been voted for the construction of a municipal electric-light plant at Warroad. Bids will be received about March 1. The Oscar Claussen Engineering Co., St. Paul, Minn., is Consult. Engr. Noted Feb. 6.

Cimarron, Kan.—The construction of an electric-light plant is included in the proposed municipal improvements provided for in the $15,000 bond issue.

✚Kingman, Kan.—The contract for the construction of a municipal electric-light plant at Kingman has been awarded to CHARLES RAYL, Kingman, at $5524. E. J. MERKLE & CO., Kansas City Mo., were awarded the contract for installing boilers at $5800. Noted Feb. 6.

✚Moline, Kan.—The contract for the installation of a municipal electric-light plant at Moline, has been awarded to I. C. BUSHONG, Ottawa, Kan., at $15,000. Noted Dec. 26.

Angleton, Tex.—The Angleton Gin & Power Co. will install an electric light plant here. It will also establish an ice factory.

De Leon, Tex.—The De Leon-Gorman Light & Power Co. will install electric-light and power plants at De Leon and Gorman. W. L. Lowe, J. T. Collie and W. M. Collie are interested.

Fort Worth, Tex.—The Fort Worth Power & Light Co. is making preliminary arrangements for the enlargement of its power plant on the Trinity River. J. C. Lord, Fort Worth, is Gen. Mgr.

Frankston, Tex.—Local citizens have organized a company for the construction of an electric-light and water plant.

Moulton, Tex.—Local citizens have organized a company for the purpose of installing an electric-light and waterworks plant.

Yoakum, Tex.—It is announced by L. L. Stevens of Big Springs, Tex., who recently purchased the electric-light and power plant here from the Yoakum Improvement Co. that he will spend $30,000 in enlarging and improving the property.

Texahoma, Okla.—Bids will be received until Feb. 25 by the city for the construction of an electric-light and water plant. Estimated cost, $25,000. John F. Allison is City Clk.

Salt Lake City, Utah—Patrick J. Moran, a contractor and builder of Salt Lake City, announces that he is planning to erect a steam heating plant in Salt Lake City, the initial cost of which would be more than $1,000,000. The plant will be located in the southwest portion of the city and have a capacity to supply heat for all business and residence districts. Mr. Moran will shortly ask the City Council of Salt Lake for a 50-year franchise for the operation of his proposed plant, and if this is granted he will have plans prepared for the erection of the plant and begin construction as soon as practicable.

Oreana, (Lovelocks post-office) Nev.—Joseph Nenzel is interested in a project to construct an electric-light and power plant at Oreana.

Reno, Nev.—The Mono Valley Power & Light Co. will erect a power plant near Reno. A large dam will also be constructed.

Albany, Ore.—Louis C. Kelsey, Consult. Engr., Portland, Ore., has been retained to prepare plans and estimates of the cost of the installation of an electric-light plant.

Fresno, Calif.—The San Joaquin Light & Power Co. will build another power plant in Crane Valley. Two reservoirs will be built to supply the plant. A. G. Wishon, Fresno, is Gen. Mgr.

Los Angeles, Calif.—The Board of Public Works will soon receive bids for the installation of an ornamental lighting system on Seventh St., from Alameda to Hoover St., about three miles. Noted Jan. 16.

Los Angeles, Calif.—The Hauser Packing Co., has taken out a permit to erect an addition to its powerhouse.

San Francisco, Calif.—The Universal Electric & Gas Co. has petitioned the supervisors for permission to extend its distributing system to all sections of the city.

San Jacinto, Calif.—The City Council is considering plans for the installation of an ornamental street-lighting system.

Sierra City, Calif.—Plans are being prepared by the Sierra Mercantile, Power & Mining Co. for the construction of a power plant at Sierra City. Dennis Phelan is Mgr.

Fraser Mills, B. C.—The construction of a power plant at Fraser Mills is being considered by the Canadian Western Lumber Co.

Amqui, Que.—We are officially advised that the Amqui Electric Co., is making preliminary arrangements for the construction of an electric-light plant. Estimated cost, $45,000. J. A. Brillant is Mgr. Noted Feb. 6.

London, Ont.—The City Gas Co. is preparing plans for expending $100,000 installing new equipment and making extensions to its system. J. C. Duffield is Mgr.

Dalhousie, N. B.—Bids will be received by W. S. Montgomery until Mar. 5, for the installation of new equipment in the electric-light plant at Dalhousie.

BRIDGES

Onset, Mass.—The State Highway Commission is preparing preliminary sketches for a bridge to be built between Onset and Point Independence. The bridge will be 200 ft. long, and is estimated to cost $40,000. A part of the expense will be borne by the state. N. R. Bessey is Chn. Bridge Com.

✚Taunton, Mass.—The contract to construct a highway bridge over the Acushnet River, in the city of New Bedford and the town of Acushnet, has been awarded by the County Commissioners, to W. H. ELLIS & CO., Boston, Mass., at $24,075. Bids were opened Dec. 17. Noted Dec. 5.

Wareham, Mass.—F. C. Wales, Consult. Engr., 1150 Tremont St., Boston, is preparing plans for a reinforced-concrete bridge, 325 ft. long, at Wareham. Bid. will probably be asked in March.

Worcester, Mass.—It is planned to build a bridge across Lake Quinsigamond, the expense to be borne by the city, the state, and the Consolidated St. Ry. Co. Estimated cost, $150,000. H. C. Page, Worcester, is Gen. Mgr. Noted Dec. 19.

Yarmouth, Mass.—The Commissioners of Barnstable County, Barnstable, have retained F. C. Wales, Consult. Engr., 1150 Tremont St., Boston, to prepare plans and specifications for the construction of a reinforced-concrete bridge at Yarmouth. Estimated cost, $15,000.

✚Auburn, N. Y.—The contract to construct the steel superstructure for a bridge at Howland Ave., Contract 102, has been awarded to LUPFER & REMICK, Buffalo, N. Y., at $25,993. Other bids were: Penn Bridge Co., Beaver Falls, Penn., $26,366; Owego Bridge Co., Owego, N. Y., $27,580; M. Fitzgerald, Hoosick Falls, $27,229. The engineer's estimate was $25,035.

✚Fonda, N. Y.—The contract to construct a bridge over the Erie Canal near Rocky Rift Dam, Contract 87, has been awarded to P. B. McCAGHEY CO., Little Falls, N. Y., at $11,203. Other bids were: S. V. R. Malcolm & Sons, Medina, $12,025; Owego Bridge Co., Owego, $18,997.

Geneseo, N. Y.—The town contemplates constructing a new steel bridge over the Genesee River, between Geneseo and York, to replace the structure now being repaired. The new bridge would have a span 220 ft. long, and is estimated to cost $28,000.

Schenectady, N. Y.—Surveys are being made for a new hiwhway bridge across the Mohawk River, at the foot of Washington Ave., connecting Scotia with the city proper. S. W. Belding, Engr. on barge-canal work in the vicinity, is in charge of the surveying.

Brownsville, Penn.—The Commissioners of Fayette and Washington Counties have submitted plans to the War Department for the proposed bridge over the Monangahela River, at West Brownsville. The bridge will have a channel span of 520 ft. in the clear, and is estimated to cost $190,000. George Porter, Uniontown, Penn., is Consult. Engr. Noted Dec. 12.

Lancaster, Penn.—The Pennsylvania R.R. Co., the Reading R.R. Co., and the Armstrong Linoleum Co. have offered to construct a viaduct over the railroad tracks on College Ave., providing that street is opened by the city from Harrisburg Ave. to Liberty St. The bridge will be 6 ft. wide and 230 ft. long, and is estimated to cost $30,000.

Philadelphia, Penn.—Bids will probably be asked immediately by the Department of Public Service, for constructing a bridge over the railroad tracks at Chester Ave. It is planned to begin construction work on this bridge in the early spring.

✚Ridgway, Penn.—We are officially advised that the contract to construct a reinforced-concrete arch bridge over Elk Creek at Depot St., has been awarded to WILL DICKENSON, Ridgway, at $7000. The other bids were: S. T. Benson & Co., Falconer, N. Y., $5300; Nelson-Merydith Co., Pittsburgh, $7922; Curwensville Construction Co., Curwensville, $7100; Fogel & Co., $8350; York Bridge Co., $6730; Albert Russo &

Bros., Wellsburg, Ohio, $7500. Bids were opened Feb. 10 to the Town Council. C. E. Gardner is Secy. Noted Jan. 30.

South Bethlehem, Penn.—According to press reports the Minzi Trail Bridge Co. has been incorporated to build a reinforced-concrete bridge at South Bethlehem, estimated to cost $325,000. R. E. Neumeyer, South Bethlehem, is City Engr.

✝Dover, Del.—We are officially advised that the contract to remove the Martins Bridge over the Leipsic River has been awarded to the RICKARDS DREDGING CO., Real Estate Bldg., Philadelphia, Penn., at $150 each for piling, and 35c. per cu.yd. for earth and stone. Bids were opened by the Levy Court of Kent County, Feb. 11. Noted Jan. 30.

★Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., Mar. 5, for furnishing and erecting a steel truss highway bridge consisting of two spans, 297 ft. center to center of end piers, with a 20-ft. roadway. The bridge is to be built over Loch Raven, and is Contract No. 6 of the water-supply work being done in that neighborhood. Plans and specifications may be obtained from Ezra B. Whitman, Water Engr., City Hall.

Baltimore, Md.—The Pennsylvania R.R. Co. has submitted plans to the Board of Estimates for the proposed bridge to be built by the railroad over Gwynn's Falls, near Western Cemetery. The bridge will be a four-track structure, of concrete. Noted Jan. 30.

Lebanon, Va.—Bids will be received until noon, Feb. 25, by the Clerk of the Circuit Court of Russell County for the construction of a bridge, 38x12 ft., across Swords Creek. P. St. John Wilson, Richmond, Va., is State Highway Comr.

✝Cordele, Ga.—The Board of Commissioners of Crisp County has awarded a contract to AUSTIN BROS., Atlanta, Ga., for the construction of a steel bridge to span Gum Creek, at a point north of Cordele.

Pensacola, Fla.—Bids will be received until Feb. 27, by the Forest Supervisor, for the construction of three steel bridges across Garniers and Live Oak Creeks in the Florida National Forest. Inman F. Eldredge is Superv.

Greensburg, Ky.—Bids will be received until Feb. 27, by the Commissioners of Green County, for the Construction of two steel and concrete bridges, one 16x80 ft., and the other 16x300 ft.

Cincinnati, Ohio—Plans have been completed for a concrete viaduct at Hopple St., over the tracks of the Baltimore & Ohio Southwestern R.R. It will cost approximately $400,000. M. W. Waite is City Engr.

Nekoosa, Wis.—The citizens of Nekoosa have voted in favor of issuing bonds for $20,000 for the purpose of constructing a bridge over the Wisconsin River. The towns on the east side of the river are also expected to bond themselves for $20,000. The proposed bridge will cost approximately $40,000.

Marshalltown, Iowa—A viaduct about 1159 ft. long, with a paved roadway 24 ft. wide will be constructed over the tracks of the Chicago & Northwestern Ry., and the Minneapolis & St. Louis R.R. The estimated cost is $75,000.

✝Muscatine, Iowa—The contract for bridge work to be done in Muscatine County during the year, has been awarded to the DECATUR BRIDGE CO., Decatur, Ill.

Greensburg, Kan.—Press reports state that the County Commissioners will receive bids until Feb. 27, for the construction of two steel and concrete bridges, one 300 ft. long and 16 ft. wide and the other 80 ft. long and 16 ft. wide.

Sioux City, S. D.—Bids will be received by the Board of County Commissioners until Mar. 4, for the construction of bridges and concrete flooring in Minnehah County, during the year. E. H. Shenkle, Sioux City, is the County Auditor.

Indianapolis, Mo.—The Board of Commissioners of Marion County is considering the construction of a bridge across the White River at New York St. Funds have been appropriated and bids will be received shortly. The estimated cost is $150,000.

Houston, Tex.—Plans and specifications have been adopted and bids will be received until Feb. 24, for the construction of a reinforced concrete bridge over Buffalo Bayou at Capitol Ave.

Ogden, Utah—The City Engineer has been authorized to secure plans and bids for the steel bridge across the Weber River at 33d St., for the Salt Lake & Ogden Ry. The estimated cost is between $4000 and $5000. Noted Jan. 9.

Vancouver, Wash.—The city has applied to the State for an appropriation of $500,000 for the construction of a bridge across the Columbia River at Vancouver, to be known as the Pacific Highway Bridge. J. P. Stapleton is Chn. of the Vancouver Bridge Committee.

Dyerville, Calif.—Press reports state that bids will be received by the Board of Supervisors of Eureka for the construction of a steel highway bridge 300 ft. long with wooden approaches, over the Eel River, at Dyerville. George W. Cousins is County Clk.

Oakland, Calif.—Bids were received as follows by the City Council for the construction of a new bridge at Eighth St., over the lagoon which connects Lake Merritt with the estuary: Pacific Engineering Co., $19,000; E. Rhead, $20,614; Healey Tibbetts Co., $20,750; State Construction Co., $33,615; [illegible]; Concrete Construction Co., $13,150; Foster Vogt Co., $29,897; Contra Costa Construction Co., $27,490; Const Improvement Co., $27,500; Ernest A. Sonberg, $28,400; [illegible]; Mattoon Brothers, $27,500. Noted Jan. 9.

Toronto, Ont.—Bids will be received until noon, Mar. 11 by the Board of Control, City Hall, for construction of the steel approach piers of the Don Valley Bridge, located east of Bathurst St. H. C. Hocken is Manager and City Engr.

WATER SUPPLY—IRRIGATION

Auburn, Maine—We are officially advised that the city contemplates extensions to its water system. The work will be done by the Lisbon Water Co. George W. Wing is Supt.

New Durham, N. H.—We are officially advised that bids will be received by the end of next June by the New Hampshire Water Supply Co. for a water system to serve Dover, Portsmouth, Dover, Rochester, Somersworth, Farmington, Salmon Falls, and possibly Newmarket, Newfield and Exeter. The system will include about 38 miles of 24- and 30-in. pipe, with the necessary intakes at Merrymeeting Lake, and connections at the various cities and towns. Estimated cost, $700,000. Sperry H. Locke, Portsmouth, is Secy. Dudley & Sawyer, Manchester, N. H., are Consult. Engrs. Noted Jan. 16.

Blandford, Mass.—A bond issue of $15,000 is contemplated for extending the fire district about a mile beyond Prospect Hill. Noted Jan. 30.

✝Boston, Mass.—We are officially advised that contracts have been awarded by the Supply Department as follows: Furnishing 55,000 lb. composition castings, to the ESSEX BRASS FOUNDRY CO., Cambridge, Mass., at $13,188; furnishing 1,250,000 lb. iron castings, to the MECHANICS IRON FOUNDRY CO., Roxbury, Mass., at $33,625; furnishing 3115 tons c.-i. water pipe and 50 tons iron castings, to the U. S. CAST IRON PIPE & FOUNDRY CO., Philadelphia, Penn., at $76,014. Bids were opened Jan. 27. J. Edward Mullen is Supt. of Supplies. Noted Jan. 16.

Clinton, Mass.—Plans have been completed by Parker, Bateman & Co., Consult, Engrs., Clinton, for enlarging the dam of the reservoir and extending the water-mains. The plans provide for a concrete core dam, 500 ft. long and 30 ft. high, with concrete gate house. Noted Dec. 19.

★New York, N. Y.—We are officially advised that bids for Contract 146, furnishing and delivering valves, hydraulic cylinders, piping and appurtenances for the city tunnel of the Catskill Aqueduct in the City of New York, were received by the Board of Water Supply, Feb. 11, as follows: Coldwell-Wilcox Co., Newburg, N. Y., $139,643; Coffin Valve Co., Boston, Mass., $141,907; Bethlehem Steel Co., South Bethlehem, Penn., $145,530; Paul S. Reeves & Co., 1415 Catherine St., Philadelphia, Penn., $184,158; Exeter Machine Works, Pittston, Penn., $94,710. Noted Jan. 23.

Oneida, N. Y.—According to press reports, the Chamber of Commerce is investigating a proposition to obtain a water supply from Florence Creek, 20 miles from the city. Estimated cost, $150,000.

★Troy, N. Y.—Owing to the death of the contractor, bids will be received for the uncompleted portion of the Martin-Dunham Reservoir for the City of Troy, comprising about 60,000 yd. of excavation and 500 yd. of concrete, together with incidental paving, rip rapping, grubbing and clearing. Plant of contractor is on the work. Plans, specifications and information may be obtained at the office of A. P. McKean, 56 Fourth St. Troy.

Berkeley, N. J.—The Peninsula Water Co. has made application to the State Water Supply Commission for permission to install a water system here. The source of supply will be artesian wells.

Clementon, N. J.—The Board of Public Utility Commissioners has approved a petition of the Clementon Spring Water Co., for a $15,000 issue of capital stock, to be used for extensions to its water plant.

Hawthorne, N. J.—We are officially advised that the Borough contemplates the installation of a well-water system, estimated to cost $100,000. John A. Shea is Boro. Clk. Noted Feb. 6.

Newark, N. J.—The Common Council has approved a bond issue of $250,000, to be used for extensions to the high-pressure water system, and the reconstruction of the existing pipelines

Homestead, Penn.—The Borough Council has called an election for Mar. 25, to vote on a bond issue of $86,000 for installing a filtration plant. Noted Dec. 12.

Lewistown, Penn.—The Borough Council will probably soon call an election to vote on municipal ownership of the water system. J. H. Saxton is Boro. Clk.

Oil City, Penn.—Bids will be received by the Commissioners of Water and Lighting, until Feb. 27, for furnishing a 1,000,000-gal. vertical, triple-expansion, condensing, crank and flywheel pumping engine. A. M. Breckenridge is Clk.

Huntington, W. Va.—A bill has passed the State legislature by which the city may vote $800,000 bonds for the installation of the proposed water system, which is to be operated by the city independent of the plant of the Huntington Water Co. Plans for such a system were submitted to the Chamber of Commerce about a year ago. An election will probably soon be called to vote on the proposition. Noted Nov. 28.

Patterson, W. Va.—The City & Elm Grove R.R. Co. has been granted a franchise by the City Council to lay water mains in various streets.

Elizabeth City, N. C.—An election will probably soon be called to vote on a bond issue of $250,000, for purchasing and improving the water system and electric-light plant.

Greer, S. C.—Bonds for $25,000 have been voted for installing a water system here. John D. Wood is Mayor. Noted Jan. 30.

Valdosta, Ga.—The Mayor and City Council have appointed a special committee consisting of E. P. Jones, S. S. Pendleton and C. F. Clark to take charge of the proposed improvements to the water system, estimated to cost $60,000. Noted Feb. 13.

Gainesville, Fla.—Bids will be received by the Board of Public Works until 4 p.m., Mar. 17, for constructing a water system and an electric light plant. The contract involves the construction of about 20 miles of pole line 4300 ft. of 14-in. cast pipe, a 150,000 gal tank on a 75-ft. tower, three 150-hp. return tubular boilers, steel or reinforced concrete stack 100 hp. feed water heater and purifier, 1,500,000 gal. duplex compound or triple-expansion pump, one cross-compound condensing compressor, 750 cu.ft. capacity, 200 gal. motor-driven centrifugal pump one motor-driven deep well centrifugal pump one 250- and 150-kw. generators, direct connected to four-valve noncondensing Corliss or compound noncondensing engines, with switchboard and exciters. Plans were prepared by the J. B. McCrary Co., Third National Bank Bldg., Atlanta, Ga. Noted Aug. 25.

Tutwiler, Miss.—Bids will be received until Mar. 1, for installing a water system here, according to plans prepared by R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn.

Marksville, La.—Rees & Wagner, Consult. Engrs., Shreveport, La., have been retained by the city to prepare plans and specifications for the installation of a water system here. Estimated cost, $30,000. T. T. Fields is Mayor. Noted Feb. 13.

Arlington, Tenn.—According to press reports, bids will be received by the city until Mar. 7, for installing a water system and an electric-light plant. Plans have been prepared by R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn. Noted Nov. 7.

Dresden, Tenn.—Bonds for $25,000 have been voted for the installation of a water system and an electric-light plant here. Noted Feb. 13.

Denton, Tenn.—Bids will be received by the city until Mar. 11, for constructing a water system and an electric-light plant here. Plans were prepared by R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn.

Lenoir City, Tenn.—Bonds for $40,000 have been voted for installing a water system here. The contemplated improvement involves laying pipe, constructing a reservoir and a filtration plant, and installing machinery.

Carlisle, Ky.—It is proposed to install a water system here. H. B. Bryson is interested.

Corbin, Ky.—The bonds recently issued for a water system here have been sold, and bids for construction will probably soon be asked. Plans and specifications for a system estimated to cost about $35,000, have been completed by the Southern States Engineering Co. Thomas F. Young is City Clk. Noted Nov. 21.

Bucyrus, Ohio—The city is preparing to install a new method of sewage disposal, to comply with the orders of the State Board of Health.

Chillicothe, Ohio—We are officially advised that J. N. Chester, of Chester & Fleming, Consult. Engrs., Pittsburgh, Penn., has been retained by the local water company as expert in connection with litigation with city.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Feb. 26, for extending the water tunnel under Cuyahoga River, at Clark Ave. Specifications are on file at the office of the Chief Engineer, City Hall.

Cleveland, Ohio—Bids will be received by the Board of Commisioners of Cuyahoga County until noon, Mar. 12, for laying water mains in Station Road, according to specifications to be furnished by Frank R. Lander, County Surv. John F. Goldenbogen is Clk.

Dayton, Ohio—According to press reports, Charles H. Hoglen, Dir. Pub. Ser., is receiving bids for furnishing 800 tons of 3- to 12-in. c.-i. pipe, and 25 tons of refined pig lead.

Hamilton, Ohio—Frank E. Weaver, City Engr., is preparing plans for laying a 16-in. c.-i. water main in Sycamore St. Estimated cost, $8000.

✚Rockport, Ohio—The contract to construct water mains in Harrington Road has been awarded to PHILLIPS & BINES, Cleveland, Ohio, at approximately $8800. Bids were opened Feb. 3. Noted Jan. 23.

Sandusky, Ohio—The City Engineer is preparing plans for a new water intake from Lake Erie.

West Park, Ohio—Bids will be received by the Board of Trustees of Public Affairs, until noon, Mar. 3, for laying water-mains in Warren Ave., Triskett Road, Raymond Ave., Settlement Road, and Brown Road, in accordance with plans and specifications on file at the office of Fred Feuchter, Clk. Plans were prepared by the William H. Evers Engineering Co., The Arcade, Cleveland.

Hobart, Ind.—We are officially advised that the water system here will be thoroughly overhauled, new mains laid, and a filtration plant installed. Ernest McCullough, Monadnock Block, Chicago, Ill., has been retained as Consult. Engr. Plans will probably be completed in March, and bids asked soon after that time. Walter G. Black is City Engr.

Bay City, Mich.—According to press reports, J. H. Bloomshield, Shearer Bldg., is preparing plans for a pumping station for the Valley Land Co., estimated to cost $45,000. C. C. Whitney is Mgr.

✚Decatur, Ill.—We are officially advised that the contract to construct a filtration plant here has been awarded to the NEW YORK CONTINENTAL JEWEL FILTRATION CO., 15 Broad St., New York, at $29,899. The other bids were: Pittsburg Filtration Co., Pittsburgh, Penn., $135,000; Norwood Engineering Co., Boston, Mass., $137,000; Beers-Offuth Co., Fort Wayne, Ind., $151,000. Bids were opened by the City Council, Feb. 11. W. G. Clark, Spitzer Bldg., Toledo, Ohio, is Consult. Engr. Noted Jan. 30.

Mukwonago, Wis.—Bids will be received by the Board of Trustees until 1 p.m., Feb. 24, for furnishing f.o.b. cars Mukwonago, about 130 tons of 4-, 6- and 8-in. c.-i. pipe, about 2½ tons of special castings, 22 fire hydrants, and 10 gate valves with extension boxes. Specifications are on file at the office of E. Wanner, Village Clk., and at the office of J. Rollins Gray, Consult. Engr., Great Northern Bldg., Chicago. Noted Feb. 6.

Davenport, Iowa—The City Council has called an election for Mar. 10, to vote on municipal ownership of the water system.

Farragut, Iowa—The Town Council has called an election for Mar. 3, to vote on a bond issue for the installation of a municipal water system.

Hutchinson, Minn.—Bids will be received by the City Council until Feb. 25, for constructing 4000 lin.ft. of 4-in. c.-i. pipe mains, with six standard hydrants, and 5025 lin.ft. of 10- and 8-in. sewers, with three flush tanks and manholes complete. C. K. Goodnow is City Clk.

✚Shakopee, Minn.—We are officially advised that the contract to install a water system here has been awarded to J. J. CONNELLY, St. Paul, Minn., at $4696, and $7.25 per cu.yd. extra for stone excavation. Plans were prepared by the Oscar Claussen Engineering Co., St. Paul, Minn. Bids were opened Feb. 7. Noted Jan. 16.

Virginia, Minn.—The city has bought the water system and electric-light plant of the Virginia Electric Power & Water Co., and plans extensive improvements. According to press reports, bids will be received by the City Clerk until Feb. 25 for the purchase of $150,000 water and light bond.

Kansas City, Kan.—Bids will be received by C. B. Lantz, City Clk., until 9 a.m., Feb. 25, for furnishing brass filter strainer plates, bolts, fittings and fixtures. Specifications are on file at the office of the Clerk and E. Dodge & Mason.

Topeka, Kan.—H. B. Young, City Engr., has completed plans and specifications for an addition to the pump house, estimated to cost $7000. Bids will probably soon be asked by the City Commissioners.

Peru, Neb.—The Village Board has retained Charles F. Sturtevant, Consult. Engr., Holdrege, Neb., to prepare plans for the installation of a water system here. The proposition will be voted on at the regular election in April.

Glenrock, Wyo.—We are officially advised that C. C. Carlisle, Consult. Engr., Cheyenne, Wyo., has been retained by the town to prepare plans and specifications for the installation of a water system.

✚Kansas City, Mo.—A contract to construct water and sewer systems at Lake of the Woods, near Kansas City, has been awarded to JAMES A. PRINGLE, Carthage, Mo., at approximately $35,000.

St. Louis, Mo.—The Board of Public Improvements has approved plans and specifications for the construction of an intake tower, to be 90 ft. above the water, the lower portion to be of concrete faced with granite, the upper portion of tooled Bedford limestone. The building will be equipped with pumps and engines for controlling water forced into tunnel carrying water to a plant on shore. Estimated cost, $450,000. Edward E. Wall is Water Comr.

Frankston, Tex.—See item under Light, Heat and Power.

Madisonville, Tex.—We are officially advised that bids will be received until Feb. 25, for constructing a new municipal water system, estimated to cost $16,000. The contract consists of furnishing all material, laying pipes, setting hydrants, etc. Plans were prepared by the O'Neill Engineering Co., Dallas. George L. Turner is City Secy. Noted Dec. 12.

Sulphur Springs, Tex.—The City Council will soon award a contract for increasing the municipal water supply. A dam will be constructed across White Oak Creek, 2½ miles north of town, from which point the water will be piped into Lake Coleman. Bonds for $30,000 have been issued for the proposed improvement.

Yoakum, Tex.—L. L. Stephenson, Sweeetwater, Tex., has purchased the plant of the Yoakum Improvement Co., and contemplates an expenditure of $50,000 for improvements.

Texhoma, Okla.—Bids will be received by the city until Feb. 25, for constructing a water system, estimated to cost $19,000. Plans were prepared by W. M. Magruder, Consult. Engr., Liberal, Kan. P. M. Williams is Mayor.

Trinidad, Colo.—An election will probably soon be called to vote on a bond issue of $45,000 for laying pipe lines for the water system.

Omak, Wash.—An election has been called for Feb. 28, to vote on the installation of a water system.

Longbeach, Calif.—The Board of Public Works has been authorized to ask bids for furnishing one carload of pipe, and for furnishing brass fittings during the year. H. B. Riley is Clk.

✚Los Angeles, Calif.—We are officially advised that the contract to construct an irrigation system on Tapo Ranch, for the Patterson Ranch Co., has been awarded to WARDALL & WAGONER, Los Angeles, at $5700. The other bids were as follows: Miller & Schnipple, Oxnard, Calif., $8700; E. D. Keil, Los Angeles, $9100. Estimated cost of work by engineer, $10,700. Bids were opened by Floyd G. Dessery, Consult. Engr., Hibernian Bldg., Los Angeles, on Feb. 6. Noted Jan. 30.

Modesto, Calif.—R. F. Ball, Fresno, Calif., contemplates an expenditure of $75,000 for irrigating a tract of land known as the George Vivian Ranch, on the San Joaquin River.

Pasadena, Calif.—Plans have been accepted by the City Council for the construction of a reinforced-concrete reservoir with a capacity of 1,000,000 gal. It will be 200 ft. long, 135 ft. wide, and 9 ft. deep. Bids will probably soon be asked. Heman Dyer is City Clk.

Riverside, Calif.—Bids will be received by H. C. Cree, City Clk., until Mar. 11, for the purchase of $1,160,000 of water bonds. Noted Jan. 9.

San Jacinto, Calif.—S. S. Langley, of Hill & Langley, Van Nuys Bldg., Los Angeles, is arranging to put a tract of land near here under irigation, requiring the construction of 8083 ft. of 6-ft. deep, 5-ft. wide ditch, 14,690 ft. of 3 ft. deep and 42-in. wide ditch.

Sierra Madre, Calif.—Bids will probably be asked some time in May for constructing and equipping a new pumping plant and extending the water mains. Estimated cost, $15,000. William F. Bixby, Mason Bldg., Los Angeles, is Engr.

✚Technical, Calif.—The contract to construct a water system here has been awarded to the MUNICIPAL & INDUSTRIAL EQUIPMENT CO., Los Angeles, at $13,791. Bids were opened Jan. 30. F. A. Lathrop, Higgins Bldg., Los Angeles, is Consult. Engr.

Bowmanville, Ont.—Bids are being received by John Lyle, Town Clk., for furnishing iron pipe, hydrants, valves, and an electric booster pump for the new water and sewer systems.

London, Ont.—The Hydro Commission is preparing plans and specifications for installing new motors and compressors in No. 1 pumping station. H. J. Glabitz is Engr.

✚Port Arthur, Ont.—We are officially advised that the contract to furnish lapwelded steel pipe, specials and flexible joints, and for supplying and delivering valves, has been awarded to the DRUMMOND McCALL CO., Montreal, Que., at $191,306. Bids were opened Feb. 3. Noted Jan. 9.

St. Thomas, Ont.—The Board of Water Commissioners plans to construct a water main and a standpipe, estimate to cost $70,000. George K. Crocker is Chn.

Sarnia, Ont. Bids will be received by the Town Clerk until Mar. 15, for improving the water system. Estimated cost, $230,000. Plans, profiles and specifications are on file at the office of R. A. McLean, Town Engr., and at the office of Chipman & Power, Consult. Engrs., Toronto. Noted Feb. 6.

SEWERS

Amherst, Mass. The town contemplates the installation of a sewer system estimated to cost $45,000. W. C. Taunett, Jr., is Engr., and has filed plans and estimates which will be voted on at a town meeting to be held soon.

Leominster, Mass.—Preliminary plans have been prepared for improvements to the sewer system estimated to cost $6000. Henry Sawtelle is Chn. Sewer Com.

Sharon Springs, N. Y.—M. Vrooman, Consult. Engr., Gloversville, N. Y., is preparing plans for the construction of a sewage disposal plant here, with a capacity of 350,000 gal. Estimated cost $7,000. C. M. Mallett is Chn. Pub. Wks.

★**Newark, N. J.**—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., Mar. 11, for constructing the northerly and southerly portions of Section 6 of the Main Intercepting Sewer in the City of Newark. The contract consists of: Northerly portion of Section 6, Station 26+00 to Station 56+00: Item 1, earth excavation and refilling, in trench, for 150-in. sewer, 3000 lin.ft.; Item 2, concrete masonry, in trench, portland cement mortar, and appurtenant work, 100 cu.yd.; Item 4, rock excavation, in trench, 500 cu.yd. Southerly portion of Section 6, Station 0 to Station 26+00, Item 1, earth excavation and refilling, in trench, for 150-in. sewer, 2600 lin.ft.; Item 2, concrete masonry in trench, portland cement mortar, 8000 cu.yd.; Item 3, brick masonry, in manholes, laid with portland cement mortar, and appurtenant work, 100 cu.yd.; Item 4, rock excavation, in trench, 10,000 cu.yd. John S. Gibson is Clk.

Secaucus, N. J. Plans have been completed for the proposed sewer system in the Clarendon Section. Estimated cost, $23,000. Sebastian Maulbeck is Boro. Clk. Noted Jan. 16.

Carlisle, Penn.—Bids will be received by the Borough Council until 8 p.m., Mar. 6, for the following contracts: Contract A, a complete sewage disposal plant, including 2,000 ft. of 24-in. terra cotta effluent pipe; Contract B, 2833 ft. of 18-in. terra cotta pipe sewer, 4800 ft. of 24-in. terra cotta pipe sewer, and 24 manholes; Contract C, 37,500 ft. of terra cotta pipe sewers, with manholes, flush tanks and other accessories, and 4300 ft. of storm water drains with street inlets and appurtenances. Specifications and blank forms may be obtained at the office of John T. Hiteshew, Boro. Engr., or at the office of T. Chalkley Hatton, Ch. Engr., Wilmington, Del. Paul Willis is Boro. Secy.

Baltimore, Md.—Bids will be received by the Board of Awards, until 11 a.m., Feb. 26, for Sanitary Contract 109, constructing lateral sewers and house connections in District No. 41. The contract includes about 22,000 lin.ft. vitrified pipe house connections, and 30,000 lin.ft. vitrified pipe sewer, 8 to 24 in. in diameter. Calvin W. Hendrick is Ch. Engr., Sewerage Comn.

Baltimore, Md.—We are officially advised that bids for Sanitary Contract 107, lateral sewers in District 8, were received by the Board of Awards, Jan. 22, as follows: Frank Brune & Co., Newark, N. Y., $117,873; Irwin & Conklin, Greenville, Ohio, $124,986; Carozza & Lavezza, 2016 Pennsylvania Ave., Baltimore, $133,528; Henry Spinach Contracting Co., Waterbury, Conn., $137,165; William McCarthy & Co., Baltimore, $144,713; Gallagher, Boyle & Bryan, 147 W. Montgomery St., Baltimore, $151,497; Ryan & Reilly, Union Trust Bldg., Baltimore, $152,120. Calvin W. Hendrick is Ch. Engr., Sewerage Comn. Noted Jan. 16.

Tampa, Fla.—Twombley & Henney, Consult. Engrs., 111 Broadway, New York, have completed plans for the construction of a sanitary sewer system and a sewage disposal plant here. Estimated cost, $1,700,000. D. B. McCay is Mayor. Noted Dec. 27.

†Birmingham, Ala. According to press reports, a contract to lay 15,000 ft. of 6- to 36-in. storm and sanitary sewers for the Milner Land Co., has been awarded to THOMAS WORTHINGTON, Birmingham.

New Iberia, La.—J. S. Power, Mayor of New Iberia, informs us that bonds will shortly be issued for the installation of a sewer system to cost from $100,000 to $120,000. Work is proposed to be done with [illegible]. N. W. Emerson, Memphis, Tenn., is prepared a report on the sewer. Noted Sept. 26.

Fort Thomas, Ky. J. E. Stewart, Consult. Engr., Cincinnati, Ohio, is preparing plans for a sanitary sewer system in the Highlands District. H. S. Lee is City Secy.

†Louisville, Ky. [illegible] contract to lay sewers in South Louisville has been awarded to J. H. CAHILL, Somerville, Ky., at $[illegible]. The other bids were: Lee & Son, $[illegible]; Lamont Wright & Bro., $[illegible]; Wood & Hall, $[illegible]; Bell Bros., $[illegible]; H. Berg & Bro., $[illegible]. Bids were received by the Board of Public Works. [illegible] Noted Feb. 6.

Paducah, Ky.—J. A. Sommerville, City Engr., has filed a report recommending the construction of a trunk line sewer to [illegible] to cost about $[illegible]. Sewers in Trimble St. to cost about $[illegible]; Second and Clark Sts., $5000; and a sewer in Eighth and Court to cost $18,000.

†Akron, Ohio. A contract to construct sewers in Cole, Carter and Moore Sts. has been awarded to M. H. & T. Co., E. Akron, at $[illegible].

Barton, Ohio. Bids will be received by A. C. Bragg, Village Clk., until noon, Feb. 20, for [illegible] and 12,500 lin.ft. of 4-in. drain tile, 1500 lin.ft. of sewers, eight catch basins, etc. E. A. Fiddler, Cleveland, Ohio, Consult. Engr.

Bucyrus, Ohio—The State Board of Health has notified the Mayor and City Council to take steps immediately to install a sewage disposal plant to discontinue the pollution of the Sandusky River.

Canton, Ohio—The Department of Public Service is considering three different sites for the proposed sewage disposal plant. An election may be called to determine the site. P. H. Weber is City Engr. Noted Nov. 28.

Canton, Ohio—Bids will be received by the Commissioners of Stark County until 10 a.m., Mar. 3, for constructing the following sewers in Wooster Road: 990 lin.ft. 18-in., 300 lin.ft. 12-in. and 51 lin.ft. 6-in. vitrified pipe laid, 30 lin.ft. 10-in., 1772 lin.ft. 12-in. and 30 lin.ft. 18-in. vitrified pipe relaid, 24 lin.ft. 12-in. c.-i. pipe relaid, 150 lin.ft. 4-in. vitrified field drain. J. H. McConnell is County Audr.

Bids will be received by the Board of Commissioners of Stark County until 10 a.m., Mar. 5, for constructing sewers in Rockhill Ave., as follows: 4120 lin.ft. 4-in. vitrified curb drain tile, four standard catch basins, 90 lin.ft. 15-in. vitrified pipe furnished and laid complete, 247 lin.ft. 6-in. vitrified pipe relaid, etc. J. H. McConnell is County Audr.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Feb. 20, for constructing main and lateral sewers and drains, with appurtenances, in various streets. M. J. Keefe is Clk.

Cincinnati, Ohio—Bids will be received by the Director of Public Service until noon, Feb. 20, for constructing main and lateral sewers, with appurtenances, in Streng St., from Top St. to Coleman Ave., and in various other streets. M. J. Keefe is Clk.

East Palestine, Ohio—Plans and specifications prepared by C. E. Vaughn, Village Engr., for a sewer system and a sewage disposal plant here, have been submitted to the State Board of Health, for approval. An election will probably soon be called to vote on this improvement.

Elyria, Ohio—Bids will be received by G. H. Lewis, Dir. Pub. Ser., until noon, Feb. 21, for constructing sewers in various streets, according to plans and specifications on file at the office of the Department of Public Service.

Sandusky, Ohio—The City Engineer is making a complete survey of the present sewer system, also plans for a system to serve the south end and such other portions of the city as will require extensions during the next few years.

Fort Wayne, Ind.—We are officially advised that bids will be received by the Board of Public Works until 7.30 p.m., Feb. 27, for constructing 684 ft. of 36-in., 2270 ft. of 30-in., 3082 ft. of 24-in., 2250 ft. of 18-in., 4168 ft. of 15-in., 10,611 ft. of 12-in. sewers. W. W. Chaffin is Asst. City Engr. Noted Jan. 16.

South Bend, Ind.—Bids will be received by the Board of Public Works until 10 a.m., Mar. 11, for constructing the Bowman Creek trunk sewer. The sewer will be approximately two miles long, ranging in diameter from 60 to 72 in. Estimated cost, $150,000. Plans and specifications are on file at the office of the Board. William S. Moore is City Engr. Noted Feb. 13.

South Bend, Ind.—According to press reports, bids will be received by the Department of Public Service until Feb. 25, for constructing a 54-in. concrete or brick pipe sewer, and a 15-in. vitrified pipe sewer in Mishawaka Ave.; also three quarters of a mile of 24-in. vitrified pipe sewer in Eddy St. A. Perley is Dir. Noted Feb. 13.

Vincennes, Ind.—Plans and specifications have been approved by the Board of Public Works for the construction of 14,490 ft. of tile and concrete sewers. C. L. V. Tucker is City Clk.

Union City, Mich.—Cox & Norton, Consult. Engrs., Coldwater, Mich., are preparing plans for laying several miles of sewers here.

Belvidere, Ill.—The City Council has passed an ordinance providing for the construction of sanitary sewers in various streets. Estimated cost, $6000.

Bradley, Ill.—We are officially advised that bids will be received at the Village Hall until Feb. 25, for constructing a sewer system estimated to cost $47,548. The bids received on this contract Jan. 30, were rejected as excessive. Ernest McCullough, Monadnock Block, Chicago, is Consult. Engr. C. A. Voorhees is Pres. Bd. Local Impvts. Noted Jan. 23.

Cuba, Ill.—According to press reports, W. A. Fuller, of the Fuller-Coult Co., St. Louis, Mo., will prepare plans for sanitary and storm sewers here.

Mattoon, Ill.—Charles Cottingham, Consult. Engr., Danville, Ill., has completed plans for a sanitary sewer system and a sewage disposal plant here. Noted Oct. 17.

Fond du Lac, Wis. The plans and specifications for the proposed new sewer system and sewage disposal plant have been completed, and are on file at the office of J. T. Hohensee, City Clk. Noted Dec. 19.

Sheboygan, Wis.—Bids will be received by the Board of Public Works until 4 p.m., Feb. 28, for constructing approximately 1036 lin.ft. of 10-in., 858 lin.ft. 15-in., 668 lin.ft. 12-in. vitrified pipe sewer, 200 lin.ft. 20-in. double strength vitrified pipe sewer, and 13 manholes. C. U. Boley is City Engr.

Davenport, Iowa—The Board of Public Works has had plans prepared for the construction of 26,240 ft. of vitrified sewer, with 70 manholes, in the 13th District. Estimated cost $24,000. J. V. Ryan is City Engr. Noted Feb. 6.

Ely, Minn. According to press reports, the city plans to expend about $40,000 for extending the storm water sewer system so as to serve the whole city. Noted Sept. 12.

Hutchinson, Minn. See item under Water Supply Irrigation.

Minneapolis, Minn. We are officially advised that bids have been received by the Purchasing Agent, as follows: On Feb. 4, furnishing 2,000,000 sewer brick, L. G. Rose, Minneapolis, Minn., $8.95 and $9.90 per M; Wisconsin Red Press Brick Co., Menominee, Wis., $8.70 per M; Hydraulic Press Brick Co., Minneapolis, Minn., $8.95 per M; furnishing 400,000 paving brick, Purington Paving Brick Co., Galesburg, Ill. No. 1 Block, $25 per M. No. 1 Brick, $19.50 per M; No. 1 Block, $16.50 per M. No. 1 Brick, $13.50 per M; Landers,

Morison, Christenson Co., Minneapolis, No. 1 Brick, $15 10 per M., Minnesota Paving Brick Co., Minneapolis, No. 1 Brick, $15 per M.

On Feb. 5, furnishing 400 tons of special castings, Standard Foundry Co., Minneapolis, $35 per ton; American Brake Shoe & Foundry Co., Minneapolis, $32.90 per ton, furnishing vitrified clay pipe for sewers: (a) 9-in., (b) 12-in., (c) 15-in., (d) 24-in. Red Wing Sewer Pipe Co., Red Wing, Minn. (a) 17c., (b) 31c., (c) 43½c., (d) $1.29 per ft.; Plymouth Clay Production Co., Fort Dodge, Iowa, (a) 17c., (b) 30½c., (c) 44c., (d) $1.25 per ft.; Streator Clay Co., Streator, Ill., (a) 16½c., (b) 29½c., (c) 41½c., (d) $1.16 per ft. E. R. Dutton is Asst. City Engr. Noted Jan. 30.

✚Shakopee, Minn.—We are officially advised that the contract to construct a sanitary outlet sewer here has been awarded to J. J. CONNOLLY, St. Paul, Minn., at $1669. Bids were opened Feb. 7. Noted Jan. 30.

Atchison, Kan.—Bids will probably be asked about Mar. 1, for constructing a sanitary sewer in Dist. 7. S. K. McCrary is City Engr.

Emporia, Kan.—M. Brown, City Engr., is preparing plans for the construction of storm sewers. Estimated cost, $8000. F. H. Smith is City Clk.

Platte, S. D.—According to press reports, the Dakota Engineering Co., Mitchell, S. D., is preparing plans for a sewer system here.

Hannibal, Mo.—Bids will be received by the City Council until noon, Mar. 3, for constructing District Sewers Nos. 9 and 100. Estimated cost, $85,000. Plans and specifications may be secured from B. F. Smiley, City Engr. and Comr. of Sewers. Noted Feb. 6.

Maplewood, Mo.—We are officially advised that the contract to construct sewers in Manchester Ave., between Big Bend Road and the city limits of St. Louis, has been awarded to R. E. COONEY, 3511 Wyoming St., St. Louis, at approximately $13,600. Bids were opened by the City Council, Feb. 11. M. F. O'Brien is City Clk. Noted Jan. 30.

✚St. Louis, Mo.—We are officially advised that the contracts for Lettings No. 10,788 and 10,789, involving the construction of 12,500 ft. of 12- to 27-in. vitrified clay pipe sewers, have been awarded to FOX & BRISTOL, Third National Bank Bldg., St. Louis, at approximately $14,960. Bids were opened Feb. 4, by the Board of Public Improvements. Noted Jan. 30.

✚Bishop, Tex.—A contract to construct five miles of sewers and a sewage disposal plant here, has been awarded to TRUEHART & JACKSON, San Antonio, Tex., at approximately $25,000. Noted Dec. 5.

Pecos, Tex.—Press reports state that bids will be received by the city until Mar. 15, for constructing a sewer system here. Estimated cost, $35,000. Noted Feb. 6.

Waco, Tex.—Bids for $25,000 were voted, Feb. 7, for constructing sewers.

Durant, Okla.—An election has been called for Mar. 18, to vote on a bond issue if $72,000 for extending the sewer system and constructing a sewage disposal plant. W. P. Danford is City Engr.

✚Tulsa, Okla.—According to press reports, contracts for constructing sewers here have been awarded as follows: To the WELLS-FRANKLIN CO., Surety Bldg., Muskogee, Okla., District 79, $8125, District 83, $5670, District 84, $12,593; JOHN T. LANDRY, District 80, $6993, District 81, $6214, District 85, $4503; DUNN & DeDONNELL, District 82, $1820; C. I. FRYE, District 1, $1689, District 2, $1560.

North Yakima, Wash.—We are officially advised that an election will be held Mar. 20, to vote on a bond issue for constructing about eight miles of trunk sewers, from 12 to 36 in. diameter, Imhof septic tanks and hypochloric treatment plant. Estimated cost, $276,486. N. A. Gilman is City Engr. Noted Dec. 12.

Dallas City, Ore.—We are officially advised that bids will be received by the city until Mar. 11, for constructing 15,000 ft. of 6-, 8- and 12-in. lateral sewers. Information and proposal blanks may be obtained on application to C. L. White, City Engr.

Elsinore, Calif.—Bids will be received by the Board of Trustees until 7:30 p.m., Feb. 24, for constructing a sanitary sewer system and a sewage disposal plant. The system will require approximately 21,880 ft. of 6-in., 7970 ft. 8-in., 730 ft. 10-in., 240 ft. 12-in. and 1360 ft. 14-in. pipe, including wyes; 3550 ft. 8-in. pressure pipe, 30 flush tanks, 51 manholes, one septic tank. Plans and specifications may be obtained from C. P. Carter, City Clk., or from Frank A. Lathrop, Consult. Engr., Higgins Bldg., Los Angeles. Noted Dec. 19.

Los Angeles, Calif.—Bids for constructing a sewer in Hoover St., from Slauson Av. to 52d St., have been received by the Board of Public Works as follows: John Radich, $27,200; J. Ukropina, $27,990; Milzenovich & Gillespie, $28,472; J. Sutalo, $28,475; W. N. Hendricks, $29,590; S. Zarubica, $29,787; M. R. Fulmis, $29,945; Nichols & Tomich, $30,500; R. N. Nikeevich, $31,600; J. Mohan, $32,500; S. M. Kerns, $33,000; W. J. Eggert, $33,867; Geo. Prcovach, $33,853; P. Grbovach, $37,989.

Oceanside, Calif.—N. K. Carpenter, Consult. Engr., Escondido, Calif., is preparing plans for the construction of a sewer system here, estimated to cost $20,000.

✚Santa Ana, Calif.—A contract to construct lateral sewers in the southern part of the city has been awarded to S. M. KERNS, Los Angeles, at $13,900.

✚Santa Monica, Calif.—We are officially advised that the contract to construct a sewage disposal plant at the Soldiers' Home, has been awarded to the J. D. KNEEN CONTRACTING CO., Santa Monica, Calif., at $19,800. Bids were opened Dec. 14. E. W. Moore is Treas. Noted Dec. 5.

STREETS AND ROADS

Narragansett Pier, R. I.—At a special meeting held Feb. 12, the Town Board appropriated $43,000 for the construction of six miles of macadam roads. Col. Harry B. Kane is Chn. of the Com. in Charge.

Providence, R. I.—See item under Miscellaneous (Road Oil—Providence).

Hartford, Conn.—Plans have been received by the State Highway Commissioner for the proposed improvement of the New London and Hartford Turnpike from Colchester to New London. The plans embrace 13,400 lin.ft. in the town of Colchester and 29,300 lin.ft. in the town of Salem. Engineers are also at work on the survey of the same road in the towns of Montville, Waterford and New London. James H. McDonald is Comr.

Middletown, Conn.—Bids will be received by the City Clerk until 6 p.m., Feb. 22, for the construction of about 35,600 sq.yd. of permanent pavement on Main St. No particular kind of pavement is specified, as the city desires to consider all the bids which may be presented for laying a permanent pavement in this street.

Albany, N. Y.—We are advised that all published reports of contracts to be awarded soon for road construction are erroneous, and no lettings are contemplated.

Brooklyn, N. Y.—Bids will be received until 11 a.m. Feb. 26 by the President of the Borough of Brooklyn, Borough Hall, for improving portions of Albany, Atkins, Irving, Newkirk, New York, First, Third, Fourth, Fifth and 16th Aves., New Lots Road, Terrace Place, West 24th, West 25th, 38th, 72d and 85th Sts. Alfred E. Steers is Pres.

Buffalo, N. Y.—The City Council has ordered the repaving of the following streets with asphalt: Bailey, St. Louis, and East Delavan Aves., East Ferry, Elk and Mortimer Sts. Francis G. Ward is Comr.

New York, N. Y. (Borough of Richmond)—Bids will be received until noon, Feb. 25, by the President of the Borough of Richmond, Borough Hall, St. George, New Brighton, for repaving with bituminous concrete, a portion of Richmond Road. George Cromwell is Pres.

Bids will be received until 2 p.m., Feb. 26 by the President of the Borough of Manhattan for repairing asphalt block pavement in the borough, with all incidental work thereto during 1913. George McAneny is Pres.

Princeton, N. J.—See item under Sewers.

Westfield, N. J.—Bids will be received until Mar. 3 by the Town Council for various street improvements. The work includes 10,100 sq.yd. waterbound macadam, 5720 lin.ft. concrete curb and gutter, and the resetting of 1370 lin.ft. stone curb. Chas. Clark is Town Clk. A. W. Vars is Town Engr.

✚Turtle Creek, Penn.—We are officially advised that the Borough Council has awarded a contract to A. V. PURNELL, 507 Jarvella St., Pittsburgh, Penn., at $185,341, for various street improvements. The other bidders were: R. H. Cunningham & Son, $218,377; Booth & Flynn, $235,080; Pietro Construction Co., $236,160; Harrop, Hopkins & Taylor, Lewis Blk., Pittsburgh, are Engrs, in Charge. Daniel E. Brown is Boro. Secy. Noted Jan. 16.

Baltimore, Md.—Bids will be received until noon, February 27, by the State Roads Commissioners 534 North Howard St., Baltimore, for the construction of 13 sections of State Highway, aggregating 35.60 miles and including two concrete bridges, in various lots as follows: A section of road along the York Road, Baltimore County, from city limits to Lyman Ave., 1.33 miles of granite construction in car tracks, and remainder of road of macadam on concrete base, and one section of same road from Lyman Ave., to Towson, 2.62 miles, to be macadam construction 1.03 miles of macadam, along road from Cranberry to Mexico, and 1.46 miles along the road from Manchester toward Mexico, macadam, both in Carroll County; 4.69 miles of macadam from Elkton to Chesapeake City, Cecil County; 3.59 miles of concrete road in Charles County; 4.71 miles from District of Columbia to Meadows, concrete construction, Charles County; two miles of macadam from Locust Grove to Galena, Kent County; 2.12 miles from Cedar Grove toward Damascus, Montgomery County; two miles, macadam from Friendship to Howard County Line, Montgomery County; 3.09 miles of macadam, from Marion to Crisfield, Somerset County; 5 miles of gravel surfacing from Mechanicsville to Charles County Line, St. Mary's County; two miles of macadam from Easton to Wye Mills, Talbot County; two 25-*ft.* span concrete bridges, spanning the Winter's Run on Belair Pike, Harford County. Plans and specifications for the above work are obtainable at the office of the State Roads Commissioners, Baltimore. Wm. L. Marcy is Secy.

Oakland, Md.—Bids will be received until 1:30 p.m. Mar. 4 by the Commissioners of Garrett County for the construction of about two miles of State Highway from Friendville to Accident, along the south branch of Bear Creek. W. L. Marcy is Secy. State Roads Com.

✚Spartanburg, S. C.—The City Council has awarded a contract to the NOLL CONSTRUCTION CO., Chattanooga, Tenn., at $1.47 per sq.yd., for about 30,000 sq.yd. asphalt paving on various streets. J. H. Shores is Supt. of Sts. Noted Jan. 30

Macon, Ga.—The City Council will shortly ask for bids for paving Walnut St., from First to New St., with concrete, at an estimated cost of $8655. Bridges Smith is City Clk.

Plant City, Fla.—See item under Sewers.

✚Birmingham, Ala.—A contract has been awarded by the Milner Land Co. to THOMAS WORTHINGTON, Birmingham, at approximately $100,000, for improvements on Red Mountain, a new residence suburb. The work includes 15,000 sq.yd. street paving, 10,000 sq.yd. concrete sidewalks, 15,000 lin.ft. concrete curb and gutter, 15,000 ft. storm and sanitary sewers and the removal of 100,000 cu.yd. of earth. Chas W Leavitt, Jr., 220 Broadway, New York, is Engr. in Charge.

Macon, Miss.—Bids will be received until 2 p.m., Mar. 5, by the Supervisors of Noxubee County for construction of about 13 miles of gravel road in Dist. No. 5. John A. Tyson is Chancery Clk.

✚Natchez, Miss.—A contract has been awarded by the Board of Supervisors of Adams County to P. W. MULVIHILL, Natchez, at $130,970, for improving about 45 miles of county roads. John T. Jenkins is Chancery Clk. Noted Jan. 23.

New Orleans, La.—We are officially advised that bids will be received until noon, Feb. 25, by the Highway Department

of the Board of State Engineers for the construction of about 11 miles of public highway, extending from Many to Natchitoches Parish Line in a northeasterly direction. W. E. Atkinson is State Highway Engr.

Shreveport, La.—The Parish Board has authorized the Parish Engineer to make all necessary surveys for grading, graveling or macadamizing about 25 miles of Parish roads for which bids will soon be asked. T. J. Bullin is Parish Engr.

Bluff City, Tenn.—Bids will be received until 1 p.m. Mar. 10, by the Pike Road Commission of Sullivan County for grading and macadamizing approximately 50 miles of road. W. D. Lyon is Chn. of the Com. C. M. Dulaney, Blountville, Tenn., is County Engr.

Memphis, Tenn.—The City Commissioners have decided to open and pave Overton Park Ave. from Claybrook to Avalon St., a distance of about 8000 ft., and have instructed the City Engineer to prepare plans for the work. Bids will be accepted for asphalt, brick or wood block paving. J. E. Weatherford is City Engr.

Franklin, Ky.—Bids will be received until noon, Mar. 10, by the Chairman of the Committee, for paving with macadam the Lincoln-Jackson Way through Simpson County. I. H. Goodnight is Chn.

✦**Akron, Ohio**—Contracts have been awarded by the Director of Public Service for street improvements as follows; E. McSHAFFREY & SON at $51,795 for paving portions of Manchester Road, Thornton, Huron and Poplar Sts.; S. W. PARSHALL at $12,786 for Kenyon St., WATERS & RUSSELL at $7041 for Prince William Alley.

Canton, Ohio—Bids will be received until 10 a.m. Mar. 3 by the Commissioners of Stark County for the construction of what is known as the Ely St. and Harrisburg Road improvement on Rockhill Ave. to Buckeye Ave., Lexington Township. J. H. McConnell is Audr.

Cincinnati, Ohio—Bids will be received until noon, Feb. 21 by the Director of Public Service for improving Eastern Ave. from Philadelphia to Ferry St. by grading, resetting curbs and paving with granite blocks. V. T. Price is Dir.

Cleveland, Ohio—Bids will be received until 11 a.m. Mar. 12 by the Commissioners of Cuyahoga County for the improvement of Solon Road Extension from Solon Road to Franklin St., Chagrin Falls Township. Frank R. Lander is County Supv. John Goldbeck is Clk.

Bids will be received until 11 a.m. Mar. 19 by the Board of County Commissioners for the improvement of Barton Road from Coe Ridge Road to the county line in Olmsted Township.

The Cleveland Trinidad Paving Co. was low bidder on all materials for repaving Carnegie Ave., S. E., from East 55th to East 59th Sts. The bids were: $87,385 for wood block, $54,760 for brick and $53,746 for brick and $53,746 for sheet asphalt. Noted Feb. 6.

Coshocton, Ohio—Bids will be received until noon, Feb. 27, by the Director of Public Service, for paving portions of North Eighth and Walnut Sts. with brick. George S. Caton is Dir.

✦**Springfield, Ohio**—A contract has been awarded by the Board of Control to EDWARD RYAN, Springfield, at $55,000, for paving North St., from Limestone St. to Western Ave. Edward Seggerson is City Clk.

Youngstown, Ohio—The following low bids for street improvements were received by the Director of Public Service: Mullen & Quinn, $19,982, for paving Jackson St.; Fleming & Platt, $6239, for paving Pine St.; Mullen & Quinn, $6759, for Market St. paving.

✦The Board of Control awarded a contract to JAMES DiCINDIA, Niles, Ohio, at $19,820, for paving North Main St. with Bessemer block. The contract for paving South Main St. was awarded to MARTIN P. CONNELLY & SON, Youngstown, at $16,116. W. H. McMillin is Clk.

Indiana—Bids for road improvements in Indiana will be received as follows: Mar. 4, at Martinsville, by Commissioners of Morgan County, for construction of a gravel road in Jackson Township. J. S. Whitaker is Audr.

Mar. 4, at Rushville, by Commissioners of Rush County, for construction of a brick and macadam road, and one waterbound and bituminous macadam road in Rushville Township. Allen R. Hoddy is Audr.

Mar. 4, at Crawfordsville, by Commissioners of Montgomery County, for construction of a gravel road in Union Township. Bennett E. Beals is Audr.

Mar. 4, at Vincennes, by Commissioners of Knox County, for construction of gravel roads in Steen and Vincennes Townships. John T. Scott is Audr.

Mar. 4, at Logansport, by Commissioners of Cass County, for construction of a macadam road in Eel Township. J. E. Wallace is Audr.

Mar. 4, at Bloomfield, by Commissioners of Greene County, for construction of a macadam road in Wright Township. C. H. Jennings is Audr.

Mar. 4, at Marion, by Commissioners of Grant County, for construction of three road [illegible] Center Township. E. H. Kimball is Audr.

Mar. 4, at Winamac, by Commissioners of Pulaski County, for construction of [illegible] Beaver Township. W. E. Munchenberg is Audr.

Mar. 4, at Salem, by Commissioners of Lawrence County, for construction of two gravel roads in Spice Valley Township. Lyle E. Eskew is Audr.

Mar. 4, at Paoli, by Commissioners of Orange County, for construction of [illegible] Stampers Creek Township. [illegible] Fulton is Audr.

Mar. 4, at Logansport, by Commissioners of Cass County, for construction of [illegible] Rock Creek Township. [illegible] Hartzell is Audr.

Mar. 4, at Kokomo, by Commissioners of Howard County, for construction of [illegible] Center Township. E. E. Scott is Audr.

[illegible] by Commissioners of Harrison County, for construction of [illegible] Harrison and Heth Townships. J. L. Coleman is Audr.

✦**Connersville, Ind.**—A contract has been awarded by the Commissioners of Fayette County to D. H. FAUCETT, Indianapolis, at $23,000 for construction of a gravel and stone road in Jackson Township. The road is three miles long. Jasper C. Kennedy is Audr.

Muncie, Ind.—Plans have been submitted by the City Engineer to the Board of Public Works for the improvement of portions of nine streets at an estimated cost of $109,415.

✦**Rushville, Ind.**—The Commissioners of Rush County have awarded a contract to WILLIAM AVERY, Waldron, Ind., at $14,737, for the construction of a macadam road in Rushville Township. George W. Stoner is Audr. Noted Jan. 23.

Belvidere, Ill.—The City Council has passed an ordinance authorizing the paving of Whitney St., from Logan Ave. to South St., at an estimated cost of $14,850. The top coating will be of granite chips with asphaltum binding.

✦**Waukegan, Ill.**—The County Commissioners of Lake County have awarded a contract to GEORGE H. PALMER, at $8826, for improving the Porter Road, from Burlington Ave. to the Cicott St. Bridge. Other bidders were: A. H. Barnes, $9463; Martin McHale, $10,467; D. A. Hyman, $10,321; Walter Girton, $10,448; James Wilbourne, $9785; Beal & Bell, $9389; James I. Barnes, $11,100. The contract for improving the Leffel Road was awarded to MARTIN McHALE, at $21,524. Other bidders were: Walter Girton, $21,967; Beal & Bell, $23,462; James I. Barnes, $24,800.

Milwaukee, Wis.—See item under Miscellaneous: Cement, Milwaukee.

Algona, Iowa—We are officially advised that bids will be received until 7 p.m., Feb. 25, by the City Council, for improving various streets, the work consisting of approximately 24,000 sq.yd. of paving and 14,300 lin.ft. of curbing. Bids will be taken on different kinds of paving, selection to be made after bids are received. S. W. Crowell is City Clk. Theo. S. De Lay, Creston, Iowa, is Engr. in Charge. Noted Dec. 17.

Belle Plain, Iowa—Bids will be received until 3 p.m., Feb. 24 by the City Council for 20 blocks of street paving of brick, asphaltic concrete, cement concrete or Dolarway. Chas. P. Chase, Clinton, Iowa, is Engr.-in-Charge. Noted Dec. 26.

Burlington, Iowa—The City Council has decided to pave sections of the following streets with concrete: Eighth, Ash, Corse, South and Marietta Sts. and Mark Lane. Henry G. Volmer is City Clk.

✦**Clinton, Iowa**—We are officially advised that the City Council has awarded a contract to THOMAS CAREY & SONS, Clinton, Iowa, at $38,030, for various street improvements. The work includes 17,600 sq.yd. vitrified block paving, 8300 lin.ft. combined curb and gutter, 16 catch basins, 150 ft. vitrified catch-basin pipe, 100 cu.yd. excess grading, and adjusting adjacent pavements. Other bidders were: The Ford Paving Co., Cedar Rapids, Iowa, $38,567; McCarthy Improvement Co., Davenport, Iowa, $40,709; John Fey, Davenport, Iowa, $41,741; Miller & Ladehoff, Clinton, Iowa, $46,454. J. H. Thorne is City Engr. Noted Jan. 23.

Mount Vernon, Iowa—Bids will be received about Mar. 25 by the City Council for one mile of street paving. Bids will be accepted for brick, wood block, asphalt, concrete or bituminous coated concrete, selection to be made after bids are opened. Chas P. Chase, Iowa Engineering Co., Clinton, Iowa, is Engr.

Washington, Iowa—Bids will be received until Mar. 19 by the City Council for approximately 12,000 sq.yd. of paving with Dolarway coated concrete. Chas. P. Chase, Clinton Iowa, is Engr.

Minneapolis, Minn.—See item under Miscellaneous: Creosoted Wood Blocks—Minneapolis.

Minneapolis, Minn.—Bids will be received until 11 a.m. Mar. 3 by Commissioners of Hennepin County for improving about 4300 cu.ft. of Road No. 25, in the village of Maple Plains and town of Medina. A. P. Erickson is Audr.

McPherson, Kan.—We are officially advised that the City Council has ordered the City Engineer to prepare plans for about 25,000 sq.yd. of brick and asphaltic concrete street paving. Bids will soon be asked. H. A. Rowland is City Engr.

St. Louis, Mo.—Bids will be received until Feb. 28, by the Board of Public Improvements for paving various alleys at an estimated cost of $62,185, and for reconstructing other alleys at an approximate cost of $15,381. Maxime Bebo is Pres. of the Bd. W. T. Findlay is Secy. Noted Sept 26.

★**Abilene, Tex.**—Bids will be received until 4 p.m., Feb. 27, by the Mayor and City Commissioners, for the construction of approximately 75,000 sq.yd. of asphalt macadam paving. P. L. Kirk is City Secy. H. J. Bradshaw is City Engr.

Corpus Christi, Tex.—See item under Miscellaneous: Causeway—Corpus Christe.

San Antonio, Tex.—Bids for the paving of Buena Vista St. were received by the City Council from R. G. Scott, at $8900, and C. M. Kelly, at $13,720.

Dalles City, Ore.—We are officially advised that bids will be received until Mar. 11 by the City Council for 30,000 sq. yd. of street paving. Bids will be accepted on bitulithic, asphaltic concrete, Dolarway or Lassauer. C. L. White is City Engr.

✦**Burbank, Calif.**—THE CONNER CONTRACTING CO., 709 Hibernia Bldg., Los Angeles, Calif., was awarded the contract at approximately $20,000 for improving Verdugo Ave. between Front and Tenth Sts. Noted Dec. 26.

✦**Corona, Calif.**—We are officially advised that the City Trustees have awarded a contract to L. G. GARNSEY, Los Angeles, Calif., at $16,233, for the improvement of Ontario Ave. C. Gulls is City Engr. M. Tropenning is City Clk.

Fullerton, Calif.—Bids will be received until Feb. 24 by the Board of Trustees for the construction of sheet asphalt oil macadam, asphaltic concrete or concrete with oil wearing surface pavements on Whitten and Spadra Roads, Chapman and Commonwealth Aves. C. A. Giles is City Clk. C. Fiske, Jr., 3001 Leeward Ave., Los Angeles, is Engr.

Imperial, Calif.—Bids will be received at once for the construction of about two miles of asphaltic concrete paving and 11,000 lin.ft. of concrete curb. Lelia Foster is City Clk.

Kingsburg, Calif.—The Board of City Trustees has ordered the macadamizing and oiling of about three miles of streets. Bids will be asked in about a month.

+Los Angeles, Calif.—A contract has been awarded to R. H. McCray, 231 West 28th St., at approximately $60,000 for constructing petrolithic pavement, concrete curb, gutter and sidewalks in the Cudahy Ranch, 500 acres of which will be subdivided into business and residence lots.

Knapp and Woodward, Consolidated Realty Bldg., will be ready to receive bids shortly on subdivision work in a large tract near Santa Monica for King C. Gillette. The work will include 132,000 cu.yd. grading, 873,000 sq.ft. oil macadam paving, 56,600 lin.ft. cement curbs; 297,800 sq.ft. of concrete sidewalks, 425 lin.ft. concrete box storm sewer, 1705 lin.ft. of 30 in. corrugated iron storm sewer, with manholes and flush tanks. Bids may be submitted on the entire contract or any part of the work.

+Los Angeles, Calif.—A contract has been awarded by the Board of Public Works to the FAIRCHILD-GILMORE-WILTON CO., Los Angeles, at $43,018 for improving Dorchester Ave. from Western Ave. to Wilton Place. Homer Hamlin is City Engr.

+Oakland, Calif.—THE BARBER ASPHALT PAVING CO. was awarded the contract at $74,464 for paving Grove St. from 40th St. to the city line; THE OAKLAND PAVING CO. was awarded the contract at $72,600 for improving Broadway from 34th St. to College Ave., and the RANSOME-CRUMMEY CO. was awarded the contract at $38,874 for paving Telegraph Ave. from 40th to 52d St.

+Puente, Calif.—THE B. R. DAVISSON CONTRACTING CO., 417 South Myrtle Ave., Monrovia, has the contrast at $15,045 for the grading and paving of 5100 lin.ft. of roadway at Hudson Station near Puente, for the Whittier Extension Co. The contract is exclusive of cement, which is to be furnished by the owner. The following quantities of cement pipe will also be laid: 51,950 ft. 10-in.; 3420 lin.ft. 8-in., 3500 ft. 18-in., ten gate boxes, 75 weir boxes, and a reinforced concrete settling basin, bringing the total contract to $31,-095.

Sacramento, Calif.—We are officially advised that bids will be received until 2 p.m., Feb. 28, by the State Highway Commission, Forum Bldg., for the construction of about 10 miles of state highway in Los Angeles County, between Rancho El Elcino and Calabasas, to be built of Portland cement concrete with bituminized surface; also for construction of about 7½ miles of highway in Mendocino County, between Ukiah and Forsthe Creek, the road to have gravel foundation and water-bound macadam surface. Austin B. Fletcher is Highway Engr., Wilson R. Ellis is Secy. of the Com.

+A contract was awarded by the State Highway Commission to FAIRBANKS & BAECHTEL at $29,957 for the construction of about seven miles of road between Ridgewood and Willetts. Bids for building a portion of rad in Butte Cunty between Lindo Channel and the northern county line, and for a section of road between San Lins Obispo and Santa Margarita were rejected as excessive. Noted Jan. 30.

+San Diego, Calif.—Contracts have been awarded to JOHN ENGBRETSON at $13,704 for grading 32d St., and to FORD & STOUT at $23,281 for improving portions of Park Blvd. and A St. Allen H. Wright is City Clk.

San Diego, Calif.—Col. Fred Jewell, W. S. Broderick and others have purchased a tract of land at 27th and National Ave., which they will improve by grading the streets, and constructing sidewalks and curbs.

INDUSTRIAL WORKS—SOUTHERN

+Springfield, Mass.—Contracts for a roundhouse, boiler house, etc., have been given by the Boston & Albany R.R. to EDWARDS & MONAHAN, of 6 Beacon St., Boston. Cost, $20,500. F. E. Freeman is Ch. Engr.

Springfield, Mass.—The Hender Mfg. Co. has purchased a 10-acre tract of land in East Springfield and is planing additional factory buildings. George M. Hendee is Pres.

Providence, R. I.—Silverman Bros. plan to build a three-story jewelry factory of reinforced concrete at Broad St. and Lexington Ave. Estimated cost, $40,000. Dwight & Seabury, Pawtucket, R. I., are Archs.

+New Haven, Conn.—A contract has been awarded to DAVID H. CLARK CO., 166 Brewery St., New Haven, for a two- and three-story factory and office building on Bristol St., for the Semon Ice Cream Co. It will be of brick, 50x150 ft. C. S. Palme, 55 Church St., New Haven, is Arch. Noted Jan. 9.

South Norwalk, Conn.—Cluett, Peabody & Co. plan to build an addition to their plant in the spring. The firm has purchased the old plant of the Artistic Bronze Co. on Union St., and other property, and will remodel the buildings now on the site, and build a structure, 80x100 ft., four or five stories high. William W. Ewing is Supt. of plant.

Waterbury, Conn.—The Scovill Mfg. Co. will build a four-story brick addition to its factory on Mill St. It will be 17x20 ft.

+Perth Amboy, N. J.—Abel Hanson State and Gordon Sts., has awarded a contract to C. C. CHRISTENSON, State and Peterson Sts., for the construction of a two-story, 234x45-ft. porcelain factory. The estimated cost is $20,000. Jenson & Brooks, 196 Smith St., are the Archs. Noted Jan. 16.

Baltimore, Md.—Plans are being prepared by John B. Hamme, Arch., York, Penn., for the construction of a new plant for the Baltimore Roofing & Asbestos Mfg. Co., 757 Calvert Bldg. There will be a one- and two-story asbestos building, 784x65 ft.; a cement building, 100x75 ft.; two shops, 25x30 ft. and 150x30 ft., and an office building, 40x40 ft. The estimated cost is $70,000.

Richmond, Va.—Bids will be received until Mar. 1 by Warner Moore, Pres., Box 304 Richmond, for the erection of a new factory, 125x165 ft., for the Manchester Board & Paper Co., whose plant was recently burned. Bids are also being received by the architect for machinery to manufacture box board. A. F. Huntt is Arch.

High Point, N. C.—Gurney and Thurlow Kemp plan the erection of a $100,000 hosiery mill. The building will be two stories, 100x60 ft.

Spartanburg, S. C.—The Standard Iron Works plans the erection of two brick buildings, one of which will be 48x100 ft., and the other 52x100 ft.

La Grange, Ga.—The Dixie Cotton Mills will erect a two-story addition, 99x196 ft., costing about $100,000. Park A. Dallas, Atlanta, Ga., is Arch.

New Orleans, La.—The Dixie Culvert & Metal Co. has leased a site and will establish a branch factory employing about 100 men.

The Purity Paper Container Co. will at once begin the erection of the first unit of its plant. T. G. Powell is Pres.

Knoxville, Tenn.—The East Tennessee Development Association is considering the establishment of a large creamery in Knoxville. Col. T. B. Thackston, of the Chamber of Commerce, may be addressed.

Lewisburg, Tenn.—The Lewisburg Foundry Co. has been organized with $50,000 capital stock, and has taken over the plant of the Sheffield Foundry Co., Sheffield, Ala., which has been removed to Lewisburg. The plant will be enlarged and new equipment purchased. W. T. Archer is Gen. Mgr.

Ashland, Ky.—Rogers, Brown & Co., Cincinnati, Ohio, are considering plans for establishing an iron furnace at Ashland.

Livermore, Ky.—The Quigg Chair Co. plans the establishment of a chair factory of moderate size. D. H. Quigg is interested.

Nicholasville, Ky.—The Evans Chemical Co. has leased a tract of land near Lexington, Ky., and will equip a mill to develop the deposits of barytes and other ores.

Alliance, Ohio—The Davis-Bach Mfg. Co., Alliance, will erect a three-story factory, 600x400 ft. The company manufactures hard rubber tires.

Akron, Ohio—The Silver Lake Aviation Co., a consolidation of the Akron Aviation Co., the Milwaukee School and College of Aviation and the American Flying Machine Corporation of Milwaukee, has been incorporated in New Jersey with a capital stock of $300,000. The new corporation has leased 66 acres of land at Silver Lake, near Akron, where it will establish a college of aviation, and erect a afctory.

Canal Dover, Ohio—A company, which will probably be known as the Dover Steel Co., is being organized and will establish a mill in Canal Dover, for the manufacture of high-grade hot and cold rolled sheets and open-hearth steel. A tract of 38 acres has been donated by the Penn Iron & Coal Co. as a site, and construction work will probably start in the spring. Incorporation papers will be taken out shortly, for a capitalization of about $1,000,000. Arrangements have been made with the Penn Iron & Coal Co. to furnish hot metal from its blast furnace for the mill. Among those interested are W. M. Parin, H. T. Myer, A. Smith and M. S. Young, Pittsburgh, Penn.

Cincinnati, Ohio—Sheblessy & Stenger, Archs., Provident Bank Bldg., Cincinnati, have awarded a contract to the CINCINNATI IRON & STEEL CO., for furnishing 300 tons of steel for a building to be erected on Main St., for the Lippencott Co., manufacturer of preserves, etc. Noted Jan. 16.

The Brunswick-Balke-Collender Co., manufacturer of billiard tables, etc., Cincinnati, has engaged Harry Hake, Arch., Provident Bank Bldg., Cincinnati, to prepare plans for a one-story brick factory, 110x600 ft., on Mitchell Ave., near the Baltimore & Ohio Southwestern R.R.

Cleveland, Ohio—The Iceless Refrigeration Co., East 72d St. and the Lake Shore R.R. has leased several factory buildings on East 152d St. for the manufacture of an iceless refregerator.

The River & Furnace Co., Cleveland, Ohio, care of Corrigan Iron & Steel Co., will build a new steel mill on land just purchased.

Bids will be received by Charles W. Stage, Dir. Pub. Safety, until noon, Mar. 3, for the erection of the two-story laundry, at the city hospital group.

Columbus, Ohio—Rosenthal Bros., wool pullers, Spruce & Henry Sts., Columbus, Ohio, will build a factory, two stories, 80x200 ft., to cost $50,000, on Spruce St. D. Riebel & Sons, New First National Bank Bldg., are Archs.

Ironton, Ohio—The Semet-Solvay Co., Syracuse, N. Y., is negotiating with local iron men for the installation of a $1,000,000 plant at Ironton, similar to the one it is now building in Ashland.

+Toledo, Ohio—The C. Well Mirror Co. has awarded the contract to the GETTINS-KOPITTKE CO. for constructing its proposed factory.

Columbus, Ind.—The Orinoca Chair Co., recently organized by Wm. H. Lincoln, George H. Lucas, John P. Sohn and others, have ordered plans and will ask for bids for the erection of a large chair factory at Columbus.

Columbus, Ind.—The Van Camp Packing Co., Indianapolis, Ind., plans to erect a canning plant at Columbus.

Hammond, Ind.—The Straube Piano Co., Hammond, will erect an addition, three stories, 50x100 ft. Bids are now being received.

Indianapolis, Ind.—The Cole Motor Car Co., Indianapolis, has authorized the preparation of plans for a four-story factory to be built on East Washington St., to cost $100,000. J. J. Cole is Pres.

Mishawaka, Ind.—The Amplex Motor Car Co., Mishawaka, will erect a 120x255 ft. one-story addition which will be used as an assembling room.

Seymour, Ind.—Plans have been completed for the new shirt factory to be erected on South Chestnut St. by the Reliance Mfg. Co. Morris Schultz is Mgr.

Detroit, Mich.—Smith, Hinchman & Grylls, Archs., 710 Washington Arcade Bldg., are preparing plans for a brick and steel machine shop for the Detroit United Ry. Co. at its new plant in Highland Park, Mich.

✚Detroit, Mich.—Albert Kahn and E. Wilby, Trussed Concrete Bldg., Detroit, have awarded the general contract, for four three-story and basement factory buildings and a five-story and basement warehouse, 94x250 ft., for the Morgan & Wright Tire Co., ft. of Bellevue Ave., Detroit; General contract, to FERRO-CONCRETE CONSTRUCTION CO., Harriett and Richmond Sts., Cincinnati, Ohio; plumbing, to JOHNSON & FARSON CO., 12 Griswold St., Detroit; structural iron work on the four factory buildings to WHITEHEAD & KALES, Beecher Ave. and M. C. R. R.; structural iron work, for warehouse, to H. B. LEWIS, Ferry and Roby Sts., Detroit. Cost $300,000.

Ionia, Mich.—Barrett & Scully, cigar manufacturers, Ionia, will erect a cigar factory to cost $10,000. It will be 2½ stories, 40x80 ft., of brick.

Mount Clemens, Mich.—The factory to be erected by the Mount Clemens Pottery Co., Mount Clemens, will cost $50,000.

Zeeland, Mich.—The Zeeland Ornamental Works, Zeeland, recently destroyed by fire, will erect a ney plant. The company manufactures wooden trimmings for caskets.

Chicago, Ill.—James B. Day & Co., 20 East Illinois St., Chicago, will erect a varnish factory, 25x100 ft. It will be five stories high.

Mattoon, Ill.—The Joseph Lay Co., Mattoon, will erect an addition to its broom factory, 80x150 ft.

Peoria, Ill.—William Rehfuss, Peoria, has taken out a permit for the erection of a two-story brick factory in the rear of 521 Main St.

Burlington, Wis.—The Spring Valley Sanitary Milk Co., Burlington, will erect a bottling plant to cost $15,000.

Green Bay, Wis.—The Chicago & Northwestern Ry. Co. contemplates improvements consisting of a brick and concrete 40-stall roundhouse and railroad and machine shops, coal sheds, ice house and new freight house. C. S. Hall, Engr. Track Elevation, will be in charge of the work.

Oshkosh, Wis.—The Davies Threshing Machine Co., Oshkosh, will erect an addition to cost $20,000. It will be one story, 60x126 ft., of mill construction.

Davenport, Iowa—E. L. Wiseman, Springfield, Ill., contemplates the erection of a factory at Davenport, to be occupied by the Tri-City Mattress Co. The estimated cost of the structure is $30,000.

New Richland, Minn.—The Co-Operative Creamery Assoc. contemplates the erection of a plant at New Richland, to cost approximately $10,000.

✚Houston, Tex.—The Texas Bag & Fiber Co. has awarded the contract for the construction of a three-story and basement factory to the JAMES BLACK MASONRY & CONSTRUCTING CO. The estimated cost is $50,000.

Denver, Colo.—The Western Columbia Laundry Co. has purchased a site covering seven lots on Lincoln St., between Seventh Ave. and Spear Blvd., and will erect a plant, to cost approximately $60,000.

Sterling, Colo.—J. G. Millen, Pres. of the Colorado Milling & Elevator Co., Denver, Colo., has purchased a site in Sterling, and will erect a flour-mlling plant with a daily capacity of 250 bbl. The estimated cost is $100,000. The capacity of the plant will be doubled next year.

Tucson, Ariz.—The Empire Zinc Co., Tucson, will erect a plant for the separation and concentration of its zinc and copper ores.

Port Townsend, Wash.—Winkleman & Donahoe, Port Townsend, have purchased a site near the head of Discovery Bay, and will erect a large shingle mill.

Sedro-Wooley, Wash.—J. E. Nutter, Sedro-Wooley, will build a new sash and door factory, to cost approximately $25,000.

Tacoma, Wash.—The American Wood Pipe Co., Tacoma, has taken out permits to erect a plant at 32d and Cedar Sts. The buildings will consist of a mill, an engine and boiler room, a dry kiln and an office building.

Kenton, Ore.—E. A. Reichel and H. W. Grunwaldt are planning the erection of a cabinet factory at Kenton, to cost approximately $70,000.

St. Johns, Ore.—The Portland Woolen Mills is having plans prepared for the construction of a new mill, 80x200 ft., at its plant. The estimated cost is $15,000. L. I. Thompson, Portland, Ore., is the Arch.

Avila, Calif.—The Independent Oil Producers' Agency has appropriated $10,000 for the purpose of erecting a test refinery at Avila. If this proves a success, a larger refinery will be built.

Los Angeles, Calif.—The Panama Rubber Co., with offices in the Los Angeles Investment Bldg., Los Angeles, has been organized with a capital of $1,000,000, for the purpose of erecting a plant for the manufacture of automobile tires. W. D. Sawyer is connected with the company.

F. O. Engstrum, Pres. of the F. O. Engstrum Co., Fifth and Grattan Sts., Los Angeles, plans to erect a commercial garage and machine shop on Orange St. The building will be 100x225 ft. and the estimated cost is $20,000.

The Greenwood Advertising Co., Los Angeles, will erect a plant on Main St. for the manufacture of bottle caps.

National City, Calif.—The San Diego Vitrified Brick & Pipe Co. has completed its 2,000-barrel plant at National City, on the old Second Bayside Race Speedway Bldg., San Diego, Cal.

Ontario, Calif.—The Hotpoint Electric Heating Co., Ontario, manufacturer of household electrical appliances, plans to erect a one-story addition to plant and has taken out a permit to cost an addition to the present shop.

Oroville, Calif.—The Ophir Mill & Lumber Co. has been organized for the purpose of operating a planing mill and general lumber business. The incorporators are E. K. Wood, Ira L. Ford and Maud L. Ford, all of Oroville.

San Diego, Calif.—The Pacific Tile Co., San Diego, has taken out a permit to erect an addition to its plant at Sheard and Main Sts. It will be constructed of concrete and steel.

San Francisco, Calif.—Plans have been prepared for the construction of a garage and machine shop at Broderick and Grove Sts., for Henry Ohlandt, Jr. The estimated cost is $30,000. Fabre & Bearwald, Western Metropolis Bldg., are the Archs.

Stockton, Calif.—Joseph E. Goodman has organized a company with a capital of $100,000, for the purpose of erecting a plant for the manufacture of an inner lining for tires, which it is said will make them puncture proof.

Taft, Calif.—The Midway Ice & Storage Co., Taft, will erect an ice and cold-storage plant at Taft, to cost approximately $35,000.

Whittier, Calif.—George H. Downing and Irving L. Downing have had plans prepared and will soon award the contract for the construction of a laundry, of brick, at Greenleaf Ave. and College St. The estimated cost is $15,000.

FEDERAL GOVERNMENT WORK

Traveling Crane—Portsmouth, N. H.—Bids will be received until 11 a.m., Mar. 8, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one 20-ton, four-motor electric traveling crane, delivered and installed at the navy yard, Portsmouth, N. H. R. Stanford is Ch. of Bureau.

Dredging—New Haven, Conn.—Bids will be received until 2 p.m., Mar. 15, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging in New Haven Harbor.

Crane—New York, N. Y.—Bids were received as follows, Feb. 8, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing one 50-ton locomotive gib crane at the New York Navy Yard: McMyler Interstate Co., Bedford, Ohio, $47,500; Browning Engineering Co., Cleveland, Ohio, $47,940.

Fire-Alarm System—New York, N. Y.—Bids will be received by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Mar. 17, for a noninterfering local fire-alarm system at the U. S. appraisers' warehouse, New York, in accordance with the specification, copies of which may be obtained from the Supervising Chief Engineer, New York, or at Washington, at the discretion of the Supervising Architect.

Dredging—Wilmington, Del.—The following bid was submitted Feb. 8 to Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Raccoon Creek, N. J.; Rickard Dredging Co., Philadelphia, Penn., 14½c. per cu.yd., place measurement.

Dredging—Wilmington, Del.—Bids will be received until 11 a.m., Mar. 8, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Wilmington Harbor.

Dredging—Wilmington, Del.—Bids were received by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Absecon Creek, N. J.: Hill Dredging Co., Atlantic City, N. J., 10.5c. per cu.yd.; Rickard Dredging Co., Philadelphia, Penn., 14c. per cu.yd.

Dredging—Wilmington, Del.—Bids were received as follows, Feb. 11, by Maj. R. R. Raymond, Corps Engrs., U. S. A., for dredging Maurice River, N. J.: Hill Dredging Co., Atlantic City, N. Y., 10.5c. per cu.yd.; Rickard Dredging Co., Philadelphia, Penn., 14c. per cu.yd.

Road Oil—Washington, D. C.—All bids received Jan. 24 by the Commissioners of the District of Columbia, Washington, for furnishing and delivering 100,000 gal. of emulsifiable road oil for use in the surface division, have been rejected.

Removal of Wreck—Norfolk, Va.—Bids were received Feb. 10, by Lieut.-Col. E. Welch Winslow, Corps Engrs., U. S. A., Norfolk, for the removal of the steel Italian barl: "Rosalia D'All," sunk in Hampton Roads, Va. The bids follow: (a) Bodily; (b) explosives: Baxter Wrecking Co., 308 Spring St., New York, (a) $22,460; F.Staud Ximenez, care I. W. Trautwein, City Dock, Annapolis, Md., (a) $24,960 (informal); T. A. Scott & Co., Inc., 229 Pegnot Ave., New London, Conn., (a) $25,325 (informal); King & Wotherspoon, Inc., 25 Broadway, New York, (a) $24,745; Merritt & Chapman Derrick & Wrecking Co., 17 Battery Place, New York, (a) $21,550; Johnston & Virden, Lewes, Del., (a) $28,000; (b) $14,500; Lewis W. Blix, 363 47th St., Brooklyn, N. Y., (b) $12,900 (informal).

Dredging—Charleston, S. C.—Bids will be received until noon, Feb. 26, by Maj. G. P. Howell, Corps Engrs., U. S. A., Charleston, for dredging Sampit Bar and River, Winyah Bay, S. C.

Ice Plant—Part Royal, S. C.—Bids will be received until 11 a.m., Mar. 15, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for an ice-making and refrigerating plant at the U. S. naval disciplinary barracks, Port Royal. H. R. Stanford is Ch. of Bureau.

Dredging—Savannah, Ga.—Bids will be received until noon, Mar. 4, by Col. Dan C. Kingman, Corps Engrs., U. S. A., Savannah, for dredging in the waterway between Savannah and Fernandina, Fla.

Post Office—Tifton, Ga.—Bids will be received until 3 p.m., Mar. 25, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches), of the U. S. Post Office at Tifton.

Mechanical Equipment—Dayton, Ohio—Bids will be received until 3 p.m., Mar. 19, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for mechanical equipment for the post-office and court house at Dayton.

Post Office—Abilene, Kan.—The contract for the construction of the new post office at Abilene has been awarded to G. W. STAUL, Seneca, Kan., at $61,500.

Canal—Dodson, Mont.—All bids received Jan. 10 at the office of the U. S. Reclamation Service for constructing Schedule 2 of the Dodson North Canal have been rejected. The lowest bid was that of Manny Bros. & Co., of Boise, Idaho, at $51,055. The work consists of 205,500 cu.yd. excavation and 10,000 cu.yd. overhaul. George O. Sanford is Project Engr.

✚Metal Vault Shelving—St. Louis, Mo.—The contract for furnishing metal vault shelving for the U. S. post office, St. Louis, has been awarded to the REYLESS LOCK CO., Indianapolis, Ind., at $20,547.

Bridges—Galveston, Tex.—Bids will be received until Feb. 20 by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, for constructing four highway swing bridges across the Inland Waterway between the Brazos River and Matagorda Bay, Tex.

Post Office—Weatherford, Tex.—Bids will be received by Oscar Wenderoth, Supervising Archt., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 24, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, and lighting fixtures of the U. S. post office at Weatherford.

+Lumber—Seattle, Wash.—The contract has been awarded to the BALFOUR-GUTHRIE CO., Portland, Ore., for 3,317,737 ft. of lumber for the Philippine Islands, at $88,688. Bids were opened Jan. 20 by the Constructing Quartermaster, U. S. A., Seattle.

Vancouver Barracks (Vancouver post-office), **Wash.**—Bids will be received by the Constructing Quartermaster, U. S. A., until Feb. 25, for removing the center boiler of a battery of three, furnishing and installing boiler at pumping plant at this post.

Sewer Extension—Vancouver Barracks (Vancouver post-office), Wash.—Bids will be received until 11 a.m., Feb. 24, by the Constructing Quartermaster, Vancouver Barracks, for the extension of the storm water sewer system at that place.

Light and Fog Signal Building—Portland, Ore.—Bids were received, Feb. 3, by the Lighthouse Inspector, Portland, for furnishing material and labor necessary for the construction, erection and delivery of a light and fog signal building at Point Wilson, Wash. The bids follow: Fisher Engineering Corporation, $14,800; J. L. Murphy & Son, $14,623; John W. Johnson, $15,695; Sound Construction & Engineering Co., $12,376; Francis W. Grant, $15,334; Mark Odell & Co., $13,797; J. W. Stanchfield, $12,665; H. E. Doering, $8349 (recommended for award).

+Repairs to Docks—Fort Mason, Calif.—The contract has been awarded by the Constructing Quartermaster at Fort Mason, for repairs to the new Army Transport Docks, which include new cluster piles, Australian iron bark rub strips and fender piles to the HEALY-TIBBITTS CONSTRUCTION CO., San Francisco, Calif.

Seawall—Fort Mason, Calif.—A reinforced-concrete seawall, 100 ft. long and 14 ft. high, will be constructed at Fort Mason, San Francisco, Calif. Plans are being prepared by the Constructing Quartermaster.

Coal Handling Machinery—Panama—Bids will be received until 10:30 a.m., Apr. 14, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purch. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing and erecting coal-handling machinery and accessories for two coaling plants.

Buildings—Cuba—Bids will be received until 11 a.m., Mar. 1, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for erecting buildings for the radio station, at the naval station, Guantanamo, Cuba. Estimated cost, $11,000. H. R. Stanford is Ch. of Bureau.

MISCELLANEOUS

Pier—Boston, Mass.—Plans for the construction of an iron, lumber and cotton pier, to be located at East Boston, are being prepared under the direction of the Directors of the Port. It will be about 1000 ft. long and between 125 and 150 ft. wide.

Greenhouse—Boston, Mass.—The city is planning to erect a greenhouse at the Back Bay Fens. Estimated cost, $100,000. M. J. Fish, 100 Sumner St., is Supt. Pub. Bldgs.

Rock, Etc.—Boston, Mass.—Bids will be received until Feb. 24, by the Public Works Department for furnishing rock, gravel, sand and crushed stone for the city during 1913. Louis K. Rourke is Comr.

+Fire Apparatus—Chelsea, Mass.—The city has awarded the contract to the ROBINSON FIRE APPARATUS MFG. CO., St. Louis, Mo., for furnishing one gasoline pump fire engine to cost $10,000.

Fire Station—Danvers, Mass.—A central fire station will be erected at Maple and Locust Sts. It will be of brick. Estimated cost, $30,000.

Fire Stations—Holyoke, Mass.—Plans are being prepared for the erection of two fire stations to replace the present High St. and Mount Tom engine houses. J. J. White is Mayor.

+Elimination of Grade Crossings—Pawtucket, R. I.—The contract has been awarded to C. W. BLAKESLEE & SONS, New Haven, by the Pawtucket and Central Falls Grade Crossing Commission for the construction of all masonry work in connection with the building of abutments, piers, sewers and necessary street work in the plans approved for the elimination of grade crossings in the twin cities and the relocation of a depot site on the dividing line.

Dock—Pawtucket, R. I.—The State Harbor Commission will construct a dock 715 ft. long. Samuel M. Conant is Chn., Providence, R. I.

Road Oil, Etc.—Providence, R. I.—The Board of Contract and Supply awarded the following contracts, Feb. 14: Furnishing 125,000 gal. road oil, to the TEXAS OIL CO., at 5¼c. per gal. f.o.b. yards at Providence; also for furnishing 50,000 ordinary paving blocks to R. B. MARRIOT, Oneco, Conn., at $61 per M.; 25,000 ordinary paving blocks with option of 25,000 more, to NELSON A. KENNEFF, Sterling, Conn., at $61 per M.; 100,000 ordinary paving blocks to NEW ENGLAND GRANITE WORKS, Westerly, R. I., $66 per M.; 50,000 ordinary paving blocks to same, $67 per M.; 100,000 improved paving blocks to BOOTH BROS. & HURRICANE ISLAND GRANITE CO., $64.50 per M.; 100,000 improved paving blocks to NEW ENGLAND GRANITE WORKS, Westerly, R. I., at $64 per M.; 100,000 improved ordinary paving blocks to same, $65 per M.

+Barge Canal Work—Albany, N. Y.—The contract has been awarded to McARTHUR BROS. CO. and the LORD ELECTRIC CO. for Contracts Nos. 92 and 94, for the erection of power plants and installation of electrical equipment and machinery for operating Barge Canal locks at many points along the line of the new canal, at $1,612,356. Bids were opened Feb. 4. List of bidders noted Feb. 13.

★Ditching and Draining—Brooklyn, N. Y.—The Kings County Anti-Mosquito Association, Inc., asks bids for ditching and draining all the marsh land mosquito breeding areas of Kings County. Address 44 Court St., Brooklyn.

Subway—Buffalo, N. Y.—The John Johnson Construction Co., Buffalo, has submitted the lowest bids at $43,353 and $39,579, respectively, for the stone masonry for the Delaware Ave. Subway under the Erie R.R. and Delaware, Lackawanna & Western R.R. tracks.

Boardwalk—Far Rockaway (L. I.), N. Y.—An oceanfront boardwalk will be constructed at Far Rockaway. Estimated cost, $75,000.

Repairs to Pier—New York, N. Y.—Bids will be received until Feb. 20 by Calvin Tompkins, Comr., Docks, for repairing the inshore end of the northerly portion of the pier at the foot of West 30th St., Boro. Manhattan, per Contract No. 1367.

Motor Trucks—New York, N. Y.—Bids will be received until 10:30 a.m., Feb. 25, by Joseph Johnson, Fire Comr., for furnishing and delivering two five-ton gasoline motor trucks.

Motor Patrol Wagons—New York, N. Y.—Bids will be received until 10 a.m., Feb. 26, by R. WALDO, Police Comr., for furnishing and delivering 10 motor patrol wagons for the use of the police department of the city of New York.

Park Work—New York, N. Y.—Bids will be received until 3 p.m., Feb. 27, by the Park Board, Dept. of Parks, Fifth Ave. and 64th St., Boro. Manhattan, for the completion of the construction of the addition to Riverside Park, east of Grants Tomb, Boro. Manhattan.

Fire Protection Work—New York, N. Y.—Bids will be received until 4 p.m., Feb. 24, by C. B. J. Snyder, Supt. School Bldgs., Dept. Education, Park Ave. and 59th St., Boro. Manhattan, for fire protection work at Public Schools 35 and 188, and Wadleigh High School, Boro. Manhattan.

Boilers—New York, N. Y.—Bids will be received until 2 p.m., Feb. 26, by George McAneny, Pres., Boro. Manhattan, for installing boilers in the Public Bath Bldg., 5 and 7 Rutgers St., Boro. Manhattan.

★Creek Improvement—Syracuse, N. Y.—William Fitzgerald, Kirk Block, Syracuse, desires to sublet his contract for the improvement of Onondaga Creek, Syracuse. The work to be done includes 5400 cu.yd. excavation and 10,500 cu.yd. of concrete masonry. Plant consists of steam shovel, dinkey, dump cars, pumps, concrete mixers, etc., on hand.

Bath-house—Utica, N. Y.—Samuel Rosenbloom, Utica, will erect a three-story and basement bath-house, 20x85 ft. T. Williams, Utica, is Arch.

+Wireless Stations—Belmar, N. J.—A contract has been awarded to the J. G. WHITE CO., 49 Exchange Place, N. Y., for the erection of two wireless telegraph stations at Belmar and New Brunswick for the Marconi Wireless Telegraph Co., 27 William St.

+Fire House—Camden, N. J.—The Fire Committee of the City Council has awarded the contract to J. W. DRAPER, Camden, at $11,500, for the erection of a fire house at 27th St. and Hayes Ave., East Side. The building will be of brick and Indiana limestone, two stories high.

Dredging—Hightstown, N. J.—The town is planning to dredge the lake in the rear of Peddie Institute, and construct a seawall, to improve the surrounding property. The project is estimated to cost about $10,000.

Ditches—Jersey City, N. J.—Bids will be received until 4:30 p.m., Feb. 21, by the Mosquito Extermination Commission of Hudson County, for about 100,000 ft. of drainage ditches, to be made on the salt marsh meadows of Hudson County at various points, beginning at the Bergen County line on the north and extending along either side of the Hackensack River to the Kill von Kull; also repairing and cleaning to a depth of 30 in., about 315,000 ft. of old ditches covering the territory above described. Louis E. Jackson, Jersey City, is Secy.

Repairs to Pier—Philadelphia, Penn.—Bids will be received until Feb. 25 by George W. Norris, Dir. Dept. Docks, Wharves and Ferries, for general repairs to the pier at the foot of Chestnut St.

Port Improvement—Philadelphia, Penn.—A bill has been introduced in the State Legislature, providing for an appropriation of $5,000,000, to improve the port of Philadelphia.

Retaining Wall—Wilkes-Barre, Penn.—The city will construct a retaining wall 1100 ft. long, on North Empire St.

Underpass—Columbus, Ga.—The city will construct an underpass beneath the tracks of three railroads at Tenth St.

+Pier—St. Petersburg, Fla.—The contract has been awarded by the city to E. W. PARKER, Tampa, Fla., for constructing the pier at the foot of Second Ave., North, at $15.95 per lin.ft., and $4375 for the landing place and freight sheds. Bids were opened Jan. 23.

Ditch and Levee—Union City, Tenn.—Bids will be received until Feb. 21 by J. A. Coble, Secy. Bd. Directors, Obion River Drainage Dist. No. 2, Union City, for approximately 314,800 cu.yd. of levee work, 178,000 cu.yd. ditch work, clearing and grubbing six miles of levee base and constructing two concrete sluiceways with automatic back water gates.

River Work—Brazil, Ind.—The Drainage Commission is considering straightening Eel River from Neal's Mill, Clay County, to Worthington, Greene County. George Sheehan, Brazil, is County Surv.

Drainage Pumping Station—Winchester, Ill.—Bids will be received until Mar. 4 by the Commissioners of Scott County Drainage and Levee Dist. at the office of J. M. Riggs, Winchester, for erecting and equipping a pumping station. The Jackson Engineering Co., Jacksonville, Ill., is Engr.

+Cement—Milwaukee, Wis.—The UNIVERSAL PORTLAND CEMENT CO., Chicago, Ill., has been awarded the contract for furnishing 100,000 bbl. of cement to Milwaukee County, to be used in street and road construction work this summer. The bid was $175,000, of which $40,000 will be returned for sacks. Work is contemplated on the Janesville plank, Howell, Port Washington, Cedarburg, North Fond du Lac, Green Bay, Mukwonago, Chicago and Blue Mound Roads.

Ditch—Des Moines, Iowa—Bids will be received until Mar. 10 by Harry B. Frase, County Audr., Des Moines, for constructing a ditch in Franklin Drainage District No. 13 of Polk County, 2¾ miles long.

Tile—Guthrie Center, Iowa—Bids were received Feb. 4 by W. M. Wells, County Audr., for furnishing and laying 6000 ft. of 24 and 3000 ft. 22-in. double strength vitrified

drain tile, 11,200 ft. 18-, 16-, 20- and 14-in. vitrified drain tile, and 9000 ft. 12-, 10-, 8- and 6-in. hard burned drain tile, for Guthrie County Drainage Dist. No. 7. Contracts have been awarded as follows: For material, to REDFIELD BRICK & TILE WORKS, Redfield, and the JEFFERSON TILE FACTORY, of Jefferson; labor, to HENRY HANSEN, of Callender. Total cost, $21,161.

Gymnasium—Dubuque, Iowa—The Dubuque German College & Seminary, Dubuque, will erect a gymnasium, to cost $30,000. J. Spencer, Dubuque, is Arch.

Drainage—Estherville, Iowa—Bids will be received until Mar. 4 by C. A. Root, County Audr., Estherville, for the construction of Joint Drainage Dist. No. 17. Estimated cost, $145,00.

Dam—Perry, Iowa—The Chicago, Milwaukee & St. Paul Ry. Co. will build a dam across the Coon River at Perry. Work will start in the spring.

+Ditch—Bemidji, Minn.—The contract has been awarded by J. L. George, County Audr., Bemidji, to C. G. ELKLUND DREDGING CO., Grand Rapids, Wis., for constructing Judicial Ditch No. 15, at about $32,000. Bids were opened Feb. 1.

Creosoted Wood Blocks—Minneapolis, Minn.—Bids have been received as follows by the Purchasing Agent for 175,000 sq.yd. of yellow pine creosoted wood blocks for the season of 1913, f.o.b., Minneapolis: (a) 3½-in.; (b) 4-in.: Kettle River Co., Minneapolis, (a) $1.46 per sq.yd.; (b) $1.65; Republic Creosoting Co., Minneapolis, (a) $1.40 (b) $1.60; Ayer-Lord Tie Co., Chicago, Ill., (a) $1.54½, (b) $1.74½.

Ditch—Redwood, Falls, Minn.—Bids will be received until Feb. 25, by the County Auditor, Redwood Falls, for the construction of Judicial Ditch No. 12, in Westline Township. The ditch will be about nine miles long. O. H. Sterk, Marshall, Minn., is Engr.

Park Work—St. Paul, Minn.—The Park Board has been granted an appropriation of $325,000 for park work.

Park—Jefferson City, Mo.—The State Senate has passed the bill appropriating $166,000 for the establishment of a state park and game preserve at Hahatonka, Camden County.

Causeway—Corpus Christi, Tex.—Bartlett & Ramey, Consult. Engrs., San Antonio, have been engaged to prepare plans for a causeway across Nueces Bay to connect Nueces and San Patricio Counties and Corpus Christi and Portland.

Extension of Seawall—Galveston, Tex.—The City Commissioners and County Commissioners are considering the question of extending the sea-wall east from sixth St. and Broadway to and including the U. S. Government property at Fort San Jacinto. L. Fisher is Mayor.

Filling—Seattle, Wash.—Sloane Bros., Seattle, have submitted the lowest bid to the Port of Seattle Commission for 520,000 cu.yd. of earth fill at the foot of Bell St., at 24.5c. per cu.yd.

Harbor—Berkeley, Calif.—Allan C. Rush, Engr., has submitted to the City Council plans for creating a large harbor and opening up a large tract of tidewater lands for factory sites. The plans include the construction of three large bulkheads, dredging of channels and construction of docks. The first step in the project, construction of the bulkheads and dredging the channels, would cost, according to the engineer's estimate, $2,000,000.

+Elevators—Los Angeles, Calif.—The LLEWELLYN IRON WORKS, Los Angeles, has been awarded the contract for installing elevators in the Knickerbocker Bldg., now being erected on Olive St., between Sixth and Seventh Sts., at $11,200.

BUILDINGS

+Boston, Mass.—The Pilgrim Publicity Association has awarded a contract to G. B. H. MACOMBER & CO., 27 State St., for the construction of an eight-story building at 44 Broomfield St. The estimated cost is $500,000. Arthur H. Bowditch, 7 Water St. is the Arch. Noted Dec. 12.

+The contract for the mercantile building for the Shearer Real Estate Trust Co., to be built at Arlington, James and Stuart Sts., has been awarded to JAMES STEWART & CO., 30 Church St., New York, N. Y. It will be of brick, stone and terra-cotta, ten stories high, 96x264 ft. The estimated cost is $600,000. Densmore & Le Clear, 88 Broad St., are the Archs.

We are officially advised that Newhall & Blevins, Archs., 9 Park St., are preparing plans for a new building for the Boston City Club, to be erected on Ashburton St. The estimated cost is $[illegible]. Noted Jan. 30.

Springfield, Mass.—The McIntosh Co. has purchased a site 101x52 ft., at Worthington and Chestnut Sts. and will build a six-story office building. The estimated cost is $60,000.

Westfield, Mass.—The city has purchased a site and is having plans prepared by John L. Hyde, Arch., Westfield, for the construction of a new high school. The estimated cost is $200,000. Additions, estimated to cost $100,000, are to be made to the Greenwood and Franklin Schools.

+Woods Hole, Mass.—The Marine Biological Society has awarded a contract to L. D. WILLCUTT & SONS CO., 146 Summer St., Boston, at $90,000 for the construction of a biological laboratory. It will be three stories high, 90x52 ft., of brick, Shepley, Rutan & Coolidge, Archs., Ames Bldg., Boston, are in charge.

+Hartford, Conn.—The Board of contract and supply has awarded a contract to P. J. CARLIN & CO., 16 East 23d St., New York, N. Y., at $623,667, for the construction of extensions to the Municipal Bldg. The contract for the granite work has been awarded to the NEW ENGLAND GRANITE WORKS, Westerly, R. I., at $197,000. Bids were received on Jan. 14. Noted Dec. 26 and Jan. 23.

Brookline, Mass.—The Board of Education is having plans prepared by Kilham & Hopkins, Archs., 9 Park St., Boston, for the construction of a school house in Brookline. It will be of brick three stories high and will be erected at Harvard and Stedman sts. The estimated cost is $[illegible].

Springfield, Mass.—Plans have been completed and estimates are now being received for a theater at Main and Worthington Sts. for S. Z. Poli of New Haven, Conn. The building will be of brick and steel, 104x129 ft., and is estimated to cost $400,000. Bromn & Von Beren, 865 Chapel St., New Haven, are the Archs.

New Britain, Conn.—The Board of Education is planning to build an addition to the High School. It will be fireproof, of light pressed brick, and is estimated to cost $150,000. Walter P. Crabtree, 272 Main St., is the Arch.

Binghamton, N. Y.—Plans are being prepared by C. E. Vosbury, Arch., Savings Bank Bldg., for the construction of a three-story high school, 196x194 ft. The estimated cost is $375,000.

+Brentwood (L. I.), N. Y.—The Brentwood Realty Co., 1 West 34th St., New York, N. Y., has awarded a contract for the construction of "The Brentwood Hotel," at Brentwood, L. I., to H. H. SMITH, of Bayshore. It will be a one-, two- and three-story structure 360x45 ft., of terra-cotta and stucco. George M. Bartlett, 103 Park Ave., New York, is the Arch.

Brooklyn, N. Y.—Plans are being prepared by Wortmann & Braun, Archs., 114 East 28th St., Manhattan, for the construction of a four-story apartment house, 103x55 ft., on Park Place, near Classon Ave., for Levy & Baird, 2027 Bath Ave. The estimated cost is $75,000.

Plans are now being prepared by William B. Tubby, Arch., 81 Fulton St., for a two-story library, 100x65 ft., to be erected by the Brooklyn Public Library Association, 26 Brevoort Place. The estimated cost is $90,000.

Buffalo, N. Y.—Bids will soon be received by Esenwein & Johnson, Archs., 781 Ellcott Square, for the construction of a three-story club house, 150x75 ft., for the Order of Orioles. The estimated cost is $75,000.

L. Michaels, 551 William St., is having plans prepared by Esenwein & Johnson, Archs., 781 Ellicott Square, for the construction of a theater, 120x80 ft. Bids will soon be received by the architects. The estimated cost is $50,000.

New York, N. Y.—We are officially advised that bids were received as follows, on Feb. 10, by the Dept. of Public Works, 13 Park Row, for the construction of the Childrens Court Building, at 139 East 22d St.: (A) without coal vault; (B) with coal vault: J. P. Brennan & Son, (a) $119,000; (b) $123,000; John Kennedy & Co., (a) $118,266; (b) $126,000; Jennings & Wellestaedt, (a) $123,737; (b) $128,215; William D. Moore, (a) $149,000; (b) $155,300; Colan & Hartwett, (a) $161,936; (b) $172,237; John H. Deeves & Bros., (a) $130,900; (b) $139,900; Thomas J. Buckley Eng. Co., (a) $127,750; (b) $133,720: Thomas J. Waters Co., (a) $125,000; (b) $130,490: John H. Parker Co., (a) $123,985; (b) $130,571: Richard E. Henningham, (a) $125,328; (b) $130,680: William Flannagan, (a) $126,950; (b) $134,200: Marble Arch Co., (a) $144,000; (b) $149,000: Robert S. Pollock Co., (a) $129,992; (b) $135,432: James McArthur Co., (a) $153,444; (b) $158,660: Richard Carvel, (a) $133,450; (b) $139,750: John T. Brady & Co., (a) $119,144; (b) $124,348: T. Carleton Co., (a) $132,912; (b) $139,442; William Home Co., (a) $139,460; (b) $147,770; Thomas McKeown, Inc., (a) $123,900; (b) $129,300: Midtown Contracting Co., (a) $132,368; (b) $136,868: William J. Hagan, (a) $[illegible]; (b) $141,192; Wegan Bartels Co., (a) $133,817; (b) $139,700; Cockerhill & Little Co., Inc., (a) $146,000; (b) $152,538: Durkin & Lass, (a) $124,448; (b) $129,408; Wills & Marvin, (a) $139,931; (b) $144,441: Thompson & Kelley, (a) $117,741; (b) $122,910: Livinan Contracting Co., (a) $117,990; (b) $122,900: George A. Fuller Co., (a) $141,900: Joseph Balaban Co., (a) $141,709. Noted Jan. 30.

Plans have been filed by H. C. Ingalls, Arch., 57 Fifth Ave., for the construction of a theater at 468 Grand St., for the Terrain Realty Co., 95 Liberty St. It will be three stories high, 100x38 ft. The estimated cost is $80,000.

Plans have been filed by F. Y. Joannes, Arch., 23 East 26th St., for a six-story store and loft building, to be erected at 21 West 39th St., for G. G. Kip, Morristown, N. J. The estimated cost is $80,000.

The Alhuson Construction Co. is having plans prepared by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a six-story apartment house at the northwest co ner of St. Nicholas Ave. and 164th St. The estimated cos is $230,000.

Plans have been filed by T. Hastings, Arch., 225 Fifth Ave., for a one- and two-story and tower church, 100x100 ft., to be erected at the northeast corner of 174th St. and Wadsworth Ave., for the West Park Presbyterian Church. The estimated cost is $150,000.

Salamanca, N. Y.—Congress has authorized an appropriation of $75,000 for a federal building, to be erected in this city.

Troy, N. Y.—The Union National Bank is having plans prepared for the construction of a four-story brick addition, 150x33 ft., to its present structure. The estimated cost is $100,000.

Camden, N. J.—The following bids were received, by the Board of Education, for the erection of the new East Side School on 29th St.: William Allen, $81,870; George Bachman, $97,447; Turner & Stewart, $108,373; Edward Fay & Son, $111,890; Henry Baton, $112,250; F. Roe Searing, $115,617; W. E. Dotts Co., $118,773; Mitchell Bros., $119,479; Wayne Construction Co., $119,500; James W. Draper, $121,239; A. Whitehead, $122,146; H. Wenszelberger, $124,722. Noted Jan. 16.

Edgewater, N. J.—Revised plans are being prepared by Adolph Mertin, Arch., 34 West 28th St., New York, N. Y. for the construction of a two-story school building, 100x140 ft., for the Board of Education. The estimated cost is $85,000.

Hightstown, N. J.—The Common Council is having plans prepared by Barry A. Hill, Arch., Trenton, for a new city hall. The structure will be of brick and steel, two or three stories high.

Hoboken, N. J.—Schneider & Dieffenbach, Archs., 220 Broadway, New York, N. Y., are preparing plans for a new school building for the Board of Education. The estimated cost is $100,000.

Newark, N. J.—Plans are being prepared by Nathan Myers, Arch., 7 Nelson Place, for the construction of a four-story brick and steel building, for John R. Eisele. The estimated cost is $60,000.

Allentown, Penn.—Plangs have been prepared for the construction of the Allentown Preparatory School adjoining

Muhlenberg College. The estimated cost is $125,000. J. A. W. Haas, is Pres., Muhlenberg College.

+Allentown, Penn.—The contract for the construction of the edifice for the Salem Reformed Church has been awarded to M. H. GANGEWERE, 11 North Seventh St., Allentown.

Altoona, Penn.—Bids will be received until 5 p.m., Feb. 28, by C. M. Piper, Secy., of the School Bd., for the construction of an addition to the school at West Chestnut Ave., and 30th St. Sholler & Hirsch are Archs., Altoona.

Ambridge, Penn.—The School Board of Ambridge, is having plans prepared by Williams & Boyer, Magee Bldg., Pittsburgh, for the construction of a high school. The estimated cost is $60,000.

+Ardmore, Penn.—The contract has been awarded to A. WHITEHEAD, for the construction of a school at Ardmore. Noted Dec. 26.

+California, Penn.—The general contract has been awarded to the CHARLEROI LUMBER CO., Charleroi, Penn., for the construction of a two-story, 120x126 ft. school.

Contesville, Penn.—H. L. Reinhold, Arch., 1309 Walnut St., Philadelphia, is receiving bids for the construction of a two-story school for the Board of Education. The estimated cost is $60,000.

Danville, Penn.—Plans have been prepared by John H. Brugler, Arch., Danville, for the construction of a hospital. The estimated cost is $400,000.

Duquesne, Penn.—Carlisle & Sharrer, Archs., Jenkins Arcade Bldg., Pittsburgh, are preparing plans for the construction of a three-story brick school building on South Third St., for the Board of Education. The estimated cost is $100,000.

Indiana, Penn.—Plans have been prepared for the construction of an eight-story dormitory at the Indiana State Normal School.

+Johnstown, Penn.—The contract has been awarded to W. W. CAMPBELL, Johnstown, for the construction of a Y. M. C. A. building. Noted Jan. 9.

Llanerch, Penn.—Blithe & Richards, Archs., 608 Chestnut St., have prepared plans for the construction of a school in Llanerch. The estimated cost is $50,000.

Philadelphia, Penn.—Showell & Fryer, real estate brokers have purchased the Scott residence at Rittenhouse Sq. and 19th St. as a site for a 15-story apartment house.

The Home for Feebleminded, located at Eyberry, will construct a tuberculosis pavilion, dormitory and dining hall, to be constructed by the city. The tuberculosis building will be 30x80 feet, with two wings each side, 82x44 feet. The estimated cost is $47,000.

Plans have been prepared by Albert Kelsey, Arch., for the construction of a one-story, building, 107x84 ft. at 65th St. and Girard Ave. for the Free Library of Philadelphia, Haddington Branch.

The Board of Education is planning the erection of a girls' high school, adjoining the present Boys' Southern High School. The estimated cost is $600,000. The Property Committee of the Board is arranging for the site.

Pittsburgh, Penn.—Bids were received for remodeling the Allegheny courthouse as follows: The George Hogg Co., $191,448; William Miller & Sons, $171,172, lowest bidder; H. L. Kreusler, $184,925; C. H. Kerr & Co., $192,815, and if Webb granite was to be used, there would be an additional cost of $28,000; George A. Cochrane Co., $187,930; James L. Stuart, $194,240; J. Charles Wilson, $209,662; Schultz, Schreiner & Clyde, $211,000, or with Massachusetts granite, $182,500. The Henry Schenk Co., presented four bids for as many kinds of granite, their bids being $209,442, $177,442, $181,636 and $184,442. The W. F. Trimble & Sons Company filed five bids, a general bid being $184,561. If Maine and New Hampshire granite was use, the price would be $157,561; with Massachusetts granite, $161,561; Pigeon Hill granite, $165,561, and New England granite, $172,561. Noted Jan. 9.

+Baltimore, Md.—The contract has been awarded by St. Joseph's Passionist Church and Monastery, Frederick Ave., to BLAKE & ENGLE, Law Bldg., Baltimore, for the construction of an additional story to school building at Frederick Rd. and Whiteford Ave., 65x140 ft. Frank & Kavanaugh are Archs., 328 North Charles St., Baltimore.

Baltimore, Md.—Plans are being prepared by Herbert G. Jory, Arch., Baltimore, for the construction of a four-story hospital 60x100 ft. for the South Baltimore Eye, Ear, Nose and Throat Hospital. The estimated cost is $50,000. Noted Nov. 21.

Cambridge, Md.—The Board of Managers of the Eastern Shore State Hospital has authorized a committee to have plans prepared for the construction of a hospital on Absco Farm. An appropriation of $165,000 has been made.

Cumberland, Md.—The Ohio Circuit Co., Moses Reis, Pres., John L. Kerr, general manager, New York, is having plans prepared by Arland Johnson, New York, for the construction of a concrete and steel theater, cantilever system of construction, 90x130 ft. F. L. McGovern, Maryland Theater, Cumberland, is Gen. Mgr.

+Frederick, Md.—The contract for the construction of the school building at Frederick, has been awarded to LLOYD C. CULLER. Parker, Thomas & Rice are Archs., Union Trust Bldg., Baltimore, Md.

+Jessups, Md.—The contract for additions and alterations to the House of Correction has been awarded to the D. M. ANDREW CO., Mt. Vernon, Ave. and 26th St., Baltimore, Md., at $85,000. Contract noted Jan. 2, was rescinded.

+Washington, D. C.—The general contract for the construction of the Normal School has been awarded to GEORGE E. WYNE, Munsey Bldg.; structural iron work, DEITRICK BROS., Baltimore, Md., reinforced concrete, FRED DREW, Bond Bldg., masonry, P. J. BRASNAHAN, Washington, D. C.

+Lynchburg, Va.—The People's National Bank has awarded the contract for the steel frame work to be used in the construction of the office building to the VIRGINIA BRIDGE & IRON CO., Roanoke, Va. Noted Jan. 23.

Greensboro, N. C.—The Traveler's Hotel Co. contemplates rebuilding the Guilford Hotel. The estimated cost is $150,000.

+Spartanburg, S. C.—The contract has been awarded to GEORGE A. FULLER CO., Washington, D. C., for the construction of an eight-story commercial building at Morgan Sq. Julius Harder is Arch., 130 West 32d St., New York.

+Athens, Ga.—The contract for the construction of the courthouse for Clark County has been awarded to LITTLE & CLECKLEY, Anniston, Ala., at $155,000. Noted Feb. 13.

Lagrange, Ga.—The Lagrange Wesleyan Female College will expend $50,000 for improvements to buildings. C. R. Jenkins is Pres.

+Savannah, Ga.—The contract has been awarded to the SOUTHERN FERRO CONCRETE CO., Atlanta, Ga., for the reinforced concrete work to be used in the construction of the Masonic Temple at Savannah.

+Jacksonville, Fla.—The contract has been awarded to the SOUTHERN FERRO CONCRETE CO., Atlanta, Ga., for the erection of a reinforced concrete skeleton frame, for the Mason Hotel. Frohling & Saxelby are Archs., New York.

+The contract has been awarded to the SOUTHERN FERRO CONCRETE CO., Atlanta, Ga., for the foundation and reinforced concrete skeleton frame for the building at Jacksonville, for the Southern Bell Telephone & Telegraph Co.

+Birmingham, Ala.—The contract has been awarded to the SOUTHERN FERRO CONCRETE CO., Atlanta, Ga., for the reinforced concrete work to be used in the construction of the chapel addition to the Convent for the Sisters of the Perpetual Adoration, at Birmingham.

Meridian, Miss.—S. H. Floyd, Arch., Meridan, Miss., has completed plans for the erection of a two-story theater. The estimated cost is $50,000.

New Orleans, La.—Bids are being received by E. A. Christy, City Arch., for the construction of a two-story and basement school. The estimated cost is $50,000.

Nashville, Tenn.—The Marathon Motor Works, Nashville, is planning the erection of a club building.

+Lexington, Ky.—The First Baptist Church has awarded the contract to FRANK CORBIN, Louisville, Ky., for the construction of a church.

+Lexington, Ky.—The contract has been awarded to FRANK CORBIN, Louisville, for the construction of the edifice for the First Baptist Church.

+Louisville, Ky.—The contract has been awarded to the SELDEN-BRECK CONSTRUCTION CO., St. Louis, Mo., for the construction of the National Theater. Noted Dec. 26.

Louisville, Ky.—Plans are being prepared by J. Earl Henry, Arch., for the construction of a two-story school building at 26th and Date Sts. for the Board of Education. The estimated cost is $100,000. Plans were erroneously noted Feb. 13, as being prepared by Brinton B. Davis.

Cincinnati, Ohio—Bids will be received by Henry T. Hunt, Commissioner of the Board of Hospital, until Feb. 28, for the construction of a special building for contagious diseases for the new general city hospital. Samuel Hannaford & Sons, Hulbert Block, are the Archs.

Dayton, Ohio—W. P. Jenkins has been granted a permit to erect an eight-story office building at Fifth and Ludlow Sts. The estimated cost is $75,000.

Dayton, Ohio—A school of concrete, to cost approximately $40,000, will be erected on Bainbridge St., for the Holy Trinity Catholic Church.

The Dickinson Seed Co. has taken out a permit for the erection of a warehouse of brick, at West 35th St. and California Ave. The estimated cost is $65,000. J. C. & R. M. Shankland are the Archs.

+Lexington, Ohio—The contract for the construction of an edifice for the First Baptist Church, Lexington, has been awarded to FRANK CORBIN, Lexington, at about $100,000.

Lima, Ohio—Plans have been prepared and an election will soon be held to vote on the proposition to issue bonds for $250,000, for the purpose of building a new court house.

Norwood, Ohio—The Board of Education will erect a three-story addition to its building on Marion St., from plans prepared by Bausmith & Drainie, Gerke Bldg. The estimated cost is $55,000.

Troy, Ohio—The Board of Education has commissioned Frank L. Packard, Columbus, Ohio, to prepare plans for the erection of a high school at Troy. The estimated cost is $125,000.

Carlisle, Ind.—The School Board is receiving bids for the construction of a new high school.

Indianapolis, Ind.—The Meridian Hotel Co., recently incorporated, is having plans prepared and will soon receive bids for the construction of a six-story hotel at Louisa and Meridian Sts. Charles E. Bacon is the Arch. Charles Thomas, A. C. Johson and Oliver M. Thomas are interested.

Paoli, Ind.—A site has been purchased and a committee appointed to receive bids for the construction of a new Carnegie Library.

+Battle Creek, Mich.—The contract for the construction of a three-story and basement city hall has been awarded to S. B. COLE & CO., Battle Creek. E. W. Arnold, 488 Main St., Battle Creek, is the Arch. Noted Dec. 12.

Detroit, Mich.—Bids will be received by Baxter, O'Dell & Halpin, Archs., 1024 Hammond Bldg., until Feb. 27, for the construction of a hotel of brick and steel, to be known as the Boston Hotel, on West Fort St., near Third St.

Plans are being prepared for the construction of a 10-story hotel on Bagley and Grand Circus Park, for the United Hotel Co. Esenwein & Johnson, Buffalo, N. Y., are the Archs.

See item under Industrial Works.

Saginaw, Mich.—The Saginaw Valley Storage & Forwarding Co. is having plans drawn for the construction of a four-story and basement storage house, 86x140 ft. It will be constructed of concrete.

+Cambridge, Ill.—The contract for the construction of the Henry County Infirmary at Cambridge, has been awarded to the APSEY & TUSCH CO., Monmouth, Ill., at $83,000. J. Grant Beadle, Galesburg, is the Arch.

Upper Alton, Ill.—Press reports state that the State Administration at Springfield, Ill., has purchased a site at Upper Alton for the new State Hospital for the Insane. W. Carbys

Zimmerman, Chicago, Ill., is the Arch. The estimated cost of the structure is $1,200,000.

St. Louis, Mo.—See item under Water Supply—Irrigation.

Austin, Tex.—The Southwestern Telephone & Telegraph Co., Austin, contemplates the erection of an eight-story office building.

Beaumont, Tex.—Press reports state that the Sisters of the Incarnate Word will erect a three-story hospital of brick at Beaumont. The estimated cost is $60,000.

✚Houston, Tex.—The contract for the construction of the new three-story junior high school on Holman Ave. has been awarded to the McKEE CONSTRUCTION CO., Houston, at $98,000. Noted Nov. 28.

Palestine, Tex.—The Commissioners' Court has been petitioned by the citizens of Anderson County to order an election to vote on the proposition to issue bonds for $150,000, for the purpose of erecting a new court house at Palestine.

✚San Antonio, Tex.—The Feden Iron & Steel Co. has awarded the contract for the construction of a two-story warehouse at San Antonio, to the TRINITY CONSTRUCTION CO., Dallas, Tex. The estimated cost is $80,000.

Ogden, Utah—Weber Academy will erect a gymnasium, to cost about $60,000. D. O. McKay is Pres.

Flagstaff, Ariz.—Plans are being prepared for the construction of a two-story dormitory at the Northern Arizona Normal School at Flagstaff. Royal W. Lescher, National Bank of Arizona Bldg., Phoenix, Ariz., is the Arch. The estimated cost of the structure is $50,000.

Phoenix, Ariz.—Plans are being prepared for the erection of a two-story and basement school in Phoenix. The estimated cost is $100,000. Norman F. Marsh, 214 Broadway, Central Bldg., Los Angeles, Calif., is the Arch.

Temple, Ariz.—A two-story industrial arts building will be erected at the State Normal School at Temple. It will be of reinforced concrete, and will cost approximately $50,000. Norman F. Marsh, 214 Broadway Central Bldg., Los Angeles, Calif., is the Arch.

Tucson, Ariz.—A masonic lodge and office building, to cost approximately $100,000, will be erected at Stone and Congress Sts.

Portland, Ore.—A new motion picture theater, to be known as "The Princess," and which will represent an investment $100,000, is to be erected by Foster & Kleiser on Sixth St. between Washington and Star Sts. Work is to start at once. The structure is to be fireproof, of reinforced concrete construction, 50 by 100 ft. The theater will have a main floor and balcony, a modern stage and all improvements in the way of equipment.

Reed College will erect a three-story dormitory on a site near Kelley Ave. It will be of reinforced concrete, fireproof construction, with an exterior facing of mission brick and Indiana limestone. The estimated cost is $120,000.

Alhambra, Calif.—Plans are being prepared for a new public library estimated to cost $45,000. It will be classic in design, of brick construction, 90x100 ft. Fred L. Roehrig, American Bank Bldg., Los Angeles, is Arch. A bond issue of $172,000 for the erection of public buildings was recently noted in Alhambra.

Los Angeles, Calif.—Frank L. Forrester, 905 Los Angeles Investment Bldg., will erect a 14-story steel frame hotel on the east side of Broadway between Eighth and Ninth Sts. The MacGibbon-Frary Co., 716 Los Angeles Investment Bldg., is the Arch.

J. J. Fay will erect a five-story and basement reinforced concrete loft building on Los Angeles St. between Seventh and Eighth Sts. Richards-Neustadt Construction Co., 704 Wright & Callendar Bldg., is the Arch.

Shirley Ward and associates will erect a seven-story building Eighth and Olive Sts. to cost not less than $150,000.

CONTRACT PRICES

✚Sewer—New York, N. Y.—Bids were received by Maurice E. Connolly, Feb. 10, for constructing a temporary dry weather flow sewer in the line of 43d St., from the pierhead line to the bulkhead line; a sewer and appurtenances in 43d St., from the bulkhead line of Flushing Bay to Ditmars Ave., a temporary grit and screening chamber in 43d St., and a sewer and appurtenances in Ditmars Ave.; Bayshore Terrace, from 43d St. to 51st St., Second Ward of the Borough of Queens. The bids were as follows: (A) LITCHFIELD CONSTRUCTION CO., 23 Flatbush Ave., Brooklyn, N. Y. (awarded contract); (B) Clancy & Van Alst; (C) Dunbar Construction Co.; Harlem River and West 175th St., New York; (D) Newman & Carey, 215 Montague St., Brooklyn, N. Y.; (E) Joseph L. Sigaretto; (F) Eon Engineering & Construction Co., 44 Court St., Brooklyn, N. Y.; Leo Kelley, 89 Montague St., Brooklyn, N. Y.

Sacramento, Calif.—A. A. Mull is having plans prepared for a hotel costing about $300,000 to be erected at Tenth and L Sts.

Mrs. F. H. Joy will erect a four-story hotel at 11th and L Sts. It will be of brick and stone construction, and is estimated to cost $75,000.

Sacramento, Calif.—H. E. Yardley, James Nicholson, William Wright, Frank Edinger and Henry Kilgraiff will erect a 6-story apartment house on Ninth St. between H and I Sts. to cost about $175,000.

San Diego, Calif.—A $70,000 addition will be made to the county hospital. Quayle Bros. & Cressey are the Archs.

Gordon-Decker and the firm of Barney, McKee & Rife will erect a four-story and basement hotel at a cost of approximately $150,000 at Fifth and A Sts. Henry Lord Gay is the Arch.

San Diego, Calif.—Bids will be received until Mar. 3 by C. L. Wilson, Gen. Mgr. of the Southern California Panama Exposition Commission, Chamber of Commerce Bldg., Los Angeles, for the construction of an exposition building at San Diego. The main building will be 100x240 ft. with two wings, each 50x50 ft.

A permit has been issued for the construction of a $40,000 electrical building on the exposition grounds. It will be two-stories high, 106x203 ft.

San Francisco, Calif.—Trowbridge & Perkins will erect a six-story apartment house on Sutter St. at a cost of $110,000. F. H. Meyer, Bankers Investment Bldg., is the Arch.

L. H. Sly will erect a five-story and basement apartment to cost about $200,000 at Post and Leavenworth Sts.

The Union Iron Works is having plans prepared for a hospital building as one of the new improvements to its plant. It will be of reinforced concrete with all modern equipments. Charles Peter Weeks, Mutual Bank Bldg., is Arch.

Joseph Cahen, 45 Kearny St. is completing plans for the construction of a three-story and basement brick rooming house. The building will be erected for Louis Friedman on Kearny St. The interior will be finished in pine and redwood. The exterior will be faced with brick.

Stockton, Calif.—The Atchison, Topeka & Santa Fé Ry. Co. will erect a freight depot to cost $50,000 on the block bounded by San Joaquin, Worth, California and Taylor Sts.

Montreal, Que.—A syndicate of local capitalists has purchased a site at St. Catherine St. and McGill College Ave. upon which a ten-story hotel will be erected at an approximate cost of $1,600,000.

Victoria, B. C.—The British Columbia-Electric Ry. Co. plans to erect a 10-story office building and passenger station at Douglas and Pandora Sts. The estimated cost is $350,000. A. T. Goward, Victoria, is Mgr.

Vancouver, B. C.—The Kitsilano M. E. Church will erect a church at Second Ave. and March St. to cost $120,000.

INDUSTRIAL NOTES

The **RAYMOND CONCRETE PILE CO.**, 140 Cedar St., New York, N. Y., has been awarded a contract by the Republic Iron & Steel Co., for placing approximately 1200 Standard Raymond concrete piles for the foundations of open-hearth buildings and furnaces at Youngstown, Ohio.

The Edwards Mfg. Co., Fifth St. and Eggleston Ave., Cincinnati, Ohio, has taken over the property of the Cellular Metal Co., at St. Bernard, a suburb of Cincinnati. This deal promises to make Cincinnati the center of the fireproofing industry of the United States. It is understood that orders will soon be placed for the installation of special machinery, to cost about $50,000. The plant when in full operation will give employment to 200 men. In addition to the making of cellular metal, which is a factor in the fireproofing of buildings, the new corporation will make a specialty of a fireproof partition, also known as a "key ridge," which has been tested by the mechanical department of the University of Michigan, and claimed to be the best fireproof material of the kind to be introduced. The frame, with plaster on both sides, is reported to take up less than 2 in. of space, and is said to resist heat in a most satisfactory manner.

Sanderson & Porter, 52 William St., New York, announces that Mr. Richard S. Buck has retired from the firm and has become chief engineer of the Dominion Bridge Co., Canada, and that Mr. Seton Porter has been admitted as a member of the firm.

Dow & Smith, New York, N. Y., chemical engineers, will move their offices from 24-26 East 21st St., to the Fifth National Bank Bldg., 121 East 23d St., New York.

SEWER BOROUGH OF QUEENS, NEW YORK, N. Y.

	A	B	C	D	E	F	G
1 screen, grit chamber [illegible] valve & sluice gate	$40000	$5800	$11 000	$8000	$7600	$9339	$8200
1 overflow chamber [illegible]	5000	5926	9 800	6500	600	7811	6500
1 drop chamber with [illegible]	1000	600	6,000	5000	150	5629	1800
1000 lin ft B. M. timber	20 00	20 05	12 25	10 00	21 64	17 05	20 00
610 lin ft 5x5 ft. [illegible]	10 54	18 37	15 00	15 00	57 80	21 50	19 00
1870 lin ft 10x7 ft. [illegible]	17 65	14 00	61 30		11 00	53 00	30 00
1200 lin ft 7x5 ft. [illegible]	25 00	42 91	37 45	40 00	41 50	37 00	37 50
1172 lin ft 7 6 ft. [illegible]	33 42	28 19	39 05	40 00	45 70	38 50	26 00
145 lin ft 12-in pipe sewer	2 00	1 70	1 30	2 00	2 01	2 00	2 25
5 [illegible] pipe sewer	5 00	5 00	4 00	8 00	5 00	4 00	7 00
2 [illegible] pipe sewer	2 00	1 50	1 30	2 00	1 50	1 50	2 25
2 [illegible]	80 00	150 00	170 00	200 00	175 00	180 00	250 00
60 [illegible]	11 00	12 00	22 00	25 00	15 00	18 00	20 00
12 [illegible]	70 00	90 00	150 00	70 00	85 00	160 00	150 00
2 [illegible]	50 00	50 00	125 00	150 00	50 00	93 00	150 00
750 [illegible]	6 00	5 00	7 20	6 00	6 50	7 00	5 00
1000 [illegible]	03	05	03	06	05	05	06
25 M. B. M. timber for [illegible]	40 00	40 00	50 00	50 00	40 00	25 00	40 00
100 M. B. M. timber for [illegible]	30 00	10 00	30 00	30 00	40 00	70 00	40 00
15 000 lb. of piles	50	50	50	40	45	47	47
	$224 788	$224,360	$286,080		$278,197	$276,925	$231,284

Engineering News

VOLUME 69 FEBRUARY 27 1913 NUMBER 9

The Sewickley Cantilever Bridge

A notable cantilever bridge was built across the Ohio River at Sewickley, Penn., about 12 miles below the "Point" at Pittsburgh, in 1911. It was completed a little more than a year ago. Its channel span is not very much less than that of the other Ohio cantilever bridges, as may be seen from the following list of large American cantilever bridges:

Bridge	River	Max. Span. ft
Quebec (not yet built)	St. Lawrence	1800
Blackwells Island	East	1182
Wabash	Monongahela	812
Memphis	Mississippi	790
Beaver	Ohio	769
Sewickley	Ohio	750
Mingo	Ohio	700
Thebes	Mississippi	671

A number of the constructive features of the bridge are particularly interesting. This will appear from the following description.*

HISTORY—Agitation for a bridge over the Ohio River at Sewickley dates back to 1894, but the movement set on foot at that time did not succeed; Allegheny County, which was to build the bridge, did not consider the probable benefits of the bridge sufficient to warrant its cost. In 1906 a new movement for a bridge was initiated, and this was approved by the County Court late in that year. General plans were drawn and the approval of the War Department secured during the latter part of 1907, and final plans were prepared in 1908 by the county engineer. On July 2, 1909, a contract for the superstructure was let to the Fort Pitt Bridge Works, and on July 6 a contract for substructure and approaches to Adam Laidlaw Co., both Pittsburgh concerns. On May 16, 1911, the suspended span was closed and the bridge swung. The structure was opened to traffic in the fall of 1911.



FIG. 1. SEWICKLEY CANTILEVER BRIDGE, OHIO RIVER

GENERAL DESIGN

The general laws governing bridges over the Ohio River require a minimum span of 500 ft., and a high-water clearance of 50 ft. and low-water clearance of 90 ft. for a 500-ft. width. The War Department has required longer spans than 500 ft. for Ohio River bridges, however, and with due reference to the spans of the near-by Wabash and Beaver bridges the county engineer decided on a span of 750 ft. for Sewickley. There is no

*Two articles on the bridge have been published recently: A. W. Buel, "The Sewickley Cantilever Bridge Over the Ohio River," Proc. Am. Soc. C. E., Sept., 1912, p. 1057; and V. R. Covell, "The Ohio River Highway Bridge at Sewickley," Proc. Engrs. Soc. of Western Penn., Oct., 1912. The former covers the superstructure in detail, while the latter gives information on surveys, substructure, etc. The two articles together describe the bridge quite completely.

bridge between Sewickley and the Point at Pittsburgh, where the Ohio is formed by the confluence of the Allegheny and Monongahela Rivers.

While the bridge was to be designed for ordinary highway loading (including a double-track electric-railway line), and therefore suspension-bridge construction could be considered, yet the available anchorage space at the end was not adequate for this type, and a cantilever span was the only kind seriously considered. The river regulations necessitated erection without falsework.

J. G. Chalfant, county engineer of Allegheny County, prepared the working plans for the substructure and general design plans for the steelwork. The foundations and piers were built in accordance with these plans. The steel superstructure was built to the designed outline and loading, but was changed in a number of details by the contractor's engineers as the result of a complete study of the design. This involved, as one important feature, a considerable increase in the weight of the bridge.

The War Department permit fixed the location of the bridge within very narrow limits, so that the subsequent fieldwork of location involved nothing more than suitable triangulation to set the piers. The bridge crosses the high-water channel at right angles, and extends from the easterly side of Chadwick St., Sewickley, between River Ave. and Chestnut St., to a point north of Coraopolis. The triangulation was made by laying down a rhomboid with the bridge axis as its short diagonal, comprising two shore bases 1150 and 1350 ft. long, which gave angles to the opposite ends of the bridge axis of about 47°. Careful work by ordinary methods yielded a bridge-axis measurement exact within ⅛ in.

The bridge is 1852 ft. 7 in. long between abutments. It comprises six approach spans and a three-span cantilever bridge 1350 ft. long, all of steel, the approach spans being supported by steel bents, while the main and anchor piers are of masonry up to the bridge-seats. The spans are as follows, beginning on the south shore: Approach spans of 75 ft. 2 in., 108 ft. 9 in. (over Pittsburgh & Lake Erie Ry.), and 75 ft. 2 in.; south anchor arm, 300 ft.; channel span, 750 ft., consisting of two cantilever arms of 200 ft. each, and a suspended span of 350 ft.; north anchor arm, 300 ft.; north approach spans, three of 75 ft. 2 in., the last one crossing Chadwick St., in Sewickley. The trusses are spaced 32 ft. center to center throughout, giving a roadway 28 ft. wide in the clear; their planes are vertical. Outside of the trusses are sidewalks 7 ft. 9 in. wide from center of truss to center of

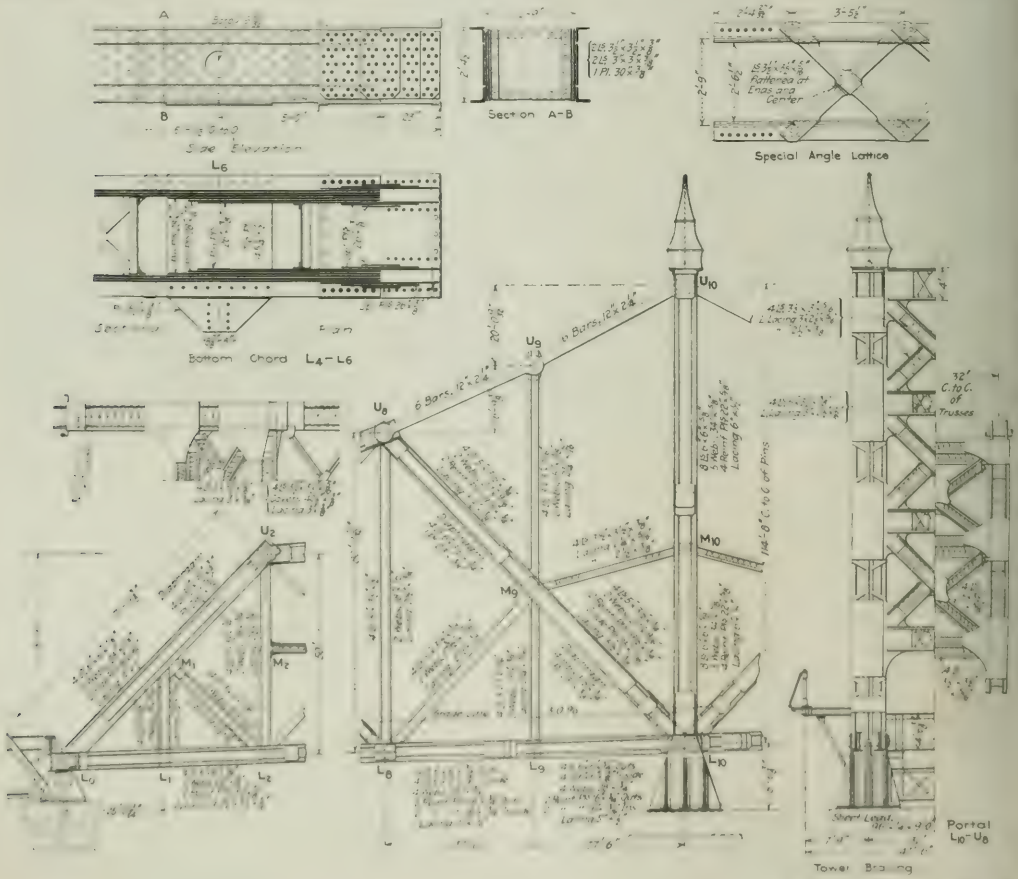


FIG. 2. TYPICAL DETAILS

railing, carried on cantilever brackets attached to the posts. The roadway has a solid-floor construction of wood block on concrete on buckle-plates. The street-car tracks are laid adjoining the trusses, with the roadway in the center, as the width was not sufficient for four lines of travel. The county laid the tracks, and rents them to the street-railway company using them.

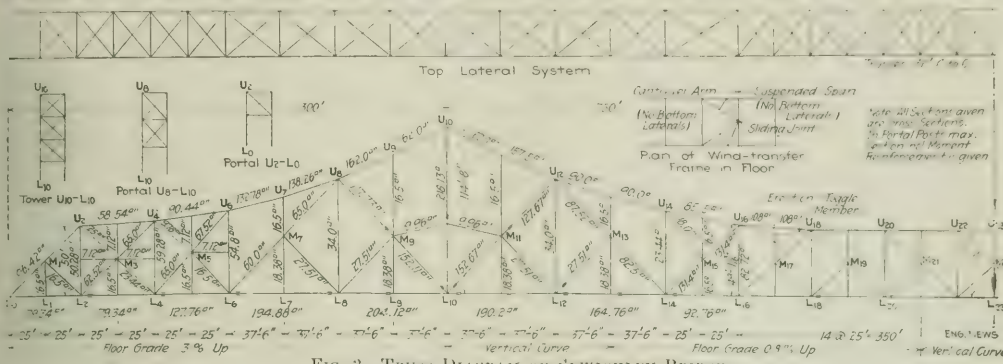


FIG. 3. TRUSS DIAGRAM OF SEWICKLEY BRIDGE

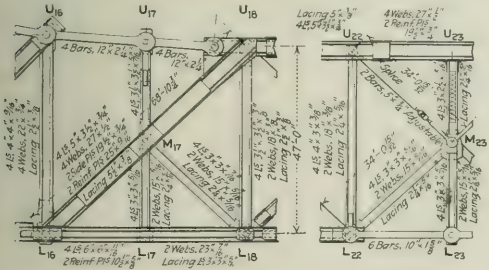
In profile, the bridge has 3% grade up toward the river on each side as far as the main piers, and 0.8% grade on the flanks of the channel span, with vertical curves connecting at the center and at the main piers to the adjoining grades.

SUBSTRUCTURE

The foundations were not difficult. Rock is not far below the surface and the earth over it is good. The piers, pedestals and abutments on land were built in open excavation. The river piers were built in open coffer-dams driven to rock, which were to be pumped out dry for concreting. But it did not prove possible to drain them entirely, and the lower 10 ft. of concrete in the river piers was deposited under water.

All parts of the substructure are of concrete, but the main and anchor piers of the cantilever bridge are faced with sandstone, and the caps of the pedestals and the bridge-seats of the abutments are also of sandstone. Beaver Valley sandstone obtained from Wampum, Penn., and Morgantown, W. Va., was used. The largest pieces were the granite bridge-seats on the main piers, each consisting of two slabs 4 ft. by 11 ft. by 3 ft. thick, joined on the longitudinal center line of the truss, making the bridge-seat 8x11 ft. by 3 ft. thick.

The two river piers were founded in 14 ft. and 6 ft. of water, respectively. The subsoil is sand and gravel with rock at comparatively shallow depth. The two piers went to 33 and 30.9 ft., respectively, below pool-full level. The lower part of each pier is 74x26 ft., and the coffer-dam was made 76x28 ft., to give room for forms. After dredging the pier site to rock, the coffer-dam was built in place by floating out rings of 12x12 timbers to form the inner bracing and driving sheathing on the outside to rock. Backfill of clay was deposited around the sheathing to seal the coffer-dam, and then the inside was cleaned down to rock with a clam-shell bucket and pumped out. The coffer-dam leaked sufficiently, however, that the break-down of one of the pumps led to a decision to deposit the lower 10 ft. of concrete under water. When this concrete had set, the leakage was small enough to be readily controlled by a small pump, and the pier was built up without further incident. The concrete below water was built in forms, while above water the sandstone facing acted as a form, being backed up with concrete as fast as the stone was set.



OF SEWICKLEY BRIDGE

The preceding refers to the construction of the first of the two river piers. The same method was used in the following spring for the other pier, as careful levels showed no settlement of the finished work and it was therefore concluded that the deposition of concrete under water to form the footing course was satisfactory. Both piers showed a settlement of about ¾ in. in nine months after construction.

The substructure work involved the following quantities:

Stone, cu yd	6,183
Foundation concrete, cu yd	4,451
Pier concrete, cu yd	2,906
Total	13,540 cu yd.

SUPERSTRUCTURE

The trusses of the bridge are of full pin-connected type. This makes the structure unusual among large modern bridges, as the tendency has been toward using pin and rivet joints in a compromise arrangement, or else riveted connections only, in bridges of large size.

LOADS AND STRESSES—The loading for which the trusses were designed was 2000 lb. per lin.ft. of truss for the approach spans, 1600 lb. per lin.ft. of truss for the three cantilever spans, and a wind load of 35 lb. per sq.ft. of exposed surface of both trusses on the unloaded bridge. The floor-system was designed for two 50-ton cars, a 15-ton roller, a 5-ton wagon, or a distributed load-

ing of 100 lb. per sq.ft., in such combination or selection as to give maximum stresses.

The unit-stresses governing the design were: In chord, eyebar and floor members, 24,000 lb. per sq.in. for dead-load and 12,000 for live-load; in stringers, 20,000 and 8,000; in posts, 20,000 and 10,000; in bracing, 13,000; in pins, bending, 25,000, etc. In all cases the allowable stress-intensities in compression were the tensile values reduced by a straight-line column formula. The maximum stress from combined dead, live and wind load was limited to 20,000 lb. per sq.in., reduced by compression formulas for struts.

Special Lattice.—The general design made all compression members of two built channels latticed together.

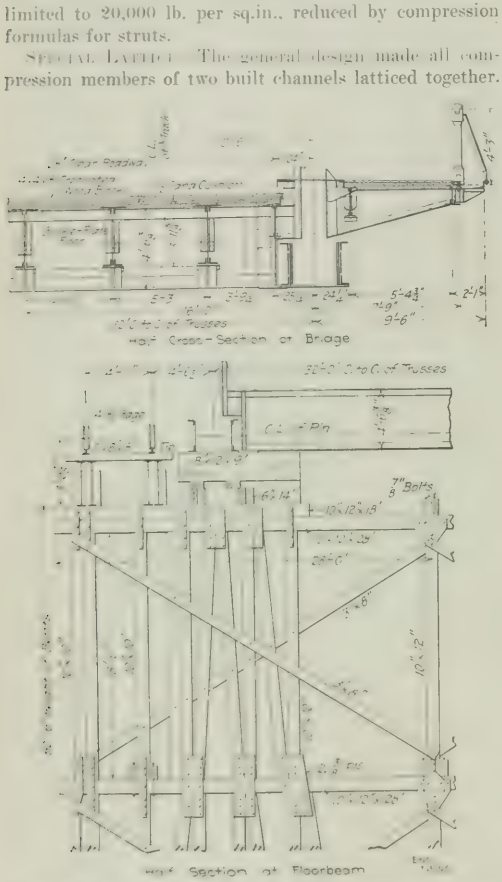


Fig. 1.—Cross-section of Steuckley Bridge and Falsework.

The contractor in checking over the design found it necessary to increase the bottom chord section considerably in many panels, and as the depth of the chord could not be increased without material changes the section was altered to two built I-shaped sections latticed, of the original depth, 28 in. The lattice was at the same time changed from 6-in. channels to flat bars, and in some panels to a special little of angle bars set with vertex up and flattened at ends and center for riveting. This type of lattice, which is new so far as is known, is shown by sketch at Fig. 2; it was used on 3⅝ x ⅞ in. and 3½ x 1 in. bars. Tests of such lattice bars showed an ultimate strength of 23,000 to 26,000 lb. per sq.in., whereas 5-in. and 6-in. channel struts failed at 16,000 to 18,000 lb. per sq.in. This special angle lattice, being placed with the point of the angle up, sheds water perfectly.

Long Rivets.—The splices in the bottom chord were made a little to one side of the panel-points. The splice-plate sections were proportioned for 50% of the stress in the member. Great thicknesses of metal were reached at the foot of the main post over the main pier and at the anchorage shoe. At the main shoe, rivets of 10¼-in. grip had to be used and, at the same panel-point, around the bearing of the main pin the rivets have 6⅜-in. grip. These are all shop rivets, and no difficulty in driving them tight is reported. A number of field rivets of 5 5/16-in. grip occur in the structure. These pass through four web-plates and six splice-plates with 18 painted surfaces, and trouble was experienced in getting them tight with pneumatic hammers. A pneumatic grip riveter was then used, and satisfactory results obtained. The size of the connections in this structure is further indicated by the fact that the largest pin is 14 in. in diameter.

Anchor-arm Top Chord.—An important change was made by the bridge company in redesigning the top chord of the anchor arm. This top chord as originally designed in the county engineer's office consisted of eyebars packed together with a light compression member. Difficulty in getting a satisfactory distribution of stress between the different parts of the member was anticipated by the contractor; also, the member had not sufficient compressive strength to enable the anchor arm to swing clear of its falsework before the erection of the cantilever arm. This meant danger of collapse if a flood should carry away the falsework before the cantilever arm was erected far enough to put tension into the top chord of the anchor arm. The design was therefore changed to make this top chord a rigid member, though still of pin-connected type. The arrangement of the successive panels of the chord offered some difficulty in securing a suitable packing of the members at the joints on the pins, the successive chord sections having to lap past each other to form tension heads. The final design shows the panels alternately narrow and wide, but with the flanges kept at practically the same total width by using angles of different widths of leg.

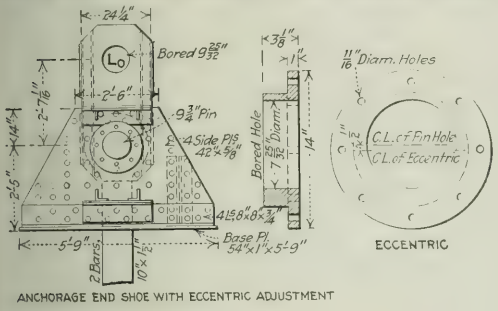
Anchorage Details.—The anchorage engages practically the full weight of the anchor pier, by means of a pair of lattice girders bedded in the anchor pier at the foot of the anchor chain, extending the full length of the pier. These girders also help to tie the anchor-pier masonry together, and prevent cracking.

To allow for the stretch of the anchor chains as the load gradually came upon them during the building out of the cantilever arm, the well around the upper part of each anchor chain was left open until the bridge was completed. This stretch had also to be allowed for at the connection of the anchor chain with the shoe, so as to keep the shoe bearing on the pier. Instead of using wedges for this purpose, as was done in the Beaver Bridge,* an eccentric adjustment was employed, which is shown in the drawing Fig. 5. The adjustment is fitted at the lower end of the short rocker which connects the end pin of the bridge with the pin at the shoe. The lat-

*See Engineering News Jan. 26, 1911, pp. 92-95.

ter is a 9 3/4-in. pin, taking the lower end of the rocker and the upper end of the anchor eyebars, and also passing through the webs of the shoe. Where passing through these webs, however, the pin is turned down to 7 3/4 in. and is surrounded by a flanged steel sleeve, whose hole is bored ½ in. eccentric to its outer circumference. This sleeve is seated in the web of the shoe, and when turned in its seat shifts the pin a total amount of 1 in. up or down.

The adjustment of this eccentric was made when the creeper traveler stood at its extreme position, near the middle of the suspended span. The anchorage pull under this loading was almost the same as the maximum load-uplift on the completed bridge. Therefore, when the eccentrics had been turned to bring the end shoes into firm bearing on their beds, the anchorage eyebars were held at maximum stretch, and no looseness or pounding could develop under any load conditions in the future. The eccentrics were retained in their adjusted position



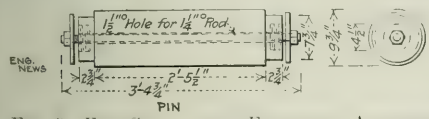


FIG. 5. END SHOE, WITH ECCENTRIC ADJUSTMENT FOR ANCHORAGE

by screws entering tapped holes in the shoe webs, drilled and tapped after the adjustment.

MAIN SHOE—The main shoes, steel-riveted assemblages, designed with three ribs and three diaphragms, receive the 14-in. pins at the base of the main or tower posts. These posts have three webs, joined by latticing. The pin bearing in the three ribs of the shoe is 17¾ in. wide. Each shoe has a base 8x9 ft., is about 8½ ft. high to center of pin, and weighs 37,860 lb.

The two shoes on each pier are connected by a strut 30 in. wide by 4 ft. deep, independent of the cross-bracing of the trusses. The end attachment gussets of the strut also carry the floor-beam over the pier, which arrangement avoids the necessity of attaching this floor-beam to the truss post and carrying the load down through the pin. The problem of making the connections at this panel-point was greatly simplified by thus eliminating the floor-beam connection.

Some of the connections of the web members at the bottom-chord panel-points were simplified by making the forked connection common to two web members. At *L8*, for instance, the connection is shop-riveted to one of the two diagonals and the other diagonal is field-riveted to it at a point 3½ ft. from the pin center. At the foot of the main tower the principal compression diagonals are similarly connected, except that here the connection is a separate erection piece, both diagonals being field-connected to it. The secondary stresses due to such connection were properly allowed for in proportioning the members.

BRACING—The bridge is braced by a full top-lateral system, supplemented by portals in the planes of the end posts and of the principal diagonals leading down to the main pier, and by transverse sway frames at all panel-points. It has no bottom-lateral bracing, however, the buckleplate floor with its stiffening by the stringers and floor-beams being relied upon to take all the wind shear. At the ends the wind reaction must pass down the rockers into the end shoes. The near-by Beaver bridge, with a full bottom-lateral system, has a separate wind abutment with sliding connection, on the middle of the anchor pier, engaging the end of the lateral system.

A sliding connection was required in the Sewickley bridge, however, at the junction of cantilever arm and suspended span. It is made on the middle line of the bridge, by a square sliding block on the end of a triangular lateral frame in the end panel of the suspended span engaging jaw plates on the end of the cantilever arm.

The type of portal and sway bracing used is indicated by the sections in Figs. 2 and 3.

CAMBER PROVISION—The bridge was cambered to come to its theoretical shape under full load. This meant changing the length of each member by an amount equal to its change of length under full load, but in the opposite direction; that is to say, building the compression members longer than their geometric length and the tension members shorter. No difficulties were encountered in bringing members together at joints during erection on account of their departure from geometric length, as there are practically no redundant or excess members in the framework.

The stringers were affected by this camber provision, as their lengths correspond to geometric lengths, while the bottom chords of the truss, being in compression, were built longer than geometric length. The stringers, intended to fit against the webs of the floor-beams and rivet to them, were thus too short until after the bottom chord was under considerable compression. For this reason during erection the stringers were carried on shelf-angles riveted to the floor-beam webs; these shelf-angles were supported by stiffeners proportioned for the erection floor-loads.

ERECTION ADJUSTMENT—For making the adjustment at the ends of the suspended span the bottom-chord wedge device and top-chord toggle which had been used in the Beaver Bridge were borrowed. These devices are shown in Fig. 6. No trouble was experienced in using them. The wedges and toggles were so set prior to beginning the erection of the suspended span that the subsequent motion would only have to be a slacking off and not a drawing up, the latter, of course, requiring much greater power to operate.

It was also necessary to provide adjustment in the center panel of the suspended span. The original design showed crossed diagonal eyebars in this panel without any adjustment. The contractors substituted compression members for the lower halves of these diagonals and adjustable eyebar members for the upper portion, with the

central connection plate riveted to the lower subdiagonal on the side first erected. With this arrangement all parts of the central panel web were readily supported, and the upper adjustable diagonals, which were detailed to be seated outside of the connection plate, were then easily slipped on and tightened up.

Erection

The anchor arms on both sides of the river were erected on falsework in accordance with ordinary practice. The traveler used for this work was a three-bent outside traveler, specially designed and built for this bridge, but so made as to be capable of use for almost any erection conditions, i.e., with trusses of any spacing and any height, by making the transverse and longitudinal framing and the vertical frames themselves adjustable in length over

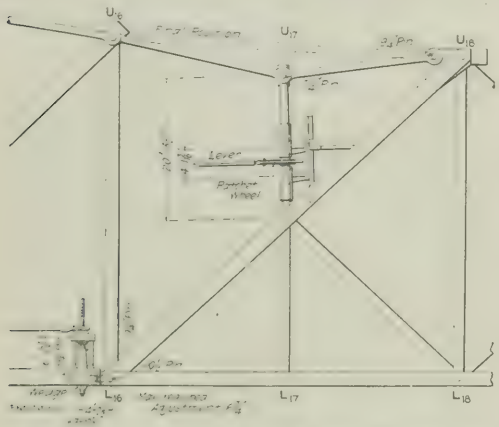


Fig. 6. Adjusting Devices at Ends of Suspended Span
(Designed for Beaver Bridge and first used there.)

centrations of load on the front trucks of the locomotive crane, to prevent overloading the stringer brackets; this was done by taking off the rear counterbalance and supporting the front of the crane by special outriggers, carrying the load to four lines of stringers.

The upper parts of the main posts were somewhat higher than the main traveler. They were erected by hoist falls slung from gallows-frame extensions built on top of the traveler and carried on rearward projections of the loading girders which extend along the top of the traveler over the truss locations. This arrangement gave rise to no difficulty.

The original plan was to erect the entire channel span by the cantilever method, setting a top-chord or creeper traveler on the trusses after erecting one panel outside of the main pier, and carrying on the further work with this traveler. The contractor, however, preferred to erect the cantilever arm with the main traveler. As the truss details were not strong enough to carry the main traveler, he secured permission from the government for extending falsework out to the ends of the cantilever arms, on one side of the channel at a time so as to leave a clear width of at least 500 ft. The main traveler, therefore, erected the bridge out to the end of the cantilever arm on either side, running on this falsework, and finally assembled the creeper traveler on the top chord for erecting the half of the suspended span; then the falsework was pulled and taken to the other side, and driven there for the erection of the other cantilever arm.

To avoid any chance of overloading this falsework by concentration of the weight of the cantilever arm, which deflected progressively as the erection went forward, the trusses were kept free of the falsework except for the panel in course of erection. This subject required careful attention, as the outer end of the cantilever arm with the traveler at that point had a deflection of about 10 in. below its unstrained position.

As the traveler was carried by the falsework at all times, in case of damage to the falsework by ice or high



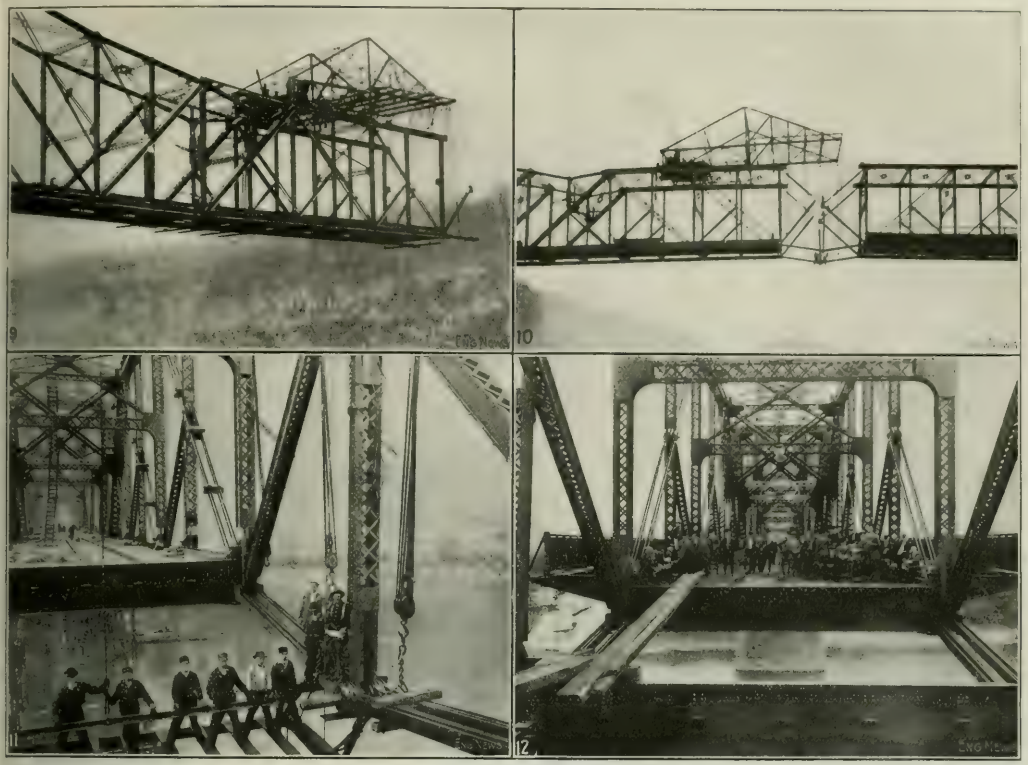
Fig. 7. Sewickley Bridge; Falsework for Anchor Arm and Gantry Traveler



Fig. 8. Creeper Traveler on End of Cantilever to Begin Erection of Suspended Span

a large range of dimensions. The floor system of the bridge, as well as the parts of falsework supporting the whole structure were, however, set by a locomotive crane, which proved very advantageous for quick working. At some points it was necessary to distribute the high con-

water there would have been great risk of loss. Therefore the effect of carrying the traveler lashed to the cantilever arm, after knocking out the blocking under the traveler so as to leave the falsework free, was investigated. It was found that the structure would be safe



FIGS. 9 TO 12. ERECTION OF SUSPENDED SPAN, AND CLOSURE.

FIG. 9. ERECTION IN PROGRESS, MAR. 21, 1911.
FIG. 10. CLOSING BOTTOM CHORD, MAY 15, 1911.
FIG. 11. DRIVING CENTER PIN IN BOTTOM CHORD, MAY 15, 1911.
FIG. 12. MIDDLE FLOORBEAM IN PLACE. ADJUSTMENT NOT YET MADE, MAY 16, 1911.

under these conditions except after the erection of the creeper traveler, under which condition the structure would be over-stressed. The working schedule was laid out so that the assembling of the creeper traveler would be done in a season when there is no danger of high-water or ice trouble. No conditions occurred at any time to endanger the cantilever falsework, though the anchor-arm falsework went through some critical periods.

The erection of the Sewickley bridge was completed during 1911, the suspended span having been closed on May 16, 1911.

The weights of the principal elements of the bridge are given in the following table:

WEIGHTS OF STEEL, SEWICKLEY BRIDGE

	Shapes and Plates lb.	Eyebars lb.	Buckle-plates lb.	Total lb.
Approach spans	1,029,704		210,475	1,240,179
Anchorages	72,646	20,600		93,246
Anchor arms (incl. tower posts)	3,717,741	464,560	247,965	4,430,266
Cantilever arms	1,849,693	533,150	162,725	2,545,568
Suspended span	1,454,230	204,405	146,445	1,805,080
	8,124,014	1,222,715	767,610	10,114,339
			Railing...	300,461
			Total	10,414,800

The cost of the bridge is as follows:

Substructure, incl. filling and paving	$120,293.84
Superstructure	398,966.83
Street-car rails	18,178.00
Total	$537,438.67

The bridge was designed by J. G. Chalfant, County Engineer of Allegheny County, and G. Gudmundsson, Consulting Engineer. A. W. Buel, Consulting Engineer, was retained by the Fort Pitt Bridge Works to take charge of revision of the design, detailing and design of the travelers; besides carrying out this work he also acted in consulting capacity during erection. H. R. Blickle is Chief Engineer of the Fort Pitt Bridge Works.

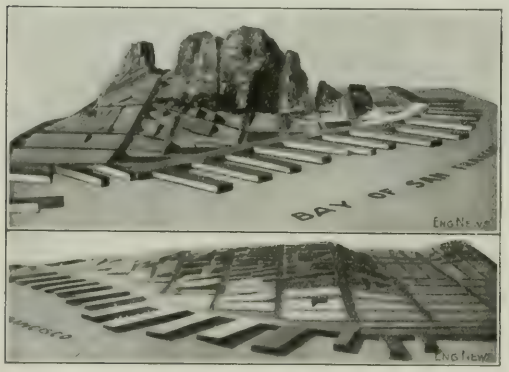
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Mineral Production of the United States in 1912, promises to show record-breaking figures, according to a recent press bulletin of the U. S. Geological Survey. In addition to the coal production of 550,000,000 tons (noted in "Engineering News," Jan. 9, 1913, p. 90), there is an estimated production of refined copper of 1,560,000,000 lb. compared with 1,434,000,000 for 1911; the Arizona production is expected to exceed 350,000,000 lb., a record for that or any other state. In the gold-mining industry, the smallest production since 1907 is estimated; for 1912 the value is expected to be $91,685,000. In silver production an output of 65,000,000 oz. is indicated, the highest figure since 1892, the average price of silver in the year was 60.9c. per oz. Preliminary figures for lead show a small decline from the high-record figures of 1912, the total output of refined, desilverized and soft lead from foreign and domestic ore being 480,965 short tons valued at $43,286,850. The domestic production was 20,000 tons greater than in 1911 441,190 short tons. Of zinc, 324,000 tons are reported from domestic ores and 14,700 tons from foreign ores, a total of 338,700 tons valued at $46,731,000 compared with 287,000 tons in 1911. The production of iron ore promises to be some 30% greater than in 1911, being about 57,000,000 long tons—a possible record figure.

A Project for Regrading Rincon Hill, San Francisco, Calif.

The city of San Francisco has been provided by nature with a reasonably good harbor, but with relatively meager land facilities for access to docks and for associated industrial districts. To make up in large measure for this deficiency a scheme is on foot to regrade a jagged elevation near the water front, known as Rincon Hill. To prepare the way for necessary action by the city the scheme has been studied in much detail for some months past by the engineering department of the San Francisco Chamber of Commerce and, as regards property values and financing generally, by a committee of the Associated Savings Banks of San Francisco. John S. Drum is chairman of this committee and he is also a director of the Chamber of Commerce. The engineering estimates have been made by A. H. Campbell, engineer in charge of the Inspection Bureau of the Chamber of Commerce. (The Bureau inspects all city work paid for from the proceeds of bond issues.)

An account of this interesting project, with Mr. Campbell's estimates in some detail, is published in the *Journal* of the Chamber for January, 1913. The *Journal* states that it proposed to remove or lower Rincon Hill in order that "San Francisco may have a defined and well



Models of Rincon Hill, San Francisco, Calif., as Now Appearing and as Proposed after Regrading

(The upper view is assumed looking northwest and the lower one looking southwest.)

equipped industrial district and easy access to the new docks south of Harrison St."

We reproduce from the *Journal* views of models of Rincon Hill now and as it would appear "after regrading had turned it into a choice warehouse and factory" district, with grades "practical for railway spurs and heavy teaming."

Of the alternative grading plans under consideration the execution of one is estimated to cost $4,786,000, and of the other, $5,267,000. Either plan would involve about 1,000,000 cu.yd. of street excavation which, with repavement and other street and sewer work, would cost about $1,500,000. The volume of material to be removed from private property in the regrading is not stated, but the estimated cost of this work is $3,282,000 under the less and $3,557,000 under the more expensive plan. The estimated present value of the 18 blocks of private property embraced in the more expensive regrading plan is $8,818,000, or an average of $2 per sq.ft. This estimate assumes the market value of the land at twice its assessed valuation. If the street grades were reduced to 2%, it is estimated that this land would be worth at least $3.50 per sq.ft., making a gain of about $6,700,000. The scheme seems to be to meet the cost of regrading by assessments for benefits distributed over a large assessment area. The *Chamber of Commerce Journal* quotes M. M. O'Shaughnessy, City Engineer of San Francisco, as saying:

> This Rincon Hill property is focally located between the new docks and the warehouse district. If it were graded it would be worth from $400 to $500 a front foot. Its present value is not much more than $125 a front foot. There is rock foundation throughout the entire area and no piling would be necessary for the construction of the largest buildings.

City Planning*

It is gratifying to note the continued interest and the growing appreciation of the value of town planning. During the past year many cities in the United States and Canada have turned their attention to the subject. Some are taking active steps to improve their water fronts, solve railroad problems or to plan civic centers. Others are turning their attention to suburban development and in a few more ambitious instances comprehensive plans are being prepared for the growth and development of the entire city.

The activity in the various societies and civic bodies continues, and lectures on city planning and meetings devoted to the subject are on the increase. The result of these activities has been to interest the city authorities themselves and it is encouraging to note that in numerous cases the local city governments have espoused the idea, and, recognizing the value of technical advice, have appointed expert advisors to guide them in the development of their cities.

It was the thought of your Committee that we could perform a service to the members of the American Institute of Architects by suggesting some general ideas that might serve as a guide for municipalities in the preparation of their plans and in the adoption of the necessary legislation. The authorities as a rule are somewhat at a loss to know how to proceed and the first steps are the most difficult.

Much interest has been shown in the Town Planning Act [1909] now in force in England and it seemed possible that this act or a modification of it might serve as a basis for a similar law that would be suitable to American cities. After consideration, however, this did not appear feasible. The English Town Planning Act provides for a central body possessing absolute power which can criticize and control the plans of all English cities which must be presented to it for its approval†. This does not appear to be possible in our country. The laws in each state are different and each town planning act would necessarily have to be drawn to conform to the state law. Lately a very strong movement in favor

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*Report of Committee on Town Planning, as read before the American Institute of Architects, Washington, D. C., December, 1912. The report will be published in full in the Journal of the Institute. The Committee was composed as follows: Messrs. Arnold W. Brunner, Chairman; W. R. B. Willcox, C. L. Borie, Jr., J. R. Coolidge, Jr. and Glenn Brown.

†This statement and the remainder of the paragraph seem likely to mislead those unfamiliar with the scope of the Town Planning Act and the way it is being administered by the Local Government Board. The act grants municipalities large new powers over the laying out of undeveloped areas, but instead of going into minute details, as is done in our own state legislation, it entrusts the formulation of details of procedure to the Local Government Board, whose approval must also be secured before any plan can be adopted. The act at least so far as yet applied, relates to the laying out of undeveloped areas. Of course central control over town planning would lie in the several states, under our plan of government. Such control would be no more a violation of municipal home rule than is the control now exercised by a number of our state boards of health, state water supply commissions, the Massachusetts Gas and Electric Commission and some of our public service commissions over public water-supplies, sewage disposal, and gas and electric light plants. Central administrative control subject to, shifting legislative control and interference, the jurisdiction of a relatively permanent body, provided with a staff of technically trained men. So far as city planning goes, most of our American cities, far from possessing home rule powers to deal with the subject, have no powers whatever; and when they want such power or any change in even minor details of it, they must run to the legislature.—Ed. Eng. News.

of what is called "home rule" for cities has manifested itself so that a general state law governing the powers of a city to make its plans would, we think, be very unpopular. The conditions, not only in different states, but in different cities, vary so greatly that we believe it would not be well to attempt to frame a general law.

The regulations that obtain in France and in Germany seem entirely inapplicable to our form of government and apparently it is advisable for our cities to make their own rules and regulations.

It has been found to be extremely difficult to obtain documents and pictures that relate to city planning and there is constant demand for such data. We suggest that the American Institute of Architects enlarge its present collection of lantern slides and procure views of the best examples in Europe and America. Many pictures can be obtained showing suburban development and garden cities, also views of civic centers, street intersections, settings for buildings, water fronts, railroad terminals and similar subjects illustrating problems connected with city planning. These might be loaned to the members of the Institute to assist them in their work, or copies might be made at a nominal cost and sold to those interested.

It is most desirable that some central library should collect plans of important cities, properly drawn to scale, and there is much detailed information that is constantly required. Undoubtedly the possession of this library would be of great value to our members and it seems to your committee that the American Institute of Architects should take immediate steps to collect maps and documents which would form the nucleus of such a library. We believe that the cost might be met by private subscription. The value of this can hardly be overestimated. The cost of additional lantern slides is easily within our means and would be a very great service to members who wish to deliver lectures on city planning, but we strongly urge the foundation of a real reference library on city planning.

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Classified Salary and Wage Budget Estimates of Chicago for 1913*

Appropriations made for salary and wages of employees in the service of the city of Chicago, exclusive of the employees in the park boards, the sanitary district and Cook County, amount to an aggregate of $28,782,699 for the year 1913. This appropriation will care for approximately 22,825 employees, of whom 14,935 are under the municipal city service.

The details of the 1913 City Budget have just been prepared by the Efficiency Division of the Civil Service Commission as the result of a comprehensive analysis of the employment conditions in the city of Chicago. This analysis shows that the compensation and distribution of positions in the city service are as follows:

Service	No. of Employees	Total salaries	Average salary	% of total
Medical	347	$ 347,925	$1003	1.2
Engineering	352	647,819	1843	2.3
Clerical	1,146	1,400,365	1222	4.9
Police	4,482	5,921,935	1323	20.5
Operating Engineering	576	1,283,284	1274	4.4
Fire	1,893	2,718,641	1436	9.4
Library	149	141,350	954	0.5
Inspection	728	945,705	1401	3.3
Supervising	320	398,558	1383	1.4
Skilled labor	2,267	2,594,960		9.0
Labor	2,676	1,920,881		6.7
Educational	7,229	8,360,685		29.0
Law and municipal courts	525	999,560		3.5
Administrative	137	456,371		1.6
Blanket appropriation—emergencies		662,660		2.3
	22,825	28,782,699	1261	100

Because of the stringency in funds, occasioned by the new interpretation of the Juul Law by the Supreme Court, only 80% of the above amounts are being paid to the employees. This will continue until such time as relief is obtained from the legislature.

According to the functions of different departments, the city is employing and expending for services the following:

	No. of employees	Total salary	Per cent
Safety of public and property	7,771	$10,298,131	35.8
Service, public works and improvements	5,103	5,668,246	19.6
Public betterments	8,750	10,749,980	37.4
Financial purposes	305	577,169	2.0
For legal service and administration of justice	525	1,008,091	3.5
For administration and legislation	281	480,785	1.7
	22,825	28,782,699	100

The total appropriations for 1913 for all purposes and services by departments are given in the following:

Board of Education	$8,041,250	28.6%
Department of Public Works	17,062,840	25.8%
Department of Police	8,968,944	13.5%
Department of Finance, Comptroller's Office	5,534,509	8.1%
Fire Department	5,093,313	7.7%
Department of Electricity	1,730,254	2.6%
Chicago Public Library	1,351,610	2.0%
Harbor and Subway Commission	1,198,470	1.8%
Department of Health	1,120,851	1.7%
Miscellaneous	5,196,477	7.9%

Distributions of total appropriations for all needs and services according to functions of the city government are as follows:

Public betterments	$21,476,487	32.4%
Service public works and improvements	20,086,954	30.4%
Safety of public and property	16,437,916	24.9%
Finance	6,059,074	9.1%
Legal	1,287,601	1.9%
Administration and properties	850,479	1.3%

The above amounts include the moneys appropriated from the corporate-purposes fund, the water fund, the bridge-bond fund, traction deposits, the sinking fund, public-library fund, Municipal Tuberculosis Sanitarium fund, school fund and funds contingent upon sale of bonds during 1913.

Diagrammatic charts have been drawn which give a pictorial and vivid display of the physical conditions of organization, compensation, class of work, and responsibilities of all positions in the city service. In addition to these, the physical detail is accompanied with all the civil-service data necessary to make the chart a complete analysis of the annual budget, both as to number of employees and the salary items in each department of the city service. The entire plan is one of scientific analysis of the public service. [See ENG. NEWS, May 2, 1912, pp. 834-5, for similar charts for 1912 and for a more detailed statement of classified positions and average salaries than are here given.—ED.]

These distribution and compensation charts serve two great functions; the first, for administrative purposes, and the second, for educational purposes.

This is the third analysis of the employment conditions of the city government and the charts show continued improvement in the classification, standardization and equalization of compensation of all positions in the city service. By this analysis it has been possible to compare the compensation of positions of similar duties.

The citizen who studies the entries on the charts and who notes the way in which each position is classified and labeled according to its general duties, and how it is measured and graded according to its importance, responsibility and authority, will see the close relationship existing between the organization of departments and the functions performed by the Civil Service Commission.

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*Condensed from a press statement sent to this journal by J. L. Jacobs, Efficiency Engineer, Chicago Civil Service Commission.

U. S. Army Aviators are to receive 20% increase in pay while engaged in this work as compensation for the added hazard of the occupation. As introduced in the House, the bill for this gave an increased compensation of 100%, but the Senate held that it was unnecessary to pay so much as there were plenty of volunteers.

Street Cleaning Efficiency Standards for Chicago

By F. H. Cenfield and A. B. Segur*

SYNOPSIS—A detailed analytical study of street-cleaning conditions and methods in Chicago was made in 1912 by the Efficiency Division of the local Civil Service Commission. Standards based on these studies have been formulated to govern frequencies of cleaning on different classes of streets and also the standard unit amount of cleaning to be expected from each cleaner for different paved surfaces.

The Civil Service Commission of Chicago, acting under instruction from the City Council, made an investigation of street and alley cleaning and of refuse collection and removal in Chicago (see this journal for Jan. 16, 1913, for an account of the latter). These activities are performed under the direction and supervision of the Bureau of Streets, Department of Public Works, and are carried on separately for each of the 35 wards of the city.

All available records concerning the kind, age and physical condition of pavements in Chicago were examined by the Commission. Records of costs of street cleaning as recorded for the city were of little value, due to recent changes in ward boundaries. This necessitated a complete study of all conditions affecting street cleaning.

The lack of a uniform system of records and cost figuring for the various cities of this country and of Europe made it impossible to use the costs of other cities as a basis of comparison. Investigation conducted by the United States Bureau of the Census indicates that the unit cost of street cleaning in cities under 300,000 population was considerably less than in cities of over 300,000. A study of methods used and efficiency of labor would lead to the opposite conclusion.

Street-cleaning work, as performed in the various sections in the City of Chicago, is intended to cover all paved streets and alleys and consists of (1) cleaning streets by hand with brooms, (2) patrolling streets with boulevard scrapers, (3) cleaning streets and alleys by gangs of men equipped with necessary tools, (4) flushing streets with machine flushers, (5) cleaning streets with machine sweepers.

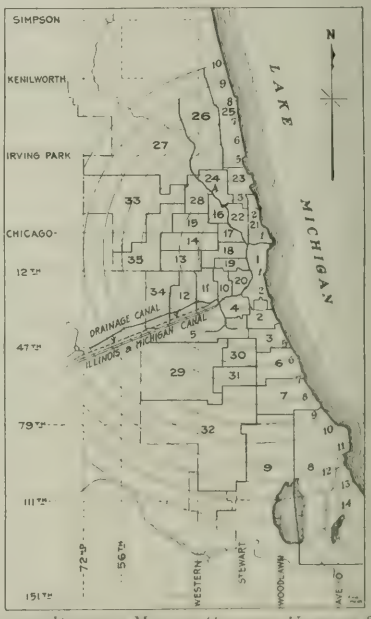
The methods employed by the various wards are generally the same, varying somewhat with the character of pavement. In most cases the streets are cleaned by hand under the block or patrol system. The street dirt is collected by the sweeper in push-carts of 12 cu.ft. capacity and dumped onto vacant lots or in unused alleys, where it is picked up by dirt wagons and carted to the dumps. All work within a ward is under the direct supervision of a ward superintendent who reports to the second assistant superintendent of streets.

The organization maintained by each ward superintendent is as follows: street sweepers are assigned to particular blocks or sections of streets and work under the direct supervision of a sub-foreman, who in turn reports daily the time of sweepers and general condition of his district to the ward superintendent.

The dirt which collects upon the streets of a city is derived from a number of different sources, the principal ones of which are as follows:

(1) Excrement of animals.
(2) Material lost by passing vehicles.
(3) Dirt swept from sidewalks and thrown from buildings onto the street.
(4) Dirt from unpaved streets and alleys.
(5) Falling leaves.
(6) Building construction.
(7) Soot and dust from the air.
(8) Material originating from the wear of pavements.

The amount of street dirt which is directly attributed to horse-drawn vehicle traffic is apparent from George A. Soper's statement "that on an average 1000 horses will excrete 500 gal. of urine and ten tons of dung during a working day of eight hours." This is by far the most important source of street dirt and has been given the greatest weight in the preparation of the schedules and standards used as a basis for the estimates of future expenditures.



Population Density Map of Chicago Used in Studies to Establish Street-Cleaning Efficiency Standards

It has been found that, except in very rare instances, the amount of cleaning which any street requires, other things being equal, is directly proportional to the density of horse-drawn vehicles upon the street.

The difficulties which lay in the way of this conclusion arose from various sources, as follows:

First: It was found that there was no standard in the city for street cleaning; that the appropriations marked the limit of expenditures; that in arranging street-cleaning schedules, various residence streets which had a very light traffic were given cleaning daily chiefly because they chanced to lie close to some other street which called for

*Engineers, Efficiency Division, Chicago Civil Service Commission, Chicago, Ill.

daily cleaning. Many people in the outlying wards desired the same service that was given within the shopping district, and in making statements to the Commission, gave their opinions upon that basis.

Second: The importance of the character of traffic, whether the wagons were heavily or lightly loaded, was greatly overestimated and details which have been proven by this investigation to be of comparatively small value were greatly magnified; that is, upon a careful tabulation to determine the importance of these factors, it was learned that some of them gave negative results.

A traffic census conducted on 500 different sections of streets in the city revealed the following:

That the number of three-horse and four-horse vehicles within any ward was almost negligible in comparison with the number of one-horse and two-horse vehicles.

That the variation in the ratio of one-horse vehicles to two-horse vehicles in various wards of the city was very small and that for all practical purposes all horse-drawn vehicles could be grouped together to form one arbitrary unit. This immediately simplified the matter of a standard.

Third: The absurd view that many held of the importance of the width of street upon the cleaning which the street should receive. It was learned, however, that the main importance of the width of the street lay in determining the density of traffic upon the street, and if the number of horse-drawn vehicles were divided by the product of the width of street and the times cleaned per week, a constant was obtained which was a standard of the cleanliness of the ward. While these cleanliness ratios were not always constant throughout a ward, still it was noted that over all main thoroughfares in any ward these ratios were practically a constant and that in wards having substantially the same street conditions, the average ward ratios were the same. In other words

$$C = \frac{E}{NW}$$

N = number of times a street is cleaned per week
E = total number of horse drawn vehicles in 8-hour day
W = width of street in feet
C = constant of cleaning

It has also been noted that as conditions exist in Chicago, it is important that the streets in the heart of the city be kept cleaner than the streets in the outlying districts, as it is the cleanliness within the heart of the city that fixes the reputation of the community. For this reason all of the wards (see accompanying map) have been divided into two classes, as follows:

Inlying wards, 1, 2, 3, 4, 5, 10, 16, 17, 18, 19, 20, 21, 22.

Outlying wards, 6, 7, 11, 12, 13, 14, 15, 23, 24, 25, 28, 30, 31, 8, 9, 26, 27, 29, 32, 33, 34, 35.

Tabulation of traffic density, street-cleaning schedules and conditions gave the following average constants:

Character of street	Inlying wards	Outlying wards
Business streets (or manufacturing)	2.6	2.8
Residence streets	2.1	2.5

It is apparent that there are limits to the application of the above constants. On many residence streets the traffic is so light that a strict application of the constant would give absurd results. Car-track streets require a definite amount of cleaning regardless of other traffic. The streets around churches, schools, hospitals, playgrounds and other general public institutions require a certain amount of attention irrespective of ordinary team traffic. The following standards have therefore been made for a minimum cleaning of streets, regardless of traffic:

MINIMUM CLEANINGS PER WEEK ON HARD PAVEMENTS, STREETS WITH LIGHT TRAFFIC

Position of ward	Cleanings per week
Inlying	3
Outlying	6

MINIMUM CLEANINGS PER WEEK ON CAR TRACK STREETS WITH LIGHT TEAM TRAFFIC

Position of wards	Cleanings per week		
	X head room	Y head room	Z head room
Inlying	5	4	3
Outlying	4	3	2

X head room—0 to 3 min.
Y head room—3 to 10 min.
Z head room—10 min. or above.

Head room as used is the average time between cars during the rush hour of the day.

MINIMUM CLEANINGS PER WEEK WHERE THERE ARE PUBLIC BUILDINGS

Churches	Schools	Hospitals and general public institutions
Large 3	Large 6	Large 6
Medium 2	Medium 5	Medium 4
Small 1	Small 4	Small 2

In cases where the pavement of streets surrounding the foregoing is macadam, the minimum number of cleanings shall be at least one-twelfth of that for hard pavements.

In studying macadam and cedar block pavements, it has been noted that there were various standards in different parts of the city for cleaning macadam pavements and that the number of times macadam is cleaned varies from twice per year in the outlying wards to four times per year in the inlying wards. Several of the wards which had more than ample appropriations gave much better service on macadam, but as an average the following results were obtained:

CLEANING OF MACADAM AND CEDAR BLOCK PAVEMENTS

Position of ward	Cleanings per year
Inlying	4
Intermediate	3
Outlying	2
Inlying	(same as above)
Intermediate	6, 7, 11, 12, 13, 14, 15, 23, 24, 25, 28, 30, 31.
Outlying	26, 27, 29, 32, 33, 34, 35

It is not believed that this standard of cleaning will give perfect results, but this standard will give uniform results throughout the city and will give the best results the finances of the city will allow at the present time. In order to obtain street-cleaning appropriations according to these standards, every street in Chicago has been classified according to kind of pavement, condition of pavement, car track, street-car head room, percentage of business and residence, length, width and traffic, and from these tabulations appropriation estimates have been determined.

One difficulty which arose in obtaining standard areas of pavement a man should clean in one day was the faulty opinion that many held as to the amount of time lost in dodging traffic on heavy traffic streets. To determine what this time loss was and to obtain a standard for street cleaning, careful stop-watch observations were made upon various streets of the city, both upon first-class men and upon average men. The results of these stop-watch observations showed that the time lost in necessarily dodging traffic seldom exceeds 3% of the total time. This result is a great deal more reasonable than would appear at first sight. A good street sweeper always watches the traffic and governs himself accordingly and when an automobile, a street car or a wagon approaches, he simply steps to one side and continues sweeping. Not all sweepers do this, and many in the city's employ lose as much as

20% to 30% of their time avoiding traffic, but in practically every case where this was found, it could be directly attributed to loafing and men who lost an excessive amount of time dodging traffic, also lost an excessive amount of time in unnecessary operations.

Stop-watch observations showed that it was possible for a man to cover 34,000 sq.yd. of asphalt pavement in good condition in one working day of eight hours. One sweeper, during a stop-watch observation extending over three hours, was observed to clean an average of 78 sq.yd. of asphalt pavement per minute on a heavy traffic street under an elevated railway, or an equivalent of 37,440 sq.yd. of pavement per day. The pavement, in order to receive perfect cleaning, should have received 10% more attention than was given it, and the number of square yards was, therefore, reduced 10%.

A man to work to 100% efficiency under present conditions should therefore cover 34,000 sq.yd. of asphalt pavement in a working day of eight hours. An average of the schedules of various ward superintendents shows that at the present time the street cleaners are cleaning about 21,100 sq.yd. of pavement per eight-hour day. It was assumed, however, that if sweepers were given a standard amount of pavement to keep clean and given a standard number of times to cover the pavement each day that the city should expect at least 63% efficiency from their street sweepers, and an assumed standard was adopted for this appropriation of 21,500 sq.yd. of asphalt per day. It is not believed that this standard is excessive, as it is being exceeded in a great many instances in different sections of the city by very ordinary sweepers, while there are a few instances where sweepers are performing 50% more work.

After making a careful study of the cleaning schedules in the city of Chicago, and after investigating the results obtained in other cities, it was determined that brick was 35% harder to clean than asphalt, or in other words, to obtain the amount of brick pavement which a man should be expected to clean in an eight-hour day, it is necessary to divide the amount of asphalt that a man can clean in a day by 1.35. Using a standard of 63% efficiency, this gives 16,000 sq.yd. per day as a standard for brick in first-class condition.

A like study showed that granite was 60% harder to clean than asphalt, or in other words, a man should be expected to clean 13,400 sq.yd. per working day of eight hours.

A careful study of various wards of the city showed that pavement in fair condition was 10% and pavement in bad condition was 20% harder to clean than pavement in good condition. The following table has, therefore, been deduced:

Material	Condition	Standard	Equivalent Standard
Asphalt		100% efficiency	34,000
Asphalt		63% standard	21,500
Asphalt	Fair	90% of good asphalt	19,300
Asphalt	Bad	80% of good asphalt	17,200
Creosote	Good	Good asphalt	21,500
Brick	Good	Asphalt ÷ 1.35	16,000
Brick	Fair	90% of good brick	14,400
Brick	Poor	80% of good brick	12,800
Granite	Good	Asphalt ÷ 1.6	13,400
Granite	Fair	90% of good granite	12,100
Granite	Poor	80% of good granite	10,700

Investigations of conditions on various street car streets and careful time studies indicated that the pavement between car tracks, all other conditions being equal, was 30% harder to clean than pavement outside of car tracks of the same material. It, therefore, became a very simple matter to determine the cost of cleaning car tracks, as 30% was added to the area between the tracks and the cost of cleaning computed according to the standards given above.

In arriving at a standard for the cleaning of macadam pavements for the first cleaning in the spring of the year, the daily reports of the gang cleaners were studied over the months of March, April and May for the following wards: the 6th, 7th, 26th, 27th and 9th. These wards have perhaps the largest percentage of macadam pavement in the city and have the most varied conditions. Constants obtained by the use of these wards are applicable to all the wards in the city. A careful study of the daily reports leads to the conclusions stated below.

In estimating the amount of money required for the cleaning of macadam pavements, the following divisions have been made and the following standards used:

COST OF LABOR REQUIRED FOR CLEANING MACADAM IN SPRING

Macadam good		Macadam fair		Macadam poor	
Heavy traffic	Light traffic	Heavy traffic	Light traffic	Heavy traffic	Light traffic
$1 05	$0 80	$1 75	$1 30	$2 00	$1 50

A sum equal to 400 teams and autos has been taken as the division between heavy and light traffic for macadam pavement—that is to say, wherever the total number of teams and autos passing in an eight-hour day is less than 400 vehicles, the street will be termed as light traffic; wherever the number of teams and autos exceeds 400, the traffic will be termed as heavy.

The investigation described above was made by the Chicago Civil Service Commission, under the direction of Major James Miles, examiner in charge of the Efficiency Division, and J. L. Jacobs, engineer in charge, and F. H. Cenfield and A. B. Segur, engineers of the Efficiency Division.

Street Cleaning Costs at Spokane, Wash., in 1912

By S. A. Levington*

As the result of a unit-cost system installed in the Department of Public Works of Spokane, Wash., by D. C. Coates, commissioner, and A. W. Swenson, superintendent of public works, the accompanying actual costs of street cleaning for the calendar year 1912 are available.

The figures given show the actual cost of cleaning, including all incidental items. We have endeavored to keep these data in such shape that the actual cost of each operation can be arrived at and so that such items of expense as are provided for under separate appropriations can be noted.

The use of flushers for only 5½ months was due to the fact that in this climate the weather is not favorable for this method of cleaning for any greater length of time. Our data show that we operated flushers cheaper than the other methods of cleaning and we are very much in favor of this method, as it is undoubtedly the ideal method of cleaning streets.

A gasoline-power sweeper was tried as an experiment and the cost of actual cleaning was found to be far below the cost of other methods of cleaning, but as this machine had not been brought to perfection, the cost of repairs amounted to more than the actual cleaning.

*Cost Accountant, Department of Public Works, Spokane, Wash.

Our system of arriving at cost and number of yards cleaned is as follows: Each street-cleaning sub-foreman is provided with a printed daily-report form and is obliged to turn in at the end of each day this report properly filled out. The report shows the hours worked, names of laborers, hired teams and the number of streets cleaned; it also gives the names of streets cleaned, together with the intersecting streets at which the cleaner started and finished. From this report the cost is figured and the yardage computed from a book, compiled by the engineer's office, showing the number of yards on every paved street in the city, from intersecting street to intersecting street.*

All tools and equipment are taken care of at the city yards and the cost of repairs, labor and material, is reported by the yard foreman in charge of this work.

The charge of $1.50 per day for use of city teams is the actual cost per day for feed, stable care and blacksmith work on two horses.

The charge of $7 per day for use of auto-truck includes gasoline, repairs and depreciation. This truck is owned by the Department of Public Works, but when not in use for street-cleaning purposes it is rented to other divisions at the above rate, plus the wages of driver and helpers.

COST OF STREET CLEANING, SPOKANE, WASH., FOR THE YEAR 1912

TOTAL AREAS CLEANED AND DIRT REMOVED:

Cleaned by sweepers and flushers	1,283,713 sq.yd
Cleaned by white wings (hand cleaning)	206,008 sq.yd.
Grand total	1,489,721 sq.yd
Cleaned by sweepers 6¼ months	1,283,713 sq.yd.
Cleaned by sweepers 5¼ months	477,584 sq.yd
Cleaned by flushers 5¼ months	806,129 sq.yd
Dirt removed	10,445 cu.yd

HORSEPOWER SWEEPER:

Area swept to keep this district clean ..... 100,785,638 sq.yd

Cost of horsepower sweeping				
Sweeping			Cost to clean once	
Hired teams and teamsters	$9226 90			
Use city teams	806.80	$10,033.70	$0.09955	per 1000 sq.yd.
Pilers	$9954 60	9,954.60	$0.09885	per 1000 sq.yd
Pick up				
Hired teams and teamsters	$5418.75			
Use city teams	628.80			
Auto truck-drivers and helpers	2276.03			
Auto truck rental (city)	2231.70	$10,555.38	$0.1047	per 1000 sq.yd
Sprinklers				
Hired teams and teamsters	$2090.00			
City teams	3.75	$2,093.75	$0.020776	per 1000 sq.yd
Maintenance sweepers				
Labor	$304.85			
Material	825.42	$1,130.27	$0.011215	per 1000 sq.yd.
Totals horse sweeping		$33,767.70	$0.335091	per 1000 sq.yd.
Cost to clean 1000 sq.yd. once				33½c.

GASOLINE POWER SWEEPER (one used as experiment):

Area swept to keep this district clean ..... 6,090,518 sq.yd.

Cost of auto-power sweeping				
Sweeping			Cost to clean once	
Operator and helper	$420.00	$420.00	$0.06896	per 1000 sq.yd.
Pilers	$485.25	$485.25	$0.079672	per 1000 sq.yd.
Pick up				
Hired teams and teamsters	$18.00			
Use city teams	10.50			
Auto truck-driver and helper	195.07			
Auto truck rental (city)	164.75	$388.32	$0.06375	per 1000 sq.yd.
Maintenance sweeper				
Labor	$311.83			
Gasoline	117.00			
Oil	19.30			
Repairs	247.85	$724.04	$0.10250	per 1000 sq.yd
Totals auto sweeping		$2,017.61	$0.314882	per 1000 sq.yd
Cost to clean 1000 sq.yd. once				31.4c

HORSE AND AUTO-POWER SWEEPERS:

Since keeping 1,283,713 sq.yd. clean for 6¼ month, and 477,584 sq.yd. clean for 5¼ months involved sweeping a total area of 106,876,150 sq.yd. this district must have been covered 110 times during the year at a cost of $36.89 per 1000 sq.yd. or $65,765.31

CLEANING BY FLUSHERS:

Total area of district kept clean ..... 806,129 sq.yd
Total area flushed to keep this district clean ..... 70,381,682 sq.yd.
Cost of cleaning by flushing:

Flushing			Cost to clean once	
Hired teams and teamsters	$8459.51			
Use city teams	950.50	$9,410.01	$0.1336	per 1000 sq.yd
Pilers	$9052.23	$9,052.23	$0.1286	per 1000 sq.yd.
Pick up				
Hired teams and teamsters	$1415.50			
Use city teams	840.75	$2,256.25	$0.03206	per 1000 sq.yd.
Maintenance flushers				
Labor	$111.67			
Material	127.34	$242.01	$0.003438	per 1000 sq.yd.
Totals flushing		$20,960.50	$0.297698	per 1000 sq.yd
Cost to clean 1000 sq.yd. once				29.7c

Cost to keep clean:

Flushing	$9,410.01	$0.01167 per sq.yd.
Pilers	9,052.23	0.01123 per sq.yd.
Pick up	2,256.25	0.002799 per sq.yd.
Maintenance	242.01	0.0003002 per sq.yd.
Totals	$20,960.50	$0.0259992 per sq.yd.

Cost to keep 1000 sq.yd. clean $26.00
Since keeping 806,129 sq.yd. clean involved flushing an area of 70,381,682 sq.yd. this district must have been covered 87.31 times during 5¼ months at a cost of $26.00 per 1000 sq.yd. or $20,960.50

WHITE WINGS OR HAND CLEANING:

Total area of district kept clean ..... 206,008 sq.yd.
Total area cleaned to keep this district clean ..... 63,886,054 sq.yd.

Cost of cleaning by hand			Cost to clean once	
Patrol	$17,528.49	$17,528.49	$0.2744	per 1000 sq.yd
Pick up				
Hired teams and teamsters	$1,486.50			
Use city teams	596.50			
Auto truck-driver and helpers	10.50			
Auto truck rental (city)	24.50	$2,118.00	$0.03316	per 1000 sq.yd
Maintenance tools				
Labor	$200.33			
Material	178.85	$379.18	$0.005936	per 1000 sq.yd
Totals hand cleaning		$20,025.67	$0.313496	per 1000 sq.yd
Cost to clean 1000 sq.yd. once				31.4c

Cost to keep this district clean:

Patrol	$17,528.49	$0.08509 per sq.yd
Pick up	2,118.00	0.01028 per sq.yd.
Maintenance	379.18	0.0018 per sq.yd
Totals	$20,025.67	$0.09721 per sq.yd.

Since keeping 206,008 sq.yd. clean involved cleaning an area of 63,886,054 sq.yd. this district must have been covered 310 times during the year at a cost of $97.21 per 1000 sq.yd. or $20,025.67

TOTAL STREET CLEANING AND AVERAGE UNIT COSTS FOR 1912:

Total area of paved streets cleaned	1,489,721 sq.yd.
Total area covered to keep clean	241,143,892 sq.yd

Cost to keep clean for one year

Cleaning	$68,037.33	$0.04567 per sq.yd.
Auto rental	2,420.95	0.001625 per sq.yd
Use city teams	3,837.70	0.002577 per sq.yd.
Maintenance	2,475.50	0.001662 per sq.yd
Totals	$76,771.48	$0.051534 per sq.yd.
Total average cost to keep clean		$51.53 per 1000 sq.yd
Total average cost to clean once		0.31 per 1000 sq.yd.

Rate of wages paid:

General foreman	$150.00 per month
Sub foreman	95.00 per month
Hired teams with teamster	6.00 per day
Teamsters	3.00 per day
Use city teams	1.50 per day
Laborers	3.00 per day
Rental city auto truck	7.00 per day
Truck driver and helpers	3.00 per day

*The record blank used is about 11 in. wide and 8 in. high. Space is provided for recording the yardage covered and the number of hours spent on each street by the subforeman, and by horse sweepers, power sweepers, flushers, pilers, pickup teams, sprinklers, auto-truck and laborers, followed by the per diem charge for each. In the upper left-hand corner there is a small tabular form with stubs for power, horse, flush and hand cleaning and column heads for dirt removed, (cu.yd.), water used (tanks of), and condition of weather. In the corresponding upper right-hand corner there is a space for date and remarks.

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The Right to Engage in Industrial Pursuits has been granted to the State of Arizona and to municipalities in that state by a constitutional amendment recently adopted by a popular vote of 14,928 to 3602. At the same election an amendment was adopted extending the recall to all public officers, whether elected or appointed, and another one to the effect that taxes may be assessed as may be prescribed by law—evidently opening the way, constitutionally, for the single tax or any other method of taxation which the legislature may see fit to adopt.

A New Entropy Analog*

By V. Karapetoff†

Thermodynamics is not the specialty of the writer of this article, but a few years ago he became incidentally interested in a certain phase of it, and made an effort to make clear to himself the physical concept of entropy. He finally worked out a mechanical analog, which may be of some interest to those who, like himself, are not satisfied with mathmetical definitions, but wish to have a physical picture, however imperfect.[1] The analog is based upon the old idea of heat-fluid or caloric.[1]

In the two well known forms of energy, namely, mechanical energy and electrical energy, we usually distinguish the quantity factor and the intensity factor. Thus, the energy of the water in a storage reservoir is a product of the weight of the water, which is the quantity factor, by the hydraulic head, which is the intensity factor. The energy of a gas compressed in a tank is proportional to the quantity of gas, which is the quantity factor, and depends upon the pressure, which is the intensity factor. Again, in the case of electrical energy, the quantity of electricity, say in ampere-hours (or coulombs), is the quantity factor, and the voltage is the intensity factor.

Similarly, heat energy is characterized by an intensity factor, temperature, and a quantity factor called entropy. The concept of temperature is familiar to us all from our every-day experience, while that of entropy is entirely outside this experience and, therefore, presents considerable difficulty to a beginner. It is, therefore, desirable to explain entropy by means of analogs before taking up the study of mathematical thermodynamics.

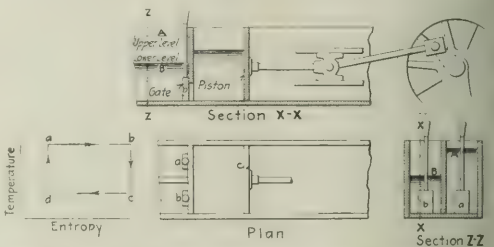
ZEUNER'S ANALOG.—In a simple analog proposed by Zeuner,[2] temperature is compared to a difference of levels, and entropy to the weight of a body to be raised or lowered. The quantity of heat, being the product of the two, represents the amount of work necessary to raise the body by a certain height. For this reason entropy is sometimes called the "heat-weight." The familiar Carnot cycle, Fig. 1, is easily illustrated by this analogy. Think of a freight elevator which transfers, say barrels of flour from the upper to the lower floor of a warehouse. While barrels are being loaded on the elevator, its level, or temperature, remains constant, while the quantity of flour upon it, or its entropy, increases. This corresponds to the isothermal expansion along the part "a b" of the cycle. The energy of the elevator for positions above the lower floor of the warehouse increases with the distance, since the barrels represent a certain amount of stored energy.

Now, let the elevator be descending; its entropy, or the quantity of flour on it, remains constant, while the height above the lower floor (or what is called in thermodynamics, the "refrigerator") decreases. This corresponds to the adiabatic (or isoentropic) expansion "b c." Unloading the barrels on the lower floor corresponds to the isothermal rejection of heat during the part "c d" of the Carnot cycle. The flour may still possess a considerable amount of energy of position, say above the sea level, but this energy cannot be utilized, and must be considered as waste. Finally, the elevator returns into its original upper position, rising at a constant entropy, which in this case is the weight of the elevator proper; this corresponds to the adiabatic compression "d a." After this, the process is repeated in the same order.

This analog, in spite of its usefulness for the beginner, has a limited application only, and moreover, some of its inconsistences are apparent at once. For instance, no external work is performed during the period of loading the barrels, while a considerable amount of work is done by the gas during the isothermal expansion.

MACH'S ANALOGIES.—A better analog has been developed by Mach.[3] He describes it in Fig. 2 in application to a hydraulic motor, in which the head of the working fluid is analogous to temperature, and the quantity of the fluid behind the piston corresponds to entropy. A cycle analogous to that of Carnot can be realized on this model as follows: Let the piston "P" be originally in its extreme left position, the gate "a" being open. The pressure on the piston corresponds then to the level of the water in the reservoir "A," which for our purpose must be assumed to be infinitely large, so that its level remains constant. The piston starts to the right, performing mechanical work, the gate "a" being open, and the water filling the space behind the piston. This corresponds to the isothermal expansion, during which the temperature is being kept constant, while the entropy increases. At a certain point of the travel, the gate "a" is closed, and the piston "C" allowed to move under the pressure of the water in the engine itself. As the volume of the space behind the piston increases, the level of the liquid becomes lower. This corresponds to the adiabatic expansion. The quantity of entropy (or water) remains constant, its temperature (water head) drops and the work is performed at the expense of the potential energy of the water.

The piston is allowed to move until the level of the water sinks to that in the reservoir "B," which corresponds to the



FIGS. 1 AND 2. TEMPERATURE-ENTROPY DIAGRAM AND HYDRAULIC ANALOG OF CARNOT CYCLE FOR PERFECT GAS

refrigerator in thermodynamics. The gate "b" is now opened and the piston begins its return stroke, forcing the water into the reservoir "B." At a certain point of the stroke, the gate "b" is closed and for the rest of the movement the level of the water behind the piston rises to its original level, just as in the reservoir "A." The two last parts of the cycle are analogous, respectively, to the isothermal and adiabatic compressions in the Carnot cycle.

The result of the process is that a certain quantity of water has been transferred to a lower level, and the energy thus lost has been converted into mechanical work. Not all of the energy of the water taken from the higher reservoir can be converted into work, since the "exhaust" water in the motor must be at least at the level of the water in the reservoir "B." The efficiency of the arrangement depends upon the ratio of the heads in the two reservoirs above the sea level. Similarly, the efficiency of a Carnot cycle depends upon the ratio of the absolute temperatures of the source of heat and the refrigerator.

THE PROPOSED ANALOG

STATEMENT.—In the proposed analog, we endow matter with a certain structure, which permits us to form a clear picture of the phenomena in which temperature and entropy enter. No claim whatever is made that the suggested picture is more than an analog. It cannot be called an hypothesis of the structure of matter.

Consider gases and vapors to consist of very small particles (Fig. 3) separated by comparatively large spaces. The particles are assumed to be absolutely rigid and not in any motion, vibratory or translational, as is presupposed by modern theories of matter. To account for heat phenomena, we introduce again the old discarded caloric, or a hypothetical heat fluid. An atmosphere of this caloric is supposed to surround each particle of gas, as shown in Fig. 3, the particle itself being conceived as some sort of nucleus for the caloric. This conception of a gas is similar to that of Rankine's except that he assumes the atmospheres to be elastic, and revolving or oscillating about their central points;[4] while for our purpose it is sufficient to suppose the substance of these atmospheres to be stationary.

Particles of caloric are supposed to repel each other, like the elements of an electric charge, and this repulsion is taken to be the cause of the elasticity of gases and vapors. The quantity of caloric in a given weight of gas represents its entropy, while the pressure in the caloric, due to the mutual repulsions of its particles is a measure of the temperature of the gas. In this wise, the quantity and the intensity factors of heat energy are represented by simple mechanical concepts.

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*From the "General Electric Review," January, 1913.

†Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

[1]After this article had been written, the author was gratified to read Prof. H. L. Callendar's address on "The Nature of Heat," in which this distinguished authority shows that "we might with advantage import into our modern theory some of the ideas of the old caloric or material theory which has for so long a time been forgotten and discredited." Science," Vol. XXXVI, Sept. 13, 1912, page 321.

[2]Zeuner, "Technical Thermodynamics," Vol. I, Art. II.

[3]E. Mach, "Principien der Warmelehre," p. 329.

[4]W. J. M. Rankine, "Miscellaneous Scientific Papers," p. 17.

The particles of gas, or the nuclei, attract each other according to the ordinary law of gravitation, but the intermolecular distances being large, these attractions are supposed to be negligably small as compared to the repulsions caused by the caloric. Incidentally, these small attractions may be said to account for the deviation of gases from Boyle's law, and may be made to explain the behavior of saturated vapors, and the phenomena of liquefaction and solidification as will be shown below.

The process of communicating heat to a gas can be pictured by saying that the gas is connected to another body in which caloric is at a higher pressure than is the caloric in the gas. The caloric is thus forced to flow from the heat source into the gas and becomes associated with the atmospheres of its particles, increasing its entropy, which, according to the definition, is the quantity of caloric. Similarly, withdrawal of heat consists in connecting the gas to another body in which caloric is at a lower pressure, so that part of the heat matter or caloric constituting the atmosphere is dissociated and transferred to the colder body, where it becomes part of the atmospheres of its particles.

The intrinsic energy of a gas is the sum of the energies necessary to build up the atmospheres of its particles, bringing these particles together against their mutual repulsion. It will thus be seen that the heat energy, according to this picture, depends upon the temperature and entropy of the gas, in other words, upon the intensity and the quantity factors of thermal energy. This is similar to charging an insulated conductor with electricity; when bringing new infinitesimal charges to the conductor, it is necessary to overcome the repulsion of the charges already communicated to it, and the work done is stored as the potential energy of the charged conductor.

The above picture is not complete in one respect; namely, it does not account for irreversible thermodynamic processes, such as sudden expansion, friction, etc. Assuming that the whole universe were constituted as is described above, the entropy of the universe or the amount of caloric in it, would be constant, since caloric is considered as a sort of fluid, which is exchanged between bodies. But it is known that in reality the entropy of a system increases during an irreversible process, without any heat or entropy being communicated from outside. We shall assume, therefore, that in addition to the free caloric which constitutes the atmospheres of particles, the nuclei themselves contain vast stores of caloric in a bound state.

As long as heat exchange takes place infinitely slowly, all the particles of the gas participate in it equally, and the process is reversible, that is to say, may go either way. If, however, heat is communicated to only one part of the gas, or at a high rate disturbing the temperature balance, or if the equilibrium of some particles is disturbed mechanically, as during the process of friction, then some of the bound caloric is liberated out of the crevices of the nuclei. This assumption is made to account for the fact that entropy increases during an irreversible process. Entropy or caloric once liberated cannot be reduced back to the bound state, hence the total amount of entropy in the universe increases, this being a well known statement of thermodynamics.

It may be objected to the foregoing view that if a certain amount of gas be subjected to a great number of irreversible processes, it might finally lose all its bound caloric and thus change its physical or chemical properties. But, in the first place, the proposed structure of matter is intended merely to give a tangible picture of the actual phenomena—an analog which may go so far and no further In the second place, it is possible to assume that a molecule of gas contains an enormous quantity of bound caloric, so that it is impossible to say how many millions of changes it has to undergo before the change would become noticeable. A minute piece of radium emits its powerful radiation for years without changing in weight or in other properties to any measurable extent.

The principal difficulties in the way of a clear understanding of thermodynamic phenomena, from a physical point of view, are:

(1) The mysterious mechanism of conversion of heat into mechanical work, and vice versa;

(2) The temperature and the pressure of a gas are closely interdependent; but while one is a thermal property, the other is a mechanical property;

(3) Entropy, in spite of its great practical importance, remains but an abstract mathematical expression;

(4) The changes from a liquid or a solid state into a gaseous state, with the latent heats, critical point, change in volume, etc., are to be accepted as separate facts, without seeing the internal mechanism of these changes;

(5) It is not clear why the state of a substance may be defined by its thermal characteristics, entropy and temperature, as well as by its mechanical features, volume and pressure.

(6) In the study of irreversible phenomena, the fact of an increase in entropy without communication of heat from outside is obscure and seems contradictory in view of the original definition of entropy as $d\phi = dq/T$.

The analogy described above makes an understanding of these points much easier because one of the forms of energy, namely, heat, is eliminated from the beginning, and its factors, temperature and entropy, are replaced by simple mechanical properties of a hypothetical fluid. Therefore, an understanding of the six points enumerated above is facilitated in the following manner.

(1) The conversion of heat into work is replaced by a conversion of the potential energy of mechanical repulsions between particles into external work.

(2) Temperature, being compared to the pressure or potential of the caloric, naturally determines the forces of repulsion between particles, hence enters as a factor which determines the pressure of the gas.

(3) Entropy becomes simply the quantity of hypothetical caloric or heat-matter, a concept easy to understand. Communication of heat is pictured as adding a certain quantity of this matter at a certain pressure; that is, against definite repulsive forces.

(4) Changes of state are easily explained by considering the repulsive forces of the caloric and the forces of attraction between the nuclei.

(5) The physical state of a body is completely defined by its entropy and temperature (provided that a zero point of entropy is given), because these two determine the size of molecular atmospheres, and the distances at which these atmospheres must be placed in order that the caloric may have the required pressure. Hence, the volume of the gas and the forces of repulsion which determine its pressure become known.

(6) The study of irreversible phenomena is simplified by the assumption of liberation of bound caloric whenever unbalancing or mechanical shocks take place within the mass of the substance.

Some fundamental thermodynamic phenomena will now be described, using the language of the caloric theory, the structure of matter being assumed to be that shown in Fig. 3.

APPLICATION TO PERFECT GASES—A perfect gas, by

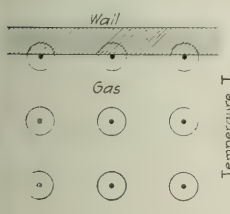


Fig. 3. Gas Particles with Caloric Atmospheres

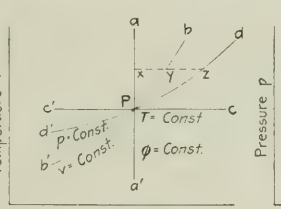


Fig. 4. Changes of Perfect Gas; Temperature and Entropy Terms

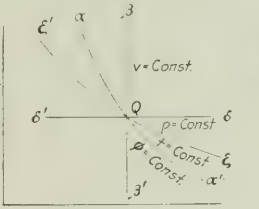


Fig. 5. Changes of Perfect Gas; Volume and Pressure Terms

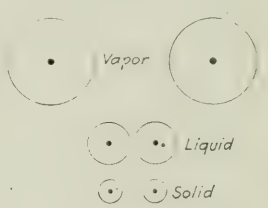


Fig. 6. Intervals and Caloric Atmospheres in Vapor, Liquid and Solid

definition, is one in which the distances between molecules are so large that the forces of attraction between them may be neglected altogether. The properties of such a gas are determined completely by the chemical structure of the molecule and by the quantity and pressure of the caloric associated with it. Let us consider four fundamental changes in such a gas, namely:

(1) At constant entropy (adiabatic);
(2) At constant volume;
(3) At constant temperature (isothermal);
(4) At constant pressure.

In all cases the changes will be presupposed to be so slow and uniform throughout the mass of gas that no bound caloric is liberated, hence the processes are reversible. In the following treatment, a kilogram of gas is supposed to be inclosed in a cylinder, the volume and the pressure being varied by means of a piston.

A change at constant entropy. Let "P" (Fig. 4) represent a definite state of a kilogram of gas in the temperature-entropy diagram, and let "Q" (Fig. 5) represent the same state in the pressure-volume diagram. A change at constant entropy is represented in Fig. 4 by the vertical line "aa'," the arrow indicating the direction in which the temperature increases. Referring to Fig. 3, it is easy to describe the physical character of the process, as shown by the corresponding curve $\alpha\alpha'$ in Fig. 5. Let the change be accompanied by an increase in volume, the distance between molecules increasing. By supposition, the entropy, or the quantity of caloric, remains constant, so that no heat is added to the gas; in other words, the molecular atmospheres in the new state possess the same amount of caloric as in the original state. The temperature is lower in the new position because we have defined temperature as the pressure to which caloric is subjected on account of the mutual repulsions of molecular atmospheres. This repulsion decreases as the distance between particles increases. Hence, the change is represented by the line "Pa'."

The pressure of the gas decreases for two reasons: First, the repulsions between particles decrease, as is explained above, and secondly, there are fewer particles per square meter of the piston in the new state than in the original state of the gas. Therefore, the pressure-volume curve has the shape $Q\alpha'$, the pressure approaching zero as the volume increases indefinitely.

(2) A change at constant volume. Let a certain quantity of gas be heated at constant volume, or, according to our analogy, be connected to a body containing caloric at a higher pressure. Caloric will then flow into the gas and become associated with its atmospheres. Since the distances between the molecules remain the same, the repulsions within the caloric increase, so that both pressure and temperature increase. This change is represented by $Q\beta$ in Fig. 5, and by "Pb" in Fig. 4. If the gas is cooled, instead of being heated, the change is represented by the parts $Q\beta'$ and "Pb'" of the curves.

(3) A change at a constant temperature. This change may be accompanied either by an increase or by a decrease in volume. Let us consider an isothermal compression. The pressure in the caloric (but not in the gas) must, by assumption, remain the same as the distance between the molecules decreases. If the entropy were to remain constant, the pressure in the caloric would increase, because the repulsions between particles of the caloric are stronger at shorter distances. Hence, in order to keep the same temperature of the gas, part of the caloric must be removed as the intermolecular distances decrease. In other words, an isothermal compression is accompanied by withdrawal of heat, and the entropy of the gas decreases. This is shown by curve "Pc'" in Fig. 4.

The corresponding curve $Q\gamma'$ shows the increase in pressure during this process; this curve is not as steep as the curve $Q\alpha'$ of the adiabatic compression, because during the latter process no entropy or caloric is abstracted from the gas, so that both the pressure and the temperature increase more rapidly. An isothermal expansion is represented by the part [illegible] of the curve. Heat or caloric must be added to the gas, as otherwise the pressure in the caloric would decrease with the increase of distance between the molecules.

At a certain initial pressure let the process be an expansion represented by $Q\beta$ in Fig. 5. Since with the increase in volume fewer particles of gas press upon one square unit of the area of the piston, the force of repulsion exerted [illegible] per unit area of the piston remain constant. With the increase of volume here, the temperature and the entropy decrease during the expansion, as shown by the curve "Pb" and $Q\alpha'$. Heat or caloric must be added during the expansion. Next it can be shown that more entropy must be added than for the same change in volume when the expansion is isothermal. The following discussion from the shape of the curve $Q\beta$ [illegible] there the caloric added is not sufficient to keep the pressure constant. Therefore, when enough caloric is added to keep the pressure constant, the temperature of the gas increases, and hence the curve has the shape "Pd," showing that the temperature increases with the entropy.

It remains to show that "Pd" lies below the curve "Pb" corresponding to a constant volume. This is equivalent to saying that for a given increase in temperature, such as "Px" in Fig. 4, more caloric must be added along "Pd" than along "Pb." This becomes self-evident when it is remembered that in the state represented by the point "z," the particles are further apart than in that represented by point "y," so that more caloric is necessary to produce the same pressure in it. Hence, "xz" is larger than "xy," and the curve "Pd" lies below "Pb."

Another way of demonstrating this is by saying that with the expansion at constant pressure the energy added to the gas is partly expended in external work, so that with the same limits of temperature more entropy must be added when the volume increases. A direct result of this statement is that the specific heat at constant pressure is larger than the specific heat at constant volume.[5]

The diagram in Fig. 4 is divided by the line "aa'" into two parts. For all points to the left of this line the entropy, or the quantity of caloric, is less than in the state represented by the point "P" for all points to the right the entropy is larger than in the initial state represented by "P." Similarly, the line "cc'" divides the plane into two parts corresponding to temperatures respectively higher and lower than at "P." The curve "bb" separates points of expansion from those of contraction and the curve "dd'" points of pressure higher than that in the initial state "P" from those lower than at "P." Hence, it is possible to define qualitatively the state of a gas represented by a point, according to its place in one of the eight sectors of the diagram.

The pressure-volume diagram (Fig. 5) is similarly divided into eight sectors. In this wise, an arbitrary thermal change of state may be represented by a succession of two or more standard changes. One must keep in mind, however, that the heat added or subtracted and the external work performed depend upon the path, while changes in entropy and in intrinsic energy are independent of the path between two points, each representing a state of gas.

VAPORS, LIQUIDS AND SOLIDS—When the temperature of a gas is reduced and the pressure is increased, particles are brought closer and closer together, so that finally the forces of attraction between nuclei become of the same order of magnitude as the repulsions between the caloric atmospheres. Under these circumstances, changes of state are determined by the balance of repulsive and attractive forces, and in general three kinds of aggregation are possible (Fig. 7).

The first state, that of a vapor, is similar in general to the state of a perfect gas considered in the previous section, except that the disturbing action of attractive forces modifies the simple laws of change of state. By removing some caloric, the particles may be brought much closer together. Without the central nuclei, this would involve enormous repulsive forces, but the attraction between the nuclei compensates for a considerable portion of the repulsion, so that a new state with new properties becomes possible at moderate pressures—that of a liquid.

By removing still more caloric, it is possible to make the molecular attractions larger than the repulsions, so that the particles are held together at a definite distance without external pressure. This is the solid state. To change from the gaseous to the liquid state, considerable amounts of entropy or caloric must be removed. The energy thus abstracted per kilogram of the substance is called the latent heat of evaporation, when the temperature, or the caloric pressure, is the same in both states. Similarly, the energy abstracted per unit weight during the process of solidification is called the latent heat of fusion.

If the original temperature of a vapor is sufficiently high, the forces of repulsion between the caloric atmospheres increase so rapidly when the molecules are brought closer together, that it is impossible to find another position of equilibrium at the same pressure and temperature. This means that at this temperature the vapor cannot be condensed or liquefied. The highest temperature at which liquefaction is possible is called the critical temperature; to this temperature corresponds a definite pressure and volume, also called critical.

IRREVERSIBLE CHANGES—It is mentioned above that in order to explain irreversible phenomena it is necessary to assume some of the caloric to be in a bound state within each

[5]Specific heat is represented graphically by the length of the subtangent to the temperature-entropy curve. We have by definition $dQ = cdT = Tds$ so that $c = T\,ds/dT$, which is the length of the subtangent to the curve $T = f(s)$.

molecule. This bound caloric is supposed to be liberated during irreversible phenomena, in order to account for an increase in entropy during such phenomena. We shall now consider some irreversible phenomena in the light of this picture.

(1) Joule's Experiment. Joule's classical experiment consisted in expanding a gas without performing external work. A vessel was filled with a gas, and connected by a pipe provided with a stop-cock to another vessel maintained at a high vacuum. The whole system was immersed in a liquid bath. When a thermal equilibrium was established everywhere, the stop-cock was opened and the pressures in the two vessels were allowed to equalize. After the equilibrium had been again established, it was found that the temperature of the system was not changed. This showed that no energy was required to separate particles of gas, and no heat was added to the gas, since no external work was performed. At the same time it can be shown mathematically that the entropy in the expanded state is considerably higher than that in the initial state. Inother words, the entropy of the system is in this case increased without adding any heat from outside. This can be explained in the light of our analogy as follows: The experiment shows the temperature in the expanded state to be the same as in the original state; this means that the pressure in the caloric remains the same. But in the final condition the particles are further apart; hence, in order to produce the same "caloric pressure" there must be more caloric in each molecular atmosphere. But since no heat has been added from outside, this caloric must be liberated out of the molecules themselves.

The liberation of the bound caloric may be explained as due to an unbalancing of pressure in the mass of the gas, and to mechanical shocks between the molecules during the process of equalizing of pressures. The efflux of the gas being sudden, it is accompanied by eddies; moreover, new molecules streaming out of the first vessel collide with those in the second vessel; and the energy of these shocks, not being utilized for external work, goes to liberate the bound caloric. Since the intrinsic energy of a perfect gas is a function of its temperature only, or of the pressure of its caloric, enough caloric is liberated to bring the pressure to its former value. This is required by the law of conservation of energy: No external work was performed, and the gas possesses no kinetic energy at the end of the experiment; therefore, its potential energy must be the same as in the beginning.

The process is irreversible, because by assumption the caloric once liberated cannot be reduced again to the bound state. Should the gas be compressed to its original volume, the new caloric previously added to the old would raise the temperature of the gas. Or, if the compression be done at a constant temperature, some of the caloric has to be removed. In either case the conditions at the end are different from those at the beginning; mechanical work must be performed and an equivalent amount of heat stored in the gas or conducted away. A reversible process is by definition one which being repeated in the opposite direction cancels separately the work performed and the heat liberated or spent. In the light of our analog, only such processes are reversible in which no bound caloric is liberated. Once some caloric is liberated the process becomes irreversible.

Clausius' famous maxim, "The entropy of the world tends toward a maximum," receives thus a simple meaning. Most processes in nature are more or less violent, unbalanced, and hence, using our picture, are accompanied by the liberation of some bound caloric. Thus the entropy of the world (the total quantity of liberated caloric) increases indefinitely, while the total energy remains constant.

(2) Liberation of heat by friction. Let two bodies, assumed to be poor conductors of heat, be rubbed one upon another: The process is necessarily accompanied by shocks communicated to the particles in contact and the energy of these shocks causes some caloric to be liberated. In this way, the pressure of the free caloric, or what is the same, the temperature of the bodies is raised. The process is irreversible: a mere cooling of the surface would conduct away the extra caloric without producing any mechanical motion.

(3) Conduction of heat. Let two reservoirs of heat, A and B, be connected by a heat conductor C. Let the body A be at a higher temperature than that of the body B. The conductor C, through which heat is flowing, possesses temperatures varying between those of A and B.

The transfer of heat may be pictured as a flow of caloric from one molecule to the next, the cause being the difference of pressures in the atmospheres of these molecules. The molecule nearest the body B, being a little warmer than the body B itself, gives up part of its caloric, with the result that some caloric flows into it from the next warmer molecule, tending to equalize the caloric pressures. It is easy to see, however, that such a mechanism would contradict the law of conservation of energy, because the final result would be a transfer of some caloric from a higher to a lower pressure, without the performance of an equivalent amount of external work. But since there is no possibility of performing external work in the phenomenon itself, the energy of the caloric serves to liberate bound caloric of the molecules of the conductor C.

The phenomenon may be compared to that of a snow ball rolling slowly down a snow-covered hillside, and increasing in size by the addition of snow on its path. The speed of the ball does not increase, but its energy is used to accelerate new snow which adheres to it. So in the case of conduction of heat, each transfer of caloric from one molecule to the next is accompanied by the liberation of some bound caloric from the nucleus of the latter molecule. In the end, the lower reservoir receives more entropy than is lost by the upper reservoir, this being necessary to satisfy the law of conservation of energy.

The phenomenon is irreversible, first, because the caloric once liberated cannot be reduced again to the bound state, and second, because it is impossible to make the caloric flow from a lower to a higher pressure.

A Duplex Rock Channeler with Turntable*

Some interesting features in rock-cutting machinery are presented by a channeling machine in one of the quarries of the Indiana oölitic limestone field. It is of the duplex type, having two chopping engines and two gangs of steel cutters arranged side by side, and it carries a vertical boiler supplying steam at 140 lb. pressure. The machine travels on a track of 6 ft. 9 $\frac{1}{4}$ in. gage (which permits of cutting blocks to standard mill size), and by means of a special turntable it can be swung round so that two parallel cuts 8 ft. apart (on opposite sides of the track) can be made at one setting of the track. Duplex channeling machines have been used previously in marble quarries, and were described in our issue of Nov. 18, 1909, but they are said to be of special advantage in cutting soft limestone. The new machine, however, has 8-in. cylinders as compared with 6½-in. cylinders in the marble-cutting machine. The pistons work alternately, one making the downward cutting or chopping stroke while the other is on the upward or return stroke, thus reducing jar and vibration. It is stated also that in channeling "blind" cuts (without an open end for the escape of sludge) the duplex machine has an advantage over the single-head machine in keeping the mud thinner by stirring it up, while the front gang pushes the mud ahead and enables the rear gang to give a free blow upon the rock. The crew consists of three men, the same as in the single-gang channeler.

The feed screw is placed between the cylinders, and where there is ample room overhead, the screw extends upward through the top of the standard in which is located the feed nut, driven by the usual bevel gears and chain. Where the overhead room is limited, as in tunnel work, the feed screw extends downward. This screw runs in an oil bath, which cools it and insures lubrication, oil being forced up the hollow screw and nut and through small holes to the threads within the nut. The feed screw permits a 36-in. run, so that it is necessary to change steels only every 3 ft. of cut. The starters, however, cut only 12 to 14 in. deep in order to secure stiffness in the gangs. Either one of the chopping engines can be operated independently.

The turntable, which enables the machine to cut on

*From information furnished by the Sullivan Machinery Co., Chicago.

both sides of its track, consists of a section of track 10 ft. long, carrying between the rails a Z-bar ring which forms the lower or fixed race for a large roller thrust bearing. The rolls consist of hardened steel discs about 4 in. diameter, and to maintain their spacing, hoops are provided which carry small rolls on vertical axes to take the horizontal thrust. Another Z-bar ring inside of and over the rolls forms the upper or moving race. To turn the channeler, it is run onto the turntable section and lifted by jacks (on the machine) until the wheel flanges clear the rails. It is then swung around, and lowered to the rails in the reversed position. The operation may be accomplished in 14 to 18 min. by three men. In a simplified design, eliminating the jacks, the turntable will consist of a plain ring, bolted and braced to the rails. Above this will be a similar ring bolted to a shorter and lighter track section, of the same gage. A roller bearing will be placed between the rings and a center pin will carry side and end thrust. Two short pieces of rail, beveled to provide an incline, will furnish access to the turntable.

Observations were made of the operation of the machine under practical quarrying conditions and in comparison with three 7-in. single channelers. A summary of the results is shown in the accompanying table. The duplex machine was at a disadvantage in that only its own crew of three men was available for moving track, while the three single machines (on one track) had nine men (three crews) for this purpose. In spite of delays and handicaps, the average cut per day of the duplex machine was nearly 2½ times that made by one single machine. Its actual cutting speed, indicated by the average cut per hour of running time, was more than three times that of one single machine. The track speed of the duplex channeler in this stone was 3¼ ft. per minute.

COMPARATIVE PERFORMANCE OF DUPLEX AND SINGLE-HEAD ROCK CHANNELERS

	1 Duplex	1 Single	2 Singles
Ave. cut per day	670.0 sq.ft	283.0 sq.ft	848.0 sq.ft.
Ave. cut per hour	72.2 sq.ft	30.5 sq.ft.	91.5 sq.ft.
Ave. cut per hour, running time	140.0 sq.ft	46.0 sq.ft.	138.0 sq.ft.
Ave. day's time	9.27 hr	9.27 hr	9.27 hr.
Ave. running time per day	4.78 hr	6.15 hr.	6.15 hr.
Ave. exceptional delays per day	1.04 hr.	none	none

Train Resistance Tests, Southern Pacific Ry.

SYNOPSIS—The effect of curves in increasing train resistance is an important factor in the operation of railways or railway divisions having heavy grades and curves in combination, and it is established practice to reduce the rate of grade on curves so that the combined resistance due to grade and curve will not exceed the resistance due to the maximum grade on tangents. Although this compensation of grade for curvature is a matter of great importance in the handling of traffic and has been investigated quite extensively, the investigations have been mainly theoretical, while experimental work and the observation of conditions in actual service have been comparatively limited. For this reason we are specially pleased to put before our readers a description of a series of careful observations made with regular freight trains, and, although these were made thirty years ago, their results represent a very important addition to the available information upon the subject.

The subject of compensating grades for curvature was discussed at some length in our issue of Aug. 15, 1912, and reference was made to the very small amount of actual test and observation upon the subject. As a result of the articles then published, we have received particulars of experiments made in 1883 with freight trains in regular service on the Southern Pacific Ry. In furnishing us with the tabulated results of the observations, Wm. Hood, Chief Engineer of that company, states that they have never been published before.

The experiments were made by observing the speed of the train on the successive curves and tangents on a certain stretch of road, the alignment and profile of which were known. The tabulations for the several observations show the results for 13 trains on ten stretches of line, and in the accompanying table we have condensed the records for seven of these trains on five stretches of line. On some of these stretches (*A*, *B* and *C* of table) the compensation was on a sliding scale ranging from 0.02 to 0.04% per degree of curvature, while on others (including *D* and *E* of the table) it ranged from 0.02 to 0.05% per degree, as shown in the table below:

Comp. = 0.02 to 0.04% per deg		Comp. = 0.02 to 0.05 per deg	
1° and over	0.020	1° and over	0.020
4° and over	0.025	3° and over	0.025
6° and over	0.030	4½° and over	0.030
8½° and over	0.035	6° and over	0.035
10° and over	0.040	8° and over	0.040
		9° and over	0.045
		10° and over	0.050

The experiments were made on long continuous maximum grades having the rate of grade reduced on curves to the extent indicated above and shown in the table. The trains were those in regular freight service, and were not made up specially for the purpose. The nearly uniform steam pressure and fixed opening of throttle and cut-off gave nearly uniform tractive power for considerable periods. The speed is given in miles per hour and also in the number of revolutions per 15 sec., the latter observations showing at once any variation in the speed and also serving to show when slipping occurred. These two columns of speed indicate (for such locomotives and train lengths as were used) a practically correct reduction of grades on the curves, for all the lines under observation, showing a marked uniformity of speed on curves and tangents. In certain isolated cases (marked by a star in the table) there is shown an acceleration on the curves, indicating that the compensation is a little in excess of requirements. In a few other isolated cases the observations show a successive reduction of speed on the curves, indicating that the compensation is slightly deficient. Enginemen operating trains over the same stretch of line and the same maximum grade differ in opinion as to where the hardest pull occurs, although each one has in mind some point or points where the train seems to him to pull the hardest.

The length and other features of the trains used in the observations are given below. When the curve or tangent was shorter than the length of the train, the speed was noted when the middle of the train was at the middle of the short curve or tangent. When the length was equal to or greater than that of the train, the speed was noted near the up-grade end of the curve or tangent, in order that the full effect of the alignment might appear in the

TABLE SHOWING RELATION OF GRADE COMPENSATION FOR CURVES TO SPEED OF TRAINS, SOUTHERN PACIFIC RY.

Compensation 0.02 to 0.04% per degree

Alignment Deg. Min.	Length of curve or tangent ft.	Grade per cent	Grade red. per sta. per degree	Train No. 1 Revs. in 15 sec	Train No. 1 M.p.h.	Train No. 2 Revs. in 15 sec	Train No. 2 M.p.h.
A Trains over Soledad Pass (Southbound)							
Maximum tangent grade, 2.2%							
0 20 L	2782	2.20	none	13.5	21	9.0	14
6 00 L	440	2.02	0.03	10.9	17	9.0	14
1 00 L	1117	2.183	0.02	9.6	15	9.0	14
Tan	181	2.183				9.0	14
3 00 R	717	2.14	0.02	9.0	14	9.0	14
7 00 R	1436	1.99	0.03	9.0	14	8.4	13
0 30 R	900	2.20	none	7.7	12	8.4	13
3 00 R	400	2.161	0.02	7.7	12	8.4	13
Tan	217	2.161		7.7	12	8.4	13
7 00 L	458	1.99	0.03	8.4	13	8.4	13
Tan	150	2.148		8.4	13		
3 00 R	1165	2.148	0.02	8.4	13	8.4†	13
Tan	2260	2.20		8.4	13	9.0†	14
6 00 L	710	2.02	0.03	7.7	12	8.4†	13
Tan	1085	2.20		7.7	12	9.0†	14
4 30 R	080	2.11	0.02	7.7	12	8.4†	13
Tan	179	2.161		7.7	12	8.4	13
2 30 L	752	2.161	0.02	8.4*	13	8.4	13
B. Trains over Soledad Pass (Northbound)							
Maximum tangent grade, 2.2%							
				Train No. 3		Train No. 4	
3 00 L	874	2.14	0.020	14.1	22	10.9	17
Tan	1059	2.20		11.6	18	10.9	17
1 20 R	1448	2.176	0.020	10.9	17	10.9	17
1 20 R	1448	2.176	0.020	10.3	16		
Tan	200	2.176		9.6	15		
8 00 L	683	1.96	0.030	9.6	15	9.6	15
Tan	1393	2.20		9.6	15	9.6	15
3 00 R	1017	2.14	0.020	9.0	14	9.6	15
Tan	2294	2.20		9.0	14	9.6	15
4 00 L	400	2.144	0.020	9.0	14	9.6	15
Tan	171	2.144					
6 00 R	450	2.02	0.030	8.4	13	Slipped	
2 30 R	535	2.15	0.020	8.4	13	8.4	13
Tan	382	2.197		8.4	13		
1 00 L	799	2.197	0.020	9.0	14*	8.4	13
Tan	237	2.197		8.4	13		
4 00 R	687	2.134	0.020	8.4	13	Slipped	
Tan	150	2.134		8.4	13	8.4	13
8 00 L	309	1.96	0.030	8.4	13	8.4	13
0 20 L	994	2.20	none	8.4	13	8.4	13
8 00 L	453	1.99	0.030	8.4	13	8.4	13
Tan	161	1.99					
8 00 R	655	1.99	0.030	8.4	13	8.4	13
Tan	363	2.176		8.4	13	8.4	13
1 40 L	1710	2.176	0.020	8.4	13	8.4	13
1 40 L	1710	2.176	0.020	9.0	14*		
Tan	272	2.176					
C Train over San Pedro Pass (Westbound)							
Maximum tangent grade, 1.4%							
				Train No. 5			
1 00 L	1018	1.305		15.4	24		
Tan	1939	1.400		13.5	21		
2 00 L	1000	1.360	0.020	12.9	20		
Tan	672	1.400		12.2	19		
5 00 R	588	1.287	0.025	11.6	18		
Tan	186	1.287	....	10.9	17		
5 00 L	1235	1.287	0.025	10.9	17		
Tan	299	1.400		10.9	17		
10 00 R	490	1.050	0.040	10.9	17		
Tan	150	1.050		10.9	17		
10 00 L	560	1.050	0.040	10.9	17		
Tan	476	1.40		10.3	16		
6 00 L	253	1.22	0.030	10.9	17		
Tan	205	1.40		10.9	17		
9 00 R	876	1.085	0.035	10.9	17		
2 30 R	665	1.35	0.020	10.9	17		
Tan	356	1.40		10.9	17		
10 00 L	586	1.051	0.040	10.9	17		
Tan	159	1.051		10.9	17		
10 00 R	506	1.051	0.040	10.9	17		

Compensation 0.02 to 0.05% per degree

Alignment	Length of curve or tangent, ft.	Grade per cent	Grade red. per sta. per degree	Speed of train, Revs. in 15 sec	M.p.h.
D Train over Maricopa Pass (Eastbound)					
Maximum tangent grade, 1%					
				Train No. 6	
7 30 L	1308	0.737	0.035	13.6	19
Tan	150	1.00		12.9	18
6 00 R	2101	0.79	0.035	11.4	16
Tan	1072	1.00		11.4	16
5 15 L	1264	0.827	0.030	11.4	16
Tan	1022	1.00		11.4	16
7 15 L	1258	0.729	0.035	11.4	16
Tan	200	1.00			
2 00 L	982	0.96	0.020	11.4	16
Tan	268	1.00			
2 00 R	637	0.96	0.020	11.4	16
Tan	1589	1.00		11.8	16½
1 30 L	2602	0.97	0.020	12.1*	17
Tan	652	1.00	....		
3 00 R	1371	0.925	0.025	12.1	17
Tan	1596	1.00	....	12.1	17
3 00 R	552	0.925	0.025	12.5*	17½
Tan	1452	1.00		12.5	17½
1 30 L	967	0.97	0.020	12.5	17½
E Train over Sierra Blanca (Eastbound)					
Maximum tangent grade, 1%					
				Train No. 7	
6 00 L	746	0.79	0.035		
Tan	924	1.00	.....	10.9	17
2 30 R	780	0.937	0.020	9.6	15
Tan	711	1.00	.....	9.6	15
5 00 R	1193	0.85	0.030	9.6	15
Tan	2169	1.00	.....	9.6	15
4 05 L	2226	0.877	0.030	9.6	15
Tan	1456	1.00	.....	9.6	15
3 30 L	363	0.912	0.025	9.6	15
Tan	562	1.00	.....	9.6	15
4 30 R	1390	0.865	0.030	9.6	15
Tan	485	1.00	.....	9.6	15
2 00 L	653	0.96	0.020	9.6	15
Tan	1314	1.00	.....	9.6	15
3 00 R	861	0.925	0.025	9.6	15
Tan	475	1.00	.....	9.6	15
9 30 L	954	0.572	0.045	Slipped	
Tan	843	1.00	.....	9.0	14
5 30 R	767	0.835	0.030	9.6	15
Tan	831	1.00	.....	9.0	14
7 30 R	841	0.737	0.035	9.6	15
Tan	540	1.00	.....	9.0	14
9 30 R	1139	0.572	0.045	9.6	15
Tan	336	1.00	.....	9.6	15
7 30 L	383	0.737	0.035	9.6	15
Tan	453	1.00	.....	9.0	14
4 00 L	431	0.88	0.030	9.0	14
Tan	897	1.00	.....	8.7	13½
10 00 L	....	0.477	0.050		

Note.—At points marked * the speed on the curve is slightly higher than on the preceding tangent, indicating that the compensation was slightly in excess of the requirement. This reduces the resistance and enables the train to accelerate on the curve

recorded speed of the train. Higher rates of speed near the bottom of the grades are due to the practice of "making a run" for the grade. In cases where short tangents have the same rate of grade as the adjacent curve or curves the reduction of grade due to the curvature is distributed over the curve (or curves) and short tangent.

The trains were made up mainly of box cars of 30,000 and 40,000 lb. capacity. The average load of general merchandise per loaded freight car in these tests was 20,635 lb. The average light weight of box cars of 30,000 and 40,000 lb. capacity was 19,750 and 21,670 lb., respectively, and a caboose was rated as equivalent to an average loaded box car. The several trains follow:

Train No. 1. Two engines, with cylinders 18x24 in., and having a weight of 32 tons, on six driving wheels 4 ft. 7 in. in diameter. One caboose, three emigrant sleeping cars and 19 box cars (two empty). Approximate weight of train (exclusive of engine), 390 tons; approximate length, 750 ft. One engine had full throttle opening and 122 to 125 lb. steam pressure; the other had 80% throttle and 120 lb. pressure.

Train No. 2. Two similar engines, caboose, one emigrant sleeping car and 19 box cars. Approximate weight of train, 240 tons; approximate length, 750 ft. Throttle and boiler pressure as above.

Train No. 3. Two similar engines, one caboose, nine emigrant sleeping cars, 19 box cars. Approximate length, 750 ft.

Train No. 4. Two similar engines, one caboose, one sleeping car and 19 box cars. The train length and conditions of boiler pressure and throttle opening were approximately the same on all these four trains.

Train No. 5. Two similar engines, one caboose and 25 freight cars. Approximate length, 906 ft. One engine with full throttle and 112 lb. to 117 lb. pressure; the other with 50% throttle and 125-lb. pressure.

Train No. 6. One engine with cylinders 17x24 in. and having a weight of 211½ tons on four driving wheels 5 ft. in diameter. One caboose and 19 box cars. Approximate length, 663 ft. Throttle opening, 80%. Boiler pressure, 125 lb., increasing to 128 lb. during the latter part of run.

Train No. 7. One engine of the larger size noted above, 14 box cars, two flat cars, two water-tank cars, one emigrant car and caboose. Approximate length, 670 ft. Throttle half open. Boiler pressure, 120 lb.

The Study of Modern Languages in Technical Schools

By Winslow H. Herschel*

For the first hundred years after the founding of Harvard College, over a third of its graduates entered the ministry. It was held at that time that the chief aim of education was to give a broad, general culture. With the realization that college prepares, or should prepare, for any vocation, and the consequent increase in the number seeking a college education, there has come a tendency to make education of more direct utility, to hold as an ideal the accumulation of information rather than the acquiring of a gentlemanly polish.

But the mere storing up of facts in the memory is of value chiefly to the student who is obliged to seek, on graduation, the highest salary possible, regardless of opportunities for advancement. An engineering student may obtain a position as draftsman or transitman, or he may acquire enough manual dexterity in shopwork to take a position as machinist; but it is not till he has been out of college some time, and has worked his way up to a position in which he must make new applications of old principles, that his training begins to tell, and he shows himself superior to the man who has worked his way up from blueprint boy or rodman, without having gained, in one way or another, a broad education.

Any school must, to some extent, compromise in its curriculum between those studies which will be of greatest immediate use to the student on graduation, and those which will best prepare him to take advantage of opportunities for advancement. Herein lies the essential difference between a trade school and a technical school. The former prepares for the immediate future; the latter pays more attention to the high positions to which it is assumed the graduates will ultimately attain.

There are several reasons why the accumulation of facts is not the most important thing. In the first place, the college period, even if extended to five or six years, is not long enough to accumulate, to say nothing of assimilate, all the facts that one will need in a lifetime. In the second place, engineering is a growing science, electrical engineering, in fact, grows so fast that it almost takes one's breath away. An engineer is not very long out of college before he realizes that he must be learning continuously to keep abreast of the times, even if blest with so good a memory as to make it unnecessary to relearn a subject once understood. And such memories are rare. Thirdly, an engineer may, in the course of his active life, change his vocation, in whole or in part, from one branch of engineering to another.

It is clear, therefore, that facts learned in college are of little importance in comparison with the ability to acquire new information, and it is from this standpoint that we must judge an engineering curriculum.

There are three general reasons for the study of modern languages which we may call cultural, commercial and professional. There can be little question concerning the cultural value of the study of languages. The objection is apt to be that the engineer does not need, or cannot afford the time for mere cultural studies. Yet culture is not without its value to an engineer. To attract clients in the first place, and afterward to induce them to place their bank accounts at the disposal of the engineer, may require all the tact and all the charm of personality that culture can bring or that is of use to the diplomat, lawyer or doctor. There are few cases like that of Winstanley, who financed his own enterprise for the benefit of mankind. More often is the engineer in the position of William Hood, who persuaded E. H. Harriman to spend the millions required for the construction of the Lucin cutoff.

It is evident that when an American engineer goes abroad for professional work, it is a great advantage to him to be able to speak the language of the country. For this reason there has been a tendency to substitute in the curriculum Spanish in place of French or German, a tendency which is to be regretted not only because Spanish is inferior as a means of mental discipline, but also because the Spanish engineering literature is comparatively insignificant.

When an American firm desires to copy European improvements in some type of machine, the desired information may be obtained in several ways. Sometimes complete working drawings are imported and are used in the American shops either with or without redrawing and changing the metric to English measures. Again, a representative may be sent to Europe or an expert imported from there. Except in the case of importing drawings, the ability to speak a foreign language is of great value to the American engineer. Some one with a knowledge of the language is selected to go abroad, or to receive instruction from the imported expert, and the engineer thus selected is in position to get information at first hand, and to become of increased value to his employers.

It may be objected that we have no need to go abroad for information; that American workmen lead the world, or, as one writer phrases it, "The best thoughts of the greatest men are available in English." I believe there is a mistaken patriotism in this kind of talk. Dr. J. A. L. Waddell, in an address delivered before the students of the Rose Polytechnic Institute in 1902, said:

> As a rule, the graduate engineer has no time to devote to the study of foreign languages, and it is questionable whether it be advisable to devote to them much time in the technical schools. The plea for their retention is that there are many good technical books in these languages that the student ought to be able to read. My reply to this is that there are more good technical books in the English language than a man can ever find time to study, and that all valuable technical works in foreign languages are soon translated into English. In my opinion a knowledge of French is only a gentlemanly accomplishment, and one that a man is very liable to lose for want of use, and a knowledge of German is of no advantage whatsoever to an American engineer.

This is surprising language indeed, coming as it does from one who, like Dr. Waddell, liberally adorns his writings with phrases from French, Spanish and Latin!

It seems to me that our attitude toward foreign languages is largely an inheritance from our English ancestors. An Englishman takes the position that what is good enough for him, is best for the rest of the world. When he goes to some half-civilized country he retains his language and his customs. He puts on his dress suit for dinner if there is not another dress suit within a hundred miles. A Frenchman under similar circumstances would be more likely to adopt the native customs and dress, and in a few years to become with difficulty distinguishable from a native. It is this attitude of mind

*Associate Professor of Mechanical Engineering, University of Maine, Orono, Maine.

that has made the English the best colonizers in the world; but it has not helped them in their export trade, and thus the Germans have been enabled, in recent years, to make great inroads on England's former commercial supremacy.

Our isolation, here in the United States, has helped us to maintain the English attitude. One can hardly take a day's journey in Europe without getting into a country where another language is spoken, so that in the ordinary course of events, either by traveling or meeting travelers, everyone hears foreign languages and realizes the advantage of understanding them.

It is a matter of common knowledge that for a number of years all the best automobiles were made in France. It may not be so well known, but it is equally true, that, at times at least, Europe has been ahead of the United States in the design of steam turbines, gas engines, hydraulic turbines, centrifugal pumps and gas turbines. Apart from correspondence and the methods already mentioned, American manufacturers had to obtain their information concerning these machines from printed books and periodicals.

It is true that there are more books in English than anyone can read, but it is quality, not quantity, that counts. If one cannot find in English the information he wants, he must either read it in a foreign language, or wait for a translation, and this brings us to a consideration of the importance of obtaining information promptly.

Suppose an automobile manufacturer in the United States finds his business seriously falling off on account of the increasing use of aëroplanes, and he proposes to start building the latter. He hears that a description of a Gnome motor, which he needs, has been published in a foreign language, perhaps in the patent specifications. How long can he afford to wait for a translation? While he is waiting, some rival who understands the foreign language may be going ahead and putting his goods on the market, and long before the translation appears, may become so firmly established as a builder of aëroplanes that our non-linguistic friend has no chance to enter the business.

If it is objected that a manufacturer could hire some foreigner to make a translation, it may be answered that it takes more than a mere linguist to make translations of engineering subjects. Even the best translations obtainable, made by engineers well versed in the language, are not as reliable as the originals. Anyone who has seen an article first in manuscript and again in proof realizes the possibilities of error in the printed page, and the probability of error is greatly increased in the case of translations.

One of the greatest difficulties is in changing formulas from metric to English units. So great in fact, is this difficulty, and so frequently have I found mistakes in the best translations, that I prefer, when possible, to take the original formula and make the necessary calculations using the metric measures. It should be noted that the fact that foreign articles are translated does not make it unnecessary for engineers to know foreign languages; on the contrary, it creates a special demand for engineers to do the work of translation.

The engineer who uses a translation has as his competitor every engineer who can read English. One who is his own translator, or rather, who reads and understands the foreign language without translation, narrows down to those who can do likewise, the number of competitors who can compete with him on equal terms, and his chances are much improved of being among the first to acquire any new and desirable bit of information.

To illustrate the rapidity, or lack of it, with which translations are made, some concrete examples will be given of books which are probably the best in their respective fields. In machine design, "Der Konstrukteur," by Reuleaux, appeared in the fourth German edition in 1889 and was translated into English in 1893. A book on internal-combustion engines which also waited four years for a translator was the second (1905) edition of Güldner's "Entwerfen und Berechnen der Verbrennungsmotoren." "Die Dampfturbine," by Stodola, appeared in the second German edition in 1904 and was translated in 1905.

At first sight it might appear as if the English-speaking steam-turbine designers were especially fortunate in the promptness of translation, but "Die Dampfturbine" has now reached a fourth (1910) German edition, greatly enlarged and improved, of which there is no translation. On hydraulic turbines, "Pfarr's Die Turbinen für Wasserkraftbau" has never been translated, although the first German edition was published in 1907, and the second in 1912. The list might be extended indefinitely, but the above should suffice to show that a manufacturer who did not have to wait for a translation would have a good start over his competitors.

To show that the Germans do not have a complete monopoly of pioneer work, mention might be made of Maurice d'Ocagne's "Traité de Nomographie, 1899," which has never been translated, though extracts from it begin to appear in American books on graphical methods of calculation. Gustav Herrmann's work on the graphical statics of mechanism, originally written in German and translated first into French and later into English, will serve to point out that one may sometimes have access to a book through a translation, when the translation itself is in a foreign language. Works in Italian, Swedish, Russian or any other language not ordinarily studied by American engineers, may usually be read in French or German before a translation into English has been made.

There is a question as to whether French or German is the more desirable. In the *Bulletin* of the Society for the Promotion of Engineering Education, 1908, p. 136, Prof. A. S. Wright tells of putting the following question to a number of engineers: "Which foreign language is of most value to the engineer, and why?" Out of 88 answers, 61 favored German. Prof. Wright comes to the conclusion "that the Germans are so far in advance in research work and so prominent in the practical application of their results that their language should be given the first place."

For special subjects or at certain times, French or some other language may become of prime importance. At one time Francis was doing research work in water measurement in the United States, and at another time it was Bazin in France. At one time Arinengaud and Lemale were working on the gas turbine in France, and the latest work seems to have been done by Holzwarth in Germany. Perfecting an invention is a slow process, and it may take the work of many men of various nations before the machine arrives at such a state of perfection

that further substantial improvement seems improbable.

It may be a matter of mere chance, and not of prior invention, that determines in what language the latest information on a subject may be obtained. Sulzer of Switzerland or Rateau of France might have written comprehensive books on centrifugal pumps, but they being too busy with commercial affairs, what seems to be the best book on the subject was written by a German, Fr. Neumann.

The German periodicals, as a general rule, are of more value to the designer than anything that can be obtained in English, and this is of special importance because information usually appears in periodicals before it is available in books. We have, to be sure, plenty of trade papers, as for example, the *Valve World*, *Reactions* and the *Universal Bulletin*, and plenty of publications that deal with popular subjects like automobiles and aëronautics, but with few exceptions such periodicals are of little use to the designer. It would be difficult to name two English or American journals of as much value to a specialist in a limited field as are, for example, *Die Turbine* and the *Zeitschrift für das gesamte Turbinenwesen*.

The most usual process by which a new idea becomes generally available is somewhat as follows. Some engineer has an idea, and as it seems important to him, he writes a paper about it and presents it before some local society which, perhaps, publishes the article. If the paper is reprinted by some periodical of wider circulation, it then becomes accessible to the writers of books, who may then, by references or extracts, render the material available to anyone who can read the language. All this takes time, and if the article is published abroad, additional time is consumed between the publication and the translation of the book. The engineer who can read the foreign periodical as soon as the mails can carry it to him, has a long start over the one who must wait until the material is available in English.

When one starts in to advocate a change in the engineering curriculum, he is always reminded that the curriculum is overcrowded and that we need to drop subjects rather than to seek after new ones. Unfortunately, every school has a different curriculum, so that no general solution can be suggested to relieve overcrowding and permit the introduction or retention of German. But in the last analysis, the amount of time available in college depends on two things, the number of years which a man can afford to spend on his education, and the training which he receives in the preparatory school. There is a limit to the amount that can be learned in four years, and while every school is ambitious to graduate students who can compete on equal terms with the graduates of the best institutions, it is not always realized that, other things being equal, the ability of the student at graduation is proportional to his ability at entrance. If the majority of instructors agree that every engineer should have a working knowledge of German, the logical thing would seem to be to require German for admission, if, as seems to be the case, there is not time enough in the college course for the necessary strictly technical studies and a thorough study of languages in addition.

If it is impracticable to require German for admission (and this, like other changes in the curriculum, is largely a local issue), other means might be adopted to provide the student with the desired knowledge of German. I hesitate to say that German is of more use to an engineer than calculus; but let us examine the proposition. The mind seems to be so constituted that one cannot recall something unless the attempt is made to recall it about once in so often. This is not saying that the mind does not retain the subject, which is something different. A subject once learned may be relearned with greater ease, een if it has been, as we say, completely forgotten. But the value of a certain kind of knowledge may often be judged like that of a mechanical calculator. If the device is so complicated, or is used so infrequently that the directions have to be consulted every time it is used, the chances are that one could make quicker progress without it.

It is claimed that the study of foreign languages is a waste of time in technical schools because the majority of students forget them after graduation. The same might be said of calculus, and the question arises whether forgetting is due to bad methods of teaching or to infrequency of use of the subject. The latter is the case with calculus. It can be used most often in determining maxima and minima; but such problems may be solved nearly as quickly by the tentative method, combined with a little intelligent guessing, which is indeed a quicker method than by calculus, if the engineer has to get out his old college textbook and try to brush up his somewhat hazy recollections of the subject. Problems in integration are either too complicated to be solved by analytical methods except by the most expert mathematicians, or else they are so simple as to have been solved long ago, with the results available in tables for any engineer. Engineers as a rule are not expert mathematicians, as was noted by Trautwine, whose remarks on the subject are well worth occasional reading.

It must be admitted that calculus is used to such an extent in engineering books that it is a great handicap to the understanding of many authors if one has never studied the subject. Without a thorough knowledge of calculus, the student may be seized with dread every time he encounters a dx or an integration sign, or at least he must pay less attention to the ideas of the author than to the medium through which they are conveyed.

The graduate engineer is in much greater danger of forgetting calculus than languages on account of the more frequent opportunity to use the latter. Furthermore, means may be more readily provided for increasing the use of foreign languages than for extending the use of calculus. The use of textbooks in French and German is a good method of impressing students with the utility of foreign languages. In fact, in some advanced subjects, especially chemistry, the difficulty of obtaining suitable textbooks in English is so great that many instructors use German texts merely for the sake of learning the subject, without any regard whatsoever to the value of German as a byproduct.

A book which could be used with profit by all engineers, because it has no equal in the English language, is the German engineers' pocketbook, "Hütte." It is a common saying that it is worth while to learn Italian for the sake of reading Dante in the original. One could say equally well that it is worth while to learn German for the sake of using "Hütte" in the original, especially since it must be used in the original or not at all. The habit of referring to that book, once acquired in college, would be retained through life.

It is not uncommon for engineering mathematics to be taught by instructors in the department of technology, rather than by those in the faculty of arts and sciences, because it is realized that there is a difference in emphasis, if not in substance, between the subject when taught as a pure science, and when taught with regard to its future application to engineering. A similar distinction holds good in the case of languages, between the proper methods of instruction with a view to their literary value, and the manner in which they should be taught with a view to their future use as an instrument for acquiring scientific knowledge.

In at least one institution, the University of Michigan, the modern language work of engineering students is entirely separate from the literary department. It is quite possible, however, that the rudiments of the languages, say one year of French and two of German, could be taken care of about as well by the faculty of arts and sciences, letting the student then take an additional year in reading scientific literature with an instructor under charge of the department of technology. After such a preparation as this, and the judicious use of foreign textbooks in advanced classes, the student should have so lost the dread of foreign books that he would naturally continue their use after graduation. An incidental advantage of foreign books is their low cost, since they may be imported free of duty. An engineer has been defined as a man who does for one dollar what anyone could do for two, and according to this, a man who, by his knowledge of foreign languages was able to get better information at less cost, would be the better engineer.

One objection to modern languages as now taught is that the students get a smattering of French and German, but do not learn enough of either language to be of practical use. It might be well worth while to consider whether it would not be of much greater value to a graduate to know German well, than to have a slight acquaintance with two or three foreign languages. If so, time for German could, as a last resort, be obtained by dropping French, both as an entrance requirement and as a prescribed study in college.

To sum up the conclusions we have reached, the chief value of modern languages to an engineer is as a means of properly obtaining the latest information on the subject he has at hand, and for this purpose, on account of the technical position of the Germans, their language is to be preferred. If, on account of a crowded curriculum, it seems impossible to teach German long enough in college to give the student a working knowledge of the subject, it should be placed among the entrance requirements, or room should be made for it in the college curriculum by omitting something else, even, if absolutely necessary, by discontinuing the study of French.

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A Year's Output of European Shipyards—What appears to be a record in marine engineering has been created by Messrs. John Brown & &Co., who during 1912 have constructed machinery of 178,500 i.hp. for seven vessels. So far as is known, there are not likely to be any figures this year to equal these. Engines of over 121,000 i.hp. have been built by Messrs. Krupp for nine vessels, and the North-Eastern Marine Engineering Co. constructed, in their Wallsend and Sunderland shops, machinery of over 129,000 i.hp. for 60 mercantile steamers. The highest figures for the world last year were those of the Vulcan Co., of Hamburg and Stettin, who constructed engines of 166,230 i.hp. for ten vessels, and this year the highest Continental figure is likely to be that of the Schichau yards at Elbing and Danzig, where machinery of over 143,000 i.hp. has been built. —"London Times," Dec. 18.

A Spring-clamp Rail-brace

A new form of combined rail-brace and tie-plate now being introduced has the special feature of exerting a spring or clamping grip on the rail base. This gives a more effective hold than when the edge of the rail base is simply fitted to a recess in a rigid rail-brace. It has another special feature in the use of screw-spikes as fastenings, the spikes serving to grip the brace to the rail as well as to hold the brace in position. The clamp shown



SPRING-CLAMP RAIL-BRACE GRIPPING THE RAIL BASE BY MEANS OF SCREW-SPIKES
(Robert D. Townsend, Inventor, Chicago)

in the cut is made from ⅜-in. steel plate, one end being first stamped to shape to form the rail-brace and being then bent over upon the flat portion which forms the tie-plate; the width is 7 in. The rail head has a good bearing against the top of the brace, which transmits the pressure to the base plate and the tie. The plate is punched with holes for four screw-spikes, and it will be seen that the outer spikes are close to the rail base and pass through both the upper and lower portions of the plate, so that as the spikes are screwed home, the upper portion (with the brace) is brought down firmly upon the foot of the rail. For locations where rail renewals are frequent and traffic is heavy (so that little time is available for renewals), ordinary spikes may be used on the inside, as they are more quickly removed to allow of slipping the old rail out as soon as the two outside clamping screw-spikes have been slackened. The design as shown in the cut is for use on curves, but another form is used as a combined rail-brace and slide-plate at switches, the flat portion being long enough to carry both the stock rail and switch rail.

About 200 of these rail-braces have been in use for nearly six months on four sharp curves of the Chicago Junction Ry., a terminal line whose tracks carry very heavy traffic and heavy yard and road engines. We are informed that previous to their use it was necessary for the section gangs to attend to these curves twice a week, but that no work on the outside rails (held by the new braces) has been necessary since the braces were placed, as the rails hold their position on the ties in spite of the severe conditions of service. The braces are not yet applied to the inside rails. The rails weigh 80 lb. per yd., and there are five braces to each rail, held by screw-spikes ⅞x6 in. This device is patented, and is the invention of Robert D. Townsend, of 5821 Michigan Ave., Chicago.

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A Competition for a Machine for Cutting Forest Undergrowth has been announced by the Societe des Agriculteurs de France, in connection with its annual agricultural competition in 1913 and 1914.

Some Experiences with Concrete Piles in Chicago

By J. Norman Jensen*

It seems on the face of it that a concrete pile ought to be an ideal form of foundation. Concrete itself is permanent, increases in strength with age, is employed to the best advantage in compression, and is unaffected by the lack or presence of moisture. In case of the lowering of the water line of a city due to the construction of subways, sewers, and other forms of deep excavation, involving, as it does, grave danger to a wooden pile, the integrity of a concrete pile should be unquestioned.

In the city of Chicago the advantages above enumerated and the increasing cost of wood piling led to the adoption of the concrete pile in the foundations of various buildings. While in some cases the piles were entirely satisfactory, in other cases the results attained were such as to cast suspicion on some forms of the concrete pile, especially when driven under adverse soil conditions.

Some of the experiences with three different forms of concrete pile are given below. The observations for each type are designated by the headings Pile Nos. 1, 2 and 3.

Pile No. 1

About four years ago piles were driven for the foundation of a building located on 22d and La Salle Sts. These piles were 21 ft. long, 20 in. in diameter at the top, and 6 in. at the point. In constructing these piles a steel shell was driven to the required depth by means of a collapsible steel core. This core was then withdrawn and the steel shell filled with concrete. The shell was

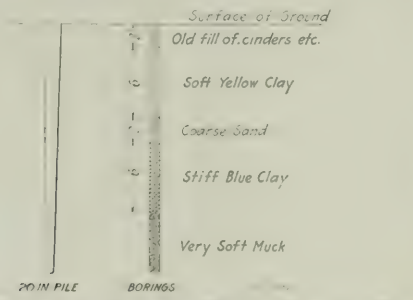


Fig. 1. Boring in Location Where Pressure Was Sufficient to Crush Pile Casings

built in three sections provided with suitable joints to keep out water and dirt.

The steel shell or casing was at first built of No. 20 gage steel. As the work progressed it was found that the thickness of metal was not sufficient to prevent the collapsing of the casings and it was found necessary to increase the thickness of the casing until at the end of the work No. 16 gage was used.

A record of the borings on the site, and the location of the concrete pile in the soil is given in the accompanying sketch (Fig. 1). Each hole was examined before filling with concrete by dropping a lighted candle to the casing or by reflecting sunlight into it by means of a mirror. In a great many cases the section of the casing in the soft muck collapsed while the inspector was watching it, and water was forced in between the lock joints of the casing. In such cases another casing would be driven, and another, if necessary, until a shell was obtained which would withstand the earth pressure. Even when the No. 16 gage casing was used, the concrete which had completely filled the shell to the top would rise as much as $\frac{1}{2}$ in. over the top of the shell, indicating that there was still a tendency to collapse the shell. When it is considered that a cylinder is especially adapted to withstand pressures of this kind, it is seen that the lateral pressure on the pile must have been very great.

As stated in the above paragraph any shell that showed signs of collapsing was reinforced with another shell driven within the first. In this way a shell and pile were obtained satisfactory to both the architect and the building department.

Pile No. 2

Recently a new form of concrete pile was driven for the foundation of a church located at 29th and Quinn Sts. A heavy steel casing and core were driven to rock. This core fits inside of the casing, and is provided with a steel point at the lower end and an enlarged head at the upper. The point projects about 4 ft. below the bottom of the casing. The enlarged head fits over the top of the casing and transmits the blow from the hammer to the casing. After the rock was reached the core was removed and concrete dumped into the hole formed by the steel point. The core was then lowered, and used to ram the concrete. More concrete was dumped in and the ramming process continued until an enlarged base of the pile was formed. The casing was then filled with concrete to the top. When the casing was filled it was withdrawn from the ground.

As required by City Ordinance, test loads were placed on several piles. A platform 12x12 ft. was loaded with sand to twice the working load, and readings of the settlement taken with an engineer's level. In some cases there was as much as $6\frac{1}{2}$ in. settlement when the load of 10 tons had been on for 24 hr.

It was decided to investigate the cause of the failure. A pit was dug around the piles which had been tested, and the piles completely uncovered. These piles had been driven through about 14 ft. of an old fill, and then through about 9 ft. of medium soft clay. Directly under this clay was a smooth rock, the bed of an old quarry.

On uncovering this pile it was found that the shaft of the pile was in very good condition to about 4 ft. from the rock. At this point the pile was supposed to be formed into a large bulb or base. The base was formed all right, but the space between the base and the shaft had been squeezed into a core about 6 in. diameter. It was at this contracted portion that the pile had failed.

Although the pile had failed, the test showed that it could carry some load in spite of its contracted section. Because of the necessity for an early completion of the building it was decided to require the driving of a great many additional piles, so as to bring the load on each pile within safe limits. It seemed the only solution of a bad situation.

It was claimed that this type of pile was still in an experimental stage, and that the foreman on the job had

*Architectural Engineer, 1515 W. Leavitt St., Chicago, Ill.

not driven the piles in accordance with the instructions given him. To support this claim, three additional piles were driven on the job, by another superintendent, in exact conformity with the building ordinance. When the concrete was about five weeks old, one of the piles was tested with a load of 60 tons. The total settlement was 0.02 of a foot after the full load had been on for 18 hours. The total settlement allowed by the ordinance for this load would have been 0.05 of a foot. This last test was satisfactory, and in full compliance with the ordinance.

Pile No. 3

Perhaps the worst failure of a concrete pile which has occurred in Chicago was that of the foundations of a building located on 5th Ave., near Van Buren St. A single row of piles 16 in. in diameter was driven to support a line wall. These piles were formed by driving a straight shell of considerable thickness to the required depth. This pile was provided with a cast-iron shoe. Concrete was poured into the shell after the driving had ceased, and the shell was raised slightly. This was continued until the hole in the ground left by the shell was completely filled with concrete.

Signs of failure occurred when the building was in the early stages of construction. When the roof was on, these evidences of settling became so alarming that a new type of foundation was decided upon.

Concrete caissons were sunk beneath the party wall. As these caissons were sunk a careful record was made of the position and size of the concrete piles which were uncovered as the excavation for the well progressed. The condition in which the piles were found is given in Fig. 2.

The upper part of the drawing represents a plan of the piles which had been driven, and also the caissons which were sunk afterward. An elevation of four of the caissons is given showing the positions of the concrete piles with reference to the caissons. At various levels the positions of the piles in plan is also shown. The typical borings showing the character of the soil are given, drawn to the same scale as the rest of the plan.

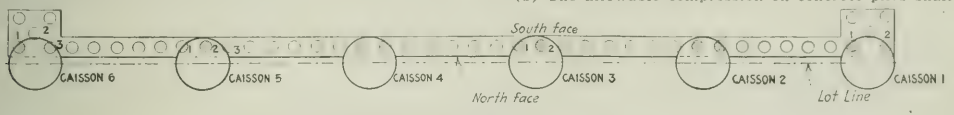
It was plainly evident why every sill in the building was out of level and badly cracked. It required no expert knowledge to see why the floors had tilted to ar alarming angle. Some of the piles had been squeezed into such a small section that there was very little left. In some cases the pile would be discontinuous, as there would be a space of 5 or 6 ft. where the dirt had replaced the concrete. None of the piles were straight or plumb in either direction, as can be seen in the elevations and plans at different levels.

City Ordinances

The City Ordinances in regard to concrete piles read as follows:

531. **Concrete Piles Allowable—Compression Tests—How Made.** (a) Where concrete piles are used, test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression on concrete piles shall not



PLAN OF CONCRETE PILES AND CAISSONS

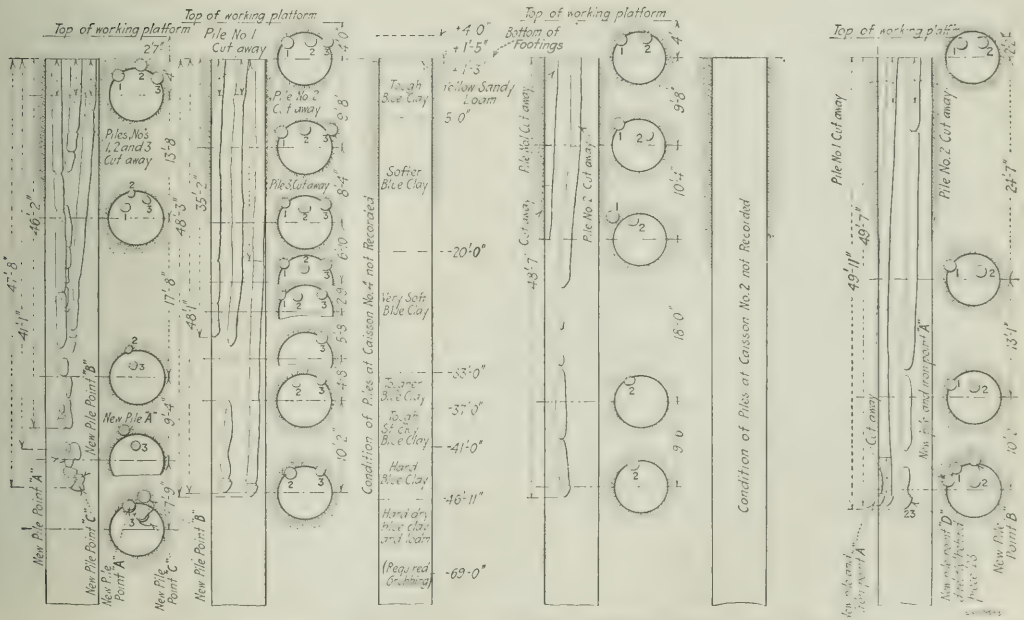


Fig. 2. Condition of Concrete Piles of Type 3 When Excavated in Caisson

exceed 400 lb. per sq.in at a section 6 ft. from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within 20 to 24 hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until 24 hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for 24 hours and the total settlement has not exceeded 0.01 in. multiplied by the test load in tons.

The Department of Buildings has taken the stand that any concrete pile which does not show good workmanship able for use in the City of Chicago.

[In accordance with a rule of long standing on ENGINEERING NEWS, proofs of the above contribution were submitted to the several concerns controlling the above mentioned types of concrete piles, and an opportunity was afforded them to present a statement regarding the above described tests in the same issue. We append the letters submitted in reply.—ED. ENG. NEWS.]

Sir—Referring to Pile No. 1 in Mr. Jensen's article, all engineers familiar with concrete piling will immediately recognize this as the Raymond pile. Since the work mentioned was done, the Raymond Concrete Pile Co. has developed a light sheet-steel shell, spirally reinforced by means of No. 1 to No. 3 hard-drawn wire, which is grooved into corrugations in the shell. This makes a remarkably strong form which is capable of resisting any back pressure encountered, and which remains in the ground.

H. R. MOYER,
Raymond Concrete Pile Co.
140 Cedar St., New York City.

Sir—Mr. Jensen's article calls for some discussion and comment, especially from those engineers who, like myself, have devoted a great part of their practice to the study and execution of concrete-pile foundations. This article is well calculated to create an erroneous impression regarding this general type of construction, because it devotes much space to unsuccessful tests, but dismisses successful ones (made under the same conditions and on the same site), with a few words. Also because it says nothing at all about the thousands of concrete-pile foundations in Chicago and elsewhere which have been installed with great economy and absolute satisfaction. Concrete-pile construction is too old, too economical and too thoroughly tried out for any question to arise as to its reliability or desirability. And let it here be affirmed that the percentage of concrete-pile failures in this country is as small as or smaller than that of any other form of engineering construction.

In speaking of Pile No. 2, Mr. Jensen should have stated that after the first test was made, the strength of the foundation was increased by the addition of 85 more piles. Work on the superstructure was then allowed to proceed by the City Department, and the building now stands practically complete. It should be mentioned in this connection that the company which installed these piles has completed, to the satisfaction of the owners and the engineers, this and every other foundation contract that it has ever undertaken.

The second tests made on this pile were not required by the Building Department, but were made by the contractors on their own initiative. When the load was taken off this pile, the top of it rose 0.01 ft., showing that the actual settlement was only 0.01 ft. The allowable settlement under this load is 0.06 ft.

Mr. Jensen's article is apt to create a false impression in his description of the pile which was excavated. This pile was one of the piles driven adjacent to the test pile proper. Its purpose was merely to see whether any damage would occur to the test pile itself upon the driving of an adjoining pile, and was not intended or expected to receive any load.

In conclusion it should be stated that Pile No. 2 is fully approved by the Building Department of Chicago for future work, provided it complies, as must all other types of pile construction, with the test-pile requirements as specified in Paragraph 531 of the Building Ordinance, as given at the end of Mr. Jensen's article.

HUNLEY ABBOTT,
McArthur Pile & Foundation Co.
11 Pine St., New York City.

The Engineering of Management The most difficult of all problems which beset the young engineer is the management of men. There are certain occupations in which a man can design and complete his work himself. The painter, the littérateur, the musician can labor in solitude, and their products are the fruit of their own brains. But with the managing engineer the case is quite different. He has largely to see through other persons' eyes, to hear through their ears, and to act through their hands. The day is not long enough for him to take personal cognizance of everything for which he is responsible. He must act to a great extent through subordinates. When they serve him well he gets the credit, and when they serve him ill he bears the blame.

It is therefore of immense importance to him, and the firm he represents, that he should, in the first place, select his assistants with skill; and, in the second, imbue them with a spirit of loyalty. Nothing conduces more to good service than the knowledge among the rank and file that the chief can take any job out of their hands and do it as well as or better than themselves.

In early years this state of affairs is quite possible, but later, as the province under a man's control widens, he can no longer be an adept in every department. Then his method of influencing those below him must be moral and intellectual rather than technical. He must be a student of character, able to discern both the strong and the weak parts of his assistants. He must encourage the diffident, stimulate the lethargic, and repress the erratic. There are no books that explain how this is to be done, and no professors who lecture upon the art. It can only be acquired by constant effort, and the effort must be begun in early years, long before the engineer has much opportunity of putting the lessons into practice.

A review of the careers of the great men of the world shows that they were always surrounded by capable assistants of their own choosing, and he who hopes to rise to a post of great responsibility must practice the study of character with assiduity while able to be on familiar terms with his fellows. As one grows older, a veil gathers between one and one's acquaintances. There is no longer the easy familiarity of earlier years. It is not possible to gaze into the depths of their dispositions with the ease of former days; opportunities of studying human nature are gradually curtailed. The foundations of the knowledge of character must be laid early in life.

[Extract from the presidential address of Sir A. Trevor Dawson to the Junior Institution of Engineers, London, England, Dec. 11, 1912.]

Chlorinating Plants, Croton Water Supply

By T. D. L. Coffin*

SYNOPSIS—Operating results of a temporary plant, which treated with hypochlorite of lime more than 100 billion gallons of Croton water for New York City in 1912, are given. A permanent hypochlorite or chlorinating plant, to treat the flow through both the old and the new Croton aqueducts, is described and fully illustrated. Brief descriptions are given of four other chlorination plants in the Croton drainage area: Three to treat the waters of tributaries of the Croton before it reaches the main supply and one to treat another tributary and a part of the sewage of the village of Brewster, N. Y.

In June, 1910, I. M. de Varona, chief engineer of the Department of Water Supply, Gas and Electricity of the City of New York, made trials of hypochlorite treatment in connection with the Croton water-supply. The results were so satisfactory that its use has been extended until the city now maintains five of these plants: one on the New Aqueduct at Pocantico, treating the entire supply from the Croton, and the other four upon various tributaries of the reservoirs.

The continuous treatment of the flow of the New Croton Aqueduct was commenced in June, 1911, the plant being located at Shaft No. 9, north of Tarrytown, N. Y., known as the Pocantico plant. It consists of a rough frame building which houses two cement-lined cypress tanks, 12 ft. in diameter and 6 ft. in height, and a constant-level feeding tank with adjustable orifice discharging through a manhole into the crown of the aqueduct. Within the aqueduct, there is suspended a wooden grid to secure a proper mixture of the chlorine solution and the flowing water. The operating floor is just above the solution tanks and in it are two screened mixing pits.

In operation, a drum of lime, weighing about 800 lb., is rolled into position over a pit and the contents washed out into the pit by a hose stream under pressure. Enough "bleach" is dissolved to treat the aqueduct flow for 12 hours. The tank is then filled with water and stirred to assure the thorough absorption of the chlorine. Four men operate the plant, two on the day shift, making solution, and one on each of the night shifts, maintaining a constant, uniform flow of the solution.

Experience has shown the desirable amount of chlorine to be between 0.40 and 0.65 p.p.m. (parts per million). The lower amount is used in warm weather and when Croton Lake is near the highwater line. The amount is

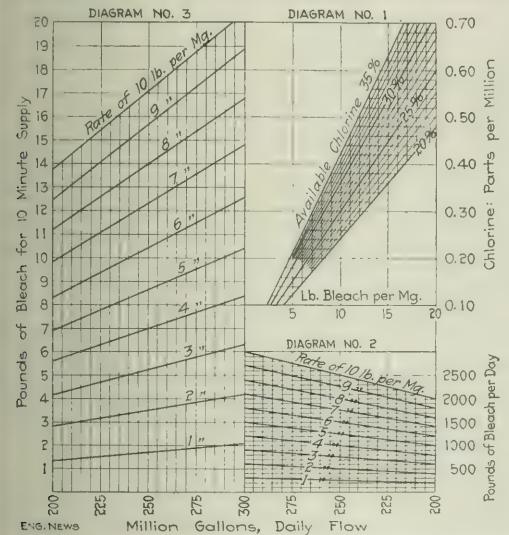


Fig. 1. Diagrams for Determining Amount of Hypochlorite of Lime (Bleach) To Be Added to Croton Water-Supply for Varying Percentages of Available Chlorine and Different Daily Rates of Water Flow

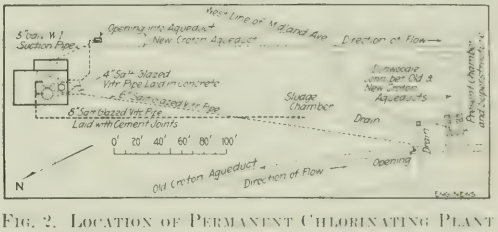


Fig. 2. Location of Permanent Chlorinating Plant for Croton Water-Supply, New York City

*Assistant Engineer, New York City Department of Water Supply, Gas and Electricity, Katonah, N. Y.

OPERATION OF THE POCANTICO CHLORINATING PLANT FOR THE TREATMENT OF THE CROTON WATER-SUPPLY IN 1912
(City of New York, Department of Water Supply, Gas and Electricity, Boroughs of Manhattan and the Bronx)

Month	Cost of labor and hauling	Million gallons treated	Amount of bleach used: Pounds	Parts per million gallons: High	Low	Av	Bacteria: Croton Lake: Agar—37°: Max*	Min.†	Av	0.10 c.c.	1.0 c.c.	10.0 c.c.	135th Street: Agar—37°: Max*	Min.†	Av.	0.10 c.c.	1.0 c.c.	10.0 c.c.
January	$559.00	7,630	97,412	0.50	0.40	0.47	105	17	45	19%	50%	96%	429	22	113	0%	6%	68%
February	452.50	8,684	88,282	0.52	0.15	0.44	888	10	249	18%	41%	77%	426	10	107	3%	28%	65%
March	519.00	9,085	95,956	0.51	0.39	0.47	884	65	353	21%	71%	96%	344	48	170	6%	61%	93%
April	449.00	8,173	95,152	0.51	0.23	0.47	338	35	112	0%	38%	56%	117	36	60	0%	14%	77%
May	403.00	8,430	100,668	0.48	0.46	0.47	182	20	59	0%	12%	67%	44	17	26	0%	0%	13%
June	344.00	7,713	95,688	0.48	0.45	0.46	104	12	41	0%	10%	47%	277	11	69	0%	0%	23%
July	486.00	8,941	102,672	0.47	0.46	0.46+	587	25	170	4%	26%	60%	367	22	91	0%	0%	16%
August	376.00	8,905	102,672	0.48	0.42	0.48	384	26	168	8%	19%	50%	231	38	134	3%	3%	22%
September	366.00	8,670	99,390	0.49	0.44	0.45	4480	31	1153	0%	25%	71%	480	21	136	0%	0%	43%
October	376.00	8,601	96,034	0.49	0.14	0.44	613	31	173	8%	29%	79%	78	16	39	0%	0%	39%
November	366.00	8,546	84,732	0.47	0.30	0.39	126	16	49	0%	22%	57%	39	10	20	0%	0%	23%
December	354.00	8,671	82,276	0.47	0.13	0.41	64	17	36	4%	12.5%	54%	21	6	14	0%	0%	24%
	$5050.50	102,049	1,140,904			0.45			217	8%	29%	71%			82	1%	9%	42%

*Average of 5 highest counts
†Average of 5 lowest counts

Cost of labor and hauling $5,050.50
Cost of chemical 16,628.68
$21,679.18

Cost per million gallons. $0.2124

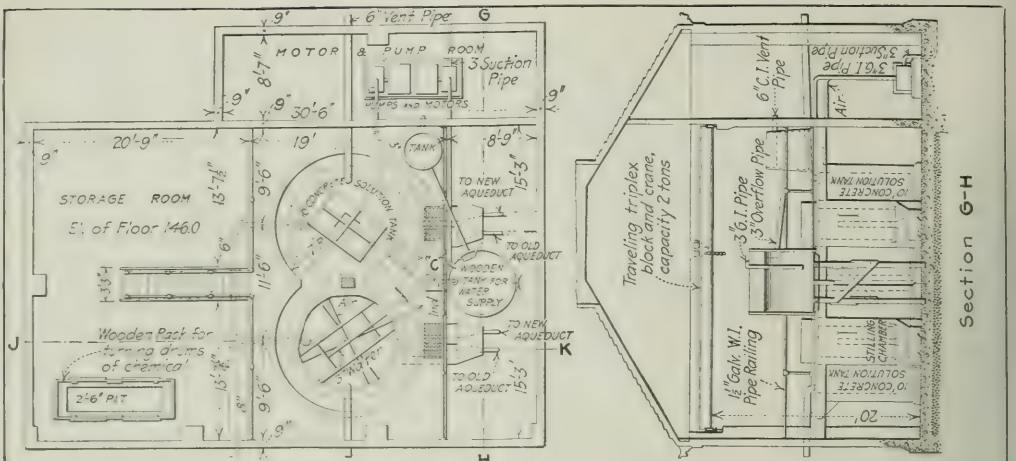
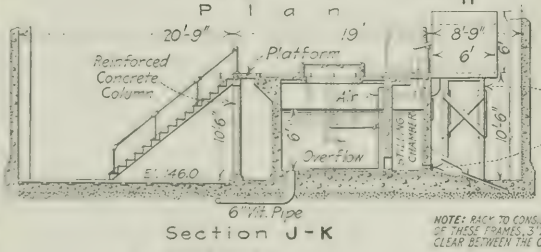
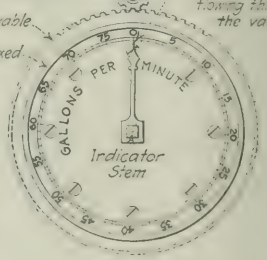
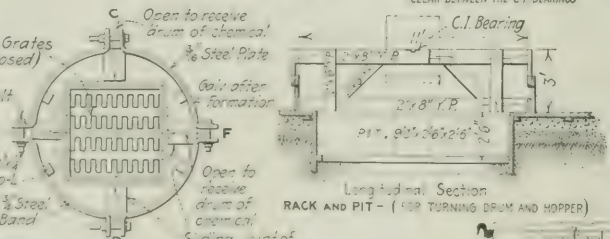
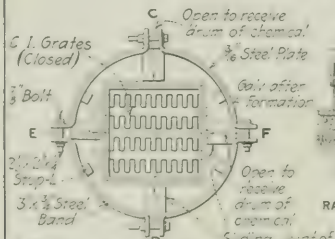


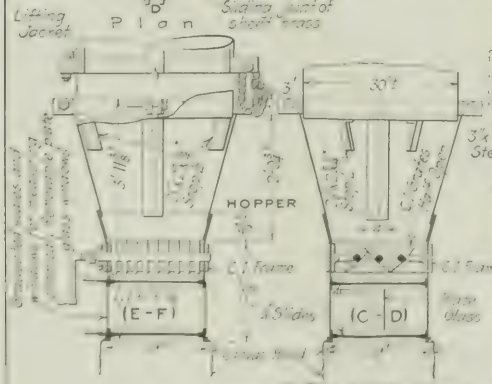
FIG. 3 - GENERAL PLAN AND SECTIONS

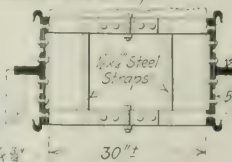


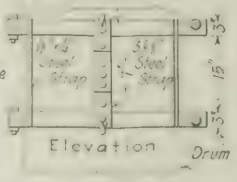


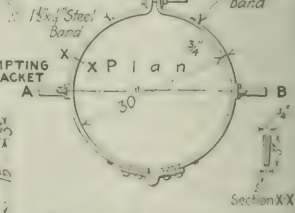












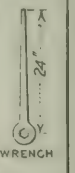


FIG. 4 - PLAN, SECTION AND DETAILS OF APPARATUS FOR EMPTYING BLEACH DRUMS

SOLUTION PLANT FOR TREATING CROTON WATER-SUPPLY WITH HYPOCHLORITE OF LIME

gradually increased as the storage in Croton Lake drops or the temperature of the water approaches freezing. The amount of "bleach" to be used daily is determined from a chart (Fig. 1), which shows that the daily amount of chemical is about 4000 lb. Where so much chemical is used, the chart shows the economy resulting from varying the charge of "bleach" in accordance with the amount of its available chlorine, as determined by laboratory analysis.

The Pocantico plant is to be superseded shortly by a more detailed plant now nearing completion at Dunwoodie, Yonkers, N. Y. At Dunwoodie, the old and the new aqueducts (Fig. 2) are near each other and near the surface, affording the only site where the water carried by both aqueducts may be treated from a single plant. This, together with the facts that electric current may be had here as a source of power and that a freight station is near-by, determined the location of the new plant at this place.

This plant is designed for a maximum capacity of 400,000,000 gal. per day and is to be operated, as is the one at Pocantico, with such auxiliary parts as are necessary to continue the plant in constant operation should

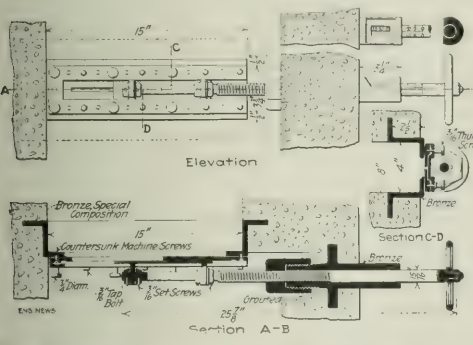


Fig. 5. Detail of Adjustable Orifice for Croton Hypochlorite Plant, New York Water-Supply

any part of one unit be undergoing repair, in which event the bleach will be dissolved at a fixed rate in a tank of solution maintained at a constant level, the water supplied and the solution discharged being identical in amount.

The general design of the Dunwoodie plant is shown by the plan and cross-sections, Fig. 3, while Figs. 4 to 6 show its details more fully. The main features are: apparatus for lifting and discharging the drums which contain the chloride of lime or "bleach"; two solution tanks, with dissolving cages and water jets, air-operated agitating pipes, and screened outlets; two solution-stilling chambers, provided with graduated discharge orifices; and water-supply tanks and various accessories. From the discharge orifices, pipe lines extend to connections with each aqueduct, where devices to be described later mix the solution with the water to be treated. These details will now be described.

To reduce to a minimum the escape of fumes, arrangements have been made whereby, after cutting the head out of a sheet-iron drum of bleach, its contents are not again exposed to the air. A metal lifting jacket (Fig. 4), which bolts about the drum, is provided with steel trunnions fitting into cast-iron bearing plates set in a wooden frame. By means of a two-ton crane, the jacketed drum is carried to the frame and rested with trunnions in the bearing plates. The top is then removed, a metal hopper clamped over the opened drum, and the drum revolved vertically. In this position, it is picked up by the crane and carried to the operating floor. The bottom of the hopper is formed by a cast-iron, hand-operated furnace grate, below which is a metal measuring box with gage. The operating floor forms the cover of each tank and is provided with an opening (Fig. 3) through which the desired amount of chemical may be passed from the measuring box into the solution screen, suspended within the tank just below the cover. The screen is made of steel structural shapes, galvanized after fabrication and covered with No. 11 bronze screening, ⅜-in. mesh. Immediately below the screen is a 3-in. galvanized-iron water pipe, perforated to throw the water upward against the bleach within the screen.

The solution tanks, two in number (Fig. 3), are of reinforced concrete, 10 ft. in diameter and 9 ft. high. Beside the solution screen and the water-supply pipe mentioned, there is, in the bottom of each tank, a grid of 2-in. galvanized, perforated wrought-iron pipe, through which air under pressure will be forced, thereby securing a thorough mixture of the solution.

Sludge will be removed from the tanks through a 6-in. salt-glazed tile pipe, terminating at the tank bottom in a bronze screw-cap.

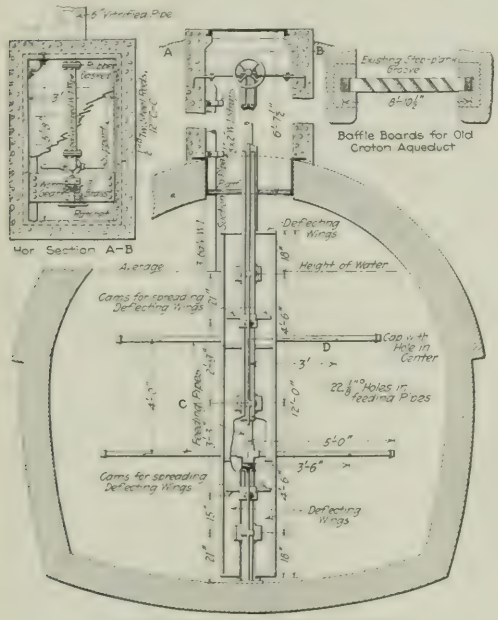
Each tank is provided with two bronze adjustable orifices (Fig. 5), one feeding the new and the other the old aqueduct. In order that the head upon these orifices may not fluctuate, due to the blowing of air through the solution, each orifice is set in a stilling chamber (Fig. 3), connected to the solution tank at its bottom by means of an opening covered with No. 16 bronze-wire screen of $\frac{3}{16}$-in. mesh.

Near the solution tanks are two elevated (Fig. 3) cypress tanks, into one of which water will be pumped from the aqueduct as a supply for the 3-in. pipe within the solution tanks. This water tank is provided with an overflow weir so placed that water is always delivered to the solution tank under a constant head of 7 ft. 9 in., the desired rate of flow being secured by an indicator valve graduated to read in gallons per minute. The second tank, receiving the overflow from the first, will afford the general water-supply for the plant.

The solution discharged from the regulating orifices will be carried to the aqueducts in 6-in. salt-glazed tile pipe, and at the old aqueduct will discharge through a 2-in. galvanized-iron perforated pipe extending vertically into the aqueduct. Below the point of application will be placed two wooden baffles (see plan, in Fig. 6) to deflect the flowing water and aid in securing a uniform mixture. The chlorine solution will be discharged into the new aqueduct (Fig. 6) by a perforated, 3-in. wrought-iron pipe, extending vertically into the aqueduct and equipped with four horizontal, perforated arms, so that the solution enters the flowing water from 22 orifices. In order that a most thorough mixture may be obtained immediately, a vertical-winged metal baffle is attached to the vertical solution pipe in the shape of a wedge. Each wing of this baffle is hinged so that, by means of cams actuated by a worm and hand-wheel from above, the spread of the baffle may be varied. By this means eddies

will be formed and the water flowing near the center of the aqueduct will be forced to the sides and the desired mixing secured.

The Dunwoodie plant will be housed in a reinforced-concrete building, having tool-picked exterior walls, relieved by smooth-dressed sills, lintels, corner blocks and cornice and surmounted by a red-tile roof and ventilating skylight. The building will be divided by a solid



Cross-Section of New Croton Aqueduct, Showing Feeding Device Assembled

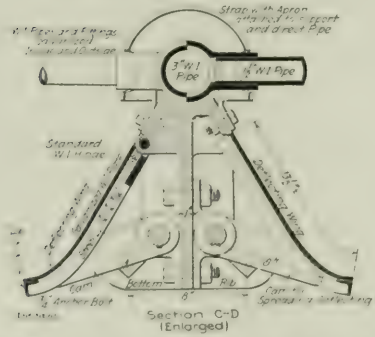


FIG. 6. DEVICES FOR ADMITTING AND MIXING CHEMICAL SOLUTIONS AT OLD AND NEW CROTON AQUEDUCTS OF NEW YORK WATER SUPPLY

concrete wall, into a machinery room, 8 ft. 7 in. by 30 ft. 6 in., containing the necessary pumps, motors, blowers and machinery to operate the station, and a storage and operating room, 30 ft. 6 in. by 18 ft. 6 in., with a clear height from floor to underside of crane of 20 ft. Of this space, the tanks and other apparatus require about one-half, the remainder being available for the storage of the "bleach." The contract for building this plant was given to L. J. Rice, at $13,720.

Within the Croton watershed, the Department of Water Supply maintains four chlorinating stations. The first one of these is on Kisco River, a tributary of Croton Lake, draining a populated district. Here it is found necessary to use between 1 and 2 p.p.m. of chlorine to produce satisfactory results. These amounts, in connection with those given for the Pocantico plant, indicate the effect of storage in reducing the organic content of Croton water. The maximum flood flow of the Kisco River, during the operation of this plant, has been 100,000,000 gal. per day.

At Brewster, N. Y., a chlorinating station has been equipped to take the place of the electrozone plant in treating a portion of the sewage of the Village of Brewster before delivering it to absorption beds, the change being made after the electrozone plant was destroyed by fire during the summer of 1911. The plant is similar to the one at Pocantico, except that it is used to chlorinate the flow of Tonetta Brook, a tributary flowing through the Village of Brewster, as well as to sterilize the village sewage. The stream flow may reach 50,000,000 gal. per day and the sewage flow 300,000 gal. daily. Sterile sewage effluents are secured by using about 15 p.p.m. and Tonetta Brook requires about the same amounts of chlorine as the Kisco River.

Two small plants, with a maximum capacity of 15,000,000 gal. a day, were completed during the past summer, one upon Katonah Brook, a tributary of Muscoot Reservoir, flowing through the Village of Katonah; the other at the outlet of Lake Glenida, a controlled natural lake whose watershed includes the Village of Carmel. These plants are duplicates in all essential parts and present no unusual features, other than the compact arrangement secured by the use of rectangular, reinforced-concrete tanks, the tops forming the operating floors. The plants have not been long enough in operation to state the amounts of chlorine required in treating these waters.

The Necessity for State Supervision of highway bridges is well illustrated by the following incident related by George H. Herrold, in a recent paper before the Civil Engineers' Society of St. Paul

The writer recently attended a bridge letting in an adjoining state. The experience is worthy of record, and replete with food for thought. Plans and proposals for ten reinforced-concrete bridges, with alternate plans for steel at four of the sites, were advertised for by the county commissioners. The specifications gave the span length, height and width of roadway, and called for a loading of 200 lb. per sq.ft., or a 20-ton road roller. Bidders were requested to visit the site of each bridge and submit a plan and a lump sum bid for the structure. On the appointed day, 15 bidders appeared at the county seat and submitted their plans and proposals before the hour of closing bids, 6 p.m. They were then informed that the bids would be opened next day. I do not wish to impugn for a moment the motive of these honest commissioners, but the visitors had the privilege of buying "eats, smokes and liquid refreshments" during the evening.

The next morning the bids were opened, approximately 125 plans were submitted to those five honest farmers, who, assisted by the county surveyor, proceeded to analyze the plans and tabulate the bids. It was finally decided to let the concrete bridges to a local cement street paver, and the steel bridges to a relative of one of the county officers. The commissioners evidently decided that, as they knew nothing about the relative value of the plans, they would take a chance on men whom they knew, regardless of other considerations. The lowest bidder was informed that they did not like his plans.

The bids ranged about as follows: A 24-ft. span reinforced-concrete bridge, $550 to $1228; a 40-ft. span, $835 to $2980; a 60-ft. span, $1175 to $3980. A number of the bidders submitted plans furnished by manufacturers of reinforcing. Some of the plans were excellent, and others were like the present-day millinery, fearfully and wonderfully designed. One bidder told me that a live load of 80 lb. per sq.ft. was good enough for designing any bridge. Another handed me his card, it read "John Doe, Manufacturer of Cement Blocks," and written across the card in ink, for this special occasion, "and Reinforced Concrete Bridge Engineer."

British Standards for Sewage Effluents

By W. L. Butcher*

The proposed standards for sewage effluents recently announced by the Royal Commission on Sewage Disposal and commented upon by Engineering News (see Dec. 19, 1912, p. 1159, and Jan. 9, 1913, pp. 76 and 79) are of great interest to sanitary engineers. Founded on exhaustive studies extending over many years they exhibit a rare use of practical "horse sense" reinforced by scientific facts. There may be differences of opinion as to their absolute value, but that they are founded and measured in the light of the best scientific knowledge of the present day, is unquestioned.

To American engineers the proposed standards seem quite stringent, and to those German sanitarians who maintain that fresh, swift moving, undiluted sewage is inoffensive if confined within proper channels, the standards must appear very rigid. It is but fair to say, however, that German sewages usually have to travel but short distances before entering large streams, whereas in England large cities and enormous industries are crowded together on small water courses. This only illustrates the impossibility of framing standards based on present scientific knowledge which will satisfy all conditions.

That they have intentionally set very rigid requirements appears to be recognized by the Commission, as it is said in their report that they realize that the application of any standard is in danger of becoming a leveling-down as well as a building-up process.

It is, nevertheless, of interest to examine, as far as such a thing is possible, what the requirements demanded would be if applied to American conditions. With regard to the so called "stringent standard" for works requiring the English "complete treatment"—settling, rapid filtration through sprinkling or contact beds and subsequent settlement of the effluent before discharge—American conditions have not as yet become such as to make this of much significance. It may be noted, however, that our largest works of the English character, those at Columbus, Ohio, judged by the last annual report of those works, would not measure up to the British standard.

The lower limit for discharge of sewage without complete treatment is placed at a dilution of 150 volumes, with the further requisite that the sewage shall not contain more than 6 parts per 100,000 of suspended matter, which latter the Commission states may be usually attained by chemical precipitation. As the flow of sewage from English communities is usually not much in excess of 30 gal. per capita per day, this standard may be restated, for comparative purposes, as being equivalent to about 7 cu.ft. per sec. per 1000 persons. Or still further, taking the average per capita flow of American sewage at 100 gal. this dilution factor, under American conditions, would become about 1 to 45.

For the discharge of ordinary settled sewage containing not over 15 parts per 100,000 of suspended matter, the Commission would require a dilution of 300 volumes, or reduced to similar American equivalents, 14 cu.ft. per sec. per 1000 persons, or 1 to 90.

In 1903, X. H. Goodnough, chief engineer of the Massachusetts State Board of Health, reported to the Committee on the Charles River Dam that, from an examination of the streams in Massachusetts, he was of the opinion that a nuisance never existed from the discharge of untreated sewage, when the flow was in excess of 6.5 ft. per sec. per 1000 persons contributing. The streams examined, moreover, were in general receiving unsettled sewage, so the suggested requirement of the Royal Commission is seen to be considerably more rigid than would be necessary to prevent a nuisance according to Massachusetts ideas. It should be explained, however, that the Commission, in fixing this limit, intended that there should be no "grey algæ growths in the streams, nor should there be injury to fish life."

The "legal dilution" in the Chicago drainage canal is fixed at 3.3 cu.ft. per sec. per 1000 persons, and recent reports show that nuisances plainly exist under these conditions, and further are probably largely caused by putrefying sludge banks, which emphasizes the great value of the low suspended matter in the effluent—6 parts and 15 parts per 100,000—imposed by the English standards.

The Commission makes rather an unsatisfactory, because highly empirical, attempt to determine what its standards would require in the way of dissolved oxygen content in the water, and arrives at the conclusion that the dissolved oxygen should never be allowed to fall below 4 c.c. per liter, which for fresh water at 65° F. would mean about 60%, and for average conditions as existing in New York Harbor, about 70% saturation. Many of the experts engaged by the New York Metropolitan Sewerage Commission to examine New York Harbor came to the conclusion that the waters would be satisfactory if the dissolved oxygen content were not allowed to fall below 50% saturation, and only one who, by the way, was an employee of the Royal Commission, thought that the limit should be placed at 70%. It is probably not too much to say that it would be extremely difficult to maintain the oxygen content at 70% saturation at all times in streams receiving appreciable amounts of crude sewage, excepting by the very efficient removal of suspended matter, as suggested.

With respect to New York Harbor and the Passaic Valley controversy, under the English standard, rigid as that is, it would probably be allowable to discharge the Passaic Valley sewage into the bay, without further treatment than settlement to reduce the suspended matter to 15 parts per 100,000.†

The economic value of such standards, if practical of enforcement, is illustrated by the two cases of Chicago and Pittsburgh. In the former, crude sewage is being discharged as by legal right up to a point far beyond that allowed by the English standard, while the Pennsylvania State Department of Health is attempting to force Pittsburgh to spend some $37,000,000 for purification works, according to estimates made by the city; although taking into account the local conditions at Pittsburgh, which the Commission emphasizes as always being necessary, the discharge of settled sewage would probably satisfy the standard.

*14 Beacon St., Boston, Mass

*See "Eng. News," Feb. 20, 1912, pp. 398, 412.—Ed.

†The standards under discussion apply to fresh waters. The Commission states that the principle which it has "recommended in regard to special standards for streams [i.e., standards formed to meet special local conditions] might usefully be applied to tidal waters where a standard is considered necessary"; but it still adheres to the conclusions of its fifth report, that "it is not practicable to lay down fixed rules as regards a standard effluent for tidal waters."—Ed.

A Triple-Plunger Artesian Well Pump

For pumping deep wells 8 in. or more in diameter, where steady flow, large capacity and high efficiency are required, together with absolute reliability of service, a novel form of triple plunger pump has been designed and put on the market by the Deane Steam Pump Co., of Holyoke, Mass.

The essential features of the apparatus are shown in Fig. 1. Three single-acting plungers operate in a cylinder, open at the lower end and with a discharge pipe attached to the closed upper end. The lowest plunger

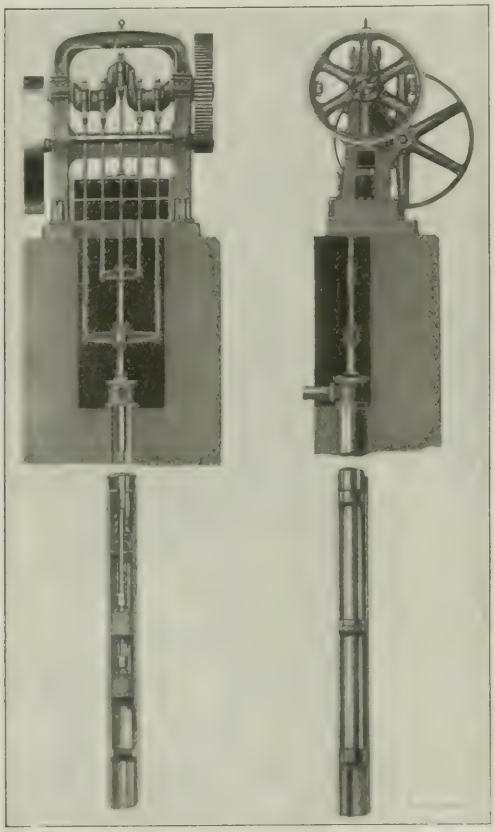


FIG. 1. FRONT AND SIDE ELEVATIONS OF THE TRIPLE PLUNGER ARTESIAN WELL PUMP
[illegible Deane Steam Pump Co., Holyoke, Mass., Makers]

is attached to the end of a solid piston rod, which operates within a hollow tube that serves as the rod of the middle plunger. This tube in turn operates within a second hollow tube to which is attached the upper plunger. The lowest plunger is driven direct from the crankshaft through a crosshead and the middle and upper plungers are attached to yokes, driven in the same way.

The plungers have valves like a common house pump, which open to allow water to flow upward, but close to prevent the flow of water downward, so that the plungers work only on their up-strokes and the plunger rods are subjected to tensile stresses only. The cranks driving the three plungers are set 120° apart on the crankpin circle so that the plungers act successively on the moving water column to give a continuous and almost uniform flow as shown in Fig. 2. The chart for the pump delivery is nearly as shown in Fig. 3. In other words, the same uniformity of flow is obtainable in this pump as in the ordinary triplex pump. The advantage of this in giving a uniform flow in the well tube of a deep well with a long water column, as well as in the delivery mains, are obvious to every engineer.

This enables the pump to be run at very much higher speed than would be possible with the ordinary single-plunger pump, and thus a large capacity is obtained with a comparatively small pump and a moderate diameter of the well casing.

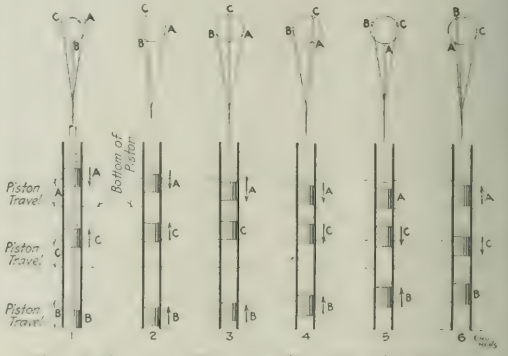


FIG. 2. DIAGRAM SHOWING RELATIVE ACTION OF PISTONS PLACED 120° APART

These pumps are made in sizes from 17 to 135 hp., to handle volumes between 140 and 2250 gal. per min. at



FIG. 3. PRESSURE-TIME CURVE SHOWING THE VARIATION OF PLUNGER DELIVERY FOR A TRIPLE PLUNGER PUMP

depths varying from 35 to 520 ft. The initial installation was made at the plant of a large irrigating company in California, and gave such satisfaction as to induce an order for three more pumps of the same type.

❖

Eight Large Wireless-telegraph Stations are to be built for the Marconi Wireless Telegraph Co. of America by the A. G. Weir Engineering Corporation, according to a recent announcement. Half of these will be sending and half receiving stations, they will be in working pairs, but with sending and receiving units placed 30 miles apart to prevent interference. One pair is to be at Oahu, Hawaii, one at Tamales Bay and Bolinas, Calif., and the third near Belmar, N. J., as noted in Engineering News June 13, 1912. The fourth will be in Eastern Massachusetts, although the site is not definitely announced. It is reported that these stations will permit transmission of messages across the Pacific Ocean, and increase the capacity of the present service between New York and London. The range is designed to be from 1000 to 6000 miles. The towers will be 400 to 450 ft. high. It is reported there being 12 at each station arranged in a semicircle to support the antennæ.

EDITORIALS

In the eyes of the law, a corporation is an artificial person, with most of the rights and some of the responsibilities of an individual. This corporate personality has been produced by a process of evolution extending over many years; and the limits to what it may become are still uncertain. f course there are such limits. It would not be practicable, for example, to invite a corporation out to dine and talk over old times. Nor could a corporation be a very active member of an athletic club. On the other hand a corporation may be an active member of some commercial, scientific or technical societies.

There are several organizations in the technical and industrial field whose membership is corporate exclusively. One or two others have both corporate and individual members, but employ different grade names to separate the corporate sheep from the human goats. Other societies, again, make no distinction between corporation and firm, or between firm and individual, but accept any and all of the three in equal standing as members.

The same general principles are now to be extended: inanimate objects are also dignified by the kind of vicarious individuality which hitherto has characterized the corporation. We find that a prominent international association names among its members "The Town Hall, Sydney, N. S. Wales"—truly a personification of wood and stone.

Incidentally, this weighty member has been listed recently under "Changes of Address." We are not informed whether The Town Hall has moved its place of residence from Melbourne to Sydney, or whether, perhaps, Sydney has moved from N. S. Wales to E. W. Wales, or what.

A few things are still left for the future to bring about. We may live to see the time when our friend The Town Hall will be elected a Vice-President of the association, or perhaps its Corresponding Secretary.

Arbitration between the Railways and the Locomotive Firemen

The decision of the committee of managers representing 54 Eastern railways to accept arbitration under the Erdman Law rather than risk a strike by their locomotive firemen, has received general public commendation. It was generally felt that since the firemen were willing to accept arbitration under the existing national law, even though defective, public opinion would hardly support the railways in standing out for arbitration in a form not expressly sanctioned by law.

The railways are unquestionably right, however, in the warning which they issue to the public that in these matters of railway wages the condition is becoming one which concerns the public even more than it does the railway companies. The firemen themselves, in their published statement, declared that "justice should be granted to the railways by the proper authorities in connection with the proper return on the capital invested, or necessity for increase in freight rates."

It needs only a little study of the records of operating expenses and earnings of the railway companies for the past two or three years to perceive that if the increase in wages granted to engineers and firemen is to be followed, as seems altogether likely, by increases to conductors, trainmen and other classes of organized employees, the public will have to choose between having the railway financial standing so injured that it will not be possible to raise capital for necessary improvements, or there must be a horizontal increase in freight and passenger rates. If rates must be raised, it will probably be freight rates rather than passenger fares, for state laws in many states prevent an increase in passenger fares beyond two cents per mile; and even where such a law does not stand in the way, the reduction in traffic which generally accompanies an increase in rates of fare goes far to offset the additional revenue to be obtained in this way.

We will probably have to be brought face to face with this situation, however, before the public will awaken to the necessity of so amending the Erdman Arbitration Act that the arbitrators may take cognizance of the interests of the public as well as the interests of the parties to the controversy.

Why American Engineers Should Know the German Language

The paper by Prof. Winslow Herschel, which appears on another page of this issue, is well worth the careful reading of all who are interested in the courses of study in our engineering schools. Prof. Herschel urges that in the present state of engineering science the knowledge of the German language is one of the most valuable acquirements an engineer can possess. Prof. Herschel speaks with a knowledge born of experience, having spent some years in Europe studying foreign practice in various special lines of engineering design.

In our opinion he puts the case none too strongly. It is true that we have in the past in this country to a certain extent made up for the deficiency of the knowledge of foreign languages possessed by American engineers by making use of the constant stream of engineers coming to this country from foreign lands and bringing with them familiarity with foreign languages. It will be recognized, of course, that this is no argument against the teaching of foreign languages in our own schools, but rather the reverse. Boys who are now studying in American engineering schools, if they are ambitious, ought to be desirous of becoming at least as valuable to their employers as their competitors who come to this country from Europe and are able to keep abreast of foreign engineering literature.

Some very eminent authorities have urged that the time spent on modern languages in the engineering schools is largely wasted because so few of the engineering students make use of these languages afterward. They acquire enough of the language to pass the exami-

nations and drop it as soon as they are out of college. This argument, however, detracts nothing from the value of a real working knowledge of a language. The fact may as well be faced that the best time to attain such a knowledge is not in the crowded years of the college course, nor during the high school course, but at a still earlier age. All experts on psychology agree that the proper time to acquire familiarity with a foreign language is during childhood. Of course, a foreign language taught in childhood should be taught by the natural method, and not by the absurd method of teaching the grammar of the language before the language is itself acquired, an educational monstrosity from which so many generations of children have suffered.

It will be evident from the above that in order to thoroughly reform engineering education, one must not deal with the college course alone or even with the college preparatory course, but with the whole subject of education from childhood. We believe, however, that just this very thing must be done if the distinguished committee represents the several engineering societies, which is investigating the subject of engineering education, is to fulfill its highest usefulness. We particularly commend Prof. Herschel's valuable paper to the careful consideration of this committee.

Where Will City Growth Stop?

Few questions are of deeper interest to the sociologist than the question where the limit will be reached to the growth of great cities. The question is important also to the engineer. All the work of the municipal engineer, for example, is based on the assumption that the growth of cities is to increase in the future as it has in the past. There are, however, certain forces at work, almost unnoticed now, which may work as profound changes as those which were wrought by the progress of invention in the 19th century.

In the last analysis, the reason why people have flocked to the city from the country for the better part of a century is because of economic conditions. Employment all the year round was to be had in the city, and at wages which were, on the whole, better than those prevailing in the agricultural districts. The development of transportation methods and the consequent reduction in cost of carriage has made it possible to carry raw materials from the country to the city to be there put into manufactured form and then carried back to the country and finally sold more cheaply than they could be produced in the country directly from the raw material.

The only means, then, by which the tide of population can be turned from the city back toward the country is some change in economic conditions. There are some signs that such a change is actually occurring. The increasing value of land in the congested districts of great cities has already driven out of the city all industries which require large amounts of land for their operation. The same thing operates to increase the cost of living and consequently the cost of doing business, since the employees of any concern must be paid at least a living wage if the industry is to continue prosperous.

A recent issue of the *Wall Street Journal* contains a significant editorial from which we quote as follows:

> Nothing has had more to do with the high cost of living than the monstrous growth of great cities. English newspapers boast about their city population. What is unquestionably an evil is a matter of rivalry between American cities. Every worker off the soil added to the urban population is an automatic addition to the intolerable burden of the cost of living.
>
> Here is a stupendous fact. London's taxable value has fallen $1,500,000 in the past year, and during the last ten years there has been a net emigration of 550,831 persons.
>
> What will our politicians, mortgaging posterity in all manner of municipal extravagance, say to this plain evidence that cities do not go on growing forever?
>
> There is no great difficulty in explaining a reduction in London's population and taxable value. Transportation is cheaper and better than it ever was before. Municipal experiments, of a benevolently expensive kind, have made the taxpayer's burden so heavy that he is only too glad to move out of the area of extravagance. If this is so in London, what must it be in New York? Our army of tax-eaters is increasing beyond the carrying capacity of taxpayers. The turn in our own population must come in the same way and for the same reason.
>
> Our people do not read history; and our politicians learn nothing from it. The population of Rome, as Mommsen has demonstrated from the water-tax receipts, was not less than 1,400,000 in the time of Hadrian. It is under 400,000 today, and, as a matter of fact, the population was taxed out of the city. Diocletian fixed the prices of some seven hundred commodities, in order to keep down prices, and one-fourth of the city was in receipt of pauper relief. No law could help. The city paid the price of reckless extravagance. Its taxable value dropped to a level where the taxpayer emigrated and abandoned his property.
>
> Here is the cure for extravagance, but it is a desperate one. London is paying the price, and there is no lack of patriotism in saying that she has probably received ten times the value for her money that New York can show, with our greatly heavier per capita cost of administration.

Granted that the above quotation represents an extreme view, it is a view nevertheless that deserves consideration. Statistics recently made public show that the cost of municipal government in New York City averages in the neighborhood of $25 per capita per annum. The enormous amount of borrowed money being spent on great public works in New York well nigh beggars comprehension. Less than a score of years ago, the proposal to spend fifty million dollars in building a rapid-transit subway system was rejected as being too large and expensive, and the project had to be reduced in size before it was accepted. In contrast, the city is now proposing to expend between three hundred and four hundred million dollars on additional rapid-transit subway lines. It has in fact already expended a considerable part of this amount. The cost of the city's new water-supply from the Catskills will probably approximate $200,000,000 before the work is finally completed. The commercial interests of the city are exerting great pressure to have $50,000,000 to $100,000,000 expended in the creation of municipal docks and freight-handling facilities for railways and steamships. Two railway companies are expending each over $100,000,000 in the improvement of freight and passenger terminal facilities in and about New York. The ultra-sanitarians, who take advantage of the popular apprehension regarding the dangers of germs, are at work upon schemes which if carried into effect will compel the city and its various suburban districts to spend hundreds of millions of dollars—it is impossible to say how much—upon long trunk sewers and sewage-disposal plants.

All these overwhelming demands will be eventually translated into taxes, which are laid as a burden upon everyone who owns or rents lands or buildings, and who either lives or does business in the great city. All these burdens eventually represent an economic handicap upon the city manufacturer compared with the manufacturer located in the country. Is it unreasonable to be-

lieve that there must and will come a time when this economic handicap will become great enough to turn the growth of population away from the great centers; if not to the country, at least toward the smaller cities?

Railway Terminals in Large Cities and the Latest Chicago Terminal Project

The railway-terminal problem in large cities is becoming of increasing importance to railways and municipalities, and to commercial interests as well. In several cities it is a very pressing problem, old terminal facilities being so congested that they are inconvenient and uneconomical. Even though the terminals may have been enlarged, these extensions have frequently been made without regard to a systematic improvement of conditions.

This applies to passenger and freight terminals alike; but while the improvement of the latter is generally by far the most important, agitation for the former is often more insistent due to the demands of the public and to the tendency of the railways to make rather excessive expenditures in this direction under the pressure of such demands.

The railway terminals of Chicago are probably the most extensive and complex in this country if not in the world. Numerous main-line railways (some 25 in number) approach the city from different directions, and their tracks cross each other at various points, making a very unsymmetrical arrangement. This is due, of course, to the fact that the lines were built at various times, each with regard to its own requirements and without any regard to a harmonious relation of the lines. This has resulted in making much land unavailable for development, and in interfering with traffic and with a proper development of the railway approaches to the city. It has resulted also in enormously expensive works for the elimination of highway grade crossings at some points and for elimination of railway grade crossings at other points. Further than this, it has resulted in a chaotic arrangement of freight yards and facilities in and around the city, each built with regard mainly to the needs and convenience of the owning line, or perhaps where it was at the moment able to obtain land, and without regard to its relations with other railways or with the needs of the city's freight traffic.

These conditions were discussed in our issue of May 9, 1912, and as far as the approach lines are concerned, the conditions seem beyond the possibility of any radical alteration. There is, however, a possibility of improvement by the concentration of interchange freight yards and the more extensive handling of interchange cars (or through cars) by belt lines, so as to keep this class of traffic outside of the city and out of the local freight yards. Such improvements have been proposed many times, and certain changes have been decided upon, but only slow progress is being made toward carrying them into effect.

Within the city, and especially within its congested business districts, the conditions are even worse. Large areas of valuable land are occupied as freight yards, coach yards, etc., and as the areas owned by different roads are contiguous, they form a great extent of waste land, the occupancy of which for such purposes prevents its own development, reduces the value of adjacent property, and obstructs the proper growth of the city. There is a very real need for improvement in this direction, but it cannot be effected on the broad basis that is necessary without coöperation on the part of the railways; and there is very little indication of any general improvement of the city freight-terminal system as a whole.

Referring to the passenger-terminal situation in Chicago, there are six widely separated passenger stations; and there are no lines of systematic or convenient communication between them (such as street-car lines or elevated railways), which is one of the weak points in the local transportation system. Numerous projects have been proposed for a centralization of passenger-station facilities, but under present conditions (noted more fully later) the advantage of this appears to be rather doubtful.

One of the first of these projects was that of Gen. Torrance (1892) for a union station to occupy land fronting on State and 12th Sts., which was then (and still is) occupied by freight tracks. Other projects were those of R. C. Sattley (1901) for a station at Harrison to 12th Sts. on the west side of the Chicago River, and of F. A. Delano (1905) for a series of individual stations fronting on 12th St., near the river.

The latest project is one advanced by Jarvis Hunt, a Chicago architect (who is architect of the new Kansas City union station), and which includes a centralization of passenger and freight facilities in one immense terminal fronting on State St., between 12th and 16th Sts., and extending west to a new and straightened channel of the Chicago River near Canal St. As in other projects, the site would occupy land already owned by the railways, and its utilization in this way would enable large areas of undeveloped land, now occupied by freight tracks and freight houses, to be released for more remunerative use. The plan has some good features (as had the others), but it is not a difficult matter to prepare a good project on paper. It is open to the objection of being so large as to be unwieldy in management and operation.

It may be questioned also whether it would be beneficial to combine all freight and passenger facilities in one immense terminal. The important questions to be considered in regard to a project of this kind are: First, the benefits to the city, the commercial interests, the railways and the public; second, the support which will be given by the railway companies (which, it is taken for granted, will have to foot the bills), and what assistance might be rendered by the city.

The fundamental question, however, is whether the railways will accept and support the project, and this feature of lack of railway support has been the main reason why none of the previous projects have been carried out. As to the passenger station, there are apparently no great advantages to be obtained. And as to the freight facilities, the present unfavorable conditions above outlined have been stated again and again, and it has been shown clearly that they are unfavorable to the railways, the commercial interests and the city, but the showing has been without practical effect. It would seem to be a rather hopeless task to endeavor to secure the definite approval and active support of any such project by the score of railway companies concerned.

Probably this condition influenced Mr. Delano (President of the Wabash R.R.) in his project for a series of

adjacent terminal stations, which could be built by the different roads as conditions might require. This would have required harmonious or concerted action in the location of sites, but would not have required consolidation of interests or of investments.

In addition to this difficulty of securing coöperation, Mr. Hunt's proposed plan would necessitate diversion of the Chicago River, and this is a matter for which consent of Congress and the War Department would have to be obtained.

The necessity of securing the support of the railways in the first place has been shown very forcibly in the case of the extensive car-interchange yards built at Chicago by an independent company nearly twelve years ago. The purpose was to relieve the city freight yards by doing all transfer or interchange of through cars at a yard outside the city. The yard was built and equipped in a very complete manner, and included electric operation of the switches by which cars were diverted from the gravity track to the several classification tracks, all these movements being controlled from a tower or bridge spanning the summit of the hump or gravity track. Such a plant was useless unless the coöperation of a number of railways in its use could be effected, and as this coöperation could not be secured, the yard has remained unused ever since it was built, except that some of its tracks were leased for storage. Last year, this yard was acquired by one of the freight belt lines, and may eventually be put into use.

In regard to Mr. Hunt's proposal for one central union passenger station at Chicago, the great union passenger stations at New York and Kansas City have been cited as indications of what is desirable and may be expected at Chicago. But the conditions at the two former places are entirely different from those at the last named place. Each of the two new terminal stations at New York is in the control of a single railway company. At Kansas City, there has long been one union station used by practically all of the railways entering that city, and the problem was the reconstruction of the station and terminal facilities on modern lines. But several years were consumed in harmonizing the various railway and other interests.

At Chicago, there are six large passenger stations which serve some 25 railways; one is used by one railway only, and the others are used by three to six railways each. Two of these stations are of modern construction (one of them opened as recently as 1911), plans have been adopted for the reconstruction of a third on a vast scale, land has been acquired for the reconstruction of a fourth, and the reconstruction of a fifth within a few years is probable. It has been suggested that the aggregate expenditures on these separate stations would exceed that required for a single central union station, but no figures have been given on which to base such an opinion. At any rate, the railways seem to take no interest in union station projects, and with many million dollars invested in individual stations, the railway companies have little incentive to [illegible] a new [illegible] central station [illegible] a terminal company which would [illegible] the practical abandonment of existing stations, except perhaps for some suburban and local service.

There would be no particular benefit to the railways or the public from the consolidation, and there would be some distinct disadvantages. There would be a little less inconvenience for through passengers transferring from one road to another, but Chicago is distinctly a terminal city. Not a single railway passes through it, but all terminate in it; and the number of through passengers who do not make any stay in the city is very small. Most of those who have to transfer from one station to another use cabs or railway transfer buses, and the convenience of others could be provided for simply and economically by arranging belt routes of street cars to connect all the stations.

A condition directly unfavorable to a project for such a single terminal station is that the construction of huge and costly passenger stations has been overdone. There is, it is true, a continual public demand for fine stations; but we have pointed out before that where the demand is largely on the basis of desiring a handsome building as an ornament to the city, the cost (above that for a reasonably commodious and handsome structure) should be borne by the city and not by the railway. In the latest great stations there has been a tendency to expend enormous sums on elaborate design and decoration, and luxurious fittings and accessories. Costly finish and fittings in a hotel or an office building may be a good investment, bringing returns by attracting patrons or tenants of a class able and willing to pay high rates or rents. But a railway cannot increase its rates on account of its investment in stations, and no passenger is influenced to travel on a particular railway because its station is beautifully finished in marble and bronze.

This is not saying that a station should not be of handsome design and finish. It does mean that there is no necessity for the excessively elaborate and enormously costly work which has become a feature of recent American terminal stations. Convenience, comfort and good train service or facilities are the important points to be considered by the railway in its relation to the traveling public. In this direction, our railways could benefit by a study of foreign practice, which might have a restricting influence upon the tendency to lavish and unnecessary display. Under present conditions of railway finance, the companies might well regulate their expenditures more closely as to the non-essentials and more liberally as to the essentials of railway service. We discussed this question at some length in our issue of Oct. 28, 1909, and pointed out at that time that these elaborate stations are really luxuries, since they yield no return on the investment and require a perpetual annual outlay for care, maintenance and taxes.

Almost every other outlay which a railway makes in improving its property is made with a view of receiving a return on the money invested in the shape of reduced cost of moving traffic or increased volume of traffic. But expenditure on passenger stations in excess of moderate and reasonable requirements is an investment which is a burden instead of a benefit to the property.

Incidentally, attention may be called to the common failure to utilize the areas of passenger terminals to produce revenue. In most cases, the station provides nothing but station accommodation. An exception to this is the La Salle Station at Chicago, which has an office building erected over the headhouse or station proper. On the other hand, the new Chicago & Northwestern Ry. station in that city, costing several million dollars, is a station and nothing more. Yet the railway company occupies an entire office building not many blocks distant, and could have accommodated all its departments in a building over the station, releasing the present office building.

But apart from questions of expense of land or buildings, it is entirely probable that there is a limit beyond which concentration of freight or passenger traffic in a terminal becomes unprofitable. Overcentralization is a condition and not a theory in some of our great industrial organizations. There are already, we believe, numerous railway freight yards so large that they have outgrown the capacity of the organization in charge to control the movement of cars through them and prevent delays.

To concentrate the enormous railway freight or passenger traffic of Chicago in a single great terminal would seem, on its face, a proposition far too large to admit of economical operation.

LETTERS TO THE EDITOR

Tests vs. Theory in Reinforced-Concrete Flat Slabs

Sir—An editorial article in ENGINEERING NEWS, Jan. 16, 1913, criticizes a paper given at the recent convention of the National Association of Cement Users, on the test of a reinforced-concrete flat-slab floor. The point in the criticism is that the failure of the author of the paper to give a detailed description of the amount of the steel reinforcing in the floor tested renders the paper so useless to the public that the editor does not think reprinting worth while. The editor, of course, concedes to the company making the test the right to withhold any part of the data, but questions the loftiness of its conception "of its duty toward the profession." So, of course, the writer concedes to the editor the right to reprint the paper or not, but questions the correctness of his verdict that the paper as given was worthless.

In the test referred to, measurements were taken which showed with the greatest accuracy obtained in any test yet made public the actual stress curves for both steel and concrete on five lines radiating from an interior column. Five points on the line of inflection around the column are thus located. The paper gives most of this information and the thickness of the slab, together with a summary of the stresses in steel and in concrete measured at more than 250 points in the floor panels loaded.

In a forthcoming bulletin of the University of Illinois Engineering Experiment station, "Tests of Reinforced-Concrete Buildings Under Load," of which the writer is joint author, the data given show that in general the concrete stresses rather than the steel stresses were critical. This has been shown in other tests also in which the writer has taken part. In some tests, the steel stresses have been very small as compared with the concrete stresses, but in no tests of which the writer knows can it be said that the principal concrete stresses were shown to be small in comparison with the steel stresses. With a given load on a floor of a given thickness the stress in the concrete will be nearly independent of the amount of steel used. With these facts in view, a knowledge of the stresses developed in the concrete with this load and this thickness of slab ought to be "worth while" to a designing engineer, though, of course, it would be still more valuable if he could know how much steel was used. The paper criticized would put at the disposal of the profession not only some details of design, but also information on the mechanics of the action of the flat-slab floor, which is of more general interest than knowing how much steel was used in the particular floor tested.

W. A. SLATER,
Engineering Experiment Station,
University of Illinois.

Urbana, Ill., Jan. 31, 1913.

[The test which we criticized was made on one floor with a fixed type of reinforcement. Obviously there could be no deduction from it that the stress in the concrete is not materially affected by the amount of steel, nor do we consider that assumption a fact of such common knowledge that the author of the paper could take for granted that the amount and distribution of the steel were immaterial to a determination of both stress and inflection points.—ED.]

Tests and Performance of Flat Slabs

Sir—Your editorial re "Flat Slab Floor Designs," Jan. 16, 1913, p. 123, was very apropos, and it placed no unnecessary emphasis upon the existing lack of knowledge as to actual stresses in this type of concrete construction.

We know the general superficial results from test loading such floors, but these very results leave us in doubt as to just what they portend, for seemingly slight and unimportant defects of today may mean practical failures after ten years of continuous service. With rare exceptions, there are few of these structures over five years old, and some of them are showing increasing defects as they age. The writer has designed some steel supports for special sections of floor in one such building which had been in service only two years.

We suppose that the circumferential cracks around the column heads, in the floor surface, indicate an excessive stress in the steel and concrete; and then, in the same type of design, the center portions of the panels develop "crows feet" cracks when there is much trucking over them with the consequent vibrations, and the surface finish breaks up and deteriorates rapidly adjacent to the cracks. Does anybody know how long such defective sections will continue safe for the "designed" traffic? In the latter instance, as there is no steel at all in the top of the slab to take care of the tensile stresses which must develop under the vibration, the result is readily understood.

Then again, in one building examined by the writer, temperature or load stresses have caused cracks, which allowed water to leak through, to develop in a 15-in. thick slab; these cracks occur approximately along the outer

edge of, and parallel to, the "belt" of reinforcement on the longer spans between columns, the longer span in this instance exceeding the shorter by almost 40%.

There was another interesting feature which developed in the completion of a building of flat-slab design and which the writer investigated. In this instance the typical slab was 9 in. thick and the column heads were depressed about 3 in. for an area 7 ft. square, the column centers being about 23 ft. in one direction and 21 ft. in the other. The finish floor-coats were being placed about one month after the slabs were completed, and these had been poured in warm weather and were set up good and hard. It was noted that the bonding, which was otherwise exceptionally good, would break and sometimes buckle up slightly on almost a straight line between columns. This break usually reached all the way up to the columns, but was more extensive in the half span space between columns; and while it developed in every instance on the 23-ft. span lines, it was far less extensive along the 21-ft. span lines.

This was at first attributed to various causes, but as new and additional precautions were taken as the successive floors were started and the results continued the same, it became necessary to find the real trouble. The damaged lines were taken up and relaid without any improvement in results. It was finally noted that whenever a wheelbarrow was being wheeled over the floor that there was a very perceptible vibration, and then as a result of careful observations and considerations the conclusion was finally reached that what might be termed the upward waves of vibration were responsible for all the trouble. It should be noted that there was no top steel in the slab to resist this motion and the bottom "belt" of steel ran at right angles to the line of upheaval. The columns were, of course, the only fixed points of support, and any lines of movement should naturally radiate between them. That the maximum lines of upheaval occurred on the square lines between the columns rather than the diagonal might seem peculiar, but as there was more dead weight, and the consequent deflection, to overcome upon the diagonal line, the results as actually noted were probably most logical. Has anybody reinforced against this action, or is it possible that it has never happened elsewhere?

Then again, there are instances of buildings, side by side practically, having flat-slab floors "guaranteed" by their "designers" to have safe load capacities, which happen to be exactly identical and which do not differ more than 5% in the amount of concrete involved per square foot of floor, but one will be reinforced with over 50% more steel than the other. This must indicate ignorance or, worse.

A. C. Nelson.

Brandeis Bldg., Omaha, Neb., Jan. 25, 1913.

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Investigation of Concrete Pavement in Chicago

Sir: In your issue of Sept. 26, 1912, p. 558, there appears an article by P. E. Green on "Concrete Pavements; Their Advantages and Disadvantages." This article has been reprinted in leaflet form and is being freely circulated by certain paving interests in an effort to prejudice property owners and others against concrete pavement. Such an article would have neither weight nor influence if it were not seemingly vouched for by ENGINEERING NEWS, which fact is being exploited on the leaflet.

The writer believes that you should be made acquainted with the facts regarding the single example of concrete pavement cited by Mr. Green in this article, that you might have the opportunity to protect the best interest of your publication and give these facts as wide publicity as you gave the original article.

Possibly Mr. Green was sincere in the views expressed in his article, but the use which has been made of it causes one to question whether or not he was entirely unprejudiced in this matter.

Mr. Green bases all his arguments and conclusions either on theory, or upon the observation principally of a single concrete pavement which no one would claim is representative. An impartial consideration of all the relevant facts regarding the construction of this particular pavement shows that Mr. Green's conclusions are wholly unwarranted.

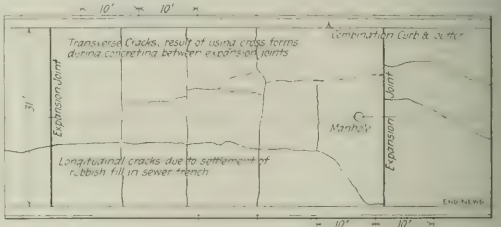


FIG. 1. PLAN OF PORTION OF OHIO ST., CHICAGO, SHOWING CRACKS IN CONCRETE PAVEMENT
(Submitted by Mr. Powell.)

Admittedly, the concrete pavement on East Ohio St., Chicago, is defective, and it is not the writer's intention to attempt to minimize these defects, but if any value is to be derived from directing attention to examples of unsatisfactory construction work, there also must be presented an analysis outlining truly and intelligently the real cause of its condition, so as to provide information whereby the same mistakes can be avoided in the future. Mr. Green has neglected to consider conditions directly responsible for the present unsatisfactory state of the Ohio St. concrete pavement, and this makes the whole article misleading.

The present condition of this pavement is not due to any "grave defects" or "characteristics" of concrete which make it an unsuitable material for a pavement, as the article referred to makes it appear. Had the pavement been laid on anything like a solid foundation, and according to present good practice, the cracks, which are the only objectionable feature of this pavement, would have been avoided.

Ohio St. from St. Clair east, a distance of 2200 ft., is a fill composed of manure, bed springs, wood, tin cans and all sorts of material which go to make up a city's rubbish dump. It is improbable that a fill composed of such material as that mentioned would ever become sufficiently compact so that it would be advisable to place over it a concrete pavement without reinforcement. Just prior to the laying of the pavement, 1800 ft. of this street was torn up in the center to a depth of 10 ft., for the construction of a sewer. Sheeting was not used the full depth of the trench, and as a consequence, the trench

was about 16 ft. wide at the surface. The excavated material alone was used for backfilling. On this account the paving contractor states he laid the pavement under protest and that he tried to compact this back fill at an expense to himself of several hundred dollars.

Under these conditions, settlement was bound to occur and at places the amount has been considerable, as is shown at one or two expansion joints by a difference in elevation of 0.08 ft. between the adjoining sections. There are large areas of this pavement which sound hollow under a passing steel-tired vehicle. From this it is obvious that settlement is the direct cause of the longitudinal cracks, yet the engineer "who witnessed this construction," would have us believe these cracks are due to the "susceptibility of concrete to temperature changes."

The transverse cracks shown in the accompanying cut (Fig. 1) occur at regular intervals of 10 to 15 ft., the entire length of the pavement. These cracks are not caused by placing the expansion joints too far apart, because in some places the distance between expansion joints is only 25 ft., but they mark the location of the forms or bulkheads placed across the street during concreting to provide a means of striking off the surface to conform to the crown of the pavement. After serving this purpose, these strips were removed and the space filled with concrete which made a joint across the pavement. The bond at this joint could not be expected to develop sufficient strength to withstand the stresses set up in the pavement by contraction and settlement, and therefore the transverse cracks developed along these lines of weakness. The present approved method of constructing such a pavement is to lay each section continuously between expansion joints without cross-forms, and this is the only satisfactory method to follow.

The only way in which a concrete pavement could have been laid on Ohio St. with successful results would have been to provide an adequate foundation and then, on account of the height of the fill and the width of the street, to have reinforced the pavements its entire width with steel-wire fabric and provided expansion joints every 25 ft. Although no "rapid abrasive action" has become evident at the expansion joints in this particular pavement, it is now considered the best practice to protect such joints by metal plates.

Mr. Green cites Ohio St. as an example of concrete pavements under a "moderate traffic (for example 150 vehicles for 24 hours)." A recent traffic census on this pavement, taken over a period of one week, showed an average of 526 vehicles per 12½-hour day. Of this number, 324 were teams, 31 motor trucks and 171 passenger automobiles. After four years under such heavy traffic, the wear on this pavement, aside from that occurring at some of the longitudinal cracks, is not excessive and the corrugations are responsible for most of that which has occurred. It is an accepted fact that a plain concrete pavement is not slippery, but if corrugations are used, it is self-evident that the wear on such a surface would naturally be more rapid while the corrugations were wearing off than afterward. The condition of this pavement does not justify Mr. Green's statements that concrete is not suitable for streets carrying traffic in excess of 200 vehicles per day.

The surface-wearing qualities of various kinds of pavements were tested recently by the city of Detroit, Mich., by a machine designed for the purpose. It consists of two large weighted metal wheels, one on each end of a horizontal shaft which revolves around a central vertical pivot. The shaft is slowly moved back and forth so that the wear from the wheels is distributed over a circular area 2 ft. wide, paved with the different materials to be tested. The shaft is also hinged so that the wheels will follow any inequalities worn in the surface of the pavement. Each wheel is equipped with five plungers faced with steel horseshoe caulks, mounted on a device which causes the caulks on each plate to strike the surface of the pavement a severe blow as the wheels revolve. The weighted wheels correspond to the tires of the vehicle and the caulks to the tread of the horses, thus producing practically the effect of street traffic.

In this test the machine was run at a speed of five miles per hour over various "permanent" pavements and the material which stood up the best under this punishment was the section of concrete laid under the specifications of the Wayne County Road Commission. The wear on the concrete was hardly perceptible.

To the writer the article in question shows a limited observation of concrete pavements and an unfamiliarity with present practice in their construction, otherwise such erroneous conclusions as the author formed would be impossible. During the last three years the writer has been closely identified with the investigation of over two million square yards of concrete pavement in various parts of the country and in no instance when proper materials and methods of construction were used, has the concrete failed to be entirely satisfactory.

C. M. Powell.
Assistant Engineer,
Universal Portland Cement Co.

Chicago, Ill., Jan. 10, 1913.

[It should be unnecessary to remark that Engineering News did not "vouch for" Mr. Green's facts or deductions any more than it does for Mr. Powell's. The reprints noted above were made by our job printing department as a matter of routine business.

Mr. Powell's letter was submitted to Mr. Green and has brought forth the following reply.—Ed.]

Sir—The various points made by Mr. Powell will be discussed briefly. At the start it should be stated that the writer is not opposed to concrete pavements in their proper place. He maintains, however, that city streets, with roadways over 18 ft. wide and carrying any considerable city traffic, are not the proper place for them.

The statement that the article in question has been reprinted and incorporated in leaflet form was news to the writer. Some months ago a request for the permission to republish was received and the writer referred the inquirer to Engineering News, with the statement that he had no further interest in the matter, having disposed of the article in question to that journal.

The personal criticisms of the writer's experience and motives may be passed over with the statement that the writer has personally supervised the construction of some $6,000,000 worth of street pavements in his professional career and therefore is of the opinion that he is entirely competent to judge of such matters.

Mr. Powell has taken the photograph showing an example mentioned in the article and made a very eloquent explanation of why the pavement failed. In his explanation he has made many misstatements which may be taken up in detail.

The statement that the ground was an unsuitable fill is incorrect. The pavement was laid on a first-class, solid foundation of sand, there being practically no rubbish on this site. This statement is made not only from the personal knowledge of the writer, but such observation has been confirmed by the engineer in charge of sewer construction for the city of Chicago, who states that the excavation for the sewer was practically all clear and very wet sand. This street is located in what is called Streatorville, named after Captain Streator, and is largely made land formed from washings of sand from Lake Michigan. The district as a whole was used as a dumping ground for many years, but as stated before, on this particular street there was very little rubbish. The sewer department of the city of Chicago also states that particular care was taken to backfill thoroughly the sewer trench.

In the same year that the pavement was laid a 2-ft. sewer was constructed in Ohio St. from Fairbanks Court to Lake Shore Drive, a distance of 1565 ft., not 1800 as stated in Mr. Powell's letter. The part shown in the published photograph accompanying the writer's original article, was west of this sewer construction some 500 ft., and therefore not at all affected by the construction of the sewer. In fact the west 600 ft., which sustains probably the heaviest traffic on the street, is in the worst condition by far. The east 1600 ft. is badly cracked in every direction, but this, however, is certainly not the fault of the sewer construction. There is absolutely no sign of settlement either on the streets or on the adjoining curb. Such unevenness as does occur (which is noted as being 0.08 ft. between adjoining sections) is undoubtdition has arisen, not because of settlement of a sewer pavement above the sub-grade. This phenomenon is evident not only on the section in which the sewer was laid, but on sections of which none was constructed or only cutpipe due to extension and construction. There are indeed large sections of this pavement which sound hollow under a passing steel-tired vehicle, but this conwhere the sewer construction could have no effect.

The writer does not believe the many transverse and longitudinal cracks shown in Fig. 1 are the result of the trench, but because expansion has bowed or raised the use of the forms placed across the pavement during concreting. They are entirely too irregular and have too much of a wandering character to be accounted for in such a manner. The explanation is not plausible and inadequately accounts for the pavement's condition.



Fig. 2. 21st Place, West from 11st Ave.



Fig. 3. Harvard St., West of Kedzie Ave.



Fig. 4. Harvard St., West of Kedzie Ave.

Figs. 2-4. Various Concrete Pavements in Chicago
(submitted by Mr. Green.)

No statement was made in the article as to the amount of traffic on Ohio St., though Mr. Powell in his letter intimates that the writer stated that there were 150 vehicles in 24 hr. and quotes a recent census to the effect that there were 324 teams over this street in a 12½-hr. day, exclusive of automobiles. Automobiles may be

eliminated from the question, as their rubber tires have little or no effect on a concrete pavement. This was so stated in the writer's article.

In regard to the amount of traffic, the writer is frankly surprised and somewhat skeptical, but he has no means of disproving it at this time. Ohio St. is largely lined by vacant property. At the extreme east and west ends, and at intervals, there are some large business houses. But though the writer has been over the street many times, he never saw evidences of this much traffic. However, in any case, 324 vehicles is but a light traffic on a business street. As a comparison, Lincoln Ave., in Chicago, which is known as a secondary business street of the North Side, has, in the vicinity of Belmont Ave., an average traffic in 12 hr. of about 1800 vehicles, exclusive of street cars, while in streets of heavy traffic, such as Clark St., in the Loop District, the vehicular traffic runs as high as 10,000 in 12 hr.

The writer has examined practically all the concrete pavements in Chicago exclusive of alleys, and these examinations have been made at irregular intervals covering the past five years. Practically all of them, whether the traffic is light or heavy, are in bad condition after they have had three years of use, and this condition is due, first, to cracking and, second, to abrasive action, which is apparent after the cracks develop. As an example may be cited what is called the Stock Yard pavement included in the Union Stock Yards in Chicago, which is in horrible condition. This was laid by private contract in 1908. The same is true of a concrete loading areaway and driveway in front of the Western Packing & Provision Co.'s warehouse in the same district. Twenty-second St., from 41st Ave. to 42d Ave., a street of moderate traffic, is in frightful condition. Twenty-first Place, west from 41st Ave., and practically a dead-end street, is also in bad condition and getting worse. The traffic is exceedingly light. Fig. 2 shows this. Figs. 3-4 show the condition of concrete pavements in front of the Sears, Roebuck & Co. plant on Harvard St., west of Kedzie Ave. These streets are in exceedingly bad condition and are being constantly repaired. The traffic is heavy. The corrugations have been worn almost smooth and the repairs now occupy more space than the original pavement and in some places repairs have been made several times.

In some of the above streets sewers were laid but a short time before the pavement was constructed, and in some the sewer was laid several years prior to the pavement construction. There is little to choose at this time between them. On 21st St., from 41st Ave. to 42d Ave., a street of very light traffic, the sewer was laid the previous year. This pavement in places shows signs of settlement, but is the only one that does. However, the street itself is badly cracked far outside the lines of settlement. Ontario St., from St. Clair to Lake Shore Drive, the next street north of Ohio, was paved with concrete in 1909 and 1910, and in part of the street a sewer was laid in 1908. The street is badly cracked. The traffic is light. Emerald Ave., between 73d and 75th, paved with concrete in 1908; Union Ave., from 73d to 75th, paved with concrete in 1909; Lowe Ave., from 73d to 75th, paved in 1911, are all very badly cracked. Schulze Ave., from 113th to 115th, paved with concrete in 1905, is in horrible condition. The traffic is heavy.

On Randolph St., on the west approach to the bridge over the South Branch of the Chicago River, a section of concrete pavement was laid in 1904 in front of Butler Brothers' warehouse. It replaced granite block and it has been stated that it was guaranteed for five years. In 1909, at the end of the guaranty period, what remained of it was taken up and granite block substituted for it. The traffic is very heavy, this stretch being but a short distance from the Loop District. During its service it was constantly being worn into large holes and as constantly repaired.

In the letter, comment is made on the new testing machine advocated by the city of Detroit. The writer saw this machine in the recent Cement Show in Chicago. He saw very carefully laid concrete slabs compared to very carelessly laid creosoted-wood block and brick pavements to the confusion of the latter. The test was absolutely childish. Any machine which by test produces results that are contrary to hard experience, simply brings ridicule on scientific observation and theory. The absurdity of a concrete pavement outwearing a first-class granite-block pavement needs no comment. The writer would suggest that blocks of concrete in the form and size of granite blocks be subjected to a rattler test and the result published.

Frequent mention is made of the results obtained by the Wayne County Road Commission of Wayne County, Michigan. The results obtained in this county on country roads are excellent. The oldest road is only four years old and according to the statement of one of the County Commissioners, is badly cracked. However, this commissioner states that this cracking has been largely overcome. The writer is inclined to think that his statement is correct. These roads have an average width of about 16 ft., and expansion joints placed every 25 ft., and they are *country* roads. It will be noted that the writer in his article stated that he believed on a country road, where the value of the abutting property would not be affected by cracking and where the traffic, even when called heavy for a country road, is light in comparison with a heavy city traffic, concrete might be entirely suitable.

One of the strong points made by the writer in his article was that any pavement which by reason of its character developed unsightly cracks in every direction was a positive detriment to the abutting property, as it would undoubtedly reduce its value.

The writer has examined concrete pavements in many cities and invariably has found that when the pavements are two or three years old, they are badly cracked. Examples of this cracking may be found in Gary, Ind., and Mason City, Iowa, both of which cities have in their time been advertised widely as to their beautiful concrete pavements. Very little is heard of these pavements now. In conclusion the writer might state that at a special meeting for the discussion of concrete pavements in the rooms of the Western Society of Engineers, one of the County Commissioners of Wayne County, Mich., who addressed the meeting, advised municipalities to go slow in putting in concrete pavements on city streets, as their development had not yet demonstrated that they would be satisfactory under such condition.

A very able paper on concrete expansion and contraction was presented by Logan Waller Page, Director of the U. S. Office of Public Roads, before the Ohio Engineering Society in 1912, and published in its proceed-

ings. It would be well for all interested in the subject to read this article.

P. E. GREEN.

17 N. La Salle St., Chicago, Feb. 4, 1913.

Concerning the Efficiency Society

Sir—I have just had called to my attention your editorial on the Efficiency Society in your issue of Feb. 6, and have been interested in what you conceive to be the field of the Efficiency Engineer.

For instance, you state that you see no necessity for the establishment of a new society of this kind so far as efficiency in relation to engineering work is concerned, and give as your reason that a special section of the American Society of Mechanical Engineers has been organized to devote itself to the so called Science of Management, and that this seems to fill all the necessary requirements for the mechanical engineers at least.

Let me state, in the first place, that there is no special section of the American Society of Mechanical Engineers such as that which you designate, but that before the Efficiency Society was started an effort on the part of certain of the members of the American Society of Mechanical Engineers was directed toward the starting of such a Section, and it aborted because it was decided by the Council of that Society that such service as efficiency engineers supply was not mechanical engineering.

There is, however, a Committee of the American Society of Mechanical Engineers which devotes itself to the subject of administration, and confines itself to a consideration of the subjects involved in machine-shop management, all of which is very proper for a Society of Mechanical Engineers; but the subjects of business promotion, of business finance, of organizing the forces involved in a business enterprise, of credits, of the collection and disbursal of funds, of advertising, or selling, of purchasing, of the principles of management, of cost accounting, of so called welfare work, of employment, of the medical supervision of the employee, of profit sharing, of systems of wage payment, of pensions of beneficial organizations, of accident insurance—these are not mechanical engineering, but are common subjects of interest to people in all lines of business.

In this city alone there are some 700 factories in which engineers may profitably be managers, but the 27,000 involving the cloak makers, the white goods manufacturers, and the hundreds of other industries which do not know an engineer in their organization—these involve the factories in which the members of the Efficiency Society are interested.

You quote at some length one paper on "Scientific Selection and Assignment of Men in the Creation of an Organization," and say that it seems well nigh unbelievable that it should find a place in the proceedings of a so called "scientific society" of the present day.

I do not know who calls the Efficiency Society a scientific society. I am sure it has never claimed to be [illegible], but I can state that the author of the paper referred to is in charge of the selection of the employees of one of the largest manufacturing concerns in this country, now being reorganized by an efficiency engineer who is a member of both the American Society of Mechanical Engineers and the Efficiency Society, and has been selecting employees under the system outlined in that paper at the rate of over three hundred per month for a considerable period of time, and after the paper was widely quoted in the press throughout the country and was distributed to the membership of the Efficiency Society, orders have been coming in for copies in lots of 500 and 1000 for distribution among the employing heads of the largest concerns in the country.

The author of your editorial, however, stamps the standard of your paper in not quoting the papers on Organization and Management which were read by members of the American Society of Mechanical Engineers, of which he claims to be an exponent, but selects this one paper for full exploitation in your issue, because, as he says, it was heralded in large headlines by the daily papers, which notoriously are given to selecting the most sensational features of an occasion in order to satisfy their readers.

H. F. J. PORTER,
Secretary, Efficiency Society.

29 West 39th St., New York City,
Feb. 14, 1913.

The Status of the Engineer

Sir—I have read your recent comments on the "Status of the Engineer" and agree with Mr. Hazlehurst, who states in his letter, in your issue of Jan. 23, that the trouble with engineers as a body is (1) lack of homogeneity and team work, (2) little regard for ethics, and (3) a very decided tendency toward commercialism in service. May I state as a fourth trouble, the posing of so many men as engineers who are absolutely unworthy of bearing the name and unfitted to carry the responsibilities that fall on one practicing as an engineer.

The general public regard the engineer only as an occasional necessity and often seem to prefer their own ideas and judgment even on technical matters, rather than those of a man trained to handle such matters. Too little importance is placed on the engineer in the settlement of important public questions.

In my opinion the remedy is this: The engineers as a body must come together, demand recognition, and require that only those be allowed to practice the profession who are able to pass a state examination. Let this examination be agreed upon by a board of competent engineers of reputation. The old objection arises in some minds that many good men might be weeded out. This, I think, would not happen, for any able engineer, though possibly not able to answer all the theoretical questions as completely correct as a recent graduate, still would be able to show any reasonable board of examiners in his own way that he knew his work. Should there be a feeling that there would be chance of too many raw graduates passing this examination while seasoned men failed, let the examination be so arranged as to make it necessary for a man to have had field as well as college or other training to secure the right to practice.

These requirements would be no more than are required in the other "professions." The word engineer has become so general that the opportunity to practice seems to depend on how much a man could induce another to believe that he knew, rather than what he really knew. Opportunity to practice depends so much on influence that the time is not far distant when the profession of engineering will cease to be recognized as a profession

and become merely, as Mr. Whinery has said, "one of the valuable commercial assets of business organization."

Then, before it becomes too late and before our profession becomes anomalous, let us demand that every man who practices the profession of engineering be required to furnish proof of his ability to do so, and of his right to good standing in his profession.

D. S. PERRY.

Leesburg, Fla., Jan. 27, 1913.

The Present Status of the Engineer

Sir—The recent articles in ENGINEERING NEWS upon the status of the profession make very interesting reading, and those who have devoted their time and study to the questions involved are rendering a distinct service to engineers everywhere.

This matter has been gradually fermenting. For years there have been read, at the various engineering society meetings, thoughtful papers on such subjects as "Compensation for Engineers," "A Recommended Scale of Prices for Engineering Services," "Why are Engineers So Poorly Compensated." Many questions of professional ethics have been discussed and various committees have been appointed to frame codes. Attempts have been made to secure legislation restricting the practice of engineering to those who have been found qualified by some board, but in only a very few instances have such attempts been rewarded with any great measure of success. All these efforts are praiseworthy, but it is difficult to see how they have improved the status of any considerable body of engineers, either as to their compensation, the dignity of their calling, or their professional, business or social relations. Committees may fix scales of prices for engineering services, but only those who are in private professional practice are interested in them. Moreover, rates which are reasonable for certain services in Chicago are unreasonable in the average town or city 100 miles away and can not be maintained there.

Committees have resolved that salaries paid to engineers are too small and that they should demand more for their services. This interests another class of engineers, which includes many grades, and these, except perhaps in the higher salaried positions, are the ones who, if they were as earnestly striving to advance their own interests as most classes of people are at the present day, would get together and form associations, similar to labor unions, and demand better pay. They are prevented by a false sense of the dignity of a profession to which the majority can hardly be said to belong, as will be more fully set forth below.

Likewise, several codes of ethics have been carefully worked out and submitted to the more or less interested members of local and national organizations and to the fraternity as a whole. They are all good and will have a general good effect. Unfortunately such codes adopted by engineering societies so far have only been in the nature of recommended practice. There has been no attempt to enforce any of their provisions, as is done in the case of the lawyers, the doctors and the ministers. The only punishment that can well be inflicted is expulsion from some more or less restricted organization, and so far that has not been attempted, it is believed.

The expulsion of a member of even one of the great national engineering organizations would not have the effect of practically putting a man out of practice, as is the case in the legal, medical and clerical professions. Indeed in a great many cases it might not injure an engineer at all in the eyes of his clients.

If, for instance, the American Society of Civil Engineers, with headquarters in New York, most of its meetings held in that city, and with the majority of its rigidly selected membership residing in that vicinity, should discipline a member residing in Kalamazoo, Mich., who is popular with his clients, it might be a question which would suffer most in local prestige—the Society or the member from Kalamazoo. All this is not meant to discourage the adoption of codes of ethics, but to point out their limitations.

It is hard to induce legislators to pass laws restricting the practice of engineering. Many of them condemn such laws as prohibiting free opportunity, and therefore contrary to the American spirit. They may have had very little contact or acquaintance with engineers, and consider that if a man wants line and grade stakes set for a new building, or a system of farm drain tile laid out, he should be privileged to employ John Jones who, he knows, has never had a technical-school education, but who has been performing such services satisfactorily for his neighbors. Other legislators think they see an attempt at monopoly, of benefit only to those who are pressing for the legislation. And moreover any such legislation must have its inequalities and injustices, even though very careful provisions are made toward avoiding them.

However, it would seem that in legislation lies the only hope for placing of the profession of engineering upon its proper plane, and establishing it in the eyes of the people upon a level with the other learned professions. But we need to get down to basic conditions, and see things if possible from an outside viewpoint. It is best to go afield of engineering, for the point of view of the average engineer is sometimes thought to be not very broad, for the reason that his training and habits of thought are along mathematical lines.

Let us examine briefly conditions inside the three leading professions, so called.

Of these *the medical group* is perhaps the most thoroughly educated and its standing in the community, as a profession in the best sense of the word, is perhaps the highest. Nearly all doctors are good citizens and are looked up to as leaders in the community. They have a well recognized and admirable code of ethics.

The clergy have all degrees of education, from the highest to nearly the lowest, depending largely upon the requirements of the different denominations and locations. But, as a rule, the poorly educated clergyman finds himself so placed as to be as efficient among the people he serves as is the more educated one in his place. Owing to the nature of their calling these men are almost universally respected—although many of them have little part in the life of the community, at least beyond that portion of it which attends their own church. The layman, perhaps, observes no strong system of professional ethics among the churchmen, as they are naturally governed by the high system of ethics and morals which they are trying to impress upon the world at large. But we all can recall cases of effective discipline, both formal and informal, following conduct inconsistent with this high calling.

The legal profession is suffering from lack of education in many of its members, and the low standards of admission to the bar in many states, together with too much pernicious political activity, and other causes. Consequently, as a whole, this profession is not in as good repute as the others. There are great temptations to use an intimate knowledge of the technicalities of the statutes to circumvent the true spirit of the law. Such codes of ethics as the profession has do not strike at this and other acts which offend the moral sense of the people. Consequently, there has grown up a feeling of more or less distrust of the whole profession, and which is well summed up in such familiar expressions as, "A man does not go to law to get justice, but to get—what he can." This is not as it should be, and is somewhat enlarged upon here to show that this one of the three leading and longest established professions has as serious problems confronting it as has the engineering profession.

Looking out over the engineering field, conditions appear to be chaotic. In spite of all the efforts mentioned above, it seems most difficult to raise the standards of practice, the rates of compensation or the standing of engineers among their fellow men. It appears to the writer that a broader and really more sensible study should be made of the possible attack on this problem.

Let us compare the practice of engineering with that of medicine. Not everyone who practices medicine is a doctor, entitled to write "M. D." after his name, with all the learning, the skill, the governmental supervision that those letters imply. The drug clerk who recommends and sells one something to ease an aching tooth or heal a bruise is performing true medical service. The housewife, with her simple skill and homely but efficacious remedies, practices medicine. The faithful nurse, who is given a considerable amount of discretion by the doctor and who is expected to act in emergencies during his absence, must be conceded to be a medical practitioner to that extent. All these and many others have an important part in treating human ills, but only the doctors, the "M. D.'s," belong to the medical *profession*.

We find, in turning to the practice of law, that the average business man tries to be well enough posted on legal principles to steer clear of entanglements. Lawyers' clerks, notaries, justices and others draw up legal papers and handle minor cases. Corporation claim agents seek to adjust legal claims. These and many others handle legal matters, but only the lawyers, admitted to the bar and licensed to represent others in court, are generally considered as belonging to the legal *profession*.

So in the profession of theology, it may be said without irreverence that we are all enjoined to minister to the wants of others in a humble way, and to inculcate principles of right living, but only the clergy, licensed and ordained, belong to the sacred *profession*.

In seeking to place the *engineering profession* upon the same high plane as these other three professions, it seems as if we lose sight sometimes of the fact that similar conditions exist in the practice of engineering. The attempt should not be made to gather everyone who, in a limited way, practices engineering or who may be called an engineer into the *profession* of engineering.

The young man, whether technically educated or not, who has charge of the construction of a piece of sewer work, for instance, will seldom be regarded by the public as a professional man, although he may be fitting himself for professional work later on. Neither will the young college graduate employed as instrument man, under the direction of a chief of party; he should be rated as a high-class mechanic, and is usually so considered by men of affairs.

Other classes which should not be included in membership in the profession which readily come in mind are the ordinary surveyor, the draftsman (unless he be a designer), the commercial engineer (who uses his knowledge as an aid to salesmanship only), the engineer holding an executive position (in most instances), most engineering contractors and some contracting engineers (if we may be allowed to make the distinction), technically educated but not trained men (that is, men who have had an engineering education but who have not put it into practice outside of a class room).

It would seem as though all the consulting engineers, the engineers in private practice, and all others who think themselves entitled to call themselves professional men according to the above standards should get together, under the leadership perhaps of the American Institute of Consulting Engineers, and work up the subject along these lines: (1) Provide for some distinguishing title, such as "Consulting Engineer," or degree, like "D. E.," or better perhaps, "D. C. E.," or "D. M. E.," etc.; (2) arrange for awarding of these degrees from within; (3) draw up and enforce a code of ethics and rules of professional conduct, modeled after the physicians', especially as regards consultation with experts in the most important cases and in work out of the ordinary.

Mention has been made of the difficulties that have been met with in trying to secure legislation. It would seem at the start inexpedient to attempt much in this line, but, as an entering wedge, a brief act providing a considerable penalty against a person who hangs out a sign with the letters "D. C. E.," for instance, after his name, or who falsely represents himself so to be, would seem to be of such a nature as to receive favorable consideration by the average legislature. The enforcement of such an act would be of great benefit from the start, and additional legislation should be less difficult to secure as time passes and the engineering profession gradually establishes itself in the eyes of the people.

E. H. COWAN,
Engineer and Contractor.

Taylorville, Ill., Feb. 3, 1913.

NOTES AND QUERIES

The Report of the Joint Committee on Concrete and Reinforced Concrete, reprinted in part in our issue of Feb. 6, 1913, p. 258, has several errors in the formulas (given on our p. 263), which were copied into our abstract. The corrections are as follows:

After equation (2) substitute j for k so that the line now reads "(For f_s = 15,000 to 16,000, and f_c = 600 to 650, j may be taken at $\frac{7}{8}$.)"

In equation (4), last term, j should be omitted so that equation now reads

$$b = \frac{2\,M}{jkbd^2} = \frac{2\,ps}{k} \qquad (4)$$

In equation (12), second term of numerator, t^2 should be t^3. Equation then reads

$$x = \frac{\left(kd^2 - \frac{2}{3}c^2\right)b + \left[kd - c^2\left(c + \frac{1}{3}(kd - c)\right)\right]b'}{t\,(2\,kd - t)\,b + (kd - t)^2\,b'} \qquad (12)$$

The Program for Completion of Culebra Cut*

Dry excavation in Culebra cut will be carried forward in accordance with the following program:

The lake level will be brought up to +50 by July 1, 1913. On and after July 1, the lake will be permitted to rise continuously, and steamshovel work in the cut can continue as long as the height of the Gamboa dike will suffice to hold back the water of the lake. The top of the dike is about elevation +78. Inasmuch as with a season of average rainfall, an elevation of +74 may be expected to be reached about Oct. 10, the dry excavation may be continued in the Cut until Oct. 1, 1913. It may be necessary to flood the cut at any time thereafter. This program has been laid out so as to obtain a lake elevation of 85 ft. above sea level on Dec. 1, 1913, and in accordance with it, Gorgona Shops will be flooded out about Sept. 15.

On Feb. 1, there had been dug out of Culebra cut 88,592,307 cu.yd. of rock and earth, and there remained to be excavated approximately four million cubic yards not including present slides. The work is now practically confined to three out of the nine miles of the Cut.

The section in which the work is being carried on is from a point near Empire, to a point near the old hamlet of Cucaracha, about one-half mile north of Paraiso. This includes the channel in front of Empire, Culebra, Rio Grande, Gold and Contractors' Hills, and a short distance south. In accordance with the original plans the work is being prosecuted so as to keep the highest point in the Cut somewhere about half way between the ends to assist in drainage, and to make it possible for loaded spoil trains to run down grade in going through the Canal. The summit in the pioneer or lowest cut is now about opposite the administration building at Culebra, and here the excavation is down to 61 ft. above sealevel, 21 ft. above the bottom of the Canal. The drainage is continued as heretofore, through the main culvert of Pedro Miguel Locks on the south end, and into the sump at Gamboa at the north end whence it is pumped into the Chagres.

At present 37 steamshovels are at work, and when emergency demands some of them are run on double shift, making twelve hours a day. The daily excavation in January averaged over 50,000 cu.yd., and this is being maintained at the present time. The equipment engaged in hauling the spoil includes 124 locomotives 1512 flat cars of 19 cu.yd. capacity, 199 steel dump cars of 17 cubic yards, and 136 dump cars of 10 cubic yards capacity. In blasting work 359 drills are employed, and in January 396,250 lb. of dynamite were used; about 0.35 lb. per cu.yd. of material excavated.

The Slides

Although there is nothing new in the manner of the development of the slides on either bank of Culebra Cut, they have shown unexpected activity during the past few weeks. The theory once held, that these movements of the banks toward the Canal were more likely to occur in the rainy season than in the dry, was abandoned a year ago when the most notable slides of the year occurred in the dry season.

The latest movement of a large amount of material occurred on the night of Feb. 4, when a pocket of earth and loose rock on the east bank opposite Hodges Hill at Culebra settled downward and moved 80 ft. into the Canal. The movement began about 9 o'clock and continued two hours, in which time the bank sank in places as much as 60 ft. The break is 1000 ft. long across the face toward the Canal, and extends back 680 ft. from the face of the bottom slope. A steamshovel was moved toward the center of the Canal, and three railroad tracks were temporarily blocked. The break in the bank that indicated a probable slide at this point was noted two months ago, but the movement was unexpected at this time. Apparently it is like a large number of other slides, merely a loose mass of rock and earth moving on an underlying surface of rock that dips toward the Canal. The toe of the slope having been dug away, the mass moved of its own weight. It is estimated that two million cubic yards are in motion here, although this is largely conjectural, because it is not known on what slope the material is moving. Two steamshovels are digging out this slide.

A survey of the old slide at Cucaracha, which has resumed activity recently, was made last week. It is estimated that from two to three million cubic yards of material are now in motion here, but this also is subject to the qualification made above. On the other hand it is not believed that all of this material will move into the Canal. Five steam shovels are now at work there. One day last week one of these was put out of service temporarily when the material it was digging flowed about it and covered the loading tracks. It was extricated within 24 hours, and is again at work. Incidents like these have become part of the day's work in Culebra Cut and the men have become so accustomed to meeting such emergencies that delays on account of them are continually growing less.

A 95-ton steam shovel is being so altered that it can lift spoil 21 feet above the track on which it is standing and load it into cars. This is necessary for the purpose of handling material to advantage in Cucaracha slide.

The bench on which the shovel will work through the sliding material is 40 feet above sea level, and it is necessary for it to load upon cars that are on a bench 57 feet above sealevel. The floor of the flat car is three feet above the track, so that the total lift is 20 feet. Shovels of this class now load 17 feet above the level of the track on which they stand. The alterations consist of extending the boom 21 inches by adding two 15-inch I-beams, and arranging the sheaves upon them as sisters instead of tandem, as at present; lengthening the dipper stick six feet making it 24 ft. 6 in. long; and fixing upon it a 3-yard instead of a 5-yard dipper.

*From the "Canal Record," Feb. 12, 1913.

Recent Cucaracha Slides, Panama Canal

The accompanying illustration shows the slide which occurred on Jan. 16 at Cucaracha on the east bank of the canal just south of Gold Hill, described in a note in our issue of last week. It will be remembered that this slide carried the earth clear across the canal prism, choking



PHOTOGRAPH OF THE CUCARACHA SLIDE OF JAN. 16 AND 17, CULEBRA CUT, PANAMA CANAL

(Copyright by Underwood & Underwood, New York City)

all five railway tracks. This slide proper contains only about 400,000 cu.yd., but its giving way was the indirect cause of further slides which will involve an additional amount of excavation estimated at over 1,000,000 cu.yd.

The Cucaracha slides have been a source of constant trouble and delay ever since the days of the French canal company. No sooner had the American engineers taken hold of the work in 1905 than they too commenced to experience difficulties. Between 1905 and July 1, 1912, nearly 3,000,000 cu.yd. of extra excavation have been necessitated by slides at this point, which had, at that time, already covered an area of 47 acres and had broken back nearly 1900 ft. from the canal center line. These slides have been due to the slipping of the top layer of clay and earth on a smooth sloping surface of harder material.

A report on the nature and geology of the slides appeared in ENGINEERING NEWS, Nov. 28, 1912, p. 1021.

Notes from a Traveler in Mexico

On account of the recent startling events in Mexico, the following extracts from personal letters of a representative of the Hill Publishing Co., now traveling in Mexico, are of interest.

(Feb. 9, at Tepeixco Camp.) From 1:30 p.m. to 5:30 p.m. I drove 20 miles in a single-seated buckboard, drawn by three mules, containing mail, express, two Mexicans and myself. Had a delightful drive through pine woods and through fields of maguey cactus—everything green, luxuriant vegetation—strange for Mexico! Turkeys, turkeys everywhere, but all too tough to eat? Everything quiet and peaceful. It is hard to believe that this fair, sunny, beautiful country is torn with civil war and bloodshed. No news from Mexico City since noon. The telephone line is working to the Nonoalco plant on the edge of the city, but not to the center of city and main office. Report at 1 p.m. was that firing had stopped. Cannon balls were falling around the Nonoalco plant in the morning. As yet, foreigners have not been bothered.

Events in Mexico City are sole topics of conversation. All women in these camps were ordered by the company to leave before Feb. 4. Most of them are in the United States, but some are in Mexico City. Some of the fellows are talking of packing grips so as to be ready to leave. The company has a stand of 19 army rifles. Tonight the men are learning how to load and aim them. My grips are in New Porter's Hotel; I hope they don't break in there—glad I am out here in a tent. I think the trouble will be all over by Tuesday night, when I get back to the city. It does not worry me a bit, only this may knock my business in the head.

(Feb. 10.) Morning spent at Camp Tepeixco—22 miles from railroad. In the afternoon walked over the mountains to Camp Quacuenella. It was only four miles, but I had to climb over two mountains that were over a thousand feet above the camp. There the superintendent dressed me up in rubber hat, slicker, and hip boots so big I had to hold them on, and then he took me into tunnel No. 17, a distance of one mile to the "face." They work without a shield; a jet of water spouts from every drill hole, running a measured 700 gal. per min. Saw an underground stream as big as my leg spouting out. Reminded me of John Burroughs' essay on "Springs." The face of tunnel was 1000 ft. ahead of the concrete and timbering. They have trouble with this water; the work was very interesting, though not so much so as the trip I took five years ago into the Detroit River tunnel under 28 lb. air pressure. Men on this job here came from the Pennsylvania R.R. tunnel in New York.

(Feb. 11.) I spent from 5 to 10:30 a.m. in a three-mule buckboard going from Tepeixco to Corinea. From 1 p.m. to this hour (3 p.m.) have been en train for Mexico City. Fierce rumors. Guess they are fighting today (though at Corinea last night we had a false report of battle).

I hear that street cars and taxis are not running in the city. A few cabs or "coaches" are said to be going, though hard to get, and they charge four to ten times ordinary rates. Reports are also that the city is surprisingly orderly with no anti-foreign feeling. I have noted very little unfriendly feeling and feel perfectly safe. There is a nervy bunch of Westerners here; the New Yorkers are going home.

(Two hours later.) We are now 1 hour late; waited at a junction for a carload of soldiers. It would make you laugh to see them. Most of them carried a game cock tied up in a piece of cloth, head and tail sticking out. Several had on their shoulders some kind of an animal with a long tail, sort of raccoon I think. One led a cow. With them were quite a number of women with packs on their backs and chickens in their arms. That is their commissary department. (This train jolts worse than the Vermont Central ever did in the mountains.)

Don't worry about me. Have plenty of money. Have cn me [illegible] to grip me to find it. Have a 32-cal. Colt automatic in shoulder holster under my arm—will [illegible] Have [illegible] and do not expect any.

(Mexico City, Feb. 12.) The hack man last night at [illegible] to the hotel but [illegible] The street cars are running [illegible] and the city was [illegible] that were out were standing in little groups talking—are very orderly and quiet. No police were in sight. These people seem to [illegible]

I reached the city [illegible] The Government forces are on the West end of Alameda, from here—only 1 block to the Alameda North). They permit citizens to approach to the lines but no farther. Federal machine guns are located in this street, two blocks south of this hotel to sweep the street at right angles to this one.

Also walked down San Francisco St. to within one block of the Zocalo or Main Plaza. Rurale outposts stop you at all corners, one block from the Zocalo. There is no anti-foreign feeling—no one even looked at me. Americans are treated with all respect.

This hotel is in line between the Government Palace at Zocalo (where Madero is) and the Cuidadela or Arsenal (where Diaz is) but it is out of the direct line of fire unless the forces move up.

A big bomb just burst in this street in the next block. Piece of bomb and some bullets dropped in the street in front of this hotel. Boys grabbed them before they stopped rolling. Sounds like 4th of July outside. I have seen no dead horses or dead men—report was that streets were full of them. But I was not permitted by soldiers to go on the streets where fighting occurred yesterday.

Firing started at 7:10 a.m. Quite interesting in town; glad to be here.

(Pachuca, Hgo., noon, Feb. 13.) The papers give sinister reports about preparations of the United States. There was no anti-American feeling shown in Mexico City. I was on the street alone, and at times with one American, two evenings and most all of yesterday. This morning we walked to the depot through two miles of the toughest part of the city, with no police on the streets, and no one even looked at us. It is surprising how well behaved the peons are; they do not seem to like either side of the difficulty and remain neutral. There was an anti-American demonstration in Pachuca last week (which caused me to visit Necaxa first) but it is over and quiet now.

R. B.

NOTES FROM THE ENGINEERING SCHOOLS

The engineering schools of the land-grant universities and colleges of the United States on Jan. 24, at Washington, D. C., formed an association to deal with problems peculiar to such institutions (by reason of the land-grant act of Congress under which they were established) and to coöperate with the agricultural association of the same colleges, which has been active for many years. The membership of the new association comprises the presidents of these institutions, the deans of the engineering schools in them and such other representatives as each president may select. A single vote is allowed to each state school represented. The U. S. Bureau of Education has a right to representation and one vote. About two-thirds of the states were represented at this first meeting by their deans of engineering or presidents. The U. S. Commissioner of Education and part of his staff were present. The following officers were elected: President, J. P. Jackson, dean of the school of engineering at Pennsylvania State College; Vice-President (*ex-officio*), T. P. Claxton, U. S. Commissioner of Education; Secretary-Treasurer, A. Marston, dean of the engineering department of Iowa State College. The executive committee consists of the foregoing and the following: W. M. Riggs, president of Clemson Agricultural and Mechanical College of South Carolina; H. W. Tyler, professor of mathematics of the Massachusetts Institute of Technology; A. W. Smith, dean of Sibley College at Cornell University; G. W. Thistle, dean of the engineering department of Michigan Agricultural and Mechanical College. C. H. Benjamin, dean of the school of engineering at Purdue University, was appointed chairman of a committee which is to be continued through the year to consider the public relations of institutions of this class.

STEVENS INSTITUTE OF TECHNOLOGY—The Alumni Association of this Institute held a dinner at the Hotel Astor, New York City, on the evening of Feb. 14 to celebrate the completion of ten years of service by Dr. Alexander C. Humphreys as President of the Institute. Out of some 1500 living graduates of the Institute, nearly 700 were present at the dinner. There were also present as invited guests a large number of prominent engineers and engineering educators. E. H. Peabody, of the class of 1890, acted as toastmaster and succeeded in enforcing a five-minute rule upon the dozen after-dinner speakers by the expedient of having the lights on the large electroliers in the center of the ball room automatically dimmed when each speaker's five minutes' interval expired.

Among the speakers were Dr. Palmer C. Ricketts, Director of Rensselaer Polytechnic Institute; Dr. Henry S. Pritchett, President of the Carnegie Foundation; Prof. Chas. F. Kroeh, who still holds the chair of modern languages at Stevens Institute and is the only one remaining of the original faculty of the Institute at its foundation in 1871. Dr. Humphreys in his address referred briefly to the plans of the Institute for enlarging its lands and facilities on its new site at Castle Point, Hoboken.

OREGON AGRICULTURAL COLLEGE—An annual engineering show has recently been given at this institution by the students in civil, electrical and mining engineering departments, and in the school of forestry. The uses of electricity were shown, including a wireless telegraph station, which attracted great attention. Communication was established between this and every station on the Pacific Coast from Alaska to San Diego, and with the Hawaiian Islands and ships at sea. There were shown also methods of irrigation, fire fighting, and forest surveying, highway construction, the construction of farm buildings and equipment. The funds received from the show are used to support a monthly student magazine.

OHIO STATE UNIVERSITY—A two weeks' winter course in highway engineering is to be given from Feb. 24 to Mar. 8, under the auspices of the Civil Engineering Department of the College of Engineering in coöperation with the State Highway Department and the Ohio Good Roads Federation. The program shows 42 items, four of which are inspection trips, two are laboratory demonstrations, two are meetings for the discussion of questions which the visitors desire to have answered, and one is a symposium on patent and proprietary materials or processes; these are in addition to lectures on the economics and engineering of roads in general, on various types of construction, on the various kinds of materials locally available, on the preparation of sub-grades, the construction of culverts, bridges and foundations, on legislation, foreign practice, maintenance, etc. It is expected that two classes of men will attend these lectures and they have been arranged to appeal to both. One class will be men having an engineering training and some experience in road construction; the other class will be men without an engineering training, but who need information about material, construction and maintenance, and the methods of securing economical and efficient work.

In addition to the regular teaching staff of the university, well known specialists have been secured for lectures. Each lecture will be one hour long, and is to be followed by a 45-min. discussion.

Synchronizing the Talking and Motion Picture Machines has been accomplished in a new invention of Thomas A. Edison. The Kinetophone, as this latest amusement machine is called, was demonstrated in five theaters in New York City on Feb. 17 and was reported to be a complete success.

The Bursting of a Centrifugal Drier in the plant of the Park Woolen Mills, at Rossville, Tenn., on Feb. 20, killed one and injured two other mill employees. The regular operator on the extractor is reported to have opposed an increase of steam pressure on the machine, claiming that it was working at its maximum safe speed. When the pressure was raised this man ran from the machine and escaped injury.

A Block on the New York Subway on the evening of Feb. 18 tied up part of the system for two hours, between 8 and 10 p.m. A broken brake-shoe on a north-bound train, in the West Farms branch, flew against the third-rail and caused a short circuit.

A Conflagration in Tokio, Japan, on Feb. 15, is reported to have consumed 3000 buildings and made 15,000 people homeless, and destroyed property worth $2,500,000.

The Railway Valuation Bill now pending in Congress passed the Senate on Feb. 24. It had previously passed the House. Some differences in the bills passed by the two houses will require a conference, but it is stated that the bill passed the Senate with little opposition and the probabilities are that it will become a law before the end of the session. The bill requires the Interstate Commerce Commission, through a corps of expert engineers, to value the property of all railways, telegraph and telephone companies and other common carriers, to determine the amount that has been expended upon the properties, the cost of their reproduction at the present time, the value of all properties now held by them, and the value of all their intangible property such as franchises and good will.

A Reinforced-concrete Roof over a moving picture theater in course of construction at 16th Ave. and Bergen St., Newark, N. J., collapsed for a portion of its area on Feb. 15, 1913, shortly after a number of laborers who were working under it had left. The roof was a flat concrete slab spanning between the wall and a girder 12 ft. back from the wall and was reinforced with straight rods. Although a larger portion had recently been cleared of its supporting struts, the fallen section was only about 40 ft. long. Apparently the design was not over safe and the set of the concrete had been retarded by the cold weather. The forms had been removed two days before the failure but there had been freezing weather up to the day of the collapse, when the temperature became quite warm. The inspector of buildings has ordered the removal and reconstruction of the entire roof.

A Profit-Sharing Plan has been placed in operation by the architectural and engineering firm of Ballinger & Perrot, with offices in New York and Philadelphia. Profit sharing has been practiced by this firm in the past to the extent of alloting a certain portion of the net profits to the heads of the several departments. This has proved so satisfactory that it has been decided to extend the plan to all employees. The firm makes no pretense that this plan is a philanthropic one but merely states that, in its experience, it results in mutual benefit to employer and employee and increases the efficiency of the entire working force.

The new plan is worked in two ways. First, there will be a division of a certain sum set aside from the profits, in which all employees will share equally, irrespective of their salaries. Secondly, there will be a division of an additional amount set aside from profits, an allotment being in proportion to the ratio of an employee's salary to the total salaries paid.

PERSONALS

Mr. L. I. Stone has been appointed Assistant Engineer of the Grand Trunk Ry., with headquarters at London, Ont.

Mr. H. H. Gibson has been appointed Chief Engineer of the New Orleans Southern & Grand Isle Ry., at Algiers, Ala.

Mr. James Boyd has been appointed Assistant Engineer of the Grand Trunk Ry., with headquarters at Hamilton, Ont.

Mr. W. A. Siegner has been appointed Assistant Engineer of the Grand Trunk Ry., with headquarters at Stratford, Ont.

Mr. H. A. Palmer has been appointed Assistant Engineer of the terminal division of the Grand Trunk Ry., with headquarters at Toronto, Ont.

Mr. J. G. Sheldrick, until recently Resident Engineer of the Minneapolis, St. Paul & Sault Ste. Marie Ry., at Superior, Wis., has been promoted to be Division Engineer at Superior.

Mr. H. R. Carpenter, formerly Assistant Engineer of the Missouri Pacific Ry., at St. Louis, Mo., has been promoted to be Engineer of Maintenance-of-way, with headquarters at St. Louis.

Mr. Frederick H. Hammill, recently Division Superintendent of the Chicago & Northwestern Ry., at Boone, Iowa, has been promoted to be Assistant General Superintendent, with headquarters at Boone.

Mr. A. Syverson, formerly Trainmaster of the Chicago & Northwestern Ry., Belle Plaine, Iowa, has been appointed Superintendent of the Ann Arbor R.R., at Owosso, Mich., succeeding Mr. W. D. Holliday, resigned.

Mr. C. E. Hix, recently Car Accountant of the Seaboard Air Line Ry., at Portsmouth, Va., has been appointed Superintendent of Transportation, succeeding to the duties of Mr. J. M. Shea, General Superintendent, resigned.

Mr. E. S. Heyser, formerly Trainmaster and Roadmaster of the St. Louis, Brownsville & Mexico Ry., at Kingsville, Tex., has been appointed General Superintendent of the San Benito & Rio Grande Valley R.R., at San Benito, Tex

Dr. Ernst J. Berg, M. Am. Inst. E. E., for the past four years Professor of electrical engineering at the University of Illinois has been appointed Professor in charge of the electrical department of Union College, Schenectady, N. Y.

Mr. F. J. Byington, Assistant Division Superintendent of the Chicago & Northwestern Ry., at Baraboo, Wis., has been promoted to be Division Superintendent at Boone, Iowa, succeeding Mr. Frederick H. Hammill, promoted, as noted elsewhere.

Mr. A. W. E. Fawkes, recently connected with the construction of the mechanical filtration plant of the Minneapolis, Minn., water-works, described in our issue of June 27, 1912, is now Engineer in charge of the water-works of Calgary, Alta.

Mr. S. J. Van Ornum, Assoc. M. Am. Soc. C. E., recently City Engineer of Pasadena, Calif., has opened an office in the Pacific Bldg., San Francisco, Calif., as a consulting engineer, specializing in reinforced-concrete construction and municipal work.

Mr. W. G. O'Malley, for a number of years General Master Mechanic of the Lackawanna Steel Co., Buffalo, N. Y., has accepted a position with the Pittsburgh Crucible Steel Co., in connection with the building of their new plant at Midland, Penn.

Mr. H. H. Eggleston has resigned as Assistant Supervisor of Bridges and Buildings of the Baltimore & Ohio Chicago Terminal R.R., at Chicago, Ill., to become Supervisor of Bridges and Buildings of the Chicago Great Western Ry., at Des Moines, Iowa.

Mr. H. B. Holmes has been appointed Resident Engineer of the Kansas City, Mexico & Orient Ry., at Kansas City, Mo. Mr. Holmes succeeds to the duties of Mr. W. W. Colpitts, M. Am. Soc. C. E., Chief Engineer, resigned, as noted in our issue of Feb. 6. The position of Chief Engineer has been abolished.

Mr. George M. Brown, a civil engineer, of Princeton, N. J. has been appointed Superintendent of Public Works of Princeton, a newly created office. The office combines the former ones of Street Commissioner and Borough Engineer. Mr. Brown is a graduate in civil engineering of Princeton University.

Mr. A. B. Warner, Engineer of Maintenance-of-way of the Chicago, Rock Island & Pacific Ry., at El Reno, Okla., has been appointed Superintendent of the Chicago, Rock Island & Gulf Ry., with headquarters at Fort Worth, Tex., succeeding Mr. C. L. Doppel, transferred to El Reno, to succeed Mr. Warner.

Mr. W. T. Main, recently Division Engineer of the Chicago & Northwestern Ry., at Chicago, Ill., has resigned to engage in private practice. He is succeeded at Chicago by Mr. J. S. Long, formerly Division Engineer at Madison, Wis. Mr. W. J. Jackson, Division Engineer at Antigo, Wis., has been transferred to Madison to succeed Mr. Long.

Dr. E. G. Acheson, of Niagara Falls, N. Y., inventor of carborundum, Aloxite, a method of making graphite and other abrasives and lubricants, has been decorated by the Czar of Russia with the Order of St. Ann, an order established in 1795 by the Emperor Paul I and ranking high among the various orders of nobility of European governments.

Mr. J. A. Somerville, Superintendent of Terminals of the Missouri Pacific Ry., at St. Louis, Mo., has been promoted to be Superintendent of Transportation of the Missouri Pacific and the St. Louis, Iron Mountain & Southern Rys., with headquarters at St. Louis, Mo., succeeding Mr. E. Kearney, recently promoted to be General Superintendent of Transportation.

Mr. Edgar S. Closson, Assoc. M. Am. Soc. C. E., recently Assistant Engineer, Public Service Commission of New York, First District, has been appointed Town Supervisor of Montclair, N. J., in charge of engineering and public works. Mr. Closson graduated from Union College, Schenectady, N. Y., in 1906, and for several years has been engaged in survey work on the New York City subways.

Mr. R. S. Buck, M. Am. Soc. C. E., recently appointed Chief Engineer of the Dominion Bridge Co., Montreal, Que., was Chief Engineer of the Manhattan and Queensborough bridges, New York City, from 1899 to 1902, and not of the Williamsburg bridge, as stated in our issue of Feb. 6. Mr. Buck was Consulting Engineer in charge of the same bridges from 1904 to 1907, but not Chief Engineer of the Department of Bridges, as erroneously stated.

Lieut.-Col. William V. Judson, Corps of Engineers, U. S. A., Engineer Commissioner of the District of Columbia, has been assigned to duty on the Panama Canal under Col. Goethals. He is succeeded as Engineer Commissioner by Maj. Chester Harding, Corps of Engineers, U. S. A., at present Assistant to Col. Sibert, Division Engineer of the Atlantic division of the Panama Canal. Maj. Harding was Assistant Engineer Commissioner of the District of Columbia from 1901 to 1906.

Mr. Ralph Budd, recently appointed Assistant to the President of the Great Northern Ry., has been appointed Chief Engineer of the Great Northern Ry., succeeding Mr. A. H. Hogeland, M. Am. Soc. C. E., who has been appointed Consulting Engineer. Mr. Budd was appointed Chief Engineer of the Spokane, Portland & Seattle Ry. in 1910, and had charge of the construction of various extensions of the Hill lines in Oregon, including the Oregon Trunk Ry. He was appointed Assistant to the President of the Great Northern Ry., on Jan. 1, last.

Lieut.-Comdr. R. H. Robinson, Naval Constructor, U. S. N., has resigned to become associated with the Lake Torpedo Boat Co., of Bridgeport, Conn. Naval Constructor Robinson graduated from the United States Naval Academy, at Annapolis, in 1892. He studied naval architecture at the University of Glasgow, Scotland. During the Spanish-American War he had charge of the refitting of the transatlantic steamers "St. Louis" and "St. Paul" into scout cruisers. He has been actively engaged in the design and construction of 12 American dreadnaughts, built or building. Naval Constructor Robinson is the twelfth member of the navy construction corps to accept positions with shipbuilding firms during the past 15 years.

The Canadian Pacific Ry. has established a new engineering grade of Division Surveyor. The duties of this position will include the preparation of plans and descriptions for purchases, sales and leases of land, resurveys of right-of-way, and such other land-survey work as comes within the jurisdiction of the operating and maintenance departments and not connected with construction work. The appointments to these positions are made by the right-of-way and lease agent with the approval of the various division superintendents. The following appointments have been made: Mr. A. P. Walker, M. Can. Soc. C. E., formerly Assistant Division Engineer at Toronto, to be Division Surveyor of the Ontario division with headquarters at Toronto, Ont.; Mr. G. E. Fiset, Assoc. M. Can. Soc. C. E., Division Surveyor of the Eastern division at Montreal, Que., and W. A. Sibbett, Division Surveyor of the Lake Superior division with headquarters at North Bay, Northern Ontario.

Mr. Clinton L. Bardo, recently Assistant to the General Manager of the Lehigh Valley R.R., at South Bethlehem, Penn., has been appointed General Manager of the New York, New Haven & Hartford R.R., at New Haven, Conn., succeeding Mr. B. R. Pollock, resigned, as noted in our issue of last week. Mr. Bardo's railway experience dates from 1885, when he entered the service of the Pennsylvania R.R. as a telegraph operator. Later he became Assistant Trainmaster of the Lehigh Valley R.R., and in 1901 was made Trainmaster of the New York division of that railway. Three years later he was appointed Freight Trainmaster of the New York, New Haven & Hartford R.R. at New York City, becoming Superintendent of the New York division in 1905. In 1907 he was appointed Superintendent of the Grand Central Station and of the Electric division of the New York Central & Hudson River R.R., which position he resigned in 1911 to become Assistant to the General Manager of the Le-

high Valley R.R. He will also be General Manager of the Central New England R.R.

Mr. A. H. Hogeland, M. Am. Soc. C. E., Chief Engineer of the Great Northern Ry. since 1903, has retired from the position of active head of the engineering department to become Consulting Engineer of the company. Mr. Hogeland was born in Pennsylvania in 1858 and graduated in civil engineering from Lafayette College in 1877. He began his railway experience as a rodman and leveler on surveys and construction of the St. Paul & Pacific Ry. in 1879. From 1880 to 1882 he was leveler, transitman and topographer on the location surveys for the Yellowstone and Rocky Mountain divisions of the Northern Pacific Ry. The following eight years Mr. Hogeland spent as Assistant Engineer on the construction of the Northern Pacific and Great Northern Rys. in Minnesota, N. Dakota, S. Dakota and Montana. From 1890 to 1896 he was Engineer of Maintenance-of-way of the Eastern district of the Great Northern Ry., and from 1896 to 1902 Resident Engineer of the same district. In 1902 he was promoted to be Assistant Chief Engineer and in February, 1903, to be Chief Engineer.

OBITUARY

George Yale, Mechanical Engineer of the Montreal, Que., Harbor Commissioners, died at his home in Montreal, Feb. 8, at the age of 60 years. He had been with the Harbor Commissioners for the past six years.

Henry Hauser, President of the H. Hauser Contracting Co., died recently at his home in Los Angeles, Calif. Mr. Hauser went to Los Angeles in 1900. For several years he was connected with the Lanty-Shary Contracting Co., and supervised railway construction throughout the West.

Sir William Arrol, head of the firm of William Arrol & Co., Engineers, of Glasgow, Scotland, died in London, Feb. 20, aged 74 years. The firm of William Arrol & Co. has been contractor for many famous English bridges and is perhaps the leading bridge building concern in England. The fame of the firm rests chiefly on the construction of the Firth of Forth Bridge.

William Riley McKeen, President of the Terre Haute & Indianapolis R.R. (now the Vandalia R.R.) for nearly 30 years, died at his home in Terre Haute, Ind., Feb. 18. He was born on Oct. 12, 1829, in Indiana. He was a delegate to the Republican National Conventions of 1872 and 1904 and active in the public life of his community. Mr. McKeen was the father of Benjamin McKeen, M. Am. Soc. C. E., recently promoted to be General Manager of the Pennsylvania R.R. Lines West of Pittsburgh, and of W. R. McKeen, Jr., M. Am. Soc. M. E., President and General Manager of the McKeen Motor Car Co., Omaha, Neb., and formerly Superintendent of Motive Power of the Union Pacific R.R.

Frank Soulé, M. Am. Soc. C. E., President Emeritus of civil engineering at the University of California, died at his home in Berkeley, Calif., Feb. 14. Prof. Soulé was born in Woodville, Miss., in 1845. He graduated from the United States Military Academy at West Point in 1866, and after serving as an ordnance officer and as an instructor in ordnance and gunnery at West Point, he resigned his commission in the army and went to California, where he became Professor of mathematics at the University of California in 1869. Later he was Professor of civil engineering and Dean of the college of civil engineering. He retired several years ago, but had practiced extensively as a consulting engineer.

William Bostwick Stilson, for many years a prominent railway engineer, died at his home in Oswego, N. Y., Feb. 12. He was born in New Milford, Conn., in 1842. He graduated in civil engineering from the Rensselaer Polytechnic Institute in 1867. For many years he was employed in the building of several important railways in the East and South. He was Engineer on location and construction for the New York & Oswego Midland R.R., now the New York, Ontario & Western Ry.; the Erie R.R. and the Shenandoah Valley R.R. From 1881 until his retirement in 1909, on account of ill health, he was Assistant Engineer for the Michigan Central R.R., at Detroit, Mich. Mr. Stilson is survived by a widow, a daughter and three sons.

Albert S. Cheever, M. Am. Soc. C. E., for several years Superintendent of the Fitchburg division of the Boston & Maine R.R., died at his home in Somerville, Mass., Feb. 17. Since December of last year Mr. Cheever had been engaged in special work in the operating department as Assistant to the General Manager. He was born in Chelsea, Mass., Sept. 17, 1857. He entered the railway service in 1880 as a clerk in the General Superintendent's office of the Fitchburg R.R. The following year he was transferred to the Chief Engineer's office and held various subordinate positions until 1886 when he was promoted to be Assistant Engineer at Fitchburg, Mass. In 1887 he was made Division Engineer and held this office until 1890, when he was promoted to be Chief Engineer. Upon the absorption of the Fitchburg R.R. by the Boston & Maine R.R. in 1900, Mr. Cheever became Assistant Chief Engineer of the latter railway. He was appointed Superintendent of the Fitchburg division in 1902.

Carl Gustaf Patrik de Laval, inventor of the turbine which bears his name, died recently at the age of 67 years. His famous turbine was the outcome of an invention for separating fluids of different specific gravities by means of a centrifugal machine. This was made in 1878 when de Laval was 34 years old. In 1883 he invented a power separator and in 1884 a special form of bearing for steam engines in which centrifugal force was adapted to suck the oil into the bearing instead of throwing it out. The first de Laval turbine was brought out in 1889, and the inventor lived to see its successful introduction into many countries. Although known chiefly for his invention of centrifugal cream separators and turbines de Laval's activities were by no means confined to these machines. He devised, while still a young man, a method of producing sound steel ingots by providing a cap of nonfusible material to fit the top of the ingot mold; other inventions were in connection with the smelting of metals by electricity, the manufacture of metal pipes, a milking apparatus, boiler, furnaces, and a great many other things. Dr. de Laval was a native of Sweden and made his home in Stockholm.

George Washington Custis Lee, an officer of the Corps of Engineers, U. S. A., before the Civil War and later an engineer officer of the Confederate Army, died at his home in Ravensworth, Va., Feb. 18. Gen. Lee was a son of Gen. Robert E. Lee, Commander-in-Chief of the Confederate Army, and a grandson of Gen. Henry Lee, the "Light Horse Harry Lee," of Revolutionary fame. He was born at Fort Monroe, Va., Sept. 16, 1832. He graduated from the United States Military Academy at West Point in 1854. After receiving his commission in the Corps of Engineers he saw service in Florida, Georgia, San Francisco and Washington, D. C. At the beginning of the Civil War he resigned his commission and was shortly afterward appointed Captain of Engineers in the Confederate Army. He constructed the fortifications around Richmond, Va., and served as an aid on the staff of the President of the Confederacy. Later he was commissioned Brigadier-General, and toward the close of the war, Major-General. In 1865 Gen. Lee accepted the office of Professor of civil engineering at the Virginia Military Institute at Lexington, Va. Upon the death of his father, Gen. Robert E. Lee, he succeeded to the presidency of the Washington and Lee University. In 1897 he retired as President Emeritus.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Feb. 26-28. Midwinter Convention in New York City. Secy., F. L. Hutchinson, 33 W. 39 St. New York, N. Y.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.
Feb. 27-28. Annual meeting at Indianapolis, Ind. Secy., A. L. Neereamer, Indianapolis, Ind.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION.
Mar. 3-5. Annual meeting at Chicago, Ill. Secy., W. P. Blair, 824 Engineers Bldg., Cleveland, Ohio.

CANADIAN MINING INSTITUTE.
Mar. 5-7. Annual meeting at Ottawa, Canada. Secy., H. Mortimer-Lamb, Windsor Hotel, Montreal, Canada.

VERMONT SOCIETY OF ENGINEERS.
Mar. 10. Annual meeting at Burlington, Vt. Secy., G. A. Reed, Barre, Vt.

NEW ENGLAND RAILROAD CLUB.
Mar. 11. Annual meeting at Boston, Mass. Secy., W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.
Mar. 18-21. Annual convention at Chicago, Ill. Secy., E. H. Fritch, 900 S. Michigan Ave., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

AMERICAN CHEMICAL SOCIETY.
Mar. 25-28. Annual meeting in Milwaukee, Wis. Secy., C. L. Parsons, Box. 505, Washington, D. C.

NATIONAL FIRE PROTECTION ASSOCIATION.
Mar. 26-27. Annual meeting in New York City. Secy., Ralph Sweetland, 141 Milk St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB.
Mar. 27. Annual meeting at Boston, Mass. Secy., H. A. Faulkner, 12 Pearl St., Boston, Mass.

AMERICAN ELECTROCHEMICAL SOCIETY.
Apr. 3-5. Annual meeting at Atlantic City, N. J. Secy., J. W. Richards, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Secy., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, Iowa. Secy., H. E. Weeks, Davenport, Iowa.

American Society for Testing Materials—It has been announced that the anual meeting of the society will be held at Atlantic City, June 24-28, 1913.

American Society of Heating and Ventilating Engineers—Following the annual meeting of the Society on Jan. 23, E. A. Scott was appointed Secretary, vice W. W. Macon, resigned.

American Road Builders' Association—The letter ballot on officers for the coming year resulted as follows: President, Samuel Hill; Vice-Presidents, Harold Parker, W. A. McLean, and G. W. Tillson; Secretary, E. L. Powers; and Treasurer, W. W. Crosby.

New York State Electrical Contractors Association—The following officers for the current year were elected at the annual meeting in Syracuse, N. Y., on Jan. 21: President, F. W. Newman; Vice-President, H. N. Smith; Secretary, G. W. Russell; and Treasurer, J. P. Burn.

The Second International Clay Products Exhibition will be held in the Coliseum, Chicago, Ill., from Feb. 26 to Mar. 8, in connection with the annual meetings of the National Brick Manufacturers Association, Mar. 2-8, and the National Paving Brick Manufacturers Association, Mar. 3-5.

A Joint Meeting of Engineering Societies of Chicago and Milwaukee is to be held at Milwaukee, Wis., on Feb. 22. Among the papers on the program are the following: "Concrete Roads and Streets," by H. J. Kuelling; "City Planning as Taught and Practiced in Europe," by L. S. Smith; "The Effect of Glare from Reflecting Surfaces on Ocular Comfort," by N. M. Black and F. A. Vaughn; and "Light and Art," by M. Luckiesh.

Iowa Engineering Society—The program for the annual meeting at Sioux City, on Feb. 19 to 21, included among others, the following papers of general engineering interest: "[illegible] Roads and Permanent Bridges," by D. B. Luten; "Municipal Franchises," by C. P. Chase; "A Proposed Engineer's License Law," by J. L. Parsons; "Purification of Water for Residences," by J. H. Dunlap; and "Hydrographic Survey for Upper Mississippi River Improvements," by C. H. Baumgartner.

Engineers' Club of Kansas City—Several features of particular interest marked the Club's annual meeting and banquet on Jan. 26. The principal speaker of the evening was Hugh L. Cooper, who gave an illustrated talk on the construction of the dam and power plant at Keokuk, Iowa. A model of the Keokuk Dam and power plant formed part of the table decoration and a minature transmission line, strung along the tables, supplied the lights for the banquet.

The officers elected for 1913 were: President, Daniel Bonbright; Vice-presidents, Homer Woodbridge and Lee Treadwell; and Secretary-treasurer, John Prince.

International Geological Congress—The twelfth session will be held at Toronto, Canada, on Aug. 7-14 and preceding and following the sessions there will be a number of excursions to points of geological interest in the Dominion. The principal paper to be presented is a monograph on "Coal Resources of the World," which was suggested by the success attending the presentation of a similar monograph on "Iron Ore Resources of the World" at the eleventh session in Stockholm, Sweden. The papers in coal resources have been two years in preparation and will contain data collected from over 50 countries. Another topic to be discussed at the Toronto meeting is "The Influence of Depth on the Character of Metalliferous Deposits."

American Institute of Electrical Engineers—The 1913 summer convention is to be held at Cooperstown, N. Y., June 23 to 28.

A two-day meeting of the Institute is to be held in Pittsburgh, during the latter part of April under the auspices of the committee on the Use of Electricity in Mines and in cooperation with the Pittsburgh section.

The dates for the lectures on "Radioactivity" (announced in the Feb. 20 issue of "Engineering News" as Mar. 18 and 25, and Apr. 1 and 8) have been changed to Mar. 19 and 26, and Apr. 2 and 9.

A section of the Institute has been authorized at Spokane, Wash. The annual Pacific Coast Convention is to be held at Vancouver, B. C., on Sept. 9 to 11.

Canadian Mining Institute—The 15th annual meeting of the Institute is scheduled for Mar. 5 to 7 at Ottawa, Ont. Over twenty papers on various subjects of mining interest are to be presented, among them the following: "The Steel Industry of Nova Scotia," by Thomas Cantley; "The Agglomeration of Iron Ores," by N. V. Hansell; "The Utilization of Exhaust Steam," by J. M. Gordon; "The Use of Rescue Apparatus in Metal Mines," by H. E. Bertling; and "Core Drilling," by P. H. Moore.

At the business session, action will be taken on four proposed amendments to the by-laws and a ballot will be taken on the following nominations of Institute officials for the ensuing year: President, A. E. Barlow; Vice-presidents, Thomas Cantley, and G. G. S. Lindsey; and Councillors, M. L. Baker, J. A. Bancroft, R. W. Brock, D. H. Browne, E. T. Corkill, T. Denis, E. Dulieux, James McEvoy, Lewis Stockett, and W. A. Williams.

American Institute of Mining Engineers—The feature of the annual meeting, held in New York City, Feb. 17 to 19, 1913, was an extensive alteration of the constitution, which abolishes the peculiar dual form of organization under which the society has existed hitherto, and also makes the Secretary an officer elected by the council instead of by the membership. The new council later elected Bradley Stoughton to succeed Dr. Joseph Struthers. One important item of the changes in the construction was the rejection of an amendment which (following the novel plan introduced by the American Institute of Electrical Engineers) proposed to create a grade of "Fellow."

The following are the principal new officers elected by vote of the members: President, Charles F. Rand; Vice-presidents, Karl Eilers, Waldemar Lindgren, B. B. Thayer, S. J. Jennings, T. H. Leggett, and F. W. Denton; Directors, C. W. Merrill, C. S. Robinson, E. L. Young, J. A. Holmes, J. H. Janeway Jr., J. W. Finch, J. W. Richards, E. P. Mathewson, L. D. Ricketts, R. W. Hunt, and James Gayley.

In the technical sessions, sound steel ingots were a special topic of discussion. E. A. Beck, in "The Use of Anti-piping Thermit in Casting Steel Ingots," described the best present-day practice in using thermit, and its success in German practice. "Piping and Segregation of Ingots of Steel and Ductility Tests for Openhearth Steel Rails," by P. H. Dudley, gave a summary of the author's deductions as to the essentials of mill practice for producing sound, pipeless rail steel, involving early charging into reheating furnaces to prevent pipe formation, and blooming thereafter, somewhat as recently proposed by Talbot. The Talbot method, described in our columns three months since, was discussed by its originator, Benjamin Talbot, in "The Production of Solid Steel Ingots." The personal or mill factor in producing good rails was illuminated by R. W. Hunt in "Comparative Notes on Steel Rail Rolling." Two parts of a single order for rails were rolled in a small and a large mill of the same company, under almost identical methods, and the product of the smaller mill was much better; no satisfactory explanation was given. A new form of ingot mold, which, by chilling the ingot more rapidly near the bottom shortens the depth of piping, was described by E. Gathmann in a paper "Commercial Production of Sound Steel Ingots."

Discussion of this group of papers brought forward a number of men prominent in the rail field, but no new matter was brought out. Manufacturers or their representatives held aloof from the discussion. Under these circumstances the scheduled symposium on increasing the length of ingot crop to insure elimination of bad metal, and on the cost of increased cropping, was not successful.

The remaining iron and steel papers dealt with mine valuation, a new openhearth furnace design, sintering fine ore, and other papers of practical interest, and several laboratory papers, including a full review of the structural problems of cast iron by Prof. A. Sauveur in "Notes on Cast-Iron."

In the only other session, the first after the business session, numerous papers on geology, mining, milling and production were presented, about half of them by title only.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Maine—Boston & Maine R.R.—This company, it is reported, will double-track its line between Spinney's switch, east of Kittery, Maine, and Portsmouth, N. H. When the work is completed the eastern route of the Portland Division will have double-track from Boston to Jewett, with the exception of the Salem Tunnel and the Portsmouth and Kittery Bridge. The laying of this track will probably mean that the proposed bridge connecting the states of Maine and New Hampshire over the Piscataqua River will be built. A. B. Corthell, Boston, Mass., is Ch. Engr.

Vermont—Boston & Maine R.R.—The State Legislature passed two bills, Feb. 20, granting permission to this company to construct two connecting links to complete its system down the Connecticut Valley to Massachusetts. A. B. Corthell, Boston, Mass., is Ch. Engr.

Massachusetts—Southern New England Ry. (Grand Trunk Ry. System)—It is reported that this company has made arrangements for financing its proposed line from Palmer, Mass., to Providence, R. I. According to press reports, one of the contractors on a section of the line has stopped the shipment of his machinery. H. R. Safford, Montreal, Que., is Ch. Engr. G. T. Ry. System.

New York—Empire United Rys.—The Public Service Commission, Feb. 17, approved the proposed merger of the Rochester, Syracuse & Eastern, the Syracuse, Lake Shore & Northern, and the Auburn & Northern railroad companies, under the name of the above company. Capital, $11,600,000.

✚**Pennsylvania**—Montour R.R.—This company has awarded the contract to JOHN MARSCH, Chicago, Ill., for grading its proposed 34-mile extension, at about $1,500,000. E. J. Taylor, Pittsburgh, Penn., is Ch. Engr.

Virginia—Carolina, Clinchfield & Ohio Ry.—This company is making surveys for the construction of an extension from Lunganron to Norton, Va., 18 miles. The extension will be built along Rock Creek. Ward Crosby, Johnson City, Tenn., is Ch. Engr.

Seaboard Air Line R.R.—This company has sold $6,000,000 of bonds for improvements and additions. W. D. Faucette, Portsmouth, Va., is Ch. Engr.

Washington & Old Dominion Ry.—This company has made surveys for the construction of its proposed extension from Bluemont to Berryville, Va., about 16 miles. O. H. Bundy, 1517 H St., N. W., Washington, D. C., is Ch. Engr.

North Carolina—South Mills, Portsmouth & Elizabeth City R.R.—This company has applied for a charter to construct a line from Elizabeth City, N. C., to Portsmouth, Va., via South Mills, about 50 miles. Capital, $100,000. O. L. Williams, Portsmouth, Va., is interested.

Carolina R.—This company will construct an extension from Pink Hill to Chinquapin, N. C., about 20 miles. W. M. Hayes, Kinston, N. C., is interested.

Florida—Gulf, Florida & Alabama R.R.—This company has sold $1,500,000 of bonds for the extension of its line to Pine Hill. The company owns the right-of-way between Pensacola, Fla., and Tuscaloosa, Ala. Eighty miles are at present in operation from Pensacola to Local, Ala. G. A. Berry, Pensacola, is Vice-Pres. and Ch. Engr.

Union Cypress Co.—This company is considering an extension to its line to connect with the Atlantic Coast Line R.R. at St. Cloud, Fla. The offices of the company are located at Melbourne, Fla.

Alabama—Louisville & Nashville, Tenn.—This company is considering the construction of a cutoff from Calera to Selma, Ala., about 60 miles, to shorten its route from Birmingham to the Gulf of Mexico. John Howe Peyton, Louisville, Ky., is Ch. Engr. of Const.

Louisiana—Southern Pacific Co.—This company, it is reported, will construct an extension from Port Barre to Moreauville and Marksville, La., about 40 miles. E. B. Cushing is Engr. of Const., Houston, Tex.

Alexandria & Western Ry.—This company has completed its survey for the construction of its proposed line from Alexandria toward Lamothe, La., about 16 miles. G. F. Cotter, Fort Worth, Tex., is Pres.

New Iberia & Gulf Ry.—Surveys have been completed for the proposed line of this company from New Iberia, La., to the salt mines at Weeks Island. Right-of-ways have been secured for some time, and construction will be started within 30 days. Henry J. Cox & Co. are the engineers and contractors.

Tennessee—Tullahoma, Lynchburg & Fayetteville Ry.—This company has been organized and will apply for a charter soon to construct a line 32 miles long from Tullahoma to Fayetteville, Tenn., via Cumberland Springs, Lynchburg and Mulberry. The work will include 12 bridges, the largest span being 40 ft.

Kentucky—Louisville Ry.—This company is considering a six-mile extension, from Kosmosdale to West Point, three miles, and from Oro to Kosmosdale, three miles. Estimated cost, $150,000. T. H. Minary, Louisville, Ky., is Supt. of Const.

Kentucky—Rockcastle R.R.—This company has been incorporated to construct a line of railroad from Livingston to McKee, about 30 miles. The incorporators are N. W. Bond, Oakland, Md.; C. C. Williams, E. S. Allbright, W. L. Richardson, A. B. Furnish and J. W. Brown, Mount Vernon, Ky., and H. W. Bowman, Livingston, Ky.

Ohio—Cleveland & Youngstown Ry.—This company plans to begin work on its proposed line, Apr. 1. The estimated cost is $6,000,000. W. E. Pease, Cleveland, is Engr.

Michigan—Grand Rapids & Northwestern R.R.—It is planned to start construction on the line of this company as soon as the weather permits. Bonds for $2,000,000 have been sold.

North Dakota—Northern Pacific Ry.—This company has awarded a contract to construct 100 miles of new line, from Stanton, Mercier County, N. D., to the south end of the Killdeer Mountains, to A. GUTHRIE & CO., St. Paul, Minn. The road will run along the Knife River.

✚**Wyoming**—Chicago, Burlington & Quincy R.R.—This company has awarded the contract to TWOHY BROS., Portland, Ore., for constructing its proposed new line between the Powder River and Orin Junction, Colo. The line will be 110 miles long. Estimated cost, $7,000,000. The contract was awarded Feb. 13. T. E. Calvert, Chicago, Ill., is Ch. Engr.

Montana—Great Northern Ry.—This company has made surveys for the construction of an extension from Plentywood, Mont., in a westerly direction, via Scobey. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Montana—Chicago, Milwaukee & Puget Sound Ry.—According to press reports work on the electrification of 450 miles of this company's line through Montana and Idaho will be started shortly. The company is also considering extending the work, where the first portion is completed, to cross over the Cascade Mountains. E. O. Reeder, Seattle, Wash., is Ch. Engr.

Texas—Missouri, Kansas & Texas Ry.—This company has completed a survey from Livingston to Milvid, Tex., 21 miles. The company will also make surveys from Weldon to Waco, Tex. A. M. Acheson, Dallas, Tex., is Ch. Engr.

Texas—Artesian Belt R.R.—This company, it is reported, has succeded in financing its proposed extension to cost $170,000. The extension will be from Christine, Tex., to Crorother, Tex., 17 miles. J. D. Jackson, Macdona, Tex., is Ch. Engr.

The Missouri, Kansas & Texas Ry. and Texas Central Ry.—The governor has vetoed the bill providing for the merger of these companies.

Colorado—Plateau Valley Ry.—This company has completed surveys for the construction of its proposed line from eight miles east of Palisades to Colbran, Colo., 25 miles. J. J. Yeckel, Century Bldg., Denver, Colo., is Pres.

Atchison, Topeka & Santa Fé Ry.—This company plans to improve its facilities at Pueblo, Colo. A belt line will be constructed and various terminal improvements made. C. F. W. Felt, Topeka, Kan., is Ch. Engr.

✚**Canada**—Grand Trunk Pacific Ry.—This company has awarded the contract to M. P. & J. D. DAVIS, Quebec, Que., for completing the construction of 130 miles of railroad between New Brunswick and the St. Lawrence River.

Ontario—Toronto Eastern Ry.—This company is having surveys made for the construction of an extension from Pickering, 12 miles. E. W. Oliver, Toronto, Ont., is Ch. Engr.

Ontario—Temiskaming & Northern Ontario Ry.—This company will construct a branch line to connect the Abitibi River and its main line. S. B. Clement, North Bay, Ont., is Ch. Engr.

British Columbia—It is proposed to construct a railroad from Hardy Bay to Suquash on Vancouver Island, B. C., about 12 miles, and to operate steamship lines from Hardy Bay, Bernard & McKeown, Montreal, Que., are Solicitors for the applicants.

ELECTRIC RAILWAYS

Springfield, Mass.—The Massachusetts Northern St. Ry. Co. is considering plans for the construction of a connecting link from Orange to Millers Falls. Construction will be started this spring. J. A. Taggart, Greenfield, is Gen. Supt.

Centredale, R. I.—The Rhode Island Co. has proposed the construction of an interurban electric railway from Centerdale to Chepachet. D. F. Sherman, Providence, is Pres.

Providence, R. I.—The Rhode Island St. Ry. Co. is planning the construction of an extension of its electric line from Centerdale through Glendale, Harmony and Chepatche to Pascoag, R. I., to cost $300,000. D. Y. Sherman, Vice-Pres., is in charge of construction.

Olean, N. Y.—The Western New York & Pennsylvania Traction Co. is considering plans for the construction of an electric railway from Olean to Hinsdale, about seven miles. W. R. Page, Olean, is Pres.

Oneonta, N. Y.—Preliminary arrangements will soon be started by the Oneonta, Charlotte Valley & Cobbleskill Ry. Co. for the construction of its 40-mile electric railway. C. G. Payne, Charlotteville, N. Y., is Pres.

East Berlin, Penn.—The City Council has granted a franchise to a company of local citizens to construct and op-

erate an electric railway in East Berlin. The line will eventually be extended to York.

Wyomissing, Penn.—The Wyomissing Valley Ry. Co. is making preliminary arrangements for double-tracking its line from Wyomissing to Hendleton. J. Milton Miller, Reading, is interested.

Richmond, Va.—Plans are being prepared by the Virginia Ry. & Power Co. for the construction of an electric railway on Franklin St., in Richmond. C. B. Buchanan, Richmond, is Gen. Mgr.

Fairmont, W. Va.—The Monongahela Valley Traction Co. will be ready to receive bids about Apr. 1, for the construction of its proposed extension from Salem to Lumberport. J. O. Watson, Fairmont, is Gen. Mgr. Noted Jan. 16.

Anderson, N. C.—The Southern Power Co. is planning the construction of an interurban railway from Anderson, N. C., to Atlanta, Ga. W. S. Lee, Charlotte, N. C., is Pres.

Columbia, S. C.—The Palmetto Ry. Co. has been incorporated to construct and operate an interurban railway from Columbia to Greenville. R. A. Cooper, Laurens, S. C., is interested.

Lakeland, Fla.—Press reports are to the effect that H. D. Mendenhall is preparing plans for the construction of an electric railway in Lakeland.

Lafayette, La.—Preliminary arrangements are being made by the Louisiana Power Traction Co. for the construction of its proposed electric line from Lafayette to Abbeville. T. H. Mandel, Lake Charles, La., is Ch. Engr.

St. Martinville, La.—The City Council has granted a franchise to the Southwestern Traction & Power Co. to construct and operate an electric railway through St. Martinville.

Bristol, Tenn.—Preliminary arrangements are being made and the right-of-way secured by James E. Cox, Knoxville, and associates, for the construction of an electric railway from Bristol to Johnson City. Noted Feb. 13.

Madisonville, Ky.—Plans are being considered by B. T. Robinson and W. W. Kingston for the construction of an electric railway from Madisonville to Nortonville

West Point, Ky.—**The Louisville Ry. Co. is making preliminary surveys for the construction of its proposed extension from Kosmosdale to West Point, about three miles. T. H. Minary, Louisville, is Supt.**

Evansville, Ind.—Plans are being prepared by the Evansville Rys. Co. for the extension of its line from Evansville to Owensville, about eight miles. W. A. Carson, Evansville, is Gen. Mgr. and Pur. Agt.

Westfield, Ind.—The Indianapolis & Delphi Traction Co. is making preliminary arrangements for the construction of its proposed interurban line which will connect Westfield, Carmel, Hortonville, Sheridan, Kempton, New London, Burlington and Delphi. H. L. Smith, Indianapolis, is Secy.

Coloma, Mich.—Preliminary arrangements are being made by the Michigan United Traction Co. for the construction of its proposed electric railway from Benton Harbor to Coloma. A. W. McLimont, Jackson, is Gen. Mgr.

Detroit, Mich.—The Rapid Ry. Co. has been granted permission to issue $75,000 in bonds for double-tracking its line from Detroit to Port Huron. F. W. Brooks, Detroit, is Gen. Mgr.

Champaign, Ill.—Plans are being considered by the Danville, Urbana & Champaign Ry. Co. for the construction of an electric railway over various streets in Champaign. H. J. Pepper, Champaign, is Gen. Supt. of Champaign lines.

East St. Louis, Ill.—The East St. Louis Ry. Co. has applied to the City Council for a franchise to construct and operate an electric railway on various streets in East St. Louis. C. F. Hewitt, East St. Louis, is Gen. Supt. and Pur. Agt.

Tampico, Ill.—The Hooppole, Yorktown & Tampico Ry. Co. has been incorporated to construct and operate an interurban railway from Hooppole to Tampico. The incorporators are Charles W. Groves, George Mathias, James Tompkinson and H. J. Ringel, all of Hooppole, and John W. Cooley and J. W. Mathias, of Tampico.

Fairchild, Wis.—The construction of an electric railway from Fairchild to Galesville has been proposed. A committee, composed of men from the various towns through which it will pass, is considering the proposition.

✚Kansas City, Mo.—The Kansas City, Raytown & Lees Summit Electric Ry. Co. has awarded the contract for grading its proposed electric railway from Sheffield to Lees Summit, about 30 miles to DAVIDSON BROS. CONSTRUCTION CO.

Denton, Tex.—E. P. Turner and associates have been granted a 50-year franchise by the Commissioners Court for an interurban electric railway that they propose constructing through the county from north to south. The proposed line will pass through the towns of Lewisville, Denton and Sanger in this county. It is to run between Dallas and Gainesville.

Tacoma, Wash.—S. C. Davis and Nicholas Lawson are interested in the construction of an 11-mile municipal electric railway in Tacoma.

Ashland, Ore.—F. P. Mulvey, Los Angeles, Calif., has applied to the City Council for a franchise to construct and operate an electric railway in Ashland.

Gresham, Ore.—The Portland Ry. Light & Power Co. is preparing plans for the electrification of its line from Gresham to Montavallo, about nine miles. F. W. Hild, Portland, is Gen. Mgr.

Bay City, Calif.—Plans are being prepared by the Pacific Electric Ry. Co. for the extension of its Alamitos line from Bay City to Los Angeles. J. McMillan, Los Angeles, is Gen. Mgr.

Los Angeles, Calif.—The City Council has granted a franchise to J. M. Haddock for the construction of a double-track line on 44th St., from Denker Ave. to the city limits.

Martinez, Calif.—The Oakland, Antioch & Eastern Ry. Co. has applied to the Board of County Commissioners for a franchise to construct and operate an electric railway on the county road from Walnut Creek to Danville. Fred Brooks, San Francisco, is Ch. Engr.

Redwood City, Calif.—The Redwood City Ry. Co. will be ready to start work about Apr. 1, on the construction of its proposed five-mile electric railway in Redwood City. George A. Merrill, Redwood City, is Pres. Noted Apr. 18, 1912.

✚Rialto, Calif.—The Crescent City Ry. Co. has awarded the contract for grading its proposed extension from Bloomington to Rialto to OSCAR FORD, Riverside.

Ottawa, Ont.—Preliminary arrangements are being made by the Ottawa-Morrisburg Electric Ry. Co. for the construction of its proposed line from Ottawa to Morrisburg. J. G. Kilt, Citizens Bldg., Ottawa, is Pres. Noted Dec. 12.

Regina, Sask.—The City Council has granted permission to Anderson & Luneny to construct and operate a street-car line on 16th Ave., from McDonald to Park St.

Halifax, N. S.—The Halifax Electric Tramway Co. is preparing plans for the construction of a three-mile extension to its line. J. W. Crosby, Halifax, is Mgr. and Pur. Agt.

Vancouver, B. C.—Preliminary arrangements are being made by the Burrand, Westminster & Boundary Ry. & Navigation Co. for the construction of its proposed railway from Stave River Falls to the Pitt River, about 20 miles.

Matamoros, Mex.—A. B. Cole and B. B. Rentfro, of Brownsville, Tex., have been granted a 50-year franchise for the installation and operation of an electric street railway system in Matamoros. They also contemplate installing a waterworks plant and the construction of a distributing system here.

LIGHT, HEAT AND POWER

Boston, Mass.—An expenditure of $1,500,000 is planned by the Massachusetts Electric Cos. for the improvement and extension of its various properties. P. F. Sullivan, Boston, is Gen. Mgr.

New Bedford, Mass.—Plans are being prepared by the New Bedford Gas & Edison Light Co. for an expenditure of $200,000, for the reconstruction and enlargement of its power plant. George R. Stetson, New Bedford, is Pres. and Gen. Mgr.

Providence, R. I.—The Rhode Island Co. is considering plans for the enlargement of its power plant at Providence. Estimated cost of the improvement, $750,000. M. H. Bronsdon, Providence, is Ch. Engr.

Windsor Locks, Conn.—The Northern Connecticut Light & Power Co. is preparing plans for the construction of a substation and transmission lines to supply electricity to the towns formerly supplied by the Housatonic Power Co. Walter P. Schwabe is Gen. Mgr.

Albion, N. Y.—Considerable improvements to its power plant are being planned by the Swett Electric Co. P. R. West, Albion, is Local Mgr.

Brooklyn, N. Y.—Bids will be received by Charles B. Stover, Pres. of Park Bd., Arsenal Bldg., Fifth Ave. and 64th St., Boro. of Manhattan, until 3 p.m., Mar. 6, for all labor and materials required for the erection and completion of steam-heating work for the new work shops and storehouse, located in Prospect Park, Borough of Brooklyn, together with all the work incidental thereto.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until 4 p.m., Mar. 3, for installing electrical equipment in new Public School 52, on the northerly side of Kelly St., east of St. Johns Ave., Boro. of The Bronx.

✚New York, N. Y.—The New York, New Haven & Hartford R.R. Co. has awarded the contract for the construction of a power plant in the Van Nest section of the Borough of the Bronx to the CASPER RANGER CONSTRUCTION CO., at $75,000.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Mar. 4, for furnishing gas for and to the public lamps on the streets, supplying gas, etc., for new lamps when required, for making certain repairs to lamp-posts, and for furnishing gas to public buildings in the Fifth Ward, Boro. Queens, from Mar. 4, 1913, to Dec. 31, 1913.

Schenectady, N. Y.—Plans are being prepared by the Mohawk Gas Co. for the construction of a gas-generating plant at Schenectady. Estimate cost, $350,000. Henry W. Peck is Gen. Mgr.

Syracuse, N. Y.—The Syracuse & Suburban Gas Co. has obtained a franchise and made application to the village authorities of East Syracuse for permission to lay 6½ miles of gas mains.

Hightstown, N. J.—The Borough Council has entered into a contract with the Hightstown Electric Light & Power Co., for the installation of a tungsten street-lighting system, in place of the arc lamps now employed.

The Borough Council has voted to offer the Public Service Gas Co. a free franchise for the installation of a gas system throughout the borough.

Bellaire, W. Va.—The County Commissioners have granted a franchise to the Wheeling Electrical Co., to construct and operate a transmission line from Bellaire to Warnock. J. B. Garden, Wheeling, is Gen. Mgr.

Gastonia, N. C.—The City Council has granted a franchise to F. H. Hicock and associates to construct and operate a gas plant in Gastonia.

McColl, S. C.—See item under Water Supply—Irrigation.

Griffin, Ga.—The City Council has authorized an appropriation of $5000, for the improvement of the municipal electric-light system.

St. Cloud, Fla.—The City Council has granted a franchise to the St. Cloud Public Utilities Co. to construct and operate an electric system in St. Cloud.

St. Petersburg, Fla.—Plans are being prepared by the St. Petersburg Electric Light & Power Co. for the construction of a new power plant, to cost about $100,000. H. W. Fuller, St. Petersburg, is Mgr.

Bessemer, Ala.—The J. E. McCrary Co., Atlanta, Ga., is preparing plans for the construction of a municipal electric-light plant for Bessemer. Estimated cost, $35,000.

Birmingham, Ala. Press reports are to the effect that the Birmingham Ry., Light & Power Co. is preparing plans for the construction of a gas holder on Seventh Ave., between 12th and 13th Sts. The structure will have a capacity of 3,000,000 cu.ft. of gas, and will cost about $200,000. K. L. Simmons, Birmingham, is Supt. Gas Dept.

Tuscaloosa, Ala.—The Tuscaloosa Ice & Light Co. has arranged for the issuance of a $250,000 of bonds and for the expenditure of $175,000 of this amount immediately in extensions of and improvements on the properties of the company and for the acquisition of additional properties. M. P. Jamison is Vice-Pres.

New Orleans, La.—The lowest bids received by F. S. Shields, Secy., Water and Sewerage Bd., Feb. 18, for furnishing and installing (a) transmission lines and (b) cables for the drainage system were those of the General Electric Co., Schenectady, N. Y. (a) $71,000, (b) $25,000. Noted Jan. 2.

Columbia, Tenn.—A committee has been appointed to investigate the feasibility of installing an ornamental street-lighting system in the business district.

Covington, Ky.—The Licking River Power Co. is considering plans for the construction of an electric-light plant. James B. Cox and S. D. House are interested.

Lexington, Ky.—The City Council is considering plans for the installation of an ornamental street-lighting system on the principal thoroughfares in Lexington. Eugene Creed is interested.

Shelbyville, Ky.—Plans are being prepared by the Kentucky Utilities Co. for the enlargement and improvement of its electric-light plant at Shelbyville. A transmission line will be extended to Pleasureville.

Kendallville, Ind.—Bids will be received by the city until Mar. 11, for the construction of a new power plant, to cost $10,000. Noted Oct. 31.

Fenton, Mich.—An election will soon be held to vote on the proposition to issue $25,000 in bonds for the construction of a municipal electric-light plant.

Grand Rapids, Mich.—The City Council has authorized an expenditure of $30,000 for the installation of new equipment in the municipal electric-light plant.

Jacksonville, Ill.—The City Council is considering the proposition to issue $50,000 in bonds for the rehabilitation of the municipal electric-light plant.

Pittsfield, Ill.—The Central Illinois Public Service Co., of Mattoon, is considering the construction of an electric-light plant at Pittsfield.

Ames, Iowa—At a recent election the citizens voted to issue $25,000 of bonds for the construction of a municipal electric-light plant. Noted Jan. 30.

Bayard, Iowa—The construction of a municipal electric-light plant is under consideration.

Fontanelle, Iowa—Plans are being considered by the City Council for the construction of a municipal electric-light plant. Estimated cost, $7500.

Redfield, Iowa—See item under Water Supply—Irrigation.

Russell, Iowa—J. D. Elder, of Albia, Iowa, has applied to the City Council for a franchise to construct and operate an electric-light plant at Russell.

Moline, Kan.—See item under Water Supply—Irrigation.

Beaver City, Neb.—The citizens recently voted to issue bonds for the construction of a municipal electric-light plant. Noted Feb. 13.

Jamestown, N. D.—Plans are being considered by the City Council for the construction of an electric-light plant.

Mohall, N. D.—The construction of an electric-light plant at Mohall is under consideration.

Winner, S. D.—The installation of an electric-light system in Winner is being considered by C. O. Cobb, of Funk, Neb.

Poplar, Mont.—The organization of a company for the construction of an electric-light plant at Poplar is being agitated.

Foreman, Ark.—W. B. and J. M. Madden have been granted a franchise to construct and operate an electric-light plant at Foreman.

Hallettsville, Tex.—The City Council will install additional machinery and equipment in the municipal electric-light and water-works plant.

†Hearne, Tex.—The City Council has awarded the contract for the construction of a municipal electric-light plant to RANDALL, LOVEGROW & WYMAN, Houston. Noted Oct. 24.

Pearsall, Tex.—The City Council has decided to extend the street-lighting system here.

Hinton, Okla.—See item under Water Supply—Irrigation.

†Boulder, Colo.—The contract for the construction of a municipal electric-light plant in Boulder cañon, has been awarded by the City Council, to C. M. HAMPSON, Boulder, at $37,500.

Alamogordo, N. M.—George Carl has applied to the Town Board for a franchise to construct and operate an electric-light plant at Alamogordo.

Cathlamet, Wash.—The proposition to construct a municipal electric-light plant is under consideration by the City Council.

Des Chutes, Wash.—The Des Chutes Power Co. has been incorporated, and will develop one or two water sites for developing power. Samuel Galland is Pres.

Elma, Wash.—The Elma Light & Power Co. has been granted a franchise to erect and operate an electric-light plant at Elma.

Albany, Ore.—A municipal lighting system will be installed by the city, consisting of engine-driven generator and 600 cluster lights. L. C. Kelsey, Portland, Ore., is Consult. Engr.

Chico, Calif. The management of the Richardson Ice Co. is considering plans for the construction of an electric-light plant, to cost $10,000.

Glendora, Calif. Bids will be received by the city until 3:30 p.m., Mar. 4, for the installation of an ornamental lighting system on Michigan, Bennett and Minnehaha Aves.

Orange, Calif. The Birch Oil Co. has been granted a 25 years franchise to construct a pipe line for natural gas along and under certain public highways.

Redwood City, Calif. A record election bonds for $8000 were voted for the extension of the street-lighting system.

Ottawa, Ont. The Ottawa Electric Ry. Co. is preparing plans for the construction of a substation on Albert St., to cost $75,000. A. E. Hutcheson, Ottawa, is Supt. and Gen. Mgr.

The Electrical Department contemplates an expenditure of $7342 for the extension of the street-lighting system.

Stratford, Ont.—The City Council is considering plans for the extension of the electric-lighting system in Stratford. C. N. Greenwood is Mayor.

Victoria, B. C. The Silver Spring Brewery, Ltd., will soon begin the erection of a new power plant, to cost $5000.

BRIDGES

Portland, Maine—According to press reports, the County Commissioners are considering plans for a bridge between Portland and South Portland, at Knightville. Estimated cost, $1,178,000.

New London, Conn.—The New York, New Haven & Hartford R.R. has decided to build a new four-track bridge at New London, estimated to cost $1,000,000.

★Norwalk, Conn.—Bids for the construction of the Washington Street Bridge will be received at the office of the Secretary of the Bridge Construction Committee in the Fairfield County Savings Bank Bldg., 51 Wall St., Norwalk, until 2 p.m., Mar. 20. The proposed bridge will be mainly of reinforced concrete construction, with a double leaf bascule over the channel, have a width of 60 ft., and a total length of about 965 ft., with brick paving on the roadway and cement sidewalks. Noted Feb. 6.

Flushing, N. Y.—The Board of Public Works has asked an appropriation of $250,000 for building a bridge over Newtown Creek. Plans and specifications for the structure have been completed by the State Engineer.

Little Falls, N. Y.—The Superintendent of Public Works received the following bids, Feb. 18, for Barge Canal Contract No. 107, which provides for a lift bridge and a fixed bridge over the Barge canal in the city of Little Falls. The lowest was that of Skene & Richmond, of Brockport, N. Y., at $127,707, as against the Engineer's estimate of cost of $124,471. Other bids were: Lupfer & Remick, Buffalo, N. Y., $135,845. Leary & Morison Co., Fairport, N. Y., $130,007. S. V. R. Malcolm & Son, Medina, N. Y., $131,848. Frank L. Cohen, Buffalo, N. Y., $132,241. Lathrop, Shea & Henwood Co., Buffalo, N. Y., $131,249. Noted Feb. 6.

Penn Yan, N. Y.—It is proposed to rebuild the bridge over Lake Keuka outlet, at the foot of Liberty St., in Penn Yan. Estimated cost, $15,000.

Perth Amboy, N. J.—Alvin B. Fox, County Engr., is preparing plans for a twin span reinforced concrete bridge to be erected over the south branch of the Rahway River, near Iselin. The structure will be 54 ft. 6 in. over all, and 30 ft. wide.

The Middlesex County Board of Freeholders has called for bids for the erection of a new king-rod truss bridge near Half Acre. The span will be 31 ft. in length, and 17 ft. wide; also for the erection of a reinforced-concrete bridge over Lawrence Brook, near Dean's Station, to be 38 ft. long and 36 ft. wide.

★Chester, Penn.—Bids for a concrete balance cantilever structure bridge over Chester River at Fifth St., in the city of Chester, will be received until 10 a.m., Mar. 17, at the office of the Commissioners of Delaware County, Media. Plans and specifications and blank forms upon which bids must be made will be furnished upon application to the Commissioners. John Griffin is Ch. Clk.

Hazelwood, Penn.—The Board of Trade will soon submit plans and specifications to the County Commissioners, for a bridge over the Monongahela River, between Hazelwood and Baldwin Township.

★Philadelphia, Penn.—Bids will be received by M. L. Cooke, Dir. Pub. Wks., until 2 p.m., Mar. 18, for the following bridges: Montgomery St. over Connecting R.R., 29th and 32d Wards, steel plate girder bridge encased in concrete on concrete masonry, 50 ft. wide 214 ft. long, with paving; 66th Ave. North over North Penn R.R., 42d Ward, concrete arch, 40-ft. span, 78 ft. wide, with paving; Chester Ave. over West Chester & Philadelphia R.R., 40th and 46th Wards, steel girders encased in concrete with extensions to present stone abutments, 70 ft. wide, 100 ft. long; City Ave. over Indian Run, inter-county, concrete arch, 20-ft. span, with filling, paving and concrete balustrade.

Pittsburgh, Penn.—Bids for constructing the Bloomfield Bridge were received by Joseph G. Armstron, Dir. Pub. Wks., Feb. 3, as follows: C. M. Neeld Construction Co., Oliver Bldg., $87,100; Dravo Construction Co., Lewis Bldg., $86,514; Cummings Structural Concrete Co., Commonwealth Bldg., $102,033; Duquesne Contracting Co., Bessemer Bldg., $97,282; McLaughlin Contracting Co., 223 4th Ave., $118,006; Booth & Flinn, Ltd., 1942 Forbes St., $94,004; F. F. Schellenberg & Co., 1134 Murray Hill Ave., $96,618; McArthur Concrete Pile & Foundation Co., 11 Pine St., New York City, $102,676; Adam Laidlaw & Co., Bessemer Bldg., $99,051; M. O'Herron Co., First and McKean Sts., $95,371; Cranford Construction Co., House Bldg., $98,289. Noted Jan. 30.

York, Penn.—The city and county officials are considering the construction of a bridge over Codorus Crek, at Market St.

Washington, D. C.—An appropriation of $500,000 has been asked to procure plans for the construction of a memorial bridge across the Potomac River, to connect Potomac Park and the Arlington National Cemetery. The bridge is estimated to cost $5,000,000.

Richmond, Va.—Competitive plans and specifications will be received until noon, Apr. 15, by the Administrative Board for the erection of a reinforced-concrete bridge and viaduct replacing the present Free Bridge across the James River, from Ninth and Byrd Sts. to Seventh and Semmes Sts. Robert Whittet, Jr., is Chn.

Marlington, W. Va.—Bids will be received until Mar. 4 by the Clerk of Pocahontas County, for the construction of a concrete bridge across Salisbury Run at Krylerton, and one across a run near Uriah Hevener's Scales, both in the Greenbank District, and both to hove 12-ft. roadways. C. J. McCarty is County Clerk.

Gainesville, Fla.—Bids will be received until noon, Mar. 4, by the Commissioners of Alachua County, for the construction of a steel beam bridge across Lochloosa Creek in the eastern part of the county.

Bay Minette, Ala.—The Commissioners of Baldwin County will shortly advertise for bids for the construction of three steel bridges in the county.

Sardis, Miss.—Bids will be received until Mar. 3, by the Board of Supervisors of Panola County, for building steel bridges across Long, Hotopha and McKinney Creeks and the Yarbrough and Sanders Ditch. R. W. Draper is Clk.

Shreveport, La.—The Police Jury of Caddo Parish will erect a steel bridge across Caddo Lake at Mooringsport and one across Twelve Mile Bayou on the Arkansas Road. Each will have a lift span for the passage of boats. The estimated cost is from $50,000 to $60,000. T. J. Bullin, Shreveport, is Parish Engr.

Paducah, Ky.—According to press reports, it is planned to construct a bridge across the Ohio River, between Paducah and Metropolis, Ill., to serve the principal railroads of the Mississippi Valley in handling the expected increase in tonnage on account of the Panama Canal's completion. The roads uniting in the construction of the bridge, it is reported, are the Chicago, Burlington & Quincy R.R., Chicago & Eastern Illinois R.R., the Cleveland, Cincinnati, Chicago & St. Louis Ry., the Illinois Central R.R., and the Nashville, Chattanooga & St. Louis Ry. A. S. Baldwin, Chicago, Ill., is Ch. Engr. Illinois Central R.R.

Cincinnati, Ohio—The City Council is considering the erection of a new bridge to replace the present structure on McMillan St., spanning Reading Road and connecting the suburbs of Mount Auburn and Walnut Hills. The estimated cost is $15,000.

✚Toledo, Ohio—We are officially advised that the Director of Public Service has awarded a contract for the construction of the Sumner St. Bridge to the A. G. THATCHER CONSTRUCTION CO., Toledo, at $30,245. Other bidders were: The Toledo Bridge & Crane Co., $31,423; King Bridge Co., $36,555; Capitol Construction Co., $35,130. G. W. Tonson is City Engr. F. G. Stockton is Secy. Noted Feb. 6.

We are officially advised that the following contracts have been awarded for the construction of the Ash and Consaul St. bridge: for removing and repairing the Cherry St. spans, to the C. H. FATH & SONS CONSTRUCTION CO., at $62,184; for concrete work, to the SHAW-THOME CO., at $71,282; for repairs to the TOLEDO BRIDGE & CRANE CO., at $24,707; for paving the approaches, to the RUSSEL & JENNISON CO., at $26,468. Noted Jan. 9.

Rockport, Ind.—Bids will be received by the County Commissioners at Rockport, until Mar. 3, for the construction of 60 bridges. J. T. Stevenson is County Audr.

Sioux City, Iowa—Press reports state that bids will be received by the County Board of Supervisors until Mar. 5, for the construction of 32 bridges.

Waterloo, Iowa—The City Council is contemplating the construction of a Melan Arch Bridge over the Cedar River at Mullen Ave.

St. Louis, Mo.—Plans have been submitted for the approval of the War Department, for two railroad bridges, one across the Mississippi River just below the mouth of the Missouri River, and the other across the Missouri River at Weldon Springs, for the St. Louis County Belt R.R. Co. The bridge over the Mississippi will cost approximately $1,500,000, and the one over the Missouri about $900,000. James D. Houseman is Pres. of the company.

Frederick, Okla.—Press reports are to the effect that the Board of County Commissioners will receive bids until Mar. 4, for the construction of two bridges, one to be built across Jack Creek and the other across Horse Creek. R. O. Ray is the County Clk.

Lawton, Okla.—Plans have been prepared and bids will be received by the County Commissioners of Comanche County, until 6 p.m. Mar. 14, for the construction of six bridges.

Oroville, Calif.—The County Surveyor has been instructed to prepare plans and specifications for the construction of a reinforced-concrete bridge to replace the Nord Ave. structure across Big Chico Creek.

Toronto, Ont.—The Committee on Civic Works has approved plans for a new steel bridge to be erected at Gerrard St. Its estimated cost is $200,000. The roadway will be 50 ft. wide, and there will be two sidewalks, each 8 ft. wide. Noted Oct. 24.

✚Fredericton, N. B.—A contract has been awarded by the Department of Public Works, for the construction of the superstructure of a new bridge at St. John, N. B., to the Dominion Bridge Co., Montreal, at approximately $275,000. Jean Monro is Ch. Comr.

WATER SUPPLY—IRRIGATION

Boston, Mass.—Bids will be received by the Metropolitan Water and Sewerage Board until Mar. 3, for furnishing 220 tons of 24-in. cast pipe, 50 tons of 20-in., 100 tons of 36-in., and 50 tons of special castings. Dexter Brackett is Ch. Engr.

Middleboro, Mass.—The town has voted to expend $20,000 for the installation of a filtration plant. Robert Spurr Weston, Consult. Engr., Boston, is investigating the situation.

Worcester, Mass.—Bids for furnishing pipes, gate valves and hydrants for the Water Department were received Feb. 11, by Geo. W. Batchelder, Water Comr., as follows: Gate valves, 6-in., 8-in., 10-in. and 12-in.: Chapman Valve Co., Indian Orchard, Mass., $8, $13, $20; Ludlow Valve Co., $11.95, $17.95, $25.65, $32.50; Kennedy Valve Co., Elmira, N. Y., $8.70, $13.90, $20.90, $26.85; Eddy Valve Co., Troy, N. Y., $11, $17, $24, $30; Rennsalaer Valve Co., $16.70, $23.70, $31.40; Crane Co., Boston, Mass., $10.50, $15.50, $25.50, $32.50; Pratt & Cady, Hartford, Conn., $8, $13, $20, $28; hydrants, 6-in. and 8-in.: Chapman Valve Co., $27, $41; R. D. Wood Co., $28, $45; Ludlow Valve Co., $31.75, $60.50; for c.-i. pipe: U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Penn., $24 per ton; Warren Foundry & Machine Co., New York, $24.40; Standard Cast Iron Pipe & Foundry Co., Philadelphia, $24.90 to $25.50; C. Millar & Son Co., Utica, N. Y., $24.90 to $26.70; R. D. Wood & Co., Philadelphia, $25.20 to $26.20. Noted Jan. 7.

★✚Hartford, Conn.—The Board of Water Commissioners has awarded the contract to furnish 38 tons of 6-in., 321 tons of 8-in., 353 tons of 10-in., 338 tons of 12-in., 111 tons of 16-in., 347 tons of 24-in. c.-i. water pipe and 108 tons of castings to the STANDARD CAST IRON PIPE & FOUNDRY CO., Bristol, Penn., at $41,192. Other bidders were: Charles Miller & Son Co., Utica, N. Y., $46,656; Warren Foundry & Machine Co., New York, $43,703.20; R. D. Wood & Co., Philadelphia, Penn., $42,199.96; United States Cast Iron Pipe & Foundry Co., Philadelphia, Penn., $42,119.80. Noted Feb. 13.

★Jamestown, N. Y.—We are officially advised that bids for furnishing labor and materials for constructing a 6,000,000-gal. pumping engine, reciprocating or turbine, were received by the Water Commissioners, Feb. 17, as follows: Reciprocating engines: William Todd Co., Youngstown, Ohio, $43,000; Bethlehem Steel Co., South Bethlehem, Penn., $23,866; Nordburg Mfg. Co., Milwaukee, Wis., $19,630; Wilson Snyder Mfg. Co., Pittsburgh, Penn., $19,525; International Steam Pump Co., Buffalo, N. Y., $19,150; Allis-Chalmers Co., Milwaukee, Wis., $19,100; Epping-Carpenter Co., Pittsburgh, Penn., $18,980; Platt Iron Works, Dayton, Ohio, $17,900. Turbines: Platt Iron Works, Dayton, Ohio, $7987; Kerr Turbine Co., Wellsville, N. Y., $10,398; Epping Carpenter Co., Pittsburgh, Penn., $14,450; Dean Mfg. Co., New York, $12,625. L. P. Hapgood is Asst. Supt. Noted Feb. 6.

New York, N. Y.—We are officially advised that bids for laying water mains and appurtenances in various streets, were received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, Feb. 20, as follows: Walton Contracting Co., $13,987; Knight & De Micio, Inc., $15,679; Saraci Contracting Co., $16,698; James O'Leary, $15,183; Joseph Grippe, $19,626; Draggonette Contracting Co., $15,945; John Cornwell, $13,829; Wilson Construction Co., $9,572; W. F. Horton Contracting Co., $17,835; Bell Cross Contracting Co., $18,86?; Henry E. Fox, $16,810; Louis D. Gregory, $20,657. Noted Feb. 13.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Mar. 5, for furnishing and constructing a high-pressure headquarters building, at No. 226 West Broadway, Borough of Manhattan; furnishing, delivering and installing eight gratings with a hoisting yoke in the gate house at Muscoot Dam in the Town of Bedford, Westchester County, New York; furnishing and installing copper roofs on the 135th St. gate house and the north gate house in Central Park, Borough of Manhattan.

New York, N. Y.—We are officially advised that bids for furnishing and delivering bronze shaft caps and appurtenances for the city tunnel of the Catskill Aqueduct, in the city of New York, Contract 84, were received by the Board of Water Supply, Feb. 18, as follows: American Manganese Bronze Co., 99 John St., New York, $90,568; Coldwell-Wilcox Co., Newburgh, $111,177; Hyde-Windlass Co., Bath, Maine, $123,296; Exeter Machine Works, Pittston, Penn., $126,121; Bethlehem Steel Co., South Bethlehem, Penn., $134,290; William Cramp & Sons Ship & Engine Building Co., Beach and Ball Sts., Philadelphia, Penn., $139,346; Paul S. Reeves & Co., 1415 Catherine St., Philadelphia, Penn., $152,859.

★✚Belmar, N. J.—We are officially advised that the contract to lay about 4½ miles of 4- to 10-in. c.-i. water mains, with the necessary valves, hydrants, specials, etc., has been awarded to PARTRIDGE & BURKE, Hohokus, N. J., at $18,370. The other bids were: T. J. McGovern, Trenton, N. J., $18,865; Monmouth Contracting Co., Red Bank, N. J., $19,183; Antonio Lambo, Waterbury, Conn., $19,495; H. K. Corbin, New York, $19,811; Antonio Costa, Orange, N. Y., $20,352; J. J. Hughes, Newark, N. J., $20,536; Daniel Donavan, Bayonne, N. J., $20,727; Kelley-McFeely, Camden, N. J., $22,056; Sutton & Corson, Ocean City, N. J., $22,229; William Horne & Co., New York, $22,240; W. F. Norton Co., New York, $22,702; Pierson Engineering & Construction Co., Hartford, Conn., $23,113; Atlantic Construction & Supply Co., Atlantic City, N. J., $23,958; Watson Engineering & Construction Co., New York, $24,977; Henry Fox, New York, $24,976; Liddle & Pfeiffer, Perth Amboy, N. J., $25,368; Sun Dredging & Construction Co., Philadelphia, $27,687; John W. Heller, Newark, N. J., $29,702; P. J. Monaghan, Perth Amboy, N. J., $29,819; Edward Jackman, White Plains, N. Y., $30,193; Joseph Gripp, New York, $35,549; D'Amato & Stefanelli, Newark, N. J., $41,939. Bids were opened Feb. 15. Clyde Potts, 30 Church St., New York, is Consult. Engr. Noted Feb. 6.

Galeton, Penn.—An election will probably soon be called to vote on a bond issue of $45,000, for the installation of a complete new water system.

Hamburg, Penn.—The borough contemplates purchasing the plant of the Windsor Water Co.

Johnstown, Penn.—We are officially advised that Chester & Fleming, Consult. Engrs., Union Bank Bldg., Pittsburgh, Penn., have been employed by the Johnstown Water Co. to review all data in connection with cost of water to consumers.

Milton, Penn.—The citizens have voted to increase the appropriation of $20,000 to $30,000, for constructing the proposed water system and sewer extensions.

Tamaqua, Penn.—An appropriation of $20,000 has been made for constructing a duplicate pumping plant at the Owl Creek Reservoir, repairing the Rabbit Run Reservoir, and raising the dam of the Owl Creek Reservoir.

Georgetown, Del.—The city contemplates a bond issue of $30,000 for the installation of a municipal water . . . tem

★+Baltimore, Md.—We are officially advised that the contract to furnish sluice gates for the new Loch Raven Dam, has been awarded the COFFIN VALVE Co., Boston, Mass., at $1151. Bids were opened Feb. 12. Ezra B. Whitman is Water Engr. Noted Feb. 6.

McColl, S. C.—An election will probably soon be called to vote on a bond issue of $60,000 for constructing water and sewer systems and an electric-light plant.

Conyers, Ga.—The town contemplates the installation of complete water and sewer systems. Bids will probably be asked during the spring or summer.

Cornelia, Ga.—Bonds for $25,000 have been voted for constructing water and sewer systems here.

Fort Meade, Fla.—Bids will be received by the Board of Bond Trustees until Mar. 4, for constructing a water system here, according to plans prepared by the J. B. McCrary Co., Atlanta, Ga. The contract involves the construction of a 75,000-gal. steel tank on a 75-ft. tower, a 75,000-gal. compound steam pump, and about 25,000 lin.ft. of c.-i. or Matheson joint steel and c.-i. water pipe. Bonds for $19,000 were recently voted for this work.

+Yazoo City, Miss.—We are officially advised that the contract to furnish water meters during the year 1913 has been awarded to the HERSEY MFG. CO., Boston, Mass., at $6.12 each for Type F ⅝-in. meters. Bids were opened Feb. 15. Noted Jan. 23.

Crowley, La.—The city contemplates installing water meters, extending mains, and building a reservoir. Estimated cost, $8000.

Kenton, Tenn.—Bids will be received by the city until Mar. 11, for constructing a water system and an electric-light plant here, according to plans prepared by R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn. Noted Feb. 20, as Denton.

Nashville, Tenn.—The Board of Public Works is arranging to call a special election for May 29, to vote on a bond issue of $2,000,000 for reconstructing the water system and the reservoir. George W. Stainback, is Chn. Noted Jan. 9.

Sandusky, Ohio—Bids will be received by John Bing, Dir. Pub. Ser., until noon, Mar. 5, for furnishing the necessary water meters during the year 1913. Edward A. Rhode is Clk.

Boscobel, Wis.—Bids will be received by H. J. Johnson, City Clk. until 8 p.m., Mar. 12, for drilling a 12-in. well 700 ft. deep, furnishing 330 tons of 6- and 8-in. c.-i. pipe, class B, 13,000 lb. special castings, 43 hydrants; 14 8-, 6- and 4-in. valves and boxes, and the construction of a reinforced concrete reservoir 35 ft. diameter by 15 ft. deep. The work of laying the water pipe will not be let until after it is determined whether a sewer system will be put in. W. G. Kirchoffer, Madison, Wis., is Consult. Engr. Noted Feb. 13.

Ogden, Iowa—Plans are being prepared for laying 1½ miles of water mains. Bids will probably soon be asked.

Redfield, Iowa—Bids will probably be asked about Mar. 1, for installing a water system and an electric-light plant here, according to plans prepared by C. W. Roland & Co., Consult. Engrs., Des Moines, Iowa. Estimated cost, $15,000. W. C. Newton is Town Clk. Noted Oct. 24.

Sloan, Iowa—The town has voted to install a water system according to plans prepared by the Alamo Engine & Supply Co., Omaha, Neb. S. J. Oliver is Town Clk. Noted Oct. 3.

Woodbine, Iowa—An election has been called for Mar. 10, to vote on the installation of a water system to cost $8000.

Deerwood, Minn.—The Oscar Claussen Engineering Co., German-American National Bank Bldg., St. Paul, Minn., is preparing plans for a water system here. Estimated cost, $14,000. Noted Feb. 6.

Minneapolis, Minn.—We are officially advised that bids will be received by K. E. Alexander, Pur. Agent, until Mar. 3, for furnishing four 54-in., five 48-in., one 42-in. one 34-in., and one 30-in. valve, also 1239 tons of 20-in. c.-i. pipe, Class A. Ellis R. Dutton is Asst. City Engr.

Pine City, Minn.—Bids will be received by H. J. Bierge, Village Recdr., until 8 p.m., Feb. 28, for constructing a complete water system, according to plans and specifications prepared by the Oscar Claussen Engineering Co., German-American National Bank Bldg., St. Paul, Minn. Estimated cost, $20,000. Noted Feb. 13.

Warroad, Minn.—Plans are being prepared by the Oscar Clausson Engineering Co., St. Paul, Minn., for the installation of a water system here, estimated to cost $8000. E. M. Heimbach is Village Clk.

Moline, Kan.—We are officially advised that an election has been called for Mar. 25, to vote on a bond issue of $40,000 for installing a water system and electric-light plant. Plans have been prepared by the Benham Engineering Co., Oklahoma City, Okla. Noted Dec. 12.

+Yankton, S. D.—According to press reports, the contract to install a complete water system here has been awarded to the ELLERMAN & McLAIN CONSTRUCTION CO., Yankton, S. D., at $51,212. Bids were opened Jan. 29. Edmunds & Norgren, Yankton, are Consult. Engrs. Noted Dec. 26.

Balmorhea, Tex.—The Mount Castle Irrigation Co. which will lay a water distributing system here, will pipe the water from a point three miles south of town. Noted Jan. 2.

Clarendon, Tex.—Bonds for $12,000 have been voted for purchasing the private water system. Plans will probably soon be made for extensions.

El Paso, Tex.—The city will install an additional pump at the water plant, to have a capacity of 3,000,000 gal. per day.

San Antonio, Tex.—J. Raybould, Frank Newton, H. J. Lamm, and W. B. Willin have taken steps to construct a system of irrigation in the valley of Salado Creek, eight miles from here. The creek will be dammed and a storage reservoir built with a capacity of about 150,000,000 cu.ft. of water. The proposed system will irrigate about 4000 acres of land.

Armstrong, Okla.—An election will be held May 14, to vote on a bond issue of $13,000 for extending the water system

Hinton, Okla.—We are officially advised that bids will be received about Apr. 1, for constructing a water system and electric-light plant, according to plans and specifications prepared by the Benham Engineering Co., Oklahoma City, Okla. Noted Oct. 17.

Cañon City, Colo.—The City Council has had plans prepared for the construction of Sanitary Sewer District No. 2. J. V. Blake is City Clk.

Deming, N. M.—The Rio Mimbres Irrigation Co. plans to expend $100,000 for the installation of pumping machinery, and other development work on its 5000-acre tract of land near here. Noted Jan. 30.

Lewiston, Idaho—D. C. Wrighter, City Engr., has prepared plans for the construction of a new intake for the water system.

Duchesne, Utah—Bids will be received by the Board of Directors of the Blue Bench Irrigation District until Mar. 5, for purchasing $100,000 of bonds. J. R. Wilson is Secy.

San Simon, Ariz.—The San Simon Valley Land & Water Co. will bore wells and construct an irrigation system on its land near here.

Holtville, Calif.—The Imperial Valley Concrete Co., El Centro, was low bidder at $13.90 per cu.yd. for constructing headgates at Station 290 and 890 for Water Co. No. 5. The Mercereau Bridge & Construction Co. bid $19.20 and $15.20.

Placerville, Calif.—The Hayward, Lane and Hobart Estates Co. will construct a dam to form a reservoir to furnish 500,000 miners' inches of water for irrigation purposes. The cost of the dam will be about $250,000.

+San Francisco, Calif.—Contracts have been awarded by the Panama-Pacific Exposition Committee, as follows: Installing a high-pressure fire protection system, to the TURNER CO., 264 Natoma St., San Francisco, at $152,225; installing a water service system, to PHILLIP SCHUYLER, Oakland, Calif., at $55,305. Bids were opened Jan. 28. Noted Jan. 16.

Santa Maria, Calif.—The Domestic Water Co. plans the construction of a new 100,000-gal. steel tank on a 100-ft. steel tower to be equipped with an automatic pump starting device. The company also contemplates replacing steam pumps with gas engines or motors.

+Stockton, Calif.—The Pacific Gas & Electric Corp. has awarded a contract to JOHN R. CAHILL at $12,410 for the construction of a concrete pit at the water works.

Tulare, Calif.—The city has voted to install a new municipal water system estimated to cost $100,000. Sloan & Robinson, San Francisco, Calif., are Consult, Engrs. Noted Nov. 28.

Winnipeg, Man.—According to press reports, bids will be received by the Board of Control, until Mar. 3, for the construction of a reservoir with a capacity of 18,000,000 gal. M. Peterson is Secy.

Bowmanville, Ont.—Bids will be received by the Town Council until Mar. 19, for installing a water system here, estimated to cost $111,000. Plans and specifications are on file at the office of Chipman & Powers, Consult. Engrs., Toronto. S. C. Hillier is Mayor. Noted Feb. 13.

Burks' Falls, Ont.—The Town Council plans extensions to the water system, estimated to cost $8000. Charles McArthur is Town Clk.

North Battleford, Sask.—Bids will be received by the Secretary-Treasurer of North Battleford, until Apr. 15, for furnishing c.-i. and steel water pipes and specials, fire hydrants, gate valves, tile sewer pipe and junctions.

Swift Current, Sask.—Bids will be received by the Town Council until noon, Mar. 17, for furnishing about 600 tons of c.-i. pipe, seven tons of specials, 46 valves and boxes, and 22 fire hydrants. George D. Mackie is Town Engr.

Sydney, N. S.—The City Council plans to build a new pumping station and pipe line and extend the water system. Estimated cost, $75,000. D. McD. Campbell is Engr.

Matamoros, Mexico—See item under Electric Railways.

SEWERS

Charlestown, N. H.—The town contemplates the installation of a sewer system. Fred Perry is Town Clk.

+Boston, Mass.—We are officially advised that the contract to construct an underground sewage pumping plant in Sumner St., South Boston, has been awarded to ANTHONY BARUFFALDI, 5 Parker Pl., Somerville, Mass., at $5465. The other bids were: McCarthy & Walsh, $6858; The Connors Bros. Co., $7380; William J. Barry, $9800; John T. Scully Foundation Co., $10,512; John J. Falvey & Co., $11,700. Noted Feb. 6.

Worcester, Mass.—The Sewer Committee of the City Council has recommended the completion of the Mann St. sewer. Estimated cost, $20,000.

Ilion, N. Y.—According to press reports, an election will soon be called to vote on a bond issue for installing a sewage disposal plant estimated to cost $33,000. A. M. Sterling is Supt. of Sewers.

+New York, N. Y.—We are officially advised that the contract to construct a temporary dry-weather flow sewer in the line of 43d. St. from the pierhead line to the bulkhead line, a sewer and appurtenances in 43d St., from the bulkhead line of Flushing Bay to Ditmars Ave., a temporary grit and screening chamber in 43d St., and a sewer and appurtenances in Ditmars Ave., Bayshore Terrace, from 43d St. to 51st St., Second Ward, has been awarded to the LITCHFIELD CONSTRUCTION CO., 23 Flatbush Ave., Brooklyn, N. Y., at $223,788. The other bids were: Clancy & Van Alst, $224,369; Dunbar Construction Co., $286,689; Newman & Carey, bid forfeited because one item was not bid on; Joseph L. Sigaretto, $273,197; Eon Engineering Co., $276,925; Leo Kelley, $231,-

284. Bids were opened by Maurice E. Connolly, Pres. Boro. Council, Feb. [illegible]. Noted Feb. 6.

Norwich, N. Y.—C. E. Harris, Town Engr., has asked the Council to appropriate $6000 for laying a sewer in South Broad St., from Hayes to Division St.

✚Rochester, N. Y.—The contract for the construction of a sanitary sewer in University Ave., has been awarded to the [illegible] at $14,282.

Schenectady, N. Y.—We are officially advised that plans are being prepared by George W. Fuller, 170 Broadway, New York City, for the installation of a sewage purification plant at Schenectady. Estimated cost, $300,000.

✚Elmar, N. J.—We are officially advised that bids for [illegible] about 4½ miles of 8- to 18-in. pipe sewers with [illegible] and appurtenances, were received by the Borough Council Feb. 15, as follows: T. J. McGOVERN CONTRACTING Co., Trenton, N. J., $21,425 (awarded contract); J. J. Hughes, Newark, N. J., $25,339; A. Costa, Orange, N. J., $26,267; Sun Dredging & Construction Co., Philadelphia, Penn., $28,738; Pierson Engineering & Construction Co., Hartford, Conn., $28,786; John W. Heller, Newark, N. J., $29,-[illegible]; Dan Donovan, Bayonne, N. J., $31,385; Liddell & Pfeiffer, Perth Amboy, N. J., $31,932; Partridge & Baker, Hohokus, N. J., $34,007; Sutton & Corson Co., Ocean City, N. J., $34,-[illegible]; C. L. Brown Miller, Cape May, N. J., $37,679; F. J. Monaghan, Perth Amboy, N. J., $39,418; Atlantic Construction & Supply Co., Atlantic City, N. J., $40,354; D'Amato & Stefanelli, Newark, N. J., $41,341; Watson Engineering & Construction Co., New York, N. Y., $79,295. Clyde Potts, 30 Church St., New York, N. Y., is Consult. Engr. Noted Feb. 6.

✚Fairview, N. J.—Bids for the construction of a sewer system and disposal plant have been received by the Council as follows. J. J. McGARRY, Edgewater, N. J., $112,450 (awarded contract); Horning & Brunner, West New York, $117,118; Joseph Murphy & Son, West Hoboken, $117,137; Edward P. O'Neill, Jersey City, $120,944; August Theil, Guttenburg, $125,000. Noted Feb. 6.

Millville, N. J.—See item under Streets and Roads.

Perth Amboy, N. J.—The City Council is preparing to extend the sewer system. Estimated cost, $23,500.

Princeton, N. J.—The Borough Council has arranged for the extension of the sewer system in the northern section of the town, and the macadamizing of Pine St., and Cleveland Lane. A budget of $12,000 for sewer construction has been adopted.

Ridgefield Park, N. J.—The Village Engineer has completed plans and specifications for a sewer in the West View Section. Estimated cost, $25,000. The plans have been submitted to the State Board of Health.

Secaucus, N. J.—We are officially advised that bids will be received about Mar. 25, for the installation of a sewer system at Secaucus. Adrian Post is Boro. Clk. and Sebastian Maulbeck is Boro. Engr. Noted Feb. 20.

Milton, Penn.—See item under Water Supply-Irrigation.

Philadelphia, Penn.—Bids will be received by the Department of Public Works, until noon, Mar. 4, for reconstructing old sewers, boring and furnishing bleaching powder for the Pennypack Creek sewage disposal works. M. L. Cooke is Dir. of Pub. Wks.

Reading, Penn.—The Board of Public Works has authorized the City Engineer to advertise for bids for the construction of storm sewers, according to plans and specifications recently completed. Noted Jan. 30.

Somerset, Penn.—The only bid received by the County Commissioners, Jan. 29, for constructing a sewage disposal plant at the County Home Farm, was submitted by Warner Ferner, Somerset, at $9000. Clyde Potts, 30 Church St., New York, is Consult. Engr.

West Newton, Penn.—An ordinance has been passed providing for the construction of a sanitary sewer in Water St., from Main St. to Mill A, thence along an alley to the river. S. L. Stoner is Pres. Boro. Council.

Delmar, Del.—The proposition to issue $40,000 of bonds for the installation of a sewer system in Delmar, is under consideration.

★Washington, D. C.—Bids will be received by the District Commissioners until 2 p.m., Mar. 17, for constructing the Rock Creek Main Interceptor, and the Anacostia Main Interceptor, according to plans and specifications on file at the office of Engineering News, 505 Pearl St., New York.

Danville, Va.—The city contemplates a bond issue of $10,-000 for sewer construction.

Lynchburg, Va.—Plans have been prepared for constructing sewers in various streets. Estimated cost, $25,000. The work will be done by city forces. H. L. Shaner is City Engr.

Woodstock, Va.—The town contemplates the installation of a complete sewer system.

High Point, N. C.—The city contemplates the installation of a sewage disposal plant to serve the western part of the city. Estimated cost $50,000.

Conyers, Ga.—See item under Water Supply-Irrigation.

Cornelia, Ga.—See item under Water Supply-Irrigation.

Plant City, Fla.—The City Council has called an election for Mar. 15, to vote on a bond issue for constructing sewers and pavements.

Arlington Heights, Ohio—We are officially advised that all bids received by A. J. Otto, Village Clk., Feb. 17, for constructing [illegible] sewers in various streets have been rejected. New bids will soon be asked. Noted Jan. 23.

Celina, Ohio—The Village Council has passed an ordinance authorizing a bond issue of $80,000 for constructing a complete sanitary and storm water sewer system. Noted Jan. 30.

★Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Mar. 4, for constructing main and lateral sewers with appurtenances in various streets. The contract involves the construction of 16,000 ft. of 12- to 60-in. combined sanitary and storm sewers. M. J. Keefe is Clk.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Mar. 6, for constructing sewers in various streets. W. H. Kirby is Secy.

Bids will be received by Charles W. Stage, Dir. Pub. Safety, until noon, Feb. 27, for furnishing materials and labor for the installation of a sewer system for the new city hospital buildings.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Dir. Pub. Ser., until Mar. 11, for constructing the West Side storm sewer extension, the Clintonville main trunk sewer, and sanitary sewers in various streets.

✚Elyria, Ohio—We are officially advised that the contract to construct sewers in various streets has been awarded to the ELYRIA CONSTRUCTION CO., Elyria, at $4500. Bids were opened Feb. 21. Noted Feb. 20.

✚New Berlin, Ohio—The Village Council has awarded the contract for the construction of a sewer system and sewage disposal plant to F. R. STONE, Lima, at $18,573. Bids were received Feb. 4. Noted Jan. 23.

Sidney, Ohio—Bids will be received by D. H. Warner, Dir. Pub. Ser., until Mar. 11, for constructing 8- to 24-in. storm sewers in various streets. Noted Jan. 23.

✚Bedford, Ind.—Press reports state that a contract to construct a sewer here has been awarded to J. J. QUINN & CO., Bedford, at $22,500.

Michigan City, Ind.—The Board of Public Works will soon ask bids for constructing a trunk sewer about 15,000 ft. long. Harry M. Miles is Engr.

✚Richmond, Ind.—The contract for constructing sewers in various streets has been awarded to F. E. SLICK, Richmond, at $21,500. Bids were received by the Board of Public Works, Feb. 13. Noted Feb. 6.

Vincennes, Ind.—According to press reports, bids will be received by the Board of Public Works until Mar. 10, for constructing three miles of storm sewer. Estimated cost, $30,-000. C. L. V. Tucker is City Clk. Noted Feb. 20.

Ludington, Mich.—We are officially advised that bids will be received by the Board of Public Works until 1 p.m., Mar. 17, for constructing about 3500 ft. of vitrified pipe sewers. Dean Thompson is City Clk.

Union City, Mich.—An election has been called for Mar. 10, to vote on a bond issue of $30,000 for the installation of a sanitary sewer system. Cox & Norton, Coldwater, Mich., are Consult. Engrs.

Fulton, Ill.—E. O. Hills, Engr., has prepared preliminary plans and estimates for the construction of a sewer system here, to cost about $30,000. Noted Dec. 19.

Marinette, Wis.—The City Council has voted to submit to the voters at the election on Apr. 1, the question of voting $20,000 for the construction of a sewer in the Fifth Ward.

Toledo, Iowa—Bids will be received by the City Council until 7 p.m., Mar. 10, for constructing a sewage-disposal plant and outlet sewer. Plans and specifications are on file at the office of J. N. Lichty, City Clk., or may be obtained from S. Steigerwalt, Consult. Engr., Nevada, Iowa. Noted Feb. 13.

Gibbon, Minn.—Bids will be received by C. W. Carlson, Village Clk., until Mar. 3, for furnishing material and laying water mains. Noted Jan. 23.

Dodge City, Kan.—A preliminary survey has been made for the installation of a complete sewer system here.

Richmond, Mo.—We are officially advised that bids will be received by R. E. Brown, City Clk., until 2 p.m., Mar. 6, for constructing a sewer system and a septic tank, estimated to cost $20,000. The contract includes main trunk sewers, septic tank, 40 manholes, and about 6000 ft. of 10-, 12- and 15-in. pipe. W. A. Mullen is City Engr. Noted Jan. 30.

St. Joseph, Mo.—The City Council has appropriated $20,-000 for constructing the Whitehead Sewer.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until noon, Mar. 7, for Letting No. 10,-847, for the construction of sewers in Chaise Creek Sewer District No. 7. Letting No. 10,849, for the construction of Forest Park Storm Water Channels. Letting No. 10,848, for the construction of sewers in Macklind Ave. Sewer District No. 1. Plans and specifications are on file at the office of the Board of Public Improvements. Maxime Reber is Pres.

Rockdale, Tex.—An election has been called for Feb. 25, to vote on a bond issue of $30,000 for purchasing and improving the water system.

Armstrong, Okla.—An election has been called for Mar. 18, to vote on a bond issue of $72,000 for extending the sewer system.

Henryetta, Okla.—We are officially advised that the city has retained the Benham Engineering Co., Oklahoma City, Okla., to prepare plans and specifications and supervise the installation of a sanitary sewer system here, estimated to cost $50,000.

✚Nogales, Ariz.—We are officially advised that the contract to construct a sewer system here, has been awarded to the HAMILTON BROS. CONSTRUCTION CO., Nogales at $43,700. The other bids were: American Light & Water Co., $44,299; Concrete Construction Co., $44,223; E. M. Eby, $44,389; Dalton & Campbell, $44,650; R. C. Lowell, Los Angeles, Calif., $48,450. Bids were opened Feb. 15. L. W. Mix is Mayor. Noted Jan. 23.

✚Alhambra, Calif.—We are officially advised that a contract to construct sewers here has been awarded to UNDERW[illegible]

HOLLOWAY, Pasadena, Calif., at $16,685. O. M. Caulk is City Clk. Noted Jan. 16.

San Diego, Calif.—The city contemplates improvements to its water and sewer systems. Bids will soon be asked for furnishing 4800 tons of c.i. pipe and fittings.

✦Santa Monica, Calif.—We are officially advised that the contract to construct a sewage disposal plant at the National Soldiers' Home has been awarded to the J. D. KNEEN CONTRACTING CO., Santa Monica, Calif., at $19,800. Noted Jan. 30.

STREETS AND ROADS

✦Narragansett Pier, R. I.—A contract has been awarded to the BRISTOW BROS. & KNOWLES CORPORATION, at $18,055, for constructing two miles of new road, and resurfacing four miles of old road.

✦Buffalo, N. Y.—The City Council has awarded a contract to the GERMAN ROCK ASPHALT & CEMENT CO., at $47,930, for repaving Amherst St., from Military Road to Elmwood Ave. The Commissioner of Public Works has been directed to advertise for bids for paving Roma Ave., and for repaving Grote, Cottage and Peacock Sts. Francis G. Ward is Comr.

New York, N. Y.—The following bids were received by the Board of Water Supply for surfacing with vitrified brick the highways around the Ashokan Reservoir under Contract No. 134. A. L. Guidone & Co., $1,301,130; John E. Consalus, $1,334,800; Booth & Flinn, Ltd., $1,383,755; Samuel Beskin, $1,396,830; MacArthur Bros. Co., $1,426,750; Chas. W. Blakeslee & Sons, $1,531,815; Winston & Co., $1,573,300; F. W. Stier, $1,612,965; J. F. Cogan Co., $1,631,040; Joseph Di Benedetto, $1,659,430. Charles Strauss is Pres. of the Bd. Noted Jan. 2.

New York, N. Y. (Borough of Richmond)—Bids will be received until noon, Mar. 4 by the President of the Borough of Richmond, Borough Hall, St. George, New Brighton, for furnishing and delivering 166,000 gal. bituminous road surfacing material with tar as base, and 240,000 gal. of macadam road binder with asphalt as base. George Cromwell is Pres.

Bids will be received until 2 p.m., Mar. 6, by the President of the Borough of Manhattan, Room 1808, 21 Park Row, for various improvements in portions of the following streets: Gramercy Park, East and West, Henrietta Eighth, 12th, 29th, 35th, 38th, 40th, 44th, 47th, 53d, 54th and 109th Sts., and First Ave. George McAneny is Pres.

✦Pawling, N. Y.—A contract has been awarded by the Town Supt. of Streets to MICHAEL R. SPINO, Fishkill-on-Hudson, at $13,775 for construction of a road on Quaker Hill.

★Schenectady, N. Y.—Bids will be received until 2:30 p.m., Mar. 5, by the Board of Contract and Supply for about 100,000 sq.yd. asphalt pavement on a concrete base. Fred E. Johnson is Secy. Bd. Chas. A. Mullen is Comr. of Pub. Wks.

★Milltville, N. J.—Bids will be received until 8 p.m., Mar. 21, by the Common Council for various street improvements. The work includes 21,100 sq.yd. of pavement, 6800 cu.yd. of excavation, resetting 6800 lin.ft. curb, 820 ft. 30-in. vitrified pipe sewer. Newton B. Wade is City Engr. L. H. Hogate is City Recdr.

Pompton Lakes, N. J.—Bids will be received until Mar. 6 by the Mayor and Borough Council for construction of sidewalks on various streets. The approximate quantities are 35,000 sq.ft. concrete, and 10,000 sq.ft. bluestone flagging. Henry Grah Hershfield is mayor.

★Chambersburg, Penn.—Bids will be received until 8 p.m., Mar. 24, by the Borough Council for the construction of approximately 15,700 sq.yd. of street paving. R. M. Huber is Boro. Engr. C. H. Patterson is Boro. Clk.

East McKeesport, Penn.—Bids will be received until 1:30 p.m., Mar 1, by the Borough Council for various improvements on portions of Broadway, Woodmont, Fifth and Punta Gorda Aves. and Josephine St. E. P. Churchfield is Boro. Secy. Douglass & McKnight, 1709 Union Bank Bldg., Pittsburgh, are Boro. Engrs.

Warwood, W. Va.—Bids will be received until 8 p.m., Feb. 28, by the Town Recorder for constructing about 118 concrete street crossings, and 1000 ft. 5x18-in. concrete curbing. Frank Klein is Recdr.

Jacksonville, Fla.—We are officially advised that all bids received Feb. 10, by the Committee on Public Works, for approximately 98,826 sq.yd. street paving, were rejected, and the work will not be readvertised for several weeks. J. Evarts Merrill is Asst. to Secy. Noted Jan. 16.

Orlando, Fla.—Bids will be received until 10 a.m., Mar. 4 by the Board of Commissioners of Orange County for construction of about 140,000 sq.yd. vitrified brick paving in Road and Bridge District No. 1. B. M. Robinson is Clk. The H. S. Jaudon Engineering Co., Atlanta and Savannah, Ga., is Engr.-in-Charge.

Birmingham, Ala.—The City Commission has decided to pave 22 blocks of streets at an estimated cost of $250,000. Bids will be asked on asphalt, wood blocks and bitulithic. Walter G. Kirkpatrick is City Engr.

Bids will be received until 3 p.m., Mar 18, by the City Council, for approximately 55,000 sq.yd. street paving, divided as follows: 15,000 sq.yd. asphalt, bitulithic, asphaltic concrete or bituminous concrete, 15,000 sq.yd. asphalt or bitulithic, 15,000 sq.yd. asphalt, bitulithic or wood block, 10,000 sq.yd. plain concrete. Walter J. Kirkpatrick is City Engr.

Natchitoches, La.—Bids will be received until Mar. 10 by the Mayor, for about 20,000 sq.yd. of gravel surfacing on various streets. Geo. W. Kile is Mayor.

Chattanooga, Tenn.—The City Commissioners are considering the reconstruction of Market St., from the Terminal station to Ninth St.

✦Louisville, Ky.—Contracts for street improvements have been awarded as follows by the Board of Public Works: To the AMERICAN STANDARD ASPHALT CO., Louisville, at $21,107, for paving Broadway, from 32d to Lincoln Court; the HENRY BICKEL CO., Louisville, at $1,176, for paving 7th St., from Main to Broadway, with asphalt; to the JEFFERSON COUNTY CONSTRUCTION CO., Louisville, at $19,229, for Oak St., from Brook to Third, and from Fourth to Seventh, with asphalt; to the LOUISVILLE ASPHALT PAVING CO., at $6577, for reconstructing Fourth St., from Market to Jefferson, with wood block. Alley contracts aggregating $33,100 were awarded to the J. W. GOSNELL CO., the HENRY BICKEL CO. and the L. R. FIGG CO. Vitrified block will be used.

The Board of Public Works will soon receive bids for repaving Main St., from Fourth to Fifth, with wood block, and for repaving Market St., from Campbell to Johnson Sts., with vitrified brick. Roger McGrath is Secy. of the Bd.

Paducah, Ky.—Bids will be received until Mar. 4, by the Fiscal Court of McCracken County, for the construction of dirt roads in the county. The work will be awarded in three divisions.

Winchester, Ky.—The City Council has decided upon eight blocks of street paving with vitrified block.

✦Canton, Ohio—A contract has been awarded by the Board of Control to P. FRESHWATER, Cleveland, at $19,502, for the improvement of South Harrison Ave. Other bidders were: Logan D. Burd, at $22,847, and John Skeels, at $20,365. Walter S. Ruff is Dir. of Public Service. Noted Jan. 16.

✦Contracts have been awarded by the Board of Control for the following street improvements: For paving Aultman Ave. to PRESS CAMPBELL at $20,730; Linden Ave. to the F. A. DOWNS CONSTRUCTION CO., at $31,431; East Lake St. to L. D. BURD at $33,893, Cassilly St., P. J. HAHN at $17,300, Dueber Ave., F. A. DOWNS CONSTRUCTION CO., at $32,256, North Dewalt St., PRESS CAMPBELL at $5435, East South St., P. J. HAHN, $8367. P. H. Weber is City Engr. Noted Jan. 16.

Cincinnati, Ohio—Bids will be received until noon, Mar. 5, by the Director of Public Service, for improving portions of Dunseth, Goose, Diamond and Noah Alleys. V. T. Price is Dir. M. J. Keefe is Clk.

Bids will be received until Mar. 4, by the Director of Public Service, for paving East Eighth and East Fifth Sts., with granite block.

Cleveland, Ohio—Bids will be received until 11 a.m., Mar. 12, by Commissioners of Cuyahoga County, for improvement of Scranton Road from Brecksville Cemetery to the Baltimore & Ohio R.R. station, Brecksville Township. John F. Goldenbogen is Clk.

✦Columbus, Ohio—We are officially advised that the Director of Public Service has awarded contracts as follows, for street improvements: Paving Engler and 19th Sts., to S. T. KNIGHT, at $5934 and $4917, respectively; Kossuth St., to GEIGELE, GARNES & CO., at $4571; Maynard Ave. to E. F. PATTERSON, at $4458; Poplar Ave. to WM. M. GRAHAM, at $10,846; Walters St., Medary and Deming Aves. to M. F. HALEY, at $9499, $18,131 and $17,785, respectively. Henry Maetzel is City Engr. Paul B. Kemper is Clk. Noted Jan. 30.

✦Columbus, Ohio—Bids were received by the State Highway Commissioner, Feb. 19, for grading and paving with brick the Ravenna Youngstown Road, Palmyra Township, Portage County. The length is 2.27 miles. The estimated cost of construction was $30,521. The bids were as follows: W. H. RINGWALD & SON, Chillicothe, Ohio, $30,400 (contract awarded); and H. F. Green, Ravenna, Ohio, $30,202.

Fostoria, Ohio—Bids will be received until Mar. 14, by the Director of Public Service, for 13,440 sq.yd. paving on West North St., and 7240 sq.yd. on West South St. Bids will be considered on vitrified brick and asphalt block. A. B. Hollenbaugh is Dir.

Newark, Ohio—We are officially advised that bids will be received until noon, Mar. 12, by the Director of Public Service, for the improvement of various streets. Bids will be considered on any kind of standard pavement. The work includes 51,961 sq.yd. paving, 25,143 lin.ft. straight curb, 1020 lin.ft. curved curb, 1694 lin.ft. edging and 28,240 cu.yd. excavating. C. H. Wells is City Engr.

✦New Concord, Ohio—We are officially advised that the Village Council has awarded a contract to HOUSTON & HENDERSON, Logan, Ohio, at $30,000, for paving Main St. with vitrified brick. J. R. Tanner, Zanesville, Ohio, is Engr. W. G. McKinney is Village Clk. Noted Feb. 6.

✦Norwalk, Ohio—The Director of Public Service has awarded a contract for paving East Main St. to the MODERN CONSTRUCTION CO., Fremont, Ohio, at $13,271; for paving Townsend Ave. to the BUCKEYE ENGINEERING CO., at $17,355. Noted Feb. 13.

✦St. Paris, Ohio—A contract has been awarded by the Village Council to WELSCH & JONES, Marysville, Ohio, at $25,695, for paving Springfield St. C. F. Offenbacher is Village Clk.

★Sidney, Ohio—Bids will be received until noon, Mar. 11, by the Director of Public Service for paving various streets and alleys. Bids will be accepted on any kind of standard paving material. The approximate quantities are: 35,190 cu.yd. grading, 66,327 sq.yd. paving, 27,476 lin.ft. curbing; 8749 lin.ft. of 8- to 24-in. sewers. D. H. Warner is Dir. The Smith-Boulay Co., Toledo, Ohio, is Engr. in Charge.

✦Indiana—Contracts for roads improvements in Indiana have been awarded as follows:

Crawfordsville, by Commissioners of Montgomery County, to O'CONNOR BROS. at $5202 for the Smith Road, Franklin Township, at $6792 for the Frank Graves Road, Union Township; to N. F. SCRIBNER at $5500 for the Reeves Road, Brown Township; to SNYDER & BARNETT at $10,874 for the Miles Road, Brown Township; to J. A. HARDER at $19,337 for a road in Union Township.

Vincennes, by Commissioners of Knox County, to J. C. RODGERS at $7997 for the Downey Road; to GEORGE MORGAN at $5137 for the Fox Road; to H. T. JONES at $4950 for the Aulteitner Road.

Versailles, by Commissioners of Ripley County, to CHARLES W. BAYLOR, Batesville, Ind., at $7623 for a road in Ripley Township.

Bloomfield, Ind.—Bids will be received until Mar. 25, by the City Council for paving about two miles of streets with brick.

Crown Point, Ind.—Bids will be received until noon, Mar. 5, by Commissioners of Lake County for construction of the W. G. Wright Road, Calumet Township, and the John G. Becker Road, North Township. Charles A. Johnson is Audr.

Peoria, Ill.—The Board of Local Improvements has decided to pave portions of Caroline, Catherine, State, Henrietta, Charlotte, Hamilton and Willow Sts., at an estimated cost of $7,571. L. L. Jenkins is City Engr.

★**Rossville, Ill.**—Bids will be received until 9 a.m., Mar. 10, by the Board of Local Improvements, for construction of 30,430 sq.yd. vitrified brick paving. About 3386 lin.ft. stone curb, 17,473 lin.ft. combined curb and gutter will also be required. Payne & Barr, Fischer Bldg., Danville, Ill., are Engrs. in Charge.

Burlington, Iowa—Bids will be received until Mar. 10, by the City Council, for paving 15 blocks of street with brick and four blocks with concrete pavement. F. C. Norton is Mayor. Henry G. Volmer is City Clk.

Hampton, Iowa—We are officially advised that bids will be received until Mar. 11 by the City Clerk for about 42 blocks of concrete paving and 26,913 lin.ft. of curbing. The estimated cost is $65,000. F. G. Luke in City Clk. A. G. Baker is City Engr. Noted Dec. 12.

✚**Helena, Ark.**—The Commissioners of Walnut St. Dist. have awarded a contract to the SOUTHERN BITULITHIC CO., for 8000 sq.yd. of brick paving. L. R. Parmelee is City Engr.

A new paving district has been formed to pave Perry St. with brick, using the present macadam as a foundation. About 10,000 sq.yd. will be required.

Houston, Tex.—Bids will be received until noon, Mar. 3, by the City Secretary for the grading and paving of Capitol Ave. from Caroline to Chartres Sts., with Texaco asphalt, and for grading and paving Lamar Ave., from Main to Milan Sts., with creosoted wood block. Frank L. Dormant is City Engr. Dan C. Smith, Jr., is City Secy.

Denver, Colo.—The Board of Public Works plans to pave various alleys in the residence districts at an estimated cost of $19,337. Seth B. Bradley is Pres. of the Bd.

El Centro, Calif.—This city will advertise for bids for paving five miles of streets with bitulithic.

✚**Imperial, Calif.**—H. H. PETERSON, Imperial, was awarded the contract for paving two miles of Imperial Ave. and Eighth Sts. The work will cost over $100,000.

Los Angeles, Calif.—The Llewellyn Iron Works was the lowest bidder at $24,997, for furnishing and erecting 398 cast-iron ornamental lamp posts, with globes and inside wiring, for the lighting of Seventh St., from the Los Angeles River to Hoover St. Other bids were: B. F. Kleruff, Jr., $27,244; J. C. Farrar, $30,787; Southern California Electric Co., $31,342.50; Newberry Benhelm Co., $31,641; Pacific Engineering Co., $33,867.

✚A contract was awarded to E. A. BAKER, at $25,516, for improving portions of various streets.

THE FAIRCHILD-GILMORE-WILTON CO., Los Angeles, was awarded the contract at $6713, for improving a section of Westmoreland Blvd.

✚A contract has been awarded by the Board of Public Works to FORD & STOUT, at $34,854, for paving with asphalt and otherwise improving Santee St., from Eighth to Washington Sts.

R. D. List, 1021 Central Bldg., will soon be ready to receive bids for street improvement work in Chesterfield Square. The work includes the paving of about six miles of streets with asphalt under city specifications, together with constructing cement curbs and sidewalks, gutters, etc.

✚**Salinas, Calif.**—U. F. KESTER has been awarded the contract at $8505 for constructing the Monterey end of the Coalinga-Parkfield Road.

✚**San Francisco, Calif.**—The Panama-Pacific Exposition Co. awarded a contract to the SUNSET CONSTRUCTION CO., 62 Post St., at $13,446, for grading the site for the Liberal Arts Bldg.

Montreal, Que.—The Board of Control has had plans prepared for paving over 100 sections of various streets during 1913 at an estimated cost of $1,764,115. Bids will be asked as soon as the City Council appropriates necessary funds.

St. Catherines, Ont.—The City Council has decided to pave Lake St. from Queen to Ontario Sts. with bitulithic, and to lay concrete pavements on Maitland and Summer Sts., Park Place and Helliwell Lane. The work will begin as soon as the weather permits.

INDUSTRIAL WORKS

Chicopee Falls, Mass. The Taylor-Bramley Knitting Co. is having plans prepared for the construction of an addition, 20x75 ft., four stories, of brick, to its factory at Chicopee Falls.

Lowell, Mass. Bids will be received until Mar. 1, for constructing the boiler and engine buildings for the Saco Lowell Shops. The boiler building will be 61 ft. and 64 ft. wide, one story high, and the engine building will be 64 ft. wide and 100 ft. long. The work is prepared by the Hooper Faulkner Engineering Co., 165 Broadway, N. Y.

South Manchester, Conn. The J. J. Pomeroy Co. will build a factory here for the manufacture of hilliard balls. It will be 100 ft. long by 50 ft. wide, and will cost $6,000. Walter R. Kidde, 140 Cedar St., New York, is Arch.

South Norwalk, Conn. Gilbert Hoyt & Co., South Norwalk, will erect a one-story addition to the plant of the Knight Envelope Co., and will remodel and erect a two-story addition to the plant of the Hoyt Co.

Albany, N. Y. The F. M. Hubbell Tire Co. is receiving bids for the erection of a one-story and basement factory building, 75x100 ft., to be located on Hudson Ave. F. M. Hubbell is Pres.

✚**Buffalo, N. Y.** The Kelly-Springfield Motor Truck Co., Elm St., has awarded a contract to CHARLES GLEBERITSCH'S SONS Co., 1151 Main St., for the construction of a one- and two-story foundry, 117x202 ft. The estimated cost is $35,000. Noted Feb. 13.

✚The Otis Elevator Co., 281 Chicago St., has awarded a contract to CHARLES H. EVERITT, White Bldg., at $78,000, for the erection of a foundry, 402x106 ft., of brick. Green & Wicks, 110 Franklin St., are the Archs. Noted Feb. 6.

✚The Barcalo Mfg. Co., manufacturers of beds, has awarded a contract to the WESTERN BUILDING CO., Buffalo, for the construction of a three-story factory, 100x50 ft., at Louisiana and Kentucky Sts. The estimated cost is $35,000. Green & Wicks, 110 Franklin St., are the Archs. Noted Jan. 16.

Bids will be received about Mar. 15, by Colson & Hudson, Archs., Dun Bldg., for the construction of five factories for the Cyphers Incubator Co. The estimated cost is $250,000.

Endicott, N. Y.—Plans are in preparation for an addition to be built by the Endicott-Johnson Co. to its tannery. The buildings will be 95x700 ft., one and four stories high. The one-story portion will be 300 ft. in length, and the four-story 400 ft. in length.

Long Island City (L. I.), N. Y.—The Board of Estimate and Apportionment has approved plans of the Degnon Terminal Realty Improvement Co., 60 Wall St., for developing an area of 260 acres on the site of the former Hunter's Point Meadow, Long Island City. The project involves an expenditure of $30,000,000, and provides for the construction of bulkheads, railroad tracks, warehouses and factories. Plans have been approved for the construction of its buildings.

Poughkeepsie, N. Y.—The F. I. A. T. Automobile Co. has had plans prepared for the construction of a two-story addition, 375x70 ft., to its plant. The estimated cost is $50,000.

✚**Jersey City, N. J.**—The Central R.R. of New Jersey has awarded a contract to the WESTINGHOUSE-CHURCH-KERR CO., Pittsburgh, Penn., for the construction of a roundhouse and repair shops at Jersey City. The estimated cost is $200,000.

Paterson, N. J.—The Stonemeal Fertilizer Co., Inc., will have plans prepared for the erection of a new plant, 300x190 ft., two stories high.

Ford City, Penn.—The Pennsylvania China Co. will make additions and extensions to its local pottery plant. A new department will be installed for the manufacture of porcelain insulators for electrical work. The company will also make improvements and additions to its plant at Kittanning. The total expenditure is estimated at $30,000.

Baltimore, Md.—Plans are being prepared by J. Freund, Jr., Arch., Hoffman Bldg., for an addition to the plant of the Maryland Enamel & Sign Co., on O'Donnell St. The estimated cost is $10,000.

Plans are being prepared by John B. Hamme, Arch., York, Penn., for the construction of a new plant for the Baltimore Roofing & Asbestos Mfg. Co., 757 Calvert Bldg. There will be a one- and two-story asbestos building, 184x65 ft.; a cement building, 100x75 ft.; two shops, 25x30 ft. and 150x30 ft., and an office building, 40x40 ft. The estimated cost is $70,000.

Spartanburg, S. C.—Dunbar Bros. are erecting a plant for the manufacture of farm wagons.

Anniston, Ala.—The Union Foundry Co., manufacturer of ornamental lighting posts, plans an addition to its plant, embracing an area of about 10,000 sq.ft. Gerard Schumacher is Gen. Mgr.

Birmingham, Ala.—The Sloss-Sheffield Iron & Steel Co. plans extensive improvements in its various properties at a total expenditure of about $300,000. J. Campbell Maben, Jr., Birmingham, is Vice-Pres.

Sylacauga, Ala.—The Sylacauga Ice & Cold Storage Co. has been organized by A. B. Parker and F. W. Ledbetter, Anniston, Ala. A site has been secured at Third and Anniston Aves., Sylacauga, upon which an ice plant of 10 tons daily will be erected.

Ashland, Ky.—C. B. Fowler, formerly manager of the Marting Iron & Steel Co., Ironton, Ohio, is reported to be planning the establishment of a blast furnace at Ashland.

Akron, Ohio—The City Laundry Co., Akron, will receive bids about Mar. 5, for the construction of a two-story and basement laundry, 40x75 ft.

Cincinnati, Ohio—Harry Hake, Arch., Cincinnati, is preparing plans for the buildings of a new concern, which will conduct a foundry and machine shop in Cincinnati, the name of which has not been given out. The plant will be located on Mitchell Ave., and will be 80x180 ft., of concrete and steel.

Cleveland, Ohio—The Ripple Engineering Co., Cleveland, will erect a plant for the manufacture of appliances, fittings and apparatus used in connection with illuminating. M. C. Ripple and Clark Baker, Cleveland, are interested.

Columbus, Ohio—The National Ice & Cold Storage Co., Columbus, will build a six-story ice factory and cold-storage plant at a cost of $400,000. The plant will have a capacity of 150 tons of ice a day. The building will be fireproof. H. C. Wood, Cincinnati, is Pres.

St. Marys, Ohio—A grist mill to cost about $9000 will be erected at St. Marys. Henry Dickman is Interested.

Logansport, Ind.—Snider & Son, broom makers, Logansport, are having plans prepared for the erection of a two-story factory, 60x100 ft.

McCool, Ind.—Louis Robinson & Son are planning for the erection of a large rail manufacturing plant at McCool.

Detroit, Mich.—Bids will be received until Mar. 1, by Albert Kahn, Arch., Trussed Concrete Bldg., Detroit, for the erection of a four-story brick and concrete addition for the Chalmers Motor Car Co. on Jefferson Ave.

The Detroit & Cleveland Detroit will erect a soap factory, three stories, 60x150 ft. Dolmar & Rapp, 602 Sun Bldg., Detroit, are Archs.

Grand Rapids, Mich. The Michigan Hearse & Carriage Co., Grand Rapids will erect a three-story and basement addition. A. C. Chapman is Gen. Mgr.

Chicago, Ill. M. Goldstein, 1216 West 12th St., Chicago, will erect a two-story and basement bakery addition, 25x125 ft.

Beloit, Wis.—The Stewart-Warner Speedometer Co., Milwaukee, will enlarge its plant at Beloit.

Neillsville, Wis.—The Neillsville Canning Co. will erect a canning plant.

Sheboygan, Wis.—The Sheboygan Conch Co. will erect a factory. Estimated cost, $50,000

Polson, Mont.—The Potato Milling & Stock Food Co. contemplates the erection of a plant at Polson, for the manufacture of its specialties. P. R. Treat represents the company.

Galveston, Tex.—T. L. Layton & Co., Philadelphia, Penn., plan to establish a fish-oil refinery and fertilizer factory at Galveston. The estimated cost of the proposed plant is $50,000.

Seadrift, Tex.—A. D. Powers and associates will erect a large canning factory at Seadrift.

Everett, Wash.—The Jamison Shingle Co. will erect a combination shingle and cedar-siding plant. It will have a daily capacity of 600,000 shingles and about 35,000 ft. of cedar.

Hoquiam, Wash.—It is reported that that the plant of the Eureka Mill Co., which was recently destroyed by fire, with a loss of $100,000, will be rebuilt.

Mt. Vernon, Wash.—The Mt. Vernon Creamery Co., Mt. Vernon, will erect a can manufacturing plant. The estimated cost is $20,000. U. M. Dickey is interested.

Spokane, Wash.—The Cereal Products Co., Spokane, recently incorporated with a capital of $500,000, will erect a plant at Spokane, for the manufacture of cereals. O. M. Graves is Pres.

Tacoma, Wash.—Richard I. Elliott, Bankers' Trust Bldg., Tacoma, has acquired a site and will erect a plant for the manufacture of aëroplanes.

Medford, Ore.—The Rogue River Fruit & Produce Assoc., Medford, will erect a cold-storage plant at Medford, to cost approximately $40,000 A. C. Randall is Pres.

Reedsport, Ore.—The Star Lumber Co. will erect a lumber mill at Reedsport, to cost about $500,000.

Newport Beach, Calif.—The Branagan Glass Co., Los Angeles, Calif., has acquired a site at Newport Beach, and will build a large glass factory. The estimated cost is $15,000. John B. Branagan is Pres.

San Diego, Calif.—Bishop & Co., Seventh and Alameda Sts., Los Angeles, Calif., plan to erect a plant at San Diego, for the manufacture of their specialties. The estimated cost is $40,000. Charles A. Small is Mgr.

FEDERAL GOVERNMENT WORK

Crane—Portsmouth, N. H.—Bids were received as follows, Feb. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one locomotive crane for the navy yard, Portsmouth: Browning Engineering Co., Cleveland, Ohio, $6401; Link-Belt Co., Chicago, Ill., $6771; Ohio Locomotive Crane Co., Bucyrus, Ohio, $5975; Orton & Steinbrenner, Chicago, Ill., $6480; Brown Hoisting Machine Co., Cleveland, $6755; McMyler Interstate Co., Bedford, Ohio, $6750; Industrial Works, Bay City, Mich., $7000; also for an extension to the foundry at the same yard: Penn Bridge Co., Washington, D. C., $9643; Conners Bros. Co., Lowell, Mass., $9700.

Building—Portsmouth, N. H.—Bids will be received until 11 a.m., Mar. 22, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing quarters for commanding officer, naval prison, Portsmouth, N. H. Amount available, $11,500. H. R. Stanford is Ch. of Bureau.

Switchboard, Etc.—Newport, R. I.—Bids were received Feb. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing direct-current switchboard and station wiring at the naval torpedo station, Newport, R. I.: Carroll Electric Co., Washington, D. C., $11,487; Westinghouse Electric & Mfg. Co., Pittsburgh, Penn., $12,995; Pringle Electric Mfg. Co., Philadelphia, Penn., $12,430; Scanlewin & Potter, Newport, $11,990; Eugene Frank, 22 East 21st St., New York, $13,969; Taunton-New Bedford Copper Co., Taunton, Mass., $12,443; Lord Electric Co., 105 West 40th St., New York, $11,454; General Electric Co., Schenectady, N. Y., $10,997; Commercial Construction Co., 24 State St., New York, $11,455; also for two air compressors at the same station: George H. Sampson, 13 Pearl St., Boston, Mass., $6162; Chicago Pneumatic Tool Co., Chicago, Ill., $7873; Bury Compressor Co., Erie, Penn., $5900; Ingersoll-Rand Co., 11 Broadway, New York, $10,680.

★**Dredging**—New London, Conn.—Bids will be received until 2 p.m., Mar. 22, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., for dredging in Branford Harbor, Conn.

Fire Escapes, Etc.—New York, N. Y.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Mar. 21, for fire escapes and elevator shaft inclosures for the U. S. Appraiser's warehouse at New York, in accordance with drawing No. 236, copies of which may be had at Washington, or at the office of the Chief Engineer and Superintendent of Repairs, 727 Custom House Bldg., New York, at the discretion of the Supervising Architect.

✚**Elevators**—New York, N. Y.—The contract for the installation of three electric passenger elevators in the U. S. barge office, New York, has been awarded to the OTIS ELEVATOR CO., Washington, D. C., at $12,932.

★**Addition to Bakery**—Fort Hancock, N. J.—Bids will be received until noon, Mar. 19, by the Quartermaster, U. S. A., Fort Hancock, for constructing an addition to the bakery.

✚**Anchor Chains**—Connellsville, Penn.—The U. S. Government has awarded the contract to the SLIGO IRON & STEEL CO., for anchor chains, at $35 000

Dredging—Wilmington, Del.—Bids were received Feb. 12, by Maj. R. R. Raymond, Corps Engrs., U. S. A., for dredging about 148,000 cu.yd. of mud, sand and gravel in the Leipsic River: The Rickards Dredging Co., Philadelphia, 8.8c. per cu.yd.; Atlantic Dredging Co., Philadelphia, 9.72c.; River & Harbor Improvement Co., Philadelphia, 11.3c.

Jetty Work—Wilmington, Del.—Bids were opened Dec. 3 by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for jetty work at the mouth of the Mispillion River. The lowest bid was submitted by Richard Parrot, Newburgh, N. Y., at $12 per lin.ft.

Sewers—Washington, D. C.—Bids will be received until 2 p.m., Mar. 17, by the District Commissioners for the construction of sewers in the district.

Destroyer Tender—Washington, D. C.—Bids will be received until noon, Apr. 21, by Beekman Winthrop, Acting Secy. of the Navy, Washington, for constructing one destroyer tender, No. 2. A circular defining the chief characteristics of the vessel and outline type plans are now ready for distribution. Forms of proposal and contract may be had on application after Mar. 15.

Battleship—Washington, D. C.—Bids were received Feb. 18, by the Secretary of the Navy, Washington, for the construction of Battleship No. 38, the "Pennsylvania": (1), in accordance with department's plans and specifications for hull and machinery (reciprocating engines); (2a), in accordance with department's plans and specifications for hull and bidder's plans for machinery (Curtis turbine type); (2b), in accordance with department's plans and specifications for hull and bidder's plans for machinery (Parsons turbine type); the vessel is to be constructed in 36 months from date of contract and to have a speed of 21 knots. Limit of cost, $7,425,000. The bids follow: Newport News Ship Building & Dry Dock Co., Newport News, Va., (1) $7,275,000; (2a) $7,260,000, with gearing; $7,235,000 without gearing; (2b) $7,295,000; New York Ship Building Co., Camden, N. J., (1) $7,375,000; (2a) $7,396,000; (2b) $7,352,000; Fore River Ship Building Co., Quincy, Mass., (2a) $7,312,000; William Cramp & Sons Ship & Engine Building Co., Philadelphia, Penn., (1) $7,399,000; (2b) $7,349,000.

Bids were also received for furnishing armor and armor-plate on the vessel: (a) on Class "A" armor, exclusive of turrets and conning tower tubes; (a1) on Class "A" armor for turrets and conning tower tubes; (b) on Class "B" armor; (c) on Class "C" armor; (c1) on hollow forgings, Class "C"; (c2) on bronze forgings, Class "C." The bids follow: Midvale Steel Co., Philadelphia, Penn., (a) $454 per ton on 6839 tons; (a1) $518 on 910 tons; (b) $496 on 252 tons; (c) $548 on 61 tons; (c1) $729 on 15 tons; (c2) $1875 on two tons; Bethlehem Steel Co., South Bethlehem, Penn., (a) $454.65 per ton on 6827 tons; (a1) $519.60 on 912 tons; (b) $497.95 on 252 tons; (c) $549.91 on 61 tons; (c1) $709.04 on 16 tons; (c2) $1,884.63 on two tons; Carnegie Steel Co., Pittsburgh, Penn., (a) $455 per ton on 6820 tons; (a1) $520 on 919 tons; (b) $498 on 252 tons; (c) $550 on 61 tons; (c2) $1900 on two tons.

★**Sewers**—Washington, D. C.—Bids will be received until 2 p.m., Mar. 17, by the Commissioners of the District of Columbia, for the construction of sewers in the district.

Grading—Washington, D. C.—The Commissioners of the District of Columbia received the following bid, Feb. 14, for grading several streets aggregating 17,000 cu.yd.: J. B. Latimer, Washington, 50c. per cu.yd. for dirt from public square and 60c. per cu.yd. for dirt supplied by bidder.

★**Dredging**—Brunswick, Ga.—Bids will be received until noon, Mar. 4, by Col. Dan C. Kingman, Corps Engrs., U. S. A., Savannah, Ga., for dredging Club and Plantation Creeks, Ga., and the harbor at Brunswick, Ga.

★**Stone**—Brunswick, Ga.—Bids will be received until noon, Mar. 19, by Col. Dan C. Kingman, Corps Engrs., U. S. A., Savannah, Ga., for furnishing and placing stone for raising low places in jetties at Cumberland Sound, Ga., and Fla., and in Jekyl Creek, Ga., and for raising and extending the jetty in Brunswick Harbor, Ga.

Alterations to Dredge—Jacksonville, Fla.—All bids opened by Capt. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, Jan. 30, for alterations to the dredge "Jacksonville" were rejected. The bids follow: James Sherwan & Sons, New York, $93,000; Merrill-Stevens Co., Jacksonville, $90,000; the Elliott Machine Corp., Baltimore, Md., $43,000, f.o.b. Baltimore, for necessary machinery and equipment only.

Post Office—Bowling Green, Ohio—Bids were received as follows, Feb. 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Bowling Green: (a) Limestone; (b) sandstone; (c) Mineral Concrete Construction Co., Louisville, Ky., (a) $54,855; (b) $57,750; Jas. Devault, Canton, Ohio, (a) $57,872; (b) $60,000; James Corse, Racine, Wis., (a) $58,850; (b) $62,100; R. S. Moore, Lafayette, Ind., (a) $59,588; (b) $62,890; William H. Fissell & Co., New York, (a) $67,600; (b) $72,600.

✚**Post Office**—Red Oak, Iowa—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office at Red Oak, to JAMES CORSE, Racine, Wis., at $66,176. Noted Jan. 30.

✚**Post Office**—Billings, Mont.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office at Billings to J. H. WIESE, Omaha, Neb., at $109,748. Noted Jan. 30.

Post Office—Concordia, Kan.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Mar. 31, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the U. S. post office at Concordia.

Post Office—Ottawa, Kan.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Apr. 13, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, and lighting fixtures, of the U. S. post office at Ottawa.

Post Office—Topeka, Kan.—Bids were received as follows, Feb. 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building extension at Topeka: Mississippi Valley Construction Co., St. Louis, Mo., $84,791; Joseph E. Betts, Kansas City, Mo., $87,230; George A. Shaul, Seneca, Kans., $89,297; Tom Lovell & Sons, Enid, Okla., $90,991; Hiram Lloyd Building & Construction Co., St. Louis, Mo., $91,347; M. Yeager & Co., Minerva, Ohio, $91,793; Conners Bros. Co., Lowell, Mass., $91,800; General Construction Co., Milwaukee, Wis., $92,900; Frank H. Latimer & Co., Kansas City, $94,239; James Corse, Racine, Wis., $95,200; King Lumber Co., Charlotteville, Va., $96,800.

✦Elevator—Sioux Falls, S. D.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for furnishing an electric passenger elevator in the post office at Sioux Falls, to KAESTNER & HECHT, Chicago, Ill., at $4[illegible].

Post Office—Rolla, Mo.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until Apr. 1, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the U. S. post office at Rolla.

★Hydraulic Lift, Pump, Etc.—St. Louis, Mo.—Bids will be received until 3 p.m., Mar. 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for a hydraulic lift, pump, etc., in the U. S. post-office at St. Louis.

✦Elevator—Texarkana, Ark.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the installation of an electric passenger elevator in the post office at Texarkana, to KAESTNER & HECHT, Chicago, Ill., at $4200.

Light System—Galveston, Tex.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., until 3 p.m., Mar. 22, for the construction of a pole line, exterior lighting system, interior wiring system, and lighting fixtures for the United States Quarantine Station at Galveston.

✦Grading—Bremerton, Wash.—The contract for grading at the navy yard, Puget Sound, Bremerton, bids opened Feb. 8, has been awarded to AGASSIZ & HADLEY, Seattle, Wash., at $5980.

✦Barges—Seattle, Wash.—The contract has been awarded to J. McALEER, Seattle, by Maj. J. B. Cavanaugh, Corps Engrs., U. S. A., for two flat-bottom, wooden-hull barges. Bids were opened Feb. 5.

Cement—Portland, Ore.—Bids will be received until 11 a.m., Mar. 10, by Maj. Jay J. Morrow, Corps Engrs., U. S. A., Portland, for furnishing 100,000 bbl. of cement.

Elevator—Soldiers' Home, Calif.—Bids will be received until noon, Mar. 10, by Major W. Moore, Treas., for furnishing and installing an electric elevator at the Soldiers' Home, Los Angeles County, Calif.

✦Dipper Dredges—Panama—The Isthmian Canal Commission has awarded the contract to the BUCYRUS CO., South Milwaukee, Wis., for two 15-yd. dipper dredges.

Transmission Line—Panama—Bids were received Feb. 15, by the Isthmian Canal Commission, Washington, D. C., for the construction of the transmission line for electric power on the Panama Canal. The bidders were (a) General Electric Co., Schenectady, N. Y.; (b) United States Steel Products Co., 30 Church St., New York; (c) Riter Conley Mfg. Co., Pittsburgh, Penn.; (d) National Brass & Copper Tube Co., 41 Park Row, New York. The bids follow: Class 1, Item 1, 725 steel track-span bridges (single-track), Type "A": (b) $413,119; alternate bids, $264,712 to $373,947; (c) $391,500, alternate bid, $365,400; Item 1a, 725 same, Type "B": (b) $332,796; alternate bids, $245,514 to $340,779; (c) $327,700; Item 2, 100 steel track-span bridges (double-track), type "A": (b) $64,960; alternate bids, $40,098 to $58,805; (c) $59,300; alternate bid, $52,400; Item 2a, 100 same, Type "B": (b) $50,445; alternate bids, $38,014 to $45,302; (c) $52,400; Item 3, 2,000,000 ft. copper wire, No. 00: (b) $165,400; alternate bid, $160,600; (d) $158,400; Item 4, 4000 insulators, 3-unit, suspension type, (a) $52,000 (sole bidder); Item 5, 2500 insulators, 3-unit, strain type, (a) $39,625; Item 6, 1000 ground plates, (a) $15,000. Class 2, Items 1 to 4, substation equipment at Cristobal, Gatun, Miraores and Balboa: (a) $308,552; alternate bids, $317,726 to $366,176 (sole bidder). Informal bids on various parts of the work were submitted by American Bitumastic Enamels Co., Philadelphia, Penn.; Lock Insulator Mfg. Co., Vivor, Ont., and National Electrical Supply Co., Washington, D. C.

Dump Cars—Hawaii—Bids will be received until 11 a.m., Apr. 5, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for thirty 20-yd. air dump cars at the naval station, Pearl Harbor, H. T.

✦Steel Oil Storage Tanks—Hawaii—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract to the RITER-CONLEY MFG. CO., 55 Water St., Pittsburgh, Penn., for furnishing steel oil storage tanks at the U. S. Naval Station, Pearl Harbor, H. T. Bids were opened Jan. 25. List of bidders noted Jan. 30.

Motor Generator Set—Hawaii—Bids will be received until 11 a.m., Mar. 22, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one 200-kw. motor generator set and switchboard accessories at the naval station, Pearl Harbor, H. T.

MISCELLANEOUS

Bath-house—Boston, Mass.—A public bath-house will be [illegible] to the Metropolitan Park [illegible]

Signal and Switching Apparatus—Worcester, Mass.—The [illegible] Co. is [illegible] for the installation of signal and switching apparatus at Bridge St., Worcester.

Aqueduct—[illegible] Co., Albany, N. Y.—Bids will be [illegible] by Bureau of Public Supply, Pub. Wks., Albany, [illegible] for the construction of the Mohawk [illegible] Contract No. [illegible]. The [illegible] Contract No. [illegible] for the work [illegible] much [illegible] the [illegible] [illegible] [illegible] which [illegible] upon. A [illegible] ft. wide will [illegible] the [illegible] about the edge of the gorges makes necessary the construction of a [illegible] ft. and will have a thickness at its base of from 15 to 35 ft. The entire work is estimated to cost $1,131,000, and must be completed by Dec. 31, 1914.

Barge Canal Terminal—Fort Plain, N. Y.—The State Canal Board, Albany, N. Y., has approved plans for the construction of a barge canal terminal at Fort Plain. Duncan W. Peck is State Supt. Pub. Wks., Albany.

✦Fire Station—Glens Falls, N. Y.—Bids were received as follows, Feb. 17, by the city for erecting a new fire station: JOSEPH FREDELLA, Glen Falls, $9265 (awarded contract); J. E. Goodman, $12,468; W. A. Burnham, $11,470; A. J. Dubee, $10,294; R. J. Lindhan, $10,293; J. Fred Acker, $11,950.

Asphalt Binder—New York, N. Y.—Bids will be received until 3 p.m., Mar. 6, by the Park Board, for furnishing and delivering 174,000 gal. of macadam asphalt binder in tank cars, at Long Island R.R. terminals, Boro. Brooklyn.

Sand—New York, N. Y.—Bids will be received until 3 p.m., Mar. 6, by the Park Board, Dept. of Parks, Fifth Ave. and 64th St., Boro. Manhattan, for furnishing and delivering 6250 cu.yd. of "Cow Bay" sand to roads and parkways, Boro. Brooklyn.

Broken Stone—New York, N. Y.—Bids will be received until noon, Mar. 4, by George Cromwell, Pres. Boro. Richmond, St. George, New Brighton, S. I., for furnishing and delivering 5000 tons of broken stone and screenings in Stone District No. 1; 13,500 tons in Stone District No. 2; 6500 tons in Stone District No. 3; 350 bbl. portland cement; and 5000 cu.yd. of grits.

Trap Rock—New York, N. Y.—Bids will be received until 11 a.m., Mar. 5, by Alfred E. Steers, Pres. Boro. Brooklyn, for furnishing and delivering 2000 cu.yd. of broken trap rock and 2000 cu.yd. of trap rock screenings to be delivered as follows: 1000 cu.yd. broken trap rock and 1000 cu.yd. trap rock screenings to Corporation Yard, 67th St., near 18th Ave.; 1000 cu.yd. broken trap rock and 1000 cu.yd. trap rock screenings to Corporation Yard, Neck road and Gravesend Ave.

Asphalt—New York, N. Y.—Bids will be received until 11 a.m., Mar. 5, by Alfred E. Steers, Pres. Boro. Brooklyn, for furnishing and delivering 1500 tons of 2000 lb. each of refined asphalt.

Engine Houses—New York, N. Y.—Bids will be received until 10:30 a.m., Mar. 10, by Joseph Johnson, Fire Comr., for furnishing all the labor and materials required for the erection and completion of new buildings, for engine and hook and ladder companies, at various following locations.

★Bronze Shaft Caps—New York, N. Y.—Bids for furnishing and delivering bronze shaft caps and appurtenances for the city tunnel of the Catskill Aqueduct in the city of New York, were received by the Board of Water Supply, Feb. 18, as follows: (A) American Manganese Bronze Co., 99 John St., New York; (B) Coldwell-Wilcox Co., Newburgh, N. Y.; (C) Hyde Windlass Co., Bath, Maine; (D) Exeter Machine Works, Pittston, Penn.; (E) Bethlehem Steel Co., South Bethlehem, Penn.; (F) William Cramp & Sons Ship & Engine Building Co., Beach and Ball Sts., Philadelphia, Penn.; (G) Paul S. Reeves & Co., 1415 Catherine St., Philadelphia, Penn.; (H) average bid:

Canal Terminal—Plattsburgh, N. Y.—D. L. Taylor & Co., Utica, N. Y., submitted the lowest bid to Duncan W. Peck, State Supt. Pub. Wks., for constructing a barge canal terminal on Lake Champlain at Plattsburgh, at $126,834, as compared with the engineer's estimate of $136,143. Four other bids were submitted, as follows: David H. Whitmer, Philadelphia, $133,945; Waterways Dredging Co., 150 Nassau St., New York, $150,528; Atlantic, Gulf & Pacific Co., Park Row Bldg., New York, $175,521. Albert M. Banker, Gloversville, N. Y., $183,407.

✦Gymnasium—Schenectady, N. Y.—The contract has been awarded to the AMSTERDAM BUILDING CO., 43 West 27th St., New York, for constructing a gymnasium for Union College, Schenectady. The building will be 70x200 ft., two stories high.

✦Barge Canal Work—Utica, N. Y.—The contract has been awarded to GRANT SMITH & LOCHER, New York, for completing the construction of the canal near Utica, Contract 42A, at $1,041,671. Bids were opened Feb. 4, by Duncan W. Peck, State Supt. Pub. Wks. Noted Feb. 13 under Albany, N. Y.

Channel Excavation—Waterford, N. Y.—Bids will be received until Mar. 18, by Duncan W. Peck, State Supt., Pub. Wks., Albany, for completing the excavation of a channel in the Hudson River, north of Waterford under Contract No. 72A. The contract will have a length of four miles.

★Road Roller—Mount Holly, N. J.—Bids will be received by the Board of Chosen Freeholders of the County of Burlington, at the County Collector's Office, Mount Holly, until 11:30 a.m., Mar. 12, for furnishing a 10-ton steam or gasoline road roller. Proposals must contain an allowance for the present county roller now located at Smithville, Burlington County, N. J. Bidders to submit detailed specifications and guarantee of the roller they propose to furnish. James Logan is County Engr.

Pier Extension—Trenton, N. J.—The State Board of Riparian Commissioners, Feb. 17, approved the plan of the War Department for the extension further into the Hudson River of the pierhead line for a distance of 1140 ft., along the water front of Jersey City and Hoboken.

Fire Station—Annville, Penn.—The Union Fire Co., Annville, will erect a three-story and basement fire station, 40x65 ft. G. H. Boyer, Lebanon, Penn., is Arch.

✦Dredging—Philadelphia, Penn.—Bids will be received by the Pennsylvania R.R. Co. until 9 a.m., Mar. 7, for pumping ashore all silt dredged from the company's docks on the west side of the Delaware River, Philadelphia, about 350,000 cu.yd. The company will do all dredging and deliver the material to the blower. Information on application to J. B. Baker, Supt., 32d St. and Powelton Ave., Philadelphia.

✦Subway—Baltimore, Md.—The contract has been awarded to EDWARD BEALY & SONS, 1113 Cathedral St., Baltimore, by the Baltimore & Ohio R.R. Co., for the construction of a subway beneath the tracks extending from present station

building at Harper's Ferry to shelter sheds on opposite side of tracks, 70 ft. long, 7 ft. wide, and 8 ft. high, concrete stairway leading from subway into waiting room.

Drainage—Portsmouth, Va.—The cost of draining 20,900 acres for Pleasant Grove Drainage District has been estimated at about $200,000. G. M. Warren is Engr.

✦Coal Tipple—Logan, W. Va.—The Monitor Coal & Coke Co., Logan, has awarded the contract to W. N. KRATZER & CO., 3218 Smaliman St., Pittsburgh, Penn., for erecting a coal tipple and conveyor at Logan to cost $10,000

Drainage—Greenville, S. C.—The Board of Health is considering draining the Greenville Meadows. It is planned to improve the channel of the Reedy River to carry out the project.

Bulkhead—Augusta, Ga.—Bids will be received by the City Council until noon, Mar. 6, for the construction complete of a reinforced-concrete bulkhead across the tail-race of Sibley Mill. Nisbet Wingfield is City Engr.

Waterfront Improvements—Savannah, Ga.—Plans for the rehabilitation of that portion of the waterfront destroyed by fire recently with a loss of more than $1,500,000, are under way. The Merchants' Mutual Transportation Co. has made arrangements for a temporary wharf, and the Ocean Steamship Co. and the Central of Georgia Ry., which owned most of the burned property, will begin the work of reconstruction at once.

Drainage Canal—Bushnell, Fla.—Bids will be received until noon, Mar. 3, by the County Commissioners of Sumter County, Bushnell, for the construction of Tompkins Creek Drainage Canal.

Bath-house—Key West, Fla.—B. B. Warren, Key West, is planning to erect a large bath-house.

Drainage—Orlando, Fla.—Bids will be received until 10 a.m., Mar. 4, by the Commissioners of Orange County, Orlando, for constructing three drainage canals in Black Hammock Drainage District. Bids are asked on the following: For the construction of one drainage canal and laterals, 12.35 miles long, requiring 177,912 cu.yd. excavation; for one drainage canal and laterals, 3.86 miles long, requiring 33,502 cu.yd.; for one drainage canal and laterals, 3.28 miles long, requiring 27,174 cu.yd.; for clearing about 19 miles of right-of-way for drainage canal and laterals. B. M. Robinson is Clk.

✦Drainage—Starke, Fla.—Bids were received by the County Commissioners for excavating about 200,000 cu.yd. canals and ditches, draining a territory embracing about 17,280 acres of land, known as the East Starke Drainage Dist. The contract has been let to J. C. LIVINGSTON & CO., Starke, at 14c., 15c. and 16c. per cu.yd.

Steel Shed—New Orleans, La.—The Board of Commissioners of the Port of New Orleans are having plans prepared for the construction of a steel shed on the wharf between Desire and Barthomew Sts., in two sections, that portion over the lower section to be 352 ft. in length and 200 ft. wide. Estimated cost, $126,400.

Wharf—New Orleans, La.—The Dock Board, according to press reports, is planning to construct a modern steel wharf and shed between Julia and St. Josephs Sts. Estimated cost, $250,000. W. A. Kernoghan is Pres. Bd.

Drainage—Fulton, Ky.—W. C. Kelly, Union City, Ky., has completed the survey for draining Harris Fork Creek from Fulton to the Obion River. Estimated cost, $45,000.

Swimming Pool—Cincinnati, Ohio—The city will construct a swimming pool and shelter house.

Wall, Steps—Cincinnati, Ohio—Bids will be received until Mar. 4, by V. T. Price, Dir. Pub. Ser., for the construction of a concrete retaining wall on Sanders St., and concrete steps, landings and sidewalks on Ardner and Englebrink Sts.

✦Ditch—Deshler, Ohio—Bids were received Feb. 12, at the Town Hall, Deshler, for constructing the J. W. Butler joint ditch, in Hancock, Henry and Wood Counties. The John Learn branch, Hancock County, is 50,171 ft. long, including 70,200 cu.yd.; the Yellow Creek Branch, Putnam County, is 50,700 ft. long, 51,054 cu.yd.; the Brush Creek branch, in Henry County, is 32,300 ft. long, 42,393 cu.yd.; the outlet known as "Ditch 12 and the Jackson Cutoff," Wood County, is 55,223 ft. long and contains 168,565 cu.yd. The three branches will be team work and the outlet, dredge work, with 12 to 20 ft. bottom. The county surveyor will have charge of the work in his own county. Contracts have been awarded as follows: To CHAPMAN BROS., Celina, dredge work of 10 miles, Ditch 12 and Jackson Cutoff, at $29,750; the Brush Creek branch, to J. E. DULL, Arcanum, at $7425; the Yellow Creek branch, to D. G. WATSON, of Malinta, at $8195; the JOHN LEARN branch, above and below Shawtown, to ERZA BAKER, Arcanum, at $9480. Elmer Hilty is Surv. Hancock County, Findlay, Ohio; F. A. Daum is Surv. Henry County, Napoleon, Ohio, and E. F. Metzger is Surveyor Wood County, Bowling Green, Ohio.

Fire Station—Lakewood, Ohio—The city will ask for bids soon for the erection of a fire and police station, to cost $25,000.

Fire Station—Niles, Ohio—The Board of Control, Feb. 10, received bids as follows, for the construction of a fire station: Charles E. Schoof, $9466; Rarick & Hillman, Warren, $9885; W. F. Thomas and C. P. Flanigan, $9250; National Supply & Construction Co., $8416.

Mausoleum—Van Wert, Ohio—The Twentieth Century Mausoleum Co., Van Wert, will receive bids in April for the construction of a one-story mausoleum, 36x48 ft. Estimated cost, $50,000.

Dredging—Indianapolis, Ind.—All bids opened by the Park Commissioners, Indianapolis, for dredging Fall Creek, have been rejected as excessive. New bids will be asked.

✦Greenhouses—Indianapolis, Ind.—The Park Commissioners have awarded the contract to the LORD & BUCHANAN CO., Chicago, Ill., for erecting two greenhouses in Garfield ark, at $30,000.

✦Drainage Pumping Station—Beardstown, Ill.—The contract has been awarded to W. T. McGASKEY & CO., Monadnock Bldg., Chicago, Ill., for the construction of a pumping station for Coal Creek Drainage and Levee District, at $19,175.

Crushed Granite, Etc.—Chicago, Ill.—Bids will be received until 4 p.m., Mar. 11, by the West Chicago Park Commissioners, for 500 cu.yd. crushed granite, 5000 cu.yd. crushed limestone and 1000 tons of asphaltic cement. George A. Mugler is Secy.

Stable—Chicago, Ill. The Farquahar Trucking Co., 100 Norton St., Chicago, will erect a three-story and basement stable, 72x67 ft.

✦Comfort Stations—Chicago, Ill. The contract has been awarded to the WARNER CONSTRUCTION CO., 32 North Clark St., Chicago, by the South Park Commissioners for constructing two comfort stations, at $23,734.

Dredging—Chicago, Ill.—The Sanitary District of Chicago Feb. 13, received bids as follows for dredging 120,000 cu.yd. from Bubbly Creek: Great Lakes Dredge & Dock Co., 28.5c.; Byrne Bros. Dredging & Engineering Co., 28.5c.; FitzSimmons & Connell Dredge & Dock Co., 35c.

Ditches—Chicago, Ill.—An appropriation of $25,000 has been voted by the Sanitary District of Chicago for constructing drainage ditches along Calumet Sag channel with the district's own force and equipment.

✦Filling—Black River Falls, Wis.—The contract has been awarded to ALEXANDER McGAVOCK, Black River Falls, Wis., for 300,000 cu.yd. of filling for the washed-out portion of Black River Falls.

✦Drain—Algona, Iowa—The contract for constructing Drain No. 75 has been awarded by B. E. Norton, County Audr., Algona, to the WELP CEMENT PRODUCTS CO., Bancroft, Iowa, at $16,500. Bids were opened Feb. 11.

★Drainage—Northwood, Iowa—The contract for the construction of improvements in Drainage District No. 14 of Worth County, Iowa, consisting of 30,000 ft. of tile, ranging in size from 6 to 24 in., will be awarded at the office of the County Auditor, Northwood, Mar. 6, at 2 p.m. For further information address C. N. Urdahl, Audr., or Frank Forbes, Northwood, Engr.

Ditch—Sidney, Iowa—Bids will be received by F. B. Jenkins, County Audr., Sidney, for work on Plum Creek Ditch and it laterals. The work includes about eight miles of main ditch, 325,000 cu.yd.; and two laterals, one 25,000 cu.yd. and the other 21,900 cu.yd.

Ditch—Webster City, Iowa—All bids have been rejected by the county for the construction of the Frayne Tile Ditch No. 4. W. T. Peterson is County Audr.

Park Work—Eveleth, Minn.—The city will improve its various parks. Paul Mueller, Minneapolis, Minn., has been engaged to prepare plans.

✦Drainage—Scotts Bluff, Neb.—The Minature Drainage Co. has awarded the contract to YODER & LILJENSTALPE for draining 13,000 acres.

Drainage—Edna, Tex.—Bids will be received until Mar. 1, by the Drainage Commissioners, Edna, for constructing all canals drains, ditches and levees and straightening and cleaning all water courses and all other improvements, including necessary grubbing and clearing, and the construction of the necessary culverts and bridges covered by the proposed drainage improvements in Jackson County Drainage District No. 1. W. C. Youngs, Edna, is Engr.

✦Filling—South Bend, Wash.—The contract has been awarded to the PUGET SOUND BRIDGE & DREDGING CO., Tacoma, Wash., for filling in a portion of the lowland section of South Bend, at 15.5c. per cu.yd.

Dredging—Los Angeles, Calif.—The North American Dredging Co., Central Bldg., Los Angeles, was low bidder at 23.75c. per cu.yd. for dredging in a portion of Wilmington Basin and placing material by filling a portion of Wilmington south of Front St. N. R. Harris bid 27.3c.

Piles, Timber—Los Angeles, Calif.—Bids were received by the Board of Public Works, Feb. 10, for furnishing creosoted piles and timbers for the construction of Pier A and bulkheads at San Pedro. The lowest bids were submitted by the Pacific Creosoting Co., Los Angeles, for creosoted Douglass fir, at $43 per M. ft. B.M., and $20.14 each for 38-ft., $18.02 for 34-ft., $15.90 for 30-ft. piles.

Wharf—Martinez, Calif.—The Associated Oil Co., Martinez, has applied for a franchise to construct and maintain a wharf in Suisan Bay at Avon.

✦Wharf—Marinez, Calif.—The city has awarded the contract to the MERCER-FRAZER CO., 16 California St., San Francisco, for the construction of a municipal wharf and approaches on the tide lands, at $26,445.

✦Wharf—San Francisco, Calif.—The Pacific Gas & Electric Corporation has awarded a contract to the THOMSON BRIDGE CO., 103 Main St., for the construction of a wharf and pump-house foundation on Delaware St., at $17,125.

✦Hauling Lumber—San Francisco, Calif.—The Panama-Pacific Exposition Co. has awarded the contract to the McPHEE STEVEDORING CO., foot of Third St., at $1.10 per M. ft. B.M., for the hauling of 6,500,000 ft. of lumber from the U. S. Transport docks to the fair site.

✦Elevator Equipment—San Francisco, Calif.—The Willis Polk Co., Arch., has awarded the following contracts in connection with the construction of elevators in the Merchants Exchange Bldg.: For elevator pump, to the DOW PUMP & DIESEL ENGINE CO., Sheldon Bldg., at $15,500; for the elevator plant consisting of four hydraulic circulating machines and a sidewalk lift, to the OTIS ELEVATOR CO., Beach and Stockton Sts., at $29,500.

✦Pier—San Francisco, Calif.—Bids have been opened as follows, by the State Board of Harbor Commissioners for the construction of Pier 39: Healy-Tibbitts Construction Co., 247 Market St., San Francisco, $436,400; F. Rolandi, $474,000; San Francisco Bridge Co., $448,000; Pacific Wakefield Co., $443,600; Grant Smith & Co., $528,000.

✦Dredging—Quebec, Que.—The contract has been awarded to the DOMINION DREDGING CO. for the removal of from 2,500,000 to 5,000,000 cu.yd. of materials, chiefly sand, to a depth of from 35 to 47 ft. below low water. Bids were opened by the Quebec Harbor Commissioners, Jan. 31. Raoul Renault is Secy.-Treas.

Breakwater Extension—Cobourg, Ont.—All bids received for the construction of an extension to the breakwater at Cobourg have been rejected by the Department of Public

Works, Ottawa, Ont., as excessive. The work will be done by day labor. R. C. Desrochers is Secy.

Fire Apparatus—London, Ont.—Bids will be received by the City Clerk until Feb. 26, for a modern combination and chemical wagon, equipped with 80-hp. motor, one 40-gal. tank, and capacity for carrying 122 ft. of 2½-in. hose. John Aitkin is Ch. Fire Dept.

+Landing Piers—Ottawa, Ont.—The contract has been awarded to QUESIME POLIQUIN, Portneuf, Que., by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for constructing two landing piers at Bastican River, Que., at $17,300.

Dredging—Port Burwell, Ont.—Bids will be received until 4 p.m., Mar. 3, by R. C. Desrochers, Secy., Dept. Pub. Wks., Ottawa, Ont., for dredging at Port Burwell.

+Wharf Extension—Providence Bay, Ont.—The Department of Public Works, Ottawa, Ont., has awarded the contract for the construction of an extension to the wharf at Providence Bay, Mantoulin Island, Algoma District, Ont., to E. V. H. White, Burlington, Ont.

Dike—New Westminster, B. C.—Plans are being prepared by Elliott & Co., Dominion Bldg., Vancouver, B. C., for a diking system on Lulu Island, near New Westminster.

BUILDINGS

Andover, N. H.—Philips Andover Academy has announced that through bequests a new dormitory, to cost $65,000, and a new recitation hall, to cost $125,000, will be erected during the spring.

Auburndale, Mass.—The Walker Home for Missionaries children will soon have plans prepared for the rebuilding of its buildings recently destroyed by fire. The new plant will consist of a three-story building of brick to be erected at Hancock and Grove Sts. The estimated cost is $50,000. H. A. Wilder is Chn.

+Boston, Mass.—The contract for the telephone exchange building to be built for the New England Telephone & Telegraph Co., on Waverly St. Roxbury, has been awarded to DANIEL L. SHEPARD, 46 Cornhill. It will be two stories high, 42x88 ft., and 33x90 ft., of brick, stone and terra-cotta. Densmore & Le Clear, 88 Broad St., are the Archs.

Boston, Mass.—A large hotel is planned to be built at Arlington and Newbury Sts., by the J. R. Whipple Co.

Cambridge, Mass.—We are officially advised that the Massachusetts Institute of Technology, Boston, has commissioned William Wells Bosworth, Arch., 527 Fifth Ave., New York, N. Y., to prepare plans for the construction of its new group of buildings. They will be located on the banks of the Charles River. The estimated cost is $4,000,000.

Somerville, Mass.—Bids will soon be received by the Public Buildings Department for extensive additions to the High School. Walter T. Littlefield, City Hall, is Comr.

Providence, R. I.—Plans have been completed by W. Howard Walker, Arch., 17 Custom House St., for the proposed new Armory and Riding Hall for the mounted commands of the R. I. National Guard. Bids will be received shortly. The est.mated cost is $135,000.

Hartford, Conn.—The plans drawn by A. Raymond Ellis, Arch., 36 Pearl St., have been accepted by the Board of Health, for an isolation hospital to be erected on the City Farm property on Vine St. A group of buildings of either brick or hollow tile, consisting of an administration building, 2½ stories high, a two-story service building and two one-story pavilions, connected by a colonnade, will be built. The estimated cost is $100,000.

+New Haven, Conn.—Contracts for the erection of a four-story building at 228 George St., for Walter E. Malley, have been awarded as follows: General contract to THE DAVID H. CLARK CO., 166 Brewery St., steel work, to the EASTERN BRIDGE & STRUCTURAL CO., Worcester, Mass. The structure will be 145x60 ft., of brick and steel, and will cost about $60,000. Brown & Von Beren, 865 Chapel St., are the Archs.

Stamford, Conn.—A site for a theater has recently been purchased on Bank St. by Anthony Geromino and Mayer Jones. It is planned to erect a building with a 25-ft. entrance and 100x100 ft. in the rear, of brick, fireproof construction. The estimated cost is $100,000.

+Brooklyn, N. Y.—We are officially advised that the Department of Education, Park Ave. and 59th St., Boro. Manhattan, has awarded a contract to the MITCHELL CONSTRUCTION CO., 4 Court Sq., at $190,487, for the construction of Public School 176. Bids were received on Feb. 17. C. B. J. Snyder is Supt.

East Syracuse, N. Y.—Bids are being received by Russell & King, Archs., Syracuse, for the superstructure of the church edifice, 83x150 ft., of granite or marble, to be erected by the St. Matthews R. C. Church. The estimated cost is $[illegible].

Gloversville, N. Y.—F. L. Comstock, Arch., is preparing plans for a new building, 60x100 ft., three stories high, of brick and stone, to be erected by the Y. M. C. A. C. J. Holden is Gen. Secy. The estimated cost is $[illegible].

Nepperhan, N. Y.—The German Odd Fellow Home Association will erect a building to cost approximately $150,000 at Hawthorne and the Concrete Way.

New York, N. Y.—Bids will be received until 1 p.m. Mar. 3, by the Department of Education, Park Ave. and 59th St., for the construction of Public School No. 97, on Manning St., near East Tremont Av. C. B. J. Snyder is Supt. School Bldgs.

Plans have been filed by Goldwyn, Starrett & Van Vleck, Archs., 15 E. 40th St., for the construction of a 12-story hotel, at the southwest corner of 50th St. and 10th Ave., for the Hill Improvement Co. Size of site to be 175x98 ft. The estimated cost is $[illegible]. Contract to be let Nov. 7.

Plans have been filed by Maybe & Hackett, Archs., 11 Madison Ave., for the construction of an eight-story apartment hotel, on the S. E. cor. of Central Park West and the Avon Realty Co., 11 Madison Ave. The estimated cost is $[illegible].

Plans have been filed by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, 500 Park Ave., for the construction of a six-story warehouse, 200x199 ft., on First Ave., between 67th and 68th Sts. It will be built for the Dept. of Education, Park Ave. and 59th St. The estimated cost is $500,000.

Bids are being received by Warren & Wetmore, Archs., 16 East 47th St., for the construction of a four-story club house, 200x81 ft., for the Racquet Club, 27 West 43d St.

Plans have been filed by Neville & Bagg, Archs., 217 West 125th St., for a 13-story office and loft building to be erected on 38th St., west of Broadway, for the McMorrow Engineering & Construction Co. The estimated cost is $300,000.

Plans have been filed by the Department of Education, Park Ave. and 59th St., for the construction of a five-story public school, on 176th St., near St. Nicholas Ave. The estimated cost is $200,000. C. B. J. Snyder is Supt. School Bldgs.

(Boro. Richmond)—We are officially advised that bids were received as follows, on Feb. 10, by the Department of Education, Park Ave. and 59th St., Manhattan, for the construction of public school No. 22, Boro. of Richmond; Durtrin & Laas, 103 Park Ave., Manhattan, $72,981; James McArthur Co., $84,432; Frymier & Hanna Co., $72,990; T. A. Clarke Co., $87,300; Paul J. Exner & Co., $73,100. C. B. J. Snyder is Supt.

Syracuse, N. Y.—We are officially advised that bids will be received until March 20, by Russell & King, Archs., for the construction of a four-story warehouse, 125x55 ft., on West Willow St., for C. W. Snow & Co., wholesale druggists. The estimated cost is $50,000. Noted Jan. 30.

Utica, N. Y.—Plans are being prepared by Cooper & Bagg, Archs., Clarendon Bldg., for a two-story school addition, 215 x71 ft., for the Board of Education. The estimated cost is $85,000.

Cranford, N. J.—The citizens, at a special election have voted favorably upon the construction of a new public school on Union Ave. The estimated cost is $90,000.

+Jersey City, N. J.—The Eckerson Co., 107 Hudson St., has awarded a contract to OSWIN W. SHELLEY, 1123 Broadway, New York, N. Y., at $150,000, for the construction of a five-story warehouse, 180x80 ft. Balch & Beardsley, 38 West 32d St., New York, N. Y., are the Archs.

Bids will be received until Mar. 6, by the Board of Education, for the construction of a wing to Public School 34, at Warner Ave. and the Boulevard. John T. Rowland, 98 Sip Ave., is the Arch. The estimated cost is $150,000.

Newark, N. J.—The Common Council has voted to issue bonds for $500,000 for the erection of a Nurses' Home at the City Hospital.

+Newark, N. J.—H. W. Barclay, 876 Broad St., has awarded a contract to the AMERICAN CONCRETE STEEL CO., Essex Bldg., for the erection of the eight-story Barclay Bldg., 110x55 ft., on Summit St. John T. Simpson, 27 Clinton St., is the Arch. Noted Feb. 6

Paterson, N. J.—The Globe Carpet, Oil Cloth & Bedding Co. is contemplating the erection of a new building at 142 Main St. It will be three stories high and will cost $75,000.

Plans have been prepared by T. John Foalks, Arch., for the construction of a new lodge for the Loyal Order of Moose. It will be two stories high, and is estimated to cost $150,000.

Princeton, N. J.—Plans have been filed by Jesse V. Bickford, 116 Nassau St., for a one-story brick building. The estimated cost is $40,000.

Stockton, N. J.—The Board of Education is considering bids for the erection of a new school building a 28th and 29th Sts. The structure is estimated to cost $100,000.

Allentown, Penn.—The Allentown Hotel Co. will erect a 10-story hotel at Hamilton and Fifth Sts.

Latrobe, Penn.—Bids will be received until Mar. 15, by A. P. Cooper, Arch., First National Bank Bldg., Uniontown, Penn., for the construction of a two-story 183x108 ft. high school. The estimated cost is $125,000.

+North East, Penn.—The contract has been awarded to THOMAS REILEY, Philadelphia, for the construction of a five-story addition to St. Mary's College. The estimated cost is $200,000.

Norristown, Penn.—The Montgomery Trust Co., is having plans prepared for the construction of a two-story and basement bank building. The estimated cost is $50,000. L. M. Childs is Pres.

+Philadelphia, Penn.—The contract for the construction of the 12-story warehouse at 23d and Arch Sts., for J. D. Larkin & Co., has been awarded to the ABERTHAW CONSTRUCTION CO., Boston.

The Finance Co. of Pennsylvania will erect a 20-story office and bank building at 1420 South Penn Sq. William H. Hoffman is Arch.

The contract for the construction of the 10-story apartment house at 1327 Spruce St., for Mrs. T. W. Barlow, has been awarded to MEREDITH R. GARDINER. The estimated cost is $180,000.

Plans are being prepared by Charles W. Bolton & Son, Archs., Witherspoon Bldg., for the construction of an eight-story apartment house, 60x100 ft., at 225 South Eighth St., for E. L. Shessler. The estimated cost is $150,000.

Brennan Bros. have purchased a site on 60th St. and will erect a terra-cotta theater. The estimated cost is $70,000.

Pittsburgh, Penn.—The County Commissioners have been authorized to condemn the Marshall and Maloney properties on Diamond St., which are to be acquitted as a site for a court house annex and City Hall.

Irwin & Witherow, Archs., Keystone Bldg., are preparing plans for a two-story brick and reinforced concrete building in North Ave., North Side, for the United Oil Co. The estimated cost is $50,000.

Edward Stotz, Arch., Monongahela Bank Bldg., is taking bids on the seven-story granite, terra-cotta and vitrified brick bank building to be erected in Federal St. North Side, for the Dollar Savings Fund & Trust Co. Noted Jan. 30

Pittsburgh, Penn.—D. F. Henry will erect a four-story mercantile building, at Fifth Ave. and Washington St. The estimated cost is $100,000.

Pittsburgh Lodge No. 11, B. P. O. E. will erect a temple

on the site of the present clubhouse. The estimated cost is $160,000.

The Department of Health is having plans prepared for the construction of a tuberculosis sanitarium on the Leach Farm.

The Central District Printing & Telegraph Co. will erect a 10-story building, 126x150 ft. at Seventh Ave. and Cherry Alley. The estimated cost is $182,000.

Scranton, Penn.—Plans have been prepared by E. H. Davis, Arch., for an addition to the Technical High School.

Uniontown, Penn.—Plans have been prepared for the construction of an edifice for the Methodist Episcopal congregation at Beeson Ave. and Dunbar St. The estimated cost is $150,000.

Valencia, Penn.—The directors of the Kingsley House Association are planning the erection of a convalescent home at Valencia. The estimated cost is $100,000.

Warren, Penn.—C. L. Gamble, Arch., Jamestown, N. Y., is preparing plans for an eight-story addition to the Carver House, James Edwards, proprietor. The estimated cost is $100,000.

Washington, Penn.—Press C. Dowler, Arrott Bldg., is receiving bids for the construction of a three-story brick sanitarium, for Washington County. The estimated cost is $60,000.

York, Penn.—John B. Hamme, Arch., Wiest Bldg., is preparing plans for the construction of a building for the Frederick Trust Co. The estimated cost is $50,000.

✦Annapolis, Md.—The contract has been awarded to D. M. ANDREW, Baltimore, at $34,600, for the construction of an armory for the City Armory and Convention Hall Commission. Noted Jan. 23.

Baltimore, Md.—Bids were received as follows by the School Board, Baltimore, for the construction of an addition to School No. 83, at Philadelphia Ave., and Lakewood Ave.: John K. McIver, 7 Clay St., $118,997; Chas. Stockhousen, First National Marine Bank Bldg., $121,300; Singer-Pentz Construction Co., 600 Equitable Bldg., $127,160; P. J. Cushen, 3 St. Paul St., $128,031; Maryland Contracting Co., 214 Courtland St., $129,990; Fred Decker & Son, East Biddle St., $132,500; John Hiltz & Son, Clay St., $134,597; J. Shamberger, $154,640. All bids were rejected.

Archer & Allen, Archs., Central Savings Bank Bldg, have prepared plans for the construction of the James Buchanan Brady Urological Clinic building. The estimated cost is $200,000.

Frederick, Md.—The following bids were received by the Frederick Armory Commission of the State of Maryland, for the construction of an Armory: Lloyd C. Culler, Frederick, Md., $33,965; Merrough Bros., York, Penn., $34,700; Eline Bros., Lonestown, Penn., $35,324; M. C. Davis, Baltimore, Md., $38,745; Arthur Smith, Washington, D. C., $38,400; John K. McIver, Baltimore, Md., $39,997; Sparr Bros York, Penn., $42,185; Cassidy Co., Washington, D. C., $42,244; King Lumber Co., Charlottesville, Va., $43,164; Merritt & Co., New York, $47,986. Noted Feb. 6.

Hagerstown, Md.—The I. O. O. F. will erect a temple on South Potomac St. The estimated cost is $40,000.

Washington, D. C.—The General Synod of the Evangelical Lutheran Church will erect a Home for the Aged, at 18th and 20th Sts. The estimated cost is $100,000.

Washington, D. C.—Plans have been revised by Milburn, Heister & Co., Union Savings Bank Bldg., Washington, D. C., for the construction of an 11-story office building at 14th and H Sts., for the Real Estate Trust Co. The estimated cost is $300,000. Noted Nov. 7.

Alexandria, Va.—Contracts for the construction of the Normal school building have been awarded as follows: General contract, PAGE CONSTSUCTION CO., Hibbs Bldg., Washington, D. C.; structural iron work, SOPER & McDONALD, 318 Main Ave., S. W.

Alexandria, Va.—The Episcopal High School, Alexandria, will erect two dormitories which will cost approximately $70,000.

Roanoke, Va.—The city will erect a city hall. The estimated cost is $250,000. C. B. Moomaw is Mayor.

Warm Springs, Va.—Bids will be received until 9 a.m., Mar. 11, by Supervisors of Bath County, for the construction of a courthouse at Warm Springs. T. J. Collins & Son are Archs., Staunton, Va.

Parsons, Va.—Plans have been prepared by Holmboe and Lafferty, Archs., Clarksburg, for the construction of a school building, 65x112 ft. The estimated cost is $40,000.

✦Wheeling, W. Va.—The contract has been awarded to H. W. ARCKER & CO., Huntington, W. Va., for the construction of an edifice for the Thompson Memorial Methodist Episcopal Church. Noted Dec. 19.

Orangeburg, S. C.—Claflin University will rebuild its main building recently destroyed by fire. The estimated cost is $100,000. M. L. Dunton is Pres.

Atlanta, Ga.—Byron Souders will erect an eight-story apartment house on West Peachtree and Linden Sts. The estimated cost is $200,000.

Augusta, Ga.—Plans have been prepared by G. Lloyd Preacher, Arch., Augusta, for the construction of a 15-story bank and office building for the Empire Life Insurance Co. The estimated cost is $400,000.

Augusta, Ga.—Augusta Lodge, B. P. O. E. will erect a four-story lodge building. The estimated cost is $100,000.

Savannah, Ga.—H. W. Witcover, Arch., National Bank Bldg., is receiving bids for the construction of an armory at Bull St. and Park Ave., for the Chatham Artillery.

✦Bushnell, Fla.—The contract for the erection of a court house and jail at Bushnell has been awarded to JENKINS & WILLIAMS, Ocala, Fla., at $65,000.

✦Lakeland, Fla.—The contract has been awarded to J. McCIRCHEN CO., Tampa, for the construction of the hotel for Kibbler Bros. Noted Jan. 9.

Andalusia, Ala.—The County Commissioners contemplate erecting a courthouse. The estimated cost is $100,000.

Birmingham, Ala.—The Loulie Compton Seminary will erect a home on Seventh Ave., near 22d St. The estimated cost is $80,000.

✦Birmingham, Ala.—The contract has been awarded to the F. W. MARLE CONSTRUCTION CO., Worcester, Mass., for the construction of a 12-story hotel. The estimated cost is $650,000.

✦The general contract for the construction of the warehouse on Sixth Ave., for the Southern Bell Telephone Co., has been awarded to the FRED A. JONES BUILDING CO., American Trust Bldg., Birmingham.

Jefferson, Tenn.—K. C. Colley, Arch., Chamber of Commerce Bldg., Nashville, Tenn., has prepared plans for the construction of a hotel at Jefferson Springs. The estimated cost is $50,000.

Memphis, Tenn.—The Commercial Trust & Savings Bank has plans for the construction of a 22-story steel and brick office building at Main St. and Union Ave. The estimated cost is $100,000.

Nashville, Tenn.—The Cumberland Telephone & Telegraph Co., Nashville, will erect a 10-story office building. The estimated cost is $250,000.

Nashville, Tenn.—Hart & Gardner, Archs., 1004 Stahlman Bldg., Nashville, have prepared plans for a group of buildings to be erected at Ward-Belmont College. Rev. Ira Landreth is Pres.

Jeffersontown, Ky.—The Fiscal Court, Louisville, will erect buildings and a reservoir at the county poorhouse. Brinton B. Davis is Arch., Louisville.

✦Jackson, Ky.—The contract has been awarded to A. DEITZ & CO., Mt. Sterling, Ky., for the construction of a hotel, for the Hotel Jefferson Co.

Louisville, Ky.—Plans have been prepared by D. X. Murphy & Bro., Archs., Louisville, for the construction of a five-story building on West Jefferson St., for Whallen Bros.

Louisville, Ky.—Brinton B. Davis, Louisville, Ky., has completed plans for the construction of a 9-story reinforced concrete warehouse for the Standard Sanitary Mfg. Co. Noted Jan. 9.

Akron, Ohio—Frank Selzer has taken out a permit to erect a five-story and basement theater and office building at Exchange and Main Sts. The estimated cost is $125,000. F. W. English is the Arch.

✦Canton, Ohio—The contract for the construction of the new hospital to be known as the District Tuberculosis Hospital has been awarded to R. H. EVANS & CO., Columbus, Ohio, at $112,000. The other bids were: Keller Huff, Canton, $122,544; George Kratt, Lorain, Ohio, $115,621.

Cincinnati, Ohio—The Building Committee of the University of Cincinnati, has commissioned Tietig & Lee, Lyric Bldg., Cincinnati, to prepare plans for the construction of the new chemistry building. The estimated cost is $225,000.

Coshocton, Ohio—Plans have been completed for the construction of a new high school at Coshocton. Frank L. Packard is the Arch. The estimated cost of the structure is $80,000.

Chicago, Ill.—The N. K. Fairbank Estate has had plans prepared for the construction of a six story and basement mercantile building at South Michigan Ave. and East 18th St., to be occupied by the Beckley-Ralston Co., dealers in automobile supplies. The estimated cost is $150,000. Holabird & Roche, are the Archs.

Plans have been completed for the construction of the new 15-story building to be known as the Michigan Ave. Building, on North Michigan Ave. and East Washington St. The estimated cost is $1,500,000. Jarvis Hunt is the Arch.

✦Rockwell City, Iowa—The contract for the construction of a new court house for Calhoun County, has been awarded to the FALLS CITY CONSTRUCTION CO., Louisville, Ky., at $162,000. Noted Nov. 14.

Cameron, Tex.—Dr. W. R. Newton, Cameron, plans to erect a sanitarium to cost approximately $40,000.

Dallas, Tex.—Sears, Roebuck & Co., will build a new ten-story building in Dallas, to cost approximately $625,000. Elmer L. Scott is Vice-Pres., Chicago, Ill.

Denison, Tex.—Bids will be received by J. D. Yocum, City Secy., Denison, until 8 p.m., Mar. 5, for the construction of a three-story high school. A. O. Watson, Austin, Tex., is the Arch. Noted Jan. 23.

Houston, Tex.—Plans have been completed and the contract will soon be awarded for the construction of a new eight-story building for A. Levy. C. D. Hill & Co., are the Archs.

Palestine, Tex.—The County Commissioners Court has ordered that a bond election be held on Mar. 8, to vote on the proposition to issue bonds for $150,000 for the purpose of erecting a new court-house. Noted Feb. 20.

✦Waco, Tex.—The contract for the construction of a three-story building for the local Masonic lodge, has been awarded to FELL & AINSWORTH, Waco., at about $60,000. T. Brooks Pearson, 1509 Amicable Bldg., is the Arch. Noted Dec. 12.

Denver, Colo.—J. Foster Symes and Oscar D. Cass are interested in a syndicate which will erect a ten-story business and office building at 16th and Curtis Sts. The estimated cost is $700,000. Robert S. Roeschlaub is Arch.

Bisbee, Ariz.—The citizens have voted in favor of issuing bonds for $80,000 for the purpose of constructing a high school.

✦Spokane, Wash.—A contract has been awarded to the MINNEAPOLIS STEEL & MACHINERY CO., Minneapolis, Minn., at approximately $150,000 for furnishing the structural steel to be used in the new Davenport Hotel. Noted Jan. 9.

Portland, Ore.—The Portland, Eugene and Eastern R. R. will erect a station and office building on Fourth St., at a cost of $1,500,000.

Bakersfield, Calif.—A new post-office will be erected in this city at a cost of $135,000.

Longbeach, Calif.—Scott W. Alexander is contemplating erecting a seven-story hotel at First and Locust Sts.

Austin & Lockridge, 15 Locust Ave., have prepared plans for the erection of a five-story brick and steel apartment building at the corner of Pacific Ave. and Third St., for H. S. Callahan. It will be 75x90 ft., pressed brick facing, marble entrance, elevator, steam heat, wall beds, and vacuum cleaner. The cost will be $50,000.

✚A. L. DUTRO, 617 Orange Ave., Long Beach, has been awarded the contract for the erection of a four-story reinforced concrete storage warehouse at the foot of Third St., West Longbeach, for the City Transfer, Van & Storage Co. It will be 50x125 ft. George W. Harding, structural engineer, Citizens National Bank Bldg., prepared the plans.

Los Angeles, Calif.—Louis C. Lohman, 105 E. Second St., will erect a five-story and basement apartment house on Hill St., near Pico. Dennis & Farwell, 618 Pay Bldg., are the Archs.

The Independent Order of Odd Fellows will erect a store and lodge building on 12th and Flower Sts. Fred E. Peterson, 332 South Broaway, is Chn. of the Bld. Com. Morgan, Walls & Morgan, Story Bldg., are preparing plans. The building will be three stories and basement, 100x150 ft. The construction will be of reinforced concrete.

The Richards-Neustadt Construction Co., Wright & Callender Bldg., is preparing plans and will erect a three-story and basement brick rooming house building on East Fifth St., for W. S. Hook, Jr. It will have concrete foundation and basement, 50x145 ft., steel beams, plate glass, pressed brick facing artificial stone trim.

W. S. Garrett, Currier Bldg., is preparing plans for a four-story and basement brick hotel building to be erected at Dudley Ave. and Ocean Front, Ocean Park, for Edward and John Newell. It will be 47x114 ft., and have concrete foundation, pressed brick facing.

C. C. Rittenhouse, Wilcox Bldg., is preparing working drawings for the four-story and basement brick apartment house, to be erected on St. Paul Ave., for M. E. Blaisier. The building will have concrete foundation and basement, 55x171 ft., pressed brick facing, with artificial stone trim.

N. W. Stowell, 681 I. W. Hellman Bldg., is contemplating erecting a 10-story steel frame hotel building on Spring St., near Fourth St.

Bids will be received about Mar. 1 for the erection of the Arcade Station for the Southern Pacific Ry. It will cost about $750,000, with track accessories. Parkinson & Bergstrom, Security Bldg., Los Angeles, are the Archs.

The MacGibbon-Frary Co., Los Angeles Investment Bldg., is completing plans for a 14-story hotel to be erected on Broadway between Ninth and Tenth Sts., for Frank L. Forrester, Los Angeles Investment Bldg. It will be 50x95 ft., steel frame, brick filler walls, pressed brick and terra cotta facing.

The Richards-Newstadt Construction Co., Wright & Callender Bldg., is preparing plans for an eight-story and basement store and loft building to be erected on the west side of Broadway between Seventh and Eighth Sts., for the Isaacs Bros. Co., 725 South Broadway. The building will have reinforced concrete frame, and enclosing walls and floors.

W. J. Saunders, International Bank Bldg., is preparing plans for a reinforced concrete loft building to be erected on Broadway between Eighth and Ninth Sts., for F. W. Braun. The building will be a ten-story structure. It will have concrete foundation and basement, 50x153 ft., reinforced concrete frame.

Scott Quintin, Douglass Bldg., is preparing plans for a four-story brick store and apartment building to be erected at the southeast corner of Temple St. and Bunker Hill Ave. for the Los Angeles Securities Co., 637 South Hill St. Dimensions, 72x130 feet; concrete foundation, steel beams and columns, ruffed brick facing, artificial stone trim.

CONTRACT PRICE

★**Valves, Etc.**—New York, N. Y.—Bids for Contract 146, furnishing and delivering valves, hydraulic cylinders, piping and appurtenances for the city tunnel of the Catskill Aqueduct, in the City of New York, were received, Feb. 11, as follows: (A) Coldwell-Wilcox Co., Newburg, N. Y.; (B) Coffin Valve Co., Boston, Mass.; Bethlehem Steel Co., South Bethlehem, Penn.; (D) Paul S. Reeves & Co., 1415 Catherine St., Philadelphia, Penn.; (E) Exeter Machine Works, Pittston, Penn.; (F) Average bid.

J. P. Peterson, Wright & Callender Bldg., J. Bloom and C. L. Robinson have secured a lease on the property at Vignes and Banning Sts. and will erect two three-story brick buildings. The lease provides that construction work be started by 90 days from Feb. 8. The property is 150x138 ft., and two buildings each 75x138 ft. will be erected. They will have pressed brick facing, galvanized-iron cornice, composition roof.

Supervisor of Construction Daum of the Board of Education, Security Bldg., has been instructed to proceed with the preparation of working plans for a five-story and basement warehouse for the Board of Education, to be erected at 1345 South San Pedro St. It will be of reinforced concrete construction throughout, with metal frames and sash, elevator, plumbing, wiring.

✚THE C. J. KUBACH CO., Pacific Electric Bldg., has been awarded the contract for the construction of the building to be erected for the Southwest Museum in the Arroyo Seco Valley. Plans call for a group of buildings to include a science hall, library and halls of archaeology and art to be of reinforced concrete construction, tile roof. Hunt & Burns, Laughlin Bldg., are Archs. Noted Jan. 9.

Dr. G. W. Caldwell, 2143 Harrison Blvd. has been granted a permit for the erection of a three-story apartment house on 22d St., to cost $60,000.

Oakland, Calif.—Cinnolaculo Bros. will erect a seven-story store and hotel building at 16th and Jefferson Sts.

William C. Hayes, Foxcroft Bldg., San Francisco, is completing working drawings for the construction of a two-story brick and steel addition to the Y. M. C. A. at 21st and Telegraph Ave. The work has been estimated to cost about $45,000. Construction will include a steel frame with the exterior of the building faced with pressed brick.

Pasadena, Calif.—Elmer Grey, Wright & Callender Bldg. has been commissioned by the board of trustees of Throop Polytechnic Institute to prepare plans for two new buildings to be erected for the Institute. One will be a music hall and art museum to be located at Wilson Ave and California St., and the other a library and science building to be erected at Wilson and San Pasqual Aves. The library and science building will be two stories. The construction will be reinforced concrete and tile, similar to the present administration building.

San Diego, Calif.—Walter S. Keller is drawing plans for a six-story reinforced-concrete store and hotel building, to be erected at First and D Sts., for M. Barnett. It will be 42x120 ft. Estimated cost, $100,000.

San Francisco, Calif.—Tirey L. Ford and associates will build a six- or nine-story apartment house, to cost about $250,000 or $300,000, at California and Jones Sts.

Thomas Q. Swortfiguer will erect a four-story brick building, to cost $50,000, on Sacramento St., between Pierce and Scott Sts.

C. W. Dickey, Oakland Bank of Savings Bldg., Oakland, Calif., has been commissioned to prepare plans for the Hawaiian Building of the Panama-Pacific Exposition in 1915.

Frederic H. Meyer, Bankers' Investment Bldg., has prepared plans for the erection of a six-story apartment house costing in the neighborhood of $110,000. The building will have brick exterior walls, faced with pressed brick. It is to be erected on Sutter street, for M. E. Perkins.

Cuningham & Politeo, First National Bank Bldg., are preparing plans for a large reinforced concrete warehouse to be erected on King St., between Second and Third Sts. for the Warehouse & Investment Co. The building will be 120x130 ft. Construction will be fireproof throughout. An automatic sprinkler system, fireproof doors, metal window sash and frames and both freight and passenger elevators are included in the building. The exterior will be faced with concrete.

G. A. Applegarth, Call Bldg., is completing plans for a 14-story steel-frame hotel which is to be erected by the Clift Estate at Geary and Taylor Sts. at a cost of $550,000. The exterior will be faced with artificial stone. Bids will be asked on the steel work within a few days, and contracts for the balance of the work will be let as rapidly as plans can be completed.

O'Brien Bros., Clunie Bldg., have completed the plans for a store and loft building to be erected for the Union Pacific Salt Co. on Sacramento St. near Drumm. The new building will be three stories high 25x87½ ft. Construction will be of brick and steel. The exterior of the building will be faced with pressed brick.

Nathaniel Blaisdell, 225 California St., has been selected to prepare plans for the new Engineers' Building which will be erected at Mission and First Sts. by the C. C. Moore Engineering Co. The building will have a frontage of 129 ft. on Mission St. and 113 ft. on First. It will be a three-story structure of brick and steel. The exterior will be faced with pressed brick and terra cotta.

VALVES, CYLINDERS AND PIPING, CATSKILL AQUEDUCT, CONTRACT 146, NEW YORK, N. Y.

	A	B	C	D	E	F
2 [illegible]	$2,520 00	$2,400 00	$3,148 80	$3,150 00	$2,920 80	$2,814 50
2 [illegible]	13,500 00	13,060 00	13,581 00	8,748 00	9,047 80	14,592 25
2 [illegible]	3,400 00	2,506 00	993 00	3,397 00	1,676 16	3,073 75
[illegible]	39 00	39 00	43 00	54 50	40 67	43 875
2 [illegible]	710 00	511 00	530 00	675 00	394 33	704 00
4 [illegible]	400 00	200 00	258 30	158 00	271 78	301 00
2 [illegible]	600 00	572 00	458 00	861 00	124 97	699 75
2 [illegible]	47 00	51 00	51 00	157 00	148 20	78 25
1 [illegible]	554 00	440 00	448 00	549 00	468 84	477 50
1 [illegible]	10	1075	969	1125	0045	088
24 [illegible]	33	37	439	175	298	356
30 [illegible]	21 60	26 14	21 20	22	21 68	24 875
2 [illegible]	97 00	96 00	98 00	41 00	20 63	98 80
12 [illegible]	12 00	09 16	39 00	50 00	32 50	31 325
02 [illegible]	12 00	12 00	46 00	62 00	11 11	55 80
2 [illegible]	33	19	385	51	324	452
36 [illegible]	26	32	313	285	1 275	302
16 [illegible]	35	50	44	10	37	122
2000 [illegible]	08	12	105	25	1 0075	139
2000 [illegible]	04	03	32	06	1 0035	112
Totals	$139,642 20	$141,906 80	$145,530 20	$184,158 20	$ 94,710 20	

* Below all bid
† Informal bid not included
‡ Received by letter after bids were opened and are given only for their incidental value

Engineering News

VOLUME 69 MARCH 6, 1913 NUMBER 10

The Fifth Street Viaduct, Fitchburg, Mass.

There has recently been completed in Fitchburg, Mass., a reinforced-concrete viaduct on the line of Fifth St. across the valley which contains the Nashua River and the seven-track lines of the Boston & Maine, and the New York, New Haven & Hartford Railroads. The viaduct is remarkable in a number of respects, but mainly in that the reinforcement for the arch ribs proper was made of structural steel which was placed in its arch form between the piers and used to support the forms into which the concrete of the arch was poured. By this means no centering was required under any of the four small arches and only the lightest sort of strutting required under the large arch. In designing the structure the rises of the arches and depths of the arch rings were the requirements of clearance at the railway crossings were such that a deck arch could not be used, which fact, together with the requirements of design noted above, led to the adoption of the through arch shown on the drawings. It will be noted that the arches are of very low rise and are on high piers. Such a structure would not be stable under the unbalanced dead load of the arches on one side of the pier, but the construction was so carried out that each pier had a balanced load upon it at all times, and when the viaduct was completed its static condition is somewhat similar to a single arch. That is, the thrust is carried through from one abutment to the other through the various arches and their piers.



FIG. 1. THE FIFTH ST. VIADUCT, FITCHBURG, MASS.

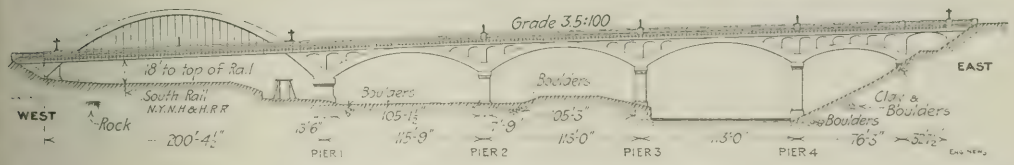


FIG. 2. OUTLINE ELEVATION OF THE VIADUCT

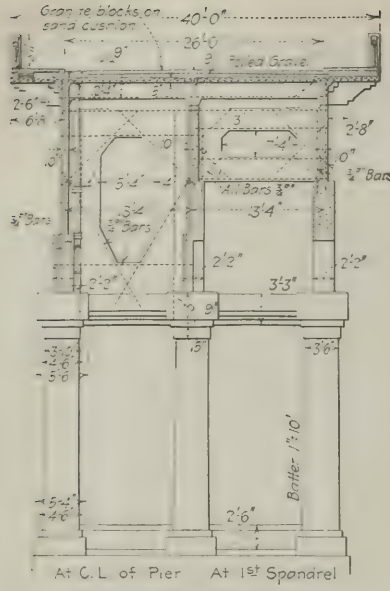
ABUTMENTS AND PIERS

The piers and abutments are all founded on rock or so proportioned as to make the steel needed for reinforcement for moving loads just about sufficient to carry the construction loads during erection.

The views above give an outline elevation of the structure. It will be noted that one side of the valley is considerably higher than the other, so that a grade of 3½% was required on the roadway. The bridge starting from the higher side of the valley comprises a small 32-ft. arch over a private road, a 76-ft. arch, three 113-ft. arches, and one 200-ft. arch across the railway tracks. All of these arch dimensions are from center to center of piers. The bridge is 40 ft. wide with a 26-ft. roadway, and two 7-ft. sidewalks, and is designed at present to carry only highway traffic, although interurban-car loadings are provided for.

All five of the smaller arches are deck structures, but heavy boulders, the rock rising nearer the surface at the west abutment, so that that abutment is founded on solid rock, whereas the east abutment is founded on a compact deposit of sandy clay. With the exception of the west abutment, all the piers and the east abutment are in quite shallow excavation, as the proper foundation was practically at the surface.

ABUTMENTS—The west abutment (Fig. 4) comprises two masses of concrete against which the two ribs of the large arch abut, together with two showing wing-walls, and a cross-wall to retain the earth fill. The abutment is of mass concrete with no reinforcement. The east abutment is in effect the pier between the 76-ft arch and the 32-ft. arch. This is similar in design to the west abutment, except that it has three masses of concrete to take the thrust from the three arch ribs which are used



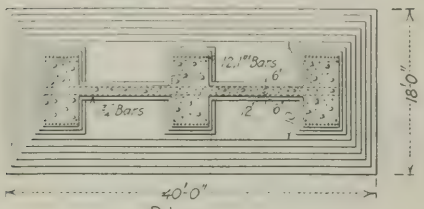


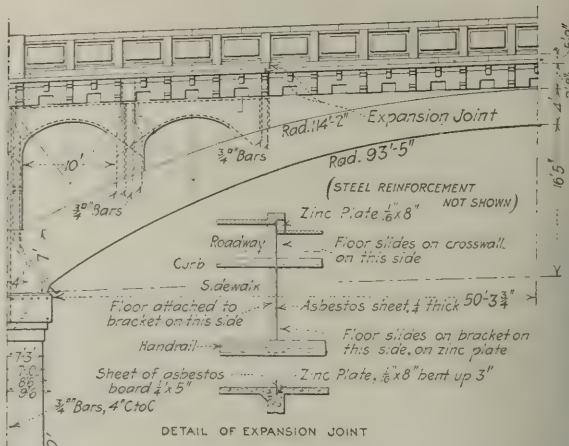
FIG. 3. TYPICAL PIER BETWEEN SMALL ARCHES AND DETAIL OF 113-FT. ARCH
(Rib reinforcement of 113-ft. arch not shown)

in the smaller arch mass. The true east abutment takes merely the thrust of the small 30-ft. arch and is provided with the customary wing-walls. These two eastern abutments are reinforced slightly.

PIERS.—A typical pier design is shown in the design of pier No. 2 in Fig. 3. This pier consists of a base solid in plan and rising therefrom three columns under the respective arch ribs, joined together with a transverse wall 12 in. thick. These columns rise to the elevation of the bottom of the arch ribs, which come together over each column. It will be noted that the thrust from these opposing arches continues from one arch through into the opposite arch, and that if one arch were removed the thrust would fall far outside the section of the pier. These piers are slightly reinforced as shown.

ARCH RIBS

SMALL ARCHES.—One of the 113-ft. arches is also shown on Fig. 3. It consists of three arch ribs placed 13 ft. 4 in. c. to c. and each 26 in. wide, 4 ft. deep at the crown, and about 7 ft. deep at the springing line. The chords of the arches are on the 3½% grade which the whole bridge has. These ribs carry the roadway on span-



drel columns and arches, which are braced transversely by open walls, the upper portions of which form the floor-beams upon which the reinforced-concrete floor-slab rests. Each rib is reinforced with a steel frame similar to that shown in Fig. 5. This frame consists of a double girder made up of an upper and lower flange, each made up of angles with a center plate, joined together with vertical and slanting web angles. These ribs were fabricated in four sections and with splices at crown and haunches. In erection they were field-spliced together as a single arch, as described below. Each rib frames at the

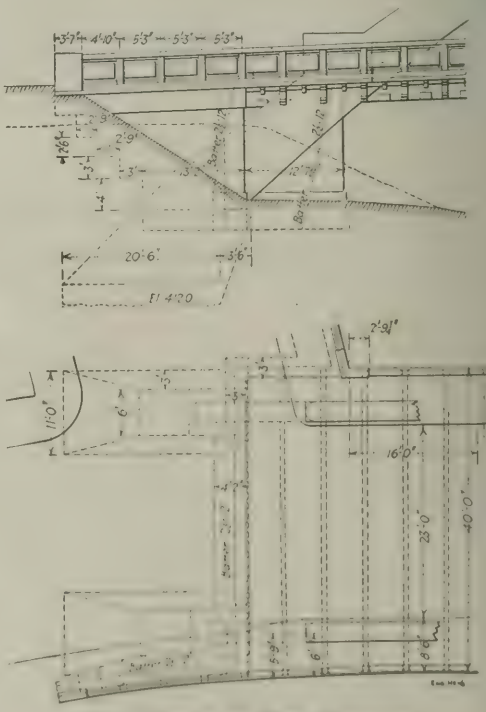


FIG. 4. DETAIL OF WEST ABUTMENT

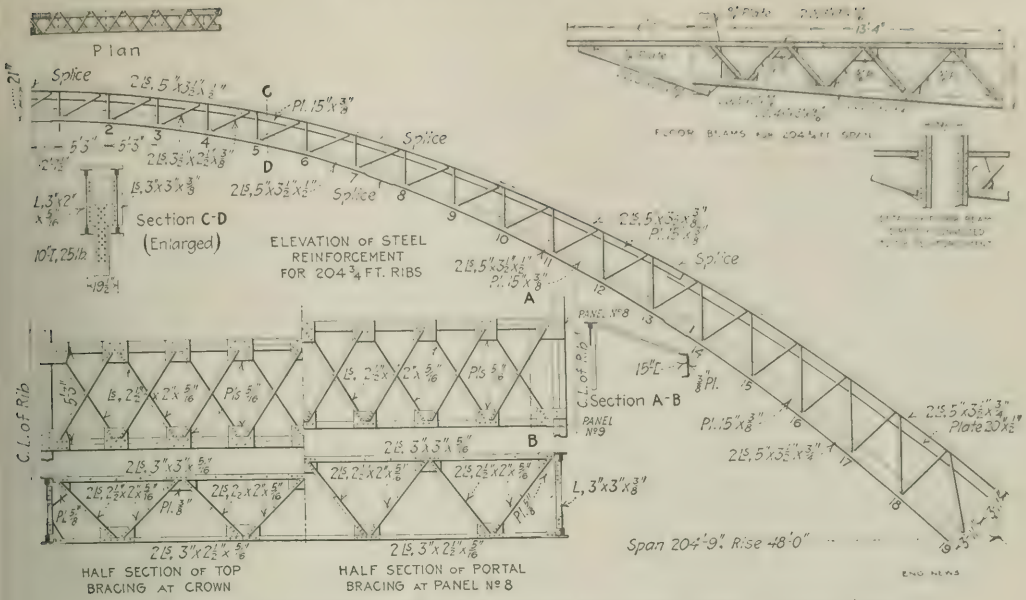


FIG. 5. DETAIL OF REINFORCEMENT FOR ARCH RIBS AND FLOOR BEAMS. (204-FT. ARCH.)

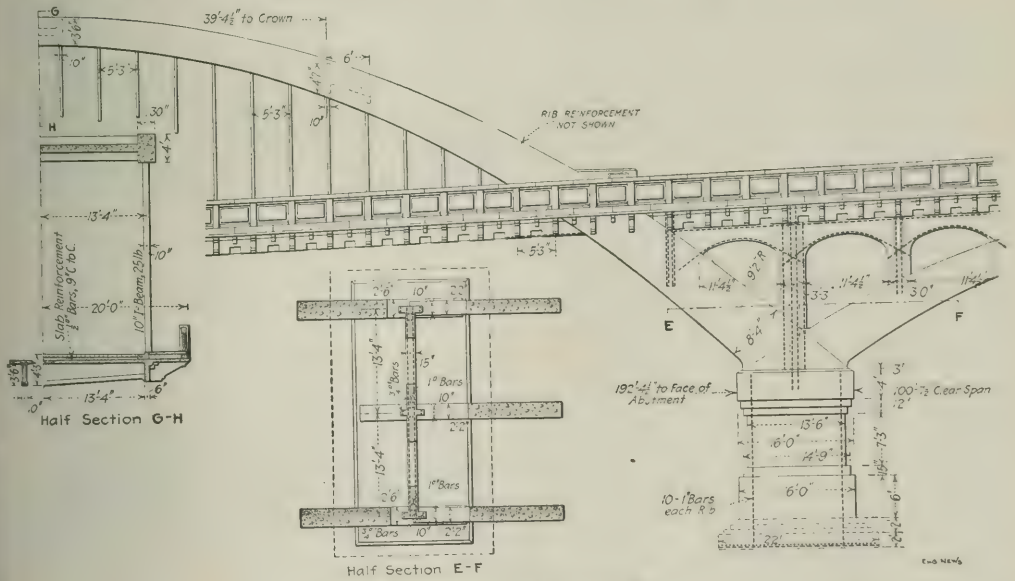


FIG. 6. DETAIL OF MAIN-ARCH SPAN

pier into a structural-steel pedestal, set on anchor bolts sunk into the pier. The detail of the pedestal between the smaller arches is shown in Fig. 7.

The spandrel columns, which rise out of the smaller arches, are of concrete reinforced with straight rods, which rods intrude into the concrete of the arch rib a short distance, forming the only connection between the spandrel columns and the ribs.

LARGE ARCH—Details of the large arch are shown in Fig. 6. The main carrying portion of this arch consists of two arch ribs 193 ft. 3 in. in the clear, with a rise of 48 ft. to the reinforcement arch, which has a center to center span of 204 ft. 9 in. Each rib is 4 ft. deep at the crown, 8 ft. 4 in. deep at the springing line, and 30 in. wide throughout. These ribs are practically on center with the two outside ribs of the adjacent small

arch (Fig. 6). The rib reinforcement is of structural steel framework, shown in Fig. 5, which was fabricated in six pieces. The two ribs are braced together at the crown and haunches by cross-framing of structural steel incased in concrete. That portion of the roadway immediately over the pier is carried by spandrel arches as in the

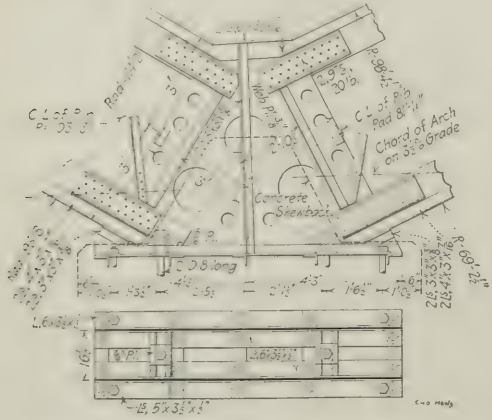


FIG. 7. STEEL PEDESTAL REINFORCEMENT ON PIER BETWEEN SMALL ARCHES

smaller span, but the main portion of the roadway is carried as a through structure from I-beam hangers framed between the two webs of the main reinforcement and carrying at their lower end the floor-beams, which are also of structural-steel framework incased in concrete.

FLOOR, RAILINGS AND EXPANSION JOINTS

That portion of the floor over the smaller arches is made up of a 5-in. reinforced-concrete slab paved with wood blocks, the whole resting on the concrete floor-beams noted above. In the hanging-floor structure under the large arch the floor-beams are reinforced with structural framework (Fig. 5), but carry the same type of floor as in the remainder of the structure. Expansion joints are provided at the haunches of each arch and above each pier. A highly ornamental railing cast in place is provided across the entire structure.

CONSTRUCTION

Work on the bridge started in October, 1911. The piers on either side of the bridge were started simultaneously with a concrete plant on each side. On the east side the plant was at the top of a hill and concrete was deposited in the piers through a gravity chute. On the west side derricks were required for the deposition of the concrete. Work on the piers was continued through out the winter, the usual precautions being taken to guard against freezing. In the pier construction these consisted mainly in covering over the forms with tarpaulins and placing salamanders inside. By the Spring of 1912 the piers were completed and a cableway was erected slightly off center of the bridge so that the concrete could be deposited in the center arch rib without interference. By April, 1912, steel erection was started.

STEEL ERECTION.—The steel erection commenced by placing on the top of each pier the steel-frame skewback for the arch rib. When these were all in place, erection of the smaller arch ribs was started. These ribs were framed on the ground into two halves and lifted into place by two derricks, one on either side as shown in Fig. 8. They were then bolted to the skewbacks and together at the crown and afterward riveted. The thrust from the steel ribs was not sufficient to change the stability of the piers, so they were erected from end to end of the viaduct without regard for balance load.

The erection of the large ribs was the last undertaken (Fig. 9). Each of these ribs was placed on the ground in the six pieces noted above and then there were erected between the tracks of the railroad on which constant traffic was passing three timber bents placed respectively at the center and the quarter points of the span. Upon these bents were placed longitudinal I-beams, which were afterward removed and from the I-beams were hung in their proper places the structural-steel framework for the transverse floor-beams. The main arch ribs were then erected in their short pieces from the piers to a point above the quarter-point timber bent, and were supported there by the I-beam hangers acting as struts. These hangers were the same ones which were utilized in the final construction of the bridge. They were framed



FIG. 8. ERECTING RIB REINFORCEMENT OF ONE OF THE SMALL ARCHES



FIG. 9. ERECTING THE 204-FT. ARCH

at their top permanently to the arch rib, and at their bottom permanently to the floor-beams, which in their turn were hanging from the temporary I-beam stringers. The framing of the ribs was then carried across from arch to crown in this same manner, utilizing the hanger I-beams as struts. When the crown of the arch was reached it was bolted together and the arch allowed to take its set. The timber bents were then removed and the I-beams assumed their proper function as hangers,

supporting the steel frames of the floor-beams. The arch was thus erected with only the three timber bents as centers.

Concreting

The small arch ribs in triplicate were not braced together in the plane of the rib in the final structure, but during construction they were interbraced by means of timber planking attached to temporary gussets bolted into the steel ribs. They were removed as soon as the concreting was completed. In the main arch the steel cross-bracing was placed previous to concreting (Fig. 10).

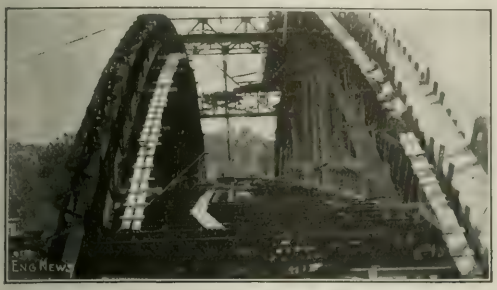


Fig. 10. 204-ft. Arch under Construction

The concrete of the arch ribs was deposited in forms which hung from the steel reinforcing. The sketch in Fig. 11 shows the general detail of this method of forming. Holes were punched in the lower flanges of the reinforcing girders and through these holes were hung bolts which carried cross-timbers of 4x4-in. material. On these timbers longitudinal lagging was placed and separated from the bottom flange of the reinforcement by previously-cast concrete blocks of the proper depth, so that the lagging could be screwed up tight against the concrete blocks to provide the proper thickness of concrete protection of the lower flange. The side forms were made of vertical 4x4-in. studs with 1⅛-in. horizontal lagging, tightened by transverse bolts and separated at the top by struts. These side forms were allowed to overlap the bottom lagging so that they did not have to be cut to the intrados of the arch. Top boards had to be laid up to within a few feet of the crown to give the proper curve to the extrados.

After all these forms were in place across the bridge concreting was started for all of the smaller arches simultaneously. A hopper was erected at the crown of each arch with chutes leading to any place on any of the three arch ribs. One arch rib was then concreted from end to end of the bridge, the two outer ones first and the center one last. Concrete was mixed at the end of the bridge, carried by cableway to the hopper where it was dumped and thence shot through the chutes to its proper location. The construction of each rib was started at the pier and continued up daily simultaneously on either side of each pier, so that at any one time each pier was carrying a balanced load on either side. The thrust from the small arches on Pier 1 was not dangerous to that pier, so the concreting of the large arch was put off until all the smaller arches were completed. It was then carried out from each side to the crown as a single operation.

The further construction was a simple matter, as the arch ribs were quite capable of carrying the load of all the superstructure concrete. Ordinary forms were used on all of the work except for the floor-beams of the large arch where the forms were supported from the steel framework in somewhat the same manner as in the main arch for the arch ribs. The concreting was completed in December, 1912, and the bridge was opened Feb. 10, 1913.

Surface Finish.—A surface finish of the rubbed type was specified for the entire showing faces of the structure, but the contractor was allowed to modify this specification. The showing faces of the spandrel walls and arches were bush hammered and the remaining showing faces were washed with a 1:4 cement grout, thus making a pleasing contrast in the two sections.

Personnel

The bridge was designed by and built under the general supervision of James H. Fuertes, Consulting Engineer, New York, and was under the immediate direction of, first, Timothy Sheehan, and then F. C. Davis, successive City Engineers of Fitchburg, Mass. The contractor was the McHarg-Barton Co., New York City, and R. C. Dewar was superintendent for them on the work. The contractor was responsible for the method of erection and construction of the bridge, acting under the general supervision and approval of the consulting engineer.

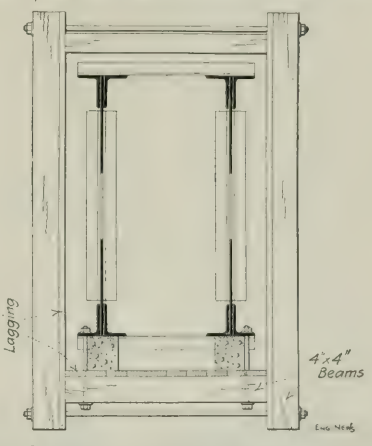


Fig. 11. Method of Hanging Forms to Rib Reinforcement, Fifth St. Viaduct

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Only Standard Weights of Steel Pipe are to be made hereafter by a number of prominent manufacturers in this country, which means that no more of the so called merchant grades are to be made by them. There have been some uses for pipe of lighter weight than that generally found advisable for most service, and, to cheapen construction where such pipe was permissible, the so called "merchant weights" were produced. The objection has been made, of course, that the "merchant weights" were substituted where full standard weights would have been better, and that this has been done without the knowledge and consent of the ultimate purchaser. It is obvious that full weight pipe is suitable for all purposes where merchant pipe has been used, though the opposite is not true. It is considered that the general advantages due to preventing substitution of light-weight stock outweigh any increase in the cost of work where a legitimate installation of merchant weights could have been made.

A Railway Grade Crossing with Steel Foundation

The maintenance of track in good alignment and surface at grade crossings is a difficult matter in most cases, owing to the tendency of the traffic to shift the crossings out of position as well as to crush the ballast which supports it. A solid concrete base has been tried and found [illegible], and although a concrete base covered with ballast has been proposed,* this design has never been carried into execution. An interesting development in this direction is the use of steel longitudinals to carry the rails at the crossing, these being connected to form a unit structure, so that the rails are maintained permanently in proper position. This system, which is described below, has been applied to a grade crossing on Ohio Ave. at Muncie, Ind., where the single-track electric line of the Indiana Union Traction Co. (on a curve of 117.07 ft. radius) crosses the two parallel main tracks of the Cleveland, Cincinnati, Chicago & St. Louis Ry. L. H. Mitchell, Superintendent of Roadway of the electric line, informs us that the daily traffic averages 64 electric cars and 18 steam trains, together with a small amount of switching.

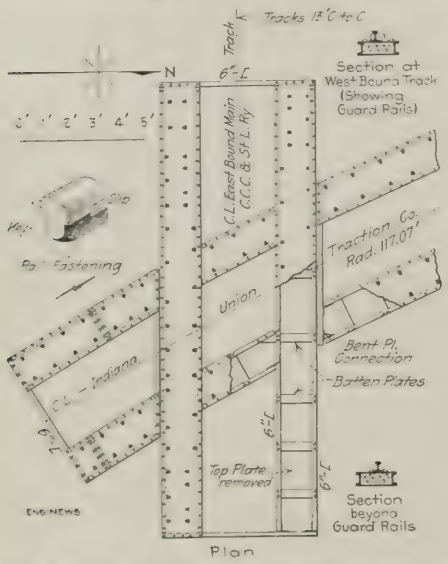


Fig. 1. Part Plan of Steel Substructure for the Grade Crossing of the Illinois Traction Co. and the C., C., C. & St. L. Ry., at Muncie, Ind.

(International Steel Tie Co., Cleveland, Ohio, Builders)

The design of this crossing support is a development of the steel-tie construction described in our issue of Mar. 30, 1911, in which each tie consists of two transverse channels or I-beams placed back to back, about 3 ft. apart, and connected by batten plates. This construction is said to be now in use on 22 railways, both steam and electric. For the crossing, each rail is carried on a longitudinal composed of two 6-in. channels 16 in. apart (with flanges outward), connected at the top by a continuous plate $20 \times \frac{5}{16}$ in., and at the bottom by straps or batten plates $4 \times \frac{5}{16}$ in., 2 ft. apart. The crossing was shipped in five pieces; one for each steam track (with cross-pieces for the electric track) and the others for the electric track between and outside of the former. Both ends of each piece were closed by a 6-in. transverse channel, riveted to the longitudinal channels by short angles or bent plates, thus forming a complete box. About three weeks before this substructure was assembled and installed, each longitudinal was filled with concrete, in which light reinforcing rods were embedded. The crossing was placed on a bed of clean stone ballast, which was well tamped under each longitudinal, the tamping being done from both sides. Ballast was afterward filled in to the level of the tops of the channels. Fig. 1 shows the construc-

*Engineering News, Apr. 29, 1909.

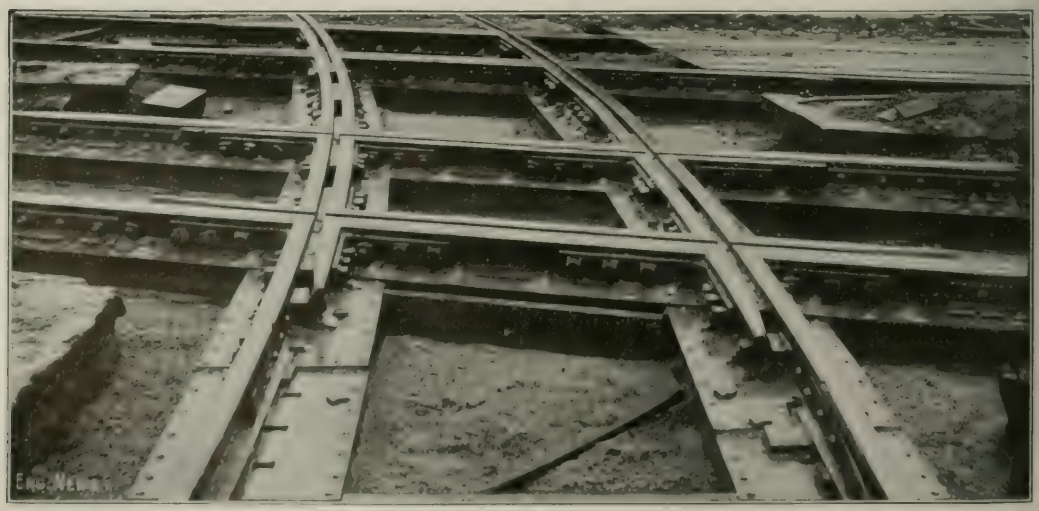


Fig. 2. Grade Crossing with Steel Substructure: Muncie, Ind.

tion of the crossing, and Fig. 2 is a view looking along the electric line.

The entire crossing is laid with 90-lb. rails of the Am. Soc. C. E. section, as used on the main tracks of the C., C., C. & St. L. Ry. The electric line has 80-lb. rails of the same type south of the crossing, while at the north end it has 6-in. 72-lb. rails. The compromise joints at these connections are carried on the crossing substructure and the approaches are laid with steel ties of the type above mentioned. Both the steam and electric lines have inside guard rails extending through the crossing. The steam line has also a relieving rail outside of each track rail to carry the false flanges of worn wheels, the ends of the relieving rails being bevelled vertically so that the wheels will engage them without shock. The rail fastenings consist of grooved clips fitted to holes in the cover plates of the longitudinals, the groove embracing the top of the rail flange and the bottom of the cover plate. When the clip is driven into position a steel key is fitted behind it, filling the hole and preventing the clip from working loose. It is stated that the crossing is in good condition and that cars ride over it smoothly and without shock.

This substructure is the invention of Wm. P. Day (inventor of the steel ties already mentioned), Vice-President and General Manager of the International Steel Tie Co., Hippodrome Bldg., Cleveland, Ohio. He informs us that it is being installed also at four crossings at Lorain, Ohio., where the Cleveland, Southwestern & Columbus Ry. crosses the New York, Chicago & St. Louis R.R.

Foreign Associations of Consulting Engineers

In the last decade there has been a general movement among consulting engineers to form professional protective associations, with the object of maintaining high professional standards. The formation of the Association of Consulting Engineers in London last year directed attention to this movement most prominently, on account of the difficulties met in organizing that body. The American Institute of Consulting Engineers, with its headquarters in New York City, had been formed a few years previously as an active body, though the organization existed in rudimentary form as early as 1905. In 1911 consulting engineers on the Pacific Coast formed the Pacific Association of Consulting Engineers.

How general is the movement for professional union among consulting engineers can be gathered from a review of the subject published by K. Perlewitz, of Berlin, Germany, in a recent issue of "Technik und Wirtschaft" under the title "Die Beratenden Ingenieure im Auslande, ihre Organisationen und ihre Gebührensätze." According to this article, there are such professional associations in Germany, Austria, Holland, Sweden, Norway, Denmark and Belgium, besides the English and the two American societies already mentioned. But of all these only four, the German, Swedish, English and American societies, have more than a very small membership (the four range from 30 members to 80 members).

The nature and functions of the consulting engineers' societies differ appreciably. Some societies limit their membership strictly to independent consulting engineers, i.e., those who do nothing but consulting work (including in this term designing and supervisory engineering); the English and American societies are especially strict in this regard. On the other hand, several societies admit engineers in the employ of corporations. These latter societies, of course, should not be included in a list of consulting engineering bodies, but must be classed with the ordinary engineering societies in which both engineers in independent practice and engineers on a salary, as well as municipal engineers and the like, may take membership. As to functions, it is noted that several of these societies have established codes of fees. Two or three have formulated codes of ethics.

None of the existing societies is more than three years old. However, electrical consulting engineers formed organizations in Germany and in Austria as early as 1903 and 1905, but these bodies could not gather strength and vitality enough to survive.

A notable condition exists in Austria at the present time, as the result of recent legislation which requires consulting engineers to form professional organizations by districts, and requires every consulting engineer to belong to the professional organization of his district. This is in part the outcome of a practice which grew up without governmental action. For the last half century, Austria has had what was known as certified engineers, "behördlich autorisierte Ingenieure." This title, granted upon passing a difficult examination, gave the right to engage in consulting service to private or public parties. The certified engineers in different parts of the empire formed local associations for promoting their professional interests. The recently enacted law practically adopts the association idea and makes it a necessary qualification for the practice of engineering.

The Boston & Eastern Electric R.R. whose attempts to secure rights to build a high-speed electric railroad from Beverly and Danvers, Mass., to Post Office Square, in Boston, have been noted in "Engineering News," Aug. 20 (p. 196), Nov. 5 (p. 504), Dec. 10 (p. 644), 1908, and June 9, 1910, p. 686, has finally secured a charter from the Massachusetts Secretary of State, following advices from the Railroad Commission. The final location provides for stations in Beverly, Salem, Lynn, Boston, Chelsea, Danvers, Peabody, Saugus, and Revere. The line will be double-track, standard-gage, 13 miles long, with a 3½-mile branch from Salem to Danvers. The final estimate of cost of construction as filed shows a total figure of $12,975,000, compared with $10,973,000 in the 1908 estimates. The latter also included a signal system ($100,000), power stations ($800,000), distribution system ($340,000), shops, etc., ($120,000), and 50 cars ($843,000), all of which items, being viewed as equipment, are not included in the above final construction cost.

The Longest Single-leaf Bascule Bridge ever built is the 235-ft. bridge carrying the Baltimore & Ohio R.R. over the Calumet River at South Chicago, Ill. This bridge has just been completed and was given its official inspection and trial on Feb. 10. The bridge has a span of 235 ft., and the clear width of channel opening is 140 ft. on the square, the center lines of the bridge and channel having a skew crossing of 50°. It is a double-track structure, with through trusses spaced 31 ft. 3 in. apart c. to c. Adjacent to the bascule span are a tower span of 50 ft. and an approach plate-girder span of 65 ft. The total weight of structural steel is about 1300 tons, and that of the machinery is 125 tons, while the total weight of steel in the main or bascule span is 510 tons. The counterweight is of concrete, reinforced with steel rods, and has a volume of 1000 cu.yd., weighing 4000 lb. per cu.yd. or about 2000 tons in all. The machinery is operated by two electric motors of 100 hp. each (both working together); two 5-hp. motors operate the rail locks at each end of the bridge, and a third 5-hp. motor operates the bridge lock at the far end of the span. The bridge was designed by the Strauss Bascule Bridge Co., of Chicago, and is of the "heel-trunnion" type described in our issue of May 2, 1912.

Interference between Oil and Gas Wells and Coal Mines

On Feb. 7 and 8, a conference of coal operators, engineers, oil and gas men, geologists and inspectors was held at Pittsburgh under the auspices of the U. S. Bureau of Mines, to discuss the difficulties encountered where oil and gas wells penetrated coal fields, and remedies available. From the papers and discussions there presented the following extracts have been taken:

Troubles Resulting from Proximity to Gas and Oil Wells

By L. M. Jones*

The relation of gas and oil wells to coal mines has been investigated by inquiring into the past and present operating practice of each and noting wherein accidents and troubles have resulted or are likely to result.

ABANDONED WELLS—Until very recently, there had been no legislation in any of the states requiring the filing of an exact location of a drill hole, and the legislation covering plugging has for the most part not covered the case thoroughly, and has been difficult to enforce.

On this account in some of the old oil and gas fields large numbers of wells have been drilled and for one reason or another have been abandoned, not plugged at all or inefficiently. Where these wells have passed through coal beds which at a later period have been opened, a number of accidents have been caused by the unexpected piercing of the wells and the resulting liberation of large volumes of natural gas.

SEEPING OF OIL—There has been a number of cases where oil has oozed through the coal from wells whose location was not accurately known, the surface indications having entirely disappeared. There have been other cases where oil has entered the mine through the coal from some neighboring well, in one case in sufficient quantity so that a pump was installed to care for it.

WELLS WITHOUT VENT—A second group of troubles was from wells which have been improperly or incompletely cased and sealed, or which have no vent to the surface for gas which has collected in the casings.

UNPROTECTED CASINGS—Greater precautions should be taken properly to seal all wells from the coal beds and to provide a vent to the surface for any gas that may collect in the casings.

There is always a possibility of danger from wells, the casings of which are unprotected from mechanical damage, passing through the workings of an operating mine. I have heard of no case where serious accident has resulted in the mines from such a condition but many such wells are a constant menace to the safety of the mine on account of the fact that the exposed condition of the casing renders them more likely to be injured than if they were inclosed by a protecting wall or pillar of some character.

BENDING OF CASING—In a mine in Western Pennsylvania a casing of an oil well passed through a working and when the room pillars were pulled, subsidence of the overlying rocks bent the casing to such a degree that it was no longer possible to operate the rods in the well. In case of this kind it would probably be impossible to plug the well effectively on abandonment and it would remain a menace both to present mining and to the possible future deep mining.

CASING BENT BY WRECKS—In another mine near Pittsburgh the casing of an abandoned well imperfectly plugged is between the haulage tracks on a parting, and wrecks of cars have bumped it to such an extent that the casing midway between bottom and roof is 7 in. out of line. The inside of this casing is plugged with concrete for 50 to 60 ft. below the mine floor but some gas and salt water comes up on the outside of the casing into the mine. The plugging of the well in this case is not satisfactory since although little or no gas rises through the casing to the surface, gas does come up outside the casing. The well should have been plugged below the casing and the casing sealed with cement.

PROTECTION OF EXPOSED CASINGS—Several methods of protection for casings exposed to mine workings are in use. One large company has adopted the plan of building a 13-in. wall of brick set in cement mortar around the well.

Concrete walls have frequently been built around wells to protect them from injury.

If pillars are to be withdrawn a pack wall may be built of slate around an interior filling of clay. This wall would partially support the roof and prevent sudden falls of great weight badly bending or rupturing the casing.

DANGER FROM DRILLING OPERATIONS—Another class of operations has sometimes been a source of annoyance and disagreement between the mining and well drilling companies This is the case in which wells have been drilled through operating mines in such a manner as to inconvenience the operation of the mining or even to endanger the safety of the miners and mules.

Probably the most aggravating of such cases had been where the well has been drilled irrespective of whether there were mine workings beneath or not. I have heard of no case where a human being has been injured in such cases but two cases have been mentioned where mules were killed.

One of these occurred in Illinois fifteen or twenty years ago when a string of tools broke into an underground stable and killed a mule. The other instance occurred more recently in Pennsylvania in which case the tools broke into an entry and killed a mule that happened to be passing that point.

LEAKAGE DURING DRILLING—A well was drilled through Rice mine near Bergholz, Ohio, some time ago which gave some trouble. The hole was drilled through a room and the casing was driven down 10 ft. below the coal. The hole was then drilled to a depth of 700 ft. to the Injun sand when oil and some gas were struck. The oil and gas came up outside the casing, and although a cement block had been built in the mine around the casing, entered the mine through crevices in the bottom.

The mining and driling operations were both suspended until changes could be made. A second string of casing was placed in the well with rubber packers above the oil-producing sand and 60 ft. below the mine floor. Liquid cement was run in between the original casing and the new one from the packer to the surface. No further leaks were found in the mine.

INFLOW OF SURFACE WATER—Another possible source of damage which may result to the mine from drilling operations through the mine workings is the inflow into the mine from the drill hole of large amounts of surface water. Such a case occurred in Ohio by a well passing through a Zerbe mine. The well was cased to a point below the coal and a concrete block had been built around the casing but the flow of water could not be stopped. The casing was pulled out and the hole filled to a point above the roof with cement. The casing was then lowered into the liquid cement and the cement allowed to set inside and outside the casing. Afterwards the hole was drilled through the cement inside the casing. This method stopped the inflow of surface water.

DESIRABILITY OF AGREEMENT—These instances show the desirability of an agreement between the well drilling company and mining company as to the location of wells through the mine workings and an agreed method by which such work shall be done so as to safeguard the mine from inflows of gas, oil or water and to safeguard the wells from damage due to mining operations.

In some fields the wells are very close together, 100 to 400 feet apart, and in such cases the mining development is a very difficult proposition.

A plan showing a projected mine development in West Virginia gives an illustration of the seriousness of the problem when coal pillars must be left to protect the wells. In this case the projected underground development work was staked out on the surface and the wells were located so that 100-ft. pillars surrounding them would not necessitate curving the entries.

In cases like this last the situation is aided somewhat by the willingness of the drilling companies to so locate their wells as to inconvenience the coal development work as little as possible. Most of the large coal and gas and oil companies in Pennsylvania and West Virginia have been willing to coöperate in this manner so that the development of either would inconvenience the other as little as possible.

When a gas or oil company desired to drill a well in a certain place they furnish the coal company with the location to determine whether there is any objection on the part of the mining company to it. Where wells would interfere with projected development work or would be difficult, changes in location are made to meet these objections.

*Assistant Mining Engineer, U. S. Bureau of Mines, Pittsburgh, Penn.

Gas and Oil Wells in Coal Fields

By George S. Rice*

The problem of gas or oil wells extending through or near coal mines, and through the future coal reserves, has gradually become more and more serious, not only on account of the danger to the miner, but also because there has been an increasing loss of coal left as pillars surrounding the wells. Fortunately so far there has not been a large loss of life in mines through explosions or fires caused by leakages of gas from wells, but there are a number of cases on record in which lives have been lost, and the possibility of occurrence of disasters has been present in a number of instances.

Wells are constantly being drilled in the coal fields of this country, and are very numerous in the coal basins of Pennsylvania, West Virginia, Ohio, Indiana, Illinois and Kansas. In Pennsylvania and West Virginia mines not infrequently strike abandoned, uncharted wells. In many cases these have been found filled with gas, and in some instances the gas has been lighted. Recently a serious fire was caused in a mine in the vicinity of Pittsburgh, through burning gas which had been ignited when an unknown well was struck in mining operations. Fortunately this was not attended by an explosion, but it led to the mine being shut down for a couple of weeks, and the bureau's engineers and rescue crew had to be called upon to investigate behind the fire stoppings. In a number of cases where wells have been encountered, there have been narrow escapes from explosions. It would therefore appear that the industry hitherto has been more lucky than far seeing, in not taking precautions in making secure and in recording the location of abandoned holes, which, while not giving gas in commercial quantities, make sufficient to be very serious in mining.

Hitherto the legislation on gas and oil wells in all the states except Ohio and Indiana, has dealt with the subject only from the standpoint of protecting the wells from one another. The Ohio laws, and to a lesser extent the Indiana laws, take some cognizance of the dangers to mining in the vicinity, but they are considered inadequate.

The problem of formulating laws is not one which alone concerns the coal operator and inspector, but it also concerns the gas- and oil-well operator. The latter must be given the opportunity to search for and obtain the gas and oil under their option or ownership. It is manifest that they wish to take reasonable precautions for safety, but do not wish to be put to unnecessary expense, or to be prevented from drilling wells in coal fields; therefore some means must be found by which the wells can be drilled through or in the vicinity of the coal mines without creating dangerous conditions. Three parties are therefore vitally concerned; the gas and oil well operator, the coal operator and the miner, whose safety is looked after by the State Mine Inspector. The State Geologists are interested from the standpoint of conserving oil and gas as well as coal. The United States Bureau of Mines is concerned both in the conservation of all mineral resources and in the safety of the miners; for which reasons it is desirable to have good as well as uniform rules and regulations throughout the country.

At preliminary meetings, the members of the Bureau of Mines staff prepared a tentative outline of rules and regulations which might serve as a basis for possible legislation on the subject of oil and gas wells through coal measures. The rules to be added to or modified in detail to suit the particular conditions which prevail in the respective state.

There are several features which have been discussed but which have not been incorporated in the rules and regulations, as it was felt that it was rather a matter of gradual development and, in certain cases, of private agreement between the parties at interest. These questions are as follows:

SIZE OF COAL PILLARS—It has been found that the pillars that have been left around gas wells in Pennsylvania and West Virginia vary from 40 ft. diameter or square, to 200 ft. diameter or square, the well being at the center. It was found that the various sizes merely represented opinions of the parties concerned, or compromises between interested parties. The courts, in rendering decisions, would appear to have determined arbitrarily the size of pillars that must be left in certain cases, presumably the size determined in each specific case representing the consensus of testimony that was presented.

It was conceded that pillars of coal of any reasonable size did not prevent leakage of gas into the mine when there were defects in the well casings, but that they served as supports to the overlying strata to prevent fracturing or breakage of the well casing anywhere from the coal seam upward to the surface.

Looking at it from this point of view, the question of size of pillar surrounding the well is a problem similar to that which has arisen as to the proper size of pillar to be left surrounding a mine shaft. Investigation by the bureau has not disclosed any uniform system of determining the size of a shaft pillar, but there have been a number of empirical formulas used by mining engineers in the various mining countries.

A formula used for barrier pillars in the anthracite district, by a number of prominent companies, and approved by one of the state mine inspectors is as follows: "The width of the barrier pillar is equal to the thickness of workings multiplied by 1% of the depth below natural drainage level, plus the thickness of the workings multiplied by five."

The necessity of protecting a shaft is doubtless greater than for a gas or oil well. It is the means of egress, and it is not simply the protection of the shaft itself that must be considered, but also the support of the surrounding buildings, including the engine and boiler plant; hence there is greater need in having large pillars surrounding shafts than around wells.

The Consolidation Coal company in the Fairmont district, is considering the necessity of leaving 200-ft. pillars surrounding the wells. A plan will be shown which indicated how serious this condition may be when the wells are close together, either from the standpoint of laying out the mine, or from the loss of coal in the pillars. This brings up the question whether or not it is necessary to retain the pillar permanently.

EXTRACTION OF COAL SURROUNDING WELL

It might be possible to dispense with a coal pillar around an oil or gas well provided an artificial pillar was substituted. This proposal is not quite so radical as it might seem at first. The coal surrounding shafts has been extracted in some of the longwall mines in Great Britain, and in one longwall mine in northern Illinois, without detriment. Where this plan has been employed, the section from which the coal has been excavated is carefully packed with broken rock and dirt, as is usually done in "longwall advancing" so that the movement downwa d is very gradual and even, the strata all the way to the surface subsiding evenly, and without damage to the surface buildings, provided the longwall face advances regularly. The final surface subsidence where the goave has been well packed with dry packing, is about 50% of the thickness of the excavation; that is, in a bed of coal 6 ft. thick the subsidence would be about 3 ft.

To suit the room and pillar conditions, the writer suggests the following plan: That a room be laid out so that the drill hole will be approximately in the center; in drilling the well, the hole to be made 2 or 3 in. larger in diameter than the outer casing which is to be inserted, so that there is a space of from 1 to 2 in. surrounding the casing. Let us suppose this outer casing is to go 30 ft. below the coal bed, then the larger size hole will be drilled an additional distance equal to the thickness of the seam, below where the shoe of the casing is to hang. The casing will then be lowered and hung from cross beam supports at the surface, the ends of which are to be placed on piers so as to make the supports permanent. These cross beams should be steel channels or girders, 8 or 10 ft. or more in length, and of sufficient strength to hold the weight of the casing. Before lowering the casing a gasket of rubber or canvas is to be fastened just above the shoe around the outside, so as to fit against the rock or shale when the casing has been lowered to place and hung from the beam supports; a grouting of clay will be run in between the casing and the sides of hole so as to completely fill the space from the gasket to the surface. This is to allow an opportunity for the casing to slide freely, either at the bottom or the top if the coal is excavated and the ground subsides. After the casing has been put in and grouted with clay, the drilling and putting down of the inner casing will proceed in the usual manner. When subsidence of the ground occurs the arrangements spoken of will be equivalent to an expansion joint in a steam line. The inner casings and the gas tube being rigid and fixed below, when the subsidence takes place will merely project that much further above the surface of the ground, and will not be effected by the subsidence.

It is, of course, assumed that a space will always be left open to the top between the outer casing and the next inner casing, so that if there are any gas leaks it will be vented to the surface, in accordance with the plan employed in recent wells where by agreement with the coal companies precautions have been taken.

LOWER COAL BEDS—If abandoned wells are properly

*Chief Mining Engineer, U. S. Bureau of Mines, Pittsburgh, Penn.

plugged from bottom to top, there would seem to be no need for other special precautions for deeper coal beds. It is manifest that in the great majority of cases these coal beds will not be worked for many years to come, perhaps 25 or 50, or as much as 100 years. It is also manifest that no casing would resist corrosion for such extended periods, therefore it is believed that the project of restoring the strata to practically the same strength and impermeability as originally found will be the best method. All the geologists in attendance at the recent meeting agreed that this was the best solution of this problem.

PLUGGING ABANDONED WELLS—It was further agreed to by the geologists that the simplest and safest way of handling abandoned wells through coal mines will be to plug them tightly all the way from the bottom to the surface. If holes are plugged so that there is no leakage of gas, there would seem to be no danger in laying out a mine, or in the working of same, without the necessity of paying attention to an abandoned hole, beyond approaching the hole carefully, and testing to see whether there is any sign of leakage of gas. This assumes that the plugging of abandoned wells in coal districts shall be done with an inspector present, preferably a gas- and oil-well inspector appointed by the state; and that a certificate showing that the plugging has been properly done, has been duly recorded.

MAPS OF PROJECTED WORKINGS—It is undoubtedly a most excellent plan for the gas and oil well operator, and the coal operator to come together and agree upon a suitable location for holes. To do this intelligently the coal operator should furnish the gas and oil operator a plan of his projected workings. It is assumed that the site of the proposed well shall be carefully surveyed to and located, and that the map of the location and at least the record of the casing as deep as 30 feet below the coal bed that is being worked, shall be matters of public record.

DRILLING THROUGH INACCESSIBLE MINE WORKINGS—The question has arisen in several cases as to the protection from leakage of a gas well drilled through an inaccessible mine opening or excavation, as for example where pillars have been pulled. In the case of leakage, there would be danger of the goave filling with gas which would escape into the active mine workings. As the courts have held that the parties possessing the gas ownership have the right to drill, it is necessary to consider how this can be done with a minimum amount of danger. All have conceded the necessity of having an outer protective casing open at the top to the atmosphere, but in the event that acid mine water may corrode it, additional protection is necessary. One plan is to make the hole large enough to insert an outer pipe opposite the coal bed and fill between it and the casing with cement. This plan seems to be an excellent one and worthy of trial. An alternative scheme might be used when the mine excavation is not too much filled with débris. When the drill has entered the excavated space and drilled through any loose rock to the bottom, fill the space with a concrete mixture of crushed rock or gravel, sand and cement, thoroughly mixed. This is to be put in rapidly, and will, if of proper consistency, form a conical heap with the apex at the top of the open space. A conical bit or tool fixed on the end of the string of tools will then be immediately lowered and used to spread out the top of the cone more concrete must then be put in and again spread out by the conical tool. The concrete should then be allowed to set, following which a hole will be drilled through it by the usual method. This hole may be a small one. Then liquid cement will be run in and forced under pressure to fill the interstices after this has set it is anticipated that there will be a strong concrete column through the mine excavation, which will be practically impervious to the mine water, and through which a hole of full size can be drilled as through a solid rock stratum, and the casings inserted in the usual manner.

Suggestions for Laws and Regulations

By O. P. Hood* and A. S. Hegeman*

The following suggestions are an attempt to harmonize as far as possible the information and advice which has so far been available to the Bureau. There has been no attempt to put these suggestions in proper legal phrase nor to make them entirely complete, but only to form a basis for discussion and further suggestion by this conference to the end that suitable laws may be suggested to the various states in order to make the business of mining more safe and to prevent mineral waste.

*Mechanical Engineer and Petroleum Expert respectively, of the U. S. Bureau of Mines, Pittsburgh, Penn.

It seemed to be the general opinion that some form of inspection is necessary in order to make operative any laws which may be enacted, and which required specific methods or results.

In order that it shall be possible to accurately locate a well which goes through a workable coal seam, and which may at some time be within a mine area, it seems desirable to require a license to drill.

In order that the wells shall be properly plugged when they are abandoned, it has been suggested that the well driller shall furnish a bond which is to be returned to him when the plugging has been properly done.

These suggestions cover only those wells which are put down through workable coal seams. A definition of this term "workable coal seam" is so difficult that it has not been attempted, and the responsibility for a reasonable interpretation of this phrase is placed on the State Geologist whenever the matter becomes one of dispute.

It is believed that the location of a bore hole should be so accurately determined that it could at any time be relocated, even after all surface indications have disappeared; and for this purpose it seems necessary to have the survey made by competent persons and reference made to established boundaries which can be located only by reference to at least three monuments or reference points.

In order that gas may not be drawn into the ventilating system of any mine, a minimum distance from a mine opening has been provided, and a similar minimum distance to those buildings which are vital to the safety of operation of a mine, so that in case of fire, of either wells or mine buildings, the risk shall not be increased. It seems evident that a bore hole should not go through any mine haulage or air way, and in order to insure this a distance of 15 ft. from such mine haulage or air way is required. It is believed that if pillars are considered necessary about such a bore hole, that the supporting power of the haulage way ribs will be sufficient.

In requiring casing from surface water, it is believed that, after the casing which goes through the coal seam is properly placed and packed as required, then the one used for excluding the surface water may be withdrawn. The double casing which is required through any coal seam is deemed necessary in the event that a mine should be opened and the casing possibly exposed to corrosion or injury from the movement of ground. In order that the ground pressures shall be applied over a considerable surface of the casing, it is required that they extend into the floor a sufficient distance; that they be surrounded with a clay pack; and that the second casing shall be brought into play through a similar clay pack. The use of clay for a packing material was preferred rather than cement, to avoid possible cracks through which corrosive water might enter if the outer casing was penetrated, and also to prevent the localizing of stresses on the second casing.

In the arrangement of casings and casing head, it is proposed to insure a free vent to the atmosphere from a point in the well below any of the casings used and to insure that this vent shall be maintained by openings that cannot be readily closed.

Where oil is allowed to rise within a casing above the floor of a mine, it may find its way past the several casing seats and into the mine, so that it seems necessary to keep the level of any such oil below the mine floor.

The matter of abandoning a well has been made a formal matter, so that a proper record shall be made and there be assurance that the work is properly done.

In suggesting a plugging method, it has been attempted to keep the method as simple and as general as possible. The method is based on the theory that while clay alone may make a good stopping that it may also flow and not be maintained where it is believed to be. Also, that cement mortar or concrete is apt to be porous, to deteriorate in oil, and to form a plug of doubtful tightness. It has, however, the quality of probably staying where it is put. To combine these two qualities it is suggested that there be a portion of cement with clay available at each end of this portion, so that if there is any movement of fluids through the cement, the clay will be carried into small openings and eventually close them. It also seems desirable that there be a hard solid portion through any coal seam, so that if struck by mining tools it is immediately disclosed.

OFFICES

METHOD OF APPOINTMENT.—A chief inspector of gas and oil wells shall be appointed by the Governor from an eligible list of men who have passed a satisfactory examination showing technical fitness for the position.

SALARY.—The yearly salary of the chief inspector of gas and oil wells shall be ——— dollars. Necessary travel expenses to the amount of ——— shall be borne by the state

and an office equipped with suitable filing arrangements provided.

ASSISTANTS—Assistant inspectors of gas and oil wells, subject to the authority of the chief inspector, may be appointed by the Governor.

DEPUTIES—Competent men may in an emergency be deputized by the Chief Inspector to perform the duties of the position in the field, but an appeal from his decisions may be had to the Chief Inspector. Deputies may receive not over ——— dollars per day and actual expenses not exceeding ——— dollars per day.

DUTIES

LOCATION—It shall be the duty of the inspector to receive applications for permission to drill bore holes and issue a license to drill to persons who comply with the law.

The inspector shall receive and file maps giving the location of bore holes; shall determine the sufficiency of such maps for the purpose of accurately locating such bore holes, and shall cause a new survey of such location in case of insufficient maps.

It shall be the duty of the inspector or his assistant to examine the maps accompanying applications for permission to drill bore holes, and where the location is in the vicinity of a mine he shall immediately proceed to the site and notify the district mine inspector and the coal operator to state whether the location on the map accompanying the application to drill is such as will interfere with the safe and economical operation of the mine.

The inspector shall issue a license when the proposed location of a bore hole is such as not to interfere with the safe and economical operation of a mine, as determined by the mine owner, state mine inspector and himself. To this end he shall have the power to move the location of a proposed hole as hereafter specified.

After hearing and duly weighing the evidence he shall permit the bore hole to be drilled at such point as will in his judgment permit the safe and economical operation of the mine.

RECORDS—It shall be the duty of the inspector to keep a complete record and prepare for publication a yearly report of the number of wells drilled in his district together with their location; date of completion; depth; production; date of abandonment and name of owner.

SUPERVISION—It shall be the duty of the inspector to examine each well in his district at frequent intervals, giving special attention to all wells containing gas in quantity which may be, in case of leakage, a menace to a mine, and to see that all the provisions of this act are observed and strictly carried out.

COMPLAINTS—He shall receive and investigate all complaints as to injury, present or impending, due to a lack of precaution on the part of any well owner or mine operator, and if he finds the complaints against the latter well founded he shall lay the facts before the state mine inspector.

PLUGGING WELLS—Upon receiving notice of intention to abandon a well the inspector or his assistant shall proceed to such well and satisfy himself that the provisions of this act referring to plugging wells are complied with. He shall join the owner in making affidavit to the manner in which the well has been plugged.

VIOLATIONS—If the inspector discovers any well being drilled, operated or plugged contrary to the requirements of this act, he shall order the workmen engaged upon such well to cease work at once and until the law is complied with.

ENFORCEMENT OF LAWS—To enable the inspector to perform the duties imposed upon him by this act, he shall have the right at all times to approach and examine any well in his district, and with the authority of the state mine inspector, enter any mine affected, and upon the discovery of any violation of this article or upon being informed of such violation, he shall institute proceedings against the person or persons at fault, under the provisions of the law provided for such cases.

In case of failure of the owner to properly plug an abandoned well, it shall be the duty of the inspector to have the work properly performed by contract and assess the cost against the well owner.

PENALTIES—(There shall be adequate penalties provided to aid in obtaining the safer conditions here proposed).

LOCATION

APPLICATION—Any person (firm or corporation) purposing to drill a bore hole through a workable seam of coal shall make application in writing to the chief inspector of gas and oil wells for permission so to do, and he shall not commence drilling until such permission, in writing, has been received by him. In case of dispute the State Geologist shall determine whether a seam of coal is workable within the intent if this act.

SURVEY AND MAPS—Accompanying the application for permission to drill such bore hole there shall be submitted a map showing the location of the proposed bore hole with reference by course and distance to the boundaries.

Said map must be made on a scale of 200 ft. to 1 in., and shall be based on surveys made by surveyors or engineers of recognized standing, and certified to by the surveyor or engineer making the same.

In case the inspector finds the map insufficient to enable him to accurately locate the proposed well, he shall require that another survey and may be made before permission to drill is granted.

If the original map is found to be correct the cost of the second survey and map shall be borne by the state.

BOND—Any person (a firm or corporation) purposing to drill a bore hole through any workable seam of coal shall be required to give bond in the amount of ——— dollars to insure that the drilling and abandoning of such bore hole shall be in accordance with the provisions of this act.

DISTANCE FROM BUILDINGS, ETC.—No bore hole penetrating a gas or oil bearing formation shall be located within 300 ft. of a shaft or entrance to a coal mine not definitely abandoned or sealed nor within 100 ft. of any mine shafthouse, boiler or engine house, or mine fan. No bore hole shall be located to drill within 15 ft. of any mine haulage way or air way.

LICENSE—Should the proposed bore hole be so located as not to interfere with the safe and economical operation of any mine and the previous requirements of this act be complied with, a license shall be granted and said person (firm or corporation) may proceed to drill such bore hole in accordance with the further provisions of this act.

PROTECTION OF COAL MEASURES

CASING FROM SURFACE WATER—Any bore hole penetrating any workable seam of coal shall be cased by the owner of the bore hole with a suitable casing (conductor or drive pipe) so as to shut off all surface water from entering the coal seam.

CASING THROUGH ANY COAL SEAM—Any bore hole, drilled for gas, oil or other mineral shall be drilled to a point at least 20 ft. below any workable seam of coal which may be penetrated, and receive a metal casing not less than ¼ in. in thickness and of an inside diameter four inches less than the bore hole. This casing shall be concentrically seated on the bottom of the hole and shall extend to the surface and shall be known as the first casing.

A second inner casing 4 in. less in diameter shall extend at least ten feet below the first casing and be seated in 1 to 2 cement mortar 9 ft. in depth. The inside of the second casing shall be open to the atmosphere its full length.

The intervening spaces between the second and the first casings and between the first casing and the bore hole or outer wall shall be filled with puddled clay to a height 30 ft. above the coal seam.

CASING THROUGH ACCESSIBLE MINE EXCAVATION—Casings which pass through a mine excavation shall be protected by a wall of concrete or of masonry or brick laid in cement mortar, extending from 2 ft. below the mine floor to the mine roof. Between the first casing and the wall thus constructed there shall be left an annular space of not less than 2 in., which must be filled with puddled clay. This work shall be done by the well owner.

Casings which are exposed by mining operations shall be covered as above by the mine operator.

CASING THROUGH INACCESSIBLE MINE EXCAVATION—Where a bore hole passes through an inaccessible mine excavation the outer casing shall be protected by cement mortar held within a metal tube 4 in. greater in diameter than the casing extending from 4 ft. below the mine floor to 4 ft. above the mine roof or cave.

CASING TO EXCLUDE WATER—Before drilling a bore hole into a gas- or oil-bearing formation a string of casing shall be so set as to exclude all water from the lower bore hole.

TUBING A GAS WELL—To conduct gas from a gas well, tubing shall be inserted with a suitable packer located below the inner casing and in such manner as to prevent the escape of gas except through the tubing.

The inner casing shall be left open to the atmosphere throughout its full length.

TUBING AN OIL WELL—To conduct oil from an oil well, tubing shall be inserted and extend from the oil bearing formation to the top of the well.

The inner casing shall be left open to the atmosphere throughout its full length.

Should gas be liberated in the well in sufficient volume to have commercial value it may be shut in by means of a packer placed below the inner casing and be conducted from the well through tubing inserted into the well parallel to the said casing.

CASING HEADS—Casing heads must have at least one opening to the atmosphere to which a valve or plug cannot be attached, so as to insure ample vent in case of leakage into casing spaces.

COMPLETION OF WELL—When a bore hole has been drilled and put into operation the owner shall file with the inspector a statement of the total depth of the hole, the sizes and lengths of casing used and remaining in the hole, the depth and thickness of all coal seams penetrated and whether oil, gas or water is obtained.

SUSPENDED OPERATION—When for any cause a bore hole which passes through a workable seam of coal shall cease temporarily to be operated, the inner string of casing shall be maintained open to the atmosphere. Should oil tend to rise in the well above the bottom of the first or outermost casing passing through the workable coal seam, such oil shall be pumped out by the owner and its level maintained below the bottom of this casing.

ABANDONMENT OF WELL

NOTICE OF INTENTION—When any oil or gas well is to be abandoned the owner shall notify the chief inspector in writing of such intent to abandon and proceed with plugging methods only after complete arrangements for inspection shall have been made and permission granted.

METHOD OF PLUGGING—In abandoning a well it must be entirely filled from bottom to surface. The lower hole must first be filled to a point 5 ft. above the lowest gas or oil bearing formation with sand, clay or rock sediment. Above each formation containing gas, oil or water and immediately below any workable seam of coal there shall be a plug as hereafter described, and each well shall have not less than three such plugs whatever the formation.

This plug shall consist of 25 ft. of cement mortar made of 1 part portland cement and two parts of sand properly mixed and placed with a bottom dump bailer upon 5 ft. of clay resting on a seasoned wood plug 2 ft. long and of the same diameter as the hole. Five feet of clay shall also be placed on top of the cement section. The space between the plugs here called for must be filled solidly with puddled clay, sand or rock sediment, cement mortar or concrete. The filling shall be complete up to the bottom of a casing before such casing can be drawn and the filling shall continue length by length as the casing is withdrawn, using cement, mortar or concrete when passing through coal seams.

LOG OF METHOD OF PLUGGING—When a bore hole has been plugged an affidavit stating the method followed, the materials used and the distances occupied by each material shall be certified to by the gas well inspector and filed with the oil well inspector and a duplicate with the county recorder.

RELEASE OF BOND—After, and not until these several requirements have been met, any bond which may have been given by the owner shall be returned.

Azimuth by Direct Solar Observation

By Louis Ross*

Direct solar observations for azimuth, without any attachments whatever, are physically far more convenient than Polaris observations, and dispense with the many objections to the use of solar attachments. In practice, however, direct solar observations are sometimes discredited among engineers, being considered inaccurate and merely a bit of theoretic or textbook fiction. The writer has gradually developed during a number of surveys a method of making direct solar observations accurately and with great facility. With a rather second-rate reconnoissance instrument, the vernier of the vertical circle of which reads to 2′ of arc, he has habitually obtained an accuracy of 1′ of arc in azimuth, without difficulty, with comparatively small effort.

Figs. 1, 2 and 3 will refresh in the reader's mind the physical concepts and factors involved in solar work.

Causes of Inaccuracy—Among the reasons why this method generally fails to give reliable answers are: erroneous readings, instrumental errors, the misapplication of the corrections to the declination and to the altitude, substituting the wrong functions of the latitude, and the errors in computing equation (1), which requires some 20 operations and is quite impracticable for field use. The remedy is to insure the accuracy of the data and to simplify the computation.

Simplified Formula—In place of the orthodox equation (1), given by nearly all textbook writers on the subject, the writer has developed and uses the equation*

$$Cos\ Z = \frac{sin\ d \quad sin\ h\ .\ sin\ L}{cos\ h\ .\ cos\ L} \qquad (3)$$

which is derived from the cosine law of spherical triangles. The interested reader can easily prove this formula by referring to the elements of spherical trigonometry. This formula is not as awe-inspiring as the

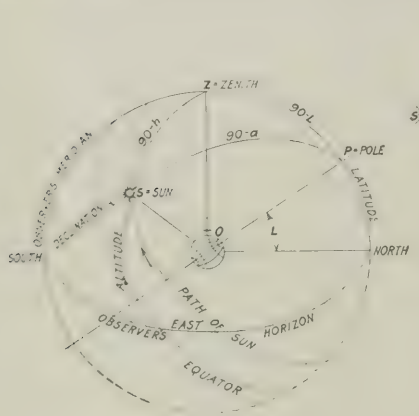


FIG. 1

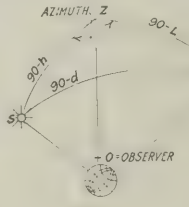


FIG. 3

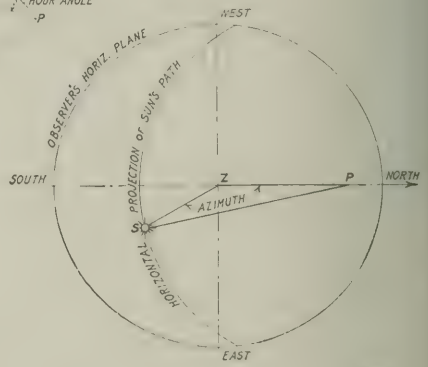


FIG. 2

Figs. 1-3. Elements of Spherical Trigonometry Involved in a Direct Solar Observation for Azimuth

In Fig. 1, O is the position of the observer, who, having his zenith Z vertically above him, is more intelligibly conceived of as being situated "on top" of the earth; directly north, at an altitude equal to the observer's latitude, is the celestial north pole P; while to the south is the sun S, shown as it would appear on a summer morning, north of the celestial equator and bearing southeasterly. The relative size of the earth has been exaggerated in the sketch for the sake of clearness. Fig. 2 shows more clearly the azimuth Z, the quantity principally discussed in this article, projected on the horizontal plane in which the transit measures horizontal angles.

The general procedure is to measure the sun's altitude h, obtain from the solar ephemeris its declination d, and take from a map the observer's latitude L. These three factors are substituted in an equation of the form

$$Cos\ \tfrac{1}{2}\ Z = \sqrt{\frac{sin\ \tfrac{1}{2}\ s\ .\ sin\ \tfrac{1}{2}\ s - (90 - d)}{sin\ (90 - h)\ .\ sin\ (90 - L)}} \qquad (1)$$

where

$$s = (90 - h) + (90 - L) + (90 - d) \qquad (2)$$

from which Z, the sun's true azimuth, is computed.

usual one, but is much more useful, requiring less effort to solve, with less chance of error. Tabular forms for computing this equation are given in Fig. 4—Table A, for logarithmic, and Table B, for arithmetic work. This formula is, of course, exact. It remains, therefore, to substitute the correct functions in this equation, and to facilitate its solution. This requires a clear, exact understanding of the quantities involved.

Declination—The declination d as taken from the ephemeris, must be corrected for the longitude and time of the observation. The application of these corrections involves a mental effort and a consequent source of error. To obviate these errors Fig. 5, with its equation, has been devised. Its use and construction are obvious.

After obtaining the true declination its sine is used in equation (3). For any extensive survey it is a waste of effort and a source of frequent error to look up these declinations at each observation, apply their corrections, and look up their sines. To obviate this a table similar

*Civil Engineer, U. S. Deputy Surveyor, 701 Sutter St., San Francisco, Calif.

*A modified form of the same equation,

$$Cos\ A = \frac{sin\ d}{cos\ h\ cos\ L} - tan\ h\ tan\ L,$$

is given in Johnson's "Theory and Practice of Surveying," 17th edition (1910), p. 99.

to Table I is prepared for several weeks in advance. This table gives *sin d* at noon of the average longitude of the survey, with the hourly change in *sin d*. Thus, for Nov. 10, 8:30 a.m., *sin d* is, from Table I, 0.2913. This quantity is directly substituted in equation (3), obviating the

The multiplications and division need be carried to four decimals only.

ANGLES	NAT. SIN	LOG SIN	LOG COS
d −23° 27′	+.39 795		
h 20° 57′		9.55 334	9.97 030
L 34° 18		9.75 091	9.91 703
Products	+.20 149	9.30 425	9.88 733
Numerator	+.19 646		9.29 327
Z 284° 45′			9.40 594
Zc 284° 37′			
Zc is 12′	to small		

LOGARITHMIC COMPUTATION

ANGLES	SIN	COS
d +23° 27′	+0.39 795	
h 20° 57′	0.35 755	0.93 389
L 34° 18′	0.56 393	0.82 610
Products	+0.20 149	0.77 149
Numerator	+0.19 646	
Z 284° 45′		+0.25 465
Zc 284° 37′		
Zc is 12′	to small	

ARITHMETIC COMPUTATION

$$\cos Z = \frac{\sin d - \sin h \cdot \sin L}{\cos h \cdot \cos L}$$

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FIG. 4. FORMS FOR COMPUTING EQUATION

field use of the ephemeris, field corrections, looking up functions, or the possibility of common errors. Northerly declination is considered positive; southerly, negative, for use in equation (3).

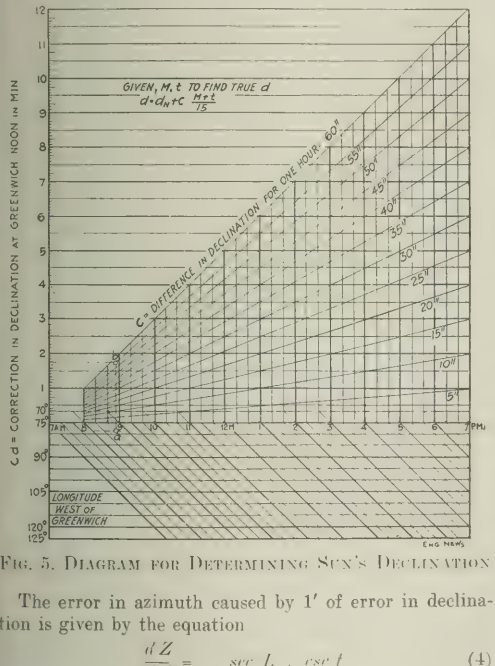


FIG. 5. DIAGRAM FOR DETERMINING SUN'S DECLINATION

The error in azimuth caused by 1′ of error in declination is given by the equation

$$\frac{dZ}{dd} = \quad sec\ L \ . \ csc\ t \qquad (4)$$

where *t* equals the hour of observation, in degrees, a.m. or p.m. Table II gives numerical values for a few typically selected arguments, and will be found useful.

The longitude for correcting the declination, Fig. 5, need not be more accurate than within several degrees, and the time not closer than 10 to 20 min. To make the observer independent of a watch, Fig. 6 has been devised, from which the time may be quickly obtained to an accuracy of a few minutes. Its use and construction will be obvious to the interested reader. In using this figure or equation the azimuth *Z* obtained from the compass, to an accuracy of 3° to 5° is sufficient.

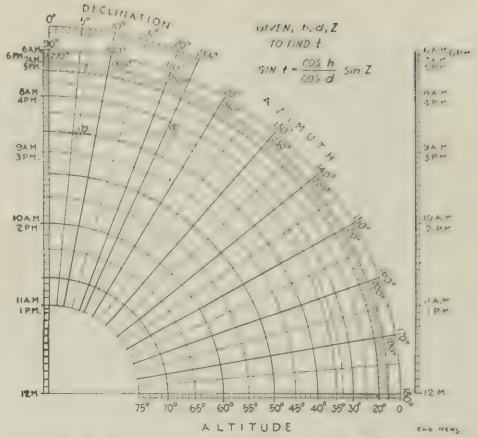


FIG. 6. DIAGRAM FOR DETERMINING TIME OF OBSERVATION

	Z	115° 00′	
Given	h	33 04′	Find t.
	d	6 19′	

Locate point at (az. 115° 00′ alt 33° 04′), project a horizontally on rad. of decl. 6° 19′, locating b, swing b radially on time scale.

Then t = 8:41 A.M.

Note—The time scale is duplicated on right of diagram to aid in projecting horizontals. Time throughout means "apparent local time"; to reduce to "mean local time" add "equation of time" from Ephemeris. To obtain standard time add to mean local time 4 min. for every degree that the observer is west of the standard meridian.

The latitude *L* is usually obtained from an accurate map. Scaling off in the field the latitude from a map, then looking up its functions, is inconvenient and frequently causes errors. To obviate this, draw on the most convenient map of the field of survey a number of parallels of latitude, preferably equidistant, ½ or 1 in. apart, and on these parallels write out, before starting on the survey, the functions, sine and cosine, of the latitudes Fig. 7 shows an outline of a township so labeled.

Thus, for a point ¼ mile north of the corner of sec-

TABLE I SINE OF SUN'S DECLINATION AT NOON IN LONGITUDE 120° W. OF GREENWICH

Date	Sin d	
Nov. 5	−0.2702	
6	0.2751	
Sun. 7	0.2803	
8	0.2852	
9	0.2900	
10	0.2948	
11	0.2994	
12	0.3040	
13	0.3085	
Sun. 14	0.3129	
15	0.3171	
16	0.3213	
17	0.3254	
18	0.3294	
19	0.3333	Add 2 in 4th place for
20	0.3371	each hour p.m.

TABLE II ERROR IN AZIMUTH CAUSED BY 1′ OF ERROR IN DECLINATION OR LATITUDE FOR VARIOUS LATITUDES AND TIMES

Time a.m.	Time p.m.	$\frac{dZ}{dd} = -\sec L \cdot \csc t$ When Decl. increases 1′ in a.m., azimuth increases am't. shown; in p.m. decreases L = 30°	L = 40°	L = 50°	$\frac{dZ}{dL} = \sec L \cdot \cos t$ When Lat. increases 1′ in a.m. azimuth decreases am't shown; in p.m. increases L = 30°	L = 40°	L = 50°
11:30	12:30	8.89	10.00	11.95	8.78	9.95	11.82
11:00	1:00	4.47	5.05	6.00	4.31	4.88	5.80
10:30	1:30	3.03	3.43	4.07	2.78	3.16	3.76
10	2	2.31	2.61	3.11	2.00	2.26	2.69
9	3	1.63	1.84	2.19	1.15	1.31	1.56
8	4	1.33	1.51	1.80	0.67	0.75	0.90
7	5	1.20	1.36	1.62	0.31	0.35	0.42
6	6	1.15	1.31	1.56	0.00	0.00	0.00

tions 14, 15, 22 and 23, the logarithmic sine is 9.75041. With the aid of such a map it would require gross carelessness to obtain wrong values of these functions. If there is no sufficiently accurate map of the vicinity, or if the topography or local names on it are too meager to identify the observing station, then the sun's altitude at noon will give the observer's latitude which, once obtained, may be carried a long distance, until another observation for latitude can be conveniently made. The

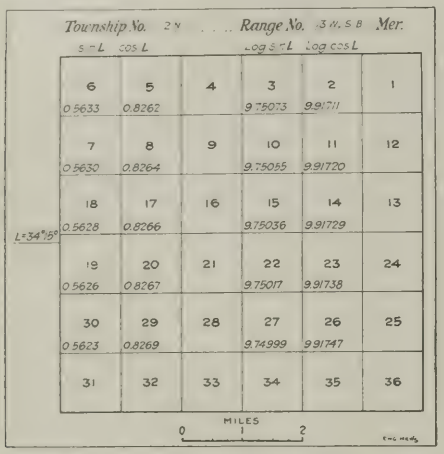


FIG. 7. TOWNSHIP MAP PREPARED FOR FIELD COMPUTATIONS

error in azimuth caused by 1′ of error in latitude is given by the equation

$$\frac{d\,Z}{d\,L} = \sec L \cdot \cos t \qquad (5)$$

Table III gives numerical values for a few typically

TABLE III. REFRACTION CORRECTION

Altitude = h	10°20′	12°30′	16°00′	21°50′	33°40′	63°30′
Refraction = r =	5′	4′	3′	2′	1′	

selected arguments. This table shows that in general the accuracy of the latitude should be about equal to that desired in the azimuth.

FIELD WORK—The altitude h of the sun is the quantity measured. Its reading must be corrected for the zero error of the vertical arc and for refraction. Refraction makes all objects in the sky appear too high; the correction is therefore *always* negative. Nearly all handbooks of the ephemeris contain certain refraction tables varying for various times of the year, and for the hour of observation, with certain coefficients for latitude and plus or minus in sign. The mistake is customarily made by engineers, and in many textbooks, of applying these refractions to direct solar observations additively or subtractively. Both the magnitude and sign of these corrections are wholly inapplicable to direct solar observations, but are intended for use with solar attachments *only*. Refraction proper is a function of the altitude only, and is expressed by the equation.

$$r' = cot\ h \qquad (6)$$

or more accurately

$$r'' = 58\ cot\ h \qquad (7)$$

where

r'' = Refraction in seconds of arc;
r' = Refraction in minutes of arc;
h = Altitude of object observed.

The refraction correction need not be more than twice as accurate as the reading of the altitude; 0.5′ being usually sufficient, the value of *cot h* need be obtained to one decimal place only. For this purpose Table III will be found useful.

The law of refraction expressed by equations (6) and (7) holds true for altitudes higher than 10° or 15°; below these altitudes the law is unreliable, the variation being rather irregular. No observation should therefore be made when the sun is lower than 10° or 15° in altitude, or, in general, when the refraction, as found by the above equation, is more than 3 to 4 times as great as the accuracy of the altitude reading. Also, near the noon hour the sun's altitude changes very slowly in comparison with its change in azimuth, so that a very small inaccuracy in reading the altitude will produce an error many times as great in the computed azimuth. No observation should therefore be made within at least 1½ hr. before or after noon.

The observation proper consists in obtaining accurate simultaneous readings of the altitude and line azimuth of the sun. Many of the personal, and all of the instrumental errors occur in these readings. The following procedure has proven itself, in the writer's experience, to be quite error-proof:

(1) Make observations twice a day, during the middle of the forenoon and afternoon; the lower the sun the better, until about 15° of altitude.

	READINGS OF		COMPUTED VALUES OF			
	h_r=alt.	Z_L=LINE AZ.	h=TRUE alt.	$\frac{dz}{dh}$=RATIO OF INCREMENTS	Z=COMPUTED AZIMUTH	Z-Z
1	22° 12′	284° 37′	20° 57′		284° 46′	9′
		11	18	0.61		
2	21° 54′	284° 48′	20° 39′		284° 57′	9′
		10	·15	0.67		
3	21° 39′	284° 58′	20° 24′		285° 05′	9′
		19	25	0.76		
4	18° 50′	105° 17′	19° 59′	X	105° 22′	9′
		10	22	0.45		
5	18° 28′	105° 27′	19° 37′		105° 35′	8′
		10	17	0.59		
6	18° 11′	105° 37′	19° 20′		105° 45′	8′
Total and Averages	60		97	0.62		5) 41
				Z_L is to small by		8′

NOTE: The difference between h_r and h in cols. 2 and 4 is the index error of the vertical circle, and refraction which was, in this case + 19′3″. The telescope was plunged between 3° and 4° readings, hence the difference in sign of index error, and .8′0″ in azimuth.

FIG. 8. SAMPLE FIELD NOTES OF SET OF OBSERVATIONS

(2) Level the transit, setting one pair of leveling screws in the direction of the sun; orient on the back azimuth, else set or assume one.

(3) Find the sun approximately, over the telescope tube, then take its image on a white piece of paper held 3 to 5 in. in front of the eye-piece; adjust the focus of the eye-piece, the crosshairs, and the distance of the paper so that the image of both the sun and the crosshairs will appear sharp.

(4) While holding the paper with one hand, manipulate with the other hand the tangent screws of the horizontal and vertical verniers, until the sun is bisected both ways. If an assistant is available for holding the paper,

so much the better. Be sure that the horizontal bisecting hair is the middle one. The bisection is made by estimation.

(5) When the bisection appears to be exact both ways, remove the paper, and read the horizontal and vertical verniers; record as in Fig. 8. If you have a watch, note the time.

(6) As soon as the first set of readings has been recorded, replace the paper in front of the telescope. The sun's image will still be within the field of view, but displaced from its symmetrical position about the cross-hairs, both in altitude and azimuth, by from 10′ to 20′ of arc. Manipulate the tangent screws again, until another bisection is made. Read and record again.

(7) Repeat this bisection, taking six readings in all. If the adjustments of the transit are in doubt, plunge and reverse the telescope after the third reading. Record all readings, as in Fig. 8, and particularly the differences between the successive readings of h and Z, also the ratios of these differences, as shown in columns 3, 4 and 5.

The ratios of the increments tabulated in column 5 of Fig. 8 represent the change in azimuth caused by 1′ of change in altitude. Without computing a single observation, these ratios pierce through the haze of mathematical, instrumental and personal errors, and tell the observer, while he is in the very act of observing, how accurate each set of readings is, which to discard, how many to take, at what altitude to observe, etc. Thus a critical examination of these ratios in Fig. 8 will show that:

(1) Since the rate of change of the sun's azimuth during the 5 min. of time occupied by the observation is practically constant, then if the measurements of h and Z were perfect these ratios would be equal; their inequality is due to instrumental and personal errors. The mean ratio, 0.62, depending as it does on a larger interval, is probably more accurate than any other individual ratio; therefore, the third and fourth ratios, tabulated as 0.76 and 0.45, are most likely incorrect. The inaccurate readings which caused these unbalanced ratios must lie in the fourth observation, since all the other readings have been used in obtaining the other ratios, which appear to agree within reasonable limits. The fourth observation should, therefore, be discarded, and not computed; but in Fig. 8 it has been computed for the purpose of showing the effect in the last column of corrections.

(2) These ratios need not agree with each other, for ordinary work, closer than within 5% or even 10%, that is, to an accuracy of between 1 and 2 significant figures. These are, therefore, best computed mentally, at the instant of recording each reading, and only to 2 or even 1 significant figure. With a little experience the observer will be able to analyze the accuracy and reliability of each reading at the instant that he writes down these ratios. Should any reading prove unreliable, omit it and take another in its place.

(3) The exact meaning of the variation of these ratios may be analyzed as follows: These observations were made with an instrument whose graduations were such that the vertical angles were in doubt by 40″, and the horizontal angles by 30″. Consider the difference between the second and third readings of Z, tabulated as 10′. Since each of them may be in error by 30″, the probable combined error is, by the method of least squares, $30\ \sqrt{2} = 42'' = 0.7'$, which is the probable error in the difference 10′. The probable percentage error in the difference is $0.7 \div 10 \times 100 = 7\%$. Likewise the probable error in the recorded difference of 15′ in the altitudes is $40\ \sqrt{2} = 57'' = 0.95'$. And the percentage error is $0.95 \div 15 \times 100 = 6.3\%$. The probable combined percentage error in the ratio tabulated as 0.67 is $\sqrt{7^2 + 6.3^2} = 9.4\%$, showing that a discrepancy of $67 \times 0.94 = 0.06$, between the various values of the ratios is permissible. Conversely, a given difference of 0.06 between the mean ratio and any individual ratio shows that the readings producing this ratio are probably accurate within the possibility of this transit. This analysis, while unnecessary in practice, will aid the reader in grasping the usefulness of these ratios. By a little study he will easily extend this analysis for further deductions.

(4) After the six readings have been obtained, it is necessary to compute only two observations, the first and last. The intermediate values of Z being proportioned according to the computed mean ratio. Thus, the computed Z of second observation equals the computed azimuth of the first observation + increment in $h \times$ mean ratio $= 284° 46' + 18' \times 0.62 = 284° 57'$.

It is the writer's practice, however, to compute all six observations, by the slide-rule. By systematic tabulation, as shown in Table IV, the computation is made in about five minutes, and the accuracy of the final average is within 1′ of arc, though some of the individual results may be 1′ or even 2′ in error, owing to slide-rule work.

In Table IV, columns 1 to 5 are identical with those in Fig. 8; the natural *sin h* and *cos h* in columns 6 and 7 are selected at one time. Under column 6 of *sin h* is entered the *sin L*. 0.5636 in this case, taken from Fig. 7, or otherwise. This is the constant multiplier for the various values of *sin h*, in order to obtain *sin h . sin L* in column 8. This multiplication is done by a slide-rule. For this particular table a 10-in. rule was used. Under column 8 is entered *sin d*, taken from Table I. or from the ephemeris. The difference between *sin d* and each of the values of *sin h . sin L*. obtained mentally, gives the numerator of equation (3), in column 9. Likewise *cos L* which is 0.8260, entered under column 7, forms the con-

TABLE IV. FINAL RESULTS COMPUTED WITH A 10-IN. SLIDE RULE

1	2	3	4	5	6	7	8	9	10	11	12	13
	hr	h	Z_L	dz dh	sin h	cos h	sin h . sin L	Num	cos h cos L	cos Z	Z	e
1	22°12′	20°57′	284°37′		0 3576	0 9339	0 2015	0 1965	0.771	0 255	284°46′	9′
		18	11	0.61								
2	21°54′	20°39′	284°48′		0 3527	0 9358	0 1988	0 1992	0 773	0 258	284°57′	9′
		15	10	0 67								
3	21°39′	20°24′	284°58′		0 3486	0 9373	0 1965	0 2015	0 774	0.2603	285°05′	7′
		25	19	0 76								
4	18°50′	19°59′	105°17′		0 3417	0 9398	0 1924	0.2056	0.776	0 265	105°22′ x	5
		22	10	0 45								
5	18°28′	19°37′	105°27′		0 3357	0 9420	0 1890	0 2090	0 778	0 2687	105°35′	8
		17	10	0 59								
6	18°11′	19°20′	105°37′		0 3311	0 9436	0 1865	0 2115	0.779	0 2713	105°45′	8
		97	60	0.62	0.5636	0 8260	0 3980				61	5) 41
							Z_L is too small by.....					8′

stant multiplier for obtaining $\cos h \cdot \cos L$ in column 10. Column 9 divided by column 10, gives column 11.

A still further simplification of the solution of equation (3) may be made by writing it in the form

$$\cos Z = (C - A) B \qquad (8)$$

where

$C = \sin d$,

$A = \sin \phi \cdot \sin L$,

$B = \cos \phi \cdot \cos L$.

A table is made for A and B, using for L the mean latitude of the survey; so that h, the altitude, is the only variable; C is taken from Table I. After computing Z, it may be corrected for the exact value of L by Table II. By this method the whole computation resolves itself to one subtraction and one four-place multiplication. The reader will easily work out the details of this last table, and a tabular form similar to that of Table IV.

SUMMARY—By avoiding the use of all attachments "the intricacies of the method" are reduced to bisecting the image of the sun, and reading the vertical and horizontal angles. A diagram similar to Fig. 7 and Tables I and III are essential. As many of the other tables and figures given as are found useful may be prepared by the observer before starting for the field. Instrumental and personal errors and mistakes are detected and adjusted by inspecting the ratios of the successive increments—the computation is reduced to a solution of equation (3), most of the factors being taken directly from special tables, without any chance for error, while the slide-rule checks any possible errors in computation. The usual time occupied is five minutes in taking the readings and five minutes in figuring, all of which may be done while waiting for the rodman. The accuracy obtainable is about one-half of the least transit reading, down to one-half minute. We therefore have in this an easy, certain and accurate method of obtaining the azimuth by direct solar observation.

❖

A Locomotive Boiler Explosion on the Detroit & Toledo Shore Line R.R. at West Detroit, Mich., on Jan. 5, has been investigated by the Locomotive Boiler Inspection Division of the Interstate Commerce Commission. The following details of the accident are taken from the report of the chief inspector.

Locomotive No. 2 was built by the Baldwin Locomotive Works in 1904. The boiler was of the extended wagon top type with radial stay firebox. The working steam pressure was 200 lb. per sq.in. On its last trip prior to the accident the locomotive was twice held up by derailments and eventually its supply of water gave out and it had to be towed to a point where this supply could be renewed. On this trip the engineer first noticed improper action of the water gages. The explosion was caused by the dropping of the crown sheet, while the locomotive was standing at the West Detroit terminal.

An examination of the boiler showed that, due to low water, the crown sheet had been overheated. It was blown down 19 in., pulling away from 343 radial stays. The door sheet was pulled over across the top and the right side sheet was also pulled over along the top for a length of about 6 ft. The color of the crown sheet showed that the metal had been overheated to a point 2½ in. below its highest part. Forty-four radial stays were found to have been broken prior to the accident. Thirty-five of these stays were in the portion of the sheet which was blown down. An examination of the bottom water glass cock showed that it was filled with scale, preventing the water glass from indicating the true water level in the boiler.

The locomotive was equipped with three 3½-in. muffled safety valves. These valves were removed and tested under steam pressure on another locomotive. One valve opened at 185 lb., the second opened at 195 lb. and the third valve [illegible] to open at 205 lb.

The company's boiler inspector certified that he set the three safety valves on Oct. 7, 1912, at 200 lb., 205 lb. and 205 lb. respectively. He also stated that he inspected the boiler on Dec. 3, 1912, and certified that the staybolts and crown sheet were in good condition. Since 11 of the radial stays were broken prior to the accident it is probable that this inspector either did not inspect the stays or he was not a competent inspector.

This accident was caused by the overheating of the crown sheet due to low water, but it is probable that the accident would never have occurred had the water glass been maintained in a satisfactory condition.

Safety on Railroads

By J. W. Coont

The great majority of American railroads are making a serious study of the Safety problem. The Baltimore & Ohio was the first Eastern road, so far as I know, to form committees affecting each branch of the service. We have been actively engaged in this work for a year and a half.

Everyone who has studied the question of preserving human life on railroads will agree that there are ample rules and instructions in effect and that they are clearly drawn. It is impossible to correct present evils simply by securing greater alertness on the part of the officers or by originating additional rules. The great majority of railroad men are careful and competent. The mistakes are made by the few, but we must work with all, for we do not know the few who will cause the trouble; it, therefore, resolves itself into getting the employees interested. With this in mind on November 1, 1911, we appointed a General Safety Committee and Divisional Committees.

Each Divisional Committee is made up as follows: Shopman. Engineer or fireman. Conductor or brakeman. Yardman. Agent. Supervisor or assistant division engineer. Medical Examiner. Division Claim Agent.

Half the divisional committee is changed every six months.

Reports are made by these committeemen weekly to the officer to whom they report, copy being sent the General Committee. The suggestions are tabulated by the General Committee, and every one is followed up.

The members of the General Committee endeavor, also, to attend at least three divisional meetings each month. They go over the division in daylight, the local members accompanying them and pointing out what work has been recommended and how much of it has been done.

We have covered over 1500 machines in the shops. We have put walkways on many bridges, especially where located near switches; moved buildings and poles back to give clearances; raised the hand railing on caboose cars as men have been jerked over the low ones, etc.; all at the suggestion of the men. The men will take about the same interest they see the company taking.

CAUSE OF FATAL INJURIES—We found, in carefully analyzing the fatal injuries to employees during the past year, that over 90% were due to cause that no expenditure of money in providing additional safeguards, etc., could possibly have prevented. They were due to failure of the human element. I do not say they resulted from carelessness; some were due to thoughtlessness, some to lack of familiarity with the movements and some to carelessness, even though possibly this was caused by over zealousness on the part of the employee in trying to do the work in too much haste.

The point I want to make perfectly clear is that the great majority of fatal injuries to employees on the railroad are due to causes the railroads cannot, in any possible way, by the expenditure of money, correct. Yet we often read articles that would lead the general public to believe that the large majority of injuries were due to the fact that railroads would not provide this or that safety device, did not maintain their track or equipment properly, etc. Some accidents ARE due to those causes, but bear in mind that 90% are NOT.

The only possible way the 90% can be reduced is to stimulate, in some manner, greater vigilance and care.

Let me make plain in what way the injuries comprising the 90% are occurring: 17 employees, during the past year, were fatally injured by stepping off one track on to another, to let a train pass, the noise of the passing train drowning the sound of the train coming in the opposite direction. Our rules require employees to step clear of all running tracks.

Ten cases were chargeable to adjusting coupler, angle cock or air hose while cars were in motion. This is strictly against the rules and in addition President Willard, in his talk before the employees at Baltimore a year ago stated: "I want to discourage the idea that you are expected, by the officers of this Company, to do anything that is not safe in performing the work that you are expected to do."

Thirty-five employees were struck by trains. Some were walking in the yard or on the track not paying proper attention. Some were working on the track, often with caps pulled down over their ears, not keeping a lookout. We have automatic bell ringers on most of our engines and the rules require the use of both bell and whistle where men are liable to be working. Two of the men struck were asleep.

*Extracts from a paper read before the New York Railroad Club, Feb. 21.

†Assistant to General Manager B. & O. R.R., Baltimore, Md.

on the track, one had been sent back to flag and protect a train; 6 fell in jumping on or off moving trains; 4 were riding the pilot of engine when either the pilot caught on something and turned under or the man jumped off between rails and fell. Strict rules are in effect against riding on pilots.

TRAIN ACCIDENTS—We now come to fatal injuries in train accidents. Please bear in mind that only 19% of all employees fatally injured in the past year were in train accidents, and this includes all the minor accidents, such as cars sidewiped in the yards, striking cars too hard, etc. Additional safety devices would not have helped the 80% in the least.

Thirty employees were fatally injured in train accidents. Please note carefully that 25 out of the 30 resulted from failure of the human element in the manner that I will illustrate by a few instances. Five of the thirty were from unavoidable causes, or from those which might be chargeable to the Company. They included such accidents as ice forming on rail, causing car to leave track.

Let me illustrate, by a few instances, some of the accidents chargeable to failure of the human element:

The first is a head-end collision in which three employees lost their lives. It was the practice of the front brakeman, who was riding on the engine, to wave at his girl in passing. On that date the train had a meeting point at this station. The girl was not on the porch, as usual, and the brakeman asked the engineer to whistle for her. Being engaged in this way and laughing and fooling together, they overlooked the fact that they had a meeting point.

After another accident, it developed that our rule providing that all train orders must be shown the fireman and brakeman, so that all would be fully informed, was disregarded. The engineer on the second engine (this being a double-header) left it to the leading engineer, who frankly admitted that he overlooked the order. The order had not been handed to the fireman or brakeman. The conductor did not check up the engineer. In other words, our rules provide a check on each man, or in this case, seven checks on the leading engineer, yet through the disobedience of a rule that is clearly understood three men paid the penalty.

Popular writers often make the statement that railroads promulgate this or that order, make Safety talks, etc., merely to blind the eyes of the public as to the actual cause of the accidents, and then issue instructions that require the men to make time regardless of weather or other conditions, or hurry them in their work so that they are not permitted to be careful. Possibly in some minor cases this is true, but in the great majority of cases it is not.

If a device were brought forth that would prevent the majority of the fatal injuries, even though it were expensive to install, there is not a railroad Executive who would hesitate one second to capitalize his personal injury expense at 5% and borrow sufficient money to install the device. But he realizes, as the public often does not, that safety devices will not do this. Employees are not meeting with fatal injuries from lack of safety devices and, in fact, very few passengers are. For, as shown, over 80% of all fatal injuries to employees in train accidents are caused by some failure of the human element.

Further in the matter of hurrying the men, let me again quote from President Willard:

> So far as I represent the management, I want the men to feel that in the matter of their line of work they are to take the time to do it as safely as possible. In passenger service, above everything else, is the safety of the train; second, comfort; third, punctuality.

You will note that speed is placed last. It is sometimes said that men have to run by signals, on rainy or foggy nights, without being sure of their position. Otherwise they would be taken off the preferred run or, at least, criticized. I have been in the operating department of this road for 25 years, and have never yet known of an engineer being censured where he could not make time because of fog or extremely stormy weather. Often a messtage is sent the engineer asking the cause of the delay. Some might consider this as a criticism. It is not. It is necessary to make report of every delay and it is to enable a local officer to do this that the message is sent.

The officers of this company believe in frankness and have directed the Safety Committee to analyze the train accidents and call the attention of employees to any special lesson regardless of whether the company is at fault or it was due to failure of the human element. The lesson is what we are after. We therefore, tell the employees, each month, in our magazine that is issued free to all, exactly how the accidents occur.

We also analyze the personal injuries and inform the employees exactly how they happen. We post on bulletin boards over the entire six thousand miles of road, within two or three days of its occurrence, the cause of [illegible] and caution our men to avoid a similar accident. The [illegible]ly employees' magazine, already referred to, is read by [illegible] sixty thousand employees, and, in this way and the bul[illegible]letins, we keep the question of Safety constantly before them.

NIGHT MEETINGS—In addition to this we hold, each month, at some point on the line a night meeting, to which all employees and their families are invited. We tell them plainly what we are trying to accomplish and how.

MAKING OBSERVATION TESTS—We also carry on observation tests—sometimes improperly called "surprise tests." Each division is required to make not less than a given number of tests. For example, a clearance card is made to show the wrong engine number or incorrect date to see if the crew are alert and detect these errors. A train order is improperly repeated to see if the dispatcher or operator is vigilant. A signal light is removed or a signal improperly displayed to see if the rules requiring train to stop under those circumstances are observed. These are not "surprise" tests; they are limited to conditions met with every day and no "catch" features are permitted or anything that endangers life or limb, but they enable one to locate the careless man BEFORE an accident occurs.

These tests should be diversified—should be made with every employee in train service and a careful record should be kept. If an engineer fails, he should be given another test of a different nature and this followed up to see if he profited by the lesson. If habitually careless he should not remain in train service. The value of these tests cannot be overestimated.

NOT A PASSENGER KILLED IN FIVE YEARS—It is most gratifying to turn, in closing, to the fact that for five years on the Baltimore & Ohio R.R. we have not killed a single passenger in a train accident, and during that time we have carried eighty-five million, or almost as many souls as there are in the United States. This speaks volumes for the good work done by the employees in caring for the passengers entrusted to them. We want them to be equally careful in their shop, yard or track work, where passengers are not involved, but where their own lives and limbs are at stake.



A Forum for Electrical Inventions is proposed as part of the activities of the New York Electrical Society for the coming year, by the newly elected president, Henry L. Doherty. The scope of the plan is indicated in a recent circular letter, sent out by the secretary, George H. Guy, part of which reads as follows:

> The simple plan that will be tried out at first is, to invite all manufacturers and inventors having meritorious inventions to submit them to the members for inspection at the regular meetings, without interfering with the set program. The idea is that the apparatus can be set up in one corner of the meeting room and there exhibited and explained to the members before and after the meetings, and if there should be sufficient time, someone representing the apparatus would be invited to open a discussion on the subject.
>
> It is thought that in this way, month by month, the new apparatus will be successfully brought to attention and all members will have an opportunity to become better posted as to what is doing, not only in their own branch of the industry but in others outside, in which they naturally have an intelligent interest.

Terminal Coaling Stations on the Panama Canal will be located at Cristobal and Balboa. At the former place, the Atlantic entrance, a plant capable of loading 2000 tons or unloading 1000 tons per hr., will be built and a smaller plant capable of loading 1000 tons or unloading 500 tons per hr. will be constructed at Balboa, the Pacific entrance. The storage capacity of the Cristobal station will be about 290,000 tons and the station at Balboa will be able to accommodate 160,000 tons.

Specifications for the machinery at the two plants have been drawn up and bids will be requested shortly. These specifications call for crane equipment for loading and unloading operations and for a conveyor system for handling the coal between the cranes and the storage bins.. It is planned to have the Government build the substructure or storage bins (which are to be of reinforced concrete), while the coal-handling machinery will be supplied by the successful bidder.

A feature of these two stations, which is somewhat out of the ordinary, is that vessels will not go alongside the wharves to receive coal, but will be loaded while lying out in the stream, from barges working in conjunction with the machinery on the dock. However, the plants will be capable of loading vessels alongside the wharves if that method is found expedient. The innovation is planned for greater convenience and economy of time.

The above information is taken from the "Canal Record" of Jan. 29.

Hardpan and Other Soil Tests.

By J. Norman Jensen*

During the present year, various architects and engineers of Chicago, in coöperation with the Building Department of the city, conducted tests to ascertain the safe load which might be placed on the soil at considerable depths below the surface of the ground. The particular soil under investigation was that commonly called "hardpan." It was found that the term "hardpan" had

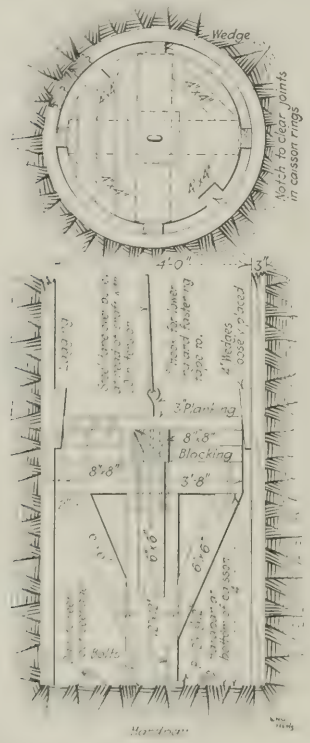


Fig. 1. Plan and Elevation of the Loading Platform Used in Measuring the Bearing Values of Soils

different meanings to different men, some designating by that term a tough surface clay, while others only considered as being true hardpan a soil almost as hard as rock, located at depths from 60 to 100 ft. from the surface of the ground. There was also a considerable difference of opinion as to what could be considered a safe load on the various hard soil, the values used varying from 8000 to 15,000 lb. per sq.ft. It was known that various buildings in the city rested on hardpan, and the dead load of these buildings could be computed with a reasonable degree of accuracy, but there was always uncertainty as to the actual live load on the floors of any one building at any time, so that the actual load on the soil was only approximately known.

The foundation proposition always has been and still is a troublesome question in Chicago. Most of the business district is on an old swamp or on "made" land. For this reason the ingenuity of architects and engineers has been brought to a test, and several types of foundations have been originated to meet the conditions found. Some of these types have been inadequate, and have proved a continual source of expense to the owners of some of the large office buildings. Others, such as the caisson type, have been evolved and seem to be the solution of the problem. In the heart of the business district these caissons usually extend to rock about 100 ft. from the surface. Where there is no danger that the adjoining property owners will ever go beneath the bottom of the caisson, these caissons occasionally rest on hardpan.

In investigating the safe load which might be placed on hardpan, it was desirable that the loading platform should be placed at the bottom of the caisson. It would be impracticable to have the load at the top of the caisson, because of the extremely long post which would be necessary. If such a long post were used, there would always be uncertainty as to whether the recorded settlement of the load represented an actual settlement or only the bending of the post.

A plan and elevation of the loading platform are shown in Fig. 1, and Fig. 2 shows a view of the device as actually used in the tests. It was 3 ft. 8 in. in diameter, 5 ft. high, and had in its center a 12x12-in. post, shod with a 12x12-in. steel plate, 1½ in. thick. Notches were cut in the 3-in. planking of the platform, so that the platform could be lowered past the lugs of the caisson rings.

Description of Hardpan.—In the first three tests the soil was a true hardpan. It may be defined as a very hard, dry, blue clay, mixed with small pebbles. This clay was so hard that a scratch could not be made upon it with the finger nail, nor would a lump be crushed under the weight of a man. It was necessary for a good stout digger to swing a drub or miner's pick with considerable force in order to drive it into the hardpan ½ in.

Test No. 1.—The first test of the series was conducted on the site of the new Cook County Hospital at Chicago. A caisson was selected which was not particularly favorable for the test, as it was adjoining an old building foun-



Fig. 2. Side View of the Loading Platform, Showing Comparative Size and Construction

* Architectural Engineer, Department of Buildings, City of Chicago. Address, 1515 N. Leavitt St., Chicago, Ill.

dation, and there was danger that the lagging of the caisson might cave in. There was also considerable seepage from a sewer pipe which had been broken in sinking the well. At the conclusion of the test there was about 12 ft. of water at the bottom of the shaft.

The caisson selected was 4 ft. 3 in. in diameter, 65 ft. below the surface of the ground, and 51 ft. below City Datum. The hardpan was about 15 ft. thick. The platform was lowered into place and wedges driven loosely between the platform and the lagging. This was done so as to steady the platform while loading. Pig iron was placed on the platform, and readings of the settlement taken at intervals. A steel tape was stretched from a fixed point on the platform, and the tape read at a fixed point at the top of the caisson.

Load.	Time	Reading
4,100 lb	Jan 26, 12 p m	52 ft 4¾ in
10,900 lb.	Jan 27, 6 a m	52 ft 4⅜ in.
24,200 lb	Jan 27, 1 p.m	52 ft ⅛ in
24,200 lb	Jan 29, 9 a.m	52 ft 5/16 in

From the above table, it is seen that the settlement was 3/16 in. in 44 hr. when the soil was loaded to 24,200 lb. per sq.ft. The test was under the supervision of Morey, Newgard & Co., engineers for the new Cook County Hospital.

Test No. 2—The hardpan under the Marshall Field Estate Building, at the corner of Wabash Ave. and South Water St., was tested in a similar manner. A steel tape was attached to a hook in the middle of the loading platform, and hung over a pulley above the center of the caisson. Weights were attached to the tape so as to maintain a constant pull. A bench mark was established, and readings with an engineer's level taken directly on the steel tape. The hardpan tested was 66 ft. below City City Datum. Throughout the test the well was dry as a bone.

Load	Time	Reading
10,600 lb	June 5, 5 p m	70 ft. 6 in.
24,200 lb	June 7, 6 p m	70 ft. 6 in.
24,200 lb	June 10, 10 a m	70 ft 6 1/16 in

It will be noticed that there was no settlement until the full test load of 24,200 lb. per sq.ft. was applied. After the full load had been on for 64 hr., a total settlement of 7/16 in. was obtained. George L. Harvey was architect of the Marshall Field Estate Building, and supervised the test.

Test No. 3—It was known that the hardpan under the Butler Building, on Randolph, Canal and Lake Sts., was of exceptional hardness, so a greater load was put on the soil than in any of the previous tests. A caisson 4 ft. 6 in. in diameter was selected, and the platform lowered to the bottom of the well. A 2x4-in. strip, long enough to project over the top of the pig-iron load, was firmly nailed to the top of the platform. A nail was driven into the top of the strip and another one into a timber in the top of the well. Careful measurements were taken between the two nails. The hardpan tested was 70 ft. below City Datum. Throughout the test the well was absolutely dry.

Load	Time	Reading
2,000 lb	June 17, 5 a m	51 ft. 5 in.
30,000 lb	June 17, 9 p m	51 ft. 5 in.
30,000 lb	June 20, 9 a m	51 ft. 5 1/16 in.

This test, as shown above, gave the highest bearing values, as a load of 30,000 lb. per sq.ft. only settled 1/16 in. in 60 hr. D. H. Burnham & Co. were the architects of the Butler Building, C. I. Hogue was superintendent.

Test No. 4—The soil in this case was not, strictly speaking, hardpan, but could be characterized as a stiff blue clay. It contained a small amount of stones, about ¼ in. in diameter. The clay was moist enough so that a slight impression could be made in it with the soft part of the finger. A good stout digger could only shovel it with persistent effort, and found it necessary to drive the shovel into the clay by stamping it with his boot. No grub was used in any of this work. The soil tested was 10 ft. below City Datum in one of the caissons of the Sears, Roebuck & Co. Building, located on Harvard and Central Park Aves. The measurements of settlement were obtained by means of an engineer's level and a rod held on a long steel rod, babbitted into a hole in the platform. The test was continued for five days.

Load	Time	Reading
3,000 lb	May 18, 10 a.m.	4 ft 1 3/16 in
6,500 lb	May 18, 11 a m	4 ft 1 3/16 in
15,200 lb	May 18, 1 p.m.	4 ft 1 3/16 in
24,100 lb	May 18, 2 p m	4 ft ¼ in
24,100 lb	May 19, 10 a m	3 ft 11¼ in
24,100 lb	May 20, 5 p.m.	3 ft. 11 in.
24,100 lb	May 21, 3 p.m.	3 ft. 10⅛ in.
24,100 lb.	May 23, 4 p m	3 ft 9 3/16 in.

As the load seemed to settle indefinitely, test was discontinued. From the data obtained, it seems that the ultimate carrying capacity of the soil in question was reached when the load per square foot was a little more than 15,200 lb. George Nimmons was the architect.

Test No. 5—It was thought that the large settlement of the previous test might have been caused by the clay oozing out from beneath the post of the platform, and rising alongside of the post. In order to test the truth

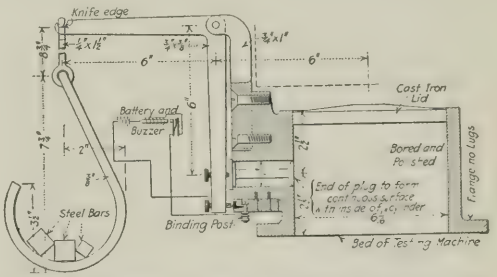


Fig. 3. Apparatus Used in Laboratory Tests on Bearing Values of Soils

of such a theory a test was run on the site of a building located on 22d and Calumet Ave. The soil was a very soft blue clay, 21 ft. below City Datum. A float was arranged alongside the post of the platform to detect any tendency of the soil to rise, when under load. The settlement was obtained by reading the distance between the top of a rod in the platform, and a fixed point in the lagging of the caisson.

Load	Time	Reading
7,700 lb	June 26, 12 m.	4 ft. 11⅞ in
7,700 lb	June 26, 10 p.m	5 ft 3/16 in
12,100 lb	June 27, 11 a.m.	5 ft. 1⅛ in.
17,000 lb	June 27, 2 p.m.	5 ft. 7 in.
17,000 lb	June 28, 2 p m.	5 ft 9 3/16 in
17,000 lb	June 29, 8 a.m.	5 ft 10 1/16 in
17,000 lb	June 30, 8 a m.	5 ft. 10 3/16 in

At the conclusion of the test recorded above, the float was examined, but there seemed to be no evidence that the soil adjoining the post had risen at all. N. Max Dunning was the architect for this building and supervised the test.

Some Laboratory Tests on Hardpan and Sand

A sample of the hardpan found in Test No. 1 was sent, for laboratory testing, to O. H. Basquin, Professor of Applied Mechanics at Northwestern University, by Mr. Randall, Chief Engineer of Morey, Newgard & Co. Through the courtesy of Prof. Basquin the writer is enabled to give the following information.

A section of the test cylinder used is shown in Fig. 3. It consists of a cast-iron cylinder with an area of $\frac{1}{5}$ sq.ft. On the side of the cylinder is a steel plug of 1 in. diameter. This plug is held in place by means of a bent lever, at the end of which is hung a stirrup carrying a number of steel bars. The lower end of the bent lever is in the circuit of an electric buzzer when the end of the plug is flush with the inside face of the cylinder. The weight of the stirrup and the smaller bar is such that it is equivalent to a load of 1000 lb. per sq.ft. on the plug. Placing an additional large bar in the stirrup means the addition of 1000 lb. per sq.ft. on the plug.

The method of procedure of the test was as follows: The apparatus was placed on the bed of the testing machine, and the cylinder filled with the soil to be tested. The lid was then placed on the cylinder, and the head of the testing machine brought down to a careful bearing on the lid. The circuit of the buzzer was closed, and the load applied. When the sound of the buzzer ceased, a reading was taken on the balance arm of the testing machine. Another bar was then placed in the stirrup, and the experiment continued until the buzzer again became quiet.

The hardpan sample from Test 1 was cut to the diameter of the cylinder and readings taken as outlined above. The data were as follows:

Lateral pressure lb. per sq.ft.	Vertical pressure lb. per sq.ft.	Ratio vertical to lateral pressure
2000	11,600	5.58
4000	16,000	4.00
6000	21,700	3.62
7000	23,700	3.39

Other information obtained was that the tensile strength of the hardpan was 5100 lb. per sq.ft. A briquette was cut roughly to the standard shape of a cement briquette, and pulled apart in the usual manner. The cohesion was found to have a value of 4000 lb. per sq.ft. The angle of internal friction was determined to be 25°.

The same test was made on bank sand found on the shore of the campus of the university. This was not a sharp sand, but had small rounded grains. It was typical of the sand upon which a great many small buildings near the lake shore of Chicago are built. The record of the test reads as follows:

Lateral pressure lb. per sq.ft.	Vertical pressure lb. per sq.ft.	Ratio vertical to lateral pressure
2,000	5,500	2.75
4,000	12,100	3.02
6,000	18,200	3.03
8,000	23,200	2.90
10,000	32,100	3.21

There was no cohesion in this material. The angle of internal friction was found to be 30°. It will be noticed that the ratio between the vertical pressure and the lateral pressure runs more uniform than in the hardpan test.

Relative Bearing Power of Small and Large Areas

The question arises in the design of foundations as to the relative bearing power of small areas compared with large areas. The same unit value is usually used, although there may be considerable variation in area in the individual footings. Is the soil resistance of a large area per unit of area greater than a small area, or *vice-versa?* This was the question in the mind of William Artingsall, Chief of Subway Engineers of Chicago, in the underpinning of the Van Buren St. railway tunnel of the Chicago Union Traction Co., about six years ago, at which time he was Principal Assistant Engineer of the above company. To settle this point, a series of tests was made, and the writer is indebted to Mr. Artingsall for the following information in regard to those tests.

A section of the tunnel is shown in Fig. 4. It was intended to place a new footing under the old wall, but in excavating for the new footing, it was found that some of the piles used in the construction of the old tunnel greatly interfered with the proposed footing. It was advisable to cut down the width of the new footing from that shown on the original design, but still be within safe limits. So it was decided to make a test to answer the question given in a preceding paragraph. The soil under

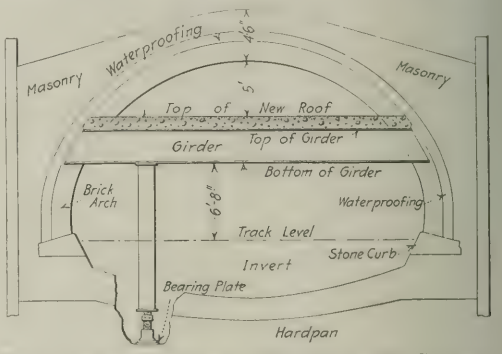


Fig. 4. Cross-section of the Van Buren St. Railway Tunnel, Chicago, Ill., Showing Method of Testing Bearing Values of Soils

investigation was a fairly hard blue clay. It could be grubbed, and yet it was not too hard to dig with a clay knife.

Referring again to Fig. 4, the steel girder shown in the section was in place. A hole was cut in the invert of the old tunnel, and a place leveled off in the clay for the steel bearing plate. On this bearing plate was placed a "drum," extending to the bottom flange of the girder above. The jackscrew was provided with a lever, on which the pull was obtained by means of a block and tackle, operated by a couple of stout laborers. The pull on the lever was registered directly by means of a dynamometer connected to the lever arm.

Several tests were made with bearing plates of different sizes and in different locations, but on the same character of soil. In each case the load that would produce the same settlement was obtained. The results were as follows:

Size of bearing, in.	Load per sq.ft., lb.
4x4	16,000
6x6	24,000
8x8	44,000
8x12	64,000
12x11	98,000

Discussion

From the preceding test, it is seen that there is a marked increase in the soil resistance per unit of area

for a large area compared with a small area. The question naturally arises, then, What should be the standard area for testing soils, at least in field tests? A great many tests have been made on an area 1 ft. square. It seems to the writer that in making tests which are to be compared with other tests, this area should be maintained, just as standard areas are maintained in making steel, cement and other engineering tests.

In the early part of the article mention was made of the fact that some large buildings in congested districts rest on hardpan. Occasionally the material at some depth beneath the hardpan is of a soft or fluid nature. Caissons have been sunk through sand and water, and great quantities of material have been pumped from the surrounding property. There are cases where an old foundation as much as 100 ft. from a new building has been disturbed by the sinking of such caissons. The writer has in mind a case where a street was badly cracked, and had to be repaired because of the material taken in the excavation of a deep caisson. It seems to him that an engineer who puts his building on hardpan instead of going down a few feet further to rock, especially in a city continually changing and growing, is showing a lack of foresight in safeguarding the future interests of the owner of the building.

This movement of the soil under heavily loaded areas is no mere theory. A late prominent engineer of this city who had been identified with the dredging operations of the Chicago River is responsible for the statement that the river bottom rises 2 or 3 ft. every four or five years. This rise is not due to the silting up of the river, as the water is practically pure as it enters the river. It was this engineer's belief that the rise of the river bottom is due to the fact that the river bottom offers the least resistance to the enormous pressure of the large buildings on both sides of the river, and that the soil is squeezed up into the river bottom.

Bearing Power of Soil under Foundations in Chicago*

Tests of the bearing power of the soil underlying Chicago, as related to foundations of buildings, are described in a recent number of the *Journal* of the Western Society of Engineers (Chicago), and with these there is a general discussion on the soil and foundation conditions in that city. From the papers and discussions we have compiled the information given below.

Test of the Bearing Power of Hardpan

A paper by Frank A. Randall† describes a test made for the foundations of the new Cook County Hospital, on the south side of Harrison St., between Wood and Lincoln Sts. This will be an eight-story steel-frame building, 550x70, with four wings 200x40 ft., and will cover a ground area of about 75,000 sq.ft. Bids were received for piles and concrete piers; the latter construction was the cheaper by about $13,000 and was adopted. Preliminary borings were made, 6 in. diameter for 30 ft. and then 3 in. diameter. These showed below the surface fill a bed of yellow clay to about 12 or 15 ft. below the street level, then a soft, sticky clay to about 37 ft. This is followed by solid blue clay, running into hard clay and gravel which extends down to the hardpan at an average depth of 47 ft. below the ground at the south end and 56 ft. at the main building. Two borings showed rock at 67 ft. and 89.5 ft., but the latter was considered the more reliable.

Because of the loads to be carried and the great difference in cost between concrete piers sunk to hardpan and to rock, it was decided to carry the piers (locally termed "caissons") only to the former, provided that the test wells showed a satisfactory bed of hardpan, with rock in the same relative location as in the borings. Four of the wells for the concrete piers were excavated as test wells. Borings were continued down through the hardpan to 85 ft.; and from soundings and borings, rock was found at 90 ft. below ground level. In order that all piers should rest on similar material, the test piers themselves were not carried to rock, but were belled at 85 ft. and 60 ft. below ground surface, the top of hardpan stratum. From the test wells the thickness of hardpan was found to be from 15 ft. to 20 ft., with hard clay beneath.

The test of the bearing power of the hardpan was made at the request of the city Building Department, and was made by means of a vertical post carrying a loading platform. This frame was 5 ft. high, and consisted of a central post 12x12 in., with struts to two 8x8 in. cross timbers at the top, and a deck of 3-in. plank forming a platform 44 in. diameter. The post was shod with a 1½-in. plate 12x12 in., and rested on a 2-in. plate of the same size, laid directly upon the hardpan. Four wedges, loosely driven between the platform and the lining of the well, kept the frame in a vertical position. In the center of the platform was a 2-in. steel rod about 12 ft. long, set in a babbitted hole 14 in. deep. This projected up through the pig-iron load, so that the steel tape attached to its upper end could be removed while handling the pig iron. The measurements were taken from a bench-mark by means of a straight-edge. This device was found to be perfectly accurate when tested by reversal of the carpenters' level, which latter was of more than ordinary sensitiveness and accuracy.

A hole 4 in. deep and about 18 in. square was dug in the center of the bottom of the well, and the 2-in. bearing plate was carefully centered, leveled and bedded. It had been intended to inclose the hole in a wooden box backed with concrete and clay to keep out all water, but as water sprinkled from above directly into the hole this had to be abandoned. The testing frame was raised and dropped onto the bearing plate several times in order to force out as much as possible of the clay which had sloughed into the hole. The pig iron was weighed out in batches averaging about 600 lb., and was lowered and placed as fast as weighed. The pigs were of varying size and were placed in layers of stretchers and headers radiating toward the center, and bonded together in addition by small pieces of wood, as deemed necessary. They were kept at least 1½ in. from the lagging, the pile when completed being about 4 ft. in diameter and a little over 12 ft. high. About 12 tons of pig iron were used. Five readings were taken, with results as follows:

Time	Load, lb.	Total settlement in.
Sat., 12:15 a.m.	4,079	0
Sat., 6:30 a.m.	10,887	0
Sat., 9:35 a.m.	17,362	1/16
Sat., Noon	23,189	1/8
Mon., 9:00 a.m.	24,200	1/8

*Elsewhere in this issue there is to be found an article by J. Norman Jensen, on this same general subject, and, in connection with the same, views are shown of the soil-testing platform used in the tests for the Cook County Hospital foundations, above mentioned.

†Chief Engineer, Morey Newgard & Co., 56 E. Van Buren St., Chicago.

The piers were designed for a load of 44,000 lb. per sq.ft. at the top and were belled at the bottom to twice the diameter of the shaft. Considering hardpan at 60 ft. below the surface, the unit designing load on the latter is about 13,300 lb. per sq.ft., or about half the test load. The test load was applied to 1 sq.ft., while the area of the well was about 16 sq.ft. It is not known how much the bearing value of the hardpan is increased when the pier is completed and the well is completely filled, but it is thought that it must be a very material increase. The results indicate that the hardpan stratum will carry the designed load with safety. Probably a portion of the settlement was due to the compression of the loose soil which sloughed off as the platform was being lowered. The well stood open ten days after the excavation was completed. No settlement was detected in the footings alongside of the wells.

Test of the Bearing Power of Moist Blue Clay

This test is described by Edwin Hancock,* as follows: Two openings about 8 ft. square were made in the concrete floor of the basement of the Federal Building, and the soil was excavated for a depth of 6 ft., so that there was a bearing on the original clay which had never been disturbed. On this clay a grillage was built up of planks 2x12 in., 2 ft. long, laid closely together so as to give a bearing of 4 sq.ft. This grillage was built up about 1 ft. high, and upon this were placed longer planks to carry the load of pig iron. The settlement was taken by means of a wye level and rod. Readings were taken as soon as each load was put on, and then again after giving an hour for settlement. If no further settlement had occurred, a larger load was placed upon the plank. If the settlement had increased, readings were taken until they showed that the settlement had ceased.

The elevation of the clay was at city datum and about 14 ft. below the street level. The distance between the two testing points was 150 ft. The results of the tests were as follows:

Load in lb. per sq.ft.	Settlement, in Test No. 1	Test No. 2
1000	$\frac{3}{8}$	$\frac{3}{8}$
2000	$\frac{5}{8}$	$\frac{1}{2}$
3000	$\frac{7}{8}$	$1\frac{3}{4}$
4000	1	$2\frac{1}{4}$
One hour later (same load)	$\frac{1}{4}$	$\frac{1}{4}$
Next day same load		$\frac{1}{4}$
Two days later	$\frac{1}{8}$	
Four weeks later	$\frac{1}{8}$	
Next day	$\frac{1}{8}$	

Discussion on Soil and Foundation Conditions in Chicago

Wm. Artingstall—Old plans giving the bearing power of the soil in the downtown district as assumed by different architects and engineers show that some have taken 1½ tons per sq.ft., others 2 tons, and others 1¾ tons. In some cases, an architect has taken 1½ tons, while his neighbor on the next 25-ft. lot has run up to 2½ tons on practically the same character of soil. I say the same soil because all these footings are at about the elevation of city datum. But when you get below datum, it is a question whether the soil is the same on one 25 ft. lot as it is on some other lot.

In underpinning the Van Buren St. tunnel a few years ago we were particularly concerned with the question whether the area of foundation had much, if any, influence on the bearing power of the soil. In other words, if the material was confined, could it sustain a heavier load? Consequently it was necessary to make several tests with increasing bearing areas. We rigged up a device which could be easily handled by two men. This was a drum with the upper end bearing against the bottom flange of a roof girder, and the lower end resting on a bearing plate in contact with the clay. A dynamometer was connected directly to the lever arm, and the block and tackle was fastened so as to obtain a direct pull. The reading on the dynamometer then had to be corrected merely for friction in the jackscrew. The bearing load increased from 8 tons per sq.ft. for a bearing 4x4 in. to 12 tons for 6x6 in., 22 tons for 8x8 in., 32 tons for 8x12 in., and 49 tons for 12x14 in. This proved that we could load our foundations with a much heavier load than we had assumed, and in the river section of the tunnel they are carrying nearly 10 tons per sq.ft. The maximum settlement, shown by levels taken 11 months after completing the work, was only ⅛ in.

F. E. Davidson—I have loaded hard clay to as much as 7500 lb. per sq.ft., and the structure, after five years, shows no unusual settlement. Any foundation constructed on clay will settle. The problem is to so design the building that the settlement will be uniform. There is danger in designing foundations for any important structure, unless provision is made for the re-designing of foundations after the actual excavation has started, to provide for changes in character of soil.

In order to provide for uniform settlement in structures subject to both live and dead loads, the proper distribution of the assumed live loads is as vital and important as the selection of the proper unit stresses. Parts of structures subject to great dead-load stresses will settle more than foundations whose load is largely live load, unless great care is exercised in determining what unit stresses to use in the various cases of loading which occur. There are at least three features of loading in building construction which must be considered in the design of foundation work: 1, the dead weight of the structure; 2, the area upon which there may be live loads; 3, impact loading, such as the vibration of heavy machines, or the impact effect from a large number of elevators. Probably the most difficult problem in connection with building design is to so proportion these loads that the settlement of the structure will be uniform.

J. W. Pearl—The deeper the foundation is placed, the more it will support safely, or the more nearly uniform will be the settlement. I believe the load that may be carried on any given soil is absolutely proportionate to the depth of the foundation, or rather the pressure on the surrounding soil. In any determination of the supporting power of a foundation, the depth of footing and the load applied upon the contiguous earth, should be entered as a function in the solution of the problem. The practice in Chicago does not seem to take this into consideration.

C. K. Moeller—Figuring the weight of earth at 100 lb. per cu.ft., gives a vertical load of 6000 per sq.ft. at a depth of 60 ft. Plastic clay should balance that amount of column load without any settlement whatever. If the foundation well is completely filled, there will be the friction of the sides of the pier against the earth to resist settlement. With the clay perfectly confined at a depth of 60 ft. there should be no settlement possible, aside from what the soil may be actually compressed by the added load. On the other hand, a compression test in an open

*Central Engineering Co., Monadnock Block, Chicago.

put on plastic clay may be no proof of what it will carry when perfectly confined.

WM. ARTINGSTALL—I do not think there is any question in the engineer's mind about the moving of the soil. On opening any large excavation, one will have a great deal of trouble about the bottom coming up. It is a notable fact that since 1856, dredging of virgin clay out of the Chicago River has been going on. About every five years one can take out 2 or 3 ft. and get down to the desired plane, but four or five years afterward you can again take out 2 or 3 ft. of solid clay which is above the former limit of dredging. In building the west approach of the Washington St. tunnel we encountered the foundation piers of the columns of the C. & N. W. Ry. terminal. These were on piles driven to 50 or 60 ft. below datum. The columns settled about 2½ in. and moved laterally about 2 in.

F. L. STONE—In the track-elevation work of the C., B. & Q. R.R. from Canal St. to the city limits, our greatest trouble was in connection with the lateral movement of the abutments. We were able to carry our loads vertically on piling, but we had to take considerable precaution as to the lateral movement.

T. L. CONDRON—One feature of the foundation problem in Chicago that will eventually require legislation, it seems to me, is the practice (in sinking big foundations) of pumping them out and removing an unlimited quantity of material. This must disturb the surrounding soil, and accounts in a large measure, in my opinion, for the settling and lateral movements of surrounding buildings. Where it is impossible to do dry excavation, the excavating should be either stopped or carried on under compressed air. A good many of our large buildings have hardpan foundations, and they will carry an indefinite amount of load until somebody pumps out the material (silt or quicksand) beneath the hardpan.

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Proportioning of Foundations for Columns and Walls

BY ERNEST MCCULLOUGH*

The writer has been struck with surprise a number of times when checking designs for buildings, at the apparent lack of information respecting a proper method for distributing loads to column and wall footings. Inasmuch as exterior columns carry a larger per cent. of dead load than interior columns, many designers content themselves with giving a slightly higher soil pressure on the interior footings. For example, in one city where the soil is commonly loaded to 3500 lb. per sq.ft., it is customary to use this for wall, and exterior column, footings and use 4000 lb. per sq.ft. for footings under interior columns and piers where the per cent. of live load is larger. As a rule in architects' offices no difference is made, the footings being proportioned according to total load, with the result that many floors break because of a greater settlement under the walls.

Experience shows that it is as disagreeable to have interior footings too large as to have them too small. In case they are too large the floors "hump," while in the case of small footings they "sink," when the buildings are occupied for any length of time, it being customary to put the bulk of merchandise close to walls and columns with vacant spaces and alleyways between interior columns. There is this difference, however, that the period of subsidence is short in the case of floors permanently carrying a fairly steady load and when the interior footings are too large, the rise after awhile becoming a fixed amount. When on the other hand, the interior footings are too small, the sinking continues for a very long time and causes so much uneasiness that frequently heavy expenses are incurred to increase the bearing surface, the cost of strutting up the floors being considerable. Why any more anxiety should be caused by the sinking of the interior columns than by sinking of the walls, the writer cannot say, but it is possibly due to the large area visibly affected, the sinking not being uniform.

A careful search of textbooks fails to reveal an explanation of any method for adequately proportioning the loads according to the differing percentages of live load, yet that such rules do exist in the offices of experienced men is very probable.

The writer lately undertook to collect some data on this subject and is forced to believe that the majority of designers use their judgment mainly in determining the portion of load to go to each column, or else they prefer to keep their methods secret. This being the case it may be of interest to engineers to see published the method used for some years by the writer and also by several engineers of his acquaintance. He makes no claim of originating this method, but has not been able, so far, to find it anywhere in print. Briefly, it consists in proportioning the footing for the column carrying the largest per cent. of dead load, multiplying the soil load by the per cent. of dead load, and then dividing this "soil factor" by the per cent. of dead load for the other columns to determine a proper bearing value. The following examples from a building recently designed will serve to illustrate the method; Col. 44 carries 8% of live load and 92% of dead load, it being a corner column under a tower carrying a water tank. The total load on the footing was 473,000 lb., which gave a footing measuring 8 ft. 3 in. x 8 ft. 3 in. The footing rests on a thick bed of sand which was tested and a bearing value of 7000 lb. per sq.ft. selected as proper. $7000 \times 92 = 644{,}000$, soil factor. Columns 1, 2, 3, etc., carried 62% of live load, and $644{,}000 \div 62 = 10{,}400$ lb. soil load per sq.ft. under these columns. 605,000 (total load) $\div$ 10,400 = 58.1 sq.ft., requiring a 7-ft. 8-in. x 7-ft. 8-in. footing. Similarly, columns 29, 30, 31, etc., carried 73% of live load and $644{,}000 \div 73 = 8850$ soil load per sq.ft. under the footings. The total load, $588{,}000 \div 8850 = 64.45$ sq.ft., requiring an 8-ft. 2-in. x 8-ft. 2-in. footing.

By the foregoing method it may be seen that the footings most likely to carry the calculated load permanently are designed to use the full allowance of soil pressure and the other footings which will only occasionally be loaded to anything like the calculated amount, will at such times load the soil more heavily, the greater part of the time the load being very light.

Another method used occasionally is that mentioned by C. C. Schneider, M. Am. Soc. C. E., in his "General Specifications for Structural Work for Buildings." It reads as follows:

> The areas of the bases of the foundations shall be proportioned for the dead load only. That foundation which receives the largest ratio of live to dead load shall be selected and proportioned for the combined dead and live loads. The dead load on this foundation shall be divided by the area thus found, and this reduced pressure per square foot shall be the permissible working pressure to be used for the dead load of all foundations.

*Consulting Engineer, Monadnock Block, Chicago, Ill.

For this method of figuring we begin with Col. 24, on which the load is 60% dead, 40% live, the total load being 632,000 lb. The footing required is 632,000 ÷ 7000 = 90.29 sq.ft., or 9 ft. 6 in. x 9 ft. 6 in. A comparison with the other method gives, soil factor 644,000 ÷ 60 = 10,750 lb. per sq.ft., and 632,000 ÷ 10,750 = 58.8 sq.ft., requiring a footing of 7 ft. 8 in. x 7 ft. 8 in.

Proceeding by the Schneider method: The total load is 632,000 lb. and the dead load is 378,000 lb. The area of the footing, found by dividing the total load by the allowable soil pressure, equals 95 sq.ft. The reduced soil pressure equals 378,000 ÷ 95 = 3980 lb. per sq.ft..

This soil pressure is now used for dead load only in proportioning the rest of the footings. Taking the examples already given, Col. 44, total load 473,000 lb. has a dead load of 433,000 lb., and this divided by 3980 gives a footing 10 ft. 5 in. x 10 ft. 5 in. Cols. 1, 2, 3, etc., total load of 605,000 lb., have a dead load of 372,000 lb., which divided by 3980 gives a footing 9 ft. 8 in. x 9 ft. 8 in. Similarly, Cols. 29, 30, 31, etc., total load 588,000 lb., have a dead load of 433,000 lb., which divided by 3980 gives footings 10 ft. 5 in. x 10 ft. 5 in.

By the Schneider method, the footings which only occasionally carry the full calculated load are designed for the allowable soil pressure when fully loaded. Consequently the footings probably never are loaded to the bearing capacity of the soil, this bearing capacity usually being from one-third to one-half the load the soil can carry on 1 sq.ft. of surface without appreciable settlement in 24 hr. The soil is generally tested with a load on a post 12 in. square, which is far more severe than anything any future loading can bring upon it. Foundations cost money and a discussion of the comparative merits of these two systems for proportioning loads on footings should be of value to both engineers and architects.

In the case above figured, the footings being designed by both methods and the method giving the smallest footing adopted, the column loads were reduced by the common rule to be found in the greater number of American building laws. The full live and dead loads on the roof are carried to the supporting columns on the top floor. The live load on the top floor is reduced 15%, with a progressive reduction of 5% for each floor below until the total reduction amounts to 50% of the live load, from which point the live load on floors below is taken at 50%. For a building eight stories high this gives practically 70% of the total live load on the footings.

In some foreign countries, and in a number of buildings erected in America in places where no building laws protect the owner, a common practice is to take 100% of the live and dead loads on the roof and 10% progressive reduction on each floor below until this reduction reaches a floor where only 40% of the live load is used. On all floors below only 40% of the live load is used for each floor, but on the footings the amount of live load to the total load is taken at 40% of all the live load on all the floors. In some places where the first rule is used for reducing live loads to columns it is customary to use 50% of the total live load in designing footings.

Surely the art of building is old enough and there are enough competent engineers in the world to enable questions such as these to be definitely settled. The strangest part about the matter is the fact that all textbooks are so vague and perhaps this is for the reason that the writers of the textbooks believe these things are settled. There is no common practice at present and practical contractors are fond of telling about the different rules given by engineers and architects of standing, when asked how to reduce live loads to columns and how to proportion footings for live and dead loads.

A 500-ton Reinforced-concrete Scow

By C. E. Sudler*

A reinforced-concrete scow or lighter, designed to carry a load of 500 tons, was launched at the yard of the Furst Concrete Scow Construction Co., at Baltimore, Md., on Dec. 31, 1912. This scow is the first of a number which this company is intending to build and for the construction of which they have recently equipped a large shipyard. A view of the vessel on the building platform is shown in Fig. 1, and Fig. 2 gives the general details of its construction.

It has a total length over guards of 113 ft., a breadth over guards of 29 ft., and an outside depth of 10 ft. 6 in. The cross-section shows rounded bilges which are worked into sloping ends, showing on the deck plan as quarter ellipses, a form adopted to give an easy towing body and also as offering maximum strength for the quantity of



Fig. 1. Reinforced-concrete Scow on the Ways before Launching

material used. The lighter is strengthened and divided into 20 watertight compartments by two longitudinal bulkheads extending the full length of the hull, five athwartship bulkheads and two additional longitudinal bulkheads on the center line extending from each end to the first cross bulkhead. Provision is made to drain each compartment and to test it for leakage by a series of pipes and cocks leading to each end of the vessel. Access to each compartment can be had through manholes in the deck, which are closed and sealed tight by flush-plates, only to be opened in case repairs are needed.

The walls are divided into panels of suitable size by a series of beams both vertical and horizontal, the main slabs forming the walls being 3 to 5 in. thick and reinforced with plain bars running in both directions. Deformed bars are used for the reinforcement of the beams.

A heavy timber guard 24 in. in depth extends clear around the vessel at the deck and in addition a lower guard 6x10 in. in section is used to protect the hull when light. Above the deck proper there rises a timber siding, as shown in the views and in the cut.

The lighter was built entirely of concrete poured between inside and outside forms. This method of building was considered as being more reliable than the occasionally used method of building barges by plastering successive coats on wire mesh to form the walls. By this

*Engineer, The Furst Concrete Scow Construction Co., Pier 2, Pratt St., Baltimore, Md.

latter method any defective bond between coats would greatly weaken the walls. It is, of course, much cheaper on account of the saving in the form work and in placing the reinforcing steel, as in the method of pouring between forms, which was used on this lighter, it was necessary to assemble the steel as the forms were set up.

The outside forms were comparatively simple, being built of wood in sections that could be conveniently handled and removed without damage. The inner forms were far more troublesome. On account of the thin walls they had to be built very accurately to size and squared up perfectly true. Some trouble was had in making a type of form that could be removed readily after the concrete was in place. This was due to the fact that most of the inner walls were divided by beams into panels of approximately 7 ft. square, and the form making the slab was surrounded on four sides by the sides of the adjacent beams. The swelling of the wood of such a form would cause it to bind tight on the four sides so that it could not be removed without destroying its usefulness. The inner forms were separated from the outer by small cement blocks, cast with holes through which were placed the bolts to draw the forms together.

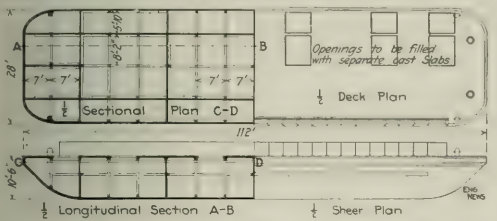


FIG. 2. DETAILS OF THE FURST CONCRETE SCOW

Concrete materials were measured and handled in small dump cars and emptied into a batch mixer located about 10 ft. higher than the deck of the scow. The mixed concrete was dumped into a storage hopper from which it was drawn into two-wheeled carts and pushed by men on a level runway to the place required. The concrete was not placed continuously, but at the outset the work was divided into sections which could be placed in one day, leaving joints in certain places where the concrete could be thoroughly cleaned, roughened and bonded with the next section. The walls were protected from the sun and kept wet for about 10 days after the concrete was placed.

A very rich concrete was used, mixed quite wet, but no other precaution in the way of waterproofing materials or paints, etc., were used to make the walls watertight. It is evident that the method of mixing and the materials used resulted in a very good concrete because no leakage has been noted in the six or eight weeks during which the scow has been in the water.

The company which has undertaken the manufacture of this scow has opened a six-acre plot of waterfront property in Baltimore for general marine repairs and construction, and particularly for the design and construction of reinforced-concrete lighters which might successfully compete with the older forms of construction. The plant as built consists of a machine shop, forge shop, compressed-air plant, wood-working shops, and a 1000-ton railway dry dock for the double purpose of docking vessels for repairs and launching the concrete scows. The scows are built on a platform supported on rollers alongside the railway so that both scow and platform may be moved bodily sidewise onto the cradle of the railway and then the whole lowered into the water. This permits launching a green or unseasoned concrete vessel without the least strain.

Actual construction of the vessel illustrated was started about July 10, 1912, and all concrete work was completed about Nov. 15. As stated above, it was launched on Dec. 31. Since it was launched it has been quite thoroughly tested in constant service in handling sand and gravel, which is loaded by a dredge and unloaded by grab buckets. It appears to be thoroughly practical and successful in every way. It has shown no sign of leakage and offers less resistance in towing than a wooden lighter of the same capacity. The tug-boat captains who have handled it state that it tows more easily than most wooden lighters.

The organization of the Furst Concrete Scow Construction Co. is primarily due to Oscar F. Lackey, Harbor Engineer of Baltimore, who holds a U. S. patent on the scow as shown in the design herewith. The president of the company is Frank A. Furst, and the writer is the designing and constructing engineer.

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Electric Traction is to replace steam on several important English suburban roads, according to recent announcements. The single-phase system of the London, Brighton & South Coast Ry. in England is to be extended, so as to include the suburban lines extending from London to Croydon, Purley and Coulsden, and to Cheam. As noted in "Engineering News" of June 8, 1911, service on parts of the Brighton road has been operated for over three years under this system. The first extension beyond the initial and experimental development was on the Victoria-Crystal Palace line, as noted in our former issue, and so far the equivalent of about 70 miles of single track is under single-phase traction. The proposed changes will bring this up to 220 miles. The present rolling stock consists of 50 motor coaches, and this will be increased to 200. Energy is bought from the London Electric Supply Corporation at present, and it is intended to purchase all current required for the enlarged system from this company. This will require the addition of something like 50,000 kw. in additional capacity, making the corporation's station at Deptford one of the largest in the country. There still will be a stretch, some 35 miles long, to Brighton to be electrified, and two similar lines which probably will not be converted under present conditions.

It is reported that the London & Southwestern Ry. Co. has definitely decided to begin the electrification of suburban lines by equipping the circular route from Waterloo to Wimbleton, Kingston, Twickenham, Richmond, and back to Waterloo again, and a connecting link with the existing line between East Putney and Wimbleton. The company has decided upon the direct-current third rail system at 600 volts, with return current in the running rails. This decision was effected largely by the fact that other London electric lines, including the Metropolitan District system, whose trains run through Richmond and Wimbleton over the Southwestern company's rails use direct current at this voltage. The company proposes to erect its own power house with a capacity of 25,000 kw. Three-phase energy will be transmitted and converted with rotating machinery at five substations. The trackage noted is equivalent to about 73 miles single track. The other portions of the system which it is proposed to convert present a further length of 173 miles, single track.

In "Engineering News," Apr. 11, 1912, the improvements inaugurated by the London & Northwestern Ry. were noted, including the construction of the new electric line from Euston to Watford, running alongside the main line and intended to relieve the latter of its suburban traffic, together with the electrification of the various lines to Camdentown, Willesden, Earlsport, etc. The system of electric traction adopted is the direct-current, 600-volt, using third and fourth rails in accordance with the system already adopted by the Metropolitan District Ry., which leaves the running rails free for the installation of track circuits and automatic signals. The company will have its own power station near Wembley station where a good supply of water is obtainable. The initial capacity will be 25,000 kw., in steam turbine generators; the station will work on a 11,000-volt, three-phase, 25-cycle system.

The Reclamation of Ancient Babylonia By Irrigation

By Edgar J. Banks*

"Egypt is the gift of the Nile." is a true saying and as old as the history of Herodotus; but the Nile is not the only river which has given a great and famous country to the world. The Tigris and the Euphrates, rising in the mountains of Armenia, have carried down and deposited much of the best of that country at their mouths. It was thus Babylonia came into existence.



Fig. 1. Map of Babylonia; a Once Fertile Country about to be Reclaimed at a Cost of $60,000,000

It is estimated that the Persian Gulf is growing shorter, or that Babylonia is growing longer, at the rate of a mile every 30 years. There was a time when the Persian Gulf extended northward about 250 miles farther than it does now, or to Bagdad. There, at the city of the Caliphs, the alluvial plain of Babylonia begins, and the rolling, stony Assyria ends. The alluvial Babylonian plain is one of the most fertile lands of the world.

As far back as Babylonian history goes, and excavations in the ruins of the Mesopotamian cities have yielded a mass of records of some 6000 years ago, the fertility of Babylonia was maintained by means of an extensive and intricate system of irrigation canals. Great canals, as large as rivers, ran parallel with the Tigris and Euphrates, and scores of others intersected the valley, connecting the two streams. There was scarcely a corner of the entire country which was not well watered; and, more than that, the canals served as waterways for the transportation of the crops.

Some 2500 years ago the city of Babylon fell. Less civilized people overran and occupied the fertile valley. The old canals were allowed to become choked up with silt brought down by the rivers in the spring-flood seasons. The date palms died, and in time the country became as dry, and apparently as barren, as any part of the Arabian desert. For centuries the valley has been scarcely more than a grazing ground for great herds of camels belonging to desert tribes.

However, two of the old canals have remained open, and during the season of high water they are navigable for the native craft. Only here and there along their shores and along the shores of the rivers are small patches of cultivated land, as rich as in the days of old, when Herodotus refused to speak of the fertility of Babylonia; for he thought that none would believe him. Southern Babylonia, which is more or less a huge swamp, is still the date garden of the world; but as you wander north and south through the center of the country, crossing every few miles the bed of an ancient canal, it is evident that all Babylonia was once a garden spot.

A dozen years ago Sir William Willcocks, the constructor of the great Nile dam at Assuan, visited Babylonia to investigate the old system of canalization, with a view to reviving it and reclaiming the country. He became enthusiastic over its great possibilities, yet at the time, under the old régime in Turkey, nothing could be done.

The former attitude of the Turkish government may be illustrated by a story told of an Arab peasant who owned some land along the Tigris. One day the Arab came to Bagdad to obtain the governor's permission to dig a ditch from the river out to his land to water it. The governor listened to the petition, and then gravely remarked, "that when Allah created the world, he made the Tigris River to carry the water from the mountains of Armenia down to the Persian Gulf, and if Allah had wished for a ditch out to his land, he would have dug one when he created the world."

Under the new régime, the attitude of the Turks has changed. Again Sir William Willcocks went to Babylonia, this time at the invitation of the Turkish government, and every facility was given him to study the conditions. As a result, Babylonia is being reclaimed; already Sir William's great project is being carried into execution. A system of canals as extensive and as complicated, perhaps, as that of the ancient Babylonians, is



Fig. 2. Bed of an Ancient Irrigation Canal under Cultivation

under way, and again Babylonia promises to become a productive as in the days of Herodotus.

The irrigation project is so extensive that under the most favorable conditions more than half a century will be required for its completion. The estimated cost is in the vicinity of $60,000,000—a huge sum for a debt-ridden country like Turkey. The value the reclamation work will be to the country is, however, almost beyond computation.

The first step in the construction of the irrigation system is the building of a large dam across the Euphrates near Feluja, north of the ruins of the ancient city of

*Greenfield, Mass. (Mr. Banks recently returned from a trip through Babylonia.—Ed.)

Babylon. That dam, now nearing completion, will control the waters of the river, releasing them to flow down the Euphrates bed, or down the Hindieh, a parallel stream, as they are needed. Higher up the Euphrates, near Hit, another dam is being constructed in connection with a canal to reach across the valley to the Tigris, and to carry away the silt-laden floods of the springtime, thus preventing the choking up of the smaller irrigating canals below.

The Shatt en-Nil and the Shatt el-Hai, old Babylonian canals, still containing water during a part of the year, and others long filled up, are to be reopened. A score of streams connecting the Tigris and Euphrates,



FIG. 3. WHEEL OPERATED BY CURRENT FOR RAISING WATER FOR IRRIGATION

will carry the water of the rivers to every part of the lower valley. The great malarial swamps of Southern Babylonia, parts of which are uninhabited and almost impenetrable, will no longer receive much of the water now flowing into them; then the remaining surplus water may be drained away, and the extent of the date-bearing region of Babylonia will be enormously increased.

Most of the soil of Babylonia, idle for two thousand years or more, is saturated with salt; in some places the surface is incrusted with it. The irrigation project provides for a secondary system of canals running throughout the valley, to cleanse the soil by washing the salt away, and carrying it down to the Persian Gulf.

The work of construction is in the hands of a British corporation, and is paid for by the Turkish government as sections of it are completed. Thirty British engineers and thousands of native workmen are employed. So great is the area of the country which will be reclaimed that the engineers fear that people enough to take up the land cannot be found as they are needed. Already the Arabs are pouring in from the north, yet the Arabs of all the tribes might settle in Babylonia, and then there would be land to spare.

At the present time there are two lines of steamboats on the Tigris River, running between Bagdad and Busreh, one British and one Turkish. Half a dozen boats carry practically all the freight to and from Bagdad; caravans of camels, laden with heavy merchandise, now seldom cross the desert. The boats, drawing only about 3 ft. of water, find difficulty during the dry season in navigating the shallow river; and when the greater part of the water shall be used for irrigating purposes, river navigation must cease. However, probably long before then, a railroad will be constructed along the Tigris shore, and the journey between Bagdad and Busreh, which now sometimes requires a week, may be made in a single day.

Along with the government irrigation scheme, the Bagdad railroad is assisting in reclaiming Babylonia. On the western side of the desert, the road, which has been under construction for several years, has reached the Euphrates. In the autumn of 1912, work was begun at the Bagdad end. Two locomotives, the first ever seen in Bagdad, were brought by boat up the river; storehouses, hospitals and homes for the officials have been constructed, and the work of laying the tracks has begun. The Germans, who are building the railroad, estimate that in three years the two ends will meet somewhere in the desert to the west of Mosul or the ruins of Nineveh. The entire track from Constantinople to Bagdad, including the Anatolian railroad through Asia Minor, will be 2600 km. in length, and then the journey, now exceedingly difficult and requiring a month or more, may be made in three days. Bagdad, so long shut off from the civilized world, will then be on the track of the tourist, and there will be an easy outlet for all the crops that Babylonia can produce.

It is still to be seen what effect the war in Turkey will have on these two projects. The Germans openly acknowledge that they expect complications to arise which will compel them to stop their work, and in the meantime they are pushing it with all possible speed. Money in Turkey is scarce; the war has impoverished the country and is disheartening the Turks, and strange would it be if work on the irrigating project is not hampered or temporarily suspended.

In the meantime the flat-bottomed boats will continue to ply the Tigris, and the great irrigating wheels on the Euphrates, turned by the current, just as they have been for the past two thousand years, will continue to water the little gardens along the shores. But ultimately, the Babylonian desert, now brown and barren from drought, will be brown from the ripening grain, and the "iron horse," more wonderful to the Arabs than Solomon's magic carpet, will bear the grain to the markets beyond the desert, and bring back gold.

⁂

Street Paving in Walla Walla, Wash., is reviewed in the 1912 annual report of W. R. Rehorn, city engineer—the first city engineer's report for Walla Walla ever made, Mr. Rehorn states. Walla Walla has a total area of 3.9 sq.mi. Of its 66.6 miles of 40- to 100-ft. streets 40.3 miles are "improved" (graded) and 13 miles have been paved, including nearly three miles of macadam. About half of the street mileage is composed of streets 70, 80 (26.87) and 100 ft. in width.

Asphalt pavements totaling 148,900 sq.yd. in area and 5.65 miles in length have been laid from 1904 to date at an average cost of $2.15 per sq.yd. Some of the 1904 asphalt "is now in poor condition and is in need of repairs."

Bitulithic was laid in 1905-6 to the extent of 64,820 sq.yd., on 2.24 miles of streets, at an average cost of $2.17 per sq.yd. The report states that the bitulithic "has given satisfaction, but a portion of it is showing the need of a top coat, or what is known as a squeegee coat."

Concrete pavement has been laid in alleys, beginning with 1911, to a total of 8155 sq.yd. or 0.80 miles, at an average cost of $1.25 per sq.yd. So far it has been satisfactory.

Dolarway totaling 13,000 sq.yd. or a length of 0.73 miles was laid in the fall of 1912, under a five-year guarantee bond, at an average cost of $1.30 per sq.yd.

The total cost of 9.42 miles of street improvements (asphalt, bitulithic, concrete and dolarway), including grading, draining, paving and curbing, was $637,857 or nearly $6700 a mile. A small yardage of brick gutter paving, in the streets first paved with asphalt, cost $3.50 per sq.yd.

The Karns Tunneling Machine

By O. J. Grimes*

The latest idea in tunnel boring, the Karns tunneling machine, is operated similarly to the small air drill now used in drilling and blasting. It simply takes the place of the drill steel that goes into the chuck of the air drill except that it is heavier and must have a supporting carriage. The motion of the machine in operation is exactly the same as that of the small drill, the blows being delivered against the obstruction by direct forward motion. On the back stroke, the reciprocating parts turn slightly by means of a rotating device, similar to the rifle nut in the small drill, so that with each succeeding blow the cutting points strike the rock at a different place. The rock, instead of being ground into dust, falls down in small chips, resulting in more rapid progress.



Fig. 1. Karns Tunneling Machine with Drill Head 6 Ft. in Diameter

The latest and largest machine constructed has a cutting head 6 ft. in diameter. It is not a combination of individual drills, but is a single drill with innumerable points, striking simultaneously and rapidly.

There are 41 cutter blades made of tool steel, each 1 in. thick, 5 in. wide and of various lengths. Points like saw teeth are machined on one edge and the other edge is fastened in the face of the head. These cutter blades are set in grooves 1 in. deep and backed on one side by an extra inch, to resist the pressure of the cut rock at the bottom when the head is turning. They are held in these grooves by two hook bolts to each cutter, which pass through the head and hold them firmly in place.

To remove the cutters, the nuts on the hook bolts are unscrewed about 1 in., permitting the cutters to be pulled forward and slipped off the ends of the bolts. The entire set of cutters may be removed and replaced in about 2 hr. One set will drive from 25 to 75 ft. of tunnel, depending on the hardness of the rock, although 97 ft. have been driven without a change.

The reciprocating parts of this machine weigh 7¼ tons. This weight is thrown against the rock about 140 times a minute, each blow making a working stroke of 7 in., cutting from 2 to 4 ft. of tunnel per hour.

The cylinders are inclosed in a shell and connected to the supporting parts of the operating machine by heavy rods. The shell supporting the cylinders is held firmly in place by four columns, two in front and two in the rear, jacked to the top and bottom of the tunnel. The columns, shell and machine are advanced simultaneously with each 6 ft. of tunnel driven. The weight of the machine rests on four wheels under the supporting carriage which run on heavy steel tracks on each side. These tracks are fastened to and move along with the carriage, eliminating the setting of tracks a second time.

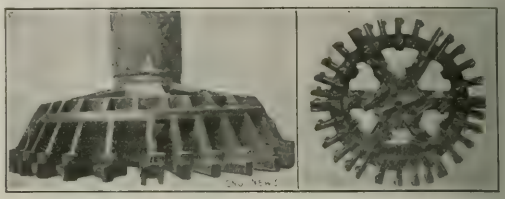


Fig. 2. Views of Rough Casting for Head of Karns Tunneling Machine

In the front cap of the machine are the front bearings, consisting of 48 steel balls, 3 in. in diameter, resting in 12 straight grooves, planed on the outside of the hub of the head casting. The other half of the grooves or bearings are on the inside of the heavy steel nut encircling the hub. The back bearings are under the rear cap and are similar to the front, except there are but 8 races of 3-in. balls, three in each row.

The middle cap covers the rotating device. It is the same as the front and back bearing except that the races

*Snow Apartments, Salt Lake City, Utah



Fig. 3. A 6-ft. Diameter Tunnel Driven with the Karns Machine

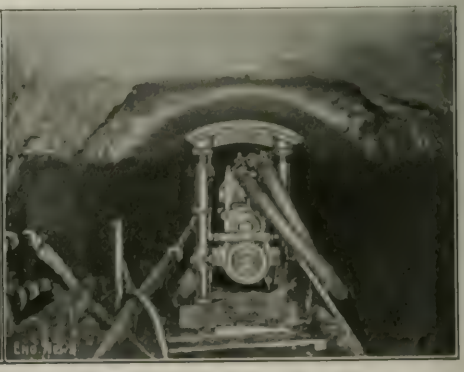


Fig. 4. Rear View of Karns Machine in Johnstown, Penn., Tunnel

for the 3-in. balls are spiral. There are four races with three balls in each race. On the outside of the steel nut there are ratchet teeth with dogs to drop into them on the back stroke and hold the nut from turning. This compels the shaft within to turn, as the ball races are spiral. On the forward stroke the motion is reversed and the nut turns, the dogs simply sliding over the ratchet teeth on the nut.

Having been fed ahead 6 ft., the moving up of the shell and holding columns under the cylinders on the feed screw is a very simple matter and requires but a few minutes. There is a truck under the shell supported by four wide-tired wheels on the rock. To move up, the columns are unjacked and made free. Then by a worm gear the surface of the supporting truck is raised so that the entire weight of the shell and columns rests on the truck. This done it is simply a matter of turning the feed screw which pulls all under the cylinders again. The surface of the truck is then lowered and the columns rest on the rock, the jacks at the top are tightened and all is ready for driving another 6 ft. of tunnel.

The engine driving this machine is a double, 9½-in., tandem cylinder, with an extreme stroke of 8¼ in.

To operate a machine of this size, 2000 cu.ft. of air per minute are required, but a plant capable of furnishing 3000 cu.ft. per minute is always installed. The purpose of the excess air is to make it easier on the compressor and boilers, thereby lengthening their lives, and to always have extra power available if a long stretch of very hard rock should be encountered. In such cases the additional air is used and the machine operated more rapidly, delivering much harder blows, with the result that the average speed is maintained throughout the work. A boiler of about 400 hp. is necessary to operate an air compressor of the required capacity.

To operate the machine on each shift, one runner and helper, two muckers, one engineer and a fireman are necessary. A blacksmith and helper are required one shift in three. The cost per foot to drive a tunnel with this machine ranges from $1 to $5, according to the rock and cost of fuel and labor at the place of installation.

Tunnels of large size can be driven quickly, safely and cheaply. If a round tunnel 18 ft. in diameter is desired, a tunnel 6 ft. in diameter may be driven through the center, and from it holes drilled 6 ft. deep in a circle with a small air drill. When blasted, the tunnel will be broken the full 18 ft. In enlarging, the rock will be shot into the tunnel, where there is sufficient room for handling the débris. The small tunnel acts as an air course through which the powder smoke passes, eliminating delays and expense now experienced in getting rid of it.

It was the idea of the late David H. Moffat to use a Karns machine to drive the gigantic tunnel through the divide on the line of his railroad, the Denver, Northwestern & Pacific. He went so far as to have a model 18 ft. in diameter constructed, but his untimely death halted all preparations.

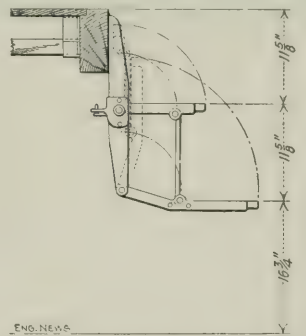
The tests to which the Karns machines have been subjected were severe and practical. The first was made with a machine 52 in. in diameter through more than 100 ft. of solid granite near Boulder, Colo. The most recent demonstration was a tunnel 6 ft. in diameter and 200 ft. long, driven for the Valley Coal & Stone Co., near Johnstown, Penn. To show the adaptability of the machine to requirements, a 10° curve was driven as shown in the photograph.

The machine is controlled by the J. P. Karns Tunneling Machine Co., Mercantile Bank Building, Boulder, Colo. The inventor, J. P. Karns, President of the company, has offices at 518 Citizens Building, Cleveland, Ohio.

The Committee on Science and the Arts of the Franklin Institute, Philadelphia, last year awarded the Edward Longstreth medal to Mr. Karns for his invention of the tunneling machine.

High Street-car Platforms with a Double Folding Step

The cars recently built for the Muskogee Electric Traction Co., in Oklahoma, show many features of novelty and interest; for instance, extremely light weight for a double-track 45-ft. car. This weight has been secured partially with the use of platforms level with the car floor, instead of the drop type, and very light side and corner posts. The omission of bulkheads and the use of level platforms, which are but 5 ft. long, has made possible a large body with a seating capacity of 52 persons, 44 occupying flat-back cross seats and eight on longitudinal seats near each corner post.



Double Folding Steps for Street Cars of Muskogee Electric Traction Co.

The cars are arranged for prepayment operation, except that some of the usual railings are omitted. The platforms are fitted with doors on both sides—on one side of each platform there being a single door at the motorman's right for exit only, with two on the other side for both exit and entrance when the car is running in the opposite direction. The entrance and exit doors are pivoted and work in unison with double folding steps. These were required in order to get a sufficiently low step with the very high platforms which were necessary in this construction. The arrangement of the step is shown in the accompanying diagram. The cars were built by the J. G. Brill Co., of Philadelphia.

Depth of New Welland Canal—The Canadian Minister of Railways and Canals announced at the recent meeting of the Dominion Marine Association held at Toronto, that it had been definitely decided to make the locks of the new Welland Canal 30 ft. deep, although the canal itself will be but 24½ ft. deep for the present. The locks are to be built large enough to accommodate vessels 600 ft. long.

Large Fish Hatchery for the State of Kansas

By L. M. Bush*

The new Kansas State Fish Hatchery, located at Pratt, Kan., was put into operation on Nov. 1 and is the largest plant of its kind in the world. The hatchery is intended to furnish enough small fish to stock all the streams of the state, and all private ponds whose owners request fish.

of 6.5 ft., and the other twelve have a 3.5-ft. depth. In all the ponds, the depth of water decreases near the shore to about 1 ft. The shallow ponds are each connected to a deep pond immediately adjoining it by a concrete culvert or distributor having no sluice gates. Slots in the walls of these distributors will permit screens to be inserted and the small bass, with which such ponds are stocked, may pass through the screens into the shallow water of the upper pond and be protected from the larger fish in the deep-water pond.

The pond embankments vary in width of crown from



Fig. 1. Intake Chamber and Section of Completed Concrete Dam



Fig. 2. Concrete Culvert Regulating Flow to Individual Ponds

The water supply for the hatchery is obtained by diverting the flow of the Ninnescah River by means of a low concrete dam, 500 ft. in length. This dam was constructed on a foundation protected by wooden sheet-piling, the piling penetrating into the clay subsoil. A concrete intake chamber (shown in Fig. 1), built at the east end of the dam, contains the central gates by which the water may be admitted into the conduit, or turned through a blow-off pipe into the river below the dam.

6 ft. to 12 ft., with 2 on 1 side slopes, the crown being 1.5 ft. above the water surface. All banks between ponds of different depths are of 6-ft. crown, and all roadways are of 12-ft. crown. All other banks are built with an 8-ft. crown. The flow of water among the ponds is by gravity, the water surface of each pond being at least 6 in. lower than that of the pond immediately above it. The elevations of the water surfaces are shown on the plan, Fig. 3.

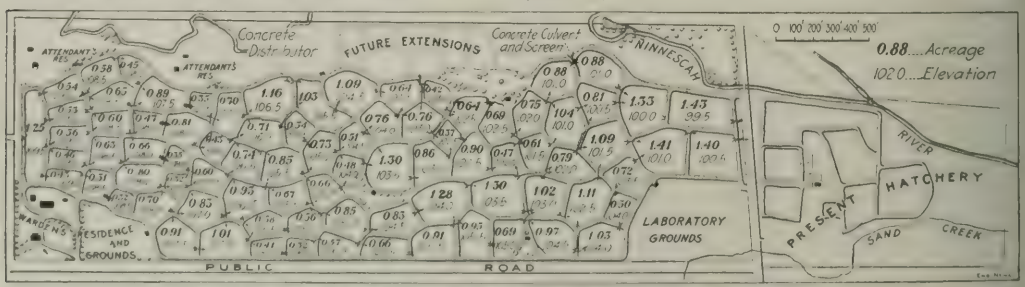


Fig. 3. Plan of the Kansas State Fish Hatchery, at Pratt, Kan.

The water-supply conduit is a 21-in. vitrified clay pipe laid on a 0.113% grade from the intake portal to the hatchery grounds, 6875 ft. distant.

The pond system at the hatchery grounds (shown in Fig. 3) consists of 83 ponds of various sizes, having a total water surface of 65 acres. The water-surface area of each pond in acres is shown on the plan, Fig. 3. Seventy-one of the ponds have a maximum depth of water

Concrete distributors (shown in Fig. 2), equipped with sluice gates, are built in the bank of each deep pond and have service pipes leading to the ponds below. Some of the distributors have two service pipes leading to different ponds, and others only one, depending on their locality in the system. Ordinarily only one service pipe from each distributor will be in use, but in case one of the ponds is drained the flow of water can be diverted into some other pond. Each distributor is equipped with

*Assistant Resident Engineer, Pratt, Kan.

splash planks, fitting in slots in the walls, to maintain the head in the pond and with two sets of screens for keeping the fish in the ponds.

The drain-pipe lines for the pond system are laid beneath the embankments and connect each distributor with the main drain, which has an outlet to the river. Each distributor has an 8-in. sluice gate controlling the opening to the drain line and, by means of this, any pond may be drained without disturbing the other ponds. The exception to this is the case of a deep and shallow pond connected by a culvert, both of which are drained at the same time.

The most important items entering into the construction of the hatchery were 6915 ft. of 21-in. vitrified clay pipe, 880 ft. of 12-in., 3875 ft. of 10-in., 16,250 ft. of 8-in. vitrified clay pipe, and 140 galvanized-iron screens. Ninety-four small concrete structures were built, to which 193 bronze fitted sluice gates were attached. The total earthwork for the pond embankments amounted to 126,000 cu.yd. The cost of the entire plant was $60,000.

The hatchery plant was designed by Prof. W. C. Hoad, formerly of the University of Kansas, but now of the University of Michigan, and was built under the direction of Prof. L. L. Dyche, State Fish and Game Warden. The contract work was done by James A. Greene & Co., of Chicago, Ill.

Embedded Radiation for Heating Buildings

A low-temperature-radiation heating system, devised by A. H. Barker, has been applied recently to a group of buildings in Liverpool, England, the Royal Liver Buildings. This particular installation uses hot water and has about 120,000 sq.ft. of radiating surface. The system is applicable to steam heating also. It is described by the term "hot panel and hot floor border system," and consists in heating pipes embedded in the floor and the walls near the surface, the pipes being arranged in vertical panels in the walls and in strips around the floor of the room. The embedding material is a semi-conducting composition whose nature is not stated.

The installation in question was described recently by Capt. H. R. Sankey, R. E., in a lecture before the Junior Institution of Engineers (London, England). He stated that experience in the Royal Liver Buildings indicates that the "hot panel and hot floor border system" requires about the same amount of radiating surface as when ordinary hot-water radiators are used, but that the heating apparatus and the distribution system can be about 20% smaller on account of the greater efficiency of heating.

In the Royal Liver Buildings the installation of wall panels consists of iron-frame units containing ½-in. drawn lap-welded pipe bent backward and forward, and embedded in the semi-conducting composition already mentioned. The hot floor border consists of similar ½-in. drawn-steel pipe (not bent backward and forward, however), embedded about an inch below the floor in a strip running around the room near the wall, 6 to 18 in. wide.

The wall panels are vertical, and are set about 1½ in. away from the wall; the space behind is connected with the outside by a fresh-air grating and with the room by way of a register. The main wall behind each heating panel is coated with non-conducting plaster; the radiation by which the room is chiefly warmed is given out from the front of the panel and the side facing the wall serves to heat the incoming air. Floor borders are formed on two or more sides of each room according to the requirements. The corridors have borders 6 in. wide formed along each side for the full length of the corridor. The material in which the floor pipes are embedded is also used as a floor covering on the remainder of the floor and thus joints are avoided.

The floor borders and wall panels are controlled by separate valves and in the corridors the floor borders are divided up into sections separately controlled for adjusting the heat to the requirements. Generally a surface temperature of 100 to 110° F. is maintained.

All joints in the ½-in. heating pipes were welded by oxyacetylene flame. The installation (which, as already noted, contains about 120,000 sq.ft. of radiating surface) has 30,000 oxyacetylene welds; none of these has leaked since the installation was completed in 1911. Barry electrically-indicating thermometers are provided at different points in the building and they can be read from the heater room, thus giving the necessary indications for controlling the amount of heat supplied.

The same system has been applied in a new building of the Amalgamated Press in Farringdon St., Liverpool, and in the Midland Adelphi Hotel. In the former case the main staircase, which has its wall faced with marble, is fitted with heating panels in the frieze between the top of the marble casing and the ceiling. These panels are about 12 in. wide. In another place in the building the heating panels were placed in the ceiling. In both instances it is claimed the heating appears to be just as effective as that at the floor level.

A Large Masonry Arch Bridge has recently been completed across the River Thur in Switzerland on the new railway, between Ebnat and Neslau. The main arch of this bridge has a clear span of 207.6 ft. (63.26 m.), and a span from center to center of the rib at the skewback of 214.3 ft. The rise of the arch is 45.4 ft., and the ribs vary in thickness from 8.9 ft. at the skewback to 5.9 ft. at the crown. The roadway is 14.0 ft. wide between railways and carries a single-track railway line. It is carried on spandrel arches resting on spandrel columns, which in turn rest on the single-barrel arch. The rib is built alternating three and four rows of cut stone voussoirs.

Excavating Machinery for Land Drainage is being introduced in the Southeastern Drainage District of the State of South Australia. This district comprises an area of nearly 2,000,000 acres, which requires an elaborate system of drainage for proper utilization of the land. At present the system is complete for a small area only, around the township of Millicent. The drainage works have been in progress for several years, but until last year the process of excavation had been very primitive, and it is only during the last twelve months that machinery has been employed on the works. Previously, the method was not only primitive, but the progress was slow. The varied nature of the materials to be removed, however, has always made the work interesting, and it is this varied nature of the ground which has been unsuitable for many of the machines of recent invention and design. During the latter part of 1912 the District erected two Ruston & Proctor 17-ton steam shovels (with a bucket capacity of 2½ cu.yd.), one Bucyrus drag-line scraper of 1½ cu.yd. capacity, and one Priestman grab bucket excavator. In January, 1913, it was erecting one centrifugal pump dredge, and an Austin excavating machine. The district has constructed 1000 miles of drains varying in size up to 50 ft. bottom width, at a total expenditure of $2,000,000. F. N. Burchell, who is located at Beachport, is Superintending Officer of the Southeastern Drainage District, under the Engineer-in-Chief's Department of the state government, and has been connected with the works for about 30 years.

Sewage Pollution of Lake Michigan from the Calumet District

The problem of checking the present and increasing sewage pollution of the Grand Calumet and Little Calumet rivers and the south end of Lake Michigan is complicated by the fact that the district from which this pollution comes is divided by the Illinois-Indiana state line, which thus arbitrarily limits the jurisdiction of authorities having regulating power. On the Illinois side, the district is within the boundaries of the Sanitary District of Chicago, but there is no corresponding authority on the Indiana side. The serious conditions of pollution at this part of the lake, and its relation to the public health of several towns and cities have been reviewed in our columns,* and the Sanitary District of Chicago has recently called the attention of Governor Marshall of Indiana to the necessity of taking some steps for the control of the situation by some public authority. It is pointed out that the Indiana State Board of Health has called attention to the existing nuisance in the Calumet River at Hammond and the adjoining towns, and has emphasized the prevalence of extremely high typhoid rates, which indicate polluted water wherever taken from the southern end of the lake.

The Sanitary District of Chicago is now constructing a canal from the Calumet River to communicate with the main drainage channel at the "Sag," in order to divert the sewage of the southern part of Chicago from Lake Michigan, and it is believed that when this is completed the Indiana cities should be prepared to keep their end of Lake Michigan reasonably free from pollution. If they wish to divert the sewage from the lake and to turn it into the Calumet River, the Sanitary District will require that the effluent be in such shape as to require no additional oxygen for its purification. The opinion of the engineers of the Sanitary District is that the most good can be accomplished by the organization of a sanitary district in northern Indiana, which will include all towns draining into the Grand Calumet and Little Calumet rivers and Lake Michigan. The population is growing fast and spreading, so that conditions are rapidly becoming worse and affecting a greater territory. A nonputrescible effluent from Indiana will, therefore, be a necessity if it is taken into the Calumet-Sag Canal. The engineers have made a preliminary study of a system for the sewage of the Calumet district in Indiana, including not only intercepting sewers and sewage-pumping stations, but also complete treatment works, including grit chambers, Imhoff tanks, sprinkling filters and secondary settling basins. By this combination a very stable effluent will be secured, which will require no additional oxygen from diluting water, and will prevent a nuisance in the Calumet River as well as prevent the formation of sludge deposits. The total estimated cost of the works, including allowance for engineering and contingencies, is $1,758,238, with an annual cost of $211,570, including interest and depreciation as well as operating charges. This, however, does not cover the cost of the treatment required at Gary, Ind. Excessive storm water flows are to be diverted to the river without treatment, but should it be decided to disinfect the portion of the storm water discharged in Illinois, the Indiana portion of such water should be disinfected also.

* "Engineering News" June 16, 1910 and Nov. 18, 1909.

Some Curious Exhibits at the 1913 Motor Boat Show in New York City

A considerable part of the space at the annual Motor Boat Show, held at Madison Square Garden during the week of Feb. 15-22, was devoted to the exhibition of various styles of hydroplane boats. Single and multiple stepped, V-shaped, and center-slotted bottoms were shown and the bow shapes ranged from the vertical to the modified scow type. There seemed to be no standard type or design of motor, and the number of cylinders appeared to bear not the slightest relation to the size or power requirements of the engines. Some small six-cylinder motors were shown, also some large two- and four-cylinder engines.

A model of the "Baby Reliance II," and the original "Peter Pan V" were among the features exhibited which attracted most attention. Each of these boats has made a speed above 40 m.p.h. Another boat shown was a 40-ft. hydroplane designed for 65 m.p.h. and "guaranteed" for 60 m.p.h. This boat has not yet had an opportunity to prove its ability to achieve such a speed.

The Curtiss Flying Boat is a hybrid craft which can either roll, float or fly, so that it is at home on the earth, in the water or in the air. The boat hull is of wood, 26 ft. long, with a beam of about 4 ft. Small wheels, which can be raised and lowered at will, enable the boat to travel on fairly level ground, such as a smooth road or beach. A superstructure carrying biplane wings is attached to the boat near the center and carries the driving motor and single large propeller. The boat is driven by this air propeller whether traveling on land, water or air, and with it speeds of 50 m.p.h. on the water and over 60 m.p.h. in the air are claimed. The weight of the Flying Boat completely equipped is about 1300 lb.

The engine used in this craft is an 8-cylinder, 4-cycle machine, with two sets of cylinders set 90° apart. The engine weighs about 290 lb. and is rated at 75 hp.

Notable engineering skill has been displayed in working out the problem of controlling the operation of this craft in the air. The designer has contrived to produce stability automatically by the natural motions of the driver in maintaining his own equilibrium. The steering wheel is double, so that either of the two occupants can guide the machine without moving from his seat. The turning of this wheel controls the lateral turning of the machine. The raising and lowering operations are controlled by the relative positions of the steering wheel shaft, which is pivoted at its lower end so that it swings freely in a fore and aft direction. In case the craft should show a sudden tendency to rise, the operator would naturally lean forward to maintain his own equilibrium, and this movement communicated to the steering-wheel shaft, acts to force the craft back to a stable position. A similar righting action is exerted in case the plane tends to dip downward. To help in maintaining a stable condition while making turns, the boat is equipped with two small auxiliary planes between and at the extremities of the main planes. These smaller planes are actuated by a system of levers so connected that, when on turning the machine tends to dip too much to one side or the other, the natural tendency of the occupant to lean toward the high side will operate to restore equilibrium.

EDITORIALS

Closely following the death of the great American engineer, John Fritz, comes the news of the death of one of the most eminent engineers of Great Britain, Sir William White. As many of our readers will recall, Sir William was the recipient of the John Fritz medal from the Board of Award representing the engineering societies of America at a notable gathering in New York City in the fall of 1911.

Few English engineers of the present day were as widely known in the United States as Sir William White, and none has won a wider circle of friends. Readers of the biography of John Fritz, which we printed a fortnight ago, will be interested to compare his career with that of the famous English engineer. Each of these men achieved the highest pinnacle of professional honor and success, and were loved by fellow members of their profession throughout a wide circle as few men have been. Each of these men won his notable success solely by his own industry and ability and fine personal qualities.

It has been well said that to achieve great success constitutes one of the severest tests to which any man can be subjected. Different as these two great engineers were in many personal qualities, they were alike in this, that success left them absolutely unspoiled. Modesty, simplicity and genuineness were essential notes in the character of each. The many American engineers who knew Sir William White will unite with their British brethren in deep regret that he was not spared to enjoy for many more years the honors he had so well earned.

More Information Concerning Tunneling Machines

Four or five years ago, as many of our readers will recall, there was considerable agitation concerning the development of machines for driving tunnels by chopping the rock into chips by mechanical power. A number of such machines were invented and a few were actually built and tried. On page 572 of our issue of May 27, 1909, a brief review and description was given of a number of these machines.

It is scarcely strange that the years which have elapsed since that time have not been sufficient to bring any of these machines to commercial success, for the mechanical difficulties involved in the design of such a machine are extremely great. Many engineers indeed think they are so great as to be insurmountable. The problem is one, moreover, where experimenting must be done on a large scale and involves heavy expense; and the usual difficulties of inventors in securing capital for revolutionary new devices are quite sufficient to account for the slow progress of the tunneling machine.

The inventors, however, have not given up the fight. A few months ago we inspected a new tunneling machine built by Dr. Olin F. Proctor in a machine shop in New York City, which has since that time, we understand, been subjected to actual trial. Elsewhere in this issue a contributor in Salt Lake City gives an account of the Karns machine, considerably fuller than any which has been heretofore published. We have information from other sources that the late David H. Moffatt and his associates gave serious consideration to the Karns tunneling machine for driving their projected great tunnel through the Continental divide.

It is noteworthy that the proposal of those backing the Karns machine is not to drive full-sized railway tunnels, but only an advance heading 6 ft. or so in diameter. Ordinary drilling and blasting methods would then be used to enlarge the heading to the final cross-section desired.

A difficulty which would be met in this method of operation, however, would be the trouble in keeping intact the large compressed-air mains which are required to supply the air to the tunneling machine. These mains would be liable to frequent breakage if drilling and blasting were going on at the bench behind the machine. Of course, where time was not important, the tunneling machine could be driven clear through the heading first and the bench could be taken out afterward.

Without being too sanguine as to the ultimate success of tunneling machines, it may at least be said that their inventors deserve some credit for their courage and persistency in endeavoring to perfect their devices considering the very great difficulties which they have in face.

The Financial Aspect of Railway Terminal Electrification

Eight or ten years ago numerous projects were in the air for the operation of railway terminal and suburban lines by electricity. Elaborate investigations were carried out for a number of important railways looking to the electrification of terminal and suburban lines in the vicinity of New York, Boston, Chicago, and, we believe, one or two other cities.

One hears not infrequently the inquiry from laymen as to why nothing further is being done toward carrying these various projects into effect. An excellent answer to such inquiries is furnished in the recent testimony given by James J. Hustis, Vice-President of the New York Central R.R. and in charge of the Boston & Albany R.R., which is leased by the Central, before the railroad committee of the Massachusetts Legislature.

That body has now before it a bill which comes up every year compelling the various railways around Boston to adopt electricity for the propulsion of all trains within the city limits. It may be remarked in the first place that in view of the extended experience of the New York Central with electric operation at its New York terminal, Mr. Hustis can speak with large authority on the subject.

At the outset of his testimony Mr. Hustis stated that he did not appear before the committee to oppose electrification, because the question was not whether the railroads should be required to electrify their lines but whether the Boston & Albany R.R. should be required by legislation to incur an annual net loss in its operation of at least half a million dollars a year as the result of such electrification.

Should the legislature decide to require this from the railway company, it must consider what the effect of such legislation would be not only upon the railway company and its property, but upon the public which it serves. We quote further from Mr. Hustis' testimony as follows:

> The railroad recognizes further that certain advantages would accrue to it under electrification. It would, for instance, admit of greater use being made of existing facilities and allow the railroad to expand its suburban service at certain hours of the day, when, under steam operation, the limit of existing facilities has been almost reached. It would be possible also to effect certain economies under electric operation that are not possible under existing conditions. Whether it would add to safety in operation is uncertain, and cannot be determined from the limited experience under electric operation.
>
> To prepare the road, that is, to equip it for electric operation, and remodel the stations, tracks and signals, and to provide the necessary equipment for a proper electric operation for passenger service within the Metropolitan district will cost approximately $6,413,300, after making a very liberal allowance for equipment released. Allowing for the normal increase in travel and for all possible economies under electric operation, it has been carefully estimated that electrification would entail an added net loss in operation of nearly $550,000 per annum.
>
> The gross passenger revenue derived in the district under consideration, including all classes of tickets and the proportion of the revenue on passengers entering and leaving Boston from or for points west of South Framingham, is approximately $1,300,000.

These figures, it is to be noted, are not mere offhand estimates, but were verified by the State Commission of 1911. It should be understood also that these estimates are based on the cost of electrifying the road *for passenger service only.*

It has been proposed that the increased operating expenses should be met by increasing the passenger fares in this district. This would mean, however, that the present fares would have to be raised fully 40%. There is no doubt that the public would not endure such an increase; and further, if it were made, it would defeat its own purpose, for traffic would be diverted to the trolley lines in such an amount that probably the higher fares would yield less revenue than the present fares.

Those who advocate electrification fall back upon the argument that the traffic would be increased thereby; but in order that the company should increase its net passenger earnings sufficient to pay the interest on the investment necessary for electrification, the present volume of passenger traffic would have to be doubled. As Mr. Hustis well says, the posibilities of any such enormous growth in traffic are exceedingly remote.

It should be understood that the estimates above recited cover the cost of electrifying the line for passenger service only. If the company were compelled to electrify all its freight lines as well, the cost would be enormously increased. Mr. Hustis stated that to electrify the Boston & Albany's Grand Junction branch would for the work of grade-crossing elimination alone cost approximately $1,500,000.

In concluding his testimony, Mr. Hustis gave a clear statement of the contrast between the financial condition of his company to-day compared with that of ten or twenty years ago. Since the conditions he recites are true of many other railway companies as well as the Boston & Albany, we quote from his testimony as follows:

> Because the Boston & Albany R.R. was once a prosperous property with ample surplus enabling it to pay 8% and make many expensive improvements from income, it is still assumed that there is no valid reason why it should not continue to do so. It has two principal sources of income, (1) from the transportation of passengers; (2) from the transportation of freight. The balance from mail, express, etc., is relatively small.
>
> The passenger and freight rates have remained practically stationary for the past ten years or more. The rate per passenger mile last year was 1.791c. The rate per ton mile last year was 0.848c. These rates are substantially the same as at the time of the lease to the New York Central in 1900.
>
> Expenses for material and labor have increased tremendously during this period; fuel, for instance, one of the largest single items of expense, being 19% of the total operating expenses, has increased approximately 25% in cost per ton since 1900. Passenger cars, which in 1900 cost $6751, today cost $15,750, an increase of 133%. Freight cars, which in 1900 cost $550, today cost $1025, an increase of 86%. Native ties which in 1900 cost 45c., today cost 65c., an increase of 44%. The cost of lumber has increased about 50%. Passenger locomotives, which in 1900 cost $13,800, today cost $23,700, an increase of 72%. Engine houses for the smaller engines cost $2000 per stall in 1900; today the cost is $7000 per stall, an increase of $150,000 for a thirty-stall house.
>
> While there have been some economies in operation, particularly in the freight service, by reason of the use of heavier power, it has not been at all commensurate with the increase in the cost of equipment. So far as the passenger service is concerned the increased weight of passenger equipment has almost entirely offset the increase in the weight of locomotives.
>
> During this period wages have likewise increased, and this has been particularly true during the past several years when increased wages and improved conditions have resulted in increased compennsation as follows: Engineers, 35%; firemen, 39%; conductors, 34%; trainmen, 42%; yardmen, 54%.
>
> It must be apparent from the foregoing that the operating management of the Boston & Albany is satisfactorily handling a very largely increased traffic at rates which are substantially the same as twelve years ago, and with reasonable expedition, regularity and economy. It has suffered in its operating showing, as have all the railroads, in the enormous increases in expenses, yet its unit costs of operation compare favorably with other roads of similar character. The lessee company has moreover not allowed the yearly deficit since 1906 to stand in the way of appropriating more money for improvements.
>
> It has now reached a point where the volume of business, at the rates which have been in effect for more than a decade, just about enables it to meet its operating expenses, taxes, interest, and rentals, leaving practically no surplus. Any contraction in its volume of business, any reductions in rates, or any additional burdens (such as that proposed by compulsory electrification) would prevent the road from earning its guaranteed rental, and would restore or increase the annual deficit, which on the date of the last report to the Railroad Commission aggregated $5,000,000.

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A Huge Piece of Engineering Work

It is probable that no law ever enacted by Congress, not even excepting the act providing for the construction of the Panama Canal, involves a larger amount of engineering work and a larger outlay of money for engineering services than the Railway Valuation Act which became law last week.

Our readers will recall that a number of the states have already undertaken and carried through a valuation of the railway property within the state. We may mention especially the states of Michigan, Wisconsin and New Jersey in which, we believe, the work has been

most thoroughly done. The records of such state appraisals already made will doubtless be utilized to a considerable extent in the appraisal work to be undertaken by the Federal Government. With these exceptions, the work of valuation will have to be done from the beginning; and particularly in the older states, the amount of research and investigation and overhauling of old records that will have to be gone through with to comply with the law's requirements, is nothing less than appalling.

In view of the great importance of this work to engineers, we have reprinted on another page of this issue the act in full as passed by the Senate on Feb. 24 and concurred in by the House of Representatives on Feb. 27. The bill originated in the House (No. 22,593) and was commonly known as the Adamson Bill. In the Senate, however, the bill was practically entirely rewritten. It is stated that this rewriting was done under the personal guidance of Senator La Follette, with the advice of Dr. B. H. Meyer of the Interstate Commerce Commission.

It should be noted in the first place that the act provides not merely for the valuation of railway property, but of the property of every common carrier subject to the Interstate Commerce Law at the present time, or which may hereafter be brought under its jurisdiction. This means, of course, that the property of water carriers and express companies doing interstate business is likewise subject to valuation.

The Commission is authorized to employ such experts and other assistants as may be necessary to make the appraisal required but nothing is said regarding the rates of compensation of such experts. In fact the act carries no appropriation and in order to make it effective an appropriation of $500,000 has been inserted in the General Deficiency Appropriation Bill.

It is particularly noteworthy that the law definitely specifies that the valuation is to be in detail. An inventory of all the property of every common carrier is to be made, and for each and every piece of property there must be ascertained and reported in detail: (1) its original cost and all that has been expended upon it since; (2) the cost at the present time of its reproduction new; (3) the cost of its reproduction less its depreciation.

In obtaining these figures of cost, no haphazard estimate will do, for the law demands specifically that an analysis of the method by which these several costs are obtained must be furnished.

The above refers to the appraisal of the physical property only. The Commission is instructed to ascertain and report separately other values and elements of value if any in the property of each common carrier. This clause refers doubtless to such elements as franchises, good will, etc.

A question as to the right of a public service corporation to earnings on the unearned increment in the value of its real estate holdings is suggested by a clause which requires that the appraisers shall report in detail:

> First, the original cost of all land, rights-of-way and terminals in use at the time they were acquired; secondly, the present value of the same, and, thirdly, the original and present cost of condemnation and damages or other expenditures incurred by the railway in their acquirement in excess of their original cost or present value.

Clause 4 of the law is one which will require, in New England and the Middle States especially, an amount of antiquarian delving into old records that would rival the labors of a genealogist. This clause requires the Commission to investigate the history and organization of the present and any previous corporations operating the property, to report upon any increases or decreases in stocks, bonds or other securities, upon the moneys received by any issues of securities, upon the syndicating, banking and other financial arrangements by which the securities were placed, and finally a blanket requirement that a report shall be made upon the expenditure of all moneys and the purposes for which the same were expended.

Under clause 5, the Commission through its examiners, is to ascertain the amount and value "of any aid, gift, grant of right-of-way, or donation made by any federal, state or municipal government, or by individuals, associations or corporations." Land grants are also to be investigated and the amount of money which any corporation has realized from such land grants to the present time.

The purpose of the requirements in this clause is in no way indicated. Doubtless it is intended to settle the question to what extent the railways and other common carriers actually paid for their present property, on which they are endeavoring to earn dividends, and to what extent they acquired it as a free gift.

The Commission is to begin the appraisal within 60 days after the approval of the act and prosecute the same as rapidly as possible, reporting its progress to Congress at the beginning of each regular session until the work is completed. Railway corporations and others subject to this law are required to furnish as may be required, maps, profiles, contracts, reports of engineers and any other documents, records and papers or copies thereof which may be called for in aid of the work of appraisal. Such corporations must coöperate with and aid the Commission in the work of valuation to such extent as the Commission may order and the Commission is given authority "to enact rules and regulations which will have the full force and effect of law."

The valuation is not merely to be made once and for all, but is to be kept up continuously to date. It is to show, moreover, not only the valuation of the properties of each corporation as a whole, but also the valuation of each corporation's property within the boundaries of each state, so that it will be available for state taxation purposes.

The concluding paragraphs of the act establish a method by which the valuation when made may become final and authoritative as prima-facie evidence in any proceedings before the Interstate Commerce Commission or in any Court. Briefly summarized, when the tentative valuation of the property of any corporation is completed, formal notice will be given to the corporation and also to the Attorney-General of the United States and the Governor of the state in which the property is located. A period of 30 days after such notice is allowed for filing protests against the tentative valuation. In the absence of such protests, the valuation becomes final. In case any protest is filed, proceedings before the Commission to determine the validity of such protest and fix the final valuation of the property are provided for.

It would be difficult to exaggerate the importance of this act, not only to the corporations affected but to the

public. The public is affected not merely because the rates to be charged by railways and other corporations under the law are in future likely to be fixed on the basis of the valuations now provided for; but because the public is first and last the owner of the railways. The stocks and bonds of railways and other corporations affected by this law are held not only by private individuals numbering probably a million or more in this country, but are held also in enormous quantities by insurance companies, savings banks, and other financial institutions holding trust funds. Every man with a savings bank deposit or a life insurance policy, therefore, is vitally interested that the valuation of the railways and other corporations which Congress has ordered shall be a fair and accurate one.

It would be easy to criticize the provisions of the law in detail. It is extremely doubtful, for example, whether the attempt to unearth all the past financial transactions of the corporations is worth the expense it will involve. Because common stock may have been given as a bonus to the people who subscribed for the bonds of a railway built ten, or twenty, or fifty years ago, there would be no justice in saying that the present owners of the stock, which may have changed hands twenty times since its original issue, are not fairly entitled to whatever fraction of value it may represent of the corporation's assets. The law, however, specifically requires this and similar delving into financial and engineering history. We will merely express the hope that the Commission in the exercise of its discretion will place the emphasis in its work on the really important features of the law and not on those which when carried out can serve no useful purpose.

In view of the vital public importance of this great work, it is to be hoped that Congress and the Commission in arranging for its prosecution will see to it that it is placed in the hands of engineers of high standing and that the salaries are fixed at a level high enough to secure the services of such engineers.

It must be said frankly that some of the work which the Interstate Commerce Commission is already prosecuting is falling far short of what it should accomplish in public usefulness and is in fact in great degree wasted because the Commission cannot or will not pay salaries sufficient to secure high-class engineers. It is to be hoped that this error will not be repeated in undertaking the enormous task of valuing the railways in the United States.

It is not to be supposed that the railways and other corporations will sit calmly by and do nothing while appraisal of their properties is being made by the federal authorities. Without doubt they will take measures to duplicate the work the Federal Government is to undertake, so far as the information is not already available in their own records. This means or ought to mean that there should be a very active demand on the part of the railway companies during the next sixty days for the services of every well known engineer who has had experience in valuation work. The railways will undertake this work for their own protection and not by any means to stand in the way of the Commission engaging the services of high-class men, provided it desires to do so and to pay the price. In fact it is distinctly in the interest of the railways that the organization which the Commission creates to carry out this important work shall be made up of the best and most competent men anywhere obtainable. A fair valuation, which will settle questions now in dispute, will be of great public service. A valuation made by incompetent men would work grave injury and would be far worse than worthless.

LETTERS TO THE EDITOR

The Effect of Sugar on Concrete

Sir—In your issue Jan. 16, 1913, p. 126, you ask for information on the effect of cocoanut oil and sugar on concrete.

The dangerous action of sugar has come to our attention very forcibly in two instances.

A few batches of concrete in an otherwise perfect job failed to harden. The sand, gravel and water were normal and the brand of cement used had given exceptionally uniform and high-grade results. Routine tests made on large cargo shipments showed a uniformly high quality. But special tests made on some few sacks off the mixer shed showed erratic results. Some articles set up hard in a few moments and others failed to harden at all. The manufacturer had kept a complete record of every shipment to this particular job and was positive that every bit of the cement was normal when it left the factory. Finally, after much tracing, it was found that a few sacks of cement had been broken open during loading on the steamer. On unloading, this cement had been swept up and re-sacked. The ship had, on a previous trip, carried a cargo of sugar. Some of the sugar remaining in the hold was swept up with the cement. Examination with a magnifying glass showed grains of sugar mixed with the cement.

On another occasion our field inspector ran short of sample bags. He asked the camp cook to help him out and was given a couple of old sacks. When this batch of samples was tested the cement contained in the bags made from old sacks showed very erratic tests. The rest of the shipment was normal. The test pieces had the peculiar appearance that we had learned to attribute to "sugared cement," so we were suspicious. Correspondence with the cook and field inspector developed the fact that the old sacks had been used to hold sugar, but "had been thoroughly cleaned." Other tests on this same lot of cement showed it to be entirely normal. That inspector will never take a chance with an "old sack" again.

Our tests show that quantities of sugar as small as 0.25% of the weight of the cement will completely kill the set. Larger quantities—1% or 2%—will make the cement quick setting, but will eventually cause the test

pieces to disintegrate. The action is more pronounced with some cements than with others. Dilute sugar solutions completely deflocculate cement when suspended in water. Even the finest-ground cement will settle out like so much fine sand. When test pieces that have been disintegrated by sugar solution are dried, clear crystals —apparently of sugar—can be detected with the aid of a magnifying glass.

We at first thought that this action was due entirely to the formation of calcium saccharate, which is soluble, and so prevents the formation of the calcium silicates and aluminates that are essential to the hardening of cement.

However, in the light of the few preliminary tests, we are inclined to attribute the effect of sugar to some sort of catalytic action; only in this way can we account for the action of such a small quantity of sugar on such a large quantity of cement.

We have more detailed and exact experiments under way. We are determining the action of sugar solution as well as solutions of other saccharides and organic substances on cement of known chemical composition and kiln treatment.

We think that in all probability the peculiar action of some sands and gravels on cement will be finally traced to the existence of some organic catalyzer.

CHAS. A. NEWHALL,
Chemical Engineer.
603-6 Northern Bank Bldg., Seattle, Wash.
Feb. 18, 1913.

The Failure of a Railway Automatic Stop

Sir—On Sept. 4, last, there was a collision on one of the Tube railways of London, as is probably known to many readers of ENGINEERING NEWS, who may also be aware that these lines are protected by automatic signals controlled by track circuits, and that, therefore, such an accident should not have occurred.

The matter has been one that has given no little anxiety to those who, like myself, pin their faith to automatic signaling. Had any weakness in the system been revealed, the future of the rapid-transit facilities of London would have been endangered. As illustrated by the experience of the New York subway, rapid train service is possible only through automatic signals. Another instance may be cited. When the underground lines between South Kensington and the Mansion House station, London, were controlled by signals operated from towers, the maximum service possible was 12 trains per hour. Now, with automatic signals, there are 40 per hour.

The accident in question had one feature that just now has more interest for American railway officials than British, because the former are more concerned over the reliability of automatic stops than we are. Automatic stops are, in London as in New York, part of the equipment of automatic signals and it was the failure of an automatic stop to work properly that contributed to the accident.

Aside, it may be briefly noted that the collision created some interest because of the attitude of the men's brotherhoods toward automatic signals. The men have no love for these new methods, as their adoption displaces towermen. The men have also a grievance against the electric-railway companies in that the latter will not employ a second man in the motorman's cab. Could the brotherhoods then produce evidence to show that automatic signals were unreliable they would have somewhat justified their agitation.

Sir Arthur Yorke, the chief inspecting officer of the Board of Trade, in his report just issued, has stated his opinion that the signals were against the second train, but that the motorman was not paying attention to his duties. He consequently missed seeing the signals and was unaware of any danger until he saw the tail-markers of the first train standing in the station, which he had probably assumed was still 2½ min. ahead of him. It had, however, been delayed by trouble with the motors.

The automatic stop should, of course, have pulled up the train automatically. On inspection half an hour after the accident, the stop was found in its normal, vertical (stop) position. On the connections being closely examined by the signal engineer, it was found that one of the brackets supporting the rocking shaft which carries the arm was loose. It is, therefore, assumed that the stop would work sluggish—as it is restored to the vertical position by a spiral spring and not by power. By the time the second train passed, evidently it had not resumed the full vertical position following the signals going to danger behind the first train. But it did so afterward, as found on inspection after the collision.

All the alleged failures mentioned by the trainmen in their campaign have been investigated, and while there have been some cases (not more than half a dozen, most likely) of signals being at clear when they should have been at danger, yet in all these cases, except one, the automatic stop remained working normally and the train was stopped. There has been one case where both signal and stop remained at clear when they should have gone to danger, and this was caused through the breakage of the copper bond-wires of the track circuits. In those days the bonds were rigid and broke easily; now they are flexible and similar failures are not expected in future. The number of cases of signals failing to "clear" is estimated at one in every 315,000 movements, and it is calculated that on the three Tube railways of the London Electric Railways Co. (which do not include the Metropolitan Railway or the District Railway) there are 240,000 signal movements every day.

H. RAYNOR WILSON.
96 Hurlingham Road, London, S. W., England,
Feb. 12, 1913.

[It is evident, from the foregoing mention of Sir Arthur Yorke's report on the South Kensington line accident, that the inspection and maintenance of signal apparatus was open to sharp criticism if it was allowed to get in such dilapidated condition. Moreover, the design of the automatic stop and signal control seems radically wrong, judged by American standards; with spring actuation instead of gravity (counterweight) an added chance of failure is included, and the failure of a track circuit should, in itself, set the signals at danger.—ED.]

NOTES AND QUERIES

Erratum. In the table of performance of rock channelers on p. 410 of our issue of Feb. 27, the third column gives the work done by three single machines, instead of by two, as stated in the heading.

Midwinter Convention of the American Institute of Electrical Engineers

There have been criticisms of inadequacy made against the standardization rules of the American Institute of Electrical Engineers (regulating largely the testing and rating of power apparatus) as they relate to recent progress. Therefore, opportunity was taken to utilize the midwinter meeting, February 26, 27 and 28, for the discussion of these shortcomings, and 44 papers were prepared under the auspices of the Standards Committee. With such a formidable program it was necessary to eliminate all entertainment features (with the exception of a reception and ball after the meetings were all over). The papers were bunched in related groups and presented in abstract. The discussions were mostly on these groups and related general topics.

New Power Unit—There were three matters of moment having to do with testing and rating though extraneous to the organized program. First, comments were made by H. G. Stott, of the Interborough Rapid Transit Co., New York City, upon the use of the "myriawatt," the proposed unit of power input to steam prime movers which, as noted in Engineering News, Jan. 30, 1912, is intended to supplant the convenient fiction "boiler horsepower." Mr. Stott reported that considerable criticism has been aroused over the proposition to institute use of the myriawatt, but that he believed it had risen from misconception of the intention of the Standards Committee in making such a proposition. They had not in reality formulated any new unit, but had put together older terms expressing the amount of power represented by 10 kw., which fortunately for their purposes was equal, within 2%, to the old boiler horsepower.

The action in endeavoring to secure the adoption of convenient units was intended to be the entering wedge for use of the metric system in measurements of mechanical power. The next step contemplated was the exclusive use of the centigrade thermometer, a convenience which was at once apparent to anyone who had ever made any extended calculations involving the odd 32° of this English scale. Whereas once it was common and permissible practice to specify the requirements of prime movers in pounds of steam, now the situation had changed with the introduction of superheat so that it was necessary to use some energy basis of rating.

Mechanical engineers and electrical engineers, he claimed, are now so closely allied that it was often impossible, as in steam-turbine electric-power plant work to separate for test the fundamental parts of the equipment units. It was his experience that the use of the centigrade degree, the kilogram and the calorie would prove no barrier to easy work in mechanical and steam engineering, though there would be a great deal of opposition to their introduction on account of their lack of familiarity to the working man in particular.

C. P. Steinmetz, of Schenectady, stated that he had secured accuracy and efficiency in all his work by using the metric system entirely for all computations and, when final results were secured, by transforming them into English units if necessary. H. M. Hobart, of Schenectady, had found the discrepancy in English and American tons the great stumbling block of the British system of units. B. G. Lamme, of Pittsburgh, called attention to the practice in machine design where a decimal system of linear units was practically used (with inches and tenths, or tens and hundreds). In research work where a multiplicity of units arose, of weight, thermal capacity, etc., this simple situation did not exist and it was necessary to go completely to the metric system or else work under the handicap of many mathematical transformations.

Effect of Heat on Insulation—The second related but unclassified matter was a paper by C. P. Steinmetz, of Schenectady, and B. G. Lamme, of Pittsburgh (comprising a sub-committee on revision of rules), entitled "Temperature and Electrical Insulation." They divided insulating materials into three groups according to their heat-resisting properties (Class A, paper, cotton and other fibrous materials, natural oils, resins and gums, etc.; Class B, mica, asbestos, etc., alone and in combination with binding materials where deterioration of the latter worked no harm; Class C, truly fireproof materials). They recommended a maximum ultimate insulation temperature of 100° C. for the first class with a permissible rise of apparatus temperature in service of 50°. For the second class this interior temperature limit was set at 150° C. with a permissible general apparatus rise of 85. An exception was noted in Class A insulation for railway motors, where the authors admitted the economy of higher temperatures (65° rise) on account of peculiar space and weight limitations of railway service.

Ratings—The third detached matter was seen in the paper, "Method of Rating Electrical Apparatus," by W. L. Merrill, of Schenectady, W. H. Powell, of Milwaukee, and Charles Robbins, of Pittsburgh (constituting a subcommittee on rating). They presented several general, sweeping and (in some cases) debatable recommendations; (I) that all electrical apparatus be rated by output and that this be expressed in kilowatts (or kilovolt-amperes for alternating current) whether it be electrical or simple mechanical power output; (II) that service ratings be divided into two main classes (A) where stationary temperatures would be reached and (B) where not, with three subdivisions under each class for (1) constant, (2) periodic and (3) pulsating loads; (III) that the rating express the maximum safe capacity without allowance for overloads exceeding 60 seconds; (IV) that the name plate carry an Institute inscription showing the class rating and such equivalent shop test as would impose as severe conditions as the expected service, (for instance, "A. I. E. E.—B 2—EQUIV. TEST. 30 HP. 1 HR.") The most serious objections raised to these proposals related to the elimination of overload capacity. Prof. W. B. Crocker (supported by S. S. Wheeler, Philip Torchio and others) characterized this as providing negative factors of safety, since the temperatures to be attained would produce actual depreciation of insulation. It was like rating the load on a bridge, he stated, beyond the elastic limit of the steel in it. Moreover such ultimate capacity ratings meant that under unexpected conditions a machine would fail and the net result would be poor service by the makers. For every sale, an intimate knowledge of all the operating conditions would have to be acquired, and under stress of sharp competition the salesman would fail to allow any margin for contingencies.

Invitations were extended to other associations to contribute expressions of opinion on the proposed ratings for the study of the Standards Committee.

Temperature and Heat Losses—The formal program showed four groups of papers: (1) Heat Measurements and Rating by Temperature; (2) Determination of Machine Losses; (3) Methods of Testing for Machine Performance; (4) Miscellaneous Topics Relating to Rating.

One portion of the first group related particularly to moving machines and included "Notes on Internal Heating of Stator Coils," by R. B. Williamson, of Milwaukee; "Measurement of Temperature on Rotating Machines," by L. W. Chubb, E. I. Chute, and O. W. A. Oetting, of Pittsburgh; "Determining Temperature of Alternating Current Machines," by H. G. Reist and T. S. Eden, of Schenectady; and "Thermo-Couples and Resistance Coils for Determination of Local Temperatures," by J. A. Clapp and L. T. Robinson, of Schenectady.

A second sub-group took up transformer work particularly, comprising "Determining Temperatures of Transformers and of Cooling Medium," by S. E. Johannesen and G. W. Wade, of Pittsfield, Mass.; "Measuring Temperature of Transformers," by C. Fortescue and W. M. McConahey, of Pittsburgh, and "Correction of Transformer Temperature for Variation of Room Temperature, Taking Account of Both Copper and Iron Losses," by C. Fortescue, of Pittsburgh.

A third sub-group of five papers took up prediction of expected temperature rise of stationary apparatus under departure from standard conditions, and the laws of heat transfer. They included: "Temperature Rise of Stationary Induction Apparatus as Influenced by Temperature, Pressure and Humidity of Cooling Medium," by J. J. Frank and W. C. Dwyer, of Pittsfield; "Effect of Room Temperature on Temperature Rise of Motors and Generators," by W. M. Day and R. A. Beekman, of Schenectady; "Effect of Air Temperature, Barometric Pressure and Humidity on Temperature Rise," by C. E. Skinner, L. W. Chubb and Phillips Thomas, of Pittsburgh; "Laboratory Investigation of Temperature Rise," by C. H. Blanchard and C. T. Anderson, of Mansfield Ohio; "Laws of Heat Transmission," by Irving Langmuir, of Schenectady.

The first three of these papers showed the limitations of the present Institute rules for corrections and presented test results indicating what substitutes were advisable. The fourth and fifth papers dealt with the more general fundamental problems of radiation, conduction and convection: the fourth described studies to expose the variations of heat transfer with variations of pressure, temperature, and humidity of air. Mr. Langmuir had a very ambitious presentation of all the data (original and compiled) which his work had shown to be reliable. The various expressions for the three methods of heat transfer were reviewed, as to their utility, and special attention given to the development of a satisfactory calculation of convection loss from various surfaces. He argued for that method which considers the natural convection effect to be the same as if a definite adherent film of gas acted by conduction. (See Engineering News, July 4, 1912, p. 38.)

In the fifth sub-group, "Current Rating of Electric Cables," by R. W. Atkinson, of Pittsburgh, and H. W. Fisher, of Perth Amboy, N. J., and "Heating of Cables," by Saul Dushman, of Schenectady, temperature limits to current capacity were discussed with formulas for precalculation.

Machine Loss Determination—The second main group of related papers discussed methods of determining losses in apparatus. There was a still further subdivision, the first item of which covered induction motors with the papers, "Induction Motor Load Losses," by H. G. Reist and A. E. Averrett, of Schenectady; "Stray Losses in Induction Motors," by A. M. Dudley, of Pittsburgh, and "Notes on Induction Motor Losses," by R. W. Davis, of Milwaukee. These papers discussed those "extra" losses which appear in some machines under load. The need was expressed of fixing on some empirical relations with quantities more easily measured and without need of actually imposing full load. A second subdivision showed studies of these same "load" losses in transformers, the papers being "Losses in Transformers," by W. W. Lewis, of Pittsfield, and "Stray Losses in Transformers," by C. Fortescue and W. M. McConahey, of Pittsburgh.

"Load" losses in generators were discussed in the papers, "Determination of Load Loss Correction Factors for Rotating Machines," by E. M. Olin and S. L. Henderson, of Pittsburgh; "Load Losses of Alternating Current Generators," by W. J. Foster and E. Knowlton, of Schenectady; "Notes on Stray Losses in Synchronous Machines," by F. K. Brainard, of Milwaukee; "Stray Losses in Direct-Current Commutating Machines," by H. F. T. Erben and H. S. Page, of Schenectady; "Determination of Stray Losses from Input-Out put Tests," by L. T. Robinson, of Schenectady; "Errors in Efficiency Determinations," by E. I. Chute and William Bradshaw, of Pittsburgh; "Brush Friction and Contact Losses," by H. F. T. Erben and A. H. Freeman, of Schenectady; "Determining Brush Losses," by H. R. Edgecomb and W. A. Dick, of Pittsburgh, and "Commutation and Brush Losses," by C. E. Wilson, of Pittsburgh.

Tests for Performance—The third main group presented studies of finding before shipment the temperatures which large alternating-current machines would attain under normal operation. The papers were: "Comparison of Methods of Loading Large Generators and Converters for Factory Temperature Test," by F. D. Newbury, of Pittsburgh; and "Comparison of Methods of Making Load Tests on Generators and Induction Motors," by A. M. Dudley, of Pittsburgh.

On account of lack of, and cost of, an unlimited power supply to test large machines under full load at the shop, it is necessary to run the machine under artificial conditions which develop full-load internal losses. Four types of such tests were discussed at the sessions where the foregoing papers were read: (1) "Open- circuit" loading with over-excited fields giving excess armature voltage and core loss to compensate for lack of armature current; (2) "short-circuit test" with the armature short circuited and the fields excited only enough to give the normal full-load current; (3) the "open-delta direct-current" scheme where the fields are fully excited but the armature windings have some delta or rectangle arrangement of the windings with one corner open and full-load value of direct current fed in; (4) the "zero-power-factor" test in which duplicate equipment to the generator under test has to be available, and the two are driven in parallel with the fields of the one over excited and the fields of the other under excited until full-load armature current flows.

In the general discussion B. G. Lamme, of Pittsburgh, called attention to the place of these "compromise" tests in the general field of electrical testing. As he would classify such effort, there would be four kinds of tests, (1) for the designer to study, (2) to satisfy the manufacturer that the specifications would be fulfilled, (3) witness tests to show a purchaser that a machine would meet load conditions, and (4) routine tests on large numbers of duplicate machines where a few data obtained and compared with results of the first class of tests showed if each individual machine was satisfactory. Groups 2 and 3, he stated, ought to give the same results, but did not always; it was the desire of the Standards Committee to show compromise tests which would be accepted for groups 1 and 2, noting the probable sources of error.

The discussion in general favored the "zero-power-factor" test where the necessary equipment was available; otherwise a combination of the "open-circuit" and closed-circuit" schemes—there being alternate periods of each so calculated that total losses secured in each part of a machine were equal to those there in normal operation.

In regard to testing induction motors, the general opinion was that various compromise tests had shown close agreement with true full-load tests and were desirable. The scheme most preferred seemed to be the "reverse-rotation," in which the motor is driven at full speed in reverse direction while the impressed voltage (reduced) is adjusted to give the full-load stator current.

Analogous schemes for testing large transformers were presented in the papers, "Load Tests on Transformers," by J. J. K. Madden, and "Sources of Error in Transformers Tests," by W. M. McConahey and C. Fortescue, of Pittsburgh.

MISCELLANEOUS SUBJECTS—In this fourth subdivision of the program came the papers on oil switches, spark gaps, wave forms (of alternating-current generators), and regulation as follows: "Rating Oil Circuit Breakers," by G. A. Burnham, of Boston; "The Sphere Spark Gap," by W. S. Farnsworth and C. Fortescue; "Calibration of the Sphere Gap," by L. W. Chubb and C. Fortescue; "Potential Waves of Generators," by W. J. Foster, of Schenectady; "Wave Form Distortions and Their Effect," by P. M. Lincoln, of Pittsburgh; "A Proposed Wave-Shape Standard," by C. M. Davis, of Schenectady; "Experimental Regulation of Alternators," by A. B. Field, of Pittsburgh; "Regulation of Definite Pole Alternators," by S. H. Mortensen, of Milwaukee; and "Generator and Prime Mover Capacities," by D. B. Rushmore and E. A. Lof, of Schenectady.

In regard to circuit breakers, it was brought out that rating for the safe circuit voltage, temperature rise and tripping value of current was no longer sufficient, since systems had grown so large that opening a switch often meant intense concentration of energy and wrecking of the mechanism. The trend of opinion was that it would be satisfactory to state the maximum kilovolt-amperes under which a switch would safely open—being the normal circuit voltage times the current for which it would trip.

The old needle spark gap (for measuring voltages) has been found too cumbersome and unreliable for the high voltages which have come into service since the Institute standardization rules were formulated. Sphere gaps have supplanted them, as was outlined in the papers mentioned, for above some 35,000 volts.

The proposal of C. M. Davis in the paper noted met with approval for the most part. He would substitute for the present rule of "maximum permissible deviation of wave from sinusoidal shape not exceeding 10%" a so called "distortion-ratio" of the given wave to one of sine shape. The determination of this is a simple measurement of the change of reactance of a condenser for the change in wave shape, involving the use of only simple standard instruments.

The Railway Valuation Act

The bill providing for valuation of the railway of the United States and of the property of other corporations subject to the Interstate Commerce law passed the Senate on Feb. 24 and the House of Representatives on Feb. 27. As the law orders the undertaking of a vast work, most of which will have to be done by engineers, its full text is printed below. A summary of the act and comment upon it is given in our editorial columns.

Be it enacted etc. That the Act entitled "An Act to regulate commerce," approved Feb. 4, 1887, as amended, be further amended by adding thereto a new section, to be known as Section 19a, and to read as follows:

"Sec. 19a. That the commission shall, as hereinafter provided, investigate, ascertain, and report the value of all the property owned or used by every common carrier subject to the provisions of this Act. To enable the commission to make such investigation and report, it is authorized to employ such experts and other assistants as may be necessary. The commission may appoint examiners who shall have power to administer oaths, examine witnesses, and take testimony. The commission shall make an inventory which shall list the property of every common carrier subject to the provisions of this Act in detail, and show the value thereof as hereinafter provided, and shall classify the physical property, as nearly as practicable, in conformity with the classification of expenditures for road and equipment, as prescribed by the Interstate Commerce Commission.

"First. In such investigation said commission shall ascertain and report in detail as to each piece of property owned or used by said common carrier for its purposes as a common carrier, the original cost to date, the cost of reproduction new, the cost of reproduction less depreciation, and an analysis of the methods by which these several costs are obtained, and the reason for their differences, if any. The commission shall in like manner ascertain and report separately other values, and elements of value, if any, of the property of such common carrier, and an analysis of the methods of valuation employed, and of the reasons for any differences between any such value, and each of the foregoing cost values.

"Second. Such investigation and report shall state in detail and separately from improvements the original cost of all lands, rights of way, and terminals owned or used for the purposes of a common carrier, and ascertained as of the time of dedication to public use, and the present value of the same, and separately the original and present cost of condemnation and damages or of purchase in excess of such original cost or present value.

"Third. Such investigation and report shall show separately the property held for purposes other than those of a common carrier and the original cost and present value of the same, together with an analysis of the methods of valuation employed.

"Fourth. In ascertaining the original cost to date of the property of such common carrier the commission, in addition to such other elements as it may deem necessary, shall investigate and report upon the history and organization of the present and of any previous corporation operating such property, upon any increases or decreases of stocks, bonds, or other securities, in any reorganization; upon moneys received by any such corporation by reason of any issues of stocks, bonds, or other securities; upon the syndicating, banking and other financial arrangements under which such issues were made and the expense thereof; and upon the net and gross earnings of such corporations, and shall also

ascertain and report in such detail as may be determined by the commission upon the expenditure of all moneys and the purposes for which the same were expended.

"Fifth. The commission shall ascertain and report the amount and value of any aid, gift, grant of right of way, or donation, made to any such common carrier, or to any previous corporation operating such property, by the Government of the United States or by any State, county, or municipal government, or by individuals, associations, or corporations; and it shall also ascertain and report the grants of land to any such common carrier, or any previous corporation operating such property, by the Government of the United States, or by any State, county, or municipal government, and the amount of money derived from the sale of any portion of such grants and the value of the unsold portion thereof at the time acquired and at the present time, also, the amount and value of any concession and allowance made by such common carrier to the Government of the United States, or to any State, county, or municipal government in consideration of such aid, gift, grant, or donation.

"Except as herein otherwise provided, the commission shall have power to prescribe the method of procedure to be followed in the conduct of the investigation, the form in which the results of the valuation shall be submitted, and the classification of the elements that constitute the ascertained value, and such investigation shall show the value of the property of every common carrier as a whole and separately the value of its property in each of the several States and Territories and the District of Columbia, classified and in detail as herein required.

"Such investigation shall be commenced within 60 days after the approval of this Act and shall be prosecuted with diligence and thoroughness, and the result thereof reported to Congress at the beginning of each regular session thereafter until completed.

"Every common carrier subject to the provisions of this Act shall furnish to the commission or its agents from time to time and as the commission may require maps, profiles, contracts, reports of engineers, and any other documents, records, and papers, or copies of any or all of the same, in aid of such investigation and determination of the value of the property of said common carrier, and shall grant to all agents of the commission free access to its right of way, its property, and its accounts, records, and memoranda whenever and wherever requested by any such duly authorized agent, and every common carrier is hereby directed and required to coöperate with and aid the commission in the work of the valuation of its property in such further particulars and to such extent as the commission may require and direct, and all rules and regulations made by the commission for the purpose of administering the provisions of this section and section twenty of this Act shall have the full force and effect of law. Unless otherwise ordered by the commission, with the reasons therefor, the records and data of the commission shall be open to the inspection and examination of the public.

"Upon the completion of the valuation herein provided for the commission shall thereafter in like manner keep itself informed of all extensions and improvements or other changes in the condition and value of the property of all common carriers, and shall ascertain the value thereof, and shall from time to time revise and correct its valuations, showing such revision and correction classified and as a whole and separately in each of the several States and Territories and the District of Columbia, which valuations, both original and corrected, shall be tentative valuations and shall be reported to Congress at the beginning of each regular session.

"To enable the commission to make such changes and corrections in its valuations of each class of property, every common carrier subject to the provisions of this Act shall make such reports and furnish such information as the commission may require.

"Whenever the commission shall have completed the tentative valuation of the property of any common carrier, as herein directed, and before such valuation shall become final, the commission shall give notice by registered letter to the said carrier, the Attorney General of the United States, the governor of any State in which the property so valued is located, and to such additional parties as the commission may prescribe, stating the valuation placed upon the several classes of property of said carrier, and shall allow thirty days in which to file a protest of the same with the commission. If no protest is filed within 30 days, said valuation shall become final as of the date thereof.

"If notice of protest is filed, the commission shall fix a time for hearing the same, and shall proceed as promptly as may be to hear and consider any matter relative and material thereto which may be presented in support of any such protest so filed as aforesaid. If after hearing any protest of such tentative valuation under the provisions of this Act the commission shall be of the opinion that its valuation should not become final, it shall make such changes as may be necessary, and shall issue an order making such corrected tentative valuation final as of the date thereof. All final valuations by the commission and the classification thereof shall be published and shall be prima facie evidence of the value of the property in all proceedings under the Act to regulate commerce as of the date of the fixing thereof, and in all judicial proceedings for the enforcement of the Act approved Feb. 4, 1887, commonly known as 'the Act to regulate commerce,' and the various Acts amendatory thereof, and in all judicial proceedings brought to enjoin, set aside, annul, or suspend, in whole or in part, any order of the Interstate Commerce Commission.

"If upon the trial of any action involving a final value fixed by the commision, evidence shall be introduced regarding such value which is found by the court to be different from that offered upon the hearing before the commission, or additional thereto and substantially affecting said value, the court, before proceeding to render judgment shall transmit a copy of such evidence to the commission, and shall stay further proceedings in said action for such time as the court shall determine from the date of such transmission. Upon the receipt of such evidence the commission shall consider the same and may fix a final value different from the one fixed in the first instance, and may alter, modify, amend or rescind any order which it has made involving said final value, and shall report its action thereon to said court within the time fixed by the court. If the commission shall alter, modify, or amend its order, such altered, modified, or amended order shall take the place of the original order complained of and judgment shall be rendered thereon as though made by the commission in the first instance. If the original order shall not be rescinded or changed by the commission, judgment shall be rendered upon such original order.

"The provisions of this section shall apply to receivers of carriers and operating trustees. In case of failure or refusal on the part of any carrier, receiver, or trustee to comply with all the requirements of this section and in the manner prescribed by the commission such carrier, receiver, or trustee shall forfeit to the United States the sum of $500 for each such offense and for each and every day of the continuance of such offense, such forfeitures to be recoverable in the same manner as other forfeitures provided for in section 16 of the Act to regulate commerce.

"That the district courts of the United States shall have jurisdiction, upon the application of the Attorney General of the United States at the request of the commission, alleging a failure to comply with or a violation of any of the provisions of this section by any common carrier, to issue a writ or writs of mandamus commanding such common carrier to comply with the provisions of this section."

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An Exhibition Roadway is being built at Olympia, Wash., by paving companies operating in the State. Each company lays a sample of paving at least 100 ft. long and 16 ft. wide in accordance with specifications which it files with the State Highway Department. The road chosen for paving is just outside the city limits and part of a main highway north and south through the state. The Olympia Chamber of Commerce has sent invitations to every city council and board of county commissioners in the State inviting them to inspect the new pavements after they have been laid and subjected to traffic. An act is pending under which the State will spend $8,000,000 on road construction during the coming year.

The Elliott Cresson Medal Awards, made annually by the Franklin Institute of Philadelphia, Penn., for notable achievements in scientific and engineering work, were made this year to the following prominent scientists:

Charles Proteus Steinmetz, Schenectady, N. Y., for successful application of analytical methods to the solution of numerous problems of first practical importance in the field of electrical engineering.

Emile Berliner, Washington, for important contributions to telephony and to the science and art of sound reproduction.

Isham Randolph, Chicago, for distinguished achievement in the field of civil engineering.

John William Strutt (Baron Rayleigh), Witham, Essex, England, for extended research of signal importance in physical science.

Sir William Ramsay, London, for numerous discoveries in the science of chemistry.

Emil Fischer, Berlin, Germany, for numerous contributions of fundamental importance to the science of organic and biological chemistry.

A Footway Tunnel in New York City

A footway tunnel 920 ft. long has just been completed by the City of New York to afford an entrance from Broadway to the new 191st St. station of the west, or Broadway, branch of the present Interborough subway.

When first built, the subway in passing under Fort George Hill had no station between 181st St. and Dyckman St., a distance of nearly one mile. On account of the present and prospective growth of population midway between these two stations, it was decided some years ago to compel the Interborough company to build a new station at 191st St. Coincident with this construction a tunnel was projected, leading from the station, which is at 191st St. and St. Nicholas Ave., practically due west to 191st St. and Broadway. This tunnel construction was carried out under the regular assessment principle, that is, the property benefited by the construction of the tunnel was assessed for the cost, and the tunnel was designed and constructed under the direction of the Borough Government of Manhattan. The entire line is built in easement, no property being purchased by the city.

The 191st St. station of the subway is some 100 ft. below the surface, and is reached by elevators from the street above. The hill underneath which it passes, however, slopes down sharply to the west, so that a tunnel could be built from Broadway some 900 ft. to the west, to the station approach with a down grade toward the station of 1%. This tunnel is some 15 ft. below grade at Broadway and is approached by a double flight of steps. It is straight for practically its entire distance, turning on a right angle curve to enter the station. It is for foot passengers only, is 12 ft. wide, and has a section with 6 ft. sides crowned with a semi-circular 12 ft. arch. It was driven for its entire length through solid rock, and lined with a minimum of 6 in. of plain concrete. The floor is paved with a slight crown with the regular granolithic concrete pavement. The Broadway portal of the tunnel is at present at a vacant lot but the owner has in prospect the erection of an apartment house which will rise above, though it will not have an entrance to the tunnel.

In the construction considerable trouble was encountered with water. The stations at 181st St. and 191st St. have both been subject to considerable infiltration of water, which has many times caused trouble in the operation of the subway. These stations have, however, been protected by waterproofing so that they are reasonably watertight. It was decided that the present use of the footway tunnel was so small that it would not pay to attempt to waterproof the sides. In consequence, the abundance of ground water in the rock has given no end of trouble in penetrating through the concrete side walls. Frequent drains in the side walls leading to longitudinal drains under the tunnel were provided in the design, and further drainage of the same sort actually built. These drains have taken care of a considerable amount of water, but there is still leakage through the walls and roof. Until there is a much larger traffic through the tunnel, however, no further effort will be made to stop this leakage.

The tunnel is lighted with incandescent bulbs in the roof, connected to the regular city lighting system. These lights, of course, have to be kept in service for 24 hours a day. The supervision of the tunnel has been placed under the police department just as though it were a city street; in fact it is known in the city departments as "Tunnel St." As this 800 ft. straight away length might afford an admirable place for the "hold-up" man, it is thought that the police department will have to keep a policeman on "peg post" there most of the time.

The tunnel was built under the direction of the Consulting Engineer to the Borough President of Manhattan, E. P. Goodrich, and was under the special supervision of C. E. Gregory, Mr. Goodrich's assistant. It was built by the Bell-Ross Contracting Co. The contract price was $72,260. It is scheduled to be opened formally on March 8, 1913.

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Standard Specifications for Drain Tile

A committee, consisting of Prof. A. Marston, Seth Dean and W. B. Warrington, has just presented to the Iowa State Drainage Association a "Standard Specification for Drain Tile," which is being printed for free distribution by the Engineering Experiment Station, Iowa State College, Ames, Iowa, and a copy may be had by writing to Director A. Marston, at Ames. The specification is too lengthy to reprint here but we give below the statement of the committee in presenting it.

We beg leave to submit for adoption a set of tentative standard specifications for drain tile, for sewer pipe, and for pipe laying. There is great need for the immediate adoption of such a tentative set of standard specifications, for the guidance of engineers, manufacturers and purchasers.

There can be no doubt that there are miles of cracked drain tile of large sizes in the ground in Iowa. New instances are constantly coming to light. Engineers who have believed their deep drains absolutely sound are constantly finding, to their chagrin and alarm, that many of the large pipes are cracked Collapses of cracked pipe have already occurred in numerous instances, and, while most of the cracked pipe will probably continue to stand up, in a more or less precarious condition of stability, we must remember that few, if any, of the large tile drains of Iowa have yet been called upon to carry floods as great as they will certainly experience in the future. We can look forward only with serious misgivings to what is likely to happen to large cracked tile drains when they are called upon, as they almost certainly will be, to carry floods which fill them more than full.

Our specifications are intended to obviate the danger of cracked pipe in ditches. We have based them largely upon the data of Bulletin No. 31, of the Engineering Experiment Station at Ames, which gives about 175 pages of data, collected in six years of experimental investigations.

To obviate the danger of cracked pipe in ditches will necessarily require a greater cost of construction than present practice, but we earnestly believe the additional expenditure to be wise, and even essential. Drain tile and sewer pipe of large sizes are generally too weak, as at presnt manufactured, to be safe against cracking in ditches of any considerable depth. We have so worded our specifications as to give the pipe contractor the option of furnishing stronger pipe, or of bedding the pipe in concrete, in the deeper parts of the ditch. The cost will be greater than for present pipe in either case.

We have specified much greater care in pipe laying than at present prevails in tile drain construction, and many will object that the resulting increased cost will make it impracticable to enforce the more rigid requirements we lay down. Nevertheless we believe that the vital interests of those who are paying the heavy costs of drainage in Iowa imperatively require safe, reliable and enduring construction, and that it is both wise and necessary that the better methods be adopted.

Of course, both the pipe manufacturer and the pipe-laying contractor must be paid fairly whatever increased cost may be necessary to secure good safe work, and this is contemplated in our recommended specifications. It will be the duty of engineers to enforce faithfully whatever fair specifications may be found necessary to insure good, safe construction.

We acknowledge, with much gratitude, valuable assistance from several drainage engineers and pipe manufacturers. We have modified our first draft materially at their suggestion.

The Accident to the Foundations of the Pearl Harbor Dry Dock

In response to our request, Rear Admiral H. R. Stanford, Chief of Bureau of Yards and Docks, U. S. N., has forwarded to us an account of the blowout that recently occurred in the coffer-dam being used in constructing the foundations of the new naval dry dock at Pearl Harbor, near Honolulu, Hawaii. The design of this dock was described in ENGINEERING NEWS, Dec. 9, 1909, p. 636. The official statement follows:

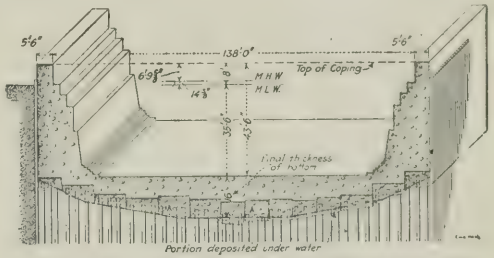
Advice received at the Navy Department, February 17, 1913, from the Naval Station, Pearl Harbor, contained startling information of an accident that day in connection with the construction of the 1000-ft. dry dock which is being built at a cost of about $3,100,000. The accident occurred at a time when the coffer-dam surrounding a portion of the work was pumped free of water, and consisted in the upheaval of a portion of the concrete seal which had been placed in the bottom of the section. The upheaval of the bottom caused the destruction of the crib bracing, thereby permitting the sheet piling to yield and the caving in of the surrounding earth. Later information from the naval station gave further particulars, and stated that the piling in the portions of the work adjacent to that in which the accident occurred showed no signs of movement, which would indicate that there was no general disturbance in the supporting strata or conditions that would preclude the carrying on of the work. Considerable time will be required for a careful examination, due to the large amount of timber wreckage which will first have to be removed.

After practically completing the necessary excavation for the work, the area to be occupied by the dock was surrounded by a coffer-dam of interlocking sheet piling composed of timbers from 70 to 80 ft. in length. For convenience in his operations, the contractor divided the length of the coffer-dam into five sections by cross walls or bulkheads, thus forming compartments, each about 148 ft. wide by 300 ft. in length, the surrounding walls of which were supported or braced by means of interior cribbing. The bottom of the dock will be supported on piles spaced about 3x4 ft., driven to a depth of about 30 ft. Before pumping out the coffer-dam it was necessary to place a mass of concrete on the bottom by the underwater method to provide a bottom water seal.

The concrete in the bottom of the finished structure will have a thickness of 16 ft. on the center line, slightly reducing in thickness to the side lines which support and carry the massive side walls of the structure. This mass of concrete is required for a proper factor of safety to resist the hydrostatic pressure which will be exerted upon the bottom of the dock, and to give the structure the necessary strength and stability after completion. It has been estimated by the contractor that if the lower 8 ft. of this bottom concrete were first placed under water, embedding the heads of the supporting piles, there would be resistance sufficient to permit of the temporary pumping out of the coffer-dam for a period sufficiently long to enable him to complete the concrete in the section. Under favorable conditions, then, the unit cost would be greatly reduced as compared with the unit cost for the concrete previously placed under water. The work proceeded on this assumption, and the accident which has been reported was probably due to insufficient thickness of the bottom concrete during this constructive stage. That this assumption was very nearly justified is proved by the fact that the section was actually pumped dry and that there was no immediate failure of the bottom; had there been a slightly greater thickness in his lower mass there would, in all probability, have been no failure. The above conditions are illustrated by the accompanying sketch showing a typical section of the dock.

The upheaval of a portion of the concrete in the bottom of Section 2 permitted an inflow from the adjacent sections, with the result that the bracing in these sections was distorted, probably leading to the buckling or yielding of this bracing and the removal of the support from the surrounding walls of the coffer-dam.

There will undoubtedly be some delay in the prosecution of this work, due to this accident, but it is hoped the contractor will be able to quickly remedy the damage and continue with his operations. Actual conditions, however, can only be determined by careful examination which will be made as the removal of the wreckage will permit.



PERSPECTIVE SKETCH, SHOWING METHOD OF CONSTRUCTING PEARL HARBOR DRY DOCK

A difficulty which was experienced about one year ago, resulted from the inferior quality of concrete which had been deposited under water, a condition due to the very difficult method which has to be followed in placing the concrete; this difficulty was successfully overcome by careful examinations and experiments, as has been proved by the fact that reports relative to the recent accident advise that the concrete in the bottom was of excellent quality.

[A Honolulu paper which has just come to hand shows a view of the dock wreckage, indicating an area of collapse much greater than the one section noted above.—ED.]

Two New Trains have been built for the New York, New Haven & Hartford R.R. to run as the Merchants' Limited, in five-hour express service between New York and Boston. Each train consists of six steel cars exclusive of the diners. There are four parlor cars, a combination parlor and baggage, and an observation smoker. The usual drawing room has been eliminated, giving 36 chairs instead of 28. The chairs are of a new type with adjustable back. The interior lighting of the cars is unique in railway service, being by what is known as the indirect system with light reflected from the ceiling. Each car contains a dozen bronze domes suspended inverted and containing a 100-watt lamp whose light is projected upward against a white ceiling. Each car carries its own lighting system, comprising an axle generator and a storage battery of capacity to light the car for ten hours. The cars are heated with direct steam radiation and have a positive system of ventilation. The lavatories have a new lock system, permitting use even when standing in stations.

NOTES FROM THE ENGINEERING SCHOOLS

HARVARD UNIVERSITY—A donation of $50,000 has been received from Harriet Otis Cruft to be used for a high-tension electrical laboratory, which will be in the Cruft Memorial Hall.

UNIVERSITY OF GEORGIA—A special road school was held under the auspices of the Good Roads Department of the University on Feb. 10 to 15, inclusive. This school was reported to be the logical development of this Department's work in acting as a clearing house for information gathered from all parts of the state and also from beyond its borders.

KANSAS SCHOOL OF MINES AND METALLURGY—This school has figured in recent newspaper reports from Kansas as the "smallest college in the country, having three students and three professors." These reports evidently were based on the enrollment at the belated opening of the institution (Oct. 10, 1912), for the number of students increased to 17 in January and the prospects are for an enrollment of 30 at the beginning of the second term.

In 1911 the Kansas Legislature created this school and established it at the town of Weir in Cherokee County, naming as its principal purpose

the teaching of such branches in mining and metallurgy as will give a fair technical knowledge of mines and mining, and all subjects pertaining thereto, including physics in mining, engineering, mathematics, chemistry, geology, mineralogy, metallurgy, shop work, drawing, the technical knowledge and properties of mine gases, assaying, surveying, drafting of maps and plans, and such other subjects pertaining to mining engineering as may add to the safety and economical operation of mines within this state.

The school was created as an independent institution, but under the supervision and control of the Board of Regents of the State University. The Regents agreed not to open the school, believing that it would interfere with the work of the State University, and that the State Legislature had passed the bill under a misapprehension. However, the Board was compelled to proceed with the project under a mandamus suit. The act of the Legislature was construed by the Supreme Court as demanding a separate and independent institution of higher learning. It is reported that there is an appreciable and growing sentiment for this school and that a distinct and useful field of service is opening up.

The Director, Burton L. Wolfe, has asked the Legislature, through the Regents, for an appropriation of $111,-961; of this, $75,000 is for a modern three-story main building, 60x120 ft.; $9826 is for added equipment, and $26,535 is for maintenance during the year 1913-1914. A further request for $93,120 is made for the year 1914-1915; of this, $33,750 is for a two-story building to house a power plant, machine shops and ore-dressing and metallurgical laboratories; $15,000 is for the equipment of this building, and $46,370 for maintenance. Citizens of Weir have offered as a site a square tract of 21 acres.

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While Thawing Out Dynamite for use on a sewer laying job in Montreal, Canada, on Feb. 24, one man was killed and another badly injured by a premature explosion.

Levee Work Is Held Up by High Water in the Mississippi River below the mouth of the Red River, according to information from Frank M. Kerr, of the Louisiana Board of State Engineers.

Concrete Laying on the Panama canal locks is near completion. On Feb. 15, the "Canal Record" states that over 97% of the concrete work in the locks had been placed, the total amount of concrete laid being 4,306,209 cu.yd.

Paris to London by Aëroplane in 6½ hr. flying time, is the feat performed by a French aviator, on Feb. 25. The trip was made with but one stop, at Calais. The channel crossing, reckoned dangerous by aviators in the best weather, was made in a fog.

The Engineering Societies Building, at 29 West 39th St., New York City, is now the headquarters of 41 different engineering societies, which either have permanent offices in the building or hold their meetings in some of its rooms or in the main auditorium.

An Advisory Good Roads Commission has been appointed by Gov. Sulzer, of New York, to confer with the governor and to advise him regarding the best way to carry out the provisions of the proposed new highway bill for the State. The commission consists of some 18 members and has in its personnel a curious mixture of machine politicians and competent engineers.

Three Safety Medals in memory of the late E. H. Harriman, have been placed at the disposal of the American Museum of Safety by Mrs. Harriman. These will be awarded annually, the first to the railroad which makes the greatest progress in accident prevention. The second, to the operation head who is judged to have done the most to promote safety during the preceding year. A third medal, of bronze, will be awarded to the employee is judged to have rendered the most conspicuous service in preventing accidents.

Concrete Pile Regulations are the subject of study by the Bureau of Buildings of the Borough of Manhattan, New York City. Rudolph P. Miller, Superintendent, has issued a note reading as follows:

The Superintendent of Buildings of the Borough of Manhattan wishes to inform the public that he has under preparation regulations governing concrete piles. He would be glad to have any suggestions or criticisms from those interested, and will send on request a copy of the tentative draft now prepared.

Blasting Operations at Gijon, Spain, undertaken for the purpose of leveling a hill between that place and the coast town of Musel, resulted on Feb. 25, in the death of about 30 persons and injuries to a large number of others. A charge of 7000 lb. of black powder had been placed and the populace had gathered to watch the effect of the explosion. When the charge was fired, instead of effecting the desired breakage of rock, according to press accounts, it projected a quantity of small stones into the crowd.

Questions of Policy affecting both the electric-light and electric-railroad industries are to be handled hereafter by a joint committee representing the American Electric Railway Association and the National Electrical Light Association; there being two appointed from each. This is the result of a joint dinner for the discussion of mutual problems held in New York City, Feb. 18. Among the topics which the committee proposes to take up at once are questions of welfare work, service annuities, minimum wages and education of employees.

An Invitation for American Bids "for the construction of a complete refrigerating plant for the cold-storage premises of the wholesale meat market of the Moscow abattoirs" is the latest tribute to American engineering skill, as recently recorded in the New York "Herald." It appears that bids had been invited previously for the same work, but with results unsatisfactory to the authorities concerned, so it was decided by them to extend the time limit from Jan. 28 to May 8 and advertise for American bids.

A feature worthy of note is that the Moscow abattoirs are under the control of the municipal administration, which is charged with the construction and maintenance of all buildings in connection with the same.

The Necaxa Power-plant Extension in Mexico is progressing favorably in spite of the political disturbances. Work is expected to be completed in a few months. This extension of the well known Necaxa hydraulic power station involves increase of the water supply by a collecting conduit which taps a number of minor drainage areas. Much of this conduit is in tunnel. Extensive and difficult tunnelling work in soft ground has been required, particularly at the lowest or downstream tunnel of the group, this being also the longest tunnel. Much caving ground and heavy water flow here have been responsible for much delay. At the present time, even under the unfavorable conditions, with the working face about a mile from the portal, a progress of 65 to 80 ft. per

month is being recorded. The tunneling work is being handled for F. S. Pearson by Jacobs & Davies, of New York City.

The Atherton Ave. 170-ft. Concrete Arch Bridge, in Pittsburgh, Penn., crossing Junction Hollow and the tracks of the Pittsburgh Junction Ry., was opened for traffic Feb. 19, 1913. The bridge was described and illustrated in our issue of Dec. 19, 1912. It provides a much-needed additional route from the business district to the East End residence territory, providing for street traffic, which is now compelled to concentrate on a street encumbered by street-railway tracks. The Atherton Ave. improvement comprises, besides the above-mentioned bridge, a three-span concrete-arch bridge over the Pennsylvania R.R., widening of the street to 60 ft. in a section which is now narrower, and a small amount of grade reduction. The Pennsylvania R.R. bridge is completed so far as the structure is concerned, but its paved roadway will not be ready until spring.

Two Freak Accidents were noted in a recent issue of the "Travelers Standard," from which the following accounts are taken:

A freight train on the Memphis branch of the Louisville & Nashville R.R. recently collided with the packet-boat "Lochie S.," at Cumberland City, Tenn. This peculiar accident was made possible by a flood in the Cumberland River. The water stood over the Louisville & Nashville tracks at several places, and the "Lochie S.," which is a light-draught boat, was steaming directly over the railroad's right-of-way, doubtless with no suspicion of this fact in the pilot's mind. The night was dark, and as the engineer on the train did not see the boat and did not understand steamboat signals, he was very close to her before he knew it. The emergency brakes were applied, but not soon enough to avoid a collision. Nobody was injured, and no harm was done to the locomotive or the train. The packet was damaged somewhat, however. According to newspaper reports, the owners of the boat claim that their craft was not trespassing in proceeding anywhere upon the waters of a navigable stream, and the railroad sets up the counter claim that it was within its rights so long as the train remained upon the company's tracks. Railroad men and river men agree that the accident is one of the most remarkable on record, and there have been many interesting discussions as to the responsibility for the damage.

While carrying a steel plate across the mill yard at the Ambridge plant of the American Bridge Company, a workman recently came within the influence of a powerful electromagnet that was unloading scrap iron from a freight car. The magnet suddenly pulled up the plate of steel that he had on his shoulders, and as he held tightly to it he was drawn up also. He cried out when his feet left the ground, and the man controlling the magnet shut off the current. The plate then dropped, and in doing so it fell upon the man and crushed him so badly that he died shortly afterward.

A River Regulation Commission was provided for by a Senate amendment to the River and Harbor appropriation bill, adopted by the Senate on Feb. 25. The amendment is understood to be the work of Senator Newlands, of Nevada. An amendment is also made to the same bill requiring the Board of Engineers for Rivers and Harbors to make a preliminary report to Congress before Dec. 1, 1913, on a general plan of improvement for all the waterways of the country. Both provisions were killed in conference, and were not made a part of the River and Harbor bill. The two clauses referred to are as follows:

That the Secretary of War shall cause the Chief of Engineers of the Army and the Board of Engineers for Rivers and Harbors to report to Congress, in which shall be included a preliminary report not later than Dec. 1, 1913, upon the saving, as well as other advantages, which can be accomplished by the adoption of the continuing contract system, the rapidity with which projects should be completed, upon methods of standardization by which the waterways of the country may be improved uniformly in proportion to their capacities and to the existing or probable demands of general commerce, and also report upon one or more systematized schemes of such improvement, involving all waterways heretofore examined, together with any natural or artificial channels, essential for the utilization thereof, whether heretofore examined or not; also upon all projects heretofore adopted, the further improvement of which is not desirable or the expenditure upon which is out of proportion to the benefit derived therefrom. Such report may include other related information pertaining to the uses or control of the waters of the country, and the sum of $100,000 or so much thereof as may be necessary, is hereby appropriated for such examination and report.

A commission, to be known as the River Regulation Commission, consisting of the Secretary of War, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce and Labor, two Members of the Senate, to be selected by the President of the Senate, and two Members of the House of Representatives, to be selected by the Speaker, is hereby created and authorized to bring into coördination and coöperation with the Corps of Engineers of the Army the other scientific or constructive services of the United States that relate to the study, development, and control of waterways and water resources and subjects related thereto, and to the development and regulation of interstate and foreign commerce, with a view to uniting such services through a board or boards in investigating questions relating to the development, improvement, regulation, and control of navigation as a part of interstate and foreign commerce, including therein the related questions of irrigation, forestry, swamp-land reclamation, clarification of streams, regulation of flow, control of floods, utilization of water power, prevention of soil waste, coöperation of railways and waterways, and promotion of transfer facilities and sites, and in forming comprehensive plans for the development of the waterways and water resources of the country for every useful purpose by coöperation between the United States and the several States, municipalities, communities, corporations, and individuals within the jurisdiction, powers, and rights of each, respectively, and with a view to assigning to the United States such portion of such development, promotion, regulation, and control as can be properly undertaken by the United States by virtue of its power to regulate interstate and foreign commerce and by reason of its proprietary interest in the public domain, and to the States, municipalities, communities, corporations, and individuals such portion as properly belongs to their jurisdiction, rights and interests, and with a view to properly apportioning costs and benefits, and with a view to so uniting the plans and works of the United States within its jurisdiction, and of the States and municipalities, respectively, within their jurisdictions, and of corporations, communities, and individuals within their respective power and rights, as to secure the highest development and utilization of the waterways and water resources of the United States; and such River Regulation Commission is authorized to appoint as members of such board or boards such engineers, transportation experts, experts in water development, and constructors of eminence as it may deem advisable to employ in connection with such plans. And for the expenses of such organization, investigation, and plans the sum of $500,000 is hereby appropriated.

PERSONALS

Mr. D. S. Terry has been appointed Construction Engineer at Cincinnati, Ohio, of the Cleveland, Cincinnati, Chicago & St. Louis Ry., succeeding Mr. F. W. Smith.

Mr. D. Gilmour has been appointed Superintendent of the Montreal, Que., terminals of the Grand Trunk Ry., succeeding Mr. R. W. Scott, relieved on account of ill health.

Mr. A. S. Proudfoot, formerly with the Suburban Engineering Co., New York City, has been appointed Assistant to the Contract Manager of the Turner Construction Co., New York City.

Mr. Burton E. Reed, for a number of years with the Vandalia R.R., has been appointed Assistant to the General Manager of the International Interlocking Rail Joint Manufacturing Co., Chicago, Ill.

Mr. Hans Helland, Superintendent of Maintenance-of-way of the San Antonio & Aransas Pass Ry., at Yoakum, Tex., has been promoted to be Construction Engineer, with headquarters at San Antonio, Tex.

Prof. Frank B. Cooper, of the Randolph Macon College, Virginia, has been appointed Professor of physics at the Stevens Institute of Technology, succeeding Prof. Roger H. Galt, resigned on account of ill health.

Mr. R. B. Titsworth, Assoc. M. Am. Soc. C. E., Contracting Engineer of the McClintic-Marshall Construction Co., Pittsburgh, Penn., has resigned to become associated with the Detroit Bridge & Steel Works, Detroit, Mich.

Mr. Isham Randolph, M. Am. Soc. C. E., Consulting Engineer, of Chicago, Ill., has been awarded an Elliott Cresson Gold Medal of the Franklin Institute, of Philadelphia, "for distinguished achievements in the field of civil engineering."

Mr. A. W. Stephens, Assoc. M. Am. Soc. C. E., formerly Designing Engineer of the Turner Construction Co., New York City, has been promoted to be Engineer of the company. Mr. Stephens has been with the company for nearly eight years.

Mr. C. H. Harlan, Designing Engineer of the McClintic-Marshall Construction Co., Pittsburgh, Penn., has been promoted to be Contracting Engineer, succeeding Mr. R. B. Titsworth, Assoc. M. Am. Soc. C. E., resigned, as noted elsewhere.

Mr. Walter H. Lienesch, formerly connected with the Illinois Traction System, has been appointed Consulting Engineer in charge of the engineering department of the International Interlocking Rail Joint Manufacturing Co., of Chicago, Ill.

Mr. William W. Bosworth, M. Am. Inst. Arch., of New York City, has been chosen as the Architect for the new buildings of the Massachusetts Institute of Technology to be erected in Cambridge, Mass. Mr. Bosworth was a student at the Institute in 1886-1888.

Mr. R. E. Harrison, Assoc. M. Am. Soc. C. E., recently Resident Engineer in charge of the construction of the water filtration plant of the Grand Rapids, Mich., water-works, has resigned to accept the position of Supervising Engineer of construction for the Roberts Filter Manufacturing Co., of Darby, Penn.

Mr. M. C. Byers, M. Am. Soc. C. E., Chief Engineer of Operation of the St. Louis & San Francisco R.R., has resigned and the office has been abolished. Mr. Byers has been appointed Assistant to the President of the Great Northern

Ry., at St. Paul, Minn., succeeding Mr. Ralph Budd, M. Am. Soc. C. E., promoted, as noted in our issue of last week.

Mr. Charles P. Steinmetz, Past-President, Am. Inst. E. E., Consulting Engineer of the General Electric Co., Schenectady, N. Y., has been awarded an Elliott Cresson Gold Medal of the Franklin Institute, of Philadelphia, "for successful application of analytical methods to the solution of problems of the first practical importance in the field of electrical engineering."

Mr. Herman W. Hoefer has resigned as State Architect of New York with charges of alleged incompetency and inefficiency pending against him. Mr. Hoefer was appointed by Governor Dix in April of last year and reappointed by Governor Sulzer. He was formerly an architect of New York City. Deputy Architect Charles A. Susdorf has been appointed Acting State Architect.

Mr. William T. Blunt, M. Am. Soc. C. E., for many years United States Assistant Engineer on harbor improvement work at the west end of Lake Erie, and more recently Superintendent of subaqueous rock excavation, Panama Canal, has become associated with the Shirley-Skeldon Dredging & Submarine Contracting Co., Toledo, Ohio, as Secretary-Treasurer and Consulting Engineer.

Mr. R. C. Wilson, recently Superintendent in charge of construction work for the Turner Construction Co., New York City, has been appointed Engineer in charge of the department of designs of the company. Mr. Wilson has been with the Turner Construction Co. for the past six years and has had charge of erection on some of the company's most important building contracts.

Mr. Robert M. Anderson, M. Am. Soc. M. E., has joined the faculty of the Stevens Institute of Technology as Instructor in engineering practice. Mr. Anderson graduated from Stevens Institute of Technology in 1887 and was a member of the faculty for several years, first as Assistant in the department of mathematics and later in the department of experimental engineering.

Mr. A. C. Tozzer, Assoc. M. Am. Soc. C. E., formerly Superintendent in charge of construction for the Turner Construction Co., New York City, has been appointed General Superintendent for the New York City district of the company. Mr. Tozzer has been with the company eight years and was recently in charge of construction of the Bush Terminal Co. model loft buildings in South Brooklyn, N. Y.

Mr. George McCormick, formerly Assistant Superintendent of the Galveston, Harrisburg & San Antonio Ry., at El Paso, Tex., has been promoted to be Assistant General Manager, mechanical department, at Houston, Tex., succeeding Mr. J. W. Small, resigned. Mr. McCormick also becomes Superintendent of motive power and machinery of Morgan's Louisiana & Texas R.R. & Steamship Co. and the Louisiana & Western R.R., other subsidiaries of the Southern Pacific Ry.

Mr. H. W. Ridgway, recently Master Mechanic of the Colorado & Southern R.R. and the Atchison, Topeka & Santa Fé Ry. at Denver, Colo., has been promoted to be Superintendent of the motive power and car departments of the Colorado & Southern R.R., at Denver. Mr. Ridgway began his railway experience as a machinist apprentice with the Denver & Rio Grande R.R. in 1881. For many years he was employed by the Mexican Central Ry., first as journeyman and foreman and later as Superintendent of Shops at Aguascalientes.

Mr. Charles J. Bennett, of Hartford, Conn., on Feb. 25, took office as State Highway Commissioner of Connecticut, following his appointment by Gov. Baldwin and confirmation by the State Senate. Gov. Baldwin, at the beginning of his first term, two years ago, appointed a successor to Commissioner James H. MacDonald, who has held the office for a number of years, but his appointee failed of confirmation. In January of this year, at the beginning of his second term, Gov. Baldwin again appointed a successor to Mr. MacDonald, but the Senate refused again to confirm. The Governor thereupon appointed Mr. Bennett, with the result noted above.

Mr. J. R. Wood, Passenger Traffic Manager of the Pennsylvania R.R., has retired under the company's pension rules, having reached the age of 70 years on Feb. 9. Mr. Wood's railway career began in 1869, at the age of 26, as Secretary to the Superintendent of the Burlington & Missouri River R.R., at Creston, Iowa. Later he was Trainmaster and General Western Passenger Agent of the same railway at Chicago, Ill. Afterward he served in the passenger traffic and operating departments of the Michigan Central R.R. and the Chicago Burlington & Quincy R.R. His connection with the Pennsylvania R.R. began in 1881 as General Passenger Agent. In 1903 he was appointed Passenger Traffic Manager.

Mr. F. G. Jonah, M. Am. Soc. C. E., Chief Engineer of Construction of the St. Louis & San Francisco R.R. and Chief Engineer of the New Orleans, Texas & Mexico and the St. Louis, Brownsville & Mexico Rys., has been promoted to be Chief Engineer of all these lines, and the office of Chief Engineer of Construction has been abolished. Mr. Jonah is a Canadian by birth. After a high-school education he entered the office of the Chief Engineer of the Intercolonial Ry. as a student in 1882, at 18 years of age. He remained here for five years, serving as chainman, rodman, leveler and transitman. In 1887 he was appointed Resident Engineer on construction of the Oxford & New Glasgow Ry., but two years later returned to the Intercolonial Ry. as Assistant Engineer. Mr. Jonah came to the United States in 1890 to accept a position as Assistant Engineer of the St. Louis Merchants' Bridge Terminal Ry. For five years, 1894 to 1899, he was Resident Engineer of the St. Louis, Peoria & Northern Ry., which position he resigned to become Engineer of Maintenance-of-way of the Chicago & Alton Ry. In 1901 he was appointed Chief Engineer of the Blackwell Enid & Southwestern Ry. His connection with the St. Louis & San Francisco R.R. began ten years ago when he was appointed Assistant Engineer.

Messrs. Samuel C. McMeen and Kempster B. Miller, M's. Am. Inst. E. E., announce the incorporation of the firm of McMeen & Miller, Engineers, 1454 Monadnock Block, Chicago, Ill. The personnel of the firm includes besides the former partners, Mr. Leigh S. Keith Assoc. Am. Inst. E. E., who has been connected with the firm for a number of years as Managing Engineer. Mr. McMeen is senior member and Vice-President of the new firm and is well known as a telephone engineer. His experience with the Central Union Telephone Co., of Chicago, covered various positions from operator to Chief Engineer. Before entering partnership with Mr. Miller he was connected with the Western Electric Co. Mr. Miller is President of the new firm, and is widely known among electrical engineers as the author of "American Telephone Practice." He is a graduate of Cornell University. For many years he was connected with the Kellogg Switchboard & Supply Co., in Chicago, as Engineer and Manager. Mr. Keith, who is the Secretary-Treasurer of the firm, graduated from the Massachusetts Institute of Technology in 1900. He was employed for a number of years in the engineering department of the New York Telephone Co. He entered the employ of McMeen & Miller about four years ago, and for the past three years has been Managing Engineer of the firm. The organization of the firm has been increased to include a sufficient corps of engineers to handle all branches of electrical engineering practice.

Among some 30-odd men to be dined and publicly honored by the City Club of New York, on Mar. 10, for honorable and efficient service rendered to New York City, and each of whose services covers a period of at least five years, are found a goodly representation of engineers and public health officials. In speaking of the action of the City Club, which is an organization of 1300 members and founded in the interest of good municipal government, the New York "Times" of Mar. 2, rightly says, "The bright light of publicity which shines and must shine on the administrative heads of the huge offices that do the municipal business of New York often leaves in the shadow and in half-shadow men who in less conspicuous posts labor year in and year out with unflagging devotion for the city's good." According to the "Times," among the guests included are:

Mr. Nelson P. Lewis, M. Am. Soc. C. E., has been Chief Engineer of three successive Boards of Estimate and Apportionment. As such, he has been distinguished by the honesty and accuracy of his reports and investigations, and by a continuously intelligent interest in the physical development of the city. . . . Week after week the public improvement calendar is referred to Mr. Lewis for scientific and disinterested service, which has been the mainstay of several administrations.

Mr. Harry P. Nichols has been Chief of the Bureau of Franchises since it was established. To him have been referred week after week all requests for grants of franchises by the Board of Estimate. He is largely responsible for the development of a uniform franchise policy by the city. At the time Mr. Nichols started his service, there was neither rhyme nor reason in the treatment of franchises by the Board of Estimate. Since that time the standardization of franchise granting has become a topic of nation-wide discussion.

Dr. Ernst J. Lederle, Health Commissioner, is an example of the increasing number of commissioners drawn from the city's permanent civil service. Dr. Lederle was an employee of the Health Department for over 20 years, before his opportunity came in 1902 to reorganize the department. His services to public health have been very great.

Dr. Walter Bensel has been Sanitary Superintendent for two successive administrations of the Health Department. Citizens of New York will not soon forget the energetic and efficient manner in which he exercised the summary powers of the department during the street-cleaning strike a few years ago. He is the energizing force in the field work of the city's health service.

Mr. J. Waldo Smith, M. Am. Soc. C. E., has been Chief Engineer of the Board of Water Supply, which started the plan and construction of the Catskill system. The board was endowed with unusually broad powers of discretion, the exercise of which brought upon it much criticism in the Ashokan Dam and other matters. The failure in other work of the contractors whose bids were rejected has since demonstrated the wisdom of the board's course, for which Mr. Smith was largely responsible. The rapidity with which the Catskill work has been carried on marks it as one of the greatest municipal engineering achievements in the United States.

Dr. Daniel D. Jackson: Over in the quiet of a little building at the Prospect Park Reservoir there are arranged daily before Dr. Jackson samples taken from each and every source of New York City's water supply. He is, therefore, the sentinel of public health. Every source showing the slightest trace of infection is immediately closed and antiseptically treated. His work has undoubtedly saved thousands of lives every year.

Messrs. Benjamin F. Welton and Otto H. Klein are engineers in the office of the Commissioner of Accounts. They have not only constantly given expert advice in the various investigations conducted by the Commissioners of Accounts, but they have been faithful students of New York's municipal problems—men whose cooperation and assistance have been invaluable in many other parts of the city government.

Mr. George W. Tillson, M. Am. Soc. C. E., an engineer in the office of the Brooklyn Borough President, is a long-time public servant whose advice and work on street pavements has been of particular value to the city.

Mr. M. L. Fouquet, an engineer of the Brooklyn Borough President's office, has made a specialty of the problems, both engineering and otherwise, connected with the subsurface use of the city's streets. He has not only established a definite department for dealing with subsurface work in the Borough of Brooklyn, but has assisted in the formation of similar, necessary divisions in the offices of other Borough Presidents.

Mr. John T. Featherston: His work, both experimental and practical, in the disposition of refuse on Staten Island, has marked him as one of the chief authorities on this subject in the United States. Some time ago the city of Chicago unsuccessfully sought to take him away from us.

Gen. Theodore A. Bingham: It is not given to all of us to be as versatile as Gen. Bingham, who not only put the fear of God into the police force for several years, but who seems able to do the same thing to contractors. He also wisely plans and advises in the engineering work of the Department of Bridges.

Dr. John S. Billings: Probably no official in the city's service has had a more versatile and interesting career than Dr. Billings. Brevetted for faithful and meritorious service during the civil war he spent many years in the medical service of the United States Army; he prepared the vital statistics of both the 10th and 11th censuses; was Professor of Hygiene in the University of Pennsylvania, and in 1896 decided to spend the rest of his life in the service of the City of New York as Director of its great public library system.

OBITUARY

Lucien M. Cunningham, a civil engineer of Denver, Colo., died in that city, Feb. 21. He had not been in active practice for several years on account of ill health.

John R. Price, a railway contractor in the early days of the Atchison, Topeka & Santa Fé Ry. and pioneer Mexican railways, died at his home in Turon, Kan., Feb. 24. He was 84 years old.

A. O. Graydon, former City Engineer of London, Ont., died at the Victoria Hospital in that city on Feb. 28. He was born in Canada in 1852. He entered the city engineering department of London as a young man and in 1891 succeeded to the office of City Engineer, which he held for nearly 20 years.

Max Boehmer, M. Am. Inst. M. E., a civil and mining engineer of Denver, Colo., died at his home in that city Feb. 14, aged 66 years. He was a native of Germany and received his technical education in that country. He came to America as a young man and was first engaged in civil-engineering work on the improvement of the Mississippi and Missouri Rivers. He went to Colorado in 1879 and for many years was Consulting Engineer for several large mining interests.

Dr. Philip Hanson Hiss, Jr., Professor of bateriology at Columbia University, died Feb. 27. He was born in Baltimore, Md., in 1868 and graduated from Johns Hopkins University in 1891; he received his degree of Doctor of Medicine at Columbia University in 1895. He was Assistant Bacteriologist of the Department of Health of New York City from 1896 to 1899. He was famous among sanitarians for his work in isolating typhoid bacilli, and his studies of the bacteriology of typhoid fever.

Robert B. Seymour, former Chief Engineer of the Chicago, Indiana & Southern R.R., died at his home at Oak Park, Ill., Feb. 23. Mr. Seymour was born at Hingham, Mass., in 1859. His engineering experience began at the age of 22 years. In 1885 he entered the engineering corps of the Illinois Central R.R., at Chicago. Later he was connected with the building of the Richmond, Petersburg & Carolina R.R., now a part of the Seaboard Air Line Ry. He was afterward Chief Engineer of the Chicago, Indiana & Southern R.R. until its absorption by the New York Central Lines, when he entered private practice as a consulting engineer.

Charles E. Gossett, General Master Mechanic of the Minneapolis & St. Louis R.R., at Minneapolis, Minn., died at his home in Rochester, Minn., Feb. 19. He was 44 years old. He was educated at the Missouri State University and entered the railway service in 1886 as a machinist helper with the Wabash, St. Louis & Pacific R.R. Later he was fireman and locomotive engineer on various railways in the Middle West. In 1905 he was promoted to be road foreman of engines of the Chicago, Rock Island & Pacific Ry. and shortly afterward Master Mechanic. Three years later he was appointed Master Mechanic of the Iowa Central R.R. and in 1910 accepted the same office with the Minneapolis & St. Louis R.R. He was promoted to General Master Mechanic on Jan. 1, 1912.

Robert Law, former Vice-President and General Manager of the Colorado & Northwestern R.R., died recently at Los Angeles, Calif. He was born in New York State in 1851. After a common school education he entered the railway service at 10 years of age, in 1861, as a water boy on the Atlantic & Great Western Ry. From 1866 to 1882 he was with the Union Pacific R.R. as foreman on trackwork and construction, Division Roadmaster, General Roadmaster, Division Superintendent, Superintendent of Construction and General Superintendent. From 1882 to 1886 he was General Superintendent of the Missouri lines of the Burlington System. From 1886 to 1890 he was Division Superintendent and Assistant General Manager of the Northern Pacific Ry. For a few years following he was Manager of the Chicago Ry. Transfer Association. In 1893 he became Manager of the Burlington & Northwestern Ry. at Burlington, Iowa. His last active work in railroading was with the Colorado & Northwestern R.R.

Sir William Henry White, Past-President of the Institution of Civil Engineers of Great Britain, and the most eminent naval engineer of his time, suffered a stroke of apoplexy on Feb. 27 and his death shortly ensued.

William White was born in the dockyard town of Devenport, England, Feb. 2, 1845. The illness of his father placed the family in straitened circumstances, and at the age of 14 William White entered the Government dockyard as an ordinary shipwright apprentice boy. He had neither means nor influence back of him, so his chances for rising above the grade of an ordinary workman were apparently no better than those of any other of the many apprentices in the yard. There was, however, a system of examinations for apprentices desirous of proving their ability and industry and William White's record in these examinations was so excellent that it won for him admission to the Royal School of Naval Architecture. He achieved high honors here and received a diploma as Fellow in the first class.

Upon his graduation he was appointed a member of the staff of the Chief Naval Constructor at Whitehall and at the early age of 22 was made confidential assistant to Sir Edward Reed of the Admiralty. For fourteen years he worked steadily in the Government service, and in 1881, when only 36 years of age, he was made Chief Constructor, the highest rank in the corps of Royal Naval Constructors.

In 1883, at the solicitation of the great engineering firm of Armstrong & Co., at Newcastle, he resigned from the Navy and assumed chief responsibility for the great Armstrong shipbuilding plant. During the two years from 1883 to 1885 while Mr. White remained with the Armstrong firm he designed and superintended the building of ships for China, Japan, Italy and Spain. At this time the United States was just setting about the preliminary steps toward creating a modern navy, and some of the designs for its first vessels were purchased from the Armstrong firm, having been made under Sir William White's direction.

In 1885, Sir Nathaniel Barnaby, who had succeeded Sir William White as Chief Constructor of the British Navy, became ill. The Government was about to undertake an enormous increase in the naval establishment far beyond anything before dreamed of. It was deemed necessary to have the most competent ship designer obtainable at the head of its work. Lord George Hamilton, First Lord of the Admiralty, asked William White to return to the Government service and take the chief responsibility for the design of this new British navy.

From the pecuniary point of view the acceptance of the Government offer meant a sacrifice, for in Great Britain as in the United States the Government pays meager salaries to men of high ability compared with what they could command in private business. The appeal was made, however, to William White's patriotism, and was not made in vain.

He returned to the British navy with a new title. While his predecessors had been known as Chief Constructors, he was made Director of Naval Construction and Assistant Controller of the Royal Navy. For 17 years he held this important office, up to February, 1902, when ill health compelled his resignation.

The creation of the modern British navy was due to Sir William White. Indeed, as naval practice in all other countries of the world is largely copied from Great Britain, it may be truly said that to Sir William White more than to any other one man is due the origination of the navies of the present day.

In recognition of his great service to his country and his great professional ability he received the honor of knighthood in 1895. Upon his retirement from the Government service in 1902, Parliament voted him a grant of money in recognition of his distinguished service.

The list of engineering societies in which Sir William held membership and from which he received honors is a very long one. He was an honorary member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the American Society of Naval Engineers and Marine Architects. Sir William had frequently visited the United States. As a Past-President and Member of the Council of the Institution of Mechanical Engineers of Great Britain, he took a large part in arranging the joint international meeting of the institution and the American Society of Mechanical Engineers held at Birmingham in 1910. In the fall of the year following he visited America, accompanied by Lady White and his daughter, and received the award of the John Fritz medal.

Sir William was a notable contributor to technical literature, both to the proceedings of the engineering societies of which he was a member and as the author of well known treatises on naval construction. Since his retirement from the Government service in 1902 and his restoration to health he has done most important work as a consulting engineer of international reputation. Doubtless the most famous piece of work with which his name is associated was the building of the "Mauretania" and "Lusitania" for the Cunard company, which vessels when built and for several years afterward were by far the largest ships in existence as well as the fastest ocean-going steamers. Sir William is also credited with being the originator of the Dreadnought type of battleship.

It is noteworthy that notwithstanding his work in the design of vessels of record-breaking size, Sir William held conservative views in this matter and was on record as favoring a return to smaller vessels both in the merchant marine and the naval service.

ENGINEERING SOCIETIES

COMING MEETINGS

VERMONT SOCIETY OF ENGINEERS.
Mar. 10. Annual meeting at Burlington, Vt. Secy., G. A. Reed, Barre, Vt.

NEW ENGLAND RAILROAD CLUB.
Mar. 11. Annual meeting at Boston, Mass. Secy., W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.

ILLINOIS WATER SUPPLY ASSOCIATION.
Mar. 11-12. Annual meeting at Urbana, Ill. Secy., Edward Bartow, Urbana, Ill.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.
Mar. 18-21. Annual convention at Chicago, Ill. Secy., E. H. Fritch, 900 S. Michigan Ave., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

AMERICAN CHEMICAL SOCIETY.
Mar. 25-28. Annual meeting in Milwaukee, Wis. Secy., C. L. Parsons, Box. 505, Washington, D. C.

NATIONAL FIRE PROTECTION ASSOCIATION.
Mar. 26-27. Annual meeting in New York City. Secy., Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL BUILDING TRADES AND EMPLOYERS ASSOCIATION.
Mar. 26-27. Annual convention at Washington, D. C. Secy., J. H. Stotler, 15 E. Fayette St., Baltimore, Md.

NEW ENGLAND STREET RAILWAY CLUB.
Mar. 27. Annual meeting at Boston, Mass. Secy., H. A. Faulkner, 12 Pearl St., Boston, Mass.

AMERICAN ELECTROCHEMICAL SOCIETY.
Apr. 2-5. Annual meeting at Atlantic City, N. J. Secy., J. W. Richards, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Vice-Pres., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, owa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Shurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STEEL RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention of Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION.
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

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The Municipal Engineers of the City of New York—At the regular monthly meeting held Feb. 26, a further discussion took place of the proposed salary schedule for New York City engineering employees. No changes were made in the schedule as published in our issue of Jan. 16, 1913, p. 110, and it was voted to refer the adoption of the committee's report to a letter ballot.

American Railway Engineering Association—The annual convention of this Association is to be held Mar. 18-21, in the Congress Hotel, Chicago, Ill. Nominations for officers for the ensuing year are as follows: President, E. F. Wendt; Vice-President, Robert Trimble; Treasurer, G. H. Bremner; Secretary, E. H. Fritch; Directors, H. S. Balliet, C. H. Ewing, J. V. Hanna, J. D. Isaacs, C. E. Lindsay, C. A. Morse, A. K. Shurtleff, Earl Stimson and J. G. Sullivan.

Minnesota Surveyors and Engineers Society—At the annual convention in St. Paul, Minn., on Feb. 11-13 officers for the ensuing year were elected as follows: President, Wm. Danforth; Vice-President, W. F. Brooks; Secretary-Treasurer, C. A. Forbes.

Illinois Water Supply Association—The annual meeting will be held at Urbana, Ill., Mar. 11-12. Among the papers to be presented are the following: "Legal Aspects of Financing Municipal Waterworks," by E. V. Orvis; "The Advantages of a Municipal Laboratory," by W. E. Park; "Value of Conductivity as Applied to Water Analysis," by C. C. Young; "Sterilization of Water by Ultra-Violet Light," by J. R. Davies; "Practical Methods for Obtaining High Efficiencies in Waterworks Pumping Plants," by S. G. Pollard; "Water Wastes," by W. D. Gerber; "The Rapid Preliminary Testing of Water for Sewage Contamination," by Adolph Gehrmann; "Hypochlorite Disinfection vs. Typhoid Fever," C. A. Jennings; "Fire Streams from Small Hose and Nozzles," by V. R. Fleming, and "Appraisal of Waterworks Properties," by D. B. Graham.

Indiana Sanitary and Water Supply Association—The sixth annual convention of the Indiana Sanitary and Water Supply Association was held at Indianapolis, on Feb. 26 and 27, with about two hundred members and guests present.

In his annual address President F. C. Jordan (Secretary, Indianapolis Water Co.) spoke of the marked interest in the association shown by water-works men, engineers and health officers throughout the state. After commenting on the non-progressiveness of some water companies, Mr. Jordan said that in view of the recent enactment of a statute creating a Public Utility Commission it would be well for all concerned to put their affairs in order.

The report of Secretary-Treasurer W. F. King (Indiana State Board of Health, Indianapolis) indicated that the association was prospering, both in membership and financially.

In a paper on "The Management of a Municipal Water Department," Henry Drach (Superintendent, Anderson Water-Works) favored the use of meters and opposed "free water" for any one, since the latter is likely to lead to trouble. He also urged that politicians should be kept out of water departments.

A feature of the program was an address on "The Prevention of Preventable Diseases," by Dr. L. L. Lumsden (U. S. Public Health Service). Allied with this subject was a paper on "The Typhoid Age in Indiana," by Dr. J. N. Hurty, State Health Commissioner of Indiana. This "age," Dr. Hurty showed, is rapidly passing away.

A dozen or more other papers were presented, dealing with water-supplies from shallow wells, sewage treatment water purification, and a number of other subjects. Several of these will be taken up in a later issue of this journal.

The following officers were elected: President, Dow R. Gwinn, Terre Haute; Vice-President, Howard Dill, Richmond; Secretary-Treasurer (reelected), Dr. W. F. King, Indianapolis.

PRICES OF ENGINEERING MATERIALS

PRICE CHANGES AND THE BUSINESS OUTLOOK

Activity in general business is fair, little or no complaint being heard from merchants, distributors or general consumers. There has, it is true, been a diminution of activity in seasonable goods, such as sleighs, heavy clothing and rubber goods, but in general, business has been fully as active as was expected.

The returns from operations, while not as satisfactory as a few years ago, are somewhat better than last year, and moreover, there is a prospect that this will improve with the season, providing the increase return is not paid out in higher wages.

Iron and steel markets have been active, and, although not as buoyant as they were in the fall of 1912, still there is very little complaint. February is ordinarily a month of unusual dullness, yet there was much buying by manufacturers paying special attention to railroad supplies, and from the railroads themselves.

There have been slight declines in the price of pig iron, particularly in the South, and a further decrease in the quotation for iron and steel scrap has unsettled sentiment. On the other hand, there is an enormous demand for light steel products, and should the general situation improve, it is expected that higher prices will be named for wire goods. The decline in coke had a sentimental effect in unsettling the iron market. The price of coke has for several months been entirely too high to correspond with the quotations of pig iron. It is believed that the production of iron throughout the world is at a maximum, and that no increase can be expected, until additional capacity is built.

Practically a continuous decline in the price of copper brought the quotation for electrolytic in New York down to 14¾c., 3c. below the high figure reached last fall, and fully ¼c. under the point where there was fair buying by American consumers. Despite the sharp reduction, there has been little or no buying by Europe, and conditions are no more satisfactory than they were a month ago. It is possible that European interests may not buy until even lower quotations are named, for it is almost axiomatic that consumers abroad will not buy after a decline, unless further inducements are offered. In February, the sharpest reduction in the price of pig tin was also witnessed. This was subsequently recovered. Other metals have been steady.

Building operations are more active than they were a month ago, particularly outside of New York, and many structures of a cost ranging from $100,000 to $500,000 have been planned. Not as much factory building is promised as eight months ago, but it is rather too early in the season to look for anything of this character. Building in New York is inactive, except in one or two restricted localities, and the probabilities are that it will continue so until definite plans are made for transit improvements.

Railroad activities were fully as pronounced as last month, and the purchases of equipment by the leading trunk lines of the country far exceed anything in recent years. Some of the largest locomotive orders ever placed have been booked in the last month, and the leading locomotive builders of the country are unable to accept business for delivery during the first half of this year. In connection with large business of this character, there have been some excellent orders for cars, and material for car building, by railroads who choose to this work in their own shops.

Financial conditions have not improved. Capitalists are more timid than usual, the heavy drain of gold in Europe continues, and a steady sagging in the price of securities in the principal markets of the country did not have a reassuring effect. Municipalities will find it difficult, if not impossible, to secure money at anything like the old rate of a year or so ago, and in consequence, much work will be postponed. In New York State, some new schemes of taxation are being advocated, which will assist materially in providing revenue for present needs. An amendment to the Federal Constitution, which will permit of an income tax, will have a far-reaching effect on local taxation, if any of the many schemes now before the public are put into force.

Labor is fairly well satisfied with present conditions. The greatest unrest of the month was among locomotive firemen and their employers. At first it looked as though a strike could not be averted, but the railway managers finally retreated from their position and decided to arbitrate under the Erdman Act. This will mean a much quicker decision in the case of the locomotive engineers, but many claim that the Erdman Act is defective in several important particulars, and in that case, it should lead to a change. Another strike of minor importance was among the shop men on the Lehigh Valley Ry., but, in general, labor conditions have been much more satisfactory. The veto of the immigration bill which provided an elaborate series of educational tests was most satisfactory, especially as this country is in need of muscle which can swing a pick or a shovel rather than scholastic requirements.

The Public Service Commission for the First District of New York approved the long-pending operating contract with the Brooklyn Rapid Transit Co. and the Interborough Rapid Transit Co., Mar. 4.

LABOR

What promised to be serious trouble in the labor world early in the month has been averted, and the firemen and the managers of the railways will arbitrate their difficulties under the Erdman Act. It took the combined efforts of a number of men, friendly to both parties, to bring about this settlement, the managers objecting to the small board, and the employees at first contending that it placed too much power behind one man. It will be remembered that each party to the controversy selects one arbitrator, and the third is selected by these two. Another objection advanced to this act was the fact that it had to complete its findings in 30 days, which it is claimed is too short a time to go into all of the details of such a controversy. It looks as though the railways may have trouble with the maintenance-of-way men, but this has not come to a head yet, and probably will not, until work opens in the spring. The Industrial Workers of the World seem to be losing ground, not only in the garment strike in New York, but also in the weavers' strike in Paterson. This new federation has not gained sympathy, and moreover has antagonized public opinion more than any other labor organization in recent years. Not only that, but it has particularly antagonized the American Federation of Labor.

The Immigration Bill, which provides for an elaborate educational test for immigrants entering this country was at first thought to be unavailing, as an attempt was made to repeal it in Congress over the President's veto. This was lost. The legislation found surprisingly good support in a great many quarters, but it is probable that such a bill would have been repealed early, had it been made a law, for if there is anything needed in this country at the present time, it is muscle and brawn rather than scholastic attainments, especially by contractors. Labor agencies in New York making a specialty of furnishing outside workmen report that there is a good demand for all kinds of labor at around $2 per day.

In the following table is given the wages per day of employees in building trades in Manhattan and vicinity. This list was in effect Mar. 1, and shows comparatively little change with that published on page 59 of the Construction News Supplement, Aug. 4, 1910.

Asbestos workers, insulators	$4 75
Asbestos workers helpers	00
Blue Stone Cutters	4 50
Blue stone cutters helpers	3 00
Boiler makers and iron ship builders	5 00
Boiler makers helpers	3 50
Bricklayers	5 60
Bricklayers helpers	3 00
Carpenters and framers	5 00
Cabinet makers	5 00
Cement and concrete masons	5 00
Cement, concrete and asphalt laborers	3 00
Derrickmen and riggers	4 00
Decorators and gilders	4 50
Decorative art glass workers	5 00
Elevators	5 28
Elevator constructors helpers	3 40
Electrical workers	4 50
Electricians helpers	2 20
Electrical fixture workers	4 50
Engineers, stationary	4 50
Engineers, portable hoisting, etc	50 2
Framers	5 00
Granite cutters	4 50 5 00
House shorers, movers and sheath pilers	$ 75
House shorers helpers	2 65
Housesmiths and bridgemen	5 00
Ironworker	5 00
Ironworkers helpers	3 50
Ironworkers apprentices	3 00
Metallic lathers	5 00
Marble cutters and setters	5.5
Marble carvers	6.00
Marble polishers	4 00
Marble sawyers	4 25
Marble bed rubbers	4 50
Marble cutters helpers	4 25
Mosaic workers	4 50
Mosaic workers helpers	3 00
Machine stone workers	4 00
Machinists of all description	5 00
Plate and sheet glass glazers	3 50
Plasterers, plain and ornamental	5 50
Plasterer modelers	$30 00 to $100 00 weekly
Plasterers laborers	3 25
Plumbers and gas fitters	5 50
Painters	4 00
Painter-decorator	0
Painter-lettering	4 50
Riggers on machinery, dynamos, boilers, etc	4.00
Roofers, tar, felt and waterproofers	=
Rockmen	4 50
Rock drillers and tool sharpeners	3 00 3 75
Sheet metal workers and tinsmiths	4 75
Slate and tile roofers	5.00
Steam and hot water	5 50
Steam fitters helpers	3 00
Tile layers	5 50
Tile layers helpers	3 75
Upholsterers of all description	4 50
Varnishers	4 00
Wood laborers on new work 3 50 Overhauling jobs	5 00

CEMENT, LIME AND BRICK

Portland Cement—The market is steady and firm, and cement dealers are more optimistic than they have been in five years. Most of them are well sold up for the first half of this year, and whatever business they take from now on will show a fair profit. While prices have been higher, during the last few months this has not been of any great advantage to the mills, as so many old-time contracts had been made at much lower figures that they were scarcely getting a new dollar for an old one. Now conditions are different.

and while there is a fair return on the investments, there is no money to put in new plants or equipments. It has been some time since any new cement capacity was built in the East, and it may be that the output this year will not be large enough to supply the demand. In the West, such conditions have prevailed for several years, and, there, sharp advancements have been made in quotations.

Prices are unchanged from last month at $1.58 per bbl. in New York with an allowance of 10c. for each bag returned. This is equivalent to about 90c. per bbl. in bulk at the mills. It has been stated that some of the mills are trying to secure business outside of New York at 80c. to $1 in bulk at the mill, but the New York market continues to be highly competitive territory. In Pittsburgh, the quotation is $1.58, with an allowance of 10c. for each bag returned.

Natural Cement—In New York, quotations are steady at 90c. per bbl., and there is a fair demand. In Boston the quotation is $1.10.

Brick—Business has not been active and quotations show only a slight advance from last month. Quotations are $7@7.35 for Hudson River common and $7@7.25 for Raritan.

Lime—The market is steady and firm with no change reported from last month. Quotations are as follows for lots of 500 bbl. delivered in New York: State common, 75c. per bbl.; Rockland-Rockport special, 300 lb., $1.37; finishing, 300 lb., $1.40; finishing, 200 lb., $1.02; 350 lb., $1.62; New Milford, $1.30.

Plaster Blocks—No change has been made in price. Quotations are as follows:

	Weight, per sq.ft., lb	Price, per sq.ft., cents
2-in.	7	6
3-in.	9½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13⅓ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

Plaster boards, ⅝ in. thick, are 16c. per sq.yd.

STONE

Blue Stone—Trade is at a standstill without even inquiries of any note, as these are the days just preceding the beginning of activity of inquiries for spring business. Prices are held steady with an outlook for a higher tendency as spring approaches. This will depend largely upon the demand, however, as a heavy one will increase the cost of quarrying and handling and so will have a stimulating effect on prices. Quotations in New York are at 19@20c. for flagging 3 in. thick delivered alongside of dock or f.o.b. cars, New York. Sewer bottom 5 ft. square and 3 in. thick, are sold at 25c. per sq.ft. Curbing, 5x16 in., is 45c.; 5x20 in., 50c.; 6x16 in., 53c.; 5x24 in., 65c.; 6x24 in., 70c., f.o.b. New York. These prices are per lin.ft.

Promiscuous shapes of building and foundation stone sell at 70@75c. per cu.ft.

Granite—The market is quiet and prices are 40@55c. per cu.ft. for run of quarry. Dressed stone is held at 80c.@$1 per cu.ft.

Limestone—Prices continue steady and unchanged at 80c@$1 per cu.ft. for limestone in the rough delivered alongside of dock in New York. Dressed stone in New York is quoted at $1.25@1.50 per cu.ft.

Interior Stone—Slate flooring, 1 in. thick, can be had at 20c. per sq.ft. for the common or ribbon variety. Clear black sells at 35@40c., and the same price is asked for Vermont. A combination of slate and marble flooring is 30c. per sq.ft.

Marble floor, finished ready to lay, of Vermont marble, is 50@70c. per sq.ft.; Italian marble, 70@90c. Tennesee marble can be had at 65c. Ordinary stair work, such as slate steps, is quoted at 24c. per sq.ft.

CRUSHED STONE SAND AND GRAVEL

Crushed Stone—Prices, though quoted at the present time as steady with no change from last month, have a much higher tendency. Business now is quiet as there is no stone to be had, and even small orders cannot be filled. It is expected that quotations will be advanced before the time for spring contracting begins. Dealers are looking forward to an enormous demand to start at the immediate opening of the season, and to continue heavy during the summer months. Prices are quoted at 85@95c. per cu.yd. for 1½-in. stone, 90c.@$1 for ¾-in. stone, and 90c.@$1 for screenings. These quotations are for full cargo lots of 500 cu.yd., delivered alongside of dock, New York.

Sand—Business is quite dull, as river transportation is closed and weather conditions have shut off the supply. The outlook for spring business is held to be unusually bright, and it is expected that the demand will exceed all previous records. The price quotation for spring business will be 50c. for full cargo lots delivered along side of dock, New York.

Gravel—Quotations are still up from 85@90c., and prices for spring contracting will have this high tendency. Business for the past month has been, of course, dull, due to the closed season, but it is expected that the coming spring and summer seasons will far surpass even the record year of 1912. An unprecedented demand is expected to materialize at the very beginning of the opening of navigation. Prices are quoted for full cargo lots of 500 cu.yd.

IRON AND STEEL

Pig Iron—Numerous declines have taken place in the market since one of them at all severe, most of them simply representing the disappearance of the premiums which were paid for prompt delivery. In the South some weak iron was offered at $13, which shows more weakness than any other market. There was also a little of this other products were able to secure $13.50 for, but few of the were willing to dispose of. It seems probable that pig-iron consumers are waiting to see what the conditions will be after the inauguration of the new President and it must be admitted that there is a great deal of timidity in business circles, with more in the iron and steel industry than any other special branch of trade.

That this timidity should exist on the part of the steel makers is not to be wondered at, since it is the avowed principle of the party in power to make a reduction in existing tariff rates.

The production of pig iron throughout the world is probably the maximum at present. Every furnace in Germany, Great Britain and the United States, which can produce iron at all economically, is in blast, and it will be impossible to have a higher operating ratio until more are built. The consumption of foundry iron has increased within the last fortnight, due, probably, to the more reasonable prices ruling for coke.

Quotations for 100-ton lots from the points named are as follows: Cincinnati, Southern Foundry No. 2, $16.75@17.25; Southern Foundry No. 4, $16.50@16.75; Northern Foundry No. 2, $17.75@18.25. In Philadelphia, Eastern Pennsylvania No. 2 plain is $18@18.25; West Virginia No. 2X Foundry, $17.25@18.50. In Chicago, No. 2 Foundry is considerably cheaper than last month at $17.25@18; No. 3 is $16.75@17.25. In New York, Northern Foundry No. 2 plain is $17.50@17.75; No. 2X, $17.75@18.25. In Pittsburgh, bessemer is $18.15 and basic $17.15. Both of these quotations include the 90c. freight rate from the valley to Pittsburgh. In the Birmingham district, resale iron has been offered a $13, and most of the iron sold has been at $13.50.

Steel Rails—Numerous orders have been received for girder rails, and this has been quite the feature of the market in the last month. Railroad companies have been buying liberally of standard section, and Western roads have not been far behind in their purchases. There has been no especially large buying, but numerous small orders have been booked. It is also noticeable that there has been an unusual quantity of light rails ordered.

Export orders have fallen off, but foreign mills are not in a position to take any large quantities for export, and it is probable that a great many orders of this character will come to American mills some time this year.

Prices continue without change on a basis of $28 for standard sections of bessemer rails, and $30 for open-hearth rails. Girder rails in 30-ft. lengths are $38.40 per gross ton; 60-ft. lengths, $40.40 per gross ton, f.o.b. New York. Other quotations, f.o.b. Pittsburgh, are as follows: Standard sections, 50 to 100 lb. per yd., 1.25c. per lb.; 40 to 50 lb., 1.21c.; 12 lb., 1.25c. In New York, relaying rails can be had at $22@22.50. In Chicago, standard sections of relaying rails are held at $24.

Track Supplies—Some heavy orders have been received for spikes, and the spike-making capacity of the country has been spoken for for several months ahead. The Pennsylvania R.R., which uses a special form of spikes made only by two mills, contracted for practically the entire output of these mills for several months in advance. Other orders for track fastenings are just as heavy, and the railroads are urging shipments.

Tie plates are in especially good demand, and prices have advanced, $33@35 per net ton being demanded in Chicago. Spikes in Pittsburgh are selling at $1.80@1.90, but for prompt delivery some sales have been made at $2.25. Angle bars are held at $1.50@1.60. In Chicago, spikes are $1.95@2.05; angle bars, $1.60; track bolts with square nuts, $2.30@2.40. All of these quotations are per 100 lb. The extras on railroad and boat spikes are unchanged as follows:

Railroad spikes	Cents
3, 3½, 4, 4½ and 5x½	Extra .10
3½, 4 and 4x⅝	Extra .20
3, 3½, 4 and 4½x¾	Extra .30
3x⅞	Extra .40
2½, 3 and 3½x¾	Extra .60
2x¾	Extra .80

Structural Materials—Business has been more active, and has increased steadily since the early part of the month. No very large orders have been taken, but there have been a great many inquiries from all parts of the country. The greatest amount of buying has been by builders of cars and railways which will build cars in their own shops. Some exceptionally large orders have been taken from Eastern railroads which will build a large proportion of the equipment required this year by company forces. Shipbuilding work, likewise, promises to be fully as active as last year, not only on coastwise shipbuilding points, but on the Great Lakes. The railroads also have purchased bridge work rather freely.

Quotations are unchanged as follows: Prompt shipments of angles and beams from Pittsburgh are held at 1.70c.; future delivery is a trifle easier than last month at 1.45c. Other quotations are as follows: I-beams over 15-in., H-beams over 18-in., angles over 6-in., 1.50c.; deck beams and bulb angles, 1.75c.; hand railed tees, 2.25c.; checkered and corrugated floor plates, 2.40c. The following extras are named for cutting to specified lengths: Under 3 ft. to 2 ft., inclusive, 25c. per 100 lb.; under 2 ft. to 1 ft., inclusive, 50c. per 100 lb.; under 1 ft., 55c. per 100 lb. No charge is made for cutting to special lengths of 3 ft. and over.

Cast-Iron Pipe—No large orders have been placed in the last month, but a good deal of buying by small water companies and private companies has been in evidence, and it is probable that the foundries have more consumers on their books than they have had in a long time. Southern foundries have all the work they can take care of for the next few months.

Quotations per ton of 2000 lb. are as follows:

Chicago, 4-in., $31; 6- to 12-in., $29; 16-in. and larger, $28.
Birmingham, Ala., 4-in., $24.50; 6-in., $22.50.
New York, 6-in., $24@25.
Gas pipe is held $1 per ton higher in all markets.

Pipe—Large inquiries have come into the market from Canadian consumers, and an attractive order was secured from the General Petroleum Co., of California, for 60 miles of 8-in. pipe. Quite a tonnage of light and low-pressure pipe will be used at the Panama-Pacific Exposition, and this contract has been divided between a Chicago firm and a San Francisco dealer. The demand for large sizes of pipe, particularly oil pipe and casing, is especially brisk. Some very good orders have been placed for the smaller sizes.

Discounts are not as firm as last month, and it is possible to shade the following from 2½ to 5 points, where a desirable order is in question. The discounts are as follows:

	Black.	Galvanized
½- to 3-in. steel butt welded	80%	71½%
2½- to 6-in. steel lap welded	79%	70½%
7- to 12-in. steel lap welded	76%	65½%

At these discounts the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
⅛-in.	2.20	3.28	5-in.	31.00	13.50
¼-in.	3.40	4.85	6-in.	40.50	57.00
⅜-in.	4.60	6.56	7-in.	57.00	$2.00
½-in.	5.50	7.85	8-in.	60.00	$6.00
¾-in.	11.70	16.60	10-in.	98.50	$1.42
3-in.	15.30	21.90	11-in.	$1.15	1.60
4-in.	22.90	32.20	12-in.	1.27	1.72

Piling—The demand is no better than it was a month ago, and quotations are slightly easier at 1.45@1.55c., f.o.b. Pittsburgh.

Sheets—Mills of the leading interest are operating to fully 80% of capacity, and while the demand is not as large as a month ago, it is sufficient to keep the mills working at this rate, even though it is a dull season of the year. Quite a little buying has taken place, but none of the large producers care to accept orders later than July 1 at present quotations. They also refuse to make any quotation for subsequent delivery. It is probable that in the middle of April, or perhaps slightly earlier, that quotations will be named for second half, and it would not be surprising if the general quotations were raised $2 per ton about that time.

Quotations from mill, f.o.b. Pittsburgh, and from store, f.o.b. Chicago, in cents per pound, are as follows:

Nos.	Cents per pound—Carload lots, Pittsburgh Black	Galv.	Small lots, Chicago Black	Galv.
10 and 11	2.00	2.50	2.75	3.35
12	2.00	2.60	2.70	3.35
13 and 14	2.05	2.60	2.75	3.35
15 and 16	2.10	2.75	2.85	3.45
17 to 21	2.15	2.90	2.90	3.60
22 and 24	2.20	3.05	2.95	3.75
25 and 26	2.25	3.20	3.00	3.90
27	2.30	3.25	3.05	4.05
28	2.35	3.50	3.10	4.20
30	2.50	3.80	3.50	4.60

Plates—The excellent business which has been taken by car builders is responsible for more activity in plates than has appeared in a number of months. It was thought with the phenomenal car buying of last year that the market would be saturated with car orders, but the activity of the railroads in buying equipment has been just as pronounced during the first two months of this year as at any time last year, and in addition, some enormous orders have been placed for motive power. Shipbuilding work continues just as active as last year, and in addition, quite a little new work has cropped up for car floats on the Great Lakes. An important order for plates for sewer work was taken last month.

Prompt shipments of plates from Pittsburgh are held at 1.70c., and from New York, 1.86c. Future deliveries are held at 1.45, Pittsburgh, and 1.61, New York. Extras are unchanged from last month as follows:

	Cents per lb.
Gages under ¼-in. to and including ⅜-in. on thinnest edge	10
Gages under ⅜-in. to and including No. 8	15
Gages under No. 8 to and including No. 9	25
Gages under No. 9 to and including No. 10	30
Gages under No. 10 to and including No. 12	40

Old Materials—While there has been practically no improvement in prices, and on the other hand, some quotations are lower than a month ago, sentiment in the West has shown a slight change, and it is believed that the prevailing prices are around the bottom. In New York the following quotations are current:

	Per net ton
Heavy-melting steel scrap	$10.50@11.00
No. 1 railroad wrought	13.00@13.50
Pipes and flues	10.00@10.50
Cast borings	7.75@ 8.25
Machinery cast, broken up	11.50@12.00
Stove plate	8.75@ 9.25
Malleable castings	11.00@11.50
Wrought turnings	8.00@ 8.50
No. 1, yard wrought long	11.50@12.00
No. 1, yard wrought short	10.50@11.00

The Chicago market is just as weak as it was a month ago, and some particularly low quotations have been named. Prices are as follows:

	Per gross ton
Heavy-melting steel scrap	$12.00@12.50
	Per net ton
No. 1 railroad wrought	$12.00@12.50
No. 2 railroad wrought	11.25@11.75
No. 1 cast scrap	12.50@13.00
Pipes and flues	8.75@ 9.25
Agricultural malleable	11.50@12.00
Railroad malleable	13.00@13.50

In Pittsburgh, lower prices have been made again this month for heavy-melting steel scrap, and $14 has been named. On the other hand, one large consumer purchased 3000 to 4000 tons on prices ranging from $14.25@14.50, which would indicate that there is a slight betterment in the lowest quotation made. The consumption of scrap in the Pittsburgh district is unusually heavy, but the complaints of shippers on rejection are practically uniform that much material is being rejected, which, under ordinary circumstances, would be gladly accepted. Quotations in the Pittsburgh district per gross ton are as follows:

Heavy-melting steel scrap	$14.00@14.25
Re-rolling rails	15.25@15.50
No. 1 cast scrap	15.00@15.25
Old car wheels	15.75@16.00
Machine-shop turnings	9.00@9.25
Stove plate	10.25@10.50
Cast borings	10.25@10.50

Wire Rope—Prices are without change. The discount to the larger trade is 42½ and 5%, from list for galvanized, and 50 and 5% for bright.

The net prices of wire rope are as follows:

Diameter in	Price per ft. Cast steel	Crucible steel	Plow steel
2½	$1.05	$1.24	$1.46
2¼	.88	1.05	1.22
2	.57	.65	.76
1¾	.55	.54	.64
1½	.32	.39	.45
1¼	.23	.28	.32
1	.15	.18	.21
⅞	.10	.11	.13
¾	.07	.09	.10
⅝	.06	.07	.07

Rivets—The demand which was so insistent a month ago has quieted down. Quotations are unchanged, structural rivets being quoted at $2.20, and boiler rivets at $2.70. These prices are per keg of 100 lb. f.o.b. Pittsburgh.

Castings, Gray Iron—There is not the active competition for orders that was in evidence a month ago, but no change has been made in quotations, and the foundries doing this kind of work seem to be well satisfied with the amount of business they are getting without any special inducement. Building castings are 1.75@2.25c. per lb. Rough castings for footings, manhole covers and similar work, are 1.75@2c.; castings for heavy machinery lock gates, where the amount of material involved is large, range from 2.40@4c. per lb., depending on the size of the order and the intricacy of the pattern.

Merchant Shapes—Stocks are better than a month ago and quotations are unchanged.

Quotations from jobbers' stores, either New York or Chicago, are as follows:

Rerolled iron:	Per lb.
1 to ⅝ in., round and square	2.15c.
1½ to 4 in. x ⅜ to 1 in.	2.15c.
1½ to 4 in. x ¼ in. to ⅝ in.	2.35c.
Norway bars	3.60c.
Soft steel:	
¾ to 3 in., round and square	2.10c.
1 to 6 in. x ¼ to 1 in.	2.10c.
1 to 6 in. x ⅛ and ⅜ in.	2.25c.
Rods—⅝ and ¼ in.	2.20c.
Bands—1½ to 6¾ in. to No. 8	2.40c.
Beams and channels 3 to 15 in.	2.25c.
Angles:	
3 in. x ¼ in. and larger	2.25c.
3 in. x ⅛ in. and ⅜ in.	2.60c.
1½ to 2½ in. x ⅛ in.	2.35c.
1½ to 2¾ in. x ⅝ in. and thicker	2.25c.
1 to 1¼ in. x ¼ in.	2.35c.
1 to 1¼ x ⅛ in.	2.40c.
Tees:	
1½ to 2½ x ¼ in.	2.30c.
1½ to 2½ x ⅝ in.	2.40c.
3 in. and larger	2.30c.

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh.

⅛ in.	$7.50
¼ in.	4.95
⅜ in.	3.95
½ in.	3.40
⅝ in.	3.20
½ and ⅝ in.	3.00
⅝ and ¾ in.	2.90
¾ and ⅞ in.	2.80
⅞ and 1 in.	2.70
1 to 1¼ in.	2.60

Extras for BB:

⅜ in.	1.50
½ in.	1.50
⅝ and larger	1.25

Extras for triple B (BBB):

⅜ and ¼ in.	2c.
⅝ and larger	1.75c.

Freight Rates—The freight rates on finished-steel products from the Pittsburgh District, including plates, structural shapes, merchant steel and iron bars, pipe fittings, plain and galvanized wire, nails, rivets, spikes and bolts (in kegs), black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandalgua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Switch Points—The following prices are named f.o.b. mill, for switch points in lots of ten or more pairs: for 60-lb. rail, 10-ft. points, $16.25; 15-ft. points, $17.50; for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25; for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points, $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 50, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter, in.	Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete		
		Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	18	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.10	74.22
10	14	66.42	71.08	96.15
12	14	71.20	76.57	102.24
13	14	83.75	89.15	118.30
14	14	89.67	96.55	127.98
14	14	98.13	105.51	138.86
15	14	108.05	114.89	152.92
16	14	117.53	124.32	166.58
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	299.32	314.86	395.70
30	10	324.81	399.15	436.24

*Made in both lighter and heavier gages at corresponding differences in price.

Lag Screws—The net price of lag screws has been advanced. Quotations per 100 lb. f.o.b. Pittsburgh are as follows:

Length, in.	Diameter in inches		
	½ in.	⅝ in.	1 in.
3½	$1.14	$2.24	$4.50
4	1.21	2.36	4.76
4½	1.20	2.50	5.02
5	1.35	2.57	5.28
6	1.50	2.92	5.80
7	1.69	3.29	6.32
8	1.78	3.48	6.84
9	1.93	3.76	7.36
10	1.97	4.04	7.88
11	2.21	4.32	8.40
12	2.36	4.69	8.92

Nails—A gradual increase was noted in the demand for nails, but it is not large, and it looks as though consumers had little fear of an advance in quotations. It is believed that their optimism in this respect is not well founded, and an advance is not unlikely within the next month. In carload lots to the largest consumers, $1.75 to $1.80 is named in Pittsburgh. In Chicago, carload lots to retailers are $1.98; less than carload lots $2.03. In New York, wire nails from store are $2.05. Cut nails are quoted at $1.70 to $1.75 Pittsburgh and $2.05 New York. These quotations are per 100 lb.

Coke—The price of coke reached a normal level during February through a series of sharp declines. In January, it was seen by those conversant with the trade that the situation would shortly be obliged to take on a new aspect, and a much lower price quoted, or there would be little or no business. By the end of the month, sales of furnace coke were made at $2.25 to $2.40 per net ton at oven, compared with $3.75 in the preceding month. Foundry coke declined in like proportion, some grades selling as low as $2.75, but the general run of 72-hr. foundry coke being quoted at $3 per net ton. An increase in the output was noted, the total production running as high as 425,000 tons weekly, early in the month and in the last week of February, the output of coke in the upper and lower Connellsville regions broke all records with a production of 433,111 tons.

Wire—Excellent business has been transacted in wire, and trade is more active than for several months past. Shipments now being made are mostly to the South. Quotations are as follows: Painted barbed wire in large lots, Pittsburgh, $1.75; galvanized, $2.15; annealed fence wire in carload lots is $1.55; galvanized, $1.95. In Chicago, annealed fence wire is $1.73; galvanized, $2.13. Barbed wire in Chicago is $1.93; galvanized $2.33. All of these prices are per 100 lb.

REINFORCING MATERIALS

Bars, Concrete Reinforcing—The action of the agricultural implement makers in anticipating their needs for bars, and buying ahead, is simply an illustration of the feeling which prevails in the entire bar market. Contractors, who have work which, later in the season, will call for a large quantity of such material, are already speaking in their specifications, the orders having been placed some time ago. All of the largest sellers of bars are placing orders for stock shipments, expecting that prices may be somewhat higher in the near future.

The base price at Pittsburgh is 1.50c.

Quotations are as follows in cents per lb.:

	Mill shipments f.o.b. Pittsburgh	From warehouse Pittsburgh
½ to ⅝ in.	1.55	1.95
⅝ to ¾ in.	1.55	2.05
¾ to 1 in.	1.60	2.05
1 to 1¼ in.	1.70	2.25
1¼ to 3 in.	2.00	2.50

Bars from stock, Pittsburgh, are usually cut to the required length, without extra charge.

Triangular Mesh—Business is active. Mills supplying this material are able to satisfy their customers' wants with the same promptness that was noted last month. Not as much material has actually been used so far in January, because of less favorable weather conditions. On the other hand, the outlook for large consumption is most excellent.

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material—Carload lots	Plain material—Less than car lots and over 10,000 sq.ft.	Galvanized—Carload lots	Galvanized—Less than car lots and over 10,000 sq.ft.
*4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*25	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
33	0.225	2.16	2.62	2.40	2.86
34	0.198	1.93	2.34	2.14	2.55
35	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 150, 300 and 600 ft.

METALS

Copper—The copper metal market proved to be on a false basis at 16.50c. when it closed Jan. 31. After the report of the Copper Producer's Association for that month was published, showing a further large increase in surplus stocks, prices broke badly. A decline of 1¾c. per lb. followed. Around 15c., consumers of the metal placed orders for large amounts which checked the decline. It is estimated that during the last two weeks of February upward of 100,000,000 lb. of copper were sold for delivery over the next two months. Some of the business was for export, but foreign buyers placed only a small portion of the business done by domestic sellers during the month. It is the absence of demand for copper from Europe that has prevailed since the outbreak of the Balkan war that has weakened the market. Until the consumers abroad begin to buy again on a large scale, the domestic demand cannot do more than hold the market at around the present level. Electrolytic is offered by leading sellers at 15c., cash 30 days, and Lake at 15c. Other sellers are willing to take business at ¼c. under these prices.

Exports for February were 26,767 tons. The January statistics showed an increase in stocks of about 18,000,000 lb., making the surplus of Feb. 1, 123,198,332 pounds.

Tin—The London tin market developed weakness early in February and all during the month the trend of prices was downward. Spot standard tin declined from £227 to £212-105, and futures from £229-105, to £206-105. There was an unusual amount of trading done in the metal in both the foreign and domestic markets. Consumers and dealers both participated in the activity in the local market. It is generally believed that the United States Steel Corporation bought a large supply of the metal at the low level. Spot sold at 47.50c., and futures at from 47.25c. as low as 45.50c. for August delivery. Toward the end of February, prices became firmer, and closed at about ¾c. from the lowest. Spot is offered at 48c. March at 47.87½c. and April 47.62½c.

Arrivals during February aggregated 3692 tons, and deliveries into domestic consumption were 3500 tons. There is a large tonnage of the metal afloat and due to arrive this month. Shipments now on the way amount to 4299 tons, and considerable addition will be made to this before the end of March.

Lead—There was a good demand for lead during February. All sellers were able to dispose of this metal at prices ranging from 4.30c. to 4.35c. in New York.

Miscellaneous Metals—Small lots of metal and metal products can be obtained from jobbers stores, New York, at the following prices:

	Per lb.
Bismuth	$2.25
Brass tubes, iron-pipe sizes:	
⅛-in.	.23
¼- to 3-in.	.22
3½-in.	.23
4-in.	.23
Brass rods	.18¾
Brass sheets	.18½
Solder, half and half guaranteed	.32
Zinc sheets	.10¼
Manganese bronze rods	.18⅝
Manganese bronze in crucible form	.16¾

Old Metals—Prices are about 1c. per pound lower, and the following are paid for old metals by dealers in New York:

	Cents
Copper, heavy and crucible	13.25
Copper, heavy and wire	13.00
Copper, light and bottoms	12.00
Brass, heavy	9.00
Brass, light	7.00
Heavy machine composition	11.50
Clean brass turnings	8.00
Composition turnings	10.50
Lead, heavy	3.75
Lead, tea	3.50
Zinc scrap	5.00

Spelter—Sellers of spelter had great difficulty in creating a market for the metal during the entire month. Successive cuts were made in quotations, until the price reached 6.20c. in New York, without attracting business. Production of the metal has suffered little from weather conditions this

winter, while consumption has not increased, judging by the demand, and there appears to be a more plentiful supply on hand than is usual at this time of the year. Fear of tariff reduction has also resulted in making buyers timid. Prime western can be freely had at 6.25c. in New York.

CLAY PRODUCTS

Sewer Pipe—Prices show a sharp advance and the market has stiffened considerably. The winter has been far above the ordinary in the amount of business done, and now there is little sewer pipe to be had. Conditions are mixed due mainly to labor troubles. Discounts applying to the Eastern list, delivered in New York, are as follows: 3 to 24 in., inclusive, 72%; for 27 to 30 in., 64%, and for 33 and 36 in., 59%. Factory discounts are quoted at 78% for 3 to 24 in., 70% for 27 to 30 in., and 65% for 33 and 36 in. At those discounts the net prices per foot are as follows.

SEWER PIPE, PER FOOT

Size	Delivered N. Y.	Factory	Size	Delivered N. Y.	Factory
3 in.	$0.07	$0.045	20 in.	$0.63	$0.405
4 in.	0.07	0.045	21 in.	0.81	0.54
5 in.	0.112	0.072	22 in.	0.81	0.54
6 in.	0.112	0.072	24 in.	0.91	0.585
8 in.	0.154	0.094	27 in.	1.62	1.35
10 in.	0.224	0.144	30 in.	1.98	1.65
12 in.	0.28	0.18	33 in.	2.56	2.18
15 in.	0.378	0.243	36 in.	2.81	2.45
18 in.	0.532	0.342			

Flue Linings—Prices are quoted at an advance. The market is firm with an excellent demand. The discount from list, delivered New York, in carload lots, is 75%.

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x 8½-in.	14	$0.075	12x16-in.	45	$0.25
4½x13 -in.	20	0.1125	13x18-in.	57	0.30
6 x12 -in.	22	0.125	14x16-in.	60	0.2725
7 x 7 -in.	15	0.875	16x16-in.	65	0.40
8½x 8½-in.	18	0.1125	16x20-in.	80	0.50
8½x13 -in.	28	0.1625	18x18-in.	75	0.50
8½x18 -in.	45	0.02225			

Hollow Tile—Prices are stiff, and an unusual demand, for winter months, is being experienced. The whole winter season has far outdistanced the records of former years. Quotations, f.o.b. Perth Amboy, are as follows.

Size	Hollow wall tile	Size	Interior partition block
4x12x12-in.	$0.06	2x12x12 in.	$0.048
6x12x12-in.	0.084	3x12x12 in.	0.048
8x12x12-in.	0.102	4x12x12-in.	0.052
10x12x12-in.	0.12	6x12x12-in.	0.072
x12x12-in.	0.15	8x12x12 in.	0.096

Roofing Tile—Exceptional business is being done this winter in this line, and most manufacturers are behind in their shipments. Prices are steady.

The best grade of promenade roofing tile in flat blocks for high-grade roofs is sold $25 per M. for run of kiln and $35 per M. for selected. A cheaper form of tile with a smooth surface may be had at about $12, but it is not suitable for roof gardens. These prices are f.o.b. New York.

Roofing tile, unglazed, of the French and Spanish type, plain, is sold at $9 per 100 sq.ft. of roof surface, f.o.b., New York. Glass tiles are sold at 60c. each.

LUMBER

February business is always quiet, and this year is proving no exception to the rule. Construction work having closed down due to weather conditions, there is little or no demand for lumber. The market is steady, however, and prices are firm, a few grades advancing.

Spruce—Prices are quoted at a slight advance. The market is firm. Yard prices in New York are as follows:

2x10-in. } 3x10-in. } 4x10-in. } 12 to 16 ft. ..... $
2x12-in. }
3x12-in. } 12 to 16 ft. $37
4x12-in. }

For 18 and 20 ft., $37; for all lengths over add 50c. for every additional foot.

Flooring—The market is firm with a good demand.

Quarter-sawed oak flooring, A1, is $38 per M. Selected white oak or red-oak flooring is $50 per M. One common flooring, red or white, is $20 per M.

Maple flooring, 13/16x2¼-in., is $50 for clear; $45 for No. 1, and $28 for factory. Long-leaf yellow-pine flooring, 13/16-in. face, is $60@65 for A heart rift; $50@55 for sap rift; $36 for No. 1 flat; $32 for No. 2, and $30 for No. 3.

Hemlock—Prices are quoted with no change.

Price per M., f.o.b. cars, New York:

	Length 10 ft.	12 ft.	14 ft.	16 ft.
2x4-in.	$27	$29	$25	$27

Shingles—As weather conditions have prohibited a demand for shingles, the market may be said to be in a fair condition. Even a small demand could not be supplied. Quotations are steady, as there is not enough business to establish higher prices. Cypress shingles, New York: 7x24-in., rived and shaved, $23.50@24 per M.; 21-in., promiscuous widths, rived and shaved, $8, 4-in. basis; 6x20-in., sawed, $12 per M.; 6x18-in., sawed, $8.50 per M.; 5x18-in., sawed, $7.50 per M.

Piling—The market is quiet, with no demand. In New York, the price of oak piling is 22@25c. per lin.ft. Oak piles, 14 in. in diameter, 2 ft. from butt with a 6-in. top, and 40 to 45 ft. long, are held at $10.50@11.50; 50 ft. long, 25c. per lin.ft. Pine piles, 25 ft. long, 12 in. in diameter, 2 ft. from butt, with a 7-in. top, held at 17c. per lin.ft., while those 25 ft. long are 16c. In general, pine piles can be had at 16@17c.; oak piles, 55 to 60 ft., are quoted at 23c. per lin.ft.

Cross Ties—No change is noted in the condition of the market. High quotations still continue and heavy buying is being made by the railroads. Prices are quoted by G. A. Baxter & Co., 15 William St., New York, as follows.

	Cents each
7x9 in. by 8 ft. 6 in.	88
6x9 in. by 8 ft. nominal	83
6x8 in. by 8 ft.	76

Long Leaf Yellow Pine—Heavy outside construction work in all parts of the country and subway contracts in the Metropolitan district, have called for large quantities of pine, and prices are now being quoted with a higher tendency. The market has stiffened considerably.

Prices per Thousand Feet in Yard, New York.

Thickness	Length 20 ft base	21 to 25 ft.	26 to 30 ft.	31 to 35 ft.
2in. thick and under by 8 in. wide and under 10 in. wide	$36	$36	$38	$38
10in. thick and under by 12 in. wide	42	42	42	45
12 in. thick and under by 14 in. wide	41	42	43	46
14 in. thick and under by 16 in. wide	47	48	50	52
16 in. thick and under by	50	52	54	60

MISCELLANEOUS

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; 4c. per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x40 in. It varies in thickness from 1/32 to 1/8 in., and in weight from 2 to 27 lb per sheet. The net price in 100-lb. lots is 5c. per lb.

Transite, asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in standard sheets, 36x48 in., 42x48 in. and 42x96 in. The prices, f.o.b. factory, Nashua, N. H., are as follows:

Thickness	Weight, per sq. ft.	Price
1/16-in.	1	$0.08
1/8-in.	1½	0.12
¼-in.	2	0.16
5/16-in.	2½	0.20
3/8-in.	3	0.28
7/16-in.	3½	0.28
½-in.	4	0.32
9/16-in.	4½	0.36
⅝-in.	5	0.40
¾-in.	6	0.44
⅞-in.	7	0.48
1-in.	8	0.52
1¼-in.	10	0.56
1½-in.	12	0.64
1¾-in.	16	0.72
2-in.	16	0.80

Waterproofing—The prices for carload lots, f.o.b. cars New York are as follows: Hydrex waterproofing felt, $1.25 per 100 sq.ft.; Hydrex compound "A," 26c. per gal.; Hydrex compound "B," 18c. per gallon.

Texaco waterproofing cement is $30 per ton in car lots, f.o.b. cars New York or Philadelphia.

Asphaltum for waterproofing is sold at $26@27 per net ton.

Glidden, graphic acid proof coating is sold at $1.25 per gal. in bbl. and ¾ bbl. and $1.40 per gal. in 5-gal. cans. These prices are f.o.b. Cleveland or are delivered from warehouse, New York, Chicago, St. Louis, Boston or Atlanta.

Slate—Quotations are as follows f.o.b. quarry.

	Prices per 100 sq.ft.
Vermont, sea green	$3.00@ 4.00
Pennsylvania, Bangor Ribbon	3.50@ 4.00
Maine, Brownsville No. 1	5.50@ 7.75
Maine, Brownsville No. 2	4.50@ 6.00
No. 1 red	7.50@10.00
Unfading green	4.00@ 5.50
Genuine Bangor	4.25@ 6.50
Pen Argyle	4.00@ 6.00

Wood Preservative—See Oils and Paints.

Roofing Paper—There is a larger demand but it is not as insistent as early in the year.

Quotations in New York are as follows

	Per roll of 500 sq.ft.
Rosin sized sheathing, 20 lb.	28c.
Rosin sized sheathing, 30 lb.	43c.
Rosin sized sheathing, 40 lb.	58c.

ROOFING RUBBER

	Per roll of 108 sq.ft.
1 ply, 35 lb.	$1.00
2 ply, 45 lb.	1.50
3 ply, 55 lb.	1.90

Tarred felt is $1.45 per 100 lb. in 1, 2 and 3 ply. Slaters felt is 60c. per roll.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Massachusetts—Boston & Albany R.R.—This company, it is reported, is planning to lay out a large freight yard at Springfield, Mass. F. E. Freeman, Boston, Mass., is Ch. Engr.

Virginia—A railroad will be constructed from Radford, Va., to Mount Airy, N. C., a distance of about 80 miles. Surveys are being made. O. Dodds, Radford, is interested.

North Carolina—Atlantic Coast Line R.R.—This company, it is reported, will soon award contracts for double-track work from Selma to Parkton, N. C., about 60 miles. The line from Parkton to Sumter, S. C., will be improved by laying 85-lb. rails. E. B. Peasalls, Wilmington, N. C., is Ch. Engr.

North Carolina—See item under Virginia.

North Carolina—Virginia & Eastern Carolina R.R.—This company will award contracts in about two months for the construction of its line from Henderson, N. C., to Wilson or Rocky Mount, N. C. J. C. Cruikshank, Henderson, N. C., is Ch. Engr.

Georgia—Savannah, Augusta & Northern Ry.—This company, it is reported, will extend its line to Thomson. The line now operates from Statesboro to Sylvania, Ga. W. T. Oliver, Knoxville, Tenn., is Pur. Agt.

Georgia—Ocilla Southern R.R.—This company will construct an extension from Nashville, Ga., its southern terminus, east to Waycross, about 50 miles. D. C. Smith, Ocilla, Ga., is Gen. Mgr.

Alabama—Hayneville & Montgomery Ry.—This company, it is reported, will extend its line from Hayneville to Camden, Ala., about 50 miles. W. S. Richardson, Montgomery, is Pres.

Louisiana—New Iberia, Lafayette & Northwestern R.R.—This company has completed the surveys, and is planning to receive bids in about two months for the construction of its proposed line. H. A. Genung, New Iberia, is Pres.

Kentucky—Louisville & Nashville R.R.—This company will enlarge its yards at Lexington, Ky. W. H. Courtenay is Ch. Engr.

✚Big Sandy & Kentucky R.R.—According to press reports, this company has awarded the contract for the construction of its proposed line to JOHN O. KELLEY, Portsmouth, Va. The railroad will be 16 miles long. Noted Sept. 9.

✚**Ohio**—Lorain, Ashland & Southern R.R.—Subcontractors will be asked to submit bids soon by the WEST VIRGINIA & OHIO CONSTRUCTION Co., Ashland, Ohio, contractor for the construction of this company's line from Wellington to Lorain, Ohio. The railroad will be 22 miles long, standard gage.

Illinois—Chicago, Rock Island & Pacific Ry.—This company will lay 30 miles of 100-lb. rail from Metz to Valley Junction, Ill., and 38 miles from Avoca, Ill., to Council Bluffs, Iowa. The work will require the reballasting of the tracks.

Chicago, Milwaukee & St. Paul Ry.—This company is planning to spend about $1,500,000 for third-track construction between Savanna and Chicago, Ill. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Minnesota—Minnesota & International Ry.—This company will relay 72-lb. rail on 25 miles of its line between Brainerd and Bemidji, Minn. It will replace the present 56-lb. rail.

Nebraska—Hemmingford & Western R.R.—This company is preparing to file articles of incorporation. The proposed line will be constructed from Hemmingford, Neb., to the eastern part of Wyoming. D. W. Butler, Hemmingford, Neb., is Pres. and Gen. Mgr. Noted Feb. 20.

✚**North Dakota**—Northern Pacific Ry.—This company has awarded the contract to the COOK CONSTRUCTION CO., St. Paul, Minn., for grading the proposed line from Stanton, up the Knife River and Spring Creek. Length, about 68 miles.

Texas—Temple, Northwestern & Gulf Ry.—W. S. McGregor, Temple, Tex., it is reported, has taken over the Temple, Gatesville & Hamilton R.R., and changed its name to the above. The line, which is partially built, will be completed and extended beyond Gatesville.

Oregon—Kerry Timber Co.—This company, it is reported, will construct a logging road from Wood's Landing, Ore., to the Nehalem Valley, Ore., about 30 miles.

California—Central Pacific Ry.—This company is planning to construct a line from its present terminus at Goshen, Calif., to Los Angeles.

Southern California R.R. & Navigation Co.—This company has been incorporated with a capital of $1,100,000, to construct railroads. Among the incorporators is M. C. Messick.

California—Mount Tamalpais & Muir Woods Ry.—This company has filed articles of incorporation for the construction of an extension from West Point, a station two-thirds the distance up the mountain, to Bolinas Bay.

Alfred Sloane, Head del Coronado, San Diego, Calif., representing an English syndicate, states it plans to build a railroad between San Diego and the Imperial Valley by way of San Felipe Valley.

✚**Quebec**—Canadian Pacific Ry.—This company has awarded the contract to JONES & GILLOARD, Montreal, Que., for the construction of its proposed 30-mile line from Temiskaming to Ville Marie, Que.

★**British Columbia**—Canadian Pacific Ry.—Bids will be received until noon, Apr. 15, by J. G. Sullivan, Ch. Engr., Western Lines, Canadian Pacific Ry., Winnipeg, Man., for the clearing, grubbing and grading of a diversion of the main line of the company in the Selkirk Mountains, from Six Mile Creek to Glacier, B. C., 17 miles. On this there is included a double-track tunnel approximately 28,000 ft. long. Plans and specifications can be seen, either at the office of F. F. Busteed, Kamloops, B. C., or at Winnipeg, Man.

ELECTRIC RAILWAYS

Thomaston, Maine—The Rockland, South Thomaston & St. George Ry. Co. is making preliminary arrangements for the extension of its line from Thomaston to the Weskeag River, about three miles. Alfred S. Black, Rockland, is Pres. and Gen. Mgr. Noted Feb. 6.

Springfield, Mass.—The Massachusetts Northern St. Ry. Co. is making preliminary arrangements and will be ready to start work this spring on the construction of its proposed electric railway from Orange to Millers Falls. J. A. Taggart, Greenfield, is Gen. Supt. Noted Feb. 27.

Hornell, N. Y.—The Hornell Traction Co. has completed plans for the reconstruction of its railway system this spring. George T. Rehn, Hornell, is Gen. Mgr. and Pur. Agt.

Olean, N. Y.—The Western New York & Pennsylvania Traction Co. has obtained all the right-of-way and is making preliminary arrangements for the construction of its proposed line from Hinsdale to Olean, about seven miles. I. W. Miller, Olean, is Gen. Mgr.

Syracuse, N. Y.—The New York State Rys. Co. is considering plans for the construction of a double-track line on West Onondaga St., from Seymour to South Ave. H. M. Butler, Rochester, is Pur. Agt.

Elizabeth, N. J.—The Elizabeth & Trenton R.R. Co. is considering plans for the extension of its line in Elizabeth. W. E. Titus, Trenton, is Supt.

Ellwood City, Penn.—The Pittsburgh, Harmony, Butler & New Castle Ry. Co. has secured all the right-of-way and will be ready to start work this spring on its proposed electric railway from Ellwood City to Beaver Falls. Harry Etheridge, Eidenau, Penn., is Supt. and Elec. Engr. Noted Oct. 17.

Sheffield, Penn.—Plans are being prepared by the Warren & Jamestown St. Ry. Co., for the construction of an electric railway from Sheffield to Kane, about 16 miles. David H. Siggins, Warren, is Pres. and Gen. Mgr.

Washington, D. C.—Plans are being considered by the Capitol Traction Co. for the construction of a street railway on 17th St., from U St. to Pennsylvania Ave., and on 18th St., from G St. to Potomac Park. J. H. Hanna, 36th and M Sts., Washington, is Ch. Engr.

Richmond, Va.—The City Council has granted a franchise to the Virginia Ry. & Power Co. to construct and operate an electric railway on Franklin St. C. B. Buchanan, Richmond, is Gen. Mgr. Noted Feb. 27.

Durham, N. C.—The proposition to construct an electric railway from Durham to Chapel Hill, about 12 miles, is under consideration. R. O. Everett and W. S. Robertson, of Durham, are interested.

Dalton, Ga.—The City Council has granted a franchise to the Georgia Ry. & Electric Co., to construct and operate an electric railway in Dalton. W. H. Glenn, Gas and Electric Bldg., Atlanta, is Gen. Mgr. Rys.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. has applied for a franchise to extend its North Birmingham line from Birmingham to Lewisburg, about three miles. A. H. Ford, Birmingham, is Pres. and Gen. Mgr.

Alexandria, La.—The Southern Traction & Power Co. has taken over the electric street railway system and other holdings of the Alexandria Electric St. Ry. Co. The new company, which has a capital stock of $200,000, will extend the line and make important improvements to the property. William P. Jenkins is Pres., Ernest Boehm, Vice-Pres. and Mgr., and Erle J. Weaver, Sec. and Treas.

Shreveport, La.—The North Louisiana Electric Ry. Co. has been organized to construct an electric railway from Shreveport to Homer and Monroe, about 100 miles. G. H. Walker, Shreveport, is Secy. and Treas. Noted Feb. 6.

Knoxville, Tenn.—Plans for the construction of an electric belt line around the city are being considered by the Board of Commerce.

Cincinnati, Ohio—The City Council has granted a franchise to the Cincinnati Traction Co. to extend its line to Bond Hill. Dana Stevens, Cincinnati, is Gen. Mgr. Noted Feb. 13.

Toledo, Ohio—The Toledo Rys. & Light Co. is considering plans for the extension of its line from Toledo Beach, Ohio, to Monroe, Mich. Joseph M. Enright, Toledo, is Supt. Rys.

Geneva, O.—The Bluffton, Geneva & Celina Traction Co. proposes to extend its line from Geneva, Ind., to Celina, Ohio. R. F. Cummins, Bluffton, is Gen. Mgr. and Pur. Agt.

Vincennes, Ind.—The Vincennes North and South Traction Co. has applied to the City Council for a franchise to construct and operate an electric railway in Vincennes. This is part of a proposed line from Vincennes to Indianapolis. Gilmer Bray is interested.

Belleville, Ill.—The City Council has granted a franchise to the Souther Traction Co. of Illinois, to construct and operate an electric railway in Belleville. H. C. Begole, Lincoln Trust Bldg., East St. Louis, Ill., is Secy.

Hamilton, Ill.—Preliminary surveys have been started by the Tri-State Traction Co. for the construction of an electric

railway from Hamilton to Warsaw and Quincy. E. O. Marsh, Warsaw, is Pres. and Ch. Engr.

Jerseyville, Ill.—The Alton, Jacksonville & Peoria Ry. Co. is considering plans for the extension of its line from Jerseyville to Fieldon and Hardin. W. H. Hearder, Alton, is Gen. Mgr.

Montreal, Wis.—The Gogebic & Iron Counties Ry. & Light Co. will construct a two-mile extension to its line from Gile to Montreal. A. E. Appleyard, Ashland, Wis., is Gen. Mgr. and Pur. Agt.

Milwaukee, Wis.—Plans are being prepared by the Badger Ry. & Light Co., for the construction of an electric railway from Lake Geneva to Elkhorn and Whitewater. H. B. Kamochulte, Milwaukee, is Pres. and Mgr.

Affton, Mo. The St. Louis, Affton & Sunset Ry. Co. has been incorporated to construct and operate an electric railway from Affton to Sunset Inn and Fenton, about 10 miles. The incorporators are C. A. Bodwell, John M. Storm, J. L. Ewehl, James Arbuckle and Victor J. Miller.

Austin, Tex.—John W. Maxey, Houston, Tex., director and Ch. Engr. of one of the companies which is preparing to construct an interurban electric railway between Austin and San Antonio by way of Lockhart and Seguin, has placed a corps of engineers in the field to locate the route of the proposed line. It is stated by Mr. Maxey that all financial arrangements for the early construction of the road have been finished. A large hydro-electric plant will be installed upon the Guadalupe River by the Guadalupe Water Power Co., a subsidiary concern. This plant will furnish power for operating the line.

Denton, Tex.—Preliminary arrangements are being made by J. T. Witt and associates for the construction of an electric railway from Denton to Cement City. Noted Feb. 13.

San Antonio, Tex.—Surveys are being made by A. B. Axtell, Dallas, for the construction of the proposed interurban electric railway from Austin to San Antonio. John W. Maxey, Houston, and Walter Crawford, Beaumont, are interested. Noted Feb. 20.

Cushing, Okla.—The Cushing and Oil Field Electric Ry. Co. has applied to the City Council for a franchise to construct and operate an electric railway in the business section of Cushing. The line will later be extended to Perry and Stillwater. C. R. Strong, Clinton, Okla., is one of the promoters.

Henryetta, Okla.—The City Council is considering the proposition to grant a franchise to C. H. Kellogg and associates to construct and operate an electric railway in Henryetta.

✚Golden, Colo.—The Castle Rock Scenic Ry. Co. has awarded contract for (a) construction and (b) grading of its proposed line from Golden to Castle Rock as follows: (a) R. D. KENYON; (b) CHARLES F. QUAINTANCE, both of Denver, Colo.

Asotin, Wash.—A franchise has been granted to F. L. Strum, for the construction of an electric railway through Asotin. This is part of a proposed line from Lewiston, Idaho, to Clarkston, Wash. Noted Jan. 9.

Tacoma, Wash.—Plans have been prepared by W. C. Raleigh, City Engr., for the construction of an 11-mile municipal street railway. Estimated cost, $84,000. Noted Feb. 27.

Chico, Calif.—The Northern Electric Ry. Co. is preparing plans for the construction of about 349 miles of new tracks. A. D. Schindler, San Francisco, is Gen. Mgr. and Pur. Agt.

Glendale, Calif.—The Glendale & Eagle Rock Ry. Co. contemplates an expenditure of $65,000, for the construction of an electric railway from Glendale to Montrose, about five miles. M. V. Hartranft, Los Angeles, is Pres.

Red Bluff, Calif.—The Sacramento Valley Electric Ry. Co., which is making preliminary arrangements for the construction of an electric railway from Red Bluff to Dixon, is preparing plans for the extension of the line to Eureka, about 160 miles. Noted Feb. 13.

Smithville, Ont.—The Imperial Traction Co. has received permission to construct an extension from Smithville to Bridgeburg, and from Hamilton to Toronto.

Regina, Sask.—The Regina & Moose Jaw St. Ry. Co. is making preliminary arrangements for the construction of its proposed new line. J. Friedman, Moose Jaw, is one of the promoters.

St. John, N. B.—The St. John Ry. Co. has applied for permission to extend and double-track some of its lines in St. John. H. M. Hopper, St. John, is Gen. Mgr. and Pur. Agt.

Lethbridge, Alta.—The Lethbridge Municipal Tramway Co. is preparing plans for a four-mile extension to its line in Lethbridge.

LIGHT, HEAT AND POWER

Boston, Mass.—The Edison Electric & Illuminating Co. is planning the construction of a power plant on Stuart St., to cost $350,000. W. H. Atkins, 39 Boylston St., Boston, is Gen. Supt.

Shirley, Mass.—The local electric-light plant has been sold. The new owner contemplates extensive improvements to the property.

Central Falls, R. I.—The Bryan-Marsh branch of the General Electric Co. at Central Falls contemplates the construction of an addition to its plant which will be three stories, 250x199 ft.

✚Brooklyn, N. Y.—We are officially advised that the contract for the installation of a heating system in public school No. 175, Boro. of Brooklyn, has been awarded to GRIMSHAW & STURGIS, at $46,944. Bids were received by C. B. J. Snyder, Supt. School Bldgs., Feb. 24.

We are officially advised that bids were received by C. B. J. Snyder, Supt. School Bldgs., Feb. 24, for the installation of an electric-light system in public school No. 172, Boro. of Brooklyn, as follows: John T. Williams Co., at $7183; Maintenance Co., $6580; Commercial Construction Co., $6964; Eugene Frank, $7623. Noted Feb. 20.

New York, N. Y.—Bids will be received by Charles B. Stover, Pres. of Park Bd., Arsenal Bldg., Fifth Ave. and 64th St., until 3 p.m. Mar. 13, for all labor and materials required for the heating and ventilating in the comfort station and playground building on 151st St., near Amsterdam Ave.

Schoharie, N. Y.—The Middleburg & Schoharie Electric Light, Heat & Power Co. is considering plans for the construction of an ornamental street lighting system in Schoharie. L. A. Haverly, Middleburg, is Ch. Engr. and Elect.

Atlantic Highlands, N. J.—The Board of Public Utility Commissioners has granted permission to the Atlantic Highlands Gas Co., for the installation of a gas system in certain sections of Rumson Borough and Shrewsbury Township.

Somerville, N. J.—The Board of Public Utility Commissioners has granted permission to the Morris & Somerset Electric Co., for the issuance of bonds for $50,000 for extensions and improvements in its electric plants.

Trenton, N. J.—The New Jersey State Hospital for the Insane has requested an appropriation of $60,000 for the erection of a new electric-power plant for heating and lighting of main hospital and adjoining structures.

Trenton Junction, N. J.—The Borough officials are considering plans for the installation of an electric street-lighting system.

Laceyville, Penn.—A. L. Vandervort is interested in the construction of an electric-light plant at Laceyville.

Wilmore, Penn.—Plans are being considered by the Penn Central Light & Power Co. for the installation of an ornamental street-lighting system in Wilmore. E. T. Penrose, Altoona, is Gen. Mgr.

Ocean City, Md.—The proposition to construct a municipal electric-light plant is being considered by the City Council.

Clay, W. Va.—Press reports state that Arthur W. Copenhaven is interested in the construction of an electric-light plant at Clay.

Burlington, N. C.—The Piedmont Electric Ry. Co. is planning the erection of a light, heat and power plant, to cost $400,000. G. W. Hatch, Burlington, is Supt.

Tarboro, N. C.—The proposition to issue bonds for the improvement of the municipal electric-light plant and system is being considered by the Town Commissioners.

Jonesboro, Ga.—Bids will be received by E. W. Hutchinson, Chn. of the Electric Light Com., until Mar. 6 for the installation of electric equipment in the municipal electric-light plant. Bonds for $10,000 were recently voted for the purpose. Noted Feb. 6.

Marshallville, Ga.—See item under Water Supply-Irrigation.

Gainesville, Fla.—Bids will be received by the Board of Public Works until 4 p.m., Mar. 17, for the installation of a municipal electric-lighting system. H. E. Taylor is Chn. of the Bd.

Hurtsboro, Ala.—See item under Water Supply-Irrigation.

Scottsboro, Ala.—The construction of an electric-light plant at Scottsville is under consideration.

Tuskaloosa, Ala.—Walter G. Franz, Union Trust Bldg., Cincinnati, Ohio, will supervise the construction of the new steam transmission lines, aggregating six miles of piping, at a cost of $50,000, for Tuskogee Institute, Tuskaloosa.

Natchez, Miss.—Bids will be received until Mar. 25 by Benjamin C. Grisenber, Pres. Bd. of School Trustees, for the installation of a heating system in the Carpenter Memorial School.

Napoleonville, La.—Bids will be received by the Mayor until Mar. 17 for the construction of a municipal electric-light plant and system. Noted Jan. 23.

St. Francisville, La.—An expenditure of $6000 is planned for the improvement of the municipal electric-light plant.

Hazard, Ky.—W. E. Hemphill and N. G. Hemphill, of Clinton, Tenn., are planning the construction of an electric light and power plant at Hazard.

Louisville, Ky.—Bids will be received by the Fiscal Court until Mar. 15 for the installation of a heating plant in the County Poor-House. B. B. Davis, Inter-Southern Bldg., Louisville, is Arch.

✚Russellville, Ky.—The contract for the installation of a central power and heating plant for Bethel College at Russellville, has been awarded to F. A. CLEGG & CO., Louisville, Ky.

Somerset, Ky.—The Middle West Utilities Co., Chicago, Ill., which is controlled by the Insull interests, has announced that it will build a new power plant at Somerset. It will operate the water-works, lighting and street railway systems.

Van Lear, Ky.—The Consolidation Coal Co., Baltimore, Md., which has under way large coal operations in eastern Kentucky, has announced that in addition to its 13,000-hp. power plant at Jenkins, Ky., another almost as large will be built at Van Lear.

Fredericktown, Ohio—Frank B. Ball, of Newark, Ohio, has been granted a franchise by the Village Council to construct and operate an electric system in Fredericktown.

Pataskala, Ohio—At an election to be held in April the citizens will vote on the proposition to issue $40,000 in bonds for the improvement of the municipal electric-light plant and water system. E. Williams is City Clk.

Clayton, Ind.—Plans are being prepared for the installation of an electric-light system in Clayton.

Kokomo, Ind.—The Kokomo Gas Co. has increased its capital stock to provide funds for the improvement of its plant and extension of its system.

Montpelier, Ind.—The Montpelier Utilities Co., recently organized, contemplates the construction of an electric-light plant and water system.

Wolcottville, Ind.—E. L. Cutler is interested in the construction of an electric-light plant at Wolcottville.

Armington, Ill.—The citizens of Armington recently voted to construct an electric-light plant.

Cambridge, Ill.—Bids will be received by E. C. Fitch,

County Clk., until Apr. 22, for the installation of an electric-lighting system in the new county infirmary.

Shawano, Wis.—Preliminary arrangements are being made for the construction of a municipal electric-light, power and water plant. W. E. Wescott is City Clk.

Kimballtown, Iowa—The citizens will hold an election on Mar. 10 to vote on the proposition to issue bonds for the construction of an electric-light plant at Kimballtown.

New Ulm, Minn.—See item under Water Supply-Irrigation.

Roseau, Minn.—The proposition to issue bonds for the construction of an electric-light plant is under consideration.

Buffalo, Kan.—The Buffalo Electric Light & Power Co. is preparing plans for the construction of an electric-light and power plant at Buffalo.

Dawson, N. D.—J. S. Werner is making preliminary arrangements for the installation of an electric-light plant at Dawson.

Joplin, Mo.—Press reports are to the effect that a company is being organized for the construction of a gas system in Joplin. S. W. Milligan, Webb City, Mo., is interested.

Maryville, Mo.—The City Council is making preliminary arrangements for the installation of an ornamental street-lighting system in the business district.

Gravette, Ark.—See item under Water Supply-Irrigation.

Sulphur Springs, Ark.—Bids will be received about Apr. 1 for the construction of the proposed municipal electric-light plant. Albert C. Moore, Joplin, Mo., is Engr.-in-Charge.

Pearsall, Tex.—Plans are being prepared for the extension of the ornamental street-lighting system in Pearsall.

Quinton, Okla.—The Quinton Commercial Club is interested in the proposed construction of an electric-light plant.

Trinidad, Colo.—The construction of an electric-light plant at Trinidad is under consideration. Estimated cost, $600,000. S. Fells, S. Patrick and Louis Tarbino are interested.

Lava (Bannock post-office), **Idaho**—J. D. Browning and L. R. Martineau, of Salt Lake City, Utah, are in the construction of a hydro-electric power plant at Lava.

Phoenix, Ariz.—Bids were received Feb. 20 by the Salt River Valley Water Users' Association for the construction of two reinforced concrete penstock pipes for the Cross-Cut power plant, as follows: Martin Gillis, $32,635; Concrete Construction Co., $35,551; Herbert J. Mann, $40,536; Grant Bros. Construction Co., $44,420; Arizona Engineering & Construction Co., $48,710; S. B. Morrison, $58,885; F. F. Prendergast, $65,145; George C. Hinckley, $68,925.

Anacortes, Wash.—The Stone & Webster Corporation, of Boston, Mass., have acquired the holdings of the Skagit Power Co., near Rockport. It intends to develop the site to generate power sufficient to electrify all the interurban lines of the company in western Washington. To put the plant in operation will require an expenditure of about $6,000,000.

Pendleton, Ore.—The city has purchased a site for the construction of a municipal electric-light and power plant.

Bakersfield, Calif.—The Pacific Light & Power Co. has been granted a franchise to construct, operate and maintain electric transmission wires across certain public highways in Kern County. A. C. Balch, Los Angeles is Mgr.

The Midway Gas Co. contemplates the construction of additional 14-in. pipe line from Bakersfield to Los Angeles.

Burbank, Calif.—The city contemplates the installation of a municipal electric-light system. Estimated cost $20,000.

Las Plumas, Calif.—The Great Western Power Co. will enlarge their hydro-electric plant at Las Plumas.

+Los Angeles, Calif.—The Board of Public Works has awarded the contract for the installation of an ornamental street-lighting system on Seventh St., from Alameda to Figueroa St., to the LIGHT-WAY IRON WORKS, Main and Peaslee Sts., Los Angeles, at $24,997. Noted Jan. 16 and Feb. 20.

Los Angeles, Calif.—The Pacific Light & Power Co. has purchased a site in the Rancho San Rafael for the construction of a transformer station to handle the 300,000-hp. development on the Big Creek project.

+Stockton, Calif.—The Oro Electric Corporation has awarded the contract for the construction of a steam plant at Stockton to C. C. MOORE & CO., San Francisco, Calif. This plant will develop 1000-hp. and will be used as an auxiliary until hydro units are installed.

Sidney, N. S.—The Cape Breton Electric Co., Ltd., is preparing plans for the erection of a distributing sub-station at Reserve, Louisburg. W. G. Ross, Gen. Mgr. and Pur. Agt.

BRIDGES

Manchester, N. H.—The city contemplates the erection of a new steel or concrete bridge over the Piscataquog River from Kelley St. to Pinard St. Samuel J. Lord is the City Engr.

Charlton City, Mass.—The erection of a bridge over Cady, three in Charlton City, is being considered. It will probably be a concrete or steel structure.

Brooklyn, N. Y.—The Commissioner of Bridges of New York City has been authorized to reconstruct a bridge over the Bronx River, formerly known as Seaton Creek. It will be located at the foot of Meacham Ave. and is to connect Lorraine and Bronx. The estimated cost is $250,000.

Freehold, N. J.—Bids will be received by the Board of Chosen Freeholders of Monmouth County, at Freehold, until 11 a.m., Mar. 12, for the raising of a bridge near the village of Oceanport. Plans and specifications can be seen at the office of the Board or can be obtained of George D. Cooper, County Engr., 60 Broad St., Redbank, N. J. J. M. Corlies is Dir. of Bds.

Freehold, N. J.—Bids will be received by the Board of Chosen Freeholders of Monmouth County, Freehold, until 11 a.m., Mar. 12, for the construction of a concrete arch bridge on Englishtown Road, near the farm of Judson Armstrong. Plans and specifications are on file at the office of T. E. Jeffries, Chn., Freehold. J. M. Corliss is Dir. of the Bd.

Brownsville, Penn.—We are officially advised that bids will not be received for about two months for the construction of the new bridge over the Monongahela River at West Brownsville. In addition to the information previously published, it will have a steel superstructure 625 ft. long, stone and concrete piers and abutments and steel and concrete viaducts on each side about 400 ft. long. The estimated cost is $200,000. Chaney & Armstrong are the Engrs. for Washington County, and George Porter, Uniontown, Penn., for Fayette County. Noted Feb. 20.

Nanticoke, Penn.—The County Commissioners of Luzerne County have selected David A. Keefe, Athens, Penn., to prepare plans and specifications for the construction of a new bridge over the Susquehanna River at Nanticoke. The estimated cost of the new structure is $300,000.

Baton Rouge, La.—A bill has been passed at Washington, D. C., granting a permit for the construction of a bridge over the Mississippi River at Baton Rouge for railroad, trolley car, wagon and foot traffic. The estimated cost is $15,000,000. Noted June 20, 1912.

Lexington, Ky.—The Louisville & Nashville R.R. will build, with the coöperation of other railroads and the city, two rainforced concrete viaducts. The estimated cost is $117,000. Plans and specifications are on file at the office of W. H. Courtney, Ch. Engr., Louisville, Ky.

Leo, Ind.—Bids will be received by the Board of Commissioners of Allen County at the Auditor's office, Fort Wayne, Ind., until 10 a.m., Mar. 12, for the construction of a reinforced-concrete bridge across the St. Joseph River at Leo. It will have two 92-ft. arches. An appropriation of $20,000 has been made for the purpose. Calvin H. Brown is the County Audr.

Waukegan, Ill.—Bids will be received by the Board of Local Improvements, 107 Washington St., Waukegan, until 8 p.m., Mar. 17, for the construction of the Genessee St. Viaduct. The estimated cost is $69,891. Plans and specifications are on file at the office of Westcott & Ronneberg, 10 South La Salle St., Chicago, Ill.

+Howard's Grove, Wis.—The contract for the construction of a steel bridge at Howard's Grove has been awarded to WORDEN & ALLEN, Milwaukee, Wis., at $5000.

Waterloo, Iowa—Plans are being prepared by the City Engineer for the construction of the proposed Mullan Ave. bridge over the Cedar River. It will have nine arches. The two end arches will be 58 ft. and the other seven 76 ft. The estimated cost is $85,000. Noted Feb. 27.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until Mar. 25, for the construction of the new 12th St. viaduct. It will be of reinforced concrete, 2049 ft. long and 86 ft. wide. L. H. Bowers is Engr.-in-Charge, Bridge Department. The estimated cost is $350,000.

+Belton, Tex.—The contract for the construction of three bridges over the Lampasas River at Belton has been awarded to HESS & SKINNER, Dallas, Tex.

Velasco, Tex.—Bids will soon be received for the construction of four highway lift bridges over the Intercoastal Canal between the Brazos River and Matagorda Bay.

Centralia, Wash.—Plans have been approved for the new bridge over the Skookumchuck River west of the city. It will be of concrete. Daniel B. Luton prepared the plans. Noted Oct. 24.

+Everett, Wash.—Press reports state that the contract for the construction of a steel and concrete bridge over the Ebey Slough, has been awarded to the INTERNATIONAL CONTRACT CO., Central Bldg., Seattle, Wash., at $28,676. The other bidders were: Everett Construction Co., $29,681; Puget Sound Bridge & Dredging Co., $31,251; Graff & Bancroft, $29,209; Portland Bridge Co., $28,370.

San Bernardino, Calif.—Bids will be received by the Board of Supervisors until 11 a.m., Mar. 24, for the construction of a bridge over Live Oak Cañon Creek, on the Riverside and San Bernardino County Line. Charles Post is County Clk.

London, Ont.—C. E. Talbot, Engr.-in-Charge, County Bldgs., London, has recommended that 12 of the county bridges be replaced by new steel and concrete structures.

The erection of a bridge at the Wharncliffe Road, to connect West and South London is under consideration. It will probably have two spans with a center pier. The estimated cost is $25,000.

+St. Boniface, Man.—According to press reports, the contract for the construction of the substructure of a bridge over the Red River, has been awarded to McDONALD, McDONALD & McGOUGAN, Winnipeg, Man., at $227,600. M. P. Blair is City Engr. Noted Feb. 13.

+Vancouver, B. C.—We are officially advised that the contract for the construction of the George Hagers St. viaduct has been awarded to J. McDIARMID & CO., of Winnipeg and Vancouver at $155,000. C. A. P. Turner, 124 Vancouver Block, Vancouver, B. C., is Engr.-in-Charge. Noted Jan. 23.

WATER SUPPLY—IRRIGATION

Boston, Mass.—Bids will be received by the Supply Department until Mar. 19 for furnishing water meters as follows: 6000 5-in., 250 4-in., 100 1-in., 150 1½-in., 75 2-in. and 30 3-in. J. Edward Mullen is Supt.

Fall River, Mass.—Bids will be received by the Water Board until Mar. 12, for furnishing four new boilers for the pumping station.

+Medford, Mass.—We are officially advised that the contract to furnish 225 tons of c.-i. water pipe has been awarded to R. D. WOOD & CO., Philadelphia, Penn., at $6075. The other bids were: Donaldson Iron Co., $6135; Standard Cast Iron Pipe Co., $6157; Chas. Miller & Sons, $6167; E. A. Hoodless & Sons, $6167; Warren Foundry Co., $6226; John Fox & Co., Scotland, $7,950; Dyal Iron Pipe Co., $6417. Bids were opened by the Sewer and Water Commissioners Feb. 12. Noted Feb. 6.

★**Meriden, Conn.**—Bids will be received by William S. Clark, City Engr., until noon, Mar. 25, for constructing a water system. The contract involves constructing a concrete dam and culverts and highway grading, a distributing reservoir, cleaning the site of the storage reservoir, and laying pipes. Plans and specifications are on file at the office of the City Engineer, and at the office of A. B. Hill, Consult. Engr., 100 Crown St., New Haven, Conn. For particulars see advertisement in this issue. Noted Sept. 5.

Buffalo, N. Y.—Bids will be received by the Department of Public Works until 11 a.m., Mar. 7, for furnishing labor and material required for erecting the Venturi meter and valve house in the new pumping station at the foot of Porter Ave. Francis G. Ward is Comr. Bd. Pub. Wks.

Madison, N. Y.—W. G. Stone & Son, Consult. Engrs., Utica, N. Y., are making preliminary surveys and estimates for the installation of a water system for the village. It is proposed to have a gravity system, the water to be pumped from a spring at the lower lake to a reservoir on higher ground back of the village. An election will probably be called to vote on the proposition as soon as the preliminary work is completed.

New York, N. Y.—Bids will be received by the Board of Water Supply until 11 a.m., Mar. 18, for Contract 730, roofing with reinforced-concrete tiles, five superstructures for breakneck gaging chamber and foundry brook and Indian brook siphon chambers. Charles Strauss is Pres. and Joseph P. Morrissey, Secy. of the Bd.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Mar. 12, for furnishing and constructing auxiliary pumping stations on Southfield Boulevard, Borough of Richmond; making necessary excavations, building engine foundations of concrete, engine pit, floor, etc., and a new feed pump room in the West New Brighton Pumping Station, Borough of Richmond; for dismantling and transporting one pumping engine now in the Baldwin Pumping Station, at Baldwin, L. I., to the West New Brighton Pumping Station, Borough of Richmond, and reërecting it complete in place with new parts, etc., and steam and exhaust piping, section and discharge piping, one dry vacuum pump, two boiler feed pumps, etc., and all valves.

West Winfield, N. Y.—Bids will be received by the Board of Village Trustees until 1 p.m., Apr. 1, for constructing a municipal water system. The contract involves a pump house, stand-pipe foundation, and the following pipe: 4176 ft. of 10-in., 1356 ft. of 8-in., 5108 ft. of 6-in., and 6348 ft. of 4-in. Plans and specifications may be procured from Dr. C. F. Wood, Village Pres., or from W. G. Stone & Son, Consult. Engrs., Mann Bldg., Utica, N. Y. A. C. Hackley is Village Clk. Noted Nov. 7.

★**Atlantic City, N. J.**—Bids will be received by the Board of Commissioners until 2.30 p.m., Mar. 13, for laying a 24- and 20-in. c.-i. water main in Arctic Ave., from Missouri Ave. to Maine Ave., with lateral mains in intersecting streets. Plans and specifications are on file at the office of the Water Department. Harry Bacharach is Comr.

Jersey City, N. J.—Bids will be received by the Board of Street and Water Commissioners until Mar. 10, for furnishing and delivering hydrants.

Coudersport, Penn.—An election will probably soon be called to vote on a bond issue of $45,000, for installing a water system. Plans have been prepared by Witmer & Brown, Consult. Engrs., Chapin Block, Buffalo, N. Y. R. R. Lewis is Boro. Solicitor. Noted Nov. 21.

Mount Joy, Penn.—The proposition to install a filtration plant, to cost $42,000, was defeated at the recent bond election. Noted Feb. 13.

★**Tarentum, Penn.**—Bids will be received by the Borough Council until 8 p.m., Mar. 24, for the following work: Concrete clear water well, pump room, filter tubs and coagulating basin; brick boiler room; mechanical dosing and regulating devices for coagulating basin; mechanical equipment for two 500,000 gal. filter units; one 300 hp. water-tube boiler; two 1,000,000-gal. steam pumping engines, two 1,000,000 gal. motor-driven centrifugal pumps; a brick pump pit at the river intake; a 14-in. c.-i. pipe line 1200 ft. long; a submerged 14-in. c.-i. pipe line 800 ft. long, to be laid in the Allegheny River; a steel stand pipe 20 ft. in diameter by 50 ft. in height. W. F. Denny is Pres. of Council. W. A. Gibson is Boro. Secy. Leo Hudson, McKeesport, Penn., is Consult. Engr. Noted Jan. 23.

Delmar, Del.—The Delmar Water Co. contemplates a bond issue of $70,000, for extending its water mains and otherwise improving its water system.

Georgetown, Del.—The state legislature has authorized the town to borrow $35,000 for the installation of a water system. Noted Feb. 27.

Bridgewater, Va.—Bonds for $25,000 were voted Feb. 21, for the installation of water and sewer systems. Otis W. Wine is Chn. Finance Com. Noted Feb. 13.

Raleigh, N. C.—According to press reports, the Wake Water Co. contemplates an expenditure of $65,000, for improving and enlarging its water system. The proposed improvements include an impounding reservoir on Walnut Creek, to have a capacity of 226,000,000 gal., a double water main into the pumping station, a main from the pumping station to the center of the city, additional pumping and filter facilities, and an increased pipe system within the city limits. Gilbert C. White, Charlotte, N. C., is Consult. Engr. Noted Jan. 23.

Marshallville, Ga.—An election has been called to vote on a bond issue of $20,000 for constructing a water system and an electric-light plant. J. Booton is Mayor.

Hurtsboro, Ala.—According to press reports, bonds for $24,000 have been voted for the construction of water and sewer systems and an electric-light plant.

Lenoir City, Tenn.—Bids will be received by James L. Rogers, Mayor, until Mar. 15, for the purchase of $40,000 water bonds. Noted Feb. 20.

Canton, Ohio—The Board of Health has recommended the construction of an underground basin for storing well water. It is proposed to construct a reservoir 320 ft. long, 143 ft. wide and 25 ft. deep, made of concrete, and covered. Estimated cost, $80,000. The City Council is considering the proposition.

Cincinnati, Ohio—Bids will be received by A. T. Polk, Dir. Pub. Svc., until noon, Mar. 12, for laying 6-in. water mains in various streets. M. T. Keefe is Clk.

Cincinnati, Ohio—An ordinance has been passed providing for a bond issue of $125,000, for improving and repairing the Eden Park Reservoirs. A. T. Polk is Dir. Pub. Svc.

✚**New Berlin, Ohio**—We are officially advised that the contract to furnish pipe for the new water system has been awarded to the MASSILLON STEEL & IRON CO., Massillon, Ohio, at $5661. Bids were opened Feb. 4. Noted Jan. 23.

Painesville, Ohio—See item under Light, Heat and Power.

Shaker Heights, Ohio—Bids will be received by Carl A. Palmer, Village Clk., until noon, Mar. 17, for constructing water mains in various streets and roads. Plans and specifications are on file at the office of E. W. Willard, Village Engr., Williamson Bldg., Cleveland, Ohio, and at the office of Carl A. Palmer, Village Clk.

Youngstown, Ohio—F. M. Lilly, City Engr., has prepared plans and specifications for the proposed reservoir estimated to cost $500,000. Noted Feb. 13.

Hebron, Ind.—The Town Board is receiving bids for the installation of a water system here, estimated to cost $34,000. F. W. Hickens, Consult. Engr., Kankakee, Ill., has prepared plans. B. F. Nichols is Pres. Town Bd.

Anna, Ill.—According to press reports, bids will soon be asked for constructing a complete water system, estimated to cost $120,000, at the State Hospital at Anna. Plans as prepared by the D. H. Maury Co., Monadnock Block, Chicago, Ill., provide for a filtration plant, transmission line, concrete and earth dam, concrete reservoir and pumping station, 10- and 12-in. c.-i. mains.

Evanston, Ill.—We are officially advised that plans and specifications for a 12,000,000-gal. mechanical filter plant with appurtenances will probably be completed so that bids will be received by J. H. Moore, Comr. Pub. Wks., during the first week in April. Copies of the plans and specifications may be obtained by contractors on or before Mar. 15 from the Engineers, George W. Fuller, 170 Broadway, New York, and Langdon Pearse, 76 West Monroe St., Chicago, Ill. Estimated cost, $150,000. Noted Feb. 6.

✚**Moline, Ill.**—We are officially advised that the contract to construct the 25th St. Water Main District has been awarded to the MOLINE HEATING & CONSTRUCTION CO., Moline, Ill., at $12,319. The other bids were: F. E. Kaminske, Racine, Wis., $12,139; C. B. McNamara, Dubuque, Iowa, $12,-159; Independent Contracting Co., Davenport, Iowa, $12,408. Bids were opened Feb. 18. Lyle Payton is City Engr. Noted Feb. 13.

Paris, Ill.—The proposition to issue bonds for $30,000, for the installation of a filtration plant here, was defeated at the recent bond election. Noted Feb. 6.

✚**Fond du Lac, Wis.**—We are officially advised that the contract to construct air lifts for six wells, and for furnishing and installing an air compressor capable of raising 4000 gal. of water per min. has been awarded to the INGERSOLL-RAND CO. OF ILLINOIS, 122 South Michigan Ave., Chicago, Ill., at $11,107. Bids were opened Feb. 20. Noted Feb. 13.

Shawano, Wis.—See item under Light, Heat and Power.

Sheboygan Falls, Wis.—W. G. Kirchoffer, Consult. Engr., Madison, Wis., has completed preliminary plans and estimates for the installation of water systems here. Estimated cost, $20,000. Noted Oct. 31.

Burlington, Iowa—Bids will be received by the Citizens' Water Co., until noon, Mar. 15, for constructing a clear water basin, according to plans on file at the office of Alvord & Burdick, Consult. Engrs., Hartford Bldg., Chicago. Frank Lawlor is Supt.

Epworth, Iowa—Bids will probably be asked soon for constructing a water system, estimated to cost $10,000. C. W. Roland, Des Moines, Iowa, is Consult. Engr. J. J. Hamilton is City Clk.

New Ulm, Minn.—The Oscar Claussen Engineering Co., German American National Bank Bldg., St. Paul, Minn., is making a report on the installation of a water system and an electric-light plant here.

✚**Glen Elder, Kan.**—We are officially advised that the contract to construct a water system here has been awarded to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, at $13,700. O. E. Pickering is City Clk. Noted Oct. 10.

Peru, Neb.—We are officially advised that bonds for $20,000 have been voted for the installation of a water system here. Charles F. Sturtevant, Holdredge, Neb., is Consult. Engr. F. N. Martin is Village Clk. Noted Feb. 20.

Silver Creek, Neb.—The Board of Trustees has called an election for Mar. 11 to vote on a bond issue of $8000 for installing a water system. Noted Feb. 13.

Twin Bridges, Mont.—The Town Council will probably soon call an election to vote on a bond issue for the installation of a water system.

✚**Gravette, Ark.**—According to press reports, the contract to install a water system and an electric-light plant here has been awarded to A. J. FOSTER, Joplin, Mo., at $25,000. Noted Dec. 26.

✚**Wynne, Ark.**—We are officially advised that the contract to improve the water system has been awarded to the U. S. SHERMAN Co., Oklahoma City, Okla., at $68,300. Bids were opened Feb. 24. Noted Feb. 13.

✚**Aspermont, Tex.**—The Aspermont Water Co. is preparing to install a water system here, and has awarded a contract to J. T. BOND for building a water storage reservoir, to have a capacity of 190,000,000 gal.

Bay City, Tex.—The city contemplates an expenditure of $17,000, for extending the water mains. John Sutherland is Mayor.

New Boston, Tex.—Bonds for $15,000 have been voted for installing a water system here.

Rockdale, Tex.—Bonds for $30,000 have been voted for acquiring a municipal water system. Noted Jan. 30.

Atoka, Okla.—The Missouri, Kansas & Texas R.R. con-

templates the construction of water reservoirs at Atoka and Crowder, estimated to cost $50,000. F. H. Van Craenbroeck, McAlester, Okla., is Engr.

†Greeley, Colo.—We are officially advised that the contract to construct Distributing Reservoir No. 2 for the water system has been awarded to FRASER & McCABE, Boulder, Colo., at $11,200. The other bids were: Sherman Construction Co., $12,235; Engineers' Construction Co., $12,700; J. S. Morrison, $12,866. Bids were opened Feb. 21. C. F. Shattuck is City Engr. Noted Feb. 13.

Tucumcari, N. M.—The El Paso and Southwestern Ry. Co. will install a water system and make improvements to its shops here. Estimated cost, $90,000.

Tucson, Ariz.—The City Council has taken steps to increase the water supply of the city. J. B. Grinde, formerly territorial engineer, Prof. L. A. Waterbury, of the Civil Engineering Dept. of the State University, and Prof. G. E. P. Smith, Irrigation Engr., have been retained to constitute a board of experts to investigate the situation and make recommendations as to the best method of increasing the supply.

Yuma, Ariz.—Frank Brooks, City Engr., has prepared plans for a new municipal water system, a sewer system, electric-light and power plant and street improvements, the aggregate cost of which is estimated at $300,000. The City Council will soon submit the proposition of issuing bonds for these improvements to a vote of the tax payers.

Seattle, Wash.—Bids for constructing water mains in Tenth Ave. were received by the Board of Public Works, Feb. 14, as follows: Dicken & Rightmire, 2728 33d Ave., South, Seattle, $12,481; Ferguson-Coit Co., $12,784; Washington Construction Co., $12,677; Jahn Construction Co., $12,978; E. J. Rounds Construction Co., $12,991; Erickson Bros., $12,924; John W. Johnson, $13,849.

Sandy, Ore.—The City Council has appointed a special committee to investigate the advisability of installing a water system.

Modesto, Calif.—At a recent meeting of the people of the Waterford Section, 14 miles from here, it was decided that steps be taken for the formation of an irrigation district of approximately 20,000 acres. The proposed district will border the Modesto Irrigation District on the east. A committee composed of Jesse Finley, J. L. Prouty, Al Gatzman, Ed Rydberg and T. W. Donnelley was appointed to draft plans for the district.

San Diego, Calif.—The San Diego Consolidated Gas & Electric Co. has applied for a franchise to construct a filtration plant and settling basin at Eighth and N Sts., for removing injurious substances from the bay. Estimated cost, $8000.

Cowley, Alta.—The city contemplates the installation of a water system, estimated to cost $10,000.

SEWERS

★Boston, Mass.—Bids will be received by the Boston Transit Commission until noon, Mar. 6, for furnishing and delivering 676,000 lb. of c.-i. pipe and 22,000 lb. of c.-i. specials for sewers in Section 6, Dorchester Tunnel. B. Leighton Beal, 15 Beacon St., Boston, is Secy.

★Worcester, Mass.—Bids will be received by Matthew Gault, Supt. of Sewers, until noon, May 1, for furnishing cement for the period from May 1, 1913, to April 30, 1914. It is estimated that 25,000 bbl. will be needed.

Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Pres., Boro of Brooklyn, until 11 a.m., Mar. 12, for constructing the following sewers: Storm water and sanitary sewer in North Henry St., from Calver St. to Greenpoint Ave., and outlet sanitary sewers with accompanying storm sewers in Greenpoint Ave., from North Henry St. to Jewell St., together with a pumping station, pump well and appurtenances at Greenpoint Ave. and Jewell St.; sewer in Canarsie Lane, from Flatbush Ave. to Bedford Ave.; sewer in 64th St., from Eighth Ave. to Ninth Ave., and an outlet sewer in Ninth Ave., from 64th St. to 63d St.; sewer in Eighth Ave., from 37th St. to 38th St., and an outlet sewer in 37th St., from Eighth Ave. to Ninth Ave. Approximate cost, $50,000.

Fairport, N. Y.—We are officially advised that an election has been called for Mar. 11, to vote on a bond issue of $40,000 for the construction of an intercepting sewer and a sewage disposal plant. Plans and specifications have been prepared by Bowerman & Fisher, Consult. Engrs.

Palatine Bridge, N. Y.—We are officially advised that bids will be received by the village until 10 a.m., Mar. 22, for the construction of a sewer system and a sewage disposal plant. Morrell Vrooman, Gloversville, N. Y., is Consult. Engr.

Perry, N. Y.—The Chamber of Commerce advocates the installation of a sewer system in the vicinity of Silver Lake. An election will probably soon be called to vote on a bond issue of $25,000.

Piermont, N. Y.—Bids will probably soon be asked for the installation of a sewer system here, according to plans prepared by Alexander Potter, Consult. Engr., 60 Church St., New York. Noted Oct. 31.

Trenton, N. J.—The Board of Commissioners is arranging to lay new sewers in Asylum Road, Edgewood Ave., Bellevue Ave., Brunswick Ave., and other streets.

Canton, Penn.—According to press reports, John H. Richardson and others of Baltimore, Md. are interested in the organization of a company with a capital stock of $500,000, to construct a sewage disposal plant for Highlandtown, Canton and Orangeville.

McKeesport, Penn.—Bids will be received by the Sewer Committee until 8 p.m. Mar. 6 for constructing 8-, 12- and 15-in. terra cotta sewers in various streets. Plans and specifications are on file at the office of the City Engineer.

Pittsburgh, Penn.—Bids will be received by the Department of Public Works, at the office of the City Controller, until 10 a.m., Mar. 7, for constructing 8-, 12-, 15- and 24-in. sewers in various streets. Joseph G. Armstrong is Dir. Pub. Wks.

†Wilmington, N. C.—The contract to construct about 36 miles of sewers here has been awarded to the AMERICAN LIGHT & WATER CO., Chicago, Ill., at $151,000. Noted Feb. 6.

Park City, Tenn.—The town contemplates a bond issue of $10,000, for the construction of sewers.

Danville, Ky.—We are officially advised that bids will be received at the Water Office until 2 p.m., Mar. 15, for purchasing $18,000 sewer bonds. J. M. Wallace is Mayor. Noted Nov. 7.

Paducah, Ky.—We are officially advised that the City Council plans to set aside approximately $50,000 every year, until it has sufficient funds to build the proposed trunk sewer in District 3. Estimated cost, $200,000. L. A. Washington is City Engr. Noted Feb. 20.

Ashland, Ohio—Bids will be received by F. Edwards, Dir. Pub. Ser., until Mar. 7, for furnishing material and constructing the South Highland relief storm sewer.

†Burton, Ohio—We are officially advised that the contract to construct about 5000 lin.ft. of sewers, eight catch basins, etc., has been awarded to GEORGE HERRING & SON, Cleveland, Ohio. Bids were opened Feb. 20. Noted Feb. 20.

Canton, Ohio—We are officially advised that the Director of Public Service has retained R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio, to make a report and general plans for a sewage disposal plant here. Noted Feb. 20.

★Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Mar. 10, for constructing main and lateral sewers and drains, with appurtenances, in the section of the city known as Evanston. Plans and specifications may be obtained at the office of the Chief Engineer of Public Service. The contract involves the construction of 8750 ft. of 12- to 36-in. sewers. M. J. Keefe is Clk.

★Columbus, Ohio—Bids will be received by Samuel A. Kinnear, Dir. Pub. Ser. until Mar. 11, for constructing four trunk and three lateral sewers. Estimated cost, $200,000. The contract involves: 1295 lin.ft. of 78-in., 1165 lin.ft. 72-in., 981 lin.ft. 66-in., 1726 lin.ft. 60-in., 1385 lin.ft. 54-in., 695 lin.ft. 48-in., 3860 lin.ft. 36-in., 2490 lin.ft. 30-in., 11,049 lin.ft. 24-in., 374 lin.ft. 20-in., 2238 lin.ft. 18-in., 4283 lin.ft. 15-in., 1700 lin.ft. 12-in., 8277 lin.ft. 10-in., 4185 lin.ft. 8-in., 195 manholes. Plans and profiles may be obtained from Henry Maetzel, Ch. Engr. Noted Feb. 27.

Conneaut, Ohio—Bids will be received by A. W. Pelton, Dir. Pub. Ser., until noon, Mar. 17, for constructing sewers in various streets. Floyd Stoneman is Clk.

Fostoria, Ohio—We are officially advised that R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio, has been retained to assist C. S. Latshaw, City Engr., to prepare plans for enlarging and remodeling the sewage purification plant. Noted Jan. 16.

Galion, Ohio—Bids will be received by the Director of Public Service about Apr. 1, for constructing 44,000 lin.ft. of 4- to 18-in. tile sewers. A. O. Theobald is City Engr.

†Linden Heights, Ohio—We are officially advised that the contract to construct about four miles of vitrified pipe sewers here has been awarded to H. E. MILLER, 1197 Franklin Ave., Columbus, Ohio, at $20,801. The other bids were: R. D. Fulton, Columbus, $25,093; H. G. Howell, Columbus, $35,506; H. E. Hunt, Jackson, Ohio, $25,237; J. T. Ryerson, Columbus, $21,718; J. O. James, Columbus, $24,850; Haskell & Battles, Painesville, Ohio, $22,163. Noted Jan. 30.

Newark, Ohio—We are officially advised that bids will be received by the Director of Public Service until noon, Mar. 12, for constructing about 12,000 ft. of 6- to 30-in. sewers. C. H. Wells is City Engr.

Indianapolis, Ind.—Bids will be received by the Board of Public Works until 10 a.m., Mar. 10, for the construction of sewers in various streets.

Marquette, Mich.—Press reports state that bids will be received by the Park, Cemetery and Street Commission until Mar. 15, for constructing a trunk sewer. Estimated cost, $50,000. Plans and specifications are on file at the office of the Secretary of the Board.

East St. Louis, Ill.—The Board of Public Improvements contemplates the construction of two new sewer districts, estimated to cost $600,000.

Edwardsville, Ill.—Bids will be received by the N. O. Nelson Mfg. Co., Edwardsville, until 3 p.m., Mar. 17, for furnishing approximately 8000 ft. of 8-, 10- and 15-in. sewers.

†Moline, Ill.—We are officially advised that a contract to construct sewers here has been awarded to the MOLINE HEATING & CONSTRUCTION CO., Moline, Ill., at $7246. The ither bids were: F. F. Kaminski, Racine, Wis., $8706; C. B. McNamara, Dubuque, Iowa, $7797; Independent Construction Co., Davenport, Iowa, $7242. Bids were opened Feb. 18. Noted Feb. 13.

Davenport, Iowa—We are officially advised that bids will probably be asked about Mar. 20, for constructing seven trunk sewers in Sewer District No. 13. Estimated cost, $60,000. A. M. Compton is Comr. Pub. Wks. J. A. Ryan is City Engr. Noted Feb. 20.

Easton, Minn.—Bids will be received by William Scheid, Village Clk., until 7:30 p.m., Mar. 7, for constructing sewers in various streets, according to plans and specifications prepared by S. C. Armstrong, Consult. Engr., Fairmont, Minn.

Ely, Minn.—See item under Streets and Roads.

Sedan, Kan.—An election will be called some time during the spring to vote on a bond issue of $35,000, for installing a sewer system. Von Unwerth & Cooke, Financial Bldg., Kansas City, Mo., are Consult. Engrs. Noted Nov. 7.

Sheridan, Wyo.—Bids will be received by James J. Withrow, City Clk., until 10 a.m., Mar. 17, for constructing a system of storm water sewers. Plans may be obtained from the City Engineer.

†Dillon, Mont.—The contract to construct two new sewer districts has been awarded by the City Council to LINDSTROM & OREN, Butte, Mont., at $15,630. Noted July 18.

St. Joseph, Mo.—The Board of Public Works plans to repair the Blacksnake Sewer in Franklin St., by day labor. Estimated cost, $5000. C. W. Campbell is City Engr.

St. Louis, Mo.—Bids will be received by the Board of Pub-

lic improvements until noon, Mar. 14, for constructing sewers as follows: Letting No. 10,851, for the construction of sewers in Rock Spring Sewer District No. 17, embracing sewers of the materials, lengths and sizes as follows: 121 ft. of 21-in., 1040 ft. of 18-in., 690 ft. of 15-in., 640 ft. of 12-in., with sewer inlets, manholes, and all other appurtenances; letting No. 10,852, for the construction of sewers in Manchester Ave. Sewer District No. 1, embracing sewers of the materials, lengths and sizes as follows: 535 ft. of 27-in., 455 ft. of 24-in., 1040 ft. of 21-in., 1685 ft. of 18-in., 1540 ft. of 15-in., 5885 ft. of 12-in., with sewer inlets, manholes, and all other appurtenances. All pipe will be of vitrified clay. Maxime Reber is Pres., and W. T. Findly is Secy.

Cushing, Okla.—At a recent election bonds were voted for the installation of a sewer system.

Idaho Falls, Idaho.—Bids will be received until Mar. 20, for constructing 7300 ft. of 8-in. sewer in Local District No. 1, and 1320 ft. of 12-in. and 14,560 ft. of 8-in. sewers in Local District No. 2. Frank Beach is City Engr.

Visalia, Calif.—The city plans to lay about 16,000 ft. of sewers, to serve outlying districts. Estimated cost, $18,700.

GARBAGE

Lockport, N. Y.—The city is considering the installation of a garbage disposal plant.

New York, N. Y.—Bids will be received until 2:30 p.m., Mar. 7, by Michael J. Drummond, Comr. Dept. Public Charities, for furnishing all the labor and materials required for overhauling the garbage crematory at the New York City Home for the Aged and Infirm, Blackwells Island, city of New York.

★**Wilkes-Barre, Penn.**—Bids will be received until noon, Mar. 7, by Fred H. Gates, City Clk., for cleaning 35 miles of paved streets in the city. Specifications and bidding blanks will be furnished on application.

★**Kansas City, Mo.**—Bids will be received by the Board of Public Works until 2 p.m., March 11, for the construction of a refuse disposal plant of 75 tons daily capacity. Specifications can be had by application to the Secretary of the Board of Public Works, Kansas City. E. J. McDonnell is Secy.

Coronado Beach, Calif.—Eugene M. Hoffman, Arch., San Diego, Calif., is preparing plans for the construction of a garbage incinerator plant of the "McGuire" type.

Stockton, Calif.—The City Council has voted in favor of purchasing a site for a garage incinerator.

STREETS AND ROADS

Hartford, Conn.—Surveys for proposed improvements of the state highway system have been received by the State Highway Commissioner, as follows: From Elmer C. Welden, Div. Engr., 14,300 lin.ft. on the road from West Stafford to Stafford Springs in the town of Stafford; from Divisional Engineer James A. McElroy, 14,100 lin.ft. on the Trumbull Road in the town of Monroe. Chas. J. Bennett is Comr.

★**New Britain, Conn.**—Bids will be received until 8 p.m., Mar. 18, by the Board of Public Works for paving West Main St., from end of present pavement to Black Rock Bridge. About 18,000 sq.yd. will be required. Bids will be considered for vitrified brick, wooden block, asphalt, granite block or bitulithic. John E. Moore is Pres.

Brooklyn, N. Y.—Bids will be received until 11 a.m., Mar. 12, by the President of the Borough, Borough Hall, for various improvements in the following streets: East 17th, Malta, Suydam, West Third, West 31st, 36th and 74th Sts., Ave. F, Lincoln and Utica Aves.; also for furnishing and delivering 7000 cu.yd. of asphalt sand, 4300 cu.yd. broken trap rock, 1820 cu.yd. trap rock screenings, and 250 cords of hardwood, all deliveries to be made as directed by Borough Engineer, Alfred E. Steers is Pres.

New York, N. Y.—Bids will be received until 2 p.m., Mar. 13, by the Commissioner of Bridges, Borough of Manhattan, 13 to 21 Park Row, for repairs to asphalt pavements on the bridge over the Harlem River. Arthur J. O'Keeffe is Comr.

✚**Syracuse, N. Y.**—A contract has been awarded by the Board of Contract and Supply to the WARNER-QUINLAN CO., at $21,319, for paving North Clinton St., from Spencer to Division St., and small sections of East and West Division and Fulton Sts. John J. Halloran is Secy. of the Bd.

✚**Atlantic City, N. J.**—We are officially advised that the City Commissioners have awarded a contract to CHARLES H. CRAMER, 236 North Maine Ave., Atlantic City, at $40,786, for about 12,880 sq.yd. vitrified block pavement. Other bidders were: McCullough Constructing Co., $41,443; T. J. McGovern, $42,432; Edward L. Bader, $43,857; Kelley-McFeeley Co., at $45,527; John E. Kahle, at $45,670. J. W. Hackney is City Engr. Noted Feb. 6.

★**Englewood, N. J.**—Bids will be received by the Common Council until 8 p.m., Mar. 18, for paving with asphalt blocks, curbing and otherwise improving Palisade Ave., from Engle to James St. Robert Jamieson is City Clk.

Hainesburg, N. J.—The Warren County Board of Freeholders has voted to build a new road between Hainesburg and Columbia, a distance of about four miles, to connect with the new Blairstown Road. The new road will have stone base and gravel top.

Jersey City, N. J.—Bids will be received by the Board of Street and Water Commissioners until 2 p.m., Mar. 10, for improving Spruce St., from Hudson Blvd. to Tonnele Ave. Specifications are on file at the office of Edward B. See, Clk. of Bd.

Bids will be received until 2 p.m., Mar. 10, by the Board of Street and Water Commissioners, for repairing and repaving the Mercer St. Viaduct. John Prout is Chn. of the Bd.

Pittsburgh, Penn.—Bids will be received until 10 a.m., Mar. 7, by the City Controller, for grading, curbing and paving portions of the following streets: Craighead, Dyer, Water, Hoevler, Devonshire, Tecumseh, Langley, Shelby, Mar, Mulford, Rockridge and Merritt Sts. and Grandview Ave. Joseph G. Armstrong is Dir.

Frederick, Md. Bids will be received until noon, Mar. 10, by the Commissioners of Frederick County, for construction of one mile of road along the Burkettsville Knoxville Road. L. C. Dinterman is Pres. of the Comrs. M. D. Harp is Clk.

★Bids will be received until 11 a.m., Mar. 26, by the Mayor and City Council, for about 3,500 sq.yd. street paving and 1000 lin.ft. curbing. Edward Schell is Mayor. E. C. Crum is City Engr.

Washington, D. C. Bids will be received until Mar. 10, by the Commissioners of the District of Columbia, for about 17,000 cu.yd. grading on various streets. C. H. Rudolph is Chn. of the Comrs.

Big Stone Gap, Va.—Wise County has recently sold $260,000 of bonds, the proceeds of which will be used for road construction. The County Court at Big Stone Gap may be addressed.

★**Fairmont, W. Va.**—Bids will be received until noon, Apr. 10, by the County Court of Marion County, for construction of 32.7 miles of road in Mannington District, Marion County. J. Russell Wilson, 163 South Main St., Washington, Penn., is Engr. J. F. Phillips is Clk of Marion County.

Atlanta, Ga.—The Cobb Realty Co., recently organized, has purchased a 10-acre tract on West Tenth St., and will expend about $35,000 in cutting, grading and paving streets and laying off residence lots. S. A. Anderson is Pres., and George McKenzie is Treas. of the company.

Washington, Ga.—Bids will be received about Apr. 3 by the City Council, for construction of 20,000 to 25,000 sq.yd. of street paving. L. D. Favor is Mayor, H. S. Jaudon Engineering Co., Atlanta and Savannah, Ga., is Engr.-in-Charge.

Lakeland, Fla.—The city is planning to construct brick street paving at an estimated cost of $60,000. The Mayor may be addressed.

✚**Live Oak, Fla.**—A contract has been awarded by the Board of Public Works to the ALABAMA PAVING CO., Birmingham, Ala., at $1.78 per sq.yd., for 25,000 sq.yd. vitrified brick paving and 43c. per ft. for granite curb. The H. S. Jaudon Engineering Co., Atlanta and Savannah, Ga., is Engr. in Charge.

Opelika, Ala.—Bids will be received until Mar. 21 by the City Council, for about 50,000 sq.yd. street paving. Bids will be accepted on brick, wood block, Dolarway, Hassam, asphalt or bitulithic. S. S. Black is City Clk...

De Ridder, La.—Bids will be asked in about a month for the construction of 10 miles of sidewalks and curb. McCorkle & Baylis, 704 Farley Bldg., Birmingham, Ala., are Engrs. in Charge.

Houma, La.—The Police Jury of Terrebonne Parish has appropriated the sum of $6000 for road construction in the Parish.

✚**New Orleans, La.**—We are officially advised that the State Highway Department has awarded a contract to C. S. JACKSON & CO., Crowley, La., at an estimated cost of $24,900, for the construction of 11 miles of road extending northeast from Many to Natchitoches Parish Line. Other bidders were: B. D. Wood and S. K. Jones. C. C. Sandoz is Secy. Noted Feb. 20.

New Orleans, La.—The Commission Council has passed an ordinance providing for the paving of Notre Dame St., from Fulton to Front Sts., with small granite blocks. W. J. Hardee is City Engr.

Morristown, Tenn.—Bids will be received until Mar. 14, by the City Council, for about 16,380 sq.yd. sheet asphalt paving on various streets, Improvement Districts Nos. 2 and 3. D. C. Morris is City Recdr.

Louisville, Ky.—The Board of Public Works will receive bids until 2 p.m., Mar. 13, for 2575 sqyd. of 3½-in. 16-lb. wood blocks for use on Main St., between Fourth and Fifth Sts. The blocks are to be laid and furnished by the contractor. D. R. Lyman is Ch. Engr.

✚**Burton, Ohio**—We are officially advised that the Village Council has awarded a contract to GEORGE B. HERRING & SON, Cleveland, Ohio, at $11,809, for 7326 sq.yd. concrete paving. Other bidders were: B. F. Hewitt, Jefferson, Ohio, at $11,742, for gravel concrete, or $11,888 for slag concrete; C. J. Chinnock, Warren, Ohio, at $11,803. E. A. Fiedler, Chardon, Ohio, is City Engr. Noted Jan. 23 and Feb. 13.

Canton, Ohio—The Commissioners of Stark County will shortly ask bids for paving about 10 miles of the Alliance-Harrisburg Road. The estimated cost of the work is from $175,000 to $202,000, according to the material used. J. H. McConnell is Audr.

Cincinnati, Ohio—The Streets and Parks Committee of the City Council has recommended the improvement of Madison Road, from Woodburn to Erie Ave., at an estimated cost of $268,438.

Cincinnati, Ohio—Bids will be received until noon, Mar. 10, by the Director of Public Service, for improving Evergreen Ave., from Cheviot to Craig Aves., by grading, curbing and paving the roadway with macadam with bituminous binder. V. T. Price is Dir. M. J. Keefe is Clk.

Cleveland, Ohio—Bids will be received until 11 a.m., Mar. 29, by the Commissioners of Cuyahoga County, for improvement of South Woodland Road No. 3, and Prospect Road No. 2. Frank R. Lander is County Surv. John F. Goldenbogen is Clk.

Deshler, Ohio—Bids will be received until noon, Mar. 11, by the Village Council, for improving Elm St., from Vine to Ash Sts., by grading, curbing and paving with brick on a concrete foundation. A. F. Samuel is Village Clk.

Hamilton, Ohio—The City Council has had plans prepared for paving portions of Greenwood Ave. and Washington St., at an estimated cost of $38,000.

✚**Lockland, Ohio**—We are officially advised that a contract for the improvement of Wyoming Ave. has been awarded by the Village Council to the KIRCHNER CONSTRUCTION CO.,

Cincinnati, at $53,070. Other bidders were: Thomas Evans, at [illegible] and C. N. Batschelor at $57,566. Ward Baldwin is [illegible]. Frank Reed is Village Clk. Noted Jan. 30.

Medina, Ohio—We are officially advised that bids will be received until noon, Mar. 15, by the Trustees of Hinckley Township, Medina County, for improving about 7400 ft. of River Road No. 1. Ira Waldo is Township Clk.

At a special election held Feb. 18, the taxpayers of Litchfield Township, Medina County, voted to issue $50,000 in bonds for road improvements. Clyde Harvey is County Surv.

Nelsonville, Ohio—Bids will be received until noon, Mar. 22, by the Director of Public Service, for improving Madison St., from Washington to Frank Sts., by grading, curbing and paving with vitrified block. C. C. Sharp is Dir.

✚Toledo, Ohio—Contracts for street improvements have been awarded by the Board of Control as follows: H. B. STREICHER, at $56,927, for paving portions of Collins and Islington Sts., Glenwood, and Maplewood Aves., with sheet asphalt; PETERS BROS., $8050, for paving Ewing St. with vitrified brick; M. F. O'SULLIVAN, $8406, for paving Rogers St. with brick; PETER H. WALTERS, $9537, for concrete paving on Redwood Ave. and Lorain St. T. R. Cowell is Dir. of Public Ser.

Bloomington, Ill.—The Board of Local Improvements has instructed the City Clerk to advertise for bids for repaving Chestnut St., from Center to Main St. Elmer Folsom is City Engr

Milwaukee, Wis.—The Department of Public Works has submitted plans and specifications to the Common Council, for paving portions of Wells and West Water Sts. and Grand Ave., with creosoted wooden blocks, at an estimated cost of $42,914. The paving of various other streets at an estimated cost of $77,231, is also recommended.

Belle Plaine, Iowa—We are officially advised that the following low bids were received on Feb. 24, by the City Council for about 20 blocks of street paving: The Des Moines Asphalt Paving Co., Des Moines, $57,895, using brick with sand filler; $61,748, brick with asphaltic filler; $54,404, for asphaltic concrete; $52,960, for asphaltic macadam; Ward & Weighton, Sioux City, Iowa, $41,780, for concrete paving; Ford Paving Co., Cedar Rapids, Iowa, $48,728 for Dolarway. The Iowa Engineering Co., Clinton, Iowa, is Engr. in Charge. Noted Feb. 20

✚Cedar Rapids, Iowa—A contract has been awarded by the City Council to PERCY P. SMITH, at $13,268, for construction of about 17,000 ft. of combination curb and gutter, 100,250 yds. of grading and 40 cu.yd. rock excavation on various streets. Other bidders were: Ford Paving Co., $14,285; Frank K. Hahn, $14,080; B. J. Sweatt, $14,937. J. L. Storey is City Clk.

Ely, Minn.—We are officially advised that bids will be received until Mar. 18 by the City Council, for the construction of concrete sidewalks, combined curb and gutter and storm sewers. The estimated cost is $37,000. C. A. Nutter is City Engr. I. Wested, Jr., is City Clk.

Minneapolis, Minn.—Bids will be received until 11 a.m., Mar. 17, by Commissioners of Hennepin County, for grading 4000 lin.ft. of road bed and boulevards on Nicollet Ave., Road No. 2.

Bids will be received until 11 a.m., Mar. 24, by the County Commissioners for grading and graveling 17,146 lin.ft. of roadbed on Penn Ave., Road No. 36. Al P. Erickson is County Audr.

St. Paul, Minn.—The Board of Public Works has directed the City Engineer to prepare plans and estimates for paving Osceola and Pleasant Aves. with asphalt, wood block or bitulithic. Oscar Claussen is City Engr.

✚Kansas City, Mo.—The Kansas City Terminal Ry. Co. has awarded a contract to E. J. WETTERSTROM, Chicago, Ill., and Memphis, Tenn., for furnishing $75,000 worth of creosoted-wood blocks to pave 30 or more viaducts which the Terminal [illegible].

Maryville, Mo.—The City Council has authorized the Mayor [illegible] to pave Texas Ave., from Main to Louisiana Sts., with creosoted-wood blocks, and Avondale Ave., from Baldwin to Ariel Sts., with bitulithic.

A contract was awarded to the TEXAS BITULITHIC CO., at $2.43 per sq.yd., for paving Burlington St., from West Alabama to Hawthorne St., with bitulithic.

Poplar Bluff, Mo.—The City Council will receive bids in March or April for about 40,000 sq.yd. of brick street paving. It is planned to improve 14 residence streets this year by grading and paving. Edward C. Thomas is City Engr.

St. Louis, Mo.—Bids will be received until Mar. 18, by the Board of Public Improvements for the improvement of various streets and alleys at an estimated cost of $186,842. The work [illegible] asphaltic concrete pavements and [illegible] oil treatment. Maxime Belcher is Pres. of the Bd. W. T. [illegible] is Sec.

Houston, Tex.—The County Road Court has decided [illegible] improvement proposed to be made by the [illegible] and plans [illegible] the county.

Cleveland, Okla.—Bids will be received about Apr. 15, by City Council, for six blocks of vitrified brick paving on Broadway [illegible] Boston to Lyndon. The Benham Engineering Co., Oklahoma City, is Engr. in Charge. Noted Jan. 30.

Sheridan, Wyo.—Bids will be received until Mar. 24 by the City Council for the construction of [illegible] and a system of [illegible] to be laid on concrete or creosoted wood block, bitulithic or Dolarway. James J. Withrow is City Clk.

Yuma, Ariz.—[illegible] Engineer.

Eagle Rock, Calif.—The County of Los Angeles has instructed the City Engineer to prepare plans for the improvement of [illegible] Eagle Rock, also for [illegible] that portion of Colorado Blvd. not already improved, about [illegible] Eagle Rock, including [illegible] Victor and Los Feliz Aves. and [illegible] and construct [illegible] C. E. Grunsky is Supervising Engr. Los Angeles City Engr.

Eureka, Calif.—The Holmes Eureka Lumber Co. will construct a stretch of logging road to the Van Duzen River. A bridge 1700 ft. long is to span the river, and the road will connect with the Northwestern Pacific Ry., at Carlotta

Imperial, Calif.—We are officially advised that, because of an error in advertising, the contract awarded to H. H. Peterson, for paving two miles of streets was annulled and new bids will be received until Mar. 10. The estimated cost is about $100,000. J. B. Funk is City Engr. Lelia Foster is City Clk. Noted Feb. 27.

Los Angeles, Calif.—Bids will be received until 2 p.m., Mar. 10, by the Board of Supervisors for improving approximately 9200 lin.ft. of San Vincente Blvd. A. M. McPherron is Deputy Clk.

✚A contract has been awarded by Chas. O. Middleton to C. C. CRANDALL, for various improvements in the first 40 acres of the Bellmead tract of 160 acres at Cypress and Florence Aves.

✚A contract was awarded to O. L. STEVENS at $6764, for constructing concrete curb and pavement in the first alley west of Andrews Blvd.

✚Riverside, Calif.—THE JOHNSON-SHEA CO., Riverside, was awarded the contract at $11,497, for constructing 1¾ miles of macadam road on the Hemet-Pleasant Valley Road. Noted Feb. 13.

✚San Diego, Calif.—FORD & STOUT, Bradbury Bld., Los Angeles, were awarded the contract at $21,734, for improving G St., from Seventh to 16th Sts.

✚Contracts have been awarded to the JESSE KNIGHT CO., at $16,255 and $35,275, respectively, for the improvement of Texas St. and El Cajon Ave.

Bids will be received until 10 a.m., Mar. 10, by the City Clerk, for improving portions of Sixth and A Sts. The work includes grading, concrete curbs and sidewalks, and a 6-in. vitrified-pipe sewer. Allen H. Wright is City Clk.

✚Venice, Calif.—We are officially advised that the Board of Trustees has awarded a contract to BRAUN, BRYANT & AUSTIN, Venice, for improving portions of Fourth, Westminster and Electric Aves. and Washington Blvd. The Barber Asphalt Co. was the other bidder. C. W. Crawford is City Engr. C. S. Thatcher is City Clk. Noted Feb. 14

INDUSTRIAL WORKS

Attleboro, Mass.—The D. E. Makepeace Co. contemplates the construction of a three-story brick factory at Attleboro. O. H. Higgins, Briggs Bldg., is Arch.

✚Boston, Mass.—The Gray & Davis Co., manufacturer of automobile lamps and self-starters, have awarded a contract to the ABERTHAW CONSTRUCTION CO., Boston, for a five-story reinforced-concrete building to be built in the Parkway, near the Cottage Farm Bridge, on the Cambridge side of the Charles River. The building will be fireproof throughout

✚Canton, Mass.—The contract for the factory additions to the Plymouth Rubber Co., on Revere St., has been awarded to A. F. WORDBECK, 63 Meredith St., Brockton. The building will be of brick, one story, 50x130 ft., and 30x60 ft. W. F. Barlow, 80 North Main St., Brockton, is Arch.

Lowell, Mass.—The Saco-Lowell Machine Co. has had plans drawn for a one-story foundry, 50x220 ft., and a cupola building, one story, 47x73 ft. Total cost, $50,000. The Hooper Faulkner Engineering Co., 165 Broadway, New York, has charge of the engineering work.

Medford, Mass.—Oliver Whyte, Treas. of the Oliver Whyte Co., Inc., of Cornhill, has bought a site at Hancock St. and Mystic Ave., Medford, and will erect a four-story brick factory, 100x100 ft., for the manufacture of ornamental bronze, brass and steel work.

Providence, R. I.—Bids are asked for a jewelry factory for Silverman Bros. to be built at Broad St. and Lexington Ave. The building will be 60x164 ft., three stories, of brick. Dwight Leading, 12 East Ave., Pawtucket, is Arch.

✚Branford, Conn.—We are officially advised that the contract for the foundation of the new annealing building of the Malleable Iron Fittings Co., has been awarded to the Mac-ARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York. Philip Sellers, New Haven, is Arch.

✚Bridgeport, Conn.—A contract has been awarded to the H. WALES LINES CO., Meriden, Conn., for building an addition to the plant of the Crane Valve Co., on South St. The building will be of brick and steel, 97x332 ft., two stories, and is estimated to cost $175,000. The plans were drawn by Hooper & Faulkner, 165 Broadway, New York.

✚New Britain, Conn.—The P. & F. Corbin Co. has awarded the following contracts for an addition to its factory: General contract, to the B. H. HIBBARD CO., New Britain; steel contract, to the AMERICAN BRIDGE CO., New York. The building will be three stories of brick and steel, 225x60 ft.

Albany, N. Y.—Bids are being received by Fuller & Robinson, Archs., 95 State St., for the construction of a four-story factory, 150x60 ft., for the Municipal Gas Co. The estimated cost is $[illegible]. Anthony H. Grady is Pres.

The Consolidated Car Heater Co. is having plans prepared for the construction of a five-story factory, on Broadway.

Buffalo, N. Y.—The Hewitt Rubber Co. is having plans prepared for the construction of additions to its plant on Lenox ton Ave. A factory 150x100 ft. and a power plant of 400 hp. capacity, will be erected.

The American Fire Proofing Cement Co. has been incorporated in Buffalo and will build and equip a plant at Broadway and the West Shore R.R., for the manufacture of fireproofing cement. H. T. Dixon is an incorporator.

The E. & B. Holmes Machinery Co., Chicago St., is having plans prepared by Lansing & Bly, Archs., Prudential Bldg., for a two-story machine shop, 116x45 ft.

Gates, N. Y.—Bids are being received by Yawman & Erbe, manufacturers of office furniture, for the construction of a new addition to its plant. The structure will be three stories high, 360x84 ft., with a wing, 250x84 ft. It will be of reinforced concrete and is estimated to cost $200,000. George C. Wright, Rochester, is the Arch.

Newburgh, N. Y.—W. W. Hawks, 120 Water St., has had plans prepared by E. E. Esabrook, Arch., 72 Second St., for a two-story addition, 125x75 ft., to his paper plant.

Bids are being received by the Albergen Pump & Condenser Co. for the construction of a two-story addition to the plant, 165x53 ft.

New York, N. Y.—Bids will be received until 11 a.m., Mar. 11, by the Department of Correction, 148 East 20th St., for the construction of repairs to the ice-making plant on Hart's Island. Patrick A. Whitney is Comr.

Rochester, N. Y.—The George J. Michelson Furniture Co. has had plans prepared by James R. Tyler, Arch., German Insurance Bldg., and bids are being received by him, for the construction of a three-story plant, 150x117 ft. A power house, one story high, 58x70 ft., will also be erected. The estimated cost is $100,000.

Plans are being prepared by Novis Brothers, Arch., Orleans St., for the construction of a two-story addition, 90x50 ft., to be made to the plant of the Sherwood Shoe Co., 263 South Goodman St.

✚Syracuse, N. Y.—Plans for the steel plant to be erected by the Syracuse Crucible Steel Co. of America, have been completed by the Ch. Engr. of the company, Joseph Brennan, Oliver Bldg., Pittsburgh, Penn., and bids for the construction of it will be received at the Syracuse office of the company, about Mar. 31. The contract for the structural steel has been awarded to the McCLINTIC-MARSHALL CONSTRUCTION CO., Oliver Bldg., Pittsburgh, Penn. The plant will be comprised of a melting house, 65x700 ft., one story high; a rolling mill to cover about 2½ acres; hammer shops; machine shop; a wire mill; a boiler house; a transformer station; a laboratory carpenter shop; a warehouse and an office building. The estimated cost of the entire plant is $1,000,000.

Yonkers, N. Y.—The Alexander Smith & Sons Carpet Co. has had plans completed for the construction of a one-story addition, 200x50 ft., to its plant on Palisade Ave.

✚Camden, N. J.—The Victor Talking Machine Co. has awarded a contract to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia, Penn., for the construction of a six-story machine shop, 170x86 ft., on Front St. Ballinger & Perrott, 1211 Arch St., are the Archs.

Perth Amboy, N. J.—The Roessler & Hasslacher Chemical Co. is having plans prepared for an addition to its plant. A new gold and silver refining structure will be erected on Front St.

✚Philadelphia, Penn.—The Richmond Radiator Co., 1480 Broadway, New York, N. Y., has awarded a contract to HENRY H. WEYMEYER, Philadelphia, at $50,000, for the construction of a two-story factory, 350x100 ft. George W. Graves, Rowland Bldg., Detroit, Mich., is the Arch. Noted Jan. 23.

Pittsburgh, Penn.—The Pittsburgh Steel Co., Frick Bldg., has announced the purchase of 74 acres of land on the banks of the Monongahela River opposite California, Penn. Upon this tract will be erected a new steel plant. The estimated cost is $3,000,000.

Baltimore, Md.—Plans are being prepared by Theodore W. Pietsch, Arch., American Bldg., for the construction of a new factory and power plant for the Tin Decorating Co., Charles and Barre Sts. The factory will be four stories high, 350x275 ft., and the power house, 110x60 ft.

Florence, S. C.—The Atlantic Coast Line R.R. plans additions to its roundhouse and shops. The roundhouse will accommodate 40 locomotives and a 90-ft. electrically operated turntable will be installed. E. B. Pleasants, Wilmington, N. C., is Chief Engr.

Birmingham, Ala.—The Southern Pipe & Foundry Co., whose plant was recently destroyed by fire at a loss of $90,000, will at once rebuild, though definite plans have not yet been anounced. S. F. King is Pres., F. W. Tull is Secy. and Treas.

Chattanooga, Tenn.—The Manufacturers Association of Chattanooga is interested in the establishment of a factory to manufacture the Ausman motor truck. It is said that the plant will represent an investment of about $100,000.

Lexington, Ky.—The Louisville & Nashville R.R. Co. has purchased a site of about 15 acres at Lexington, upon which it will erect shops and roundhouses, costing approximately $500,000.

Louisville, Ky.—The C. C. Mengel & Bro. Co., Fourth and H Sts., has increased its capital stock from $[illegible] to $500,000, and will erect a larger sawmill. Additions to the veneer mill are also under consideration.

Newport, Ky.—Press reports state that a new steel plant will be established in Newport near the plant of the Andrews Steel Co. It is stated that the plant will cover about five acres, and have a daily capacity of 250 tons of high-grade steel.

Cincinnati, Ohio—The John Hoffman Packing Co., Cincinnati, Ohio, will erect a three-story addition to its factory, 25x60 ft.

The J. K. Nickerson Co., Cincinnati, will erect a factory for the manufacture of metal lockers and fireproof doors.

Canal Dover, Ohio—The Dover Steel Co. has made application for a charter under the laws of Ohio, with a capital stock of $1,200,000, the incorporators being Albert P. Meyer, W. L. M. Parkin, E. M. S. Young, Archibald Smith and H. C. Meyer, Pittsburgh, Penn. The company will erect at Canal Dover, an openhearth steel plant with two 75-ton furnaces, a three-high bar mill, six hot mills and other necessary equipment for the manufacture of high-grade hot- and cold-rolled sheets. It will have an initial capacity of 400 tons of openhearth steel a day. Noted Feb. 20.

Cleveland, Ohio—The J. Spang Baking Co., Cleveland, is having plans prepared for the construction of a two-story bakery, 70x104 ft.

Cleveland, Ohio—The American Steel & Wire Co. will enlarge its cold-roll and flat-wire department at the Cuyahoga plant, Cleveland. The sum of $600,000 will be expended for new equipment.

Elyria, Ohio—The Superior Metal Product Co. Ft. [illegible] will erect a factory. It will be one story, 100x200 ft.

Lakewood, Ohio—The Cleveland Machine Knife Co., 946 West Ave., Cleveland, Ohio, has completed plans for a new machine shop and forging plant, to be erected at Fry Ave. and the New York, Chicago & St. Louis Ry., Lakewood, Ohio. The firm will engage in the manufacture of a larger line of than it now produces.

Toledo, Ohio—The Willys-Overland Co., Toledo, is planning to erect a foundry, 100x250 ft., on the site of the Spear brick yard, Toledo. Estimated cost, $35,000.

Fort Wayne, Ind.—Sherman, White & Co., Fort Wayne, are having plans prepared for the erection of a cold-storage plant. Estimated cost, $100,000.

Gary, Ind.—The United States Steel Corporation, Pittsburgh, Penn., is planning to erect four additional blast furnaces at its plant at Gary.

Lansing, Mich.—The [illegible] Drop Forge Co., Lansing, will erect a new plant to double its present output.

Bloomington, Ill.—The Hoberling Medicine & Extract Co. has purchased a site at Center and Mill Sts., and intends to erect a four-story factory, of steel and concrete construction.

Milwaukee, Wis.—A three-story factory with stone foundation, 30x80 ft., of reinforced-concrete construction, is being planned by Fernekes & Cramer, Archs., for Percy C. Avery, Pres. Avery Portable Lighting Co. Estimated cost, $10,000.

The Harsh & Edmunds Shoe Co., Maple and Hanover Sts., Milwaukee, will erect a brick addition to its factory, 50x140 ft. Estimated cost, $100,000.

Charles J. Dixon, Milwaukee, is considering the erection of a five-story light manufacturing building, 11x125 ft., at Milwaukee and Erie Sts. Estimated cost, $35,000.

The Feilbach Motor Co., 1144 Holton St., Milwaukee, has acquired a 5½-acre site on Keefe Ave., between Booth and North Pierce Sts., upon which to erect a large factory.

La Crosse, Wis.—The La Crosse Industrial Association, La Crosse, will erect a factory for the National Gage & Register Co.

Racine, Wis.—The Racine Stool Co., Racine, will erect a four-story, 71x115-ft. addition to its plant. It will be of brick and fireproof. A sprinkler system will be installed. Estimated cost, $26,000.

Hanley Bros., commission merchants, North Erie St., La Crosse, are having plans prepared for the construction of a refrigerator plant. Estimated cost, $10,000.

Minneapolis, Minn.—The Emerson-Brantingham Co., Minneapolis, makers of gas traction engines, plans to erect an addition to its plant, to cost approximately $20,000.

Joplin, Mo.—The Bentonville Cooperage Co. has purchased a site at Joplin, and will erect a new plant.

St. Louis, Mo.—The Fred Medart Mfg. Co., St. Louis, plans to build an addition to its plant for the manufacture of metal lockers and gymnasium supplies.

St. Louis, Mo.—The Williams Crusher & Pulverizer Co. has purchased a site and will enlarge its plant.

The National Camera Co., St. Louis, recently incorporated with a capital of $20,000, will equip a plant for the manufacture of cameras and supplies. C. J. Shea and C. H. Dudley are interested.

The St. Louis Independent Packing Co., St. Louis, plans to erect a cold-storage plant on Chouteau St., to cost approximately $150,000.

The Valier & Spies Milling Co., St. Louis, has taken out a permit to erect a seven-story factory at Marcus Ave., and the North End Terminal Belt Line. The estimated cost is $40,000.

Wellston, Mo.—The Curtis & Co. Mfg. Co., Wellston, has had plans prepared for the construction of additions to its foundry and machine shop.

Fort Worth, Tex.—The Cement Stave Silo Co., Des Moines, Iowa, has acquired a site in the stock yards district, Fort Worth, and will erect a silo factory.

Galveston, Tex.—The Edwards Henry Co., is negotiating for the purchase of a site for its proposed cotton ginning plant and reinforced concrete cotton sheds, which are to be erected at a cost of $100,000. T. A. Edwards, Dallas, Tex., is the Pres. and J. R. Henry is Vice-Pres.

Mineola, Tex.—John Butcher, Vassar, Mich., plans to rebuild his box factory at Mineola, which was recently destroyed by fire. The estimated cost of the new structure is $60,000.

Yale, Okla.—The Waters-Pierce Oil Co., St. Louis, Mo., has purchased a site at Yale, and will construct a large refinery.

Pocatello, Idaho—A. E. Cooper, Pleasant Grove, Utah, is planning the erection of a flour-milling plant at Pocatello. A grain elevator may also be built.

Bellingham, Wash.—The Colonial Sash & Door Co., Ltd., Vancouver, B. C., has purchased the plant of the Bay City Sash & Door Co., Bellingham, and will make extensive improvements. New equipment will be installed.

Dayton, Wash.—Stockholders of the Whetstone-Turner Warehouse Co., of Dayton, have subscribed $30,000 for the erection of grain elevators at Dayton, Turner, Whetstone, and Newbill Siding, Wash. The elevators will have a daily capacity of 500,000 bushels.

Portland, Ore.—The Portland Sheet Metal Works, East Madison St., Portland, will erect a new factory and workshop on Holgate St., to cost approximately $10,000.

Portland, Ore.—The Pacific Bar Fixture Co., Portland, will build a two-story factory, 100x200 ft.

Prairie City, Ore.—It is understood that the flour-milling plant of the Prairie Light & Power Co., Prairie City, which was recently destroyed by fire, causing a loss of about $20,000, will be rebuilt. F. W. Peet, V. C. Belknap and A. C. Beese are the owners.

Alameda, Calif.—The California Bestwall Co., makers of patent wall boards, will build several additions to its plant and will install considerable new equipment.

✚Berkeley, Calif.—The American Photo Player Co. has awarded the contract for the construction of a two-story factory on Bonair St., to BERG PEARSON, 2163 Grant St.

at $17,230. Coates & Fraver, Head Bldg., San Francisco are the Archs.

Dinuba, Calif.—The Pioneer **Fruit Co.** will build a packing plant at Dinuba, and will also **construct** additions and make other improvements to its plants at **Melvin** and Las Palmas.

Fresno, Calif.—The American Vineyard will erect a large packing house on a site covering six lots, on Ventura Ave.

Orange, Calif.—The Orange County Vegetable Growers' Association will erect a cannery at Orange, for **utilizing** vegetables not available for shipment.

Richmond, Calif.—The St. Johns Woolen **Mills Co.**, Portland, Ore., has purchased a site at Richmond, and will build a plant, to cost approximately $85,000. L. Carter and H. Butler, Portland, are interested.

Richmond, Calif.—The Los Angeles Pressed **Brick Co.**, Los Angeles, plans to make improvements and construct **additions** to its plant, to cost approximately $30,000.

Wilmington, Calif.—The Los Angeles Smoked **Fish Co.**, 1338 East Sixth St., Los Angeles, will erect a one-story brick building on Main St., Wilmington. It will be equipped with machinery for the curing and packing of fish, and will include a 200-ton cold-storage **plant**.

✦Hamilton, Ont.—The **Steel Co.** of Canada has awarded a contract to the HAMILTON BRIDGE WORKS, at about $25,000 for the erection of a boiler house, blacksmith shop and locomotive crane shelter.

London, Ont.—The National Brass Co., Ltd., has been incorporated with $50,000 capital stock and will erect a plant for the manufacture of brass goods and **plumbers' supplies**. Jno. E. Grant and Chas. H. Frey are Dir.

London, Ont.—The Richard-Wilcox-Canadian **Co., Ltd.**, has been organized with $70,000 capital stock. A plant will be erected and equipped for the manufacture of builders' hardware and allied products. Wm. R. Vendall, Wm. A. Fitch and Lee E. Mighell are directors.

Sudbury, Ont.—The Dominion Nickel & Copper Co., **Sault** St. Marie, Ont. plans to erect nickel smelters near **Sudbury**, producing at Pump Lake. The estimated cost is $5,000,000. Surveys have already been begun, and it is hoped to have the plant in operation within a year. The company will construct a railway from its property to the Algoma Eastern Ry.

Sudbury, Ont.—J. B. Laberger & Son will erect a planing mill, door and sash factory.

Toronto, Ont.—The Reynolds Products Co., Ltd., has been organized with a capital of $40,000, and will build and equip a plant to manufacture steam and electric appliances and special machinery. Gideon Grant, David F. Grant, and Bruce Williams are provisional directors.

The Masterton Wrench Co. has been incorporated with $45,000 capital stock, and will establish a plant to manufacture hardware and metal goods. Robert McKay, Gibson Grant and George A. Urquhart are provisional directors.

Welland, Ont.—The Empire Cotton Mills, Ltd., will erect an additional mill for the manufacture of automobile tire duck exclusively; $400,000 worth of new stock has been issued to cover the cost of the new mill.

✦Welland, Ont.—The Canada Forge, Ltd., has awarded a contract to the STANDARD STEEL CONSTRUCTON CO., for the erection of a new forge plant to replace the one recently burned. A crane runway of 50 ft. span will be installed with one 20-ton and two five-ton electric cranes. The equipment will also include steam hammers, hydraulic forging presses, annealaing and heat-treating furnaces.

Winnipeg, Man.—The Hughes Electric Heating Co., Chicago, Ill., has leased quarters in the Brown Power Bldg., and will at once equip a plant to manufacture electric stoves, ranges and heaters. George A. Hughes is Pres.

FEDERAL GOVERNMENT WORK

Post Office—Biddeford, Maine.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Biddeford to CONNERS BROS. CO., Lowell, Mass., at $68,967.

✦Rock Excavation—Boston, Mass.—Bids were received as follows by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston, for rock excavation in Boston Harbor: Gilbert H. Harries, Boston, $29.35; Johnston & Virden, Lewes, Del., $28.90; EASTERN DREDGING CO., Boston, $28.37 (awarded contract).

✦Post Office—Bristol, Penn.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Bristol, Penn.: (a) Limestone; (b) sandstone: Interurban General Construction Co., New York, (a) $64,683; (b) $65,583; Guernsey O'Meara Co., Philadelphia, (a) $65,297; (b) $68,297; Daniel T. McCarthy, Philadelphia, (a) $62,500; (b) $64,500; West Chester Engineering Co., New York, (a) $74,760; (b) $77,310; Edward Eyre & Son, Philadelphia, (a) $66,655; (b) $69,655; Matthew Construction Co., Princeton N. J., (a) $60,-000; Frey & Hertz & Co., Philadelphia, (a) $67,732, (b) $70,732; Wells Construction Co., Philadelphia, (a) $68,100; (b) $70,100; Henry L. Brown, Philadelphia, (a) $61,543, (b) $64,543; Lewis Iszard, Trenton, N. J., (a) $75,000; (b) $79,000; E. W. Van Loon, Philadelphia, (a) $62,587, (b) $66,850; Wells Construction Co., Philadelphia, (a) $61,771; (b) $63,000.

Dredging—Washington, D. C.—Bids were received as follows, Feb. 14, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Willmington, N. C., for dredging approximately 15,500,000 cu.yd. in Approach and Basin to Wilmington Harbor: Dredging Co., Philadelphia, Penn., 41.2c. per cu.yd.; Great Lakes Dredge & Dock Co., Philadelphia, 43c.; The Rickards Dredging Co., Philadelphia, 50c.

✦Metal Vault Equipment—Washington, D. C.—Bids will be received until 3 p.m., Apr. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for metal vault equipment for the new building for the Bureau of Engraving and Printing, Washington, D. C. Drawings and specifications may be obtained at the discretion of the Supervising Architect.

✦Battleship—Washington, D. C.—The Navy Department has awarded the contract to the NEWPORT NEWS SHIPBUILDING & DRYDOCK CO., Newport News, Va., for the construction of Battleship No. 38, the "Pennsylvania," at $7,260,000. List of bidders noted Feb. 27.

Buildings, Etc.—Washington, D. C.—Bids will be received until 2 p.m., Mar. 24, by the Department of the Interior, Washington, D. C., for furnishing materials and labor for the erection of seven frame cottages, frame warehouse, frame office, frame pump house and concrete guardhouse and the installation of a water and sewer system at the Cœur d'Alene Indian Agency, Idaho. All bids must be addressed to the Commissioner of Indian Affairs, Washington, D. C.

Resurfacing—Washington, D. C.—Bids will be received until 2 p.m., Mar. 14, by the Department of Agriculture, Washington, for resurfacing with macadam that section of the Rockville Pike extending from the boundary line of the District of Columbia at Station 0-15 to Station 61-20 at Bradley Lane, and such other work specified.

Heating and Ventilating—Washington, D. C.—Bids were received as follows, Feb. 21, by the Commissioners of the District of Columbia, for the heating and ventilating system for the Normal School Building 169, on Georgia Ave., between Howard Place and Fairmont St., West: Standard Engineering Co., Washington, $22,850; Biggs Heating Co., Washington, $24,887; $24,187 and $24,087; W. J. Cornell Co., Washington, $24,719; Walters, Parks & Mellon, Philadelphia, Penn., $33,000; York Engineering Co., York, Penn., $22,011.

★Vaults—Washington, D. C.—Bids will be received until 3 p.m., Apr. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for the construction complete including the electrical protection, conduit and wiring, lighting fixtures, plumbing, heating, and ventilating equipment) of vaults, except vault doors, for the new building for the Bureau of Engraving and Printing at Washington, D. C. The work contemplated is the construction of four interior vaults, of reinforced concrete, having an aggregate floor area of about 7350 sq.ft., and one exterior vault of reinforced concrete, with a floor area of about 4950 sq.ft. area, fireproof construction, stone faced, tile roof. Drawings and specifications may be obtained at Washington at the discretion of the Supervising Architect.

Post Office—Covington, Va.—Bids will be received until 3 p.m., Apr. 29, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Covington.

Generator Set—Norfolk, Va.—Bids will be received until 11 a.m., Mar. 22, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a three-wire, direct-current, engine-driven, 125-kw. generator set at the U. S. Naval Hospital, Norfolk. Amount available, $5200.

Electric Elevator—Charleston, W. Va.—Bids will be received until 3 p.m., Mar. 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation complete of an electric passenger elevator in connection with the extension, U. S. post-office and court house at Charleston, in accordance with the drawing and specification, copies of which may be had at the discretion of the Supervising Architect.

✦Post Office—Morgantown, W. Va.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Morgantown, W. Va., to JOHN G. UNKEFER & CO., Minerva, Ohio, at $92,893. Noted Oct. 31.

Post Office—Oxford, N. C.—Bids will be received until 3 p.m., Apr. 26, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the post office at Oxford.

Dredging—Charleston, S. C.—The following bid was received, Feb. 26, by Maj. G. P. Howell, Corps Engrs., U. S. A., Charleston, for dredging Sampit Bar and River, Winyah Bay, S. C.: P. Sanford Ross, Inc., Jersey City, N. J., 18.8c. per cu.yd. for 220,810 cu.yd. Total, $41,512.

★Wire, Etc.—Memphis, Tenn.—Bids will be received until noon, Mar. 24, by the Mississippi River Commission, First and Second Districts, at the office of Maj. E. M. Markham, Corps Engrs., U. S. A., Custom House, Memphis, for furnishing and delivering about 613,200 lb. galvanized wire, silicon bronze wire, wire strand, and staples, about 24,000 wire rope clips, and about 67,500 lb. manila rope.

★Canal Work—Louisville, Ky.—Bids will be received until 11 a.m., Mar. 26, by Maj. J. C. Oakes, Corp Engrs., U. S. A., Louisville, for widening the Louisville and Portland Canal at Louisville.

✦Post Office—Bellefontaine, Ohio—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Bellefontaine to JOHN UNKEFER & CO., at $65,500

✦Lighting Equipment—Detroit, Mich.—The contract has been awarded to the SAFETY CAR HEATING & LIGHTING CO., for lighting equipment for 43 lights in St. Mary's River, Mich., 11th Lighthouse District.

Post Office—Petoskey, Mich.—Bids will be received until 3 p.m., May 1, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at Petoskey.

Post Office—Harrisburg, Ill.—Bids will be received until 3 p.m., Apr. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Harrisburg.

Building—Milwaukee, Wis.—Bids will be received until 3 p.m., Apr. 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. appraisers' stores at Milwaukee.

Post Office—Le Mars, Iowa.—Bids will be received until 1 p.m., Apr. 22, by Oscar Wenderoth, Supervising Architect, Treasury Dept., Washington, D. C., for the construction complete including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Le Mars.

Post Office—Douglas, Wyo.—Bids will be received until 2 p.m., Apr. 12, by Oscar Wenderoth, Supervising Architect, Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Douglas.

Revetment—Kansas City, Mo.—Bids were received as follows, Feb. 17, by Maj. Herbert Deakyne, Corps Engrs., U. S. A., Kansas City, for constructing 12,000 ft. of standard revetment at Pinckney Bend, and 12,000 ft. at St. Aubert Bend: Pinckneys Bend: Fox & Bristol, St. Louis, Mo., \$9.30 per lin.ft.; Rust & Swift, St. Louis, \$10.15; Dewitt & Shobe, Glasgow, Mo., \$9.90; J. W. McMurray Contracting Co., Kansas City, \$9.90; McGuire, Stanton & Jones, Leavenworth, Kan., \$8.74. St. Aubert Bend: Fox & Bristol, St. Louis, \$9.30 per lin.ft.; Rust & Swift, St. Louis, \$9.79; Farney, Morsman Construction Co., Kansas City, \$11.15; J. W. McMurray Contracting Co., Kansas City, \$10.90; McGuire, Stanton & Jones, Leavenworth, Kan., \$9.47.

Grading—Bremerton, Wash.—Bids were received as follows, Feb. 8, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for grading at the navy yard, Puget Sound, Bremerton: (a) Work complete, per plans and specifications; (b) per cu.yd. for material excavated from the through bank on the east or the northeast corner of the grounds and deposited on the westerly line of the fill: Andrew Peterson, 324 Pioneer Bldg., Seattle, Wash., (a) \$7000; (b) 27c. cu.yd.; S. E. Baisden, 6528 Woodlawn Ave., Seattle, (a) \$7280; (b) 27.5c.; Eckerson Construction Co., 25 Downs Bldg., Seattle, (a) \$8500. F. McDonald, Charleston, Wash., (a) 27c.; Agassiz & Hadley, 1712 First Ave., South Seattle, Wash., (a) \$5980; (b) 23c.; Rufus Buck, 821 17th St., Seattle, (a) \$8490; (b) 40c.; Sloane Bros., 1717 Belmont Ave., Seattle, (a) \$7280; (b) 28c.

Cranes—Bremerton, Wash.—Bids will be received until 11 a.m., Apr. 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for delivering and erecting locomotive cranes, with grab-bucket equipments, at the Puget Sound Navy Yard, Bremerton.

Buildings—Bremerton, Wash.—Bids were received as follows, Feb. 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for contagious group buildings at the naval hospital reservation, Puget Sound, Wash.: Item (1) work complete; (2) price for installation of wire fence; (3) work complete, omitting Ward A: George Eckman, Seattle, Wash., (1) \$13,998; (2) \$600; (3) \$10,358; Finne & Gjarde, Seattle, Wash., (1) \$14,771; (2) \$811; (3) \$10,765; J. L. Murphy & Son, Tacoma, Wash., (1) \$15,432.55; (2) \$225; (3) \$11,347; Erikson & Dahl, Seattle, Wash., (1) \$17,474.68; (2) \$1300; (3) \$12,643; Carl M. Stebinger, Portland, Ore., (1) \$16,714; (2) \$342. (3) \$12,373.

Pier—Bremerton, Wash.—Bids will be received until 11 a.m., Mar. 29, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for Pier No. 4, Puget Sound Navy Yard, Bremerton. Amount available, \$175,000.

Building—Seattle, Wash.—Bids will be received until 11 a.m., Mar. 18, by Maj. J. B. Cavanaugh, Corps Engrs., U. S. A., Seattle, for constructing a lock-keeper's house at the lock-site, Lake Washington Canal, Seattle.

Dynamite, Etc.—Panama—Bids were received as follows, Feb. 26, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing 27,000 cross-ties, 7x9 in. x 8½ ft.: American Tie & Timber Co., New York, \$1.02⅞ each; Balfour-Guthrie Trust Co., Portland, Ore., \$1.11¾; William P. Cook & Co., 100 Wall St., New York, 95.9c.; G. Elias & Bro., Buffalo, N. Y., \$1.25; Gress Mfg. Co., 18 Broadway, New York, \$1.06½; J. K. Joice, 22 East Jackson Boulevard, Chicago, Ill., \$1.06; Robinson Lumber Co., New Orleans, La., \$1.05; Rainwater Lumber Co., New Orleans, La., \$1.047; W. R. Grace & Co., San Francisco, Calif. (fir, delivery, Balboa), \$1.17; Templeman Bros., New Orleans, \$1.15. All bids on cypress or long-leaf yellow pine, delivery at Colon, unless otherwise specified.

+Steel Work—Panama—The Isthmian Canal Commission has awarded the contract to the BELMONT IRON WORKS, Philadelphia, Penn., for furnishing the steel work for shed, Pier No. 17, Cristobal Docks, Panama, at \$76,368.

Cranes—Hawaii—Bids will be received until 11 a.m., Apr. 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for eleven 15-ton locomotive cranes with grab-bucket equipments, delivered and erected at Pearl Harbor Naval Station, H. T.

Buildings—Cuba—Bids will be received until 11 a.m., Apr. 5, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing buildings for the proposed radio station at the naval station, Guantanamo, Cuba.

MISCELLANEOUS

Filling—Boston, Mass.—The Directors of the Port of Boston have decided to fill 50 acres of flats in East Boston at the foot of Maverick St., preparatory to the dock development in East Boston. F. W. Hodgdon, 40 Central St., is Ch. Engr.

+Towboat—Boston, Mass.—The PORTLAND CO., Portland, Maine, has been awarded the contract by the Commercial Towboat Co., Boston, for the construction of a towboat to cost, equipped, \$95,000.

★Dredging—New London, Conn.—Bids will be received until 2 p.m., Mar. 27, by Maj. G. E. Pillsbury, Corps Engrs., U. S. A., New London, for dredging in Mystic River, Conn.

Wall—Amsterdam, N. Y.—Bids will be received until noon, Mar. 6, by the State Armory Commission, Albany, N. Y., for constructing a concrete retaining wall and waterproofing the rear wall, State Armory, Amsterdam. F. W. Ward is Sec.

+Ditch—Ackport, N. Y.—The contract has been awarded to the ATLANTA CONSTRUCTION CO., Atlanta, N. Y., for the construction of a four-mile ditch 17 ft. wide through the muck lands of Ackport and Elba.

Dredging—Bridgeville, N. Y.—Work to be done at Bridgeville on the power project of the New York & New Jersey Power Corporation will include eight miles of dredging. Parsons & Clapp, 60 Wall St., New York, are Engrs.

+Grade Crossing Elimination—Buffalo, N. Y.—The city has awarded the contracts to the JOHN JOHNSON CONSTRUCTION CO., 741 Abbott Road, Buffalo, for the construction of subway work, concrete and steel, under the tracks of the Erie R.R., at Main St., to eliminate grade crossing, at \$60,544; and for a subway of similar character under the tracks of the Erie R.R. and the Delaware, Lackawanna & Western R.R. at Delaware Ave., at \$39,579.

Lumber—New York, N. Y.—Bids will be received until Mar. 13, by Arthur J. O'Keeffe, Comr of Bridges, for furnishing and delivering yellow pine lumber to the Brooklyn Bridge.

Comfort Station—New York, N. Y.—Bids will be received until 3 p.m., Mar. 13, by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan, for all labor and materials, excepting plumbing and gas fitting, heating and ventilating, required for the erection and completion of a comfort station and playground building at 151st St., near Amsterdam Ave.

Road Oil, Etc.—New York, N. Y.—Bids will be received by Cyrus C. Miller, Pres. Boro. The Bronx, until 10:30 a.m., Mar. 14, for 150,000 gal. tar road oil; 200,000 gal. asphalt road oil; 4000 cu.yd. of grits to the Bureau of Highways, and broken trap rock and screenings.

Seawall, Etc.—New York, N. Y.—Bids will be received until 11 a.m., Mar. 14, by Maurice E. Connolly, Pres. Boro. Queens, Long Island City (L. I.), N. Y., for the construction of a concrete seawall, together with all work incidental thereto, to replace the present wall on the Willetts Point Road, beginning at a point 650 ft. west of Bell Ave. and extending to a point 2050 ft. westerly therefrom, Third Ward; for furnishing and delivering 5000 cu.yd. of sand in the Borough of Queens; for furnishing and delivering to the Bureau of Highways 140,000 cu.yd. of broken stone and screenings of trap rock in the Borough of Queens; for furnishing and delivering to the Bureau of Highways 170,000 wood paving blocks in the Second, Third and Fourth Wards, Borough of Queens; for furnishing and delivering bituminous road surfacing material (tar or asphalt) in the Borough of Queens; for furnishing and spreading light road oil and sand or refined tar and sand in the Second, Third, Fourth and Fifth Wards of the Borough of Queens; for constructing a concrete retaining wall on the Shore Road, between Hoyt Ave. and Woolsey Ave., First Ward.

+Canal Terminal—Plattsburgh, N. Y.—The contract has been awarded to D. L. TAYLOR & CO., Utica, N. Y., by Duncan W. Peck, State Supt. Pub. Wks., Albany, for the construction of the Barge Canal terminal at Plattsburgh, at \$126,834. List of bidders noted Feb. 27.

Stable—Ridgewood (L. I.), N. Y.—The Bureau of Street Cleaning of the Borough of Queens has filed plans for the erection of a two-story brick stable, 107x53.8 ft., on Flushing Ave., near Metropolitan Ave., Ridgewood. Estimated cost, \$48,000. Daniel Ehnthalt is Supt. St. Cleaning, Boro. Hall, Long Island City (L. I.), New York.

★Jetties—Trenton, N. J.—Bids were received Feb. 27 and rejected by the state for reinforced-concrete jetties at Shark Inlet, Shark River Inlet Improvement. The bids follow: H. Gardner, \$82,237; Young & Hyde, Inc., \$77,616. New bids will be received but no date is as yet set. H. B. Kummel is State Geologist.

+Bulkhead—Philadelphia, Penn.—The contract has been awarded to the FRANKLIN CONSTRUCTION CO., for the construction of a bulkhead at the foot of Locust St., on the east side of the Schuylkill River.

Bulkhead and Wharf—Philadelphia, Penn.—The Department of Wharves, Docks and Ferries, Feb. 17, granted a permit to M. Ehret, Jr., & Son, Philadelphia, to extend the wharf on their property and reconstruct the bulkhead. Estimated cost, \$15,000.

Pier Improvements—Philadelphia, Penn.—Bids were received as follows, Feb. 25, by the Department of Wharves, Docks and Ferries, for making improvements to the Chestnut St. Pier: Ernest Turtz, \$16,697; A. Monday, \$17,913; W. S. P. Shields, \$25,556.

+Shelter Houses—Pittsburgh, Penn.—The city has awarded contracts for the construction of shelter houses as follows: In Olympia Park, to J. C. WILSON, Pittsburgh, at \$11,979; West End Park, to same contractor, at \$12,775; Riverview Park, to F. F. SCHELAENBERG & CO., at \$11,284; McKinley Park, to CUTHBERT BROS. CO., at \$13,095.

Comfort Station—Wilkes Barre, Penn.—The city will have plans prepared for the construction of a comfort station, to cost \$20,000.

Dredging—Wilmington, Del.—Bids were received as follows by Maj. R. R. Raymond, Corp Engrs., U. S. A., Wilmington, for dredging Alloway Creek: Atlantic Dredging Co., Philadelphia, Penn., 15.4c. per cu.yd.; River & Harbor Improvement Co., Philadelphia, 17.5c.; Rickards Dredging Co., 17.5c.

Piers—Canton, Md.—The Northern Central Ry. Co. is considering the construction of two freight piers at Canton. J. H. Nichol, Williamsport, Penn., is Principal Asst. Engr.

Excavation—Norfolk, Va.—Arthur C. Freeman, Jr., Consult. Engr., Norfolk, has a contract to let for about 15,000 yd. of excavation, to be removed by dipper dredge.

Coal Piers—Charleston, S. C.—The Directors of the Carolina, Clinchfield & Ohio Ry. Co. have approved plans for the construction of modern coal piers here. The Charleston plant will be provided with storage space for 350,000 tons.

†Seawall—Bay St. Louis, Miss.—The contract for the construction of the proposed seawall has been awarded by the city to T. FAVRE and M. FRANCIS, Gulfport, Miss. The wall will be 1500 ft. long.

†Barges—Lake Charles, La.—A contract for the construction of barges to cost $100,000, has been awarded by the Teche Transportation & Fuel Co. to the CLOONEY CONSTRUCTION CO., Lake Charles.

Drainage—Union City, Tenn.—Bids were received Feb. 21, by J. A. Cable, Secy., Bd. Directors of Abion River Drainage Dist. No. 2, Union City, for 314,800 cu.yd. of levee work, 178,000 cu.yd. ditch work, clearing and grubbing six miles of levee base, and constructing two concrete sluiceways with automatic back water gates. The contract has been awarded to Philip McGuIAN, Nine Mile, Ind., at $60,000.

Elevators—Louisville, Ky.—The Realty Investment Co., Louisville, will install several elevators in the apartment house it proposes to erect at Fourth and Ormsy Sts.

Fire Station—Cincinnati, Ohio—The city has engaged Sheblessy & Stagner, Archs., to make plans for a combination firehouse and patrol stations at College Hill and Sayler Park.

Bath House—Cleveland, Ohio—Bids will be received until noon, Mar. 12, by W. T. Springborn, Dir. Pub. Ser., for constructing the superstructure for the public bath house at East 93d St. and Woodland Ave.

Park—Cleveland, Ohio—The city is having plans prepared for the construction of Kingsbury Run Park. W. J. Springborn is Dir. Pub. Ser.

Fire Station—Lorain, Ohio—The city will erect a fire station. The building will be two stories high and will cost $10,000. E. A. Ault is Dir. Pub. Safety.

Track Elevation—Piqua, Ohio—Plans for the elevation of the Chicago, Hamilton & Dayton Ry. tracks in this city have been presented to the City Council. The elevations to be made are necessary on account of similar work being done by the Pennsylvania Lines west of Pittsburgh.

Drain—Ithaca, Mich.—The contract for Drain No. 1 in Newark and Arcadia Counties will be let Mar. 20, at public outcry, at the residence of Azum Robert, near Ithaca. The drain is in two four-mile sections. E. W. Redman, Ithaca, is County Drain Comr.

†Channel Work—Chicago, Ill.—Bids will be received until noon, Mar. 27, by John McGillen, Clk. Sanitary District of Chicago, 76 West Monroe St., Chicago, for the excavation and collateral work on Contract Sect. 6 of the Calumet-Sag Channel of the Sanitary District of Chicago, in the Township of Palos, County of Cook, Ill. The approximate quantities to be used in comparison of bids are: (a) 675,000 cu.yd. of excavation of glacial drift, (b) 135,000 cu.yd. of excavation of sand rock, (c) 53,000 sq.yd. of stone pitch slopes.

Drainage Ditch—Burlington, Wis.—Contracts will probably be awarded in April for cleaning out and deepening the old Yorkville-Raymond Drainage Ditch, and constructing various lateral ditches. The work will require 112,190 cu.yd. of excavation; 500 lin.ft. of 18-in.; 1950 lin.ft. of 16-in.; 10,120 lin.ft. of 12-in., and 745 lin.ft. of 10-in. tile drains.

Road Roller, Etc.—Milwaukee, Wis.—The Department of Public Works has asked for bids for one 12-ton road roller, two concrete mixers, and seven asphalt wagons. J. P. Sherer is Deputy Comr. Pub. Wks.

†Ditches—International Falls, Wis.—Contracts for ditches have been awarded as follows by L. H. Slocum, County Audr., International Falls: For Ditches Nos. 4 and 5, to JACOB K. EHLERS, Warroad, Minn., at $30,125 and $34,720, respectively; for Ditch No. 8, to M. BELL, Rochester, Minn., at $37,000. Bids were opened Feb. 20.

Ditches—Minneapolis, Minn.—Bids will be received until 11 a.m., Mar. 17, by A. P. Erickson, County Audr., Minneapolis, for constructing Ditches Nos. 20 and 24.

Fire Station—St. Joseph, Mo.—The city is considering the erection of a central fire station. C. A. Pfeiffer is Mayor.

†Cement—Denver, Colo.—Contracts were awarded, Feb. 18, as follows, by the Reclamation Service, Denver, for portland cement: For 31,000 bbl. to the COLORADO PORTLAND CEMENT CO., Denver, 99c. per bbl. f.o.b. Portland, Colo.; [illegible] to the SOUTHWESTERN PORTLAND CEMENT CO., El Paso, Tex., at $1.40 per bbl. f.o.b. Courchesne, Tex.

Stadium—Spokane, Wash.—The city is considering the construction of a [illegible] to seat 10,000 people.

Wharf—Huntington Beach, Calif.—The Board of Trustees will receive bids until 7 p.m., Mar. 10, for the construction of the municipal wharf, to cost not more than $65,000. C. E. [illegible]

†Elevators—Los Angeles, Calif.—Austin & Powell, Archs., have awarded the contract to the LLEWELLYN IRON WORKS, Los Angeles, for installing two electric passenger and one electric freight elevators in the Knickerbocker Bldg., all 1200.

†Piles and Lumber—Los Angeles, Calif.—The contract has been awarded to the PACIFIC CREOSOTING CO. by the city for furnishing creosoted piles and lumber for use at Wilmington Inner Harbor.

Dredging—Los Angeles, Calif.—The Board of Public Works has awarded all the bids for dredging and filling a portion of Wilmington St., south of Front St. The Harbor Advisory Board recommended that the specifications be so amended that the city can perform the work itself. The Wilmington directors have conditions changed so that the [illegible] which [illegible] will [illegible] of material.

Levee Work—Palo Verde, Calif.—The Mutual Water Co. No. 2 will construct protection [illegible] about four miles of [illegible]

Wharf—San Diego, Calif.—The San Diego Consolidated Gas & Electric Co. has applied to the Legislature to construct a wharf on the tide lands at the foot of Ebbett St.

Tunnel—San Francisco, Calif.—The Public Works Commission will shortly ask bids for the construction of the Stockton St. tunnel. The estimated cost of the work is $10,267.

†Levee—Port Gibson, Miss.—HATTICH & NIMMO, Los Angeles, Calif., have been awarded the contract for the construction of a levee 1½ miles long and 6 ft. high on Buena Vista flats for the Kern Trading & Oil Co.

Subway Substructures—Toronto, Ont.—Bids will be received until noon, Mar. 26, by B. Ripley, Engr., Grade Separation, Canadian Pacific Ry., Toronto, for the construction of the substructures of subways at Davenport Road, Spadina Road, Howland Ave. and Bathurst St., North Toronto.

★Asphalt and Wagons—Toronto, Ont.—Bids will be received until noon, Mar. 11, by H. C. Hocken, Chn. Bd. of Control, for supplying refined asphalt and 12 asphalt wagons. Specifications and forms of proposal may be obtained upon application at the office of the Purchasing Section, Dept. of Works, City Hall.

BUILDINGS

†Hanover, N. H.—The contract has been awarded to the H. P. CUMMINGS CONSTRUCTION CO., Ware, Mass., for the construction of the Hitchcock Property Dormitory at Dartmouth College. Charles A. Rich is Arch., 320 Fifth Ave., New York.

†Andover, Mass.—The contract for the erection of a dormitory for Phillips Andover Academy was awarded to the HOLT-FAIRCHILD CO., 178 Devonshire St., Boston. It will be of brick and stone, three stories, 45x114 ft. Guy Lowell, 12 West St., Boston, is Arch.

Boston, Mass.—Bids will be received until Mar. 18, by the School House Comm., for the erection of an elementary school in the Oliver Wendell Holmes District. Chas. Lopie, 120 Boylston St., is Chn.

Cambridge, Mass.—The B. P. O. E. will erect a four-story brick and terra-cotta building, 90x100 ft., on Central Sq. The estimated cost is $100,000. Chas. R. Greco, 8 Beacon St., is Arch.

Framingham, Mass.—Bids will be asked about Apr. 1, for the construction of a two-story brick school at Framingham Centre. The estimated cost is $65,000. Chas. M. Baker, 70 Equitable Bldg., and M. Austin, 50 Bromfield St., are Archs.

Grafton, Mass.—Fuller & Delano, Archs., 44 Front St., Worcester, Mass., are preparing plans for the buildings which will be needed for the State Asylum when it is moved to its new location in Grafton, Mass. The largest of these buildings will be 74x40 ft., two stories high, of brick.

Northampton, Mass.—The City Council, Feb. 20th, authorized the special committee on high schools to secure plans for an addition to the present high school. The estimated cost is $50,000. F. K. Congdon is Supt. of Schools.

†Springfield, Mass.—The contract for the six-story block to be built on Chestnut and Worthington Sts., for the United Realty Co., was awarded to W. D. McKENZIE.

Worcester, Mass.—Bids are being received by Harry P. Granes, Arch., Lowell, for the construction of a six-story theater, 108x155 ft., on Mechanic St. The estimated cost is $300,000.

Fuller & Delano, Arch., 44 Front St., are preparing plans for an infirmary building for the Grafton Colony State Hospital for Insane. It will be 2 stories of brick, 40x74 ft. Dr. E. V. Scribner is Supt. Grafton, Mass.

The Polish Cadets Organization is having plans prepared for a two-story and basement club house of brick to be erected at Grant and Amherst Sts.

Newport, R. I.—Pres. Mellen, of the N. Y., N. H. & H. R.R., has announced plans are being prepared for a passenger station, to be erected in Newport.

†Albert G. Harkness, 7 Cooke St., has awarded the contract for the erection of a four-story concrete and brick mercantile building, 40x105 ft., on Weybosset St., to WILLIAM WILLIAMS, 86 Weybosset St.

Albany, N. Y.—Plans are being prepared by W. J. Obenaus, Arch., Albany, for the construction of a 14-story office building at Hudson Ave. and South Pearl St., for Henry Kramrath, 98 Willett St.

Buffalo, N. Y.—The lowest bidder for the beneral contract on the Hutchinson High School was R. T. Ford Co., Rochester, at $740,000. Other bidders were: The Durolithic Co., Buffalo, general construction, $567,000; John W. Danforth, heating and ventilating, $101,998; George H. Soffell, plumbing and draining, $37,000. It is the desire of the High School Commission that the cost shall not exceed $700,000. Action by the Commission and the Common Council will be taken at once. Noted Feb. 13.

New York, N. Y.—The Board of Education, Park Ave. and 59th St., Boro. Manhattan, will erect a six-story, 200x100-ft. storage building at First Ave. and 67th St. The estimated cost is $550,000. C. B. J. Snyder is Supt. School Bldgs.

The Elena Realty Co. has purchased a site at Thompson St. and Washington Sq., South, upon which to erect a 12-story apartment house. The estimated cost is $1,000,000. Dominick Abatte is Pres.

Horace Mann School has raised a fund of $300,000 and will erect school buildings at 246th St. and Broadway. Henry C. Pearson is Principal.

The Supreme Lodge of the Loyal Order of Moose is planning the erection of a five-story club house in the vicinity of Columbus Circle. The estimated cost is $500,000.

†The contract has been awarded to the WILLIAM CROW CONSTRUCTION CO. for the construction of the library building, to be erected at 535 West 179th St., for the New York Public Library, Bryant Park. Noted Jan. 23.

Plans have been completed by L. A. Abramson, 37 Liberty St., Arch., for the construction of a ten-story Y. M. H. A. building, 100x100 ft., at 110th St. and Lenox Ave. The estimated cost is $500,000.

Plans are being prepared by George M. McCabe, Arch., for the construction of a 16-story loft building, 100x100 ft., at Seventh Ave. and 27th St., for the Twenty-eighth St. and Seventh Ave. Realty Co. The estimated cost is $500,000.

The Whitney Opera Co. has purchased a site at 131 West 55th St., upon which will be erected a theater. P. C. Whitney is Pres.

Plans have been filed by I. C. Cucker, Arch., 2017 85th Ave., for the construction of a six-story apartment house at 180th St. and Fort Washington Ave., for the Harvey Realty Co., 40 East 22d St. The estimated cost is $150,000.

New Rochelle, N. Y.—We are officially advised that bids will be received until Mar. 10, by Brazes & Robb, Arch. 1133 Broadway, N. Y., for the construction of a Parish House for St. Pauls Parish. Estimated cost, $60,000.

White Plains, N. Y.—Plans have been prepared by McKim, Mead & White, Archs., 160 Fifth Ave., New York, for the construction of the Winifred Masterson Burke Foundation Home for Convalescents at White Plains. The estimated cost is $1,000,000.

✦Bayonne, N. J.—The Board of Education has awarded contracts for the erection of an addition to Public School No. 6 as follows: General construction, ABEL BOTTOM & SONS, Philadelphia, Penn., $113,096; heating and ventilating plant, McGINNESS & CO., Pittsburgh, Penn., $21,999; plumbing, GEORGE J. TOBIN, Plainfield, N. J., $5769; electrical work, BEAVER ENGINEERING CO., Newark, N. J., $2144. Noted Jan. 9.

Bloomfield, N. J.—Plans have been filed by George M. Cadmus, for the construction of a three-story brick building on Washington St., for Joseph Green. The estimated cost is $50,000.

✦Jersey City, N. J.—St. Aecan's Church has awarded a contract for the erection of a new church and school building on Tuers Ave., to the M. T. CONNOLLY CONTRACTING CO., 17th St., Jersey City, at a cost of $86,900.

Morris Plains, N. J.—Bids will be received until 3 p.m., Mar. 13, by James M. Buckley, Pres. Bd. of Managers, New Jersey State Hospital, for the construction of an addition to the Female Nurses' Cottage, and addition to the laundry building.

Newark, N. J.—Irving C. Hopper, Arch., Newark, is revising plans for the market building, which will be two stories instead of a one-story structure. The estimated cost is $500,000. Noted Dec. 19.

Woodbridge, N. J.—The Board of Education has had plans prepared by John N. Pierson & Son, Archs., 95 Smith St., Perth Amboy, N. J., for a brick school, to be erected in the Avenel section.

Erie, Penn.—The Independent Order of B'nai B'rith has purchased a site on the outskirts of Erie, upon which a Home for Friendless Children will be erected. Harry Allen Jacobs is Arch., 320 Fifth Ave., New York. The estimated cost is $500,000.

✦Germantown (Philadelphia post-office), **Penn.**—The contract for the construction of the theater at Germantown and Maplewood Aves., for F. G. Nixon-Nirdlinger, has been awarded to F. J. BOAS.

✦Kutztown, Penn.—The contract for the construction of the library for the Keystone State Normal School, has been awarded to the OCHS CONSTRUCTION CO., Allentown, Penn. Noted Jan. 30.

Monessen, Penn.—J. A. Lohman, Arch., 522 Donner Ave., is receiving bids for the construction of a three-story brick and stone clubhouse for Monessen Lodge, B. P. O. E.

Philadelphia, Penn.—Plans are being prepared by Pilcher & Tachau, Archs., 109 Lexington Ave., New York, for the construction of a building at Broad and Columbia Sts., for the Keneseth Israel Alumni Association. The estimated cost is $100,000.

✦The contract for the construction of the eight-story mercantile building at 117 North Seventh St., for Samuel Price Wetherill, has been awarded to CRAMP & CO.

✦The contract has been awarded to GEORGE HOGG, for the construction of a theater, at Broad and Thompson Sts., for Kahn & Greenburg. Stuckert & Sloan are Archs.

Berman Bros. have purchased a site at North 52d and Stiles Sts., upon which will be erected a theater. The estimated cost is $100,000.

Plans are being prepared by Stewardson & Page, Arch., Philadelphia, for the construction of the Cleemen Dormitory at the University of Pennsylvania, as a memorial to the late doctor cleeman's brother Ludwic C. Cleeman.

Plans have been prepared by Pilcher & Tachan, Archs., New York, for the construction of an alumni building at Broad and Columbia Sts. The estimated cost is $100,000.

✦Pittsburgh, Penn.—The contract for the construction of the Baer-Kaufman department store on Smithfield St. has been awarded to the THOMPSON-STARRETT CO. Noted Feb. 6.

The contract for the construction of the Bash building at Fifth Ave. and Market St., has been awarded to JAMES L. STUART.

Pittsburgh, Penn.—Frank & Seder will remodel the building on Smithfield St. The estimated cost is $100,000. Harry A. Low is Mgr.

Charles Bickel, Arch., May Bldg., is preparing plans for the Concordia Club, which will erect a $100,000 club house in the Schenley Farms district. The building will be 65x110 ft.

The General Fireproofing Co., which will build a three-story brick and terra cotta mercantile building at 1006-1012 Fifth Ave. for D. F. Henry, of the Hotel Henry, will soon ask for sub-bids. The building will be 63x112 ft.

Plans are being considered for a market house and convention hall, on the site of the present Diamond Sq. market.

Plans are being prepared for the construction of buildings and improvements to the City's Poor Farms at Marshalsea. The estimated cost is $850,000. E. R. Walters is Dir. of Health and Charities.

✦Pottsville, Penn.—The contract has been awarded to the MacARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York, for placing the foundation of the new State Armory, in Pottsville. One hundred and fifty-four pedestal concrete piles will compose the foundation of this building. Walter Mertley & Sons, Pottsville, general contractors. McCormick & French are Archs.

✦Reading, Penn.—The general contract for the construction of the school building at Douglass and Wieser Sts. has been awarded to the BEARD CONSTRUCTION CO., Reading.

South Bethlehem, Penn.—Lehigh University will erect a gymnasium building, 200x240 ft. The estimated cost is $200,000.

Washington, Penn.—The Board of Education contemplates erecting a high-school building at East Beau and East Chestnut Sts. The estimated cost is $60,000.

Hagerstown, Md.—The Potomac Lodge of odd Fellows contemplate erecting a temple on South Potomac St. The estimated cost is $100,000.

Lynchburg, Va.—Plans have been prepared by McKenzie-lin & Johnson, Archs., Lynchburg, for a bank building, to be erected for the Lynchburg Trust & Savings Bank. The building, which is to be constructed of brick, terra cotta or marble, will cost approximately $100,000.

✦Richmon, Va.—Contracts for the construction of the Administration Building at Richmond College have been awarded as follows: Stone work, to the WISE GRANITE CO., brick, FULTON BRICK CO. Cram, Goodhue & Ferguson, are Archs., New York.

Wheeling, W. Va.—The Wheeling Traction Co. will erect car barns at Wheeling. The estimated cost is $1,000,000.

Charlotte, N. C.—The School Commissioners contemplate erecting a school building on the site of the present South School on East Morehead St. John D. McCall is Chn. of School Bd.

Winston-Salem, N. C.—Plans have been prepared by P. Thornton Mayre, Arch., Atlanta, Ga., for the construction of a hospital at Winston-Salem. The estimated cost is $90,000.

St. Matthews, S. C.—Bids will be received until noon, Mar. 18, by J. S. Wanamaker, Chn. of Court House Comn., for the construction of the Calhoun County court house and jail buildings. William A. Edwards is Arch., 632 Candler Bldg., Atlanta, Ga.

✦Athens, Ga.—The contract has been awarded to LITTLE & CLECKLEY, Anniston, Ala., for the construction of the court house for Clark County at Athens. Estimated cost, $155,000. Noted Feb. 13.

Atlanta, Ga.—Bids will be received until noon, Mar. 10, by Shattuck & Hussey, Archs., Atlanta, for the construction of an eight-story Y. M. C. A. building.

Augusta, Ga.—St. Joseph's College is having plans prepared by G. Lloyd Preacher, Arch., Augusta, for the construction of a brick college building. The estimated cost is $100,000.

✦Miami, Fla.—The contract has been awarded to WILLIAM A. OTTER, for the construction of the two-story building to be known as the Townley Block. The estimated cost is $12,000.

✦Tallahasse, Fla.—The contract has been awarded to GEORGE A. CLAYTON, Atlanta, Ga., for the construction of a bank and office building for the First National Bank, of Tallahasse, Fla. The estimated cost is $50,000.

Tarpon Springs, Fla.—The Tarpon Springs Hotel Co., recently incorporated, will erect a hotel at Tarpon Springs. The estimated cost is $60,000. J. K. Cheney is Pres.

✦New Orleans, La.—The contract has been awarded to GEORGE J. GLOVER, for the construction of the annex to the Hotel Dieu. About $500,000 will be expended on improvements.

Jackson, Tenn.—The Merchants' & Manufacturers' Association contemplates the erection of an auditorium and city hall. The estimated cost is $100,000.

✦Memphis, Tenn.—The contract has been awarded to the ALEXANDER CONSTRUCTION CO., for the construction of a five-story and basement warehouse for E. C. Atkins & Co. Noted Jan. 16.

Lawrenceburg, Ky.—Bids will be received until 3 p.m., Apr. 8, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post office at Lawrenceburg.

Paducah, Ky.—The Palmer Hotel Co. have had plans prepared for the construction of a ten-story hotel at Fifth and Broaway to replace the Palmer House. The estimated cost is $300,000.

Akron, Ohio—Bids will be received by the Board of Education until Mar. 13, for the erection of a West Side high-school.

Bellaire, Ohio—The City will erect a three-story and basement city hospital. The estimated cost is $50,000. F. L. Packard, New Haven Bldg., Columbus, Ohio is Arch. Bids will be received until Mar. 15.

✦Carrollton, Ohio—Bids were received Feb. 24, for the school at Carrollton, as follows: E. K. Hibbs, $47,250; Charles P. Kircher, Athens, $47,076; E. E. BOPE, Columbus, $41,777 (awarded contract); and George Katt, Lorain, $45,924. Noted Dec. 19.

Cincinnati, Ohio—The Board of Education will erect a high school at Erie and Delta Ave. The estimated cost is $100,000.

✦Cincinnati, Ohio—Harry Hake and Chas. Kuck, Archs., Provident Bank Bldg., Cincinnati, have awarded contract for ornamental iron and bronze work for the telephone company's new building at Fourth & Hammond St. to the NOELKE-RICHARDS IRON WORKS, of Indianapolis, Ind.

Cleveland, Ohio—Bids will be received until noon, Mar. 15, by Chas. Ammerman, Clk., Bd. of Education, for the construction of an addition to the Rozelle School. Willard Hirsch is Arch., 1302 Swetland Bldg., Cleveland.

St. John's Hospital will erect a new hospital building. The estimated cost is $165,000. M. F. Bramley is Chn. of the Bldg. Fund.

Kenton, Ohio—Bids are being received by E. G. Carey, County Audr., Kenton, for the construction of a two-story and basement court house at Kenton. The estimated cost is $275,000. Kichards, McCarty & Bulford, Columbus, Ohio, are Archs.

✦Norwood, Ohio—The contract for the construction of the theater on Montgomery Road, for the Norwood Theater Co., has been awarded to the OHIO BUILDING & CONSTRUCTION CO.

Springfield, Ohio—Bids will be received until noon, Mar. 13, by W. H. Holmes, Clk., Bd. of Education, Springfield City School District, for the construction of an addition to the

Springfield High School. Albert Pretzinger & E. P. Musselman are Archs., 1126 Reibold Bldg., Dayton, Ohio.

+Steubenville, Ohio—The contract for the construction of the church for the New Westminster Congregation has been awarded to CHARLES J. GOERMAN, Butler, Penn., at $85,600. Noted Jan. 9.

Toledo, Ohio—The Toledo Humane Society will erect a building. The estimated cost is $75,000. Walter F. Brown is Pres.

Troy, Ohio—The city will erect a three-story and basement high school. The estimated cost is $125,000. F. L. Packard, Tew Hayden Bldg., Columbus, Ohio, is Arch.

Union Furnace, Ohio—Bids will be received by the Board of Education until Mar. 26, for the erection of a two-story school.

Youngstown, Ohio—Plans have been completed for a six- or seven-story terminal furniture warehouse to be built for the Mauser Warehouse Co. Noted Jan. 9.

Gary, Ind.—H. A. Vossler; R. O. Johnson, P. H. Stevens, and H. A. Paine, are planning the erection of a public market at Seventh Ave. and Massachusetts St. The estimated cost is $100,000.

South Bend, Ind.—The South Bend Lodge, Knights of Pythias will erect a lodge building. The estimated cost is $75,000. Albert Slick is Chancellor Commander.

+Detroit, Mich.—The general contract has been awarded to SCHMEID SISMAN CO., 395 Beaufait Ave., for the construction of a four-story brick and steel warehouse for the Crowley-Miller Co. Fuller Claflin is Arch., Elks Temple Bldg.

Wells D. Butterfield, Arch., 601 Stevens Bldg., will receive bids after March 7 for a reinforced concrete building on Gratiot and Farrer Sts., to be occupied by Louis Liggitt & Co., Druggists.

Chicago, Ill.—Plans are being prepared by George S. Kingsley, Arch., for the construction of a nine-story office building at 105 North Dearborn St. for Max L. Brede. The estimated cost is $300,000.

Plans have been prepared by George C. Nimmons, Arch., for the construction of a nine-story reinforced concrete warehouse at the Chicago River between North Clarke St. and La Salle Ave., for Reid, Murdoch & Co. The estimated cost is $1,000,000.

Plans have been prepared by D. H. Burnham & Co., Archs., Chicago, for the construction of a building at South Fifth Ave. and Quincy St., for David Mayer. The estimated cost is $250,000.

Peoria, Ill.—The Illinois Traction system will erect a terminal on the site of the old National Hotel. The estimated cost is $350,000. H. E. Chubbuck is Vice-Pres.

South Chicago, Ill.—Bids will be received until 3 p.m., May 2 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at South Chicago.

+Medford, Wis.—The general contract for the construction of the new three-story court house of brick and stone has been awarded to the HUTTER CONSTRUCTION CO., Fon du Lac, Wis., at $57,203. Noted Dec. 5.

CONTRACT PRICES

Concrete Sewer—New York, N. Y.—Bids for constructing sewers and appurtenances in Lacombe Ave., between the Bronx River and Bronx River Ave., and in other streets, were received by Cyrus C. Miller, Pres. Boro. The Bronx, Jan. 15, as follows: (A) Rodgers & Hagerty, Inc.; (B) John J. Hart; (C) Fraser, Brace & Co.; (D) F. V. Smith; (E) Ryan & Reilly Co.

Milwaukee, Wis.—Plans have been completed by Arch. Van Ryn & De Gelleke for the new Riverside High School, at Folsom, Newhall St. and Bartlett Ave. The estimated cost is $425,000.

A 16-story office building will be erected by the Camp estate at East Water and Wisconsin Sts., to replace the present five-story structure. The estimated cost is $1,750,000.

Milwaukee, Wis.—The Plankinton Estate, will erect buildings at Second and Wells St. The estimated cost is $4,000,000. George W. Harvey, Milwaukee is interested.

Sheboygan, Wis.—Plans have been prepared by W. C. Weeks, Arch., for the construction of a three-story brick city hall, 150x56 ft.

Des Moines, Iowa—James M. Pierce, publisher, will erect a building at Third St. and Grand Ave. The estimated cost is $200,000.

Naushwauk, Minn.—Hunt, Sullivan & Kelly, Archs., Duluth, will erect a school at Keewatin estimated to cost $60,000. and an addition to the Naushwauk school estimated to cost $40,000.

Boonville, Mo.—Bids will be received until 3 p.m., Apr. 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post office at Boonville.

St. Louis, Mo.—The Kingston Investment Co. will erect a three-story mercantile building at 617 Locust St. The estimated cost is $60,000.

Little Rock, Ark.—Plans have been prepared by Theodore Sanders, Arch., for the construction of a three-story mercantile building at Second and Scott Sts. The estimated cost is $50,000.

Dallas, Tex.—Sears, Roebuck & Co., of Texas, will erect a ten-story building at South Lamar, Arnold and Bellevue Sts. The estimated cost is $625,000.

+Fort Worth, Tex.—The contract for the construction of the five-story reinforced concrete and brick building at Fifth and Throck-morton Sts., for the Denver Investment Co., has been awarded to the TEXAS BUILDING CO.

+Houston, Tex.—The contract for the construction of the six-story hotel at La Branch St. and Preston Ave., has been awarded to the CENTRAL CONSTRUCTION CO.

Denver, Colo.—Plans have been prepared by Edbrooke & Horn, Archs., Denver, for the construction of an 11-story apartment house at 14th Ave. and Lincoln St. The estimated cost is $225,000.

+Seattle, Wash.—The contract has been awarded to the RAYMOND CONCRETE PILE CO., New York and Chicago, for placing Standard Raymond concrete piles for the foundation of the freight house, for the Oregon-Washington R.R. & Navigation Co. Noted Dec. 12.

Spokane, Wash.—Mrs. L. Dessert is planning the erection of an eight-story hotel, at First and Post Sts. The estimated cost is $300,000.

Fresno, Calif.—P. M. Roessler will erect a building at Tulare and L. Sts. The estimated cost is $100,000.

Fresno, Calif—The following bids were opened by the City Council for completing the Rowell Auditorium: H. A. Hansen, $41,887; Trewhitt & Shields, $40,846; McElroy & Riggins, $35,600.

Los Angeles, Calif.—The Biescar Estate will erect an 8-story reinforced concrete hotel at the northwest corner of Eighth and Hope Sts. W. J. Saunders, 801 International Bank Bldg., is Arch.

+Oakland, Calif.—The contract has been awarded to BOYD, KERR & McLEAN, San Francisco, at $48,800, for the construction of the school at 54th and Market Sts., and the VAN SANT-HOUGHTON CO., San Francisco, at $66,468, have the contract for the Perry St. school building. Noted Feb. 6.

CONCRETE SEWER, NEW YORK, N. Y.

	A	B	C	D	E
695 lin. ft. double concrete sewer, 9 ft.x6 ft. and 11 ft. 3 in.x8 ft.	$52 70	$47 00	$48 00	$64 50	$95 00
105 lin.ft. double concrete sewer, 11 ft. 3 in.x8 ft.	57 56	90 00	49 00	82 00	100 00
2,788 lin.ft. double concrete sewer, 10 ft.x8 ft.	50 31	51 00	55 00	60 50	69 00
723 lin.ft. double concrete sewer, 8 ft. 9 in.x8 ft.	44 22	42 00	41 00	54 50	43 00
60 lin.ft. double concrete sewer, 8 ft. 6 in.x8 ft.	41 85	37 00	40 00	53 00	42 00
825 lin.ft. double concrete sewer, 8 ft. 3 ft.x8 ft.	37 97	38 50	41 00	45 00	39 00
785 lin.ft. single concrete sewer, 12 ft. 6 in.x8 ft.	39 73	37 00	37 00	48 00	40 00
312 lin.ft. single concrete sewer, 12 ft.x8 ft.	34 66	37 00	37 00	45 00	40 00
75 lin.ft. single concrete sewer, 11 ft. 6 in.x8 ft.	34 98	31 00	36 00	46 00	39 00
74 lin.ft. single concrete sewer, 11 ft. 3 in.x8 ft.	31 67	31 00	36 00	44 00	35 00
723 lin.ft. single concrete sewer, 10 ft.x8 ft.	26 95	28 50	27 00	39 00	27 00
500 lin.ft. single concrete sewer, 9 ft. 6 in.x8 ft.	25 13	27 00	27 00	38 00	26 00
1,606 lin.ft. single concrete sewer, 7 ft.x8 ft.	25 21	22 50	27 00	32 00	28 50
1,4 lin.ft. single concrete sewer, 9 ft.x6 ft.	27 43	23 50	28 00	35 00	87 00
25 lin.ft. single concrete sewer, 6 ft. 9 in.x6 ft.	25 36	17 00	25 50	34 00	25 00
10 lin.ft. single concrete sewer, 10 ft. in diameter	9 83	9 00	15 00	15 00	12 00
28 lin.ft. single concrete sewer, 12 in.x50 in.	11 25	10 00	18 00	16 00	13 00
7 lin.ft. [illegible] in.x33 in.	13 70	13 00	17 00	18 00	12 00
18 lin.ft. [illegible] 24 in.x50 in.	11 70	14 00	17 00	19 00	11 00
74 lin.ft. [illegible] 34 in.x46 in.	9 49	10 00	16 00	16 00	10 00
67 lin.ft. [illegible] 29 in.x40 in.	10 26	10 00	14 00	16 00	9 00
[illegible]	10 92	8 00	9 00	7 00	6 00
148 lin.ft. [illegible] 24 in.	7 12	8 00	6 00	6 00	6 00
29 lin.ft. [illegible] 20 in.	4 98	6 00	5 00	5 00	4 00
2 lin.ft. [illegible]	8 31	5 00	5 50	4 00	4 00
[illegible]	3 84	4 00	5 00	3 00	3 50
1,370 lin.ft. [illegible]	1 30	1 00	75	1 00	2 00
[illegible]	4 80	2 00	1 50	1 50	1 00
75 [illegible]	82 95	50 00	80 00	55 00	60 00
3 [illegible]	195 00	250 00	200 00	200 00	150 00
7,300 [illegible]	2 25	2 50	3 50	2 00	2 50
7 [illegible]	7 50	8 00	8 00	5 50	7 00
7 [illegible]	3 90	3 00	3 00	1 00	3 00
1,700 [illegible]	40 00	50 00	45 00	40 00	40 00
500 [illegible] M. ft.	.30	.35	.30	.25	.25
285 [illegible] lin.ft.	.01	.03½	.03½	.03½	.03½
312,000 lb. [illegible]	4.22	5 00	1 00	2 00	2 00
300 lin.ft. pipe drains, 12 to 24 in.					
Totals	$568,917.20	$581,907 50	$589,973 75	$620,381.50	$650,237 00

Orange, Calif. George Kenchel was the lowest bidder at $36,774, for the erection of two brick high school buildings for Orange High School District. Fred H. Eley, Harvey-Finley Building, Santa Ana, is Arch.

Sacramento, Calif. The Native Sons Hall Association will erect a building at 11th and J Sts., Sacramento. The estimated cost is $90,000.

San Diego, Calif. George E. Hart will erect an eight-story office building, 100x150 ft. at Eighth and D Sts. The estimated cost is $350,000. The MacFlary Co. is Arch., Los Angeles, Calif.

San Francisco, Calif. Heald's Business College will erect a $100,000 reinforced concrete building at Van Ness Ave. and Post St. Slyvain Schnaittacher, First National Bank Bldg., is Arch.

Bids will be received until 11 a.m. March 11, by the Building and Grounds Committee of the Panama-Pacific International Exposition Co. 415 Exposition Bldg., Pine and Battery Sts. for the construction of the Education Building.

San Francisco, Calif.—Henry H. Myers, Arch., Kohl Bldg., is preparing plans for the construction of a five-story and basement Class C store and hotel, to be erected at Eddy and Taylor Sts., for Mary and Joseph Hyman. The estimated cost is $130,000.

The following contracts have been awarded by Miller and Colmesnil, Lick Bldg., for the construction of a reinforced concrete store and office building for the Realty and Rebuilding Co. at the corner of Turk and Fillmore Sts.: Lathing and plastering, LYDEN AND BRICKEL, 269 Fell St., $13,-060; Sheet metal work, WESTERN FURNACE AND CORNICE WORKS, 1645 Howard St., $3250. Plumbing, CONDON AND BAND, 318 Ellis St., $11,869; Concrete work, A. LYNCH, 185 Stevenson, St., $40,270. Noted Feb. 13.

Santa Rosa, Calif.—The lowest bidders for the construction of the city hall were as follows: General contract, Gallagher & Wygant, $25,250; structural steel, Ralston Iron Works, $4283; vault and cell work, A. G. West Co., $2766; heating, J. G. Sutton Co., $1770. Noted Jan. 9.

Ottawa, Ont.—The Government estimates for the ensuing year provide two million dollars for new departmental buildings in Ottawa; also an item of $50,000 for a new drill hall. In addition to this, plans are being prepared for a five-story addition to the city post office, on which work will be started early in the spring.

Plans are being prepared by the Wallace Realty Co. for the erection of a ten-story building on Queen St., Ottawa. Work will commence early in the spring.

Regina, Sask.—Bown & Vallance, Archs., Montreal, Que., have prepare plans for the construction of a building, 175x60 ft., for St. Chad's College. The estimated cost is $1,000,000.

THE RIVER AND HARBOR BILL

The appropriations for River and Harbor improvement were as follows:

Maine: Bar Harbor, $10,000; Deer Island thoroughfare, $40,000; Carvers Harbor, $16,000; Pepperells Cove, $63,400; Portland, $150,000; Kennebeck River, $30,500; Medomak River, $17,000; St. Croix River, $75,000.

Vermont: Burlington, $2000; Narrows of Lake Champlain, $6000.

Massachusetts: Boston, $25,000; Hyanne's, $25,000; Lynn, $84,000; Nantucket, $51,312; Newburyport, $25,000; Plymouth $83,500; Pollock Rip Channel, $125,000; Merrimac River $10,-000; Mystic River, below mouth of Island End River, $25,000.

Rhode Island: Block Island, harbor of refuge, $50,000; Point Judith, harbor of refuge, $100,000; Providence River and Harbor, $264,800; Pawcatuck River, $6000.

Connecticut: Fivemilé River, Greenwich Harbor, Westport Harbor and Sangatuck River, $5000; Milford, $5000; New Haven, $90,000; Mystic River, $8160; Thames River, $12,000; Connecticut River, below Hartford, $15,000; Housatonic River, $20,000.

New York: Buffalo, $167,375; Cape Vincent, $36,000; Flushing Bay, and channel to Main St. bridge, $255,700; channel in Gowanus Bay, Bay Ridge Channel and Red Hook Channel, $300,000; Great Sodus Bay, $4000; Great South Bay, $5000; Jamaica Bay, $300,000; Mattituck, $10,000; New York, $200,000; Ogdensburg, $37,970; Olcott, $4000; Oswego, $110,000;

Highways—New York, N. Y.—Bids for constructing vitrified brick block highways around the Ashokan Reservoir, Contract 134, were received by the Board of Water Supply, Jan. 21, as follows: (A) A. L. Guidone & Co.; (B) John E. Consalus; (C) Booth & Flinn, Ltd.; (D) Samuel Reskin; (E) MacArthur Bros. Co.; (F) Charles W. Blakeslee & Sons; (G) Winston & Co.; (H) F. W. Stier; (I) J. F. Cogan Co.; (J) Joseph Di Benedetto.

Plattsburg, $1000; Port Chester, $5000; Rondout, $5000; Saugerties, $25000; Huron River, $120,000; Browns Creek, $5000; East Chester Creek, $20,000; Improving three spurs in East River and Hell Gate, $250,000; Harlem River, $[illegible]; Hudson River, $1,000,000; Hudson River Channel, $[illegible]; Newtown Creek, $20,000; Wappinger Creek, $2500; West Chester Creek, $12,000; Staten Island Sound, $20,000.

New Jersey: Keyport Harbor, Matawan Creek, Raritan River, South River, Shoal Harbor, Compton Creek, and Cheesequake Creek, $35,500; Toms River Harbor, $20,000; Absecon Creek, $1000; Absecon Inlet, $10,000; Alloway Creek, $4000; Cooper River, $5000; Elizabeth River, $15,443; Hackensack River, $50,000; Mantua Creek, $15,000; Maurice River, $30,000; Newark Bay and Passaic River, $[illegible]; Raritan Creek, $13,000; Salem River, $15,000; Shrewsbury River, $10,000; Toms River, $1000; Tuckerton Creek, $5000; Woodbridge Creek, $5000; Woodbury Creek, $5000; Delaware River, about Larbor St., Trenton, $114,000; from Labor St., Trenton, to Allegheny Ave., Philadelphia, Penn., to the sea, $1,750,000; in all, $1,884,000.

Pennsylvania: Pittsburgh, $5000; Allegheny River, $2500, for maintenance; Allegheny River, $300,000; Monongahela River, $178,200; Delaware River, see New Jersey.

Delaware: Wilmington, $30,000; Appoquinimink, Murderkill and Mispillion Rivers, $27,000; Broad Creek River, $2000; Brandkill River, $5000; Leipsic River, $5000; Little River, $1000; Saint Jones River, $5000; Inland waterway between Rehoboth Bay and Delaware Bay, $41,725.

Maryland: Nanticoke River, $3600; Baltimore, $305,250; Harbors at Rockhall, Queenstown, Clairborne and Cambridge, and the Chester, Choptank, Warwick, Wicomico, Pecomoke, La Trappe and Manokin Rivers, and Tyaskin Creek, $33,510; Susquehanna River, above and below Havre de Grace, $51,236.

District of Columbia: Anacostia River, $75,000; Potomac River at Washington, $30,000; at Lower Cedar Point, Md., $3000.

Virginia: Norfolk, $195,500; Elizabeth River (Western branch), $82,000; James River, $75,000; Mattaponi and Pamunkey Rivers and Occoquan Creek, $15,000; Onancock River, $1000; Pagan River, $1000; Rappahannock River, $25,000; Upper Machodoc Creek, $3200; Inland waterway from Norfolk to Beaufort Inlet, N. C., $800,000.

North Carolina: Beaufort, $2000; Beaufort Inlet, $10,000; Inland waterway (see Virginia); harbor of refuge, Cape Lookout, $500,000; Morehead City, $2000; Bay River, $1000; Cape Fear River, at and below Wilmington, $352,940; Fishing Creek, $1500; Neuse and Trent Rivers, $12,000; New River and waterways to Beaufort, $5000; Northeast, Black and Cape Fear Rivers, above Wilmington, $12,000; Shallotte River, $9845; South River, above Aurora, $6092.20; Swift Creek, $500; Waterways connecting Core Sound and Beaufort, $20,000; Waccanaw River, $30,000.

South Carolina: Charleston, $71,616; Winyah Bay, $65,-000; Gouat Peedee River, $15,000; Archers Creek, $25,000; Santee and Wateree Rivers, and the ConGaree River as far as the Gerwais St. bridge, Columbia, $60,000; Waterways between Charleston and Allegator Creek, and between Charleston and McClelanville, $25,000.

Georgia: Brunswick, $33,250; Savannah, $345,000; Attamaha, Oconee and Ocmulgee Rivers, $40,000; Fancy Bluff Creek, connecting Turtle River and Brunswick Harbor with the Little Satilla River, $8000; Flint River, $15,000; Satilla River, between Burnt Fort and Waycross, $10,000; Savannah River, above Augusta $3470; below Augusta, $125,000; at Augusta, $60,000; Chattanooga River below Columbus $80,-000; Coosa River, $136,000; Waterway between Savannah and Fernandina, Fla., $100,000.

Florida: Channel between Saint Johns River and Cumberland Sound, $50,000; protecting shore of Anastasia Island, $15,000; Apalachicola Bay, $20,000; Charlotte, $4000; Channel from Clearwater Harbor through Boca Ceiga Bay to Tampa Bay, $7000; Fernandina, $40,000; Hillsboro Bay, $100,000; Key West, $15,000; Miami, (Biscayne Bay), $100,000; Saint Josephs Bay, $10,000; Saint Lucie Inlet, $108,000; St. Petersburg, $1500; Sarasota Bay, $13,000; Tampa Bay, $9000; Channel from Apalachicola River, $700; Caloosahatchie River, $2000; Crystal River, $2000; Holmes River, $2500; Indian River, between Goat Creek and Jupiter Inlet, $22,000; Lake Crescent and Dunns Creek, $25,000; Manater River, $5000; Orange River, $1000; St. Johns River, from Jacksonville to the ocean $550,-000; from Jacksonville to Palatka, $19,600 and from Palatka to Lake Harney, $42,200; Withlacoochee River, $5000.

Alabama: Choctawhatchee River, $9000; Escambia and Conecuh Rivers, $8000; Mobile bar, $20,000; Mobile, $255,000; Alabama Riber, between Montgomery and Wetumpka, $100,-000; Black Warrior, Warrior and Timbigbee Rivers, $1,338,-500; Tombigbee River, from the mouth to Walkers Bridge, Miss., $27,500; Channel connecting Mobile Bay and Mississippi Sound, $20,000.

Mississippi: Tombigbee River, (See Alabama); Biloxi, $5000; Gulfport, $87,000; Horn Island Pass, $5000; Pascagonta, $110,000; Big Sunflower River, $120,000; Pascagoula and Leaf Rivers, $14,000; Pearl River, below Rockport, $37,000; Yazoo

HIGHWAYS, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H	I	J
207,000 lin.ft. of road excavation and grading	$0 30	$0 70	$0 40	$0 18	$0 50	$0 44	$0 80	$0 51	$1 00	$0 35
45,000 cu.yd. earth excavation	40	60	75	50	50	49	80	85	[illegible]	[illegible]
1,000 cu.yd. rock excavation	3 50	2 00	2 00	1 25	3 00	2 00	3 00	1 25	[illegible]	[illegible]
30,000 cu.yd. broken stone	2 00	1 50	1 00	1 37	2 00	2 73	1 50	1 83	[illegible]	[illegible]
8,000 cu.yd. broken stone on top	2 50	4 00	4 00	2 81	4 00	3 25	3 00	3 75	[illegible]	3 60
60,000 cu.yd. concrete masonry pavement foundations	3 14	3 50	3 00	2 56	3 90	4.95	4 50	3 42	4 36	6 00
6,000 cu.yd. concrete masonry	4 00	5 50	5 50	5 00	10 00	6 50	8 00	12 36	7 50	12 00
50,000 bbl. portland cement	1 88	1 90	1 68	2 31	1 75	1 88	2 15	2 28	1 60	2 20
95,000 sq.yd. vitrified brick pavement	2 02	1 80	2 32	2 42	2 05	2 17	2 15	2 44	2 50	2 30
4,000 cu.yd. dry rubble masonry	3 75	3 50	1 50	2 50	3 00	3 90	3 00	2 67	2 50	3 00
8,000 lin.ft. vitrified pipe	30	20	50	31	40	45	75	26	20	1 25
1,500 sq.ft. flagging	1 00	20	15	20	25	22	50	25	20	50
85 M ft. B.M. timber and lumber	50 00	80 00	60 00	50 00	65 00	55 00	60 00	60 00	40 00	66 00
40 concrete posts	40 00	20 00	15 00	6 25	10.00	25 00	25 00	25 00	6 00	25 00
10,000 lb. cast iron, wrought iron and steel	05	10	06	03	10	05½	07	08	04	05½
70,000 lin.ft. guard-rails and fences	25	10	10	12	.10	22	10	24	15	25
100,000 lin.ft. painting guard-rails and fences	05	06	.05	06	.07	02½	05	11	05	06
Totals	$1,301,130	$1,334,800	$1,383,755	$1,396,830	$1,426,750	$1,531,815	$1,573,300	$1,612,965	$1,631,040	$1,659,430

River, mouth of river and harbor at Vicksburg, $60,000; Yazoo River and tributaries, $40,000; removing water hyacinth, Wlorida, Mississippi, Louisiana and Texas, $15,000.

Louisiana: Bartholomew, Macon, O'Arbonne and Corney Bayous and Boeuf and Tensas Rivers, $16,000; Bogue Falia, Manchac and Amite Bayons, and chefuncte and Tickfaw $2000; Bayou Queue de Tortue, $1000; Southwest Pass, Mississippi River, $...500,000; Bayou Tiche, $40,000; Bayou Vermilion, and Mermentau River, $16,200; inland waterway from Mermentau River to Sabine River, Louisiana and Texas, $190,000.

Tennessee: Cumberland River, above Nashville, $5000; Cumberland River, below Nashville, $5000; French Broad and Little Pigeon Rivers, $15,000; Tennessee River, in Tennessee, Alabama, and Kentucky; above Chattanooga, $510,000; between Chattanooga and Browns Island, Ala., $385,000; between Florence, Ala., and Riverton, Ala., $100,000; below Riverton, Ala., $110,000; in all for Tennessee River, $1,105,000.

Ohio: Cleveland, $76,000; Conneaut, $500; Toledo, $105,000; Ohio River, $1,800,000; Ohio River, open-channel work, $550,000.

Indiana: Indiana harbor, $225,000; Calumet River, Indiana and Illinois, $20,000.

Michigan: Arcadia, $20,000; Cheboygan, $14,000; Frankfort, $3000; Harbor of refuge at Grand Marais, $20,000; Ludington, $5000; Manistee, $312,000; Harbor of refuge, Marquette Bay, $5000; Ontonagon, $9000; St. Joseph harbor and river, $6000; Sanguatuck and Kalamazoo, $8000; South Haven, $3000; Detroit River, $155,000; Rouge River, $5000; Clinton River, $20,000; Saginaw River, $100,000; St. Mary's River, $500,000; Menominee harbor and river, Michigan and Wisconsin, $24,000.

Illinois: Chicago, $100,000; Waukegan, $18,500; Chicago River, $10,000; Illinois River, $100,000; Calumet River, Illinois and Indiana, $20,000.

Wisconsin: Ashland, $40,000; Green Bay, $14,000; Kenosha, $24,000; Kewaunee, $6000; Port Washington, $4500; Port Wing, $10,000; Sheboygan, $237,000; harbor at Two Rivers, $4000; Fox River, $20,000; Superior, Wis., and Duluth, Minn., $375,280.

Minnesota: Duluth and Superior, Wis., $375,280; Warroad Harbor, $2000; Zippel Bay, Lake-of-the-Woods, $1000; Red River of the North, $7500.

Mississippi River Improvements: from Head of Passes to the mouth of the Ohio River, $6,000,000, $100,000 of which is for Helena, Ark., Examination of river from Cape Girardeau, Mo., to Rock Island, Ill., $200,000; from the mouth of the Ohio River, to and including the mouth of the Missouri River, $1,000,000; from the mouth of the Missouri River to Minneapolis, Minn., $1,500,000; from St. Paul, Minn., to Minneapolis, Minn., $185,000; from Winnibigoshish and Pokegama Reservoirs, and the Luch River, $116,000.

Missouri River Improvements: from Kansas City, Mo., to the mouth of the river, $2,000,000; from Kansas City, Mo., to Sioux City, Iowa, $325,000.

Missouri: Gasconade River, $10,000; Osage River, $15,000.

Arkansas: Ouachita River, Arkansas and Louisiana, $202,500; Arkansas River, $48,000; Arkansas River (levee work), $30,000; Cashe River, $2000; St. Francis River, L'Anguille River and Blackfish Bayou, $7000; Saline River, $3000; White River, $20,000; White River, at Dewall Bluff, $14,000; Black and Current Rivers, $25,000.

Texas: Red River, $117,000; Galveston Channel, $200,000; channel from Galveston Harbor to Texas City, $500,000; Houston ship channel, $400,000; Fort Aransas, $600,000; Port Bolivar, $50,000; Sabine Pass, $400,000; West Galveston Bay Channel, Trinity River Anahuac Channel, Oyster Creek, and Cedar, Chocolate, Turtle, Bastrop, Dickinson, Drabb and East Bay Bayous, $25,000; Brazos River, from Old Washington to Waco, $375,000; mouth of Brazo River, $125,000; Trinity River, $270,000; channel from Aransas Pass to Corpus Christi, $10,000; channel from Pass Cavallo to Port Lavaca, $5000; Inland waterway on coast of Texas, $50,000; Cyprus Bayou, $500.

Washington: Grays Harbor and Chehalis River, $30,000; Cowlitz and Lewis Rivers, $23,500; Grays River, $500; Skagit River, $10,000; Puget Sound, $25,000; Inland waterway connecting Port Townsend Bay and Oak Bay, $62,500; Inland waterway connecting Puget Sound with Lakes Union and Washington, $5900.

Oregon: Coos Bay, $80,000; Nehalem Bay, $100,000; Tillamook Bay and Bar, $100,000; Coquille River, $6000; Siuslaw River, $5000; Willamette and Yamhill Rivers, $52,000; Yaquina River, $28,800; Columbia and Lown Willamette Rivers, below Portland, $160,000; mouth of Columbia River, $1,000,000; Columbia River, at Cascades, $100,000; Columbia River between the Dallas Rapids and Cellio Falls, $1,200,000; Columbia River, above Cellio Falls, $60,000; Columbia River between Bridge port and Kettle Falls, Wash., $40,000; Swake River, $25,000.

California: Humboldt Harbor and Bay, $20,000; Los Angeles, $121,000; Oakland, $275,000; San Diego, $423,637; San Pablo Bay, $40,000; Mokelumne River, $1000; Pitaluma Creek and Napa River, $18,000; Redwood Creek, $3000; Sacramento and Feather Rivers, $40,000; San Joaquin River, $186,132; Suisun Channel, $14,500.

Hawaii: Honolulu, $225,000.

CONTRACT PRICES

Sewer Extensions, Belmar, N. J.—Bids for extending the sewer system here according to plans and specifications prepared by Clinton Potts, consulting Engr., 30 Church St., New York, were received by the Borough Council, Feb. 15, as follows: (A) T. M. Quinn, Contracting Co., Trenton, N. J.; (B) J. J. Hughes, Newark, N. J.; (C) A. Costa, Orange, N. J.; (D) Sun Dredging & Construction Co., Philadelphia, Penn.; (E) Pierson Engineering & Construction Co., Hartford, Conn.; (F) John W. Heller, Newark, N. J.; (G) Dan Donovan, Bayonne, N. J.; (H) Liddell & Pfeiffer, Perth Amboy, N. J.; (I) Bartolabe & Baker, Hoboken, N. J.; (J) Sutton & Curson, Co., Ocean City, N. J.; (K) L. E. Brownbridge, Cape May, N. J.; (L) P. J. Monaghan, Perth Amboy, N. J.; (M) Atlantic Construction & Supply Co., Atlantic City, N. J.; (N) D'Amato & Stefanelli, Newark, N. J.; (O) Watson Engineering & Construction Co., New York, N. Y.

SEWER EXTENSIONS, BELMAR, N. J.

	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P
7,500 lin. ft. 8-in. vitrified sewer pipe, 0 to 6 ft.	$0 35	$0 14	$0 46	$0 653	$0 57	60	88	72	48	70	88	90	70	1 00	2 31
11,000 lin. ft. 8-in. vitrified sewer pipe, 6 to 8 ft.	45	14	60	772	70	75	96	76	1 12	82	1 10	1 00	1 15	1 25	2 52
1,000 lin. ft. 8-in. vitrified sewer pipe, 8 to 10 ft.	65	34	85	903	1 00	85	1 01	82	1 50	1 49	1 50	1 10	1 65	1 54	2 93
500 lin. ft. 8-in. vitrified sewer pipe, 10 to 12 ft.	85	54	1 00	77	80	1 00	1 08	86	2 05	1 93	2 25	1 85	2 10	1 10	3 56
240 lin. ft. 8-in. vitrified sewer pipe, 12 to 14 ft.	85	54	1 00	77	85	1 00	1 08	90	53	1 93	98	1 00	1 40	1 10	2 82
10 ft.	85	64	2	80	78	1 25	1 07	90	70	99	1 20	1 10	1 32	1 25	2 82
10 ft.	95	73	2 00	88	88	1 00	1 16	1 00	1 00	1 60	1 60	1 30	1 85	1 35	3 52
10 ft.	1 50	1 73	2 00	1 78	1 00	1 00	1 02	1 00	1 00	1 60	1 65	1 35	1 90	1 40	3 65
10 ft.	1 75	1 73	2 00	1 78	1 00	1 00	1 02	1 00	1 00	1 60	1 65	1 35	1 90	1 40	3 65
10 ft.	2 00	1 75	2	1 78	1 02	1 10	1 20	1 10	1 18	1 67	1 75	1 70	2 00	1 40	3 88
10 ft.						1 10	1 20	1 20	1 50	1 67	1 75	1 70	2 00	1 40	3 88
575 lin. ft. 10-in. vitrified sewer pipe, 0 to 6 ft.	40 00	50 00	36 00	49 50	44 00	40 00	45 00	48 00	48 00	71 71	38 50	30 00	45 00	45 00	54 40
100 lin. ft. 10-in. vitrified sewer pipe, 6 to 8 ft.															
100 lin. ft. 10-in. vitrified sewer pipe, 8 to 10 ft.															
1,500 lin. ft. 10-in. vitrified sewer pipe, 10 to 12 ft.															
225 lin. ft. 10-in. vitrified sewer pipe, 12 to 14 ft.															
79 manholes, 8 ft. and under	5 00	3 00	5 00	10 00	7 00	5 00	4 00	3 25	3 00	6 25	3 00	6 25	5 00	5 00	8 37
2 manholes, extra depth	10 00	6 00	10 00	16 25	14 00	15 00	8 00	6 50	6 00	12 50	6 00	7 00	10 00	10 00	9 73
22 lamp holes	30	1 50	60	25	2 00	60	1 00	45	15	2 10	1 10	48	35	75	49
100 telephone connections															
10 M ft. B.M. foundation timber	50 00	1 00	60 00	45 00	50 00	40 00	70 00	40 00	55 00	71 00	40 00	45 00	60 00	40 00	59 25
1 M ft. B.M. sheeting timber	30 00	60 00	45 00	35 00	30 00	30 00	30 00	30 00	35 00	30 00	30 00	30 00	35 00	35 00	39 40
1 ton c.i. pipe	150 00	60 00	100 00	75 00	75 00	60 00	60 00	50 00	50 00	77 78	50 00	65 00	80 00	50 00	52 40
20 cu. yd. concrete	8 00	15 00	8 00	7 00	8 00	8 00	12 00	7 00	8 00	125 00	6 50	7 50	8 00	7 50	7 95
Totals	$21,425	$25,338	$20,266	$26,738	$28,786	$29,012	$31,585	$31,932	$34,007	$34,331	$37,678	$30,118	$40,354	$41,341	$79,295

Engineering News

VOLUME 69 MARCH 13, 1913 NUMBER 11

An Example of Street Grade Improvement

The Pittsburgh "Hump Cut," described in ENGINEERING NEWS of Jan. 11 and Sept. 26, 1912, is carried on in two sections, the contract requiring the first section to be completed before the second section is begun. The first section, which comprises the work in the principal streets, was practically completed by the end of 1912. The view herewith shows the effect of the work on the principal street involved, the block in Fifth Ave. between Smithfield and Grant Sts. The white sloping line drawn on the picture is intended to represent the line of the street surface at the south building line before the hump cut was begun. The improvement in gradient is obvious. The steep slope of Fourth, Fifth and Sixth Aves., east of Smithfield St., has hitherto acted as a bar to the eastward expansion of the congested business district.



VIEW WEST ON FIFTH AVE. FROM GRANT ST. TOWARD SMITHFIELD ST., PITTSBURGH, SHOWING RESULT OF THE "HUMP CUT"

The hump cut involved extensive building changes, as we have already noted in our previous articles. One of the simplest items was the reconstruction of the basement stories of several important buildings, such as the Frick Bldg., shown in the left foreground of the view. This structure had been originally planned to be adaptable to an ultimate reduction of grade, and therefore the construction of a facade in the basement story was a relatively simple matter. The Carnegie Bldg., just beyond, also offered a not difficult problem, although the smaller amount of cut at that building made the adjustment less convenient.

The cost of the changes in buildings was evidently a very large item, much larger than the cost of the street work itself. That the city could undertake the hump-cut improvement at all was due only to the fact that by far the largest number of property interests affected by the change waived claims for damages, before work was undertaken. What this means will be appreciated to a small extent from the statement that the cost of the changes in the Frick Bldg. was about $100,000. The street frontage of this building represents less than 3% of the total street frontage affected by the cut. Much of the hump-cut frontage was occupied by old and low-grade buildings, which were not worth the cost of alteration. The district will, therefore, be in large part rebuilt.

Windbracing without Diagonals for Steel-frame Office-buildings

By R. Fleming*

If an apology is needed for adding to the literature of the above subject, it may be found in the fact that many of the methods given in technical papers for determining stresses due to wind loadings are not *workable*. That is, the average engineer to whom falls the lot of designing the average office-building has neither the time nor the ability to handle the cumbersome equations involved. One paper published a few years ago and now before the writer has for its purpose "to develop the exact theory of framework with rectangular panels, and then to suggest such short-cuts as may be of use in actual designing." This is an elaborate paper in which the theorem of four moments is used. A bent of two unequal bays, three columns and two girders, is considered and by the "short-cuts" seven equations are found from which the values of all the moments for the floor in question may be found. Whatever may be the merit of this and similar papers, it has not been recognized sufficiently to be followed to any appreciable extent. It is to be regretted that the treatment of the subject in our textbooks is not more complete and adequate.

Buildings like the Trinity, the Fuller, the Singer, the Woolworth, or the Metropolitan Tower, in New York City, are each in a class by itself, and of necessity careful study is given to the windbracing. For another and a large class of office-buildings, little or no attention is given to the matter of bracing for wind, either in the proportioning of main members or in the equally important matter of details.

Without further introduction the writer gives three methods in current use of calculating wind stresses and moments in office-buildings where diagonals are not permissible. Each method has its own advocates.

Considering a single bent: It will be assumed that all columns in any given story have the same sectional area and the same section modulus, that all girders of the same floor have the same section modulus, and that the joints are perfectly rigid. It is obvious that if the forces in the several members of the frame are small in relation to the stiffness of the members, the longitudinal distortions may be neglected; hence the adjacent joints occupying the corners of a rectangle will after distortion occupy the corners of an oblique parallelogram.

It is assumed that the point of contraflexure of each column is at midheight of the story. The first method described further involves the tacit assumption that the girders have their points of contraflexure at midlength. Specific assumptions as to the distribution of column shears and direct stresses are made in the several methods. In no one of the three methods are the assumptions strictly consistent. For example, in Method I the assumption as to location of points of contraflexure would make the distorted shape of panel constant in any given story, and from this would follow that the column shears must be equal; but the calculation gives column shears of different amount.

The resistance to overturning will cause a direct stress in tension on the windward side of the neutral axis, taken by all or some of the columns on that side according to the method used, and a direct stress in compression on the leeward side taken by the columns on that side.

Figs. 1, 7 and 9 give results obtained from calculations according to Methods I, II and III respectively. Loads and stresses are given in thousands of pounds and bending moments in thousands of foot-pounds. Direct stresses are given in parentheses ( ).

Method I

This is a restatement with some modifications of an article entitled "Windbracing with Kneebraces or Gusset-plates," by A. C. Wilson, in *The Engineering Record*, Sept. 5, 1908. A section or bent of the building is considered similar to a beam loaded as a cantilever.

If a beam of rectangular section be loaded as a cantilever with concentrated loads, it is possible by the theory of flexure to find the internal stresses at any point. If, however, rectangles be cut out of the beam between the loads, there will then be a different condition of stress. What was the horizontal shear of the beam will now be a shear at the point of the contraflexure of the floor girders, causing bending, and, as in the beam, the nearer the neutral axis the greater the shear. The vertical shear in the beam would be taken up by the columns as a shear at the points of contraflexure and the amount of this shear taken by each column would, as in the beam, increase toward the neutral axis. The direct stresses of tension or compression in the beam would act on the columns as a direct load of either tension or compression, and as in the beam would decrease toward the neutral axis.

Each intersection of column with floor girders would be held in equilibrium by forces acting at the points of contra-

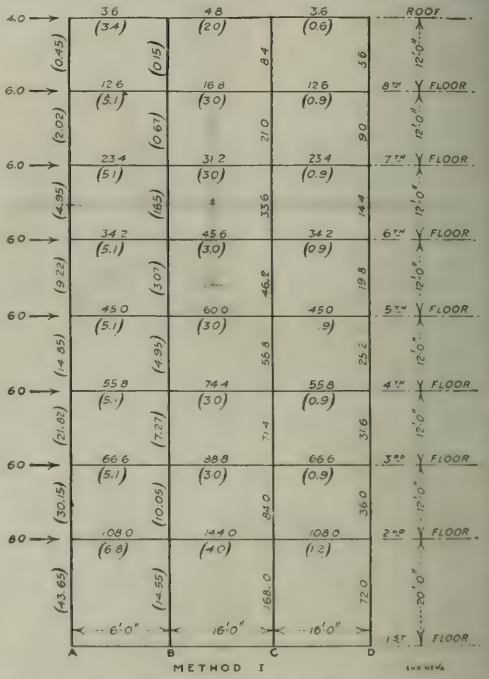


Fig. 1. Rectangular Building-frame: Direct and Bending Stresses Calculated by Approximate Method I

144.0 Moment of 144,000 ft.-lb.
(4.0) Direct stress of 1000 lb.

*Designing Engineer American Bridge Co., 30 Church St., New York City.

flexure; and to find all the forces acting around a joint at any floor the bending moments of the building at the points of contraflexure of the columns above and below the floor in question are found as will be explained later.

It is assumed that if a beam of constant, symmetrical cross-section and homogeneous material is fixed at both ends, and that if forces tend to move those ends from a position

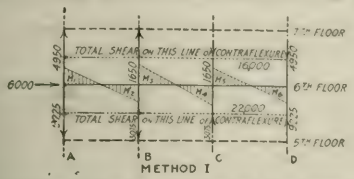


FIG. 2. COLUMN SHEARS AND GIRDER MOMENTS AT SIXTH FLOOR, CALCULATED BY METHOD I

in the same straight line to a position to one side with the ends still parallel, reversed bending will occur with the point of contraflexure in the center of the unsupported span. And since this condition exists in all columns and floor girders it will be necessary to find the shears at the points of contraflexure as well as the direct stresses in all members. .

Fig. 1 gives stresses and maximum moments in all members of a section of the building in accordance with the above statement.

The calculation of stresses and bending moments in members about the sixth floor will be given in detail. The direct stress in any column is assumed to be proportional to its distance from the neutral axis of the cross-section of the building. In the cross-section considered, the neutral axis coincides with the center line of the building. The total moment of the wind loads above the sixth floor about the line of inflection of the sixth-story columns must equal the moment of the direct stresses in these columns about the neutral axis. Let $8X$ be the direct stress in each of the sixth-story columns B and C, then $24X$ will be the direct stress in each of the sixth-story columns A and D. Hence we have

$$(4000 \times 30) + (6000 \times 18) + (6000 \times 6) = (24X \times 24) + (8X \times 8) + (24X \times 24)$$

From which $8X = 1650$ and $24X = 4950$.

In the same way for the fifth-story columns we have the equation

$$(4000 \times 42) + [6000 \times (30 + 18 + 6)] = [(24X \times 24) + (8X \times 8)] \times 2$$

From which $8X = 3075$, the direct stress in the fifth-story columns B and C; and $24X = 9225$, the direct stress in the fifth-story columns A and D.

The total horizontal shear on any line across the building is the sum of the wind loads above that line. The shear taken by any column in any story is proportional to the total horizontal shear in that story.

In Fig. 2, if X = shear of any fifth-story column at its point of inflection, then $\frac{16,000}{22,000}X$ or $\frac{8}{11}X$ = shear at point of inflection of the sixth-story length of the same column, and $\frac{6,000}{22,000}X$ or $\frac{3}{11}X$ = increment of shear taken by the column at the floor girder.

We are now ready to consider the forces about the first joint, or the intersection of Col. A with the sixth-floor girder, sketched separately as Fig. 3.

The difference between 9225 and 4950 = 4275 is taken up as a shear in the floor girder between Cols. A and B. The moments of the shears must hold the joint in equilibrium. Taking moments about the lower point of inflection we have

$$({}^{8}_{11}X \times 12) + ({}^{3}_{11}X \times 6) = 4275 \times 8$$

from which $X = 3300$, ${}^{8}_{11}X = 2400$ and ${}^{3}_{11}X = 900$. The bending moment $M1$ for the floor girder is $4275 \times 8 = 34{,}200$ ft.-lb. The bending moment for the fifth-story column is $3300 \times 6 = 19{,}800$ ft.-lb., and that for the sixth-story column is $2400 \times 6 = 14{,}400$ ft.-lb. The direct thrust on the floor girder is $6000 - 900 = 5100$.

Proceeding to the second joint, sketched in Fig. 4: The difference between 3075 and 1650 = 1425 acts as a shear in the girder between Cols. B and C. This added to the 4275 shear continued from the girder between A and B makes a total shear of 5700 in the girder. The equation of moments is

$$({}^{8}_{11}X \times 12) + ({}^{3}_{11}X \times 6) = (4275 \times 8) + (5700 \times 8)$$

From which $X = 7700$; ${}^{8}_{11}X = 5600$, and ${}^{3}_{11}X = 2100$, are the shears taken by Col. B to hold the joint in equilibrium.

The bending moment $M2$ of the girder from A to B at Col. B is the same as at Col. A with an opposite sign; $M3$, of the girder from B to C, is $5700 \times 8 = 45{,}600$ ft.-lb. The bending moment of the fifth-story column is $7700 \times 6 = 46{,}200$ ft.-lb., and that of the sixth-story column is $5600 \times 6 = 33{,}600$ ft.-lb. The direct thrust on the girder between B and C is $5100 - 2100 = 3000$.

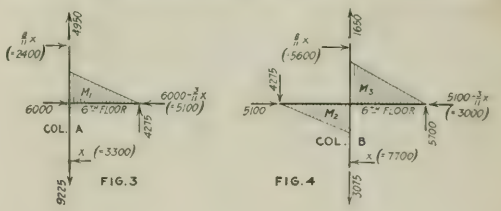
At the third joint, Fig. 5, the shear taken by the girder between C and D is $5700 - (3075 - 1650) = 4275$. From the equation of moments

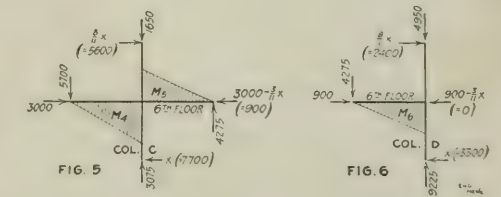
$$({}^{8}_{11}X \times 12) + ({}^{3}_{11}X \times 6) = (5700 \times 8) + (4275 \times 8)$$

whence

$$X = 7700,\ {}^{8}_{11}X = 5600,\ {}^{3}_{11}X = 2100$$

As expected, the moments in Col. C are numerically equal





FIGS. 3-6. SIXTH-FLOOR JOINTS OF BUILDING-FRAME, WITH STRESSES CORRESPONDING TO METHOD I

to those in Col. B, and the girder moments $M4 = M3$, and $M5 = M2$. The compression in the floor girder between C and D is $3000 - 2100 = 900$.

At the fourth joint, Fig. 6, we have

$$({}^{8}_{11}X \times 12) + ({}^{3}_{11}X \times 6) = (4275 \times 8)$$

the same equation as at the first joint, and hence the same numerical values for moments and shears.

The designer in following this method for the various floors will find many short-cuts. A relationship between the floors can soon be established. If the distances between columns are not even spaces, or the columns have different sectional areas, the direct stresses vary both in proportion to their distances from the neutral axis and their sectional areas. It will be necessary to first find the neutral axis of the cross-section in question and then the direct stresses. With these the shears and bending moments can be obtained.

Method II

This may be called the Portal Method. It is assumed that the horizontal shear on any plane is equally distributed among the columns cut by that plane. The

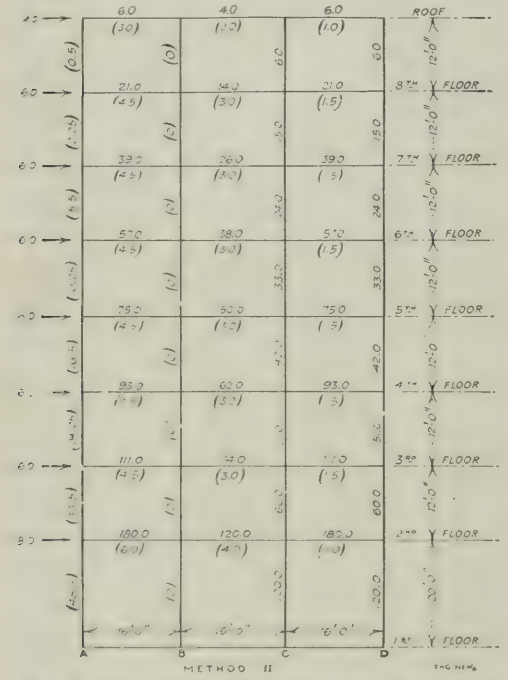


Fig. 7. Rectangular Building-frame: Direct and Bending Stresses Calculated by Approximate Method II

120.0 Bending moment of 120,000 ft.-lb.
(4.0) Direct stress of 4000 lb.

structure is also regarded as equivalent to a series of independent portals. The stresses and maximum bending moments for a cross-section of the building are as given in Fig. 7.

Taking any axis we find the direct stress in the fifth-story columns to be

$$\left(\frac{4000}{A} \times 12\right) + \left(\frac{6000}{A} \times 30\right) + \left(\frac{6000}{A} \times 18\right) + \left(\frac{6000}{A} \times 6\right) \text{ divided by } 16 = \frac{10,250}{A}$$

The direct stresses coming upon any interior column

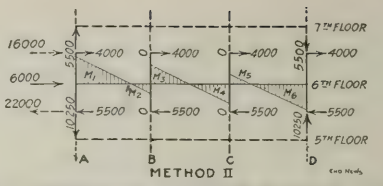


Fig. 8. Column-shears and Girder Moments at Sixth Floor. Calculated by Method II

from the adjacent aisles are equal in amount but opposite in direction. Hence their algebraic sum is zero and only the outside columns have direct stresses. This may be found directly for any story, say the sixth,

$$(4000 \times 30) + (6000 \times 18) + (6000 \times 6)$$
$$\text{divided by } 48 = 5500$$

Considering in detail, as in Method I, the sixth floor, we have in Fig. 8 the direct stresses and shears in the columns.

The shear in each girder is 10,250 — 5500 = 4750. The equations for bending moments in the girders can be written as follows:

$$M1 = [(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 16] = +57,000 \text{ ft.-lb.}$$
$$M2 = [(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 16] = -19,000 \text{ ft.-lb.}$$
$$M3 = [2(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 16] = +38,000 \text{ ft.-lb.}$$
$$M4 = [2(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 32] = -38,000 \text{ ft.-lb.}$$
$$M5 = [3(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 32] = +19,000 \text{ ft.-lb.}$$
$$M6 = [3(4000 \times 6) + (5500 \times 6)] - [(10,250 - 5500) \times 48] = -57,000 \text{ ft.-lb.}$$

The bending moment at the sixth-floor girder of each sixth-story column is 4000 × 6 = 24,000 ft.-lb., and of each fifth-story column is 5500 × 6 = 33,000 ft.-lb.

The compression in the floor girders is 6000 — 1500 = 4500 between Cols. *A* and *B*, 4500 — 1500 = 3000 between *B* and *C*, and 3000 — 1500 = 1500 between *C* and *D*. General equations can easily be deduced which will simplify the calculation of stresses and moments for other floors. If the spaces between columns are unequal, the direct stresses from adjacent portals will be unequal. This difference is a direct stress in the column between the two portals considered. If the columns have different section moduli, the horizontal shear taken by each column will be in proportion to its section modulus.

An interesting special case of this method is for buildings having self-supporting walls or where the outer columns carry floor loads only. For even spacing the exterior columns will carry only half the floor load of the interior columns. Assuming the section modulus of the column in the outer row to be one-half of that in the interior, the bending moments due to wind for all girders on the same floor for any transverse bent will be alike and the bending moments of the interior columns will be twice that of the outer columns. This is an ideal condition for the designer, the detailer, and the shop.

Method III

This may be called the Continuous Portal Method. The direct stresses in the columns are assumed to vary as their distances from the neutral axis, and the horizontal shear on any plane is equally distributed among the columns cut by that plane. Stresses and maximum bending moments for a cross-section of the building are as given in Fig. 9.

The direct stresses in the columns are found the same way and are the same in amount as in Method I.

Considering in detail the sixth floor, we have in Fig. 10 the direct stresses and shears in the columns. The

shear in the girder A to B and the girder C to D is 9225 — 4950 = 4275. The shear in the girder B to C is (9225 — 4950) + (3075 — 1650) = 5700.

The equations for bending moments in the girders can be written as follows:

M1 = [(4000 × 6) + (5500 × 6) = +57,000 ft.-lb.
M2 = [(4000 × 6) + (5500 × 6)] − [(9225 − 4950) × 16] = −11,400 ft.-lb.
M3 = 2[(4000 × 6) + (5500 × 6)] − [(9225 − 4950) × 16] = +45,600 ft.-lb.
M4 = 2[(4000 × 6) + (5500 × 6)] − [(9225 − 4950) × 32] − [(3075 − 1650) × 16] = −45,600 ft.-lb.
M5 = 3[(4000 × 6) + (5500 × 6)] − [(9225 − 4950) × 32] − [(3075 − 1650) × 16] = +11,400 ft.-lb.
M6 = 3[(4000 × 6) + (5500 × 6)] − [(9225 − 4950) × 48] − [(3075 − 1650) × 32] + [(3075 − 1650) × 16] = −57,000 ft.-lb.

The bending moment at the sixth-floor girder of each sixth-story column is 4000 × 6 = 24,000 ft.-lb., and of each fifth-story column is 5500 × 6 = 33,000 ft.-lb. The compression in the floor girders is 6000 — 1500 = 4500 lb. between Cols. A and B, 4500 — 1500 = 3000

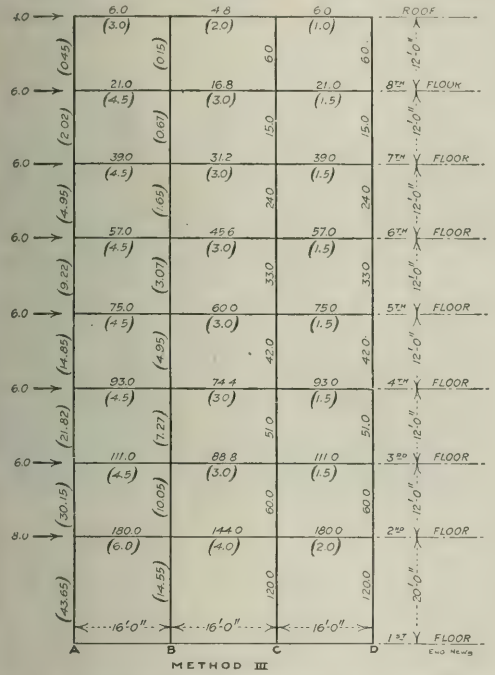


Fig. 9. Rectangular Building-frame: Direct and Bending Stresses Calculated by Approximate Method III

144.0 = Bending moment of 144,000 ft.-lb.
(4.0) = Direct stress of 4000 lb.

between B and C, and 3000 — 1500 = 1500 between C and D.

If the columns are unequally spaced or their sectional areas are different, the location of the neutral axis must first be found. The direct stresses in the columns will vary both as their distances from the neutral axis and their sectional areas. The horizontal shears taken by the columns will vary as their section moduli.

Conclusion

It can be said of each of the above three methods of calculating wind stresses that it is easily workable; and, to quote Prof. W. H. Burr: "So long as the stresses

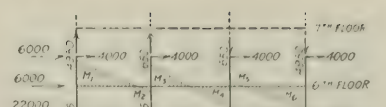


Fig. 10. Column-shears and Girder Moments at Sixth Floor, Calculated by Method III

found by one legitimate method of analysis are provided for, the stability of the structure is assured." At the present time Method I is probably more used than either II or III. It has been followed in designing a number of important buildings in New York City and elsewhere. Method II has been used quite extensively and Method III to a limited extent. The writer personally prefers Method I, though during the past ten years he has used both I and II.

It is often convenient to assume the wind loads on the basis of using the same unit-stresses as for live- and dead-loads. The Building Code of the City of New York calls for a horizontal wind pressure of 30 lb. per sq.ft. and allows working stresses to be increased 50% for windbracing. A wind load of 30 lb. per sq.ft. with unit-stresses of 24,000 lb. per sq.in. is equivalent to a load of 20 lb. per sq.ft. with a unit-stress of 16,000 lb. per sq.in.—the working stress generally used for live- and dead-loads. The diagrams of moments for any floor girder can easily be combined in one figure (see Fig. 11), and the total moment at any point read by scaling.

Some engineers neglect the wind stresses when the combined stresses, due to live-, dead- and wind-loads, do not increase by 50% the stresses due to live- and dead-loads alone.

Special attention should be given the column splices, and the connections of floor girders to columns. It is folly to add material to columns or floor girders to meet stresses and moments due to wind and then neglect their connections. Care should be taken that in all cases the connections are made strong enough for the bending moments coming upon them.

It is also advisable to calculate the building for wind in a longitudinal direction as well as transversely, a simple thing to do but which in some marked cases has been neglected.

Addendum

The wind loads and working stresses to be used are seldom left to the choice of the designer, being generally fixed by the building code of the city in which the building is located. The Building Code of the City of New York is mentioned above. The codes of Rochester, Jersey

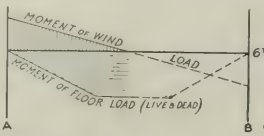


Fig. 11. Graphical Combination of Moments from Vertical Loads and Wind Loads in Floor Girder

City, Minneapolis, Atlanta and a number of other cities follow that of New York regarding wind pressure. Baltimore and Buffalo each specify a horizontal wind pressure of 30 lb. per sq.ft. and use the same working stresses for all loads. The Philadelphia law requires a provision for wind pressure of 30 lb. per sq.ft. on buildings in open spaces and on wharves. For high buildings in built-up districts the pressure specified is from 35 lb. per sq.ft. at the fourteenth story and above to 25 lb. at the tenth story and below. Working stresses may be increased 30% for wind loads. Chicago and San Francisco specify a horizontal wind pressure of 20 lb. per sq.ft. and allow an increase of 50% in working stresses for wind loads. The St. Louis building law has the provision: "Where there are buildings immediately adjoining, the wall surface covered by such buildings will be considered as not exposed to wind pressure." The building law of Boston has for its only requirement regarding wind the single sentence: "Provision for windbracing shall be made wherever it is necessary."

C. C. Schneider, in his "General Specifications for Structural Work of Buildings," calls for a wind load of 20 lb. per sq.ft. on the sides and ends of buildings and on the vertical projection of roof. He allows an increase of 25% for bracing and combined stresses due to wind and other loading.

An interesting monograph on "Wind Pressure in Engineering Construction," by Capt. W. H. Bixby, may be found reprinted in ENGINEERING NEWS of Mar. 14, 1895.

Downward Ventilation in a Schoolhouse*

By Clinton E. Beery†

The system of heating and ventilation for the Hall School Building, Rockford, Ill., was designed by and installed under the supervision of the author last summer, and has been in operation since the beginning of the last school year. In view of the revolutionary tendencies in the method, he desires to make a brief explanation, believing it will help to convey a clearer understanding of the theory on which this installation operates. Incidentally, he has applied for a patent on the system.

In the author's experience, based for the most part on practice and observation, he became impressed with the importance of saving, if possible, the great heat losses frequently found in fan-blast heating and ventilation, which seemed to him not only a waste, but actually a handicap to good results. With the knowledge that air of lower temperature and greater density always finds a position at the floor, and that higher temperatures prevail at the ceiling, he reasoned that, if the temperature near the ceiling could be controlled by some means other than the ventilating apparatus, the air customarily at a high temperature at or near the ceiling could be held to a minimum difference in temperature between the floor and the ceiling, and in this way a beneficial influence could be produced on the results obtained from the ventilating apparatus.

With this theory as a basis he first arranged in 1912 a regular school room for experimental work. This was in the northwest corner of the first floor, the coldest room in the building. On the second floor, directly over it was an exact duplicate of it. Each of these rooms was 26 ft by 31 ft., with ceilings 13 ft. 6 in. high. Each had 100 sq.ft. of glass exposure facing the west, and 50 sq.ft. of glass exposure facing the north. All windows are protected with wood grooved weather strips. These two rooms were operated the remainder of the heating season, and more or less careful observations of their operation noted.

During the early part of January a comparative test was made of the room temperatures, with 60 sq.ft. of wall radiation in the northwest corners. The air delivery in the rooms was 1544 to 1560 cu.ft. per min., measured at the exits. Twelve temperature readings were taken at 5-min. intervals in each corner of both rooms. Twelve readings of the temperature of the entering air were also taken at 5-min. intervals. The outside temperature at the time of the first reading was 2° below zero F., and at the time of the last reading 3° below. An extremely cold west wind, estimated at 18 to 20 miles per hour, was blowing. The maximum and minimum temperature, Fahrenheit, of the twelve readings taken are given in Table I:

TABLE I—MAXIMUM AND MINIMUM EXPERIMENTAL-ROOM TEMPERATURES DURING COMPARATIVE TESTS

Room	Northwest corner.	Northeast corner.	Southeast corner.	Southwest corner.
Experimental	70-67	71-70	70-68	69-67
Regular	83-80	70-68	69-66	69-64

The temperature of the entering air as per twelve readings, expressed in Degrees F., at 5-min. intervals, are given in Table II:

TABLE II—TEMPERATURE OF ENTERING AIR DURING TEST, EXPERIMENTAL AND REGULAR EQUIPMENT

Room	1	2	3	4	5	6	7	8	9	10	11	12
Experimental	74	70	72	73	70½	73	70	71	73	70	73	69
Regular	68	76	109	76	98	72	80	94	68	97	65	83

A simple device for humidifying was located between the tempering stacks and the fan inlet, and controlled by a humidistat, which was in a part of the building isolated from any influence or conditions in rooms Nos. 3 and 8. The relative humidity readings in the experimental room showed 63%, and in room with regular heating, 54%. With the encouraging results there obtained the Hall School was equipped throughout, during the summer, with the new method and has been in operation since Sept. 1, 1912.



FIG. 1. A ROOM IN THE HALL SCHOOL, AT ROCKFORD, ILL.

The building is of brick with wood-floor construction, two stories in height and full basement. It contains five regular school rooms on each of the two floors, with wardrobes, recitation rooms, principal's office, and corridors. The contents above the basement comprise 124,500 cu.ft. The building has a pitched roof with asbestos slate covering. One room in the basement is used for the mechanical equipment. The powerhouse is isolated and constructed mostly below grade. It communicates with the mechanical equipment room in the basement by a concrete tunnel 4 ft. wide, 6 ft. 6 in. in height, and 17 ft. long.

The mechanical equipment comprises a multivane fan (No. 13) direct connected to a side-crank engine, and operating at 174 r.p.m. All radiation and blast coils are operated on a vacuum system. Temperature regulation with intermediate control is used in each room. All galvanized ducts from the plenum chamber are of regulation design, with the exception of having been run to points where it was possible to take air delivery into the rooms from the front end.

Each of the ten school rooms is equipped as follows: A coil consisting of about three 1¼-in. pipes, extends entirely around the room approximately 5 ft. from the exposed walls and 6 ft from the inside walls. These pipes are suspended by special hangers 20 in. below the ceiling, as shown in an accompanying illustration. These coils are supplied individu-

*From a paper before the American Society of Heating and Ventilating Engineers, New York City, Jan. 21, 1913.

†Superintendent of Buildings, Board of Education, Rockford, Ill.

ally by a 1¼-in. riser from the main in the basement. The riser is equipped with a modulation valve about 31 in. above the floor, which gives it a slight offset. A single return takes care of two coils from the first and second floors respectively.

A galvanized-iron duct, 14x28-in., extends from the connection with the flues from the basement to a point centrally over the seating section of the room, from which the air is delivered to the room through an especially constructed diffuser, which breaks the velocity and directs the fresh air out in all directions over the breathing zone. This diffuser is located at a height to admit the air for ventilation to the room just below the stratum of the air at the ceiling, which is holding a uniform density by contact with the direct radiation.

The foul-air exits on the first floor are at the floor line in the four corners of the room, and are faced with sheet-metal frames and louvers. The air discharges into vertical galvanized pipes, 12 in. in diameter, which extend upward through the second floor.

The foul-air exits on the second floor are located the same as on the lower floor, and connect with the foul-air, 12-in. round pipes from below, increased to 17 in. in diameter. These vent pipes lead to the attic, where they are gathered in groups, and discharge to the outer atmosphere. The sizes of these vent pipes were simply increased by multiples of the cross-sectional area, the increase of resistance being relied



FIG. 2. STEAM TEST FOR AIR DIFFUSION; HALL SCHOOL, ROCKFORD, ILL.

on in the use of this method to maintain a sufficient static pressure in the rooms. All galvanized vent pipes below the attic are lathed and plastered on the outside. Only the exit frames are visible.

The air for ventilation is directed over the area of the room and is increasing in density at the moment of discharge. The air is forced out of the room at the floor line, producing a general downward velocity of approximately 2 ft. per min. with positive absence of lateral drafts or air currents. This condition is not disturbed until below the top of the exits, and even then there is no noticeable air movement over the floor, due to the comparatively small exits compared with the size of the room. Each vent screen contains 1.1 sq.ft. clear area, which equals 4.4 sq.ft. for each room.

Table III gives the velocity and delivery records of all exits for ten 1-min. readings, taken after the system has been put in operation.

TABLE III—RECORDS OF EXIT AIR VELOCITIES AND DELIVERES, HALL SCHOOL

Room Number	North-west exit.	North-east exit.	South-east exit.	South-west exit.	Total delivery cu. ft. per minute.
1	270	384	326	400	1518
2	390	394	396	350	1683
3	390	400	450	314	1709
4	332	354	460	446	1751
5	364	360	334	332	1529
6	336	346	345	342	1506
7	352	406	334	350	1586
8	434	428	448	366	1843
9	344	328	356	384	1553
10	412	336	370	282	1590

The following is a summary of observations made while this system has been in operation:

A temperature of 85° at the ceiling has been found to be sufficient as a maximum.

The temperature is controlled within a range of 1 deg. F., in all parts of the room throughout the breathing zone.

Air never enters the room above 73° to 74° F.

All rooms show an absolute sense of proportion and freshness.

There is no noticeable effect on the conditions of the rooms caused by the glass exposure, but tests show a slightly higher rapidity in downward movement of the air surface several inches in from the glass.

The air distribution is positive and under normal school-room conditions, the aërial envelope around any individual is moving downward and does not come in contact with that of another but is discharged from the room without rising again to the breathing zone.

There is an entire absence of drafts or currents, and the cold surface of desks and furniture does not contrast against high temperatures of atmosphere surrounding them, as is often complained of in other systems.

During the week of Dec. 15, 1912, tests were conducted by the school authorities. The temperature was uniformly 68°, and the humidity 58%. To demonstrate that no cross currents existed, live steam was introduced into the room through the diffuser in the ventilating system (Fig. 2). The steam distributed equally throughout the room and dropped gradually toward the floor, like a blanket, until it reached the level of the exits through which it escaped. Another test comprised the suspending of a large number of strings about the room with small pieces of paper attached to the end of each. The absence of any swaying of these pieces of paper showed that there were no cross currents generated by the ventilating system.

Some observations have been made of the amount of leakage. Readings of static pressures were taken with a differential draft gage, which, being balanced at zero outside of the building, showed 0.03 in. pressure when connected with the inside of the room. All windows are provided with grooved weather strips, and are more than ordinarily tight, yet all these tests where steam was turned into the room showed a decided leakage outward, particularly between the meeting rails of the sash, which were purposely pried slightly open to allow a chance to observe if leakage was inward or outward.

Economy of operation is evident, but as yet no effort has been made to determine any facts or comparative saving. The studies of this method are incomplete at this time, owing to not having the time or opportunity to continue an uninterrupted study.

[The author reports a supplementary test on Feb. 4, 1913, comparing one room with a room in another building. The one room (Hall School) had 10,296 cu.ft. contents, 873 sq.ft. exposed wall, 159 sq.ft. glass while the other had respectively 11,016 cu.ft. contents, 555 and 168 sq.ft. of wall and glass. The respective air deliveries were 1529 and 2024 cu.ft. per hr. and the air changes 6.5 and 5.5 per hour. The outside temperature rose from 9° F. at 7:20 a.m. to 14° at noon.

At 7:10 in the Hall School the entering air was raised to 72° and to 121° at the Freeman. From 7:35 a.m. to 8:45 the air at the Hall building was kept at 76° and from then to 11 o'clock did not vary 1° from 75°; from then to noon it was held at 70°. The room temperature rose from 40° to 68° (at 8:30) and remained constant until 10:30 when it rose. The rise was checked and the room was again at 68° from 11:10 to noon.

In the Freeman building room, the entering air was held between 120° and 126° until 8:45, when the room reached 76°. By varying the temperature of the entering air between 70° and 125°, the room temperature was held to within 2° above or below 70°. From 10:50 this result was secured by small variations of entering air temperature—first 75-105 and then 74°-85°.—Ed.]

The consensus of opinion with the members of the Board of Education is that the installation at Hall School is a decided success. Teachers are enthusiastic. Pupils show no signs of restlessness toward the close of the school day. The school principal claims a noticeable improvement in the work done by both teachers and pupils.

Heat Indicator for Bearings—A new heat indicator introduced by the General Electric Co. (Limited) consists of a paint for application to bearings or other parts of machinery and electrical apparatus, which normally is of bright vermilion, but on reaching a temperature of 120° F. shows a change of color and at 190° to 210° F. is almost black. When the temperature of the part falls below 120° F. the paint resumes its normal red color. It is claimed that the paint is practically indestructible, that it is unaffected by lubricating oils, that it prevents the formation of rust, and that the warning which it gives enables a machine to be stopped before any damage is done by overheating.—London "Times" (Engineering Supplement), Dec. 26, 1912.

Bulkhead and Pier for the New Port of San Diego, Calif.

San Diego, Calif., is the most southerly of the American and Canadian Pacific ports which are now engaged in a suddenly acquired activity to enlarge their facilities to meet the expected traffic through the Panama Canal. It is located at the extreme southern end of California, within 10 miles of the Mexican boundary line, on one of the most nearly land-locked harbors of the world. In natural facilities and location it is one of the finest ports on the Pacific coast, but its railway isolation is such that the advantages gained by its fine harbor are very apt to be offset by the difficulties of rail transportation to other points of the state. If San Diego were provided with a terminal for some transcontinental railway, or even with some eastern connection to a transcontinental railway, it would have undoubted advantage as a port of call for all ocean traffic to South America or through the Panama Canal, but unfortunately at present its only rail communication with the inland is a line along the coast to Los Angeles, and thence inland. There is in course of construction a railway to connect San Diego to Yuma, Ariz., where it will connect with transcontinental railways, but this road has so far only been built for 14 miles east of San Diego and, according to latest published statistics, it is under construction only for 40 miles. The distance from Yuma to San Diego is about 220 miles.

Nevertheless, the city of San Diego is now engaged in an extended port improvement. In 1910, the State of California voted $1,500,000 in bonds for the development of a harbor, but at the request of the people of San Diego the legislature afterward annulled this grant and deeded all tide land within the city limits to the city of San Diego on condition that the latter expend $1,000,000 in port developments along specified lines and within a specified time. On Nov. 14, 1911, the citizens voted the required $1,000,000 and under this appropriation work was immediately started. The legislative act carries with it certain saving clauses which prevent the city government from ever disposing of any portion of the tide land or the leasing thereof for abnormal periods, and it further protects the municipality by forbidding extended areas being leased to any party or aggregation of parties. Saving clauses are also inserted which prevent the monopoly of the berth or dock space.

A tentative scheme for future improvement has been made, and in the immediate development of a portion of this scheme work has been started on a bulkhead and pier at the north end of the city's waterfront and provision made for extensive dredging in the harbor proper.

The Bay of San Diego comprises an area of 22 sq.mi. It is completely land-locked and has a depth of water over the bar of 31 ft. at low water. The main channel inside the bay will average from 1500 to 2000 ft. in width and from 35 to 60 ft. in depth at low water. The tentative plans for the ultimate improvement of the harbor contemplate piers 1000 ft. in length and 130 ft. in width, with slips of 250 ft. They are designed to extend out diagonally from the reclaimed shore line. With this arrangement the ultimate berth room will aggregate approximately 30 miles. In addition to this there is to be reclaimed between 50 and 60 acres of tide land, which are to be made by dredging the necessary channels and depositing the material behind bulkheads. This dredging is now going on with two hydraulic dredges owned by the city. The floor of the bay is of such character as to present a firm foundation for harbor improvement, but at the same time it yields readily to dredging at a minimum cost. No fresh-water streams flow into the bay, so consequently when once dredged the work is practically completed, thus eliminating one of the chief sources of expense in harbor upkeep.

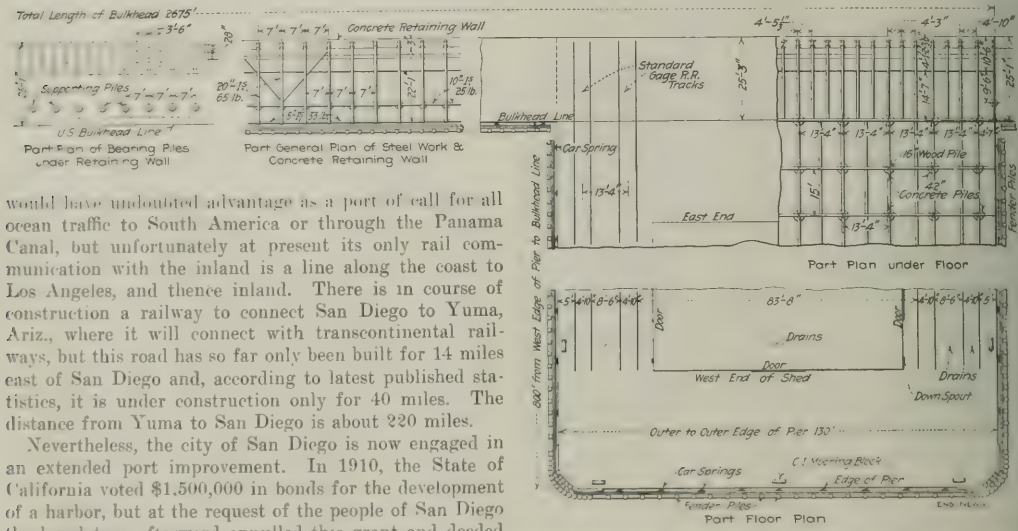


FIG. 1. PLAN OF BULKHEAD AND PIER, SAN DIEGO, CALIF.

The data regarding the new port may be summarized as follows:

Area of bay, 22 sq.mi.
Area of tide land, belonging to the city or port, 1450 acres.
Length of piers proposed, 1000 ft.
Width of piers proposed, 130 ft.
Distance between piers, 250 ft.
Length of bulkhead line in front of city, 11 mi
Approximate ultimate berth room in city control, 30 mi.
Depth of water over the bar at low water, 31 ft.
Depth of channel inside of bay, 35 to 60 ft.
Average width of channel, 1500 to 2000 ft.
Average rise and fall of tide, 5 ft.

The improvements under construction at present comprise a length of bulkhead some distance out from the present shore line, with a 130-ft. pier at one end of it (Fig. 1), besides the reclamation of tidal land, which is going on at the same time. The bulkhead, as will be noted from Fig. 2, consists of a gravity concrete retaining-wall, founded on wooden piles, against which the reclaimed tarth is pumped, and arrying in front of it a concrete-slab floor, resting at its inner edge on the retaining-wall and at its outer edge on concrete piles driven

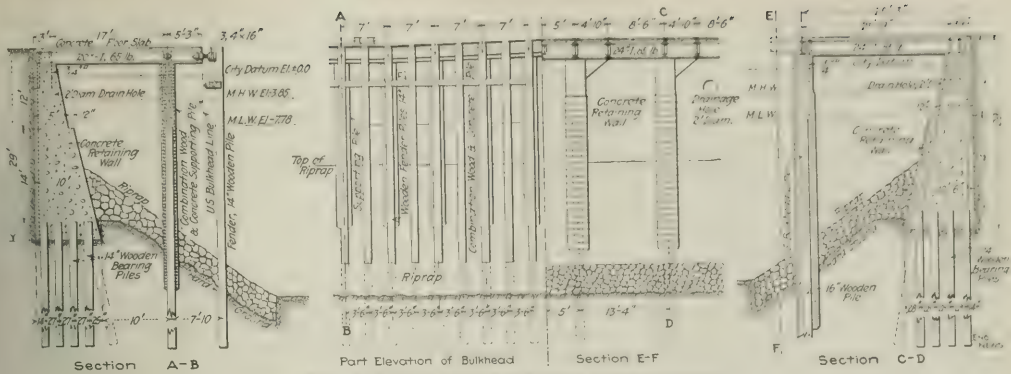


FIG. 2. DETAILS OF BULKHEAD CONSTRUCTION
[Section A-B at bulkhead proper; Section C-D at pier]

into the harbor. The main section of this extends for seven blocks, a distance of 2675 ft., while the pier extends out of one end of it a width of 130 ft.

Fig. 2 (Section A-B) shows a section through the bulkhead. The outside bearing piles, as will be noted in the figure, consist of wooden piles, 14 in. in diameter, driven into the harbor bottom and surrounded above water by concrete piles which carry on their upper ends the transverse I-beams, which are incased in concrete to form the floor-beams. The piles are made by first driving the timber pile, then sinking above it a hollow concrete cylinder, cast on shore, to a depth 4 or 5 ft. below the bottom of the harbor and filling the cylinder around the wooden pile with concrete. They are spaced 7 ft. c. to c. At the extreme end of the floor-beams there are spaced every 3 ft. timber fenders with car-spring buffers, spaced every 14 ft.

At Section C-D, Fig. 2, is shown the section through the portion of the bulkhead at the pier. The design is similar here to the bulkhead proper, except that a larger concrete pile carries the outer end of the floor-beam and the spacing of these piles is somewhat different. The pier is 130 ft. wide and 800 ft. long. The concrete piles are bracketed at the top to form column supports to the I-beams, which are incased in concrete and which carry in their turn a concrete slab with asphalt paving for a floor. Running along either side of the pier are two railway tracks of standard gage, which extend out from the shore and which will connect eventually with a municipal port railroad.

The supporting piles under the pier are being built according to a specification that reads as folows:

After dredging the bottom of the bay to the approximate depth required for the concrete footings to the piles, a steel cylinder caisson 7 ft. in diameter of sufficient strength to resist the external pressure of the water, and of necessary length to reach to the desired depth, shall be brought into position concentric with the center point of the pile to be constructed, it shall then be driven down into the mud and earth constituting the floor of the bay until the outside water is entirely cased off. The mud and water on the inside of the caisson shall then be removed and the earthern bottom excavated to a satisfactory depth, and a safe bearing ground of not less than 3 tons per sq.ft. is obtained for the concrete footing of the pile. After which, the wooden pile constituting the central core of the pile, shall be brought accurately into position, perfectly plumb, concentric with the exact point of alignment and driven down to a 30-ton safe bearing load, which shall be determined by the drop of a 2000-lb. hammer for a distance of 19 ft., with a penetration of ¼ in. for each of the last five blows of the hammer, the head of the pile being sawed off square, presenting a hard, firm surface to the hammer for each blow.

The top of the wooden pile shall be sawed off at right angles to its length, at any point between mean low-water mark and 18 ft. below the city datum plane of levels.

The wooden stave cylinder, reinforcing metal and the cement concrete shall then be placed into position all as shown on the plans hereto attached and in the manner as specified herein.

The inside of the steel caisson shall be free from water at all times during the construction, and under no condition shall any concrete be deposited under or into water.



FIG. 3. VIEW OF STEEL CAISSONS USED IN PILE CONSTRUCTION, SAN DIEGO HARBOR

The Engineer shall determine the depth of concrete footings for each pile, and he shall be the sole judge of the fitness of the bearing ground for the concrete footings to each pile constructed. No concrete shall be deposited upon said bearing ground until permission is given the contractor to do so by the Engineer.

In the event that satisfactory bearing ground cannot be had at a reasonable depth, then resort may be had to driving of wooden bearing piles in the manner as shown upon sheet No. 2, of the plans hereto attached. In no case shall resort be had to this form of construction without the written consent of the Engineer.

The steel caisson shall remain in place for at least 48 hours after the last concrete is deposited, and then removed with such care as to prevent any disturbance whatever of the completed work.

Immediately after the removal of the steel caisson, the completed pile shall be rigidly braced in all directions to absolutely prevent any movement or displacement.

Fig. 3 is a view of the two steel caissons used in making the pier piles. These caissons are made of boiler plate, ¾ in. thick in the bottom rings and ¼ in. thick in the top rings, with a heavy reinforced cutting ring on the bottom. A heavy wooden cap is used on top of the caisson to cushion the blows of the hammer, which in this case weighs 4000 lb. The derrick which manipulates these caissons is capable of lifting 100 tons, which capacity is nearly reached in pulling the caissons.

On the pier proper is to be built a steel-frame warehouse, 72 ft. clear in width and 765 ft. long, which will be provided with roller doors, skylights and ventilators all in accordance with the best modern practice. For facilitating the rapid handling of cargo a number of loading platforms and auto trucks will be provided. Alongside the pier 35 ft. of water will be maintained, and alongside the bulkhead 20 ft.

The harbor work is under the direction of the city of San Diego and under the special direction of Edwin M. Capps, Supervising Engineer, to whom we are indebted for the accompanying drawings and technical description.

The contract for the bulkhead was let to Shields & Son, San Diego, for $330,000; that for the pier to Messmer & Rice, Los Angeles, for $350,000. The city is doing its own dredging, with two suction dredges, one with a 12-in. and one with an 18-in. pipe. It is expected that the work will be completed in February, 1914.

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Electric Power Distribution for the Panama Canal operation and lighting will require 246 miles of lead-covered cable, which is about 40% of the total amount placed by the largest electric power company in the United States during the 20 years preceding 1908. These cables will be carried through the lock walls in vitrified clay ducts. On account of the large amount of cable to be placed in the ducts a special device using an electrically operated winch was resorted to.

Before the operation is begun the ducts are carefully cleaned. Then a small steel lead wire is pulled through, and by this means a manila cable is drawn through the duct. The electric cable is attached to the rope, and the winch is set in motion. By this method it is possible to pull 900-ft. lengths of No. 0000 B. & S. gage lead-covered cable at one time, whereas the average length by other methods is about 200 ft. The outside diameter of this cable is a trifle more than 2 in. In such a length the cable passes through two intermediate manholes, and is greased at three points to aid in reducing friction. The advantage of pulling the long sections at one operation is that the making of two joints is saved and this is a considerable economy. The winch used for the purpose is mounted upon trucks operated over the return tracks of the canal towing system. The cable is placed directly below the floor of the operating tunnel, and therefore the pull by the winch is direct.

In addition to the amount of cable mentioned above, the lighting system will require about 112 miles of wire of miscellaneous sizes from Nos. 12 to 00 B. & S. gage.

Oil Pipe Lines in California

By B. K. Stroud*

The first oil pipe line of any length in California was built by the Standard Oil Co. in 1901 from the Kern River fields in the San Joaquin Valley to Point Richmond, on San Francisco Bay, a distance of about 300 miles. The line was 8 in. in diameter and the pumping stations were placed approximately 24 miles apart, as was the company's practice in the Eastern oil fields. By reason of the heavy gravity of the oil of the Kern River fields (12 to 16° Baumé) it was found that the pumps could not move it, although steam heating to high temperatures was resorted to. As a result, twelve intermediate stations were added, and the oil was then moved through to Point Richmond satisfactorily.

The Associated Pipe Line Co., in 1907, built a pipe line from the Kern River fields to Porta Costa, a distance of about 280 miles, Porta Costa being at tidewater, about 30 miles north of San Francisco. This also was an 8-in. line, but the pipe, instead of being smooth, was corrugated or "rifled," the corrugations making one complete revolution in every 10 ft. This was a new departure from anything previously tried in pipe-line practice, and its working was watched with great interest. In theory, enough water was to be injected into the line at each station to encase the oil in a water envelope, thus giving the oil a water bearing and reducing the friction. This pipe is known as the "rifled-pipe" by reason of the rotary motion it imparts to the oil. It was found in practice that 10% of water was about the necessary proportion to move the oil readily, and by reason of the reduced friction the Associated Pipe Line Co. found it practicable to put the pumping stations approximately 26 miles apart. The oil was heated slightly in order to bring it freely to the pump from the tanks, high temperatures not having been found necessary. This line has been in use for the past five years and is a pronounced success.†

There are now several oil pipe lines in California, but their equipment is much the same in each case. In general, each pumping station is composed of from three to five water-tube or Scotch marine boilers of 200 to 250 hp. each, fired with oil, and two horizontal duplex compound steam pumps connected in manifold. The oil end of the Associated Pipe Line Co.'s pumping engine is 9½x36 in. and moves a barrel of oil per revolution. The engines are run from 12 r.p.m., on heavy gravity oil, to 22 r.p.m. on higher gravity oil, and will move from 15,000 to 25,000 barrels per 24 hr. An 8-in. pipe line equipped with these pumps has moved over 30,000 bbl. of oil per 24 hr., or over 1,000,000 bbl. per month. The average, however, is about 22,000 per 24 hr. Each station has from two to five tanks of 55,000-bbl. capacity each, and if the topography of the country permits, these are set above the level of the pumps, in order that the oil may flow by gravity to the latter. The suction lines are from 20 to 28 in. in diameter. Four men are in charge of each station, working in pairs for alternate shifts of 12 hr. each. Telephone and telegraph lines parallel all pipe lines, and the companies have installed shops at important points, so that breaks in the lines or the machinery are taken

*Universal Oil Co., Wasco, Calif.

†The use of rifled pipe on an earlier oil pipe line of the Southern Pacific Ry. was described in an article by J. D. Isaacs, Consulting Engineer of the Harriman Lines, in "Engineering News" of June 7, 1906.

care of with dispatch. The pumping stations and pipe lines are built in a substantial manner, and their efficiency is correspondingly high.

Nearly all the oil pipe lines in California are of steel pipe 8 in. diameter, weighing 28 lb. per ft. and tested to 1500 lb. pressure per sq.in. The working pressure is about 750 lb. Openhearth steel pipe is preferred, but bessemer steel is used extensively. The pipe is all made at Eastern mills, and the sections are 20 ft. long. Ordinary screw couplings are used on nearly all the lines, although in some cases there are flanged unions joining the blank ends of the joints. There is practically no leakage at the joints, the lines being generally tested under water pressure before oil is pumped through them. No air chambers are used, but relief valves are often placed at the summits.



FIG. 1. MACHINE FOR MAKING SCREW JOINTS ON OIL PIPE LINE IN CALIFORNIA

The pipe lines, as a rule, have their sources in the warm interior valleys of the state and before reaching the coast have to pass over high mountain ranges, and are therefore subjected to more changes of heat and cold than is usually supposed. Each company therefore has its own problems to solve, so California has been the pioneer in many branches of the pipe-line transportation practice. The low-temperature conditions at the high summits are met by burying the pipes much deeper than in the valleys, the depth being 3 to 4 ft. below the surface, instead of 20 to 24 in. As to the profiles, the Standard and Associated pipe lines through the San Joaquin Valley are practically level; the Coalinga-Monterey line has an elevation of about 300 ft. at its initial pumping station in the oil field, and 20 miles beyond this it reaches an elevation of 2300 ft. The General pipe line from Maricopa to Los Angeles has a maximum elevation of about 4000 ft. All the lines terminate a few feet above sea level. In curvature, it is aimed to have a radius of not less than 150 ft. for changes of direction.

In laying its lines, the Associated Pipe Line Co. cuts a trench 18 in. wide, and the pipe is thrown to opposite sides of the trench every 100 ft., thus providing for expansion in the line. The Standard Oil Co. does not provide for expansion. The lines are buried at least 20 in. deep, and in crossing a marsh or stream the lines are placed on trestles. As a protection to the lines, coatings of especially prepared asphalt are applied after the pipe has been scraped to remove all mill scale. The pipe is then wrapped with an asbestos or fiber paper, after which another heavy coat of paint is applied. This work is very necessary to protect the line from moisture and alkali in the soil. Otherwise the life of the pipe would be short. Pipe-laying, trenching and backfilling machines have been invented which do the work of several men and insure more uniform results. The trenching machines are ordinary power-driven bucket machines, or revolving wheels carrying buckets. Backfilling machines are road graders or V-scrapers drawn by horses.

A pipe-laying or pipe-jointing machine has been invented by Mahoney Brothers which will lay 7000 ft. of pipe per day with a complete crew of 20 men, as against 50 or 60 men with tongs. Fig. 1 is a view of the machine and Fig. 2 shows it on a pipe line. It is run on the pipe, which it uses as a track. The motive power is supplied by a marine or automobile gasoline engine of the four-cylinder vertical type, water cooled, the machine carrying an ordinary auto radiator and fan. The illustrations show the machine and its position on the pipe. The line runs through a 10-in. pipe or sleeve under the machine and when the latter is ready to travel, the legs which support it on the ground are automatically drawn up until the machine rests on the pipe. A clutch is then thrown in, which causes the small rollers inside the 10-in. sleeve to revolve, thus moving the whole forward. It is prevented from turning over by a long lever on the side, which is handled by the men. The pipe line is supported at the end by blocking and as soon as the machine reaches the end of the joint, the legs are again thrust to the ground and the weight of the machine taken off the line. A joint of pipe is swung in by the boom, automatically



FIG. 2. LAYING AN OIL PIPE LINE IN CALIFORNIA, WITH A MACHINE FOR SCREWING UP THE JOINTS

placed into position and caught with the grip, which rapidly screws it up. This grip is operated by an ordinary automobile clutch. The machine is further supported when on the ground by cross pieces of wood, which prevent it from turning over into the trench.

The Standard Oil Co. has large tank farms both at Bakersfield and Point Richmond. In the latter city it has its refinery, and all the oil taken from the San Joaquin Valley by the company goes to that point. The Associated Oil Co. markets the oil for fuel, and maintains a fleet of tank steamers and oil cars for that purpose. Its equipment at Porta Costa is such that it can load a 55,000-bbl. tank steamer in less than 2 hr.

Mortality Statistics of the Pennsylvania Coal Mines, during 1912, are contained in the annual report of the Department of Mines. In the bituminous branch, 160,973,500 tons were mined, 182,700 men and boys employed, and the death list summed up to 437. In the anthracite fields, the production was 84,258,100 tons, and of the 175,900 employees, 593 were killed.

A New Module or Constant-discharge Device for Irrigation Works

An irrigation module without moving parts, which effects an approximately constant discharge of water under varying heads by means of a series of obstructing plates, let part way down into a trough, which is rectangular in section and circular in plan, has been devised by A. Shirra Gibb, executive engineer, Irrigation Department of Punjab (Lahore, India). The baffle-plates serve to destroy the head in excess of what is needed to give the desired volume. We are indebted to Mr. Gibb for the following description of the device:

In its simplest form the apparatus, in which the regulation of the supply is effected, consists of a semi-circular

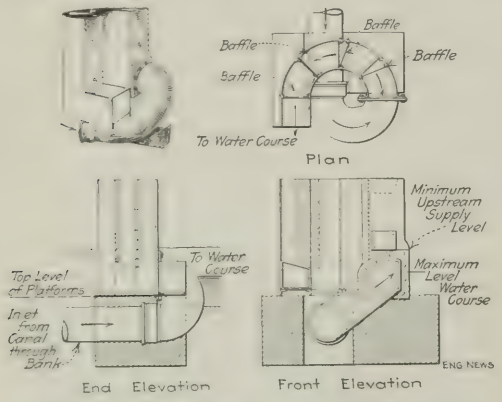


FIG. 1. THE GIBB IRRIGATION MODULE

[in plan], flat-bottomed, steel trough of considerable depth, round the bottom of which the water flows (see accompanying sketch and details, Fig. 1). The water enters the trough at one end through a 180° bent cast-iron pipe, the upstream end of which communicates with the canal through the bank by means of the requisite length of straight pipe. The exit is at the other end of the trough.

The 180° bend and the semicircular trough together form a complete loop round which the water flows and in which a condition of free vortex flow becomes established. In this condition the water at the outer circumference of the stream is kept up at a comparatively high level by its centrifugal force and the surface curves down convexly toward the inner circumference. The height at which the water flows round against the outer circumference of the trough depends on the velocity, being higher the greater the velocity.

A series of baffles are fitted at intervals across the upper portion of the trough, their lower edges being cut and bent in such a way as to allow just the required discharge of water to flow below them uninterrupted. These diaphragms come into play whenever the head of water in the canal is such as to cause the water at the outer circumference of the trough to rise above their lower edges. When this happens a portion of the stream at its outer circumference is interrupted by the diaphragm, and its centrifugal force being thus destroyed, the water falls across the stream to its inner circumference, where the surface is low. This fall of the water and the circulating cross or radial flow which it produces uses up the energy that the water had by virtue of the increased head in the canal, and leaves only sufficient to discharge such supply as can pass undisturbed under the remaining diaphragms.

As the head increases and more energy has to be eliminated the diaphragms come into action in turn, beginning from the upstream end of the trough, but no action can take place downstream of the point at which the energy in the water is reduced to the required amount. Thus, the correct supply is discharged constantly in spite of variations of head in the canal.

The minimum head required to give the correct supply is very small, being very little more than is carried by the water in the form of velocity head. This is an important point because the head available is often only a few inches.

There can be no question of this module being tampered with by those interested in the water-supply, because short of complete demolition there is no means by which it can be made to give more than its correct supply; and silt or other matter in the water obviously cannot interfere with its action.

The module is in actual use in India, where about 100 have been installed on Punjab Canals—mostly of an earlier and more complicated design, but employing the same principle.

The irrigation authorities in Sind and in Bengal have installed some of the latest type on their canals. The agricultural departments of Punjab and Bombay each have modules of the latest type installed at their experimental farms for regulating and measuring the quantity of water given to experimental plots. These installations have given entire satisfaction.

As supplementing the description by Mr. Gibbs, we

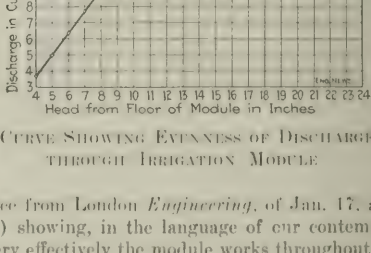


FIG. 2. CURVE SHOWING EVENNESS OF DISCHARGE FLOW THROUGH IRRIGATION MODULE

reproduce from London *Engineering*, of Jan. 17, a curve (Fig. 2) showing, in the language of our contemporary, "how very effectively the module works throughout its designed range of operation, which in this case is from 9 to 18 in." It may be added that *Engineering* of the date named contains a number of illustrations of the device which were also forwarded to us, but are not reproduced here as our Fig. 1 clearly shows the working principle of the module.

The Gibb module is made by Glenfield & Kennedy, of Kilmarnock, Scotland, under a license from Mr. Gibb as patentee.

The Automobile Testing Laboratory, maintained in New York City by the Automobile Club of America, and which it was recently reported was to be abolished, will be continued by a recent decision of the Board of Governors of the Club.

Antityphoid Vaccination in the Reclamation Service

By Dr. Hugh A. Brown*

Although sporadic cases of typhoid fever have been reported at long intervals from a few of the larger construction camps of the United States Reclamation Service, these camps have never experienced an epidemic of the disease. This is probably largely due to the fact that from the outset every precaution has been taken to maintain the highest degree of sanitary excellence possible. On the larger works, where often hundreds of men are concentrated in the camps, physicians are employed by the Service, either under contract or holding civil-service appointments. The camps are carefully policed and every attention given to the proper disposal of refuse, purity of the water-supply, the extermination of the so called "typhoid fly" by means of trapping and the destruction of its breeding places, and other incidental sanitary measures tending to maintain the health of the camps at the highest point. Not the least of the reasons for this action on the part of the Service has, of course, been the knowledge that efficiency and health go hand in hand.

Consideration of the remarkable results obtained in the Army, as indicated by the various reports of Major F. F. Russell and others, naturally led to the belief that, in its efforts to maintain high efficiency through proper sanitary measures, the Service should not overlook the prophylactic value of inoculation with antityphoid vaccine. Negotiations were acordingly entered into with the War Department and arrangements made in July, 1912, whereby Major Russell, of the Army Medical Corps, in charge of the bacteriological laboratory of the Army Medical School, was directed to furnish the prophylactic when and in the amounts requested by the Reclamation Service, "payment to be made at the rate of 12½c. for each complete treatment, by transfer of funds at stated intervals."

Compulsory vaccination of the employees of the Service was, of course, impossible, but it was believed that a large proportion would volunteer for treatment if the dangers of infection and the advantages of prophylaxis were fully presented to them. A beginning along this line was made by publishing in the *Reclamation Record* (August, 1912), the official organ of the Reclamation Service, an article contrasting the results obtained in the Army subsequent to compulsory vaccination with conditions as they existed prior to the treatment, briefly describing the method of inoculation and the reactions that might be expected, and urging all field employees to volunteer for treatment.

About the same time there were sent to the supervising engineers, project engineers and project managers copies of Circular No. 7 of the Surgeon General's Office, which describes the method of inoculation, contraindications, and the care of the prophylactic during the course of treatment, together with copies of an article by Major Russell on "Results of Antityphoid Vaccination in the Army in 1911, and Its Suitability for Use in Civil Communities." In addition, the projects received several copies of a circular to be posted in conspicuous places around the camps. This circular, written in more or less popular style, called attention to the danger of contracting typhoid fever, the possible economic loss to the individual and the Service, the comparative harmlessness of the inoculation method of prevention, and the ordinarily slight reaction resulting from inoculation, closing with the folowing injunction:

> Typhoid fever can be prevented.
> You can aid by being vaccinated.
> Prevention beats the physician and undertaker.
> Healthy persons may have typhoid tomorrow.
> Only those vaccinated or who have had typhoid are immune.
> Immunity lasts three years.
> Don't hesitate. Volunteer today.

That the employees took a lively interest in the matter was shown by the number of volunteers. During the fall and early winter requests were received for vaccine sufficient to inoculate approximately 500 persons, while up to Feb. 25, 1913, enough of the prophylactic to inoculate 625 persons has been sent to 19 projects and field offices, at a cost to the Service of $78.13. Each treatment consisted of three inoculations at ten-day intervals, the first of ½ c.c. (7½ m.), containing approximately 500,000,000 bacteria, and the second and third of 1 c.c. (15 m.), containing one billion each.

The reports received by the Service regarding the general reactions following inoculation show that in over 92% of the cases such reactions were either absent entirely or mild in character (i.e., presenting a temperature above normal and below 100°; or normal temperature with headache and malaise) following the first two doses, while these results were obtained in all cases following the third inoculation, no moderate or severe reactions being recorded. The reactions were found to be far less severe than those generally accompanying vaccination for smallpox, and in only three or four instances were employees incapacitated for work, and then only for a few hours.

As above stated there have been no epidemics of typhoid fever in the construction camps of the Service. An epidemic has, however, occurred recently at Malta, Mont., a small town with a population of about 450, located on the Milk River project. About twenty cases of the disease developed in a hotel in which the drinking water was furnished from a shallow well. During the period of the epidemic four employees of the Reclamation Service were living at the hotel, two of whom had received the antityphoid treatment prior to the outbreak, while a third had recently had typhoid and therefore did not take the treatment. The fourth man had declined to be inoculated and was the only one of these four to contract the disease. The value of this as an object lesson need not be commented upon.

The cost of typhoid fever per patient, irrespective of lives lost, was estimated in the 1907 epidemic in Pittsburgh at $138, while Dr. Kober estimates the annual loss from this disease in the United States at $350,000,000. It is, of course, impossible to state how many cases of typhoid, if any, among the field employees of the Reclamation Service have been prevented by the use of this latest of prophylactic measures, but, on the basis of the above figures, the prevention of only one case would more than justify the small expenditure made. In this connection it is believed that similar preventive measures might, with propriety, be taken by other employers of labor concentrated in construction camps or otherwise exposed to infection with the typhoid bacillus.*

*U. S. Reclamation Service, Washington, D. C.

*This has been done in a few instances.—Ed.

Action of Acids, Oils and Fats on Concrete

The action of acids, oils and fats upon concrete was the subject of a paper by W. L. Gadd, delivered Dec. 12, 1912, before the Concrete Institute at London, England. In general, Mr. Gadd's conclusions, made as the result of some rather limited study, are the same as have been held for some years in this country, namely, that vegetable and animal oils are destructive of concrete, but that mineral oils have apparently no effect upon concrete which has reached a certain degree of set. His paper, however, was misleading in one respect, in that he seemed to assume that the recent advocacy in this country of oil-mixed concrete as a waterproof material included animal and vegetable oils as well as mineral oils. We quote below a portion of Mr. Gadd's paper:

Neither cement nor concrete will withstand the action of hydrochloric, nitric and sulphuric acids. They decompose and dissolve the constituents of cement, even in dilute solution. Even a weak acid, like carbonic acid, has a distinct action upon cement, which, suspended in water, can be practically entirely carbonated by passing a current of carbon dioxide into it. The action of organic acids, such as lactic and butyric acids, tannic acid, tartaric and citric acids, and acetic acid or stale beer, is not so marked; but it is very probable that the whole of the series of higher fatty acids will be detrimental to concrete. The tendency of organic acids to combine with carbonate of lime is much less than with hydrate of lime, and it follows that an acid which would be dangerous in contact with green concrete might be perfectly harmless in contact with old or indurated concrete. Thus, stale beer has a distinctly detrimental action upon new work, but once the concrete has indurated by exposure to air for some time, the acid of sour beer has little action upon it. Fresh beer has, itself, a weakening action on green concrete; but the deterioration in this case is due to the sugar and other organic constituents of the beer, and not to the action of beer acids.

The author submitted some test pieces of neat and of 1:3 mortar briquettes, first to the action of pure water and second to the action of beer. The test pieces were gauged with water in the usual way, and after 24 hr. in moist air were immersed in water and beer, respectively, until due for breaking. It was found that the briquettes kept in water were about 10 to 15% stronger than those kept in beer. The author further says:

Lactic acid is produced by the fermentation of milk, and is a possible acid to come in contact with concrete structures in farm buildings. The action of this acid is confined to combination with calcium hydrate, forming calcium lactate. This salt is soluble in water, and in wet situations would be readily leached out of concrete in which it was formed, so that the deleterious effect of lactic acid would consist in the gradual removal of the lime hydrate, which plays an important part in the induration of concrete. For practical purposes, it is probable that this action would be very small.

Some tests were made to show the effect of prolonged immersion in a solution of lactic acid, prepared by fermenting milk and removing the curd. Test pieces were placed in water and in whey, but it was found that the results of the two sets of briquettes were so close that no destructive action of the lactic acid could be claimed. The conclusions of the author in regard to the whole matter are given below. It might be said that his tests on the waterproofing of different types of concrete do not appear to us to be very reliable.

CONCLUSIONS

1. The addition of oil or fat of any kind to concrete results in a weakening of the strength.

2. Animal and vegetable oils have a direct action on green concrete, and in time will bring about its destruction.

3. Indurated concrete is less liable to be attacked by oils and fats.

4. Oil-mixed concrete is not rendered more waterproof. The least permeable concrete is, in the author's opinion, a dense mortar in which the aggregate is properly graded to fill the voids.

Water Ram in Water-Works Distribution Systems

Two papers on water ram were read at the meeting of the New England Water-Works Association on Jan. 9, 1913. An abstract of each follows:

Lawsuit over an Hydraulic Elevator at Northeast Harbor, Me., and Tests of Effect of Locomotive Standpipe Operation at Ellsworth, Maine

Charles W. Sherman, principal assistant engineer of Metcalf & Eddy, Boston, Mass., related an experience with an hydraulic elevator supplied by the Northeast Harbor Water Co. (Me.), which led to some tests being made on a locomotive standpipe connection, at Ellsworth, Me.

The Northeast Harbor Water Co. supplied an hydraulic elevator in a hotel through a 4-in. pipe 300 to 400 ft. long, connected with an 8-in. supply main at a point two or three miles below the lake intake. The static pressure at the hotel was 30 lb. and a relief valve, set at 45 lb., was installed near the elevator.

The company pressed the hotel to install a tank for the supply of the elevator. After litigation, the State Supreme Court held that this request was reasonable.

Mr. Sherman was called in to testify for the hotel. Local data as to the increase of pressure caused by the operation of the elevator not being available, experiments were made on the water-works of Ellsworth, Me., where the court was being held. For this purpose, a 4-in. pipe, some 400 ft. long, supplied a locomotive standpipe under a normal pressure of 68 lb., was selected. This pipe connected with an 8-in. main which came from a distant reservoir.

Quoting now from Mr. Sherman's paper:

The pressure gage was attached to a house service pipe about 150 ft. from the locomotive standpipe, and the standpipe valve was opened wide, as rapidly as possible, left open until a condition of steady flow was obtained, and then closed as rapidly as possible. The maximum velocity in the 4-in. pipe is estimated to have been not less than 10 ft. per sec. The time of opening the 4-in. valve was 30 sec., and the time of closing was 20 sec. The pressure dropped almost immediately upon starting the valve from 68 to 28 lb., or to 41% of the normal; and at the instant of closing the pressure gage registered 134 lb., or 202% of the normal.

This maximum pressure is not great enough to be dangerous to any well-constructed pipe system, although the sudden fluctuations would doubtless be annoying at times.

The officers of the water company presented gage readings showing what the actual fluctuations had been in various parts of town. The significant figures, as taken down during the testimony, are as follows:

PRESSURES OBSERVED AT VARIOUS PLACES DURING OPERATION OF HYDRAULIC ELEVATOR

Normal	Pounds per sq. in. Highest	Pounds per sq. in. Lowest	Percent of normal Highest	Percent of normal Lowest
56	75	40	135	71
58	60	35	104	60
55	62	32	112	58
32	40	10	126	31
32	50	10	156	31
60	80	40	133	67
58	85	35	147	60
55	75	35	136	63
51	70	25	138	16
51	70	28	137	55
30	50	10	167	33
30	50	8	167	27
28	60	10	213	35

The foregoing figures show that in general the operation of the elevator caused a drop in pressure ranging from 40% to between 60% and 70% when the valve was opened, and an

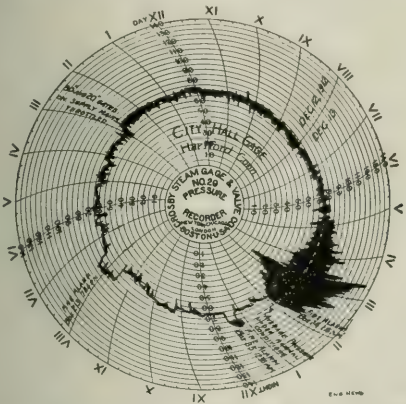
increase in pressure, or water ram, amounting to from 30 to 50% of the normal pressure under ordinary circumstances, and sometimes runing up to about 100% increase in pressure.

These results confirm in a general way the conclusions reached by the writer from the experiment described above—that the pressure might drop about 60% below normal when the valve was opened, and rise to a maximum of about 100% above normal at the moment of closing the valve. These fluctuations are sufficient to cause annoyance, but, where the normal pressures are as low as in the cases cited, should not be dangerous to the pipes.

None of these results can be applied to conditions differing materially from those quoted above, but they may serve to give some indication of the extent of the water hammer that may be experienced in a small water-works system from the rapid closing of valves or fire hydrants.

Experiments with Locomotive Standpipe and with Fire Engines at Hartford, Conn.

Supplementing Mr. Sherman's paper, Caleb Mills Saville, chief engineer of the water-works of Hartford, Conn., recounted some observations which he had made on the works under his charge. These observations were prompted by several breaks in the water mains, which had been attributed to the operation of the locomotive



Pressure Recording-gage Chart, Hartford Water-works System, Showing Vibrations Caused by Fire Steamers

standpipe at the main station of the New York, New Haven & Hartford R.R.

A recording pressure gage on the 8-in. lateral supplying the standpipe showed extreme vibration of 120 lb. per sq.in. Another gage, at the City Hall, about a half mile from the station, showed "that the water ram impulse is transmitted to considerable distance through a distribution system with a decidedly appreciable force."

Average conditions attendant on locomotive filling through the 8-in. lateral, connecting with a 12-in. and 16-in. main show a velocity in the lateral of 9.5 ft. per sec., and a period of flow of 2 min. 50 sec. The quantity usually drawn is 4230 gal. per locomotive, but the tanks on the through locomotives have a capacity of 6000 to 7000 gal.

Various expedients for lessening the ram have been discussed with the railroad officials. There are summarized and commented on by Mr. Saville as follows:

(1) By a slower motion valve on the standpipe. This is objected to by the railroad people on account of delay to train service. (2) The use of a water cushion valve on the standpipe which would act similar to the air checks on doors. This device is now in operation in various places and when new works very satisfactorily. After constant use, however, the parts wear and if repairs are not made the conditions of ram become as bad as before installation. (3) An air-pressure tank or chamber may be installed so devised that theoretically at least the shock of the quick-closing valve will be mostly taken up by an air cushion. Such a device is in operation in several places, but it is understood to be not entirely satisfactory. This condition may be due, however, to a defect in installation rather than being inherent to the system. (4) An elevated and independent tank may be used, and this from a water-works standpoint is probably the most satisfactory solution of the problem. In this case the water may be drawn out as quickly as desired and the tank refilled by a steady stream that will be automatically and gradually cut off as the tank is filled. Unfortunately this method of solving the problem is not always feasible either on account of esthetic conditions which forbid an unsightly tank or on account of the cost of an architecturally satisfactory structure.

Effect of Steam Fire Engines

Water ram caused by steam fire engines forms an interesting study. On Dec. 13, 1912, at 2:15 a.m., an alarm sounded for what it was feared would prove to be a bad fire. Four steamers responded; two with a capacity of 1200 gal. per min. and one of 900 and one of 600 gal. capacity. In addition, some near-by fire pumps were put in use. These hose lines were laid: Two 3-in., four 2½-in. and three 1½-in. lines. A Venturi meter indicated that 350,000 gal. of water were used at the fire. The rate per hour during 16 periods of 10 min. each increased from 125,000 gal. for the first to 240,000 gal. for the fourth period and then showed a general but not uniform decline to 110,000 gal. for the ninth period, a rise to 140,000 for the eleventh period and a decline to 30,000, 20,000 and 30,000 gal. for the 14th, 15th and 16th periods, respectively.

The accompanying diagram was reproduced from a recording pressure-gage chart taken at the water office, 500 ft. from the location of the fire. Mr. Saville states that "the gage and the steamers were on the same main or on closely cross-connected parallel mains in the same locality as the fire." The "extreme length of vibration corresponds to about 110 lb. per sq.in." The falling-off in range of vibration at 3:15 a.m. corresponds to the withdrawal of some of the fire engines from the scene of the fire.

Quoting now the concluding paragraph of Mr. Saville's paper:

In connection with this diagram it may be of interest to state that the city of Hartford has recently passed through a rather disturbing period due to low rainfall and the excessive calls that have been made on the storage in the reservoirs. In order to take every precaution possible to conserve the supply and to put off as long as possible the evil day of turning to the Connecticut River for an emergency supply, the gates on the supply mains were throttled down during the later afternoon and night. The intention was to keep the pressure during this period at about the same point as it stood during the day hours of maximum consumption. A drop in pressure of about 15 lb. per sq.in. was made in this manner, and the Venturi meter records indicate a saving of at least a quarter of a million gallons per day.

By good fortune there are two fire engine houses not far from the city line and also near the main gates on the supply main. Two men were stationed at each of these houses, and on an alarm of fire they open the gates as soon as possible. A number of alarms have come in during this period, but at no time has there been any lack of pressure when the engines arrived. The ordinary night consumption at this season of the year is at a rate of about 4,000,000 gal. per day. The time of closing the gates appears on the diagram about 3 p.m., and the effect of opening up on account of other fire alarms the same night is shown at 8 p.m., 12:45 a.m. and 2.15 a.m. Ordinarily the gates are opened each morning at 5:30 a.m.

Surplus Waters of the Los Angeles Aqueduct

By Burt A. Heinly*

SYNOPSIS—The Los Angeles Aqueduct, having been built to supply the future needs of a large city, will provide a vast surplus of water for years to come. Two rival plans for selling this surplus are reviewed in this article: (1) The Mulholland plan, which proposes to sell water substantially at cost to irrigate land which, it is assumed, will ultimately become a part of the city; (2) the Graham plan, which proposes to sell water at the highest obtainable market price to a more remote district. Under (1) the area irrigated by the surplus water, it is assumed, would be gradually transformed from cultivated land to city lots, the volume of water required in either case being practically the same. Under (2) the irrigators would be compelled to find water elsewhere, as best they might, as soon as Los Angeles needed the water. The Mulholland plan is a scheme of coöperation with outlying districts to be brought into the city. The Graham plan is a strictly commercial proposition. The city authorities have adopted the Graham plan, but the plan must be approved by popular vote before it can be put into effect.

Today the Los Angeles Aqueduct system, by which the city of Los Angeles is to carry a daily water-supply of 258,000,000 gal. from the Sierra Nevada Mountains across the Mojave Desert and into the San Fernando Valley, a total distance of 234.7 miles, is practically completed. The latter part of March should see the new aqueduct, which is the longest† and in many respects the most remarkable in the world, ready for operation.

To many it will come as a surprise that for the larger part of the 20,000 miner's inches which the aqueduct is designed to deliver, no system of distribution mains have as yet been provided. It is the purpose of this article to take up in briefest detail the causes productive of this condition and then proceed to an examination of the two distribution plans proposed. It is believed by the writer that the exposition of each of the two propositions will be of interest to the engineering world: (1) because each is unusual from the end it is desired to accomplish; (2) because the conditions to be overcome are not to be met with in any project of its kind now on record, and (3) the magnitude of the proposed system involves a work comparable only to the reclamation projects of the federal government.

Primarily the Los Angeles Aqueduct is designed for the purpose of supplying with domestic water the city of Los Angeles and the surrounding towns which in time will become a part of the municipality. Ultimately, the entire flow of the aqueduct will be required for this purpose, but now and for some years to come, nearly nine-tenths of the whole flow may be classed as "surplus." In any section of the Eastern states this "surplus" would be classed as "waste" until such time as it was required for domestic consumption. In the semi-arid Southwest, however, this "surplus" when devoted to irrigation has a value second only to that of domestic use. Nowhere in the United States does water command so high a rental as it does in Southern California, as will be brought out by figures to follow.

Of the 195,000 acres of dry land contiguous to Los Angeles it was early estimated that approximately 135,000 acres could be irrigated profitably. Early in 1909 the preliminary engineering investigations were undertaken to this end. The subject received not only attention at the hands of the city's Board of Water Commissioners, but for a period of several months weekly meetings were held in the council chamber of the city hall, at which every citizen was given the fullest opportunity to express his views on the important subject. An account of this rather unusual procedure was published in Engineering News for Dec. 29, 1910.

By March, of 1911, the topographic surveys of the whole region contiguous to Los Angeles were completed and in that month a Commission of Advisory Engineers was appointed to make an investigation and report on all phases of the irrigation problem. This commission was composed of John R. Quinton, W. H. Code and Homer Hamlin, all of whom have been connected with many of the large projects of the United States Reclamation Service. This board filed its report in June, 1911, and its findings were practically in accord with the views of William Mulholland, chief engineer of the Department of Public Service and designer and constructor of the aqueduct system. (For a summary of this report see Eng. News, p. 514, Oct. 26, 1911.) The map of the districts selected by the board is herewith presented (Fig 1), because it plays an important part in the discussion to follow.

Soon after the report had been filed, the Board of Public Service, either through death or by resignations, was almost entirely changed in its membership. Mr. Mulholland was requested by the new board to file with it his own plan of distribution with an estimate of the cost of the system. This was done on Mar. 16, 1912. As to the area to be covered it coincided with the report of the Advisory Engineers, the acreage and districts being somewhat changed as shown by Fig. 2.

No one of these reports definitely included water distribution in the San Gabriel Valley. Mr. Mulholland was instructed to prepare plans and estimates for this district. S. C. Graham, one of the new commissioners, believing that there lay a rich field for the water in that direction.

The San Gabriel Region was selected by Mr. Graham for economic reasons, and the plan of distribution that he has devised and proposed is called the Graham plan. This includes a conduit called the "High Line" (Fig. 3), to be built at a cost of approximately $5,250,000. Some time within the next few months the city will be asked to vote bonds for the installation of the distribution system according to the plans of Mr. Graham.

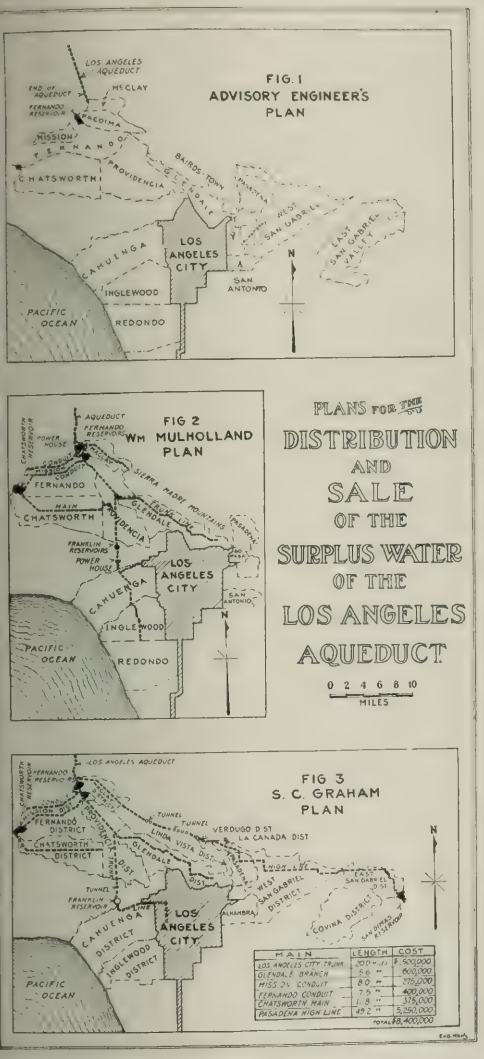
Anticipating that the city will at least vote bonds for the purpose of delivering aqueduct water into the city, the Board of Public Service is advancing $1,500,000 out of the revenues of the Water Department to construct a pipe line with a carrying capacity of 7500 miner's inches* from the aqueduct outlet to connect with the

*636 South Hill St., Los Angeles, Calif.

†The Goldfields pipe line, Western Australia, is 351.5 miles long, but it is a 30 in. st. l. main, through which water is lifted 1299 ft. by means of eight pumping stations.—Ed.

*A California miner's inch is 12,960 gal. per day.

present distribution system in the western part of the city. Of this quantity, Los Angeles will at present require 2000 miner's inches for domestic consumption. It is expected that the quantity in excess of this amount can be sold to other and smaller communities and to prospective irrigators along the line where it passes through the Fernando Valley and in the Cahuenga District. This



line is called the Franklin Cañon pipe line, and the work of construction is now under way.

A year of drought is (Feb. 7) apparently in prospect.* While the Franklin Cañon pipe line can not be completed to connect with the distribution system during the coming summer, it can be finished as far as the point where it crosses the Los Angeles River. Here the water, temporarily, may be emptied and be taken into the city's present supply mains, which are adequate for the purpose, so that possible water famine may be thus averted.

Other than the Franklin Cañon line, no work on the distribution system is under way. If the people approve the Graham plan by voting bonds, then the long and difficult tunnel work (there is a single tunnel with a length of 3½ miles) on the High Line, designed to carry 11,000 miner's inches, will require at least three years for its completion. [Bond election called for Apr. 15; see news notes page, this issue.—Ed.]

The Advisory Engineer's Plan.—Let us first review the original plan of distribution for the reason that it entered primarily into the plans under which the aqueduct enterprise was projected and afterward undertaken. Naturally, the disposition of the surplus water received more than the usual amount of study and investigation because the city's engineers faced problems in irrigation entirely new to the science. In a nutshell, the great problem was how and where to build an irrigation system so that with the growth of population, automatically and with no hardship, it would become insensibly a domestic water-supply system. This was not so difficult as it first appeared. By more than a year of tests in various residence sections of the city it was found that a miner's inch, or a flow of 12,960 gal. per day, sufficed for 7.77 acres of city dwellings and gardens, the sprinkling of streets, fire protection and sewer flushing.

By a most fortunate coincidence, the same quantity of water, continuous flow, provides irrigation for 7½ acres of land given over to the cultivation of citrus trees. The problem in the main, therefore, resolved itself into anticipating the growth and direction of population, setting aside districts in anticipation of this growth and applying the water to these districts. As the city extends its boundaries the acreage nearest the city's center in course of time becomes so valuable that horticulture is unremunerative, the acreage is subdivided into city lots and the water which formerly nourished vegetable growth is diverted to the purposes of domestic supply. This same transition as it applies to the present water-supply has gone on in the city of Los Angeles for many years and was brought to an end within the past decade entirely for the reason that the present water-supply had reached the point where it was inadequate to meet the demands of domestic use.

In following this law of the city's growth as it applies to the water-supply, there is no shifting of economic conditions, no lawsuit over the most troublesome and entangling phase of legal procedure, water rights, and no section is made to revert to non-productiveness by reason of the transfer of water from one locality to another. This plan, then, looks forward always toward the end for which the aqueduct was constructed, namely, to provide an adequate domestic supply for several millions of population. Irrigation in this plan is held to be only the temporary disposal of the present 18,000 miner's inches of sulplus water. As a part of this plan, the Advisory Board of Engineers recommended that the San Fernando Valley, which lies to the northwest of the city and below the mouth of the aqueduct and its storage reservoirs (Fig. 1), should be made a part of the proposed area of distribu-

*This fear was removed by extensive rainfall late in February, 1913. The rainfall from July 1, 1912, to Feb. 7, 1913, was 3.11 in., against a normal of 8.89. By March 1 the seasonal rainfall had been increased from 3.11 to about 12 in.

tion. From the position of the valley the board believed that as much water as should be required should be applied there, (1) because of its juxtaposition to the aqueduct—it was so situated geographically that the distribution system could be built at the minimum of cost; (2) because in the anticipation of obtaining water the great ranches of from 15,000 to 40,000 acres were being broken up into 1-, 2-, 3-, 5-, 10-, 15- and 20-acre tracts and population was trending in that direction. And what was much more important, they reasoned that if the quantity they had assigned to the district were taken up the return water, which ultimately would find its way through the gravels into the Los Angeles River, thence into the conduits of the city's present supply system, would amount to 4000 miner's inches. This supply, they stated, could be applied to the major part of the Redondo and Inglewood Districts (Fig. 1).

In summation, the board made its report on the assumption that the municipality should not place itself in the position of a private public-service corporation bargaining and selling its commodity at the highest possible rate, irrespective of the future growth of the city and the purposes of the aqueduct. On the contrary, the board, if not openly, at least in so many words, implied that the distribution of the surplus is a present means to a future end, the profits to the city during the period of surplus to accrue from the city's use of the water in power development as it passes through the aqueduct, from the indirect wealth that comes to a city in a large suburban population and from the capitalization of the irrigation water at a fair rate of interest over the cost to the city of carrying the water from the Sierra Nevadas to the lands in question; these lands to be contiguous to the city and of an area not greater than the assignment of one miner's inch to 7½ acres. Competition by prospective water-users, it will be seen, does not enter into the plan.

Soon after the board had reported the members were requested to file a supplementary report with reference to the application of the water in the San Gabriel Valley. This was done, it being pointed out that there would be an additional cost of distribution, a loss in power development, as the water must be taken out at an elevation of 1461 ft., or at the very outlet of the aqueduct and above the last power drop, and that there would be little or no return water in seepage for use elsewhere.

The Board of Engineers further recommended that the water should be applied solidly, that is, one miner's inch to 7½ acres, with no scattering, the ultimate use of the water being always held uppermost. It was suggested in this connection that the rates should be reasonable, so that it would be advantageous for whole districts to take the water. The Board of Engineers made no recommendation as to rates, but merely stated that 20,000 acres in the Riverside citrus belt, one of the richest and most valuable horticultural sections in the world, paid $12.65 per acre per annum. This is at a rate of very slightly more than 1c. an inch per hour, or 1.86c. per 1000 gal.

The Board of Engineers recommended that the districts themselves should finance the construction of the distributing systems, either by the formation of irrigation districts under the California law or by any other means that would be sound and feasible, and thereupon be annexed or consolidated with the city. The pipe lines were to be constructed by city engineers and were then to become the sole property of the municipality. They believed that at a favorable rate the water would be purchased solidly in the districts where the city most desired to have it, but they made the provision that if irrigators held out for a lower rate than was equitable to the city, then it was within the city's power to carry the water into other less favorably situated districts where the city would be met with fairness; for, they said, "the municipality is under no obligations whatsoever to furnish irrigation to any district or area."

THE MULHOLLAND PLAN—With a statement concerning Mr. Mulholland's report on distribution, we shall be ready to pass on to a discussion of the Graham plan, which is distinctly new in its application to the sale and distribution of water designed to be used in irrigation.

Mr. Mulholland, in his report of Mar. 16, 1912, submitting plans of conduits and pipe lines with estimates of costs, followed closely the plan of the geographical distribution as proposed by the Board of Advisory Engineers as well as the means by which it should be brought about, i.e., annexation of the districts in which the water is distributed with the districts defraying the entire cost of installation. (See Fig. 2 for Mulholland plan.)

With reference to the construction of the distribution system and the area to be covered, Mr. Mulholland made the following statement:

> With the exception of the permanent structures of concrete, the tunnels and reservoirs and the pipe designed for the city's use alone, the mains should be designed of a capacity sufficient only to supply one-half the water that will be ultimately required, if distributed at the rate of one miner's inch to 7½ acres. The purpose of building the pipe lines on this basis at first is that much of the land to be covered is at present but sparsely settled and it is but natural to expect that the accretion of population will be gradual, and that a very considerable time must elapse before an amount in excess of half of the ultimate needs is required. When the time arrives that this first system of pipes shall be outgrown, the water users will then probably be better able to add a duplicate system, which may or may not be laid along the lines covered by the system here proposed. This duplication will add safety to the works and obviate the immediate large expenditures necessary to build the pipes of full capacity, as well as saving deterioration on the second half to be built. This practice is one usually followed in water-works construction and has been notably successful in operation of the present works of the city of Los Angeles.
>
> In point of fact, the capacity of the pipes here proposed will be able to supply water at the rate of one miner's inch to each ten acres and it may be twenty years or more before any increase in this capacity will have to be provided. The rate of 1 in. to 7½ acres, figuring for the year round, makes liberal provisions for any conditions that may arise as to the character of development, and is the rate recommended by the Board of Engineers who carefully considered and reported on this matter, and is based on a very broad experience in Southern California.
>
> It will be observed that no line is proposed to convey water to Pasadena or the territory lying easterly therefrom, the reason for this omission being that Pasadena has made surveys of her own for this purpose and carefully prepared estimates thereon. The San Gabriel country lying to the east of her borders can only be reached from the aqueduct by passing through the city of Pasadena, involving the acquisition of a right of way and the tearing up of the streets. It has always appeared to the writer that the only solution of the problem presented by this difficulty is, that if the San Gabriel country is desirous of procuring Owens River water, it should be annexed to the city of Pasadena and move jointly with her in the matter, that is, providing, of course, that Pasadena herself will want the water.
>
> Surveys have been made and complete data collected for the building of a line both to Pasadena and the San Gabriel country by this department, but the cost of such lines seem too excessive to be undertaken by the city of Los Angeles. Indeed, the question is still an open one as to whether the city should undertake the building of any lines for the terri-

tory outside her borders other than that intended for the city and which will be exclusively devoted to the city's use within her present limits.

The construction for a half supply as outlined by Mr. Mulholland, according to his estimates, would cost $3,401,000. The construction of the lateral system he discussed in the following paragraph:

> The design of the network of distribution pipes to be attached to these main pipes must be left to the future, as much of the land proposed to be covered is still unsubdivided, so that no outline of streets exists. It is possible, however, to make a reasonably close estimate of cost. Assuming average ideal conditions, this cost may vary widely, in accordance with the purpose and quality of the work. A grid-work of sheet-steel mains of ample capacity for irrigating or domestic purposes can be constructed in accordance with the figures herewith presented. A complete grid-work of sheet-steel pipe can be constructed over almost any given area embraced by these districts for about $35 per acre, the mains to be one-eighth of a mile apart, or on a system of 660-ft. squares. Ideal construction of cast iron with all appurtenances required in densely peopled towns, such as fire-hydrants, street-sprinkling hydrants, etc., involves an average expense, under southern California conditions, of about $125 per acre. The soil conditions of most of the country that will be served by this system permits of the free use of sheet-steel pipe. There are a few restricted localities, however, where sheet steel would not be found durable. This is a minor matter, however, as it would be many years even under adverse conditions before renewals would be required.

THE GRAHAM PLAN—Commissioner Graham's plan, as it has been set forth by him and as it has been indorsed by the Board of Public Service Commissioners and by the City Council, takes the fullest cognizance of the economic use of the surplus aqueduct flow as irrigation water *per se*. Mr. Graham holds "that where one has something thing to sell, he attempts to secure for it as large a market as possible, the idea being that if the demand is in excess of the supply, all the supply can be disposed of and at a very much better price than if the supply is equal to or in excess of the demand.

Therefore, the Graham plan provides that the water shall be carried to points covering as large an area as it is possible to reach (Fig. 3). Competition among land owners can only be brought about by distribution over an area intentionally much larger than can be served in order to get the highest profits from water sales. The application of water to dry land increases the value of the land from $300 to $500 an acre and the municipality is justly entitled to as much of the unearned increment as it is able, through competition, to wrest from the land owner. There is within the irrigable area of every district a portion of the land generally least productive without water that is most productive when irrigated. For this reason the increase in the production of wealth brought about through the use of aqueduct water will be greater if the area covered by it is larger than it can supply.

By an economic law, the water must find its way to land the productiveness of which will be most greatly increased by using it, for this land is able to offer the highest price for the water. And the prosperity of the city will be best assured by having the water used on these lands of highest productivity. The Graham plan contemplates that it will make very little difference to the people living within the present limits of the city whether the water is used within the city or in territory contiguous to it, for it assumes upon present conditions within the city (large areas of vacant lots not built upon) that there never will come a time when all the land within the limits of the city will be using water and that this applies equally to any district outside of the city. On this account it is no more essential that there should be held a full reserve supply for contiguous irrigation districts than it has been necessary in the past that Los Angeles should have received a full supply of water for all the lands within the city.

The plan further provides that all the pipe lines, conduits, reservoirs, and appurtenances of the city should be built with the proceeds of bonds issued by the city and that the distribution mains and conduits of any considerable length should be constructed of a size sufficient to supply all the lands requiring water that could be reached in the direction in which the lines are being extended.

It is further assumed that the other plan proposed would require a generation before all the water were placed in service, whereas under the Graham plan, with a proper distribution system installed, Mr. Graham asserts that two to four times as much water would go into use when the distribution system is finished as would be the case if the distribution is confined to a limited area, and that within a comparatively short time all the water will be in service.

The plan contemplates the possibility of the ultimate withdrawal of the water from the lands on which it is originally placed. This is provided for by the fact that the owner of the land receives no title or right of ownership to the water. Under a form of contract, he will take the water at whatever rate may be finally determined, for a term of 15 years. (This is the longest period under the charter of the city that a lease of surplus aqueduct water can be made, and no right in fee simple can be given without a two-thirds vote of the people. It is not at all probable that the city will ever vote to give a right where the water is used for irrigation. Where the water is to be used for domestic purposes in towns contiguous to the city, as Pasadena, Santa Monica, Monrovia, etc., the exigencies of use would demand a right in perpetuity which the citizens of Los Angeles would probably be willing to give by vote.)

Within this period of 15 years, the city, at any time that it sees fit, may increase the rate of payment. The irrigator must then either meet the increased rental or surrender the water. It is provided, however, that the city shall not increase the water rate to exceed 10% during the irrigating season, i.e., between May 1 and Nov. 1. Upon any increase in rates, the irrigator, if he refuses to pay the higher rate, surrenders the water upon 30 days' notice.

The city agrees in the contract to deliver the water to mutual water companies within one mile of their central plant and to private water owners, not in any mutual company, within two miles of the land designated. It is further provided that the rate charged shall be the same wherever irrigation water is sold, irrespective of the cost of delivery through any individual line or conduit, there being one exception, which is that where the water is taken out above the lower aqueduct power drop, the irrigators shall pay an additional sum, equivalent to the value of the horsepower that is lost.

It will be seen from the foregoing that by the Graham plan, the least productive lands will be unable to pay the increased premium and will revert to their former dry state, while the water will henceforth be devoted to the higher use of domestic supply.

Opponents of the Graham plan assert that no irriga-

tor can be treated fairly if his water-supply is taken from him after he has once started to use it, for a considerable investment will be lost when the person making it is deprived of the water.

Mr. Graham answers the argument by asserting that this is true only of orange, lemon and deciduous lands where the cost of planting is considerable and where the lands must be cared for during a period of years before a revenue is secured. He asserts that where the water is used in the production of field crops no particular investment is required, and if it is ever necessary to remove the water from such lands, the loss involved will be slight. Even so, both the city and the consumer will have benefited because of the temporary use of the water on the lands to the extent that a greater amount of wealth has been produced than if the water had not been in service for that purpose. As to orchard lands, the hypothesis is made that the removal of the water is so remote as to be hardly worthy of consideration, or if it is granted for the sake of argument, at least a life time must elapse before any water applied to citrus lands is needed for domestic consumption.

Under the Graham plan the city council has set the official rate at 2c. per in. per hour, or $23.36 per acre per year, on the basis of 1 in. to 7½ acres. To show the very high value of water in Southern California many irrigators in the basin of the San Gabriel are signing contracts at this rate with the pro rata of lost power production added. The locality is by far the richest and most valuable fruit-growing district adjacent to Los Angeles. The water-supply of the valley, even by the driving of wells, is insufficient to cover the area of arable land. Wherever water is available it is devoted to the irrigation of citrus groves, which in truth have been extended beyond the capacity of the water resources of the valley.

To reach the dry lands of this valley it will be necessary to build a pipe line high along the base of the Sierra Madres, at a cost of $5,250,000. This conduit would supply Pasadena, but for many miles between the outlet of the aqueduct and the San Gabriel Valley the character of the country through which it passes precludes the use of any large quantity of water in irrigation. This High Line, as now located, has a length of 48 miles and is designed to carry a maximum of 11,000 miner's inches, or more than half of the normal flow of the aqueduct diverted from a drainage area which might give a proportional return of several thousand inches of ground water.

The Graham plan, however, does not admit this loss of return waters as a financial loss to the city. It makes the assumption that the high rates obtained by use of the water in the San Gabriel Valley will more than remunerate the city in point of money, over that suggested by the Advisory Engineering Board through the use of the water in the San Fernando Valley. Used high in the San Gabriel Valley, the same percentage as in the San Fernando will sink into the gravels and be drawn off by ranchers lower down, once and in decreasing quantity possibly a second time. Thus the city profits not only directly from the higher sales of water, but it profits largely, although indirectly, from the prosperity of those who recover it without paying tribute to the municipality.

It will be seen that the success of the Graham plan depends upon the construction of the High Line into the San Gabriel Valley and the possibility of making all the other sections pay the same rate as can there be obtained.

The city in setting two cents as the official rate has not done so without the power of revision. That the rate will not be increased at this time is a foregone conclusion, but the Council may lower it if the price is found too high for the economic disposal of the whole quantity.

In the San Fernando Valley and sections other than the San Gabriel Valley there has been little disposition on the part of irrigators to sign contracts. They make the claim that only in exceptional cases of citrus lands under high cultivation can they hope for a profit where the water rental is $23.36 per acre per year, and that much of their lands are unfitted by reason of lower climatic conditions for the growing of citrus trees.

The foregoing comprises a fair review of the whole situation as it exists at the present time. Whatever may be the outcome, Los Angeles, in the satisfactory disposal of the surplus waters of the aqueduct, with the heavy attendant expenditures for a distribution system, faces a problem hardly less vital or important than the one with which she was confronted in 1905 in the construction of the comprehensive Owens River supply system that is now on the eve of completion.

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Reinforced-concrete Trolley Poles in Cleveland*

By L. P. Crecelius†

The subject of concrete trolley poles has received attention by the Committee on Power Distribution of the American Electric Railway Engineering Association, and a report has been submitted. The information contained therein was mostly of an engineering nature as was to be expected, principally strength, sizes, etc., were treated. The discussion accompanying the report related for the most part to expression of doubt as to the ultimate life of this structure, especially, when viewed from the standpoint of electrolytic destruction of reinforcing steel used in the make-up of all concrete poles. In short, little confidence was expressed as to the durability of this pole and considerable criticism was advanced against its use by representatives of the lighting interests because of possible danger to linemen. Therefore, the installation of concrete trolley poles upon a rather comprehensive scale by a large and important railway company in the face of the above may be interesting.

For more than two years the Cleveland Ry. Co. has been using concrete trolley poles; at first only to replace old wooden poles in the outlying districts and later in practically all new work, with the result that now over 750 poles of this character are in service. The reason for this may be of interest. The poles were introduced on the system at the suggestion of J. J. Stanley, the president of the company, who became interested in poles of this character some three years ago, because of the neat appearance of the structure.

In the beginning, only 50 poles were made and placed in the streets experimentally. At once they received favorable public comment. The neat appearance of the drab colored octagonal pole in the street in great and favorable contrast to the old, crooked, wooden poles in use, together with the dark and colored steel poles, appears to have been responsible for this feeling, and it soon developed that whenever new work was encountered the request for concrete poles followed.

In the work shown in Figs. 1 and 2, the use of poles in the district was forbidden, in fact within two years' time all poles were required to be removed by ordinance, the cables to be placed under ground. However, by agreeing to use concrete poles, the right was received to install poles instead. Thus the advantage of the concrete poles over its predecessors on this score was pronounced; coupled with the fact

*From "Aera," the monthly publication of the American Electric Railway Association, Issue of February, 1913.

†Superintendent of Motive Power, Cleveland Ry. Co., Cleveland, Ohio.

of low cost of manufacture and maintenance we have (wa)lving for the time being consideration of ultimate life) at last a serious competitor to the old types of poles used in carrying overhead wires and cables.

A short description of the standard concrete poles used by the Cleveland Ry. Co. may not be amiss. The length is 28 ft.; diameter at butt, 11 in.; diameter at top, 6 in. The shape is full octagonal, commencing 6 ft. from butt. The butt is square. The finish is a natural cement color. The weight is 1700 lb., and the poles are safe for a 500-lb. pull at the top when set 6 ft. in the ground with large margin for safety. The cost of manufacture is $12.

In the effort to prevent possible electrolytic destruction



FIG. 1. CROSS-SUSPENSION TROLLEY CONSTRUCTION



FIG. 2. RAILWAY FEEDER-LINE CONSTRUCTION

FIGS. 1 AND 2. STANDARD REINFORCED-CONCRETE POLES USED IN CLEVELAND, OHIO

of steel, only porcelain insulators are used, safe for 6000-volt service, both for feeders and span wires.

Fig. 3 shows the yard in which all poles were made. The great and burning questions, "How long will the pole last and how will it behave in severe wind and sleet storms"?, as yet remain without an answer. However, the following conclusions are borne out by this short experience.



FIG. 3. YARD FOR MANUFACTURE OF REINFORCED-CONCRETE POLES, CLEVELAND RAILWAY CO.

(1) The pole is received favorably by the public.

(2) The pole is immeasurably superior in every respect to wooden poles for railway work.

(3) They cost considerably less than tubular steel poles.

(4) They apparently require little or no maintenance.

The specifications for manufacture follow:

SPECIFICATIONS FOR CONCRETE TROLLEY POLES

The concrete for poles shall be composed of one part by volume of packed cement, to three parts of gravel and sand conglomerate.

The cement shall be portland cement and conform to the specifications of the American Society for Testing Materials.

All sand and gravel shall be sound, hard, and not contain soft shale or other injurious or decayed matter.

All gravel and sand shall be entirely free from loam or clay and kept clean at all times.

Gravel and sand shall be of rounded shape, the aggregate to be graded from largest size of gravel downward to the smaller grains, the large to predominate and shall just pass a 1-in. square mesh sieve. Tests shall be made on samples for maximum specific gravity and for minimum of voids, both before determining on the grading, and also at frequent intervals as required during construction.

STEEL REINFORCEMENT—The steel reinforcement shall consist of eight ⅝-in. square twisted bars placed 1 in. from concrete surface to center of (or axis of) steel bars.

Bars shall be kept in exact place with wire or spacing material.

Each second bar shall have hook shaped ends, returned 12 in. after bending around with a 4½-in. radius for bottom end, and 2-in. radius for top end. Returned ends shall be securely coupled with wire to the unbent end.

Tangent of bends shall be about 3 in. from end surface of concrete.

PROPORTION OF WATER—The proportion of water for mixing shall be such that the concrete shall not be so wet as to let the cement settle, but wet enough to mold readily against the steel and forms.

The concrete shall be poured into the forms with the utmost care, for non-disturbance of steel and forms, and for keeping uniformity of mixture from end to end without leakage, and obtaining true straight lines and smooth exposed surfaces.

REMOVAL OF FORMS—Forms shall not be removed prematurely nor shall the handling of the casted concrete while seasoning be such as to cause initial and destructive strains.

SEASONING—During the first period of 28 days of seasoning the cast poles shall be kept continuously and uniformly wet by some approved sprinkling system, that can be perfectly controlled and regulated.

SUPERVISION—The contractor or his foreman shall give his entire personal supervision to the work.

INSPECTION—The contractor shall permit the railway company's engineers, and all persons appointed by him to visit and inspect the work at all times and places during the progress of work, and shall give every required assistance for such inspection.

⁂

Lock Gate Erection Progress at Panama is reported as follows, in the "Canal Record" of Feb. 19:

All the material for the lock gates has been shipped from the shops of the contractor in the United States, and the last delivery should be made on the Isthmus this week.

At the end of January the gates were 68% erected, 51% riveted, and 5% finished, the state of completion at each lock being:

	Gatun	Pedro Miguel	Miraflores
Erecting	78	82	43
Riveting	66	70	15
Finishing	10	..	..
Number of leaves	40	24	28

Work is in progress at Gatun on all of the 40 gate leaves, at Pedro Miguél on all of the 24 leaves, at Miraflores on 20 of the 28 leaves. During January the progress was better than during any previous month. The number of rivets driven in January, the total driven to Feb. 1, and the number yet to be driven are shown in the following statement:

Locks	Driven in January	Driven to Feb. 1	Remaining to be driven approximately
Gatun	269,372	1,590,600	819,400
Pedro Miguel	152,279	980,000	420,000
Miraflores	119,568	261,000	1,479,000

Practically all the men operating riveting machines are negroes. The hand riveting is done by white Americans. The total force at work on the gates in January was 514 Americans, and 3371 negro laborers.

Concrete Bank Protection for Deep Rivers

By B. Okazaki*

Synopsis—In Engineering News, *May 16, 1912, p. 922, Mr. Okazaki described an experimental stretch of mattress river-bank protection, in which the mattress is formed by threading together into a mat a number of reinforced-concrete blocks, 6x6x24 in. in size. This article took up only the protection of shallow rivers. In the present article he describes some further work on a deeper river where the problems of laying the mattress were somewhat more complicated.*

The experimental concrete mattress work on the Yubari River, which was described by the writer in a previous issue of Engineering News, was all laid in shallow water. At this location where the water in its low stage is about 4 ft., the placing of the mattresses is easily accomplished by means of the simple free-log scaffold, which was described in the previously noted article, and the mattress may be laid at once for its full width. For additional protection, a horizontal apron some 6 ft. in width may be added to cover the river bottom in front of the bank to be protected as an extra protection against future probable scour. This would be laid in addition to the width required to cover the entire slope of the bank below low water down to the deepest river bottom. In such a case the upper portion of the bank, which is sometimes not covered by the mattresses in use in the writer's work, may at the same time be protected by any kind of covering. When work is to be done in deep water, however, the case is entirely different and the difficulties in setting the mattress markedly increased.

The setting of a concrete mattress on the bank of the Ishikari River, having more than 40 ft. depth of water at low stage, is probably the first attempt at such construction. Indeed, the application of the concrete mattress for the protection of a caving bank of a river having such depth is one of the most careful operations required of river engineers. This is particularly so when the mattress is first set down with a minimum width, or, in other words, when the so called trial method is adopted. In such a case the mattress with a preliminary small width is sometimes subject to an expected, but sudden and violent, settlement after it has been set in place, owing to the subsequent severe caving of the bank at the foot of the mattress. Usually there is no protection work provided for the uppermost portion of the bank, and so the mattress is left merely resting on the middle portion of the bank to wait for further natural dislocation.

The original setting of a mattress for the estimated full width in deep water is very costly and may involve the expense for a width which will not be needed. It is for this reason that the writer has adopted the trial method, that is, it is the practice to set the mattress bit by bit according to the demands of nature, mainly depending upon the natural action of the caving bank, and paying only for the width which is really necessary for the site at the time of placing.

The mere setting of the mattress for a width as great as 36 ft. is easily done by means of the pontoon hung scaffold described in the previous article. With a slight improvement in this scaffold even a mattress as wide as 45 ft. may, with not much difficulty, be set in deep water. However, a close watch is required to supplement this width at the upper edge in order to follow the settlement of the mattress as the lower part of the mattress settles. The extent of the settlement of this mattress may be sometimes as great as 20 ft. in one flood, particularly where the bank and bottom of the river consists of very fine sand lacking any coherence. To meet and manage such violent settlement of any structure is an arduous

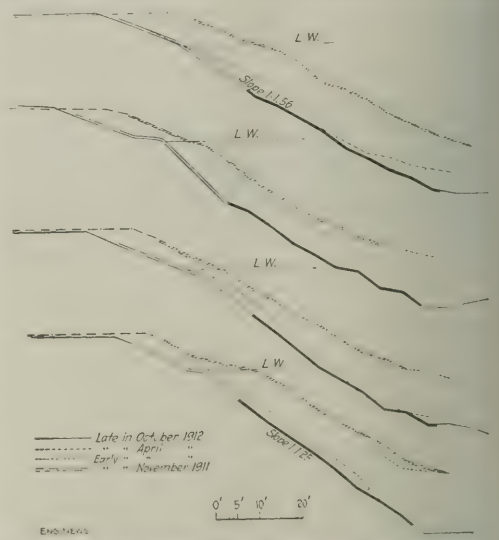


Fig. 1. Cross-section of Ishikari River Bank, Showing Settlement of Mattress

task. No one can be more active and vigilant than the engineer in charge of such work.

Take for example the case of the concrete mattress bank-protection work of the Ishikari River at Bannaguro. Below are given the results of comparative surveys made particularly for the purpose of ascertaining the occasional changes in the mattress work after remarkable floods. This bank-protection work was placed for a distance of about ½ mile. The accompanying Fig. 1 shows three typical sections taken at ken* 130 to ken 160. The work was placed in October, 1911, and the three sections show the condition in November, 1911, April, 1912, and October, 1912. Floods occurred in April and October, 1912. From these sections it will be noted that the mattress has nearly reached the deepest river bottom of 30 ft. below low water, and that the maximum total width of the mattress now amounts to 93 ft. That is to say that the mattress has almost satisfactorily settled down to its final position by the natural sinking down, and, by occasional additions on the upper edge of the width of the mattress successfully prosecuted by the

*Chief Engineer, Ishikari River Improvement Works, Sapporo, Japan.

*1 Ken = 6 ft. nearly.

proper management of the resident engineers, the mattress has been fitted to the bank soon after the caving of the latter.

As a matter of investigation, if the progress of the settlement of the mattress is traced by measuring its horizontal and vertical dislocation separately, it will be found that the horizontal dislocation may take place in two ways, as shown by the positive and negative signs in the summarized table herewith. A positive translation means the dislocation forward, that is, toward the thalweg, and a negative translation means the retrograde dislocation or a motion of the mattress back to the bank. The negative dislocation of the lower edge of the mattress usually takes place when the upper edge of the mattress is anchored, or when the friction between the mattress and the bank is greater than the natural force tending to make the mattress slide and sink down. In this case the lower portion only of the mattress bends down, and hence back, to fit into the gap behind produced by the severe caving or scouring of the river bed. As to the vertical dislocation there is no negative or upward motion of the mattress, which is as it ought to be. The maximum horizontal translation of the lower edge of the

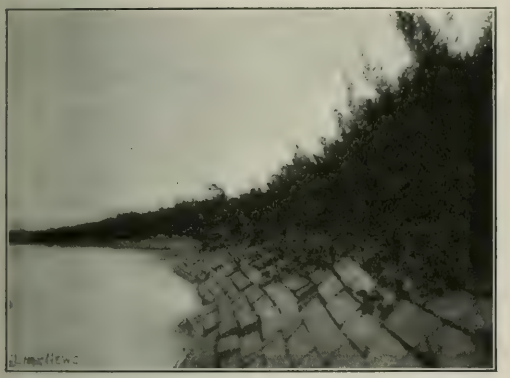


FIG. 2. VIEW OF CONCRETE MATTRESS, SHOWING WILLOW GROWTH IN ONE YEAR

mattress of 22.2 ft. occurred at cross-section 140 ken, and the maximum vertical translation of 22.5 ft. occurred at cross-section 160 ken as may be seen in Fig. 1.

SUMMARIZED TABLE SHOWING THE TRANSLATION OF MATTRESS

Cross-section at *	Horizontal translation of the upper edge of mattress, ft	Vertical translation of the upper edge of mattress, ft	Horizontal translation of the lower edge of mattress, ft	Vertical translation of the lower edge of mattress, ft	General slope of the mattressed bank at present	Remark
40 ken.	6 5	3 0	7 3	7 8	1/1.25	General slope of the mattressed bank is measured between the low water surface and the lower edge of mattress
50 ken	1 3	1.0	−3 2	4 0	1/1.15	
60 ken.	0	0 5	0	0 8	1 1 10	
70 ken.	−1 0	2 2	−2 4	2 4	1 1 37	
80 ken	8 3	1 0	2 0	12.0	1/1.22	
120 ken	8 0	12 6	5 2	16 4	1/1 53	
130 ken.	12 0	16 9	11 0	18 3	1 1 63	
140 ken.	22 4	21.0	22 2	20 3	1 1 47	
150 ken.	21 2	18 0	19 2	18 8	1 1 53	
160 ken.	17 3	14 6	13 0	22 5	1 1 30	

* 1 ken = about 6 ft.

When the mattress has moved to such an extent as to allow its lower edge to touch the bottom of the thalweg, the bank may be considered to have assumed a stable condition and the upper portion of the slope of the bank which is not covered by the concrete mattress may be then protected by any kind of pitching. In a section of the Ishikari River the upper portion of the bank has been protected by riprap placed within the 3-ft. square panels made by the willow mattress (described in the previous article in ENGINEERING NEWS), and the willow has grown in one year after the fence was made to the extent shown in the halftone in the view in Fig. 2. Thus the bank in question has become completely protected both above and below the water surface.

CONCLUSIONS

From the foregoing it may be concluded that, (1) in some cross-sections the mattress has by itself nearly reached to its final destination so as to need very little further supplementing of the width; (2) in general the slope of the mattressed bank is left flatter by nature after the severe caving when the mattress (set at first with only a slight width) makes a positive or forward translation, than when its lower edge makes retrograde translation; the stability of the protected bank is insured more in the former case than in the latter; (3) the setting of the mattress may better be made at first with a slight width, as the best economy may be accomplished in this way when only so much of the mattress width is added bit by bit as is really necessary for the site in question, thus avoiding the costly setting at first of the full width of mattress down to the bottom of the thalweg; (4) it is wise to leave the upper portion of the slope of the bank unprotected until it may safely be protected by any kind of pitching work, after the protection of the lower portion has attained its perfect state, although sometimes temporary protective works are placed for the upper portion of the bank at the same time as the first width of the mattress is set. This is done when too much caving of the naked upper portion of the slope is to be avoided, before the completion of the bank protection.

❖

The Quartz-tube Mercury-vapor Lamp, which was developed in Europe on the principles of the ordinary mercury vapor lamp (see "Engineering News," Sept 12 and Dec. 5, 1907), has been introduced in this country by the Cooper Hewitt Electric Co. It will be recalled that the standard mercury-vapor lamp runs at a vapor density equal to a pressure of about ¼-in. mercury column, while in the quartz-tube type the pressure may run up to atmospheric or higher. As the potential per inch of length of the mercury-vapor column is great in the quartz-tube lamp, a short tube is necessary. On account of the high temperature of the mercury vapor in this type the lamp has also a minor continuous spectrum in addition to the characteristic bands of the mercury vapor, there are thus more of the red and orange rays than in the common lamp. As the ultra-violet rays of the mercury arc are readily transmitted by quartz, this lamp would be injurious to the eye unless guarded. A satisfactory screen for this undersirable radiation is secured by using a surrounding globe of clear glass. This, together with the metal casing for the mechanism gives the device the appearance somewhat of an ordinary arc lamp.

Two types of the quartz-tube lamp are found in the American line, one for 110 and one for 220 volts, direct current. For alternating-current supplies, the direct current must be secured from a rectifier or converter. In the one type, the tube is held in an aluminum support, which is pivoted and connected with a tilting lever linked up with the armature of an electro-magnet. The burner, magnet and resistance coils are all connected in series and with the lamp at rest the tube is inclined, so that mercury bridges the electrodes. When current is turned on, the magnet moves the tube until the mercury column is broken and an arc starts. So long as current continues, the burner is held in this running position. In the second type, for the higher voltage, the tube is in the same position burning as at rest, in starting, the mercury bridge is formed by a shunt magnet which tilts the tube. When the electrodes are short-circuited, a series magnet breaks the circuit of the first magnet, and allows the burner to drop back to its original position, breaking the mercury column and starting the arc.

A Compact Sand and Gravel Washing Plant

About a mile north of the city of Peekskill, N. Y., on the east bank of the Hudson River, there is a large sand and gravel bank, the location of which offered unique opportunities for developing a washing and shipping plant. The property under development covers 112 acres, located on a hill, the highest part of which is some 252 ft. above the high-water level of the river. One of the new state highways runs through the property and the greater part of the washing and screening plant is located in a tunnel under this road. The Hudson River is something over a mile distant, but a connecting creek borders the property, in which a channel 110 ft. wide and 11 ft. deep at low water is being dredged. The distance of the loading wharf from deep water in the river is 1¾ miles.

From numerous test borings over the entire area there is good reason to suppose that nearly the whole hill is composed of sand and gravel, with almost no large stones or boulders. There is a hogback running lengthwise through the area, outcropping in places, but not so located as to offer a serious obstacle to development work. The sand and gravel is of excellent quality, and except for a thin top soil of loam contains but 2 or 3% of waste, and is about 70% gravel. It is proposed to excavate the hill with steam shovels, which will load into dump-cars hauled by Shay-geared locomotives.

The washing plant, shown in Fig. 1, is located on the state highway, about in the middle of the property. The dump-cars from the sand bank in the rear are dumped directly into a hopper, and the material flows by gravity into a 2-in. mesh revolving cylindrical screen 5 ft. in diameter and 12 ft. long. The material which does not pass this screen falls into a 10x12-in. jaw-crusher having a capacity of about 20 tons per hour.

The outputs from the screen and crusher fall through chutes upon three deck-shaker screens, the first 2 ft. wide by 74 ft. long with a 2-in. mesh, the next below, 2 ft. 9 in. by 72 ft., with a 1½-in. mesh, and the bottom screen 3 ft. 6 in. by 70 ft., with a 1-in. mesh. These three screens are on a pitch of ½ in. to 1 ft., and are superimposed one above the other so that the material passing one falls below to the next, which is 9 in. wider in each case.

The washing is done simultaneously with the screening. Water is pumped from an inlet at the wharf by an electrically-driven centrifugal pump having a capacity of 1000 gal. per min., into a 6-in. main which extends on the center line through the top of the concrete tunnel containing the shaker screens. The pipe is perforated at frequent intervals and the water falls through the screens, carrying the waste material to the bottom of the concrete tunnel, where it is flushed by means of a 4-in. extension, from the end of the 6-in. main to the bottom of the tunnel, into a concrete settling basin, shown in Fig. 2.

The tunnel containing the screens, shown in profile in Fig. 2, is built of reinforced concrete, with inside dimensions of 9x7 ft., giving ample room for workmen to move alongside the screens if the occasion requires. The floor of the tunnel has a total fall of 3 ft. in 79 ft., or 1 ft. in 36 ft. Fig. 3 shows the location of the crusher and revolving screen with respect to the center line of the tunnel. The lower end of the tunnel, as already mentioned, leads into the reinforced-concrete settling basin where the final separation of the sand and loam takes place by gravity.

The waste material washed from the sand in the settling tank flows off the top of the tank and runs through



Fig. 1. Sand and Gravel Washing and Shipping Plant, Peekskill, N. Y.

an 8-in. discharge main by gravity to a fill which is being made above the wharf.

The three shaker screens discharge at their lower ends upon as many 24-in. belt conveyors which diverge from the lower end of the screen tunnel in different directions, Fig. 4, and unload the different sizes of gravels upon storage piles on the concrete wharf, from a height of 24 ft. The sand after settling to the bottom of the concrete tank is scooped up by a 36-in. scraper flight conveyor and discharged into a storage pile near the middle of the concrete wharf. The belt conveyors are driven by individual

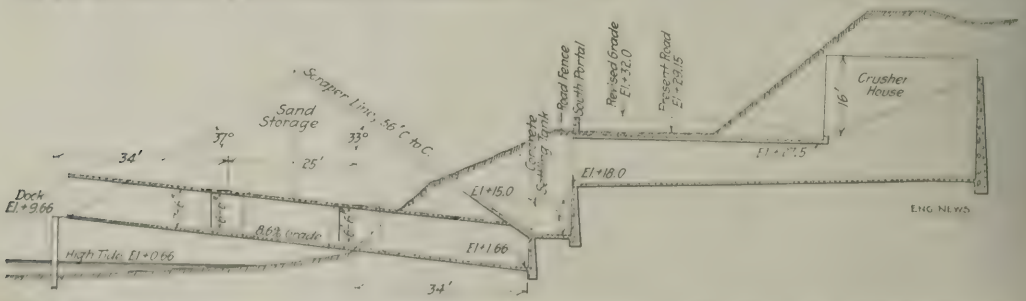


Fig. 2. Profile of Screening and Washing Plant of the National Sand and Land Development Co., Peekskill, N. Y.

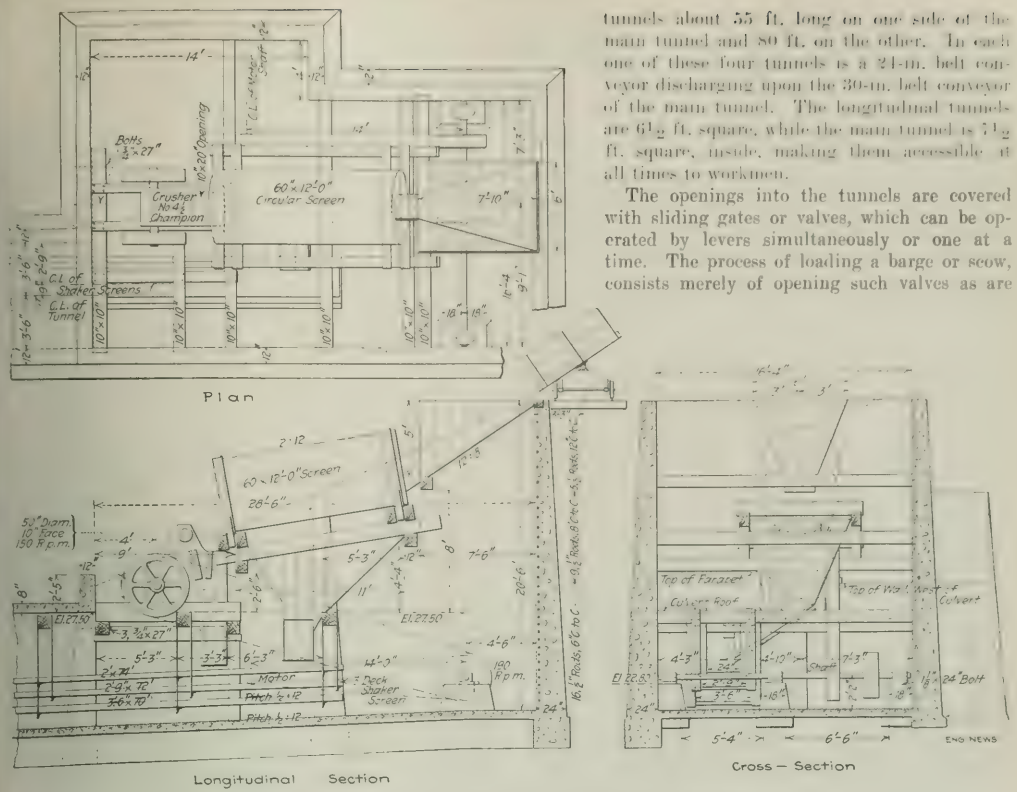


FIG. 3. PLAN AND ELEVATION OF CRUSHER AND SCREENS

20-hp. alternating-current motors, housed at the upper end of each conveyor frame.

Beneath the reinforced-concrete floor of the storage piles is a series of concrete tunnels which have 20×20-in. openings on their center lines under the sand and gravel piles. Through the middle tunnel, 76 ft. long, crosswise of the wharf, runs a 30-in. belt conveyor, 90 ft. long, which discharges over the end of the wharf directly into scows alongside. Intersecting this main tunnel on each side, and 25 ft. between centers, are the two longitudinal tunnels about 55 ft. long on one side of the main tunnel and 80 ft. on the other. In each one of these four tunnels is a 24-in. belt conveyor discharging upon the 30-in. belt conveyor of the main tunnel. The longitudinal tunnels are 6½ ft. square, while the main tunnel is 7½ ft. square, inside, making them accessible at all times to workmen.

The openings into the tunnels are covered with sliding gates or valves, which can be operated by levers simultaneously or one at a time. The process of loading a barge or scow, consists merely of opening such valves as are necessary to give the desired material and allowing the sand and gravel to flow from the piles to the belt conveyors below, by which the material is automatically transported and discharged into the scow. The loading capacity of the conveyor system is 500 cu.yd. per hour.



FIG. 4. BELT CONVEYORS FOR TRANSFERRING SAND AND GRAVEL TO STORAGE PILES

The plant is remarkably compact and easy of operation. It is designed to have a capacity of 2000 cu.yd. per 10-hr. day with an operating and excavating force of eight men. All the power used is electricity, at present purchased in Peekskill, but ultimately it is intended to have a power plant on the works. The plant cost complete $82,000, of which $20,000 represents the cost of dredging the channel.

The plant was designed and built by George C. Hudson, General Manager of the National Sand and Land Development Co., of Peekskill, to whom we are indebted for the foregoing data and plans.

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Corrugated Iron Pipe for Storm Sewers was the subject of an inquiry in our issue of Feb. 13 (p. 324), and we are informed by the National Corrugated Culvert Mfg. Co., of West Berkeley, Calif., that there are many storm sewers of corrugated pipe made of American "ingot iron." At Berkeley, Calif., there is a 30-in. pipe 600 ft. long, while at Taft, Calif., there is a 12-in. pipe 1200 ft. long, both of which are said to be giving satisfactory service. At El Paso, Tex., a 24-in. pipe 3700 ft. long, has been built as the outlet of a sewage-disposal plant. This line has several bends, a short drop of 3½ ft. and a long curve.

Twin Falls—Oakley Irrigation Project

By A. M. Korsmo*

SYNOPSIS—An unusually high earth dam, 145 ft. high from the creek bottom to the top of its crest and containing more than a million yards of earth, had, as its most notable construction feature, motor-driven belt conveyors to transport the larger part of the earth fill. Two steam shovels, working at different levels, lifted the dirt into dump cars drawn by dinkey engines. These moved the dirt a half mile to a loading hopper which discharged onto a 250-ft. conveyor on a 3.5% grade. The dirt then passed, successively, to a 680-ft. conveyor on a 16% grade and to a level belt conveyor 900 ft. long. These conveyors were of rubber, 36 in. wide. The last conveyor dumped into a storage bin, from which the dirt was discharged through two chutes into dump wagons. The dirt was dumped onto the dam in windrows, from which it was leveled by ploughing lengthwise and using tongued scrapers. The 6-in. earth layers were sprinkled and rolled. The concrete core-wall, from 9 ft. above the natural surface, was only 1 ft. thick, but it was reinforced with meshed wire. The core-wall extends to bed rock, 40 ft. below the natural surface. The outlet tower and gates have interesting features.

The Carey Act irrigation project described in this article is located in Cassia County, southern Idaho, about 30 miles east of Twin Falls.

Leading Features.—The main features of the project are (1) an earth dam 145 ft. high, 1025 ft. long, and 750 ft. wide at the base, with slopes of 3 to 1 on the upstream side and 2 to 1 on the downstream side. The fill required 1,074,000 cu.yd. of earth; 65,000 cu.yd. of rock were used for riprapping the slopes, and 6200 cu.yd. of concrete in the core-wall. (2) The reservoir, which is in the natural cañon of Goose Creek, will have a length of 5 miles and an average width of $\frac{1}{4}$ mile, storing 74,900 acre-ft. of water. (3) A spillway at the west end of the dam, in solid rock, with capacity for 2000 sec.-ft. The spillway lip, which follows a contour, is 600 ft. long and the total excavation in the spillway cut is 25,000 cu.yd. (4) A concrete-lined outlet tunnel, 870 ft. long, 8 by 10 ft. in section, and driven through solid rock under the cliff at the east end of the dam. Two indepenent types of outlet gates are used, one the standard sluice gate, the other of the tower type. (5) The water stored comes from four creeks. Goose Creek and Trapper Creek, which runs into it, are impounded by the main dam. Cottonwood and Birch creeks require diversion dams and feeder canals leading to the main reservoir. These feeder canals total twenty miles in length and include earth and rock ditches, tunnels, flumes and concrete inclines or drops. (6) The distribution system includes 150 miles of canals and laterals and covers a segregation of 50,000 acres of land.

The duty of water is fixed at 1½ acre-ft., actually delivered. The land has a very gentle slope, the laterals following the section lines to a considerable extent. The average elevation of the tract is 4600 ft. above sea level. The average annual precipitation for the last 15 years was 9.1 in. (7) There are 870 sq.mi. in the drainage area, which is a part of the Columbia River Drainage Basin, located in Utah, Idaho and Nevada.



Panoramic View of Goose Creek Dam under Construction.

Construction of the Main Dam

The dam is located in the mouth of Goose Creek Cañon (see plan, section and profile, Fig. 1). At the east end the rock cliff stands almost vertical, while at the other end there is a much more gentle slope with bedrock coming to the surface. In the creek bottom, bedrock was

*Assistant Engineer, The Farm Engineering & Construction Co., Twin Falls, Ida.

found at a maximum depth of 40 ft., under strata of sand, gravel and boulders, with about 15 ft. of loam at the surface. The core-wall trench was dug first and a 3-ft. concrete wall built up from bedrock to 9 ft. above the natural surface, puddling in on both sides with selected material. A cutoff trench 10x10 ft. in earth section and 8x10 ft. in rock was dug at each end of the dam, about 100 ft., upstream from the core-wall. This likewise was back puddled with selected material. At the upper toe another cutoff trench was dug, this time to bedrock, with a 10-ft. base and 1 to 1 slopes in earth, and an 8x6-ft. section in rock at either end. An 18-in. concrete wall 3 ft. high was built in this trench and back puddled with selected material. On the downstream side a drainage trench 10x6 ft. in section was dug along the toe and backfilled with loose rock.

In the meantime the outlet tunnel was driven from four faces and the creek diverted through it. This enabled the core-wall and other trenches to be dug across the old creek channel and completed. Derricks and skips operated by teams were used in the excavation and wheeled scrapers carried the material away. This method proved efficient and good time was made, considering the large amount of water and boulders encountered.

The original plans called for a cutoff trench at the upper toe similar to the intermediate trench, but after encountering the large amount of sand and water in the core-wall trench it was decided to carry the upper trench to bedrock and put a small concrete wall in it.

The east cliff has a great many crevices and fissures in it. To guard against seepage through them the cliff was shot about 18 ft. back to give a solid bond for the core-wall. Three other vertical walls of concrete, each 1½x4 ft., were built about 15 ft. apart on the side of the cliff upstream from the core-wall as an additional guard against seepage. All the crevices were cleaned out and back puddled with selected material. These cutoff walls were anchored to the cliff by ⅞-in. square twisted Ransome bars, grouted and wedged on 3-ft. centers.

The base of the dam was cleared of all brush and willows and ploughed to make a good bond for the fill placed on it. With the intention of sluicing the earth fill into place, the lower toe was built up about 20 ft., using wagons loaded from a near-by trap or loading platform.

Sluice flumes were built on the hill at the east end of the dam, on a 4% grade, with a 20-in. base paved with cottonwood blocks placed on end. Later this flume was changed to a 10% grade, same section, but lined with iron. The earth for sluicing was taken from a pit near the one used in 1912 and hauled by conveyors to the sluicing flumes. It was soon found that the sluicing method was impractical, chiefly on account of the lack of water, all of which had to be pumped from Goose Creek against a 175-ft. head. It was also found that the material from the borrow pit had a large percentage of black sand in it, which continually choked in the sluice flumes. Sluicing was then abandoned and preparations were made for building the dam by the mechanical method, or by placing the material dry in layers, sprinkling and rolling it.



Twin Falls-Oakley Irrigation Project, Idaho

Borrow Pits—No borrow pits were to be found near-by which were high enough to allow dirt trains to run to the east cliff over the dam. Several small pits were found in gulches beyond the west end of the dam, but this material was a fine lava ash soil unfit for the body of the dam. Suitable earth was found about a mile east. It is a cemented gravel containing a heavy percentage of earth.

The following equipment was used in the pit to handle the material. Two No. 60 Marion steam shovels, three 16-ton Davenport dinkies and 50 4-yd. Western dump cars. Forty-pound rail was used both on loading tracks and main line. Lighter rails were unsatisfactory because they required constant surfacing.

From test pits it was found that the material would be very hard to excavate. The pit was then laid out so that the shovels worked on separate benches, giving each about a 20-ft. face. Considerable shooting had to be resorted to, even though neither shovel was ever required to dig its capacity. Shooting the material cost from 2

to 7c. per yd. Churn drilling and coyote holes were used, the former costing about 27c. per ft. The lower bench, where No. 1 shovel worked, did not require any shooting. Care had to be exercised that the material was not shot too hard, or it would sluff down on the loading track, besides making large chunks that could not be handled by the shovels or broken up at the loading hopper. The best results were obtained when just enough powder was used to loosen the bank and let the shovels break it up. On No. 2 shovel the teeth had to be changed every 6 to 10 days. Fifteen-car trains were used, one being in transit while the other two were loading.

Conveyors—The land adjacent to the dam site is very rough, having many deep gulches. To have moved the

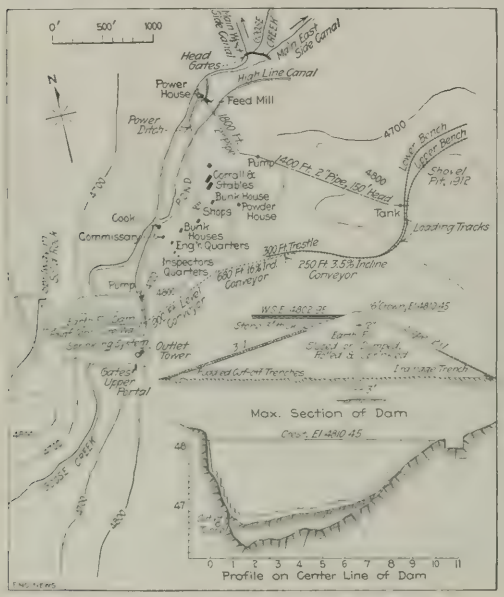


Fig. 1. Layout, Cross-section and Profile of Goose Creek Dam, Twin Falls-Oakley Irrigation Project, Idaho

material composing the dam by rail would have required miles of contour track laying. The location of a suitable borrow pit, as regards elevation, would have meant impossible grades for dinkey trains if bridges were built across the gulches. This led to the adoption of the conveyor system, as shown in the general plan, Fig. 1, and the views Figs. 2, 3 and 4. The three units are (A) a level conveyor 920 ft. long; (B) a 680-ft. conveyor on a 16% grade; (C) a 250-ft. conveyor on a 3.5% grade. These conveyors are built on trestles whose maximum height (Conveyor B) is 68 ft. at Mill Gulch.

In general, the bents have two posts, are on 24-ft. centers, and the stringers are on 12-in. centers. The head drive and tail-drum frames are anchored in concrete which is set on solid rock. The belts are of rubber, 36 in. wide and six ply.

When the dirt becomes wet in rainy weather it is very hard to handle it in the chutes at the dam. To avoid this difficulty as much as possible, and as a protection for the belts against the sun and wind, the conveyors were housed.

To take up the slack in the belts, which in the case of long belts is an important consideration, two types of idlers were used, one of the gravity type, the other of the "S" type (Fig. 5). Both were efficient, but the latter has an advantage where there is little underneath clearance. The belts are run on a speed of 450 ft. per minute and easily handled 750 4-yd. cars in a 10-hr. shift. This amount could have been increased 25% by speeding up the belts and loading heavier. The maximum output for both shifts was made in September, 1912, when 105,000 yd., measured in place, were conveyed. The average output for the season was about 95,000 yd. per month. The night shift handles about 90% of what the day shift does.

Power and Equipment for Conveyors—Conveyor A is driven by a 40-hp., 2200-volt, 60-cycle, 3-phase, type F.H., Westinghouse induction motor; Conveyor B, by a 75-hp. motor of the same type as the Conveyor A machine, and Conveyor C by a 30-hp. motor, also the same type as the Conveyor A machine. Running under no load the conveyor system requires about 50 kw., and when under full load from 100 to 125 kw. The variation is caused chiefly by the run-of-pit material, which at times has a great deal of gravel in it, and again may be all earth. The motors are started in succession, beginning with Conveyor A, a signal system being used by the motormen to communicate with each other. In this way the starting torque does not exceed 150 kw.

Current is brought from a hydro-electric plant on the Snake River, a 3¾-mile private transmission line being built from Oakley to the dam by the Construction Co.

Feed Hopper—A feed hopper of 300 yd. capacity is built over the end of Conveyor C (see Fig. 5). It has three compartments, with individual openings, so that the variation in pit material may be kept separated and conveyed to the dam as needed. The coarser material is used on the downstream side and the more select in the trenches and on the upper toe. A trestle alongside the hopper carries the dirt trains out on it so that they can dump into the latter.

A grid of parallel bars, 5 in. c. to c., with a slope of 4 to 1 down from the track, covers the hopper. The bars are ¾x4 in. in section and 24 ft. long. This grid separates all large rock and lumps of cemented gravel which cannot be broken up, and they are wasted on a near-by dump. As many as 18 men have been used here when the large cemented lumps came, but ordinarily two or three men could keep the bars clear.

The openings under the hopper are 1 ft. by 4 ft. wide, with no doors. Feed belts, 8 ft. wide of 39-oz. canvas, revolving under these openings, catch the material and drop it onto the conveyor belt. These three belts, which are independent of each other, are operated by chain drives and friction clutches from a line shaft which extends to the tail drum of Conveyor C.

Storage Bin—On the east cliff, under the head drive of Conveyor A, and on the center line of the dam, a storage bin is built with two chutes leading from it (see Fig. 2). This bin has a capacity of 200 yd. and was designed to provide for the fluctuation in the conveyor haul. The two chutes are built on trestles with a slope of 17.5 degrees and have a section of 20x22 in. They are covered with doors and lined on the bottom; one with

crescent-shaped iron castings and the other with 4-in. cottonwood blocks, set on end. Both chutes were satisfactory except that when the material got wet it would cake against the sides and bottom and the entire section of the chutes would gradually choke up. At such times it required from two to six men to clean out one chute while the other was being used. Because of this caking, which continued to a certain extent throughout the entire season, it was found that neither the iron nor cottonwood block linings wore down to any appreciable extent.

A portable hopper, with a capacity of eight wagon loads, was placed under the lower end of the chutes, which are parallel and 5 ft. apart. The dump wagons come under the hopper and are loaded. When running steadily four 1.5-yd. dump wagons are loaded per minute, one man operating the feed door of the hopper. Another man operates the chute gates, which are up under the storage bin, keeping the portable hopper full. At first the gates were placed at the lower end of the chutes and wagons loaded directly from them, but this proved very unsatisfactory, as the material would pack and choke in the chutes when the gates were closed. The material would not run smoothly, but moved in sections, one section making a heavy impact against the section below when it suddenly became released and slid down. As the fill of the dam raises, the chutes are cut off and the loading hopper raised.

Method and Sequence of Construction.—From the portable hopper the material is hauled out and dumped in windrows parallel to the core-wall. Ploughing lengthwise and using tongued scrapers these windrows are leveled out to a 6-in. layer. The dirt is then sprinkled with water, using about 15%, and rolled with a 16-ton Avery traction engine. The rear wheels soon wore out, running over the loose uneven fill, and were replaced with Marion steam-shovel wheels, 24 in. wide and each weighing 1½ ton. The fill is laid on a 1.5% grade down from the loading hopper to the west end of the dam. This was done to help the stock in hauling loaded wagons, 16



Fig. 2. Dam under Construction, September, 1911



Fig. 3. Conveyors B and C, Feed Hopper, Dinkey Trestle and Cut to 1912 Borrow Pit



Fig. 4. General View of Conveyor System, Terminating at Right above the Storage Bin and Chutes Shown in Fig. 2

Figs. 2 to 4. Views Showing Construction Work on Goose Creek Dam, Idaho

teams being used per shift on an average run. The material is sluiced into place on either side of the core-wall, in the trenches, and also where the fill joins the cliff at the east end and the natural surface at the west end of the dam. The material is ideal for dam construction, and when sprinkled and rolled becomes very compact, due to the cementing qualities of the earth. The upper toe is built up of selected material for a distance of 20 ft. back from the face. This material, which is used along with the run of finer material from the shovel pit, is obtained from two small pits beyond the west end of the dam, using traps and a wagon haul. This material is a lava-ash formation, free from rock or gravel, and especially adapted for sluicing in the trenches.

Following the fill as it raises, the riprap is placed by hand, 3 ft. thick on the upstream face and 2 ft. thick on the downstream side. The stone is from ¼ to 1 cu.ft. in size, except a layer 1 ft. thick next to the earth on the 3 to 1 side, which is much smaller. The rock used is taken largely from the spillway excavation, although a terial. The reinforcing used is the American Wire Co.'s No. 9 mesh reinforcing wire, butt-joined and wired together. A portable half-yard Smith mixer, with self-charging skip and mounted on a wagon, is used. It is operated with a 7.5-hp. motor. Sand and crushed rock are used in proportions to get as dense and nearly impervious a concrete as possible. A crusher plant is operated in connection with the spillway excavation.

Reservoir Outlet Gates

The main sluice gates at the upper portal of the outlet tunnel are two in number, set 5 ft. apart on an incline of 45 degrees, and are 2.5x10 ft. in size. The gates are made of cast iron, heavily ribbed, and move on bronze slides. In closing them they are drawn tight by bronze wedges, three on each side of each gate. The hoisting devices are designed to operate against a head of 135 ft. The gate stems are 4.5 in. in diameter, with guides every 17 ft.

The tower (Fig. 6) is independent of the sluice gates. It is connected with the outlet tunnel, 150 ft. from the

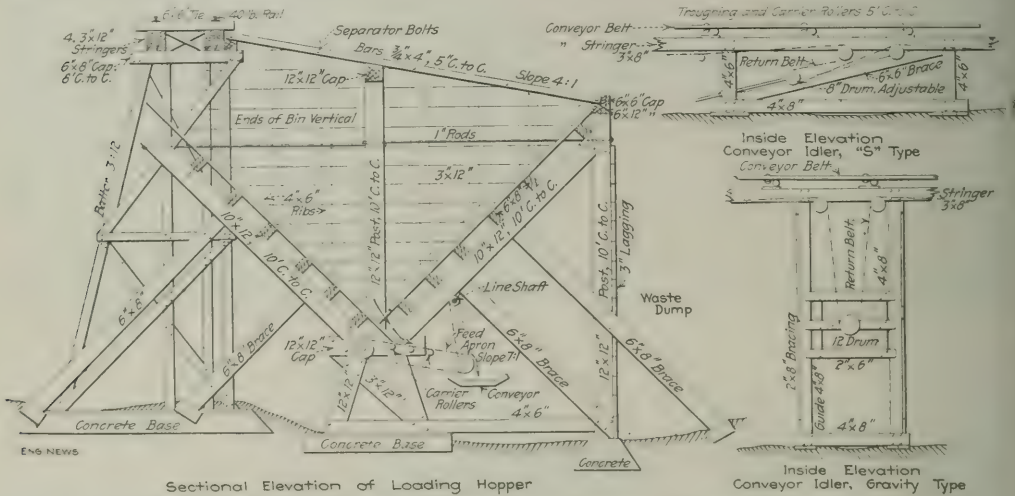


Fig. 5. Details of Loading Hopper and of Idlers for Conveyor System

considerable amount was shot down from the east cliff where it fell on the fill and was easily placed.

Sprinkling System. The pump for the sprinkling system is at the lower portal of the outlet tunnel. This pump is a two-stage, 3-in. American, pumping 100 gal. per minute against a 230-ft. working head, and requiring 25 kw. to operate it. A 3-in. main runs from the pump up over the east cliff. Three 2-in. pipes take out from it and are laid in the fill parallel to the axis of the dam (see plan, in Fig. 1). Two-inch standpipes are erected every 100 ft. on each pipe line and 3-ft. sections are added as the fill raises. Using a hose and nozzle, the entire surface of the dam can be easily reached from these standpipes. As an auxiliary, a triple plunger pump was installed on a pontoon on the reservoir at the upper toe, with a connection to the pipe-line system on the dam.

Core-wall. The 3 ft. wall was built from bedrock to 9 ft. above the natural surface, from which height the 1-ft. wall was built up, along with the dirt fill, in 34-in. lifts, this being the width of the woven reinforcing ma-

upper portal, by means of a short tunnel 10 ft. long. A 20-ft. sump in the bottom of the tower provides against the impact of water falling from above. The tower is built of reinforced concrete, on a solid rock foundation, with three sets of ports, one above the other and 30 ft. apart.

Each set of ports has eight openings, 2x2.5 ft. in section, which are opposite in pairs. This arrangement destroys all impact of incoming water against the inside of the tower. Two cylindrical castings form the gate for each set, after the manner of the cylinder gate waterwheel. One of them is set in the concrete on the inner face of the tower and has the 2x2.5 ft. openings. The other, 3 ft. high, slides down into position just inside the outer stationary casting. Beveled bronze wedges make them fit water-tight when the gate is closed. Two stems are provided for each gate. The hoisting devices are on the top of the tower and are similar to those used for the sluice gates. The ports, being 30 ft. apart, make it unnecessary to operate any gate under more than a 40-ft.

head. Likewise, the big sluice gates at the upper portal need not be operated under more than a 60-ft. head. The tower and sluice gates were built and installed in the fall and winter of 1911-12.

GENERAL.—Active construction of the dam was begun in May, 1911, but the trenches were dug and the sluicing method tried during the season of 1910. When work



FIG. 6. TOP OF OUTLET TOWER, GOOSE CREEK DAM

closed down for the winter of 1912-13, there remained about two weeks' work (35,000 cu.yd.) to complete the dam. The distribution system for the project has been completed. By the close of December, 1912, 55 ft. of water was in storage in the reservoir, ready for use in 1913.

PERSONNEL—The Faris Engineering & Construction Co., of Boise, Idaho, are the engineers and contractors on this Project. R. W. Faris is president and chief engineer of the company. A. J. Wiley, of Boise, Idaho, is the consulting engineer and J. C. Porterfield is the construction engineer, the writer acting as his assistant. W. S. and J. S. Kuhn, of Pittsburgh, who have built a number of irrigation projects in this vicinity, are also promoting this one.

Standards for the Hygienic Purity of Public Water-Supplies

Standards of purity for water and for sewage-works effluents have been sought long and ardently by many analysts and sanitarians. At the meeting of the Indiana Sanitary and Water Supply Association, held at Indianapolis the last week in February, 1913, J. W. Ellms* presented a paper with the foregoing title.

After mentioning the standards for laboratory analyses of water and of sewage formulated by a committee of the American Public Health Association (report printed in 1905) and revised some five years later, and remarking that laboratory technic did not stand still, as some feared, because standards were established, Mr. Ellms took up standards of purity for water. The remainder of his paper, except for one paragraph suggesting the need of state and federal enforcement of any purity standards which might be set up, and one on safe limits of bacterial removal, is as follows:

It is evident that unless there are fairly accurate methods of measurement for the purity of a drinking water, and that unless these methods are reasonably uniform, the results obtained will only lead to confusion and bitter disputes. The question, therefore, resolves itself into this form: Are our modern standard bacteriological methods sufficiently reliable to properly measure the hygienic purity of water? It is difficult to answer this question without qualifications. Without hesitation one may say, that as we can only find specific disease germs in natural waters with a great deal of difficulty, and that if found a knowledge of their number and virulency are of prime importance before the water can be absolutely condemned, it does not appear that our methods are as yet entirely adequate. On the other hand the circumstantial evidence easily and readily obtained by examining the water for the presence of organisms which may be and usually are associated with disease germs, would lead one to declare that some of our methods at least were quite sufficient to establish the degre of impurity which might exist.

It seems to the writer that if this subject of standards of purity is investigated in an open frame of mind, and with the same spirit of impartiality that the subject of standard methods of analysis was approached, it will be possible to establish tentative standards of purity. These standards will of necessity be subject to modification by local conditions, and may have to be frequently revised.

If it is kept in mind that a drinking water is hygienically pure when it does not produce disease nor disturb in any way the normal physiological processes of those who drink it, it will not be difficult to agree upon what shall constitute the safe limits of bacterial and chemical purity.

The writer believes that the angle from which the subject of standards of purity is viewed is of fundamental importance for a practical solution of the problem, and has endeavored to set forth this phase of the matter, instead of attempting to state what such standards should be. The whole question is one which is intimately related to the extent of permissible pollution of natural waters, and must be considered in conection with it.

By what method these problems shall be atacked is perhaps open to question; but the writer would suggest that it may be gotten under way by the appointment of delegates from each of our large engineering societies, water-works and sanitary associations, who shall meet to formulate a plan of procedure. These delegates may work in conjunction with any existing committees now in the field, or with any State or United States departments which have already given this matter attention.

Some of the points which such a body should discuss are:

(1) What diseases may be legitimately regarded as water borne?

This involves a consideration of the Mills-Reincke phenomenon and the Hazen theorem as set forth by Prof. W. T. Sedgwick and J. S. MacNutt, and the ideas of chronic intestinal tract infection advanced by N. S. Hill, Jr., and L. R. Whitcomb (see "Eng. News," Jan. 30, 1913), for it means a careful analysis of all the available and reliable vital statistics of those communities having impure water-supplies as well as those having pure supplies.

(2) A clear definition of what really constitutes a pure drinking water.

This means that much light is needed upon the relative numbers and kinds of bacteria, and of the nature and amount of the organic and inorganic matter which may be present in public water-supplies, and their significance in the causation of disease. It necessitates the examination of the available bacteriological and chemical data of public water-supplies, and its classification in relation to vital statistics.

(3) The selection of the maximum limits for the numbers and kinds of bacteria in a drinking water, and the permissible amounts of organic and inorganic matter which such a water may contain.

This selection, of course, will be the result of the logical conclusions reached from a study of the compiled statistics, and should be adopted only after a careful consideration and free discussion of the evidence.

*Of Pollard & Ellms, Consulting Enginers, Miles Greenwood Building, Cincinnati, Ohio.

The Prevention of Missed Fires in Blasting

While electric fuses are generally recommended as the safest detonators for blasting operations, yet there seems to be some difference of opinion concerning the best method of connecting a number of charges which it is desired to fire simultaneously. In ENGINEERING NEWS, Sept. 22, 1910, there appeared an article on "Precautions for Maximum Safety and Effectiveness in Blasting," in which the statement was made that "electric fuses are connected in parallel sometimes for firing from lighting circuits," but that "when the source of current is a blasting machine or battery of the usual type, the bore holes should be connected in series," because "the common blasting machines and batteries will not satisfactorily set off detonators connected in parallel."

The apparent advantage of a series connection is that the charge has to pass through all the detonators in order that any one of them may be exploded. The great practical objection to this method, however, is the difficulty of making electric exploding cartridges of equal or nearly equal sensitiveness. In ENGINEERING NEWS of Jan. 25, 1906, there was described an improved form of electric exploder; but even in that type there is danger of inequalities in the periods of apparently similar cartridges. When a number of electric exploders are connected in series, it is true that the current passes through all or none of the cartridges (unless there are two or more grounds), but it is equally true that the exploding of the first charge may interrupt the circuit and prevent the exploding of the other charges. While it is not likely that the majority of cartridges of similar size and type would differ enough in period to be affected, it is easy to see how an occasional defective cartridge of abnormally long or short period might be used in such a series circuit and result in one or more missed-fire holes.

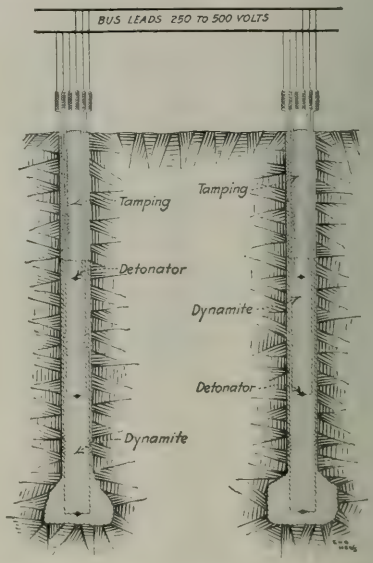
W. H. Mason, superintendent of the Edison Portland Cement Co., Stewartsville, N. J., in a paper read at the annual meeting of the American Society of Mechanical Engineers, December, 1912, advocated the use of parallel connections for firing a number of charges simultaneously. He also proposed the use of several detonators in each hole as an added precaution against missed fires. An abstract of the above mentioned paper is given in the following paragraphs:

A frequent cause of serious accidents in cement manufacture is the blasting methods used in the quarries. Many of these accidents are due to what is commonly called "missed fires," that is, charges which have been placed in the bore holes and have failed to explode under the usual firing conditions. Formerly when charges were exploded by time fuses these were probably more frequent than at present, when it is common practice to explode a series of holes by an electric battery, fuses being used only to explode the small "plug holes" or dobies, for the purpose of breaking large stones which have already been blasted from the ledge.

A missed fire is always a source of danger. There is no known way of unloading the hole safely and when an attempt is made to drill another hole near it, so as to blast it out, the drill bit not infrequently comes in contact with the dynamite in the loaded hole with disastrous results to the driller. When the driller is fortunate enough to get the hole in without accident, it is loaded and blasted. This usually throws the powder from the missed-fire hole among the débris and frequently when the latter is being loaded, a laborer will strike it with some tool and cause an explosion. The only way to avoid this danger is to prevent the missed fires.

For about eight years the Edison Portland Cement Co. has been exploding all churn drill blast holes with a 500-volt direct-current power circuit. Many of these blasts are made simultaneously on from 12 to 20 holes, each loaded with 500 to 800 lb. of 40% and 50% gelatin powder, and during this time there has been only one missed-fire hole. It was impossible to find the cause of this failure, but it was attributed to a poor connection from the exploder leads to the bus wires. Before this time, they had been using the common pushdown magneto machines—and it was a usual thing to have several missed-fire holes per month. One of the quarries of the company is so located that no power circuit is available and for a year or two the blasts were set off by push-down machines. After having had several missed-fire holes, and some resulting accidents, they installed a small 250-volt direct-current generator, driven by a steam turbine. This has been in operation several years and there have been no missed fires since its installation.

Gelatin powder is the most difficult of all the dynamites to detonate and it is a well known fact that if exploded by a powerful detonator, the full effect of the powder is obtained, while if improperly detonated, much of the effect is lost. For this reason and also on account of the danger and expense which always accompany a missed-fire hole, the writer believes it is better to use too many exploders, or electric fuses, of high power than not enough. In a 6-in. borehole, running 60 ft. deep, not less than three exploders should be used. One of these should be directly at the bottom, so that if when loading the hole with dynamite, a stone should slide in from the side and block it off, it would still be possible to explode the dynamite below, and thereby avoid the danger from the otherwise unexploded dynamite; the other two are distributed one near the center and the other near the top. All are connected directly across the 500-volt or 250-volt direct-current line, so that all exploders are in parallel and receive the full voltage of the power circuit. By this method any number of holes may be exploded at one time, up to the current capacity of the supply circuit. The cost of the extra exploders is always a small proportion of the cost of the dynamite used and the writer believes that this expense is warranted by the increased detonation power of the exploder, as well as by a sort of insurance against missed fires, which are always expensive aside from their potential danger.



CROSS-SECTION OF BLAST HOLES, SHOWING USE OF MULTIPLE DETONATORS

In the accompanying cut is shown the method of connecting the wires of the electric exploders to the bus wires. The argument has been advanced frequently that the insulation on the leads of the electric fuses is not sufficient to withstand the high voltage. This, no doubt, is true, but experience shows that the fuse in the exploder blows while the insulation is breaking down, and it is then a matter of no importance whether the insulation fails or not.

EDITORIALS

A Belated Reparation

It is now thirteen months since Messrs. C. G. Elliott and A. D. Morehouse, Chief and Assistant Chief, respectively, of the Bureau of Drainage Investigations of the U. S. Department of Agriculture, were removed from their positions on the charge of malfeasance in office. During all that time these men have been under the shadow of dishonorable dismissal; their acts have been the subject of a long-drawn-out Congressional investigation; they have been subjected to the disgrace of an indictment on criminal charges and they have suffered large pecuniary loss in injury to reputation and in expenses incurred in conducting their defense.

After a careful investigation of the charges against these engineers, this journal concluded that their offense at worst was a bookkeeping subterfuge, common enough in departmental circles and, in this particular case, approved by the auditors directly responsible. This opinion was confirmed by the investigation conducted by the Congressional committee, which, in August last, exonerated Messrs. Elliott and Morehouse of any criminal intent, and reported that their punishment had been unnecessarily severe. As a result of this report, the government authorities acknowledged their error to the extent of requesting the quashing of the indictment brought against the two men, but withheld the complete vindication of an immediate reinstatement. We now note in our "personal" columns on another page, a belated reparation. Almost the last official act of the 16 years' service of the Secretary of Agriculture, James Wilson, was the restoration of the two engineers to their original positions.

Whether this was in the nature of a deathbed repentance, or merely the celebration of the release from the sinister influence of his departmental Solicitor, McCabe, Mr. Wilson's act was one of simple justice only. We therefore pay the venerable and tenacious ex-secretary a dubious compliment when we say that we are gratified at his conversion—or his liberation as the case may be.

The Offer of a Prize for a Substitute for Gasoline

A good deal of publicity is being given to the offer of a prize of $100,000 by the International Association of Automobile Clubs for a fuel suitable for use in internal-combustion engines, the conditions being that the fuel must be less expensive than gasoline, must be readily procurable, and must be of such a nature that it cannot be "cornered" by trusts, national or international.

The prize might as well have been set at a million dollars or ten million dollars, for there is, so far as we can see, no possibility of its award. There are indeed other well known volatile hydrocarbons than gasoline which it is possible to produce chemically and mechanically. Benzol is a volatile hydrocarbon produced by distillation of coal tar, but the total amount which can be produced is trifling compared with the demand for a material to supplement the present supply of gasoline; and only when produced as a byproduct from coal can it be obtained at low cost.

Alcohol is a volatile hydrocarbon produced by the fermentation and distillation of vegetable growth. The limitations of alcohol as a substitute for gasoline are that the vegetable growth from the world's productive lands is already pretty fully utilized as food for man and domestic animals. While there has been much talk of processes of making alcohol from refuse vegetable matter, the final cost per gallon of alcohol produced by any such process appears to always work out far above present prices of gasoline.

We have now, however, exhausted the list of possible sources from which a volatile hydrocarbon may be derived; that is to say, it must either be obtained from liquid hydrocarbon (petroleum), which furnishes the present supply of gasoline, from the solid hydrocarbon, soft coal, which furnishes the benzol already referred to, or from refuse vegetable matter in the form of alcohol.*

It may be that the production of benzol may be increased. Such materials as lignite and peat may be laid under contribution to obtain it or some equivalent volatile hydrocarbon fluid. There may be some further development, also, of alcohol-producing processes. There is little hope, however, that any of these processes can so supplement the supply of gasoline as to prevent a steady increase in price. The two directions from which a check on the increase in the price of gasoline is most probable are, first an increased supply of petroleum, due to the stimulus upon production resulting from increased selling prices of crude oil and, second, and most important, the modification of the gasoline engine so that it can successfully burn heavier oils.

Point of Weakness in Low-truss Highway Bridges

The defects in design which are responsible for such truss failures as that of the Wellsville bridge (whose collapse is described on another page) are obvious, and it needs little more than examination of the sketch of the bridge to make the failure appear a perfectly normal and natural event. Much better pony-truss bridges have failed from the same cause, buckling of the upper chord. Most of the failures have gone unrecorded, but it may be stated as a safe estimate that in the last half-dozen years there have been at least ten or fifteen cases of just this kind; short-span steel pony-truss highway bridges, built with concrete floors and designed to carry traction engine loads, collapsing before they were opened to traffic.

Through plate-girder design, which is very extensively represented in the railroad bridge field, affords a thoroughly satisfactory model for the rigid and safe con-

*A small amount of gasoline is already obtained from the earth's stores of hydrocarbon in gaseous form or natural gas.

struction of low-truss highway bridges. Ample rigid bracketing to the transverse floor members at frequent intervals is known to be necessary in order to make the upper chord or flange secure against lateral buckling. Yet it is a fact that a great many low-truss highway bridges built for erection in remote country districts are almost devoid of bracketing or other stiffening of the top chord. In the present case, as may be seen from the sketch in the article already mentioned the only reliance lay in the slight stiffening effect of the vertical members of the truss web, assuming that these were rigidly riveted to the floorbeams. If, as the drawing suggests, the inner flange of each of these posts was cut in order to give room for riveting the floorbeams directly to the gusset-plate, practically all of this remaining stiffening effect was thrown away, and the top chord left virtually unstiffened from end to end. That these faults would coöperate with the common sin of building such trusses with unstiffened hip points (the upper chord at these points being interrupted and connected only by the thin flexible gusset-plate) can be realized at once.

After finding the design of the bridge thus fatally defective, one need not be further surprised to learn that the upper chord was so slight in section that even with its panel-points adequately stiffened it would probably have been too weak to carry more than its dead-load, without margin for carrying heavily loaded wagons.

It has before been noted that this type of bridge when built with concrete floor and a roadway surface of broken stone is greatly exposed to the danger of overloading by excessive thickness of the floor concrete and gradual accumulation of an excessive thickness of road metal. A little figuring will show that in any bridge of moderate span and intended for ordinary highway travel the weight of concrete and broken stone makes up a large part of the total load, and that a relatively small overrun in these two items may put considerable overstress into the members of the truss. As far as the concrete itself is concerned, a safe rule might be established requiring the supporting members of such a bridge to be designed for a 50% greater thickness of concrete than shown by the design. But even beyond this, provision must be made for probable future increase in thickness of the macadam surfacing, for road repair on country highways is not carried on by bridge engineers, and is often conducted on the plan of simply piling on more stone without regard to a set of long forgotten blueprints.

A Model for Engineering Conventions

The recent midwinter convention of the American Institute of Electrical Engineers, reported in our issue of a week ago, deserves study by other societies' officers for its unusually well organized program and immediate utility. This was helped perhaps by concentrating attention on a single aim—the discussion of discrepancies between recent attainments in the design of electric-power apparatus and the formal standards of testing and rating. This seemingly is a narrow field when so stated, but really is one which broadens and ramifies when more carefully considered. All engineers concerned in the recent production or purchase of electrical machinery in large units have run against this snag or that in the accepted ways of testing and rating this equipment, though, perhaps, unaware of others lurking. But everyone who attended these Institute sessions a couple of weeks ago must have carried away a comprehensive idea of advances in technical practice which the formal standards had not kept up with.

There were 44 formal papers on the program, but they were presented in related groups and discussed in groups. The practice at these sessions, of holding the authors to concise prepared abstracts of two or three paragraphs, is worth at least passing mention as a contrast with meetings (not necessarily of this society) where in the oral "abstracts," authors drag along for twice the time needed to read the whole paper. There was a snap and a dispatch to the business of this convention that speaks well for the parliamentary ability and tact of the presiding officers, and the intelligent application of the assembly.

The papers themselves disclosed the experience of manufacturing concerns in a way that once would have been feared as giving away the secrets of success. One important advance will probably be found to have been crystallized by this convention when, at some future date, we see the expected new standardization rules. Engineers, as purchasers of power machinery, have demanded that it should be tested before acceptance to demonstrate its ability to meet the conditions imposed. Manufacturers naturally have wanted to make such tests at their shops to assure themselves that changes were not going to be necessary after shipment and installation. While it is desirable in most instances to have acceptance tests made after installation and under the actual conditions of normal operation, yet occasions multiply when the conditions designed for cannot be developed without delay and excessive cost, or when the desired test cannot be made with sufficient accuracy without heavy expense for temporary equipment and staff. When machines were of comparatively small individual capacity actual full loads could easily be imposed at the factories; but with tremendous growth in sizes the power available at shops for driving has proved all too small—to say nothing about the excessive cost of true full-load tests, which after all, have to be paid for by the purchaser. So compromise tests are often desired by both parties—shop runs with full-load losses produced artificially in each part of a machine to permit the approximation of performance characteristics, heating, etc. We may now expect that the best of such tests for various types of motors, generators, converters, transformers, etc., will be standardized, eliminating the uncertainty with which they are regarded by some purchasers on one hand, and on the other hand preventing the delay and expense which worries the manufacturer.

An Old Object Lesson on Track Jacks Recalled

The extent to which both the reading pages and advertising pages of ENGINEERING NEWS are critically scanned by its readers, is illustrated by a letter received recently from a Division Engineer on a leading railway. We quote from the letter as follows.

I was rather surprised upon taking up the last "Engineering News" to see on one of the advertising pages a sketch showing a group of section men at work on a railway track

where one rail was jacked up with a track jack placed on the INSIDE of the rail.

As you, of course, remember, this practice was the cause of a very disastrous wreck on the Old Colony R.R., in eastern Massachusetts about 25 years ago, in which a number of lives were lost. I could not resist writing to you as I felt that a journal of the standing of "Engineering News" would not wish to use such an illustration even as an advertisement.

Our correspondent's letter serves a very useful purpose in calling attention anew to an important object lesson which received wide attention at the time of its occurrence, but of which many engineers of the younger generation have very likely never heard.

The accident referred to occurred Aug. 20, 1890, near Quincy, Mass., on the Old Colony R.R., now a part of the New York, New Haven & Hartford system. A fast express train came around a curve upon a party of section men who had not heard its approach because of the noise made by a passing gravel train on the other track. The men were engaged in tamping ties with a track jack under the rail placed on the inside of the rail.

As described in ENGINEERING NEWS of Aug. 30, 1890, the man in charge of the jack saw the train coming down on him and as the drop hook on the jack was not thrown forward to engage with the pawl, the man threw up the handle of the jack hurriedly in the endeavor to drop the jack. The drop hook failed to catch and the train was then too close to make a second attempt. The side of the locomotive pilot struck the jack, broke off its foot and tipped it over upon the rails directly in front of the advancing truck wheel. The locomotive went down the bank and one of the following cars slid over it and knocked off a projecting cock on the locomotive boiler. The contents of the boiler poured out through the hole, filling the car with scalding steam. The total casualties in the accident were 19 deaths and 27 persons injured.

We may add that a member of the present editorial staff of ENGINEERING NEWS not only recalls the accident but attended the investigation by the Massachusetts Railroad Commission.

The wide publicity given to this accident caused the general promulgation of a rule in railway track work that track jacks should be placed on the *outside* of the rail in all cases. It also led many railways to favor the use of jacks of a type which do not project above the top of the rail at all, and do not, therefore, endanger a train, should one come along suddenly before there was time to remove the jack.

It may be worth while, also, to note in calling attention to this accident of many years ago, that in an editorial upon it, written at the time of its occurrence, by the late Arthur M. Wellington, attention was called to a rule which should be in universal force on all double-track railways. Whenever an employee steps off from a track to get out of the way of an approaching train he should step to the outer side and not onto the other track. A very large proportion of the accidents to employees and others who are run down on railway tracks is due to men avoiding a train on one track and stepping in front of an approaching train on another track. At this time when the safety movement is attracting so much attention in railway circles, it is worth while to call attention to the wisdom of enforcing, so far as possible, this important rule.

The City Manager Plan

The city manager plan may become the next popular innovation in municipal government. It therefore seems desirable to review briefly its general progress, to show its relation to the old federal plan and also to the new and popular commission plan, as well as to discuss the city manager plan on its own merits.

The first city to adopt the city manager plan, so far as we know, was Staunton, Va. This small city, governed by a two-chambered council and a mayor, wishing greater municipal efficiency, appointed a general manager late in 1907, or early in 1908 (ENG. NEWS, July 8, 1909, pp. 32 and 42). The action was taken by the council and the mayor. Constitutionally the city was without power to adopt the commission plan, but whether or not it wished to do so we cannot state.

Several years later the Board of Trade of Lockport, N. Y., promoted a charter for third-class cities in New York State. The proposed charter provided for a small council and a city manager. The chairman of the council was to be known as mayor, and the charter would have had other commission plan features, but, unlike commission charters, the council here contemplated would have had few or no executive powers. (ENG. NEWS, March 16, 1911, col. 2, p. 333.) It is reported that a similar plan has been advocated for Dayton, Ohio.

Within the past two months, Sumter, S. C., a city governed by a small low-salaried commission, advertised for a city manager (see editorial comment, ENG. NEWS, Oct. 24, 1912, p. 783). We understand that the position was soon filled.

At the present time the city of Westmount, Que., a suburb of Montreal, is advertising for a "General Manager, who would give his entire time to the business management of the city"

Quite recently there have been introduced in the New Jersey legislature two bills (Assembly Nos. 402 and 403) which would make it possible for any commission plan city in that State to provide by popular vote for a city manager, to be appointed by the commission and to serve at its pleasure, but otherwise to exercise all the appointive and executive powers now vested in the commission governed cities. In commission cities which voted for a city manager the salaries of the commissioners would by that vote be reduced by 80%.

The city manager plan is much like the old "federal plan" of city administration, with its clear-cut separation of legislative and executive functions. Where the federal plan prevails in all its strength the adoption of the city manager plan would substitute a council-appointed manager for a popularly elected mayor as chief executive officer, either eliminating the mayor or stripping him of all or nearly all except his ornamental and social functions. But where commission government exists the grafting on of the city manager plan would have to be preceded by a violent wrenching away and separation of all executive powers from the council, except the single power of appointing a city manager. In other words, it would be a reversion to or adoption of the one distinguishing feature of the federal plan. There would be left, of course, to the commission plan cities such features as the initiative, the referendum and the recall, nomination and election reform, publicity in municipal affairs, and election of councilmen at large in-

stead of by wards, but any and all of these features are as readily incorporated in a federal plan charter as in a commission plan charter, although some of them may be more essential to the success of the commission than of the federal plan.

We have gone thus far into the effect of combining the city manager and commission plans not because we are opposed to city managers but in order to make it clear that such a combination is nothing more nor less than the abandonment of the basic feature of the commission plan. Tear away executive powers from a commission plan charter and vest them in a city manager and the result is a combination of the federal plan and the short ballot, with a city manager vested with the powers of the mayor. Having, as we trust, made this clear, a few words may be said regarding the merits of the city manager.

One of the greatest sources of weakness in our municipal government has been and still is the failure to select executive officers on the basis of fitness and fitness alone. A leading principle of the federal plan of city government was that the mayor, as chief executive officer, with sole power of appointing and removing all other executive officers, would not only have a free hand in selecting the executive staff of the city but, having a free hand, could also be held responsible for the personnel of the whole executive branch and thus to a large degree for the character of the work done by that branch.

If our mayors, like the nearest corresponding official in a German city, were themselves selected, on a competitive basis, for fitness to govern a city, and were retained in office during efficient service and good behavior, then a mayor under the federal plan might give efficient city government as a city manager. But at best our mayors are citizens above the average in business or professional ability and in moral character, while at their worst they go to the other extreme. In either case they are mere birds of political passage, coming into office with little or no experience as municipal executives and almost certain to be swept out of office by some political chance before much experience has been gained. While various election reforms and a general awakening of the electorate as to the importance of putting men of more capacity and sounder integrity in the mayor's chair may result in mayors of a higher average, the traditions and present tendencies of the mayoralty in the United States all indicate that during their usually brief terms our mayors will continue to be first, last and always the chief political representatives of the people—or of the political bosses, as the case may be—rather than being efficient, trained executive municipal heads.

The commission plan of city government reduces the mayor to the level of the other councilmen, so far as power and nearly everything else but title is concerned. Under the commission plan all executive as well as legislative power is vested in the commission and each commissioner heads a so called department, which oftentimes is, functionally, a combination of a number of departments into one. In some instances each commissioner has executive control of his own department and in others that control is exercised by the whole council. In no case is there a single executive head for the whole city, as under the federal plan. The theory, or at least the tacit assumption, is that by making each commissioner responsible for a so called department a layman citizen, through coming into office by the chances of popular election, in some mysterious manner becames qualified as an "expert."

Every engineer knows that neither "experts" nor any competent executive officers of any kind can be selected by popular vote. Failure to understand and be guided by this fact is one of the weakest points in the commission plan.

Another weak point in the commission plan is that while each commissioner is popularly supposed to be an "expert" and is supposed to devote a considerable part, if not all, of his time to the work of the city, the salaries paid are rarely commensurate with either supposition, much less with both of them. And yet the total of the five salaries is often a considerable item. There would be a distinct gain in paying the greater part of the sum total of these salaries to one real expert rather than to five imaginary ones.

From the foregoing considerations it seems to follow that the combination of the city manager and commission plans has much to commend it as a means of greater municipal efficiency, but it should be remembered that, as already explained, such a combination is virtually a return to the federal plan.

The adoption of the city manager plan in connection with a mayor and council possessed of more or less independent powers either confirms and strengthens the separation of functions under the federal plan, where that plan is in force, or virtually establishes that separation where it has never been adopted.

In any event, the city manager plan, if carried to its logical end, puts all the executive work of the city, including the making of appointments, the enforcement of laws and the execution of policies and works in general, in the hands of a single man, selected for fitness and retained in office during efficiency and good behavior. That this would be a great step in advance of present methods of municipal administration no one can successfully deny.

The success of the city manager plan, like the success of any other plan, depends upon the faithfulness with which it is carried out. To be successful, the manager must be selected for fitness only, must be retained in office during efficiency and good behavior, and must be absolutely free of all control by the city council or commission, except that inhering in the power of removal for cause. Anything short of this means weakness and probable failure in corresponding degree.

The city manager plan should appeal to engineers and to technically trained men generally, for besides improving the character of city government, where adopted and carried out in full, it would assuredly raise the status of the engineer and every other trained man in the municipal service. Engineers would often prove to be the successful candidates for city managerships and whether city managers were engineers or not the position of all engineers in the municipal service would be raised in dignity, merit would be more sure of having its due reward and the engineering work of the city would be on a higher plane.

It is highly desirable that the city manager plan be given full trial, under a wide variety of conditions. It will not prove to be a cure-all but it will help show the need and the value of employing and retaining competent trained men in the municipal and other branches of the public service.

LETTERS TO THE EDITOR

The Effect of a High Wind?

Sir:—You may be interested in the accompanying somewhat unusual photograph. Perhaps you may find it possible to imagine a wind strong enough to cause the deformation in the structure as shown, which is the east end of the O. W. R.R. & N. Co. bridge over the Willamette River during construction! Personally, it is puzzling to



What a Photographer Can Do to a Bridge

see the calm security of the men seated by the watchhouse while such a terrific hurricane rages about them!

E. E. Howard.

Kansas City, Mo., Feb. 13, 1913.

[The distortion of the photograph in this view is so great as to be obvious, but it is readily conceivable that a similar distortion of less magnitude might confuse fact and fancy. The reliability of a photograph as evidence in court could be successfully attacked on the strength of this example.—Ed.]

Compound Rails on Chicago Street Railways

Sir—My attention has been called to statements contained in your issues of Nov. 28, 1912, and Jan. 23, 1913, in relation to the Romopac compound rail, and I ask you to correct some points upon which you have been misinformed.

A. No corrugation or cupping had appeared on the Romopac rail up to the date of my last visit on Nov. 26, 1912. No corrugation or cupping has developed on the Romopac rail laid in Leeds (England) in 1906. B. The inward bending of the flanges does not cause the head to bend slightly upward in any degree whatever. C. The heavier machine built in 1912 was constructed to utilize the power from the trolley wire and to insure greater speed. I inclose copy of report on the track laid in 1911, made to the Board of Supervising Engineers, Chicago. This report stands good as of Nov. 26, the date of my last visit, and as far as I know it stands good today.

E. Rhodes.

136 Third Ave.,
New Brighton, Staten Island, N. Y.
Feb. 6, 1913.

[Our statement as to the corrugation and grinding of the compound rail and its distortion during crimping was made on the strength of information by the engineering department of the Chicago City Ry. Co. From reports accompanying Mr. Rhodes' letter it appears that the grinding of the rails was to true up the joints, and that the rocking of the head section on the base section was due to failure of the mills to roll the rails true to the drawings. As to the corrugation, we have made inquiry of Mr. Fleming, Vice-President (and former Chief Engineer) of the railway company, for confirmation or correction of the former statement in our article, but he replies that the compound rail was laid as an experiment and he does not wish to make any statement for or against it until it has been given a good trial; and that it has not been in service long enough to enable conclusions to be reached. Mr. Rhodes and Mr. Del Mar (whose letter was published in our issue of Jan. 23) are engineers for the Continuous Rail Co., of New York, which is introducing the Romopac compound rail. The former sends us copies of reports made by him to the Board of Supervising Engineers (which has supervision over the Chicago street railways), and a report made to the rail company by Geo. Weston, Engineer of the Board of Supervising Engineers. As a matter of record and of interest in regard to the new type of rail, we give below (in condensed form) some of the matter contained in these reports:

From Report of Mr. Weston: Dec. 20, 1912. The contracts of the Continuous Rail Co., of New York, with the Chicago City Ry. Co. and Chicago Railways Co. covered the use of the Romopac compound rail for four miles of single track and were completed during the latter part of November, 1912. The total length of all track laid is 20,769 ft. of single track, all with granite block paving. The track laid in 1911 is on the west side of Halsted St., from 31st St. to 38th Place, 4401 ft.; the rails are on steel H-beam ties 4½ in. deep, 6 ft. 9 in. long, weighing 14½ lb. per ft. The base portion of the rail was electrically welded on the Lorain system, but no attempt was made to bond the head portion of this rail. The east track is laid with the standard Chicago 129-lb. grooved girder rail, with wood ties 2 ft. apart on a bed of rolled stone. The cars on this line weigh 54,000 lb. empty, or about 76,000 lb. with full load. The traffic is about 700 cars per day, on a headway of 15 to 40 sec. During the time the rails were being crimped, part of the track was open and exposed to variations of temperature amounting to 60° F., and there was at one time a fall of 61° in 24 hr. The winter of 1911-12 was severe, with a minimum temperature of 16° below zero; the maximum summer temperature was 95°. Inspection made in the spring of 1912 showed that the track was in good condition.

The track laid in 1912 was laid for double track on W. 16th St. and W. 47th St., equivalent to 10,957 ft. of single track. It has wood and steel ties at different parts. To increase the conductivity, an experiment was made by placing copper strips under the flanges of the head at the joints, and crimping the flanges over them. The specifications for the compound rail required 0.5 to 0.6% carbon, 0.6 to 0.9% manganese, and not over 0.04% phosphorus or 0.2% silicon. The

weight was 83.3 lb. per yd. for the head portion and 74.3 lb. for the base section, a total of 157.6 lb. per yd. The specifications for the Chicago 129-lb. grooved girder rail require 0.6 to 0.7% carbon, but otherwise are the same as the above as to chemical compensation.

The steam machine for crimping the rail, which was brought from England, was not powerful enough for the rails supplied, which had flanges 0.48 to 0.486 in. thick (0.4832 in. average), while the drawing supplied to the mill showed a thickness of 0.4569 in. A more powerful electrically operated machine was built, and worked on the 1912 rails, whose flanges varied from 0.48 to 0.512 in. thick. This machine crimped 1972 ft. of rail in five working hours, and 5862 ft. in 27½ working hours during four days.

From Report of Mr. Rhodes; Sept. 30, 1912. The track laid (in 1911, on the west side of Halsted St.) is smooth running, and there is less noise from traffic than is usually the case. There are between 250 and 300 joints in the Continuous rail. When the rail was laid the work of filing or grinding these was begun, but was not completed before cars were run on the track. It is better to reduce the inequalities at the joints when the rails are first laid, and to use files worked by hand rather than to use a power grinder. The joints are in good order and the track seems to have been improved by the cold-rolling of the traffic during the last 10 months. The joints in the head section are difficult to detect at first sight, and this is particularly true of the rail nearest the curb, which bears the heavier weight owing to its being laid ¼ in. lower than the other rail.

In some of the first rails the head sections were found to be twisted, causing trouble in crimping them upon the base section. The flanges of the head sections also were thicker than they should have been and the radii of the curves of the fitting surfaces were not according to the drawings, so that in some cases the head section showed a tendency to rock on the base section, thus subjecting the flanges to stresses which should not exist. It has been arranged with the rolling mills to deliver the rails free of twist with flanges not varying more than 1/64 in. from the required thickness, and with correct radii of the contact surfaces. Investigation of the metal showed great homogeneity and closeness of grain, due to the method of rolling, and the weight of the metal averaged 10.47 lb. per 36 cu.in. as against 9.92 to 10.25 lb. for standard rails. These characteristics result in greater wearing qualities and greater conductivity. As to the latter point, tests show that it is 191.3% of the conductivity of the standard grooved girder rail in the adjacent track; taking the head section alone, the conductivity is 74.3% greater than in the grooved girder rail.

ED.]

Should Pipe Lines Be Carried under or over Streams?

Sir:—In an editorial in your issue of Feb. 20, 1913, under the title, "Cases Where Engineering Judgment Differs," you refer to a pipe line built in England, which was carried across the Trent River on a bridge having a clear span of 220 ft.

You say: "The puzzling question is why this line of conduits was carried over the stream on a bridge instead of laying the pipes beneath the river bed. The bridge was built especially for the pipe line, and carries nothing else save a footway."

You say further that an American engineer would have built this line under the river, rather than on a bridge.

Without knowing any of the details of this particular case, it is not possible to judge how an American engineer would solve the problem, but as a general proposition, I do not think it can be said the American engineers are particularly partial to crossings underneath rivers. In ENGINEERING NEWS of March 28, 1912, the writer described a pipe, and a bridge for carrying same across a river 500 feet wide. The decision to carry this pipe across the river on a bridge was reached after an expensive experience had with another pipe line previously carried *under* the bed of the same river. Not only was the first cost of this construction expensive because of troubles with water and excavations, but the pipe recently developed a leak which cost about $1300 to repair, and for a time it was feared that the flow of water would be cut off entirely, thus depriving 3000 acres of land of a much needed water supply for irrigation and resulting in a possible loss of many thousands of dollars. If the pipe had been on a bridge and exposed for inspection, this leak would never have been allowed to develop, or, had it developed, the cost of repairs would have been insignificant. Conditions being reasonably favorable, this seems to me sufficient argument for carrying a pipe across a river on a bridge and, in my opinion, it is generally a safer and more economical proposition.

Modern tendency is toward the construction of works so as to have all parts accessible for inspection and repair in case of accident, and placing a pipe on a bridge instead of carrying it under the river is only one example of this practice. It may be that the difference (granting that there is such) between American and English engineers in the case under consideration is not one of judgment, but one of progressiveness.

I heartily agree with you that "it is far more important to the engineer who reads engineering literature for its practical usefulness, to find out *why* a thing was done than *what* was done" and it seems to me that you editors are the ones to direct engineers along these lines (no doubt you do to some extent) and to suggest to prospective contributors at what points an article should be revised and amplified to make it of real value. Hundreds of descriptions of structures are published yearly, but many of them are not worth the time it takes to read them, because they do not contain ideas and methods which will be useful in future construction. They merely state *what* was done, not *why* it was done in a particular way.

E. A. MORITZ.

338 Maryland Ave., N. E.
Washington, D. C., Feb. 27, 1913.

[We may add that the pipe carried across a bridge and described in our issue of March 28 last was a 30-in. wood stave pipe forming part of an irrigation conduit. There were doubtless good reasons for preferring to carry the conduit over instead of under the river under the conditions described on that project. Where a steel or cast-iron conduit is to be laid and the conditions for placing it in the river bed are favorable, most engineers, we believe, will feel that the undercrossing is fully as reliable as the overcrossing.—ED.]

The Status of the Engineer

Sir—Having read the many and decided opinions expressed in your columns regarding the status of the practicing engineer, I wish to express some of the ideas that have come to me.

In my limited number of years in the field, I have been associated with graduates of the best technical schools in the United States, and some few from schools of Europe, also with men who have never finished a course in any school of engineering. It is needless here to draw a comparison. Suffice it to say, that if a comparison were drawn it would cause many a graduate of a high-grade institution to sit up and take notice.

Many so called engineers are such for the same reason that U. S. Grant became a cadet at West Point, namely, because his father said he should be. After they have gotten through school they lack the natural initiative to pull themselves out of the rut their mistaken but well meaning parents placed them in. They lack love for the work sufficient to crowd themselves to the top or even into a good responsible position. These seem to me to be the ones who are clamoring the loudest for legislative protection.

It has been my experience that good, reliable men in the engineering field have found due appreciation from their superiors and from the general public.

It seems to me unwise that legislative bodies should be called on to draw the line between trained and untrained men of any calling or profession. I am of the same opinion as the man who wrote that: "A race horse of true mettle cared not how many mules ran on the same track: it was only the would-be race horse, with his tail full of cockle burrs, who, when he felt the breath of the oncoming mule hot on his flank, would jump the track and say, 'I am down on mule equality.'"

Men who have enjoyed all the privileges of a liberal education, who are blessed with health and vigor, and endowed by nature with strength of character, good judgment and clear faculties, are in my humble opinion, in a weak position, when they ask to be protected from untrained men by state legislation, or other like processes.

Which of these engineers, who are in favor of a board of examiners, to deal out tin tags to applicants for a license to practice engineering, would willingly accept a position on such an examining board and then be directly responsible for all or any engineers who are granted a license? It is not always a question of whether a man is able to do a piece of work, but rather, whether he will do it.

It has been my experience that the very large majority of employers are entirely capable of judging between a good and a poor engineer. They do not ask him generally from what school he came, or how many degrees he took at college, or to how many and which engineering societies he belongs. But, rather, What have you done for the world in general? Who were your last two or three employers? In what capacity did you serve them, and why did you leave their employ?

The right to decide whether a man is capable of doing any piece of work, from shoveling dirt to the highest class of professional duties, belongs rightfully to the employer. That is where the question is decided now, so far as it concerns each and every employer, and always will be, no matter how many prefixes or suffixes you may attach to the engineer's name.

Do not understand that this is meant to cast a shadow on the credentials of any man. These have their place and are part of the essentials by which a professional man judges a professional man; but to the public they mean nothing now, and each year they are meaning less.

The argument for an engineering combine may be boiled down to this: that if an employer does not see fit to hire John Jones (a college graduate, and a member of two or three engineering societies, and holding a license from a State Board of examiners, and working at the union scale of wages) to run a line of levels for a drain ditch, that he may not hire Dick Smith, who has been doing this kind of work in an irrigation district for a number of years, and has given satisfaction, and does not care whether you call him an engineer or a surveyor or a levelman.

It would be as logical to say that if a man could not afford to carry a 21-jeweled Hamilton movement in a solid gold case, that he must not, under danger of prosecution, carry a one dollar watch.

Employers have the right to hire whom they please to do their work and there is no way of legislating this right away from them.

Let me illustrate my idea; suppose a man qualifies as an engineer by successfully passing an examination given under the supervision of a state board of examiners and is therefore entitled to write M. C. E. after his name. Suppose that another man fails to pass the same examination and he therefore writes X. Y. Z. after his name. They both live in the same district and through the operation of the law of supply and demand, X. Y. Z. is called on to perform certain duties, in the performance of which he clearly demonstrates that he is capable of doing this work as well at a lesser cost to the operators or owners than M. C. E., who has done a like piece of work. The employers in this district will quickly learn that X. Y. Z. means more to them than M. C. E., and unless a law is passed positively prohibiting X. Y. Z. from entering this field, he will slowly but surely crowd M. C. E. out of business.

M. C. E. is a very fine scholar and has passed a very good examination but he lacks the executive ability necessary to do big work and your examination has failed to show this lack, while X. Y. Z. may be lacking in technical knowledge but is especially gifted in executive ability and the examination has failed to give him due credit.

Let us stop trying to regulate everything and everybody by legislation! Let us cease to be governed by boards of examiners, investigating committees, and commissioners appointed by a politician, chosen from the ranks of politicians and ward healers, and live again as once we lived, when the foundation of our country was being laid, when it was a case of a man being judged by his deeds and not his titles, when a man's true worth placed him in a commanding position, and branded him as a leader. I say, give equal opportunity to all and may the best man win!

D. S. Burnett.

Wausau, Wis., March 3, 1913.

NOTES AND QUERIES

Erratum. In the article on "The Oil Industry of California," in our issue of Feb. 6, reference was made to a report of the Commercial Club of San Francisco. This should have read the Commonwealth Club of San Francisco. Mr. Walcott, Executive Secretary of the club, calls our attention to the error.

A. J. Himes, Cleveland, Ohio, writes:

Apropos of your editorial in the current issue of "Engineering News," entitled "Cases Where Engineering Judgment Differs," I wish to refer you to a paper read before the Western Society of Engineers by A. A. Schenck on Dec. 17, 1902, entitled "Diversity of Practice in American Railway Engineering." This paper was published in the "Railway & Engineering Review," of Mar. 14, 1903.

I have kept a copy of this paper in my office for a number of years and refer to it occasionally, and advise young engineers, including my assistants, to read it. It is worth a great deal to know that there are other successful ways of doing work, besides your own.

The Army Engineers and Secretary Fisher on Hetch Hetchy and the San Francisco Water-Supply

Just before leaving office ex-Secretary of the Interior, Walter L. Fisher, issued a report which was designed to refer to Congress, but which may result in leaving to his successor in office, the long-standing controversy over the right of San Francisco to construct a dam and reservoir in the Hetch Hetchy Valley to store the headwaters of the Tuolumne River in the high Sierras. The report was dated March 1. On the previous Feb. 19 an Advisory Board of Army Engineers had submitted a report which was virtually an endorsement of the modified and enlarged Hetch Hetchy plan, as framed by John R. Freeman for San Francisco (see ENG. NEWS, Dec. 26, 1912). The Board concluded that the Hetch Hetchy supply would cost $20,000,000 less than any other feasible and adequate gravity supply, and $30,000,000 less than a filtered and pumped supply from the Sacramento River ($13,000,000 less if discounted to 1914, since the Sacramento supply could be built piecemeal). The Board also decided that in view of the inevitable, irresistible demand, sooner or later, for "all available water in the Valley of California" there is no valid reason for making San Francisco delay the Hetch Hetchy development until the Lake Eleanor and Cherry Creek sources have been utilized to their full capacities, as was required in the Garfield permit of 1908.

THE REPORT OF THE ADVISORY ARMY ENGINEERS

The Board was appointed in May, 1910, to advise Ex-Secretary Ballinger in connection with his order to show cause why the Garfield permit for rights in the Hetch Hetchy Valley should not be revoked. The Board consisted of Col. John Biddle, Lieut.-Col. Harry Taylor and Major Spencer Cosby. Congress granted it $12,000 for its investigations.

The Board secured the services of H. H. Wadsworth, assistant engineer, Engineer Department, U. S. A., to make personal examinations, estimates and a report on the questions at issue. Mr. Wadsworth's data and findings comprise a large part of the report which the Board submitted on Feb. 19.

It may be explained further that ex-Secretary Fisher inherited ex-Secretary Ballinger's order to show cause why the portion of the permit covering Hetch Hetchy should not be revoked, and that he granted to San Francisco a number of extensions of time to answer the Ballinger order. Some of these extensions, however, were due to the great detail which Mr. Fisher required San Francisco to go into in support of its application for an enlarged permit to enable it to build at once a higher dam in the Hetch Hetchy Valley than was originally proposed. It should also be stated that since San Francisco first proposed to utilize Hetch Hetchy a plan has been devised for a metropolitan or bay cities water district.

The report of the Board and particularly Mr. Wadsworth's much more detailed report, compares the estimated cost of the various sources of water-supply which it considers available to San Francisco and its neighbors. Although considering Mr. Freeman's Tuolumne or Hetch Hetchy unit costs as too low the Board, nevertheless, uses these in its various estimates, since they will serve for comparative purposes. It also assumes that the proposed works would be built in installments, beginning with 100,000,000 gal. daily capacity available in 1920 and continuing until 400,000,000 gal. capacity had been provided by the year 2000—all the capacities being additional to the existing water-supply, we understand. Dealing only with the full supply of 400,000,000 gal., the comparative costs assumed by the Board are as follows

	Cost	Present (1914) value*
Hetch Hetchy, including Lake Eleanor	$77,367,400	$38,900,000
Eleanor, Cherry, Stanislaus, Mokelumne†	99,246,800	57,700,000
American, Cosumnes, Stanislaus, Mokelumne	96,711,700	55,300,000
McCloud, via Bay Crossing		57,750,000
McCloud, via Dumbarton Point		63,910,000
Sacramento Filtered Supply, via Bay Crossing	107,012,200	51,700,000
Sacramento Filtered Supply, via Dumbarton Point	118,953,000	57,000,000

* Value of amounts required for financing projects, 4½% compound interest.
† This is really the Tuolumne River supply, minus the Hetch Hetchy storage, plus two other river supplies to make good the loss of Hetch Hetchy.—Ed.

Water-power development possibilities in connection with the first three of these schemes, capitalized at 4½%, and not included in the foregoing cost estimates, are given by the Board as follows:

	Horsepower	Value
Hetch Hetchy	115,000	$45,000,000
Eleanor, Cherry, etc.	95,000	37,250,000
Stanislaus-Mokelumne, etc.	62,000	24,300,000

The conclusions of the Board are as follows:

The board is of the opinion that there are several sources of water-supply that could be obtained and used by the city of San Francisco and adjacent communities to supplement the nearby supplies as the necessity develops. From any one of these sources the water is sufficient in quantity and is, or can be made, suitable in quality, while the engineering difficulties are not insurmountable. The determining factor is principally one of cost; in some cases, however, such as the Sacramento, sentiment must be taken into consideration.

The project proposed by the city of San Francisco, known as the Hetch Hetchy project, is about $20,000,000 cheaper than any other feasible project for furnishing an adequate supply. The only exception is the filtered Sacramento project, which in actual cost is about thirty millions greater than the Hetch Hetchy project, but by discounting to 1914 becomes only $13,000,000 greater.

The Hetch Hetchy project has the additional advantage of permitting the development of a greater amount of water-power than any other.

The best available sources, outside of the Tuolumne River, appear to be the filtered Sacramento, the McCloud, a combination of the Lake Eleanor-Cherry-Stanislaus and Mokelumne, and a combination of the American-Cosumnes-Stanislaus and Mokelumne. For a smaller supply the Eel River or the Yuba River could be used, but they do not lend themselves economically to combination with other sources, and are therefore to that extent not available.

From the statement of John R. Freeman, in the hearing beginning Nov. 25, before the Secretary of the Interior, it appears that the city, in case of being denied the Hetch Hetchy, will desire to use the Lake Eleanor-Cherry-Stanislaus-Mokelumne combination. In the report of Mr. Freeman of Jan. 30, 1913, the cost of this project is largely in excess of either the McCloud or the Sacramento River projects.

The board is of the opinion that the use of the Hetch Hetchy Valley as a reservoir site is necessary if the full flow of the upper Tuolumne is to be conserved.

The board further believes that there will be sufficient water if adequately stored and economically used to supply both the reasonable demand of the bay communities and the reasonable needs of the Turlock-Modesto Irrigation District for the remainder of this century.

The Valley of the San Joaquin has less rainfall and less run-off from its river than the Valley of the Sacramento. The Tuolumne River could, if not used for city supply, be used to irrigate a large amount of fertile land, as could almost any river in the Valley of California if means are found economically to store the water.

The board believes that on account of the fertility of the lands under irrigation and their aridness without water the necessity of preserving all available water in the Valley of California will sooner or later make the demand for the use of Hetch Hetchy as a reservoir practically irresistible. The

board does not think that a delay of a few years in transforming the Hetch Hetchy Valley into a reservoir is of importance, and therefore does not think it necessary to require delaying construction of this reservoir until the Lake Eleanor and Cherry sources have been fully developed.

The board believes that the regulations proposed by the city will be found sufficient to protect the waters from pollution, and that these regulations will tend toward the protection of campers and others using the park and will not be onerous upon them. It recommends, however, that the permit to the city require the city to take other means, such as filtration, to purify its water-supply if these regulations are ever deemed insufficient.

The construction of reservoirs, especially the Hetch Hetchy, will destroy a few camping grounds in the park. The construction of the proposed trails will, however, render accessible other parts of the park not now readily reached, and the number of camping places within the park is large.

The water situation that will confront the communities around San Francisco Bay, if the plan proposed by the city of San Francisco is adopted, may be recapitulated as follows:

Purchase of Spring Valley Water Co., $35,000,000 to $40,000,000.

Further development of this company's system to about half the extent proposed by the company, $10,000,000.

Purchase of water systems of communities outside of San Francisco, no estimate made.

Construction of Tuolumne system as proposed by city of San Francisco, to be extended over about 50 years, $77,000,000.

Against the above expenditures there will be developed 115,000 hp., having an estimated capitalized net value of $45,000,000.

Finally, the board wishes again to emphasize the fact that it does not present the various estimates given as reliable estimates of the cost of the different projects. Sufficient data are lacking as well as time and funds for making adequate investigations. The board believes, however, that the estimates are sufficient to permit such comparisons as are necessary to be made for judging the relative cost and merits of the different projects.

The latest form of the modified permit desired by San Francisco contained the following very brief and simple sanitary requirements, which follow suggestions made by Allen Hazen and George C. Whipple:

(1) No human excrement, garbage, or other refuse shall be placed in the waters of any reservoir or stream, or within 50 ft. thereof.

(2) All sewage from permanent camps and hotels within the watershed shall be filtered by natural percolation through porous earth, or otherwise adequately purified.

(3) It is forbidden to bathe, wash clothes or cooking utensils, to water stock, or in any other way pollute the waters within the limits of the Hetch Hetchy Reservoir or any reservoirs so consructed by the city, or in the streams leading thereto, within 1 mile of said reservoirs; or, with reference to the Hetch Hetchy Reservoir, in the water from the reservoir or waters entering the river between it and the "Early intake" of the aqueduct (as indicated in the report of John R. Freeman, on file in these proceedings), pending the completion of the aqueduct between "Early Intake" and the Hetch Hetchy Dam site.

The Board advised that there be added to these requirements the following:

The cost of the inspection necessary to secure compliance with these rules under the direction of the Secretary of the Interior shall be defrayed by the city of San Francisco and other cities. If at any time the rules are deemed by the cities insufficient to protect the purity of the water-supply, then the cities shall install a filtration plant or adopt other measures to guard the purity of the water. No other sanitary rules or restrictions shall ever be demanded by the cities as to the use of the watershed by campers, tourists, hotels, cottages, etc.

The Fisher Report

Ex-Secretary Fisher's communication to the city officials of San Francisco, dated Mar. 1, 1913, first reviews a portion of the history of the Hetch Hetchy controversy. It shows that the Yosemite National Park was created, not as a National park but as a forest reservation, by an Act of Congress in 1890. This act placed the reservation under the control of the Secretary of the Interior, directed him to make regulations for its care, and stipulated that those regulations should "provide for the preservation * * * of all natural curiosities or wonders, within said reservation, and their retention in their natural condition."

In 1901 Congress passed an act authorizing the Secretary of the Interior to grant rights of way through public lands, forests and certain national parks, including the Yosemite, for pole and wire lines, pipe lines, dams, etc., for electrical, irrigation and domestic water-supply purposes. The act provided that any such rights might be revoked by the Secretary of the Interior.

Under the act of 1901 the city of San Francisco, in the same year, made its first application for reservoir rights at Hetch Hetchy and Lake Eleanor. E. A. Hitchcock, then Secretary of the Interior, decided in 1903 and again in 1905 that he lacked statutory authority to grant these rights, and that such authority must be secured from Congress. In 1908, James R. Garfield, successor to Mr. Hitchcock, granted a permit, despite strong opposition from those who claimed that to flood Hetch Hetchy would be a desecration of nature; but the Garfield permit required the city to postpone the construction of the Hetchy dam until other reservoir sites on upper Tuolumne had been utilized and become insufficient. The Ballinger order to show cause why the Garfield permit, so far as it applied to Hetch Hetchy, should not be revoked, has already been mentioned, as has Secretary Fisher's inheriting of that order and subsequent proceedings (see also Eng. News, Dec. 26, 1912, for further details).

In brief, Mr. Fisher decided that while he had statutory authority (thus disagreeing with Mr. Hitchcock and agreeing with Mr. Garfield) to grant the modified and enlarged permit, such a grant, as a matter of public policy, should be exercised by Congress and not by an administrative officer, since (1) a reservoir in the Hetch Hetchy Valley would materially change one of the "wonders" which the Yosemite National Park is supposed to preserve and (2) since the only control over pipe lines, dams, etc., given the Secretary of the Interior by the act of 1901 is through a "revocable permit," which is an anomalous condition in the case of any right-of-way and particularly so where the right is for a huge reservoir and aqueduct for the water-supply of a large urban district. Furthermore, Mr. Fisher found himself, due to the many postponements in supplying him with data, wholly without time to draft a permit to his satisfaction, even had be been willing to issue a permit in this case. Consequently he took no action on either the Ballinger order to show cause why the Hetch Hetchy portion of the Garfield permit should not be revoked nor on the application for an unlimited Hetch Hetchy permit be granted but left both in *statu quo* until the city could apply to Congress for an enabling act.

Mr. Fisher was particularly careful not to pass upon the merits of the question. On the one hand he did not feel warranted in accepting as the "principal determining factor" in the case "the difference in cost between available alternative sources of water-supply, whether that difference be $13,000,000 or $20,000,000, or even more than $20,000,000," for to do so "would, in a certain important sense, be placing a monetary value

upon the preservation of the Hetch Hetchy Valley in its present natural condition" and would be calling upon "the people of the whole country to change the natural condition of the Hetch Hetchy Valley" to save the people of San Francisco "a certain sum of money." On the other hand: "It may well be that such consent would be justified. It depends upon the effect of the use permitted, and upon the amount saved, as well as upon other considerations." Furthermore:

> This conclusion is not based upon the opinion that the conversion of the Hetch Hetchy Valley into a reservoir or lake would so seriously mar the scenic beauty of the valley as is contended by many of the objectors to the city's application.
>
> I have been convinced that the proposed use of the Hetch Hetchy as a reservoir will not require undesirable sanitary restrictions upon the use of its watershed by the public, if the permit contains the provisions recommended by the Advisory Board.
>
> If the use of the Hetch Hetchy Valley was clearly necessary for the city of San Francisco and its adjacent communities, I believe that such a change in its condition and such a loss or impairment of scenic beauty as might possibly occur would be amply justified and would not be a matter of such serious moment as to be at all controlling. It is indeed an open question about which real differences of disinterested and intelligent opinion exist whether the valley would not be as beautiful if it contained the lake created by the dam as it is with its present natural floor. Nevertheless, the valley should be retained in its natural condition unless ample justification exists for changing it. . . . . This provision [for preserving park "wonders" in "their natural condition"] should be followed unless there is clearly some adequate justification for a different course.

Towards the close of his report Mr. Fisher says he prefers to express no opinion upon what action Congress ought to take in this case. This is partly due to what he considers to be a lack of information and a need of further consideration regarding two of the conclusions reached by his Advisory Board: (1) that "the use of the Hetch Hetchy Valley as a reservoir site is necessary if the full flow of the upper Tuolumne River is conserved"; and (2) that "the San Joaquin Valley is relatively less well provided with water than the Sacramento Valley both as to rainfall and as to runoff of rivers. The demands of the valley for complete irrigation are in excess of the water available."

Finally, Mr. Fisher believes with the Advisory Board that it would be unsound economics for San Francisco to duplicate the distributing system of the Spring Valley Water Co. and that the city should acquire nearly, if not all, the company's sources of supply. In fixing a price for these properties Mr. Fisher urges equal justice to the city and the company. Referring to unsuccessful purchase negotiations he declares that if the city and company cannot agree on the price "both parties should be compelled to submit to some impartial tribunal the questions at issue."

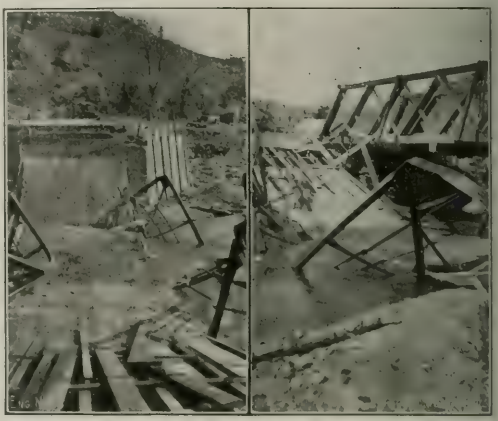
Failure of a Steel-truss Highway Bridge in Colorado

By W. H. Hubbard, Jr.*

On Feb. 4, 1913, a steel highway bridge which was being built across the Arkansas River, near Wellsville, approximately 6 mi. east of Salida, Colo., failed to support its own weight, and fell into the river. Figs. 1 to 3 illustrate the wreck.

The bridge had a span of 85 ft. and a width of 15 ft. 7 in. in the clear, and was being built to take the





Figs. 1-3. Wreck of Partly-built Low-truss Highway Bridge over Arkansas River at Wellsville, Colo., by Buckling of Unstayed Upper Chords

place of an old wooden structure (seen in the background of two of the views). The main members were steel riveted trusses of the low-truss Warren type. The floor was to have been of reinforced-concrete slab on steel I-beam stringers.

At the time of the failure, the steelwork had been completed and the falsework removed. The concrete floor was being laid, beginning at one end of the bridge and proceeding to the other end; a little more than half of it was in place.

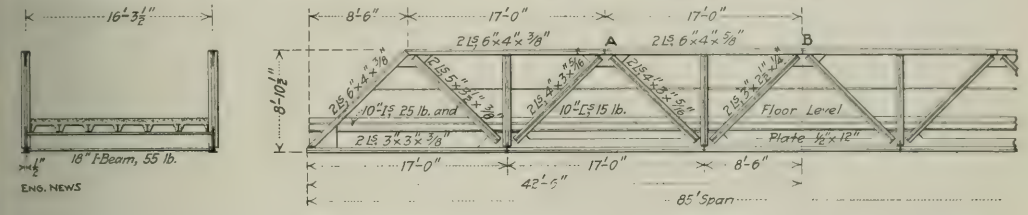
The writer inspected the wreck shortly after the failure and trusts that this brief information on the subject may be of interest to the profession.

It was found that all principal riveted connections were intact. A few minor rivets were sheared, but this evidently was the result rather than the cause of the failure. The same may be said of the slight damage to one of the concrete abutments. Investigation points to the fact that the failure was due to improper distribution of the steel in the structure; primarily, lack of sufficient lateral stiffness in the upper chords of the trusses.

*Engineer for the Ohio & Colorado Smelting & Refining Co., Salida, Colo.

The sketch Fig. 4 shows the general design of the structure, together with a stress diagram for estimated dead-load. Study of the design suggests that in length of span this bridge crowds the limit set by best practice for riveted low-truss bridges. If, however, such a truss was to be used for this span, the T-shaped section of the upper chord is objectionable. The use of this section is particularly open to criticism in view of the fact that no bracing whatever was provided for the upper chord. The resulting lack of rigidity of the upper chord seems to be a sufficient reason for the collapse of the bridge.

It will be noted that the floorbeams were attached by lug angles to the web-plate connections at the panel-points, and above the lower chords. This connection tended to produce eccentric loading of the trusses, which would create further need for upper-chord bracing. There is certainly not enough stiffness represented in the verticals at the loaded panel-points to warrant the absence of any diagonal braces.



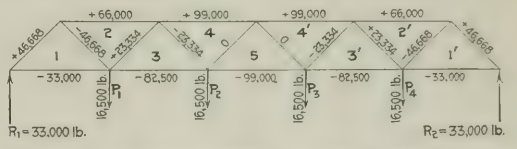


FIG. 4. DESIGN SKETCH AND DEAD-LOAD STRESS DIAGRAM. ARKANSAS RIVER BRIDGE AT WELLSVILLE, COLO.

The writer made no effort to ascertain the live-load which this bridge was expected to carry, since the failure occurred before any such was brought upon it. The dead-load, figured from estimated weights of main members and concrete only, amounts to approximately 16,500 lb. at each lower panel-point. The direct stress in the middle bays of the upper chord by these loads would be 99,000 lb. The cross-section of the member which must resist this stress consists of two 6x4x$\frac{5}{8}$ in. angles set ½ in. back to back, which gives a radius of gyration of 1.71 in. and a sectional area of 11.72 sq. in. The length of the strut is 119 radii.

J. A. L. Waddell specifies the formula for unit-stress in upper chords of $18{,}000 - 80\,\frac{l}{r}$, which would allow on such a chord a total stress of 99,385 lb. Prof. M. S. Ketchum's specifications call for a unit-stress of $16{,}000 - 70\,\frac{l}{r}$ which would safely allow a stress on the above chord of 89,892 lb. In the absence of upper-chord bracing, and the consequent uncertainty as to strut-length in the upper chord, of course the above figuring does not represent a true condition. It merely serves to show the condition which proper bracing would have brought about, and to illustrate how little in reserve this strut had for live-load.

While such failures are a misfortune, the citizens of the district may congratulate themselves that the impact of a rapidly moving touring car or the weight of a traction engine was not needed to point out the weakness of this so called design.

Information to Passengers as to cause of delays is to be freely given on the Pennsylvania R.R. hereafter, according to recent instructions which have been issued to all conductors of passenger trains. This order states that when traffic is interrupted trainmen shall go immediately through their trains and tell passengers the reason for the delay, and if necessary the best means of proceeding on their journey. Instructions have been given to station agents to post on their bulletin boards, or in other conspicuous places, notices giving the location of whatever obstruction to traffic is taking place, the probable length of delay, and any other information in their possession.

Lower Street-car Steps in New York City have been ordered by the Public Service Commission for the First District, State of New York, and it is directed that all closed cars shall be reconstructed on or before Jan. 1, 1914, with steps whose maximum height is 15 in. The New York & Queens County R.R. Co., the New York & Long Island Traction Co., and the Queens County Electric Co. (operating on Long Island), however, are allowed to delay the equipment of one-half their cars until Jan. 1, 1915. Complaints of excessive height of step were made some two years ago by various woman clubs, and the commission on investigation found that the first step varied from 12 to 20 in. The use of folding steps was investigated in New York and other cities, and it was reported that they were feasible and popular.

A Public Utilities Commission for the District of Columbia was provided by an act of the Congress which adjourned on Mar. 4, 1913. For the past few years the street railways within the District have been under the general supervision of the Interstate Commerce Commission (assisted by a non-salaried Electric Railway Commission), but this Commission has been so burdened with its regular work that the attention paid the District's railways has been quite small. The new Public Utilities Commission has a broader range than was provided for the Interstate Commerce Commission in the previous act. According to the act, the term public utility embraces every street railroad, street railroad corporation, common carrier, gas plant, gas corporation, electric plant, electrical corporation, water power company, telephone corporation, telephone line, telegraph corporation, telegraph line, and pipe line company. The commission is to have the power generally accorded to public service commissions, and is particularly ordered to make a valuation of all the public utilities in the District of Columbia. The commission is to consist of the three Commissioners of the District of Columbia, acting ex officio as members of the Public Utilities Commission and acting apparently without additional salary. It is to have as its counsel the Corporation Counsel of the District of Columbia, who is to receive an additional annual salary of $1000 for this service. An appropriation of $40,000 is granted the commission for its first year's work.

The Hamburg-American Liner "Europa," sister ship of the "Imperator," is to be launched on Apr. 3, according to recent press dispatches. The "Europa" is 950 ft. long and has a beam of 100 ft.

A Fire in the Business District of Yokohama, Japan, on Mar. 6, consumed about 700 buildings and caused an estimated loss of $7,500,000.

A Runaway Locomotive on the Philadelphia & Reading Ry. crashed through the wall of the new roundhouse at St. Clair, Penn., and down an embankment, on Mar. 2.

The German Torpedo Boat "S-178" Was Rammed by the cruiser "Yorck" off Heligoland, on the night of Mar. 4, and sank immediately, with two officers and 69 of the crew, 13 being rescued. The fleet of war vessels was returning from naval manoeuvers and the accident occurred when the torpedo boat became unmanageable while crossing the bows of the larger ship, which was traveling at full speed. From newspaper reports it appears that it has been customary for the small high-speed craft to cross between larger boats, traveling at full speed, a practice which would obviously invite disaster.

Two Trestle Failures, involving freight wrecks, were recorded during the past fortnight. At Athens, Ga., on Mar. 5, the last four cars of a 22-car freight on the Central of Georgia Ry., fell through a trestle to the bed of a creek, 45 ft. below. It is believed that one of these cars became derailed on the trestle and tore through, carrying the others along with it. The front part of the train passed over the trestle safely.

At Richmond, Ind., on Mar. 4, a trestle failed under a heavy freight and the entire train fell through to the ground. As in the previous case, it is believed that a derailment tore the trestle timbering apart and allowed the cars to fall. This accident occurred on a branch of the Chesapeake & Ohio R.R.

Blame for the Wreck of Feb. 16, at the Cedar Hill yards, New Haven, Conn., was placed on the New York, New Haven & Hartford R.R., in the report of the Connecticut Public Utilities Commission. The charges made were that the trackage at the place where the collision occurred was insufficient to accommodate the traffic, that the signal apparatus was inadequate, and that the speed of the passenger train was excessive in view of the weather conditions and the known dangers of that section. Suggestions for increasing safety were made to the railroad, including improvement of the signal system.

Three Hundred Tons of Dynamite Exploded in the hold of the British tramp steamer "Alum Chine," on Mar. 7, while she was being loaded in the harbor at Baltimore, Md. It is estimated that about 50 were killed and 60 injured in the explosion. The "Alum Chine" was totally demolished, together with a barge lying alongside and also loaded with dynamite. The United States collier "Jason," a short distance from the scene of the accident, was set on fire and badly damaged and the tug "Atlantic," which was rescuing the crew of the tramp steamer, was wrecked and sank shortly after the explosion.

Fire was discovered in the hold of the "Alum Chine" before the explosion and was the signal for the crew's escape. The cause of the fire is not known, but it is believed that it resulted finally in setting off the dynamite. It is claimed by some of the survivors that the explosion was caused by the negligence of one of the stevedores in handling a box containing either dynamite or exploding caps. The property damage is placed at $500,000. According to newspaper reports the shock of the explosion was felt at points over 100 miles from its scene. The steamer was a steel vessel, and parts of the hull and superstructure are said to have been found along the shore, three and four miles away. The dynamite was destined for use at the Panama Canal.

More Water for Power Purposes may be taken from the Niagara River, because of the failure of Congress to re-enact the Barton Law, which for several years has limited the amount of water available for this use to 15,600 cu.ft. per sec.

Bonds Totaling $12,500,000 for Water and Power Distribution from the Los Angeles Aqueduct are to be voted on at Los Angeles, Calif., on Feb. 15. Of this total, $6,000,000 is for water distribution (see "Supplying Wants of the Los Angeles Aqueduct," pp. 506-510 of this issue), divided as follows: Chatsworth Line, $1,500,000; Franklin Canon Line, $1,500,000, to start Granada High Line, $2,500,000.

One of the Longest Railway Tunnels in North America is to be built for the Canadian Pacific Ry. The tunnel is located in the Canadian Rockies near Rogers Pass. It will have a total length of about 25,000 ft. Its purpose is to lower the summit level and improve the grades and alignment of the Rogers Pass division. Bids for its construction are to be opened at Winnipeg, on April 15.

The Proposed Subway under St. Paul's Cathedral, in London, was withdrawn by the London County Council on Feb. 25. As noted recently in "Engineering News," a report by Sir Francis Fox, the eminent English engineer stated that such a subway would be extremely dangerous to the stability of the Cathedral.

A Workman's Compensation Act was put in force for government employees in the Canal Zone on Mar. 1. Under the terms of this act, an employee totally disabled from work by an accident will receive a monthly compensation equal to half of his monthly pay. For accidents causing partial disability, the employee will receive compensation equal to half the difference between his former monthly pay and his wage earning capacity per month when partially disabled. In case of accidental death the surviving widow receives 35% of her husband's monthly wages for the first six-year period. After that time until the death or the marriage of the dependent occurs, between 20 and 30% is paid. Ten per cent. additional is paid for each dependent child, the total compensation, however, not exceeding 50% of the wages.

A New Park in the District of Columbia is provided by an act of the recent Congress. This park is to connect the present Rock Creek Park in the northwest section of the city with the Potomac Park in the southeast portion of the city and bordering on the Potomac River. It will thus make a park system in the District, which will girdle the city for practically half of its circumference. The total sum authorized to be expended in the purchase of this park is not to exceed $2,300,000. It is provided in the act that the U. S. Botanic Garden, which is now located just west of the United States Capitol, is to be transferred to this new park when it is completed.

The Loetschberg Ry. in Switzerland was completed on Feb. 28 by the laying of the last rail. This is the new line from the Bernese Oberland to the Rhone Valley through the great Loetschberg Tunnel. This new line gives a direct route from Berne, the capital of Switzerland, south to Italy through the Simplon Tunnel, and is expected to cause a considerable increase in traffic over the Simplon route. Work on the driving of a second parallel tunnel to the Simplon has already been under way several months. The contractor for the first tunnel was obligated to do the work, but declined, and has now settled with the government, which is carrying it out.

A Storage-battery Car, designed by R. H. Beach, of the Federal Storage Battery Co., of Silver Lake, N. J., and equipped with Edison nickel-iron cells, made a trial trip over the New York Central Lines from New York City to Boston on March 7. The run of 310 miles was made at a running speed of 40 miles per hour. The equipment is claimed to have a distance capacity of 120 miles per charge. It is reported that if this car proves suitable in trial service, similar ones will be used on a number of feeder lines where the density of traffic does not warrant a frequent steam service.

The Wright Brothers' Patents on flying machines have been sustained by Judge J. P. Hazel, in the U. S. District Court, at Buffalo, N. Y. This suit was brought against Glenn H. Curtiss and others to restrain them from making and selling aëroplanes alleged to infringe the Wrights' patents. The chief infringement claimed was in the matter of warping wing tips in connection with the vertical and horizontal rudders. The court held that the Curtiss "allerons," or auxiliary wing-tip planes, operated to restore equilibrium and were a mechanical equivalent of the Wrights' invention. The defendants contended that the Wright devices were but adaptions of earlier schemes, but the court dismissed that consideration, stating that it had not been shown that any of the earlier devices were capable of successful operation, nor that their defects could have been removed by mere mechanical skill. The court was of the opinion that the Wrights "by their methods of securing equilibrium of the planes have made an important advance in an embryonic art."

Cable dispatches from Leipzig, Germany, state that the decision of the German Patent Office, made a year ago and adverse to the Wright claims, has been in part set aside by the Imperial Supreme Court.

PERSONALS

Mr. William N. Ashplant has been appointed City Engineer of London, Ont.

Mr. Caleb Corser has been appointed Superintendent of the Copper River & Northwestern Ry., with headquarters at Cordova, Alaska, succeeding Mr. George Geiger, resigned.

Mr. V. K. Hendricks, M. Am. Soc. C. E., Principal Assistant Engineer of the St. Louis & San Francisco R.R. at Springfield, Mo., has been promoted to be Assistant Chief Engineer.

Mr. J. E. Gardner has been appointed Electrical Engineer of the Chicago, Burlington & Quincy R.R., with headquarters at Chicago, Ill., succeeding Mr. H. A. Gardiner, resigned.

Mr. N. W. Jones, Trainmaster of the Philadelphia & Reading Ry., at Tamaqua, Penn., has been promoted to be Inspector of Transportation, with headquarters at Reading, Penn.

Mr. Wilbur C. Fisk, Vice-President of the Hudson & Manhattan R.R., New York City, has been elected President, to succeed Mr. William G. McAdoo, resigned.

Mr. E. E. Finley has been appointed Superintendent of Maintenance-of-Way of the San Antonio & Aransas Pass Ry., with office at Yoakum, Tex., succeeding Mr. Hans Helland, resigned.

Mr. John H. Harris, formerly with the Chicago, Rock Island & Pacific Ry., has been appointed General Manager of the Peoria Railway Terminal Co., Peoria, Ill., succeeding Mr. J. H. Franke.

Mr. John H. Marble, recently Secretary of the Interstate Commerce Commission, has been appointed a member of the commission. Mr. Marble is a lawyer and was formerly in practice in California.

Mr. F. W. Hawks, who went to China in 1909 with Mr. W. S. Dawley, M. Am. Soc. C. E., as Assistant Chief Engineer of the Yunnan-Szechuan & Tengyueh Ry., has returned to this country, and is now in Galesburg, Mich.

Mr. E. N. Brown, formerly Assistant Superintendent of the Southern Pacific R.R. of Mexico, has been appointed Superintendent of the Chicago & Eastern Illinois R.R., at Danville, Ill., succeeding Mr. John C. Muir, resigned.

Mr. Henry R. Kent, M. Am. Soc. M. E., has resigned as Vice-President of Westinghouse, Church, Kerr & Co., to enter business for himself. Mr. Kent has been associated with the company since its organization over 28 years ago.

Mr. C. A. Dunham, recently appointed Signal Engineer of the Grand Trunk Ry., at Montreal, Que., has resigned to accept his former position as Signal Engineer of the Great Northern Ry., at St. Paul, Minn.

Mr. I. W. Patterson, Jun. Am. Soc. C. E., formerly Highway Construction Engineer for the Texas Co., has been appointed Chief Engineer of the Rhode Island State Board of Public Roads, at Providence, R. I.

Mr. John Hoffhine, formerly Assistant Chemist, Union Pacific R.R., Omaha, Neb., has been appointed Chemist of the American Brake Shoe & Foundry Co., New York City. Mr. Hoffhine is a graduate of the Ohio State University, class of 1904.

Mr. Charles V. Seastone, Assoc. M. Am. Soc. C. E., formerly Principal Assistant Engineer for Prof. Daniel W. Mead, M. Am. Soc. C. E., Consulting Engineer, Madison, Wis., has been taken into partnership with Prof. Mead in his engineering practice.

Mr. W. C. Perkins, Assoc. M. Am. Soc. C. E., Resident Engineer of the New York State Highway Department, Niagara Falls, N. Y., has been appointed Chief Engineer of the inspection department of the Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio.

Mr. George Ross, recently Assistant Superintendent of the Oregon Short Line R.R., at Salt Lake City, Utah, has been appointed Assistant Superintendent of the Oregon-Washington R.R. & Navigation Co., at La Grande, Ore., succeeding Mr. J. W. Anderson, resigned.

Mr. E. S. Carman has been appointed Chief Engineer in charge of design and construction of the molding machine department of the Osborn Manufacturing Co., Cleveland, Ohio. For the past 10 years Mr. Carman has been associated with the Johnson & Jennings Co., of Cleveland.

Mr. George N. Adams, for the past three years Resident Engineer of the Arrowhead Reservoir & Power Co. project in San Bernardino County, Calif., has formed a partnership with Mr. L. L. Shears, of Los Angeles, Calif., as civil and hydraulic engineers, with offices in the Security Bldg., Los Angeles.

Mr. C. Gordon Reel, Assoc. M. Am. Soc. C. E., has been removed from his office as State Superintendent of Highways of New York by Governor Sulzer. Mr. Reel was formerly a consulting engineer of Kingston, N. Y., and previous to his appointment as Superintendent he had served as Deputy Superintendent.

Mr. Nicholas L. Smitham, formerly Master Mechanic of the Texas Central R.R., has been appointed Assistant Superintendent of Motive Power of the Missouri, Kansas & Texas Ry. of Texas, with headquarters at Denison, Tex. Mr. Smitham's railway experience began as a boiler maker's apprentice with the Lehigh Valley R.R. in 1877.

Mr. E. E. Clark, a member of the Interstate Commerce Commission since 1906, has been elected Chairman, succeeding Mr. Franklin K. Lane. Mr. Clark entered the railway service in 1873 and for several years was a train conductor. From 1890 until his appointment to the Interstate Commerce Commission he was the head of the Order of Railway Conductors of America.

Messrs. Harry L. Maier, Assoc. M. Am. Soc. C. E., and William J. Horrigan, Jun. Am. Soc. C. E., announce the organization of the firm of Maier & Horrigan, Consulting Engineers, Ford Bldg., Wilmington, Del. Mr. Maier was formerly Assistant Engineer of the street and sewer department of Wilmington, and Mr. Horrigan has been President of the Horrigan Construction Co., of Wilmington.

Mr. C. G. Elliott, M. Am. Soc. C. E., former Chief Engineer of the U. S. Bureau of Drainage Investigations, was reinstated on Mar. 4, by Secretary of Agriculture Wilson. Mr. A. D. Morehouse, Assistant Engineer, was also reinstated. The reinstatement of Mr. Elliott is reported to have been the last official act of the Secretary of Agriculture by whose order Messrs. Elliott and Morehouse were summarily dismissed on Feb. 3, 1912.

Mr. Herbert S. Balliet, Engineer of Maintenance-of-way of the Grand Central Terminal, New York City, and Signal Engineer of the Electric division of the New York Central & Hudson River R.R., has been appointed Assistant Manager of the Grand Central Terminal. He will continue to perform his present duties as Signal Engineer and Engineer of Maintenance-of-way. Mr. Balliet was formerly Assistant Signal Engineer of the Lehigh Valley R.R.

Mr. R. F. Morkill, Assoc. Am. Inst. E. E., recently Electrical Engineer of the Railway Signal Co. of Canada, Ltd., Lachine, Que., has been appointed Signal Engineer of the Grand Trunk Ry., with headquarters at Montreal, Que. Mr. Morkill was formerly Signal Engineer of the Central South African Ry. Later he was connected with the New York City office of the Union Switch & Signal Co., and with the signaling department of the Pennsylvania R.R.

Mr. David B. Reger has been appointed Assistant Geologist on the staff of the West Virginia Geological Survey. The position is a new one created by the recent session of the legislature. Mr. Reger served as Field Assistant in the United States Geological Survey from 1903 to 1906, and as Chief Hydrographic Surveyor at the United States Naval Station at Guantanamo, Cuba, in 1906 and 1907. He has been Field Assistant with the West Virginia Geological Survey from 1908 until the present time. Mr. Reger is a graduate of the West Virginia University.

Mr. Alfred H. Smith has recently been promoted to be the Senior Vice-President of the New York Central Lines. Mr. Smith began his railway career in 1881 in the construction department of the Lake Shore & Michigan Southern Ry. and in nine years had become foreman of bridges. In 1890 he was promoted to be Division Superintendent. In 1901 he was made Assistant General Superintendent and a year later General Superintendent. In 1902 he was appointed to the same position with the New York Central & Hudson River R.R., and in 1903 was promoted to General Manager, and a few years later elected a Vice-President.

Mr. Samuel T. Park, formerly Superintendent of Motive Power of the Chicago & Eastern Illinois R.R., Danville, Ill., has resigned to become President of the Monarch Pneumatic Tool Co., of St. Louis, Mo. Mr. Park entered the railway service in 1884 an an apprentice machinist of the Louisville & Nashville R.R. After various shop positions as foreman and draftsman, he became Division Master Mechanic of the Atchison, Topeka & Santa Fé Ry., at Winslow, Ariz., in 1900. He became Master Mechanic of the Chicago & Eastern Illinois R.R., in 1905, and a few months later was promoted to be Superintendent of Motive Power.

Mr. Franz Schneider, Jr., Instructor in biology and public health at the Massachusetts Institute of Technology, has resigned to become Sanitarian of the department of surveys and exhibits of the Russell Sage Foundation, New York City. This department of the Sage Foundation is a new one and its work is largely advisory, such as defining social surveys by specific illustrations, outlining the first steps toward organization for both surveys and exhibits, assisting in the selection of subjects to be covered, estimating costs, etc. Mr. Schneider will devote his time to questions of municipal sanitation and board of health organization and administration.

Dr. Homer M. Derr, Assoc. M. Am. Soc. C. E., Professor of civil engineering at the South Dakota State College, has been appointed State Engineer of South Dakota, succeeding Mr. Samuel H. Lea, M. Am. Soc. C. E., resigned. Prof. Derr grad-

uated from Leland Stanford, Jr., University in 1898 and received an A. M. degree from Columbia University in 1901. For a year he was Instructor in mining engineering and geology at the University of Wyoming. He received the degree of Ph.D. from the University of Pennsylvania, in 1903, and for a short time was Superintendent of the Santa Margarita Mining Co., of Colombia, South America. Returning to this country he was for two years Professor of mathematics and civil engineering at the Clarkson School of Technology. In 1907 he was appointed Professor of civil engineering at the South Dakota State College.

Mr. R. C. Falconer, M. Am. Soc. C. E., who is Acting Chief Engineer of the Erie R.R., succeeding Mr. H. H. Althouse, resigned, as noted in our issue of Feb. 20, was born in Elk County, Penn., Mar. 21, 1874. He graduated from the University of Wisconsin in civil engineering in 1895. For the first four years after graduation he was engaged in structural steel designing, first with Purdy & Henderson, New York City, and later with the Cambria Steel Co., of Johnstown, Penn. In 1899 Mr. Falconer entered the service of the Pennsylvaia R.R. Lines West of Pittsburgh, as a transitman and was in charge of third and fourth track work between the Allegheny and Conway yards, of Pittsburgh track elevation and other work. In 1901 he accepted a position with the American Bridge Co., as Contracting Engineer at Pittsburgh, Penn. The two years following 1902 he was Superintendent of the Pittsburgh Zinc Co., Contracting Engineer of the Walton Iron Co., of Cincinnati, Ohio, and Designing Engineer with the McClintic-Marshall Co., of Pittsburgh. Mr. Falconer joined the engineering staff of the Erie R.R. in 1905 as Assistant Engineer in charge of surveys and construction work. In 1911 he was promoted to be Division Engineer of the New York division and a year later Principal Assistant Engineer of the Eastern lines. In February of this year he was made Superintendent of Construction, with the duties of Chief En-

OBITUARY

Philip Henry Coombs, M. Am. Soc. C. E., City Engineer of Bangor, Maine, died at his home in Bangor, Mar. 6. Mr. Coombs was 56 years old and had been City Engineer for nearly 30 years.

J. Lasseter, Superintendent of the Southern Ry., at Selma, Ala., died in his private car near Meridian, Miss., Feb. 27. He was 53 years old.

John R. Price, the veteran railway contractor whose death was briefly noted in our issue of last week, was known to a wide circle of the engineers who supervised the construction of the first railways into the Southwest and Mexico. It has been estimated that Mr. Price was contractor for at least 3000 miles of these railways. During the last few years of his life he had made his home in Turon, Kan., where he was the owner of a large ranch and flour mill. Mr. Price was born in Breckonshire, South Wales, Sept. 16, 1828. He came of a family of builders and contractors, and a bridge built by the Price family 200 years ago still spans the River Meath in Wales. As a boy he served as an apprentice stonemason; at the age of 20 years he was Superintendent of Construction on the Merthyr & Abergavenny Ry., in South Wales. In 1866 he came to American as a prospector for gold in California mines. For five years he prospected in California and British Columbia, but fortune did not favor him and he returned to his family in Wales. He soon after emigrated to the United States and entered business at Oskaloosa, Iowa, in 1872, as a railroad contractor. After building a number of railways in this part of the country he moved to Topeka, Kan., and took contracts for constructing various branches of the Santa Fé Ry. lines in Kansas and the Southwest. He was the builder of large portions of what are now parts of the Atchison, Topeka & Santa Fé Ry. system including the famous Atlantic & Pacific R.R. through New Mexico and Arizona, of which Henry R. Holbrook and Lewis Kingman were the Chief Engineers. He was also contractor for large sections of the Iowa Central R.R., what is now the Chicago, Rock Island & Pacific Ry., the Chicago & Alton R.R. and the St. Louis & Omaha R.R. One of his most famous works was the construction of the Kinsley cut-off from Hutchinson to Kinsley, Kan., for the Santa Fé Ry. This line held the record for fast railway building—84 miles of completed grade and track in 20 days. Another notable contract held by Mr. Price was for the construction of the Mexican Central Ry. from San Luis Potosi to Tampico, Mex. His last work in railway building was the construction of a line from Osage City to Ottawa, Kan., a private enterprise which was afterward sold to the Atchison, Topeka & Santa Fé Ry.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN RAILWAY ENGINEERING ASSOCIATION.
Mar. 18-21. Annual convention at Chicago, Ill. Secy., E. H. Fritch, 900 S. Michigan Ave., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Mar. 19. Annual meeting at Boston, Mass. Secy., S. E. Tinkham, 715 Tremont Temple, Boston, Mass.

AMERICAN CHEMICAL SOCIETY.
Mar. 25-28. Annual meeting in Milwaukee, Wis. Secy., C. L. Parsons, Box. 505, Washington, D. C.

NATIONAL FIRE PROTECTION ASSOCIATION.
Mar. 26-27. Annual meeting in New York City. Secy., Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL BUILDING TRADES AND EMPLOYERS ASSOCIATION.
Mar. 26-27. Annual convention at Washington, D. C. Secy., J. H. Scates, 15 E. Fayette St., Baltimore, Md.

NEW ENGLAND STREET RAILWAY CLUB.
Mar. 27. Annual meeting at Boston, Mass. Secy., H. A. Faulkner, 12 Pearl St., Boston, Mass.

AMERICAN ELECTROCHEMICAL SOCIETY.
Apr. 3-5. Annual meeting at Atlantic City, N. J. Secy., J. W. Richards, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Vice-Pres., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, owa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Shuetleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STEEL RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

Idaho Society of Engineers—At the fourth annual convention of the Society on Feb. 21-22, at Weiser, Idaho, the following officers were elected for 1913: President, J. F. Congdon; Vice-President, R. J. Wood; Treasurer, Edward Hedden; Secretary, J. F. Shaffner. Highways and irrigation problems were the main subjects discussed at this meeting. An inspection trip was made to the Oxbow power site on Feb. 23.

Wisconsin Electrical Association—The annual meeting of the Association was held at Milwaukee, Wis., on Jan. 15, at which time the following officers were elected for the ensuing year: President, W. H. Winslow; Vice-Presidents, William Wallen, P. H. Korst, and M. C. Ewing; and Secretary-Treasurer, George Allison.

American Society of Engineering Contractors—At the fourth annual meeting of the Society in New York City, Jan. 14, the election of officers for 1913 resulted as follows: President, H. J. Cole; Vice-Presidents, Edward Wegmann, and G. T. Clark; Secretary, J. R. Wemlinger; and Directors, A. S. Bent, DeWitt V. Moore and L. F. Peck. A movement was started for the inauguration of an Information Bureau for the benefit of members of the Society.

American Chemical Society—The following papers, among those on the program of the annual meeting at Milwaukee, Wis., on Mar. 25-28, are worthy of notice: "Industrial Chemistry," by M. C. Whitaker; "Agricultural and Food Chemistry," by G. F. Mason; "Biological Chemistry," by I. K. Phelps; and "Chemical Education," by J. F. Norris. The arrangements have been planned so that technical sessions will be held in the forenoon each day, excursions in the afternoon and entertainment features in the evening.

National Fire Protection Association—The annual meeting of the Electrical Committee will be held on Mar. 26-27, in New York City, at which discussion will be held on proposed changes in the "National Electric Code." Among the prominent engineering societies represented on this committee are the American Institute of Electrical Engineers, American Electric Railway Association, National Electric Contractors' Association and National Electric Light Association.

ENGINEERING LITERATURE

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EDITORIAL

The Dewey Decimal System of Classification Extended to Engineering

So much has been written and said about indexing and filing engineering literature and so many systems have been described and recommended that engineers will be interested in knowing what the standard library methods are; and perhaps think it best to adopt them for their own use. We have received letters indicating that many engineers and manufacturing firms have already adopted the Dewey decimal system or a similar one for classifying, indexing and filing current technical articles, trade catalogs, etc., and its advantages over any irregular, haphazard system are undoubtedly very great.

The Dewey system divides all knowledge into nine classes numbered from 1 to 9, such as Philosophy, Religion, History, etc. Under this classification 6 is Useful Arts, within which is found Engineering. Each general heading is subdivided as follows: Useful Arts 600, Medicine 610, Engineering 620, Agriculture 630, etc. Each subhead is further subdivided as Mechanical Engineering 621, Mining Engineering 622, etc. Each of these in turn may be elaborated indefinitely as for example Mechanical Engineering into Steam Engineering 621.1, Mechanism of Steam Engine 621.11, Types of Engines 621.112, and so on, making a new decimal point every three figures.

The great advantage claimed for the Dewey system is that it can be expanded indefinitely; and when applied to all human knowledge to be grouped and classified and filed for all kinds of people it would indeed be difficult to hit upon a scheme so well adapted to give the best possible satisfaction. Applied, however, to an index and a file maintained primarily for a given purpose, as an aid to the business of an individual or single firm or corporation, it is more elaborate than necessary, and its very elaborateness at once leads into difficulties.

As an example we will give an instance of actual experience. It was suggested to us to put the Dewey classification number on the articles listed in our table of contents, so that engineers could file the articles according to that system.

From a single individual's point of view this is very easily done. But we will take an article at random, say "Explosion-Proof Electric Equipment for Mining Service," in our issue of Feb. 20. The article deals with a number of investigations of devices for rendering electric motors and switches safe for use in gaseous mines.

The electrical engineer keeping a file for his own use would probably classify this under Electrical Engineering Dynamo Electric Machines, etc., 621.312.....etc. A mining engineer might look at it from an entirely different point of view and classify the article under Mining, Ventilation and Lighting of Mines, Motive Power for Mine Fans, Electricity, 622.445.3, or under Lighting, Safety Lamps, etc., 622.47, or under Dangers and Accidents, 622.8...etc.

Obviously to be completely indexed or filed it should appear under all these and more, or there should be cross-references. This is what a professional librarian aims to do, but any one who has had much to do with public libraries and library indexes knows that such articles or books are not indexed under enough headings to give the searcher all the available information in the library on the subject of his search. Of course it is a physical impossibility to carry out such a system of indexing in an ideal way so that each heading gives all references or cross-references to the subject matter in all the books and articles in the library. An index complete enough to do so would require a building by itself.

Whoever has tried to make an index for general use, quickly meets the question of when to stop indexing a given article or book. The more knowledge the indexer has of the subject matter in the book or article, the harder such a limit is to determine, because he realizes that there are very valuable data there to which the title or general heading gives no clue. In fact, a single chapter in a good book by an experienced author may be more valuable to the searcher than a dozen poor books devoted to the particular subject treated in that chapter.

Another random example of a shortcoming in the Dewey system is the classification of Surveying. We doubt if any person who has studied or practiced surveying would think of classifying a description of a survey which contains data of value on the art of surveying under Mining, Drainage, Railway Location, or any other heading designating the purpose of that particular survey. Yet under the Dewey system we have no general classification Surveying, but must put the entry under every branch of engineering work which involves a use of surveying, in order that the subject shall be available to every searcher. Carried out in detail this system would separate correlated articles so far apart in the files that to find all the articles wanted for information on surveying would require a most thorough search and study. As

the file grows the more widely separated allied subjects become.

These are, as we said, mere random illustrations. We do not wish to belittle the work done by the inventor of the Dewey system, or those who have extended it. In principle, it is an exceedingly simple solution of a complex problem. We merely suggest that any engineer who will study the system and get its fundamental principles can undoubtedly work out a system of classification of his own, which, from his own expert knowledge of the subjects to be classified, will be more convenient for his purposes than the elaborate Dewey system extended as is done in two recent publications designed for engineers: "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," by L. P. Breckenridge and G. A. Goodenough, University of Illinois *Bulletin,* Nov. 11, 1912, Vol. 10, No. 11 (Price $0.50), and the October, 1912, *Quarterly* of the Colorado School of Mines, Vol. 7, No. 3. The latter of these is for mining and metallurgical classification, while the former purports to give a system of classification for all engineering literature.

Each of these pamphlets has a relative index at the end which will help considerably in determining under what classification to look for a given subject. The following is an example, purposely an example of poor terminology, taken from the first mentioned pamphlet:

Sewerage
- Discharge of into sea.
- Deodorization and disinfection of.
- Disposal of.
- Farming.
- Irrigation, etc.

It is only fair to say that this heading and these classifications are the work of a Professor and an Associate Professor of Mechanical Engineering. Yet they go to show how individualistic any classification is; and no man with ideas of his own and a little ingenuity need accept unqualifiedly a system which, with a little consideration of his own needs and uses, can be much improved upon. And unless one aspires to be a professional librarian we doubt the value of his mastering the minute classifications required to use the Dewey system with all its ramifications.

CORRESPONDENCE

A Reply to Review of "Engineering of Shops and Factories"

Sir—The review of my book, "Engineering of Shops and Factories," printed in "Engineering News," of Feb. 13, 1913, states:

> It contains also some chapters on location and planning, and on certain items of equipment, such as heating and lighting, air washing, sewerage, etc. But in examining these chapters it becomes evident that the subjects are not the author's own, etc.

This statement is misleading and might give the impression that I have used the writings of others without giving credit. The fact is that material for several chapters on shop equipment was supplied by specialists in certain lines, whose names are given in my book. Furthermore, the fact that these chapters were written by specialists is particularly emphasized in my preface, and special value is claimed for the book on that account.

H. G. TYRRELL.

Boston, Mass., May 7, 1913.

[The "etc." which Mr. Tyrrell omits in the foregoing quotation was: "and that in compiling he has missed completeness and in many instances correctness." We declared that some of the "subjects," not the language and mode of presentation, were not the author's own.

The most striking example in the book of lack of mastery of a subject appears to be the chapter on "Drainage of Industrial Plants"—which the author specifically credits to himself in a footnote. This chapter forcibly illustrates the pitfalls which beset the author or compiler who goes too far outside his own field. Since all-too many authors go astray in this fashion, to the injury of publishers and readers alike, we exhibit some of the many glaring faults in this chapter. This we will do solely by quotations, which, with the aid of blackfaced type of our own using, speak for themselves:

[P. 286, on Water Closets.] They should have a tight valve and a double water seal, with water enough under the seat for immediate **disinfection.**

[P. 290, on The Drainage of Plants.] As a stream flows on, **its velocity will increase, and consequently its volume will diminish.** Therefore a pipe running full at its upper end, **may receive a large quantity more during its course.**

[291, on Ventilation of Sewers.] In the city of Windsor, England, in 1856, a case of typhoid fever was discovered. From lack of proper sewer ventilation, the foul and poisonous gases from the fecal matter of this one patient, rising through forced and siphoned traps, caused the death of no less than 450 other persons, all of whose houses without exception were connected with this sewer. Windsor Castle, having its own drain, escaped. In another city, the breaking out of typhoid fever in the higher parts of the town **while the lower portions remained untouched** was considered a mystery until it was found that the sewers, not being properly arranged, allowed the poisonous gases to rise to the higher parts of the system, where they escaped and spread the germs of disease. In this, as in many other cases, the community was stirred to action only by the cruel hand of pestilence.

[Pp. 293-4, on Pneumatic System.] All elements have been called upon as aids in the **drainage** of communities, including water, **dry earth and ashes,** and now the aid of compressed air is used in removing refuse from buildings. On account of its **comparatively recent discovery,** this system is but little used, but in Holland and Austria where it has been tried, good results have been obtained. It is to the research and ingenuity of a Dutch engineer that the world is indebted for the discovery of a system which has been declared as **the greatest modern invention in sanitary science.** * * * * * As the sewage at the final depot is run through sieves, and evaporated for use as fertilizer * * * * * * the income from the sale of the product soon pays for the extra cost of construction.

[P. 294, on Conservation of Sewage.] With the water system, refuse run into the lakes or ocean is lost, as far as the present era of the world is concerned. * * * * * *

By discharging its sewage into a lake or waterway, a city of 100,000 loses annually no less than $70,000. Assuming the present population of the United States to be 90,000,000 the nation loses annually from this waste $60,000,000 to $70,000,000.

At Coventry, England, the liquid sewage is rendered **harmless** by mixing it with sulphate of alumina. * * * * * The solid matter from the sewer, after being separated from the liquid, is dried and sold as a fertilizer for the land. **In order that the discharge may be more copious various storage tanks have been devised, so that when a flow occurs it will be dispersed over a greater area of land.**

Another method of sewage disposal is that of ignition. The **precipitated sewage** is first run into shallow pits where it is partially dried, after which it is burned in large kilns. This method, although producing no revenue from the waste, and on the other hand creating some expense, has the advantage of immediately and thoroughly destroying the source of disease, which is far better than storing up evaporated excreta with the expectation of selling it, and the liability of spreading sickness throughout the country.

[Conclusion, p. 296.] **From the above it appears that large manufactories instead of incurring constant expense for the disposal of sewage can cause it to be a source of revenue,** and streams may continue pure and clean instead of being polluted as they so often are with dyes and refuse from shops and mills.

It is only fair to say that the chapter on "Drainage" appears to be the worst example in the book of "subjects" which are "not the author's own."—Ed.]

REVIEWS AND NOTES

English for Engineers

Reviewed by H. P. BREITENBACH*

A HANDBOOK OF ENGLISH FOR ENGINEERS—By Wilbur Owen Sypherd, Professor of English in Delaware College, Chicago and New York: Scott, Foresman & Co. Flexible leather; 4x7 in.; pp. 314. $1.50.

Attractively bound in black leather, with rounded corners, and of convenient pocket size, Sypherd's "Handbook of English for Engineers," in its outward appearance well bears out the suggestion of its name. Its contents are intended to be "of practical assistance to engineers in college classes and in the early years of professional life." The author's modest aim should easily be fulfilled by the book. In preparation for his task he has faithfully read the literature available on the subject, and his book bears evidence of painstaking care. While his strength has lain in compilation and selection rather than in origination, Prof. Sypherd has made a useful contribution in a field that is rapidly increasing in importance.

The book contains five chapters, devoted respectively to General Problems of Engineering Writing, Mechanical Details Common to the Various Forms of Technical Writing, Business Letters, Reports, and Articles for Technical Journals.

The first chapter is chiefly remarkable for its direct and simple approach to the problems of technical writing. The author here, as generally elsewhere in the book, avoids the usual formal terms of rhetoric. In the second chapter are included directions for the use of abbreviations, punctuation marks, capital letters, etc. To engineers who desire a little strengthening of their English these two chapters are likely to be most serviceable.

The chapter on business letters briefly states the main principles governing successful business correspondence and supplies examples of good and bad usage. One important omission may be noted here. Modern business correspondence has become so voluminous that means of securing special emphasis are frequently necessary. Mention of some of these might well have been included in the chapter. It may be remarked, too, in passing that the author gives his sanction to the objectionable "Respectfully" (without the "yours") for use in the close of a letter.

In the next chapter engineering reports receive what, so far as the reviewer's knowledge goes, is their first systematic rhetorical treatment. The author discusses the general essentials of reports; then gives more fully the requirements of reports on tests, reports on inspection work, and periodical reports, with examples of each kind.

To such faithful readers of engineering periodicals as peruse the book-review columns, doubtless the final chapter, on Articles for Technical Journals, will have more than a passing interest. Dividing his subject into Short Articles and Longer Articles, Prof. Sypherd includes under the former head editorials, summaries and abstracts, book reviews and explanations of new inventions. Not to dwell upon the unpedagogical and illogical order in which these are presented, it is noteworthy that the author's main generalization on editorial writing is unwarranted either by current editorial practice or by the examples he himself cites. He says:

> Following the practice of most editorial writers, he (the student) should, as a rule, express the main point or the general thought of his paragraph in the first sentence.

In both this dictum and throughout his discussion of technical journalism, the author does not sufficiently recognize the increasing importance in present-day journalism of fact-statements.

The last chapter of the book, in short, is likely to be least satisfactory to both student and practicing engineer. It is subject to one other criticism, which applies more or less throughout the book. Of the 85 pages which this chapter contains, some 75 are devoted to examples. In a book which purports to be a handbook, such copious use of illustrative material would be justifiable only if it were elsewhere scarce. But, of course, good examples of technical writing are to be found today in every issue of nearly every first-rate technical journal. Furthermore, the articles selected, with possibly a single exception, have little general or permanent value. "Thawing Pipes by Electricity," for instance, may be well worth while as a timely article, but neither its rhetorical form nor its content value justifies its inclusion in an engineer's handbook.

But that the author, in a field where so much pioneer work remains to be done, has generally missed the right path is easily condoned. The book should prove useful in beginner engineering classes, and doubtless will find a place on the reference shelves of many progressive engineers.

With a view to the former use, the author has supplied, in connection with the various chapters, assignments for composition work. Appendices contain further useful pedagogical material, including a bibliography of the subject. The bibliography includes references on contracts and specifications, but in the book proper there is only casual mention of these subjects.

*Instructor in English, Enginering Department, University of Michigan, Ann Arbor, Mich.

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FORESTRY IN NEW ENGLAND—A Handbook of Eastern Forest Management. By Ralph Chipman Hawley, Assistant Professor of Forestry, Yale University, and Austin Foster Hawes, State Forester of Vermont and Professor of Forestry, University of Vermont. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9½ in.; pp. 474; 140 text illustrations. $3.50, net.

There is reason for congratulation in the fact that forestry in the United States has made sufficient progress to warrant the publication of a book devoted to "the specific forestry problems" of one section of the country.

The volume before us deals first with forestry in general and then takes up forest conditions, practices and possibilities in New England. Much of Part II is applicable to considerable portions of New York, New Jersey, Pennsylvania and southeastern Canada, while Part I is of general application—although for complete treatment the authors refer their readers to other and more extended works.

Confining our further remarks chiefly to Part II, New England Forests and Their Management, we note that the authors first review briefly the original forests of New England and their early development and also present forest conditions. Having divided New England forests into four regions—Spruce, Northern Hardwoods, White Pine and Sprout Hardwoods—each region is taken up in detail. The main heads here employed are General Considerations; Forest Types; Methods of Handling the Forests (of each type); Logging Methods; Market Conditions; Industries (using lumber, etc.); Character of the Land and Ownership; and Forest Protection. Two folding maps show the location of the four regions and also the railways which serve them. These four chapters contain a large amount of practical information, useful alike to students of forestry and to present or prospective owners of forest lands (actual or potential) in New England and its adjacent territory.

Particularly interesting in this and other sections of the book are the facts and opinions regarding the availability of large areas of New England lands for forest improvement and for afforestation by city people who wish to own farms in the country, either for summer use or as retreats after their active business careers are ended. Such persons will find forestry less exacting than farming, both in point of continuous supervision and drain upon the purse.

A chapter on The Progress of Forestry in New England presents a systematic review of what has been done up to 1912 by each of the six states. While much remains to be done, it is a pleasure to note how good a beginning has been made in most of the states and that each state is doing some forestry work.

A brief final chapter deals with possible forest yields under proper management. An appendix contains some statistics of forest fires, a brief bibliography and 40 pages of tables for finding volumes of logs, the growth of individual trees, and the yields of whole stands or forested areas.

The book should stimulate forestry work in New England and deserves a wide circulation there and in adjacent districts. The halftone illustrations are notable for choice of subjects and for the high character of the original photography, the engraving and the presswork.

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WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED—A Practical Treatise Embracing Complete and Detailed Explanations of the Theory and Practice of Modern Radial Apparatus and Its Present Day Applications, Together with a Chapter on the Possibilities of Its Future Development. By Alfred P. Morgan, Editor, Mechanical and Electrical Department of the "Boy's Magazine," author of "Wireless Telegraph Construction for Amateurs." New York: The Norman W. Henley Publishing Co. Cloth; 5x7½ in.; pp. 154; 156 illustrations. $1.

The book contains a good deal of valuable information on wireless apparatus and operation with a large amount of speculation as to future developments. While not in any sense a scientific work nor entitled to be called a practical treatise, the book should prove of interest to many who

desire simply a little non-technical information concerning recent scientific advances.

A number of the conventional circuit diagrams shown in various parts of the book might interest the amateur operator. A creditable attempt is made to explain by simple analogies the theories of detectors, resonant circuits, tuning, couplings and directive siginaling, and the principal pieces of wireless apparatus in common use are described.

The book gives a wrong impression, more by implication than by positive statement, of the present importance of wireless telephony. Much has been actually accomplished in this field in the way of perfecting sending and and receiving apparatus, but for the lack of an adequate selective device, the wireless telephone is still about as far from commercial applicability as it ever was.

Perhaps the feature of the book which stands out most prominently is the large extent to which it is illustrated. It is a matter for regret that more attention is not paid by technical writers in general to the use of pictorial descriptions.

Measuring Electrical Resistance

Reviewed by C. H. SHARP*

METHODS OF MEASURING ELECTRICAL RESISTANCE—Edwin F. Northrup, Ph. D., M. A. I. E. E. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii + 389, 159 text illustrations. $4 net.

When a book on a restricted field in electrical measurements, such as the measurement of electrical resistance, is announced, it is likely to raise a question as to whether there is sufficient material in this subject alone to justify a book being written on it. The present work, which extends to nearly 400 pages, is a sufficient answer to that question, and is furthermore a striking evidence of the great extent to which the science of electrical measurements has been carried.

The measurement of electrical resistance in an especial way demands an extended treatment, because measurements of resistance occupy, in the present state of the art, a fundamental position among electrical measurements. Not only is resistance one of the three factors of Ohm's law, but it is in practice one of the two which lie at the basis of all electrical measurements. Current strength is a derived quantity, the standard resistance and the standard cell furnishing the means for its measurement.

This work treats of the measurement of resistance in practically all of its phases. The treatment is essentially practical, there is a marked and very welcome absence of mathematical gymnastics and a decided leaning toward simple and common-sense treatment.

The author starts out with a very excellent treatment of the subject of accuracy, of the question of relative errors and of the necessity of forming a discriminating judgment as to the relative importance of quantities, and as to the accuracy required in various factors. The theory of errors is discussed in a simple and adequate manner.

Next are taken up the voltmeter methods of measuring resistance, including one method original with the author. In this chapter, as in all the following ones, numerical examples are given, mostly from practical experiments, which illustrate the application of the methods, and which indicate their limitations and their accuracy. This feature of the book is most commendable.

A single paragraph is given to direct reading instruments for the measurement of resistance, these being classed as "ohmmeters and meggers." To the reviewer it seems unfortunate that the principle of the latter class of instruments is not more fully explained, particularly since the so called "megger" is not the only deflection instrument which is direct reading in ohms. The explanation that these are instruments rather than methods of measurement seems hardly adequate, in view of much that follows. The principle of these instruments is due to Maxwell, and the modern types have a considerable commercial importance.

Null methods are next discussed, the differential galvanometer being treated and the various forms of bridges. The Wheatstone bridge is considered in great detail, the Carey Foster bridge being rightly treated as a Wheatstone bridge with mechanical accessories which serve for switching purposes. The improvement of resistance boxes is taken up in detail great attention being paid to the method of connecting coils. It might be objected that this does not come under the head of methods of resistance measurement, but criticism is disarmed by the fact that the matter treated of is valuable and pertinent and that the author speaks with authority.

In considering methods of measuring low resistance, the author takes up first those which are available for the measurement of the resistance of a continuous conductor carrying a current, such as a busbar or as an underground pipe through which a stray current is flowing, and proceeds next to a discussion of the Kelvin double bridge. This bridge method which, not many years ago, was but little known in practice, has come to have a recognized and very important place in enginnering measurements. It is treated in a very clear and adequate way.

Commercial conductivity measurements are next taken up and commercial apparatus is considered. The treatment here would be more complete if the method which is in use at the Electrical Testing Laboratories were described. This method consists briefly in the use of fixed conductivity standards of copper, with which the resistance of a measured length of the unknown sample is compared. The measured length is so chosen in relation to the weight per unit length of the sample, that if the sample has 100% conductivity, its resistance will be equal to that of the standard. Using a Kelvin double bridge, a comparison of the relative resistance of the standard and of the measured length of the sample is made, and the result shows the percentage conductivity directly.

High resistance measurements by deflection and by loss of charge are adequately treated and the theory of galvanometer shunts is taken up at this point. In this connection also the peculiarities of cables with respect to time of charge, etc., are discussed.

A relatively new type of resistance measurements is next considered; namely, the measurement of resistance of conductors with alternating currents flowing through them. Alternating current resistances are particularly important in the case of conductors composed wholly or partly of iron, such as steel cored wire, railway rails, etc.

Further chapters discuss the practical questions of the resistance to earth, of electric distribution systems, as measured with the power on. The measurement of the resistance of electrolytes is discussed, and a long chapter is devoted to the theory of the location of faults in cables. The latter subject is treated in a very practical way with adequate diagrams and numerical examples.

The book concludes with a discussion of the measurements of the resistance of resistance thermometers and with general considerations as to the construction of standards and as to the behavior of galvanometers.

In the Appendix, various useful data are given, not the least valuable of which are collections of constants of galvanometers of different types and different makes, and of the resistivity of various elements and alloys.

A book of this character demands close attention on the part of the reader. Anything which distracts the attention needlessly is a detriment. It may, therefore, be asked whether, in view of the present common usage in spelling, the total efficiency in the use of language in this book would not have been greater if the word "through" had been spelled in the usual manner rather than in a way dear to the hearts of spelling reformers but annoying to the old-fashioned reader who resents textual idiosyncracies which interrupt the continuity of his train of thought. Is a seriously intended textbook any proper place for the exploitation of orthographic experiments anyway? Apart from this blemish the reviewer has nothing but commendation for the mechanical makeup of the book.

It may be said in conclusion that the book is of a very practical character and commends itself highly to engineers whose work brings them into touch with resistance problems. The long experience which the author has had, both as a designer and user of electrical instruments, enables him to speak with peculiar authority and with much commonsense on the various topics which he has treated.

THE CURTISS AVIATION BOOK—By Glenn H. Curtiss and Augustus Post. With Chapters by Captain Paul W. Beck, U. S. A., Lieutenant Theodore G. Ellyson, U. S. N., and Hugh Robinson. New York: Frederick A. Stokes Co. Cloth; 5x7 in.; pp. x + 307; numerous illustrations. $1.35, net.

This is surely a Curtiss book. It is Curtiss from cover to cover—the Curtiss story as told by himself and as told by others. Mr. Post first tells of Curtiss' life, his boyhood days, his speed manía and how it all led him into the manufacture of motor-cycles, and how this in turn got him into touch with T. S. Baldwin, of dirigible balloon renown.

From this point on Mr. Curtiss' interest in aëroplanes is discussed by himself. He modestly speaks of his own work in collaboration with Alexander Graham Bell, S. W. Baldwin,

*Electrical Testing Laboratories, 80th St. and East End Ave., New York City.

J. A. D. Macurdy, Lieut. Selfridge and Mr. Post. It is an interesting narrative, compelling in its simplicity, directness, and vividness, especially where Mr. Curtiss tells of his races abroad. His love for fast travel shows itself, but the reader gets the impression also that he is now leaving that behind him for his greater delight in making various machines that will travel fast, and in surmounting all the possible obstacles to their dependable operation.

Curtiss tells his own story of the development of the hydro-aëroplane which has now reached the stage of a feasible land-water flying boat. Capt. Paul Beck, U. S. A., and Lieut. T. G. Ellyson, U. S. N., who were among the officers detailed for instruction and duty under Mr. Curtiss, have contributed chapters on the use of the aëroplane in the army and navy. Capt. Beck gives a somewhat theoretical discussion of its military aspects; Lieut. Ellyson performs a similar task, but adds a little on the life in 1911 at the San Diego experimental station where most of the development work was done on the hydro-aëroplane. There are various chapters on amateur work in learning to fly, and on the detailed construction of the Curtiss machine. Most of these are by Mr. Curtiss, but a few are by his associates.

The role played by Mr. Post in this work is worthy of passing mention. When the publishers feel that some references to Mr. Curtiss and his work, which his own modesty conceals, are needed, then the tale is told by Mr. Post, either in an interjected chapter or as a footnote. Mr. Post's contributions show on their face a Boswellian character. He seems to have industriously collected newspaper clippings about his most interesting chief, and have noted down in an ever-present notebook Mr. Curtiss' remarks at the theater and in his bath.

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A German Pocket Book for Sewerage Engineers

Reviewed by EMIL KUICHLING*

TASCHENBUCH FUER KANALISATIONS-INGENIEURE—By Dr.-Ing. K. Imhoff. Drawings by O. Bernards. Second edition. Munich and Berlin: R. Oldenbourg. Cloth; 4¼ x 6¾ in.; pp. 29; 16 pp. of diagrams. Marks, 2.80.

A brief compendium of the principles of sewerage and sewage disposal is presented in the small space indicated above. Each subject is discussed in comparatively few words, and wherever possible reference is made to the diagrams which represent the underlying mathematical and physical data. These diagrams relate to the prospective increase of population in a community, the rainfall, runoff, size of sewer section, and the mean velocity and discharge for different depths of flow in twelve sections of different shape. The diagrams in the latter series are novel and ingenious, as every form of cross-section considered is expressed in terms of a circle whose diameter is equal to the maximum width of the given section.

It is obvious that a complete review of this publication would require much more space than is here available, and hence only a few of the important features of sewer design will be considered. Diagram 3 exhibits the relation between the maximum intensity of rainfall, expressed in liters per hectare per second, and its duration in minutes, as observed for the Emscher drainage district. The equation of the curve showing this relation in the case of a municipal sewerage system is not given, but the writer has deduced it approximately as follows:

$$i = \frac{5.217}{\sqrt{5.8 + t}}$$

where (i) is the expected maximum intensity of rainfall, expressed in depth in inches per hour (or cubic feet per acre per second), and (t) is the duration of such intensity in minutes. This shows that for (t) = 10, 30, 60 and 120 minutes, the values of (i) adopted for said district are respectively = 1.31, 0.87, 0.64 and 0.47 in. per hr. It may be noted that these values of (i) are very much smaller than those which have been observed to occur in our New England and Middle States.

Diagram 4 exhibits the approximate relation between the runoff in liters per hectare per second reaching the sewers, and the magnitude of the municipal drainage area in hectares. Three curves are given, referring respectively to densely built-up districts with good grades, to average conditions, and to sparsely built-up districts with flat grades; but their equations are omitted, and the writer has deduced the following approximate expressions from the given curves:

(1) For densely built-up areas $q = \frac{1.301}{A^{1/8}}$. (2) for average municipal areas $q = \frac{1.303}{A^{1/9}}$. (3) for sparsely built-up areas $q = \frac{1.514}{A^{1/4}}$, where (q) is the quantity of storm-water reaching the sewer in cubic feet per acre per second, and (A) is the area of the given sewer district in acres. (The fractions following (A) are exponents). These expressions are interesting, as they exhibit the principle on which the author computes the volume of storm-water to be provided for in sewers. No proof of the correctness of these curves, however, is offered, and hence further comment is excluded.

For computing the mean velocity and discharge in a given sewer cross-section, the author uses an abbreviation of the Kutter formula commonly adopted by German and French engineers. Reduced to measure in feet, this formula is approximately:

$$v = \left(\frac{178.56\sqrt{r} - 1.75}{0.600 + \sqrt{r}}\right)\sqrt{rs}$$

in which the degree of surface roughness is n = 0.0135, and the factors (r) and (s) have their usual significance. No comment on this convenient abbreviation of a cumbersome formula is required, except to remark that in sewer work its use will give as trustworthy results with a given value of (n) as the unabbreviated formula.

Diagram 15 exhibits the relation between the diameter and the cost per unit of length of furnishing and laying sewer pipes of cast iron, earthenware, cement, reinforced concrete and large masonry conduits, exclusive of trenching; and Diagram 16 shows the necessary sinking-fund charges or percentages of original cost required with different periods of years and rates of interest. Both of these diagrams are useful for approximate work, but they are not as satisfactory as tables, which would occupy no greater space. In regard to the costs of pipes and large sewers in Germany, no comment is made as they do not apply to American conditions.

The general principles of sewage treatment are tersely set forth on pages 7-16, and many valuable data are given. Thus in regard to quantity of sludge produced in settling tanks, it is stated that when removed in freshly deposited condition from a filled tank by pumping or hydraulic pressure, the volume will be about 0.0424 cu.ft. per head of population per day; that when the clarified liquid over such fresh sludge is carefully drawn off its volume will be about 0.0212 cu.ft. per head per day; that when the sludge is allowed to decompose thoroughly, as in a septic tank, its volume will reduce to 0.0071 cu.ft. per head per day; and finally, that in the case of a strictly separate system of sewerage, its volume, when drawn from a septic tank, may reduce to 0.0035 cu.ft. per head per day. It must be understood that these figures refer to the wet or liquid condition of the sludge as it is drawn from the tank; and in the case of septic tanks they refer only to that portion of the contents which is thoroughly decomposed, and not to the entire mass or volume of sludge contained therein.

The author regards septic tanks through which the total volume of sewage is compelled to flow as being antiquated and applicable only to small plants. Such tanks are usually designed to have a capacity of 24 hours flow of sewage. For larger plants he urges the provision of a separate compartment for the sludge in which decomposition may proceed without affecting the effluent from the settling chamber.

Many other subjects of interest in connection with the treatment of sewage are clearly and concisely presented, thus making the book a very useful addition to the library of every sewerage engineer.

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PRACTICAL DESCRIPTIVE GEOMETRY—By William Griswold Smith, M. E., Assistant Professor of Descriptive Geometry and Kinematics, Armour Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. ix + 208; 132 text figures. $2, net.

Like other branches of mathematics, this one has been covered by a number of excellent treatises which have recorded the modern advances along the lines of mathematical research and drafting-room practice. But this subject, like almost any other, is capable of presenting several different appearances, depending on the point of view of the investigator; or in terms of descriptive geometry itself, depending on the "plane of projection." It is easy to see that the methods and arrangement of text which would appeal to the mathematician might and probably would be Greek to the draftsman or the student.

The author of this book, speaking from the student's viewpoint, makes the criticism that "in spite of the indisputable excellence of many of these textbooks, they seem to have failed to arouse the interest of the student, partly by ignoring the practical applications, and partly by making only a

*Consulting Engineer, 52 Broadway, New York City.

slight attempt to present the subject attractively." His own aim in this book, he explains, is "to present the subject to the student in a simple manner as progressively as possible, reminding him constantly of the relation which exists between Descriptive Geometry and Practical Drafting; and to avoid needless difficulty by using language and directions of the greatest possible clarity." This aim is to a large extent realized.

The book is obviously meant for the student of engineering and it appears to have found at least a partial solution for the psychological difficulties referred to above. It might also prove of interest to draftsmen and to designers on sheet-metal form work, although it contains more theory than is required by them.

The first half of the book is largely devoted to the elucidation of the fundamental theory and methods, while the practical applications are given in the succeeding portion. The sections treating of Shades and Shadows, Perspective and Isometric Projection deal with matters of interest principally to architectural students. The mechanical engineering applications are treated at length in the chapter on Curved Lines and Surfaces.

More Books on Drawing

Reviewed by ROSSITER R. POTTER*

DESCRIPTIVE GEOMETRY—In Six Parts. By William Calvin Hoover Slagle, C. E.; Assistant Professor of Descriptive Geometry and Drawing, University of Pennsylvania. New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in. $6 net, per set.
Part I. Projections. Pp. 94; 76 text figures. $1.
Part II. Problems of the Point, Line and Plane. Pp. 142; 284 text figures. $1.50.
Part III. Warped Surfaces. Pp. 90; 35 text figures. $1.
Part IV. Shade and Shadows. Pp. 49; 38 text figures. 75c.
Part V. Isometric Drawing. Pp. 77; 74 text figures. 75c.
Part VI. Perspective. Pp. 95; 75 text figures. $1.

ELEMENTARY MACHINE DRAWING AND DESIGN—By William C. Marshall, M. E., C. E., Assistant Professor of Machine Design, Sheffield Scientific School of Yale University; Formerly Assistant Professor of Descriptive Geometry and Drawing in S. S. S.; M. Am. Soc. M. E. New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. 320; 202 text illustrations. $3, net.

HOW TO READ A DRAWING—By Vincent C. Getty. Philadelphia: J. B. Lippincott Co. Cloth; 6x9 in.; pp. 64; 61 illustrations, including 19 one- and two-page plates. $1, net.

A six-volume text book on descriptive geometry requires some explanation and rather prejudices one against it at the start. The only clue offered by the author is that this treatise was inspired by the desire to present a symmetrical development of the subject and avoid the tendency to accentuate some particular division at the expense of others. Apparently he has insured against slighting any one division of the subject by making each the topic of a separate volume.

The divisions chosen as the topics of the several volumes comprise projections; problems of the point, line and plane; warped surfaces; shade and shadows; isometric drawing, and perspective. Surfaces of revolution are taken up in the volume on warped surfaces. The style of the book is in general of a formulated type rather more dry than the ordinary, although beyond criticism in regard to clearness. In fact a careful perusal of the work leads to the conclusion that in spite of its six volumes it is an ordinarily good though somewhat lengthy text book. The suggestion arises that a more reasonable price could have been set had its 545 pages been bound up in a single volume, or at most in two volumes, with no loss in convenience.

The work is not separated into chapters but is divided into portions a couple of pages or so in length by the legend "Rec. 1," "Rec. 2" etc. The same abbreviation is used in the table of contents without explanation and the preface is silent on this subject. The reviewer's guess is that this is short for "recitation." If this is correct, the work is divided into assignments for each lesson, an idea which may be worthy of imitation by other text-book writers.

Prof. Marshall's "Machine Design" is intended for use in schools rather than for home study without an instructor. However, it might be of use as a handbook by structural draftsmen or others having occasion now and then to fix the proportions of some machine detail. Rules for proportions are given together with directions for the conventional representation of rivets, pipe fittings, screws and bolts, keys and cotter, half couplings, stuffing boxes, bearings and [illegible] pistons and piston rods, crossheads, connecting rods, engine cranks and eccentrics, pulleys and belting, spur, bevel and worm gearing, and globe valves, check valves, safety valves and stop cocks.

A feature distinguishing this from the general run of books on the design of machine details is the combination in one volume of elementary instruction in drafting, machine design and nomenclature of machine parts. The opening chapter covers the preparation of working drawings, including such elementary details as directions for erasing and for the use of tracing cloth. The other chapters, after equally elementary definitions and explanations of machine parts, take up much more advanced matters, such as the calculation of pipe diameters for steam engines and the determination of the area of least opening in a globe valve. It seems strange, incidentally, that in the chapter on rivets there is nothing in regard to the calculation of efficiencies of riveted joints.

The author has a marked fancy for graphical methods, as is evidenced by numerous diagrams for finding proportions of the various machine parts considered. Another notable feature, in connection with the problems assigned at the end of each chapter in the form of drawings to be made, is the data on the average time required for doing the work. The author states that these problems are taken from test papers that have been in use for the past ten years, which gives some weight to these figures as time-study data.

Mr. Getty's, "How to Read a Drawing," is written for those absolutely unacquainted with the principles or methods of projection drawing. So far as can be judged by one already familiar with working drawings, he has been fairly successful in presenting the subject in such a way that the reader can acquire at least the ability to understand a drawing with the minimum of effort and study. In the brief space of 64 pages, the author succeeds in covering not only the elements of the method of representing an object by a drawing, but also some of the chief points of difficulty in mechanical, architectural and structural drawing. Doubtless the best way to learn to read drawings is by making them but for one who cannot afford the necessary time and effort, Mr. Getty's book will be most helpful.

AMERICAN CITY GOVERNMENT: A SURVEY OF NEWER TENDENCIES—By Charles A. Beard, Associate Professor of Politics in Columbia University. New York: The Century Co. Cloth; 5¼x8¼ in.; pp. 420; 14 illustrations. $2, net.

This "Survey," we learn from its Preface, is addressed "to students and citizens" who wish general information on "recent leading tendencies." It is designed to lay stress "on the social and economic functions of city government." The author believes that "the most fundamental concerns of cities" are "matters of state and national, not local, control."

In seeking to realize these aims and express these beliefs, the author discusses home rule, city democracy, municipal government and administration, all broad and more or less general subjects. He then takes up the more specific problems of city finance, police, public-service companies, municipal ownership, streets, health, tenement-house reform, education, recreation and city planning. Appendixes deal still further with franchise matters and congestion of population. A brief bibliography closes the volume.

As a review of various interesting recent tendencies along the lines indicated, the volume is commendable in subject matter and in mode of presentation. The chapters on Streets and Health (which cover paving, street cleaning, garbage collection and disposal, lighting, shade trees, water-supply, sewage treatment and fire protection) contain many statements which are sure to mislead all who have no more accurate and discriminating sources of information. This is a common fault when an author ventures too far outside his own well mastered field and attempts to garner, combine and elucidate the statements of others regarding technical matters. The results are all the worse where one makes an unfortunate choice of guides in little known fields, as portions of these two chapters and corresponding books in the bibliography plainly indicate was the case in several instances. Fortunately these chapters, and particularly the parts of them which are open to question, make up only a relatively small percentage of the whole volume.

GENERAL SPECIFICATIONS FOR BRIDGES By J. E. Greiner, Consulting Engineer, Fidelity Bldg., Baltimore, Md. Part I. Steel Stationary Bridges. pp. 28. Part II. Movable Bridges. Pp. 28. Part III. Superstructures and Concrete Bridges. Pp. 39. [Bound separately.] Paper; 11x8½ in.

Bridge specifications from so experienced a practitioner as the author of this new work are sure to command careful

*Shop Engineer, Blood Bros. Machine Co., Kalamazoo, Mich.; formerly Assistant Editor "Engineering News."

study. The reader will find enough innovation both in substance and in arrangement to engage his interest and in most cases, we believe, his hearty approval. The pamphlet on movable bridges will doubtless rank as the most noteworthy of the three, on the ground of novelty, apart from any questions of excellence; it covers a number of questions which have usually been regarded as open, and subject to individual judgment, and makes definite provision for some items of design that have often been neglected or glossed over.

The Development of Oil Flotation

Reviewed by F. W. TRAPHAGEN*

CONCENTRATING ORES BY FLOTATION—Being a Description and History of a Recent Metallurgical Development, Together with a Summary of Patents and Litigation. By Theodore J. Hoover, A. B., Leland Stanford, Jr., University; M. Inst. M. & M. London: The "Mining Magazine." San Francisco: Mining & Scientific Press, Agents. Cloth; 6x9 in.; pp. 221; 55 text illustrations. $3.75.

One of the most important metallurgical improvements of the present decade has been the development of oil flotation. For many years it has been known that great metallurgical losses were caused by the tendency of many sulphide minerals to float off on the water during the process of concentration. Finely divided minerals are much the hardest to concentrate and the richest tailing in ore dressing plants is usually that which is also most finely divided. Flotation processes make possible the saving of a large percentage of these small sulphide particles, a thing no other process will do.

Mr. Hoover, from his own experience and from a series of descriptions by others, has collected together much valuable information and has furnished a reliable guide on this important process.

The book is divided into 12 chapters. After a chapter each on history, patents, litigation, theories and tests, there are taken up the Potter-Delprat, the De Bavay, the Elmore Vacuum Flotation, the Minerals Separation and Other Flotation Processes. Then a chapter each is devoted to Economics and to a bibliography. The descriptions of various processes are very complete and afford not only an excellent basis for comparison, but will serve also as guides to the practice.

Considerable credit is due to the American school teacher, Miss Carrie J. Everson, who was the first to grasp and apply the important fundamental principles of oil flotation as practiced today.

Henry E. Wood's very clever work on direct flotation fails to receive notice, possibly because only recently have descriptions of the Wood's apparatus appeared.

The bibliography is excellent, very complete and will serve as a guide to the scattered literature of this very interesting field of metallurgy. Hoover concludes his book with these words:

> As a demonstration of the utility of the invention, we may say then that it has already added to the world's wealth nearly 1,000,000 tons of spelter, 100,000 tons of lead, 20,000,000 oz. of silver and 5000 tons of copper; and at the present rate is adding 200,000 tons of spelter, 20,000 tons of lead, 5,000,000 oz. of silver and 1000 tons of copper yearly.

Mr. Hoover deserves the thanks of metallurgists, especially those interested directly in ore dressing, for his work in placing, in compact form, such a large amount of important information concerning flotation processes.

DER EISENBAU—Ein Hilfsbuch fur den Bruckenbauer und Eisenkonstrukteur. By Luigi Vianello. Second edition, enlarged and rewritten by Carl Stumpf, Konstruktions-Ingenieur an der Kgl. Technischen Hochschule zu Berlin. Munchen and Berlin: R. Oldenbourg. Cloth; 5½x8½ in.; pp. xviii + 687; 526 text illustrations. 20 marks.

This revision of Vianello's book published eight years ago is almost a new work. The reviser (after the author's death) simplified the book by omission of the matter on mathematics, etc., which is available in other handbooks, and the great amplification of the structural matter. At present, after 50 pages on Statics, the work is a full treatise on the analysis of frames and their elements (and also beams, columns, reinforced beams, etc.). There are also nearly 200 pages on details and designing, but this phase of the subject is, as usual in similar works, treated less efficiently than the analytical part. A small amount of matter on masonry walls, arches, etc., is also included.

*Professor of Metallurgy and Assaying, Colorado School of Mines, Golden, Colo.

STATISCHE BERECHNUNG VON TUNNELMAUERWERK. Grundlagen und Anwendung auf die Wirklichkeit. Beispielsungsfälle. Von Dr.-Ing. Otto Kommerell, Kaiserl. Baurat im Reichsamt für die Verwaltung der Reichseisenbahnen. Berlin: Wilhelm Ernst & Sohn. Paper; 7x10 in.; pp. 168; 10 plates and 144 text figures. Geh. 12 M., Geb 13.50. American price, $4.50 and $5.40, net.

A serious attempt is made in this work to provide some basis of proportioning tunnel lining, i.e., determining its profile and thickness. The factors which must be taken into account in this problem are far more varied than those which affect retaining-wall design, and may perhaps best be compared in diversity to the factors involved in determining the bearing capacity of piles. Just as in this latter problem, it will probably never be possible to secure any reasonably general or assured method of analysis. Doubtless the only hope for obtaining a working method lies in abandoning any attempt at fixed theory and in substituting specific practical assumptions. In tunnels of low and moderate depth of cover it is far more likely that useful conclusions can be drawn on the basis of certain assumptions which consider the ground to be made up of loose blocks of such or such size than on the basis of any theoretical analysis of granular materials; the latter, however, is practically always made the starting point, and in part its assumptions are used in the present work. Tunnels of very great depth of cover, those in which temperature and plasticity problems arise, are in a radically different class. At the same time the very factors which differentiate this problem from that of high-lying tunnels free the problem from many of the uncertainties and perplexities which surround the simpler case. On the whole it is to be said that the subject has received so little study and is so far from any reasonably satisfactory solution that every serious discussion of it must be welcome. For this reason, while the author's attempt is hardly more than an attempt, it will prove to be of great value and, by its interlacing of theoretical consideration and practical comparison, will engage the earnest attention and perusal of all who are concerned in tunnel work. The presentation of a series of suggested standard cross-sections makes the book of additional interest.

MOTOR CAR CONSTRUCTION—A Practical Manual for Engineers, Students and Motor Car Owners, with Notes on Wind Resistance and Body Design. By Robert W. A. Brewer, Fellow of the Society of Engineers; author of "The Art of Aviation." New York: D. Van Nostrand Co. London: Crosby Lockwood & Son. Cloth; 5¼x8¾ in.; pp. xi + 242; 78 illustrations. $2 net.

The reader of this book must not expect that he will find here a critical comparison or, for that matter any very extended or complete comparison, of different motor cars which are to be seen either in this country or abroad. The author, when he makes comparisons at all, for the most part does so between types of apparatus, design and construction. Furthermore, the American reader must bear in mind always that while the book bears the imprint of an American publisher, it is nevertheless not an American book, but was written in England, and relates to English methods and results.

Bearing in mind these necessary limitations to the text, a study of the book shows that it is very readable, interesting and useful for those persons who may be engaged in one way or another in the construction or design of pleasure vehicles. It is not a book for the owner or for the driver. The first part of the work is largely historical and this is followed with descriptions of the ways in which the various parts of the machinery are processed, particular attention being paid to the use of jigs. Among these, stands out prominently the universal jig which is much more used in England than in this country with the greater use here of very special machines and jig fixtures.

A considerable part of the book is taken up by discussions of fundamental matters relating to gas and gasoline engines rather than to their place in automobiles. Thus we find discussions of thermal efficiency, relations of power and weight, friction and lubrication, two-cycle vs. four-cycle machines, carburation and the properties of liquid fuel, etc., and the more practical matters of valves, igniters, etc. It must not be supposed, however, that the automobile entity has been neglected, for the need of transmission gearing, brakes, spring suspensions, etc., are all taken up, both in theory and by discussion of equipment such as clutches, change gears, transmission systems, differential gears between drive wheels, control levers, parts of frames and bodies, springs, hubs, axles, etc. The final chapter of the book is given over to a discussion of the need for conforming the body shapes to some approach to stream-line form where power consumption and high speeds are important considerations.

Information on Patents for Engineers

ENGINEERS' HANDBOOK ON PATENTS—By William Macomber, of the Buffalo Bar; author of "The Fixed Law of Patents"; Lecturer on the Law of Patents, Cornell University College of Law. Boston: Little, Brown & Co. Flexible leather; 4x7 in.; pp. xv + 288; illustrated. $2.50, net.

The author of this little book is lecturer on the law of patents in the College of Law of Cornell University. His object in the book before us is not by any means to make every engineer his own patent lawyer, but to give engineers enough knowledge of the general principles of patent law and patent practice to enable them to deal intelligently with such matters regarding patents and inventions as necessarily come before them.

There is need for such a book, without doubt. Most engineers, other than those connected with manufacturing companies, frankly confess their ignorance regarding patent law and patent practice. A large proportion of the engineering profession holds a more or less hostile attitude toward patents generally. It is common to hear the opinion expressed that the patent system operates as a bar to progress. Engineers who have been in touch with the development of important inventions, however, realize that no manufacturer or capitalist could be induced to spend money on new machinery or methods which are departures from existing practice unless he had held out to him the prospect of a property right in such improvement.

Another thing which comparatively few engineers realize is that important inventions are no longer made by country blacksmiths and clerygmen and amateurs. Every department of industry has now been so developed and specialized that only men who have made a thorough study of the art and are familiar with what has already been done and with the foundation principles involved can make useful contributions for improvement. The following quotation from the introductory chapter of the book presents this in admirable form:

> The time was when the American inventor was merely a clever Yankee. He could sit and whittle and whistle, and in due time produce something patentable. The clever Yankee and his day are history. Great engineering schools have come; they are everywhere, big and little. In almost any village with but a single industry may be found a trained engineer such as McCormick could not have found in 1850 to develop his reaper had he searched two continents. Any one of our five hundred colleges is turning out yearly chemists who know more of analysis and synthesis than all the chemists Goodyear could have found in 1839, when he discovered, by accident, the process of vulcanizing rubber. The inventor of today begins leagues upon leagues beyond where the New England Yankee ended. In another decade it will be nearly the whole truth to say that the American inventor is the trained engineer and chemist.
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> Since true invention begins where the known ends, it is evident that, before any man may even enter upon the larger fields of important invention, he must possess an enormous mass of complex and difficult knowledge—else he wanders aimlessly in a field unknown to him, but known to others, and invents over and over things long since invented, patented and found useful or worthless, as the case may be.
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> There is a natural tendency on the part of many engineers to rather look down upon a patent and upon the patent system as something obsolete, along with the Yankee genius who whittled trivialities out of the unknown. There is just reason for so regarding the great mass of microscopic patents which are issued * * * but the drawing of a general conclusion therefrom is quite unwarranted.
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> * * * * *
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> The engineer may scorn a patent, scorn the idea of being an inventor; but that does not alter the fact that his client or his concern has to come in contact with the inventions and patents of others. He cannot avoid the condition or the fact; and it is his business to see that his client or his concern does not become involved in infringement or other patent troubles.

The foregoing quotation does not mean, of course, that every engineer can be or ought to be an inventor. Only a small percentage of engineers have the necessary ability to undertake original design. In fact in the great majority of engineering work what is desired is not original work, but the application to the problem in hand of well-established and standard methods of construction and operation.

As the author says however, whether the engineer wishes to do so or not, he will more or less frequently have questions in connection with inventions and patents put up to him. It will be well worth his while, therefore, to gain at least such a rudimentary knowledge of patent law and procedure as may be obtained from this book.

Our only question concerning the book is whether, despite the author's effort to keep out legal technicalities, he has not after all made the book rather hard reading for the average engineer wholly unfamiliar with matters relating to patents. Even if this is the case, however, a large part of the book is understandable by anyone and gives just the sort of information that every engineer, or for that matter every business man, ought to have.

It is difficult to understand the reason why the publishers choose to present the book in small pocketbook form. The book is one for the library shelf and not for the pocket. Every engineer knows that these small, odd-sized books are a nuisance on library shelves.

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An Uptodate Book on Gas and Oil Engines

EVOLUTION OF THE INTERNAL COMBUSTION ENGINE—By Edward Butler, Consulting Engineer; author of "Carburettors, Vaporisers and Valves." London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth; 6x9 in.; pp. xiv—237; 188 text illustrations. $3, net.

The title to this book is somewhat misleading. The author himself says in the opening paragraph of his preface "the purpose of this treatise is not so much concerned with the historical development of internal-combustion engines as to present in a clear and concise form the basic principles underlying their construction and working."

It will be understood, therefore, that the book is not a historical record of the development of gas and oil engines, but is rather a discussion of the various features of gas and oil engine design which are of most interest to the inventor and designer at the present day. The following excerpts from some of the chapter headings will give some idea as to the scope of the author's treatment: Four-Stroke Cycle Engines, Methods of Scavenging, Two-Stroke Cycle Engines, Compounding Explosion Engines, Difficulties of Realizing Success on the Turbine Principle, Admission and Exhaust Valves, Ignition Methods, Starting and Reversing Engines, Cooling and Lubricating Methods.

The book is a very recent work (the preface is dated November, 1912) and the author takes pains to treat fully such recent developments as sleeve valves (best known in the United States as applied to the Knight automobile engine) and the very light high-speed engines used for aëroplanes and hydroplanes.

The illustrations have been specially made for this book, and instead of showing reproductions of shop drawings or cuts of trade catalogs, as is too often the case in technical books, typical sectional views in diagramatic style are used which show the essential features only of the parts which are being described.

One feature of the book which may be criticized is the use of very long paragraphs, sometimes exceeding a page in length, and the sparing use of side heads and center heads, which are a great convenience when a book is to be used as a reference work.

The book is strictly a technical work, intended for engineers already familiar with oil and gas engine construction and design. Other engineers will find the previous study of some more elementary work necessary to enable them to understand Mr. Butter's discussion.

This is especially the case because the author is not always clear in his explanations and is sometimes inaccurate in his use of terms. On page 65 for example, "latent heat' is used when specific heat is meant. In his discussion of the problems of design, moreover, he touches on many points on which opinions of the best experts are by no means unanimous, and the designer will in many cases not be inclined to accept the author's statement as final.

The book is, however, a valuable one, for it is just such frank discussion of the problems of design with a summary of what previous inventors and designers have done that enables us to make progress.

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MAIN DRAINAGE OF LONDON. By Sir Maurice Fitzmaurice, M. Inst. C. E., Chief Engineer of the London County Council. Revised edition. London: P. S. King & Son. Paper, 8x13 in., pp. 19, 10 plates and 6 folding plans. Post free, 1/9.

The works here described include a system of main trunk sewers, an outlet sewer on either side of the Thames, various pumping stations and two chemical precipitation plants. The latter treat the sewage and a portion of the storm water from a population of more than 5,000,000 people, amounting in 1911-12 to an average of 387,000,000 U. S. gal. per day and costing £121,523, or about $585,000 for treatment and for sludge disposal at sea, not including pumping expenses. Land for bacterial treatment has been acquired, but it is not expected that such treatment will be required for years to come, nor for more than a small part of the sewage at the outset. Brief mention is made of the promising results obtained in the summers of 1911 and 1912, with plain sedimenta-

tion instead of chemical precipitation, but with sludge removal once in 30 instead of 60 hours.

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Alternating Currents Simplified

ALTERNATING-CURRENT MACHINERY—A Practical Treatise on Alternating-current Principles and Systems, Commercial Types of Alternators, Synchronous Motors, Transformers, Converters, Induction Motors, Switchboard and Station Appliances, etc. By William Esty, S. B., M. A. Head of Department of Electrical Engineering, Lehigh University. Chicago: American School of Correspondence. Cloth; 6¼x9¾ in.; pp. xii + 467; 409 text illustrations. $3.

As one would expect, and as the author clearly states in his preface, this book has been prepared for beginners and so called practical men in order to give them a working knowledge of alternating currents. The book is written without recourse to mathematics beyond trigonometry, and this necessarily has resulted in a somewhat discursive treatment. In view of these self-imposed limitations one cannot look for extreme novelty in such a work; the material that can be presented in this way must be elementary and the requirements for clearness, balance and perspective must prevail.

The author has succeeded in maintaining the simplicity and directness of his presentation throughout the book. So many good teachers have expounded the elementary characteristics of alternating-current circuits that there would be perhaps less excuse for not having had the opening parts well adapted to the known ends; but it is not the easiest task to maintain this style and treatment throughout.

The balance of parts and the scope of treatment correspond well with the commercial importance of the topics; if there is any criticism in this regard it is in respect to a few notable omissions mentioned later.

From the properties of alternating-current circuits the reader is led through descriptions of instruments and expositions of their action. Then he is led to take up the study of the alternating-current generator and the measurement of power in polyphase circuits. Very few criticisms are to be made of the author's work here, and those relate to comparatively minor points. For instance, in discussing steam-turbine alternators he reports that the vertical-shaft construction is the usual one for the Curtis (General Electric Co.) type and one page is given to a reprint of the old arguments which have been made for that design, but he fails to note that the present tendency is decidedly toward horizontal units, owing to the limitations of the vertical type which have developed in central-station practice.

The author has a few good pages on the economical considerations which effect speed, efficiency, frequency, etc. This he follows with other good material on rating and testing. Strangely enough, under these two topics, he reprints considerable portions of the American Institute of Electrical Engineers standardization rules without noting that they have become notoriously inadequate for most modern practice, so much so in fact that the Institute has taken vigorous action for the complete revision of the code.

The author describes tests which need to be made on a generator to ascertain its voltage regulation between no load and full load, and similar operating characteristics, together with the "standard" tests for separately obtaining the individual-part losses which may be combined in the calculation of efficiency. But unfortunately he does not note that this gives no true efficiency nor does he speak of those "extra" losses, which are introduced along with the more legitimate ones, at full load—due to the changed internal conditions which are produced only by running under actual full load. Neither does he make mention of those now very important "compromise" tests which have to be made on large machines where an unlimited source of power is not available for driving under operating-load conditions. These tests, it will be recalled, are under such artificial conditions as reproduce in each part of the machine approximately full-load losses therein; they may be made by the expenditure of power only sufficient approximately to meet the sum of these various losses. The only approach to this sort of testing is the method, explained by the writer under heat tests, for making the "bucked spool" (opposed field) run with the armature short circuited. This method, however, is applicable only to generators of 12 poles or more, and completely lacks reliability for a smaller number.

The same sort of extra load losses are not mentioned under induction motors and, while with some designs they are really negligible, yet in many cases they are disturbing factors. A teacher like the author surely knows of growing shop use of "reversed-rotation" compromise tests for large induction motors and excluding mention of them in such a practical book must be attributed to his judgment of their place. But that surely is debatable as is his statement that the induction generator (driven induction motor) "has not much importance."

The practical man presumably will run up against talk of the "split-pole" converters which have come into use because of their ability to furnish from constant-potential circuits direct current at variable voltage. It will be a disappointment when such a reader fails to find here some elucidation of the action of these most interesting machines.

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Water for Industrial Uses*

Reviewed by GEORGE C. WHIPPLE*

WATER: ITS PURIFICATION AND USE IN THE INDUSTRIES—By William Wallace Christie, M. Am. Soc. C. E., Consulting Engineer; Editor, Mechanical Section of Foster's "Electrical Engineers' Pocketbook." New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. xi + 219; 79 text illustrations. $2, net.

This book treats of water and the purification of water from the standpoint of the steam producer and the manufacturer. It is an interesting compilation of various commercial methods that are now available. The illustrations are good and in some cases excellent. They give a good idea of the various devices used in the process of water softening. A few of the illustrations are colored.

In some respects the book is quite unsatisfactory and the reviewer would not be doing his duty if he failed to point out some of the defects. The most unsatisfactory chapter in the book is the first one, which treats of the impurities found in water. The analytical data given there are very inadequate and in some cases the facts are incorrect. In speaking of the solubility of oxygen in water the results are expressed in terms unfamiliar to the ordinary analyst and only a few of them are given. In the same space it would have been possible to have printed data that would have been of real use.

Elsewhere the author states that "muriatic acid saponifies the fatty soaps." What this means is a mystery.

In the section on the Use of Water in Ice Making, the author says that "natural ice is liable to contamination and should only be used for cooling the exterior vessels containing drinking fluids and never put in them unless the user is absolutely sure of its purity." This idea is contrary to the teachings of modern sanitarians, who hold that natural ice as ordinarily harvested and sold is almost entirely without danger to the public health.

On another page mention is made of the use of alum as a disinfectant, but the paragraph which follows refers to bleaching powder as a disinfectant, alum itself being merely a coagulant.

Other errors in the book might be mentioned, but these are sufficient to show the unreliability of those sections that relate to the chemistry of the processes described. It should be pointed out, also, that the tables at the end of the book on the flow of water through pipes must be used with caution, as most of them are figured with coefficients higher than are ordinarily obtained in practice after pipe has been for some time in use.

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A handsome relief map of New Jersey, which at first glance seemed to show the Delaware River flowing into Raritan Bay, proves on closer examination to represent a "Proposed Sea Level Ship Canal and Intercoastal Waterway" of the New Jersey Ship Canal Commission (Worthington M. Jacobus, secretary, Rutherford, N. J.; William F. R. Griffith, consulting engineer; C. P. Gray, mapmaker, 24 Park Place, New York City). The ship canal leaves the Delaware at or near Bordentown, not far below Trenton, and extends northeasterly to Raritan Bay, south of Staten Island. The intracoastal waterway runs from Bay Head, some distance south of Asbury Park, to Cape May. The map proper is about 10x20 in., or 11x20 in. overall. The relief was obtained by embossing heavy cardboard. A very pleasing effect has been secured by using green shading to bring out the elevations, a delicate blue for the water, and a light yellow for the land body color.

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The prices of the United States Geological Survey maps were increased on Jan. 1. Hereafter the standard topographic atlas sheets, 16½x20 in., will cost 10c. each in retail lots, or 6c. in lots of 50 or more. Besides the standard topographic maps the Survey issues a number of special prints, including maps of the United States, several individual states, Niagara

*Consulting Civil Engineer, 103 Park Ave., New York City; Professor of Sanitary Engineering, Harvard University.

River, Yosemite National Park, etc., lists and prices of which may be had on application to the Director of the United States Geological Survey, Washington, D. C.

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The Practical Side of Electric Transmission Line Construction

TRANSMISSION LINE CONSTRUCTION, METHODS AND COSTS—By R. A. Lundquist, E. E., Consulting Engineer. New York: McGraw-Hill Book Co. Cloth; 6x9½ in.; pp. 295; 183 text illustrations. $3, net.

It may seem like an innovation to write a work on electric transmission-line construction, which says almost nothing about the electrical features of design, and gives no method for the calculation of line spans and structures. But that is what the author has actually done here. The book is thoroughly readable, and promises to be extremely interesting to an electrical engineer, in spite of being chock full of cost data from cover to cover. Naturally, if the book shows types of construction and field methods at all comprehensively, it must be for the greater part a compilation of experience. This lessens opportunity for expressing individual opinion, but the author has taken advantage of most of the chances afforded him to criticize and suggest. As a rule, his remarks at these places are conservative. The one notable exception, if we interpret him correctly, is that he would specify wood poles according to their length, and top and butt diameters, whereas it is common practice to specify length and top diameter only. If the top diameter is specified properly, there is ordinarily no danger of poles that are available being too weak. Indeed some might be too heavy, but that would affect the appearance of the pole line to the eye, rather than its safety and utility.

The author starts off by outlining what he considers to be a proper preliminary map study of the territory through which it is desired to run a transmission line. This he would follow up, of course, with a field reconnoissance, a preliminary office location, a preliminary location survey, a study of costs of right-of-way and construction, of difficulties to be encountered, and of all such work which is preliminary to the final location of lines and determination of types of construction.

This final location is given prominence by a chapter to itself. In the following chapter the author generally compares wood, steel and reinforced-concrete towers and poles as available support for the line wires. Each of the chapters following takes up one of these types of support, steel towers and steel poles being treated separately. These sections are fully illustrated to show what practice is to be seen in various parts of the country, including methods of shop or yard construction and field erection, with plenty of cost data. It should be noted here that the author's use of cost data does not "savor of the shovel," for he has attempted the very difficult task of warning the reader of the conditions governing costs.

The section on reinforced-concrete structures will be welcomed, we believe, by construction engineers who should appreciate every attempt to collect all available information on what little work has been done in this field. The poles of the Oklahoma Gas & Electric Co. figure largely here, and are illustrated elsewhere throughout the work. Some German novelties are also discussed, and some poles described, which are perhaps not truly transmission-line structures, but which are of equal interest in this chapter.

One chapter describes some special conditions and the structures designed to meet them—river and railway crossings, outdoor switching stations, transition and branch-line poles or towers, etc. A chapter on crossarms, pins and hardware consists partly of familiar description and partly of notes, after the style of the author's introductory chapters, on expedition of distribution and placing. The criticisms of braces, guys and anchors in the chapter on guying, and the whole chapter on stringing wire, further confirm the general impressions of originality and practicability. As appendices, there are given specifications for white cedar poles, steel towers, pin-type and link-type insulators, galvanized work and creosote oil.

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THE DESIGN OF STEEL MILL BUILDINGS AND THE CALCULATION OF STRESSES IN FRAMED STRUCTURES—By Milo S. Ketchum, C. E. Dean of College of Engineering and Professor of Civil Engineering, University of Colorado; Consulting Engineer. Third edition, enlarged. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xxi + 556; 265 text illustrations and 7 folding plates; 63 tables. $4, net, postpaid.

The feature of this edition is an appendix chapter entitled "Structural Drawings, Estimates and Designs." In substance this is a book by itself. It contains hints and instructions for the work of the structural-steel draftsman and estimator, including also a few of the more common tables used in designing, detailing and estimating. It is to be hoped that this part of the book may be ultimately so much enlarged and elaborated as to require publication as a separate work.

The book has been improved and enlarged in other parts also, though only in a minor way. The author's continued attention to the improvement of the book is apparent. Thus the third edition represents a real advance, rather than a simple new printing of the book.

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The Theory of Stream Flow

Reviewed by C. R. WEIDNER*

UNTERSUCHUNGEN UEBER DEN ZUSAMMENHANG DER ERSCHEINUNGEN IN WASSERLAEUFEN AUF GRUND HYDROMETRISCHER ERHEBUNGEN. Zur Förderung des Flussbaues und Seines Unterrichtes für Studierende und Ingenieure—By Ing. C. Krischan. Graz (Austria): "Leykam." Paper; 7x10 in.; pp. 150; 1 text illustration, and 19 plates, arranged in a portfolio 12x13 in. 15 K.

The author of this book has made a special study of the hydraulics of rivers and canals, and the book under review is the third of a series which presents the results of his researches; a fourth is to appear shortly. The plates are intended to supplement the study of the two previous volumes entitled, "Beitrag zur Pulsation des Wassers mit Rücksicht auf den Flussbau" and "Einführung in die rationelle Methode der Beobachtung im Flussbau," with a graphical representation of a large number of hydrometric observations taken in Austrian rivers and the Danube canal.

For a number of gaging stations showing widely different characteristics, curves have been drawn for each station giving the following information: Mean velocity, maximum velocity, mean surface velocity, mean velocity at the bed of the stream, area, discharge, power and impact for each of the different sections into which a cross-section of the stream has been divided; the sums of the area, discharge and power for any of these sections; and the distribution of the velocity in the entire cross-section and in vertical planes in each section. This mass of material, for several different gage heights at a station, has been plotted in one figure for the convenience of comparison, the result necessarily being a labyrinth of lines, which is extremely difficult to fathom until one becomes accustomed to the task.

The text explains the methods of plotting the observations, gives a thorough discussion of the results, and a theoretical and mathematical analysis of the different curves, which is interesting but not of much practical value until the intricate relation between theory and practice in the flow of water in open channels is more thoroughly developed.

The book adds considerable information of a theoretical nature to the study of stream flow and will probably be of interest to students of the subject.

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THIRTEENTH CENSUS OF THE UNITED STATES—E. Dana Durand, Director. Vol IX Manufactures. Reports by States, with Statistics for Principal Cities. Prepared under the supervision of William M. Steuart, Chief Statistician for Manufactures. Washington, D. C.: Bureau of the Census. Cloth; 9x12 in.; pp. 1404.

The reports of the Thirteenth Census (1910) are to appear in 11 volumes and in a one-volume Abstract which will be a condensation of both the text and tables forming the reports. Four volumes will be devoted to Population, three each to Agriculture and to Manufacturers and one to Mining. Only a small edition of the 11 volumes will be printed, "intended chiefly for libraries, institutions and special students of statistics." An edition of the Abstract will be issued for each state, containing first summaries for the whole country and then more detailed supplementary tables and text for the particular state concerned. It should be noted that state bulletins have already been published dealing separately with Population, Agriculture and Manufactures—and perhaps with Mining. The volume noted above is the first one published for the Thirteenth Census. Vol. VIII summarizes manufacturing statistics by states and gives a general analysis and discussion, while Vol X will consist of monographs on special industries. Each of these monographs will also be published separately.

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Three paving specifications recently adopted by the American Society of Municipal Improvements (50 Union Square, ...

*Instructor in Hydraulic Engineering, University of Wisconsin, Madison, Wis.

New York City) have been printed in advance of the 1912 "Proceedings," in order that they might be available before the paving season of 1913. They are for (1) brick and (2) asphalt, adopted in September, 1911, and amended in November, 1912; and (3) creosoted wood block, adopted in November, 1912.

British Sewage Disposal

A TEXTBOOK ON SEWAGE DISPOSAL IN THE UNITED KINGDOM—By Henry Lemmoin-Cannon, P. A. S. I. Author of "The Sanitary Inspector's Guide," "Modern Sewage Disposal: A Popular Handbook." London: St. Bride's Press. Cloth; 5½x9 in.; pp. xx + 320; 52 text figures. 7/6, net.

To write a book on sewage disposal seems to be a temptation which it is hard for Englishmen to resist. Every few months a new book on the subject appears which differs from most of the earlier ones only in being a little nearer uptodate, or perhaps merely in drawing upon a more recent report of the Royal Commission on Sewage Disposal.

The book before us is almost wholly a compilation and contains little of value that is not readily available in printed form. Underlying principles are given scanty consideration and some of the most important subjects listed in the chapter headings are given surprisingly little space.

Following traditional British practice, the author ranges over the whole field of night soil collection and disposal, and of sewage collection systems before he gets down to his real subject—Sewage Disposal. This done he describes the various methods of sewage treatment along familiar British lines, drawing freely on the Fifth Report of the Royal Commission on Sewage Disposal.

The following chapters, on small isolated plants, on an excreta sterilizer for hospital use, on the oxychloride process of "deodorizing and sterilizing sewage effluents" (a little over one page) and on automatic appliances are little more than highly condensed trade catalog descriptions of commercial apparatus or processes.

Particulars of some municipal installations, in tabular and in text form, are given. A topic not usually treated in such books is Sewage Disposal for Troops in the Field (4 pp.), but this contains little except Field Service Regulations issued by the British War Office.

The last hundred pages consist of a series of appendices in which are summarized (1) the requirements of the three Local Government Boards of the United Kingdom in connection with applications for loans for municipal sewerage systems or sewage disposal works; and (2) sewerage, drainage and sewage-disposal legislation by the British parliament, with notes on judicial interpretations.

Many of the illustrations are poor reproductions of trade catalog cuts and the lettering on some of the line drawings can be read with difficulty. In fact, the reader is advised, by means of a foot note, that "A magnifying glass will be found useful in studying most of the illustrations in this book."

The book will be found useful to those who possess none of the other and comparatively recent British books of the general type of this one, provided only a general review of British practice is needed.

NEW YORK STATE FACTORY INVESTIGATING COMMISSION—Preliminary Report, 1912. Three volumes. Albany, N. Y.: Pub. Doc. Cloth; 6x9 in.; pp. 837, 986 and 1000, respectively.

After the fire in the Harris & Blanck Co.'s shirtwaist factory in the Asch Building in New York City two years ago, when so many of the workers lost their lives, the Legislature of the State of New York appointed a commission to look into the conditions under which manufacturing is carried on in cities of the first and second class in that state. This commission has now been at work some two years, the last year, however, under a continuation appropriation, and the report of the first year's work has just been issued in three volumes. The meat of the report is contained in the first volume, the latter two being devoted entirely to the stenographer's report of testimony. This first volume should be of great interest to those engineers who are concerned with the design and operation of factories, although the report in general is of greater sociological than enginering importances.

The first volume contains, first, a general sanitary investigation of existing conditions in factories and workshops, submitted by Dr. Price, and a chapter on the fire hazard submitted by H. F. J. Porter, these two gentlemen being the experts employed by the commission. Further, the report contains special investigations on bakeries, woman workers, occupational diseases, home work, and an industrial survey of a selected area in New York City, together with briefs submitted on fire protection by various experts, and on factory inspection by other experts. The recommendations of the commission in regard to future necessary laws are also included.

MAGNETO AND ELECTRIC IGNITION—By W. Hibbert, Head of the Physics and Electrical Engineering Departments, Polytechnic Institute, London. London: Whittaker & Co. [New York: The Macmillan Co.] Cloth; 4¼x6¾ in.; pp. 154; 90 test illustrations. 70 cts., net.

This is the third book on electric ignition for internal combustion motors, to come to our notice very recently. In general, it covers about the same ground as the recent American book by F. R. Jones ("Electric Ignition," reviewed in Engineering News, May 16, 1912), but in much more condensed shape and from a British viewpoint. This volume is about the same size as "Primary Battery Ignition" by C. Wadsworth, reviewed in these columns Dec. 12, 1912, but it is far more comprehensive.

At the outset the author explains some electrical concepts in accordance with the old "fluid" theory of electricity though couched in terms of "corpuscles," "ions," etc., to accord with the later but closely allied "electron" theory. The construction of different magneto machines is shown in much detail, together with sections on faults, gearing and timing arrangements, etc. This fills some 60% of the text, the rest taking up battery and combination schemes. The make-up of "dry" (primary) and storage cells is briefly outlined and accompanied by items on troubles, circuits, induction coils and contact devices. The recent schemes combining a generator (convertible into a motor), and storage battery for an ignition, lighting and starting system are only briefly noted. The illustrations are numerous and many are of the catalog variety; the original ones, however, are still less pleasing to the fastidious eye though quite useful.

EXPERIMENTAL WIRELESS STATIONS, Their Theory, Design, Construction and Operation—A complete account of sharply turned modern wireless installations for experimental purposes, which comply with the new wireless law. By Philip E. Edelman, author of "Inventions and Patents," "Simple Experiments in Chemistry," "An Experimental Quenched Arc System," "How to Comply with the New Wireless Law." Minneapolis, Minn.: Published by the author, at 2432 Lyndale Ave. South. Cloth; 5¼x8 in.; pp. 220; 80 illustrations. $2.

An equal amount of information might have been given to advantage in less space. The facts stated are accurate, but the arrangement is poor and the text displays the common fault of jumping too quickly to the practical points without a sufficient preliminary treatment of the fundamental theory.

In spite of the apparent lack of any definite plan in the arrangement of the text, the book certainly contains a large amount of useful practical information on wireless apparatus and methods. The author definitely states that he is aiming to supply information for experimenters whose previous knowledge of the subject is limited, and his language is correspondingly non-technical. A little simple mathematics is used in showing approximate methods for calculating inductances, capacities and wave-lengths, and a large number of illustrations are provided. The conclusion contains some advice on the subject of patents.

Beginning with January, 1913, the American Institute of Architects has substituted for its regular monthly Proceedings, a publication similar to the Proceedings of other technical societies, a magazine entitled The Journal of the American Institute of Architects under the editorship of Mr. D. Knickerbacker Boyd, who is chairman of the Committee on Public Information of the Institute. This publication is intended to embody the regular society announcements, and, according to the preface in the first number, to afford to the members a frequent and intimate interchange of authentic news items relating to the progress of development in the field of architecture. The first two numbers which have appeared are most pleasing typographically.

A Gasoline Engine Trouble Chart, 22x36 in., has been published (Norman W. Henley Publishing Co., New York City; price, 25c.), showing a sectional elevation of a typical four-cylinder, four-cycle gasoline engine of automobile type. The different parts of the machine are lettered on the drawing, and at the sides of the chart are tables which should assist the amateur, or beginner, in the cure of lost power, heating, noise and irregular operation; different columns show the parts affected, the ultimate nature of the trouble, the identifying symptom, and the remedy.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION—Proceedings for 1912. New York City: The Association, 29 W. 39th St. Cloth; 6x9 in.; pp. 978; illustrated.

AMERICAN SOCIETY FOR TESTING MATERIALS—Selected Standard Specifications for Steel and Steel Products, in English, German, French and Spanish. Philadelphia: Prof. Edgar Marburg, Secretary, University of Pennsylvania. Cloth; 6x9 in.; pp. 109; illustrated. $3 per volume. (Specifications in each of the four languages, in pamphlet form, paper cover, $1 each.)

ANLEITUNG ZUR DURCHFUEHRUNG VON VERSUCHEN AN DAMPFMASCHINEN, DAMPFKESSELN, DAMPFTURBINEN UND DIESELMASCHINEN—Zugleich Hilfsbuch für den Unterricht in Maschinenlaboratorien technischer Lehranstalten. By Franz Seufert, Ingenieur, Oberlehrer an der Kgl. höheren Maschinenbauschule zu Stettin. Third edition. Berlin: Julius Springer. Flexible linen; 5x8 in.; pp. vii + 105; 43 text illustrations. 2.20 marks.

BUREAU OF BUILDINGS OF THE CITY OF NEW YORK, Borough of Manhattan. Report for 1911. New York: R. P. Miller, Superintendent, 220 Fourth Ave. Paper; 7x10 in.; pp. 143; illustrated.
A full report, containing all the building statistics, orders issued during year, notes on special cases, unsafe building cases, testimony, new protective features before the State Factory Investigating Commission, etc. Some figures from the report were given in our issues of Oct. 3 and Oct. 24, 1912.

CALIFORNIA WATER COMMISSION—Report for 1912. San Francisco: Louis R. Glavis, Secretary. Paper; 6x9 in.; pp. 75; illustrated; with 32 profile sheets in pocket.

CHECKLIST OF UNITED STATES PUBLIC DOCUMENTS, 1789-1909—Congressional: To Close of Sixtieth Congress. Departmental: To End of Calendar Year 1909. Third Edition, revised and enlarged. Vol. I. Lists of Congressional and Departmental Publications. Compiled under the direction of Superintendent of Documents, August Donath. Government Printing Office, Washington, D. C. Buckram; 6x9½ in.; pp. xxi + 1767. $1.50.

DIFFERENTIAL UND INTEGRALRECHNUNG, INFINITESIMALRECHNUNG FUER INGENIEURE INSBESONDERE AUCH ZUM SELBSTSTUDIUM—By Dr. W. Koestler, Dipl.-Ingenieur, and Dr. M. Tramer. Berlin: Julius Springer. Paper; 6x9 in.; pp. 484; 221 text figures. 13 marks.
The first part of a work on Calculus, laid out on a rather large scale. Covers the field from the theory of numbers, factors and functions up to the elementary consideration of differentials and integrals. An 11-page historical abstract concludes the volume.

EARTH ROADS AND CULVERTS—By E. F. Ayres, Highway Engineer; Assistant Professor of Civil Engineering, Corvallis, Ore.: Oregon Agricultural College. Paper; 6x9 in.; pp. 79; illustrated.

THE ELECTRON THEORY OF MAGNETISM—By Elmer H. Williams. Urbana, Ill.: University of Illinois. Paper; 6x9 in.; pp. 66; illustrated. 35c.

ELEMENTARY PRINCIPLES OF ELECTRICITY AND MAGNETISM FOR STUDENTS IN ENGINEERING—By Robert Harbison Hough, Assistant Professor of Physics, and Walter Martinus Boehm, Instructor in Physics, University of Pennsylvania. New York: The Macmillan Co. London: Macmillan & Co., Ltd. Cloth; 5x8 in.; pp. vii + 233; 95 text illustrations. $1.10, net.

ELEMENTS OF THE PRECISION OF MEASUREMENTS AND GRAPHICAL METHODS—By H. M. Goodwin, Professor of Physics, Massachusetts Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 191; illustrated. $1.25 net.

FIELD EQUIPMENT FOR LABORATORY WORK ON WATER SUPPLIES—By H. A. Whittaker, Assistant Director, Laboratory Division, Minnesota State Board of Health. [Reprinted from American Journal of Public Health, Vol. 2, No. 12.] Paper; 7x10 in.; pp. 7; illustrated.

THE GAS, PETROL AND OIL ENGINE—Vol. II, The Gas, Petrol and Oil Engine in Practice. By Dugald Clerk, M. Inst. C. E., and G. A. Burls, M. Inst. C. E. New and revised edition. New York: John Wiley & Sons. Cloth; 6x9 in.; pp. [illegible]; illustrated; [illegible] net.

THE GLASS SANDS OF OKLAHOMA—By Fred L. Bullard. Norman, Okla.: Oklahoma Geological Survey. Paper; 6x9 in.; pp. 94; illustrated.

HANDBOOK OF RAILROAD EXPENSES—By J. Shirley Eaton, formerly Statistician, Lehigh Valley R.R.; author of "Railroad Operations: How to Know Them" and "Education for Railroads." Railroad Gazette. New York and London: McGraw-Hill Book Co. Flexible leather; 5x8 in.; pp. v + 500. $5, net.

HETCH HETCHY VALLEY—Report of Advisory Board of Army Engineers to Secretary of the Interior on Investigations Relative to Sources of Water Supply for San Francisco and Bay Communities. Washington, D. C.: Pub. Doc. Paper; 6x9 in.; pp. 146; illustrated.

WATER SUPPLY, CITY OF SAN FRANCISCO—Application for Lake Eleanor and Hetch Hetchy Valley Reservoir Sites. [Letter from Walter L. Fisher, Secretary of the Interior, to Mayor and Supervisors of San Francisco, dated Mar. 1, 1913]. Washington, D. C.: Pub. Doc. Paper; 6x9 in.; pp. 10.
These two reports, brought out by the long-standing controversy, over the utilization of a portion of the Hetch Hetchy Valley, within the Yosemite National Yark, as a water-works reservoir site for San Francisco, are abstracted on pp. 521-522 of this issue.

ILLINOIS BOARD OF EXAMINERS OF ARCHITECTS—Eighth Biennial Report, Chicago, Ill.: Secretar . Peter B. Wight, 1113 Chamber of Commerce.

ILLINOIS RIVERS AND LAKES COMMISSION- Annual Report for 1912. Chicago, Ill. Paper; 6x9 in.; pp. 31.
Report and Plans for Reclamation of Lands Subject to Overflow in the Kaskaskia River Valley. By Jacob A. Harman, C. E. Cloth; 6x9 in.; pp. 70; illustrated.
Also bulletins: The Illinois Waterway—A Guide for Navigators, and The Illinois Waterway—A Review, by Isham Randolph; and European Harbor Development, and Common Sense Applied to the Inland Waterway Problem, by Robert R. McCormick. Paper; 6x9 in.; pp. 26, 21, 9 and 7, respectively; illustrated.

INVESTIGATIONS ON METHODS OF ANALYSIS OF CANE PRODUCTS—By Wm. E. Cross, Baton Rouge, La.; Louisiana State University. Paper; 6x9 in.; pp. 83; illustrated.

THE MATHEMATICS OF APPLIED ELECTRICITY—A Practical Mathematics. By Ernest H. Koch, Jr., Instructor in Mathematics, School of Science and Technology, Pratt Institute, Brooklyn, N. Y. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xvi + 651; 316 text illustrations. $3 (12/6), net.

OREGON ALMANAC FOR 1912—Portland, Ore.: C. C. Chapman, State Immigration Agent, Commercial Club Bldg. Paper; 6x9 in.; pp. 144; illustrated.

ORGANES DES MACHINES OPERATRICES ET DES TRANSMISSIONS—By L. Jacob, Ingenieur General D'Artillerie Navale; Director de Laboratoire Central de la Marine. [Being part of Encyclopedie Scientifique Series, published under the direction of Dr. Toulouse]. Paris: O. Doin & Fils, 8 Place de L'Odeon. Cloth; 5x7 in.; pp. xl + 358; 372 text figures.

PORTLAND CEMENT RESOURCES OF ILLINOIS—By A. V. Bleininger, E. F. Lines and F. E. Layman. Urbana: Illinois State Geological Survey (F. W. DeWolf, Director, University of Illinois). Cloth; 6x9 in.; pp. 121; illustrated.
In addition to being a very full report upon the portland-cement resources in the State of Illinois, this bulletin contains a short, but quite complete, exposition of the method of manufacturing portland cement by one of the authors of the whole report, A. B. Bleininger.

PRACTICAL MEASUREMENTS IN RADIO-ACTIVITY—By W. Makower, Lecturer and Demonstrator in Physics, and H. Geiger, Lecturer in Physics, University of Manchester, England. New York and London: Longmans, Green & Co. Cloth; 5x9 in.; pp. ix + 151; 61 text illustrations. $1.60, net.

THE PRINCIPLES OF SPECIFICATION AND AGREEMENT WRITING—By C. R. Young, Consulting Structural Engineer; Lecturer in Structural Engineering, University of Toronto. Second edition. Toronto: Reprinted from the Canadian Engineer, 62 Church St. Paper; 6x9 in.; pp. 52. 50c.
A second edition of the pamphlet reviewed in Eng. News, May 16, 1912, p. 959. This edition contains additional matter in the form of an appendix covering typical short agreements.

RAILWAY ROUTES IN ALASKA—Message from the President of the United States Transmitting Report of Alaska Railroad Commission. Washington, D. C.: Pub. Doc. Paper; 6x9 in.; pp. 172; illustrated.

STEAM BOILERS, THEIR THEORY AND DESIGN—By H. deB. Parsons, M. Am. Soc. M. E., M. Am. Soc. C. E., Professor Emeritus of Practical Engineering, Rensselaer Polytechnic Institute. Fourth edition. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. xvii + 377. 156 text illustrations. $4, net.

STEAM ENGINEERING—A Text-Book. By William R. King, U. S. N., Retired; Principal, Baltimore Polytechnic Institute. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vii + 450; 177 illustrations. $4, net.

ST. LOUIS PUBLIC SERVICE COMMISSION—Report to Municipal Assembly on the United Railways Co. of St. Louis. Vol. II. Cardboard; 6x9 in.; pp. 34; illustrated.

STRESSES IN TALL BUILDINGS—By Cyrus A. Melick, D. C. E. Columbus, Ohio: Ohio State University. Paper; 6x9 in.; pp. 227; illustrated.

SYNCHRONOUS MOTORS AND CONVERTERS: Theory and Methods of Calculation and Testing. By André E. Blondel, Hon. M. Am. Inst. E. E., Professor in National School of Bridges and Highways of France. Translated from the French by C. O. Mailloux, Consulting Electrical Engineer, with additional chapters by Comfort A. Adams, Professor of Electrical Engineering in Harvard University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xviii + 295. 118 text illustrations. $3, net.

WINDING ENGINES AND WINDING APPLIANCES: Their Design and Economical Working. By George McCulloch, Inspector of Machinery, Department of Mines, West Australia, and T. Campbell Futers, M. Inst. M. E., author of "The Mechanical Engineering of Collieries." New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 6x9 in.; pp. viii + 152. 175 illustrations. $6, net.

WORM GEARING—By Hugh Kerr Thomas, A. M. Inst. M. E. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. ix + 86. 33 illustrations. $1.50, net.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

New York—The Board of Estimate of the city of New York, Mar. 6, approved the construction contracts for Sections 2 and 3 of the Corona-Woodside elevated extensions. The contract for the construction of Section 2 awarded to the Cooper & Evans Co. was approved along with an appropriation of $860,743.50 of corporate stock to provide means for the extension of the contract. Section 3 went to the E. E. Smith Contracting Company and an appropriation of $2,-$63,588 in corporate stock was provided for to cover the costs.

✚**Pennsylvania**—Montour R.R.—Subcontracts have been awarded to the KEYSTONE CONTRACTING CO., Keystone Bldg., Pittsburgh, Penn., for Sections A and B of this company's proposed 30-mile extension. The general contractor for the work is John Marsch, Chicago, Ill.

✚**Virginia**—Southern Ry.—This company has awarded the contract to the CURTIS & SHUMWAY CO., Lynchburg, Va., for the construction of double-track work between Monroe and Amherst, Va.

Virginia—Norfolk, Yorktown & Washington R.R.—A charter was granted to this company, Feb. 22, to construct and operate a railroad from Norfolk, through Newport News, Hampton, Yorktown, Alexandria and through the counties of Gloucester, Middlesex, Essex, Carolina, King George, Stafford, Prince William and Fairfax, all in the state of Virginia. The officers of the new road are C. T. Hobart, Pres.; Leon C. Steele Vice-pres.; S. S. Pope, Treas.; Leon C. Steele, Secy.; all of Norfolk. The directors are: Louis Feuerstein Louis Mansbach, Harvey M. Dickson, W. F. Dusch, George H. Lewis, C. T. Hobart, W. W. Terry, all of Norfolk and C. T. Blake, of Greenburg, Penn.

✚Norfolk & Western Ry.—This company has awarded the contract to the RINEHART & DENNIS CO., Jefferson National Bank Bldg., Charlottesville, Va., for about 500,000 cu.yd. of unclassified excavation and considerable masonry, etc. The work is double-tracking near Petersburg, Va.

West Virginia—Williamsport, Nessle & Martinsburg R.R.—This company has been issued a charter to construct and operate a railway from Williamsport to Martinsburg, W. Va. Capital, $250,000. The offices are located at Martinsburg, W. Va.

✚Virginian Ry.—This company has awarded the contract to GOODWIN, BOXLEY BRAY & CO., Roanoke, Va., for the completion of the Jenny's Gap tunnel.

North Carolina—Black Mountain R.R.—This company is considering the construction of an extension of its line from Burnsville to Weaverville, 29 miles. The line is owned by Dickey, Campbell & Co., Black Mountain, N. C.

Atlantic Coast Line R.R.—This company has authorized the construction of the masonry required for the construction of the masonry required for the construction of second-track work between Selma and Parkton, N. C., a distance of about 60 miles. The contract for the grading has not been awarded as yet. E. B. Pleasants, Wilmington, is Ch. Engr.

Beaufort Terminal R.R.—This company has made application to the State Legislature for a charter to construct its proposed line from Beaufort to Point Lookout, about 20 miles. The company has a capital of $5,000,000. E. C. Duncan, Raleigh, N. C., is interested.

Alabama—Gulf, Florida & Alabama Ry.—This company is preparing to award the contract for grading its proposed 20-mile extension north from Local, Ala., into Monroe County. G. A. Berry, Pensacola, Fla., is Vice-pres. and Ch. Engr. Noted Jan. 16.

✚**Alabama**—A contract has been awarded to OSCAR J. PRUETT, Montgomery, Ala., for constructing 12 miles of railroad from Eclectic to Vincent, Ala., in Elmore County.

Mississippi—Mississippi & Northern R.R.—This company has been authorized to organize by the state. W. G. Seaver, Biloxi, Miss., is Pres.

Tennessee—Birmingham & Northwestern R.R.—This company is considering the construction of a branch from north of Alamo to Maury City and Brownsville, Tenn., about 20 miles. I. B. Tigrett is Pres.

Kentucky—Louisville & Nashville R.R.—This company, will double-track its Cumberland Valley Division, between Pineville and Corbin, Ky., a distance of 30 miles, early in the spring.

Indiana—Laporte, Logansport & Southern Ry.—This company with a capital of $100,000 has been incorporated to construct a line between Logansport and Laporte, Ind. B. P. Thomas, Laporte, Ind., is Const. Engr.

South Dakota—Chicago & Northwestern Ry.—This company is planning to construct into Sylvan Lake, nine miles southwest of Custer, from Fairburn to a point on its Black Hills Line from Chadron, Neb. The distance from Fairburn to Sylvan Lake is about 30 miles and the route has already been surveyed and work on it is expected to commence this summer. E. C. Carter, Chicago, Ill., is Ch. Engr.

✚**Wyoming**—Chicago, Burlington & Quincy R.R.—Subcontracts have been awarded as follows by Twohy Bros., Portland, Ore., general contractors in this company's proposed line between the Powder River and Orin Junction: GILBERT BROS., 24 miles; BAKER BROS., 10 miles; J. FRED ROBERTS, 10 miles; C. R. CONOVER, six miles; P. J. KING, six miles; J. COATES, six miles, all of Denver, Colo.

Montana—Billings & Central R.R.—This company has completed financial arrangements for its proposed 20-mile railroad. The Billings Land & Irrigation Co., Billings, Mont., is interested.

Texas—Pecos Valley Southern Ry.—This company is preparing to extend its line south from San Salmon Springs to Alpine, about 50 miles, and north from Pecos to Tahoka, about 200 miles. At the recent annual meeting of the directors the following officers were elected: W. L. Carwile, Dallas, Pres.; G. C. Mountcastle, Fort Worth, Vice-Pres. L. W. Anderson, Pecos, Gen. Mgr. and Ch. Engr.

According to press reports a railroad will be constructed from Knox City, to Crystal Falls and ultimately to Fort Worth. The new line is to traverse the northern part of Stephens County. G. W. Thomason, Haskell, Tex., is interested.

Missouri, Kansas & Texas Ry.—According to press reports the State Senate has passed the Missouri Kansas & Texas R.R. Consolidation Bill over the governor's veto. The bill authorizes this company to merge under one management—the Missouri, Kansas & Texas R.R. of Texas, the Wichita Falls & Northwestern, the Wichita Falls & Southern, the Texas Central and the Beaumont & Great Northern railroads. Though the last named lines are subsidiaries of the Missouri, Kansas & Texas Ry., they have maintained separate offices under Texas charters. The lower branch of the legislature already had passed the bill over the veto.

Mountain, Valley & Plains R.R.—See item under Oklahoma.

Oklahoma—Mountain, Valley & Plains R.R.—This company, it is reported, has made financial arrangements for the construction of its proposed line. The company was chartered in February to construct eastward from Cimarron, N. M., through Higgins, Clarendon and Balhart, Tex., to Guthrie, Okla. E. C. Gray, Higgins, Tex., is interested.

Colorado—Missouri, Kansas & Texas Ry.—This company plans the extension of its line from near the Kansas western border into Denver, Colo. S. B. Fisher, St. Louis, Mo., is Ch. Engr. Const.

Chicago, Burlington & Quincy R.R.—This company has awarded the contract for the construction of its proposed cutoff between Hudson and Greeley, Colo. Estimated cost $800,000. F. T. Darrow, Lincoln, Neb., is engr. M. W.

New Mexico—Mountain, Valley & Plains R.R.—See item under Ohlahoma.

Idaho—Twin Falls, Oakland & San Francisco R.R.—This company has been incorporated to construct a railroad from Twin Falls, Idaho, to Wells, Nev. Capital, $2,000,000.

Idaho—Pittsburg & Gilmore R.R.—This company, it is reported, is planning to continue the construction of its line from Salmon City, Idaho, down the Salmon River, to Lewiston, Idaho.

Idaho—Great Northern Ry.—This company is considering the construction of an extension of nine miles to the property owned by the Consolidated Interstate Callahan Mining Co. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Nevada—Twin Falls, Oakland & San Francisco R.R.—See item under Idaho.

Oregon—The construction of a railroad on the old Lewis and Clark right of way is being planned. Estimated cost, $200,000. Robert Kinney, Astoria, Ore., is interested.

✚**Canada**—Grand Trunk Pacific Ry.—This company has awarded the contract to FOLEY BROS., WELCH & STEWART, for constructing the remaining section of 425 miles connecting the eastern and western lines, from a point at Mile 195 east of Prince Rupert, B. C., to Mile 1124 west of Winnipeg, Man. The work includes terminals of Fort George, B. C., a 775 ft. tunnel at Mile 1153 and a 2000 ft. tunnel at Mile 1181.

✚**Ontario**—Toronto Eastern Ry.—The contract has been awarded to EWEN MACKENZIE, Toronto, Ont., by this company, for the construction of its proposed line through Pickering, Whitby, Oshawa and Bowmanville, Ont. The grading involves about 14,000 cu.yd. of earth per mile. E. W. Oliver is Ch. Engr., Toronto.

Alberta—Calgary, Edmonton & Fort McMurray R.R.—The Canadian Government, Ottawa, Ont., has sanctioned the incorporation of this company with a capital of $10,000,000. The company proposes to construct a line from Calgary to Edmonton and then to Fort McMurray, Chipewyn, and on to the Great Slave Lake; also two branch lines.

ELECTRIC RAILWAYS

Augusta, Maine—The Livermore & Augusta St. Ry. Co. has been incorporated to construct and operate an electric railway to connect East Livermore, Fayette, Readfield, Manchester and Augusta. The incorporators are, R. J. Noyes, E. E. Newbert and L. O. Tebbetts, Augusta, C. P. Hatch, Portland, B. E. Leighton and N. T. Gordon, Readfield.

Perth Amboy, N. J.—The Public Service Corporation is considering the double-tracking of its traction lines on Smith and State Sts., extending to the city limits. John J. Burleigh, Newark, is Vice-Pres.

Charleroi, Penn.—Preliminary arrangements are being made by the Westside Electric St. Ry. Co. for the construction of nine miles of new track from Charleroi to Ellsworth. D. G. Callihan, Charleroi is Gen. Supt.

Shippensburg, Penn.—The City Council has granted a franchise to the Chambersburg & Shippensburg Ry. Co. to construct and operate an electric railway through Shippensburg. This is part of a proposed line to connect Chambersburg and Shippensburg. T. M. Mahon is Pres. Noted Feb. 20.

Warren, Penn.—The Warren St. Ry. Co. is making preparations for the extension of its line from Warren to Youngsville, about nine miles. Work will be started in this near future. The Warren and Sheffield line will also be extended to Kane, 28 miles distant, by the construction of 12 miles of new road. It is also announced that the lines of the Titusville Trolley Company that now reach to Pleasantville will be extended to connect with the Warren and Youngsville line. D. F. A. Wheelock, Warren, is Ch. Engr. Noted Jan. 30.

Baltimore, Md.—The Board of Awards received the following bids, Feb. 26 for the construction of an electric railway from the Harford Road tracks of the United Rys. & Electric Co., to Lake Montbello, to be used for hauling supplies for the construction of the new filtration reservoirs: Malcolm W. Hill, $11,555; the Whiting-Turner Construction Company, $12,549, and C. W. Lane & Co., $18,043.

Durham, N. C.—Preliminary arrangements are being made by the Durham Traction Co. for the construction of the proposed electric railway from Durham to Chapel Hill, about 12 miles. R. H. Wright is Pres. Noted Mar. 6.

Wilmington, N. C.—The Peninsula Ry. Co. has been incorporated to construct and operate an electric railway from Wilmington to Ocean Beach. Iredell Meares is interested.

New Orleans, La.—Extensive improvements to its Villere line in New Orleans are planned by the New Orleans Ry., Light & Power Co. A. L. Black, New Orleans, is Ch. Engr.

Shreveport, La.—Preliminary surveys have been started by the North Louisiana Electric Ry. Co. for its proposed line from Shreveport to Homer and Monroe, about 100 miles. A. B. Blevins, Jefferson, La., is Pres. Noted Mar. 6.

Pahucah, Ky.—The Kentucky Southwestern Electric Ry. Light & Power Co. is receiving bids for the construction of its proposed line from Paducah to Murray, about 55 miles. H. S. Rhodes is Pres. Noted Jan. 16.

Cleveland, Ohio—Plans are being considered by the Cleveland Ry. Co. for the construction of a crosstown line on 79th St. Charles H. Stanley, Cleveland, is Pur. Agt.

Columbus, Ohio—L. P. Stephens, Receiver of the Columbus, Urbana & Western Electric Ry. Co., has advertised for bids for the extension of the line from its present terminus at Fishingers Bridge to the Girls Industrial Home, near Delaware. Bids will be received in two ways, first for the construction of the line entirely including the right-of-way and secondly for the construction of the road exclusive of the right-of-way.

Pioneer, Ohio—The Toledo & Western R.R. Co. has prepared plans and is making preliminary arrangements for the construction of an electric railway from Pioneer to Angola. At Angola the line will connect with that of the St. Joseph Valley Traction Co. W. E. Pierce, Sylvania, Ohio, is Supt.

Indianapolis, Ind.—Press reports are to the effect that the Chicago, Indianapolis & Meridan Rys. Co. is considering plans for the construction of an electric line from Gary to Indianapolis.

Laporte, Ind.—The Laporte, Logansport & Southern R.R. Co. will soon receive bids for the construction of an electric railway from Laporte to Logansport. Warren W. Travis is Vice-Pres. Noted Feb. 20.

Richmond, Ind.—The Richmond, Portland & Fort Wayne R.R. Co. has been incorporated to construct and operate an interurban railway connecting Richmond, Portland and Fort Wayne. Grant S. Staub, William F. Harbison, Richard J. McCarthy and C. H. Frank are interested.

Rochester, Ind.—Steps have been taken to build a traction line from this city to Akron a distance of 10 miles. A subsidy will be asked from Henry township Fulton County to pay for the right-of-way, and an additional subsidy will be asked from Rochester township to pay for the rails. Douglas Head & Co. propose to do the work on the Rochester-Akron line.

Terre Haute, Ind.—Plans are being prepared by the Springfield & Central Illinois Traction Co. for the construction of an electric railway on Walnut St. in Terre Haute.

Evanston, Ill.—The City Council has granted a franchise to the County Traction Co. to construct and operate an electric railway in Evanston. Emil G. Schmidt is Pres.

Springfield, Ill.—Press reports state that the construction of an interurban line from Jacksonville to Springfield is again being agitated. This project was discussed some time ago. Fred Amerheim of New Berlin, is interested.

Beloit, Wis.—Press reports are to the effect that a company of Indianapolis, Ind., capitalists are considering plans for the construction of an electric railway from Beloit to Delavan.

Mt. Pleasant, Wis. The Milwaukee Electric Ry. & Light Co. is considering plans for the extension of its line in Mt. Pleasant. R. H. Starin, Milwaukee, is Gen. Mgr.

Mason City, Iowa The construction of an electric interurban railway from Mason City to Cresco is being agitated by F. H. Baker and J. W. Patterson, of Cresco.

Duluth, Minn. The Interstate Traction Co. is considering an expenditure of $70,000 for the improvement of its street railway system. New cars, trolley lines and cables will be installed. Charles H. Dixon, Duluth, is Gen. Mgr.

Coffeyville, Kan The Kansas-Oklahoma Traction Co. has been incorporated to construct and operate an electric interurban railway from Coffeyville, Kan., to Tulsa, Okla., about 70 miles. E. H. Squires, Coffeyville, is interested.

Lincoln, Neb. We are officially advised that the Nebraska State R.R. Commission has approved the application of the Omaha, Lincoln & Beatrice Ry. Co. to issue $2,250,000 in bonds to be used for the completion of its proposed line from Lincoln to Omaha, about 50 miles. H. S. Norton, Lincoln, is Secy. of the company. Noted Jan. 23.

Cleburne, Tex.—A committee of local citizens headed by S. M. Braswell has been appointed to assist E. P. Turner of Dallas in promoting the construction of an interurban electric railway between Dallas and Glen Rose via Cleburne. Plans for carrying out this project are said to be well advanced. Noted Feb. 27.

Galveston, Tex.—The Galveston-Houston Interurban Ry. is planning to make extensive improvements to its line from Galveston to Houston, about 51 miles. It is also planned to construct two or three branch lines to thriving towns situated in the section the proposed line will traverse. V. W. Berry, Houston, is Supt.

Greenville, Tex.—The Greenville Electric St. Ry. Co. has purchased the street railway that runs from Greenville to Mineral Heights from the Greenville Development Co. The acquired line will be extended and otherwise improved.

Temple, Tex.—The Southwestern Traction Co. which owns and operates the interurban electric railway between Temple and Belton, about ten miles, has succeeded in financing the construction of an extension of the line from Temple to Marlin, 30 miles, and is now working on plans to build a trunk interurban railway between Dallas and Houston, 250 miles, via Marlin. It is stated by A. F. Bentley, Pres. of the company, that the construction of the Marlin extension will soon be started and that plans for building the proposed trunk line are well advanced.

Miami, Okla.—It is proposed by the Oklahoma, Kansas, Missouri Interurban Ry. Co. to construct an extension to its line from North Miami to Blue Mound. A. K. Wilder, Miami, is Gen. Mgr.

Ogden, Utah—The Ogden Rapid Transit Co. announces that it will be ready to start work this summer on its proposed interurban electric line from Ogden to Logan. Joseph A. West, Ogden, is Ch. Engr.

Ashland, Ore.—M. T. Minney and associates of Oakland, Calif., have been granted a franchise to construct and operate an electric railway in Ashland. Noted Feb. 27.

McMinnville Ore.—The Oregon Electric Ry. Co. is preparing plans for the extension of its line from Tualitin to McMinnville, about 30 miles. C. A. Coolidge, Portland, is Gen. Mgr.

Portland, Ore.—The City Council has granted a franchise to the Portland Ry., Light & Power Co. to construct approximately 18 miles of electric railway in Portland. F. W. Hild, Portland, is Gen. Mgr.

Vincent, Ore.—The Walla Walla Valley Ry. Co. is considering plans for the construction of a five-mile extension to Vincent. C. S. Walters, Walla Walla, Wash., is Gen. Mgr.

Bay City, Calif.—Plans are being prepared by the Pacific Electric Ry. Co. for the extension of its Alamitos-Longbeach line through Bay City. J. McMillan, Los Angeles, is Gen. Mgr.

Modesto, Calif.—Plans are being prepared by the Modesto & Empire Traction Co. for the construction of an interurban line from Modesto to Newman, about 20 miles. W. A. Cooper, Modesto, is Ch. Engr.

Fredericton, N. B.—A company is being organized for the construction of a street-car line in Fredericton.

LIGHT, HEAT AND POWER

+Hadley, Mass.—The American Thread Co. has awarded the contract for the construction of a boiler house at its Hadley branch, to V. V. GODDARD, Gardner, Mass.

+North Billerica, Mass.—The contract for the installation of a heating system in the new car shops of the Boston & Maine R.R. at North Billerica, has been awarded to the JENNISON CO., Fitchburg, at about $80,000.

South Hadley Falls, Mass.—The South Hadley Falls Power Co. has sold its plant and property to the Amherst Power Co. The new owners will establish a substation and install new equipment in the plant. Philip Cabot, Boston, is Pres.

Springfield, Mass.—Bids will soon be received by W. S. Pierce, Commanding Colonel of the U. S. Armory at Springfield, for the enlargement and improvement of the boiler house and installation of two new boilers in the armory.

+New Haven, Conn.—The contract for alterations and an addition to the power house of the United Illuminating Co. on Grand Ave. has been awarded to B. N. BLATCHLEY, 902 Chapel St., New Haven. C. F. Townsend, 55 Church St., is Arch. Noted Feb. 13 and 20.

Stamford, Conn.—Estimates are being received on plans drawn by Nelson E. Emmens, Washington Bldg., Stamford, for the construction of two buildings at the plant of the Stamford Gas & Electric Co. on South St. One will be 60x60 ft., two stories high and the second 60x90 ft. one story high, both of brick and concrete fireproof construction.

+Waterbury, Conn. The Connecticut Co. has awarded a contract to FRED T. LEY & CO., INC., of Springfield, Mass., for an addition to its power house on West Main St. The structure will be 60x100 ft., three stories high, of brick, steel and reinforced concrete. D. S. Miller, New Haven, Conn., is Elec. Engr. Noted Feb. 13.

Buffalo, N. Y.—Plans are being prepared for a new power house to be added to the plant of the Hewitt Rubber Co. at Kensington Ave. and the New York Central R.R. Belt Line.

The Augustine Rotary Engine Co. will add a boiler house 56x81 ft. and a testing plant to its plant at Elmwood Ave. and the Erie R.R.

Fulton, N. Y.—Plans are being prepared by Sackett & Parke, Archts., Syracuse, N. Y., for the construction of a power house 50x25 ft. to be erected by the Volney Paper Co.

Hornell, N. Y.—The Hornell Electric Co. has been acquired by a syndicate of Philadelphia, Penn., capitalists. It is understood that the new owners will expend about $100,000 on improvements to the plant. L. T. Mason, Hornell, is interested.

Ilion, N. Y.—At an election to be held soon the proposition, to issue $20,000 of bonds the proceeds to be used for the improvement of the municipal electric-light plant, will be submitted to the vote of the citizens.

✦New York, N. Y.—We are officially advised that the contract for the installation of electric equipment in public school No. 52, Boro, the Bronx, has been awarded to the COMMERCIAL CONSTRUCTION CO., 24 State St., New York, at $10,331. Bids were received by C. B. J. Snyder, Supt. School Bldgs., Mar. 3. Noted Feb. 27.

Syracuse, N. Y.—The Syracuse Crucible Steel Co. of America will build a boiler house and transformer station in connection with its extensive steel plant and rolling mills it is erecting near Halcomb mills. General specifications are obtainable from G. M. Black, Gen. Supt., Oliver Bldg., Pittsburgh, Penn.

Boonton, N. J.—The Mountain Lakes Gas Co. has been organized to establish and operate gas and electric-lighting plants to serve Mountain Lakes and vicinity. A franchise has been asked in Hanover Township. Edwin W. Kimball is Pres. and Charles A. Norris, Vice-Pres. of the company.

Camden, N. J.—The Delaware & Atlantic Telegraph & Telephone Co. is planning for the following improvements: New underground cable from its Camden exchange to Glouster City; new underground cable between Camden and Collingswood; new underground conduit and cable between Collingswood and Haddonfield; and local improvements and additions in its lines at Camden and other places mentioned. The estimated cost of the work is $79,000. T. B. McClain, Camden, is District Mgr.

Trenton, N. J.—The Ewing Township Committee has voted to install an electric street-lighting system on Pennington Road and on the Trenton Junction Road, and will confer with the Public Service Electric Co. for such installation.

Trenton, N. J.—Plans are under consideration for the construction of an electric-light plant to supply electricity for lighting the streets and public buildings. George B. La Barre is City Comr.

Reading, Penn.—A committee has been appointed by the City Council to investigate the feasibility of installing a municipal electric-light plant.

Reading, Penn.—According to press reports the Metropolitan Electric Co. has decided to rebuild its power plant on the Schuylkill River below Reading. The plant will furnish 4000-hp. The company also plans an expenditure of $1,500,000 for the improvement of its transmission lines from Annville to Reading. K. A. Fichthorn, Reading, is Gen. Mgr.

Richmond, Va.—Plans are being prepared by the Richmond & Henrico R.R. Co. for the construction of a power plant at Richmond to cost, $35,000. C. Sims-Bailey, Richmond, is Gen. Mgr. and Ch. Engr.

Richmond, Va.—The City Council is considering the proposition to expend $26,192 for the installation of an ornamental street-lighting system in the business district.

Rocky Mount, Va.—See item under Water Supply-Irrigation.

Conyers, Ga.—The Panola Light & Power Co. has applied for permission to increase its capital stock to provide for the proposed improvements which are contemplated by the company. It proposes to rebuild its power dam on the South River, near Conyers and to construct a steam plant at Lithonia.

Gadsden, Ala.—Press reports state that the Tri-State Gas Co. has decided to extend its gas mains from Gadsden to Attalla. C. H. Higgins, Centralia, Ill., is Pres.

✦Corydon, Ky.—The contract for the construction of a municipal electric-light plant at Corydon has been awarded to the L. H. SWANSON CO., of Evansville, Ind., at $5000. Noted Nov. 14 and Feb. 6.

Middleboro, Ky.—The Kentucky Utilities Co., of Lexington, Ky., has purchased the plant of the Middlesboro Electric Light Co., and is planning improvements.

Paducah, Ky.—The Kentucky Southwestern Electric Ry., Light & Power Co., Paducah, will build a power plant in the near future for the operation of its proposed 55-mile electric railway.

Indianapolis, Ind.—The Citizens' Gas Co. has been granted permission to expend $12,972 for the improvement of its gas plant. Two new 500-hp. boilers will be installed.

Indianapolis, Ind.—The Indianapolis Light & Heat Co., has increased its capital stock and will receive bids in a short time for the improvement and increasing the capacity of its plant.

Flint, Mich.—Plans for the installation of an ornamental street-lighting system are being considered by the Lighting Committee of the City Council.

Aurora, Ill.—The Interstate Power & Telephone Co. contemplates an expenditure of $75,000 for the extension and improvement of its system.

Jacksonville, Ill.—An election will be held Apr. 15 to vote on the proposition to issue $50,000 in bonds for the installation of a new municipal electric-light plant. Joseph F. Brennan is Comr. of Pub. Property.

Warren, Ill.—F. T. Morrison, of Dixon, Ill., has been granted a franchise by the Village Board to construct and operate an electric-light plant at Warren.

Eden, Wis.—The Eden Electric Co., has been incorporated by John O'Brien, Frank Sielaff and Kathryn O'Brien, for the purpose of maintaining and operating an electric light and power plant in the village of Eden.

Ossian, Iowa—The proposition to construct an electric-light plant at Ossian is under consideration. Estimated cost, $8000.

Augusta, Kan.—At a recent election the proposition to install a municipal electric-light plant was carried. J. R. Switzer is City Engr.

Canton, Kan.—Bids are being received by the city for the construction of a new electric-light plant.

Douglass, Kan.—Local business men are interested in the project to install an electric-light plant in Douglass.

Turon, Kan.—At a recent election the citizens voted to issue $20,000 in bonds for the construction of a municipal electric-light plant.

Hildreth, Neb.—The proposition to issue bonds for the installation of an electric-light system has been approved by the citizens.

✦Devil's Lake, N. D.—The contract for the installation of an ornamental street-lighting system has been awarded to ROBERTS & PERKINS, Minneapolis, Minn., at $12,995. Bids were received by the city Feb. 10. Noted Jan. 16.

Reynolds, N. D.—Bids will be received by the City Council until Mar. 15, for the construction of a municipal electric-light plant. M. N. Brathorde is City Audr. Noted Nov. 21.

Webb City, Mo.—The City Council is considering the proposition of installing a new street-lighting system.

Sulphur Springs, Ark.—See item under Water Supply-Irrigation.

Flatonia, Tex.—C. A. Pierson, of Axtell, Neb., has purchased the electric-light and power plant, the water-works system and the ice factory here of the Flatonia Ice, Water & Electric Co. He will make extensive enlargements and improvements to the property.

Deming, N. M.—It has been announced that the Federal Light & Traction Co. will construct a new power plant at Deming. The estimated cost of the project is $400,000. W. D. Murray, Silver City, and H. H. Kelly, Deming, are interested.

Oreana, (Lovelocks post office), Nev.—The Nenzel Electric Co. has been incorporated by Joseph F. Nenzel, J. T. Sullivan, J. H. Causten and J. Barger. The company will construct a large power plant at Oreana and furnish electric power and light for Rochester.

Ephrata, Wash.—The installation of an electric-light plant at Ephrata is being agitated.

Baker, Ore.—We are officially advised that the proposition to issue bonds for 160,000 for the construction of a municipal electric-light plant was defeated at a recent election. James Cunning is City Clk. Noted Feb. 13.

✦Alhambra, Calif.—The contract for the installation of an ornamental lighting system on Garfield Ave., Main St. and Fair Oaks Ave., has been awarded to the NEWBERRY-BENDHEIM CO., Los Angeles, at $20,456.

Burbank, Calif.—An election will be held on Mar. 26 to vote on the proposition to issue bonds for $20,000 for the installation of a municipal electric-light system. Noted Mar. 6.

Porterville, Calif.—The San Joaquin Light & Power Co. will construct additional power transmission lines to points not now touched in this and adjoining villages. D. L. Wilson, Fresno, is Supt.

Seneca, Calif.—The Indian Valley Light & Power Co. contemplates the installation of a 1000-hp. unit in its plant on the Feather River near Seneca. C. G. Zschockett, Greenville, Calif., is Supt.

Westboro, Ont.—Plans are being considered by the Village Board for the installation of an electric-light system in Westboro.

Regina, Sask.—Bids will be received by A. W. Pool, City Clk., until Mar. 15 for supplying six 500-hp. water tube boilers, two 133,000 cu.ft. per min. fans and stacks, according to plans and specifications on file at the office of E. W. Bull, Supt. Light and Power.

Vernon, B. C.—The city contemplates an expenditure of $50,000 for the construction and equipment of a power plant. D. G. Tate is City Clk.

BRIDGES

Providence, R. I.—All bids which were received for rebuilding the approaches of the Rhode Island Stone Bridge, on Feb. 24, have been rejected and the work will be readvertised. Henry C. Wilcox, Romm 213, R. I. State House, is the Chn. of the Comn. Noted Feb. 13.

★Livingston Manor, N. Y.—Bids will be received by John R. Baldwin, Town Clk., Livingston Manor, until 3 p.m., Mar. 31, for the construction of a bridge and foundations over the Willowemoc River, State Road Route No. 4. Plans and specifications are on file at the State Highway Department, Albany, N. Y.

★New York, N. Y.—Bids will be received until Mar. 20, for the construction of both stone towers of the Hell Gate Arch Bridge over the East River. Plans and specifications are on file at the office of G. Lindenthal, Const. Engr. and Arch., 68 William St., New York.

New Brunswick, N. J.—Bids will be received by the Board of Chosen Freeholders, until Mar. 24, for the construction of a steel and concrete bridge over South Branch, Rahway River, on the Woodbridge-Iselin Road, Woodbridge Township, according to plans and specifications prepared by Alvin B. Fox, County Engr., Perth Amboy, N. J. Peter H. S. Hendricks is Dir. of the Bd.

Allentown, Penn.—The City contemplates the erection of a bridge over the Lehigh River at Tilghman St., to cost approximately $250,000. Charles Rinn, North Seventh St., Allentown, is Mayor.

Butler, Penn.—Bids will be received by the County Commissioners at Butler, until Mar. 22, for the construction of three reinforced-concrete bridges in Butler County and a concrete and brick floor on the Fenelton Bridge at Fenelton, Penn. W. B. Scott is Clk.

★Pittsburg, Penn.—Bids will be received at the office of the City Controller, Municipal Hall, until 10 a.m., Mar. 25, for the removal of the present bridge and the construction of a reinforced-concrete arch bridge on the line of Murray Ave., over William Pitt Blvd. Plans and specifications are on file at the office of Joseph G. Armstrong, Dir. of the Dept. of Pub. Wks., 432 Oliver Bldg. William A. Magee is Mayor.

Pittston, Penn.—Bids will be received by the Controller of Luzerne County, Court House, Wilkes-Barre, Penn., until noon, Apr. 1, for removing the wood and iron superstructure of the present bridge over the Susquehanna River at Pittston, alterations to the piers and abutments, constructing five pin-conneced spans each 202 ft. long with 25-ft. roadway and

two 8-ft. sidewalks. Fuller R. Hendershot is the Controller. E. R. Troxell, Jr., Pittston, is the Engr. Noted Feb. 6.

Reynoldsville, Penn.—Bids will be received by the County Commissioners at Brookville, Penn., until Mar. 15, for the construction of a concrete arch over the Sandy Lick Creek, between Reynoldsville and West Reynoldsville, where the Waterford and Susquehanna Turnpike crosses the creek. W. C. Byerly is Clk.

★**Smethport, Penn.**—Bids will be received by the Commissioners of McKean County at the Court House, Smethport, until 11 a.m., Mar. 25, for removing the present structure and constructing a new 70-ft. span, reinforced-concrete ribbed arch bridge over Marvin Creek. A. B. Walker is Clk. G. A. Flink, Trust Bldg., Harrisburg, Penn., is the Consult. Engr.

✚**Baltimore, Md.**—The contract for the construction of a viaduct over the tracks of the Baltimore & Ohio R.R. at Lee St., has been awarded to the VANG CONSTRUCTION CO., Cumberland, Md. The estimated cost is $15,000. Noted Feb. 6.

Lumberport, W. Va.—Bids will be received until Mar. 17, for the construction of a bridge across the West Fork River at Lumberport, for the Baltimore & Ohio R.R. Co., the Monongahela Valley Traction Co. and the Harrison County Court. The bridge will be 530 ft. long and 24 ft. wide, and will connect the towns of Lumberport and Haywood. The estimated cost is $32,000.

Hanover, Va.—Bids will be received at the office of the State Highway Commissioner, Richmond, Va., until noon, Mar. 20, for the removal of the old bridge and the construction of a new concrete structure over Falling Creek at Hanover. P. St. J. Wilson is the State Highway Comr.

✚**Charlotte, N. C.**—We are officially advised that the contract for the construction of the reinforced-concrete bridge on East Morehead St., over the tracks of the Southern Ry. Co., has been awarded to TRAVERS WOOD CO., Richmond, Va., at $6500. Noted Feb. 6.

✚**Pensacola, Fla.**—We are officially advised that the contract for the construction of three steel bridges across Garniers and Live Oak Creeks in the Florida National Forest has been awarded to the SOUTHERN BRIDGE CO., Birmingham, Ala. Inman F. Eldridge is Forest Supvr. Noted Feb. 20.

Louisville, Ky.—The Louisville Bridge Co., Louisville, which is controlled by the Pennsylvania R.R., has submitted plans for the construction of a new bridge over the Ohio River at Louisville, to the War Department, for approval. Noted Oct. 11, 1912.

Owensboro, Ky.—Bids will be received until Mar. 15, for the construction of a joint bridge and abutments between Daviess and Hancock Counties, across Blackford Creek on the Maceo and Lewisport Road, according to plans and specifications on file at the office of the County Judge of Daviess County in Owensboro. W. W. Owen is County Judge of Daviess County and G. D. Chambers, of Hancock County.

London, Ohio—The County Commisioners have decided to issue bonds for $19,000, for the purpose of building two new bridges. One will be over the Deercreek on the London and Mechanicsburg Turnpike and the other over Darby Creek on the Van Ness Road.

Anderson, Ind.—Bids will be received by the Commissioners of Madison County until 10 a.m., Mar. 24, for the construction of three steel bridges and one reinforced-concrete bridge in Madison County. J. B. Benefiel is the County Audr.

✚**Chicago, Ill.**—The contract for the steel for the highway bridge over the North Branch of the Chicago River at Wilson Ave., has been awarded to the CHICAGO STEEL PRODUCTS CO. Noted Dec. 12.

Edwardsville, Ill.—Bids will be received at the court house, Edwardsville, until 10 a.m., Mar. 22, for the construction of Silver Creek Bridge, between the towns of Hamel and Pin Oak, Madison County. It will have a 60-ft. span and an 18-ft. roadway. The estimated cost is $4000. L. F. Steinman, R. R. 4, Alhambra, Ill., is the Town Clk.

Hutchinson, Kan.—The proposition to issue bonds for $16,000 for the purpose of constructing two bridges, will probably be submitted to the voters on Apr. 1. The proposed bridges are to be constructed over Cow Creek, one at First Ave. West, and the other at Ave. B, East. Each will cost approximately $8000. G. L. McLane is City Engr.

St. Louis, Mo.—Further information has been received concerning the construction of the new 12th St. viaduct, as follows: Bids will be received by the Board of Public Improvements until Mar. 21, instead of Mar. 25, as previously published. The proposed viaduct will be about 2000 ft. long and 79 ft. wide, and will cost approximately $355,000. L. R. Bowen is the Engr.-in-charge, Bridge Department. Noted Mar. 6.

Galveston, Tex.—The lowest bid submitted for the construction of four highway bridges across the inland waterway between the Brazos River and Matagorda Bay, was that of the Blodgett Construction Co., Kansas City, Mo., at $10,400. The other bidders were: S. H. Hugins, Velasco, $10,800; Spence & Howe Construction Co., Port Arthur, $11,750; C. Q. Horton, Austin, $11,400, and the Midland Bridge Co., Kansas City, $16,700.

Homedale, Idaho—The State legislature has appropriated $25,000 for the construction of a wagon bridge across the Snake River at Homedale.

✚**Eugene, Ore.**—The contract for the construction of the new steel wagon bridge over the Willamette River, has been awarded to the COAST BRIDGE CO. The estimated cost is $34,500. Noted Feb. 13.

WATER SUPPLY—IRRIGATION

Attleboro, Mass.—We are officially advised that the Water Department has recommended the installation of a Venturi meter and other improvements to the water system. H. F. Conant is Supt. W. Wks.

Boston, Mass.—Plans have been completed for a comprehensive system of high-pressure water piping for fire purposes which will take 18 months to complete, and is estimated to cost $1,000,000. An immediate loan order for $175,000 will probably be passed by the City Council to start the work. L. K. Rourke is Comr. Pub. Wks. Charles H. Cole is Fire Comr.

✚We are officially advised that bids were received by the Metropolitan Water and Sewerage Board, Mar. 3, as follows: (a) 220 tons 24-in. Class F pipe; (b) 80 tons 30-in. Class D pipe; (c) 100 tons 36-in. Class D pipe; (d) 50 tons special castings; (e) total: FLORENCE IRON WORKS (awarded contract), (a) $23; (b) $23; (c) $23; (d) $55; (e) $11,950; U. S. Cast Iron Pipe & Foundry Co., (a) $23.35; (b) $23.35; (c) $23.35; (d) $52.50; (e) $11,965; Standard Cast Iron Pipe & Foundry Co. (a) $24.30; (b) $24.30; (c) $24.30; (d) $55,00; (e) $12,470; Warren Foundry & Machine Co., (a) $25; (b) $25; (c) $25; (d) $55; (e) $12,750. Noted Feb. 27.

Mansfield, Mass.—We are officially advised that the Water Commissioners are considering the installation of water meters throughout the town.

Woonsocket, R. I.—The City Council has appropriated $45,000 for the construction of a storage tank for the water system. A. F. Ballou is Supt. Water Dept.

Albany, N. Y.—Plans are being prepared for enlarging the pumping station at Quackenbush St. Estimated cost, $30,000. Wallace Greenalch is Comr. Pub. Wks.

Black River, N. Y.—We are officially advised that the Board of Water Commissioners contemplates the construction of a new water system. Charles L. Seybold is Pres.

Buffalo, N. Y.—The lowest bid received by the Department of Public Works, Mar. 7, for constructing a meter and valve house in the new pumping station at the foot of Porter Ave., was submitted by the Bison Construction Co., at $155,152. Francis G. Ward is Comr. Pub. Wks. Noted Mar. 6.

✚**New York, N. Y.**—We are officially advised that the contract to furnish and construct a high-pressure headquarters building at No. 226 West Broadway, Borough of Manhattan, has been awarded to PASQUAL STRIPPONE, 304 East 116th St., at $22,600. The other bids were: Cockerill & Little Co., Inc., $28,525; Frank J. Felgenbaur, $25,782; A. V. Johnson & Co., $23,893; Neptune B. Smith, Inc., $27,960; Joseph Balaban Co., $23,630; Werner & Bartels Co., $23,587; Thomas J. Waters Co., $22,892; William E. Moore, $27,540; William Flanagan, $23,990; Thomas McKeown, Inc., $23,700. Bids were opened by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, Mar. 5. Noted Feb. 27.

✚We are officially advised that the contract to furnish and deliver bronze shaft caps and appurtenances for the city tunnel of the Catskill Aqueduct, in the City of New York, Contract 54, has been awarded to the AMERICAN MANGANESE BRONZE CO., 99 John St., New York, at $90,568. Bids were opened by the Board of Water Supply, Feb. 18. Noted Feb. 27.

✚We are officially advised that the contract to furnish and deliver valves, hydraulic cylinders, piping and appurtenances for the city tunnel of the Catskill Aqueduct in the City of New York, Contract 146, has been awarded to the COLDWELL-WILCOX CO., Newburgh, N. Y., at $139,643. Bids were opened Feb. 11. Noted Feb. 20.

Asbury Park, N. J.—We are officially advised that bids will be received by the City Council until 8 p.m., Mar. 17, for improving the water systeu. The contract involves additions to the pumping equipment, and the laying of 100,000 lin.ft. of c.-i. pipe. Estimated cost, $275,000. R. L. Savage is City Engr. Noted Jan. 23.

★✚**Atlantic City, N. J.**—We are officially advised that the contract to furnish pipe for a 24-in. and a 20-in. c.-i. water main in Arctic Ave., from Missouri Ave. to Main Ave., with lateral mains on intersecting streets, has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Morris Bldg., Philadelphia, Penn., at $50,782. The other bids were: Florence Iron Works, $51,620; Standard Cast Iron Pipe & Foundry Co., $52,390; Warren Foundry & Machine Co., $55,600. Contracts for furnishing valves were awarded as follows: 42- to 48-in., to the RENSSELAER VALVE CO., at $3975; 16- to 24-in., to the KENNEDY VALVE CO., at $3765. Bids were opened by the Board of Commissioners, Feb. 14, and contracts awarded Mar. 6. L. Van Gilder is Supt. and Engr. Water Dept. Noted Feb. 13.

We are officially advised that the date of receiving bids for laying a 24-in. and a 20-in. c.-i. water main in Arctic Ave., from Missouri Ave. to Maine Ave., with lateral mains in intersecting streets, has been postponed to Mar. 20. Harry Bacharach is Comr. Noted Mar. 6.

Woodbury, N. J.—A bill has been passed by the Legislature authorizing the city to expend $200,000 for the erection and installation of an artesian water system.

Danville, Penn.—We are officially advised that the Board of Water Commissioners has employed Chester & Fleming, Hydraulic Engrs., Union Bank Bldg., Pittsburgh, Penn., to prepare plans and specifications for a reinforced-concrete settling basin to be built at the filtration plant. The work will be ready for bids in April.

McKeesport, Penn.—Bids will be received at the office of C. E. Soles, City Controller, until 4 p.m., Mar. 17, for furnishing and installing one 400-hp. vertical water-tube boiler for the Water Department. Specifications may be obtained at the office of the Water Department.

Rankin, Penn.—We are officially advised that bids are now being received for the construction of a 16-in. c.-i. intake pipe for the water system of the McClintic-Marshall Construction Co., at Rankin. Plans for this work can be seen at the office of Chester & Fleming, Consult. Engrs., Pittsburgh. The work will embrace laying 250 ft. of 16-in. c.-i. pipe under the bed of the Monongahela River and constructing a gate house. Noted Jan. 16.

Baltimore, Md.—Board of Estimates has authorized the Water Board to proceed with the preparation of plans for installation of a filtration plant, and, if necessary, to ask for additional loan to raise the Loch Raven Dam to the height originally intended, 237 ft., compared with the height of the dam now being constructed, which is 192 ft. According to the report of Ezra B. Whitman, City Water Engr., the dam of 192 ft. and filtration plant would cost $4,943,000, as compared with $7,060,645, for the dam at 237 ft., and a filtration plant.

★**Richmond, Va.**—Bids will be received by the Administrative Board until noon, Mar. 21, for furnishing 500 tons aluminum sulphate high basicity, for water clarification, containing from 17 to 18 per cent aluminum oxide, delivered at Rob. Korah Station, Chesapeake & Ohio Ry.; also for furnishing 40 tons aluminum sulphate, high basicity, for water clarifica-

tion, containing 17 per cent. aluminum oxide, delivered f.o.b. pump house siding.

Bids will be received at the same time for furnishing gate valves, cast-iron pipe, special castings, three-nozzle fire hydrants, valve boxes, meters, meter boxes, pig lead, wiping solder, brass work, lead pipe, hauling, laying and relaying granite or cobblestone paving, cutting and refilling pipe trenches and repaving over pipe trenches. E. E. Davis is Supt. City W.-Wks.

Rockymount, Va.—Bids will be received by C. S. Greer, Mayor, until Mar. 15, for purchasing $50,000 bonds for water, sewer and electric-light improvements. Noted Feb. 13.

✠Clayton, N. C.—We are officially advised that contracts for constructing water and sewer systems and an electric-light plant here have been awarded as follows: Laying mains and constructing the clear water basin, to DABBS & MYERS, Meridian, Miss., at $19,747; furnishing c.-i. water pipe, U. S. CAST IRON PIPE & FOUNDRY CO., $11,391; furnishing vitrified sewer pipe, to the POMONA TERRA COTTA CO., at $3393; tower and tank, to the DES MOINES BRIDGE & IRON CO., at $5184; triplex pump, to JOHN P. McGOWAN CO., at $1425; gasolene engine, to the INTERNATIONAL HARVESTER CO., at $1712; centrifugal pump and motor, with accessories, to the PLATT IRON WORKS, at $1144; electrical apparatus, probably to the WESTINGHOUSE ELECTRIC & MFG. CO., at $5560; station wiring and pole line complete, to TUCKER & LAXTON, Charlotte, N. C., at $6735. Bids were opened by the Board of Commissioners, Feb. 25. Gilbert C. White, Charlotte, N. C., is Consult. Engr. Noted Feb. 6.

Mulberry, Fla.—Bids will be received by H. J. Koerner, City Clk., until Apr. 1, for purchasing $25,000 water bonds, and $20,000 sewer bonds. Noted Oct. 31.

Atalla, Ala.—According to press reports, the Tri-City Gas Co., Gadsden, Ala., will extend its mains from Gadsden to Atalla. Estimated cost, $25,000. H. C. Higgins, Centralla, Ill., is Pres.

Elizabethtown, Ky.—According to press reports, the City Council has decided to install a filtration plant for the water system.

Madisonville, Ky.—Bids will be received by the Board of Public Works until Apr. 2, for furnishing and laying c.-i. water mains, constructing a steel tank, and laying sewers. W. J. Dulin is Secy.

Cheviot, Ohio—Bids will be received by Jacob Krollman, Jr., Village Clk., until noon, Mar. 19, for laying 6-in. water mains in various streets. Plans, specifications and profiles are on file at the office of the Clerk.

Elmore, Ohio—According to press reports, the village contemplates purchasing the private water plant, and has voted $20,000 for that purpose.

Lorain, Ohio—C. M. Osborn, City Engr., is preparing plans for improving the municipal water system. Estimated cost, $7000.

✠West Park, Ohio—We are officially advised that the contract to lay water mains in Warren Ave., Triskett Road, Raymond Ave., Settlement Road, and Brown Road, has been awarded to the LANESE CO., Columbia Bldg., Cleveland, Ohio, at $12,624. The other bids were: Phillips & Bixel, $15,-262; W. B. Smith, $13,469. Bids were opened Mar. 3. Plans were prepared by the William H. Evers Engineering Co., the Arcade, Cleveland. Noted Feb. 20.

Mishawaka, Ind.—Bids will be received by the city until Mar. 10, for laying a suction line connecting with six 10-in. wells. E. F. Crabill is Supt. Water Dept.

Carpentersville, Ill.—J. Rollin Gray, Consult. Engr., Chicago, Ill., is preparing plans for the installation of a water system here. Estimated cost, $30,000. M. D. Baldwin is City Clk. Noted Jan. 16.

✠Chicago, Ill.—A contract to furnish 5000 tons of c. i. pipe has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., at $24.80 per ton. Bids were opened Feb. 26.

Palmyra, Wis.—An election will probably soon be called to vote on a bond issue of $15,000, for the installation of a water system here. L. F. Agen is City Clk.

West Allis, Wis.—Tentative plans are being considered for the construction of five or six miles of water mains, to be laid this season. F. S. Baldwin is Mayor.

Estherville, Iowa—The proposition to issue $25,000 bonds for the installation of a water system here was defeated at the recent election. Noted Feb. 6.

Lake City, Iowa—We are officially advised that bonds for $12,000 were voted Mar. 6, for extending the water system. The improvements include a new well 2000 ft. deep, new pumps, and main extensions. A. O. Anderson is Engr. Noted Dec. 12.

Faribault, Minn.—We are officially advised that the proposition to construct a reservoir of 3,500,000 gal. capacity here, will probably not be taken up before next year. F. W. McKellip is City Engr. Noted Dec. 5.

✠Pine City, Minn.—We are officially advised that the contract for three divisions of the new water system has been awarded to the UNION MACHINE CO., St. Paul, Minn., at $16,485. The contract consists of: Div. 1, 12,000 ft. c.-i. bell and spigot pipe; Div. 2, 75,000-gal. tower and tank, 100 ft. to the balcony; Div. 3, 14x16-ft. pump house. The other bids were as follows: Thomas E. Woolley, La Crosse, Wis., Div. 1 to 5 complete, $24,767; Fraser & Danforth, St. Paul, Minn., Div. 1 to 5, complete, $23,600; E. A. Peterson, Hutchinson, Minn., Div. 1, complete, $12,815; W. H. Gausewitz, Pine City, Div. 1 to 5, complete, $15,106 Pastoret Co., Duluth, Minn., Div. 1 to 5, $23,190; Rock Island Bridge & Iron Works, Div. 2, $4500; Chicago Bridge & Iron Works, Chicago, Ill., Div. 2, $4850; C. W. Rowland Co., Des Moines, Iowa, Div. 1, $13,900; Div. 3, $3500; Plat Iron Works, Minneapolis, Minn., Div. 3, $835; Matt Holland, Cannon Falls, Minn., Div. 5, 8-in. well, complete, 150 ft. deep, $840; Div. 5, 10-in. well, complete, 150 ft. deep, $940; Kircher Bros., Hudson, Wis., Div. 1, $15,663; Lawrence McCann Co., Duluth, Minn., Div. 1 to 5, complete, $22,660; Div. 1 to 3 and 4, $18,160; Div. 1, $15,925; Des Moines Bridge & Iron Works, Des Moines, Iowa, Div. 1 to 5, complete, $21,159; Div. 1, 2 and 4, $18,500; Union Machine Co., St. Paul, Minn., Div. 1 to 5, complete, $20,490; Div. 1, $11,471; Minneapolis Steel & Machinery Co., Minneapolis, Div. 2, $1855; Keystone Deiller Co., Chicago, Ill., Div. 3b, $2263; Div. 3a, $2361; W. D. Lovell, Div. 1, $14,800; Div. 2, $4685; Div. 3, $2600; Div. 3a, $3400; Div. 3b, $2000; Div. 3c, $2300; Div. 4, $800. Plans were prepared by the Oscar Claussen Engineering Co., National German American Bank Bldg., St. Paul, Minn. Noted Feb. 27.

Herington, Kan.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., are preparing surveys and estimates for obtaining a spring water supply here. A bond election to provide for the improvement will probably be called in April.

Turon, Kan.—Rollins & Westover, Consult. Engrs., Kansas City, Mo., are preparing plans for the constructing of a water system and electric-light plant here. Bonds for $20,000 have been voted.

Ruiston, Neb.—The Towle Engineering Co., Omaha, Neb., is preparing plans for the construction of a concrete reservoir and an electric-light plant here. Estimated cost, $16,000.

✠Yankton, S. D.—We are officially advised that the contract to construct an iron tank for the water system has been awarded to the CHICAGO BRIDGE & IRON CO., Chicago, Ill., at $12,800. Noted Feb. 27.

Cascade, Mont.—Bids will be received by W. R. Call, Town Clk., until Mar. 17, for furnishing pipe and specials, and laying mains. Swearingen & McCulloh, Great Falls, Mont., are Consult. Engrs.

Livingston, Mont.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., have completed plans for a municipal water system to take water from the Yellowstone River. Estimated cost, $200,000. An election to vote on bonds will probably be called in April. Noted Jan. 23.

Twin Bridges, Mont.—H. S. Green, Consult. Engr, Spokane, Wash., has been retained by the Town Council to make surveys and ascertain the best source for the proposed water system. Noted Mar. 6.

Maryville, Mo.—Hiram Phillips, Consult. Engr., St. Louis, Mo., has been retained by the Board of Public Works to prepare plans for the construction of a water tower, and other improvements to the water system. C. L. Gann is City Clk. Noted Feb. 13.

Monroe City, Mo.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., are preparing plans for water and sewer systems here. Estimated cost, $75,000.

St. Louis, Mo.—We are officially advised that bids will be received by the Board of Public Improvements, City Hall, until noon, Apr. 18, for Letting 10,877, constructing an intake tower, tunnel and screen chamber, estimated cost, $450,000; Letting 10,878, filter equipment, estimated cost, $375,000; Letting No. 10,879, filters estimated cost, $375,000. Plans, specifications and contract blanks may be obtained from Edward E. Wall, Water Comr. Noted Feb. 20.

Clarksville, Ark.—We are officially advised that bids will be received by the Board of Improvements, Water District No. 3, until Mar. 28, for constructing a water system to include 380 tons of c. i. pipe and special castings, forty 4- to 8-in. double gate valves and 39 hydrants, tank and tower, pump and motor. Plans and specifications are on file at the office of D. Ward Duniap, Secy., and may be obtained at the office of Winters & Dove, Consult. Engrs., Fort Smith, Ark.

Sulphur Springs, Ark.—We are officially advised that bids will be received at the office of the Improvement Board, until Mar. 20, for constructing a complete water system and electric-light plant, including power house, pump house, machinery and electrical equipment, water pipe, valves, and a standpipe of 100,000 gal. capacity. Plans and specifications are on file at the office of the Improvement Board, and at the office of A. C. Moore, Consult. Engr., Joplin, Mo. C. J. Williams is Chn. of Bd. Noted Feb. 13.

Beaumont, Tex.—The Commissioners of Jefferson County have granted a franchise to W. C. Teter to lay and maintain water mains on county roads for a distance of ten miles from the county court house, except in the direction of Port Arthur, where the distance is limited to six miles.

Canadian, Tex.—Bids for the machinery for the new water system here will be opened by the city on Mar. 17. The system here will be opened by the city on Mar. 17. The system will include a pump house, 12x60 ft., of frame and galvanized iron, and a standpipe, 25x60 ft. H. F. Kilburn, Woodward, Okla., is Consult. Engr. Noted Nov. 14.

Fort Worth, Tex.—The City Commission has called an election for Apr. 8, to vote on the proposition of issuing $300,000 of water bonds.

✠Texhoma, Okla.—We are officially advised that the contract to construct a water system here has been awarded to BASH & GRAY, Joplin, Mo., at $20,066. The next lowest bid was submitted by the Humrichouse Construction Co., Carmen, Okla., at $20,415. Bids were opened Feb. 25. P. M. Williams is Mayor. Noted Feb. 20.

Gunnison, Colo.—O. H. Aikine, City Engr., is preparing plans for the construction of a concrete reservoir for the system. The reservoir will have a capacity of 200,000 gal.

✠Phoenix, Ariz.—We are officially advised that the contract to lay 4500 ft. of 7-ft. reinforced-concrete penstock pipe has been awarded by the Salt River Valley Water Users' Association, to MARTIN & GILLER, Tempe, Ariz., at $32,000. Charles A. Van der Veer is Secy. Noted Jan. 30.

Ellensburg, Wash.—The ranchers served by the Cascade Canal have voted bonds for $600,000 for laying a concrete flume to replace the wooden flume now in use. The Cascade Canal Co. is in charge of the work.

Arlington, Ore.—We are officially advised that Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland, Ore., is preparing plans and specifications for the installation of a new pumping plant and reservoir for the water system, and an electric-light plant.

Linnton, Ore.—We are officially advised that bids will be received some time in April for installing a water system here. Bonds for $100,000 have been sold. Plans and specifications are being prepared by Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland. The system will connect with the Bull Run water supply of the city of Portland.

Davis, Calif.—Bids are being received by R. T. Stone, Pres. and Gen. Mgr., Sacramento Valley Land & Water Co., for the construction of a rubble dam to contain 350,000 cu.yd. of masonry, and to be 250 ft. high and 800 ft. long.

✚Puente, Calif.—A contract has been awared to E. A. SIMMONS, Upland, at $12,100, for the construction of a concrete reservoir near Puente, for the Cross Land Co., H. W. Hellman Bldg. Other bids were: J. C. Thurman, El Monte, $12,600; Louis Ferrell, Pomona, $12,972; Redlands Cement Works, $13,810; W. W. Atkinson, $15,880; W. A. Gillette Co., $15,950; C. Sheerer Co., $16,333; E. D. Keil, $17,396; Putnam Stone Construction Co., $21,574; Russell-Greene-Foell Co., $21,821. Bids were opened Feb. 15. Noted Feb. 13.

San Diego, Calif.—H. A. Whitney, Engr. Water Dept., is drawing plans for a second pipe line from Chollas Reservoir to connect with the high-presure water mains. The new line will comprise 4½ miles of 28-in. pipe.

San Jacinto, Calif.—The Citizens' Water Co. contemplates the construction of a 2-ft. concrete conduit, estimated to cost $20,000.

Santa Monica, Calif.—According to press reports, the city has decided to install a municipal water system, instead of the salt-water fire-service system previously contemplated. The City Engineer has been instructed to prepare plans for the new system, which is estimated to cost $76,000. Noted Dec. 26.

★Halifax, N. S.—Bids will be received by the Mayor until noon, Apr. 2, for constructing a reinforced-concrete reservoir and gate house. Plans are on file at the office of the City Engineer. J. J. Hopewell is Clk. Bd. Pub. Wks.

✚Regina, Sask.—We are officially advised that the contract to supply and erect a 5,000,000-gal. turbine pump and compound vertical condensing engine has been awarded to ESCHER, WYSS & CO., Montreal, Que., at $16,000. Bids were opened Jan. 29. Noted Jan. 9.

SEWERS

✚Boston, Mass.—We are officially advised that the contract to furnish and deliver 676,00 lb. of c.-i. pipe and 22,000 lb. of c.-i. specials for sewers in Section B, Dorchester Tunnel, has been awarded to the HERSEY MFG. CO., Tremont Temple, at $39,198. The other bids were: Neptune Meter Co., $60,850; Thomson Meter Co., $56,295; National Meter Co., $55,-950; Henry R. Worthington, $49,737. Bids were opened Mar. 6. Noted Mar. 6.

★✚Boston, Mass.—We are officially advised that the contract to furnish 676,000 lb. of c.-i. pipe and 22,000 lb. of c.i. specials for sewers in Section B, Dorchester Tunnel, has been awarded to the STANDARD CAST IRON PIPE & FOUNDRY CO., Bristol, Penn., at $14,070. The other bids were: U. S. Cast Iron Pipe & Foundry Co., $24,081; R. D. Wood & Co., $19,370. Bids were opened by the Boston Transit Commission, Mar. 6. Noted Mar. 6.

Franklin, Mass.—Bids will probably soon be asked for the installation of a sewer system here. J. J. Van Valkenburg, South Framingham, Mass., is Consult. Engr. B. M. Rockwood is Chn. of Comrs.

Worcester, Mass.—Bids will be received by Matthew Gault, Supt. of Sewers, until noon, Mar. 14, for furnishing supplies during the period from May 1, 1913 to Apr. 30, 1914. The approximate quantities required are as follows: 600,000 brick, 2400 tons lime, 50,000 ft. vitrified pipe and fittings, 150,000 lb. castings, and 25,000 bbl of cement. Noted incorrectly Mar. 6.

✚Mansfield, Conn.—A contract to construct a sewage disposal plant at the state colony for epileptics at Mansfield, has been awarded to ARCHBALD TORRANCE, Norwich, Conn., at approximately $10,000.

Albion, N. Y.—We are officially advised that bids will be received by Edward S. Eaton, Village Clk., until 7 p.m., Mar. 24, for the purchase of $150,000 bonds. The bonds were issued for the installation of a sewer system and sewage disposal plant according to plans and specifications prepared by Charles A. Ingersoll, Consult. Engr., Buffalo, N. Y. Noted Aug. 8.

Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Pres. Boro. Brooklyn, until 11 a.m., Mar. 19, for constructing sewers in various streets. Estimated cost, about $40,000. Blank forms and all necessary information may be obtained at the office of the Bureau of Sewers, 215 Montague St., Brooklyn.

Eastwood, N. Y.—George Higgins, Consult. Engr., Syracuse, N. Y., has been retained to prepare plans and specifications for a sanitary sewer system here.

Jamaica, N. Y.—The Town Board contemplates the construction of a sewer in Atlantic Ave., Harold Ave., Fulton St. and Napier Ave., at an estimated cost of $33,500, also a sewer in Hillside Ave. and North Vine St., estimated to cost $5,...

New York, N. Y.—Bids will be received by George McAneny, Pres. Boro. Manhattan, until 2 p.m., Mar. 17, for reconstructing a sewer in East 18th St., from Ave. C. to the East River.

✚Atlantic City, N. J.—Bids for extending the storm water sewer system were received by the Board of Commissioners, Feb. 28, as follows: Atlantic Construction & Supply Co., Atlantic City, $202,441; Cunningham Paving & Construction Co., Philadelphia, Penn., $202,811; EDWARD L. BADER, Atlantic City, N. J., $199,344 (awarded contract); McGovern Contracting Co., Trenton, N. J., $208,986; I. Schmeidler, Atlantic City, $204,570. Noted Feb. 13.

Metuchen, N. J.—The Borough Council has passed a resolution calling for a special election to vote on a bond issue of $125,000 for a sewer system and street improvements.

★✚Beaver Falls, Penn.—Press reports state that the contract to construct about 16 miles of 8- to 24-in sanitary sewers here has been awarded to the PIETRO PAVING & CONSTRUCTION CO., Morgantown, W. Va., at $142,577. Bids were opened by the Borough Council, Feb. 19. Noted Feb. 6.

Conshohocken, Penn.—The Town Council will appoint a committee to appoint an engineer to prepare plans and specifications for the proposed sewage disosal lant, ordered by the State Commissioner of Health. J. Quincy Thomas is Pres. Town Council.

Sharon, Penn.—The State Commissioner of Health has approved plans recently submitted by the Borough Council, for a sewage disposal plant. An election may be called to vote on the proposition. Horace W. Davis is City Solicitor.

Upper Darby, Penn.—The Commissioners of Upper Darby Township propose to build sewers estimated to cost $35,000.

Newark, Del.—An election will probably be called some time in April to vote on a bond issue of $60,000 for the installation of a sewer system. Samuel J. Wright is a member of the commission in charge of the project. Noted Aug. 22.

Rocky Mount, Va.—See item under Water Supply-Irrigation.

Mulberry, Fla.—See item under Water Supply-Irrigation.

Orlando, Fla.—Bids will be received by the Bond Trustees until noon, Mar. 27, for the purchase of $140,000 sewer bonds. Plans for a sewer system have been prepared by G. R. Ramsey. Noted Nov. 28.

✚Tampa, Fla.—The contract to construct reinforced concrete storm drains in Hyde Park has been awarded to E. W. PARKER, Tampa, at $37,064. Bids were opened by the Board of Public Works, Feb. 18. Noted Feb. 13.

Mobile, Ala.—Bids will be received by H. Pillans, Comr., until noon, Mar. 25, for constructing about 30,000 lin.ft. of 8- to 20-in. vitrified pipe sanitary sewers in the western portion of the city. Plans and specifications are on file at the office of Wright Smith, City Engr. Noted Oct. 10.

Lafayette, La.—Bids will be received by the Sewer Committee of the Parish of Lafayette, until Mar. 27, for constructing and operating a sewer system here under the franchise system, with rates for service. The territory to be covered is about 40,000 lin. ft. C. D. Bourdeaux is Chn. Noted Dec. 19.

Shreveport, La.—Bonds for $20,000 were voted, Mar. 4, for the construction of storm sewers. For further information, address C. G. Rives, Comr. of Finance.

Martin, Tenn.—Bids will be received by J. T. Perkins, Mayor, and the Board of Aldermen until 2 p.m., Mar. 24, for constructing a complete system of sanitary sewers, to comprise 3000 ft. of 15-in.; 6200 ft. of 12-in.; 3500 ft. of 10-in.; 15,350 ft. of 8-in. 23,000 ft. of 6-in. sewers with necessary manholes and flush tanks. Plans and specifications are on file at the office of J. H. Wilson, City Recdr., and at the office of R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis.

Lexington, Ky.—George M. Sullivan, Consult. Engr., Lexington, has been retained by the City Commissioners to prepare plans and specifications for a sewage disposal plant and for laying sewers. Noted Jan. 9.

Louisville, Ky.—Press reports state that bids will be received by the Board of Public Works until Mar. 14, for constructing 48 blocks of sewers. David R. Lyman is City Engr.

Madisonville, Ky.—According to press reports, bids will be received by the Board of Public Works until Apr. 2, for constructing a sewer system. W. J. Dulin is Secy.

✚Ashland, Ohio—We are officially advised that the contract to construct the South Highland relief sewer has been awarded to ALEXANDER CAIRNS, Ashland, at $7702. Bids were opened Mar. 7. Noted Mar. 6.

Geneva, Ohio—Bixler, Weir & Leggett, Consult. Engrs., Ashtabula, Ohio, estimate the cost of installing a new sewage disposal plant here, at $20,000. This includes six filter beds, siphons and a septic tank.

Bids will be received by the Village Council until noon, Mar. 25, for laying sewers in various streets. W. E. Morgan is Clk.

St. Bernard, Ohio—Bids will be received by the Director of Public Service until noon, Mar. 20, for laying vitrified pipe sewers in various streets. William J. Voller is Clk.

Shaker Heights, Ohio—Bids will be received by Carl A. Palmer, Village Clk., until noon, Mar. 17, for the construction of sewers in Weymouth Road, Coventry Road, Drexel Road and Elham Road.

Youngstown, Ohio—According to press reports, bids will be received by the Director of Public Service until Mar. 14, for furnishing mateial and laying sewers in portions of Ridge and Westlake Aves. W. M. McMillin is Clk.

✚Fort Wayne, Ind.—A contract to construct about 20,000 lin ft. of sewers here has been awarded to the MOELLERING CONSTRUCTION CO., Fort Wayne.

Chesaning, Mich.—We are officially advised that the W. J. Sherman Co., The Nesby, Toledo, Ohio, has been retained to prepare plans and specifications for the installation of a sewer system for the village.

★Iron Mountain, Mich.—Bids will be received by Sol Beauparlant, City Clk., until 9 a.m., Apr. 12, for the construction of about 1650 ft. of 48-in. Jackson pipe reinforced concrete sewer on Kimberly Ave. from alley between Ludington and Hughitt St. to Ludington St., thence east on Ludington St. to a point where open ditch crosses, together with necessary manholes, catch basins 616 ft. of 6-in laterals and 366 ft. of 8-in. catch basin, drains, and for furnishing all labor and material necessary; also for laying about 1650 ft. of 12-in. iron drain pipe alongside said sewer, according to plans and specifications prepared by the City Engineer and now on file in the office of the City Clerk.

★De Kalb, Ill.—Bids will be asked about Mar. 15, for the construction of approximately 16 miles of vitrified pipe sanitary sewers ranging in size from 8 to 24 in., and a sewage disposal plant. A. R. Russell is City Engr. Noted Jan. 9.

Ottawa, Ill.—The City Engineer has prepared preliminary plans for the construction of a sewer in the northern section of the city. Estimated cost, $55,000.

Rockford, Ill.—The Board of Public Improvements has approved the estimates of the City Engineer for the construction of sewers in various parts of the city. Estimated cost, $45,000. Noted Jan. 23.

Springfield, Ill.—Bids will probably soon be asked for installing a sewer system in North Wayne Heights. Estimated cost, $57,000.

+Sheboygan, Wis.—We are officially advised that the contract to construct sewers here has been awarded to the DAVID VON STELLE CO., Sheboygan, at $6396. The other bids were: Robert Nelson, Racine, Wis., $7418; Franz Radloff, Plymouth, Wis., $8478; Charles A. Homold, Sheboygan, $6934. Bids were opened Feb. 28. Noted Feb. 20.

+Davenport, Iowa—Bids will be received by the Board of Public Works until 2 p.m., Mar. 29, for constructing a sanitary sewer system in the 13th Sewer District. The contract includes the following: 2400 ft. of 96-in. drainage sewer; 3000 ft. of 24-in. sewer; 2400 ft. of 18-in. sewer; 3500 ft. of 15-in. sewer 2400 ft. of 12-in. sewer; 2900 ft. of 24-in. sanitary invert. A. M. Compton is Comr. Noted Mar. 6.

+Tipton, Iowa—We are officially advised that a contract to construct ten miles of sewers here has been awarded to the J. TURNER IMPROVEMENT CO., Des Moines, Iowa, at $69,543. The other bids were: Independent Construction Co., Davenport, Iowa, $80,119; Lytle Construction Co., Sioux City, Iowa, $74,713; Lana Construction Co., Council Bluffs, Iowa, $78,889; Fraser & Danforth, St. Paul, Minn., $78,080; E. T. Webster, St. Paul, Minn., $83,357; J. O. Severins, Oklahoma City, Okla., $87,874. Plans and specifications were prepared by the Iowa Engineering Co., Clinton, Iowa. Bids were opened Feb. 26. Noted Feb. 13.

+Hutchinson, Minn.—We are officially advised that a contract to lay sewers here has been awarded to E. L. DIMICK, Laurel, Neb., at $7082. The other bids were: G. W. Lovell, Minneapolis, $9457; E. A. Peterson, Hutchinson, $6566; Jonson & Christenson, $7656; Kircher Bros., Hudson, $8785. Bids were opened Feb. 25. Noted Feb. 20.

Valley Falls, Kan.—We are officially advised that Worley & Black, Consult Engrs., Reliance Bldg., Kansas City, Mo., have been retained by the town to prepare plans and specifications for a complete sewer system here.

Bankroft, Neb.—The Towle Engineering Co., Omaha, Neb., has prepared preliminary plans for the installation of a sanitary sewer system here. Estimated cost, $25,000.

California, Mo.—We are officially advised that bids will be received until Mar. 17, for constructing about 4½ miles of lateral sewers. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs.

Clarksville, Ark.—We are officially advised that bids will be received by the Board of Improvement, Sewer District No. 4, until 8 p.m., Mar. 28, for furnishing material, and constructing a sanitary sewer system and a sewage disposal plant. The plans provide for 23,250 ft. of 8-in. to 12-in. vitrified pipe sewers, 62 manholes, ten flush tanks and settling tank. D. W. Dunlap is Secy. Winters & Dove are Consult. Engrs.

+Wynne, Ark.—The contract to install a sewer system here has been awarded to the N. S. SHERMAN MACHINE & IRON WORKS, Oklahoma City, Okla., at $68,900. Noted Feb. 13.

Temple, Tex.—The City Council has called an election for Apr. 1, to vote on a bond issue of $75,000, for purchasing the privately owned sewer system, or constructing a system from plans prepared by Burns & McDonnell, Engrs., Scarritt Bldg., Kansas City, Mo. Noted Jan. 23.

Cushing, Okla.—According to press reports, bids will be received until Mar. 18, for constructing a sewer system, for which bonds for $29,000 were recently voted. Hunter & Hunter, Oklahoma City, Okla., are Consult. Engrs. George A. Dungan is City Clk. Noted Mar. 6.

+Lewistown, Idaho—A contract to construct sewers in District 3 has been awarded to WILLIAM ENOCH, Lewistown, at $5970.

+Everett, Wash.—The contract to construct the Harrison St. sewer has been awarded to the JAHN CONTRACTING CO., Seattle, Wash., at $162,500.

+Alhambra, Calif.—A contract to construct 4230 ft. of reinforced-concrete storm sewer has been awarded to ANDREW HOLLOWAY, Pasadena, Calif., at $16,085. Bids were opened by O. M. Caulk, City Clk. Noted Feb. 13.

Dinuba, Calif.—We are officially advised that bids will be received by the City Clerk until Mar. 19, for constructing 6- to 16-in. sewers and septic tanks. Estimated cost, $35,000. C P. Jensen, Fresno, Calif., is Consult. Engr. Noted Dec. 19.

Elsinore, Calif.—Bids for constructing a sanitary sewer system and a sewage disposal plant here were received by the Board of Trustees, Feb. 24, as follows: Westlake Construction Co., Byrne Bldg., Los Angeles, $18,053; S. M. Kerns, $18,830; R. C. Lowell, $19,098; M. Millitch, $19,365; C. D. Vincent, $21,963; Star Cement Co., $20,055.

Oceanside, Calif.—We are officially advised that a system of sanitary sewers estimated to cost $32,000, will be installed here. The plans provide for 7½ miles of vitrified pipe mains and laterals, and a septic tank disposal plant. N. K. Carpenter is City Engr. Noted Feb. 20.

GARBAGE

New York, N. Y.—Bids will be received until noon, Mar. 20, by Calvin Tompkins, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, for Contract 1370, for the furnishing and delivery of all labor and materials required for receiving and removing ashes.

Bids will be received until noon, Mar. 20, by Calvin Tomkins, Comr. of Docks, for Contract 1377, for the labor and materials necessary for sprinkling certain new made land on the North and East Rivers, Boro. Manhattan.

Newport, Ky.—The city is considering the installation of an incinerator for the disposal of garbage. The City Commisisoners are now making plans.

STREETS AND ROADS

Athol, Mass.—The Committee on Streets has decided to resurface Main and School Sts., at an estimated cost of $18,000. Fred W. Lord is Chn. The General Engineering Co., Springfield, Mass., is Engr. in Charge.

Lockport, N. Y.—The Common Council has received bids as follows for grading, curbing and paving La Grange St. with brick; C. N. Stainthorpe & Co., $10,634; the C. B. Whitmore Co., $10,690; F. J. Le Valley, $10,690; Henry P. Burgard Co., Buffalo, N. Y., $11,341; S. V. R. Malcom & Son, Medina, N. Y., $10,992.

+A contract was awarded to THE C. B. WHITMORE CO. at $32,360 for paving North Transit St. with Metropolitan vitrified shale block.

New York, N. Y.—Bids will be received until 2 p.m., Mar. 17, by the President of the Borough of Manhattan, Room 1808, 21 Park Row, for repairing sidewalks on Madison Ave. from 85th to 86th Sts., and on 85th St., near Madison Ave. Geo. McAneny is Pres.

(Borough of Queens)—Bids will be received until 11 a.m., Mar. 17, by the Borough President, Borough Hall, Fifth St. and Jackson Ave., Long Island City, for various improvements in the following streets: Grand, Beddard (or Barclay), Stockholm, Ninth, and Woodbine Sts., Kelly, East 11th, Edsall, First, Woodward, Hull, Polk and Ninth Aves., Napier Place and Union Place. Maurice E. Connolly is Boro. Pres.

Bids will be received until noon, Mar. 20, by the Commissioner of Docks and Ferries, Pier "A," foot of Battery Place, North River, for paving with asphalt the deck of Pier 42, East River. Calvin Tomkins is Comr.

+(Borough of Richmond)—Contracts have been awarded by the President of the Borough to the STANDARD OIL CO., 26 Broadway, New York, at $6250, for furnishing 100,000 gal. macadam road binder, and $8400 for 140,000 gal. macadam road binder; to the UNITED GAS IMPROVEMENT CO., Broad and Arch Sts., Philadelphia, at $6347, for 110,000 gal. bituminous road surfacing material. George Cromwell is Pres. Noted Feb. 27.

+Schenectady, N. Y.—We are officially advised that the Board of Contract and Supply has awarded a contract to JOHN W. DAVITT, Troy, N. Y., at $1.40 a sq.yd., for about 100,000 sq.yd. asphalt pavement on concrete base. C. A. Mullen is Comr. of Pub. Wks. Noted Feb. 27.

+Long Branch, N. J.—Bids will be received by the Board of Commissioners until 10 a.m., Mar. 26, for paving portions of Rockwell, Second and Third Aves. Bids will be accepted for vitrified brick, asphalt or bituminous concrete paving. Winfield R. Warwick is City Clk. J. Wesley Seaman is City Engr.

Metuchen, N. J.—See item under Sewers.

Newark, N. J.—Bids will be received until 3 p.m., Mar. 13, by the Board of Street and Water Commissioners for various improvements on the following streets: Miller, Halsey and Parker Sts., Noll Place and Ave. L. M. R. Sherrerd is City Engr.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., Mar. 24 by the Board of Chosen Freeholders of Middlesex County for improving the road from the railroad to and across the County Bridge at Cheesequake Creek. Peter H. S. Hendricks is Dir.

Carlisle, Penn.—Plans are being prepared by the City Engineer for about 5000 sq.yd. of vitrified brick paving on High St. at an estimated cost of $6000.

+Greenville, Penn.—A contract has been awarded by the Borough Council to ROESS & LESURE, Oil City, Penn., at $72,143 for paving Clarksville, North High, North and South Mercer, North and South Main Sts. Brick, brick block and asphalt block will be used.

Monongahela, Penn.—Bids will be received until Apr. 1, by the Borough Council, for about 8000 sq.yd. brick pavement. The estimated cost is $12,000. J. A. Morrow is City Engr.

+Philadelphia, Penn.—Bids will be received until noon, Mar. 27, by the Department of Public Works, for various street improvements under Schedules B, C, D, E, F, G and H. M. L. Cooke is Dir.

Pittsburgh, Penn.—The City Council has passed an ordinance authorizing the improvement of West Liberty Ave., at an estimated cost of $382,000.

+Rochester, Penn.—The Borough Council has awarded a contract to S. B. MARKLEY, Woodlawn, Penn., at approximately $42,000, for grading and paving Adams St., Kentucky, Virginia and Maine Aves.

Wilmington, Del.—Bids will be received until noon, Mar. 18 by the State Highway Commissioner of New Castle County for construction of about three miles of waterbound macadam road, known as the Odessa-St. Georges Road. James Wilson is Comr. Noted Dec. 19.

+Baltimore, Md.—Contracts for street improvements have been awarded as follows by the Board of Awards: Contract No. 43, to M. J. BEACH at $43,171 for vitrified block paving; contract No. 45, to P. FLANIGAN & SONS at $18,254 for sheet asphalt and bituminous pavement; contract No. 46 to P. F. REDDINGTON, at $14,161 for vitrified block; contract No. 48, to the GEO. LONG CONTRACTING CO., at $19,458 for granite block; contract No. 49, to P. FLANIGAN & SONS at $16,323 for granite block paving. R. Keith Compton is Chn. Noted Feb. 6.

+We are officially advised that contracts as follows were awarder by the State Roads Commissioners from bids received on Feb. 27: McGUIRE & CO., Norfolk, Va., three contracts, THE ELDER PAVING CO., Baltimore, one contract, CAROZZA & LAREZZA, Baltimore, one, THE JUNIATA PAVING CO., Philadelphia, one, ALLEN ENGINEERING CO., Netcong, N. J., one, ALLEN & BOYLE, Baltimore, one. The total amount of the contracts is $242,326. Wm. L. Marcy is Secy. Noted Feb. 20.

Washington, D. C.—Bids will be received until 2 p.m., Mar. 25, by Commissioners of the District of Columbia for making repairs to asphalt pavements for a period of two

years, ending June 30, 1915. C. H. Rudolph is Chn. of the Comrs.

★**Wheeling, W. Va.**—Bids will be received until 9 a.m., Mar. 27, by the Board of Control, for improving various streets by curbing with stone or concrete and paving with brick and sheet asphalt or bitulithic on concrete foundation. C. B. Cooke is City Engr.

Archbold, Ohio—Bids will be received until Mar. 22, by the Village Council for 9000 sq.yd. brick paving, estimated to cost $19,000. J. H. Fagley is Village Clk.

Cambridge, Ohio—We are officially advised that bids will be received until noon, Mar. 20, by the Director of Public Service, for about 6070 sq.yd. of street paving. Street improvements, aggregating about $125,000, are planned for this year. Karl M. Cosgrove is City Engr.

✚**Canton, Ohio**—We are officially advised that the Commissioners of Stark County have awarded a contract to URBAN & CLEMENTS, Massillon, Ohio, at $72,351 for paving with brick about four miles of the Massillon-Wooster Pike. Other bidders were: Wm. H. Vogt & Sons, $74,076, Philip Dieffenbacher & Sons, $78,723. O. W. Hall is County Engr. J. H. McConnell is Audr. Noted Feb. 21.

✚A contract has been awarded by the Commissioners of Stark County to JOHN WILSON, Alliance, Ohio, at $17,439, for paving about 6900 lin.ft. of the Ely St. extension road. Other bidders were: Thomas C. Devine and R. J. Hahn. Noted Feb. 20.

Chagrin Falls, Ohio—Bids will be received until noon, Apr. 3, by the Village Council for grading, draining curbing and paving Front and Bell Sts. from Main St. to Russell Road. H. B. Pugsley is Village Clk. The Wm. H. Evers Engineering Co., 332 The Arcade, Cleveland, Ohio, is Engr.-in-Charge.

Cheviot, Ohio—Bids will be received until noon, Mar. 19, by the Village Council for improving Francis and Lora Aves., and Center St. Jacob Krollman, Jr., is Village Clk.

Cleveland, Ohio—Bids will be received until noon, Mar. 18 by the Director of Public Service for furnishing creosoted wood paving blocks and planking. W. J. Springborn is Dir. W. H. Kirby is Secy.

Columbus, Ohio—Bids will be received until noon, Mar. 18 by the Director of Public Service for furnishing and delivering materials for street construction and repair work during 1913. The approximate quantities are; 2100 tons asphalt sand, 375 tons refined asphalt, 225 tons limestone dust, 15,000 gallons asphalt flux, 800 cu.yd. stone for binder, 100,000 paving brick, 300 tons stone block, 300 tons paving pitch, 1500 cu.yd. sand, 9555 tons macadam, 20,000 gallons plutrin, or equal, 50,000 gallons asphalt road oil, 10 manhole castings, complete, open lid; 10 manhole castings, complete, closed lid; 80 manhole ground rim castings; 80 manhole lids, open; 50 manhole lids, closed; 10 catch basins, complete, No. 1; 10 catch basins, complete, No. 2; 40 catch basin ground rims, 40 catch basin top rims, No. 1; 50 catch basin top rims, No. 2; 30 catch basin lids. S. A. Kinnear is Dir.

Bids will be received until 2 p.m., Mar. 21, by the State Highway Commisioner for road improvements as follows: For grading and paving with waterbound macadam, 1.23 miles of the Turnpike No. 3 Road, Upper Township, Lawrence County, at an estimated cost of $12,112; for grading and paving with waterbound macadam 1.87 miles of Section 1, the Tiffin Road, Richmond Township, Huron County, at an estimated cost of $14,402; for grading and paving with brick 1.93 miles of the Akron-Canton Road, Springfield Township, Summit County, at an estimated cost of $32,204; for grading and paving with waterbound macadam 2.21 miles of the Galion Road, Sandusky Township, Richland County, at an estimated cost of $9753; for grading and paving with bituminous concrete, 1.116 miles of the Scotland Station-Derby Road, Chester Township, Geauga County, at an estimated cost of $10,966; for grading and paving with waterbound macadam 1.24 miles of the Port Clinton & Locust Point Road, Erie Township, Ottawa County, at an estimated cost of $7009; for grading and paving with waterbound macadam, the Bucyrus Mansfield Road, Jefferson Township, Crawford County, for a distance of 1.17 miles at an estimated cost of $7480; for grading and paving with bituminous concrete one mile of the Circleville and London Road, Darby Township, Pickaway County, at an estimated cost of $9918; for grading and paving with waterbound macadam 2.01 miles of the Angola-Madison Township Road, Williams County, at an estimated cost of $16,677; for grading and paving with waterbound macadam 0.90 miles of the Bell Road, Erie Township, Ottawa County, at an estimated cost of $4620.

Bids will be received until 2 p.m., Mar. 31, for grading and paving with waterbound macadam 1.92 miles of the Beatty Road, Cardington Township, Morrow County, at an estimated cost of $14,315, and for grading and paving with brick 0.80 miles of the Woodsfield Northern Road, Center Township, Monroe County, at an estimated cost of $15,866.

Bids will be received until Mar. 21, by the State Highway Commissioner, for grading and paving with water-bound macadam one mile of the Delta and Swanton Road, at an estimated cost of $6292. James R. Marker is Comr.

Bids will be received until Mar. 26, by the Director of Public Service, for the improvement of various streets and alleys. Paul B. Kemper is Clk.

East Youngstown, Ohio—Bids will be received until noon, Mar. 21 by the Village Council for improving portions of the following streets: Robinson Road, Fifth, Sixth, Seventh, Eighth, Ninth, 10th and 13th Sts., Reed, Wilson and Murray Aves. F. J. Carney is Village Clk.

Geneva, Ohio—Bids will be received until noon, Mar. 25, by the Village Council for improvement of Walnut St from South Broadway to Sherman St by grading, draining curbing and paving with brick. W. E. Morgan is Village Clk.

Medina, Ohio—Bids will be received until 10 a.m., Mar. 26, by Commissioners of Medina County, for grading and paving with brick 0.74 mile of the Wadsworth-Wooster Road, Wadsworth Township, Medina County, at an estimated cost of $8761, and for grading and paving with waterbound macadam 0.98 mile of the Medina Wooster Road, Montville Township, Medina County, at an estimated cost of $5673. James R. Marker is Highway Comr.

Minston, Ohio—Bids will be received until noon, Mar. 19, by the Village Clerk, for the improvement of Main St., from Seventh to First Sts., and Fourth St., from Main to North Sts., by grading, draining, curbing, paving and constructing sewers. Louis R. Schmieder is Village Clk.

✚**New Concord, Ohio**—A contract has been awarded by the City Council to HOUSTON & HENDERSON, Logan, Ohio, at $30,997 for paving Main, St. with vitrified brick. Other bidders were: Hoard & Hoard, Leesville, Ky., Adams Bros. Contracting Co., McElfresh & Danford, Emery & Son, Zanesville, Ohio. Noted Feb. 27.

Ravenna, Ohio—Bids will be received until noon, Mar. 31, by the Director of Public Service for the improvement of Cleveland Ave. and North Chestnut St. from the Erie R.R. tracks to the north corporation line. The work includes 10,210 sq.yd. of paving, 6865 lin.ft. curbing, 4500 sq.ft. sidewalks relaid, 4000 cu.yd. excavation, catch basins, manholes, etc. W. H. Linton is Dir. Noted Jan. 23.

Sandusky, Ohio—Bids will be received until noon, Mar. 18, by the Director of Public Service for paving portions of Central Ave. and First St. John Bing is Dir., Edward W. Rhode is Clk.

Shaker Heights, Ohio—Bids will be received until noon, Mar. 31, by the Village Clerk for the improvement of Coventry Road by grading, draining, curbing, paving with asphalt block or vitrified brick, and constructing sidewalks. Carl A. Palmer is Clk.

Youngstown, Ohio—Bids will be received until noon, Mar. 14, by the Director of Public Service, for paving Ridge Ave., from Market St. to Oak Hill Ave. W. H. McMillin is Clk.

Indiana—Bids for road improvements in Indiana will be received as follows:

Mar. 21, at Spencer, by Commissioners of Owen County, for construction of a road in Wayne Township. George W. Stwalley is Audr.

Mar. 27, at Bluffton, by Commissioners of Wells County, for construction of two macadam and two stone roads in Harrison Township; a stone road in Rock Creek Township; and a gravel road on the line between Harrison and Liberty Townships. L. A. Williamson is Audr.

Apr. 7, at Greencastle, by Commissioners of Putnam County, for a macadam road in Greencastle Township. C. L. Airhart is Audr.

Apr. 7, at Jeffersonville, by Commissioners of Clark County, for construction of two gravel roads. Geo. W. Stoner is Audr.

Apr. 7, at Newport, by Commissioners of Vermillion for construction of gravel roads in Helt and Eugene Townships. Roy Slater is Audr.

Apr. 7, at Kentland, by Commissioners of Newton County, for construction of six gravel roads. S. R. Sizelove is Audr.

Apr. 7, at Salem, by Commissioners of Washington County, for gravel roads in Polk and Washington Townships. F. S. Munkelt is Audr.

Apr. 7, at Rockfort, by Commissioners of Spencer County, for construction of a gravel road. John T. Stevenson is Audr.

Apr. 8, at Logansport, by Commissioners of Cass County, for construction of a stone road in Eel Township. J. E. Wallace is Audr.

Apr. 8, at Decatur, by Commissioners of Adams County, for construction of macadamized roads in Washington, St. Mary's, Blue Creek and Monroe Townships. Thomas Baltzell is Audr.

Apr. 8, at Delphi, by Commisioners of Carroll County, for construction of gravel roads in Monroe and Tippecanoe Townships. M. G. Haun is Audr.

Apr. 8, at Marion, by Commissioners of Grant County, for a stone road in Center Township. E. H. Kimball is Audr.

Apr. 8, at Vincennes, by Commissioners of Knox County, for construction of six gravel roads. John T. Scott is Audr.

✚**Crown Point, Ind.**—We are officially advised that the Commissioners of Lake County have awarded contracts to MILTON D. HEINY, Gary, Ind., at $48,500, for construction of the W. G. Wright Road, Calumet Township, and to ANDRIAN L. COURTRIGHT, Crown Point, at $56,500, for the John C. Becker Road. Noted Feb. 27.

Indianapolis, Ind.—Resolutions have been adopted by the Board of Public Works authorizing the improvement of various streets at an estimated cost of $115,000. Henry W. Klausmann is City Engr.

✚The Commissioners of Marion County have awarded a contract to J. D. REASON, Pendleton, Ind., at $16,987, for construction of the National Road.

Michigan City, Ind.—The Board of Public Works has declared it necessary to pave portions of Tennessee, Center and Tremont Sts., and Hermitage Ave., at an estimated cost of $29,100. Harry M. Miles is City Engr.

✚**Rushville, Ind.**—The Commisioners of Rush County have awarded a contract to DEGOLYER & CO., Seymour, Ind., at $40,884, for brick paving; to WALKER & McMAHIN, Fortville, Ind., at $12,793, for the Bruce Graham gravel road. Allen R. Holden is Audr.

★**Des Plaines, Ill.**—Bids will be received until 3:70 p.m., Mar. 12, by the Village Board for construction of 24,000 sq.yd. asphaltic concrete pavement and 20,000 lin.ft. concrete curb and gutter. William Wicke is Secy. of the Bd. H. L. Emerson, 1115 Chamber of Commerce Bldg., Chicago, is Engr.-in-Charge.

Moline, Ill.—Plans and estimates are being prepared for construction of about 45 blocks of concrete sidewalks. H. G. Paddock is City Engr.

✚**Rock Island, Ill.**—A contract has been awarded by the Board of Local Improvements to the INDEPENDENT CONSTRUCTION CO., Davenport, Iowa, at $2 per sq.yd. for paving Third Ave., from 15th to 24th Sts., with brick. Other bidders were: McCarthy Improvement Co. and the Tri-City Construction Co.

West Allis, Wis.—The city will pave about four miles of streets the coming summer, including 51st Ave., for a distance

of 1½ miles, and five blocks each on 63d, 65th, 71st, 72d and 73d Aves. The Mayor may be addressed.

Clarence, Iowa—We are officially advised that bids will be received until 8 p.m., Apr. 8, by the Town Council, for 7500 sq.yd. of concrete paving. Scott McNeil is Town Clk. The Iowa Engineering Co., Clinton, Iowa, is Engr. in Charge.

Mount Vernon, Iowa—We are officially advised that bids will be received until 2 p.m., Mar. 25, by the City Council for one mile of street paving. Bids will be taken on brick, creosoted wood block, asphalt, asphaltic concrete, plain concrete and bituminous coated concrete. Wm. E. Gamble is Town Clk.

Crookston, Minn.—The City Council has asked bids for the the construction of five blocks of Dolarway paving on Broadway, and one block on Seventh St. The estimated cost is $15,000.

Duluth, Minn.—The City Council has declared it necessary to improve West Fifth St. from 38th to 43d Sts., by graveling the roadway and constructing concrete curb and gutter. The estimated cost is $12,175. C. S. Palmer is City Clk.

McPherson, Kan.—We are officially advised that bids will be received until Apr. 9 by the City Clerk for the improvement of East Euclid St. The work includes excavation, drains, curb and gutter and brick and asphaltic concrete pavement. Milton Hawkinson is Clk. H. A. Rowland is City Engr. Noted Feb. 20.

Joplin, Mo.—The Park Board plans to spend about $175,000 in improving the city's parks and boulevard system during 1913.

✦Abilene, Tex.—We are officially advised that the City Commissioners have awarded a contract to E. M. EBY, Wichita, Kan., at 74c. a sq.yd. for approximately 75,000 sq.yd. of asphalt macadam paving. Other bidders were: A. O. Doyer, Sweetwater, Tex., 88½c., Roy McDonald, Austin, Tex., 79c., Monack & Barnet, Abilene, Tex., 79c., Municipal Paving Co., Dallas, Tex., 86c., J. A. Gregory, Dallas, Tex., 82c., General Construction Co., Fort Worth, 88c., Peerless Construction Co., Sweetwater, 88c., Moore & Smith, Abilene 84c. H. J. Bradshaw is City Engr. Noted Feb. 20.

Marshall, Tex.—The City Commissioners have decided to pave East Austin St., for a distance of about eight blocks. The estimated cost is $125,000. H. S. Rice is City Secy.

Bisbee, Ariz.—Bids are being received by the City Council for the construction of brick pavement on Subway St. at an estimated cost of $40,000.

North Bend, Wash.—Plans are being prepared by the City Engineer for paving the streets of the business district, at an estimated cost of $250,000.

Waterville, Wash.—Bids will be received until 2 p.m., Mar. 21, by the Directors of Local Improvement District No. 2, Douglas County, for grading and surfacing with waterbound macadam about 4½ miles of road. O. V. Sellers, C. J. Olson and F. B. Taylor are Dir.

The Dalles, Ore.—We are officially advised that the date of receiving bids for about 30,000 sq.yd. of street paving has been changed from Mar. 11 to Mar. 25. Bids will be accepted on various kinds of standard pavement. C. L. White is City Engr. Noted Feb. 20.

Chula Vista, Calif.—This city plans to spend $40,000 in improving streets.

✦El Centro, Calif.—A contract has been awarded to the BARBER ASPHALT PAVING CO., Los Angeles, at approximately $100,000 for construction of about two miles of street paving. Noted Feb. 27.

✦Fullerton, Calif.—We are officially advised that a contract has been awarded by the Board of Trustees to FRED OSBURN, Fresno, Calif., at $121,200, for improving Whittier and Spadra Roads, Chapman and Commonwealth Aves. Other bidders were: The Los Angeles Paving Co., Rogers Bros., the Barber Asphalt Paving Co., Bent and Pennebaker. C. A. Giles is City Clk. W. J. Renshaw is City Engr. Noted Feb. 20.

Los Angeles, Calif.—Bids will be received until 2 p.m., Mar. 17, by the Board of Supervisors for improving a portion of the San Gabriel Mission Road. The approximate quantities are: 1850 cu.yd. excavation, 8150 lin.ft. shaping roadbed, 5650 tons oil macadam, 5.3 cu.yd. concrete, 219-ft. 18-in. reinforced concrete pipe. A. M. McPherson is Deputy Clk.

✦A contract was awarded to T. E. SHAFER at $93,133 for improving portions of Alvarado and other streets.

Santa Barbara, Calif.—The City Engineer has completed plans for a boulevard running through the city along State and Haley Sts. The estimated cost is $157,363.

San Bernardino, Calif.—Plans are being made for the construction of 21 blocks of macadam paving on Sixth, Seventh and B. Sts.

✦Watts, Calif.—E. A. BAKER, I. W. Hellman Bldg., Los Angeles, was awarded the contract for improving Edwards and Christian Sts., and Pacific Drive by grading, oiling and constructing curbs.

INDUSTRIAL WORKS

Hartland, Maine—H. C. Baxter & Bro., who own several corn-canning plants in Maine, plan the construction of a new plant at Hartland. The main building will be 40x180 ft.

✦Chicopee Falls, Mass.—A general contract has been awarded to FRED T. LEY & CO., Springfield, Mass., for a group of buildings at the plant of the Fiske Rubber Co. One will be 90x202 ft., two stories, of brick and steel, with wood floors, another 90x242 ft., three stories, with reinforced concrete floors, a cement house 20x115 ft., one story and a blacksmith shop 24x32 ft., both of brick with concrete floors and roofs, and metal windows. The BERLIN CONSTRUCTION CO., Berlin, Conn., will furnish the steel work and the CAREY ROOFING CO., Springfield, Mass., will do the roofing.

✦Greenfield, Mass.—The contract for the erection of a machine shop for the Goodall & Pratt Co. has been awarded to the WILLIAM F. KEARNS CO., Albany St., Cambridge. It will be of brick and reinforced concrete, three stories, 85x119 ft., to cost $50,000.

Medford, Mass.—A four-story brick factory 100x100 ft. will be built at Hancock St. and Mystic Ave. by the Oliver Wythe Co., Inc., 41 Cornhill, Boston, for the manufacture of brass and steel work. Oliver Wythe is Pres.

Providence, R. I.—The Rhode Island Co., Providence, is having plans drawn by its engineer, for additions and improvements, which, when completed, will cost about $750,000. One addition will be 35x160 ft. for new electrical apparatus, and another addition will be 72x150 ft., for two new turbines. The plans also call for a new steel stack to be erected near the turbine house.

✦Pinnisville, Conn.—Contracts for the factory buildings of the Blakeslee Forging Co. have been awarded as follows: General contract, to the B. H. HIBBARD CO., 140 Main St., New Britain, Conn., concrete floors and roofs, GARDINER G. RIGGS, Waterbury, Conn., outside fireproofing, the H. W. JOHNS-MANVILLE CO., New York, tile roofs, the AMERICAN CEMENT TILE ROOF CO., of New York; steel work, JAMES E. FARMES, New Haven, Conn. A. E. Greene, Hartford, Conn., is Engr.

Stamford, Conn.—The Yale & Towne Mfg. Co., contemplates two additions to its plant. One building will be 245x296 ft. one and three stories, and the other 50x200 ft. six stories, both of brick and steel construction, fireproof, with elevators. A. J. Horne, Supt., is taking bids.

Waterbury, Conn.—Plans are being completed for a new factory to be erected at Platts Mills for the Bristol Co. It will be a three-story brick building, 52x160 ft. Griggs & Hunt, Waterbury, are Archs.

Batavia, N. Y.—Additional property, adjoining its present plant, has been secured by the Batavia Preserving Co. Upon this the company contemplates the construction of several new buildings, two of which will be four stories high.

Brooklyn, N. Y.—Plans have been completed by Dodge & Morrison, Archs., 135 Front St., Manhattan, for a five-story brick and steel bakery, 120x80 ft., to be erected at Clinton and Waverly Aves., by the Drake Bros. Co., 1006 Wallabout Market. The estimated cost is $100,000.

The Standard Oil Co., 26 Broadway, New York, has filed plans for 13 one-story brick factories on the east side of Charlick St., north of Front St. The estimated cost is $56,000.

Jamestown, N. Y.—The manufacturing plant of Setter Bros., at Cattaraugus, is to be moved to Jamestown, where a plant will be built and equipped for the manufacture of furniture veneers.

Malone, N. Y.—The Thomas Hinds Foundry is having plans prepared for the construction of its plant which was recently destroyed by fire. A foundry, a machine shop and pattern buildings will be erected.

New York, N. Y.—A. G. Zimmerman, Arch., 11 East 24th St., has completed plans for the construction of a new bakery for the National Biscuit Co. The building will be 12 stories, with a ground area of 47,338 ft., and is estimated to cost from $1,000,000 to $1,500,000. It will be built at 15th and 16th Sts., Tenth Ave. and the Hudson River.

Niagara Falls, N. Y.—Plans have been prepared for the construction of an addition to the plant of the Norton Emery Wheel Co., on Buffalo Ave. The addition will be of reinforced-concrete construction, and will cost $50,000.

North Tonawanda, N. Y.—The Buffalo Steam Pump Co. has purchased property adjoining its present plant and is having plans prepared for additional factory buildings, three and four stories high.

✦Bayonne, N. J.—We are officially advised that the Vacuum Oil Co. has awarded a contract to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for the construction of five reinforced-concrete structures at its plant. A boiler house, railroad trestle, tanks, retaining walls and fire walls will be erected.

Newark, N. J.—We are officially advised that bids are now being received by John T. Simpson, Consult. Engr., Essex Bldg., for the construction of a new building for the Williams Baking Co. It will be two stories high. The estimated cost is $75,000.

Parkersburg, W. Va.—D. B. Crawford, of the Parkersburg Rig & Reel Co. has purchased a site on the main line of the Baltimore & Ohio R.R. upon which he plans to erect a factory to manufacture oil-well drilling machines and supplies. The company will be a new organization, not connected with the Parkersburg Rig & Reel Co.

Washington, N. C.—The Washington Buggy Co. has secured a site adjoining its present plant on West Third St., and will erect an addition to double its output. The new building will be three stories, 435x100 ft. George Hackney, Jr., is Pres.

✦Boyles, Ala.—A contract has been awarded to the F. W. MARK CONSTRUCTION CO. at approximately $100,000 for the erection of a plant for the National Cast Iron Pipe Co. The buildings include a foundry 480x66 ft., machine and pattern shop 210x66 ft., two cleaning sheds, 30x252 ft. and 30x126 ft. respectively. A. H. Ford is Pres. E. E. Linthicum is Gen. Mgr.

Mobile, Ala.—A company has been organized in Mobile to establish a factory for the manufacture of a patented device to register street-car fares. Paul P. Locking, H. H. Hess and John F. Durham are among those interested.

Algiers, La.—The Johnson Iron Works recently closed its plant in New Orleans, having sold its site to the Illinois Central R.R. for a freight terminal. It is now negotiating with the Algiers Improvement Association for the establishment of a foundry at Algiers. Joseph W. Lennox is Pres.

Lewisburg, Tenn.—The Lewisburg Foundry Co. will receive bids before Apr. 1 for the erection of a foundry 70x150 ft. and a factory of mill construction, 50x250 ft. The com-

pany will manufacture cook stoves, cast iron and steel ranges and heaters. S. T. Hardison is Pres. Noted Feb. 20.

Cincinnati, Ohio—The Ohio Knife Co., Cincinnati, has filed application for a building permit to erect a manufacturing plant at Dreman St., near the C. H. & D. track, to cost $30,000. It will be 117x360 ft., one story. Bert Baldwin & Co. are Archs.

Application for a permit has been made by the Brunswick-Balke-Collender Co. for permission to erect a one-story brick factory on Mitchell Ave., Cincinnati. Estimated cost, about $52,000.

The Victor Lamp Co., Colerain and Sassafras Aves., Cincinnati, will double the size of its plant. A four-story building will be erected. Martin Fisher is Arch.

George Helmer, Cincinnati, will establish a woodworking plant on Cavanaugh Ave., near Lexington Ave. Max Kau is Arch.

Niles, Ohio—The Knox Pressed & Welded Steel Co., Niles, will rebuild its plant recently destroyed by fire.

Toledo, Ohio—The Sterling Cork & Seal Co., Toledo, is planning the erection of a new plant at Oakwood Ave. and Hawthorne St.

Hammond, Ind.—The H. W. Johns-Manville Co. has secured a site of 125 acres at Riverdale, six miles west of Hammond. The company will erect a plant to cost several million dollars.

Indianapolis, Ind.—The Fairbanks-Morse Electrical Mfg. Co., Indianapolis, has submitted plans to the Building Inspector for a one-story factory, 81x120 ft., at Northwestern Ave. and 21st St.

Indianapolis, Ind.—S. A. Tescher and G. W. Watkins, Indianapolis, are planning the establishment of several iron-working concerns on the Ohio River between Jeffersonville and New Albany, Ind. Commercial organizations of those two cities and Louisville, Ky., are interested in the project.

Laporte, Ind.—The Rumeley Co., Laporte, will award contracts for the construction of its proposed plant as soon as plans have been completed.

Liberty, Ind.—The Rude Mfg. Co., Liberty, has increased its capital stock to $300,000, and will enlarge the capacity of its plant, which makes grain drills and manure spreaders. S. B. Rude is Pres.

Chicago, Ill.—The Century Rubber Works, Chicago, will erect a two-story factory, 125x90 ft., of brick, at 1346 Ransom St.

Glenn, Ill.—The Chicago & Alton R.R. is planning to construct a 30-stall roundhouse at Glenn. J. H. Leyonmarck, Bloomington, Ill., is Mech. Engr.

Peoria, Ill.—W. H. Rehfuss, Peoria, Ill., will erect a candy factory and bakery at Peoria. The building will be occupied by J. C. Gimelich, and will be two stories, 40x50 ft.

Altoona, Wis.—Improvements, including a 36-stall roundhouse, it is reported, are contemplated by the Chicago, St. Paul, Minneapolis & Omaha Ry., A. G. Rask, Spooner, Wis., Supt. of Bldgs., road to cost $150,000.

Manitowoc, Wis.—The Aluminum Goods Mfg. Co. has had plans prepared by C. H. Tegen, Arch., for an addition to its plant on 15th St. It will be 200x50 ft. Cost, $40,000.

Milton, Wis.—A factory, to manufacture Burdick electric bath cabinets and other medical, sanitary and hygienic equipment, is contemplated between here and Milton Junction, by the Burdick Cabinet Co. This concern has just been incorporated with $150,000 capital stock, by Paul M. Green, B. H. Wells and others of Milton and Milton Junction.

Milwaukee, Wis.—The Harah-Edmonds Shoe Co., Maple and Hanover Sts., Milwaukee, has submitted plans for the construction of an addition, to cost $100,000. T. J. Esser, Milwaukee is Arch.

Clinton Iowa—The Chicago & Northwestern Ry. has announced plans for the construction of new repair shops at Clinton. The estimated cost is $500,0000.

Libby, Mont.—The Libby Steam Laundry Co., Libby, will erect a steam laundry plant to replace the one recently destroyed by fire.

Mission, Tex.—The Almalgamated Sugar Co., Ogden, Utah, plans to erect a large combined sugar-beet and sugar-cane factory at Mission, near San Benito, Tex. The estimated cost is $500,000

San Benito, Tex.—F. Augustus Heinze is considering the installation of a sugar-beet manufacturing department at his large sugar mill at San Benito.

Harrison, Idaho—The Harrison Box Co., Harrison, recently incorporated with a capital of $20,000, will erect a plant for the manufacture of boxes.

Lewiston, Idaho—The Green Lumber Fir Co., Lewiston, has taken out a permit to erect a furniture factory on Topaz Ave.

Las Vegas, Nev. Carl Leonardt, Los Angeles, Calif., has purchased what is known as the "Bishop" gypsum property, about six miles from Las Vegas, and will erect a large plaster plant, estimated to cost $100,000.

Junction City, Wash.—The Standard Oil Co., Junction City, plans to make extensive additions to its plant.

Sequim, Wash. The Swiss American Milk & Chocolate Co. plans to erect a large condensing plant, to cost about $80,000. Fred Frank and James C. Langley are interested.

Spokane, Wash. Charles E. Parks, Spokane, Wash., Western representative of the American Sign Co., states that the company will erect a plant at Spokane, for the manufacture of electric signs.

Tacoma, Wash. Robert M. Jarvis and associates, Tacoma, have purchased the mill of the Raze Lumber Co. located on the tide flats, Tacoma, and will expend about $15,000 in making additions and improvements.

Sacramento, Calif. The City will hold a special election Apr. 5, to vote bonds for $40,000 for the establishment of a municipal ice plant. E. M. Wilder, Commissioner of Public Works, is in charge.

FEDERAL GOVERNMENT WORK

Crane—Portsmouth, N. H.—Bids were received as follows, Mar. 8, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for one 20-ton, four-motor electric traveling crane, for the Portsmouth, N. H., Navy Yard: Manning, Maxwell & Moore, New York, $6949; Whiting Foundry & Equipment Co., Chicago, Ill., $6780; Niles-Bement-Pond Co., 111 Broadway, New York, $6350.

★**Seawall**—Fort Andrews, Mass.—Bids will be received until 11 a.m., Apr. 4, by the Constructing Quartermaster, U. S. A., for construction of a concrete sea wall at Fort Andrews, Mass. Full information furnished on application. Plans and specifications can also be seen at office of Chief Quartermaster, Eastern Dept., Governor's Island, N. Y. Harbor. Lt.-Col. George B. Davis, U. S. A., is Const. Quartermaster, Boston, Mass.

✚**Post Office**—Rochester, N. Y.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Rochester, N. Y., to the INTERURBAN-GENERAL CONSTRUCTION CO., New York City, at $68,288.

✚**Post Office**—Bristol, Penn.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Bristol, to MATTHEWS CONSTRUCTION CO., Princeton, N. J., at $60,336.

Dredging—Philadelphia, Penn.—Bids will be received until noon, Mar. 24, by Lieut.-Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Philadelphia for dredging a channel to the wharf at Fort Mott, N. J.

Shell—Washington, D. C.—Bids will be received until noon, Mar. 11, by William Crozier, Ch. of Ordnance, War Department, Washington, for furnishing 500 six-inch shell, Model 1907.

✚**Armor**—Washington, D. C.—The contract for furnishing armor for the new battleship "Pennsylvania," bids opened Feb. 18, has been awarded as follows: CARNEGIE STEEL CO., Philadelphia, for 2683 tons; MIDVALE STEEL CO., Philadelphia, for 2666 tons; BETHLEHEM STEEL CO., South Bethlehem, 2723 tons.

★**Jetty Work**—Washington, D. C.—Bids will be received until noon, Apr. 7, by Lieut.-Col. W. C. Langfitt, Corps Engrs., U. S. A., Washington, for repairing and extending jetties in Urbanna Creek and Milford Haven, Va.

Post Office—Grafton, W. Va.—Bids were received as follows, Mar. 6, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Grafton, W. Va.; (a) limestone, (b) sandstone, William H. Fissell & Co., New York, (a) $115,000; (b) $117,340. J. E. & A. L. Pennock, Philadelphia, (a) $118,840; (b) $122,900. Conners Bros. Co., Gowell, Mass., (a) $120,543; (b) $123,409. C. M. Leach, Boston, Mass., (a) $124,873; (b) $128,873. Wise Granite Co., Richmond, Va., (a) $127,660; (b) $134,000. Wells Construction Co., Philadelphia, Penn., (a) $129,000; (b) $133,000. John G. Unkefer & Co., Minerva, Ohio, (a) $130,200; (b) $132,800. M. Yeager & Co., Danville, Ill., (a) $132,740; (b) $136,240. James Devault, Canton, Ohio, (a) $133,000; (b) $136,000. Peter Gross-Gerai Construction Co., New York, (a) $134,562; (b) $136,682. Olin Gerlach, Frostburg, Md., (a) $134,960; (b) $139,500.

★**Cement**—Wilmington, N. C.—Bids will be received until noon, Apr. 5, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for furnishing and delivering portland cement.

✚**Pipe Towers**—Charleston, S. C.—The contract has been awarded to JOSEPH SEAY & CO., for constructing 22 reinforced concrete substructures and the erection of pipe towers on them, Cape Fear River, N. C., at $10,800. The other bidders were: L. H. Skinner, $15,950; A. J. Robbins, $17,400; Raymond Concrete Pile Co., $31,105.

Post Office—Augusta, Ga.—Bids were received as follows, Mar. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Augusta, Ga.: (a) limestone (b) sandstone. J. E. & A. L. Pennock, Philadelphia, (a) $242,800; (b) $249,400. Wells Construction Co., Philadelphia, (a) $244,000; (b) $250,000. William H. Fissell &Co., New York, (a) $247,700; (b) $262,000. Wise Granite Co., Richmond, Va., (a) $248,700; (b) $266,700. George W. Stiles Construction Co., Chicago, (a) $255,466. Charles McCaul Co., Philadelphia, (a) $258,522; (b) $276,522. Interstate Construction Co., Ltd., Saginaw, Mich., (a) $259,760; (b) $268,500. King Lumber Co., Charlottesville, Va., (a) $268,700; (b) $274,700. Hiram Lloyd Building & Construction Co., St. Louis, (a) $269,977; (b) $279,977. James Devault, Canton, Ohio, (a) $270,000. George Becking, Chattanooga, Tenn., (a) $279,987. Algernon Blair, Montgomery, Ala., (a) $274,500; (b) $284,000. Henry E. Baton, Philadelphia, (a) $279,000. Conners Bros. Co., Lowell, Mass., (a) $279,724. Miles & Bradt, Atlanta, Ga., (a) $293,000; (b) $305,000.

★**Retaining Wall, Etc.**—Fort Barrancas, Fla.—Bids will be received by the Constructing Quartermaster until noon, Mar. 31, for constructing a retaining wall, sidewalks and a macadam road.

Dredge Machinery—New Orleans, La.—Bids will be received until 11 a.m., Mar. 20, by the U. S. Engineer, New Orleans, for dredge machinery.

Earthwork—New Orleans, La.—Bids will be received until 11 a.m., Mar. 21, by Capt. C. O. Sherrill, Corps Engr., U. S. A., New Orleans, for about 210,000 cu.yd. of earthwork in Lower Tensas and Lafourche Levee Districts.

Lock and Dam—Louisville, Ky.—Bids will be received until 11 a.m., Apr. 19, by the U. S. Engineer, Louisville, for the construction of Lock and Dam No. 45, Ohio River, near New Amsterdam, Ind.

Post Office—Grand Junction, Colo.—Bids were received as follows, Mar. 5, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Grand Junction, Colo.: (a) limestone, (b) sandstone.

William H. Maxwell, Phoenix, Ariz., (a) $98,738. J. H. Wiese, Omaha, Neb., (a) $104,335. Hiram Lloyd Building & Construction Co., St. Louis, (a) $121,839; (b) $123,839. John J. Lumsden, Grand Junction, Colo., (a) $125,670; (b) same. Dieter & Wenzel Construction Co., Wichita, Kan., (a) $132,500; (b) $131,800. Campbell Building Co., Salt Lake City, Utah, (b) $118,700.

★Transformers and Motor—Fort Bayard, N. M.—Bids will be received by the Quartermaster until 6 p.m., Apr. 4, for furnishing and delivering three transformers and one motor.

Steel Work—Panama—Bids were received as follows, Mar. 6, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing the structural steel work for the Administration Building at Ancon: Belmont Iron Works, Philadelphia, Penn., 2,700,000 lb. at 4.65c.; $125,500; Riter-Conley Mfg. Co., Pittsburgh, Penn., 2,487,000 lb., at 3.845c.; $95,625; UNITED STATES STEEL PRODUCTS CO., New York (for American Bridge Co.), 2,500,000 lb., at 3.94c.; $98,500 (awarded contract).

Locomotives—Hawaii—Bids were received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for switching locomotives at the naval station, Pearl Harbor, H. T.: Item (1) for three locomotives, complete; (2) on bidder's specifications; (3) on six locomotives, five for standard-gage track and one for narrow-gage track: Vulcan Iron Works, Wilkes-Barre, Penn., (3) $37,700; alternate bid, if no supervising mechanic is required, $36,500; Baldwin Locomotive Works, Philadelphia, Penn., (3) one narrow-gage locomotive, $5050; one or six standard-gage locomotives, $6650 each; if one locomotive is desired and erected by government, deduct $350; if six locomotives are desired and erected by government, deduct $50 each; H. K. Porter Co., Pittsburgh, Penn., (3) $36,650; Davenport Locomotive Works, Davenport, Iowa, (2) $23,205; deduct $1500 for assembling, testing, etc.; (3) $48,810, deduct $1900 for assembling, testing, etc.

MISCELLANEOUS

Harbor Development—Boston, Mass.—H. V. Macksey, Engr., who has been employed by the Port Directors to make plans for harbor development of East Boston, has submitted complete plans for the entire project, which will be the basis of work for many years and which will require $100,000,000 to complete. Hugh Bancroft is Chn. of Bd.

★Tunnel—Boston, Mass.—Bids will be received until Mar. 25, by the Transit Commission for constructing Sect. B of the Dorchester Tunnel in Summer St., 500 lin.ft. E. E. Davis, 15 Beacon St., is Ch. Engr.

Bulkhead and Filling—Boston, Mass.—The Directors of the Port have commissioned F. W. Hodgdon, Ch. Engr., to prepare to ask bids for the construction of a wooden bulkhead and filling in 50 acres of land off Maverick St., East Boston. This is in connection with the proposed East Boston harbor developments.

Fire Station—Hartford, Conn.—The Board of Fire Commissioners has made recommendation to the City Council that an appropriation of $200,000 be made for a central fire station and repair shop at 197 Main St. It is planned to erect an absolutely fireproof building, about four stories high, which will provide offices for the Fire Commission and headquarters for the fire alarm telegraph system.

Metallic Cases—New York, N. Y.—Bids will be received until 11 a.m., Mar. 19, by Alfred E. Steers, Pres. Boro. Brooklyn, for installing metallic cases and fixtures and electric fixtures and electric lighting same in the Register's office, Kings County Hall of Records.

Fire Protection Work—New York, N. Y.—Bids will be received until 4 p.m., Mar. 17, by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, Park Ave. and 59th St., Boro. Manhattan, for fire protection work at Public Schools Nos. 1, 3, 6, 9, 11, 12, 18, 19, 24, 25 and 26, Boro. Richmond.

Piles—New York, N. Y.—Bids will be received until noon, Mar. 18, by Calvin Tomkins, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, for Contract No. 1365, Classes 2 and 3, for furnishing all the labor and materials required for furnishing and delivering piles.

Asphalt Binder—New York, N. Y.—We are officially advised that the following bids were received on Mar. 6, by the Department of Parks, Fifth Ave. and 64th St., for furnishing and delivering 174,000 gal. of macadam asphalt binder in tank cars, at the Long Island R.R. terminals, Boro. Brooklyn: Standard Oil Co., 26 Broadway, New York, $10,962; United States Asphalt Refining Co., 90 West St., New York, $11,745; Lun Co., Morris Bldg., Philadelphia, Penn., $13,443.

✚Stone—New York, N. Y.—The contract has been awarded to the NEW YORK TRAP ROCK CO., 17 Battery Place, New York, for furnishing and delivering 5000 tons of broken stone and screenings, in Stone District No. 1, at $8750; 13,500 tons in Stone District No. 2, at $24,570; 6500 tons in Stone District No. 3, at $13,000.

Docks—Trenton, N. J.—The City Engineering Department has completed plans for the proposed municipal docks between the plant of the American Bridge Co. and the Pennsylvania R.R. bridge, and will submit same to the Mayor for approval. The department will also prepare plans for the municipal docks planned from the bridge company plant to Riverview Cemetery.

Pier—Baltimore, Md.—The Baltimore & Ohio R.R. Co., F. L. Stuart, Ch. Engr., Baltimore and Charles St., Baltimore, contemplates the construction of a coal pier at Curtis Bay, with additional terminal facilities at Baltimore, out of the proposed bonds of $63,250,000, issuance of which is being planned.

✚Dredging—Miami, Fla.—The contract has been awarded to the TRUMBO DREDGING CO. for filling at Brickells Point, Miami. The contract requires the removal of 125,000 yd. of sand from Biscane Bay. The sand will be spread over several acres of land near the Bay.

Dredging—Tallahassee, Fla.—Bids will be received until 10 a.m., Mar. 20, by the Internal Improvement Fund for dredging. F. C. Elliot is Acting Ch. Drainage Engr.

Bath-house—New Orleans, La.—The Alhambra Baths, Inc., New Orleans, will erect a three-story bath-house, 30x150 ft., to cost $35,000. S. Stone, Jr., 714 Union St., New Orleans, is preparing plans.

Levee—Shreveport, La.—All bids opened Mar. 5, by the Board of Commissioners of Caddo Levee District, Shreveport, for bank protection work, have been rejected. W. A. Kerley is Secy.

Wharf—Nashville, Tenn.—The city is considering the construction of a municipal wharf on the Cumberland River. W. W. Southgate is City Engr.

Monument—Decatur, Ind.—The Commissioners of Adams County will receive bids at Decatur, Ind., until 10 a.m., Apr. 8, for the construction of a soldiers' monument. T. H. Baltzell is Audr.

Ditch—LaGrange, Ind.—Bids will be received until 4 p.m., Mar. 14, by Carl Mishler, Comr. Const. LaGrange, for the construction of the J. E. Baker ditch.

Levee Work—Cairo, Ill.—The city has voted in favor of issuing $100,000 of bonds to raise and strengthen its levee system. The work will start late in the spring. George F. Dewey is City Engr.

★Channel Work—Chicago, Ill.—Bids will be received until 2 p.m., Apr. 3, by the Board of Trustees of the Sanitary District of Chicago, 76 West Monroe St., Chicago, for the excavation and collateral work on Contract Sect. 10 of the Calumet-Sag Channel of the Sanitary District of Chicago, in the Township of Worth, County of Cook, State of Illinois. The approximate quantities to be used in comparison of bids are: (a) 670,000 cu.yd. of excavation of glacial drift. (b) 300,000 cu.yd. of excavation of solid rock. (c) 72,000 sq.yd. of riprap slopes. (d) 2500 lin.ft. of roadway construction. (e) 800 cu.yd. of concrete. (f) 20,000 lb. of reinforcing metal. (g) Erection of Forty-Eighth Ave. bridge (lump sum). John McGillen is Clk.

Seawall—Algoma, Wis.—The city is considering the construction of a seawall as a protection for its lake front. William T. Hobus is City Engr.

Dock—Ashland, Wis.—The Pitsburgh & Ashland Coal Co., Ashland, has decided to improve and enlarge its dock at a cost of $20,000.

Ditch—Mauston, Wis.—Bids will be received until 10 a.m., Mar. 22, by the Secretary of Cutler Drainage District, Mauston, for the construction of 11.3 miles of main ditch in the district.

✚Ditch—Des Moines, Iowa—The contract has been awarded to the WAGNER CONSTRUCTION CO., Des Moines, Iowa, for ditch work for the county, at about $10,000.

Flood Protection—Des Moines, Iowa—The city is considering the issuance of $148,000 of flood protection bonds.

Ditch—Sioux City, Iowa—All bids received, Feb. 25, by the County Commissioners for the construction of Little Sioux Drainage Ditch, have been rejected. The work involves 482,700 cu.yd. of excavation. E. E. Hosmer is County Audr.

Ditch—Buffalo, Minn.—The Commissioners of Wright County are considering the construction of a public ditch in the county through the town of Corrina and Maple Lake. John A. Berg is County Audr., Buffalo.

Ditches—Jackson, Minn.—Bids will be received until 3 p.m., Mar. 18, by P. D. McKeller, County Audr., Jackson, Minn., for the construction of judicial ditches 18, 19 and 20.

✚Ditch—Ortonville, Minn.—The contract for the construction of Ditch No. 8 has been awarded to the GADE EXCAVATING CO., Iowa Falls, Iowa, at about $10,000.

✚Concrete Piles—Kansas City, Kan.—The contract has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York, and Chicago, Ill., for placing 2047 standard Raymond concrete piles for the foundation of the new Rock Island elevator, Kansas City. The MacDonald Engineering Co., Chicago, is the general contractor.

✚Cleaning Ditch—Fremont, Neb.—The contract has been awarded to MATZEN BROS., Hooper, Neb., for cleaning Winslow Ditch, at 12.5c. a yd.

✚Lumber—Bottineau, N. D.—The contract has been awarded to the Imperial Elevator Co. for furnishing bridge lumber and piling for the county for the year 1913, at prices ranging from $27 to $31 per M.

Asphalt—Kansas City, Mo.—Bids will be received until 2 p.m., Mar. 21, by A. C. Wright, Pur. Agt., for furnishing and delivering asphaltic cement, raw asphalt, or raw asphalt and flux, f.o.b. cars on the railway switch track at the municipal asphalt plant. The asphalt is to be delivered at such times and in such quantities as the Board of Public Works may designate, or approximately 1500 tons.

Harbor Improvement—Bay City, Ore.—This city is planning to improve its harbor at a cost of $197,000.

✚Wharf, Etc.—Alameda, Calif.—The contract has been awarded to ROBERT DALZIEL CO., San Francisco, Calif., for the construction of the wharf and pipe line for the municipal electric-light works.

Mausoleums—Los Angeles, Calif.—The California Mausoleum Co. has been organized and will build mausoleums at Inglewood Cemetery and in the cemetery at Pasadena. The mausoleum at Inglewood will contain 1500 crypts. The construction will be of reinforced concrete with granite exterior facing and marble interior and tile or slate roof. N. W. Hamilton is Pres. of the company.

Poles—Los Angeles, Calif.—The following bids were received by the Board of Public Works for furnishing the city with cedar poles: Consolidated Lumber Co., $4.35 each for 230 thirty-foot poles; $7.50 each for eight 40-ft. poles. B. F. Kierluff, Jr., & Co., $4.45 each for 230 thirty-foot poles; $6.95 each for eight 40-ft. poles. L. W. Blinn Lumber Co., $4.45 each for 30-ft. poles, $7.20 each for 40-ft. poles.

✚Driving Piles—New Westminster, B. C.—The contract has been awarded to WAUGH, LISNER & BAILEY, Vancouver, B. C., for driving piles in Trent St., at $102,000.

BUILDINGS

✚Boston, Mass.—The contract for the construction of the office building at 1 Tremont Row, for the Tremont Row Realty Trust Co., has been awarded to the GEO. A. FULLER CONSTRUCTION CO., Chicago, Ill.

✚Boston, Mass.—The contract for the eight-story brick and stone office building at Milk and Kelly Sts. for the Boston Insurance Co., has been awarder to A. C. WHITNEY, 18 P. O. Sq. The estimated cost is $200,000. Peabody & Stearns are Archs., 53 State St.

✚Framingham, Mass.—The contract for the erection of two storehouses for the Carr Rubber Co. has been awarded to J. J. PRENDIVILLE CO., So. Framingham. To be of brick, one story, 60x130 ft. and two stories, 50x500 ft. J. A. Duval is Supt. Monks & Johnson, 7 Water St. are Engrs.

Malden, Mass.—Edwin D. Kaulback has purchased the site at 164 Pleasant St., upon which will be erected a mercantile block. The estimated cost is $50,000.

✚Peabody, Mass.—The contract for the Thomas Carroll school building has been awarded by the School Committee to J. J. FLYNN & SONS, Salem.

✚Springfield, Mass.—The contract for the storehouse and office building to be erected on Chestnut near Liberty St., for the Sturtevant-Merrick Co. has been awarded to the CASPER RANGER CO., of Holyoke. The building will be 700x100 ft. four stories, brick and steel. McClintock & Cray are Archs. Noted Jan. 30.

✚The McIntosh Co., has awarded the contract for the erection of a six-story business block to W. D. MACKENSIE, Springfield, at $46,000. Noted Feb. 20.

Westboro, Mass.—The Boston & Worcester St. Ry. Co. is about to erect a freight and express depot on Lyman St.

Hartford, Conn.—Plans have been drawn by Whiton & McMahon, Archs., for the new school for the Northwest District, which is to cost approximately $85,000. The district has authorized the expenditure and the legislature will be asked to authorize the district to issue bonds for $100,000, for the purpose. Henry C. Storrs is Chn. of Bldg. Com.

★Buffalo, N. Y.—A theater 86x110 ft. is to be erected at Pearl and Huron Sts. by the Shea Amusement Co. 40 Court St. for the Columbia Amusement Co. Lessee. The estimated cost is $250,000.

Elmira, N. Y.—Considine & Haskell, Archs., are receiving bids for a brick store and office building 41x100 ft. three-story and basement to be erected on Church St. by De Valley & McLeod.

Huntington (L. I.), N. Y.—An appropriation of $58,000 has been made for the construction of a school building in the Huntington Station District.

New York, N. Y.—Plans have been filed by Von Beren & Lavelle, Archs., 507 Fifth Ave., for the construction of a one-story theater at 207th St. and Vermilyea Ave., for G. L. Lawrence, 2225 Broadway. The estimated cost is $60,000.

✚The contract has been awarded to the UNDERPINNING & FOUNDATION CO., 290 Broadway, for the steel pile foundation for the 16-story loft building at 7 West 45th St. FLEISCHMAN BROS. are general contractors. Schwartz & Gross are Archs., 347 Fifth Ave.

New York, N. Y.—We are officially advised that bids were received as follows on Mar. 3, by the Department of Education, Park Ave. and 59th St., for the construction of Public School 97, on Mangin St., near East Houston St.: Cockerill & Little, 1968 Broadway, $248,870; H. C. Stowe Construction Co., $250,000; Durkin & Laas, $251,000; Richard E. Henningham, $264,713; T. A. Clarke Co., $257,000; J. H. Taylor Construction Co., $285,897; W. H. & F. E. Cane Inc., $254,917; James McArthur, $271,842; Paul J. Exnor Co., $254,600; Speedwell Construction Co., $310,000 J. & F. Walsh & Bro., $253,800; John Hedy & Co., $257,000. Noted Feb. 27.

Rouse & Goldstone, Archs., 40 West 32d St., are preparing plans for the construction of a nine-story apartment house, 100x52 ft., at the southwest corner of Third Ave. and 70th St., for the 178 East 70th St. Co. The estimated cost is $250,000.

Plans have been completed by Neville & Bagg, Archs., 217 West 125th St., for the construction of a nine-story apartment house, 85x56 ft., on 81st St., near Amsterdam Ave., for the Wesley Realty Co., 2245 Broadway. The estimated cost is $200,000.

The Herald Square Holding Co., 62 West 45th St., is having plans prepared by Wallis & Goodiville, 346 Fourth Ave., for the construction of a nine-story apartment house at 126 West 45th St. The estimated cost is $200,000.

Plans have been filed by George & Edward Blum, Archs., 505 Fifth Ave., for the construction of a five-story club house, 100x43 ft., at 105 West 57th St., for the Freundschaft Society, 112 East 72d St. The estimated cost is $150,000.

Plans have been filed by Cross & Cross, Archs., 10 East 47th St., for the construction of a new home for the Novitiate Fathers of Mercy, at the northwest corner of Morningside Ave. and 114th St. It will be five stories high, 91x32 ft. The estimated cost is $50,000.

Plans have been completed by Sommerfield & Steckler, Archs., 31 Union Square, for the construction of a six-story apartment house on the south side of 139th St., near Edgecomb Ave. for the Solon Construction Co., 507 West 179th St. The estimated cost is $225,000.

Plans The Record—L. Pincus 1626 East 12th St. has selected Gronenberg & Leutchtag, Archs., 303 5th Ave., Manhattan, to prepare plans for the improvement of the tri-angular block fronting on Park Avenue and 162d St., with three apartment houses estimated to cost about $500,000. Two of the houses will be 12 and 120 ft. in 163d St. six stories in height. The third will be five stories, high, 135x177 ft. in Park and Spencer St.

Bronx The Record—Bids are being received by the August Jacob Construction Co., 3000 Marble Ave. for the construction of four six-story apartment houses at the northwest corner of Morris Ave. and 172d St. They will be of brick, 75x100 ft. and 100x100 ft. The estimated cost is $265,000. Reed Improvement, Tremont and Park Aves. is the Arch.

Syracuse, N. Y.—The First National Bank will erect an office building on the site of the Vanderbilt Hotel, at Warren and East Washington Sts. The estimated cost is $250,000.

✚Belleville, N. J.—The Board of Education has awarded contracts as follows: For the erection of a new school in the Greylock Manor section, CORNELIUS KEVITT, Glen Ridge, N. J., general construction, and the JOHNSTON HEATING CO., New York, for heating plant. Total cost, $51,539.

Camden, N. J.—Bids will be received until Mar. 17, by Board of Education, for the construction of a two-story, 129x154-ft. school building. The estimated cost is $100,000. Moffett & Stewart are Archs., Jessup Bldg., Camden.

East Orange, N. J.—The Fairchild-Baldwin Co., Newark, N. J., will erect a four-story apartment house at Prospect St. and Park Ave., East Orange. The estimated cost is $150,000.

✚Elizabeth, N. J.—The Union Township Board of Education has awarded a contract for the erection of a school at Lyons Farms to C. C. BAILEY, Elizabeth, at $35,501; contract for the heating and ventilating plant, to the AMERICAN HEATING & VENTILATING CO., Philadelphia, at $4200.

Freehold, N. J.—By the passing of Senate Bill No. 122, and its approval by the Governor, Monmouth County is authorized to erect and equip a branch county court house in the seashore district, at a cost not to exceed $100,000.

✚Newark, N. J.—The contract for the construction of the 12-story hotel at Military Park has been awarded to the HERMAN C. SCHNEIDER BUILDING & CONSTRUCTION CO. Guilbert & Betelle are Archs. Noted Jan. 2.

Buchman & Fox, Archs., New York, are drawing plans for a six-story department store for L. S. Plaut & Co., Newark, which will take in an entire city block.

Butler, Penn.—C. C. & A. L. Thayer, Arch. New Castle, have plans completed for the four-story building for the Y. M. C. A. at Butler. The estimated cost is $100,000. Noted Jan. 30.

✚Chambersburg, Penn.—The contract for the construction of the passenger station at East Market and East King Sts., for the Cumberland Valley R.R. has been awarded to M. R. RHOADES, Chambersburg.

Richmond, Va.—The Davis Hotel Co., Richmond, Va., has announced plans for the construction of a seven-story steel-frame hotel. Carneal & Johnson are Archs.

Harrisburg, Penn.—The Board of Industries of Harrisburg has announced the erection of a hotel on the site of the Commonwealth Hotel. The estimated cost is $1,000,000.

Chapel Hill, N. C.—The University of North Carolina will erect a dining hall at the University. The estimated cost is $40,000. Josephus Daniels is Chn. of Bldg. Com., Raleigh, N. C.

Greenville, S. C.—The Southeastern Life Insurance Co. is considering the erection of a 14-story reinforced-concrete building at Greenville.

Atlanta, Ga.—W. T. Gentry, Pres. of the Southern Bell Telephone & Telegraph Co., announces that the company is planning to erect a new building.

Atlanta, Ga.—Bids will be received until noon, Mar. 17, by Blair & Adams, Archs., Forsyth Bldg., Atlanta, for the construction of a nurses' dormitory at Grady Hospital. W. S. Elkins Jr., is Chn. Bd. of Trustees.

Macon, Ga.—R. H. Hunt, Arch., Chattanooga, Tenn., is preparing pans for the erection of a Baptist Church at Vineville, Ga. The estimated cost is $60,000.

Jacksonville, Fla.—The Seaboard Air Line Ry. is planning the erection of a combined union depot and office building at Jacksonville.

✚Lakeland, Fla.—The contract for the construction of the hotel at Lakeland for Kibbler Bros. has been awarded to McGUCKEN & HYER, Tampa, Fla. Noted incorrectly Feb. 27.

Kenton, Ohio—Bids will be received by the County Commissioners of Hardin County until noon Mar. 31, for the construction of a new court house. The bids will be in three sections. The first for the building of the main court house, second, for the building of a 12-ft. terrace around the building and third, for the heating and ventilating plant.

Richmond, Ind.—Charles W. Gordon, Pres. of the Richmond Guest House, will receive bids for the erection of a Working Girls' Home as soon as plans are completed. Estimated cost, $100,000.

✚Detroit, Mich.—W. H. Edgar Sugar Co. has awarded the general contract for the fireproof warehouse on Campbell Ave., and the Michigan Central Ry., to BRYANT & DETWILER CO., 511 Hammond Bldg.

Flint, Mich.—Malcomson & Higginbotham, Archs., 405 Moffatt Bldg., Detroit, Mich., are receiving bids for a temple for the B. P. O. E. Noted Nov 28.

E. W. Howd, Arch., Flint, is preparing plans for buildings for the Michigan School of the Deaf. Plans will be ready about May 1.

Geo. W. Swift, Arch., is receiving bids until Mar. 14, for a reinforced-concrete warehouse for Geo. W. Hubbard.

Chicago, Ill.—Plans have been approved for the union passenger station to be erected on the block surrounded by Canal, Clinton, Adams and Jackson Sts. The estimated cost is $25,000,000. Noted Oct. 31.

Plans are being prepared by Patterson & Davidson, Archs., for the construction of a three-story and basement office and theater building at Argyle St. and Kenmore Ave., for Gustav Hochstadter. The estimated cost is $100,000.

Oakland, Calif.—The First Trust & Savings Bank will erect an 11-story commercial building at SE 16th and San Pablo Ave. The estimated cost is $2000,000. L. B. Dutton, Chronicle Bldg. is Arch.

Richmond, Calif.—The Dahnken Theatrical Circuit will erect a theater on Macdonald Ave., and Eighth St. The estimated cost is $75,000.

Gardston, Alta.—The Mormans will erect a temple at Cardston. The estimated cost is $100,000. Joseph F. Smith Salt Lake City is Pres.

✚Brantford, Ont.—The contract for the construction of the post office building, has been awarded to P. H. SECORD & SONS. Noted Oct. 17.

Engineering News

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The Crooked River Bridge, Oregon

By Clement E. Chase*

A notable example of the spandrel-braced two-hinged arch has just been erected on the Oregon Trunk Ry. (the new Hill line into central Oregon) at the crossing of Crooked River cañon, about 26 miles north of Bend, Ore. This is 130 miles south of Fallbridge, Wash., where the new line leaves the Spokane, Portland & Seattle Ry. and crosses the Columbia River on the Celilo bridge, recently completed. To reach the central portion of the state the road follows up the cañon of the Des Chutes River for 95 miles, with a gradient not exceeding 0.6%, and then climbs onto the central Oregon plateau in 20 miles of 1.3% grade, leaving the Des Chutes and working up Willow Creek Cañon. Just north of Madras, where the cañon widens out into a broad and fairly level plain, the line passes under the viaduct which carries the Des Chutes R.R. (the Harriman road which parallels the Oregon Trunk) over Willow Creek Cañon, 222 ft. above. From this point the remaining 16 miles to Bend, the present terminus, is over a great rolling plain, across which Crooked River zigzags its way in a very deep and very precipitous gorge in the basalt country-rock.

At the site of the bridge the cañon narrows down to about 350 ft. in width, with a steep and broken slope on the north side and a sheer cliff of 300 ft.—overhanging in many places—on the south. Both walls are basalt, with a markedly columnar fracture. The rim of the cañon is deeply cracked and seamed for some distance back from the edge, and the action of the weather yearly adds new boulders to the talus slopes below.

The site naturally adapted itself to an arch span, as the opening was comparatively narrow, the walls capable of taking unlimited thrust when excavated below the



Fig. 1. Five Panels of North Half Erected



Fig. 2. Setting Closing Section of Top Chord, Sept. 2, 1911

*510 Michigan Apartments, Toledo, Ohio.

cracked and weathered surface rock, and the depth so great that cantilever erection was necessary. The spandrel-braced arch lends itself very readily to the latter requirement. In this case it was particularly well adapted, as the first two sections of top chord were the only members whose section was affected by the erection stresses, and in no members were these stresses of different nature from those to be expected in service (since all the web and top-chord members experience reversal of stress under certain live-load and temperature conditions). A viaduct, besides requiring extremely high towers, would have been in danger of damage at any time from the rock slides which are continually occurring along the steep walls.

The uncertainty connected with the construction of the ordinary type of two-hinged arch from the difficulty of securing the proper division of dead-load compression between the top and bottom chords at the crown, was done away with by the feature in the design which caused the dead-load stresses in the structure to be those of a three-hinged arch, while the live-load and temperature

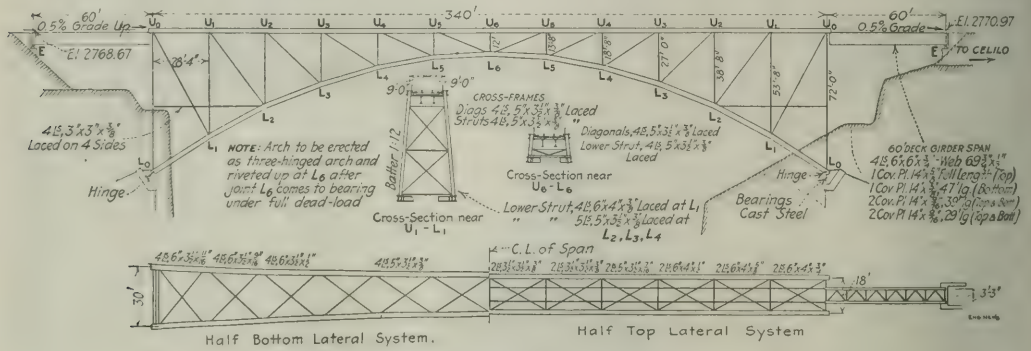


FIG. 3. OUTLINE DIAGRAM OF CROOKED RIVER ARCH

stresses acted as in a two-hinged arch. The finished structure is an extremely graceful and well proportioned span, set off with fine contrast by the ruggedness of its surroundings, as may be judged from the view Fig. 2.

FOUNDATIONS

In order to shorten as much as possible the delay to track-laying while waiting for the completion of the bridge, work on the foundations was begun in the fall of 1910, so that erection could begin as soon as track should be laid to the bridge site. To do this, all supplies, machinery and cement had to be freighted overland from Shaniko, the nearest railroad point, a distance of 65 miles. At 40c. per ton-mile, the cost of the cement was quadrupled and freight bills on the plant amounted to 100% of its original cost. Although the amount of concrete to be placed was small, the estimated volume of the four pedestals with their footings being only 265 cu.yd., yet in order to secure monolithic construction and uniform high quality of the concrete a machine mixer was decided upon. A ¾ yd. Ransome mixer, driven by a 12-hp. gas engine, was freighted in for the purpose. The balance of the plant consisted of a small McCully stone crusher, a double-drum hoisting engine and a 1¼-in. cableway, 150 ft. long. The latter, built on the centerline of the bridge, was used, first to hoist stone for the crusher and water from the bottom of the cañon, and later to deposit the concrete in the pedestal forms.

The excavation was slow and difficult, as the broken nature of the rock along the edge of the cañon above and the nearness of the pedestal sites to the cañon wall required light and careful shooting. On the south side of the cañon, where the wall is vertical for 300 ft., the rock was excavated about 15 ft. from the face of the cliff, for a width of 40 ft. and a depth of 50 ft. In addition to this, four shafts were sunk approximately 30 ft., through solid rock the entire distance, to take the anchorages of the erection device. There were two of these on each side of the cañon. The railroad did the work by force account, because of its inaccessibility and uncertain cost.

Crushed basalt stone and screenings were used for the 1:2:4 concrete of the pedestals, with reinforcement consisting of ¾-in. square Johnson bars, 12 in. on centers and 6 in. from the surface. The footings and shaft of the pedestals were each cast continuously, to avoid planes of weakness at the end of a day's work. Four of the six 2-in. anchor bolts were put in position before concreting, with provision for slight movement, the other two to be placed after erection of the shoes. The abutments which carry the ends of the 60-ft. girder approach spans were not built at this time, as they would come in the way of the erection device.

The distance between pedestals was determined by triangulation from an 828-ft. baseline laid out on the south side of the cañon.

ARCH DETAILS AND DESIGN

The structure is, as mentioned above, a two-hinged spandrel-braced arch (Fig. 3), with the dead-load stresses in the members (at 60°) those of a three-hinged arch. This condition was secured by bringing the two halves of the arch to bearing on a pin at the crown (see Fig. 4), and then placing the center top-chord section covering two panels, drilling its blank ends and riveting it up at a temperature of 60°. The span center to center of end bearings is 340 ft., divided into 12 panels. The spacing of trusses at the top chord is 18 ft. c. to c., and at the skewback pins 30 ft. c. to c., the trusses being battered 1 to 12. The depth of the truss is 12 ft. at the crown and 72 ft. at the ends. The bottom chord has the form of a

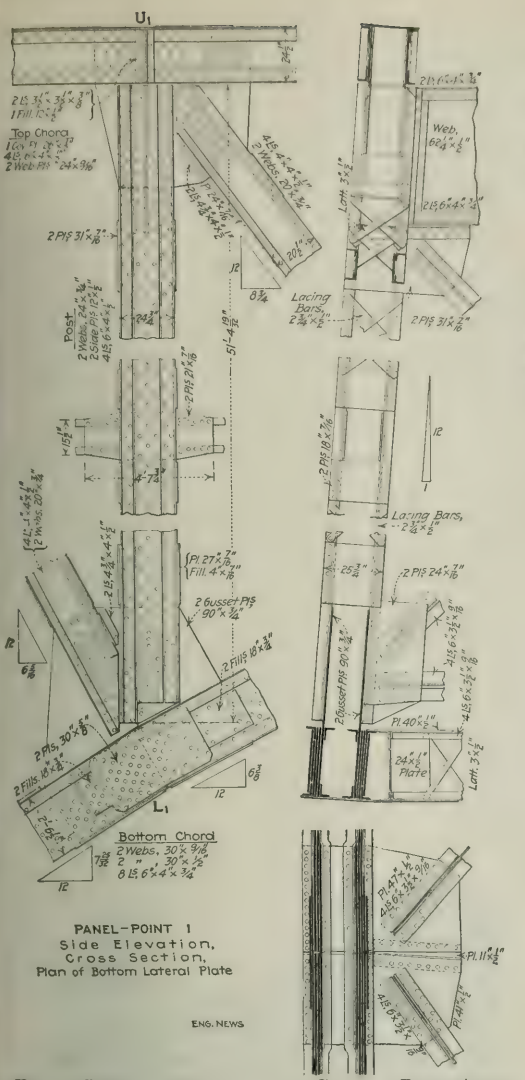
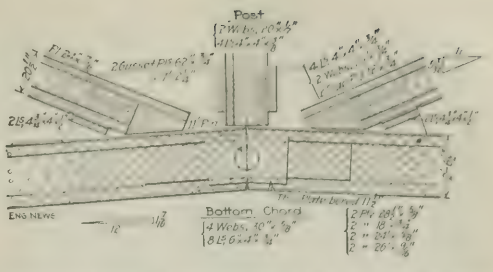


FIG. 1. TYPICAL DETAILS OF THE CROOKED RIVER ARCH

parabola. The connections throughout are riveted. All details were worked out with a view to ease of cantilever erection.

The loading used was that standard for all bridges on the Oregon Trunk: two 188.5-ton engines followed by 5000 lb. per ft. for the trusses, and one 214-ton engine followed by the same uniform load for the floor-system. The bridge is single-track.

A maximum area of 141.2 sq.in. is required in the bottom chord, in L_4-L_5, the section consisting of two built I-ribs with 30-in. webs, laced top and bottom with $5 \times \frac{7}{16}$-in. bars. A large ¾-in. gusset-plate is shop-riveted to the outer end of each chord section for connection to the web members. Great care was taken in the shops to secure accurate facing of the ends of the sections. The



compression chords are field-spliced for 50% of the stress. Diagonals and posts are composed of two built channels, turned out, and are stiffened at the connection to top and bottom chord by longitudinal diaphragms transverse to the plane of the truss. The top chord is built up of two webs, cover-plate, and in the first two panels four angles; in the others, six. At the L_0 point, the hinge consists of a 13-in. pin resting horizontally on the three webs of the cast-steel shoe. The pin holes in the bottom chord are bored to the skew necessitated by the 1:12 batter. The shoes weigh 10½ tons each; they are set on a rust joint about 1 in. in thickness.

The floor-beams, 62½ in. in depth, connect to the inside webs of the posts just below the top chord, and rest also on brackets riveted to the posts (Fig. 4), which brackets in addition form the connection for the sway-bracing. The stringers, 48½ in. deep by 28 ft. 4 in. long c. to c. of floor-beams, connect into the webs of the latter with top flanges practically on the level of floor-beam flanges. They are without stiffeners or sway frames, being braced by their connections to the heavy top-lateral angles, which cross immediately above the top flanges of the stringers and rivet to them. At U_0 a cross-girder supports the end of the 60-ft. approach girder

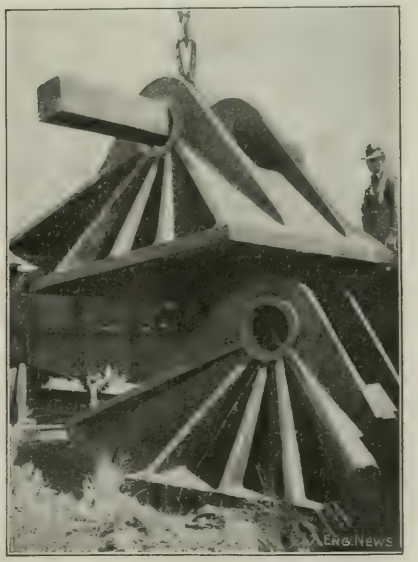


FIG. 5. CAST-STEEL END SHOES OF THE CROOKED RIVER ARCH, OREGON TRUNK RY.

spans, which are in turn provided with seats to take the shore ends of the stringers. Bottom laterals and sway-bracing are composed of four angles, laced to an I-section.

In order to raise the ties above the upstanding legs of the top laterals, a 5x12-in. sleeper is laid along the tops of the stringers. The ties are 8x10-in. Oregon fir, dapped

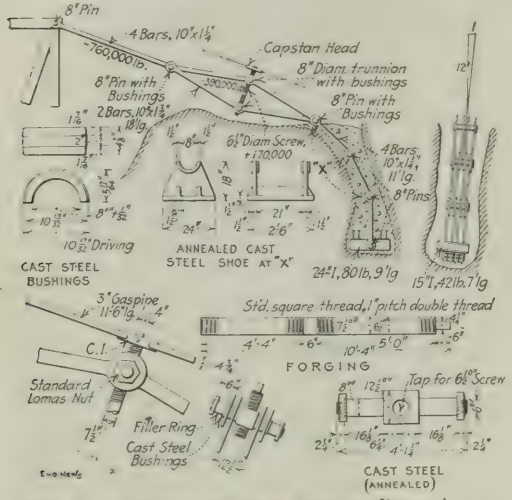


FIG. 6. ANCHORAGE TOGGLE, CROOKED RIVER ARCH

⅝-in. over the sleepers, 12 and 16 ft. in length, every fourth tie being long. Every second tie is bolted through sleeper and stringer-flange. The outer guard-rail is placed at the end of the short ties, over which it is dapped 1 in., and is bolted to every third tie. The long ties carry a 2-ft. plank walk outside the guard-rail. A ⅞-in. wire rope, supported by stanchions bolted to the top chord, serves as a hand-rail. The inner guard-rail is a 4x5x⅝-in. angle, with the 5-in. leg vertical, bolted through every tie.

ERECTION DEVICE

Anchorage during the cantilever erection of the two arms was provided by a strong and very simple erection device (Fig. 6), a chain of four 10x1¼-in. eyebars (giving 50 sq.in. to resist the maximum pull of 760,000 lb.), running down from the 1/4 point at an angle of about 20° with the horizontal to the adjustment toggle, and thence in a curve to the grillages placed at the bottom of the anchorage shafts, the last set of bars being vertical in side elevation. The whole device was set in the plane of the trusses, i.e., battered 1:12 in end elevation. The grillage was composed of three 24-in. 80-lb. I-beams, pin-connected to the bottom eyebars, with four 15-in. 42-lb. I-beams resting transversely on their upper flanges. Cast-steel shoes were provided at each point of inflection in the curve to take the radial reaction, amounting to 145,000 lb.

The erection toggle was a parallelogram made of eight 10x1⅝-in. eyebars 18 ft. long, and was controlled as to length by a screw 6½ in. in diameter working through trunnions, on the short diagonal of the parallelogram. The screw was turned (see view Fig. 7) by eight bars engaging a capstan head fixed to the end of the screw. The joint pins of the toggle were 8 in. in diameter, but the eyebars were bored with 10½-in. pinholes, in which were placed steel bushings 4⅞ in. wide, turned for a driving fit in the eyebars, but bored with ⅜-in. play on the pin. These were given before erection a heavy coat of solid lubricant, composed of one-third tallow and two-thirds lard, mixed with flake graphite to the consistency of thick syrup when melted.

After erecting this anchorage, the shafts were filled with 1:2:4 concrete for about 10 ft., and above that 1:3:6 concrete with one-man stone dropped in.

The toggle provided for 9⅞-in. change in length in the anchorage, corresponding to movement of the screw from 2 ft. 5 in. spread of toggle (extreme lowered position) to 8 ft. spread (extreme raised position). This was sufficient to raise the semi-arch at crown 15 in. or lower it 8 in. from the normal position, if required.

ERECTION TRAVELERS

A timber traveler of rather simple design (Figs. 8 and 9) was used by the contractor in the erection of the arch. Two were required, one for each arm. They were alike, except that the one used on the north arm had clearance under the engine deck for the derrick-car. As no car was used on the south side, the posts on that traveler were made 4 ft. shorter and the deck was placed just above the sills.

The travelers had a length over all of 76 ft., with an overhang of 32 ft., allowing the falls to be hung over any point in a panel. The two 8x16-in. sticks which composed each side of the jib were 18 ft. apart on centers, bringing the falls over the center-line of top chord. The sills were the same distance apart, the traveler rail being laid on the center of the top chord on short ties which were beveled on the lower side (on account of the batter of the cover-plate) and were kept in position by being dapped over the rivets in the cover-plate. Supporting the engine deck were six posts, framed to fit in



FIG. 7. ERECTION ANCHORAGE AND TOGGLE, CROOKED RIVER ARCH

between the sills at their lower ends, so that the blocking under the traveler could have end bearing on them. The two front posts, 12x14 in. in section, extended 22 ft. above the deck and were capped by a 12x14-in. stick 30 ft. long. On top of this cap were bolted the hardwood saddles to which the ends of the tie rods which supported the jib were bolted. These tie rods were of 1¾-in. round medium steel, with ends upset, and were placed two on

each side of the traveler. About 16,500 ft. b.m. of Oregon fir was required for each traveler. The estimated weight with full rigging, engine, coal and water was 15 tons.

Six tackles of 1¾-in. manila line, five-part and six-part, were hung from the jib of the north traveler, in line

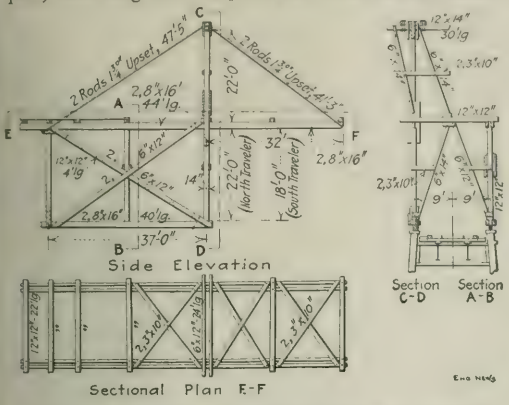


Fig. 8. Cantilever Traveler Used for Crooked River Arch Erection

with the center of top chord. Material was handled from the derrick-car and drifted out to these tackles by a five-part tackle of ⅞-in. wire rope, which was hung at the rear of the boom over the center of track. Later, during the erection of the south arm, the manila falls were removed and a six-part falls, 340 ft. in length, of ¾-in. rope, was placed at the outer end of the jib to lower steel to the bottom of the cañon in transferring it to the south side. The two ends of this wire rope were attached to separate drums on the engine, giving greater speed in handling this long falls and an opportunity to cool one friction while lowering steel with the other.

On the south traveler the manila falls were rigged essentially as on the north side, and in addition a six-part wire tackle was hung in the center of the jib to raise material from the bottom of the cañon.

The derrick-car used to unload material and bring it from the storage yard to the north traveler was one of the contractor's standard cars, rated at 10 tons capacity, but able to handle the 14-ton endposts.

Erection

Preliminary work necessary before actual erection could be begun occupied the time from May 15, 1911, when the contractor arrived on the ground and began unloading steel, until June 23, when the first shoe was placed on the north side. This work consisted in preparing the anchorages (assembling the eyebars and grillages and filling the shafts with concrete), building trestle and falsework from the end of the grade to the span, and building the north traveler.

The falsework consisted of five-post bents of 12x12-in. timber, three posts to carry the track and an outer one on each side to support the traveler, except the last bent, in which were used five piles about 62 ft. long. On top of these bents were placed three pony bents, the inner one of three posts supporting the track, and the two outer ones of two posts each, supporting the traveler run.



Fig. 9. Wooden Traveler Used in Erection of Crooked River Arch

Spacing of posts, height of cap, etc., in the bents varied, in order to allow clearance for the anchorage eyebars through the structure. These bents supported the traveler during its construction, and later, by removing the pony bents, allowed of the placing of the 60-ft. approach girder and supported its outer end.

The traveler was framed in the yards, and its sides, jib, top bent, etc., assembled as units on the ground, and later carried out and put together by the derrick-car.

After placing the second shoe, on June 24, 1911, the bottom chords were lowered and the L_0 pins driven. To drift the chords out to their position as required by the batter of the trusses, outhaul lines were run to points further along the cañon wall. The U_0-L_0 posts, which were 72 ft. long and weighed 14 tons, were then connected to the bottom chord, the temporary pins at U_0 connecting to the anchorage device driven, and the diagonal swung into place, making the panel self-supporting.

The shoes until this time had been carried on wedges and not accurately set in position; it had been found impracticable in the shops to check exactly the boring of the skew pinholes in the L_0-L_1 chords, and it was intended, in case these should prove slightly inaccurate, to shift the position of the shoe and its horizontal pin, to prevent unequal bearing on the webs of the chord. As a matter of fact, the shopwork proved very accurate and no

change was required in the position of the shoes. Before setting the pedestals on center-line, the distance across the cañon was checked by direct measurement with a steel wire, previously calibrated for a distance of 340 ft. unsupported. This method gave results agreeing very closely with the distance obtained by triangulation. A correction was also made for the difference between the shop and field standard tapes—which amounted to ¼ in. for this span. After setting the shoes in position, a rust joint was placed under them. This consisted of 1 lb. sulphur, 2 lb. sal-ammoniac and 283 lb. iron borings,

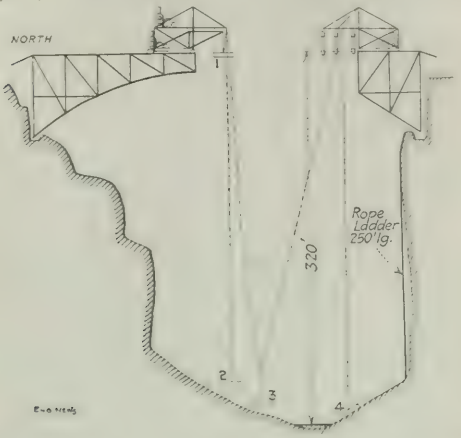


FIG. 10. SKETCH OF CANYON CROSS-SECTION, SHOWING METHOD OF TRANSFERRING STEEL ACROSS GORGE: CROOKED RIVER ARCH

thoroughly moistened, and was rammed evenly under the pedestals, the holes around the anchor bolts first being filled with grout.

The erection then proceeded with the placing of the U_1-L_1 posts and floor-beam, which was entered between the posts several feet below its position and then moved vertically up to position—the plates covering the brackets which riveted to its bottom flange being temporarily slid aside. Top chords, stringers and bracing were then placed and riveting begun.

It had been decided to rivet in each panel, as erected all the principal truss connections except the bottom-chord splices. This was done because of the high erection stresses in some of the members and to keep down erection costs by reducing the number of bolts and drift-pins required, there being 17,000 rivets in the connections which were riveted at this time alone. Bottom laterals, sway-bracing and bottom chords were bolted up 50%.

Before running out the traveler and proceeding with the erection of the second panel, the toggle in the erection device was cracked until its short diagonal was increased to 7 ft., corresponding to an elevation of the outer end of the semi-span of 9 in. The erection of the remaining panels proceeded, the truss members being placed in the same order as the first panel, and each panel being riveted before erecting the next. After the first panel had been placed, the remaining panels were erected in one day each, the riveting, with three gangs, taking an average of three days to the panel. Fig. 11 shows erection work in progress.

In order to reduce the erection weight, the sixth panel was not placed at this time; the fifth panel was completed on July 26, 1911 (see Fig. 1). During the next two weeks the contractor's force was engaged in setting the approach girders on the north side, completing the framing and erecting of the south traveler and falsework, erecting the south anchorage, and lowering the steel for the first three panels of the south arm into the bottom of the cañon.

The timber for the traveler, the engines and rigging, and the steel for the anchorage device, were all transferred across the cañon on the cableway which had been used in placing the foundation concrete. The profile of the cañon made possible the rather unusual method of transferring material to the other side shown by the sketch Fig. 10, using the tackles of the two travelers. The south wall rises vertically from a point within a few feet of the extreme bottom of the cañon, thus allowing the material to be drifted across the cañon with very long fall lines (and consequently slight horizontal pull on the travelers) and then hoisted vertically, after removing the holdback tackles, to the level of its final position, where the blocks of the side tackles were hooked into chains already attached, and the member was fleeted over into position. It had first been planned to transfer material across only as needed for erection, using much shorter falls and removing the holdback tackles while the piece was in the air. Consideration of the probable swinging of the load while being transferred, its racking effect on the travelers, the necessity of outhauling across the gap one set of tackles each time, and the fact that time would be saved by lowering steel for several panels to the bottom while erection was proceeding on the south side, prompted the choice of method used.



FIG. 11. SETTING ONE OF THE DIAGONALS, CROOKED RIVER ARCH

Very long six-part wire tackles were required, 2200 ft. of ¾-in. line being used on one side and 2300 ft. of ⅝-in. line on the other. Erection was very little delayed by the fact that material had to be transferred in this way.

A feature of the work which caused great local interest was a rope ladder, 250 ft. long, hanging free from the top of the undercut south cliff, and used by the men in crossing the cañon until the travelers came within reach of each other.

The south arm was started on Aug. 8 and finished through the fifth panel Aug. 31, an average of 11½ days

being spent in erecting each panel after the first one and two days in riveting. After the fifth panel had been erected, the diagonals and bottom chords of the two center panels were erected with the center pin in place in its half-hole in the end of one chord. Then the anchors were let down till the half spans came to a bearing on the pin, making the structure a three-hinged arch. Four or five men on each capstan easily lowered the arms under a tension of 500,000 lb. The remaining members of the panels were then dropped into place. The top-chord section, which was two panels in length, was about $\frac{3}{4}$ in. shorter than the opening at 60°. Both ends of this chord section had been left blank, and they were drilled after erection to match the splice-plates attached to the adjoining chords, at a temperature of 60°. One end was center-punched, drilled and riveted, after dividing up the opening at the ends of the chord equally at about 60° F., and the other end was then center-punched through the splice-plates at exactly 60°. One side of this splice was then riveted and the point left until a cloudy day, when the temperature of the steel was again 60°, when it was quickly riveted up. There were 1000 field holes to be drilled in these chord connections and in the post.

The railroad was naturally very anxious to begin laying track toward its terminus in Bend as soon as possible, and so the tracklayer and work train were sent over the bridge on Sept. 17, 1911, with the riveting only 50% complete—the bottom chords, laterals, sway-bracing and floor-system being unriveted, but well bolted and pinned. The remaining 21,500 rivets were driven in five weeks by three four-men gangs, using Thor hammers at a pressure of 100 lb. A Fairbanks-Morse gas-engine-compressor unit furnished the air.

The arch was designed and erected under the supervision of Ralph Modjeski, Chief Engineer of Bridges O. T. Ry., with W. R. Weidman Resident Engineer. Ralph Harris was Assistant Engineer during the foundation work, and the writer during erection. The steel was fabricated by the American Bridge Co., and erected by the Missouri Valley Bridge & Iron Co., of Leavenworth, Kan.; E. H. Barkmann was their engineer in charge, and J. J. Kelley their superintendent. Ralph Budd is chief engineer of the Oregon Trunk Ry.

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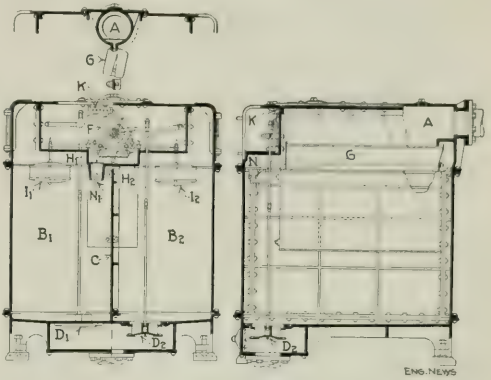
Macadamized Roads in New Castle County, Delaware, up to Jan. 1, 1913, aggregated 138½ miles, which is nearly 14 per cent. of the entire mileage of roads in the county. Since the passage of the first State good roads law by the Delaware Legislature in April, 1903, there has been spent on the construction of stone roads in New Castle County, $1,206,780. This makes the average cost per mile for construction $8715. The above figures are taken from the report of the New Castle County State Highway Commissioner, Francis A. Price.

A Motor Truck Reliability Run is to be held under the auspices of the Washington "Post," on May 5-8. This contest, which is held under the rules and sanction of the American Automobile Association, will cover a distance of 325 miles, starting from Washington, D. C., and passing through Frederick and Hagarstown, Md., Shippensburg, Harrisburg, Lancaster, Gettysburg, Penn., and Baltimore, Md.; back to Washington. Twelve classes of trucks will compete, the classification being by carrying capacity, and the average speed for each class is prescribed. A grand trophy consisting of a large silver vase is to be awarded for the best score of all entered and division trophies will also be given for the best score in each class. The scores will be determined on the basis of penalties for repairs, lateness, failure of fuel supplies or batteries, replacements, stops, and on the economy of operation. A pamphlet giving full directions and rules has been issued by the Washington "Post," together with entry blanks for the contest.

A Liquid Meter of the Measuring Tank Type

For the most accurate measurement of liquids, where weirs, flumes, orifices, or commercial water meters are to be calibrated, the common plan is to measure the amount of water or other liquid in tanks which are alternately emptied.

A liquid meter which operates on the above principle, the tanks being automatically emptied when full, has been put on the market recently by the Alberger Pump & Condenser Co., of New York City, and is known as the Hammond meter. The accompanying sectional views make clear its method of operation.



FRONT AND SIDE SECTIONAL ELEVATIONS OF AN AUTOMATIC CONTINUOUS LIQUID METER OF THE MEASURING TANK TYPE

The meter has a cast iron built-up box case with an inlet pipe at the rear near the top and the outlet in front at the bottom. The liquid to be measured flows first into receiving tank A from which it escapes through a narrow slit in the bottom. The flow from this slit is directed into either tank B or B_2, according to the position of the deflector G. Assuming it to be B_1, this flow continues until the liquid just closes over gage N_1. At this instant the upward pressure on float I_1 releases the latch at H_1, and the downward pressure on discharge valve D_1 rotates the wristplate F to a latched position at H_2, closing discharge valve D_2 and throwing deflector G to the left. The motion of the wristplate also registers one count on the recorder K. The opening of valve D_1 permits the contents of tank B_1 to discharge. The same process is repeated now on the other side, measuring tank B_2 being in service while B_1 is discharging. A similar gage N_2 (not shown) marks the maximum height of fluid in measuring tank B_2.

The operation of the meter is automatic and continuous and it is guaranteed to register with an error of not over 1% at any rate of flow up to its capacity, when properly cared for and when the liquid is at the temperature for which the meter is calibrated.

While of course much more bulky and costly than ordinary types of flow meter, it can be used for hot and corrosive fluids for which such meters are of doubtful accuracy.

Novel Tunnel Work on the Cleveland Short Line Ry.

The double-track freight cut-off line built by the Lake Shore & Michigan Southern Ry. around the south side of the city of Cleveland, Ohio (from Newburg to Collinwood), and known as the Cleveland Short Line, presents some interesting features in its two tunnels: 1, they were built in open cut and backfilled; 2, one of them has an

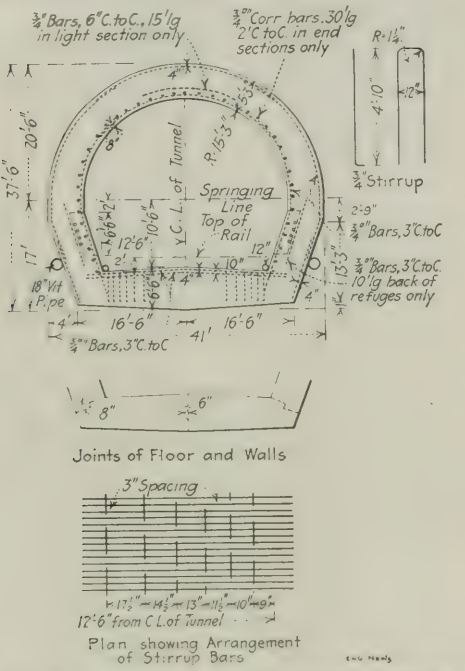


Fig. 1. Tunnel on the Cleveland Short Line, with Heavy Reinforced-Concrete Lining

extremely heavy lining of reinforced concrete; 3, the other has two sewers carried through the crown by steel trusses embedded in concrete. A considerable part of the line is kept below the level of the ground in order to avoid grade crossings of the streets and of the several railway lines intersected. At two points in a long cut, tunnels were required under railway yards and manufacturing sites, and as the depth of cover would be relatively slight and the district had not been built up at that time, the opportunity was taken to reduce the cost of construction by building the tunnels in open cut and then backfilling over the masonry. The excavation was done by steam shovels.

Tunnel with Heavy Lining

The larger tunnel, 775 ft. long, passes under numerous railway tracks and under a site to be occupied by a new plant of the American Steel & Wire Co., where heavy machinery would be operated, and in order to prevent injury to the tunnel by the shocks and continual vibration a very thick concrete lining is used, heavily reinforced by steel bars. The cut here is in gravel and water-bearing sand. The tunnel is of horseshoe shape, 25 ft. wide at the floor and 30 ft. 6 in. at the springing line, with a roof radius of 15 ft. 3 in. and a height of 25 ft. 9 in. at the middle or 23 ft. 9 in. above the rails. The cross-section and the arrangement of the reinforcement are shown in Fig. 1. In the heaviest section of the tunnel, the lining is 5 ft. 3 in. thick at the arch and 6 ft. 6 in. at the center of the floor. Toward one end, the thickness at these points is 4 ft. 9 in. and 5 ft. 9 in., respectively. The steel bars are laid near the inner and outer faces of the concrete, and 4 in. from the surface, except that on the inner face of the arch this distance is increased to 8 in. to insure ample protection for the steel after erosion of the concrete by the blast of the engines. The longitudinal bars are used only in the end sections. In the floor, there is a double layer of bars, 4 in. and 10 in. from the surface, while the sides of this massive floor slab are reinforced by vertical steel stirrups, as shown. In the lighter section of the lining an aditional set of transverse bars is used at the crown, as indicated by dotted lines. Most of the reinforcement consists of corrugated bars ¾ in. square.

The floor slopes from the center to the sides, where 12-in. drain tiles are laid in the ballast, and on the outside are two lines of 18-in. drains, which extend through the portals. All these are vitrified pipes. To accommodate signal, telegraph and other wires, four lines of 4-in. wrought-iron pipe, spaced 12 in. apart, are embedded in the concrete on each side of the tunnel. On each side also there are refuges 50 ft. apart (staggered on opposite sides); these are 2 ft. deep, 2½ ft. wide and 6½ ft. high. As the face reinforcement is necessarily omitted at these points, lines of steel bars are placed at the back of the recesses, as shown.

The concrete lining is built in lengths of 30 ft., with tar-paper expansion joints between them, and the longitudinal bars of the end sections are therefore 30 ft. in

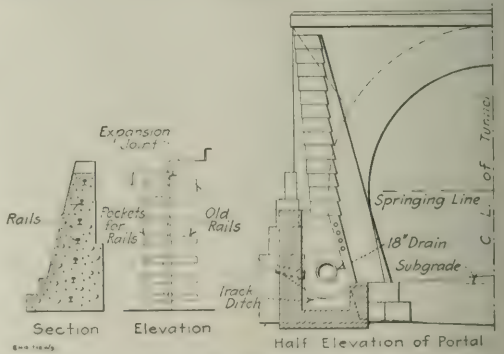


Fig. 2. Portal and Expansion Joint in Wing Wall of Tunnel; Cleveland Short Line

length. Near the north portal, a line of 54-in. cast-iron pipe crosses the arch, extending 20 in. below the outer surface, and the circular bars are bent to keep 1 in. clear of the pipe. Two smokestacks or ventilating shafts are provided, extending from the crown of the arch to the surface. Each of these is 4 ft. inside diameter, with an 18-in. concrete wall reinforced by vertical bars, and having the top fitted with a cast-iron grating bolted down. The north portal is shown in Fig. 2, with the masonry

sump and track ditch and also the wing wall. At this portal one of the wing walls is of such length (92 ft.) as to have an expansion joint. At this joint, pieces of old rail 7 ft. 5 in. long are embedded in the end nearest the tunnel, while the projecting ends lie in pockets formed

sections. The lap of the bars is specified to be 50 times their least diameter. The arch is built with expansion joints 30 ft. apart and filled with tar-paper, and the refuges are of the same size and spacing as in the other tunnel. The outside of the arch was given a water-

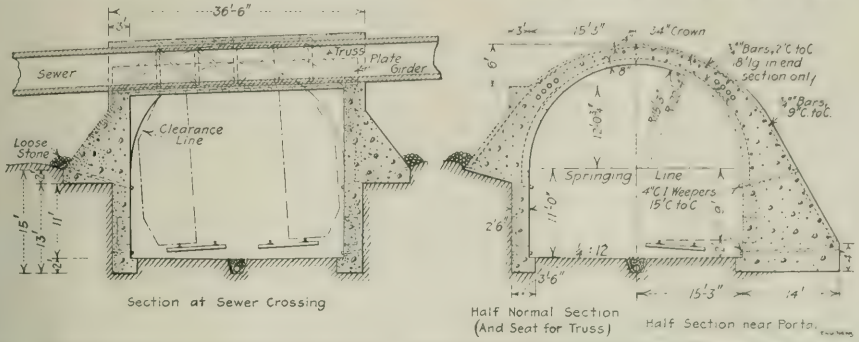


Fig. 3. Cross-sections of Tunnel Having Its Lower Portion in Solid Rock: Cleveland Short Line

in the adjacent portion of the wall so as to permit of free expansion movement.

The concrete is 1:2:4 for the lining and parapets, and 1:2:5 for the wing walls. It was required that the exposed surfaces should have a dense and smooth face, and that the other surfaces should not show honeycombing. In the construction of the lining, the floor was built in two parallel parts connected at the middle by a key or tongue-and-groove; the width of this is 6 in. and its depth is one-third the floor thickness. The side walls also are recessed into the floor for half their width and to a depth of 8 in., thus giving a shoulder to resist external thrust. This arrangement is shown in Fig. 1. The concrete was mixed at a stationary plant and delivered by dump cars on narrow-gage industrial tracks. For the floor the concrete was dumped directly from the cars. For the side walls, the bodies were lifted by a locomotive crane and dumped into the forms. For the roof, the bodies were lifted in the same way, but the concrete was dumped into small push cars running on a track laid over the forms on the center line of the tunnel. The railways crossing the line of the tunnel were carried temporarily by plate-girder spans on pile bents, while a suspension bridge was thrown across the cut for pedestrian traffic; this was 240 ft. span, with anchorages 500 ft. apart.

Tunnel Crossed by a Sewer

The other tunnel is where the line crosses Broadway, and has a length of 345 ft. It is of very different section from the one first described, owing to the fact that it is mainly in solid rock below the springing line, so that only a thin lining is required at the sides and the rock is dressed to form the floor. This floor has a slope of ¼ in. per ft. to the center, where there is a trench having a tile drain and stone filling. The upper surface of the rock is shaped to form a bearing for the roof arch, but near the portal the concrete is carried down to a broad footing at the floor level. These sections are shown in Fig. 3. The arch is 34 in. thick at the crown, and is reinforced by transverse rods near the upper and lower faces, while longitudinal rods are used also in the end

proofing coat of pitch. For the signal and other wires there are four 4-in. pipes laid on each side of the crown.

At Broadway, the tunnel arch intercepts an oval brick sewer, 56½x44⅜ in., and a 2-ft. pipe. The grades could not be changed, and the sewers are therefore carried across the tunnel by a steel structure incased in concrete. There are two trusses 36 ft. long and 7 ft. deep, on opposite sides of the brick sewer, while outside of the pipe is a plate-girder, held in place by horizontal

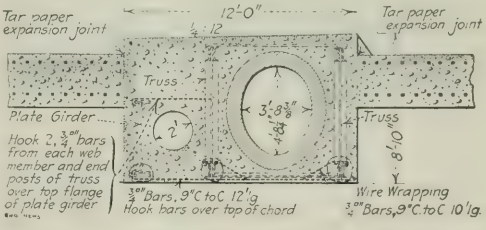


Fig. 4. Sewers Carried across Tunnel by a Steel Structure Encased in Concrete: Cleveland Short Line

rods hooked over its top chord and to the posts and diagonals of the adjacent truss. Transverse steel rods are laid over the tops of the trusses and beneath the girder and trusses, and other rods beneath the sewer are bent up to have their ends hooked over the tops of the bottom chords. These chords (for the trusses and girder) are wrapped with wire mesh for their entire length. The entire structure is incased in concrete, forming a block 8 ft. high and 12 ft. wide, extending about 3½ ft. below the crown of the tunnel, as shown in Fig. 4. Its top is given a lateral slope of ¼ in. per ft. for drainage, and the sewer has a grade of 3.5% across the tunnel. The trusses rest upon seats formed on the back of the tunnel arch, but between them the arch is omitted and the side walls are carried up to meet the bottom of the sewer casing, which forms the flat roof, as is shown in Fig. 3.

Temporary Hypochlorite Plant for Treating the Sewage of Norristown, Pa.

By S. Cameron Corson*

Several months ago there was a serious break in one of the large water-supply pipes of Philadelphia, which necessitated the temporary pumping of water directly from the Schuylkill River into one of the water-works reservoirs of that city. About that time there were some 25 cases of typhoid fever in Norristown. All of the sanitary or house sewers of Norristown drain into one intercepting sewer, which empties into the Schuylkill River at a point near the mouth of Saw Mill Run, at the lower end of Norristown.

The State Department of Health at Harrisburg desired that all the municipalities and large manufacturing plants along the Schuylkill should erect some kind of a temporary plant by which their raw sewage could be treated with hypochlorite of lime, and thereby eliminate many of the typhoid-fever germs. Our town council granted this request and the writer was instructed to erect a temporary plant.

Having ascertained the daily flow from this intercepting sewer to be about 1,250,000 gal. per 24 hr. and being requested by the State Department of Health to use at least 100 lb. per 1,000,000 gal. per day, this little plant shown in the accompanying sketch was arranged.

The five hogsheads, *A-B-C-D-E*, are connected together by a 2-in. galvanized-iron pipe and over the manhole there is a shutoff valve, which is set to drain the five hogsheads in 12 hr. The other set, *1-2-3-4-5*, are similarly connected and they are operated the second half of the day.

In the shed which covers the 10 hogsheads, paste barrel and supply drum is a stove to prevent the pipes and barrels from freezing, but this stove is only fired when the thermometer registers 24° F. or under.

The hypochlorite of lime is purchased in quantities of 3000 lb., in 500-lb. drums, at a cost of $1.83 per 100 lb., f.o.b. cars, Norristown, Penn. Recent quotations per 100 lb. f.o.b. Norristown, are $1.52 with a time delivery reserve and $1.63 for two weeks from order. The price of $1.83 was paid to a local drug house. These prices are from different companies.

The cost of operating the plant per day has been as follows: Laborer, 13 hr. at $0.175—$2.28;† 100 lb. of hypochlorite of lime at $1.83; total, $4.11 per day.

The total first cost of the plant was:

12 hogsheads	@ 75c	$9 00
Two buildings 8x16 ft. and 6x8 ft. (hemlock, covered with three-ply roofing felt)		35 00
Two stoves, $12 and $6		18 00
Water pipe, spigot connections, plumbing, etc.		12 00
		$85.00

The inspectors of the State Department of Health make almost daily visits and fill a bottle with raw sewage from a manhole next above the manhole at this plant, and also fill a bottle from the treated effluent at the mouth of the sewer. The writer is informed that the laboratory tests [made in Philadelphia several hours later.—Ed.] are satisfactory.

*Borough Engineer, Norristown, Penn.

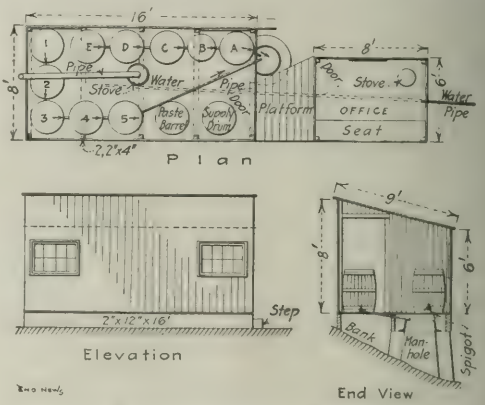
†It is necessary to have this man at work this length of time to thoroughly better work to keep the pipes between the hogsheads open, the materials well stirred and the outlet spigots open.

The small house used as a shelter for the caretaker is purposely kept away from the open manhole and the lime house for his better protection. The powdered hypochlorite of lime is measured for one dose, then placed in the supply barrel, where a sufficient amount of water is added to bring it to a consistency of thick paste. This is then dipped into the barrels to be charged, placing about 15 lb. of the paste in each barrel, but experience has shown that we get the best results by not having any of the lime in the last barrel, marked on the sketch "A" or "5."

The ¾-in. water-supply pipe is brought directly from the street main and is in constant use. While one battery of barrels is draining out into the manhole the other is being refilled.

The stream from the shut-off valve is so arranged that it falls on an old tin grater and the perforations of this grater distribute the solution uniformly over the sewage down in the sewer.

The sewer at this point is 27 in. in diameter, the depth of the sewage averages 6½ in. and the distance from the



Temporary Hypochlorite Plant for Treating Sewage of Norristown, Penn.

spigot to the surface of the sewage is about 8 ft. The distance from this manhole to the outlet of the sewer is 225 ft., and the grade is about 0.25%.

When we first erected this plant it was to temporarily carry out the request of Dr. Samuel G. Dixon, Commissioner of Health, and the plant was of the very crudest. We have since learned that we are expected to treat the sewage until the proposed new sewage-disposal plant is in operation, and more permanent arrangements have been made. The writer would suggest to any who may be forced to treat sewage, as we have been, to at once install small concrete vats or tubs, for the reason that within a few months we have had to renew several hogsheads entirely and put on new hoops on all of the others. In some we have put in concrete linings and if we must continue this treatment indefinitely, or until such time as our proposed disposal plant is in operation, we will be compelled to put in concrete tubs.

George W. Fuller, 170 Broadway, New York City, as consulting engineer for Norristown, has recently submitted a report on a sewage-treatment plant to the State Board of Health.

New Ultra-violet Ray Lamps*

The development of the studies of the chemical and biological reactions produced by ultra-violet rays shows that there is a great need (if commercial processes are to be developed) for a lamp having an ultra-violet radiation much more powerful than from the usual 110 to 220-volt mercury lamp. In the lamps which have been heretofore used the electrodes have been placed on two ends of a straight luminous tube. These lamps often have bulb ends which form cooling or condensation chambers, and tend to reduce the effective luminosity. Messrs. Heilbronner and Recklinghausen have produced a new lamp which has the following modifications: (1) the luminous tube is given the form of a U-tube; (2) the two electrode ends of the tube are brought to the same side of the lamp and as near as possible to one another; (3) the voltage is increased. The lamp which they have recently presented before the French Academy of Sciences contains, as the luminous part, a quartz U-tube in which the two branches are brought together almost touching one another. The interior diameter is about $\frac{5}{16}$ in. and the length of each branch is 4 in. The two mercury electrodes are joined one to the other. This lamp burns on a 500-volt system with a difference of potential at the electrodes of from 375 to 390 volts, with a current of 3 amp. This tube consumes, therefore, 1150 watts. In a plane perpendicular to the axis of the lamp passing through the middle of the arc the lamp has an average candlepower of about 8000.

In testing this lamp the effect on various chemical and bacterial compositions has been noted in comparison with the action of an ordinary ultra-violet ray lamp on 110 volts. The results of the tests are as follows:

(1) Action on starch: The same reaction was obtained with the new lamp in six hours as was obtained with the 110-volt type lamp in 260 hours.

(2) Action on glycerine: The same action was obtained in 4 hours with the new lamp as was obtained in 240 hours with the old lamp.

(3) With the 500-volt new lamp, a polymerization of carbon and hydrogen compounds was accomplished in a very definite fashion, whereas with the 110-volt old type lamp the action was very limited.

The tests on the bactericidal properties of the two lamps were as follows: It was found that the sterilization of B. coli with the new type lamp was obtained 60 times as fast as with the 110-volt old type lamp. In comparing the time it took to kill certain growths placed under a 220-volt lamp, burning with 156 volts at the tube electrodes and 3½ amp., with those under a 500-volt lamp, burning with 397 volts at the tube and 3 amp., it was found that the relation was about 11 to 1, the higher powered lamp being more effective. On the other hand, the 220-volt lamp had a bactericidal action 5 times more tense than 110-volt lamp. In consequence, it can be figured that the 50 volt lamp is 55 times more active than the 110-volt lamp.

Summing up, the new lamp possesses an ultra-violet radiation 50 to 60 times more intense than a 110-volt lamp burning with 75 volts at the tube and 3.4 amp. The relative consumption of the two lamps is about 1 to 4.0.

In testing the life of the lamp, it has been found in one urban installation that with four units, each containing two 500-volt lamps, the whole plant has been in operation more than 1200 hours, and so far as could be observed by the effect on sensitized paper the luminosity of the eight lamps has not changed in all this time. It is proposed to use this new lamp in water sterilization for large installations.

*Abstracted from an article in "La Technique Sanitaire et Municipale," of Paris, February, 1913.

An Old Time Overshot Waterwheel

Thirteen years ago, in our issue of Dec. 21, 1899, we published a double inset sheet giving views of some of the old-time waterwheels in northern New Jersey, many of which, though long out of use, were then still to be seen.

We illustrate herewith an old-time waterwheel in Connecticut which has done service for probably more than 75 years, and though now displaced by a modern turbine is still in perfect condition. The wheel is located at the paper goods mill of the Smith & Winchester Manufacturing Co., at South Windham, Conn. The business of this company was established in 1828 by the father and uncle of the present senior partner, who is now 73 years of age. According to his best information the original wheel was first constructed at least 75 years ago. The arms and rim and buckets were renewed 45 or 50 years ago and the rim and buckets were again renewed about 20 years ago.



An Old Overshot Waterwheel at South Windham, Conn.

It seems not unlikely that this wheel may be the oldest prime mover in this country still in use or in condition to be used. It seems reasonable to believe that no steam engine built prior to 1838 can be still in use anywhere on this side of the water; and nearly all the overshot waterwheels of old-time construction which remained in use in New England and the Middle States were abandoned when the American turbine became popular twenty-five years and more ago. If any correspondent knows of any older prime mover in this country, we shall be glad to hear of it.

We are indebted for the above information to Mr. A. J. Ellis, Junior Geologist, U. S. Geological Survey.

A Large Reinforced-concrete Girder Bridge

By Harry J. Rodgers*

A reinforced-concrete bridge of a type well adapted to country-highway service has recently been completed across the Iowa River, near Marshalltown, Iowa, for the county supervisors of Marshall County. The bridge is 182 ft. long with a roadway width of 16 ft., and is made up of four similar 42 ft. 2 in. girder spans, resting on slender wall piers. Details of the design are shown in Fig. 1 and a view of the bridge nearing completion in Fig. 2.

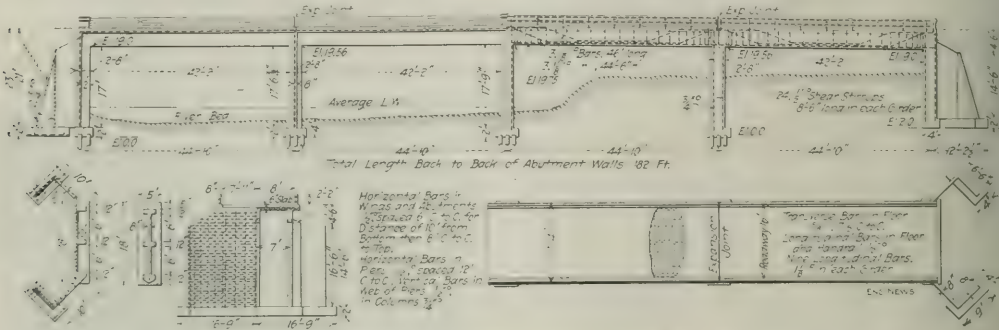


Fig. 1. Details of Reinforced-concrete Girder Bridge, Marshalltown, Iowa

The three piers are similar in design, though the middle one is slightly higher than the others to provide a camber to the whole bridge. Each pier is composed of three 12x32-in. columns, which are braced and tied together by 8-in. web-walls. These webs extend from the foundation to the bottom of the deck slab, and they are reinforced horizontally and vertically with ½-in. round bars, set 12 in. c. to c. both ways, and wired at intersections. The columns are reinforced with ¾-in. round bars placed one in each corner, and banded with ¼-in. bars, spaced 12 in. c. to c. Upstream nosings were poured as a part of each pier.

The piers stand on foundations 2 ft. deep, 5 ft. wide, and 18 ft. long. The bottoms of the foundations in the channel are 4 ft. under the bed of the stream. Each foundation rests on a footing of nine piles. The vertical reinforcing bars in the columns and web-walls penetrate the foundations, and those in the center pier, the abutments and the fixed side of the intermediate piers extend up into the girders and floor.

The abutments consist of the typical column and wall construction with additional wing-walls, shown in Fig. 1, for holding the earth fill. These walls are 21 ft. high, 10 ft. long and 8 in. thick, and are reinforced with ½-in. round bars. They were poured monolithic with the abutments and were anchored at the ends to a counterfort on the rear of each wall. The counterforts and ends of the walls rest on footings 9 ft. long, 4 ft. wide and 2 ft. deep.

Each span is composed of three 12x36-in. girders, spaced 7 ft. c. to c. The main reinforcing of the girders is nine 1⅛-in. square bars, placed in three layers near the bottom of the section. The lowest layer extends parallel to the bottom of the girders, but the two upper layers are bent up through the top of the girders, near their ends, to take the diagonal shear, and are embedded in the deck slab. Each girder is also reinforced vertically, and tied to the deck, with twenty-four ½-in. round shear stirrups, spaced 3 ft. c. to c. in the middle of the girders, the spaces contracting to 8 in. at the ends of the girders.

The floor slab is 6 in. thick. It is reinforced near the top and bottom with transverse ⅝-in. round bars, set 7½ in. c. to c., and with three longitudinal ½-in. round bars, placed near the bottom of the slab between the girders. The longitudinal bars in the girders and slab of the central spans overlapped above the middle pier. It carries an ordinary macadam road.

The hand-rails are 30 in. high. They are composed of two 6x6-in. concrete bars, supported by 6x6-in. concrete posts at intervals of 4 ft. 5 in. Each bar and post is reinforced with two ½-in. round bars.

A joint, cut through the guard-rails, deck and girders over the center of the abutment-piers, provides for linear expansion, as does also a slip-joint between the under side of the girders and the top of these piers. A 6-in. fill of earth covers the deck, and a drop of 9 in., center pier to abutments, drains the roadway lengthwise of the bridge.



Fig. 2. View of Marshalltown Bridge across the Iowa River

Labor and materials were used economically in pouring concrete and in making and erecting forms. Concrete for the foundations was discharged by chute from the old bridge, alongside of which the new one was built, into coffer-dams.

The falsework was supported by six bents of piles to each span, with three piles in a bent. Each bent was capped transversely with two 3x12-in. sticks, 16 ft. long, bolted to the top of the piles. On top of these caps were longitudinal stringers, each one composed of three lines of 3x12's on edge, placed directly beneath the girder

*Marshalltown, Iowa.

forms. On these stringers there were laid transversely 3x12's, 24 ft. long, spaced 3 ft. c. to c. The girder forms were supported and trued by driving wedges between the bottom of the forms and these transverse planks.

While the falsework was being erected, the forms for all the columns, sides and bottoms of the girders were made in panels on the shore. As soon as the falsework was up the panels were ready to set in place. The forms were of 1-in. lumber, nailed to 2x4-in. cleats, spaced 2 ft. c. to c. This left them in shape to be taken down quickly, moved easily and erected for the next job with a minimum amount of waste of lumber and labor. None of the concrete for piers or abutments was poured until the girder and deck-slab forms were completed.

Gravel and sand was taken from the river bed near the bridge site. The mix was 1 cement to 4 parts of well graded gravel. The mixer was set upon the slab form so that the piers and abutments could be run by gravity discharge. As soon as one pier was poured the mixer was moved forward to the next. To pour the spans, the mixer was set in the center of each one, and the floor and girders were run at the same time, without moving the mixer until the next span was to be run. The two cen-

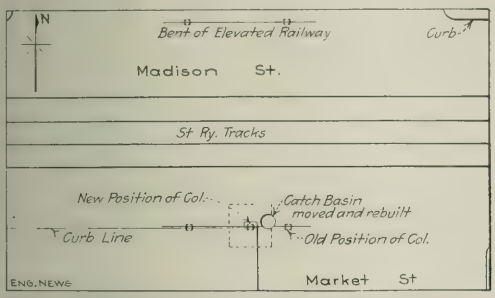


FIG. 1. PLAN SHOWING THE OLD AND NEW POSITIONS OF THE COLUMN OF AN ELEVATED RAILWAY WHICH WAS SHIFTED ON ACCOUNT OF BEING AN OBSTRUCTION IN THE STREET

tral spans were poured as a unit. Each span was run in an average of seven hours. The concrete was poured wet enough to run down a trough on a 1 to 7 slope.

The roadway was designed to carry a distributed live load of 200 lb. per sq.ft., or the concentrated loading of a 20-ton road roller. It contains 19½ tons of steel and 320 cu.yd. of concrete and cost $7439. A gang of 10 to 12 men completed the construction in 88 working days. The designer was George D. Dobson, of the Capital City Construction Co., of New Hampton, Iowa, which built the bridge, but the design was checked and approved by Thos. H. MacDonald, State Highway Engineer.

The concrete structure described replaced a 150-ft. steel bridge, the upper chords of which show above the new bridge in Fig. 2. The county supervisors at first proposed that the new bridge should be only 140 ft. long. This idea was abandoned when it was believed that owners of lowland farms, bordering on the river, would make claims for flood damage if the channel of the stream was narrowed by erecting a shorter bridge than the old one. So, to prevent possible lawsuits, based on the claim that flood water was diverted from its natural course by the shorter bridge, and inundated the land, another span was added and extended well out over the low south bank.

Shifting the Column of an Elevated Railway

The Chicago & Oak Park Elevated Ry., of Chicago, has a stub branch extending south on Market St. to the south side of Madison St., and consisting of two-column bents with transverse plate girders between which the longitudinal girders are framed. There is a considerable jog in the line of Market St. at this intersection, so that one of the columns in the end bent (on the south side of Madison St.) came at an awkward position in the roadway near the corner of the curb, forming an obstruction to traffic. The city's street department requested the removal of this column to the curb line, a distance of about 8 ft., and this has been done. Fig. 1 shows the general situation, with the old and new locations of the column. Fig. 2 shows the end-bent as reconstructed.

The column spacing is now 12 ft. 9 in. instead of 20 ft. 9 in., giving an overhang of 13 ft. for the east end of the girder. The end of the girder was supported by timber posts, with jack-screws and blocking, while the east

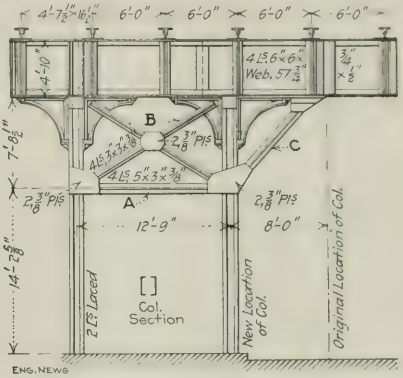


FIG. 2. RECONSTRUCTED BENT OF CHICAGO & OAK PARK ELEVATED RY. WITH ONE COLUMN SHIFTED TO REMOVE IT FROM THE ROADWAY

column was removed and shifted. The two columns were then connected by a horizontal brace *A* and the cross-frame *B*, the ends of the latter being riveted to the new connection-plates on the columns and to the kneebraces under the girder, as shown in Fig. 2. To support the overhanging end of the girder, the inclined strut *C* was applied. This arrangement theoretically puts a slight upward lift on the west column of the bent, but this is sufficiently anchored to its foundation to take care of any such uplift. The new column is anchored by four bolts 1¼x53 in., connected at the bottom by four flats 6x25½x⅜ in. These are embedded in the concrete pedestal, which extends about 11½ ft. below the sidewalk level. For drawings and information relating to this interesting and unusual piece of work we are indebted to C. M. Mock, Chief Engineer of the Chicago Elevated Rys. Co., which controls all the elevated railways of that city.

The Hudson Bay Ry. is to have its southern terminal at Le Pas on the south side of the Saskatchewan River. Engineering and construction headquarters will be located here and sufficient machine and repair shops to care for the contractors' equipment while the line is under construction will be built the coming summer.

Sand-cement as Used by the U. S. Reclamation Service

It was noted in ENGINEERING NEWS, Jan. 16, 1913, p. 118, that the U. S. Reclamation Service is using in two of its large irrigation dams, the Elephant Butte and the Arrowrock, a sand-cement made up of an equally blended mixture of sand and portland cement ground together to a fineness approximating that of normal portland cement. This is so obviously an economy in the cost of cement that the behavior of such a mixture is of great interest to engineers who might consider its use in future work. Some notes on this behavior were given by Charles H. Paul, Construction Engineer on the Arrowrock Dam, in the February, 1913, *Proceedings* of the American Society of Civil Engineers, p. 271, as a discussion of J. B. Lippincott's previous paper on "Tufa Cement." The important parts of Mr. Paul's discussion are given below.

In the construction of the Arrowrock Dam—which is being built by the U. S. Reclamation Service to store the flood waters of the Boise River—about 550,000 cu.yd. of concrete will be laid, and the cost of cement is, of necessity, a most important item. The dam is about 22 miles above the City of Boise and 17 miles above Barberton, the nearest point on the Oregon Short Line R.R. A railroad from Barberton to Arrowrock has been built by the United States Government, over which the freight rate on cement charged against the work is 23c. per bbl. The commercial freight rate on cement from Utah mills to Barberton is $1.14 per bbl., from California points $2 per bbl., and from Kansas points $2.09 per bbl.; so that the total freight charges on cement to the Arrowrock work are from $1.37 to $2.32 per bbl.

Laboratory tests on sand-cement have been carried on by the Reclamation Service for 6 years or more, and, during the winter 1910-11, when the investigations in connection with the storage works on the Boise River were nearly finished, a series of these tests was started, using for blending material the native rocks in the vicinity of Arrowrock, particularly granite from the spillway site, a large quantity of which would have to be wasted during the construction period. Table I is an average of three long-time tensile tests of sand-cement mortars (1:3, by weight, standard sand), each test being an average of 5 briquettes, compared with mortars made from portland cement used in the manufacture of the sand-cements and tested under the same conditions. The blending material for sand-cement was river sand or granite, blended in each case with equal parts by weight of portland cement.

TABLE I. LONG-TIME COMPARISON OF SAND-CEMENT AND PORTLAND CEMENT

[Tensile strength in lb. per sq.in.]

Kind of cement	7 days	28 days	3 mos.	6 mos	1 year	2 years	3 years	5 years
Sand-cement....	219	333	397	423	457	423	449	444
Portland cement	266	400	425	482	460	496	428	404

TABLE II. TENSILE TESTS OF STANDARD 1:3 PORTLAND CEMENT MORTAR BRIQUETTES

[Lb. per sq.in.]

7 days	28 days	3 months	6 months	1 year	2 years	3 years	5 years
260	373	448	447	432	411	379	398

TABLE III. SAND-CEMENT TESTS ON MATERIAL FROM ARROWROCK DAM SITE, ARROWROCK, IDAHO

Blending material, spillway granite. Mix, 1:3 by weight with standard sand. Lb. per sq.in.

Tensile Tests on Standard Briquettes

Percentage of blending material	7 days	28 days	3 months	6 months	1 year
0	333	428	461	467	498
30	374	417	467	499	494
40	368	467	501		
50	340	419	469	452	410
60	294	369	409		
70	156	247	266	329	335

Compression tests on 2-in. cubes

0	1677	1969	3729	3741	
30	1631	2454	3171	4302	4656
50	1471	1763	2729	3121	3712
70	458	938	1215	1256	1560

Table II shows average long-time tensile tests on 13 brands of portland cements used by the U. S. Reclamation Service during the last five years. It is noticeable that there is not the marked decrease in strength in the case of the sand-cement briquettes as is shown here, and is so common with portland cements.

The first column of Table III (percentage of blending material) in each case represents the portland cement from which the sand-cement is made, tested under the same conditions.

Investigations of the actual use of sand-cement in structures which had been in service for 10 or 15 years, further tests in the local laboratory, and estimates of cost of installation and operation of the necessary equipment, finally led to the decision to use sand-cement, in so far as practicable, in the construction of the Arrowrock Dam, and to use for blending material granite from the spillway excavation.

A sand-cement plant, with a capacity of 1000 bbl. per 24 hrs., consisting of a crusher and sand rolls, rotary dryer, ball mill, mixing machine and three tube mills, all electrically operated, with the necessary bins, hoppers and conveying machinery, has been erected and has been in operation for about two months. The cost of this mill complete was about $46,000, itemized as follows:

Excavation	$1,500
Foundations	3,750
Erection of building, chutes, etc.	8,150
Equipment, including freight	23,000
Installation of equipment	7,850
Electrical work	1,750
	$46,000

The total output of the mill to date has been about 25,000 bbl., and about 20,000 cu.yd. of sand-cement concrete have been placed in the dam, up to the present time.

All incoming portland cement is tested and accepted before shipment. All sand-cement is tested for fineness, blend, setting time, and tensile strength in 1:3 sand briquettes, and is subjected to the boiling test before being used in the work. Tests for fineness and blend are made every hour that the mill runs, or oftener if either needs correction, and the other tests are made on an average sample from each day's run. The blend now being used is 45% granite by weight, and the requirement for fineness is a least 90% passing a 200-mesh sieve. Standard portland cement requirements are satisfied by the other tests, and no sand-cement is used until it has passed the 7-day tensile tests of 200 lb. per sq.in. The writer's experience is that no sample tested has ever failed to pass the boiling test.

None of the sand-cement tested has failed to pass either the 7-day or the 28-day requirements. Occasionally, briquettes have been broken at the age of 4, 5, or 6 days, and in every case yet tested these briquettes have shown a strength exceeding 200 lb. per sq.in.

TABLE IV.—MILL-RUN TENSILE TESTS ON SAND-CEMENT MANUFACTURED AT ARROWROCK

All tests on 1:3 standard sand briquettes. Strength in lb. per sq.in.

Average of all (52) 7-day tests	258	Average of all (29) 28-day tests	332
Average of 10 lowest 7-day breaks	221	Average of 10 lowest 28-day breaks	304
Average of 10 highest 7-day breaks	297	Average of 10 highest 28-day breaks	366

A representative cost of manufacturing 1 bbl. of 45% by weight blend of sand-cement at Arrowrock is given in Table V, which includes depreciation, on the plant and installation, at a rate which will wipe out the total cost at the time that a total output of 500,000 bbl. is reached. It does not include sacking, as most of the sand-cement will be used in bulk.

TABLE V. COST OF MANUFACTURING SAND-CEMENT

Items	Unit cost of sand-cement per bbl.
Granite delivered to crushers	$0 92
*Portland cement, including freight and storing	1 35
Handling and storing portland cement	0 08
Labor, operating	0 10
Power and lights, including maintenance, etc	0 16
Installation, depreciation, supplies, repairs, etc	0 14
Total cost	$1 85

* Portland cement @ $2.36 per bbl., f.o.b., Arrowrock.

The use of sand-cement under actual working conditions brings out several characteristics that are different from those of portland cement.

Comparing sand-cement concrete with portland concrete, batch by batch, an experienced concrete man will note no difference, either in its appearance or in its behavior while being spread, but, after a run of an hour or two, in mass work, it will be noticed that an ordinary plastic or quaking

mixture gives off water more readily than does portland cement concrete, and that this water is clearer and apparently carries less cement than is the case with ordinary concrete.

A mushy or really wet mixture which is worked up continually shows, at the surface, an accumulation of sloppy material which is more marked than in portland cement and sets and hardens very slowly. In fact, it is the writer's opinion that, for this reason, extremely wet mixtures should be avoided, especially with sand-cement concrete.

Sand-cement concrete sets more slowly than ordinary portland-cement concrete, and its slowness in hardening is very marked. It is natural to asume that internal shrinkage stresses, due to setting and hardening, will be less on this account, but, at the present time, we have no other evidence on this point.

The writer has not noticed that sand-cement concrete adheres to the forms any more than portland concrete, and as he has had no occasion to use sand-cement plaster, he has not had an opportunity to compare it with ordinary cement plaster.

It is natural for the ordinary construction man to look on a new product with prejudice, especially when it shows characteristics to which he is not accustomed; but supposing, for the sake of comparison from another viewpoint, that sand-cement had been in general use for years and that portland cement were the new product being introduced; would we look with favor on a cement which almost invariably showed a decrease in strength after a few months? Or one which not infrequently failed to pass the boiling test? Would we consider it a favorable sign that the excess water coming to the surface of concrete apparently brought with it an unusual quantity of cement? Quick-setting cements are usually considered undesirable for use in mass work, and were we accustomed to the slow-setting and slow-hardening sand-cement, might we not look with suspicion on a quick-setting cement, especially if one of the quicker setting portlands happened to be the first of the new product to fall into our hands?

The use of sand-cement in mass work, where the requirements are enough to justify the installation of the necessary grinding machinery, where suitable blending material is available, and where the transportation charges on portland cement amount to a considerable portion of its cost laid down, will result in a marked saving in construction costs, and will give a product which is at least the equal of the portland cement from which it is made, in fact, one which, for ordinary requirements, is not open to the least suspicion.

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A Non-corrosive Iron Alloy*

A practically non-corrosive iron alloy has recently been put on the market under the trade name "duriron." This metal is the result of study at the plant of the Dayton Malleable Iron Co., under the lead of P. D. Schenck, president of the company. The alloy is quite resistant to ordinary rusting and is only slightly attacked by alkalies and acids, with certain few exceptions. As instances of these properties, the following data are arranged from tests which are still under way in the laboratory of Dr. C. F. McKenna, New York City:

Acid	Loss of Weight				
	Cast iron	Wrought iron	Monel metal	Tobin bronze	"Duriron"
Nitric	100% in 63 hr.	100% in 58 hr.	100% in 58 days	100% in 7 5 days	0 01% in 20 weeks
Sulphuric	100% in 16 days	100% in 30 days	1 58% in 26 weeks	0 43% in 16 weeks	none in 26 weeks
Hydrochloric	100% in 97 hr.	100% in 46 days	18 4% in 16 weeks	17 9% in 16 weeks	1-1.5% in 16 weeks

All specimens in these tests were approximately ¼x¾x3 in. in size. The acids were 25% monohydrate, used cold. It has been noted that this new alloy is more markedly attacked, however, by high concentrations of phosphoric acid, though not by more dilute solutions. It is reported that up to 50% monohydrate (50° B) there is no action, but at 85% it is decided. More complete data on the corrodability of this alloy are not yet available. Cyanide solutions have no appreciable action and the metal has proved entirely stable for use as dye house tools, where "off color" of dyed material gives a delicate test for the entrance of metallic salts into the dye solutions.

"Duriron" closely resembles cast iron, but it is some 10% lighter in weight. It has shown an average ultimate strength of 70,000 lb. per square inch in compression, with 15,000 lb. tension; the elastic limit is very close to the ultimate strength, as the metal is somewhat more brittle than cast iron. It melts at 2250° F. and is a much better conductor of heat and electricity than cast iron. The actual composition of the metal is not announced, though the makers admit that some 10% or more of silicon is to be found. They claim also that an analysis of "duriron" specimens does not give a key to success in making up such an alloy, as certain processes and materials which are necessary are not disclosed by the final product. It is claimed that full control over the final composition has been obtained, so that the desired qualities are always assured.

The only way of working this alloy is by casting and grinding; as it is about one-half harder than cast iron, it cannot be machined by the older processes. The abrasive found most successful with it is carborundum. Shrinkage in casting is found to be about $\frac{3}{16}$ in. to a foot, compared with the ⅛ in. ordinarily assumed for cast iron. At first great difficulty was found in obtaining good castings on account of peculiarities of shrinkage, but many troubles have been removed by experience, though the foundry loss is still heavier than with ordinary iron castings. The pig alloy has to be remelted in a gas-fired cupola in order to prevent the entrance of foreign materials which rob the castings of the desired characteristics. It has been found that cupola practice is so important that "duriron" is not recommended to general foundrymen, although the makers will sell the alloy in pig form.

Up to the present, large plane surfaces have not been successfully cast, the principal trouble being in shrinkage cracks. This difficulty is removed by giving the surfaces a certain curvature, the minimum corresponding to a maximum radius of 8 ft. This works no inconvenience in comparatively small work and in the miscellaneous fittings for which the alloy has been reported particularly desirable.

While castings of this metal have been commercially available for less than a year, already a considerable demand has sprung up according to reports of the makers. The present use is mostly in acid pipe-line fittings, valves, cocks, receptacles, etc., in centrifugal pumps, steam siphons, and in substitutes for earthenware fittings of chemicals works, powder and celluloid factories.

Apparatus is made to order from this alloy by the Duriron Castings Co., of New York, with foundries at Dayton, Ohio.

*From information furnished by J. R. Pitman, Vice-President and General Manager of the Duriron Casting Co., 90 West St., New York City.

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Government Ownership of Telegraph Lines was recommended by Postmaster-General Hitchcock in his last annual report, as follows:

In the last annual report the opinion was expressed that telegraph lines in the United States should be made a part of the postal system and operated in conjunction with the mail service. It is believed that under proper management such a consolidation would result in important economies and permit adoption of lower telegraph rates. Now that a postal savings system has been established and a parcel post provided for, there would seem to be no better opportunity for the profitable extension of our postal business than through the adoption of a government telegraph system.

Report of the Alaska Railroad Commission

On Aug. 24, 1912, Congress passed an act authorizing the President to appoint a commission

to conduct an examination into the transportation question in the Territory of Alaska, to examine railroad routes from the seaboard to the coal fields and to the interior and navigable waterways; to secure surveys and other information with respect to railroads, including cost of construction and operation; to obtain information in respect to the coal fields and their proximity to railroad routes; and to make report of the facts to Congress on or before the first day of December, 1912, or as soon thereafter as may be practicable, together with their conclusions and recommendations in respect to the best and most available routes for railroads in Alaska, which will develop the country and the resources therein for the use of the people of the United States.

Within a week after this date, President Taft had appointed to this Commission Major J. J. Morrow, Corps of Engineers, U. S. Army, as chairman; Alfred H. Brooks, geologist in charge of Division of Alaskan Mineral Resources of the U. S. Geological Survey, vice-chairman; Civil Engineer Leonard M. Cox, U. S. Navy, and C. M. Ingersoll, consulting railroad engineer, New York City. On Sept. 3 those members of the Commission resident in or about Washington left that city for Seattle. On Sept. 7 the whole Commission sailed for Alaska. From Sept. 7 to Nov. 17 the Commission spent its entire time traveling in and about Alaskan territory, examining topography, investigating proposed routes, and studying existing railways. This time was most strenuously occupied. For instance, on each of 25 successive days the entire Commission traveled some distance in either a buckboard, a wheel or sled stage, or an automobile, and on several of the days traveled over 35 miles, in one day covering 57 miles from 1 a. m. to 8 p. m. They returned to Seattle on Nov. 17, traveled through Canada to acquire what information they could of the northern Canadian railways, and reached Washington on Dec. 2.

On Jan. 20, 1913, their report was transmitted to the President. This report has just been published as "Document 1346 of the 62nd Congress, third session of the House of Representatives." It is a most exhaustive analysis of the resources and commercial requirements of that enormous territory of the United States whose great value is just being realized. The report, a book of 172 pp., with maps, tables and diagrams, will bear study by anyone interested in the Alaskan territory. Space only will be taken here for a short description of the present railway facilities of Alaska and a reprint of the summary and recommendations of the Commission.

Resources of Alaska

The mineral wealth of Alaska is at present its most important resource, and the one which has brought about its present state of development. The developed mineral resources include gold lodes and placers, copper, tin and silver deposits, together with petroleum, marble and gypsum. There are also extensive fields of bituminous and lignitic coal and some iron ores, which are practically undeveloped. In addition to these, silver-lead, zinc, antimony, quicksilver, and other ores, and peat, graphite, asbestos and mica have been found. The most important mineral industry has been placer mining with gold lode mining a fair second. It may be said, however, that only the surface of Alaska has been scratched as far as mineral production is concerned, the more difficult methods of mining having been disregarded on account of the lack of transportation facilities.

Though public attention has for several years been focused on the coal deposits of Alaska, no coal mining has been carried on except that of its lignitic deposit for local use which was begun some 13 years ago. Large sums have been spent on surveys, development work, etc., in the Bering River and Matanuska fields. In spite of all this activity, the total output of coal in the territory up to the close of 1912 was insignificant, being less than 40,000 tons. During this period upwards of one million and a half tons have been imported into the territory. The main coal fields, as noted on the accompanying map, are the Bering River and Matanuska fields along the coast, and the Nenana field lying about 60 miles southwest of Fairbanks in the central portion of the territory. While the recent controversies regarding patent rights in these fields have served to retard their exploitation, the lack of railroad facilities has been equally responsible.

It is further stated by the Commission that there are large tracts of arable and grazing lands in central Alaska, for the most part unutilized because of the lack of transportation. These, too, should be opened by railroads.

Looking at the accompanying map it will be seen that the south coast is easily accessible by steamships and by the short railroads already built, but that the central area north of the Pacific Coast range, which area contains the bulk of the coal and mineral deposits and in which area is located the prosperous cities of Fairbanks, in the central portion, and Nome, in the western portion, is practically isolated except by means of wagon or sled traffic or in the summer by the river steamers. It is mainly to open this interior section that the construction of railways is recommended.

Present Transportation Routes

The total area of Alaska is nearly one-fifth that of the United States. About a quarter of this area lies north of the Endicott range, which is itself north of the Artic Circle. This portion of the territory is arctic and it alone presents the bleak and frozen aspect popularly associated with Alasks. South of this range in Alaska there is an area greater than all the space east of the Mississippi and north of the Ohio and Mason and Dixon's line, which is as capable of high development as many well traveled and rich countries. To the north of the Pacific mountain system, which parallels and is close to the southern coast of the territory, lie two rivers, the Yukon and the Kuskokwim, both of which pass through valleys with broad, open bottom-lands and gently rolling uplands. Both of these rivers, however, enter the Pacific Ocean at a latitude so far north as to be open to navigation only three or four months of the year. During those periods they are navigable far into the interior of the territory. There are other rivers entering the rich interior, notably the Copper River and Susitna River, both to the south, but these two rivers opening as they do into year-round harbors are more valuable for railway location than they are for river navigation. Steamboat service between the States and the southern portion of the territory is quite frequent, and during the summer months an equally frequent service is maintained to the north and west sides of the peninsula. The interior, where most of the mining, the principal industry of the peninsula, is carried on, is reached by river navigation

noted above, some wagon roads described later, and the following railroad lines (see accompanying map), built and operated by private companies:

	Mileage
Southeastern Alaska:	
White Pass and Yukon route, Skagway to White Pass (narrow gage)	
Terminal at White Horse, Yukon Territory—total mileage, 102 miles	20 4
Yakutat Southern Railway, Yakutat to Situk River (narrow gage)	9 0
Copper River Copper River & Northwestern Railway, Cordova to Kennicott (standard gage)	195 0
(The same company has built a few miles of track at Katalla, where the Alaska Pacific Railway & Terminal Co. has also done some work. At Valdez a few miles of track of the Alaska Home Railway were laid in 1907, and some work was previously done on the Copper River & Northwestern Railway and on the Valdez & Yukon Railway.)	
Kenai Peninsula: Alaska Northern Railway, Seward to a point near head of Turnagain Arm (standard gage)	71 6
Yukon Basin: Tanana Valley Railway, Fairbanks and Chena to Chatanika (narrow gage)	46 0
Seward Peninsula:	
Seward Peninsula Railway, Nome to Shelton (narrow gage)	80 0
Paystreak Branch, Seward Peninsula Railway (narrow gage)	6 5
Council City & Solomon River Railway, Council to Penelope Creek (standard gage)	32 5
Wild Goose Railway, Council to Ophir Creek (narrow gage)	5 0
	466 0

Since 1905 the U. S. Government has maintained a Board of Road Commissioners in Alaska, and that commission has had constructed up to July 1, 1912, 829 miles of wagon road for use in winter and summer, 599 miles of winter sled roads, 1552 miles of trail, and in addition many miles of trail for winter travel only. According to the Railway Commission's report these roads, while not comparable with the best highway construction in the States, have shown remarkable return for the money expended. As is well known, the larger part of the travel in Alaska, especially in the winter months, has been carried on over these roads and trails. In its account of the transportation facilities now in Alaska, the Commission sums up as follows:

All Alaska has less than 500 miles of railway in nine disconnected systems, less than 1000 miles of wagon road, 600 miles of winter sled road, less than 2000 miles of trail, with 5000 miles of important navigable waterways, which are closed by ice for about three-quarters of the year and this in a country comparable in size, resources and climate to Norway and Sweden

Summary

The main design of the Commission in its suggested routes has been to open up for industrial development the two great inland navigable water systems, the Yukon and the Kuskokwim, and to lay out the railways that these regions may be brought into communication with one or more ocean ports ice-free the year round. The other sections of the country should also be developed in the opinion of the Commission, but the main and primary effort should be the two named.

The summary of the Commission's report is as follows:

The data presented show that the United States possesses in Alaska a frontier territory of great size and of wonderful industrial possibilities. The Commission believes that its climate is favorable to permanent settlement and to agriculture; that its mineral resources are vast and as yet but little exploited; that its population is sparse, but only by reason of its inadequate transportation facilities; and that its people are of the same type of hardy pioneers that have carried the United States frontier to its present limits.

In arriving at conclusions and formulating findings the Commission has had in mind the terms of the act of Congress constituting its precept, which, briefly stated, provides for recommendations in respect to the best and most feasible railroad routes in Alaska from the seaboard to the coal fields and to the interior navigable waterways "which will best develop the country and resources thereof for the use of the people of the United States." It interprets this precept to mean recommendations:

1. For a railway or railways which give promise of affording the lowest transportation cost to tidewater of coal from one or both of the two best coal fields.

2. The projection of railways along such route or routes as would open the interior to commerce and colonization; the selection of such route or routes to be made after giving due weight to lowest cost, and shortest time of construction, maximum economy of operation, and service to the largest areas of known natural wealth, best adapted to permanent colonization; and, finally

3. That these proposed railways must be based on the best ocean terminals.

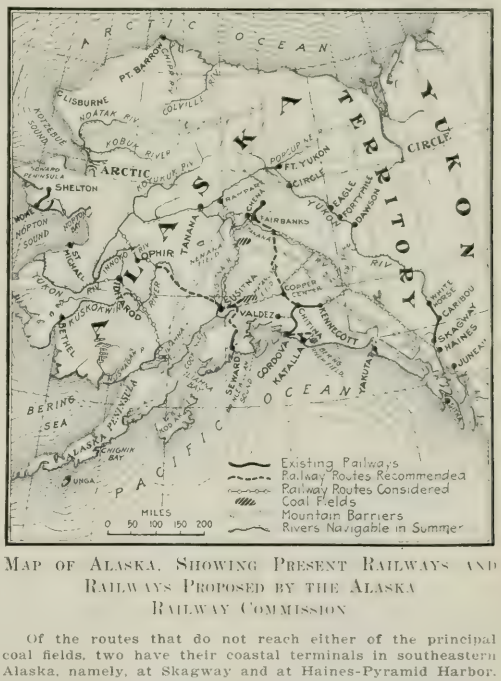
The routes considered by the Commission fall into three classes.

(1) Those which reach the interior, but do not give economical access to either of the two principal coal fields. In this class are: The Skagway route; the Haines-Fairbanks route; the Illamna-Kuskokwim route; the Valdez-Fairbanks route.

(2) Routes which reach the coal fields only. In this class fall the routes from Katalla and Controller Bay.

(3) The routes which reach the interior and at the same time will furnish economical transportation for the two coal fields. In this class are the Cordova-Fairbanks route; the Seward-Fairbanks route; the Seward-Innoko-Iditarod route. These routes will be considered in the order above presented.

For convenience in discussing the relative merits of the various routes under consideration, it has been deemed expedient to arrange the physical and economic characteristics of each in such form as to facilitate comparison. Accordingly, two tables have been prepared and are here inserted. Table I shows the various features of the six through or trunk routes, while Table II refers to the proposed coal roads. The headings of the different columns are descriptive of the data furnished and therefore require no further explanation.



Map of Alaska, Showing Present Railways and Railways Proposed by the Alaska Railway Commission

Of the routes that do not reach either of the principal coal fields, two have their coastal terminals in southeastern Alaska, namely, at Skagway and at Haines-Pyramid Harbor. These two routes have much in common, but as between the two harbors, the location at Haines, with its possibilities of development on both sides of the peninsula, and with its good anchorage area, possesses advantages over Skagway.

The Commission believes that a railroad will be built at an early date, connecting Haines with the Canadian interior, for the development of local resources, and that the development of central Alaska and adjacent portions of Canada will ultimately call for an extension of this line into the Tanana Valley and possibly on to the Seward Peninsula. The route presents many attractive features; but in common with the route based on Skagway, the mileage to Fairbanks is excessive, is partly in foreign territory, and as yet no high-grade coal has been discovered which can be conveniently served by either of these routes. The Commission therefore feels justified in confining its further considerations to the routes reaching the interior from ports on the Gulf of Alaska west of the one hundred and forty-first meridian.

The third route, which does not give access to either of the principal coal fields, is the route from one of the harbors on Cook Inlet into the valley of the Kuskokwim. These harbors may be passed over the statement that no railroads can be based on any of them that will assist in the development of the Territory as efficiently or as economically as can be done by lines reaching the coast farther north and east. They lie too far southwest to develop conveniently the known resources of the interior. The Commission, however, desires to state that Iliamna Bay or Iniskin Bay has possibilities for use as a terminal for a short line intended to develop the resources and industries of the immediately tributary region. This eliminates all routes to the interior that will not economically serve either of the two principal coal fields, excepting the route from Valdez.

Valdez has a harbor inferior only to that of Cordova and about equal to that of Seward. There is no probability, however, of its being utilized as an outlet for either Bering River or Matanuska coal. The commission considered the possibilities of developing Matanuska coal by way of this port; but the haul involves the surmounting of two major summits (Tahneta and Thompson Passes) and one minor summit (Ernestine), besides being longer in distance than the haul over the alternate route to Seward. It is not surprising, therefore, that operating costs are shown to be excessive. With industrial advancement it is probable that Valdez will require the construction of one or the other of the lines connecting it with the Copper River Valley. The Thompson Pass route would also have value in case equitable trackage arrangements for traffic through to tidewater cannot be effected by the proposed Chitina-Fairbanks road.

This leaves for consideration the routes giving economical access to the two coal fields. Before discussing these routes which are affected by the development of these fields it is desirable to briefly consider the coal question.

In the absence of information to the contrary the Commission assumes that the coal deposits of the Bering River and Matanuska fields are on a parity as to quality of product and cost of mining. The heart of the Bering field lies about 30 miles from the coast at either Katalla or Controller Bay, about 76 miles from Cordova, and about 38 miles from the existing tracks of the Copper River & Northwestern Ry. The heart of the Matanuska field is 187 miles from Seward, 115 miles from the present northern terminus of the Alaska Northern Ry. Both fields are reported to contain bituminous coal of good coking and steaming quality, in composition approximating the best coals of the eastern fields in the United States, but both are so folded and crushed as to add to the expense of mining and to much reduce the percentage of lump in the output.

It has been shown by analyses of operation costs that these coals can probably be delivered at their respective terminal points for the following figures per ton. These figures are based on an assumed output of about 500,000 tons annually, and include only transportation and terminal costs.

Estimate of cost of transporting and loading coal:

	Per ton
Bering River coal to—	
Katalla	$0.97
Controller Bay	0.89
Cordova via Lake Charlotte	1.44
Matanuska coal to Seward	3.38

It has been shown that Alaska coal could probably compete with other coals in the west coast markets, provided that the operators both of the mines and of the transportation lines are content with reasonable profits.

Controller Bay and Katalla each require for terminal development a first cost of construction that will assuredly be high and will certainly require high maintenance charges. Moreover, the completion of such terminal would offer harbor facilities very inferior to those that can, at little expense and at low maintenance charge, be had at Cordova. While the costs of transportation to these points are lower than that to Cordova, the Commission believes that it would be unwise to attempt harbor construction at either Katalla or Controller Bay at present. An additional and important reason for this decision lies in the fact that if either of these places were developed as a coal-shipping port all Bering River coal used in Alaska would have to be transshipped unless a line from Katalla to a junction with the Copper River Ry. were built. It is evident that such a railway would serve, for the present at least, to make harbor construction at either Katalla or Controller Bay superfluous, for it would at once give the coal an outlet to tidewater at Cordova, as well as inland by the Copper River Valley.

The Commission is of opinion that the routes based on Skagway, Haines, Iliamna Bay and Valdez are eliminated for the lack of high-grade coal, and those based on Katalla and Controller Bay by the present unsuitable harbor facilities, which would be remedied only by difficult and costly construction. This reduces the discussion to the three routes which penetrate inland Alaska and at the same time give convenient access to the two coal fields. Two of these routes reach the heart of the Tanana Valley, one from Cordova and one from Seward. The third reaches the Kuskokwim from Seward. The two routes into the Tanana will first be compared.

After its study of all available harbors, the Commission is of the opinion that the one at Cordova is, without question, the best. It has no disadvantage not possessed by all and one great advantage possessed by no other, namely, an ample area of good anchorage. Seward is evidently the seaport for the Matanuska coal and Cordova the logical outlet for the Bering River coal. The comparisons of transportation rates given in the foregoing table show that for an output of 500,000 tons annually it will cost $1.96 a ton more to haul Matanuska coal to Seward than it will to haul the Bering River coal to Cordova, and the analysis further shows that for double this output the additional cost will be $1.11. This places the Matanuska coal at such disadvantage that it could probably not be marketed at tidewater in competition with the Bering River coal.

To now consider the trunk lines to Fairbanks over their two routes: For the purpose of comparison a digest of the analyses of mileage and cost of new construction, mileage between terminals, and freight rates on these two lines is here again presented.

TABLE I.—COMPARISON OF TRUNK LINES

Name of route	New track mileage	Existing track mileage	Total cost of new construction	Average construction cost per mile	Maximum grade northbound Per ct.	Maximum grade southbound Per ct.
Haines-Fairbanks	638		$28,186,000	$44,300	2	2
Cordova-Fairbanks	313	132	13,971,000	44,600	1.13	1.51
Valdez-Fairbanks	330		18,545,000	48,800	3	3
Seward-Fairbanks	391	72	17,708,000	45,000	2.3	2.2
Seward-Iditarod	344	72	17,970,000	52,300	2	2
Iliamna-Kuskokwim	400		22,199,000	55,400		

Name of route	Number of summits	Total lift northbound Feet	Average freight rate per ton-mile Cents	Average rate per passenger-mile Cents	Through freight rate per ton	Through passenger rate
Haines-Fairbanks	2	4000	8.30	7	$36.94	$31.15
Cordova-Fairbanks	1	4260	5.49	6	24.43	26.70
Valdez-Fairbanks	3	5970	9.13	7	31.69	26.60
Seward-Fairbanks	3	4900	6.04	6	22.95	22.80
Seward-Iditarod			8.55	7	40.20	32.90
Iliamna-Kuskokwim			5.08	6	26.71	28.20
			10.5	10	68.64	41.60
			11.63	6	48.38	33.28

Cost of new construction contains equipment and overhead charges.

TABLE II.—COMPARISON OF COAL LINES

(Freight rates calculated for 1500 tons daily output at mines.)

Name of route	New track mileage	Existing track mileage	Total cost of new construction	Average construction cost per mile
Bering River-Katalla-Cordova	55	38	$2,700,000	$49,000
Bering River, Lake Charlotte, Cordova	38	38	2,054,000	54,000
Bering River, Katalla Bay	54	...	11,702,000	55,000
Bering River, Controller Bay	25	...	11,430,000	57,000
Matanuska, Chitina, Cordova	163	132	8,431,000	51,700
Matanuska, Kern Creek, Seward	115	72	1,945,000	13,000
Matanuska, Valdez	230		12,662,000	55,000

Name of route	Maximum grade northbound Percent	Maximum grade southbound Percent	Number of summits	Total lift southbound Feet	Average freight rate per ton-mile Cents	Through freight rate, mines to terminal	Through freight rate, mines to ship
Bering River, Katalla-Cordova	1.3	0.58		145	1.39	$1.29	$1.54
Bering River, Lake Charlotte-Cordova	1.3	1.7	1	360	1.51	1.17	1.42
Bering River, Katalla Bay	1.3	0.58		145	2.50	77	97
Bering River, Controller Bay	1.3	0.58		145	2.79	69	89
Matanuska, Chitina, Cordova	1.13	2.2	1	2180	1.66	1.90	5.15
Matanuska, Kern Creek, Seward	2.3	2.2	2	1750	1.36	3.13	3.38
Matanuska, Valdez	3	3	3	3980	1.70	3.91	4.16

Exclusive of terminal, which is estimated at $2,500,000.

Cost of new construction contains equipment and overhead charges.

Terminals	Distance	New mileage	Cost of new construction	Average freight per ton Estimate 2*	Estimate 3†
Cordova-Fairbanks	445	313	$13,971,000	$36.94	$24.43
Seward-Fairbanks	463	391	17,708,000	40.29	27.71

*Based on passenger-mile tariff of 7c and freight-ton-mile tariff of 9.13c, and private construction, requiring 6% of first cost as fixed charges.

†Based on passenger-mile tariff of 6c and freight-ton-mile tariff of 6.94c and government construction or aid, reducing the fixed charges to 3% of first cost and omitting a $100 per mile license tax.

It is evident that, on the Cordova route, the first investment will be less than on the Seward route, the resulting freight rates will be lower; the terminal port offers a better harbor than the one at Seward; and the tributary coal field promises the earlier development because its product can be marketed cheaper. Each of these economic features points clearly to the advisability of reaching the Tanana Valley via the valley of the Copper River, and the Commission therefore recommends the construction of a railway from Chitina to Fairbanks.

The construction of a railway through the Copper River Valley to the Tanana would leave a large and very important part of Alaska unprovided for. It would in no way furnish transportation facilities to the rich agricultural lands and mineral wealth of the lower Susitna or make available the coals of the Matanuska fields. While this coal is probably barred for the present from tidewater competition with the Bering River coal, it yet has great value for local use. Moreover, and still more important, a railway to Fairbanks from Cordova will not serve the great Kuskokwim Valley, and therefore not fulfill all the demands for rail connection with inland navigable waters. Fortunately both the Kuskokwim and Susitna Valleys can be developed by a railway from Seward to navigable waters on the Kuskokwim.

The building of this line into the Susitna Valley is second in importance only to a line to Fairbanks, and its extension into the Kuskokwim should also be provided for as soon as possible, and the Commission so recommends.

The Commission believes that the two railway lines into which this discussion has resolved itself will form two systems that will at once advance development in the Territory. This recommendation for two trunk lines connecting navigable waters is in accord with the natural evolution of railway construction. In new countries the first lines of communication established are always those built over the main divides and connecting with navigable waters, and thus serving to supplement water transportation. It is only in well-settled countries that lines tying together such transverse systems and paralleling waterways are built.

The industrial advancement which will follow the building of the main trunk lines cannot fail to call for the extension of many branches to serve adjacent districts. There is no reason to believe that such branches will not follow in Alaska as they have in all railroad history, and such extensions will ultimately provide for intercommunication between the two systems here recommended. Several such extension lines have been mentioned in this report. Those most important, in the opinion of the Commission, are the coal branches; the extensions from Fairbanks to the Yukon River, so that the scope of rail service may reach the main Yukon Valley; the extension from the Chitina-Fairbanks line to reach the Nebesna Valley; and one at least of the two routes connecting Valdez with the Copper River Valley. In the opinion of the Commission the two coal branches should be built at once; the others will follow the demand created by industrial development.

The Commission therefore recommend the construction of railway lines as follows:

1. Chitina to Fairbanks, 313 miles	$31,971,000
2. Bering River coal branch, via Lake Charlotte, 38 miles	2,054,000
3. Kern Creek to Susitna Valley, 115 miles	5,209,500
4. Matanuska coal branch, 38 miles	1,616,000
5. Susitna Valley to Kuskokwim, 229 miles	12,760,500

In conclusion, it should be stated that the Commission is unanimously of opinion that this developmnt should be undertaken at once and prosecuted with vigor; that it cannot be accomplished without providing the railroads herein recommended under some system which will insure low transportation charges and the consequent rapid settlement of this new land and the utilization of its great resources.

Prospective Ownership of Railways

In regard to the possible ownership of these projected railways the report of the Commission contains the following statement:

Its instructions from Congress do not contemplate that any recommendation should be made as to how railroads in Alaska should be constructed, i.e., by private corporate ownership or by one of the many forms in use whereby government assistance is rendered. The Commission disavows any intention of making such recommendations, believing that Congress, in its wisdom, desired to reserve to itself the solution of that problem; but it has been impossible to form any estimates of costs of operation without some assumption as to the interest rate on the capital required for construction. This interest rate would obviously differ in two cases—construction by Government or bond guaranty, and construction by private capital. Moreover, were construction carried on by private capital unassisted, the necessity of earning sufficient income to pay operating expenses and interest on bonded indebtedness might make it the duty of the directors of the corporation to impose rates on traffic that would seriously retard the development which the Territory so greatly needs.

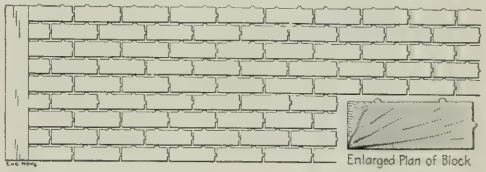
The Commission has therefore been forced to base its studies upon two hypotheses, viz.: That the capital necessary for construction is obtained at 6% interest, assumed as possible if construction is carried out by private corporate ownership unassisted; and that capital is obtained at 3% interest, assumed as possible if the construction is done either by the Government itself or by private capital with bonded indebtedness guaranteed both as to principal and interest.

In submitting the report to Congress Pres. Taft said in regard to this ownership question:

The necessary inference from the entire report is that in the judgment of the Commission its recommendations can certainly be carried out only if the government builds or guarantees the construction cost of the railroads recommended. If the government is to guarantee the principal and interest of the construction bonds, it seems clear that it should own the roads, the cost of which it really pays. This is true whether the government itself should operate the roads or should provide for their operation by lease or operating agreements. I am very much opposed to government operation, but I believe that government ownership with private operation under lease is the proper solution of the difficulties here presented.

Wood Paving with Lug-blocks

A special form of creosoted wood-block paving now in use to some extent has lugs formed on the sides and ends of the blocks, and three advantages are claimed for this construction: 1, with a compressible filler for the joints, the lugs provide for expansion of the blocks, and so prevent buckling or heaving of the pavement; 2, the open joints give a better foothold for horses than a wood-block pavement laid with close joints; 3, the blocks must necessarily be laid in proper position, as they cannot be laid on the side (or with grain horizontal).



Lug-blocks for Creosoted Wood Paving

The arrangement of the blocks in the pavement is shown in the accompanying cut. The lugs are formed by cutting beads on the planks as they go through the planer at the mill, the planks being then run through gang saws and cut up into blocks in the usual way. The blocks are made from Southern yellow pine, tamarack, beech or maple, and are of the ordinary sizes for wood-paving blocks.

At Toledo, Ohio, this paving is used on a part of Jackson Ave., where there is a grade of about 3%. We are informed that during recent sleety weather, when the streets were covered with ice, teams had no difficulty in ascending the hill paved with the lug-blocks. These blocks are the invention of H. G. Jennison, of the Jennison-Wright Co., Toledo, Ohio, which has been manufacturing them for about two years. The company states, however, that they may be made by any creosoting firm.

FIELD AND OFFICE

Clearing Up Steel Wreckage at Low Cost

A storage and shop building of the Carnegie Steel Co., at Bush and Wicomico Sts., Baltimore, Md., was burned Jan. 2, 1913. The steel frame of the building was converted into a tangle, lying on the stock piles; the latter and the machinery apparently were not much damaged. The wreckage was cut apart by oxyacetylene torch (see



Oxyacetylene Cutting in Wreckage of Steel-frame Warehouse, Baltimore, Md.

view herewith). A truck-mounted equipment (No. 3-T) of the Alexander Milburn Co., Baltimore, was used, with 50-ft. hose. A single torch, served by one operator with a helper, cut up the steel into lengths small enough to handle, faster than a gang of five men could load and take away the pieces.

The building was 130x300 ft. in plan. The cutting-up job took 10 nine-hour days, with some delay, or a net time of about 9 days (2 men with torch). G. C. Willett, Secretary of the Alexander Milburn Co., says that the cutting was done at a cost of about $10 per day.

Concrete Sewer-pipe Tests in Kansas City

By E. S. Wallace*

Briefly, the tests required by Kansas City, Mo., in accepting concrete sewer pipe are:

Hydrostatic—Untreated pipe shall show no percolation up to 10 lb. pressure and shall resist fracture at 33 lb. per sq. in. pressure.

Crushing Test—When supported on a bed of sand, so that an even bearing is provided throughout the length of the pipe, the various sizes of pipe shall withstand the following pressures, applied at the crown uniformly along a line 1 in. in width and extending the whole length of the pipe exclusive of the bell:

6 to 8 in.	1000 lb. per lin.ft.
9 in.	1050 lb. per lin.ft.
10 in.	1100 lb. per lin.ft.
12 in.	1150 lb. per lin.ft.
15 in.	1300 lb. per lin.ft.
18 in.	1450 lb. per lin.ft.
21 in.	1700 lb. per lin.ft.
24 in.	2000 lb. per lin.ft.

In recent specifications a clause has been inserted requiring clay pipe to pass the same tests as concrete pipe.

The first hydrostatic tests were made early in 1912, under the supervision of L. R. Ash, City Engineer. No arrangements had then been made for crushing tests. The left half of Fig. 1 will show the method. The bevel plate acted as a wedge against the slope of the bell, and when ruptures occurred we were unable to determine whether they were caused by water pressure, or by stress exerted by the plate. Also the leakage around the clamp bolts was such as to make percolation tests impossible.

The right half of Fig. 1 shows an improved design, with bolts outside. While far from satisfactory, this apparatus was a decided improvement, and we secured some very good tests. Almost without exception, fractures started at the bell, indicating that they were caused by wedge action of the bevel plate, so that our negative tests were unreliable.

Mr. Ash suggested the use of rubber-cup gaskets, and ordered a set made for 15-in. pipe. These were made 15 in. diameter on the bottom and flared to 15¼ in. at the top of rim, and 1½ in. deep. Tests with these gaskets were made Oct. 12, 1912. The pipe was set on the baseplate, bell down, over a wooden core 3½ in. thick by 14½ in. in diameter, and the bottom gasket forced down inside until it rested on this core. The top gasket was secured to a cover-plate by a locknut on a nipple in the center of the plate through which water pressure was applied. As the gaskets were inside of the pipe, it was only necessary to draw the clamp-bolts tight enough to hold the plates in position. The pipe now received full

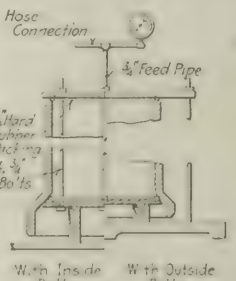


Fig. 1. First Device

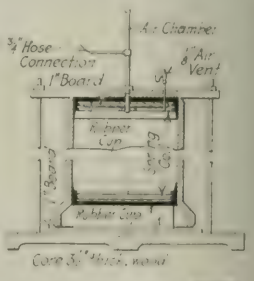


Fig. 2. Final Device

Hydrostatic Tests of Sewer Pipe

water-pressure, without undue stresses caused by drawing of bolts, etc., but as the gaskets were shallow and poorly

*Cement Inspector, office of City Chemist, Kansas City, Mo.

made the excessive leakage made percolation tests impossible, though no difficulty was experienced in making internal-pressure tests. The pipe thus tested fractured longitudinally from the spigot end, confirming the theory that in former tests made with the old apparatus the ruptures were caused by wedge action of the bevel-plate.

Satisfied that we were on the right track toward a solution of hydrostatic tests, three sets of gaskets were made for 18-in., 21-in. and 24-in. pipe, 3 in. deep and made

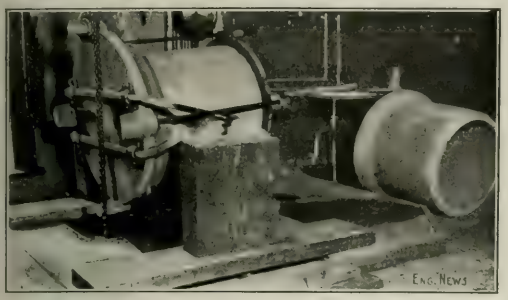


FIG. 3. KANSAS CITY SEWER-PIPE-TESTING APPARATUS WITH TILTING CRADLE
(24-in. pipe in position for testing.)

from the best motor-tire rubber obtainable. With these new cups, tests were made on 21-in. pipe. Brass spring-wire coils were placed inside of each gasket, which exerted enough pressure to hold the rim firmly against the side of the pipe (see Fig. 2). The bottom gasket was pressed down inside until it rested on a wooden core in the bell, the spring was drawn into a small coil and released inside of the gasket, the other spring was suspended inside of the top gasket, and the latter secured to the top plate and placed in position. As yet there was enough leakage around the top gasket, due to inaccuracy of the pipe surface, to make accurate percolation tests impossible, but on tipping the apparatus over until the pipe stood at an angle of about 15° from the floor, the little water that leaked through flowed along the ends of the pipe, leaving the body dry.

The tests were now so satisfactory that a cradle was ordered which could carry the whole apparatus on trunnions, as shown in Fig. 3. This makes it possible to place the pipe in position and, after drawing the bolts tight enough to hold it securely, fill it with water, and tilt it on its side for testing.

This apparatus is served by a 1000-lb. differential-hoist trolley running on a 5-in. I-beam suspended from the floor above. The water for testing is received through a ¾-in. 4-ply garden hose about 5 ft. long, connected to the main water line which supplies the building; a ¾-in. globe valve is used for filling the pipe, after which it is shut off and a ½-in. needle valve on a bypass is used to make the tests, as with this arrangement the pressure can be regulated evenly and water-hammer avoided. A specially designed water-pressure gage, with 12-in. dial, graduated to 1-lb. readings up to 200 lb., is used; this stands directly in front of the operator during the tests.

The above-described apparatus was designed by the writer, under the direction of L. R. Ash, City Engineer, and Dr. W. M. Cross, City Chemist.

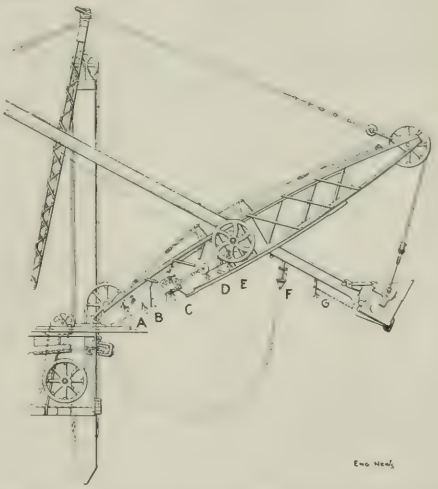
Quick-acting Steam-operated Trip for Dredge Dippers; Panama Canal

In the June 15, 1911, and Jan. 25, 1912, issues of ENGINEERING NEWS there appeared descriptions of several forms of dipper-tripping mechanisms in use on the Panama Canal dredges. One of the types described in the latter article consisted of a steam cylinder and plunger arrangement for use on a short-arm dredge. Of particular interest in the same connection is an article appearing in the Dec. 18, 1912, issue of the *Canal Record*, describing a similar steam-operated trip now in use on the dredges "Mindi" and "Chagres," which are operating in the Atlantic entrance channel in coral-rock excavation for the new piers of the Panama R.R. Co., at Cristobal. An abstract of the article is printed below.

This trip was devised to overcome the additional complications of tripping a long-arm dredge dipper. The device described was improvised by one of the cranemen from pieces of scrapped machinery.

The dredges, mounting 5-yard dippers, are used entirely in rock, which when necessary, has been partly broken up by the operations of the drillboat "Terrier." They are cutting channels of a minimum depth of 42 feet at mean tide, and this requires dipper handles of the great length of 62 feet, while the boom supporting the shipper shaft is 50 feet long. Because of the momentum of the heavy booms and dipper, the bucket is discharged on the swing, into hopper barges moored alongside the site of excavation.

This requires a quick-acting trip, to avoid spilling over the edge of the barge on the return swing. Operation by hand was slow and uncertain, because of the weight and accumulated slack in so long a trip line, and required the use of both hands by the craneman. It was necessary that a tripping device be both positive in action and simple in construction, because of the arrangement of boom and dipper stick. The device had to be so arranged that the tripping line would not have to be overhauled, on a drum or otherwise.



QUICK-ACTING DIPPER TRIP USED IN DEEP DREDGING AT CRISTOBAL, C. Z.

It will be seen by the accompanying sketch that the Cartier device consists of a steam ram C, mounted on a foundation in an out-of-the-way position on the interior of the boom. The steam exhausted from the operation of the ram is discharged below the surface of the water, in order that it may not obstruct the operator's view.

The cylinder is 5-inch bore and has a stroke of 8¼ inches. The piston rod carries the equalizing sheave, D, and the jamb movement of the ram piston is decreased by allowing the shock to be taken up in two heavy ½-inch by ½-inch springs 3½ inches long, mounted on the supporting guide arms for the equalizing sheave. The cylinder valve is of simple design and operated through the operating lever A and the reach rod B.

The latch chain is led to the purchase lever G, which is made fast to the dipper handle in the manner shown, and

a ½-inch flexible steel cable F, is made fast to the opposite end and led back over the small idler to keep the slack of the line from becoming entangled. It is then led over one of the two idler sheaves E, mounted on a stationary shaft parallel to each other, thence over the sheave D, back over the other idler sheave E, and up and dead-ended at the top end of the dipper handle. The 8¼-inch movement of the ram piston takes up 16½ inches out of the line to overcome the necessary operating slack and pulls on the latch, this being sufficient to secure positive action. The line's being attached as shown overcomes the necessity of winding in and out the otherwise free end upon a drum, this line being free to travel with the dipper handle over the idler sheaves E and the equalizing sheave D.

The closing of the door is accomplished by its flat surface striking the water with such force that it not only closes, but takes up the slack in the tripping line F and pulls the piston to a starting position in the ram.

The saving in time and the increase in yardage through use of this device cannot be arrived at, as no efficiency tests have been made. It is known, however ,that a considerable increase in the yardage has been achieved.

❋

Some Short-cuts in Reinforced-concrete Beam Design

By M. J. Lorente*

The writer has found the following methods of great convenience in the design of reinforced-concrete beams. As far as he knows they have not been published before.

Beam Weight Determination.

In designing reinforced-concrete beams, especially when the load and the span are large, the weight of the beam itself is a factor which considerably influences the depth of the beam. The general method of determining beam weight is of the "hit and miss" variety. It consists first in assuming a certain weight, for which the bending moment and consequent depth is computed. This is compared with the depth (computed from the weight) assumed, and the process continued until agreement is reached. This method depends altogether for its accuracy on the experience of the designer. If he be an expert he may guess the weight pretty accurately and he will need to use the bending moment formula only twice. If he be not an expert he will very likely have to guess several times before he arrives at the proper depth. But even experts, owing to the large range of widths for a beam, will find it rather difficult to gage the weight within, say, 20 lb. per ft.

In order to do away with this guessing process, the writer has evolved three formulas which, used in connection with the accompanying curve (Fig. 1), will give with almost perfect accuracy the weight of a rectangular beam.

The formulas are:

$$W' = (c + 0.003\ L)\ \frac{WL}{100},\ \text{when B.M.} = \frac{WL^2}{8}.$$

$$W' = (c - 0.09 + 0.003\ L)\ \frac{WL}{100},\ \text{when B.M.} = \frac{WL^2}{10}$$

$$W' = (c - 0.17 + 0.003\ L)\ \frac{WL}{100},\ \text{when B.M.} = \frac{WL^2}{12}$$

Where:

W' = Weight of beam in lb. per ft.
W = Live-load on beam in lb. per ft.
L = Clear span in ft.
c = Reading from the curve (Fig. 1.)

It should be observed that the ordinates of the curve are obtained by, first, ascertaining the load carried by the beam per foot of span, and then dividing this load by the width of the beam, in inches, so that we have the load carried by the beam per foot length per inch width.

*Civil Engineer, 11 Everett St., Lynn, Mass.

When extreme accuracy is not imperative, the above formulas may be used to find the depth of the beam by substituting d (the depth) for W', and w (i. e., the weight carried by the beam per foot length per inch width) for W. It will be found that the results obtained from the curve only err, when they do err, very slightly and always conservatively, so that for purposes of estimating it will be very convenient to obtain the depth directly from the curve. For purposes of design the

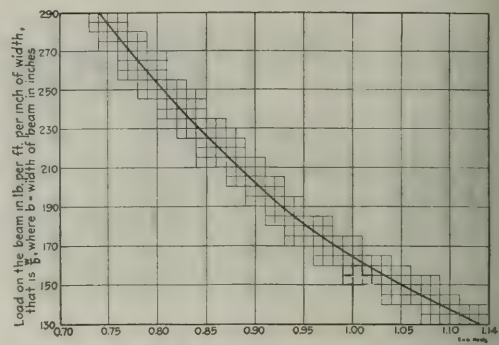


Fig. 1. Curve for Finding Weight of a Rectangular Reinforced-concrete Beam
[See text for explanation]

depth so obtained should be checked with the bending moment formula.

To illustrate the uses of the curve, let us take a particular example. Let us consider a beam 24 in. wide, with a clear span of 25 ft. and carrying a load of 5000 lb. per ft.

The load per ft. length per inch width will be:

$$\frac{5000}{24} = 209\ \text{lb.}$$

From the curve we obtain $c = 0.885$.

If we take the B. M. $= \frac{WL^2}{8}$, then the weight of the beam per foot length will be:

$$W' = (0.885 + 25 \times 0.003)\ 5000 \times {}^{25}/_{100} = 1200\ \text{lb. per. ft.}$$

If we wanted to find, approximately, the depth of the beam, we would have:

$$d = (0.885 + 25 \times 0.003)\ 209 \times {}^{25}/_{100} = 50\ \text{in.}$$

Working out the bending moment formula it will be found that the depth of the beam should only be 49.25 in. The error, therefore, is insignificant in a beam of this size, specially if only an estimate is wanted. In working out the formula, the writer has assumed the weight of concrete at 144 lb. per cu. ft. This is a very fair average and it renders calculations somewhat easier from the fact that a prism one square inch in section and one foot in length will weigh one pound. He has also assumed $f_c = 650$ lb. per sq.in., $f_s = 16{,}000$ lb. per sq.in. and $n = 15$.

Location of Bending Point for Diagonal Reinforcement.

The accompanying table is designed to show the location of the points where tensional reinforcement is no longer needed in the lower part of the beam and where

TABLE SHOWING THE POINT AT WHICH BARS MAY BE BENT IN A REINFORCED-CONCRETE BEAM SUPPORTED AT THE ENDS

(The figures give the distance from either abutment in 1-100ths of the span)

Number of bars to be bent	Number of bars in the Beam																	
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	11.4	21.0	25.0	27.6	29.5	31.0	32.1	33.0	34.0	34.8	35.4	35.7	36.0	36.8	37.0	37.5	38.0	38.4	38.4
2		9.3	14.6	18.2	21.0	23.4	25.0	26.5	27.6	28.6	29.6	30.3	31.0	31.7	32.1	32.6	33.0	34.0	34.0
3			7.3	11.4	14.6	17.1	19.3	21.0	22.7	24.0	25.0	26.0	27.0	27.7	28.3	28.9	29.4	30.2	30.7
4				5.3	9.3	12.2	14.6	16.4	18.2	19.7	21.0	22.2	23.4	24.3	25.0	25.7	26.5	27.2	27.6
5					4.4	7.8	10.4	12.7	14.6	16.1	17.8	18.8	20.0	21.0	22.0	22.8	23.8	24.5	25.0
6						3.6	6.8	9.2	11.4	13.0	14.6	15.8	17.1	19.2	19.3	20.3	21.0	22.0	22.7
7							3.2	6.0	8.3	10.1	12.0	13.3	14.6	15.8	16.7	17.5	18.8	19.6	20.4
8								2.8	5.3	7.4	9.3	10.8	12.2	13.6	14.6	15.6	16.4	17.4	18.2
9									2.6	4.7	6.8	8.4	10.0	11.4	12.5	13.5	14.5	15.5	16.4
10										2.3	4.4	6.2	7.8	9.3	10.4	11.6	12.7	13.8	14.6
11											2.0	4.0	5.6	7.2	8.6	9.7	11.0	12.0	13.0
12												1.9	3.6	5.2	6.8	8.1	9.2	10.3	11.4
13													1.8	3.5	5.0	6.2	7.5	8.8	9.7
14														1.7	3.2	4.6	6.0	7.3	8.3
15															1.6	3.0	4.3	5.6	6.8
16																1.5	2.8	4.2	5.3
17																	1.4	2.7	3.9
18																		1.36	2.6
19																			1.3

the rods there may be bent up into the beam to form diagonal tension reinforcement.

The distances from the supports, or from the points where B. M. = 0, at which bars may be bent are given in hundredths of the clear span, or of the distance between the points where the B. M. = 0, and they should never be increased but may be decreased *ad libitum*.

Location of Shear Bars.

Another point which the writer has endeavored to facilitate, is the bending of bars and the spacing of stirrups for diagonal tension. The method advocated in the majority of textbooks is open to criticism. Briefly stated the method consists in projecting the neutral axis of the beam, from the point where the concrete does not stand any shear or diagonal tension, at an angle of 45°. Then, from the point of support a line is drawn perpendicularly to the projected axis, meeting it at the point *B* (Fig. 2). Along *BD* any arbitrary length *BC* is taken to represent the diagonal tension = *vb*. The triangle *ABC* is then divided up into as many equal parts as there are bars to be bent. Through the center of gravity of each equal area, lines are drawn parallel to the line *BC*, which meet the neutral axis at certain points. The bars are then bent to follow these lines.

In the first place, it is quite unnecessary to project the axis at an angle of 45°. Any angle would do equally well, provided that the line *DB* is made perpendicular to *AB*. The lines through the centers of gravity of each equal area would always meet the neutral axis exactly at the same points. Then the bars could be drawn through these points at whatever angle we pleased. Of course, this angle would have to be decided upon previously, as the strength of the bars is affected by their inclination.

As a matter of convenience, it is better to draw the

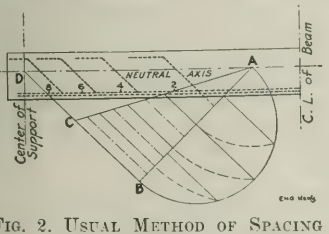


Fig. 2. Usual Method of Spacing Diagonal Reinforcement

triangle, and make the required divisions *above* the neutral axis, without making any misleading projections.

Moreover, the method is faulty because we cannot bend the bars wherever we please. Supposing the diagonal tension in a particular beam could be taken up by, say, four pairs of bars, we would probably find that, owing to the horizontal tension at the bottom of the beam, the bars could not be bent to suit the particular points where the lines through the centers of gravity, above mentioned, cut the neutral axis. It is clear that the method would, then, absolutely fail.

For instance: if, in the beam shown in Fig. 2, we had 10 bars, and we found that 8 bars bent in pairs, as shown in the figure, sufficed to take up the diagonal tension and proceeded to bend them according to the method in question, we would find that the tension side of the beam would be too weak, for the bars should not be bent any further away from the support than the points marked 2, 4, 6, 8. Of course, bending the bars at these points throws the method out of gear.

Another objection to this method is that it could only be applied when the shear diagram is a triangle, but this is far from being always the case. Shear diagrams very often present a broken outline, in which case the method could not be employed.

The writer follows a method of his own which is applicable to any shear diagram. It is as follows (Fig. 3):

Above one-half of the beam draw the diagram of shear, to any convenient vertical scale.

Having decided how many bars are to be bent, find from the table, or by calculation, the points of bending.

At the points thus found, bend the bars at any suitable angle.

Where the bars meet the neutral axis of the beam, erect perpendiculars into the diagram of shear. The length, within the diagram of shear, of these perpendiculars will represent so many pounds.

Divide the number of pounds which the section of a bar or couple of bars can stand in tension by the number of pounds represented by the corresponding perpen-

dicular, within the shear diagram, and the result will be a particular length.

Along the base of the shear diagram, set off half of this length on either side of the perpendicular and at the extremes draw two perpendiculars. The area inclosed by these perpendiculars, in the shear diagram, will represent the shear taken up by the bar, or couple of bars.

This process is repeated for each bar or couple of bars.

It frequently happens that the bars cannot take up all the shear. In this case there will be left what we might call "blank" spaces in the shear diagram. The shear represented by these "blanks" must be taken care of with stirrups. Having selected the size of the stirrup to be used, set out an area in one of the "blanks" next to the space corresponding to one of the bars, equal to the amount of shear each stirrup will stand, and along a line passing through the center of gravity of this area place a stirrup. And so on till the shear diagram has been "filled up."

It will be observed that this method is only an approximation for, as regards the bars, the line which ought to pass through the center of gravity of the area representing the shear sustained by the bar is taken as an average, and from it the length along the base of the diagram is found. This makes the shear coming on the bar somewhat eccentric and the stress on the bar will be correspondingly increased. The error, however, will depend on the form of the shear diagram, and in the majority of cases will be negligible.

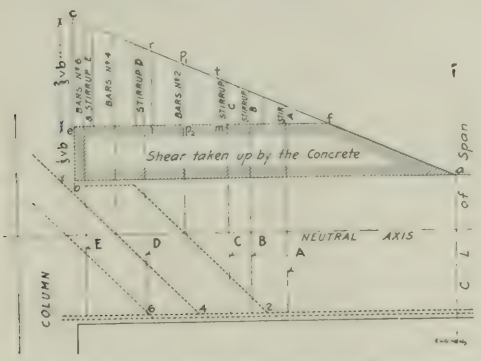


FIG. 3. NEW METHOD OF SPACING DIAGONAL REINFORCEMENT

However, we can always be on the safe side if, instead of setting out the length equally on either side of the perpendicular from the point where the bar cuts the neutral axis, we set the length $^5/_{12}$ to the left and $^7/_{12}$ to the right of the perpendicular. This is, of course, when the center line of the beam is to our right.

This simple correction will give us an area whose center of gravity will be almost on the perpendicular from the bar. The area obtained in this fashion will represent a smaller shear than what the bar can stand, but the discrepancy is very small, and the bar will be all the safer.

To find with mathematical precision the area representing the shear sustained by a bar whose center of gravity would be on the perpendicular corresponding to the bar, an enormous amount of time would be consumed, altogether out of proportion with the result obtained.

The method adopted by the writer will be illustrated by the following example:

In Fig. 3 we have a beam with 10 bars, of which 6 are to be bent in couples.

From the table, we find the points where these bars may be bent. These are indicated in the figure by the numbers 2, 4 and 6.

On half the beam, draw the triangle *abc* representing the shear. Along *bc*, measure off *be* equal to the shear allowable for the concrete per inch length of the beam. Draw *ef* parallel to *ab*. The trapezium *abef* will represent the shear taken up by the concrete.

From the points where the bars cut the neutral axis, draw perpendiculars to that axis, meeting the line *ac*. The length of these perpendiculars intercepted by the lines *ef* and *fc* divided by the tension allowed for each couple of bars, will give the length to be measured along the line *fe*.

Taking the bars No. 2, the perpendicular will represent 800 lb. If the bars are good for 20,000 lb., then the length *lm* will be 25 in. Make $lp_2 = p_2m$. The area *lrtm* will represent the shear taken up by bars No. 2.

Repeat the process for the other bars and insert stirrups to take care of the areas not taken up already by the bars.

Two Common Faults in Detailing Windbracing

BY H. ARTHUR*

While designers of steel structural work are usually careful in determining stresses and sections of the members, they rarely specify on their drawings the sizes of connection angles and other details. It happens often that the resulting structures are considerably weakened because smaller connection angles are put in than the designer would have approved or specified.

The details are usually decided on in the drawing room of the successful bidder. The detailer or draftsman naturally has the interest of his employer first in his mind, and makes the connection as economical as possible, both in weight and in fabricating cost. He never thinks of using an angle more than ¾-in. thick, in accordance with fixed office-practice. The checker also is not likely to make a very careful study of the details, but limits himself to seeing that the sizes of material are as specified by the engineer's drawing, that the required number of rivets are provided, and that due economy has been observed in the detailing. He knows that the engineer subsequently passes on the plans and approves them as to strength. But when the drawings reach the engineer the details probably receive cursory examination, the engineer's principal anxiety being to verify the main sections of the members.

A specific case is presented by the details at the foot of the knee-brace *dm*, Fig. 1, shown separately by small sketch. Here the connection angles used are 4x4x3⅜-in., with a gage of 2½ in. in each leg. The outward pull on the pair of connection angles is 15,000 lb.; the two angle legs riveted against the face of the column being considered as a beam fixed at the ends, the moment produced

*Log Cabin Inn, Stearns, Polk Co., N. C.

(central load 15,000 lb., span $5\frac{3}{8}$ in.) is $\frac{1}{8} \times 15{,}000 \times 5\frac{3}{8}$, or about 10,000 in.-lb. If the allowable extreme fiber stress is 20,000 lb. per sq.in., the $\frac{3}{8}$-in. leg of the angle could take a moment of $10\frac{1}{2} \times \frac{3}{8}^2 \times 20{,}000 \div 6$, or about 5000 in.-lb. As the actual moment is 10,000 in.-lb., the angle is dangerously overstressed. It should be at least $\frac{9}{16}$-in. thick.

Similar deficiency in detailing is often found at the detail at the top of the column. In Fig. 1, for instance,

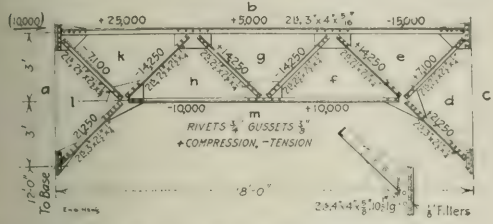


Fig. 1. Portal Frame and Kneebrace Detail

the connection of the portal frame to the top of the right-hand column is subjected to a pull equal to the stress in *bc* less the horizontal component in *ed*, or 10,000 lb. pull, and the connection angles should be designed so that they will be safe under this load.

Another point of neglect is found in connection with the members *fe* and *dm*. It will be seen from the stresses marked in Fig. 1 that while *dm* has a stress of 21,250 lb., the stress in *fe* is 7,000 lb. less. The detailer, who has his attention fixed on the object of keeping the weights down as low as possible, will use two angles of different sizes for the two members, e. g., 3x2½x¼-in. angles for the lower length and 2½x2x2¼-in. angles for the upper length, spliced by the gusset-plate. Nine out of ten trusses of this kind show compression members made up in the way described, although good construction requires that *dm* and *fe* should be in one piece extending from the foot of the kneebrace to the top chord.

It will be recognized at once that the two members *dm* and *fe* together are a single compression member, and that if they are made in two lengths with the thin flexible gusset-plate connecting them at the middle the strut will simply buckle out at the gusset-plate instead of resisting its load. When this happens, the entire work of

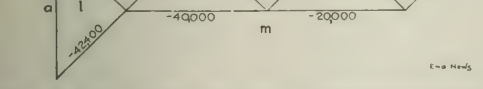


Fig. 2. Portal Stresses When Compression Kneebrace Goes Out of Service

bracing the portal is thrown on the tension kneebrace. The result of this is shown by the stress diagram (Fig.2), from which it appears that the stresses are doubled or more.

Even where such a kneebrace and web strut is called for in one length, the detailer will invariably break it at the center and ship the kneebrace loose, for ease of shipment and erection. The erection difficulty will be eliminated if the foot of the kneebrace is kept away from the face of the column by a clearance of about $\frac{1}{4}$-in. This clearance should always be provided, and the kneebraces should be the last thing riveted up in the entire frame. The inaccuracies of shop and erection can be taken up by the clearance in conjunction with a number of thin fillers behind the kneebrace connection angles. However, the total thickness of fillers should always be kept scant rather than full, as in the latter case a rise of temperature would tend to buckle the truss out of its plane.

❋

Range-finder Stations for Forest Fires*

The inability of a danger-zone patrol system to locate fires remote from the danger zones suggested the erection of lookout and signal stations on the highest peaks, 10 to 15 miles apart. To locate fires definitely, it became necessary to devise a mechanical range-finder, since experience proved that the use of compass and protractor and the more complicated range-finder equipment introduces innumerable errors, due to the unskilled labor available and to the hurry and excitement incident to discovery of fire.

Towers

The cost of material and erection of five wooden towers, including construction of roads and pack trails, stub telephone line, and equipment, was $2100, or an average of $420 each. The net cost of towers and range-finding device alone was not over $300 each. Steel towers 40 feet high can be erected at $400 each. The steel structures would be more economical, and there is not a great difference in first cost. However, it is well to consider the danger from electrical storms, which would be greatly increased by the use of steel, a danger likely to be much magnified in the minds of the class of people who could be employed as temporary fireguards.

The tower proper has an addition 12x12 ft., for living quarters for the fireguard, who is required to remain in the tower day and night during the fire season. It was possible in most cases to employ men with small families for the lookout work. The bottom of the tower, which is also 12x12 ft., afforded another room for their use. The towers were from 20 to 30 ft., high, according to the topographical conditions.

The roof of the wooden tower is a truncated pyramid and of the steel tower a truncated cone, to furnish a flat upper deck approximately 5 ft., square. This deck is rain proof and made accessible by a hatchway 18x24 in. A movable ladder leads from the second story to this opening.

In the center of the superstructure a 25-ft. revolving signal mast is erected, with crossarm and halyards for lowering and raising lanterns, the different positions of which constitute a series of predetermined signals. If this mast is made of iron pipe, a rod may be extended through it, upon which is mounted a vane which registers on a dial over the watchman's head in the cupola below. The dial is laid off and oriented to conform to the points

*Extracts from Bulletin No. 113, Forest Service, U. S. Department of Agriculture: "Methods and Apparatus for the Prevention and Control of Forest Fires," by Daniel W. Adams, Forest Examiner. Copies of the bulletin may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 10c.

of the compass, so that when a fire is sighted he may determine the bearing of the prevailing wind.

The Range Finder

In the second story or cupola of the lookout station there is a sighting hood made with vertical wires 2½° apart, set around the outer circumference. These wires are numbered clockwise from 1 at the north, toward the east, clear around to 144, which gives the 360° of the circle. The wires are 20 gage, tightly drawn. It was found necessary to use thumb nuts threaded on larger wires, to which the small wires were spliced, so that they could be kept taut under varying atmospheric conditions.

In the center of the sighting hood a self-winding plumb bob is suspended; this is drawn down when a fire is sighted and the number of the wire in line between the plumb line and the smoke is noted.

These signal stations are connected both by telephone and signal apparatus. The guard who first sights the fire asks the next nearest signal station for the number of the wire in line with the smoke from his tower. Then by glancing at a map upon which the lines from the wires are projected each guard would instantly note the exact location of the fire by following the numbered lines to their intersection. The lines correspond to the lines of sight through the plumb line to the circle of wires in the sighting hoods. The sighting hood is equipped with a high-back swivel chair, somewhat of the nature of a box with an open side. This protects the watchman, and affords a shelter for maps at his right and a place to secure a telephone at his left.

Portable Range-Finder Station

In addition to the wire-cage device, a portable instrument for range finding has been designed. The base of this instrument is set off into 180 divisions, 2° apart, instead of the 144 vertical wires in the first-described apparatus. This gives a somewhat finer subdivision of the field, and it has the further advantage of a mounted telescope with powerful lens, which will result in a better determination of the location and size of the fire. On top of the telescope barrel there are front and rear sights (similar to those of a rifle) to be used when it is too smoky or dark to use the lens.

A pointer in line with the long axis of the telescope registers in numbered indentations on the base of the supporting plate. When a fire is sighted, the telescope is focused upon it, and the number read at the pointer corresponds to a deflection line on the base map of the forest. As with the wire finder, the intersection of these lines can be determined by the next nearest signalman making a similar reading. The base plate has spirit tubes and leveling screws so that it may be adjusted to any surface and brought to a level.

This base plate enables the apparatus to be set up on any form of tower or, indeed, on a mountain top where there is no tower, provided there is an unobstructed view on all sides. In such a case it is sufficient to have a rough foundation of logs supporting a flattened log upon which the instrument may be fastened by lag screws.

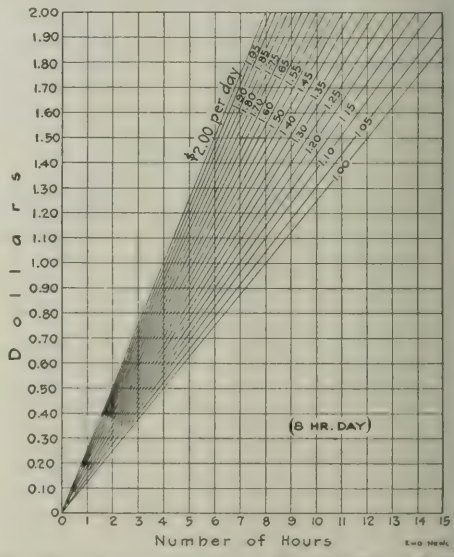
Where it is necessary to erect towers for this apparatus, light wind-mill towers would be sufficient. Such towers are light, and come in detached sections which could be packed to the tower site without having to construct special roads and trails. The sites of the towers must be predetermined, and triangulation maps made to conform to these sites. The cost of the windmill towers is approximately $30 to $50 at points of manufacture.

The approximate cost of the range-finding instrument complete is $75. Allowing $40 for the tower, $10 for transportation, and $25 for installation, the total cost is only $150. With this apparatus it is not necessary to orient the tower or foundation to conform to the public-land surveys, since the instrument itself can be shifted.

This range-finder is suitable for cheap and improvised installation, and the telescope gives it a sufficient accuracy. Yet, where an established protection is desired the permanent tower station previously described should be used. This is especially true because it provides living quarters for the watchman, and a sheltered position from which to keep watch and make observations.

Fractional Wage Diagram

Diagrams like the one shown in reduced size herewith have been made by Russell H. Peck*, Palmerton, Penn., for quickly finding part-day payment based on a fixed day rate. The pay can be read correct to a cent. The original of the illustration was drawn on a standard sheet of cross-section paper (about 8½x11 in.) in millimeter ruling, and, the height of the sheet being taken as $2, a height of 1 mm. ($^1/_{25}$ in.) represents 1 cent.



Pay Diagram for Part of a Day, Based on 8-hr. Rates

(Original diagram, on 8½x11-in. cross-section paper, reads to cents)

The diagram shown covers various day-rates with an 8-hr. day. A similar diagram would be drawn for a 10-hr. working day, etc.

The diagram is extended to 15 hr. using the same rate as for the regular day. If a special rate for overtime is to be used, it can be handled just as readily by drawing the diagonal lines as broken lines (with the upper part of different slope from the lower part.)

*Engineer for the Palmer Land & Water Co.

A Frog-angle Triangle for Plotting Turnouts

By W. W. Gruber*

A very convenient device for plotting frog angles, in laying out railway turnouts, and one which has for some time proved a great time-saver to the writer, is shown in Fig. 1. Any draftsman can easily make a "frog-angle triangle" by simply placing lines on it which make angles with the edge equal to the various frog angles. The frog number is determined by the length in feet from the point to a place where the spread is 1 ft. Or, mathematically, it is half of the cotangent of half the frog angle. For instance, a No. 8 frog angle would be the angle at the vertex of an isosceles triangle 8 ft. high with a 1-ft. base. The frog numbers and their respective angles are given in the accompanying table.

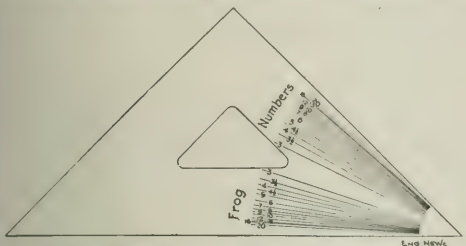


Fig. 1. Triangle Graduated for Frog Angles and Used for Plotting Turnouts

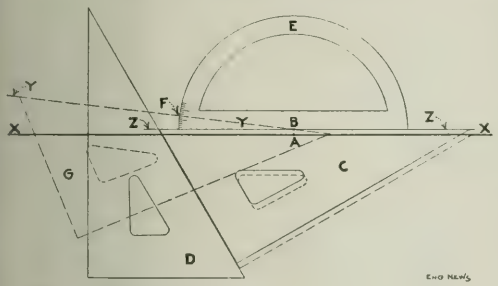


Fig. 2. Method of Plotting a Turnout with a Protractor

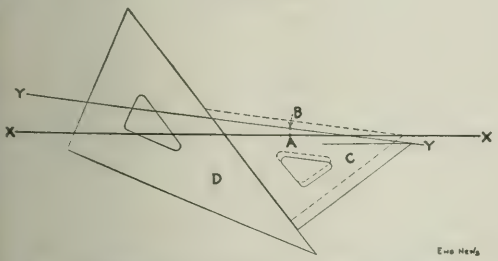


Fig. 3. Method of Plotting a Turnout with a Graduated Frog-angle Triangle

These angles for the various numbers of frogs are easily plotted on the triangle with a soft pencil, after which the lines may be scratched in with the aid of another triangle and prick point. The lines should be made from both edges, so that right-hand and left-hand frogs may be plotted without turning the triangle over, thus always keeping the graduations next to the paper that they may coincide perfectly with the line the angle is being plotted from. Figures designating the frog number for each angle should be put on the opposite side of the triangle from that on which the lines are drawn, or they may be stamped backward on the same side as the lines. In scratching the lines, they should be made by a light pressure and gone over several times, so as to avoid the slipping of either triangle.

Fig. 2 shows the ordinary method of plotting the center line of turnouts through frogs, and Fig. 3 the method by use of the frog-angle triangle. The respective methods are described below:

1. Plotting Frog Angle with Protractor (Fig. 2)—The heavy line *X-X* represents the center line of the main track, and a No. 8 frog (angle 7° 9′ 10″) is to be located at *A*. Plot the center line of turnout through this frog. From point *A*, measure a distance of 4 ft. 8½ in. at right angles to *X-X*, locating point *B*, which is in the center line of the turnout and directly opposite the frog point. Place the triangle *C* with its edge on the center line *X-X*, as shown by the dotted lines. Holding the triangle *D* firmly against it, slide the triangle *C* to bring its upper edge against the point *B*, as shown by the full lines. Then draw a line through *B*, as *Z-Z*. Place the protractor *E* on the line *Z-Z*, and plot point *F* at the desired angle (7° 9′ 10″). Place one of the triangles at *G*, as shown by the dash lines, with its edge touching points *B* and *F*, and through these points draw the line *Y-Y*, which is the desired center line of the turnout with frog at *A*.

2. Plotting Frog Angle with Frog-angle Triangle (Fig. 3)—With the conditions as above, place the graduated frog-angle triangle *C* so that its line *8* (for No. 8 frog) coincides with the main-track center line *X-X*, as indicated by the dotted lines. Place the triangle *D* against it. Holding this firmly, slide the graduated triangle *C* so as to bring its upper edge against the point *B* (previously plotted at 4 ft. 8½ in. from the designated position of frog-point at *A*). Draw a line through point *B*, as *Y-Y*, and this will be the desired center line of the turnout with frog at *A*.

*Office of Engineer of Maintenance of Way, Kentucky & Indiana Terminal R.R., Louisville, Ky.

Cost of Erecting a Steel Bridge

The adequacy of the cost figures for erection of a three-span railway bridge given by M. A. O. Stilson (our issue of Feb. 20, p. 362) is questioned by Frederick Tench (Terry & Tench Co., Inc., Grand Central Terminal, New York City), who says:

> A glance at his cost list simply shows labor and a small percentage charged in for certain items of plant, without provision for tools, fitting-up bolts, coal, liability insurance, overhead charges, freight and traveling expenses, which naturally have got to come in in figuring up accurate costs.
>
> The rate of wages specified is $3 a day for bridge men; this rate has not been in existence for 15 years, and the present rate is $5 per day in New York and vicinity and in other locations throughout the country, while foremen's rates run very much higher than are listed.

In reply Mr. Stilson says that the various general-expense items not included in his list, while adding to the total, would not materially increase the cost per ton.

He states that the job was done 8 years ago. The article gave the working time for the different operations, and from this the cost for any particular wage schedule can be figured. Mr. Stilson discusses the several points as follows:

The item of fitting-up bolts chargeable to the job would hardly show in the tonnage price. Very few bolts were stripped or lost overboard and the tools lost in this way amounted to so little as to be immaterial. The item of insurance is handled in different ways; I am ignorant of the method used in this case, as I am also in regard to what treatment was given the accidental drowning of the night watchman preceding the tampering with some of the scaffolding. In regard to coal, no forced draft being used in an eight-hour day, the amount (for the two boilers a little over a ton per day, or for three weeks 20 tons, at $3.75 is $75) also changes the ton price but little.

The value of such a record of cost as was given lies as much in knowing the discrepancies of it as compared to another piece of work under consideration for estimate as in using it absolutely as a basis of cost. The fact that this piece of work has been in service about eight years seems to me simply to emphasize the need of applying present rates to it as to a formula.

The difference of opinion really revolves itself to the wage question, and I am sure an experienced erector will not consider $8 a day a low wage for superintendence. He will perhaps see in it some explanation of the lowness of the other scales, due to the man's efficiency in handling any class of men. I know of work at present being done under $5 a day, and also that were the gangs economically built up around an experienced nucleus (bull gang also considered) as were the gangs on this work, the average rate of wages paid would scale down considerably. Further, the remark on wages explains no doubt why this bridge was erected by this organization and not by the company fabricating the steelwork. A glance at the last paragraph, giving the number of days in which the erection was completed, will perhaps tell more to the experienced man as to the evident low cost (i.e., efficiency) than a comparison of wage schedules. It was undoubtedly a well-handled job.

As to traveling expenses it happens that this same organization did considerable erecting within a short radius, so that this item was also small.

C. S. Davis (Consulting Engineer, Spitzer Bldg., Toledo, O.) makes remarks similar to those of Mr. Tench as to omission of various expenses and use of low wage rates, though he does not go as high as Mr. Tench's $5 per day. He makes the following summary of cost data for the job in question, using *hours per ton* as unit for labor:

Taking the figures, as I understand them, given by Mr. Stilson, I would analyze the cost as follows:

COST OF ERECTING A THREE-SPAN DOUBLE-TRACK RAILWAY BRIDGE, WEIGHT 1761 TONS

(1) Transportation of men and tools (not given), say	$300	$300
(2) Falsework		
Lumber, 40 M ft B M at $30	1200	
6 M ft B M at $25	150	
Piling	390	
		1740
(3) Traveler:		
Lumber, 10 M ft B M at $35	$350	
3 M ft B M at $25	75	
Hardware	54	
		$479
(4) Labor on payroll (all time figured on basis of 8-hr day):		
(a) Placing tools		
Foreman, 1 man 4 d		32 hr
Labor, 12 men 4 d		384 hr.
(b) Traveler		
Foreman, 1 man 4 d		32 hr.
Labor, 6 men 4 d		192 hr
(c) Erecting falsework		
Foreman, 1 man 4 d....		32 hr
Engineman, 1 man 4 d		32 hr
Labor, 4 men 4 d...		128 hr
Foreman, 1 man 8 d		64 hr
Labor, 8 men 8 d		512 hr
(d) Erecting traveler		
Foreman, 1 man 6.5 d		52 hr
Engineman, 1 man 6.5 d.		52 hr
Labor, 4 men 6.5 d		208 hr.
(e) Dismantling		
Foreman, 1 man 18 d		144 hr
Engineman, 1 man 18 d		144 hr
Labor, 8 men 18 d.....		1152 hr.
(f) Erecting three-span easy three times span No. 3)		
Superintendent 3x30 d		720 hr.
Foreman, 3x8 d		972 hr
Engineman, 3x13 d		1,032 hr.
Labor, 3x852 d		19,968 hr

SUMMARY OF LABOR

Superintendent	720 hr. or 0.41 hr. per ton
Foreman	1,268 hr. or 0.72 hr. per ton
Engineman	1,260 hr. or 0.72 hr. per ton
Labor	22,544 hr. or 12.8 hr. per ton

A contractor, with the above information at hand, and with labor at a wage more in keeping with present practice, would estimate a bidding price about as follows:

COST ESTIMATE

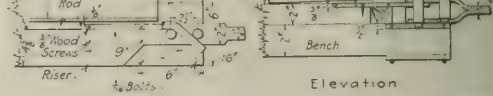
Transportation		$300 or $0.17 per ton
Falsework		1740 or 0.99 per ton
Traveler		479 or 1.43 per ton
Labor:		
Superintendent.....	0.41 hr. at $1.25...	$0.51
Foreman.....	0.72 hr. at $0.75...	0.54
Engineman.....	0.72 hr. at $0.60..	0.43
Labor.....	12.8 hr. at $0.50..	6.40
Total labor pay roll		$7.88
Liability insurance [varies, say 6% of payroll]		0.47
Sundry expenses, say 10% pay roll		0.79
Overhead expense, say 10% pay roll.....		0.79
Total cost per ton.		$11.36
Add for profit 10%..		1.14
Contractor's bidding price per ton		$12.50

In making the analysis above, it was necessary to estimate the number of hours erecting traveler from the labor cost which was given. The scale of wages used in making the estimate of cost was taken at random, but approximately near what a contractor would have to pay for this kind of work.

NOTES

A Cheap Rod-bending Machine—The following sketch and description of a cheap home-made machine for bending steel rods, which has been found satisfactory for use with bars up to ¾ in. diameter is sent by Clark F. Towers, Ossining, N. Y. The apparatus may be fastened to any heavy bench and its cost complete would be about $2.50.

Its structural details are shown clearly in the accompanying cut. A 6x8x½-in. steel pivot plate with a 1-in. diameter steel pin riveted in its center is bolted onto the bench



PLAN AND ELEVATION OF AN IMPROVISED BENDING MACHINE FOR STEEL RODS UP TO ¾ IN. DIAMETER

flush with the top and sides. The pin extends up about 4 in. from the face of the pivot plate. The forked lever is forged from 2x⅜-in. steel, is about 33 in. long and has its handle end drawn out to take a pipe handle. Another 1-in. diameter steel pin is riveted to the bottom prong and projects up through the top prong, and both prongs are bored out to fit over the first-mentioned pin. A hinge plate of 2x⅜-in. steel is bored near the outer end to receive the same pin and the inner end is screwed to a wooden riser on the bench. Removable steel back plates of 2x⅜-in. steel 1 ft. long complete the equipment.

In the Aug. 26, 1909, and the Sept. 28, 1911, issues of "Engineering News" there were illustrations of two other forms of rod-bending machines both of which differed from the one above described in having line contact between dies and rod instead of the point contact of the above apparatus. The earlier issue describes a bending machine, ratchet operated, which method seems to be more convenient for heavy work than the simple lever.

Decay of Wooden Piles in Tidewater was examined by the Prussian Royal Materialprüfungsamt in the case of a sheet-pile wall in the Weser River. The piles were in place nine years. The mean tide range was from + 2.3 ft. to − 8.2 ft. There was marked decay around El. 0. The lower limit of decay was found to lie between − 1.5 and − 3 ft. Samples cut at various points between − 6.5 ft. and 0 showed a regular decrease of crushing strength as zero elevation was approached. [From 1911 annual report of the Materialprüfungsamt, Gross-Lichterfelde West, Germany.]

Another Broken-line Column-formula- The three-segment column-formula used in the new structural specification of the American Bridge Co. (our issue of Feb. 20, 1913, p. 365), brings a proposal for a three-segment formula of different outline from E. B. La Salle, 159 Harrison St., Batavia, Ill. Taking the plate-and-angle column tests made at Watertown Arsenal and reported in "Engineering News," Aug. 26, 1909, and fitting a series of straight lines to the results, he determined the following vertex-points: 35,000 for length equal to 25 r; 33,000 for length equal to 50 r; 30,000 for length equal to 125 r (these three values being the same for flat-end and pin-end columns); and, for length equal to 175 r, the value of 25,000 for flat-end and 20,000 for pin-end columns. The three lines joining these four points represent the ultimate strength. They are represented by the following formulas:

$$\text{For } \frac{l}{r} \quad 25 \text{ to } 50.$$

$$\text{ultimate strength} \quad 35{,}000 - 80\left(\frac{l}{r} - 25\right)$$

$$\text{For } \frac{l}{r} \quad 50 \text{ to } 125.$$

$$\text{ultimate strength} \quad 33{,}000 - 40\left(\frac{l}{r} - 50\right)$$

$$\text{For } \frac{l}{r} \quad 125 \text{ to } 175.$$

$$\text{ultimate strength} \quad 30{,}000 - 100\left(\frac{l}{r} - 125\right) \quad \text{(flat ends)}$$

$$30{,}000 - 200\left(\frac{l}{r} - 125\right) \quad \text{(pin ends)}$$

Assuming that this series of lines truly represents the ultimate strength of such columns, Mr. La Salle compares the working values given by the new American Bridge Co. three-segment formula and the straight-line formula of the American Railway Engineering Association with his line of ultimate strengths, and determines the factor of safety which the other two formulas give. He finds the following factors: For the A. R. E. formula, from 2.45 for the shortest columns up to 6.67 for the longest columns. For the A. B. Co. formula, from about 2.50 for short columns up to 5.88 for very long columns. He concludes:

I believe that an actual safety factor of 3 is the least that should be used for work of any importance; also that formulas should be used which do not cut off too fast as the length increases, since this is wasteful of material.

This conclusion involves two doubtful points: (1) The question whether Mr. La Salle's line does represent the actual ultimate strength of columns, and (2) the question whether columns should be designed with a uniform factor of safety, or whether a different factor should be used for long columns from that used for short columns. His line is concededly based on a single small series of tests, while most column formulas used in practice are supposed to be based on comparisons covering nearly all available column-test records.

Relative Age of Lines on Drawings—In a lawsuit against C. A. P. Turner (Minneapolis, Minn.), some time ago, the authenticity of a drawing was questioned, the charge being made that some of the drawing had been added after the original date. It therefore became necessary to determine, if possible, whether certain lines of the drawing had been drawn before or after others. Prof. A. Zeleny, of the Physics Department, University of Minnesota, studied the matter for Mr. Turner. It was found that microscopic examination gave pretty clear information on the order of production of intersecting lines. While the case finally did not depend on the microscopic proof, the results of the study as reported by Mr. Turner are given below:

Placing the drawing under a high-power microscope, magnifying the lines to about ¾ in. width, the thickness of the ink layers showed up clearly, together with cracks which had developed in drying. Where one line was drawn subsequent to the other, the new ink in the later line had filled all cracks in the older line and softened up the older ink, then as the two layers dried together, new cracks had developed, continuing into the area of the new line beyond the intersection with the old; this revealed specifically the order of the drawing, even where the ink used was somewhat thin and the line of demarcation indistinct.

Subsequent to this examination, the original drawing in question was lost. There remained as evidence only blueprints from it, a bromide negative, and a 14x17-in. photographic negative. Some indications were found on the blueprint to indicate with certainty the order in which the lines were drawn on the original. By throwing light up through the bromide print and enlarging, but without using high magnifying power, the majority of intersections showed the relative order of drawing in the line. The photographic negative was clearer than the bromide. All uncertainty, however, it is believed, can be removed in such cases, if the original tracing is placed under the microscope.

While the above statement does not touch a number of questions involved in such an examination (e.g., what difference in age of the lines is necessary to give distinct indications), the method can be tried on known test samples by anyone who has occasion to use it. If the subject has been studied by others and definite conclusions obtained we shall be glad to learn of the results.

When the Frost Is on the Transit. Extra-heavy winter conditions affect instruments as well as men. The transit shown by the adjoining picture appears to be badly frost-bitten. It is a Keuffel & Esser transit. P. W. Jones, of Denver, Colo., informs the makers that the instrument had been left untouched in a blowing frost for half an hour at 11,600 ft. elevation. Some overhauling was probably required after the transit was thawed out.



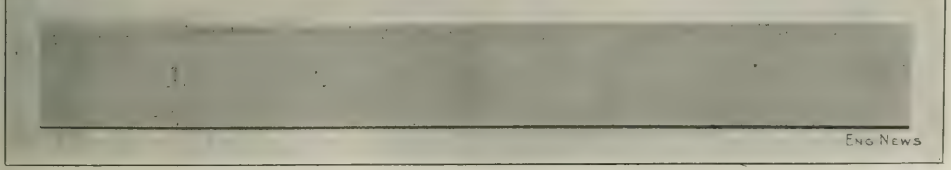
COLORADO WINTER

The Meaning of Theodolite—As the term "theodolite" is used by makers of surveying instruments, its meaning is rather indefinite. The distinction prevailing between theodolite and transit at one time, namely that the telescope of the theodolite could not be reversed through the standards, no longer holds. Dictionaries (which are always behind technical practice in special terminology) do not agree on the distinction between transit and theodolite. One maker of surveyors' instruments writes:

"We have used the word 'theodolite' to distinguish between our U-standard and double-standard construction."

This does not agree, however, with the practice of other makers, who apply the term "transit" to U-standard instruments as well as to those of the older form of construction.

A Readable 64th Graduation—The scale graduation shown in the halftone below is a new and very convenient arrangement of graduation which permits of getting dimensions to $^1/_{64}$ of an inch with a scale having only sixteen lines to the inch. How this is accomplished can be seen at once from the cut. The face of the rule shown has along one edge a scale whose graduations are on the points corresponding to $^1/_{64}$, $^5/_{64}$, $^9/_{64}$, etc., and along the other edge a scale



SPECIAL GRADUATION ON "ALLEN IMPROVED SCALE," GIVING 64TH-IN. READINGS WITH $^1/_{16}$-IN. SPACING

corresponding to 3/64, 7/64, 11/64, etc. The even sixty-fourths appear on the other face of the rule in the shape of a 16th scale and a 32ds scale of ordinary arrangement. The scale shown is the "Allen Improved Scale," made by the Lufkin Rule Co., Saginaw, Mich.

Buckling in Webs of Beams—The following derivation of a formula for the buckling tendency of the web of a steel beam is given by W. W. Pearse (of Radley Steel Constr. Co., New York City). He compares his formula with the results of several tests and finds a surprisingly close agreement. The form of the formula is like that of the Gordon column formula, but the method of derivation fixes the constants in this formula, as follows:

The end shear on the beam is regarded as being absorbed wholly by that part of the web lying between the flanges, this being also the unsupported depth of web. Taking a length of the web equal to this unsupported depth, the longitudinal shears at the upper and lower edges must equal the vertical shear. While all these shears are distributed along the edges of the web section to which they are applied, they may for the present purpose be taken as concentrated at the middle points, and each resolved into two diagonal components as shown in the sketch Fig. 1, herewith. It will be seen that the components w act as compressive forces on this piece of web, while the components w′ are tensile forces. To a certain extent the tensile forces would probably help to stay the web against the buckling action of the forces w, but it will be safer to consider only

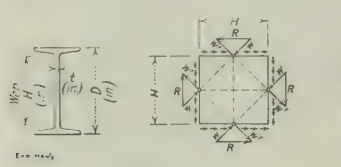


FIG. 1

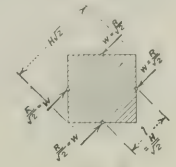


FIG. 2

the resistance of the unstayed web to the compressive forces. The total compression on the piece is 2w, and, comparing this with the end shear R, it will be seen that 2w is equal to the $R\sqrt{2}$. Dividing the web (Fig. 2) into strips parallel to the line of action of the compressive forces w, it appears that all these strips must be buckled if any of them is to fail, or in other words, the resistances of all the strips add together in making the total resistance to the buckling forces. These strips all differ in length, but the average length may be taken as half the diagonal of the web section, or $\frac{1}{2}H\sqrt{2}$. The middle cross-sectional area of the column is equal to the length of the diagonal times the web thickness t, or $A = tH\sqrt{2}$, and the compression per square inch is equal to $\frac{2w}{A} = \frac{R}{Ht}$. The column formula is taken from Merriman's "Mechanics of Materials," 1894 edition, page 132, as follows:

$$\frac{P}{A} = \frac{Sc}{1 + \frac{Sc}{m\pi^2 E}\left(\frac{l}{r}\right)^2}$$

The factor m is equal to 4 in the present case, corresponding to fixed ends. From Prof. E. Marburg's tests of I-beams, reported in "Engineering News," Aug. 12, 1909, Mr. Pearse takes the following values for beams 15 in. deep and less: E = 26,900,000 (average); Sc = 46,100 (average). With these values substituted, the equation gives

$$R = \frac{46{,}100\ Ht}{1 + \frac{H^2}{4000\ t^2}}$$

which is the value of the end reaction that will buckle the web in I-beams 15 in. or less in depth. For 24-in. and 30-in. I-beams he concludes that Marburg's tests authorize the values E = 25,300,000; Sc = 32,000; which make the end shear formula

$$R = \frac{32{,}000\ Ht}{1 + \frac{H^2}{5300\ t^2}}$$

Some tests are given in the Bethlehem Steel Co.'s large handbook (1907), page 88. For 10-in. I-beams with web 0.13 in. thick and H = 66.5t, the limiting end shear was 24,750 and 24,300, or average 24,525. The formula above quoted (the first of the two) gives R = 24,670.

Tests of 8-in. I-beams with web thickness 0.125 in. and H = 54.6t showed a limiting end shear of 22,900 and 21,850, average 22,375. The formula gives R = 22,300.

Tests for 6-in. I-beams gave 22,650 and 22,900. The formula gives 21,600.

A Test for the Proper Degree of Concrete Mixing was proposed by J. F. Owens in a paper before the Concrete Institute of London on Jan. 30, 1913. In this test a funnel, provided with a conical 12-mesh wire screen, is fitted into the top of a test glass and a sample of the concrete mixture (just mixed) is poured into the funnel and the glass shaken until all the material which will pass through the mesh has dropped into the glass. At the same time a small stream of water is allowed to trickle through the concrete. The stones retained on the mesh are then thrown away or retained for measurement if desired, but are not necessary to this test. The test glass, having been filled with water, is shaken up and placed to settle. It is then found that the sand and the cement will settle in about 10 min. into well defined layers. The relation of these layers to each other can then be measured and the proportion of the sand to the cement in the concrete thus ascertained. It is the idea of the inventor of this test that if the sand and cement are thoroughly mixed there is no doubt but that the large aggregate will be well mixed also. He proposes that an inspector of concrete mixing should every so often make this test in order to determine the degre of mixing. He states that it is easy to distinguish by this test a 1:2 mortar from a 1:2½ mortar for instance, whereas by mere inspection it has been found that it is quite difficult to distinguish a 1:2 mortar from even a 1:3½ mortar.

Preservatives for Stone have been under test for four or five years in Germany. The report on the results after four years' exposure is given by Prof. F. Rathgen, of Berlin, in "Zeitschrift für Bauwesen," No. 1, 1913. The stones under test comprise seven or eight varieties each of sandstone, limestone, and marble. The preservatives under test are two kinds of "fluates," "Testalin," "Zapon," "Szerelmey," beeswax, and carnauba wax. The two-year results were reported in the same journal in 1910. Neither the two-year nor the four-year tests give any very definite ranking, but in so far as indications can be found in either set of tests they do not agree. The four-year tests tend to show that sandstone is protected somewhat by magnesium fluate and by Zapon; that limestone is protected somewhat by Szerelmey, and marble by beeswax (but the protection of the beeswax is slight after the first two years). The tests are being continued, and more stones are being included in the comparison. Further, through the assistance of the Prussian government, in 1911 and 1912 applications of three kinds of preservative were made to numerous stones in old and new buildings in twelve cities of Prussia for the purpose of large-scale experimentation. In the case of these larger tests it is presumably necessary to judge by surface appearance rather than by weighing.

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Diagram for Wheel and Truck Clearances of Cars

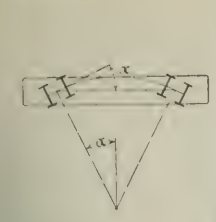
BY WILLIS BOOTHE*

The diagram herewith is intended to facilitate the work of laying out the location of points on the circumference of a truck wheel at any point above the rail, in relation to the center line of the car, when rounding a curve. The scope of the diagram is such as to include all conditions met in dealing with 33- and 36-in. wheels, truck spacing varying from 12 to 60 ft., and radius of track curvature ranging from 30 to 200 ft.

The diagram primarily is a graphic representation of a series of results in the determination of angle α (see sketch above diagram), combined with a means of indicating directly the bevel in inches per foot corresponding to each value of angle α. This bevel is given to obviate the necessity of using a protractor in the layout work.

The wheel is considered as being cut by a series of horizontal planes spaced 1 in. apart; the distances *A* and *B*, which are the distances from center line of wheel to the points on the high part of flange and the extreme

*501 Wabash Bldg., Pittsburgh, Penn.



SECTIONAL DIMENSIONS				
ANGLE	33" WHEEL		36" WHEEL	
	A	B	A	B
17	1'- 5⅝	1'- 4⅛	——	——
18	1'- 5⅝	1'- 4⅛	——	——
19	1'- 5⅝	1'- 4	1'- 6⅝	1'- 5⅞
20	1'- 5⅜	1'- 3⅞	1'- 6⅜	1'- 5⅞
21	1'- 5⅜	1'- 3⅞	1'- 6⅜	1'- 5⅞
22	1'- 4⅞	1'- 3⅝	1'- 6⅛	1'- 5¼
23	1'- 4⅞	1'- 2⅞	1'- 6⅛	1'- 4⅝
24	1'- 3⅝	1'- 2⅝	1'- 6⅛	1'- 4⅝
25	1'- 3⅝	1'- 1⅝	1'- 5⅞	1'- 4¼
26	1'- 2⅝	1'- 1⅜	1'- 5¼	1'- 3⅝
27	1'- 2⅝	1'- 0⅝	1'- 4⅞	1'- 3¼
28	1'- 1⅝	0'- 11⅝	1'- 4⅝	1'- 2⅝
29	1'- 0⅝	0'- 10⅝	1'- 3⅝	1'- 1⅞
30	0'- 11⅝	0'- 8⅝	1'- 2⅝	1'- 1
31	0'- 10⅝	0'- 7⅝	1'- 1⅞	1'- 0
32	0'- 8⅝	0'- 4⅝	1'- 0⅝	0'- 10⅜
33	0'- 6⅝	0'- 0	0'- 11⅝	0'- 8⅜
34	0'- 2⅝	——	0'- 10¼	0'- 7⅞
35	——	——	0'- 8½	0'- 4⅝
36	——	——	0'- 6½	0'- 0
37	——	——	0'- 0	

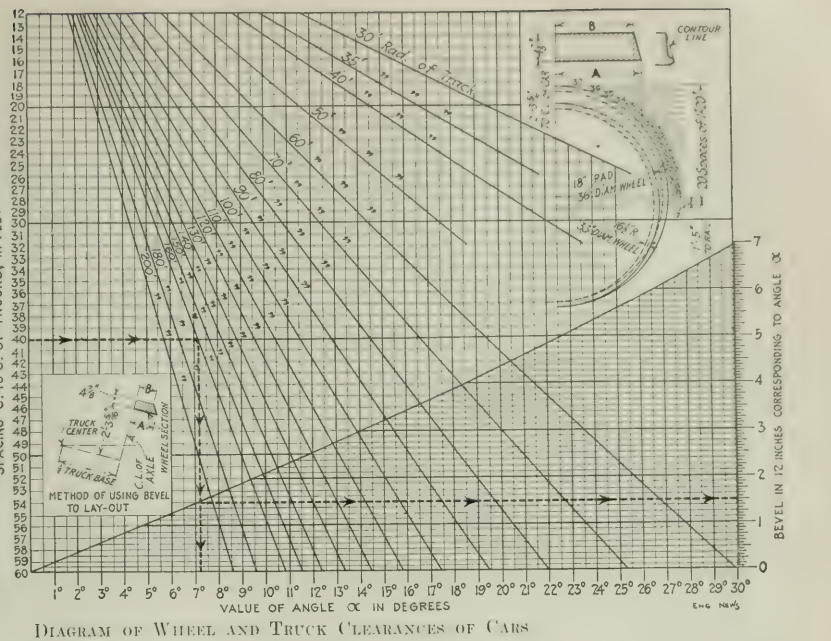


Diagram of Wheel and Truck Clearances of Cars

part of tread, respectively, for each horizontal plane, are tabulated at the left of the diagram.

For illustration: It is desired to know the location of a point 30 in. above the rail, on a 36-in. wheel, when truck spacing is 40 ft. and radius of curvature of track is 160 ft. From left-hand edge of sheet, graduation 40, read across sheet to diagonal designating 160 ft. radius, thence down on the vertical line to opposite inclined diagonal and across the sheet to bevel scale, 1½ in. bevel in 1 ft. By following the vertical line passing through intersection of 40 ft. graduation and 160 diagonal to bottom of sheet the value of angle a may be read 7° 12′. The table gives the distances A and B for 30-in. height on a 36-in. wheel as 1 ft. $2\frac{23}{32}$ in. and 1 ft. 1 in., respectively. These quantities enable the point in question to be located by layout or by computation.

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Formulas for Radial Distances Between Curves

By George Paaswell.*

In many designs of railroad structures, especially subsurface structures, it is a matter of prime importance to get distances between tracks normal to a center line of survey, which is itself a curve. To obtain these distances is a matter of tedious and laborious trigonometrical calculation.

The writer offers a short method which, though approximate, is sufficiently exact for all purposes. For subways where bents are spaced 5 ft. apart and are set normal to a center line this method has proved satisfactory and time-saving. All calculations are made by ordinary slide-rule, except that for the distance D, which is obtained by simple trigonometric formulas.

*Public Service Commission, 154 Nassau St., New York City.

Referring to the accompanying sketches Figs. 1 to 4, let

R = radius of circle to which distances are radial.
r = radius of the other curve,
L = distance required,
a = angle as shown, expressed in radians,
D = distance between centers.

For the different sets of conditions shown in the four sketches the exact formulas are:

Fig. 1. $L = -D\cos a + \sqrt{r^2 - D^2 \sin^2 a} - R$

Fig. 2. $L = D\cos a + \sqrt{r^2 - D^2 \sin^2 a} - R$

Fig. 3. $L = D\cos a - \sqrt{r^2 - D^2 \sin^2 a} + R$

Fig. 4. $L = -D\cos a - \sqrt{r^2 - D^2 \sin^2 a} + R$

These are simplified by expanding the first and second terms with the help of Maclaurin's Theorem, so as to eliminate trigonometric terms and get a series in powers of the angle a.* The resulting equations, omitting all terms above a^4, are:

$$L = -R + r - D + D\,2\,(1 - D/r)\,a^2 - D\,24\,(1 - 4\,D\,r + 3\,D^3/r^3)\,a^4$$

$$L = -R + r + D - D\,2\,(1 + D\,r)\,a^2 + D\,24\,(1 + 4\,D/r - 3\,D^3/r^3)\,a^4$$

*Maclaurin's theorem states

$$f(a) = f(o) + f_1(o)\,a + f_2(o)\,\frac{a^2}{1.2} + f_3(o)\,\frac{a^3}{1.2.3} + \ldots$$

where $f(a)$ is the original function and $f(o)$, $f_1(o)$, $f_2(o)$, etc., are the values of the function and its derivatives when the variable is equated to zero. In applying it to the expression

$$D\cos a + \sqrt{r^2 - D^2 \sin^2 a} - R$$

the first term becomes the cosine series,

$$D\cos a = D\left(1 - \frac{a^2}{1.2} + \frac{a^4}{1.2.3.4}\right)$$

The expansion of the second term, $\sqrt{r^2 - D^2 \sin^2 a}$, is more complicated. It comes out as a series with only the even powers of a, which can be foreseen because it is an even function, i.e., has the same value for positive and negative a, and therefore cannot contain odd powers of a. Adding the coefficients of the respective powers in this expansion and in the Dcos a series, the result is obtained in the form

$$L = K_1 + K_2\,a^2 + K_4\,a^4 +$$

$$L = R - r + D - D\,2\,(1 - D\,r)\,a^2 + D\,24\,(1 - 4\,D\,r - 3\,D^3\,r^3)\,a^4$$

$$L = R - r - D - D\,2\,(1 + D\,r)\,a^2 - D\,24\,(1 + 4\,D\,r - 3\,D^3\,r^3)\,a^4$$

These may be rewritten in the following forms:

For Fig. 1, $L = A + C\frac{D}{2}a^2 - E\frac{D}{24}a^4$

For Fig. 2, $L = F - G\frac{D}{2}a^2 + H\frac{D}{24}a^4$

For Fig. 3, $L = A - C\frac{D}{2}a^2 + E\frac{D}{24}a^4$

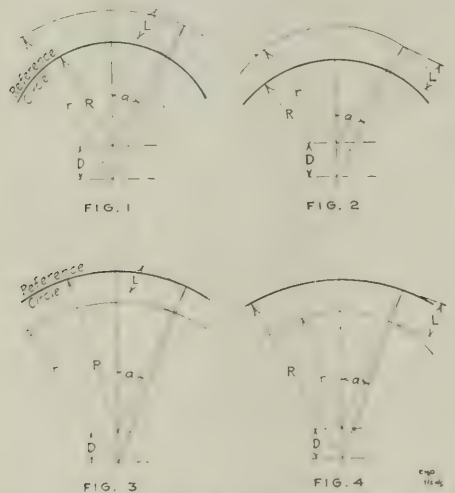
For Fig. 4, $L = -F + G\frac{D}{2}a^2 - H\frac{D}{24}a^4$

where

$A = -R - r - D$ $\quad F = -R + r + D$

$C = 1 - D\,r$ $\quad G = 1 + D\,r$

$E = 1 - 4\,D\,r + 3\,D^3\,r^3$ $\quad H = 1 + 4\,D\,r - 3\,D^3\,r^3$



FIGS. 1 TO 4. TO FIND RADIAL DISTANCE OUT FROM CURVED CENTER-LINE R TO CURVE r

The values of the coefficients C, E, G and H may be obtained from the graphs reproduced in Fig. 5. Compute the ratio $\frac{D}{r}$, and enter the curves with this value.

In general we may put

$$L = P + \frac{D}{2}Qa^2 + \frac{D}{24}Sa^4$$

The term Sa^4 need only be used when its value for the largest value of a becomes appreciable.

A table for the conversion from degrees into radians is given herewith.

If the stations along the R circle are equally spaced, then only the first angle need be computed. The length of one station divided by the radius gives the difference to be applied to the first angle obtained. Thus the various values of a are quickly tabulated. The squares, and if need be the fourth powers, are read off on the slide-rule. The coefficients Q and S are taken from the curves in Fig. 5; then the values of Qa^2 are tabulated with one setting of the slide-rule, and similarly the values of Sa^4.

TABLE FOR CONVERTING DEGREES, MINUTES AND SECONDS INTO RADIANS

Degrees	Radians	Minutes	Radians	Seconds	Radians
1	0.0175	1	0 0003	10	0 0000
2	0.0349	2	0 0006	20	0.0001
3	0.0524	3	0 0009	30	0.0001
4	0.0698	4	0.0012	40	0.0002
5	0.0873	5	0.0015	50	0.0002
6	0.1047	6	0 0017	60	0.0003
7	0.1221	7	0 0020		
8	0.1396	8	0 0023		
9	0.1571	9	0 0026		
10	0.1745	10	0 0029		
20	0.3490	20	0 0058		
30	0.5236	30	0 0087		
40	0.6981	40	0 0116		
50	0 8727	50	0 0145		
60	1 0472	60	0.0175		
70	1.2217				
80	1.3963				
90	1.5708				

Since the approximation in the formulas consists in dropping the higher powers of a, it is well to check one or two values by substitution in the exact formulas. Should an appreciable error be noted it is better to use the exact formulas in the range affected by the error rather than carry the expansion further. The value of L obtained by the approximate and exact formulas for the maximum a will at once show whether the approximate formulas apply for all cases.

For example: In Fig. 1 take $R = 1000$; $r = 1050$; $D = 25$. Assume the allowable error to be $\frac{1}{8}$ in., or 0.01 ft. The ratio $D\,r = 0.02$. From the graphs, $Q_1 = 0.98$, and $-S_1 = 0.92$. Then

$$L = 25 + 12.25a^2 - 0.96a^4$$

To see for what value of a the term $0.96a^4$ becomes appreciable, equate $0.96a^4$ to 0.01, whence $a = 0.345$, or 20°.

Suppose the maximum value of a is 30°, or in radians 0.5236. From the approximate formula $L = 28.28$. Substituting in the exact formula

$$L = -D\cos a + \sqrt{(r^2 - D^2\sin^2 a)} - R$$

$L = 28.28$, the same result; which shows that the abandoned powers of a exert no influence on the result.

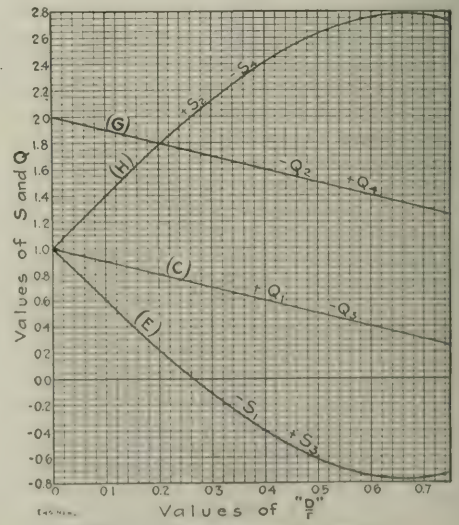


FIG. 5. COEFFICIENTS Q AND S

EDITORIALS

In railway advertising literature nowadays, one notices frequent appeals to the passenger's desire for safety in his journey. "Block signals" are more frequently the foundation of the advertiser's appeal than "Cannon Ball Flyers." The climax is reached, however, in the following paragraph from a publicity man's account of two new five-hour express trains between Boston and New York.

These new trains are practically indestructible. Made of steel they could go through a stone wall without being scratched. Reinforced underneath with two immense steel girders running the length of the car and attached at the end to a solid cast steel U frame forming the vestibule, no impact, however great, could telescope them. A rear-end collision might tilt them up on end a bit, but that would be all. So far as resisting powers go they are built like battleships.

We fear the publicity man is unaware how thick are the stone walls that surround some of New England's rock-ribbed farms. We have no word to say against the excellent provisions for strength in car construction but it is well to remember that the greater the weight of a car the greater the impact in a collision. To talk of "indestructible trains" is a little too much like the talk of "unsinkable ships," to which the "Titanic" disaster put an end. In these days when the public is prone to demand too much of the railways the latter should be very careful not to claim too much.

One Man Control for the New York State Highway Work

The bill of Governor Sulzer, of New York, to abolish the present State Highway Commission (created in accordance with a law passed during Governor Dix's administration) and to place the entire highway work of the state under the jurisdiction of a Commissioner of Roads, became a law on Mar. 15. Comment on this measure has already been made in these columns. We will merely observe at this time that three successive governors of New York have each of them changed, not merely the men in control of the state highway work, but the organic law under which that control is exercised.

It is a pretty safe guess that the end is not yet reached. It would be a very remarkable thing if the next governor of New York, whoever he may be, should leave Governor Sulzer's appointee in charge of the state highway work. Should the Governor appoint an honest and thoroughly efficient engineer to take charge of the work, such a man would doubtless accumulate sufficient influential enemies during his term of office to make his reappointment an impossibility. On the other hand, if Governor Sulzer gives the job to a politician, then rival politicians will surely have some other man slated for the place by the time another governor is inaugurated.

How long would a mercantile or manufacturing firm be able to keep out of bankruptcy if it changed its president and manager every two or three years, and if all those holding responsible positions in the firm knew that they were likely to lose their places at any time when a change in management occurred? New York has a long way to travel before it learns the elementary principles of efficient public works management.

Engineering Work Which Pays

In the current discussion in these columns concerning the status of the engineer, it is well to put on record that there are cases where the work of the engineer *is* appreciated. We have before us a newspaper interview with the head of a noted bridge engineering concern, which interview bears every evidence of authenticity, in which he says: "We complete about $10,000,000 worth of bridges each year and we have erected altogether at least $120,000,000 worth of bridges in this and foreign countries. Our gross annual income is about $300,000 and our net profits about $100,000. We have a staff of about 70 to 80 engineers."

If the above figures may be accepted as correct, this firm's charges for its engineering work averages 3% of the cost of the structure. The figures quoted furnish another illustration of the tendency toward the concentration of engineering work in the hands of large organizations.

Another very pleasant newspaper story, which will sound strange to many engineers, but which we have verified from independent sources, concerns a prominent engineer who had carried through a very large enterprise for a well known capitalist. The manner of execution of the work so pleased the man of wealth that he not only paid the engineer's bill, but as an evidence of his high appreciation sent the engineer as a Christmas present a check for $20,000. May his tribe increase!

The Conviction of Well Known Men for Fraudulent Mine Promotion

In the United States Court at New York City, on Mar. 14, Julian Hawthorne, Dr. W. J. Morton, and Albert Freeman were found guilty of fraud in connection with the promotion of Canadian mining companies, and were given a penitentiary sentence. Josiah Quincy, ex-Mayor of Boston, who was indicted with the others, was acquitted, but indictments on other counts are yet to be tried.

The trial of these men has attracted wide attention, partly because of their prominence and partly because of the remarkable literature which was circulated by these men in promoting their mining properties. Julian Hawthorne is the son of the famous American author, and has for practically his whole life made his living by literature, although he studied as a young man at the Lawrence Scientific School and in the early '70's he spent two years in hydrographic work as an engineer in the New York Dock Department.

Three or four years ago, at the time of the public excitement over the silver discoveries in the Nipissing and

Cobalt region, Freeman, Morton and Hawthorne organized companies to develop mining claims in this region. To sell the stock of these companies, Hawthorne prepared and circulated literature in which the most extravagant claims were set forth as to the value of the properties. These circulars were prepared with a literary ability which made them widely read, and had doubtless a large influence in securing the sale of the stock.

From the information developed during the trial, however, it may well be doubted whether the profits of those who engage in the task of promoting fraudulent enterprises are as great as is often claimed. Apparently the money received from the sale of stocks was rapidly used up in paying the cost of sending out circulars, renting expensive offices, and keeping up a show of work on the Canadian mining claims. It is doubtful whether the promoters gained much profit other than salaries which lasted no long time, for it did not take long for the bubble to burst.

There is no doubt that the verdict and the sentence of Hawthorne and Morton were abundantly justified by the facts which the trial developed. Doctor Morton is the son of the Dr. Morton who first used ether as an anæsthetic. Both Hawthorne and Morton used the names which their fathers had made famous, as a bait for investors in an enterprise of whose character they could not have been ignorant. Their conviction and punishment is a valuable and salutary warning as to the danger of connection with any enterprise of a dishonest nature.

The sentence most richly deserved, however, is that meted out to Albert Freeman, for this is not the first time that Freeman has been the active agent in promoting fraudulent mining concerns by the aid of distinguished names. Many members of the engineering profession will recall the circulation of literature a dozen or more years ago, in which roseate prospects were held out to investors in certain mines located in the Leadville district of Colorado and in Mexico, and the names of a number of distinguished and blameless engineers, a number of whom have since that time passed away, were advertised as assurance of the soundness of the enterprise.

Had the Federal Government at that day enforced the law against the use of the mails for fraudulent purposes with the same vigor and persistence that it has in the last three or four years, there is little doubt that Mr. Freeman's career as a financier would have come to an end long before the days of Cobalt and Temagami.

Rules against Smoking on Street Cars

Ever since the introduction of street cars there has been more or less protest against permitting passengers to smoke on the cars. In recent years the protest has become stronger and more insistent, with the result that in a number of cities smoking has been prohibited entirely. A brief editorial reference to this matter was made in an issue of Nov. 28, 1912, but the subject appears to call for some further notice in view of its relation to street railway administration and economies, and to public comfort, cleanliness and health.

With the old style of cars having open platforms there was little objection to smoking by those on the platforms. Practically no smoke would enter the car, and smokers could (and did) expectorate into the street, so that the platform did not become very dirty. With open cars, also, there is not much objection to smoking on the rear seats; except that the foul condition of the floor is very offensive to non-smokers and especially to women who may have to take seats in this part of the car.

With modern cars having vestibuled or inclosed platforms the conditions are very different. There is no adequate escape for the smoke, and nearly all expectoration is upon the floor. Whenever smoking is allowed in part of the car (as in the vestibules of street cars or in a partitioned compartment on interurban cars), the smoke and the foul odors from the filthy floor invariably penetrate throughout the car. Indeed, on some interurban cars, where the conductor and passengers are continually opening the door in the partition, the conditions in the main body of the car are highly objectionable, even to those who are not averse to smoking.

It may be of interest to refer to some specific instances. The Chicago street railways operate a number of cars having large vestibules, with the main exit at the front. On these cars smoking is permitted in the front vestibule, and the constant swinging of the door in the bulkhead or partition causes smoke and smell to extend through the car. The more serious objection in this case, however, is the filthy condition of the floor of the vestibule from the continual expectoration. The new front-entrance cars of the Chicago lines have no rear vestibule, and the front vestibule or platform is not separated from the body of the car by any partition. No smoking is allowed on these cars.

Three of the four elevated railways in Chicago operate smoking cars on their trains, and there has been complaint as to the condition of these cars, and as to the practice of smokers passing through other cars (which are often crowded) to reach the smoking car. This latter trouble is due in part to the fact that this car is not in the same position on every train. Some time ago, in consequence of numerous and persistent complaints, the Chicago & Oak Park Elevated Ry. decided to prohibit smoking on its trains. There were violent protests on the part of smokers; some banded together to use other transportation lines, with the idea that the loss of their patronage would bring the company to terms. Others adopted the plan of smoking in the regular cars, but this nuisance was abated partly by ejecting the offenders and partly by stopping the train until the smoking was stopped. Fights were somewhat frequent for a time, but all these means of protest failed, and after a short but stormy period, the non-smoking rule was obeyed.

Incidentally it may be noted that the smoking cars and compartments of many rapid-transit lines in London are far less objectionable than those in American cities. This is due to the fact that British smokers seem to get along without continual expectoration, and the further fact that the chewing of tobacco is practiced only to a small extent in Great Britain. Consequently, only the smoke and tobacco ashes are noticeable conditions, while the floor is dry instead of being in the filthy and wet condition which causes a large part of the objections to smoking cars in this country.

At Kansas City, a controversy which involved the city authorities, the street railway company and the public, was settled in 1912 by a referendum vote of the passengers. It appears that in 1910, the company issued an

order prohibiting all smoking on the cars, but in 1911 an agitation was raised by smokers, and in 1912 the City Council was induced to pass an ordinance requiring the company to permit smoking. The company refused to accept the conditions imposed, claiming that the regulation of smoking was a matter entirely within its own hands, and that the prohibition was in the interest of the greater number of passengers. The dealers encouraged the smokers to fight by offering free cigars and tobacco and matches to persons who would smoke on the cars, but this move (as well as that of the Council) was checkmated by the company ordering its employees to stop their cars and refuse to move as long as any passenger insisted on smoking. The complaints of other passengers soon overcame the obstinacy of the offending smokers. Finally, the company decided to take a vote of the passengers as to whether they desired to have smoking allowed in the cars, with the result that nine voted against it for every six in favor of it. This settled the matter, and the prohibition against smoking remains in force.

In New York, smoking is not allowed on the subways, elevated lines or street cars, except on rear seats of open surface cars, on upper seats of the proposed double-deck closed cars being tried, and on open cars run in summer on one of the elevated lines. We understand that the prohibition was due largely to action taken by the Health Department. It has been reported that the street-railway companies of Milwaukee, Wis., and Portland, Ore., have announced that no smoking will be allowed in future upon any of their cars. The companies benefit from the elimination of a special class of accommodation and from the reduction of special cleaning required for cars in which smoking is permitted.

In many American cities there have been similar agitations against smoking on street cars, accompanied by more or less active controversies between smokers and the general public and between smokers and the street railway companies. If the undesirable conditions noted above are admitted (and in many cases there is no room for argument) there would seem to be no good reason to require the transportation interests to maintain a nuisance, simply to meet the convenience of a small proportion of their passengers. That this proportion is small is indicated by the relative amount of space assigned for smokers and non-smokers. The prohibition has no effect in reducing the revenues of the companies, as persons will ride even if they must not smoke during the ride.

There can be no question but that as matters of simplified and economical street-railway administration and of general comfort and convenience of all passengers who do not smoke on urban transit cars the prohibition of smoking is justified. Public cleanliness points in the same direction. Just how far the public health demands the prohibition of smoking in street cars it is not so easy to say—at least not in specific terms, supportable by scientific evidence; evidence, too, which is not equally applicable against smoking in any public place. The spitting so commonly associated with smoking is a possible means of spreading the germs of tuberculosis and other communicable diseases. The smoke-laden atmosphere of a smoking car or compartment is certainly far from an ideal medium of conveying life-giving oxygen to the lungs. It has been claimed also in Chicago, and with some show of reason, that placing the motorman in a vestibule whose atmosphere is heavy with smoke and foul odors does not conduce to his health, comfort or efficiency, or to his prompt and clear-headed action in an emergency.

On the general ground of conserving the interests of the greater number of passengers, the force of the argument seems to be decidedly against permitting smoking. The tendency undoubtedly is in this direction, and where the non-smoking principle has been established there seems to be little, if any, complaint or dissatisfaction after the first protest has been overcome.

The Proposed New Cleveland Charter and the Engineering Organization of Cities

What is the best plan of engineering organization for the larger cities of the United States? The question is pertinent because Cleveland, Ohio, has recently elected a Charter Commission of 15 members by popular vote. The commission is headed by Hon. Newton D. Baker, now Mayor and for many years City Attorney of Cleveland, and seems to be tackling its complex problem with vigor and intelligence.

Although, aside from expenditure on schools, the bulk of the money paid for running our cities goes for engineering work, few American cities have a rational system of engineering organization. Instead, the engineering work is generally distributed in a haphazard fashion among a number of city departments. The boards or commissioners in charge of these departments are but rarely engineers and quite as rarely are they selected because of any marked qualifications for the important duties which they must perform and supervise. The engineers who do the responsible work, and upon whom are heaped all the blame if anything goes wrong, get comparatively little credit for their achievements, are generally paid meager salaries, and, like their political chiefs, are liable to be turned out of office at any election.

There is need for a functional reorganization of the administrative work of most of our cities, both large and small, with a correlation and at least a considerable degree of centralization of the engineering work of the various departments. This much is certain. There is more or less uncertainty as to whether there should be a single and largely independent engineering department for the whole city, or whether each functional department should have an engineering department of its own, largely independent of all other departments.

A middle course is to have a separate engineering staff for each department and a city engineer independent of any and all departments. The city engineer might be a general consulting engineer to the Mayor, under the federal plan of city government, and to the council under the commission plan. The city engineer and the department chief engineers might together form an engineering board which would pass upon all interdepartment or overlapping engineering problems. The city engineer might be chairman of this board and might have a deciding vote; or he might be chairman with no vote, but with power to veto the decision of the other members—which some might think too radical a plan.

The foregoing plan of engineering organization is suggested for purposes of discussion rather than for general adoption, although we believe that some plan of centra-

lized engineering organization is essential to the best possible success in municipal administration. This general principle applies to small as well as to large cities, but the smaller the city the less will be the difficulties of its application, since the number of engineers becomes fewer and fewer until with a small city only the city engineer himself is involved.

Consideration of this or any other plan of municipal engineering organization should be kept separate from the question as to whether or not department heads should be engineers. In any case there must be an engineering staff or staffs. The question is how can the engineering work of all the city departments be harmonized or unified?

Some years hence, all the heads of strictly executive city departments will be selected and retained for fitness, and fitness only, and the chances of partisan politics will no longer determine their appointment. So long as political considerations dominate the selection of department heads, they will continue to rotate into and out of office according to the popular votes on such national issues as the tariff, the currency, and State rights, on the one hand and, on the other, such local issues as the control of various forms of vice. Obviously, none of these considerations has any relation whatever to a man's fitness to manage a city's engineering works; nevertheless, out go the heads of such departments with every change in the political complexion of Mayor and Council.

Fortunately, a goodly number of citizens already realize the folly of such changes, and the number is increasing. Many cities which are not ready to take the heads of public works departments out of politics of the baser sort are quite ready to place their technical staffs above this baneful influence—or they would be ready if they had leadership to that end.

Who could more properly and effectively lead this great reform than the engineers themselves? Not merely the engineers in the city service but all members of the engineering profession. In fact, for obvious reasons, engineering leadership in such reforms would be more effectively promoted if they sprung from or were guided by engineers who were not in the city service. We do not mean by this that engineers in the employ of a city should take no part in the movement. They should take as active a part as is consistent with the proprieties. Heretofore, most engineers in the city service have been altogether too modest in this respect. They might well learn from the lawyers how to keep within professional bounds and yet mold city charters, ordinances and administration in accordance with the best ideas of their profession.

Reverting to the situation at Cleveland, a new charter is being drafted there under auspices favorable to excellent results. The Cleveland Engineering Society has already taken a hand in shaping public opinion regarding important engineering problems. We presume it is awake to its present opportunity and duty.

Frankly, we are not sure that the Cleveland or any general engineering society is fitted to undertake detail work in this field; for the membership of such a society is too complex and the chief interests of many if not most of its members are too remote from problems of municipal administration. But the society as a whole can readily and properly take a strong stand upon such fundamental matters as choosing and retaining the members of the city's technical staff on the basis of fitness alone; and it might refer to a carefully selected committee such questions as demand special knowledge of municipal engineering and administration.

At Cleveland and elsewhere, engineers seeking to do their part in the reform of city charters should of course coöperate with men of other professions. Such cooperation should be easy to secure, for all citizens alike are interested in securing good government and it is easy to show that all branches of the municipal service, and particularly the technical branches, upon which in great measure economy and efficiency depend, can only be well administered by men chosen solely for their ability, amply paid for services rendered and retained in office indefinitely, so that the city may gain the benefit of their years of accumulated experience. In fact, the politicians themselves who realize there is an elastic limit to what the public will stand have found it necessary to retain in office permanently many of the men whose technical knowledge and experience make them indispensable to keep the wheels of public business turning.

Finally, in this and all other civic matters, the engineer should dismiss his diffidence, come out from the shadowy background where he has too often lost himself in the past and do his part in shaping public opinion.

LETTERS TO THE EDITOR

Rapid Railway Bridge Reconstruction in India

Sir—I send you herewith a short account of the renewal of the girders of the Kiul Bridge on the East Indian Ry. The work carried out is of considerable magnitude and is an excellent example of a well-thought out project successfully completed. Owing to the rapidity with which the work has been done a considerable saving has been effected on the estimate; while the inconvenience of having to work on a single line of railway has been reduced to a minimum, the value of which is difficult to estimate.

The first work, completed last March, was the regirdering within three months of starting work of the "Up" road of the Kiul Bridge at Mile 261⅞ on the Main Line of the East Indian Ry., but this fine record has been surpassed in regirdering the "Down" road. The old bridge was of nine spans of 150-ft. lattice girders weighing 141 tons per span, with footways supported on brackets on the outside girders. Before the work of erecting the new girders could be put in hand the old girders had to be dismantled, involving the cutting out of 103,000 rivets. The piers had to be demolished and new bed stones set at a lower level for the reception of the new girders. The new girders are of the open N type of 150

ft. clear span and were designed by Messrs. Sir A. M. Rendel and F. E. Robertson, Westminster, London. Each girder weighs 160 tons and 15,000 rivets per span were required in their erection.

The work of dismantling the old girders of the "Down" road was started on Nov. 14, 1912, and the track was laid across the new bridge on Jan. 11, 1913. So far as we are aware the rapidity with which this work has been carried out has never been equaled in India, let alone surpassed. For all practical purposes it means that one span of old girders was dismantled and a new span of 150-ft. girders completed w th track every seven days.

The officers in charge of the work were A. H. Aslett, District Engineer, J. Leitch, Resident Engineer, C. O. Meredith, Bridge Foreman and Maurice Melling, Contractor.

A. H. Aslett.

Dinapore, Bengal, India.
Jan. 14, 1913.

Licensing Engineers

Sir—In the discussions of the problem known as "licensing engineers," the customary point of view has generally been that the engineer alone was to be consulted. A recent news item reveals a different point of view.

The item states that the National Association of Paving Brick Manufacturers at its recent meeting in Chicago, adopted resolutions favoring laws that will require examinations for civil engineers and engineers engaged in construction work of all kinds.

The resolutions indicate that probably more than one member has been "stung" in times past.

If it is necessary to have a house cleaning, would it not be better to have it done in the interest of engineers or rather by those composing the so called profession? There is a strong feeling among the younger generation that the older members have prevented action in this matter because they are employers and that has biased their judgment. In these prosperous days when a great many engineers do not belong to engineering societies, etc., because they cannot afford the price, a good many votes on this question are never registered. How to get an accurate vote is a problem in itself. To my mind it has not been had at the present time. If you take an impromptu gathering you will not find a very strong belief in the average employer, whether he is an engineer or not, and it seems too much to expect that those on that side of the fence will be anxious to further a scheme which may apply a cut to themselves. The employers are well represented in all votes while the employee probably keeps still because he does not desire to "squeal" and make a public announcement that he is a failure according to modern standards.

In our large cities an average man 15 years out of school cannot get married unless he wishes to live way back on a back street. At 50 he is not wanted. When in his lifetime is he supposed to be prosperous? At the same time concerns whose profits rest entirely upon engineering information, acquire more than they know what to do with, judging by the way the beneficiaries spend it. There is an economic law governing the matter and it is not very obscure.

P. L. B.

Chicago, Mar. 10, 1912.

The Railway Valuation Act

Sir—The title of your interesting editorial in Engineering News of Mar. 6, on the Railway Valuation Act, "A Huge Piece of Engineering Work," seems to be well chosen. Indeed it is conceivable if not probable that the work provided for by this Act is only the preliminary survey of what may develop into a task far greater than has yet been suggested in the public discussions of the subject.

Your statement that "A fair valuation, which will settle questions now in dispute, will be of great public service" will generally be accepted as true. But what is a "fair valuation"? As the writer views this question, a mere physical valuation may be decidedly unfair for some or all of the purposes intended.

From the viewpoint of one who has had the opportunity to work for some years on a number of railway economic problems, the only fair valuation is one that includes the operating value and an estimate of the efficiency ratio of operation and management as well as the economics of such revisions and betterments as appear feasible.

To make such a valuation for over 362,000 miles of track would be a stupendous undertaking but it could be done. When the insufficiency of the proposed physical valuations becomes apparent, perhaps the larger task may be undertaken.

The question is, would it not be safer and better to go slow and make a complete economic and operating valuation from the start, even if it should take two or three times as many years to complete the work for all the railways which come under the operation of the act.

A. W. Buel.

15 William St., New York City.
Mar. 7, 1913.

[Our correspondent raises a question which will eventually have to be given serious attention. If the public is not willing that efficient management shall be given recognition in some form in fixing railway rates, what incentive will there be to run the railway business efficiently? And the question is broader than the railway business alone. If any public utility may charge such rates as will enable it to earn a fair rate of interest on the value of its plant, then it may raise rates by simply neglecting to run its business economically, allowing labor costs and material prices to run up.

This is but a sample of the economic and political questions that must be threshed out before the big problem of public control of public utilities under private ownership is successfully solved. The valuation of these utilities now provided for is merely a beginning.—Ed.]

The Detroit Machine for Testing Paving

Sir—I read with some interest the discussion between Mr. Powell of the Universal Portland Cement Co. and Mr. P. E. Green, regarding concrete pavements, in your issue of Feb. 27. It may be of interest to you to know why the machine called the "paving determinator" was constructed. It is a well known fact that no matter what article of commerce you place in the hands of a salesman, he will be able to dig up excellent quali-

ties for the article and induce a great many buyers to take his word for it.

Detroit has yearly spent a great deal of money for the construction of brick pavements. The manufacturers who are able to furnish a brick of a very low abrasion loss in the standard rattler naturally claim great excellence for their product. The experience of the Department of Public Works, from actual wear of the paving blocks in the streets, did not confirm the assumption that the block with the lowest rattler loss gave the best service. Representatives of the manufacturers claimed that the failure of the low abrasion block not giving the best service, was because of the faulty construction of the pavement. The facts in the case did not warrant this charge. In order to determine just where the trouble was, this "paving determinator" was designed and tests were run with various kinds of material. Mr. Green says:

> Any machine, which, by test, produces results that are contrary to hard experience, simply brings ridicule on scientific observations and theory. The absurdity of a concrete pavement outwearing a first-class granite block pavement needs no comment.

In regard to this statement, we did not find that concrete outwore granite. We did find, however, that under the conditions at which one test was run at speeds varying from five to seven miles per hour, with all the paving (concrete included) laid to a straight-edge, owing to the roughness of the surface of the granite pavements the grouting was broken and the granite blocks forced into the sand to a depth of 1 in. or more and the edges of the blocks were chipped in places. However, there was very little actual wear on the granite block.

We have made rattler tests on the granite block and found that rattler loss was about 3% on fresh blocks with sharp corners, and only 1½% on the same block on a second test. We have also rattled sandstone block and concrete blocks, obtaining in the sandstone about 11% and the concrete about 40%. I have also found individual vitrified blocks in the product of one of the very best brands of paver that has run as high as 60% loss.

Our observations were made for the purpose of finding what relation, if any, the rattler indicates as to actual wear, and we believe we are in a fair way to learn this. We have found that the greatest weakness in a vitrified block pavement is in the behavior of the sand cushion. In our tests the floating or shifting of the sand has been the inciting cause of the failure of the brick. It would be natural to say that the filling of the joints must have been defective to admit of this.

In regard to the creosote block being loosely laid, I understand that this was used, not as a test on creosote block, but only to introduce the wheels to each successive sample of concrete in the same manner.

The work done in Detroit was entirely for the information of the Department of Public Works, and is by no means completed at the present time. The machine is nothing more or less than a method of providing wheel abrasion on a pavement surface in a concentrated manner, and may at times show that a presumably inferior material, properly laid, may give superior results over a supposedly superior material improperly laid.

J. C. McCabe.
City Boiler Inspector.

Detroit, Mich.
Mar. 13, 1913.

The Three-segment Column-formula; Increasing Column Stresses

Sir—The publication in your issue of Feb. 20 of extracts from a new set of specifications applying to the design of steelwork for buildings, etc., issued by the American Bridge Co., brings up again the time-honored question of formulas for the reduction of allowable unit-stresses in columns.

The new three-segment formula as suggested resembles very much that used by the Bethlehem Steel Co. in figuring its table of "safe loads" for the special H-section column rolled by that company. In fact, between the limits $\frac{l}{r} = 40$ and $\frac{l}{r} = 80$ these formulas will give practically the same allowable unit-stress, and it is between these limits that probably 85 to 90% of the tonnage of columns fabricated for building work will occur.

If then, we confine our attention to a comparison of the formulas (as shown on the diagram published with your article referred to above) between these limits, it can readily be seen that the new three-segment formula (and hence also that used by the Bethlehem Steel Co.) allows a much higher unit-stress than any other formula except that contained in the Boston Building Law, which law at the same time imposes extreme conditions of loading in connection with the use of its formula, conditions that cannot be actually realized. Both of these formulas differ from the old "Gordon" formula, which is the one on which the majority of tables of "safe loads" given in the various hand-books are based, by as much as 13 % where $\frac{l}{r}$ equals 55.

It would be proper to know, therefore, upon what data the new American Bridge Co. formula and the Bethlehem Steel Co. formula are founded. It is recognized, of course, that column formulas are to a great extent empirical, but those upon which current practice in regard to the strength of columns is based were founded on the results of actual tests combined with the best theory applicable. The new formulas mentioned seem to be based on assumptions which may or may not be well founded. If there have been tests made the results of which would warrant the adoption of a formula that will permit the use of unit-stresses in columns in some cases 13% higher than has heretofore been considered good practice, the writer is not aware of it. It seems only fair to the engineering profession that the authority for these formulas should be made public, and intelligent and honest criticisms invited from those competent to judge, before they come into general use in tabular forms of alleged "safe loads" in hand-books, among the host of "text-book designers" with whom, unfortunately, the final decision in the matter of far too large a quantity of structural steelwork is placed.

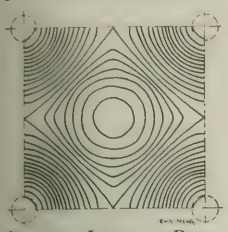
The writer would suggest that an opportunity be given through these columns for a thorough establishment of the merits of the two column-formulas here mentioned. If well founded, they are deserving of universal use where applicable; if not, their existence tends to mislead and may be productive of much harm and injustice.

N. R. McLure.

Phoenixville, Penn., Feb. 25, 1913.

Tests and Performance of Flat Slabs

Sir—In reference to A. C. Arend's letter in ENGINEERING NEWS, Feb. 27, 1913, p. 429, on the subject of flat-slab floors, it may be of interest to your readers to study the accompanying diagram or "contour map" of a flat plate supported on points and loaded uniformly. The illustration given is the result of one of the numerous experiments carried on by this company in arriving at a rational basis of design for floors of the flat-plate type.



CONTOUR LINES OF RUBBER FLAT SLAB DEFLECTED BY AIR PRESSURE
(Reprinted from "Engineering News," Feb. 29, 1912, p. 403)

A sheet of rubber was fastened over an air-tight box, containing columns dividing the surface of the rubber into nine panels. Load was applied by exhausting the air from the box with a water-jet aspirator and measured by a U-tube manometer. Deflection readings were then taken at points over the interior panel spaced one-tenth of the span apart and the readings plotted in the form of a contour map, showing in a remarkably clear manner the character of the surface assumed by a flat plate, supported on points and uniformly loaded.

It shows conclusively that tension exists in the top surface of the slab along the center lines between columns, thus confirming Mr. Arend's observations regarding the behavior of the floor finish in the building which he investigated. In the majority of flat-slab floors no provision is made for reinforcing the top of the slab in a direction normal to the center lines connecting columns, and to this lack of proper reinforcement may be attributed the cracks which Mr. Arend mentions as occurring in this region of the panel.

The experiments mentioned above indicated that a two-way system of reinforcement would be desirable as providing the most satisfactory method of meeting the stresses developed in flat-plate floors. It provides the necessary steel in the top of slab between columns and results in but two layers of bars in the top of slab over the column heads where maximum stress conditions exist. In the usual four-way system of reinforcement, the bars cross the column head in four layers so that the two layers are rendered largely ineffective through a shortened lever arm. To contribute further to the lack of efficiency of this reinforcement, it drops too rapidly towards the central portion of the slab, leaving a zone of concrete in tension unprotected by reinforcement, which accounts largely for the formation of circumferential cracks around the column in the top surface.

This condition is obviated in the two-way system by having the bars in but two layers over the column head and by extending them in the top of the slab past the line of contraflexure, thus giving the protection necessary against the formation of circumferential cracks.

W. S. THOMSON.
Chief Engineer, Corrugated Bar Co.
Mutual Life Building,
Buffalo, N. Y.
Mar. 7, 1913.

The Status of the Engineering Profession

Sir—In connection with the remarks on the status of the engineering profession in your issue of Jan. 3, I would like to relate an incident which came to my notice two weeks ago.

In the State of Wyoming, we have a State Engineer and also a Commissioner of Public Lands, both having charge of state departments. In handling applications for segregation of public lands for Carey Act irrigation projects, practically all of the matters concern the Commissioner of Public Lands. This being the case, it was thought it would be well to have an engineer, who should be a state official, with authority to examine and report on such applications, and then the state, when applying for a segregation, could have its own engineer certify to the feasibility of the project, and thus present the same to the Secretary of the Interior, backed up by the expert examination of a state's engineering official. On the other hand, if the project was inadvisable, the state could notify the original applicant and end the matter.

Several plans were suggested; first, that such an engineer should be appointed as an assistant to the State Engineer, and that then the whole matter of Carey Act segregations should be turned over to the State Engineer's office. Second, that a separate department should be organized under an engineer who would have charge of all Carey Act matters. Third, that an engineer assistant should be given to the State Land Commissioner, who should work under his direction upon Carey Act applications.

The Legislature is now in session and probably a bill for one of these measures will be brought before it. Several engineers were consulted as to which would be the best way to handle the matter. The whole crux of the question was this: How best to present this matter in the form of a bill, and how to word the bill so that the state should be sure of always getting a good engineer and a competent man?

Usually the qualifications for such a position as embodied in laws are about as follows:

> The . . . .. engineer, shall be a man who is practically and theoretically qualified to perform the duties of said office and shall be appointed by the Governor for the term of ..... years.

This, as you see, means nothing. Who is to be the judge of the qualifications? Very often politics have far more to do with the matter than competency. Then, if an incompetent man is appointed he is virtually saddled on the public for a term of years.

After carefully considering the matter, several of us concluded the best way would be to authorize the State Land Commissioner to appoint his own engineer assistant, and to fix the time of service to suit himself. This would give the State Land Commissioner the power to "hire and fire" his engineer at any time. This would also fix the responsibility for any delays in Carey Act matters directly upon the State Land Commissioner, and applicants would know exactly who was to blame. The State Land Commissioner could not shift responsibility upon an engineer appointed by the Governor, and whom the Commissioner could neither hurry nor remove.

Mr. Stillwell, in his address before the Institution of Consulting Engineers, referred to incompetent engineers,

and asked if in flagrant cases some method could not be devised whereby the responsibility could be placed where it belongs.

I would like to ask if some method could not be devised whereby the great engineering societies could not prevent a great deal of incompetency in public engineering positions, by helping to get the right men in the right place at first?

Mr. Stillwell also mentions the fact that for this and other situations of which engineers complain, they are themselves to blame, because of their retiring dispositions, and he is right.

To a great part of the public, one engineer is as competent as another. All that it is necessary to do is for a man to hang out a shingle "Civil Engineer," "Mining Engineer," and many men would employ him as quick as they would the president of a national engineering society.

This ignorance of the public as to the qualifications of an engineer is not confined to uneducated men either. I am personally acquainted with a bank president, a prominent judge, and another man who conducts a business of four or five million dollars a year. Each of these men would employ one engineer as quick as another. Yet each of these men are very careful to employ the very best lawyers they can obtain.

Such being the case, who can blame a Governor should he appoint an incompetent engineering official, or the public should they elect one?

Will a standardization of minimum fees to be charged by engineers help? I am very doubtful. It would probably do a great deal of good in such a place as New York, Chicago and other large cities; but it is a question if it would work in places of 100,000 or less. It would certainly help if the public knew that a good engineer, like a good lawyer or doctor, costs money; but they have first to be educated to this idea.

I know many engineers in the West who are called upon to testify in law suits, an employment which usually pays well; but they all agree that they are called because the lawyers in the case know the value of their testimony, and not the litigants themselves.

Engineers do not "butt into" things. Also they do not pull together. This is evidenced in the small engineering societies. Take the Salt Lake City engineering society, for instance. They have a nice society, whose members meet and read a paper or two, and possibly they have a little refreshment. Then they separate and forget about it until next time.

Now, in the City of Salt Lake, there are a good many engineers; but I do not know of one that has a large enough business to warrant his buying a multiplying machine, or a fine rolling planimeter, or a plane table, or a fine pantagraph, or an integrating machine. Each engineer has his own little library, his own little kit of instruments, which are, of course, ample for his usual work. When, however, a man who uses a transit almost entirely, runs up against a small plane-table survey, he has no instrument. If engineers pulled together, he could have any one of these instruments from the society. There would not be enough work to warrant one engineer getting them, but there would be enough if they were available for the use of all. Then in small societies (and big ones, too), there is always a lot of reading and publication of papers, of which each will interest only a small number. The society should be thinking some of advancing the business interests of its members as well as of technical papers.

In order to do this, it should take an interest in seeing that engineering positions of every kind are well filled. Technical papers read at the meetings are extremely helpful; but we really derive more benefit from the man who gets us or gives us a job than we do from the finest paper ever written.

This, perhaps, looks sordid; but to come down to cold facts, I have yet to meet the engineer who is not hunting a job, with all the avidity that he hunted his first job after graduation.

If we could get our four great national engineering societies into a position where they would be called upon to recommend men for positions, and where their recommendations would be of weight, it would be a great thing.

The societies fight shy of this. Why? Possibly because they would not like to offend certain of their members. There is reason in this, too. But they could partially avoid this, if called upon to recommend men for a place by sending out the names of a dozen, two dozen or more men, considering availability in every respect, geographically and otherwise.

At the present time, consider what it means when a man writes after his name the cabalistic letters signifying his society membership. In the case of the four national societies, is this any guarantee whatever that he is an expert in his line? I am thankful to say that it usually means he is; but this is due more to the fact that the majority of the members are men of honor than the fact that they are members. I belonged to the American Institute of Mining Engineers as a full member when a student in college. This was good for me, but it certainly did not redound to the professional standing of the society. I know there are men belonging to the American Society of Civil Engineers who are rather below mediocrity. I presume the same thing exists in the other societies.

When one talks of a standard minimum price for engineering services it savors very much of trade unionism. We all know that one man is worth more than another. Trade unions get over this fact by saying that they only fix the minimum wage, and that as much more can be paid as the workman can get. The fact of the matter is that the minimum wage as fixed by the union almost invariably fixes the ruling price for labor. The same thing occurs to a great degree whenever a standard wage is fixed by tacit agreement. In Wyoming, it has become the custom to pay a U. S. Deputy Mineral Surveyor either $10 or $15 a day. It used to be $15 all around, but new men came in and cut the price to $10. Now only a very few of the old deputies with an established clientele can get $15. As there was more mineral surveying done than almost any other kind of surveying work, the above prices have gradually come to rule as the general price for engineering services. The result is that the beginner charges $10 a day, and many an experienced engineer, who can do twice as much work as the beginner, works for the same price. The plain reason for this is that the public is unable to differentiate as to the value of the service rendered by different men.

If the oldest and best deputies were to get together and set a minimum price of, say $25 a day, the result would

be that in general the public would choose to employ the men who would work for $10. Then also, we must remember that all kinds of work are not worth the same money. This fact is noted in the code of ethics of various societies, where the code makes a rather increased charge for services in court. It is certainly worth more to locate the line of a good sized irrigation canal, and to make the survey so that it will conform to all the laws and customs, than it is to run out lines and find section corners. Any ordinary surveyor, with a few months' experience, after leaving college, can do the latter (in ordinary cases) as well as the most experienced engineer, so the latter should not charge more for such work if he takes it than the new beginner would charge. In other words, "For like work, like pay."

Lawyers charge more per hour or per day for services in court than they do for drawing up an ordinary mortgage. And this is right. The idea of a minimum wage rate, however, is directly opposed to this idea. The minimum wage is essentially based on the time element alone. It says in effect that one man is as good as another, and one kind of work is as important as another, and, therefore, the pay per day should be the same. Is this the correct way to look at it?

To my above suggestion that the four great engineering societies should recommend engineers for positions, there is another very serious objection, and that is ignorance of the true qualifications of members. Take the American Society of Civil Egineers and note the requirements for admission to full membership. First, the endorsement of seven members is required; second, the applicant must have pursued engineering for ten years; third, he must have been in responsible charge of work for a certain number of years; fourth, he must submit a list of the work he has done, which must be approved.

The foregoing are the essentials, and are perfectly sufficient for membership. But are they sufficient for the Board of Direction of the Society to warrant its recommending the member for a certain piece of work? Probably the Board knows nothing personally of the member; they do not know how strenuously he may have worked for ten years; there is considerable latitude in responsibility; and there may be a good deal of elasticity in the list of work done.

Of course, there are members of all the societies whom the Board could recommend without question; but I refer to those members who have no national reputations and whom they would have to recommend. Suppose some small county in southern Utah decided to build a half dozen small highway bridges, and called upon the society to recommend an engineer for this purpose. It would be useless to recommend Wm. H. Burr, or Ralph Modjeski, or J. A. L. Waddell, or men of like caliber, because the work would be too small and the cost of the engineer would be out of all proportion to the probable cost of the structures.

Could the Board, however, recommend John Doe, of Provo, Utah, who had recently joined, and of whom the Board knew nothing more than his recommendations showed? A considerable responsibility would rest upon the members of the Board, and were I a member I would be loath to assume this, for a man whom I did not personally know.

I submit this letter to arouse discussion and trust that we will get the views of others on the subject.

W. Newbrough.

Evanston, Wyo., Feb. 3, 1913.

[Since Engineering News has been foremost in urging the establishment of employment bureaus or appointment bureaus by engineering societies, it may be well to suggest how such bureaus should be conducted.

It would be manifestly impossible for the prominent engineers who usually constitute the governing body of an engineering society to give their personal time to the work of such a bureau, nor could such a bureau undertake to recommend a particular engineer for a particular appointment.

Such a bureau would naturally be managed by the Secretary or other salaried officer of the Society. The bureau would in the first place obtain from every member of the Society who was in any way open to an offer of a position (either a salaried place or an engagement as a consulting or designing engineer, or in any other capacity), a complete statement of his professional record in detail with a statement also as to the particular class of engineering work in which he was open to offers of a position or of employment in a consulting capacity. With this data there would be filed also a list of references with copies of letters of recommendation, testimonials, etc.

If, as our correspondent supposes, an application came into the bureau for an engineer to design a dozen small highway bridges for a county in Utah, those in charge of the bureau would select from the files the names of three or four or half a dozen engineers who were indicated in the classified list as competent and available for this particular class of work and who were located near enough to enable them to perform it economically. There would be transmitted to the applicant the names of these men with a complete copy of their professional experience, letters of recommendation, references, etc., as above stated. The county authorities applying could then undertake correspondence with the several engineers available and make their own selection from them with the aid of the information furnished by the employment bureau.

We make bold to say that only with the aid of some such complete record of a man's professional work, can *any* intelligent recommendation of an engineer for a particular piece of work be made. It is a common experience of every prominent engineer to receive letters requesting him to recommend an engineer for this, or that, or the other piece of work, or position. The engineer receiving such a letter runs over in his mind his list of personal acquaintances in the profession, and very likely recommends one of them for the place; but if he were cross-examined as to his positive and definite knowledge of some of the men whom he so recommends, it would develop in many cases that he was really rather hazy as to just what the man had done longer ago than two or three years perhaps.

There are engineers who, by some lucky stroke which has brought them into public notice, find plenty of important work coming their way. There are other engineers who have had long and valuable experience in responsible work, but which has attracted little or no public attention. Such men, when some change of fortune

obliges them to seek new engagements, find their past experience rated at nothing like its proper value.

It may be said that if such a bureau were conducted in a similar manner to the private employment bureaus, as the above suggestion may seem to indicate, this work should be left to private enterprise instead of taken up by the engineering societies. The answer to this is that an engineering society could so conduct such a bureau that no loss of prestige whatever would result to an engineer registering in it.

Here is the opportunity for the leaders of the profession to be of great service to their less fortunate brothers. The mere fact that such a bureau had the great men in the profession registered in its records as available for consultation and appointment would give the bureau a character and standing and reputation that cannot possibly be attained by any employment bureau carried on as a private business.

It may be well to say further that there is no reason why such work as we have outlined above should be confined to the national societies. State engineering societies and the local organizations of engineers in the smaller cities have an equal opportunity to engage in such work for the benefit of their members. And not alone for the benefit of their members, but for the public benefit. For there is probably no greater service which an engineering society, either national or local, can render for the public welfare than by providing means whereby engineers of thorough competence can be placed in the positions demanding responsibility.—ED.]

NOTES AND QUERIES

The description of the construction of the footway tunnel at 191st St. and Broadway, New York City ("Engineering News," Mar. 6, 1913, p. 484) omitted to state that the engineer in charge of construction was R. A. MacGregor, Assistant Engineer, Bureau of Highways, and that the line and grade work was done by A. E. and G. C. Wheeler, City Surveyors. The tunnel was not entirely in rock, as stated in the article, but was built for the 200 ft. nearest to Broadway by cut-and-cover work in earth. We are informed that the leakage into the tunnel has been steadily decreasing since its completion.

Several correspondents have noted an apparent error in the stated number of typhoid germs used in anti-typhoid inoculation on one of the U. S. Reclamation projects, as given in the letter by W. S. Merrill in our issue of Feb. 20, 1913. Mr. Merrill appears to have accidentally omitted three ciphers from his figures, since in the general article on U. S. Reclamation Service practice by Dr. Hugh A. Brown, in our issue of Mar. 13, 1913, the first inoculation is given as 500 million and the second and third as one billion each. The large dosage, we understand, is the one commonly employed in other services as well.

Annual Meeting of the Highway Engineers Association of Missouri

In Missouri, as in most of the central states, there is an immense mileage of roads which (during the mud season) are roads in name only, while the engineering and administrative problems of obtaining a system of good roads are only in the early stages of their solution. Missouri, however, has a state highway department and a state highway engineer, whose duties are mainly educational. It has also adopted the system of having county highway engineers; but not every country has such an official as yet, and in such cases the duties come within the jurisdiction of the county surveyor.

The sixth annual meeting of the Highway Engineers Association of Missouri was held at the Planters Hotel, St. Louis, Mo., on March 5 and 6, with a fair attendance. The President, J. M. Stallard (St. Joseph), was in the chair. In an opening address, the State Highway Engineer (Curtis Hill) laid particular stress upon the questions of maintenance and repair, pointing out that there is altogether too little of the former and too much of the latter. Maintenance means keeping a road in proper condition, while repair means restoring a damaged road to the condition in which it should have been kept. Maintenance is absolutely essential in the case of earth roads.

The subject of road legislation received attention, and a committee on legislation was proposed, to give proper bills the support of the association. This was opposed by Mr. Hill, on the ground that the bills are continually liable to radical changes introduced for political purposes, so that the indorsement might apply to bills having objectionable features. Main roads crossing the state and connecting county towns were advocated by S. J. Roy (Hannibal). He suggested a bond issue of $10,000,000 for roads, but pointed out that to secure this it would be necessary for the engineer to prove that it would be a good investment. In any system of taxation for roads, the cities should be included, and not exempted, since they benefit as well as the rural districts.

Roy Britton, President of the Missouri State Highway Commission, spoke in favor of state aid, but considered that such aid should be mainly educational and promotional, and should not apply to road construction by the state. The work of the State Highway Engineer also should be largely of an educational character; all locations and plans for roads should be subject to his approval, and all designs for bridges and structures should also require his examination and approval, but he should not undertake to prepare such plans or designs. The county highway engineers should be in direct charge of the execution of the work. Local effort is a fundamental requirement for road improvement; and the state should not undertake to initiate work where there is no such effort. One bill now before the legislature provides that the state shall pay $2000 for dragging the roads provided that the county raises $2000 and the landowners along the road also raise $2000; no piece of work to be less than five miles in length. A resolution was adopted requesting the governor to have the engineering profession represented on the proposed public service commission.

A paper on "Concrete Highway Bridges" was presented by D. B. Luten (Indianapolis, Ind.); this dealt not only with questions of design, but also with those of patent rights, and of the unfortunate tendency to put construction in the hands of inexperienced men. This last is due largely to the letting of contracts by lump sums, and he submitted a form of detailed estimate which would tend to check this condition. He did not approve of the engineer submitting detailed plans, and then passing upon his own plans as well as those submitted in competition. The engineer should prepare general plans and complete specifications, and the bidders should submit detailed plans conforming to the requirements. In this way the several designs would be

comparable, which is not the case when bidders submit their own plans in competition with those of the engineer for the work. Two other papers on bridge work were read by title; "Steel, Concrete and Wood Bridges," F. J. Kersting; "Progress in Design and Construction of Highway Bridges," F. D. Hughes. Other papers (also read by title) were: "The County Surveyor," Alfred Riske; "The County Highway Department, and the Relations Between the County Court and the County Highway Engineer," L. M. Stallard; "Streets and Pavements in St. Louis," Walter Hempelmann. On one evening the members attended a meeting of the Associated Engineering Societies of St. Louis, when a paper on city planning as related to the development of the city of St. Louis was read by Mr. Gundlach, President of the City Council.

The officers for 1913 are as follows: President, Alfred Riske, County Surveyor and Highway Engineer, St. Charles, Mo.; Vice-President, R. C. Allen, Clinton, Mo.; C. Cargill, St. Joseph, Mo. The next meeting will be held at St. Joseph.

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Flooding of Sewage Pumps at Batavia, N. Y.

A few weeks ago the sewage pumps of Batavia, N. Y., were stopped for a short time as a result of high water. We are indebted to K. B. Mathes, chairman of the Sewer Commission and to Robert L. Fox, city engineer, for the following account of the difficulty and the way it was met:

The sewage pumping station is 32 ft. in diameter and about 27 ft. in depth. Its bottom is divided into six compartments. In two of these there are two 1050-gal. per min. submerged, vertical, centrifugal pumps and in a third compartment there is a similar pump with a capacity of 470 gal. per min. The shafts pass upwards, with the runner supported on a ball-bearing step. This step is about 12 ft. above the bottom of the pumps and 2 ft. above the top of inlet sewer.

At the time of the trouble one of the large pumps had been taken apart for an examination. About this time a thaw accompanied with rain caused the Tonawanda Creek to overflow its banks and to cover certain outlying and low streets. Elsewhere certain streets were covered with storm water due to the inefficiency of the old storm water system. The result was that this water naturally ran through the perforated manhole tops of the sewers in several places. Certain cellars of houses along the shallow creek commenced to fill with water seeping through the walls. The occupants opened up their cellar drains and sewers. From these various causes the pump well soon received all the water that the two pumps could handle.

About this time a faulty ball bearing on the second pump broke, leaving the small one to take care of the flow. Before the ball bearing could be repaired the plant became flooded, forcing the machinists out of the well. The sewage being to a certain extent gritty, very soon got into the bearing of Pump 3 and caused the bearings to break, thus forcing a complete stoppage of pumping.

Within 24 hours a temporary steam-driven centrifugal pump of 1050 gal. per min. capacity was installed at a manhole outside of the pump station and one of the regular pumps was jacked up and run on split collars, fastened on the pump shaft and resting on a journal box in the basement. Within forty minutes after these two pumps commenced to run the sewage was lowered and new balls inserted in the raceways of the bearings of Pump 3. Then Pump 2, which had been running on split collars resting on a journal box, was repaired. Within two hours the pump station was running the same as usual, the two pumps handling the entire flow. The fact that the creek had receded only a few feet, enough to prevent surface water from entering the manhole tops, is indicative that the capacity of the pumping station is ample, excepting in an extreme case of the river flooding the low streets, as has been described.

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Edwin F. Wendt: President, American Railway Engineering Association

Edwin Frederick Wendt, Assistant Engineer of the Pittsburgh & Lake Erie R.R. (New York Central Lines) was elected President of the American Railway Engineering Association at the annual meeting held in Chicago, Mar. 18-20. He was educated in the public schools of New Brighton, Pa., and in 1888 he graduated from Geneva College, Beaver Falls, Penn., with highest hon-



EDWIN F. WENDT, PRESIDENT OF THE AMERICAN RAILWAY ENGINEERING ASSOCIATION
(Assistant Engineer, Pittsburgh & Lake Erie R.R.)

ors in the classical course. He has been a member of the Board of Trustees of that institution since 1907.

He entered railway service in 1888 as axman and chainman in the engineering corps of the Pittsburgh & Lake Erie R.R., and rose through the positions of rodman, levelman and transitman. In October, 1898, he became Assistant Engineer in charge of maintenance-of-way and construction and contract work. Since he has

held that position extensive improvements have been made, the road extended and reconstructed, and widened for additional main tracks, extensive yards and shops have been built, and the new terminal station and office building at Pittsburgh, while the entire road has been equipped with automatic block signals and interlocking plants. Mr. Wendt is a charter member of the American Railway Engineering Association, has served on many of its committees and has been Vice-President and a member of the Board of Direction. He is a member also of the American Society of Civil Engineers and the Engineers' Society of Western Pennsylvania.

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Tests on Cast-in-place Concrete Piles

By Francis L. Pruyn*

Owing to some very unfortunate experiences with cast-in-place concrete piles, the writer started out in search of a concrete pile which, if possible, could be relied upon at all times and places, or in other words, would be as nearly fool-proof as possible. He was perfectly familiar with the distortion that takes place with cast-in-place piles when they are driven in succession on close centers, such conditions as were disclosed in Engineering News, Sept. 12, 1912, and Feb. 27, 1913, and was of the opinion that this distortion was caused by the movement in each stratum of the soil as it was punctured and displaced laterally by the forming apparatus for the adjacent pile. He felt that if a freshly cast pile could be protected during this driving process, a perfect cast-in-place pile would be the result. It was to prove this theory the following tests were made and no one was more surprised and disappointed than the writer when his carefully conceived theory did not work out in practice.

The tests prove conclusively that in the driving of piles by the displacement method a heavy pressure is set up in the surrounding earth, that the deeper the penetration the heavier this pressure is likely to be, and that this pressure is not immediately dissipated through the surrounding earth, but remains, for a period of 24 hours at least, an active force, intent on crowding back into its original position as soon as the restraining element is removed.

Two tests were made—one consisting of a group of six piles driven on 30-in. centers, and the other consisting of a group of piles with varying distances between centers of 3, 4 and 6 ft.

Test No. 1 was made by driving six 16-in. diameter steel shells, 20 ft. long, one at a time, into the ground by means of a steel core fitting tightly therein; in other words, by the displacement method. The day after all the six steel shells were driven in the numerical order shown they were concreted one at a time (also in the order shown) and the casings pulled. A 2-in. rod was left in the concrete piles so that after they had seasoned they could be pulled out of the ground and examined. This was done about three weeks after the piles were driven. The concrete was of a 1:2:3 mixture. The results of the tests are shown in the accompanying diagram (Fig. 1).

It will be noted in one case that the 2-in. steel rod was straightened out so that the pile slipped off the end of the rod, and that in other cases, the lower part of the pile was missing, while the hook on the bottom of the rod remained intact. It is very evident that three weeks is not sufficient time to set up the point of some of these piles, a condition probably brought about by the admixture of sand and mud with the concrete and caused by the pressure of the earth on the wet concrete as soon as the shell was removed.

After the very unexpected failure of these piles on 30-in. centers, a second group was driven (Fig. 2). The three piles driven on 3-ft. centers were never concreted, but Nos. 10, 11 and 12 were finished and later pulled out and examined. All the shells, however, in this group were driven and remained in place until after Nos. 10, 11 and 12 were concreted and their shells withdrawn.

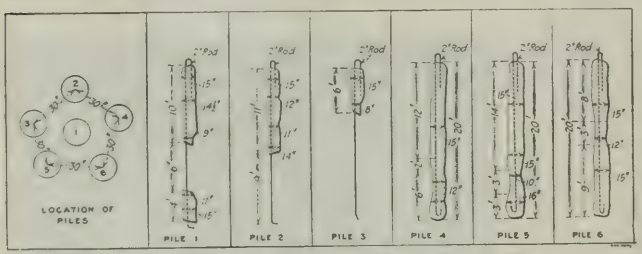


Fig. 1. Cast-in-place Concrete Piles Three Weeks after Driving on 30-in. Centers

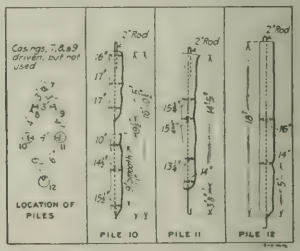


Fig. 2. Cast-in place Concrete Piles Three Weeks after Driving on 4-ft. and 6-ft. Centers

Those piles on 4-ft. centers showed about the same deformation as those on 30-in. centers, while the one on 6-ft. centers showed an almost perfect pile, proving that at long distances between piles, the earth pressures are not transmitted.

The test was made in Long Island City, several blocks south of the Queensborough Bridge. The ground was soft water-bearing loam and sand, or a good average of the materials met with in ordinary practice.

In Test 1, the inside pile was driven first, and the outside piles were the last ones driven. Considerable difficulty was met with in driving the last piles on account of the compacting of the material through the driving of the other piles.

It is evident that there has developed a heavy compression in the soil through which the pile is driven, and that this compression is not dissipated in the surrounding material, but is always present to squeeze the soft

*Vice-president The Underpinning & Foundation Co., 290 Broadway, New York City.

concrete out of position as soon as the protecting shells are withdrawn. If this is true in the case of the piles driven on 4-ft. centers, it is very remarkable, and demonstrates quite clearly that under the majority of conditions met in practice this type of pile is not reliable.

Great care was used in driving the piles and filling them, as well as in the mixing of the concrete. A very rich mixture of concrete was used, and everything was done in the hope that a perfect pile could be formed by this method.

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The Improvement of the Cuyahoga River at Cleveland, Ohio

There has been agitation for a number of years at Cleveland for the straightening of the Cuyahoga River as an inner development of the lake harbor there. A survey of the river was authorized by Congress in February, 1911, and a detailed study with an estimate of the cost of possible improvements was made by Col. John Millis, U. S. A., in charge of the Cleveland district. To provide a definite starting point for discussion and negotiation, Gen. W. H. Bixby, Chief of Engineers, U. S. A., suggested that a city commission be appointed and authorized to report on the various questions relating to the improvement of the lake front and river. In June, 1911, the city council authorized such a commission and the mayor appointed as the five members J. H. Cassidy, E. S. Griffiths, H. C. Gahn, W. P. Rice and Augustus Mordecai. The commission immediately organized and began its discussions with city officials, government engineers, state authorities, civic organizations, property owners, railroads, steamship lines and other carriers. It also visited numerous lake and Atlantic ports.

No appropriation was given for detailed engineering studies, but plans and surveys of the federal and city engineers were at the board's disposal. In January of this year the commission made its report—outlining in rather broad fashion the most feasible projects. These are outlined below as disclosed by this report.

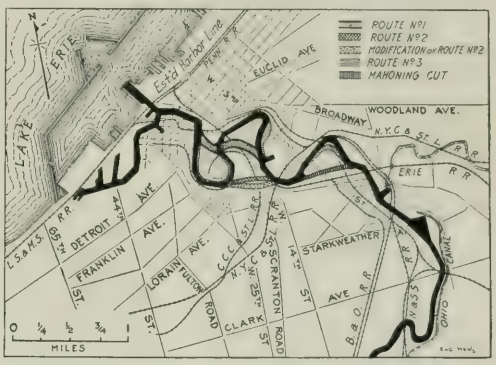
Present Conditions—In the city of Cleveland and for 10½ miles south from its mouth the Cuyahoga River runs through a flat valley, from 80 to 100 ft. deep and from 3000 to 5500 ft. wide, in a level plateau bordering the lake; the approach to this valley is steep. The flats are of clay and sand. From the Superior Ave. viaduct (see accompanying figure) to the Erie R.R. bridge, the flats are some 300 ft. wide between the side hills. The river channel is very crooked, crossing the valley four times. From the Erie R.R. bridge to Thornburgh, 10½ miles from the mouth, the flats are irregular, but the channel is straighter, though there are several short and sharp bends which must be corrected. Thornburgh is considered the economic head of river navigation.

Between the Superior Ave. viaduct and the Erie bridge it is 7900 ft. in a straight line, but 17,420 ft. by the river; the area of the adjacent flats is 686 acres. From the Erie bridge to Thornburgh it is 41,406 ft. in a straight line, but 54,582 ft. by the river. The area of adjacent flats here is 3946 acres, of which only 541 acres are now used for manufacturing.

The present navigable channel extends 5.2 miles from the mouth of the river. Above this point no improvements have been made, but the work contemplated includes straightening and deepening the channel and building docks along the river for about 8000 ft. farther up the stream to a point near the Harvard-Denison St. bridge. Here a new connection can be made with the Ohio canal which is being improved by the state. This canal connects near Zanesville with the Muskingum River on which the federal government maintains eleven locks, so that there is a possibility of a through waterway from Lake Erie to the Ohio River at Marietta. In the short stretch of the Cuyahoga River, where improvement is contemplated, there are 24 bridges, nine of which have draw-spans and 13 of which carry railway tracks.

The commission reports that the improvement of the flats above the Erie bridge would permit of an industrial development represented by the expenditure of $50,000,000 in manufacturing plants and the creation of river traffic amounting to 20,000,000 tons per year, largely having to do with the reduction of iron ore. It is on account of this possible development that the commission justifies the proposed expenditures for river development and even states that the waterway must be improved as suggested if the city is to maintain its important position and encourage the development of local industries.

Before 1890, boats of 200 to 300 ft. in length, drawing



Map of Cleveland, Showing Proposed Improvements of the Cuyahoga River

15 and 16 ft. of water, were considered large in this district, but now the committee finds that 50% of the traffic is carried in boats 500 ft. or more in length, drawing 19 ft. of water. Some boats are 600 ft. long and two new ones are 617 ft. None of these 600-ft. boats can get through the Cuyahoga River where improvement is contemplated, although a channel depth of 21 ft. is maintained by the city.

In July, 1912, the commission favorably reported on the improvement of the upper valley by cutting a new channel in the middle of the low land to open up 3½ miles of river frontage above. The plan has been approved by federal and city engineers and the preliminary steps are under way. For the fullest use of this development, however, the commission finds that the lower-river improvements discussed in their recent report are necessary.

Proposed Changes—These latest plans are aimed to make the river as straight as necessary and with reasonable cost and least possible interference with present occupants of the flats (lumber yards, planing mills, miscellaneous industries, railroad tracks and terminals). The

commission admits that a considerable readjustment of the holdings in this territory will be required but holds that the lumber interests can be shifted with less harm than can the railroads and that the minor industries involved do not require the use of water fronts. They have found no plans of improvement which can be developed without the opposition of all parties adversely affected. The attempt of the commission has been to lay out plans which would interfere as little as possible with the large plants where ore is transshipped and with the main tracks of railroads.

There are three projects under consideration, one of which (No 3. in accompanying figure) is but the widening and deepening of the present channel, resulting in a route of 17,420 ft. The route most favored by the commission is 9555 ft. long and the second one, 10,340 ft.

Plan No. 1 involves the relocation of the channel beginning at a point 400 ft. south of the Superior Ave viaduct, and intersecting the old channel between the C. C. C. & St. L. Ry. freight bridge and the same railroad's passenger bridge, and also opposite Central Ave. This route meets with the least objections from the railroads, is most central regarding the flat lands and best calculated to serve them. It has advantages over the second route in that immediate relief can be afforded by completion of the first cut, while the balance of the river improvement is being completed; this first benefit can be secured by an expenditure of about one-quarter the total including the Mahoning Ave. cut which is a desirable part of the work.

This project conflicts somewhat with the new high-level bridge which is being built. On account of the relocation of the channel, the new bridge will offer only 80 ft. of clearance over the water (compared with 93 ft. over the old channel), which is less than the required height of the rear-light mast on some freight vessels. The commission holds, however, that there has been no serious objection offered to the use of adjustable masts for passing this point.

The estimates presented for the cost of the three routes are given in the commission's report as follows:

Route No. 1 exclusive of Mahoning cut	$3,100,000
Route No. 2 inclusive in Mahoning cut	3,300,000
Route No. 3 exclusive of Mahoning cut	3,854,000
Mahoning cut	1,700,000
Route No. 3 carried above proposed Mahoning cut	4,455,000

The above estimates for Routes 1 and 2 are given by the U. S. District Engineer's office, and No. 3 by the City Engineer. While No. 3 is not a radical proposition and does not appreciably shorten the distance to the upper river, there is shown no decided economy in it on account of the great cost of bulkhead construction and land condemnation.

Different interests and persons have proposed various substitute routes, the best of which shown, according to the commission, is a modification of route No. 2, which avoids some of the complications and disturbances to industries incident to route No. 2. It would make necessary the leveling off of a large portion of the southern hills to the lower level. This would increase the land available for manufacturing purposes; the railroad situation, however, would not be improved.

As compensation to the railroads for damage suffered by Plan 1, the commission suggests consideration of a plan to fill in Collision Bend with excavated materials to carry West 3rd St. across the fill on a low viaduct, thus doing away with the maintenance of two city drawbridges, and allow the Erie R.R. to replace its lost track facilities by extending to the made land. The C. C. C. & St. L. R. R. would be relieved of the care and maintenance of an extra bridge at Carter Road by filling up the old channel between the present bridge and Collision Bend, though this would necessitate shifting the lumber interests to another locality.

FINANCING—The commission points out that, on account of the relation of this work to the outer harbor of the city, to the Ohio canal being enlarged by the state, and to the improvement of the Muskingum River by the federal government, a wide community of interests is shown. The commission recommends that the city should assure the federal government of its willingness and ability to bear 50% of the cost of this river improvement, and that this cost be directly apportioned on the interests benefited.

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Tornadoes in the Lower Mississippi and Gulf States, on Mar. 12, caused the loss of a hundred or more lives and extensive property damage.

Panic in a Moving-picture Theater, at Vervius, France, on Mar. 9, resulted in 10 deaths and injury to 45 others among the audience. The fire was insignificant and was quickly extinguished without damage to persons or property.

An Explosion of Natural Gas wrecked two buildings and caused injury to 13 of their occupants on Mar. 7, at Hot Springs, Ark. The gas had collected in the basement of one of the buildings.

A Dynamite Explosion at Arder, Scotland, on Mar. 10 destroyed the works of the Nobel Explosive Co., killing six and injuring 10 persons, and wrecking buildings in Arder and the adjacent village of Irvine. The scene of the accident is about 20 miles from Glasgow.

The Wright Aëroplane Patents were upheld in a decision of the French Court of Appeals, rendered Mar. 13. The principal claims made were relative to alleged infringements of the warping wing effect as in the American and German proceedings in which the courts concerned have recently given verdicts upholding the Wright patents.

A New Altitude Record for aëroplanes was established in the vicinity of Paris, on Mar. 11, when a French aviator, using a monoplane, reached a height of 6000 meters (about 19,600 ft., or close to 3¾ miles). The previous record was 5450 meters (17,900 ft.) made at Villacoublay, Sept. 17, 1912, by another Frenchman, Legagneux.

A New Building at Washington for the U. S. Geological Survey, Reclamation Service, Indian Office and Bureau of Mines, was provided for by an act of the last Congress. The building is to occupy the entire block bounded by 18th, 19th, E and F Sts., N. W., and is to cost approximately $3,000,000. The design will be started immediately.

The Formation of Union Water Districts in New York by agreement between municipalities and the construction of water-supply works for such districts by the State Conservation Commission is authorized by Assembly Bill 1147, now before the legislature. The works would be paid for by the water districts.

The New Capital City of Australia is to be named Canberra, after the district where it is to be located. The foundation stone of the capital building was laid with appropriate ceremonies on Mar. 12, 1913. The governmental commission appointed for the purpose has made a plan for the city based on the numerous plans submitted in the recent competition, but the formal adoption of this official plan has not yet taken place.

Company Stores for supplying employees with meat and groceries at cost price, are contemplated on a large scale by the Interborough Rapid Transit Co. and the New York City Railways Co., and the first of these stores was opened on Mar. 13 and did an unexpected volume of business. The stores are only open to employees of the two allied companies or members of their families. Goods are sold at cost price, the expense of running the store being borne by the company. Sales are made on a strictly cash basis and no deliveries are made. The use of currency rather than company slips makes it entirely optional with the employee as to whether or not he will use the service.

Two Large Diesel Oil Engines have been purchased by Phelps, Dodge & Co., of New York City, for an electric power plant at one of its Arizona mines. The engines have been ordered from Carels Bros., of Ghent, Belgium, and are 2-stroke cycle, 4-cylinder machines to be direct-connected to 60-cycle alternators. The engines are guaranteed to each deliver 1000 hp. when operating at an elevation of 6500 ft. above sea level with a fuel consumption not exceeding 0.48 lb. oil per b.hp.-hr. The two alternators are to be operated in parallel. These are the first 2-stroke cycle Diesel engines to be sold in the United States. In Europe, however, the 2-stroke cycle Diesel engine is in very extensive use.

Commerce Passing Through the Duluth-Superior Harbor during the calendar year 1912, showed an increase of 35.22% over the tonnage of the previous year. Of this increase hard coal, soft coal, wheat and other grains, iron ore, flour, lumber and oils, all show an increase in both quantity and valuation, while general merchandise shows a decrease. The total valuation of the receipts in the harbor is $89,661,073, and the total value of the shipment is $231,260,859, making a total of $320,921,932. The harbor was open only 235 days, so considering the mean monthly freight movement during the season of navigation, Duluth-Superior Harbor practically stands next to New York. In a value of total shipment and receipts the past year was the greatest in the history of the harbor.

A Contract for Electrical Energy for use in constructing the Sun River Irrigation Project has been made by the U. S. Reclamation with the Great Falls Power Co., of Montana. The contract is for six years and calls for 2500 kw. of power. The company will transmit the power one hundred miles to a number of substations, from which it will be distributed for use on the work. The Service states that the use of electrical energy for canal excavation is new and will reduce the time and cost of the work. Proposals for excavating the main canal, 45 miles long, will soon be invited. The diversion dam, 140 ft. high, and the diversion tunnel will be built by Government forces.

The Third International Congress of Refrigeration will be held at Chicago, Ill., on Sept. 17-24, inclusive, at which time the industrial applications and engineering problems of refrigeration will be discussed jointly by American and foreign specialists in that line. The program is being arranged for six parallel sections, so that the desired ground can be covered in the limited time available.

New York City will be a rendezvous for the foreign delegates, during the week preceding Sept. 14, on which date they will proceed to Washington, D. C., where the Congress will be formally opened on Sept. 15. The Chicago program starts on Sept. 17. The Congress sessions will be held in the forenoon each day, leaving the afternoon and evening open for excursions and entertainment features. Papers for the Congress should be in the hands of the Section Committee before May 1. Regular membership is secured on the payment of a fee of $4. The Secretary is J. F. Nickerson, 431 S. Dearborn St., Chicago.

The International Engineering Congress, to be held at San Francisco in September, 1915, in connection with the San Francisco Exposition, is being organized by delegates appointed by the five national engineering societies and selected from members resident on the Pacific Coast with the president and secretary of each society as ex officio members. Those appointed by each society are as follows:

The American Society of Civil Engineers—A. L. Adams; C. D. Marx; W. A. Cattell; C. Derleth, Jr.; the president, Geo. F. Swain; the secretary, Chas. Warren Hunt.

The American Institute of Electrical Engineers—A. M. Hunt; Calvert Townley; the president, Ralph D. Mershon; the secretary, F. L. Hutchinson.

The American Society of Mechanical Engineers—W. F. Durand; R. S. Moore; T. W. Ransom; C. R. Weymouth; the president, W. F. M. Goss; the secretary, Calvin W. Rice.

The American Institute of Mining Engineers—E. H. Benjamin; H. F. Bain; W. S. Noyes; Newton Cleaveland; the president, C. F. Rand; the secretary, Bradley Stoughton.

The Society of Naval Architects and Marine Engineers—G. W. Dickie; W. R. Eckart; W. G. Dodd; J. V. Paterson; the president, R. M. Thompson; the secretary, D. H. Cox.

Hydro-electric Companies transmitting current across state boundaries are made subject to the Interstate Commerce law by a clause in the River and Harbor appropriation bill as passed by the Senate on Feb. 25. The clause is as follows:

That the provisions of the Act entitled "An Act to regulate commerce," passed and approved Feb. 4, 1887, together with the amendments thereto, shall apply to any corporation or any person or persons engaged in transmitting hydro-electric power or electricity from one State, Territory, or District of the United States to any State, Territory, or District of the United States, or from one place in a Territory to another place in the same Territory or to any foreign country, and that the term "common carrier" as used in said Act and the amendments thereto shall include companies engaged in transmitting hydro-electric power or electricity as aforesaid: Provided, That said Act shall not apply to the transmission of hydro-electric power or electricity wholly within one State and not transmitted to or from a foreign country, from or to any State or Territory as aforesaid; that the rules prescribed in said Act as to just and reasonable charges or rates and the procedure relative to other common carriers, in so far as applicable, shall apply to such company, person, or persons transmitting hydro-electric power or electricity as aforesaid, and to the fixing and establishing of just and reasonable charges or rates fully and completely.

A Six-months' Safety Campaign in the public schools of the Borough of Brooklyn has been recently announced by the Brooklyn Rapid Transit Co., in conjunction with the American Museum of Safety, which has done similar work in Manhattan for some time. Lectures are to be given in all the schools, illustrated by models and lantern slides, and pamphlets and buttons will be distributed to arouse interest.

The Diversion of Water from Lake Michigan for the Chicago drainage canal is claimed to be an inherent right, not subject to the approval of the Federal Government; according to the latest position taken by the Sanitary District of Chicago. The decision rendered by the (then) Secretary of War on Jan. 8, denying the application of the District for permission to increase the present rate of diversion, was not accepted as final, and in fact a proposition for the withdrawal of the application was made a few days before the decision was rendered, as noted in our issue of Feb. 6. The application was made originally in February, 1912. The reason for this proposed withdrawal was the assumption that no such permission for the Secretary of War is necessary to enable the Sanitary District to take such water as is required for the purposes of the canal (as a drainage channel and as part of a deep waterway) there being inherent rights to the water, and the canal having been built without objection on the part of the Federal Government, while the diversion of water has been neither authorized nor prohibited by Congress. A review of the case and of the issues involved has been prepared by Lyman E. Cooley, the present consulting engineer for the District, and has been issued in book form. It denies that the desired increased flow in the canal will have serious effects upon the lake levels, and that in any case the advantages will be so much greater than any damage caused that the conditions will call for remedial works (which can be carried out without difficulty) and not for the restriction of water-supply to the canal. The preface states:

While the Sanitary District has always taken the position that it had the right to divert or flow through its canal sufficient of the waters of Lake Michigan to take care of the needs of the inhabitants of the District, yet, in view of the blending or close relations of the State and Federal governments in such matters, the District has so far sought to obtain the acquiescence of the Secretary of War with respect to the amount of the flow of water.

Sewage Pollution of Lake Erie with Relation to City Water-Supplies was the subject of a conference held at Cleveland, Ohio, on Mar. 4, 1913, between a committee of the members and staff of the Ohio State Board of Health and representatives of the cities of Cleveland, Toledo, Sandusky, Lorain and Lakewood. The State was represented by John W. Hill, of Cincinnati, and Wm. T. Miller, Cleveland, members of the State Board of Health, and W. H. Dittoe, Chief Engineer, and Dr. Thomas R. Brown, bacteriologist of the Board. We are indebted to Mr. Dittoe for the following summary of the main points brought out by the discussion at this conference:

(1) Untreated sewage emptied into Lake Erie directly and into tributary streams at points near their mouths and the discharge of tributary streams receiving sewage from inland points contribute to local pollution and possibly to general pollution of Lake Erie.

(2) It is probable that no general pollution of Lake Erie exists and that the pollution, if any, is confined to zones within limited distances of the cities and mouths of rivers contributing sewage.

(3) It is probable that the sewage from any particular city has a more detrimental effect upon its own water-supply, if taken from the lake, than upon the water-supply of any other city taken from the lake.

(4) The problems involved should be consideed as primarily local and in general the solution in any particular case will probably be the carrying out of a plan for the protection of the city making the improvement.

(5) The water-supplies taken from Lake Erie at limited distances from the shore should be purified.

(6) In the absence of any extensive data relative to the general quality of the water of Lake Erie and the effect of sewage discharged therein, it is advisable that the degree and extent of the pollution of the lake be investigated.

A resolution was adopted declaring it to be the sense of the meeting that an investigation of the degree and extent of the pollution of Lake Erie caused by sewage from Ohio municipalities should be carried on by the State Board of Health and the municipalities coöperatively. A resolution was also adopted providing for the appointment of a committee to fix standard methods of analysis of samples and the nature of the determinations to be made in the investigation. The committee appointed for this purpose was composed of Dr. Brown, Dr. Roger G. Perkins, bacteriologist, Cleveland Board of Health, and Dr. Paul E. Bethards, bacteriologist, Toledo Board of Health.

A Station for the U. S. Bureau of Mines, to cost $500,000, is provided by an appropriation in the recent act of Congress for the erection of new public buildings, etc., approved March 4. The work of the Bureau is now scattered in different parts of the country and its experiment station is in Pittsburgh. The station is located on property of the U. S. War Department, which now needs the space for its own work, and has ordered the Bureau to move. The station buildings originally proposed were: (1) Engineering building, 500x200 ft., three stories, to cost $100,000; (2) mine-rescue building, 50x100 ft., 2½ stories, $40,000; (3) chemical building, 50x200 ft., three stories, $100,000; (4) explosives building, 50x80 ft., 2½ stories, $30,000; (5) mechanical building, 50x150 ft., three stories, $75,000; (6) fuels building, 50x150 ft., $55,000; (7) service building, 60x100 ft., $60,000; tunnels, pipe lines, etc., $20,000; sidings, storage bins, etc., $20,000. Dr. J. A. Holmes, in commenting on his request for the appropriation, noted that suitable buildings for this special work cannot be rented and that it is necessary to build new. The cheapest construction permissible with dignified appearance is planned. The site offered, in exchange for a part of the present U. S. Arsenal ground (13¼ acres), is what is known as the Magee High School site, on Forbes St., and along the Baltimore & Ohio R.R. It contains 11½ acres.

PERSONALS

Mr. James McCrea, former President of the Pennsylvania R.R., is seriously ill at his home in Haverford, Penn.

Dr. S. W. Stratton, Director of the U. S. Bureau of Standards, Washington, D. C., has been elected a member of the council of the Underwriters' Laboratories, Chicago, Ill.

Mr. Theodore N. Vail, President of the American Telephone & Telegraph Co., has been elected a life member of the corporation of the Massachusetts Institute of Technology.

Mr. R. C. Wise, formerly Mechanical Engineer of Henion & Hubbell, Chicago, Ill., has been elected Secretary of the Western Pump & Engineering Co., 339 Railway Exchange, Chicago.

Mr. G. A. Law, formerly Trainmaster of the Chicago, Burlington & Quincy R.R., at Aurora, Ill., has been promoted to be Superintendent of the Hannibal division, with office at St. Louis, Mo.

Mr. J. E. Bond, formerly Chief Engineer of the B. M. Osbun Co., Chicago, Ill., has been elected President and Treasurer of the Western Pump & Engineering Co., 339 Railway Exchange, Chicago.

Mr. George W. Greene has been appointed Resident Manager of Morgan T. Jones & Co., Inspecting and Supervising Engineers, Chicago, Ill., with headquarters at 313 Wabash Bldg., Pittsburgh, Penn.

Mr. G. K. Cooper, formerly Junior Engineer, Panama R.R., has been appointed Acting Chief Engineer of the Costa Rica division of the United Fruit Co., with office at Limon, Costa Rica. Mr. Cooper succeeds Mr. F. Brune, who has resigned.

Mr. H. C. Eddy, formerly Secretary of the Electric Railway Commission of the District of Columbia, has been appointed Engineer for the new Public Utilities Commission of the District, which superseded the former commission, as noted in last week's issue of "Engineering News."

Dr. David Franklin Houston, Chancellor of Washington University, St. Louis, Mo., has been appointed Secretary of Agriculture. Dr. Houston was President of the Agricultural and Mechanical College of Texas from 1902 to 1905, and from 1905 to 1908 was President of the University of Texas.

Mr. Everett Morss, M. Am. Inst. E. E., President of the Simplex Electrical Co., and Vice-President of the Simplex Electric Heating Co., of Boston, Mass., has been elected a life member of the corporation of the Massachusetts Institute of Technology. Mr. Morss is a graduate of the Institute, class of 1885.

Mr. C. R. Allen, Jr., Assoc. M. Am. Soc. C. E., for the past seven years with the New York State Highway Department and recently Deputy Division Engineer at Mechanicsville, N. Y., has resigned to enter private practice as Consulting Engineer, with offices at 16 Knickerbocker Bldg., 95 State St., Albany, N. Y.

Mr. H. A. Chandler has been appointed Division Surveyor of the Atlantic division of the Canadian Pacific Ry., at St. John, N. B. The duties of this position include the preparation of plans and descriptions for purchases, sales and leases of land, re-surveys of right-of-way and other survey work connected with the operating and maintenance-of-way departments.

Mr. W. J. Stoneburner, recently with the industrial department of the Missouri, Oklahoma & Gulf Ry., has been appointed General Superintendent of the Alabama, Tennessee & Northern R.R. and the Tombigee Valley R.R., with headquarters at York, Ala. Mr. Stoneburner will have general supervision of the operating, maintenance-of-way and the mechanical departments.

Mr. William C. Redfield, former Vice-President of the American Blower Co., and Member of Congress, New York City, is the new Secretary of Commerce. Mr. Redfield was born in Albany, N. Y., in 1858. For a number of years he was President of J. H. Williams & Co., and of the Sirocco Engineering Co., of New York City. He has been President of the Manufacturers' Export Association for several years.

Mr. Franklin K. Lane, former Chairman of the Interstate Commerce Commission, is the new Secretary of the Interior. Mr. Lane is a lawyer and after practicing in San Francisco, Calif., for a number of years, he was made Corporation Counsel of the city. Mr. Lane was a candidate for Governor of California in 1902. He was appointed a member of the Interstate Commerce Commission in 1905 and was recently elected Chairman.

Mr. J. A. Jordan, Vice-President of the Green Bay & Western R.R., has been elected President, succeeding Mr. S. S. Palmer, deceased. Mr. Jordan entered the railway service in 1869 as an agent of the Chicago & Alton R.R. The other affiliated companies of which Mr. Jordan also becomes President are, the Kewaunee, Green Bay & Western R.R. and the Iola & Northern R.R. Mr. Edgar Palmer, of New York City, succeeds Mr. Jordan as Vice-President.

Mr. Lindley M. Garrison, who has been appointed Secretary of War in President Wilson's cabinet, is a lawyer by profession, and for a number of years was head of the firm of Garrison, McManus & Enright, of Jersey City, N. J. Since 1904 he has been Vice-Chancellor of the State of New Jersey. One of Mr. Garrison's first official acts, according to newspaper reports, was to uphold the decision of his predecessor in the New York harbor pierhead line controversy.

Mr. F. Ringer, recently Engineer of Maintenance-of-way of the Missouri, Kansas & Texas Ry., at Parsons, Kan., has been appointed Division Superintendent with headquarters at McAlester, Okla., succeeding Mr. J. F. Hickey, resigned. Mr. Ringer is a graduate of the School of Engineering, University of Kansas, class of 1893. He entered the service of the Missouri, Kansas & Texas Ry. in 1894 as a levelman on location surveys; a year later he accepted a position as rodman in the maintenance-of-way department, and since then has risen steadily to his recent position of Engineer of Maintenance-of-way.

Mr. William G. McAdoo, the newly appointed Secretary of the Treasury, is known to engineers as the former President of the Hudson & Manhattan R.R., New York City. Mr. McAdoo was born near Marietta, Ga., in 1863. He was admitted to the bar in 1885, and came to New York City in 1892. Mr. McAdoo was the promotor of the Hudson & Manhattan R.R. Co., which carried through to completion the first Hudson River railway tunnels. The scheme for tunneling the river originated in 1874, and the work of excavating the tunnel was carried on intermittently until Mr. McAdoo took hold of the enterprise in 1902.

Mr. Samuel C. Stickney, former Vice-President and General Manager of the Chicago Great Western R.R., and recently in private practice, New York City, has been appointed Assistant to the President of the Erie R.R. Mr. Stickney attended the Massachusetts Institute of Technology, 1883-1886, and began railway work as a rodman on location and construction in Minnesota. He was shortly afterward promoted to be Locating Engineer in Iowa of the Chicago, St. Paul & Kansas City R.R. Later he was appointed Superintendent of Construction and Engineer of Maintenance-of-way of the same railway. In 1890 he was appointed Chief Engineer of the Chicago Union Transfer Ry. From 1892 to 1894 he was Assistant to the President of the Chicago Great Western R.R. and from 1894 to 1909 was Vice-President and General Manager.

Mr. George M. Basford, M. Am. Soc. M. E., has resigned his position as Assistant to the President of the American Locomotive Co., to become Chief Engineer of the railway department of Joseph T. Ryerson & Son, Chicago, Ill. Mr. Basford graduated from the Massachusetts Institute of Technology in 1889, and at once entered the Charlestown, Mass., shops of the Boston & Maine R.R. Later he was a draftsman for the Chicago, Burlington & Quincy R.R., at Aurora, Ill. His next experience was with the motive power department of the Union Pacific R.R., at Omaha, Neb. Following this work he

was Signal Engineer of the Chicago, Milwaukee & St. Paul Ry. and Superintendent of Construction of the Johnson Railway Signal Co. Later he was connected with the Union Switch & Signal Co. and Signal Engineer of the Hall Signal Co. From 1895 to 1897 Mr. Basford was Editor of the "Railway & Engineering Review," and from 1897 to 1905 Editor of the "American Engineer and Railroad Journal." Mr. Basford's headquarters will remain in New York City, where his offices will be at 30 Church St.

OBITUARY

John W. Crissey, Assistant Engineer of Construction of the Lake Shore & Michigan Southern Ry., at Cleveland, Ohio, died, Mar. 7, at Chicago, Ill., from pneumonia. Until recently he was Resident Engineer at Chicago.

Seth Lee Keeny, a railway contractor, who built portions of the Delaware, Lackawanna & Western R.R. through the Delaware Water Gap, died at his home in Brooklyn, N. Y., on Mar. 13. Mr. Keeny was also contractor for the Prospect Park reservoir in Brooklyn.

Alexander H. Sherrerd, M. Am. Inst. M. E., died at his home in Newark, N. J., on Mar. 14, from acute indigestion. He was 53 years old. For many years he was connected with the Lackawanna Iron & Coal Co., and more recently had been in private practice as a mining and metallurgical engineer in Scranton, Penn. He is survived by a widow and one son.

Dr. Frederick Schniewind, a chemist known chiefly for his many discoveries in the use of byproducts of coke ovens, died at his home in Englewood, N. J., on Mar. 13. He was 52 years old and was born in Germany and educated at the University of Heidelberg. He was a member of the American Gas Institute and of the Iron and Steel Institute of Great Britain.

Arthur W. Moss, Superintendent of the Schuylkill division of the Pennsylvania R.R., died Mar. 12, at Reading, Penn. He was born in Philadelphia, Penn., May 4, 1859. He received his education at Phillips Scientific School and entered the service of the Pennsylvania R.R. in 1877 as a shop apprentice. He was promoted successively to be draftsman, assistant in the test department, assistant road foreman of engines, assistant freight trainmaster, passenger trainmaster and division superintendent.

Peter Brady, a prominent citizen of Easton, Penn., and a former pioneer Western railway engineer, died at his home in Easton on Feb. 27. He was born in Ireland in 1823 and attended the famous engineering school at Castle Pollard, County West Meath, where he was graduated in 1845. The following two years he served as an assistant engineer on public works for the British Government. He emigrated to America in 1848 and for several years was engaged in survey and engineering work in the Pennsylvania coal mining region. He then went West and for a time was engaged in surveys for the Marietta & Cincinnati R.R., in Ohio. He continued in railway location and construction in the Middle West until 1859, when he returned to the East and settled in Easton, Penn. After several years in various kinds of engineering work he was appointed Chief Engineer of the Wilmington & Reading R.R. He then turned to mining engineering and for more than 30 years was associated with Glendon Iron Co.

Dr. John Shaw Billings, former Director of the New York Public Library, at one time a prominent army medical officer and famous as a sanitarian, died at his home in New York City, Mar. 10. He was born in Switzerland County, Ind., Apr. 12, 1839, and was graduated from Miami University in 1857. He received the degree of Doctor of Medicine at the Medical College of Ohio in 1860. Here Dr. Billings served as an instructor until the outbreak of the Civil War, when he entered the army as an assistant surgeon. He remained in the Medical Corps of the army until 1895, when he retired with the rank of Lieutenant-Colonel, after having served as Deputy Surgeon General. Dr. Billings was in charge of the library of the Surgeon General's office for a number of years and made an index in 16 volumes of this library. He was in charge of the compilation of vital statistics of the 10th census and of the social and vital statistics of the 11th census. He was Professor of hygiene at the University of Pennsylvania in 1891. From 1893 to 1896 he was Director of the New York Public Library. Dr. Billings was a member of many learned societies in this country and abroad. He received honorary degrees from the Universities of Edinburgh, Harvard, Buda-Pesth, Yale, Johns Hopkins, Munich, Dublin and Oxford. He was the author of numerous works on medicine, hygiene, sanitation and allied subjects.

Sir William Arrol, the famous English bridge builder, whose death was noted in our issue of Feb. 27, was one of those eminent engineers, whose lives furnish inspiring examples fo the generations who follow them. An interesting sketch of his long and useful career appears in London "Engineering" of Feb. 21 from which we take the following abstract:

Sir William Arrol won honor and fame by following the simple plan of acting well his part. There fell to his lot some of the greatest problems in constructional engineering and in the organization of men and affairs, but he always met them with the firm assurance that a solution could be found by hard work and unfailing perseverance, and no seeming failure ever caused him to despair or to resort to subterfuge. Time and again he undertook works in which there was no precedent to guide him, and which were so far in advance of experience as to constitute a new departure in engineering science. And yet his preparation for his life's tasks was the antithesis of that involved in the modern conception of an engineer's training.

No one despises the higher accomplishments of scientific knowledge, least of all did the late Sir William Arrol; they are essential to development in engineering. But the achievements of his life tend to demonstrate that other things are needful, and chief among them is character. The secrets of Sir William's success were his ingenuity in mechanics, his sound common-sense, his tenacity of purpose, and his uprightness, especially in his relationship with workmen.

Sir William was born in the village of Houston in 1839. He was fortunate in having ideal schoolmasters, with the result that there was laid a solid foundation upon which to build up the experience and to assimilate the lessons of everyday life. At an early age he entered Coats' mill, being engaged in the turning-shop or spool department. At the age of 14 he was apprenticed to Thomas Reid, blacksmith, in Paisley. By working in various towns in England and Scotland he widened his experience and accumulated knowledge. Even as a blacksmith he displayed the inventor's faculty which ultimately made him one of the greatest engineering constructors of our time.

In 1863, when only 24 years of age, he became foreman in Laidlaw's boiler works in the Bridgeton district of Glasgow. There he continued for five years, after which he started business on his own account. His capital, the savings of his life up to that time, amounted to about $425. The engine for driving his shop was purchased for $90, and the boiler for $125. From this small beginning there has arisen the largest structural steel works in the United Kingdom, ocupying about 20 acres and employing at times something like 5000 men.

The first important work undertaken, and the first to bring Sir William prominently before engineers, was the erection, in 1875, of a viaduct over the River Clyde at Bothwell, for the Caledonian Ry. The practice had hitherto been to erect such bridges in position upon extensive scaffolding, but Sir William set up the longitudinal girders on the land, and, by means of rollers, actuated by ratchet-bars, projected them as a continuous girder across the river from pier to pier, until the completed length of 727 ft. was in position. The superstructure was afterward completed on the main longitudinals.

The next important contract was the building of the very heavy viaduct across the Clyde at Glasgow, for the Caledonian Ry. On this bridge he first applied his hydraulic riveter. After devising the machine itself, he found great difficulty in getting flexible supply-pipe to withstand the hydraulic pressure of 1000 lb. per sq.in. But it was characteristic of his method of procedure that he went to the rubber works and remained there continuously until, by a cut and try process, he had himself devised a satisfactory pipe.

The most famous works accomplished by Sir William were the reconstruction of the viaduct over the Firth of Tay and the building of the great cantilever bridge over the Firth of Forth. This bridge was for long, and is still, one of the wonders of the world. While universal recognition was paid to the designers for the conception and design, equal credit was conceded to Sir William Arrol, without whose services in devising mechanical methods of executing the work, the bridge could not have been built in the time and for the cost—namely, $15,000,000. It is only possible here to indicate some of the directions in which Sir William's ingenuity displayed itself. There were details in connection with the machinery for sinking the caissons for the piers under air pressure. When the hard boulder clay was reached, for instance, it was found so dense and tenacious that until Sir William Arrol devised an hydraulic spade the work of excavation could not be proceeded with. The

hydraulic cylinder head was set against the roof of the working chamber, and the spade, with its cutting and lifting surfaces, was connected to the ram, so that the introduction of hydraulic pressure drove the spade into the hard clay. Another new appliance contributory to the success of the work was the mounting of drills on a circular frame in connection with the construction of the cylindrical lower booms of the cantilever arms. It would be impossible to exhaust the record of the many ingenious devices for the execution of the work. Many different forms of hydraulic riveters to suit special positions had to be designed.

It was at the Forth Bridge that Sir William first introduced the oil-fired rivet-heater, which greatly simplified the work of riveting the structure. The preparation of the machinery alone occupied a year, and the temporary plant cost about $2,500,000, two facts which of themselves establish the extent of the work involved.

In the structure itself and its approaches there were used 51,000 tons of steel, as well as 65,000 cu.yd. of cement concrete, 49,000 cu.yd. of rubble, and 750,000 cu.ft. of granite. As is known, the bridge has a total length of 8295 ft. 9½ in., the three cantilevers accounting for 5349 ft. 6 in. The height is quite 150 ft. above high-water level in the center, while the towers rise to a height of 361 ft. above high-water level.

It was in connection with the opening of the Forth Bridge that Sir William Arrol received the honor of knighthood, and soon afterward Glasgow University conferred upon him the honorary degree of Doctor of Laws (LL. D.).

In many other departments of work Sir William Arrol's advice has exercised considerable influence toward industrial efficiency. He was among the first to advocate the substitution of steel for timber in the roofs of factory shops, and always contended for the maximum of light. The effect of his guidance is to be seen in many of the most important engineering and other factories at the present time, where the roof is almost invariably glazed, and the extent of natural light conduces to efficiency of labor.

Many projects were put before Sir William, but commonsense was a dominant trait of his character. Even when offered remunerative terms, he refused to be a party to schemes which were not of definite utility. Thus, we remember a case where he refused to accept a contract for building one of the accessories of a large exhibition because it was of no practical use. Difficulties, on the other hand, attracted him, and most of them yielded to his sound mechanical ingenuity and judgment.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN CHEMICAL SOCIETY.
Mar. 25-28. Annual meeting in Milwaukee, Wis. Secy., C. L. Parsons, Box. 505, Washington, D. C.

NATIONAL FIRE PROTECTION ASSOCIATION.
Mar. 26-27. Annual meeting in New York City. Secy., Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL BUILDING TRADES AND EMPLOYERS ASSOCIATION.
Mar. 26-27. Annual convention at Washington, D. C. Secy., J. H. Scates, 15 E. Fayette St., Baltimore, Md.

NEW ENGLAND STREET RAILWAY CLUB.
Mar. 27. Annual meeting at Boston, Mass. Secy., H. A. Faulkner, 12 Pearl St., Boston, Mass.

AMERICAN ELECTROCHEMICAL SOCIETY.
Apr. 3-5. Annual meeting at Atlantic City, N. J. Secy., J. W. Richards, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Vice-Pres., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, Iowa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Shurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION.
May 6-10. Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

Lake Michigan Sanitary Association—This association represents the States and communities bordering on Lake Michigan and interested in its use for water supply or sewage disposal, or both. Its aim is to restrict or prevent pollution of the lake, in the general interests of public health. The sixth annual meeting was held, Mar. 10, at the Elks Club, Racine, Wis., with President A. J. Horlick in the chair. There were no papers presented, but a number of brief addresses were made. Dr. G. A. Bading (Mayor of Milwaukee) outlined the conditions at Milwaukee and the measures for relief as planned by the special commission composed of J. W. Alvord, H. P. Eddy and Geo. C. Whipple. Mr. Simmons (Commissioner of Public Works, of Milwaukee) also discussed this matter, and he commented upon the remarkable freedom from odor of the Proctor Creek sewage-disposal plant at Atlanta, Ga.; this plant comprises Emscher tanks, sprinkling filters and sludge beds ("Engineering News," Mar. 14, 1912). Dr. Tully described the sanitary surveys made recently along the Wisconsin River. Dr. Dixon referred to health conditions and the small appropriations for health work in Michigan, as well as the lack of control over water supplies. Langdon Pearse (Sanitary District of Chicago) urged coöperation of the cities around the lakes in the matters of sanitation, and pointed to the progress made in the treatment of industrial wastes in Chicago. Col. Appel (Medical Dept., U. S. Army) described the water filtration and sewage-treatment plant at Fort Sheridan, Ill. He spoke also of the value of inoculation against typhoid, as shown by experience in the U. S. Army; among 17,000 men only 8 cases occurred during 1912, and all these cases were men who had not been inoculated. Dr. Evans (former Health Commissioner of Chicago) urged continual activity for a pure water supply (even though typhoid decreases), as an insurance against future epidemics.

Resolutions were adopted indorsing the following: 1, the Evans bill in Congress to prohibit dumping in the Great Lakes, with other restrictions; 2, the new enabling act now in the Michigan legislature for the State Board of Health. The bill in the Indiana legislature for a general sanitary district act was referred to the executive committee for consideration. Officers for 1913 were elected as follows: President, Dr. R. L. Dixon, Secretary of the State Board of Health, Lansing, Mich.; Vice-Presidents, Dr. G. A. Bading, Mayor of Milwaukee, Wis., and W. G. Hibbard, Chicago; Secretary, W. R. Humphrey, Association of Commerce, Chicago.

American Society of Mechanical Engineers—At a meeting to be held in New York City, on Apr. 8, under the auspices of the Railway Committee, the subject of Steel Car Design will be discussed.

North Dakota Society of Engineers—Officers for the ensuing year, elected at the annual meeting at Bismarck, N. D., on Feb. 13-14, were as follows: President, W. A. Baker; Vice-Presidents, E. J. Thomas and W. R. Veigel; and Secretary-Treasurer, E. F. Chandler.

American Society of Engineer Draftsmen—The office and headquarters of the Society have been changed from 116 Nassau St. to 74 Cortlandt St., New York City. Announcement is also made of the arrangements for establishing a section or chapter in Boston, Mass., for which purpose a meeting will be held at Franklin Union on Mar. 25.

Vermont Society of Engineers—At the annual meeting at Burlington, Vt., on Mar. 7, the following officers were elected for 1913: President, C. S. Carleton; Vice-Presidents, D. Williams and A. C. Grover; Treasurer, A. E. Winslow; Secretary, G. A. Reed; and Directors, H. M. McIntosh, W. H. Vorce and B. M. Hayward.

New England Railroad Club—The officers for 1913, elected at the annual meeting and dinner of the club, in Boston, on Mar. 11, were as follows: President, C. B. Smith. Vice-President, H. E. Ashley, and Secretary-Treasurer, C. W. Sherburne.

CONSTRUCTION NEWS

★ Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Massachusetts—New York, New Haven & Hartford R.R.—This company will rebuild its 78 crossovers on the main line between Boston and New York. This work, with additional betterments, will cost $1,000,000. Edward Gagel, New Haven, Conn., is Ch. Engr.

New York—Otsego & Herkimer R.R.—This company has been authorized by the Public Service Commission to execute a mortgage for $2,500,000 and to issue bonds for $1,200,000. The proceeds will be used for betterments. S. W. Mower, Cooperstown, N. Y., is Gen. Mgr.

Pennsylvania—Central R.R. of New Jersey—This company will four track its line between Easton and Northampton, Penn., a distance of about 24 miles. J. O. Osgood, New York, is Ch. Engr.

✚Lehigh Valley R.R.—This company has awarded the contract to F. H. CLEMENT & CO. for the work necessary to effect a two track entrance to the Bethlehem Steel Works, South Bethlehem, Penn., at its eastern end, and to reach the Didier-March coke plant. The work will cost about $100,000.

Baltimore & Ohio R.R.—This company will four track its line between Pittsburgh and McKeesport, Penn., and two additional tracks will be laid between McKeesport and Connellsville. This will require a 42 mile rock cut. F. L Stuart, Baltimore, Md., is Ch. Engr.

Maryland—Cambridge & Chesapeake R.R.—This company will construct a line 25 miles long from Cambridge to Fox Creek, Md., by way of Church Creek, Madison and Taylors Island. The work will require several small bridges. Victor C. Carroll of Cambridge, Md., is interested.

West Virginia—Baltimore & Ohio R.R.—This company will three-track its line between Connellsville, Penn., to Do Gully, W. Va., about 15 miles, and a two-track line will be laid between Orleans Road and Little Cascapon, W. Va. In connection with the work, it is reported, a bridge to cost $3,000,000 will be erected over the Allegheny River. F. L. Stuart, Baltimore, Md., is Ch. Engr.

✚Norfolk & Western Ry.—This company has awarded the contract to W. W. BOXLEY, Roanoke, Va., it is reported for the construction of second-track work from Disputanta to Estes.

North Carolina—North State Ry.—This company has been chartered to construct a line from Bunn to Raleigh.

Selma, Louisburg & Northern R.R.—This company has applied to the Legislature for a charter.

Carolina & Yadkin River R.R.—This company has awarded the contract to C. W. LANE & CO., Atlanta, Ga., for the construction of an extension from Thomasville to High Point, N. C., about eight miles.

Georgia—Southern Ry.—This company has authorized the double-tracking of its line between Armour and Cross Keys, Ga. W. H. Wells, Washington, D. C., is Ch. Engr. Const.

Savannah & Southern Ry.—This company is having surveys made for the construction of an extension from Willie to Glenville, Ga., 16 miles. Stewart Starr is Gen. Mgr., Letford, Ga.

Alabama—Birmingham & Tuscaloosa Ry. & Utilities Co.—This company has been incorporated to construct a line from Gadsden to Tuscaloosa by way of Attalla, Ashville, Birmingham and Bessemer. The charter provides also for the constructing of a belt line in Tuscaloosa County. The incorporators are: C. R. Carter, C. A. Gannon and W. D. Adams.

Seaboard Air Line R.R.—This company plans to construct an extension from Ohatchie to Anniston, Ala., about 19 miles. W. D. Faucette, Portsmouth, Va., is Ch. Engr.

Chicago, Memphis & Gulf R.R.—This company has applied for incorporation in Kentucky. The headquarters of the company are at Dyrsburg, Tenn. The line runs from Dyersburg to Hickman, Ky., and it is reported that extensions may be built. Capital, $1,000,000. W. L. Park is Vice Pres.

Illinois—Illinois Central R.R.—This company it is reported, will commence work in the early spring on the construction of third- and fourth-track work on its line from Matteson to Kankakee, Ill., about 28 miles. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Wisconsin—Chicago, Milwaukee & St. Paul Ry.—This company will start work on track elevation in the city of Milwaukee, Wis., this summer. G. F. Loweth, Chicago, Ill., is Ch. Engr.

Wisconsin & Michigan Ry.—This company contemplates the extension of its line south from Green Bay, Wis., possibly as far as Crandon. P. Strang, Peshtigo, Wis., is Ch. Engr.

Iowa—Iowa Northern Ry.—This company has been incorporated to construct a line from Clinton to Turkey River, Clayton County. S. G. Durant, Clinton, Iowa has been elected Pres.

Tabor & Northern Ry.—This company, it is reported, will construct an extension to connect with the Wabash R.R. Robert McClelland, Tabor, Iowa, is Pres. and Mgr.

Nebraska—Union Pacific R.R.—This company, it is reported, is considering the construction of the Kearney & Black Hills Branch from Stapleton to connect with the main-line west of North Platte, Neb. R. L. Huntley, Omaha, Neb., is Ch. Engr.

Wyoming—Chicago, Burlington & Quincy R.R.—This company is planning to start work in the early spring on the reconstruction of its short line between Guernsey and Hartville. T. E. Calvert, Chicago, Ill., is Ch. Engr.

Missouri—Moberly, Huntsville & Randolph Springs R.R.—This company, it is reported, will let contracts about May 1 for the grading and bridging for its proposed line from Moberly, Mo., to Randolph Springs, Mo., about 12 miles. J. J. Mundinger, Huntsville, Mo., is Ch. Engr.

Texas—Interstate Development Co.—This company plans to construct a railroad from either Dallas or Fort Worth, Tex., to Port Arthur, Tex. P. A. McCarthy, Lufkin, Tex., is Secy.

Pecos Valley Southern Ry.—This company, it is reported, will construct an extension from San Salmon Springs to Alpine, Tex., about 50 miles. L. W. Anderson, Pecos, Tex., is Gen. Mgr. and Ch. Engr.

Texas—Missouri, Kansas & Texas Ry.—This company plans to construct extensions of the various lines which, under the provisions of the bill that was recently passed by the Texas Legislature, it is authorized to merge into its main system in the state of Texas.

The Consolidation Bill provides that the Texas Central line of the Missouri, Kansas & Texas Ry. shall be extended west from Rotan to a point on the Texas-New Mexico line, a distance of about 200 miles. The branch line from De Leon to Cross Plains is to be extended west from the latter place to Sweetwater, a distance of about 75 miles. A branch of the Texas Central is also to be constructed from Dublin to the coal fields of Palo Pinto County, a distanc3 of about 50 miles. The bill also provides for an extension of the Wichita Falls & Southern Ry. from New Castle to Cisco, a distance of about 60 miles, connecting the Wichita Flias lines with the Texas Central. The Denison, Bonham & New Orleans line is to be extended from Bonham to Wolfe City, a distance of about 20 miles, and a branch line is also to be built from Ravenna to Gilmer, a distance of about 150 miles. The bill further provides for an extension of the Dallas, Clebunre & Southwestern line from Cleburne to Dallas a distance of about 59 miles. The total proposed new track to be constructed, according to the provisions of this merger bill, is about 655 miles.

The subsidiary roads which are taken over and merged into the Texas System of the Missouri, Kansas & Texas Ry. are the Texas Central, the Wichita Falls & Northwestern, the Wichita Falls & Southern, the Wichita Falls & Wellington, the Wichita Falls Ry., the Denison, Bonham & New Orleans, the Dallas, Cleburne & Southwestern, and the Beaumont & Great Northern roads. S. B. Fisher, St. Louis, Mo., is Ch. Engr. Const.

Idaho—See item under Industrial Notes, page 55.

Oregon—Kerry Lumber Co.—This company is planning to start work soon on the construction of the Columbia & Nehalem Valley Ry. Articles of incorporation have been filed. The capital is $1,000,000. Among the incorporators are J. C. and A. L. Veasie and J. H Henderson.

California—Mexico & San Diego Ry.—This company has filed articles of incorporation and will construct a line of railroad into Mexico. The road will be about 18 miles in length. The incorporators are E. S. Babcock, R. B. Talbot, L. M. Drown, Thomas Leavy and A. L. Goodrich.

The city of Los Angeles, Calif., is planning to finance the construction of the proposed belt line. It is estimated that the line as planned will cost about $1,000,000. Homer Hamlin is City Engr.

Ontario—Bruce Mines & Algoma Ry.—A bill has been introduced in the Ontario Legislature providing for the increase of this company's capital stock from $300,000 to $12,000,000, and to change the name to the Lake Huron & Northern Ontario Ry. The new charter being applied for contemplates the construction of 300 miles of railroad in the Algoma District. W. H. McCallum, Sault Ste. Marie, Mich., is Ch. Engr.

Manitoba—Canadian Northern Ry.—See item under Alberta.

Manitoba—The government of Manitoba is planning an extensive system of railroad building to serve the northern part of the province. The proposed lines center around La Pas, which is to be the terminal of the two roads from Winnipeg, Man., one on each of the lakes.

Alberta—Edmonton, Stony Plain & Wabamun R.R.—This company has applied for incorporation in Alberta for the construction of a railroad from Edmonton to Stony Plain, and thence westerly to Lake Wabamun. The provisional directors include A. Boileau and E. S. McQuaid, of Edmonton, and A. V. Pujebet of Paris, France.

Canadian Northern Ry.—This company has applied to the Canadian Parliament for incorporation of a line to be constructed from or near Letherbridge, Alta., northeasterly to or near Winnipeg, Man., and from Winnipeg to or near La Pas, Man., passing near Dominion City, Manitou, Brandon and Grand View, and another line from Lethbridge, Alta., northeasterly through Alberta and Saskatchewan to La Pas, Man., by way of North Battleford and Prince Albert, Sask., Brosseau, Tansey & Angers, Ottawa, or solicitors for applicants.

✚**British Columbia**—Canadian Pacific Ry.—This company has awarded the contract to W. P. TIERNEY, Vancouver, B. C., for the construction of its proposed standard gage line on the Kaslo and Slocan Division.

Grand Trunk Pacific Ry.—This company has awarded contracts for the construction of the last section of its line through the central part of British Columbia. B. B. Kelliher, Winnipeg, Man., is Ch. Engr.

British Columbia—Burrard Westminster Boundary Ry. & Navigation Co.—This company is making application to the Canadian Parliament to grant it an extension of time to construct the following lines: From the north side of False Creek, Vancouver, B. C., crossing False Creek by a bridge southeast-

erly through Vancouver, Hastings, South Vancouver, Burnaby and New Westminster to the Fraser River bridge; then northeasterly through New Westminster and Coquitlam to Port Moody, and westerly to the proposal location of the Vancouver, Westminster & Yukon railway bridge at the second narrows of Burrard Inlet, thence westerly through Hastings back to Vancouver; from the south end of the proposed Vancouver, Westminster & Yukon bridge, northerly, crossing the bridge along Seymour creek to the northerly boundary of North Vancouver, thence easterly to the north arm of Burrard Inlet, and from North Vancouver westerly to Howe Sound; from the north end of the Fraser river bridge at New Westminster, crossing the bridge and thence southerly to the international boundary between Semiamu bay and Sumas; from the south side of False Creek, through Vancouver and South Vancouver to Point Grey, returning in a southeasterly direction to the starting point; from Port Moody easterly to Dewdney trunk road through Coquitlam, Maple Ridge and Mission to the Stave river, and from the Fraser river bridge line in an easterly and northerly direction through Yale, Lilloeot and Cariboo to Tete Jaune, joining the proposed Vancouver, Westminster & Yukon branch to Edmonton, Alta. A. G. Kitto, Vancouver, B. C., is solicitor for applicants.

Mexico—Mexico & San Diego Ry.—See item under California.

ELECTRIC RAILWAYS

Springfield, Mass.—The City Council has granted a franchise to the Springfield St. Ry. Co. for the extension of its Franklin St. line. E. J. Dickson, Springfield, is Mgr.

Dover, N. J.—The Morris County Traction Co., is making surveys for a proposed traction line from Morris Plains to the eastern line of Dover, to connect with its present system at such point. W. S. Swain, Summit, is Supt.

Trenton, N. J.—The Trenton & Mercer County Traction Co., is planning for the reconstruction and improvement of its system on North and South Broad Sts., and on Centre St. Rankin Johnson, Trenton, is Vice-Pres. and Gen. Mgr.

Bloomsburg, Penn.—The Bloomsburg, Millville & Northern Ry. Co., is making preliminary arrangements for the construction of its proposed trolley line from Bloomsburg to Millville. Walter A. Hughes, West Berwick, Penn., is Pres.

Bridgeport, Penn.—The Phoenixville, Valley Forge & Stafford St. Ry. Co. is contemplating the construction of an electric railway in Bridgeport.

East Berlin, Penn.—The East Berlin Trolley Co., recently organized, will soon start surveys for the construction of its proposed electric railway from East Berlin to York. At present the line will be confined to East Berlin but will eventually be extended to York. Peter C. Smith, East Berlin, is Pres.

Harrisburg, Penn.—The construction of a belt line on Market, Front, Second and Walnut Sts., in Harrisburg, is being considered by the Valley Traction Co. C. H. Bishop, Lemoyne, Penn., is Supt.

Wellsboro, Penn.—The Tioga County Traction Co. is considering plans for the construction of a line from Wellsboro to Mansfield, and from Wellsboro to Knoxville. James F. Fisher, Williamsport, Penn., is Engr.

Cambridge, Md.—A committee has been appointed to secure financial backing for the proposed construction of an electric railway from Cambridge to Lower Dorchester. A. J. Fobb and George W. Woodford are members of the committee.

Williamsport, Md.—The Williamsport, Nessle & Martinsburg Ry. Co. has been incorporated to construct and operate an electric railway from Williamsport, Md., to Martinsburg, W. Va., about 12 miles. The incorporators: Alexander J. Dildrick, John P. Michael and Eugene P. Hoffman of Baltimore; William Deale of Hamilton, Md., and Alexander Clohan of Martinsburg, W. Va.

Fayette, W. Va.—Plans are being prepared by the Fayette Traction Co., recently incorporated, for the construction of a trolley line from Fayette to Fayetteville, about four miles. R. L. Carter, Fayetteville, is interested.

Huntington, W. Va.—Plans are being prepared by the Ohio Valley Electric Ry. Co. for double-tracking all its lines in Huntington. W. W. Masson, Huntington, is Gen. Mgr.

Albany, Ga.—The Albany Transit Co. has been granted an extension of time on its franchise to construct about two miles of additional railway in Albany.

Atlanta, Ga.—The Georgia Ry. & Power Co. has applied for permission to double-track its line along the river, on Mason Ave. W. H. Glenn, Gas & Electric Bldg., Atlanta, is Mgr. of Rys.

Hastings, Fla.—The City Council has granted a franchise to the Palatka-Hastings Interurban Ry. Co. to construct an electric railway in Hastings. This is part of the proposed line from Hastings to Palatka, about 10 miles. C. A. Dupont is Pres., and H. A. Davis is Vice-Pres. Noted Jan. 23.

Miami, Fla.—Plans are being prepared by J. E. Lummus and associates for the construction of a four-mile electric railway in Miami. They have applied for a franchise and the Council is considering the proposition.

Miami, Fla.—A franchise has been granted to the Lawrence Estate Co. for double-track electric railway on Ave. M and 12th and through the Lawrence estate property. S. M. Tatum is Pres.

Crowley, La.—Plans are being considered by the Crowley Board of Trade for the construction of an electric railway in Crowley and vicinity.

Collierville, Tenn.—Preliminary arrangements are being made by the Eagle View Traction Co. for the construction of its proposed line from Collierville to Covington, Tenn., and Charlesdale, Miss. W. W. Hostetter, Eagle View, Miss., is Ch. Engr.

Nashville, Tenn.—The charter of the Nashville Ry. & Light Co. has been amended authorizing the company to construct and operate additional lines on the streets of Nashville. H. A. Dunn, Nashville, is Supt. Ry. Dept.

Toledo, Ohio—Surveys have been started by the Toledo Ry. & Light Co. for the extension of the line from Toledo Beach, Ohio, to Monroe, Mich. Joseph M. Eastwood, Toledo, is Supt. Ry. Noted Mar. 6.

Chicago, Ill.—Plans are being prepared by the Chicago Rys. Co. for the extension of its Armitage Ave. line to Elston Ave. J. B. Hogarth, 1165 North Clark St., Chicago, is Gen. Supt.

Evansville, Ill.—The Evansville, Mount Carmel & Olney Interurban Ry. Co. is reported to be making good progress in the promotion of its proposed line to connect Evansville, Mount Carmel and Olney. It is expected that work will be started on the construction of the line from Olney to Mount Carmel, this spring. Gilmer Bray, Indianapolis, Ind., is interested.

Clinton, Iowa—The Northern Iowa Ry. Co. has been incorporated to construct and operate an electric railway from Clinton to the Turkey River. S. G. Durant is Pres.

Cushing, Okla.—The City Council has granted a franchise to the Cushing & Oil Filed Electric Ry. Co. to construct and operate an electric railway in the business section of Cushing. The line will later be extended to Perry and Stillwater. C. R. Strong, Clinton, Okla., is one of the promoters and John B. Queen, Perry, is interested. Noted Mar. 6.

Henryetta, Okla.—The City Council has granted a frinchise to C. H. Kellogg and associates, for a period of 25 years, to construct and operate an electric railway in Henryetta. Noted Mar. 6.

Bellingham, Wash.—An expenditure of $150,000 is planned by the Pacific Northwest Traction Co. for the improvement of its railway system in Bellingham. L. R. Coffin, Bellingham, is Gen. Mgr.

North Yakima, Wash.—Plans are being prepared by the Yakima Valley Transportation Co. for the construction of a 12-mile extension connecting North Yakima, Selah and Moxee. A. G. Kamm, North Yakima, is Supt.

Port Townsend, Wash.—The City Council has granted a franchise to the Key City Light & Power Co. to construct and operate an electric railway in Port Townsend.

Seattle, Wash.—The City Council has granted a franchise to the Puget Sound Traction, Light & Power Co. to construct an extension of its Kinnear Park line. L. H. Bean, Tacoma, is Mgr.

Fossil, Ore.—The Oregon-Washington R.R. & Navigation Co. has been petitioned by a committee of citizens of Fossil, to extend its Arlington-Condon branch to Fossil, a distance of about 20 miles. J. P. O'Brien is Vice-Pres.

Portland, Ore.—The Portland Ry., Light & Power Co. will spend $4,000,000 in improvements. About $2,500,000 will be used for railroad construction, new buildings, equipment, repairs, etc. in connection with the city and interurban lines. About $1,500,000 will be expended for light and power departments. F. W. Hild, Portland, is Gen. Mgr.

Portland, Ore.—Plans are being considered by the East 72d St. Improvement Club for the extension of the Rose City car line to East 82d St. and Barre Road.

Stayton, Ore.—A company has been organized to construct an electric railway from Stayton to Bend. The line will run through Linn and Crook Counties to the Des Chutes Valley, where it will connect with the Harriman and Hill lines. G. A. Kyle, Railway Exchange Bldg., Portland, is interested.

Bay City, Calif.—Preliminary arrangements are being made by the Pacific Electric Ry. Co. for the extension of its Alamitos-Longbeach line through Bay City. J. McMillan, Los Angeles, is Gen. Mgr. Noted Mar. 13.

Eureka, Calif.—The Northern California R.R. & Navigation Co. proposes the construction of an electric railway from Eureka to Fort Jones. Oscar G. Bartle and N. C. Messick of Los Angeles, are interested.

†Oakland, Calif.—The San Francisco-Oakland Terminal Rys. Co. has awarded the contract for the construction of its electric railway from Oakland to San Jose, to TWOHEY BROS., Portland, Ore.

San Diego, Calif.—The Mexico & San Diego Ry. Co. has been incorporated to construct and operate an interurban railway from National City to South San Diego. The incorporators are E. S. Babcock, Thomas M. Leevey, R. B. Talbot, A. Goodrich and L. W. Brown.

†San Francisco, Calif.—The Board of Public Works received bids Feb. 26, for the construction of a municipal electric railway on Market St., as follows: F. ROLANDI, $21,990, (awarded contract); F. E. Hilmer, $21,990; Healy-Tibbitts Co., $34,000; R. C. Storrie & Co., $26,000; Contra Costa Construction Co., $25,500; A. J. Raisch, $26,920; Central California Construction Co., $23,800; Union Construction Co., $24,248. Noted Nov. 7.

Upland, Calif.—The Pacific Electric Railway Co. was granted a 50-year farnchise to construct, maintain and operate an electric railroad on and across certain streets in Upland. J. McMillan, Los Angeles, is Gen. Mgr.

LIGHT HEAT AND POWER

†Boston, Mass.—The contract for the electric wiring in the City Hall Annex has been awarded by the Public Building Department to the HINON ELECTRIC CO. at $30,695, or $1,045 for alternate wiring. Other bids were: Edwin C. Lewis, $31,881, to $32,258. M. E. Foster & Co., $31,950, $32,550, and the Lord Electric Co., $32,000, $33,170. Manus J. Fish, 100 Summer St. is Supt. of Dept. Noted Dec. 5.

Webster, Mass.—The trustees of the Webster State Hospital have requested an appropriation of $70,000 for installation of a new power plant. John L. Coffin, Northboro, Mass., is Chn.

The Webster Southbridge Gas & Electric Co. has announced the proposed erection of an addition to its plant and the installation of new boilers and a new steam turbine to double capacity of the plant. H. S. Shaw is Supt.

Worcester, Mass.—The Worcester Electric Light Co. is to build a transformer station, 80x30 ft. of brick on concrete, and will install three 500 k.v. transformers to furnish 3000 hp. Estimated cost $20,000. R. W. Robbins is in charge.

†Central Falls, R. I.—The contract for the construction of an addition to the Bryan-Marsh power plant of the General Electric Co., has been awarded to SAMUEL AUSTIN & SONS, Cleveland, Ohio. Noted Mar. 6.

Litchfield, Conn.—Preliminary arrangements are being made by the Litchfield Electric Light & Power Co. for the installation of additional equipment in its power plant. A. J. Fromholz is Mgr.

New Haven, Conn.—The New York, New Haven & Hartford R.R. Co. is planning the construction of a power plant at New Haven to supply part of the current needed for the operation of the electric line from New Haven to Boston. Edward Gagel, New Haven, is Ch. Engr.

Williamantic, Conn.—The engineers who have been investigating the building of another great reservoir on the Natchang River to increase the water supply for the Uncas Power Co., of Scotland, where large power and lighting plant can now be operated by water power only during the high-water season, have reported favorably on the matter and same will undoubtedly be built.

Buffalo, N. Y.—The American Cataract Power Co., recently filed papers of incorporation. It proposes to spend between $4,000,000 and $5,000,000 for the construction of its plant, site has not yet been decided upon.

Saranac Lake, N. Y.—The Paul Smith Electric Light, Power & R.R. Co. is contemplating the extension of its transmission lines from Blackbrook to Ausable Forks, about 14 miles. P. A. Gould, Saranac Lake, is Mgr.

Schenectady, N. Y.—The Mohawk Gas Co., has plans in preparation for the construction of a $350,000 gas generating plant.

Suspension Bridge (Niagara Falls postoffice), **N. Y.**—The United States Light & Heating Co., propose to erect another addition to its plant at Suspension Bridge.

Beverly, N. J.—In connection with the plans of the Public Service Electric Co., to reconstruct its electric system at Beverly, the City Council has appointed a committee to confer with the company relative to the installation of an underground conduit system for its lines throughout the city.

Freehold, N. J.—The Board of Public Utility Commissioners has granted permission to the Monmouth Light Co., to issue bonds for $14,000 and notes for $2500, to provide for extensions in its system.

Morristown, N. J.—The Morris & Somerset Electric Co., has made application to the Hanover Township Committee for an electric light and power franchise in certain sections of the township, including Hanover Neck, Halseytown and Troy Hills.

Phillipsburg, N. J.—A franchise has been granted to the Phillipsburg Light, Heat & Power Co. to construct and operate an electric-light plant at Phillipsburg.

Stockton, N. J.—The Board of Public Utility Commissioners has granted the New Jersey Northern Gas Co., permission to construct new gas mains in Stockton, and through Delaware Township.

Sharpsburg, Penn.—Bids will be received at the office of the Borough Clerk, until 3 p.m., Mar. 27, for furnishing power plant equipment as follows: Two 375-kw. 2300-volt, three-phase, 60-cycle generators, complete with exciters; Alternative bids on prime movers as follows: Two 450-hp. direct connected type simple steam engines. Two 450-hp. direct-connected cross-compound steam engines. Two 375-kw. steam turbo driven A. C. generating units. Complete condensing equipment. Three 50-light, four-ampere metallic-flame arc-lamp equipments complete. One four-panel switchboard complete. Sidney Martin, Penn Bldg., Pittsburgh, is Consult. Engr.

Ellerslie, Md.—A franchise has been granted to the Andrew Ramsey Corporation, Mount Savage, Md., by the Alleghany County Road Commissioners, for the construction of an electric light and power plant, for which ground has been purchased near Ellerslie, and also for the construction of transmission lines, from Ellerslie to Corrigansville.

Spencer, N. C.—The city has been granted authority to issue $50,000 of bonds for the construction of an electric-light plant and water system.

Rochelle, Ga.—Plans are being prepared by the J. B. McCrary Co., Atlanta, for the construction of a municipal electric-light plant. W. C. Carter is City Clk. Noted Feb. 6.

Vidalia, Ga.—See item under Water Supply-Irrigation.

✦Jacksonville, Fla.—See item Miscellaneous Cable, Jacksonville.

Milton, Fla.—The proposition to issue $40,000 in bonds for the construction of an electric-light plant and water system is being considered by the Town Council.

Tampa, Fla.—The Tampa Electric Co. is planning to expend $400,000 for improvements including additions to its power plant and the installation of new machinery. J. C. Woodsome, Tampa, is Local Mgr.

Jennings, La.—The Southern Heat & Light Co. has taken over the C. C. Johnson electric light plant and will move it to the company's plant and enlarge it.

✦Lexington, Ky.—The contract for the installation of a heating plant and system in the Fayette National Bank building at Lexington, has been awarded to F. A. CLEGG & CO., Louisville, at $25,000.

Williamstown, Ky.—A franchise has been granted to J. M. Riley to construct and operate an electric-light plant at Williamstown.

✦Cleveland, Ohio—The contract for the construction of a substation on St. Clair Ave. for the Cleveland Electric Illuminating Co. has been awarded to F. HAUSELMAN.

Jeffersonville, Ind.—The State Legislature has approved an appropriation of $16,000 for the purchase of additional boilers to be installed in the Indiana Reformatory. D. C. Peyton is Supt. Noted Feb. 13.

Battle Creek, Mich.—Plans are being considered for the extension of the municipal ornamental street-lighting system on various streets. Thomas H. Thorne is City Clk.

Corunna, Mich.—The Consumers Power Co. is making preliminary arrangements for the installation of an ornamental street-lighting system in Corunna.

Flint, Mich.—Plans are being prepared by A. M. Kingman, Cleveland, Ohio, for the installation of an ornamental street-lighting system for Flint.

Muskegon, Mich.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system on Western Ave. B. H. Tellman is City Clk.

Galesburg, Ill.—Plans are being prepared by the Galesburg Utilities Co. for the construction of a transmission line from Dallas City to Galesburg. Estimated cost of the project, $85,000.

✦Moline, Ill.—The contract for the reconstruction of the power plant of the Peoples Power Co. has been awarded to HENRY W. HORST, Rock Island, Ill., at $25,000.

Silvis, Ill.—The Village Board is making preliminary arrangements for the installation of an ornamental street-lighting system.

Brondhead, Wis.—At a recent election the citizens voted to issue $40,000 in bonds for the construction of a municipal electric-light plant.

Greenfield, Iowa.—The City Council will be ready to award contracts about Apr. 11 for the construction of a municipal electric-light plant. J. B. Hill, Iowa City, is Consult. Engr.

Liscomb, Iowa—At a recent election it was voted to grant a franchise to the Iowa River Light & Power Co., of Eldora, to construct and operate an electric system in Liscomb.

Low Moor, Iowa—The City Council will soon vote on the proposition to install a municipal electric-light plant in Low Moor. John T. Chandler is City Clk.

Preston, Iowa—Plans are being prepared for the construction of a municipal electric-light plant at Preston. Bonds for $8000 have been voted for the purpose. J. B. Hill, Iowa City, is Consult. Engr. Noted Nov. 21.

Quasqueton, Iowa—The City Council has been petitioned to call an election to submit the proposition to issue bonds for the construction of an electric-light plant, to the voters.

Spencer, Iowa—Plans are being prepared for the enlargement and extension of the municipal electric-light plant and system. K. C. Gaynor, Sioux City, is Consult. Engr.

Paynesville, Minn.—Plans are under consideration for the improvement and extension of the municipal electric-light plant and water system. John H. Haregan is City Recdr.

Binford, N. D.—Plans are being prepared for the construction of an electric-light plant in Binford.

Mayville, N. D.—Plans are being considered by the City Council for the improvement and enlargement of the municipal electric-light plant. Noted Oct. 17.

Sinton, Tex.—The local electric-light plant has been purchased by the Coleman-Fulton Pasture Co. The new owners are planning extensive improvements to the plant and system.

Tucson, Ariz.—The Borderland Mines Co. of Tucson, will establish a power plant at Calabasas, and extend a power line through Santa Cruz valley to Oro Blanco. Todd C. Woodworth is Pres.

Los Angeles, Calif.—Bids will be received until 11 a.m., Mar. 31, by the Board of Public Works for furnishing and installing an ornamental lighting system on Sixth St. between Hill and Alameda Sts. and on Eighth and Ninth Sts. between Main and Figueroa Sts. H. B. Ferris is Secy.

Marysville, Calif.—The Oro Electric Corporation has applied to the City Council for a franchise to operate light and power lines in this city, also for a franchise to operate in Yolo County.

Mountain View, Calif.—The Board of Trustees has decided to call an election soon to submit the proposition to issue bonds for the construction of a municipal electric light plant in connection with the water system, to the vote of the citizens.

Oakdale, Calif.—J. R. Anderson of Pasadena will establish a gas plant at Oakdale to cost approximately $40,000.

✦Oceanside, Calif.—The contract for the extension of the power and electric lines of the Oceanside Electric Co. into the San Luis Rey Valley, has been awarded to F. F. FOSTER & CO., 443 East Third St., Los Angeles, at $20,000.

Oroville, Calif.—The Great Western Power Co. announces that upon the completion this year of the Big Meadows dam work will begin immediately on the construction of four additional power plants at a cost of $8,000,000. It is planned to develop a total of 675,000 hp., the installation to be complete by 1915.

SanDiego, Calif.—The Southern Sierra Power Co., Title Insurance Bldg., Los Angeles, is preparing to extend its power lines through San Bernardino and Riverside into San Diego.

San Francisco, Calif.—The Board of Directors of the Panama-Pacific Exposition Co. has awarded a contract to the Pacific Gas & Electric Co. for the furnishing of all gas, steam and electricity for use in the fair grounds from the present time until the dismantling of the exposition. The contract will aggregate $1,000,000. According to the terms of the contract the Exposition Co. will use a minimum of 12,000 hp. during the construction of the fair and 20,000 hp. during the actual life of the exposition. The Pacific Gas and Electric Co. will erect a big generating plant on the North Beach.

Venice, Calif.—The City Trustees are considering the proposition to construct a municipal electric-light plant.

Willows, Calif.—Albert C. Agnew, representing the Sierra Electric Power Co., of Oakland, has made application to the Board of Supervisors for a franchise for his company through Glenn County for the erection of steel towers poles and for the stringing of electric wires to furnish heat, light and power. Applications have already been made for like franchises in Plumas, Butte, Shasta and Tehhma Counties. The company intends to enter into active competition for the power business of these districts.

Carillon, Que.—The National Hydro-Electric Co. is considering plans for the construction of a power plant to develop 160,000-hp. Estimated cost, $10,000,000. Henry Miles, St. Lawrence Boulevard, Montreal, is Pres.

Dundas, Ont.—Plans are being prepared by the Ontario Hydro-Electric Power Commission for the installation of an electric-lighting system in Dundas. R. W. Karch, Dundas, is Chn.

St. Catharines, Ont.—A new power station will be built by the Niagara, St. Catherines & Thorold Ry. Co. which will be equipped with two 500 kw. rotary concerters and transformers

from the Canadian General Electric Co. The company has also purchased a 570 kilowatt rotary converter and transformer for the operation of its Niagara-on-the-Lake extension.

Toronto, Ont.—See item under Miscellaneous: Trolley Wire, Toronto, Ont.

Wingham, Ont.—Plans are being considered by the Council for an expenditure of $7000 for the installation of additional equipment in the municipal electric-light plant. J. F. Groves is Town Clk.

Edmonton, Alta.—Plans are being prepared by A. Jeffers, City Arch., for the construction of an addition to the municipal power plant to provide the additional power required for the operation of the proposed municial railway extension. Estimated cost, $485,000. Noted Oct. 17.

St. George, N. B.—Plans are being prepared by the St. George Hydro-Electric Co. for the construction of three power dams to manufacture electricity. Percy W. Thompson, St. John, N. B., is Pres.

BRIDGES

✚Providence, R. I.—The contract for repairing the Rhode Island Stone Bridge has been awarded to HOLBROOK, CABOT & ROLLINS, 6 Beacon St., Boston, Mass., at $65,000. Noted Mar. 13.

Pleasantville, N. J.—Plans are being prepared for the construction of a bridge between Beasley's Point and Somers Point. The estimated cost is $350,000.

✚Sunbury, Penn.—The Pennsylvania R.R. has awarded the contract for the construction of two double-track steel bridges across the north branch of the Susquehanna River at Sunbury to the EYRE-SHOEMAKER CO., Philadelphia, Penn. The estimated cost is $500,000.

Sussex, Va.—Bids will be received until Mar. 27, at the office of County Clerk, Sussex County, for the construction of three steel structures, spaning the Blackwater River, near Milton, two 29-ft. and one 58-ft. spans, on concrete and pile substructures. Also four steel bridges, located near Waverly, spaning various streams, one 29¾ ft., one 37¾ ft., and one 192 ft., and the other 28 ft., on concrete and pile substructures. Also for a 54-ft. steel bridge near Homerville, all to have 12-ft. roadway. Plans are obtainable at the office of Childrey-Surry Co., and P. St. J. Wilson, State Highway Commissioner, both of Richmond, Va.

Little Cascapon, W. Va.—See item under Railways: West Virginia.

Lebanon, Tenn.—The Bridge Committee at Lebanon has rejected all bids recently received for the construction of three bridges and will receive bids until Apr. 6.

Cincinnati, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County, until noon, Apr. 4, for the construction of a concrete bridge on Whiskey Run Road at Zimmerman's place, in Springfield township, under specification No. 417. Albert Reinhardt is County Clk.

Cincinnati, Ohio—Bids will be received by the County Commissioners of Hamilton County, until Apr. 4, for the construction of a bridge on the Bogart Road, in Anderson Township. Albert Reinhardt is the Clk.

Cleveland, Ohio—Bids will be received by the Board of Commissioners of Cuyahoga County until 11 a.m., Mar. 26, for the construction of bridge work per Report 3070. Frank R. Lander is the County Surveyor. John F. Goldenbogen is County Clk.

Madeira, Ohio—Bids will be received by the County Commissioners of Hamilton County, Cincinnati, Ohio, until noon, Apr. 4, for the construction of a concrete bridge on Camargo Pike, west of the Baltimore & Ohio Western R.R. in the village of Madeira. Albert Reinhardt is the Clk.

Painesville, Ohio—Bids will be received by the Board of Commissioners of Lake County, until noon, Apr. 7, for the construction of the abutments and wing walls for the bridge near the farm of Charles Dewey in Kirtland township, according to plans and specifications on file at the office of W. Albert Davis, County Audr.

✚Leo, Ind.—We are officially advised that the contract for the construction of a reinforced concrete bridge across the St. Joseph River at Leo, has been awarded to the BURK CONSTRUCTION CO., Newcastle, Ind., at $16,980. Calvin H. Brown, Fort Wayne, Ind., is the County Audr. Noted Mar. 6.

✚Rockport, Ind.—The contract for the construction of 52 bridges in Spencer County has been awarded to the VINCENNES BRIDGE CO., Vincennes, Ind.

Green Bay, Wis.—An election will be held Apr. 1, to vote on the proposition to issue bonds for $170,000 for the purpose of building a bridge across the Fox River.

Manhattan, Kan.—Bids will be received by George Hungerford, County Clk., until noon, Apr. 11, for bridge work in Riley County, according to plans and specifications on file at the office of the State Highway Engineer, K. S. A. C., Manhattan.

Fulton, Mo.—Bids will be received by the City Council until Mar. 27, for the construction of a reinforced-concrete arch bridge 80 ft. long and 26 ft. wide. P. D. Thurmond is the City Engr.

✚Fort Forth, Tex.—The contract for the construction of a bridge at 12th St. has been awarded to AUSTIN BROS. CONSTRUCTION CO., Dallas, Tex., at $31,100.

Houston, Tex.—Bids for the construction of a reinforced concrete bridge over the Buffalo Bayou at Capital Ave., were received as follows: H. C. Coe, $100,000 and $104,100; James Stewart Co., $90,050 and $90,400; W. P. Carmichael Co., $114,850 and $115,500 and E. G. Bates, $112,900 and $113,900. Noted Feb. 20.

Denver, Colo.—Estimates have been prepared by the Engineer of the Board of Public Works and bids will soon be received for the construction of a viaduct at West Colfax St. The estimated cost is $71,000. Noted Nov. 7.

Monrovia, Calif.—Plans are being prepared for the construction of a reinforced-concrete bridge at Monrovia. The estimated cost is $50,000. H. S. Gerlach is the City Engr.

Toronto, Ont. Bids will be received by the Board of Control, Toronto, until noon, Apr. 1, for the construction of the concrete piers, abutments and floor for the St. Clair Ave. Bridge, east of Bathurst St. H. C. Hocken is Mayor and Chn. of the Bd. Noted Feb. 20.

✚Newcastle, N. B.—The contract for the construction of a new steel bridge across the Miramichi River at Newcastle, has been awarded to the FOUNDATION CO., LTD., Montreal. The estimated cost is $350,000.

WATER SUPPLY—IRRIGATION

Easthampton, Mass.—Bids will be received by the Board of Selectmen until Mar. 25, for furnishing about 150 tons of c.-i. water pipe and 1½ miles of clay sewer pipe. Y. E. Lyman is Chn.

Melrose, Mass.—Bids will be received by the city until Mar. 21, for furnishing c.-i. water pipe, edgestone, flagging and sewer pipe. George O. W. Servis is City Engr.

✚Millis, Mass.—A contract to furnish and lay 15,000 lin.ft. of 6- and 8-in. water pipe has been awarded by the Water Commissioners, to ANTONY DE PIETRO, Boston, Mass., at approximately $10,000.

Quincy, Mass.—It is proposed to construct a standpipe at Hough's Neck. Estimated cost, $20,000. E. C. Sargent is City Engr.

✚Bethany, Conn.—A contract to build a reservoir for the Naugatuck Water Co., in the town of Bethany, has been awarded to the TIDEWATER BUILDING CO., 1499 Broadway, New York. An earth dam, 780 ft. long and 65 ft. high with concrete core wall and spillway, will be constructed. George C. Ham, 98 Church St., Naugatuck, Conn., is the Engr. Noted Dec. 5.

Buffalo, N. Y.—We are officially advised that bids for constructing a meter and valve house in the new pumping station at the foot of Porter Ave., were received by the Department of Public Works, Mar. 7, as follows: Bison Construction Co., Buffalo, $155,152; Joseph F. Stabell Co., $155,176; Eastern Concrete Steel Co., $155,458; J. H. Tilden Co., $161,239; John Johnson Construction Co., $167,435; John Baker Long, $194,700. Henry L. Lyon is Deputy Water Comr. Noted Mar. 13.

Fort Plain, N. Y.—An election has been called to vote on an appropriation of $12,000 for lowering the water mains crossing the Mohawk River to a depth sufficient to meet the requirements of the Barge Canal.

New York, N. Y.—We are officially advised that bids were received by Henry S. Thompson, Mar. 12, as follows:

Furnishing and constructing auxiliary pumping stations on Southfield Blvd., Borough of Richmond: Otto Metz, $17,942; Werner-Bartels Co., $21,094; Neptune B. Smythe, Inc., $22,859; U. W. Osborne & Sons, $19,335; J. M. Knopp, $18,641; Jos. Balaban Co., $18,400; John Milnes Co., Inc., $22,780; Durkin and Laas, 103 Park Ave., New York, $17,527.

Making necessary excavations, building engine foundations of concrete, engine pit, floor, etc., and a new feed pump room in the West New Brighton pumping station, Borough of Richmond: Otto Metz, $2647; Neptune B. Smythe, Inc., $2221; Wm. Horne Co., $2040; Geo. D. Atwood Co., $2502; Jos. Balabon Co., $2182; Durkin and Laas, $1850.

Dismantling and transporting one pumping engine now in the Baldwin pumping station at Baldwin, L. I., to the West New Brighton Pumping Station, Borough of Richmond, and reerecting it complete in place with new parts, etc., and steam and exhaust piping, section and discharge piping, one dry vacuum pump, two boiler feed pumps, etc., and all valves: George D. Atwood Co., $11838; Evans & Almirall Co., $11,025 John W. Sullivan Co., $15,380; Jas. Curran Mfg. Co., $15,490.

Furnishing and delivering 260 tons c.i. pipe: John Fox & Co. $6344; U. S. Cast Iron Pipe & Foundry Co., $6292; Florence Iron Works, $6175; Warren Foundry & Machine Co., $6760; Standard Cast Iron Pipe & Foundry Co., $6344.

Plattsburg, N. Y.—The Board of Public Works has directed the City Clerk to advertise for bids for constructing a wire and wood fence around Farley and Fitzpatrick Reservoir. The Board of Public Works also contemplates building a water main to Cliff Haven, and a new storage reservoir on the West Brook.

Rochester, N. Y.—E. S. Osborne, City Controller, has asked an appropriation of $100,000, for purchasing land in the vicinity of Canadice Lake, and for extending the water mains. This land will be used in connection with the new water supply, which is being developed at Canadice Lake. Noted Aug. 29.

Waterloo, N. Y.—The Waterloo Water Co. contemplates the construction of a 150,000-gal. water tower, and the purchase and installation of a 2,000,000-gal. direct-connected steam pump, a 500,000-gal. power pump, a 1,000,000-gal. pressure filter, and 50 %-in. meters. C. H. Ross is Supt.

✚Atlantic Highlands, N. J.—We are officially advised that a contract to sink a well here has been awarded to EDWARD CHRISTMAN, Masselon, Ohio, at $6.50 per ft. Bids were opened by the Department of Public Works, Feb. 25. Noted Feb. 13.

✚Dover, N. J. The contract to install a new pumping plant here, and supply power for operation has been awarded to the DOVER, ROCKAWAY & PORT ORAM GAS CO., at $6000 for pumping machinery and 1.65c. per 1000 gal. for power. Noted Feb. 13.

Farrell, Penn. An election has been called for Apr. 8, to vote on a bond issue of $125,00, for the installation of a municipal water system. John Nolan is Secy. of Council. Noted Jan. 9.

Reading, Penn.—The plant of the Mohnaville Water Co. has been bought by a newly organized company, at $110,000. The new owners have decided to extend the service to the suburbs of Mohnton and Shillington. Allen E. Hildebrand is Pres.

York, Penn. The Special Committee of the City Council appointed to consider the water situation, reported against buying the plant of the York Water Co., and in favor of installing a municipal system.

Rehoboth, Del. Bids will probably soon be asked for installing a water system here, estimated to cost $30,000. The plans provide for 50,000- and 100,000-gal. elevated tanks, pipe, hydrants, pumps, etc. C. S. Horton Secy. Bd. Pub. Wks.

McColl, S. C.—An election has been called for Mar. 31, to vote on a bond issue of $30,000 for the construction of a water system. Noted Feb. 27.

Winnsboro, S. C.—It is proposed to install water and sewer systems here. An election will probably soon be called to vote on the proposition.

Atlanta, Ga.—According to press reports, bids will be received by the Water Board until Mar. 20, for furnishing and installing one 10,000,000-gal. rotary pump. W. Z. Smith is Gen. Mgr.

✚Cartersville, Ga.—A contract to complete the construction of a reservoir here has been awarded to the JORDAN-STEWART CO., Atlanta, Ga., at $13,948. Plans were prepared by the Solomon-Norcross Co., Atlanta.

Rochelle, Ga.—The J. B. McCrary Co., Atlanta, Ga., has been retained to make surveys and estimates for the installation of a water system and an electric light plant here. Noted Feb. 6.

Vidalia, Ga.—An election has been called for Apr. 5, to vote on a bond issue of $15,000 for improving the water system and electric light plant.

Milton, Fla.—The city contemplates the installation of a water system and an electric light plant, estimated to cost $40,000. Bonds for the amount have been voted.

Sarasota, Fla.—Bids will be received by the Board of Public Works until Mar. 25, for constructing a water system to include 1890 ft. of 12-in., 5732 ft. of 10-in., 3857 ft. of 8-in. and 7539 ft. of 6-in. t.c. sewer pipe, 40 manholes and four flush tanks. W. A. Summer is Chn. Noted Dec. 26.

Georgetown, Miss.—The Town Council contemplates calling an election to vote on a bond issue of $7500, for constructing an artesian well and laying water mains.

Georgetown, Miss.—The city contemplates a bond issue o $7500 for improving the water system.

★Laurel, Miss.—Bids will be received by the Mayor and Board of Commissioners until 2 p.m., Apr. 1, for the purchase of $15,000 water bonds, $30,000 sewer bonds, and $25,000 school bonds. D. A. Scarborough is City Clk. Noted Jan. 30.

Tutwiler, Miss.—We are officially advised that bids will be received until Apr. 25, for constructing a water system here, according to plans prepared by R. C. Huston & Co., Consult. Engrs., Exchange Bldg., Memphis, Tenn. The bids received on this contract, Mar. 4, were rejected. D. W. Fite is Mayor. Noted Feb. 20.

Shreveport, La.—Bonds for $300,000 have been voted for the purchase of lands surrounding Cross Lake. It is intenedd to use the territory as a site for a reservoir for the water system. Noted Jan. 16.

Henderson, Tenn.—Press reports state that an election has been called for Mar. 28, to vote on a bond issue of $50,000 for constructing a water system and electric light plant.

Jackson, Tenn.—The City Council has approved the sale of $25,000 bonds for enlarging and improving the water system.

✚Kenton, Tenn.—We are officially advised that the contract to construct a water system here has been awarded to the WEST TENNESSEE CONSTRUCTION CO., Memphis, Tenn. Bids were opened Mar. 11. R. C. Huston & Co., Exchange Bldg., Memphis, are Consult. Engrs. Noted Feb. 27.

Memphis, Tenn.—The Water Department has asked an appropriation of $500,000, for extending water mains to portions of the city recently built up.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Mar. 25, for laying c.-i. water mains, with appurtenances, in Beekman St. Plans and specifications may be obtained at the office of the General Superintendent of Water Works.

Lakewood, Ohio—Bids will be received by J. W. Chrisford, Dir. Pub. Ser., until noon, Mar. 24, for furnishing and laying water mains in Warren Road and McKinley Ave.

Pleasant City, Ohio—Bids will probably be asked some time in April for installing a water system here, estimated to cost $15,000. H. L. Maddock, Newark, Ohio, is Consult. Engr. M. L. Devine is Village Clk. Noted Nov. 21.

✚Sandusky, Ohio—We are officially advised that the contract to furnish the necessary meters during the year 1913 has been awarded to HENRY R. WORTHINGTON, 115 Broadway, New York, at $5.50 each for ⅝-in. meters. Bids were opened Mar. 5. Noted Feb. 27.

Willoughby, Ohio—We are officially advised that bids for constructing a 1,000,000-gal. water purification plant here were received by the Board of Public Affairs, Feb. 22, as follows: (1) Filters, basins, building, and equipment; (2) clear well: (3) outside piping; (4) total: ALBERT RUSSO & BRO., Willoughby, Ohio, (1) $18,290; (2) $2712; (3) $940; (4) $21,942 (awarded contract); B. F. Hewitt, Jefferson, Ohio, (1) $17,500; (2) $4200; (3) $1420; (4) $23,120; Lanese Co., Cleveland, Ohio, (1) $14,000; (2) $6500; (3) $1637; (4) $22,337; The Pitt Construction Co., (1) $17,700; (2) $3800; (3) $2000; (4) $23,500; J. W. Danforth Co., Buffalo, N. Y., (1) $20,806; (2) $5988; (3) $973; (4) $27,767; Nicola Bldg. Co., Pittsburgh, Penn., (1) $23,210; (2) $4525; (3) $2215; (4) $29,950; Gail-Wilson Co., Inc., Buffalo, N. Y., (1) $29,091; (2) $6740; (3) $1555; (4) $37,386. Burgess & Long, Columbus Savings & Trust Bldg., Columbus, Ohio, are Consult. Engrs. Noted Jan. 16.

Evansville, Ind.—Bids will be received by the Board of Water Works Trustees until noon, Apr. 14, for furnishing and erecting one 300-hp. water-tube boiler, one mechanical stoker for same, and three mechanical stokers, to be installed on 225-hp. Sterling boilers now in place at the pumping station. Plans are on file at the office of the Board. Henry L. Heilman is Secy.

Fort Wayne, Ind.—Bids are being received for furnishing 300 tons of 6-in. and 120 tons of 12-in. c.-i. pipe for the Water Department. H. W. Becker is City Engr.

Jackson, Mich.—Tht Water Department contemplates the installation of a pump estimated to cost $20,000.

★Milwaukee, Wis.—Bids will be received by the Department of Public Works until 10:30 a.m., Apr. 24, for furnishing all materials and doing all the work required to construct a water-works tunnel 12 ft. in diameter, for a distance of approximately 4000 ft. out into and under Lake Michigan, from a point on the lake shore on the center line of Linwood Ave. extended, one lake shaft, including connections and steel cylinders, one short shaft, including two gate wells and all connections, and approximately 150 cu.yd. of rock excavation, according to plans and specifications on file at the office of the Department. Fred G. Simmons is Comr. Pub. Wks. Noted Jan. 9. For additional information, see advertisement in this issue.

Mukwonago, Wis.—We are officially advised that all bids received, Feb. 24, for furnishing about 130 tons of 4-, 6- and 8-in. c.-i. pipe, 2½ tons of special castings, 22 fire hydrants and 10 gate valves, were rejected by the Board of Trustees. Emil Wanner is Village Clk. Noted Feb. 20.

Wittenberg, Wis.—The village is agitating the installation of municipal water and sewer systems. Estimated cost, $33,600.

★Epworth, Iowa—Bids will be received by J. P. Hamilton, Town Clk., until Apr. 1, for constructing a complete water system here, according to plans and specifications on file at the office of the Clerk. Estimated cost, $1000. Noted Mar. 6.

LeMars, Iowa—The town contemplates purchasing the water system and electric-light plant of the LeMars Water & Light Co. An election has been called for Mar. 20, to vote on the proposition.

✚Muscatine, Iowa—The contract to construct a distributing reservoir between Cook St. and Kindler Ave. and north of Lucas St., has been awarded to W. E. MIDDLETON, Kansas City, Mo., at $18,381. Bids were opened by the Board of Trustees, Mar. 10. Noted Feb. 13.

Newton, Iowa—Bids will be received by E. G. Finch, City Clk., until 7:30 p.m., Mar. 24, for laying 6500 lin.ft. of water pipe. Pipe, lead and jute will be furnished by the city.

✚Minneapolis, Minn.—We are officially advised that the contract to furnish 16,000 ft. of 50-in. steel pipe for the water system has been awarded to the EAST JERSEY PIPE CO., Paterson, N. J., at $116,705, for lock-bar. The other bids were: Carroll-Porter Co., $121,691, for riveted; Treadwell Construction Co., $142,861, for riveted. Bids were opened Feb. 24. K. E. Alexander is Pur. Agt. Noted Feb. 13.

We are officially advised that bids for furnishing valves were received by K. E. Alexander, Pur. Agent, Mar. 3, as follows: (a) Four 54-in., (b) five 48-in., (c) one 42-in., (d) one 34-in., (e) one 30-in.: Roe-Stephens Mfg. Co., Detroit, Mich., (a) $1450: (b) $1040; (c) $675; (d) $455; (e) $298; J. E. Clow & Sons, Chicago, Ill., (a) $985; (b) $630; (c) $575; (d) $420; (e) $270; Rensselaer Valve Co., Troy, N. Y., (a) $1248; (b) $880; (c) $495; (d) $358; (e) $235; Ludlow Valve Co., Chicago, Ill., (a) $1160; (b) $813; (c) 578; (d) $412; (e) $287; Coffin Valve Co., Boston, Mass., (a) $693; (b) $515; (c) $495; (d) $380; (e) $243; Pittsburgh Valve & Foundry Co., Pittsburgh, Penn., (a) $1025; (b) $880; (c) $750; (d) $490; (e) $350. Noted Feb. 27.

★Bassett, Neb.—We are officially advised that the contract to install a complete water system and electric-light plant here has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $12,565. Bids were opened by W. E. Buckendorf, Village Clk., Feb. 17. Noted Feb. 13.

Broken Bow, Neb.—Bids will be received by R. E. Thompson, City Clk., until Mar. 25, for furnishing and installing an internal-combustion engine of 35 hp. capacity, using fuel oil or distillate, a triplex power-driven water pump of 500 gal. per min. capacity, and an oil storage tank of 13,000 gal. capacity.

Wisner, Neb.—Bids will be received until Mar. 24, for constructing a pumping station and wells for the water system. Estimated cost, $7000. C. S. Deily is City Clk.

Fort Pierre, S. D.—The Great Plains Irrigation Association, Fort Pierre, contemplates the construction of an irrigation pipe line from the mouth of the Yellowstone River in North Dakota, to the White River in Lynan County, South Dakota. G. G. Inman is Secy.

✚Upton, Wyo.—A contract to construct a complete municipal water system here has been awarded to A. C. EVANS, Sheridan, Wyo., at approximately $25,000.

Charleston, Mo.—Frank L. Wilcox, Consult. Engr., St. Louis, Mo., has been retained to make an appraisal of the private water system and to prepare plans for the new water and sewer systems and a sewage disposal plant. Estimated cost, $85,000. Noted Feb. 6.

Spur, Tex.—Bonds for $25,000 have been voted for installing a municipal water system. Noted Feb. 6.

✚Phoenix, Ariz.—A contract has been awarded to the WOODRUFF CONSTRUCTION CO. for the construction of a diversion dam across the Gila River, about 12 miles north of Florence, and a distributing system to irrigate a tract of land near here for the Mutual Irrigation Co. A storage reservoir for storing storm waters will also be built near Casa Granda.

Salt Lake City, Utah—W. H. Korns, Comr. Water Dept., is considering a plan to secure water from the Black Cañon Springs. The plan provides for 123 miles of gravity pipe line from the springs to the city, and a reservoir, 600x200x50 ft., capacity 45,000,000 gal., approximate elevation, 4800 ft., near Bear River and the Idaho-Utah line. The cost of the pipe line, reservoir and land rights, is estimated at $5,000,000.

Friday Harbor, Wash.—Bonds for $14,000 have been voted for the installation of a water system here. Noted Jan. 9.

Omak, Wash.—We are officially advised that bids will probably be asked some time in April for installing a pump and engine, laying mains and constructing a reservoir. Estimated cost, $8600. S. J. Umbrite is Town Clk. Noted Feb. 20.

Lawndale, Calif.—The Lawndale Land & Water Co. has made application to the State Railroad Commission for permission to issue $50,000 of bonds for installing a water system and other improvements at Lawndale. Frank A. Lathrop, Higgins Bldg., Los Angeles, is Consult. Engr.

Los Angeles, Calif.—A. L. Sonderegger, Consult. Engr., Central Bldg., is drawing plans for a pumping plant and irrigation system on Fairview Farms for Bryan & Bradford. The system will comprise a centrifugal pump, two 1,000,000-gal. reservoirs, six miles of riveted steel pipe from 6 to 16 in. in diameter, and a 35-ft. standpipe.

†San Diego, Calif.—We are officially advised that contracts to construct a water system for the San Ysidro Irrigation District, have been awarded as follows: Pump house, four electric induction motors, two centrifugal pumps, to the HAZZARD-GOULD CO., San Diego; 22,000 ft. 2- to 8-in. steel pipe, to the BAKER IRON WORKS, Los Angeles; laying pipe, to M. A. DALLY, San Ysidro; two cement-lined reservoirs of 186,000 and 204,000 gal. capacity, to L. E. BLACK, Chula Vista. Bids were opened Feb. 13. Josiah Peeton is Secy. Noted Feb. 6.

Ridgetown, Ont.—The Town Council is having plans prepared for the construction of a water system here, estimated to cost $7000. D. Cochrane is Clk.

Windsor, Ont.—Bids will be received by the Chairman of the Water Commissioners until Mar. 25, for about 400 tons of c.-i. water pipe, 6 in. to 12 in.; also specials consisting of crosses, tees and bends. W. A. Hanrahan is Secy.

Drummondville, Que.—Bids will be received by the Town Council until Apr. 1, for constructing two standpipes, one of 300,000 gal. capacity. W. A. Moisan is Secy.-Treas.

Saskatoon, Sask.—Bids will be received by F. E. Harrison, Mayor, until Apr. 15, for furnishing one motor pumping engine of 500 gal. capacity, and one motor pumping engine of 1000 gal. capacity.

★Esperanza, Mexico—The construction of an irrigation canal near Esperanza, for which bids were to be opened Apr. 1, has been indefinitely postponed. L. H. Taylor is Ch. Engr.

SEWERS

Amherst, Mass.—An appropriation of $48,000 has been made for installing a new system of sewers here. W. C. Tannatt, Consult. Engr., Easthampton, Mass., has prepared surveys and preliminary plans.

Boston, Mass.—The City Council, Mar. 15, passed to a second reading a loan order of $400,000 for sewer work in the Charles River Basin. L. K. Rourke is Comr. Pub. Wks.

Boston, Mass.—Bids will be received until Mar. 28, by the Metropolitan Water and Sewerage Board for the construction of a 24x36-in. concrete sewer in Winchester. The contract involves 3535 lin.ft. of pipe, 2050 cu.yd. concrete masonry and 1800 cu.yd. rock excavation. Frederick D. Smith, Ashburton Pl., is Ch. Engr.

Franklin, Mass.—J. J. Van Valkenburgh, Consult. Engr., South Framingham, Mass., is preparing plans for the installation of a sewer system here. Bids will probably soon be asked for this work.

Medford, Mass.—The city contemplates a bond issue of $75,000 for improving and extending the sewer system. F. R. Charnock is City Engr.

Springfield, Mass.—The city plans to complete its sewer system this spring. Estimated cost, $43,000. F. H. Clark is Comr. Pub. Wks.

Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Pres. Boro. of Brooklyn, until 11 a.m., Mar. 26, for constructing sewage purification experimental plant, at the 26th Ward sewage disposal works, Hendrix St., near Vandalia Ave.

Bids will be received by Alfred E. Steers, Pres. Boro. of Brooklyn, until 10 a.m., Apr. 2, for constructing sewers in Hewes St., from Wallabout Canal to Classon Ave.; in Classon Ave., from Hewes St. to Park Ave., and in Park Ave., from Classon Ave. to Skillman St.; for constructing sewers in Vernon Ave., from Marcy Ave. to Tompkins Ave., and in Tompkins Ave., from Vernon Ave. to Greene Ave.

Buffalo, N. Y.—The City Council has ordered the construction of a 10-in. tile sewer in Peacock St. Francis G. Ward is Comr. Pub. Wks.

Fairport, N. Y.—We are officially advised that bonds for $40,000 were voted Mar. 11, for the construction of intercepting sewers and a sewage disposal plant, according to plans prepared by Boerman & Fisher, Consult. Engrs., Fairport. Noted Mar. 6.

Johnstown, N. Y.—Bids for constructing sewers in Littauer and Water Sts., have been received by the Common Council as follows: A. M. Banker, Johnstown, $10,531; Kellum & Shaffer Co., Schenectady, $11,183; Thomas R. Crane, Schenectady, $12,972.

New York, N. Y.—Bids will be received by Maurice E. Connolly, Pres. Boro. of Queens, until 11 a.m., Mar. 28, for constructing sewers.

Bids will be received by Cyrus C. Miller, Pres. Boro. The Bronx, until 10:30 a.m., Mar. 26, for constructing sewers.

Oswego, N. Y.—According to press reports, bids will be received until Apr. 1, for constructing sanitary and storm water sewers. Bonds for $200,000 were recently voted for this work. Charles H. Snyder is City Engr. Noted Jan. 30.

Spring Valley, N. Y.—The village contemplates an appropriation of $5000 for making a survey for a sewer system.

Audubon, N. J.—The Borough Council has authorized the Borough Clerk to advertise for bids for sewer construction. The proposed sewer system is estimated to cost $65,000.

Hammonton, N. J.—The Borough Council has accepted the report of the Sewer Commissioners for the proposed system. Estimated cost $87,000.

Newark, N. J.—We are officially advised that bids for construction Section 6 of the main intercepting sewer were received by the Sewer Commissioners, Mar. 11, as follows: Southside portion, Booth & Flinn, Ltd., Pittsburgh, Penn., $357,900; O'Gara & Maguire, Inc., Newark, N. J., $328,402; Patrick McMeel, Passaic, N. J., $314,100; Dock Contractor Co., Hoboken, N. J., $300,640; Oscar Daniels Co., New York, N. Y., $292,200; McCabe-Manton Co., Newark, N. J., $285,000; Frawley-Kaufman Contracting Co., Inc., New York, $284,000; Northside portion, Foehn Contracting Co., Brooklyn, N. Y., $580,506; Booth & Flinn, Ltd., Pittsburgh, Penn., $474,300; Dock Contractor Co., Hoboken, N. J., $344,210; Oscar Daniels Co., New York, $340,000; Frawley-Kaufman Contracting Co., Inc., New York, $265,000. Noted Feb. 20.

Secaucus, N. J.—We are officially advised that an election has been called for Apr. 22, to vote on a bond issue of $29,000, for the installation of a sewer system. Sebastian Maulbeck is Boro. Engr. Noted Feb. 27.

Ventnor, N. J.—W. I. Risley, City Engr., has completed plans for the construction of a pumping station for the sewer system. A bond issue of $75,000 is now pending for this work.

†Bridgeville, Penn.—We are officially advised that a sanitary sewer system and sewage-disposal plant are being installed here by the Flannery Bolt Co., according to plans of Chester & Fleming, Hydraulic Engrs., Pittsburgh, Penn. The contract has been awarded to PIHL & MILLER, of Pittsburgh.

†Carlisle, Penn.—We are officially advised that bids for constructing a complete water system here, according to plans prepared by T. Chalkley Hatton, Consult. Engr., Wilmington, Del., were received by the Borough Council, Mar. 6, as follows: (a) Sewage disposal plant; (b) outfall sewer; (c) sewer system and drainage conduit: W. H. & C. F. Thompson, Law Bldg., Baltimore, Md., (a) $60,000; (b) $24,437; (c) $102,345; William Horn & Co., New York, (a) $45,450; (b) $19,366; Bennett & Randall, Lebanon, Penn., (b) $14,849; (c) $107,428; J. L. DICK, Scottdale, Penn., (b) $13,098 (awarded contract); (c) $124,000; H. C. BROOKS, Martinsburg, W. Va., (b) $19,101; (c) $87,170 (awarded contract); G. W. Ensign, Camp Hill, Penn., (a) $49,600; (b) $17,150; Costa & Co., Orange, N. J., (c) $111,992; S. P. ANGLE, Hagerstown, Md., (a) $38,467 (awarded contract); Lewis Jacques, Elisabeth, N. J., (b) $17,819. Noted Feb. 20.

†Philadelphia, Penn.—We are officially advised that the following contracts were awarded by the Board of Public Works, Mar. 4: Reconstructing old sewers, to EMILIO PASCUZZI, at $25,000; test boring, to PHILIP FLAGHOUSE, at $1000. Noted Feb. 27.

†Pittsburgh, Penn.—Contracts to construct sewers in various streets have been awarded by the Department of Public Works, as follows: M. O'HERRON CO., Liberty Ave., $5431; Butler St., $2986; Pattern St., $861; Ridgway St., $1366; Ampere St., $685; McClarren St., $649; Wyman Alley, $4732; THOMAS CRONIN CO., Melvin St., $5689; W. J. PAYNE, JR., & CO., Liverpool St., $547. Bids were opened Mar. 7. Noted Mar. 6.

Pottstown, Penn.—O. E. Collins, Consult. Engr., Philadelphia, has been retained by the Town Council to prepare plans for the installation of a sewer system and a sewage disposal plant here.

Scranton, Penn.—Bids will be received by Willard Matthews, Pres. Scranton Poor District, until Apr. 1, for the construction of a sewage disposal plant at Hillside Home. Estimated cost, $15,000. C. R. Acker is Secy.

Wilkes-Barre, Penn.—Bids will be received by Fred H. Gates, City Clk., until noon, Mar. 20, for constructing sewers in 24 streets. For plans and specifications address B. K. Finch, City Engr.

★Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., Apr. 2, for constructing storm water drains, Contract No. 26. The contract involves: 3000 lin.ft. 78x36-in. to 54x36-in. rectangular masonry drains; 11,200 lin.ft. 48- to 30-in. circular masonry drains; 365 lin.ft. 30- to 20-in. c.-i. pipe drains; 26,500 lin.ft. 24- to 12-in. terra cotta pipe drains; 10,300 lin.ft. 18- to 12-in. inlet connections; 216 manholes; 420 inlets. Calvin W. Hendrick is Ch. Engr. Sewerage Comn.

Charleston, W. Va.—Bids will be received by the Board of Affairs, until Mar. 24, for constructing sewers in various streets. Profiles and specifications are on file at the office of J. S. Ross, City Recdr.

McColl, S. C.—An election has been called for Mar. 31, to vote on a bond issue of $20,000, for the installation of a sewer system.

Dublin, Ga.—The town contemplates a bond issue of $10,000 for sewer construction.

★Laurel, Miss.—See item under Water Supply—Irrigation.

New Orleans, La.—According to press reports, bids will be received by the Sewerage and Water Board until 3 p.m., Apr. 18, for furnishing and delivering one 150-hp. motor to be known as Contract 54 D. F. S. Shields is Secy.

†Columbus, Ohio—We are officially advised that contracts for constructing sewers were awarded by S. A. Kinnear, Dir. Pub. Ser., Mar. 11, as follows: To J. C. BEASLEY, 649 South 22d St., Grogan main trunk sewer No. 1, at $94,440; to I. O. JONES, 707 Grove St., Broad St., at $5330; Arcadia St., $2671; Neff Ave., $494; West Side storm sewer, $1696; to J. F. RYERSON, Miller St., $2236, Clintonville Sewer No. 2, $36,837. Noted Mar. 6.

Fort Wayne, Ind.—We are officially advised that the contract to construct sewers here was not awarded Feb. 27. The contract will probably be readvertised. The proposed construction is divided into two contracts, Main Sewer No. 31, estimated to cost $24,400, and Main Sewer No. 32, estimated to cost $32,300. W. W. Chaffin is Asst. City Engr. Noted Feb. 20.

Vincennes, Ind.—We are officially advised that the proposition to construct three miles of storm sewer here has been defeated. C. L. V. Tucker is City Clk. Noted Feb. 27.

Flint, Mich.—We are officially advised that an election has been called for Mar. 20, to vote on a bond issue of $300,000 for constructing sewers and pavements, and purchasing parks. D. E. Newcombe is City Clk.

†Ironwood, Mich.—A contract to construct 7000 lin.ft. of 18-in. tile sewer in Lake St., has been awarded to MEEGAN & ROSS, Ironwood, at $13,557. The other bids were Oxman & Sutherland, $14,106; Owens & Ninewenkamp, $15,229.

Marquette, Mich.—We are officially advised that bids will be received until Mar. 20, for constructing 9500 ft. 12- to 30-in. pipe sewers. Estimated cost, $50,000. Charles Cummings is City Engr. Noted Mar. 6.

Union City, Mich.—We are officially advised that the proposition to issue $20,000 bonds for the installation of a sewer system here was defeated at the bond election, Mar. 10. W. C. Henderson is Mayor. Noted Feb. 27.

Chicago, Ill.—Bids will be received by the Department of Public Works until 11 a.m., Mar. 22, for furnishing about 15,000 pieces of 1-in., 800 pieces of 6-in., 500 pieces of 9-in. and 100 pieces of 12-in. sewer pipe. L. E. McCann is Comr.

Fond du Lac, Wis.—The Common Council has approved the plans and specifications for the new sewer system and sewage-disposal plant for the West Side. Estimated cost, $58,000. J. T. Hohensee is City Clk. Noted Feb. 20.

Wittenberg, Wis.—See item under Water Supply—Irrigation.

Carroll, Iowa—Bids will be received by J. A. Dougherty, City Clk., until 8 p.m., Mar. 31, for constructing sewers as follows: 15,090 ft. of 8-in. sewers; 3230 ft. of 6-in. sub-drains; 25 manholes, 12 combined manholes and flush tanks, six lampholes. Plans, specifications and blanks are on file at the office of the City Clerk, and may be obtained at that office. Henry M. Haussen is City Engr. Noted Feb. 13.

✦Toledo, Iowa—We are officially advised that the contract to construct a sewage disposal plant and an outlet sewer here has been awarded to A. W. MERRICK, Boone, Iowa, at $6448. The other bids were: Capital City Contracting Co., $8429; Wenkhank Contracting Co., $6878; W. D. Yeager, $7597; George W. Hass Engineering & Contracting Co., $8550; Des Moines Engineering & Contracting Co., $7970; C. W. Ennis, $6700; M. T. Schuzi & Sons, $6689; Wood & Weighton, $7616. Noted Feb. 27.

✦Sidney, Neb.—A contract to install a sewer system here has been awarded to D. G. GORDON, Denver, Colo., at $17,164.

Charleston, Mo.—See item under Water Supply—Irrigation.

✦Richmond, Mo.—We are officially advised that the contract to construct a sewer system and a septic tank here has been awarded to the LANNDER CONSTRUCTION CO., 3821 Bell St., Kansas City, Mo., at $12,199. The other bids were: E. Eby, Wichita, Kan., $12,773; Brown & Nichols, Caney, Kan., $14,927; Bell & Hudson, Poplar Bluff, Mo., $13,720; Bash & Gray, Joplin, Mo., $13,518. Noted Feb. 27.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until noon, Mar. 25, for constructing the Rocky Branch Joint District Sewer in Rocky Branch Joint Sewer District. Plans, specifications and form of contract may be obtained at the office of the Board.

Salt Lake City, Utah—Bids will be received by Noble Warren, City Recdr., until 10 a.m., Mar. 25, for the construction of sewer extension No. 321.

North Yakima, Wash.—The special election which was to be held Mar. 20, to vote on a bond issue of $260,000 for constructing about eight miles of trunk sewers, has been postponed. The date when another election will be held has not been determined. N. A. Gilman is City Engr. Noted Feb. 20.

Portland, Ore.—The City Council will soon receive new bids for the construction of the East Gilsan St. extension of the East Stark St. sewer. Thomas Hurlburt is City Engr. Noted Jan. 16.

Colfax, Calif.—We are officially advised that bids will be received by the Board of Trustees until 8 p.m., Mar. 25, for the construction of a sewer system. Estimated cost, $13,000. Plans are on file at the office of U. S. Marshal, Engr., Forum Bldg., Sacramento.

✦Elsinore, Calif.—The contract for the construction of a sewer system in Elsinore has been awarded to the WEST-LAKE CONSTRUCTION CO., Byrne Bldg., Los Angeles, at $18,053. Bids were received by the Board of Trustees, Feb. 24. Noted Feb. 20.

Fullerton, Calif.—All bids received by the Board of Trustees for the construction of a sewer system have been rejected. New bids will be asked.

Lodi, Calif.—Bids will soon be received by the City Trustees for furnishing 11,300 ft. of pipe and 350 Y's for the extension of the sewer and water system.

✦Los Angeles, Calif.—The following bids were received for the construction of a sewer in Idell St. from San Fernando to Cypress St.: JOHN RADICH (awarded contract), $45,990; J. Mohan, $46,356; Pekich & Ukropins, $47,839; R. N. Nikcevich, $48,760; Miagenovich & Gillespie, $48,974; W. D. Newell Plumbing Co., $51,467; S. M. Sipes, $53,000; Nichols & Tomich, $53,500; John Gristich, $53,500; J. C. Wykojevich, $56,300; W. N. Hendricks, $56,600; John Balch, $59,987.

✦The following bids were received for the construction of a sewer in Marengo St. from State to Soto St.: NICHOLS & TOMICH (awarded contract), $8500; Miagenovich & Gillespie, $8900; John Radich, $8990; Sam Kruly, $9685; W. N. Hendricks, $10,600.

Los Gatos, Calif.—Preliminary plans have been prepared by F. A. Nikirk, City Engr., for the construction of a sewer system in Los Gatos. Bonds have been voted for the purpose.

Visalia, Calif.—The city contemplates spending $19,000 for extensions to its sewer system. Approximate quantities are 12,745 ft. of 6-in. pipe, 2181 ft. 10-in pipe, and 1611 ft. 8-in. pipe.

GARBAGE

Munhall, Penn.—Bids will be received until Mar. 25, by H. I. McClay, Boro. Secy., for constructing the foundations, buildings, lining kilns, furnaces and appurtenant work required for the completion of the garbage disposal plant. The work includes everything except the furnishing of two rotary kilns, driving machinery and stacks and the erection of stacks as the contract for this work has been let.

Reading, Penn.—The city is considering the erection of a garbage incinerating plant. Estimated cost, $21,000.

Washington, Penn.—The bid submitted by W. K. Herbert for the construction of a 20-ton garbage disposal plant has been recommended for acceptance. The bid was $10,000.

★Kansas City, Mo.—Bids were received, Mar. 11, by the city, for the construction of a garbage and refuse incinerator. The lowest bid, it is reported, was submitted by Lewis & Fitchen, Chicago, Ill., at $41,985.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Mar. 24 by the Commissioner of Public Works for construction of asphalt pavement on Union Park St. from Washington St. to Tremont Ave. L. K. Rourke is Comr.

Southbridge, Mass.—The Board of Selectmen has voted to pave Main St. with wood block at an estimated cost of $20,000. Work will be begun as soon as weather permits. Charles Proulx is Clk.

Springfield, Mass.—Plans have been prepared for about one-half mile of wood block paving on North Main St. F. H. Clark is Street Comr.

Worcester, Mass.—Bids will be received until 11 a.m., Mar. 25, by the Mayor for furnishing curbstone and block paving. The approximate quantities are: 20,000 lin.ft. straight curbing, 250 small circular corners, 2-ft. radius, and 750,000 paving blocks. A. T. Rhodes is Street Comr.

Wallingford, Conn.—Bids will be received until 5 p.m. Apr. 8, by the Warden and Court of Burgesses for construction of about 15,510 sq.yd. pavement. Bids will be considered on various kinds of standard materials. John E. Martin is Warden. Wm. A. McKenzie is Boro. Engr.

Brooklyn, N. Y.—Bids will be received until 11 a.m., Mar. 26, by the President of the Borough of Brooklyn, Borough Hall, for various improvements on Barrett, 85th, Dupont, East Second, East Third, Forrest, Junius, Pilling, Sullivan, West, West 30th, White, 45th, 71st, 80th, 82nd and 83rd Sts., Ave. C, Coney Island Ave., East New York Ave., Montauk Ave., Oakland Place, Sunnyside, Thatford, Williams, 12th, Belmont, Sutter, 16th and New York Aves.; also for grading certain lots in the Boro., and for furnishing and delivering 30,000 Medina sandstone blocks. Alfred E. Steers is Pres.

Buffalo, N. Y.—The City Council has authorized the Commissioner of Public Works to advertise for bids for paving Dunstan Ave. and repaving Spring St. with asphalt. Francis G. Ward is Comr.

✦Lockport, N. Y.—We are officially advised that the Common Council awarded a contract to C. N. STAINTHORPE & CO., Lockport, at $10,634 for paving La Grange St. with brick. Julius F. Frehsee is City Engr. Schuyler Beattie is City Clk. Noted Mar. 13.

✦New York, N. Y.—We are officially advised that the President of the Borough of Manhattan has awarded contracts for paving various streets, with sheet asphalt, as follows: To the CLEVELAND TRINIDAD PAVING CO., at $9511, for paving 40th St., from Park Ave. to Fifth Ave.; at $44,892, for paving 44th St., from Sixth Ave. to 11th Ave.; to DAYTON HEDGES, 1451 Broadway, at $26,149, for paving 47th St., from Eighth to 11th Aves.; at $19,087, for paving 53d St., from Park Ave. to Sixth Ave.; at $8666, for paving 54th St., from Ninth to Tenth Aves.; at $13,836, for paving 109th St., from First Ave. to Third Ave.; to the EASTERN PAVING CO., at $18,451, for paving 53d St., from Ninth Ave. to 11th Ave.; at $58,923, for paving Henry St., from Grand to Oliver Sts., and Oliver St., from Madison St. to Chatham Square; at $6147, for paving First Ave., from 70th to 71st Sts.; at $7835, for paving Eighth St., from Avenue C to Avenue B; at $22,214, for paving 12th St., from Avenue B to Second Ave.; at $16,175, for paving 29th St., from First Ave. to Third Ave.; at $9564, for paving 35th St., from Ninth to Tenth Aves.; at $17,150, for paving 40th St., from Sixth Ave. to Eighth Ave. Bids were received on Mar. 6. George McAneny is Pres. Noted Feb. 27.

New York, N. Y. (Boro. of Queens—Bids will be received until 11 a.m., Mar. 24, by the President of the Borough of Queens, Borough Hall Fifth St. and Jackson Ave., Long Island City, for repairing sheet asphalt and all work incidental thereto in the Third Wards of the Boro., also for the same work in the Second and Fourth Wards of the Boro. Maurice E. Connolly is Pres.

Rochester, N. Y.—The Board of Contract and Supply has directed the City Clerk to advertise for bids for repairing asphalt pavements during 1913. The approximate amount is 50,000 sq.yd. Thomas Dransfield is City Clk.

✦Syracuse, N. Y.—A contract has been awarded by the Board of Contract and Supply to GUY B. DICKINSON, Syracuse, at about $40,000, for paving Hawley Ave. George J. Metz is City Clk.

Newark, N. J.—The Board of Public Works has decided to pave Broad St., from Belleville Ave. to Poinier St., with wood block. The City Engineer has been instructed to prepare plans and estimates so that bids may be asked. Morris R. Sherrerd is City Engr.

✦Pompton Lakes, N. J.—We are officially advised that the Mayor and Borough Council have awarded a contract to CHARLES ALBERG, Paterson, N. J., at 10¾c. per sq.ft. for construction of sidewalks on various streets, and 35c. per cu.yd. for grading and filling. There were 30 bidders ranging from 10¾ to 18½c. per sq.ft. for concrete. J. B. Jackson is City Engr. Noted Feb. 27.

Woodbridge, N. J.—With the sanction of the Governor and State Road Commissioner, the Board of Freeholders has taken over the road between Rahway Ave., Roosevelt, and Presbyterian Church, Woodbridge, as a Middlesex County road. State aid will be obtained in rebuilding the road, which will be of asphalt and concrete; County Engineer Alvin B. Fox, Perth Amboy, has been instructed to arrange for the preliminary work in connection with reconstruction.

✦East McKeesport, Penn.—A contract has been awarded by the Borough Council to JAMES TOPLEY & CO., at $102,285 for various improvements in sections of Broadway, Fifth and Punta Gorda Aves., Woodmont and Josephine Sts. There were five other bidders. E. P. Churchfield is Boro. Secy. Noted Feb. 27.

✦Erie, Penn.—Contracts have been awarded by the City Council to DOYLE BROS. for repaving Ninth St. from State to German at $1.25 per sq.yd. and at 90c. per sq.yd. for paving Cedar and Vine Sts., from Seventh to Eighth Sts. Mayer Bros. bid $2.10 for the Ninth St. paving.

✚Philadelphia, Penn.—A contract has been awarded by the Department of Public Works, Bureau of Highways to the McNICHOL PAVING & CONSTRUCTION CO., Philadelphia, at $1,317,845 for completion of the Northeast Blvd. from Second to Rhawn Sts. The Hassam Paving Co., Boston, Mass., bid $1,570,649. M. L. Cooke is Dir. Noted Feb. 6.

✚Pittsburgh, Penn.—Contracts for street improvements have been awarded as follows by the Department of Public Works: Craighead St. to the THOMAS CRONIN CO. at $13,-170; to BOOTH & FLINN, LTD., at $39,861 for portions of Water, Hoeveler, Devonshire, and Tuscarora Sts., to the F. O'HERON CO. at $39,483, for portions of Dyer, Gangtry, Shelby, Mary and Rockledge Sts. and Grandview Ave., to NEELAN & DALY at $4814 for improving Merritt St. Joseph G. Armstrong is Dir. Noted Mar. 6.

Washington, D. C.—See item under Federal Government Work: Grading, Washington, D. C.

Waycross, Ga.—Bids will be received until 7:30 p.m. Apr. 1 by the Mayor and City Council for about 20,000 sq.yd. pavement on various streets. Bids will be accepted on brick, wood block, asphalt block, bitulithic and sheet asphalt pavement. B. H. Klyce is City Engr.

Tampa, Fla.—The Board of Public Works has authorized the City Clerk to advertise for bids for construction of about 200,000 sq.yd. brick pavement and 10 miles of granite curb. W. A. Johnson is City Clk.

Birmingham, Ala.—The City Commission has decided to pave 24th St. from Eighth to 12th Aves. and 12th Ave. from 24th to 32d Sts. at once, and bids will be asked as soon as plans can be prepared. Walter J. Kirkpatrick is City Engr.

New Orleans, La.—We are officially advised that plans and specifications for paving Notre Dame St., from Fulton to Front Sts., are now in the hands of the Commission Council for approval, and bids will probably be asked within two weeks. Thomas L. Willis is Asst. City Engr. Noted Mar. 6

Shreveport, La.—We are officially advised that bids will be received until noon, Apr. 10, by the Police Jury of Caddo Parish for grading and surfacing with gravel or macadam, 20 miles of highway. The estimated cost is $120,000. T. J. Bullen is Parish Engr. Noted Feb. 20.

✚Macon, Miss.—We are officially advised that a contract has been awarded by the Commissioners of Noxubee County to the HEALEY CONSTRUCTION CO., Meridian, Miss., for construction of about 13 miles of gravel road in Dist. No. 5. John A. Tyson is Clk. of the Bd. Noted Feb. 20.

✚Louisville, Ky.—We are officially advised that the Board of Public Works has awarded a contract to the LOUISVILLE ASPHALT CO. at $7648 for furnishing and laying 2575 sq.yd. 3½-in. 16-lb. blocks on Main St. between Fourth and Fifth Sts. The Bickel Asphalt Paving Co. bid $7816. D. R. Lyman is Ch. Engr. Noted Mar. 6.

Cincinnati, Ohio—Bids will be received until noon, Apr. 4 by the Board of Commissioners of Hamilton County for improvement of the North Bend Road from Hamilton Pike to Carthage, Springfield and Millercreek Townships. Albert Reinhardt is Clk.

Bids will be received until noon, Mar. 25 by the Director of Public Service for improvement of Knox St. from Thompson Ave. to Saturn St. and Yonkers Ave. from Beekman St. to Moosewood Ave. V. P. Price is Dir. M. J. Keefe is Clk.

Bids will be received until noon, Mar. 27, by the Board of Park Commissioners for grading Section 5 of the Bloody Run Parkway, approximately 16,500 cu.yd. Wm. Hodgins is Secy.

The County Commissioners have decided to improve the River Road from Blue Rock Pike to the Colerain Pike at an estimated cost of $26,880.

Cleveland, Ohio—Bids will be received until 10 a.m., Mar. 25, by the Commissioners of Cuyahoga County for grading and paving with brick the No. 3 Improvement Richmond Road, Euclid Township, Cuyahoga County for a distance of 1.33 miles at an estimated cost of $33,982. James R. Marker is State Comr.

Columbus, Ohio—Bids will be received until 2 p.m., Mar. 31, by the State Highway Commissioner, for the following road improvements: Grading and paving with brick, 2.51 miles of the Ashland-New London Road, Ruggles Township, Ashland County, at an estimated cost of $33,075; for grading and paving with waterbound macadam and bituminated concrete 1.8 miles of the Columbus Extension Road, Hilliar and Milford Townships, Knox County, at an estimated cost of $19,286; for grading 5.62 miles of the Lake Shore Road, Black River and Brownhelm Townships, Lorain County, at an estimated cost of $9330; for grading 3.33 miles of the Pittsfield-Wellington Road, Wellington and Pittsfield Townships, Lorain County, at an estimated cost of $7954. James R. Marker is Comr.

Columbus, Ohio—Bids will be received until noon, Apr. 1, by the Director of Public Service for various improvements in the following streets: Bruck, Esper, Mound, Sixth and Tallmadge Sts., Davis, Eureka, Indianola, Wrexham and Weyerhaul Aves., and sections of three alleys. S. A. Kinnear is Dir. Paul B. Kemper is Clk.

✚Coshocton, Ohio. The Board of Control has awarded a contract for paving North Eighth St. with Metropolitan brick to T. J. NORMAN & SONS at $7650. Other bids were: John Hall, $8012; George J. Rock & Sons, $8178; Henderson Bros., $7996. George S. Caton is Dir. of Pub. Service. Noted Feb. 20.

Lakewood, Ohio. Bids will be received until noon, Mar. 24 by the Director of Public Service for grading, draining, curbing and paving with brick sections of Gladys and Marlow Aves., West Clifton Road and Robin St. J. W. Chisford is Dir.

✚Niles, Ohio.—The Board of Control has awarded contracts for street improvements as follows: To MARTIN P. CONNELLY & SON, Youngstown, Ohio, at $26,219 for Beaver and Cedar Sts.; to McDERMOTT & HANNON, at $29,952 for Church, Chestnut and Mechanic Sts. J. E. Tregaskis is Clk. Noted Feb. 13.

Indiana. Bids for road improvements in Indiana will be received as follows:

Apr. 8, at Kokomo, by Commissioners of Howard County, for construction of a stone road in Jackson Township, and three gravel roads in Center Township. E. B. Swift is Audr.

Apr. 8, at Wabash, by Commissioners of Wabash County, for construction of a road in Noble Township. D. Showalter is Audr.

Apr. 8, at Bloomfield, by Commissioners of Greene County, for construction of a macadam road in Stockton Township. Caswell H. Jennings is Audr.

Apr. 8, at Corydon, by Commissioners of Harrison County, for construction of a road in Taylor Township. J. L. O'Bannon is Audr.

Apr. 8, at Bloomington, by Commissioners of Monroe County, for construction of a road in Bloomington Township. W. F. Kinser is Audr.

Apr. 8, at Winchester, by Commissioners of Randolph County, for a road in White River Township. Henry F. Wood is Audr.

Apr. 9, at Muncie, by Commissioners of Delaware County, for a road in Harrison Township. F. M. Williams is Audr.

Apr. 10, at Peru, by Commissioners of Miami County, for one road in Butler Township, two in Pipe Creek Township, and two in Peru Township. Frank H. McElheny is Audr.

Greensburg, Ind.—The City Commissioners have prepared various plans to improve Broadway and keep within the available funds. Plan A provides for one block of vitrified brick paving and the remainder of bituminous macadam at an estimated cost of $31,349. Plan B calls for all bituminous macadam at $28,887. Plan C is to resurfacing the street at $25,922. Plan D is for resurfacing at $23,890, using less macadam. Bids will be received until Apr. 7.

Indianapolis, Ind.—Bids will be received until 10 a.m., Mar. 26, by the Board of Public Works for construction of concrete sidewalks in Hoefgen and Chadwick Sts., for gravel roadways in Tabor, Ohio and Hoefgen Sts., Kealing, La Grange, Park and State Aves., and for curbing in various streets. Edward A. Ramsey is City Clk.

New Albany, Ind.—The Board of Public Works will soon advertise for bids for paving Market St. for a distance of about 1.25 miles with vitrified brick. Charles W. Appleby is City Engr. Noted Dec. 19.

✚Richmond, Ind.—We are officially advised that a contract has been awarded by the Board of Public Works to SISK. SPRINKLE & LEVEL, Portland, Ind., at $1.72 per sq.yd., for 16,200 sq.yd. of brick paving on various streets. Other bidders were: J. F. Hipskind, $1.92; Cronin & Meredith, $1.83; D. G. Burkhardt, $1.83; Truppur & Son, $1.89; C. M. Kirkpatrick, $1.83; Fred R. Charles is City Engr. Noted Feb. 13.

✚Battle Creek, Mich.—The Good Roads Commissioners of Calhoun County have awarded a contract to H. C. BARNES, Saginaw, Mich., at $15,300 for construction of 7½ miles of road in the county.

Hastings, Mich.—Bids will be received until 7:30 p.m., Mar. 28, by the Common Council for improving sections of Jefferson and Green Sts. The estimated quantities are: 6880 cu.yd. excavation, 18,825 sq.yd. concrete pavement, 11,520 lin.ft. combined curb and gutter. James M. Patten is City Clk.

Manistique, Mich.—Bids will be received until 2 p.m., Apr. 15, by the Board of County Road Commissioners of Schoolcraft County for construction of about 3.2 miles of macadam road. John N. Forshar is County Clk.

Galesburg, Ill.—The Board of Local Improvements has advertised for bids for paving a part of Main St. with brick at an estimated cost of $48,878 and for paving Water St. from Cherry to Broad Sts., estimated to cost $8530. F. M. Connolly is Engr. of the Bd.

Joliet, Ill.—The Board of Local Improvements has authorized the improvement of McDonough, South Chicago and Railroad Sts. and Eastern Ave. The estimated total cost is $104,000. C. D. O'Callahan is City Engr.

✚Rossville, Ill.—We are officially advised that the Board of Local Improvements has awarded a contract to G. W. PRUTTSMAN, Danville, Ill., at $64,395, for 30,430 sq.yd. vitrified brick paving, 3386 lin.ft. stone curb and 17,473 lin.ft. combined curb and gutter. Other bidders were: Pronger & Fletcher, Blue Island, Ill., at $65,658; A. J. Parrish, Paris, Ill., at $65,019. Payne & Barr, Danville, Ill., are Engrs. in Charge. Noted Feb. 27.

Superior, Wis.—The City Commission has instructed the Board of Public Works to advertise for bids for paving Baxter Ave. from Third to 21st Sts. Bids will be asked for reinforced concrete, sheet asphalt, asphaltic concrete, brick or creosoted blocks with a concrete base. E. R. Banks is City Engr.

✚Clinton, Iowa—We are officially advised that bids as follows, were received by the City Council for paving Elm St. and Second Ave.: (A) KAW PAVING CO., Topeka, Kan. (contract awarded); (B) Ford Paving Co., Cedar Rapids, Iowa; (C) Thos. Carey & Sons, Clinton, Iowa; (D) A. Kornemann & Co., Muscatine, Iowa. Elm St., concrete with bituminous top coat; (A) $14,717, (B) $15,444. Elm St., concrete paving; (A) $16,589, (B) $18,496, (C) $16,954. Second Ave., concrete with bituminous top coat; (A) $22,591, (B) $24,703, (D) $27,607. Second Ave., concrete paving; (A) $23,-943, (B) $29,465, (C) $23,355. J. G. Thorne is City Engr.

Butte, Mont. Bids will be received until 5 p.m., Apr. 2, by the City Council for approximately 1912 sq.yd. vitrified paving in Special Improvement List No. 135; also for grading, curbing and construction of concrete sidewalks in List Nos. 134 and 137. The approximate quantities are: 95,000 cu.yd. excavation, 34,300 sq.yd. concrete sidewalk, and 65,500 lin.ft. concrete curb. W. A. Willis is City Clk.

Little Rock, Ark. Bids will be received until noon, Mar. 24, by the City Secretary, for paving sections of East Second, Scott, Cumberland and Byrd Sts. and Rector Ave. Henry Levinson is Engr. in Charge. George A. Stratman is City Secy.

Cleveland, Okla.—We are officially advised that because of alleged irregularity of the proceedings, all bids received on Mar. 10 for paving Street Improvement District No. 1 were rejected, and new bids will be received by the City

Clerk until 5 p.m., Mar. 24. The Benham Engineering Co., Oklahoma City, Okla., is Engr.-in-Charge.

Kingman, Ariz.—Mojave County has voted an issue of $100,000 in bonds for construction of the Santa Fe Cañon-Needles national highway.

Tacoma, Wash.—The City Council has authorized the City Engineer to prepare plans for paving South Yakima Ave. from 38th to 48th Sts. W. C. Raleigh is City Engr.

+Los Angeles, Calif.—The City Trustees have awarded contracts as follows, for street improvements: To the FAIRCHILD-GILMORE-WILTON CO., at $44,387, for improving Vermont Ave., from Sixth to Washington St.; B. C. NICHOLS, $25,319, for Broadway, from East First to East Fourth Sts.; the BARBER ASPHALT PAVING CO., at $6065 for improving Fourth Ave., from Pico St. to Country Club Tract.

Los Angeles, Calif.—Bids will be received until 2 p.m., Mar. 24, by the Board of Supervisors of Los Angeles County, for grading a portion of Santa Susana Pass Road. The approximate quantities are: 52,206 cu.yd. excavation, 8491 lb. of steel, 431½ cu.yd. concrete, 316 ft. of 18-in. reinforced-concrete pipe, 563 ft. of 24-in. reinforced-concrete pipe, 196 ft. of 36-in. reinforced-concrete pipe. Bids will be received at the same time for construction of a portion of the El Monte-Pomona Road, including a reinforced-concrete bridge. The approximate quantities are: 3375 cu.yd. excavation, 2806 lin.ft. shaping roadbed, 1965 tons oil macadam, 230.2 cu.yd. concrete, 22,896 lb. steel, 66 lin.ft. 18-in. reinforced-concrete pipe. A. M. McPherron is Deputy County Clk.

Merced, Calif.—The Trustees have ordered the paving of 29 blocks of streets.

+Pasadena, Calif.—A contract has been awarded to the FAIRCHILD-GILMORE-WILTON CO., Los Angeles, Calif., at $40,044, for paving Raymond Ave., from Dayton to Glenarm Sts., with asphalt.

J. E. HADDOCK, 357 North Chester Ave., was awarded a contract at $5623, for improving Kirkwood Ave., from Hammind to Mountain Ave.

Sacramento, Calif.—We are officially advised that bids will be received until 2 p.m., Mar. 24, by the State Highway Commission, 55 Forum Bldg., for construction of about 9½ miles of state highway in Stanislaus County, to be built of Portland cement concrete and bituminous surface. Wilson R. Ellis is Secy. Austin B. Fletcher is Highway Engr.

J. D. MARSH, 155 Wilson Bldg., Los Angeles, was awarded the contract at $55,555, for constructing 10.13 miles if state highway in Los Angeles County, between Rancho Encino and Calabasas. Noted Feb. 20.

Bids as follows were received by the State Highway Commission for constructing 7½ miles of waterbound macadam road in Mendocino County, between Ukiah and Forsythe Creek: Sawyer & White, Willits, Calif., $53,313; the E. B. & A. L. Stone Co., San Francisco, $60,840; Fairbanks & Baechtel, Willits, $67,143; the Baisch Improvement Co., San Francisco, $92,299. Noted Feb. 20.

San Fernando, Calif.—The Mission Land Co. will spend approximately $50,000 for improving about 7500 ft. of Celis, Coronel, Hollister, Hewitt and Kewen Sts., between McDougal and Stanford Sts. The work includes asphalt paving, curbs and sidewalks.

Montreal, Que.—The Municipal Council of Lachine, Montreal, plans the construction of pavements on St. Joseph and Notre Dame Sts. at an estimated cost of $300,000. E. Leclerc, 58-14th St., is Engr.-in-Charge.

Toronto, Ont.—The Board of Control plans highway and park improvements to include the following: Driveways in Rosedale Ravine, estimated to cost $15,000, improvement of roads and new pavilion in High Park, $46,000, improvements in Island Park and Exhibition Park at $42,000 and $32,000 respectively.

Saskatoon, Sask.—Bids will be received until Mar. 28 by the City Commissioners for construction of approximately 42,000 sq.yd. of street paving, 12,800 lin.ft. concrete gutter, 28,760 lin.ft. separate curb, 22,050 lin.ft. combined curb and gutter, 5700 sq.ft. street crossings, 265,390 sq.ft. concrete sidewalks. T. E. Harrison is Mayor, Geo. T. Clark is Chn. of the Comrs.

INDUSTRIAL WORKS

Boston, Mass.—An entirely new plant will be built by the Mead-Morrison Mfg. Co., of Boston, on land recently acquired in Boston, along the Boston & Albany R.R. This comprises some 10 acres, and is the result of the company's having outgrown its facilities at East Cambridge. This organization, as is well known, makes a specialty of coal handling machinery, and in addition, hoisting machinery for docks, quarries and contractors' plants. The company is controlled by the same interests which organized and built it up, Eugene M. Foss, Governor of Massachusetts, being President.

Binghamton, N. Y.—The Central Flat-Iron Mfg. Co. is considering the erection of a new concrete, factory, 100x30 ft., at Grand St. and Cook Aves. The estimated cost is $35,000.

+Brooklyn, N. Y.—The Ebinger Baking Co., 36 Snyder Ave., has awarded a contract to the WILLIAM KENNEDY CONSTRUCTION CO., 215 Montague St., for the construction of a two-story addition to its bakery. It will be 98x60 ft., and will cost $30,000. C. D. Cooley, Arch., 490 Bellaire, Ave., Pittsburgh, Penn., is the Arch.

Middleport, N. Y.—The Middleport Cold Storage Co., in which C. H. Breed, of Medina, is interested, will erect a cold-storage plant at Middleport. The building will be 186x84 ft., two stories and basement, stone foundation, brick construction, with a capacity of 60,000 bbls. The estimated cost is $80,000. G. R. Sheldon, First National Bank of Middleport, is also interested in the proposition.

+New York, N. Y.—A. G. Zimmerman, Arch., 11 East 24th St., has awarded a contract to the CAULDWELL-WINGATE CO., 381 Fourth Ave., for the construction of a new bakery for the National Biscuit Co. The building will be 12 stories high, with a ground area of 47,338 sq.ft., and is estimated to cost $1,500,000. It will be built on the block bounded by Tenth Ave., Marginal St., 15th and 16th Sts. Noted Mar. 13.

Rochester, N. Y.—The Rochester Ry. & Light Co., will build a plant for the manufacture of concrete poles, posts, manhole forms, etc. The plant will be equipped with electric hoists and conveyors. The principal building will be 40x80 feet.

Rome, N. Y.—Bids are now being received by the Rome Wire Works, for the construction of a one-story addition to its plant, 200x135 ft.

Syracuse, N. Y.—Henry Schmoll, 202 Noxon St., is having plans prepared by Merritt C. Conway, Arch., 205 Furman St., for the construction of a three-story box manufacturing plant, three stories high, 100x50 ft. The estimated cost $20,000.

+Jersey City, N. J.—The American Chocolate Almond Co., 901 Jefferson St., Hoboken, has awarded a contract to DERIOS ARENA CO., Fifth St., Union Hill, at $35,000, for the construction of a three-story factory, 90x51 ft., in Jersey City. The estimated cost is $35,000.

Philadelphia, Penn.—S. Sklaroff & Sons will build a five-story plant at 710-712-714 South Second St., to consist of a fully equipped cold storage, fish-curing and smoking establishment. The estimated cost is $150,000.

Pittsburgh, Penn.—William Kosuks Sons, West End, is having plans prepared by H. E. Kennedy & Co., Archs., Home Trust Bldg., for the construction of a two-story machine shop, 115x37 ft., at its plant. The estimated cost is $20,000.

Warren, Penn.—The Protective Account Co., a new incorporation, is having plans prepared for the erection of a new manufacturing plant, in the West End. The estimated cost is $25,000.

York, Penn.—Ernst & Herman Levy, Pine and Boundry Aves., are having plans prepared by J. C. McClaymot, Lehmayers Bldg., for the construction of an addition to its plant. It will be four stories high, 96x65 ft. The estimated cost is $25,000.

Baltimore, Md.—Bids are now being received by John Freund Jr., Arch., 11 East Lexington St., for the construction of a two-story bakery, 350x100 ft., for the City Baking Co.

Cumberland, Md.—The Western Maryland R.R. contemplates the construction of a roundhouse at the Ridgely Yards. The estimated cost is $150,000. H. R. Pratt, Baltimore, is Ch. Engr.

West Raleigh, N. C.—The North Carolina College of Agriculture & Mechanical Arts will erect a new shop and laboratory building for the mechanical engineering department. This will cost aproximately $50,000, and will contain a machine shop, foundry, forge shop, wood shop, as well as laboratories for mechanical engineering. H. E. Satterfield, Professor of Mnchanical Engineering, will have charge of the construction.

Alliance, Ohio—The Alliance Motor Car Co., Alliance, will erect a 52x160-ft. two-story brick factory, to cost between $16,000 and $20,000. Work will begin Apr. 1, and it is expected that the building will be completed within 60 days.

Canal Dover, Ohio—The Dover Brick Co., operating a plant near Strasburg, is planning the erection of a new plant at Canal Dover.

Cincinnati, Ohio—The National Sugar Cone Co., Cincinnati, recently incorporated by L. L. Stricker and others in connection with the Banner Grocery & Baking Co., has purchased the original plant on Campbell St. Changes will be made in the factory so that the daily output will be 250,000 cones.

Cincinnati, Ohio—The blacksmith shop, boiler house, woodworking and machine shops of the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co., at Cincinnati, Ohio, recently damaged by fire, will be rebuilt

Dayton, Ohio—The Trimble Brick Paving Co., Dayton, recently incorporated, will take over the plants of the Trimble Paving Brick Co., and the Wassel Brick Co., of Gloucester, Ohio. The capacity of the new plant will be 100,000 bricks a day.

Lowellsville, Ohio—H. W. Lindsay, representative of the Seamless Tube & Iron Co., has purchased the King farm of 25 acres, east of Lowellsville, and adjoining the power plant of the Mahoning & Shenango Ry. & Light Co. It is planned to erect a laboratory which will later be followed by shop buildings, for the manufacture of seamless tubing.

Loveland, Ohio—The Federal Carbon Co., Loveland, will erect a new plant, to cost about $100,000.

Mount Vernon, Ohio—The Mount Vernon Bridge Co., Mount Vernon, will erect a factory. George Israel is Secy.

Reading, Ohio—The Tool Steel Gear & Pinion Co., Cincinnati, Ohio, has abandoned the enlarging of its plant at Carthage, it is reported, and will move to Township Ave., Reading, where it will erect a plant larger than the one planned for Carthage. The new plant will cost between $50,000 and $75,000. Plans were prepared by Bert L. Baldwin & Co., Cincinnati.

Youngstown, Ohio—A sheet-metal lath plant will be erected on Clay St., Youngstown, by Ira A. and C. R. Thomas, of Youngstown. Plans have been prepared.

South Bend, Ind.—The branch of the International Harvester Co., at South Bend, Ind., will erect a new plant at Lafayette and Stuil Sts. The building will be 115x260 ft., four stories, of brick and stone. The main offices of the company are at Chicago, Ill.

Bay City, Mich.—The Bay City Iron Co., Bay City, will erect a machine shop, 50x200 ft. Plans are now being prepared.

Highland Park, Mich.—Bids are being received by Smith, Hinchman & Grylls, Archs., Detroit, Mich., for the machine shop and factory for the Detroit United Ry., Detroit, at Highland Park. Estimated cost, $60,000.

Saginaw, Mich.—The Wilcox-McKim Co., Saginaw, recently organized, has completed plans for the erection of a factory for the manufacture of automobile accessories.

Chicago, Ill.—The Warren Motor Boat Mfg. Co., Chicago, will erect a one-story factory, 50x150 ft., for the manufacture of motor boats.

J. B. Madsen, Chicago, Ill., will erect a three-story furniture factory, 50x100 ft., at 1743 West Grand Ave., Chicago. Holabird & Roach, Chicago, are Archs.

Manchester, Wis.—The Manchester Roller Mills, recently destroyed by fire, will probably be rebuilt.

Neenah, Wis.—Walter Bros., Neenah, will erect a bottling plant to cost about $15,000.

Sigel, Wis.—The farmers in the vicinity of Sigel are considering the erection of a cheese factory. The Board of Trade of Sigel may be addressed for further information.

South Milwaukee, Wis.—The Bucyrus Co., South Milwaukee, will erect an addition to its plant, to cost $25,000.

Sherman, Tex.—The Interstate Cotton Oil Refining Co., which has a capital of $600,000, will establish a cotton seed oil-refining plant at Sherman. C. A. Sanford, H. D. Stinnet and J. M. Satterfield are interested.

Texas City, Tex.—The Pierce-Fordyce Oil Association will enlarge its oil refinery by adding a new factory for the manufacture of paraffin wax.

Aberdeen, Wash.—Bowen Bros., Aberdeen, will erect a commercial garage and machine shop at Aberdeen. The estimated cost is $10,000. Troutman & Hayes are the Archs.

Bellingham, Wash.—A. J. Schram, former manager of the California Motor Car Co., Oakland, Calif., is interested in a project to erect a plant for the manufacture of light and heavy auto trucks, at Bellingham, Wash. Approximately $500,000 will be expended.

Seattle, Wash.—Bids are being received by V. W. Voorhies, Eithel Bldg., Seattle, for the construction of a two-story building on 12th Ave., for L. N. Roe, to be used as a commercial garage and machine shop. It will be 118x121 ft., and will cost about $30,000.

Portland, Ore.—The Albers Bros. Milling Co., Portland, has increased its capital from $1,000,000 to $2,500,000 for the purpose of increasing its manufacturing facilities.

Anaheim, Calif.—John H. Smith, Denver, Colo., will establish an ice plant and refrigerating and precooling plant at Anaheim, to cost approximately $25,000.

Dominguez, Calif.—The Los Angeles Motor Truck Co., Los Angeles Investment Bldg., Los Angeles, Calif., will erect five reinforced concrete factory buildings at Dominguez. The site covers an area of about 68,000 sq.ft.

Fresno, Calif.—The Stewart Fruit Co., Fresno, has acquired a site at Ventura and R Sts., and will erect a packing plant, estimated to cost $30,000.

Los Angeles, Calif.—The Martin Shock Absorber Co. has taken out a permit to erect a new factory on Ascot Ave., Los Angeles.

Newhall, Calif.—Clampitt Bros. are considering the erection of a topping plant to handle the product from nine oil wells.

Reedley, Calif.—The Union Oil Co. will erect a distributing plant at Reedley, which will include several tanks.

Richmond, Calif.—The Rebuilt Typewriter Co. of America, Chicago, Ill., has purchased a site at Richmond, and is having plans prepared for the construction of a four-story factory, 75x150 ft. The estimate dcost is $100,000.

San Francisco, Calif.—The Workman Packing Co., San Francisco, is having plans prepare dfor the construction of a four-story canning plant on Harrison St. It will be a fireproof structure.

Santa Rosa, Calif.—The Santa Rosa Shoe Mfg. Co. is having plans prepared for the construction of a new brick factory at Third and F Sts.

Barrie, Ont.—The Underhills, Ltd., plans additions and improvements to its boot and shoe factory at a cost of $10,000. One building of four stories, 48x40 ft. and one of two stories, 68x40 ft. will be erected. Brick construction with concrete foundation.

Bridgeburg, Ont.—The Chicago Bridge & Iron Works, Chicago, Ill., has purchased a site of seven acres near the Lantz Mfg. Co.'s plant, and is having plans prepared for the erection of a Canadian branch.

Peterborough, Ont.—The Bonner-Worth Co., Ltd., McDonnel and Cambridge Sts., will erect an addition to its spinning plant at a cost of $12,000. It will be two stories, 70x80 ft., white brick construction with stone foundation.

Winnipeg, Man.—The Manitoba Bridge & Iron Works plans the erection of a new foundry on Logan Ave. It will be of brick construction, two stories, 63x178 ft. The estimated cost is $28,000.

FEDERAL GOVERNMENT WORK

+Bridge—Portsmouth, N. H.—The Bureau of Yards and Docks has awarded the contract for the construction of a highway bridge at the Portsmouth Navy Yard to SNARE & TRIEST, 143 Liberty St., Ne wYork, N. Y., at $109,700. Noted Dec. 19.

Seawall—Winthrop, Mass.—Bids will be received by Col. Frederic V. Abbot, Corps Engrs, U. S. A., Boston, Mass., until noon, Apr. 10, for the construction of a seawall at Fort Heath, Winthrop, Mass.

+Switchboard—Newport, R. I.—The contract has been awarded to the GENERAL ELECTRIC Co., Schenectady, N. Y., by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the installation of a switchboard in the naval station at Newport, at $11,165.

Post Office—Utica, N. Y.—A bill has been passed authorizing the Secretary of the Treasury to acquire property adjacent to the post office at Utica, cost not to exceed $25,000, for the erection of new post office and government buildings. The bill carries an appropriation of $180,000 to start the work, the total not to exceed $205,000.

Drainage—West Point, N. Y.—Bids will be received until 2 p.m., Apr. 7, by the Quartermaster, West Point, for draining and filling swamps on Constitution Island.

+Lock Gates—Pittsburgh, Penn.—The contract has been awarded to the PENN BRIDGE Co., Beaver Falls, Penn., for furnishing and erecting four steel lock gates, four gate recess covers for Dams Nos. 7 and 9, Ohio River. Bids were opened Feb. 25 by Lieut.-Col. Francis R. Shunk, Corps Engrs, U. S. A., Pittsburgh.

+Post Office—Lewes, Del.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post office at Lewes to GERMAN & TAYLOR, Hurlock, Md., at $36,600. Noted Dec. 12.

Dredging—Wilmington, Del.—Bids were received, Mar. 8, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Wilmington Harbor, Del.: American Dredging Co., Philadelphia, 8.3c. per cu.yd.; Maryland Dredging Co., Baltimore, Md., 9.2c.; Atlantic, Gulf & Pacific Co., New York, 9c.

+Grading—Washington, D. C.—The contract has been awarded to MARTIN DODGE, Landover, Md., by the Commissioners of the District of Columbia, for grading about 17,000 cu.yd., at 39c. per cu.yd. Other bidders were: E. G. Gummell, Washington, 47c.; Warren F. Brenizer, Washington, 40c.

+Cement—Washington, D. C.—The contract has been awarded to the STANDARD PORTLAND CEMENT CO., San Francisco, Calif., for furnishing 30,000 bbl. of portland cement to be used on the Klamath, Umatilla, Okanogan, Yakima and Orland irrigation projects, at 1.40 per bbl., f.o.b., Napa Junction, Calif.

Removal of Wreck—Norfolk, Va.—Bids will be received by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., until noon, Apr. 10, for the removal of the iron barge "Florida," sunk in Hampton Roads, Va.

Dredging—Charlestown, S. C.—Bids will be received until noon, Apr. 10, by Maj. G. P. Howell, Corps Engrs., U. S. A., Charlestown, for dredging in Archers Creek.

+Dredging—Jacksonville, Fla.—The contract has been awarded to P. SANFORD ROSS, INC., Jersey City, N. J., for dredging Sampit Bar and River, Winyah Bay, S. C., at 18.8c. per cu.yd. for 220,880 cu.yd.; total, $41,512.

Post Office,—New Orleans, La.—Bids were received as follows, Mar. 13, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the interior finish of the post office at New Orleans, La.: Norman Ker Co., Washington, D. C., $372,950; Conners Bros. Co., Lowell, Mass., $389,066; Wells Bros. Co., New York, N. Y., $456,500; William H. Maxwell, Phoenix, Ariz., $461,250.

Repairing Dam—Cincinnati, Ohio—Bids will be received by Maj. L. H. Rand, Corps Engrs., U. S. A., Cincinnati, until Apr. 8, for repairing Dam No. 4, Muskingkum River, Ohio.

Post Office—Denison, Iowa—Bids were received as follows Mar. 17, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Denison, Iowa: (a) limestone; (b) sandstone. William O'Neil & Son Co., Faribault, Minn., (a) $48,931. C. E. Atkinson, Webster City, Iowa, (a) $59,961; (b) $60,961. James Corse, Racine, Wis., (a) $48,500; (b) $50,000. General Construction Co., Milwaukee, Wis., (a) $55,589; (b) $57,389. Northern Construction Co., Milwaukee, Wis., (a) $55,600; (b) $58,400. W. D. Lovell, Minneapolis, Minn., (a) $51,785. Joseph B. Betts, Kansas City, Mo., (a) $59,500; (b) same. Noted Feb. 6.

Post Office—Waukesha, Wis.—Bids were received as follows Mar. 15, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Waukesha: (a) limestone; (b) sandstone. George W. Stiles Construction Co., Chicago, (a) $73,825. Northern Construction Co., Milwaukee, Wis., (a) $72,561; (b) $75,661. General Construction Co., Milwaukee, Wis., (a) $68,780; (b) $72,380. American Construction Co., Milwaukee, Wis., (a) $74,200; (b) $78,200. James Corse, Racine, Wis., (a) $70,420; (b) $73,310. Thomas W. Cissell, Washington, D. C., (a) $72,637; (b) $76,000. R. S. Moore, Lefayette, Ind., (a) $75,111; (b) $79,361.

Post Office—Brookings, S. D.—Bids were received as follows, Mar. 14, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Brookings, S. D.: (a) limestone; (b) sandstone: Rogers & Kaiser, Chicago, Ill., (a) $71,376, (b) $73,976; W. D. Lovell, Minneapolis, Minn., (a) $72,990; J. W. Miller, St. Paul, Minn., (a) $73,382; Northern Construction Co., Milwaukee, Wis., (a) $74,890, (b) $77,590; General Construction Co., Milwaukee, Wis., (a) $68,973, (b) $71,973; C. H. Atkinson, Brookings, S. D., (a) $78,852, (b) same; William O'Neil & Son Co., Faribault, Minn., (a) $69,385; Moore & Danner, Kokomo, Ind., (a) $69,975. Noted Feb. 6.

Post Office—Springfield, Mo.—Bids were received as follows, Mar. 13, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Springfield: General Construction Co., Milwaukee, Wis., $96,666; Wise Granite Co., Richmond, Va., $98,900; Hiram Lloyd Building & Construction Co., St. Louis, Mo., $103,313; J. W. Dumas, Jr., Construction Co., Columbia, Mo., $107,400; Springfield Planing Mill Lumber & Construction Co., Springfield, Mo., $115,905. Noted Feb. 6.

Elevator—St. Louis, Mo.—The Otis Elevator Co., Washington, D. C., submitted the following bid to the Supervising Architect for the installation of a hydraulic lift, pump, etc., at the U. S. post office, St. Louis, Mo., $9433, time, June 30, 1913.

Cement—Dallas, Tex.—Bids will be received by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, Tex., until noon, Apr. 10, for furnishing about 9000 bbl. of portland cement.

Cranes—Panama.—Bids will be received until 10:30 a.m., Mar. 26, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for electric traveling cranes, steel rails, angle bars, track bolts, etc., under Circular 764.

Steel Towers—Panama.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Apr. 12, for erecting steel towers for the high-power radio station at Canuto, Canal Zone. The contract includes radio equipment under the supervision of the Bureau of Steam Engineering.

Coal-hoisting Towers—Hawaii.—Bids will be received until 11:3 m. Apr. 19, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for two coal-hoisting towers for the naval station, Pearl Harbor, H. T.

MISCELLANEOUS

+Signal Tower—Orient Heights, Mass.—The general contract has been awarded to the BARROWS-STEWART CO., Marshall Bldg., 40 Central St., Boston, Mass., for the construction of a steel and concrete signal tower for the Revere Beach & Lynn R.R. Co., at Orient Heights.

Underpasses—Springfield, Mass.—The Boston & Albany R.R. has had plans prepared for the construction of underpasses at Dwight and Water Sts. F. B. Freeman, Boston, Mass., is Ch. Engr.

Canal—Hartford, Conn.—The State Board of Rivers, Harbors and Bridges, Hartford, has ordered an estimate of cost made for the construction of tde proposed 10-mile canal from the Connecticut River at Middletown, Conn., to New Britain, Conn.

Drainage—Buffalo, N. Y.—The Board of Aldermen has approved the bill authorizing the city to spend $185,000 for abatement of floods in the North Genesee St. District, and the draining of Scajaquada Creek.

Piers—New York, N. Y.—The Sinking Fund Commission of the city of New York, Mar. 5, ordered that plans be prepared for the construction of two new piers on the Hudson River. One of the piers will be located at the foot of West 46th St., and one will be located at the foot of West 44th St. The two piers will cost $4,000,000.

+Engine Houses—New York, N. Y.—We are officially advised that the Fire Dept., 135 East 67th St., has awarded contracts as follows for the construction of new engine houses; To FRANK J. FELGENHAUER, 4 Court Square, Brooklyn, for an engine house at Sheffield, Ave. Brooklyn, at $35,587; to GEO. F. DRISCOLL, 548 Union St., Brooklyn, at $36,429, for a house at Grand St., Queens, and at $36,872, for one at Fish Ave., Queens to the GEORGE F. HILTL CO., 114 East 28th St., Manhattan, at $32,400, for a house at Jamaica Ave., Queens, and at $35,708, for one at Metropolitan Ave., Queens. Bids were received on Mar. 10. Joseph Johnson is Comr.

Street Signs, Lumber and Stone—New York, N. Y.—Bids will be received by Maurice E. Connolly, Pres. Boro. Queens, Long Island City (Info.), N. Y., until 11 a.m., Mar. 24, for street signs, broken stone, lumber, five 10-ton steam road rollers, road oil, paving blocks, etc.

Ferry Boat—New York, N. Y.—Bids will be received by Calvin Tomkins, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, until noon, Apr. 10, for Contract No. 1323, which provides for the construction and delivery of one steel, screw-propelling ferry boat.

+Seawall, Etc.—New York, N. Y.—We are officially advised that Maurice E. Connolly, Pres. Boro. of Queens, Long Island City, has awarded the following contracts, from bids received on Mar. 14: To J. DI BENEDETTO, 627 East 222d St., at $25,560, for the construction of a concrete seawall, together with all work incidental thereto, to replace the present wall on the Willetts Point Road, beginning at a point 650 ft. west of Bell Ave. and extending to a point 2050 ft. westerly therefrom, Third Ward; to CHARLES A. MYERS, 230 Mulberry St., at $9000, for furnishing and delivering 8000 cu.yd. of sand in the Borough of Queens; to the NEW YORK TRAP ROCK CO., 17 Battery Place, for furnishing and delivering to the Bureau of Highways in the Boro. of Queens, of broken stone and screenings of trap rock in the Borough of Queens; to the BARBER ASPHALT PAVING CO., Woolworth Bldg., at $5919, for furnishing and delivering to the Bureau of Highways 170,000 wood paving blocks in the Second, Third and Fourth Wards, Borough of Queens; to FRANK S. HUTCHINSON, Flushing, at $4562, for furnishing and delivering bituminous road surfacing material (tar or asphalt) in the Borough of Queens, and at $10,140, for furnishing and spreading light road oil and sand or refined tar and sand in the Second, Thir, Fourth and Fifth Wards of the Borough of Queens; to J. DI BENEDETTO, 627 East 222d St., at $15,215, for constructing a concrete wall on the Shore Road, between Hoyt Ave. and Woolsey Ave., First Ward. Noted Mar. 6.

Car Shed—Atlantic City, N. J.—The Atlantic City & Shore R.R. Co. will construct a car shed. The cost has been estimated at $30,000.

+Ditches—Jersey City, N. J.—Bids were received Feb. 21, by the Mosquito Extermination Commission of Hudson County, for about 100,000 ft. of drainage ditches, to be made on the salt marsh meadows of Hudson County at various points, beginning at the Bergen County line on the north and extending along either side of the Hackensack River to the Kill von Kull; also repairing and cleaning to a depth of 30 in., about 315,000 ft. of old ditches covering the territory above described. Louis E. Jackson, Jersey City, is Secy. The contract has been awarded to JESSE P. MANAHAN, Red Bank.

Elimination of Grade Crossings—Trenton, N. J.—The Pennsylvaia R.R. Co. is considering an expenditure of $5,000,000 within the next two years for the elimination of grade crossings in Trenton. All main line crossings will be removed, the freight station on East State St. will be moved to Perry St. and the passenger station will be enlarged and remodeled.

+Station Platforms—Philadelphia, Penn.—The contract has been awarded to the KEYSTONE STATE CONSTRUCTION CO., Philadelphia, for erecting two concrete station platforms for the Pennsylvania R.R. Co., at its North Philadelphia station, at $30,000.

Metal Lockers—Philadelphia, Penn.—Bids will be received by the Board of Education, addressed to A. F. Hammond, Supt. of Supplies, City Hall, until 2 p.m., Mar. 27, for furnishing and installing metal lockers.

+Cement—Richmond, Va.—The contract was awarded, Feb. 27, by the Administrative Board to the STEPHEN A. ELLISON CO., for furnishing 20,000 bbl. of cement, at $1.49 per bbl.

Cable—Jacksonville, Fla.—The contract for the underground cable necessary in the lighting of the business section of the city has been awarded to the FLORIDA ELECTRICAL CO., Jacksonville, at $115,000.

Drainage Ditches—Arcadia, Fla.—Bids will be received until Apr. 8, by the Desoto County Commissioners, Arcadia, for construction of about 48 miles of drainage ditches in the Murdock Drainage District. The work will require the excavation of 600,000 cu.yd.

Docks—Miami, Fla.—The Commissioners of Dade County are considering the construction of docks and wharves on Biscayne Bay. They have petitioned the Legislature for permission to issue bonds for the purpose.

Levee Work—Shreveport, La.—Bids will be received until Apr. 2 by the Caddo Levee Board, Shreveport, for the construction of levee work to cost $230,000. The bids opened Mar. 5 for this work were rejected. W. A. Kelley is Secy.

Drainage—Huntington, Tenn.—The County Surveyor, Huntington, is chairman of a committee of an organization formed at Huntington for the purpose of draining a large area of land in Carroll County.

Mausoleum—Paducah, Ky.—The West Kentucky Mausoleum Co., Paducah, has plans for the construction of a reinforced-concrete mausoleum to cost $45,000. It will be 100 x 130 ft.

+Boilers—Cincinnati, Ohio.—The contract has been awarded to the TUDOR BOILER WORKS, Cincinati, for the boilers to be installed in the new Hotel Gibson. G. W. Drach and Bert Baldwin are Assoc. Archs.

Ditch—Salem, Ohio.—Bids will be received until Apr. 1 by the County Commissioners, Salem, for the construction of a county ditch. B. M. French is Engr.-in-Charge.

Ditch—Bluffton, Ind.—Bids will be received until 2 p.m., Mar. 22, by C. W. Decker, Supt. of Const., Bluffton, for the construction of the Arthur Kelly Ditch.

River Improvement—Springfield, Ill.—The Internal Improvement Commission of Illinois, Springfield, has completed its survey for the improvement of the Kaskaskia River, running through the eastern section of the counties of St. Clair, Shelby, Fayette, Clinton, and Randolph. It is estimated that the work will cost about $1,000,000.

Ditch—Eastherville, Iowa.—Bids were not opened Mar. 4, for the construction of Joint Drainage Ditch 17, as the matter of establishment of the district has not yet been decided by court. Cost, $145,000.

Dredge Boat Work—Oregon, Mo.—Bids will be received until 1 p.m., Mar. 22, by W. M. Morris, Secy. Nodaway Drainage District No. 1, Oregon, for dredge boat work, aggregating about 140,000 cu.yd.

Drainage—Lonoke, Ark.—The Commissioners of Indian Bayou Drainage District are planning for the drainage of the territory lying between the Indian Bayou and the Jefferson County Line. The cost of the project is estimated at $125,000. C. M. Witherspoon is Pres., Lonoke.

Dredge Ditches—Newport, Ark.—Bids will be received by the Board of Commissioners of Overcup Drainage District of Jackson and Woodruff Counties, at the office of Jones & Campbell, Newport, for the construction of about 30 miles of dredge ditches. The Morgan Engineering Co., Goodwyn Institute, Memphis, Tenn., is Engr.-in-Charge.

Drainage—Piggott, Ark.—The Central Clay Drainage District, Piggott, on Mar. 6, sold bonds for $500,000 for drainage work.

Drainage Work—Donna, Tex.—Bids will be received by G. B. Merriweather, Chn. Hidalgo Drainage District Comrs., Donna, for drainage work in the district. The work will involve grubbing and cleaning right-of-way about 500 ft. wide, containing 2310 acres of land in Sections 1, 2, 3, 4, 5, 7 and 8; for 67,000 cu.yd. excavation, erection of bridge and grubbing and clearing about 117 acres of land in a strip 500 ft. wide and 9 miles for drainage in Section 6.

+Dock—Tacoma, Wash.—The contract for constructing a dock for the Commercial Dock Co., has been awarded, it is reported, to CORNELL BROS., Savage-Scofield Bldg., at $30,000.

Channel Work—Sacramento, Calif.—The state of California is considering straightening the channel of the Mokelume River between Reclamation Dist. 348 and the island. The work will require the moving of 488,700 cu.ft. of earth. Estimated cost, $15,000.

+Bath House—San Bernardino, Calif.—MYZELLE & IMHOFF have been awarded the contract for the construction of a bath house and plunge at Urbita Springs for the Pacific Electric Ry. Co. It will be 96x150 ft., with plastered exterior over metal lath, tile roof and towers, cement plunge, 25 tub baths, private baths, dressing rooms and parlors. The cost will be $40,000.

Tunnel—San Francisco, Calif.—The Board of Public Works has directed the City Engineer to prepare plans for the construction of the Fillmore St. Tunnel.

Tunnel—San Francisco, Calif.—Bids will be received until Apr. 9, by the city, for the construction of a tunnel with approaches in Stockton St., between Sutter and Sacramento Sts. Noted Mar. 6.

Wharf—San Francisco, Calif.—The State Board of Harbor Commissioners have approved plans for the construction of Pier 45. This pier will be built near the mouth of the channel south of the Pacific Mail docks. It will be 800x200 ft. Estimated cost, $200,000.

Pier—Santa Monica, Calif.—The Great Western Amusement Co. has asked the City Council for a franchise for the construction of a pier, to cost $250,000.

+Bulkhead—Venice, Calif.—The contract has been awarded to CHARLES STANSBURY, 407 H. W. Hellman Bldg., Los Angeles, Calif., for constructing a concrete bulkhead with a protecting deck along a portion of the Ocean Front Walk and the Strand and across intersecting streets between Dorothy and Clark Aves.

Ferry Terminal—Cape Tormentaine, N. B.—Bids will be received until noon, Apr. 8, by L. K. Jones, Secy. Dept. Rys. and Canals, Ottawa, Ont., for the construction of a car ferry terminal at Cape Tormentine, N. B.

Breakwater—London, Ont.—The City Council is considering the construction of a breakwater.

BUILDINGS

Boston, Mass.—Bids will be received until Mar. 24, for the erection of a municipal building in Ward 7. Manus J. Fish, 100 Summer St., is Supt. of Pub. Wks.

A bill was favorably reported Mar. 13 in the Massachusetts House of Representatives providing for the erection of an addition to the state house. It will be of marble. The estimated cost is $600,000.

✦New Bedford, Mass.—The contract for the construction of a high school on Cherry St., has been awarded to GEO. W. HOWARD & SONS, 638 Warren Ave., Brockton. It will be of brick and stone, three stories. The estimated cost is $420,600. W. R. B. Remington is Chn. of Com. Clough & Wardner, 46 Cornhill, Boston, are Archs. R. D. Kimball, 6 Beacon St., Boston, is Steam Engr.

Springfield, Mass.—Plans for the proposed High School of Commerce have been prepared by Kirkman & Parlett. It will be 220x240 ft. three story and basement. The estimated cost is $600,000. J. A. Dennison Mayor.

✦Webster, Mass.—The contract for the erection of the $50,000 school for Sacred Heart Parish has been awarded to VIRGIL DORAIS, Worcester, Mass. Noted Nov. 28.

Webster, Mass.—Bids will be received at once for a church for St. Joseph's Parish to be built at Whitcomb and Maynard Sts. The estimated cost is $90,000. Rev. Anthony A. Cyran is Pastor.

✦Worcester, Mass.—The contract for the construction of an addition for the Worcester Storage Co., on Clinton St., has been awarded to the E. J. CROSS CO., 82 Foster St.

A site has been chosen for a normal school to be built by the State Board of Education. David Snedden is Chn., 15 Ashburton Pl., Boston.

Providence, R. I.—The Terminal Warehouse Co., will erect a five-story ware house 100x200 ft. on Allend Ave.

Plans have been prepared by Clark, Howe & Homer, Archs., for the construction of a school for the Lincoln School Inc. The estimated cost is $100,000. James Richardson, is Pres. of Trustees.

New Haven, Conn.—Plans are being prepared for a building at the Crittenden Home for Children in Allingtown. It will be 40x125 ft., three stories and basement, of hollow tile blocks and stucco construction with tile roof. C. F. Townsend 55 Church St., New Haven, is Arch.

Albany, N. Y.—Charles G. Ogden, Arch., Albany, is revising plans for improvements to the Central Y. M. C. A. building. The estimated cost is $60,000.

Isaac Hough, Hough Block, State St., contemplates the erection of a 14-story hotel on Columbia St., between North Pearl St. and Broadway.

Buffalo, N. Y.—Plans are being drawn for a 3-story 75x110 ft. Club House to be erected by the Fraternal Order of Eagles at Pearl and Tupper Sts.

A site has been purchased by the city for a library, gymnasium and assembly hall on Niagara St. near Hamilton St. 70x163 ft. and the preparation of plans for the building authorized. Francis G. Ward, is Comr. of Pub. Wks.

✦Buffalo, N. Y.—The general contract for the construction of the Hutchinson high school has been awarded to the DUROLITHIC CO., Buffalo, at $567,000. Noted Mar. 6.

Lockport, N. Y.—Chester R. Phelps, Arch., has revised plans for an addition to the courthouse. The estimated cost is $75,000. Noted Feb. 18.

✦New York, N. Y.—Valentine & Kissam, Archs., 346 Fourth Ave., have awarded a contract to the W. L. CROW CONSTRUCTION CO., 103 Park Ave., for the construction of a seven-story building, 100x50 ft., at 121 East 29th St., for the Anthony Home for Working Girls.

✦Robert Goelet, 9 West 17th St., has awarded a contract to the LIBMAN CONTRACTING CO., 107 West 46th St., for the erection of a three-story theater and mercantile building, 162x100 ft., at the southeast corner of Broadway and 50th St. James F. Connell, Mariners Harbor, S. I., is the Arch. The estimated cost is $250,000.

✦Goldwin, Starrett & Van Vleck, Archs., 45 East 17th St., have awarded a contract to E. BROOKS & CO., 1 East 41st St., for the construction of the department store to be erected on Fifth Ave., between 38th and 39th Sts., for Lord & Taylor, Fifth Ave. and 20th St. It will be ten stories high ,200x148 ft., and is owned by Mrs. J. H. & F. V. Burton Co., 384 Broadway. The estimated cost is $2,000,000. Noted Feb. 13.

Plans have been completed by Cross & Cross, Archs., 527 Fifth Ave., for the construction of a nine-story apartment house at 111 East 53d St., for the 118 East 54th St. Co., 516 Fifth Ave. The estimated cost is $160,000.

Plans have been filed by Daus & Otto, Archs., 134 Fulton St., for the construction of a six-story home, 100x40 ft., to be erected on 8th St., near Third Ave., for the Society of Catholic Mechanics, 261 West 137th St. The estimated cost is $60,000.

Plans have been filed by J. C. Cocker, Arch., 2017 Fifth Ave., for the construction of a six-story apartment house on Northern Ave., near 181st St. It will be built for the Trosacho Realty Co., 40 East 22d St. The estimated cost is $171,000. Noted Feb. 6.

Plans have been filed by Heidelberg & Lury, Archs., 320 Fifth Ave., for the construction of a six-story hospital clinic for the Hospital of Deformities and Joint Diseases. It will be 90x34 ft. and will be erected on 123d St., near Madison Ave. The estimated cost is $90,000.

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a 12-story apartment house to be erected on the northeast corner of Riverside Drive and 141st St., for Newmark & Davis, 435 West 119th St. The estimated cost is $300,000.

Plans have been filed by Mann & McNeille, Archs., 70 East 45th St., for the construction of an 11-story hotel, on 152d St., near Riverside Drive, for John Muir, 17 West 86th St. The estimated cost is $120,000.

(Boro. The Bronx.) The City of New York has filed plans for the construction of a new fire house, on Mt. Hope Ave., near 175th St. It will be three stories high, 52x42 ft., of brick. Boehmer, Hering & Burkhardt, 175 Fifth Ave., Manhattan, are the Archs. The estimated cost is $47,000.

(Boro. The Bronx.) Plans have been filed by Neville & Bagge, Archs., 217 West 125th St., Manhattan, for the construction of a two-story brick theater, 154x163 ft., on Boston Road, near 167th St., for the Weisgayer Amusement & Construction Co. The estimated cost is $100,000.

✦Schenectady, N. Y.—The general contract for the construction of the gymnasium building for Union College has been awarded to the AMSTERDAM BUILDING CO., 43 West 27th St., New York. Noted Dec. 26.

Perth Amboy, N. J.—The Y. M. C. A. will soon advertise for bids for the erection of a new four-story building for its use on Jefferson St. Shattuck & Hussey, Archs., Chicago, Ill. The estimated cost is $95,000. S. M. Lipscomb is Secy.

Cresson, Penn.—The Pennsylvania R.R. will erect a passenger station at Cresson. The estimated cost is $40,000. A. S. Vogt is Mech. Engr., Altoona, Penn.

Erie, Penn.—The Board of Education will ask bids about Apr. 1, for the construction of a three-story brick building at East Ave. and Sixth St. J. W. Yard & Sons., Penn Bldg., Erie, Archs. About $100,000 will be spent on the work.

North Catasauqua, Penn.—Henry Webber, Secy., 1107 North Third St., North Catasauqua, Penn., will receive bids for the construction of a brick and stone school building. The estimated cost is $42,000.

Philadelphia, Penn.—J. Horace Cook, Land Title Bldg., is receiving bids for the construction of the three-story brick addition to the school building at 59th and Race Sts., for the Board of Education.

✦The contract has been awarded to CRAMP & CO., for the construction of the three-story and basement school building on Third St., between McKean and Mifflin Sts., for the School District of Philadelphia. The estimated cost is $416,855.

✦The contract for the construction of the surgical ward building at 34th and Spruce Sts., for the University of Pennsylvania Hospital, has been awarded to IRWIN & LEIGHTON, 126 North 12th St.

The Supreme Council of the Loyal Order of Moose will erect a college for the education of the children of the Loyal Order of Moose The estimated cost is $1,000,000.

J. F. Bradley is planning the erection of the theater, 80x197 ft., on Main St., near Green Lane, Manayunk, for the Mozart Amusement Co. The estimated cost is $120,000.

M. Weinmann has purchased a site at 4032 Market St., for a syndicate, which will erect a theater thereon. The estimated cost is $150,000.

Pittsburgh, Penn.—F. C. Sauer, Arch., is preparing plans for the construction of a three-story club building at Fifth Ave. and Jumonville St., for Pittsburgh Lodge No. 11, B. P. O. E. The estimated cost is $200,000. Noted Feb. 27.

The B. F. Jones Estate will erect a hotel on Liberty Ave. The estimated cost is $5,000,000.

Plans have been announced by the Pittsburgh Masons, for the construction of a temple at Fifth Ave., between Tennyson and Lyton Aves. The estimated cost is $1,500,000.

✦The CHESSNE CONSTRUCTION CO., Bessemer Bldg., has been awarded the general contract for the construction of St. Regis Home, in Ann St., to cost $70,000. The building will be four stories high, of brick construction, 60 x90 ft.

✦The contract has been awarded to the PENNSYLVANIA MARBLE & MOSAIC CO., Jenkins Arcade Bldg., for the marble work to be used in the remodeling of the Allegheny County Court House, made necessary by the removal of the "Hump." William F. Trimble & Sons, Penn Ave., are the general contractors.

Ridgway, Penn.—Bids will be received until noon, Mar. 28, by G. F. Greiner, 27 Rigway Nat'l Bank Bldg., for the construction of a stone edifice for the First Evangelical Lutheran Church of Ridgway.

✦Wilmington, Del.—The contract for the construction of the church edifice at Park Place and Van Buren St., for the First Church of Christ, Scientist has been awarded to WILLIAM D. HADDOCK & CO.

✦Baltimore, Md.—The contract has been awarded to J. L. ROBINSON CONSTRUCTION CO., Knickerbocker Bldg., Baltimore, for the construction of a clubhouse for the Germania Maennerchor. Walter M. Gieke, Gunter Bldg., is Arch.

✦Charlottesville, Va.—The contract has been awarded to the KING LUMBER CO., Charlottesville, Va., by the Young Men's Christian Association, for the construction of a building, Shattuck & Hussey, Association Bldg., Chicago, Ill., and A. Ten Eyck Brown, Forseythe Bldg., Atlanta are Assoc. Arch. The estimated cost is $450,000.

Petersburg, Va.—Bids will be received until Apr. 20, by A. W. Walch, Secy. 22 McIlwaine Bldg., for the construction of a Y. M. C. A. building, 60x40 ft. Shattuck & Hussey, Chicago, Ill., and S. Daly Craig, Petersburg, Va. are Archs. The estimated cost is $65,000.

✦Richmond, Va.—The contract has been awarded to H. L. MATTHEWS, Richmond, Va., at $84,000, for the construction of a three-story brick, stone and concrete Y. M. C. A. building, Noland & Baskerville, are Archs., Richmond.

Richmond, Va. Bids will be received about May 15, by Carneal & Johnston, Archs., for the construction of a hotel for the Davis Hotel Co. The estimated cost is $80,000.

✦Spartanburg, S. C.—The contract for 500 tons of fabricated steel to be used in the construction of the office building at Morgan Sq., has been awarded to the ROANOKE BRIDGE CO., Roanoke, Va. Noted Feb 20.

✦Atlanta, Ga.—The contract has been awarded to MILES & BRADT, for the erection of the edifice for the Church of Christ, Scientist. Dougherty & Robertson are Archs. The estimated cost is $87,000

Atlanta, Ga.—The lowest bidder for the construction of a Y. M. C. A. building was the King Lumber Co., Charlottesville, Va., at $277,158

✦Vidalia, Ga.—The contract for the construction of the masonic temple at Vidalia, has been awarded to J. F. DARBY

Jacksonville, Fla. Plans are being considered by Success Council, No. 18, Junior Order, United American Mechanics

for the construction of a three-story brick lodge building. The estimated cost is $50,000.

Indianapolis, Ind.—The Grand Lodge, Improved Order of Red Men, will erect a hotel at Capitol and Market Sts. The estimated cost is $300,000. Charles Weatherhogg is Arch., Ft. Wayne, Ind.

+Indianapolis, Ind.—The general contract has been awarded to HENRY DOLLMAN, 1302 Merchants Bank Bldg., for the construction of a thater for F. W. Sanders, 1023 Shelby St.

+Kokoma, Ind.—The general contract has been awarded to FRANK MEDLAND, Logansport, for the construction of a hospital for St. John's Academy.

Detroit, Mich.—Bids will be received until Mar. 28, by Baxter, O.Dell & Halpin, Archs., 1024 Hammond Bldg., for the construction of a brick and steel armory, for Troop Detroit Cavalry.

The Whitney Realty Co., 604 Whitney Bldg., will erect an 18-story office building on Washington, Grand Circus Park and Woodward Aves.

+Muskegon, Mich.—The Muskegon Theater Co., Carl Long, Secy., will erect a brick and steel theater. SCHLISS & BACHMAN, Grand Rapids, Mich., are Engrs., and Contractors.

Ironwood, Mich.—The plans of Anderson & Williams, Arch., Green Bay, Wis., for a new school at Ironwood, have been accepted by the Board of Education. The estimated cost is $100,000.

Galesburg, Ill.—Plans have been prepared by J. Grant Beadle, Arch., 207 Main St., for the construction of a five-story hotel at Tompkins and Seminary Sts., for S. A. Kelly. The estimated cost is $80,000.

Milwaukee, Wis.—Plans are being considered at the offices of the Chicago & North-Western R.R., for the depot and hotel, to be erected at the foot of Wisconsin St. The estimated cost is $2,000,000.

Mt. Sinai hospital will erect a seven-story hospital building at 12th and Cedar Sts. The estimated cost is $100,000.

Milwaukee, Wis.—Saxe Bros. will erect a 14-story hotel at Third and Sycamore Sts. The estimated cost is $1,000,000.

Milwaukee, Wis.—Improvements, including buildings and sites, contemplated by the Wisconsin Telephone Co., at Milwaukee are to cost $1,500,000. A 10-story building may be erected on the site adjoining the Grand exchange on Fifth St., between Grand Ave. and Wells St.

+Superior, Wis.—The contract for a mercantile building at 13th St. and Tower Ave. has been awarded to JACOBSON BROTHERS. Cost, $50,000. Noted Jan. 9.

Des Moines, Iowa—The J. I. Case Co., Racine, Wis., will erect a six-story concrete building, at Des Moines. The estimated cost is $200,000.

Des Moines, Iowa—Plans have been prepared by Proudfoot, Bird & Rawson, Archs., Flyn Bldg., for the construction of the Empress Theater for Elbert & Gretchell.

Dubuque, Iowa—The B. P. O. E. will erect a three-story club building at Locust and Seventh Sts. The estimated cost is $100,000.

+Duluth, Minn.—The contract for the construction of the Boston store building, at 13th St. and Tower Ave., has been awarded to JACOBSON BROS., Duluth.

St. Louis, Mo.—Plans have been prepared for the construction of a club house for the Midland Valley County Club. The estimated cost is $150,000. F. R. Canter is Pres.

+Little Rock, Ark.—The general contract has been awarded to WINDHAM BROS., Birmingham, Ala., for the construction of the four-story building, to be erected at Ninth St. and Broadway. F. M. Blaisdell, Little Rock, is Arch.

Dallas, Tex.—The Union Terminal Co. will erect a Union depot at Dallas. Jarvis Hunt is Arch., Chicago, Ill. The estimated cost is $3,000,000.

Denison, Tex.—Bids will be received until Mar. 26, by J. D. Yocum, City Secy., for the construction of a three-story, steel and reinforced-concrete high school. A. O. Watson is Arch., Austin, Tex.

El Paso, Tex.—Trost & Trost, Archs., are preparing plans for the construction of a ten-story office building on the site of the First National Bank at San Antonio and El Paso Sts. The estimated cost is $200,000.

+Houston, Tex.—The contract has been awarded to W. E. WOODRUFF for the construction of the building for the Sid Westheimer Co. The structure will be four stories high, of brick and reinforced concrete. The estimated cost, $50,000. Noted Nov. 14.

+San Antonio, Tex.—The contract has been awarded to E. NIGGALL & SON, at $61,000, for the erection of the dormitory for St. John's Orphanage.

+Waco, Tex.—The contract for the erection of the masonic temple has been awarded to FELLS & AINSWORTH, at $65,000. Noted Dec. 5.

+Salt Lake City, Utah—The contract for the construction of the bank building for the Farmers & Stockgrowers Bank has been awarded to OLIVER HODGSON, Salt Lake City.
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+Spokane, Wash.—The contract has been awarded to the Hurley-Mason Co., for the construction of the department-store building for Patrick Welsh.

Portland, Ore.—A. C. Going, 462 Wasco St., will erect a six-story reinforced-concrete apartment house at 10th and Lovejoy Sts. The estimated cost is $165,000.

Alahambra, Calif.—Bids will be received until 9 a.m., Mar. 22, for erecting a city hall. The estimated cost is $40,000. Parkinson & Bergstrom, Los Angeles, are Archs.

Davis, Calif.—The Davis Supply Co. contemplates erecting a three-story hotel and business block in Davis. The estimated cost is $150,000.

+Fresno, Calif.—The contract has been awarded to D. A. COWAN at $36,000 for the construction of a one-story brick lodge building for the Knights of Pythias. It will be 75x700 ft., of brick and stone construction. Starbuck & Clark are Archs.

Los Angeles, Calif.—A syndicate represented by Ira W. Byrnes, 220 Coulter Bldg., Los Angeles, contemplates erecting a reinforced-concrete hotel at Spring and Franklin St. Dennis & Farwell are Archs.

Pasadena, Calif.—The Citizens' National Bank will erect a seven-story and basement reinforced-concrete office building at East Colorado St. and Marengo Ave. The cost will be about $100,000. Parkinson & Bergstrom, Security Bldg., Los Angeles, are the Archs.

Sacramento, Calif.—The State Legislature is contemplating erecting a 10-story office building on Tenth St., opposite the Hotel Sacramento, to house overflow offices from the capitol.

San Diego, Calif.—The Simpson Construction Co., American Bank Bldg., is the low bidder at $67,000 for the erection of an Exposition building at San Diego, for the Southern California Panama Exposition Commission. C. L. Wilson is Mgr., Chamber of Commerce, Los Angeles. Noted Feb. 20.

+Santa Barbara, Calif.—The general contract has been awarded to E. F. EDWARDS, East Pedrogosa St., for the construction of the Y. M. C. A. building at Chappela and Carillo Sts.

San Francisco, Calif.—C. F. Hornung will erect a five-story and basement reinforced-concrete building on Valencia St., south of 16th St. Rhodes & Marisch are Archs.

The Metropolitan Life Insurance Co. will erect a three-story adidtion to their building at Pine and Stockton Sts. The estimated cost is $100,000. Miller & Colmesnil, Lick Bldg., are Archs.

Ottawa, Ont.—Bids will be received until 4 p.m., Mar. 31, by R. C. Desrochers, Secy., Dept. of Pub. Wks., for the construction of a Customs building on Mackenzie Ave., Ottawa.

Ross & McDonald, Archs., Montreal, Que., have plans for the addition of two stories on the present store of A. E. Rea & Co., Ltd., at Ottawa, Ont., also an entire new addition adjoining the present premises on the north, to be seven stories high.

INDUSTRIAL NOTES

The Forest Service of the United States Dept. of Agriculture has announced that bids will be received until Apr. 1, by the District Forester, Missoula, Mont., for the purchase of 267,000,000 board feet of timber in the Priest River Valley, Kaniksu National Forest, Idaho. It is standing timber, and the object of the department is to clear this part of the area for agriculture, instead of providing for forest renewal. When the tract has been cleared of timber the land will be thrown open to homesteading. If the Forest Service does not sell off the timber before opening the land to entry, the value of the present stand of timber would result in the land being held for speculative purposes instead of being cleared for farms. The timber offered for sale is on the Priest River watershed in three tracts or "logging chances," located, respectively, on the upper West Branch of the Priest River, on the main Priest River and on the lower West Branch. It is in the northwest corner of Idaho, and extends 40 miles north of the Great Northern R.R. Priest Lake is 20 miles long. On the Upper West Branch Chance there is approximately 146,000,000 ft. of timber offered for sale; on the Priest River Chance, 32,000,000 ft., and on the Lower West Branch Chance, approximately 66,000,000 ft. The upper and Lower Branches offer difficulties to driving, but the timber on the main Priest River Chance must be driven. If the timber is to be transported by stream, the longest driving distance is 30 miles.

The timber consists of several species. White pine and larch predominate, with a considerable amount of cedar, Douglass fir, yellow pine, spruce and some hemlock and white fir. More than half of the timber to be cut is white pine, and about one-fourth is larch.

Conditions are exceptionally favorable for the construction of a logging railroad from the Great Northern R.R. at Priest River to reach the timber on the Upper and Lower West Branch Chances. In addition to the usual great advantages of railroad logging, such a railroad should have a large residual value at the end of cutting operations in connection with these sales, for there is approximately 200,000,000 ft. of privately owned timber interspersed with that belonging to the Government on the sale areas. Furthermore, a short extension of the railroad of about five miles from the Upper West Branch Chance to the foot of Priest Lake will tap a body of timber of approximately one billion feet, of which the Government owns seven hundred million. The Government timber on the lake will be sold from time to time. In addition to the merchantable timber around the lake there is also a great amount of young growth which will be come merchantable in due time. A mill set on the lake at the terminus of the railroad could handle all of the timber included in the Upper and Lower West Branch Chances and also the timber tributary to the lake when it is ready for cutting. Such a railroad would have an indefinite life, serving the important agricultural development which will undoubtedly take place within the next few years following the cutting in the Priest River and Lake valley, on the 35,000 acres, approximately, of agricultural land. This agricultural area is Government land and will be open for entry after the timber is removed. Twenty-six miles of main line from the town of Priest River on the Great Northern R.R. will be required to handle the timber on the West Branch Chances. In addition to the main line approximately 53 miles of spurs will be required. Full information may be obtained from the Forest Supervisor, Newport, Wash.

The Allis-Chalmers Manufacturing Co. has been formed and will succeed the old Allis-Chalmers Co. The new company has purchased at foreclosure sale the plants of the old company and has obtained working capital by assessments on the old stock. The lack of funds to finance the business coupled with small profits was the reason for the failure of the old company.

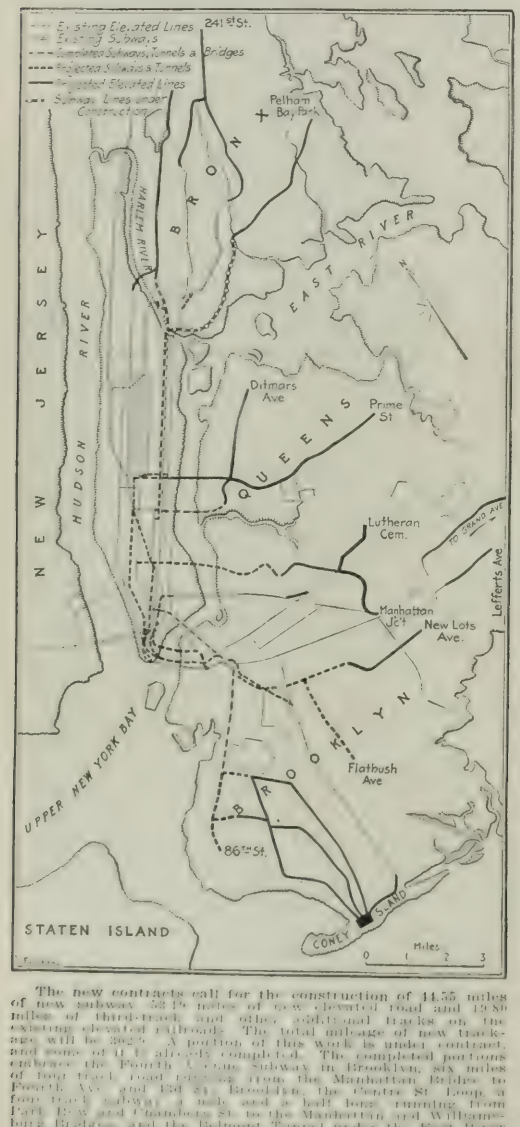
The officers are: John H. McClement of, New York Chairman of the Board of Directors, and Otto H. Falk, of Milwaukee, President.

The Executive Committee: Frederick Vogel, Jr., Pres., of the First National Bank of Milwaukee; Gustave Pabst, Chairman of the Pabst Brewing Co., J. D. Mortimer, President of the Milwaukee Heat, Light & Traction Co.; Oliver C. Fuller, head of the Wisconsin Trust Co. of Milwaukee, and the Messrs. McClement and Falk. The company will manufacture the same line of equipment as the old Allis-Chalmers Co.

NEW RAPID TRANSIT LINES IN NEW YORK

A delay occurred after the following was written, but it is expected that, by the time this paper reaches the readers, that it will be substantially correct.

The Board of Estimate and Apportionment of the City of New York, the Public Service Commission for the First District, the Interborough Rapid Transit Co. and the New York Municipal Railway Corporation (Brooklyn Rapid Transit) have concluded their negotiations for the construction and operation of the new rapid transit lines in New York City. These new lines comprise what is known as the Dual System of rapid transit, so called, for the reason that two companies already extensively engaged in City transportation, namely, the Interborough and the Brooklyn Rapid Transit companies, are to get leases for the operation of the new system.



The new contracts call for the construction of 14.55 miles of new subway, 5.2 miles of new elevated road and 12.80 miles of third-track and other additional tracks on the existing elevated railroads. The total mileage of new trackage will be 38.6. A portion of this work is under contract, and some of it is already completed. The completed portions embrace the Fourth Ave. Subway in Brooklyn, six miles of four-track road running from the Manhattan Bridge to Fourth Ave. and 53d St., Brooklyn, the Centre St. Loop, a four-track subway 1 mile and a half long, running from Park Row and Chambers St. to the Manhattan and Williamsburg Bridges, and the Belmont Tunnel under the East River from 42d St., Manhattan to Long Island City. There is some work yet to be done on all of these lines, but all are practically completed, and the remaining work will occupy only a few months.

Other work, under contract consists principally of the construction of the Lexington Avenue Subway, which is now going on from 53d St. and Lexington Ave. northward to and under the Harlem River and thence to 167th St. and River Ave. in The Bronx. Work is also in progress on the final section of the Southern Boulevard extension of the Lexington Avenue Subway in 138th St. and Southern Boulevard, between Alexander Ave. and 147th St. These two subways are a part of the lines to be operated by the Interborough Rapid Transit Co. Of the lines to be operated by the New York Municipal Railway Corporation (Brooklyn Rapid Transit), work is already going on in the lower part of Manhattan on that portion of the Broadway Subway, between Morris St. and Trinity Place on the south and Bleecker St. and Broadway on the north. Contracts recently have been let for elevated railroads in the Borough of Queens. These lines will be operated jointly by the Interborough and Brooklyn companies. Work will begin at once upon construction of 19 miles of elevated railroad in the Boro. of Queens. These lines will be operated jointly by the Interborough and Brooklyn companies. All extensions of the subway system, whether underground or elevated, will be owned by the City of New York, although both companies contribute toward the cost of their construction.

The Dual System plans are an evolution of the plans for the Tri-Borough System, adopted by the Public Service Commission in 1907-1908 and 1909. They are substantially the same as those approved by the Board of Estimate and Apportionment in May, 1912, the chief features of which were the extensions of the existing subway from 42d St. up Lexington Ave., with branches in The Bronx, and down Seventh Ave. to the lower part of Manhattan, with a tunnel to Brooklyn and an extension out Eastern Parkway, Brooklyn—for operation by the Interborough company; and the tieing in of the existing elevated railroads in Brooklyn, owned by the Brooklyn Rapid Transit Co. with the Fourth Avenue Subway in Brooklyn and the Centre Street Loop in Manhattan, both owned by the City, the extension of the Fourth Avenue Subway down Fourth Ave., from 43d St. to 89th St., and the third-tracking and extension of the principal Brooklyn elevated railroads. The crosstown line, which has generally been known as the Greenpoint line, running through Franklin Ave., for the present has been abandoned. With the starting of construction of the Queens elevated lines, work will be going on in four boroughs—Manhattan, Brooklyn, The Bronx and Queens. Contracts will be awarded at the earliest possible time for the construction of the East River tunnels and other parts of the Dual System. The proposed tunnel from Brooklyn to Staten Island, while provided for in the Dual System plan, is left for future construction. Probably the first part of the new system to be placed in operation will be the Fourth Avenue Subway and the Centre Street Loop. If the reconstruction work on the South Brooklyn elevated lines goes on as rapidly as anticipated, these subways should be put into service in from 14 to 18 months. Within a few months also it will be possible to have temporary operation of the Belmont Tunnel by trolley cars or subway trains and transfer to the existing subway.

In perfecting the plans for the Dual System, the Public Service Commission has been almost constantly at work since 1907, when it was created. The first step was taken Dec. 31 of that year, when the Commission laid out the route for the Broadway-Lexington Avenue Subway. In the Commission's effort to enlarge the measure of rapid transit relief, the Broadway-Lexington Avenue and Fourth Avenue Subways grew into the Tri-Borough System, and the latter into the Dual System. In the intervening time many conferences have been held between the Public Service Commission and members of the Board of Estimate, representing the City, and officers of the two transportation companies mentioned. In the final agreement, the plans call for an extension of the rapid transit facilities to cost about $325,000,000 for construction and equipment. The companies are to bear the entire cost of equipment, although it becomes the property of the City, the entire cost of reconstruction and extension of their own lines, and are also to contribute many millions toward the cost of construction of the City lines.

Some of the work now going on was let under contracts awarded on bids received in October, 1910, when parts of the Tri-Borough System were put up for bidding. No contracts were awarded at that time, as the proposals from the transportation companies to join the City in the operation of the new lines were under consideration. In 1911 when the Dual System plan had been evolved, some of the contracts were offered to and accepted by the lowest bidders who had put in their proposals in October, 1910. At the time the Commission received these bids, which were for construction only with municipal funds, it also asked for proposals for the construction, equipment and operation by private capital of the Tri-Borough System. No bids were received under the private capital form of contract, but this was mainly for the reason that the Tri-Borough plan, as a whole, did not appeal to those having private capital to invest in transit leases. Upon modification of these plans the Commission received a number of offers from private companies to join the City in construction in return for an operating lease. First the Interborough Rapid Transit Co. and later the Brooklyn Rapid Transit Co. submitted proposals, and these proposals, after months of negiotiation, were combined in the Dual System arrangement.

It is expected that the new system will be completed by Jan. 1, 1917. When full operation is under way, the Brooklyn Rapid Transit trains will be able to enter Manhattan by means of three bridges across and three tunnels under the East River, and can be operated northward through Broadway and Seventh Ave. to 59th St., and eastward through 59th St. and over the Queensboro Bridge to Astoria and Corona in Queens. On the Brooklyn side the system will include the lines to Coney Island and other remote parts of the borough. Over the whole Brooklyn Rapid Transit system the fare will be 5c., and transfers will be freely given.

On that part of the system to be operated by the Interborough company the length of the 5c. ride also will be greatly extended. A person will be able to ride from Pelham Bay Park, through The Bronx into Manhattan, down the whole length of Manhattan, under the East River to Brooklyn and out Eastern Parkway and Livonia Ave. to New Lots Road for a single 5c. fare.

INDUSTRIAL NOTE

The City of Millville, N. J., will purchase a brick testing rattler to be used in connection with the proposed street paving work, bids for which will be received until Mar. 21, as advertised in the Engineering News of Feb. 27. Newton B. Wade is City Engr.

Engineering News

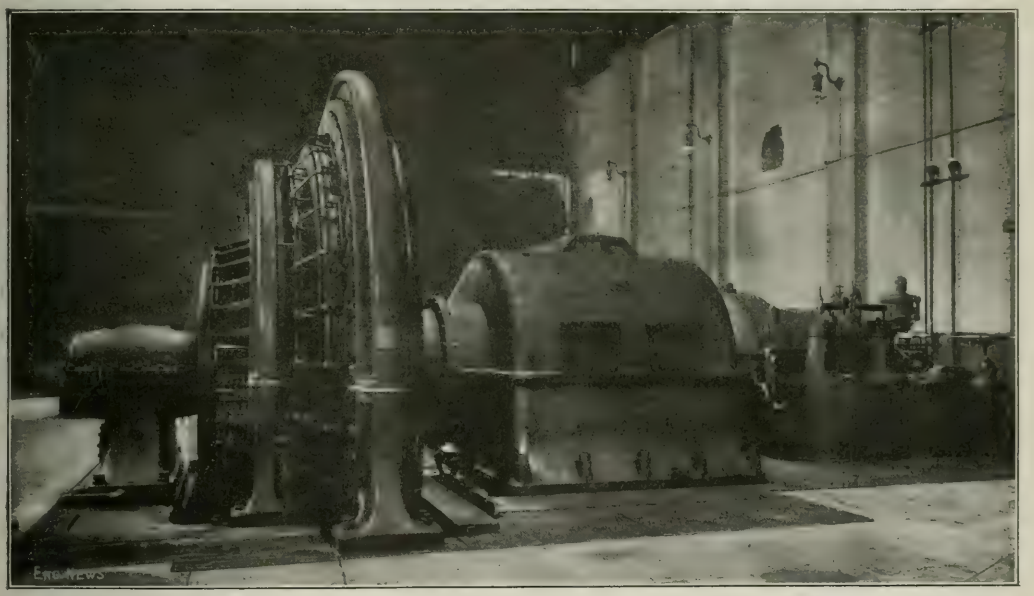
VOLUME 69 MARCH 27, 1913 NUMBER 13

A 5350-hp. Steam-Turbine Generator Unit with Speed-reduction Gears

The two largest direct-current generators yet built have recently been installed in the Canal Road plant of the Cleveland (Ohio) Electric Illuminating Co. Each of these is a 3750-kw. 275-volt 180-r.p.m. shunt-wound machine driven by a Parsons-type steam turbine through Westinghouse reduction gears having a 10 : 1 ratio. These machines are intended to supply the light and power circuits in the business section of this city. The company's installation was originally a direct-current three-wire system, but, with increase of business, alternating-current apparatus was used for distribution to outlying districts. The capacity of 200,000 kw. This plant is 3½ miles from the business center of the city, and it was not proposed to abandon the old plant entirely, but rather to convert this latter into a non-condensing direct-current generating station with the exhaust steam from the units here used for the heating mains of the business district.

The size of the equipment noted has been chosen on account of the exhaust steam needed, rather than on account of generator capacity. The machines will be run only during the months in which exhaust steam is required; in the other seasons rotary converters will be used, drawing power from the alternating-current lines.

The gear in the reduction mechanism (Fig. 2) is 100



A 5350-HP. STEAM TURBINE DRIVING A 3750-KW., DIRECT-CURRENT GENERATOR THROUGH REDUCTION GEAR
(In the Canal Road Plant of the Cleveland Electric Illuminating Co.)

supply system for the congested business district, however, was never changed and up to now for this service about 8000 kw. in engine-driven direct-current generators have been retained. On account of growth of business and poor quality of condensing water obtained from the Cuyahoga River, a new alterating-current station with 22,000 kw. of steam-turbine generators, was built on the lake front, with provisions for an ultimate

in. in diameter with 259 helical teeth. The pinion has 26 teeth, giving a ratio of 26 to 259 and introducing the so called "hunting tooth" to prevent frequent recurrence of contact between the same pair of teeth. The full rated load of the gear is 5350 b.hp. and, on account of overloads, this has been increased to 6000 b.hp. without indications of distress. The generator, shown in Fig. 1, is 21 ft. 4 in. in diameter, across the frame-feet base, and it stands 14 ft. 2 in. above the floor. The entire unit is 37 ft. 2 in. long and this length is divided be-

*From information furnished by the Westinghouse companies' Publicity Department, East Pittsburgh, Penn.

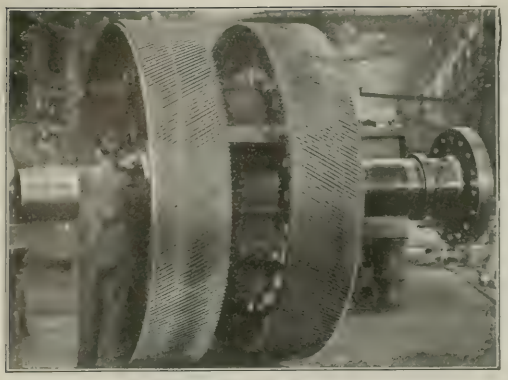


FIG. 2. DOUBLE HELICAL GEAR OF CLEVELAND GENERATING UNITS

tween the generator, gear, and turbine as 10 ft. 1 in., 12 ft. 5 in., and 14 ft. 8 in., respectively.

The turbine and gear were made by the Westinghouse Machine Co., and the generator by the Westinghouse Electric & Manufacturing Co., Pittsburgh.

Building a Paved Roadway across a Swamp*

BY JAMES OWEN†

The recent construction of the Plank Road from Newark to Jersey City, N. J., furnished some interesting foundation problems. The road was constructed partly on an old causeway that was built in Colonial times and partly on a new fill in the territory known as the Jersey meadows. To properly appreciate the conditions here it must be remembered that what is known as the Jersey meadows was originally an open estuary with the tide ebbing and flowing over it. By gradual deposition, and with wash from the highlands, this estuary was gradually filled up with material more or less solid in consistency to a height of about 1 ft. above low tide. When vegetation started in the shape of coarse grass or reeds, this growth accelerated the deposition until the high-water level was reached, when, of course, the earth accumulation ceased, but the perennial growth of reeds continued.

The foundation under the Plank Road is consequently soft silt with occasional pockets of clay. Nearer the highlands shallow beds of coarse sand are encountered. The depth of the silt was not ascertained; 80-ft. piles were driven without touching hard bottom. On top of this silt is about 1 ft. of decayed vegetation and from 2 to 4 ft. of matted roots which form the upper surface. The original foundation of the road may therefore be considered as unstable and liable to movement under pressure.

Filling in swamps for roads and railroads is, of course, a frequent occurrence; but, as a rule, with unstable foundations it is possible to relevel or realign the surface either of the road or track. Whatever settling occurs can be relieved by surface work. In the case of the Plank Road such a proposition could not be entertained for it was desired and expected to have a finished surface of block pavement with no settling after the completion of the work; practically to have an unadjustable top.

Two instances of a similar kind came to the author's mind before beginning the work: At the corner of Grand and Henderson Sts., Jersey City, the vibration due to the nearby trolley cars or loaded wagons was very perceptible when standing on the sidewalk, although this section of the old meadows is solidly built up and the streets permanently paved, probably over 50 years ago; in the valley of the Red River of the North in North Dakota, the surface is also soft silt to an unknown depth, covered with a mat of about 6 ft. of solid prairie grass. All buildings erected in that locality were built on this grass mat, never penetrating it. In one case an ambitious architect in erecting a bank building, built it on piles, and a resident told me that this was the only building which ever settled out of place.

The two salient points of construction in the writer's mind were, therefore, to put in enough material to prevent perceptible vibration, and in placing this material care was to be used not to break through the surface. As to the vibration the problem was to find the economical limits of fill for the character of travel, it being understood, of course, that there should be a sufficient mass of fill to take up the momentum of a moving vehicle. For a roadway to carry an 18-ton motor truck or a 35-ton trolley car the mass required would be less than for a 100-ton locomotive.

The original design of a minimum fill of 4 ft., probably haphazard at first inception, resulted in practically eliminating perceptible vibration for the travel to be encountered on the Plank Road, it being understood that this surface fill above the old level of the meadow was augmented by from 60 to 70% more which had sunk below.

The next problem was to make a fill that would not break the surface mat. In the writer's experience with such work in earlier years, and in common with the practice of most other engineers in the country, the fill was dumped on the meadows in a ruthless manner, and sufficient earth was finally brought in to reach the desired grade. The mat was broken through and in many cases swelled up on the side of the fill itself.

To obviate this trouble the specifications were carefully drawn. They may be briefly outlined as follows: None other than good material was allowed and no large stones were used, and whatever stones were applied were scattered. The first layer of fill was not more than 2 ft. thick, which was then rolled with a horse-roller; and each deposition was made in layers of 1 ft. and no more. As soon as conditions were favorable a steam-roller was used and each layer was thoroughly rolled until the final surface was reached. No permanent pavement was laid until the fill had gone through one winter. In some places that were exceptionally soft the horse-roller was omitted and sufficient material was dumped to enable the steam-roller to get to work.

This rolling was sometimes a heart-breaking proposition as continual miring and stalling was experienced. On one section this was obviated by placing a layer of stone screenings from 4 to 6 in. thick. The material used for the fill was good selected earth from New York and Jersey City.

*Read on a paper read before the meeting of the County Engineers of New Jersey, Jan. 13, 1913.

†Consulting Engineer, 150 Market St., Newark, N. J.

The precautions taken in construction have so far proved efficacious. In only one case was the surface crust broken through, and that was for about 150 ft., causing a crack in the fill. This happened in the early part of the work and was soon remedied. In another case where the fill was outside the old causeway a settlement appeared for about 100 ft. after the curb and concrete foundation were laid. The curb was reset to true line and a supplementary surface was put on the concrete. On the whole length of the finished roadway any perceptible vibration has been entirely eliminated.

The road as built is 100 ft. wide with two high-speed trolley tracks in the center elevated 6 in. above the roadways, two roadways 27 ft. wide, one side paved with close grouted granite blocks, and the other side with creosoted wood blocks, and two outside sidewalks 10 ft. wide.

The selection of the pavement was a subject of protracted controversy between the advocates of wood and granite block. A compromise was finally reached with the above result. A curious fact was noted with the opening of travel in that 70% of the travel is on the wood block as against 30% on the granite block. The travel on the road is very large for it is practically the only wagon road from New York City westward to the rest of the United States.

In using the road, in regard to vibration, one curious result was noticed, and that was the difficulty in getting the grouting on the granite to stay. In other contracts for close jointed grouted granite blocks the grouting was placed in the same manner with satisfactory results, waiting the usual period of 10 to 14 days before travel was allowed. On the Plank Road, however, the grouting simply wore off almost immediately. My assistant thought that the vibration of the whole road destroyed the bond. This vibration was, of course, imperceptible to the senses but undoubtedly existed.

This experience recalled two previous experiences of the writer where vibration was a cause of failure. In building an arch bridge of brick along a railroad track the centers of the arch were struck in accordance with the usual practice, but the arch fell in. In another case 50 ft. of a brick sewer, carried along the line of the railroad track, fell in. This question of vibration may, therefore, be important to consider in similar instances.

In conclusion it may be said that the part of the Plank Road now in use (about two-thirds is finished) shows no sign of settlement or deviation and is a satisfactory piece of work.

Fast Work in Driving a Mine Drift

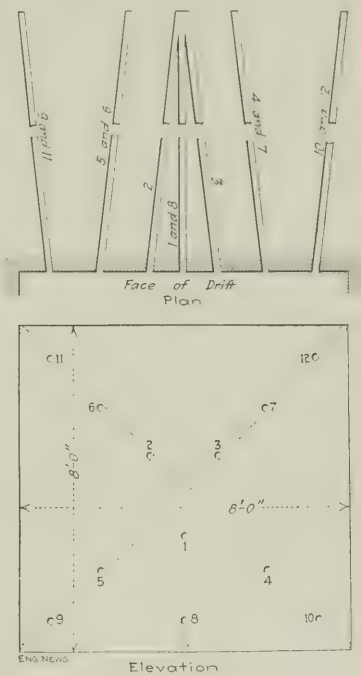
By E. T. Lednum.*

On Feb. 1, 1913, the Vinegar Hill Zinc Co. completed a double-track tramming drift at the Ellsworth Mine, near Livingston, Wis. (in the lead and zinc district). The drift is 8 ft. high and 8 ft. wide, and 391 ft. in length and was driven in 57 shifts of 9 hours each. The total time consumed was 37½ days. Part of the time drilling was carried on during each shift but during the latter part of the work drilling and blasting were done on the night shift only and the muck was removed during the day shift. The drift was in the oil-rock formation of Galena limestone.

*E. I. duPont de Nemours Powder Co., Chicago, Ill.

A part of the drift was driven by drilling but [illegible] holes; three cut holes near the bottom in the middle of the heading, drilled to meet at the points; two bottom corner lifter holes, and two upper corner holes. In mineralized ground twelve holes were drilled, and the arrangement of these holes is shown in the accompanying cut. The cut holes Nos. 1, 2 and 3 were drilled to meet at the points and were, of course, fired first. The average advance per shift was 6.85 ft. The average advance per day was 10.4 ft.

One No. 8 Leyner drill was used, and all holes were drilled 12 ft. deep. The total amount of powder used



Arrangement of Drill Holes for a Mining Drift

was 6930 cartridges (1¼x8-in.) of duPont forcite gelatin and duPont low-freezing gelatin of 40% strength. The powder was exploded with Metallic Cap Mfg. Co. and duPont No. 6 caps; 1012 caps were used and 7613 ft. of Climax-Crescent fuse.

During January the temperature dropped below zero, but at no time did the mining company find it necessary to thaw the duPont new low-freezing gelatin in the thawing magazine. The powder was taken from the storage magazine into the mine at the beginning of the shift and when drilling was finished the powder was ready for use. It was necessary to install a blower, and there was no ventilation. The work was under the direct supervision of Goodsell Billings, Superintendent.

Safety on the Oil-burning Vessels in the Navy will be increased by the provision, on such ships, of an oxygen breathing apparatus. It is estimated that about 10 lives are lost each year on these oil-burning vessels, when men are overcome by gases escaping from the liquid fuel. The apparatus is simple, consisting merely of a small oxygen tank, a flexible tube, and a mouth piece covering the nose and mouth, but not hindering the vision as the usual helmet does.

Stereophotographic Surveying

By Otto Lemberger*

SYNOPSIS—A short history of the development of photographic surveying in Europe, with a few examples of photographic railway location and reconnoissance surveys; the theory of photogrammetry briefly explained; the invention of stereophotogrammetry, its theory and practice. A description of the instruments used in stereophotogrammetry, the stereomicrometer and the stereocomparator with examples of their practical use. A description of the stereoautograph, which automatically draws a map while an operator manipulates the stereocomparator, with examples of its uses and its possibilities.

Although photo-topographical surveys have been made on a large scale in Canada since 1888, and were made by United States government topographers in 1893-94 on the boundary survey between Canada and Alaska, this method of surveying has not gained followers in America outside of the government engineering circles, and is restricted in Canada as well as in the United States to government surveys. American literature is very meager on the subject, and considering the large number of technical schools in this country, it is surprising that more attention is not given to this branch of surveying.

It is one of the objects of this article to show the application of photo-surveying methods to preliminary railway surveys in countries where the customary methods of surveying are very difficult to apply, or fail to give satisfactory results; or where the topographical conditions are such that we can get the quickest and cheapest results by photogrammetry. In the article we will sketch very briefly the history of the method and give only as much theory as is absolutely necessary for understanding the cited examples. For further information the reader is referred to Capt. E. Deville's book "Photographic Surveying," and J. A. Flemer's "Elementary Treatise on Photographic Methods and Instruments,"† in which publications he will find a full treatment of the subject.

Photogrammetry is the art of producing a horizontal, orthogonal projection from a perspective view of a body, i.e., producing topographical maps with contour lines from photographs, based on the laws of perspective and of descriptive geometry. Photogrammetry may be said to be almost as old an art as photography itself. In 1839, when Arago, the famous French scientist, presented to the Chamber of Deputies in Paris the dissertation written by Daguerre and Niepce on the invention of photography, he expressed the opinion that "Photographic pictures are subject to the rules of geometry, and knowing some points, it will be possible to make plans of parts of buildings, which are now inaccessible." He further ventured the opinion, that the time was not far distant when it would be possible to make topographical plans based on photo-topographic surveys. Arago's prophecy was fulfilled a few years later. A French captain, Laussedat by name, was the first to use a camera for topographical surveys.

A method of making a topographical map from a free-hand perspective sketch had been previously devised, and Laussedat applied this method to photography. It was not until the year 1861, however, that Laussedat made the memorable survey of the village of Buc and vicinity, near Versailles, which made his name famous. For this work he received a gold medal in 1863, conferred by the Royal Academy of Science, Madrid. Laussedat died in 1907 at the patriarchal age of 88 years. His thankful pupils, admirers and the French government have erected a monument to his memory in his native town, Moulins, with the following inscription: *Tout à la science, pour son pays.*

*25 W. 124 St., New York City.

†Reviewed in Eng. News, July 12, 1906.

Theory of Photogrammetry

To locate a point by means of photography, we must have this point on two photographs. In Fig. 1, let PP and $P'P'$ represent vertical photographic plates, S_1 and S_2 the two positions corresponding to the nodal points of the objective lenses of the camera; a' and a'' the projections of a point A of the landscape on the two plates. The two elements of a picture are the principal point or eye-point and the distance line. The principal point is

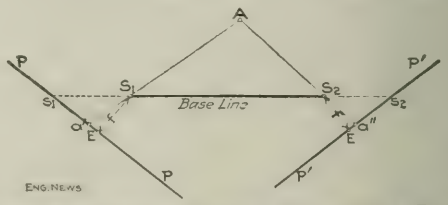


Fig. 1. Fundamental Principle of Locating a Point in Space by Means of Photographs

the point where a perpendicular from the nodal point, or point of view, intersects the plate, marked E in Fig. 1. The length of this perpendicular is the distance line. If the photographs are so taken that they also contain pictures of the points of observation S_1 and S_2, we can locate these points by intersection, based on the principle of the planetable, but having the advantage over the planetable that the problem is solved in the office.

In Fig. 2, P represents the photographic plate in vertical position, S_1 the nodal point or focus of the lens, A a point in space, a its projection or picture. A horizontal plane through S_1 intersects P along hh', called the horizontal line. A vertical plane V through S_1 intersects P along the line vv', called the principal line. The intersection of the principal line vv' and the horizontal line hh' gives the principal point E, and S_1E is then the distance line according to the definition already given. In practice, to locate the principal point E on the plate of a phototheodolite we photograph a pair of cross-wires.

Fig. 3 shows how to find the position of the plate for plotting at station S_1, if the distance line f and the length of the base line S_1 to S_2 are known. The base line may be drawn to any scale, but the distance line f must be the actual distance. The point s_2 is the projection on the photographic plate of the position S_2. The distance s_2E is scaled from the photograph and the perpendicular to the base line, $RT = s_2E$.

Again referring to Fig. 2, we find that the horizontal projection of a on the plane of S_1 is a', and of A in space A'; aS_1 and AS_1 are in a straight line and the triangles S_1aa' and S_1AA' are similar for obvious reasons. We then have the relation:

$$AA' : S_1A' = aa' : S_1a' \text{ and}$$

$$AA' = \frac{S_1A' \times aa'}{S_1a'}$$

Therefore, if we have the horizontal line hh' and the point a on our plate we know aa' by direct measurement,

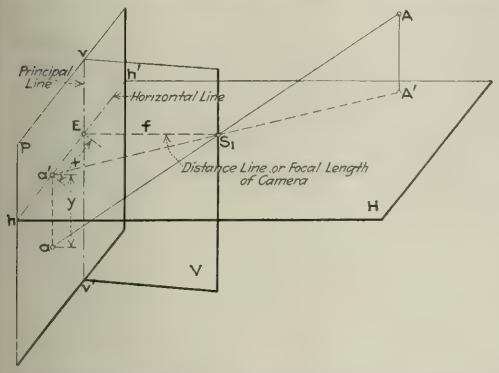


Fig. 2. Photographic Plate in Position, Illustrating Elements of Picture

also the lengths S_1a' and S_1A' may be determined, knowing f and x, and we are able to calculate or determine graphically AA', which is the elevation of the point A in space above the height of instrument.

These are the bare elements of photo-surveying; we will now describe their application to a few surveys.

Avalanche Protection Works on the Arlberg Railway

Shortly after the completion of the Arlberg railway in Northern Tyrol, considerable trouble with avalanches developed, which made the railway service unsafe. In the year 1889 the officials of the Austrian State Rys. sent Vincenz Pollack to prepare the necessary plans for constructing protection works. A part of the slope exposed to avalanches is inaccessible, being very steep, rocky and full of deep gulches. It is located on the western slope of the Arlberg and therefore open to the west winds, which are laden with rain. Hardly one day passes without rain.

This survey was made as follows: Instrument positions were selected on the opposite slope of the valley, special attention being paid to getting good views of the different gulches. The distances between the different positions were so arranged that the sights did not intersect at too small angles. The camera positions were tied into the railway center line by horizontal and vertical angles. The distances from the camera stations to the photographed points were from 1000 to 1500 m. Some mountain tops were from 2000 to 2500 m. and more away.

A sufficient number of points on the slope were located, their elevations calculated with a slide-rule and a contour map made. As a rule there were three and more sights for each point, so that checks were possible. There were only a few cases where triangles of error occurred and these, as a rule, could be traced back to inaccurate drafting.

Location of the Jungfrau Railway along the Eigerwand and Eiger Glacier

This work was done by the late Dr. C. Koppe, professor of geodesy at the Polytechnic Institute of Braunschweig, who also had made the triangulation for the St. Gotthard tunnel. For the work he used a phototheodolite, a combination of camera and theodolite, which enabled him to take pictures with camera inclined. He started his field work in August, 1896, and finished it in the first week of September, a little more than one month. The difficulties of a survey to locate exactly a railway which very often approaches an inaccessible rock wall, and at different times appears to daylight in form of galleries at places where an overlooked crevasse would carry the line out into space, can be easily imagined. Along with the necessary triangulation, very extensive photo-surveys were made so that it was possible to locate on a contour map 1½ miles of the railway line in an entirely inaccessible region.

Possibly quite a few of the readers of this article have taken a trip on the Jungfrau Railway and admired the grand scenery which opens from one of the gallieries known as the Eismeer station. It was a condition of the survey that the line should strike that point of the Eismeer, as only there the rock formation is solid. In places it was necessary to take the photographs from as steep an angle as from 30° to 40°, to avoid going back too far for the pictures to show the necessary detail. Some pictures were taken with telescopic lenses, which enabled the professor to study closely certain groups of rock. The photographs were developed in the field every day.

The triangulation stations were marked with 3- to 10-cm. gas pipes from 30 to 40 cm. long, with an iron cross at the bottom and were embedded in concrete. The photographs of the Eigerwand and Eiger glacier were made

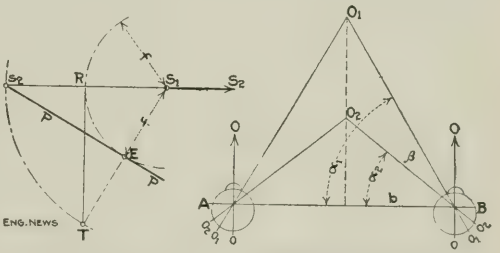


Fig. 3. Placing Plate in Position for Plotting
Fig. 4. Stereoscopic Effect of Distant Objects on the Retinas of the Eye

from 12 such triangulation stations as well as from five other stations tied into this triangulation. One hundred good plates were the result of this work, but Prof. Koppe did not finish the whole survey, as difficulties arose with the promoter who, unable to grasp the engineering side of the enterprise, wanted the remaining work done in a less scientific way.

Photo-surveys for Preliminary Railway Work in Russia

In Russia photogrammetry is used very extensively. As far back as 1891 it was used for preliminary railway

work in the Caucasus. The pioneer of photogrammetry in Russia was the late Counsellor of State, R. Thiele, a civil engineer, who later achieved international fame by his land and river surveys by means of kites, one of the most promising branches of photo-surveying. Thiele applied photogrammetry to preliminary surveys in Transbaicalia for a part of the Trans-Siberian railway in the year 1897. The work included a strip of land about 400 km. long from Usty-Anon to the Chinese border. The intention was to connect the Siberian railway projected along the Amur River with the proposed Chinese railway.

Two field parties were formed, each consisting of an engineer as chief-of-party, two students of the School of Communications, one helper and one mechanic, besides the necessary number of native laborers. The country offered splendid opportunities for photo-topographical work, being formed of almost continuous chains of conical hills and covered with short grass without bush or trees. The highest hill tops were not more than 200 m. above the valley bottom. The elevations of the stations were taken with Goldschmidt and Naudet aneroids, thus giving a good check. Prominent points, which could be seen from many stations, were sighted at, and vertical angles carefully read. On account of bad water the plates were not developed in the field. From July 22 to Sept. 1, 128 km., including the triangulation work, were surveyed in 17 working days from 96 stations; and the triangulation was checked by two additional base-line measurements.

On a new survey, Thiele kept only his mechanic. New laborers were engaged, the summer tent was replaced by a round felt tent called "yurte," used by the Burjates, a nomad tribe. The purpose of the new survey was to avoid a crossing of the Argims, a very wild, as well as deep stream, and the tunneling of a mountain, called Schiwi-Guntej. Thiele finished this survey of 174 km. in only one month of 18 working days, in which time he took 83 full panoramic views, and measured four base lines. The weather in general was very favorable, but for three days there were snow storms, which stopped all field work. The camp was moved every day.

The Minister of Communications wanted the plans very urgently, to enable a decision as to which line would be the cheapest to build, so Thiele did not prepare a contour map, but made a map, showing merely the watersheds and principal elevations. It took him a month and a half to prepare this plan. It was never completed, as the government abandoned that line. The map of the second survey, however, was carried to completion, and the precision of its contours was examined later by plotting the railway line as determined by a level. This line fitted to the contours in all details. Thiele, as well as his former assistant, Schtschuroff, made many other photo-surveys for railways.

Advantages and Disadvantages of Photo-surveying

We have given the foregoing descriptions in order to show the great difficulties the engineer would have to overcome in countries far away from civilization and without means of communication, if a heavy camp outfit had to be carried along. In these instances, splendid results were obtained with very small surveying parties in an incredibly short time.

While the fieldwork did not take up much time, the office work was painstaking and very tiresome. The finding of corresponding points, the determination of their coördinates, the calculation of their elevations above the horizontal line, took very long, and often resulted in mistakes. With increasing lengths of base lines the difficulty also arises in photogrammetry of identifying the same parts of the ground in both photographs, because the landscape looks entirely different from widely separated viewpoints. In using a short base, we have very similar pictures, which make the identification of the same points easy; but in this case the sights intersect with such small angles that it becomes necessary to find the same points on three pictures. To avoid this the length of the base line is chosen, when possible, in such a manner that the intersection angles are not smaller than 30°. Added to these disadvantages is the one that the necessary accuracy is often difficult to obtain.

Stereophotogrammetry

A method by which the troubles arising in photogrammetric surveys are eliminated is based on the principle of making the necessary measurements on stereoscopic pictures, and is called stereophotogrammetry. The method is a modification of the principle of the Zeiss

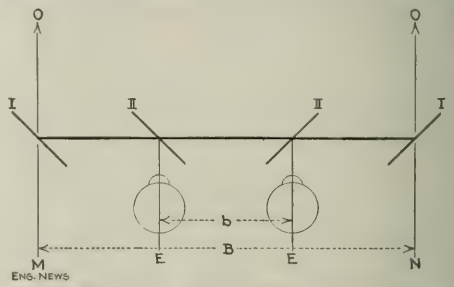


Fig. 5. Principle of the Telestereoscope of Helmholz

telemeter, which is based upon measuring distances by the difference in depth of the stereoscopic image.

If we look with both eyes at objects in different planes we perceive them to be at different distances, but if we look at them with one eye only, they appear to be in the same plane. Rays coming from objects located at a great distance, enter both eyes parallel and produce on symmetrical places of the retinas images o (Fig. 4). An object O_1 will produce an image o_1, and an object O_2 an image o_2 on different places of the retinas. This difference of position of the images on the retinas produces the effect by which we perceive relative distances. Between the position of these images and the distance of the objects, or the angles α, exists a simple relation.

The difference of the two angles α, $\alpha_1 - \alpha_2 = \beta$, is called the parallax. We are able to distinguish differences in the distance of objects to about $\beta = 30''$. It varies with different individuals, as it depends on the eyesight and on the distance between the eyes. The limits are between 100 and 500 m. We can, however, increase this ability by using glasses. If we look through a field-glass, which for instance enlarges eight times, the angle β will increase accordingly, and we will see the landscape stereoscopically for a distance of 3200 to 1000 m.

An instrument which relatively enlarges the distance between the eyes is based on the telestereoscope of

Helmholz. It consists of four mirrors, arranged as shown in Fig. 5. The observer, looking with his eyes E through $H\,H$, sees the landscape reflected from H as if his eyes were at M and N, and the eye-distance is, in effect, enlarged from b to B. If for instance b = 60 mm. and B = 600 mm., then the parallactic difference will be increased 10 times, and we will note differences in depth to a distance of from 4000 to 5000 m.



Fig. 6. Landscape Viewed through a Zeiss Telemeter

The Zeiss relief telescope comprises a double telescope and a telestereoscope, where the mirrors are replaced by prisms. The enlargement e and the base relation $\frac{B}{b}$ appears as a product, called the total plastic, $e \times \frac{B}{b}$, which indicates how many times the stereoscopic effect is increased. For instance, for an enlargement of eight times and the base relation of $\frac{B}{b} = 10$, we have $e \times \frac{B}{b} = 8 \times 10 = 80$. We will then see a plastic image of the landscape to a distance of about 32 km.

The converging angles increase according to the total plastic, so that it is possible to notice very small changes of the parallactic angle and to judge from this difference the difference in distance of two objects. While we are able to notice parallactic differences of angle of about 30″ with the naked eye, with a relief telescope with a total plastic of 80, we can distinguish a parallax of about ⅜″.

The principle of the Zeiss telemeter consists of measuring the parallax by stereoscopic observations of depths. The instrument consists of a relief telescope, as described, the outer prisms of which are adjusted in different models to 51, 87 and 144 cm., which form the bases for the measurement of distances. In the image plane of the eye-piece are glass plates, each a little detached from its neighbor, with numbered marks so arranged that when one looks through the eye-pieces the graduated plates form a stereoscopic picture (Fig. 6). The landscape is seen in enlarged plastic, the scale extending back into space. Distances can now be measured by direct comparison of the prominent points of the image with the scale. We do not measure the parallax, but compare the stereoscopic depth, which depends upon it, with a known scale. As we are able to notice very small changes of the parallax, it is possible to get very exact results with a short base.

This principle has now been applied to photogrammetry. We replace the images of the landscape by photographic plates, which are taken from the ends of a short base line. These pictures can be taken with the same camera one after the other. Looking at the plates through an apparatus, similar to a Zeiss telemeter, they replace the natural landscape, and the distance to any point can be measured by means of a depth scale.

The Stereocomparator

The instrument used for measuring distances from stereo-photographs is known as a "stereocomparator," and

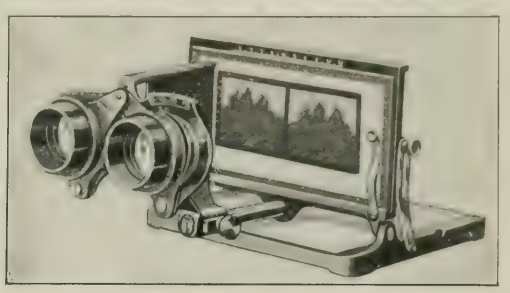


Fig. 7. An Ordinary Stereoscope

is illustrated in Fig. 10. To understand better the working of this apparatus, Dr. C. Pulfrich, the inventor, has equipped an ordinary picture stereoscope with an attachment called the stereomicrometer, which enables a study of the principles of stereophotogrammetry and the handling of the stereocomparator. Fig. 7 shows the stereoscope without the stereomicrometer, and Fig. 8 the stereomicrometer.

The apparatus consists of a metal-frame (R) with two rectangular openings, which hold the stereoscopic photographs. The so called "wandering mark" consists of two metal pointers, which are curved in toward the pictures, so that their points come very close to the photographs. As seen through the stereoscope these pointers appear as one suspended in space.

This pointer can be brought into coincidence with any

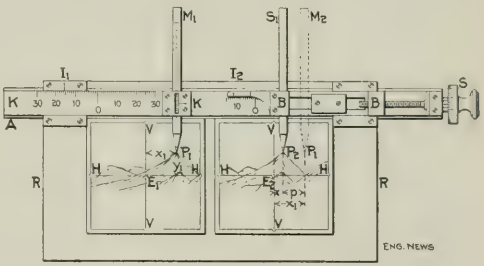


Fig. 8. Stereomicrometer Attachment for an Ordinary Stereoscope

point P of the picture, the coördinates of which x, y and a (parallax), can be measured. For this purpose the pointers M_1 M_2 can be moved on the sliding scales I_1 and I_2. A slight horizontal movement of the right-hand pointer M_2 is possible by means of the micrometer screw S. The scales I_1 and K give the coördinates x and y of the point P; and the readings on scale I_2 of M_2 and drum S give a function of the angular parallax a. We are thus able to make stereophotogrammetric measurements on any stereoscopic pictures, but these measurements are not

exact, the use of this instrument being only to make beginners acquainted with the nature of stereophotogrammetric methods and especially with the working of the "wandering mark."

To find the coördinates of a point P, from its projections P_1 and P_2, respectively, on the stereophotographs, we proceed as follows: First set the pointers M_1 and M_2 on the principal points E_1 and E_2 (Fig. 8) and read the three scales. This is the zero position of the pointers. All other readings are thereafter referred to the zero position. In this position the pointer M in space appears to be at an infinite distance (Fig. 9), as the rays M_1 through E_1 and M_2 through E_2 are parallel.

We now look through the left-hand eye-piece and set the pointer M_1 so that it is immediately above the point P_1 of the photograph (Fig. 8). Then we look through the right-hand eye-piece and set the pointer M_2 in a corresponding position, above the picture point P_2. Now looking through the stereoscope with both eyes we see the image of the pointer at M' or M'' (Fig. 9). By moving the pointer M_2, forward or backward, by means of the micrometer screw S (Fig. 8), the image of the pointer will appear to move to or from the observer, and we can now set the pointer with great accuracy and take the different readings.

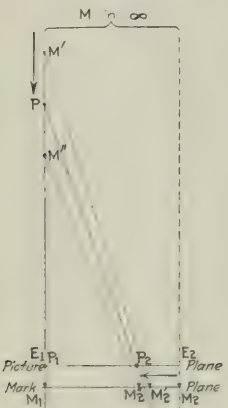


FIG. 9. PRINCIPLE OF MEASUREMENT BY THE STEREOMICROMETER

The pointer serves the purpose of a stadia rodman in the field as one can send it over the whole picture and take the measurements to any of its points. It has the great advantage over a stadia rodman that there are no physical obstacles to overcome. Furthermore, it cannot get lost, as sometimes happens with a rodman, or get outside of the control of the observer, as all its movements are made by him.

The essential difference between the stereocomparator and the stereoscope with its stereomicrometer attachment is that the pointers of the stereomicrometer move, and the pictures remain fixed, while in the stereocomparator the pointers are fixed, and the plates (negatives) and the eye-piece microscope move; but the principle is the same in both, for we are under the impression that the marker of the stereocomparator moves and not the pictures.

Figs. 10 and 11 show a stereocomparator. Both photographic plates are placed on a movable frame; I, II, I_2, II_2 are the four prisms of the mirror stereoscope $K_1 K_2$; the images are seen through a binocular microscope, with an enlargement amounting to three or six times. By introducing a system of Porro's prisms, we see the images erect. In the image plane of the microscopes are glass plates e, marked with a vertical line, which appears through the eye-piece as a stereoscopic image suspended in space, and takes the place of the pointers of the stereomicrometer, already explained.

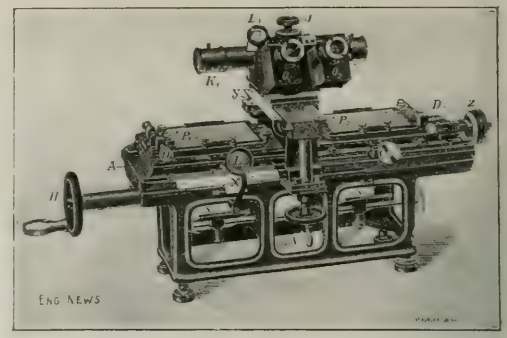


FIG. 10. A STEREOCOMPARATOR FOR MEASURING DISTANCES AND ELEVATION OF STEREOPHOTOGRAPHS

A Table carrying the two plates P_1 and P_2, sliding horizontally in the direction of the length of the plates; operated by the handwheel H.
B Table of the Stereocomparator carrying the stereomicroscope and sliding horizontally in a direction at right angles to A; operated by the handwheel V.
C Setscrew compensating differences in height on the two plates, in consequence of the unequal altitudes at which the stereophotographs were taken.
D_1 and D_2 Setscrews adjusting the plates P_1 and P_2.
E Clamp fixing the slide which carries the plate P_1 and which is shiftable in the direction of the main table A.
S_1 and S_2 Two illuminating mirrors revolvable about a common axis.
x Scale with adjustable vernier for reading off the abscissas.
y Scale for reading off the ordinates.
z Micrometer screw with adjustable measuring drum to measure parallax.

It is a condition of the instrument that the position of the two plates in the movable frame be identical with the position of the plates in the camera when the photographs were being taken, because only in this case we have comparable pictures; that is, both plates are in the same plane, so it is necessary that the camera at the two ends of the base line should have been in the same vertical plane parallel to the base line. Photographic negatives are used because it would be impossible to get positive prints, which were not subject to inaccuracies which do not occur on the negatives.

USE OF THE STEREOCOMPARATOR

To get the necessary data for calculating the positions and elevations of the different points shown on the photographic plates we proceed as follows: The plates are placed on the movable frame (Fig. 10), so that their horizontal lines are parallel to the X axis of the instrument and that their principal points E_1, E_2, lie in the direction of the principal rays (the rays perpendicularly through them). To accomplish this the hand-wheel H is provided, which moves the both plates together horizontally; the

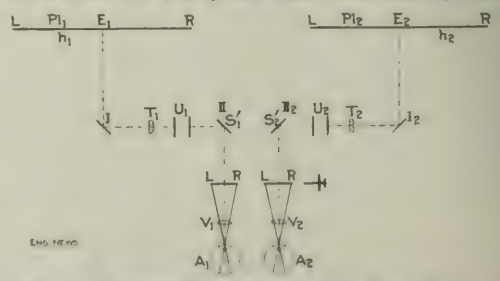


FIG. 11. DIAGRAM ILLUSTRATING THE CONSTRUCTION OF A STEREOCOMPARATOR

screw C changes the position of the right-hand plate in a horizontal direction at right angles to the horizontal movement governed by H, thus permitting the plates to be adjusted so that the same point on the two plates may be brought into the same vertical plane through the instrument, or the same horizontal plane of the landscape; by means of the hand-wheel V the stereomicroscope is moved on the Y axis of the instrument, thus bringing the principal rays to any point within the width of the plates, corresponding to a vertical movement (or change in elevation) over the landscape.

Having placed the plates as described, we read the coordinates X, Y and the parallax a on the respective scales x and y and the drum Z, which, if the instrument is in adjustment, are on zero points. Then, as with the stereomicrometer, we place the wandering marker over a point in the plastic stereoscopic picture by moving the hand-wheels H and V and the micrometer screw Z. Instead of moving the right-hand pointer as in the stereomicrometer, we move the right-hand plate, independently of the left-hand plate, by the micrometer screw Z. The readings on the scales X, Y and Z enable us now to figure the position of the point P in space.

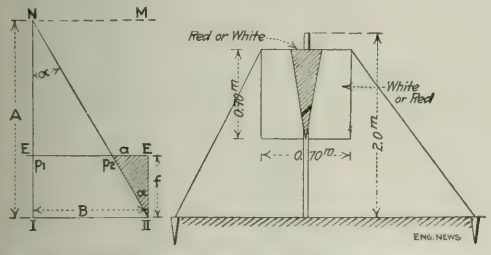


FIG. 12. DIAGRAM SHOWING PRINCIPLE OF STEREOSCOPIC MEASUREMENTS

FIG. 13. TYPE OF SIGNALS FOR STEREOPHOTOGRAPHIC SURVEY FOR BAGDAD RAILWAY

We find the folowing relation from Fig. 12: B is the base line, I and II the stations from which the photographs were taken and f the focal distance of the objective. If the plates in the stereocomparator are placed in such a way that the picture p_1 of the point P lies in the perpendicular through the center of the left-hand eyepiece (the principal ray); and p_2 is the same point on the plate at the right-hand side, then a is a function of the parallax α as measured by the comparator. If we draw two rays from I and II through p_1 and p_2, we do not get the point p, but a point N in the horizontal plane of I and at a distance A from the base. The distance of this point N from I is $A = B \cot \alpha$, and $f = a \cot \alpha$; $\cot \alpha = \frac{f}{a}$, and therefore $A = \frac{Bf}{a}$. A only depends on a, if B and f are given. Hence it follows that all points with parallax measured by the same a correspond to the same N, and that P is located on a line, drawn through N parallel to I-II. The formula $A = \frac{Bf}{a}$, therefore, gives us the perpendicular distance of the point P from the end of the base line and we find its position on the line NM from the x abscissa of the point on the picture at the left.

The elevation of P above the station I is found from the ordinate y of the left-hand picture.

$$H = y\frac{A}{f} - y\frac{B}{a}$$

LENGTH AND MEASUREMENT OF BASE LINE

The necessary length of the base line is found by differentiation:

$$A = f\frac{B}{a}; \quad dA = f\frac{B}{a^2}da; \quad a = \frac{fB}{A}; \quad dA = \frac{A^2}{Bf}da;$$

which shows that the error in locating points increases with the square of the distance and diminishes with increased lengths of base line and focus. In this way we are able to compute the required length of base, assuming the limit of error. For instance, when $f = 240$ mm., the parallax 0.01 mm., which means $da = 0.01$, and allowing an error of 5 m., in a distance of 3000 m., we have:

$$B = \frac{A^2}{fdA}da = 75\text{m}.$$

In locating points still farther away the errors increase; for instance, it is 9 m. for 4000 m. and 14 m. for 5000 m. The length of the base line should be kept within 80% of the theoretical one.

The measurement of the base line must be fairly accurate, although no more so than required in ordinary traverse work. According to German experience the error of measurement should never exceed 1 in 1000, an accuracy which may be obtained on level ground with a steel tape. In connection with the field work of stereophoto-surveying, Dr. Pulfrich has invented a horizontal rod-measuring device, 1 m. long, which can be set up on one of the tripods of the phototheodolite over one station at right angles to base line. By stadia methods, using the phototheodolite at the opposite end of the base line, the length of the base line may be read directly on the rod to the required degree of accuracy, by means of marks moved by micrometer screws.

ADVANTAGES AND USES OF STEREOPHOTOGRAMMETRY

The advantages of stereophotogrammetry are the facilities for finding corresponding points, which with photogrammetry takes great practice and is a very painstaking work, and the possibility of locating a point on comparatively level ground with the same accuracy as a prominent point. It is possible to follow any line by locating points of same. The fieldwork is also reduced, as the number of stations can be reduced.

Before this invention photogrammetry was restricted to work in mountainous country without vegetation; it can now also be applied to wooded, hilly and mountainous country. With this method photographs need not necessarily be sharp, for exposures made with poor light and from bad positions are giving good results in the stereocomparator. Instead of a perspective picture we have before our eyes a landscape as seen in nature, only on a smaller scale, like a plastic reproduction.

The accuracy of stereophoto-surveying as found from actual experience is fully up to the standard of a good stadia survey. The location of points at a distance from the instrument of 1000 m., using a base line 50 m. long, and a phototheodolite having a focal length of 241.5 mm., was found to be uncertain within 0.8 m. In railway-location surveys with average distances of 200 to 400 m., and base lines of 25 to 50 m., the accuracy has

been found to be within 0.2 or 0.3 m. for distances and 0.07 to 0.12 m. for elevations.

Dr. Pulfrich brought the stereocomparator before the public in 1901. It is an apparatus which has proved of great value in other branches of scientific research work, especially in astronomy. Dr. Pulfrich discovered a new planet with it, by comparing stereoscopic pictures of the sky. At present stereocomparators especially adapted to star photography are found in the great observatories all over the world.

Eleven years have passed and stereophotogrammetric surveying for railways has now been introduced in Austria, Germany and Russia. In order to illustrate better the foregoing explanation of stereophotogrammetry, we will give a notable example of a stereophotogrammetric survey—that for the Bagdad railway in Asia, executed by H. Luescher.

Stereophoto-survey for the Bagdad Railway

The survey by stereophotogrammetric methods covered a part of the Taurus in Asia Minor. Although stadia surveys of this section already existed, it is a very wild country, partly inaccessible and with many deep gulches. Luescher used the following instruments for his work: One Zeiss phototheodolite, 9 cm. x 12 cm., with micrometers; three tripods; a horizontal measuring rod; two stereocomparators, 9x12 cm.; two small and one large signals; furthermore, the necessary instruments for reconnoissance, consisting of a telemeter and an iconometer, with a small planetable. The intention was to investigate how stereophotogrammetric surveying would compare with a stadia survey.

This survey was made for preparing maps to the scale of 1:500 upon which to base estimates for the necessary bridges and retaining walls. There was very little vegetation and no difficulties arose in selecting positions commanding complete views of the different gulches. The strip was about 600 m. long, the average distance to the section photographed was about 150 m.; five stations were necessary.

The survey was preceded by a careful reconnoissance, for the selection of the right instrument stations was of the greatest importance, especially as to light conditions and position of sun. Photographs taken against the sun are avoided when possible. The average distance to the part of the landscape to be photographed was found with a Zeiss stereoscopic telemeter with an enlargement amounting to eight times and a base of 50 cm. The iconometer served to find the width of a strip which could be photographed from one double station, and to select the proper distances between stations for taking pictures, with a sufficient allowance for overlapping. The iconometer used consisted of a frame, corresponding to the size of the plate, and of a diopter placed at the focal distance of the objective of the phototheodolite, so that in looking through one could see exactly what the photograph would cover.

Fig. 13 shows the type of signal used. The size of the signal depended on the distance. The ends of each double station were connected with a footpath, so as to be able to transfer the phototheodolite (Fig. 14) quickly from one end to the other. Triangulation with necessary levels served as skeleton for the survey. The stations were not necessarily triangulation points, but if not they were carefully tied to the system.

It was proven by this stereophotogrammetric survey that the field as well as the office work was considerably shorter than if it were done by stadia; besides that the resulting contour maps showed much more detail than those prepared from the stadia survey.

Other Stereophoto-surveys

Stereophotogrammetry was very extensively employed by Russian government engineers in preliminary surveys for the Amur railway in Asia. Three parties were sent into the field and many miles of territory were mapped from stereophotographs.

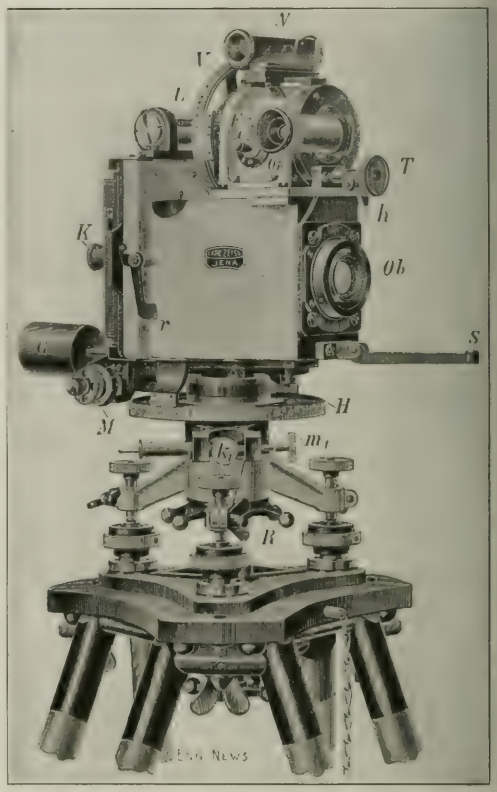


Fig. 14. Phototheodolite Used for Stereophotographic Surveys

The Austrian government was enabled to conclude the preliminary surveys for the state railway through the Dinaric Alps along the Dalmatien coast by stereophoto methods, where the ruggedness of the country had practically prevented a satisfactory survey by ordinary methods.

On a survey for the preliminary location of a branch of the Austrian State Rys. in Tyrol, a locating engineer, with one assistant and four helpers, using a phototheodolite, was able to complete work in a few weeks, where stadia parties had been unable to get the requisite data in a whole season's work. On this survey it was found possible to complete about 3 km. of reconnoissance work a day. The preliminary survey as a whole was done

with a progress of 1 km. per day. The maximum distance from the instrument to the landscape photographed was 600 m. The country was very rough and the necessary grades could not be obtained without extensive development.

Many surveys for water-power development in the Alps Mountains have been made by stereophotogrammetric methods. Extensive topographical surveys have been made by stereophotographic methods in German Southwest Africa. The German, Austrian, French and Russian armies all make use of stereophotographic methods for obtaining maps from balloons, and recently the

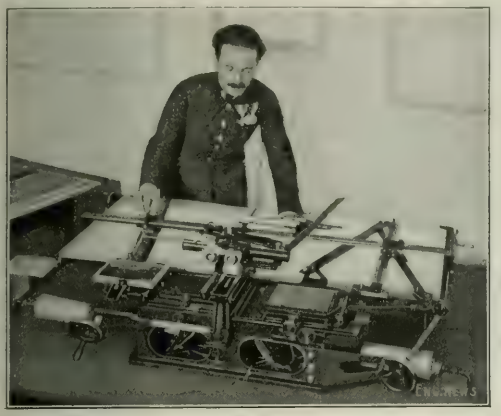


FIG. 15. THE STEREOAUTOGRAPH AND ITS INVENTOR, CAPT. RITTER VON OREL

British government has purchased a complete aëronautical stereophotographic surveying outfit for similar work.

THE STEREOAUTOGRAPH

There is another improvement which still more reduces the office work of using the stereocomparator. In working with the stereocomparator, we get the necessary data from different scales and then calculate the distances of the points from the base line by the formula $A = \frac{Bf}{a}$, before we are able to plot these points on the drawing.

Dr. Pulfrich invented some years ago a drawing apparatus which enables one to plot any point directly from the values read on the different stereocomparator scales without preceding calculations. But by a still more recent improvement the readings on the different scales are also eliminated and the plotting can now be executed automatically. As has been shown, in order to find the elements of a point we have to move the frame and set the marker. If all these movements are transferred directly to a drawing apparatus automatically, all the computation is avoided. Captain Ritter von Orel, of the Austrian Military Geographical Institute, is the inventor of an apparatus to accomplish this. He transformed the distance formula $A = \frac{Bf}{a}$ or $A : B = f : a$, which would give impracticable intersections, into $A : Bx = \frac{f}{x} : a$, in this way increasing the intersection angle in the same proportion as the base line. This modified distance formula is the basis of his instrument, which he calls a stereoautograph (Fig. 15).

The stereoautograph is connected with a drawing board, and transfers all the sliding movements through levers by an arrangement similar to a pantograph (Fig. 16). The wheel on the left (Fig. 15) moves the frame containing the two plates (negatives) and gives the X ordinate as already explained. The wheel on the right moves the plate on this side only and thus gives the stereoscopic parallax, taking the place of the micrometer drum. The lever-arms visible in the background transfer these movements to the drawing pin, on which Capt. von Orel's right hand is placed.

Fig. 16 shows a diagram of the stereoautograph. The horizontal drawing board is connected with the lower supporting part of the stereocomparator. The pin joints *I, II* and *III* are located on a line parallel to the X axis of the instrument and are the turning points for the lever-arms which are actuated by the three movements X, Y and a. The movement of the arm through *I* traces the horizontal projections of the points of the landscape of the left-hand plate; *II* their vertical projections, and the movement of the arm through *III* is a magnified function of the parallax.

Fig. 16 shows the instrument set on a point to the left of the principal line a distance x_1, and above the horizontal line a distance y_1. The distance f equals the focal distance previously described, and the distance A depends on (Bx) the chosen scale. The X movement of the stereocomparator is transmitted by the sliding guide F_1 to the lever turning around the axis *I*. The movement of F_1 measures x, the tan α (Fig. 16), while the movement of the arm reproduces the angle α directly on the board, and the angle α can be read on protractor T_1. This corresponds to a direct horizontal angle measurement between a perpendicular to the base line at the station and the point of the landscape on the left-hand plate.

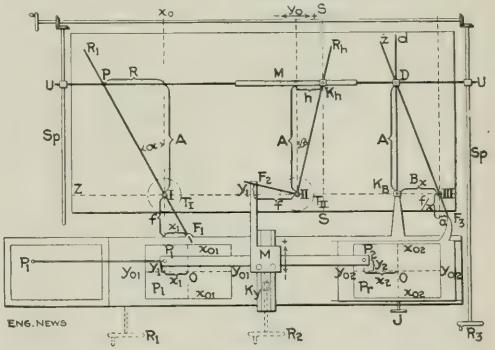
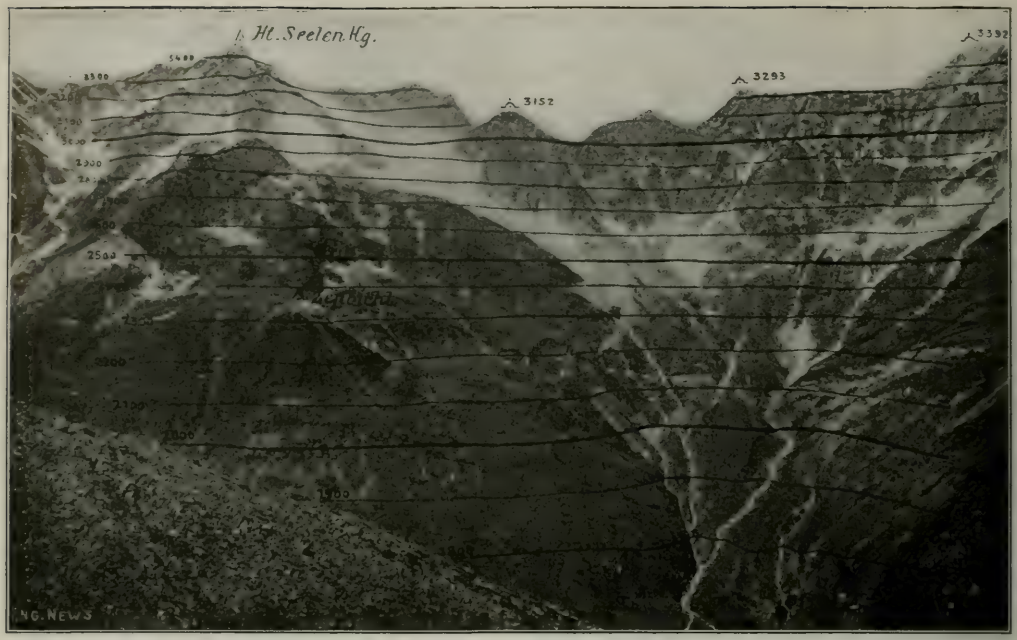


FIG. 16. DIAGRAM SHOWING CONSTRUCTION OF THE STEREOAUTOGRAPH

As soon as the marker is set, the position of the lever R_1 gives the direction of the point P. In a similar way we find the vertical angle. By turning wheel R_2 the movement of the slide Y is transmitted by means of a lever R_h, which is connected by a right-angle arm at F_2 with the Y slide; its axis also is located at the focal distance f from F_2. This movement reproduces automatically the vertical angle from the horizontal plane of the station to the point in the landscape.



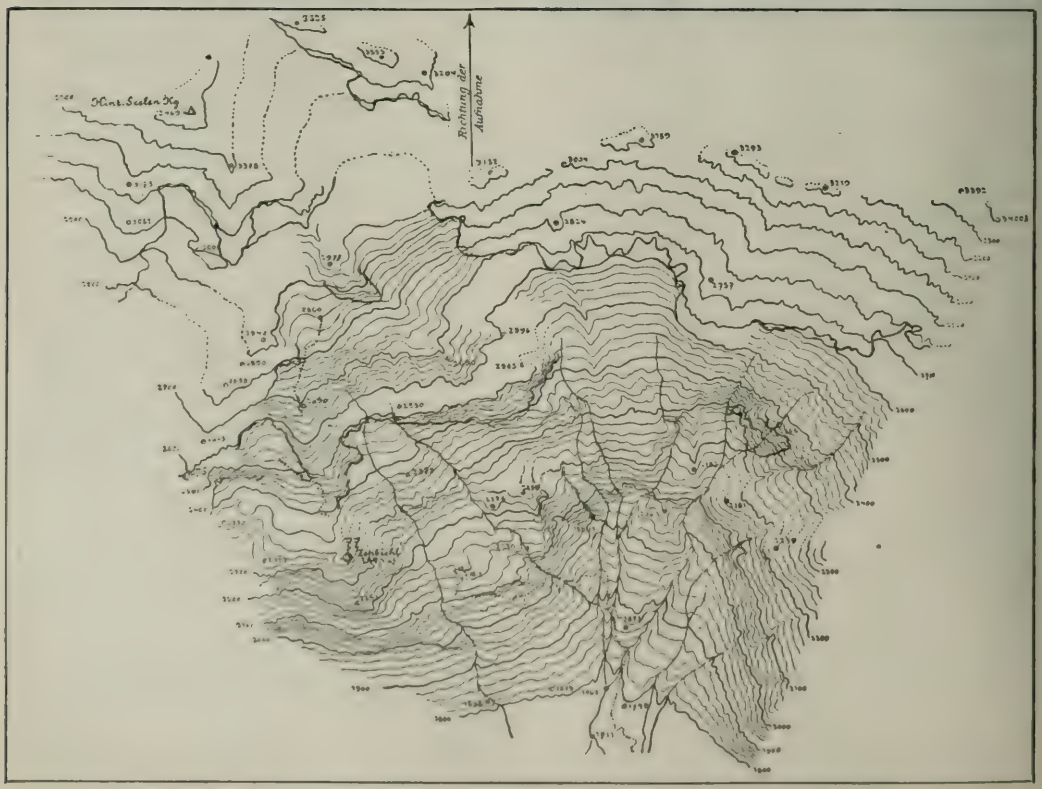


FIG. 17. EXAMPLE OF A STEREOPHOTOGRAPHIC SURVEY; ORTLER MOUNTAINS IN TYROL.

The setting of the marker on any point on the left-hand negative thus gives the horizontal and vertical angles of the point automatically. The position of the point itself depends upon the distance A and is found by a system of gears which carry a long straight-edge, each end of which is attached to a worm-screw carrier. The carriers travel along the screws Sp, and are moved by means of the wheel R_3, called the depth wheel. The carriage on which the right-hand negative moves has no micrometer scale to read the parallax; but wheel R_3 governs the movement of the lever Z by means of the sliding carriage F_3, and moves the right-hand negative at the same time until the marker is placed correctly, when the stereoscopic parallax and required distance correspond. Here we are finding the parallax and distance simultaneously, in opposition to the old way, where we calculated the distance, which corresponded to a predetermined parallax.

The straight edge UU is parallel to the base Bx and therefore contains the horizontal projections of all points of the same parallax. We now have automatically the solution of the problem illustrated in Fig. 12; while the intersection of the line of the arm R_1 with the line NM (Fig. 12) gives the position of P. At P a pencil is provided for marking the point. On the scale M is read the relative elevation of the point P in space, referred to the H.I. To read the real elevation of P, it is only necessary to adjust the scale M in such a way that it will read the correct elevation when the instrument is set on the known datum plane. It is clear that the scales of T, h and A are always the same, as all three are dependent on the constant f and the base Bx. This latter can be changed to allow a change in the scale of the drawing. The scale is limited only by the size of the drawing board and the whole or part of the photographs to be plotted.

Contour lines may be drawn automatically. To do this the elevation scale M has a division which corresponds to the scale of the drawing. By means of the clamp K_h on the lever R_h, h can be set to any desired elevation; then by releasing the movement of the microscope carriage by unfastening clamp K_y and moving the straight-edge UU by the wheel R_3, points of the same height may be easily and quickly located. The point K_h will follow mechanically the line SS, which is nothing else than the horizontal projection of a contour plane. Shifting of the microscope carriage apparently makes the marker trace the course of the contour as seen in perspective from the station on the left.

It is also a simple matter to draw contour lines directly on a photographic print of the plate on the left. To do this it is only necessary to transmit to the print movements corresponding to the apparent movement of the marker (on the left-hand plate). For this purpose a photograph is fastened on a little board, which is connected with the X movement of the carriage, so that it follows all its movements. The arm P_1P_1 ending in a point transmits the changing y of the microscope carriage and traces the apparent vertical movement of the marker.

To find now the intersection of the contour plane with the stereoscopic picture we move R_1 with the left hand and R_3 with the right hand, starting from the left side of the picture. The wheel R_2 is not used. Wherever the marker is made to touch the plastic picture are points of equal altitude. The pencil at P will draw the horizontal projection of this cut on the plan and the point P_1 on the print the perspective course of it. Without moving the eyes from the eye-piece the two pencils will draw automatically the contour line on the map and its perspective picture on the photograph (Fig. 17).

The exactness of these contour lines depends entirely on the ability of the operator. In the first place he must be able to see stereoscopically, so that he is able to move the wandering marker with exactness along the stereoscopic picture. Every contour line can, of course, be checked by going over it a second or third time.

A new stereoautograph is in the course of construction, in which the wheel R_2 can be moved by the foot, so it will be possible to execute all three movements simultaneously.

Applications of the Stereoautograph

In 1907, the stereoautograph was used to plot the stereophoto-survey of the Ortler Mountains in Tyrol

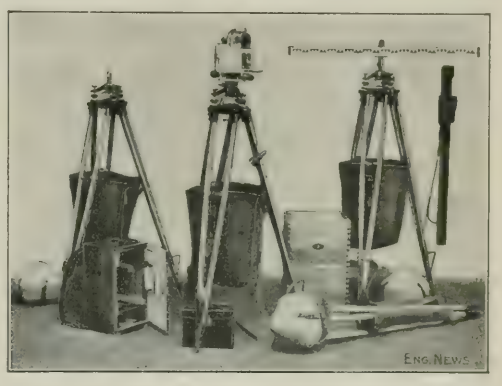


Fig. 18. Complete Set of Instruments for a Stereophotographic Survey

(see Fig. 17). The field work occupied eight days and the office work ten days. The result was a splendid map of the Ortler group, for which the International Exposition of Photography, held in Dresden, in 1909, awarded the honor prize, and it received the grand prize at the International Exposition of Means of Communications, held in Buenos Aires, Argentina, in 1910. The work was checked in 1909 by other surveying parties.

Extensive stereophoto-surveys have been made in the Austrian Alps; surveys which gave very good results when checked by other methods. In two days of field work an area 20 km. square, situated in the higher part of the "Zwickauer-hütte," in the valley of Passeier, were photographed from two double stations. The office work was completed in 16 hours. The result was a map to a scale of 1:25000, with 20 m. contours in the lower levels and 100 m. in the higher levels.

The field for stereophoto-surveys in combination with the stereocomparator and autostereograph is a vast one; to mention only a few cases, there are coast surveys from a ship with a camera placed at each end; surveys for studying the movements of glaciers, and stereophoto-surveying from balloons, aëroplanes and by means of kites. Last but not least, photogrammetry and stereophotogrammetry may be used extensively by architects, by taking interior and exterior pictures of ancient build-

ings, to enable them to make plans, elevations and sections for their own use and for posterity.

The German government created a special department in 1882, called "Königlich Preussische Messbildanstalt," which now has a very numerous collection of photogrammetric surveys of all the public buildings, churches, monuments, etc. A few years ago, this institute was commissioned by the Grecian government to survey by photogrammetry all the antique ruins of Greece, a work which was finished successfully . Photogrammetric instruments are of great value to explorers, and there is now no German or Austrian expedition sent out without the necessary instruments for photo- or stereophoto-surveying.

[Since this article was prepared for publication, we have been informed that the instruments described are to be handled in this country by the Bausch & Lomb Optical Co., Rochester, N. Y. The list price of the phototheodolite is $684, or $1137 with accessories and extras. The list price of the stereocomparator is $815.—Ed.]

A Small Water Works Plant for Kingsburg, Calif.

By C. F. Braun*

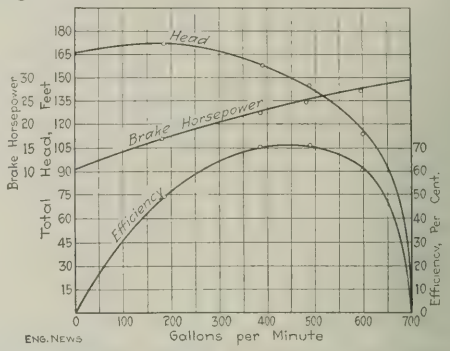
The town of Kingsburg is one of the many growing small town, in the San Joaquin valley, and has a population of about 1000. In order to keep pace with its progressive neighbors, and to secure its share of California's increasing population, the city fathers planned a system of water-works for which the people voted a $26,000 bond issue. One of the features of the plant is the pump installation. This includes two centrifugal pumps, of which one is driven by an electric motor with an automatic control, while the other pump is driven by a gasoline engine.

The supply of water is obtained from two wells about 80 ft. deep. A combined flow of about 900 gal. per minute is produced, the water being clear, palatable and only slightly hard. The surface water-level is about 8 ft. with respect to the ground and is lowered 20 ft. when the full quantity of water is being pumped. Particular care was taken that the part of the well-casing near the surface should be made tight, so that surface water should be excluded from the well, and possible contamination avoided.

Owing to the small size of the plant, automatic operation was as far as possible desirable and the electrically driven centrifugal pump was selected as meeting the requirements. The general-service pumping unit consists of an Alberger 4-in., two-stage, turbine-type, centrifugal pump, direct connected to and mounted on a common cast-iron base with a General Electric induction motor, operating at a synchronous speed of 1800 r.p.m. The motor is of the squirrel-cage type, rated at 30 hp., with an overload capacity of 25% for two hours, and operating on 110-volt, 60 cycle, 3-phase current.

The normal rating of the unit is a delivery of 150 gal. per minute against a total head of 150 ft., with an overall efficiency from electric line to water, of 60%. Under test, an actual overall efficiency of 62% was obtained, which is a result exceedingly gratifying with so small a unit. The pumps may discharge to the tank or mains as desired.

The characteristics of the pump are such that at no point over the entire range of discharge, even with closed discharge valve, can the pressure developed by the pump exceed the normal by more than 12%. The pump is absolutely automatic in this action, and a dangerous pressure cannot possibly be developed on the mains or pump casing.



Characteristic Curves for Alberger Two-stage Turbine Pump
(Constant speed, 1720 r.p.m.)

The head curve is unusually flat (see accompanying diagram). Variations in capacity above and below normal do not produce great variations in the pressure. This characteristic is very desirable in water-works service, for if water is pumped into the mains the quantity required is continually varying, while if pumped into a tank the head varies. The power curve shows that under no conditions of load can the power required be greater than 20% above normal, the motor and other electrical equipment thus being protected from overloads beyond their capacity. This feature is important, as with other types of apparatus the rupture of a pipe main and consequent sudden reduction of head on the pumping unit often causes overloading the motor to such an extent as to destroy it. This unit is thus made practically fool-proof without the aid of relief valves, by-passes or other protecting or reguating devices.

Such characteristics as have been described are also adapted to fire-fighting purposes. One good fire stream can be delivered at 71 lb. pressure, two good streams at 62 lb. pressure, or three fair streams at 32 lb. pressure, all automatically.

The attention required and the cost of upkeep for such a unit are practically nil. The only parts requiring lubrication are the two bearings on the pump and two on the motor. These are ring-oiling, and are constructed with renewable bronze bushings, so that in case of wear a replacement is a matter of only a few minutes. The pump is provided with a marine-type thrust-bearing to take care of any slight, unbalanced thrust that might develop, due to wear in the pump, and slight inaccuracies in manufacture. The thrust-bearing is water-cooled, which prevents any possibility of heating. The water passages of the pump, including impeller and diffusion vanes, are of bronze, carefully machined and polished, which insures long life and sustained efficiency.

* Engineer of C. F. Braun & Co., Mechanical Engineers and Contractors in Electric Power Machinery, Alberger Pump & Condenser Co., 568 Market St., San Francisco, Calif.

While the efficiency of such an outfit may not be quite as high as that of a plunger pumping-unit under test, the efficiency of the centrifugal pump will be maintained in actual service, whereas leaky valves, poorly packed stuffing boxes, and general wear will soon reduce the initial efficiency of the triplex to a much lower figure.

Electrical energy to operate the motor is purchased from the public service corporation whose lines serve the town. Transformers to step down the primary voltage from 1000 to 220 are placed outside the pump house.

To insure continuous service to meet the requirements of the fire underwriters calling for two sources of power, and to be independent of electric power corporations, an auxiliary gasoline engine pumping-unit was provided. The pump-end of this unit is an exact duplicate, both mechanically and hydraulically, of the motor-driven pump, so that the parts are interchangeable. The pump is mounted on a common cast-iron base, and gear-driven by a 30-hp., three-cylinder, vertical, gasoline engine, operating at 350 r.p.m. A gasoline supply-tank is placed underground outside the building.

The pumping machinery is situated in a concrete waterproof pit, 12 ft. long, 14 ft. wide and 8 ft. deep. This places the pump at the water level, so that the suction lift is reduced to a minimum, which is a desirable condition for the best operation of centrifugal pumps. A 6-in. suction pipe runs from the bottom of the pit horizontally to each well and extends 30 ft. down, terminating with a foot valve. Each suction pipe is provided with a gate valve inside of the pump pit, so that each well may be operated independently. A 3-ft. manhole and pit over each well provides access to the suction pipes and foot valves for cleaning or repairs.

A 40x40-ft. house covers the pump pit and also contains a meeting room for the city officers and a room for a hose wagon and small fire-fighting apparatus, a very convenient and economical arrangement. The house is constructed of metal lath and concrete, so that it is fireproof and at the same time inexpensive.

A 60,000-gal. steel tank on a 100-ft. tower provides an adequate reserve supply for domestic or fire service. Four converging legs with wind bracing and struts, resting upon concrete blocks, form the tower. These support the tank, which is 19 ft. in diameter, 22 ft. deep and has a hemispherical bottom of 10½ ft. radius. A conical roof gives the structure a finished appearance and excludes birds and dirt.

A float in the tank makes an electrical connection when the water level is reduced to 4 ft. below normal, and the motor-driven pumping-unit is automatically started by a solenoid-resistance-type starter. When the water level again reaches normal, the float breaks the contact and the pumping is stopped. A regular operator can therefore be dispensed with.

The city employs a man who makes service connections, collects money and attends to all general water department business, and merely looks over the pumping machinery occasionally to see that the oil reservoirs are full.

The population to be served at the start did not warrant a very elaborate distributing system. Care was taken in laying out the system, however, so that lines would be sufficiently large for fire-fighting purposes, and that extensions could readily be made. The money available for this work limited the selection of pipe to steel casing with lead joints. This was carefully dipped in asphalt so that corrosion would be retarded, and reasonable life obtained. There was laid 2000 ft. of 8-in., 18,000 ft. of 4-in., and 11,000 ft. of 2-in. pipe.

The cost of the entire plant was about $21,000. Olmstead & Gilleden, of Los Angeles, were the engineers, and C. F. Braun & Co., of San Francisco, were the constructors of the entire work.

The Milwaukee Ave. Viaduct, Chicago

The viaduct carrying Milwaukee Ave., Chicago, across a group of railway tracks has been rebuilt recently and is the first of the kind in that city in which reinforced-concrete spans have been used. The following description is from a paper read by L. K. Sherman (one of the contractors) at the annual meeting of the Illinois Society of Engineers and Surveyors:

The viaduct crosses the main tracks of the P., C., C. & St. L. Ry. and the main and yard tracks of the C., M. & St. P. Ry. and the C. & N. W. Ry. at an angle of 45°. There are ten spans, as follows, starting from the south: 66-ft. steel through girder span, 157-ft. steel through truss span, eight reinforced-concrete girder spans varying from 52 ft. 6 in. to 58 ft. The north reinforced span consists of encased steel girders. The steel spans were used over the main tracks, where continuous operation of trains precluded the use of the falsework necessary for concrete construction. The foundations for the piers rest on 50-ft. piles, which had to be arranged so that the pier footings straddle the Illinois Tunnel Co. tunnel, which runs under Milwaukee Ave. The piers are a feature of the structure. On account of car clearance on the adjacent tracks they are only 15 in. thick. Each bent consists of four of these concrete piers or columns, 15x48 in. and 15x72 in., with a concrete cross girder.

The roadway is 40 ft. wide, with two tracks for electric cars. Outside of the main girders on each side are 8-ft. cantilever sidewalks, making a total width of 61 ft. The concrete floor is about 10 in. thick, supported by reinforced-concrete girders 25 in. wide and 2 ft. 9 in. deep, placed at right angles to the piers, giving a 40-ft. span. The main girders, along the curb line, are 10 ft. 6 in. high and about 2 ft. thick, and owing to the skew these are required to support the floor girders. The main girders are supported on the piers by heavy structural steel brackets encased in the concrete. The clearance from top of rail to bottom of girder is about 17 ft.

Some complications in construction were involved. Most of the yard tracks had to be left clear each evening for switching purposes at night. In order to give the necessary clearance for cars and the team roadways, the floor and girder forms had (in most cases) to be suspended by rods from overhead falsework. Timbers, 8x16 in., were required for falsework on account of the 12-ft. spans over tracks and roadways. The foundation concrete was placed from a mixer set up on a flat car. The superstructure was built by hoisting the concrete in an elevator from a mixer near the supply track and distributed by push carts of 6 cu.ft. capacity. Electric power was used to operate the two mixers, hoist, sawmill and boring machines. There are about 4000 cu.yd. of concrete in the structure and over 300 tons of reinforcing steel, or about 125 lb. of steel per the cu.yd. The concrete in general was 1:2:4 (using crushed limestone), except 1:4 for columns and 1:3:6 for some footings. Tests of the concrete have shown over 4100 lb. per sq.in. compression, with an average of about 3000 lb. The columns are heavily reinforced with square spiral and vertical rods, four to six sets in a column, and bound with horizontal stirrups. The columns were difficult to pour and spade and required much experimenting for satisfactry results. The cement gun was used for pointing to some extent.

The structure was designed by the engineers of the C., M. & St. P. Ry., and the erection of the steel spans was performed by them. All of the concrete structure was built by L. K. Sherman & Co.

An Ordinance for the Removal of Poles and wires from residence streets of the city of Madison, Wis., has been held void by the State Railroad Commission. The commission is of the opinion that the ordinance was prompted by esthetic considerations only and, therefore, is unreasonable.

The Latah Creek Bridge, Spokane, Wash.

By J. F. Greene*

A concrete bridge of pleasing design and monumental size is now under construction across Latah Creek, in Spokane, Wash. As shown in the plan in Fig. 1, the new bridge is so located that its center line parallels an adjacent old timber trestle which is in such precarious condition as to demand replacement. The new line is curved at one end so as to connect two different streets on opposite sides of the valley.

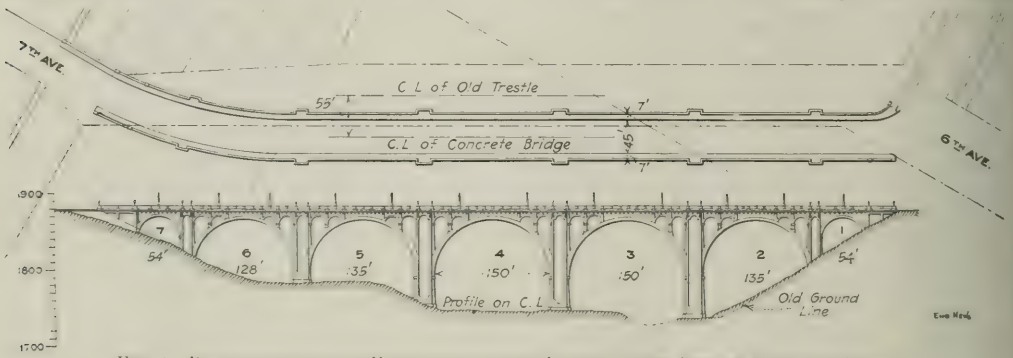


Fig. 1. Plan and Outline Elevation of the Latah Creek Bridge, Spokane, Wash.

The Latah Creek Bridge is 940 ft. long and consists of seven arch spans, varying in length from 54 to 150 ft. clear span. Two of the arches at the west end are on the curve; with their piers on radii. It has a 45-ft. roadway, with two 7-ft. sidewalks and carries a double track for heavy interurban railway cars. Each arch consists of four arch ribs, carrying the roadway slab on spandrel columns and arches.

In the determination of span lengths for the arches, architectural considerations were given much weight and an effort was made to effect a combination which was adapted to the ground line and site. The intrados and extrados curves are many centered, and were so laid out as to give a neutral axis which conformed very closely with the thrust line under dead load. The thickness of the arches are such that under any system of loads the line of resistance lies within the middle third, and the maximum stress is below 500 lb. per sq.in. Steel rods are added for temperature stresses.

Foundations.—Before beginning the design, test pits were sunk which disclosed a bed of hardpan below the creek bottom and a very compact sand at other points. As a result of loading tests upon the sand, the maximum pressure of 6 tons per sq.ft. was determined upon and heavy reinforced-concrete spread foundations were designed for this condition. In Pier 1, located on the east bank, in addition to the base shown on the plan, a cut-off wall 10 ft. deep, 6 ft. wide at the top and 3 ft. wide on the bottom was built along the west edge of the pier. During excavation for this pier, the sand along the east face stood without sheeting for a depth of 30 ft.

Piers.—The piers are of the box type, with solid longitudinal sections in line with the arch ribs and connecting curtain walls. Below the level of the sidewalks they are solid.

Arches.—The arch ribs are spaced 16 ft. 6 in. c. to c. and in all the spans are 5 ft. wide for the outer two ribs and 6 ft. wide for the inner two. They vary in thickness with the length of the span. Each outer rib is connected to the adjacent inner one by a thin slab at the intrados, but the inner two ribs are not connected except by the floor slab. As shown in Figs. 2-3, this floor slab is of reinforced concrete, carried on beams between the arch ribs and the spandrel arches and dropped down below level to allow space for the railway track. A waterproofing mat consisting of three alternate layers of burlap and asphalt cover this slab; a waterproofing cover of 2½ in. of concrete and a 1-in. sand cushion for 4 in. creosoted-wood blocks rest on top.

The two arches on the curve are of interesting design. In them the piers are on radial lines and the four arch ribs are straight, parallel and of varying length, as shown

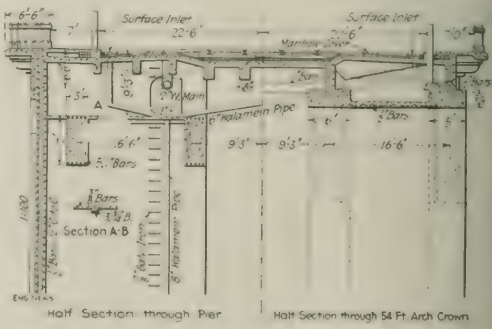


Fig. 2. Cross-section through Floor of Typical Arch

in Fig. 3. The curve is made in the transverse floor-beams spanning across the longitudinal beams, which are in line with and above the arch ribs.

Expansion Joints.—In the spandrel walls, expansion joints are provided at the ends of each panel and concealed behind pilasters. The design of spandrel arches is one about which there is considerable difference of opinion among engineers. In the Connecticut Ave.

*Construction Engineer, City Engineer's Department, Spokane, Wash.

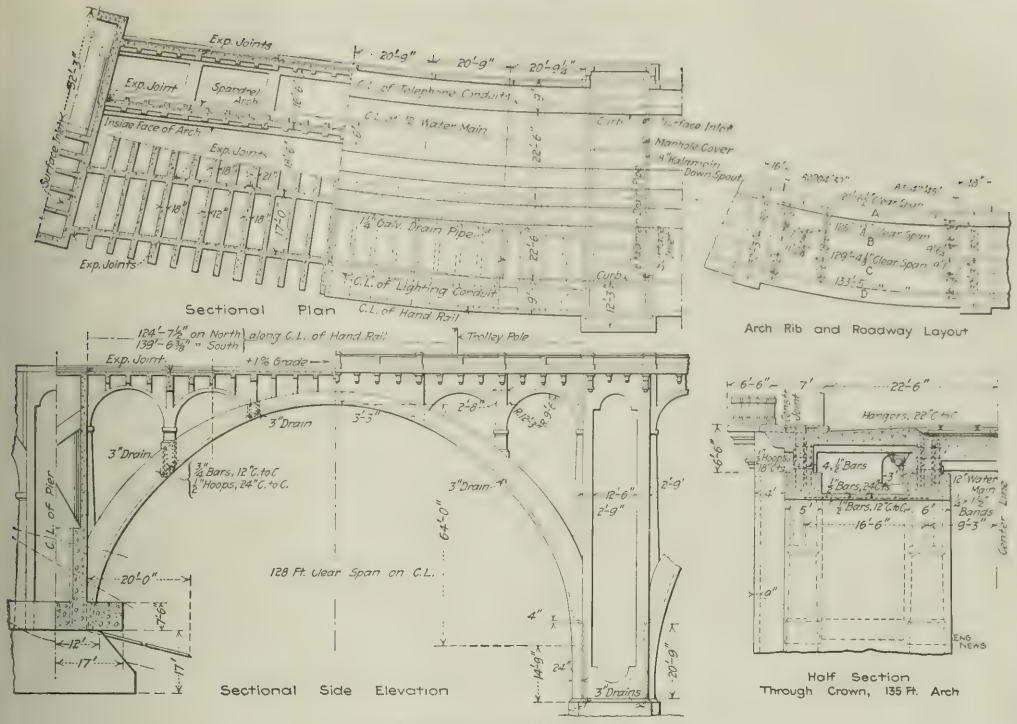


FIG. 3. DETAILS OF ARCH ON CURVE

Bridge, at Washington, D. C.,* and the Monroe St. Bridge at Spokane,† the simple treatment of the longitudinal faces of spandrel walls eliminated pilasters for concealing expansion joints. A fall in temperature, which lowers the main arch, draws the spandrel arches away from the piers, provided that there are no joints between the pier and crown of the arch.

In the Connecticut Ave. Bridge joints were left at the crown of each of the spandrel arches, which are visible at a distance of several hundred feet. On the Monroe St. Bridge, joints were placed at the third points and steel enough placed in the walls from joint to joint to take up the thrust of the two outside arches. Unconcealed joints are unsightly and even concealed joints are objectionable because it is exceedingly difficult to prevent leaks from these points.

MINOR DETAILS—Surface drains are provided at each pier and sub-drains for the expansion joints lead into these main drains. Provision has been made for a 12-duct line for the Washington Water Power Co., an 8-duct line for the telephone company; for a 12-in. water main and for a 12-in. gas main. Ornamental cast-iron posts resting on a concrete handrail support lights on the piers.

CONSTRUCTION

MATERIALS—The aggregate, consisting of screened gravel, ranges in sizes from 2½ to ¼ in. with an average percentage of voids equal to 37. The sand, screened from the same pit, is well graded and with a uniform percentage of voids equal to 33. At times owing to the difficulties of hauling over wet roads or a demand in excess of the capacity of the gravel plant, a crushed rock, showing voids of 45%, was used.

To eliminate the necessity for excessive cement-storage capacity at the bridge, an inspector was sent to sample



FIG. 4. VIEW OF PIERS DURING CONSTRUCTION

the cement placed in storage at the mill, the cement being shipped upon the expiration of the time required for 30-day tests; and this cement was frequently taken directly from the cars to the mixer, thereby eliminating rehandling.

*"Engineering News," June 1, 1905, p. 571.
†"Engineering News," Sept. 2, 1909, p. 241.

PLANT—The concrete plant is located at the east end of the bridge and consists of a storage bin for sand and rock, a half-yard batch mixer, a cement shed of 2000 bbl. capacity located on a railroad siding, and adjacent to the mixing plant, and an industrial railway running along on the south half of the trestle with turn-outs, and hoppers for depositing the concrete in the arches and piers.

LAYING CONCRETE—The concrete after mixing, was loaded into a train of two two-yard side-dump cars and drawn to the proper location by a gasoline locomotive. After dumping through holes cut in the deck of the old wooden trestle, the concrete flowed through open steel chutes to place.

This method of concreting produced an atmosphere of continual turmoil with the contractor owing to a natural desire to use an excessive amount of water. The water was measured in a tank with a float attachment, controlled by a 2-in. valve, and the amount was under the control of the operator. Any tendency of the concrete to stick in the mixing hopper or in the cars, or to clog in the chutes, is most readily offset by the addition of water, and a fluid mix requires little or no handling upon final deposition. During the construction of the piers, which contained about 40 yd. of concrete for each lineal foot of depth, the concrete was placed in layers of a foot at a time and an interval of an hour would elapse between the completion of pouring upon a section and the beginning of another pouring upon the same section. During this interval any excessive water in the concrete would rise to the surface and lie in pools thereon. Such a condition resulting from this or other causes is bad for several reasons. First, because this water, standing long enough to clear, deposits a layer of scum or laitance such as one may see upon a pier deposited under water; secondly, the new concrete crowds the water ahead of it, and this water in its movement washes the cement from the aggregate over which it passes. If it passes near a form, even though that portion of the concrete be spaded, streaks of wash sand will be visible upon the removal of forms. If the mixture as it is being deposited is so liquid that it will flow into place with little or no shoveling, it is very probable that there are pockets of grout, and of rock, and that there is not a uniform aggregate. Whether concrete poured with an excess of water, such as one sees on many of the jobs in which the chuting system is employed will equal in life that which just quakes under foot and no more, time alone will tell.

Under the system of inspection adopted, one man placed at the mixer, watched the measuring and mixing, checked the receiving and use of cement, and took void tests on sand and rock at two-hour intervals during the runs. From these void tests the quantity of concrete placed each day was determined and checked against the estimated amount of the run figured from the dimensions in place and a variation of more than 1% was investigated. A second inspector, located at the point of placing supervised the spading and working up of the concrete.

METHOD OF CONCRETING—The arches were concreted with voussoir sections, eight to each pair of ribs, and three keys, one at the crown and one at each third point. Each of the third point keys contained a 12x12-in. reinforced-concrete strut as a hinge. In every case, owing to the settlements of the falsework, these struts developed open cracks on the top side. The keys were composed of the same aggregate, 1:2:4, as the rest of the arch ring, but were placed very dry to reduce shrinkage.

In the process of concreting, the crown sections of the arches were placed first. As several of the arches were upon filled ground and settled 0.06 ft. under load, and as under this rib system no provision had been made to relieve the compression of the ribs owing to the settlement, there was a bulging at the third points which had to be relieved.

FORMS—The forms for the piers consisted of panels 5 to 7 ft. high, with vertical sheeting, 2x10-in. tongued-and-grooved pieces, and 3x8-in. horizontal waling spaced 4 ft. c. to c. The walings are tied by twisters of ¼-in. galvanized wire spaced 4 ft. c. to c., pulling against spreaders which are inserted between forms and removed as the concrete level rises. An objection to vertical sheeting on pier work is that the vertical board marks accentuate the horizontal joint marks between different day's runs.

The side forms for the arches were framed on the ground in panels with both the extrados and intrados cut to curve. These forms were tied together across the top with 2x8-in. planks, cleated to the lagging at the bottom and tied with galvanized-wire twisters at an intermediate level. The forms for the inner walls of the arch ribs were held up by temporary legs resting on the lagging and were removed as the concreting progressed, the weight of the forms coming upon the 2x8-in. ties which connected the outer forms. The lagging for the extrados was nailed on the backs of the side forms.

FALSEWORK—The falsework consisted of 8x8-in. posts spaced about 14 ft. centers longitudinally, and 5 ft. centers transversely. Upon these posts were placed corbels, 3 ft. long cut to curve, over which was built up a rib consisting of seven planks 1⅝ in. by 12 in. by 16 ft., nailed together and bolted with ⅝-in. bolts spaced 18 in. c. to c. It was intended that these ribs should carry the load to the posts by arch action, and provided that the ends of the ribs could have been fixed, there was sufficient section to do the work safely. During the process of adjusting the lagging it was found possible to take the arch out of these ribs with light wooden wedges, and in view of this, the contractor was required to reduce the spans of the ribs to one-third the original length by inserting 4x6-in. struts running from the bottoms of the ribs to the adjoining posts.

The erection of falsework was undertaken upon Arch 6 first, located at the west end of the bridge and upon a curve. This arch has a span of 128 ft. on center line, with its west face at springing line upon a radial line forming an angle of 82° 4′ with the center line. Both of these conditions, namely the beginning of the work and the peculiarity of the span, combined to make the unit cost of erection of falsework in this span 3.2 times that of Span 4, and the labor cost on forms 1.4 times that of Span 4. From a standpoint of economy, it seems evident that radial piers are not desirable.

CONSTRUCTION METHODS—A comprehensive cost report of the job has been kept; a daily report, embracing total quantities and cost for each individual portion of the work, and a monthly report upon which the totals for the month are drawn off, the unit pieces for the different classes figured and the percentages of the completed

portion to the whole estimated. Duplicates of all reports are made, one copy for use at the bridge, and one for the city engineer's office files.

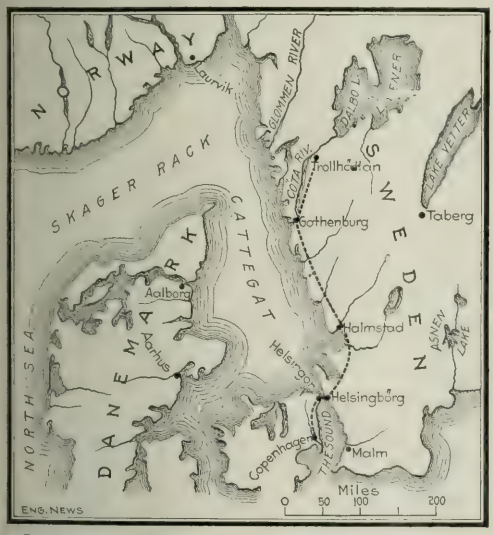
A diary is also made out daily containing a record of accidents, discussions and disagreements, and whatever else that might prove of use or interest.

PERSONNEL

The contractor for the bridge is J. E. Cunningham, of Spokane; the contractor's superintendent, J. C. Stack. The design and construction of the bridge were under the direction of Morton Macartney, City Engineer, the design having been made by W. S. Malony, and checked by Waddell & Harrington, Consulting Engineers, of Kansas City, and the construction in charge of J. F. Greene, with W. H. Fisher as assistant. The contract price for the whole structure was $416,000.

A 200-Mile, 90,000-Volt, Direct-current Power Transmission Project in Sweden and Denmark

The Danish government, to meet the increasing demand for electric power in Copenhagen, for some time has been negotiating with the Swedish government for the sale and transmission of electric current from the new large hydro-electric station recently built by the latter at Trollhättan. The report of the engineers, retained by these governments to study the feasibility of the project, has now been made and is abstracted in the *Electrical World* of Feb. 8, from which the following is arranged.



LINE OF THE PROPOSED TROLLHATTEN-COPENHAGEN 90,000-VOLT DIRECT-CURRENT TRANSMISSION LINE

The Trollhättan plant is now equipped with eight 10,000-hp. turbine units, with space provided for two more of the same capacity. It is proposed to transmit to Copenhagen this spare 20,000 hp. At the outset additions to the existing steam plant were considered, but it was found that the cost of generating such a local supply would be made up of a fixed annual charge of $5 per kw., plus 0.1c. per kw.-hr.

In order to make the transmission project feasible, a nearly continuous load was found necessary on account of the large expenditure in the transmission line. It was found that about a third of the local maximum demand, or 11,600 kw., could be maintained during 5200 hr. per year, or for some 11 hr. per day, giving a load factor of nearly 60% for this portion of the local service. The 11,600 kw., with transmission losses, corresponds to about 20,000 hp. at the Trollhättan plant, and this would absorb the output of two generating units not yet installed.

The route of the proposed line, shown in the accompanying sketch map, would be along the west coast of Sweden, from Guthenburg to Helsingbörg over the Strait of Oresund to Helsingör, and along the coast of Den-

ESTIMATED COST OF GENERATING AND TRANSMITTING ELECTRIC POWER; TROLHATTAN-COPENHAGEN PROJECT

	Alternating Current		Direct Current	
	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses
Generating station:—				
Two 10,000-hp. turbines and auxiliaries	$81,000	$7,600		
Three-phase generators	70,500	6,600		
Transformers at Trollhättan	31,500	2,950		
Switch gear	27,000	2,950		
Wages, oil and supplies	.....	3,200		
	$210,000	$23,000		
Changes for turbines			$40,500	$3,400
Isolating machinery			2,700	200
			$43,200	$3,600
Four 5000-hp. turbines			$81,000	$7,600
Direct-current generators and auxiliaries			216,000	21,400
Wages, oil and supplies			.....	3,200
			$297,000	$32,200
Transmission line:—				
Iron poles, including erection, at at $1350 per mile	$275,000	$27,200		
Insulators, at $390 per mile	80,000	7,900		
Iron cable, at $87 per mile	17,900	2,500		
Copper conductors, at $1525 per mile	310,100	21,000		
Wages for linemen	.....	2,200		
	$684,000	$60,800		
Poles, including erection			$125,100	$13,000
Insulators			31,900	3,200
Iron cable			17,800	2,500
Copper conductors			166,200	11,300
Wages for linemen			.....	2,200
			$341,000	$32,200
Three transformer stations:—				
Buildings	$40,500	$3,400		
Transformers	81,000	7,600		
Instruments	30,500	3,000		
Auxiliaries	40,500	4,200		
Wages and supplies	.....	4,000		
	$192,500	$22,200		
Submarine cables:—				
Four cables, each 3.4 miles, at $5780 per mile	$78,600			
Loading on steamer, laying and splicing	20,000	$14,200		
Freight and marine insurance	5,400			
Anchorage at cables	9,500			
	$113,500	$14,200		
Two cables, each 3.4 miles, 150,000 circ. mils			$24,600	$5,400
Laying of cables, etc.			18,900	
			$43,500	$5,400
Frequency-converter station:				
Three frequency changers, 25 cycles to 50 cycles; total 11,600 kw	$122,000	$11,400		
Switch gear	13,500	1,300		
Wages, oil and supplies	.....	3,200		
Incidentals	27,000	3,200		
	$162,500	$19,000		
Direct-current motors and auxiliaries			$221,000	$22,000
Three-phase generators			51,500	4,800
Switchboard and switch gear			10,800	1,100
Wages and supplies			.....	3,200
Incidentals			54,000	6,200
			$337,300	$37,300
Incidentals	$231,500	$24,100	$140,000	$14,400
Total	$1,593,000	$163,300	$1,202,000	$125,100
Total per kw	.....	$15.66	.....	$11.16

mark to Copenhagen, a total length of 204 miles. The greatest natural obstruction met with along this route is at the Strait of Oresund, where a stretch of water is encountered of 3.4 miles, making resort to submarine cables necessary.

Two schemes were worked out, one covering the use of three-phase equipment and lines, and the other direct current at 90,000 volts, under the Thury constant-current system. In the first case, was a 100,000-volt line with 150,000-circ.mil. conductors in a single three-wire circuit on iron poles with suspension-type insulators. At Helsingbörg it would be necessary to step down to 20,000 volts and carry the current in four three-phase submarine cables. From the Danish side of the strait the transmission could be continued at 20,000 volts, or at 100,000 volts, the latter being more economical. The main features of the estimate for this scheme are shown in the accompanying table.

The great advantage of the direct-current system was found to lie in the ability to transmit current under water at 90,000 volts without transformer stations at Helsingbörg and Helsingör. Over against this advantage would have to be set the necessity of 20 direct-current generators in series. The generators would be arranged in four groups, each of five in series, and each group connected to a 5000-hp. turbine. The efficiency of the direct-current generators and motors was assumed to be 93%, compared with 95% average for the alternating-current generators and motors. A single transmission line would be used with a ground return. The transmission wire, however, would be split into two parallel sections, each of 119,000-cir.mil. cross-section. Both steel-lattice and impregnated-wood poles were compared, and the latter found more economical in first cost and annual expense. The total annual expenditures are estimated to be $6.75 per kw. for direct current and $11.16 per kw. for cycle alternating current, with 12,615 kw. available in the first case and 11,200 kw. in the second.

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Reservoir and Canal Losses in Irrigation

SYNOPSIS—One of the supervising engineers of the United States Reclamation Service has compiled valuable data on evaporation and seepage losses from four large reservoirs and on the total losses from reservoirs, main ditches and laterals of six irrigation projects. All the data are for the northwestern part of the United States. Canal linings and the use of pipe to prevent the loss of irrigation water are described. Figures are given to show the ultimate economy of lined as compared with unlined canals.

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At the Seattle meeting of the American Society of Civil Engineers, there was read on June 27, 1912, a paper entitled "The Economic Aspects of Seepage and Other Losses in Irrigation" by E. G. Hopson, supervising engineer U. S. Reclamation Service, Portland, Ore. The paper has since been published in the *Proceedings* of the Society, Vol. XXXVIII, No. 8, p. 1223, where it was scheduled for discussion on Dec. 4, 1912. The article which follows is based on a copy of the original Seattle paper and illustrations supplied us by Mr. Hopson. The introductory portion of the paper has been slightly condensed, a few of the photographs have been omitted, and the tables and illustrations have been grouped for the sake of greater clearness and convenience.

Mr. Hopson's paper opens with a reference to data on the waste of water in city water-works systems, given in the report made in 1900 by John R. Freeman on the water-supply of New York City. Mr. Hopson points out that the arguments for cutting down waste in a water-works system apply with even more force to an irrigation system, since the economic burden of irrigation upon land under cultivation is much greater than that of domestic water-supply upon city dwellers, and since, too, it often happens that every bit of irrigation water wasted means just that much less land that can be made productive.

Having introduced his subject by this comparison, Mr. Hopson states that irrigation water wastes, like those from city water-works systems, may be divided into curable and incurable classes and that the object of his paper is to discuss these two classes of wastes, as illustrated by government irrigation works built in the Northwest during the past half-dozen years.

Broadly speaking, incurable irrigation losses are those due to absorption in reservoir beds and to evaporation into the air, while curable losses are confined almost wholly to seepage from canals and losses from other conduits.

TABLE I. WATER LOSSES FROM FOUR IRRIGATION RESERVOIRS. NORTHWESTERN UNITED STATES

East Park Reservoir, 1910-1911

(Maximum capacity, 45,000 acre-feet Maximum water surface, 1690 acres)

	Acre-feet	Percent of influent
Influent	65,400	
Effluent and losses.		
Evaporation	7,100	11
Use, waste and surplus	58,300	89
*Seepage	0	0

*No appreciable seepage loss.

Cold Springs Reservoir, 1908-11.

(Maximum capacity, 50,000 acre-feet Maximum water surface, 1550 acres)

	1908		1908-9		1909-10		1910-11	
	Acre-feet	Per cent	Acre-feet	Per cent.	Acre-feet	Per cent.	Acre-feet	Per cent.
Influent	20,366		42,820		61,526		72,273	
Effluent & losses								
Evaporation	2,400	12	4,295	10	5,333	9	6,252	9
Seepage	4,515	22	*4,021	9	*10,461	17	10,878	15
Use, waste and surplus	13,451	66	34,504	81	45,732	74	55,163	76
*Return flow			865		503		182	

Clear Lake Reservoir, 1909-11

(Maximum capacity, 450,000 acre-feet Maximum water area, 25,000 acres)

	1909-10		1910-11	
	Acre-feet	Percent	Acre-feet	Percent.
Influent	141,000		225,000	
Effluent and losses				
Evaporation	80,000	57	88,000	39
Seepage	48,000	34	24,000	11
Use, waste and surplus	13,000	9	113,000	50

Deer Flat Reservoir, 1909-11

(Maximum capacity, 186,000 acre-feet Maximum water area, 9250 acres.)

	1909		1909-10		1910-11	
	Acre-feet	Percent	Acre-feet	Percent	Acre-feet	Percent.
Influent	64,000		130,000		230,000	
Effluent						
Evaporation	4,000	6	18,000	14	20,000	9
Seepage	55,000	86	80,000	62	140,000	61
Use, waste and surplus	5,000	8	32,000	24	70,000	30

The percents in each case are percentages of volume of influent.

Water Losses from Irrigation Reservoirs

It is an economic impossibility for an engineer to prevent absorption or seepage losses from the beds of irrigation reservoirs, but he must accept responsibility for the choice of reservoir sites which will be a factor in reservoir losses. On this account Mr. Hopson presented data for four typical irrigation reservoirs built by the federal government in the Northwest. We quote from his paper as follows:

THE EAST PARK RESERVOIR is strictly a storage reservoir built on a branch of Stony Creek, one of the Coast Range feeders of the Sacramento River. The dam site is a good one, being a notch in a great conglomerate dike or ridge that runs through the country in a north and south direction, and

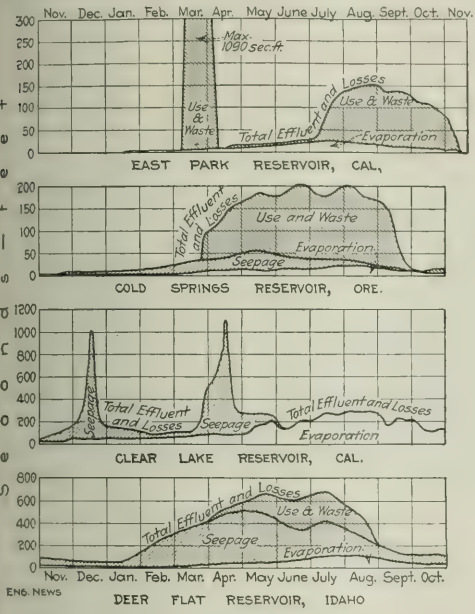


Fig. 1. Monthly Records in Second-feet, 1910-1911

This reservoir was first placed in commission in the Spring of 1908, and has been operated ever since. We have, therefore, four yearly records of results. In this case measurements were obtained with unusual accuracy, as the inflow practically all passed over a sharp crested weir at the lower end of the feed canal and the effluent was also carefully measured over another weir below the outlet gates. This reservoir shows losses ranging from 34% to 24% of the influent during the four-year period. Judging by the record of the past two years, it would appear that a fair condition of stability has been attained in the regimen, in which about one-fourth of the water entering this reservoir is subject to unavoidable loss through seepage and evaporation. (See Table I and Figs. 1 and 2.)

THE CLEAR LAKE RESERVOIR in California is a feature of the Klamath Project, situated just south of the California-Oregon line. It occupies a great natural depression or sink some 25,000 acres in extent at the reservoir flow line. About one-half of the bed consists of a natural sink of alkaline water known as Clear Lake that has for ages received and evaporated the surplus waters of Willow Creek. This reservoir was built by the Government for the principal purpose of holding back the

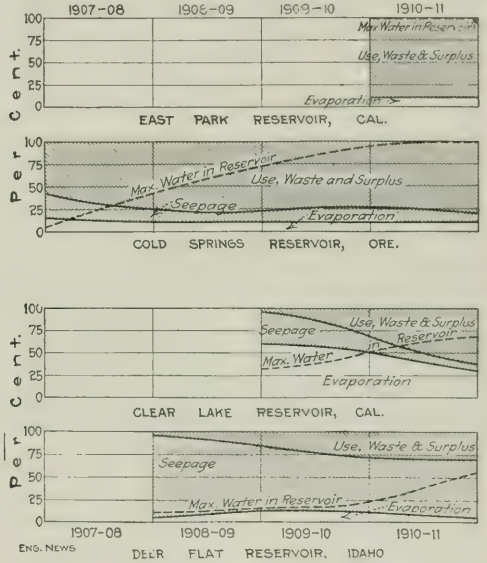


Fig. 2. Percentages for Four Years

Figs. 1 and 2. Evaporation, Seepage, Use and Waste of Water for Four Government Irrigation Reservoirs in the Northwestern United States

the dam is a solid masonry structure of gravity type on an arched plan. The bed of the reservoir is practically wholly in the typical California shale. The dam was completed in 1910 and water first stored in the winter and spring of 1910 and 1911. Weekly measurements are taken of the influent and effluent, the storage and rates of evaporation.

The maximum capacity of the reservoir is 45,000 acre-feet, and maximum area of water surface 1690 acres. In Table I may be found the results in the 1910-1911 season, the season being from Nov. 1 to Nov. 1 in this and all following cases. (See also diagrams Figs. 1 and 2.)

This reservoir represents the highest condition of efficiency of any of the four herein illustrated. The records fail to show any seepage loss, the only appreciable loss being that by evaporation, thus nearly 90% of the water entering this reservoir being available for use.

THE COLD SPRINGS RESERVOIR of the Umatilla Project in Oregon is a good average reservoir from a western standpoint. In the East it would probably not be regarded as a site of special promise. The dam is an earthen one, nearly 4000 ft. long, of a maximum height of close to 100 ft. The general structure of the country is volcanic, with vast overlying beds of stratified sands, gravels and hardpan. The valley constituting the reservoir site is the outlet of some 200 sq. miles of drainage area with little or no ordinary runoff. The reservoir is supplied by a feed canal some 25 miles long diverting from the Umatilla River at times when the latter has available water. waters of Willow Creek, to facilitate the unwatering of land marginal to Tule Lake, a body of water into which Willow Creek ultimately discharges. The reservoir was intended to combine the purposes of a great evaporating pan and regulator of the diversion channel that diverts the discharge of Lost River from Tule Lake into Klamath River. More recent plans have, however, considered its possibilities as a source of irrigation supply. The reservoir is enormous in capacity as compared with the available water-supply, being 450,000 acre-feet, with an area of 25,000 acres. The dam on Willow Creek is a rock-fill structure some 30 ft. in height, completed in 1909. We have two years records of the action of this reservoir. (See Table I. and Figs. 1 and 2.)

The rate of evaporation in this vicinity has been estimated at a little more than four feet in an average year. It will be noted that evaporation is the principal loss in this reservoir, as had been anticipated. Seepage losses during the first year were heavy, but apparently the marginal lands became filled up so that losses in 1911 were comparatively moderate. It is important to note that in a year of copious runoff, like 1910-11, as much as 50% of the supply was subject to unavoidable loss or waste, which in this case was intentional, the principal purpose of the reservoir being the disposition of surplus water, rather than its conservation for use.

THE DEER FLAT RESERVOIR, a feature of the Boise Project, in Idaho, presents different natural conditions from the three preceding types. It does not occupy a natural drain-

age valley or sink, being, on the contrary, situated on a flat saddle between the hills, the lower ends of which are closed by two earthen dams. The reservoir derives its supply, as in the case of the Cold Springs Reservoir, through a feeder canal, known as the New York Canal, diverting from the Boise River some ten miles southeast of Boise. The reservoir was first placed in commission in 1909, and has been in operation ever since. The bed of the reservoir consists in large part of silts, sands and gravels, with a covering of from 3 to 5 ft. of soil. Seepage losses in this case have been pronounced from the outset, and constitute the bulk of all losses. When the reservoir was first placed in commission almost 90% of the water entering it was lost by absorption in the reservoir bed. In that year, however, the reservoir was only filled to one-tenth of its capacity. During the next two seasons larger and larger quantities were introduced, and the proportion of losses has appreciably fallen, but still remains high. During the last season about two-thirds of the water entering this reservoir was subject to loss through evaporation and seepage. It may be expected that conditions will improve at this point, as the adjacent and underlying strata of the reservoir gradually become filled by the constant application of water, but the extent and period of these ameliorating conditions are quite uncertain. (See Table I and Figs. 1 and 2.)

The above records, while incomplete and faulty in many respects, are among the best obtainable in a new country like this, and in any event are instructive. I think the general problem of reservoir losses is often given less attention by engineers than its importance warrants. The dam site is apt in many cases to monopolize attention, and an engineer accustomed to deal with reservoir sites in eastern river valleys, where the adjacent water tables are high and losses are almost confined to evaporation, may be led to the commission of grave mistakes.

A great deal has been said and written about return flow. One of my earliest recollections in connection with reservoir studies is the discussions in the proceedings of the Society between Messrs. FitzGerald. Stearns, Fteley and others on ground water storage of certain reservoirs in the East. Mr. FitzGerald's conclusions as to the general inadvisability of giving credit to the invisible storage of a reservoir, is I believe, wise. Save under exceptional conditions, I doubt whether much, if any, additional draft can be made from Western reservoirs in excess of the visible storage.

The Cold Springs Reservoir has, during the past four years, absorbed some 30,000 acre-feet of water in its bed. It has apparently only yielded back about 1500 acre-feet of this amount. The Deer Flat reservoir has apparently absorbed 270,000 acre-feet, with little or no return.

It should be observed that the amount of water discharged into Deer Flat Reservoir has largely increased each succeeding year, thus submerging large areas of new surface and that in spite of this fact, the percentage of loss is steadily decreasing. This decrease of loss has extended into the year 1912, of which complete records were not yet available when this paper was written.

It is important to note that in a reasonably good representative irrigation reservoir, such as Cold Springs, one-quarter of the water turned into it is lost, and that apparently under the most favorable circumstances, as at East Park, 10% will be lost.

The main lesson to be derived from these few illustrations is that the geologic structure of the site should be given the most careful consideration, it being vital to determine in advance as nearly as may be the amount of reservoir losses, and whether they are likely to be of a permanent character.

On the Umatilla Project the cost of the irrigation works per acre of irrigable land is from $60 to $70; on the Truckee-Carson Project about $40; on the Orland Project about $50; the Tieton about $90; Sunnyside about $50, and Klamath from $30 to $40, say an average of about $55. This is a fair indication of the general run of costs in large irrigation work hereabouts, and is probably lower than the average costs on newer projects either [illegible]

LOSSES FROM RESERVOIRS, CANALS AND FARMERS' DITCHES

The [illegible] of the water-supply system as expressed in percentages of the water diverted are shown in Table II.

The losses from the diversions down to the end of the regular [illegible] that are operated by the Government [illegible] from reservoirs to supply the whole supply, but below these are the ramifications of the small ditches built by the farmers to distribute water to their farms. These farm ditches are usually small earth trenches, in which heavy seepage occurs before the water actually reaches the crop. Although in some cases farmers use water-tight flumes and pipes for their [illegible] distribution. The proportion of these cases is as yet comparatively small, although on the increase. It has been estimated that seepage losses in the farmers' ditches or gates probably are not less than 20% of the losses in both canal and lateral systems. It should be understood that the losses in the farmers' ditches (Table II.) are merely the expression of individual opinion, not of actual measurement.

TABLE II. TOTAL WATER LOSSES FROM SIX IRRIGATION PROJECTS

		Canal Losses		Total	
	Reservoir	Canals and laterals	Farmers' ditches	Without farmers' ditches	With farmers' ditches
Umatilla	20	32	15	52	67
Truckee-Carson	0	41	15	41	56
Orland	8	23	10	31	41
Klamath	0	48	15	48	63
Tieton	0	24	8	24	32
Sunnyside	0	27	7	27	34

[Fig. 3 shows volumes of water diverted to six irrigation projects in the irrigation season of 1911 and what became of the water—Ed.]

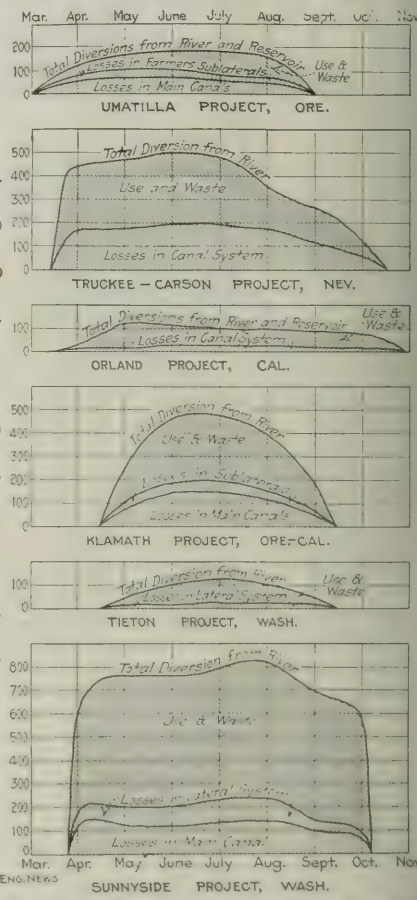


FIG. 3. TOTAL RIVER DIVERSION, USE AND WASTE LOSSES IN SUBLATERALS AND IN MAIN CANALS ON SIX IRRIGATION PROJECTS IN THE NORTHWESTERN UNITED STATES, SEASON OF 1911

LINING CANALS TO PREVENT SEEPAGE LOSSES

Seepage losses on the Umatilla Project early assumed serious proportions, owing to the sandy character of the soil and the gravelly substrata. With the unlined earth ditches as originally constructed only about one-third of the water diverted reached its proper destination. The works were costly and the quantity of supply limited. Unless means could be found to lessen these losses it was evident the entire area could not be irrigated and the building costs would not be wholly repaid.

Other severe proportional losses were found on the Truckee-Carson Project in Nevada and the Klamath Project in Oregon,

but in both of these latter is more elasticity due to their greater available supplies and, in the case of the Klamath Project, to the small aggregate quantity used.

Losses on the Tieton and Sunnyside Projects are probably much more satisfactory than in the average well constructed project in this vicinity, due in the first cast to the complete concrete lining of the main canal and the tight character of the substrata of the irrigated lands. In the Sunnyside Project the relatively small canal losses are due mainly to the fine texture of the soils.

It is probably a fact that in the average project from 40 to 50% of the supply is lost by seepage in the beds of channels before it reaches the actual point of application. As the farmer is paying from $30 to $90 per acre for this water the loss has a very appreciable value.

In Southern California valuable orchard lands have been under irigation for a generation. Corp values have been very high and, in many cases, the water-supply has been so limited that effective measures toward conservation have been enforced. On many projects there the distributing channels are lined with concrete or pipe is used with liberality. The high values of lands and the scanty supply have rendered these measures not only desirable but necessary. Strict economy in use has also been enforced for the same reason, but in the newer projects in the Northwest, where lower valued crops obtain, it has not hitherto been seriously regarded as feasible to resort to such expensive treatment. Conditions have, however, materially changed here with regard to crop values, and many of the water-supplies that appeared inexhaustible a few years ago are rapidly getting fully appropriated, so that reasons for economy and waste prevention are becoming more and more cogent.

Some interesting experiments* carried out under the auspices of the College of Agriculture of the University of California, in 1906, by Prof. B. A. Etcheverry, on various kinds of canal linings, including concrete, clay puddle and oiled surfaces, are worthy of consideration. The object of this experiment was to determine relative costs and efficiencies of different classes of lining in reducing seepage and preventing growth of vegetation. Without attempting to enter into details of these experiments, which can be obtained in the University Bulletin*, the general results showed that the concrete lining, although the most expensive, alone gave assured results. The oiling, as would be expected, is very much cheaper than any other treatment, being only about one-quarter the cost of the concrete per square foot. During the first year it appears to be of some value in reducing seepage losses, measurements showing that losses as compared with those in an untreated earth canal are only about 40% of the latter. The oil seemed to be principally valuable in preventing growth of vegetation. The lining by clay puddle gave somewhat better results in preventing seepage than the oiled surface. The mortar and concrete linings, however, prevented from two-thirds to nine-tenths of the total losses and, of course, entirely stopped the growth of vegetation.

Apparently the effect of the oil treatment is only temporary, and a re-examination of the canals in which the experiments were made a year or two afterwards showed that the oil treated canals had grown up to vegetation to an equal extent to those untreated, and in all probability the seepage losses were equally as great.

*See Eng. News, Dec. 5, 1907, pp. 620-2, for abstract.

In 1910 and 1911 a lateral on the Umatilla Project was lined with mortar 1 in. thick and careful measurements made to determine losses. The lateral had been selected for lining on account of the very porous character of its bed and in order to reduce seepage loss. With the lateral closed at the ends by dams, measurements showed that the water surface lowered about 0.1 ft. each day in the lined ditch, and applying this rate of loss to the canal system as a whole, making due allowance for velocity of flow, it was computed that the aggregate seepage loss in the project, if all canals were lined, would be about 5% of the supply. With the unlined system the loss is close to 50%. Other measurements that have followed confirm the above, and the conclusion has been reached from this and other data that seepage losses can be kept down to less than 10% of the amount diverted if good linings are placed.

[Two mortar-lined laterals and one unlined farmer's ditch on the Umatilla Project are shown by Figs. 4 and 6 and a concrete-lined canal on the Tieton Project by Fig. 5.—Ed.]

During the past two years a great deal of canal and ditch lining has been placed on government projects in the Northwest. These linings are from 4 in. to 1 in. in thickness, depending on the size of the canal and the conditions. The heavy lining is made of regular sand and gravel concrete proportioned about one cement to eight of sand and gravel. The linings are generally placed without forms, the sides of the channel being trued up and a rather dry mix being used. Costs have usually run about $6 per yard. The great bulk of the ditch lining has not, however, been of regular gravel concrete but of mortar, usually being mixed one of cement to four of sand. Before placing the mortar the ditches are carefully trued up by running a movable form or templet along their courses and wetting and tamping the earth around the form. Immediately after the form is removed the mortar is placed and kept damp until well set up. It is jointed usually at about 4-ft. intervals to take care of temperature shrinkage. This lining is done with much rapidity by experienced gangs, the materials being mixed by small portable gasoline-driven mixers, the completed canals being kept full of water. Costs of work of this kind carried out on a fairly large scale—for lining 1½ in. thick, reinforced at the top by an extra heavy curbing—runs from 55 to 60c. per sq.yd., inclusive of all administrative and engineering charges and of the earthwork. In general, the cost of the earthwork is about one-third of the entire cost.



Fig. 4. Mortar-lined Laterals and Concrete Structures



Fig. 5. Mortar-lined Lateral, Showing Joints

Figs. 4 and 5. Lined Irrigation Canals on the Umatilla Project

Taking for example a small lateral of the Umatilla Project lined in this way during 1911: the length was 12,400 ft.; ditch dimensions 4 ft. wide at bottom, 4 ft. deep, with side slopes 1½ to 1; the entire cost of the work averaged $1.05 per ft. Comparing a small ditch thus lined with one unlined, the lined ditch will be from three to four times the cost of the unlined ditch, but one of the economic advantages the lined ditch possesses is the greater velocity of flow possible and the consequently smaller cross-sectional area of the channel. Another advantage of importance is the avoidance of drop structures possible in the lined ditches. It is surprising what a large proportion of the total cost of ditch building goes into drop structures that are necessary to keep velocities below the eroding point in an earth channel. With lined channels high velocities are not only possible but desirable in order to keep the channel clean.

As an illustration of the proportion the cost of structures in a distribution system bears to the entire expense of the latter, figures taken from the Orland Project in California are given. The territory here is notably free from topographic irregulari-

ties and the earth is firm and good for building purposes. The proportion of cost of structures here, therefore, would be expected to be small.

The lateral system covers 14,000 acres and includes 54 miles of ditches ranging from 12 to 75 sec.-ft. capacities. Very little ditch lining has been placed, but structures are all of concrete, the cheapest building material. Cost totals are as follows:

Excavation work	$64,376
Structures	57,632
Total	$122,008

The structures included in the above comprise the following types:

Checks and drops	$20,885
Turnouts	12,901
Bridges	9,972
Railroad crossings	6,924
Special structures	5,805
Spillways	1,143

Checks, drops and turnouts total $33,780, or 28% of the entire cost of the lateral system. Not all of this cost could be obviated by lining the system, but certainly a very large proportion of it would be.

With a smaller cross-sectional area, the saving in drop structures, and the more direct and economical location possible in the lined ditches, the actual difference in cost per acre of land served by lined or unlined canals is comparatively small. It will generally be found less than $10 per acre, in many cases less than $5. If one takes into consideration the operating economies, the lined laterals have a distinct advantage in their freedom from breaks, seeped banks, and growth of vegetation in the channels, all of which should admit of a material reduction in operating costs. If these latter savings could be figured from an investment standpoint and capitalized, the advantage in first cost of the unlined ditches would often disappear and a substantial margin be shown on the other side.

PIPE FOR DISTRIBUTION SYSTEMS

While considering canal lining it would be well to pay a little attention to the merits of pipe work in a distributing system. Large quantities of pipe work have been used in the distributing systems of the Umatilla, Tieton and Sunnyside Projects. The great bulk of this pipe is concrete, both reinforced and plain, in sizes running from 54 in. down to 12 in. in diameter. Sizes below 24 in. have been usually made by the dry process, reinforcement consisting of outside wire, wound under tension. Larger diameters have usually been wet mixed, the pipe being manufactured in forms and handled and laid like cast-iron pipe. Some of these lines of pipe are of great length and are working under heads running up to 110 ft. They have practically given satisfaction from every standpoint. A distribution system consisting wholly of concrete pipe would undoubtedly be the most satisfactory from an operating standpoint, and although the first cost would be comparatively high, it might in the end prove to be more truly economical than the open ditch systems. With concrete pipe seepage losses are practically negligible. A number of tests of different lines of 4-ft. pipe, with 3-in. shell, under operating conditions, show the following:

Length, ft.	Head, ft.	Average seepage, second-feet per mile
4700	39	0.07
5400	28	0.05
3600	19	0.04
9800	85	0.20

Apparently the loss per mile of this size pipe is nearly directly proportional to the head, averaging about 0.02 sec.-ft. per mile for each 10 ft. head carried on the pipe. A pipe distributing system of concrete throughout, under an average pressure of 50 ft. head, with delivery to each 40-acre subdivision, would thus only lose about 1% in amount, which is practically negligible.

Taking the average of the six projects quoted, we have an average cost of the irrigation works of $55 per acre and an average combined loss in reservoirs and canals of about 50% of the entire water-supply. Of the latter about 6% is practically incurable reservoir loss; the remaining 44% has been classed as curable; that is to say, the great bulk of it can be cured or prevented if economical conditions render such action wise.

Should the ditch systems of these projects be wholly lined with concrete or pipe the losses might be reduced from 44% to 10% or less in amount, a net saving of 34%, or say one-third of the whole supply. It is therefore evident that either the systems could be extended to cover about one-third more area, or should that land not be available, the works might be constructed of smaller dimensions and at less cost. In the case of works already built the latter alternative is inapplicable and is merely illustrative of what might have been done but what cannot be helped now. The lesson should, however, be applied to new work. In cases, however, where new lands can be taken in under existing works consideration should be given to the possibilities of extension by lining the present systems.

ADVANTAGES OF CANAL LININGS AND OF PIPE

Suppose, for example, a project of 20,000 acres costing $55 per acre, or a total of $1,100,000; if by lining the ditches the irrigable area can be increased to 27,000 acres there will be first an additional cost for the new laterals with lining which has been found to be somewhere about $18 per acre in a fairly difficult country, or for the 7000 acres an additional construction cost of $126,000 will be necessary. Secondly, there will be the cost of lining the present ditch system covering 20,000 acres, which, taken at $12 per acre, would mean an added charge of $224,000. The gross cost of the extended project would, therefore, be $1,450,000, or an average cost of $54 per acre. This does not apparently result in a material reduction in the acreage cost, but the great advantage lies in rendering available for profitable use the larger areas of land, the conservation of the water-supply and the avoidance of drainage evils referred to hereafter. As a matter of fact, the process of extending a project already constructed with unlined earth canals, by the subsequent lining of ditches, is always much more expensive than if the system had been constructed de novo with all of the system lined.

In the case of a proposed large extension of the Umatilla



FIG. 6. TYPICAL FARMER'S IRRIGATION DITCH, UMATILLA PROJECT



FIG. 7. CONCRETE-LINED MAIN IRRIGATION CANAL, TIETON PROJECT

Project it is planned to completely line the entire canal system from the headworks down to the minor ramifications of the distribution system delivering to each 40-acre subdivision. At no point in the system will the water be exposed to avoidable seepage loss, and when the headgates at the reservoir are opened the government will have assurance that upwards of 90% of the supply will actually reach the cultivated fields.

THE DRAINAGE PROBLEM

Closely connected with the question of canal losses is the drainage problem. On nearly every irrigation project there will be found large and frequently increasing areas subject to the rise of ground water. The principal contributing influence in most cases is the seepage losses from the lateral systems, although a proportion, of course, is due to over irrigation of the fields.

On the Sunnyside Project in Washington some four or five thousand acres of the best land was seriously affected when the United States purchased the system a few years ago, large areas having been practically forced out of cultivation. In this case the United States was compelled to build a deep channel at a cost of some $340,000, mainly for the purpose of affording an outlet to the surplus water. On the Minidoka Project in Idaho the drainage feature is one of the most serious problems.

At Umatilla the seepage water accumulating below the project in the Umatilla River has increased the summer flow some 100 sec.-ft. and has rendered necessary the excavation of extensive drainage ditches through the lower lands.

At Klamath some $40,000 has been spent during the past three years on this account, and on the Truckee-Carson Project it is planned to expend not less than $400,000 in addition to the large sums already spent.

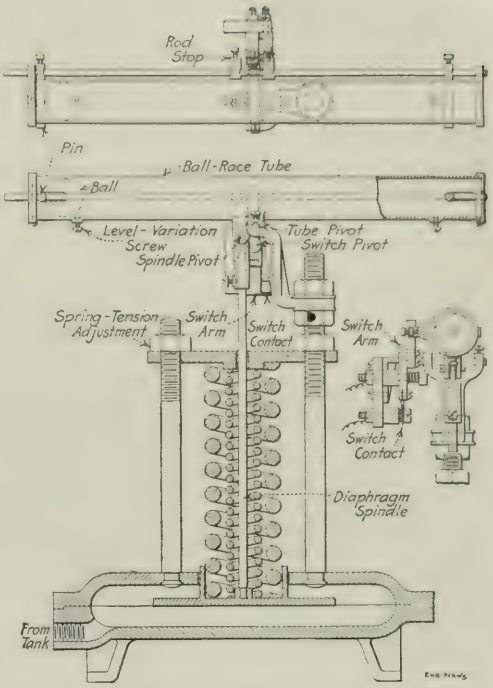
There is no question that much relief from this increasing danger will be experienced by eliminating from the ground water accumulations the bulk of the canal seepage. It is my belief that as time goes on it may even be found necessary for legislatures to require canal systems to be lined or otherwise protected from seepage loss not only in the interests of the investor and water user but as a reasonable measure of conservation when water-supplies are limited. As an engineering and business policy it is well in the front rank for consideration by all those building new works or operating and extending those already constructed.

❋

A Pressure-operated Switch for Pump Motors and Low-water Alarms

The electric switch shown in the accompanying figure has been designed to serve the purpose of the more cumbersome float-operated switches which require a considerable travel of the float mechanism and are subject to such mechanical difficulties as sticking, freezing, etc. Pressure from the receiving tank is transmitted to the chamber under the diaphragm, forcing this, with its attached rod, upward and tilting the horizontal hollow cylinder at the top of the device. This movement of the cylinder permits a large ball inside to roll from the left-hand end to the right, striking a pin which projects into the interior of the cylinder and which is attached to a rod moving parallel to the cylinder. This motion is transmitted through a stop on the rod to the switch arm, opening the electric circuit and stopping the pumping motor.

When the water level drops, and with it the pressure under the diaphragm, the springs about the diaphragm spindle force the latter down and return the cylinder to its horizontal position, whereupon the ball rolls from right to left, striking the corresponding pin projecting into the cylinder at the end, and moving the parallel rod so that the stop on it throws the switch lever into contact to complete the motor or alarm circuit. The inclination of the horizontal tube, which is necessary before the ball is released, can be adjusted by the screws shown on the under side. This controls the variations of water level in the water tank; actual height of water level is varied by changing the tension on the springs of the diaphragm



DIAPHRAGM TYPE OF ELECTRIC SWITCH FOR PUMP MOTORS OR LOW-WATER ALARMS
(Golden Anderson Valve Specialty Co., Pittsburgh)

spindle, and for this two frame rods are provided with adjustment nuts and a plate bearing on the springs. The device is built by the Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh.

❋

Public Ownership of Telephones in Canada has reached considerable proportions. A pamphlet report, giving "telephone statistics" of Canada for the year ending June 30, 1912 (A. W. Campbell, Deputy Minister, Department of Railways and Canals), states that in Manitoba and Alberta all telephone companies have been practically absorbed by the provincial governments, while in Saskatchewan similar absorption is now in progress. The number of municipal telephone systems owned by the various provinces is as follows: Ontario, 27; Alberta, Saskatchewan, Manitoba and British Columbia, 8 altogether, making 35 municipal telephone systems in the whole Dominion. There are also in the Dominion 133 coöperative, 31 partnership, and 113 private telephone systems against 368 stock companies and the public systems already mentioned.

Electrically Operated Excavating Machinery is to be used in the construction of the diversion channel of the Little River Drainage District, in Missouri. Current will be generated at a central power station, transmission lines being run along the channel. The excavators will be revolving machines handling clam-shell and drag-line buckets, and traveling on tracks laid along the work. The excavated material will be used to form levees. This channel will discharge into the Mississippi River about two miles below Cape Girardeau, Mo. It will intercept the Castor and Whitewater Rivers, Crooked Creek, and other streams whose present outlet is through Little River to the St. Francis, and then into the Mississippi River, near Helena, Ark. The contractor for this work is D. C. Stevens, of Buffalo, N. Y., whose bid for the two sections amounted to about $1,229,585. This covers 3907 acres of clearing and 8,621,500 cu.yd. of excavation. The right-of-way has been obtained and the clearing of the timber will be commenced shortly. The district has an area of about 500,000 acres.

A Comparative Test of Two Full-sized Reinforced-concrete Flat-slab Panels

By Henry T. Eddy*

Two experimental reinforced-concrete flat slabs were submitted to test by Prof. W. H. Kavanaugh, of the University of Minnesota, at Minneapolis, during the latter part of 1912. The first slab was made in accordance with the specification of the Norcross patent† except that belts of rods were substituted for the netting mentioned in the each belt. The concrete was of 1:2:4 mix, and while only about four weeks old, had been poured warm and under such unusually favorable conditions as to have become well hardened at the time of test.

The astonishing difference in stiffness and the remarkable difference in strength of these two slabs, the sudden, complete and total collapse of the first slab, contrasted with the slow, gradual yielding of the second under an excessive load several times as great as that which caused the first to fail, present an object lesson in safe and economic design worthy of the most careful study.



Fig. 1. Norcross Slab



Fig. 2. Mushroom Slab

Figs. 1-2. Test Slabs before Concreting, Showing Reinforcement Arrangement

specifications. The second slab was made according to the Turner "mushroom" system.

These slabs were both of the same thickness, viz., 6 in., and were supported by columns placed at the corners of a square 12 ft. from center to center of columns. The slabs projected approximately 2½ ft. beyond the centers of the columns on each side and had each precisely the same number and size of reinforcing rods, in

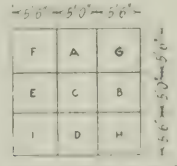


Fig. 3. Arrangement of Loading on Norcross Slab

TABLE I. LOADS ON NORCROSS SLAB IN POUNDS

Load No.	1		2		3		4	
Area	Per sq. ft.	Total	Per sq. ft.	Total	Per sq. ft.	Total	Per sq. ft.	Total
A	114.1	3,138	228.7	6,288	228.7	6,288	228.7	6,288
B	114.1	3,138	228.7	6,288	228.7	6,288	228.7	6,288
C	114.1	2,852	240.1	6,002	456.8	11,420	456.8	11,420
D	114.1	3,138	228.7	6,288	228.7	6,288	228.7	6,288
E	114.1	3,138	228.7	6,288	228.7	6,288	228.7	6,288
F							250	7,500
G	Corner Areas not loaded						250	7,500
H							250	7,500
I							250	7,500
Sum	90	15,404	121	31,454	143	36,572	276	66,812

*Professor of Mathematics and Mechanics, College of Engineering, and Dean of the Graduate School, Emeritus, University of Minnesota, Minneapolis, Minn.

†See Specification U. S. Patent No. 658,542

Norcross Slab

Norcross, in his patent already referred to, describes his construction as consisting

> essentially, of a panel of concrete having metallic network encased therein, so as to radiate from the posts on which the floor rests. . . . The posts are first erected, and a temporary staging built up level with the tops of posts. Strips of wire netting are then laid loosely in place on top of the staging. . . . The concrete is then spread upon or molded in place on the staging to inclose the metallic network. In practice I have sometimes laid the concrete in layers of different quality, the lower layer of the floor which incloses the wire being laid with the best concrete available. . . . If the forces acting upon a section of flooring supported betwen two posts be analyzed it will be found that the tendency of the floor section to sag between its supports will cause the lower layers of the flooring to be under tension while the upper layers of the flooring will be under compression, these stresses being, of course, the greatest at the top and bottom layers, respectively.

The number and arrangement of the reinforcing rods in the experimental slab (eleven ⅜-in. round rods in each side and diagonal belt), is clearly shown in Fig. 1, which is a view of the forms ready for pouring the concrete. It will be noticed that these rods lie very nearly upon the bottom of the forms throughout their entire length, both over the columns and elsewhere, and the main distance from the center of action of the steel to the top surface of the slab is taken as $5\frac{3}{4}$ in. This arrangement is in accordance with the Norcross specifications. Steel plates, 20x20x⅞ in., carry the rods and rest on the tops of the columns which, in this case, consisted of steel pipes about 5½ in. in diameter, filled with concrete and embedded at their lower ends in large concrete blocks.

A vertical central bolt in the concrete at the upper end of each pipe permitted the plates to be firmly secured to the tops of the columns. Fig. 4 shows the manner of loading the slab with pig iron. The slab is 16x16 ft. and the columns are on the corners of a 12-ft. square. The loading at first covered an area having the form of a Greek cross whose central square was 5 ft. on a side with arms 5 ft. 6 in. long, as represented in Fig. 3, and the progress of the loading is shown in Table I.

When 10,000 lb. had been piled on the central part of the slab in addition to load No. 4, of 66,812 lb., the slab suddenly failed. In anticipation of such failure, timber blocking had been placed under the slab to prevent its falling more than possibly 10 or 12 in.

Fig. 5 shows the condition of the slab after removing part of the final loading in order to render the nature of the failure visible. Careful extensometer measurements of the elongations of the steel rods at the middle of the side and diagonal belts were made under the action of loads Nos. 1, 2, 3 and 4, and also similar extensometer measurements in the concrete both on the top and the bottom of the slab along the center line of the side and diagonal belts near those edges of two of the steel plates which were nearest the center of the belts. Besides these, certain other measurements of the concrete were made at right angles to the diagonals. Deflections were also measured under these loads at the middle of the diagonal belt and of two of the side belts.

These measurements all show beyond question that the side and diagonal belts act like simple beams in this form of construction, since the stresses in the steel and concrete on the under side of the slab in the direction of the rods is invariably tensile, while the stresses in the same directions on top of the slab are always compressive. It was the avowed intention of Norcross to reinforce the slab in this manner since he regarded the upper part of the slab as being subjected everywhere to compression and the lower part to tension only, as stated in his specifications as already quoted.

The computation tabulated in Table II shows a good approximate agreement of the results of this test with the beam theory of flexure, assuming, for simplicity, that the stiff steel supporting plate and interlacing of the ends of the belts diminishes the effective span of the side belts by 12 in. and the diagonals in the same proportion, and further assuming that the loading was all applied at the middle of the side and diagonal belts.

The comparisons given in Table II were computed according to the following methods:

Extensometer measurements were made for a length of 8 in., consequently the stress per square inch in the steel is

$$f_s = \tfrac{1}{8}\, e \times 30{,}000{,}000 \qquad (1)$$

Where e = elongation in 8 in.

Then, using the following notation:

W = Load causing elongation e;
A = Total area steel;
d = Depth of slab to center of steel;
L = Length of span;
j = Ratio of lever arm of resisting couple to depth d;
jd = Distance from center of steel to neutral axis.

Assuming a concentrated load W at the middle of the beam,

$$M = \tfrac{1}{4}\, W\, L$$

$$M = Ajdf_s \qquad (3)$$

$$W = \frac{4Ajdf_s}{L} \qquad (4)$$

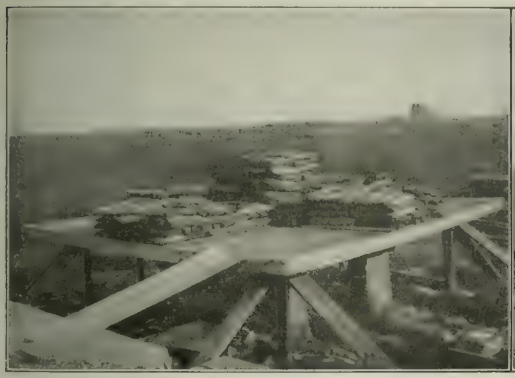


Fig. 4. Under Loading

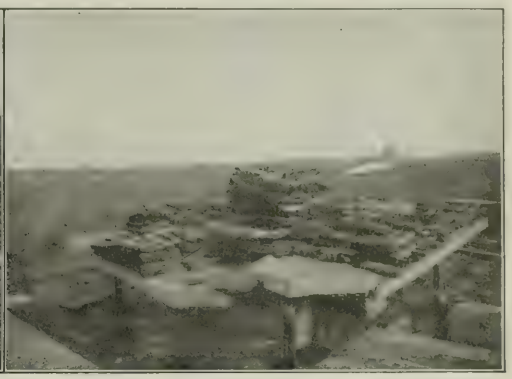


Fig. 5. Failure

Figs. 4-5. Norcross Slab under Test

In the Norcross slab

$A = 11 \times 0.11 = 1.21$ sq.in.;
$j = 0.9$;
$d = 5.55$ in.;
$L = 132$ in. for side belts;
$= 132\ \sqrt{2}$ in. for diagonal belts;
$i = 0.69$.

TABLE II. COMPARISON OF COMPUTED AND ACTUAL DATA ON NORCROSS SLAB

		Load Number 1	2	3	4
Side belts.	Average observed elong. in 8 in.	0.00205	0.00746	0.00922	0.01133
	f_s in pounds by Eq. (1)	7690	27980	34575	42500
	W_1 computed by Eq. (4)	1465	5330	6590	
Diag. belts.	Average observed elong. in 8 in.	0.00195	0.00722	0.00939	0.01229
	f_s in pounds by Eq. (1)	7313	27070	35200	45900
	W_2 computed by Eq. (4)	985	3650	4745	
$4W_1$	Comp. load in 4 side belts	5860	21320	35850	
$2W_2$	Comp. load in 2 diag. belts	1970	6700	9490	
$4W_1+2W_2$	Total comp. load on slab	7830	28020	35850	
$4W'_1+2W'_2$	Total actual load on slab	15404	31154	36572	
Side belts.	W'_1 actual load by Eq. (5)	2880	5800	6690	
	D, mid deflection by Eq. (6)	0.186	0.37	0.43	
	D' observed mid deflection	0.128	0.41	0.52	
Diag. belts.	W'_2 actual load by Eq. (5)	1940	3970	4820	
	D, mid deflection by Eq. (6)	0.35	0.72	0.865	
	D' observed mid deflection	0.22	0.707	1.02	

From the above formulas the loadings on the side and diagonal belts which should have caused the given elongations are computed and are given in Table II. It is then assumed that the total actual loads are carried by the various belts in the same proportion as the computed loads, since there is no other way of dividing the total load between the belts. This may be stated mathematically as follows:

Let

W_1 = Computed load on a side belt;
W_2 = Computed load on a diagonal belt;
W'_1 = Actual load on a side belt;
W'_2 = Actual load on a diagonal belt.

Then

$4\,W_1 + 2\,W_2$ = total computed load on slab;
$4\,W'_1 + 2\,W'_2$ = total actual load on slab.

$$\frac{4\,W'_1 + 2\,W'_2}{4\,W_1 + 2\,W_2} = \frac{W'_1}{W_1} = \frac{W'_2}{W_2} \qquad (5)$$

W_1, W_2 and $4\,W'_1 + 2\,W'_2$ being known, W'_1 and W'_2 can be computed.

Having found the actual distribution of loading, the center deflections of the belts have been computed by simple beam theory from the formula

$$D = \frac{W' L^3}{48\,E\,A\,I\,j\,d^2} \qquad (6)$$

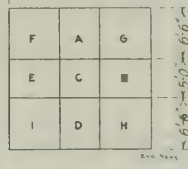


FIG. 6. ARRANGEMENT OF LOADING ON MUSHROOM SLAB

In Table II it will be noted that loading No. 1 is too small to develop sufficient elongations or deflections to overcome the initial compression in the concrete in which the reinforcement is embedded, so that the load carried by the steel is only about one-half of the actual load, the other half being carried by the concrete in which it is embedded. This is in complete accord with other similar experiments. But in case of loads No. 2 and No. 3, where the steel is stressed close to the yield point, the sum of the loads as shown by the stresses in the steel is very close to the total actual load. The stresses in the steel under loading No. 4 are so far beyond the yield point as to make computation useless.

It appears from Table II that the effect of the reinforcement is accounted for to a reasonably close approximation by considering the belts to act as a combination of simple beams, at least within the range of loading near the yield point of the steel. The steel reached its yield point under a total load on the slab of from 15 to 18 tons, and final collapse occurred under a total load of a little over twice the latter amount not distributed uniformly but piled more in the general form of a pyramid.

It was observed that the application of the relatively small loading on the corner areas *F, G, H* and *I* (Fig. 3) had a very injurious effect upon the slab, tending to break it across the tops of the columns.

The results of the test may be summarized in the Norcross system as follows:

(1) This slab is of the simple beam type, and the test shows no circumferential slab action and no cantilever action.

(2) The narrow belts running diagonally leave large areas without reinforcement, and there is consequently no provision for resisting circumferential tensions as required in slab action.

(3) The concrete showed compressive stresses on the

TABLE III LOADS ON "MUSHROOM" SLAB IN POUNDS

Load	1		2		3		4		5	
Area	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total
A	100 8	3,276	210 6	6,552	201 6	6,552	425 3	13,822	625 3	20,322
B	100 8	3,276	201 6	6,552	201 6	6,552	425 3	13,822	625 3	20,322
C	160 8	2,532	201 6	5,040	418 3	10,458	861 8	21,546	1261 8	31,546
D	100 8	3,276	201 6	6,552	201 6	6,552	425 3	13,822	625 3	20,322
E	160 8	3,276	201 6	6,552	201 6	6,552	425 3	13,822	625 3	20,322
		Corner	Areas		Not	Loaded				
Slab	48 2	15,624	96 4	31,248	113	36,666	237 0	76,835	348 0	112,835

Load	6		7		8		9		10	
Area	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total	Per sq.ft.	Total
A	746	23,922	772 9	25,122	899	29,222	899	29,222	899	29,222
B	736	23,922	722 9	25,122	899	29,222	899	29,222	899	29,222
C	1480 2	37,006	1566 4	39,236	1889 4	47,236	2689 4	67,326	3329 4	83,236
D	736	23,922	772 9	25,122	899	29,222	899	29,222	899	29,222
E	736	23,922	772 9	25,122	899	29,222	899	29,222	250	29,222
I			250	10,560	250	10,560	250	10,560	250	10,560
G			250	10,560	250	10,560	250	10,560	250	10,560
H			250	10,560	250	10,560	250	10,560	250	10,560
I			250	10,560	250	10,560	250	10,560	250	10,560
Slab	709	132,695	564 5	181,965	637	206,365	700	226,365	748	242,365

TABLE IV COMPARISON OF COMPUTED AND ACTUAL DATA ON "MUSHROOM" SLAB

Load no.	1	2	3	4*	5*	6	7
Side belt	Computed elong. of middle reinf. steel	0 00026	0 00058	0 00071	0 00040 0 00270	0 00373 0 00610	0 00628	0 00708
	Side belt load	975	2175	2662	5,250 10,120	14,000 22,900	23,550	26,550
Diag. belt	Diagonal belt load	65	145	190	350 675	933 1,526	1,569	1,800
	Computed mid deflection	0 0174	0 0388	0 0508	0 0936 0 1800	0 250 0 108	0 420	0 482
	Actual mid deflection	0 0170	0 0353	0 0463	0 121 0 251	0 395 0 108	0 439	0 517
	Computed elong. of steel	0 00017	0 00041	0 00069	0 00126 0 00272	0 00101 0 00607	0 00681	0 00758
Side belt	Load	637 5	1160	1460	4,725 10,200	15,000 22,762	25,500	28,400
	Computed mid deflection	0 0088	0 0198	0 0254	0 0467 0 0901	0 125 0 204	0 210	0 241
	Actual mid deflection	0 0100	0 0202	0 0250	0 0653 0 155	0 173 0 241	0 256	0 303

* Double readings under Loads Nos. 4 and 5 explained in text

upper surface of the slab in the direction of all the reinforcing rods.

(4) The concrete showed tension at the bottom surface in the direction of all the reinforcing rods, in agreement with Norcross' own analysis.

(5) This slab deflected 1.6 in. under 33 tons and then broke down completely under 38 tons.

(6) The first crack appeared under a load of 15 tons and deflection of 0.7 in.

(7) The slab, not being reinforced on the top surface over the columns, inevitably cracks at a column when the slab is loaded around the column.

"Mushroom" Slab

The "mushroom" system is defined by C. A. P. Turner, its inventor, as a continuous flat plate of concrete, supported on columns, and reinforced in such a manner that circular and radial stresses are both provided for by metal reinforcement in the tension zone above the column, and similar provision is made for tensile stresses in the lower part of the slab concentric with the center of the panel situated diagonally between columns.

The "mushroom" test slab was 6 in. thick, and was supported on four 18x18-in. square reinforced-concrete columns distant 12 ft. c. to c. each way. These had square capitals, 42x42 in. The slab was approximately 18x18 ft. in plan, and the diameter of the outer ring rod of the "mushroom" was 66 in., while the inner ring was 42 in. These were supported on eight 1⅛-in. round radial column rods. These radial and ring rods together constitute the mushroom head proper and make a very stiff arrangement of diagonal steel in all directions, which serves to raise the regular belts of reinforcing that rest on it to the top of the slab over each column. The amount of steel so employed is, however, not greater than that necessarily used in the steel plates covering the tops of the columns in the Norcross system. The construction will be clearly understood from Fig. 3, which shows the reinforcement and forms ready for pouring the concrete. Figs. 7 and 8 show the progress of the loading and the final appearance of the slab. In this slab the belts of reinforcing rods at the bottom were lifted above the forms while the concrete was being poured by resting on cross pieces of ⅞-in. round bars, except over the mushroom heads, where the reinforcement was raised until it came to view at the upper surface. The mean values of d may be taken to be: At mid side belt $d = 5\frac{1}{2}$ in. from the top; at crossing of diagonals $d = 5\frac{1}{8}$ in. from the top; at edge of cap $d = 5$ in. from the bottom.

The diagram of loaded areas for the "mushroom" slab (Fig. 6) is like that already given for the Norcross slab in every particular except that the size of the former being 18x18 ft., while the Norcross slab was 16x16 ft., the arms of the Greek cross in the "mushroom" slab are each 6 ft. 6 in. long and 5 ft. wide. Table III exhibits the loads per square foot of each of the subsidiary areas shown in the diagram as also the total loads on each of those areas.

Elongations of steel were measured by extensometers in two of the side belts and in one of the diagonal belts until the yield point of the steel was reached at load No. 8. Deflections were also measured. In Table IV these will be considered so far as they relate to the middle points of the belts. Loads Nos. 8, 9 and 10 are of great interest as exhibiting the behavior of the slab under excessive loads, showing, as they do, yielding and large permanent deformation without dangerous collapse.



Fig. 7. Under Loading



Fig. 8. Failure

Figs. 7-8. "Mushroom" Slab under Test

The writer desires to state that Table IV is partly based on a complete rational analysis which he has himself developed for the continuous flat slab when uniformly loaded. The numerical application of that analysis is found to be in close agreement with the very numerous tests for deflection which are now available, and with the smaller number of extensometer tests of the elongation of the steel in such slabs, which have been made up to the present time. It is impracticable to develop that analysis in this paper, but it is the intention of the writer to publish the more essential parts of his slab theory at an early date. Meanwhile he will take the liberty of employing certain parts of it in computing the approximate results given in Table IV.

He has computed in the first place w, the effective load per square foot, which is the intensity of loading which according to his slab theory, would, in a continuous uniformly loaded slab of many panels cause the observed stress f_s in the steel at the center of the panel. This

computed value of w should be compared with the corresponding intensities of loading of the entire slab of the panel, and especially of the central area C. As the yield point of the steel is approached the effective load w tends to coincide with the intensity of the loading on the area C, which appears otherwise reasonable.

If now the effective load w be employed to compute the central deflection of a continuous slab of many panels carrying a uniform load of this intensity, it is found that this slab theory gives a set of deflections at the middle of the diagonal belts practically identical with those observed.

The same is true of the deflections computed for this loading at the middle points of the side belts. Slab theory shows that for this particular slab these last deflections are one-half as great as those at the center of the panel. Slab theory also shows that a continuous slab with the present reinforcement, size and thickness of the panels, etc., would show f_s at the center of the side belts to be 15% greater than at the center of the panel, as the yield point is approached. This limit is nearly reached under loads Nos. 6 and 7, and fails evidently of doing so by a small amount by reason of the lack of continuity of the slab.

The double set of values given under loads Nos. 4 and 5 is due to the fact that readings were had under load No. 4 immediately after the load was applied, and again seven days later before applying load No. 5. The second set of readings was the larger as shown. The second set of readings under load No. 5 was taken four days subsequently to the first set.

It appears from Table IV that the observed results are accounted for to a good degree of approximation up to the yield point of the steel by the slab theory.

It will be seen from Tables I and III that the first three loads were practically the same for both slabs. In the Norcross slab load No. 3, of 18 tons, stressed the steel up to the yield point, but in the "mushroom" slab the stress was so small (being in fact less than 10% of the former), as probably not to remove all the compression from the concrete in which it was embedded. Indeed the load on the latter slab became five times as much, 90 tons, before its steel approached the yield point, at which time it was carrying about twice the load which caused the complete failure of the Norcross slab.

Moreover the deflection of the Norcross slab under load No. 3 was 22 times that of the "mushroom" slab under the same load. This result is in full accord with slab theory, which shows that the central deflection of a continuous diagonal beam with fixed ends uniformly loaded with one-sixth of the total load on the slab and having the same thickness and reinforcement as the diagonal belt, would have more than six times the central deflection of the slab, while the stress in its steel would be three or four times as much. This gives a measure of the effect of slab action. By the phrase "slab action" we designate the increased strength and stiffness of the slab by reason of its resistance to circumferential stresses around the columns and around the center of the panel.

Furthermore, if this continuous beam be compared with a simple beam uniformly loaded and having the same reinforcement, the latter would have five times the deflection of the continuous beam, or 30 times that of the slab, while the stress in the steel would be one and one-half times that in the continuous beam, and six or seven times that in the slab. This last exhibits the effect of cantilever action combined with slab action.

By the phrase "cantilever action" we designate the increased strength and stiffness which is due to the continuity of the beam or slab by reason of its being fixed in direction at its supports so that it is convex upward at such points.

The concentration of the loading toward the middle of the panel such as was the case in this test will prevent any precise agreement of these numerical estimates based on uniform loading with the results of the tests, but they tend strongly to sustain our confidence in the validity of the analysis from which these concordant approximate estimates are obtained.

The amazing difference in the strength and stiffness of these two slabs, which contain practically the same amount of concrete and steel, is due to the difference of principle of their construction, which may be summarized for the "mushroom" system by considering its slab action and its cantilever action under the following counts, viz.:

(1) Circumferential slab stresses are most economically and effectively provided for by the ring rods around the column heads.

(2) The size of the "mushroom" heads is such as to make the belts so wide as to provide reinforcement over the entire area of the slab, thus securing slab action in the central part of the panel where the belts lie near the lower surface.

(3) The reinforcing belts cover a wide zone at the top of the slab over the columns and "mushroom" head, which thus provides resistance to tension, and insures effective cantilever action.

(4) Concrete is thus stressed in compression at the bottom of the slab for a wide zone around the columns.

(5) Under the breaking load of the Norcross slab, amounting to 38 tons, the "mushroom" slab deflected at first only ⅛ in., but after exposure to rain and great changes of temperature for seven days had somewhat softened the concrete, the deflection increased to ¼ in.

(6) The first crack appeared underneath the edge of the slab across the side belt under load No. 5, of 56 tons, with a center deflection of 0.4 in. and an average deflection at the middle of side belts of ¼ in.

(7) No cracks appeared on the upper side of slab at the edge, nor were any seen elsewhere, until load No. 7 of 90 tons was applied, when the yield point of the steel was evidently nearly or quite reached, giving a center deflection of ½ in.

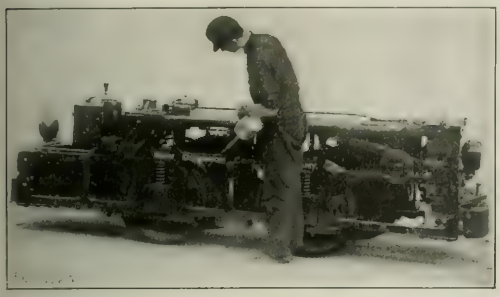
(8) The slab carried its final load of over 120 tons for 24 hr. without giving way. It demonstrated the impossibility of its sudden failure by a gradually yielding until it reached a final deflection of some 9 in., as seen in Fig. 8.

❖

The Underwriters' Laboratory, Inc., has secured 10,000 sq.ft. of additional land adjoining its present property on East Ohio St., Chicago. It plans to extend its present building to provide space for hydraulic and chemical laboratories and offices. When this addition is made the institution will have a total ground area of 26,600 sq.ft., and a total floor area of 45,000 sq.ft., devoted to various tests of materials, devices, and processes for fire prevention. It is reported that the year 1912 showed a 50% increase of volume of business handled. The completed plant represents an expenditure of $175,000, this having been contributed by the fire-insurance companies holding stock and supporting the project.

A Mine Locomotive Designed for Accessibility*

The accompanying figure shows a mine locomotive with a cast-steel open bar frame in which every attempt has been made to secure accessibility, simplicity, durability and strength. It is claimed that it will operate satisfactorily under the worst conditions with minimum attention and maintenance expense. The frame is designed to give maximum strength and to allow ready access to all parts so that the locomotive can be inspected or overhauled, when necessary, in the least possible time. The construction is the same as that used on heavy steam freight engines.



A Mine Locomotive with Cast-Steel Open Bar Frame
(Baldwin Locomotive Works and Westinghouse Electric & Manufacturing Co.)

The open frame gives much better ventilation to the motors and resistance than that obtained by plate-frame construction. The motors, brake rigging, brake shoes and sand boxes are easily accessible. The upper parts of the motors and armature bearing housings can be removed without disturbing the suspension, so that each part of the motor is exposed for inspection. To remove the grid resistance the only work necessary is to take off the locomotive covers and loosen the bolts and terminals that hold the resistance-grid frames in place.

On locomotives with outside frames, as in the accompanying figure, the Vauclain removable journal-box gib has been used. To remove a journal box with this gib, it is only necessary to drop the binder and take the weight off the journal box. The journal box may then be slipped out from the side. With frames inside the wheels, the journal-box collars are arranged to be easily dropped out for re-packing. If it is desired to take out a set of wheels and axle, this may be done without disturbing the motor suspension or connections by simply blocking the motors in place and removing the binders. The wheels may then be dropped.

The motors are a commutating-pole type, with cast-steel frames split diagonally. The axle bearings and suspension nose are on the lower half of the frame, so that the upper half, the armature, and bearing housings can be removed without disturbing the suspension or axle brackets. All windings are impregnated and the field coils are protected from vibration by heavy cushion springs placed between them and the motor frame.

This locomotive is the joint product of the Baldwin Locomotive Works, of Philadelphia, and the Westinghouse Electric & Manufacturing Co., of Pittsburgh.

*From information furnished by the Westinghouse Companies Publicity Department, East Pittsburgh, Penn.

A Comparison of Recent Bids for Various Types of Paving in the New York Navy Yard

By Walter H. Allen*

Proposals recently opened for paving in the Brooklyn Navy Yard contained bids upon several classes of pavement, both granite block and creosoted wood, and under the specifications that now govern the laying of these pavements in the Borough of Manhattan, New York City, as well as the Navy Department specifications. These bids furnish some very interesting comparisons.

The site of the Navy Yard paving is the area surrounding the recently completed dry dock. It is desired to obtain the best class of granite paving, not only on account of the heavy loads that the pavements in the vicinity of dry docks frequently sustain, but also on account of the poor success experienced in the Navy Yard with most of the pavements that have been laid there.

Bids were invited upon four classes of pavements, as follows:

Class (A) 4-in. granite cubes.
Class (B) "Durax" granite blocks.
Class (C) Oblong granite paving blocks.
Class (D) Creosoted wood paving blocks.

The specifications provide that, in the Class A pavement, a variation from the 4-in. dimension of not more than ¼ in. would be allowed, and the blocks should have parallel sides and right-angle edges. They should be laid as close together as possible in straight courses. The "Durax" granite blocks should be irregular cubes, similar to those extensively used in England, the edges to vary in dimension from 3½ in. to 2¾ in. The blocks should be laid in close contact with no joint exceeding ½ in. and in concentric interlocking segments.

Special provision was made that men employed to lay this pavement should be experienced workmen accustomed to laying this class of pavement. The oblong blocks should be from 7 in. to 9 in. in length, 3 in. to 3½ in. wide, and from 3½ in. to 4 in. in depth, depressions not in excess of ⅜ in. being allowed. Joints between courses and at ends of blocks should not exceed ½ in. This block has been extensively used in the city of Havana, Cuba. The creosoted wood blocks were to be in accordance with the usual Navy specifications and laid in the usual manner.

It was specified that the 4-in. cubes and the "Durax" blocks should show a compressive strength of not less than 30,000 lb. per sq.ft. and a coefficient of wear of not less than 15 (French standard). For the Class C paving, these figures are 25,000 lb. and 14 respectively. Bidders were required to furnish samples of blocks with the bids, and tests were to be made before the award of the contract.

The foundation for whichever class may be used will be concrete. Under the granite paving blocks, comprising the first three classes, the cushion will be fine gravel having no particles less than ⅜ in. greatest dimen-

*Civil Engineer, U. S. Navy, Brooklyn, N. Y.

sion, or chips of granite or gneiss which pass a ⅜-in. and are retained on a ⅛-in. sieve. The cushion under the granite paving is to be ½ in. thick, and the joints are to be swept full of material similar to the cushion and then filled flush with coal-tar pitch. Under the wood paving blocks a sand cushion ⅜ in. thick was specified.

The amount of grading necessary is small, averaging not far from 5 in. of excavation. Bluestone headers are required at the edges of paving adjacent to unpaved areas or pavements not upon a concrete foundation. A small part of the paving is to be done upon concrete foundations furnished by the government in connection with railroad tracks about the dry dock. On this work, only the cushion and blocks are to be furnished and placed by the contractor. Work is to begin in the spring of 1913, as soon as the frost is entirely out of the ground and the contractor is allowed three calendar months to complete his work after being notified to start.

The bids were opened on Nov. 23, 1912, and are as shown in the table below.

UNIT PRICES IN BIDS FOR PAVEMENTS, BROOKLYN, N. Y., NAVY YARD

	Class	Paving per sq.yd. including foundation	Paving per sq.yd. on foundation, laid by government	Headers, per lin.ft.
Bidder No. 1	B	4.10	3.25	1.00
Bidder No. 2	D	3.37	2.48	1.42
Bidder No. 2	D(1)	3.26	2.37	1.42
Bidder No. 3	C	5.80	4.37	1.00
Bidder No. 4	A	5.53	4.89	0.90
Bidder No. 4	C	4.05	3.40	0.90
Bidder No. 4	C(2)	3.98	3.28	0.90
Bidder No. 4	D	3.96	3.20	0.90
Bidder No. 4	D(2)	3.69	2.98	0.90
Bidder No. 5	A	7.23	5.98	1.60
Bidder No. 5	C	5.93	4.68	1.60

(1) This bid slightly modifies the government specification in regard to expansion joints and the filling of joints.
(2) New York City specification.

From these bids it is possible to draw several interesting conclusions. All bids on the 4-in. cube pavement (Class A) were very high, showing that this class of pavement, which would probably give excellent results from the standpoint of satisfactory service and low maintenance cost, is so costly to lay that except in rare instances it is impossible to consider it. Doubtless the high bids are due in part to the rather too stringent specifications regarding the variations allowed in the blocks.

The only bid for "Durax" pavement, Class B, is very close to some of the bids on oblong block pavement, Class C. This is rather remarkable in view of the fact that there is but one machine* in this country for making "Durax" blocks so that it will probably be necessary to make a large part of them by hand, and that no pavements of this class have been laid in this country and there are no experienced pavers for this class of work, so that it will be necessary to send men to Europe to acquire skill in this class of paving.

The bids for oblong granite block paving varied greatly, but it is noticeable that the low bidder also submitted an alternate bid for blocks in accordance with the specifications of the city of New York; and the difference in cost is very little, although the New York City block is larger and the specifications in regard to evenness of the surface and allowable width of joints are less rigid in the New York specifications.

*For a description of these machines and this type of pavior block see "Eng. News," Mar. 28, 1912, p. 614.

Three bids were received for creosoted wood paving blocks, two in accordance with the government specifications and one in accordance with the New York City specifications. The lowest bid is in accordance with the government specifications.

The reductions in the cost of paving for the work upon the government foundation in the vicinity of the railroad tracks vary from 64c. to $1.43. These figures do not fully represent the estimated cost of foundation alone, but probably involve the different opinions of the contractors as to the amount of excavating to be done and the difficulties of paving about the railroad tracks.

Undoubtedly, some of the contractors were influenced in their bids by the rigidity of the government specifications and their unfamiliarity with work for the Navy Department, some bids being out of all proportion to the actual cost of the work.

The most interesting feature of the bids is that the one for the "Durax" pavement is among the lowest of all the bids for granite paving, although, due to the novelty of this pavement in this country, it was to be expected that the bids for this class would be much higher than those for the oblong blocks. It indicates that with some familiarity and experience in laying this pavement and with better means for getting out the blocks, "Durax" pavements can be constructed in this country at a less cost per sq.yd. than the best class of oblong granite blocks which are found in the streets of the large cities of the United States.

Graduate Industrial Courses for Electrical Engineers

A development of the older courses for student engineers in the testing department of the General Electric Co. is being made by giving them experience for a period not exceeding three months under the consulting-engineering department. Student engineers in good standing in the testing department for not less than one year are eligible. The work will consist in assisting one of the consulting engineers, and the time spent will depend on the time required to complete the particular work in a project, and may be from a few days to several months. A student engineer may thereafter return to the testing department or assist in some further work under the consulting-engineering department, depending on conditions in the departments at the time.

Furthermore, a general extension course under the direction of the consulting-engineering department has been made available to a limited number of student engineers who must have been in the testing department not less than a year, must have had some previous experience under the consulting-engineering department, and must have been recommended either by that department or by the transformer department.

The course extends over seven months. Of these at least four are spent in the consulting-engineering department, and three in the transformer-engineering department, or other allied divisions. While under the former department, the student engineer is given work with various classes of theoretical, practical, experimental, and development work, being assigned to the different consulting engineers. On each Saturday forenoon weekly lectures are given by prominent men.

EDITORIALS

Excess Water in Spouted Concrete

Among the many devices to reduce the cost of transporting concrete from the mixer to its place of deposition, no one has had a more successful and rapid growth than the spouting or gravity chute. If a convenient central station can be located, this system provides the advantageous combination of a permanently placed mixing plant with flexible conveying system, plus the marked economy of "letting gravity do your work," as one of the spouting systems advertises. It is small wonder that such superior merits have resulted in wide use.

Unfortunately, however, we live in an imperfect world, and these admirable contrivances partake of this imperfection. Unless properly designed and operated, they are very apt to produce a water-logged concrete, or, if that term is not precisely appropriate, an excess of water in the concrete deposited. Some months ago a correspondent in these columns called attention to this possibility and suggested the urgent need of tests to determine the effect of excess water in a concrete mixture. The article by J. F. Greene on the Latah Creek Bridge at Spokane, on another page of this issue, emphasizes this need by reference to a specific case.

Mr. Greene's experience is a common one. Concrete, when mixed to what has been generally supposed to be a proper consistency, has a fairly high friction coefficient, and to get it to flow easily one of three things is necessary. Either the grade of the pipe or trough must be high, auxiliary human pushers must be employed or a large proportion of water must be used in the mixing. The first of these alternatives is a matter of original design in a gravity plant and a proper elevation is often an impossibility. The second adds just the extra cost the system is designed to avoid. There remains then only the third alternative, which is the one almost invariably resorted to. The consequence is that in many installations of this type of conveyor, concrete is sluiced down the trough or pipe in an entirely too liquid condition, with the results as noted by Mr. Greene.

The difficulty lies in determining at just what point super-saturation commences. The old quibble over wet and dry concrete is a thing of the past. No one now doubts the efficacy of a certain degree of fluidity in concrete. On the other hand, no one can doubt that too much water is a dangerous thing—for concrete. As the matter now stands, there is no definite dividing point between just enough and too much, and the opportunity for the testing engineer is great.

Another Flat Slab Test

The comparative tests of two different types of flat-slab floor, described by Dr. H. T. Eddy on another page of this issue, are very illuminating in spite of some very serious defects in the plan of the tests and a certain incompleteness in the analysis of the stresses. As an indication of the initial strength of a well designed flat slab and of that no less desirable quality, the ability to fail slowly when failure is unavoidable, the tests could not be better. But the construction of the so called Norcross slab and the methods of analyzing both slabs leave much to be desired.

In the first place no one should ever think of building in an actual structure a flat-slab floor of the type called the "Norcross slab" in the tests. This panel may approximate in design the specifications of the Norcross patent; but the lack of any negative moment reinforcing at the columns, the extreme narrowness of the diagonal belts and the absence of any spreading bars to provide cantilever action over the columns all mark the slab as impracticable. The test results only confirm the impression that the design suggests. It is probable, however, that the slab would have shown up much stronger if the same amount of steel in the diagonal bands had been widened so as not to leave any unreinforced concrete area, a very simple amendment of the system. The transmission of the loads through so great an area of plain concrete to the concentrated steel undoubtedly subjected the concrete to undue stress and caused cracks (not noted in the test) which developed to such size as to cause the observed sudden collapse of the slab.

In regard to the analysis of this slab, Dr. Eddy's figures certainly show that the simple beam theory can account for stresses and deflections in this type of construction with remarkable fidelity, in spite of the obvious fact that a series of beams integrally tied together can not act in the same fashion as the same beams separated into units.

The analysis of the "mushroom" slab is equally interesting, although as yet so incomplete as to be of no value to those numerous engineers who are seeking a rational method of analysis of this highly successful type of construction. It is to be hoped that Dr. Eddy will soon make public his promised method of analysis and thus show conclusively the accordance between the tests here discussed and a rational theory of stress. Meanwhile, publication of the tests is full and open so that any engineer may make his own deductions therefrom.

A British Defense of the Open Fireplace

A long-standing puzzle to Americans resident in England is the tenacious hold of the open fireplace as a method of heating dwellings. While steam and hot-water systems have long been in general use for heating public buildings, it is extremely rare to find in England any other means of heating in a private residence, even the most expensive, than the open fireplace.

An American accustomed at home to normal living-room temperatures of 70° maintained throughout the cold-weather months as a matter of course, finds himself, on taking up residence in England in the winter, in constant discomfort from the cold. In severe weather, the

open fireplace, which is usually very tiny in proportion to the size of the room, can only make comfortable persons who are close beside it. Remote parts of the room are exceedingly chilly and halls and passages are wholly without heat.

The American stranded in such a chilly place will recall longingly the hot-air furnaces and steam radiators of his native land; but let him not hope to make a fortune by educating Englishmen to the comfort attainable by such simple means. The Englishman accustomed all his lifelong to the modicum of heat that the hearth fire affords, prefers that mode of living to the artificial summer temperature which the American regards as a primal necessity.

A curious correspondence has been recently going on in the columns of the London *Times* Engineering Supplement respecting the use of anthracite stoves for heating living rooms. This correspondence draws forth a vigorous reply in the *Times* of Feb. 19 from a correspondent who rushes to the defence of the open fireplace as if it were the British constitution itself that was under attack. We quote from his letter as follows:

> An open fire has great charms in its romantic play of flame and ever-changing form; it varies the monotony of life and leads us to exercise ourselves in the making of it up. We are disappointed at its dullness or charmed with its brightness, and we regard it almost as an individual, one of the household, and gain from it something of the stimulation of and variation in our mental life which we gain from intercourse with a friend. It has indeed been the best friend of man through vast ages of his earthly pilgrimage, and is interwoven with the poetry and romance of life.
>
> The anthracite stove is warm but an ugly clod of a thing, and cannot touch the spirit of man. If the open fire were always made to fulfill the conditions of complete combustion, and did not darken the atmosphere, we would not give it up for any of the new-fangled inventions of the heating engineer. Is not the extra money spent on the coal well spent if it contributes to our health and happiness? Is not the open fire as valuable to a cultured Englishman as his pictures and his books?

The Greatest Piece of Engineering Work in the World

Measured by the amount of money to be expended, the largest piece of engineering work ever undertaken in the world, not even excepting the Panama Canal, is the New York Rapid Transit Subway System, on which the final steps were taken last week by the signing of the final contracts between the city and the Interborough and Brooklyn Rapid Transit Companies. According to the official statement made by Borough President McAneny at the meeting of the Board of Estimate on Mar. 18, the total expenditure on the extensions of the Interborough System, for both construction and equipment, will amount in round numbers to $140,600,000, and on the Brooklyn Rapid Transit System to $161,200,000. This makes a total of nearly $302,000,000. Adding to this the expenditure on third-tracking and other improvements on the elevated lines and such work as the Steinway tunnel, which is to be included in the new system, the total investment will approximate some $330,000,000. Adding to this the investment already made in the existing subway system, we arrive at a valuation of the entire subway system when completed which will considerably exceed the cost of the Panama Canal work.

As our readers are aware, a considerable mileage of the new subway work is already under contract. The total amount of contracts already let is some $75,000,000. Contracts are still to be let on the work to the amount of $160,000,000.

The amount of engineering work involved in the construction will be considerably greater than that involved in executing the comparatively simple work on the Panama Canal construction. There are now about 750 employees on the engineering staff of the Public Service Commission and 200 to 250 more will be necessary. The most important and most difficult part of the engineering work was the preparation of the general design, which has already been completed. What remains to be done is chiefly supervision and inspection of the actual construction work.

The importance of the new lines in adding to the transit facilities of the great city can hardly be overestimated. As to whether their earnings will be sufficient to pay interest on the enormous investment involved, there are so many varying and conflicting opinions that we shall venture to express none here. This much, however, is certain, that the city's representatives in the Public Service Commission and the Board of Estimate, who have given years of study to the subject of transit development and to the best methods of securing it for the city, are satisfied that the great development now to be undertaken is necessary for the city's welfare, and that the terms on which it is to be carried out represent the best that it was possible for the city to secure.

According to the contracts just signed, the entire system is to be completed and ready for operation by Jan. 1. 1917.

Stereophotogrammetry

In view of the tremendous progress in every branch of engineering practice during the past century, it is remarkable that so little progress has been made in the work of surveying, upon which practically all other civil engineering work is based. We still have to actually measure the ground and afterward reproduce those measurements, reduced in scale, upon paper. It is true that there have been great improvements in surveying instruments, resulting in much greater accuracy; but the essential elements in the theory and practice of surveying are the same today that they were when George Washington surveyed in the forests of Virginia, using a compass for angle measurements and pacing the distances.

The introduction of photography as a means of obtaining information for topographical maps has been practically the only radical change in survey methods in a century; yet photogrammetry is a term none too familiar to American engineers and surveyors, considering the wide possibilities of the art. As a method of surveying, its use in this country, we believe, has been limited to a few government surveys, and these have been made principally in Alaska. Regarding this work in Alaska we are informed by J. W. Bagley, topographic engineer of the United States Geological Survey, as follows:

> A method of photo-topographic surveying for mountainous country has been used with success by the Geological Survey in Alaska since 1910. A panoramic camera designed with considerable precision has taken the place of the photo-theodolite or plate camera. It is used in connection with the planetable to supply data for constructing the contours. The most evident advantages in the field work are the substitution of films for plates, thereby reducing the weight of equipment,

the lessening of time required to take three views instead of eight, and the greater convenience of preserving and transporting exposed films rather than plates.

In the compilation of data the economy is even greater. An apparatus designed for the rapid transference of horizontal angles to the map places the photograph in the same position relative to the map as that portion of the landscape lay when the sheet was properly oriented at the field station. This relation can be easily established at any time, so that sights may be taken very much as sights are taken on the planetable by means of an alidade, without the necessity of noting readings. Elevations can be computed from the photographs at a rate somewhat greater than from telescopic angular readings.

The method has proved sufficiently accurate to give excellent results on a scale of a mile to the inch, using 50-ft. contours. The photographs can be relied upon to furnish elevations at distances up to five miles within 20 ft. The cost of the work has been less than the cost of work by the familiar planetable method.

It is doubtful if any American engineering college gives actual practice in photo-surveying, although the principles of photogrammetry are now included in some standard textbooks on surveying.

In Europe, on the other hand, the practice of photogrammetry has steadily developed, and this development has now reached a high degree of perfection, evolving a new term "stereophotogrammetry," quite unknown to the vast majority of American engineers.

Stereophotogrammetry, moreover, is not so formidable an art as its name implies. Whoever is familiar with an ordinary picture stereoscope can quickly appreciate the possibility of taking measurements of points on the pictures in all three dimensions. The perception of depth in stereoscopic pictures is the result of looking at two photographs taken simultaneously on two plates which were a distance apart of only a few inches. Imagine then how much the perception of stereoscopic depth may be increased if the plates are exposed at a distance apart of 50 or 100 ft. Place these plates in an apparatus designed to still further increase the stereoscopic effect and to magnify the image—increasing the stereoscopic effect a thousand times over that of an ordinary picture stereoscope—and we are able to understand how it is possible to make measurements by stereophotogrammetry with no mean degree of accuracy.

The most serious objection to stereoscopic measurements is due to the large personal equation involved. The ability to see stereoscopically varies much with different individuals; some persons are unable to perceive stereoscopic depths at all. Such a personal element is, of course, a drawback to any method of making measurements. Stereophotogrammetry has, however, made such progress in Europe that American engineers cannot long neglect giving it a trial, and we believe that the article elsewhere in this issue describing the progress and methods of photo-surveying in Europe will be read with interest by all American engineers interested in survey methods.

Stereophotogrammetry has wide fields of usefulness in many branches of art and science. Its application to architecture can readily be appreciated. By means of two photographs taken at the ends of a short base line, it is possible to take all the dimensions of an inaccessible dome or tower. It has been used to study the movement of glaciers; photographs taken from the same stations at intervals of time make it possible to perceive very slight movements in the ice. Stereophotogrammetry has also been used to study the height and length of sea waves; to study and measure the features of the human face as an aid to sculptors; to study the stars, and for a variety of other scientific and useful purposes.

Stereophotogrammetry so far extends and simplifies the practice of photogrammetry that it is perhaps the most interesting and revolutionary development which has ever entered into the practice of surveying. Think of the possibility of sending a hair-line marker from point to point of the virtual landscape and taking all the measurements of those various points with many times the ease and speed with which a stadia rodman could cover the distances in the actual landscape! It seems certain that this method will be extensively applied to obtain topography of large areas throughout the world, of which no topographical maps now exist. For small-scale topographical details, not requiring a high degree of accuracy, stereophotogrammetry seems to offer great advantages over any of the old time methods.

How much effect these recent improvements in photosurveying will have on railway-location practice remains to be determined. By means of stereophotogrammetry it will be possible for a chief engineer to examine every mile of a projected railway line without stirring from his office door. It will be possible to send a two-man party into the ruggedest country and obtain in a few weeks all the necessary data for a preliminary location. In mountainous countries where no previous maps exist, it cannot fail to be of great advantage, for by use of the stereophotographs it will be possible to readily and quickly make measurements which could not be made in the field without elaborate triangulation.

Proposed Water-Supply and Sewage Disposal Legislation in Minnesota

Minnesota has been so progressive in some public health matters that it seems strange that it has so long delayed taking the necessary steps for adequate sanitary control by the state of water-supply and sewage disposal. A bill is now before the legislature which, if enacted, will do much to place Minnesota in line with Massachusetts, New York, New Jersey, Pennsylvania and Ohio, in this respect. The bill might well be strengthened at some points and made more specific in others, but perhaps it goes as far as can be expected at the beginning of such legislation.

In substance, the bill provides that all persons, corporations and municipalities other than first-class cities supplying "water for private or public consumption" or disposing of sewage within the state must, within six months of the passage of the bill, file with the State Board of Health certified copies of plans of their water or sewerage systems, with descriptions of the sources of water-supply and places of sewage disposal; and that "no *other* (italics ours) source of water-supply or place of sewage disposal shall be adopted until complete plans therefor have been submitted to the State Board of Health and a favorable report shall have been made thereon by said Board." The provision that no other source of water-supply shall be adopted without a favorable report thereon by the Board is supplemented by a section providing that no water-works shall hereafter be built to supply "water for private or public consumption" until the plans therefor have been submitted to the Board and favorably reported on it by it.

As the bill contains no other provisions regarding

plans for water-supplies, sewerage or sewage disposal it will be seen that it does not go so far and is not so specific in giving the Board control of these matters as is common in the legislation of other states. No one would be required to file plans of sewerage systems built later than within six months of the passage of the bill, and no control over plans for sewerage systems is given the Board, except as regards new *places* of sewage disposal. One would suppose that if it were essential to have plans of existing sewerage systems filed with the Board it would be equally essential to have plans for new systems filed, or at least plans for sewage disposal *works*. However, judiciously exercised state control over the selection of sources of public water-supply and places of sewage disposal would be a long step in advance for Minnesota and for many other states which have thus far let this important sanitary and health matter go by default. It is well to note that the pioneer in state control of water-supply and sewage disposal, Massachusetts, has not extended the jurisdiction of its State Board of Health beyond *sources* of water-supply and *modes* (not places) of sewage disposal; and that the action of the Massachusetts board stops short with "advice"—but in practice this advice governs.

State approval of sources of water-supply, of plans for water-works systems, and of places of sewage disposal, valuable as such approval may be, is only a start in the right direction. Unless public opinion in support of a state board is remarkably strong, means should be provided to insure that plans as approved are executed and then that the works built in accordance with those plans are not only properly operated but are modified in design, construction and operation as may be necessary to meet the original or changed conditions.

The Minnesota bill contains a section on the operation of water and sewage purification works which is good as far as it goes but which is weak because it makes no provision for such water-supply and sewerage systems as do not treat the water or sewage, and also because the Board can do nothing but make "recommendations" for changes which no one is bound to follow. We quote as follows:

SEC. 6. Whenever the State Board of Health finds upon investigation that any water or sewage purification works, because of incompetent supervision or inefficient operation, are not producing an effluent as pure as might reasonably be obtained from such plant, and by reason of which any water-supply has become dangerous to health, or any stream or body of water has become offensively polluted or has become a public nuisance, said board shall issue a notice to the proper officer, board or department of any municipal corporation, to the proper officer of a private corporation or company or to the person or persons having charge of or owning such a plant, apprising him or them of the conditions found, together with recommendationss as to the proper procedure necessary to remove the danger.

It is obvious, as already stated, that this section does not go far enough. Possibly existing legislation supplements this section, but we think not. To fully control, the State Board of Health should have power to require cities or companies which are supplying impure water to install purification works and should also be enabled to compel the abatement of sewage disposal nuisances.

The penalty clauses of the Minnesota bill appear to apply only in case of failure to comply with the requirements to file plans, as already outlined. To make the bill fully effective the penalties should be extended to cover failure to follow the plans filed with the Board and failure to follow advice as to needed changes in water purification and sewage treatment works. Moreover, the money penalty (a $50 to $100 fine, regardless of the period of non-compliance), appears ridiculously small, especially as the alternative of 60 to 90 days imprisonment in a county jail seems to stand little chance of ever being applied.

We have reviewed the provisions of the Minnesota bill because legislation along this general line is greatly needed in other states than Minnesota and because upon our engineering readers rests in large measure the duty of seing that such legislation, wisely framed, is enacted with as little further delay as possible. If the engineers of Minnesota, both individually and as members of the local and state engineering societies, will rise to the occasion, they can doubtless insure not only the enactment but also the strengthening of this bill—which gives evidence of having been drawn in moderate terms lest a stronger bill should be defeated. Certainly the engineering and law libraries of the twin cities must contain the statutes by which other states have vested control over water-supplies and sewage disposal in their state boards or departments of health. These statutes should be studied—but in the light of their actual workings in daily practice.

LETTERS TO THE EDITOR

A Bill to License Engineers in Iowa

SIR:—I inclose a circular letter which is being sent out to engineers in Iowa by a special committee of the Iowa Engineering Society, urging them to use their influence with legislators to secure the passage of a bill now pending in the Iowa Legislature to license engineers.

Especially noteworthy is the argument which the committee uses in support of the bill. I quote as follows:

Anyone may practice without license, if he wishes, and anyone now in practice may have a license without examination.

* * * * *

The proposed law is a protection to the public similar to that now afforded by laws regulating the practice of Attorneys, Physicians, Pharmacists, Dentists, Veterinarians, Undertakers and Nurses.

If anybody now in practice may have a license and anybody else may practice without a license, the puzzle is to find where the "protection to the public" comes in!

The special committee further declares that "the engineers and surveyors are willing to pay all the cost." How does it know they are willing? Perhaps some may fail to see where they will receive any benefit to compensate for the tax.

The special committee voluntarily classes engineers

with veterinarians, undertakers and nurses; but I doubt if the profession as a whole will consider the movement a well directed effort for the uplift of the engineering profession.

N. A. Y.

Mar. 19, 1913.

[The circular letter inclosed is as follows:—Ed.]

Dear Sir: The bill for licensing Civil Engineers and Surveyors has been introduced in the Senate. It is known as Senate File No. 434.

The Committee has exercised its best efforts in getting this bill before the General Assembly and the question as to whether it will become a law must now be answered by each man in the practice for himself as its passage will depend on individual action.

So far as we know, there is no opposition to this bill. But the inertia of the Legislature, combined with the inevitable rush at the close of the season, will defeat it unless individual influence is brought to bear on the legislators by those of us who are interested.

You are urgently requested to write to your senator and representative, asking for the passage of this bill, if you believe that it is a step in the right direction. As the time is short, the letters must be written at once in order to be effective.

Here are some of the points of the bill which you may advantageously mention in writing to your legislators:

The proposed commission is self-supporting and will require no appropriation of public funds.

Anyone may practice without license, if he wishes, and anyone now in practice may have a license without examination.

The proposed law is a protection to the public similar to that now afforded by laws regulating the practice of Attorneys, Physicians, Pharmacists, Dentists, Veterinarians, Undertakers and Nurses; AND THE ENGINEERS AND SURVEYORS ARE WILLING TO PAY ALL THE COST.

J. L. PARSONS, THEO. S. DeLAY, SETH DEAN, Special Committee, Iowa Eng. Society.

Experience with Wood Stave Pipe

Sir—With reference to the article on wood-stave pipe for irrigation, by R. K. Tiffany, in your issue of Feb. 6, 1913, I beg to give my experience to corroborate the conclusions reached by Mr. Tiffany.

The Burbank Co. took over the uncompleted Burbank irrigation project in September, 1912, and immediately commenced the rehabilitation and improvement necessary to place the property in suitable shape for operation. The project consists of 14,000 acres of very arid sagebrush land in the western end of Walla Walla County, Wash., in which the soil and climatic conditions are almost identical with those described by Mr. Tiffany.

Our experience with one pipe line has been especially illuminating. It was an inverted siphon 6200 ft. long, of 38-in. continuous wood-stave construction, which was built five years ago and had been used for only four irrigation seasons. It had been buried originally, but the wind had blown away the light soil so as to leave the top of the pipe partly uncovered. One section of the pipe in the bottom of the depression was partly submerged and covered with damp soil for a distance of about 300 ft. During the last irrigation season, it became so badly impaired as to be unreliable for further service. Upon investigation, it was found that the staves had rotted from the outside only; but where the pipe had been uncovered, and where it had been submerged and covered with damp soil, the staves were absolutely sound. This information indicated three general conclusions: (1) that wood-stave pipe, without a preservative coating, buried in dry volcanic ash soil and not under hydraulic pressure continuously, would be subject to rapid decay; (2) that its life would be much greater if the staves were exposed directly to the air, and (3) that rapid decay would not take place if buried in wet volcanic ash soil.

In reconstructing this pipe line, it was concluded that it would be best from every standpoint to entirely rebuild the line, using new staves and tongues, but employing the old bands and shoes, placing the pipe line entirely above the ground. To accomplish this purpose, cradles or mud sills were placed under the pipe 6 ft. apart. The cradles were made of 6x8-in. common fir lumber, 4 ft. long, set on edge. The tops of mud sills were milled out to a maximum depth of 3 in., to a curve of 20-in. radius [giving a curved bearing with a chord of about 20 in.—Ed.].

These cradles were sawed in 4-ft. lengths and milled at the sawmill, the additional cost for milling being $5 per M b.m., or approximately 8c. additional for each cradle.

Such construction will make the maintenance of the pipe line much simpler, as all leaks can be immediately detected at their inception, and repaired, and thus make it possible to keep the pipe line full of water during the winter season, except in freezing weather.

The pipe line was reconstructed along these lines and we believe that under the circumstances a reasonably long life will obtain. The Burbank Co. has constructed several miles of continuous wood-stave pipe in the last six months, and this construction has been followed throughout.

In another instance on the Burbank project, an inverted siphon 1200 ft. long and made of 14-in. machine-banded pipe, heavily coated with tar, had been constructed five years ago and buried under 2 ft. of earth. It was found to be in exceptionally good condition. We credit this result to the heavy protective coating and confirm the conclusions reached by Mr. Tiffany.

The Burbank Co. is installing several miles of machine-banded pipe for distribution purposes, and in doing so, departs from its practice with the larger size continuous staves pipes, by first providing a heavy coating of asphalt, about ⅛ in. thick, and then burying the pipe fully 18 in. below the ground surface. The object is to place the pipe lines below the frost line so that they may be kept full of water, not only during the irrigation season, but during all other times as well, thus preventing access of air to the interior of the pipes and relying upon the preservative coating to prevent decay from the exterior.

It is apparent, therefore, that the general results of our observations coincide identically with those of Mr. Tiffany and we differ only in the methods employed in overcoming the difficulties for the continuous stave construction.

ELBERT M. CHANDLER.

Burbank, Wash., Feb. 13, 1913.

Sir—The article by R. R. Tiffany in your issue of Feb. 6, 1913, giving experiences with wood-stave pipe leads me to contribute notes on a similar experience.

In 1903 a 14-in. wire-wound stave pipe was laid by the city of Tacoma along tide-land streets which had been filled by dredging sand from the adjacent waterways. The pipe was constructed of 1⅛-in. fir staves, with $\frac{5}{16}$-in. bands spaced in winding approximately 1⅛

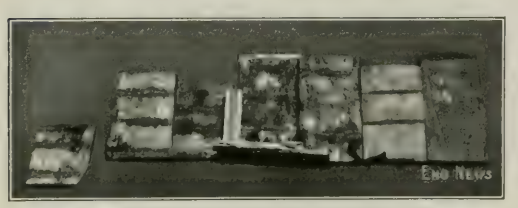
in. c. to c. and was under a pressure of 106 lb. per sq.in. This pipe was in a sawmill district and connected with a large number of hydrants which were used a great deal for sprinkling and frequently for fire service.

Frequent repairs were necessary on account of leakage through open seams and usually cut bands were found. The open seams were attributed to the careless use of hydrants, causing water hammer, thereby increasing the already high pressure. The consequent leakage churned up the sand backfill, cutting the bands and so aggravating the trouble. This pipe was replaced in 1910 with a cast-iron main.

During the summer of 1912 a section of 31-in. stave pipe, laid in 1899, was replaced. The pipe was uncoated. It was laid in a light, sandy loam and covered two feet above the top with the same character of soil. At this point the pressure was 40 lb. per sq.in. Fir staves, 1⅜-in. thick were used with coated iron bands and shoes.

The staves were found to be water-soaked and in fair condition on the inside. On the outside, the bottom staves were good but a small amount of rot showed along the sides above the spring line of the pipe, with excessive rot along the top staves.

The accompanying view shows sections of staves from



Wood Stave Pipe after Use at Tacoma, Wash.

this pipe. The two right-hand sections show the condition of the inside and outside of staves at the bottom of the pipe. The other sections are the outside of staves from the upper part of the pipe. The coins are 25 and 50c. pieces and the scale is 6 in. long. The metal tongues are shown on two sections.

The right-hand section shows approximately $\frac{1}{16}$ in. of soft wood on the inside, a portion of which has been scraped away to sound wood. This surface appeared to be in excellent condition when first taken out, but it rapidly dried and checked. This was the general condition on the inside of pipe, at all points.

Along the top of pipe there was not over one-half inch of sound wood, that part between bands not having sufficient cohesion to stay on the staves while being removed. The coins are resting on the ridge of wood under the bands.

In replacing this pipe most of the original coated bands were used again and all of the malleable-iron shoes.

Another section of this pipe, where uncovered a few blocks away in a clay soil and five feet back of backfill, was in perfect condition on the outside.

Corroborating the experience of Mr. Tiffany, the drying out of our backfill during the summer heat with the absorption of the surface moisture from the staves was the cause of our trouble.

Mr. Arthur L. Adams in Vol. LVIII, Trans. Am. Soc. C. E., states several of the important points of his experience on the Astoria Water-Works, three of which agree with general conditions here on uncoated pipe as follows:

> Where buried, its durability has depended upon the soil conditions and the depth of backfill.
>
> When the depth of backfill has exceeded two feet above the pipe, and the material has been free from vegetable matter, and has been of a fine and impervious character, much less deterioration has taken place.
>
> Wherever the staves have been in contact with loamy earth or earth containing vegetable matter, or wherever they have been covered with porous material, or to a depth of less than 2 ft., rapid decay has resulted.

The replacing of the above noted pipes came under the direction of W. B. Short of the Tacoma Water Department who has the sections shown in his museum.

F. H. Cushman,
Assistant Engineer.

Tacoma, Wash., Mar. 3, 1913.

The Status of the Engineer

Sir—I was surprised to read the arguments of Mr. C. S. Burnett in Engineering News of Mar. 13. Does not Mr. Burnett know that such arguments as "let the employer judge," "the better man will climb to the top of the ladder," etc., are old and stale? They were and are used against union laborers all over the world. Yet the facts show that wherever a union of laborers does not exist the wages are brought down by the employer to the starvation rate.

How many of the so called experts do we find at the top of the ladder of a municipal staff of a big city like New York, Philadelphia and Chicago? How many experts do we find in the big bridge or railroad companies which employ hundreds of engineers? We find very few, and most of those few climbed to the top of the ladder through political or some other backing, while the rest of the hundreds are toiling in the offices or fields like drudges, and very often for salaries less than the organized laborer gets.

I suggest that engineers should delve a little not only into the engineering sciences, but also into political economy, history, sociology and modern philosophy; then they will be able to work out their salvation.

S. Reswick.

Barge Canal, N. Y. State, Mar. 17, 1913.

Legislation to Restrict the Practice of Engineering

Sir—The writer would like to add his mite to the present discussion on "The Status of the Engineer."

Analogies drawn between engineering and the older professions, such as medicine, law and theology, fail because of one critical point not emphasized by those who have heretofore discussed the question.

In all these older professions no false hopes are held out, to the youth who proposes to enter them, of large incomes and ultimate affluence. Statistics have been published and novels have been written to acquaint people with the fact that the young lawyer, or physician, or clergyman, has an exceedingly small income, on the average, and a dismal old age to look forward to unless Dame Fortune is good to him.

These young fellows, having taken up their chosen professions with no false hopes, realize that only a very small proportion gain more than a fair living and that

very many never make a living, being dependent upon friends and relatives for many years.

In 1907, Mr. Onward Bates in his Presidential Address before the American Society of Civil Engineers, presented a study of occupations of the active members of the society and showed that more than three-fourths of them were dependent upon salaries for compensation and less than one-fourth received fees as compensation. He neglected to take into consideration that every member of the society, in whatever grade, styles himself an "engineer" and therefore the study should have included Associate Members and Junior Members. The percentages would have been decidedly altered by such a study. Less than 10% of the men who style themselves engineers are in private practice.

On the other hand, less than 10% of the young fellows who enter engineering schools understand that the engineer is a "hired man," connected throughout his life with seasonal labor. A few secure positions where they may become permanent fixtures. A few meet with success. The percentage is perhaps about that of every business in the world.

There is much to be regretted in the fact that conditions of pay and employment in engineering work are not better; but this is not the most serious trouble. That lies in the fact that the students entering engineering schools do not know as much about the possibilities of engineering and the probability of success, as do the freshmen in the law or medical or theological schools about the professions they have chosen. Highly colored advertisements of certain schools and the standing advertisements of numerous corporations employing large numbers of very low-paid draftsmen, deceive parents and youths alike. Even many school teachers are deceived. The general impression in all quarters is that engineering is a remarkably high-paid vocation.

Let the truth be known, and discussions of ethics will stop. Men who have been led to take up the study of engineering through a misunderstanding of the work will avoid it and the men who do go into the work will have a sincere liking for it and have less of the commercial spirit, which is really what interferes with a decent attitude of one competing engineer towards another.

The writer is opposed to legislation restricting engineering practice. He has always been opposed to it; but at the present time he finds himself in the position of advocating the passage of a license law for structural engineers in the state of Illinois.

In 1897 the architects of the state had a license law passed to make a profession of architecture. All architects then practicing in the state who had been in practice for three years preceding the date of the passage of the act, were given licenses without examination. A few structural engineers of standing were also granted licenses in the same manner. The law was passed ostensibly to protect architects in their practice against ignorant contractors and builders and provide the public with safe buildings, from a structural and sanitary standpoint.

At first the examination papers were so marked that a number of engineers were able to pass; but lately, while the character of the examinations given has not altered, (and in all candor we must admit they are very fair), the methods of marking and the weights given to each subject have changed so that it is well nigh impossible for engineers not accustomed to *artistic* architectural drafting, to pass the examination. Thus the act has now become a law to protect the architects against the competition of engineers; and the work of the Board of Examining Architects, and the decisions of the legal advisers of the board, are against engineers; all this despite the fact that a modern building is more of an engineering than an architectural proposition.

The writer is one who has felt severely the effects of the law and with others he has been attempting to come to some understanding with the architects so that owners desiring to erect certain classes of structures may exercise some option as to the employment of either an architect or a structural engineer for proposed new buildings. The larger corporations employ in their office licensed architects merely to comply with the law requiring the seal and signature of a licensed architect Some of these salaried architects are competent men, but some get low salaries and are employed merely as draftsmen, their ability as designers of the classes of structures their employers erect being markedly lacking.

So in Illinois we who must live are working to secure some legal rights for engineers as against architects; and a number who are on principle, opposed to any legal protection for engineers, find ourselves confronted by facts, not theories, which make legal protection become necessary.

The matter was first agitated six years ago; but the architects are very clever men and nothing was done by the committees appointed by engineers. Four years ago the same thing happened and again two years ago the clever architects managed to switch the committee of engineers on to the preparation of an impossible dream, the codification of the building laws of the state. Such a measure would be fought pretty generally for it adds to the cost of building; and a building ordinance suitable for Chicago cannot be enforced in a smaller place. This year the Legislature is once more in session and the engineers are talking and not doing.

The architects act together. Of the men who call themselves engineers, 90% are on salary, yet they persist in taking prominent part in discussions and some high-salaried corporation engineers are usually selected to head committees and find themselves unable to appreciate the situation of men in private practice. The older men among engineers are opposed to license laws as being in a sense degrading. The men who have architects' licenses are satisfied with things as they are. The men on salary who feel their positions secure are exceedingly conservative. The men in private practice are in a woeful minority. This state of affairs explains the reason why little has been done in the past to secure recognition for the engineer as a professional man. It shows why a code of ethics will be difficult to adopt.

I have said that 90% of engineers are on a salary. When one loses a position, he goes into private practice for a time pending the securing of another position. Few engineers in private practice went into it of their own accord but rather because they were laid off at a time when salaried positions were hard to secure.

Ninety per cent., it is safe to say, of the men educated as engineers knew positively nothing of conditions of employment and pay in the business when they registered at college for an engineering course. Many come from the homes of dissatisfied clerks and mechanics who felt their own lives to have been failures and desired for

their sons something better. Such boys studied engineering under the impression that it was a high-paying vocation and their home affiliations being with the class that extols the labor union, we have now a strong movement in the ranks of younger men to organize labor unions among men employed upon engineering work.

There is no real profession of engineering, at least not one so widespread as many would have us believe. There are a number of men with good business minds educated as engineers and to them engineering is commercial and not professional. Because of their keen business intellects they are apt to be dominant men when codes of ethics are discussed and they are generally, because of the advertising thus obtained, to be found heading committees and taking very prominent places in the councils of engineers. Many of them consist of the misplaced laborers, mechanics and clerks who were led to study engineering through misleading statements that it is an exceedingly remunerative occupation.

In the opinion of the writer, reform can only come by first teaching every high school boy and freshman in an engineering school as much about the vocation of the engineer as the followers of other vocations know about their future life work when they enter upon the study of it. The young men who then go to school will be well fitted to make a profession of the calling. The next thing to do is to eliminate from all committees having to do with the public relations of engineers all men employed on salary. This will leave the discussion of engineering ethics entirely to the private practitioners. Divide the men who call themselves engineers into two distinct classes, commercial engineers who are on salary or are engaged in manufacturing or contracting; and professional engineers who are in private practice. Until a true definition of an engineer is obtained, nothing can be done to remedy matters even after eliminating the many misplaced youths. More or less fanciful definitions are given of engineers but what is wanted is a positive definition of the kind of engineer who is in need of a good code of ethics.

ERNEST MCCULLOUGH.

Chicago, Mar. 5, 1913.

Tests of Large Brick Piers

Crushing tests of brick piers many times larger than any tested previously were made recently by the Bureau of Standards on the new 5000-ton testing machine erected in the Pittsburgh laboratory of the bureau. Heretofore it has been known, from a number of tests on small brick piers (12x12 or 12x16 in.), that the compressive strength of brickwork is much less than that of single brick. But how far this conclusion would apply to larger bodies of brickwork was not known, i.e., whether the larger piers would prove to be weaker, or stronger, or just as strong as small piers. The recent tests were made to give information on this question.

When brickwork is subjected to compressive load, the bricks first break in bending instead of in direct compression, and the result is to form long, vertical cracks in the mass, passing through the end joints of one course and the breaks in the brick of the next course. In this condition the brick mass is little more than an aggregation of slender vertical columns 4 in. square. Further loading produces a result which might be expected: the pier bursts or spalls. This result, which previously has been found for piers of small lateral dimensions, is now found also for large piers.

The crushing strength of the large piers tested is substantially the same as that of small piers (in pounds per square inch), and the manner of failure is the same.

The two piers tested were 48x48 in., by 12 ft. high. They were laid up directly on the table of the testing machine, and were tested at about one month (the second pier laid up after the first one was tested). One pier was laid in 1:1 cement mortar, the other in 1:3 lime mortar. The former was tested for modulus of elasticity when 16 days old (the test being confined to moderate loading so that the strength of the pier would not be affected); 15 days later, or at age 31 days, it was tested to failure. The lime-mortar pier was tested for modulus of elasticity and also to rupture at age of 25 days.

The cement-mortar pier failed at a load corresponding to 2917 lb. per sq.in.; an ordinary small-size pier of the same brick and the same mortar would be expected to show a strength of 3000 lb. per sq.in., in the Bureau's experience. This means that the strength of a large pier and a small pier is the same.

The lime-mortar pier failed at 757 lb. per sq.in. The same brick and mortar in a small-sized pier would be expected to fail at 900 lb. per sq.in., in the Bureau's experience.

The three views herewith show stages of the testing. Fig. 1 is the cement-mortar pier as laid up on the table of the machine and under test for modulus of elasticity. Fig. 2 shows this pier after failure. Fig. 3 shows the lime-mortar pier after failure. The more extensive split-

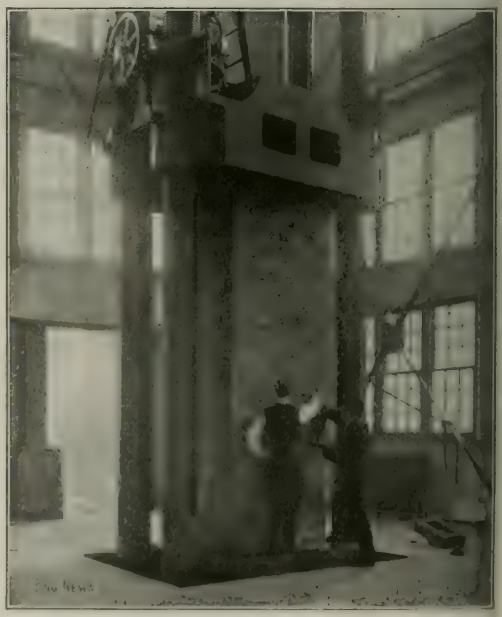


FIG. 1. BRICK PIER LAID IN CEMENT MORTAR, 48x48 IN. BY 12 FT. TEST FOR COMPRESSIBILITY IN 5000-TON TESTING MACHINE



Fig. 2. Brick Laid in Cement Mortar



Fig. 3. Brick Laid in Lime Mortar

The Two 48x48-in. by 12-ft. Brick Piers after Test

ting apart apparent in Fig. 3 indicates that the lime mortar had much less bonding action than the cement mortar.

The moduli of elasticity of the two piers, at half the ultimate strength, were: Cement-mortar pier, 1,760,000 lb. per sq.in.; lime-mortar pier, 75,000 to 100,000 lb. per sq.in.

These tests were reported recently by J. E. Howard, Engineer-Physicist of the Bureau of Standards, in a paper before the National Brick Manufacturers' Association.

Licensing Engineers in New York

The movement to require engineers to pass examinations and receive licenses before practicing their profession in New York State is again being pushed in the New York Legislature. Readers of Engineering News will recall that a similar movement in New York two years ago was defeated in the Legislature through the efforts of prominent engineers who appeared before the committees in charge of the bill.

The bill now pending in the Legislature was introduced by Mr. Larrimer and is No. 1126 on the Assembly files. It is in general similar to the McGrath bill, introduced two years ago, and is understood, like it, to have been framed by and to have the backing of the Technical League of America. The Committee in charge of the bill will give a hearing upon it Apr. 1.

The pending bill is by its terms limited to the practice of civil engineering. It defines civil engineering as follows:

> A person practices civil engineering who holds himself out as able to do or undertakes to do work such as a civil engineer is called upon to do in the designing, construction and engineering inspection of public works, which require engineering experience and the same technical knowledge as engineering schools prescribe for graduation.

A brief summary of the provisions of the bill follows:

After Aug. 1, 1917, no person shall practice civil engineering as above defined in New York unless registered or licensed. The administration of the law is placed under the Board of Regents of the University of the State of New York. That body is to appoint a state board of engineering examiners, which shall register those qualified and shall hold examinations for the issue of licenses. To be either registered or admitted to examination, an engineer must pay a fee of $25. In order to take the examination, candidates must have graduated from an engineering course in an engineering school or correspondence school approved by the Regents. If a correspondence-school certificate is offered, candidates must also have had at least three years' experience in engineering work. In place of training in an engineering school, five years or more in practice may be accepted. The act provides means for revoking licenses of engineers who are guilty of any fraud or deceit.

The following persons may receive licenses without examination and for a $10 fee, by making application therefor before Aug. 1, 1917: Anyone actually engaged for three years in the practice of civil engineering; any

graduate from a four-year course in a reputable engineering school; any person who shall have been engaged in supervising, inspecting, designing or constructing public works of engineering character for three years or more. Engineer officers of the United States Army or Navy may practice their profession without license and without fees.

The bill is in the hands of the Assembly committee on public education, the members of which are Messrs. McKee, of Richmond, Wilmott of Kings, Larrimer of Kings, McMahon of Bronx, Fitzgerald of Erie, Doty of Orange, Grimme of Rockland, Lewis of New York, Hammer of Bronx, Schnirel of Ontario, Edwards of Broome, Webb of Putnam, Schaap of New York.

The committee gave a hearing on the bill in the State Capitol on Mar. 17. A dozen or more engineers resident in Albany, Troy and vicinity were present and opposed the bill on the ground that the engineering profession did not need or want such legislation. Mr. Eliot, representing the Technical League, spoke in favor of the bill and urged in its favor that many eminent engineers who last year opposed the bill were not present this year to oppose it because the bill had been redrawn to meet the objections then made. In reply it was said by those opposed that the engineering profession throughout the state had generally no knowledge that such a bill was pending.

It is stated, however, that the committee seemed to be prejudiced in favor of the bill. Engineers desirous of expressing their sentiments on the pending legislation can address letters to any member of the committee, or merely to the Assembly Committee on Public Education, Room 236, State Capitol, Albany, N. Y.

Annual Convention of the American Railway Engineering Association

The 14th annual convention was held at the Congress Hotel, Chicago, Mar. 18 to 20, and there was the usual display of sustained interest in the proceedings which is characteristic of the meetings of this society. There was also a commendable promptitude in the attendance at the hours set for the meetings which is unfortunately a rare experience at conventions of this sort.

The address of the President, Mr. Churchill (N. & W. R.R.) reviewed some of the work and objects of the association, calling attention specially to its investigations regarding concrete and rails. The reports of the secretary and the treasurer showed a membership of 1066, and a balance of $10,745. The officers for 1913 are as follows: President, Edwin F. Wendt, Assistant Engineer, Pittsburgh & Lake Erie R.R.; Vice-Presidents, W. B. Storey, Jr., Vice-President, A., T. & S. F. Ry. System, and Robert Trimble, Chief Engineer of Maintenance of Way, Pennsylvania Lines (Northwest system); Treasurer, George H. Bremner, Engineer of Illinois District, C., B. & Q. R.R.; Secretary, E. H. Fritch, 900 South Michigan Ave., Chicago.

The 21 committees all had reports and all of these were presented at the meeting. They had been published in advance, and no time was wasted by reading reports in full. The chairman of each committee presented an outline of the report, and all conclusions were read, so that they might be discussed before being adopted. In this way the great majority of the time was occupied in active discussion of important matters.

The proceedings were disposed of in five long sessions, The annual reception was held the first evening, and was followed by an illustrated talk on the Panama Canal by Mr. McNab (Grand Trunk Ry.). The annual dinner was held the second evening, and on the third evening Prof W. K. Hatt (Purdue University) gave an illustrated talk on tests of rails rerolled into reinforcing bars for concrete.

In connection with the convention there was the annual exhibit of railway machinery and appliances, filling both the Coliseum and the adjacent Armory building. In order that this extensive and costly exhibit might receive a proper show of attention, the meeting was scheduled for four days, the last day being assigned entirely to visits to the exhibition. Referring again to the reports, we may note that most of them were comparatively short, and all were of a practical and definite character, dealing with certain assigned subjects. Three were of special importance in that they dealt with matters of a special character, vitally related to the economics of railway operation: (1) The report on economics of railway location discussed questions of grades and curvature in relation to train tonnage and operation; (2) the report on rails presented the results of exhaustive and valuable investigations as to rail manufacture and design; (3) the report on yards and terminals presented graphic systems for analyzing the train movements at passenger terminals and the train capacity of such terminals. We give below an outline of each of the reports, and abstracts of some of the reports will be published later.

Roadway

Ventilation of Subway Tunnels—This report presented a lengthy review of the principles of ventilation and the methods employed in ventilating numerous subway or rapid-transit tunnels in this country and abroad. The methods may be classed as follows: (1) Exhausting air at various points by fans; (2) forcing a current of air the whole length of the line by fans; (3) so called natural ventilation, by means of openings or "blow-holes"; (4) the piston action of trains. Although many subways are now provided with some system of ventilation by fans, by far the greater number still depend upon air currents set up without special mechanical aid.

Roadbed Pressures—The report advocated the appointment of a special committee (representing the roadway, ballast and track committees) to make experiments on the loads transmitted through the ballast and on the bearing power of roadbed materials. The experiments would necessitate considerable expenditure of time and money. The committee stated that the large number of rail failures, together with the constant increase in locomotive axle loads and the undoubted advent of the 100-ton car, make it imperative that some systematic study should be made of the roadbed as the foundation for the track. This report was accepted without discussion.

Ballast

The report recommended that as to physical tests, stone for ballast should be high in weight, hardness, toughness and compressive strength, and low in water absorp-

tion, wear and cementing qualities. An investigation made by the Pennsylvania R.R. shows that the total cost of ballasting with stone is $7911, $5708 and $5264 per mile for ¾-in., 1½-in. and 2½-in. stone respectively, while the cost of maintenance for four years is about $91.66, $84.94 and $82.13 per mile respectively. The report also discussed the methods of testing the quality of gravel for ballast, showing the results obtained from various gravels on different railways. An appendix described the method of cleaning stone ballast by the use of screens on the Baltimore & Ohio R.R. In line with the suggestion of the Roadway Committee (noted above), this committee presented an outline of a proposed test to determine the proper depth of ballast of different kinds to insure uniform distribution of loads upon the roadway; the cost is estimated at $3000 for three tests. The report was accepted without discussion.

Ties

In the report of 1912, the committee reported that it is not feasible to lay down fixed rules for the size and spacing of ties in relation to density of traffic, but this matter was then referred back to the committee with instructions to consider it from the point of view of the stresses to which the ties are subjected. The committee now reiterates its position as to the impracticability of the idea, due to the numerous factors (and the varying and indeterminate qualities of these factors) which affect the stresses in ties. The report contained also a detailed review of the various forms of steel tie-plates employed on various railways, and a continuation of the annual information relating to steel and concrete ties actually in use on steam and electric railways. The committee has not yet any definite information as to the relative effect of different designs of spikes and ties on the life of ties, but it is thought that experiments now being made will throw some light on the subject. The report was accepted without discussion.

Rails

This is one of the most important committees and it has done some very notable and original work in investigations of rail section and rail manufacture, besides preparing standard rail specifications which are now extensively used by the railways. The report this year was brief, but was accompanied by a number of appendices (nearly 400 pages) covering the committee's special investigation work, and its detailed statistics of rail failures. The principal feature of the report proper was in regard to rail sections. It stated that while some changes have been suggested, it is not yet time to consider them, as the A. R. A. sections, which are being used by a number of roads with good results, have been in service only two or three years. It is considered probable, however, that it may be found advisable to add a little metal to the upper and lower fillets.

The committee submitted also some changes in the wording of the specifications for carbon-steel rails (already adopted), and notes on the special investigations which have been carried on by Mr. Wickhorst, Engineer of Tests for the committee. As an indication of the importance of this work it may be noted that in the past three years the American Railway Association has appropriated $31,000 towards the expense. The report, being in the nature of a report of progress, was adopted without discussion, the proposed changes in the specifications being adopted also.

Track

The most important matter taken up by this committee is that of economics in track labor, this being the commencement of an exhaustive study of an important matter that has been largely neglected. The committee's work so far has been an investigation of the methods of educating and securing section foremen. The report presented also plans for main-line turnouts, a revised table of functions of the ten-chord spiral, and specifications for such track material as tie-plates, bolts, common spikes, screw spikes, spring nut-locks and anti-creepers. The specifications were discussed by paragraphs, and were adopted, with a few amendments. The turnout plans were adopted also. In view of recent disputes as to the proper design of crossovers in high-speed main tracks, Mr. Lindsay (N. Y. Central R.R.) suggested that the committee should take up the question of such crossovers, especially in regard to the curve at the switch angle, with switch rails of different lengths. In regard to the committee's investigation of the question of economics in track labor, Mr. Wendt (P. & L. E. R.R.) pointed out that wages represent an increasing proportion of the gross earnings, while the proportion represented by interest and dividends is on the decrease. He thought the consideration of economic questions one of the important developments in the work of the association.

Buildings

The report consisted mainly of a revision of former detailed information in regard to various roof coverings. There was also some information in regard to freight-house floors. While hard maple is generally preferable, beech and birch are sometimes used, and there is a good field for the introduction of gum (especially tupelo). This last is somewhat softer than maple, but it wears evenly and does not splinter much more than the former; there is a large supply of this timber in the South, and its use for floors is recommended.

The floor planks should be laid diagonally, except that if there is a pronounced amount of trucking in one direction they may be laid parallel to this direction, but if the traffic is heavy, a runway of steel plates may be built. Concrete has been used successfully where the wear is not too severe, and a concrete subfloor protected by a layer of asphalt will give good results, while asphalt blocks seem to have some advantages. The report was accepted without discussion.

Wooden Bridges and Trestles

Bridge Floors—Two important subjects are covered in this report: (1) Guard rails and guard timbers on bridge floors; (2) fire protection on bridge floors. In both cases, the matter consisted mainly of statements of practice on a number of individual railways, but as to the former, the following conclusions were adopted: (1) It is good practice to use outside guard timbers on open-floor bridges, the timbers being so constructed as to space the ties and hold them in place; (2) the guard timber and inner guard rail (when used) should be so spaced with reference to the track rail that a derailed truck will strike the inner guard rail before striking the timber; (4) the top of the guard rail should not be higher than

and not more than 1 in. below that of the track rail. Apparently no roads extend the outside timbers beyond the bridge (with the notable exception of the N. Y., O. & W. Ry.), this timber being considered as a tie spacer only and the inner guard rail being relied on to hold derailed trucks. Very few roads use rerailing devices, although these few include some important roads. For fire protection of floors on wooden bridges a covering of ballast or sheet metal is used, and sometimes both.

The discussion related particularly to the inside guard, and a recommendation in regard to the use and construction of such rails was referred back to the committee. This discussion showed a rather surprising amount of objection to guard rails, or rather to a requirement for their general use. This was partly on the score of doubtful efficiency, although we should consider their efficiency amply proved by experience; but the principal objection seemed to be the cost of equipping all bridges with these protective devices. The argument was made that they might as well be required on high embankments as at short bridge openings, but on the other hand it was shown that the length is not a factor, the more important consideration being the location of the structure.

Masonry

This committee presented only a brief report of progress, accompanied by an appendix on the disintegration of concrete and the corrosion of reinforcing metal. To prevent disintegration by the effects of sea water or water containing acids or alkalies, the concrete should be dense and impermeable, of good material and workmanship, and allowed to harden before being exposed to the action of the water. The use of special preparations is not considered necessary in good concrete. The report was accepted without discussion.

Signs, Fences and Crossings

The report presented a large amount of information as to fence posts of wood, metal and concrete, and submitted the conclusion that "concrete posts are practical, economical and a suitable substitute for wood." It presented also some further information as to securing fence wire that will resist corrosion and have good durability, but it recommended that this investigation be discontinued for the present, as certain experiments relative to it have been abandoned.

The third subject of the report was the construction of track in and across paved streets; this recommended 9-in. 141-lb. grooved rails on treated ties and a ballast bed 8 to 12 in. thick, this to be laid and rammed in 3-in. layers. In the discussion some changes were made to the specifications for concrete fence posts and to those for street crossings. As to the latter, there was a rather general opinion that the foundation was not sufficiently substantial, and that a heavier ballast bed or even a concrete base beneath the ballast might be necessary. Mr. Campbell (El P. & S. W. R.R.) said that he had found a concrete bed a great improvement in keeping the track in surface and mentioned cases where this is required by the city authorities.

Signals and Interlocking

This committee submitted a system of fundamental signal indications and aspects, and means of designating stop signals operated under automatic block system rules. The committee has considered also the effect of treated-wood ties and metal ties on track circuits. Its report states: (1) Each metal tie must be effectively insulated from the rail; (2) the effect of creosoted ties is not serious and with alternating current is negligible; (3) the effect of zinc-treated ties is more serious.* As to these last ties it appears that when they are used extensively track circuits a mile in length are rendered inoperative, but that circuits 3000 ft. long may be operated successfully even with 50% or more of treated ties. While the subject of signal indications and aspects has been under consideration for some years, this is the first time that the committee has been able to agree upon any one system. In presenting the report, Mr. Rudd (Pennsylvania R.R.) stated that these matters, as given in the report, have been adopted by the Railway Signal Association by a vote of 574 to 10. It was voted to adopt them and to refer them to the American Railway Association. The matter relating to track circuits was accepted as information.

Records and Accounts

This report showed the necessity of coöperation of different departments of railway service. It pointed out that the accounting department is as much interested as the maintenance-of-way department in the proper forms for time books, distribution sheets, authorizations of expenditures, etc., as these forms are the basis of the accounting system. Therefore, this association should seek the coöperation of the Railway Accounting Officers' Association in the development of a set of such forms. In the study of the economical management of store supplies the committee is already acting in coöperation with the Railway Storekeepers' Association. The committee also submitted a subdivision of the account for "roadway and track" in the Interstate Commerce Commission classification of operating expenses. This is desirable in order to analyze the expenses and secure uniformity in labor costs. The subdivision is as follows: (1) Track maintenance; (2) applying track materials; (3) cutting weeds and general clearing; (4) ditching and bank widening; (5) changing alignment and grades; (6) flood damage; (7) bank protection; (8) filling bridges; (9) other care of roadway and track (trackwalking, watching, etc.). The report was accepted without discussion.

Rules and Organization

This committee submitted a number of rules or instructions for maintenance-of-way employees, these being of a more specific character than the general rules which they supplement. They relate to such matters as gage on curves, superelevation and easement at ends of curves, switches, frog-guard rails, etc.; also rules for protecting unsafe and obstructed track and for the use of hand or motor cars in maintenance work.

The discussion occupied the greater part of one session, indicating that rules of this sort are considered of importance in relation to maintenance work. The committee's rule as to protecting track obstructed by repair work required stop signals to be displayed "not less than 20 telegraph poles" from the point of obstruction, but this was changed to read "in accordance with rule 99 of the American Railway Association," and it was suggested that in automatic block-signal territory the foreman

*See "Engineering News," Feb. 6, 1913.

should see that the signals governing the section to be obstructed are in the "stop" position, so that trains will enter the section under control. A new rule was adopted calling attention to the importance of the uniformity of gage, but the rule for widening gage on curves was adopted without dispute. This provides for a widening of ⅛-in. for each 2° over 8°, with a maximum widening of ¾-in. and a maximum gage (including wear) of 4 ft. 9½ in. At frogs on the inside of curves (which should be avoided where possible) the gage should be standard. Mr. Wendt (P. & L. E. R.R.) suggested that the committee should now undertake the study of the principles of organization of the maintenance-of-way department, which is an important subject needing more attention than has hitherto been given to it.

Water Service

Deep-Well Pumps—The report proper dealt with deep-well pumping apparatus, including reciprocating or plunger pumps, vertical-shaft centrifugal and propeller pumps, air-lifts and air-displacement pumps. In this last system, the air acts as a piston upon the surface of the water in a discharge chamber, depressing it and forcing it out through a pipe. It is shown that each has its field, but that the first named type is not adapted for operating scattered wells unless electric power is available; the efficiency may be increased by using double-acting and non-pulsating pumps. The vertical-shaft pumps are particularly adapted for handling water which contains a considerable amount of sand; the practical length of shaft does not usually exceed 200 ft. The air-lift is of low efficiency, but it can raise a larger amount of water from a small hole than any other form of apparatus; it can operate wells having sandy water, or those which are too small or too crooked for any other method. The air-lift, however, will not convey water horizontally, so that if the wells are at any distance from the tank a second pump is necessary, but this objection does not apply to the air-displacement pump. The report was supplemented by a paper on "Track Tanks" by G. W. Vaughan, N. Y. Central R.R. It was submitted as information, no conclusions being presented, and was accepted without discussion.

Yards and Terminals

Operating Capacity of Passenger Terminals—This report was of exceptional interest in dealing with the novel and important subject of the analysis of the operating capacity of passenger terminals. This analysis is made by the aid of diagrams or charts showing the train movements throughout the day, and showing at what times each platform track and approach track is occupied and clear, thus facilitating a study of changes for increasing the capacity. One of these chart systems has been worked out on the Belgian State Railways, and another on the Pennsylvania R.R., while the committee submitted a modified system. Sketch plans of terminals were given, with information as to the traffic and the facilities for handling passengers, baggage, express and mail. Another important subject included in the report was that of the mechanical handling of freight, this being supplementary to former reports. It included the telferage system, electric trucks, overhead traveling cranes with revolving horizontal booms under the trolleys, elevating and stacking conveyors, and freight-handling equipment for docks and steamship terminals.

The committee's recommendation as to limiting the curvature through switches on the approach or throat tracks of a passenger station to that of a No. 8 slip switch or tangent brought some protest from engineers who are using No. 6 and No. 7 slip switches, but on the other hand some thought the principle desirable, although it may not be possible to follow it in every case. One road has found it necessary to call the attention of its motive-power department to the derailment of engines on No. 7 turnouts which they were supposed to pass safely. This led to certain changes in the engines. For storage and loading tracks a minimum curvature of 6° was recommended, to avoid trouble in coupling cars. In two cases the committee recommended certain features as being "safe" but this word was eliminated, as it implied that any departure from the recommendation might be unsafe. In fact the suggestion was plainly made that there is too much talk of "safety first," since railways are built to handle business, and safety is only one of many factors in their efficient and economical operation. The report included some additional information in regard to hump or gravity switching yards, and its recommendations as to such yards were approved.

Iron and Steel Structures

Inspection—The committee submitted rules for the instruction of inspectors in mill, shop and field; while a minority report suggested that railways coöperate in establishing an inspection organization which would represent the railways in general. The idea was that this would be more satisfactory than to have the work done by individual railways or by private inspection bureaus, and it was suggested also that the rules submitted in the majority report would not apply to bureau inspection, which represents more tonnage than railway inspection. A progress report was made in regard to tests of built-up columns, which tests are to be made this year. The rules were read and discussed and were adopted with some few amendments. Mr. Lindsay (N. Y. Central R.R.) thought they should include instructions as to care in loading, unloading and storing the material, and as to looking for and rectifying members damaged in unloading or erecting. No reference was made to the minority report or to the relative merits of inspection by railway engineering departments and by private bureaus.

Economics of Railway Location

This was probably the most important of all the reports, dealing with matters which vitally affect the efficiency and economy of operation. One subject dealt with was the analysis of maintenance-of-way accounts in the general operating accounts. It was pointed out that while the majority of problems relative to this subject deal with main tracks, occasional problems introduce the consideration of side tracks, and it is therefore necessary to separate certain of the operating accounts for main-track cost and side-track cost. The committee presented an analysis of these accounts, with a formula for determining the annual charge per mile of main track for any account which embraces both main and side tracks. The report discussed also the relative damage to track by the locomotive and its train; figures from about 50 railways showed that the passenger locomotive does as much damage as the cars of its train, while the freight locomotive does about one-third as much damage as its cars. One of the conclusions presented was to the effect that one

ton of passenger train does more damage to track than one ton of freight train, and that the locomotive creates more disturbance than an equal weight of cars and contents. These conclusions were referred back to the committee, as they were admittedly only estimated and objection was made that as the increased damage due to passenger trains is on account of their speed, the running of high-speed freight trains would tend to lessen the difference.

Appended to the report was a paper on an extensive series of dynamometer tests made by the B. & O. R.R., and their relation to tonnage rating and train resistance. The committee submitted a scheme of varying grade compensation for curvature to meet different conditions. Also a statement that there is no absolute value for train resistance, and that for practical purposes freight-train resistance can be considered constant between 7 and 35 m.p.h. These were adopted, but some of the conclusions relating to formulas for tonnage rating were referred back to the committee for further consideration.

The discussion on this report occupied nearly an entire session. Mr. Sullivan (Can. Pac. Ry.) pointed out the value of the committee's work in analyzing operating conditions and costs in relation to physical conditions, and he considered that there should be greater coöperation between the engineering and operating departments in order to secure higher efficiency of operation. Mr. Tratman (ENGINEERING NEWS) thought the great importance of the report was in showing the advantages and actual economies which may be effected by introducing scientific refinements in location and maintenance. These are limited somewhat by the effects of weather, traffic and track labor in disturbing the actual grades, and he suggested that while the varying scale of compensation recommended by the committee is valuable as an ideal to be aimed at, it may be questioned whether these actual compensated grades would remain undisturbed for any long period of time under present conditions of track, traffic and maintenance work.

Wood Preservation

The committee reported that the use of water-gas creosote is limited but increasing, and that there is a growing sentiment in favor of mixing this with coal-tar creosote. The principal objection to the former seems to have been its unauthorized use as an adulterant of the latter, but its use is now increasing in legitimate or authorized mixtures. The report was accepted without discussion.

Electricity

ELECTROLYSIS—The principal part of the report of this committee dealt with the conditions of electrolysis and the means for its prevention. It included reference to investigations made and measures adopted for the Brooklyn Bridge, the Brooklyn and Chicago street railways, the Grand Central and the Pennsylvania terminals in New York, the Bergen tunnels of the D., L. & W. R.R. and Erie R. R., and the Baltimore terminal of the B. & O. R.R. This report was accompanied by an extensive bibliography. It was accepted as information, without discussion, after a brief explanation of its purport by the chairman of the committee, Mr. Kittredge (N. Y. Central R.R.).

Conservation of Natural Resources

The main feature of this report was its presentation of the work being done by the Canadian authorities for the protection and conservation and proper utilization of the timber, coal, peat, natural gas and oil resources. It is thought that large quantities of petroleum may be discovered in Alberta, which would be of great importance for the oil-burning locomotives on the coast lines of the Canadian Pacific Ry. and the Canadian oil-burning coasting steamers, all of which now use California oil. A rather surprising reactionary opinion in opposition to the modern principle of conservation was voiced by Mr. Downs (Ill. Cen. R.R.), but was answered very emphatically by Prof. Williams (Cornell College, Iowa), and others who showed the reckless waste and destruction of natural resources (instancing the increasing consumption and decreasing production of oil), and the responsibility of the railways in various directions. It was suggested that engineers and engineering associations certainly should lend their aid to a movement for the protection and proper use of the natural resources. This view was held almost unanimously, and the report was accepted and approved by a large vote.

Uniform General Contract Forms

This special committee presented the completed form of its construction contract, and asked to be discharged as it has now finished its work. The draft form has been submitted to all railways represented in the Association; of 70 replies, 35 approved it, 25 made some criticisms (generally as to wording or minor matters), 6 preferred their own forms, 3 did not criticize, and only one thought it impracticable to draw a uniform contract form. The contract was read in full and adopted, with a few amendments. It contains the usual clause giving to the engineer the power of deciding all questions and controversies which may arise between the company and the contractor, and this led to some discussion. As to the method of settling such disputes by arbitration, as has been suggested recently, Mr. McDonald (N., C. & St. L. R.R.) thought they could be settled in court quicker and at no greater expense. It was explained, however, that the committee was of opinion that the engineer should have this power while the work is under construction, but of course any case can be submitted to arbitration or to court action afterwards.

Grading of Lumber

One of the objects of this committee has been to secure the adoption of the rules drawn up jointly by the committee and the lumber associations. It reported that the Am. Ry. Eng. Association's rules for maintenance-of-way lumber for yellow pine, hardwoods and Douglas fir have been adopted by the respective lumber associations, but that those for white pine have not been accepted. It presented grading rules for cypress. The report was accepted without discussion.

A Derailed Milk Train on the New York Central & Hudson River R.R., near Spuyten Duyvil, some eight miles north of the Grand Central Station, tied up all traffic on the main line of the railway to and from the Grand Central Terminal on Mar. 14. The accident occurred about 8 p.m., when a southbound milk train, approaching the city at a 20-mile rate, was derailed and the cars piled up across all four tracks. Although composed chiefly of milk cars the train is reported to have had a steel coal car near the middle, the hopper of which is supposed to have come loose and caught on the third rail, which carries the current for the electric locomotives. The third rail was torn up for some 500 ft., which necessitated the electric power being shut off for a considerable time. It was nearly two hours before the tracks were sufficiently cleared to permit a resumption of traffic.

The Commission Plan of City Government will be voted on in Jersey City, N. J., on Apr. 15.

An Explosion of Nitroglycerin destroyed one of the factories of the Burton Powder Co., at New Castle, Penn., on Mar. 17. The explosion was caused by fire and the 50 men employed at the works had time to escape before the explosion occurred.

A Rear Collision between two freight trains on the Union Pacific R.R., near Hearndon, Neb., on Mar. 14, caused the deaths of five trainmen. A blizzard was raging throughout the state at the time.

Another German Zeppelin Dirigible Balloon was wrecked by a windstorm on Mar. 20. The airship was known as "Substitute Z 1." After beating against a 50-mile gale for an hour and a half the crew succeeded in making a landing in safety near Karlsruhe. A second violent burst of wind caught the balloon at anchor and entirely demolished it.

A Gas Explosion at the canning factory of the Western Canada Cold Storage & Packing Plant, Medicine Hat, Alta., caused the deaths of five employees and serious injuries to a score or so more. The explosion is reported to have been caused by a small fire, which started while plumbers were repairing a leaky gas main. The building, a three-story structure, was entirely destroyed.

A Rear Collision between two fast express trains on the Union Pacific R.R., near Gothenberg, Neb., on Mar. 14, caused the deaths of four passengers and serious injuries to about 30 more. The accident occurred about 4 o'clock in the morning, during a blinding snowstorm. Train No. 4, known as the Atlantic Express, was reported to have been at rest, when train No. 12, known as the Colorado Special, crashed into the rear car, a Pullman sleeping car. This car and a coach ahead were partly demolished, and all the dead and most of the injured were in the sleeping car.

Severe Windstorms all through the Middle West between Mar. 20 and 22 caused widespread damage and a loss of life reported as nearly 100. The storm extended from Texas, through the Mississippi Valley, Alabama, Illinois, Ohio and western New York State. At Chicago, telegraph and telephone connection with outside cities was interrupted for several hours. Here the wind was accompanied by snow, sleet and rain, causing much damage to shipping. At Detroit, Mich., the wind is reported to have reached a velocity of 86 miles per hour, the highest ever attained in that city. In Indiana the damage done by the storm is estimated at $1,000,000.

A Severe Tornado, accompanying a cyclonic storm, swept across Nebraska and Iowa on Mar. 24. The greatest damage was done at Omaha, where telegraphic dispatches as we go to press report a death list of 152 and property damage estimated at $5,000,000. At Yutan, Neb., 16 persons were killed, at Council Bluffs, Iowa, 12 persons, at Terre Haute, Ind., 18 persons were killed and 250 injured. Other cities suffered less severely. The total number of lives lost is estimated in press dispatches at 230. Next to Omaha, the city of Terre Haute is believed to have suffered the most. The property loss here is estimated at $1,000,000.

The cyclonic storm extended from Modena, Utah, through Denver, Colo., Omaha, Neb., Milwaukee, Wis., across Lake Michigan to Sault Ste. Marie and through the Province of Quebec. This was the second severe storm in the Middle West within a week.

High Floods throughout Ohio and Indiana caused the loss of many lives in Dayton, Ohio, Peru, Ind., Delaware, Ohio, and many other cities and towns on Mar. 25. Many dams and bridges were destroyed and railway service in the flooded district has been practically adandoned.

The Mississippi River Levee Association has just been organized in Tennessee to disseminate information as to the practicability and feasability of the plans for levee construction and flood prevention in the Mississippi River Valley recommended by the Mississippi River Commission. A. S. Caldwell, a banker of Memphis, is president of the association, and Mr. John A. Fox is secretary-manager, with offices in the Scimitar Building.

Dock Construction in New York City, at an expense of $15,000,000, including outlays for land purchases and damages, was decided upon at a meeting of city officials on Mar. 17. Of the total amount it is stated that about $5,000,000 will be spent on a 1200-ft. pier and an adjacent half pier located at West 44th St. and the North River. There will also be two 800-ft piers near Desbrosses St., where the pier-head line is to be straightened; and a considerable amount of work will be done in Brooklyn.

PERSONALS

Dr. Willis L. Moore, Chief of the United States Weather Bureau, has announced that he will resign July 31.

Mr. Ernest Brown, an architect of Regina, Sask., has been appointed Deputy Minister of Public Works of the Province of Saskatchewan, Canada.

Mr. Alexander Dow, M. Am. Soc. M. E., General Manager of the Detroit (Mich.) Edison Co., has been elected President of the company and also of the Peninsula Electric Light Co.

Mr. H. W. Fenno, Resident Engineer of the Lake Shore & Michigan Southern Ry., at Erie, Penn., has been appointed Resident Engineer at Chicago, Ill., succeeding the late J. W. Crissey.

Mr. Marcus A. Dow has been appointed General Safety Agent of the New York Central & Hudson River R.R., with headquarters in New York City, succeeding Mr. George Bradshaw, resigned.

Mr. De Witt V. Moore, formerly associated with the W. C. Halstead Co., Contractors, of Indianapolis, Ind., has opened an office in the Merchants Bank Bldg., Indianapolis, as a consulting engineer and architect.

Capt. Julian L. Schley, Corps of Engineers, U. S. A., Assistant to the Engineer Commissioner of the District of Columbia, has been appointed Executive Officer of the new Public Utilities Commission of the district.

Mr. F. H. Fowler, Assoc. M. Am. Soc. C. E., formerly Hydro-electric Engineer, U. S. Forest Service, San Francisco, Calif., has been promoted to be District Engineer, succeeding Mr. Walter L. Thurber, resigned.

Mr. E. B. Dailey, Assistant Mechanical Engineer of the Union Pacific R.R., at Omaha, Neb., has been appointed Assistant to the Director of Purchases of the Southern Pacific Co., with headquarters in New York City.

Mr. Charles J. McGonigle, M. Am. Soc. C. E., formerly Contracting Manager of the Portland, Ore., office of Milliken Bros., Inc., has opened an office in the Chamber of Commerce Bldg., Portland, as a consulting structural engineer.

Mr. Charles Forrester has been appointed Superintendent of the Grand Trunk Ry., with headquarters at Stratford, Ont. Mr. Forrester began his railway work as a telegraph operator, and until recently was Trainmaster at Stratford.

Mr. John G. Greiner, formerly General Foreman of the shops of the Cincinnati, Hamilton & Dayton R.R., at Lima, Ohio, has been appointed Master Mechanic of the San Pedro, Los Angeles & Salt Lake R.R., with headquarters in Salt Lake City, Utah.

Mr. Almon L. Fales has resigned as Superintending Chemist of the Worcester, Mass., sewage-disposal works to become associated with Metcalf & Eddy, Consulting Engineers, Boston, Mass. Mr. Fales is succeeded at Worcester by Mr. Roy S. Lanphear, as noted in our issue of Jan. 9.

Mr. C. J. Morrison, M. Am. Soc. M. E., formerly associated with Suffern & Son, New York City, as Manager of the engineering department, has announced the formation of the firm of Froggatt, Morrison & Co., with offices at 149 Broadway, New York City. Mr. Morrison is Chief Engineer of the new firm.

Mr. Horace H. Esselstyn, M. Am. Soc's C. E. and M. E., has resigned his position as Engineer with Westinghouse, Church, Kerr & Co., to become Construction Engineer of the Detroit Edison Co., Detroit, Mich. Mr. Esselstyn has been associated with Westinghouse, Church, Kerr & Co., for the past 12 years.

Mr. David H. Blossom has resigned as City Engineer of Salt Lake City, Utah. Mr. Blossom is a graduate of Middlebury College, Vermont, and studied civil engineering at the Massachusetts Institute of Technology. For six years previous to his appointment as City Engineer, in 1911, he was Chief Engineer of the American Falls Canal & Power Co., at Salt Lake City.

Mr. J. B. Berry, M. Am. Soc. C. E., Chief Engineer of the Chicago, Rock Island & Pacific Ry., has been appointed Assistant to the President. Mr. Berry has been Chief Engineer of the Chicago, Rock Island & Pacific Ry. since 1905; previous to that time he had been Consulting Engineer of the St. Louis & San Francisco R.R. and Chief Engineer of the Union Pacific R.R. Mr. Berry is succeeded as Chief Engineer by Mr. Charles A. Morse, M. Am. Soc. C. E., as noted elsewhere.

Mr. E. E. Adams, Assoc. M. Am. Soc. C. E., Assistant to the Consulting Engineer of the Union Pacific System and Southern Pacific Co., has been appointed Consulting Engineer of

the Union Pacific System, succeeding Mr. John D. Isaacs, M. Am. Soc. C. E., who has resigned as Consulting Engineer of the Union Pacific System, but remains Consulting Engineer of the Southern Pacific Co. Mr. Adams was born at Watertown, Mass., in 1879 and graduated in civil engineering from the University of California in 1904. His service with the Southern Pacific Co. began in 1905 as Assistant Engineer of Pipe Lines. Later he was Superintendent of Pipe Lines. In December, 1906, he was appointed Assistant to the Consulting Engineer, with offices in New York City.

Mr. Charles A. Morse, M. Am. Soc. C. E., has resigned as Chief Engineer of the Atchison, Topeka & Santa Fé Ry. System to become Chief Engineer of the Chicago, Rock Island & Pacific Ry., with headquarters at Chicago, Ill., succeeding Mr. J. B. Berry, promoted as noted elsewhere. Mr. Morse was born in Bangor, Maine, and received his technical education at the University of Maine. In 1880 he entered the service of the Chicago, Burlington & Quincy R.R. as a chainman. From November, 1881, until the completion of the railway in 1884, he was Division Engineer of the Mexican Central Ry., and then returned for a short time to the service of the Chicago, Burlington & Quincy R.R. In January, 1886, he entered the service of the Atchison, Topeka & Santa Fé Ry. as a transitman. Later he was promoted to Division Engineer and Resident Engineer at Fort Madison, Iowa, and Pueblo, Colo. He was appointed Assistant to the Chief Engineer, at Topeka, Kan., in 1901, and the following year was appointed Principal Assistant Engineer with headquarters at La Junta, Colo. Mr. Morse was promoted to be Engineer of the Eastern Grand division of the Santa Fé lines in 1903, and a short time later became Acting Chief Engineer. In 1904 he was appointed Assistant Chief Engineer. In 1905 he was made Acting Chief Engineer of the Coast lines of the company and in August, 1906, was promoted to be Chief Engineer of the Atchison, Topeka & Santa Fé Ry. System.

OBITUARY

Charles Noah Wood, City Engineer of Norwalk, Conn., died Mar. 19, aged 66 years.

James H. Gannon, State Superintendent of Public Works of New York, under Governers Cleveland and Hill, died Mar. 21, at the age of 71 years.

Samuel Tiller Benner, former President and Chief Engineer of the Keystone Bridge Co., Pittsburgh, Penn., died at his home in Philadelphia, Penn., Mar. 19, aged 73 years.

Charles Kellogg, M. Am. Soc. C. E., founder of the Elmira Bridge Co., and the Athens Boiler Works, died at his home in Athens, Penn., Mar. 23, aged 76 years. Mr. Kellogg had also served as President of the Imperial Pneumatic Tool Co.

Peter S. Archibald, M. Am. Soc. C. E., Consulting Engineer, of Moncton, N. B., died at his home in that city, Mar. 16. He was born at Truro, N. S., in 1848, and educated at the Truro Normal School. He was Assistant Engineer of the Intercolonial Ry. from 1869 to 1879 and Chief Engineer from 1879 to 1897, when he retired to private practice as a consulting engineer. He also served as Commissioner of Railways for the New Brunswick Government and as Manager of the Elgin & Havelock Ry. Mr. Archibald was a member of the council of the Canadian Society of Civil Engineers.

Richard Fenner Hawkins, a famous New England bridge builder, died at his home in Springfield, Mass., Mar. 12. He was born in Lowell, Mass., Mar. 9, 1837, but his family moved to Springfield soon afterward and he remained a resident of Springfield all his life. He was educated in the public schools, and at an early age began work as an office boy with the firm of Stone & Harris, of Springfield, famous in that day as a railway bridge building concern. This firm had been founded in 1840 by William Howe, inventor of the Howe truss, and his brother-in-law Amasa Stone. They were the builders of the first Connecticut River railway bridge at Springfield.

In 1862, at the age of 25 years, Mr. Hawkins became a partner in the firm with Daniel Harris and A. D. Briggs under the firm name of Harris, Briggs & Co. A short time later Mr. Briggs retired to become Railroad Commissioner of Massachusetts and the firm became Harris & Hawkins. By degrees Mr. Hawkins succeeded to the entire control of the business which came to be known as the R. F. Hawkins Iron Works. This concern built many Howe truss railway bridges throughout New England and New York and also many trainsheds and large roof trusses. Besides structural work, the company also manufactured boilers, iron and steel castings and special machinery.

Mr. Hawkins was active in public life and served as Alderman and Water Commissioner of Springfield. He was married in 1862 to Miss Cornelia Morgan Howe, a niece of Elias Howe, inventor of the sewing machine, and of William Howe, of Howe truss fame.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ELECTROCHEMICAL SOCIETY.
Apr. 3-5. Annual meeting at Atlantic City, N. J. Secy., J. W. Richards, South Bethlehem, Penn.

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Vice-Pres., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, owa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Shurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sambborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

American Water-works Association—The annual convention will be held in Minneapolis, Minn., June 23-27, 1913.

Cleveland Engineering Society—The Cleveland city civil service commission has asked the coöperation of the Cleveland Engineering Society in preparing more practical questions for the examination of applicants for engineering positions. The request has been favorably acted upon by the society and the executive board of the society has expressed a willingness to be of such assistance as the commission may desire.

Boston Society of Civil Engineers—At the annual business meeting held Mar. 19, the following officers were elected: President, Frederic H. Fay; Vice-President, Charles R. Gow; Secretary, S. Everett Tinkham; Treasurer, Charles W. Sherman. About 200 members attended the meeting. J. Waldo Smith, Chief Engineer of the Board of Water Supply of the City of New York, gave an illustrated talk on the New York City water supply.

Institution of Automobile Engineers of Great Britain—A party, composed of members of the Institution and of the Society of Motor Manufacturers and Traders, will leave London on May 17 for New York, arriving May 26. After trips to Pittsburgh, and Indianapolis, the party will go to Detroit, to attend the summer meeting of the Society of Automobile Engineers, returning by way of Cleveland and Buffalo. This trip is the result of a series of communications between the British and American automobile engineering societies, dating from the trip taken by a party of members of the latter society to the Olympia show in London in 1911.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Maine—Grand Trunk Ry. System—This company is considering running a branch line from Yarmouth, Maine, to Bath, Maine, passing through the towns of Freeport and Brunswick. H. R. Safford, Montreal, Que., is Ch. Engr.

Connecticut—New York, New Haven & Hartford R.R.—This company, it is reported, is planning to four-track its shore line division. The work will require the construction of a tunnel through the city of New London, and a four-track bridge at New London. Edward Gagel, New Haven is Ch. Engr.

New York—New York Central Lines—The New York Central Lines will spend $10,000,000, it is reported, to relieve traffic congestion at Albany, N. Y., by the construction of additional tracks and another bridge across the Hudson River eight miles south of Albany. G. W. Kittredge, New York, is Ch. Engr.

Hudson River Connecting R.R. Corporation—This company was incorporated, Mar. 19, to construct three short sections of railroad embracing about 25 miles of line in Albany, Rensselaer and Columbia Counties. The capital of the company is $250,000. Among the incorporators are William K. Vanderbilt, Harold S. Vanderbilt and William C. Brown, all of New York. N. Y.

New Jersey—Philadelphia & Reading Ry.—This company has completed surveys for the laying of an additional track on its right-of-way between Hopewell and Belle Mead, N. J., a distance of about 10 miles. William Hunter, Philadelphia, Penn., is Ch. Engr.

Pennsylvania—Pennsylvania R.R.—The Directors of this company, Mar. 12, voted in favor of electrifying its line for suburban traffic from the Broad St. Station to Paoli, Penn., a distance of about 20 miles. The work will cost about $4,000,000. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

West Virginia—Norfolk & Western Ry.—This company is having surveys made for the reconstruction of the Clinch Valley Division including the relaying of the tracks with heavier rails, reinforcing the bridges and widening the tunnels. C. S. Churchill, Roanoke, Va., is Ch. Engr.

West Virginia—Baltimore & Ohio, R.R.—This company will construct a connecting line from its Ohio division to the Little Kanawha R.R. The cost of this work has been estimated at $200,000. F. L. Stuart, Baltimore, Md., is Ch. Engr.

North Carolina—Warrenton & Norlina R.R.—This company has received a charter from the state to construct and operate a line of railroad from Warrenton to Norlina, a distance of five miles. The capital is $50,000. J. K. Plummer, Jr., Raleigh, N. C., is interested.

Georgia—Bainbridge & Northeastern Ry.—This company has applied to the State Railroad Commission, Atlanta, Ga., for permission to issue $1,000,000 of bonds for the construction of its proposed line to connect Pelham, Bainbridge and Hardaway, Fla., about 50 miles. Harvey Harding, New Haven, Conn., is Pres.

Florida—Tampa & Gulf Coast R.R.—This company, it is reported, has sold bonds for the extension of its proposed line to St. Petersburg, Fla. Surveys will begin at once. P. O. Knight, Tampa, Fla., is interested.

✚**Alabama**—Central of Georgia Ry.—This company, it is reported, has awarded the contract to YOUNG & MILLER, Montgomery, Ala., for making improvements to its line from Montgomery to Eufaula, Ala., about 80 miles. C. K. Lawrence, Savannah, Ga., is Ch. Engr.

Tennessee—Tullahoma, Lynchburg & Fayetteville Ry.—This company will construct a railroad, about 32 miles long from Tullahoma to Fayetteville, Tenn.

Kentucky—Louisville & Nashville R.R.—This company is preparing for the reconstruction of its line from Louisville, Ky., to Nashville, Penn. Portions of the line will be double tracked and curves will be eliminated at several points.

Kentucky—Chicago, Memphis & Gulf R.R.—This company is considering the construction of an extension of its line from Hickman to Paducah, Ky., about 50 miles. W. O. McMillan, is Ch. Engr., Hickman, Ky.

Ohio—Cleveland, Cincinnati, Chicago & St. Louis Ry.—This company, it is reported, is considering double-tracking its line between Bellefontaine and Crestline, Ohio, a distance of about 65 miles, on the St. Louis Division. G. P. Smith, Cincinnati, Ohio, is Ch. Engr.

Illinois—Milwaukee, Peoria & St. Louis Ry.—This company has secured the necessary capital to finance the construction of its proposed line from Peoria to Rockford, about 120 miles. The cost has been estimated at $18,000 per mile. As planned, the line after leaving Peoria will be constructed through the bayous and sloughs of the Illinois River, and will pass through or touch all the important towns between the cities of Peoria and Rockford. F. W. Cherry, Princeton, Ill., is interested.

Chicago, Burlington & Quincy R.R.—This company, it is reported, will double-track its system in the central part of Illinois. W. L. Breckenridge, Chicago, Ill., is Engr. M. W.

✚**Minnesota**—Minnesota, Dakota & Western R.R.—This company has awarded the contract to M. W. BARNARD, Globe Bldg., Minneapolis, Minn., for 10 miles of construction work on its Deer River extension.

Nebraska—Chicago, Burlington & Quincy R.R.—This company, according to press reports, will double-track its Omaha-Lincoln Division. Work will commence as soon as weather conditions will permit.

Texas—Memphis, Dallas & Gulf Ry.—This company will extend several links of its line, now completed in Arkansas, as rapidly as possible to Dallas and Fort Worth via Clarksville, Tex. Grading is now in progress on the division of this proposed system between Hot Springs and Murfreesboro, Ark. The Texas Division will run from the Red River crossing near Ashdown, Ark., to Dallas, Tex., thence to Fort Worth, Tex., passing through a number of towns in the northeastern part of the state. The plans of the promoters call for the construction of approximately 350 miles of track. The main line will run between Memphis and Fort Worth with several branch lines, the most important of which will be that from Murfreesboro to Hot Springs. The general offices of this road will be situated at Nashville, Ark. W. N. Brown is Pres.

Texas—Artesian Belt R.R.—This company will award the contract soon for the construction of its proposed line from Christine to Crowther, Tex., 1 mile. The work will require the construction of 10 trestles. P. H. McNemer is Gen. Mgr. J. P. Jackson, Macdona, Tex., is Ch. Engr. Noted Mar. 6

Texas—Atchison, Topeka & Santa Fé Ry.—This company, it is reported, will construct an extension to its line from Lamesa to Sterling City, a distance of about 100 miles. C. F. W. Felt, Topeka, Kan., is Ch. Engr.

Idaho—Pacific & Idaho Northern Ry.—This company is considering the extension of its line from New Meadows down the Little Salmon River to Riggins, Idaho. Lee Highley, New Meadows, Idaho, is Ch. Engr.

Washington—Great Northern R.R. and Northern Pacific Ry.—These companies, it is reported, will construct jointly a line of railroad in the Olympia Peninsula. Contracts will be awarded at once. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Canadian Pacific Ry.—This company has awarded contracts for about $3,000,000 of work. The contracts let were for 60 miles on the final 80-mile section of the Jukeson-Golden cutoff, and for 20 miles of the line from Jukeson to Golden. J. G. Sullivan, Winnipeg, Man., is Ch. Engr.

Oregon—Du Bois Lumber Co.—This company will construct a railroad from its timber lands in the Nehalem country to the Columbia River in the vicinity of St. Helena.

Porter Bros., railroad contractors, Portland, it is reported, have purchased 102,000 acres of timber land in Eastern Linn County, Ore., and will construct a railroad from Albany, Ore., to its holdings, a distance of about 25 miles.

California—Trona R.R.—This company has filed articles of incorporation and will construct a railroad 32 miles long through Kern, San Bernardino and Inyo Counties. The directors are Joseph K. Hutchins, of San Francisco, Calif. and W. R. Slack and W. R. Whyte, of Oakland, Calif.

✚**Toronto**—Canadian Pacific Ry.—This company has awarded contracts for double-tracking 165 miles of its line as follows: Lake Superior Division, Cartier sub-division, 29 miles, COOK CONSTRUCTION CO., of Sudbury, Ont.; Chapleau sub-division, 13 miles, DOMINION CONSTRUCTION CO., of Toronto; White River sub-division, 33 miles, DOMINION CONSTRUCTION CO.; Schrieber sub-division, 13 miles, DOMINION CONSTRUCTION CO.; Schrieber sub-division, 22 miles, CHAMBERS, McQUAIG, McCAFFREY & COCHRANE; Nipigon sub-division, 25 miles, DOMINION CONSTRUCTION CO. Ontario Division, London sub-division, 30 miles, from Guelph Junction east to Islington, JONES & GIROUARD, Ottawa, Ont. Of the above, 135 miles form part of the Lake Superior Division, and 30 miles are situated in the Ontario Division, immediately west of Toronto. The contracts cover the grading, bridge and culvert work, and steel laying. The total cost of the work will be about $5,000,000.

Ontario—Toronto, Hamilton & Buffalo Ry.—This company will double-track its line between Welland, Ont., and Smithville, Ont. Bids are asked until Mar. 31. R. L. Latham, Hamilton, Ont., is Ch. Engr.

British Columbia—Canadian Pacific Ry.—This company will receive bids until Mar. 29 for grading its right-of-way on the Arrow Rock Subdivision. Bids must be addressed to H. B. Walker, Acting Div. Engr., Vancouver, B. C.

ELECTRIC RAILWAYS

Beverly, Mass.—Plans are being considered by the Bay State St. Ry. Co. for double-tracking its Cabot St. line. H. E. Reynolds, Boston, is Asst. Gen. Mgr.

Brockton, Mass.—The Bristol & Norfolk St. Ry. Co. contemplates the extension of its line from Randolph to Brockton. E. W. Clapp, Randolph, is Supt. and Pur. Agt.

Fairhaven, Conn.—Plans are being prepared by the Union St. Ry. Co. for the extension of its line in Fairhaven in order to form a belt line to Fort Phenix.

Lockport, N. Y.—Plans are being prepared by the International Ry. Co. for double-tracking its line from Lockport to North Tonawanda, about 16 miles. Estimated cost $500,000. Thomas Penney, Buffalo, is Pres.

Syracuse, N. Y.—The New York State Rys. Co. contem-

plates an expenditure of $250,000 for improvements to its system. This work includes the double-tracking of several of its lines, laying new track and the installation of new equipment. B. E. Wilson, Rochester, is Gen. Mgr.

Dunmore, Penn.—Application has been made by a recently organized company for a franchise to construct an electric railway through Dunmore to Lake Ariel. Gerald McDonald, Scranton, is interested.

Honesdale, Penn.—The Wayne County Traction Co. has been granted a franchise by the Borough Council to construct and operate an electric railway in Honesdale. Harry H. Richards, Honesdale, is Vice-Pres. and Gen. Mgr.

Pittsburgh, Penn.—The Pittsburgh Rys. Co. is making preliminary arrangements for the construction of an electric railway on Corliss St. P. N. Jones, Pittsburgh, is Gen. Supt.

Wilmington, Del.—Preliminary arrangements are being made by the Wilmington & Philadelphia Traction Co. for the extension of its Eighth St. line. William A. Heindle, Wilmington, is Gen. Mgr.

Baltimore, Md.—The United Rys. & Electric Co. has applied to the City Council for a franchise to construct and operate an electric railway on various streets in Baltimore. T. A. Cross, Continental Trust Bldg., Baltimore, is Gen. Mgr.

+Baltimore, Md.—The Board of Awards has awarded a contract for the construction of an electric railway from the Harford Road tracks of the United Rys. & Electric Co. to Lake Montbello, to be used for hauling supplies for the construction of the new filtration reservoirs, to M. W. HILL & CO., Baltimore, at $11,555. Noted Mar. 13.

Saluda, N. C.—The Saluda-Hendersonville Interurban R.R. Co. has been incorporated to construct and operate an interurban railway in Saluda and vicinity.

Passagrille, Fla.—Noel A. Mitchell, St. Petersburg, Fla., is interested in the construction of an electric railway in Passagrille.

Birmingham, Ala.—The Birmingham & Tuscaloosa Ry. & Utilities Co. has been incorporated to construct and operate an electric railway connecting Gadsden, Attalla, Ashville, Birmingham, Bessemer and Tuscaloosa. C. R. Carter, 1831 Fifth Ave., Birmingham, is interested.

Bristol, Tenn.—James B. Cox and associates of Knoxville have secured practically all right-of-way for their proposed electric railway from Bristol to Johnson City. Noted Feb. 13.

Nashville, Tenn.—Plans are being prepared by the Murfreesboro Interurban Co. for the construction of a new interurban line from Nashville to Woodbury. Richard T. Wilson, Nashville, is interested.

Somerset, Ky.—Plans are being prepared by the Kentucky Utilities Co., Lexington, for the construction of an electric railway from Somerset to Burnside, about eight miles.

Middletown, Ohio—The Middletown, Reading & Cincinnati Interurban Ry. Co. has been incorporated to construct and operate an electric railway connecting Middletown, Monroe, Cincinnati, Bethany and Reading. The incorporators are John Brate, Michael Klaiber, Jr., and R. M. Billingslea.

Richmond, Ind.—Preliminary arrangements are being made by the Richmond, Portland & Fort Wayne R.R. Co. for the construction of an interurban railway to connect Richmond, Portland, Fort Wayne and intervening cities and towns. G. S. Staub and William F. Harbison are interested. Noted Mar. 13.

East St. Louis, Ill.—The East St. Louis & Suburban Ry. Co. is considering plans for the extension of its 40th St. line to the northern city limits. A. J. Purinton, East St. Louis, is Gen. Supt. and Pur. Agt.

Galesburg, Ill.—The People's Traction Co. is preparing plans for the extension of its line to connect Galesburg, Galva, Watoga, Oneida and Altona. S. E. Boggess, Galesburg, is Gen. Supt. and Pur. Agt.

Taylorville, Ill.—The City Council has granted a franchise to the Decatur, Sullivan & Mattoon Transit Co., to construct and operate an electric railway in Taylorville.

Iola, Kan.—The City Commissioners have granted a franchise to the Union Traction Co. to construct and operate an electric railway in Iola. This is part of a proposed line to connect Iola and Sherryvale. D. H. Siggins, Coffeyville, is Pres. and Gen. Mgr.

Newton, Kan.—The Commissioners of Harvey County have granted a franchise to the Arkansas Valley Interurban Ry. Co. to construct and operate an electric railway through the county. Charles D. Bell, Wichita, Kan., is Supt., Pur. Agt. and Ch. Engr.

Laramie, Wyo.—The Laramine Electric Co. is interested in the project to construct a street car line in Laramie. C. E. Van Dorst, Laramie, is Mgr.

Little Rock, Ark.—The City Council has granted a franchise to the Little Rock & Hot Springs Electric Ry. Co. to construct and operate an electric railway in Little Rock. This is part of a proposed line from Little Rock to Hot Springs. L. Garrett, Little Rock, is Gen. Mgr. Noted Dec. 12.

El Paso, Tex.—The El Paso Electric Ry. Co. has made application to the City Council for a franchise to construct and operate two additional street railway lines here. One is to run from the Arizona St. intersection of Oregon St. to Hague St., and east on Hague St. to Kansas St. The other line is to run east on Tenth St. and north on Campbell St. to Seventh St. H. S. Potter, El Paso, is Gen. Supt.

Fort Worth, Tex.—The North Texas Traction has increased its capital to provide funds for double-tracking its line from Fort Worth to Dallas. C. E. Hollender, Fort Worth, is Pur. Agt.

Galveston, Tex.—Plans are being prepared by the Galveston Electric Co. for the extension of its line on 17th St. Harry E. Sewell, Galveston, is Gen. Supt.

Riviera, Tex.—The Riviera Beach & Western Ry. Co. has finished the construction of its interurban line between Riviera and Riviera Beach 10 miles, and will soon begin work on an extension from Riviera to a point on the Texas Mexican R.R. between Realitos and Hebronville via Falfurrias, a distance of about 67 miles. E. F. Yoakum, of New York, and associates are interested in this new road.

San Antonio, Tex.—The San Antonio Traction Co. will double-track several of its lines and make other improvements to its street-railway system here, at a cost of about $200,000. E. E. Eysenbach, San Antonio, is Gen. Mgr.

Sherman, Tex.—A franchise has been granted by the City Council to the Texas Traction Co. to extend its line to St. Vincent's Sanitarium. R. B. Stichter, Dallas, is Gen. Mgr.

Temple, Tex.—B. F. Beverly, of Temple, and associates, have taken steps to construct an interurban electric railway from Temple to Austin via Belton and Georgetown. The proposed line will be about 75 miles long.

Bartlesville, Okla.—The proposition to extend its line from Bartlesville to Oglesby is being considered by the Bartlesville Interurban Ry. Co. H. Askin, Bartlesville, is Gen. Mgr. and Pur. Agt.

Artesia, N. M.—Morgan Hand of the General Electric Co., of Kansas City, Mo., and associates, who are promoting the construction of an interurban electric railway between Alamogordo, and Artesia, a distance of about 100 miles, recently completed a trip over the route and have made preliminary arrangements for pushing work on the project. They stated that the proposition has been financed and that as soon as the surveys are made and the right of way obtained construction work will be started.

Seattle, Wash.—Plans are being prepared by the Puget Sound Traction, Light & Power Co., for the extension of its Alki Point line in Seattle. G. A. Richardson, Seattle, is Gen. Supt. Rys.

Salem, Ore.—The Columbia & Nehalem River R.R. Co. is being organized at Salem, to construct and operate an electric railway from Wood's Landing to the Nehalem Valley. J. H. Hendrickson and J. C. Veasie are interested.

Los Angeles, Calif.—The Pacific Electric Ry. Co. is preparing to double-track its line on 64th Ave. in Los Angeles. J. McMillan, Los Angeles, is Gen. Mgr.

San Rafael, Calif.—The Mount Tamalpasis & Muir Woods Ry. Co. has been incorporated to construct and operate an electric railway. The proposed road will extend from the present terminal of the Mill Valley and Mount Tamalpasis Scenic railway to Mesa Station near Willow Camp. The directors are James K. Lynch, Frank F. Bostwick, Charles H. Crocker, Charles E. Green, R. H. Pease, Jr., Kenneth C. Gillis and M. E. Fitzpatrick.

Toronto, Ont.—The Metropolitan Ry. Co. will extend its electric line through Markham Township in advance of the Toronto-Markham-Port Perry line.

Carbon, Alta.—Preliminary arangements are being made by the Alberta Interurban Ry. Co. for the construction of its interurban line to Carbon. H. J. C. Zinck, Calgary, Alta., is Gen. Mgr.

LIGHT, HEAT AND POWER

Rutland, Vt.—A merger of several New England public utility concerns has been announced. The new interests plan the construction of a 6000-hp. plant at Clarendon, Vt. and power lines to various towns. An expenditure of $1,000,000 is contemplated.

Cambridge, Mass.—Press reports state that the construction of a central light and power plant to be located in Boylston Hall to supply light and heat to all college buildings at Harvard University, is under consideration. It is proposed to spend $40,000 for the plant and $10,000 for wiring.

Millers Falls, Mass.—A site has been purchased by the Franklin Electric Light Co., at Greenfield Hill and Grant Ave., for the construction of a substation.

Spencer, Mass.—The Spencer Gas Co. is preparing plans for extensive improvements to its plant.

+Stamford, Conn.—Contracts for two buildings at the plant of the Stamford Gas & Electric Co. have been awarded as follows: Mason work, VUONO CONSTRUCTION CO., carpenter work; GETMAN & JUDD CO., both of Stamford. The EASTERN BRIDGE & STRUCTURAL Co., of Worcester Mass., will furnish the steelwork. The buildings will be 60x 60 ft., two stories and 60x90 ft. one story, of brick and steel-concrete fireproof construction. Nelson E. Emmons, Washington Bldg., Stamford, is the Arch. Noted Mar. 13.

+Waterville, Conn.—A contract has been awarded by the American Pin Co. to GARDINER G. RIGGS, Manhan St., Waterbury, Conn., for the construction of a boiler house and coal handling plant. A boiler house, 44x100 ft. of brick, one high story, a pump house, 16x24 ft. of brick with reinforced concrete roof, a coal bunker 42x88 ft. of reinforced concrete, the concrete foundation for a radial brick stack and concrete pit, 21x40 ft. for oil tanks comprise the items of the contract.

Batavia, N. Y.—The Genesee Light & Power Co. will erect a steel addition to its power plant and install an electric traveling crane. H. K. Stein is Supt.

Buffalo, N. Y.—Francis T. Ward, Municipal Bldg., Comr. Pub. Wks., will receive bids Apr. 4 for power heating and ventilating plants for the Masten Park High School, including boilers, pump, gas engines, motors, generators, etc. Estimated cost, $100,000.

Clayville, N. Y.—H. D. Wood, of Phoenix, N. Y., is having plans prepared for a power house to be erected here.

Jamestown, N. Y.—The installation of new equipment in the municipal electric-light plant has been recommended by C. O. Johnson, Supt. of the plant.

New York, N. Y.—Bids will be received by Joseph Johnson, Fire Comr., until 10:30 a.m. Mar. 31 for furnishing all the labor and materials required for repairs and new electric lighting system at quarters of Engine Company No. 68, at 1080 Ogden Ave., Boro. the Bronx.

Connellsville, Penn.—Plans are being prepared by the West Penn Electric Co., for the improvement and extension of its power plant at Connellsville. W. E. Moore, Pittsburgh, is Gen. Mgr.

Washington, D. C.—Plans are being prepared by Walter C. Allen, Elec. Engr. for the installation of an ornamental street-lighting system on Pennsylvania Ave. An appropriation of $5000 has been made for the purpose.

Eastville, Va—Stanley Scott is interested in the proposition to construct an electric-light plant at Eastville.

Springfield, W. Va.—Press reports are to the effect that a company has been organized for the construction of a hydrielectric plant on the Potomac River near Springfield. Estimated cost, $100,000. William E. Walsh, Peter J. Seaver, C. B. George, A. M. Diehl and E. V. Brackett, all of Cumberland, Md., are interested.

Kinston, N. C.—See item under Sewers.

Wilson, N. C.—At an election to be held Apr. 15 the citizens will vote on the proposition to issue $80,000 in bonds for the construction of a municipal electric-light plant. Noted Jan. 23.

Abbeyville, Ga.—An election will be held Apr. 8 to submit to the vote of the citizens the proposition to issue bonds for $8000, for the construction of a municipal electric-light plant.

Marshallville, Ga.—See item under Water Supply-Irrigation.

Lake Butler, Fla.—See item under Water Supply—Irrigation.

Micanopy, Fla.—Bids are being received for the installation of new equipment in the local electric-light plant.

Florence, Ala.—The Board of Engineers in charge of the Mussels Shoals section of the Tennessee River will receive proposals until 11 a.m., June 24, at the office in Nashville, Tenn., for water-power development at this point subject to numerous conditions. The plan of the board is for the construction of three dams between Florence and Decatur, Ala., the first to have an available head varying from 64.5 ft. to 45.5 ft.; the second, 35 ft. to 29.5 ft, and the third from 35 ft. to 28.5 ft. The plan provides locks necessary for 6-ft. navigation between Florence and Decatur, with provision for ultimately deepening it to 9 ft. It is estimated that these three dams will develop 105,000 hp. for primary power and 95,000 hp. for secondary power. Proposals should state how much money the bidder will pay to the United States for the power franchises for each dam independently and for the power franchise of the three dams as a whole. The payment will be used for the construction of the locks, dams, substructures of the power houses, and in payment for other rights. The franchises which may be granted will be subject to conditions somewhat as follows: 100-year lease of the power, the United States to be owner of the locks, dams, superstructure of the power house and lands from the beginning; the lessee to own the power house, the hydraulic and electrical equipment, transmission lines and substations, etc. At the expiration of 100 years the power house will become the property of the United States; the machinery and transmission lines remain the property of the lessee. The flow of the river will be under the control of the United States at all times. Plans prepared by the board and details of the hydraulic study are on file at the office of the U. S. Engineer, Nashville, Tenn., and blueprints will be furnished at actual cost.

Dyersburg, Tenn.—The Business Men's Association is receiving bids for the installation of an ornamental street-lighting plant in the business district.

+Louisville, Ky.—The contract for the installation of a heating plant in the county Poor House, near Louisville, has been awarded to JAMES McWILLIAMS & CO., Louisville. Bids were received Mar. 15 by the Fiscal Court. Noted Mar. 6.

Maysville, Ky.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system in the business district.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Serv. until noon, Mar. 27, for the construction of concrete foundations and railroad siding for the municipal electric-light plant.

Coryville, Ohio—The Ohio Valley Electric Ry. Co. has been granted a franchise by the County Commissioners to construct and operate transmission lines from Coryville to Ironton. W. W. Magoon, Huntington, W. Va., is Gen. Mgr.

Lima, Ohio—Bids will be received by the Board of Education until Apr. 15, for the installation of a new heating system in the Lima High School.

Wapakoneta, Ohio—The Western Ohio Ry. Co. is considering plans for an expenditure of $20,000, for the construction of transmission lines from Wapakoneta to St. Mary's. H. V. Swinehart, Lima, is Elec. Engr.

+Kendallville Ind.—The contract for the construction of a municipal electric-light plant has been awarded to the BEERS-OFCUT CONSTRUCTION CO., Fort Wayne, Ind. Bids were received by the city, Mar. 11. Noted Feb. 27.

+Logansport, Ind.—The contract for the installation of surface condenser in the municipal electric-light plant has been awarded by the Board of Public Works to the REEVES-SKINNER CO., St. Louis, Mo., at $12,783. Noted Jan. 2.

Ecorse, Mich.—Press reports state that the Village Council is making preliminary arrangements for substituting electricity for gas in the street-lighting system.

Hastings, Mich.—Extensive improvements to its plant and system at Hastings are planned by the Thornapple Gas & Electric Co. Estimated cost, $16,000. Lewis W. Heath is Mgr.

Joliet, Ill.—Plans are being prepared by the Western United Gas & Electric Co. for improving its gas plant. The capacity of the plant will be doubled and will cost, $350,000. Patrick O.Malley is Supt.

Kimballtown, Iowa—The citizens recently voted to issue bonds for the installation of an electric-light plant John Neilson is interested. Noted Mar. 6.

Ottumwa, Iowa—The Ottumwa Gas Co. is considering an expenditure of $100,350 for the construction of a gas plant at Ottumwa. E. L. Lambert is Mgr.

Roseau, Minn.—At a recent election the citizens voted to issue bonds for the construction of a municipal electric-light plant. P. H. Buran is Clk. Noted Mar. 6.

Holton, Kan.—Worley & Black, Engrs., Reliance Elec., Kansas City, Mo., are preparing plans for the improvement of the municipal electric-light plant at Holton.

Jetmore, Kan.—The construction of an electric-light plant at Jetmore, is under consideration.

Russell, Kan.—An election will soon be held at which the proposition to issue bonds for the construction of an electric-light system will be submitted to the voters.

Turon, Kan.—We are officially advised that bids will be received by the city about Apr. 1 for the construction of a municipal electric-light plant. Estimated cost, $20,000. Plans have been prepared by Rollins & Westover, Kansas City, Mo. R. A. Greeson is City Clk. Noted Mar. 13.

+Bassett, Neb.—The contract for the construction of an electric-light plant has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $12,565. Noted Feb. 13.

Willow Lake, S. D.—Bids will be received about May 1 for the construction of an electric-light plant at Willow Lake. J. F. Flindt is Auditor.

Austin, Tex.—The Austin Gas Light Co. will install an addition to its gas plant here that will add 125,000 cu.ft. daily to the present capacity.

Bryan, Tex.—H. P. Ball, of Detroit, Mich., and associates are arranging to install a gas manufacturing plant and lay a distributing system here.

Fowlerton, Tex.—Preparations are being made for the installation here of an electric light and power plant and an ice factory. Construction of a waterworks system will also soon be started.

Franklin, Tex.—The Franklin Water & Light Co. is preparing to make extensive improvements to its electric-light and power plant here. Two producer gas engines and other machinery will be installed. P. H. Kellogg is Pres. and Mgr.

Kyle, Tex.—The City Council has been granted a franchise for a period of 55 years to J. W. Tompkins and associates to construct and operate an electric-light plant at Kyle.

Lubbock, Tex.—The Lubbock Light & Ice Co. has sold its electric-light plant and ice factory here to John R. Cullinane, of St. Louis, Mo., and associates. The properties will be enlarged and improved.

Marshall, Tex.—The Marshall Electric Co. has been incorporated to construct and operate an electric-light and ice plant at Marshall. E. S. Fry M. Turney and E. L. Wells, Jr., are the incorporators.

Mercedes, Tex.—S. A. Robertson, of San Benito, Tex., has been granted a franchise by the City Council for the installation of an electric-light and waterworks plant here. An ice plant is also contemplated.

Mount Pleasant, Tex.—Plans are being prepared for the improvement of the local electric-light plant which was recently purchased by the Albert Emanuel Co., of Dayton, Ohio. The proposed work will involve an expenditure of $50,000.

San Antonio, Tex.—The San Antonio Gas & Electric Co., will spend about $100,000 in extending its gas mains and making improvements to its electric lighting system here. E. E. Eysenbach, San Antonio, is Mgr.

Sulphur Springs, Tex.—T. Coleman, Mayor, is negotiating with a syndicate of Columbus, Ohio, men for the installation of a gas manufacturing plant and the laying of a distributing system here.

Timpson, Tex.—The Timpson Light & Power Co. will install a complete system of street lighting here and make improvements to its plant.

Wichita Falls, Tex.—The Wichita Falls Light Co. is preparing to extend the street-lighting system of this city. It has entered into a ten-year contract with the City Council for the establishment and maintenance of a street-lighting system. Charles A. Malone, Wichita Falls, is Mgr.

San Diego, Calif.—The Southern Sierra Power Co., Title Insurance Bldg., Los Angeles, is preparing to extend its power lines through San Bernardino and Riverside into San Diego. F. A. Worthley, Riverside, is Mgr.

Ogden, Utah—To provide for a reserve reservoir to take care of the additional water supply needed since the enlargement of the power plant the Utah Light & Ry. Co. has purchased eight acres of land immediately southwest of the powerhouse on the Cañon road. The reservoir will be from 4 to 7 ft. deep and will cover the entire eight acres. J. S. Welles, Salt Lake City, is Gen. Mgr.

Provo, Utah—The Utah Valley Gas & Power Co. is considering an expenditure of $150,000 for the construction of a gas plant at Provo. F. C. Richmond, Salt Lake City, is Pres.

+Los Angeles, Calif.—The Southern California Edison Co. has awarded a contract for the construction of a substation on Owensmouth St., to F. O. ENGSTROM CO., Fifth and Seaton Sts., Los Angeles.

+San Francisco, Calif.—The Pacific Oil & Lead Works awarded a contract to the DECKER ELECTRICAL CONSTRUCTION CO., 111 New Montgomery St., for the temporary wiring and construction of a power and light system in its plant on Townsend St., at $6517.

Ottawa, Ont.—The Electrical Department has prepared plans for the proposed installation of new equipment in the municipal electric-light plant. Estimated cost, $22,000.

St. Thomas, Ont.—Plans are being prepared by the Michigan Central R.R. Co. for the construction of a power plant at St. Thomas. Estimated cost, $150,000. C. E. Taylor, Detroit, Mich., is Supvr. Elec. L. and P.

Oxbow, Sask.—An expenditure of $12,000 is being considered for the installation of an electric-light plant here.

Vernon, B. C.—Bids will be received by D. G. Tate, City Clk., until Apr. 11, for the installation of one 500-hp. Diesel engine, one 375-kw. 2300-volt three-phase 60-cycle generator with direct-connected exciter and one 10-ton traveling crane.

Sackville, N. B.—The construction of an electric-light plant is contemplated. Estimated cost, $70,000.

BRIDGES

New York, N. Y.—The New Jersey Interstate Bridge Commission, appointed by the State of New Jersey for the purpose of ascertaining the practicability of building either a bridge across the Hudson River or tunnels underneath it, for highway traffic, has submitted its report to the State Legislature at Trenton, N. J. In it the Commission recommends that a bridge be constructed jointly by the States of New York and New Jersey across the Hudson River, from 57th St., New York City, to a point directly opposite on the Jersey shore. That it is entirely practicable and necessary for the now increasing traffic between New York and New Jersey is the opinion of the Commission. Tentative designs for the structure have been made by engineers and call for a bridge with a span of 2800 ft., with 612 ft. steel towers and a length of approximately 6000 ft. over all. The estimated cost of such a structure is estimated by the commission to be $42,000,000. This includes land values, interest, engineering expenses, etc. Henry W. Hodgdon, 149 Broadway, has been the engineer for the New York Commission and J. Vipond Davies, 30 Church St., has acted in the came capacity for the New Jersey Commission. The New York Commission will make the same recommendation to its Legislature at Albany and the project will then rest with the two Legislatures for final action.

New Brunswick, N. J.—The bids received on Jan. 13, for the construction of the steel and concrete bridge over Noes Creek on the Blazing Star Road, have been rejected and new bids will be received by the Board of County Freeholders until Apr. 1. Alvin B. Fox is the County Engr. Peter H. S. Hendricks is the Dir. of the Bd. Noted Jan. 9.

✦Trenton, N. J.—The Philadelphia & Reading Ry. has awarded the contract for the construction of a new four-track concrete arch bridge over Stony Brook, to the STIER-MARSH CONSTRUCTION CO., Philadelphia, Penn.

✦✦Chester, Penn.—The contract for the construction of a concrete balance cantilever structure bridge over the Chester River at Fifth St., has been awarded to CARL L. CAMP, Montrose, Penn., at $33,800. The other bidders were: The Fans Concrete Co., Philadelphia, $58,948; James Kelley, Sharon Hill, $41,000; Palmer & Snyder Philadelphia, $34,988 Nelson Meredith, $34,884; Pennsylvania Bridge Co., $39,700. Noted Feb. 27.

✦✦Philadelphia, Penn.—Bids for the construction of bridges were received on Mar. 18, as follows, for the Montgomery St. Bridge over the Connecting Ry.: F. J. BOAS, (a) 201 N. Broad St., Philadelphia, $49,224 (awarded contract); M. & J. B. McHugh, (b) 714 Arcade Bldg., Philadelphia, $54,948; Stier-Marsh Co., (c) 1011 Chestnut St., Philadelphia, $51,430; Richard Walsh, (d) $5922 Tacony St., Philadelphia, $54,275; American Paving & Construction Co., (e) 211 S. 9th St., Philadelphia, at $54,750; Cramp & Co., (f) Denckla Bldg., Philadelphia, $48,960; for bridge at 66th Ave. Notth, over the Pennsylvania R.R.: James Kelly, (g) $26,500; Stier-Marsh Co., (c) 1011 Chestnut St., Philadelphia, $24,900; RICHARD WALSH, (d) 5922 Tacomy St., Philadelphia, $24,750 (awarded contract); City Ave., over Indian Run, between Philadelphia and Montgomery Counties: Jos. Perua, (h) 334 N. 65th St., Philadelphia, $26,500; Ferro.-Concrete Co., (c) 1011 Chestnut St., Philadelphia, $25,800; James Kelly, (g) Bulletin Bldg., Philadelphia, $24,900; M. & J. B. McHugh, (b) 714 Arcade Bldg., Philadelphia, $34,980; Nelson Meredith Co., (i) Chambersburg, Penn., $24,880; P. J. LAWLER, (k) Bela, Penn., $21,942 (awarded contract); Chester Ave., over Philadelphia & Baltimore R.R.: M. & J. B. McHUGH, (b) 714 Arcade Bldg., Philadelphia, $31,448 (awarded contract); F. J. Boas, (a) 201 N. Broad St., Philadelphia, $31,943. Henry H. Quimby is Engr. of Bridges. Noted Feb. 27.

Reynoldsville, Penn.—We are officially advised that the bids received for the construction of the concrete arch over Sandy Lick Creek, between Reynoldsville and West Reynoldsville, have been rejected and bids will be receivd by the County Commissioners at Brookville, Penn., until Apr. 11. W. C. Beyerly is Clk. Noted Mar. 13.

✦Lumberport, W. Va.—The contract for the construction of a bridge across the West Fork River at Lumberport has been awarded to the RIVERSIDE BRIDGE CO., Wheeling, W. Va., at $30,230. Noted Mar. 13.

Newman, Ga.—Plans have been prepared for the construction of a steel bridge, 300 ft. long, at La Grange St., for the Central of Georgia R.R. and the city. The estimated cost is $12,000. C. K. Lawrence, Savannah, Ga., is the Ch. Engr.

Clara, Fla.—Press reports state that bids will be received by the County Commissioners at Berry, Fla., until Apr. 7, for the construction of a steel bridge across Rocky Creek at Clara. R. L. Stripling is the County Clk.

Columbus Ohio—Bids will be received at the office of the County Commissioners until Apr. 11, for bridge work according to Engineer's Estimates Nos. 445, 463, 466, 467, 468 and 469. Plans and specifications are on file at the office of F. M. Sayre, County Audr.

Delaware, Ohio—Plans are being considered for a new bridge on Cheshire St. to span the tracks of the Cleveland, Cincinnati, Chicago & St. Louis Ry. The estimated cost is $12,000.

Elyria, Ohio—See item under Streets and Roads.

Hamilton, Ohio—Bids will be received by the County Commissioners until Apr. 22, for the construction of a new bridge over the canal at Heaton St. The estimated cost is $14,000.

Madison, Ind.—Bids will be received by the Commissioners of Jefferson County, at the Court House, Madison, until 1:30 p.m., Apr. 8, for bridge work in Jefferson County. Plans and specifications are on file at the office of A. M. Taff, County Audr.

Newport, Ind.—Bids will be received by the Commissioners of Vermillion County until Apr. 7, for the construction of a steel and concrete bridge about 150 ft. long, at Newport. Roy Slater is the County Audr. Noted Feb. 13.

✦Waukegan, Ill.—The contract for the construction of the Genesee St. Viaduct at Waukegan, has been awarded to the JOHN WHEELER CONSTRUCTION CO., Geneva, Ill., at 72,619. Westcott & Ronneberg, 10 La Salle St., Chicago, Ill., are the Consult. Engrs. M. J. Donthitt, City Hall, Waukeegan, is the City Engr. Noted Mar. 6.

✦Waterloo, Iowa—We are officially advised that the contract for the construction of the Mullan Ave. Bridge across the Cedar River at Waterloo has been awarded to N. M. STARK & CO., Des Moines, Iowa, at $99,773. The other bidders were: Gould Construction Co. $105,127; the Blackhawk Construction Co., Davenport, $101,073; Miller-Hey Construction Co., $103,034. Noted Mar. 6.

✦We are officially advised that the contract for the construction of two reinforced deck girder bridges crossing Blackhawk Creek has been awarded to the MILLER-HEY CONSTRUCTION CO., Waterloo, at $22,576. The other bidders were: The Blackhawk Construction Co., Waterloo, $27,473; Waterloo Construction Co., $25,701; Gould Construction Co., Davenport, $24,693.

Redwood Falls, Minn.—The proposition to erect a bridge with a 20-ft. roadway and two 4-ft. walks at Redwood Falls, is under consideration. The estimated cost is $10,000. W. J. Smithers is the City Recorder.

Lexington, Neb.—Bids will be received at the office of the County Clerk until 10 a.m., Apr. 22, for the construction of a reinforced-concrete bridge over the Platte River. Plans and specifications are on file at the office of the State Engineer at Lincoln, Neb.

Mitchell, S. D.—The contract for the construction of the bridges in Davison County during 1913, has been awarded to A. N. BJODSTRUP, Mitchell. An appropriation of $18,000 has been made for the work.

Selby, S. D.—Press reports state that bids will be received until Apr. 1, for bridge construction during the year 1913. D. A. Taylor is the County Audr.

Lakota, N. D.—Bids will be received by Peter Sjurseth, County Auditor, until Apr. 6, for the construction of a steel span bridge 60 ft. long, over the Cheyenne River at Halverson Crossing.

★Osceola, Ark.—Bids will be received by the Commissioners of Drainage District No. 11, Mississippi County, Ark., for the construction of 11 steel bridges. Willis E. Ayres, Randolph Bldg., Memphis, Tenn., is the Consult. Engr. G. L. Waddell is Chn. of the Com.

Fort Worth, Tex.—The Commisioners' Court has accepted the plans of Brenneke & Fay, Consult. Engrs., St. Louis, Mo., for the construction of two new bridges. Noted Jan. 9.

Olympia, Wash.—Press reports state that an appropriation of $50,000 has been made for the purpose of constructing a steel bridge over the Pen de Orille River, to connect Washington and Idaho.

Medford, Ore.—Press reports state that bids for the construction of a bridge over the Rogue River at Medford, were received as follows: E. G. Pelham, $18,800; U. S. Steel Products Co., $19,492; Portland Iron Works, Portland, $22,400; N. S. Steel Co., $24,925.

✦Dyerville, Calif.—The contract for the construction of the steel highway bridge over the Eel River at Dyerville, has been awarded to the CHICO CONSTRUCTION CO., Chico, at $25,557. Noted Feb. 20.

Willows, Calif.—Plans are being prepared for the construction of a bridge to cost $100,000. The expense will be shared by Glen and Colusa Counties.

WATER SUPPLY—IRRIGATION

★Amherst, Mass.—Bids will be received by the Board of Selectmen until 9:15 a.m., Mar. 29, for furnishing the following: 4 tons c.-i. pipe 8- to 12-in., 69.4 tons 16-in. c.-i. pipe, 51 tons specials, consisting of stock patterns of bends, branches, plugs, increases and sleeves, 8-, 12- and 14-in. John Mullen is Chn.

Boston, Mass.—Bids for furnishing meters were received by the Supply Department, Mar. 10, as follows: (a) 6000 ⅝-in., (b) 250 ¾-in., (c) 100 1-in., (d) 150 1¼-in., (e) 75 2-in., (f) 20 3-in.: Hersey Mfg. Co., (a) $5; (b) $7; (c) $9.80; (d) $19.50; (e) $32.50; (f) $55.25; Neptune Meter Co., (a) $8; (b) $12; (c) $16; (d) $30.00; (e) $50; Thomson Meter Co., (a) $7.20; (b) $10.80; (c) $14.40; (d) $27; (e) $45; (f) $76.50; National Meter Co., (a) $7; (b) $10; (c) $14; (d) $30; (e) 50; (f) $90; H. R. Worthington, (a) $6.25; (b) $10; (c) $13; (d) 25; (e) 42.50; (f) $75. Noted Mar. 6.

East Long Meadow, Mass.—It is proposed to install a water system here, estimated to cost $35,000. The supply will be procured from Springfield. The construction work necessary will consist of laying about 32,000 ft. of 6- and 8-in. c.-i. pipe, with hydrants, valves, etc. F. C. Burton is Chn. Bd. of Selectmen.

Brooklyn, N. Y.—See item under Buildings.

Lyndenville, N. Y.—Wilmer & Brown, Consult. Engrs., Buffalo, N. Y., have prepared plans for the construction of a water system here. Bonds for $25,000 have been voted for this work.

Madison, N. Y.—Bonds for $14,600 were voted at the recent election for installing a gravity water system here, according to plans prepared by W. G. Stone & Son, Consult. Engrs., Utica, N. Y. Fred Welch is Village Pres. Noted Mar. 6.

Marion, N. Y.—We are officially advised that the proposed installation of a water system here is held up by the Conservation Commission. Charles L. Seybold is Pres. Bd. Water Comrs. Noted Mar. 13, as Black River, N. Y.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Apr. 9, for Section 1, for furnishing, delivering and laying high-pressure fire service mains and appurtenances in 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32d, 33d and 34th Sts., and in Madison, Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, 11th, 12th and 13th Aves. Section II, furnishing, delivering and laying high-pressure fire-service mains and appurtenances in Bayard, Baxter, Broome, Bowery, Elizabeth, Elm, Houston, Hudson, Mott, Mulberry, Prince, Spring, Stone, West and

Worth Sts., and West Broadway, including furnishing, delivering and installing motor operated valves, waterproof valve vaults and subsidiary ducts on the Bowery, Hudson St. and Stone St., and Subsidiary ducts and service boxes at the Oliver St. and the Gansevoort St. high-pressure pumping stations. Specifications are on file at the office of Engineering News, 505 Pearl St., New York.

We are officially advised that bids to roof with reinforced-concrete tiles, five superstructures for breakneck gaging chamber and Foundry Brook and Indian Brook siphon chambers, Contract 130, were received by the Board of Water Supply, Mar. 18, as follows: Martin Murray, Inc., Troy, N. Y., $5200; American Cement Tile Mfg. Co., 29 Broadway, New York, $7400. Noted Mar. 6.

★Bids will be received by the Board of Water Supply, until 11 a.m., Apr. 8, for Contract 105, furnishing, delivering and installing bronze riser valves and appurtenances for the city tunnel of Catskill Aqueduct in the City of New York. Charles Strauss is Pres. and Joseph F. Morrisey, Secy.

★We are officially advised that contracts have been awarded by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, as follows: To DURKIN & LAAS, 103 Park Ave., New York, furnishing and constructing auxiliary pumping stations on Southfield Blvd., Borough of Richmond, $17,527; making necessary excavations, building engine foundations of concrete, engine pit floor, etc., and a new feed-pump room in the West New Brighton pumping station, Borough of Richmond, $1850; to the JOSEPH BALABAN CO., dismantling and transporting one pumping engine now in the Baldwin pumping station at Baldwin, L. I., to the West New Brighton Pumping Station, Borough of Richmond, and reërecting it complete in place with new parts, etc., and steam and exhaust piping, suction and discharge piping, one dry vacuum pump, two boiler feed pumps, etc., and all valves, $11,025; to the FLORENCE IRON WORKS, furnishing and delivering 260 tons of c.-i. pipe, $6175. Bids were opened Mar. 12. Noted Mar. 20.

★**Walden, N. Y.**—Bids will be received by the Board of Water Commissioners until 8 p.m., Apr. 9, for furnishing and erecting a steel standpipe, 16x50 ft. Ezra Young is Village Clk.

Asbury Park, N. J.—We are officially advised that bids for improving the water system here were received by the City Council, Mar. 17, as follows: J. F. Shanley Co., Newark, N. J., (c) $112,903; Henry Spinach Contracting Co., Waterbury, Conn., (b) $62,376; (c) $75,047; Atlantic Construction & Supply Co., Jersey City, N. J., (a) $78,779; (b) $74,361; G. B. Richardson & H. K. Corbin, Owego, N. Y., (a) $95,500; (b) $66,000; (c) $82,000; Partridge & Burke, Lodi, N. J., (b) $62,938; Edwin L. Atlantic City, N. J., (a) $91,512; (b) $107,515; John W. Danforth Co., Buffalo, N. Y., (a) $78,246; William J. Norton, New York, N. Y., (c) $106,275; J. Allen Conklin, Newark, N. J., (a) $82,229; Andrew T. Van Cleve, Asbury Park, (a) $85,718; (b) $71,756. R. L. Savage is City Engr. Noted Mar. 13.

Allentown, Penn.—George A. Johnson and Nicholas S. Hill, Consult. Engrs., and Charles D. Weirbach, City Engr., have submitted a report for an additional water supply.

Carbondale, Penn.—R. J. Gillis, City Engr., is preparing plans for improvements to the water system, estimated to cost $59,000. Bids will probably be asked this summer.

★**McKeesport, Penn.**—We are officially advised that the contract to furnish and install one 4,000-sq. ft. water-tube boiler for the Water Department, has been awarded to BABCOCK & WILCOX, Pittsburgh, Penn., at $5331. Bids were opened Mar. 17, by C. E. Soles, City Controller. Noted Mar. 13.

✚**Rankin, Penn.**—We are officially advised that the contract to construct the 16-in. c.-i. intake pipe for the water system of the McClintic-Marshall Construction Co., at Rankin, has been awarded to the DRAVO CONTRACTING CO., Pittsburgh. Chester & Fleming, Pittsburgh, are Consult. Engrs. Noted Mar. 13.

Rehoboth, Del.—We are officially advised that bids will be received by the Board of Public Works until Apr. 15, for furnishing and laying c.-i. pipe, constructing a 200,000-gal. water tower, furnishing and installing engines and pumps. Estimated cost, $30,000. H. T. Downing is City Engr. C. S. Horn is Secy. Bd. Pub. Wks. Noted Mar. 20.

★**Alexandria, Va.**—Bids will be received by David J. Howell & Son, Consult. Engrs., Union Trust Bldg., Washington, D. C., until 1 p.m., Apr. 15, for constructing a concrete masonry dam for the Alexandria Water Co. The contract includes: 16,000 cu.yd. of earth excavation, 1600 cu.yd. of rock excavation, 17,500 cu.yd. of concrete masonry, 1150 cu.yd. of rubble masonry, gate house, and setting of pipes, gate valves, sluice gates and appurtenances.

Warrentown, N. C.—It is proposed to install water and sewer systems here. An election has been called for May 6 to vote on the proposition. J. W. Allen is Mayor.

Manning, S. C.—J. Newton Johnston, Consult. Engr., Florence, S. C., is preparing plans for a water system here, estimated to cost $30,000. The contract will involve 24,000 ft. of pipe, 32 gate valves, two 100-hp. boilers, 45 hydrants, one 1,000,000-gal. steel tank, service pumps, brick pumping station and a reservoir.

Marshallville, Ga.—The J. B. McCrary Co., Atlanta, Ga., is preparing plans for the installation of a water system and an electric-light plant here, estimated to cost $20,000. J. O. Boonton is Mayor. Noted Mar. 6.

Rome, Ga.—The Solomon-Norcross Co., Candler Bldg., Atlanta, Ga., is preparing plans for improving the water system at Rome. The plans provide for the installation of a new pumping system, and the replacing of steam-power equipment with electric pumps.

Carrabelle, Fla.—According to press reports, bids are being received by the Water Works Committee for installing water and sewer systems here. Chauncey Coombs is a member of the committee.

Lake Butler, Fla.—An election will probably soon be called to vote on a bond issue for the installation of water and sewer systems and an electric-light plant.

★**Pensacola, Fla.**—Bids will be received by the Water and Gas Committee of the City Council until noon, Apr. 22, for constructing a reinforced-concrete reservoir, 100x150 ft., and 8 ft. deep, covered with galvanized iron roof supported by timber trusses. Plans, specifications and blank forms may be obtained from L. Earle Thornton, City Engr. Dave Kuehlmeh is Chn. of Com.

Knoxville, Tenn.—The Water Department is having plans prepared for the construction of an additional filtration basin adjoining the present reservoir. George P. McTeer is Comr. Noted Dec. 19.

Augusta, Ky.—The town is considering the installation of a water system either as a municipal proposition or by awarding a franchise to M. A. Castoe & Co. The Commercial Club is interested.

Danville, Ky.—The city contemplates increasing the capacity of the pumping station on the Di River, and is also considering extensions to its distributing system. J. M. Wallace is Mayor. Noted Dec. 12.

Akron, Ohio—Bids will be received by R. M. Pillmore, Dir. Pub. Ser., until noon, Mar. 28, for furnishing and delivering cutting-in-sleeves and valves for sluice gates.

Akron, Ohio—Bids will be received by the Department of Public Service until noon, Apr. 8, for constructing the Cuyahoga River Dam, Water-Works Contract No. 24. The contract involves: 7000 cu.yd. earth excavation above elevation 252.0; 26,000 cu.yd. earth excavation below elevation 252.0; 15,000 cu.yd. rolled embankment; 15,000 sq.ft. steel sheet piling; 3000 sq.ft. wooden sheet piling; 1700 cu.yd. riprap; 12,000 bbl. cement; 350,000 lb. steel reinforcement; 9230 cu.yd. concrete masonry; 5000 lb. power-plant superstructure sheet lead; 2700 lb. sheet iron; 4000 lb. chains. Plans and specifications are on file at the office of R. M. Pillmore, Dir. Pub. Ser., and at the office of F. A. Barbour, Consult. Engr., Boston, Mass.

✚**Cheviot, Ohio**—We are officially advised that the contract to lay a 6-in. water main in various streets has been awarded to N. RUEBEL, Cheviot, at $8000. Bids were opened by Jacob Krollman, Jr., Village Clk., Mar. 19. Noted Mar. 13.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Apr. 1, for furnishing special castings for the Water Department. Specifications may be obtained from the Superintendent of the Water Department.

Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Apr. 4, for furnishing 250,000 ft. of 3½-in. fiber conduit for the Water Department. Specifications may be obtained at the office of the Superintendent of the Water Department.

✚**Mishawaka, Ind.**—We are officially advised that the contract to lay a suction pipe here to connect with six 10-in. wells has been awarded to G. F. STOECKINGER, 109 West Second St., Mishawaka. Bids were opened Mar. 10. Noted Mar. 13.

✚**Grand Rapids, Mich.**—According to press reports, a contract to furnish c.-i. pipe for main extensions has been awarded to the LYNCHBURG FOUNDRY CO., Lynchburg, Va., at $40,000. Noted Feb. 6.

Jackson, Mich.—We are officially advised that bids will be received by the Board of Public Works until 10 a.m., Apr. 7, for furnishing and installing a pumping engine, and furnishing and laying about four miles of water mains, with the necessary valves and hydrants. A. W. D. Hall is City Engr., and J. F. Harrison, Supt. Pub. Wks. Noted Mar. 20.

★**Anna, Ill.**—Bids will be received by the Illinois State Board of Administration, Springfield, Ill., until 2 p.m., Apr. 21, for furnishing and erecting complete, near Anna, a new water system, including brick and reinforced-concrete pumping station electrically equipped; filter plant, earthen dam with concrete spillway; a 2,000,000-gal. reinforced-concrete storage reservoir; a power-transmission line, and a 10- and 12-in. pipe line about 3¼ miles long; also for furnishing and installing all material, tools, labor and appliances for the equipment of three filters of a total capacity of about 1,000,000 gal. per day, complete and ready for operation. Plans and specifications are on file at the office of Dabney H. Maury, Consult. Engr., Monadnock Block, Chicago, Ill. Frank D. Whipp is Fiscal Superv. Noted Mar. 6.

Chicago, Ill.—Bids will be received by the Department of Public Works until 11 a.m., Mar. 27, for furnishing and delivering special castings for c.-i. water pipe, as required by the Bureau of Engineering during the period ending Dec. 31, 1913. The approximate quantities are: 360 tons of 4- to 12-in., and 40 tons of 16- to 36-in. Bids will be received at the same time for furnishing and delivering at the city plumbing shop, at 14th St. and Indiana Ave., 1000 1-in. and 100 1½-in., 300 1½-in. and 400 2-in. valves. L. E. McGann is Comr. Pub. Wks.

★**Evanston, Ill.**—Bids will be received by John H. Moore, Comr. Pub. Wks., until 4 p.m., Apr. 14, for constructing a 12,000,000-gal. mechanical filtration plant and appurtenances on a site adjacent to the pumping station. The work includes the construction, complete, covering earth excavation, mixing tank, coagulating basins, filtered water reservoir, filter tanks and equipment, piping, buildings, low-lift pumps, steam driven, steel wash water tower. Plans and specifications were prepared by George W. Fuller, 170 Broadway, New York, and Langdon Pearse, 76 West Monroe St., Chicago, Ill. The plant is estimated to cost $180,000. Noted Mar. 6.

Moline, Ill.—Bids will be received until 10 a.m., Mar. 28, for remodeling and extending the pumping station. Estimated cost, $12,000. L. Payton is City Engr.

Sheboygan Falls, Wis.—We are officially advised that Jeriniah Donohue, of the firm of Donohue & Sinz, Consult. Engrs., Sheboygan, is preparing plans for water and sewer systems here. L. A. Weisse is Pres. Village Bd. Noted incorrectly Mar. 6.

✚**Burlington, Iowa**—We are officially advised that the contract to construct a clear water basin for the Citizens' Water Co., has been awarded to the PHEE CONSTRUCTION & ENGINEERING CO., People's Gas Bldg., Chicago, Ill., at $24,964. Bids were opened Mar. 15. Frank Lawlor is Supt. Noted Mar. 6.

Marcus, Iowa—A franchise has been granted to K. C. Gaynor, Sioux City, Iowa, to install a water system here. Estimated cost, $12,000.

Woodbine, Iowa—Bonds for $28,000 have been voted for installing water and sewer systems here. Noted Feb. 27.

Deerwood, Minn.—We are officially advised that an election has been called to vote on a bond issue for the instal-

lation of a municipal well-water system, estimated to cost $15,000. C. C. Adams is Mayor. Noted Feb. 27.

Bennington, Kan.—Bids will be received by F. O. Reinhardt, City Clk., until 7:30 p.m., Mar. 31, for constructing a water system here. The contract involves a 50,000-gal. tank on a 100-ft. tower, one motor-driven turbine pump, capacity 100 gal. per min., a brick pumping house, well with casing, c.-i. pipe, etc. J. H. Nelson is Act. Mayor.

Turon, Kan.—Bids will probably soon be asked for installing a water system here, estimated to cost $20,000. Rollins & Westover, Kansas City, Mo., are Consult. Engrs. Noted Mar. 13.

Benkelman, Neb.—The town contemplates the installation of a water system, estimated to cost $20,000. An election will probably be called to vote on the proposition.

Volin, S. D.—The Town Board has authorized the installation of a municipal water system. Bids will probably soon be asked for this work.

Livingston, Mont.—The City Council has accepted the plans of Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., for the installation of a water system here, and an election has been called to vote on a bond issue of $225,000. Noted Mar. 13.

Beaumont, Tex.—H. G. Land and associates will install a system of irrigation to water about 6000 acres of land near here. A pumping plant will be erected on Hillebrandt Bayou.

Fort Worth, Tex.—The City Commission has ordered an election to be held on Apr. 8 to vote on the proposition of issuing $300,000 of water bonds and $175,000 of school bonds.

Rosenberg, Tex.—The City Council is making preliminary arrangements for installing a water system here.

Durant, Okla.—Bonds for $80,000 were voted, Mar. 18, for extending the water and sanitary sewer systems. W. P. Danford is City Engr. Noted Jan. 23.

Gunnison, Colo.—We are officially advised that bids will be received by M. J. Schmitz, Town Clk., until 5 p.m., Apr. 1, for constructing a concrete reservoir of 200,000 gal. capacity. The contract involves excavation for reservoir and trenches, retaining wall, trenches for intake and outlet tubes, and concrete work. O. H. Aikine is Town Engr. Noted Mar. 13.

Logan, Utah—We are officially advised that the city contemplates the construction of a settling basin and filter in connection with the municipal water system. T. H. Humpherys is City and County Engr.

Ellensburg, Wash.—We are officially advised that the survey for the tunnel and flume work in the Cascade Irrigation District will be completed in about two months, and bids will probably be asked soon after that time. The improvement is estimated to cost from $350,000 to $400,000. R. Lee Parnes is Secy. Noted Mar. 13.

Kirkland, Wash.—An election has been called for Apr. 5, to vote on a bond issue of $18,250, for the installation of a water system.

Dayton, Ore.—Bonds for $14,000 have been voted for rebuilding the water system. W. T. H. Tucker is City Recdr. Noted Feb. 13.

Fowler, Calif.—The city contemplates an expenditure of $18,000, for extending and improving the municipal water system.

San Diego, Calif.—We are officially advised that bonds for $340,000 have been voted here, to be used for constructing about 12 miles of 8- to 36-in. water mains, repairing the various distributing reservoirs, and building a reinforced-concrete reservoir 160 ft. in diameter and 33 ft. high, in the center of Balboa Park. About half of this work will be done by day labor, under the supervision of H. A. Whitney, Hydraulic Engr., and the rest will be contracted for. The Department of Water also has under consideration the construction of a 28- or 30-in. water main from the Cholas Heights filtration plant to the low service district in San Diego. This pipe will probably be either a well-dipped steel pipe or a built-up wood stave. Herbert R. Fay is Supt. Dept. of Water. Noted Mar. 13.

Tulare, Calif.—The city has voted to purchase the plant of the Tulare City Water Co., at $30,000, and make it a part of the proposed municipal system. The new system is estimated to cost $100,000, and plans for it are being prepared by Sloan & Robinson, Consult. Engrs., San Francisco. Noted Feb. 27.

Brighton, Ont.—Bids will be received by T. Aird Murray, Lumsden Bldg., Toronto, until Apr. 7, for 11,600 ft. of 10-in. steel pipe, 2100 ft. of 6-in. pipe, and 39 six-in. hydrants for water extensions at Brighton.

St. Thomas, Ont.—James A. Bell, City Engr., is preparing plans for constructing a standpipe, installing new mains at the pumping house and laying a 20-in. main. Estimates cost, $165,000. Bids for construction will probably be asked soon.

North Battleford, Sask.—Bids will be received by H. W. Lewis, Secy.-Treas., until 8 p.m., Apr. 15, for the following: Contract A, purchasing of water-works and sewers. Contract B, furnishing c.-i. and steel water pipes and specials. Contract E, fire hydrants and gate valves. Contract S, furnishing vitrified tile sewer pipe and junctions. Contract T, constructing concrete sidewalks and curbs.

Regina, Sask.—Bids will be received by the City Commissioners until noon, Apr. 5, for the following: Contract B, 27,857 lin.ft. of 6-in. c.-i. pipe, 7180 lin.ft. of 8-in. c.-i. pipe, 2983 lin.ft. of 10-in. c.-i. pipe, 1140 lin.ft. of 12-in. c.-i. pipe, 9958 lin.ft. of 16-in. c.-i. pipe, 10,941 lin.ft. of 18-in. c.-i. pipe, 16,712 lin.ft. of 24-in. c.-i. pipe, 96.02 tons specials. Contract C, 165 tons 7-in. lead pipe, 25 tons 4-in. lead pipe, 4500 lin.ft. 2-in. galvanized pipe and couplings, 500 lin.ft. 3-in. galvanized pipe and couplings, 1000 lin.ft. 1-in. black pipe, 1233 tons pig lead, 4 tons braided jute rope. Contract D, 150 2-in. brass gate valves, 251 6-in. iron body gate valves, 29 8-in. iron body gate valves, 4 10-in. iron body gate valves, 2 12-in. iron body gate valves, 15 16-in. iron body gate valves, 13 18-in. iron body gate valves, 13 24-in. iron body gate valves, 1 18-in. check valve, 348 valve boxes, 190 6-in. fire hydrants, 10 8-in. fire hydrants. Contract E, 1750 ¾-in. corporation cocks, 800 1-in. corporation cocks, 1750 ¾-in. curb cocks, 800 1-in. curb cocks, 300 ¾-in. lead to lead unions; 200 1-in. lead to lead unions, 150 1-in. four-way branches, 1500 No. 2 curb boxes, 200 No. 4 curb boxes, 200 curb box tops.

SEWERS

Sanford, Maine—According to press reports, an appropriation of $8000 has been made for sewer extensions.

Charleston, N. H.—Preliminary estimates and plans are being prepared for the installation of a sewer system here, estimated to cost $15,000. J. H. Locke is Chn. Sewer Com. Noted Feb. 27.

Exeter, N. H.—The town contemplates extensions and improvements to its sewer system. Fred S. Fellows is Town Clk.

Bellows Falls, Vt.—An election will probably soon be called to vote on a bond issue for improving and extending the sewer system. Estimated cost, $20,000.

Boston, Mass.—Bids will be received by the Department of Public Works until Mar. 28, for laying sewers and drains in Helena St. and Lime St. L. K. Rourke is Comr. Pub. Wks.

Norwood, Mass.—Lewis D. Thorpe, Consult. Engr., 201 Devonshire St., Boston, is preparing plans for completing the sewer system here. Estimated cost, $70,000.

Watertown, Mass.—The following appropriations have been made for sewer extensions: From Mount Auburn St. to Quimby St., $3900; in the northern section of the city, $2000; in the western section of the city, $9700.

Providence, R. I.—The City Council will probably during the coming season arrange for the installation of a sewage disposal plant to care for the sewage now treated at the city filter beds west of Lonsdole Ave. The plant will be of the Imhoff type, and is estimated to cost $23,000. Otis F. Clapp is City Engr.

Bridgeport, Conn.—Press reports state that bids will be received by the Paving and Sewer Committee until Mar. 31, for constructing sewers in Fairfield Ave. and Sherman St.

Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Pres. Boro. of Brooklyn, until 11 a.m., Apr. 2, for constructing sewers in various streets. Approximate cost, $70,000.

Brooklyn, N. Y.—We are officially advised that the following bids were received on Mar. 19, by the President of the Boro. of Brooklyn, for the construction of sewers in various streets: For sewers in Carroll St., from Washington St. to Bedford Ave, John C. Schrade, $6690; Stanhope Construction Co., $6708; James F. Gorman, $6748; Joseph Jennings, $7188; Murphy Bros., $7218, Tony Lapadula, $7629: For sewers in West 24th St., from Mermaid Ave. to Surf Ave., Murphy Bros., $7030; Newman & Carey Co., $7631: For sewers in Hopkinson Ave., from Lott Ave. to Viena Ave., Murphy Bros., $389*; A. B. Nichols Inc., $6190; A. Paino, $6295; Stanhope Contracting Co., $6471; Culp Co. Inc., $6647; Robert Tomlinson, $6649; Joseph Jennings, $6720; Albert H. Kich Inc., $6784; James J. Gorman, $6897; John J. Schrade, $7352; Hugh J. Blake, $7781: For sewers in 49th St., from 17th Ave. to the L. I. R.R., Seaboard Construction Co., $19,250; James J. Gorman, $19,427; Stanhope Construction Co., $19,683; Joseph Jennings, $20,189; John J. Schrade, $22,048; Murphy Bros., $22,429; Culp Bros. Inc., $22,467. Noted Mar. 13.

Fort Erie, N. Y.—Witmer & Brown, Consult. Engrs., Buffalo, N. Y., are surveying for the proposed sewer system here. The system is estimated to cost $50,000.

†Johnstown, N. Y.—The Common Council has awarded a contract to A. M. BANKER, Johnstown, at $10,531, to construct the Littauer extension sewer and a sewer in Water St. Noted Mar. 20.

★Schenectady, N. Y.—Bids will be received by the Board of Contract and Supply until 2:30 p.m., Apr. 2, for laying about 30,000 lin.ft. of sewers. For particulars address W. Thomas Wooley, City Engr.

Sharon Springs, N. Y.—Bids will be received by the Board of Sewer Commissioners until 5 p.m., Mar. 29, for furnishing sprinkling filters and settling tanks. Morrell Vrooman, Gloversville, N. Y., is Consult. Engr.

Spring Valley, N. Y.—We are officially advised that the proposition to issue bonds for making a survey for a sewer system, was defeated at the election, Mar. 18. C. H. B. Trumbull is Village Clk. Noted Mar. 20.

★Audubon, N. J.—Bids will be received by Jay Y. Krout, Boro. Clk., until 8 p.m., Apr. 21, for constructing sanitary sewers and a sewage disposal plant. The contract involves: 66,000 lin.ft. of vitrified sewer pipe, with manholes and flush-tanks, 15,000 ft. of agricultural tile drain in sewer trench, sewage and pumping outfit, and a complete disposal plant. Plans and specifications may be obtained from the Borough Clerk, or may be examined at the office of Robinson & Wagner, Consult. Engrs., 37 East 28th St., New York, and at the office of John J. Albertson, Boro. Engr., Magnolia, N. J. Noted Mar. 20.

Cliffside Park (Cliffside post-office), **N. J.**—Bids will be received by the Mayor and Borough Council until 8 p.m., Apr. 14, for constructing Sections 2, 3 and 4 of the proposed trunk sewers. Myles J. Murphy is Boro. Clk.

★Newark, N. J.—Bids will be received by the Passaic Valley Sewerage Commission until 2 p.m., Apr. 15, for constructing Section 11 of the main intercepting sewer in the town of Nutley. The contract involves: Item 1, earth excavation and refilling trench, for 120-in. sewer, 6500 lin.ft. Item 2, concrete masonry, in trench, portland cement mortar, 13,000 cu.yd. Item 3, brick masonry, in manholes, laid with Portland cement mortar, and apartment work, 100 cu.yd. Item 4, rock excavation, in trench, 100 cu.yd. John S. Gibson is Clk.

Ligonier, Penn.—A site has been purchased for the proposed sewage disposal plant, and bids for construction will probably be asked this summer. C. M. McClune is Secy. Boro. Council.

Pitman, Penn.—The Borough Council has passed an

ordinance providing for the construction of a storm water sewer in Holly Ave. Estimated cost, $7000.

Somerset, Penn.—Bids will be received by the Commissioners of Somerset County until 1 p.m., Apr. 3, for constructing a sewage disposal plant at the County Home and Hospital for the Insane, two miles east of Somerset. L. M. Phillips is Clk.

Wilmington, Del.—The City Council contemplates a loan of $150,000 for sewer extensions and street paving. A. J. Taylor is City Engr.

★Baltimore, Md.—We are officially advised that bids for Sanitary Contract No. 109, Lateral Sewers in District No. 41, were received by the Board of Awards, Feb. 26, as follows: Carozza, Levesen & Carozza, 2016 Pennsylvania Ave., Baltimore, $92,697; Gallagher, Boyle & Bryan, 147 West Montgomery St., Baltimore, $94,242; Wm. McCarthy & Co., 1518 Maister Ave., Baltimore, $97,819. Calvin W. Hendrick is Ch. Engr., Sewerage Commission. Noted Feb. 20.

Parkersburg, W. Va.—The City Administration has completed plans for the construction of two storm sewers, which will be built to drain parts of the Fourth, Fifth and Eighth Wards. The sewers will be of concrete, the first extension being 60 in. and the second 40 in. Plans and specifications are in the hands of the City Engineer.

★Charlotte, N. C.—Bids will be received by the Executive Board until 8:30 p.m., Apr. 2, for constructing about 18,221 ft. of 8- to 24-in. sewers and drains with the necessary appurtenances, and 200 ft. of c.-l. pipe for creek crossings. A. H. Wearn is City Clk. and Treas. Noted Dec. 5.

Kinston, N. C.—An election will probably soon be called to vote on a bond issue of $75,000, for extending the sewer system, improving the electric-light plant, and paving streets.

Warrenton, N. C.—See item under Water Supply—Irrigation.

Manning, S. C.—J. Newton Johnston, Consult. Engr., Florence, S. C., has prepared plans for laying about 8000 lin.ft. of 8-in. terra cotta pipe sewers, with 22 manholes and 10 flushing siphons. Bids will probably soon be asked.

Carrabelle, Fla.—See item under Water Supply—Irrigation.

Lake Butler, Fla.—See item under Water Supply—Irrigation.

✦Mobile, Ala.—A contract to construct sewers in the western part of the city has been awarded to G. A. CHAMBLIN, Mobile, at $5000. Bids were opened Mar. 25. Noted Mar. 20.

Lebanon, Tenn.—The city contemplates a bond issue of $75,000 for installing a sewer system. A. B. Martin is Chn. Bd. City Comrs. Noted Feb. 13.

✦Bremen, Ohio—A contract to construct sewers here has been awarded to HOUSTON & HENDERSON, Logan, Ohio, at $9372.

Piqua, Ohio—Plans are on file at the office of the City Engineer, for constructing sewers in various streets, as follows: Boone St., 1400 ft.; Cottage Ave., 1400 ft.; Chestnut St., 3500 ft.; 10,560 ft. in other sections south of the railroad, and 4700 ft. in the vicinity of the Park addition on north Broadway.

✦Sandusky, Ohio—A contract to construct a sewer in Hayes Ave., from Taylor St. to Fillmore St., has been awarded to ANTHONY G. O'DONNELL, Sandusky, at $7754.

Springfield, Ohio—The City Council has adopted a resolution declaring it necessary to construct a combined sewer in Stanton Ave., from Mason to Sycamore St., and in Pearl St., from Clifton to Grand Aves.

Menominee, Mich.—Albert Hass, City Engr., has prepared plans and specifications for the construction of sewers in Spies Ave., from Jenkins to Emma St., in Holmes Ave. from Jenkins to Emma St., and in Holmes Ave., from Broadway to Ingalls St. The plans have been submitted to the City Council.

Carlyle, Ill.—Bids will be received by the Board of Local Improvements until 1 p.m., Mar. 29, for improving the sewer system. It is estimated there will be required about the following quantities of materials: 19,966 lin.ft. of 6-in. sewer pipe; 7008 lin.ft. of 8-in. sewer pipe; 2298 lin.ft. of 10-in. sewer pipe; 1024 lin.ft. of 12-in. sewer pipe; 720 lin.ft. of 15-in. sewer pipe; 1098 lin.ft. of 18-in. sewer pipe; 910 lin.ft. of 20-in. sewer pipe; 732 lin.ft. of 22-in. sewer pipe; 2540 lin.ft. of 24-in. sewer pipe; headwall; 38 manholes; 35 lampholes; 12 flushtanks, etc. Langley Whitley is Chn. of Bd.

Dixon, Ill.—Bids will be received about Apr. 15, for constructing about 10,000 lin. ft. of vitrified pipe sewers, from 8- to 15-in. diameter, and 4000 lin.ft. of 6-in. house connections. Estimated cost, $9000.

Fond du Lac, Wis.—Bids will be received by the Board of Public Works until Mar. 28, for constructing sewers and a sewage disposal plant as follows: Section 1, a pump pit with motor-driven centrifugal pumps, settling tank and hypochlorite treating plant; Section 2, 8410 ft. 38- to 15-in. tile pipe sewer, 23 manholes and a river crossing; Section 3, 5375 ft. 18- to 12-in. sewer, 17 manholes and a river crossing. J. S. McCullough is Chn. Noted Mar. 20.

Kenosha, Wis.—The question of issuing $75,000 bonds for constructing a trunk sewer for the north and northwest sides, will be voted on at the coming city election.

Woodbine, Iowa—See item under Water Supply—Irrigation.

Great Bend, Kan.—H. A. Rowland, Consult. Engr., McPherson, Kan., has been retained by the City Council, to prepare plans for a gravity outfall sewer. Bids will probably be asked this summer.

✦Madison, Neb.—The contract to construct a sewer system here has been awarded to the KATZ CONSTRUCTION CO., Omaha, Neb., at $15,880. The other bids were: C. F. Lytle, Sioux City, $16,700; William Lana, Council Bluffs, $17,104; A. A. Dobson Co., Lincoln, $15,775; Park Leffler Co., South Omaha, $16,321; Bash & Gray, Joplin, Mo., $16,425; H. J. Cathrow, Omaha, $15,945; Elkhorn, Construction Co., Fremont, $16,330; Mathews Construction Co., Kansas, $16,900; Public Service Construction Co., Omaha, $15,980. Plans were prepared by the W. K. Palmer Co., 919 Baltimore Ave., Kansas City, Mo. Noted Jan. 9.

Valley City, N. D.—Press reports state that bids will be received by M. J. Boyd, City Audr., until Apr. 4, for constructing an intercepting and outfall sewer system. Estimated cost, $75,000. D. O'Malley is Chn. of Sewer Com. Noted Dec. 12.

✦California, Mo.—We are officially advised that the contract to construct about 4½ miles of lateral sewers here has been awarded to B. INMAN, California, at $15,647. The other bids were: E. D. Tyner, Kansas City, Mo., $17,244; Edgar Main, Liberty, Mo., $18,640; Plummer & Adams, Springfield, Mo., $19,240; Page Construction Co., Kansas City, Mo., $13,956; T. W. Roberts, Independence, Mo., $16,173. Bids were opened Mar. 17. Burns & McDonnell, Scarrit Bldg., Kansas City, Mo., are Consult. Engrs. Noted Mar. 13.

✦Hannibal, Mo.—Press reports state that contracts to construct sewers here have been awarded as follows: District 9, to MATTHEWS & FORRESTER, Kansas City, Mo., at $22,007; District 100, to JACOB ALTHOUSE, St. Louis, Mo., at $45,072. Bids were opened Mar. 3. B. F. Smiley is City Engr. Noted Feb. 20.

Monroe City, Mo.—Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., are preparing plans for a sewer system here.

St. Joseph, Mo.—See item under Streets and Roads.

Kingsville, Tex.—The City Council is having plans prepared for the installation of a complete sewer system here.

Caddo, Okla.—The City Attorney has been directed to call an election to vote on a bond issue of $20,000, for constructing a sewer system.

Durant, Okla.—See item under Wtaer Supply—Irrigation.

Mountain Home, Idaho—An election has been called for Apr. 1, to vote on a bond issue of $35,000 for the installation of a complete sewer system.

✦Corvallis, Ore.—Press reports state that a contract to construct a sanitary sewer system here has been awarded to COLVER, SHASKY & WOELKE, Grants Pass, Ore., at $17,662.

✦Fowler, Calif.—Press reports state that the contract to construct a sewer system here has been awarded to CHAMBERS & HEAFY, Oakland, Calif., at $16,079.

✦Pasadena, Calif.—A contract has been awarded to PETER GRBOVACH, 1318 Kearny St., Los Angeles, at $14,888, for constructing sewer in District No. 6, including Grand Ave. and other streets. The approximate quantities are 17,376 ft. of 8-in. and 3487 ft. of 10-in. pipe, 62 manholes, 14 flush tanks, 611 6x8-in. Y's and 115 6x10 in. Y's.

Fort Erie, Ont.—Witmer & Brown, Consult. Engrs., Buffalo, N. Y., are making a survey for a sewer system here, estimated to cost $50,000. The plans will be completed in a month, and bids will probably be asked some time in the spring.

Sault Ste. Marie, Ont.—The city contemplates an expenditure of $26,000 for constructing sewers and sewer outlets. W. W. Van Every is City Engr.

GARBAGE

Buffalo, N. Y.—The city is considering the removal of ashes and garbage with its own forces instead of by contract, the present method of removal. Francis G. Ward is Comr. Pub. Wks.

New York, N. Y.—Bids will be received by Calvin Tomkins, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, for springling certain new made land on the North and East Rivers, Boro. Manhattan.

STREETS AND ROADS

Blackstone, Mass.—The Board of Selectmen has appropriated $7000 for repairing the macadam paving on Main St. in conjunction with the State Highway Commission which is expected to appropriate an equal amount. John J. Downey is Chn. of Selectmen.

Worcester, Mass.—Bids will be received until 11 a.m., Mar. 29, by the Street Commissioner for oiling about 2,000,000 sq.yd. of streets during 1913. Not less than ¼ gal. of 40% asphaltic oil to each sq.yd. A. T. Rhodes is Comr.

★Bridgeport, Conn.—Bids will be received until 8 p.m. Mar. 31 by the Paving and Sewer Commission for about 13,270 sq.yd. pavement on various streets. Bids are asked for wood block, asphalt block, stone block, brick, bitulithic or Hassam. Bernard Keating is Secy. of the Com.

New Britain, Conn.—The following bids were received by the Board of Public Works, Mar. 18, for paving West Main St. Hastings Pavement Co., New York City, asphalt blocks $2.50 per sq.yd.; Edward Balfe Co., Hartford, Conn., Bermudez or California asphalt $2.53; Pierson Engineering & Construction Co., Hartford, Conn., vitrified brick, $2.58 and $2.62; asphalt blocks, $2.60; Warren Bros. Co., Boston, Mass., bitulithic, $2.37; sheet asphalt, $2.47; Connecticut Hassam Paving Co., New Haven, Conn., Bessemer shale block, $2.73; Thomas Leonard, New Britain, Conn., Mack block, $2.53; Union Paving Co., Schenectady, N. Y., sheet asphalt, $2.28. Noted Mar. 6.

Brooklyn, N. Y.—Bids will be received until 11 a.m., Apr. 2, by the President of the Borough of Brooklyn, Borough Hall, for regulating and repaving with asphalt a section of Flatbush Ave.; for furnishing and delivering 400 tons of paving pitch as directed by the Engineer; for furnishing and delivering 20,000 wood paving blocks at Corporation Yard, Wallabout Basin, foot of Howes St., to be delivered at such time and in such quantities as may be directed. Alfred E. Steers is Pres.

Buffalo, N. Y.—Bids will be received until 11 a.m., Apr. 3, by the Department of Public Works for paving a portion of Roma St. and for repaving sections of Balcom and Amherst Sts. and Delaware Ave. Francis G. Ward is Comr.

New York, N. Y.—We are officially advised that the low bidder for paving the deck of Pier 42, East River, with asphalt, the bids for which were received by the Dept. of Docks and Ferries on Mar. 20, was the Sicilian Asphalt Paving Co., 41 Park Row, at $1.68 per sq.yd. The total bid, however, exceeded the appropriation for the contract. Calvin Tomkins is Commr. Noted Mar. 13.

New York, N. Y.—(Borough of Queens)—We are officially advised that the following bids were received on Mar. 17, by Maurice E. Connolly, Pres. Boro. of Queens, for improvements to various streets. Only the low bidders are given. For paving Grand St., from Flushing Ave. to the L. I. R.R., with granite block, H. J. Muller, $112,613; for regulating and grading Kelly Ave., from Woodside Ave. to Anderson Ave., Cannon Engineering Co., $9120; for paving 11th Ave., from Broadway to Grand Ave., with asphalt, Barber Asphalt Paving Co., $11,457; for paving Edsall Ave., from Anthony Ave. to Onderdonk Ave., with asphalt, Borough Asphalt Co., $5907; for paving First Ave., from Paynter Ave. to Washington Ave., with asphalt, Barber Asphalt Paving Co., $21,606; for paving Grand St., from the L. I. R.R. to Old Flushing Ave., Cornelius J. Murphy, $11,792; for paving Hull Ave., from Mueller St. to Willow Ave., Callagan & Roulet, $11,500; for paving Ninth Ave., from Jackson Ave. to Graham Ave., Barber Asphalt Paving Co., $19,113. Noted Mar. 13.

New York, N. Y.—Bids will be received by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., until 3 p.m., Apr. 3, for construction of concrete sidewalks at the 44th St. and Sixth Ave. entrance and the Seventh Ave. entrances to Sunset Park, Borough of Brooklyn. Chas. B. Stover is Pres.

Syracuse, N. Y.—Bids as follows were received by the Board of Contract and Supply for resurfacing 21,000 sq.yd. asphalt pavement: Warner -Quinlan Co., $1.03 per sq.yd.; Guy B. Dickinson, $1.17; John Young, $1.10.

Frederick J. Baker was low bidder for paving North Franklin St., at $14,012, for sandstone, and $10,570 for vitrified brick.

The low bids for paving Livingstone Ave. were: Vitrified block with stone curb, John Young, $5349; vitrified brick, combined curb and gutter, John Young, $4987; asphalt, John Young, $4957; asphalt, stone curb, the Warner-Quinlan Co., $5348.

Yonkers, N. Y.—Bids will be received until 3:30 p.m., Apr. 7, by the Board of Contract and Supply for various improvements on Scott Ave., from Kimball Ave. to the Bronx River Road. James V. Mahony is Secy.

✚Englewood, N. J.—We are officially advised that the Common Council has awarded a contract to the HASTINGS PAVING CO., 25 Broad St., New York, at $33,594 for improvement of Palisade Ave., from Engle to James St. Other bidders were: P. F. Kenney, 2291 Broadway, New York, $34,626; the Barber Asphalt Paving Co., New York, $40,235; Watson G. Clark is Engr. Robert Jamieson is City Clk. Noted Mar. 6.

★Jersey City, N. J.—Bids will be received until 11 a.m. Apr. 2, by the Boulevard Commissioners of Hudson County for furnishing and delivering the following: About 100,000 gal. asphalt road oil, about 85,000 gal. asphalt road binder, about 100,000 gal. tar road oil, about 30,000 gal. tar road binder, about 3000 cu.yd. paving sand and 5750 cu.yd. broken trap rock and screenings. John C. Sweeney is Clk.

Newton, N. J.—Bids will be received until noon, Apr. 7, by the Board of Chosen Freeholders of Sussex County, for construction of approximately 3550 ft. of the Whitehall Section of the Newton Stanhope Road, and for completion of the Franklin Furnace-Stockton Road, Hardyston Township. R. L. Slater is Clk. of the Bd.

Princeton, N. J.—The City Council has adopted an ordinance authorizing the macadamizing of Cleveland Lane, and directing that bids for the work be asked.

✚Westfield, N. J.—We are officially advised that the Town Council has awarded a contract to JOSEPH F. BURKE, Plainfield, N. J., for various street improvements, including 10,100 sq.yd. waterbound macadam, 5720 lin.ft. concrete curb and gutter, and resetting 1370 ft. stone curb. There were 11 other bidders. A. W. Vars is City Engr. Charles Clark is Town Clk. Noted Feb. 20.

Bids will be received until 8 p.m. Apr. 7, by the Town Council for improving various streets under Contract Nos. 2 and 3. The pavement is to be of bokarway and waterbound macadam. Charles Clark is Town Clk.

Charleroi, Penn.—Bids will be received until Apr. 1 by the Borough Clerk for grading and curbing a part of Fellowfield Ave., and Long Alley, from First to Fourth and Seventh to Eighth Sts. H. A. Nickson is Boro. Clk.

✚Claysville, Pa.—The Borough Council has awarded a contract to M. P. Ellerbee & SON Versailles, N. Y., at approximately $2,000 for paving Main St.

Doylestown, Penn.—Bids will be received until 8 p.m. Apr. 2, by the street Committee of the Borough Council, for improvements of Main and Turnpike Ave. McClure Smith McClure, Raymond and Ravine Sts. S. M. Morrison is Chn. of the Com. Theodore L. Schellhamer is Boro Secy.

North Braddock, Penn.—Bids will be received until 3 p.m., Apr. 3 by the Borough Council for grading Ravine St. from Locust St. to Lavelette Ave. for grading, curbing and repaving Franklin ave. from Lavelette Ave. to the Borough line. Geo. E. Seibert is Boro Engr.

Pittsburgh, Penn.—The County Commissioners of Allegheny County have authorized a bond issue of $1,000,000 for the construction, repairing and maintenance of county roads. Of this amount $500,000 will be spent in the construction of 10 miles of new road.

Wanamie, Penn.—Bids will be received until Apr. 4 by the Board of Commissioners of Newport Township, for grading, curbing and paving with brick, part of Main St. in the village of Glen Lyon, and part of Main Road, Sheatown. W. O. Davis is Secy. Bd. of Comrs.

★Baltimore, Md.—Bids will be received until 11 a.m., Apr. 2, by the Board of Awards for grading, curbing and paving with vitrified block, granite block, sheet asphalt or bituminous concrete various streets under Contract Nos. 52, 53 and 54. J. Meyers, Hedian, is Secy.

Chestertown, Md.—Bids will be received until noon, Apr. 1, by the Commissioners of Kent County, for construction of about 4.14 miles of state aid road, between Betterton and Still Pond Station. Chas. D. Wood is Pres. of the Comrs. Samuel Hicks is Clk.

Danville, Va.—Bids will be received at the Engineer's office, Danville, until April 1, for the construction of 40 miles of soil road insections of 10 miles each, and eight miles of macadam road, in Dan River District of Pittsylvania County. Bids will be received for any section of the work, or for the entire construction. Plans and specifications, obtainable at the office of the State Highway Engineer and at the office of City Engineer Magruder, Danville.

Norton, Va.—Bids will be received until 4 p.m., Apr. 5, by the Mayor and Street Committee for from two to three miles of macadam paving. T. M. Pepper is Mayor.

✚Richmond, Va.—Contracts have been awarded by the Administrative Board, to J. C. CHEATWOOD, Richmond, for 100,000 sq.yd. of granite and smooth paving, on various streets, at $58,500; also to JOHN C. WENBRUM, Richmond, for various streets, at $12,500; and to ASPHALT BLOCK & TILE CO., and the ATLANTIC BITHULITHIC CO., both of Washington, D. C., at $90,000, for paving various streets.

Kinston, N. C.—See item under Sewers.

Jacksonville, Fla.—Bids will be received until 10 a.m., Mar. 28, by the Board of Commissioners of Duval County for paving portions of the Fernandina Road, the John Anderson Highway and various roads in South Jacksonville. Bids will be accepted for vitrified brick or concrete on a sand foundation. E. P. Holmes is Chn.

✚Birmingham, Ala.—The City Commission has awarded a contract to the CREOSOTED WOOD BLOCK PAVING CO., New Orleans, La., at $40,000, for paving two streets. Walter J. Kirkpatrick is City Engr.

Montgomery, Ala.—Bids will be received until noon, Apr. 7, by the Board of Revenue of Montgomery County for grading about three miles of the Federal Road, and for graveling about 2½ miles of the Hunter Road. Thos. H. Edwards is County Engr.

Collins, Miss.—Bids will be received until noon, Apr. 7, by the County Commissioners, for the construction of 26½ miles of earth and sand clay roads, including bridges and culverts, in District No. 2, Covington County. A. L. Smith is Highway Engr.

New Iberia, La.—The Police Jury of Iberia Parish will issue $120,000 in bonds, the proceeds of which will be spent in road improvements.

The City Council has instructed the City Engineer to prepare plans for about 12 miles of concrete sidewalks, and has authorized the Mayor to call for bids for the work.

Natchitoches, La.—Bids will be received until 6 p.m., Apr. 1, by the Mayor for paving with gravel portions of various streets, aggregating about 20,000 sq.yd. George W. Kile is Mayor.

Morristown, Tenn.—All bids received Mar. 14, by the City Council, for about 16,380 sq.yd. asphalt paving in Improvement Districts 2 and 3 were rejected as too high, and new bids will be asked. D. C. Morris is City Recdr. Noted Mar. 6.

London, Ky.—Clay and Laurel Counties plan the construction of 24 miles of macadam road from London to Manchester. The Commercial Club of London may be addressed.

✚Brunswick, Ohio—We are officially advised that the Trustees of Hinckley Township, Medina County, have awarded a contract to GEORGE S. MELLERT, Medina, at $9975 for improving about 7400 ft. of River Road No. 1. Ira F. Waldo is Township Clk. Noted Mar. 6.

✚Cheviot, Ohio—We are officially advised that the Village Council has awarded a contract to N. RUEBEL, Cheviot, at approximately $25,000, for improving Francis and Lora Aves. and Center St. J. Krollman, Jr., is Village Clk. W. E. Sullivan is Engr. Noted Mar. 13.

Cleveland, Ohio—Bids will be received until 11 a.m., Apr. 12, by the Board of Commissioners of Cuyahoga County, for the improvement of Stone Road. Frank R. Lander is County Surv. John F. Goldenbogen is Clk.

Columbus, Ohio—Bids will be received until 2 p.m., Mar. 31, by the State Highway Commissioners, for road improvements as follows: For grading and paving with bituminous concrete one mile of the Columbus Road, Scioto Township, Ross County, at an estimated cost of $10,350. Alternative bids will also be received for paving the same road with brick at an estimated cost of $18,902. For grading and paving with waterbound macadam, 2½ miles of the New Market Road, Franklin and Washington Townships, Brown County, at an estimated cost of $11,225. For grading and paving with waterbound macadam 2.58 miles of the Cincinnati-Chillicothe Road Miami Township Clermont County, at an estimated cost of $21,613. For grading and paving with bituminous surface treated concrete, 2.21 miles of the Weeds Corner Extension Road, Leroy Township, Lake County, at an estimated cost of $25,011. James R. Marker is Comr.

✚Columbus, Ohio—Contracts for road improvements have been awarded by the State Highway Commissioners as follows: To EVANS & BOACH Mounee, Ohio at $15,600 for 2.01 miles of the Arcola Madison Township Road Madison Township, Williams County to PETREE & LONG Logan Ohio at $11,808 for 1.22 miles of Turnpike No. 3 Upper Township Lawrence County to HARMON BROKATE, Port Clinton, Ohio, at $6350 and $4615, respectively for the Red Cloud Road Locust Point Road, and Section 2, of the Bell Road, both in Erie Township.

Ottawa County; to RYAN & ROACH, at $5800, for one mile of the Delta and Swanton Road; to the KELLY CONSTRUCTION Co., Bryan, Ohio, at $13,957, for 1.87 miles of the Tiffin Road, Richmond Township, Huron County; to P. BROWER, Chillicothe, Ohio, at $9709, for one mile of the Circleville and London Road, Derby Township, Pickaway County; to L. R. MICHAEL, Bucyrus, Ohio, at $7290, for 1.17 miles of the Bucyrus-Mansfield Road, Jefferson Township, Crawford County. Noted Mar. 13.

+Deshler, Ohio—The Village Council has awarded a contract to WITHERN & HOLMES, Deshler, at $18,338, for paving Elm St., from Vine to Ash Sts., with brick. Other bidders were: H. S. Enck, Lima, $20,911; Glass Brothers & Co., Hamler, $19,107; C. B. Hall & Son, Findlay, $21,757; Minick & McClarron, Newcastle, Ind., $21,741; McMahon & Spain, Toledo, $21,233; Ross & Morris, Frankfort, Ind., $20,346; Ritz & Johnson, Napoleon, $22,163. A. F. Samuels is Village Clk. Noted Mar. 6.

Elyria, Ohio—We are officially advised that bids will be received until 1 p.m., Apr. 17, by the Board of Commissioners of Lorain County for construction of a new floor in Erie Ave. Bridge No. 1, one-half mile north of Lorain. Creosoted block on creosoted plank will be used and the estimated cost is $17,533. F. L. Ellenberger is Clk.

+Fostoria, Ohio—We are officially advised that the Director of Public Service has awarded a contract to the MODERN CONSTRUCTION CO., Fremont, Ohio, at $30,508 and $17,018, respectively, for improvement of West North and West South Sts. Other bidders were the Deshler Construction Co., Deshler, Ohio, $30,916 and $17,458; Hall & Sons, Findlay, Ohio, $31,498 and $25,855; the Asphalt Block Co., Toledo, at $31,712 for West North St. and the King Co., Tiffin, Ohio, $31,996, for West North St. Chas. Latshaw is City Engr. A. B. Hollenbaugh is Dir. Noted Feb. 27.

+London, Ohio—A contract has been awarded by the City Council to J. O. SHOUP & CO., Dayton, Ohio, at $27,597, for paving Main St. with brick. Other bidders were W. E. McHugh, Springfield, $28,054; Jerry Neville, London, $28,968; Bentz Bros., Columbus, $30,033; Lambert Bros. & Wirt, Delaware, $30,490; Asphalt Block Co., Toledo, $24,601.

Newark, Ohio—We are officially advised that the Director of Public Service has awarded a contract to R. H. NUTTER, Newark, Ohio, for various street improvements. The work includes 51,961 sq.yd. paving, 25,143 ft. straight curb, 1020 ft. curved curb, 28,240 cu.ft. excavating. C. H. Wells is City Engr. Noted Feb. 27.

+Sandusky, Ohio—We are officially advised that contracts have been awarded by the Director of Public Service to M. J. CALLAN and the ANDREWS ASPHALT PAVING CO., for improvement of First St. and Central Ave., respectively. R. L. Hagar is City Engr. E. W. Rhode is Chief Clk. Noted Mar. 13.

Shreve, Ohio—Bids will be received until noon, Apr. 15, by the Mayor and Village Council, for improving Market St. by grading, curbing and paving with vitrified block. The estimated cost is $19,342. L. E. Chapin, Canton, Ohio, is Engr. Clem Morgan is Village Clk.

+Sidney, Ohio—We are officially advised that the Director of Public Service has awarded contracts to G. H. HEFFNER & CO., Celina, Ohio, and DANIELS, LYST & DOUGLAS, Anderson, Ind., at $40,000 and $100,000, respectively, for various street improvements. D. H. Warner is Dir. The Smith & Boulay Co., Toledo, is Engr.-in-Charge. Noted Feb. 27.

Warren, Ohio—Bids will be received until noon, Apr. 8, by the Director of Public Service, for repaving North Park Ave. with brick, asphalt or creosoted block. Approximately 8400 sq.yd. will be required. Charles L. Craig is Dir.

Indiana—Bids for road improvements in Indiana will be received as follows: Apr. 8, at Lebanon, by Commissioners of Boone County for construction of a gravel road. D. M. Clark is Audr.

Apr. 8, at Noblesville, by Commissioners of Hamilton County for construction of six gravel and macadam roads. Geo. Griffin is Audr.

Apr. 8, at Paoli, by Commissioners of Orange County, for construction of three gravel roads in Northwest and Stampers Creek Townships. Ed. A. Palmer is Audr.

Angola, Ind.—We are officially advised that bids will be received until 3 p.m., Apr. 9, by the City Council, for approximately 7930 sq.yd. of street paving. The W. J. Sherman Co., Toledo, Ohio, is Engr.-in-Charge.

Michigan City, Ind.—We are officially advised that bids will be received until Apr. 2, by the Board of Public Works, for about 6000 sq.yd. brick, asphalt, bitulithic or creosoted wood-block pavement. The work includes grading, concrete foundation and concrete curb and combined curb and gutter. H. M. Miles is City Engr.

Kalamazoo, Mich.—Bids will be received until 5 p.m., Mar. 31, by the City Council, for 4000 sq.yd. brick and 30,000 sq.yd. asphaltic concrete, machine mix. C. L. Miller is City Clk.

+Mount Clemens, Mich.—We are officially advised that the City Council has awarded a contract to R. M. ADAMS at $1.97 per sq.yd., for about 11,300 sq.yd. of brick pavement on Cherry, Pine and East Sts. A. A. Devantin is City Clk. Noted Feb. 6.

St. Louis, Mich.—At a recent special election it was voted to issue bonds for $16,000, the proceeds of which will be used for paving the main street, and three blocks to the railroad station.

Chicago, Ill.—The Board of Local Improvements has ordered bids to be advertised for paving portions of Fifth and Wabash Aves. and Washington St. with creosoted wood block at an estimated cost of $53,500, $52,650 and $11,000, respectively. George A. Shilling is Pres.

+Galesburg, Ill.—We are officially advised that a contract has been awarded by the Board of Local Improvements to J. B. McAULEY, Galesburg, at $40,745, for paving Main St. with brick, and at $7883, for paving Waters St., from Cherry to Broad Sts. Other bidders were: Burlington Construction Co., Burlington, Iowa, at $41,318, for Main St. only; P. H. Tiernan, Macomb, Ill., $41,344 and $7968; Gund-Graham Co., Freeport, Ill., $41,711 and $8121; E. R. Harding Co., Racine, Wis., $41,882 and $8081; Brereton Cement Walk Co., Galesburg, $8813, for Waters St. only. F. M. Connolly is City Engr. Noted Mar. 20.

Waukegan, Ill.—We are officially advised that bids will be received until 8 p.m., Mar. 31, by the Board of Local Improvements for grading, curbing, draining and brick paving on Grand Ave., at an estimated cost of $41,791. M. J. Douthitt is City Engr. Noted Jan. 9.

+Belle Plaine, Iowa—The City Council has awarded a contract to the DES MOINES ASPHALT PAVING CO. for 12 blocks of paving on Eighth Ave. and five blocks on Ninth Ave. Asphaltic concrete will be used. The contract for 12th St. has not yet been awarded. Noted Mar. 6.

+Burlington, Iowa—We are officially advised that the City Council has awarded a contract to F. W. GUENTHER, 1111 Oak St., Burlington, at $12,500, for brick and concrete street paving. H. G. Vollmer is City Engr. Noted Feb. 27.

Bids will be received until 9 a.m., Mar. 31, by the City Council, for grading, curbing and paving with concrete, parts of Eighth, Ninth, Ash and Corse Sts. and Mark Lane. Noted Feb. 20.

+Washington, Iowa—We are officially advised that the City Council has awarded a contract to J. J. McKEANE, Washington, Iowa, at $22,915, for approximately 12,000 sq.yd. bituminous coated concrete paving. Other bidders were: J. J. Ryan, Muscatine, Iowa, $23,237; McCarthy Improvement Co., Davenport, Iowa, $24,040; D. E. Keeler Construction Co., Davenport, $24,585; Kaw Paving Co., Topeka, Kan., $23,720. Chas. P. Chase, Clinton, Iowa, is Engr. in Charge. Noted Feb. 20.

+Ely, Minn.—We are officially advised that the City Council has awarded a contract to D. H. CLOUGH & CO., Duluth, Minn., at $24,465, for construction of sidewalks and curbs on various streets. Other bidders were: C. J. Mott and H. Nelson, Colerain, Minn., $32,548; K. S. Johnson, Biwabik, Minn., $26,752; Kircher Bros., Gilbert, Minn., $26,464; Eveleth Construction Co., Eveleth, Minn., $26,124; Gus. Linder, Hibbing, Minn., $24,505; Boclin & Son, Duluth, $29,262; Russell Construction Co., Superior, Wis., $32,628; A. A. Mitchell & Co., Bovey, Minn., $26,812; Lawrence & McCann, Duluth, $26,607; E. A. Dahl, Duluth, $30,045; Ed. Johnson, Superior, Wis., $26,194; the C. S. Rogers Co., Duluth, $26,705. Chas. A. Nutter is City Engr. Noted Mar. 6.

Independence, Kan.—Bids will be received until Apr. 3, by the City Council for approximately 3300 sq.yd. brick paving and 2500 lin.ft. concrete curb and gutter in Maple and Earl Sts. G. H. Krienhagen is City Clk. G. D. Weaver is acting City Engr.

St. Joseph, Mo.—The Board of Public Works has directed the City Clerk to advertise for bids for asphalt or brick paving on various streets, sewers in Districts 26, 32, 88 and 139, and artificial stone sidewalks on Messame St. from 26th to 27th Sts.. Joel E. Gates is City Clk.

Springfield, Mo.—The City Council has instructed the City Engineer to prepare plans for paving sections of Grant, West Elm, Winfield, Phillips and George Sts. C. E. Phillips is City Engr.

Anderson, Tex.—Bids will be received until 2:30 p.m., Apr. 14, by the Commissioners' Court of Grimes County, for road construction in the Navasota district. The work includes 30 miles of macadam and eight miles of sand clay with necessary culverts and bridges. Reid Rikard is County Judge.

Nacogdoches, Tex.—We are officially advised that the City Council has decided to spend about $70,000 for street improvements this year. The Aetna Engineering Bureau, 17 North La Salle St., Chicago., Ill., is Engr.-in-Charge, and would like prices on gravel, crushed stone and cement.

Dewey, Okla.—The City Council is having plans prepared for about 25,000 sq.yd. of brick paving. F. Lindsey is City Clk. King & Co., Coffeyville, Kan., are Engrs.-in-Charge.

Ogden, Utah—The City Commissioners have decided to pave Washington Ave. with concrete. H. J. Craven is City Engr.

+Bellingham, Wash.—The City Council has awarded a contract to the PUGET SOUND BRIDGE & DREDGING CO., Seattle, Wash., at $13,804 for clearing, filling and otherwise improving six blocks of the waterfront.

+Seattle, Wash.—The Board of Public Works has awarded a contract to the GILLES-DE FLONG CO., at $69,176, for paving Fremont Ave., from Blewett St. to 50th St., with brick. Arthur H. Dimock is City Engr.

+Portland, Ore.—A contract for paving the Thompson St. district, Rossmere, with asphaltic concrete has been awarded to the OREGON INDEPENDENT PAVING CO. at $103,000. Thomas M. Hurlbut is City Engr.

The City Council has decided to pave East 48th St. from Newport to East Harrison St.

+Glendora, Calif.—The City Trustees have awarded contracts to GEORGE C. PAONESSA, Story Bldg., Los Angeles, for the following street improvements: Bennett Ave. at $9427, Minnehaha Ave. at $5764, Michigan Ave., $34,243.

Imperial, Calif.—We are officially advised that no bids were received on Mar. 10 for sidewalks and street paving, and all advertisements have been withdrawn and annulled for the present. Lelia Foster is City Clk. Noted Feb. 27 and Mar. 6.

La Manda Park, Calif.—The City Trustees will shortly ask bids for sidewalks, curbs and gutters on various streets at an estimated cost of $50,000.

+Pasadena, Calif.—A contract has been awarded by the City Council to ANDREW HOLLOWAY at $26,469 for the improvement of Walnut St. Other bidders were: Barber Asphalt Paving Co., $26,928, C. W. Finch, $26,928, Fred Osborn, $27,387. S. J. Van Ornum is City Engr.

Quebec, Que.—The Government plans the construction of a macadamized road from the City of Quebec to Montreal. The sum of $10,000 has been borrowed for the first section. L. A. Taschereau is Minister of Pub. Wks.

Toronto, Ont.—The Board of Control plans asphalt pavements on various streets as follows with the estimated cost of

each; Ossington Ave., $18,000; Talbot St., $3350; Greenlaw Ave., $12,250; Harvie Ave., $12,870, Woodbine St., $15,000, Wellington St., $24,130. R. C. Harris is City Engr.

INDUSTRIAL WORKS

+Chicopee, Mass.—The Taylor-Bramley Knitting Co. has awarded a contract to JOHN D. SULLIVAN, Chicopee, to construct an addition to its mill. The new building will be of brick, four stories, 30x75 ft., and is estimated to cost $18,000. George H. Fugere, 67 Main St., is Arch. Noted Feb. 27.

+The contract to construct a factory for the Dwight Mfg. Co. has been awarded to the CASPER RANGER CONSTRUCTION CO. The building will be of brick, 72x180 ft., six stories, of mill construction. Charles I. Main, 201 Devonshire St., is Engr.

Everett, Mass.—The General Electric Co. has purchased land adjoining its plant at Everett, and contemplates the construction of a gear factory, 200 ft. long.

Akron, N. Y.—Bids are being received by H. W. Homelius & Son, Archs., Batavia, for the construction of a one- and two-story factory, 150x66 ft., to be erected in Akron for the Akron Plaster Board Co.

+Auburn, N. Y.—The Enterprise Foundry Co. has awarded a contract to J. L. ALNUT, 11 Logan St., for the construction of a one-story foundry at its plant. A. H. Nichols is Gen. Mgr.

Buffalo, N. Y.—Plans have been completed for a one-story, steel frame fabricating shop and electric crane runway to be built by the Ferguson Steel & Iron Co., a recent incorporation, on a site at Bailey Ave., Stanley St. and the New York Central R.R.

Syracuse, N. Y.—The Peoples Ice Co. will build an ice-manufacturing plant, 31x142 ft., with a wing, 31x60 ft., and a power house, 32x42 ft., on North State St. The estimated cost of the plant and equipment is $35,000.

The Syracuse Chilled Plow Co. will make improvements and additions to its plant at Wyoming and Marcellus Sts., which are estimated to cost $200,000.

+Harrison, N. J.—The Hyatt Roller Bearing Co. has awarded a contract to the DAVID HENRY BLDG. CO., 207 Market St., Newark, for the construction of a new three-story factory, 158x65 ft., at its plant.

Beaver Falls, Penn.—The Keystone Driller Co. will soon receive bids for a number of finishing contracts for its plant in Sixth Ave. The building will be 61x361 ft., and will be brick with saw tooth roof construction.

+Dickerson Run, Penn.—The Pittsburgh & Lake Erie R.R., Pittsburgh, has awarded a contract to WALKER & CURLEY, Bessemer Bldg., Pittsburgh, for the erection of the brick and steel, railroad shops, round house and power house in Dickerson Run. The power house will be 70x60 ft., the round house, 100x60 ft., and the machine shops, 130x60 ft. The estimated cost is $80,000. G. H. Sales, Pittsburgh, is Supt. of Bldgs. and Bridges. Noted Jan. 2.

Ellwood City, Penn.—R. A. Colby, Arch., is preparing plans for a one-story steel and corrugated iron mill, 315x315 ft., to be erected by the Shelby Steel Tube Co., as an addition to its plant. The estimated cost is $100,000.

Philadelphia, Penn.—The Weder Mfg. Co., 20th and Market Sts., has had plans prepared for the construction of a five-story concrete factory, at Stanton and Germantown Aves. It will be 102 ft. on Stanton Ave. and 115 ft. on Germantown Ave.

Pittsburgh, Penn.—The Hunting-Davis Co., Farmers Bank Bldg., is preparing plans for private parties for the construction of a manufacturing plant to cost $150,000. It is proposed to erect a number of buildings of brick and reinforced concrete ,one to be 60x128 ft., two stories; one 70x192 ft., two stories, and a third 60x353 ft. Plans will be completed by the end of April.

Red Lion, Penn.—Bids are now being received by the Red Lion Table Co. for the construction of a two-story table factory, 260x150 ft. The estimated cost is $20,000. Charles A. Williams, Jacobus, Penn., is the Arch.

Lynchburg, Va.—The Thornhill Wagon Co. will enlarge its factory in the near future. Its capitalization has been increased to $1,000,000.

Nicolette, W. Va.—A contract between the Nicolette Development Co. and the Nicolette Canning Co., both of this city, has just been closed, whereby the Nicolette Development Co. has given the Nicolette Canning Co. a site for a canning plant to be erected at once. It will for the first year be of sufficient size to care for the tomatoes from 100 acres of land. Work will commence Apr. 1, under the direction of W. S. Dawson, at Nicolette, W. Va.

Winston-Salem, N. C.—The Forsyth Dining Room Furniture Co. has been organized with a capital of $250,000 and will erect a plant for the exclusive manufacture of medium- and high-grade dining-room furniture. W. Lee Springs, Philadelphia, Penn., J. A. Vance and Charles Sievers, Winston-Salem, are interested.

Atlanta, Ga.—Nunnally & McCrea, mfrs. of clothing, will erect a four-story fireproof building of reinforced concrete construction on Tilghly Ave., at a cost of $45,000. The building has been leased for five years by Marsus, Loeb & Co., mfrs. of overalls.

Leeds, Ala.—Press reports state that Bancroft & Hatton will establish a knitting mill with a daily capacity of 1200 pairs of hose at Leeds.

Nashville, Tenn.—The Harry E. Eyans Co., Pittsburgh, Penn., plans the establishment of a branch at Nashville, for manufacturing high-power and marine engines and concrete-mixing machinery.

Cincinnati, Ohio—The Cincinnati Foundry Co., James B. Schumacher, Pres., will build a plant on Mitchell Ave., near the B. & O. S. W. Ry. It will be 82x180 ft., and the pattern shop will be 40x80 ft.

Cleveland, Ohio—The Scott-Ullman Co., 2091 East 19th St., Cleveland, has purchased a site on Perkins Ave. Northeast, and is preparing plans for the erection of a four-story factory. The company manufactures electric-lighting fixtures and appliances.

The Peerless Motor Car Co., Cleveland, has completed plans for the construction of a five-story brick, concrete and steel factory building. Estimated cost, $250,000.

Adolf Schiffer, Cleveland, has secured a permit for the erection of a factory and warehouse at 4612 St. Clair Ave.

Cleveland, Ohio—Bids are being received by the Standard Automatic Machine Screw Co., Cleveland, for the erection of a four-story addition. M. J. Gleason is Secy.-Treas.

The Chisholm & Moore Co., Cleveland, will erect an addition to its plant at Cleveland. The company makes steel shovels.

Mansfield, Ohio—The H. L. Bowers Co., Mansfield, will erect a new factory, 60x80 ft., of brick.

Montpelier, Ohio—The plant of the W. S. Heller Mfg. Co., Montpelier, destroyed by fire, Feb. 28, will soon be rebuilt.

Toledo, Ohio—The Mather Spring Co., Toledo, has increased its capital from $100,000 to $300,000. Improvements and additions to cost $100,000 will be made.

Indianapolis, Ind.—The National Motor Vehicle Co., Indianapolis, will enlarge its plant by the erection of a brick and cement addition, three stories in height. It will contain 20,000 sq.ft. of floor space.

Detroit, Mich.—The Hudson Motor Car Co., Detroit, will erect a third addition to its plant, 570x90 ft.

Detroit, Mich.—The Wagner Baking Co., Grand River Ave. and Bagg St., will erect a three-story brick and steel factory and shop building. Plans will be ready about June 1.

Chicago, Ill.—The American Can Co., Chicago, is considering the erection of a factory on a site recently purchased at Clay and Clyburne Sts. The building will be five stories in height.

The Western Felt Works, Chicago, will erect a three-story factory addition. The building will be 100x150 ft.

The Williams Piano & Organ Co., Chicago, is receiving bids for the erection of a five-story and basement factory, 30x120 ft. The cost is estimated at $40,000.

The Monarch Motor Mfg. Co., Chicago, will erect a one-story machine shop, 50x75 ft. The cost of the proposed building is estimated at $15,000.

The Chicago Scale Co., Chicago, is considering the erection of a new plant and also plans to remodel its old plant.

Marinette, Wis.—The Wisconsin Aluminum Co., Marinette, is planning to erect an addition to cost about $20,000.

+Lakeside, Wis.—The Milwaukee Electric Ry. & Light Co. has awarded the contract to JAMES CORSE, for constructing the new car barns and station at Lakeside, to cost about $25,000.

Waukesha, Wis.—The R. L. Kenyon Mfg. Co., Waukesha, is considering the construction of an addition to its plant at Waukesha, to cost $10,000.

A brewery with a capacity of 25,000 bbl. daily, is contemplated here. The Wausau Brewing Co. has been incorporated for the purpose of erecting and managing the same. F. W. Krause, Nicholas Veeser, and August F. Marquadt are among the incorporators. Capital, $125,000.

Wausau, Wis.—Anderson Bros. and Johnson, Wausau, are considering the erection of a granite manufacturing plant. The business will be moved here from Granite Heights. Estimated cost, $25,000.

Dubuque, Iowa—Press reports state that the Brunswick-Balke-Collender Co., Dubuque, Iowa, maker of billiard tables, will construct an addition to its plant. Between 80,000 and 100,000 sq.ft. of floor space will be added.

Rutland, Iowa—O. E. Hunt, Eagle Grove, Iowa, is interested in a company which is being organized for the purpose of building a stone-crushing plant at Rutland.

Anoka, Minn.—D. S. Gow, H. L. Russell and D. E. Russell are planning to build a factory on River and Monroe Sts., for the manufacture of bob sleds and harrows.

Carthage, Mo.—The Carthage Machine Co., Carthage, will erect and equip a new building, 50x100 ft. It will be built of brick. About $30,000 will be expended.

Kansas City, Mo.—J. N. Carnahan, Washington, D. C., representing a subsidiary corporation of the Bernsten Steel Wheel Co., Pittsburgh, Penn., will establish a factory at Kansas City for the manufacture of steel wheels for automobiles.

Austin, Tex.—The Losey Motor Works, Cape Girardeau, Mo., contemplates the establishment of a factory in Austin. The company makes motor engines.

Marshall, Tex.—The Purity Ice Co. will increase the capacity of its ice factory and cold-storage plant.

San Antonio, Tex.—Albert Steves and Ernest Steves will erect a sash and door factory at San Antonio, at a cost of about $200,000. The building will be of reinforced concrete. Leo M. J. Dielmann is the Arch.

Tacoma, Wash.—The Alabama Consolidated Coal & Iron Co., Bellingham, Ala., plans to erect a steel plant at Tacoma, estimated to cost $600,000. H. S. Mathews is Pres.

The Spokane Auto-Parts Co., Tacoma, Wash., has completed plans for the manufacture of trucks.

Vancouver, Wash.—The Jobson Tire Co., Vancouver, has been incorporated, with a capital of $1,000,000, by L. A. Kent, and J. Davis, of Portland, Ore. The company will erect a plant at Vancouver, for the manufacture of automobile tires to replace automatic rubber tires.

Richmond, Calif.—The Gage Weight & Scale Co. has purchased a site and is having plans prepared for the construction of a factory and machine shop.

Chatham, Ont.—The Steel Bending Brake Works has been organized with a capital of $35,000, and will establish a factory to manufacture metal brake machines. Herman K. and Walter H. Dreis and Nicholas Krump are interested.

Hamilton, Ont.—The Hamilton Ideal Mfg. Co., Ltd., mfrs. of Ullman cash registers, hay and grain unloaders, etc., is having plans prepared for an addition to its present plant at Shaw and Emerald Sts.

St. Thomas, Ont.—The Michigan Central R.R. plans the establishment of machine shops and a power house at St. Thomas, estimated to cost $150,000.

Toronto, Ont.—The W. E. Dillon Co., manufacturer of sheet metal goods, is having plans prepared for the erection of a new four-story factory on George St.

Torbrook, N. S.—The Canada Iron Corp., Ltd., Mark Fisher Bldg., Montreal, Que., will erect a hoisting and crushing plant at Torbrook.

Edmonton, Alta.—The Dickson Bridge Works has purchased a site, and is having plans prepared for buildings, covering about one acre, for the manufacture of steel girders and similar products.

FEDERAL GOVERNMENT WORK

Officers' Quarters—Portsmouth, N. H.—Bids were received as follows by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of officers' quarters at Portsmouth: Conners Bros. Co., Lowell, Mass., $13,642; C. H. Holmes Co., Inc., Portsmouth, $11,448; C. M. Leach, Box 2285, Boston, Mass., $15,793.

Marine Barracks—Charlestown, Mass.—Plans are being prepared for the construction of marine barracks at the Charlestown Navy Yard. The estimated cost is $150,000.

★**Dredging**—Hartford, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., until 2 p.m., Apr. 12, for maintenance dredging in the Connecticut River below Hartford.

★**Dike Work**—Hartford, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., until 2 p.m., Apr. 21, for removing riprap stone dike in the Connecticut River above Hartford, Conn.

Dredging—Middletown, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., until 2 p.m., Apr. 28, for dredging in the Connecticut River below Middletown.

★**Dikes**—New London, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U S. A., New London, until 2 p.m., Apr. 19, for the construction of timber and brush spur dikes at Press Barn Bar, Connecticut River, Conn.

★**Dredging and Rock Removal**—Southport, Conn.—Bids will be received until 2 p.m., Apr. 29, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging and rock removal in Southport Harbor, Conn.

★**Wharf Repairs, Etc.**—Fort Totten, N. Y.—Bids will be received by the Quartermaster, Fort Totten, until 2 p.m., Apr. 16, for making general repairs to the wharf, piling, caps, strings, etc.

★**Dredging**—New York, N. Y.—Bids will be received by Col. S. W. Roessler, Corps Engrs., U. S. A. Army Bldg., New York, for dredging in inlet to Sheepshead Bay, N. Y.

★**Dredging**—New Jersey—Bids will be received by Col. William T. Russell, Corps Engrs., Army Bldg., 39 Whitehall Bldg., New York, N. Y., until Apr. 18, for dredging in Woodbridge Creek, Matawan Creek, Shoal Harbor and Compton Creek, and Shrewsbury River, N. J.

Post Office—Vineland, N. J.—Bids will be received until Apr. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post office at Vineland.

Dredging—Wilmington, Del.—Bids will be received by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, until 11 a.m., Apr. 15, for dredging Little River, Del.

Building—Washington, D. C.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contracts as follows in connection with the new Bureau of Engraving and Printing building, Washington, D. C.: Interior partitions and fittings, F. J. GORMLEY, Union Trust Co., Washington, D. C., $481,344; mechanical equipment, THOMPSON-STARRETT CO., 51 Wall St., New York, $295,295; hydraulic elevator equipment, OTIS ELEVATOR CO., New York, $84,844.

Vault Entrances—Washington, D. C.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, until 3 p.m., Apr. 19, for the construction, complete, of the vault entrances for the new building for the Bureau of Engraving and Printing.

Submarine Tender—Washington, D. C.—Bids will be received by the Navy Department, Washington, for the construction of one submarine tender, No. 2, until noon, May 19. A circular defining the chief characteristics of said vessel and outline type plans are now ready for distribution among prospective bidders. Forms of proposal and contract may be had on application to the department after Apr. 1. Josephus Daniels is Secy. of the Navy.

Fortfications—Norfolk, Va.—The U. S. Government is negotiating for a site at Cape Henry, Va., for the proposed fortification to defend the entrance to Chesapeake Bay. The 62d Congress appropriated $100,000 for this purpose and to acquire about 230 acres of land. Lieut.-Col. E. E. Winslow, Norfolk, is in charge.

Dredging—Fort Caswell, N. C.—Bids will be received by Lieut. Jas. R. Campbell, Const. Q. M., U. S. A., Ft. Caswell, until Apr. 14, for dredging the creek at Ft. Caswell.

Dredging—Savannah, Ga.—The lowest bid for dredging a waterway between Savannah, Ga., and Fernandino, Fla., has been submitted to Col. Dan C. Kingman, Corps Engrs., U. S. A., Savannah, by the Simons H. Mayrant Co., Charleston, S. C., at 25c. per cu.yd.

Pump House—Louisville, Ky.—Bids will be received by the Commissioner of Fisheries, Dept. of Commerce and Labor, Washington, D. C., until 2 p.m., Apr. 17, for the construction of a pump house at the fisheries station at Louisville.

Post Office—Dayton, Ohio—Bids were received as follows, Mar. 19, at the office of Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of the mechanical equipment in the post office at Dayton, Ohio: S. Faith & Co., Philadelphia, Penn., $56,787; Fitzpatrick & Hoepfner, Columbus, Ohio, $57,877; W. G. Cornell & Co., Washington, D. C., $60,490; Thompson-Starrett Co., New York, $65,500; Mechanical Construction Co., Milwaukee, Wis., $88,850; R. F. Fletcher, Columbus, Ohio, and M. J. Gibbons, Dayton, Ohio, filed incomplete bids.

Post Office—Iowa Falls, Iowa—Bids will be received until 3 p.m., May 6, by Oscar Wanderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches), of the U. S. Post Office at Iowa Falls, Iowa.

Stone and Rock—Dallas, Tex.—Bids will be received by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, until noon, Apr. 14, for delivering one-man stone and crushed rock at Crockett, Tex., on the International & Great Northern Ry.

Post Office—Weatherford, Tex.—Bids were received as follows Mar. 24, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Weatherford: (a) Limestone; (b) sandstone: Thomas W. Cissell, Washington, D. C., (a) $70,000; (b) $73,000: Wise Granite Co., Richmond, Va. (a) $66,600; (b) $68,600; Newport Contracting & Engineering Co., Newport News, Va.: (a) $64,884; (b) $67,884; Tom Lovell's Sons, End, Okla., (a) $62,594; (b) $64,058. Noted Feb. 20.

★**Canal**—Montrose, Colo.—Bids will be received by the U. S. Reclamation Service, Montrose, until 4 p.m., Apr. 17, for the construction of about 6.2 miles of Selig Extension Canal and 3.4 miles of Peach Valley Lateral, Uncompahgre Valley Project, in the vicinity of Olathe, Colo. This work involves the excavation of about 171,500 cu.yd. of material in open cut and 930 lin.ft. of tunnel. For particulars address the United States Reclamation Service, Montrose, Colo.; 519 Commonwealth Building, Denver, Colo., or Washington, D. C. Morris Bien, Acting Director.

Dredging—Oakland, Calif.—Bids will be received by Lieut.-Col. Thomas H. Rees Corps Engrs., U. S. A., Custom House, San Francisco, Calif., until 11 a.m., Apr. 14, for dredging in Oakland Harbor.

Railings and Steel Doors—Panama—Bids will be received by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., until Mar. 27, for railings for spillways and steel doors for entrances to the operating tunnels of all locks of the Panama Canal, under Circular 765.

Structural Steel, Etc.—Panama—Bids will be received until Apr. 5 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for reversing motor planer equipments, motors, structural steel, galvanized roofing, steel pipe, c.-i. pipe and fittings, sheet lead, lead pipe, etc., under specification No. 766.

MISCELLANEOUS

✚**Crushed Stone and Screenings**—Boston, Mass.— Contracts have been awarded as follows by the Department of Public Works for furnishing crushed stone and screenings in various sections of the city; prices given being for a ton of 2000 lb.: In South Boston, to J. C. COLEMAN & SONS CO., Boston, at $1.40; in East Boston, to the ROWE CONSTRUCTION CO., Boston, at $1.40; in Charlestown, to COLEMAN BROS., at $1.43; in Brighton, to JOHN F. BEATTY, at $1.50; in West Roxbury, to the TRAP ROCK CO., at $1.05; in Dorchester, to WILLIAM A. BARRY, at $1.28; in Roxbury, to the NEW ENGLAND CRUSHED STONE CO., at $1.15; in the city proper, to the NEW ENGLAND CRUSHED STONE CO., at $1.18; in the North End, to J. C. COLEMAN & SONS CO., at $1.45; in Hyde Park, to WILLIAM J. BARRY, at $1.28. L. K. Rourke is Comr.

Fire Apparatus—Brockton, Mass.—The city is considering appropriating $15,000 for motor fire apparatus.

Bathhouse—Salem, Mass. — The city is considering the erection of a bathhouse in Beverly. The building will cost $25,000.

Subways—Providence, R. I.—Plans are being prepared for a special committee of the City Council of Providence for the construction of a system of subways for the East Side Elwood Olneyville sections. Howard Carson, Boston, Mass., is Consult. Engr.

Aqueduct (Barge Canal Work)—Albany, N. Y.—Duncan W. Peck, Supt. Pub. Wks., received bids, Mar. 18, an two Barge Canal contracts; one providing for the construction of a concrete arch at Medina, known as Cont. No. 65, and the other for completing the excavation of four miles of channel in the Hudson River north of Waterford. The lowest bid for Cont. 65 was that of the Maryland Dredging & Contracting Co. of Baltimore, Md., at $1,000,098, which was $131,425 below the engineer's estimate of the cost of the work. The other bidders were: MasArthur Bros. Co., New York, $1,144,804; Barrally & Ingersoll, Rochester, N. Y., $1,030,813; H. S. Kerbaugh, Inc., New York, $1,101,978; Lathrop, Shea & Henwood Co., Buffalo Dredging Co., Buffalo, $1,098,569; Kennedy & Hamilton, Utica, $1,223,978; Falk & Menzies, Buffalo, $1,074,771; Fraser, Brace & Co., New York, $1,096,915; J. M. Ludington's Sons, Inc. Rochester, $1,048,761; T. A. Gillespie Co., New York, $1,104,768.

Two bids were received for the Hudson River excavation contract, that of James Stewart & Co., Inc., of New York at $1,534,603 and that of P. McGovern & Co., of New York, at $1,573,278. This is the third advertisement of this contract, one bid only having been received on each of the two former lettings and which was practically the same as the low bid now received.

Contract No. 65 for the Medina arch is probably the last

large contract to be awarded on the Erie Canal section of the Barge Canal. The plans and specifications for the work have received much study during the past half dozen years. At this point the canal crosses the deep ravine in which Oak Orchard Creek flows and the method finally decided upon included the construction of a concrete arch aqueduct of 50 ft. span and 128 ft. wide to carry the canal across the gorge. The canal curves along the edge of the gorge and masses necessary the construction of a concrete retaining wall several hundred feet in length. This wall will vary in height from 20 to 40 ft. and will have a thickness at its base of from 15 to 30 ft. The entire work must be completed by the end of next year.

Barge Canal Work—Albany, N. Y.—Bids will be received by Duncan W. Peck, State Supt. Pub. Wks., until Apr. 15 for contracts 112 and 113, Erie Canal.

✦Dock—Newburg, N. Y.—The City Council, Mar. 18, awarded the contract to WILLIAM PARROT for the construction of the proposed dock at the foot of South St. Estimated cost, about $10,000.

Shelter Building—New York, N. Y.—Bids will be received until Apr. 2 by the Commissioners of the Palisades Park, 31 Nassau St., New York, for the construction of a shelter building, together with two separate kitchen buildings to be used, respectively, for laundry and kitchen building and toilet building, also a small sewage disposal plant in connection with same, together with the necessary piping, appurtenances, etc.

Trenching and Draining—New York, N. Y.—Bids will be received until 3 p.m., Apr. 3, by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan, for trenching and draining the salt meadow lands in Pelham Bay Park, Boro. the Bronx.

Alterations to Fire Station—New York, N. Y.—Bids will be received until 10:30 a.m., Mar. 31, by Joseph Johnson, Fire Comr., for furnishing all the labor and materials required for additions and alterations to the quarters of Hook and Ladder Co. No. 127, Union Ave., Jamaica.

Fire Alarm Telegraph System—New York, N. Y.—Bids will be received by Joseph Johnson, Fire Comr., Boro. Manhattan, until 10:30 a.m., Mar. 31, for furnishing all the labor and materials required for establishing and equipping an extension to the fire-alarm telegraph system in the Borough of Manhattan.

Spraying Machine—New York, N. Y.—Bids will be received by the Park Board, Dept. of Parks, until 3 p.m., Mar. 27, for furnishing and delivering one spraying machine for the Department of Parks, Boro. the Bronx.

✦Coaling Station—Poughkeepsie, N. Y.—The contract has been awarded to the J. W. BISHOP CO., Worcester, Mass., for the construction of the coaling station for the New York Central & Hudson River R.R.

Ditching—Atlantic City, N. J.—The County Board of Freeholders, Atlantic City, has appropriated $26,000 for the ditching of marshes and oiling various ponds for the extermination of mosquitoes.

Docks—Erie, Penn.—The Pennsylvania R.R. Co., will erect a drydock, coal and ore-docks and track extensions at Erie. The improvements will cost about $1,000,000. H. R. Leonard, Philadelphia, Penn., is Engr., Bridges and Bldgs.

Drydock—Erie, Penn.—The Pittsburgh Steamship Co., Erie, is considering the construction of a drydock at the foot of Cascade St.

Abolition of Grade Crossings—Philadelphia, Penn.—Plans for the abolition of grade crossings throughout the entire city of Philadelphia were agreed upon, Mar. 19, by the city and the Pennsylvania R.R. Co., the Baltimore & Ohio R.R. Co. and the Philadelphia & Reading Ry. Co. It is estimated that the work will cost about $15,000,000.

★Rebuilding Pier—Washington, D. C.—The Alexandria Chemical & Fertilizer Co., has awarded the contract to the CLARKE & WINSTON CO., Washington, for rebuilding its pier at the foot of Queen St.

Drainage Work—Shreveport, La.—Bids will be received until Apr. 2 by the Board of Commissioners of Caddo Levee Dist., Shreveport, for improving the Kelly Bayou Drainage Canal, Caddo Parish.

Creek Work—Louisville, Ky.—The Board of Public Works will have plans and specifications ready in about 30 days for improving the channel of Beargrass Creek. The proposed work provides for the flooring of the creek with concrete, and walls of the same material. David R. Lyman is City Engr.

✦Ditch—Greenville, Ohio—The contract has been awarded to E. A. FISHBACK, Horatio, Ohio, for the construction of the Whitewater Ditch, at $11,600. Bids were opened Mar. 8.

Subway—Lorain, Ohio—The Baltimore & Ohio R.R. Co. has accepted the plans as prepared by the City Engineer for the construction of the 28th St. Subway. It is estimated that the work will cost $155,000. Of this amount the city will pay half. F. L. Stuart is Ch. Engr. B. & O. R.R., Baltimore, Md.

Dredging—Indianapolis, Ind.—Plans and specifications for dredging Fall Creek will be revised by J. H. Lowrey. New bids will be asked. The creek will be dredged from 30th St. to the Fair Grounds Bridge and from Northwestern Ave. to the Cleveland, Cincinnati, Chicago & St. Louis Ry.

Ditch—Valparaiso, Ind.—Bids will be received by the County Surveyor of Porter County, Valparaiso, until Mar. 27, for the construction of the Keeper Ditch. The work includes the following: 50,778 cu.yd. floating dredge work, 72,000 cu.yd. dragline work, 6,355 lin. ft. 8- to 24-in. drain tile.

Ditches—Carmi, Ill.—Bids will be received by the Commissioners of Edwards, Lawrence, Wayne, Clay and White Counties until 1 p.m., May 9, for the construction of various drainage ditches in the district. Bids are to be addressed to F. W. Beal, Texas First National Bank Bldg., Carmi. Specifications are on file at the office of the County Clerk of White County, Carmi.

Canal—Springfield, Ill.—The state of Illinois is considering the improvement of the Illinois-Michigan Canal. A bill has been introduced in the State Legislature providing for an appropriation of $1,000,000 for the purpose.

Ore Dock—Ashland, Wis.—The Chicago & Northwestern Ry. Co. will construct another ore dock east of its present docks at Ashland. It will be of concrete and steel and will cost about $1,000,000. J. C. Little, Chicago, Ill., is Mech. Engr.

Park Work—Milwaukee, Wis.—The Park Board has approved the plans of A. C. Clas, Park Comr., for the construction of a driveway park along the lake shore, for 1½ miles south of the harbor entrance. Estimated cost $40,000.

Ditch—Des Moines, Iowa—All bids received Mar. 10 for constructing drainage ditch in Drainage Dist. No. 13, Franklin Township, approximately three miles, requiring the removal of 36,240 cu.yd. of earth, have been rejected. H. B. Frace is County Audr.

✦Ditch Work—Forest City, Iowa—Contracts have been awarded as follows by the county for ditch work: to W. H. LAWTON, Newel, Iowa, for 21,300 cu.yd. of open ditch; to DAVIDSON & DELL, Forest City, for tile.

✦Ditch—Sidney, Iowa—The County Supervisors, Mar. 7, awarded to RANKEN & COWDEN, of Riverton, the contract for constructing the Plum Creek Drainage Ditch, at 7.69c. per cu.yd. for the main ditch, and 12.7c. per cu.yd. for two laterals.

✦Ditch—Albert Lea, Minn.—The contract has been awarded to A. HENRIKSON, Askov, Minn., for the construction of Ditch No. 25, at $16,900. Bids were received for the work on Mar. 6.

Harbor Improvements—Texas City, Tex.—About $3,000,000 will be expended at Texas City during the year in the construction of harbor improvements, the enlargement of docks and the erection of new buildings. The Texas City Transportation Co. will make improvements to the wharf and warehouse system at a cost of more than $1,000,000, it is announced. The federal appropriation for the improvement of the harbor here available for the present year is $1,400,000.

✦Drainage—Spokane, Wash.—The contract for constructing drainage ditches in Dist. No. 12 has been awarded by the County Commissioners to PEDERSON & WOOD, at $20,800.

Dock, Etc.—Tacoma, Wash.—The city is considering the construction of a municipal dock and a cold storage plant.

Flume Work—Wenatchee, Wash.—Grant Smith & Co. Henry Bldg., Seattle, Wash., it is reported, will receive bids until Apr. 10 for constructing 600,000 ft. of flume work at Wenatchee.

Jetty—Portland, Ore.—The Port of Portland Commission and Maj. J. J. Morrow, Corps Engrs., U. S. A., Portland, have agreed upon construction of a 700-ft. jetty at the entrance to Tillamook Bay. The sum of $407,000 is now available. The ultimate plan for Tillamook bar is 20 ft. at low water.

Vessel—Portland, Ore.—The Associated Oil Co., Portland, Ore., has decided to build a new tanker for service between Monterey and the Willamette River. The vessel will have a capacity of 75,000 bbl.

Pipe Line—Bakersfield, Calif.—The Southern Pacific Co. and the Atchison, Topeka & Santa Fé R.R. Co. are considering the construction of an oil pipe line from Bakersfield to Mojave, over the Techachapi Mountains. W. Hood, San Francisco, Calif., is Ch. Engr. Southern Pacific Co.

Fire Apparatus—Hermosa Beach, Calif.—The city is considering appropriating $10,000 for the purchase of a chemical engine and auto apparatus.

✦Pier—Huntington Beach, Calif.—The contract has been awarded to the MERCEREAU BRIDGE & CONSTRUCTION CO., Los Angeles, for the erection complete of the municipal pier, at $63,500.

Wharf—Los Angeles, Calif.—The E. K. Wood Lumber Co., Los Angeles, has decided to construct a 325-ft. wharf at Wilmington. Estimated cost, $15,000.

Machinery—Los Angeles, Calif.—The Board of Public Works will call for bids for the machinery necessary for the hill razing at San Pedro, under the bond issue of $2,500,000. Among the items required are four locomotives, 42 six-yard dump cars, steam shovels, tails, ties and repairs.

Switch Tower—Oakland, Calif.—The Southern Pacific Co. is receiving bids for the construction of a three-story reinforced-concrete switch tower at the new 16th St. depot at Oakland.

Levees—Sacramento, Calif.—The Sutter Basin Improvement Co., Sacramento, will reclaim about 70,000 acres of land by the construction of levees, etc. G. N. Randle is Engr.

River Work—Sacramento, Calif.—The state is considering the improvement of the navigability of Mokelumee River, from Newhope to the mouth of the river, at a cost of $29,000.

Pier—San Francisco, Calif.—The State Board of Harbor Commissioners, San Francisco, has approved the plans and specifications for the construction of Pier No. 46. Bids will be asked soon. The structure will be 800x200 ft.

Road Rollers—St. John, N. B.—Miles Agar, Comr., has been authorized to purchase machinery for the new street plant including two steam road rollers, a small motor roller, portable stone crusher, motor truck and hot mixer for bituminous concrete.

Canal Work—Montreal, Que.—Bids will be received until Mar. 31 by L. K. Jones, Asst. Deputy Minister and Secy. of Railways and Canals, Ottawa, Ont., for improvements to the upper approach, Lock No. 4, Cote St. Paul, Lachine Canal.

✦Scows—Kingston, Ont.—The contract has been awarded by the Canadian Government to the KINGSTON SHIPBUILD-

ING Co., Kingston, for the construction of two 500-cu.yd. steel dump scows.

+Harbor Improvements—British Columbia—It is reported that the contract has been awarded to SIR JOHN JACKSON for improving the harbors of Vancouver and Victoria, B. C., and building a drydock 1000 ft. long, at a cost of $20,000,000.

Dock—Vancouver, B. C.—Plans have been completed by T. H. Bamforth, 319 Pender St. W., for constructing a 225-ft. concrete dock and warehouse for the H. A. Forsythe Co., at the foot of Smythe St. Estimated cost, about $30,000.

BUILDINGS

Berlin, N. H.—The Y. M. C. A. has raised a fund of $85,000 for erection of a new building.

Brookline, Mass.—Plans have been completed by Kilhan & Hopkins, Archs., 9 Park St., Boston, Mass., for the construction of a school building on Harvard St. The estimated cost is $138,000.

Fall River, Mass.—The construction of a railroad station is being agitated in connection with bridges and tunnels to be built by the N. Y., N. H. & H. R.R. Co. Edw. Gagel is Ch. Engr., New Haven, Conn.

Pittsfield, Mass.—Bids will be received until Apr. 1, for the erection of a Union passenger station for the Boston & Albany and N. Y., N. H. & H. R.R. at Pittsfield. J. L. Trunden is Supt. of B. & A. Noted Jan. 30.

Williamsburg, Mass.—A grammar and high school will be erected at Main and South Sts. Bids will be asked about April 1. It will be of brick, 70x106 ft., two stories. Lawrence Malloy is Chn. of Com. E. C. & G. C. Gardner, 53 Lyman St., Springfield are Archs.

Worcester, Mass.—The Trustees of the Worcester City Hospital will ask the City Council for an appropriation of $100,000, for a children's ward building. It will be two stories, 120x68 ft. Fuller & Delano, Archs., Chase Bldg., have prepared plans.

+Providence, R. I.—The contract for erection of the new East Side private school for girls has been awarded to WILLIAM WILLIAMS. Noted Mar. 20.

+Woonsocket, R. I.—The Woonsocket Realty Co. has awarded the contract for the four-story office building on Main St. to ALFRED DAIGNAULT, 176 Main St. The estimated cost is $45,000.

Bridgeport, Conn.—Arthur S. Meloy, Arch., 17 Post Office Arcade, Bridgeport, is preparing plans for a theater and office building on State St. for Peter Dawe. The building will be four-stories, of brick.

+Stamford, Conn.—The general contract for the construction of a clubhouse for the Suburban Club has been awarded to the SHEA-SULLIVAN CO., Main St. Noted Jan. 9.

Willimantic, Conn.—The Town has voted to build a school, and $60,000 has been appropriated for the purpose.

+Albany, N. Y.—The contract for the construction of the nurses' home for the Albany Hospital has been awarded to BARROWS-STEWART CO., 17 Battery Place, New York. Noted Oct. 24.

+Albany, N. Y.—The contract has been awarded to the WILLIAM G. SHELDON CONSTRUCTION CO., for the construction of a three-story brick hospital for the Francis Elliott Austin Maternity Hospital, at Main and Western Aves.

Brooklyn, N. Y.—Bids will be received until 2 p.m., Apr. 9, by the Commissioners of Water Supply, Gas and Electricity, 21 Park Row, Manhattan, for the construction of buildings at the East New York pipe yard, 131 Jamaica Ave., and also at the Gowanusc pipe yard, at Butler and Nevins St. Henry S. Thompson is Commr.

Buffalo, N. Y.—The Bualo Maintenance Co., 24 Goodrich St. will erect a three-story brick and steel store and loft building, 106x160 ft., at 1085 Main St.

Ulysses G. Orr, Arch., Builders Exchange is completing plans and will receive bids about Apr. 15, for a 7-story, steel and brick store and loft building 170x220 ft. to be erected at Main & Carlton Sts. by the G. H. Poppinberg Co. 674 Main St.

W. H. McElfatrick, Arch., 701 Seventh Ave., New York City is receiving bids for a theater 85x115 ft. of structural steel and brick to be erected at Pearl and West Huron Sts. by the Columbia Amusement Co. Noted Mar. 13.

Endicott, N. Y.—The Board of Education will erect a brick and stone high school at Washington Ave. and Main St. The estimated cost is $100,000. George Ames is Pres.

Herkimer, N. Y.—S. W. Cassidy, Arch., Herkimer Bank Bldg. is preparing plans for a two-story and basement theater, store and office building 33x180 ft. to be erected by Stephen Hines on Prospect St.

Little Falls, N. Y.—The Herkimer County National Bank, South Ann and Albany Sts., contemplates the erection of a bank building at Main and North Ann Sts. The estimated cost is $100,000.

New York, N. Y.—Plans have been filed by W. E. Austin, Arch., 46 West 24th St., for the construction of a 17-story printing house on the southwest corner of Lafayette and White Sts., for the Hasenbeck-Hungerford Realty Co., 497 Pearl St. The estimated cost is $1,200,000.

+We are officially advised that the FOUNDATION CO., 115 Broadway, has been awarded the contract for the foundations of the new banking house for J. P. Morgan & Co., at Broad and Wall Sts. The contract is for the sinking of 18 exterior pneumatic caissons to bed rock. The basement floor will be carried down 49 ft. below the curb, from which level 19 interior piers will also be sunk to bedrock. Trowbridge & Livingston, 527 Fifth Ave., are the Archs. for the structure. Noted Oct. 3.

Plans have been filed by Rouss & Goldstone, Archs., 33 West 32d St., for the construction of a 17-story loft building, 88x50 ft., on the south side of 32d St. west of Fifth Ave., for the Bradkine Realty Co., 40 West 32d St. The estimated cost is $385,000.

Wallis & Goodwallie, Archs., 346 Fourth Ave., are preparing plans for the construction of a nine-story apartment house at 124 West 55th St., for the Herald Square Holding Co., 62 West 45th St. The estimated cost is $200,000.

The Brixton Construction Co., 314 West 87th St., contemplates the erection of a 12-story apartment house, at 110 West 79th St. Edwin S. Brickner is Pres.

Plans have been filed by W. H. Gompert, Arch., 2147 Broadway, for the construction of a 16-story office building at northeast corner of 33d St. and Madison Ave. for the Burrel Realty Corp., 71 Madison Ave. The estimated cost is $400,000.

We are officially advised that bids will be received in about a month by Henry Otis Chapman, Arch., 334 Fifth Ave., for the construction of two six-story buildings, 50x100 ft., for Dreicer & Co., jewelers, 560 Fifth Ave. Only one building will be used by the owner.

Plans have been filed by Rouss & Goldstone, Archs., 33 West 32d St., for a nine-story apartment house to be erected on 70th St., near Third Ave., for the 173 East 70th St. Co. Inc., 160 Broadway. The estimated cost is $175,000.

Plans have been filed by Walter Haefeli, Arch., 17 Madison Ave., for the construction of an 11-story garage building, on 61st St., east of Columbus Ave., for A. Pinchot, 60 Broadway. The estimated cost is $325,000.

Plans have been filed by Rouss & Goldstone, Archs., 33 Ave., for the construction of a three-story office and theater building, 220x102 ft., at the southeast corner of Broadway and 81st St., for the Fulton Building Co., 2255 Broadway. The estimated cost is $150,000.

(Boro. the Bronx)—Plans have been filed by Frederick Seeger, Arch., 441 Tremont Ave., for the construction of a six story, brick apartment house at the northwest corner of 179th St. and Morris Ave., for August Jacob, 2000 Morris Ave. The estimated cost is $180,000.

(Boro. Richmond)—Plans are being prepared by George W. Conable, Arch., 456 Fourth Ave., Manhattan, for the construction of a two-story, brick and stone church at Beach and St. Paul Aves., Stapleton, S. I., for the George Lutheran Church. The estimated cost is $70,000. Rev. Frederick Sutter, 106 Beach St., is Pastor.

+Utica, N. Y.—The contract for the construction of the union passenger station has been awarded to J. HENRY MILLER, Baltimore, at $691,000. Other bidders were: Griffiths & Pearce, Utica, at $761,000. R. Richards & Son, Utica, $783,000. Noted Jan. 30.

Jersey City, N. J.—The Congregation of Aguudth Scholem is having plans prepared for a synagogue to be erected on a site recently acquired on Bergen Ave. The estimated cost is $50,000.

Newark, N. J.—Plans have been filed by the Public Service Corporation for the construction of a trolley terminal at Park Place and Pine St. The estimated cost is $4,000,000. Noted Jan. 30.

Trenton, N. J.—Plans have been completed by the Pennsylvania R.R. Co., for the construction of a passenger station and elimination of grade crossings. About $5,000,000 will be expended. A. S. Vogt, Mech. Engr., Altoona, Penn.

Trenton, N. J.—The Delaware & Atlantic Telegraph & Telephone Co. will erect a five-story fireproof central exchange at Nos. 216-18 East State St. John T. Windrim, Arch., Commonwealth Bldg., Philadelphia, Penn., is the Arch. The structure, with equipment and switchboard, is estimated to cost about $250,000. C. R. Fairchild is District Mgr.

+Union Hill, N. J.—The contract has been awarded to DE RISO BROS., Union Hill, by Carl F. Michelfelder, for the erection of a theater on the Hackensack Turnpike, near Bergenline Ave., at a cost of $11,500.

+Ashland, Penn.—The contract for the construction of the school for St. Joseph's parish at Ashland, has been awarded to GORDON NAGLE, Cressona.

Cheltenham, Penn.—The Methodist Episcopal Church has had plans prepared for a church building to be erected at Central and Myrtle Aves. The estimated cost is $45,000. Rev. John T. Gray is Pastor.

+Frankford, (Philadelphia post office) **Penn.**—The contract has been awarded to IRWIN & LEIGHTON, for the construction of a theater at Frankford Ave. and Margaret St.

Monessen, Penn.—Bids will be received until 5 p.m., Apr. 15, by J. A. Lohman, Arch., Monessen, for the construction of a brick building for the Loyal Order of Moose. Noted Mar. 6.

New Castle, Penn.—The Pittsburg & Lake Erie R.R. will erect two stations at New Castle. The estimated cost is $100,000. W. P. Richardson is Mech. Engr., Pittsburgh, Penn.

+Philadelphia, Penn.—The contract has been awarded to the CHARLES McCAUL CO., Philadelphia, Penn., for the construction of a Y. M. C. A. building at 1720 Christian St. Noted Dec. 26.

A syndicate composed of William West, Dr. George H. Kolber, and others have purchased a site at 1142 Passyunk Ave., upon which will be erected a theater. The estimated cost is $50,000.

The Harrison C. Rea Co., obtained a permit for the nine-story Metropolitan Building to be erected at Broad and Wallace Sts., for the Metropolitan Realty Co. The estimated cost is $465,000.

A permit has been obtained by William Steele & Sons, for the erection of an eight-story warehouse, 155x297 ft., at 10th and Berks Sts., for the N. Snellenburg Co. The estimated cost is $655,000.

Pittsburgh, Penn.—Jarvis & Hunt Archs., Chicago, Ill., are preparing plans for the new department store building of the Rosenbaum Co., to be erected on Sixth St., at a cost of $1,500,000. The building will be 12-stories, 150x200 ft. Noted Feb. 6.

Plans are now being prepared by Archs. Janssen & Abbott, Renshaw Bldg., for the Masonic temple, to be erected in Fifth Ave., Schenley Farms. The estimated cost is $900,000.

The School Board will erect a school 333 ft. east of the Bedford Basin, and another, at Webster Ave. and Watt St. About $400,000 will be expended. S. L. Heeter is Supt.

Plans have been completed by Janssen & Abbott, Archs.,

Renshaw Bldg., for the construction of a one-story stone, 60x60-ft. bank building for the First National Bank, North Side. The estimated cost is $75,000.

+Pottsville, Penn.—The contract has been awarded to J. MESSERSMITH, at $50,000, for the construction of a theater for the Pottsville Amusement Co. Other bidders were: Walter Wertley Sons, Gordon Nagle, Pottsville; H. L. Brown, Philadelphia; S. Y. Frederick & Son, Hazleton.

Reading, Penn.—Bids will be received until 2 p.m., Apr. 9, by Muhlenberg Bros., Archs., Second National Bank Bldg., 511 Penn St., for the construction of a school, for the school district of the Borough of Shillington, Berks County, Pennsylvania.

+Baltimore, Md.—The contract has been awarded to the CONSOLIDATED ENGINEERING CO., Emerson Tower Bldg., for the construction of a warehouse, at 401-3-5 N. Calvert St. J. F. Gerwig, Equitable Bldg., and Chas. C. McColgan, 12 East Lexington St., are Archs.

The Western Maryland R.R. Co., H. R. Pratt, Hillen Station, Baltimore, Ch. Engr., has commissioned Emory & Nussear, Archs., Professional Bldg., Baltimore, to prepare plans for depot improvements to include erection of addition, remodeling present structure, construction of shed and concourse, redecorating, installing sanitary plumbing equipment, etc. The estimated cost is $300,000.

Bids are being received by the John Hopkins Hospital, Bldg. Committee, for the construction of Gilman Hall Academic buildings at Homewood, Baltimore. Parker, Thomas & Rice, Union Trust Bldg., are Archs. The building will be four stories, of brick, 161x243 ft.

Sykesville, Md.—Plans are being prepared by Parker, Thomas & Rice, Archs., Union Trust Bldg., Baltimore, Md., for the construction of a hospital for the Springfield State Hospital for the insane. The estimated cost is $75,000.

+Richmond, Va.—The contract has been awarded to JAMES FOX & SONS, for the construction of a building on Stuart Ave., to cost $44,000.

+Warm Springs, Va.—The contract has been awarded to FALLS CITY CONSTRUCTION CO., for the construction of a courthouse. Noted Feb. 27.

Clarksburg, W. Va.—S. W. Ford, Arch., Clarksburg, is preparing plans for a two-story brick school Clarksburg, for the Board of Education. Bids will be taken about Apr. 1. The estimated cost is $50,000.

Bids will be received until Apr. 3, by William B. Ittner, Arch., Ninth and Locust Sts., St. Louis, Mo., for the construction of a high school at Clarksburg. The estimated cost is $50,000. Noted Jan. 23.

+Columbia, S. C.—The contract has been awarded to JOHN J. CAIN CONSTRUCTION CO., for the construction of a 15-story building at Washington and Main Sts., for the Palmetto Construction Co. The estimated cost is $300,000.

Atlanta, Ga.—Plans have been prepared for the construction of a reinforced concrete market building at Central Ave. and Washington St., for the Atlanta Joint Terminals Co. The estimated cost is $200,000.

Savannah, Ga.—Wallin & Young, Archs., Savannah, have prepared plans for the construction of a reinforced concrete clubhouse, for the Yacht Club. The estimated cost is $60,000.

Waycross, Ga.—Bids will be received until Apr. 15, by A. G. Miller, Supt. of Schools, for the construction of two brick school buildings. The estimated cost is $40,000. T. F. Lockwood, is Arch., Columbus, Ga.

Tuscaloosa, Ala.—Bids will be received until Apr. 2, by J. I. Harrison, Clk., Bd. of Education, for the construction of a school in West End. W. E. Benns, is Arch., Bessemer, Ala.

+Laurel, Miss.—The contract has been awarded to W. M. NORRIS, Laurel, for the construction of a lodge building for the B. P. O. E.

Marks, Miss.—Bids will be received until noon, Apr. 1, by L. Marks Sons, Marks, Miss., for the construction of a two-story mercantile block, 85x100 ft., at Marks. M. M. Alsop is Arch., Houston, Miss.

New Orleans, La.—The Equitable Realty Co., Ltd., will erect a building on Baronne St. The estimated cost is $125,000.

New Orleans, La.—Bids were received for the construction of the Third Ward School, at White and Broad Sts. as follows: John Minot, $46,750; John Reiss, $46,880; Michael Cheese & Co., $53,500.

Shreveport, La.—Plans have been prepared by C. W. King, Arch., Shreveport, for the construction of a five-story addition to the North Louisiana Sanitarium. The estimated cost is $75,000.

Knoxville, Tenn.—The Imperial Realty Co. will erect a 12-story hotel at Knoxville. The estimated cost is $750,000. J. B. Jones is Pres.

Memphis, Tenn.—The Memphis Lodge, Royal Order of Moose, will erect a five-story clubhouse, at Memphis. The estimated cost is $150,000.

+Memphis, Tenn.—The contract has been awarded to KAECHELE, HODGES & CO., Memphis, for the construction of a six story bank and office building, for the Germania Savings Bank & Trust Co. Price, Broadway & Mahan are Archs., Memphis.

The Illinois Central R.R. Co. will erect a depot at Memphis. The estimated cost is $400,000. D. H. Burnham & Co., Chicago, Ill., are Archs.

Memphis, Tenn.—Memphis capitalists will erect a 22-story office building. The estimated cost is $1,000,000.

Nashville, Tenn.—C. K. Colley, Arch., Nashville, has prepared plans for the construction of a 21-story, 43x71-ft office building at Union St. and Second Ave., for the Davis Cockrill Finegan Real Estate Co. The estimated cost is $500,000.

Ashland, Ky.—John C. Mayo, Paintsville, Ky., is planning the erection of a hotel at Ashland. The estimated cost is $250,000. Webber & Webber, Covington, Ky., are Archs.

Pineville, Ky.—The Louisville & Nashville R.R. Co. will erect a concrete and brick passenger station at Pineville. W. H. Courteney is Ch. Engr., Louisville, Ky.

+Shelbyville, Ky.—The contract has been awarded to the FALLS CITY CONSTRUCTION CO., Louisville, Ky., for the erection of a courthouse at Shelbyville, Ky. Joseph & Joseph, Louisville, are Archs. Noted Jan. 30.

Cincinnati, Ohio—The St. Nicholas Holding Co., representing a corporation known as S. D. Peacock, of Cincinnati, will erect a 12-story store and office building at Fourth and Race Sts., Cincinati. G. W. Drach, Union Trust Bldg., is preparing plans. The Wells Bros. Construction Co., Chicago, will have charge of erection. The approximate cost of the building will be $1,400,000 with improvements.

+Cleveland, Ohio—The contract for the construction of Hospital Building No. 2, of the sanitarium group at the city farm, has been awarded to the REAUGH CONSTRUCTION CO., 516 Garfield, Bldg. Noted Feb. 13.

+Cleveland, Ohio—The contract for the construction of a 10-story addition to Halle Bros. Co. store has been awarded to the TIDEWATER CONSTRUCTION CO, New York, at $1,000,000.

+Cleveland, Ohio—The general contract for the construction of the eight-story office building at Prospect Ave. and East Fourth St., for the Sincere Realty Co., has been awarded to ROY BLACK, 2066 East Fourth St.

Columbus, Ohio—Bids will be received until Mar. 31, by J. N. Bradford, University Arch., for the construction of a botany building at the Ohio State University.

+Newark, Ohio—Bids were opened Mar. 11, for the erection of the Newark City Hospital as follows: B. F. BOLIN & CO., Columbus, $44,499 (contract awarded): E. K. Hibbs, Columbus, $54,135; J. C. Davidson, Columbus, $50,770. L. Packard, Columbus, is Arch. Noted Feb. 6.

Troy, Ohio—Plans are being prepared by F. L. Packard, Arch., Columbus, Ohio, for a high school. The estimated cost is $125,000.

Warren, Ohio—Plans have been prepared by Walker & Weeks, Archs., Cleveland, Ohio, for the construction of a building, 40x100 ft. The estimated cost is $40,000.

+Crawfordsville, Ind.—The general contract for the construction of a Y. M. C. A. building at Green and Pike Sts., has been awarded to W. C. CARR & SON.

Fort Wayne, Ind.—Charles R. Weatherhogg, Arch., Fort Wayne, is preparing plans for the construction of a building for the First National Bank, Laporte. The estimated cost is $80,000.

Gary, Ind.—The Commercial Realty Co. will erect a four-story hotel at Broadway and Fifth Ave. The estimated cost is $45,000. Herbert Erickson is Arch.

+Indianapolis, Ind.—The general contract has been awarded to the BERFORD STONE & CONSTRUCTION CO., for the construction of a hotel at Georgia and 11th Sts. for Henry Severn, 1002 Central Ave.

+Battle Creek, Mich.—The contract has been awarded to GEORGE OSGOOD, Traverse City, Mich., for the construction of the Masonic Temple at Battle Creek.

Detroit, Mich.—R. E. Rasmen, Arch., Penobscot Bldg., will receive figures about Apr. 15, for a brick and steel six-story office building on Shelby and Congress Sts. for the Murphy Estate, to be occupied by the Western Union Telegraph Co.

Albert Kahn, Arch., Trussed Concrete Bldg., has been selected to draw plans for the 8-story reinforced concrete club building to be erected on Madison and John R Sts. Plans will be ready about May 1. The estimated cost is $500,000.

Albert Kahn, Arch., will prepare plans for the construction of a club building for the Detroit Athletic Club.

Grand Rapids, Mich.—The Peninsular Club is considering the erection of a five-story clubhouse at Fountain and Ottawa Sts. The estimated cost is $125,000.

Kenosha, Wis.—Building operations, to cost $125,000, are contemplated by the School Board. The north wing of the proposed central high school will be erected this year at a cost of $75,000; an eight-room addition to the Bain school will cost $35,000; an eight-room addition will also be erected to the Durkee school later in the season. The architect has also prepared plans for a large school at the south city limits, which were laid over indefinitely.

Milwaukee, Wis.—An eight-story store and office building, is contemplated by the Milwaukee Press Club. A committee, with Frank Markle as Chn., is considering sites. L. E. Meyer is Secy. The estimated cost is $85,000.

The plans for the House of Correction, to cost $500,000, which Milwaukee County contemplates on a site north of this city, as drawn by Leenhouts & Guthrie, Archs., have been approved by the County Supervisors.

+St. Paul, Minn.—The general contract for the construction of the church edifice for St. Dominick Catholic Church has been awarded to HENRY R. LANGE, 750 Blair St., St. Paul, at $32,800.

Grand Forks, N. D.—De Remer & Wallis, Archs., Title Insurance Bldg., are preparing plans for a Masonic Temple to be erected in Grand Forks. It will be of steel frame and

brick construction, four stories, 58x138 ft. The estimated cost is $115,000.

Casper, Wyo.—Bids will be received until 3 p.m., Apr. 7, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post office at Casper.

+Chinook, Mont.—The contract for the construction of the court house for Blaine County has been awarded to LEASE & RICHARDS, Great Falls, at $43,896.

+Chillicothe, Mo.—The general contract has been awarded to the L. W. DUMAS CONSTRUCTION CO., Columbia, for the construction of the three-story courthouse for the County Commissioners of Livingston County.

St. Louis, Mo.—A. B. Groves, Arch., Stock Exchange Bldg., has prepared plans for the construction of a one-story bank building, for the Germania Savings Institution. The estimated cost is $125,000.

+University City, Mo.—Contracts have been awarded for the construction of the school for the Board of Education as follows: General contract, E. C. GERHARD BLDG. CO., 518 Victoria Bldg., St. Louis; structural steel, SPUCK IRON & FOUNDRY CO., St. Louis; sheet metal, CAPLAN GALVANIZED IRON CORNICE CO., 4414 Easton Ave., St. Louis.

CONTRACT PRICES

Sewer System—Carlisle, Penn.—Bids for constructing an outfall sewer, a system of sewers and a drainage conduit here, according to plans prepared by T. Chalkley Hatton, Consult. Engr.; Wilmington, Del., were opened, Mar. 6 as follows: (A) Engineer's estimate; (B) W. H. & C. F. Thompson, Law Bldg., Baltimore, Md.; (C) William Horn & Co., New York; (D) Bennett & Randall, Lebanon, Penn.; (E) J. I. Dick, Scottdale, Penn.; (F) H. C. Brooks, Martinsburg, W. Va.; (G) G. W. Ensign, Camp Hill, Penn.; (H) Costa & Co., Orange, N. J.; (K) Lewis Jacques, Elizabeth, N. J.

+Los Angeles, Calif.—The BARBER-BRADLEY CONSTRUCTION CO., 1824 East Fifteenth St., has been awarded the contract at $55,000, for the construction of a three-story and basement brick and reinforced-concrete store and hotel.

+Los Angeles, Calif.—F. R. Dorn, Arch., awarded the contract to B. V. COLLINS, 945 So. Los Angeles St., at $72,000 for the marble and tile work in the 10-story office building being erected for Robt. Marsh at Ninth and Main Sts.

Pasadena, Calif.—The Pasadena Athletic Club and the Overland Club contemplate erecting a four-story brick club house. S. B. Marston, 600 Chamber of Commerce Bldg., Pasadena, is Arch.

+San Diego, Calif.—The contract has been awarded to the SIMPSON CONSTRUCTION CO., American Bank Bldg., at $67,000 for the erection of an exposition building for the Southern California Panama Exposition Commission. Noted Feb. 20.

San Francisco, Calif.—The following bids were received by the directors of the Panama-Pacific Exposition Co. for the construction of the Educational Bldg.: General Construction (lumber furnished by Exposition): Lange & Bergstrom, $198,691; F. Rolandi, $336,000; Fred P. Fisher, $255,000; Reese & Rountree, $237,500. Strehlow, Freese & Petersen, $207,500; E. A. Hettinger, $208,900; McLaren & Petersen, $224,846; John Monk, $270,000; H. Fisher, $254,842; Commary, Petersen Co., $249,416; J. Lawrence Brown, $380,000. General Construction (lumber furnished by Contractor): Lange & Bergstrom, $266,324; F. Rolandi, $429,000; Reese & Rountree, $318,500; Strehlow, Freese & Petersen, $268,735; John Monk, $359,000; H. Fisher, $317,937; J. Lawrence Brown, $380,000. The Turner Co. submitted the lowest bid on the plumbing work at $14,779. Noted Mar. 6.

+Arch. Creighton Withers, 125 Sutter St. awarded the following contracts in connection with the erection of the six-story brick and steel store building for Florence A. Brown, on Post St. Leonard and Day, Engrs. Steel work, awarded to the RALSTON IRON WORKS, 20th and Indiana Sts.; concrete work, FOSTER VOGT CO., Hearst Bldg.; terra cotta work,

SEWER SYSTEM AND DRAINAGE CONDUIT, CARLISLE, PENN.

	A	B	D	E	F	H
300 lin.ft. 8-in. pipe sewer up to 4 ft. deep	$1.30	$1.23	$1.25	$1.15	$1.30	$1.20
400 lin.ft. 18-in. pipe sewer up to 4 to 6 ft. deep	1.40	1.17	1.10	1.33	1.40	1.35
951 lin.ft. 18-in. pipe sewer 6 to 8 ft. deep	1.55	1.71	1.68	1.18	1.60	1.60
540 lin.ft. 18-in. pipe sewer 8 to 10 ft. deep	1.70	1.95	2.20	1.62	1.80	2.00
540 lin.ft. 18-in. pipe sewer 10 to 12 ft. deep	2.00	2.19	2.75	1.76	2.30	2.60
250 lin.ft. 18-in. pipe sewer 12 to 14 ft. deep	2.30	2.43	3.00	1.92	2.30	4.00
670 lin.ft. 15-in. pipe sewer 4 to 6 ft. deep	1.10	1.16	1.20	1.13	1.07	1.05
690 lin.ft. 15-in. pipe sewer 6 to 8 ft. deep	1.25	1.38	1.55	1.30	1.25	1.30
470 lin.ft. 15-in. pipe sewer 8 to 10 ft. deep	1.40	1.60	2.00	1.42	1.50	1.55
190 lin.ft. 15-in. pipe sewer 10 to 12 ft. deep	1.90	1.82	2.50	1.55	1.70	1.90
250 lin.ft. 12-in. pipe sewer up to 4 ft. deep	.60	.60	.80	.82	.80	.80
150 lin.ft. 12-in. pipe sewer 4 to 6 ft. deep	.80	1.00	.86	.87	.85	.85
540 lin.ft. 12-in. pipe sewer 6 to 8 ft. deep	1.04	1.19	1.20	1.14	1.00	1.05
400 lin.ft. 12-in. pipe sewer 8 to 10 ft. deep	1.25	1.39	1.63	1.27	1.15	1.30
100 lin.ft. 12-in. pipe sewer 10 to 12 ft. deep	1.50	1.59	2.00	1.40	1.45	1.70
270 lin.ft. 10-in. pipe sewer 4 to 6 ft. deep	.70	.86	.80	.84	.73	.75
2340 lin.ft. 10-in. pipe sewer 6 to 8 ft. deep	.78	1.04	.98	1.04	.88	.90
3023 lin.ft. 10-in. pipe sewer 8 to 10 ft. deep	.87	1.22	1.50	1.18	1.05	1.15
1490 lin.ft. 10-in. pipe sewer 10 to 12 ft. deep	1.07	1.40	1.95	1.78	1.40	1.45
4980 lin.ft. 8-in. pipe sewer 4 to 6 ft. deep	.60	.72	.53	.78	.62	.60
14,185 lin.ft. 8-in. pipe sewer 6 to 8 ft. deep	.70	.88	.70	.98	.70	.75
2815 lin.ft. 8-in. pipe sewer 8 to 10 ft. deep	.80	1.04	.95	1.06	.85	.95
838 lin.ft. 8-in. pipe sewer 10 to 12 ft. deep	1.10	1.20	1.26	1.16	1.25	1.30
160 Y branches in 18-in. pipe	1.50	2.50	1.50	2.86	1.45	2.50
100 Y branches in 15-in. pipe	1.20	1.80	1.00	1.92	1.10	1.50
72 Y branches in 12-in. pipe	.90	1.40	.70	1.66	.80	1.10
338 Y branches in 10-in. pipe	.60	1.15	.50	1.42	.65	.85
1100 Y branches in 8-in. pipe	.50	.80	.40	.78	.45	.60
935 vert. ft. of manholes	3.25	5.00	5.00	4.05	4.50	4.00
100 manhole frames and covers	10.00	10.00	12.00	18.00	12.00	12.00
100 catch buckets	3.75	5.00	2.50	5.50	2.50	2.00
23 flush tanks complete	80.00	50.00	90.00	68.00	75.00	110.00
6400 cu.yd. rock excavation	2.00	3.50	2.80	2.85	2.50	3.25
23 flush tank frames and covers	10.00	10.00	12.00	18.50	12.00	15.00
42 lampholes complete including frames and covers	15.00	10.00	8.00	15.00	8.00	15.00
660 lin.ft. 54-in. concrete drain up to 6 ft. deep	6.98	6.50	8.30	10.30	5.50	9.40
951 lin.ft. 54-in. concrete drain 6 to 8 ft. deep	7.38	7.00	8.90	11.80	6.00	10.00
540 lin.ft. 54-in. concrete drain 8 to 10 ft. deep	7.78	7.50	9.70	13.10	6.75	10.90
538 lin.ft. 54-in. concrete drain 10 to 12 ft. deep	8.27	7.90	11.20	14.80	7.75	12.00
240 lin.ft. 54-in. concrete drain 12 to 14 ft. deep	9.04	8.80	13.10	16.00	9.00	13.50
275 lin.ft. 54-in. concrete drain 14 to 16 ft. deep	9.85	9.00	14.90	17.40	10.50	15.00
3204 lin.ft. 54-in. drain, concrete inverted segmental block arch, to be added	.58	.70	.....	.....	1.20	.....
3204 lin.ft. 54-in. drain, concrete inverted segmental block arch, to be deducted	.....	.....	.10	1.60	.....	.75
650 lin.ft. 46-in. concrete drain 6 to 10 ft. deep	6.30	6.00	9.20	11.95	5.50	9.00
650 lin.ft. 46-in. drain, concrete and vitrified block 6 to 10 ft. deep	6.95	6.00	9.10	10.15	6.00	8.40
300 lin.ft. 44-in. concrete drain 6 to 10 ft. deep	5.96	5.90	9.20	11.50	5.25	8.50
300 lin.ft. 44-in. drain, concrete and vitrified block 6 to 10 ft. deep	6.56	6.60	9.10	10.20	6.30	8.00
250 lin.ft. 24-in. t.c. pipe up to 6-ft. deep	2.50	2.60	6.78	1.50	1.75	1.60
250 lin.ft. 12-in. t.c. pipe up to 4 ft. deep	.80	.80	.60	.80	.85	1.00
160 lin.ft. 10-in. t.c. pipe up to 4 ft. deep	.70	.70	.55	.75	.75	1.00
15 closed manhole frames and coveres	10.00	10.00	12.00	18.00	12.00	12.00
5 corner inlets, complete	42.00	50.00	38.00	65.00	55.00	50.00
15 side inlets, complete	37.00	45.00	.....	60.00	55.00	.....
3 grate inlets, complete	28.00	35.00	35.00	27.50	37.50	40.00
Totals	$54,397	$102,345	$107,428	$124,000	$87,170	$111,992

OUTFALL SEWER, CARLISLE, PENN.

	A	B	C	D	E	F	G	K
500 lin.ft. 18-in. pipe sewer up to 4 ft. deep	$1.30	$1.71	$1.42	$1.06	$1.09	$1.50	$1.46	$1.30
2000 lin.ft. 18-in. pipe sewer 4 to 6 ft. deep	1.40	2.19	1.64	1.32	1.33	1.65	1.56	1.50
830 lin.ft. 18-in. pipe sewer 6 to 8 ft. deep	1.60	2.67	1.84	1.52	1.48	1.95	1.74	1.80
100 lin.ft. 18-in. pipe sewer 12 to 16 ft. deep	3.00	4.30	8.00	2.80	1.62	5.00	5.27	5.50
2100 lin.ft. 24-in. pipe sewer up to 4 ft. deep	1.50	2.68	2.20	1.60	1.30	2.15	1.90	1.95
2150 lin.ft. 24-in. pipe sewer 4 to 6 ft. deep	2.00	3.32	2.39	1.95	1.52	2.45	2.05	2.50
590 lin.ft. 24-in. pipe sewer 6 to 8 ft. deep	2.20	3.96	2.50	2.24	1.82	2.90	2.30	2.50
1 Y branch in 18-in. pipe	1.50	3.00	3.45	1.50	2.68	1.85	1.40	3.00
1 Y branch in 24-in. pipe	2.00	5.50	6.10	2.30	4.65	2.75	2.65	5.50
132 vert. ft. manholes	3.25	5.00	6.00	4.00	4.00	5.00	4.60	3.50
26 manhole frames and covers	10.00	10.00	12.00	12.00	18.00	12.50	14.00	10.00
26 catch buckets complete	.....	5.00	2.20	2.50	5.50	2.75	6.00	3.00
150 cu.yd. rock excavation	2.00	3.50	4.75	2.80	2.85	3.00	4.00	3.00
Totals	$14,818	$24,437	$19,366	$14,849	$13,098	$19,101	$17,150	$17,819

STEIGER TERRA COTTA CO., Mills Bldg. The structure will cost $100,000.

✦A. F. and C. M. Rousseau, Archs., Monadnock Bldg., awarded the contract to DYER BROS., 17th and Kansas Sts., for the steel work in the five-story brick and steel apartment building being erected for Calvin E. Knickerbocker on Leavenworth St.

✦✦**Main Intercepting Sewer**—Newark, N. J. Bids for constructing the northerly and southerly portions of Section 6, were received by the Passaic Valley Sewerage Commissioners, Mar. 11, as follows: (A) Booth & Flinn, Ltd., Pittsburgh, Penn.; (B) O'Gara & Maguire, Inc., Newark, N. J.; (C) Patrick McMeel, Passaic, N. J.; (D) Dock Contractor Co., Hoboken, N. J.; (E) Oscar Daniels Co., New York; (F) McCauley-Manton Co., Newark, N. J.; (G) Frawley-Kaufman Contracting Co., Inc., New York; (H) Donlon Contracting Co., Brooklyn, N. Y.:

INTERCEPTING SEWER, NEWARK, N. J.

Section 6, Southerly Portion.

	A	B	C	D	E	F	G
2600 lin.ft. earth excavation and refilling in trench, for 150-in. sewer	$101.50	$79 77	$92.50	$77.50	$68 00	$70 00	$24 00
8000 cu.yd. concrete masonry in trench	9 00	10 50	9 00	7.83	8 00	9 00	7 50
100 cu.yd. brick masonry in manholes and appurtenant work	20 00	20 00	15.00	15 00	20 00	20 00	15 00
10,000 cu.yd. rock excavation in trench	2 00	3 50	.01	3 50	5 00	3 00	1 25
Totals	$357,900	$328,402	$314,100	$300,640	$292,300	$286,000	$136,400

✦**Venice, Calif.**—A contract has been awarded to the WESTERN CONSTRUCTION CO., Bradbury Bldg., for the construction of the concrete foundation for a four-story and basement brick store and hotel to be erected at Venice, for

Water Improvements—Asbury Park, N. J.—Bids for improving the water system were received by the City Council, Mar. 17. The contract involves additions to the pumping equipment, and the laying of 100,000 lin.ft. of c.-i. pipe. R. L. Savage is City Engr. The bids were as follows: (A) J. F. Shanley Co., Newark, N. J.; (B) Henry Spinach contracting Co., Waterbury, Conn.; (C) Atlantic Construction & Supply Co., Jersey City, N. J.; (D) G. B. Richardson & H. K. Corbin, Owego, N. Y.; (E) Partridge & Burke, Lodi, N. J.; (F) Edward L. Bader, Atlantic City, N. J.; (G) John W. Danforth Co., Buffalo, N. Y.; (H) William J. Norton, New York; (I) J. Allen Conklin, Newark, N. J.; (J) Andrew T. Von Cleve, Asbury Park:

Albert H. Beach. Bids for the general contract will be taken at once. It will have concrete foundation and basement 90x84 ft., pressed brick facing, galvanized iron cornice. The cost will be about $50,000. W. S. Garrett, Currier Bldg., is Arch. Noted Feb. 6.

✦**Morden, Man.**—The general contract for the construction of the building for the Department of Public Works, has been awarded to the BROWN CONSTRUCTION CO., Ltd., 10 Monadnock, Bldg., Winnipeg, Man.

Winnipeg, Man.—Bids will be received until 5 p.m., Apr. 3, by R. H. Smith, Secy., Winnipeg Public School Bd., for the construction of a stone and brick school at Clifton, Mabel and Spruce Sts.

Winnipeg, Man.—Clemesha & Portnall, Archs., Regina, Sask., have prepared plans for the construction of a city hall at Winnipeg. The estimated cost is $3,000,00.

INTERCEPTING SEWER, NEWARK, N. J.

Section 6, northerly portion

	H	A	D	E	G
3000 lin.ft. earth excavation and refilling in trench, for 150-in. sewer	$175 00	$128 00	$83 13	$84 00	$27 00
9000 cu.yd. concrete masonry in trench	6 00	9 00	7 93	8.00	7 50
100 cu.yd. brick masonry and appurtenant work	15.00	20.00	15.00	15.00	15 00
500 cu.yd. rock excavation in trench	0 01	6 00	3 50	6 00	2 00
Special steel and timber sheeting, etc., Sta. 26+75 to 28+75, lump sum	1.00	3000.00	13,200.00	11,500 00	12,000 00
Totals	$850,506	$474,400	$343,210	$340,000	$163,000

WATER IMPROVEMENTS, ASBURY PARK, N. J.

Contract A

	A	B	C	D	E	F	G	H	I	J
1 Corliss high duty pumping engine			$10,897	$9,590		$15,700	$10,307		$10,195	$9,738 02
Repairing present Worthington pumping engine			350			500	1			
Installing two additional filter units			6,645	7,700		8,400	5,889		9,412	8,390
Remodeling present receiving well			13,041	24,777		10,948	11,582		12,296	14,187 70
Installing 200-hp. internally fired boiler			5,000	4,912		6,400	4,729		4,700	5,051 00
Erecting circular brick chimney 125 ft. high, 9 4 in. inside diam			2,950	4,000		3,780	2,951		2,948	3,708 75
Installing 10-hp. motor with transformer			427	850		600	575		250	693 00
Installing air compressor, 1600 cu.ft. air to 100 lb. sq.in.			9,100	9,714		11,000	9,010		9,710	1,345 00
Installing new steam piping system to all prime movers			13,869	16,274		16,400	13,895		16,334	16,274 20
Addition to filter and pump houses, concrete floors, etc.			9,600	8,460		9,224	9,894		11,184	9,108 00
Installing suction and discharge mains to pumps and wells			6,900	9,223		8,520	9,413		5,000	9,223 07
Totals			$78,779	$95,500		$91,512	$78,246		$82,229	$85,718 72

Contract B

24-in. pipe, per lin.ft			$5 60	$5 83	$5 04	$4 69	$7 16			5 10
18-in. pipe, per lin.ft			3 17	3 25			7 15			
16-in. pipe, per lin.ft			1 90	2 77	2 59	2 46	3 91			2 74
12-in. pipe, per lin.ft			1 34	1 89	1 69	1 64	3 16			1 84
10-in. pipe, per lin.ft			1 16	1 53	1.30	1 32	2 36			1 50
8-in. pipe, per lin.ft			.9125	1 23	.98	1 04	2 07			.95
6-in. pipe, per lin.ft			.5525	.92	.68	.70	1 79			.85
24-in. gate valves, each			197 00	177 00	195 00	207 00	297 00			266 20
18-in. gate valves, each				97 00	110 00		250 00			
16-in. gate valves, each			115 00	74 00	72 00	92 00	104 00			120 56
12-in. gate valves, each			37 00	36 00	38 00	30 50	57 00			45 20
10-in. gate valves, each			29 25	27 00	31 00	25 00	40 00			37 10
8-in. gate valves, each			21 00	21 00	21 00	17 00	26 50			28 20
6-in. gate valves, each			13 25	14 00	15 00	8 50	18 51			20 80
4-in. gate valves, each			10 25	10 00	11 00	7 00	12 00			14 87
6-in. fire hydrants, each			9 75	36 00	35 00	32 00	15 00			30 86
Resetting old fire hydrants, each			34 05	10 00	5 00	12 00	10 00			6 00
Totals			$62,476 05	$74,361 36	$66,000	$62,938 18	$107,515 40			$71,736 71

Contract C

12-in. pipe, per lin.ft	$2 09	$1 34	$1 66	$2 00	
10-in. pipe, per lin.ft	1 75	1 16	1 28	1 80	
8-in. pipe, per lin.ft	1 [illegible]	.9125	96	1 30	
6-in. pipe, per lin.ft	1 [illegible]	.5525	65	95	
4-in. pipe, per lin.ft	80	.3875	45	80	
24-in. pipe, per lin.ft	5.32	5.60	4 98	5 50	
[illegible] each	98	5525	2 00	1 00	
12-in. gate valves, each	43 50	37 00	35 00	38 00	
10-in. gate valves, each	37 20	29 25	28 00	34 00	
8-in. gate valves, each	29 75	21 00	18 00	25 00	
6-in. gate valves, each	21 00	14 25	12 00	17 00	
4-in. gate valves, each	29 00	10 25	8 00	12 00	
24-in. gate valves, each	175 00	195 00	192 00	175 00	
6-in. fire hydrants, each	48 50	34 05	33 00	38 00	
Changing and resetting old fire hydrants, each	7 00	15 00	5 00	7 00	
Valve boxes, each	6 00	3 50	3 00	5 00	
Totals	$112,005 74	$75,017	$82,000	$106,275	

+San Juan Bautista, N. M.—The contract for the construction of the jail at San Juan Bautista has been awarded to GREGG & MINGO BENITO.

Portland, Ore.—The Y. M. C. A. and the railroads entering Portland contemplate erecting two Y. M. C. A. dormitories in Lower Albina and the terminal yards in the city for railroad men. The estimated cost is $100,000.

Portland, Ore.—The Associated Tenants Corporation will erect an apartment house on Northeast, 19th and Lovejoy Sts. The estimated cost is $250,000. Charles H. Leyman is syndicate M.E.

++Bridges—Philadelphia, Penn.—M. L. Cooke, Dir. Pub. Wks., received bids, Mar. 18, for constructing the following bridges: Bridge No. 1, at Montgomery St., over the Connecting R.R., 29th and 32d Wards, steel plate girder bridge encased in concrete on concrete masonry, 50 ft. wide, 214 ft. long, with paving; Bridge No. 2, at 66th Ave., North, over the North Penn R.R., 42d Ward, concrete arch, 40-ft. span, 78 ft. wide, with paving; Bridge No. 3, at City Ave., over Indian Run, Inter-county, concrete arch, 20-ft. span, with filling, paving and concrete balustrade; Bridge No. 4, at Chester Ave., over West Chester & Philadelphia R.R., 40th and 46th Wards, steel girders encased in concrete with extensions to present stone abutments, 70 ft. wide, 100 ft. long. Henry H. Quimby is Bridge Engr. The bids were as follows: (A) F. J. BOAS, 201 North Broad St., Philadelphia (awarded contract on Bridge No 1); (B) M. & J. B. McHUGH, 714 Arcade Bldg., Philadelphia (awarded contract for Bridge No. 4); (C) Stier-Marsh Co., 1011 Chestnut St. Philadelphia; (D) RICHARD WALSH, 6922 Tacony St., Philadelphia (awarded contract for Bridge No. 2); (E) American Paving & Construction Co., 211 South Ninth St., Philadelphia; (F) Cramp & Co., Denckla Bldg., Philadelphia; (G) James Kelly, Bulletin Bldg., Philadelphia; (H) James Perua, 334 North 65th St., Philadelphia; (I) Ferro Concrete Co., Calder Bldg., Harrisburg, Penn.; (J) Nelson Merydith Co., Chambersburg, Penn.; (K) F. J. LAWLER, Pala, Penn. (awarded contract for Bridge No. 3):

BRIDGES, PHILADELPHIA, PENN.

	Bridge No. 1						Bridge No. 2			Bridge No. 3							Bridge No. 4	
	A	B	C	D	E	F	G	C	D	H	I	C	G	B	J	K	B	A
Item 1.	$49,224	$54,948	$51,430	$54,275	$54,750	$49,960	$26,500	$24,000	$24,750	$26,500	$28,621	$25,500	$24,100	$34,950	$24,880	$21,942	$31,448	$231 94
Item 2	7 50	10 00	7 00	6 75	7 00	9 00	8 50	7 00	5 00	7 00	11 00	7 00	8 50	12 00	12 00	7 00	6 60	6 60
Item 3	8 50	12 00	12 00	7 00	7 00	8 00	9 00	8 50	7 00	8 00	11 00	8 50	9 50	12 00	15 00	9 25	7 00	7 00
Item 4	.05	.09	.06	.06	.06	.045	.05	.05	.06								.09	.05
Item 5	.04	.06	.03	.04	.06	.03	.04	.03	.04	.04	.05	.03	.04	.06	.035	.05	.06	.04
Item 6	.50	1.50	.80	1 00	.50	.50	1 50	.80	.80	.55	1 00	.60	1 50	1 00	.50	.50	.75	.50
Item 7	1 00	1 25	1 00	1 00	1 00	.90	.80	1 00	1 00	1 00	.75	1 00	.80	1 50	1 00	.60	1 25	1 00
Item 8	1 50	2 00	1 80	1 50	1 50	1 80	1 62	1 80	1 50	1 80	1 75	1 80	1 62	2 00	1 35	1 80	2 00	1 50
Item 9	3.00	2 50	2 50	2.75	3 50	1 60	3 00	2 50	2 50								2 50	3 50
Item 10	3 00	3 00	3 25	3 00	3.50	2 70	2 50	3 25	3 00	3 00	2 75	3 00	2 50	3 00	2 50	3 00	2 75	50
Item 11										1 50	2 75	1 50	1 50	1 60	1 25	1 20		
Item 12																	1 50	
Item 13										3 00	2 00	3 00	3 00	3 50	4 50	3 00	3 50	
Item 14										2 00	1 00	1 00	1 00	3 00	2 00	1.00		

Item 1:—For the entire work complete, as per plans and specifications.
Item 2:—For additional masonry in foundations including excavation and all other appurtenances, per cu.yd.
Item 3:—For additional masonry above neat lines, including all appurtenances, per cu.yd.
Item 4:—For additional structural steelwork, in place, complete including painting and all other appurtenances, per lb.
Item 5:—For additional steel rods, for reinforced concrete in place, complete, including all appurtenances, per lb.
Item 6:—For additional grading, either filling or excavation, including all appurtenances, per cu.yd.
Item 7:—Foradditional 8-in. steel-found granolithic curb, in place complete, including excavation and all appurtenances, per lin.ft.
Item 8:—For additional granolithic sidewalk paving, including excavation and all appurtenances, per sq.yd.
Item 9:—For additional asphalt paving on 6-in. concrete base, including excavation and all appurtenances, per sq.yd.
Item 10:—For vitrified brick or block paving, roadway or gutter on 6-in. concrete base, including excavation and all appurtenances, per sq.yd.
Item 11:—For additional Telford paving, including excavation and all appurtenances, per sq.yd.
Item 12:—For additional repaving roadway, on old base, with granite blocks, vitrified bricks or blocks, including excavation and all other appurtenances per sq.yd.
Item 13:—For additional dry stone packing, behind abutment and retaining walls, per cu.yd.
Item 14:—For additional 15- or 18-in. vitrified clay pipe, not in concrete including excavation and all other appurtenances, per lin.ft.

Barge Canal—Albany, N. Y.—Bids were received by Duncan W. Peck, State Supt. Pub. Wks., Albany, Mar. 18, for Contracts 65 and 72A. The bids were as follows: (A) Engineer's estimate; (B) Barrally & Ingersoll, Rochester, N. Y.; (C) Kennedy & Hamilton, Utica, N. Y.; (D) MacArthur Bros. Co., 11 Pine St., New York; (E) Oscar Daniels Co., New York; (F) Lathrop, Shea & Henwood Co., Buffalo, N. Y.; (G) H. S. Kerbaugh, Inc., New York; (H) Maryland Dredging & Contracting Co., Baltimore, Md.; (I) Falk & Menzies, Buffalo, N. Y.; (J) I. M. Ludington Sons Co., Inc., Rochester, N. Y.; (K) T. A. Gillespie Co., New York; (L) Buffalo Dredging Co., Buffalo, N. Y.; (M) Fraser, Brace & Co., New York; (O) P. McGovern & Co., 1 Madison Ave., New York; (P) James Stewart & Co., New York:

BARGE CANAL CONTRACT 72A, ALBANY, N. Y.

	A	O	P
Clearing, lump sum	$100.00	$100.00	$100.00
540,939 cu.yd. excavation	2.50	2.81	2.75
2 M. ft. B.M. sheeting and bracing	60.00	65.00	60.00
400 lin.ft. round timber bracing	0.24	0.25	0.25
2400 cu.yd. stone filling in cribs	2.75	3.00	3.00
1000 cu.yd. rock spoil filling	0.75	1.00	0.90
9000 lb. structural steel	0.06	0.08	0.06
5800 lb. iron castings (plain)	0.04	0.05	.04
180 M. ft. B.M. sawed lumber	60.00	65.00	60.00
Completing construction of upper guide wall (Lock 3), lump sum	25,000.00	30,000.00	27,000.00
Totals		$1,571,278	$1,534,603

BARGE CANAL CONTRACT 65, ALBANY, N. Y.

	A	B	C	D	E	F	G	H	I	J	K	L	M
Cofer-dams, pumping, bailing and draining, lump	$5,000.00	$5,000 00	$5,000 00	$6,000 00	$5,200.00	$3,000 00	$5,600 00	$1,000 00	$5,000 00	$6,000.00	$5,000 00	$6,000.00	$5,000 00
515,000 cu.yd. excavation	.92	.80	1 20	1 00	999	77	82	60	87	.75	90	.85	91
15 M. B.M. sheeting and bracing	50.00	50.00	50 00	60 00	50 00	50 00	50 00	50 00	50 00	50 00	50 00	48.00	50 00
13,400 cu.yd. forming embankment	.20	.20	.20	20	15	20	20	20	24	24	20	24	20
7850 cu.yd. lining	1.50	1.50	1.50	1 75	1 40	1 50	1 65	1 50	1.80	1 80	1.50	1.80	1 50
100 cu.yd. puddle	2.50	2.50	2.50	2 50	2 50	3 00	2 90	2 50	3 00	3 00	3 00	2.40	2 50
24 M. ft. B.M. sawed lumber, yellow pine	60 00	60 00	60 00	65 00	50.00	60 00	65 00	60 00	60 00	60 00	60 00	60 00	60.00
60,000 cu.yd. second class concrete	7.00	6 50	7 25	6 50	7.00	7 20	7 00	7 50	6 50	6 80	6 85	7.00	6 65
250 cu.yd. third class concrete	6.50	6.50	6.50	6.25	7 00	6 90	6 64	7 00	6 50	5 70	6 50	6 25	6 50
2000 cu.yd. reinforced concrete	10.00	10.00	10 00	9.50	9 50	10 00	11 00	12 00	10 00	10 00	9 00	12 00	11 33
640 cu.yd. rubble masonry	4 00	4.00	4 00	4 50	4 00	4.80	4 50	4 00	4 00	4 80	3 50	4 20	4 00
12,600 cu.yd. wash wall	2.00	1.65	2 00	1.40	1.75	2 00	2 00	2 00	2 00	1 75	1 75	1.80	2.00
44 sq.yd. second-class stone paving	1.50	1.50	1.50	1 75	1.25	1 50	1.80	1 50	1 50	180	1 50	1.20	1 50
3190 sq.yd. third-class stone paving	1.25	1.25	1.25	1.50	1 25	1.25	1 50	1 25	1 25	1 50	1 25	1.20	1.25
1080 sq.yd. cobblestone paving	1.00	1.00	1.00	1.20	12.5	1.00	1.20	1 00	1 00	1 20	1 00	1.20	1 00
137,000 lb. c.i. culvert pipe and specials	.03	.03	03	03	.03	02½	03½	03	03	03	.03	.02½	.03
1,357,150 lb. structural steel	.045	.04	.04½	5 2	.014	04½	5 4	04½	04½	5 4	.04½	.04½	.04
74,000 lb. metal reinforcement	.035	.3½	.03½	.03½	.03	.02½	.03½	04	4 2	3 5	.03½	03	.3
13210 lb. iron castings, plain	.035	.3	.03½	04	.03½	.03½	04	03½	4 2	03½	.03½	03	03
5242 lin.ft. wooden fence	.20	.20	.20	20	.20	20	24	20	20	24	20	24	20
1400 lin.ft. w.i. pipe railing	1.50	1.50	1 50	1 10	1 50	1 00	1 40	1 50	1 50	1 50	1 50	1.20	1 50
760 lin.ft. lattice railing	2.00	2 00	2 00	2 00	2 00	1 50	2 10	2 00	2 00	2.00	2 00	2 40	2 00
1470 lin.ft. drilling bolt holes in old masonry	1.00	1.00	1 00	1 00	0.75	0 40	1 00	1 00	1 00	1 00	1 00	0 60	1 00
3 sluice gates 36"x36" complete in place, each	325.00	325.00	325 00	325 00	300.00	325 00	314 00	325 00	325 00	325 00	325 00	325.00	325 00
235,000 lb. metal in guard gates	.065	.6½	06	.07½	.06	.06½	7 8	.06½	.06½	7 8	06½	.07	06
12,800 sq.ft. waterproofing	.20	.20	20	20	.15	1 7	24	.20	20	20	20	.18	20
1100 sq.yd. bituminous wearing surface	30	30	30	35	30	30	34	30	30	30	30	30	30
1 maintaining navigation, lump sum	3,000 00	3,000.00	3,000 00	1,500.00	3,200.00	2,000 00	3,000 00	1,000 00	3,000 00	3,600 00	3,000 00	3,000.00	3,000 00
1 maintaining highway traffic, lump sum	500 00	400.00	500 00	500 00	200 00	500 00	500 00	500.00	500 00	600 00	500 00	500 00	500 00
38 buildings to be removed, each	50.00	50 00	50 00	60.00	50.00	45 00	50 00	60 00	50 00	50 00	50 00	60 00	50 00
1 deduct for highway br. superstructure, lump sum	300.00	300 00	300 00	350 00	300 00	300 00	300.00	300 00	300 00	300 00	300 00	300 00	300 00
Totals	$1,131,523	$1,030,813	$1,292,973	$1,144,804	$1,160,759	$1,061,779	$1,101,978	$1,000,098	$1,074,771	$1,048,761	$1,104,768	$1,098,569	$1,096,915

★★Bronze Shaft Caps—New York, N. Y.—Bids for furnishing and delivering bronze shaft caps and appurtenances for the city tunnel of the Catskill Aqueduct, in the city of New York, Contract 84, were received by the Board of Water Supply, Feb. 18, as follows: (A) AMERICAN MANGANESE BRONZE CO., 99 John St., New York (awarded contract). (B) Coldwell-Wilcox Co., Newburgh, N. Y.; (C) Hyde-Windlass Co., Bath, Maine; (D) Exeter Machine Works, Pittston, Penn.; (E) Bethlehem Steel Co., South Bethlehem, Penn.; (F) William Cramp & Sons Ship & Engine Building Co., Beach and Ball Sts., Philadelphia; (G) Paul S. Reeves & Co., 1415 Catherine St., Philadelphia; (H) Average bid:

BRONZE SHAFT-CAPS, NEW YORK, N. Y

	A	B	C	D	E	F	G	H
24 shaft-caps 48 in.x30 in x30 in	$2393 00	$2888 00	$2853 00	$3375 00	$3250 00	$3491 00	$3797 00	$3149 571
1 shaft-cap 48 in.x30 ft x36 in	2364 00	2925 00	3200 00	3177 00	3340 00	4494 00	3843 00	3338 857
4 shaft-caps 72 in.x48 in x48 in	4765 00	6170 00	8402 00	6782 00	8540 00	8127 00	9340 00	7446 571
2 shaft-caps 72 in.x48 in.x30 in	4879 00	6105 00	8308 00	6383 00	8395 00	8105 00	9139 00	7330 571
3000 lb. miscellaneous bronze	315	33	24	35	30	345	35	319
5000 lb. miscellaneous iron and steel	07	08	04	06	10	125	10	082
Totals	$90,568	$111,177	$123,296	$126,121	$134,290	$139,346	$152,859	

✦Storm Sewers—Atlantic City, N. J.—Bids for extending the storm water sewer system were received by the Board of Commissioners, Feb. 20, from: (A) EDWARD L. BADER, Atlantic City (awarded contract); (B) Atlantic Construction & Supply Co., Atlantic City; (C) Cunningham Paving & Construction Co., Philadelphia, Penn.; (D) McGovern Contracting Co., Trenton, N. J.; (E) Isidor Schmeidler, Atlantic City. The item bids follow:

STORM SEWERS, ATLANTIC CITY, N. J.

	A	B	C	D	E
560 lin.ft. 40-ft.x2-ft. 9-in. concrete drain	$12 25	$14.72	$11 89	$15.00	$15 00
650 lin.ft. 3-ft. 6-in.x2-ft. 9-in. concrete drain	12.18	13.67	11.59	10.00	16.00
1350 lin.ft. 36-in. brick and concrete drain	17 0	12 12	12.79	10.00	16 00
920 lin.ft. 33-in. brick and concrete drain	7.35	10.27	8.49	10.00	13.00
2765 lin.ft. 30-in. brick and concrete drain	8 10	8 95	8 71	10 00	13 50
1598 lin.ft. 27-in. brick and concrete drain	7 20	8 11	9 74	10.00	12 50
2520 lin.ft. 24-in. t.c. pipe drain	8 95	8 04	9 12	8 00	13.50
760 lin.ft. 22-in t.c. pipe drain	6 72	7 41	6.70	5 00	10 50
389 lin.ft. 20-in. t.c. pipe drain	7.32	7.08	6.52	5.00	10.00
2595 lin.ft. 18-in. t.c. pipe drain	4 92	6 75	5 69	5.00	10.50
635 lin.ft 15-in. t.c pipe drain.	5 10	4 77	5 82	5 00	9 50
275 lin.ft 12-in. t.c. pipe drain.	4 08	4 45	5 58	5 00	8.50
526 vertical ft. of manholes.	6 10	9 00	15 45	10 00	13 00
83 manhole covers	9 60	10 0	12 30	10 00	17.50
212 storm water inlets	33.60	50.00	22.92	75.00	65.00
212 c.i. hood traps	3.60	4.00	3.44	6.00	5.50
110 catch basins	100 94	5 00	90 20	100 00	100 00
4155 lin.ft. 10-in. t.c. inlet pipe	2.40	2.77	3.20	2.00	3.75
1130 lin.ft. 12-in. t.c. inlet pipe	2.88	3.00	3.26	3.00	4.50
132 lin.ft. 10-in. c.i. inlet pipe	4.28	3.00	5.35	2.50	4.50
96 lin.ft. 12-in. c.i. inlet pipe	4.76	3.25	5.90	3.00	5.00
72 lin.ft. 24-in. c.i. drain	12.00	11.64	15.45	15.00	14.00
108 lin.ft. 18-in. c.i. drain	6.96	9.40	8.83	7.00	13.00
150.56 M ft. B. M. timber foundation	40.00	40.00	32.00	50.00	45.00
24.675 M ft. B.M. timber caps.	40.00	45.00	42.00	50.00	45.00
15,000 lin.ft. timber underdrain	.36	.60	.28	.50	.75
18,860 lin.ft. piles	.298	.35	.28	.50	.42
204 lin.ft. 5-in. c.i. track drain	1.59	3.00	2.29	1.00	5.50
Time, in days	150	150	250	200	300
Totals	$190,834	$202,441	$202,811	$205,986	$294,870

FOREIGN

Railway—Brazil—The government has authorized the construction of the first section of a branch of the S. Paulo —Rio Grande railway, starting from Guarapuava. The lengt his to be about 30 miles. The cost is estimated at about $1,000,000.

Watermain—Italy—Bids will be received until Apr. 3, at the Palazzo Municipale di Cividale, Province of Udine for the labor and materials necessary for the construction of the Poiana water-main.

Railway—Persia—The Société des Routes Djoufah-Tauris et Enzell-Téhéran, represented by the Banque Russe d' Escompte et de Prêts de Perse, have been authorized by the Persian Government to construct a railway from Djoufah to Tauris, with a branch in the direction of Lake Ourmia. The same company it is reported, has also been granted the exclusive right to construct, within eight years, a railway from Tauris to Kasvin.

Railway—Spain—Bids will be received by the Ministry of Fomento, Madrid, until Aug 9 for the construction of a strategic railway from Guardiola to Olot.

Bids will be received also until July 9 for the construction of a strategic railway from Castellon de la Plana to Lucena.

INDUSTRIAL NOTE

The National Railway Appliances Association, which conducts the annual exhibit of railway appliances in connection with the convention of the American Railway Engineering Association, held its annual meeting at Chicago on Mar. 18, at which officers were elected as follows: President, T. R. Wyles, Detroit Graphite Co.

IMPROVING TRANSIT CONDITIONS IN NEWARK, N. J.

For some time the need of lessening traffic congestion at the intersection of Broad and Market Sts., Newark, N. J., has been obvious. Conditions exist at that point which are not duplicated in any other city of the United States. These two main arteries of the city run east and west and north and south, and intersect at the heart of the city. Newark has almost become a two-street city, and through Broad and Market Sts. the bulk of the pedestrian, trolley, truck and motor traffic flows, congesting at their intersection. To relieve the conditions which now exist, President Thomas N. McCarter, of the Public Service Corporation, which operates the existing city and suburban trolley service, has offered a plan for the approval of the city and state, which will eliminate the inconvenience at that point to traffic. The plan as presented by Mr. McCarter provides not only for the present relief and improvement of the service, but also provides for future development.

The plan is, first, that the Public Service Corporation shall construct a new terminal building on Park Place, between North Canal and East Park Sts. The terminal itself will be eight stories high, irregular in ground area, extending to Mulberry St., in the rear. It will have three track levels: subway, street level and elevated. The main concourse, unlike other terminals in the Metropolitan district, will be on the street level, from which traffic will ascend to the upper level or descend to the lower level, according to the routing of cars. The different levels will have their tracks, with separating unloading and loading facilities, the cars making a loop after unloading and before loading. The outgoing and incoming traffic will be entirely apart, thus avoiding confusion. The subway line leading to and from the terminal will extend under Park Place, Broad St., Cedar St. and Halsey St., coming to grade at Washington St. The upper floors of the building will be devoted to the offices of the company

It is not the plan of the company that all cars will start or end their routes at the terminal. The aim which the company is trying to reach is to take the heavy traffic away from the congesting point at Broad and Market Sts., and divert it by means of the terminal at Park Place. Other ways will be the turning off from Broad St. of cars by the construction of new trackage facilities. These are described in the following paragraphs.

To operate efficiently the new terminal it is evident that new routes and connecting trackage facilities must be built. One of the problems in accomplishing this aim was that in relieving the congestion by the construction of new routes and so the rerouting of lines, it would not at the same time inconvenience the riding public and the demands of the commercial interests of the city, which are naturally located at the present congested district.

The new routes planned to give service to the terminal on Park Place are contained in the following: New tracks to be laid on Park Place, from North Canal St. to Fulton St.; on Centre St., from Park Place to Mulberry St.; on Warren St., from Washington St. to High St.; on High St., from Warren St. to Springfield Ave.; double-track curves at the intersection of Market and Mulberry Sts.; on Lafayette St., from Broad St. to Mulberry St., and the double-tracking of Front and Ogden Sts. were necessary. The northern end of Park Place would be used to divert the southbound cars on Broad St. to the terminal. The Lafayette St. extension is intended for the diversion of northbound cars on Broad St. to the terminal. The switch permitting the movement of cars from Market St. to Mulberry St. will lessen the congestion at Market and Broad Sts. as the heaviest vehicular and pedestrian traffic of the city passes at this point. It is also less likely at Mulberry and Market Sts., as the number of cars using that curve would be materially smaller than the present number now turning at the "Four Corners." The switch at Market and Broad Sts. would then be done away with. The purpose of tracks for Warren and High Sts. is to provide relief for Market and Washington Sts. It is proposed to divert the present Market St. cars, and from Washington St., and thence to the terminal via the subway. If in time Washington St. should become over burdened, it is planned to send cars through Warren St. and High St. to the Orange, South Orange and Springfield Ave. lines.

Plans have also been prepared by the Public Service Corporation for extensions to its lines in suburban territory. These include the extension of the Mulberry line on the north from its present "dead end" at Ogden St. and Fourth Ave., up through Fourth Ave., connecting it with the existing tracks on Belleville Ave.; the Mulberry line on the south by laying tracks on Hawthorne Ave., from Elizabeth Ave. westerly, and to double-track the present line on Miller St., Front St. and two sections of Ogden St.; the extension of the Clifton line from its present terminus at Hawthorne Ave. souththrough Bergen St. to Lyons Ave., through which it would be connected with the tracks on Elizabeth Ave.; the extension of the Central Ave. line, from the East Orange city line through Orange to Lincoln Ave., where a connection would be made with the present crosstown line. Consents are being sought for the extension of the South Tenth St. line, from South Twelfth St., crossing the Central Ave. line, and then over to Main St., and also for a connection from the tracks on Market St. to the Fourth St. line in Harrison.

A bill has now been passed by both houses of the Legislature, which provides for official recognition, the right of construction and the assignment of authority. As soon as this is accomplished, plans will be in readiness for the beginning of construction work as the project has already been approved by the city of Newark.

The cost of the entire undertaking has been estimated by the engineers of the company to be $4,000,000. The financiering of the entire project has been satisfactorily arranged. Thomas N. McCarter is President of the Public Service Corporation and Martin Schrieber, Engr. of Maintenance of Way, Public Sevice Bldg., Newark, is in charge of the undertaking. Noted also on Jan. 30.

Engineering News

VOLUME 69 APRIL 3, 1913 NUMBER 14

Making a Cutoff Wall by Grouting Fissured Rock, Lahontan Dam

By D. W. Cole*

The Lahontan Dam, now under construction by the U. S. Reclamation Service as a part of the Truckee-Carson Project, is located across the Carson River, in Nevada, just downstream from the discharge terminal of Truckee Canal, which with a capacity of 1200 sec.ft. brings water from Truckee River, 31 miles distant, for supplementing the flow of the Carson.† The dam will consist of an earth embankment having a length of 1359 ft., a maximum height of 121 ft., and a volume of about 750,000 cu.yd. It will form a storage reservoir with a capacity of 290,000 acre-feet, utilizing the water to

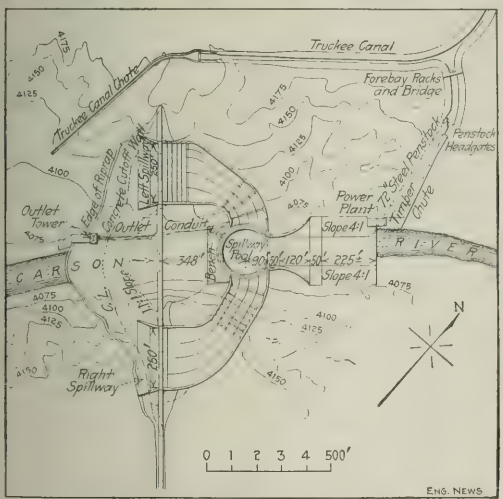


Fig. 1. Map of Lahontan Dam Site, Truckee-Carson Project, U. S. Reclamation Service

irrigate that portion of the Truckee-Carson Project, about 150,000 acres, which can be watered by gravity flow from the reservoir. The embankment is to be 20 ft. wide on top with an upstream slope of 3 to 1 protected by 2 ft. of riprap, and a downstream slope of 2 to 1 protected by 1 ft. of riprap. Near the upstream toe is a cutoff wall, the construction of which is described in this article.

The Foundation

The river at this location has cut a gorge which presents only a fairly good dam-site. There are two geological formations, the upper being of lacustrine deposits laid down by the ancient Lake Lahontan, which, previous to human history, flooded a vast area of which the nearby Carson Sink is one of the few remaining wetted remnants. These sands, gravels and marls of the old lake bed overlie a curious and more ancient sedimentary rock in which the dam is founded.

The rock in general resembles red sandstone; the geologists designate it "mudstone." Portions of it are very hard and close grained like marble. From this condition of induration and density it varies by imperceptible gradations to a tough red clay, and even to an unstable sandy clay.

Between these extremes there are all degrees of firmness, the hard rock being infinitely veined so that it breaks readily into angular fragments from a cubic yard to a cubic millimeter in size, while the clay is granular or amorphous by turns. In arrangement there are all sorts of intermixtures and stratifications, with hard conglomerates carrying egg-sized "pudding stones," soft clay seams separating layers of hard rock, with the various resulting "breakfast bacon" types of formation.

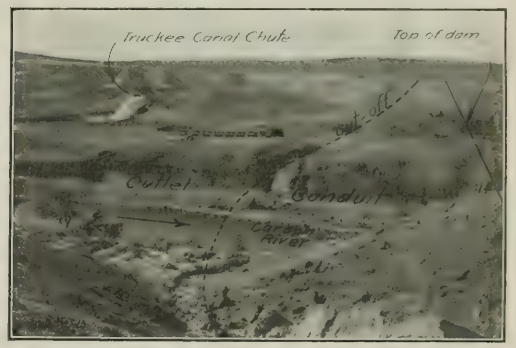


Fig. 2. View Looking across Lahontan Dam Site

The stratification dips from a nearly horizontal position to about 24° and is folded and faulted to a marked degree. Faulting ranges, in all directions, from an infinitude of slips measured in inches, or smaller units, to a few throws of several feet. The clay in the trenches cuts like cheese, exposing faces in nearly all shades of the spectrum, red and yellow predominating.

Fissures and thin veins in the rock are usually filled with clay or siliceous cement, but in general the rock is not impervious and water-bearing passages of small or moderate capacity are of frequent occurrence. The immediate river bed is in fairly continuous rock, laced with ¼ in. of smaller fissures irregularly displaced by faults, with occasional clay strata a few inches in thickness.

*Project Engineer, U. S. Reclamation Service Truckee-Carson Project, Fallon, Nev.

†See "Engineering News," Oct 18, 1906, p. 391, for description of the Truckee-Carson Project

Design of the Dam

Much study was given to the character of structure which could be safely be built on this foundation to withstand a reservoir head of 120 ft. The original proposal of a gravity masonry dam was abandoned, and finally the embankment type with deep cutoff wall was adopted, as illustrated in cross-section in Fig. 3.

In sinking the cutoff trench across the river bed it was found that the proposed depth of 50 ft. could be reached only by great expense for sheeting, bracing and pumping, attended by delay which might seriously derange the construction program. The design was therefore changed to provide for a 30-ft. trench, which could be excavated at reasonable expense in available time, with a view to placing vertically in the concrete cutoff wall, footed at this depth, galvanized well casing (Fig. 5) to facilitate the subsequent boring of the foundation below the bottom of the wall. Into the holes thus bored grout was to be pumped so as to seal effectually the strata below.

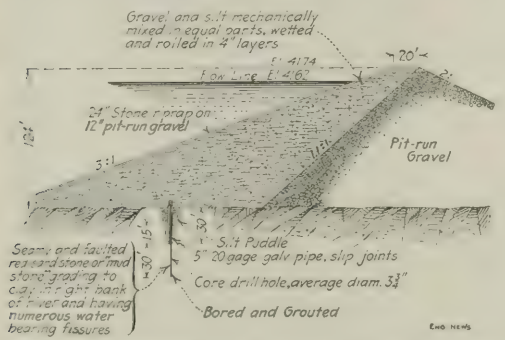


Fig. 3. Section through Lahontan Dam, Truckee-Carson Project, U. S. Reclamation Service

This plan was executed with the minor change of a minimum penetration of 60 ft., half of it by boring and grouting, instead of the 50 ft. of diaphragm wall originally proposed. This minimum was adhered to and at one point a depth of 100 ft. below river bed was reached and sealed with grout.

Boring the Holes

Equipment—Electric current in ample supply was available for all construction purposes from the power plant, in which the drop of Truckee Canal, 120 ft. into Carson River, is utilized at this site.

Electric-driven derricks were used in excavating the trench by hand-loaded skips and buckets. Vertical direct-connected motor-driven centrifugal pumps served to unwater the trench of the considerable inflow. A pipe line direct from Truckee Canal furnished water under head of 127 ft. at the bed of the river for all purposes, including testing the borings for leakage under more than reservoir pressure, constant supply for core drilling at adequate and uniform pressure and for grout mixing purposes. A small motor-driven air compressor furnished ample pneumatic pressure up to 100 lb. per sq.in. for operating the grouting machine. A duplex cylinder air-stirring grouting machine of the Cannift pattern was found very effective in forcing the grout into place.

Two drills were used, duplicates, manufactured by Ingersoll-Rand Co., of the "Class G-O" Davis Calyx type, using the calyx bit in the clays and the chilled shot equipment for the harder rocks. This is the smallest made of this type of drill. It is designed for manual operation but these two machines had been each fitted with a 5-hp. motor, giving practically double the capacity at less expense than hand work. Outside diameter of bits was $2\frac{3}{8}$ in., inside $1\frac{3}{16}$ in., yielding hardrock core $1\frac{1}{2}$ in. in diameter. (Fig. 4.)

Boring Procedure—Domestic wells throughout this section are usually cased with about 24-gage galvanized pipe 5 in. in diameter, in 30-in. lengths made by local tinners. This standard stock being available at considerably less cost than 3-in. wrought-iron pipe (which otherwise would have been used), it was assembled in 26-ft. lengths and erected vertically, footed on the rock in the bottom of the 30-ft. trench. These pipes were placed in a double row 2 ft. apart, on 3-ft. centers in each row, with positions alternating in rows so that transversely of the river there was a pipe every 18 in.

The pipes were securely held in position by T-shaped poles made of 2x4-in. stuff inserted in each pipe, while a light framework at the top and halfway down served to steady the battery of tubes in plumb position while concrete was poured into the trench surrounding them.

The coupling on the bottom of a 4-ft. length of 4-in. wrought-iron pipe was thrust into the top of each 5-in. casing and thus completed the 30-ft. depth of drill casing, while serving the further purposes of making a concrete tight joint and a secure anchor for the pipe in the concrete when the grouting pressure was afterward applied.

Concrete was placed in the walls enclosing the casings as shown in Fig. 3. This work was done in two sections, the river being diverted as required. Following concrete placement in the first section the river was diverted over it, while the drilling and grouting were done from movable trestles about three feet above the water, with connection with each casing in turn.

Drills were worked continuously in 8-hr. shifts, thus employing six crews of two men each for operating the drills, with one daylight crew of two to four men for grouting and testing.

Drillrunners were selected mainly from the men of good mechanical bent available on the job, with one or two importations of experts who had been previously trained. Runners were paid 40c., and helpers 30c. per hr.

Daily bulletins were posted showing output of the several crews and thus a wholesome rivalry was developed.

The maximum depth drilled by one machine in 8 hr. was 19 ft., in rather soft material. The average 8-hr. penetration of a drill was only 6 ft. Omitting the earlier period of work, which was largely experimental, the average performance of each 8-hr. shift was about 7 ft. of hole.

There was much hindrance from seamy and caving ground, in which drills would frequently stick, and sometimes a whole shift would be lost in recovering the tools. In redrilling caved ground with shot drills there is difficulty and delay in holding the shot to the hit. In two holes the bits were lost by twisting off the rods, and in one case by pulling them apart with jack screws.

Cores of the penetrated strata were regularly taken where they were hard enough to hold together. Sections of core a foot long were unusual, most of them being $\frac{1}{2}$ in. to 3 in. in length.

Testing Leakage of Holes

For determining the leakage of each hole, or, stated in another way the rate of percolation, under reservoir head, through the ground surrounding the boring, a test was made and a record kept of such leakage from every hole.

The pipe line from the canal was practically bottle tight and was connected in turn with each boring immediately after its completion. By manipulation of valves the water under 127 ft. head was turned into the boring and allowed 1 to 3 min., as found necessary, to fill all interstices and come to static pressure, or to a constant rate of flow which was too small to appreciably affect pressure.

The rate of leakage was found to be practically constant for each hole, though varying widely for different holes. Pressure was usually maintained for 10 min., or long enough to show any advance in rate of leakage.

The same method of testing was employed in "secondary" and "tertiary" borings, situated between borings that had been grouted, for showing decrease of leakage resulting from the adjacent grouting.



Fig. 4. Drilling Outfit at Work at Lahontan Dam

Grouting Process

Experience indicated a mixture of about 1 cement to 7 or 8 parts of water for the greater part of the work. At times when the grout seemed to get away too freely the mixture was thickened to nearly equal parts of cement and water, and in a few instances fine sand was added for filling apparently large seams or cavities.

Air pressure of 25 lb. was employed for first batches, as higher pressures sometimes resulted in appearance of air bubbles and even cement color rising from the bed of the river at some distance from the boring; and violent displacement of the formation was not desired.

As the grouting advanced the later batches were driven in at a higher pressure, gradually increasing to 100 lb. per sq.in. at the finish of each hole.

In some of the tighter holes the extreme pressure was required for an hour or more to drive home the grout, but ordinarily the flow of grout was nearly continuous and as fast as the alternating process with the double-cylinder machine could be performed. A view and a drawing of the grout machine are shown in Figs. 6-7.

The desired quantity of water was first put into the tank through an improvised gooseneck nozzle inserted in the line of hose and hooked over the top of the tank. Air was then admitted into the tank under the water which was thereby agitated for the required stirring effect. The cement being dumped in at this stage, the door in top of the tank was then swung upward against its gasket and held there by increasing air pressure while the mixing process was quickly completed. Meantime the mixture in the opposite tank was being discharged under any pressure desired, as shown by the gage in front of the operator.

With the disappearance of the grout from the telitale at the machine the valves were thrown, air pressure released from the empty tank, and the door fell by gravity. The gooseneck was then hooked on for the next charge of water. And so the process goes on until that particular boring cannot be charged further with grout under 100 lb. pressure.

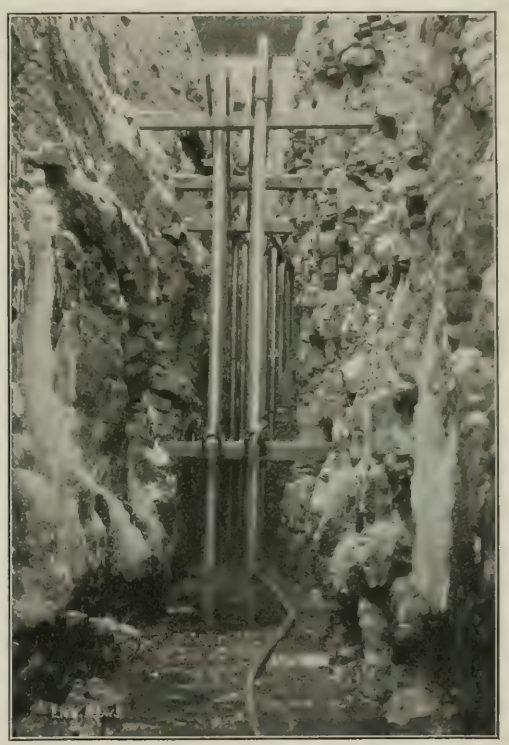


Fig. 5. View of Well-Casings in Cutoff Trench

To accelerate the setting of the cement in the fissures the grout was mixed in warm or hot water passed through a boiler for the purpose.

Order of Progress

The work divided naturally into two sections, conformably to the diversion of the river. In the "First Section" the alternate holes, 6 ft. apart, of the upstream row were drilled, tested and grouted. The drills then passed over the ground a second time to put down the intermediate holes, thus completing the borings on 3-ft.

centers in the upper row, the intention being to fill in to the 18-in. centers by boring and grouting the downstream row if results in the first row proved unsatisfactory. From the results achieved it appeared necessary to drill but few of the holes in the downstream row. In the "Second Section" the plan was adopted of first sinkink each fourth hole, 12 ft. apart, then filling in the intermediates at 6-ft. intervals, followed successively by the quarters at 3-ft. spacing, the testing and grouting progressing in the same order (Fig. 8).

Results of the Work

Among other things it was observed that the grouting had a marked effect in stiffening up the adjacent ground, so that drilling of secondary and subsequent holes was performed with distinctly less difficulties from caving, with consequent clogging of drills. The horizontal seams in the rock were so thin that cement did not intrude in sufficient thickness for making a core which would withstand cutting by the drill in secondary holes. Furthermore the time between drillings was too short to permit hardening of grout in the seams sufficient for coring.

That the grout did harden, however, was proved by the cores taken from deposits which were forced into adjacent casings along the footing plane of the concrete wall. The

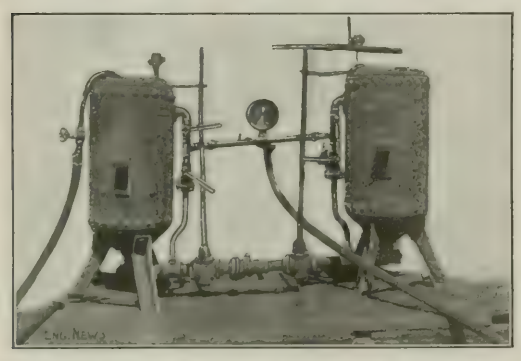


Fig. 6. View of Canfield Grouting Machine Used on Lahontan Dam

(Left-hand tank set for mixing, right-hand tank set for discharge.)

principal evidence of the effectual sealing of fissures and seams appeared in the progressive decrease in leakage as the work advanced from the first to the second, third and fourth sets of holes and also in the decrease of cement required for grouting the later holes.

The latter evidence is less consistent than the former, owing to various freakishness in the escape of grout into pockets formed by caving of the holes, or into casings of other holes, which would not have the same influence on the leakage test. This inconsistency, relatively unimportant, is more pronounced in work of the first section where methods were not at first standardized and less skillful interpretation of results was possible. But in the second section, although leakage of the ground was greater in the initial holes and more cement was required, the reduction of leakage was progressively accomplished with a consistent and highly satisfactory showing, further confirmed by the corresponding reduction in amount of grout required for final holes. One other bit of evidence, not entirely conclusive, was the apparent rise of the water plane, after grouting, in portions of the river bed inclosed by coffer-dam, with consequent inflow to the open trench ahead of concrete work, at points where such inflow had not previously occurred. This phenomenon might have been partially caused by other means, but apparently the sealing of passages in the bed rock by grouting was the principal cause.

The diagrams in Fig. 8 show graphically and in detail the relative position of borings, with a complete record of the drilling, testing and grouting of each hole.

The principal average results are given in Table I.

TABLE I. SHOWING AVERAGE LEAKAGE UNDER PRESSURE TEST AND AVERAGE USE OF CEMENT IN GROUTING

	Leakage of water under 127-ft. head. Gallons per minute per boring	Sacks cement used in grouting. Average per boring
Primary holes, (18) first section	33.1	10.3
Secondary holes, (17) first section	5.5	12.7
Primary holes, (10) second section	71.5	42.3
Secondary holes, (10) second section	28.3	17.6
Tertiary holes, (11) second section	11.2	4.5
2nd tertiary holes, (11) second section	6.4	3.7

Two of the downstream holes in section one, situated in the two 9-ft. diameter outlet conduits through the dam, were bored to a depth of 70 ft. and not grouted. These borings will afford future opportunity to observe

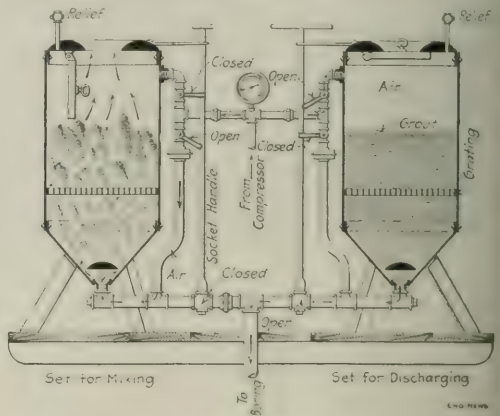


Fig. 7. Details of the Canfield Grouting Machine

the effect of filling the reservoir upon the percolation of the section of foundation which is penetrated by them.

The casings through the concrete wall where not grouted were plugged with concrete.

As elsewhere stated, the deepest boring and grouting reached 100 ft. below the natural stream bed. A number of holes reached 80 ft., and the average depth of sealed foundation strata is about 70 ft.

With the deep concrete cutoff wall extending into the more homogeneous and impervious clay banks of the abutments on both sides of the river it is confidently expected that seepage from the reservoir through the foundation of the dam will be negligible.

Fig. 1 is a map of the site showing the layout of the dam structure. It will be noted from that that the cutoff wall is not in a straight line. Fig. 2 is a view of the site looking northeast. Fig. 4 shows the drilling outfit at work, and Fig. 5 the well casings in position.

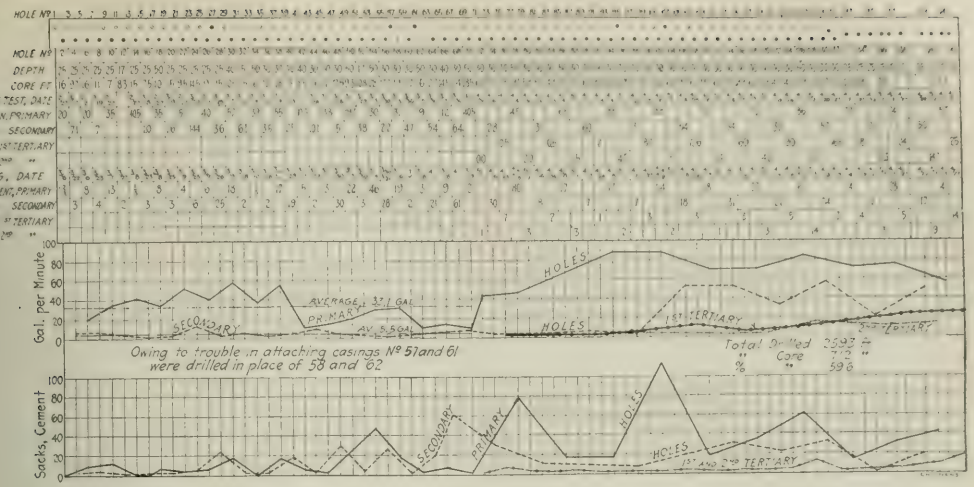


FIG. 8. LOG OF BORING AND GROUTING HOLES IN FOUNDATION OF LAHONTAN DAM

DATA ON HOLES NOT GIVEN IN TABLE

(Holes in upper row on diagram)

	9	17	27	93	103	131
Depth, ft.	40	25	25 70		50	25
Core, ft.	18	14	13 5 35		16	105
Date	2/1	2/1	2/1	25 ft. 1.1 gal 50 ft. 9.1 gal	2 5 gal 11 9 gal.	13 7
Gal. per min.	3.1	2.8	1 7	70 ft 21.8 gal		
Grouted.	Not	Not	2/1			
Sacks of cement			3	6	4	3

COSTS

The cost account is given in the following tabulation and in Table II:

Lin ft. of cutoff treated	220
Number of holes drilled and grouted	83
Average depth holes drilled and grouted, ft	32
Total depth holes drilled and grouted, ft.	2593
Total sacks cement used	1174
Total cost per ft. of hole	$3.57
Total cost per ft. of cutoff wall	42 12
Total cost of boring and grouting	9,267.17
Cost of equivalent length of cutoff by trenching and concreting, based on figures for 30 ft. trench, probably minimum of	$12,590.00
Saving by boring and grouting process	$3,322.83

TABLE II. FEATURE COSTS

Item	Cost Total	Cost Ft. of hole
Foremen	$753.77	$0.29
Making forms, placing pipe	474.94	0.18
Drilling	2397.81	0.93
Grouting	742.68	0.29
Corral expense	98.00	0.04
Supplies—fuel and oil	19.60	0.01
Supplies—lumber	75.03	0.03
Supplies—miscellaneous	192.32	0.07
Material—cement	814.45	0.31
Material—pipe	1121.38	0.43
Repairs	186.74	0.07
Power	86.83	0.03
Repair plant	138.46	0.05
Equipment depreciation	911.87	0.35
Total field cost	$8013.88	$3.08
Engineering	487.03	0.19
Superintendence	195.43	0.08
Clerical	165.47	0.06
Camp maintenance	306.54	0.12
General office expense	98.84	0.04
Aggregate cost	$9267.17	$3.57

PERSONNEL

The work was done between February and May, 1912, under the regular organization of the U. S. Reclamation Service engaged in the construction of Lahontan Dam by administration forces. Immediately in charge of details was H. S. Rands, Assistant Engineer, who had previously accomplished similar work in the foundation of the Estacada Dam, Clackamas River, Oregon, for the Portland Railway Light & Power Co.

The excellent results and the complete record of them are largely due to the expert and faithful efforts of Mr. Rands in coöperation with the Superintendent, L. G. Maney, and the Resident Engineer, F. H. Tillinghast.

❋

Corrosion of a Long Steel Pipe Line, at Port Elizabeth, South Africa, is reported in the Cape Times," of Jan. 30, as follows:

A long debate on the water-works took place at today's meet of the Port Elizabeth Town Council, when it was stated that seven million gallons of water were being lost monthly between the water-works and the town owing to a leakage in the pipes. When the new water-works were constructed some six or seven years ago the town saved many thousand pounds in the cost of transport by laying down steel mains instead of cast iron. Washouts about a year ago revealed that this steel pipe was not wearing at all well; in fact, at several points it was discovered to be completely rusted through. The defective pipes were replaced, but now it transpires that practically the whole main, over 25 miles long, is affected and will have to be replaced. The Council decided to delay action pending a detailed inspection of the main by the Board of Works.

A New Form of Cooling Tower, for use in connection with low-pressure steam turbine installations where the available supply of condensing water is limited, is being introduced by the Wheeler Condenser & Engineering Co. The tower is of wood, largely cypress, which lasts indefinitely under conditions that would rot out other varieties. No fan is used, the draft being natural. Cold air enters at the bottom of the stack, and is drawn up by the chimney effect produced by its taking heat away from the water jets. The water is admitted about half way up the stack and is distributed evenly in the horizontal plane through a system of pipes. Flowing through apertures in these pipes, the water falls through layers of wooden lathing inclined and crossed in such a way as to produce a thorough breaking up of the drops into very fine particles, resembling a thin film or spray. At the bottom of the tower the water flows into a storage tank or wells from which the condenser is supplied.

With such an arrangement as described, the temperature gradient between air and water tends to remain fairly constant since the initial contact between them at the bottom of the tower occurs with the air and water both at their coolest, while the final contact takes place at the top of the cooling bank with both air and water at their warmest point. Figures taken from 24 tests at two different plants and under varying conditions of temperature, humidity and quantity of water, show an average temperature difference between air entering and water leaving of 9+° F. and the same difference of temperature between water entering and air leaving. In the same tests the air was found to leave in each instance with 100% humidity, that is, it carried away all the water theoretically possible at the given temperature and pressure.

The Topographic Survey of Cincinnati*

By Hugh C. Mitchell†

SYNOPSIS—A description of the topographic survey of a thickly settled city, primarily for the improvement of a comprehensive sewerage system, giving the various steps, the triangulation, measurement of the base line, precise levels, transverse work and planetable work in detail.

In planning a topographic survey of a city like Cincinnati, Ohio, or of any extensive area, various questions arise which must be satisfactorily answered before the parties take the field. These questions may be stated briefly as follows: (1) On what scale is the map to be made? (2) What kind of projection is to be used in plotting? (3) To what datum plane will elevations be referred? (4) How is the relief to be shown and in what detail? (5) What artificial features are to be mapped? Dependent on these are two more questions, (1) With what degree of accuracy is the map to be made? and (2) How is it to be made? That is, what instruments and what methods are to be used?

Primarily the uses which the topographic map is to subserve determine the amount and kind of detail (relief, drainage and culture) which is to be mapped, and the accuracy with which this mapping is to be done. This being decided upon, a scale is selected on which the various desired features can be shown, and instruments and methods adopted with which the required results can be obtained.

What projection to use is another question. Its selection is governed largely by the extent of the area under consideration. Many different kinds of projection have been devised by mathematicians, but only two, besides the simple rectangular system, have been adopted to any extent by engineers: the Mercator, a projection on a tangent cylinder, and the polyconic, a projection on a series of tangent cones. For limited areas the rectangular linear projection is generally used. Its simplicity recommends it, and the ignoring of the convergence of the meridians makes it a desirable projection for use in traverse work.

The questions proposed are best answered in a general way, as follows:

Objects of the Survey—It was decided after a thorough study of the subject to produce a map which would serve not only the immediate needs of sewer planning, but would also be acceptable for general engineering use in the office of the city engineer. Such a map could be used not only for planning relief and storm sewers, or a complete sanitary sewer system and the location of disposal works, but would also serve in locating new roadways, laying out subdivisions, improving creeks for landscape and park work, for bridge work, city planning, and even for architectural work.

Scale Adopted—In order to show the desired features, relief, roads, drainage, streets, prominent and public buildings, and benchmarks, with sufficient detail and accuracy a scale of 1 in. = 400 ft. was adopted. In proportional parts this is 1 in 4800. On this scale it is possible to show the heavy relief around Cincinnati by contour lines. Even where the cliff-like slopes merge the contours into almost solid masses, the effect is to accentuate the expression of the topography. To fit the varying degrees of relief, it was decided to use a 2½-ft. contour interval on slopes of less than 6° (10%); a 5-ft. contour interval on slopes of more than 6° and under 12° (20%); and a 10-ft. contour interval on slopes of more than 12°.

Datum Plane—The datum adopted was mean sea level, the ultimate datum of all engineering work. We were fortunate in having in Cincinnati and vicinity a number of benchmarks whose elevations above mean sea level are known, having been determined by lines of precise levels run by the United States Coast and Geodetic Survey, dependent on many years of tidal observations. To show the effect of the adoption of a mean sea level datum on the horizontal projection, I will say that a line 18 miles long (Cincinnati's greatest dimension) and at an 800-ft. elevation, when projected on a mean sea-level surface is shortened 3.6 ft., or $^1/_{26000}$. On the scale adopted for the survey this amounts to less than $^1/_{100}$ in.

Putting this in another way, the engineer who uses our map is safe in measuring his traverses in the usual way and applying the results to the map without first making a sea-level reduction. If the engineer is using a 1 in. = 400 ft. sheet, the correction to sea level on a line across one sheet can never amount to more than $^1/_{1000}$ in. If he be using a 1 in. = 1200 ft. wall map, which it is hoped we will be able to publish, the longest line will receive a reduction which will plot less than $^3/_{1000}$ in.

Kind of Projection—In selecting the kind of projection to be used the polyconic projection was rejected for the slightly less accurate rectilinear coördinate system. By slightly less accurate is meant that for small areas the polyconic projection gives the most accurate representation on a plane of a system of lines measured on the ground and referred to a common datum. The laying out of a polyconic projection, however, requires a special set of tables; and where a number of projections are to be worked on and later combined into one map, as we expect to do here, these various projections must be laid out, not independently, but as parts of a single system having only one central or straight meridian. This, most assuredly, would be no small task.

Inaccuracies of a Rectilinear System of Projection—If we construct a polyconic projection on a scale 1 in. = 400 ft., a parallel of latitude 18 miles long would be represented by a curved line about 20 ft. long; the total actual curvature being 42 ft. or 0.1 in. on the map. On the rectilinear projection this same parallel would be shown as a straight line of practically the same length. Other parallels would be similarly displaced; the displacement of meridians would be much less.

These values represent the greatest divergence between two maps of the city made on the two projections on the adopted scale of 1 in. = 400 ft. Notice, however, that the divergence is one of position, not of length. The divergence in length of any line scaled from the two maps would not be as much as 10% of 42 ft., or less than 5 ft.; and on a single sheet, representing as it does an area ap-

*Read on a paper read before the Engineers' Club of Cincinnati, Nov. 21, 1912.

†Engineer in charge of topographic survey, Cincinnati, Ohio; formerly Assistant and Computer, U. S. Coast and Geodetic Survey, Washington, D. C.

proximately 1½ by 2 miles, the two projections practically agree, their greatest divergence amounting to 0.5 ft. or only $^1/_{800}$ in. by scale.

The advantages of the rectilinear coördinate system are the simplicity of construction and the use of a single meridian for all traverse work, thus avoiding the use of tables for convergence of meridians, and greatly simplifying the computations.

Methods and Instruments—The survey work may be divided into three groups: (1) precise control, (2) primary control and (3) topographic work.

(1) The precise control consists of the triangulation and the precise levels.

(2) The primary control comprises the measured traverses and elevations determined with wye levels. It is the connecting link between the precise control and the topographic mapping.

(3) The topographic work consists of the making of the map itself—the delineation on paper of the various artificial and natural features required to be shown.

The Triangulation—The triangulation scheme consists of primary stations, secondary stations, and intersection or tertiary stations. The lengths of this triangulation are controlled by two base lines. One is a line of the great arc of triangulation which extends across the United States approximately along the 39th parallel of latitude. Not only does this line (the southern line of our scheme), which lies in Kentucky some 8 or 10 miles south of Cincinnati, control the lengths in our triangulation, but it fixes the position and orientation of that triangulation on the spheroid. In other words the geodetic latitudes, longitudes and azimuths of this line furnish the data for computing the geographic positions of all points of our triangulation, and the true azimuths of all our lines. This will make our triangulation a part of the great system of triangulation which comprehends practically the entire country. From our triangulation station on the Hughes high school we can go by unbroken chains of triangulation to the Straits of Juan de Fuca, to Key West, Fla., to Calais, Me., or to San Diego, Calif.

The other line which controls the triangulation lengths (and lengths only) is a measured line (Fig. 1), measured along Clifton Ave. and referred to the line connecting the two triangulation signals on the Hughes high school and the Clifton school.

Base-line Measurement—This base was measured with apparatus generously loaned to the city of Cincinnati by the U. S. Coast and Geodetic Survey and consisting of three invar tapes, each 50 m. in length, with tape stretching apparatus and thermometers. These tapes have a coefficient of expansion per degree Centigrade of 0.0000001 as compared with 0.000011 for steel tapes. In measuring, these tapes were supported at both ends and middle, the middle point being on grade between the end points. The ends of the tape were held to fine lines on copper strips nailed on 3x4-in. posts set firmly in the ground. In measuring the base line an innovation in such work was introduced by breaking the line actually measured by right-angle offsets. This was necessitated by a jog in the line of the street and in order to have the measurement made along the lawn bordering the street, instead of in the middle of the street. The Clifton Ave. base line is 2395.8665 m. long, with a probable error of 6.5 mm., which represents 1 part in 400,000. This is a rather large probable error for a measure of this kind, but it was expected because of difficulties encountered in measuring along a much traveled thoroughfare like Clifton Ave.

The base line as measured was referred by measured angles to the line of the triangulation connecting the signals on the Hughes high school and Clifton school (see Fig. 2). In carrying this length through the triangulation to the line Stevens-Tanner of the Coast and Geodetic Survey triangulation the discrepancy developed, as determined by the least square computation, was 1 part in 55,000.

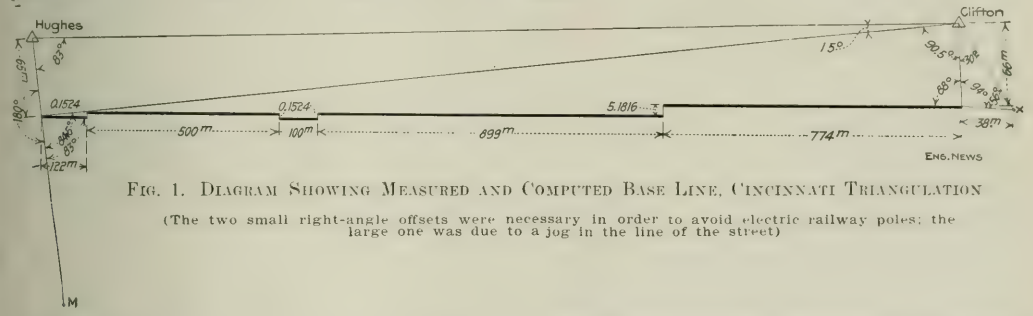


Fig. 1. Diagram Showing Measured and Computed Base Line, Cincinnati Triangulation

(The two small right-angle offsets were necessary in order to avoid electric railway poles; the large one was due to a jog in the line of the street)

Angle Measurements—The angles of the triangulation net were measured either with a 12-in. direction theodolite or with a 10-in. Gambey repeating theodolite. The direction theodolite was used on signals such as Eden Park water tower, Hughes high school, and on especially constructed towers which rested on the ground. The repeating instrument was used on the more unstable signals, such as the towers which rested directly on the roofs of the Madisonville, Westwood and Warsaw public schools.

In using the 12-in. theodolite the directions of the various signals observed were referred to some one signal as an initial. The primary directions were observed with telescope direct and reversed, and for the horizontal circle in each of 16 positions. The tertiary signals were observed from each of two positions of the circle. The direction instrument has no vernier, but its circle carrying 5′ graduations is read by means of three micrometer microscopes to single seconds. A primary station like the Hughes high school, from which 13 primary directions radiate, necessitated 2500 micrometer readings on the primaries alone.

In using the repeating instrument the angles between adjacent stations were measured, the angle to close the horizon being always measured. Each angle was measured with six repetitions on the angle itself with telescope in position direct and followed immediately with six

repetitions on the explement with telescope reversed. Each six repetitions constitute a "set," and 10 such sets of measures were made on each angle, five on the angle and five on its explement. Any set giving a residual of more than 4″ from the mean was rejected and a new measure made to replace it. In the direction instrument work the limit of rejection was 5″.

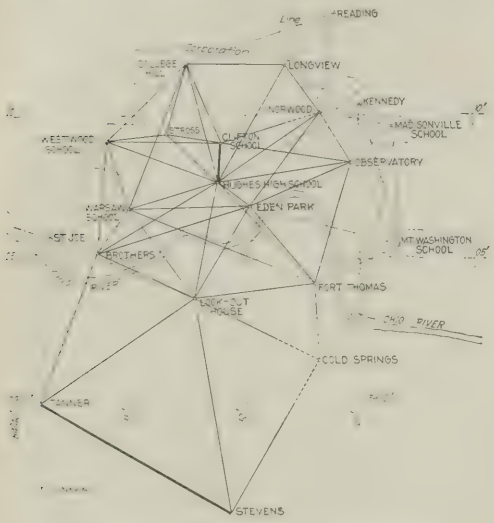


FIG. 2. TRIANGULATION NET OF CINCINNATI TOPOGRAPHIC SURVEY

The tertiary signals of the triangulation net consist of objects such as steeples, cupolas, chimneys and stacks. Their positions were determined to help control the topography. The average closure for all the triangles of the net was 2.61″. In all, the triangulation fixed the geographic position of 17 primary stations, 2 secondary stations and about 50 tertiary stations.

PRECISE LEVELS—The precise-level instrument and rods used in this survey were loaned the city of Cincinnati by the Coast and Geodetic Survey. The instrument used is a type devised in the instrument shop of the Coast and Geodetic Survey, and is steadily coming into favor with the geodetic surveys of foreign governments, and with municipal engineers.* This instrument is irreversible and as simple as possible. The telescope is mounted on trunnions between its center and objective, while its eye-end is supported on the point of a micrometer screw. The level phial is countersunk into the barrel of the telescope and is fixed except for a small range of motion required for its adjustment. By the use of nickel iron having a low coefficient of expansion for the casting of this instrument, the effect of temperature has been practically eliminated.

The rods used with this instrument are self reading, single sticks of cross-shaped section, and have been rendered impervious to weather conditions by boiling in paraffin. The shoe of the rod is cylindrical, with a rounded or hemispherical-shaped bottom. Such a shoe requires a plane or a cup-shaped surface for a turning point. Speaking of turning points, let me say that the use of street-car rails as turning points has been thoroughly tested and found to be most satisfactory. In the precise-level work done by the U. S. government, rails are used almost exclusively for turning points.

Two rods were used, but only a single line was run at one time. Each section between benchmarks was leveled over backward and forward. The two measures are usually made under different conditions, that is at different times of day, and the like. The limit, which, when exceeded, demanded a rerunning of a section between benchmarks is an agreement between the backward and forward runnings over that section of 4 mm. $\sqrt{K}$ or 0.017 ft. $\sqrt{M}$, in which K or M represents the length of the section in kilometers or miles.

In planning the precise-level work reference was had not only to the needs of the topographic survey, but also to the future needs of the city's engineering department. In all 217 benchmarks have been set in and around Cincinnati.

BENCHMARKS—These benchmarks consist of either bronze caps or discs, bearing the legend: "City of Cincinnati, Topographic Survey of 1912, Bench Mark No. ——" (see Fig. 3). The discs have a corrugated tenon extending from their under side, which is cemented into solid and permanent masonry structures. In a few cases a column of concrete was made and the discs set in top of same. The caps are screwed on top of iron pipes, which are split and spread at the bottom and are filled with concrete and set in concrete.

These benchmarks are, as a rule, set in pairs, and are given such geographic distribution as will place at least one pair of benchmarks in each square mile of territory. In placing the benchmarks in pairs it was aimed to insure against the use of a benchmark which had undergone

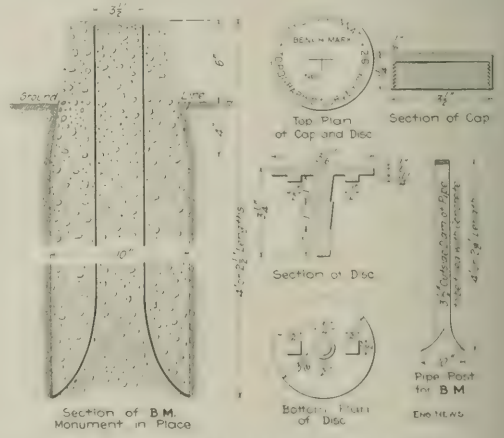


FIG. 3. STANDARD BENCHMARK, CINCINNATI CITY TOPOGRAPHIC SURVEY

any change in elevation. It was intended that the engineer should start from a pair, and if he finds the two benches of a pair unchanged in their relation to each other he is reasonably safe in assuming the elevation of the benches correct. The two benches of a pair, while usually placed about one block apart, are sometimes several blocks apart.

*A complete description by Mr. Mitchell of this level may be found in ENG. NEWS, Mar. 23, 1911, p. 356.

A few of the closing errors of the precise-level circuits may prove interesting. The first circuit—from Winton Place through Norwood to Madisonville, down through Hyde Park and Walnut Hills to the Court House, thence through Clifton to Winton Place—failed to close by 17 mm., or ⅔ in. The length of the circuit was 15 km., or 28 miles. The circuit from the Court House over Eastern and Delta Aves. to Erie Ave. closed on a portion of the line just referred to with an error of 13 mm., or ½ in. The length of the entire circuit was 27 km., or 17 miles. A line out Reading and Paddock Roads from Florence Road to Ross Avenue failed to close by 15 mm., or 0.6 in., on the circuit through Madisonville. The length of



FIG. 1. TRIANGULATION STATION ON THE HUGHES HIGH SCHOOL; TRIPOD RESTS ON CONCRETE FLOOR BELOW THROUGH HOLES IN ROOF

the entire circuit was 31 km., or 19 miles. A line up Mill Creek Valley between permanent benchmarks of the Coast and Geodetic Survey failed to close 12 mm., or ½ in. The line was 9.5 km., or 6 miles, in length.

TRAVERSE—The connecting link between the precise control and the actual mapping of the topography is the traverse work or, to more definitely distinguish it, the principal traverse. This consists of a network of measured lines fixing the horizontal positions of a large number of stations which are well marked on the ground. These lines were nearly all measured with a 150-ft. steel tape, deflection angles being measured with a Berger engineers' transit, reading to minutes. This network of traverse lines will, in a certain measure, be adjusted to the triangulation. Over these various traverse lines are run lines of wye levels which are connected with precise-level benchmarks, and in this manner a sea-level elevation is obtained on each traverse station. The traverse lines were run in closed circuits, the average closing error being 0.37 ft. per 1000 ft., or 1 part in 3000. The average closing error on the wye-level lines amounted to 0.031 ft. per mile.

TOPOGRAPHY—After considerable study of instruments and methods the planetable was adopted as best suited for this part of the work. It may be interesting to mention some of the arguments for and against the planetable as compared with the transit. The principal arguments for the transit are the greater number of engineers available who are familiar with such work; the greater progress in the field, due to carrying a good portion of the work into the office, and, perhaps the greatest consideration of all, the fact that when the map is completed the transits secured for the work can be utilized for other purposes.

Against the taking of topography with the transit is the one very important reason, the possibility of blunders in the observations creeping undetected into the map; and the smaller consideration, the unnatural appearance or stiffness of the resulting map. Against the use of the planetable are two arguments: the difficulty of securing men trained in such work, and the fact that the completion of the map would leave the city in possession of a number of planetables, instruments practically useless for other work. Balancing these arguments were the facts that with the planetable a good topographer secures an accurate and a true expression of the topographic forms, and that blunders such as do sometimes occur in transit work can not occur in planetable work where reasonable care is taken.

METHODS—Each topographer is furnished the smooth sheet on which the control, that is the traverse stations, is plotted to scale. This he fastens to his planetable board with thumb screws. He is also given a data sheet—a blueprint on which is shown on the same scale as his smooth sheet all the traverse work on which the topography plotted on the smooth sheet is based. On the blueprint are given all data which the topographer requires, consisting of descriptions and elevations of all stations. Referring to this blueprint the topographer identifies the stations marked on the ground, and orients his table. In certain portions of the map where tests show that there is no local magnetic attraction and also where



FIG. 5. EXAMPLE OF CINCINNATI TOPOGRAPHY: MILL CREEK, A PRESENT SEWER EFFLUENT

thick brush and high weeds render orientation by backsighting impracticable, the magnetic needle is used for placing the table in orientation.

Each topographer works in circuits, which he always closes. His closing error is the index of his work, and we demand that it shall not exceed 5 ft. or one division of the plotting scale. Some of these circuits are really traverses with the planetable between points fixed by the principal traverse and more than 3000 ft. apart. Our demand for a closure that is practically exact is always met. These closures are quickly and easily checked in the field by an inspector. A random line cross-sectioning any part of planetable traverse also gives an excellent



FIG. 6. PLANETABLE WORK UNDER DIFFICULTIES: TOPOGRAPHIC SURVEY OF CINCINNATI

check on the general accuracy of the planetable work and would show at once any "fudging" of traverse lines.

The greatest obstacle which has been encountered in holding the high degree of accuracy which has been adopted as standard is the unstable character of the paper used for the planetable maps. Ordinarily paper which is to be used for work of this kind should have at least two years of seasoning. Such paper could not be secured for this survey, but the best paper available was obtained. Some of it, however, was in the field within less than a month after it was mounted. As a result some of the paper shows an extreme change of 7 or 8 ft. per 1000 between a dry day and a humid one. The sheets consist of two pieces of super-super paper mounted with grains at right angles with muslin between. The sheets are 24x31 in. in size, the map area being 20x27½ in., representing an area on the ground 8000x11,000 ft., or 3.16 sq.m. The accuracy of the planetable work which is being done on the map of Cincinnati is such that the shrinkage of the paper used swallows up all errors of observation and plotting.

This planetable work is done by contract, which was entered into only after it was determined that experienced men in this line of work were not otherwise available. The firm of Brown & Clarkson, topographic engineers of Washington, D. C., is doing this work, and the city of Cincinnati is fortunate in having secured the services of men who bring so much ability, experience and integrity to their work as will insure the city a topographic map comparable in many ways with the maps of the cities of Washington and Baltimore. The cost of the Cincinnati map will be less than one-fourth that of the Baltimore or Washington maps.

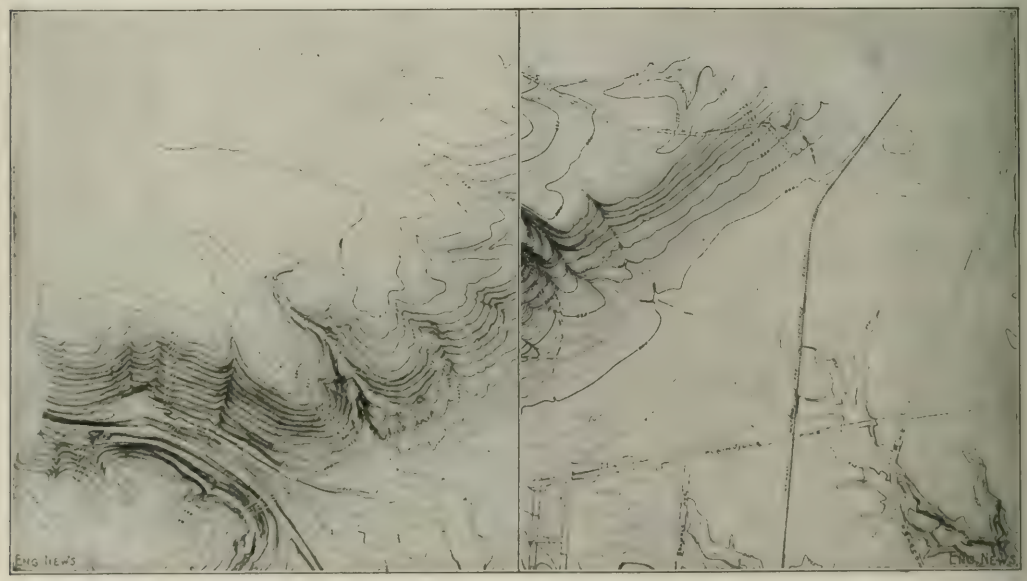


FIG. 7. SAMPLES OF CINCINNATI TOPOGRAPHY: PHOTOGRAPHS OF PLANETABLE SHEETS

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Electric Traction is to replace steam, for suburban traffic, on the main line of the Pennsylvania R.R. between Philadelphia and Paoli, Penn., a distance of some 20 miles, according to an announcement of the directors on Mar. 13. It is expected that the cost will amount to $4,000,000.

A Great Steam-Electric Power Plant*

By W. L. Abbott†

SYNOPSIS—The electric-generating plants of the Commonwealth Edison Co., at Chicago, have presented many special features of interest in novelty and size of the equipment, and among the most recent developments is the planning of an immense station of 240,000 kw. capacity, with turbo-generator units of 20,000 kw. each. The first two units are now in operation and are notable as being the largest ever built. The following article descriptive of this new power station is of interest in that it outlines some of the features governing the location and design of the station, besides giving a description of the complete plant (as proposed) and its initial installation. We call particular attention to the last portion of the article, which shows that owing to the rapid development of machinery of this kind, the present units (although of such recent date) will soon be eclipsed by others, and that the future units probably will be of an entirely different type from those now in service.

The dominant factors in determining the selection of a power site are those involving the economical handling and utilization of coal. As the cost of fuel greatly exceeds all other operating costs combined, and as the consumption of fuel when running condensing and non-condensing is in the ratio of 2 to 3, it appears that unless the coal consumption is to be increased 50% the power house must be accessible to an abundant supply of condensing water. This then is the first consideration for a power-house location.

If we assume $1.70 per ton as the average price of coal in Chicago, and 60c. a ton as the minimum cost of cartage from a railway to the power house, it appears that unless the cost of fuel is to be increased 25% the power house must be located adjacent to a railway and preferably on the road which brings the coal to the city. Therefore, the determining factor of second importance is railway facilities.

SELECTION OF SITE

Desirable power-house sites are hard to find, so when a satisfactory location is found it is advisable to provide for a good-sized installation, which will take care of all increases in the load for a considerable period, say five years. At the time the Northwest Station was to have been started (winter of 1911-12) the maximum load on the company's system was about 200,000 kw., and the indications were that for a number of years the increase would average 15% a year, which indicated that the net increase of load during the following five-year period would amount to about 220,000 kw. Accordingly, acreage sufficient to accommodate two power houses of 120,000 kw. each was sought. It was not the intention to install this amount of power all at one time, nor even during the five years mentioned, as existing power houses could still be added to and other new power houses might be commenced. But it was considered that a site which might be built up at will and eventually accommodate 240,000 kw. would not be at all too large.

What acreage is required to accommodate a 240,000 kw. power house? Experience has shown that a power house supplying a diversified metropolitan load will at some seasons of the year run at a load factor of 50% of the installed capacity. For a 240,000-kw. installation this will require a daily coal supply of something over 4000 tons, or about 100 car-loads. To make a moderate allowance for the uncertainties of freight traffic over a distance of 200 miles, provision should be made for storing on the property at least three days' supply of loaded and one day's output of empty cars, amounting altogether to 400 cars, which will require four miles of storage tracks. The Chicago market is subject to an interruption of its coal supply every two years, pending a discussion of the wage scale, such interruptions lasting sometimes as long as three months. Therefore, a public service company of our kind should have facilities and room to store at least 90 days' supply of coal, which for the power house under consideration would be about 350,000 tons.

The power house, storage tracks, storage pile, and switch tracks will require about 50 acres, but after allowing for convenient spacing, parking and recreation grounds it will be found that the total space required for such a plant is not less than 75 acres, the greater part of which is for receiving, storing and handling coal.

On the west side of the north branch of the Chicago River, and north of Roscoe St., was found a 55-acre tract, the remains of the old Bickerdike farm. The Chicago & Northwestern Ry. is nearly a mile from the river, but the intervening space is occupied by the Bickerdike tract, two blocks of dwelling houses and a 40-acre truck garden. This situation at once suggested that the two pieces of property be bought, and also right-of-way for a private railway connecting with C. & N. W. Ry. and crossing the residence blocks, which are built up with cottages and two-story dwelling houses.

GENERAL DESIGN OF POWER STATION

An aggregate of 240,000 kw., or 350,000 hp., in one building would create possibilities for an interruption to the entire supply. It was deemed prudent, therefore, to divide this capacity between two separate power houses of equal size.

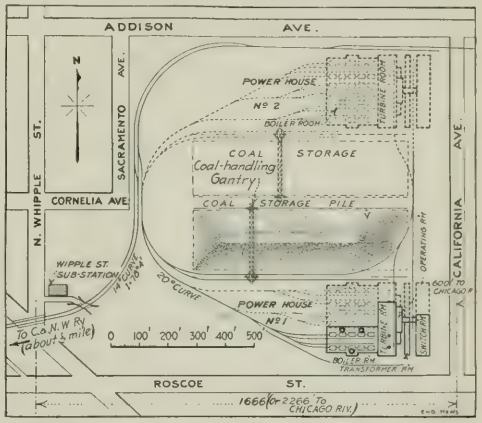


FIG. 2.

Fig. 1. Plan of Projected Northwest Generating Station of 240,000 Kw. Capacity, and Its Initial Installation; Commonwealth Edison Co., Chicago

Since the purchase of the land, California Ave. has been opened, cutting the site in two. But this probability had been foreseen, and the station's coal pile and trackage were located west of this avenue.

Fig. 1 is a general plan, showing the two power houses, facing on California Ave. and symmetrically arranged on either side of a central east and west axis. Each has its system of railway tracks and has a large storage field spanned by a gantry crane 265 ft. long.

Each of the two buildings consists essentially of a turbine room 70x290 ft., and 55 ft. high, on one side of which is the boiler room. The boilers are arranged in rows of ten, one row opposite each turbine and with a smokestack to each row. Each building is designed for six turbines and 60 boilers, as shown. The transformer house and the switch house are in separate though connected buildings. About 66% of the first building group has been completed, although only 33% of the equipment has been installed.

The coal railway to the C. & N. W. Ry is a double-track line, elevated so as to cross all streets by bridges, and the city ordinance under which the company built this line in a residence district required that electricity must be used for the motive power. The company has purchased two 60-ton electric locomotives (each with four motors of 200 hp.), and

*Abstract of a paper on "The Northwest Power Station of the Commonwealth Edison Co.," read before the Western Society of Engineers, Chicago, Dec. 22, 1912.

†Chief Operating Engineer, Commonwealth Edison Co., Chicago.

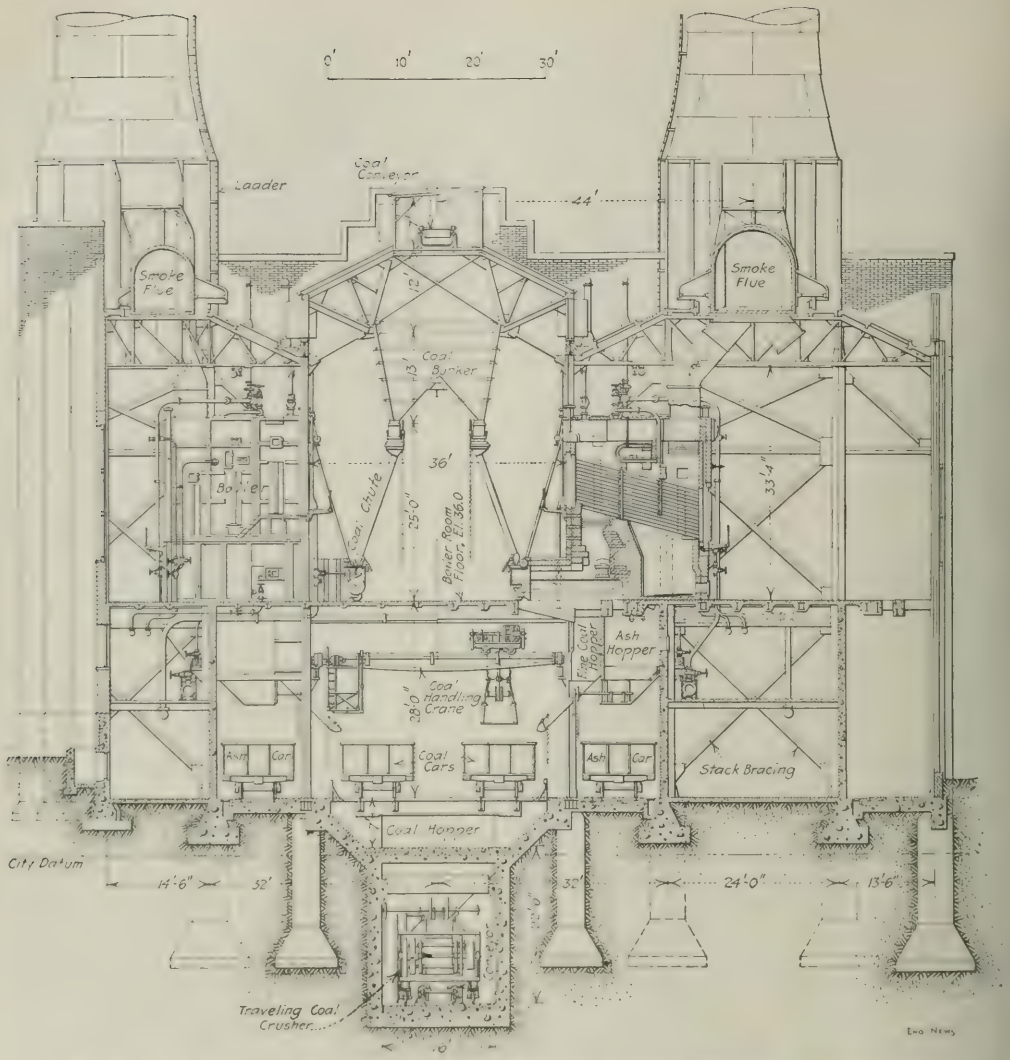


FIG. 2. CROSS-SECTION OF BOILER HOUSE AT THE NORTHWEST POWER STATION; COMMONWEALTH EDISON CO., CHICAGO

tee sheads equipped three miles of track with a third-rail conductor. It is recognized, however, that in a switch yard an overhead supply of power may be preferable, and for that reason each locomotive is equipped with a pantagraph trolley.

CONDENSING WATER

The water for condensing is drawn from the river through a double-deck tunnel, the upper conduit being used for the outflow, which is discharged into the river at a point several hundred feet down stream from the intake. In dry weather the natural flow of the north branch is relatively insignificant. The greater part of the flow is pumped from the lake into the North Channel of the Chicago Drainage Canal at Wilmette and a smaller quantity is pumped from the lake through the Lawrence Ave. conduit.

The Wilmette pumps are electrically operated, and should this power be interrupted and the pumps stopped when the station is carrying a full load, the flow of the river would not be equal to the amount pumped for the condensers. It would, therefore, be necessary to pump a portion of the discharge around and through the condensers a second time, at a higher temperature and with some impairment of the vacuum. If the Wilmette pumps and the Lawrence Ave. pumps were stopped at the same time, the river water in a few hours would become too hot to be of use for condensing. To minimize as far as possible the embarrassment which would result in the improbable coincidence of a long shutdown of both the pumping plants during dry weather and at time of full load on the station, the intake tunnel is made to draw its water from the bottom of the river at a point some distance up stream from the warm water discharge, thus using for a time the river as a storage reservoir and a cooling pond.

BOILER PLANT

The coal supply system and coal and ash handling arrangements are shown in Fig. 2. Cars containing coal are

run onto tracks over the receiving hoppers under the boiler room. There the coal is dumped into the first receiving hoppers and from there it passes through the coal crusher and into the conveyor, which elevates it to the second receiving hopper above the firing floor in the boiler room. From this hopper it is drawn by gravity, as required, to the stokers in front of the boilers. If the coal cars have drop bottoms, the unloading is quickly done by opening the drops. If a car does not have a drop bottom, it is unloaded at a cost of 2c. a ton by a 2-yd. clam-shell bucket operated from an overhead crane.

In its passage through the boiler house the coal is handled on five different levels and in nine operations, as follows: 1, delivered on the unloading track; 2, dumped into first receiving hopper; 3, run through crusher, 4, discharged into conveyor; 5, elevated to second receiving hopper; 6, drawn off to stokers; 7, dumped from back end of chain grate to ash hopper; 8, discharged into empty coal cars; 9, hauled away. The boiler house is so designed and equipped that at no point in the handling of the great volume of coal is it necessary to use manual labor.

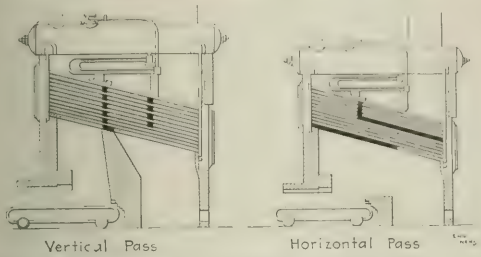


FIG. 3. ALTERNATIVE ARRANGEMENT OF BOILERS WITH VERTICAL AND HORIZONTAL PASS FOR THE GASES

The boilers are arranged in rows of ten each, facing each other on opposite sides of a common firing room, so that one set of firemen and water tenders can look after 20 boilers. Each ten boilers is served by a tile-lined steel stack 17 ft. inside diameter and extending 275 ft. above the boiler room floor.

In designing the boiler furnaces it was recognized that they must burn the smokiest kind of soft coal screenings practically without smoke. The fundamental principle in smokeless furnace design is to provide a chamber of high temperature and of sufficient length or volume to insure complete combustion of the luminous flame before it comes in contact with the boiler tubes. This can be done perfectly in a furnace having a tile roof, but unfortunately two other things, both undesirable, are also accomplished. The changed gas passage restricts the draft and reduces the boiler capacity, and at the same time the furnace temperature is so high that the expense of maintaining furnace walls and arches is greatly increased.

In the design used at the Northwest Station the boilers were set with the high end of the sloping tubes to the front and 10 ft. above the grate, this great height serving as a vertical combustion chamber, with ample capacity to give the flame time to burn out before it reached the tubes. The draft would not be restricted and the brick work would be conserved by the temperature being kept down through the absorption of radiant heat by the exposed tubes. The second battery was set like the first (except that they were given a horizontal gas pass, the purpose being to give the two designs thorough comparative tests and adopt that which proved to be best. The two arrangements are shown in Fig. 3.

Each boiler should be able to easily generate 30,000 lb. of steam an hour, or 70% more than normal rating, and this rate of steaming will require a rate of coal burning of 4500 lb. an hour under each boiler, or 75 lb. a minute. This means that in each second of time 300 cu.ft. of air passes through the grate and in the heat of the furnace becomes 1500 cu.ft. With 60 boilers all running at the maximum rate, the amount of air entering the grates each minute is over 1,000,000 cu.ft. If this were all drawn through the boiler room on a winter day, the firemen would be obliged to go out of doors to get warm; but provision is made to admit air directly under the grates from the train-shed below.

These boilers have each 5800 sq.ft. of water heating surface and 350 ft. of steam superheating surface, and are equipped with traveling chain grates of 115 sq.ft. area. Steam is raised to a pressure of 250 lb. and is superheated 125°. The steam is taken from the boilers through 6-in. pipes connected with a 16-in. header supported on roller bearings in the header room. Connecting the steam headers is an 8-in. crossover, by means of which steam from one unit may be supplemented with steam drawn from the adjoining unit. The safety valves blow off through vertical exhaust pipes leading to the roof, thus eliminating the danger and discomfort of steam at high pressure discharging into the boiler room.

Each battery of boilers is provided with two 5-in. three-stage centrifugal boiler-feed pumps driven by Curtis steam turbines at 2300 r.p.m., and having a capacity of 700 gal. per min. against a pressure of 285 lb. The feed-water is pumped from the condenser at a temperature of about 75° into a closed feed-water heater of 4000 sq.ft. heating surface, in which it is heated by exhaust steam from the auxiliaries. A float valve at the top of the heater regulates the admission of make-up water into the condenser.

TURBINES AND GENERATORS

The 290 ft. length of the turbine room permits a spacing of 44 ft. for the generator units, and as the maximum outside diameter of the turbines is 15 ft., there is ample floor space for the auxiliaries. This room is spanned by a 110-ton traveling crane. The turbines are of the Curtis vertical-shaft type, rated at 20,000 kw. capacity and running at 750 r.p.m. One of these great units is shown in Fig. 4. They are six-stage, each wheel having two rows of buckets built in sections and riveted to the disk which forms the central part of the bucket wheel. The outside diameter of the sixth wheel is 13 ft. 2 in. and the peripheral velocity is over 500 ft. per sec., or about 6 m. per min. The guaranteed steam consumption, with steam at 250 lb. pressure and 100° superheat, is 14 lb. per kw.-hr. at loads of 10,000 and 20,000 kw. and 13.45 lb. at a load of 15,000 kw.

The weight of the steam end is 200 tons and of the generator 230 tons, making a total of 430 tons, of which 100 tons is in the revolving elements. This great weight is supported on the step bearing, the two halves of which are kept from direct contact by oil which is forced into the bearing at a pressure of 800 lb. per sq.in., to which the pump pressure of 1200 lb. is baffled down. Floating on this oil system is an accumulator weighted to 30 tons. Should the accumulator sink to a predetermined level, owing to failure of the steam pump, it would automatically put into operation an auxiliary electrically driven pump.

The condenser, on which the turbine rests is designed to condense 280,000 lb. of steam per hour, using for each pound

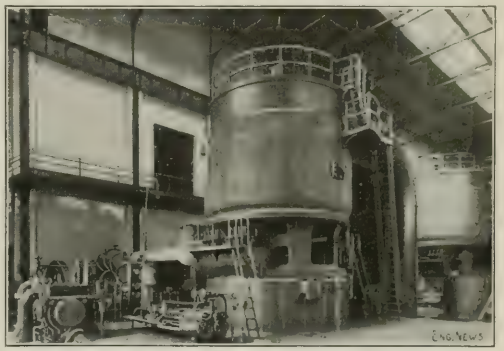


FIG. 4. TWO TURBO-GENERATOR UNITS OF 20,000 KW. CAPACITY IN THE NORTHWEST POWER STATION OF THE COMMONWEALTH EDISON CO., CHICAGO

of steam condensed 75 lb. of cooling water, whose temperature will be raised 14° F. in passing through the condenser. The condenser contains 7600 tubes 1 in. diameter and 17 ft. long, comprising 32,000 sq.ft. of cooling surface as compared with 58,000 sq.ft. of water heating surface in the boilers. A 20x30-in. Corliss engine, running at 120 r.p.m., drives the circulating-water and dry-vacuum pumps. The former is a 36-in. volute of a capacity of 40,000 gal. per min. against a head of 20 ft. The condenser, with its inlet and discharge pipes, forms a closed syphon, so that after the system is once filled with water the lift in one leg is balanced by the fall in the other, and the circulating pump has only to overcome the friction and inertia to circulate the water.

The cylinder of the dry vacuum pump is 28x30 in., mounted in tandem with the steam cylinder of the Corliss engine, and at the speed mentioned has a displacement of 2550 cu.ft. per min. Water of condensation is removed from the condenser by a 5-in. horizontal two-stage centrifugal turbine-driven pump with a capacity of 660 gal. per min.

The generator mounted above the turbine is of the revolving-field type and generates 25-cycle, 3-phase current at a pressure of 4500 volts, which is stepped up by transformers to 9000 volts. The revolving field has four poles and weighs 52 tons. The armature is star wound and has a continuous rated capacity of 2570 amperes per phase. For the barrel-shaped armature in which the field revolves, forced ventilation is created by a fan mounted on the main shaft above the generator. The efficiency of the generator is very high (96%), and yet because of the great amount of energy transformed in the generator, the heat evolved is equal to that resulting from the perfect combustion each hour of 270 lb. of coal. The air for the forced ventilation is drawn from outside of the building.

For excitation purposes 75 kw. at 125 volts is required. In the completed station there will be four exciters. Two of these will be of 300 kw. capacity each, driven by a two-stage horizontal Curtis steam turbine running at 1500 r.p.m. and generating current at 125 volts. The other two, of 200 kw. capacity each, will be driven by 3-phase, 25-cycle, 220-volt motors running at 750 r.p.m. In addition, there will be two storage batteries of 70 cells each, with a capacity of 1000 amp.-hr.

The operating gallery is located in a bay projecting into the turbine room, and from here the operator has a clear view of the entire turbine room floor.

TRANSFORMERS AND OTHER APPARATUS

With the advent of the high-speed turbine it was found possible to build a generator whose reactance was only one-fourth or one-fifth of that of the slower speed generators. This was thought to be a highly desirable improvement and the utmost advantage was taken of the new design to keep the reactance as low as possible; but when such generators of large sizes were built and connected to a common set of busbars, it was found that nearly the whole energy stored in the high-speed revolving masses would be instantly hurled into any near-by short circuit which occurred, the energy output of the machines for the moment being perhaps 20 times the normal. Such violent surges were so destructive to generators, switches, busbars, lines and connected apparatus that it was found necessary to restore to the circuit nearly as much reactance as had been gladly eliminated. In the machines of the Fisk St. station this was accomplished by installing in each of the three armature leads to the busbar a 6% reactance—that is, a coil of wire supported on a concrete and wood frame, whose choking effect, together with the 2% reactance in the generator, at full load of the generator, is equal to 8% of the voltage generated. This effect, which is unobjectionable at normal loads, increases with the square of the current flowing and, therefore, in times of trouble affords protection which is ample and at the same time automatic. In fact, one of the Fisk St. 12,000 kw. generators was repeatedly short circuited through a set of these reactances without harm to generator or coil.

At the Northwest Station the additional reactance needed was introduced into the circuit in the auto-transformers, which step up the pressure from the machine voltage of 4500 to the system voltage of 9000. These transformers are installed in a separate building, between the turbine room and the switch house. Each transformer is installed in a separate fireproof compartment and is of 3333 k.v.a. capacity. They are water- and oil-cooled, and contain 1700 gal. of oil. Water is circulated through pipes immersed in the oil, at a rate of 16½ gal per min. Each tank has an emergency drain, by means of which it can be emptied of oil in a very short time. The efficiency of these transformers is very high, being 99.4% at half load and 99.3% at full load. They are 13 ft. high, 9 ft. long and 5 ft. wide, and weigh (with oil) 25 tons.

To the east of the transformer house is the switch house, a three-story building containing all the oil switches, high-tension busbars, and instrument transformers. On the first floor the busbars, cables, bells and generator leads are installed. The second floor contains the oil switches, the pots of which are built in a single row instead of a double row. This arrangement provides greater safety, in that each oil pot is separated from the adjoining one by a concrete partition. There are 19 switches for each unit: Nine line switches, eight bus and tie switches, and two generator switches.

FUTURE EXTENSIONS

The station was designed for six units, two of which were to be included in the first installation and the remaining four to follow soon thereafter, so that the station when completed would contain a symmetrical, uptodate equipment of the largest size and highest efficiency. But—alas for the best laid plans of men—between the dates that the plans were finished and the station was put in service, as great strides were made in the art as had been made during any period of equal length in its history. The Northwest Station is doing all that was expected of it, but within a little more that a year from the time its initial installation was put into service its equipment will be eclipsed by an installation at the Fisk St. station of larger and more efficient boilers and turbines. The indications are that the equipment which will be installed at the Northwest Station in the future will be of an entirely different type from that now in use, and we may even hope it will be as great an improvement over the newer Fisk St. turbines as those are expected to be over the present machines in the Northwest Station.

Annual Meeting of the Illinois Water Supply Association

The fifth annual meeting was held at the University of Illinois Champaign-Urbana, Ill.) on Mar. 11 and 12, with a large attendance and a list of about 40 papers representing various matters relating to the supply, use and treatment of water, the administration of the supply, and the relation of the water supply to the public health. In fact there were so many papers for the five sessions that in some cases discussion had to be checked in order that the program might be proceeded with. A rather undue proportion of the papers dealt with the chemical rather than the engineering side of water supply problems. The meeting was characterized by active interest in all the various subjects presented. The election of officers resulted as follows: President, C. H. Cobb (Kankakee); Vice-Presidents, H. M. Ely (Danville), W. J. Spaulding (Springfield), and E. McDonald (Lincoln); Secretary and Treasurer, Dr. Edward Bartow, Director of the Illinois State Water Survey, Urbana, Ill.

WATER SUPPLY AND WATER WORKS

A large proportion of public water supplies in Illinois are drawn from deep wells, and a paper by T. E. Savage (University of Illinois) reviewed the studies of the geological formations which have been made by the State Geological Survey. The results of general investigations are checked by comparison with the records of well borings, and the request was made that such records be kept of all deep borings and furnished to the Survey for file. A paper by D. H. Stacks (Moline, Ill.) related to the action of well water upon galvanized pipe, as noted elsewhere, and a third referred to the pollution of wells at Rockford and the use in that city of an auxiliary supply from deep wells with electrically-driven centrifugal pumps in the well. The first of these wells has a six-stage pump and 125-hp. motor, showing on the final test an overall efficiency of 62½% at 1000 gal. per min. against 301 ft. total head. This paper was by G. G. Crane, Superintendent of the Water Department.

A paper on "Water Waste" by W. D. Gerber (Chicago) showed the existence in many cases of serious loss by underground leakage from broken mains and open joints. This applies to small plants as well as to those of large cities, and the only way of discovering such loss is by systematic water-waste surveys. The financial loss resulting from such loss, due to excessive work of the machinery and the heavy draft on the supply (with enlargement of plant or source of supply in some cases).

is not generally recognized by the public or the authorities. The discussion indicated that these conditions are probably very general.

A paper by E. V. Orvis (Waukegan) discussed the legal aspects of financing municipal waterworks, and the appraisal of waterworks properties was dealt with by Douglas A. Graham (Chicago). This paper described four methods of appraisal: 1, the market value of the stocks and bonds; 2, the value of the plant as compared with average values of other similar plants; 3, the past cost; and 4, the cost of reproduction. The last two are the most accurate, and the reproduction method was recommended. A paper on experience with algæ in the reservoir at Quincy, Ill., was presented by W. R. Gelston (Superintendent, Citizens Waterworks Co.); copper sulphate is used regularly for treating water in this reservoir during cold weather.

Water Filtration and Treatment, and Typhoid Fever

Besides references to filters in some of the papers descriptive of waterworks, there were two papers on the recent filter plants at Rock Island and Mt. Vernon, Ill., while Mr. Monfort (Chemist of the Water Department at St. Louis) discussed the efficiency of coagulating basins. The operation of filter plants is perhaps even more important than their design and construction, and this is especially true of the smaller plants; for this reason the most important paper under this classification was one by Mr. Hilscher (Assistant Engineer, Illinois Water Survey) on the condition of small filter plants in Illinois. This paper (an abstract of which we shall publish later) shows a rather general existence of unsatisfactory conditions.

A typhoid epidemic at Rockford was attributed to (1) an air-lift well, (2) a pumping pit polluted by surface water, (3) privy vaults near an old reservoir, and (4) sprinkler connections using water other than the city supply. The well and pump pit were abandoned, vaults removed, and double check valves put on the sprinkler connections. After building a new reservoir it was found to be contaminated by ground water entering the open joints of a conduit from the wells. This pipe will have to be relaid, using bolted flange joints and expansion joints. The new reservoir is of reforced concrete; to prevent seepage, the concrete was made dense by using a very rich mixture, and it was lined on the inside with a waterproofing compound.

A paper on the use of hypochlorite in England, by A. C. Jarvis (Honor Oak Park, London) showed that special attention is given to the removal of taste from the treated water. A paper on "Hypochlorite Disinfection and Typhoid Fever," by C. A. Jennings (Chicago) showed the extensive use and great efficiency of this system of water treatment. At Erie, Penn., the reduction in fever cases and deaths due to the hypochlorite treatment has been regular and consistent. In 1912 there were 125 cases and 8.6 deaths per 100,000, a record which approaches that of European cities. At Cleveland, in 1912, there were 258 cases and 37 deaths, giving a typhoid-fever rate of 5.9, which is the lowest of any of the large American cities.

Two papers dealth with the treatment of Lake Michigan water by this process, and a paper by Arthur Ledcrer and Frank Bachman (Sanitary District of Chicago) discussed the elimination of taste in water thus treated. Their tests indicated sodium sulphate and sodium thiosulphate as satisfactory chemicals for removing the taste. About 1.2 lb. sodium sulphite is required per pound of chlorinated lime, and would add 125% to the cost of lime. One objection to the sulphite is that it deteriorates readily, forming sulphates which have no taste-removing property, and this is especially the case with weak solutions. The sodium thiosulphate has great advantages over the sulphite and is used very extensively. It is required in proportions of 0.28 lb. per pound of chlorinated lime (or about 33% of the weight of the lime); its commercial price is about 1.85c. per lb. in 100-lb. lots. As compared with the sulphite, it is cheaper, it is more stable, it requires a smaller amount, and it adds but 40% to the cost of the lime treatment.

The sterilization of water by ultra-violet light was the subject of a paper by J. R. Davies (Northwestern University). He reviewed the developments following the discovery that the ultra-violet ray of light possesses bactericidal action to a high degree, and described experiments as to the relative value of carbon and iron ores. Turbid waters are difficult to sterilize in this way, owing to the low degree of penetration of the light. Nothing was said in the paper as to the practical application of the process.

The use of permutit for softening water was dealt with in a paper by J. F. Garrett (University of Illinois). The material is an artificial zoölite produced and patented by Dr. Gans, in Germany; it is comparatively new and its commercial possibilities have been investigated only to a limited extent. It may be used either as sodium-permutit for the removal of calcium and magnesium, or as manganese-permutit for the removal of iron, manganese and organic matter. The former is of the greater importance commercially, reducing the hardness of almost any water to zero at very low cost, so that it has great advantages for treating water for boilers, dyeing, bleaching and laundry work. For the last purpose it has special advantages over the lime and soda process, since this cannot soften the water to less than 3½ grains per gal., while the permutit can reduce it to zero; the cost is about the same in either case. The high efficiency and low cost are expected to result in an extensive industrial application of the process.

Miscellaneous Subjects

Two papers dealt with the subject of laboratories. Dr. Park (Health Commissioner of Rockford) outlined the advantages of a municipal laboratory in conserving public health, and a paper by Dr. Lewis (City Chemist of Evanston) described some experiences of a health department laboratory. Dr. Gehrmann (Chicago) described a method of rapid preliminary testing of water for sewage contamination, and Dr. Jordan (Chicago), dealt with methods of bacterial examination of water. Prof. Forbes (University of Illinois) discussed the biological and chemical conditions on the upper Illinois River before and after the opening of the Chicago drainage canal, which discharges into this river. Of a different character was a paper on hydrotherapy, or the use of water (liquid, solid or vapor) in the treatment of disease, by Dr. Norbury (Illinois State Board of Administration). The relation between vital statistics and waterworks was discussed by Mr. Hansen (Engineer of

the State Water Survey), and at his instance a resolution was adopted endorsing a bill which is to be presented to the legislature, providing for vital statistics that will be recognized by the American Public Health Association and the U. S. Census Bureau. At the present time, the statistics in Illinois are so incomplete that they are not accepted and the state is "outlawed" in this respect.

In a paper on "Water Required by Railways," C. R. Knowles (Illinois Central R.R.) estimated that in Illinois 4,236,838,000 gal. of water are used annually by locomotives; 1,751,790,000 gal. of this are purchased from waterworks plants, and 138,645,000 gal. are treated by purifying plants owned by the railways. Adding the water for washing and filling boilers, for power plants and sanitary purposes, the total annual consumption is 5,736,838,000 gal., of which 43% is purchased from city plants. Mr. Knowles thought this proportion would be greater if lower rates were made, but in many cases they are so high that the railway finds it cheaper to build its own plant.

A paper by S. G. Pollard (Cincinnati) dealt with the proper methods of operating a pumping plant to insure a high degree of efficiency. Mr. Amsbary (Superintendent, Champaign & Urbana Water Co.) discussed the use of the flushometer type of water closet, and this led to a general discussion as to the proper size for the pipe connections. Mr. Stacks (Moline) described the effect of artesian water in removing the zinc coating from galvanized pipe, causing zinc poisoning among persons using the water. Mr. Fleming (University of Illinois) described some experiments with fire streams from small hose and nozzles.

We give below notes from a few of the papers noted in the above report of the meeting.

EFFECT OF ARTESIAN WATER UPON GALVANIZED PIPE*

To supply drinking water throughout a manufacturing plant, a well was sunk 1467 ft. to the St. Peter sandstone, and tests showed the water to be of excellent quality and with a mineral analysis of ordinary character, although the water as it issues from the pump has a strong odor of hydrogen sulphide. The distribution system, completed in October, 1911, includes about 20,000 ft. of galvanized steel pipe and 300 fountains of the valve type. Owing to the large number of fountains, it was necessary to keep their valves closed when not in use, especially after working hours. About 30 days after the water system had been in operation there were complaints about the water, and many of the employees suffered cramps, fainting spells and nausea soon after drinking the water. Inspection showed that the water appeared cloudy and contained a white sediment, which analysis proved to be zinc; this was not found in the water as it came from the pump. Tests of the pipe proved the action of the water upon the metal, and microscopical examination disclosed pitting as well as large patches where the zinc coating had been removed entirely. The water was found to contain as high as 1.80 grains of zinc per gal., with an average of 0.5 grains. When the trouble was at its height an average of 40 to 50 men were ill daily, and many were confined to their homes for several days.

As conditions grew worse during the 60 days occupied by the investigation, experiments were made as to the possibility of removing the zinc without injuring the pipe seriously. It was found that a 5% solution of sulphuric acid would remove the greater part of the zinc in three hours, when the action ceased. The engineering department estimated that about 700 gal. would be required to fill the pipe system, and a pump was installed to handle the acid solution. On a Saturday night the system was drained, and air blown through it. On Sunday morning the valves at the fountains were all shut and the pipes were filled with the solution in about 35 min., each valve being opened until air and gas were driven off and the fountain showed a full flow. The pressure required was from 70 lb. at the beginning to 125 lb. at the end. After three hours the acid was drained off. The pipe system was then connected to the feed-water pipe of the boilers, and hot water containing boiler compound was pumped through for several hours, after which it was connected to the well pump and well water forced through the pipes until they were thoroughly washed. The work was completed in time to have the water supply in use Monday morning. This treatment was repeated in 30 days, after which the water contained but a slight trace of zinc.

A medical inquiry showed very little information as to zinc sulphide. It appeared that the smallest dose of zinc-sulphate fatal to adults is 15.5 grams; the dose as an emetic, 1 gram; the regular dose 0.016 to 0.032 gram, or 0.25 to 0.5 grain per gal. With the average condition of the water it would be necessary to drink one to two gallons of water to get a full medicinal dose, but as the opening of the valve would raise a large amount of zinc-sulphide that had collected in the pipe, this would be swallowed so that much less than a gallon of water would cause serious results. The entire pipe system will have to be renewed in a short time, involving considerable expense and inconvenience.

*By D. H. Stacks, Chief Chemist for Deere & Co., Moline, Ill.

WATER SUPPLY AND POLLUTION AT ROCKFORD, ILL.*

This city has a municipally owned (and in the past politically operated) water department. In March, 1912, there existed a disastrous epidemic of typhoid fever, which the experts employed credited to the city water supply. The plant consisted of a number of deep wells (connected with the shaft and tunnel system) from which the water was raised by low-lift centrifugal pumps and delivered into the pumping pit. From this pit the high-pressure engines took the water and delivered it direct to the service mains, but by means of a by-pass some of the water was delivered to a concrete reservoir of 1,200,000 gal. capacity. One of the wells was also operated with an air-lift, and two other wells with motor-driven impeller pumps.

Dr. Jordan placed the blame for this epidemic: 1, upon the well operated by the air-lift; 2, upon the pumping pit, through the walls of which leaked a quantity of polluted surface water; 3, the old reservoir, which was closely surrounded by privy vaults. Mr. Hansen, of the State Water Survey, pointed out the possibility of contamination through fire-protection sprinkler connections, where water was used foreign to the city supply. Substantiating his theory was the fact that the majority of the cases of intestinal grip usually followed by typhoid fever originated and were located in certain sections of the city where it was possible for the water to be affected through sprinkler connections. Tests of all sprinkler connections proved the necessity of protection. This was accomplished by the installation of special double check valves wherever other than city supply was in use, and these sprinkler connections were further guarded by regular monthly inspections.

The evils at the pumping station were corrected by the abandonment of the air-lift well and the pumping pit, removal of the privy vaults, and construction of a new reservoir. After the completion of this reservoir it was discovered that contaminated water was entering it from a conduit line leading from two of the wells. It was found that every joint of this line was leaking and whenever the water in the new reservoir was drained off, this conduit line offered a ready path for the polluted ground water. This line was cut off from the system and has undergone a complete overhauling, but will have to be relaid, with flanged and bolted joints and expansion joints at intervals. The condition of the joints in this conduit line was the result of expansion and contraction, as these wells were only pumped intermittently.

Hypochlorite of lime was used until July, when careful tests proved it was no longer necessary. The last cases of typhoid fever traceable to the city water supply were reported early in May.

The new reservoir is of reinforced concrete, circular in shape, roofed with a concrete dome, and the walls above the ground are covered with brick veneer. The floor, side-walls and roof, each in turn, were made in one pouring of concrete. To make the concrete impervious to seepage, a very rich mixture was used and the reservoir was lined inside with a water-proofing compound. This reservoir cost $19,663.

DEEP-WELL PUMP.—Well No. 7 is the result of a recommendation offered by a special commission appointed by the city in 1910 to make report on an increased water supply. This is an experiment with what is known as the unit well system.

*By G. G. Crane, Superintendent of Water Department, Rockford, Ill.

the object being to locate several of these wells in the different outlying portions of the city. The new well will be electrically operated. Originally it was specified to be 1500 ft. deep, the first 200 ft. to be 16 in. casing and balance 12 in. casing, but the diameter of the larger casing was increased to 18 in. to permit the installation of a multi-stage turbine-type deep-well pump. The purchase of the equipment for this well was not based upon specifications, but the bidders were instructed that the contract would be awarded to the company agreeing to furnish equipment of the highest operating efficiency at the lowest maintenance cost, for a given period of time; cost and delivery were secondary considerations.

WATER FILTRATION PLANT AT MT. VERNON, ILL.*

Although no sewers empty into the creek from which the supply is taken or the three reservoirs, the water is contaminated and has always been unsafe for domestic purposes. There has never been any typhoid epidemic, and 95% of the typhoid cases can be traced to cisterns or out-of-town sources. There is a great accumulation of silt, and although the mains were cleaned last year, the pressure is already decreasing due to the fresh accumulations. The company decided to put in a filter plant in order to improve the supply, to increase the number of consumers and to reduce the expense of cleaning mains and renewing services. The plant is of 1,500,000-gal. capacity, with Pittsburgh filters.

The concrete of the walls and floors is watertight, being made very dense with a very wet mixture of 1 cement, 1 sand and 4 coarse chatts (from lead mines). The mixing chamber is 9x17 ft., and 12 ft. deep; it has five sets of baffles, after passing which the water flows through a 16-in. tile in the sedimentation basin; this is 87x35 ft. and 12 ft. deep, and is divided by a baffle well, so that the water travels twice the length of the basin before passing over the skimming wall to the skimming trough. The three filters are 11x16 ft., 9 ft. deep, with cast-iron manifolds having ¾-in. strainers 6 in. apart. They contain 6 in. of coarse 1-in. gravel, 6 in. of ⅜-in. gravel and 32 in. of sand of 0.36 to 0.56 mm., with a uniformity coefficient of 1.70. The filtered water passes out through balanced valves guaranteed to control the flow within 3% of any desired rate of filtration.

The Water flows to a clear well of 75,000 gal. capacity, having a connection with the new 150,000-gal. water tower, giving a fairly good reserve in case of fire. The water from this tower (with pressure reduced to 10 lb.) will be used for washing the filters, and no air will be employed unless it is found necessary; as this use of water alone requires a greater quantity, the size of the wash pipe had to be increased from 6 in. to 8 in. The pipe gallery contains three motor-driven centrifugal pumps; one of these is for fire service, but the others can be cut in to help in case of a large fire. The alum can be fed at the mixing chamber, the outlet end of the sedimentation trunk, or the skimming trough, according to the condition of the water. Lime (when necessary) will be fed into the mixing chamber, and hypochlorite into the flume before entering the filters. The plant will not be in operation till after the middle of March.

FILTER PLANT AT ROCK ISLAND, ILL.†

The rapid sand-filter plant at Rock Island, Ill., was put into continuous operation March 28, 1911. It has a capacity of 6,000,000 gal. per 20 hours with two settling basins which have a coagulation period of from four to twelve hours when the plant is operated at full capacity. This plant is built within one of the old 1,000,000-gal. slow sand-filters of which there were three, and gives a good ocular demonstration as to the amount of space that is required for the two types of filters.

The coagulant is applied to the raw water at the inlet of the basins, and after passing through the basin the treated water is conducted to the filters by a 30-in. conduit into which the bleach is applied about 25 ft. from the filters. There are six filter units, each 24x17 ft., with a filtering area of 365 sq.ft., equipped with separate manifolds so that the air and water may be applied at the same time during the washing period if desired. Each filter has three concrete wash troughs giving a maximum lateral flow of the soiled wash water of 2 ft. from any part of the filter to the weir of the troughs. The water collecting system and the underdrain piping of the filters (except the strainers) are entirely of cast iron embedded in concrete, with brass strainers set at 6-in. centers. Each filter is equipped with recording loss-of-head gases, outlet rate controllers and hydraulically operated valves, while all pumps and other machinery are operated by electricity.

According to the specifications the plant was required to produce a filtrate having less than 100 bacteria per c.c., except that when the raw water contained over 3000 bacteria per c.c., the production should be at least 97% and the wash water was not to exceed 5% of the amount of water filtered. In the test, the average bacterial count for the raw water was 1875 per c.c. (max. 3150, min. 1075). The average for the settled water as it passed to the filters was 110 per c.c. (max. 450, min. 32). The average for the filtered water was 27 per c.c. (max 80, min. 6). This shows that the average removal between the total raw and filtered water was 98%. About 8 lb. of bleach per million gallons of water was used from May 31 to June 20; the balance of the test was conducted with sulphate of alumina alone, an average of 3.6 grains per gal. was used (max. 5, min. 1.5). The average color was reduced from 75 to 20 parts per million, and the average alkalinity from 96 to 67 parts per million, while the removal of the turbidity was complete.

In the raw water, gas formers were found in all but three of the samples. In the filtered water, all but one of the samples were negative while the bleach was being used, but out of 20 samples that were taken after the bleach was discontinued, 9 showed gas formers. The average amount of wash water used during the test was 2.4% of the amount filtered (max. 4%, min. 0.8%). During 1911, the average colony count in the raw water was 6448 per c.c., with 84% of the samples showing gas formers. For the filtrate, the average count was 168 per c.c., with 9% of the samples showing gas formers, and the color was reduced from an average of 62 to 24 parts per million. During 1912 the average colony count in the raw water was 7660 per c.c. with 82% of the samples showing gas formers. For the filtrate, it was 67, with 10% of the samples showing gas formers, and the color was reduced from an average of 75 to 15 parts per million. During this time alum and bleach was not used in parallel at all times, but was alternated from time to time to check up the different modes of operating the plant with the various changes in the raw water.

About a month after the test on the plant considerable difficulty was experienced with the coagulant feed pipes, which are about 350 ft. in length. The first installation was with lead-lined iron pipe, which proved unsatisfactory, and was replaced with fiber pipe and rubber hose on July 8, 1912; this has given much better results

*By S. B. Severson, Manager of the Citizens Gas, Electric & Heating Co., Mt. Vernon, Ill.

†By R. W. Sharp, Superintendent of the Water Department, Rock Island, Ill.

Cost and Maintenance of Stone Ballast

An investigation made by the Pennsylvania R.R. as to the cost of laying and maintaining stone ballast, using stone of different sizes, is recorded in the report of the Committee on Ballast, presented at the annual meeting of the American Railway Engineering Association, at Chicago, Mar. 18-21. The experimental stretch of double track was three miles in length, one mile being laid with ¾-in. stone, one with 1½-in. stone and the third with 2½-in. stone. The investigation covered the period of 51 months between August, 1899, and October, 1903 (inclusive), and indicated a lower cost in all respects for the larger sizes.

The main features of the results are shown in the accompanying table:

TABLE OF RELATIVE COST OF STONE BALLAST OF DIFFERENT SIZES

Size of stone	¾ in	1½ in	2½ in
Double-track ballast, feet	5280	5211	5280
Double-track ballast, miles	1.0	0.987	1.0
Stone ballast, cars	228	171	198
Stone ballast, tons	6200.5	4651.8	4947.9
Cars stone per mile double track	228	173	198
Tons stone per mile double track	6200	4713	4948
Lin.ft. double-track to 1 car	23.1	30.5	26.7
Lin.ft. double-track to 1 ton	0.85	1.12	1.07
Ave. depth ballast under ties	7.25 in	6.5 in	6.75 in
Total first cost of ballast, freight, unloading, putting in tracks, lining and surfacing, etc.	$7911.60	$5633.51	$5263.92
Ave. cost per ft. double track	1.50	1.08	0.997
Ave. cost per mile double track	7911.60	5708.10	5263.92
Cost ballast per ton at quarry	60.70c	60.68c	58.69c
Ave. cost of maintenance for period of 51 months, per mile	$94.66	$84.94	$82.13

A New Railway Freight Terminal at St. Louis

SYNOPSIS—The reconstruction and remodeling of city freight terminals is a class of work which most railways have in hand more or less frequently, in order to adapt their facilities to the growth of business and the requirements for efficiency and economy of the freight service. The following article describes a recent piece of work of this kind at St. Louis, Mo. One feature of this terminal is the construction of a five-story freight house; only the first floor is needed for ordinary freight business, and the upper floors are for warehouse or storage purposes. This is an economical utilization of high-priced land, as it provides revenue-producing facilities on an area where only a one-story structure would be needed for the railway use of the terminal. The freight house is designed for the handling of freight by trucks in the usual way, the railway officials considering that as yet no mechanical system of freight handling offers greater economy or advantages in ordinary freight-house work. With this view, the building is designed to secure a high degree of efficiency with the trucking system.

A large new freight terminal, including a freight yard and combined freight house and warehouse, has been built at St. Louis, Mo., by the St. Louis Southwestern Ry., and this takes the place of old facilities which were quite inadequate for handling the increasing volume of freight under the growth of the company's business. The new terminal has been made of ample capacity for a further increase in business, and special care has been taken to make it efficient and economical in operation. About 90% of its traffic is outbound. The cost of the building was about $300,000, while that of the entire terminal, including land, was about $2,000,000. This new terminal was designed and built under the direction of C. D. Purdon, Chief Engineer of the St. L. S.-W. Ry. System; O. D. Schmidt, Chief Draftsman in the Bridge and Building Department, was architect for the building. The general contractors were Thompson & Scott, and the steel frame was fabricated and erected by Christopher & Simpson. The plumbing and heating system was installed by the Wm. Burke Plumbing Co., and the sprinkler system by the Globe Automatic Sprinkler Co. E. W. Samen was superintendent for the contractors, and Winters Haydock was resident engineer for the railway company. For information we are indebted to Mr. Purdon and Mr. Haydock. The terminal was opened for business on Jan. 1, 1913.

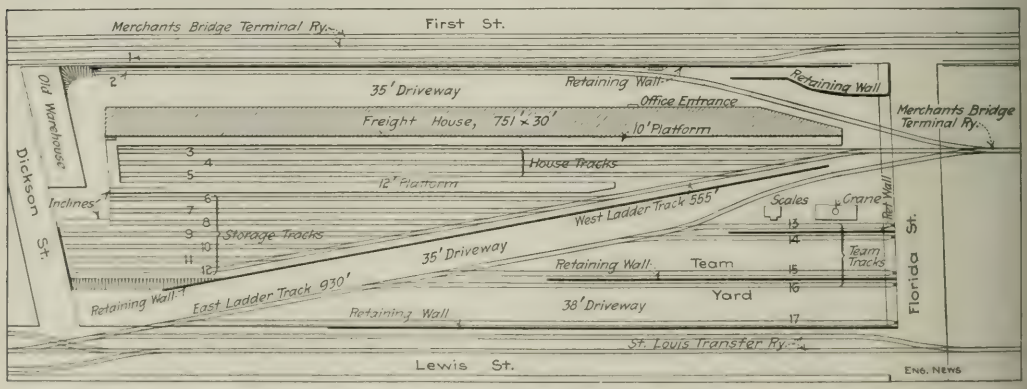


FIG. 1. PLAN OF NEW FREIGHT TERMINAL AT THE ST. LOUIS SOUTHWESTERN RY. AT ST. LOUIS, MO.

LAYOUT FOR TERMINAL

The new terminal occupies three city blocks and lies between 1st and Lewis Sts., and Florida and Dickson Sts., as shown in Fig. 1. It is about 874 ft. long and 274 ft. wide. The main line tracks of the Terminal Railway Association, leading from the Merchants Bridge, are on 1st St. (west of the property), and the tracks of the St. Louis Transfer Ry., which is a part of the Terminal Railway, are on Lewis St. to the east. Lewis St. is about 20 ft. lower than 1st St., and Florida and Dickson St. at the north and south ends of the property respectively, slope down from 1st St. to Lewis St. on a grade of 7%. For the fullest utilization of the property, which has been bought at great expense, it was necessary in designing the yards to plan for a connection with the tracks both on 1st St. and Lewis St. This involved a serious difficulty on account of the difference in elevation of these tracks and the steep slope of the property. The final arrangement was adopted as providing a maximum of convenience of operation with a minimum waste of space, and requiring no steep grades. This is shown by the typical plan and section in Figs. 1 and 2.

The principal features of the terminal are as follows: a five-story freight house, 751x30 ft.; a yard of ten tracks to serve the freight house and for the storage of cars; a covered transfer platform 500 ft. long; and a team-track yard of five tracks. The spacing of track centers is 12½ ft. in general; 25 ft. at the freight platform and 38 ft. at the team driveways. The difficulty of getting tracks into all four corners of a comparative small rectangular area was overcome by running two ladder tracks diagonally through the property; from one of these the house and storage tracks lead toward the south, and from the other the team tracks lead toward the north. Between these two tracks is a diagonal driveway between Florida

and Dickson Sts., forming a connection with the ends of the driveways between the team tracks. In the team-track yard, the elevations of the tracks and driveways conform in general to the 7% slope, the various levels being divided by small retaining walls. The typical section of these walls has a top width of 27 in. (including a 3-in. projection for the 12-in. coping); the batter

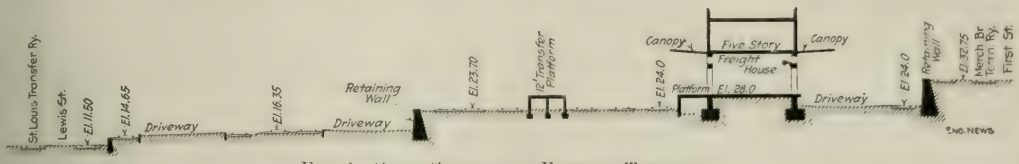


Fig. 2. Cross-Section of Freight Terminal

is 1 in. per ft. on the face and 3½ in. per ft. on the back. The driveways of the team yard are paved with granite blocks and have concrete curbs. This yard has a wagon scale and a crane of 25-ton capacity mounted in the middle of a concrete platform. The track capacity of the terminal is given in the accompanying table:

CAR CAPACITY OF FREIGHT TERMINAL; ST. LOUIS SOUTHWESTERN RY.

Track	Length, ft.	No. of cars	Track	Team-yard tracks Length, ft.	No. of cars
1. Siding	935	19	13. Team	240	3
2. Team	930	14	14. Team	240	3
3. House	835	18	15. Team	440	9
4. House	905	15	15. Team	510	10
5. House	640	14	17. Team	760	13
6. Storage	510	11	Total		38
7. Storage	460	9	Grand total		163
8. Storage	400	7			
9. Storage	380	6			
10. Storage	295	6			
11. Storage	230	3			
12. Storage	230	3			
Total		125			

Freight House and Warehouse

The design of the freight house was adopted in the belief that though various systems of handling freight have been tried, such as telferage systems, hoists, motor trucks, etc., nothing can surpass for economy the simple plan of trucking freight to or from the cars through a narrow building. Hence the building was made long for capacity and narrow for economy of operation. The building is 751 ft. long and 30 ft. wide, and has a 10-ft. platform on the track side. On the west side is a driveway paved with brick. Steel rolling doors are provided on each side of the building for a series of doorways 11 ft. wide and 9 ft. high, separated by 30-in. piers. The windows of the warehouse floors are 11x3 ft. On each side is a steel-framed concrete canopy, 12 ft. wide. At short intervals along the middle of the building there are platform scales, set in the floor.

The building is five stories high, and has no basement under the main portion. It is of fireproof construction, having a steel frame with concrete walls, floors and roof. Fig. 3 is a sectional elevation, with floor-framing plan; Fig. 4 shows the steel framing, and Fig. 5 shows certain details. The panels between floor centers are 13 ft. 6 in. The floors are designed for a load of 500 lb. per sq.ft.; the roof and the canopy or awning for a live load of 50 lb. per sq.ft., and the platforms for 300 lb. The four upper stories are intended for warehouse purposes and are served by four electric elevators. This extension of the plan to include a large warehouse area without using any more ground space was warranted by the permanent demand which exists for such space in St. Louis, and by the additional freight business which such a warehouse connection would naturally bring. Each floor is divided into compartments about 100 ft. long by division walls having openings 12 ft. wide, which are provided with rolling steel doors having automatic fire latches. The entire building is protected by an automatic sprinkler system. The building is made as pleasing in appearance as its massive design and utilitarian purpose warrant. The flatness of the concrete surface is relieved by lion heads at the ends of the canopy rods, shields at the corners and a large sign; all these decorative features are in verde-green terra-cotta.

Near the north end of the building, on the first floor, is a large office for the bill clerks and cashier; and above this on the second floor is a larger office for the freight agent and his clerical force. On the first and second

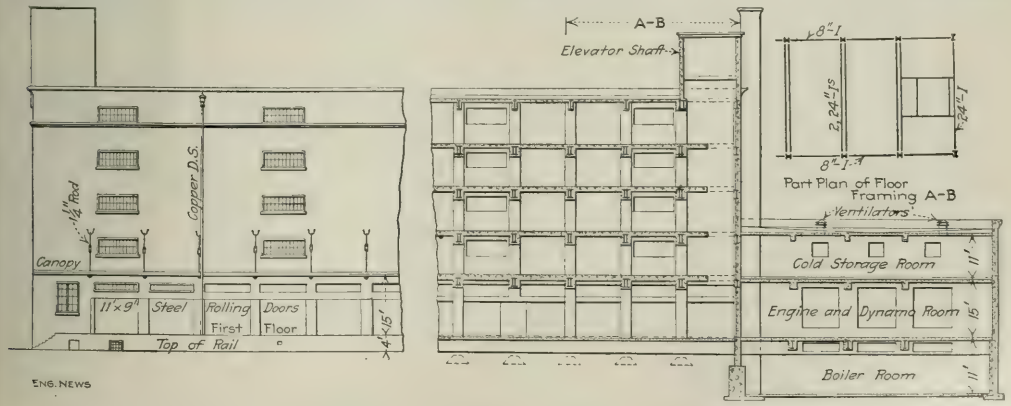


Fig. 3. Part Elevation and Section of Freight House; St. L. S-W. Ry.

floors are seven toilet rooms. These and the offices are heated by steam from a boiler located in the cellar of the two-story portion of the north end of the building. The vacuum system of steam heating is used. One compartment on the third floor is also heated; this being intended

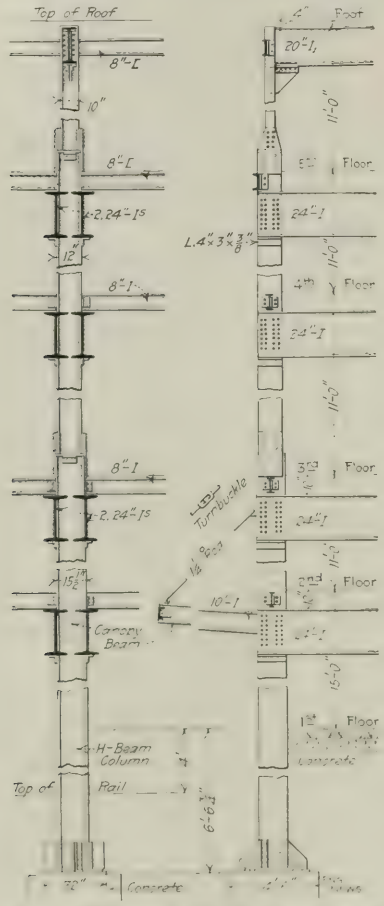


FIG. 4. STEEL FRAMING OF FREIGHT HOUSE

for use as a storeroom for fruit. Above the boiler room (in the basement) is a two-story building, having the engine and generator room on the first floor and a refrigerator room on the second floor. This latter room has a capacity of about five carloads of freight, and is served by a special elevator. The walls, floors and roof of the room are insulated with 3-in. cork slabs and refrigeration through ammonia pipes is provided by the St. Louis Cold Storage & Refrigeration Co.

In order to provide for the transferring of freight from car to car, a reinforced-concrete platform about 500 ft. long and 12½ ft. wide, with shed roof, has been built between the third and fourth tracks east of the freight house (Fig. 1). This is connected with the building by a cross platform at the south end. A convenient feature is a concrete loading incline at the end of one of the tracks, providing a ready means of loading traction engines, threshing machines, boilers, fire trucks, automobiles, etc.

The steel structural framing is shown in Fig. 4. The columns are steel H-beams, 14x15½ in. for the first two stories, and 12x13 in. for the next two, while in the top story the columns are 10-in. I-beams. In all cases the web is parallel with the side of the building. The transverse floor-beams are pairs of 24-in. I-beams, while the roof girders are single 24-in. I-beams. The longitudinal members between the columns are 8-in. I-beams and channels. The roof girders rest on top of the columns, but the floor beams have the inner flanges coped so that the webs are riveted against the faces of the columns, while the outer flanges rest on angle brackets. The canopy roofs are carried by inclined 10-in. I-beams, 13 ft. long, the inner end of the beam rests on an angle bracket on the column web while the outer end is attached to a 1¼-in. hanger rod whose upper end is fitted to an anchor plate on the column. Along the ends of the I-beam runs a 6-in. channel as a fascia beam. The columns have riveted shoes with ¾-in. base plates 32x42 in. and these are placed on top of the concrete footings. Fig. 5 shows the concrete floor slabs and the concrete casing of the beams. The outer walls are of 8-in. concrete, reinforced with horizontal and vertical ⅜-in. rods spaced 12 in. apart. Over the door and window openings (11 ft. wide) are laid ¾-in. bars, and the lintels over the doorways are reinforced-concrete girders. The floor slabs have ¾-in. transverse bars 24 in. apart, and ¾-in. longitudinal bars 6½ in. apart. The main roof and canopies have all ⅜-in bars, with 5-in. spacing for the longitudinal bars. In the two-story portion, the first floor has floor girders of pairs of I-beams encased in concrete, while the second floor and roof have reinforced-concrete beams and slabs. In the main building, the first floor has a flooring of maple 1¾x2¼ in., spiked to creosoted pine sleepers 3½x6 in., which are spaced 18 in. centers and rest on the concrete base. Concrete filling is placed between the sleepers to a depth of 3 in., leaving a 2½-in. air space below the floor. The floor planks are laid

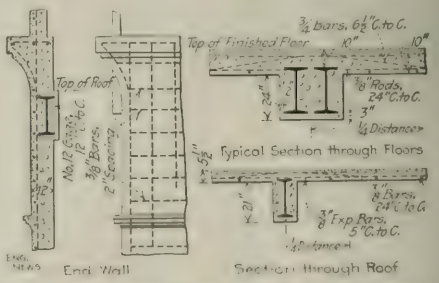


FIG. 5. REINFORCED-CONCRETE WALLS, FLOORS AND ROOF; AND CONCRETE CASING OF FLOOR AND ROOF BEAMS

transversely, but on the platform they are laid longitudinally.

CONSTRUCTION WORK

The work of tearing down the old buildings of the Charter Oak Stove Co., from which the real estate was bought, was begun in September, 1911. Wrecking and

grading were then carried on, but the severity of the winter prevented the accomplishment of much, except the erection of the steel frame. The tower and chute system was used in concreting, supplemented by hopper cars for the long hauls. About 15,000 cu.yd. of concrete were used in the entire construction. The long and narrow form of the building lent itself admirably to economy in form-work. The outside wall forms were built in large panels 40 ft. 6 in. long and one story high. The beam, floor and inside wall forms were built in small panels, light enough to be handled by two men. The concrete was poured in sections including about one-quarter of one story. While one of these sections was being concreted another was being erected by the carpenters; then the form panels of the first were moved to the next section, and thus the forms were used over and over. The large outside panels were moved along the building and from story to story by a wooden traveler, which ran on rails temporarily placed on the longitudinal beams of the steel roof framing. They were handled from the traveler by multiplying-chain hoists. A smooth and uniform surface of the concrete walls was secured by the use of dressed lumber for the forms, and no finishing treatment was used after the removal of the forms. The concrete was a 1 : 2½ : 5 mixture, made with stone principally, but some gravel was used when the supply of stone ran short. The maximum size of the stone was such as would pass a 1-in. ring. The concrete was mixed to a "sloppy" consistency, so that it could flow freely in the inclined chutes. As there was a large amount of stone masonry in the old building, and also brick, for which there was little or no sale in St. Louis, a crusher was installed on the site. The crushed stone (hard limestone) was used for the concrete, and the crushed brick was used for ballasting the tracks, this being in effect burned-clay ballast.



FIG. 6. CONSTRUCTION OF FREIGHT HOUSE AND WAREHOUSE FOR THE ST. LOUIS SOUTHWESTERN RY. AT ST. LOUIS, MO.

(The tower and spouts for the concrete work are shown at the middle. The forms for the elevator tower at the left are suspended from blocks on the projecting beams.)

Boiler Inspection Standards and Regulations will be uniform throughout the Canadian provinces, after July 1, as a result of much negotiation between representatives from the different provinces. These regulations provide for the rigid inspection of all boilers, during construction, to see that proper materials and safe methods are employed. The object in making the regulations uniform is to insure a uniform degree of safety and to enable a certificate, granted in respect to a boiler in one province, to be accepted in any of the others.

To carry out the provisions of the act the province will be divided into districts with a chief inspector and two or three district inspectors. These inspectors will be given ample discretionary power in their work, with authority to insist on a proper standard of efficiency being maintained. Hitherto there has been no such system of inspection. Steamboat and railway boilers are not included, as these are dealt with in a separate act. Once a boiler is inspected and installed it passes under the jurisdiction of the inspectors under the Factories Act. But where an old boiler is resold that has not been examined within one year of the time of sale, it may not be moved and applied to new work without a further inspection.

Foreshore Protection by Reinforced-Concrete Groins

The protection of foreshores against erosion by the use of groins or jetties is not very usual in this country, but in England and the continent of Europe it is a common practice. As a rule, these groins are of masonry or timber, but recently in England some successful reinforced-concrete groins have been built near Brighton. These are described in a paper before the Institution of Civil Engineers by Messrs. Owens and Wood.* The occasional need of such construction in this country is sufficient excuse for the abstract of this paper given below.

The works referred to in the paper are located on the Sussex coast of England, about 6 miles east of Brighton. The chalk cliffs here vary between 40 and 120 ft. in height, the average batter of the cliff-face being about 1 in 12, although in places the cliff overhangs. The foreshore consists of practically bare chalk with a little shingle along the toe of the cliff at certain points. There is considerable littoral drift of the shingle and an abundance of sand at and below low-water mark. The preponderate drift of shingle (from west to east), and the action of the sand and the wave had been cutting under the cliff at the rate of about 3 ft. per annum for the 11 years preceding 1907. Along the top of the cliffs very close to them, as shown in the portion of the shore in Fig. 1, a main road with the main outfall sewer from Brighton runs, and the steady encroachment of the sea threatened to destroy not only the road but the sewer. It was, therefore, necessary to provide some protection at the foot of the cliff to prevent its continued erosion.

Early Construction

In 1907, work was commenced at the west end of the cliff at the location shown in Fig. 1, and five reinforced-concrete groins were built there by the authorities of the neighboring towns. These groins are shown in Fig. 1 as Groins 1 to 5. Groin 6 there shown is somewhat similar to Groins 1 to 5, but was built later, and later still Groins 7 to 19, the latter nine of which are not shown in the drawing, were built according to a somewhat similar design as the one for Groins 1 to 5.

The design for Groins 1 to 5 is shown in Fig. 2. It consists essentially of a reinforced-concrete fence extending from low water to the base of the cliff and at right angles to the latter. Each groin comprised a series of columns 16 in. square in cross-section and spaced 5 ft. 6 in. apart from center to center for the first 200 ft. from the cliff and thence to low water 7 ft. apart. The spaces between the columns were closed by slabs 6 in. thick and 1 ft. deep, dropped into position in grooves molded in the sides of the columns. These slabs were fixed in their grooves by means of cement grout which was run in from the top after the sides of the opening between the slabs and columns had been filled with cement mortar. The columns were fixed in concrete in holes excavated in the solid chalk to a depth of 2 to 4 ft., depending on the height of the column. They stood 8 ft. clear at the cliff, gradually reducing in height to 2 ft. 6 in. at the leaward end.

The reinforcement of the columns consisted of four 1¼-in. round steel rods tied together by links of ¼-in. steel wire at intervals of 6 in. The column was of the section shown in Fig. 2, the slabs being held between the flanges. In order to support these flanges, short, straight rods of ⅜-in. steel were placed across the main rods and projected into the flanges. It was found that these were too easily displaced and reliance could not be placed on their remaining in their proper position while ramming the concrete into the forms, which were placed horizontally on the ground in molding the columns.

As it was anticipated that the greatest accumulation of material would occur on the west or windward side, the columns, where they were over 5 ft. above their base, were provided with raking struts of reinforced concrete on the east side. These struts were the source of considerable trouble later, owing to the severe grinding action of the flint boulders about the base. As the columns were erected, two or three slabs were fixed in each bay, the intention being to increase the height by the addition of more slabs as the shore-level was raised.

It is stated that the groins commenced to collect material as soon as they were erected, chiefly coarse flint, but sand at certain points. The accretion of flint shingle was almost entirely on the west side of the groin in the form of a triangle in plan, having its base against the collecting groin and its apex some point between this and the next to windward. The apex of each triangle gradually extended to windward as more material collected. Thus for a considerable distance the cliff was protected



Fig. 1. Portion of Protected Shore near Brighton, Eng.

by the shingle, the falls of chalk, which have been of constant occurrence during previous winters, became less frequent. Sections of the foreshore showed that between September, 1907, and December, 1908, the quantity of material collected by the groins was approximately 6247 cu.yd.

Where they are beyond the action of flint boulders, the groins have suffered no damage at all, except that two or three slabs were broken out of their bays by a floating piece of wreckage during a gale. Where, however, the landward ends were exposed to the action of large irregular flints present in any quantity, a certain amount of attrition of the concrete was noted. This attrition first showed itself upon the corners of the columns and the lower parts of the struts on the east side of the groin. In some cases the faces of the slab suffered also, but not to the same extent as the columns and struts. Careful observation of the attrition showed that it was due chiefly, if not almost entirely, to two or three special factors. In the first place the method of making a strut and columns on land with unfinished ends and subsequently uniting them on the foreshore by filling concrete into the forms built around the junction did not permit these parts to become properly seasoned before they were exposed to the grinding action of the flint. It was also found that the concrete made from flint shingle suffered in a curious

*"Reinforced-Concrete Sea Defenses," by John Switzer Owens and Frederick James Wood. Paper No. 3998, The Institution of Civil Engineers, London, Eng.

way. When a heavy stone was driven by the sea against the concrete, frequently one of the flint pebbles on the surface was struck and shattered, and the splinters soon worked loose, leaving the empty socket, the edges of which soon wore down until a fresh pebble was exposed and thus the process went on.

In all repairs, therefore, a very tough granite was used for the concrete, as this showed much better wear under the severe conditions. In making the repairs there was no indication of rusting of the reinforcement, except where the small cross rods for reinforcing the flange of the column had been permitted to come too close to the surface. In these cases small patches of rust appeared on the surface of the concrete, but no harm seemed to result. Slabs which had been in the work for a year or more were broken open and the steel was found to be free from rust.

Wall Protection

At Groin 6 (Fig. 1) the proximity of the road to the cliff led to the decision to protect the toe of the cliff at this part by a concrete sea-wall. This wall was built in mass concrete, lightly reinforced with steel. Its position was such that during high tide it was not touched by the water. It was considered possible to use concrete in mass instead of facing the wall with blocks. No difficulty was experienced in building this wall, as the cliff wall was sufficiently protected from the waves by the bank of chalk thrown out from the foundation excavation. Although successful here, this method is not generally to be recommended, since the risk of injury from storms is too great. A facing of concrete block is advisable, as it provides a hard face immediately the wall is built for the seas to strike against and also gives protection to the work during construction. In order to provide against attrition by shingle, the wall was faced with flint 46 in. in diameter embedded in the concrete. These large flints were not easily broken by the impact of other stones driven against them by the sea, and provided a face which withstood the attrition well.

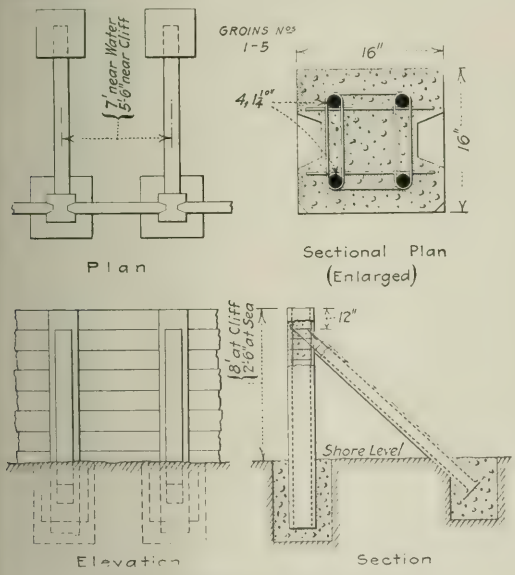


Fig. 2. Details of Groins 1 to 5

Later Construction

The groins which were built later from 1909 to 1911 are shown in detail in Fig. 3. For each of these, it will be noted from Fig. 1, a wall was built as an additional protection. The groins were similar to those already described, but embodied certain important differences in detail. They were built approximately at right angles to the shore line, or 500 ft. long and 500 ft. apart. As it was anticipated that shingle would quickly collect on the west side of the groins, but would be slower to collect on the east side, the walls referred to were erected in length of about 200 ft. immediately to the east of each groin. Thus it was hoped that protection would be given to the most vulnerable part of the coast line while the shingle and sand collected. The wisdom for this procedure had been amply proved by experience.

As a result of the experiences with the earlier work, the landward part of each groin for about 120 ft. from the cliff was so designed that all irregularities on the face were avoided. The slabs were all made 16 in. instead of 6 in. thick, thus bringing their surfaces flush with those of the 16-in. column. The tops of the groins were finished smooth and rounded and present unbroken lines, instead of columns projecting above the slabs. Struts were abandoned and the columns were sunk deeper into the chalk and provided with a system of tie-rods on the windward side. These tie-rods, shown in Fig. 3, although not in the most effective position for holding up the column, were put in owing to the possibility of scour taking place on the lee side of the groin. The absence of the projections on the groins not only obviated injury from the grinding action of shingle, but also diminished the disturbance of the water, and there-

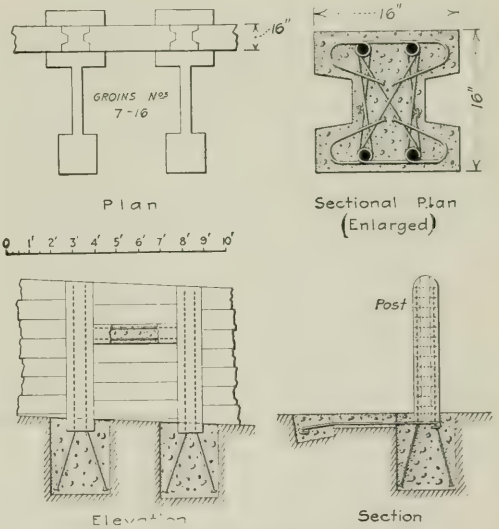


Fig. 3. Details of Groins 7 to 16

fore promoted conditions more favorable to the deposition of shingle.

The columns and slab forming the heavy, smooth part were made entirely of granite concrete of the kind which showed up well in the repairs on the first work. The construction was practically the same as in the other form, that is, the columns and slabs were molded separately and tied together with grout and rod.

As the sea-wall was to be subjected to the attack of the ocean, a separately-molded block face was adopted. These concrete blocks were molded on shore and placed in the wall, tied back into a concrete revetment laid up against the cliff.

The groins here filled up rapidly on the windward side near the toe of the cliff, chiefly with coarse shingle and flint. During the summer of 1911 when all the groins were complete, sand began to collect over a large area of the foreshore which before consisted principally of bare chalk. The quantity of shingle or sand moving along the foreshore at this part is comparatively small, but a very considerable quantity of both sand and shingle had already been collected.

The authors state that the problem here is somewhat different than it would be if it were a pure sand shore. Their arguments follow:

The problems connected with erosion are here quite different from those in the case of sandy or shingly foreshores. In the latter case the material moves about under the influence of tides and waves, eroding here, accreting there, but on the whole remaining on the foreshore. When chalk is removed by the sea, however, it disappears, the particles being so fine that they are carried away by the currents and entirely lost to the shore. The only product of the disintegration of such chalk cliffs or foreshores which is of any value as a protection against the sea is the flints. The chalk contains about 10 or 12% of flints in the form of irregularly and often grotesquely shaped boulders, and in flat sheets. These remain on the foreshore after the chalk is finally broken up by the waves and washed away. While affording protection to the toe of the cliff, a bank of flint shingle, which contains on this coast a fair proportion of stones 3 to 6 in. in diameter, is a very effective disintegrating agent, when the flints are dashed against the cliff or foreshore by the waves.

On a sandy or shingly shore, when the erection of groins has to be considered, not only must the probable benefit due to accumulation on the windward side of the groins be taken into account, but also the possible injury resulting from stoppage of the littoral drift, which shows itself as depletion on the leeward side of the groins, must be kept in view. On a shore where there is practically no loose material, this question of erosion at the leeside is not of such importance, and groins may, with advantage, be constructed higher than on a sandy shore. When the cliff is protected by a shingle bank from actual contact with the waves, erosion is checked; for not only is the undermining action stopped, but also the lowering of the foreshore level, since the chalk is protected by the overlying shingle. This flint shingle appears to wear very slowly, being reduced in size not by a simple grinding action, but by chipping and grinding combined. It offers, however, great resistance to abrasion. This peculiarity of flint shingle renders it an unsuitable material for concrete which is exposed to severe blows, since the surface pebbles are splintered and removed.

Conclusions

The authors give the following conclusions as to the design in general of concrete sea-defence work:

Consideration of the works here described, and of the difficulties met with, points to certain important principles in connection with the design of concrete sea-defenses, which may be briefly summarized as follows:

A smooth surface, free from projections, should be given to groins and sea-walls. Irregularities on the sides of a groin offer obstruction to the waves, the work is thus exposed to unnecessary stresses, deposition is hindered, and attrition of the groin surface is increased. Struts or ties, being open to the same objections, should be avoided where it is not possible to bury them entirely below the surface.

A tough stone should be used for the surface of concrete groins exposed to attrition shingle. Flint-shingle is unsuitable except for parts of the groin which run through sand or are below the surface.

Where it is possible to avoid it, concrete work on the foreshore, except in foundations, should not be put in in situ, but should be molded in the form required and well seasoned before being placed in position. It is difficult to prevent injury to the fresh concrete before it has properly set. This does not apply, of course, to concrete mass work in sea-walls, which are protected on the face by seasoned blocks.

All concrete should be made non-porous by carefully proportioning the ingredients and well ramming. Ordinary rounded shingle contains up to 40% of voids; it is, therefore, desirable to provide about 50% of sand, both shingle and sand being composed of ungraded particles of as great a variety of sizes as possible.

Steel used for reinforcing should be embedded more deeply than for land work. This allows for displacement in construction, for the action of salt water where the concrete covering is not quite impervious, and for abrasion or wearing away of the surface by the attrition of shingle.

⁂

A Japanese Engineering College

The Imperial University of Tokyo comprises six colleges, of law, medicine, engineering, literature, science and agriculture. The University as it exists at present was organized on Mar. 1, 1886, by an Imperial Decree consolidating the two former institutions, the University of Tokyo and the Imperial University; and it is maintained chiefly by government appropriations. The faculties of the various colleges are composed almost exclusively of Japanese; in the college of engineering but one chair is held by a foreigner, the professor of naval architecture, who is Frank P. Purvis, M. Inst. C. E.

There are a number of interesting features connected with the courses and work of the University, which are described in a recent catalog, from which we have made a number of brief abstracts.

Officers—The officers of the University are as follows: President, Secretaries, Business Manager, Superintendent of Students, Librarian, Clerks and Library Assistants. The two Secretaries have charge of all matters relating to the administration and to the treasury of the University; the Business Manager is subordinate to the Secretaries and his title sufficiently explains the nature of his duties; the two Superintendents of Students correspond somewhat to Proctors in American universities. The faculty of the university consists of 156 professors, 66 assistant professors and 132 assistants.

Degrees—The degree granted to graduates of the University is that of *Hakushi*, of which there are nine varieties, corresponding to the different courses of study. The degree is conferred by the Imperial Minister of Education on (1) persons who have passed the prescribed examinations, or "on those who, having applied for the degree by producing a thesis on any subject in connection with their special branch of study, shall be considered at a faculty meeting of one of the colleges to possess attainments equal to or higher than those necessary for passing the said examinations"; (2) those who are considered at one of the *Hakushi* assemblies to possess the requisite attainments for the degree of *Hakushi*.

There are nine varieties of *Hakushi* assemblies, corresponding to the different varieties of that degree. These assemblies are called by the Minister of Education whenever he deems necessary, or on demand of the chairman of the assembly. Each assembly consists of all the hold-

ers of the particular kind of that degree which it represents. Half the members are necessary for a quorum.

If the holder of a degree be found guilty of any conduct detrimental to its honor, he may be deprived of his degree by the Minister of Education in accordance with a resolution passed by a *Hakushi* assembly. A resolution granting a degree requires a majority of not less than two-thirds of the members present; and the forfeiture of a degree requires a three-fourths majority of the members present, voting by ballot.

School Year—The academic year begins on Sept. 11 and ends July 10, and is divided into three terms. There is a two weeks' vacation at the end of the first term, a week at the end of the second term, and the summer vacation is just two months. Lectures are suspended only on Sundays and holidays.

Student Regulations—When a student is admitted to any one of the colleges he is required to take a prescribed oath. A student desirous of leaving college must present a written application to that effect, signed by himself and one of his sureties. A student who is distinguished for his scholastic attainments and good morals may be made an honor student; such honor students enjoy the privilege of exemption from tuition fees, but by misconduct, idleness or illness they may be deprived of their honors.

Engineering Courses—The engineering college offers ten courses of three years each, as follows: (1) Civil Engineering; (2) Mechanical Engineering; (3) Naval Architecture; (4) Technology of Arms; (5) Electrical Engineering; (6) Architecture; (7) Applied Chemistry; (8) Technology of Explosives; (9) Mining; (10) Metallurgy.

The course in Civil Engineering is as follows:

CIVIL ENGINEERING

	Hours per week		
	1st term	2d term	3d term
First year			
Mathematics	3	3	
Applied mechanics	6	2	3
Outlines of heat engine	1	1	1
Building materials	3		
Mechanical and metallurgical technolgy	2	3	
Geology			2
Masonry		5	2
Hydraulics		1	2
Bridges			4
Road-making		1	2
Surveying	2	2	
Design, drawing, and practice	19	18	20
Second year			
Hydraulic engineering	2	4	5
Railways	3	3	3
Bridges	4	4	
Sanitary engineering	4½	3	3
Masonry			3
Outline of electrical engineering	2	2	
Workshop appliances	1	2	
Industrial economy		1½	1½
Design and drawing	10	17	21
Practical exercises			
Third year			
Hydraulic engineering	2		
Street railways	3		
Masonry	2		
Hydraulic machinery	1½		
Seismology	2	3	
Administrative law affecting engineering works	3		
Building construction	2	2	
Geodesy	4	3	
Design and drawing	20	29	
Practical exercises			
Graduation design			

Students' Standing—The yearly mark a student receives in any subject is determined by the average of his term marks in that subject; and in determining a student's average for an academic year, the year mark in each subject is multiplied by a coefficient appropriated to that subject according to its relative importance, and the sum of the products is divided by the sum of the coefficients. A student is passed when his general average mark is above 60 and his year work in every subject above 50. One who fails to pass is required to attend all the classes which he attended the previous year. At the end of each academic year lists of the students showing these general average marks are issued.

Practical Training—Practical work may be done either at the college or outside. Students at practical work in college are always guided by instructors, and if they undertake any practical work outside the college, or make excursions to inspect outside establishments by themselves, they are furnished beforehand with detailed instructions or directions in writing. Students undertaking practical work or excursions are required to submit a written report of their work, unless such work is done with an instructor. Special examinations are held to test the knowledge gained in practical work.

Students in practical, outside work or on excursions are particularly warned to do nothing derogatory to the honor of students of the University; and while on such tours are forbidden to remain in any other place than their destination; should a student be obliged to do so on account of illness or circumstances beyond his control, he is required to produce a medical certificate in case of illness, or a certificate from the local office of the city, town, or village showing cause for his being there. While engaged in practical work, whether in the college or without, the students are compelled to wear their university uniforms. Students are not allowed to do anything except what they have been directed to do in the way of practical work, but if a student is obliged by circumstances to alter any point in the directions given him, he may submit the matter to the instructor for consideration and approval.

Museums—Among the interesting features of the University are the eight museums devoted to specimens, models, instruments, etc., necessary to illustrate work in each course of study. The museum of civil engineering comprises a collection of models of railways, bridges, canals, ports, water-works, drainage-works, etc., 164 models in all. In the mechanical engineering museum are various machines and models of machines, instruments, steam engines, samples of test pieces, etc., in all 1800 exhibits. The museum of naval architecture contains models to the number of 1230. There are also museums of arms, electrical engineering, architecture, chemistry, mining and metallurgy.

❖

A State Highway Law, just enacted in West Virginia, combines the offices of state highway engineer and professor of highway engineering in the State University. We quote from the act as follows:

Sec. 1. There is hereby established a state road bureau. It shall consist of the following persons: The professor in charge of the railway and highway department at the state university for the time being, who shall be the chief road engineer and the head of the road bureau; the director of the experimental station at the state university for the time being and two additional members of said bureau, who shall be qualified voters of the state, and shall be appointed by the governor. The said two additional members shall not be both appointed from the same political party.

Sec. 2. The governor shall appoint some qualified and experienced civil engineer to be the professor in charge of the railway and highway department at the state university.

Sec. 3. The said chief road engineer shall receive an annual salary of $3500. The two additional members of the said bureau shall each receive out of the state treasury $10 per day for so many days, not exceeding 90 days in any one year, as he may be employed in the duties of his office, and his actual expenses incurred in the discharge of his duties.

Sec. 4. It shall be the duty of the state road bureau to supervise and to furnish information as to the location, construction and maintenance of all public roads in this state, to provide for giving instruction in road building and to supervise such instruction, and render assistance to the county road authority.

A Notable Reservoir for Flood Control in Germany

By Kenneth C. Grant*

The largest dam in Europe has just been completed on the Bober River, a tributary of the Oder, in the province of Silesia, in southeastern Germany. It has been built by the Prussian Government and the province of Silesia for the purpose of controlling floods and developing water power.

The Bober rises in the Riesengebirge ("Giant mountains"), which form the boundary between Bohemia and Silesia, and flows northward through a beautiful hilly country, emptying into the Oder a short distance below Crossen. Its drainage basin receives a heavy rainfall, particularly in the upper portions, and its valley has frequently been visited by disastrous floods. The greatest of these floods, that of July, 1897, was the cause of the construction of this dam. The capacity of the reservoir is great enough to impound the damaging part of the flood water, only the discharge that the channel below the dam can carry without overflow being allowed to pass through the gates during a flood. It is also great enough so that the reservoir can be kept about half full and the water thus stored used for the generation of electric power at a large powerhouse immediately below the dam, as well as for the increase of the flow of the lower Bober, a great benefit to the power plants along its course.

The dam is located about 6.2 miles below the town of Hirschberg, and about 1¼ miles above the village of Mauer. At this point, the Bober makes a wide reverse curve, and the sides of the valley draw close together, with steep, rocky walls over 300 ft. high, forming a site apparently designed by nature for the erection of a large dam.

The drainage area above the dam is 167 square miles. The maximum recorded discharge from this area, which occurred in July, 1897, amounted to 42,360 sec.-ft., or 91 sec.-ft. per square mile. The minimum discharge is about 53 sec.-ft., or 0.11 sec.-ft. per square mile.

The total capacity of the reservoir is 1,765,000,000 cu.ft. When the reservoir is full, the surface area is 593 acres, the greatest water depth is 153 ft., and the length is 5¼ miles.

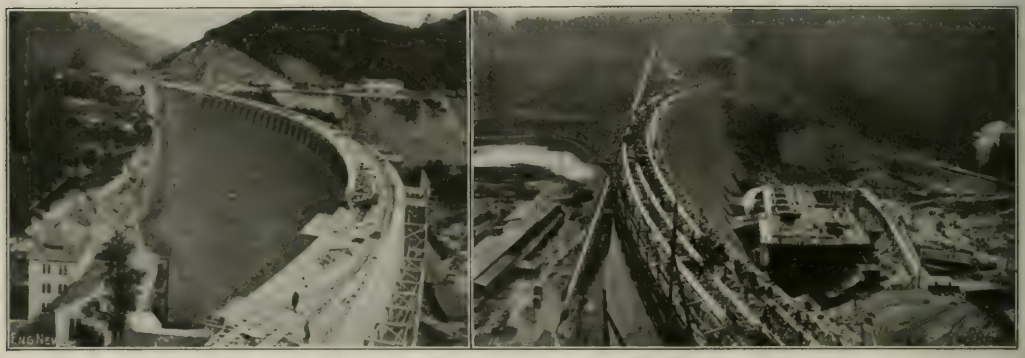
*Consulting Engineer, Arrott Bldg., Pittsburgh, Penn.

The dam is 203 ft. high, 23.6 ft. wide on top, and 165 ft. wide at the base; in plan it is curved upstream, with a radius of 820 ft. A roadway runs along its crest, which is 918 ft. long. It is built of stone masonry, of which it contains 332,000 cu.yd. The total excavation for the dam amounted to 222,000 cu.yd.. A mortar composed of 1 part cement, ½ trass, ⅓ lime and 5 sand was used. The stone was quarried in the valley about 2½ miles above the dam site. The sand was obtained from the valley directly below the dam. The other materials and equipment were brought to the site over a railroad line constructed for this purpose.

The material was distributed on the work by means of hand-cars operating on tracks on top of the dam. A long inclined trestle on the upstream side of the dam brought the cars up to the level of the work by means of cable haulage, after which they were pushed by hand. No overhead cableway was used during construction, the curved form of the dam not being adapted to this method of bringing material to the work.

During construction, the water of the Bober was deflected by a diversion weir 30 ft. high, built about 900 ft. above the site, and was passed around the work through a tunnel 1255 ft. long, 29.5 ft. wide and 23 ft. high, driven through the solid rock on the right side of the valley. A second low dam, just above the outlet of this tunnel, and about 460 ft. below the site, prevented the water discharged through the tunnel from backing up and overflowing the work. The tunnel had a discharging capacity of 10,590 sec-ft., or only about ¼ the maximum discharge of the Bober. As a result, the work was several times delayed by overflow of the site.

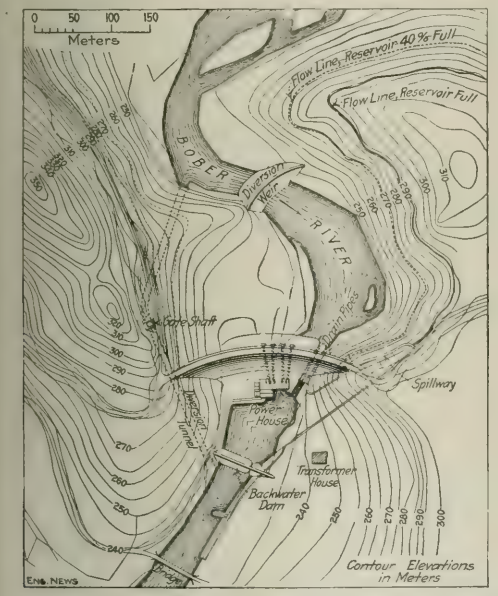
After the completion of the dam a section near the middle of the diversion tunnel was walled up and three 5-ft. discharge pipes were built into this bulkhead. These pipes are provided with double sliding gates, which are operated by spindles extending up through a vertical shaft to a gate-house above high-water level in the reservoir. Near the left end of the dam, two other discharge pipes of the same size pass through the dam at the bottom of the reservoir; these are provided with gates on both the upstream and downstream sides of the dam. When the reservoir is full, the five pipes can discharge 8825 sec.-ft., which is the amount the channel of the



Figs. 1 and 2. The Bober River Dam at Mauer, Germany, near Completion

Bober below the dam can carry without overflow. This discharging capacity is in addition to the amount that passes through the four 64-in. penstocks of the turbines.

At the left end of the dam there is a spillway 285 ft. long extending along the side hill, with its crest 5.9 ft. below the crest of the dam. Water passing over this spillway flows under an arch at the dam and between guiding walls down to the river bed below the backwater dam over a cascade on the rocky side of the valley, which has been cleared of all soil and loose material. The discharge over this spillway in the event of the water rising to the crest of the dam would be 17,650 sec.-ft., and at this level the reservoir capacity would be increased by 158,850,000 cu.ft. Such a condition can never arise, however, as extended records of the flow of the Bober show that its floods are not of long duration. By the time the reservoir has filled, the maximum rate of flow, or peak discharge of the flood, will have passed, and the discharging apparatus above described will be ample to accommodate the flood discharge that may still remain.



The powerhouse is located immediately below the dam. The water is brought to the turbines through four circular concrete brick-lined tubes, 5¼ ft. in diameter, provided with gates on the upstream side. There are 4 units of 1500 hp. each (rated at average water level in the reservoir) or 6000 hp. in all. With the reservoir 60% full, 8000 hp. can be developed. In years of normal rainfall the power is reckoned as 3000 hp., 24-hr. power, with 89 ft. head.

This power is operated in connection with that developed at the Marklissa dam, a similar structure about 17 miles to the west, completed in 1905, on the Queiss, a tributary of the Bober. The Marklissa plant has 3000 hp. maximum capacity, and 1500 hp. average. The power from the Marklissa plant is brought to a transformer station at the Mauer dam at 30,000 volts, and there stepped down to 10,000 volts. The combined power from the two dams is then distributed over a wide area of the surrounding country. About 154 villages and 14 towns are thus supplied, at a price of from 2 to 4c. per kilowatt-hour.

About 60% of the total capacity of the reservoir, or 1,059,000,000 cu.ft., will be used for power purposes, and kept as full as possible. The remaining 706,000,000 cu.ft. of capacity will be kept empty for flood control. It was at first planned to keep 60% of the capacity empty for flood-control purposes, but the successful experience of 8 years in manipulating the Marklissa reservoir for combined purposes of flood control and power development, and careful studies of the flow of the Bober River, have proved that it will be sufficient to keep only 40% of the capacity empty for flood control. In the original designs an overflow weir discharging through a downfall shaft into the tunnel at the right of the dam was proposed. This shaft would have emptied into the tunnel below the bulkhead containing the discharge pipes already described. The spillway would have been placed at the level at which the reservoir has a capacity of 706,000,000 cu. ft., or 40% of the total capacity. Discharge over its crest would therefore have commenced as soon as the flood-control capacity at first contemplated, or 60%, began to be encroached upon. The weir was to be controlled by gates in such a manner that the discharge by this outlet would never exceed the carrying capacity of the river channel below the dam, or 8825 sec.-ft. This device would have served the double purpose of keeping the river within its banks below the dam, and of reserving the 60% flood capacity of the reservoir for the storage of damaging flood water only.

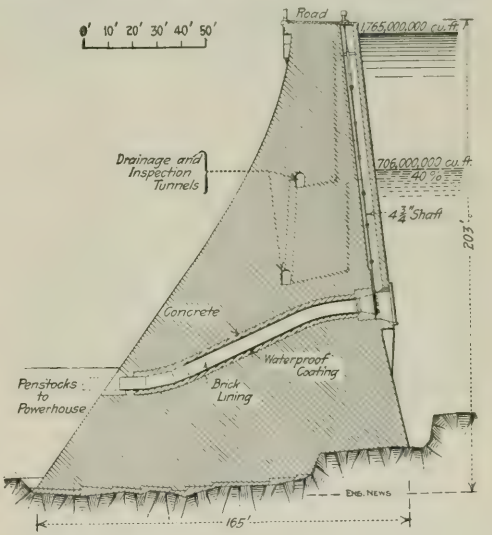


FIG. 3. LOCATION PLAN AND MAXIMUM CROSS-SECTION OF MAUER DAM

As already stated, however, the successful experience with the Marklissa Dam, and the studies of the Bober's flow, showed this part of the plan to be unnecessary; for

it was found that the floods were of short enough duration so that by the time the reservoir might fill up, the rate of flood discharge would have fallen to an amount that could be taken care of by the other discharging apparatus already described. The saving in cost and the increase in power output that have been obtained by this important change of the plans are a striking example of the necessity of having adequate stream-flow records in



FIG. 4. THE BEND OF THE BOBER, BELOW THE MAUER DAM

order to design a reservoir of this character safely and economically, and in such a way as to get the greatest possible use of the water stored.

The cost of the dam and appurtenances was $1,416,000, and of land and damages, $576,000; making a total cost of $1,992,000, or about $1130 per million cubic feet of storage. The flooded area in general was not built up, but the damages were raised to the above high



FIG. 5. CROSS-SECTION OF POWER HOUSE BELOW MAUER DAM

figure by the fact that a large paper mill and a pulp mill had to be bought.

Of the above cost of $1,992,000, the state of Prussia bore four-fifths and the province of Silesia one-fifth. In addition to this, however, the province of Silesia has also appropriated about $1,968,000 for the power plants at Marklissa and Mauer and for the transmission lines. Further, the province has paid the state about $180,000 for the water rights at the reservoir site.

The first work on the reservoir was begun in 1902. Land was bought and the investigations of the footings at the dam site were carried out. The latter were not completed until 1903, being attended with considerable difficulty, on account of the bed of the valley being filled with sand, gravel, boulders and other water-worn drift. In 1904 the diversion tunnel was begun; it was completed in 1905. The excavation for the dam was carried out in 1906 and 1907. Work on the dam itself was begun in 1908, and in June of that year the cornerstone was laid with great ceremony. When the work was in full progress about 250 masons and 550 laborers were employed. The maximum amount of masonry placed per day was about 1000 cu.yd.

The dam was finally completed in Nov., 1912. On Nov. 16, it was formally opened by the Emperor with great ceremony in the presence of a distinguished body of statesmen and engineers.

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Reminiscenc of a Pioneer Engineer of the Great Northern Ry.

(CONTRIBUTED)

The present style of lettering maps and plans came into vogue in the '90's, and it gradually superseded the more elaborate style of earlier times. Map draftsmen, who were expert letterers, were none too common in the early days and they received better salaries thirty years ago than are paid today. Roman and script texts were the standards, and much time was devoted to designing artistic map titles. The Roman letter, extremely flexible, lent itself to an endless variety in composition. In a well executed title, each letter was proportioned to the place it occupied and no mechanically set dimensions were tolerated by the best draftsmen.

Good script writers were more rare than masters of the Roman type. The necessary firm but delicate touch, the result in some cases of years of practice, was not to be attained to perfection by the common run of draftsmen. In still earlier times the bold flourish and fancifully decorated letters were commonly used.

The accompanying sample is from the pen of one of those early experts, a hasty title executed offhand by a man several years past three score and ten, but who was still active in the closing years of a busy life in the drafting room of the great railway system which he once served for twelve years as Chief Engineer. This man, Charles A. F. Morris, was a type of a group of hardy pioneer engineers, now fast disappearing.

Charles A. F. Morris had taken his degree at Trinity College, Dublin, Ireland; he had served a three years' apprenticeship under a prominent British civil engineer, and spent two years in the government service on railroad, bridge, highway and seawall construction. He had become apt in organization and in the direction of large forces of men before reaching his majority.

He married and emigrated to America. Immediately after his arrival in New York City he entered the employ of the Hudson River R.R. Co. and spent five years on railroad location and construction on various Eastern railways.

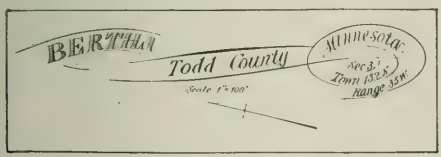
He then decided to take a hand in the development of the Northwest. Within a year of his arrival in St. Paul, Minn., in 1854, he secured a large tract of land on Lake Minnetonka and erected a steam sawmill at St. Al-

bans Bay. For one full season he supplied the demand for oak lumber of a territory within a radius of some hundred miles. The next year the mill was burned and $40,000 went up in smoke with no insurance.

Thus forcibly switched back to his old profession, he associated himself with the men who organized the Minnesota & Pacific R.R. Co. As promoter, engineer and contractor, he followed the misfortunes of this first railroad enterprise of Minnesota for three futile years, when the property reverted to the state. Hundreds of miles of line had been located north, south and west of St. Paul, and 60 miles of grading were completed on the east side of the Mississippi River, but 1400 ft. was the sum total of track laid.

The St. Paul pioneers, however, were not the men to let go of a good thing at the behest of adversity. Two years later the company was reorganized as the St. Paul & Pacific R.R. Co. Ten miles of track between St. Paul and Minneapolis were laid on the roadbed already graded and the locomotive, "Wm. Crooks, No. 1," was put into commission. A few months ago, on the occasion of James J. Hill's 74th birthday, the old "Wm. Crooks" was again put under steam at the St. Paul Union Depot.

During the year of reorganization of the railway, Mr. Morris served a term as City Surveyor of St. Paul. In 1863-'4 he graded under contract the Winona branch of the St. Paul & Pacific R.R. from St. Paul to Hastings. Later he was employed in various capacities under Chief



SAMPLE OF AN OLD-STYLE SCRIPT TITLE
(One-third actual size.)

Engineer James D. Skinner, whom he succeeded in 1868. In 1867 he had bridged the Mississippi for the city of St. Cloud. During the greater part of his service as Chief Engineer the St. Paul & Pacific was in the hands of a Receiver.

When Mr. Morris became Chief Engineer of the St. Paul & Pacific in 1868, the road had been completed only from St. Paul to St. Cloud, 75 miles up the Mississippi River. In 1879 the St. Paul, Minneapolis & Manitoba R.R. Co. was organized by James J. Hill and his associates for the purchase of the St. Paul & Pacific. The Dutch bondholders were glad to turn over the wearisome burden of their holdings to the new company. About 600 miles of track and a land grant of two and a half million acres were secured for about $6,000,000.

Mr. Morris resigned a year later to take charge of the construction of the Oregon & California R.R. from Portland, Ore., south. When this work was completed, about five years later, he took a little vacation in Paris before becoming the Chief Engineer of the St. Paul & Duluth R.R. He now began to think about settling down to a quiet life, and he built himself a home on Lake Minnetonka, not far from the site of his early misfortune.

But his time was not altogether devoted to rural enjoyment. After six years on the St. Paul & Duluth he was chosen Building Inspector of the city of St. Paul for the term 1892-'3. He then retired. Naturally this did not suit a man of his active temperament. At the age of 71 he returned to the service of the great railway system whose early development he had so well directed. At the age of 75 years he could still be found in the drafting room where his hand was still steady, and his touch firm. Mr. Morris was a stocky, round-faced little man, much below medium height, impulsive and quick of speech, but much beloved by his associates. He died in 1906 in his 79th year.

A 50-Ton Locomotive Crane*

A 50-ton locomotive jib crane has been ordered by the U. S. Navy Department for the Brooklyn Yard, from the Browning Engineering Co., of Cleveland, O. When completed it will probably be the largest locomotive crane in the country. The design will be similar, except for the boom, to the 40-ton type shown in the accompanying figure, built by the same company for the Navy Yards at Portsmouth, N. H. and Norfolk, Va.

The 50-ton crane will have that gross lifting capacity at 70 ft. radius; at 85 ft. the capacity will be 40 tons and at 123 ft. (the maximum radius) 15 tons. The main boom will carry a counterweighted auxiliary end boom



A 40-TON LOCOMOTIVE JIB CRANE
(As built by the Browning Engineering Co., for the U. S. Navy Yards at Portsmouth, N. H., and Norfolk, Va.)

with its control machinery on the body of the crane. The main-boom hoist will have 1-in. steel cable (30 parts) with both ends wound on 24-in. drums.

The estimated weight of this machine is 500 tons. There will be 16 rolled-steel, double-flange 30-in. wheels, keyed to the axles; the wheel base will be 29 ft. 9 in. and the track gage 18 ft. A track speed of 120 ft. per min. will be secured.

The particular service for which this crane is needed is reported to be in handling the wire-cage type of military mast. Heretofore it has been necessary to remove these in two or three sections during overhauling. The crane track will run around one end and both sides of the dry dock for general service in lifting boilers, machinery, armor plate and ordnance.

Panama Canal Excavation during February, totaled 2,108,530 cu.yd., a daily average of 91,675 cu.yd. for each of the 23 working days. The rainfall was 1.09 in. The amount of concrete laid in February was 77,489 cu.yd., and 123,792 cu.yd. of fill was placed in dams.

*From information furnished by the Browning Engineering Co., Cleveland, Ohio.

A Bill to Provide for State Water Conservation and State Control of Dams in Pennsylvania

For a number of years past there has been in existence in Pennsylvania a State Water Supply Commission, consisting of five members. The powers of the commission have not been very extensive. They have included the passing upon applications of water company charters and limited control over the building of dams or other obstructions in navigable streams. There is now pending before the Pennsylvania Legislature a bill which, if enacted, would create a State Water Commission with powers much larger than those of the present commission and at the same time consolidate earlier legislation for water control.

The feature of the proposed legislation that is of most interest to engineers is the proposal to subject the location, design, and construction of dams and all other stream obstructions to the control of the State Water Commission. Other notable features of the bill are its provision for what might be termed a water conservation survey of the whole state; the surrender to the state of all unused water and dam site rights; the control over the chartering, consolidation and lease of water-supply and water-power companies; compensation for water or water-power improvements under certain conditions; and in general state control, through the commission (in some cases in conjunction with the governor), of the water resources of the state and their utilization for various purposes.

Like the present State Water Supply Commission, the new commission would consist of five members, including three to be appointed by the governor subject to the confirmation of the Senate and two members ex-officio. The ex-officio members would be the Commissioners of Health and of Forestry. The new bill provides that the three members appointed by the governor would serve four years with salaries of $5,000 per year, while the ex-officio members would be paid their necessary expenses only. The commission would be authorized to appoint a chief engineer, who would have to be "a competent civil and hydraulic engineer," at a salary of $5000 per year, and three principal assistant engineers, of whom one would receive $3000, one $2400, and one $1800 per year. Authority is also given for employing other engineers, geologists, clerks and field assistants.

The objects of the bill and its provision for a water conservation survey of the state are as follows:

Sect. 5. The intent and purpose of this act is to provide a method and powers for a full and complete investigation, survey, conservation, development, utilization and distribution of the water resources of the State in such a way as to make them of the greatest possible use to the largest number of people for the longest possible time and each provision of this act is to be interpreted in the most liberal manner for the best accomplishment of this purpose. The jurisdiction of the State Water Commission shall extend over and include all streams situate, lying and being wholly within this State or between this and any other State or States, including the river Delaware and all lakes, ponds or bodies of water either wholly or partly within this State, and over the use of the waters thereof as herein set forth.

Sect. 6. In order to carry out the provisions of this act it shall be the duty of the commission to procure as speedily and thoroughly as possible all data and facts and collect, tabulate, record and preserve in files and publish complete information concerning the water resources of the State, taking an inventory stream by stream and district by district of the amount of flow and present utilization thereof, to the end that a comprehensive plan may be eventually adopted covering the entire State, together with such recommendations as will best conserve, utilize, develop and distribute the waters thereof and so regulate the flow of the streams as to reduce floods in times of high water and provide increased flow in times of drought.

A number of comprehensive sections are included in the bill, each and all designed to make necessary the approval of the commission and also by the governor of the state of any charter which authorizes the "supply, storage and transportation of water and water power for commercial and manufacturing purposes." The approval of the commission and of the governor is also necessary for the consolidation of existing companies created for the purposes just named, or for the sale, assignment or transfer or lease of any franchise or real or personal property used for water-supply or water-power purposes. All these sections state with particularity that necessary applications to the end just stated should specify the "point or points on said streams or other bodies of water at which it is proposed to take or use water or water-power thereafter." Provision is made for the reversion to the state of the unused water rights of existing companies which apply for further powers.

All municipalities and private corporations desiring new or additional sources of water-supply for water or power must apply to the State Water Commission for the authorization before such sources can be utilized. Permits may be granted only on approval by a majority of the members of the State Water Commission, and also the approval of the governor. When such permits are granted they must be duly recorded with the secretary of state and the record must stipulate just what rights have been granted.

The sections of the act designed to give the State Water Commission full control over the construction of dams and reservoirs or any other obstructions to streams provide that "no persons or persons, corporations, states, counties, cities, borough or township officials shall have the right to build in or along any of the streams, lakes, or ponds" of the state "any dam, wall, wingwall, wharf, pier, embankment, abutment, projection, or other obstruction" or "cause to be deposited over the bank or in the channel of any such stream, lake, or pond any trades waste, municipal waste, ashes, or refuse of any kind, or material, nor make any addition to any existing dam," etc., "nor in any manner change or diminish the course, current, or cross-section" of any stream, lake, or pond without a permit of the State Water Commission, which permit shall contain "such restrictions, limitations, or other provisions as the commission may deem necessary or advisable." Applications for such permits must be accompanied by full plans and descriptive matter.

The bill provides for supervision and control of the construction of dams and reservoirs for which permits have been granted by the State Water Commission. The commission may require such changes and modifications in the plans as "may be necessary to conform to public policy and to insure public safety." To this end the commission shall "cause frequent examinations and inspections to be made during the progress of construction and at any time thereafter during the period of operation" of any dams and reservoirs built under its permit.

Either on its own initiative or on complaint from any

citizen, the commission may at any time "direct its engineer or other persons selected by it to examine into the condition of any dam or structure referred to in this act constructed or controlled by any person, corporation, county, township or borough for the purpose of determining whether the same is properly constructed and safe, or whether it be in any way dangerous to the public safety." If the examination indicates that the dam or structure is unsafe, then the commission may order it altered as it sees fit but not until after an order and hearing. If such an order is not obeyed, then the Attorney-General shall be notified and take such action as is necessary "for the removal or abatement of said structure as a public nuisance or a menace, as may be authorized by law."

The bill also authorizes any borough or city to request the State Water Commission to "establish permanent harbor or shore lines along any stream, lake or other body of water lying within" its boundaries, and the commission is authorized to act upon such applications as it sees fit after making various investigations.

In order to cinch still tighter the control of the commission no corporation or municipality may exercise the right of eminent domain as regards the waters or lands of the state without a permit to that end granted by the commission after application and investigation by the commission.

The right to purchase any works or plants constructed by any private corporation under the bill being reviewed is reserved to the state and any of its municipalities, but the right cannot be exercised until the expiration of 50 years from the date of the grant or privilege. Provision for appraisal by arbitrators is made in the case of such purchases, with appeal to the courts.

Compensation to the state and municipality or any corporation is provided for in the bill in cases where "the construction of storage reservoirs improve, regulate, or control the flow of any stream directly or indirectly" in such a way that the "now use" of the stream "is benefited or enhanced by such improvements, regulation or control." The amount of compensation to be paid is to be determined by the commission.

The right of water or water-power companies to operate under their charter may be inquired into by the commission at any time, either on its own initiative or in response to a petition. Such an inquiry would "determine whether such company has commenced work upon its plant or completed the same within the time provided by the law." Unless this investigation showed that this was not the case, then the commission would have power to issue a decree "declaring the company defunct or certify the facts in the case to the Attorney-General with a request that he institute *quo warranto* proceedings against such corporation for the annulment and revocation of its charter."

An interesting provision of the bill designed in the interests of the conservation and full use of the natural waters of the state is as follows:

Sect. 20. All reservoirs hereafter built by any person, persons, corporations, State, counties, townships or boroughs for which permits shall be issued under the foregoing provisions of this act shall if the State Water Commission deem it necessary, and so direct, be designed and constructed with adequate storage capacity over and above that needed for the storage, supply, transportation and power purposes of the applicant sufficient to store and hold peak-flood waters during periods of maximum flows and with adequate facilities for increasing the low water flow at such periods of the year in which this, in the opinion of said commission, shall be deemed advisable, and the State Water Commission shall have the right and is hereby given the power to determine from its investigations and knowledge what requirements shall be deemed advisable and to take all necessary steps to control such flood flows and regulate low water flows, and any violation of the orders of the commission in connection therewith shall constitute a misdemeanor punishable as hereinafter provided.

In order that the commission may be fully informed, the bill provides that all "persons, corporations, municipal or private, storing, supplying or transporting water or generating or transmitting power therefrom" shall by Jan. 31 of each year make a report to the commission covering the calendar year ending Dec. 31 previously." Such reports shall "include a statement of the character and conditions of all the works proposed and plants and structures used for the purpose under the permit granted by the commission under the authority of this act, and such other information and details as may be required by the rules of the State Water Commission."

Violations of the bill constitute misdemeanors and render persons convicted of the same liable to fines of from $100 to $1000, or imprisonment of not over a year, or both fine and imprisonment at the discretion of the court.

The Appraisal of Water-Works Properties*

By Douglas A. Graham†

Water works properties are appraised for three purposes —for purchase, for rate-making and for the issuing of securities.

There are four distinct methods which have been employed in the appraisal of water-works properties and which have been quite generally recognized by the courts and appraisal boards as giving an indication, at least, of the true value of a property.

First, and perhaps of least importance, is the method of estimating the value of a plant by means of the market value of its stocks and bonds. This method would, of course, not be applicable to a municipally owned plant, and the instances are rare, in the West at least, where a continuing and representative market for such securities can be said to exist. Furthermore, the value of securities is generally based on the earning power of the utility and where limited franchises and municipal control prevail, such a basis would render the estimate of little value.

Another method, also based on generalities, is what might be termed the commercial or comparative method. This involves a consideration of the value of the plant in question as compared to averages of the values of other plants in general and to the values of individual plants in which all conditions affecting value are known to be similar. This is the method most available to the ordinary business man and, when used intelligently, gives useful results. It must be used with caution, however, and without prejudice, as individual plants differ widely in characteristics and values.

Next in importance comes the "past cost" method. Where the data can be accurately obtained, the past cost undoubtedly furnishes an excellent and, in some respects, a fair measure of value. Unlike reproduction cost it involves no estimation of depreciation, but, to offset this, no credit is given for the appreciation of land, material and labor values. Its chief objection lies in the difficulty usually encountered in obtaining reliable audits of the construction accounts, as few water companies have kept their early books in sufficiently complete detail to permit an accurate separation to be made between construction and operation accounts. Its chief advantage is that past cost represents actual expenditures

*Abstract of a paper read at the annual meeting of the Illinois Water Supply Association, at Urbana, Ill., March 11, 12, 1913.

†Principal Assistant Engineer for Dabney H. Maury, 1137 Monadnock Block, Chicago.

and, when the plant has been wisely managed according to the local laws and requirements, the actual cost would seem to give a very fair measure of the true value of the plant to the community.

Last, and in most general use because of its universal adaptability, is the "reproduction method." This is in keeping with our common methods of trade appraisal and, in the hands of skilled appraisers, it furnished a very excellent measure of value. This method involves the hypothetical construction, step by step, of an exactly similar comparative plant, the hypothesis being carried successively through all the stages of origination, construction, and business development which would be necessary in the actual construction of a water-works system. The structures, machinery, pipes and the general or overhead items are estimated at what it would reasonably cost to reproduce them at the existing normal prices of material, labor and money, and the reproduction costs are then reduced by the amounts of depreciation the plant has suffered from all causes. The reproduction method is not as simple in application as is commonly supposed. The ability of the appraiser must be precisely that required in actually planning and constructing a new plant. Though the estimator has before him full sized plans and specifications, in the form of the existing plant and a complete inventory of the details involved, yet there are many items, such as temporary structures and conditions of hazard, which must necessarily disappear from view upon the completion of the plant, yet which must be estimated and included in the total cost of the work.

This method has both advantages and disadvantages. It requires a detailed study of the conditions involved and a logical reason for each step or theory adopted. It, therefore, tends to eliminate guess work and the effect of prejudice as far as possible. On the other hand detailed estimates tend to lessen the probability of a broad consideration of the subject and to substantiate small errors in unit prices which, because they are many times multiplied in the total, may materially affect the final result.

The first step in the appraisal is the preparation of the inventory. Properly prepared the inventory is quite different from that ordinarily made by business houses, where the object is to list up and describe articles which have a recognized market value. It should be a complete record of the details of the plant and should give the history of the plant, the laws or ordinances which might affect value, the conditions which would be met with during reconstruction and lists of the materials involved in convenient form for use in making estimates. It should contain such drawings and photographs as may be necessary to fully explain and verify the quantities given. The cost of a thorough and complete inventory is never wasted for, besides greatly increasing the probabilities of a fair appraisal, it saves much valuable time when the actual estimates are undertaken. Furthermore a complete inventory is a great help in the intelligent financing and operation of a plant, by giving the managers an intimate knowledge of the property under their care.

The actual appraisal begins with the estimation of the time element. The time available is of almost equal importance with the cost of materials, as the cost of construction, lands, water rights, etc., increase when the time available for construction is limited, and the amount of the general costs, such as interest during construction and going value, decreases under the same conditions. It is essential therefore at the beginning that a careful program of construction and business development be planned, and that all values be estimated with the time element clearly in view.

The item of costs preliminary to construction comes next. In any new enterprise the general scheme must first be originated, and much preliminary engineering investigation and legal work accomplished, before construction can be begun. Such costs are generally grouped under one heading, and estimated according to the experience of the appraisers in such matters. Lands and other real estate are usually valued by local men, as few engineers would be sufficiently well versed in local land values.

Then follows the estimates of cost to reproduce the pumps, pipe and other physical parts of the plant. These items are estimated from the lists of material and labor involved, using what might be termed the "normal" prices of each class of work in the locality considered. In most instances the "normal price" will be the prevailing market price, as most materials entering into the construction of a water works do not suffer appreciably from market fluctuations. In the case of some items, however, notably cast iron pipe, the fluctuations over a single year may be so rapid as to make it entirely unreasonable to adopt the price at any one moment.

For example, if it is desired to find the value of a plant for the purpose of fixing rates, it is the value of the plant for future service that must be considered. Should the price of materials be extremely high or unusually low at the moment, the resulting value would only be the value of the moment, and rates based upon such a value would be neither fair nor reasonable. It is obvious, therefore, that only by the use of an average or normal price can justice be done to both the city and the company.

After the construction estimates have been made there are certain general items which must be considered, namely Engineering, Legal, Administrative and Contingent costs, during the construction period, and the interest on the various expenditures until operation begins and the fixed charges can be carried to operating accounts. These items may be estimated in different ways and included either with the items of construction or in lump sums as separate items. They are just as much a part of the physical value of the plant as its buildings, machinery and pipes.

After the Reproduction cost of the Physical Property has been found the estimates must be reduced to present worth by the deduction of an amount which will represent the loss in value the plant has suffered by reason of its past service, and its possible inadaptability to the service which will be demanded of it in the future. If the appraisal is for rate-making purposes, depreciation must be considered in connection with the proper allowance to be made as fair return, as the Courts have held that a Public Utility is entitled to provide a fund which will keep its investment intact.

Water-works depreciation may properly be divided into three general divisions, viz.: Ordinary, Functional and Contingent Depreciation, the latter being considered only in operating accounts.

By Ordinary Depreciation is meant that decrease in the service value of a machine or structure which takes place by reason of ordinary wear and tear. The rate of loss in value from this form of depreciation increases as time goes on, being small at first and rising rapidly as the end of the life of the structure or machine approaches. Ordinary depreciation is very small in cast-iron pipe and in earth and masonry recervoirs, and large in machinery and most metal construction.

By Functional Depreciation is meant that decrease in value which comes from obsolescence, due to changes in conditions or in the art of construction, or to any things which make a structure or apparatus unsuitable for the service it is called upon to provide.

This form of depreciation is especially noticeable in machinery, which has become inefficient or inadequate, and in the distribution system when small mains must be replaced by larger ones, owing to the growth of the city, or where incrustation has reduced the original capacity of the pipes.

Contingent Depreciation is estimated only for use as an operating account, and does not affect the reproduction value of the plant. It is simply a device for spreading certain extraordinary expenses over a period of years. Such expenses occur in the operation of every plant and, when no special provision is made for them, they make it difficult to properly understand and provide for the ordinary expenses of operation. Examples of Contingent Depreciation are the costs involved in the bursting of mains with consequent damage to private property, electrolysis of mains, and the lowering of mains when street grades are changed.

After the appraisal of the plant has been carried to this point, there remains only the reproduction of the business and income of the plant. This is commonly termed the "Going Value" or "Going Concern Value" and its existence and the necessity of including it in a complete appraisal have been almost universally recognized by the Courts.

Many attempts have been made to find a simple method for estimating Going Value but with little success, and it may be said that there are but two methods in general use. One, the Reproduction method, involves a comparison of net incomes, either actual or estimated on the basis of fair rates, between the existing plant and the comparative hypothetical plant. The other, the Past Cost method, is based upon a computation of the deficits in operation and fixed charges during the entire life of the plant. The former should be used in a reproduction estimate and the latter only as an addition to the cost of construction as found by the Past Cost method. Here again it should be remembered, that the results by either one of these theories give us, not the value of the income, but one measure of that value.

When all of the items mentioned above have been estimated and included, the Reproduction Value is complete, and there remains only a broad review of the problem, and the fixing of the final or Service Value of the property. If the data are available, the value of the plant should be estimated by all of the methods outlined above, and the final value fixed by a comprehensive study of the several values obtained.

EDITORIALS

One early result of the Ohio flood is that interest is being displayed in river regulation problems by state legislators and by many persons who probably never thought of the subject before. There is an active, if unorganized, campaign to find a specific means of preventing river floods. One outgrowth of this is a river-regulation bill, introduced into the Ohio Assembly on Mar. 26. The Cincinnati *Enquirer* reports:

In the belief that the flood damage can be lessened and the washing away of arable soil prevented in great measure by straightening the courses of rivers and creeks, Representative James Carroll, of Franklin, offered in the General Assembly a joint resolution for the appointment by the Governor of a commission of three members to investigate in conjunction with the Superintendent of Public Works the practicability of straightening channels of streams for increasing their capacity to carry off storm water without overflow. Provision is made for lease by the state of increased water power resulting from swifter flow of the current in straighter channels. The resolution was drafted by Representative Adam Frick, of Scioto, who believes that to straighten the channels of rivers and creeks would do more to prevent damage from floods than anything else, except reforestation, and that the receipts from water and electric power which the state could develop would more than pay the cost.

Out of the darkness will come light possibly. A few engineers have long realized that here, as in Europe, the work of scientific river regulation must sooner or later be undertaken. It requires such vast destruction of property and life as that which the past week has witnessed to make the public understand that the obstruction of river channels must not be allowed to continue without some safeguard for the public interests. But unless the work is placed in the hands of competent engineers, the legislators may only succeed in making a bad matter worse.

⁂

The death of Mr. J. Pierpont Morgan removes from public life the most remarkable financier and business man of his generation; in fact, the most notable probably that has ever appeared in American financial history. The most essential feature to success in a large measure in the banking and financial world is confidence, and there is no doubt that Mr. Morgan had the confidence of business men and men of wealth both in this country and abroad to a greater degree than any other American financier. Some of the great fortunes which have been amassed in Wall St. were won by methods of destructive financiering which caused the names of those who won them to become a synonym for corruption and dishonesty. The vast profits reaped by Mr. Morgan and his firm, all impartial critics will agree, were gained by constructive methods.

It is perhaps a risky matter in the present conflicting state of public sentiment to express an opinion as to the public service rendered by Mr. Morgan in his business career. We believe, however, that those able to look at the matter without prejudice will agree that Mr. Morgan's services to the business and financial world have been of inestimable value, and that his influence for sound and safe business methods and for honorable and honest standards of business conduct throughout the wide range of industries in which his firm had a voice has been of vast benefit to the public as a whole, even though it has been little realized. Mr. Morgan has also been a lavish giver for many public causes. The passing away of such a commanding figure is indeed a national loss.

⁂

An unusually well considered and comprehensive bill for state control of the conservation, development, distribution and use of the natural water resources of Pennsylvania is now before the Pennsylvania legislature. The bill is so fully outlined elsewhere in this issue that we will not attempt to summarize it here. Many of our readers will be particularly interested in its provisions for full state control of dams, including their location, design, construction and maintenance. Of all the states of the Union, Pennsylvania has had the most severe lessons as to the need of state supervision by competent engineers of the construction and maintenance of dams. The Johnstown disaster and the Austin disaster destroyed property enough to have paid the cost of supervision of dam and reservoir construction in the state for a century, to say nothing of the enormous loss of life in those great calamities. It goes without saying that many other states ought to take similar measures for the protection of the public and for a broad control of the water resources of the state so that they may be utilized to produce the greatest measure of public benefit.

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State Water-Power Development in New York

A very active controversy is in progress in the New York Legislature at Albany over the project to have the State itself develop water power from some of the surplus waters of the Barge Canal, generate electricity and sell current to consumers in the near-by cities. If the State were to undertake such water-power development, it would come into competition with the private companies now engaged in the sale of electric current. Naturally these companies are making a strong fight against the proposition.

Many of the arguments brought forward by them are weighty and deserving of attention. In their zeal to prove their case, however, they have unfortunately been extremely careless in the use of figures. In a letter distributed to the press on Mar. 28, the following appears:

In publications of the State Conservation Commission, it is asserted that a million and a half horsepower of water power is running to waste and the Conservation Commission purposes to develop this for the State. As the United States Census places the cost of electrical development at $525 per kilowatt, exclusive of cost of a distributing system, it is easy to figure that a horsepower being equal to 746 watts, the cost for such a state-wide development assumes very large proportions. It is variously estimated at from three to six hundred million dollars.

We do not know when or where the United States Census has placed the cost of electrical development at $525 per kilowatt; but even if it has been guilty of such an absurd and extravagant statement, the officials of the electric lighting companies who are fighting this conservation proposal should know better than to offer such

figures to the public. Such a careless use of figures is, in fact, a two-edged sword. If it were indeed true that the present cost of electric power development was any such enormous amount as is here affirmed, then the estimates of the cost of developing the Barge Canal water power would by comparison be so small that there would be no question as to the wisdom of the State undertaking the work.

It is very likely true that the value of and the possibilities from the use of the surplus Barge Canal water for hydro-electric power development have been largely overestimated. On the other hand, it is well known that in the past the water stored by the State for canal purposes has been largely used for power development under leases which have been exceedingly profitable to the private parties holding them, and have brought in only trifling revenue to the State. There is, therefore, some reason back of the public demand that the large surplus power which the Barge Canal storage will make available should be developed by the State for the public benefit and not leased to private parties under conditions which will not bear investigation.

Examinations and Licenses for Engineers

We recorded in our last week's issue the reappearance of a bill in the New York Legislature to place the engineering profession under the control of the State Board of Regents and require engineers to pass an examination and have a state license as a precedent to the practice of their profession.

We have in previous years so fully discussed in these columns the general proposition embodied in this bill that we need take little space for its discussion at the present time. As our older readers at least can testify, ENGINEERING NEWS has for many years taken an advanced position in favoring state control and regulation of many matters affecting public welfare. The past quarter century has seen enormous progress in the extension of state and federal regulation of industry and commerce. We are well aware, however, of the serious limitations to the efficiency of government work, and we believe the general rule which ought to be followed is that the State should not interfere with any private enterprise or occupation except when it is clearly established that such interference is a necessity for the public welfare. We have yet to see any proof that interference by the State with the practice of engineering is necessary for protection of the public or that it would in fact, effect any measure of public benefit. We recognize that many excellent members of the engineering profession have come to believe that state regulation of engineering practice will in some way better the conditions of engineering employment and engineering compensation; but we are unable to see any sound foundation for such a belief. ENGINEERING NEWS has been foremost in opening its columns to the discussion of the status of engineers, and to suggestions of methods by which the conditions of engineering employment can be improved. We welcome such a discussion for we are firmly convinced that united action by the profession is essential if the status of the profession is to be bettered. But the records of experience both here and abroad furnish conclusive evidence that the proposal to place the whole engineering profession under state control means no benefit to the profession, but a serious injury.

There are, we are aware, a number of eminent engineers who have come to believe that some sort of state regulation of engineering practice is inevitable; and that since it must come sooner or later, it is not worth while to take the trouble to oppose such legislation. We cannot subscribe to such a view. There is no public demand whatever for the passage of laws to restrict the practice of engineering. The bills which have been introduced and pushed in the New York Legislature appear to be solely due to an organization of which nothing but the name is definitely known, its list of members and its officers being kept a secret. It is well known that the difficulty of securing the passage of even most excellent and desirable legislation, unless it has some political backing, is very great. Past experience has shown that it only needs a clear presentation before a legislative committee, by responsible engineers, or representatives of rsponsible engineering societies, of the facts regarding the engineers' license scheme, to cause any such bill to be killed without question.

Eternal vigilance was long ago said to be the price of liberty. The engineering profession should be willing to make some effort each year, if necessary, to protect itself from unwise legislation tending to restrict its liberty of action.

To those who hold the position that licenses for engineers are inevitable or that such licenses ought to be required, we suggest that instead of attempting the well nigh absurd task of branding with the title "licensed engineer" every man who has graduated from an engineering school, they attack the problem in a more intelligent way, and require licenses not for engineers in general but for special branches of engineering work. There are, for example, sound arguments in favor of the proposition that those who engage in the work of land surveying should be examined and licensed. Such a thing is entirely practicable and has in fact been carried out in many cities. If those who are anxious for engineers' license legislation wish to undertake something of real public benefit, let them secure expert aid, draft a model license law for land surveyors and secure its enactment in the different states of the Union.

If they wish to proceed further in the promotion of legislation to benefit the public and the engineering profession, let them secure in each state the enactment of a law creating a state department of public works under direction of a state engineer, which should not only have control and direction of the engineering works carried out by the state direct, but should see that the public welfare is safeguarded in the construction and maintenance of dams, reservoirs, highway bridges, and numerous other works where carelessness or incompetence on the part of the engineer may cause injury to the public welfare.

It is often said that engineers ought to be examined and licensed because lawyers and doctors are; but there is a better way to protect the public against incompetent engineers than can be done by any examining and licensing system. It is possible to inspect the plans and the work of the engineer and protect the public in that way. No such system is possible in connection with the work of the lawyer or the physician.

The Flood Disasters in Ohio and Indiana

At the time our last issue went to press, the first news had just arrived of the disastrous flood which visited many cities in Ohio and Indiana on Mar. 25. The extent of the damage to property and to life, however, was not at all realized from these early dispatches. The great extent of area which the floods covered, the interruption of the railroad and mail service, as well as of telephone and telegraph communications all have contributed to make the full extent of the disaster even now a matter of uncertainty. In fact, as has happened in other great disasters, such as the Johnstown flood, the Galveston hurricane, and the St. Louis tornado, the exact loss of life can never be accurately determined. As to the damage done by the floods to the property of railways, states, cities, manufacturers, merchants and private individuals, there again only the vaguest approximation can ever be made.

From the reports now available from the flooded districts, however, it appears probable that the damage done as a result of the rain storm of Mar. 23 to 27 in Indiana, Ohio, western Pennsylvania, and New York will exceed that ever caused by any storm on record in this country.

Accurate records of the storm's extent and severity are still lacking. The difficulty of communication with the flooded districts, and the terrible destruction to life and property which has turned the attention of all responsible persons to the immediate work of relief makes it doubtful whether accurate records of the rainfall and of the volume of the flood flow in the various rivers will ever be gathered.

Such records are of interest and importance to the civil engineer and we hope that any of our readers in the flooded districts who may have been able to make even approximate records of rainfall or stream flow will communicate their observations either to us or to Mr. M. O. Leighton, Chief Hydrographer of the U. S. Geological Survey, which organization will without doubt collect data concerning the floods.

The rainfall which caused these destructive floods was part of a general cyclonic storm which began on Easter Sunday, Mar. 23, and swept a broad belt of country from Wyoming eastward through Nebraska, Iowa, Illinois, Indiana, Ohio, Pennsylvania and New York, terminating on Thursday, Mar. 27. The destructive tornadoes which caused great loss of life in the cities of Omaha, Terre Haute and many smaller places on Mar. 23 were a part of this general storm.

As to the extent of territory subjected to heavy rainfall, this is really more accurately determined by the reports of floods in the various streams than by the Weather Bureau reports of rainfall because the Weather Bureau stations from which telegraphic reports are received are located long distances apart. Further, the flood damage interrupted telegraphic communication from some of the stations where the storm was most severe.

Weather Bureau rainfall records are as follows:

Station	Period covered March:	Total rainfall inches
Terre Haute, Ind	24 and 25	3 64
Indianapolis	24 to 26	5 38
Louisville, Ky	25 to 27	5.94
Toledo, O	24 to 26	5.46
Cleveland, O	24 to 27	7.08
Columbus, O	24 to 26	5.94
Pittsburgh, Penn	24 to 27	3.46
Erie, Penn	24 to 27	6.14

These records supplemented by others more fragmentary, with the reports of flood heights indicated that the heaviest rainfall occurred on Mar. 24 and 25 in Northern Ohio and Indiana and was probably most severe along the belt of fifty or a hundred miles of highest land where the rivers have their source which flow southward to the Ohio and northward toward Lake Erie.*

The rainfall records at Indianapolis, Toledo, Cleveland and Columbus indicate the probability that this section of heaviest rainfall probably received a precipitation of 5 to 7 inches or even more.

This rainfall came at a time when the ground was well saturated by previous rains and at a time of year when evaporation is almost *nil*. A very large percentage of this rainfall, therefore, flowed at once into the streams; and while the average slope of the area covered is quite moderate, the rivers draining it also have a moderate slope, so that the accumulation of water in the valleys was enormous and far beyond all previous records. The Ohio River tributaries which have been at high flood stage and have caused the greatest damage, naming them from the west toward the east, are the Wabash, the White River and the Whitewater River in Indiana, the Miami, the Scioto and the Muskingum in Ohio, and the Beaver and Allegheny in Eastern Ohio and Western Pennsylvania. The intensity of the storm in the northern part of Indiana and Ohio is further indicated by the high-flood stages in the Maumee, the Sandusky and the Cuyahoga, flowing into Lake Erie.

Judging by the reports of life and property loss, it seems probable that the heaviest rainfall and highest flood stages were recorded on the Miami River and its tributaries. The city of Dayton, where the greatest destruction occurred, lies in the valley of this stream. The life and property destruction, however, is, of course, dependent even more on the local topographical conditions in a city than upon the flood height of the stream flowing through it.

To what extent the failure of dams or reservoirs may have contributed to the life and property loss is impossible at the present time to state. The press dispatches which have reported the breaking of this, or that or the other dam or reservoir or dike are by no means to be accepted at their face value and most of them have been contradicted by later information. In the panic, fright and confusion attendant upon such a flood, all sorts of vague wild rumors are set afloat and given quick credence.

Most of the reservoirs referred to in the dispatches as failing or threatening to fail, are probably those which were built nearly a century ago in connection with the old Ohio state canal system. With the practical abandonment of the canals for many years past, the maintenance of these reservoirs has been more or less neglected. It would not be at all strange that, subjected to such a heavy rainfall, some of these reservoirs should have given way. We believe, however, that most of these reservoirs, although of considerable area, are of compar-

*Since the above was in type this conjecture has been confirmed by later reports from the Weather Bureau recording a rainfall at Marion, Ohio, Mar. 24 to 27, of 10.60 in. Marion is located in the central part of the state, some 50 miles north of Columbus, and is within a few miles of the summit dividing the Lake Erie and Ohio River drainage basins. At Bellefontaine, 40 miles southwest of Marion, near the headwaters of Spring Creek, which joins the Miami River at Dayton, the rainfall in the same period was 11.16 in. At Bangerville, 30 miles east of Marion, 9.50 in. was recorded. At Wooster, 70 miles east of Marion, on the headwaters of the Muskingum River, 9 in. of rain fell, Mar. 24 to 26.

atively shallow depth. If the total volume of water they held had been discharged, it could not have made a very great difference in the flood height of the rivers below. If, however, their breakage should cause a sudden rise of the streams which would catch people before they had time to escape from the flood's path, their breakage may have had something to do with the loss of life.

At more than one place it is reported that the breakage of levees along the river front was responsible for a sudden rush of the river's flood through the streets and consequent loss of life. If this report is confirmed, it will be of great interest to engineers, since it points to the desirability of building river-front levees of ample height and strength if a city is to have such protection at all.

What is equally obvious, however, is that if a city is to be rendered reasonably safe against floods, ample width must be allowed for the passage of a flood flow through it between protecting embankments. The obstruction of the channel by bridge piers, etc., or by fixed dams must be kept within reasonable limits. It is noteworthy that among the bridges reported destroyed by the floods are some very substantial concrete arch structures erected within recent years. One at least of these, the famous Y Bridge at Zanesville, Ohio, is said to have been dynamited, doubtless to reduce the obstruction to the river's flow.

Such extraordinary floods as this emphasize the wisdom of crossing such rivers with long spans and few piers rather than the opposite course. It is common in estimating on the economic length of spans for a bridge structure to consider only the relative cost of piers and superstructure. Such extraordinary flood flows emphasize the wisdom of choosing long spans and fewer piers, even at somewhat greater original cost of construction.

It should be emphasized, however, that the engineer should not be held responsible for the inadequacy of bridges to pass such extraordinary floods as the present. The waterway at a bridge should be sufficient to pass all ordinary floods with safety; but to make it sufficient to pass the extraordinary floods which may come once in a century or in two or three centuries would make the cost unreasonably great and in the Miami and Cuyahoga Rivers at least, present indications are that the flood flow has far surpassed all previous records. This may very likely be true also of the other rivers mentioned above.

A question of great interest is what flood stages may be expected in the lower Ohio and lower Mississippi valleys during the next few weeks. Everything depends upon the extent to which the flood waves from the different tributaries may chance to synchronize with each other, and also upon the extent to which the flow in these and other Mississippi River tributaries may be augmented by additional rainfall within the next two or three weeks. The flood in the Allegheny and in the Ohio and Indiana Rivers named above will be sufficient to keep the Ohio itself above the danger stage at various points for probably at least a fortnight to come.

Fortunately, so far as present information extends, the rainfall has not been heavy on the drainage area of the rivers flowing into the Ohio from the south and west. That there will be high water and an anxious time along the lower Mississippi for a month to come at least may be taken as certain. It is of much interest to note that a very heavy rainfall on a comparatively small portion of the drainage of the Ohio alone can cause high water in the Mississippi, with its other tributaries merely at a normally full stage.

The widespread destruction of life and property wrought by these floods will doubtless give renewed life to the agitation for reservoir construction as a means of river regulation, and even for reforestation as a means of lessening the destructive effect of floods. The argument for such preventive measures may seem convincing to a layman; but to an engineer it seems to us the lesson of the disasters in Ohio and Indiana is rather the futility of any attempt which man can make toward storing the rainfall either by planting forest trees upon the watersheds or by building dams and reservoirs upon the smaller tributaries. Every hydraulic engineer who knows anything about rainfall and runoff knows that a rain precipitation of four to seven inches depth coming on top of ground already saturated will produce high flood stages in the rivers draining such a region no matter if the entire drainage area were covered with forest.

When we turn to the proposition for artificial storage it must be seen that what is perfectly feasible on such little rivers as those which furnish water power to small mills in Rhode Island, or furnish water supply to New York City and Boston, becomes a task of impossible magnitude when dealing with a river draining thousands of square miles.

According to the press dispatches, the Miami River, which wrought such destruction in Dayton and Hamilton and Middletown, was at its highest stage a stream three to four miles in width covering to a great depth the entire bottomland between the bluffs. To thoroughly safeguard against such a flood, would mean building reservoirs of enormous capacity, and having them empty or practically so, when the storm arrives which is to test their usefulness. Moreover, to achieve the desired security, such reservoirs must be built not only on one stream, but on every stream. A vast amount of damage was wrought during the last week by comparatively small tributaries which were swollen for a short time to great rivers.

In saying this we should not be understood as condemning wholly the reservoir system of river regulation, for, as has been pointed out in these columns, lessening the destructive effect of floods is only one function and perhaps one of the least valuable functions of reservoir storage on a stream's headwaters. There are probably cases where under favorable topographical and other conditions the construction of storage reservoirs may be a wise measure, especially for the maintenance of the low-water flow in times of drought in connection with the use of the water for the production of power.

A feature which is not without interest to the engineer is the severe test which the recent floods have given to the foundations of buildings, bridges, dams, etc. Perhaps there are few cases where an engineer lays the foundation of an important building that he plans to have it withstand safely the effect of high floods. Where a building is located on a river bottom which may be submerged to considerable depth by high floods, it is certainly well to take this into account and to see that foundations are so built that they will not be undermined and that the building walls have sufficient stability to withstand the force of any current that may come against them.

LETTERS TO THE EDITOR

The Study of Foreign Languages in Technical Schools

Sir—After reading Prof. W. H. Herschel's paper and your editorial on Modern Languages in Technical Schools, published in your issue of Feb. 27, I beg to call your attention to the common practice abroad, which is the obligation of studying one language, not two, leaving the choice to the preference of the student. The advantages of this solution are:

1. It gives the student the possibility of using in a better way his personal ability and previous opportunities. One may learn more easily one language than another, and also one may have had opportunity to learn fairly well a certain language in his youth.

2. It gives the country at large all the benefits which can be possibly derived from the knowledge of the different languages by engineers.

It seems to me it would be a great mistake to limit the study of foreign languages to one all over the country, whatever it may be. It is preferable to limit it to one language for each individual, leaving the choice between two or three to the option of each.

C. Siqvot.

6 East German St., Baltimore, Md.
Mar. 3, 1913.

The Study of Foreign Languages by Engineers

Sir—Your issue of Feb. 27 contains an article by Prof. Winslow H. Herschel on "The Study of Modern Languages in Technical Schools" and an editorial, "Why American Engineers Should Know the German Language." As the question of the study of modern languages, to assist engineers in their professional work, as well as to give them a liberal education, is a very timely one, a few remarks regarding my own experience and the conclusions gained from it, may furnish some additional thoughts.

When a boy I learned both the German and French languages by being sent to Europe for my education. The advantages which I have obtained therefrom both in my profession and in general, have been so satisfactory to me that I have followed the same plan with all of my five children. They have all been in a German and in a French speaking country for at least one year, and thus learned these foreign languages readily in their youth.

The advantages of knowing German and French are not merely ornamental, or, as Dr. Waddell says concerning French, "only a gentlemanly accomplishment." They are also of great practical value, as you intimate in your editorial and as stated by Prof. Herschel. A mechanical or chemical engineer especially, and a civil engineer only slightly less, miss much encouraging inspiration at the centers of progress in these professions, through lack of familiarity with at least the German language.

It is not merely the ability to read foreign engineering literature that is of advantage to the engineer. It is the personal contact and personal conversations with the engineers and investigators that are of most benefit to us. Many things are said that are not written, and many ideas are talked about that are a spur to further progress, long before they are sufficiently crystallized to be embodied in published articles or books.

It is easier and requires much less time to learn foreign languages in childhood and when we constantly hear them spoken around us, than in the tedious, slow and irrational way in which they are generally taught in our schools.

If it is not practicable, because too expensive, to send our children abroad for one or two years, it may become practicable, within a decade or two, to have established in our own country similar and less expensive opportunities for children to learn foreign languages in a natural way. This would be possible at large German or French boarding schools located in secluded and healthful places where the entire environment and management can be suitably arranged for the purpose of teaching, for practical use, either foreign tongue, within one or at most two years.

In French Switzerland, there are boarding schools where a large number of the scholars are English and American. The instruction in all general branches is in the French language, so that, besides advancing in the general studies, the foreign scholar acquires the use of a new and live tongue. An American scholar in a similar school in our own country could study mathematics, history, drawing, Latin and other branches for a year or two as well in French or German as in English and not be the worse for it in after life.

Certain restrictions would be obligatory. No communication could be allowed with the outside world except for a short time and at intervals of a month or two, or by letter. Following further the practice of the above-mentioned Swiss schools, from a designated time after entrance no conversation among scholars would be allowed except in the language to be acquired. All teachers, attendants and servants would naturally be required to speak only the language of the school. All games, sports and other recreations would be conducted in the same language.

This idea of special language schools where the scholars should remain but one or two years, was originally suggested in Europe; but owing to the fact that European countries are comparatively small, it is easier to send a child at once to a neighboring foreign country and this is now the usual custom. In our country of large dimensions and rapidly developing educational interests, it does not seem impracticable to have a few such one- or two-year course German, French and Spanish schools, successfully conducted in suitable localities, where the

cost of attendance could be brought within the means of the average family.

RUDOLPH HERING.

170 Broadway, New York City.
Mar. 7, 1913.

The German Language as an Indispensable Element of Engineering Progress

Sir—The great value to American industrial progress of a knowledge of the German language on the part of our engineers, as pointed out in Prof. Winslow H. Herschel's article in ENGINEERING NEWS of Feb. 27 and in your editorial, is too little realized by our manufacturers and the profession in general.

There is some encouragement to be found, however, in the improving point of view which is in marked contrast to opinions encountered a few years ago, when it was actually argued that German for engineers was a waste of time. In a letter of mine, published Aug. 12, 1909, in answer to a statement of Mr. J. G. White before the A. I. E. E. (discussing Dr. C. P. Steinmetz' paper, "The Value of Classics in Engineering Education") that "scarcely one graduate in 10,000 had any real use for German," I pointed out some of the reasons why German is only second in importance to English itself, all of which still holds good in an even greater degree as events are constantly demonstrating.

There is, in fact, no single collateral subject of as great importance to engineers as a knowledge of German, although this is likely to be contradicted by those most ignorant of the facts in the case. The value to our industries of a knowledge of German on the part of our engineers would be almost incalculable. Their ignorance results in a correspondingly great loss and it is not too much to say that we are five years behind the times from this one cause alone. Yet not only is the engineering profession blind to the benefits of German, but it refuses, for some reason, to become enlightened. It is a case of none being so blind as those who will not see.

An exactly opposite course is followed in Germany, although she is far ahead of English-speaking countries in engineering. There is more English read in Germany than there is German read in English-speaking countries all over the world. The result is that the Germans instantly adopt every possible British or American improvement while we are years behind the times in adopting German improvements. This is one of the secrets of Germany's great progress, and is a practice which will continue to keep her in the lead.

It is, however, of very much less importance for Germany to do this than it is for us to keep up with German improvements for out of the English chaff she can find but few ideas of value compared to the rich supply that awaits us in her improvements. The German system of education is a generation ahead of ours and she is turning out a body of engineers, scientists and technical men who have little or nothing to learn from us while our systems of education and manufacture have the effect of choking off as far as possible all individual initiative and progress and of crowding into the rut of standardization every original idea that may manifest itself.

Some of our largest manufacturers, instead of developing the initiative of their workmen, keep them as far as possible in the class of automatons and obtain as large a proportion as possible of the annual output of graduates of technical colleges for shop positions. In the guise of benefiting these young men, who are paid an insignificant wage, a lot of work is gotten out of them and they are turned out in due course of time as practically experienced men. They have, however, been so thoroughly imbued with the methods and practice of the manufacturers that they know little or nothing of anything else, and are entirely ignorant of foreign improvements. They carry their biased knowledge away with them and the whole stream of engineering is contaminated with this drain of standardization. In specifications, even, written by such byproducts of manufacturing monopoly, apparatus is specified not by name, which would be unfamiliar to the graduates, but by the catalogue number of the manufacturers, as if no other manufacturers ever made such apparatus. Yet this whole influence is exerted in the name of the good of the profession!

There is small wonder that from such sources there should come no encouragement to learn German, as long as antiquated standardized products can be forced on the public to avoid and discredit foreign improvements.

As a result of her wonderful educational system, her progressive attitude on all public questions and her modern methods in industry, finance and business, Germany is far ahead of other countries. The true state of affairs being concealed to a great extent from American understanding by ignorance of the German language, and still further beclouded by special interests, we are unable to take advantage of German discoveries and must therefore straggle far behind. Yet those German engineers who come to America for the purpose of disseminating new ideas meet with jealousy and lack of coöperation. They find that our manufacturers and engineers not only do not know what is going on abroad, but are content to remain in ignorance and even when the truth is demonstrated are loath to admit it, which is, though not commendable, at least understandable, since they do not like to concede that progress has been made which they themselves should have made had they been properly diligent.

The profound ignorance of German affairs is, to put it mildly, surprising. A few examples taken at random will serve to illustrate it. The American Society of Civil Engineers displays in its library, charts showing the growth of our national engineering societies as compared with the leading British and French engineering societies. These charts are very instructive as far as they go, but the most prominent engineering society in existence is conspicuous by its absence, namely, The Verein Deutscher Ingenieure, the leading society of Germany which numbers among its members the most eminent engineers throughout the world, besides being the largest of all engineering societies, as is well known. Its membership has in the past decade perfected more inventions and improvements and made more researches, than are credited to the members of all other societies combined, and it has undoubtedly proven the greatest single factor in the progress of the world during the present century.

If our technical press and even the general press de-

voted space to describing the triumphs of the engineers of this society instead of wasting paper and ink on the trivialities with which their columns are crowded, vastly different conditions would prevail in this country today.

An concrete example of the kind of welcome that meets a German improvement in this country is seen in the case of a certain CO_2 recorder which came into notice several years ago. In a paper on the subject of Power Plant Economy, read before the A. I. E. E., it was stated that this recorder accomplished remarkable results, but the inference was given that it was a British improvement. This was due either to ignorance or malice, between which there is not much to choose. The apparatus, as a matter of fact, had been for many years in successful use in Germany where it originated.

In a paper on Steam Pipe Covering, read before the Association of Edison Illuminating companies, the results of extensive and costly tests of steam pipe covering were reported and it appeared that a certain German covering showed an efficiency of 86.9% while the best American covering showed an efficiency of 84.2%, a difference of 2.7%. This covering, however, was discredited, as being inflammable. The tests had been made on ordinary high-pressure steam pipes. As a matter of fact, this particular pipe covering had long been and is still being widely used in Germany on superheated steam piping, proving non-inflammable at temperatures far beyond those which can ever be employed on our own prime movers, for American manufacturers are entirely unable to build prime movers for high degree superheated steam, failing accordingly to obtain the low steam consumption of 9 lb. and less per horsepower hour, so common in German practice. At the conclusion of the paper the facetious allusion of "made in Germany" contributed no little to the entertainment of the gathering and it was reported in the same spirit by the engineering press.

An occasional engineer recognizes the value of German progress and attempts to take advantage of it by using German formulas without understanding the German language. The result, is of course, far from a happy one. Young engineering students are more appreciative and often attempt translations of highly technical material but without being competent to do it, while such experienced engineers as are competent have but little time for translations, and for this reason a great amount of valuable material will always remain unavailable until our engineers, as a rule rather than an exception, understand German. Translation for itself seldom offers sufficient remuneration to be properly done, and is always more or less a labor of love, which passes with but little credit or appreciation.

The failure of our engineers to keep uptodate is the cause of enormous losses to manufacturing and industrial undertakings all over the country. Numerous failures and gross inefficiency in engineering undertakings produce stagnation, for our bankers, by bitter experience have learned to distrust our slap-it-together engineering methods and refuse to invest in new projects, particularly in hydro-electric and other power developments, which in turn prevents other dependent industries from coming into existence.

Quite the opposite condition obtains in Germany where bankers not only invest German capital in German undertakings but make calls on foreign capital, especially from France, since on account of the efficiency of German engineers, they can show profits on engineering undertakings which cannot be realized by the bankers and engineers of any other country.

This is all accomplished without the hurrah which accompanies such movements as "scientific management," as we know them. The thing that is called by this fine name in America is only regarded as common practice in Germany where the writer, for example, employed it in his shop practice some 18 years ago, being instructed by his superintendent who had practiced it for some 40 years, quite innocent of its future fame in America. The writer in 1904 had occasion to make a report on a power plant in the United States which resulted in a saving of more than $200,000 a year in operating expenses, while in a smaller plant $50,000 a year was saved, without dreaming that the processes recommended were later on to be classified as "scientific management."

If our engineers were really efficient and uptodate, we could not only save millions of dollars per day in our engineering, industrial and administrative undertakings, but could obtain an enormous foreign trade and could give our capitalists opportunities for great new investments which cannot now be made on a profitable basis. Simply the knowledge of German on the part of a few thousand engineers would accomplish this since they would not then have any excuse for ignorance or lack of progressiveness. The country is paying a large price for our engineering inefficiency.

The same condition is found in England as is recognized by those who are familiar with conditions. In a speech made in the British Parliament the truth was pointed out in these words:

> One of our greatest failures is that less than 1 per cent. of our engineers and officers understand the German language; everything that we wish to know of German progress must come to us second-hand in insufficient and delayed translation; today we are at a point where Germany is able to build ten ships against our one; we have to learn to imitate Germany.

How indispensable a knowledge of the German language is to our engineers is obvious. It is to be hoped that the engineering profession will be spared any further exhibitions on the part of those who take pride in their ignorance.

Frank Koester,
Consulting Engineer.
50 Church St., New York City.
Mar. 7. 1913.

Multiple Headings in Rock Tunneling

Sir—The writer's attention has been directed to the interesting article published in your Feb. 13th issue, by John F. O'Rourke, entitled "Elimination of Timbering in Rock Tunneling: A Proposal." Although not wishing to venture upon criticism of the merits of concrete-block lining for rock tunnels, as outlined by Mr. O'Rourke, the writer cannot abstain from commenting on the method proposed for driving rock tunnels.

It is a fact only too well known that, comparatively, heading excavation is the costliest item in tunnel excavation; and on the success of driving the heading depends to a large extent the successful completion of the tunnel.

In modern tunnel practice the tendency is to keep the number and size of headings down to a practical minimum. In this country one heading only has so far been advocated as being most advantageous to drive railroad tunnels. In Europe, only rock tunnels over two miles long have been and are driven with a top and one bottom heading, the reason being obvious, for the greater the number of headings, the more complicated the driving operations are, and it is only with a first-class organization of men and mining operations, and on long tunnels, that a tunnel can be driven successfully with two headings. The tunnel must be long enough to warrant such an organization to be made available, and the necessity for rapid driving must be warranted by the capital invested, time being of the essence for an economical completion of the work.

The driving method proposed by Mr. O'Rourke would involve three headings, the area of which would represent one-third of the total tunnel section, as against two headings aggregating one-fifth only of the tunnel section. All contingencies pertaining to the driving of a bottom heading would be practically duplicated, not speaking of the drilling equipment, tracks, rolling material, air and ventilating pipes, working shifts, etc.

The operating conditions would also be greatly complicated, and only one familiar with the top-and-bottom-heading method can appreciate these features.

Why not first try methods which have been used abroad, modifying them so as to suit local conditions? Within the past ten years the top-and-bottom-heading method has been used successfully in driving the following tunnels: Simplon, 65,042 ft. long; Loetschberg, 47,680 ft. long; Weissenstein, 12,136 ft. long; Ricken, 28,200 ft. long; Wasserfluh, 11,666 ft. long. This very same method is used at the present time to drive the tunnels of: Hauenstein (26,683 ft.), Mont d'Or (20,021 ft.), and Granges (28,093 ft.). This tunneling method would not interfere with the use of interlocking concrete blocks as illustrated in Mr. O'Rourke's article, and it is the writer's belief that in tunnels subjected to moderate ground pressure the use of such blocks will be found advantageous, without, however, doing entirely away with the timbering. It should be borne in mind that timber segmental arching for tunnel work is costly and inadequate where high and unbalanced pressure prevails, and usually a timbering method similar to that used in Alpine tunnels has to be resorted to.

This naturally makes impossible the use of traveling steel or timber forms supporting the lining, and the masonry has to be laid in short sections or rings, by taking down the temporary timbering as the lining progresses. In such cases a tunnel lining formed of interlocking blocks might prove advantageous by reason of the speed with which the lining could be placed in position.

E. Lauchli.

2 Wall St., New York City.
Mar. 12, 1913.

[The above discussion was submitted to Mr. O'Rourke, whose reply follows.—Ed.]

Sir—Mr Lauchli takes the ground that by the use of the three headings shown the expense is largely increased, and calls attention to the general practice of keeping down the number and area of the headings to a minimum.

I may not have gone into sufficient detail to be perfectly clear, as to the conditions under which the use of concrete interlocking blocks is suggested as a substitute for timbering. I had in mind, however, the timbering of tunnels through rock more or less broken and what is called heavy, and not for tunnels where the superimposed mass is so great that movement occurs, which under less weight would be perfectly safe without timbering. With this in mind, it is no longer a question of the cheapest system of excavation, but the most practical one, which permits of doing the work without excessive "falls." To accomplish this purpose, two side headings are necessary for placing the bench walls, and a top heading would most likely be found desirable to facilitate and minimize the amount of excavation required immediately in front of where the lining is being placed. Moreover, the driving of headings in the character of rock assumed is not so costly as in stronger rock, which seems to be that considered by Mr. Lauchli. As the side headings are inevitable, I see no reason for modifying my views expressed in the former article.

I would like also to add that I fully agree with Mr. Lauchli in all he says as applied to the character of rock encountered in the tunnels he cites, and am also greatly pleased to find that he considers the interlocking concrete blocks superior to concrete laid upon forms in place under the timber conditions in his tunnels.

The main idea of my former article was that by the use of interlocking blocks, timbering might be eliminated with a gain both in speed and economy and Mr. Lauchli's communication seems to confirm that belief.

John F. O'Rourke.

345 Fifth Ave., New York City.
Mar. 20, 1913.

Flow of Liquids through Narrow Rectangular Channels

Sir—In Engineering News, of Dec. 19, 1912, was an article by Ernest Jonson giving a series of tests of the leakage around a piston closely fitting in its cylinder, with corresponding calculated leakages based on analysis.

The figures show a remarkably close corroboration of the measured flow with that given as calculated, but the details of tests and of computation indicate that such corroboration is not to be expected on theoretical grounds, and may be the result of the accidental balancing of errors of weight.

(1) The increase of channel width owing to extension of the cylinder and compression of the piston is not negligible. Without having the structural details of the test apparatus it is not possible to determine these, but it is not unlikely that at the higher pressures used, 120 lb. in the first series, the increase of channel width may amount to 0.0001", indicating that the calculated flow figure should be increased 15%. This correction would decrease at the lower pressures.

(2) It is not stated that precautions were taken to maintain the piston concentric with the cylinder so as to give a channel of uniform width. If this was not done, it is possible that the piston was forced to one side of the cylinder, giving a channel width of 0 at one side, and a channel width of double the average at the opposite side of the piston. Under such conditions, and without any exact analysis, which would not here be warranted, it is

obvious that, taking the larger half of the crescent shaped opening, the mean hydraulic radius r at the point of maximum opening is twice the average, the rate of flow at this point is eight times the average, and the mean hydraulic radius r at the point of least opening is equal to the average, and the rate of flow likewise the average, and the average rate of flow for this larger half of the crescent is 4½ times the average calculated on the assumption of uniform channel width. Ignoring the flow in the smaller half of the crescent, the total flow is still twice that calculated for uniform average channel width of $2r$. If the piston and clyinder do not touch at any element, somewhere between once and twice that given by the formula.

(3) In the first series of tests, the measured opening 0.0018 in. is corrected to 0.001946 in. to make the calculated flow agree with the measured flow over the greater part of the range. This correction amounts to 8% of the channel width and amounts to an increase of calculated flow of 26%. The data given does not seem to warrant this correction.

(4) The value given for the coefficient of viscosity

$$u = \frac{0.000013}{18 + T}$$

reduced to the usual C. G. S. units reads

$$u = \frac{0.018}{1 + 0.036\,t}$$

which corresponds to the figure obtained by the flow of water in glass tubes, and based on the assumption of no slip between the water and the glass. Where the walls are of bronze, such assumption is probably unwarranted, and the equivalent coefficient might have to be modified.

The test figures reported are of value, but the formula for flow should be used with an understanding of the limitations of accuracy not fully expressed in Mr. Jonson's paper.

It is of interest to note that the formula developed by Mr. Jonson is given in slightly different form in Lamb's Hydrodynamics, 3d Edition (Cambridge University Press, 1906), p. 542, and reads in Mr. Jonson's notation (correcting for typographical error)

$$\int_{-r}^{+r} v \cdot dx = \frac{2}{3} \frac{r^3}{u} \cdot \frac{dp}{dl}$$

CHARLES B. BUERGER.

Department of Water Supply, Gas and Electricity,
21 Park Row, New York City, Feb. 18, 1913.

Sir—In response to questions raised by Mr. Buerger, I would say:

(1) The general character of the apparatus does not seem to justify any greater refinement than that used. An average enlargement of 0.00005 in. of the channel and a corresponding increase in the flow of 7% would be possible if there were no flanges on the cylinder and no solid top in the piston. The average enlargement of the cylinder might be roughly estimated as 1.5% at 120 lb. pressure with a corresponding increase of flow of 4.5%. This correction would somewhat decrease the average difference between the calculated and the measured flow.

(2) A piston clearance of 0.002 in. is equivalent to a sliding fit, hence the piston was self-centering.

(3) The correction is well within the limits of error in the micrometer measurements, and still more so within that of the apparatus. It is justified by the resulting close agreement between measured and calculated flow. In other words; the theoretical formula applied to the flow of a clean liquid gives a more accurate measurement of the hydraulically effective width of the channel than may be had in any other way.

(4) The assumption of slip in a liquid or between a liquid and a solid is utterly inconsistent with all hydraulic phenomena hitherto observed, and hence highly improbable. It is a well established law of hydraulics that the loss of head in a pipe is independent of the pressure. If the water slipped on the surface of the pipe there would be friction, which is a function of the pressure. There would thus be introduced an element of resistance which would be a function of the pressure. The close agreement between test results and calculations show that no slip occurred in the present case.

Mr. Buerger intimates that there are certain limitations to the accuracy of the formula given in my paper but he does not state what they are. There are no such limitations. The formula is absolutely accurate. Its applicability is, however, limited to the conditions for which it was developed. These conditions were defined in the original paper. They were; uniform (rectilinear) flow, relatively very small width of channel so that the resistance produced by top and bottom surfaces is not appreciable. If sides of the channel are so elastic that an appreciable enlargement will take place under pressure a formula taking account of this enlargement would have to be developed, but for such a formula there seems to be no practical need. Where there is any considerable enlargement it may be figured separately for each case and the resulting average enlargement added to the original width before introducing it into the formula.

ERNST JONSON.

Board of Water Supply, 147 Varick St., New York City.

March 5, 1913.

Proportioning of Foundations for Columns and Walls

Sir—I desire to make a correction in my article in your issue of Mar. 6, 1913, p. 465, on the "Proportioning of Foundations for Columns and Walls." On p. 465, second column, about 3½ in. from the bottom of the column appears the following sentence: "Columns 1, 2, 3, etc., carried 62½% of live load . . . . ," and five lines below " . . . . carried 73% of live load." The word "live" should be "dead" in each of these cases.

While the method proposed is based on dead load, I have been asked why any part of the live load is considered. The reason is that in all buildings a part of the load, such as machinery, furniture, etc., is almost as steady as the permanent dead load and therefore should be taken into account. The allowance of 15% to 25% of live load should care for this permanent load usually.

My attention has been called to the fact that the method proposed, which readers will bear in mind was not claimed by me to be original, is given in the "Encyclopedia of Civil Engineering" published by the Amer-

ican School of Correspondence, which was not known to me when the article was written.

ERNEST MCCULLOUGH.
Monadnock Block, Chicago, Ill.
Mar. 13, 1913.

Sir—In Mr. McCullough's article on "Proportioning of Foundations for Columns and Walls," the author does not explain the underlying principles involved so that it is impossible to determine exactly what he proposes. In the proportioning of footings as between dead and live loads a correct method involves an estimate of the actual live loads which will come on the footings at various times in the life of the building. This may vary in different classes of buildings from 5% to theoretically 100% of the floor loads used in calculating the strength of beams. It is impossible to proportion footings so that the unit load under all footings shall be the same if there is any variation in the live loads during the life of the building. The best that can be done is to select some condition of loading between the case of no live load on one hand and the maximum probable live load on the other hand, and proportion the footings so that for the conditions of loading selected the sum of the dead and live loads on the foundation bed will be uniform under all footings.

I have devised and used in my own practice, a method of proportioning footings involving the use of the maximum probable live load obtained by an estimate based on the probable use of the building, in place of the live load obtained by adding together the floor loads used in calculating the strength of the floor beams, or the use of any fixed proportion of such arbitrary floor loads. Furthermore, the method involves proportioning the footings, not for the maximum probable live load, but for one-half of the maximum.

By the use of this method the load on all footings will be equal when one-half of the estimated maximum live load acts on the footings. During erection, and before any live load acts on the footings, those footings having a high proportion of dead load will inevitably have the highest loading on the soil, and if the soil is compressible will at the time of the completion of the building have settled the most. As the use of the building brings the live load into action, the load on the supporting areas for interior columns will gradually increase. When one-half of the live load acts on the footings the unit load under all footings will be equal. It at any time more than one-half of the estimated maximum live load acts, then the unit load under interior footings will be greater than under exterior walls, but in general the variation in loading and the resulting difference in settlements will be the least possible under varying proportions of dead and live load.

DANIEL E. MORAN.
53 Liberty St., New York.
Mar. 20, 1913.

Sir—The writer was much interested in the article by Mr. McCullough on "Proportioning of Foundations for Columns and Walls."

The methods given can be stated somewhat differently and shown to be similar.

Let D = Dead load on representative column
" W = Total load on representative column
B = Bearing value of soil
D', W', and B' represent similar functions for any column in building

By the method given by Mr. McCullough

$$B' = \frac{BW'D}{D'W}$$

and the area of footing equals

$$\frac{W'}{B'} = \frac{D'W}{BD}$$

By the method given by Mr. Schneider

$$B' = \frac{BD}{W}$$

and the area of footing equals

$$\frac{D'}{B'} = \frac{D'W}{BD}$$

The methods then are alike and only give different results with the selection of different representative columns. In other words, the foundation is designed for the dead load arbitrarily increased for live load. The amount of increase being determined by some column selected as being representative, the measure of the increase is the ratio of the total load on the footing to the dead load.

Mr. McCullough selects the column with the least live load in proportion to the dead load, while Mr. Schneider selects the column with the greatest live load in proportion to the dead load. Between these two extremes there is a considerable range of choice.

The method of reducing live loads going to columns affects the size of the foundations. The writer believes that we should be conservative, in this respect, and favors the method used by C. C. Schneider in his "General Specifications for Structural Work for Buildings," mentioned by Mr. McCullough. It reads as follows:

> For columns carrying more than five floors, these live loads may be reduced as follows:
>
> For columns supporting the roof and top floor, no reduction. For columns supporting each succeeding floor, a reduction of 5% of the total live load may be made until 50% is reached, which reduced load shall be used for the columns supporting all remaining floors.
>
> This reduction is not to apply to live load on columns of warehouses, and similar buildings which are likely to be fully loaded on all floors at the same time.
>
> The live loads on foundations shall be assumed to be the same as for the footings of columns.

EDWARD HUTCHINS.
P. O. Box 255, Glens Falls, N. Y.
Mar. 13 1913.

The Railway Valuation Act

Sir—I have read with interest the editorial in your issue of Mar. 6 entitled, "A Huge Piece of Engineering Work," referring to the Railway Valuation Act, the full text of which appears in the same issue.

The caption of your editorial should alone serve a useful purpose. In the morning issue of the *Wall Street Journal* of Mar. 19, appears an article which quotes the Chairman of the Interstate Commerce Commission as follows:

> The work is one of great magnitude, but the Commission is not, as has been suggested, staggered or dazed by the duties that have been placed upon it. The work will be approached and proceeded with in a businesslike, impartial and thorough way.

It is no reflection on the Commission or its Chairman if we suggest that the Commission is not "staggered"

by the duties to be assumed for the reason, possibly, that it does not yet comprehend the magnitude of this work and the insufficiency of the means provided by Congress for prosecuting this work "in a business-like, impartial and thorough way."

In this connection, you justly point to the unsatisfactory character of some of the work which the Commission is now prosecuting. Certainly the railroads should encourage the employment of the most competent engineers and accountants for this work. But this requires more than the encouragement of the corporations. It requires that Congress shall appreciate better the market value of the services of these men. The Congressmen naturally will make comparisons with their own salaries, and this will not be helpful.

But supposing that experts are employed who are chosen by reason of their experience, will that secure satisfactory results? There are such differences of opinion now apparent between these "experts" that anything like uniformity of results cannot at present be looked for.

And the differences in the principles and methods followed will give the Commission the opportunity to select from the mass the items least favorable to the corporations. On at least two points there will be a great variation on the part of the appraisers; overhead charges and depreciation.

As to overhead charges: an inventory—even if it should be more complete than any inventory which ever has been made—is only a surface indication of the total legitimate investment. Consider, for instance, an appraisal on the basis of inventory, made 20 years hence of the New York Central Terminal or the Hudson Tube. The inventory might not disclose 50% of the total cost.

As to depreciation: Notwithstanding opinions and court decisions to the contrary, I hold that no depreciation should be deducted from the cost to reproduce new, provided the plant is so maintained by current repairs and renewals as to give the public efficient and economic service. Here is where too many of the engineers and still more of the accountants confuse theoretical or estimated depreciation *to accrue,* with actual depreciation.

A certain man, speaking with authority, has stated recently that a railroad, as soon as put into operation, is reduced to 85% of its cost, and can be so maintained by current repairs and renewals. If, in a rate-making case, this estimate is made the basis for a depreciation deduction of 15% from cost, then we can assume that this is a *necessary* loss to the investor. If it is a *necessary* loss, it is a legitimate overhead charge. So we deduct it from the cost of plant, as such, and we add it in as one of the overhead charges. We have walked around the circle and are back again at the point of starting.

As applied to a rate-making case, the proposition of certain experts, able and experienced men though they are, that certain portions of the plant which are so renewed in part, year by year, as to maintain those parts at a uniform condition of efficiency should be depreciated 50%, is, in my opinion, indefensible. This again, as in the 15% case, means confiscation of investment. It is out of the power of the corporations to do more than maintain their plants at maximum efficiency. If renewals are so made each year as to prevent the depreciation of the quality of service, and if the current repairs and renewals and final renewals are paid for from income, the public is protected. The responsibility for renewals, current and final, rests upon the proprietors, not upon the public served. The investor (including the widow and orphan as well as the Wall Street magnate) should in turn be protected to the full measure of their legitimate investments.

From a long and wide experience in these matters I quite agree with you as to the doubtful value of the provision of the law which requires the appraisers to analyze the past financial transactions. In many cases the records will not be obtainable and in many other cases the records will be incomplete and not self-explanatory.

In the case of some of these corporations, if the appraisals in any measure approach accuracy, the results will be astonishing to the public and perhaps to the Commissions also. It seems to be the opinion of the unmformed, including some university professors of economics, that almost without exception the capitalization of the Public Service Corporations of the United States is heavily watered. But it will be found when the valuation is made that in many cases *the total capitalization does not equal the cost of plant alone.*

The truth is mighty and will prevail; but the trouble is that it sometimes takes a long time to assert itself, and while it remains in the background many innocent people get hurt.

ALEX. C. HUMPHREYS,
President Stevens Institute of Technology.

Hoboken, N. J.,
Mar. 25, 1913.

Retempered Mortar as a Finishing Coat for Concrete Surfaces

Sir—About six months ago, the writer cast about for some safe method of applying a cement-mortar finish coat to a well aged concrete structure, whose surface was not satisfactorily smooth.

In talking with a pair of old cement workers, it developed that for many years skilled workers have coated old concrete surfaces with comparatively thin wearing coats, of 1:1½, 1:2, or 1:2½ proportions, with noted success, their method being to allow the mortar to arrive at its initial set, then retempering with barely enough water to enable it to be easily troweled, and applying to the roughened, cleaned and moistened old surface.

Many severe tests of the method during the past few months, together with the examination of a pier thus coated 27 years ago, reported by R. C. Gowdy, Chief Engineer, Ft. Worth & Denver City Ry., and correspondence with E. A. Fisher, City Engineer, Rochester, N. Y., who specifies retempered mortar between old and green concrete, seem to bear out the "trade method" of the practical workers.

A general correspondence with several of our most noted professional brothers indicates considerable scepticism as to the merit of the process, and this is submitted for the purpose of bringing on discussion of the point, which, if worthy, is of large importance.

JOHN B. HAWLEY.

Fort Worth, Tex.,
Mar. 19, 1913.

The Tornado of March 23 at Omaha, Neb.

The tornado which struck Omaha, Neb., and neighboring places in Nebraska and Iowa, about 6:50 p.m. on Mar. 23, was one of the first disasters due to the heavy and widespread storms throughout the Central States during the week beginning on that date. While serious enough in itself, it afforded little information affecting engineering work, as no high office buildings and no bridges or other engineering works (with the exception of a timber trestle) were in the area swept by the wind. This area was at a considerable distance from the business district, the storm cutting diagonally across the western and northern portions of the city, through residence districts ranging from the wealthiest to the poorest character. The path of the storm across the city was about six miles long, and had the unusually great width of ¼ to ½ mile. Its direction and approximate area and the profile of the ground along the center line are shown in Fig. 6.

The day had been warm and sultry, with rain and some thunder and lightning. The wind was in general from the southwest, and at 5:30 p.m. from the south, but shortly before the tornado the wind shifted fitfully to nearly all points of the compass. Then the clouds became rapidly darker, and there was the greenish tinge of color usually associated with storms of this class, and finally the concentration of the clouds into a dense black mass.



Fig. 1. The Joslyn Residence at 42d and Chicago Sts.



Fig. 3. View at 33d and California Sts., Omaha, Neb.



Fig. 2. The Sacred Heart Academy, 37th and Burt Sts., Omaha, Neb.



Fig. 4. On No. 33d St., Omaha, Neb., Group of Frame Buildings Overturned and Blown Against Each Other in a Heap of Ruins



Fig. 5. At Lake and 24th Sts., Omaha, Neb., Where Brick and Frame Buildings Were Wrecked

The tornado struck the city about 6:50 p.m. The meteorological records are of only relative interest, since these were at the U. S. Weather Bureau office in the Post Office Building, which is more than a mile from the nearest limits of the path of the storm. However, we learn from the local officials that the precipitation for the previous 24-hour period (ending at 6 p.m.) was 0.18 in., while for the period of the storm it was 0.36 in. The maximum wind velocity recorded at the station for a 5-min. period was 32 m.p.h., while the actual maximum was 34 m.p.h. for two minutes. There was a sharp drop in temperature directly after the storm, and during the next few days there was a cold wave, with some snow.

The scene of the disaster was visited by a member of our editorial staff, and three features of interest were called to attention by Watson Townsend, City Engineer of Omaha. In the first place, the wreckage marking the path of the storm was continuous, although in many such storms there is the phenomenon of the tornado bounding from point to point and leaving intermediate spots practically untouched. In the second place, while the storm crossed rolling and hilly ground, the buildings on the lee side suffered as much as, or more than, those on the windward side and the summit. This may have been due in part to the fact that the lee slopes were occupied largely by buildings of the lighter class of construction, but it indicated also the way in which the storm followed the slope of the ground. In the third place, two or three buildings were found to have been moved actually against the general direction of the wind, shifting to the south or west on their foundations.

It is of interest to note that a substantial brick and concrete one-story substation on Leavenworth St. stood directly in this path and received no injury except that falling wires and cables pulled down the steel frame upon its roof. The timber trestle noted later on had a steel girder span on steel bents (over railway tracks); this span remained intact, with the trestle on each side blown down.

The center of the storm struck the western city limits at about 54th and Center Sts. and continued in a northeast direction to the residence district at Bemis Park, where it turned slightly to the east and then proceeded again northeast, leaving the city at about 14th and Spencer Sts., where the ground falls to the lowlands along the river. Along Leavenworth St. the total width of the path was about ½ mile, from 39th to 48th Sts. Near the corner of 48th St. a street car was overturned, trucks and all. Leavenworth St. is at the foot of a slope from the south and was lined with small lightly built frame buildings, many of which were not only blown down but literally blown to pieces, not a sign of a roof or wall being left and the wood being scattered far and wide, together with the furniture and contents. At 40th and Farnam Sts., a brick building was wrecked, and here a number of people were killed, having taken refuge in a garage which collapsed.

Beyond this the storm struck rising ground on which are some of the finest and most substantial residences in the city. These suffered comparatively little structurally, although chimneys and ornamental masonry work were carried away, roofs partly stripped, and interior damage was done by the wind which broke the windows. The trees here were either blown over or had all the boughs broken off. Around Bemis Park is another residence district, but having mainly frame buildings, and here the destruction was extensive. Beyond this, where the storm turned easterly, is a section of the poorer class of residences, which suffered severely. Along 24th St. both brick and frame buildings were wrecked, and among those which fell were a moving-picture theater and a pool room. Here numerous lives were lost. Along Sherman St. (as along Leavenworth St.) the wreckage extended for several blocks.

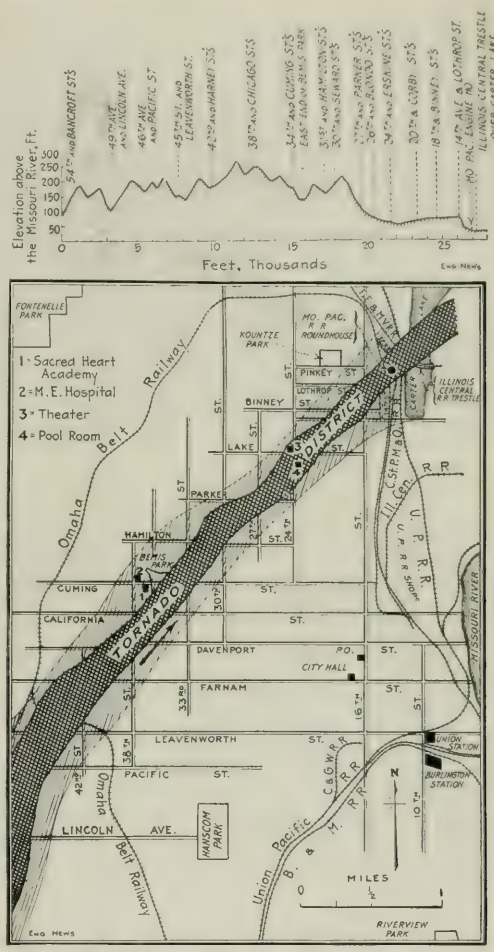


FIG. 6. MAP SHOWING PATH OF TORNADO AT OMAHA, NEB., AND PROFILE THROUGH CENTER LINE OF PATH

(The heavily shaded area includes all of that portion of the city in which the buildings were practically wrecked; the lightly shaded area indicates the partially damaged territory).

At 14th St. is the edge of a bluff which drops abruptly to the low ground along the Missouri River, much of which is occupied by railway tracks and yards. On this low ground was a new roundhouse of the Missouri Pacific Ry., a brick structure with timber roof. This was blown down and the wreckage caught fire (probably from the stoves used for heating), and the building was entirely destroyed. Across the low ground and the lake

(part of an old channel of the river) is a high timber trestle of the Illinois Central R.R., having a plate-girder span over the Chicago & Northwestern Lines. A part of the trestle was blown down, but the steel span (on steel bents) remained standing.

The points of greatest destruction were at 40th and Farnam Sts., and at 24th and Lake Sts., at both of which points brick buildings were wrecked. Fires broke out at several points but the fire department succeeded in getting them under control in spite of the difficulties. The rain also helped to check the fires. The electric wires and cables were in great confusion, many poles being blown over or broken off, and the wires stretched on the ground and tangled in the wreckage. Getting them in order so that light, telegraph and telephone service could be resumed was a serious task, which was tackled at once. Three or four lines of the street railway system were blocked by wreckage. The U. S. troops at Fort Omaha and the local companies of the state militia were put in charge of the wrecked district to prevent robbery and to keep out curious sightseers, who would only be in the way of the necessary work.

It is estimated that 150 persons were killed and 300 injured. A careful examination showed about 1700 houses damaged, of which 700 were destroyed or need entire rebuilding. This renders 2000 or 3000 people homeless, many of them losing practically all they possessed. Relief measures were undertaken promptly.



FIG. 7. VIEW AT 30TH AND HAMILTON STS.



FIG. 8. BUSINESS DISTRICT WHERE LOSS OF LIFE WAS HEAVIEST

The storm struck the small towns of Ralston and Yutan just west of Omaha, and passed through Council Bluffs and some small towns in Iowa after leaving the city. It appears that with the casualties in these places the total number of persons killed was about 185, and of persons injured, 350. There were other smaller windstorms in Nebraska, Iowa, Illinois and Indiana on the same night. One of these struck the northwestern part of Chicago, wrecking and overturning a number of buildings, and about six persons were killed. Another did a large amount of damage at Terre Haute, Ind.

The accompanying views indicate the amount of destruction in the path of the storm. The location of the various structures shown may be noted on the map in Fig. 6.



FIG. 9. WRECKAGE OF FRAME HOUSES

VIEWS IN THE TORNADO-SWEPT DISTRICT OF OMAHA, NEB.

(Copyright, Underwood & Underwood)

The Ohio Valley Floods

Tornadoes and floods in a combination without parallel in the history of the United States wrought great havoc over an area a thousand miles long and several hundred miles wide, during the week beginning Mar. 23, 1913. The loss of life will probably total nearly a thousand. The damage already in sight aggregates many tens of millions of dollars. A spreading area of disaster may be reported during the current week and the following, from extreme floods in the lower Ohio and Mississippi Rivers. The stage of the upper half of the Ohio nearly reached (and at some points surpassed) the highest previous records as early as six days after the beginning of the torrential rains.

A tornado at Omaha, Neb., Sunday evening, Mar. 23, killed about 150 people and destroyed all houses over a long diagonal strip through the city; similar damage resulted in smaller towns in Nebraska, Iowa, Illinois and Missouri (Yutan, Berlin and Ralston, Neb.; Council Bluffs, Neola, Glenwood and Missouri Valley, Iowa; Sterling and Des Plaines, Ill.; Flag Springs, Mo.). At the same time great damage was done by a tornado in the southern part of Terre Haute, Ind., and in the village of Prairieton, 6 miles south, with a death list of about 25.

Floods exceeding all prior heights occurred in many streams of Indiana and Ohio on Mar. 25 to 27. Every river-valley city was inundated, many being partly destroyed; some 500 lives were lost in the two states. Incomplete reports give the following figures for lives lost: On the Whitewater River, Brookville (Ind.), 16. On the Wabash River, Peru (Ind.) and other towns, 25. On the Miami River, the cities of Piqua, Dayton, Middletown and Hamilton total about 200, of which Dayton has 100 to 150; the smaller places in the valley increase the total. On the Scioto River, Delaware and Columbus aggregate about 100 dead, with 65 to 75 at Columbus. On the Muskingum, Zanesville was the chief sufferer, with probably 50 dead.

All streams from the Wabash east to the Connecticut were in flood between Monday, Mar. 24, and Friday, Mar. 28, and many of them passed the highest stages known to have been reached in prior years.

All through railway communication across Ohio from east to west was broken, except for the line of the Lake Shore & Michigan Southern Ry. Six trunk lines connecting New York with Chicago and St. Louis were com-



Fig. 1. View in the Outskirts of Dayton. Wooden Buildings Massed Together by the Current.



Fig. 2. A Rope Line for Rescue Work in Swift Current at Dayton



Fig. 3. Dynamiting Wreckage Piled against Bridge Span, Youngstown, Ohio



Fig. 4. The Baltimore & Ohio Passenger Station, Youngstown, Ohio

pletely interrupted for three days: Baltimore & Ohio, the Fort Wayne and Panhandle lines of the Pennsylvania system, Erie, Big Four, and Nickel Plate. Wire communication was just as completely broken, and for periods of one to two days all cities chiefly affected were isolated except for highway communication. Many other railway, telegraph and telephone lines were interrupted, as far as Illinois, West Virginia, Pennsylvania and Connecticut.

Weather Conditions—Rainfall

Unusual meteorological conditions brought about this series of disasters. The four Weather Bureau maps for 8 a.m. Sunday Mar. 23 to Wednesday Mar. 26 are reproduced herewith in abridged copy; the isobars and wind arrows are given, and rain areas indicated by hatching, other storm-wind effects from Texas to Michigan. West of the Mississippi River, blizzards interfered with railway movement. Telegraph and telephone wires suffered extensive damage, and they were not yet restored to normal condition by Sunday, Mar. 23.

The primary cyclone area on Sunday evening, Mar. 23, carried violent tornado eddies along its southerly edge, one cluster of which caused the ruin on the Nebraska-Iowa border, while others appeared in Illinois, Missouri and at Terre Haute, Ind. As the low-pressure area moved northeast it became more concentrated (compare weather maps Mar. 23 and Mar. 24). An extraordinary rainfall occurred over the whole north-central area from Illinois to New York, with less heavy rain southwest and east of this area. These rains began Saturday, becoming concentrated Sunday and Monday, and continu-

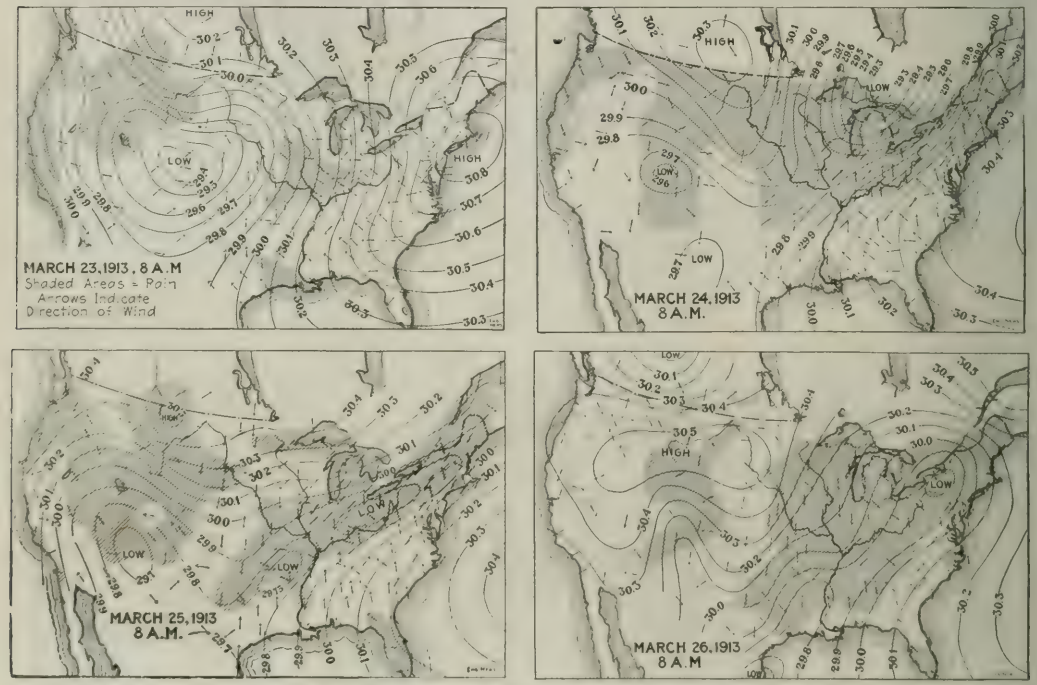


Fig. 5. U. S. Weather Maps, Mar. 23-26, 1913

isotherms being omitted. As the maps show, a series of sharp low-pressure areas traveled across the continent at high speed, and throughout they maintained remarkably steep pressure gradients, amounting to nearly 0.15 in. per 100 mi. on Monday morning.

Preceding the period covered by the maps, storms during the week beginning Mar. 16 were violent locally, but on Friday, Mar. 21, the whole country east of the Rocky Mountains was visited by blizzards, gales and tornadoes. Observed velocities of 88 mi. per hr. were reported at Detroit and Buffalo, 84 mi. at Toledo, O., and 64 mi. at Memphis, Tenn. There was widespread storm damage, but in addition a number of small towns in Alabama, Arkansas, Louisiana, Tennessee and Missouri were demolished by tornadoes, some 50 persons being killed, besides half a dozen deaths from falling chimneys and ing more or less until Thursday, Mar. 27. The north half of the valley of the Ohio River was deluged.

Roughly stated, over 5 in. of rain fell in three days on a region of about 150,000 sq.mi. between the Great Lakes and the Ohio. There was a precipitation of from 1 to 6 in. over the entire territory from the Missouri River east to the Alleghanies, and from the southern tier of states to the Canada line.

Table I gives the rainfalls at main stations from Sunday to Thursday, which covers practically the full period of precipitation except in the Atlantic States. Table II gives partial totals for 16 points in northern and central Ohio, where the heaviest rains fell. Both these tables were furnished us by the U. S. Weather Bureau.

The figures in these tables show clearly that the state of Ohio had the peak of the rainfall, and that the central

TABLE I. RAINFALL IN THE EASTERN MISSISSIPPI VALLEY, MARCH 23-27, 1913

(Figures in first five columns are precipitations in inches for 24 hr. ending at 8 a.m. of the date at head of column.)

	Mar. 24	Mar. 25	Mar. 26	Mar. 27	Mar. 28	Total, in.
Chicago	1.36	0.08	0.01	M	0.00	1.48
Peoria	M	0.06	0.01	0.08	0.00	0.15
Springfield, Ill	0.72	2.22	M	0.24	0.00	3.18
Cairo	0.06	1.56	2.72	0.26	0.00	4.60
Notre Dame	1.42	0.84	0.00	M	M	2.26
Terre Haute	0.98	2.66	M	0.38	M	4.02
Indianapolis	1.52	3.40	0.46	M	0.00	5.38
Louisville	0.00	0.16	5.40	0.68	0.00	5.94
Lexington	0.00	0.20	M	1.56	0.01	
Toledo	2.44	2.68	0.34	0.68	0.02	6.16
Cleveland	1.96	2.88	1.26	0.98	0.10	7.18
Columbus	0.60	2.62	2.72	1.00	0.00	6.94
Cincinnati	0.40	2.24	1.75	0.80	0.00	5.19
Parkersburg	0.08	0.04	1.60	1.26	M	2.98
Pittsburgh	0.20	0.72	1.70	0.84	0.01	3.47
Erie	1.32	2.76	1.02	1.04	0.12	6.26
Detroit	1.30	1.26	0.24	0.60	0.06	3.46
Nashville	0.00	0.00	2.32	0.64	0.00	2.96
Memphis	0.08	0.00	1.60	0.18	0.00	1.86
Knoxville	0.00	0.00	0.24	2.16	0.00	2.40
Chattanooga	0.00	0.00	0.16	1.52	0.00	1.68

TABLE II. RAINFALL TOTALS AT CENTRAL OHIO POINTS, MARCH 23-26, 1913.

(Figures are total rainfall in inches for the week's flood storm, up to 8 a. m. of the date at top of column.)

	Mar. 24	Mar. 25	Mar. 26	Mar. 27
Piqua	6.68			
Sidney		6.60		
Fremont		6.12		
Tiffin		6.72		
Canton		3.22		
Coshocton		2.90		
Kings Mills		4.34		
Oregonia		4.00		
Zanesville			5.16	
Wooster			9.00	
Toboso			6.34	
Upper Sandusky			8.44	
Circleville				6.46
Bangerville				9.50
Bellefontaine				11.16
Marion				10.60

part of this state (embracing the Erie-Ohio divide and on either side the headwaters of the streams flowing to north and south) received the most concentrated deluge, 8 to 11 in. falling in three days. Remembering that the intense precipitation was not local but statewide, the source of the great floods throughout the Ohio river valleys can be understood.

Unusually high water was reported as early as Monday noon from points in northeastern Indiana (Fort Wayne, Elwood, Marion, Kokomo, Winchester, Huntington, Wabash) and northwestern Ohio (Fremont, Findlay, West Liberty). These flood reports came from the headwaters districts. Late Monday night all streams were at record heights. Early Tuesday morning the Dayton levees broke and the water rapidly spread over the business section, flooding practically two-thirds of the city. At Middletown and Hamilton, also, the rise to extreme height occurred about daybreak Tuesday, and the flooded area seems to have been an even greater proportion of the total area than at Dayton. By Tuesday forenoon all river-valley cities in Ohio south of the divide were flooded. The Columbus levees were overtopped Tuesday noon, and crest stage reached at 1.30 p.m.

Railway culverts were washed out Monday at a few places, and traffic interrupted or delayed. By detouring, trains were kept moving until Monday night and at some points to Tuesday morning. By the latter period all through rail traffic and a large part of the local traffic in Ohio was at a standstill.

Recession of the floods began Tuesday evening to Wednesday, though not until Thursday were the rivers down to levels comparable with ordinary flood stages.

River Stages—Only a few figures are available at the present writing as a measure of the high water. At Terre Haute, Ind., not far above the mouth of the Wabash, flood stage is 16; the Weather Bureau gage readings showed 7 ft. on Mar. 23, and 31.2 ft. on Mar. 27, a rise of 24 ft. in four days. At Cleveland, Ohio, E. B. Thomas reports the Cuyahoga River to have been 4 ft. above normal at Main Ave. bridge, one-half mile mile from the river mouth, and 19½ ft. above normal at the head of navigation, 5½ miles from the lake. The Scioto River at Columbus, Ohio, had a flood flow of 93,000 sec.ft. above the junction with the Olentangy. This is an excess of 40,000 sec.ft. over the previous high-water record of 1898. Levees which had been built 6 ft. higher than the record high water were overtopped for many miles. At Circleville, above Columbus, the stage was reported 3 ft. higher than before known. At Franklin, Ohio, the Miami reached a maximum stage about 3 ft. above the previous high record, on Tuesday evening. At Dayton, where the flood reached its crest at midnight Tuesday, the highest stage is claimed to have been 10 to 20 ft. above prior records, but no definite levels can yet be obtained. At Hamilton, Ohio, it is said that some points not covered by the highest previous flood were submerged 10 ft.; substantially the whole city was covered by the water.

As to Eastern points, outside the area of heaviest rainfall, the Genesee at Rochester rose higher than at any



Fig. 6. Part of the Hudson River at Watervliet, N. Y., Opposite South Troy, Mar. 28



Fig. 7. A View on River St., Troy, N. Y., Mar. 28.

Flood Views on Hudson River

(From photographs copyrighted by Underwood & Underwood).

previous time since 1864, according to advices from E. A. Fisher, City Engineer. The Hudson below the Troy dam reached a stage of 22½ ft., which apparently is well above prior records. At Mechanicville, some fifteen miles above, the maximum discharge of the Hudson was estimated at 81,000* sec.-ft., as against 70,000 for the greatest discharge known before.

The Ohio River reached a crest-level of 30.4 ft. at Pittsburgh early Friday, Mar. 28. This height is within a foot of January's flood, 31.3 ft. (see ENGINEERING NEWS, Jan. 30, 1913), but is 5 ft. below the record, 35.5, reached in 1907. The highest level at Wheeling, W. Va., was reached about noon Friday, 51 ft. gage. Cincinnati had a crest stage of 69.8 on Apr. 1, against a record stage of 71 ft. Gallipolis and Portsmouth, between Wheeling and Cincinnati, report floods above the highest records, possibly due to flood flow of near-by tributaries.

Railway service, by highly concentrated effort, was restored fragmentarily late in the week, few points being reached before Thursday, and none of the broken main lines being operated before Saturday. The Pittsburgh, Ft. Wayne & Chicago resumed through operation to Chicago Saturday, with a small detour over Erie tracks. On the same day the last of the flood towns were reached by trains. The Erie resumed New York-Chicago through service Saturday morning, having repaired its washed-out embankments; it reports no bridges destroyed. The Panhandle was not connected through by Monday, Mar. 31, being cut at Dennison, Ohio. Broken railway lines outside of Ohio were restored much more rapidly with isolated exceptions; the New York Central's main line in the Hudson River Valley, submerged just below Albany, was not in use until Sunday, Mar. 30.

Damage to engineering structures cannot yet be reported. A number of railway bridges and a large number of street and road bridges were destroyed, among them some large and important ones. No important dams or reservoir embankments appear to have failed; the river dams at Middletown and Columbus and the reservoir dam at Akron, all rumored to have been destroyed, are standing, although there was a breach through the natural embankment at the latter place. Buildings, shops and factory plants form the largest item of structural damage or destruction. Municipal engineering structures are perhaps next as to value destroyed. Sewer and water-supply systems in all the flooded cities were wholly or partly put out of commission, and estimates of the damage cannot yet be obtained (see also letter of W. H. Dittoe, below). The flooding of filter plants and pumping unpurified water through the mains implies further damage, whose importance cannot be fully foretold at present. Conditions along the New York barge canal are briefly mentioned on p. 697.

⁂

Flood Protection at Paris, France, since the destructive floods of 1910, has only consisted in repairing the damage caused by those floods, at a cost of about $400,000. Nothing has been done to carry out remedial work by raising the quays and facilitating the flow of water through Paris by widening the narrow parts and deepening the river, the estimated cost of which has been put at about $7,000,000. Given the same conditions which existed in the Fall of 1909, and the Spring of 1910, there is no reason to suppose that the same amount of destruction would not be caused to the city of Paris.

*See report of Consulting Engineers in "Report of State Engineer on Barge Canal," 1905, p. 177. "It is reasonably certain that a discharge of 60,000 cu.ft. per sec. is not likely to be exceeded at Mechanicville."

Notes on the Floods in Ohio and the Related Work of the Ohio State Board of Health

By W. H. Dittoe*

At this time (Mar. 29) it is almost impossible to give any definite information concerning the damage done by the floods which have been especially severe in the Great Miami, Scioto and Muskingum Rivers.

At Columbus a number of highway bridges were destroyed and owing to several breaks in levees the west side of the city was entirely flooded to depths reaching 15 ft. The property loss in this section was great. The gage height of the Scioto River reached 22.9 ft., about 1½ ft. higher than the 1898 record. A rumor that the storage dam above the city had broken was entirely erroneous. A rough estimate gives the discharge over the dam as 80,000 cu.ft. per sec.

At Dayton the entire central business and residence sections were flooded, with water reaching 15 to 18 ft. in depth. The property loss there has been estimated from $15,000,000 to $30,000,000. Breaks in the levees added to the destruction.

The water-supply at Dayton was thrown entirely out of commission and its reconstruction cannot be commenced before Monday, Mar. 31. Drinking water for Dayton is being furnished by the Springfield water-supply, presumably by means of tank cars.

The Zanesville water-supply is out of commission due to the high water but will probably be placed in service as soon as the water subsides.

The Columbus water-supply was temporarily out of commission for about 24 hours, due to a break in one of the discharge mains. The easterly part of the city is now being supplied and the westerly section will be served in a day or so.

Thus far we have not ascertained that any of the state [canal] reservoirs have failed. James E. Marker, state highway commissioner, was placed in charge of the various reservoirs.

The State Board of Health, through its secretary, Dr. E. F. McCampbell, immediately organized a staff to deal with the situation and it was arranged that a sanitary engineer and medical inspector should visit the cities most affected. The general work of the inspectors has been to organize the local departments, to reëstablish quarantine and to reëstablish sanitary conditions within the flooded districts. Visits have been made to Dayton, Zanesville, Newark, Springfield, Urbana, Xenia, Delaware, Piqua, Troy, Middletown, Miamisburg, Hamilton and a number of other cities. We do not anticipate that serious epidemics will result from the floods.

The following rules for reëstablishing sanitary conditions and for the control of communicable diseases in the flooded districts were sent by the State Board of Health to the local health boards of the various cities affected.

Rules of the Ohio State Board of Health for Reëstablishing Sanitary Conditions within Flooded Districts

(1) Reëstablishment of water-supply.
(2) Disinfection.
(3) Removal of putrescible matters.
(4) Cleaning of streets and walks.

*Chief Engineer, Ohio State Board of Health, Columbus, Ohio.

(5) Reëstablishment of sanitary conveniences.
(6) Cleaning of yards, houses and buildings

All of the above should be accomplished in general in the order named. If possible, all of the remedial measures should progress simultaneously, but this may be impossible.

(1) Reëstablishment of water-supply.
   a. Boil all water used for drinking purposes.
   b. If fuel cannot be obtained, municipality must distribute [water] supply of assured sanitary quality by tank wagons, barrels or otherwise.
(2) Disinfection. (Note below for disinfectants.)
   a. Spread lime generously over flood deposits which cannot immediately be removed.
   b. Whitewash interior of buildings after deposits have been partially removed by scraping by the owner or municipality.
   c. Disinfect fecal matter in vaults and upon surface, which cannot be immediately removed, by use of calcium hypochlorite.
   d. Disinfect dwellings in which a contagious disease has existed by the use of formaldehyde.
(3) Removal of putrescible matters.
   a. Fecal matter, dead animals, garbage and other putrescible wastes should be immediately removed, if possible in wagons, and properly disposed of.
   b. Fecal matter and other semi-liquid wastes may be discharged into existing sewers through manholes.
(4) Cleaning of streets and walks.
   a. By flooding if water-supply is available.
   b. By scraping and brooming if water-supply is not available.
(5) Reëstablishment of sanitary conveniences.
   a. Where sewer is available and can be used. If dwellings have no indoor sanitary conveniences or water-supply is not available build temporary closets over manholes.
   b. Where sewer is available but cannot be used. Provide watertight metallic covered receptacles to be used until other provision is made, and to be emptied into nearest sewer or vault at the direction of the health department.
(6) Cleaning of yards, houses and buildings.
   a. Owner shall scrape ceilings, inside and outside walls, floors, walks and yards, piling material in street. If owner is unable to accomplish this the municipality should proceed with the work.
   b. Ceilings, walls and floors should be whitewashed. Walks and yards should be sprinkled with lime.
   c. Cleaning by owner may be completed after whitewash has dried.
   d. Provision for pumping flooded cellars must be made by municipality.

DISINFECTANTS

Lime:

If lump lime is used it should be slaked to a dry powder, which should be scattered freely over deposits.

If hydrated or slaked lime is used apply as before.

For whitewash mix hydrated or slaked lime with twice its volume of water to proper consistency, to apply with brush.

Hypochlorite:

Make solution from paste in proportion 5 lb. of powder to 1 bbl. of water (30 gal.).

Use one barrel of such solution to 1 cu.yd. of fecal matter.

Note—If fecal matter is in solid condition remove immediately without use of hypochlorite. If in semi-liquid condition disinfect, stirring to accomplish mixture.

Formaldehyde:

To be used in accordance with regulations of local health department.

Rules of the Ohio State Board of Health for the Control of Communicable Diseases in Flooded Districts

(1) Where it is necessary to remove persons quarantined for contagious diseases or for having been exposed thereto, especially smallpox, diphtheria and scarlet fever, they must be taken in charge by the board of health and removed to separate buildings, and physicians, nurses and food supplied.

(2) All persons, societies or institutions taking in refugees from flooded districts should immediately notify the board of health so that an investigation can be made to determine if any such refugees have a communicable disease or have been exposed thereto. A register of all persons coming under the supervision of the board of health should be kept.

(3) All refugees sent to large buildings or volunteered homes must be examined by a physician with especial reference to sore throat, fever and eruption. All suspects should be placed in a detention building or kept under observation by the board of health.

(4) All exposures to and persons coming from districts where smallpox exists must be immediately vaccinated.

(5) Typhoid patients should be carefully guarded and their feces and urine disinfected immediately.

(6) Anti-typhoid inoculation will prevent typhoid fever and should be practiced where possible.

(7) The board of health and water-works officials must give continuous warning to **BOIL ALL WATER FOR DRINKING PURPOSES** where the supply is from private wells in flooded areas or where the public supply is taken from a stream or from wells that are in a flooded area. Boiling should be continued until notice from the board of health.

(8) Physicians should volunteer for medical and sanitary work and place themselves at the disposal of the board of health and coöperate with it.

Severe epidemics of typhoid fever and scourges of other contagious diseases often follow in the wake of floods. All precaution must be taken to prevent this.

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Flood Damage along New York State Barge Canal

High water along the line of the New York State Barge Canal did considerable damage to contractors' plants and to work under construction, but did not seriously damage many of the finished structures. The State Engineer has deferred giving out any official statement of the extent of the damage until authentic information has been received from all points along the canal. He has, however, taken occasion to deny a widely circulated report to the effect that $50,000,000 damage had been done to the Canal structures and equipment.

As far as can be now ascertained, most of the injury along the line of the Barge Canal has been the washing away of embankments and the possible filling of channels. At Yosts, on the Mohawk River, one of the movable bridge dams of the type described in ENG. NEWS, Dec. 8, 1910, p. 611, was somewhat damaged. The gates of the dam were down and the flood, rising during the night, washed against them so much débris that the gates could not be raised. Some of the gate frames were bent back out of line. It is not thought, however, that the damage was very serious.

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Hearing on Engineers' License Bill at Albany (by telegraph)—At the hearing, on Apr. 1, before the Assembly Committee on Education, having in charge the bill before the New York legislature to license engineers, a large delegation of engineers appeared in opposition to the bill. Among the speakers in opposition were State Engineer Bensel, R. D. Mershon, President of the American Institute of Electrical Engineers, Prof. W. R. Whitney, Chairman of the Research Department of the General Electric Co., Frederick Molitor, Prof. Olin B. Landreth, of Union University, Frank J. Sprague and Prof. Arthur M. Greene, Jr., of Rensselaer Polytechnic Institute. Letters were also read from Alfred Noble and Prof. William H. Burr, opposing the bill. The speakers in favor of the bill were Messrs. Eliot, Weinberger, Zartmann, Schoonmaker and Seely. The chief arguments of the speakers opposing the bill were the obstruction to general engineering practice, were licenses to be required by each State; that there was no demand for the passage of the bill from the public, nor from the engineering profession; that the bill had originated with a small society called the Technical League, the purpose and membership of which are kept secret, and which has no recognized standing in the engineering profession. It was further argued that the state should protect the public against incompetent engineering work by examining the work itself rather than the men. The Civil Service examinations for engineers engaged on public works, and the examination of plan for public works by state authorities are better protection than any form licensing. As the present bill licenses anyone to practice as an engineer who has had three years' experience merely in the inspection of engineering work, the result would be to lower rather than raise the standards of the profession. Members of the Committee seemed to favor the bill.

A Tall Brick Chimney of a manufacturing plant at Des Plaines, Ill., was blown over by the wind on Mar. 24. The chimney fell on the caboose of a passing freight train on the Minneapolis, St. Paul & Sault Ste. Marie Ry., causing the deaths of two trainmen and serious injury to another.

Aëroplane Accidents on Mar. 28, caused the deaths of three army officers; Lieut. Brossard, of the French Army, was killed at Verdun, France, when the motor of his aëroplane burst at an altitude of 2500 ft.; two Japanese army officers, Lieuts. Tokuda and Kimura, were killed at Tokyo, while giving an exhibition flight before a large gathering of Members of Parliament.

Hydro-Electric Power Companies doing an interstate business are not yet subject to federal control. In our issue of Mar. 20 last, p. 595, we quoted a clause from the River and Harbor Appropriation Bill as passed by the Senate which made such companies subject to the Interstate Commerce law on their interstate business. This clause was eliminated from the bill by the conference committee, however, so that it does not appear in the law as finally enacted.

The British Steamship "Lugano" Grounded on Ajax Reef, near Key West, Fla., on Mar. 9, and shortly afterward her 110 passengers were transferred to the wrecking tug "Rescue," which answered distress signals. The "Lugano" was badly damaged by the rocks and shipped a good deal of water, but her crew stayed in an attempt to save the vessel. This is a Lloyd Line boat plying between Liverpool and Havana by way of Spain Shortly after this accident another British steamer the "Howth Head" went aground on the nearby Molasses Reef.

Two Railway Automatic Stops are to be tried out by the New York, New Haven & Hartford R.R. in accordance with its recent offer of $10,000 for a successful development of such a device (see "Engineering News," Dec. 9, 1912). It is reported that these two devices are somewhat similar and both give promise of accomplishing the general purposes desired, though neither one meets all of the eighteen requirements specified by the New Haven road in accordance with the desirable characteristics outlined by the Block Signal & Train Control Board of the Interstate Commerce Commission (see "Engineering News," Feb. 20, 1913). One of these stops is being developed by the Union Switch & Signal Co., of Swissvale, Penn., and the other by the International Signal Co., of New York City.

The cash prize noted is of course unimportant and the cost of development promises to be several times any such amount. However, under the conditions of the invited competition, the company agreed to assist the inventor by contributions of money or by use of tracks or both, provided the device selected for development appeared in the judgment of the road's signal engineer to have sufficient merit. In all, 1574 applications were received but most of them were not prepared in accordance with the conditions governing the competition. Only 5% were worthy of consideration at all, and of these only the two mentioned above met with sufficient approval to warrant experiments.

One inventor wrote that his device would not be dangerous to passengers but would probably kill the engineer and fireman. Another man proposed to use a heavy spring hook, which would rise up from the roadbed and catch hold of an axle on one of the cars. Applications were received from all over the world, and the competitors represented nearly every walk in life; four of the inventors were in jail, and four in insane asylums.

Subjects for Economic Prizes for the "best studies in the economic field" have just been announced for the tenth year (1914) by Prof. J. Laurence Laughlin, of the University of Chicago, chairman of a committee of five. As heretofore, the fund for the prizes is provided by Hart, Schaffner & Marx, of Chicago. Any American may contest for the prizes of $1000 and $500 in Class A except college undergraduates, but for the $300 and $200 prizes in Class B the contestants must be college undergraduates at the time the papers are sent in. The judges reserve the right to award the Class A prizes to Class B contestants "if the merits of the papers demand it." Subject to the approval of the committee, contestants may choose their own subjects; or without such approval they may choose from a long list of subjects listed by the committee in former years, or from any of the following eight subjects suggested by the committee for 1914:

1. The competitive relations of the Suez and Panama Canals.
2. A study of the economic conditions preceding and following the crisis of 1907.
3. Price regulation by governmental authority.
4. A theory of public expenditures.
5. A study of shipping combinations in ocean transportation and their influence on rates.
6. How far has the regulation of freight charges affected the development of railways in the United States?
7. A study on the changes of modern standards of living.
8. A study of the cost to the United States of its possession of the Philippine Islands.

The papers must be sent to Prof. Laughlin on or before June 1, 1914. The announcement has been made thus early to enable students to utilize summer vacations. Further details may be obtained from Prof. Laughlin.

The Sanitary District of Chicago has received an order from the Secretary of War to reduce the amount of water now being diverted from Lake Michigan by the drainage canal. The Trustees of the district, however, hold that the Secretary of War is without jurisdiction in regard to the flow of water in the drainage canal and the old Illinois & Michigan Canal. It is claimed that the Sanitary District is acting under the authority of a statute of the State of Illinois, and must comply with the requirements of this statute until it is set aside by some superior authority. It is presumed that action will be brought by the United States Government in a court of equity.

New Developments in Panama Canal Slides—On the night of Mar. 12-13, the break on the east bank of the canal, opposite Culebra, which first moved into the canal on the night of Feb. 5, again made another rapid movement downward and toward the canal. The bottom of the canal, near the center, was heaved up for a distance of about 1000 ft., and to a maximum vertical height of about 30 ft., destroying five tracks in the bottom of the canal, overturning steamshovel No. 220, and partly tipping over steamshovel No. 205. Only one track remained in commission after the break had ceased moving, but a second one has since been connected, so that there are now two tracks in use on the west side of the canal. Two steamshovels were set to work at once removing that part of the slide which had heaved up at the bottom, and satisfactory communication was again restored on Mar. 17. ["Canal Record," Mar. 19, 1913].

Order for the Largest Direct-Current Generators, noted in our issue of Nov. 7, 1912, as having been designed (though not built) by the General Electric Co. for the Southern Aluminum Co., has been canceled. There were to be installed at Whitney, N. C., seven vertical waterwheel units, each driving a 5000-kw. 20,000-amp., 250-volt, 170-r.p.m. generator.

It is reported that the Southern Aluminum Co., which uses French capital, has abandoned its proposed hydro-electric development at Whitney, N. C., and may build a new dam several miles below the present site on the Yadkin River. There is apparently some question whether this lower development will be pushed. The Whitney development has passed through many vicissitudes since its beginning in 1901. Work was promoted first by the late George Whitney, of Pittsburgh, and there was unusually expensive construction. Some 4½ miles of canal were necessary to develop a head of 120 ft. and make available 45,000 hp., but this was available for only 10 to 12 hr. In 1907 the old enterprise was abandoned, although the hydraulic works were nearly completed. The same French capitalists that were interested in the Southern Aluminum Co. were interested in this power company, which is reported to account for the latter company taking over the works. It is reported that the electrolytic process requires 24-hr. power and that the old development has not shown possibilities of sufficient storage.

PERSONALS

Mr. Mason H. Baker, Assoc. M. Can. Soc. C. E., has resigned as City Engineer of St. Thomas, Ont., to become City Engineer of Prince Albert, Sask.

Mr. J. K. McGrath, formerly with the Maryland State Roads Commission, has been appointed Principal Assistant Engineer of Paving of the city of Baltimore, Md.

Mr. B. G. Horton has been appointed Superintendent of Locomotive Fuel Service of the New Orleans, Texas & Mexico R.R., with headquarters at De Quincy, La.

Mr. O. Tefteller has been appointed Superintendent of Locomotive Fuel Service of the St. Louis, Brownsville & Mexico Ry., with headquarters at Kingsville, Tex.

Mr. J. E. Chamberlain, for some years connected with the engineering department of Evans, Almirall & Co., Engineers and Contractors, New York City, has resigned

Mr. R. L. Stewart, formerly Master Mechanic of the Chicago, Rock Island & Pacific Ry., at Trenton, Mo., has been appointed Master Mechanic of the Chicago Terminal of the same railway.

Mr. C. C. Blood, Office Engineer of the Portland, Eugene & Eastern Ry., Portland, Ore., has resigned to accept a position with the maintenance-of-way department of the Northern Pacific Ry.

Mr. Fred Hooker, formerly Traveling Engineer, has been appointed Superintendent of Locomotive Fuel Service of the St. Louis, Brownsville & Mexico Ry., with headquarters at Kingsville, Tex.

Mr. Samuel W. McClure has been appointed Resident Engineer of the Lake Shore & Michigan Southern Ry., at Erie, Penn., succeeding Mr. H. W. Fenno, transferred, as noted in our issue of last week.

Mr. Frank Hopper, formerly Division Master Mechanic of the Chicago, Rock Island & Pacific Ry., at Estherville, Iowa, has been appointed Master Mechanic of the Duluth, Winnipeg & Pacific Ry., at West Duluth, Minn.

Mr. E. E. Larkins, Assoc. M. Am. Soc. C. E., Engineer of Bridges and Sewers, at Omaha, Neb., has resigned in order to take charge of some heavy reinforced-concrete construction work for the Larkin Soap Co., at Buffalo, N. Y.

Mr. J. E. Saunders, until recently Assistant Signal Engineer of the Atchison, Topeka & Santa Fé Ry., Topeka, Kan., is now Office Engineer with the signal department of the Delaware, Lackwanna & Western R.R., at Hoboken, N. J.

Mr. C. F. Smith, Assistant Superintendent of the Oregon Short Line R.R., at Nampa, Idaho, has been promoted to be Superintendent of the Montana division, with headquarters at Pocatello, Idaho, succeeding Mr. W. R. Armstrong, resigned.

Mr. J. L. Doupe, Chief of the land department of the Canadian Pacific Ry., has been appointed Chief Surveyor of the operating and maintenance-of-way departments, under the new organization described in our personal columns of Feb. 27.

Mr. J. H. Roach, Assoc. M. Am. Soc. C. E., formerly with the Robt. Grace Construction Co., New York City, has been appointed Assistant Engineer of Construction of the Lake Shore & Michigan Southern Ry., with headquarters at Cleveland, Ohio.

Mr. Kenneth C. Grant, M. Am. Soc. C. E., of Pittsburgh, Penn., was married, Mar. 26, to Miss Janette Adams Garner, daughter of Mr. and Mrs. John Lake Garner, of Los Angeles, Calif. Mr. and Mrs. Grant are spending their honeymoon in Honolulu, H. I.

Mr. J. C. Muir, formerly Superintendent of the Chicago & Eastern Illinois R.R., at Danville, Ill., has been appointed General Superintendent of the Chicago, Terre Haute & Southeastern Ry., with headquarters at Chicago, Ill., succeeding Mr. M. W. Wells.

Mr. A. J. Astroe, Chief Draftsman of the Portland, Eugene & Eastern Ry., has been promoted to be Office Engineer, at Portland, Ore., succeeding Mr. C. C. Blood, resigned, as noted elsewhere. Mr. Ward H. Rupp, former Right-of-way Engineer, succeeds Mr. Astroe.

Messrs. C. P. Howard, M. Am. Soc. C. E., former Assistant Engineer of the Illinois Central R.R., at Chicago, Ill., and Shelby S. Roberts, M. Am. Soc. C. E., former Division Engineer of Construction, Illinois Central R.R., Chicago, Ill., have formed a partnership with offices in the Transportation Bldg., Chicago, for the general practice of civil engineering, specializing in railway surveys, construction and operation.

Mr. W. F. Steffens, Assoc. M. Am. Soc. C. E., formerly Engineer of Structures of the Boston & Albany R.R., Boston, Mass., has been appointed Assistant Chief Engineer of the Chesapeake & Ohio Ry., with headquarters at Richmond, Va. Mr. Steffens graduated from the Massachusetts Institute of Technology in 1898 and was at one time Engineer of Bridges and Buildings of the Carolina, Clinchfield & Ohio Ry., in Tennessee.

Mr. R. C. Hardman, Assoc. M. Am. Soc. C. E., has resigned his position as Civil Engineer and Superintendent of Construction with the War Department, at Fort Huachuca, Ariz., to become connected with the engineering staff of Mr. E. C. van Diest, M. Am. Soc. C. E., Consulting Engineer, 412 Mining Exchange Bldg., Colorado Springs, Colo. Mr. Hardman was formerly Provincial Supervisor and District Engineer, Bureau of Public Works, in the Philippine Islands.

Geo. T. Gwilliam, M. Am. Soc. M. E., formerly connected with the Hess-Bright Manufacturing Co., of Philadelphia, is President of the Gwilliam Co., makers of ball bearings of various types and other supplies for automobiles, etc., with headquarters at Broadway and 58th St., New York City. The other officers of the company are: John Gwilliam, Vice-President; George T. Gwilliam, Jr., Treasurer; Charles R. Norris, formerly of U. S. N., Secretary; S. Fabian Goodman, General Manager.

Mr. George B. McGinty, former Assistant Secretary of the Interstate Commerce Commission, has been appointed Secretary, succeeding Mr. John H. Marble, appointed a member of the commission, as noted in our issue of Mar. 13. Mr. McGinty was born in Monroe County, Ga., in 1878. He has spent a number of years in the clerical departments of the Atlantic Coast Line R.R., the Georgia R.R. and the Southern Ry. He first entered the service of the Interstate Commerce Commission in 1908, in the division of statistics and accounts.

Mr. H. E. Talbott, M. Am. Soc. C. E., Consulting Engineer, of Dayton, Ohio, has been appointed by Governor Cox, of Ohio, Chief Engineer of the military zone now under martial law, established by the State National Guard in the flooded districts about Dayton. According to newspaper dispatches, Mr. Talbott has announced that four departments have been created under his jurisdiction, with an Assistant Engineer in charge of each. One division will have charge of rebuilding the streets and alleys, another the levees along the rivers, another the sewer system and the fourth will have charge of the reconstruction of bridges.

Mr. J. J. Bernet, Assistant Vice-President of the Lake Shore & Michigan Southern Ry., and other Western lines of the New York Central System, has been elected Vice-President of these lines in charge of operation, maintenance and construction, with headquarters at Chicago, Ill. Mr. Bernet was born in Erie County, New York, in 1868, and received his education in the public schools of Buffalo, N. Y. At the age of 21 years he entered the service of the Lake Shore & Michigan Southern Ry. as a telegraph operator. He was promoted through the grades of train dispatcher, trainmaster to be Division Superintendent in 1905. A few months later he was made Assistant General Superintendent. On Oct. 1, 1906, he was promoted to be General Superintendent with headquarters at Cleveland, Ohio, where he remained until June 1, 1911, when he was made Assistant to the Vice-President of the New York Central Lines west of Buffalo.

Mr. C. F. W. Felt, M. Am. Soc. C. E., Chief Engineer of the Atchison, Topeka & Sante Fé Ry., has been promoted to be Chief Engineer of the entire Sante Fé System, succeeding Mr. C. A. Morse, M. Am. Soc. C. E., whose appointment as Chief Engineer of the Chicago, Rock Island & Pacific Ry. was noted in our issue of last week. Mr. Felt was born in Salem, Mass., Apr. 29, 1864. He was educated at the Massachusetts Agricultural College at Amherst, and entered the railway service in 1886 as an axman on construction with the Atchison, Topeka & Sante Fé Ry. in Kansas and Colorado. He was shortly afterward promoted to be rodman and a year later to be a Bridge Engineer. In the spring of 1888 he was a levelman with the Denver & Rio Grande R.R., and then spent a year as instrumentman with the Arizona & Southeastern R.R. After a year as transitman with the Topolobampo R.R., in Mexico, he returned to service with the Santa Fé Lines as Resident Engineer of the Northern division of the Gulf, Colorado & Santa Fé Ry., at Cleburne, Tex. In 1892-93, he was Office Engineer of the Rio Grande Southern Ry., returning to the Gulf, Colorado & Santa Fé Ry. in February, 1893, as Division Engineer. Later he was Resident Engineer of the same railway at Galveston, Tex., and for several years following 1896 he was Chief Engineer.

Mr. A. T. Hardin, Assoc. M. Am. Soc. C. E., Assistant Vice-President of the New York Central & Hudson River R. R., has been elected Vice-President in charge of operation, maintenance and construction of the New York Central Lines east of Buffalo, with offices at the Grand Central Terminal, New York City. Mr. Hardin is a native of South Carolina, where he was born in 1868. At the age of 14 years he was a telegraph operator on the Richmond & Danville R.R. For the following eight years he was agent and stenographer with the same railway, giving up his position in 1890 to attend the University of South Carolina, from which he was graduated four years later with the degree of Civil Engineer. From 1894 to 1898 he was with the maintenance-of-way department of the Southern Ry. Mr. Hardin's service with the New York Central Lines began in 1898 as Supervisor, and a short time later, Division Engineer of the Eastern division of the New York Central & Hudson River R.R. In September, 1899, he was promoted to Engineer of Track, and continued in this position until February, 1903, when he was made Engineer of Maintenance-of-way. In 1905, he was changed to the operating department as Assistant to the General Manager, and after a year's experience in this capacity Mr. Hardin was promoted to be Assistant General Manager, holding this office until April, 1912, when he was promoted to be Assistant Vice-President.

OBITUARY

John L. Grim, President of the Atlantic Dredging Co., of Philadelphia, Penn., died at his home in that city Mar. 27, aged 70 years.

W. B. Searle, a civil engineer of Provo, Utah, died in New York City, Mar. 23. He was born in Topeka, Kan., 51 years ago. His first engineering work was with the construction department of the Atchison, Topeka & Santa Fé Ry. He went to Utah in 1890, and since then he had been connected with the development of several large hydro-electric power plants and irrigation enterprises, including the Telluride Power Co., Telluride, Colo., of which he was Chief Engineer, the Utah Power & Light Co., on the Provo River, in Utah, and the Green River irrigation project, in Utah.

Ellsworth A. Peck, Superintendent of the St. Louis Southwestern Ry., at Pine Bluff, Ark., died Mar. 20, at Hot Springs, Ark. He was born in Westfield, Ohio, in 1852, and entered the railway service as a telegraph operator with the Cleveland, Columbus, Cincinnati & Indianapolis Ry. Later he was Assistant General Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis Ry., and from 1892-1893, General Superintendent. From 1893 to 1901 he was General Superintendent of the St. Louis, Iron Mountain & Southern Ry. Since 1901 he had been superintendent of the St. Louis Southwestern Ry.

George T. Nicholson, Vice-President of the Atchison, Topeka & Santa Fé Ry. System, in charge of traffic, died at his home in Chicago, Ill., Mar. 30. He was born at Belvidere, N. C., on July 1, 1856. He was educated at the Kansas State University and entered the railway service in 1882, as a clerk in the general passenger and ticket office of the Atchison, Topeka & Santa Fé Ry. He passed through various clerical positions to the office of General Passenger Agent, which position he resigned in 1897 to accept a similar office with the St. Louis & San Francisco Ry. The following year he returned to the Santa Fé System as Passenger Traffic Manager, and in October, 1905, he was elected Vice-President in charge of traffic.

James McCrea, former President of the Pennsylvania R.R., died at his home in Haverford, Penn., on Mar. 28. He had been in ill health for many weeks. A biographical sketch and portrait of Mr. McCrea was published in our issue of Nov. 21, 1912, at the time of his retirement from the presidency of the Pennsylvania R.R., after a continuous service of 42 years. Speaking of Mr. McCrea's death, Mr. Samuel Rea, M. Am. Soc. C. E., President of the Pennsylvania R.R., is quoted by the New York "Tribune" as follows:

> I am deeply grieved at the loss of Mr. McCrea and the sad bereavement to his family. He was my friend and associate since he gave me employment in the engineering corps of the Pennsylvania R.R. 42 years ago. A strong personality and a faithful worker has passed away. He devoted his life solely to that great public service connected with transportation. He was an able manager, executive and conservator of the entire Pennsylvania system, with the result that the public will more greatly appreciate him as the years go by. His sense of fair dealing, his faithfulness for others, his love of his family and his ready response to calls for charity make a loss in public and private life that will be hard to replace.

John Pierpont Morgan, famous banker, financier and promoter of trusts, died Mar. 30, at Rome, Italy. Mr. Morgan was born in Hartford, Conn., Apr. 17, 1837. He was educated at the English High School of Boston, Mass., and the University of Göttingen, in Germany. Later in life he received honorary degrees from Yale and Harvard Universities. His banking career began in 1857, when he became associated with Duncan, Sherman & Co., New York City. In 1860 he became attorney and agent in the United States for George Peabody & Co., Bankers, of London, England, of which his father was a partner. From 1864 to 1871 he was a member of the firm of Dabney, Morgan & Co., Bankers and Brokers, of New York City. In 1871 he became associated with the famous Drexel family of bankers of Philadelphia, Penn., as a member of the firm of Drexel, Morgan & Co., which developed into the present firm of J. P. Morgan & Co., the leading private bankers of the United States. Mr. Morgan was instrumental in financing a large number of railway reorganizations and consolidations and of the consolidation of many great industrial enterprises. Among these works was the floating of $60,000,000 of United States bonds during the administration of President Cleveland, the financing of a $50,000,000 British war loan in 1901, the consolidation or agreement among the anthracite coal operators of Pennsylvania and the soft-coal operators of Ohio, Indiana and Pennsylvania, the formation of the International Mercantile Marine Co., and the consolidation of the steel-manufacturing industries into the famous United States Steel Corporation.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL DRAINAGE CONGRESS.
Apr. 10-12. Annual convention at St. Louis, Mo. Vice-Pres., E. T. Perkins, Chicago, Ill.

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

NATIONAL GOOD ROADS FEDERATION.
Apr. 24-25. Annual convention. Secy., J. A. Rountree, Birmingham, Ala.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, owa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Schurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24 Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL, AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

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Fifth National Conference on City Planning—The Conference headquarters will be the Hotel La Salle, Chicago, Ill., where the registration of delegates will commence on Monday morning, May 5. Following a luncheon at 12:30 p.m., an automobile tour of the city will be made. The first session begins at 8 p.m., with a paper by Frederick Law Olmstead, of Boston, Mass., entitled "A City Planning Program"; following this paper will be a statistical report prepared by the secretary on the progress of the year in city planning. At the second session commencing at 10 a.m., Tuesday, May 6, two papers will be read: "A City Planning Survey," by Virgil G. Bogue, of New York City, and "A Survey of the Legal Status of a Specific City in Relation to City Planning," by Edward M. Bassett, of Brooklyn, N. Y. At the third conference at 2:30 p.m., there will be papers: "Gaining Public Support for a City Planning Movement," by Chas. H. Wacher, Chairman of the Chicago, Ill., City Plan Commission, and "Organization and Functions of a City Planning Commission," by Hon. W. A. Magee, Mayor of Pittsburgh, Penn. At 8 p.m., at the fourth conference, M. R. Maltbie, Member of the Public Service Commission, First District, New York, will read a paper on "Planning Improved Means for the Circulation of Passengers and Freight." The fifth conference at 10 a.m., May 7, will take up papers: "The Actual Distribution of the Cost of Kansas City Parks and Boulevards," by G. E. Kessler, of St. Louis, Mo.; and "German Methods of Paying for Improvements Out of Excess Land Purchases," by Dr. Werner Hegeman, of Berlin, Germany. At the sixth and last conference at 2:30 p.m., E. H. Bennett will read a paper on "Some Aspects of the Chicago City Plan." The secretary is Flavel Shurtleff; address until Apr. 24, 19 Congress St., Boston, Mass., after Apr. 24, Hotel La Salle, Chicago, Ill.

PRICES OF ENGINEERING MATERIALS

PRICE CHANGES AND THE BUSINESS OUTLOOK

The timidity of capitalists is having more effect on business than any other one thing. Numerous men of means and affairs have idle money, and, although many lucrative propositions are offered, they are unwilling to take a chance with the present temper of politicians, and the attitude of existing executives. Not since the time immediately preceding, and for a few months after the panic of 1907, has there been so much general distrust. Men of affairs know not which way to turn. In New England, the investment situation is particularly disquieting. The leading railroad which served the community for over half a century has seen the price of its stocks cut in two, its dividend reduced, with the probability that it will be further diminished. In northern New England, railroads which have for years paid regular dividends are now unable to continue their disbursements to stockholders. Moreover, they are unable to sell any securities and thus raise funds for needed improvements. The situation has already suggested that the State of Massachusetts step in, and operate this road. While there is no doubt that men of large affairs have misused their power, it cannot be denied that they have developed the country, and probably in a far more effective way, than could otherwise have been done. Conditions such as these are retarding real development.

In New York State, the $50,000,000 bond issue voted last fall cannot be used to provide funds for road building for some time to come. Two months at least must elapse before any actual work is done, and it is very improbable that any bids will be called before June 1. There is a growing disposition in the State of New York to consider that many affairs have been handled extravagantly, and to get down to a more reasonable attitude in the matter of expenditures.

Subway work in New York will begin this summer, probably on the East River tunnel. Announcement has already been made that the Steinway tunnel will be put in operation within the next three months. It is probable that subway construction will not be as active as many contractors would like.

Iron and steel prices have declined moderately during the month, but principally in the disappearance of large premiums for prompt delivery. The leading producer of iron and steel has not as many orders on its books as last month, but, on the other hand, it has been unwilling to accept business for delivery after July 1. The most promising part of the iron and steel industry is the fact that the decline in scrap has apparently been arrested, and prices have improved within the last fortnight.

The copper market has shown much improvement, and exports have been astonishingly large, amounting to nearly 40,000 tons during March.

New railroad construction is not at all active, and the buying of equipment has shown a marked decline. There are prospective inquiries for about 15,000 cars, and a recent order closed for locomotives involves an expenditure of $3,500,000.

Conditions abroad are apparently much better, which has relieved the financial situation in New York to a marked degree.

Early press estimates of damage to engineering structures in the flooded districts of Ohio and Indiana were far too high yet a vast amount of rebuilding yet take place. After the first rush of restoration is completed, the remaining work will go forward slowly.

LABOR

The demand for labor is not as urgent as it was at this time last year, principally because so much work has been pushed during the winter months and there is not the same incentive to rush out-of-door operations. In municipal work, there does not seem to be the same amount of it coming out as last year at this time, and in the good roads movement in the State of New York, there have been many disappointments. The "expedited routes," such as the Albany-Buffalo route and the Montreal-New York route, will be carried through, but the rest of the work will probably be deferred for some time. In any event, no actual work can be done on new contracts for sixty days, at least.

Building work is not as active in the East, and a great many large public improvements have been held up because of difficulties in financing the plans. Laborers in New York are unwilling to leave the city, especially Italians and Sicilians, because there is a prospect that the subway work will require a great many more laborers in the next two months. The rate of wage continues unchanged at $2 per day for general rough labor. In the steel mills, there is just as active a demand as at any time in the last few years, but the coke regions report that the labor supply is more plentiful.

CEMENT, LIME AND BRICK

Portland Cement—The manufacturers of cement are most optimistic regarding the outlook from their viewpoint. Construction work in the East has been especially active all winter, and there has not been a time in the last six or seven years when supplies were so low at the mills. Plants, which have ordinarily shut down for six to eight weeks during the winter, did not close for more than a fortnight this year. One of the cement companies has been attempting to buy 100,000 bbl. of cement in the open market, but has had no success yet.

The dissolution of an association among cement manufacturers is not in any way connected with the price situation, and for years, quotations have not been discussed at the meetings. It is noticeable, however, that in many lines of business, noonday luncheon clubs, business associations and the like, are going out of fashion.

Manufacturers are now getting a much better price for their material, and it is the expectation that quotations will be advanced in the next few weeks.

The outlook for consumption is large, and most of it has been already discounted, notably the subway work in New York. It must be remembered that general construction work outside of New York is not as active as a year ago. Then, too, it was expected that a large sum of money would be released for good roads in New York, and there is no prospect of this for some months, so that conditions may not be as rosy as the manufacturers think.

Quotations are unchanged from last month at $1.58 per bbl. in New York. This is equivalent to 90c. per bbl. in bulk at the mills in the Lehigh Valley district, and also at Hudson River points. This low price also corresponds to the price of the mills in the Pittsburgh district. An allowance of 10c. per bag is made for each bag returned. Some of the mills are attempting to secure 95c., but so far have had little or no luck in that direction. There was a fair amount of cement dumped in the New York market, which had been exported or purchased for export and thrown back on the buyers, and therefore disposed of at a sacrifice sale. In Boston, Portland cement in wood or cloth is $1.72, less 40c. for bags returned: In paper, $1.42.

In Pittsburgh, the price is $1.58.

Natural Cement—Quotations are higher. Manufacturers have advanced prices to 95c. per bbl. in New York, and $1.10 to $1.15 in Boston.

Brick—The market is not at all active, and those who will need brick in the next week or so have plenty of supplies on hand. While the opening of navigation in New York promises that brick will be much more plentiful, as yet no brick has come down the river for the 1913 season. Prices are barely steady at $7 to $7.25 for Hudson River common, and $6.85 to $7 for Raritan River brick. In Newark, brick is sold at the yard at $8.25.

Lime—Numerous changes have been made in the price of lime by the leading seller in the New York market, and quotations for wholesale lots of 500 bbl, or more, delivered in New York, are as follows: State common, 200 lb. net, 97c. per bbl.; the former brand Rockland-Rockport, special, 300 lb., has been succeeded by the brand "300 Star," $1.37; finishing 300 lb., $1.55, an advance of 15c.; finishing 200 lb., $1.10, an advance of 8c.; 350 lb., $1.72, an advance of 10c.

Plaster Blocks—Prices are without change, and the market is fairly active, quotations being as follows:

	Weight, per sq.ft., lb.	Price, per sq.ft., cents
2-in.	7	6
3-in.	8½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13⅓ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

Plaster boards, ⅜ in. thick, are 16c. per sq.yd.

STONE

Blue Stone—Business is dull with very little inquiry or demand noted. The spring rush for stone for outside construction work has not materialized, and prices prevail at the current winter quotations. Whether prices will stiffen as the season advances or not, is problematical, as it is doubtful if business will permit higher prices to be secured. The new subway construction work in New York City, for which contracts have just been let, will require large quantities and is bound to have a stimulating effect on the trade. Conditions at the present time, however, are not what might be called encouraging.

Quotations in New York are at 19@20c. for flagging 3 in. thick delivered alongside of dock or f.o.b. cars, New York. Sewer bottom 5 ft. square and 3 in. thick, are sold at 25c. per sq.ft. for large quantities. Curbing, 5x16 in., is 45c.; 5x20 in., 50c.; 6x16 in., 53c.; 5x24 in., 65c.; 6x24 in., 70c., f.o.b. New York. These prices are per lin.ft.

Promiscuous shapes of building and foundations stone sell at 70@75c. per cu.ft.

Granite—The market is quiet with little demand. Prices are steady at 40@50c. per cu.ft.

Limestone—Prices continue steady and unchanged at 80c. @$1 per cu.ft. for limestone in the rough delivered alongside of dock in New York. Dressed stone in New York is quoted at $1.25@1.50 per cu.ft.

Interior Stone—Slate flooring, 1 in. thick, can oe had at 20c. per sq.ft. for the common or ribbon variety. Clear black sells at 35@40c., and the same price is asked for Vermont. A combination of slate and marble flooring is 30c. per sq.ft.

Marble floor, finished ready to lay, of Vermont marble, is 50@70c. per sq.ft; Italian marble, 70@90c Tennessee marble can be had at 65c Ordinary stair work, such as slate steps, is quoted at 24c per sq.ft.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—Although the season has opened to some extent, bad weather has hindered shipments from the quarries. Throughout March the contracts received were mainly from paving companies for stone to finish up winter contracts but

the coming month will see the beginning of the demand for the supply for the spring construction work of all kinds. Dealers are looking forward to a very active season with a strong demand and correspondingly stiffer prices. At the end of last season the available supply was exhausted and it is expected that during the coming summer and fall an even heavier demand will be experienced. Stone will be required in large quantities for the subway work in New York City as it is known that not enough gravel will be available. Prices are quoted at 85@95c. per cu.yd. for 1½-in. stone, 90c.@$1 for ¾-in. stone, and 90c@$1 for screenings. These quotations are for full cargo lots of 500 cu.yd., delivered alongside of dock, New York.

Sand—Conditions are unchanged. Spring business is expected to far exceed the records of all former years. Construction work throughout the country will require immense quantities of sand with stiff prices prevailing. The price for full cargo lots, delivered alongside of dock, New York, is 50c.

Gravel—Quotations are 85@90c. per cubic yard alongside of dock. Prices are quoted for full cargo lots of 500 cu.yd.

IRON AND STEEL

Pig Iron—The decline in pig iron has not been wholly arrested, but it has been retarded and $13 continues the minimum for No. 2 Southern foundry in Birmingham. While some further softening in price in the North has taken place, it was by no means as extensive as in February. The production still continues at record-breaking pace, and it is probable that March or April will set a new high figure as far as the total output of iron is concerned. The daily output in February made a high record. Most of the business during the last fortnight has been from foundries in New England, and from pipe foundries. Steel-making irons are in relatively better demand than foundry grades.

Quotations for 100-ton lots from the points named are as follows: Cincinnati, Southern Foundry No. 2, $16.25 to $16.75, a decline of 50c. compared with last month; Southern Foundry No. 4, $15.75 to $16, a decline of 75c.; Northern Foundry No. 2, $17.25 to $17.75, a decline of 50c. In Philadelphia, Eastern Pennsylvania No. 2 plain is $17.50 to $17.75, a decline of 50c.; West Virginia No. 2X Foundry is $17.75 to $18, a decline of 50c. In Chicago, No. 2 Foundry is $17.25 to $17.50, approximately the price last month, but then, it must be remembered, there was a heavy decline; No. 3 Northern Foundry is $16.75 to $17.25. In New York, Northern Foundry No. 2 plain is $17.25 to $17.50, a decline of 25c.; No. 2X is $17.50 to $17.75. In Pittsburgh, bessemer is $18.15, and basic $17. These prices are approximately the same as last month, and both include the 90c. freight rate from the valley to Pittsburgh. In Birmingham, it is stated that resale iron can be had at around $13.

Steel Rails—Rail makers of the country have all the business they can take care of, and during the last fortnight of March, renewed buying of rails made its appearance. A Texas road bought 7000 tons, and a 45,000-ton order for bessemer rails was taken. The most important factor was the buying of 20,000 tons of rails for export. This is the first export order of any magnitude this year. The report of special activity is in light rails, and in this department, it is practically impossible to secure deliveries as needed.

Girder rails are in better demand than before in several years, and what makes the girder rail business seem all the more active, is the fact that a great deal of capacity formerly reserved for girder rails has been put on T-rails, and this has resulted in retarding delivery for girder rails. It is probable that renewed business in the export line will appear in the very near future.

Prices continue unchanged on a basis of $28 for standard sections of bessemer rails, and $30 for openhearth rails. Girder rails in 60-ft. lengths are $36.40 per gross ton; in 60-ft. lengths, $38.40 per gross ton f.o.b. New York. Other quotations, f.o.b. Pittsburgh, are as follows: Standard sections, 50 to 100 lb. per yd., 1.25c. per lb.; 25 to 45 lb., 1.25c.; 16 to 20 lb., 1.30c.; 12 to 14 lb., 1.35c.; 8 to 10 lb., 1.40c. In New York, relaying rails are held at $22 to $22.50, and in Chicago, standard sections of relaying rails, subject to inspection, can be had at $24.

Track Supplies—The greatest activity prevails in the manufacture of spikes. All the mills of the country practically are sold up for the next four months, at least, and with the opening of spring weather, railroads are clamoring for deliveries. In a great many instances, spikes have been bought ahead, and the railroads now have them on their own property. In Pittsburgh, spikes in large lots to railroads are $1.80, but small contracts command $1.90 to $2. Tie plates are in good demand, prices varying from $32 to $35 per net ton in Chicago. In that market, spikes are held at $1.95 to $2.05; track bolts with square nuts, $2.30 to $2.40, and angle bars $1.50. These quotations are per 100 lb. The extras on railroad and boat spikes are unchanged as follows:

Railroad spikes	Cents
2, 2½, 4 1⁄8 and 5x½	Extra 10
2½, 4 and 4x¾	Extra 20
2, 2½, 4 and 4½x¾	Extra 30
2½x¾	Extra 40
2½, 3 and 3½x¾	Extra 60
2x	Extra 80

Structural Materials—The most important piece of news in this line is the fact that the Pennsylvania lines west of Pittsburgh are inquiring for about 25,000 tons of bridge material. This is an unusually large order. The New York Central, it is understood, is also in the market for some heavy construction, and one bridge for the New York barge canal will require about 1000 tons. General building work is unusually quiet, the only new thing in New York being 3500 tons for the Hallenbeck structure, and about 2000 tons for the new Hill Publishing Co. building at 36th St. and 10th Ave. The demand for railroad cars is not as active as a month ago, but mills rolling angles of the size usually employed in steel cars have a great deal of this kind of work on their books.

Quotations are slightly easier for future delivery, but otherwise they are unchanged as follows: Prompt shipments of angles and beams from Pittsburgh are held at 1.70c., while orders for later delivery can be placed at 1.45c. Other quotations are as follows: I-beams over 15-in., H-beams over 18-in., angles over 6-in., 1.55c.; deck beams, bulb angles, 1.75c.; hand-rail tees, 2.20c.; checkered and corrugated floor plates, 2.40c. The following extras are named for cutting to specified lengths: Under 3 ft., 2 ft. inclusive, 25c. per 100 lb.; under 2 ft. and more than 1 ft., 50c. per 100 lb., less than 1 ft., $1.55 per 100 lb. No charge is made for cutting to special lengths of 3 ft. and over.

Cast-Iron Pipe—Business is not as active as it was a month ago, and there has been a sharp downward revision in quotations, amounting to $1.50 a ton in Chicago, and $1 a ton in Birmingham. In New York quotations are unchanged. The item of greatest importance is an order for 1000 to 1500 tons from Minneapolis. Aside from this, most of the orders received are for carload lots and over, most of them being for immediate delivery.

The Southern foundries continue active. Quotations per ton of 2000 lb. are as follows:

Chicago, 4-in., $29.50; 6- to 12-in., $27.50; 16-in. and larger, $26.50.
Birmingham, Ala., 4-in. $23.50 6-in. $21.50.
New York, 6-in. $24@25.
Gas pipe is held $1 per ton higer in all markets.

Pipe—The market for pipe, particularly line pipe, has been upset by the recent flood, while it is known that lines have been seriously damaged, the extent of the last cannot be determined yet. It is assumed that much buying of pipe will take place this summer, which ordinarily would not have been needed, and while the market was rather soft for large sizes previous to the disaster in Ohio, since that time it has been much firmer. The market for smaller sizes has been particularly active, and promises to continue so. Orders have recently been taken for 70 miles of 18-in. pipe, and 80 miles of 18-in. pipe, as well as 40 miles of 6-in. pipe. Discounts are firm as follows:

	Black	Galvanized
¾- to 3-in. steel butt welded	80%	71½%
2½- to 6-in. steel lap welded	79%	70½%
7- to 12-in. steel lap welded	76%	65½%

At these discounts the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.30	3.28	5-in.	31.00	43.50
1-in.	3.40	4.85	6-in.	40.50	57.00
1¼-in.	4.60	6.56	7-in.	57.00	82.00
1½-in.	5.50	7.85	8-in.	60.00	86.00
2-in.	11.70	16.60	10-in.	98.50	$1.42
3-in.	15.30	21.90	11-in.	$1.15	1.60
4-in.	22.90	32.20	12-in.	1.27	1.72

Piling, Sheet Steel—Prices are much firmer and the lowest quotation made is 1.60c. Pittsburgh.

Sheets—Reports of concessions in the price of sheets are premature and misleading. While it is true that a number of mills have been securing handsome premiums for prompt delivery, and this having been discontinued by reason of the lessening demand, they have offered their output at slight concessions from existing quotations, but only for small lots, and for immediate delivery. The general sheet market is firm, and the demand is fairly heavy. The shortage in the supply of steel would scarcely permit any decline from existing quotations, and with the higher prices of wire that have been announced this week, it is likely that the sheet market will stiffen appreciably. Quotations from the mills, f.o.b. Pittsburgh or f.o.b. Chicago, in cents per pound are as follows:

Nos.	Cents per pound—Carload lots, Pittsburgh Black	Galv.	Small lots, Chicago Black	Galv.
10 and 11	2.00	2.50	...	...
12	2.00	2.60	2.70	3.35
13 and 14	2.05	2.60	2.75	3.35
15 and 16	2.10	2.75	2.85	3.45
17 to 21	2.15	2.90	2.90	3.60
22 and 24	2.20	3.05	2.95	3.75
25 and 26	2.25	3.20	3.00	3.90
27	2.30	3.35	3.05	4.05
28	2.35	3.50	3.10	4.20
30	2.50	3.80	3.50	4.60

Rivets—Deliveries of rivets are unsatisfactory, because of the inability to get raw material promptly. Quotations are without change at $2.50 for structural rivets and $2.30 for boiler rivets. These prices are per keg of 100 lb. in carload lots, f.o.b. Pittsburgh.

Castings, Gray Iron—Business is fair, but not as active as it was two months ago. Prices are well maintained, and general building castings are held at 1.75 to 2.25c. per lb. Rough castings for footings, manhole covers, and similar work are 1.75 to 2c. Castings for heavy machinery, lock gates where the amount of material involved is large, are 2.25 to 3.75c. per lb., depending on the size of the order and the shape of the castings.

Plates—The heavy stress under which manufacturers of plates were working two months ago has lessened materially, and plate makers are in a measure catching up with their orders. Car buying last month was extremely quiet, and compared with the large business booked a few months ago, this appeared even more than it really was. The Buffalo, Rochester & Pittsburgh is figuring on 1000 steel cars, the Seaboard Air Line on 1800, and it is reported that inquiries are in the market for approximately 12,000 to 15,000 cars, but the price has advanced so rapidly that railways are trying to do with their old equipment. The East

Jersey Pipe Co. placed an order for 1800 tons of plates, which will be used for 3 miles of 36-in. pipe. Deliveries are considerably better, and the premiums have been cut in two. They range now from $4 to $8 per ton.

Quotations are as follows: Prompt shipments of plates from Pittsburgh are 1.60 to 1.65c., a reduction of 5 to 10c. compared with last month; for contracts, 1.45c., the same as last month, is demanded. In New York future deliveries command 1.61c., and prompt shipments 1.76 to 1.81c. Extras are unchanged from last month as follows:

	Cents per lb.
Gages under ¼-in. to and including ⅜-in. on thinnest edge	.10
Gages under ⅜-in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40

Old Material—The market is firmer, and quotations have moved upward about 50c. per ton. There is an enormous supply, much of it being pressed on the market for sale, but consumption is also at a high rate, and it is reasonable to suppose that the lowest prices for the time being have been reached. Later in the year, a large supply will be forced on the market as a result of the recent floods. In New York the following quotations per gross ton are named:

Heavy melting steel scrap	$11.00 to $11.50
No. 1 railroad wrought	13.75 to 14.25
Pipes and flues	10.75 to 11.25
Cast borings	8.00 to 8.50
Machinery cast, broken up	11.25 to 11.75
Stove plate	8.75 to 9.25
Malleable castings	11.00 to 11.50
Wrought turnings	8.25 to 8.75
No. 1 yard wrought	12.00 to 12.50

The Chicago market has been much encouraged by liberal buying from the bar mills, and quotations are fully 25c. a ton higher all around. There is a much better feeling in the market. Quotations are as follows:

	Per Gross Ton
Heavy-melting steel scrap	$12.25 to $12.75
	Per Net Ton
No 1 railroad wrought	$12.25 to $12.75
No. 2 railroad wrought	11.50 to 12.00
No. 1 cast scrap	12.50 to 13.00
Pipes and flues	9.25 to 9.75
Agricultural malleable	11.50 to 12.00
Railroad malleable	13.00 to 13.50

The Pittsburgh market has a better tone, and slightly higher prices have been named, particularly for heavy-melting steel scrap which is sold up to $14.24 compared with $14 last month. There is no complaint about the consumption. This is large. The great trouble is that the supply will be ample, and a little more. Just as long as this continues, there is no hope for higher quotations. The market in Pittsburgh may be quoted as follows:

Heavy-melting steel scrap	$14.25 to $14.50
Re-rolling rails	16.25 to 16.50
No. 1 cast scrap	14.25 to 14.50
Old car wheels	15.75 to 16.00
Machine shop turnings	8.50 to 8.75
Stove plate	10.25 to 10.50

Wire Rope—Prices are without change. The discount to the larger trade is 42½ and 5% from list, for galvanized, and 50 and 5% for bright.

The net prices of wire rope are as follows:

Diameter in.	Price per ft. Cast steel	Crucible steel	Plow steel
2½	$1.05	$1.24	$1.46
2¼	.85	1.05	1.22
2	.57	.65	.76
1⅞	.55	.54	.64
1½	.32	.33	.45
1¼	.23	.28	.32
1	.15	.18	.21
¾	.10	.11	.13
⅝	.07	.09	.10
½	.06	.07	.07

Steel Shapes—Trade has not been as active, and those carrying stocks of this material have been able to secure large supplies. This has caused some shading of prices.

Quotations from jobbers store which are 5@10c. per 100 lb. lower than last month are as follows:

	Per lb.
Refined iron:	
1 to 1⅞ in., round and square	2.10c.
1½ to 4 in. x ⅜ to 1 in.	2.10c.
1½ to 4 in. x ¼ in. to ⅜ in.	2.30c.
Norway bars	3.60c.
Soft steel:	
¾ to 3 in., round and square	2.05c.
1 to 6 in. x ⅜ to 1 in.	2.05c.
1 to 6 in. x ¼ and ⅛ in.	2.20c.
Rods—⅝ and ½ in.	2.15c.
Bands—1½ to 6 x ⅛ in. to No. 8	2.35c.
Beams and channels—3 to 15 in.	2.15c.
Angles:	
3 in. x ⅛ in. and larger	2.15c.
2 in. x ⅛ in. and ⅛ in.	2.55c.
1½ to 2½ in. x ⅛ in.	2.30c.
1½ to 2¾ in. x ¼ in. and thicker	2.20c.
1 to 1¼ in. x ⅛ in.	2.30c.
1 to 1¼ x ⅛ in.	2.35c.
Tees:	
1½ to 2½ x ¼ in.	2.25c.
1½ to 2½ x ⅛ in.	2.35c.
3 in. and larger	2.25c.

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

⅝ in.	$7.50
¼ in.	4.75
⅜ in.	3.75
5/16 in.	3.40
⅛ in.	3.20
⅛ and 7/16 in.	3.00
5/16 and 7/16 in.	2.90
¾ and ⅞ in.	2.80
⅞ and 1 in.	2.70
1 to 1¼ in.	2.60

Extras for BB:

⅞ in.	1.50
¼ in.	1.50
⅛ and larger	1.25

Extras for triple B (BBB)

⅞ and ¼ in.	2c.
⅛ and larger	1.75c.

Freight Rates—The freight rates on finished-steel products, from the Pittsburgh District, including plates, structural shapes, merchant steel and iron bars, pipe fittings, plain and galvanized wire, nails, rivets, spikes and bolts (in kegs), black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandaigua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Switch Points—The following prices are named f.o.b. mill, for switch points in lots of ten or more pairs; for 60-lb. rail, 10-ft. points, $16.25; 15-ft. points, $17.50; for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25; for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points, $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 10, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter in in.	Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	16	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.10	74.22
10	14	66.42	71.08	96.15
11	14	71.20	76.57	102.34
12	14	83.75	89.15	118.30
13	14	89.67	96.55	127.98
14	14	99.14	105.51	138.85
15	14	108.05	114.89	151.92
16	14	117.53	124.82	166.58
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	301.32	314.89	395.37
30	10	324.81	399.15	430.64

*Made in both lighter and heavier gages at corresponding differences in price.

Lag Screws—The net price of lag screws has been advanced. Quotations per 100 lb. f.o.b. Pittsburgh are as follows:

Length in.	Diameter in inches ½ in.	¾ in.	1 in.
3½	$1.14	$2.24	$4.50
4	1.21	2.36	4.76
4½	1.20	2.50	5.02
5	1.35	2.57	5.28
6	1.50	2.92	5.80
7	1.69	3.20	6.32
8	1.78	3.48	6.84
9	1.93	3.76	7.36
10	1.97	4.04	7.88
11	2.21	4.32	8.40
12	2.36	4.69	8.92

Nails—On Mar. 19, one of the independent manufacturers advanced the price of wire nails $1 a ton. This was followed by similar advances from larger manufacturers, and also the leading interest. Business has been dull, and specifications have not been up to normal, but, with the clauses introduced in contracts recently, that a definite proportion of contracts must be shipped each month or canceled, it is expected to stimulate shipments. New contracts are made at $1.90 f.o.b. Pittsburgh. In Chicago, carload lots to retailers are $2.03; less than carload lots, $2.08. In New York, wire nails from store are $2.10, and cut nails are $1.75 to $1.80 Pittsburgh, and $2.10 New York. All of these quotations are per keg of 100 lb.

Coke—The inforced blowing out of a number of furnaces due to the high waters, inability to secure ore and supplies, resulted in an accumulation of supplies. The production of coke in the upper and lower Connellsville region made a new high record during the week ending Mar. 22 of 445,494 tons. Prices have not eased off much, but it is probable that contracts for prompt shipment, or shipment as soon as the railroads can deliver cars, could be made at material concessions. The generally quoted price is $2.30 to $2.40, and contract furnace coke is $2.25 for prompt shipment. Seventy-two hour foundry coke for prompt delivery can be had at $3 at $3.50 per net ton at oven.

Wire—Quotations of wire, and wire products were advanced $1 a ton, Mar. 19. This had been anticipated by consumers, and large contracts had been made previously for later shipment, but specifications on these contracts have been disappointing. It is expected that this advance will stimulate specifications by consumers. Quotations are as follows: Painted barbed wire in large lots, Pittsburgh, $1.80; galvanized, $2.20; annealed fence wire in carload lots, $1.60; galvanized, $2. In Chicago, annealed fence wire is $1.75; galvanized, $2.18. Barbed wire in Chicago is $1.98 and galvanized, $2.38. All of these quotations are per 100 lb.

REINFORCING MATERIALS

Bars, Concrete Reinforcing—The agricultural implement makers have not been anxious to make contracts for bars during the last fortnight, even though some attractive prices have been made. The concrete bar market is active, and deliveries have decidedly improved. Prices from Pittsburgh warehouses are slightly easier.

The base price in Pittsburgh is 1.50c.

Quotations are as follows in cents per lb.:

	Mill shipments f.o.b. Pittsburgh	From warehouse Pittsburgh
¾-in. and larger	1.50	1.95
⅝-in.	1.55	2.05
½-in.	1.60	2.15
⅜-in.	1.70	2.25
¼-in.	2.00	2.50

Bars from stock, Pittsburgh, are usually cut to the required length, without extra charge.

Triangular Mesh—Manufacturers of triangular-mesh report business satisfactory, in fact somewhat better than a month ago, but the large consumption has not made its appearance yet. Prices are steady and unchanged from last month.

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material—Carload lots	Plain material—Less than car lots and over 10,000 sq.ft.	Galvanized—Carload lots	Galvanized—Less than car lots and over 10,000 sq.ft.
•4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.90	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
•7	0.041	0.49	0.60	0.55	0.66
•23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
•26	0.110	1.17	1.42	1.30	1.55
•27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
•39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
•43	0.101	1.10	1.34	1.23	1.46

•This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 150, 300 and 600 ft.

Rope—Prices of rope have advanced steadily, and are now at the highest figures named in recent years. This is largely because of an enormous and world-wide demand for all kinds of hemp products. Best grades of Manila rope are held at 15c. per lb., other grades ranging from 12 to 13c.

METALS

Copper—Supported by a better demand from Europe during the early part of March, a decidedly better tone developed in the domestic market. All the leading selling agencies had established their quotations on electrolytic copper at 15.12½c. delivered 30 days by the middle of the month, and have succeeded in maintaining that level up to date. As is usual in a period not marked by continuous active buying, metal held by speculators and some of the small producing interests, was offered below that figure. Such offerings, however, have not been an conspicuous during the past month as they were throughout the first two months of the year. Domestic consumers also contributed a large aggregate of business though the buying from this quarter did not reflect fully what is generally supposed their requirements will be for the next three months. The improved sentiment is based on the reversal of the unfavorable statistical trend that started in last fall. Up to Mar. 11, every month from November, 1912, was marked by an increase in surplus in the hands of domestic producers, and it was fully expected in the trade, the statement for February would be of a like nature. This anticipation was not realized, as the report of the Copper Producers' Association for that month disclosed a decrease of about 1,000,000 lb. Particularly heavy export shipments took place during March, the total reaching close to 90,000,000 lb., and establishing a new high record for European shipments. At the end of March the price of electrolytic copper was generally held at 15.12½c.; lake at 15.25c., and casting at 15c.

Tin—Even lower prices were made during the first few days of March than had been recorded in the previous month. Sales of tin for delivery in August were made under 46c., this was the lowest point reached in nearly a year. Consumers and speculators bought freely at around 48c. and in consequence were unable to purchase more as prices receded. The statistical position is not as satisfactory, from the point of view of holders of the metal as it was a month ago.

Lead—The market is steady and without change at 4.35c. New York, and 4.20c. St. Louis.

Spelter—Prices have eased off slightly, being quoted in New York at 6.20, and in St. Louis at 6.05. Future deliveries can be had at even lower figures.

	Per lb.
Bismuth	$2.25
Brass tubes, iron-pipe sizes:	
⅛-in.	.23
¼- to 3-in.	.22
3½-in.	.23
4-in.	.23
Brass rods	.18¼
Brass sheets	.18½
Solder, half and half guaranteed	.32
Zinc sheets	.10¾
Manganese bronze rods	.18¾
Manganese bronze in crucible form	.16¾

Old Metals—The decline of last month resulted in a hoarding of metal and business has been extremely quiet.

Prices are as follows:

	Cents
Copper, heavy and crucible	13.25
Copper, heavy and wire	13.00
Copper, light and bottoms	12.00
Brass, heavy	8.00
Brass, light	7.00
Heavy machine composition	11.50
Clean brass turnings	8.00
Composition turnings	10.50
Lead, heavy	3.75
Lead, tea	3.50
Zinc scrap	5.00

CLAY PRODUCTS

Sewer Pipe—Prices are steady and conditions show no apparent change from last month. The opening of activity in outside construction work is expected to call for large quantities. Discounts applying to the Eastern list, delivered in New York, are as follows: 3 to 24 in., inclusive, 72%; for 27 to 30 in., 64%, and for 33 and 36 in., 59%. Factory discounts are quoted at 78% for 3 to 24 in.; 70% for 27 to 30 in., and 65% for 33 and 36 in. At those discounts the net prices per foot are as follows:

SEWER PIPE, PER FOOT

Size	Delivered N. Y.	Factory	Size	Delivered N. Y.	Factory
3 in.	$0.07	$0.045	20 in.	$0.63	$0.405
4 in.	0.07	0.045	21 in.	0.84	0.54
5 in.	0.112	0.072	22 in.	0.84	0.54
6 in.	0.112	0.072	24 in.	0.91	0.585
8 in.	0.154	0.094	27 in.	1.62	1.35
10 in.	0.224	0.144	30 in.	1.98	1.65
12 in.	0.28	0.18	33 in.	2.56	2.18
15 in.	0.378	0.243	36 in.	2.87	2.45
18 in.	0.532	0.342			

Flue Linings—Prices are quoted with no change. The discount from list, delivered New York, in carload lots, is 75%.

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x 8½-in.	14	$0.075	12x16-in.	45	$0.25
4½x13 -in.	20	0.1125	13x18-in.	57	0.30
6 x12 -in.	22	0.125	14x16-in.	60	0.2725
7 x 7 -in.	15	0.875	16x16-in.	65	0.40
8½x 8½-in.	18	0.1125	16x20-in.	80	0.50
8½x13 -in.	28	0.1625	18x18-in.	75	0.50
8½x18 -in.	45	0.02225			

Hollow Tile—Prices are firm with a steady market. Quotations, f.o.b. Perth Amboy, N. J., are as follows:

Size	Price per block—Hollow wall tile	Size	Interior partition block
4x12x12-in.	$0.06	2x12x12-in.	$0.048
6x12x12-in.	0.084	3x12x12-in.	0.048
8x12x12-in.	0.102	4x12x12-in.	0.052
10x12x12-in.	0.12	6x12x12-in.	0.072
12x12x12-in.	0.15	8x12x12-in.	0.096

Roofing Tile—Business is quiet with steady prices. Although small orders are being received no brisk trade is noted, it being mainly scattering inquiries for small quantities. The Central and Western states also report a dullness being experienced at this time. The best grade of promenade roofing tile in flat blocks for high-grade roofs is sold $25 per M. for run of kiln and $35 per M. for selected. A cheaper form of tile with a smooth surface may be had at about $12, but it is not suitable for roof gardens. These prices are f.o.b. New York.

Roofing tile, unglazed, of the French and Spanish type, plain, is sold at $9 per 100 sq.ft. of roof surface, f.o.b., New York. Glass tiles are sold at 60c. each.

LUMBER

Prices are stiffer with a firm market. Spring indications show a higher tendency. The outlook for the spring demand is good as plans and forecasts of much construction work have been announced. This will depend largely on whether or not prices are too prohibitive.

Spruce—The call is for large quantities and prices are stiff. Yard prices in New York are as follows:

2x10-in. 3x10-in. 4x10-in.	12 to 16 ft.	$35
2x12-in. 3x12-in. 4x12-in.	12 to 16 ft.	$37

For 18 and 20 ft., $37, for all lengths over add 50c. for every additional foot.

Flooring—The market is firm with a good demand.

Quarter-sawed oak flooring, A1, is $88 per M. Selected white-oak or red-oak flooring is $50 per M., and common flooring, red or white, is $30 per M.

Maple flooring, ¼x2¼-in., is $55 for clear; $50 for No. 1, and $28 for factory. Long-leaf yellow-pine flooring, ¼x2½-in. face, is $60@65 for A heart rift; $50@55 for sap rift; $36 for No. 1 flat; $32 for No. 2, and $30 for No. 3.

Hemlock—The demand is large with prices quoted with a higher tendency.

Price per M., f.o.b. cars, New York:

	Length			
	10 ft.	12 ft.	14 ft.	16 ft.
2x4-in.	$27	$25	$25	$27

Long Leaf Yellow Pine—Heavy outside construction work in all parts of the country and subway contracts in the Metropolitan district, are calling for large quantities of pine, and prices are now being quoted with a higher tendency. The market has stiffened considerably.

Prices per Thousand Feet in Yard, New York.

	Length			
	20 ft. base	21 to 25 ft.	26 to 30 ft.	31 to 35 ft.
2in. thick and under by 8 in. wide and under	$36	$36	$36	$38
10 in. wide by 10 in. thick and under	42	42	40	45
12 in. wide by 12 in. thick and under	42	42	43	45
14 in. wide by 14 in. thick and under	47.50	48	50	50
16 in. wide by 16 in. thick and under	50	52	54	60

Shingles—Unsettled weather conditions during the past month have kept business at a low ebb. Floods in all sections of the country are expected to play havoc with the demand and to raise prices far above the mark of previous years. It is doubtful if even a small part of the spring demand can be supplied. Prices are steady as there can be no business done and so no reason for establishing high quotations. Cypress shingles, New York: 7x24 -in., rived and shaved, $23.50@24 per M.; 21-in., promiscuous widths, rived and shaved, $8 4-in. basis; 6x20-in., sawed $12 per M.; 6x18-in., sawed, $8.50 per M.; 5x18-in., sawed, $7.50 per M.

Piling—Conditions are unchanged with a firm market. In New York, the price of oak piling is 22@25c. per lin. ft. Oak piles 14 in. in diameter, 2 ft. from butt with a 6-in. top, and 40 to 45 ft. long, are held at $10.50@11.50; 50 ft. long, 25c. per lin.ft. Pine piles, 25 ft. long, 12 in. in diameter, 2 ft. from butt, with a 7-in. top, held at 17c. per lin.ft., while those 25 ft. long are 16c. In general, pine piles can be had at 16@17c.; oak piles, 55 to 60 ft., are quoted at 23c. per lin.ft.

Cross Ties—Heavy buying continues to be the order of the day and prices have stiffened. Prices are quoted by G. S. Baxter & Co., 15 William St., New York, as follows:

	Cents each
7x9 in. by 8 ft. 6 in.	88
6x8 in. by 8 ft.	78
6x9 in. by 8 ft. nominal	83

OILS AND PAINTS

Linseed Oil—Consumers are not anticipatrng their needs to any extent, and stocks are large. At the same time, it must be recognized that consumption this year will be larger than for several years past, and, in all probability, the supplies now accumulated will be heavily drawn upon before summer is over. In New York, city raw is held at 48 to 49c. per gal., and out-of-town raw is slightly less. In Chicago, raw oils in lots of 5 bbl. and over, is held at 45c. per gal.; boiled oil is held at the usual advance of 1c. per gal. over raw.

Paints—The season promises to be one of large business. Prices are steady, and in New York, are as follows: White lead in oil in 100-, 250- and 500-lb. kegs is 7¼@7½c. per lb.; in 25- and 50-lb. kegs, 7¾c. per lb. Red lead and litharge in 100-lb. kegs is 7@7½c. per lb.

Hyrex preservative paint is 75c. per gal. in bbl. lots, New York City.

Colors in oil are quoted at the following prices per lb.: Lamp black, 12@14c.; Chinese blue, 36@46c.; Prussian blue, 32@36c.; Van Dyke brown, 11@14c.; Chrome green, 12@16c.; raw or burnt Sienna, 12@15c.; raw or burnt Umber, 11@14c.

Spirits Turpentine—The market has been very much disturbed, due to the failure of the American Naval Stores Co. It is not felt at this time that any large quantity of turpentine will be forced out of the market, at least not a quanity large enough to seriously affect prices. Turpentine is quoted at 41c. per gal., New York.

MISCELLANEOUS

Heating Supplies—Makers of boilers of small sizes, such as are used in suburban residences, have for many years been in the habit of slightly lowering their quotations around Jan. 1. This has also been the case with the leading manufacturers of radiators. This year, no such decline took place, and while there is a great deal of outside cutting in the price of boilers and radiators, this by no means establishes a market. The slackening of quotations is more noticeable in the boiler trade than in the radiator line. Business in these lines is not especially active.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; 4c. per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x40 in. It varies in thickness from 1/32 to 1/8 in., and in weight from 2 to 27 lb. per sheet. The net price in 100-lb. lots is 5c. per lb.

Transite, asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in standard sheets, 36x48 in., 42x48 in. and 42x96 in. The prices, f.o.b. factory, Nashua, N. H., are as follows:

Thickness	Weight, pounds	Price
1/16-in.	1	$0.08
3/32-in.	1½	0.12
¼-in.	2	0.16
5/16-in.	2½	0.20
3/8-in.	3	0.28
7/16-in.	3½	0.28
½-in.	4	0.32
9/16-in.	4½	0.36
5/8-in.	5	0.40
¾-in.	6	0.44
7/8-in.	7	0.48
1-in.	8	0.52
1¼-in.	10	0.56
1½-in.	12	0.64
1¾-in.	16	0.72
2-in.	16	0.80

Waterproofing—The prices for carload lots, f.o.b. cars New York, are as follows: Hydrex waterproofing felt, $1.25 per 100 sq.ft.; Hydrex compound "A," 26c. per gal.; Hydrex compound "B," 18c. per gallon.

Texaco waterproofing cement is $30 per ton in car lots, f.o.b. cars New York or Philadelphia.

Asphaltum for waterproofing is sold at $26@27 per net ton.

Glidden, graphic acid proof coating is sold at $1.25 per gal. in bbl. and ½ bbl. and $1.40 per gal. in 5-gal. cans. These prices are f.o.b. Cleveland or for delivery from warehouse, New York, Chicago, St. Louis, Boston or Atlanta.

Slate—Quotations are as follows, f.o.b. quarry.

	Prices per 100 sq.ft.
Vermont, sea green	$3.00@ 4.00
Pennsylvania, Bangor Ribbon	3.50@ 4.00
Maine, Brownsville No. 1	5.00@ 7.75
Maine, Brownsville No. 2	4.50@ 6.00
No. 1 red	7.50@10.00
Unfading green	4.00@ 5.50
Genuine Bangor	4.25@ 6.50
Pen Argyle	4.00@ 6.00

Wood Preservative—See Oils and Paints.

Roofing Paper—There is a larger demand but it is not as insistent as early in the year.

Quotations in New York are as follows:

	Per roll of 500 sq.ft.
Rosin sided sheathing, 20 lb.	28c.
Rosin sided sheathing, 30 lb.	43c.
Rosin sized sheathing, 40 lb.	58c.

ROOFING, RUBBER

	Per roll of 108 sq.ft.
1 ply, 35 lb.	$1.90
2 ply, 45 lb.	1.10
3 ply, 55 lb.	1.30

Tarred felt is $1.45 per 100 lb. in 1, 2 and 3 ply. Slaters felt is 60c. per roll.

Rubber—The large consumers of rubber in all parts of the world seem to be under the impression that supplies can be secured cheaper later on and have not made any extensive purchases for forward delivery. The stocks they have are ample for present requirements. The stocks in the hands of agents are large. It has been more than three years since as low prices have ruled for rubber as those current today. Quotations are as follows: Up-river Para, fine, 90c.; up-river Para, coarse, 65c.; Caucho Ball, 67c.; Mexican strips and scrap, 63@65c.; Massai, red, 85c.; black Congo, 82c.

INDUSTRIAL NOTE

Mr. J. W. White, of the Jeffrey Manufacturing Co., Columbus, Ohio, with the title of engineering salesman, and located until recently at Athens, Ohio, will hereafter make his headquarters at Duluth, Minn. Mr. White will look after the sales in the eastern part of Minnesota, Northern Wisconsin, and the entire upper peninsula of Michigan. His headquarters are now located at 1905 East Superior St., Duluth, Minn.

CONTRACT PRICES

+Paving—Washington, Iowa—Bids for paving according to plans prepared by Charles P. Chase, Consult. Engr., Clinton, Iowa, were received by the city, Mar. 19, as follows: (A) J. J. Ryan, Muscatine, (B) McCarthy Improvement Co., Davenport, (C) D. E. Keeler Construction Co., Davenport, (D) Kaw Paving Co., Topeka, Kan., (E) J. J. McKEONE, Washington (awarded contract). The item bids were as follows:

	PAVING, WASHINGTON, IOWA				
	A	B	C	D	E
4600 cu.yd. grading	$0.47	$0.55	$0 45	$0 50	$0.40
7500 lin.ft. combined curb and gutter	.57	.66	.73	.68	.65
12,000 sq.yd. bituminous coated cement concrete pavement	1 40	1 38	1 42	1 36	1 35
Totals	$23,237	$24,040	$24,585	$23,720	$22,915

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RIVER FLOODS

Ohio River Floods—Advices from Cincinnati state that the bridges of the Pennsylvania Lines in the Ohio Valley are damaged to the extent of $3,000,000, other railroads in proportion. Terminal systems are destroyed. The damage to telegraph and telephone is estimated at $3,000,000. The loss of Hamilton and Butler County bridges will reach $2,250,000. Waterworks, gas and electric-light plants are out of commission. The Lorimer Reservoir burst, and Miami River levees broke. At Lawrenceburg, Ind., twenty miles below Cincinnati, the Ohio River levee broke, submerging the town.

RAILWAYS

Massachusetts—Boston & Maine R.R.—This company, A. B. Corthell, Boston, Mass., Ch. Engr., it is reported, has announced that it will immediately curtail all construction work not absolutely necessary for safety. This decision means that the proposed scenic railway to the summit of Mt. Washington, which included a large hotel at the top, which was to cost $3,000,000, will be given up; also the proposed hotel at Bar Harbor will not be erected.

New York, New Haven & Hartford R.R.—The city of Fall River, Mass., and this company, Mar. 22, agreed on plans for the construction of the proposed $2,000,000 tunnel under the city, and for the erection of a station on Pleasant St. Work, it is expected, will begin soon. The plan to construct a bridge across the Taunton River will be dropped on account of the cost, which was estimated at $2,400,000. Edward Gagel, New Haven, Conn., is Ch. Engr.

Pennsylvania—Cornwall & Lebanon R.R.—This company has been purchased by the Pennsylvania R.R. The line is 22 miles long, extending from Conewago, on the Pennsylvania R.R., to Lebanon, at which point it connects with the Philadelphia & Reading Ry. It is reported that the Pennsylvania R.R. will extend the line to Pottsville, Penn., or Reading, Penn., to connect with the Schuylkill Division. Alex. C. Shand, Philadelphia, is Ch. Engr.

New York Central Lines—The New York Central Lines, it is reported, plans to double-track its Pennsylvania Division from Holland to Lawrenceville, Penn. Estimated cost, about $200,000 G. W. Kittredge, New York, N. Y., is Ch. Engr.

West Virginia—Charleston, Parkersburg & Northern R.R. A charter was issued, Mar. 21, to this company for the construction of a railway from Charleston, W. Va., to Parkersburg, W. Va. The main offices of the company will be located at 217 Fourth St., Parkersburg. The capital is $100,000. The incorporators are K. B. Stephenson, Parkersburg, W. Va.; H. M. Fowler, E. R. Riedl, J. R. Fowler and A. H. Geiger, Washington, D. C.

✚**North Carolina**—Atlantic Coast Line R.R.—This company has awarded the contract to W. Z. WILLIAMS & CO., Macon, Ga., for the concrete masonry necessary in the construction of the second-track work from Parkton to Selma, N. C.

Florida—It is reported that work will soon start on the construction of the proposed railroad to connect Tampa, Fla., and St. Petersburg, Fla. Bonds to cover the cost of construction have been sold. Charles H. Lutz, Tampa, is interested. Noted Mar. 27.

✚**Mississippi**—The contract has been awarded to the FERGUSON & PALMER CO., Paducah, Ky., for the construction of a railroad from Houlka, Miss., to timber lands.

✚**Kentucky**—Louisville & Nashville R.R.—A subcontract has been awarded to CARR & GIBSON, Winchester, Ky., on the double-tracking of this company's line from Winchester to Renick, Ky. The general contractors are Mason, Hanger & Carmichael.

Ohio—Lake Shore & Michigan Southern Ry. (New York Central Lines)—Plans for the elevation of the tracks of the New York Central Lines in the city of Cleveland, Ohio, to meet the grade necessary to run into the proposed new union station will be submitted to the city at once. L. Rust, Cleveland, is Resident Engr.

Indiana—Baltimore & Ohio—This company, it is reported, is planning to spend $800,000 for the construction of new yards at Miller, Ind. F. L. Stuart, Baltimore, Md., is Ch. Engr.

Illinois—Peoria & Galesburg R.R.—This company is having the final surveys made for the construction of its proposed line. The contract for construction has been awarded to the Peoria Engineering & Construction Co., Peoria, Ill. Horace Clark is Pres., Peoria. The necessary capital has been secured. L. L. Summers & Co., Peoria and Chicago, Ill., are Consult. Engrs.

✚**Minnesota**—The contract has been awarded to OLSON & TILLY, Arthur Main, for grading 17 miles of railway from Deer River to Little Fork, Minn. The road is owned by the Backus Lumber Co.

Kansas—Newton, Kansas & Nebraska R.R.—This company has made arrangements to construct its line from Milton, Kan., north via Newton, Kan., and from Milton, Kan., to Fairfield, Neb. T. H. McMannis, Newton, is Pres.

✚**North Dakota**—Midland Continental R.R.—This company has awarded the contract to FREDERICK & BARNARD, Globe Bldg., Minneapolis, Minn., for grading work from Jamestown, N. D., north. The work includes about 50 miles.

South Dakota—Sioux Valley & Northern R.R.—This company has been incorporated with a capital of $1,000,000, for the construction of a railroad through Coddington, Grant and Roberts Counties, to the north line of the state, a distance of about 100 miles. The incorporators are F. T. Heathcote, T. C. T. Jones, T. N. Bergam, J. E. Mitchell and Mark Johnson. The offices of the company will be located at Watertown, S. D.

Montana—Big Black Foot R.R.—This company has filed with the Secretary of State of Montana an amendment to its articles of incorporation, certifying that it will extend its line from its present terminus in the Big Blackfoot across the range to Great Falls, Mont. The extended line will pass in an easterly direction through Powell, Lewis and Clark and Cascade Counties.

✚**Montana**—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company has awarded the contract to FOLEY BROS. & STEWART & WELSH, St. Paul, Minn., for the grading of its line from Ambrose, N. D., to Metropolis, Mont., about 80 miles.

Texas—The construction of a railroad is under consideration from Teague, Tex., via Bristol, Alsdorf and Tellico, to Paris, Tex., a distance of about 80 miles.

Texas & Pacific Ry.—This company is considering the reballasting of its line from Texarkana to Fort Worth, via Dallas, a distance of about 246 miles. The company has decided to lay new rails over a large part of the distance. C. H. Chamberlain, Dallas, Tex., is Ch. Engr.

El Paso & Southwestern R.R.—This company has made application to the State Legislature to purchase and operate the El Paso & Northeastern R.R. This line extends from El Paso, Tex., to Tucumcari, N. M. If the company's application is acted upon favorably, it is reported that the road will be extended through the panhandle of Texas to some point in the State of Oklahoma. G. F. Hawkes, El Paso, Tex., is Gen. Supt.

Idaho—Oregon Short Line R.R.—This company has decided to double-track its line between Lava and Renfro, Idaho. The company plans ultimately to double-track its Idaho and Utah lines. Carl Stradley is Ch. Engr., Salt Lake City, Utah.

California—California, Shasta & Eastern Ry.—This company will operate a railroad between Anderson and Ingot, Calif., a distance of 28½ miles. It will take over the Anderson & Bella Vista Ry., 16½ miles in length and construct the remaining 12 miles to Ingot.

California—Atchison, Topeka & Santa Fé Ry.—This company is preparing to double-track its line from Victorville to Summit, Calif., about 19 miles. Estimated cost, $1,000,000. C. A. Morse, Topeka, Kan., is Ch. Engr.

Alaska—Railroads costing in the aggregate $35,000,000 may be constructed in Alaska if the report of the Alaska Railway Commission receives the sanction of Congress. The roads recommended are: First, a line from Chitina to Fairbanks, 313 miles; second, a branch line 38 miles long in the Bering River coal field; third, the construction of a line into the lower Susitna Valley, involving 115 miles of new construction; four, a Matanuska branch, 38 miles long; and, fifth, an extension of the Susitna line into the valley of the Kuskokwim and the Iditarod section, 229 miles. Maj. J. J. Morrow, Washington, D. C., is Chn.

Ontario—Temiskaming & Northern Ontario R.R.—This company, S. B. Clement, Ch. Engr., North Bay, Ont., has awarded the contract for the construction of six miles of railroad from Iroquois Falls Junction to Iroquois Falls on the Abitibi River. The work is being done for the purpose of connecting the pulp mills of the Abitibi Pulp & Paper Co. with the main line of the railway.

Canadian Pacific Ry.—The contracts awarded by this company for double-track work covering 165 miles of its line in the province of Ontario were erroneously noted Mar. 27, under Toronto, instead of Ontario.

✚**British Columbia**—Canadian Pacific Ry.—This company has awarded the contracts as follows, for double-track work in British Columbia: To GRANT SMITH & CO., Seattle, Wash., for work between Hammond Creek and Ruby, B. C.; to PATRICK WELSH, Seattle and Spokane, Wash., for work east of Hammond Creek.

✚Canadian Pacific Ry.—This company has awarded the contract to BURNS & JORDAN, Spokane, Wash., for constructing 60 miles of the final section of its Kootenay Central Branch in British Columbia. The contract for 100 miles of work on the same line has been awarded to BOOMER & HUGHES, Spokane.

ELECTRIC RAILWAYS

Bangor, Maine—The Bangor Ry. & Electric Co. is considering plans for the construction of a two-mile extension to its Hampden line. C. H. Johnson, Bangor, is Supt. Ry.

Rochester, Mass.—The New Hampshire Electric Ry. Co. is considering plans for the construction of an electric line from Rochester to Farmington. Franklin Woodman, Haverhill, is Gen. Mgr.

Albany, N. Y.—Plans have been prepared and preliminary arrangements are being made for the extension of the Arbor Hill line of the United Traction Co. James F. Hamilton, Albany, is Gen. Mgr. Noted Jan. 30.

Geneva, N. Y.—R. R. Quay, of Pittsburgh, Penn., has purchased the electric railway of the Geneva & Auburn Ry. Co.

Plans are being prepared by the new owner for the extension of the line to Auburn.

Bloomsburg, Penn.—Surveys have been made and work will soon be started by the Bloomsburg, Millville & Northern Ry. Co. on its proposed electric railway from Bloomsburg to Millville. Walter A. Hughes, West Berwick, Penn., is Pres. and Treas. Noted Mar. 20.

Harrisburg, Penn.—The Harrisburg Traction Co. is preparing plans for the extension of its Market St. line to 21st St., and for the construction of new tracks on Race St. Frank B. Musser, Harrisburg, is Pres. and Gen. Mgr.

Latrobe, Penn.—The Borough Council of Latrobe has granted permission to the West Penn Traction Co. to improve and extend its system in Latrobe. W. E. Moore, Pittsburgh, is Gen. Mgr.

Wilmington, Del.—The State Legislature has granted permission to the Wilmington & Philadelphia Traction Co. to construct and operate an electric railway on Ninth St. to the fair grounds. William A. Heindle, Wilmington, is Gen. Mgr.

Martinsburg, W. Va.—The Shenandoah Valley Ry. Co., which proposes to construct a trolley line from Williamsport, Md., to Hedgesville, Martinsburg, Sheperdstown and Charlestown, W. V., and Winchester, Va., about 60 miles in length, has organized and elected the following officers: Gray Silver, of Martinsburg, Pres. and Gen. Mgr.; C. W. Watson, of Fairmount, W. Va., Vice-Pres.; Frank E. Wilson, Martinsburg, Secy., J. O. Watson, Fairmount, Treas.; J. H. Wheelright and Van Lear Black, Baltimore, Md., Stuart W. Walker, J. William Stewart, Dr. S. N. Myers and Clarence E. Martin, all of Martinsburg, W. Va., Dudley D. Britt Clarkesburg, W. Va., are the Directors. Dudley D. Britt, Clarkesburg, W. Va., is Ch. Engr.

New Martinsville, W. Va.—Plans are being prepared by the Wheeling Traction Co. for the extension of its Moundsville branch to New Martinsville. George O. Nagle, Wheeling, is Gen. Mgr.

Greensboro, N. C.—The County Commissioners have been petitioned to grant a franchise to the Southern Power Co. for the construction of an electric railway from Greensboro to High Point. C. I. Burkholder, Charlotte, is Mgr.

High Point, N. C.—The North Carolina Public Service Co. is considering plans for the extension of its line out of High Point. C. H. Andrews, Greensboro, is Gen. Mgr. and Pur. Agt.

Warrenton, N. C.—The Warrenton & Norlina Ry. Co. has been incorporated to construct and operate an electric railway from Warrenton to Norlina. The incorporators are, W. H. Burroughs, J. P. Scoggin, W. E. Twitty, of Warrenton, A. C. House, of Weldon, and J. E. Bowers of Scotland Neck.

Macon, Ga.—Plans have been prepared by the Macon Ry. & Light Co. for double-tracking its line on Monroe St. from Washington Ave. to Forsyth St. L. S. Boggs, Macon, is Gen. Mgr.

Jacksonville, Fla.—Preliminary arrangements are being made by the Jacksonville Traction Co. for the extension of several of its lines in Jacksonville. Hardy Croom, Jacksonville, is Local Mgr. and Pur. Agt. Noted Feb. 6.

Birmingham, Ala.—The Birmingham Realty Co. has applied to the City Council for a franchise to construct and operate an electric street-car line in Norwood, a suburb of Birmingham. I. C. Beatty, Birmingham, is Gen. Mgr.

Cleveland, Ohio—The Cleveland Interurban Ry. Co. is considering plans for the construction of an electric railway in Shaker Heights, a suburb of Cleveland. W. D. Turner and L. M. Henders are interested.

The City Council has granted a franchise to the Cleveland Ry. Co. to extend its line on Union Ave. to 116th St. Charles H. Stanley, Cleveland, is Pur. Agt.

Covington, Ohio—The Piqua & Bradford Traction Co. has been incorporated to construct and operate an electric railway to connect Covington and Bradford. The incorporators are J. H. Marlin, A. W. Minton and Hugh C. Martin.

Portsmouth, Ohio—The Portsmouth St. R.R. & Light Co. has applied to the City Council for a franchise to extend its line from Portsmouth to Jackson. R. D. York, Portsmouth, is Gen. Mgr.

Laporte, Ind.—The Waterloo, Cedar Falls & Northern Ry. Co. is preparing plans for the construction of an electric railway from Laporte, Ind., to Urbana, Ill., about 40 miles. C. D. Cass, Waterloo, Iowa, is Gen. Mgr.

Iron River, Mich.—The construction of an electric railway from Iron River to Stambaugh is contemplated. M. M. Reid, of Ironwood, Mich., is interested in the project.

Centralia, Ill.—The East Side Electric Co. has been incorporated to construct and operate an electric railway from Centralia to Irvington. The incorporators are H. C. Higgins, C. F. Lender, Robert Rohl, S. A. Frazier, W. M. Grisson and G. L. Pittenger.

Hillsboro, Ill.—The Board of County Supervisors has granted a franchise to the Springfield & Central Illinois Traction Co. to construct and operate an electric railway through Montgomery County.

Junction, Ill.—Preliminary arrangements are being made by the Centralia & Central City Traction Co. for the construction of an electric railway from Junction to Sandoval, about five miles. Monroe McRoy, Centralia, is Supt.

Springfield, Ill.—Plans are being prepared by the Springfield & Jackson Electric Ry. Co. for the construction of an electric railway to connect Berlin, Springfield and Jacksonville, about 30 miles.

Cedar Rapids, Iowa—The Iowa Ry. & Light Co. has been granted permission to extend eight of its lines in Cedar Rapids. J. D. Wardle, Cedar Rapids, is Supt. Rys. and Ch. Engr.

Eureka, Kan.—The Manhattan City & Interurban Ry. Co. proposes to construct an electric railway to connect Eureka, Ogden and Fort Riley, about 13 miles. Joseph T. West, Manhattan, is Gen. Mgr. and Pur. Agt.

Salina, Kan.—Plans are being prepared by the Salina St. & Interurban Ry. Co., for a number of extensions in Salina this spring. H. C. Smither, Salina, is Pres.

Dickinson, N. D.—The Commercial Club of Dickinson is interested in the proposition to construct an electric railway from Dickinson to Mott.

Hannibal, Mo.—Henry Funk, Clarence, Mo., is promoting the construction of an interurban railway from Hannibal to Philadelphia, Mo.

Easton, Calif.—Preliminary arrangements are being made by the Easton St. Ry. Co. for the extension of its line from Easton to San Mateo. F. J. Rodgers, San Francisco, is interested.

Los Angeles, Calif.—Preliminary surveys are being made by the Los Angeles-Pacific Ry. Co. for the extension of its Franklin Ave. line through Beachwood Park to connect with the Brush Cañon line. J. McMillan, Los Angeles, is Gen. Mgr.

The Los Angeles Ry. Co. has applied to the City Council for a franchise to extend its 10th St. line from Hoover St. to the city limits. C. A. Henderson, Los Angeles, is Asst. Gen. Mgr. and Pur. Agt.

Sacramento, Calif.—Plans are being considered by the Pacific Gas & Electric Co. for the construction of an electric railway on Third St. from I to M St. John A. Britton, San Francisco, is Vice-Pres. and Gen. Mgr.

San Francisco, Calif.—The Board of Works has approved the plans and specifications for the construction of the western extension of the Geary St. railway from 33rd. Ave. to the ocean beach and has requested the Supervisors to appropriate $57,400 for the purpose.

San Francisco, Calif.—The State Board of Harbor Commissioners are considering plans for the extension of the Belt Line R.R., through Fort Mason to the Exposition grounds and Presidio.

San Jose, Calif.—Preliminary arrangements are being made by the Peninsular Ry. Co. for the extension of its line to the southeastern section of Santa Clara Valley. F. E. Chapin, San Jose, is Gen. Mgr. and Pur. Agt.

Hamilton, Ont.—The City Council has granted a franchise to the Hamilton St. Ry. Co. to extend its lines in Hamilton. George E. Waller, Hamilton, is Supt. Ry. Dept.

Burnaby, B. C.—Plans are being prepared by the British Columbia Electric Ry. Co. for the extension of its line along Barnet Road in Burnaby, for a distance of three miles. R. H. Sperling, Vancouver, is Gen. Mgr.

Vancouver, B. C.—The British Columbia Electric Ry. Co. is planning to extend its line into the Fernwood district to connect with the electric lines in Victoria. A. T. Goward is Local Mgr.

LIGHT, HEAT AND POWER

Sherborn, Mass.—The Town Council has decided to install an ornamental lighting system on various streets.

Westboro, Mass.—The citizens at a recent election voted to extend the ornamental street-lighting system on several streets.

Terryville, Conn.—Plans are being prepared by the Andrew Terry Co. for the construction of a new power plant in connection with its establishment.

Buffalo, N. Y.—The Cataract Power & Conduit Co., Electric Bldg., has awarded the contract to WHITNEY & DERDENGER, for the erection of an addition to its transformer station at East Ferry and Kehr Sts.

The International Brewing Co. contemplates the construction of a boiler house in connection with its establishment at Niagara and Albany Sts., Buffalo.

Cohocton, N. Y.—The City Trustees have been authorized to make preliminary arrangements for the installation of an ornamental street-lighting system in Cohocton.

Chatham, N. J.—See item under Water Supply-Irrigation.

Hampton, Va.—Plans are being prepared by the Newport News & Old Point Ry. & Electric Co. for the reconstruction of the electric-light systems at Hampton and Phoebus. J. N. Shannahan, Hampton, is Vice-Pres. and Gen. Mgr.

Rockfish, N. C.—Preliminary arrangements are being made by the Raeford Co. for the installation of an electric-light plant at Rockfish.

Wilmington, N. C.—Plans are being considered by the Tidewater Power Co. for the construction of a power substation at Winter Park. A. B. Skelding, Wilmington, is Gen. Mgr.

Woodland, N. C.—The Woodland Electric Light & Power Co. has been organized, and will immediately start to erect an electric-power plant at Woodland. E. G. Griffin and C. J. Parker are directors.

Guyton, Ga.—At an election to be held Apr. 15 the proposition to issue $5000 in bonds for the installation of an electric-light system, will be submitted to the voters.

La Grange, Ga.—The construction of a substation and distributing system in La Grange is contemplated by the Columbus Power Co. Estimated cost, $35,000. J. S. Bleeker, Columbus, is Mgr.

Waycross, Ga.—Plans are being considered by the Ware County Light & Power Co. for an expenditure of $50,000, for the installation of additional equipment in its plant. J. Wright Reeve, Waycross, is Mgr. and Supt.

Girard, Ala.—See item under Water Supply-Irrigation.

Hurtsboro, Ala.—At a recent election bonds for $14,000 for municipal improvements, including the installation of an electric-light plant, were voted. Noted Mar. 6.

Henderson, Tenn.—The proposition to issue $50,000 of bonds for the construction of a municipal electric-light plant and water system is under consideration.

Elizabethtown, Ky.—The Kentucky Utilities Co., of Lexington, Ky., has applied to the Council for a franchise for the sale of current for power, and will enlarge the plant which it recently bought here.

Irvine, Ky.—Elmer Northcutt, of Chicago, Ill., has applied for franchises for electric-light and water systems at Irvine, and has arranged to build the plant as soon as the franchises are granted.

Midway, Ky.—The Kentucky Utilities Co., of Lexington, Ky., has purchased the municipal electric-light plant at Midway. Extensive improvements and extensions are planned by the new owners.

Sebree, Ky.—The Sebree Light & Milling Co. is preparing plans for the construction of an electric-light plant at Sebree. J. J. Korb and M. J. Ramsey are interested.

Whitesburg, Ky.—Wesley Wright, of Wright & Chase, Jenkins, Ky., has announced plans for the establishment of an electric-light plant at Whitesburg, in the heart of the new coal mining district.

+Williamstown, Ky.—The Williamstown Mill & Light Co., which has been incorporated by J. M. Riley and others has awarded the contract for the construction and equipment of an electric-light plant to ELLIS KING, of Falmouth, Ky. Noted Mar. 20.

Ohio—News from this state has been held pending the arrival of information since the disaster.

Elkhart, Ind.—The Council is considering plans for the installation of an ornamental lighting system on Main St. Estimated cost, $6000.

Loogootee, Ind.—A franchise has been granted to the Petersburg Electric Light & Power Co. to construct and operate an electric-light plant at Loogootee. George E. King, Petersburg, is Mgr.

Battle Creek, Mich.—Preliminary arrangements are being made by the Commonwealth Power Co. for the extension of the ornamental street-lighting system in Battle Creek. Estimated cost, $25,000. Noted Mar. 20.

Belleville, Mich.—Bids will soon be received by Gardner S. Williams, Consult. Engr., Ann Arbor, for the construction of a power plant and dam for the Eastern Michigan Edison Co. Estimated cost, $450,000. Noted Jan. 23.

Reading, Mich.—We are officially advised that plans are being prepared by B. K. Goodman, Ch. Engr., of Reading, for the construction of new power plant equipment including boilers, engines and generator for the local electric-light and water-works plant.

Aurora, Ill.—Plans are being considered by the Western United Gas & Electric Co. for the installation of additional equipment in its power plant at Aurora.

Jefferson, Wis.—A movement to add a central heating plant to the municipal electric-light and water-works plants is planned here. John Spangler is Mayor.

Wauwatosa, Wis.—Bids for two steam boilers and two steam electric units will be received at the office of the Superintendent of the Asylum for Chronic Insane of Milwaukee County, at Wauwatosa until Apr. 9. This work is in connection with new buildings, plans for which have been completed by Allan D. Conover, Arch., Madison, Wis.

Belle Plaine, Iowa—Plans are being prepared by the Belle Plaine Gas Co. for the installation of a duplicate set of machinery and the enlargement of its plant. C. I. Tenney is Pres.

Bloomfield, Iowa—Plans have been prepared by J. B. Hill, Consult. Engr., Iowa City, for the construction of a new power plant for Bloomfield. Estimated cost, $10,000.

Clinton, Iowa—The Civic Improvement Committee is agitating the extension of the ornamental street-lighting system throughout the city.

Hawarden, Iowa—Bids will be received by T. J. Reeves, City Clk., until 8 p.m., Apr. 7, for furnishing two h.r.t. boilers, two Corliss engines, two generators and switchboard equipment. Plans are on file at the office of the City Clerk and K. C. Gaynor, Consult. Engr., United Bank Bldg., Sioux City, Iowa.

Stanwood, Iowa—A committee has been organized to investigate the feasibility of installing an electric-light plant at Stanwood. A. D. Claney is interested.

Warsaw, Iowa—The City Council has granted a franchise to the Stone & Webster Engineering Corporation, Boston, Mass., to rebuild the local power plant and install a new substation on Sixth St. Estimated cost, $18,000.

Minneapolis, Minn.—The citizens of Central Ave. have petitioned the City Council for the extension of the ornamental lighting system through that section of the city.

Beaver City, Neb.—Bids will be received by the Mayor until Apr. 4 for the construction of an electric-light plant. Bonds were recently voted for the purpose. Noted Feb. 27.

La Moure, N. D.—A franchise has been granted to I. I. Bennett, of Sioux Falls, S. D., to construct and operate an electric-light plant at La Moure.

Helena, Mont.—Bids will be received by the City Clerk until Apr. 7, for the installation of an ornamental street-lighting system in the business district.

+Sulphur Springs, Ark.—The contract for the construction of a new municipal electric-light and water plant has been awarded to E. M. GALBRAITH, Pine Bluff, at $130,161. Bids were received by the city Mar. 20. Noted Mar. 6.

Dallas, Tex.—The Dallas Chamber of Commerce is agitating the construction here of amunicipal electric-light plant, to cost about $375,000. At a meeting of the organization the subject was discussed but no definite action has yet been taken. J. M. Preston is City Engr. Noted Jan. 30.

+Galveston, Tex.—The City Council has awarded the contract for the installation of an ornamental lighting system on the boulevard to MAX LEVY, at $11,000.

Kyle, Tex.—A franchise has been granted to J. W. Tompkins and associates to construct and operate an electric-light plant at Kyle.

Nacogdoches, Tex.—The City Council has purchased the electric-light and power plant of the Nacogdoches Light & Power Co. The property will be improved and enlarged.

Port Arthur, Tex.—The Port Arthur Gas Co. has been organized for the purpose of constructing a gas-manufacturing plant and laying a distributing system. The incorporators are I. S. Connelly, J. H. Burbank and George McCraine.

Colorado Springs, Colo.—The County Commissioners are considering the proposition to construct an electric-light and power plant to furnish light and power for the court house, county jail and detention house.

Olympia, Wash.—Wilbur Forshay, of Portland, Ore., and associates, have applied to the City Council for a franchise to construct and operate an electric-light plant at Olympia.

Wenatchee, Wash.—The Wenatchee Valley Gas & Electric Co. contemplates an expenditure of $100,000 for the installation of a gas-manufacturing plant at Wenatchee. Arthur Gunn is Pres.

Newport, Ore.—The Yaquina Electric Co. is planning to install new equipment and enlarge its power plant at Newport.

Beaumont, Calif.—The Council has granted a franchise to the Southern California Edison Co. to construct and operate an elertric-light and power system at Beaumont. E. H. Ballard, Los Angeles, is Mgr.

Marysville, Calif.—The Pacific Gas & Electric Co. is planning the reconstruction of its gas plant at Marysville. It is the intention of the company to start work immediately on the erection of a gas holder to have a capacity of 150,000 cu.ft. The cost of the new improvements will be approximately $30,000. J. H. Hunt, San Francisco, is Pur. Agt.

Oakland, Calif.—The City Council has been petitioned to consider plans for the installation of an ornamental lighting system on various streets.

Pasadena, Calif.—The City Council has adopted a resolution ordering the construction of ornamental light posts on Los Robles Ave., from the north to the south city boundaries, a distance of four miles.

Pasadena, Calif.—The Home Telephone Co. will install a new power plant and three new sections to the main switchboards at an estimated cost of $50,000.

Sacramento, Calif.—The Sacramento Natural Gas Co. is considering plans for the construction of a new gas holder and the extension of its gas mains.

Suisun, Calif.—The Pacific Gas & Electric Co. is preparing plans for the construction of a substation at Suisun. John A. Britton, San Francisco, is Vice-Pres. and Gen. Mgr.

Berlin, Ont.—Plans are being considered by the Electric Commission for the installation of additional equipment in the hydro-electric plant.

Kingston, Ont.—Plans are being prepared for the construction of a new gas-producer plant. Estimated cost, $60,000. T. J. Rigney is Mayor.

London, Ont.—The London Electric Co. contemplates the installation of two 500-hp. steam turbine engines and additional electrical equipment in its plant. W. T. Jenkyn is Mgr.

Strathmore, Alta.—Plans are being prepared by the Strathmore Light & Power Co. for the construction of an electric-light and heating plant at Strathmore.

Hastings, B. C.—Plans are being considered by the British Columbia Electric Ry. Co., Ltd., for the construction of two new substations at Hastings. R. H. Sperling, Vancouver, is Gen. Mgr.

BRIDGES

Lawrence, Mass.—Press reports state that George Thompson, Wakefield, Mass., has been retained to prepare plans for the construction of a new central bridge at Lawrence.

+Flemington, N. J.—The Board of Freeholders has awarded the contracts for the construction of two concrete bridges, one over the South Branch of the Raritan River, near Packers Island, and the other crossing Wickcheoche Creek, near Frailsville, to WILLIAM Y. HOLT, Flemington.

Washington, Penn.—Bids will be received by John H. Moffitt, County Controller, until 1 p.m., Apr. 10, for bridge work in Washington County. Plans and specifications are on file at the office of Armstrong & Chaney, County Engrs., at the Court House.

Vicksburg, Miss.—Bids will be received at the office of the Chancery Clerk of Warren County until noon, Apr. 7, for the construction of a steel bridge over Clear Creek on Link No. 2, about 11 miles from Vicksburg. J. D. Laughlin is the Clk.

+Owensboro, Ky.—The contract for the construction of the new bridge across the Blackford River, on the Lewisport and Mace Road, has been awarded to the VINCENNES BRIDGE CO., Vincennes, Ind., at $3945. This does not include the concrete work, for which all bids were rejected. Noted Mar. 13.

Akron, Ohio—Information received previous to the floods is as follows: Bids will be received by the Commissioners of Summit County, until noon, Apr. 24, for the construction of the reinforced-concrete bridge at North Howard St. The estimated cost is $78,000. The Wilbur J. Watson Co., Cleveland, Ohio, is Consult. Engr. C. B. Brower is Clk. Noted Feb. 6.

Cincinnati, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County, until noon, Apr. 18, for the construction of a concrete bridge over Muddy Creek on Lower River Road, near Addyston, in Miami Township, under specification No. 441. Albert Reinhardt is the County Clk.

Bids will be received by the Board of County Commissioners of Hamilton County, until noon, Apr. 18, for the construction of a concrete culvert on Shawnee Run, near Wooster Pike in Columbia Township. Albert Reinhardt is the Clk. Noted Jan. 16.

+Edwardsville, Ill.—We are officially advised that the contract for the construction of the Silver Creek Bridge, between the towns of Hamel and Pin Oak, Madison County, has been awarded to JOSEPH STEIN. L. F. Steinmann, Alhambra, is the Town Clk. Noted Mar. 13.

Ottawa, Ill.—Bids will be received at the office of the County Clerk, Ottawa, until 1 p.m., Apr. 22, for the construction of a reinforced-concrete bridge in Freedom Township, LaSalle County. The estimated cost is $5000. Leslie McClure, Earlville, Ill., is the Town Clk.

+Springfield, Ill.—The contract for the construction of 12 bridges in the North Fork Drainage District, Hamilton County, has been awarded to the VINCENNES BRIDGE CO., Vincennes, Ind., at $6374. The other bidders were: Miller & Borcherding, St. Louis, Mo., $6770; East St. Louis Bridge Co.,

East St. Louis, Ill., $6650; Rock River Bridge Co., Oregon, Ill., $7518; Blodgett Construction Co., Kansas City, Mo., $7200; Stupp Bros., St. Louis, Mo., $6525; Rock Island Bridge & Iron Co., Rock Island, $7800; J. G. Berger, Fort Branch, Ind., $6648; O. H. Hyatt, Broughton, Ill., $7250; Baker Mfg. Co., Chicago, Ill., $7720.

Urbana, Ill.—Bids will be received by the County Clerk at the Court House in Urbana, until 11 a.m., Apr. 5, for the construction of a highway bridge across the Sangamon River, about 1½ miles south of Fisher, Ill. J. D. Holtermann is Chn. of the Bridge Committee. F. O. Dufour is the Engr.

Council Bluffs, Iowa—The Union Pacific R.R. is considering plans for the erection of a new bridge across the Missouri River, at Council Bluffs.

Eldora, Iowa—The erection of a new bridge across the Iowa River at Eldora is being considered. The estimated cost is $35,000.

Forest City, Iowa—Bids will be received by the Board of Supervisors of Winnebago County at the office of the County Auditor, until 11 a.m., Apr. 10, for the construction of a steel and concrete bridge across Lime Creek, where the present highway crosses the stream between Section 32, Norway Township, and Section 5, Center Township, Winnebago County. C. K. Nelson is the County Audr.

Grand Island, Neb.—Press reports state that bids will be received by G. E. Neuman, County Clk., until Apr. 8, for the construction of 11 steel bridges.

Kansas City, Mo.—The War Department has notified the Commissioners of Wyandotte County that plans have been approved for the rebuilding of four county bridges that span the Kaw River.

✚Galveston, Tex.—The contract for the construction of four highway bridges across the inland waterway between the Brazos River and the Matagorda Bay, has been awarded to the BLODGETT CONSTRUCTION CO., Kansas City, Mo., at $10,400. Noted Mar. 13.

Houston, Tex.—Bids will be received at the office of Dan C. Smith, Jr., City Secy., City Hall, Houston, until noon, Apr. 7, for the construction of a reinforced-concrete viaduct, connecting Capital Ave. and Rusk with Moore and Young Sts., in the Sixth Ward, Houston. Plans and specifications are on file at the office of F. L. Dormant, City Hall, Houston.

Bids will be received by Dan C. Smith, Jr., Controller and City Secy., City Hall, Houston, until noon, Apr. 7, for the construction of a reinforced-concrete bridge on San Jacinto St., across the Ship Canal. Two kinds of bayou spans will be considered, one a concrete arch and the other a rolling lift bridge. Plans and specifications are on file at the office of F. L. Dormant, City Engr. Noted Dec. 19, 1912.

Lubbock, Tex.—Bids will be received by Edward R. Haynes, County Judge, until Apr. 14, for the construction of a steel bridge with concrete abutments, over the Yellow House Creek. The proposed bridge will be 60 ft. long and 12 ft. wide.

San Angelo, Tex.—Bids will be received by the County Commissioners until Apr. 15, for the construction of a new viaduct over the North Concho River at South Chadbourne St. A. M. Davis, Fort Worth, is the Engr. Noted Jan. 30.

Wickenburg, Ariz.—Estimates of the cost of a concrete bridge over the Hassayampa River at Wickenburg are being prepared by Labar Cobb, State Engr., Phoenix, Ariz. The proposed bridge will be about 300 ft. long.

Aberdeen, Wash.—According to press reports, the construction of a steel bridge over the Washkah River is under consideration. The estimated cost is $90,000.

Bedding, Calif.—The City Trustees have accepted plans of Charles T. Dozier, C. E., for a highway bridge across the Sacramento River, at Redding, and decided to call an election to vote on the proposition to issue bonds for $60,000, for the construction of the bridge and approaches. Noted Jan. 30.

San Diego, Calif.—D. K. Adams, Supt. of Streets, plans to erect a concrete bridge over the San Diego River at Old Town, to cost approximately $22,000. W. M. Rumsey is the City Engr.

WATER SUPPLY—IRRIGATION

✚Rumford, Maine—The Rumford and Mexico Water District has awarded a contract to JAMES McGREGOR & CO., for the construction of a water system here. The contract involves the construction of a reservoir of 110,000,000 gal. capacity, a dam 800 ft. high, and the laying of four miles of pipe. Estimated cost, $150,000.

Troy, N. H.—Investigations are being made as to the advisability of installing a water system here.

Boston, Mass.—Bids will be received until Apr. 6 by the Supply Department, for furnishing semisteel castings for the high-pressure fire service, also for furnishing 2,730,000 lb. of iron castings. J. E. Mullen, Tremont Bldg., is Supt.

Boston, Mass.—Bids will be received by the Board of Public Works until Apr. 4, for laying and relaying water mains in Ferry, Fulton, Richmond, Union Park, Fargo and B Sts., and in Eastern Ave. L. K. Rourke is Comr.

East Long Meadow, Mass.—Bids will be received about Apr. 20, for the proposed water system. The system involves about 32,000 ft. of 6- and 8-in. c.-i. pipe, with valves, hydrants and meters. Estimated cost, $40,000. F. C. Burton is Chn. Bd. of Selectmen. Noted Mar. 27.

Greenfield, Mass.—The city contemplates the construction of a pumping plant at Country Farms, to take water from sunken wells near the river. Estimated cost, $50,000. George F. Merrill is Supt. Water Dept.

Lowell, Mass.—It is proposed to lay water pipes in a number of streets in Chelmsford, the work to be done by the Lowell Water Department. Robert J. Thomas is Supt.

Sonyea, N. Y.—Bids will be received by Percy L. Lang, Pres. Bd. Managers, Craig Colony for Epileptics, at Sonyea, until Apr. 8, for improving the water system.

Troy, N. Y.—Bids will be received by the Board of Contract and Supply until Apr. 18, for furnishing material and constructing a reinforced-concrete overflow conduit for the Oakwood Reservoir, from Cragin and Glen Aves., to the Hudson River. J. M. Diven is Supt. W.-Wks.

✚Asbury Park, N. J.—The contract to improve the water system here has been awarded to the ATLANTIC CONSTRUCTION & SUPPLY CO., Bartlett Bldg., Atlantic City, N. J., at approximately $75,000. Bids were opened by the City Council, Mar. 17. Noted Mar. 27.

Atlantic City, N. J.—Bids for laying a 24-in. and a 20-in. c.-i. water main in Arctic Ave., from Missouri Ave. to Maine Ave., were received by the Board of Commissioners, Mar. 20, as follows: E. L. Bader, $44,781; Kelly, McFeely Co., $47,568; Antonio Cocco, Philadelphia, $51,056; Johnson Construction Co., $54,373; Atlantic Construction & Supply Co., $54,709; T. J. McGovern, $65,705; Fallon & Donnelly, $66,561. Noted Mar. 13.

★Belleville, N. J.—Bids will be received by the Town Council until 9 p.m., Apr. 16, for furnishing 335 short tons of 12-in. c.-i. water pipe, and 7 short tons of special castings. Specifications may be obtained at the office of John DeGraw, Consult. Engr., 11 Clinton St., Newark, N. J. E. E. Mathes is Town Clk.

Chatham, N. J.—Bids will be received by the Board of Water Commissioners until Apr. 7, for extending and improving the water system and electric-light plant. W. S. Angell is Boro. Clk.

Garfield, N. J.—The Borough Council contemplates the construction of a pumping plant and artesian wells for the water system. Estimated cost, $50,000. Frank Romadlia is Clk. A. L. Pettersen, Post Office Bldg., Passaic, is Consult. Engr.

Irvington, N. J.—The Town Council has authorized the Chairman of the Water and Light Committee to have estimates and preliminary plans made for the installation of a municipal water system and an electric-light plant.

Aspers, Penn.—The Aspers Water Supply Co. contemplates the construction of two miles of water mains and a concrete reservoir. Bids will probably soon be asked. S. M. Miller, Gettysburg, Penn., is Consult. Engr.

Homestead, Penn.—We are officially advised that the proposition to vote bonds for $86,000 for the installation of a filtration plant here, was defeated at the election, Mar. 25. Noted Feb. 20.

Raleigh, N. C.—We are officially advised that the improvements proposed by the Wake Water Co. at Raleigh will not be made. The city of Raleigh will take over the plant at a price to be fixed by three arbitrators: B. M. Hall, of Atlanta, Ga., Judge Shaw, of Greensboro, and Gilbert C. White, of Charlotte. The city will probably make improvements to the plant, but nothing definite has as yet been decided on. Gilbert C. White, of Charlotte, N. C., was Consult. Engr. for the Wake Water Co. on their proposed improvements. Noted Mar. 6.

Atlanta, Ga.—We are officially advised that bids for furnishing and installing a 10,000,000-gal. rotary pump were received by the Water Board, Mar. 20, as follows: De Laval Co., $5064; Morris Machine Works, $6254; H. R. Worthington Pump Co., $7315; Allis-Chalmers Co., $8350; R. D. Wood Co., $10,000. Noted Mar. 20.

Lagrange, Ga.—James Nesbit Hazlehurst, Consult. Engr., Atlanta, Ga., has been retained by the City Council to prepare plans and specifications for a water system, estimated to cost $140,000. J. W. Edmondson is Mayor. Noted Nov. 14.

Fort Myers, Fla.—Bonds for $7000 have been voted for extending the water system here.

✚Sarasota, Fla.—We are officially advised that the contract to construct a water system here has been awarded to the AMERICAN LIGHT & WATER CO., Chicago, Ill., at $19,501. Bids were opened by the Board of Public Works, Mar. 25. Noted Mar. 20.

Aliceville, Ala.—Bonds for $11,000 have been voted here for acquiring a municipal water system.

Girard, Ala.—An election will probably soon be called to vote on a bond issue of $45,000, for the construction of a water system and an electric-light plant. Noted Dec. 19.

Hurtsboro, Ala.—We are officially advised that bids will be received by the city until Apr. 10, for purchasing $14,000 bonds. When the bonds have been sold an engineer will be employed to prepare plans for the proposed water and sewer systems. W. Williams is Mayor. Noted Mar. 6.

Tutwiler, Miss.—According to press reports, bids will be received until Apr. 15 for the proposed water system, and not until Apr. 25, as noted Mar. 20. The system will include two miles of water mains, hydrants, gate valves, steel tower and tank, pump and engine, and one mile of sewers. Noted Mar. 20.

Lafayette, La.—Bids will be received by the city until Apr. 9, for furnishing and installing pumping equipment for the water system. A. R. Trahan is Mayor. Noted Feb. 6.

Aliceville, Ala.—Bonds for $11,000 were voted, Mar. 17, for the installation of a municipal water system.

Irvine, Ky.—See item under Light, Heat and Power.

Lancaster, Ky.—The City Council is having plans prepared for the installation of a filtration plant for the water system.

Altamont, Ill.—Bids will be received by J. E. Hoover, City Clk., until Apr. 11, for drilling one or more deep wells. Plans were prepared by the Fuller-Coult Co., Chemical Bldg., St. Louis, Mo.

Chicago, Ill.—Bids will be received by the Board of Local Improvements until 11 a.m., Apr. 4, for constructing water mains in various streets. George A. Schilling is Pres. Plans are on file at the office of the Board.

Riverside, Ill.—Bids will be received by Charles D. Sherman, Village Clk., until 8 p.m., Apr. 14, for the following: Three 700 G. P. M. motor-driven centrifugal pumping units; piping, switchboard, wiring and appurtenances and installation of pumping machinery; 150,000 gal. steel water tank with gallery and appurtenances; pumping-station building and masonry tower for water tank. Dabney H. Maury, Monadnock Block, Chicago, is Consult. Engr.

Springfield, Ill.—Bids will be received by J. S. Schnepp, Mayor, until 10 a.m., Apr. 5, for furnishing 60 lengths of 10-in. c.-i. water pipe.

✚Madison, Wis.—A contract to lay water mains in the Highland Park extension and in West Johnson St. has been awarded to JOHN T. BLAKE, Madison, at $7260.

West Allis, Wis.—Bids will be received by the Board of Public Works until 8 p.m., Apr. 7, for laying water mains, with the necessary hydrants, connections, etc., in various streets. George M. Leonard is Chn. Noted Mar. 13.

Eldora, Iowa—An election has been called for Apr. 14, to vote on a bond issue of $18,000, for constructing water mains and sewers.

Miles, Iowa—We are officially advised that bids will be received by the city until 2 p.m., Apr. 10, for constructing a water system here. The contract involves 75 ft. of 8-in. c.-i. pipe, 3600 ft. of 4-in. c.-i. pipe, 3600 ft. of 6-in. c.-i. pipe, a steel tank on a steel tower, a brick pump house, triplex pump and gasoline engine. Plans were prepared by Charles P. Chase, Consult. Engr., Clinton, Iowa. Charles Allen is Town Clk.

Herington, Kan.—An election has been called for May 1 to vote on a bond issue of $50,000, for installing a water system here. The supply will be obtained from springs some distance from the city. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Mar. 13.

Harper, Kan.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., have completed plans for improving the water system. Estimated cost, $20,000.

Moline, Kan.—We are officially advised that bonds for $40,000 were voted, Mar. 25, for the installation of a water system and an electric-light plant, according to plans prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted Feb. 27.

Billings, Mont.—We are officially advised that bonds for $575,000 were voted, Mar. 25, for the installation of a complete new water system here. Plans are being prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo. Bids for construction will be asked as soon as the bonds have been sold. Noted Jan. 23.

✚Cascade, Mont.—A contract to furnish pipe and specials and lay water mains here has been awarded to the MIRACLE CONCRETE CORP., Kalispell, Mont. Bids were opened by W. R. Call, Town Clk., Mar. 17. Swearingen & McCulloh, Great Falls, Mont., are Consult. Engrs. Noted Mar. 13.

Livingston, Mont.—We are officially advised that an election has been called for Apr. 14, to vote on a bond issue of $225,000, for the installation of a complete new water system and filtration plant. Plans have been completed and approved by the City Council. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Mar. 13.

Maryville, Mo.—We are officially advised that bids are being received for the following improvements to the water system: Furnishing one high-duty 50,000,000-ft.-lb. compound-condensing, horizontal duplex pump, two low-service pumps, centrifugal, two 100 hp. boilers, one 50,000-gal. pressure filter, one feed-water heater, one feed pump; repairing the standpipe and a concrete dam. Hiram Phillips, Liggett Bldg., St. Louis, Mo., is Consult. Engr. Noted Feb. 13.

✚Sulphur Springs, Ark.—We are officially advised that the contract to install a water system here has been awarded to R. M. GALBRAITH, Pine Bluff, Ark., at $21,346. Bids were opened by the Improvement Board, Mar. 20. A. C. Moore, Joplin, Mo., is Consult. Engr. Noted Mar. 13.

Canadian, Tex.—We are officially advised that all bids received Mar. 17, for furnishing machinery for the proposed water system, were rejected. Bids will soon be asked for the entire contract. J. S. Hood is Mayor. Noted Mar. 13.

San Antonio, Tex.—The Winter Garden Irrigation Co., which has a capital stock of $100,000, will construct an irrigation system in this section. Alexander Boynton, William George and M. E. Lindheimer are interested.

✚Auburn, Wash.—A contract to construct a reservoir for the municipal water system has been awarded to J. L. PLAYMAN, Auburn, at $5900.

South Bend, Wash.—The Northwest Electric Water-Works Co. plans the construction of a large reservoir for its water system here. Chas. E. Shepard is pres.

Nyssa, Ore.—Bids will probably soon be asked for the installation of a water system here, according to plans prepared by Green & Co., Consult. Engrs., Paulson Bldg., Spokane, Wash. W. Sexton is City Recdr.

Fall Brook, Calif.—The California Farm & Home Builders, Van Nuys Bldg., Los Angeles, will construct a water system near Fallbrook. The water will be pumped from wells into two concrete reservoirs, from which it will be piped over the property. Theodore B. Comstock, Van Nuys Bldg., Los Angeles, is Engr.

Santa Barbara, Calif.—The city contemplates the construction of a dam four miles long and 150 ft. high on the Santa Ynez River, for storing water for the city and valley of Santa Barbara. Estimated cost, $253,000. George M. McCombes, Frank E. Kellogg and J. B. Henck are members of the Council Committee.

✚Montreal, Que.—The city has awarded a contract to LAURIN & LEECH, Montreal, to construct a 36-in. steel water main from Point St. Charles to the McTavish Reservoir. The main will be laid 3 ft. below the bed of the canal, and is estimated to cost $100,000.

Regina, Sask.—Bids will be received by the City Commissioners until noon, Apr. 9, for furnishing and delivering f.o.b. cars, Regina, c.-i. pipe, lead pipe, couplings, valves, cocks, etc. Specifications may be obtained at the office of J. M. Mackay, Supt. W.-Wks.

SEWERS

St. Albans, Vt.—The proposition to issue $45,000 of bonds for the construction of a sewage disposal plant here was defeated at the recent election. J. C. Renner is City Engr.

Boston, Mass.—We are officially advised that bids for Section 70, Contract 103, of the New Mystic Sewer, which involves the construction of a concrete sewer in Winchester, were received by Metropolitan Water and Sewerage Board, Mar. 28, as follows: G. M. Byrne & Co., 166 Devonshire St., Boston, $53,584; A. G. Tomasello, 69 Gibson St., Dorchester, $52,293; Coleman Bros., Boston, $50,690; Conners Bros. Co., Lowell, Mass., $50,010; Michael Russo & Son, 240 North St., Boston, $46,658; McCarthy & Walsh, 454 Saratoga St., Boston, $41,078; J. H. Ferguson, 22 Parkman St., Dorchester, $39,117; Tony Ross, 43 Oak St., Boston, $37,555. Charles D. Smith, 1 Ashburton Pl., is Ch. Engr. Noted Mar. 20.

Brookline, Mass.—An appropriation of $20,000 has been made for sewer and surface drain construction.

Fitchburg, Mass.—Metcalf & Eddy, Consult. Engrs., Boston, Mass., are preparing plans for the construction of a sewage disposal plant in South Fitchburg. David A. Hartwell is Ch. Engr. Noted Feb. 6.

Hartford, Conn.—Roscoe N. Clarke, City Engr., has prepared plans for an intercepting sewer in the Blue Hills District. The sewer will follow the line of the north branch of the Park River from Albany Ave. to the tracks of the Central New England R.R. It will be 3800 ft. long, and is estimated to cost $17,000.

Wallingford, Conn.—Bids will probably soon be asked for laying about 14,000 ft. of concrete and tile sewers. W. A. Mackenzie is City Engr.

★Albion, N. Y.—Bids will be received by the Board of Sewer Commissioners until 2 p.m., Apr. 15, for constructing a sewer system and a sewage disposal plant. Plans and specifications are on file at the office of R. R. Fernow, Engr. of the Bd. The work consists of laying about 16 miles of terra cotta sewers, verying in size from 8 to 20 in., and a sewage disposal plant. John B. Bordwell is Pres. Noted Mar. 13.

Brooklyn, N. D.—We are officially advised that bids for constructing a sewage purification experimental plant at the 26th Ward sewage disposal works were received by Alfred E. Steers, Pres. Boro. of Brooklyn, Mar. 26, as follows: Thomas O'Connor, $22,458; F. W. Lewis, $23,826; Earl C. Maxwell, $26,295; Thomas J. Carlin, Inc., $27,704; Joseph Balaban Co., $32,957; Marble Arch Co., $36,570; John Kelly Plumbing & Construction Co., $42,002; John C. Schrade, $48,645; Robt. L. Stead, $49,787. Noted Mar. 20.

Middletown, N. Y.—The Common Council has ordered the construction of 12,000 ft. of trunk sewer in the eastern part of the city.

★Oneonta, N. Y.—Bids will be received by Sheldon H. Close, City Clk., until 8 p.m., May 7, for constructing a main line intercepting sewer from Rose Ave. to Lyman Ave. The contract involves the following: 4800 cu.yd. excavation; 1920 lin.ft. 10-in. vitrified tile sewer; 4020 lin.ft. 12-in. vitrified tile sewer; 1500 lin.ft. 18-in. vitrified tile sewer; 1710 lin.ft. 21-in. vitrified tile sewer; 30 concrete manholes; 150 lin.ft. wood stave pipe. Plans and specifications are on file at the office of the City Engineer.

Troy, N. Y.—Bids will be received by the Board of Contract and Supply until 11 a.m., Apr. 15, for constructing a reinforced-concrete overflow conduit for the Oakwood Reservoir from Cragin and Glen Ave. to the Hudson River. Specifications are on file at the office of the City Engineer. James M. Riley is Secy. of Bd.

Jersey City, N. J.—Bids will be received by the Board of Street and Water Commissioners until 2 p.m., Apr. 7, for constructing a sewer in Wales Ave. Edward B. See is Clk.

Trenton, N. J.—Bids will be received by the Board of Commissioners until Apr. 4, for constructing sewers in Roosevelt St., Mayne Ave., Indiana Ave., and Ellsworth Ave. Plans and specifications are on file at the office of the City Engineer. Frank Thompson is City Clk.

Pittsburgh, Penn.—Bids will be received by the McCully Engineering Co., Township Engrs., Berger Bldg., Pittsburgh, until 4:30 p.m., Apr. 17, for constructing about 11 miles of pipe sewers in the Painters Run, Big Sawmill Run and Little Sawmill Run Districts of Mount Lebanon Township. H. M. Johnston is Secy. of Comrs.

Reading, Penn.—Bids will be received by L. S. Ramsey, City Clk., until 2 p.m., Apr. 22, for constructing concrete storm sewers known as the West Elm St. relief sewer, the North Sixth St. sewer, the Third St. sewer, with branches, also about 13,500 ft. of pipe sewer varying from 15 to 30 in. Estimated cost, $170,000. Blank forms and specifications may be obtained at the office of Edmund B. Ulrich, City Engr.

South Bethlehem, Penn.—The Town Council has decided to condemn six acres of land near the Lehigh River. The land will be used as a site for the proposed sewage disposal plant, which is estimated to cost $100,000.

✚Wilkes-Barre, Penn.—Bids for constructing sewers in 24 streets were received by Fred H. Gates, City Clk., Mar. 30, as follows: R. M. Rosser, Kingston, $34,804; B. G. Coon, Kingston, $48,150; Penn Sewer Co., Wilkes-Barre, $30,860; Curnow & Gates, Wilkes-Barre, $30,367; C. M. REILLY, Wilkes-Barre, $30,089 (awarded contract). Noted Mar. 20.

★Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., Apr. 16, for constructing sanitary lateral sewers and house connections in District 16B, Sanitary Contract 110. The contract involves furnishing and laying 14,500 lin.ft. of house connections, and 17,500 ft. of vitrified pipe sewer, from 8- to 18-in. in diameter. Plans are on file at the office of Calvin W. Hendrick, Ch. Engr. of the Sewerage Comm. James H. Preston is Pres. Bd. of Awards.

Bids will be received by the Board of Awards until 11 a.m., Apr. 9, for the construction of miscellaneous lateral sewers, Contract 108. The contract involves furnishing and laying 6600 ft. of 8- to 10-in. vitrified pipe sewer, and 1900 lin.ft. of vitrified pipe house connections.

Rowlesburg, W. Va.—Bids will be received by George Hayes, Town Recdr., until noon, Apr. 5, for the construction of approximately 7000 ft. of storm and sanitary sewers.

Plans are on file at the office of E. J. Miller, Consult. Engr., Wheeling, W. Va. Noted Oct. 10.

Arcadia, Fla.—Bids will be received by the City Council until 6 p.m., Apr. 6, for extending the sanitary sewer system. Guy Harward is City Clk.

Dayton, Fla.—We are officially advised that Clyde Potts, Consult. Engr., 30 Church St., New oYrk, has been retained to report on the sanitary conditions of this city, and prepare plans for a sewer system and a sewage disposal plant.

Plant City, Fla.—Bonds for $35,000 were voted at the election, Mar. 18, for the construction of a sewer system. Noted Feb. 27.

Roanoke, Ala.—An election has been called for May 1, to vote on a bond issue of $20,000, for constructing a sewer system. W. H. Mann is Mayor.

Tutwiler, Miss.—According to press reports, bids will be received by J. L. Donald, City Clk., until Apr. 15, for constructing one mile of 8-, 10- and 12-in. sewers, eight manholes and four flush tanks. R. C. Huston & Co., Exchange Bldg., Memphis, Tenn., are Consult. Engrs.

✦Martin, Tenn.—We are officially advised that the contract to construct a complete sanitary sewer system here has been awarded to the BELL-HUDSON CONSTRUCTION CO., Poplar Bluff, Mo., at $27,633. Other bids were: F. D. Harvey, $27,889; P. H. Porter, $29,500; Zeb Ward, $31,855; Murphy & Veltman, $31,342; Pauncey P. & C. Co., $30,638; M. P. Flynn, $35,319. Bids were opened Mar. 24. R. C. Huston & Co., Memphis, Tenn., are Consult. Engrs. Noted Mar. 13.

Cincinnati, Ohio—Bids for constructing main and lateral sewers and drains in the section of the city known as Evanston, were received by V. T. Price, Dir. Pub. Ser., Mar. 10, as follows: McCarthy Bros., $39,976; Connelly Contracting Co., $40,799; Silk & Meyer, $41,098; Henkel & Sullivan, $43,464; Sieverling & Fairbain, $43,477; Welling & Franz, $45,768; J. J. Brown, $48,429; Evan Evans, $50,519; Engineer's estimate, $42,417. Noted Mar. 6.

Toledo, Ohio—Bids will be received by F. G. Stockton, Dir. Pub. Ser., until Apr. 7, for constructing sewers in the Boulevard in Highland Park, in South Ave., and various other streets.

Marquette, Mich.—Bids for constructing 9500 ft. of 12- to 30-in. sewers were received by the city, Mar. 20, as follows: Thomas E. Wooley, La Crosse, Wis., standard pipe, $47,047; vitrified segment block, $46,489; Herman Stensrud, pipe, $39,866; segment block, $39,285; Powell & Mitchell, $41,690 for either material. Noted Mar. 20.

Champaign, Ill.—We are officially advised that bids will be received until Apr. 8, for constructing the Fountain Head storm sewer. Estimated cost, $9460. L. N. Sizer is City Engr. Noted Feb. 13.

✦Galesburg, Ill.—A contract to construct a sewer in West Main St. has been awarded to the MERRIFIELD CONSTRUCTION CO., Monmouth, Ill., at $10,440.

★Morton Grove, Ill.—Bids will be received by the Board of Local Improvements until 8 p.m., Apr. 17, for cleaning out certain parts of the Dempster St. sewer system. Specifications and blank proposals may be obtained at the office of the Secretary of the Board, and at the office of Edgar A. Rossiter, Consult. Engr., Reaper Block, Chicago.

Olney, Ill.—Plans have been completed for the installation of a sewer system here, estimated to cost $78,000. Bids for construction will probably soon be asked.

Ottawa, Ill.—Bids will probably be asked in May for constructing about four miles of 8- to 30-in. sewers. Estimated cost, $85,000. G. L. Farnsworth is City Engr. Noted Mar. 13.

Fond du Lac, Wis.—We are officially advised that the lowest bid received, Mar. 28, for constructing sewers and a sewage disposal plant was submitted by E. R. Harding & Co., Racine. Noted Mar. 27.

Park Falls, Wis.—W. G. Kirchoffer, Consult. Engr., Madison, Wis., is preparing plans for the installation of a sewer system here, estimated to cost $7000. J. F. Blanchard is Town Clk.

West Milwaukee, Wis.—Bids will be received by the Village Clerk until Apr. 15, for constructing a sewage disposal plant here. G. A. Geiger, Mack Block, Milwaukee, is Consult. Engr.

✦Cedar Rapids, Iowa—A contract to construct about two miles of sanitary sewers here has been awarded to DEARBORN & JACKSON, Masonic Temple, Cedar Rapids, at $5878.

Eldora, Iowa—See item under Water Supply—Irrigation.

✦St. Peter, Minn.—A contract to construct about 3300 ft. of sewer here, with catch basins, manholes, etc., has been awarded to LARS OVERN, St. Peter, at $6150. Bids were opened Mar. 17.

✦Sheridan, Wyo.—We are officially advised that the contract to construct a system of storm water sewers here has been awarded to G. H. NASH & CO., Missoula, Mont., at $9118. Bids were opened Mar. 17, by James J. Withrow, City Clk. Noted Mar. 6.

Eureka, Mont.—An election has been called for Apr. 7, to vote on a bond issue of $7000, for the installation of a sewer system. A. L. Jaqueth, Kalispell, Mont., is Consult. Engr.

Hermann, Mo.—We are officially advised that Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo., are preparing plans for constructing five miles of sewers here. Bids will probably soon be asked.

✦St. Louis, Mo.—We are officially advised that the contract to construct the Rocky Branch Joint District Sewer in Rocky Branch Joint Sewer District has been awarded to FRANK C. RAND, 1501 Washington Ave., St. Louis, at $450,663. The only other bid received was submitted by the Fruin-Colnon Contracting Co., at $462,202. Bids were opened Mar. 25. C. A. Morena is Sewer Comr. Noted Mar. 20.

✦Slater, Mo.—A contract to construct a sewer system here has been awarded to T. C. BROOKS & SON, Jackson, Mich., at $15,771. The other bids were: Bash & Grey, Joplin, Mo., $17,000; A. Jaeckes, Kansas City, Mo., $18,711; W. F. Plummer, Springfield, $17,078. Bids were opened, Mar. 18, by J. A. Stern, City Clk. Rollins & Westover, Midland Bldg., Kansas City, are Consult. Engrs.

Monticello, Ark.—Bids will be received by the Sewage Committee until Apr. 4, for perfecting the sewage-disposal plant now in operation. E. H. Wells is Chn.

Pine Bluff, Ark.—Bids will be received by the Commissioners of Sewer District No. 16, until 2 p.m., Apr. 19, for furnishing material and laying 3100 ft. of 8-in. and 8300 ft. of 6-in. vitrified clap pipe sewers. Plans and specifications may be obtained from F. E. Allen, Consult. Engr., Pine Bluff.

✦Austin, Tex.—The contract to construct the Shoal Creek main of the new sewer system has been awarded to C. Q. HORTON, Austin, at $8005. Noted Feb. 6.

Houston, Tex.—Bids will be received by Dan C. Smith, City Controller, until noon, Apr. 7, for the following: Contract No. 1, for the construction of 1850 lin.ft. 72-in. storm sewer, 1780 lin.ft. 84-in. storm sewer, 1340 lin.ft. 102-in. storm sewer, 4520 lin.ft. 108-in. storm sewer, 27 manholes, 108 catch basins, 2000 lin.ft. 15-in. catch basin connections. Contract No. 2, for the construction of 800 lin.ft. 24-in. lateral storm sewer, 5440 lin.ft. 36-in. lateral storm sewer, 760 lin.ft. 42-in. lateral storm sewer, 1260 lin.ft. 48-in. lateral storm sewer, 4300 lin.ft. 54-in. lateral storm sewer, 32 manholes, 128 catch basins, 2300 lin.ft. 15-in. catch basin connections.

Temple, Tex.—The taxpayers of Temple have voted favorably on the proposition to issue $75,000 of bonds to purchase the system of the Temple Sanitary Sewer Co. and make extensions. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Mar. 13.

✦Idaho Falls, Idaho—We are officially advised that contracts have been awarded to PARROTT BROS., Baker City, as follows: 7300 ft. of 8-in. sewer in Local District No. 1, at $7263; 1320 ft. of 12-in. and 14,560 ft. of 8-in. sewer in Local District No. 2, at $18,482. Bids were opened Mar. 20. Noted Mar. 6.

✦Clarkston, Wash.—A contract has been awarded to L. I. LENT, Bremerton, Wash., at $37,202, to construct a sewer system here.

Olympia, Wash.—The City Engineer has been instructed to prepare plans and specifications for a sewer system in Jefferson Park, Maple Park and Cherry Park.

Seattle, Wash.—The Board of Public Works has approved the plans for sewers in Dayton Ave. and other streets, to cost $87,700, and for a sewer in West 56th St., to cost $2200. Work will be ordered shortly.

✦A contract has been awarded to DAHLSTROM & RODAL, 2432 West 56th St., at $58,196, for constructing sewers in West 55th St. Other bids were: Ward & Scherer, $60,278; James Donofric, $52,301; McGuire & Moon, $72,117; Ferguson-Coit Co., $63,117.

Brawley, Calif.—According to press reports, bids will be received by T. H. Blais, City Clk., until Apr. 7, fo rfurnishing 8- and 10-in. sewer pipe, Y's, manhole covers, brick, sand, gravel, etc., in carload lots.

✦Dinuba, Calif.—We are officially advised that the contract to construct a sewer system here has been awarded to HALL & HUNT, Fresno, at $32,470. The other bids were: Redman & Bier, Fresno, $33,434; Coalinga Tank & Plumbing Co., Coalinga, Calif., $39,009; Chambers & Heafy, San Francisco, $33,818; Cowden & Glackin, San Francisco, $36,614. Plans were prepared by Chris P. Jensen, Consult. Engr., Fresno. Noted Mar. 13.

San Francisco, Calif.—Bids will be received by the Board of Public Works until Apr. 19, for completing Contract No. 57, which involves the construction of sewers and appurtenances in Golden Gate Park and 48th Ave.

★Toronto, Ont.—Bids will be received by H. C. Hocken, Mayor and Chn. Bd. of Control, until noon, Apr. 15, for constructing the following sewers: West Toronto Division No. 1, Bloor St.; West Toronto Division No. 1, Clendennan Ave.; West Toronto and Earlscourt Outlet. Specifications may be obtained at the office of the Sewer Branch, Department of Works, City Hall.

Vancouver, B. C.—R. H. Thomson, Engineer in charge of Strathcona Park for the Province of British Columbia, and C. H. Rust, City Engr., of Victoria, B. C., have been requested by the Provincial Government to report upon the proposed sewage scheme for greater Vancouver, which has recently been submitted to the various municipalities interested by R. S. Lea, of Montreal. The Government has agreed to guarantee the interest upon bonds to the extent of $5,000,000, this being the amount that Mr. Lee recommends should be expended at once. The remaining $5,000,000 will be spread over a period of some years.

STREETS AND ROADS

Everett, Mass.—Bids will be received until 7:30 p.m., Apr. 7, by the Board of Public Works, for sand, gravel, concrete edgestone, granite blocks, water pipe, dust preventives and bituminous binders. William Walker is Chn.

✦Springfield, Mass.—The Board of Contract and Supply has awarded the following contracts: for wood block paving, UNITED STATES WOOD PAVING CO., New York City, at $2.06 per sq.yd., for furnishing granite curbing, HILDRETH GRANITE CURBING CO., Boston, Mass., at 43c. per lin.yd. for 4-in. straight, 45c., 5-in. curved, 70c., 6-in. curved, 73c., and $2.30 each for curved driveway corners.

✦Worcester, Mass.—We are officially advised that a contract has been awarded to the WEBB GRANITE & CONSTRUCTION CO., 40 Crescent St., Worcester, at 44c. per ft. for straight curb, 90c. per ft. for circle curb, $2.50 each for circle corners and $1.60 and $1.42 per sq.yd. respectively for 6-in. and 4-in. block. A. T. Rhodes is Street Comr. Noted Mar. 20.

The Committee on Streets of the City Council has approved plans for macadam and wood-block paving on various streets to be done this spring at an estimated cost of $80,000. Albert T. Rhodes is Street Comr.

✦New Britain, Conn.—We are officially advised that the Board of Public Works has awarded a contract to the UNION

PAVING CO., Schenectady, N. Y., at $3.38 per sq.yd. for wood block and $2.56 per sq.yd. for Mack brick pavement on West Main St., about 18,000 sq.yd. in all. Frank Oldershaw is City Engr. John E. Moore is Pres. Bd. of Wks. Noted Mar. 6.

Binghamton, N. Y.—The Highway Committee of the Common Council has decided that new pavements shall be laid on Henry, Carroll, State, Eldridge and Hawley Sts., and the Ferry St. Bridge. This will comprise the city's street improvements for the year, as the city charter limits the annual expenditure to $20,000.

Dunkirk, N. Y.—Bids will be received until Apr. 15, by the Common Council, for paving six streets. The approximate quantity is 18,160 sq.yd. J. M. Hackett is City Engr. R. H. Heppell is City Clk.

New York, N. Y.—Bids will be received until 2 p.m., Apr. 8, by George McAneny, Pres. Boro. Manhattan, for regulating and repaving various streets.

Olean, N. Y.—Bids will be received until Apr. 11 by the Street Commissioner for about 10,450 sq.yd. vitrified brick paving on portions Green, South Fourth, and Wayne Sts. D. W. Dean is Comr. J. A. Torrey is City Clk.

Troy, N. Y.—The State Highway Department has approved plans for the new state road from Castleton through East Greenbush and Schodack to the Rensselaer city line. The road will be 8.25 miles in length, and its estimated cost is $122,600. Mr. Roemer is Highway Supt. of Rensselaer County.

Watertown, N. Y.—Bids will be received until 8 p.m. Apr. 4, by the Board of Public Works for the construction of about 4500 sq.yd. bituminous macadam pavement in Jay and Gotham Sts. from Sterling to Winslow St. E. W. Sayles is City Engr.

Belvidere, N. J.—Bids will be received until 11.45 a.m., Apr. 16, by the Board of Chosen Freeholders of Warren County, for construction of about 4½ miles of waterbound macadam road in the county. J. R. Thatcher, Washington,, N. J., is Dir. Bd. of Freeholders.

Bloomfield, N. J.—Bids will be received until 8 p.m., Apr. 7, by the joint Orgnigation of the Council of the Town of Bloomfield and the Council of the Borough of Glen Ridge for grading and paving Essex Ave. from Comeley Place to Bay Ave., partly in the Town of Bloomfield and partly in the Borough of Glen Ridge. The approximate quantities include 2900 cu.yd. excavation, 900 sq.yd. cobble gutter and 3300 sq.yd. Telford pavement with asphalt binding. Raymond F. Davis, Bloomfield National Bank Bldg., Bloomfield, is Secy.

Jersey City, N. J.—Bids will be received until 2 p.m., Apr. 7, by the Board of Street and Water Commissioners for the improvement of Wegman Place from Ocean to Garfield Ave. Edward B. See is Clk.

Long Branch, N. J.—We are officially advised that all bids received on Mar. 26 for paving sections of Rockwell, Second and Third Aves. were rejected, and new bids will be received by the City Commissioners until Apr. 16. Winfield R. Warwick is City Clk. J. Wesley Seaman is City Engr. Noted Mar. 13.

✚Millville, N. J.—We are officially advised that the Common Council has awarded a contract to the EASTERN CONSTRUCTION & PAVING CO., 1218 Chestnut St., Philadelphia, Penn., at $52,270, for various street improvements, including 21,100 sq. yd. Mack brick paving. Newton B. Wade is City Engr. Noted Feb. 27.

✚New Brunswick, N. J.—We are officially advised that the Board of Chosen Freeholders of Middlesex County has awarded a contract to CONRAD SEBOLT, 16 Richmond St., New Brunswick, N. J., at $5857 for improvement of the road from the railroad to and across the County Bridge at Creesequake Creek. Alvin B. Fox is County Engr. P. H. S. Hendricks is Dir. Noted Mar. 13.

Ashland, Penn.—Bids will be received until 7 p.m., Apr. 15, by the Street Committee of the Borough Council for the construction of about 15,000 sq.yd. of vitrified brick paving on Oakland and Locust Dale Roads. J. William Ritz is Town Clk.

Lebanon, Penn.—Bids will be received until 11 a.m., Apr. 17, by the City Clerk for highway material including asphalt block and vitrified brick, paving stones, broken stone, lumber, steel culverts and concrete paving. Dan M. Sharp is City Clk.

Mount Pleasant, Penn.—Bids will be received until 2 p.m., Apr. 19, by the Township Supervisors for construction of a stone road, 3250 ft. in length. David M. Griffith is Secy.

Pittsburgh, Penn.—The City Council has decided to pave portions of Brighton Road, Laurel Ave., Cassidy and McCullough Sts. on the North Side. The estimated cost is $52,000.

Wilkes-Barre, Penn.—Bids will be received until noon, Apr. 7, by the Township Commissioners for curbing and paving North Walnut St. with vitrified block. Harrison & Butts, Davidson Bldg, are Township Engrs. Patrick Nilon, 17 Prospect St., Wilkes-Barre, is Township Pres.

✚Wilmington, Del.—We are officially advised that a contract has been awarded to the HORRIGAN CONTRACTING Co., Wilmington, Del., at $27,500 for paving about three miles of the Odessa-St. Georges Road with waterbound macadam. James Wilson is State Highway Comr. of New Castle County. Noted Mar. 13.

Baltimore, Md.—The Paving Commission has decided to pave the following streets in addition to those now under contract: West St. from Riverside Ave. to Light St., Andre St. from Fort Ave. to Marriott St., Franklin St. from St. Paul to Charles St., Eutaw St. from Camden to Lee St. R. K. Compton is Chn.

✚Frederick, Md.—We are officially advised that the City Council has awarded a contract to CHARLES H. KLIPP, Frederick, Md., at $11,000 for 5500 sq.yd. vitrified brick paving, 1000 lin.ft. concrete curb and 500 lin.ft. 6 to 12 in. sewer. E. C. Crum is City Engr. Noted Mar. 6.

Towson, Md.—Bids will be received until Apr. 17, by the Highway Commission of Baltimore County for construction of a highway along the Falls Road, running north from Beaver Dam Run. E. Stanton Bosley, Towson, Md., is Secy.

Washington, D. C.—Bids were received as follows on Mar. 25, by the Commissioners of the District of Columbia for making repairs to asphalt pavings for a two-year period ending June 30, 1915: (a) using natural pitchlike asphalt, (b) using any asphalt that will conform with specifications. (1) Newton Paving Co., Trenton, N. J., (2) Cranford Paving Co., Washington, D. C. Laying standard asphalt pavements (2½-in. asphalt surface, 2-in. binder before compression) with 6-in. concrete base: (1) a, $1.79 per sq.yd.; b, $1.79; (2) a, $1.73; b, $1.68. Same, 2½-in. before compression: (1) a, 87c.; b, 87c.; (2) a, 66c.; b, 62c. Laying asphalt binder in connection with resurfacing work: (1) a, 33c.; b, 31c.; (2) a, 27c.; b, 26c. Laying standard asphalt surface for repairs and miscellaneous work: (1) a, 63c.; b, 61c. (2) a, 51c. b, 45c. Laying asphalt binder for repairs, etc.: (1) a, 47c.; b, 45c.; (2) a, 40c.; b, 38c. Laying standard asphalt surface for repairs in space required by law to be kept in repair by street car companies: (1) a, 63c.; b, 61c.; (2) a, 58c.; b, 50c. Laying asphalt binder in above space: (1) a, 47c.; b, 45c.; (2) a, 45c.; b, 43c. C. H. Rudolph is Chn. Noted Mar. 13.

Fort Myers, Fla.—At a recent election it was voted to issue $47,000 in bonds for street improvements.

✚Orlando, Fla.—We are officially advised that contracts were awarded by Commissioners of Orange County to HAND BROS., Sanford, Ala., and the WILSON CONSTRUCTION CO., Jacksonville, Fla., for about 140,000 sq.yd. vitrified brick paving in Road and Bridge District No. 1. There were two divisions of the work. B. M. Robinson is Clk. Noted Feb. 27.

Tampa, Fla.—The City Council has ordered the Board of Public Works to advertise for 11 blocks of asphalt paving on the Bayshore Blvd. from Magnolia to South Rome Aves. F. F. Warren is City Engr.

✚Birmingham, Ala.—Contracts have been awarded by the City Commissioners to the SOUTHERN WOOD BLOCK PAVING CO., at $36,075; the SOUTHERN BITULITHIC CO., at $17,042, and the SOUTHERN ASPHALT & CONSTRUCTION CO., at $23,485, for the improvement of various streets. Walter J. Kirkpatrick is City Engr.

Dadeville, Ala.—The Mayor and City Council are preparing plans for macadamizing various streets of Dadeville, at an estimated cost of $15,000.

Laurel, Miss.—The Street Commissioners will at once advertise for about 15 blocks of sheet asphalt paving on Fifth, Sixth and Seventh Aves. and Fifth St., in the residence section. Work will begin as soon as the paving in the business district is completed. P. C. Cooke is Comr.

Lexington, Ky.—The City Council has decided to pave the following streets with asphalt: West Short from Broadway to Georgetown St., Jefferson from Main to Fourth St., West Second St. from Limestone to Broadway, North Ashland St. from Main to Hambrick St. Jas. W. Guyn is City Engr.

The Fiscal Court of Fayette County is considering plans for the construction of a mile of the Harrodsburg Pike for which Tarvia will be specified.

Winchester, Ky.—Bids will be received until Apr. 8, by the Fiscal Court of Clark County, for the construction and maintenance of county roads.

Ohio—News from this state has been held pending the arrival of information since the disaster.

✚Cambridge, Ohio—We are officially advised that the Director of Public Service has awarded a contract in two parts to CISLER & MORSE, Marietta, Ohio, at $3818 and $10,911 for about 6070 sq.yd. street paving. Other bidders were, McElfresh, Grover & Danford, Caldwell, Ohio, $4056 and $11,-620, Adams Bros., Zanesville, Ohio, $3847 and $11,755, Morehead & Turvey, Cambridge, Ohio, $3695 and $10,807. THE NOBLE BRICK CO., Glenwood, Ohio, will furnish brick at 67¾c. per sq.yd. Karl M. Cosgrove is City Engr. Noted Mar. 13.

Cleveland, Ohio—We are officially advised that no bids were received by the County Commissioners for improvement of the Richmond Road, Euclid Township, at an estimated cost of $33,982, and the work will be readvertised. John F. Goldenbogen is Clk. Noted Mar. 20.

Bids will be received until 11 a.m., Apr. 26, by the Board of Commissioners of Cuyahoga County, for improvement of Barton Road and Gardner Road No. 2. John F. Goldenbogen is Clk.

Euclid, Ohio—Bids will be received until noon, Apr. 28, by the Village Clerk, for grading, draining and paving with brick, Dunham Ave., from Euclid Ave. to the N. Y. C. & St. L. R.R. right of way. The F. A. Pease Engineering Co., 931a Williamson Bldg., Cleveland, Ohio, is Engr. in Charge. Fred H. Shoaff is Clk.

Covington, Ind.—Bids will be received until 1:30 p.m., Apr. 8, by Commissioners of Fountain County, for improvement of a road, 15,760 ft. in length, in Shawnee Township. W. B. Gray is Audr.

Flint, Mich.—At a recent election, the citizens voted two bond issues, one of $120,000 for paving, and one of $40,-000 for graveling streets.

✚Grand Haven, Mich.—We are officially advised that the following bids were received by the City Council for concrete paving on sections of Fourth, Fifth, Howard and Washington Sts.: Harry Vander Veen, Grand Rapids, Mich., $16,-568; A. J. WARD, Grand Haven, $15,265 (contract awarded), McDermott & Cooper, Grand Rapids, Mich., $17,608, Wierenga & Rinter, Grand Haven, $17,248. The W. J. Sherman Co., Toledo, Ohio, is Engr.-in-Charge.

Cairo, Ill. The Board of Local Improvements has ordered vitrified brick pavement on portions of the following streets: Holbrook Ave., Fourth, Sixth, 10th and 12th Sts. Geo. F. Dewey is City Engr.

Champaign, Ill.—We are officially advised that bids will be received until Apr. 9, by the Board of Local Improvements on East University Ave., from Market to Wight Sts., West University Ave., from Prospect Ave. to Russell St., West Park Ave., from Prospect Ave. to Russell St. The work includes 35,100 sq.yd. brick pavement, excavation, curb and gutter, etc., and the estimated total cost is $87,239. Bids will be asked a little later for 13,700 additional sq.yd. paving. L. W. Sizer is City Mgr.

Rock Island, Ill.—The Board of Local Improvements will at once begin preliminary plans for paving 14th St. from Third to Ninth Aves. with asphalt. Wallace Treichler is City Engr.

+Watertown, Wis.—A contract for paving various streets during this year has been awarded to EDWARD C. BARTLETT, at $43,753.

West Allis, Wis.—Bids will be received until 8 p.m., Apr. 14, by the Board of Public Works, for paving parts of Elm St., 63d, 65th and 73d Aves. The approximate quantities are: 28,000 sq.yd. of pavement, 16,000 lin.ft. combined curb and gutter, 8000 cu.yd. grading. L. F. Fish is City Clk. Noted Mar. 13.

Bloomfield, Iowa—Bids will be received until 8 p.m., Apr. 15, by the City Council, for about 25,000 sq.yd. of street pavement. Bids will be accepted on brick, asphaltic concrete, and Portland cement concrete. A. B. Welsh is City Clk.

+Mount Vernon, Iowa—We are officially advised that the City Council has awarded a contract to the DEARBORN CONSTRUCTION CO., Waterloo, Iowa, at $42,765 for about one mile of street paving. Chas. P. Chase, Clinton, Iowa, is Engr. in Charge. William E. Gamble is Town Clk. Noted Mar. 13.

Minneapolis, Minn.—Bids will be received until 11 a.m., Apr. 14, by the Board of Commisioners of Hennepin County for grading 3700 ft. of Road No. 8 in the Village of Robbinsdale under Contract No. 14. Al. P. Erickson is County Audr.

St. Paul, Minn.—The Board of Public Works has approved the plans of the City Engineer for paving Summit Ave. from Dale to Lexington Sts. with creosoted wood blocks. The estimated cost is $95,200 including gas, sewer and water connections. Oscar Claussen is City Engr.

Fort Scott, Kan.—The City Council will shortly advertise for bids for about 18 blocks of paving on portions of Oak, Broadway, Sixth and Margrave Sts. The estimated cost is $20,000.

+Sheridan, Wyo.—We are officially advised that the City Council has awarded a contract to G. H. NASH & CO., Missoula, Mont., at $33,584 for 21,850 sq.yd. Dolarway pavement. James J. Withrow is City Clk. Noted Mar. 6.

Fort Worth, Tex.—The Commissioners' Court of Tarrant County has adopted plans and specifications by J. O. Travilla, St. Louis, Eng. in Charge, for the construction of an extensive system of good roads in the county. The proposed work will cost about $800,000 and bonds have already been issued for the purpose. Noted Dec. 26.

+Cleveland, Okla.—We are officially advised that bids as follows were received, Mar. 24, by the City Council for vitrified brick paving in Improvement District No. 1: SWATEK & PARKER, Oklahoma City, Okla., $39,955 (contract awarded). Connelly Construction Co., El Reno, Okla., $40,762, R. R. Fuller, Oklahoma City, $41,357, Dudley Paving Co., Stillwater, Okla., $43,435, Cleveland-Trinidad Asphalt Co., Cleveland, Ohio, $44,681. The Benham Engineering Co., Oklahoma City, is Engr. in Charge. Noted Mar. 20.

+Waterville, Wash.—We are officially advised that a contract has been awarded to J. J. McNERNY, Wenatchee, Wash., at approximately $40,000 for grading and surfacing with waterbound macadam about 4½ miles of road in Douglas County. Other bidders were: Albert Smith, Spokane, Wash., $50,000; Columbia Engineering & Construction Co., Wenatchee, $62,000; John Mohr, Waterville, Wash., $42,000. Robert F. Foster is Deputy County Engr. Noted Mar. 13.

Coronado, Calif.—The Board of Trustees has begun the necessary legal proceedings for grading and paving the streets west of Orange Ave. The estimated cost is $165,000.

+Escondido, Calif.—A contract has been awarded to C. M. MARTIN, Escondido, at $11,222, for grading and surfacing about three miles of streets.

+Los Angeles, Calif.—Contracts for street improvements have been awarded as follows: To D. D. CHAPMAN, at $10,050, for Johnson St., from Altura to Agate Sts.; to W. J. Eggert, at $11,419, for Western Ave., from Harrington Ave. to Pico St.; the FAIRCHILD-GILMORE-WILTON CO., at $6917, for San Julian St., from Ninth to 11th Sts.

+A contract has been awarded to the BARBER ASPHALT PAVING CO., at $75,555, for improving Sixth St., from Vermont Ave. to Bronson St. E. A. BAKER received the contract at $15,619, for improvement of Hoover St., from Marathon to Temple Sts.

Pasadena, Calif.—The City Council received bids as follows for improvement of Lake and Oak Knoll Aves.: Andrew Holloway, $42,547; Fred Osburn, $43,495; Barber Asphalt Paving Co., $43,835. For improving Hillcrest Ave., Andrew Holloway bid $17,556; Fred Osburn, $17,875; Barber Asphalt Paving Co., $19,045. S. J. Van Ornum is City Engr. Noted Jan. 23.

Pomona, Calif.—The City Engineer has been instructed to prepare plans for street improvements to connect with the State Highway. The pavement will probably be crushed rock and asphaltic oil. The estimated cost is $50,000. Clarence E. Bayley is City Engr.

San Diego, Calif.—The Board of Trustees of East San Diego has ordered the paving of University Ave., from the city limits to Colonial St. Some other street improvements are planned, and the total cost is estimated at $80,000.

San Francisco, Calif.—The City Engineer is preparing plans for construction of a scenic boulevard from the foot of Van Ness Ave. through Fort Mason to the Exposition grounds.

The city has ordered the improvement of San Bruno Ave., and $75,000 has been appropriated by the city, it agreeing to pay for one-half of the improvement, and the property owners to pay the other half. The street will be paved with asphalt on a concrete base.

+Visalia, Calif.—A contract was awarded to SCHLAICH & KREY, Visalia, at $10,467, for improvements on West Center St., from Encino to Giddings Ave.

INDUSTRIAL WORKS

Attleboro, Mass.—An addition will be made to the factory of the Watson Co. on Mechanic St. It will be of brick, four stories, 60x185 ft., to cost $60,000. The power house is also to be enlarged. F. P. Sheldon & Son, Industrial Trust Bldg., Providence, R. I., are Archs.

Holyoke, Mass.—A. B. Hemphill contemplates the erection of a mill for light manufacturing at Cabot and Bond Sts. The proposed building will be three or four stories, about 40x75 ft., of brick.

Springfield, Mass.—The John Swaine Iron Works Co. has secured a site in Cypress Court, and is having plans drawn for a new four-story building of mill construction, which will be 50x60 ft.

Waltham, Mass.—Plans have been drawn for a factory to be built on Newton St. for the Stephens Mfg. Co. It will be of concrete blocks, three stories, 28x108 ft., to cost $12,000. G. E. Strout, 621 Main St., is Arch.

Bantam, Conn.—Plans are being figured for a new factory to be erected in Bantam, for the Trumbull-Vanderpool Electric Co., to replace the building recently destroyed by fire. It will be built of brick, three stories and basement, 40x80 ft. Plans were prepared by the Fletcher Engineering Co., Bridgeport, Conn. Noted Mar. 6.

Bristol, Conn.—Unkgelbach & Perry, Archs., New Britain, Conn., are preparing plans for an addition to the factory of the C. J. Rost Co. It will be of brick, mill construction, 40x120 ft., three stories.

New Haven, Conn.—Estimates are asked by the National Folding Box & Paper Co. for an addition to its plant on James St. This building will be five stories, 100x200 ft., of brick, heavy mill construction. Freight elevators will be required. The Sperry Engineering Co. has prepared plans.

Rockville, Conn.—The J. J. Regan Mfg. Co. will build a brick addition to its factory, to be two stories, 70x100 ft.

Amsterdam, N. Y.—Plans have been prepared by C. R. Makepeace, Arch., Butler Exchange Bldg., Providence, R. I., for the construction of a two-story knitting mill, 74x40 ft., for the Blood Knitting Co.

+Brooklyn, N. Y.—The Bay Ridge Ice Co., 725 Chauncey St., has awarded a contract to J. AUER & SONS, 648 Lexington Ave., for the construction of a two-story brick ice plant, 138x76 ft., on 62d St., near Sixth Ave., Brooklyn. The estimated cost is $200,000. Koch & Wagner, 20 Court St., are the Archs.

+Buffalo, N. Y.—Gerhardt Long has awarded a contract to HERMAN BECK, 325 Winslow Ave., at $21,000, for the construction of a two-story, brick bottling works, 132x86 ft., at Best and Jefferson Sts. J. C. Schultz, 1370 Main St., is the Arch.

Bryan, Ohio—The Bryan Show Case Co., Bryan, is receiving bids for the erection of a showcase factory, 75x100 ft. A. C. De Curtins, Lima, Ohio, is Arch.

Cleveland, Ohio—Bids are being received by the Eagle Laundry Co., Cleveland, for the erection of a three-story and basement laundry, 62x104 ft. The cost has been estimated at $40,000.

The W. S. Biddle Co., Cleveland, has been incorporated with a capital of $25,000. A site has been purchased on East 45th St., on which the company plans to erect a factory.

The Lindsay Wire Weaving Co., Cleveland, is having plans prepared for the erection of an addition to its plant. The Osborn Engineering Co., Cleveland, is preparing the plans and will supervise the work.

The West Steel Co., Cleveland, has plans in preparation for the erection of an addition to its foundry. D. F. Lansdowne, 805 East 70th St., Cleveland, is Secy.

Toledo, Ohio—The Toledo Spark Plug Co., Toledo, Ohio, is planning to erect an addition to its factory, to cost $10,000.

Toledo, Ohio—The Advance Machine Co., Toledo, will increase its capital from $80,000 to $100,000, to provide for the erection of its proposed addition.

West Toledo, Ohio—The Lake Shore & Michigan Southern Ry. is preparing to let contracts for the erection of two roundhouses and a power plant at its Airline Junction yards at West Toledo.

Fort Wayne, Ind.—The American Road Machinery Co., Fort Wayne, will make improvements to its plant, to cost about $50,000.

Ann Arbor, Mich—The Hoover Steel Ball Co., Ann Arbor, plans to double the capacity of its present plant at Ann Arbor.

Detroit, Mich.—The Keeton Motor Co., Detroit, will erect several new additions to its new factory at Detroit. C. B. Shaffer is Pres.

The Goodspeed-Detroit Mfg. Co., Detroit, will erect a brick factory, 48x154 ft., for the manufacture of automobile accessories.

Flint, Mich.—The Weston-Mott Co., Flint, will erect a heat-treating plant, 75x325 ft. The company manufactures automobile axles.

Rockford, Ill.—The Eclipse Gas Stove Works, Rockford, has plans in preparation for the erection of an addition, 65x85 ft.

Bloomington, Ill.—The Chicago & Alton R.R. plans to erect four new shop buildings which, with improvements to the present equipment, will cost $1,000,000.

Chicago, Ill.—G. J. Haupmann, North American Bldg., Chicago, will erect a foundry, to cost $20,000, at 1725 North 45th Court. E. J. Arenstein, 105 South Dearborn St., Chicago, is Arch.

The L. F. Nonnast Co., Chicago, plans to erect an addition to its factory. The new structure will be seven stories, 50x70 ft.

Charles City, Iowa—The Eureka Carburetor Co. plans to erect a plant in Charles City, to cost approximately $25,000.

Davenport, Iowa—The Independent Baking Co., Davenport, will erect a five-story bakery and office building. George M. Bechtel is Pres.

Minneapolis, Minn.—The Shotwell-Harris Co., Minneapolis, has approved plans and will soon ask bids for the construction of a plant for the manufacture of tools and dies.

H. R. Patten, Minneapolis, has secured a permit to erect a three-story bakery and garage at 49-51 Western Ave. The estimated cost is $30,000.

Omaha, Neb.—The Carpenter Baking Co. plans to erect an addition to its bakery, to cost approximately $100,000. It will be a four-story structure.

Missoula, Mont.—The Missoula Canning & Produce Co., Missoula, recently incorporated with a capital of $25,000, will erect a plant. L. B. Converse, P. M. Reilly and F. Hensolt are interested.

St. Louis, Mo.—The St. Louis Motion Picture Co., St. Louis, plans to enlarge its plant at 25th and Montgomery Sts., to about double its present capacity. O. E. Goebel is Pres.

Reno, Nev.—The Union Oil Co., Los Angeles, Calif., is planning to erect adistributing plant at Reno, Nev. About $100,000 will be expended. E. L. Van Buren is in charge.

Lake Wenatchee, Wash.—Appleton & Carter, Lake Wenatchee, plan to erect a new shingle mill, which will cost approximately $15,000.

Little Falls, Wash.—The Toronto City Products Co., Little Falls, has been incorporated with a capital of $100,000, by J. A. Veness, George W. Daniels and W. R. Riley. The company will erect a plant at Little Falls for the manufacture of tile.

Seattle, Wash.—The Harbor Island Lumber Co., Seattle, plans to rebuild its sawmill, which was damaged by fire on Mar. 1, to the extent of about $50,000.

Tacoma, Wash.—The Coast Iron & Machine Works has acquired a site at Center and Hood Sts., and will erect a factory.

The City of Tacoma will vote bonds at the spring election for the erection of a cold-storage plant at the municipal dock. The machinery will cost about $90,000. J. C. Corbin, Seattle, Wash., has prepared plans.

Wenatchee, Wash.—The Wenatchee Natural Ice Co., recently incorporated by H. A. Harrison, A. E. Wieland and A. D. Morton, plans to erect an ice plant at Wenatchee.

Portland, Ore.—The Troy Laundry Co., Portland, is having plans prepared for the construction of a steam laundry plant at East 11th and East Pine Sts., Portland. The estimated cost is $75,000. E. F. Lawrence is the Arch.

Portland, Ore.—Porter Bros., Railway Exchange Bldg., Portland, have purchased 102,000 acres of timber land in Flinn County, and will erect two large sawmill plants.

Bakersfield, Calif.—The U. S. Asphalt Co., Bakersfield, will erect an asphalt plant, to cost approximately $150,000. T. C. Bond is in charge.

Lodi, Calif.—The Lodi Electric Appliance Co., Lodi, will be incorporated with a capital of $50,000, and will erect and equip a factory at Lodi, for the manufacture of automatic water heaters.

Los Angeles, Calif.—The California Well Tool Works, Los Angeles, has taken out a permit to erect a new machine shop.

The California Paint & Glass Co., Los Angeles, has acquired a site on Lafayette St., Los Angeles, and will erect a plant for the manufacture of its specialties. The estimated cost is $50,000. J. A. Traters and A. R. Townsend are interested.

Los Bancos, Calif.—Frank Roselli, Los Bancos, is interested in a company which is being formed by local business men with a capital of $10,000, for the purpose of establishing an ice plant and cold-storage plant at Los Bancos.

Loyalton, Calif.—A. F. Dodge, Exeter, Calif., and E. E. Squires, Salt Lake City, Utah, have taken over the mill of the California Lumber Co., near Loyalton, and will expend about $10,000 for improvements.

Niles, Calif.—G. M. Anderson will erect a group of factory buildings at Niles, for the manufacture of moving picture films. The estimated cost is $50,000. G. W. Page, Rea Bldg., San José, Calif., is the Arch.

Oak Park, Calif.—The Phoenix Milling Co., Sacramento, Calif., is having plans prepared for the construction of a four-story milling plant at 12th and E Sts., Oak Park. The estimated cost is $80,000.

Taft, Calif.—E. C. Jackson, recently of Los Angeles, is planning to build a steam laundry plant at Taft. About $12,000 will be expended.

Wilmington, Calif.—The Monarch Canning Co. will erect a fish cannery, to cost about $25,000, including equipment. G. L. Hogan, 428 Citizens National Bank Bldg., Los Angeles, C. F. Holland and A. P. Scudder are the owners.

FEDERAL GOVERNMENT WORK

Dredging—Branford, Conn.—Bids were received Mar. 22, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging in Branford Harbor, Conn. The bids follow: Atlantic Dredging Co., 81 Broad St., New York, 22.9c. per cu.yd.; Maritime Dredging Co., 80 Broad St., New York, 19.5c.; John A. Steele, 300 Church St., New York, 25c.; the T. A. Scott Co., New London, Conn., 19.75c.

✦Dredging—New Haven, Conn.—Bids were received Mar. 15, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging in New Haven Harbor: The bids follow: Contracts for the work have been awarded as follows: Sections 1 and 2, 350,000 cu.yd. and 92,000 cu.yd., respectively, to the TAYLOR DREDGING CO., Jersey City, N. J., at 13.5c. and 14c. per cu.yd.; and Sect. 3, about 23,000 cu.yd. to the T. A. SCOTT CO., INC., New London, at 22c. per cu.yd.

Dredging—New London, Conn.—Bids were received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., Mar. 27, for dredging in the Mystic River, Conn. The bids follow: The J. S. Packard Dredging Co., Providence, R. I., 20c. per cu.yd.; the T. A. Scott Co., Inc., New London, 18c. per cu.yd.

Riprap Dikes—New London, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, for the construction of riprap dikes and revetment on the Connecticut River.

✦Crane—New York, N. Y.—The contract has been awarded by the Bureau of Yards and Docks, Navy Dept, Washington, D. C., for furnishing a locomotive crane of 50 gross tons capacity for the New York Navy Yard, to the BROWNING ENGINEERING CO., Cleveland, at $47,950. List of bidders noted Feb. 20.

Dredging—Wilmington, Del.—All bids for dredging Wilmington Harbor have been rejected. Bids were opened by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington. List of bidders noted Mar. 20. Bids were opened Mar. 8.

Stone or Gravel—Wilmington, N. C.—Bids will be received by Maj. H. W. Stickle, Corps Engrs., U. S. A., until Apr. 25, for about 16,000 tons of crushed stone or gravel.

Riprap—Washington, D. C.—Bids will be received by Lieut.-Col. W. C. Langfitt, Corps Engrs., U. S. A., Washington, until Apr. 23, for furnishing and unloading riprap on Anacostia Falls, D. C.

✦Submarines—Washington, D. C.—The Navy Department, Washington, D. C., Mar. 18, awarded the contract to the LAKE TORPEDO BOAT CO., Bridgeport, Conn., for the construction of three submarine boats.

★Quarterboats—Norfolk, Va.—Bids will be received by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, until noon, Apr. 26, for furnishing or constructing two wooden quarterboats.

Post Office—Tifton, Ga.—Bids were received as follows, Mar. 26, for the construction of a post-office at Tifton: J. L. Crouse, Greensboro, N. C., (a) $56,800; (b) $57,800; J. F. Jenkins & Co., Ocala, Fla., (a) $54,700; (b) $55,700; George Becking, Chatannooga, Tenn., (a) $54,700; (b) $55,700; George Becking, Chatannooga, Tenn., (a) $54,293; (b) $54,793; C. M. Leach, Boston, Mass., (a) $54,831; (b) $55,973; Newport Contracting & Engineering Co., Newport News, Va., (a) $53,894; (b) $54,894; Algernon Blair, Montgomery, Ala., (a) $48,500; (b) $50,000; Wise Granite Co., Richmond, Va., (a) $52,800; (b) $53,800; Daniel T. McCarthy, Philadelphia, Penn., (a) $53,395; (b) $53,730; James Deveault, Canton, Ohio, (a) $47,500; (b) $48,000; (a) limestone; (b) sandstone.

Levee—Vicksburg, Miss.—Bids were opened Mar. 20, by the U. S. Engineer, Vicksburg, for the construction of the subbanquette levee, involving about 25,000 cu.yd. The bids follow: Helgason Brothers, Vicksburg, 27½c. a cu.yd.; Outpost Planting Co., Alsatia, La., 24c.; R. T. Clark, Natchez, 30c.; Robert Nicholson, Lake Providence, La., 35c.

Canal—Louisville, Ky.—Bids were received by Maj. J. C. Oakes, Corps, Engrs., U. S. A., Louisville, for widening the Louisville and Portland Canal: Henry Bickel Co., Louisville, $656,095; J. H. Cahill, Louisville, $673,033; Callahan Construction Co., Knoxville, Tenn., $700,808; Mason & Hanger Co., Richmond, Ky., $713,107; Asheville Construction Co., Asheville, N. C., $743,809.

★Canal—Babb, Mont.—Bids will be received by the U. S. Reclamation Service, Babb, until 2 p.m., Apr. 28, for the construction of 22 miles of the St. Mary Canal Milk River Project, Mont. The work will involve the excavation of about 1,201,000 cu.yd. of material and extends along the St. Mary River from Lower St. Mary Lake to the North Fork of Milk River in the northwest portion of the Blackfeet Indian Reservation, Mont. For particulars address the U. S. Reclamation Service, Washington, D. C., Helena, Mont., or Babb, Mont. Morris Bien is Acting Dir.

Bremerton, Wash.—Congress has appropriated $486,600 to be used as follows, in the Navy Yard here: The sum of $120,000 to start work on ship-fitters shop and steel-storage house; power-plant extension, $50,000; sewer extension, $30,000; improvements to Pier 8, $10,000; paving, $4000; renewal of telephone system, $2000; extension of heating system, $10,000; rebuilding of Pier 1, $10,000; machinery, implements, etc., $10,000; quarters for Marine Corps officers, $30,000; key wall, $15,000; gunners quarters, $6000.

Pier—Puget Sound, Wash.—Bids were received as follows, Mar. 29, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of Pier No. 4 at the navy yard, Puget Sound, Wash: (1) Net price for pier and dredging complete (based on dredging 27,000 cu.yd.); (2) net price for pier complete, not including dredging; (3) net price per cu.yd. for dredging complete; (4) net price to be deducted from contract for each interior bay of 30 ft. deducted from length of pier; (5) net price, per cubic yard for dredging in specified restricted areas: Penn Bridge Co., Washington, D. C., (2) $176,739; (4) $10,000; Pearson Construction Co., Seattle, Wash., (2) $177,288; (4) $9936; International Contract Co., Seattle, Wash., (1) $196,683; (2) $184,533; (3) 60c.; (4) $9388; (5) 90c.; Graff Construction Co., Seattle, Wash., (1) $233,909; alternate, $175,000; (2) $220,409; (4) $7500; Erickson Construction Co., Seattle, Wash., (1) $166,331 (received after the hour of opening).

Scrap Metal—Panama.—Bids were received Mar. 24, by Maj. J. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comm., Washington, D. C., for the purchase of 752,000 lb. of brass and copper scrap from the Commission: Argus Smelting Co., 60 Greenpoint Ave., Brooklyn, N. Y., $86,182; Chicago House Wrecking Co., Chicago, Ill., $90,121; Columbia

Smelting & Refining Co., 365 West St., New York, $83,581; George S. Fowler, Washington, D. C., $81,886; Nassau Smelting & Refining Co., 603 West 29th St., New York, $84,948; Joseph Rosenthal's Sons, Inc., Philadelphia, Penn., $77,130. Material will be delivered to contractor f.o.b. cars at Colon.

Lumber—Panama—Bids were received as follows, Mar. 26, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing 1,431,000 ft. B.M., of lumber, long-leaf yellow pine or Douglas fir, of various sizes: A. S. Bacon & Sons, Savannah, Ga., $49,736; Chicago Lumber & Coal Co., St. Louis, Mo., $42,121; G. Elias & Bro., Buffalo, N. Y., $46,538; Great Southern Lumber Co., Bogalusa, La., $42,353; J. K. Joyce, Chicago, Ill., $41,922; Long Bell Lumber Co., Kansas City, Mo., $43,836; Templeman Bros., New Orleans, La., $47,079; W. R. Grace & Co., San Francisco, Calif., $39,781 (fir, delivery at Ancon); Thomas E. Coale Lumber Co., New Orleans, La., $47,391; Rainwater Lumber Co., Chicago, New Orleans, La., $40,068. Delivery at Colon, lumber, long-leaf yellow pine unless otherwise specified.

Buildings—Hawaii—Plans have been completed by the Bureau of Yards and Docks, Washington, D. C., for the construction of a group of hospital buildings at the naval station at Pearl Harbor, H. T. Bids will be received until May 10. The buildings will be constructed of reinforced concrete. The estimated cost is $880,000.

MISCELLANEOUS

Bulkhead—Boston, Mass.—The Directors of the Port of Boston will construct about 11,500 ft. of oak and spruce bulkhead at Jeffries Point, East Boston. The cost of the proposed wrk has been estimated at $200,000. Bids will be asked soon.

Tunnel—Boston, Mass.—Bids were received Mar. 25 by the Boston transit Commission for the construction of Sect. B Dorchester tunnel: Rowe Contracting Co., Brighton, Mass., $476,389; James J. Coughlan Co., 43 Tremont St., Boston, $407,766; P. McGovern & Co., 6 Beason St., Boston, $397,720; Conners Bros. Co., 157 Plain St., Lowell, Mass., $380,739; Coleman Bros., 1 Marginal St., Chelsea, Mass., $367,480; HUGH NAWN CONTRACTING CO., 82 Savin St., Roxbury, Mass., $351,048 (awarded contract).

Sand, Gravel, Etc.—Everett, Mass.—Bids will be received by the Board of Public Works until Apr. 7, for furnishing sand, gravel, cement, granite blocks, etc.

Wharf Extension—Nantasket, Mass.—The Nantasket Beach Steamboat Co., Nantasket, is considering the construction of an extension to its wharf and to include a public dock.

Bath Houses—Providence, R. I.—The city of Providence has been authorized by the State Legislature to borrow $50,000, for the purpose of erecting two public bath houses. J. H. Gainer is Mayor.

Comfort Station—Hartford, Conn.—Plans have been completed and bids will be received soon by the city for the construction of a comfort station on a site in the rear of the City Hall. The building will cost about $25,000. Smith & Bassett, 36 Pearl St., are Archs.

Brick, Cement, Sand—Hartford, Conn.—Bids will be received by the Board of Contract and Supply until 11 a.m., Apr. 8, for furnishing about 100,000 brick, 900 bbl. of portland cement in cloth sacks and 100 cu.yd. of sand for the use of the Street Department.

Dredging—Albany, N. Y.—The State of New York is considering the dredging of Owasco Lake and the construction of a breakwater at the foot of the lake. The cost of the lake is estimated at $20,400. Duncan W. Peck, Albany, is State Supt. Pub. Wks.

Barge Canal—Albany, N. Y.—Bids will be received by Duncan W. Peck, State Supt. Pub. Wks., Albany, for Barge Canal Contract No. 112, Erie Canal Sections 9 and 10, for driving steel sheet piling in the embankment of the canal at certain localities within the limits of Contracts No. 60 and 66; also contract No. 113, Erie Canal, Sections 9 and 10, for furnishing piles at Bushnell's Basin, N. Y., and at Holley, N. Y. Detailed specifications, engineer's estimate of quantities, bidding blanks, form of contract and bonds required and other information may be had at the office of the Superintendent of Public Works, Albany, at the office of the Assistant Superintendent of Public Works for the Middle Division, Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division, Rochester, N. Y.; and at the Canal Office, Spaulding's Exchange, Buffalo, N. Y.

✚Aqueduct (Barge Canal Work)—Albany, N. Y.—The contract has been awarded to the MARYLAND DREDGING & CONTRACTING CO., Baltimore, Md., for Contract No. 65 which provides for the construction of a concrete arch at Medina, N. Y., at $1,000,093. Bids were received Mar. 18, by Duncan W. Peck, State Supt. Pub. Wks., Albany. List of bidders noted Mar. 27.

Stables and Storehouse—Binghamton, N. Y.—The state of New York is considering the construction of an addition to the state armory to be used for military stables and a storehouse. Estimated cost, $100,000. Duncan W. Peck, Albany, N. Y., is State Supt. of Pub. Wks.

Bridge Plaza—Brooklyn, N. Y.—The Board of Estimate, Mar. 27, agreed to expend $675,000 on the Brooklyn plaza of the Manhattan Bridge. The board gave its approval to the form of contract, plans, specifications and estimate of cost of the work. It includes roadways, footwalls, stairs and architectural treatment, including pylons, railings, parking, drainage and lighting system. It also includes the subway connection between the bridge and the Fourth Avenue subway. This is the only portion of the Fourth Avenue subway system not now under contract or completed.

Boat House—Buffalo, N. Y.—Plans are being prepared in the office of the State Architect, Albany, N. Y., for the erection of a three-story boat house with dock, at the foot of Porter Ave. The building will be of brick. Estimated cost, $40,000.

Barge Canal Terminal—Fort Plain, N. Y.—Bids were received by Duncan W. Peck, State Supt. Pub. Wks., Albany, N Y., for the construction of Barge Canal Terminal at Fort Plain. The bids follow: The Leary & Morrison Co., Fairport, N. Y., $26,860; Albert M. Banker, Gloversville, N. Y., $27,086. S. Pearson & Son Co., New York, $37,305. The work consists of the construction of a harbor and dock wall on the west side of the Mohawk River north of the highway bridge.

✚Piles—New York, N. Y.—Bids were received Mar. 18, by the Department of Docks and Ferries for furnishing and delivering piles, Classes 2 and 3. The contract has been awarded to J. H. BENTON & CO., INC., 45 Broadway, New York.

✚Comfort Station—New York, N. Y.—We are officially advised that the Department of Parks, Fifth Ave. and 64th St., has awarded a contract to JOSEPH DI BENEDETTO, 423 East 115th St., at $17,565, for the erection and completion of a comfort station and playground building at 151st St., near Amsterdam Ave. Bids were received on Mar. 13. Charles B. Stover is Pres. Noted Mar. 6.

Repairs to Recreation Structures—New York, N. Y.—Bids will be received by Calvin Tomkins, Comr. of Docks, Boro. Manhattan, until noon, Apr. 11, for Contract No. 1363, Classes 1 and 2, for furnishing all the labor and materials required for making repairs to recreation structures on the East and Harlem Rivers, Boro. Manhattan.

Piers—Hoboken, N. J.—The Hamburg-American Line is considering constructing two concrete piers in place of the two present wooden piers, Nos. 2 and 3, at its Hoboken terminus.

Stable—Millvale, Penn.—Plans are being prepared W. E. Snaman, Arch., Empire Bldg., Pittsburgh, Penn., for the erection of a stable for A. Pfeiffer, Millvale. The building will be two stories, 54x100 ft.

Bath House—Pittsburgh, Penn.—The Oliver Estate has secured MacClure & Spahr, Archs., Keystone Bldg., to prepare plans for a brick and terra cotta fireproof bath house, to be built at South Tenth and Carson Sts., for the playgrounds at that point, to cost about $100,000. The building is to be 60x90 ft. Plans will be completed by Apr. 15.

Dike—Wilkes-Barre, Penn.—The city is considering the construction of a dike along the river front at a cost of $150,000.

★Mechanical Equipment—Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., Apr. 16, for additional equipment to be installed in the new Polytechnic Institute, North Ave., Calvert and 20th Sts. C. E. Stubbs is Inspector of Bldgs.

✚Stable—Washington, D. C.—The American Ice Co. has awarded the contract to J. K. McIVER, 7 Clay St., Baltimore, Md., for the erection of a stable to cost $13,000.

Electric Block Signals—Alexandria, Va.—The Southern Ry. Co. has decided to install automatic electric block signals on its line between Alexandria and Orange, Va., a distance of about 78 miles. B. Herman, Washington, D. C., is Ch. Engr.

✚Bulkhead—Augusta, Ga.—Bids were received Mar. 6 by the River and Canal Commisison, for furnishing material, cofferdams, etc., and constructing a reinforced-concrete bulkhead across the tail race. The bids follow: (a) Sibley Mill, approximately 3750 cu.yd. concrete, 45 tons reinforcing steel, 6 gates, 1900 cu.yd. excavation, 2000 cu.yd. rock excavation, etc.; (b) reinforced-concrete bulkhead across the tail race of King Mill, 2950 cu.yd. concrete, 40 tons reinforcing steel, 6 gates, 1500 cu.yd. rock excavation, 2100 cu.yd. earth excavation; Porter & Boyd, Charlotte, N. C., (a) $66,500, (b) $54,000; J. A. Gaboury, Jacksonville, Ala., (a) $78,950, (b) $61,137; W. Z. WILLIAMS, Macon, (a) $59,906 (awarded contract), (b) $51,288; A. J. Twiggs & Son, Augusta, (a) $68,677, (b) $52,770; Simmons-Mayrant, Charleston, S. C., (b) $56,761; Berry-Fortune Construction Co., Augusta, (a) $64,793, (b) $51,863; C. W. Requarth, Charlotte, N. C., (a) $78,917, (b) $69,668; Thos. Sheehan,fi Richmond, Va., (a) $68,500, (b) $58,000; A. J. Martin, Danville, Va., (b) $47,748; Municipal Engineering and construction Co., Atlanta, (a) $73,437, (b) $62,615; Stuart-Jones Co., Rock Hill, S. C., (a) $61,000, (b) $51,000. The contract was awarded on (b) to A. MART'N.

Concrete Dock—Kissimmee, Fla.—The City Council has authorized the City Engineer to take surveys and estimates for the reclamation of the harbor and for the construction of a concrete dock.

Drainage Canal—Orlando, Fla.—Bids will be received by the Black Hammock Drainage District, Orlando, until Apr. 8, for the construction of 19.49 miles of drainage canals and laterals. The work will require the removal of 240,588 cu.yd. of earth and the clearing of about 19 miles of right-of-way. B. M. Robinson is Clk.

✚Rock—Lexington, Ky.—The contract has been awarded to LUTES & CO., Lexington, for furnishing the rock necessery to repair the Fayette County roads, at $1.30 per ton of 2000 lb.

Dam—Athens, Ohio—Bids will be received by Williams & Patterson, 118 East Mill St., Athens, until 1 p.m., Apr. 15, for the construction of a 9-ft. dam across the Hocking River at the mill site known as Barth's Mill.

Cement and Crushed Slag—Cleveland, Ohio—Bids will be received by the city until noon, Apr. 8, for furnishing portland cement and crushed slag for the city water department. W. J. Springborn is Dir. Pub. Ser.

Subway—Lima, Ohio—The city and the Erie R.R. Co. have reached an agreement whereby the Metcalf St. Subway will be constructed.

Fire Station—Xenia, Ohio—The city is considering an issue of $10,000 of bonds for the erection of a fire station.

Motordrome—Grosse Point, Mich.—W. S. Lougee, Arch., Cleveland, Ohio, is receiving bids for the necessary materials required for the construction of a motordrome to be located at Grosse Point.

Fire Station—Glenview, Ill.—Bids will be received by the village until 7 p.m., Apr. 8, for the erection of a fire station.

✚Tile Drain—Paris, Ill.—The contract has been awarded to the BAUM CONSTRUCTION CO., Paris, for tile drain (shale) in Paris Union Drainage District, at $10,520.

Coal Docks—Superior, Wis.—The M. A. Hanna Coal Co.,

Superior, will make improvements to its coal docks at Superior, to cost $500,000.

Ditching—Creston, Iowa—The Creston, Winterset & Des Moines R.R., Creston, will have a considerable amount of ditching, cut widening and track surfacing to do during the summer and will probably be in the market soon for the lease or purchase of a used steam shovel, dump cars and light locomotive or to contract with some parties having an outfit of this kind. Theodore S. Delay, Creston, is Engr.

Drain—Dakota City, Iowa—Bids will be received by the County Commissioners, Dakota City, until Apr. 9, for construction of Drain 54. The work will require 16,710 ft. 6- to 20-in. pipe; also Drain No. 45, 35,326 ft. 6- to 36-in. pipe. Bids will be received on clay and cement tile.

+Ditch—Minneapolis, Minn.—Bids were received, Mar. 17, by the County Auditor, Minneapolis, for the construction of Judicial Ditch No. 20. The contract has been awarded to ALBRECHT, ANDERSON & ISENBERG, Glencoe, Ill., at 16c. per cu.yd. The ditch will be 5½ miles long and will run through portions of Hennepin, Wright and Carver Counties. The total cost will be about $10,000.

+Dredge Boat Work—Oregon, Mo.—The contract has been awarded to FRANK B. STEVENS, Geneseo, Ill., by the Nodaway Drainage District No. 1, Oregon, for about 140,000 cu.yd. of dredge boat work in the district at 11.3c. per cu.yd. Bids were opened Mar. 22.

Storm Channel—St. Louis, Mo.—The city has awarded the contract to JAMES CARROLL, Navarree Bldg., St. Louis, for park improvements. The work consists of constructing a storm channel in Foresark.

Subway—St. Louis, Mo.—A constitutional amendment authorizing the city of St. Louis to become indebted to the extent of $30,000,000 for the construction of a municipal subway passed the lower house of the Legislature Mar. 22. The amendment already has passed the Senate and will go to the people for ratification at the fall election of 1914. If the amendment is ratified St. Louis can issue the subway bonds if the flotation is approved by a two-thirds vote. Under the proposed amendment Kansas City, Mo., also is authorized to vote subway bonds.

+Drainage—Mabton, Wash.—The contract has been awarded to the HANS PEDERSON CONSTRUCTION CO., Seattle, Wash., for the construction of a drainage system near Mabton, at $20,800.

Wharf—Florence, Ore.—The city is considering the construction of a public dock to cost about $10,000.

Fire House—San Francisco, Calif.—Plans for the construction of a fire house to be erected at Hoffman Ave. and Alvarado St. have been completed by the City Architectural Department. The cost of the structure has been estimated at $30,000.

Pier—San Francisco, Calif.—The Board of Harbor Commissioners, Mar. 20, approved the plans and specifications for the construction of Pier 35. The structure will be 200x900 ft., with a railroad track on each side and will be used for freight service. The construction will be of reinforced concrete and steel.

Wall—Burlington, Ont.—Bids will be received until Apr. 21 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a concrete revetment wall along the shore front of Lake Ontario, at Burlington.

Wharf—Willow Point, B. C.—Bids will be received until Apr. 4 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a wharf at Willow Point, B. C.

Street Car System—Hawaii—The Hilo Traction Co. Ltd., has been incorporated to construct and operate a street-car system in the city of Hilo, H. T.

BUILDINGS

Arlington, Mass.—A high school will be erected here. Alton M. Tupper, 44 Gray St. is Chn. of School Com.

Methuen, Mass.—A brick school building will be built on Ashford St. Probable cost $40,000.

Pittsfield, Mass.—A four-story business block will be erected on Tyler St. by David S. Freeman, Columbus Ave., to be used in part as a hotel.

+Springfield, Mass.—The Hampden Trust Co. has awarded the contract for a two-story brick office building, 122x66 ft., to be erected on Main St., to the Y. T. LEY CO., Springfield.

Buffalo, N. Y.—Mitchel H. Mark, Pres. Mark-Brock Theatrical Enterprises, White Building, has had plans prepared for a theater, store and office building at West Ferry and Grant Sts. The estimated cost is $90,000.

Plans have been completed for a store, office and motion-picture theater to be erected at Main and West Utica Sts. by the Erie Holding Corporation. The estimated cost is $70,000.

Frederick Ullman, Mutual Life Bldg., has had plans drawn for a motion-picture theater to be erected on Elmwood Ave. near West Utica St., 60x138 ft. The estimated cost is $50,000.

Hempstead, (L. I.) N. Y.—The Mercy Hospital will erect a building on the site of the Hempstead Sanitarium. The estimated cost is $80,000.

Long Island City (L. I.) N. Y.—James P. Linihan, Boro., Manhattan, New York, has purchased a site at Jackson Ave. and the Sunnyside Yards of the Pennsylvania R.R., upon which will be erected a six-story mercantile building. The estimated cost is $150,000.

New York, N. Y.—Schwartz & Gross, Archs., 347 Fifth Ave., have been commissioned by the Fabian Construction Co. to prepare plans for the construction of a 12-story store and office building at 33 East 28th St. The estimated cost is $200,000.

Peabody, Wilson & Brown, Archs., 389 Fifth Ave., have completed plans for the construction of a 12-story apartment house at 231 West 76th St., for W. W. Astor. The estimated cost is $100,000.

Bing & Bing, 505 Fifth Ave., have purchased property at 46-50 East 58th St., upon which it is stated they will erect a 12-story apartment house, 100x74 ft.

Bids will be received during this month by Charles W. Buckham, Arch., 307 Fifth Ave., for the construction of a 21-story apartment hotel, 100x75 ft., on the south side of 59th St., near Sixth Ave., for A. S. Cochran, 355 Palisade Ave., Yonkers, N. Y. The estimated cost is $600,000. Noted Dec. 13.

Plans have been filed by W. & J. Cloane, 575 Fifth Ave., for the construction of a ten-story warehouse, 98x66 ft., on the north side of 29th St., near 11th Ave. The estimated cost is $120,000. John B. Snook & Sons, 261 Broadway, are the Archs.

Plans have been filed by Oscar Hammerstein, Seventh Ave. and 42d St., for the construction of a four-story opera house, on the east side of Lexington Ave., between 51st and 50th Sts. W. H. McElpatrick, 701 Seventh Ave., is the Arch. The estimated cost is $450,000.

Plans have been filed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a six-story apartment house at the northwest corner of St. Nicholas Ave. and 164th St., for the Albion Construction Co., 2228 Broadway. The estimated cost is $300,000.

(Boro. The Bronx)—The city of New York has filed plans for the construction of a new five-story brick school, 200x91 ft., on the north side of 158th St., from Jackson to Trinity Aves. The estimated cost is $250,000. C. B. J. Snyder, 500 Park Ave., is Supt. School Bldgs.

Syracuse, N. Y.—Esenwein & Johnson, Archs., 781 Ellicott Square Bldg., Buffalo, N. Y., are preparing plans for a 10-story and basement addition, 64x132 ft., to be made to the Onondaga Hotel. F. W. Rockwell is Mgr.

Russell & King, Archs., have completed plans and are ready for bids for a four-story and basement wholesale drug warehouse, 70x142 ft., to be erected on West Willow St., by C. W. Snow & Co. The estimated cost is $50,000.

Utica, N. Y.—The Christian Science Church contemplates the erection of an edifice at Genesee St. and Avery Place. The estimated cost is $40,000.

Atlantic City, N. J.—Bids will be received until Apr. 23, by H. A. Stout and W. B. Riebenack, Assoc. Archs., Bartlett Bldg., for the construction of a school at Massachusetts and Atlantic Aves. Noted Nov. 21.

+Camden, N. J.—The contract for the construction of a two-story stone and brick school at Mt. Ephraim and Jackson Sts., has been awarded to E. D. BOYER, Camden, N. J., at $89,584. Noted Mar. 13.

The lowest bidders for the construction of the school at 29th and Muckle Sts. were as follows: Turner & Stewart, Camden, N. J., at $88,361; George Bachman, Camden, at $89,363.

Jersey City, N. J.—The Board of School Estimate has decided to erect an addition to School No. 34 at the Boulevard and Warner Ave., Greenville. The estimated cost is $137,297. Henry Snyder is Supt. of Schools.

+The contract has been awarded to JOSEPH BIRD & CO. for the construction of an edifice, 53x143 ft., parish, 20x91 ft., and a rectory, 26x44 ft., for the St. Barnabas Protesant Episcopal Church at Sixty-fourth and Haverford Ave. Archs. Duhring, Okie & Ziegler.

Paterson, N. J.—Fred W. Wentworth, Arch., 140 Market St., is preparing plans for the construction of a four-story brick stroe and loft building, at Main and Van Houten Sts., for the Henry Gerstley Estate, 1411 N. Broad St., Philadelphia, Penn. The estimated cost is $40,000.

Abington, Penn.—Bissell & Sinclair, Archs., Philadelphia, Penn., have been commissioned to prepare plans for the construction of buildings, for the Abington General Hospital. The buildings will be two and one-half stories high, of brick construction, 107x48 ft.

Crafton, Penn.—Press C. Dowler, Arrott Bldg., Pittsburgh, will draw plans for the Board of Education for a brick and stone high school at Noble and Ridge Ave. The estimated cost is $90,000.

Erie, Penn.—The Palace Hardware Co., will erect a 10-story building at 913 State St.

Huntington, Penn.—The Board of Education will erect a school building, in the Fourth Ward. The estimated cost is $40,000.

Latrobe, Penn.—A. P. Cooper, Uniontown, Penn., will draw plans for the Board of Education for the construction of a two-story brick high school. The estimated cost is $125,000.

Oil City, Penn.—Meals &Johnston, Archs., Oil City, have been selected to draw plans for the Y. M. C. A. building. The building will be four stories 74x181 ft. The estimated cost is $100,000.

+Philadelphia, Penn.—Contracts have been awarded by the City to CRAMP & CO., for the construction of two schools one at Fifty-sixth and Christian Sts., to be 160x76 ft., three stories and basement, cost $201,000. Another at Twenty-seventh and Clearfield Sts., to be 160x76 ft., to cost $205,000.

Plans are being prepared by Furness Evans & Co., Philadelphia for the Pennsylvania R.R. Co., for the extension to their arcade building, at Fifteenth & Market Sts. The building will be thirteen stories of structural steel, and granite and brick construction. The estimated cost is $750,000.

Philadelphia, Penn.—The Board of Education has purchased a site at 13th, Jackson and Juniper Sts. and Snyder Ave., upon which will be erected a high school for South Philadelphia.

Bids will be received until Apr. 7 by Paul A. Davis, Arch., 1713 Samson St., for the construction of a two-story brick, 36x100-ft. bank building at Front and Norris Sts., for the Ninth National Bank.

+Pittsburgh, Penn.—The contract for the construction of the bank and office building at Federal and Stobo Sts., for the Dollar Savings Fund & Trust Co., has been awarded to D. T. RIEFLE. Noted Feb. 27.

Williamsport, Penn.—Bids will be received until May 6, by

Eward L. Taylor, Chn., School Board Bldg. room., for the construction of the high school. Noted Jan. 23

Uniontown, Penn.—Charles H. Garley and others will erect a theater. The building will be two-stories and basement, 50x150 ft., of brick and steel. The estimated cost is $80,000.

Wilmington, Del.—Charles A. Rick, Arch., New York, has prepared plans for the construction of a theater at Eleventh and Market Sts., for the I. E. DuPont de Nemours Powder Co. The estimated cost is $200,000.

Lexington, Va.—Washington & Lee University will erect a gymnasium. B. C. Flourney, 701 Withers Bldg., is Arch., Washington, D. C. The estimated cost is $75,000.

Petersburg, Va.—The Chamber of Commerce and the Retail Merchants' Association are planning the erection of the Shirley hotel. The estimated cost is $100,000.

Richmond, Va.—Bids will be received until Apr. 3, by C. P. Walford, Clk. and Supervisor, 805 East Marshal St., for the construction of a school building, at 28th and Lehigh Sts. Carneal & Johnston, Archs., National Bank of Virginia Bldg., Richmond.

Charleston, W. Va.—Phillip Frankeberg & Co., contemplate the erection of a four- or five-story store and mercantile building. The estimated cost is $100,000.

+Hinton, W. Va.—The contract has been awarded to C. W. McNULTY, Charleston, W. Va., by the Hinton Warehouse Co., for the construction of a warehouse, 25x125 ft.

Newbern, N. C.—Bids will be received until Apr. 19, by S. M. Brinson, Secy. of Trustees, of Craven County's proposed Farm Life School as follows: (1) For each building separately; (2) for bungalow and dormitory; (3) for dormitory and school; (4) for buildings as a whole. F. K. Thomson is State Arch.

Augusta, Ga.—Bids will be received until noon, Apr. 10, by Hugh H. Alexander, Chn., Chronicle Bldg. Com., for the construction of a 10-story office building for the Chronicle Building Co. Noted Nov. 21.

Macon, Ga.—Blair & Adams, Archs., Macon, are preparing plans for the construction of a high school. The estimated cost is 100,000.

Madison, Fla.—Bishop & Greer, Archs., Candler Bldg., Valdosta, Ga., have prepared plans for the construction of a court house at Madison, for the County Commissioners. The estimated cost is $50,000.

+Seabreeze, Fla.—The contract has been awarded to D. F. FUQUAY, Daytona Beach, Fla., for the construction of a hotel for Henry W. Haynes.

Birmingham, Ala.—Bids will be received until Apr. 5, by the Board of Revenue of Jefferson County, for the construction of an addition to the court house. H. B. Wheelock is Arch., Birmingham, Ala. Noted Jan. 23.

+Subcontracts for the construction of the hotel for the Roden Hotel Co. have been awarded as follows: Otis Elevator Co., New York, for elevators; electric wiring and heating, F. E. Newberry, St. Louis, Mo.; marble, Alabama White Marble Co., Birmingham; general contract, Marks Construction Co. Noted Jan. 30.

CONTRACT PRICES

Paving and Sewers—Minster, Ohio—Bids were received by the city, Mar. 19, for paving and sewer work as follows: (A) Coss & Myers, Wheeling, W. Va.; (B) Deshler Construction Co., Deshler; (C) P. Drake & Sons, Marion; (D) H. S. Euck, Lima, (E) Fitzmaurice & Beard, Winchester, Ind.; (F) G. H. Heffner & Co., Celina; (G) C. C. Huffine & Co., Frankfort, Ind.; (H) William J. Kernan & Co., Dayton; (I) Lambert Bros. & Wirt, Delaware; (J) Lowry, Mannix & Hayes, Dunkirk, Ind.; (K) Midland Construction Co., Lima; (L) T. J. Mulligan, Lima. The item bids were as follows:

PAVING AND SEWERS, MINSTER, OHIO

	A	B	C	D	E	F	G	H	I	J	K	L
22,469 cu.yd. grading	$0 40	$0 33	$0.40	$0.37	$0.50	$0.35	$0.40	$0.44	$0 44	$0 45	$0.40	$0 30
500 lin.ft. 15-in. vitrified sewer pipe in place	1.00	1.00	.95	1.00	1.12	1.10	1.15	1.20	1.55	1.00	.90	92
920 lin.ft. 12-in. vitrified sewer pipe in place	.86	.92	.85	.75	.82	.90	.90	.90	1.15	.90	.73	.74
4075 lin.ft. 10-in. vitrified sewer pipe in place	.82	.80	.70	.65	.77	.96	.85	.85	.90	.80	.62	64
4225 lin.ft. 8-in. vitrified sewer pipe in place	.76	.57	.60	.55	.60	.86	.80	.85	.80	.70	.50	54
910 lin.ft. 6-in. vitrified sewer pipe in place	.72	.50	.50	.50	.60	.77	.65	.66	.70	.60	.46	44
9 brick manholes	45.00	25 00	40.00	35 00	48 00	40 00	35 00	25 00	45 00	40 00	35.00	35 00
57 brick catch basins	50 00	25 00	30 00	30.00	45 00	40.00	38 00	25.00	38.00	35.00	32 00	30 00
13 c.i. inlets	45 00	15 00	16 00	20.00	15.00	15.00	20.00	20.00	23.00	30.00	14.00	20 00
9 inlets reset	35 00	7 50	8.00	5.00	5.00	3.00	5.00	6.00	10.00	5.00	4.00	10 00
2 track drains	15.00	6 00	5 00	25.00	20.00	10.00	15 00	15.00	15 00	10.00	10.00	24 00
15,172 lin.ft. sandstone curb	.62	.54	.57	.57	.72	.59	.65	.73	.60	.65	.59	.56
943 lin.ft. circular sandstone curb	.90	.75	.94	.75	.95	1.00	.80	1.10	1 20	.90	.90	84
1080 lin.ft. marginal limestone curb	.40	.35	.32	.45	.70	.35	.50	.40	.55	.50	.33	.40
15,000 lin.ft. 4-in. drain tile	.10	.05	.08	.045	.10	.05	.04	.06	.15	.05	.04	.04
100 cu.yd. extra concrete	6 00	5 00	5 00	4.00	6 00	5 00	4 50	8 00	6 00	6 50	4 95	4 50
32,044 sq.yd. vitrified brick pavement, including 6-in. concrete foundation, 1-3-5, and 1½-in. sand cushion	2 20	1 66	1 72	1 76	1 83	1 75	1 76	1 82	1.80	1 93	1.78	1.79
4935 sq.yd. vitrified brick pavement between street-car tracks and to a width of 18-in. on each side	3 20	2.45	2.11	3 13	2.53	2 45	2 61	2 76	2.80	2.48	2 58	2.80
36,979 sq.yd. 1-1 cement filler	.12	.10	.11	.10	.12	.10	.08	.08	.01	.10	.09	.10
Alternative bids:												
36,979 sq.yd. asphalt filler	.25	.30	.27	.25	.25	.25	24	.23	.30		.26	.30
32,044 sq.yd. 2¼-in. creosoted wood block pavement, including 6-in. concrete foundation 1-3-5, and ½-in. sand cushion, and sand filler			2.70	2.45			2.75					2.43
4935 sq.yd. 2½-in. creosoted wood block pavement between street car tracks and to a width of 18-in. on each side			2.70	3.93			3.65					3 43
For gravel in place of crushed stone in concrete foundation, deduct						.05		.15				.02
15,172 lin.ft. concrete curb	.52	.59	.46	.35	.50	.35	.35	.50	.55	.47	.43	.38
943 lin.ft. circular concrete curb	.80	73	1.00	.50	.50	.90	.35	.50	1 00	.55	.90	.44
15,172 lin.ft. concrete curb and gutter	.90	74	.60	.44	.75	.50	.50	.50	67	55	.51	40
943 lin.ft. circular concrete curb and gutter	1.00	.85	1.00	.60	.85	1.00	.55	.50	1 10	60	.90	46

+Memphis, Tenn.—The Commercial Trust & Savings Bank has awarded the contract for the construction of the 15-story bank and office building to the CONSOLIDATED ENGINEERING CO., 61 Gunther Bldg., Baltimore, Md. Noted Feb. 27

+Bardwell, Ky. The contract has been awarded to FALLS CITY CONSTRUCTION CO., Louisville, for remodeling the court house. Andrew J. Bryan is Arch.

Fulton, Ky.—The Illinois Central R.R. will erect a depot at Fulton. The estimated cost is $75,000. W. O. Moody, is Mech. Engr., Chicago, Ill.

+Pineville, Ky.—The contract has been awarded to W. M. JONES, for the construction of a hotel at Pineville, for local capitalists.

Cleveland, Ohio—The May Department Stores Co., will erect a six-story building at Prospect Ave. and Ontario St. The estimated cost is $3,000,000.

St. Bernard, Ohio—Bids will be received until noon, Apr. 15, by W. L. Taylor, Asst. Clk., Bd. of Education, for the construction of a school building at Tower and Jackson Sts. P. E. Moosmille is Arch., Mitchell Bldg., Cincinnati, Ohio.

+Auburn, Ind.—Contracts for the construction of the Y. M. C. A. building have been awarded as follows: structural steel, FT. WAYNE IRON & MACHINE CO., Ft. Wayne, cut stone, KEELER & SON, Ft. Wayne, roofing, GERDING & AUMANN, Ft. Wayne.

Michigan City, Ind.—The Chicago, Indianapolis & Louisville Ry. Co., has prepared plans for the construction of a depot. The estimated cost is $110,000.

Detroit, Mich.—Burnham & Co., Archs., Chicago, Ill., will receive bids about May 15, for the construction of an 18-story office building at Woodward Ave., Washington Blvd., and West Grand Circus Park, for the Whitney Realty Co., 1724 Ford Bldg. Noted incorrectly Mar. 20.

Marquette, Mich.—Plans are being prepared by Meyer J. Stuem, Arch., 116 S. Michigan Ave., Chicago, Ill., for the construction of a three-story hospital, 50x140 ft. The estimated cost is $60,000.

+Champaign, Ill.—The foundation contract has been awarded to FREEMAN & BROOKS, for the high school at State and Green Sts. Noted Feb. 6.

Chicago, Ill.—The Empire Express & Van Co., Chicago, will erect a seven-story brick warehouse.

+Chicago, Ill.—Contracts for the construction of the furniture exposition building at 1410 S. Wabash Ave., have been awarded as follows: masonry, R. & S. SELLITT, 79 E. Adams St.; roofing and sheet metal, SYKES STEEL ROOFING CO., 930 W. 19th St., structural steel, A. BOLTERS SON, 2301 Ward Ave.; ornamental metal, UNITED ORNAMENTAL IRON WORKS, 189 West Madison St.

+The general contract has been awarded to O. W. ROSENTHAL & CO., 80 E. Jackson Blvd., for the construction of a synagogue at Douglas Blvd., and Homan St., for the Anshe Kanesses Israel Congregation. Aron & Summers are Archs., 139 N. Clark St.

+Contracts have been awarded as follows, for the construction of a hotel at Monroe and 62nd St., for the Gladstone Hotel Co.: masonry, J. DOUGHERTY, 189 W. Madison St., carpentery, THOS. HUGHES, 5709 Drexel Ave., plastering, WM. BRANDENBURG & SONS, 1034 N. Oakley Ave.

Evanston, Ill.—Plans are being prepared by Perkins, Fellows & Hamilton, Archs., 6 N. Clark St., Chicago, for the construction of a school for the Bd. of Education. The estimated cost is $75,000.

+Ottowa, Ill.—The contract for the construction of the building at Madison and Columbus Sts., for the Central Life Insurance Co., has been awarded to J. L. SIMMONS, Chicago, Ill.

Milwaukee, Wis.—The city of South Milwaukee has pur-

chased a 10-acre tract at Hawthorn and Tenth Aves. upon which will be erected a high school.

Davenport, Iowa.—The Manufacturers' Hotel Association, will erect a hotel at Fifth Ave. and 14th. St. H. W. Whitsitt is Arch. The estimated cost is $400,000.

+Des Moines, Iowa.—The contract has been awarded to CHARLES WEITZ SONS, Des Moines, for the construction of the Empress Theater on West Eighth St. Noted Mar. 20.

+Glenwood, Iowa.—The contract for the construction of the Girl's Cottage at the institute for feeble-mined children has bee awarded to PETERS & RICHARDS, Plattsmouth, Neb., at $103,228. Other bidders were J. C. Mardis, Des Moines, Iowa, $106,975; C. C. Young, Creston, Iowa, $104,791; J. C. Jensen, Council Bluffs, Iowa, $122,900; F. X. White, Eldora, Iowa, $107,622; W. Z. Zitterall, Webster City, Iowa, $107,800. H. F. Liebbe is State Arch.

Hutchinson, Minn.—Bids will be received until 8 p.m., Apr. 9, by Kirby T. Snyder, Arch., Minneapolis, Minn., for the construction of a bank building for the Farmers National Bank.

Minneapolis, Minn.—The First National Bank and the Minneapolis, St. Paul & Sault Ste. Marie Ry. will erect a building on the site of the First National Bank. The estimated cost is $1,200,000.

Salina, Kan.—C. A. Smith, Arch., is receiving bids for the construction of the hospital at Johnstown, Penn., Ash and Oakdale Sts. The estimated cost is $100,000.

Omaha, Neb.—Thomas R. Kimball, Arch., 503 McCague Bldg., is preparing plans for the construction of a hotel at 18th and Douglass Sts., for the Douglas Hotel Co. The estimated cost is $800,000.

Kansas City, Mo.—The Board of Education is having plans prepared for a north wing 48x140 ft. on the library. The estimated cost is $100,000.

Batesville, Ark.—St. Louis, Iron Mountain & Southern R.R. will erect a stone and marble station at Batesville. The estimated cost is $50,000.

+Austin, Tex.—Contracts have been awarded to STREET & BORN, Houston, Tex., for the construction of the depots for the Atchison, Topeka & Santa Fé Ry. Co. at Bellville, Caldwell and Cameron, at a cost of $75,000.

Dallas, Tex.—Plans are being prepared by I. A. Walker, Arch., for the construction of a theater on the site of the Crystal Theater. The estimated cost is $100,000.

+The contract has been awarded to the GILSONITE CONSTRUCTION CO., for the erection of the superstructure of the Busch Building, at a cost of $500,000.

H. A. Overbeck, Arch., Dallas, has prepared plans for the construction of an eight-story, 100x100-ft. jail of reinforced-concrete and steel construction. The estimated cost is $200,000.

Palestine, Tex.—C. H. Page & Bro., Archs., Austin and Houston, Tex., has prepared plans for the construction of a three-story and basement court house, for Anderson County Commissioners. Noted Feb. 27.

Bartlesville, Okla.—Bids will be received until Apr. 9, by J. C. Mitchell, County Clk., for the construction of a court house and jail.

+Globe, Ariz.—The contract has been awarded to MICHAELSON & WIEDMAN, Globe, for the construction of a three-story store and lodge building on Broad St. for the Masonic Temple Association.

Tucson, Ariz.—John Heidel will erect a four-story reinforced concrete hotel on Congress St. opposite the El Paso & Southwestern R.R. station. The estimated cost is $100,000.

Seattle, Wash.—A. Warren Gould, American Bank Bldg., has been instructed by the County Commissioners to prepare plans for a three-story court house, covering the entire county-owned block bounded by 3rd and 4th Aves., James and Jefferson Sts. Bonds in the sum of $950,000 were voted at a recent election and have been disposed of.

CONTRACT PRICES

+Sidewalks and Sewers.—Ely, Minn.—Bids for constructing sidewalks, curbs and sewers were received by the city, Mar. 18. Charles A. Natter is City Engr. The bids were: (A) C. J. Mott & H. Nelson, Coloraine, Minn.; (B) Pastoret Construction Co., Duluth, Minn.; (C) K. S. JOHNSON, Biwabik, Minn. (awarded contract for sewers); (D) Kircher Bros., Gilbert, Minn.; (E) John Hedberg, Duluth, Minn.; (F) Eveleth Construction Co., Eveleth, Minn.; (G) Gustave Linder, Hibbing, Minn.; (H) Bodin & Son, Duluth, Minn.; (I) Russel Construction Co., Superior, Wis.; (J) A. A. Mitchell & Co., Bovey, Minn.; (K) Lawrence & McCann, Duluth, Minn.; (L) E. A. Dahl, Duluth, Minn.; (M) Edward Johnson, Superior, Wis.; (O) C. S. Rogers Co., Duluth, Minn.; (P) D. H. CLOUGH & CO., Duluth, Minn. (awarded contract for sidewalks and curbs).

Portland, Ore.—Bids for the construction of the Hoffman and Kenton schools are being received by School District No. 1, F. A. Naramore, Supt. The proposed structures will each be two stories in height, of reinforced-concrete construction. The estimated cost of each is $75,000.

Portland, Ore.—Fritz & Rometsch will erect an eight-story reinforced-concrete building at Third and Alder Sts. The estimated cost is $100,000. Aaron H. Gould is Arch.

The Investors' Building & Trust Co., will erect a four-story and basement reinforced concrete building at Third and Couch Sts. for A. C. Pike. The estimated cost is $80,000.

+Los Angeles, Calif.—The general contract has been awarded to the ALTA PLANING CO., 830 McGarry St. at $61,000 for the erection of the Class A steel frame warehouse to be erected at Second and Alameda St. for the John A. Roebling Sons Co. The cost will be $120,000. The contract for the structural steel has been awarded to the BAKER IRON WORKS, and elevators to the OTIS ELEVATOR CO. Hudson & Munsell, Stimson Bldg., are Archs.

Los Angeles, Calif.—Bids will be received until noon, Apr. 12, by W. F. McClure, State Engr., Capitol Bldg., Sacramento, Calif., for the group of 10 buildings for the state normal school at Los Angeles, Calif.

N. W. Stowell, 667 I. W. Hellman Bldg., Los Angeles, will erect a 12-story and basement reinforced concrete hotel on Spring St. south of Fourth St. Frederick Noonan, 904 Wright & Callender Bldg., is Arch.

+Oakland, Calif.—The following contracts have been awarded from the office of Arch. W. C. Hayes, 68 Post St. San Francisco, in connection with the construction of the new Y. M. C. A., building at Twenty-fiirst and Telegraph Aves. Marble and tile work; C. L. CUMMINS, $1500; Carpenter work C. CHRISTENSEN, at $12,476; heating and ventilation, ROBT. DALZIEL, JR., 218 First St., S. F. $2137; electrical work, H. S. TITTLE, 263 Tenth Ave., S. F. at $1168; plumbing, Fredk. W. SNOOK, 596 Clay St. S. F. at $2490; masonry, ARTHUH ARLETT, 461 Market St., S. F. at $7087; sheet metal work, YAGER SHEET METAL WORKS, at $1742; lathing and plastering, A. KNOWLES, 985 Folsom St., S. F. at $6722. Noted Feb. 27.

A manual training and commercial high school to cost $500,000 will be erected at 45th St. and College Ave. J. J. Donovan is Superv. Arch.

Matthew Slavin will erect an eight-story office building on North Raymond Ave., between Colorado and Union Sts. The estimated cost is $90,000.

San Diego, Calif.—The Cabrillo Athletic Club will erect a 6-story reinforced concrete building at State and D Sts. Theo. C. Kistner is Arch. and W. Grant Johnson is Pres.

San Francisco, Calif.—Reid Bros., Archs., San Francisco, have prepared plans for the construction of a 25-story, Class A, reinforced-concrete office building, at Market and Fourth Sts. The estimated cost is $1,500,000.

Montreal, Inc.—The Grey Nuns will erect a hospital at Clarke Ave., and St. Catherine St. The estimated cost is $1,000,000.

+Moose Jaro, Sask.—The contract has been awarded to PETER LYALL & SONS CONSTRUCTION CO., Winnipeg, Man., at $114,700, for the construction of a school building at Moose Jaw.

Regina, Sask.—The Grand Trunk Pacific Ry. will erect a hotel and stations at Regina. The estimated cost is $2,000,000.

CONTRACT PRICES

★Barge Canal—Albany, N. Y.—Bids for Contract 22, which consists of constructing a harbor and dock wall on the west side of the Mohawk River north of the highway bridge at Fort Plain, were received by Duncan W. Peck, Supt. Pub. Wks., Mar. 25, as follows: (A) Engineer's estimate; (B) S. Pearson & Son., Inc., 507 Fifth Ave., New York; (C) Leary & Morrison Co., Fairport, N. Y.; (D) Albert M. Banker, Gloversville, N. Y.:

BARGE CANAL CONTRACT 22, ALBANY, N. Y.

	A	B	C	D
19,700 cu.yd. excavation	$0 50	$0 81	$0 55	$0 54
240 cu.yd. lining	1 25	1 38	1 30	1 37
27,550 lin.ft. round timber	25	46	28	274
1275 cu.yd. stone filling	1 50	1 28	1 50	1 65
660 cu.yd. second-class concrete	7 50	8 50	7 75	8 20
120 cu.yd. second-class rip-rap	3 00	4 00	3 00	3 30
200 lb. structural steel	05	06	05	05
300 lin.ft. malleable c.i. nosing	1 00	1 00	1 00	1 00
1530 lb. iron castings, plain	035	041	034	033
902 lin.ft. wooden fence	25	25	25	27
Totals	$21,872	$37,308	$28,860	$27,086

SIDEWALKS AND SEWERS, ELY, MINN.

	A	B	C	D	E	I	G	H	I	J	K	L	M	O	P
3400 cu.yd. earth excavation	$0 90		$0 58	$0 80		$0 70	$0 52	$0 65	$1 25	$0 50	$0 75	$0 50	$0 70	$0 60	$0 60
rock excavation, per cu.yd.	8 00		8 00	10 00		8 00	7 00	8 00	8 50	8 00	8 00	9 00	6 00	3 00	3 00
120,055 sq.ft. sidewalks	145		103	11		11	105	12	12	12	114	125	11	11	105
6048 sq.ft. driveways	175		177	15		15	145	18	175	15	15	17	13	15	135
8400 sq.ft. crosswalks	175		17	15		15	145	18	17	15	15	17	13	16	135
16,742 lin.ft. curb and gutter	57		59	50		50	48	60	68	51	57	65	52	55	47
Curb, per lin.ft.	22		30	35		30	30	40	50		42	65	30	40	25
Extra, tile drain, per lin.ft.	08		06	06		08	05	08	20	09	07	15	08	05	04
Totals for sidewalk and curb	$42,548		$26,752	$26,464		$20,124	$24,505	$29,262	$32,620	$26,812	$26,007	$30,045	$26,194	$26,705	$24,465
2800 cu.yd. earth excavation		$0 78	54	70	$0 75	80	64		1 70	95	82	75	80	1 00	85
100 cu.yd. rock excavation		8 80	8 00	8 50	8 00	8 00	9 00		8 50	8 00	7 50	9 00	7 50	6 00	8 00
3524 lin.ft. 15-in. pipe in place		62	46	60	58	60	67		68	65	72	70	52	75	63
906 lin.ft. 10-in. pipe in place		45	34	42	45	10	53		47	55	52	50	35	55	47
900 lin.ft. 8-in. pipe in place		30	22	22	32	30	42		31	30	36	25	26	40	35
14 manholes		34 00	41 00	35 00	40 00	35 00	63 00		90 00	42 00	30 00	38 00	31 00	40 00	40 00
46 catch basins		35 00	48 00	35 00	40 00	29 00	53 00		90 00	40 00	32 00	38 00	26 00	68 00	36 00
Totals for sewers		$7660	$6741	$7255	$7640	$7322	$9498		$13,163	$8554	$7007	$8050	$6744	$9018	$7960
Totals			$33,483	$33,720		$43,446	$34,002		$45,791	$35,367	$34,574	$38,095	$32,818	$36,024	$32,463

Engineering News

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Philippine Road Maintenance Problems*

The accompanying illustration shows a view of Bued Cañon and the Benguet Road on the Island of Luzon, P. I., about 125 miles north of Manila. At this place the road climbs 845 ft. in a distance a trifle less than two miles. The road is much used by automobile trucks for both freight and passenger service between the nearest railway and the city of Baguio, which has become quite a health resort. The automobile bus line over this road carried over 19,000 passengers in the year 1911-1912, but the railway is now being extended to Baguio, which will materially decrease the importance of the Benguet Road.

In July, 1911, the Bued Cañon was visited by an extraordinary storm, during which 16 in. of rain fell in a single day and 88 in. in four days. This unprecedented rainfall, falling on the bare, precipitous sides of the cañon, with its disintegrated and unstable earth and rock covering, resulted in extensive damage to the road; for, although the upper half of the road stood the flood remarkably well, great destruction was done on the lower part by two enormous landslides, the contents of which were estimated at nearly 2,000,000 cu.yd.

These two slides formed a natural dam across the cañon 150 ft. high, behind which a great volume of water collected until the dam was overtopped. During the few hours this dam existed, sand and gravel were deposited for a distance of several miles above the dam to a depth of 40 to 50 ft. above the former river bed. The bursting of this dam let loose a tremendous flood, which swept down the cañon, tearing out a steel highway bridge and doing great damage to the lower part of the road. The city of Baguio was cut off from all communication for eight days, and then a temporary trail was opened from the west side of the city.

The reconstruction of the road seemed doubtful for a time. Several miles of the roadbed had disappeared under the vast deposit of gravel and boulders, and the construction of a new road higher up on the mountain side was believed to be a financial impossibility for the provincial government.

While the authorities were debating what measures should be taken, another extraordinary rainfall came in September, when 31 in. of rain fell in 24 hours. This flood cut through the great gravel deposit and swept a large part away, making it possible to reconstruct a road more or less on the same location as the old road. The reconstruction work was started in October and completed so that automobile trucks could use the road by Dec. 22, 1911. The cost was about $50,000. The view shown is from a photograph taken in June, 1912. The engineer in charge was Will Arthur.

The yearly maintenance charge for this road (about 20 miles long) for the previous five years had varied from $82,000 to $180,000, including also contributions for the maintenance of the central organization of the Bureau of Public Works and road improvements.

With the opening of the railway into Baguio, the traffic on the road will drop off to such an extent that the cost of maintenance will be much lessened; for a considerable portion of the cost of maintenance is not due to floods, but to the exceedingly heavy traffic and to the necessity for rush work and expensive work to keep the road in condition for traffic during the rainy season.



View of the Benguet Road, Bued Canyon, Island of Luzon, Philippine Islands, June, 1912

The automobile line operates 18 trucks, which have a carrying capacity of two tons each. The rates charged for passengers, baggage and freight are much lower than were formerly charged when the traffic was handled by mule teams and bullock carts.

*From data contained in the recently issued Annual Report of the Director of Public Works, for the year ending June 30, 1912; Manila, P. I.

A Coffer-Dam on Sand Bottom; Ohio River Dam No. 48*

By J. C. Oakes†

Of the 54 dams proposed for the canalization of the Ohio River all of those thus far built or contracted for, except No. 48, at mile 846, or 6 miles below Henderson, Ky., have fairly firm foundations, most of them being on rock and a few on gravel. The material at all lock sites above Louisville is supposed to be of a character that will not be easily eroded by the current, so that up to the present time no special precautions have had to be taken for protection of coffer-dams during construction or for protection of the works against undermining by the current after completion and during operation.

Below Louisville, however, a totally different type of foundation is encountered. In the 13 dams to be constructed in the lower 400 miles of the river, rock is found at the sites of only three; elsewhere foundations are fine sand and silt, so fine that the bottom changes with every stage of the river. This fact has caused considerable anxiety, not only with reference to the planning of the works to insure stability after completion, but particularly with reference to the

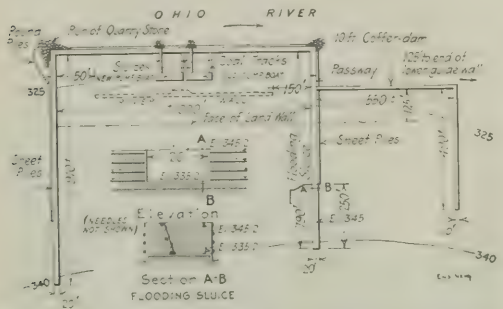


FIG. 1. PLAN OF COFFER-DAM FOR DAM 48, OHIO RIVER

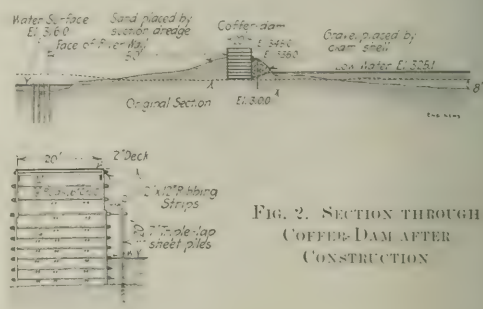


FIG. 2. SECTION THROUGH COFFER-DAM AFTER CONSTRUCTION

danger to the coffer-dams and erosion of the bed of the river during the period of construction. It has been openly affirmed by some of the contractors who have had experience on the Ohio River that it would be impossible to construct coffer-dams in the shifting sands of the lower river that would remain during the period of construction, and, second, that if constructed, they could not be made sufficiently impervious against seepage to withstand the ordinary pressure heads, and that they could not be pumped out sufficiently to enable the work to proceed.

Bids were opened for the construction of No. 48 on Sept. 7, 1911, and it was found that only one bidder had sufficient confidence to offer to do the work. On Oct. 11, 1912, bids were to be opened for the construction of dam No. 43, but no bids were received. The contract for No. 48 was finally awarded to the only bidder, the Ohio River Contract Co., and during the past season the coffer-dam surrounding the lock, inclosing an area of 20 acres has been constructed, pumped out, and the round piles under the river wall driven. Work was shut down for the winter on Dec. 31, 1912, and during January, 1913, this work was submerged by one of the worst floods of record at that site, high water reaching an elevation of 371, which is within 2 ft., of record high water. No particular damage has been done the coffer and it is expected that it will be in as good condition next season as is usual at other sites after the winter floods. It has therefore been proved that safe coffer-dams can be constructed, maintained, and pumped out without undue trouble at the sites in question as well as in other parts of the river where better foundations exist.

At the site selected for dam No. 48, the width between low water lines is 1600 ft.; between 20-ft. contours, 3100 ft. The lock is to be located on the convex shore of a bend in the river, the radius of which is approximately 1600 ft. Low water is at elevation 325 (Sandy Hook datum), with high water (1884) at 373. The flood of January, 1913, at this site almost equaled that of 1884, reaching an elevation of 371. The lock is to be constructed on the Indiana side where the general level of the banks is at elevation 360. On the Kentucky side the bank is somewhat higher, being approximately at 380. The river wall of the lock is to be approximately along the line of low water, which places that wall some 700 ft. from the contour of the bank corresponding to that of the elevation of the top of the walls. The terreplein between gate recesses is to be connected with the river bank by a causeway or dike at a general elevation of the top of the land wall.

The lock is the standard size adopted for the river, 600x110 ft., with lift of 9 ft. The dam is to have a navigable pass 800 ft. wide with Chanoine wickets 16 ft. 5 in. long; a Chanoine weir 600 ft. wide, wickets 11 ft. 9 in. long, and a permanent weir 890 ft. long, the elevation of whose crest is to be 1 ft. below upper pool, or 337. Upper pool is at 338, lower pool 329, top of river wall 341, and top of land wall 343.

The material found at the site is a fine sand and silt intimately mixed, with an occasional pocket of very fine gravel. In driving a few long piles to a depth of 47 ft. below low water some difficulty was experienced and it is supposed that a layer of gravel was encountered, but no borings have been taken to verify this. This material when quite dry or when entirely submerged in still water stands at about the slope of 2 on 3, but any movement of water either through it or over it rapidly flattens such slope to about 1 on 20. For this reason the coffer-dam was kept 150 ft. away from the walls.

Owing to the distance of the lock from the shore and the necessary contraction of the river, it was thought inadvisable to include any of the navigable pass in the first coffer-dam, which was built therefore to inclose only the lock with arms extending to the bank. The area inclosed is about 20 acres. It is feared that this reduction of the cross-section of the stream will cause considerable erosion, and it may happen that the bed of the river will be so greatly changed as to make it necessary to raise the bed before it will be possible to construct the dam as planned.

The type of coffer (Figs. 1-2) is that known as the Ohio River box type, built 20 ft. above low water and 20 ft. thick for the greater part of its length; it consists of two rows of sheet piles 20 ft. apart, tied together by steel rods varying in diameter from ¾ in. at the top to 1¼ in. at the bottom, held apart by separators and held together by wales on the outside 6x6 in. at the top, varying to 10x10 in. at the bottom. The space between the rows of sheeting was filled with sand removed from within the coffer by a 10-in. suction dredge, the material being excavated from the lock site. The sides of the coffer were carried into the bank, the top being of uniform elevation 20 ft. above low water. To increase the stability of the coffer and decrease seepage a line of 7x12 in. triple-lap sheet piles, 20 ft. long, was driven outside of and around the coffer and bolted to it.

No special difficulty occurred during the construction of the coffer and seepage through the coffer was easily controlled by three 15-in. pumps placed on a pump boat resting on piles near the front of and discharging over the coffer. Some difficulty was met in the extension of the upper arm, owing to the fact that the river rose at a critical period and the pile driving and placing of skeleton of the coffer was carried on in water as deep as 17 ft. As this coffer-dam extends some 700 ft. from the bank at this stage there was, of course, a very serious current around the end, and extraordinary means had to be taken to protect the end of the coffer. Round piles with brush between them weighted

*Portion of paper in "Professional Memoirs, Corps of Engineers, U. S. A., and Engineer Department at Large," March-April, 1913.

†Major Corps of Engineers, U. S. A., 125 Customs House, Louisville, Ky.

down by sandbags and rock were used, and after the corner was turned a pile of riprap was placed to protect it permanently against current and ice. The banking along the front of the coffer was protected by several masses of rock (Fig. 1) forming short spur dikes to prevent a racing current alongside the dike and the whole length of banking was covered with gravel. (Fig. 2.) This gravel was fine, the largest particles being not more than ½-¾ in. in diameter, and some of the material was practically nothing but coarse sand. In my opinion, this gravel is much too fine for the purpose intended and the contractor was so notified. He feels, however, confident that it will serve its purpose, and it will be very interesting to see whether his belief is justified.

The greatest trouble met in the unwatering of the coffer was in protecting the banking against the inside of the coffer from undermining by seepage and drainage water. Wherever there was flowing water the sand was eroded and the banking gradually sloped until it was almost flat. To prevent this, sandbags were used freely, and practically the whole caving surface was covered with the same kind of gravel as that used on the outside. For this protection this gravel was very suitable, and as soon as the sand was covered by a thin layer further erosion did not take place, and the banks remained with a slope of about 2 on 3.

It is believed that the Wakefield sheet piling driven around the coffer were not used to the best advantage. These piles should have been driven deeper, so as not to overlap the coffer sheeting over 5 ft., instead of about 13 ft. as actually driven, and should have been driven close to the coffer. The driving of a great part of the Wakefield piles occurred at medium stages of the river (10 to 17 ft.) with the result that the driving was poorly done and this sheeting is not as tight as it should have been.

The use of a pump boat with all of the pumps concentrated, the boat resting on piles as the water lowers, has been excellent and it is believed is very economical and much preferable to other methods commonly used. When the coffer is flooded the boats are simply disconnected from the discharge pipes, their suctions raised, and they are floated out of the coffer through the passway. This furnishes a very simple and economical manner of removing and placing the pumping apparatus.

This being the first coffer to be placed on sand foundations in the Ohio River, the contractors have taken very great care to use the best material and to make everything as secure as posible. It is possible that in future coffer-dams some of the measures adopted in this case may be found to be unnecessary and the cost of the coffer-dam material reduced.

CONSTRUCTION

The following is an extract of a report of the Government inspector in charge of the work, Junior Engineer Edward H. West, in which the work is described in fuller detail:

The coffer, both inside and out, is heavily banked with sand. A typical cross-section is shown on Fig. 2. Plans were closely followed in construction, the only exceptions being as follows: For a distance of 670 ft. from the land end of the upstream wing and 520 ft. from the land end of the downstream wing, tie-rods were spaced 8 ft. on centers instead of 6 ft. on centers; in some portions of the coffer, instead of 2x12-in. deck joists spaced 24 in. on centers, 2x10-in. joists were used, spaced 16½ in. on centers, and in a short portion of the river arm 2x10-in. joists 18 in. on centers were used. The sheet piles were driven from a floating pile driver, and at times the river was too high to permit the piles to be driven to the proper depth; consequently, such piles do not have quite the penetration intended, the maximum difference between actual and intended penetration being about 3 ft.; at the upstream outer corner the length of a number of sheet piles was increased to 32 ft. for additional safety at the point of supposed greatest weakness; at this corner about fifty round piles were driven as shown on Fig. 1, the area inclosed within them was filled with brush weighted with sandbags. Afterward the entire corner was protected with derrick stone piled as high as the top of the coffer. The lower outer corner was also protected by derrick stone and several stone dikes were built along the river side.

On June 20, 1912, the line of sheet piles was commenced, beginning at a point 250 ft. from the land end of the upper wing. These sheet piles were driven rather carelessly, making alignment poor, and leaving the joints not very tight. After the driving of sheet piles had been begun, trenches about 2 ft. deep and 20 ft. apart were dug parallel to the sheet piles. In these a skeleton was erected consisting of wales and those pieces of sheeting through which the tie-rods passed, the sheeting being driven about 2 ft. into the sand. All wales were scarfed for 2 ft. at both ends and holes bored for tie-rods through the center of the scarf. Where the spacing of tie-rods was 8 ft., 18-ft. timbers were used for wales and where the spacing was 6 ft., 20-ft. wales were used, thus allowing a lap of 2 ft. at each end. At each tie-rod a temporary separator perpendicular to the wales and 20 ft. long was placed and the nuts on the rod tightened. The remainder of the sheeting was then driven and after the proper cut-off elevation had been marked the ribbing strips were spiked on and the sheeting cut off to grade. Cracks between adjacent pieces of sheeting were closed by 1x3-in. battens nailed on the inside. When the coffer had been extended into water so deep as to prevent further work from land the skeleton was bolted together on a small barge, one section at a time, and as each section was completed it was lifted by a derrick boat until the barge could be moved forward, when it was lowered into the water (Fig. 3). Sheeting was then driven by men standing on the wales.

Throughout the construction two gangs of carpenters worked; at times each gang extended both skeletons and sheeting, but better progress was made when one gang worked on skeleton only and the other followed up with sheeting. Each gang contained at different times from 10 to 20 men; it was found that not more than 20 men could work together to advantage. In general, it may be said that the rate of progress depended upon the rapidity with which the

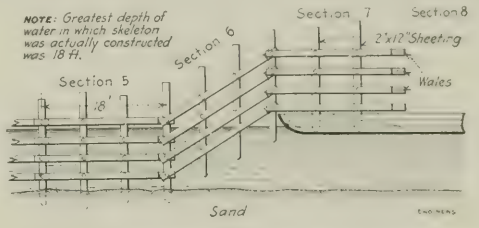


FIG. 3. METHOD OF CONSTRUCTING SKELETON OF COFFER-DAM

skeleton was advanced, no difficulty being experienced in keeping close up with the other work. As a matter of fact, sheeting was frequently delayed in order that the skeleton might be extended. During the season the skeleton was actually extended on about 71 days an average of 38 ft. per day; this value corresponds to two wale lengths, either 36 or 40 ft., depending on the length of wales being used; it was noted in the field that two wale lengths constituted an average day's work. Sheeting was actually driven on 53 days, an average of 52 ft. per day (double row) from a minimum of 10 ft. to a maximum of 103 ft., but on a great many days on which sheeting was driven much other work was done by the same gang and the above values are not reliable for progress estimates. It is believed that one gang can extend a double row of sheeting 100 ft. per day. The extension of skeleton may be assumed to be work accomplished by a single shift since night on this portion of the coffer is negligible; sheeting, however, was driven quite satisfactorily at night.

After the sheeting had been cut off to proper elevation, the deck joists were laid and spiked to the ribbing strips. This having been done, the discharge pipe of the 10-in. suction dredge was moved into position and the sheeted portion of the coffer filled with sand taken, if possible, from the "pay excavation" for the lock walls. Bulkheads across the coffer were built at convenient intervals as the construction advanced. As the coffer filled, the separators were removed and afterward used again. At first, a long trough built on top of the deck joists of rough lumber, on a grade of 1%, was used for distributing the sand, but it proved to be very inefficient and was discarded; subsequently the desired distribution was accomplished by moving the end of the discharge pipe. Short time tests of the suction dredge showed that it could place 100 cu. yd. of fill per hour, through 300 ft. of discharge pipe, maximum lift 20 ft. It handled a total of about 100,000 cu.yd. of material. The coffer contains only about 40,500 cu.yd.; the remainder was used for banking. Of the total excavation made, about 50% was within the specified limits of "pay excavation."

As shown on Fig. 1, a flooding sluice was built in the lower wing and a passway for removing boats, etc., was also left in the lower wing. Discharge sluices and coal tracks were constructed in the river side near the crest line of the dam. A layer of fine gravel was spread over the whole river side of the coffer-banking to prevent scour as much as possible. It is believed that the one flooding sluice will be all that is necesary, unless very extraordinary conditions

arise; in flooding the coffer when the river is near its top and too great a volume of water entering would endanger the permanent work, it is intended to place blocks behind alternate needles, as is often done in regulating pools above needle dams. In the event that this scheme should fail to pass a sufficient quantity of water to fill the coffer before it is topped by a rise, it is intended to use the passway as an emergency opening after constructing a temporary sluiceway.

The coffer-dam was closed Nov. 12, 1912. Inside were left both pump boats; the old derrick boat for use as a clam-shell dredge; and both pile drivers. A temporary sluiceway was constructed, discharging through the passway, and a coal track was built to supply fuel to the pump boat, which was temporarily located over the hole excavated for the lower gate track and recess. Gages had been set inside and outside the coffer and an inspector was kept on the pump boat continuously during the first pumping. The slope of the discharge water was measured in the sluiceway by a series of small gages set before pumping commenced, and the actual discharge while the pumps were making 350 r.p.m., was computed by Kutter's formula, using a coefficient of rugosity of 0.009, and found to be 24,000 gal. per min. for three pumps. An attempt was made to obtain more or less accurate estimates of the seepage through the coffer-dam at different heads. Since the pumpboat was floating, the vertical distance from water surface to center line of discharge pipes did not vary and the discharge was assumed as constant at 480,000 gal. per pump-hour as measured. The inside gage was read as closely as was possible (to hundredths of a foot) and recorded hourly and a careful record kept of the actual number of pump-hours run. The outside gage was read at 8 a.m., 12 m., and 4 p.m., and the river stage at other hours could readily be estimated. From the readings of these two gages the head on the coffer at any time could be computed. A careful survey had been made of the interior of the coffer by soundings on Oct. 31; from the data obtained by this survey a contour map was plotted on a scale of 1 in. = 40 ft., contour interval 1 foot, and areas were measured by planimeter at each foot of elevation through the probable range of water surface during pumping. The area of water surface at each hour was obtained by interpolation and the amount by which the water content of the coffer was reduced was computed by average end areas; the seepage during each hour was taken as the difference between the amount of water handled by the pumps and the amount by which the coffer content was reduced.

While conditions were such that an absolutely accurate estimate of seepage is impossible, the values given* are believed to be close enough for all practical purposes. It would seem that the seepage should vary as the square root of the head, following the well known laws for flow through pipes and orifices, the passage of the water through sand amounting to flow through an infinite number of minute pipes, but the values actually obtained as outlined above indicate a straight line variation, that is, directly as the head.

After the piles for the pump boat foundations had been driven and capped the coffer was allowed to fill, the boats were floated into position and pumped down, allowing them to settle on their foundations. Pumping was continued until the water surface inside reached an elevation of 310.7, when the coffer was accepted as satisfactory; it was then allowed to fill up to 316, and driving of round piles for river wall foundation was begun from floating drivers.

Seepage was apparently uniform around the entire coffer perimeter, since a single large leak would have resulted in great damage and the wrecking of a portion of the coffer-dam. Naturally, this seepage water collected into a relatively small number of rather large streams, moving toward the pumps, each of which caried a large quantity of sand, which was deposited in the still water where the pile drivers were floating. Taking care of the seepage was a simple matter, but serious difficulty was encountered in preventing the excavation from filling with this sand. The clam-shell dredge proved to be an inefficient and costly method of solving the problem.

On several occasions pile driving was suspended until sand thus washed in could be removed. It was thought that by building dams of sandbags across those streams the movement of sand could be stopped. This was done and proved to be very advantageous, but when water began to flow over the dams sand continued to move into the excavation, though in diminished quantities. A further diminution in this sand movement was effected by spreading a 6-in. layer of gravel over the greater part of the river side of the interior banking. In spite of all efforts, however, large quantities of sand continued to move into the "hole" and at the time work was suspended for the winter the problem of driving piles without constant excavating was still unsolved.

*A fair approximation to a straight line, varying from 18,000 gal. per inch at 2-ft. head to 15,000 gal. per inch at 5-ft. head. Ed. Eng. News.

Rates of Rainfall for Storm-Sewer Calculations

By J. A. Cushman*

Recently in making estimates for a sewer system the writer had occasion to use formulas for storm-water flow. The widely differing results obtained from different formulas led to further study of rates of rainfall. A tabulation was made showing for a considerable period of years all the storms of a greater rate than 0.1 in. per hr.

Since 1897, observations of rainfall have been made at four stations on the watershed of the Wachusett Reservoir (Metropolitan Water-Works of Massachusetts). The accompanying table gives the results at one station—Jefferson in the town of Holden, Mass. This point is in Worcester County, near the center of the state of Massachusetts, and at an elevation of 820 ft. above sea level, the measurements were made by weighing the amount of rainfall by means of properly graduated scales, and the results are probably characteristic and true for the central and south part of New England.

It is shown in the table that a rate of over 1 in. of rain falling in an hour is an exception, this rate occurring approximately three times in five years, and that a storm of over 1¾ in. per hr. is a rarity—only one occurring in 16 years. The table shows, moreover, that only once a year can a rate of over ½ in. per hr. be expected. Yet engineers are using McMath's formula which, although it takes the rate of rainfall into account, is

*Assistant Engineer Metropolitan Water-Works, Clinton, Mass.

RATES OF RAINFALL IN THE TOWN OF HOLDEN, MASS., 1897 TO 1912

Rate* / Year	0.1 to 0.2 Sh	0.1 to 0.2 Ra	0.1 to 0.2 Sn	0.2 to 0.3 Sh	0.2 to 0.3 Ra	0.2 to 0.3 Sn	0.3 to 0.4 Sh	0.3 to 0.4 Ra	0.4 to 0.5 Sh	0.5 to 0.6 Sh	0.6 to 0.7 Sh	0.7 to 0.8 Sh	0.8 to 0.9 Sh	1 to 1¼ Sh	1¼ to 1½ Sh	Over 2 Sh
1897	3	5	1	2	2	0	1			1		1		1		
1898	7	6		4	1		2	1		1		1				
1899	3	1			1				1	1	1			1	1	
1900	2	3		4	1		1				1		1			
1901	1	1			2		1		1							
1902	1	1	1		1								1			1
1903	3	2						1	1							
1904	1	2			1			1		2		1				
1905	2	1					1		1			1				
1906	5	6	1	3	3	0	1		2					1		
1907	2	6	0	1			2	1	1			1				
1908	6	7		3	1		2		1	1				1		
1909	5	4		3	2		1	1	2							
1910	5		3	7			2		1		2					
1911	8	3	1	1	1		1		1							
1912	3	5		1	1			1								
Totals 16 yr.	61	56	7	31	17		15	6	13	7	5	5	2	5	3	1
Occurrence	8-9 in 1 year			3 in 1 yr.			4 in 3 yr.		1 each yr.	1 in 2¼ yr.	1 in 3¼ yr.	1 in 3¼ yr.	1 in 8 yr.	1 in 3¼ yr.	1 in 5¼ yr.	1 in 16 yr.
Av. duration	44 hr.			41 hr.			24 hr.		14 hr.	1 hr.	1 hr.	35 min.	14 hr.	55 min.	1 hr.	20 min.

* Inches of precipitation per hour. Sh = Shower less than 3 hours duration. Ra = Rain more than 3 hours duration. Sn = Snow.

based on a rate of 2.75 in. per hr., and Fanning's, which apparently assumes a rate of 2.75 in. as a maximum and leaves no opportunity to reduce or correct this rate.

The whole question of runoff is extremely uncertain and depends not alone on the rate of rainfall, but on the porosity of the soil, the slope of the area under consideration, the characteristics of vegetation (cultivated, pasture, forested, etc.), the number of buildings, and possibly other factors. Without doubt, it is impracticable to attempt to devise a working formula for runoff. In fact the writer is inclined to think that, for the sake at least of calculations of sizes of sewer pipe required in city and town systems, it would be just as accurate and much simpler to say that the amount of storm water in cubic feet per second will be the product of the rate of rainfall (reduced to feet per second) by the area in square feet. It is at least on the safe side, and that is more than can be said of some of the existing formulas. Of course this result assumes that no water seeps into the ground and that it all gets to the sewer at the same rate that it falls. Assumptions (depending on local conditions) based on the various factors above mentioned may be made, and this large quantity may be reduced as much or as little as the judgment of the engineer may dictate. The amount of the appropriation may also take a hand in the process of reducing the amount of storm water to be taken care of in the sewers.

The total *quantity* of storm water brings in the factor of *duration* of heavy showers. The table shows that storms of excessive rates are showers of less than three hours' duration, in fact the heaviest rate, which was 2.40 in. per hr., lasted only 20 minutes, and with two exceptions all of the storms of more than 0.4 in. per hr. lasted less than two hours. Almost all these storms occurred in the summer time when the ground was most receptive. It is interesting to note that there were no snowstorms of greater rate than 0.2 in. per hr., and only seven in 16 years greater than 0.1 in. per hr.

Based on a study of these results, it seemed to the writer absurd to assume as a maximum rate of rainfall, in this part of the country, 2.75 in. per hr., and uneconomical to assume a rate of more than 0.5 in. per hr.

Growth of a Commercial Research Laboratory

The development of the physical and chemical research laboratory of the General Electric Co. in the twelve odd years of its existence shows many features of general interest. In 1901, Prof. W. R. Whitney, of the Massachusetts Institute of Technology, was engaged to organize a department of chemical and physical research. By the middle of that year the force employed had reached the number of five and this soon was increased to a dozen, but it was three years before Prof. Whitney left the Institute and devoted his entire time to this project.

The first laboratory was in one small room in an old building, but at the end of the first year it was necessary to remove to larger quarters. About the time Prof. Whitney took complete personal oversight of the work, the number of assistants had reached 35 and it was necessary to move again. Then the present quarters were secured, consisting of some 40 rooms, each about 20x20 ft. These all have good natural and artificial illumination and are piped for water, illuminating gas and hydrogen, with nitrogen, oxygen, steam, suction and compressed air in a few rooms. A complete system of wiring makes electrical energy available in each room with potentials up to 6600 volts, currents up to 200 amp. and power up to 150 kw. For furnishing this supply one room is equipped with some 15 motor-generator sets of up to 200 hp. variously arranged to secure the necessary range of voltages and frequencies. Of course, a machine shop and supply room are adjuncts, and there is a special library (distinct from the main technical library of the company in another building).

The department will move again shortly, for the company is building a seven-story brick building at a cost of about $300,000, exclusively for housing this department and the standardization laboratory. One of the features of this building will be an assembly room for the accommodation of general staff discussions which are held for an hour and a half on each Saturday morning.

Among the hundreds of investigations which have been brought to successful conclusions, some have stood out because of magnitude and importance of commercial results. Among these there should be mentioned first perhaps, the production of ductile tungsten for incandescent-lamp filaments. After that in close order come the development of the metallized-carbon lamp filament, the mercury-arc rectifier, the magnetic-arc lamp, silicon steel for transformers cores, special-alloy resistance wires, new electric furnaces and innumerable furnace products, the improvement of insulating materials and metallurgical operations, etc.

It is believed by the enthusiastic workers in this laboratory that the conditions here for successful investigation are ideal; each man is one of a group marked by its training and enthusiasm for chemical and physical study. The resources of the company back of the laboratory are varied and great, and it is assumed that, if the probable results of an investigation are sufficient to warrant its pursuit, then time and money are little considered. Some $200,000 is now spent annually on the laboratory.

One factor which has contributed much to the satisfaction with which men have pursued important investigations is the willingness of the company to publish his results at the proper time. This is done through papers before various technical societies by the principal investigators themselves. Instances of this are seen in the announcements which have been made from time to time of the use of boron for producing homogeneous copper castings, the production of ductile tungsten, the derivation of laws for conduction and convection transfer of heat from solids to fluids.

A Saving of $40,000 a Year in Water Filtration Cost at Pittsburgh, Penn., in 1912 is noted in the annual report of Charles A. Finley, Superintendent of the Water Bureau. This saving is attributed to improved methods of operation, particularly as regards sand handling. The new methods were suggested by George A. Johnson, of New York City, who was engaged in 1910 to report on certain features of construction and operation of the plant. Mr. Finley says:

> The principal changes in operating conditions within the filters were the introduction of the process of "raking" the filters between "scrapings," thereby securing additional yields from the filters at less expense than by continuous scraping, and a change in the process of restoring sand from restoring by machine to restoring from open hose lines under water.

An account of constructional changes in the Pittsburgh water purification plant, written by Mr. Johnson, appeared in our issue of Oct. 3, 1912, p. 610.

Two New State Public-Utility Laws

The States of Indiana and Missouri have recently adopted new public-utility laws which become effective soon.

INDIANA—The Indiana public-utility law, which becomes effective on May 1, abolishes the old railroad commission and confers its rights, powers and duties on a new Public Service Commission. This will consist of five members, not more than three of whom are to be members of one political party. Members are appointed by the governor for a four-year term and at a salary of $6000; the commission elects its own chairman. The governor also appoints a general counsel for four years at a salary of $6000. A secretary is provided at $3600 and a clerk at $3000. The employment of attorneys, engineers, experts, examiners, accountants, etc., is authorized.

The commission is given broad powers over the rates and services of public-service companies and authority over the issue of stocks and all evidences of indebtedness. It can ascertain and fix standards for testing the quality and adequacy of service and for the examination and testing of all related appliances. It can inquire into the management of business of all public utilities and obtain all necessary information, having the right to inspect books, accounts, papers, records, etc., and to examine under oath any officers, agents or employees. It is charged with the determination of proper and adequate rates of depreciation for the several classes of property of each public utility. It is required to keep itself informed of all new construction, extensions and additions, and to fix the form and manner of keeping construction accounts so as to distinguish between operating expenses and construction.

The statute defines a "public utility" as including municipally owned, operated or controlled heat, light, water, power, railway, telegraph or telephone companies; and "service" is construed to include not only accommodation for customers but also any product or commodities furnished.

The statute imposes many injunctions on public-utility concerns. They are required to keep and render uniform accounts such as may be prescribed, to have an office in some town or city of the state where some of its property is located, and there to keep its books and records. Adequate depreciation allowances must be carried and based upon the determination of rates of depreciation by the commission. These charges may be carried in a fund expended in new construction or invested in certain securities. Each company must forward rate schedules to the commission and keep copies open for public inspection. No stocks or evidences of indebtedness may be issued except for money or labor or property actually received and equal to not less than 75% of the value of such paper. Bonded indebtedness of any utility must bear a reasonable proportion to the total issue of capital stock, considering the nature of the business, credit, future prospects and earnings. Money received from the sale of securities must be applied to specified purposes.

The commission is enjoined from authorizing the capitalization of franchises, or rights to own or operate a franchise, in excess of the amount actually paid to the community as a consideration. On merging two corporations, the combined capitalization must not exceed the sum of the capital stock of the two constituents, except for new cash actually paid out. The law expressly states that the state does not indorse or guarantee any issue of securities. No utility concern can transfer or lease its franchise or system without the consent of the commission, and no concern can directly or indirectly acquire stocks or bonds of another corporation engaged in such business unless authorized to do so by the commission. Only upon the consent of three-fourths of the capital stock outstanding can two systems be jointly operated.

The law prohibits competition in any given territory unless the commission shall declare at the public hearing that public convenience and interest require it.

The law provides for issuing indeterminate permits which continue in force until a municipality exercises its inherent option to purchase the property, or until the permit shall be terminated otherwise by law. By filing a declaration of surrender prior to July 1, 1915, any public utility can exchange its existing license or franchise for an indeterminate permit. To secure a permit, a new utility must be a corporation organized under the laws of Indiana or be owned by a citizen of the state. The acceptance of such a permit is deemed to be a consent, without recourse to law or courts, to the future purchase of its property by the municipality in which the major part is situated and at a valuation to be fixed by the commission.

Free service, passes, special privileges and rebates are forbidden. All accidents attended with loss of human life must be immediately reported to the commission which may investigate and inquire into neglect or violation of any state law or ordinance.

MISSOURI—The Missouri bill, which was signed on Mar. 18, abolished the old railroad Commission, repealed the statute by which the municipal assemblies of various cities were impowered to create local utility commissions, and established a new state commission with broad powers and duties.

The new body consists of five members at a salary of $5500; $4500 is provided for an attorney; $3600 for a chief clerk; $1800 each for other clerks and $1200 each for stenographers. Examiners, accountants, agents, experts, engineers, inspectors, etc., may be appointed by the commission.

The commission is given control of the issue of all public-utility stocks and bonds and the regulation of rates and service. Depreciation funds of all utility concerns are required by this statute in accordance with the determinations of the commission, which also has the power to fix physical value for purposes of taxation and rate making. It has exclusive jurisdiction in the abolition of railway grade crossings and the distribution of the cost thereof. New railroad or street-railroad construction must be in accordance with a permit obtained from the commission. The commission may require three brakemen on freight trains if it deems necessary and may compel the general installation of electric head lights. It may demand additional switching facilities, improvements of track or rolling stock, the construction of stations, uniform accounting, and adherence to a fixed railroad schedule; judgment of adequacy of service and the proper handling of rolling stock is specifically laid upon the commission. The power to investigate interstate rates is also given and the right to apply to the Interstate Commerce Commission for relief when it desires.

Conditions of Small Water Purification Plants in Illinois*

By Ralph Hilscher†

In Illinois there are about a dozen water purification plants with rated capacities of about 2,000,000 gal. per day, or less, which involve the use of coagulants, settling basins and filters. Of these, with possibly two or three exceptions, it can be said that none produce an effluent that attains at all times the standard of purity that any municipality should demand for its public water-supply. Some of these plants yield an effluent during the major part of the time, which is of quite satisfactory quality, but fall far short of successful operation during periods of excessive turbidity and color in the raw water. Others produce an effluent at no time that is of good appearance and satisfactory from a hygienic standpoint.

The poor results realized are due largely to certain faults in design and operation, which are more or less common to these small installations. Many of the plants are of obsolete design, and in practically all the plants too great economy was attempted in building and certain essential features were omitted. The operation has usually been deficient due to lack of experience and expert advice in such matters. Certain faults largely responsible for the short-comings of these plants will be discussed.

CHEMICAL FEED

In a small plant the matter of economy in the use of chemicals is not of great importance, for the amount that can be saved by the greatest economy along this line is very small in comparison with other costs. What is most desirable is that the chemicals be added at as uniform rates as practicable, consistent with simplicity in mode of application. In many plants, however, simplicity seems to have been the foremost consideration, and greatly at the expense of uniformity in application. Undue economy also seems to have been attempted in some cases. Probably the simplest method of chemical feed, and the method used in a number of these small plants, consists of preparing the chemical solution and applying it in a single continuous operation. This is accomplished by placing the dry chemical in a small tank, through which there is a continuous flow of water, and allowing the overflow (carrying chemical in solution) to pass to the water receiving treatment.

The uniformity of dose administered by this method depends mainly upon the frequency with which the supply of undissolved chemical is replenished, and may also be materially affected by temperature. If the quantity of undissolved chemical is approximately the same at all times the strength of solution applied will be fairly constant, but very often operators cannot be depended upon to give this matter proper attention. In one instance a solution of iron sulphate was found to weaken about 15% in one hour, and at this plant it was the practice to recharge the tank only as often as once in about six hours.

The solubilities of chemicals are affected more or less by the temperature of the solvent. For instance, the solubility of iron sulphate in water at 45° F. is only about 66% of what it is at 70°. Alum, on the other hand, is but little affected in solubility by temperature, varying about 7% between 45° and 70° F.

The most reliable and simple means of feeding chemicals is probably by the use of a constant-head orifice box fed through a float valve from a tank containing a supply solution having a constant strength. By this means the uniformity of dose need be subject to no interruptions so long as the rate of pumping is constant, as is ordinarily the case in a small plant.

SEDIMENTATION

The period of sedimentation that should be given a coagulated water (previous to filtration) to afford the maximum efficiency for the entire plant depends somewhat upon local conditions. But as a general rule, it would seem that a detention period of at least four hours would be desirable with such waters as are found in most Illinois streams. In 12 small gravity filter plants in Illinois the theoretical settling periods range from zero to about 8.8 hr., and the average is in the neighborhood of 3.5 hr. In addition, there are a number of pressure filter plants where no sedimentation is provided.

These settling periods, however, figured as the total volume contained between the walls of the basins, are frequently not realized fully on account of improper baffling, which results in considerable dead space. In two instances there are provided circular basins with radial baffles, and the course taken by the water is around the inner and outer ends of these baffles, successively through the various compartments. With such an arrangement the rates of flow in different parts of the basin must necessarily be widely different, for in each of the compartments there is a large space in one corner that is of almost no service on account of its containing practically dead water. In a number of other instances there are basins of rectangular shape across which the flow is in a diagonal direction. In such a basin also there is dead water in two corners remote from the diagonal line of flow.

To obtain the fullest benefit from the available settling capacity a basin should have such inlet and outlet facilities as will effect a uniform rate of flow throughout the whole cross-section. This may ordinarily be accomplished easily by admitting the water to the basin through numerous small holes in a vertical wall at the inlet end, and by drawing it off over a weir extending across the outlet end.

FILTRATION

A variety of faults may be found with the filters themselves in various plants, especially in the older installations. The most objectionable features ordinarily lie in the method of control, in the facilities for washing the filters, and in the character of the filter medium. Other features of importance, such as arrangement of pipes and valves and convenience for operation, are also frequently open to criticism. A wide variation in the character of filter sands exists in Illinois, the effective sizes ranging from 0.28 to 0.85 mm., and the uniformity coefficients from 1.15 to 2.10. These sands are more often too coarse than too fine, a characteristic which makes filtration more economical but less effective.

In a number of plants proper control of the rate of filtration is not possible on account of the absence of automatic controllers on the effluent pipes. Without these the load of the filtration is certain to become unequally distributed between the various units. In two of the smallest of these plants, where but single filter units are installed, some pretense is made at regulating the rate by occasionally adjusting a gate valve on the effluent pipe, but the effectiveness of such control depends wholly upon the skill and watchfulness of the operator, which is undesirable. In washing filters, the ultimate consideration is economy. The main object should be to filter a given amount of water using a minimum amount of wash water, and of air if that be used for agitating the sand during washing.

The majority of plants are not provided with loss-of-head gages, so the operators cannot know when the proper time to wash, consistent with best economy, arrives. It is frequently the practice to wash once every 24 hr., regardless of the character of the water treated and of the real filter needs. In one plant the filters are so poorly equipped for washing that the filter medium much of the time is of a muddy, clayey appearance, while, as a matter of fact, when clean this sand is of excellent character for filter needs. The filter runs between washings here are at times only two hours. In another plant the amount of air used in agitating has been so great that the violence of washing has caused about one-third of the original sand to be lifted into the waste gutters and carried away.

OPERATION

Unfortunately the small city or water company cannot afford (or is not willing) ordinarily to make the necessary expenditure to obtain expert filter operation. As a result the operation is usually left largely to the pumping station engineman, who is possibly a good mechanic and well equipped for his own line of work, but who, frequently, has never even seen any other filter plant than the one of which he has charge. Very few plants are equipped with laboratory facilities for testing the quality of filtered water. In the majority of cases the only test is that of appearance, and even in this the standards at some places are surprisingly low. In two or three instances the water has a milky appearance a large part of the time; but this is not objected to because it is somewhat of an improvement over the water delivered previous to the installation of filters.

In fact, the local authorities have not, as a rule, had a fair understanding of what a purification plant should be able to accomplish, and there is rarely anyone who has the time or the inclination to look beyond his own experience enough to really appreciate the fact that the best results under the circumstances are not being obtained.

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*Abstract of a paper read at the annual meeting of the Illinois Water Supply Association, at the University of Illinois, Mar. 11, 12, 1913.

†Assistant Engineer, State Water Survey, Urbana, Ill.

New Intake for the Capilano Water-Works, Vancouver, B. C.

By H. M. Burwell.*

In the year 1906, an intake to the new 36-in. water-supply main then constructed for Vancouver, B. C., was placed at a point known as the "Pool," about ¾ mile upstream from the original intake at the dam, which has since been abandoned. This pool (Figs. 1 and 2) is formed by a reef of granite rock extending out into the channel of Capilano Creek, from the east side, and has a depth in the center of about 15 ft. at low water.

The intake pipe and racks were placed in the pool (see Fig. 1) just behind this point of rock, clear of the current of Capilano Creek, which is a very rapid running mountain stream, with a fall of about 80 ft. to the mile.

The deflection of the current by the above-mentioned point of rock caused an eddy in the pool behind, which had heretofore always kept it deep and free from gravel or sediment, and for this reason it was thought at the time to be an ideal location for an intake.

Subsequent experience proved that the slight alteration of the natural conditions caused by placing this intake, changed the eddy to such an extent that large quantities of sediment were annually deposited in what was originally deep water in front of the intake, greatly reducing its value.

After having observed the operation and effect of this intake for four years, it was decided to construct a new intake in the center of the point of rock referred to, so that the water entering into it would flow in a direction at right angles to the current of the Creek.

In a mountain stream of this nature, which, at freshet times, occurring once or twice a year (usually in the month of November), carries down great quantities of boulders, gravel and sediment, the advantage of this arrangement is obvious. The velocity of the creek current being very much greater than the velocity of the water entering into the intake, carries the most of the sediment past the intake which would otherwise enter into or pile up in front of it.

The new intake (Figs. 2 and 3) has a width of 10 ft. and height of 18 ft., the latter fixed by the highest known flood level during the last 25 years. The intake has reinforced-concrete side-walls and a concrete bottom, the entrance being provided with head-racks of oak strips set in angle-iron frames.

There are four racks, each measuring 5x9 ft., placed in guides, formed with an I-beam in the center, and channels set in the concrete walls. These racks extend from the bottom to the top of the intake and can be raked at any stage of the water and removed when desired.



Fig. 1. General View of Both Intake Sites



Fig. 2. Front View of New Intake, Showing Head Racks

Figs. 1 and 2. Old and New Intakes at Pool on Capilano Creek, Water-Works of Vancouver, B. C.
(The position of the old intake is indicated by the concrete pedestal. The eddy in the pool shows clearly in each view)

The upper section of the intake conduit, for a length of about 75 ft., was excavated through granite rock. In plan it has a sharp curve at a point about 10 ft. from the intake and below this point its width reduced to 7 ft.

The head gate is placed at a point 175 ft. from the intake and below this point the side-walls of the conduit are reduced to 10 ft. in height by three steps.

The conduit is an open concrete flume, and has a total length of 570 ft. from the intake down to the sediment tanks.

It is constructed throughout with side-walls 12 in. in thickness reinforced with ¾-in. round iron. Beams extend from one wall to the other to withstand the pressure of the earth banks.

The bottom of the flume has a thickness of about 12 in. and below the head gate it is also reinforced to withstand the upward pressure which is put against it during the high-water stages of the creek, owing to the porous nature of the ground.

The head gate is built of channel irons and has a

*Engineer-in-Charge Water-works Extensions, Vancouver, B. C.

width of 7 ft. and a height of 5 ft. 10 in. It is placed in channel guides set in the concrete walls and is operated by a long stem and spur-gear, which is fastened to the channel frame set on top of the walls. The gate opening at the bottom of the flume is 5 ft. in height and above this is a concrete bulkhead reinforced with steel rails.

There are two gates at the lower end of the flume

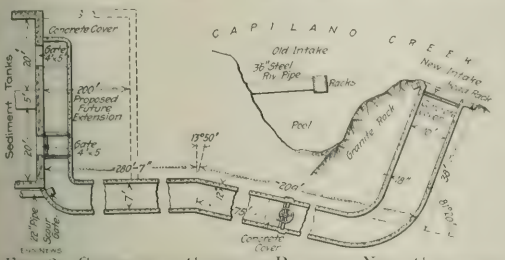


FIG. 3. CONDENSED GENERAL PLAN OF NEW CAPILANO INTAKE, FOR WATER-WORKS OF VANCOUVER, B. C.

which admit water into each of the sediment tanks. These gates are set in holes 4x5 ft., cut in the concrete wall of the tanks.

The new intake was put in operation in the month of August, 1912, and in the following November was subjected to a very severe test by an extremely heavy freshet



FIG. 4. LOOKING DOWN CAPILANO INTAKE TOWARD HEAD GATE AND SEDIMENTATION HOUSE

in the creek. It was observed, after the water receded, that not more than about one-quarter of the usual sediment was deposited in the tanks, and in every other respect the new intake has proven to be much superior to the old one.

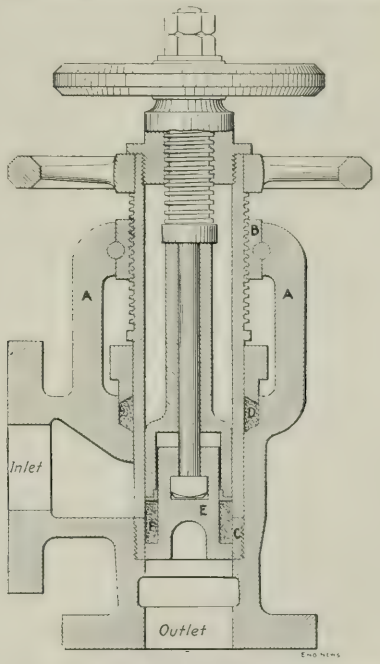
The intake was designed and its construction was supervised by the writer and the construction work was performed by the water-works superintendent of Vancouver with day labor.

A Double Plunger Angle Blowoff Valve

The accompanying cut shows a novel form of blowoff valve, which is so designed that it does not depend for its tightness on a metal to metal joint. The body of the valve and the yoke *A* are cast in one piece. A bushing *B* is inserted in the yoke and keyed in place by two bolts. The valve seat *C* has finished top and inside surfaces and is screwed into place so that it can be removed when necessary. The sleeve valve has its lower annular face ground to fit the top of the valve seat and leakage upward along the sleeve is prevented by packing at *D*. The plunger valve *E* is ground to a sliding fit inside the valve seat and packing at *F* serves to prevent leakage around the valve stem and also leakage past the valve seat to the outlet.

The cut shows the valve closed. To open it the upper handwheel is first rotated its full limit, drawing the plunger valve up until its lower face is flush with the bottom of the sleeve valve. The valve is then opened by rotating the lower handwheel. In closing the process is reversed.

These valves are made by the Eynon-Evans Mfg. Co.,



A DOUBLE-PLUNGER ANGLE BLOWOFF VALVE

of Philadelphia, Penn., in sizes from 1½ to 3 in., inlet diameter. They are tested to withstand 600 lb. per sq.in., hydraulic pressure.

Hydraulic Dredging on New York Barge Canal

By Emile Low*

SYNOPSIS—The excavation required for enlarging the New York State Canals to form the 12-ft. Barge Canal across the state amounts to 110,000,000 cu.yd. A large amount of this material is being removed by hydraulic suction dredges, which have been specially designed for the work. The record of the performances of these dredges will be of interest to every contractor and engineer who deals with earth handling. Descriptions of some of the most recent types of 20-in. suction dredges are included, together with the approximate costs of operating them, and the contract prices for excavation in the Barge Canal construction.

The enlargement of the New York State Canals requires the excavation of over 110,000,000 cu.yd. of material. Much of this excavation is being done by hydraulic dredges, supplemented by dipper and ladder dredges. Because the route of the enlarged canals, in large measure follows the alluvial beds of the Hudson, Mohawk, Oneida, Oswego, Seneca and Clyde Rivers, the conditions are particularly favorable for the use of hydraulic suction dredges.

Work of the Dredges "Oneida" and "Ontario" on Contracts Nos. 4 and 5

The first work of this character was done on Contract No. 4, at the eastern end of Oneida Lake, and further west on Contract No. 5, along the reaches of the Seneca River and through the Montezuma marshes by the Empire Engineering Corporation, with two hydraulic dredges, built especially for the work, after designs by the former president of the company, Lindon W. Bates.

These dredges, the "Oneida" and the "Ontario," were built so as to pass the locks of the present Erie Canal, and are of the following dimensions: length 97 ft., beam 17.5 ft. and molded depth to deck, 10 ft., with a light draft of 5.5 ft. To insure stability during dredging operations, pontoons were attached, one on each side. The dredges went into operation late in the fall of 1906. A full description of the dredge "Oneida" was published in Engineering News, of Dec. 5, 1907.

Owing to a change of location in the part of the canal under Contract No. 5, west of Fox Ridge, the dredge "Ontario" was transferred to Contract No. 4, during the spring of 1908. While on work on Contract No. 5, the dredge excavated 901,601 cu.yd., mainly during the year 1907. During four months of this period its average output was about 5300 cu.yd. per day, although at certain times it accomplished over 16,000 cu.yd. in a single day. After June, 1908, until the completion of the contract (No. 4), both dredges were employed on this work. Although three hydraulic dredges, the "Oneida," "Ontario" and "Owego" were employed on Contract No. 4 during the year 1908, the output was only about 700,000 cu.yd., the main reason for the small yardage being that the cutters were unsuitable for the material encountered.

A new cutter and other machinery were installed in the dredge "Ontario" during the winter of 1908-'09. The remodeled dredge during April, 1909, excavated 141,147 cu.yd. of material, working in a 25-ft. cut, of which the lower 5 ft. consisted of hard clay containing many boulders. One of these entering the suction pipe, caused a delay, which materially reduced the month's output. It may be added that blasting was necessary to loosen this material. The best output of the "Ontario" was during the month of June, 1909, when 172,844 cu.yd. were excavated, which, however, included a small yardage done by the "Owego."

The original estimate of excavation on Contract No. 4 was 2,280,000 cu.yd., the contract price being 14c. per cu.yd. The final estimate was 2,844,909 cu.yd. As about 30 months were occupied in the dredging operations, the average monthly output was about 90,000 cu.yd. which appears small when there are records of nearly 20,000 cu.yd. for a day of 24 hours. With the exception noted above the material pumped was a very fine sand, so light and friable when dry that the wind would blow it about.

Contract No. 4 is one of the first six advertised and let, the date of letting being Apr. 18, 1905. The contract extends 4.83 miles east from Sylvan Beach at the eastern end of Oneida Lake, up the valleys of Fish and Wood creeks. It was finally completed in July, 1910. The contractor's bid was $726,815, and the final estimate was $720,073.

Work of the Dredges "Champlain" and "Fort Edward" on Contracts Nos. 15 and 25

The Atlantic, Gulf & Pacific Co. is contractor for Contracts Nos. 15 and 25, on the Champlain canal, extending from Dunhams Basin northward to Lake Champlain, at Whitehall, a distance of nearly 20 miles. The engineers' estimate of excavation on Contract No. 15 was 2,900,000 cu.yd. and on Contract No. 25, 4,763,000 cu. yd., a total of 7,663,000 cu.yd. Certain alterations on Contract No. 25 increased the amount of excavation about 800,000 cu.yd. The contract price on No. 15 is 28½c. and on No. 25, 23c. per cu.yd.

Two hydraulic dredges built especially for these contracts began excavating in 1907. The "Champlain" on Contract No. 15, and the "Fort Edward" on Contract No. 25. During the winter of 1907-1908 numerous repairs and improvements were made on them, resulting in largely increasing the output. The dredge "Fort Edward" excavated 216,425 cu.yd. during the month of May, 1908, while the work of the "Champlain" was 204,838 cu.yd. during the same period, although about three days were lost in delays of various kinds. The dredges worked three shifts of 8 hours each, on 6 days of the week. Contracts Nos. 15 and 25 are adjacent pieces of work, operated under one management.

The "Champlain" during September, 1908, excavated 231,473 cu.yd. and the "Fort Edward" 255,859 cu.yd.; the output of the latter dredge during October, 1908, was 261,149 cu.yd. while dredging south of the Smiths Basin highway. Up to this time these were the largest monthly performances of single dredges on the canal construction. The actual performances of these dredges were considerably larger by reason of extra excavation which the contractor did for his own convenience in prosecuting the work. These additions increase the out-

*606 Ashland Ave., Buffalo, N. Y.

put of the "Fort Edward" by about 10,000 cu.yd. and that of the "Champlain by 28,000 cu.yd. for the month of September, 1908. The whole record of excavation for this month, including both paid and unpaid work, reached a total of more than 622,000 cu.yd.

Following these large monthly outputs the work of the two dredges rapidly fell off, hovering around the 100,000-cu.yd. mark during the favorable summer months and was very much less during the unfavorable spring and fall months. However, in September, 1910, the output of the "Champlain" reached 318,193 cu.yd. and in October, 1910, it excavated 500,352 cu.yd. of material. Although a part of the excavation came from below grade, the paid material was 470,352 cu.yd., a quantity considerably above the record of any other single dredge on the canal up to this date. Reduced to actual working time, 565 hr. and 35 min., the average yardage per hour was 885 cu.yd., or over 21,000 cu.yd. per day of 24 hours.

What interests the engineer and the contractor is the average output and not sporadic instances. The work of the "Fort Edward" occupied about 17 months, during which time about 2,400,000 cu.yd. of material was excavated, or at the rate of 140,000 cu.yd. per month. Dividing the operations of the "Champlain" into two periods, we find for the first, an output of 2,000,000 cu.yd. during 13 months—150,000 cu.yd. per month, and for the second period, 1,400,000 cu.yd. in 18 months, a monthly rate of 80,000 cu.yd. For the whole period, 31 months, the average monthly rate was 120,000 cu.yd.

Work of the Dredge "Geyser" on Contract No. 12

Contract No. 12, originally held by the Stewart-Kerbaugh-Shanley Co., extends from Brewerton, at the western end of Oneida Lake to the Montezuma marshes at Fox Ridge, and follows generally the course of the Oneida and Seneca Rivers, with occasional cutoffs where long bends occur.

The contract includes a length of nearly 44 miles, the longest on the canal. On account of the variable character of the material to be removed—7,090,000 cu.yd.—the excavation was divided into four classes or divisions: No. 1 comprising hard-pan, slate, shale and rock wherever occuring; No. 2 comprising the excavated and remaining rock of the so called State Ditch, east of Cross Lake; No. 3 comprising the cutoff bends, and No. 4 the channel excavation of the two rivers other than ledge rock, ranging all the way from the softest ooze, mud, silt, sand, muck, marl and clays, and comprising nearly one-half of the entire excavation, or 3,270,000 cu.yd. The contractor's bids for the four classes or divisions were respectively: $1.089, 56.1, 30.8 and 18.7c. per cu. yd.

For the removal of the soft material the contractors employ a hydraulic dredge, built by the Bucyrus Co., of South Milwaukee, Wis., which is named the "Geyser." The hull dimensions of the dredge are: length, 96 ft., beam, 29 ft. and draft, 9 ft. It will excavate material 19 ft. below the water surface and discharges its spoil at a distance of 1500 ft. through the pontoon pipes to a shore elevation of 25 ft. above water.

The steel A-frame at the bow supports the suction pipe and cutter head, the driving shaft and the gearing. The ladder is 33 ft. long and is pivoted at the inner end on one side of the elbow of the suction pipe and on the other side by a hollow pivot through which the cutter shaft is driven by a countershaft geared to a double 10x12-in. engine of 65 hp.

In the inboard suction pipe is a sluice provided with heavy bars to prevent large boulders from passing through to clog or break the pump. This latter is a 20-in. centrifugal, directly connected to a triple-expansion marine engine of 450 nominal hp., which will readily develop 550 hp. on overload. The pump is located about in the center of the hull, transversely to its length. The discharge pipe passes back on the port side to the stern, connecting with the pontoon pipe-line.

The boiler plant consists of two Babcock & Wilcox boilers, of about 230 hp. each, working under 160 lb. pressure. Duplex pumps are used to feed the boilers, to furnish water to the cutter-head bearing and for fire purposes. A 6-kw. generator supplies electric current for lighting purposes.

The line of pontoon boats which support the 20-in. discharge pipe is built and floated upon heavy water-tight casks, placed underneath. The steel discharge pipe is in 32-ft. sections on the pontoons and 16-ft. sections on shore. Connections between the pontoon pipe sections are made by means of heavy rubber sleeves fitting over the ball-shaped ends of the pipe. The shore lengths are adjusted by simple telescoping, no sleeves being required. At the shore end a terminal pontoon is used for the purpose of raising the end of the pontoon line to connect with the shore line. This is done by a block and tackle and an A frame, which supports one end of the pipe. For the pontoon line about 600 ft. of pipe are provided and for the shore line 800 ft.

The "Geyser" was placed in commission on July 7, 1908, and worked until Dec. 5, 1908, when it was closed down for the winter. During this period of 5 months' work, the dredge excavated about 450,000 cu.yd. of material, the average monthly rate being 90,000 cu.yd.

The "Geyser" when built was intended only for use in the softer material, but early in its operation it encountered a quantity of cemented gravel. To expedite matters, the dredge was driven through this gravel with no adverse results beyond a decrease in the output and a more rapid wearing of the cutter. This, however, was remedied by the substitution of a much stronger cutter, weighing some 7000 lb., which answered the purpose. This cutter is 5½ ft. in diameter, by about 4 ft. long.

No record of the output of this dredge for the season of 1909 is available. While working near Brewerton, the dredge became stalled on a bar in the river on Sept. 26, 1909, making it necessary to undergo repairs, after which the dredge worked during October, 1909. On Nov. 5, 1909, the dredge broke a cutter and was closed down for the winter on Nov. 8, 1909, partly dismantled and placed in the repair shop. Repairs having been completed during the winter, the dredge resumed work on May 16, 1910, in the land cut above Three River Point, the junction of the Oneida and Seneca Rivers forming the Oswego, where fair progress was made until August, 1910. Hard material was then encountered, which required blasting ahead of the dredge. The progress, therefore, was very slow, only some 25,000 cu.yd. of material being excavated in October, 1910.

Progress during the following three months was slow. The "Geyser" was shut down on Jan. 24, 1911, for re-

pairs. Work was resumed in April, 1911, but repairs were necessary during August, 1911, and, work was finally shut down for the winter on Dec. 22, 1911. Work was resumed May, 1912, during which month about 65,000 cu.yd. were excavated in the Oneida River, at Oak Orchard. During the month of June, 1912, the dredge worked intermittently, where material would permit; only about 38,100 cu.yd. was removed during this period.

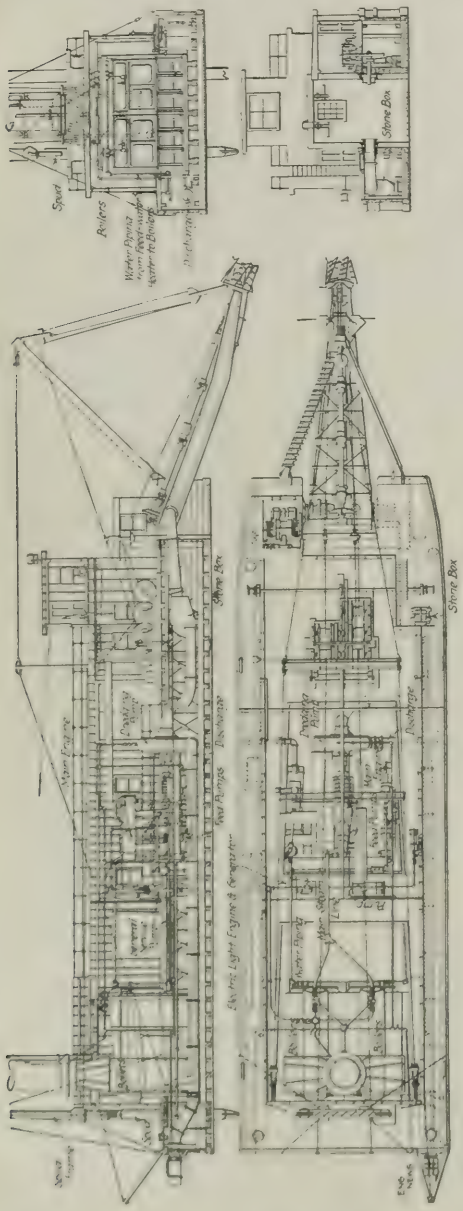


Fig. 1. General Plans for 20-in. Hydraulic Suction Dredges Built by Morris Machine Works

Description and Work of Dredge "Montezuma" on Contract No. 46

Six hydraulic dredges were built by the Morris Machine Works of Baldwinsville, N. Y., for various contractors of the enlarged canals. All these dredges are steam operated except the "Fairport," which is electrically driven, the main pump being directly connected to a 750-hp. electric motor. The general plans for these dredges are illustrated in Fig. 1.

The first of these dredges, the "Montezuma," is operated by the Kinser Construction Co., of Chicago, on Contract No. 46, which extends from Fox Ridge to the southeast corner of the town of Galen. This contract lies in the well known Montezuma marshes, the outlet of the Cayuga and Seneca Lakes. The main item of the contract is excavation, the original estimate of which is 5,035,000 cu.yd.; the contract price was 17c. per cu.yd.

Contract No. 46, extends from Sta. 5203, which is about 1 mile east of the crossing of the New York Central & Hudson River R.R. to Sta. 5700, a distance of about 9½ miles. The depth of cutting on the first 2½ miles runs from 18 to 20 ft., the upper layer is muck and marl about 4 ft. deep, under which the material is fine sand, here and there some clay and hardpan. The second 2½ miles lies in the bed of the Seneca River, with cuttings ranging from 3 to 12 ft., the material being muck and marl, clay and sand. The last portion, about 4 miles, parallels the Clyde River, and is in its bed for a short distance at the western end; the cutting is 20 ft. east of Lock No. 25, and 14 ft. west of it. The material on the third section is much the same as on the first and second, with possibly more hardpan.

The hull of the "Montezuma" is 117 ft. long, 35 ft. beam and 8 ft. 6 in. deep, and is built of wood. The machinery equipment consists of a 20-in. all cast-steel dredging pump with 84-in. diameter runner, directly connected to a triple-expansion engine with cylinders 15x22½x36-in. diameter by 18-in. stroke. There are two Babcock & Wilcox water-tube boilers having 5000 sq.ft. of heating surface and built for 200 lb. steam pressure. The cutter ladder is made of steel and is 45 ft. long. The cutter engine is 12x12-in. double cylinder. The main cutter-shaft is 8½ in. in diameter. The hoisting engine was a 8x12-in. double cyclinder, with 5 hoisting drums. In addition the dredge contains the usual equipment, such as surface condenser, centrifugal-circulating pump, 7½-kw. electric generator set, and a full equipment of pumps for boiler feed and for general service.

The "Montezuma" was built during the spring of 1909 and began dredging operations on June 15, 1909, in the Seneca River at a place known locally as Kipps Island, west of Montezuma. The first half-month's output was 68,110 cu.yd., working three 8-hr. shifts in a cut about 22 ft. deep. The output for July was 121,242 cu.yd., for August 251,741 cu.yd., and for September 462,010 cu. yd.; this latter quantity established a new monthly record for hydraulic dredges on the enlarged canals.

The peculiar nature of the material is largely responsible for the large yardage. There was no vegetable growth to clog the pipes nor hard material to retard progress. The excavation was made to the entire width and depth of the prism and 1600 ft. long, the banks being low and practically level, and the spoil area ample and

contiguous, the discharge through the line of pipe was greatly facilitated. But one dike, the front one was required, the spoil being retained at the rear by the embankment of the adjacent Erie canal.

The output of this dredge during October, 1909, was only 176,293 cu.yd., due to hard material encountered at the site of Lock No. 25, where blasting was necessary. This same material retarded progress during November, only 19,030 cu.yd. being removed, but the output increased to 136,518 cu.yd. in December following.

The highest output during the year 1910 was in May, when 175,630 cu.yd. were excavated. With the exception of January and April, the output for the remainder of the year was much below the 100,000-cu.yd. per month mark, reaching only 19,313 cu.yd. in December, 1910. This was due to the hardness of the material, drilling and blasting ahead of the dredge being necessary. A much better showing was made during the year 1911, the dredge working north of the present Erie canal. During the month of November, 318,011 cu.yd. were excavated in the vicinity of the West Shore R.R.



Fig. 2. Cutter-Head of the Dredge "Montezuma"

During the 7 months in 1909 in which the "Montezuma" was operated, the dredge excavated 1,235,244 cu. yd. or an average of 175,000 cu.yd. per month. For the 11 months of 1910, the figures are 915,850 cu.yd. and 83,000 cu.yd. and for the 12 months of 1911, 1,660,473 cu. yd. and 140,000 cu.yd., respectively. Figs. 2 and 3 show views of the "Montezuma" and give an idea of the character of the country traversed by this dredge.

Work of the Dredge "Clyde" on Contracts No. 47 and *B*

Contract No. 47 adjoins No. 16 on the west and is in fact a continuation of the same, extending from the southeast corner of the town of Galen to Lyons, a distance of 14½ miles. The new canal parallels the Clyde River for the entire length of the contract, here and there occupying the bed of the river where straight reaches make this possible. The contract is essentially one of hydraulic-dredge excavation, the engineers' estimate of which is 5,310,000 cu.yd. The contract price is slightly higher than on No. 46, being 19.9c. per cu.yd. The contract was awarded Nov. 30, 1908, and is held by the Crowell-Sherman-Stalter Co., of Cleveland, Ohio.

The hydraulic dredge on this work is known as the "Clyde." It was built by the Bucyrus Co., of South Milwaukee, Wis., and assembled at Clyde, N. Y., which is located about in the middle of the work under contract. The construction of the hull commenced Mar. 27, 1909, and the dredge was launched May 1. The boilers, engines and fittings were installed after the dredge was launched. No derrick was used and all the machinery was placed by hand. The "Clyde" has a timber hull 101 ft. long and 34 ft. wide, the discharge pipe is 20-in. The main engine on the pump is 500 hp., and is operated by two Babcock & Wilcox water-tube boilers of 325 hp. each.

Actual operations were commenced with the dredge on June 28, 1909, in the river at Clyde. The object in starting at this point was to dig a channel deep enough to float the dredge, also for boating coal and supplies to deep water below. In order to do this the dredge was required to excavate at least 2 ft. below grade to secure flotation. Between Sta. 6029 and Sta. 6011+62, 17,000 cu.yd. of hard material was removed, which consisted



Fig. 3. Dredge "Montezuma" on Contract No. 16

of gravel, clay and soft shale. The gravel was cemented together with clay and formed a very hard crust on the river bottom above the shale.

A view of the spoil bank which shows how the cobble stones, boulders and shale rock were piled in places 10 ft. high in front of the discharge pipe is given in Fig. 4. After working 14 days, the contractors decided that it was not practicable to continue in this hard material as it seemed to be racking the dredge. The close cutter used, was doing the work without blasting but the wear on the fittings and the strain on the hull were too great to risk a new dredge at that season, for a serious breakdown might delay further operations for months. Work was stopped at this point until a temporary dam was built in the river 3 miles below and the water raised to a sufficient height to float the dredge over the bars.

The dredge then moved down to about Sta. 5886 and started in the Heit cut, July 19, and cleaned up the prism entirely to Sta. 6871+60 by July 31, removing about 126,000 cu.yd. in thirteen days, of which 111,415 cu.yd. was paid for material. The actual amount of material removed in July was about 140,000 cu.yd.

On Aug. 4, the "Clyde" encountered quite compact

gravel at Sta. 5868+64, and a very strong effort to clean to grade was not made. An inspector was put on the dredge at this time with instructions to keep complete records of lost time, performance of dredge and progress in the different kinds of material. His reports show, from day to day, the elevations at which loose gravel was encountered, also that which was more firm and compact.

After working a few days in the gravel, cracks began to show on the shell of the pump and they became so serious that it was evident the shell would not hold together much longer unless it was handling light material. Not having an extra shell on hand, the dredge crew was compelled to abandon the cut at Sta. 5854+30 on Aug. 22. From Aug. 1, the dredge had removed about 135,000 cu.yd., or about 6100 cu.yd. per day. This amount is not up to the average and I believe could



FIG. 4. SAMPLE OF STONES AND BOULDERS EXCAVATED BY HYDRAULIC DREDGE "CLYDE"

have been increased by using a shorter discharge pipe while in the heavy material. The wear and tear in this cut was, I believe, negligible, considering that in the first cut, the wear was extremely heavy; and any ill effects on the dredge noted were probably caused by this heavy first cutting.

The dredge was then moved back to Sta. 5887+50, below the lower approach for Lock No. 26, and finished up to the lock on Aug. 30. The material was mostly soft clay and 80,500 cu.yd. were excavated in 8 days. From the lock the dredge was moved down the river to Sta. 5810 and began working Sept. 2. On Sept. 10, at Sta. 5830+45, hard material was again encountered being the same as found at Sta. 5854+30. The new shell had not yet arrived and the dredge was compelled to turn back. Working but 14 days in this cut the dredge had removed 193,000 cu.yd. of material which included about 13,000 cu.yd. of gravel, making an average of 13,800 cu.yd. per day.

On Sept. 19, the "Clyde" began at Sta. 5810 and worked down stream in the river. At Sta. 5805, the line again enters a land cut and intersects the river at Sta. 5778. This cut was 3200 ft. long, contained 275,000 cu.yd. of soft clay and was completed in 23 days, an average of 12,000 cu.yd. per day. On Oct. 12, the dredge entered the river at Sta. 5778. From this point the river is canalized. Heavy gravel was encountered and two days were occupied in installing the new pump shell. Gravel and logs delayed the progress on the river stretch until on Nov. 9, when 88,000 cu.yd. of material had been removed, which included about 35,000 cu.yd. of gravel. An average of only 3200 cu.yd. per day was maintained. The remaining excavation, 1800 ft. long, containing 127,000 cu.yd. of soft material, was excavated in 10 days and completed Nov. 19.

The dredge was brought back to the cut which before had been abandoned and resumed operations again at Sta. 5830+40. With the new shell, it was thought possible to go through the hard material and clean up all work east of the lock. But the material was too hard and on Dec. 3, after making about 800 ft. and removing 70,000 cu.yd. of which 31,000 cu.yd. was gravel, the cut was abandoned for the second time.

The only excavation remaining in this contract which was suitable for a suction dredge was between Clyde and the east end of the contract, was located above the lock and this, amounting to 70,000 cu.yd., was completed on Dec. 17. All the work that the dredge was able to do east of Clyde was finished and it was tied up for the winter, for it was impossible to move it over the rifts at Clyde until the spring flood.

Of the 172 days from the time the dredge began work until it was tied up for the winter, 18 days were lost in moving and repairing, making 154 working days, in which 1,181,500 cu.yd. of material was excavated, including about 166,000 cu.yd. of heavy gravel; 1,037,605 cu.yd. was pay material, which ran about 12% under the actual work done. The average per working day for the season was 7668 cu.yd. and about 3½ miles of canal was completed.

The following is a résumé of the work performed by the "Clyde" during the season of 1909, all the material excavated being east of Clyde: During July about 106,000 cu.yd. and during August, 210,000 cu.yd. were removed. This was increased during September to about 250,000 cu.yd. In October, 1909, the quantity of excavation was 192,000 cu.yd., and in November, 220,000 cu.yd. The dredge suspended operations for the winter on Dec. 15, 1909, up to which date it had removed 60,000 cu.yd. of material.

Necessary repairs were made to the dredge during January and February, 1910, and dredging operations were resumed on Mar. 25, 1910. Hard material resulted in slow progress and during the remaining days of the month about 525 lin.ft. of prism were excavated, making 8000 cu.yd. of material removed.

The dredge continued to work westerly from Clyde towards Lyons, reaching the crossing of the West Shore R.R. at Sta. 6293+80, Aug. 21, 1910, and was held up here until Sept. 7, 1910, awaiting the completion of a temporary railroad bridge. After that, operations were continued well into the winter of 1910-'11.

Owing to the large output of this dredge it is of interest to give the following details for the year 1910:

Month	Excavation. (cu.yd.)	Prism. (lin.ft.)	
April	204,000	5225	
May	319,000	5150	
June	70,000	1300	hard material
July	361,000	5075	
August	267,000		West Shore R.R.
September	157,000		
October	251,000	3173	
November	343,000		
December	26,000		
Total	2,010,000		

During the season of 1910, the dredge completed about

5.9 miles of the canal, removing 1,858,000 cu.yd. of pay material. This amount is the record for the year for any one contract on the whole line of canal. In all, the dredge worked 235 days, of three 8-hr. shifts each, averaging 7900 cu.yd. per working day for the season, and occasionally removed as high as 24,000 cu.yd. in 24 hours.

The front dikes on the spoil area were built by a Browning excavator, which handled a 1½-yd. scraper bucket. The majority of the back dikes were made of planks, which lessened the cost and proved entirely satisfactory.

Notwithstanding the winter weather, the dredge continued operations during the months of January, February and March, 1911, the monthly outputs being small, 13,392, 9580 and 3000 cu.yd., respectively. During March, 1911, the "Clyde" was removed to Contract B, Cayuga and Seneca canal, which is also held by the Crowell-Sherman-Stalter Co. This contract is for excavating a channel mainly in the Seneca River from Montezuma to deep water in Cayuga Lake, and from Cayuga Lake to Seneca Falls, and from Waterloo to deep water in Seneca Lake. The length of canal prism in the contract is 17½ miles; the engineers' estimate of excavation is 6,400,000 cu.yd., and the contract price is 21c. per cu.yd.

The "Clyde" began operations on Contract B, on Apr. 7, 1911, and continued work until Jan. 14, 1912, when it was laid up for the winter. The extraordinary outputs on this contract are worth giving in detail:

Month	Excavation, (cu.yd.)
April, 1911	139,000
May	286,617
June	368,584
July	272,712
August	533,561
September	117,466
October	214,035
November	118,058
December	118,344
Total	2,167,377
January, 1912	107,105
April	228,842
May	218,545
June	138,130
July	230,243
August	153,871
September	336,333
October	268,666
November	90,998
December	8,520
January, 1913	61,927
Total	1,843,180

It will be noted that the output for August, 1911, was 533,561 cu.yd. of material. This enormous output constituted a new record for the work of suction dredges in the construction of the enlarged canals. The nearest approach to this record was made by the "Champlain" on Contract No. 25 in October, 1910, with a month's output of 500,352 cu.yd. Before that, the record was held by the "Montezuma" on Contract No. 46, which excavated 454,706 cu.yd. during September, 1909, under somewhat similar conditions to those encountered by the "Clyde." Fig. 5 shows a view of the "Clyde."

This work of the "Clyde" was performed in a section of the canal extending into Cayuga Lake, for a distance of about a mile north of the New York Central & Hudson River R.R. bridge. The cut was made for the full width of 200 ft. of channel prism and for a depth of 2 ft. below grade. Deducting this additional 2 ft., amounting to 152,880 cu.yd., the record of pay material still stands at 480,681 cu.yd. The spoil was pumped about 1500 ft. through a 20-in. discharge pipe to the west and spread over a large area.

Owing to repairs the output was reduced during the month of September, 1911, and again in November, 1911, when on the morning of Nov. 16, a tube in the boiler of the dredge exploded, killing four men employed by the contractors. The dredging was stopped for 10 days while the boilers were overhauled.

The operating cost of this dredge for one month is approximately as follows:

1 chief engineer	$150
3 operators	$125 00 = 375
3 engineers	100 00 = 300
3 oilers	70 00 = 210
6 deckhands	50 00 = 300
3 firemen	60 00 = 180
3 helpers	40 00 = 120
1 pipe-line foreman	125
17 laborers	40 00 = 680
Total	$2440
700 tons coal	2 50 = 1750
Supplies	300
Building dikes	2,500
Superintendence	510
Total	$7500

With an output of 200,000 cu.yd. per month with 24-hr. days of three shifts, the operating cost would be 3¾c. per cu.yd.

Work of the Dredge "Mohawk"; Contract No. 20-C

Contract No. 20-C is for dredging in the Mohawk River channel between Dam No. 9 at Yosts and Dam No. 10 at Canajoharie, a distance of nearly 8 miles. The engineers' estimate of excavation, the main item of



Fig. 5. Dredge "Clyde" Which Holds Record of 533,561 Cu.yd. per Month

work, is 1,100,000 cu.yd. The American Pipe & Construction Co. of Philadelphia, Penn., is the contractor; the contract price for excavation is 51c. per cu.yd. The section when completed will form the pool between the dams mentioned above, and also Locks Nos. 13 and 14.

The material to be removed on this, as well as on the adjoining sections, consists of small and large boulders, gravel and sand. To get an idea of the character of the material, the contractor in November and December, 1909, dug four test pits, from 6 to 9 ft. square and to the prism grade. The test pits showed that a large percentage of the material to be removed consisted of fine sand, which would have to be placed well back upon the shore and beyond the possibility of scour. Actual operations, however, developed that more stone and gravel existed than the test pits disclosed.

A hydraulic dredge, the "Mohawk," was built by the Morris Machine Works of Baldwinsville, N. Y., for this contract, and was put in operation in November, 1910. Soon after work was stopped by cold weather. During the following winter some alterations were made in the dredge, and it resumed the next season's work on Apr. 11, 1911, making a cut 80 to 90 ft. wide and depositing about 23,000 cu.yd. in spoil. Figs. 7 and 8 show views of this dredge. To show better the workings of



FIG. 6. DREDGE "AMSTERDAM" ON CONTRACT NO. 20-D

the "Mohawk," its monthly output is shown in tabular form below:

Month.	Excavation, (cu.yd.)
April, 1911	23,000
May	
June	50,613
July	54,054
August	96,890
September	129,859
October	13,413
November	41,356
December	45,472
April, 1912	4,052
May	39,114
June	77,487
July	95,806
August*	55,428
September*	117,470
October*	206,645
November*	224,670
December*	18,123
Total	1,293,436

*The dredge "Mohawk" was engaged on Contract 20-D

The quantities dredged are only those above the prism grade. In the softer places in the river, the dredge excavated large areas several feet below grade, to afford room for the disposal of hard material, excavated by a dipper dredge. This material was loaded on scows and dumped in the low places excavated by the hydraulic dredge.

DESCRIPTION OF THE DREDGE "AMSTERDAM" ON CONTRACT NO. 20-D

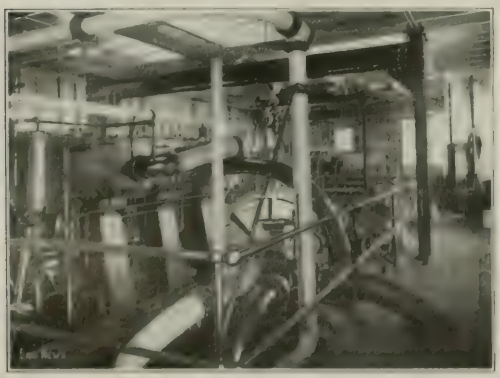
Contract No. 20-D is for channel excavation in the Mohawk River between the Rexford Flats aqueduct and Dam No. 9, at Yosts, a distance of 36 miles. The engineers' estimate of excavation, the main item of work, is 5,144,000 cu.yd. The contract is held by the American Pipe & Construction Co. of Philadelphia, Penn., the same contractor as for No. 20-C. The contract price is also the same for excavation, 51c. per cu.yd.

Hydraulic dredges can do most of the excavating, though some dipper dredge work will be needed. There is a considerable quantity of soft grade of rock included in the contract. A dipper dredge began operations May 18, 1911.

A hydraulic dredge, the "Amsterdam," has been constructed for this contract, the hull of which was launched in April, 1912. The machinery was installed by the Morris Machine Works of Baldwinsville, N. Y. The dredge hull is of wood, 137 ft. 8 in. long, 40 ft. wide and 10 ft. 2 in. deep. The ladder well goes into the hull 20 ft. 4 in. and is 16 ft. 6 in. wide. The main dredging pump has a 20-in. suction and discharge and is made throughout of manganese-steel with a runner 90 in. in diameter. The pump is directly connected to a three-cylinder triple-Expansion engine, with cylinders 17x27½x42 in. in diameter, all with a common stroke of 20 in. The engine operates with a steam pressure of 200 lb. and is capable of developing 1000 hp. It is of very heavy construction and built for high speed. The thrust bearing of the pump is water-cooled, and is of the marine type.

The suction and discharge piping within the hull is made throughout of manganese-steel; the piping is about 1¼ in. thick. There is a stone trap in the suction line to catch any material too large to pass through the pump.

The boiler equipment consists of four boilers built by the Heine Safety Boiler Co.; each boiler is rated at 225 hp. The boilers are arranged in two batteries, facing each other. Forced draft from a directly connected blower is employed in order to utilize an inferior grade of coal and in order to have short smokestacks. The con-





FIGS. 7 AND 8. VIEWS OF THE DREDGE "MOHAWK" ON CONTRACT NO. 20-C

denser equipment consists of a C. H. Wheeler condenser of 2000 sq.ft. of cooling surface. All steam is exhausted into the condenser except from a few of the smaller pumps which exhaust into the heater.

The air pump is of the vertical twin-beam type, size 7½x16½x10 in. There are two 8-in. Morris centrifugal-circulating pumps having 10-in. discharge and 10-in. suction, directly connected to an 8x8-in. vertical engine. These pumps are so arranged that either can be in service, one pump delivers to the condenser in one direction and the other in the other direction. Therefore by alternating the use of the pumps the condensers can be kept clear of any obstruction on the tube head.

There are two boiler feed pumps, each of vertical duplex Admiralty type, size 7½x5x6 in. There is also one water service pump of vertical duplex pattern, size 6x7½x6 in.; also a jet water pump ,of vertical duplex pattern, size 6x6x6 in. The feed-water heater is a Reilly multi-coil marine type and there is also a Reilly grease extractor, to remove any grease or oil from the feed water.

The ladder is 50 ft. long from the center of trunnion to front of cutter. It is made of steel throughout and is of very heavy construction, the depth of the ladder girder at the upper end being 42 in. The ladder shaft is 8½ in. in diameter with flanged coupling on the end, and is held in operating position by means of a multi-collar marine type thrust bearing.

The gears in the cutter drive are made throughout of cast-steel with cut teeth. The main driving gear on the ladder shaft is 14-in. face and 4-in. pitch. The cutter driving engine is a horizontal 12x12 in. double cyclinder of very heavy proportions, and is designed so as to operate at about 225 r.p.m. with the cutter making about 12 r.p.m.

The cutter is of cast steel with renewable blades, and is attached to the cutter shaft on a 10-in. square end. There is a water-sealed ring joint at the upper end of the ladder in the suction pipe to give the necessary flexibility in raising and lowering the ladder.

The winding machinery consists of a Flory five-drum engine with double cylinders 8¼x12 in. The engine is compound geared. The ladder drum is 24 in. in diameter. The two swinging drums are each 20 in. in diameter, and the two spud drums 24 in. in diameter each. The gearing throughout is made of cast steel. The winding machinery is operated from a lever house arranged on the roof in the forward end of the dredge. The lever house also contains the gages for watching the operation of the main dredging pump.

There are two spuds, each 23 in. in diameter, with very heavy cast-iron points. The spuds are handled from a gantry frame made of structural steel and so arranged that the frame may be lowered for passing under bridges with little trouble.

There is a 15-kw. electric generator set directly connected to a 7x7-in. vertical engine. The swinging wires are wire rope 1 in. in diameter. The ladder hoist and spud hoist are also wire rope ⅞ in. in diameter. All sheaves are made of steel and are 30 in. in diameter.

This dredge began actual operations in July, 1912. During August it handled 92,532 cu.yd. of material, sand and extremely heavy and large gravel. A view of this dredge is shown in Fig. 5. Since its installation, the monthly output has been as follows:

Month	Excavation, (cu.yd.)
July, 1912	13,155
August	[illegible]
September	47,200
October	73,702
November	67,488
December	6,089

Work of the Dredge "De Witt Clinton" on Contract No. 30

Contract No. 30 is for dredging a channel in the Mohawk River a part of the distance and alongside the river the remaining distance, between Little Falls and Sterling creek, a distance of nearly 15 miles. The engineers' estimate of excavation is 5,095,000 cu.yd., for which the contractor, the Acme Engineering & Constructing Co., receives 33¾c. per cu.yd.

A hydraulic dredge, built by the American Locomotive Co., named the "De Witt Clinton," began dredging on Aug. 20, 1910. The following table shows the output of this dredge from the time of beginning to date:

Month	Excavation, (cu.yd.)	
September, 1910	156,060	
October	201,100	
November	118,413	
December	173,882	649,755
April, 1911	161,000	
May	75,900	
June	103,200	
July	245,100	
August	52,523	
September	135,000	
October	57,000	
November	22,200	851,923
April, 1912	62,089	
May	233,159	
June	167,000	
July	99,437	
August	193,504	
September	90,348	
October	53,839	
November	100,000	
December	7,544	
January, 1913	7,100	1,014,020
		2,515,698

The reason for some of the low monthly records is that very hard material was encountered, making progress slow and also causing considerable wear of the pumping machinery. In the case of some cuts as much as 4 ft. of material had to be left in the bottom to be removed otherwise. Much of this material was gravel and cobble formation.

The largest output was in July, 1911, when 245,100 cu.yd. of material was excavated and 2400 lin.ft. of prism partly finished, some 3 ft. of material being left in the bottom. Also at times it was necessary to dig below grade so as to float the dredge, water being held by temporary dams. The winter months were employed in making alterations and repairs to the dredge, which is a 20-in. suction type.

Work of the Dredge "Niagara" on Contract No. 19

Contract No. 19 is for that section of the canal between Tonawanda and the Sulphur Spring guard lock, and is 12½ miles long. It lies for its entire length in Tonawanda creek, with three exceptions, where three sharp bends are crossed. The main item of work is excavation, of which the engineers' estimate is for the rock section, 240,000 cu.yd., the contract price for which is 60c., and the earth section 2,842,000 cu.yd., the contract price of which is 17½c. per cu.yd.

In the beginning the work of excavation was done by means of a cableway, a Page excavator, a dipper dredge and two clam shell dredges, the plant being augmented

later by the addition of the hydraulic suction dredge, "Niagara," which was launched in June, 1909.

Its output for the season of 1909 was as follows:

Month	Excavation, (cu.yd.)
June, 1909	27,000
July	63,840
August	116,063
September	70,345
October	69,351
November	187,558
December	55,907
Total	590,064

The normal working of the dredge was from 23 to 25 ft. from water level to the point of delivery. Operations for the season of 1910, were begun on Mar. 28, and the output was as follows:

Month	Excavation, (cu.yd.)
March, 1910	21,250
April	111,512
May	118,787
June	117,845
July	74,139
August	18,650
September	109,774
October	99,091
November	100,239
December	53,547
Total	934,537

During the month of April, owing to the immense weight of the spoil, the bank holding the same gave way and caused a large amount of material to slide back into the prism. A broken shaft during July caused a falling off in the monthly output. Up to this time the dredge worked in triple shifts.

For the season of 1911 the output per month was as below:

Month	Excavation, (cu.yd.)
April, 1911	31,000
May	74,652
June	26,231
July	113,289
August	36,410
September	27,700
October	20,301
November	17,980
Total	347,563

The small output was caused by working double shift only (two of 8 hours each), time lost on account of repairs, but principally because the material was very hard.

For the season of 1912, the output was also small, the dredge working double shift and rehandling material excavated by a dipper dredge; repairs also delayed the work:

Month	Excavation, (cu.yd.)
April	3,971
May	76,551
June	11,182
July	32,802
August	29,069
September	21,415
October	35,681
November	29,430
December	14,357
Total	254,458

Work of the Dredge "Fairport" on Contracts Nos. 63 and 49

Contract No. 63 extends from the Wayne-Monroe county line to Kings Bend. The amount of excavation on this contract is 2,772,000 cu.yd., the contract price is 33c. per cu.yd., the contractor is H. S. Kerbaugh, Inc., of Philadelphia, Penn.

An electrically operated dredge "Fairport" is in operation on this contract. Work began at the eastern end of the section under contract, in what is known as the Perrinton swamp on June 21, 1911.

The monthly output of this dredge has been as follows:

Month	Excavation, (cu.yd.)	
June, 1911	13,000	
July	80,000	
August	204,970	
September	98,000	
October	80,000	
November	90,376	On contract No. 49
December	59,993	On contract No. 49
March, 1912	18,270	On contract No. 49
April	133,583	On contract No. 49
May	31,414	On contract No. 49
Total	809,606	

This dredge was transferred to Contract No. 49 on November 13, 1911, continuing there until the middle of May, 1912, when it returned to Contract No. 63.

The material at the east end of the contract is sand which pumped easily, with an average output of about 7000 cu.yd. in 24 hours. In this material what is called an "open cutter" was used. Near Fairport a shale rock is encountered which runs in layers from 6 to 8 in. in thickness and is separated by a mud seam running about ½ in. thick. This material was removed by using a cutter with blades and teeth, which worked satisfactorily and broke up the material without blasting, but with small output, averaging about 1800 cu.yd. per day. We have no record of the dredge "Fairport," June, 1912, to date. Owing to hard material the output was very small.

Work of the Dredge "Stanwix" on Contract No. 43

Contract No. 43 is for that part of the canal which extends from Oriskany to Rome, paralleling the Mohawk River. The engineers' estimate is 5,017,500 cu.yd. of excavation; the contract price is 18c. per cu.yd. and the contractor is M. A. Talbot Co., of Baltimore, Md. This contract comprises the work on the eastern end of the Rome summit level, which extends from Oriskany on the east to the village of New London, on the west.

A hydraulic dredge, built by the Morris Machine Works, of Baldwinsville, N. Y., called the "Stanwix," operates on this contract and its monthly output is given below:

Month	Excavation, (cu.yd.)
July, 1911	86,258
August	95,740
September	135,919
October	73,259
November	77,561
December	35,624
January, 1912	47,454
February	17,288
April	20,000
May	86,675
June	93,681
July	145,696
August	90,464
September	53,566
October	83,800
November	105,673
December	60,750
Total	1,309,408

The following is a statement of the operations of the dredge "Stanwix," from July, 1911, to July, 1912: The dredge was launched in July, 1911, and started work at Sta. 6156, at Mill St., Rome, and worked east to the easterly crossing of the New York Central & Hudson River R.R., at Sta. 6097, and returning reached Sta. 6156 about the middle of December, 1911. After passing under the newly constructed Mill St. bridge and reaching Whitesboro St. in the early part of February, 1912, the dredge was put out of commission for two months. The present Erie Canal was cut through in April, 1912, and in the middle of July the westerly crossing of the New York Central & Hudson River R.R., at Sta. 6228

was reached. Working again eastwardly, the dredge has been excavating a 225-ft. widewater between Lawrence and James Sts.

The material east of the Erie canal is coarse gravel running out to muck west of James St. Practically all the material was pumped into embankment, 425 ft. south of the canal for the relocation of the New York Central & Hudson River R.R. This embankment ranged from 10 to 20 ft. in height and is 85 ft. wide on top. The material is discharged between dikes thrown up by Lidgerwood excavators.

Delays, aside from time consumed in passing under bridges and through the Erie canal, were caused by the necessity of replacing the pump shells which were twice worn through by the gravel, which delayed operations for about two days each time. Delays were also caused by the necessity of repeatedly heightening the dikes west of the Muck road. The softness of the material excavated here caused the dikes to break down very often.

The output as shown above does not represent the quantities actually excavated as a great deal of the fine material was deposited on the canal bottom west of Mill St. from the return water, and during July and August, 1912, there was a large amount in the widewater for which the contractor was not paid.

Work of the Dredge "Palmyra" on Contract No. 77

Contract No. 77 is for the construction of the new canal from Port Gibson to Palmyra. The engineers' estimate for excavation is 2,657,980 cu.yd., for which the contract price is 38c., the contract being held by the T. A. Gillespie Co., of Pittsburgh, Penn.

A hydraulic dredge named the "Palmyra" commenced operations on July 6, 1911. The following table shows its output from that time to date:

Month	Excavation, (cu.yd.)
July, 1911	14,274
August	35,000
September	63,753
October	243,766
November	67,681
December	60,000
January, 1912	8,264
February	26,966
March	30,445
April	95,972
May	58,467
June	166,972
July	64,180
August	44,427
September	72,100
October	11,742
November	71,542
December	39,559
January, 1913	43,000
Total	1,107,110

The following statement shows the cost of operating this dredge one month, working three shifts of 8 hours each:

1 captain		$250
1 chief engineer		175
3 engineers	$150.00	450
3 levermen	150.00	450
3 mates	100.00	300
6 firemen	70.00	420
3 oilers	70.00	210
13 deckhands	60.00	780
1 pipe line foreman		125
26 laborers	1.75 per day, 26 days	1183
Total labor cost		$4343
Miscellaneous expenses, fuel, etc.		1657
Total		$6000

Assuming the monthly output as 60,000 cu.yd., the operating expenses per cu.yd. would be 10c.

The following, relative to the character of the material on Contract No. 77, has been furnished by M. J. Coffey, Superintendent for The T. A. Gillespie Co.

When the dredge started to work in the year 1912, there was a loam on top for about 4 or 5 ft. in depth, but underlying this was a bed of boulders, many of them so large that they would not go through the dredge, which greatly hampered the working of the dredge, cutting down the output to almost nothing, as well as causing some breakdowns. Then a ledge of very hard material was encountered in the bottom, which was practically rock. The canal line follows the valley of Mud creek: the stream is very crooked and the canal crosses it a number of times.

In October, 1911, and June, 1912, the dredge was working in pretty good material for a hydraulic dredge—loam and sand, in some cases practically a quicksand.



Fig. 9. Dredge "Lyons" on Contract No. 48

The discharge pipe line varied in length anywhere from 1200 to 4000 ft. The long pipe-line was necessary because the spoil is discharged on lands appropriated by the state for this purpose, which was not always alongside the prism.

Work of the Dredge "Lyons" on Contract No. 48

Contract No. 48 is for that part of the canal extending from Lyons to East Newark. The engineers' estimate of excavation is 2,002,500 cu.yd., for which the contract price is 48c. The contractor is the Crowell-Sherman-Stalter Co., of Cleveland, Ohio.

A suction dredge named the "Lyons" was launched on Aug. 31, 1911, and commenced work on Oct. 24, 1911. The "Lyons" (Fig. 9) was built by the Bucyrus Co., of South Milwaukee, Wis. Its operations were confined wholly to the eastern end of the contract, east of Lock No. 28-A where the material is muck, red clay, sand and gravel. The dredge "Lyons" operated until Sept. 15, 1912, and was then laid up for repairs. The following is the monthly record of its operations:

Month	Excavation, (cu.yd.)		
October, 1911	11,067	12,696	dredged on contract No. 47
November	191,360	11,745	dredged on contract No. 47
December	46,683		
January, 1912	50,774		
February	41,030		
March	88,963		
April	153,871		
May	140,200		
June	40,000		
July	53,000		
August	63,000		
September	23,000		
Total	902,948		

Description of 20-in. Hydraulic Dredge of the "Lyons" Class

The following is a detailed description of a Bucyrus dredge of the same general type as the "Lyons" but slightly less in power:

HULL—Steel, 104 ft. long by 34 ft. wide and 9 ft. deep. The dredge is adapted to dig to 22 ft. below water level with ladder inclined to 40° and discharges through 1500 ft. of floating and shore pipe at a height of 25 ft. above water level.

DREDGING PUMP AND ENGINES—The pump has a 20-in. inlet and discharge. The runner is 78 in. in diameter. The casing and heads are of nickel-chrome-steel castings and are made very thick where the greatest wear comes on them. The casing is not lined. The runner is a single nickel-chrome-steel casting having five curved arms mounted on a forged steel shaft 8 in. in diameter. The pump is direct connected to a vertical triple-expansion marine type engine of 520 hp. running 230 r.p.m. and has steam cylinders 13½ in., 20 in. and 33 in. by 16-in. stroke.

CUTTER HEAD—The cutter head is a single nickel-chrome-steel casting 5 ft. 10 in. in diameter and has six blades and renewable cutting edges fastened to the inside of the blades. It is mounted on a forged-steel shaft 7¾ in. in diameter and is driven by a 10x14-in. double engine through heavy steel gearing.

OUTBOARD SUCTION PIPE—The outboard suction pipe is of 20 in. in inside diameter made of lap-welded steel pipe ½ in. thick, having a suction head on the outboard end with bearings for supporting the cutter-head shaft. It connects with the inboard suction pipe by two cast-steel elbows, one of which revolves on a horizontal axis. The pipe will be braced by structural framework hinged to the bow of the hull. The inboard discharge pipe is lap-welded steel ½ in. thick in the straight stretches with cast-steel elbows. Between the pump and the intake pipe a stone box is provided with a manhole to permit removal of any stones stopped by the grating at the pump intake.

DISCHARGE PIPE—The inboard discharge pipe is of lap-welded steel pipe ½ in. thick. The outboard discharge is ⅜ in. thick riveted in 20-ft. sections, having a total length of 700 ft., and is provided with rubber sleeves and floated on pontoons. The remaining 800 ft. are provided with telescopic joints for shore disposal. The pontoons are of the barrel type, consisting of four large water-tight hogsheads connected by timbers upon which the discharge pipe rests, but with sufficient deck to facilitate working on the pipes.

WINCH AND OPERATING LEVERS—The winch is driven by double engines having cylinders 8½ in. in diameter by 8-in. stroke and has five drums, two for the swinging line, two for handling the spuds and one for raising and lowering the suction pipe. It is also provided with two winch heads, which can be used for handling scows, etc. The operating levers are concentrated in the pilot house so that the machine can be operated by one man.

SPUDS—There are two steel spuds, 22 in. in diameter, having sharp chisel-shaped steel points.

DECK SHEAVES AND FAIR-LEADS—All necessary sheaves and fair-leads were furnished. The sheaves are all made of steel and are 24 in. in diameter.

BOILERS, FEED PUMPS—Two Babcock & Wilcox boilers, having a heating surface of 2350 sq.ft. each and adapted to work at 160 lb. pressure are provided. Two feed pumps of adequate size are furnished and were fitted with connections so that they may be used for fire purposes or for washing decks. One surface condenser, having 1250 sq.ft. of cooling surface is furnished, with the necessary circulating and air pumps and feed-water heater.

BILGE PUMPS—Six steam siphons and a connection from the circulating pump with the inside of the hull were furnished for removing the bilge water. The connection from the circulating pump to the inside of the hull was one that could be used in the case of an emergency. The steam siphons were quite able to take care of any ordinary leak in the hull that might occur.

ELECTRIC-LIGHT PLANT—An engine and dynamo capable of supplying current for 100 incandescent lamps, together with the necessary instruments mounted on a slate switchboard are furnished.

INCIDENTALS—Pump and piping to provide water for bearings of main engines and dredging pump and for cutter-head shaft bearing in suction head are furnished. Also the necessary whistles, bells, speaking tubes, gages, etc.

In addition to the hydraulic dredges enumerated above, there were dredges of this class employed on Contracts Nos. 20-A, 30, 41 and 42 of the Erie canal and Contracts Nos. 27, 72 and 73 of the Champlain canal. The suction and discharge of all these dredges are 12 in., except on Contract No. 30, where a remodeled dipper dredge has a 16-in. discharge, and on Contract No. 73 where the size is 20 in. In addition there are a number of dipper dredges engaged on various contracts, there being four employed on Contract No. 12.

On Contract No. 20-B there is a so called hydraulic disposal boat, material being supplied by two dipper dredges, the large stone discharged into scows and the finer material pumped ashore. Two ladder dredges are at work on Contract No. 12, the "Cyclone" and the "Tornado," on Contract No. 60, the "Mohawk," and on Contract No. 66, the "Mineola." The monthly output of the ladder dredges is not large, being about 25,000 cu.yd. That of the dipper dredges has reached as high as 50,000 cu.yd. per month, while the monthly output of the smaller hydraulic dredges is from 15,000 to 27,000 cu. yd. per month.

A Typhoid Epidemic Caused by Uncalked Joints in an Intake Pipe*

By W. M. Cobleigh†

During the summer of 1909 a typhoid fever epidemic broke out among the railway employees in Laurel, Mont. There are two water systems supplying the city. One furnishes water to the people living in the original townsite, and the other furnishes water to the residents of a new addition built by the Northern Pacific R.R. There were about 100 cases of typhoid fever in the railway addition, and the older part of the town was practically free from the disease. This fact and other circumstances quickly indicated that the water-supply of the addition was the source of the infection.

This water-supply is taken from the Yellowstone River through a cast-iron intake pipe which delivers the water to a large brick-lined pump well. A pumping plant at this well forces the water to tanks in the railway yards a mile away.

A sewer system discharges into an irrigation canal at a point near the pump well and the sewage flows in an open ditch directly over the cast-iron intake pipe and as the ditch overflowed at times a large area of soil was polluted.

The intake pipe from the river became partially clogged with sand and there was in consequence a shortage of water in the well. To increase the water-supply in the well, surface water was piped into it from a point above the sewer outlet for a few days only. Two or three weeks after this a typhoid epidemic began. The infection could have come either from this surface water, or from ground water contaminated by sewage entering the intake pipe through uncalked joints. The writer was called on to report on the sanitary condition of the water system.

Samples were analyzed of the river water at the intake and of water from one of the tanks in the yards. The results were as follows:

	First test Parts per million		Second test Parts per million	
	Intake	Water tank	Intake	Water tank
Total solids	161	740	182	611
Free ammonia	03	13	05	05
Albuminoid ammonia	17	09	13	15
Nitrogen as nitrites	Trace	0091	0036	0024
Nitrogen as nitrates	Trace	22	Trace	23
Chlorine	6 1	14 8	1 5	9 5
Sulphates as SO_4	25 0	350 4	12 1	300 4

A comparison of the results indicates very plainly that the pumps were not delivering pure river water to the tanks. The high solids, sulphates and chlorides indicated that ground water was entering the system in large quantities and that it was no doubt contaminated, as shown by high free ammonia and nitrites. In this connection it should be stated that the well and the intake pipe line were located in wet ground highly charged with "white alkali," which is high in sulphates.

In a report to the railway company the writer stated that the ground water entered the system either by seepage into the well or by leaks in the intake pipe line. The company officials, having confidence in the construction of the pipe line, decided that the well was the cause of the trouble and therefore connected the intake pipe directly to the pumps so as to pump water directly from the river. When this change was completed analyses were again made and proved that ground water was still entering the system and that a faulty pipe line was no doubt the cause. To locate the position of the leaks in the line, the pumps were stopped and water from the tanks was allowed to flow through the pipe to the river. In a few minutes the water appeared on the surface of the ground over the intake pipe.

This intake pipe was then dug up where the leaks were evident and it was found that the cast-iron pipe had been laid for a distance of about 400 ft. without calking the joints.

The leaky joints in the pipe line were calked and the pumping plant was put in shape to deliver to the tanks river

*Abstract of a paper prepared for the annual meeting of the Illinois Water Supply Association, March 11, 12, 1913.

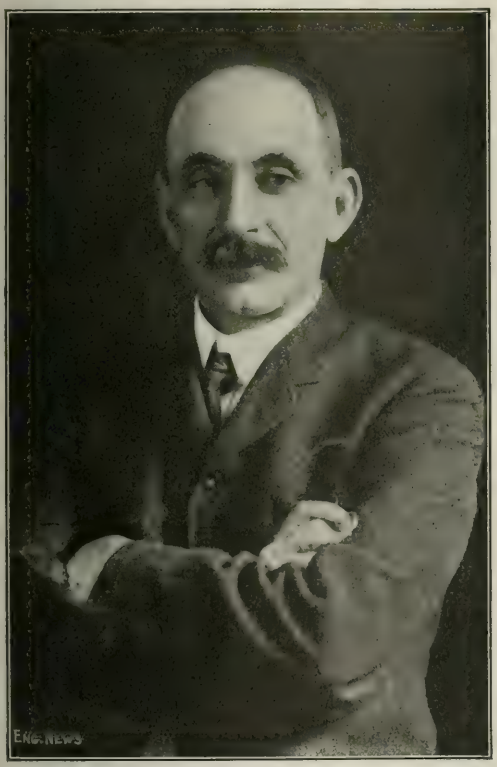
†Professor of Chemistry, Montana State College, Bozeman, Mont.

water which was not contaminated by ground water. The system has been in use for domestic purposes now for several months and no typhoid fever or enteritis has been reported since the repairs were completed.

In justice to the engineer who put in the water system for the railway company, it should be said that when the plant was first started, it was intended to supply water for engine use only. The intake pipe line was not calked because it was intended to be used as a gravity line; but the fact that this line was in wet ground high in white-alkali was overlooked as was also the possible effect of the sewage disposal system on the purity of the water.

Ira N. Hollis, the New President of Worcester Polytechnic Institute

Announcement has been made that the trustees of the Worcester Polytechnic Institute, Worcester, Mass., have elected Prof. Ira N. Hollis, of Harvard Uiversity, President, to succeed Dr. L. L. Conant, Professor of Mathematics, who has been Acting President since the resignation of Dr. Edmund A. Engler, two years ago.





Prof. Hollis was born near New Albany, Ind., in 1856. He was educated in the public schools of Louisville, Ky., and after a year's work as apprentice in a machine shop and foundry, he was appointed to the U. S. Naval Academy at Annapolis, Md. He graduated at the head of his class in 1878 and was appointed a member of the Engineer Corps.

The succeeding 15 years were spent in various work in the Navy, both at sea and on shore. After service at the Union Iron Works, San Francisco, Calif., in the inspection of machinery, he went to sea as Chief Engineer of the U. S. S. "Charleston," then the flag-ship of the Pacific Squadron. One of her long voyages was the well remembered chase of the filibuster "Itata," a merchant ship taken by the insurgents in the Chilean War, and loaded with arms in California. At Iquiqui, where she was surrendered to the American fleet, Lieut. Hollis volunteered for service in her, and for his work was commended officially to the Navy Department by Admiral McCann.

He returned to the United States in the "Itata," which was delivered to the United States Marshal at San Diego, Calif., in July, 1891.

In January, 1892, he was ordered East and served under the late Rear-Admiral Melville until October, 1893, when he resigned to take the Professorship of Engineering at Harvard University.

During the summer of 1892 he delivered a short course of lectures at the Naval War College on "The Ships of Our Modern Navy." These lectures were afterward issued to the service in book form.

At Harvard he was charged with the duty of developing the engineering instruction, and he remained at the head of the Department for 16 years. It was during these years that he did much work in connection with student activities, in that way coming into intimate relation with student life outside of the class-room. He was Chairman of the Athletic Committee for seven years while Soldiers' Field was being turned into a recreation ground for the students. During this time the whole field was regraded, and the boat house, the ball cage and the Stadium were built.

Prof. Hollis has also been for many years a trustee of the Harvard Union, and a director of the Cambridge Trust Co., the bank where many professors and students have their deposits.

In 1898, Prof. Hollis was associated with Rear-Admiral Wainwright in the reorganization of the personnel of the Navy, and the bill written by them was used as a basis for action in Congress. He has served twice on the Board of Visitors at the Naval Academy.

In 1899, he received the honorary degree of A. M. from Harvard and has since received honorary degrees from other institutions. He is President of the Engineers Club of Boston, Vice-President of the American Society of Mechanical Engineers, Past-President of the Boston Society of Civil Engineers, and has served on the Council of the American Academy of Arts and Sciences. He is a member of the Society of United States Naval Engineers, the Society of Naval Architects and Marine Engineers, the Society for the Promotion of Engineering Education, and the Massachusetts Military Historical Society. He has contributed many articles to engineering and naval journals, and in intervals of leisure he wrote the "History of the Frigate Constitution." The final summing up of his career at Harvard is best shown by an abstract of the student editorial of the "Harvard Crimson."

The announcement that Prof. Ira Nelson Hollis has been elected president of Worcester Polytechnic Institute makes Harvard men rejoice at the signal honor that has been bestowed upon him, but it also brings them intense regret because it means the loss of a great teacher and steadfast friend. The admiration with which all Harvard men regard him illustrates the influence a teacher of strong personality may wield when he tries to know and serve his students outside the class room.

A New Type of Sewage Sedimentation Tank, Mount Washington, Md.

By Howard T. Oliver*

The latest method of treating sewage is that in operation at Mt. Washington, Baltimore County, Md. The process consists of a thorough sedimentation in a tank so arranged with baffles and compartments that the more heavily loaded waters at the bottom are retained a longer period; the deposited sludge is siphoned off to be deodorized in a separate chamber, while provision is made to disinfect the effluent after leaving the tanks. At present the effluent is discharged from the sedimentation tank to the neighboring stream in a stable condition, because of the efficiency of the tank in removing 80% of the settling solids and the fact that the sedimentation takes place near the source of the sewage.

Speaking generally, the problem of sewage disposal will be simplified if the process of sedimentation be allowed to take place near the source of the sewage; there will be a greater percentage of solids removed and there will be less organic matter in solution after the removal, for, the farther that sewage travels: the more broken become the solids and the less their subsiding value; the more colloidal forms of no subsiding value there are; and the more bacteria and organic matter are released to solution. Removing the solids near the source permits a higher degree of sedimentation, gives a greater opportunity for the absorption of atmospheric oxygen, and relieves any necessary final treatment of a large percentage of overburdened and unstable waters.

The type of tank used at Mount Washington seems especially adaptable to the idea of separating the solids early in the course of the sewage: the space occupied is small; the cost of construction and maintenance is relatively low; the percentage deposition effected is high; the inlet and outlet may be at the same level; and the tanks may be built underground and so be placed anywhere within a sewer system.

There are few cities where it would be impracticable to group sections of 40,000 to 80,000 population so that the sewage might be treated in a fresher condition to give better and cheaper results.

Mount Washington is a residential suburb covering about two square miles north of the city limits of Baltimore. The present population is about 5000. The sewage is entirely free of trade wastes or other complications and is carried to the plant in separate sewers of 24-in. and 12-in. mains (see view, Fig. 1). The plant is now owned by the County of Baltimore, having recently been purchased from The Baltimore Suburban Sewage Disposal Co This company constructed the tanks, following designs and directions of Messrs. A. H. Wehr, of Baltimore and M. J. Wiest, of Govans, Md. The plant is at present operated under the supervision of Mr. Wiest. It is neat and compact, the effluent is clear, and there is a complete lack of odor about the premises; built of reinforced concrete, it does not give an unattractive appearance to the neighborhood.

Referring to the plan (Fig. 2), it will be noticed that on leaving the sewer the sewage flows through an 8-ft. channel into a grit chamber for the removal of sand deposits; this chamber has a plain V-shaped section 4 ft. deep and 8 ft. long, and is cleaned out weekly. From the grit chamber the waters pass through bar screens for the removal of débris; for this purpose bars ¼ in. thick are placed with a clearance of 1 in. and leaned slightly downstream. Bypasses have been provided for emergencies of sudden increased flow to carry the waters directly to the tanks.

Each unit is one tank (Fig. 1), but divided by partition walls into eight compartments. The first compartment serves as inlet and outlet, these being separated by a longitudinal baffle which extends through all the compartments, but is cut away in the last to allow the stream to return on the outlet side. This center baffle does not extend to the bottom of the tank, but terminates in a flared end, 5½ ft. above the bottom, in such a way that the upper waters are divided, but the lower waters of the influent and the effluent join. Other longitudinal baffles, on either side of the center baffle, extend from the top of the tank vertically to the level of the outlet, then flare inwardly to near the center baffle. These tend to a greater displacement of the waters and to prevent lateral



Fig. 1. View of Sewage Sedimentation Tanks, Mount Washington, Md.

and vortexual motions; they also serve, to a large extent, to hasten the deposition of the solids, for in any up and down movement of the sewage in the tank the particles have only a partial opportunity to rise again to the surface and to be carried on.

The sewage enters the first compartment between the displacement baffle and the center baffle, but enters the second compartment over the partition wall on both sides of the displacement baffle and so continues through each compartment to the last from where it passes to the outlet side of the center baffle and returns to the first compartment; here the outlet is confined to the space between the center baffle and the displacement baffle on the far side.

Each compartment is provided with bottoms sloping downward from each side toward the center, providing an increased floor space and retention chamber for the deposited solids. In each compartment there is a siphon which serves to carry off the sludge from the floor to a connecting pipe line, thence to the sludge deodorizing basin; each individual siphon is provided with a valve to regulate the flow of the sludge. In the center of each compartment, extending downward from the tank cover, are braces running across the current, but so far as tending to disturb the solids or to direct the greater displace-

*Engineer, 149 Broadway, New York City.

ment of the waters they serve rather as scum boards, preventing the carrying of these matters through the tank. Manholes give entrance to each compartment and are provided with covers to prevent the escape of any odors.

After leaving the sedimentation tank, the effluent is at once released to the creek for dilution, having no need for further clarification. The stream which receives the effluent has a normal flow of about 25,000,000 gal. a day, a volume quite sufficient to maintain the stability of the sewage delivered from this district even if it were received in a raw state. For experimental purposes, the designers of the plant at Mt. Washington constructed a

The sludge which is deposited on the floor of the tank is siphoned off about every two months and conveyed by gravity through a 12-in. pipe to a digesting chamber, 10x10x6 ft., where it is treated with a deodorant. The designers of the plant refuse to disclose what chemicals or what particular products they use for this purpose and how they are applied, so it can only be stated here that the results attained are most satisfactory. There is no appreciable odor and no flies or insects are present.

After the process of deodorization the sludge is spread over the ground, in the open air to dry, and is then sold as fertilizer. The dried sludge contains practically its original content of organic matters in the form of

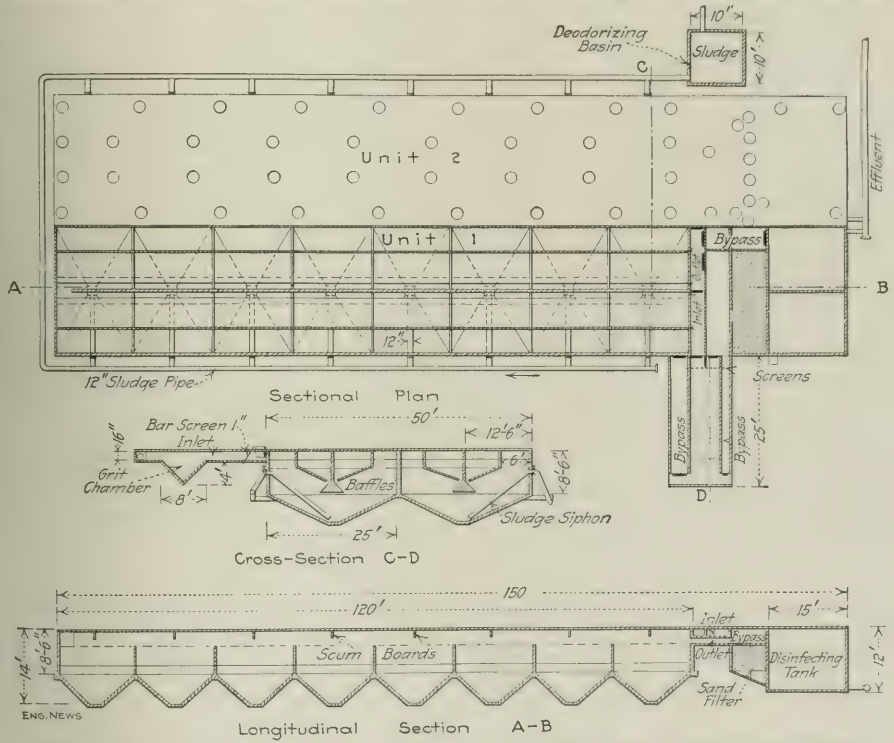


FIG. 2. PLAN AND SECTIONS OF SEWAGE SEDIMENTATION TANKS, MOUNT WASHINGTON, MD.

small sand filter box and chemical tanks for any further treatment of the effluent that might be desired. The sand box serves as a means of partial oxygenation to the waters, but because of the comparatively small filtering surface the greater value of the box will probably be found in its further removal of "fines." The results of experiments with the sand box and certain mechanical "scrubbers" are withheld. From the sand box or directly from the sedimentation tank the effluent may pass directly to tanks where, if necessary, chemicals may be added. The designers of the plant are prepared to add ferric salts in these tanks in case of a saturation of H_2S; also, if it should become necessary or advisable to destroy the bacteria content, they expect to use hypochlorite.

nitrates, nitrites and phosphorus, is odorless and harmless. Individuals who have used the final product for fertilization have spoken very highly of the results obtained by its use in a small way. These facts point to a practical method of disposing of sludge in a way to prevent odors and to prevent the transference of intestinal bacteria by insects or air currents; and because of the impossibility of organic decomposition, the old idea of using sludge as a fertilizer is again revived.

The Mount Washington plant will eventually consist of two units, each containing eight compartments, as shown in the plan and longitudinal section, Fig. 2. At present only one unit is in operation. The principal dimensions of each unit, with capacities of compartments, units and total, together with other selected data are shown in the following tabulation:

Overall dimensions	150x50x14 ft.
Width of each compartment	48 ft.
Length of each compartment	15 ft.
Capacity of each compartment	50,250 gal.
Capacity of each unit	402,000 gal.
Capacity, total	804,000 gal.
Present sewage volume	50,000 gal. at 100 gal. per capita daily
Percentage extraction of the solids	80%

The effluent is completely stable; there is no septic action in the tanks; there is no odor about the plant.

The results obtained are all that could be asked, but unfortunately the probable efficiency of the tanks as applied to population of from 40,000 to 80,000 can not be determined from these statements. At 50,000 gal. a day, it would require about eight days to fill the compartments of one unit; this means that the deposition of the solids occupies eight days, more or less, dependent on the "coefficient of retardation" of these particular tanks. It is entirely impracticable to determine this coefficient with the small volume of sewage now being treated. To know the normal flow or degree of stillness of the tanks, larger volumes must be tested.

The tank arrangement, however, endeavors to utilize several principles involved in some of the later theories of a maximum deposition of the solids under conditions least likely to result in bad odors. The large floor surface tends to allow the solids less horizontal movement, while its shape tends to prevent disturbances in the sludge already deposited. The arrangement of the tank walls and baffles seems to produce in actual practice an unusually high displacement of the waters with a minimum of internal disturbances.

A better arrangement of the sewer entrance would permit the elevation of the outlet to be the same as the inlet, which in this case is raised in order to permit the flow of the sewage to the second unit past the effluent from the first.

Remembering that the inlet and the outlet are in the first compartment, but on opposite sides of the center baffle, and that this baffle does not reach the bottom by about 5½ ft. at the center, it seems evident that there will be a short circuit established which will permit the sewage to pass out in the effluent. This would, of course, defeat the purpose of the tanks. By observing the course of an analine dye during a number of tests it was determined that 10 min. longer were required for the color to show in the effluent by passing under the central wall than by following its regular course through eight compartments and return. Thus: time required in the regular course, 60 min.; time required in short circuiting, 70 min.

There is an important advantage in the short center baffle which seems to overbear the objections to permitting any of the sewage to leave the prescribed course by short-circuiting: the sludge which is deposited beneath the wall is constantly surrounded by the clarified waters which have returned, so that only aërobic conditions are maintained about the sludge, making septic action in it very unlikely. Also supposing that a small portion of the entering sewage does flow out there is an equal amount returning for further clarification or to aid in decreasing any possibility of septicization.

The general action seems to be that of a comparatively rapid surface velocity with a long retention of the main body of the water. Using an analine dye as a basis of observation, the velocity of the surface is about 1 in. per sec.; if this velocity were maintained in a shallow, flat bottomed tank, the efficiency of the deposition would be extremely low, for there not only the surface is moving, but a large percentage of the body with it.

The most effective sedimentation is obtained by holding in one place as much of the sewage as long as possible, not in endeavoring to reduce the surface velocity or the velocity of the mass by the use of immense tanks. The Mount Washington plant procures an 80% sedimentation with a surface velocity of 1 in. per sec., but requires more than eight days to replace the whole body, while large tanks, covering acres, are compelled to be built large enough to permit a velocity of less than 0.5 in. per sec. to procure a 60% deposition. This statement is only intended to show that sedimentation depends on holding each portion which needs it, unusually still, to allow the solids to settle, allowing a rapid run-off of the upper waters which have been clarified.

These arrangements of the walls and baffles deserve a thorough consideration and tests with large volumes of sewage, for theoretically, and practically in a small way, they fit in with the most modern ideas of obtaining a thorough sedimentation. If it can be proved that similar construction, of no greater size than 150x50x14 ft., can even obtain as low as a 50% sedimentation, handling the sewage from sections of 40,000 to 80,000 population, it will pay to install a number of them underground, in the very midst of a city, if only to relieve the final treatment; no odors could be released and the final effluent would be less unstable and less objectionable to be released at once for dilution in rivers, lakes, or bays. The use of some such method of sewage treatment would be especially valuable to conditions such as exist in Mexico City: a low water-supply giving a heavily charged sewage, a low velocity in the sewers, and an overburdened drainage canal having to carry the solids for miles, makes their removal at short intervals almost obligatory in order even to remove the effluent.

The Mount Washington plant could be duplicated for $27,500 per unit; each unit to accommodate a population of 40,000. The annual cost per unit of maintenance should not exceed: supplies, $2000; labor, $1800; total, $3800. There should be no odors in the vicinity of the plant. The sludge should be a source of income as a fertilizer if treated with a satisfactory deodorizer.

The effluent could be released either to a final filtration or to a final dilution, separated from a high percentage of the solids because of the possibility of introducing the process of sedimentation close to the source of the sewage.

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The Use of Chlorine or Hypochlorites for disinfecting potable water is reviewed editorially in London "Engineering," for Feb. 7, 1913. After discussing the general subject and giving some data (mostly well known here) for Toronto, Ont., and other places, the article concludes as follows:

Thus, in many parts of the world chlorine has been used in drinking water with excellent results, the number of bacteria being reduced to safe figures and sometimes even to zero, and the B. communis coli being almost entirely removed, as far as plate tests on large quantities of water could determine. It is satisfactory to know that we have such a process which can easily be applied at very short notice to stamp out a water-borne epidemic, should accidental contamination of a supply occur. At the same time it is not clear that a British community would accept it except as a remedy in an emergency. The evidence as to taste is conflicting, and even if some of the complaints are due to imagination, an outcroy would soon be raised here against water which had been treated with strong chemicals, first to sterilize it and then to remove the taste. As far as we can see, the slow filter is likely to remain the sheet-anchor of the water engineer, either alone or in conjunction with roughing filters of the Puech-Chabal type, although mechanical filters using a precipitant such as sulphate of alumina are exceedingly useful in some places, particularly where the water is highly colored with humic, crenic and apocrenic acids, as often occurs when it is derived from the peat of the upland moors found in the North of England. As to processes depending on ozone and ultra-violet rays, further practical experience is needed before their exact commercial value can be determined, although the former type is in use in several places on the Continent.

Methods of Estimating Stream Flow When Streams Are Frozen

By W. G. Hoyt†

Since the publication of my paper on "Gaging Minnesota Streams in Winter," I have had numerous requests for information regarding the methods employed in making computations of flow of water in ice-covered streams. I therefore submit the following notes on this subject:

The usual methods of obtaining daily discharge of streams under open-water conditions may be briefly given as follows: Daily gage heights are obtained from a gage maintained at a permanent datum. Current meter measurements are made to determine the flow at different stages of the river. The results of these measurements are plotted with gage heights as ordinates and discharge in second-feet as abscissas. A curve is drawn through these plotted points and the daily discharge is obtained by applying the mean daily gage heights to the curve. If the channel is fairly permanent, such a curve will remain constant and measurements made from year to year will plot in close proximity to it.

When the temperature falls below freezing, numerous conditions affecting stream flow are liable to be produced which tend to destroy the otherwise fairly constant relation between stage and discharge, thus making it necessary to employ special methods to arrive at the true daily discharge. (Fig. 1.)

Measurements of discharge which indicate the flow at the time they are taken are fundamental in any method for winter estimates. The accuracy of the results will depend largely on the frequency of the measurements, and, in connection with records of gage heights, temperature, precipitation and ice conditions, they form the basis for estimates of flow.

Precipitation is the cause of all runoff, and since temperature is the controlling factor in regulating the rate at which winter precipitation reaches the streams, it follows that temperature is, in general, the most important governing factor and should be given special consideration in making winter estimates of runoff.

Estimates of stream flow under winter conditions may be made by the following methods:

1. By the application of the gage heights of the water surface to the open-water rating, when it is known that the controlling point for the gage is clear of ice and that no backwater exists at the gage.

2. By developing a curve based on discharge measurements and gage heights to the water surface to which is applied directly the open water-gage heights as taken by the observer.

3. Basing the flow directly upon discharge measurements, taking into account the climate, ice conditions and gage heights.

(a) By the eye method, working directly with the daily discharge, varying it between times of measurement by inspection of the temperature and precipitation records and gage heights, and adjusting by comparison of results for nearby stations.

(b) By applying the open water rating to the gage heights and applying to these discharges a coefficient as determined at times of measurements, varying the coefficient according to a knowledge of temperature, precipitation and ice conditions.

(c) By the graphic method, plotting the records of temperature, precipitation and gage heights to the water surface and determining the amount of correction necessary to apply to the gage heights in order that the open-water rating table may be used, basing the variation in this correction between times of measurements directly on the variations in gage heights and temperature conditions and modifying the same by record of precipitation and ice conditions.

The accuracy of Method 1 depends primarily upon the location of the station. Stations are now located at several points in the United States and Canada at which this method is giving excellent results, but, as their number is few, the method can only be used in special cases.

The accuracy of Method 2 will depend largely upon the number of discharge measurements and their conformity to a true curve. It is believed that this method can be used at former stations than can Method 1.

The methods described in No. 3 will apply at practically all gaging stations which are affected by ice conditions. Method 3(a) is the one now commonly used, but is believed that 3(b) and 3(c) will give better results than 3(a) and that Method 3(c), which is described more fully hereafter, has an advantage over either 3(a) or 3(b).

A discharge measurement taken under ice conditions, when plotted to the open water gage heights (Fig. 1),

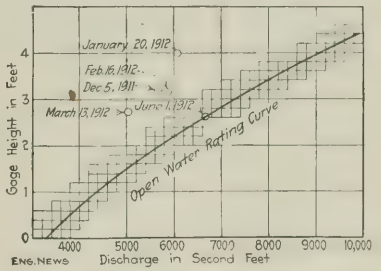


Fig. 1. Open-Water Rating Curve for Rainy River at International Falls, Minn.

(The curve is based on a large number of current meter measurements and plotted winter measurements showing how relation between stage and discharge is destroyed by ice conditions).

will always plot either on the open water curve or to the left, showing that the disturbing conditions result in a backwater effect. Therefore to arrive at the true flow for a given gage height it is only necessary to determine the magnitude of this backwater effect at the gage. Since the formation of ice is due entirely to climatic conditions, it follows in general that the amount of backwater varies directly with climatic conditions.

Having determined accurately the amount of backwater at stated intervals by discharge measurements, it is possible to determine the backwater effect between times of measurement by constructing a curve of backwater. Such a curve can be drawn by following the observed gage heights and the climatic and other conditions which cause the backwater.

The development of this method has been largely based on studies made during the winter of 1911 and 1912 on the Rainy River, at International Falls, Minn. At this point there is a regular current meter gaging station just below the plant of the Minnesota & Ontario Power & Paper Co. The Canadian Department of Public Works determines the flow at the plant by means of wheel ratings and the same flow is also computed by the U. S. Geological Survey at its regular gaging station.

*Permission for publication given by the Director of U. S. Geological Survey.

†District Engineer, Water Resources Branch, U. S. Geological Survey, Old Capitol Building, St. Paul, Minn.

The average monthly variation in flow, as determined by these two methods during the five months from June to October, 1912, was 0.75%.

The Rainy River, for some miles below the power plant, has a very slight slope, so that notwithstanding the fact that this part is usually free from ice, due possibly to the presence of acid from the paper mill and to

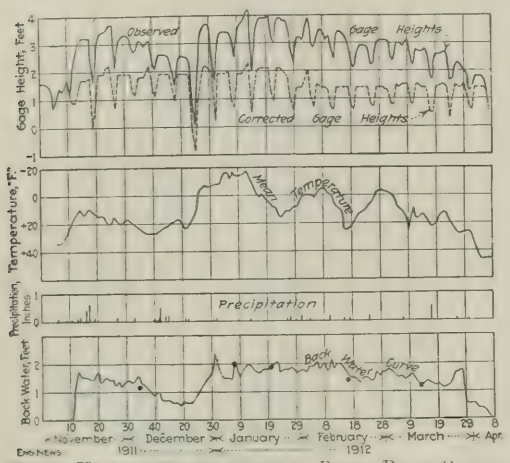


FIG. 2. VARIOUS OBSERVATIONS AT RAINY RIVER GAGING STATION, INTERNATIONAL FALLS, MINN., NOV. 1, 1911, TO APR. 8, 1912

(The observed gage heights have been corrected on the basis of the backwater curve. The mean temperature was averaged in 5-day periods. The backwater observations were taken at the gage. The full circles on and near the backwater curve indicate dates of current meter measurements).

the agitation of the water as it passes through the wheels, there is more or less backwater effect due to the formation of ice which occurs below the open water stretch.

We have therefore at this point a gaging station which is so affected by ice that the regular methods of computation of daily discharge do not apply, and also a station where the true daily flow is obtained, so that data are available for studying the effect of the ice. This study has been made graphically on Fig. 2, which shows the following curves:

1. The observed daily gage height for the gaging station below the dam.

2. The corrected daily gage height obtained by using the rating table for the station below the dam and finding the daily gage height corresponding to the daily discharge given by the records of flow through the plant (no water passes over the dam).

3. The mean daily temperature at the gaging station.

4. The daily precipitation at the gaging station.

5. The daily backwater effect obtained by taking the difference between the observed and corrected gage height curves, which shows the amount which the recorded gage height reading should be corrected to give a gage height which will, when used with the open water rating table, give the true discharge.

A study of the mean temperature curve and the backwater curve shows that these two curves tend to follow the same general direction, which confirms the assumptions previously stated. This is also borne out by records at other stations, and it is therefore believed that this relation will hold on the average stream, unless it is destroyed by unusual precipitation or ice conditions; that is, ice jams which cannot be taken into account in the construction of the backwater curve.

Based on this assumption, it is possible to construct the backwater curve from a comparatively few measurements of discharge distributed through the period affected by ice from which the backwater effect on the days on which they are taken can be obtained. By plotting these values as ordinates and days as abscissas under a daily temperature curve, it is possible to draw a curve through the point so plotted, following the same general shape as the temperature curve, which will give the backwater conditions for each day. In drawing this curve, account should be taken of the daily precipitation and of ice jams or other unusual conditions which may introduce backwater effect.

The circles plotted with the backwater curve (Fig. 2) show the backwater as determined from the discharge measurements on various days during the period in question. If these and the temperature records had been the only data available, a backwater curve could have been drawn which would have approximated the true backwater curve which was obtained from the daily records of flow over the dam. Of course care must be taken to study all the possible conditions which may affect the estimates.

Aside from giving more accurate results, this method has an advantage over any other method that has been devised, in that it gives a complete record of all the steps taken, so that the estimates may readily be reviewed or checked by a second person and show at once exactly how they were prepared.

The data necessary for use with this method are:

1. Daily gage heights observed to the water surface through a hole made in the ice if the section is frozen over.

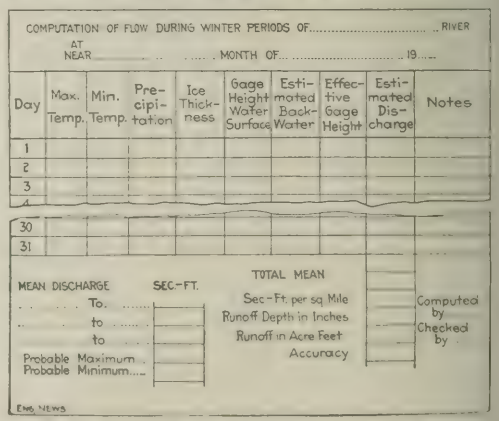


FIG. 3. SUGGESTED FORM OF SPECIAL COMPUTATION SHEET FOR RECORDS AND ESTIMATES OF STREAM FLOW BENEATH ICE

2. Records of daily temperature at the gaging station.

3. Record of mean precipitation over the drainage area above the gaging station.

4. Measurements of discharge* at intervals during the period when frozen conditions existed.

*See "Eng. News," Sept. 12, 1912, for methods of making

As already stated, the accuracy of this method will depend upon the frequency of these measurements. If the winter conditions are more or less constant, less fre-

quent measurements will be required, as it is during periods of thaws that the principal uncertainties occur. Regardless of this method, a special computation sheet should be used and some fairly standard method followed, which will bring winter estimates on a standard basis so that full records may be had. The headings on the typical card given in Fig. 3 are suggested for such a form.

In connection with this study, I wish to advance the following tentative conclusions, based upon observations of conditions in Minnesota since the Fall of 1911:

1. Ice conditions usually cause backwater at the gage.
2. Backwater increases rapidly at the beginning of each cold period, partly dropping off later.
3. The amount of backwater will tend to vary with the temperature.
4. Stream flow will drop off suddenly, following a cold period, and will be partly regained later.
5. Stream flow tends to decrease when temperatures go below 32°, but the flow tends to increase with any rise in temperature, especially when the minimum temperature goes above 32° F.
6. A snow cover on the ice may cause increased backwater.
7. Flow may increase without a rise in gage height, due to the wearing away of the ice.

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Railway Construction and Train Tonnage*

By R. N. Begien†

SYNOPSIS—A railway is built for the purpose of carrying trains, and with the increasing demand for operating efficiency and economy it is of increasing importance to know what maximum train-load an engine will haul under required time-table or schedule conditions and under the conditions due to the physical characteristics of the division. The determination of these loads on a scientific basis is effected by tonnage-rating systems. The size and power of the locomotive itself are important factors, but the factors of the physical characteristics of the road are equally important and the paper given herewith shows very clearly the relations between train tonnage and these characteristics (which include profile and grades, curves, tracks, etc.). Conversely, it may be said that the physical characteristics of new lines are limited by prescribed operating conditions as to train-loads and speeds. Consequently, the railway engineer (in location, construction and maintenance) is vitally interested in the operating conditions as well as in the engineering problems of his road or division.

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Proper tonnage rating is that load which can be hauled by the locomotive over the road at an economical speed. Owing to factors which are, in a measure, indeterminate, it is not an exact science. Strictly economical tonnage rating would be different for every train, since no two engines or cars are in the same condition. Road conditions differ on different parts of the same division, and some men are better and more uniform performers than others. Perfect uniformity of mechanical and roadway conditions would result in large economies in the way of a decreased number of trains due to increased tonnage per train. Where it is impossible to secure perfection, uniformity pays well, even if it costs money to get it.

MAINTAINING THE NORMAL PROFILE

Railway profiles change in the course of years. Fills settle, causing sags in the grade line. The raising of tracks through cuts is cheaper than ditching, but is responsible for summits in cuts. The sequence of raised cuts and depressed fills causes a wide variation from the original ruling grade. On some lines it has been found that stretches of 0.3% grade have become 1%. If places of this character occur near a point of heavy resistance, an immediate effect on the tonnage of a train is the result. Such places may cause the stalling of a train, and in a short time the frequent delays will result in decreased tonnage rating. [In the accompanying cut, the correction of grades shown by the upper line of the profile would allow about 25% increase in the tonnage rating for slow freight trains.]

Raising tracks is not as economical as is sometimes believed. While better drainage is undoubtedly secured, it is generally better practice to clean the ballast, and widen cuts to secure a ditch, and to raise track only when it becomes necessary to put roadbed to a proper line and surface. On such occasions, grade stakes should be used to establish the grades. On many roads an effort has been made to place permanent monuments, so that the track could be kept at a constant elevation. The difficulty of maintaining monuments along a roadbed is well known. They are not only likely to be a menace to the lives of the trainmen, but they are constantly settling, and being knocked by section men, and occasionally by derailments. However, the importance of placing permanent monuments cannot be overestimated.

COMPENSATING GRADES ON EXISTING TRACK

Compensation of grade for curvature is not vital to small trains running at speed. The resistance due to curvature is principally felt by heavy-tonnage trains on ruling grades where the engine is rated at a high percentage of its cylinder tractive power. Various experiments have been made to determine how much reduction in grade would compensate for the added resistance of curvature. It has generally been the practice to compensate this at a stated amount, and, while this method is not as accurate as could be desired, it is very much better than no compensation at all. From considerable observation of the influence of curvature, together with the examination of numerous tests of its effect, it is felt that some rules can be laid down which will improve the present practice.

1. Compensate 0.3% per degree: (A) when the length of curve is less than half the length of the longest train; (B) when a curve occurs within the first 20 ft. of rise of a grade; (C) when curvature is in no sense limiting.

2. Compensate 0.035% per degree: (A) when length of curves is between 50 and 75% of that of the longest train; B, when the curve occurs between 20 and 40 ft. of rise from the bottom of the grade.

3. Compensate 0.04% per degree: (A) where the curve is habitually operated at low speed; (B) where the curve is longer than 75% of length of the longest train; (C) where superelevation is excessive for freight trains; (D) at all places where curvature is likely to be limiting.

4. Compensate 0.05% per degree where the loss of elevation can be spared.

An illustration will show what can be accomplished by compensation of curvature on old roadbeds: Take a grade of of 0.5% five miles long, with an average curvature of 60° per mile, without compensation. If the maximum curve is 6° and the curve equal in length to the longest train, the curvature will have the same effect in limiting tonnage as a grade of 0.24%. This, added to the 0.05% grade, would make a ruling grade of 0.74%. The effect of the curvature on the five miles of grade would be 300°, which, at an average of 0.035% per degree, would amount to 10½ ft. If this 10½ ft. is added to the 132 ft. of rise in the five miles of grade, it will be equivalent to 142½ ft., or 28½ ft. to the mile, which is equal to a grade of 0.54%.

If this latter compensated grade is laid so as to be superimposed immediately above the present roadbed, it will be found that by reballasting the track to permanent stakes on this grade, a new ruling grade can be established, which will be 0.2% below the 0.74% equivalent to the 0.5% uncompensated grade. On a grade of this length, it will be possible to haul nearly 25% greater tonnage per train, thereby secur-

*Abstract of a paper on "Dynamometer Tests on the Baltimore & Ohio R.R., and Their Application to Tonnage Rating," forming an appendix to the report of the Committee on Economics of Railway Location, presented at the annual convention of the American Railway Engineering Association, at Chicago, Mar. 18-21.

†Assistant General Superintendent, Baltimore & Ohio R.R., Baltimore, Md.

ing a very large economy in operation for a small expenditure of money.

COMPENSATION OF LOW GRADES.

The effect of curvature on low grades (level stretches and up to 0.3%) is generally greater than on heavy grades, provided the length of train is what would be justified by the low grade. On double-track roads, particular attention should be paid to curves (whether uphill, downhill or level) at places where steam is being taken by the engine in moving in either direction. On virtual level grades each track should have its tangents slightly raised and its curves slightly sloping down hill, so that the pull by the engine may be uniform, and the resistance of the line constant. The value of keeping the line resistance constant becomes more important as the length of the train increases.

One of the prime objections to hauling a long train is the danger of parting, and in this danger curvature plays an important part. If the line has many short curves, it is usual for the slack of the train to be constantly taken up and let out. If the engine runs out on straight track, when the rear of the train is bunched on the curves, it will accelerate faster than the other end of the train. Unless the engineman is watching, and using the brakes slightly, he may pull out a drawbar. On the other hand, if the front end of the train is on a curve, and the rear end on straight track, the tendency is for the rear end to run in on the front end, and break a knuckle. It should not be supposed that it is impossible to have different classes of compensation on each track of a double-track railway.

SUPERELEVATION ON CURVES

From a scientific standpoint (not always from a financial view), it is evident that a six-track road is the most desirable for a railway that handles a three-speed service. This will give a passenger track, a fast freight track, and a slow freight track in each direction. It becomes necessary for a train to stop occasionally on a curve, and for that particular case the superelevation is always wrong. As no superelevation is necessary at very low speeds, it may be eliminated entirely on tracks that are used exclusively for standing cars, and very low superelevation (if any) should be used in yard tracks.

On a single-track road carrying more than one class of traffic, there are two ways to treat superelevation: 1. Make the freight tonnage rating as great as possible, and in accordance with the ruling grade; in this case, it will be necessary to elevate the curves for freight speed, and run the passenger trains slowly over ruling grades. 2. Use a higher superelevation for passenger speeds, and decrease the tonnage rating to make up for the increased resistance caused by the wheels of the freight trains binding against the lower rail.

Single-track roads which are crooked can rarely haul as high a percentage of rating as double-track roads, on account of the superelevation being wrong, for it is easy to see that every down grade becomes an up-grade for movements in the opposite direction. As the movement downhill is likely to be faster than it is uphill, the superelevation must be made for the downhill movement or speed limits introduced on downhill trains.

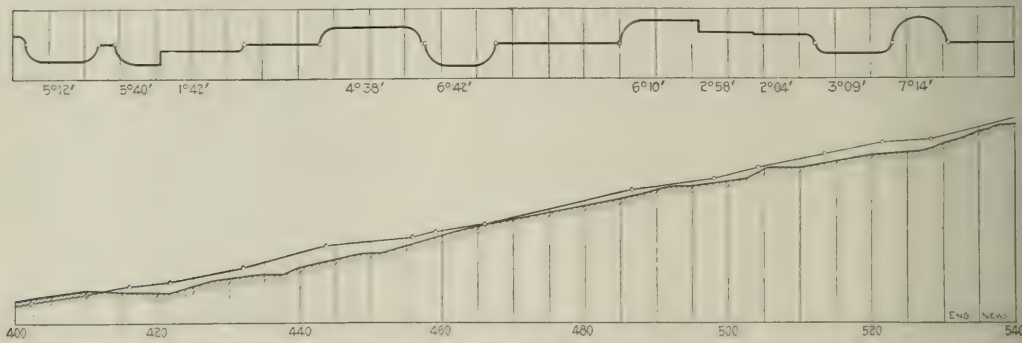
On single lines that are exclusively for freight, superelevation on ruling grades should be made for not over 15 mi. per hr. It is less expensive to slow down the descending movement than to reduce tonnage rating on account of excessive superelevation. This is specially true on curves of large central angle. As an example, two engines (one helping) hauling 3500 tons of coal ordinarily stalled on an 8½° curve with 185° central angle and 5½-in. elevation. The elevation was reduced to 3 in. and no difficulty was had. This curve was compensated 0.04% per degree and was on an 0.85% grade. On many mountain roads a long train may be on seven or eight curves at once, and when such is the case, observation of minor points are of great value when tonnage is the main issue.

SPIRAL OR TRANSITION CURVES

The object of the spiral curve is twofold: 1, to afford a run-off and a run-on from a level cross-section to a superelevated cross-section; 2, to ease the horizontal passage from a straight line to a curve.

It is evident that in passing from a level position to a superelevated position, when the inner rail of the curve is laid at grade, the center of gravity of the mass of the train must be raised through a distance equal to half the superelevation. This is generally a minor rise, but in order to haul uniform tonnage this minor point should be carefully observed, especially where limiting conditions are found, such as places near the end of a long-continued effort.

It has been proposed that the inner rail be depressed a distance equal to half of the superelevation, and the outer rail be raised the same amount. While this has been objected to, it can be done and so maintained, and from a tonnage haul standpoint it is desirable. The railway of the future, scientifically operated, will find conditions such as these limiting its tonnage unless care is taken. While it might be said that refinements in the track are unimportant, it should be borne in mind that, in order to realize the full value of improvements, these matters must be taken into consideration. A combination of correct conditions results in the most effective operation.



PROFILE OF ACTUAL GRADES AND PROPOSED CORRECTION WHICH WOULD ALLOW ABOUT 25% INCREASE IN TONNAGE RATING FOR SLOW FREIGHT TRAINS

REVERSE CURVES

Curves that reverse without any tangent between them mean operating expense. Not only must the superelevation change abruptly, but the trucks must change their position in the same manner. It is considered good practice to leave room between the points of spiral for four freight cars to straighten up after they change direction. On most new construction, provision is made for at least 1000 ft. between curves, and this practice is recommended unless great expense is involved.

THE EFFECT OF TRACK CONDITION

From a tonnage standpoint good track includes the following: (1) Mathematical alignment; (2) superelevation conforming to the speed; (3) an unyielding sub-grade; (4) rails heavy enough so that the depression under the ruling grade is small; (5) sufficient ties beneath the rail to transmit the load uniformly to the sub-grade; (6) ballast deep enough to secure good drainage and distribution of loading; (7) as much strength as is necessary.

On a branch line under construction, the work engine had difficulty at first in handling eight cars of ballast. During the ballasting, the surface was very bad, and the alignment

poor. As each section of the line became ballasted, the work engine was gradually able to haul more cars until it was finally able to haul 20. On the main line of the same division, where the same grade ruled the tonnage, this same engine could haul 25 of these cars. This represents the effect of improving line and surface. As the refinements of surface are gradually attained, the effect becomes noticeable at once in the speed of the tonnage trains, irrespective of hauling increased tonnage.

A mountain grade of 116 ft. to the mile (2.2%) and 12 miles long, was in bad shape, due to poor drainage and dirty ballast. It was determined to overhaul the grade, giving the ballast a thorough cleaning and repairing the drainage. After setting line and surface stakes, the engineers were accustomed to board the freight trains going up the grade on their way home at night, doing so with ease on account of the slow speed of the train. As the work progressed, and the track came to better line and surface, the speed of these trains so improved that the engineers had to slow them down to get aboard, until this procedure was stopped by the superintendent. As the power of a locomotive can be translated into either tonnage or speed, the effect of the better surface of the track can readily be seen.

EFFECT OF TUNNELS

Many railroads are suffering today on account of the fact that during the early days of construction it was not thoroughly realized that a tunnel might be a limiting feature. The following are the causes of the limiting effect: (1) Darkness, making the engine crew less confident; (2) a derailment is almost sure to result in serious damage and loss; (3) the heat in long tunnels, especially if of small section; (4) the track conditions, such as line and surface, are never as good as on the outside; (5) the rail is generally damp, causing either the excessive use of sand, or the slipping of drivers; (6) drainage is usually bad and difficult to improve; (7) there are usually speed restrictions; (8) it was formerly the practice to carry maximum grades through tunnels in order to shorten them, and this serious defect in many cases makes tunnels the ruling points; (9) in tunnels of small section the use of helper engines is undesirable on account of the heat; (10) the smoke and gas add to discomfort of operation; (11) the impracticability of firing in long tunnels causes a drop in steam pressure.

There have been many plans devised for tunnel ventilation. Most of them are successful under some circumstances, but none is successful under all conditions. The Churchill system of ventilation, by which air is blown through the tunnel from one end through nozzles fitted at the sides of the tunnel, is successful if the enginemen operate the locomotive so that the smoke is blown ahead of the engine.

Double-track tunnels are of sufficient section so that there is little discomfort in a tunnel a mile long, even if the locomotive is fired all the way through. The practice in Europe has always been much better in that even with single-track tunnels their section has been large enough so that they are less uncomfortable than those in this country. Tunnel ventilation in Europe is largely restricted to the dilution of locomotive gas with plenty of fresh air, rather than driving the smoke and gas ahead of the engine.

In the construction of new tunnels, an effort should always be made to reduce the grade in the tunnel considerably below the ruling grade, so that there may be no need of touching the fire during the passage through the tunnel. Ample section to secure good conditions is essential. In this connection it should be noted that the effect of long single-track tunnels of narrow section on the ruling grade is to reduce the tonnage rating in the tunnel by 10% at least.

EFFECT OF LENGTH OF GRADE

The effect of the length of a ruling grade depends entirely on what speed it is necessary to make up that grade. Hardly any operating division has more than 40% of ruling grade in either direction. It is generally computed that a train must average 10 mi. per hr. over a division of 100 miles in order to secure the best economy. Assume a division with 40 miles of ruling grade, and 60 miles of either downhill or less than ruling grade. If 8 m.p.h. is averaged on the ruling grades, and 12 m.p.h. on the down grades and less than ruling grades, the run may be made in 10 hr. If a grade is very short, following a stretch of either downhill or less than ruling grade, sufficient speed may be had at the bottom to carry the train over the top, even though the ascending grade be considerably more than the ruling grade. As the train goes up the hill, its speed will constantly decrease. The speed at the top of the hill must be such that the engine still has some margin between its maximum tractive effort and what is required of it. This result depends entirely on the speed of the train at the foot of the grade.

Such a grade is called a "momentum grade," and it is probable that there is not an important railroad in the country but what has portions of the line operated in that manner, even though the officers do not know it. Were it not for momentum, it is likely that many curves would prove to be stalling points that are now passed around with little (if any) trouble. We are learning more every day about handling trains and power at low speeds, but it must be understood that these low speeds are only for use for short periods of time, and not for general practice over a whole run.

When the grade is long enough for the train to become stretched out fully upon it, or, in other words, when the engine settles down to a constant speed with its maximum tonnage, the rating speed for that particular train becomes fixed. Without a rise in the steam pressure, the train cannot accelerate as long as the grade remains the same. If there is a large percentage of this character of line on the division, the rating speed must be considerably higher than if there are only one or two such places. For instance, it may be possible to average 7 mi. per hr. over one piece of grade, if that is the only piece on the division, because the difference in time should be made up on the rest of the division. But it would be manifestly improper to load an engine so that such a low speed would be made over the whole run. Not only on account of the low speed, but the constant demand on the engine would be such that the fireman would play out, and a failure would be the result.

ADHESION TO RAIL

An engine cannot do work and overcome train resistance unless it can transmit its cylinder work to the rail by means of adhesion due to the weight of the engine and the friction between wheel and rail. The adhesion may be reduced by a number of conditions as follows: (1) Moisture acting as a lubricator; (2) frost; (3) grease; (4) poor rail surface; (5) manganese or other metals in the steel; (6) excessive superelevation, throwing too much weight on one side; (7) inability to use sand (as shown on a curve the sand does not flow well upon the rail). Poor rail surface may be due to poor subgrade, worn rails or insufficient maintenance work. Driving wheels slip more readily on manganese-steel (as in crossing frogs) than on ordinary rails, as the coefficient of friction is reduced.

PROPER PERCENTAGE OF RATING

A locomotive standing on a dry steel rail should be capable of exerting a pull on a spring balance equal to (approximately) 25% its weight on drivers. This amount can be increased by the application of some medium to increase the coefficient of friction, such as sand, to about 35% (for momentary purposes only). This same pulling power can be used to haul a train, including, of course, the engine and the tender itself.

Ratings in use are never as great as could be pulled by the locomotive utilizing a tractive power of 25% the weight on drivers. The reason is apparent. Time is the essence of rating. The governing question is: For how long a time must the locomotive be required to exert its maximum pull during any particular run? If it is required to exert a maximum effort for only about five minutes at a time, the rating might be established for a maximum effort, provided that time for rest of man and recuperation of fire elapses between the periods of maximum effort.

The Placing of Monuments in Relation to City Planning is discussed in an article entitled "The Decoration and Furnishing of the City—Statuary," in "The Town Planning Review," for February, 1913 (University of Liverpool, England). We quote a paragraph from the article, which is by S. D. Adshead, as follows:

The successful placing of monuments, and especially of the smaller ones, calls for a sense of appropriateness, possessed only by the artist. The most important of all monuments is that which commemorates an epoch-making event which is of national and of common interest, and which is erected to keep alive in the bosom of the nation a crisis from the throes of which it has successfully emerged. Arcs de Triomphe, Washington Obelisks, Statues of Liberty, Crimean monuments, and others stand for such events. These should be erected on the most crowded of public sites. Then there are the monuments which are erected to the memory of statesmen, philanthropists and kings. Here is the greatest need for discretion, for it is not all men who can be counted worthy of being petrified in stone, and if their statues are really to beautify our thoroughfares, we must needs dress up or pose John Smith out of all recognition. Everyone must admit the difficulties of metamorphosing the plain man into a beautiful form. With a Henry Irving, a state official or a soldier, it is possible, but not so in the case of the plain man. Better would it be to resort to the medallion or the bust on a column; the first duty of the erector of monuments is to beautify the town. But there is another kind of sculpture—that which is allegorical. This is best placed amidst trees and fountains and Nature's retreats; it is essentially the sculpture for the park.

A Reinforced-Concrete Beacon Tower, Alexandria, Egypt

The entrance to the outer harbor at Alexandria, Egypt, is protected by a beacon tower located one and a half miles from the nearest coast line and about three and one-half miles from the port itself. In 1907 a new tower was placed at this location, consisting of steel struts reaching down into the ocean bottom and carrying at their top a steel-frame work which held the gas tank and the light. In a severe storm Feb. 10-11, 1911, this tower was completely destroyed and the main part of its framing was afterward found nearly two miles away. The harbor has a very large use, over 4000 steam vessels entering it every year, and at the same time it is located in a zone where severe storms are quite frequent. It was, therefore, necessary to replace the steel beacon as soon as possible, and at the same time to replace it with a structure capable of withstanding the shock of waves and wind.

The four types of beacon considered were, first, a steel-frame work similar to the old one; second, a solid masonry lighthouse structure; third, a similar structure of concrete block made on shore, and, fourth, a reinforced-concrete structure, the main part of which was to consist of a hollow caisson cast on shore, floated to its proper location, and sunk on prepared foundations, after which it would be filled with concrete to form a solid masonry structure. On account of the solidity of the bottom and the impracticability of driving the steel piles very deep into it, the first type was not considered. The solid masonry types, while being of a certain stability, yet would require so much time in construction and a construction so apt to be disturbed by the prevailing winds and waves, that they, too, were discarded. This left the fourth type, which was designed and which now is in place.

The structure as designed and built is shown in detail in Fig. 1. It consists, first, of a seven-sided base in the shape of a frustum of a pyramid made as a hollow reinforced-concrete box and floated out to its location and sunk into place by filling it with concrete. This is surmounted with an eight-sided hollow reinforced-concrete tower which contains the gas tanks and which carries the light on its summit. The base was shaped as shown and placed to properly resist the prevailing winds and waves. The lengths of its main axes are 41.1 and 37.8 ft.; the thickness of the base, 8 in. This base is further reinforced with five transverse beams, each 8x16 in. and one longitudinal beam 12x24 in. The total height of this base section is 46 ft. It slopes up as shown, with an outer shell made up of reinforced concrete 6 in. thick, and braced with a central 12x12 in. column, from which radiate 8x8-in. bracing beams. All sections are reinforced, though this reinforcement is not shown on the drawings. The tower is 36 ft. high and is designed as shown in the figure. It is 12.3 ft. in diameter at this base and 8.2 ft. at its summit. The thickness of the walls is 4 in. and the beams which brace these walls 6x6 and 8x8 in. In addition to the beams there are transverse floors which serve to brace the structure and to hold the gas tanks.

This whole structure weighs about 1700 tons, which, after subtracting the loss of weight under water, makes a total pressure on the base of about 1100 tons. There was no exact method of figuring the pressure of the waves upon it, but the designers considered that such a weight was sufficient to withstand the worst storm possible at this location. The reinforced concrete was figured according to the French ministerial instructions, except that the walls were made somewhat thicker and the steel

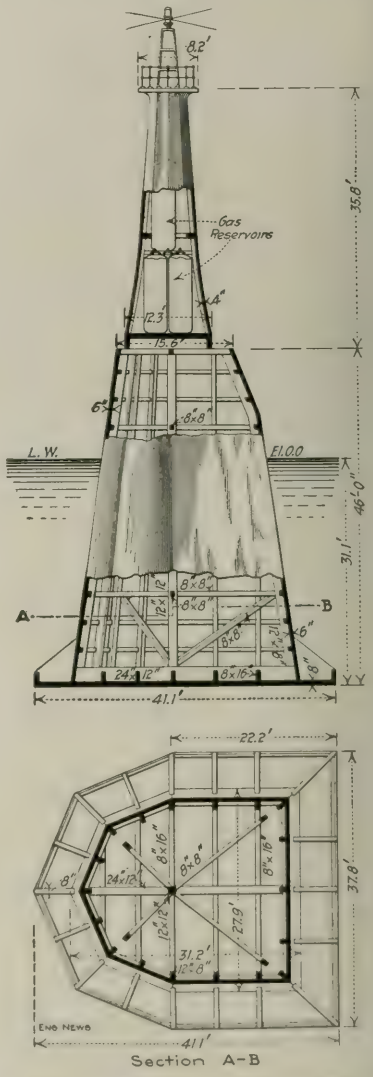


Fig. 1. Details of Concrete Beacon Tower, Alexandria, Egypt, Harbor
(Reinforcement not shown)

somewhat larger on account of the possible attack of the salt of sea water. A 1:2:4 concrete was used for the reinforced-concrete work, and great care was used in placing it. No other waterproofing precautions were taken.

The base caisson was made on shore in two parts. The

lower 24 ft. of the caisson was cast in place on a launching platform on shore, and after it had reached a sufficient set was launched off the platform into the water, as shown in Figs. 2-4. This caisson was floated to alongside of a wharf and the remaining 11 ft. cast, carrying the structure to the floor on which the tower portion rests. At the same time, at another place on shore, the tower structure was cast in place and lifted it has since been set up as a beacon light on one of the piers there. The base of the structure was somewhat injured by the upper part falling on it, but not so seriously but what it could be repaired in the course of two or three days. The towing of this base caisson was then continued, without incident, to the proper location.

This location had been dredged level and somewhat lower than the surrounding sea bottom. The caisson

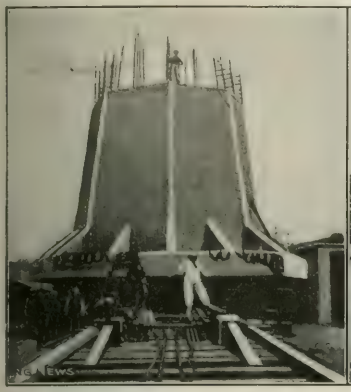


Fig. 2. Caisson in Launching Stage

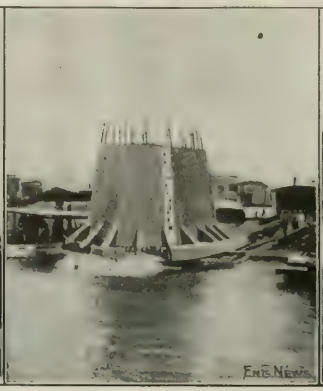


Fig. 3. Just Entering Water



Fig. 4. In Water

Figs. 2-4. Progress in Launching Lower Caisson of Beacon

by a heavy derrick onto a barge, which was floated alongside of the base.

It was the original intention to place this tower portion upon the base and to float the two together to the proper location of the beacon in the far harbor. Operations toward this end were successfully started. The tower was placed on the base and securely fixed thereto with interior timber struts and connections. Lines were then passed around the top of the tower, the top of the base, and the bottom of the base, and these lines carried to the outer gunwales of two sea-going barges which were lashed together on either side of the structure. Tugboats were then attached to the outside of these barges, and the towing commenced. The lines to the structure, which are shown in Fig. 5, were provided with tackle so that the tower could be moved one way or the other to keep it vertical.

This towing was started on July 6, 1911, and the distance of about a mile and a half from the place of manufacture to the breakwater of the port was successfully completed. From this point to the location of the beacon was in open sea, subjected to severe winds, and the second part of the journey was postponed from the 6th of July to the 1st of August, awaiting favorable weather conditions. On the 1st of August it was thought that these conditions were favorable, and the towing toward the proper location, some 2¾ miles farther on, was started. Owing to a certain anxiety on the part of those in charge, and also to a slight, though not great, swell in the sea, the tower became loose from its cables and toppled over on one of the towing barges. This accident seriously delayed the work. The tower was not so damaged that it could not be used again, but it was considered inadvisable to attempt to use it in the fashion in which it was originally designed. It was, therefore, removed from the lower structure and brought back to Alexandria, where base was brought above the level portion and pumped full of water until it sank to a good bed. When it had been sunk, concrete was placed in the water-filled box for a depth of some 20 ft., the process being continuous so as to prevent the formation of laitance planes. The remaining water was then pumped out of the caisson and the rest of it filled with concrete laid in the open. At the same time the extra chains and iron which were used in



Fig. 5. Towing Caisson and Tower in Harbor

connection with the work were dumped into the outside boxes formed by the extension of the base beyond the outside of the walls of the caissons.

A construction plant was then set up at the barges and a framework erected on the base which now had a solid footing on the ocean bottom. Inside of this framework the reinforced-concrete tower was erected. The work was completed without any very great difficulty, although the weather was at times so heavy that it would have been impossible to have carried on any very great amount of work if a solid masonry structure had been decided upon. The falsework was removed and the structural part completed on Oct. 1, and on Nov. 10, 1911, the beacon was

...et alight for the first time. This meant a period of six months from the beginning of the work until its completion, two months of which were delays due to impossibility of getting material and unexpected accidents connected with the work.

During a severe storm on Dec. 23, 1911, a 4,000-ton steamer lost its course in getting into the harbor, and was thrown against the beacon light. Under the combined effort of the very violent storm and the shock of the ship, the tower was slightly displaced and was given an inclination of about 4°. It, however, suffered no structural damage and the light was not put out. This severe test has proved that the structure is able to withstand a very severe usage.

The light was designed and built by the Corps de Ponts et Chaussées, of France. Its construction and design is described in *Annales des Ponts et Chaussées*, 1912–VI–November-December.

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An Unusual Design for Paving a Street Intersection

By S. Cameron Corson*

In the year 1911 a franchise was granted by the Borough of Norristown, Pa., to the Norristown Transit Co., a branch of the Philadelphia & Western Electric Ry. Co., to occupy Airy and Markley Sts. In return for this privilege a certain amount of paving was required to be done by the company, including the intersection of Markley and Airy Sts.

These streets are 66 ft. wide over all and 36 ft. wide between curb lines. On Airy St. there is a viaduct which passes over Markley St., the adjoining tracks of the Philadelphia & Reading Ry. Co. and Stony Creek. The roadway of this viaduct is about 25 ft. wide, beyond which there are sidewalks, each 9 ft. wide. The balance of the total width of Airy St., or 24 ft., is divided into two 12-ft. roadways, but the real street intersection is entirely clear.

The track of the Norristown Transit Co. is laid on and along a curved right of way with a radius of 120 ft. on the center line. All of this area, including a sidewalk 9 ft. wide on the east end to 15 ft. wide on the north end of the curve, was purchased by the company and formally dedicated to and accepted by the borough for public use.

The traffic at this intersection is very heavy in every direction.

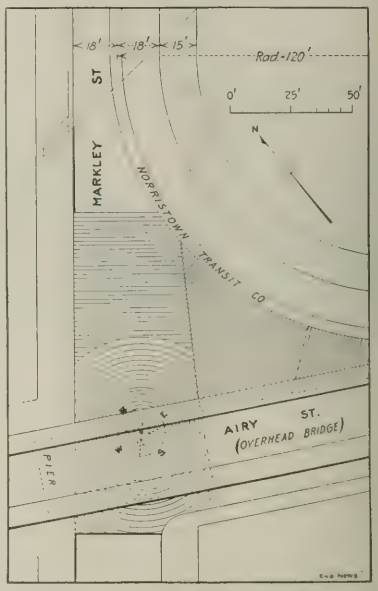
Ordinary methods of meeting these traffic conditions did not meet all of our requirements, so we decided to put in a circular intersection, as shown by the sketch, which was suggested by my assistant, Harry P. Hiltner.

The sewer manhole lid was used as a center and blocks were laid on radial lines set on the four points of the compass. The interior of the inner circle, which has a radius of 10 ft., was made to represent a maltese cross, and on the extremities of each wing of the cross and on the meridian lines we placed four buff-colored blocks, one at each point to indicate the points of the compass.

Each radius was increased by the thickness of the blocks until it had covered that portion of the intersection that it was desired should have the transverse lines to the general traffic. The extreme outside radius was about 40 ft.

This work was done at no extra cost to the railway company; in fact, the engineer in charge informed me that there was less loss for cutting and breaking than he had had in a much smaller street intersection.

Outside of the 10-ft. radius the blocks were laid whole, which was an especial advantage for the reason that in the lines of traffic there would not be the usual small



Street-Intersection Paving Plan, Airy and Markley Streets, Norristown, Penn.

pieces of blocks used to piece out on the lines of the ordinary gussets.

The only difficulty encountered in this construction was on the circumference of the circles as they gradually increased in length. The difficulty was to break joints This was overcome, after several trials, by inserting a block of two-thirds length at regular intervals.

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A New Design of Underfeed Stoker for steam boilers is being put out by the Sanford Riley Stoker Co. of Worcester, Mass. The coal is forced by a plunger from a hopper through large passages in reciprocating grate bars having inclined (20°) upper surfaces. A grate and its corresponding coal piston are moved together by parallel connections to a crank on a jack shaft. The cranks for adjacent grates are set 180° apart so that each grate slides past its neighbor. The lower ends of the reciprocating grates are built as pusher noses to force the ashes to the bridge wall over lapping auron plates, which hang down at the ends of a rack. The ashes thus pass through an opening which can be adjusted by changing the position of the rack.

A blower for each furnace is chain driven from the stoker jack shaft and discharges into a chamber whose roof is formed by the inclined grate bars and whose bottom is a roof to the ash pit. The ratio of air to coal fed remains constant unless the blower sprockets are changed. It is claimed that this results in better combustion. It is also claimed that the repeated shearing of the fuel bed by the moving grates prevents accumulations of clinker and that ash chunks are crushed by the grate noses.

*Borough Engineer, Norristown, Penn.

EDITORIALS

Co-operation between Engineering Schools

A few years ago a project for consolidating the Massachusetts Institute of Technology with Harvard University was actively discussed; but opposition of the alumni of the Institute caused its abandonment. Since then the advocates of the union of these institutes have talked of a more or less close coöperation, in view of the impending removal of Massachusetts Institute to Cambridge. Just what sort of coöperation may perhaps develop, is disclosed in the recent annual report of President MacLaurin. He lays down the following three propositions:

(1) No extensive coöperation can be maintained with any satisfaction to either party and consequently with any chance of permanence unless the idea of competition between the institutions is eliminated. (2) The scheme to be worth much consideration must be broad enough to throw open the resources of both institutions (in equipment and in teachers) to at least some of the students of the other. (3) The obvious way to coöperate is in the treatment of the graduate students, leaving the greater part of Technology entirely alone.

President MacLaurin calls attention to the fact that duplication of effort in two neighboring institutions is not always regrettable, provided the men and plants involved are employed to their full capacity. The unit cost of educating young engineers does not follow the same laws which govern the production of machine screws in a shop. It is accepted that the efficient unit of education, if we may for the moment regard individuals thus impersonally, increases with subdivision and duplication of the classes after a certain point is reached, and this point, is doubtless attained long before institutions grow to the size of Harvard and Technology.

President MacLaurin in this report points out a few of the ways in which coöperation would be advantageous, and instances ways in which one institution or the other, if furnished with duplicate equipment, would not utilize it to complete advantage. For example, it would cost Harvard hundreds of thousands of dollars to duplicate the complete mining and metallurgical laboratories which the Institute is planning to erect, and all the students in mining and metallurgy at Harvard could easily be accommodated in the Institute's new laboratories without detriment to the latter's students. On the other hand, the Institute could not possibly duplicate the Harvard University Museum with its enormous collection of minerals, fossils, etc., which might well be open to senior students of the Institute without interfering with the work of the Harvard students. The Institute contemplates a large development of its department of naval architecture and the building of a model basin, costing upwards of $100,000. This could be used by Harvard students as well. The same rule applies to certain eminent teachers. Recently the Institute lost a highly esteemed professor of geology by the transfer of his work to Harvard where his classes are not so crowded but that students of both institutions could be effectively dealt with by a man of his capacity. A similar condition exists in the case of this professor's successor at Massachusetts Institute, as it appears that the two men have earned their reputations in different branches of the same broad subject, so that their courses need not conflict.

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Legislation to Avoid Railway Strikes

The Railway Business Association has issued a letter urging Congress at the coming extra session to undertake the enactment of a law for the better avoidance of railway strikes. The Erdman law, under which arbitration is now in progress between the railways east of Chicago and the locomotive firemen, is admittedly defective in many respects. Entire responsibility for the decision of the case is placed in the hands of a single arbitrator. The other two arbitrators, for which the act provides, are chosen by the respective parties to the dispute, and cannot be counted on for unprejudiced action. Again, the time fixed by the act for the investigation and taking testimony by the arbitrators is insufficient. In the present arbitration of the firmen's case it has been necessary, by agreement of both sides, to extend the time for presentation of testimony. The Erdman act applies only to employees engaged in train service. Other classes of railway employees, however, are equally necessary to railway operation, and means should be provided by which disputes concerning their conditions of employment, many of which have been of a very serious nature during the past dozen years, can be submitted to arbitration.

In order to bring the Erdman act into operation, also, one of the parties to the dispute must make a request for arbitration. In case both parties to a dispute assume a stubborn attitude, there is no one authorized to come forward representing the public interests and urge upon them an agreement for arbitration. It is, moreover, uncertain what effect the act creating the new Department of Labor will have upon the Erdman act. Section 8 of the Department of Labor act empowers the Secretary of Labor "to act as a mediator and to appoint commissioners of conciliation in labor disputes whenever, in his judgment, the interest of industrial peace may require it to be done." If this clause is given a broad construction, it would appear that the Secretary may intervene in any industrial dispute whatever and use his good offices for the establishment of an arbitration agreement, as has been done in the recent labor disputes between the railways and the engineers and the railways and the firemen by Commissioner Neill, of the Department of Labor, and Judge Knapp, of the Commerce Court. It may be considered a step in advance to have a Cabinet officer definitely charged with the duty of conciliation in labor disputes; but this is only a single step in advance.

It is doubtful if there is a single measure now appealing for action by Congress which has so important a relation to public welfare as the provision of a better law for the avoidance of railway strikes. Just at the pres-

ent time the country is witnessing a demonstration, in the flood-stricken cities of Ohio and Indiana, of the dire results which follow even a partial interruption of railway traffic for a few brief days. The widespread calamity which has befallen a dozen cities in the Ohio River valley, is a trifle in its disastrous effect in comparison with what would result from such a widespread annihilation of railway transportation as might at any time be caused by a general railroad strike. The Railway Business Association will render a valuable public service if it can arouse public sentiment to the extent of inducing Congress to deal with this important matter.

A Unique Explanation of the Chemistry of Combustion

The proceedings before the Arbitration Commission which is taking testimony in the dispute as to wages and conditions of service between the railways east of Chicago and the Brotherhood of Locomotive Firemen were enlivened last week by the testimony of Frank Kelley, a fireman on the Cumberland division of the Baltimore & Ohio. Mr. Kelley is no friend of the mechanical stoker, and declared that by hand firing he could decrease the coal consumption of a locomotive 50 per cent. over the amount used by a mechanical stoker. His explanation of the process of combustion is given as follows in *The New York Times* of Apr. 3:

> The chemical reactions, you understand, that take place in a firebox are entirely different on a stoker engine than what they are on a hand-shoveled engine. Science tells us that 75 per cent. of the air we breathe is oxygen, while a very small portion of it is hydrogen. Oxygen itself is an aid to combustion only, while hydrogen will burn with an intense heat. The presence of the hydrogen gas burning can be noted by extremely white, bright flames in the firebox.
>
> Now, then, I have found this to be my actual experience, that while on the line of road, after we get a little fire built up with a shovel and wet our coal, and when we have got the engine to working, the temperature of the firebox is something over 110 degrees Fahrenheit. That is naturally pressure enough to separate the oxygen from the hydrogen, and consequently by wetting the coal we get what is known as H_2O, two atoms of hydrogen and one atom of oxygen in the make-up of a molecule of water, and by freely distributing the water over the coal, we get the hydrogen that is necessary to burn, and we also get a little more in addition to the elements that are taken out of the atmosphere to add to our oxygen, and it will be much more aid to the combustion of any foreign or volatile substance that might arise in the coal, consequently we do not have the amount of clinkers to put up with, we are getting a freer draught through the grates and on the other hand we do not have to be inhaling dust from one end of the division to the other.
>
> I was only looking for an opportunity of this sort, Mr. Lee, where I could get up and put myself in evidence that if the stoker people or the stoker inventors would question our rights in regard to a man's amount of wages for a man's amount of work, I would place myself in evidence as going to the Grand Lodge and getting them to coöperate with the various anti-tuberculosis societies of the different states, if the stoker was allowed to remain in vogue, and have them abolished.

One is more or less used to seeing such amusing pseudo-science spread abroad in the newspapers, but it has a very serious side. This is part of the testimony in a case involving an annual expenditure of several million dollars which the public, in the long run, will have to pay. It does not require any great stretch of the imagination to see bills introduced in state legislatures and enacted into laws forbidding the use of mechanical stokers on locomotives. Such legislation against the use of labor-saving machinery means, in the long run, a further increase in the cost of living.

The Need for Scientific River Regulation; the Opportunity of the Engineering Profession

The terrible destruction of life and property by the floods of last week, covering a broad stretch of densely populated territory from Indiana and Illinois on the west to Vermont and New Hampshire at the east, has aroused the public as it has never been aroused before to the need of taking some measures to minimize such flood destruction. As to what can be done, what measures are feasible and what are not, the public and even a large part of the engineering profession are wholly at sea.

The papers are filled with vague talk concerning forestation, levees, reservoir construction, outlets, auxiliary channels. All sorts of nostrums are put forward. Mr. Riker, of Brooklyn, for example, declared in a published letter last week that the storm which produced the destructive floods was caused by the cold polar current, which swats the Gulf Stream amidships and crowds its beneficent influence away from the United States! Mr. Riker would prevent such storms and floods, therefore, by building a dam in the ocean across the Banks of Newfoundland in water some 200 to 300 ft. deep.

There is danger that as a result of all this mass of crude theory and pseudo-science the public may be led to undertake some wild and foolish expenditure. Millions and tens of millions may be wasted on some crudely planned scheme. The money for it would be raised, of course, by an issue of bonds, the payment of which would be conveniently shoved off onto a future generation.

The other danger, and probably the greater one, is that the aroused public demand for something to better present conditions and to safeguard against similar future destruction may be allowed to spend itself in useless frothy talk for lack of intelligent guidance. Here, it seems to us, lies the opportunity for the engineering profession, or at least for its wiser and abler members, to render a great public service and at the same time give opportunity for the profitable employment of many competent engineers.

The situation is very well put by Mr. Julian Griggs in his valuable paper on the Columbus, Ohio, flood, which appears elsewhere in this issue.

Mr. Griggs says that a few engineers had realized, years ago, that effective means ought to be taken to enlarge the channel of the Scioto so as to protect the city against the dangers of enormously destructive floods; but these engineers had realized also that the great amount of money this work would require would prevent such a proposal receiving public approval until the people had been given an object lesson of the destruction which a flood could bring to their homes.

The object lesson has come to Columbus, and, in a form more or less severe, to fifty other cities. The engineering profession has now an opportunity to guide the public aright as to what measures should be taken to guard against such destruction.

Some of our older readers may recall that nearly a quarter of a century ago when the city of Johnstown, Penn., was wrecked by a flood brought down upon it by the failure of an insignificant dam, the American Society of Civil Engineers appointed a committee to investigate the disaster. That committee reported (and its report was given wide circulation) that the dam which

caused the destruction was built without competent engineering supervision and that no responsible engineer had charge of its maintenance.

Unfortunately, the committee went no further than to absolve the engineering profession from blame for the disaster. Had it gone further and taken the initiative in promoting legislation, as it might have done, the object lesson taught by the Johnstown disaster might have resulted in the establishment of systematic state supervision of dams and storage reservoirs in a number, at least, of the most important states; and a huge amount of waste and destruction which has resulted from dam failures in the past 25 years might have been avoided.

It seems to us that a similar great opportunity is now open to the engineering profession. The public is in a mood to welcome information from an authoritative source. It ought to be informed that the science of river regulation is not a vague mass of conflicting theory; but that it has been developed in Europe to an important and well established branch of engineering. Many years ago it came to be realized on the continent of Europe that in order to protect from frequent destruction the dense population on the river flood plains, means must be taken for the regulation and control of rivers great and small. Most important of all, it was realized that streams and rivers cannot safely be left for each riparian owner to do with as he pleases, or even for each city and town to deal with according to its own condition. In Germany, for example, there is a general organization dealing with the rivers as a whole, with power to prevent the obstruction of their beds or their flood plains in a way that may injure the general welfare.

Contrast with this the situation in the United States. Suppose a railway is to be built across a river bordered on each side by a broad flood plain. It is not uncommon to see the flood plain crossed by an embankment which will entirely cut off the flow of the water except through the river channel itself. In fact this is done so frequently that it hardly excites remark. If the river is navigable, some officer of the Corps of Engineers may be responsible to see that the passage of boats up and down the stream is not unduly obstructed by the bridge, but there is no authority whatever, State or National, which has the responsibility for preventing improper obstructions being placed across a river's flood plain.

In some cases, indeed, the engineer of the railway company, or of the municipality, in case the bridge is built by a city, may have the foresight and wisdom to urge provision not merely for the ordinary flood flow in the main channel but for such extraordinary flood flows as may be expected to come once in a quarter or half a century. In nine cases out of ten, however, we venture to say that if such provision for extreme floods causes an increase in expense, the engineer will be overruled by the so called practical business men who are in authority over him. This is to be expected, and will continue until the time when the Federal government or the individual States perceive the necessity of putting under government control the whole matter of river regulation.

It is a pretty safe conjecture that in most of the cities which suffered flood damage during the last week of March, it will be found on investigation that there had been gradual encroachment upon the river channel in the city, such encroachments tending, of course, to raise the flood levels where they occur. This was so in Columbus, as shown by Mr. Griggs' article elsewhere in this issue. In Dayton, which suffered so severely, the need of enlarging and straightening the channel of the Miami River through the city had already been realized. Only five days before the flood came, a letter reached us from a city official informing us that plans for this work had been prepared and were to be carried out this summer. In the floods which ten years ago caused enormous loss in Kansas City, one contributing cause was the encroachment upon the river channel.

These encroachments proceed from causes entirely natural. Real estate in the center of a city becomes very valuable. Each riparian owner on the bank of a stream desires to add to the area of his property by filling in along his water front. When one property owner does this, others are not slow to follow his example. The City Engineer, if the city is progressive enough to have such an official, may possibly protest and call attention to the danger of such encroachments; but his voice is like that of one crying in the wilderness. What is the influence of one engineer compared with that of a dozen or a hundred wealthy property owners?

A most notable example of the strong influences which operate to produce encroachments upon river channels is furnished at New York City, where for half a dozen years the city authorities, backed by a vast array of political influence and even by high technical authority, have been seeking permission to build piers farther out into the Hudson River, and thus narrow further the width of the city's great commercial artery. Fortunately, in these navigable waters, Federal authority has stepped in and prevented the city from the shortsighted attempt to injure its own welfare. The officers of the Corps of Engineers have stood like a rock against the propositions to further encroach upon the channel of the Hudson.

Had there been established thirty or forty years ago, State and Federal systems of river regulation under the direction of competent engineers, with authority to prevent encroachment upon river channels, a vast amount of destruction of property and life wrought by floods might have been saved. Because it was not done a quarter of a century ago is no reason why it should not be done now.

We should like to emphasize, however, that if such work as this is to be carried out successfully, it must be placed in the hands of engineers with the requisite ability, and they must be furnished with enough money and given enough independent authority and tenure of position so that they can create an engineering organization able to do things.

As we have before pointed out in these columns, every State in the Union needs a high-class engineering department organized on a permanent basis, free from political control, and with authority to protect the public welfare in all matters relating to the use of water, drainage, irrigation, power development, navigation, flood prevention and maintenance of low-water flow. Such a department might also undertake very properly the supervision of highway construction where state funds are applied to this work and the inspection of highway bridges built and to be built, to see that public safety is secured and honest methods of construction are followed.

The public does not realize that for the lack of such intelligent, competent engineering direction to protect the interests of the public, many millions of dollars are

annually lost. Instances of this could be multiplied without number. In Florida, for example, recent newspaper reports before us state that the East Coast Canal, which was built under a land grant by a private company a few years ago, is now practically impassable. It is further stated that of 21,000,000 acres of land which the State of Florida was to sell for drainage purposes, but 1,000,000 acres still remain in the state's possession, the other 20,000,000 acres having been deeded away in a reckless manner with very little in the way of actual drainage effected to show for it. Our readers will recall, also, that the State of Florida undertook a few years ago to carry out drainage works on a large scale in the southern part of the state but without any adequate engineering investigation beforehand as to methods, plans, and costs and with results which are grievously disappointing.

In the far Western states a dozen years ago a great opportunity for profitable development was afforded by the passage of the Carey act, under which the Federal government agreed to turn over to the arid states certain areas of public lands which the states could improve by irrigation. Had any of these states been wise enough to establish a first-class engineering department with authority to supervise irrigation and to see to it that the plans made for works to be carried out under this law were sound and well matured, the act might have been made of the greatest benefit; and numerous prosperous and successful irrigation projects might have been established. But with the single exception of Wyoming the opportunity was wholly neglected. Land made available under the act was in many cases turned over to private promoters to speculate with as they pleased, with practically nothing in the way of effective and competent engineering supervision on the part of the state. The result is that with few exceptions, the project for developing irrigation under state control which the Carey act made possible has proved a dismal failure.

We need not take further space, however, to set forth the many ways in which the lack of efficient engineering control under governmental authority is involving the country in enormous waste and loss. The lack is due, we believe, to the fact that the public does not understand what a competent engineer can accomplish; and it is not willing to pay the price of competent engineering because it does not realize what valuable benefits such work can produce.

The public needs to learn that the engineer is not merely a man who squints through a transit or who draws lines on paper which, to the average layman, are absolutely meaningless. It is the province of the engineering profession, as long ago defined, to harness the great powers of Nature for the service of man. Equally is it its province to harness these great powers so that they shall not compass destruction.

We do not by any means suggest that the engineer should come forward at this time, like the quack physician in the midst of an epidemic, with the declaration that he can offer a cure-all for the evils that beset us. We do believe that the engineering profession, through its representative organizations should take means to inform the public as to what engineers can accomplish and as to the benefits which the public may gain by establishing competent and permanent engineering organizations for conserving the public welfare.

LETTERS TO THE EDITOR

The Need for Systematic River Regulation Work by the Government

Sir—The floods in the Ohio River valley and in New York, with their great destruction of life and property, once more forcibly call attention to the increasing necessity of controlling our river systems by suitable regulation. Most people still believe that such disasters are unpreventable and must be duly paid for, as in the case of war, by sacrificing many lives and large amounts of money. It seems to be unknown to them that river floods can be controlled, and that means of doing this are well known to engineers posted in this branch of their profession.

There are few directions where our national revenues could be spent on public works to better advantage than in river correction for protection against floods. Eleven years ago at the annual convention of the American Society of Civil Engineers, in Washington, D. C., I called attention to this subject and pointed out means and ways by which a beginning might be made in this important branch of engineering.

Western Europe is far ahead of us in this matter. While flood disasters in that part of the world are not impossible, yet their magnitude and the frequency of occurrence, where they occur at all, are now, or will soon be, so reduced, that the permanent investments for protection works are many times repaid.

Our streams are still to a large degree running wild in their original state. We have changed the face of the land by deforestation, by agriculture and by inhabitation; but we have not changed the rivers to correspond with the different rainfall runoff from these altered surface conditions. A larger proportion of rainwater now at once runs off from the more open and less retentive surfaces and thereby increases the flood volume of the streams. The denuded areas also allow more silt to be washed into the streams, which, by deposit in many instances, has tended to raise their beds and banks. These two changed conditions produce correspondingly somewhat quicker and higher floods.

The regulation of river channels to better the stream alinements and gradients, for the improvement of the adjoining land surfaces, is seen in Europe chiefly by the works along the Rhone, the Rhine and the Danube.

France and Switzerland, and particularly Germany and Austria, have been working on river regulation for over half a century and have become masters in the art of controlling and improving streams. The European engineers usually provide a fixed and suitable channel for the

river's ordinary flow, and an enlarged but also definite channel for the extreme flood flow. The exposed land of the latter channel is often cultivated to some extent, but yields a lower rental because the crops are occasionally lost by floods. Permanent bridges, roads, locks and harbors are provided primarily for the flood conditions, but are made suitable as well for ordinary conditions.

I believe the United States is the only civilized nation which has no government department in charge of river regulation. The army engineers by law look after navigation interests alone. There is no single authority here, as there is in other countries, controlling the entire stream, and regulating its alinement, gradients and cross-sections from source to mouth, with reference either to its floods, to its ordinary flow, to any improper pollution, to any deposit of offensive matter or to any reduction of its cross-section by artificial obstructions.

Is it not time that our river systems and lakes should receive the same intelligent treatment by expert engineers that is given to the rivers of Western Europe? That the subject is intricate and difficult is only a further reason why its scientific study should be undertaken as soon as possible.

It has been said that the cost of extensive river regulation works would be too great for our new country. Before the work in each drainage basin can be undertaken economically, it is necessary first to have a central authority established, and secondly to give the river systems the required preliminary study, and to decide upon the principles which are to govern their regulation. The cost of doing this much towards starting the work of river regulation is certainly not too great. There is no reason why all of our rivers should not at least be systematically studied and why proper solutions of the problems should not be prepared for all of the important streams. Their gradual and economic regulation in accordance with the results of such studies could then be undertaken in the order of their importance, and as the funds therefor were made available by Congress.

RUDOLPH HERING.

170 Broadway, New York City, Apr. 1, 1913.

The Wellsville Bridge Failure

Sir—In your issue of Mar. 13, 1913, you have an article on the failure of a steel-truss highway bridge in Colorado, by W. H. Hubbard, Jr. It might be interesting to state that if even the top chord of that truss had a vertical web in addition to the two 6x4-in. angles, the method of putting on the reinforced-concrete floor slab is absolutely dangerous, and permanently injurious to any bridge.

If the contractor saw fit to begin the construction of the reinforced slab at one end and built it continuously to the other end of this or any other bridge, then the Inspector's duty was to see that there was a counterweight (either of sand or gravel which was to go into the construction, or other dead load) placed at the center and halfway between the center and the far end, sufficient to balance the oncoming load due to the continuous construction of the reinforced floor slab.

If this were not done the amount of distortion in practice generally exceeds double the amount for which it is figured. Why the distortion should be greater I cannot tell, but I do know it takes place in actual construction. In stating this I am not criticising anybody's design except my own, and in quoting this and standing behind such a statement I am simply quoting my own experience in the same kind of construction. In building the Kennerdell bridge across the Allegheny River in Venango County, Penn., where the construction of a reinforced-concrete slab was started at one end with the purpose of continuing it across the different spans to the other end, the bridge had to be actually counterweighted. There was not only a perceptible distortion, but I was called from Pittsburgh to go to the bridge site by the local engineer in charge (Emery C. Read, Franklin, Venango Co., Penn.), for fear of permanent damage being done to the structure. When I arrived at the bridge site I was simply amazed at the excessive distortion, and was fearful that the top chord had received a permanent buckle, which, fortunately, proved afterwards not to be the case.

This was a structure that was designed for a good deal heavier loading than is common in highway practice, yet here was dead-load, without any live-load, causing the greatest and most excessive distortion I had ever seen in any bridge. I can speak with some intelligence as I had been in the past a contractor and erector of bridges for fifteen years of my life, and have spent my life continuously since 1876 in bridge designing and construction.

Since the experience at Kennerdell I begin the construction of a reinforced-concrete slab at the extreme ends, the center and quarter points.

E. K. MORSE.

Commonwealth Bldg., Pittsburgh, Penn.
Mar. 14, 1913.

Sir—In your issue of Mar. 13, you describe and illustrate the collapse during erection of a low-truss Warren-girder bridge; and in the same issue you comment editorially on the necessity of properly bracketing the upper chord to the transverse-floor system.

An examination of the drawings does not reveal that this bracketing was done, and no lateral bracing of the floor system is indicated at all, which would be necessary to make the bracketing (no matter how well done) effective. Evidently the concrete floor slab was to take the place of the usual diagonals. It occurs to me that the upper chords during construction were acting as unsupported columns of length equal to the span of the bridge. If this is the case it would be well that you would point out the lesson to be learned from this failure—the necessity of bracing and holding the chords in line until the concrete has set.

D. J. MCLACHLAN.

Calgary, Alta., Mar. 18, 1913.

A College Course in Photo-Surveying

Sir—In an editorial on "Stereophotogrammetry" in your issue of Mar. 27, 1913, you state, "It is doubtful if any American engineering college gives actual practice in photo-surveying, etc."

I beg to advise that the theory and practice of photographic surveying has been a part of the civil engineering curriculum at Syracuse University for the past three

years. The course offered covers eight recitation periods and 60 hours in the field and drafting room. Squads of five men each take about fifteen photographs which they develop and print. Contour maps, plotted from these prints or the negatives, are required from each student.

LOUIS MITCHELL.
Assistant Professor of Civil Engineering.
L. C. Smith College of Applied Science,
Syracuse University, Apr. 2, 1913.

Tornado and Flood Damage at Terre Haute, Ind.

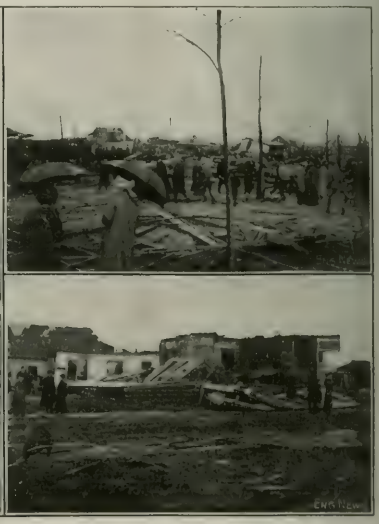
Sir—In accordance with your request, Prof. McCormick and I went over the track of the tornado which passed through the southern portion of Terre Haute, Sunday night, Mar. 23. The first serious damage near the city was to the farm buildings and surrounding grove of trees owned by W. P. Ijams, the owner of Axtell. The house was constructed many years ago. This suffered comparatively little damage. Only a portion of the roof is gone, one small gable end and most of the glass. On the east front the building is cracked from top to bottom. A large barn near-by is a complete wreck, as well as tenant houses of wood. The trees were turned over but not moved forward excepting where the tops were broken out. These were sometimes carried quite a distance.

Moving from the Ijams farm towards the city, the storm wrecked a frame house and crossed open fields to a railroad where empty coal cars were turned completely over, the trucks being on top, and then struck the Root glass factory where the wind and a fire which followed did $20,000 to $30,000 damage.

The main portion of the damage in the city was confined to a strip between 400 and 500 ft. wide and two miles long. The buildings were, for the most part, one-story cottages or bungalows. The better class of these lost roofs and windows but the others were completely wrecked, in some cases merely a small pile of rubbish being left. Occasionally roofs were transported some dis-



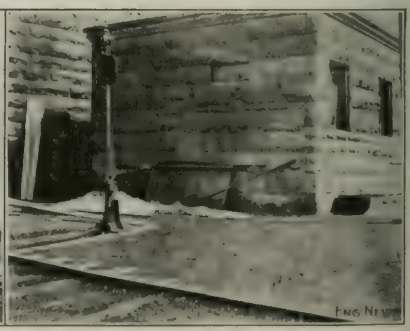
RUINS OF ROOT GLASS WORKS



VIEWS AT SOUTH 6½ ST.



A SUBSTANTIAL BRICK HOUSE



STONE PUSHED INWARD ON BUILDING

VIEWS IN PATH OF TORNADO OF MARCH 23 AT TERRE HAUTE, IND.

tance, but in general the material was left near its original position.

Buildings which were well constructed of good materials suffered less damage as witnessed by a two-story brick house constructed with 13-in. walls of paving brick. This lost the roof with the ceiling of the second story, the windows and a small portion of the side walls. A good photograph of this building shows the south side. Across the street from this building (east) a stucco cottage was practically wrecked while a well built cottage just north of the stucco building suffered very little damage.

The cottages in many cases were turned on their foundations, some going clockwise and others going contra-clockwise.

Examples of soft wood piercing hard wood occur. Stone copings were torn away and in one case an individual stone in the side of a building was pushed in some three or four inches (see photograph).

The damage done is variously estimated at from $750,000 to $1,500,000. I think $750,000 will cover the entire damages. This includes a loss of $60,000 by Mr.



Flood in Wabash River Overflowing Brick-Paved Roadway to West Terre Haute

Ijams (who lost fine horses) and $30,000 by the Root Glass Co. The latter lost a goodly portion in the fire following the storm.

Fortunately there were but very few fires and these were quickly controlled. Of course the street railway and telephone companies lost wires and poles.

The loss of life totals about 20, which is remarkably small when one considers how thoroughly some of the buildings were wrecked. There were possibly 200 homes in the immediate track of the storm.

In a general way weather conditions were such that weather observers might predict a storm of the tornado type somewhere in the district but the station here recorded nothing unusual other than a quick rise of temperature of some 25°.

Immediately following the tornado the Wabash river commenced to rise and by 7 a.m., Mar. 27, the stage was 31 ft. 3 in., which is about 3 ft. 6 in. higher than any previous record and our records go back 60 years.

The Terre Haute, Indianapolis & Eastern Traction Co. was put out of business for about 16 hours and the city was without electric light, electric power and street railway service. The gas company shut down Thursday morning and did not give any service from Thursday night until Saturday afternoon. Fortunately the waterworks company was able to pump water; but it was unable to filter the water efficiently.

The town of West Terre Haute and the settlement called Taylorville, the two having a population of about 1500, were submerged so that all the people had to leave. Thus far four fatalities have been recorded and these were due to exposure.

The Vandalia lines and N. Y. Central lines lost stretches of roadbed west of the city but all bridges here are standing and in use.

The traction company lost its track on the side of the road leading to West Terre Haute. The photograph shows the water flowing over the brick-paved roadway and washing away the fill under the track.

Malverd A. Howe.

Terre Haute, Ind., Mar. 31, 1913.

A Valuable Set of Stream Gaging Records

Sir—Hearing this morning that Mr. John E. Codman, of the Bureau of Water, Philadelphia, has severed his connection with the Bureau, I recall an important work which he has carried on since 1883 and up to the time of his retirement, which I consider to be a contribution of great value to the science of hydraulic engineering and which is not generally known. It relates to a record, which has been maintained for 30 years, of the run-off of the Perkiomen, Neshaminy and Tohickon Creeks, near Philadelphia—streams which were at one time considered available as a water supply for that city—and of the Schuylkill, which has been used from the beginning of the city's public water supply in 1801.

In length of time covered, these records are nearly equal to the records of the Sudbury River in Massachusetts and the Croton River in New York, but the special value of the Philadelphia records is that the records are given in much detail. I may mention the automatic rainfall and stream flood gages kept on each watershed and the detailed physical survey, plotted to a scale of 400 ft. to the inch, of the entire watersheds from which the run-off has been continually measured.

By this detailed survey I refer not only to the 10-ft. contour lines, but also to the measurement of the areas which are covered with forests, the roof and road surfaces and the permeable agricultural surfaces. The three watersheds mentioned are topographically different in character, one having its steepest slopes near the periphery, another near the lower areas and the third being somewhat more uniform in slope and more cultivated than the others. By these differences and with a continuous record of rainfall and run-off, the data allow deductions to be made which must be of exceptional value to the profession at large.

Rudolph Hering.

170 Broadway, New York City, Mar. 10, 1913.

[We referred the above letter to Mr. Codman with a request for further information regarding these stream gagings, and append his reply.—Ed.]

Sir—Mr. Hering's letter, respecting the Philadelphia hydrographic surveys, might convey the impression that all of the work he mentions was mine; for he refers to

me as having carried on this work since 1883 (when it was begun) and makes no reference to his own connection with it.

As a matter of fact, Mr. Hering himself, beginning in 1883, made the monumental survey of the territory involved; whilst I (rated as Chief Draftsman in the Water Department) took up the work after the close of Mr. Hering's survey in 1888, since which date I have merely remained in charge of the observations and studies of stream flow.

Mr. Hering's survey occupied a period of some three years, and required the services of a highly trained corps of some fifty engineers. It covered all of the country practically available for a water supply to Philadelphia, including large portions of the Schuylkill, Lehigh and Delaware water-sheds. It was divided into investigations for topography, hydrography and sanitation. It was then and it has always since been known, in the Water Department and Bureau, as "The Hering Survey for a Future Water Supply for the City of Philadelphia." It is fully described and illustrated in a special report, bound up with the report of the Water Department for 1886.

Replying to Mr. Hering's concluding query, I have the pleasure to say that his survey is made the basis of detailed statements of maximum, minimum and average stream flows, in the annually published reports of the City's hydrographic survey, of which I have, until recently, been in charge.

JOHN E. CODMAN,
330 So. 42 St., Philadelphia.

March 12, 1913.

A Reinforced-Concrete Building in a Tornado

Sir—In regard to the terrific cyclone experienced by Omaha, Neb., on Mar. 23, the most interesting feature to the engineering profession is the comparison of the effect on the modern and out-of-date methods of construction.

The first large structure encountered was the Medical College of the University of Nebraska, which is just nearing completion at a cost of $100,000. This building (Fig. 1) is L-shaped, 102x100x55 ft., with three stories and basement, of reinforced-concrete and brick, and strictly fireproof. The floors and roof are of reinforced-concrete slab design, supported by steel columns incased in concrete. The outside walls are of brick; the inside partitions are of pyrobar, except for the bearing walls along the halls.



FIG. 1. THE MEDICAL COLLEGE OF THE NEBRASKA STATE UNIVERSITY AT OMAHA, NEB., AFTER THE TORNADO OF MAR. 23

(Steel columns, brick walls and reinforced-concrete slab floors and roof. A row of five new modern houses occupied the lots to the left of the road and just beyond the concrete building. They were completely destroyed.)

After the storm, the building was carefully gone over to ascertain the extent of damage. As to the structural part of the building not a single check could be found. However, a few of the inside partitions were blown down and window frames blown out, but $1000 will cover all damage. The contractor's buildings were all carried away and demolished. The territory surrounding the building was thickly populated and the destruction is plainly evident in the accompanying view.

The next large building encountered was a three-story automobile garage. This building was not fireproof. The exterior was of brick and the interior of slow-burning construction. This was demolished (Fig. 2). Both buildings were in the direct path of the storm.



FIG. 2. AUTOMOBILE GARAGE AT OMAHA, NEB., AFTER THE TORNADO OF MAR. 23

(Brick walls and slow-burning interior construction.)

JOHN R. RIPPEY,
Assistant Superintendent of Construction, Grounds and Bldgs., University of Nebraska.

Omaha, Neb., Mar. 29, 1913.

[The college is near Harney and 44th Sts. The garage is at the corner of Farnam and 40th Sts., as noted in our issue of Apr. 3.—ED.]

NOTES AND QUERIES

A. R., Los Angeles, Calif., writes:

In your issue of Mar. 20, there appeared a discussion regarding the status of the engineering profession. There could be no better means of getting at a solution than by having every man belong to the American Society of Civil Engineers, or a corresponding society for his particular line of work, said society to conduct an employment bureau as you suggested. But I do not believe that this would be possible because there are many men well established in the profession who never have and never will contribute a cent to the support of such a society. It is such men as these that make the task of the few who are trying to better conditions doubly hard. I am speaking from experience when I say that the only object these men have in mind is the cutting down of engineering expense in order to satisfy their superiors. The result is that the cheap ones get the jobs and the others either have to amend their prices or go without eating. The effect of this is to cause those who hire engineers to form an idea that the cost of engineering should be very little. So when a first-class engineer comes along and names his price for this or that service it at once conveys to the mind of the employer the idea that the price is just a wee bit high. He figures that so and so would do the same work for half the amount, and the next time there is a similar service to be rendered so and so gets the job. If something is not done, the man with the money will soon have his engineering done for nothing.

For those who are seeking a remedy, I would like to suggest that they start at the beginning. The trouble lies with those higher up, and until some means can be found of getting all those at the top to take an interest in the members there is no use in figuring on better conditions.

Reports from the Flooded Districts

Recent High Water in Pennsylvania Streams

The floods of the latter part of March, 1913, seem to have done relatively little damage in Pennsylvania, compared with Ohio, but the sum total was doubtless considerable. The following summary of the effects of high water in the state is based on information kindly supplied by Farley Gannett, Engineer of the Water Supply Commission of Pennsylvania.

No dam failed, so far as is yet known. Numerous bridges were destroyed, especially in the western part of the state. In the Sharon district a number of building foundations were disturbed, resulting in the destruction of the corresponding superstructures. Many miles of railroad embankment were eroded, both in the west and the east.

By far the worst destruction was wrought along the Shenango and Beaver rivers. The commission is preparing a comprehensive report on what occurred in this district. The report will include precipitation, hydraulic data and damage done, based on material collected by a representative of the commission who was on the ground almost at the beginning of the high water and stayed there until Mar. 31.

The commission also had men in many other parts of the state, taking meter measurements, recording flood heights, taking photographs and collecting data on the damage done. When all the information has been brought together it will make a complete story of high water on all the main streams of Pennsylvania.

Flood Effects at the Works of the Indianapolis Water Co.

By Charles H. Hurd*

The water-supply for the city of Indianapolis was interrupted from 12:30 p.m., Tuesday, Mar. 25, until 7:00 a.m., Friday, Mar. 28, on account of high water due to the breaking of a city levee along the west bank of Fall Creek. [We understand that this break put the Riverside pumping station out of service.—Ed.]

We suffered no damage which would interfere with our regular operation at our main station or at our filtration plant, except the flooding of some small motors which were used to pump seven deep-rock wells. Conditions are now (Apr. 3) normal with a total pumping capacity of 82,000,000 gal., which is approximately four times our average requirements.

The breaks in the banks of the canal have been repaired and water is now being supplied to our filtration plant from White River, at Broad Ripple. During the time these repairs were being made, our supply was furnished by the emergency station located on Fall Creek.

Our Washington St. or water-power station is temporarily out of service on account of the breaking of the conduit which furnishes the supply to this station. This break was caused by the collapse of the West Washington St. Bridge, which crosses White River at this point. The shutting down of this station will not interfere with our service in any way, as the equipment at Riverside was designed to take care of the maximum requirement at such times as Washington Station might be out of service on account of low water or for other causes.

The proposition is now being considered to strengthen and raise the city levee along Fall Creek and to provide additional waterway to protect the portion of the city in which the Riverside pumping station is located.

The crest height of the present flood was 4½ ft. higher than any other flood of which we have a record.

*Superintendent and Chief Engineer, Indianapolis Water Co., Indianapolis, Ind.

The Flood at Rochester, N. Y.

By E. A. Fisher*

The Genesee River was higher during the floods late in March, 1913, than at any other time since 1864.

The water was about 8 ft. deep over what is known as the Court Street Dam. This was about 4 or 5 in. higher than the high water of 1902. The estimated maximum flow was about 45,000 cu.ft. per sec.

The Genesee River overflowed its westerly bank between Main St. and Central Ave. and flooded a portion of Front St. and adjacent intersecting streets to a depth of from 1 to 3 ft. There was no appreciable current, and the damage consisted in the flooding of cellars in the area covered by the water, and also the flooding of some cellars on Main St. connected with the outlet sewer passing through Front St., which sewer was gorged by the water entering through the surface sewers and manholes in Front St.



The Genessee River in Flood at Rochester, N. Y.; at the Canal Aqueduct

I have no reliable estimates of the amount of the damage. This damage was lessened, due to the fact that the merchants had considerable notice of the high water and many of them made preparations by removing their goods from the cellars.

The high water was due to a continued rainfall on the upper river. We have no records of the rainfall on the territory. The rainfall at Rochester was comparatively light, as shown by the accompanying table. The highest water occurred on Friday, Mar. 28, between 10 and 12 p.m.

*City Engineer, Rochester, N. Y.

RECORD OF RAINFALL AT ROCHESTER, N. Y., MARCH 20 TO 28, 1913

(Total for month, 5.16 in.)

	Inch
March 20	0.42
March 21	Trace
March 22	Trace
March 23	0.21
March 24	0.40
March 25	1.06
March 26	0.77
March 27	0.65
March 28	Trace

The Effect of the March Floods on the Terre Haute Water-Works

By Dow R. Gwinn*

The tornado of Mar. 23, 1913, which caused a loss of over 20 lives and a property damage of perhaps $1,500,000 in Terre Haute, Ind., was followed by an unprecedented flood. During this flood the river rose to a level of about 31 ft. 3 in., as nearly as we could measure, all gages being submerged. The river was 4.7 in. higher than during the last flood of 1883 and when the new gages were established, no one dreamed of the water reaching the height of even 30 ft., so provision for such a height was not made.

The gas plant and the electric-light plant on the river were put out of business, but, fortunately, we were able



Flood Conditions at the Pumping Station of the Terre Haute Water-Works on Mar. 27, 1913

(The river height was 31 ft. 3 in., as nearly as could be told. The building to the right contains old pumps, not in use. At the extreme left a bit of the corner of the Allis-Chalmers pump room is shown. The vine-covered building in the center is the old boiler room, the boilers in which were submerged. In the right background is the bridge of the Big Four R.R.)

to keep the water-works plant in operation so far as the general service was concerned.

We have an Allis-Chalmers triple-expansion vertical pumping engine in a reinforced-concrete pit 21 ft. deep and approximately 45x45 ft. in plan. The bed plate of the engine is on the floor level; that is, 21 ft. from the bottom of the pit. The water came within about 18 in. of the floor level.

The concrete pit was separated from a brick pump pit by a brick wall. The brick pit was made of very heavy walls (I should judge about 2 ft. thick) but these were not impervious to the water and we had considerable leakage. Then later on, the water flowed over the brick wall partition, flooding the Allis-Chalmers pump pit. The water did not interfere with the operation of the high-service pumps, but in this same pit is also located our low-service pump, which delivers the water to the sedimentation basin. It is a centrifugal pump operated with a rope drive from a Williams compound engine, located on the floor level. After the water reached the level of the rope drive, about 2 ft. from the bottom of the pit, we were compelled to shut down the pump.

As the turbidity was in the neighboorhood of 1200 to 1500, it was impossible to get good results from the filters, although they were washed four or five times in one day. The settling basin was cut out for about 45 hours, during which time the water pumped into the mains was anything but satisfactory. However, the citizens of Terre Haute were very much pleased to have any kind of water, as neighboring cities were cut out of a public water-supply entirely.

As soon as we can do so, we will raise the brick division wall and endeavor to make it impervious to water by proper treatment. We will also arrange for better facilities for pumping flood water from the pit and are considering the installation of a 6-in. centrifugal pump direct connected with a steam turbine. We are also considering the idea of installing a low-service centrifugal pump with a vertical shaft and vertical steam turbine to deliver water into the settling basin, the idea being to have the turbine several feet above the highest water.

We were well pleased with the result of the flood test of the concrete pit. This pit was built under plans made by Prof. Daniel W. Mead of the University of Wisconsin, the walls being 3 ft. thick at the bottom and 2 ft. at the top, with ample reinforcement. We did not use any waterproof compound in the concrete mixture, but took great care to have a strong liquid mixture. We used a gravity mixer and had unusually good forms or boxes, and spades were used to keep the coarser material from lodging next to the forms. After the forms were removed, the outer surface of the walls was covered with Tarsch Bros. R. I. W. marine paint, care being taken to have every portion of the wall covered. The bottom of the pit was laid in several layers with a coating of the marine paint between the same. Notwithstanding the fact that the water from the river was very close to the top of the 21-ft. walls, we did not find a single leak at any place in the concrete walls.

*President and Manager of the Terre Haute Water Works Co., Terre Haute, Ind.

Flood Damage at Sidney, Ohio

By W. R. Blake*

Sidney, Ohio, was greatly damaged by the recent flood, but on account of the favorable location of the city as regards the river the damage did not amount to nearly so much as at the lower towns, Piqua, Troy and Dayton. Piqua lies 12 miles south of Sidney, Troy 20 miles and Dayton 40 miles, all lower down the river.

The greater part of Sidney lies well up on high ground and most of the residence district is located on rather high hills. Besides this advantage there is a rather sharp decline of the river bed and the water flows rapidly and does not have a chance to back up.

The other towns mentioned are not built on such high ground, and besides this there was a tendency for the water to form basins at these places, especially where there happened to be certain obstructions favorable to make those conditions, such as bridges and railroad embankments.

This city was in total darkness for a time, many elec-

*City Engineer, Sidney, Ohio.

tric-light wires being down and gas mains being broken. The sewers were out of commission in the lower part of the city. The water-works, being well up, was not put out of commission, but the only water-supply available was muddy river water, as the wells were overflowed.

A total of 7.8 in. of rain fell between Sunday noon (Mar. 23) and Monday night or early Tuesday morning. The rain came in a steady downpour. As far as can be learned this heavy rain fell over such a large territory as to entirely fill all streams beyond their capacity. Besides the above rain the condition of the ground was rather wet, rain having fallen very steadily for three or four days during the previous week, ending Friday night.

By very hard work to save them, no bridges were completely destroyed in Sidney, although some of them were badly damaged. The loss of bridges and roads in the immediate vicinity of Sidney is estimated at $125,000 to $150,000. About six or eight houses were completely washed away in this city.

⁂

The Floods in New York State and the Work of the State Department of Health

The damage wrought by the floods of March, 1913, in New York State was largely concentrated in the "Capitol District." Some damage was done at Rochester, as stated in a brief report from E. A. Fisher, published elsewhere in this issue. The extent of the damage done to the Barge Canal has not yet been officially announced.

Up to Apr. 1, 1913, we are informed by Alex. Rice McKim, inspector of docks and dams, State Conservation Commission, only eight dams had been reported as having been damaged to any considerable extent. These were small, and of either earth or crib construction. All of them were old dams, built before the Commission was established.

The flood of a year ago (April, 1912) carried out several times as many dams as that of 1913, Mr. McKim having inspected 22 failures out of a larger number which occured in 1912.

The gaging stations of the Conservation Commission were all in working order, so flood data for the entire state will be available later on.

Considerable portions of Troy, Watervliet and Albany were inundated, practically paralyzing the trolley service and, in sections, the electric-light service as well, besides causing heavy damage to water-front industries and some suffering among residents.

The water-filtration plants of Albany, Rensselaer and Green Island were thrown out of service by the flood. Full particulars as to the Albany plant are given elsewhere in this issue. The following particulars regarding the Rensselaer water-supply are from a correspondent:

The filter plant is located on the banks of the river and when the floods arose the pumping station was submerged sufficiently to put it out of commission so that no water could be pumped into the system. The city has a distributing reservoir but unfortunately the main pipe line from this reservoir broke as a result of a washout so that the city was entirely without water for about two days, Friday and Saturday. As soon as the pipe could be repaired, which was in about 48 hours, the city system was put in operation, and water has since been supplied regularly to the citizens. Before its storage was exhausted the river had lowered so that the pumping and filter plant could be put in operation, from all of which it is evident that, except for the two days during which the people had to rely upon wells or water from any source from which they could secure it, the water-supply system was in operation. There was no pollution of the water in the reservoir and consequently outside of the two days' interval referred to, filtered water has at all times been supplied to the citizens.

The Rensselaer filtration plant is supplemented by a permanent hypochlorite plant, which has been in continuous operation for about two years.

The Green Island water-filtration plant and well system was flooded for two days, but sufficient storage was available to supply the consumers without drawing on the untreated river water.

The Troy water-supply is by gravity from the hills and was not affected by the flood. The Watervliet supply was not shut off by the flood.

Outside the "Capitol District" there were practically no reports of polluted water up to April 1, except that the ground water-supply area of Oswego was flooded with water believed to be polluted. Samples were collected for analysis by the State Department of Health and the people were warned to boil the water.

Before the flood reached its height Dr. Eugene H. Porter, State Commissioner of Health, sent warnings through the Associated Press and by telegrams to the most important cities of the state urging the authorities in control of threatened water-supplies "to use every safeguard to protect these supplies and to notify the public of the safe precaution to boil all water until all effects of flood conditions have passed."

On Saturday, Mar. 29, Governor Sulzer took up the Albany water-supply situation with the State Department of Health (the city had already acted, as stated in the article by Mr. Greenalch, elsewhere in this issue). The department pointed out to Governor Sulzer that to bring in drinking water by rail, as the Governor had suggested, would give rise to difficulties if not to dangers. The department advised that faith should be pinned to boiling water used for drinking purposes. To remove or lessen the turbidity of the water a plan for household treatment was outlined by Theodore Horton, chief engineer of the department, as follows:

> Add 1 oz. of alum to 1 bbl. of water, or for smaller volumes at the rate of 1 level teaspoonful to 3 gal., and let it stand over night. The clarified water should be boiled subsequently. The "flat" taste of the boiled water may be removed by pouring the water, as wanted, into a glass held 12 to 18 in. below a pitcher. It is advisable to pulverize the alum, then dissolve it in a small quantity of water before the alum is admitted to the water to be clarified, and the water should be stirred after the solution is added.

⁂

Dayton, Ohio

In Dayton every effort is being directed toward making the city livable and no accurate estimate of the damage has been made. The flood stage reached approximately 29 ft., the highest previous record being 21.8 ft. The levees were designed for a stage of 25 ft. Two steel highway bridges and two spans of a steel railway bridge were washed away but all of the concrete arches are safe. The levees, being overtopped, were badly riddled and asphalt pavements in the flooded districts ruined. [By telegram from Gaylord C. Cummin, City Civil Engineer.]

The Recent Flood at Columbus, Ohio

By Julian Griggs*

The extraordinary rainfall of Mar. 23-27 over the drainage areas of the Scioto and the Olentangy Rivers produced record high water in the two rivers at their confluence in the City of Columbus, Ohio, and caused flood damage and loss of life without precedent in the history of the city. The Olentangy River has a drainage area of about 514 sq.mi. and the Scioto a drainage area above the city of approximately 1050 sq.mi. The flood plain of the valley at Columbus is about two miles east and west from bluff to bluff, and the well settled portion of the same north of Mound St. to the Scioto River averages a mile in width (see map, Fig. 1). At the beginning of the flood week it was occupied by a population of approximately 30,000, generally living in comfortable frame houses, having an average value of about $2500. It also had its fair share of factories, stores, shops, schools, hospitals and churches.

The Scioto River,† after passing over the Storage Dam, about 4½ mi. above the confluence of the two rivers, runs through a narrow valley descending at the rate of approximately 5½ ft. per mi. for about four miles to the corporation line at the mouth of the Dry Run, located at the foot of the western bluff. Thence the Scioto flows under the bridges of Grand View Ave., the Big Four Ry. and Sandusky St. to the Hocking Valley Ry. (north crossing), being joined just above that bridge by the Olentangy and passing on the way the water-purification works and the municipal electric-light plant in a meandering channel two miles in length. Thence it flows southeast, south and southwest for 1½ mi. under eight bridges spaced 0.085 to 0.284 mi. apart to the Mound St. bridge; thence south and southeast for 1.4 mi. to Greenlawn Ave., generally along lands devoted to market gardens; thence south through farming lands passing the City R.R. bridge, the sewage pumping station, the Frank Road bridge, the city purification plant and the garbage-reduction works in a distance of 2 mi.; thence about 1½ mi. in a wide, alluvial bottom to the mouth of Big Run.

Flood of 1898—The record flood in the rivers previous to this year was in 1898. In that year the high-water slope of the river in the first two miles east of Dry Run was then 2 ft. per mi. From the Hocking Valley Ry. (north crossing) to Greenlawn Ave., a distance of 2.8 mi., it was 4.83 ft. per mi.; thence to the mouth of the Big Run, 3.46 mi., it was approximately 2.37 ft. per mi. The profile of this high water, with the location of the bridge and the works as above noted, is drawn to scale in Fig. 2. The steep slope of high water the Scioto River, for the section of which State St. is the approximate center, is due to the throttling of the stream by encroachments upon the channel and the contractions at the bridges. The Broad St. bridge affords the smallest opening, being only 290 ft. at right angles to the thread of the current, including one pier.

Present Levees and Embankments—The Scioto has a levee on its western bank from the natural bluff at Dry Run to the garbage-reduction works south of the city, a distance of a little more than 7 mi. This levee had been in process of construction for many years, but was completed, after the flood of 1898, to a uniform height of 6 ft. above the high-water marks of that year. About one-half of this levee was occupied by a railroad track in daily use.

It should further be observed that a separation of the grade of the streets and the four railways passing through the flood plain south and west of the Scioto River had

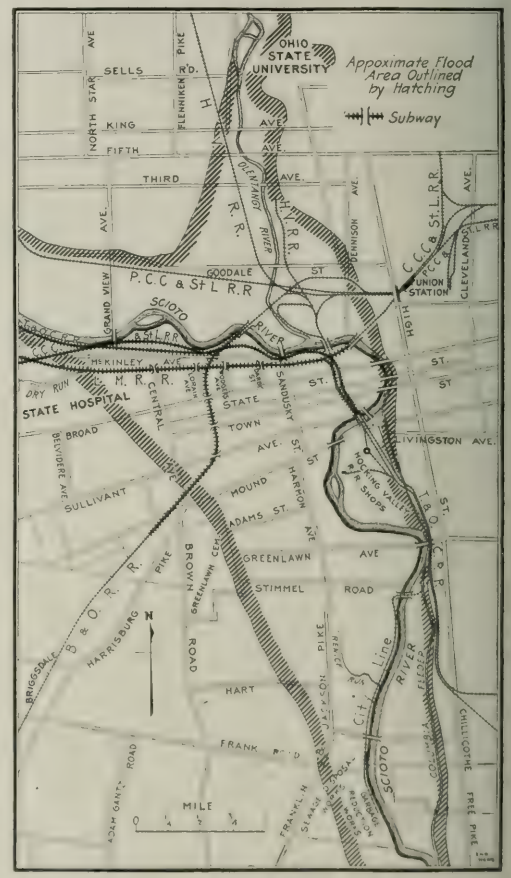


Fig. 1. Map of Columbus, Showing Extent of Recent Flood

(Only important streets shown, levee and railway embankments indicated by heavy black lines.)

just been completed in accordance with the best present-day standards for such construction. The railroad embankments had nearly the same elevation as the top of the adjacent levee, except in one place, at the joint crossing of the Little Miami, Hocking Valley and Toledo & Ohio Central Rys. (Fig. 5) which was 5 ft. below the levee

*Chief Engineer, Lancaster Traction & Power Co., Columbus, Ohio.

†The entire new water and sewage works of Columbus was described in an extensive paper entitled "The Improved Water and Sewage Works of Columbus, Ohio," by John H. Gregory, in the "Transactions" of the American Society of Civil Engineers, Vol. 67, 1910, p. 206. The so-called "Storage Dam," noted throughout Mr. Griggs' article forms the reservoir from which the water supply is taken. It is a concrete structure of gravity section, about 1000 ft. long, consisting of two abutment sections, one on each bank of the river with an overflow section between. The overflow section is at El. 73 (low water being at El. 42 and is 500 ft. long. The section is such that the overflow portion can in future be raised to the same elevation as the abutment sections, that is, to El. 117.—Ed. "Eng. News."

grade to permit the subsequent raising of the L. M. R.R. for an overhead crossing of the other railroads at that point. The L. M. R.R., west of this crossing had five street openings through its embankment at Sandusky St., Darby St., Rodgers Ave., Lorain Ave. and Central Ave., spaced about 1100 ft. apart. The Baltimore & Ohio R.R. embankment was pierced by four subways located at McKinley Ave., Broad St., Town St. and Sullivant Ave.

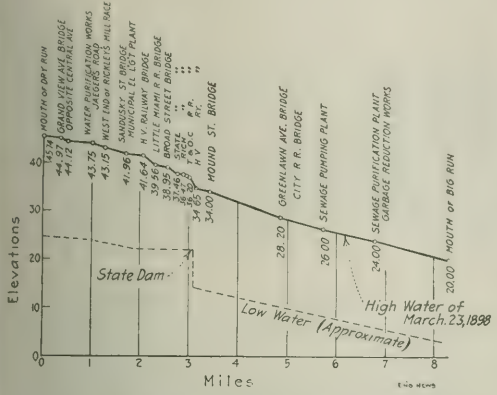


FIG. 2. PROFILE OF SCIOTO RIVER DURING RECORD FLOOD OF MARCH, 1898

It was known by a few who had made a study of the situation, that the river channel would ultimately have to be widened in the vicinity of Broad St., and for that reason extensive expenditure in the construction of high concrete levee walls at this point was avoided. It was known that no money for the widening of the river channel at this point could be had until a calamitous flood should occur to bring the community to a realization of the necessity for such enlarged channel, but no one ever had an imagination sufficient to visualize, in his mind's eye, the awful magnitude of the calamity when it finally came, nor the extent of the new works required adequately to meet the demands of the situation.

signed to the Olentangy and 50,000 sec.ft. to the Scioto River.

FLOOD OF 1913

Fig. 3 shows a plotted curve of the gage readings on the crest of the storage dam in the Scioto from 7:30 p.m. on Mar. 24, 1913, to 9:30 a.m. of the 28th. The table herewith also shows the rainfall

U. S. WEATHER BUREAU RECORD OF RAINFALL IN INCHES

Date 1913	Bellefontaine, Logan Co.	Marion, Marion Co.	Columbus, Franklin Co.
March 23, p.m.	1 37	1.23	0 53
March 24, a.m....	1 52	1.02	0 09
March 24, p.m.		1 12	1 94
March 25, a.m....	5 61	3 65	0 68
March 25, p.m....		1 06	1.14
March 26, a.m..	2 13	1 03	1.58
March 26, p.m.		1 00	0.55
March 27, a.m	0 53	0 50	0.46
March 27, p.m			trace
Total..	11 16	10.71	6 97

record of the U. S. Weather Bureau for Columbus, and at two points in the drainage area of the Scioto, 45 mi. above this city for four days beginning at noon on Easter Sunday, Mar. 23. It will be noted that the heaviest rainfall of any 24 hours occurred at Bellefontaine on the 25th and was 5.61 in., with Marion 4.71 in. on the same date, while the total precipitation for the four days was 11.16 in., 10.71 in. and 6.97 in. at Bellefontaine, Marion and Columbus, respectively.

The runoff from this rainfall caused a rapid rise at the Scioto River Storage Dam.* The head on the round-topped weir, 500 ft. in length, is plotted to scale in Fig. 3 and shows a head of 10 ft. at 8 a.m. on Tuesday, the 25th, when the channel capacity of 63,246 sec.ft. was passing. The river began to flow over the levee at a point five miles below at 9:25 a.m. of the 25th.

The discharge shown in Fig. 3 was computed by the Francis formula with 4 as a constant for a round-topped weir ($Q = 4 \times 500 \times H^{\frac{3}{2}}$). It will be noted that the river continued to rise and reached its crest of 12.9 ft. at 1:39 p.m., 5½ hours later. By the same weir formula above noted the maximum discharge was 92,665 sec.ft. or 46% in excess of the channel capacity on a 10-ft. head, and the discharge continued in excess of

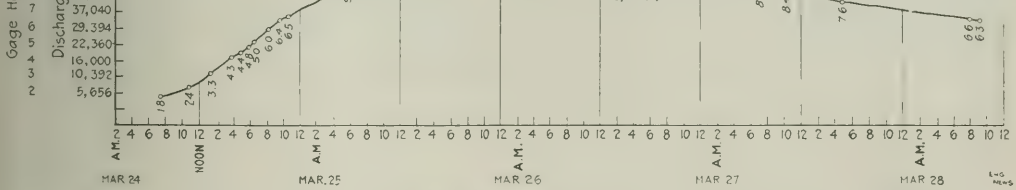


FIG. 3. GAGE READINGS AND DISCHARGES OVER STORAGE DAM, SCIOTO RIVER, MAR. 24-28, 1913
(Discharge = $Q = 4\ L\ H^{3/2}$.)

The flood of Mar. 23, 1898 was the greatest known up to that time. It was estimated that by providing a levee 6 ft. higher than that flood, a margin of 25% for greater floods would be secured.

From the best available data the maximum discharge of the river in that flood was estimated by an expert engineer as 75,000 sec.ft., of which ⅓ or 25,000 sec.ft. was assuch capacity for a total of 26 hours, until 10 a.m. of Wednesday, Mar. 26. In the meantime the earth levee

*Mr. Gregory's Am. Soc. C. E. paper says in regard to the overflow section of the dam: "The overflow is 500 ft. long and was designed to discharge a maximum rainfall of 6 in., on the drainage area of 1032 sq.mi. above the dam, flowing off in 24 hours, or about 166,500 cu.ft. per sec. To discharge this quantity would require a depth of about 21.7 ft. on the overflow."—Ed. "Eng. News."

was overtopped at all points west of the L. M. R.R. bridge, badly damaged in numerous places and totally destroyed at six gaps aggregating 3300 ft. in a length of 2.75 mi. This length includes 0.50 mi. along the east and south bank of Dry Run, which had only one gap of 69 ft., located on the State Hospital grounds near the bluff at its western end.

it were to be seen blocks of sandstone coping from the abutment 3x5 ft.x18 in. transported by the current. Ten substantial frame dwellings, which were immediately below this break, had disappeared, having been destroyed or floated away.

After passing the L. M. R.R. tracks at Central Ave., Loraine Ave. and the break at the B & O. R.R. crossing,



Fig. 4. Sullivant Ave. Subway, B. & O. R.R., Columbus, Ohio, Looking South



Fig. 5. B. & O. R.R. and Little Miami R.R. Crossing Looking North

Figs. 4 and 5. Breaks through Railway Embankments, Columbus, Ohio

As soon as the levee was overtopped, as above noted, the flood in great volume poured into the basin ¼ mi. wide and a mile in length, bounded by the L. M. R.R. and B. & O. R.R. track-elevation work and passed with a tremendous scouring velocity seeking an outlet through the three subways at Central, Lorain and McKinley Aves. This basin was soon filled with water 16 ft. deep, and the railroad tracks, which at this point had substantially the same elevation as the levee above them, were overtopped at the crossing of the two railroads. Of the 16-ft. high embankment, 600 ft. long on the L. M. R.R. and 400 ft. on the B. & O. R.R. was totally destroyed, and in addition holes were washed in the natural ground upon which they rested.

the water passed on and again piled up west of the B. & O. R.R. at Sullivant Ave., filling that subway and topping the embankment for more than 400 ft. at the dip in the grade there (base of rail elevation 43.17 ft.), causing the water to accumulate in a few moments to a depth of 17 ft., rising high over the second-story floors of dwellings in a populous and desirable residential section, thus driving the inmates up into their attics, where such a refuge was available. From the Sullivant Ave. subway the water had a free outlet into low ground, where its flow was unobstructed. The numerous frame dwellings in its path yielded quickly to its destructive action, the north abutment of the subway was destroyed and a single line of rails on the 28th remained suspended for 180



Fig. 6. Looking Southeast



Fig. 7. Looking West

Figs. 6 and 7. Views from Sullivant Ave. Crossing, B. & O. R.R.

At Central Ave. the force of the current undermined the east abutment of the subway and the embankment behind it for 150 ft. in length. At the time it was viewed, about noon on Friday, Mar. 28, although the water had then fallen 12 ft., a small corner of the destroyed abutment was projecting above the water at an angle of 15°. Where the embankment rested was water 15 ft deep, with a strong current. Gravel from this hole was deposited over the rear yards east of Central Ave. for perhaps 4 ft. in depth, at a distance of 100 ft., and among

ft. above the gap, as seen in the view in Fig. 4. Fig. 6 is from a view also taken from the top of this same embankment; looking southeast at this location is a picture of a few of the damaged dwellings remaining. It shows distinctly the high-water mark on the brick dwelling in the middle distance.

Fig. 7, also taken at this place, looking west, shows houses which were in the most deeply flooded district where the water was 17 ft. above the street grade. The frame dwelling in the left foreground shows a hole in

its gable end through the weather-boarding into the attic, caused by floating drift, or possibly made by design in effecting a rescue of its inmates.

Fig. 5 is a view of the location of the B. & O. and Little Miami Ry. crossing, looking north from the top of the B. & O. embankment, and shows in the left-hand foreground the destroyed brick building of the Hayden-Corbet Chain Works. In the left-hand distance is a corner of the T. & O. C. R.R. roundhouse, where two bodies were recovered. The Big Four R.R. ran east 100 ft. or so, north of the roundhouse on top of the levee, which has been washed away and wholly destroyed. The McKinley Ave. subway just beyond the signal tower in the right-hand middle ground has settled and cracked, and the B. & O. embankment beyond it is washed away as well as those of the T. & O. C. and Big Four companies.

Fig. 8 shows a gravel deposit to within 6 in. of the top of a first-story window. In advance of the flood this location would have been selected as a place of great se-



FIG. 8. VIEW SHOWING GRAVEL WASHED UP TO FIRST STORY OF HOUSE

curity protected as it was, first, by the levee on the river bank and then by two heavy railway embankments, each carrying a well constructed double track. When the flood topped them, however, they soon melted away and the released waters carried destruction to property in its path.

The havoc wrought by the flood in the territory east of the B. & O. R.R. to the Scioto River is similar to that above described. Many photos showing wreckage like that illustrated in Fig. 9 might be furnished.

An incident of the flood was a rumor at 4:30 p.m. on Wednesday that the Storage Dam had burst. Messengers on horseback and the telephone quickly spread it over the city and many, on higher ground than the surface of the reservoir itself, frantically tried to climb into lofty buildings, struggling for places of preferment until the rumor was officially declared false by other messengers sent out for that purpose.

It is interesting to note that the flood caused but little damage to the new sanitary works of the city. About 2 p.m. on Tuesday the pump at the new water station, which had been gradually increasing its discharge, lost its pressure altogether when the 36-in. main to the west side at the Sandusky St. bridge was washed out by the breaking of the levee and could not be shut off for 24 hours till the subsidence of the water permitted access to to the valve at the intersection of Dublin pike and Sandusky St. The concrete floor in the pumping station over the space reserved for pumping unit No. 3 was lifted about 8 in. by the ground-water pressure, but settled back into place again as the flood receded.

At the sewage-purification works the levee surrounding the plant was injured only at one point, 300 ft. in length, when it was cut away beyond its center line at the northwest corner, but a few sand bags prevented a break admitting the back water. The men operating the sewage pumping station participated in the panic occasioned by the rumor of the burst dam to the extent of deserting their posts and allowing about 2 ft. of water to accumulate over the floors.

There was a maximum of 28 ft. of water over the apron of the storage dam (El. 40) the elevation of this tail water being 68 ft. city datum. The crest elevation of the weir is 73 ft. and with 12.9 ft. of water above the crest the difference of level between the water above and below the dam at its maximum flood stage was 17.9 ft. When the water had fallen 10 ft. to a depth of about



FIG. 9. FLOOD WASHING OVER BIG FOUR R.R. TRACKS

18 ft. over the apron, large stones deposited by the current were just visible 200 ft. below the dam at its eastern end. After the flood subsides it will be interesting to note to what extent, if any, the channel in the rock immediately in front of the apron has been deepened by the backlash of the water. It is apparent, as expected, that it has been extended down the stream for possibly 100 ft.

The levee just south of Mound St. for 500 ft. was broken and destroyed, and also in several short gaps north of Greenlawn Ave. where it was overtopped, but elsewhere the city levee was not damaged except as herein noted.

The Government gage on the Mound St. bridge indicated a maximum of only 1.6 ft. above the 1898 flood, which was quite misleading, because of the volume of flood water taken out of the channel and turned through the west side for two miles above the L. M. R.R. bridge.

BRIDGES—Of the 15 bridges spanning the Scioto from Grand View Ave. to the City R.R., inclusive, and of the 10 bridges on the Olentangy, all 25 bridges being within the city limits, only two were completely destroyed and two others lost one or two spans, as noted in the table below. The bridges damaged within the city limits were as follows, all being truss bridges:

Town St.—pier failure—two center spans—11 a.m. 3/25.
State St.—pier failure—whole bridge—11:30 a.m., 3/25.
Broad St.—abutment failure—west span—11:30 p.m., 3/25.
Mound St.—abutment failure—whole bridge—5:20 a.m., 3/26.

Between the city and the Storage Dam several other failures may be noted. The first, at the stone quarries, 1.5 mi. below the dam, was an old iron Pratt truss railroad bridge re-erected not very high above the water, crossing the stream at right angles. Probably if it had resisted the flood, high water would have reached nearly to the top of the trusses, as the valley was very narrow. Sixteen miles above the dam an old wooden covered bridge was carried away and, according to the testimony of an employee at the dam, it passed over that structure without breaking up, so that the stone quarry bridge noted above, together with the Robinson highway bridge (which was washed away), 1.6 mi. below the dam, and the Pennsylvania R.R. bridge, 2.2 mi. below the dam, were all in line for what shock might occur from heavy drift. The Pennsylvania R.R. bridge noted carried its track on a double-track deck structure 50 ft. or so above the water in three spans of 150 ft. each. The water did not reach the lower chord by about 3 ft., but drift to some extent lodged in the defective pier, which appeared to have been undermined a little at its head, although supposed to have been founded on solid limestone.

Below the city the following bridge failures are reported:

At Chillicothe, 50 mi. south of Columbus, the Scioto is reported to have been about 8 ft. higher than ever before. The Scioto Valley Traction Co. lost the north pile trestle approach (1500 ft.±) to its bridge, excepf one section of 50 ft. which had been weighted with a steel girder crossing. It also lost the embankment leading to the trestle and had its track washed off and overturned. About half a mile beyond this crossing of the Scioto, the Norfolk & Western R.R. Co. had a new structure, consisting of four channel deck-plate girders of 100 ft.± and about seven shorter deck girders crossing above the bottom lands, all set on stone piers on piles. It lost all of the short spans, the north abutment and the north channel span by the undermining of the foundations, so that a fragment of one pier of those destroyed can now be seen above the water surface.

One span, the east span, of a large steel highway bridge over the Scioto River at its mouth, at Portsmouth, was lost in the flood, due to erosion and slip of the abutment into the stream. A bridge of the Scioto Valley Traction Co. at Reeses, Ohio, 7.5 mi. southeast of Columbus, consisting of two 110-ft. spans over the Big Walnut River, is now resting on piers which foot on piles standing up about 10 ft. above the eroded bed of the stream. A Norfolk & Western R.R. bridge just above this latter bridge, in which the masonry of the abutments joins the previously noted structure, had its south abutment undermined by a wild eddy of water flowing in across the bottom land to the south, so that its piles were likewise exposed. The railway company dumped several carloads of stone in behind with the thought of protecting the abutment, and so pushed it into the river.

Damage

The Columbus Building Department has made careful investigation of the West Side, and gives out the following conservative estimate of damage:

900 houses wholly destroyed at $2000	$1,800,000
200 houses damaged to the extent of $3200 each	640,000
Loss of clothing and damage to personal property	260,000
Total	$1,500,000

The number of lives lost is reported at 85.

Proposed Remedies

Remedies for future floods have been suggested as follows:

(1) Fill the west side to a grade above floods.

(2) Abandon the territory to parks, playgrounds and municipal gardens.

(3) Raise the levee to a greater elevation.

(4) Provide additional river channel or channels.

(5) Widen the existing channel.

No. 1 involves the loss of a large part of the value of the existing pavements, sewer, water, gas and other pipes, and the recent large expenditure for grade separation by track elevation, with great additional expense for the filling and changes required. It is probably beyond the financial resources of the community.

No. 2, a rough estimate of the present value for taxation of the two square miles of well built up and populous low-ground territory is $20,000,000, a sum which makes it evident that this thought of a remedy occurs too late in history to be useful. It is suggested that the community organize now to protect itself against the creation of other "west sides" by the occupation of low unsuitable areas with truck gardens rather than dwellings.

No. 3. In the light of the lessons to be drawn from this recent flood the limit of advisable levee height would seem to have been already reached.

No. 4 and 5. The problem involved in a design for a river channel of adequate capacity, which shall not be self-destructive under the widely varying stages of the river, together with the related questions of sewerage and drains, the whole running into an expenditure calling for a sum of money which can only be expressed in seven figures, cannot be answered offhand, but will tax the capacity of the highest order of engineering talent.

The city, however, is hopefully looking towards its future.

Coöperation in Irrigation Development between Federal and State authorities on a new plan has been initiated by Secretary of the Interior, Franklin K. Lane, in a contract approved by him between the United States and the State of Oregon. At a conference held in his office at which were present Secretary Lane, Director F. H. Newell, of the Reclamation Service, Senator Chamberlain, of Oregon, and John H. Lewis, State Engineer of Oregon, a formal agreement was signed which provides for coöperation between the Federal Government and the State of Oregon in the investigation of irrigation and power projects. The Secretary agrees to withdraw the necessary land and the State Engineer agrees to hold the necessary water for the irrigation of projects under investigation. Any project or unit may be released for construction by private capital upon payment of the cost of preparing plans, providing such development will be carried out in harmony with the public plan for the highest utilization of the waters of the State.

The sum of $100,000 is now available, half of which is contributed by each party and will be expended largely on the investigation of the 300,000-acre Deschutes River project starting immediately on the Tumalo Creek unit of 35,000 acres. The State has appropriated $450,000 for the partial construction of this unit and Secretary Lane has agreed to allot an equal amount for construction of the entire project in coöperation with the State.

The Oregon Legislature has submitted a constitutional amendment for the vote of the people authorizing the issuance of bonds for the construction of irrigation and power projects. To complete the Deschutes project will require about $8,000,000. Secretary Lane stated that he was in sympathy with the entire plan of coöperation and if the State of Oregon would put up $4,000,000 toward the construction of this project, it was his opinion that an equal amount of money could be allotted fro mthe Reclamation Fund by that time for this work in Oregon.

The Flood of March 25 at Akron, Ohio

[Special Correspondence]

The city of Akron, Ohio, and the county of Summit, in which it is located, have during the past week presented the unusual spectacle of territory located on the crest of the divide separating the watershed of the Great Lakes from that of the Ohio River suffering heavy loss from flood.

The greater part of the city drains into the Cuyahoga River through the Little Cuyahoga and the Ohio Canal (see map, Fig. 1) both of which pass through the heart of Akron, and ultimately into Lake Erie at Cleveland. The Little Cuyahoga River has its source about eight miles east of Akron and flows through the city in a deep valley, entering the Cuyahoga just north of the city limits. Its watershed is about 50 sq.mi.

The Ohio Canal is fed by the Tuscarawas River, which flows in a westerly direction, passing about three miles to the south of the city. The waters of this river are stored in a series of semi-artificial reservoirs, known as the Portage Lakes, to the amount of about 1,250,000,000 gal. From these lakes not only the summit level of the canal, but the city of Akron and several large industrial plants derive their present supply of water. The lakes and canal are controlled by the State of Ohio.

The canal falls rapidly through Akron, there being 21 locks with a total drop of about 200 ft. before reaching the approximate level of the Cuyahoga north of the city. This fall was formerly utilized to some extent for small power plants but the small quantity of surplus water available for this purpose has caused the virtual abandonment of these powers.

The combined watershed of the Tuscarawas and the Portage Lakes is about 50 sq.mi. The Tuscarawas lies in the Ohio River drainage area, flowing south to the Muskingum. The Portage Lakes were constructed at intervals, beginning about 1840, by throwing up earth embankments along the northerly side of a natural basin. These banks, as far as can be learned, depend entirely on the mass of earth to withstand the water and in places have been rather unsafe in appearance for years. The average top width of the banks is estimated at 30 ft. and the slopes perhaps 1½ horizontal to 1 vertical. The river is diverted by a low dam about 3½ miles upstream and the lakes fed by means of an open canal or feeder built along the sidehill.

The Cuyahoga River rises near Burton and flows south a distance of about 40 miles, through the villages of Kent and Cuyahoga Falls, to the northern limits of Akron, where it turns abruptly on itself and flows northerly to Lake Erie. Its watershed at Kent is 300 sq.mi., at Cuyahoga Falls 350 sq.mi. and but little more until joined by the Little Cuyahoga at Akron, with its 50 sq.mi. of watershed already mentioned. The Cuyahoga is remarkable for the abrupt drops in its profile at certain points, notably at Cuyahoga Falls, where in two miles the fall is about 200 ft. Many small plants have utilized

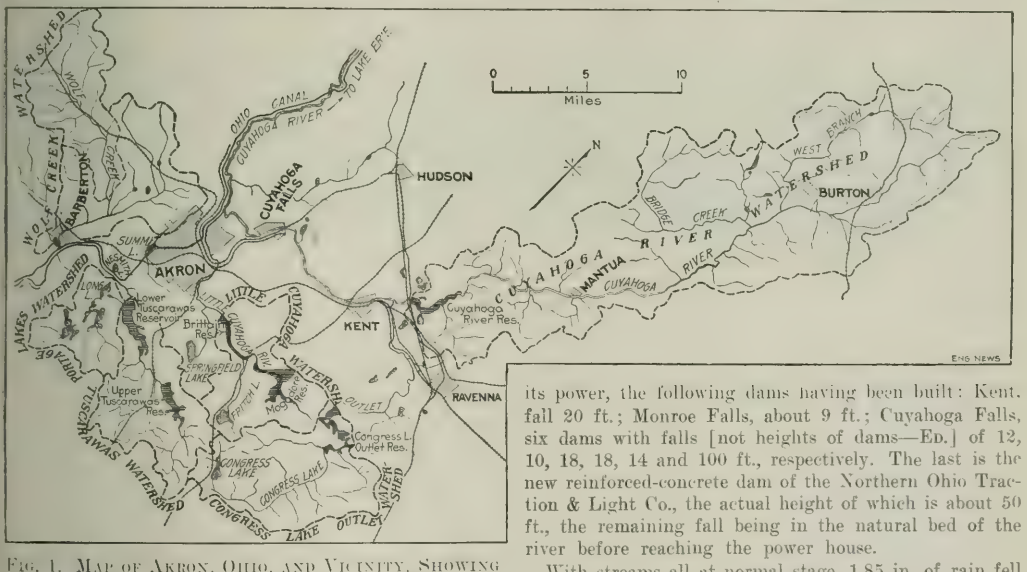


Fig. 1. Map of Akron, Ohio, and Vicinity, Showing Rivers, Reservoirs and Canal Which Caused Flood Damage

its power, the following dams having been built: Kent, fall 20 ft.; Monroe Falls, about 9 ft.; Cuyahoga Falls, six dams with falls [not heights of dams—Ed.] of 12, 10, 18, 18, 14 and 100 ft., respectively. The last is the new reinforced-concrete dam of the Northern Ohio Traction & Light Co., the actual height of which is about 50 ft., the remaining fall being in the natural bed of the river before reaching the power house.

With streams all at normal stage, 1.85 in. of rain fell on Sunday, Mar. 23, followed by 4.75 in. on Monday. On Tuesday, Wednesday and Thursday 3.05 in. more fell, making a total of 9.65 in. in about four days. The streams rose rapidly on Monday and reached their maximum stage on Tuesday. The principal damage was done by the Little Cuyahoga and the Ohio Canal. Along the Cuyahoga two of the small dams at Cuyahoga Falls were swept out and a number of bridges carried away, but no loss of life or heavy property damage has been reported.

Damage along the Little Cuyahoga

The Little Cuyahoga, discharging a volume roughly estimated at about 3000 cu.ft. per sec., found the water-

way through East Akron insufficient, and leaving the channel it poured through the city streets and the right-of-way of the Baltimore & Ohio R.R. to a depth of several feet, flooding the lower floor of the Goodyear Tire & Rubber plant, the Robinson Clay Products Co. and many smaller works. The power equipment and storerooms of the Goodyear Co. were flooded, causing a loss variously estimated at from $50,000 to $100,000. The roadbed of the Baltimore & Ohio R.R. was washed out down to bedrock for several hundred feet and a new channel cut longitudinally through Case Ave., where about 15 houses were demolished.

Farther down the valley the tracks of the Baltimore & Ohio were undermined and about 15 or 20 loaded freight cars tipped over the bank. The grounds of the Summit County Fair Association were badly cut up.

Elizabeth Park, one of the city playgrounds, fitted up during the past year, was practically demolished, with a loss of about $12,000. Below this point the havoc in Case Ave. was duplicated, and many houses destroyed.

The plate girder bridge at Howard St., connecting the northern part of the city with the business portion, was badly damaged but was one of the few bridges which stood. This bridge is about 75-ft. span, the girders being supported by piers 20 ft. from each abutment. The piers and abutments will probably have to be rebuilt. A concrete arch bridge of about 40-ft. span at Cuyahoga St. was entirely swept away.

Damage from the Canal Storage Lakes

The largest of the Portage Lakes, known as East Reservoir, cut through the bank at the point where the feeder from the Tuscarawas River enters. The bank here was almost entirely a natural formation, the artificial dikes remaining practically uninjured.

By quick and hard work state employees were able to dam the connection from the other lakes so that but about 2 ft. of water was lost from them, while East Reservoir was lowered 13 ft. Part of the water passed to the south, down the Tuscarawas, and the remainder to the north, down the Ohio Canal, where considerable damage was done to bridges and buildings built close to the canal level. The principal losses were the Alexander block, a three-story brick building, of which one end was entirely destroyed, the Cherry St. bridge, a plate-girder structure whose abutments were badly undermined and will have to be rebuilt, and a 5-ft. outfall sewer of reinforced concrete, lined with brick, under construction by the city of Akron in the old tow path, which was torn out for nearly 2000 ft. This was the main outfall sewer for the entire city and no other location is available for it. A serious problem presents itself in the reconstruction of this work. The tow-path embankment was washed away in several places, the total length destroyed being at least a mile.

Several of the canal lock gates were dynamited to prevent greater damage. This, together with the break in the reservoir and numerous failures of banks of feeders and of the canal, causes a renewal of the question as to the policy of the State of Ohio in regard to this canal system, now obsolete and used only for supplying water for industrial purposes.

Effect on Akron Water-Supply.—A serious phase of the canal situation is its effect on the water-supply of Akron. The new source of supply, now under development, will not be ready for use for at least a year, and unless the reservoir is repaired in time to be filled before summer a disastrous water famine is certain in Akron, as the Tuscarawas is wholly inadequate during the dry months and the remaining storage is not sufficient to supply the demand. Work has been started on the necessary repairs and this danger is believed to be averted.



Fig. 2. Looking Upstream from Point Opposite Gasholder



Fig. 3. New Channel Cut by River; East of North Case Ave.

Figs. 2 and 3. Views of the Little Cuyahoga River at Akron, Ohio, between 1 and 2 P.M., Mar. 25, 1913
(At the point shown in Fig. 2 the water had been some 4 ft. higher before the view was taken.)

Damage along the Cuyahoga

The flow in the Cuyahoga at maximum stage is estimated, from the observed flow over the dams, at about 37 cu.ft. per sec. per sq.mi. of watershed. The old dam at Kent, the Monroe Falls dam, the Turner, Vaughn & Taylor dam at Cuyahoga Falls, and the new Northern Ohio Traction & Light Co. dam successfully withstood the flood. The first is a heavy stone-arched dam, the second a low masonry structure, the third a primitive timber crib of but 55 ft. spillway and the last a reinforced-concrete structure of the Ransome type, having a spillway 119 ft. long, depressed 5 ft. below the remainder of the structure and a total length of 449 ft. It has been recently described in several of the engineering journals.* The flow over this dam was 7.7 ft. on the spillway, and over the Turner, Vaughn & Taylor dam, 11.3 ft. Both are in sand-rock formation. The two dams which were destroyed were old timber structures of small value.

*A letter telling how this dam withstood a flood while under construction appeared in "Engineering News" for Nov. 11, 1915, p. 917. The height of the dam from stream bed to spillway top is there given as 52 ft.—Ed.

The Flood of March-April, 1913, on the Ohio River and Its Tributaries

By John C. Hoyt*

Disastrous floods may result from the following causes or combination of them: (1) Excessive rainfall; (2) the rapid melting of accumulated snow; (3) the failure of reservoirs; (4) the forming and breaking of ice jams; (5) the breaking of levees.

The recent floods on the Ohio and its tributaries, which at places have exceeded all those previously recorded, resulted primarily from excessive rains and at some points the damage was extended by the breaking of levees. The floods followed an exceptionally open winter during which frequent rains had completely saturated the ground and no snow or ice had accumulated.

The rain that started on the morning of Mar. 24 continued practically without interruption over the entire

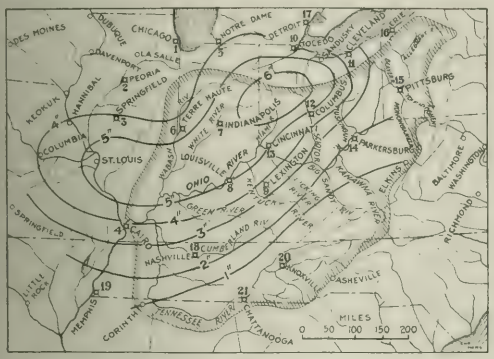


Fig. 1. Precipitation in Ohio and Indiana Flood Area

(For the period from 8 p.m., Mar. 22, to 8 a.m., Mar. 26.)

Ohio River basin until Mar. 27 and in a large area of maximum precipitation (Fig. 1), in western Ohio and eastern Indiana, the total precipitation exceeded 6 in. prior to Mar. 24. During this storm the total precipitation to Mar. 27 recorded at Bellefontaine, Ohio, was 11.16 in., at Marion, Ohio, 10.6 in., and at Bangerville, Ohio, 9.5 in. As shown in Tables I and II and on Fig. 1, the precipitation was about twice as great on the area drained by the northern tributaries of the Ohio as that drained by the southern tributaries.

As the result of this widely extended and heavy precipitation, floods began on the various tributaries of the Ohio, starting on Mar. 24 and increasing in intensity until Mar. 27. The rise of the tributaries was followed by a rise of the Ohio proper which began on Mar. 27 and on Apr. 4 the crest of the flood had not passed Cairo.

The highest stream stages occurred in the area of maximum precipitation, on the tributaries entering the Ohio from the north. The Miami, which drains the larger portion of the area covered by the storm center, showed the greatest effect of the flood.

Although the loss of life and property was large in many places, it was probably greatest at Dayton, Ohio, which is located at the junction of the Miami River with its two principal tributaries—the Mad from the east and the Stillwater from the west (Fig. 2). The combined drainage area of these three streams is 2490 sq.mi., divided as follows: Miami River, 1160; Stillwater River, 650; and Mad River, 680.



Fig. 2. Confluence of Rivers that Caused the March Floods at Dayton, Ohio

(From Topographical Map, U. S. Geological Survey—Surveys of 1903-4.)

The drainage area above Dayton comprises a comparatively flat, rolling country, in which the stream gradients are light and which is provided with no large artificial or natural storage reservoirs. For 15 miles above Dayton the Miami slopes about 1 ft. to the mile and flows through flats which vary in width from ½ to 1½ miles and are bordered by low bluffs. At Dayton these flats unite with those bordering the Mad and Stillwater, thus

*Engineer-in-Charge, Division of Surface Waters, U. S. Geological Survey, Washington, D. C.

TABLE I PRECIPITATION AT REGULAR WEATHER BUREAU STATIONS IN AND ADJACENT TO THE OHIO RIVER DRAINAGE BASIN, MARCH 20 TO APRIL 2, 1913

(Figures supplied by U. S. Weather Bureau. Values in inches for the 24 hours ending 8 a.m. on the respective dates.)

	Place	Mar. 20	Mar. 21	Mar. 22	Mar. 23	Mar. 24	Mar. 25	Mar. 26	Mar. 27	Mar. 28	Mar. 29	Mar. 30	Mar. 31	Apr. 1	Apr. 2
1	Chicago	0.04	0.68	0.32	0.00	1.36	0.08	0.04	...	0.00	0.00	0.00	0.08	0.00	0.36
2	Peoria	0.16		0.00	0.22		0.06	0.01	0.08	0.00	0.00	0.00	0.10	0.00	0.00
3	Springfield	0.08		0.00	0.62	0.72	2.22		0.24	0.00		0.00	0.00	0.00	0.00
4	Cairo	0.26		0.00	0.00	0.06	1.56	2.72	0.26	0.00	0.00	0.00	0.00	0.00	0.00
5	Notre Dame	0.10	0.60		0.00	1.42	0.84	0.00			0.00	0.00	0.12	0.00	0.12
6	Terre Haute	0.02		0.00	0.46	0.98	2.66		0.38		0.00	0.00	0.00	0.00	0.00
7	Indianapolis	0.00	0.46	0.00	0.16	1.52	3.40	0.46		0.00	0.00	0.00	0.01	0.00	0.08
8	Louisville	0.01	0.56	0.02	0.00	0.00	0.16	5.10	0.68	0.00	0.00	0.00	0.00	0.00	0.00
9	Lexington	0.01	0.32	0.00		0.00	0.20		1.56	0.01	0.00		0.00	0.00	0.00
10	Toledo	0.00	0.46	0.00	0.00	2.14	2.88	0.34	0.68	0.02	0.00	0.00	0.34	0.00	0.00
11	Cleveland	0.00	0.01	0.02	0.00	1.96	2.88	1.26	0.98	0.10	0.00	0.00	0.18	0.00	0.00
12	Columbus	0.00	0.22	0.01	0.00	0.60	2.62	2.72	1.00	0.00	0.00	0.00	0.01		0.00
13	Cincinnati	0.01	0.38	0.00	0.00	0.40	2.24	1.75	0.80	0.00	0.00	0.00	0.04	0.00	0.00
14	Parkersburg	0.00	0.00	0.10	0.00	0.08	0.04	1.60	1.26	...				0.06	0.00
15	Pittsburgh	0.00	0.00	0.01	0.00	0.20	0.72	1.70	0.84	0.01	0.00	0.00	0.00	0.02	0.00
16	Erie	0.00	0.00	0.04	0.00	1.32	2.76	1.02	1.04	0.12	0.00	0.00	0.18		0.00
17	Detroit	0.01	0.64	0.02	0.00	1.30	1.26	0.24	0.80	0.06	0.00	0.00		0.00	0.00
18	Nashville	0.00		0.00	0.00	0.00	0.00	2.32	0.64	0.00	0.00	0.00	0.00	0.00	0.00
19	Memphis	0.00		0.00	0.00	0.08	0.00	1.60	0.18	0.00	0.00	0.00	0.00	0.00	0.00
20	Knoxville	0.00	0.74	0.02	0.00	0.00	0.00	0.24	2.16	0.00	0.00	0.10	0.08	0.00	0.00
21	Chattanooga	0.06	....	0.00	0.00	0.00	0.00	0.16	1.52	0.00	0.00	0.06	0.00	0.00	0.00

making a considerable area of low land which has been protected from overflow by a system of levees and through which Miami River flows in a double "S."

The excessive precipitation which occurred simultaneously over the area above Dayton not only rapidly filled the channels of the Miami and its tributaries but also flooded the adjacent flats. The system of levees at Dayton formed, as it were, a large storage reservoir for which the Miami served as a waste channel but a channel of insufficient capacity to keep the floods from overtopping and breaking through the levees. Such breaks admitted large quantities of water to the city, with the disastrous results that have been reported in the daily press. The highest flood previously recorded at Dayton was in 1866, when the river reached a stage of 21.3 ft. On Mar. 26 this stage was exceeded by nearly 8 ft., the height reached being about 29 ft.

No data are yet available from which to compute the maximum or total flow at Dayton. The rainfall records indicate that at least 800,000 acre-feet of water fell on the drainage area above Dayton during the storm that caused the flood. This amount of water represents an average flow of 100,000 sec.-ft. for four days. Low-water flows of less than 200 sec.-ft. have been recorded at Dayton.

As shown in Table III, the floods started in the westerly tributaries from the north, progressed eastward, and were much more intense on the northern tributaries which heretofore have never been especially important in causing floods on the Ohio.

Fortunately, the maximum stage occurred first on the lower tributaries, and, although these rapidly filled the channel of the main stream, sufficient time elapsed to permit the peak flow to pass before the water from the upper tributaries came in. For this reason the damage on the main stream was not so serious as it would have been if the storm had traveled downstream.

At Pittsburgh the Ohio did not rise as high as in January, as the Monongahela was not in heavy flood and extreme floods did not exist on the other streams which enter from the south. This relieved the situation on the main stream. The progress of the flood down the main stream is shown in the last column of Table III. New maximum high-water marks were established on the northern tributaries and at points along the main river. The stages on the southern tributaries were considerably below the previous maximums.

Table V gives the stages of the principal floods at Cincinnati since 1832.

Rating tables are available for various points along the Ohio River and on the more important tributaries, but owing to the interruption in transportation facilities sufficient gage heights have not been received at this

TABLE II. TOTAL PRECIPITATION, FROM SPECIAL OBSERVERS, FROM STARTING OF STORM TO MORNING OF DAY INDICATED

(Figures supplied by U. S. Weather Bureau)

		Inches
Piqua	March 24	6.68
Sidney	March 25	6.60
Fremont	March 25	6.12
Tiffin	March 25	6.72
Canton	March 25	3.22
Coshocton	March 25	2.90
Kings Mills	March 25	4.34
Oregonia	March 25	4.00
Zanesville	March 26	5.16
Wooster	March 26	9.00
Tobosa	March 26	6.34
Upper Sandusky	March 26	8.44
Circleville	March 27	6.46
Bangerville	March 27	9.50
Bellefontaine	March 27	11.16
Marion	March 27	10.60

TABLE III. GAGE HEIGHTS FOR PRINCIPAL FLOODS OF OHIO AND TRIBUTARY RIVERS

(Figures from U. S. Weather Bureau. All elevations in feet.)

River	Place	Drainage area, sq.mi.	Danger line	Max. (date)	Feb. 1883	Feb. 1884	Mar. 1890	Feb. 1897	Mar. 1898	Jan. 1907	Mar. 1907	Mar. 1912	1913 Date	1913 Stage	1913 Difference from previous maximum
Ohio	Pittsburgh, Penn.	17,000	22	35.5 (1907)	26.8	31.9	22.5	28.9	28.5	23.3	35.5	28.1	Mar. 28	30.4	—5.1
Ohio	Wheeling, W. Va.	25,200	36	53.1 (1884)	35.5	53.1	32.5	37.0	43.9	36.1	50.1	38.4	Mar. 28	51.1	—2.0
Ohio	Marietta, Ohio	32,400	25	52.0 (1884)	43.7	52.0	33.5	36.0							
Ohio	Parkersburg, W. Va.	37,200	36	53.9 (1884)		53.9	35.0	37.5	47.8	39.9	51.4	36.7	Mar. 28	58.9	+5.0
Ohio	Point Pleasant, W. Va.	51,500	39	60.0 (1884)		60.0	47.9	52.3	51.2	52.0	54.8	43.0			
Ohio	Huntington, W. Va.	58,600	50	64.8 (1884)		64.8	.			57.8	58.1	48.1	Mar. 31	66.1	+1.6
Ohio	Cattlettsburg, Ky.	59,300	50	72.0 (1884)		72.0	52.6	58.5	56.0	60.0	60.1	49.4			
Ohio	Portsmouth, Ohio	66,300	50	66.3 (1884)		66.3	55.5	59.0	57.3	60.9	60.8	51.0			
Ohio	Cincinnati, Ohio	73,900	50	71.1 (1884)	66.3	71.1	59.1	61.1	61.4	65.2	62.1	53.4	Apr. 1	69.8	—1.3
Ohio	Louisville, Ky.	87,200	28	46.7 (1884)	43.8	46.7	35.3	35.1	36.3	41.1	36.0	28.7	Apr. 2	45.0	—1.7
Ohio	Evansville, Ind.	102,000	35	48.5 (1884)	47.8	48.8	44.1	43.6	43.7	46.2	43.8	42.6	Apr. 5	48.3	—0.5
Ohio	Paducah, Ky.	203,800	43	54.2 (1884)	50.7	54.2	47.2	43.7	47.3	45.7	42.3	49.9			
Ohio	Cairo, Ill.	204,300	45	51.0 (1912)	52.2		48.7	51.6	49.8	50.4	46.2	54.0	Apr. 5	54.7a	+0.7
Ohio (North Ohio Muskingum	Zanesville, Ohio	6,170	25	36.8 (1888)			14.4		36.8	25.3	30.1	22.8			
Scioto	Columbus, Ohio.	1,570	17	21.3 (1888)					21.3	17.3	19.0	16.0	Mar. 25	27.9	+6.6
Miami	Dayton, Ohio.	2,490	18	21.3 (1866)				16.3	18.3	12.0	15.2	14.0	Mar. 26	29.0	+7.7
Wabash (Great Ohio	Mount Carmel, Ill.	26,300	14	28.3 (1875)			22.0	26.1	27.0	24.5	24.0	23.2	Mar. 30	31.0	+2.7
Kanawha	Charleston, W. Va.	9,200	30	46.0 (1861)			30.9	41.0	19.5	29.3	20.9	18.5	Mar. 28	33.0	+13.9
Big Sandy	Louisa, Ky.	3,630		50.0 (1875)		45.3	10.0	46.6					Mar. 28	44.8	—5.2
Licking	Falmouth, Ky.	2,990	25	48.0 (1854)			24.7	24.0	17.6	28.5	28.1	22.3			
Kentucky	Frankfort, Ky.	4,140	41	44.0 (1878)	42.0		31.0			29.6	20.6	25.6	Mar. 28	38.3	—5.7
Cumberland	Nashville, Tenn.	11,000	40	55.3 (1880)	41.6	47.2	40.9	37.5	24.0	28.2	38.9	46.5			
Cumberland	Clarksville, Tenn.	14,000	44	60.6 (1882)						38.8	36.2	50.6	Mar. 28-29	50.5	—10.1
Tennessee	Chattanooga, Tenn.	30,700	25	48.0 (1882)	29.0	44.3	28.0	48.0	21.7	12.5	22.5	35.1			

a Crest not passed.

time from which the quantity of water flowing during the present flood can be computed.

Preliminary estimates show a maximum flow at Cincinnati of 676,000 sec.-ft., or an average for the whole drainage area of 9 sec.-ft. per sq.mi. For the 10-day period from Mar. 26 to Apr. 4, about 12,100 acre-feet passed Cincinnati.

Excessive rainfall will inevitably produce floods in

TABLE IV. STAGES OHIO RIVER AND TRIBUTARIES, MARCH 23 TO PAST CREST OF FLOOD

(Readings at 8 a.m. Figures from U. S. Weather Bureau)

	Ohio River Stages						
Date	Pittsburgh	Parkersburg	Cincinnati	Louisville	Evansville		Cairo
Danger line	22 0	36 0	50 0	28 0	35 0		45 0
March 23	4 8	10 0	24 7	10 8	28 3		39 0
March 24	4 5	9 5	22 6	10 0			40 3
March 25	7 8	10 0	20 3	11 4			
March 26	20 1	22 1	50 3	22 5			43 5
March 27	28 0	43 0	57 2	33 6	36 6		45 5
March 28	30 4	54 9*	62 6	38 4	40 4		47 4
March 29	24 8	58 7	66 0	44 1			49 1
March 30	17 8	57 9	67 9	42 1	44 4		50 6
March 31	13 7	53 8	69 2	43 7			52 0
April 1	11 4	47.5	69 8	44 7	46 4		53 2
April 2	9 6	38 1	69 5	45 0	47 2		54 1
April 3	8 6	27 2	68 0	44 6	47 8		54 5
April 4	7 9	19 5	66 0	43 8	48 2		54 7
April 5	7.1	16.5	63.3	42 9	48 3		54 7

	Stages of Tributaries									
Date	Mt. Carmel on Wabash	Dayton on Miami	Columbus on Scioto	Beaver Falls, Penn., on Beaver	Freeport, Penn., on Allegheny	Fairmont, W. Va., on Monongahela	Charleston, W. Va., on Kanawha	Frankfort, Ky., on Kentucky	Clarksville, Tenn., on Cumberland	Charl... Tenn... Tenn...
Danger Line	15 0	18 0	17 0	11 0	20 0	25 0	30 0	31 0	43 0	33 0
March 22	11 9	3 0	4 4	4 6	6 5	15 1	6 0	8 6	29 7	12 9
March 23	13 4	3 0	4 8	4 4	6 2	15 0	5 9	8 7	29 4	12 9
March 24	13 6	7 0	6 2	6 6	5 9	14 9	5 7	8 5	29 6	12 8
March 25	19 8†	29 0†	22 9†	13 2	16 2	14 8	5 5	8 5	29 1	11 2
March 26	21 4	28 1‡	20 9	16 7	26 4	14 8	5 5	15 8	31 6	10 1
March 27	23 0	22 2‡	19 7	17 4	32 2†	23 6†	10 2	35 2	47 3	13 3
March 28	25 8†	15 7‡	17 4	15 1	29 5	22 4	33 0	38 3	50 5	25 1
March 29	29 5†	11 6	14 7	12 0	23 5	19 1	30 0	37 5	50 5	31 2
March 30	31 0	9 1	12 0	8 9	19 0	16 9	21 0	37 2	49 6	33 5
March 31	30 2	7 3	9 6	6 8	15 4	16 4	19 0	35 1	49 3	32 9

* Maximum at 8 p.m., 58 9. † Maximum occurring before or after 8 a.m. reading. ‡ Calculated from measurements made at north end of Dayton View [illegible]

which the improvements that follow the progress of civilization must be recognized as important factors. The cutting away of forests and the artificial drainage systems which accompany agricultural and municipal development create conditions favorable for quick runoff. The building of bridges, railroad embankments, levees, and other structures has in many localities by encroaching on

TABLE V. FLOOD STAGES OF OHIO RIVER AT CINCINNATI, OHIO

(Danger line, 50 ft. on gage; maximum 71.1, February, 1884; lowest stage, 1.9 September 17-19, 1881 Figures from U. S. Weather Bureau)

Year	Date	Stage, feet	Year	Date	Stage, feet
1832	Feb. 18	64 3	1890	March 26	59 2
1847	Dec. 17	63 6	1891	Feb 25	57 3
1862	Jan. 24	57 3	1893	Feb. 20	54 9
1865	March 7	56 3	1897	Feb. 26	61 2
1867	March 14	55 8	1898	March 29	61 4
1870	Jan. 19	55 3	1899	March 8	57 2
1875	Aug 6	55 3	1901	April 27	59 7
1876	Jan. 29	51 8	1902	March 5	50 9
1877	Jan. 20	53 8	1903	March 5	52 3
1880	Feb. 17	53 2	1905	March 13	48 3
1881	Feb. 16	50 6	1907	Jan. 21	65 2
1882	Feb. 21	58 6	1908	April 4	55 9
1883	Feb. 15	66 3	1909	Feb 28	54 6
1884	Feb. 14	71 1	1910	March 7	51 8
1886	April 9	55 8	1912	March 27	53 4
1887	Feb. 5	56 3	1913	April 1	69 8

river channels materially reduced the carrying capacity of streams, choking the channel at flood stages and backing the water over adjacent lands.

The extent to which the damage caused by the flood would have been abated by a comprehensive system of protection is now a matter of intense public interest. Many of the press reports of the flood have stated that the loss would have been largely reduced by reservoirs, proper forestation, levees, channel improvements, and other works. All these works are recognized aids in flood protection, but their effectiveness on any river system can be determined only by careful studies of all conditions, and little reliance should be placed on broad statements in regard to flood control.

The topography of the drainage area north of the Ohio River is of a type which does not, in general, afford any large possibilities for storage. If there are no large reservoir sites on the northern tributaries of the Ohio, relief by means of storage is impossible on these streams and flood protection must be gained primarily by levees and channel improvement. Preliminary studies of the basins drained by the southern tributaries indicate that there are many reservoir sites in these basins sufficiently large to afford storage for flood waters.

The maximum stages on the Ohio in the present flood were caused by the combination of the exceptionally excessive floods from the northern tributaries and the moderate floods from the southern tributaries. Proper storage on the southern tributaries might, therefore, have held back sufficient water to have materially reduced the crest height on the main stream. The effect of such storage can be determined only by a comprehensive study which should be made in connection with a study of possible river improvements.

Another question which must be considered in the flood problem is the factor of risk. Shall we provide for the average flood, or shall we provide for the exceptional flood, knowing that the increased cost of construction, maintenance, and operation of works needed to provide for extreme conditions will be offset by the reduction in loss of life and in the damage resulting from the excessive floods? This phase of the subject is always in the mind of the engineer who designs river improvement works, but does not always appeal to those who control the funds.

As already intimated, the combination of conditions that caused the recent flood, if reversed on the drainage area, would probably have produced much more serious results. That such a flood may occur is not improbable. The results of such a disaster can be estimated by extending the damage and loss in the congested area of the present flood to the lowlands of the entire basin and probably to the lower Mississippi.

If such a flood should occur on the Ohio, in conjunction with the floods on the upper Mississipi and Missouri (which, of course, is possible since excessive rains in this locality are not peculiar to any season), the damage that would result on the lower Mississippi River would probably produce a calamity unprecedented in the history of this or any other country. With this possibility confronting the country, it is the opinion of all who have studied the situation that there should be no further delay in establishing a complete system of river control, in which there shall be systematic coöperation between the National Government and the States and local interests.

The Flooding of the Albany Filtration Plant and Previous High Floods at Albany, N. Y.

By Wallace Greenalch*

The recent flood in the Hudson River first assumed dangerous proportions on the morning of Thursday, Mar. 27, when at 8 a.m. the water reached an elevation of 17 ft. above mean low water. At 2 p.m. the water reached Elev. 18 and at midnight reached Elev. 21, the level of the top of the slow sand filtration plant. The water then rose quickly, reaching Elev. 22 at 3 a.m. and continued to rise until 1 p.m. Friday, Mar. 28, when it reached its highest level at Elev. 23.1. The water then slowly receded and fell below Elev. 21 about 6 a.m., Saturday, Mar. 29.

Precautions were hurriedly taken on Thursday to keep out as much of the flood as possible by barricading the doors of the pumping station and preliminary filters which were above Elev. 21. The doors of the regulator houses in the slow sand filter court were also braced from the inside and the cracks calked with oakum to prevent the entrance of raw water into the pure-water effluents from the filters and into the pure-water reservoir should the water get over the tops of the filters and into the



Filtration Plant at Albany, N. Y., under Water on Mar. 28, 1913

(Taken from Erie Canal Lock, looking east. Water 2 ft. over top of covering of slow sand filters and over sedimentation basin.)

courtyard, which is at about Elev. 15. A temporary embankment of sods and dirt about 2 ft. high was hurriedly thrown up around the courtyard. This embankment kept the water out of the court for a few hours and would probably have been effective had the water not risen more than 1 ft. above the tops of the filters. As it happened, the water broke through the embankment and filled the courtyard at about 4 a.m., Friday morning.

As the high-service reservoir has a capacity of only 7,000,000 gal., about half of which can be drawn upon for about six hours without affecting the supply of buildings on the upper levels, and as there was grave danger of fires occurring in the flooded districts of the city, it was deemed necessary to keep up the reservoirs by pumping, even though the water might contain some raw water which would find its way into the filtered water from the slow sand filters which would continue to operate.

After the flood receded below Elev. 21, it was found that the door of the regulator house to Filter 7 had been broken in by the water pressure which allowed the raw water to enter the pure-water reservoir. The cover of the manhole over the pure-water reservoir was also blown off by the air confined by the rising water and made another entrance for the raw water.

When the flood receded to below Elev. 21 the water fell in the court and by 10 a.m., Saturday, the filters were delivering nothing but filtered water to the city after having been flooded about 30 hours.

The hypochlorite plant, which was put out of commission when the flood entered the court, was placed in operation Saturday afternoon with an increased dose of hypochlorite in the filtered water. On Friday night, when danger of overflowing was imminent, the newspapers were notified to warn the people to boil all water before drinking it and the notices appeared in the papers Saturday morning before any raw water reached the city. The city water was more or less turbid Saturday but samples taken on that day showed no B.coli present in 10 c.c. of water.

Samples of water taken Monday, Mar. 31, showed coli present in the high-service reservoir, so the water was at once treated with hypochlorite suspended in bags from a boat on the reservoir. This method seems to have been effective as samples taken on Apr. 3 showed no evidence of coli in the reservoir. The water mains have also been flushed by opening hydrants. In the flooded section of the city a large amount of water was used for flushing the streeets as soon as the heaviest accumulation was removed by the street cleaning force.

Water is supplied to the entire city from two services by direct pumpage of filtered water into the systems, with reliefs to the reservoirs. The low service may also be supplied by gravity from Rensselaer Lake through a brick conduit four miles long. This water was immediately turned into the low-service reservoir at the rate of about 7,000,000 gal. per 24 hours so as to reduce the pumpage of contaminated water into the low service.

The deposit from the flood was not enough to interfere with the slow sand filters, the operation of which was promptly resumed as soon as the water passed out of the court. The filters, of course, are now (Apr. 5) being scraped, one at a time, in the usual manner, as soon as the loss of head shows that they require it. The first water filtered was slightly turbid but soon cleared, while the bacteria were reduced by an extra dose of hypochlorite of lime. The dilution of the raw water was so great during the period the plant was flooded that no danger from typhoid is expected.

Although the water rose to a height of 13 ft. above the floor of the pumping station (Elev. 10), the barricading of the doors (at Elev. 21) kept out the water so that the boilers and pumps were kept in operation pumping out water which leaked into the station.

The following is a list of the principal flood heights above mean low water at Albany, from the records of the United States Engineer's office in this city:

	Feet		Feet
Jan. 27, 1839	17.78	May 5, 1893	16.12
May 15, 1846	18.27	Apr. 10, 1895	15.96
Feb. 9, 1857	21.25	Mar. 1, 1896	17.78
Jan. 11, 1869	18.00	Mar. 13, 1898	13.30
Apr. 22, 1869	19.00	Mar. 6, 1899	12.46
Oct. 4-5, 1869	18.52	Feb. 14, 1900	19.96
Feb. 16, 1878	14.00	Dec. 12, 1901	13.58
Feb. 14, 1886	17.89	Mar. 2, 1902	18.50
Apr. 12, 1887	15.00	Mar. 27 1903	16.32
Mar. 26, 1893	18.43	Mar. 28, 1913	21.00

The flood in the river was no doubt due to the large rainfall, with possibly some melted snow on the upper Hudson and Mohawk rivers. The newspapers on Thurs-

*Commissioner of Public Works, Albany, N. Y.

day reported a rainfall of 5.19 in. at Glens Falls and 1.35 in. at Corinth. The flood came to us very unexpectedly as only 1.75 in. of rain had fallen at Albany, which was not sufficient to produce a freshet.

At the filtration plant the water on Mar. 28, 1913, reached Elev. 23.1, while opposite the center of the city two miles south of the filtration plant the U. S. Engineer's Office reports Elev. 21 and the U. S. Weather Bureau reports Elev. 22.4. The last two datum levels are not the same, there being a difference of 1.35 ft. between them. On Feb. 14, 1900, the water at the filtration plant reached Elev. 20.5, which was 6 in. below the top of the filters, while the last (1913) flood was 25 in. above the top of the filters. The newspapers reported that the last flood exceeded the flood of 1857 by 2½ ft., but investigation shows that the 1857 flood was higher by from ½ to 3 in.

[It might be noted that the present freshet appears to have resulted solely from a coincidence of heavy rain-water flow from the various tributaries of the Hudson and was affected little, if any, by melting snow. Most of the previous high-water stages were partly brought about by melting snow.—Ed.]

Measures will be taken during the coming summer to prevent a repetition of the last experience by building protection walls or embankments at the filtration plant.

The only damage done by the flood besides that mentioned was the breaking of several doors on the slow sand filters and the depositing of mud in the court and elsewhere.

[The following additional information on the use of hypochlorite at Albany has been received from a correspondent.—Ed.]

Hypochlorite has been used at the Albany filtration plant, as a finishing process, since 1909; continuously since 1911, and except for certain periods in summer from 1909 to 1911, when it was thought that double filtration was sufficient. A temporary hypochlorite plant was fitted up for use when the regular plant was flooded, and the agent was used in extra quantities both then and after the regular plant was again put in use.

In applying the hypochlorite to the Prospect Reservoir, it was found necessary to punch holes in the bags containing the bleaching powder and to move the bags vigorously in order to liberate the powder. Apparently the powder was well distributed through the water in this way. Bacterial counts of water samples indicated that the available chlorine was fairly well liberated before the powder reached the bottom of the reservoir. Bacterial counts made by the State Department of Health showed B. coli present in 0.1 c.c. of water before treatment but absent in two out of three 10-c.c. samples.

On April 5 hypochlorite was being applied to the reservoir a second time and arrangements were being made to eliminate all possibly polluted water from the distributing pipes by flushing. The State Department of Health is coöperating in the measures being taken to safeguard the Albany water-supply.



The Famous Concrete Y-Bridge at Zanesville, Ohio, was not destroyed by the flood or dynamited to clear the channel, as the first reports from Zanesville stated. It is reported in good condition except for the parapets, which were badly battered by drift. The railway bridges above and below the Y-bridge were carried away.

The Floods in the Ohio and Mississippi Rivers

During the past week, the flood wave in the Ohio River, resulting from the heavy storm on the northern tributaries of the Ohio during the last week in March, passed down the river from Pittsburgh to Cairo, causing at some points the highest stage of water that has ever been recorded. Very few lives were lost, as cities along the Ohio River are accustomed to high-flood stages and the rise of the river was gradual, giving plenty of warning in advance. The amount of property destruction and resulting suffering, however, was enormous.

On Sunday, Mar. 30, the Ohio River was falling from Pittsburgh down stream about as far as Parkersburg, W. Va., where the height reached was 22 ft. above the flood stage, and at all points below the river was rising, the stage at Cincinnati being 67.9 ft. and at Cairo 50.6 ft. The maximum stage reached at Cincinnati was 69.8 ft. at 8 a.m. on Tuesday, Apr. 1. This is the highest stage ever reached in that city with the exception of the flood of 1884, when a stage about 2 ft. higher was recorded. The crest of the 1884 flood, however, was a very short time in passing the city with a rapid rise and fall on each side. In the present flood the crest of the flood wave was very flat, the gage reading 67.9 on Sunday, Mar. 30, and 68 ft. on Thursday, Apr. 3. The fall since then has been rapid, but a very high stage of water prevailed also during the previous week, due to the heavy flood coming down the Miami and the Scioto in advance of the floods from the upper tributaries. It appears certain, therefore, that the volume of flood water discharged by the Ohio as a result of the recent storm is greater than that in any flood ever recorded.

On Wednesday, Apr. 2, the crest of the flood was at Louisville, where a stage of 45 ft. was reached, 17 ft. above the flood level. At Cairo on the same date the gage stood at 54.1. On Friday the crest had moved down the river to Evansville and a stage of 54.7 ft. was reached at Cairo, at which point the gage remained about stationary for several days with slight variations, due to the breakage of minor levees above Cairo and the flooding of lowlands, giving some relief to the flood height.

The above data are taken from the official weather maps issued by the Weather Bureau of the Department of Agriculture, which on Friday, Apr. 4, issued a special flood bulletin predicting maximum stages for points on the Mississippi from Memphis to New Orleans. These maximum stages are nearly identical with the maximum heights reached in the flood of 1912, and are based on the supposition that the levees along the lower Mississippi continue to hold water, and also on the occurrence of no storms along the tributaries of the lower Mississippi which will add materially to the height of the flood wave. The maximum stage reached at Cairo is about 1 ft. higher than the highest record of the 1912 flood, and, as noted above, the crest of the flood wave was very flat, making the test of the levees to resist wave and current action very severe. The Weather Bureau predicted that the crest of the flood will reach Vicksburg, Miss., by Apr. 23 or 24, and New Orleans between Apr. 24 and 30. At the latter point a crest stage of about 21.3 ft. was predicted in the special bulletin dated Apr. 4. In a bulletin issued four days later, by the Bureau, maximum flood stages slightly higher were predicted.

By the Falling of a Scaffold a foreman and three laborers were killed at the Miraflores locks, Panama Canal, on Apr. 3.

The Derailment of a Freight Train on the Southern Ry., near Hickory, N. C., caused the deaths of three railway employees on Mar. 31.

A Butting Collision between a freight and a passenger train on the Western Maryland Ry., at Bidwell, Penn., on Mar. 30, resulted in the deaths of two railway employees and serious injuries to two passengers.

A Butting Collision between two passenger trains on the Chicago, Burlington & Quincy R.R., occurred Apr. 3, near Sheridan, Wyo. A passenger and an express messenger were killed and eight other persons were seriously injured. According to press dispatches the accident was due to the failure of the engineer of the eastbound train to follow his orders to take a siding at Wakely, Wyo., and wait for the westbound train to pass.

Accidents to Railway Employees in the State of Georgia for the year 1912, showed an increase of 100% over the number of accidents in 1911, according to a recent report of the Georgia State Railroad Commission. On the steam railways of the state 2384 employees were injured and 74 employees were killed in 1912.

A Locomotive Crashed Through the Station Building at Hoytville, Ohio, on the Baltimore & Ohio R.R., on Apr. 5. The locomotive was attached to an eastbound passenger train and ran into an open switch at high speed. The locomotive was torn loose from the rest of the train and crashed into the wood station building, killing the locomotive fireman and a man who was in the station waiting-room.

A Dynamite Explosion killed four laborers and fatally injured a fifth, near Sherbrooke, Que., on Mar. 26. The men were engaged in blasting ice in the Legendre River for a log drive. The explosion occurred while they were attempting to thaw some dynamite in pails of hot water.
News Note N.R.

Contact of a Steel Tape with the High-Tension Wires used to carry the current for operating the electric locomotives on the New York, New Haven & Hartford R.R., caused the death of Edward J. Fogarty, a civil engineering student of Yale University, on Apr. 2. The accident occurred near New Rochelle, N. Y. Mr. Fogarty and a schoolmate had been engaged by an attorney of New Haven, Conn., to make measurements to be used as evidence in a damage suit against the railway on account of the death of a locomotive runner, who was killed by an electric shock. Mr. Fogarty and his companion were measuring the height of the charged wires above the rail; he was standing on the stone abutment of a bridge holding a steel tape, when the tape was blown against the charged wire by the wind. The shock caused him to fall headforemost to the tracks, fracturing his skull. His companion, who was holding the lower end of the tape, was severely but not fatally burned.

The Cape Cod Canal builders have applied for another extension of time. The canal was to have been completed in June, 1912, but an extension of two years was granted previous to that time. A petition filed with the Massachusetts state legislature on Apr. 4, asks for 18 months more in which to complete the work. The petition is filed in the name of the Boston, Cape Cod & New York Canal Co., and recites that many unforseen physical conditions have been encountered to make the construction work slow. The subcontractors who have been unable to fulfill their contracts with the Cape Cod Canal Construction Co., have been released from further responsibility, and new arrangements have been made for the prosecution of the work. In making the new subcontracts the Canal company was unable to secure any builders who would agree to complete the work on the date set by the previous agreements, June 3, 1914. The total cost of the work is estimated at $12,000,000; and stocks and bonds have been issued to date to the amount of $6,675,000. Capital for construction work can be raised by the sale of stock and bonds only in installments as the work progresses, subject to the approval of the Massachusetts Board of Harbor and Land Commissioners and the State Railroad Commission. There is now pending before these Commissions an application to issue about $4,800,000 more in stock and bonds. It is reported that the canal is 76% completed at the present time.

The Center St. Loop Subway, in New York City, is nearly completed, and will soon be operated by the Brooklyn Rapid Transit Co., trains running over the Williamsburgh Bridge from the Broadway (Brooklyn) elevated railway. The Loop Subway, though the larger part was finished several years ago, has been idle because the terminal station under the Municipal Building had to wait for the construction of that building. This station is now nearly completed; when in operation it will be used as a four-track stub terminal until connection is made to the Brooklyn Bridge or south by subway through Nassau St. to a new East River tunnel at South Ferry. Track is to be laid in the Loop Subway soon. It will consist of 80-lb. rail on sawn yellow-pine ties in stone ballast, and 80-lb. third-rail. All rail is to be of 100-lb. section ultimately, 80-lb. rail from stock being put in now to save time. Two sets of crossovers and two interlocking machines for them are involved.

Tunneling on the Necaxa Power Plant, Mexico, Extension Work, "Eng. News," Mar. 6, 1913, p. 486, is going on very much more rapidly than there stated. The engineers of the tunnel work, Jacobs & Davies, have called attention to the fact that our figures (intended as feet per week, but printed as feet per month) were in error, and quote the following figures for recent rate of advance in Tunnel No. 1, the lowest and longest of the series: January, 1913, heading advance, 636 ft.; February heading advance, 496 ft.; March heading advance, 746.2 ft. This represents two faces.

This tunnel is 3473.8 m. (11,394 ft.) long. It is in soft ground, and the whole length of the headings has been fully timbered. Concrete lining is put in close behind the bench excavation. Work is prosecuted from both ends. The outlet heading is now 1290 m. (4231 ft.) in from the portal, having advanced 400 ft. in March; the inlet heading is 1802.3 m. (5911 ft.) in, having advanced 346 ft. in March. The total advance of headings is therefore 10,142 ft. (Mar. 31, 1913), leaving 1252 ft. to be penetrated.

The Protection of New Castle, Penn., against Floods from Neshannock Creek has been reported on by R. Winthrop Pratt, consulting engineer, of Cleveland, Ohio. The flood of Mar. 25, 1913, did considerable damage in the city and on Apr. 3 Mr. Pratt submitted his report. The following statement on the subject has been supplied to us by R. F. McDowell, assistant engineer to Mr. Pratt:

New Castle, having a population of about 40,000, is located in the valleys of the Shenango River and Neshannock Creek, just above the confluence of these streams. The Shenango and Mahoning rivers unite to form the Beaver River at a point about four miles below the city.

The watershed of the Neshannock Creek, which covers about 250 sq.mi., has a hilly topography and the bed of the stream has a steep slope. The runoff is hence rapid and at times of excessive rains the banks are overflowed within the city.

The immediate causes of damage from floods at New Castle are the deposits in the stream bed; the low elevation of the banks in the upper part of the city; and the obstruction to flow caused by several bridges and a dam within the city limits. Also the backwater from floods in the Shenango River sometimes passes up the Neshannock Creek channel and overflows the low banks in the lower part of the city.

The general plans for protection of the city, recommended in Mr. Pratt's report, include the dredging of the existing deposits in the bed of the stream; widening the channel in places; building reinforced-concrete retaining walls and earth-fill dikes to elevations above possible future flood levels; removing the Rosena dam; improving the channel in the vicinity of the East Washington St. bridge by modifying the approaches to the same, placing a concrete floor in the bed of the creek; and raising or lengthening the railroad bridges near the mouth of the creek.

PERSONALS

Mr. J. Frank Bowen, of Hartford, Conn., has been appointed City Engineer of Manchester, Conn.

Mr. H. P. Parsons, formerly Assistant Engineer of Ottawa, Ont., has been appointed City Engineer of Peterborough, Ont., at a salary of $2500 per annum.

Mr. Charles M. Schwab has resigned as President of the Bethlehem Steel Co. to become Chairman of the Board of Directors. He is succeeded as President by Mr. E. G. Grace.

Mr. A. D. Case has been appointed Engineer of Structures of the Boston & Albany R.R., succeeding Mr. W. F. Steffens, Assoc. M. Am. Soc. C. E., resigned, as noted in our issue of last week.

Mr. W. J. McLean, formerly Master Mechanic of the Duluth, Winnipeg & Pacific Ry., at West Duluth, Minn., has been appointed Master Mechanic of the Kettle Valley Ry., at Penticton, B. C.

Mr. J. A. Loughlin has become associated with Mr. H. DeW. Rapalje, Assoc. M. Am. Soc. C. E., for the general practice of civil engineering under the firm name of Rapalje & Loughlin, with offices in Wilmington, N. C.

Mr. Henry Jungerman, formerly with the motive power and inspection department of the Union Pacific and Southern Pacific Rys., has been appointed Railway Representative of Tate-Jones & Co., Inc., of Pittsburgh, Penn.

Mr. Lewis W. Baldwin, Engineer of Maintenance-of-way of the Illinois Central R.R., at Chicago, Ill., has been appointed Superintendent of the Kentucky division, at Louisville, Ky., succeeding Mr. A. H. Egan, promoted, as noted elsewhere.

Mr. Marco Johnson, Assoc. M. Am. Soc. C. E., Assistant Engineer of Bridges of the Illinois Central R.R., has been promoted to be Engineer of Bridges and Buildings, at Chicago, Ill., succeeding Mr. Fred L. Thompson, promoted, as noted elsewhere.

Mr. Daniel J. Brumley, M. Am. Soc. C. E., formerly Engineer of Construction of the Illinois Central R.R., at Chicago, Ill., has been appointed Engineer of Maintenance-of-way, at Chicago, succeeding Mr. L. W. Baldwin, promoted, as noted elsewhere.

Mr. Mellis V. Ferguson, Assoc. M. Can. Soc. C. E., has resigned as City Engineer of Guelph, Ont., to accept the position of City Engineer of St. Thomas, Ont., at a salary of $2000 per annum. He is succeeded at Guelph by Assistant City Engineer Holland.

Mr. Fred L. Thompson, Engineer of Bridges and Buildings of the Illinois Central R.R., has been promoted to be Engineer of Construction, with headquarters at Chicago, Ill., succeeding Mr. D. J. Brumley, M. Am. Soc. C. E., promoted, as noted elsewhere.

Mr. George W. Berry, formerly General Superintendent of the Yazoo & Mississippi Valley R.R., at Memphis, Tenn., has been promoted to be Superintendent of Terminals of the Illinois Central R.R., at Chicago, Ill., succeeding Mr. James H. Brinkerhoff, resigned.

Mr. W. H. Breithaupt, M. Am. Soc. C. E., Consulting Engineer, Toronto, Ont., has associated with him Mr. Charles B. Kingsley, Assoc. M. Am. Soc. C. E., to continue the engineering practice of the late E. H. Keating and Mr. Breithaupt (Keating & Breithaupt).

Mr. H. M. Taylor, M. Am. Soc. C. E., Director of Construction of the National Rys. of Mexico, has resigned, and his former position has been abolished. The duties of the office will hereafter be assumed by the Chief Engineer of Construction, Mr. G. P. De Wolf.

Mr. E. R. Conant, recently Principal Assistant Engineer, United States Engineer Office, Savannah, Ga., has been appointed Chief Engineer of the City of Savannah, a position recently created which combines the former offices of City Engineer and Director of Public Works.

Mr. Alfred H. Egan, formerly Superintendent of the Illinois Central R.R., at Louisville, Ky., has been promoted to be General Superintendent of the Yazoo & Mississippi Valley R.R., with headquarters at Memphis, Tenn., succeeding Mr. George W. Berry, promoted as noted elsewhere.

Messrs. James A. Armstrong and Chester H. Prouty, for several years connected with the engineering department of the Union Sugar Co., Santa Barbara, Calif., have formed a partnership with offices in the Forsythe Bldg., Fresno, Calif., for the general practice of engineering, specializing in soils and irrigation work.

Mr. William E. Morris, former Assistant General Manager of the Chicago & Northwestern Ry., has been appointed General Manager of the Denver, Northwestern & Pacific Ry., at Denver, Colo. Mr. Morris was compelled to resign his position with the Chicago & Northwestern Ry. about a year ago, because of ill health.

Mr. E. Richards, formerly Superintendent of the St. Louis Southwestern Ry. of Texas, at Mt. Pleasant, Tex., has been appointed Superintendent of the St. Louis Southwestern Ry. at Pine Bluff, Ark., succeeding the late E. A. Peck. Mr. F. J. Hawn, formerly Superintendent of Transportation at Tyler, Tex., succeeds Mr. Richards at Mt. Pleasant.

Mr. William A. Nettleton, M. Am. Soc. M. E., former General Superintendent of Motive Power of the Chicago, Rock Island & Pacific Ry., was seriously injured recently in collision between the taxi-cab in which he was riding and a street car in Chicago, Ill. Mr. Nettleton was alone and was taken to a hospital in an unconscious condition, and it was several days before his identify was established.

Mr. George E. Datesman, M. Am. Soc. C. E., Principal Assistant Engineer of the Bureau of Surveys, Philadelphia, Penn., sailed recently from New York City for Europe, where he expects to spend three months investigating the recent improvements in sewage-disposal works in England and on the continent. Mr. Datesman is sent by the City of Philadelphia, which under the recent state law will soon be obliged to stop the pollution of the Delaware and Schuylkill Rivers. It has been estimated that the proposed sewage-disposal works will cost $30,000,000 and require eight or ten years to build.

Mr. C. J. Smith, recently General Manager of the Richelieu & Ontario Navigation Co., has been made Vice-President and General Manager of the North Ry. and Hudson Bay Steamship Co., of Canada. This project has been subsidized by the Dominion Government and an extensive land grant has been made the company by the Government of the Province of Quebec. The railway has been surveyed between Montreal and James Bay and it is reported construction work will start soon. It is expected to complete the entire 500 miles of track in two years. Mr. Smith was born in Hamilton, Ont., in 1862, and has had an extensive railway experience in both Canada and the United States.

Messrs. Eugene E. Haskell, M. Am. Soc. C. E., Director of the college of civil engineering, Cornell University, William J. Stewart, M. Can. Soc. C. E., Chief Hydrographer, Department of Marine and Fisheries, Canada, and Victor F. W. Forneret, M. Can. Soc. C. E., Engineer-in-charge, St. Lawrence Ship Channel, have been appointed a commission to investigate the water levels on the St. Lawrence River, at and below Montreal, Que. The investigation is to be made under the direction of the Minister of Marine and Fisheries to determine the best means of obtaining and maintaining the proposed 35-ft. ship channel, and to determine the effect of the Chicago Drainage Canal on the St. Lawrence River levels.

Mr. Sylvester Q. Cannon, a Consulting, Mining and Hydraulic Engineer, of Salt Lake City, Utah, has been appointed City Engineer of Salt Lake City, succeeding Mr. D. H. Blossom, resigned, as noted in our issue of Mar. 27. Mr. Cannon graduated from the Massachusetts Institute of Technology in 1899. For a time he was in partnership with his two brothers in Salt Lake City. He then served as a missionary for the Mormon Church in Rotterdam, Holland. On his return to Salt Lake City, he was appointed to a position under the State Engineer of Utah and had charge of the hydrographic survey of the Weber River in 1905 and 1906. From 1906 to 1909 he served on another mission for the Mormon Church. Since 1909 he has been in private practice in Salt Lake City.

Mr. R. A. C. Smith, Chairman of the New York State Harbor Commission, has been appointed Commissioner of Docks of the City of New York, succeeding Mr. Calvin Tomkins, Assoc. Am. Soc. C. E., removed by Mayor Gaynor, as noted elsewhere. Mr. Smith is President of the American Mail Steamship Co., President of the North American Mail Steamship Co., President of the Oakland Bayside Realty Co., the Pelham Electric Light & Power Co., and the W. K. Niver Coal Co.; Vice-President of the Chicago Union Traction Co., a trustee of the American Surety Co., Chairman of the Executive Committee of the Westchester Lighting Co., a director of the American Tobacco Co., the Connecticut Railway & Lighting Co., H. deCamanas y Carbajal, the Havana Commercial Co., the Havana Tobacco C., the Holmes Electric Protective Co., the International Banking Corporation, the Interstate Tunnel Railway Co., the New Niquero Sugar Co., New York City Railway Co., Flint & Co., John Stephenson & Co. and the Plainfield Gas & Electric Light Co.

Mr. Calvin Tomkins, Assoc. Am. Soc. C. E., has been removed from the office of Commissioner of Docks, New York City, by Mayor Gaynor, because of a difference of opinion as to the proposed dock and pier improvements. An abstract of the statement Mr. Tomkins gave to the press on Apr. 4 is as follows:

> The two big things that brought about my removal were my fight against the New York Central R.R. Co.'s private development of Manhattan's waterfront, and the exploitation of South Brooklyn's waterfront by the Bush Terminal Co. Every indication now is that the private interests will supplant the public control of New York City's waterfront.
>
> I am unconditionally opposed to the recent policy of the Board of Estimate—whether adopted by choice or accepted for expediency—by which the great bulk of our profit-paying dock investment exemption ($50,000,000 out of $65,000,000) has been taken for subways and the development of a freight terminal system left for exploitation by private monopolies; the laws, by which but two years ago New York pledged herself to furnish modern port facilities at the lowest cost at which they could be made self-sustaining, and now so amended as to return to the old system under which our commerce has been charged "all it would bear" for public and private profit; and the limited fund left for the Dock Department, which it is planned to use to procure exclusive New York Central right-of-way and most expensive express steamship piers, instead of for the general extension of our commercial, dock and terminal system, including ample long pier provisions.—[New York "Evening Post," Apr. 4.]

Mr. E. H. McHenry, M. Am. Soc. C. E., has resigned as Vice-President of the New York, New Haven & Hartford R.R., effective May 1. Mr. McHenry has been Vice-President in charge of maintenance and construction since 1904, and it has been under his general supervision that electric power system of the railway has been established and extended. Until a short time ago, Mr. McHenry was in charge of the construction and maintenance departments of the Boston & Maine R.R. also. Mr. McHenry was born in Cincinnati, Ohio, in 1859 and was educated at the Pennsylvania Military College at Chester, Penn. He began engineering work in 1883 as a rodman on the Black Hills branch of the Northern Pacific Ry. In 10 years Mr. McHenry passed through all the engineering grades from rodman to Chief Engineer. After three years as Chief Engineer of the Northern Pacific Ry., he was appointed Receiver, and on the reorganization of the railway again became Chief Engineer. He resigned in 1901, and after spending two years abroad in Japan, China and the Philippine Islands, he became Chief Engineer of the Canadian Pacific Ry. In October, 1904, he was made Vice-President of the Consolidated Ry., in charge of construction, operation and maintenance of the electric railway lines of the New York, New Haven & Hartford R.R. The office of Vice-President in charge of construction and maintenance will be abolished and the duties of the office assumed by different branches of the engineering department.

OBITUARY

Robert Wadsworth Prentiss, Professor of Mathematics and Astronomy at Rutgers College, died at his home in New Brunswick, N. J., Apr. 5. He was born at Brighton, Mass., in 1857, and graduated from Rutgers College in 1878.

William H. Fletcher, M. Am. Soc. M. E., Vice-President of the W. & A. Fletcher Co., steamboat and yacht builders, President of the Consolidated Iron Works, of Hoboken, N. J., and Vice-President of the North River Iron Works, of Hoboken, died at his home in New York City, Apr. 2, Mr. Fletcher's firm has built some of the largest steamships and steam yachts in America, including the turbine steamers "Harvard" and "Yale" for the Metropolitan Steamship Co., now in service on the Pacific coast, the steam yacht "Corsair" for the late J. Pierpont Morgan, and many others. Mr. Fletcher was a member of the Society of Naval Architects and Marine Engineers and a Past-President of the Engineers Club of New York City. Mr. Fletcher was 56 years old and is survived by a widow, two sons and a daughter.

James Wilson Petheram, former Chief Engineer of the Missouri, Kansas & Texas Ry. of Texas, died at his home in Dallas, Tex., Mar. 26, aged 70 years. He was born at Largo, Scotland, and was educated at St. Andrews University. He came to America in 1873 and entered the service of the Credit Valley Ry. in Canada as Resident Engineer. From 1875 to 1879 he was Assistant Engineer of the same railway. Two years later Mr. Petheram was appointed Chief Engineer of the Georgian Bay & Wellington Ry., but a year later he resigned to become Assistant Engineer of the Chicago & West Michigan Ry. In 1884 he was promoted to be Chief Engineer of this railway. In 1888 he was appointed General Roadmaster of the Missouri, Kansas & Texas Ry. of Texas, and in 1893 became Chief Engineer, which position he held until 1909, when he suffered a stroke of paralysis. From this he never fully recovered and was not again able to practice his profession.

Rear-Admiral John W. Moore, former Chief Engineer of the United States Navy, died at his home in Ridgewood, N. J., Mar. 30. He was born at Plattsburgh, N. Y., May 24, 1832. He was educated at Plattsburgh Academy and Williston Seminary, and in 1853 received an appointment in the United States Navy as Third-Assistant Engineer. He was promoted through the various grades to be Chief Engineer in 1861. He served on the U. S. S. "Niagara" on the first Atlantic cable expedition and saw much active service during the Civil War. Rear-Admiral Moore is credited with being the originator of chain cable protection for the sides of wooden ships, of "war paint" for making ships less visible in action, of the fighting top now universally used on war vessels and other improvements in warships. He served as Superintendent of Ironclads at New York and Boston, 1863-65; he was Fleet Engineer on the staff of Admiral Farragut on the cruise of the European squadron in 1865-7 and was afterward on duty at various times in all the important Navy Yards. He was retired in 1894 with the rank of Commodore and advanced to the rank of Rear-Admiral in 1906.

George William Quintard, President of the Quintard Iron Works, New York City, died at his home in that city on Apr. 3, in his 91st year. Mr. Quintard was born in Stamford, Conn., and when 15 years of age went to New York City, where he found employment as a grocery clerk. Later he established a grocery business of his own. In 1844 he married Miss Frances A. Morgan, daughter of Charles Morgan, of the Morgan Iron Works. A few years later he was admitted to membership in the firm of T. F. Secor & Co., owners of the Morgan Iron Works. Mr. Quintard assumed control of the company in 1852, and, excepting two years, was Manager until 1867, when he sold his interests and became President of the New York & Charleston Steamship Co. During the Civil War Mr. Quintard's company built many marine engines and other equipment for the United States Navy. Two years after his retirement from the Morgan Iron Works he established the Quintard Iron Works and built up a large and prosperous industry for the manufacture of marine engines and machinery. Some years ago he retired from the active management of this company and from numerous other enterprises with which he had been associated, to enjoy a well-earned rest. Mr. Quintard was a life member of the Society of Naval Architects and Marine Engineers.

ENGINEERING SOCIETIES

COMING MEETINGS

DETROIT ENGINEERING SOCIETY.
Apr. 18. Annual meeting at Detroit, Mich. Secy., F. H. Mason, 614 Moffat Bldg., Detroit, Mich.

UTAH SOCIETY OF ENGINEERS.
Apr. 18. Annual meeting at Salt Lake City, Utah. Secy., R. B. Ketchum, 702 Newhouse Bldg., Salt Lake City, Utah.

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

NATIONAL GOOD ROADS FEDERATION.
Apr. 24-25. Annual convention. Secy., J. A. Rountree, Birmingham, Ala.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, owa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Schurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION.
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
May 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

American Society of Civil Engineers—The annual convention will be held in Ottawa, Can., June 17-20, 1913.

National Good Roads Federation—This association will meet in Birmingham, Ala., Apr. 24-25. Delegates are expected from all the states of the union. The object of this federation is stated to be to organize the advocates of improved highways in "one grand consolidated body" to aid in securing federal, state and county aid for road building. One of the features of the meeting will be an exhibition of road-making machinery and material, including the much exhibited exhibit of the U. S. Office of Public Roads. The secretary is J. A. Rountree, Birmingham, Ala.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Rhode Island—Grand Trunk Ry.—This company, according to press reports, has offered to turn over to the state of Rhode Island its entire unfinished Southern New England R.R. on condition that the state complete and operate the road under certain specified conditions. Ed. J. Chamberlain is Ch. Engr.

Pennsylvania—Chambersburg & Shippensburg Ry.—This company has applied for a charter for the construction of a railroad from Red Bridge Park, Chambersburg, north and east through Greene and Southampton Townships, Franklin County, following in a general direction the line of the Harrisburg, Carlisle and Chambersburg turnpike road, to the western line of Shippensburg, a distance of nine miles. Capital, $250,000. The main offices of the company will be at Chambersburg. J. G. Schaff, Chambersburg, is an incorporator.

✚Buffalo, Rochester & Pittsburgh R.R.—This company has awarded contracts as follows: To the MILLER CONSTRUCTION CO., Loch Haven, Penn., for grading and masonry work on a branch five miles in length near Lucerne, Penn.; to LANE BROS. CO., Altavista, Va., for grading and masonry on 12 miles of second track work and for grade revision between Rochester, N. Y., and Scottsville.

Alabama—Seaboard Air Line R.R.—This company is planning for the construction of a branch line from Wellington, to Lagarde, Ala. W. D. Faucette, Portsmouth, Va., is Ch. Engr.

✚Gulf, Florida & Alabama Ry.—This company, it is reported has awarded the contract to J. T. McCARTHY & CO., Gainesville, Ga., for grading 20 miles of its extension from Jonesville, northerly.

Louisiana—Monroe, Louisiana & Gulf Ry.—This company has been organized for the purpose of constructing or purchasing a railroad from Monroe, La., in a southwesterly direction to Winfield, with a New Orleans connection. The charter of the company has been filed. Capital, $1,000,000. J. M. Parker, New Orleans, is Pres.

Ohio—Lorain, Ashland & Southern R.R.—Bids will be received until noon, Apr. 15, by the West Virginia & Ohio Construction Co., for the construction of 24 miles of railroad between Wellington, Ohio, and Ashland, Ohio. Specifications and full information may be obtained at the office of J. P. Ramsey, Ch. Engr., Wellington.

Illinois—Illinois, Iowa & Minnesota R.R.—This company plans to construct a line of railroad from Rockford, Ill., to Beloit, Wis.

Illinois Central R.R.—This company is planning for the construction of its four-track system from Matteson to Kankakee, Ill. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Wisconsin—Chicago, St. Paul, Minneapolis & Omaha Ry.—This company has been granted permission to straighten its tracks, reduce grades and double-track its line from Knapp to Northline, about 50 miles. C. W. Johnson, St. Paul, Minn., is Ch. Engr.

Wisconsin—Chicago, Burlington & Quincy R.R.—This company will construct second-track from McCartney, Wis., to Bagley, Wis., a distance of about 23 miles; from Prairie du Chien to Charmo, seven miles; from De Soto to Victory, six miles, and from Fountain City to Alma, 14 miles. Estimated cost, about $3,800,000. T. E. Calvert, Chicago, Ill., is Ch. Engr.

South Dakota—Sioux Valley & Northern R.R.—This company has obtained a charter for the construction of a railroad 100 miles in length, from Watertown, S. D., through Codington, Grant and Robert Counties to the northern section of the state. The capital of the company is $1,000,000. F. J. Klix, Summit, S. D., is one of the directors.

Missouri—Shelby County R.R.—This company has grading work to let to the amount of about 22 miles. Further information may be obtained from L. B. Houck, Cape Girardeau, Mo., Pres.

Texas—Gulf, Texas & Western Ry.—This company is making preliminary surveys for the construction of an extension westerly from Seymour, Tex. One survey extends from Seymour, northwesterly to Floydada, 150 miles. The other survey was run from Seymour to Crosbyton, 125 miles. B. B. Cain, Dallas, Tex., is Vice-Pres. and Gen. Mgr.

Colorado—Plateau Valley R.R.—This company has completed financial arrangements for the construction of its proposed railroad from Grand Junction, Colo., to Collbran, Colo. J. J. Yeckel, Denver, Colo., is Pres.

Washington—Walla Walla Valley Ry.—This company will spend $150,000 for extensions and improvements near Walla Walla, Wash. D. F. McGee, Portland, Ore., is Ch. Engr.

✚**Washington**—Northern Pacific Ry. Co.—W. L. Darling, Chief Engineer of this company, has let the contract to CAUGHREN & WOLDSON, of Seattle and Spokane, Wash., for rebuilding the portion of the company's line between Seattle and Sumas, on the international boundary. The contract involves the immediate expenditure of approximately $700,000. This is the first unit of extensive improvements planned by the road to be completed within two years, which will call for an aggregate expenditure of not less than $4,000,000. The Keasel Construction Co., Tacoma, has the contract for rebuilding that portion of the Lake Washington belt line of the company between Kirkland on the east shore of Lake Washington and Woodinville by means of which the road is to be straightened and steep grades eliminated. There is a two-fold purpose back of this improvement, viz., the placing of Everett on the main line between Seattle and Vancouver, B. C., and reconstruction of the trackage so that heavy shipments of timber can be handled from the country north of Seattle direct to Auburn Junction, where eastbound train-load traffic will be made up.

The Fidelity Lumber Co. will build a logging railroad from the mouth of Skookum Creek to timber holdings several miles away. Another line from LeClerc Creek to timber owned by the Panhandle Lumber Co. is proposed.

Grants Pass & Crescent City R.R.—This company is planning to construct a railroad from Grants Pass, Ore., to Crescent City, Calif., together with a number of branch lines totaling over 120 miles. The company is capitalized at $5,000,000 and J. F. Reddy, N. L. Gilky and W. W. Harmon are interested.

California—Chowchilla Pacific R.R.—This company, it is reported, has awarded contracts for the construction of its proposed line. Work will begin at once.

California R.R. & Navigation Co.—This company plans to construct a railroad from Snowden, on the line of the Southern Pacific Co., to Fort Jones, Calif., and various branches. The entire length of the proposed line will be 350 miles. Surveys for the construction of the first 110 miles have been made. G. W. Bartle, 604 Exchange Bldg., Los Angeles, Calif., is Pres.

California—Nevada County Narrow Gage R.R.—This company is planning to change the gage of the road to standard gage and make other improvements to cost $500,000. The work of changing the gage will be commenced shortly on the section from Colfax to Bear River, a distance of four miles. C. P. Longbridge is Gen. Mgr. and Ch. Engr., Grass Valley, Calif.

Northern California R.R. & Navigation Co.—This company, recently incorporated, with a capital stock of $1,000,000, announces its intention of constructing 110 miles of railroad lines in Siskiyou County as follows: From Snowden on line of the Southern Pacific Co., to Yreka, thence to Fort Jones, Etna and the Callahan Ranch, the western terminus to be at Happy Camp. The directors of the company are: George W. Bartle, Pres.; Oscar W. Bartle, J. D. Rhoades, S. Swinson, R. B. Howarth and F. C. Messick, all of Los Angeles, Calif.

New Brunswick—Suburban Rys.—The Legislature of the Province of New Brunswick has passed a bill authorizing this company to construct suburban lines from St. John, N. B. The following lines will be built: To Loch Lomond, 10 miles; to Rothesay, nine miles; to Millidgeville, three miles, and to Westfield, 14 miles. The bill provides that $50,000 in construction must be spent the first year, the same amount the second year, and $100,000 the third year.

ELECTRIC RAILWAYS

Portland, Maine—The construction of a 10-mile line from Portland to Lewiston is contemplated by the Portland, Gray & Lewiston R.R. Co. C. H. Barron, Lewiston, is Ch. Engr.

Meridan, Conn.—Committees have been appointed from Meridan, New Britain and Kensington to take steps toward the extension of the line of the Connecticut Co. to the towns which they represent. Franklin Atwater, of Meridan and C. F. Lewis, of Kensington, are interested.

Yonkers, N. Y.—The Yonkers R.R. Co. has applied for permission to extend and double-track several of its lines in Yonkers. P. J. Donovan, Yonkers, is Supt.

Trenton, N. J.—The New Jersey & Pennsylvania Traction Co. has applied to the City Council for permission to build a double-track line from the Calhoun St. Bridge to the feeder on Calhoun St. W. H. Janney, Philadelphia, Penn., is Gen. Mgr. and Pur. Agt.

Bridgeport, Penn.—The Phoenix, Valley Forge & Stafford St. Ry. Co. is making surveys for the construction of its proposed line from Valley Forge to Bridgeport.

California, Penn.—The Allenport & Roscoe Electric St. Ry. Co. has been granted a franchise to construct and operate an electric railway through California.

Cambridge, Penn.—The Northwestern Rys. Co. is considering plans for the construction of an electric railway from Venango to Cambridge. Charles Murray, Meadville, is Gen. Mgr. and Pur. Agt.

Geistown, Penn.—The Oakland, Geistown & Arbutus Park Ry. Co. has been organized for the purpose of constructing an electric railway to connect Oakland, Geistown and Arbutus Park. William H. Sunshine, O. P. Thomas and Albert Stenger are interested.

Richmond, Va.—The City Council has granted the Richmond & Henrico Ry. Co. two franchises to extend its Fulton Hill and 35th St. lines. C. Sims-Bailey, Richmond, is Gen. Supt. and Pur. Agt.

Grafton, W. Va.—Plans are being prepared by the Grafton Traction Co. for the extension of its line to Pruntyville, this spring. George L. Hartley, Grafton, is Supt. and Pur. Agt.

Morgantown, W. Va.—The Morgantown Interurban Ry. Co. has been granted a franchise by the City Council of Morgantown to construct and operate an electric line over several streets of the city. This is part of a proposed line to connect Morgantown, W. Va., and Point Marion, Penn.

Beaufort, N. C.—The Beaufort Terminal Ry. Co. has been incorporated to construct and operate an interurban railway from Beaufort to Cape Lookout, about 12 miles. E. C. Duncan and F. L. Nicholson, of Norfolk, are interested.

Athens, Ga.—Plans are being considered by the Athens Ry. & Electric Co. for the extension of its line to Barberville, Fla. C. L. Proctor, Athens, is Gen. Supt. and Pur. Agt.

Atlanta, Ga.—The Georgia Ry. & Electric Co. has applied to the County Commissioners for a franchise to extend its line on Howell Mill Road to Collier Road. G. W. Brine, Electric & Gas Bldg., Atlanta, is Vice-Pres. and Gen. Mgr.

Rome, Ga.—The Rome Ry. & Light Co. is considering plans for the construction of a two-mile extension to its line in Rome. H. J. Arnold, Rome, is Supt. and Pur. Agt.

Birmingham, Ala.—J. B. Coyle has applied to the City Council for a franchise to construct and operate an electric railway to connect the West End of the city with South Bessemer and Ensley.

Amesville, La.—The New Orleans & Western Ry. Co. is planning the construction of an extension to its line from Amesville to Westwego. The company also plans to construct a belt line around the Harvey and Marrero additions in New Orleans. C. D. Warren, Gretna, La., is Pres.

Knoxville, Tenn.—The construction of an electric railway from Knoxville to Bearden, about five miles, is under consideration by the Knoxville Ry. & Light Co. T. C. Kelly, Knoxville, is Supt. Ry.

Piqua, Ohio—Work is to be started early in April by the Piqua & Bradford Traction Co. on a line to connect towns of Covington and Bradford. The company was recently organized for the purpose. J. H. Marlin is interested. Noted Apr. 3.

Gary, Ind.—Plans are being prepared by the Gary & Interurban Ry. Co. for the extension of its lines in Gary. W. C. Phillips, Gary, is Supt.

Newcastle, Ind.—Preliminary arrangements are being made by the Union Traction Co., of Indiana, for the construction of its proposed electric railway from Newcastle to Muncie, about 18 miles. H. A. Nicholl, Anderson, Ind., is Gen. Mgr. Noted Nov. 7.

Owosso, Mich.—Plans have been completed for the proposed electric railway to connect Owosso and Pontiac. W. B. McLaughlin and O. H. Lau, of Detroit, Mich., are interested.

Quincy, Ill.—The Quincy Ry. Co. proposes to build two miles of additional track in Quincy this spring. H. E. Chubbuck, Peoria, is Gen. Mgr.

Allouez, Wis.—Plans are being prepared by the Great Northern R.R. Co. for the construction of a trolley line from Allouez to Sanders. C. L. Daugherty, St. Paul, Minn., is Elec. Engr.

Pigeon, Wis.—The Pigeon Valley Ry. Co. has been organized to construct and operate an electric railway from Pigeon to Hale and Northfield.

Clinton, Iowa—The City Council has granted a franchise to the Clinton St. Ry. Co. to construct and operate an electric railway in Clinton. A. L. Schuyler, Clinton, is Secy.

Arkansas City, Kan.—Press reports are to the effect that the Interstate R.R. & Traction Co. is considering plans for the construction of an interurban railway to connect Arkansas City, Kan., and Ponca City, Okla., and eventually Guthrie, Okla. O. L. Brown, Arkansas City, and J. M. Van Winkle, Ponca City, are interested.

Topeka, Kan.—Plans have been prepared by the Topeka-Kansas City Interurban Ry. Co. for the construction of an electric railway to connect Lawrence, Kansas City and Topeka. F. H. Thomas and R. E. Townsend, of Topeka, are interested.

Grand Forks, N. D.—Included in the extensive improvements planned by the Grand Forks St. Ry. Co. is the extension of its line into East Grand Forks. Thomas Roycraft, Grand Forks, is Gen. Mgr. and Pur. Agt.

St. Joseph, Mo.—Plans are being prepared by the St. Joseph Ry., Light, Heat & Power Co. for the construction of a two-mile extension to its line in St. Joseph. J. H. Van Brunt, St. Joseph, is Vice-Pres. and Gen. Mgr.

Sand Springs, Okla.—Plans are being prepared by the Sand Springs Ry. Co. for the construction of a 10-mile extension to its line in Sand Springs. Henry T. Morrison, Tulsa, is Supt.

Canon City, Colo.—Preliminary arrangements are being made by Frederick B. Smith for the construction of an electric railway from Canon City to Royal Gorge.

Denver, Colo.—Plans are being prepared by the Denver City Tramway Co. for the construction of a two-mile extension to its Sixth Ave. line. John A. Eeeler, Tramway Bldg., Denver, is Gen. Mgr.

Caldwell, Idaho—The Caldwell Traction Co. contemplates the extension of its line around the Deer Flat Reservoir in Caldwell.

Petaluma, Calif.—The Petaluma & Santa Rosa Ry. Co. is considering plans for the construction of a trolley line from Liberty station to Two Rock station, about six miles. E. M. Van Frank, Petaluma, is Pres.

San Francisco, Calif.—Bids will be called for shortly for the extension of the Geary St. Municipal Ry. from Geary St. and 33rd Ave. to the beach. The work will cost about $60,000. M. M. O'Shaughnessy is City Engr. Noted Apr. 3.

San Jose, Calif.—A standard-gage electric railway will be constructed from San Jose to the San Jose Golf and Country Club, a distance of five miles, by the Southern Pacific Co. F. E. Chaplin is Gen. Mgr. of the electric line for the Southern Pacific Co. in Santa Clara County.

San José, Calif.—The San Jose Terminal Ry. Co. is considering plans for the construction of an electric railway on Delmas Ave. and East Santa Clara St. John Mehling, San Jose, is Vice-Pres. and Gen. Mgr.

Stockton, Calif.—Plans are being prepared by the Stockton Terminal & Eastern R.R. Co. for the construction of an electric railway from Ballota to Jenny Lind, about 11 miles. George S. Cameron, Stockton, is Gen. Mgr.

St. John, N. B.—The Suburban Ry. Co. has been organized to construct suburban lines from St. John in four directions, to Loch Lomond, about 10 miles, to Rothesay, about nine miles, to Millidgeville, about three miles, and to Westfield, about 14 miles.

LIGHT, HEAT AND POWER

Beverly, Mass.—The Beverly Gas & Electric Co. is considering plans for the improvement of its plant and extension of its system. A Macauley, Beverly, is Supt.

Brimfield, Mass.—The Council has decided to install an electric street-lighting system in Brimfield.

✚Brockton, Mass.—The contract for the electric-power plant in the F. E. White and Marshall factories has been awarded to the ANDREWS ELECTRIC CO., 17 North Main St., Brockton.

✚Easthampton, Mass.—The Easthampton Gas Co. has awarded the contract for laying five miles of gas mains, to the JOHN M. DINEEN & SONS CO., of Easthampton.

Springfield, Mass.—The city is considering plans for the installation of an electric-light plant to furnish light for the recently completed group of municipal buildings. John A. Dennison is Mayor.

Williamstown, Mass.—Preliminary arrangements are being made for the installation of an electric-light plant at Williams College, to supply electricity for all the college buildings.

Falls Village, Conn.—The consolidation has been completed of the Connecticut Power Co., Middletown Electric Light Co., New London Gas & Electric Co. and the Eastern Connecticut Electric Power Co. to be known as the Connecticut Power Co. under management of the Stone & Webster Management Association of Boston, Mass. The Connecticut Power Co. also owns the Berkshire Power Co. Canaan N. H. Norlfolk Electric Co. and Sharon Electric Co. It is proposed to develop a hydroelectric plant at Falls Village on the Housatonic River to generate 12,000 hp. with a later increase to 16,000 hp.

New Haven, Conn.—The New Haven Gas Light Co. is to change its gas plant from an oil gas-making plant to a coal gas plant and will also make extensive additions to the plant.

✚Shelton, Conn.—The Derby Gas Co. has awarded the contract for the construction of an addition to its gas retort house at Shelton, to MAX A. DURRSCHMIDT, Main St., Derby.

Elmira, N. Y.—Plans are being prepared by the Elmira Water, Light & R.R. Co. for the construction of a new power station. H. M. Beardsley, Elmira, is Mgr.

Phoenix, N. Y.—At a recent election it was voted to install an ornamental street-lighting system.

Seneca, N. Y.—The Town Board of West Seneca, has decided to install an ornamental street-lighting system in the district including Ebenezer, Gardenville and Winchester. About 350 lamps will be required.

Troy, N. Y.—The city is considering plans for an expenditure of $67,000 for the installation of an ornamental street-lighting system.

Jersey City, N. J.—The Public Service Electric Co. has been granted permission to construct an addition to its power station on Duffield Ave. Estimated cost, $80,000. Dudley Farrand, Newark, is Gen. Supt.

✚Montclair, N. J.—Bids will be received by Harry Trippett, Town Clk., until 8 p.m., Apr. 14, for the installation of a fire-alarm cable on Bloomfield Ave. and other streets in Montclair. Plans are on file at the office of Edgar S. Classon, Town Engr.

Westport, Md.—The Consolidated Gas & Electric Co., of Baltimore, will construct an addition to its boiler house at Westport, to give 15,000 kw. to its present capacity. E. D. Edmonston, Baltimore, is Gen. Supt.

Camden, S. C.—Plans have been prepared for the construction of a municipal electric-light plant for Camden. Estimated cost, $35,000.

Orangeburg, S. C.—See item under Water Supply-Irrigation.

Atlanta, Ga.—The city is considering an expenditure of $9500 for the installation of an electric-generating plant in the river pumping station. R. M. Clayton is Ch. of the Construction Dept. R. C. Turner is City Elecn.

Guyton, Ga.—See item under Water Supply-Irrigation.

Macon, Ga.—The City Council has granted a franchise to the Georgia Public Service Co. to construct and operate a gas plant at Macon.

✚Tuscaloosa, Ala.—The Birmingham-Tuscaloosa Ry. & Utilities Co. has awarded the contract for the construction of a power plant at Tuscaloosa to the GENERAL ELECTRIC CO., Schenectady, N. Y., at $145,660.

Dresden, Tenn.—The citizens will vote Apr. 24, on the proposition to issue $24,000 in bonds for the construction of an electric-light plant.

Gleason, Tenn.—Plans are being considered for the construction of an electric-light plant at Gleason.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. of Pub. Serv. until noon, Apr. 10, for installing a steam engine and generator in the Collinwood Station of the municipal electric-light plant.

Lindsey, Ohio—Preliminary arrangements are being made by the village for the construction of an electric-light plant.

Goshen, Ind.—Plans have been prepared for the improvement of the municipal electric plant and system at Goshen. Estimated cost $30,000. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs.

Muncie, Ind.—A committee has been appointed by the City Council to take steps toward the installation of an ornamental street-lighting system for Muncie. Thomas B. Parkinson is a member of the committee.

Rushmore, Ind.—Plans are being prepared for the installation of an electric-lighting system in Rushmore.

Albion, Mich.—Plans are being considered by the City Council for the construction of a municipal electric-light plant.

Ann Arbor, Mich.—Bids will soon be received by Gardner S. Williams, Consult, Engr., Ann Arbor, for the construction of a power plant and a dam at the Argo plant, near Ann Arbor of the Eastern Michigan Edison Co.

Carsonville, Mich.—Plans are being prepared for the construction of a municipal electric-light plant at Carsonville.

Ecorse, Mich.—The Eastern Michigan Edison Co. is considering plans for the installation of an electric system in Ecorse. J. W. Brennan, 18 Washington Ave., Detroit, Mich., is Pur. Agt. Noted Mar. 27.

Grand Rapids, Mich.—Plans have been prepared for the installation of an ornamental street-lighting system on Ionia Ave., from Oakes to Lyon St. Estimated cost, $8520. L. Stevens is City Engr.

Centralia, Ill.—The City Council is considering the installation of an ornamental lighting system on several streets. Lee S. Trainor is City Engr.

Mount Pulaski, Ill.—The City Council has granted a franchise to West & Veail, owners of the local electric-light plant, to improve its plant and extend its system.

Springfield, Ill.—Plans have been prepared for the installation of an electric-lighting system in Sabula. Estimated cost, $11,200. Wade D. Seeley is City Engr.

Des Moines, Iowa—The Board of Supervisors is considering the installation of bronze electroliers to be placed at the entrance to the county building. Estimated cost, $5600.

Eldridge, Iowa—The Town Council has been petitioned to take steps toward the installation of an electric-lighting system in Eldridge.

Hampton, Iowa—H. H. Coughlan, of Waterloo, Iowa, has purchased the local electric-light plant. The new owner will rebuild the plant and install new equipment.

Jesup, Iowa—The Council has granted a franchise to H. C. Young and Charles Brush to construct and operate an electric-light plant here.

Sabula, Iowa—Plans are being prepared for the installation of an electric-lighting system in Sabula. Estimated cost, $8000.

Windom, Minn.—Plans for the construction of a new municipal electric-light plant are under consideration.

✝Canton, Kan.—We are officially advised that the contract for the construction of a municipal light-plant at Canton, has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $12,413. Bids were received Mar. 26 by T. N. Frantz, City Clk. Noted Mar. 13.

Interior, S. D.—The construction of an electric-light plant at Interior is under consideration.

Oacoma, S. D.—J. E. Kennedy is interested in the recently organized company at Oacoma for the purpose of installing an electric-light plant.

Rockham, S. D.—The Town Board is making preliminary arrangements for the installation of an ornamental street-lighting system.

White, S. D.—The Commercial Club is taking steps toward the installation of a municipal electric-light plant and water system.

Joplin, Mo.—An election will be held on Apr. 15, at which the proposition to issue $50,000 in bonds for the improvement of the municipal electric-light plant and the extension of the street-lighting system, will be submitted to the voters. Noted Feb. 13.

Marshall, Mo.—Henrici, Kent & Lowry, Consult. Engrs., Kansas City, Mo., have been retained by the City Council to make an estimate of the cost of installing a new municipal electric-light plant.

Ridgeway, Mo.—Rollins & Westover, Midland Bldg., Kansas City, Mo., are preparing plans for the construction of a municipal electric-light plant at Ridgeway. Estimated cost, $15,000.

Harrison, Ark.—The Harrison Electric Light & Ice Co. is considering plans for the improvement of its plant and the installation of new equipment. R. M. Fellows, Harrison, is Mgr.

Bryan, Tex.—H. P. Ball is considering plans for the installation of a gas plant at Bryan. Noted Mar. 27.

El Paso—The Electric Ry. Co. of El Paso which is a subsidiary of the Stone & Webster Corporation will construct a system of transmission lines to points in the Rio Grande valley for the purpose of supplying farmers and others with electric power for operating electric pumping plants and other industries. N. S. Potter, El Paso, is Gen. Supt.

Ennis, Tex.—The Texas Light & Power Co. has purchased the light and power plant of the Ennis Light & Power Co. here. It is announced that the new owner will enlarge and improve the electric-light and power plant and the ice factory.

Seadrift, Tex.—G. E. Tusull, of Eagle Lake has been granted a franchise by the City Council of Seadrift for the construction of an electric-light plant here. He will also build an ice factory in connection with the enterprise.

Waxahachie, Tex.—The Waxahachie Gas Co. will soon begin the work of erecting its gas manufacturing plant here and laying a system of distributing mains.

Bristow, Okla.—Bonds for $25,000 have been voted for the construction of an electric-light plant at Bristow.

Deming, N. M.—The Deming Ice & Electric Co. will install in its electric power plant here high-pressure boilers and stokers, new substation transformers; direct-connected Chuse Corliss engine, 225 hp.; new switch-board panels, motor-driven pumps, condenser pumps and all the incidental equipment necessary for the installation of an uptodate power plant. The cost of this machinery is about $80,000.

Arlington, Wash.—Plans have been prepared by Lewis C. Kelsey, Engr., Selling Bldg., Portland, Ore., for the installation of an electric-lighting system in Arlington.

✝Portland, Ore.—The City Council has awarded the contract for the installation of a lighting system on the new Broadway Bridge across the Willamette River, to the WEST COAST ENGINEERING CO., Portland, at $21,000.

Silverton, Ore.—At an election to be held May 5 the proposition to issue $50,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters.

Fresno, Calif. The Pacific Light & Power Corporation of Los Angeles has been awarded a franchise to construct a tower power line from the Big Creek power house to the Fresno-Tulare county line. The power line will be almost 350 miles in length. C. A. Luckenbach, Los Angeles, is Mgr. of Construction.

✝Los Angeles, Calif.—The Los Angeles Gas & Electric Corporation awarded a contract to the C. C. MOORE CO., of San Francisco, for the construction at its plant on Aliso St., of one 36 in. and 72x60 in. and two 53x60 in. horizontal duplex acting Hamilton-Corliss Gas compressors with a capacity of 1,000,000 cu.ft. of gas per hour, at $52,000. The specifications call for Corliss valves. Manzel oil pump, steel cylinder, etc.

Redding, Calif.—Preliminary arrangements are being made by the Northern California Power Co. for the construction of a new gas plant at Redding. Estimated cost, $10,000. E. V. D. Johnson, Redding, is Mgr.

Sacramento, Calif.—Plans have been prepared by Albert Givan, City Engr., for the construction of a municipal power distributing plant. A sub-station with 75 miles of pole lines is planned. Estimated cost, $113,600.

✝Santa Paula, Calif.—The Ventura County Power Co. has awarded a contract for the construction of a gas reservoir to have a capacity of 50,000 cu.ft., to the WESTERN PIPE & STEEL CO., of Los Angeles.

Sausalito, Calif.—The Pacific Gas & Electric Co. will extend its gas mains to Sausalito and Mill Valley John A. Britton, San Francisco, is Vice-Pres. and Gen. Mgr.

✝Venice, Calif.—The contract for the installation of an ornamental lighting system on Ocean Front in Venice, has been awarded to W. F. RABINEAU, at $14,900.

BRIDGES

Hingham, Mass.—It is proposed to build a reinforced concrete bridge over the Wier River at Rockland St., to cost approximately $6000. Walter B. Foster, South St., Higham, is the Engr.

Pittsfield, Mass.—The City Council has authorized the preparation of plans for a new bridge at Merrimac St. The estimated cost is $200,000. P. J. Moore is Mayor.

South Norwalk, Conn.—Bids were received Mar. 20, by the Bridge Construction Committee, for the construction of the Washington St. Bridge. The bids follow: (a) For the reinforced-concrete substructure and superstructure for Designs A and B, Scherzer Rolling Lift Bascule bridge; (b) and for Designs C and D, Strauss Bascule bridge: D. F. Toomey, South Norwalk, Conn., (a) $285,822 and $269,745; (b) $286,401 and $270,544; Frawley & Kaufman Co., New York City, (a) $235,000 and $223,000; (b) $234,000 and $222,000; Conners Bros. Co., Lowell, Mass., (a) $228,384 and $217,848; (b) $236,886 and $216,386; Snare & Triest Co., New York City, (a) $204,100 and $196,000; (b) $203,700 and $193,100; McHarg, Borton & Co., New York City, (a) $204,000 and $193,400; (b) $204,000 and $194,000; for steel bascule superstructure: (a) Scherzer Rolling lift; (b) Strauss Trunnion Bascule; Frawley & Kaufman Co., New York City, (a) $57,225; D. F. Toomey, South Norwalk, Conn., (a) $55,000; (b) $58,000; Conners Bros. Co., Lowell, Mass., (a) $50,242; (b) $58,191; McHarg, Barton & Co., New York City, (a) $44,900; (b) $43,200; Penn Bridge Co., Beaver Falls, Pa., (a) $43,300; (b) $47,400; Scherzer Rolling Lift Bridge Co., 220 Broadway, New York, (a) $32,927. For paving the bridge roadway and approaches, D. F. Toomey, South Norwalk, Conn., submitted the lowest bid at $14,000. Noted Dec. 12 and Feb. 27.

★Livingston Manor, N. Y.—Bids that were to have been received by John R. Baldwin, Town Clk., Livingston Manor, until Mar. 31, will be received until 3 p.m., Apr. 30, for the construction of a bridge and foundations over the Willowemoc River, State Route No. 4, Livingston Manor. Noted Mar. 13.

Caldwell, N. J.—Plans for a new steel bridge on concrete abutments for the Erie R.R., have been submitted to the Board of County Freeholders for approval.

Elizabeth, N. J.—Bids will be received by the Board of Chosen Freeholders until 3 p.m., Apr. 14, for the construction of a new steel superstructure for the bridge over the Elizabeth River at South St. Jacob L. Bauer is the County Engr.

Sea Girt, N. J.—The Board of Freeholders will have plans prepared for the construction of a new highway bridge over Wreck Pond, near Sea Girt.

Toms River, N. J.—We are officially advised that the Island Heights & Sea Side Park Co., is waiting for the action of the War Department before giving out a date for receiving bids for the construction of two timber trestles and one earth fill across Barnegat Bay. Jesse P. Everham is the Secy. Noted Jan. 30.

Mount Carmel, Penn.—Bids will soon be asked for the construction of a reinforced concrete bridge about 75 ft. long over Coal Run at Mount Carmel.

★✝Pittsburgh, Penn.—We are officially advised that the contract for the removal of the present bridge and the construction of a reinforced concrete arch bridge on the line of Murray Ave., over William Pitt Blvd., has been awarded to the DRAVO CONTRACTING CO., Pittsburgh, at $98,206. Joseph G. Armstrong, Dir. of the Dept. of Public Works, 432 Oliver Bldg. Noted Mar. 13.

We are officially advised that all bids received by the Controller of Luzerne County, Apr. 1, for removing the wood and iron superstructure of the present bridge across the Susquehanna River at Pittston, alterations to the piers and abutments, constructing five pin-connected spans, each 202 ft. long with 25-ft. roadway and two 8-ft. sidewalks, have been

rejected and the work will be readvertised. Fuller R. Hendershot is the Controller. Noted Mar. 13.

Smethport, Penn.—Bids for the removal of the present bridge and the construction of a new 70-ft. span, reinforced concrete arch bridge over Marvin Creek, were received by the Commissioners of McKean County on Mar. 28 as follows: G. W. Ensign, $6650; Curwensville Construction Co., Curwensville, Penn., $8880; Applegate & Son, Bradford, Penn., $7000; Nelson-Meredyth Co., Chambersburg, Penn., $7792; Ferro Construction Co., Harrisburg, Penn., $6980. Noted Mar. 13.

Baltimore, Md.—The lowest bid submitted for the construction of a steel truss highway bridge over the dam at Loch Raven, was that of the Roanoke Bridge Co., at $50,925. Noted Feb. 20.

Denton, Md.—See item under Streets and Roads.

Hagerstown, Md.—The Norfolk & Western Ry. has appropriated $600,000 for the construction of bridges along the Shenandoah Valley Division, between Roanoke and Hagerstown. C. S. Churchill, Roanoke, Va., is the Ch. Engr.

Cleveland, Ohio—Bids will be received by the Board of Commissioners of Cuyahoga County until 11 a.m., May 7, for the construction of a concrete bridge at Lee Road, East Cleveland Township, per Report No. 3069. John F. Goldenbogen is the Clk.

Columbus, Ohio—At the request of James Marker, State Highway Comr., Walter Braun, Engr., of Franklin County has furnished the state a list of bridges lost by the county with an estimate of how much it will take to replace or repair the same. The approximate loss of the county will aggregate $1,000,000 and the legislature expects to pass a bill appropriating money for the re-construction of bridges lost in the flood.

The bridges over the Olentangy destroyed by the flood and the approximate replacement costs are: Wilson Bridge, $15,000; Worthington, $30,000; Weisheimer, $20,000; Dodridge, $2000; Lane Avon., $20,000; King Ave., $20,0; Fifth Ave., $2000; waterworks, $5000.

Over the Scioto River: Williams, $50,000; Grand View, $25,-000; Sandusky St., $15,000; Broad St., $200,000; Mound St., $75,-000; Greenlawn Ave., $2000; Frank Road, $30,000; Clckenger Road, $30,000 and Shadeville, $15,000.

Over the Big Walnut Creek: Chillicothe Pike, $5000; Lockbourne, $2000; McCloud, $75,000; Platter, $5000; Groveport Pike, $6000; Refuge Pike, $6000; Taylor, $5000; Dohner, $2000 and Moore, $20,000.

Over Alum Creek: Eberly Road $2500; Matheny, $2000; Park Mills, $5000; Westerville Road, $5000 and Westerville, $2000.

Over Big Darby Creek: Converse, $5000; High, $3000; National Road, $12,000; Gergesville, $5000; Chenoweth Mills, $2000; McKinley, $3000 and Harrisburg, $25,000.

Over Little Walnut: Winchester, $1000; Burgstresser, $4000; Harris, $2000; Seymour, $2000; Corbett, $4000 and Hopewell, $10,000.

The total expense of replacing and repairing these bridges aggregates $787,500 but with a $50,000 loss to the city through the washing away of the State St. bridge and the $150,000 loss through the Town St. bridge, this total is increased to $987,500. Telegraphic advice puts the damages to city bridges at $300,000.

Youngstown, Ohio—We are officially advised that the steel bridges at Division St., and West Ave. were washed away by the flood and the South Ave. bridge damaged.

Lexington, Neb.—We are officially advised that the date for awarding the contract for the construction of the reinforced concrete bridge over the platte River at Lexington, has been indefinitely postponed. Donald D. Price, Lincoln, Neb., is the State Engr. Noted Mar. 27.

Wickenburg, Ariz.—The Board of Supervisors of Maricopa County, have appropriated $10,000 for the construction of a concrete highway bridge across the Hassayampa River at Wickenburg. Noted Apr. 3.

Seattle, Wash.—The lowest bid submitted to the Board of Public Works, for the construction of the West Wheeler Street Bridge, was that of J. M. Bruce & Co., at $206,422. Noted Nov. 14, 1912.

✦Newberg, Ore.—The contract for the construction of a county bridge over the Willamete River at Newberg, has been awarded the PACIFIC COAST BRIDGE CO., Portland, Ore. The estimated cost is $83,000.

Toledo, Ore.—Bids will be received by the Commissioners of Lincoln County, until May 7, for the construction of a bridge over the Alsea River at the mouth of Five Rivers. Plans and specifications are on file at the office of R. H. Howell, County Clk.

✦La Grande, Calif.—The contract for the construction of a steel and concrete bridge over the branch of the San Joaquin River has been awarded to WILLISON & FOSTER, Oakland, Calif., at $24,133.

Naples, Calif.—Plans are being prepared for the construction of four reinforced concrete bridges of the girder type at Naples; two to be erected at Neopolitan Lane, 70 ft. long and 15 ft. wide, and two at Toledo St., 70 ft. long and 20 ft. wide. Mayberry & Parker, 689 Pacific Electric Bldg., Los Angeles, are preparing the plans.

Willows, Calif.—Plans have been selected by the Board of Supervisors for the new bridge across the Stony River, near Orland. It will be built of reinforced concrete and will cost approximately $145,000. The plans were prepared by the Ross Construction Co., Sacramento, Calif.

WATER SUPPLY—IRRIGATION

★Claremont, N. H.—Bids will be received by the Board of Water Commissioners until noon, Apr. 18 for laying about 7000 ft. of 20-in. c.-i. water pipe, about 3000 ft. of 8-in. c.-i. water pipe, about 500 ft. of 8-in. tile, placing about 1000 cu.yd. of reinforced concrete including about 40 tons of steel, and moving and placing about 27,000 cu.yd. of earth. Plans and specifications are on file at the office of E. P. Davis, Consult. Engr., Northampton, Mass. James L. Rice is Supt.

Blackstone, Mass.—The town has voted to exper.d $20,000, for extending the water system through the Millville District. John J. Downey is Chn. of Selectmen.

Boston, Mass.—Bids will be received by the Department of Public Works until Apr. 14, for laying about 28,000 lin.ft. of 6- to 16-in. water pipe in Rorchester, Hyde Park and West Roxbury. L. K. Rourke is Comr.

Greenfield, Mass.—An appropriation of $50,000 has been made for the installation of a ground water pumping station here. C. C. Dyer is Water Comr.

Brooklyn, N. Y.—We are officially advised that the following bids have been received by the Department of Parks, Fifth Ave. and 64th St., Manhattan, for the furnishing and construction of c.-i. water mains and appurtenances in Prospect Park: Beaver Engineering & Contracting Co., 182 Broadway, Manhattan, $33,984; Robert Carks & Co., 350 Fulton St., $29,713; Dragonette Bros., 1178 Clay Ave., Bronx, $36,977; Frank J. Gallagher, 490 Park Ave., $30,178; Knight & Miccalve, 4441 Park Ave., Manhattan, $29,742; McBride & Callan Contracting Co., 670 Eighth Ave., Manhattan, $43,983; Murphy Bros., 25th Ave., $25,146; Nelson & Dowling, 432 Baltic St., $29,171; William & Worton Contracting Co., 215 West 125th St., Manhattan, $22,365; Thomas O'Connor, 103 Cedar St., Manhattan, $30,128; Soraci Contracting Co., 170 Broadway, Manhattan, $27,998; The Toau Corporation, 11 East 125th St., Manhattan, $37,692; Young & Hyde, Inc., Produce Bldg., Manhattan, $49,143. Bids were received on Apr. 3.

Deposit, N. Y.—We are officially advised that Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., has been retained by the village of Deposit to prepare plans for the construction of a water supply system. The estimated cost is $50,000.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Apr. 17, for furnishing, delivering, stacking and storing valves and double-nozzle fire hydrants.

Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Apr. 16, for hauling and laying water mains and appurtenances in Pelham, Crotona, Tremont and Belmont Aves., Boro. The Bronx.

Pleasantville, N. Y.—Bids will be received by the Board of Trustees until 8 p.m., Apr. 14, for improving the present method of distributing water to the village, and for furnishing and installing a pump, motor valves and other necessary appurtenances, making changes in the piping, doing the wiring, and equipping the plant for service. W. H. Dominick is Pres.

★Troy, N. Y.—Bids will be received by the Board of Contract and Supply until 11 a.m., Apr. 15, for constructing a reinforced concrete overflow conduit for the Oakwood Reservoir, from Cragin and Glen Aves. to the Hudson River, in the city of Troy. The contract involves the following: Earth excavation, 12,850 cu.yd.; rock excavation, 250 cu.yd.; reinforcement bars ⅝, 94,200 lb.; I-beams, 10-in., 24,000 lb.; expanded metal, 3-in. No. 6, 3100 lb.; concrete, 2661 cu.yd.; manholes, 8. The conduit is 8 ft. in diameter and approximately 2130 ft. in length. James M. Riley is Secy. Noted incorrectly Apr. 3.

Bridgeton, N. J.—The Town Council contemplates the construction of 14-, 12- and 6-in. water mains in various streets. Estimated cost, $12,000. Henry Ryan is Comr. Pub. Wks. Noted Dec. 26.

Altoona, Penn.—Plans for the proposed new filtration plant here have been completed and will be submitted to Samuel G. Dixon, State Comr. of Health. James Harding, 170 Broadway, New York, is Consult. Engr.

Hershey, Penn.—The Hershey Water Co., recently incorporated, is taking steps to increase and improve the water supply here. The supply will be taken from Manada Creek in Hanover Township, and a pumping plant and filtration plant will be built near the village of Sand Beach, about three miles north of Hershey.

Meadville, Penn.—We are officially advised that Chester & Fleming, Consult. Engrs., Union Bank Bldg., Pittsburgh, Penn., have been retained by the city to make examinations and a report on increasing the supply from the well water system.

★Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., Apr. 30, for Contract 11, which provides for the construction of 32 mechanical filter units, two coagulating basins, one mixing basin, and two earth dams and appurtenances. The contract includes: Excavation, 106,000 cu.yd.; two coagulating basins, capacity of each, 8,500,000 gal.; one mixing chamber with capacity of 3,000,000 gal.; 32 mechanical filter units each of 4,000,000 daily capacity with equipment; filtered water basin with capacity of 2,500,000 gal.; two earthen dams built from the excavated materials. Plans and specifications are on file at the office of Ezra B. Whitman, Water Engr. Noted Mar. 13.

Tolsnot (Wilson post-office), **N. C.**—An election has been called for Apr. 29, to vote on a bond issue of $10,000 for constructing water and sewer systems.

Greenwood, S. C.—The town contemplates laying about five miles of water mains. Bids will probably soon be asked.

McCall, S. C.—We are officially advised that bonds for $30,000 have been voted for the construction of a new municipal deep well water system. J. R. Bivens is Mayor. Noted Mar. 20.

Manning, S. C.—We are officially advised that bids will be asked in about five weeks for the construction of a complete water system and for extending the sewer system. Estimated cost, $35,000. The contract will include a brick pumping station, a reservoir of 50,000 gal. capacity, a 100,000-gal. elevated steel tank, two 100-hp. boilers, service pumps, deep wells, four miles of mains, and 8600 ft. of terra cotta pipe sewers. J. Newton Johnson, Florence, S. C., is Consult. Engr. Noted Mar. 27.

Orangeburg, S. C.—An election has been called for Apr. 29, to vote on a bond issue of $60,000, for removing the water and light and power plants and erecting them on municipal property near the Edisto River.

Cordele, Ga.—Arthur Pew, Consult. Engr., Temple Court Bldg., Atlanta, Ga., has been retained by the City Bond Com-

mission, to prepare plans and specifications for extending the water system. Estimated cost, $40,000.

Guyton, Ga.—The J. B. McCrary Co., Empire Bldg., Atlanta, Ga., is preparing plans for a water system and electric-light plant here, estimated to cost $10,000. An election has been called for Apr. 15 to vote on a bond election. G. T. Haywood is Mayor.

Valdosta, Ga.—Bids will be received by J. T. Roberts, Mayor, and the City Council until 3 p.m., Apr. 24, for furnishing and erecting a Corliss cross-compound condensing pumping engine, 3,000,000 gal. capacity, and a semi-rotative triple-expansion duplex pumping engine of 3,000,000 gal. capacity. D. S. Quartermaster is Supt. W.-Wks.

Zebulon, Ga.—An election has been called for Apr. 18, to vote on a bond issue of $10,000, for constructing a water system.

Anniston, Ala.—A resolution has been passed providing for the extension of the mains of the Anniston Water Co., to the Fifth Ward. Noted Dec. 5.

Meridian, Miss.—Bonds for $100,000 have been voted for improving the water system. J. W. Parker is Mayor.

Arlington, Tenn.—The lowest bid received here for the construction of a water system and electric-light plant was submitted by the West Tennessee Construction Co. at $14,020. R. C. Huston & Co., Memphis, Tenn., are Consult. Engrs. Bids were opened Mar. 7. Noted Feb. 20.

Henderson, Tenn.—We are officially advised that the election to vote on a bond issue of $50,000 for constructing a water system and electric-light plant here has been postponed until Apr. 26. J. I. Galbraith is Mayor. Noted Mar. 20.

Danville, Ky.—We are officially advised that bonds for $28,000 have been sold for improving the water system. J. M. Wallace is Mayor. Noted Mar. 27.

Frankfort, Ky.—The Board of Prison Commisioners contemplates the installation of a water system and electric-light plant at the state penitentiary at Frankfor. A. J. G. Wells is Warden.

Lexington, Ky.—The Lexington Hydraulic & Mfg. Co., which operates the water system at Lexington, plans to increase the height of the dam at Reservoir No. 4. This will involve raising the grade of Richmond Pike. John G. Stoll is Pres.

Akron, Ohio—The date of receiving bids for the Cuyahoga River Dam Water-Works Contract No. 24, has been extended to Apr. 17. The contract involves: 7000 cu.yd. earth excavation above elevation 252.0; 26,000 cu.yd. earth excavation below elevation 252.0; 15,000 cu.yd. rolled embankment; 15,000 sq.ft. steel sheet piling; 3000 sq.ft. wooden sheet piling; 1700 cu.yd. riprap; 12,000 bbl. cement; 350,000 lb. steel reinforcement; 9230 cu.yd. concrete masonry; 5000 lb. power-plant superstructure sheet lead; 2700 lb. sheet iron; 4000 lb. chains. Plans and specifications are on file at the office of R. H. Pillmore, Dir. Pub. Ser., and at the office of F. A. Barbour, Consult. Engr., Boston, Mass. Noted Mar. 27.

Cleveland, Ohio—Bids will be received at the office of W. J. Springborn, Dir Pub. Ser., until noon, Apr. 10, for the steel and iron work for the intake shaft of the 10-ft. West Side Lake tunnel for the city Water Department. W. H. Kirby is Clk.

✚Chicago, Ill.—We are officially advised that contracts have been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Peoples' Bank Bldg., Chicago, as follows: Furnishing 360 tons of 4- to 12-in. special castings for c.-i. pipe, at $49 per ton; furnishing 40 tons of 16- to 36-in. special castings for c.-i. pipe, at $56 per ton. Bids were opened by the Department of Public Works, Mar. 27. Noted Mar. 27.

Moline, Ill.—Bids for remodeling and extending the pumping station were received by the city, Mar. 28, as follows: C. E. Heaps, Moline, $13,656; E. H. Lorenz, Moline, $13,695; Robert Ed, $13,700; Abraham-Porter Construction Co., East Moline, $13,875; William McConochie & Sons, Rock Island, $14,673; John Volk & Co., Rock Island, $14,773; Concrete Engineering Co., Davenport, $14,990; Brissman & Co., Moline, $17,790; George W. Stiles Co., Chicago, $15,244. L. Payton is City Engr. Noted Mar. 27.

✚Moline, Ill.—We are officially advised that the contract to remodel the pumping station has been awarded to C. E. HEAPS, Moline, Ill. Estimated cost, $12,000. Bids were opened Mar. 28. L. Payton is City Engr. Noted Mar. 27.

Milwaukee, Wis.—The Water-Works Committee of the City Council has authorized Fred G. Simmons, Comr. of Public Works, to advertise for bids for furnishing and installing a 12,000,000-gal. pump at the North Point pumping station. Estimated cost, $75,000.

✚✚Epworth, Iowa—We are officially advised that the contract to construct a complete water system here has been awarded to the C. W. ROLAND CO., Des Moines, Iowa, at $9300. Bids were opened by J. P. Hamilton, Town Clk., Apr. 1. Noted Mar. 20.

Minneapolis, Minn.—The City Council has ordered the construction of a 48-in. feeder extension, to be laid in Central Ave., from 37th to 25th St., thence to Johnson St. Estimated cost, $105,000. A. Ellis Dutton is Asst. City Engr.

✚Minneapolis, Minn.—The contract to furnish a trenching machine for the water and sewer systems has been awarded to the F. C. AUSTIN DRAINAGE EXCAVATION CO., Chicago.

✚Bennington, Kan.—We are officially advised that the contract to construct a water system here has been awarded to JAMES A. PRINGLE, Carthage, Mo., at $13,610. Bids were opened Mar. 31, by F. O. Reinhardt, City Clk. Noted Mar. 27.

Ralston, Neb.—We are officially advised that bids will be received at the office of the Towle Engineering Co., City National Bank Bldg., Omaha, until Apr. 15, for constructing a water system here. The contract includes: 31,850 ft. 8-, 6- and 4-in c.-i. pipe; 16 8-, 6- and 4-in. valves; 50 4-in. hydrants with two nozzles; one 12-ft. diameter standpipe, 80 ft. high; one pump house; one deep well pump, capacity 200 gal. per min., to lift water against 150-lb. pressure; one 20-hp. motor or internal-combustion engine. Since this work was advertised, the entire business section of the city was swept away by the cyclone, but C. M. Skinner, Mayor, advises us that the city expects to proceed with the work. Noted Nov. 7.

Dickinson, N. D.—Bids will probably be asked in May for laying about 4400 ft. of 4- and 8-in. water pipe. Estimated cost, $5400. W. R. Regal is City Engr.

White, S. D.—See item under Light, Heat and Power.

Kennett, Mo.—Bids will be received by J. D. Spencer, Mayor, until Apr. 30, for constructing a water system to include about 8½ miles of 1- to 8-in. c.-i. mains, 76 hydrants, 64 valves, with boxes, a 70,000-gal. tower and tank, a pumping station and two 10-in. wells. Frank L. Wilcox, Chemical Bldg., St. Louis, Mo., is Consult. Engr. See also item under Sewers.

Fort Smith, Ark.—The Water-Works Commission has purchased 17 acres of land on the Greenwood Road as a site for proposed high pressure basins for the water system.

Crystal City, Tex.—The Winter Garden Ranch Co., recently organized to construct a system of irrigation near Crystal City, will build a reinforced-concrete dam across Espendosa Lake and another dam across the Nueces River for the purpose of creating water storage reservoirs. The dams will cost about $200,000. Alexander Boynton, San Antonio, is Supt.

Rosebud, Tex.—Plans are being prepared for the installation of a municipal water system here. The supply will be taken from the Brazos River, where a pumping plant will be built.

San Marcos, Tex.—J. A. Bachman, who is installing a system of irrigation near here, contemplates the construction of a pumping plant.

✚Sapulpa, Okla.—A contract to construct a water system and extend the sewer system here, has been awarded to BASH & GRAY, Joplin, Mo., at approximately $74,000. H. K. Howard is City Engr. Noted Jan. 16.

Ogden, Utah—A. G. Fell, Mayor, acting for the city of Ogden, and William Glasmann, Pres. of the Ogden River Reservoir Co., have signed an agreement which provides for the construction of a dam and reservoir in South Fork Cañon, 20 miles from Ogden, at an estimated cost of $350,000. The company will use the water thus obtained in connection with its irrigation project, while the city will use it for general municipal purposes. The dam will be built from 80 to 90 ft. high, and will impound 10,000 acre-feet of water. Noted Oct. 24.

Rochester, Nev.—The Rochester Water Co. has been formed to supply the towns of Rochester Cañon with water from Indian Peak. From eight to ten miles of pipe will be laid. The company, which is capitalized for $150,000, is composed of J. G. Huntington, J. M. Savage, F. Richardson, M. Castle and F. B. Hargett.

Tacoma, Wash.—The City Council has decided to expend $25,000 for protecting the Green River water shed. Approximately $10,000 will be used for constructing a hypochlorite plant at the McMillen Reservoir, and $15,000 for building septic tanks and individual vaults for residences.

Pendleton, Ore.—Frank C. Kelsey, Consult. Engr., retained by this city to prepare plans and estimates for the construction of a water system here has made the following report: Thorn Hollow plan, $198,773; North Fork plan, $326,000; and Cayuse Springs plan, $135,000. Noted Oct. 31.

Fowler, Calif.—Bids will be received by the city until Apr. 15, for constructing a water system to serve the entire city. Sloan & Robson, Nevada Bank Bldg., San Francisco, are Consult. Engrs. Noted Mar. 27.

Pasadena, Calif.—Bids will probably soon be asked for furnishing pipe for the Water Department. Estimated cost, $35,040. Heman Dyer is City Clk.

San Diego, Calif.—Bids are being received by the Board of Water Commissioners, for furnishing the following amounts of c.-i. water pipe: 402 tons of 30-in., 732 tons 24-in., 996 tons of 16-in. Class B; 442 tons of 16-in. Class C; 1140 tons of 12-in., Class B; 155 tons of 12-in., Class C; 45 tons of 10-in., Class B; 181 tons of 10-in., Class C; 112 tons 8-in., Class B; 80 tons of 6-in., Class C; five tons of 5-in. H. H. Fay is Supt. Noted Mar. 27.

Tulare, Calif.—We are officially advised that bids will be received until about Apr. 30, for installing a water distributing system and constructing a 150,000-gal. steel tank and tower. Specifications may be secured from Sloan & Robson, Consult. Engrs., Nevada Bank Bldg., San Francisco, and from the City Clerk at Tulare. Noted Mar. 27.

Nanaimo, B. C.—An election will soon be called to vote on the proposition of appropriating $50,000 for repairs to the south Fork pipe line and the extension of the distributing system.

Vancouver, B. C.—The City Council will soon ask bids for the construction of water mains on the Westminister Road and others, entailing an expenditure of approximately $37,500.

✚Swift Current, Sask.—We are officially advised that the contract to furnish about 600 tons of c.-i. pipe, seven tons of specials, 46 valves and boxes, and 22 fire hydrants, has been awarded to DRUMMOND, McCALL & CO., Winnipeg, Man., at $23,903. The other bids were: Contracting Equipment & Supply Co., $22,517; Canadian Sales Co., $24,558; National Tube Co., pipes only, $23,759. Noted Feb. 27.

★Halifax, N. S.—We are officially advised that bids for constructing a reinforced-concrete reservoir and gate house here were received by F. W. W. Doane, City Engr., Apr. 2, as follows: (a) Without roof; (b) with roof (c) extra excavation; (d) extra concrete: Thomson & Theakston, (a) $52,444; (b) $61,257; (c) $4.50; (d) $9; George B. Low, (a) $61,874; (b) $81,245; (c) 75c.; (d) $8.50; M. E. Keefe Construction Co., (a) $70,231; (b) $75,900; (c) $1; (d) $12; British American Construction Co., St. John, N. B., (a) $67,304; $84,300; (c) $5; (d) $18; Standard Construction Co., Ltd., (a) $48,474; (b) $55,107; (c) $3.50; (d) $7.50; E. J. Horne, (a) $76,360; (b) $88,600; (c) $5; (d) $8.50; Thomson & Theakston (on their own plan), (a) $46,591; (b) 55,394; (c) $4.50; (d) $9; E. J. Horne (on his own plan), (a) $63,380; (b) $75,000. Noted Mar. 13.

SEWERS

★Kennebunk, Maine—Bids will be received by the Board of Selectmen until 2 p.m., Apr. 26, for constructing a sewer system according to plans and specifications on file at the office

of the Town Clerk. The contract involves: 8000 ft. of 6-in. pipe, 3200 ft. of 8-in. pipe, 1100 ft. of 10-in. pipe, 1400 ft. of 12-in. pipe, 1500 ft. of 15-in. pipe, 40 manholes, 30 catch basins, 20 cu.yd. of concrete masonry. A. A. Richardson is Chn.

Boston, Mass.—Bids will be received by the Department of Public Service until Apr. 11, for laying pipe sewers and drains in South and Spalding Sts. and Montclair Ave., West Roxbury District; also for laying sewers and drains in Vesta Road and Howard St., and for constructing catch basins in South Boston and Dorchester. L. K. Rourke is Comr. Pub. Wks.

Fitchburg, Mass.—We are officially advised that the advertising for bids for the proposed new sedimentation plant and filter system, and another section of the trunk sewer has been delayed, owing to the fact that plans are not yet fully completed. Bids will probably soon be asked. David A. Hartwell is Ch. Engr. Sewerage Comrs. Noted Feb. 6.

Pittsfield, Mass.—The City Council has appropriated $35,000 for extending the sewer system. P. J. Moore is aMyor.

Quincy, Mass.—The City Council has appropriated $40,000 for extending the sewer system. P. J. Moore is Mayor.

Springfield, Mass.—We are officially advised that the sewer system here will be completed by day labor. The work is estimated to cost $43,000. F. H. Clark is Comr. Pub. Wks. Noted Mar. 20.

Torrington, Conn.—We are officially advised that bids will be received until 8 p.m., Apr. 14, for furnishing and laying 1237 ft. of 18-in. tile, 312 ft. of 15-in. tile, 180 ft. of 8-in. tile, 725 ft. of 8-in. tile, nine manholes, five catch basins and 33 cu.yd. of concrete. C. A. Patterson is Boro. Engr.

Brooklyn, N. Y.—We are officially advised that the following bids were received by the Bureau of Sewers, on Apr. 2, for the construction of sewers in various streets: In Hewes St., from Wallabout Canal to Classon Ave., etc., John J. Creen Co., $390,545; J. F. Cogan & Co., $394,609; Cranford Co., $479,446; Newman & Carey Co., $495,323; Lee E. Kelley Inc., $511,467; Rogers & Haggerty Inc., $526,171; Degnon Contracting Co., $528,491; Petprick Bros., & Co., $616,414; E. E. Smith Contracting Co., $678,827; in Skillman St., from Park Ave. to Myrtle Ave., John J. Green Co., $384,795; John F. Cogan Co., $418,661; Cranford Co., $431,386; Degnon Contracting Co., $509,404; Newman & Cary Co., $544,241; Rogers & Haggerty Inc., $544,575; E. E. Smith Contracting Co., $662,862; in Verona Ave., from Marcy Ave. to Tompkins Ave., etc., John J. Creen Co. $314,323; John F. Cogan Co., $388,345; Cranford Co., $406,992; Ryan & Reilly, $419,781; Newman & Carey Co., $424,783; Rogers & Haggerty Inc., $444,757; Degnon Contracting Co., $496,447; E. E. Smith Contracting Co., $532,410; McCauky Manton Co., $554,439; in Gravesend Ave., from Vanderbilt, St., to Fort Hamilton Ave., etc., Stanhope Construction Co., $21,182; Eustis Shelardi, $21,516; John C. Schrade, $22,343; Joseph Jennings, $23,711; James G. Duffy, $24,344; H. E. Nichols Inc., $24,370; Culp Contracting Co., $24,903; F. Merendino Inc., $26,785; Frank J. Gallagher, $26,785; in Battery Ave., from 92d St. to Warihouse Ave., etc., Stanhope Construction Co., $44,548; McCauley Manton Co., $46,617; John C. Schrade, $47,924; Culp Contracting Co., $48,327; H. B. Nichols, Inc., $51,711; Murphy Bros., $52,671. Noted Mar. 27.

✦New York, N. Y.—(Boro. The Bronx)—We are officially advised that the following contracts for the construction of sewers in various streets have been awarded by the President of the Boro. of The Bronx: In West 236th St., from Broadway to Kingsbridge Road, to WILLIAM LOSS, at $15,083; in Gun Hill Road, from Olinville Ave. to Perry Ave., to the ESTATES CONTRACTING CO., at $42,950; on West 254th St., from Broadway to Fieldston Road, all bids rejected. Bids were received Mar. 26. Noted Mar. 20.

New York, N. Y.—(Boro. of Queens)—We are officially advised that the following bids for the construction of sewers were received by the President of the Borough of Queens on Mar. 28: In Mott Ave., from Van Dam St. to Hulst St., in Anable Ave., from 35 Dock St., to Hulst St., and Hulst St., from Anable Ave. to Mott Ave., Clancey & Van Alst, $22,635; Pease Bros., $24,466; Degnon Contracting Co., $31,676; Green Contracting Co., $22,222; Sigaruto & Co., $22,161; Joseph Benedetto, $22,441; in Hamilton Ave., Walnut St., Briggs Ave. and Church St., from Liberty to Jerome Aves., and in Kimball Ave., from Stoothoe Ave. to Lecerts Ave.; Thomas J. Healy Co., $20,567; Joseph Benedetto, $20,989; Joseph L. Sigaretto, $19,845; Henry Britton, $20,757; Clancy & Van Alst, $19,367; Evergreen Construction Co., $22,898; M. J. Mirando, $19,725; Charles A. Meyers, $19,567; Pease Bros., $17,771; in Cypress Ave., from Cooper St. to Vermont Ave., Charles A. Meyers, $31,943; Joseph Benedetto, $22,867; Pease Bros., $49,832; Clancy & Van Alst, $27,837; Tuthi Ave. Construction Co., $27,769; in Lefferts Ave., from Liberty Ave. to Atlantic Ave., Thomas H. Tuohy & Co., $10,184; Evergreen Construction Co., $11,396; Joseph Headuren, $10,675; M. J. Miranda, $10,635; George Marshall, $10,463; Peace Bros., $9123; Charles A. Meyers, $11,369; Joseph L. Sigaretto, $9190; Henry Britton, $10,184; Clancy & Van Alst, $9511; Joseph Benedetto, $9279; in Liberty Ave., from Stoothoff Ave. to Chester St., in Cedar Ave., from Liberty Ave. to Kimball St., in Chestnut St., from Liberty Ave. to Kimball St., Thomas H. Tuohy, $8162 M. J. Miranda, $10,230; Joseph L. Sigaretto, $5307; Clancy & Van Alst, $4876; Joseph L. Benedetto, $5131; Charles A. Meyers, $5902; Peace Bros., $8165; in parts of Jerome Ave., McCormick Ave., Oxford Ave., Seattle St., Portland Ave., and Hirald Ave.; Joseph L. Sigaretto, $23 185; Joseph Benedetto, $23 730; Charles A. Meyers, $22 185; Joseph Headuren, $25 866; Clancy & Van Alst, $26,026; in Cypress Ave., from Myrtle Ave. to Wyckoff Ave., in Wyckoff Avenue, from Myrtle Ave. to Wykoff Ave., in Wyckoff Ave., from Madison St. to Halsey St., in Halsey St., from Wyckoff to Irving Ave.; Charles A. Myers, $44,832; Joseph Benedetto, $32,225; Peace Bros., $57,023 Joseph L. Sigaretto, $40,617; Clancy & Van Alst, $46,189. Noted Mar. 20.

✦Oswego, N. Y.—Bids will be received by the Department of Works until 2 p.m., May 2, for constructing trunk and lateral sewers and a sewage disposal plant here. The work is to be done under the supervision of approximately 17,200 ft. of sanitary sewer from 8 to 36 in. in diameter, and 11,500 ft. of storm sewer, from 10 to 72 in. in diameter, and a disposal plant. The work will be done under eight separate contracts. Bonds for $200,000 were recently voted for this improvement. Specifications and printed forms may be obtained from Charles H. Snyder, City Engr. Plans and specifications are on file at the office of the Department of Works, and at the office of Engineering News, 505 Pearl St., New York. John Smith is Comr. of Works. Noted Mar. 20.

East Orange, N. J.—We are officially advised that plans and specifications have been completed by the Engineering Department for the construction of a storm water drain sewer in the vicinity of the Brick of Assessment Commissioners and when property owners along the route signify their approval of the project, favorable action will be voted by the Board and authority given to the Engineering Department to proceed with the work. It is expected that bids for the construction work will be advertised on or about June 1. The estimated cost of the entire undertaking is $260,000. W. D. Willegerod is City Engr.

Morristown, N. J.—We are officially advised that Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., has been retained by the town of Morristown to prepare plans for the construction of extensions and improvements to the sewer system. This work will be enacted under the recent bond issue for $30,000.

Princeton, N. J.—Bids will be received by the City Council until Apr. 14, for constructing sewers in Charlton St. and Greenview Ave. Noted Feb. 27.

✦Trenton, N. J.—The Board of City Commissioners has awarded a contract for the construction of sewers in Emmett, Melrose and Quinton Ave., to GUISEPPE BOSCARELLE, Trenton.

Charleroi, Penn.—The Borough Council contemplates constructing sewers in the Hill District in North Charleroi. Estimated cost, $8700.

Jenkintown, Penn.—Preliminary plans are being considered for the installation of a sewer system and a sewage disposal plant here, estimated to cost $150,000. J. Walter Ruddach is Boro. Engr. Noted Jan. 16.

Pottstown, Penn.—We are officially advised that the Sewer Committe expects to ask for bids for the construction of the sanitary sewer system before May 1. The system will consist of 46 miles of pipe sewers varying in size from 6 in. to 30 in. The work will be let in two or four sections. The disposal plant consists of a pumping station and equipment, settling tanks and sprinkling filters. Charles E. Collins, Drexel Bldg., Philadelphia, is Consult Engr., and Frank Seasholtz Chn. Sewer Com. Noted Mar. 20.

Pottstown, Penn.—According to press reports, the city plans to expend $100,000 for the construction of a sewer system and sewage disposal plant. Plans are being prepared by O. E. Collins, Consult. Engr., Philadelphia. R. E. Shaner is Boro. Engr.

Petersburg, Va.—See item under Streets and Roads.

Bluefield, W. Va.—An election will probably be called in May to vote on a bond issue of $25,000, for completing the sewer system in the southern section of the city, and extending the system to the western section.

Toisnot (Wilson post-office), **N. C.**—See item under Water Supply—Irrigation.

Roxboll, S. C.—Bonds for $20,000 were voted Mar. 31, for constructing a sewer system. J. B. Rivens is Mayor. Noted Mar. 20.

Manning, S. C.—See item under Water Supply—Irrigation.

Atlanta, Ga.—Bids will be received by the Chairman of the Sewer Committee until 3 p.m., Apr. 15, for constructing five groups of sewers, varying in length from three to five miles. Specifications may be obtained from R. M. Clayton, Chief of Construction.

Macon, Ga.—A committee of the Board of Health is investigating the Tybee Section, with a view to installing a sanitary sewer system there. This section of the city was not provided with sewers at the time the general system was installed, because its surface is on the level with the bed of the river. It is proposed now to build a trunk sewer with an outlet into the canal below the city limits. The matter will be taken up at an early meeting of the Board.

Miami, Fla.—According to press reports, an election has been called for May 13, to vote on a bond issue of $40,000, for constructing sewers. J. W. Watson is Mayor.

Birmingham, Ala.—We are officially advised that bids will be received until May 6, for constructing the South Side trunk sewers, which comprise about 3000 ft. of 8x12-ft. concrete sewer, 5000 ft. 8-ft. circular brick sewer, 3000 ft. small brick sewers and 10,000 ft. of pipe laterals. Plans and specifications are on file at the office of Walter G. Kirkpatrick, City Engr.

Cleveland, Tenn.—The city plans an expenditure of $75,000, for improving the sewer system. An election will probably soon be called to vote on a bond issue.

Louisville, Ky.—We are officially advised that bids for constructing sewers were received by the Board of Public Works, Mar. 14, as follows: (a) W. H. Koppelman, New Albany, Ind.; (b) Edward L. Parsons, H. L. Pigg & Co., Louisville; (d) Henry Backel Co., Louisville; (e) A. W. Cole; (f) James Fairy & Son, 2111 Madison Ave., Baltimore, Md.; (g) J. H. Cahill, (h) Frank Shfold (i) Guild & Co.; in Breckenridge and Jacob Sts. (a) $10,810; (b) $12,919, (e) $13,215; (d) $15,528; (e) $16,165, (f) $18,191; (g) $13,348; (h) $13,419

In Shelby and Kentucky Sts., (a) $10,329, (a) $10,493; (b) $11,991 (d) $14,329, (g) $15,931; (f) $16,416

In Burnett and Camp Sts., (a) $21,630 and $22,123; (e) $28,786 and $29,982, (f) $30,406, $34,477 and $36,020; (g) $31,389 and $34,115. (f) $33,901, $35,104 and $35,762

In Gray, Finzer and Lampton Sts., (a) $21,817 and $22,084; (b) $23,162; (a) $23,691 and $25,457; (e) $26,629; (d) $27,044; (f) $29,893 and $30,388; (g) $31,126 and $31,827. The item bids on these contracts will appear in this or some early issue under Contract Prices. Noted Mar. 13

Somerset, Ky.—The city is considering a proposition to in-

stall a sewer system to cost $150,000. For particulars, address the Mayor.

Akron, Ohio—We are officially advised that R. Winthrop Pratt, Consult. Engr., Cleveland, Ohio, has been retained by the City Council to prepare a report and general plans for a sewage disposal plant.

Bexley, Ohio—We are officially advised that bids will be received by the city until noon, May 1, for constructing a sanitary sewer system estimated to cost $30,000. The contract involves the construction of about eight miles of 8-, 10-, 12-, 15- and 18-in. vitrified pipe sewers, 63 manholes, and 17 flush tanks. Plans and specifications have been prepared by A. Elliott Kimberly, Consult. Engr., 8 East Long St., Columbus, Ohio. Noted Dec. 5, under Water Supply—Irrigation.

Canton, Ohio—We are officially advised that bids will be received by the city until noon, Apr. 6, for constructing sewers as follows: 2200 lin.ft. 7-ft. two-ring brick block storm sewer; 3500 lin.ft. 3-ft. one-ring brick block storm sewer; 4300 lin.ft. of 24-in. vitrified pipe sewer; 1400 linft. of 15-in. vitrified pipe sewer; 900 lin.ft. of 18-in. vitrified pipe sewer; 2100 lin.ft. of 8-in. vitrified pipe sewer; 61 catch basins and 30 manholes. Estimated cost, $55,000. Philip H. Weber is City Engr. and Walter S. Ruff is Dir. Pub. Ser. Noted Feb. 20.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Apr. 10, for constructing main and lateral sewers and drains with appurtenances in various streets.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Apr. 22, for furnishing vitrified sewer pipe, curves and stoppers for the Water Department.

Wooster, Ohio—According to press reports, bids will be received by the city until Apr. 14, for constructing sanitary sewers. Estimated cost, $25,000. T. P. Brown is City Engr.

New Philadelphia, Ohio—We are officially advised that George E. Arnold, City Engr., and R. Winthrop Pratt, Consult. Engr., Cleveland, are preparing plans for the construction of a sewage disposal plant here.

Booneville, Ind.—The city contemplates the construction of a trunk sewer in the northern section. Estimated cost, $84,000.

Flint, Mich.—We are officially advised that bids will be received by D. E. Newcombe, City Clk., until 3 p.m., Apr. 25, for constructing approximately 33 miles of 8- to 66-in. sewers. Estimated cost, $93,125. H. E. Terry is City Engr. Noted Mar. 20.

Ann Arbor, Mich.—Preliminary plans have been prepared for constructing about 1½ miles of storm and one mile of sanitary sewers. M. Osgood is City Engr.

†Marquette, Mich.—The contract to construct the eastern trunk sewer has been awarded to HERMAN STENSRUD, Marquette, at $39,285 for segment block. Bids were opened Mar. 20. Noted Apr. 3.

Pontiac, Mich.—Bids will be received by C. L. Groesbeck, City Clk., until 1:30 p.m., Apr. 21, for constructing sewers in various streets.

Saginaw, Mich.—Bids will probably soon be asked for extending the sewer system. Estimated cost, $30,000. H. H. Eymer is City Engr.

Alton, Ill.—Press reports state that bids will be received at Alton until Apr. 15, for constructing a sewer system in Madison County.

Cuba, Ill.—Surveys are being made for the installation of a storm and sanitary sewer system here, estimated to cost $30,000.

Danville, Ill.—W. Lewman, Mayor, is interested in a proposition to construct a 6-ft. storm sewer in the northern section of the city. The sewer will empty into the north fork of Sony Creek.

Fulton, Ill.—According to press reports, bids will be received by the City Clerk until Apr. 15, for constructing about 25,000 lin.ft. of 8- to 30-in. vitrified pipe sewers. Noted Jan. 9.

Monmouth, Ill.—The Board of Local Improvements will probably soon ask bids for the construction of a sewer system in the southeastern section of the city. According to plans and specifications prepared by Ralph Ferguson, City Engr., the system is estimated to cost $29,040.

Fond du Lac, Wis.—The bids received, Mar. 28, for constructing sewers and a sewage disposal plant here, were as follows: Sewage disposal plant: (a) complete plant; (b) machinery; (c) hypochlorite plant: E. R. Harding Co. Racine, (a) $31,900, (b) $5450, (c) $860; Yeoman Bros., Chicago, (b) $5450; Brogan & Pitz, Green Bay, (a) $28,201, (b) $5450, (c) $710; Buffalo Steam Pump Co., Chicago, (b) $2270; Power Improvement Co., Milwaukee, (b) $2420. Noted Apr. 3.

Bids on Section 2 which includes 2410 lin.ft. of 15-in. pipe, 570 ft. of 18-in. pipe, 550 ft. of 24-in. pipe, 1260 ft. of 20-in. pipe, and 23 manholes, were: E. R. Harding & Co., $24,090; Brogan & Pitz, $26,072; F. E. Kaminski, Watertown, $26,305; Theill, Manning & Whalen, La Crosse, $23,879; L. W. Schruth, Fargo, N. D., $23,736.

Bids on Section 3, including the laying of 2290 ft. of 12-in. pipe 1304 ft. of 15-in. pipe, 1611 ft. of 18-in. pipe, and 170 ft. of 18-in c.-i. pipe were: E. R. Harding, $9017; Brogan & Pitz, $11,236; F. E. Kaminski, $10,594; Theill, Manning & Whalen, $10,974; Robt. Bernett, Fond du Lac, $11,174; L. W. Schruth, $10,831. Noted Apr. 3.

Superior, Wis.—Plans have been prepared by the City Engineering Department for extending the municipal sewer system to the suburb of Allouez, to drain into Allouez Bay.

Wausau, Wis.—Plans have been prepared for constructing about 2500 ft. of 6-ft. and 2500 ft. of 12-in. pipe sewers, and bids for construction will probably soon be asked.

Carroll, Iowa—We are officially advised that all bids received Mar. 31, for constructing sewers, were rejected. The contract will probably be readvertised. J. A. Dougherty is City Clk. Noted Mar. 20.

†Davenport, Iowa—We are officially advised that the contract to construct a sanitary sewer system in the 12th Sewer District has been awarded to the HYDRAULIC CONCRETE CONSTRUCTION CO., Davenport, Iowa, at $50,620. The other bids were: Ryan & Layton Construction Co., $50,935; D. E. Keeler Construction Co., $73,001; Little Construction Co., $88,440; Independent Construction Co., $89,899; Harding & Co., $90,512. A. M. Compton is Comr. Bd. Pub. Wks. Noted Mar. 13.

Fort Dodge, Iowa—Bids will be received by the City Council until 9 a.m., Apr. 28, for constructing sanitary sewers in Eighth Ave., Park Boulevard, and other streets. W. L. Tang is City Clk.

Sibley, Iowa—Press reports state that bids will be received by Oscar Meyers, Town Clk., until Apr. 15, for constructing sanitry sewers and a sewage disposal plant.

†Kansas City, Mo.—A contract to construct a combined storm and sanitary sewer on the East Side, has been awarded by the Board of Public Works, to W. C. MULLINS, at $73,956. The sewer will serve the district bounded by White and Bennington Aves. and 8th and 16th Sts.

Kennett, Mo.—Bids will be received by J. D. Spence, Mayor, until 7 p.m., Apr. 30, for constructing about 8½ miles of 8- to 15-in. pipe sewers, 95 manholes, 62 flush tanks, a sewage disposal plant and sewage pumping equipment. Plans and specifications are on file at the office of S. G. Fisher, City Clk., and may be obtained from Frank L. Wilcox, Consult. Engr., Cchemical Bldg., St. Louis Mo. See also item under Water Supply-Irrigation.

★Poplar Bluff, Mo.—Bids will be received by the City Council until 7:30 p.m., Apr. 21, for constructing sanitary sewers in Sewer District No. 3. The contract involves: 20,187 ft. of 6-in. pipe average cut 6.4 ft.; 1756 ft. of 8-in. pipe average cut 6.4 ft.; 922 ft. of 10-in. pipe average cut 7½ ft.; 3424 ft. of 15-in. pipe average cut 7 ft.; 1440 ft. of 24-in. pipe average cut 8.3 ft.; and 51 manholes: Plans and specifications are on file at the office of J. J. Wilcox, City Clk., and may be obtained from Edward C. Thomas, City Engr.

Henryetta, Okla.—We are officially advised that bonds for $50,000 were voted, Apr. 1, for the construction of a sewer system, according to plans and specifications perpared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted Feb. 27.

Ogden, Utah—The City Engineer has prepared preliminary plans and estimates for the construction of a storm sewer from Washington Ave. to the Weber River in the district between 22nd and 26th Sts. Estimated cost, $25,000.

Salt Lake City, Utah—We are officially advised that the advertisement for bids to be received Mar. 25, for constructing sewer extension 321, was withdrawn. If it is decided to do the work at some later time, the contract will be readvertised. Noble Warrum is City Recdr. Noted Mar. 20.

Phoenix, Ariz.—An election will probably be called some time this year to vote on a bond issue for constructing outlet storm sewers. It is estimated that this work would cost about $200,000.

Ontario, Ore.—The City Council has been authorized to construct an underground drain and trunk sewer from the city limits to the Snake River.

†Colfax, Calif.—We are officially advised that the contract to construct a sewer system here has been awarded to JAMES STANLEY, San Salito, Calif., at $13,033. U. S. Marshall, Forum Bldg., Sacramento, is Engr. Bids were opened Mar. 25. Noted Mar. 20.

†Fullerton, Calif.—The contract to construct a sewer system here has been awarded to R. C. LOWELL, Monrovia, Calif., at $46,000. Noted Mar. 20.

†San Francisco, Calif.—A contract to construct a main sewer across Golden Gate Park from Lincoln Way to 48th Ave., has been awarded to F. ROLANDI, 55 Montgomery St., San Francisco, at $195,767.

Berlin, Ont.—Bids will be received by A. C. Millar, City Clk., until Apr. 17, for furnishing and laying about 12,000 lin.ft. of 48-in. reinforced concrete pipe, 3265 lin. ft. of 30-in. and 5400 ft. of 18-in. salt glazed vitrified pipe. H. Johnston is City Engr.

★Toronto, Ont.—Plans and specifications for the sewer contracts to be awarded by the Board of Control on Apr. 15, are on file at the office of Engineering News, 505 Pearl St., New York. Noted Apr. 3.

GARBAGE

North Warren, Penn.—The board of Trustees of the State Hospital for the Insane at North Warren has awarded the contract to the New York Incinerator Co. for furnishing and installing incinerators in the building, at $4400.

Birmingham, Ala.—The city is having plans prepared for the erection of a garbage and refuse incinerator plant at Ave. B and 11th St., Ensley. W. G. Kirkpatrick, is City Engr.

Plans are also being prepared for the construction of a rendering plant near 40th St. and 15th Ave., North East.

Los Angeles, Calif.—Bids will be received by the Board of Public Works until June 20 for the erection of the proposed garbage disposal plant. Alternative bids are asked as follows: (a) The contractor to erect and operate a plant capable of disposing of all the garbage in the city north of Manchester Ave. at a certain price per ton; (b) for erection of a plant guaranteed to dispose of all the garbage, to be municipally owned. According to the specifications, the bidders may submit bids on either plants of the reduction or incinerator type, as long as the garbage shall be disposed of in a sanitary manner.

STREETS AND ROADS

Athol, Mass.—The State Highway Commission will have charge of repaving Main and School Sts., for which an appropriation of $48,000 was recently made. Bids will be received about May 1. Mm. D. Sohier, Boston, is Chn. Highway Com. Noted Mar. 13.

Attleboro, Mass.—The Board of Selectmen is considering plans for paving "The Loop," which consists of Park, North Main, South Main and Union Sts. H. P. Kent is Chn. of Selectmen.

+Boston, Mass.—The following bids were received Mar. 24 for paving Union Park St., from Washington St. to Harrison Ave.: (a) Bitulithic; (b) asphalt: F. S. & A. D. GORE CORP. (awarded contract) (a) $7892; (b) $7987; Warren Bros. Co., (a) $8267; (b) $8338; Michael Meehan, (b) $8573; Charles A. Leary, (b) $10,750. L. K. Rourke is Comr. of Pub. Wks.

Contracts as follows have been awarded by the State Highway Commission: For construction of 5300 lin.ft. macadam in Acton to R. F. HUDSON, Melrose, at $10,853. Other bids were: The Horne-Lowe Construction Co., Worcester, $11,061; J. J. Martin, Watertown, $11,670; A. Corchia, Boston, $12,538; A. Williams & Co., Boston, $14,987. The HORNE-LOWE CONSTRUCTION CO. was awarded a contract at $10,941, for 5300 lin.ft. of gravel and macadam road in Granby. W. N. Flint and Wm. Orlando bid $14,055

The contract for 4600 ft. of macadam road in Lunenburg was awarded to R. F. HUDSON, at $8957. Other bids were Flint & Orlando, $9386, and D. H. Damon, Ashby, $10,107. Arthur W. Dean is Chief Engr.

Bids will be received until Apr. 14 by the Commissioner of Public Works for about one mile of asphalt pavement in Norfolk St. from Codman Square to Corbet St., Dorchester District. L. K. Rourke is Comr.

Chelsea, Mass.—See item under Federal Government Work.

Leicester, Mass.—The Town of Leicester plans the construction of a number of macadam roads. Parker, Bateman & Chase, Clinton, Mass., are Engrs.-in-Charge.

Millbury, Mass.—The town has appropriated $3000 for macadam surfacing on West Main St., and will receive $1500 from the State Highway Commission for the same purpose to be expended by Selectmen. John R. Greenwood is Clk.

Winchendon, Mass.—The Town has appropriated $5000 to be added to a like amount given by the State Highway Commission. The sum will be used for constructing four miles of highway from Winchendon to Ashburnham under direction of the State Commission. W. D. Sohier, Boston, is Chn.

+Worcester, Mass.—We are officially advised that a contract has been awarded by the Street Commissioner to the NEW ENGLAND CONTRACTING CO., 9 Bellevue St., Worcester, at 0.01½c. per sq.yd. for ¼ gal. of oil applied, or ⅝c. for ⅛ gal. applied. The American Car Sprinkler Co., Worcester, bid 1.2c. for ¼ gal. and 1c. for ⅛ gal. oil applied on about 2,000,000 sq.yd. streets. A. T. Rhodes is Comr. Noted Mar. 27.

The City Council has recently made appropriations of $34,000, for construction of new streets, $46,500 for paving and $3900 for macadamizing various streets.

South Norwalk, Conn.—See item under Bridges.

Brooklyn, N. Y.—Bids will be received until 11 a.m., Apr. 16, by the President of the Borough, Borough Hall, for improving portions of Degan St., Park Place, St. John's Place, East New York Ave., St. Mark's Ave., Gravesend Ave., and various other streets. Alfred E. Steers is Pres.

Buffalo, N. Y.—Bids will be received until 11 a.m., Apr. 15, by the Department of Public Works, for street improvements as follows: Paving Beckwith St., from Sycamore to Adams Sts., repaving Fell Alley, from Carolina to Virginia Sts., paving a portion of Weyand St., paving Frank Ave., from Mineral Spring Road to Kamper St. Francis G. Ward is Comr.

Buffalo, N. Y.—We are officially advised that the following low bids were received for improving portions of Amherst, Balcom and Roma Sts. and Delaware Ave.; The H. P. Burgard Co., Buffalo, $32,135, for paving Amherst St., from Delaware to Calvin, with asphalt; $11,735 for Amherst St. from Delaware to North Lincoln, with asphalt; $39,716 for paving Delaware Ave. from Amherst to Hertel with asphalt; the German Rock Asphalt & Cement Co., 1104 D. S. Morgan Bldg., Buffalo, $6580 for Balcom, from Main to Linwood with asphalt; $17,200 for paving Roma St. with asphalt; the Erie Contracting Co., 401 D. S. Morgan Bldg., Buffalo, $13,500 for paving Roma St. with brick. Geo. H. Norton is Deputy Engr. Wm. J. Troup is Asst. Engr. Noted Mar. 27.

New York, N. Y. (Borough of Richmond)—Bids will be received until noon, Apr. 15, by the President of the Borough of Richmond, Borough Hall, St. George, New Brighton, for relaying the present granite block pavement on the south wing of Richmond Terrace from Davis Ave to John St., and for repaving with redressed granite blocks, Broadway from Henderson to Castleton Aves. George Cromwell is Pres.

(Borough the Bronx)—Bids will be received until 10:30 a.m. Apr. 16, by the President of the Borough of the Bronx, 177th St. and Third Ave., for improving portions of Gleason Ave. East 156th, West 172nd, West 170th, East 150th, East 151st, East 155th, West 231st, West 254th Sts., Globe Ave., Tremont Ave., Elton Ave., Brook Ave., Fox St., Cauldwell Ave., Ogden Ave., and Morris Ave. Cyrus C. Miller is Pres.

+New York, N. Y.—(Boro. The Bronx)—We are officially advised that the President of the Borough of The Bronx has awarded a contract to the THOMAS CUMMINS CONTRACTING CO., at $79,995, for paving Beach Ave., from Bronx River Ave. to Gleason Ave. Bids were received on Mar. 26. Cyrus C. Miller is Pres.

Hoboken, N. J.—Bids will be received until 1 p.m., Apr. 23, by the City Council for repaving and repairing the asphalt pavement on various streets. James H. Londrigan is City Engr. and Clk.

★Long Branch, N. J.—Bids will be received until 10 a.m., Apr. 16, by the Board of City Commissioners, for paving portions of Rockwell Second and Third Aves. with vitrified brick, asphalt or bituminous concrete. W. H. Warwick is City Clk. Noted Apr. 3.

+Charleroi, Penn.—We are officially advised that the Borough Council has awarded a contract to THOMAS ARBUCO, Charleroi, at a little more than $12,000, for improving portions of Fallowfield Ave. and Long Alley. Other bidders were: The Isaness Construction Co. and Hallem Bros., each of whose bids was between $11,000 and $15,000. Alex Gray is Engr. for L. Nicholson is Boro. Clk. Noted Mar. 27.

Mount Pleasant, Penn.—The Borough Council has instructed the Borough Engineer to prepare plans for paving Center Ave., Washington St., from Hitchman to Morewood, and Morewood Sts.

West Chester, Penn.—Bids will be received until 6 p.m., Apr. 18, by the Supervisors of West Bradford Township, for grading and macadamizing a road leading from Trimble's Mill to Northbrook. John E. Baldwin, West Chester, R. D. No. 8, may be addressed.

Sunbury, Penn.—Bids will be received until 11 a.m., Apr. 25, by the Commissioners of Northumberland County for improving Eighth St. in the Borough of Shamokin by paving the roadway with Belgian blocks, and constructing sidewalks. J. C. Tressler is Ch. Clk.

Baltimore, Md.—Bids will be received until Apr. 16, by the Board of Awards for improving various streets under Contract Nos. 106, 108, 109, 110 and 111. Eugene E. Grannan is Pres. of Street Comrs.

★Baltimore, Md.—Bids will be received until 11 a.m., Apr. 23, by the Board of Awards, for the construction of about 1.9 miles macadam road located on property at Loch Raven, Baltimore County, Md. Ezra B. Whitman is Water Engr. James H. Preston is Pres. Bd. of Awards.

Denton, Md.—Bids will be received until Apr. 15 by Commissioners of Carolina County for construction of 1.63 miles of state highway between Denton and Willowpond, including construction of a drawbridge. W. H. Anderson is Clk.

Washington, D. C.—The Commissioners of the District of Columbia have rejected all bids recently received for repairing asphalt paving for a period ending June 30, 1915, and will do the work under the old contracts for the ensuing six months. Noted Mar. 13 and Apr. 3.

Petersburg, Va.—The City Council has appropriated $48,700 for the improvement of River St. This amount covers the cost of raising River St., from Rock Alley to Third St., raising Second St. and constructing a storm sewer from Pike to Third Sts. R. D. Budd is City Engr.

+Darlington, S. C.—The Town Council has awarded a contract to J. R. STEELE, Bennettsville, S. C., for the construction of about 18,000 sq.ft. of sidewalks. The council is also considering plans for paving portions of Pearl and South Main Sts.

+Rome, Ga.—A contract has been awarded by the City Council to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., at $8966, for the construction of about 4520 sq.yd. sheet asphalt paving. W. W. Wilson is City Engr.

+Waycross, Ga.—We are officially advised that a contract has been awarded by the City Council to the ALABAMA PAVING CO., Birmingham, at $1.64 per sq.yd., for about 20,000 sq.yd. pavement on various streets. Other bidders were: The Creosoted Wood Block Paving Co., the Atlantic Bitulithic Co., the Southern Asphalt & Construction Co., the Hastings Pavement Co. B. H. Klyce is City Engr. Noted Mar. 20.

Clearwater, Fla.—The Town Council is having plans prepared for grading and paving Fort Garrison Ave., from Jones to Eldridge St., with vitrified brick, concrete curb and gutter. R. T. Daniels is Town Clk.

Birmingham, Ala.—We are officially advised that bids will be received until about Apr. 29 (date to be announced later) for approximately 7000 sq.yd. asphalt paving on North 24th St., 16,000 sq.yd. asphaltic concrete on 12th Ave., 14th Ave., Ash and Beech Sts. (open specifications); also 15,000 sq.yd. creosoted wood blocks on 19th St., Second and Morris Aves.; also 20,000 sq.yd. of relaying granite blocks in certain alleys. Walter G. Kirkpatrick is City Engr.

Guntersville, Ala.—Bids will be received until noon, Apr. 22, by the Commissioners' Court of Marshall County for improving a part of the Guntersville and Warrenton Road at an estimated cost of $5000, and for improving a section of the Albertville and Boaz Road at $4000. W. S. Keller is Highway Engr.

De Ridder, La.—We are officially advised that bids will be received until Apr. 22, for about 10 miles of concrete sidewalks. McCorkle & Baylis, 704 Farley Bldg., Birmingham, Ala., are Engrs. in Charge. Noted Mar. 6.

+Harriman, Tenn.—A contract has been awarded by the City Council to GOODRICH & CRINKLEY, Harriman, for grading and paving with asphalt, portions of East Roane, Morgan and Clifty Sts.

Franklin, Ky.—We are officially advised that all bids received for macadamizing the Lincoln-Jackson way through Simpson County were rejected, and new bids will not be asked before next autumn or winter. J. H. Goodnight is Chn. of the Com. Noted Feb. 20.

Lexington, Ky.—See item under Water Supply-Irrigation.

Archbold, Ohio—We are officially advised that the Village Council has awarded a contract to MINICK & McCLARREN, New Castle, Ind., at $17,088, for 9000 sq.yd. of brick paving. Other bidders were: Asphalt Block Paving Co., Toledo, Ohio, $20,046; E. A. Freshwater & Son, Cleveland, $19,843; A. W. Fishbaugh, Celina, Ohio, $19,119; Marsman & Green, Grand Rapids, Mich., $19,140; Jos. Karsh & Son, Celina, $18,728; Chas. F. Rice, Archbold, $19,210. Geo. Champe, 610 The Nasby, Toledo, Ohio, is Engr. J. H. Fagley is Clk. Noted Mar. 13.

Bellevue, Ohio—Bids will be received until noon, Apr. 14, by the Trustees of Lyme Township, for improving various roads of Lyme Road District, Huron County. Henry Bochler is a Trustee. W. H. Erdrich is Clk.

Cincinnati, Ohio—Bids will be received until noon, Apr. 18, by the Board of County Commissioners for improving about 1000 lin.ft. of Oak Ave.

Bids will be received until noon, Apr. 25, by the County Commissioners for improvement of the following highways: Miami Ave. from Pond Road to Camargo Pike, Columbia Township; Highland Ave. from Sycamore to Cosbey Aves., Sycamore Township, County Club Road from Ridge to Ohio Aves., Sycamore and Columbia Townships. Stanley Struble is Pres.

Bids will be received until noon, Apr. 18, by the County Commissioners for improvement of Chester Ave. from Sharon

Ave. to the Butler County line, the Mill Road from the Hamilton Pike to the Butler County line, the Batavia Pike from the Ohio Pike to the Clermont County line.

Bids will be received until noon, Apr. 25, for the following county work: Improvement of Rapid Run Pike in Delhi Township, improving the Sand Run Road, Whitewater Township, improving the Shaker (Oxford) Road, Crosby Township.

Cleveland, Ohio— Bids will be received until noon, Apr. 16, by the Director of Public Service for furnishing creosoted wood paving blocks and planking. W. J. Springborn is Dir. W. H. Kirby is Secy.

Bids will be received until noon, Apr. 15, for laying, relaying and repairing stone and concrete sidewalks in the city of Cleveland.

Bids will be received until 11 a.m., Apr. 30, by the Board of County Commissioners for improvement of the Solon Road Extension. Frank R. Lander is County Surv. Noted Feb. 20.

Columbus, Ohio—Bids will be received until Apr. 24, by the Commissioners of Franklin County, for the following road improvements: Macadamizing the New Albany and Reynoldsburg Road, in Truro, Jefferson and Plain Townships, the Boehm Road and the Kider and Taylor Road, both in Blendon and Plain Townships, the Godown Road, Perry Township.

✦Columbus, Ohio—Contracts for road improvements have been awarded by the State Highway Commissioners as follows: To H. L. HASTINGS, Caldwell, Ohio, at $15,865 for paving Section No. 1 of the Woodsfield Northern Road, Center Township, Monroe County; to J. PAUL LONG, Canterburg, Ohio, at $19,286 for grading and paving with water-bound macadam, 1.8 miles of the Columbus Extension Road, Hillar and Milford Townships, Knox County; to THOMAS BURTON & SON, Wellington, Ohio, at $7899 for 3.33 miles of the Pittsfield Wellington Road; to the ELYRIA CONSTRUCTION CO., Elyria, Ohio, at $9325 for 5.82 miles of the Lake Shore Road, Lorain County; to J. M. STONE, Marion, Ohio, at $14,200 for constructing 1.92 miles of the Beatty Road, Morrow County; to BALDWIN, LITTLE & WILLIAMS, Willoughby, Ohio, at $25,010 for grading and paving with bituminous surface treated concrete, 2.21 miles of the Weeds Corner Extension Road, Leroy Township, Lake County. Noted Mar. 20 and 27.

✦East Youngstown, Ohio—The Village Council has awarded contracts for street improvements as follows; to KENNEDY BROS. at $36,974 for paving Wilson Ave., to TURNER & OLSON, $4617 for paving Robinson Road, and 12c a sq.ft. for laying about five miles of sidewalk on various streets, to E. DIORA at $7405, and GALLAGHER & AARON at $9127 for grading and laying sewers in various streets. P. J. Carney is Village Clk. Noted Mar. 13.

✦Geneva, Ohio—The Village Council received bids as follows for grading, draining, curbing and paving Walnut St. from South Broadway to Sherman St. with brick; THOMAS P. FITZGERALD, Ashtabula, Ohio, $11,592 (contract awarded) Ohio Engineering Co., Lorain, $12,782, B. F. Hewitt, Jefferson, Ohio, $12,534, Freshwater & Sons ,$12,101, Linniger & Bennett, Conneaut, Ohio, $13,351. W. E. Morgan is Village Clk. Noted Mar. 13.

Minster, Ohio—The Deshler Construction Co. was low bidder at $98,172, for vitrified block paving on Main and Fourth Sts., using stone curb. T. J. Mulligan, Lima, Ohio, at $96,269, was low bidder, using concrete curb. Louis R. Schmieder is Village Clk. Noted Mar. 13.

✦Nelsonville, Ohio—We are officially advised that the Director of Public Service has awarded a contract to CHAS. VORHES, Nelsonville, for grading, paving with brick, and constructing concrete curb on sections of Madison, Poplar and Adams Sts. C. C. Sharp is Dir. Noted Mar. 6.

New Lexington, Ohio—The Commissioners of Perry County have granted petitions for improvement of the Licking County Road, the Brooksville Road and the Sayre Station Road, and bids for the work will soon be asked.

Wauseon, Ohio—Bids will be received until Apr. 21 by the Village Clerk for improvement of West Chestnut St., from Fulton to Brunnel St.

New Albany, Ind.—The Board of Public Works has decided to reconstruct East Eighth St. Sarco macadam probably will be specified.

Richmond, Ind.—Bids will be received until 11 a.m., Apr. 12, by Commissioners of Wayne County, for construction of a road in Wayne Township. Lewis S. Bowman is Audr.

✦Hastings, Mich.—We are officially advised that a contract has been awarded by the Common Council to LEE HOWLAND, Charleroi, Mich., at $23,336, for improving portions of Jefferson and Green Sts. R. W. Roberts, Saginaw, Mich., is Engr. James M. Patten is City Clk. Noted Mar. 20.

Assumption, Ill—We are officially advised that bids will be received until 2:30 p.m., Apr. 14, by the City Council for 15,000 sq.yd. of brick paving on concrete base with asphalt filler. R. F. Johnson is City Secy.

✦Galesburg, Ill.—A contract has been awarded by the Board of Local Improvements to P. H. TIERNAN, Macomb, Ill., at $19,084, for paving Beecher Ave. Other bidders were: Brereton Cement Walk Co., $19,568; M. Heckard & Sons, Canton, Ill., $19,981; J. B. McAuley, $19,115; McCarthy Improvement Co., Davenport, Iowa, $19,659. F. M. Connolly is City Engr.

Joliet, Ill.—We are officially advised that bids will be received until Apr. 14, by the Board of Local Improvements, for resurfacing Eastern Ave. with asphaltic concrete at an estimated cost of $14,151. C. D. O'Callahan is City Engr. Noted Mar. 20.

Moline, Ill.—The Board of Local Improvements has rejected all bids received for paving portions of High St., Eighth Place and Sixth Ave., and new bids will be received until 1 p.m., Apr. 11. H. G. Paddock is City Engr.

Wausau, Wis.—We are officially advised that bids will be received until May 15 by the City Council, for 11,000 sq.yd. of street paving. Bids will be accepted for vitrified brick, creosoted block, sandstone or bitulithic pavement. B. C. Gowen is City Engr. C. C. Adams is City Clk.

✦Cedar Rapids, Iowa—The City Council has awarded contracts to the CONCRETE CONSTRUCTION CO., Cedar Rapids, at $8470 and $15,030 respectively for construction of sidewalks, and concrete curb and gutter on various streets. Other bidders were: F. K. Hahn, $8990 and $17,146; P. P. Smith, $8660 and $18,279, the Ford Paving Co., $8610 and $16,529. J. L. Storey is City Clk.

Des Moines, Iowa—Bids will be received until 9 a.m., Apr. 16, by the City Council for approximately 3855 sq.yd. bitulithic pavement on parts of Enos Ave and 12th St. James R. Hanna is Mayor. Horace Susong is City Clk.

Duluth, Minn.—Bids are being asked for the improvement of various streets, the total cost of which will be approximately $200,000. John Wilson is City Engr. C. S. Palmer is City Clk.

St. Paul, Minn.—The Board of Public Works is considering paving Victoria St., from Summit Ave. to Marshall Ave., at an estimated cost of $23,955 for asphalt and $28,747 for creosoted wood block. Oscar Claussen is City Engr.

Helena, Mont.—Bids will probably be asked some time in May for the improvement of Breckenridge St. from Ewing St. to Montana Ave. The estimated cost is $16,700. J. A. Mattson is City Clk.

✦Fulton, Mo.—The Commissioners of the special road district of Fulton have awarded a contract to the J. H. SUTHERLAND CONSTRUCTION CO., Kansas City, Mo., at approximately $30,000 for improvement of 14 miles of road.

✦Nevada, Mo.—A contract has been awarded by the City Council to J. M. CLARK for laying 17,000 sq.yd. Dolarway pavement on various streets.

★Poplar Bluff, Mo.—Bids will be received until 7:30 p.m., Apr. 21, by the City Council, for improving portions of Main, Vine and Pine Sts. The work includes about 28,175 sq.yd. vitrified brick pavement, 18,790 lin.ft. combined curb and gutter, grading, pipe, etc. H. H. Wilcox is City Engr.

Fayetteville, Ark.—The Commissioners of Street Improvement Dist. No. 1 will receive bids about May 1, for construction of about 20,000 sq.yd. pavement, for which $50,000 is available. E. A. Kingsley, 717 Southern Trust Bldg., Little Rock, Ark., is Engr. in Charge.

✦Little Rock, Ark.—We are officially advised that a contract has been awarded to SHELBY & BATEMAN, Little Rock, at $72,000, or $2.37 per sq.yd., for paving portions of East Second, Scott, Cumberland and Byrd Sts., and Rector Ave. with creosoted wood blocks. Henry Levinson is City Engr. Geo. A. Stratman is Secy. Noted Mar. 20.

Fort Worth, Tex.—The Commissioners' Court of Tarrant County has under consideration the construction of 16 miles of brick highway extending from Fort Worth to the Dallas County line.

Houston, Tex.—Bids will be received until Apr. 14, by the City Secretary, for grading and paving a portion of Walker Ave. with vitrified brick with asphalt filler. F. L. Dormant is City Engr. Dan C. Smith, Jr., is City Secy.

Waxahachie, Tex.—The City Council has instructed the City Secretary to advertise for bids for paving West Main St., from Monroe St. to the M. K. & T. R.R. crossing, a distance of almost one mile. Bids will be asked on various standard materials.

Bisbee, Ariz.—We are officially advised that all street improvements are postponed indefinitely, and that no bids will be asked for some time. R. A. Ziesemer is City Engr. M. S. Butler is City Clk. Noted Mar. 13.

Prescott, Ariz.—The Chamber of Commerce will recommend to the Supervisors of Yavapai County a bond issue of $200,000 for the improvement of county roads.

Tucson, Ariz.—Press reports state that the City Council has ordered the paving of Congress St. and Stone Ave. with bitulithic. W. H. Thompson is City Engr.

North Yakima, Wash.—The City Commission plans to pave First Ave. North, with vitrified brick, for a distance of four blocks. Harry Coonse is Comr. of Pub. Wks.

Spokane, Wash.—Spokane County will have the sum of $1,082,405 to expend for road construction during 1913-14.

Tacoma, Wash.—The following bids were received by the Commissioners of Pierce County for construction of the Tacoma-Puyalap Road and the unfinished portion of Permanent Highway No. 2: William Ollar, $39,400; W. J. Murphy, $40,114; J. Wartes, $41,888; Hans Pederson, $42,804; McHugh Construction Co., $43,164; P. E. McHugh and George P. Wright, $43,265; Keasel Construction Co., $44,773; D. H. Traphagen, $46,070; Bidwell & Hayden Co., $51,437; Independent Asphalt Paving Co., $54,950.

Lordsburg, Calif.—The Highway Construction Co., Redlands, Calif., at $23,600, was low bidder for 14,000 lin.ft. street work, oil surface on a concrete base.

Los Angeles, Calif.—Bids will be received until 2 p.m., Apr. 14, by the Board of Supervisors of Los Angeles County, for improving a portion of San Fernando Road. H. J. Lelande is County Clk. A. M. McPherron is Deputy.

✦A contract was awarded to the CONNER CONTRACTING CO., at $5162, for improving a section of the San Gabriel Mission Road. Noted Mar. 13.

✦ROLLINS & JURECHI, 309 S. Cordova St., Alhambra, Calif., were awarded the contract at $25,374 for improving Santa Susana Pass Road.

✦Sacramento, Calif.—We are officially advised that the State Highway Commission has awarded a contract to the CONSIDINE & BATES CO., Los Angeles, Calif., at $32,389, for construction of 9½ miles of concrete with bituminous surface road in Stanislaus County. Wilson R. Ellis is Secy. Noted Mar. 20.

✦Contracts as follows have been awarded by the State Highway Commission: To RICHARD KEATING & SONS, San Francisco, at $49,396 for about 13 miles of road in Santa Clara County; to SAWYER & WHITE at $53,313 for about two miles of road in Mendocino County; to S. P. DOYLE at $41,720 for 3.3 miles of highway in San Mateo County.

Bids will shortly be asked on five sections of state highway as follows: In San Mateo County between San Mateo and Beresford, two miles; Santa Clara County, 4.35 miles between San Jose and Edenvale; Ventura County 7.34 miles, Yuba County, various sections between Marysville and Morrison's Crossing; Stanislaus County, various sections between Turlock and Ceres. Austin B. Fletcher is State Highway Engr.

+Saskatoon, Sask.—We are officially advised that the City Commissioners have awarded a contract to the WESTERN PAVERS, LTD., Winnipeg, Man., at $63,966, for construction of concrete sidewalks, curb, gutter and crossings. The contract for street paving has not been awarded. Geo. Johnston is Secy. Noted Mar. 20.

INDUSTRIAL WORKS

Cambridge, Mass.—Plans are being prepared by Monk & Johnson, Archs., Boston, for the construction of a five-story factory, 381x61 ft., at Brookline St. and the Charles River Parkway, for Gray & Davis. Estimated cost, $20,000.

Clinton, Mass.—The Earnsdale Worsted Co. contemplates the construction of an addition to its plant at Clinton. Estimated cost, $15,000.

+Pittsfield, Mass.—We are advised that the contract for the construction of building No. 43 of the General Electric Co., at Pittsfield, has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y. It will be 500x63 ft., five stories.

+Bantam, Conn.—The contract for the construction of a factory, 40x80 ft., three stories, at Bantam, for the Trumbull-Vanderpool Electric Mfg. Co., has been awarded to the J. W. DAVIS CO., Security Bldg., Bridgeport. Noted Apr. 3.

+Bridgeport, Conn.—The Weed Chain Tire Grip Co. has awarded the contract for the construction of the first building of a new plant at Hewitt and Logan Sts., to the R. H. HOWES CONSTRUCTION CO., 105 West 40th St., New York, N. Y. The structure will be 110x242 ft., one story, of brick mill construction. Henry A. Wolcott, Elmwood, Conn., is Engr., and is preparing plans for another building of the same construction, which will be three stories high.

+Hartford, Conn.—From plans drawn by Charles Balderston, 411 Walnut St., Philadelphia, Penn., contracts have been awarded to JAMES O'LAUGHLIN, 756 Main St., Hartford, for the mason and carpenter work and EASTERN BRIDGE & STRUCTURAL CO., Worcester, Mass., the steel work for a two-story brick bakeshop on Broad St., for George L. Kolb, of Philadelphia, Penn. The building will be 75x117 ft., of mill construction. A smaller building of the same construction, 30x31 ft., will also be built.

Plans have been completed and estimates are being received by the Fletcher Engineering Co., 1087 Broad St., Bridgeport, Conn., for a factory building on Wellington St., for the Mugford Printing & Engraving Co. The structure will be of brick, 218x45 ft., and two stories. Noted Jan. 16.

South Manchester, Conn.—Estimates are being received on plans drawn by Walter R. Kidde, 140 Cedar St., New York, N. Y., for a factory building on Hilliard St., for the J. T. Robertson Co. The structure will be 52x130 ft., three stories, of brick, mill construction, with artificial stone trim. Noted Feb. 27.

+Brooklyn, N. Y.—We are officially advised that the Robert Gair Co., Washington St., manufacturers of paper goods, has awarded a contract to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for the construction of a 10-story reinforced-concrete factory, 200x125 ft., at Washington and Front Sts. William Higginson, 21 Park Row, New York, N. Y., is the Arch.

+New York, N. Y.—John Thuerer, 804 11th Ave., hasd awarded contracts for the construction of a one-story wheelwright shop, 100x50 ft. NIOMAN & LUTH, 25 West 42d St., have been given the general contract, and McDOUGALL & POTTER CO., 606 West 55th St., the contract for the structural steel. The estimated cost is $30,000.

North Tonawanda, N. Y.—The W. G. Fahnestock Co., of Philadelphia, Penn., will at once erect a three-story factory, 150x120 ft., at Paynes Ave. and the Erie R.R., and will equip the same for the production of cocoa and chocolate. The estimated cost is $150,000.

Poughkeepsie, N. Y.—The Sedgwick Machine Works, manufacturers of elevators and dumbwaiters, is having plans prepared for the erection an dequipment of an additional plant on a site recently received. Dwight R. Sedgmick is Mgr.

Camden, N. J.—Plans are being prepared by Ballinger & Perrot, Archs., 1211 Arch St., Philadelphia, Penn., for the construction of three factory buildings, two stories high, 125x50 ft., in Camden, for W. P. Westcott. The estimated cost is $50,000.

Camden, N. J.—The Joseph Campbell Co., manufacturer of food products, is considering plans for the erection of an addition to its plant to double the present capacity. The new plant will include departments for can manufacture, and for wood crate and case making. Dr. John T. Dorrance is a managing director of the company.

East Orange, N. J. Bids have been received by Fred A. Phelps, Arch., 9 Clinton St., Newark, for the construction of a two-story factory 120x66 ft., in East Orange, for the Howard Miniature Lamp Co., 327 Academy St., Newark. The estimated cost is $20,000.

Jersey City, N. J. The Robert Griffin Co., manufacturers of wall paper, 425 Fifth Ave., New York, N. Y., is having plans prepared by W. W. Knowles, Arch., 1133 Broadway, New York, for the construction of a two-story factory, 280x112 ft., in Jersey City.

+Newark, N. J.—The Eclipse Tanning Co. has awarded a contract to the JOHN W. FERGUSON CO., 152 Market St., for the construction of a two-story brick factory, 212x100 ft., at 113 Sussex Ave.

The J. H. Ladew Co., 45th St. and First Ave., New York, N. Y., is having plans prepared for the construction of a tannery in Newark. L. M. Legine, First Ave. and 45th St., New York, N. Y., is the Engr.-in-charge. The estimated cost is $10,000.

+Harrisburg, Penn.—The Moorhead Knitting Mills has awarded a contract to STAFF & BENFOR, 23 South Third St., for the construction of a four-story factory, 56x46 ft. The estimated cost is $28,000. C. Howard Lloyd, Telegraph Bldg., is the Arch. Noted Jan. 23.

+Philadelphia, Penn.—Gustav Becker, Frankford Ave., has awarded a contract to GEORGE GRAY, 4340 Factory St., for the construction of a one- and two-story bakery, 100x56 ft. The estimated cost is $10,000. Charles Balderson, 411 Walnut St., is the Arch.

Burk Bros., manufacturers of leather, 409 Arch St., have awarded a contract to JOHN H. GILL & CO., 1215 Filbert St., for the construction of a two- and three-story reinforced-concrete factory, 132x106 ft., at 919 North Third St. The estimated cost is $80,000.

Plans have been prepared by Oliver Randolph Parry, Arch., 1723 Chestnut St., for an addition to the dairy building of the Willis-Jones-McEwen Co., on 26th St., between Jefferson and Oxford Sts. It will be three stories high, 225x90 ft.

+Pittsburgh, Penn.—The Pittsburgh Art Glass Co., 1026 Fifth Ave., has awarded a contract to HENRY BUSSE & CO., West End Bank Bldg., for the erection of a two-story factory, 100x60 ft. The estimated cost is $10,000.

Bids are now being received by Irving & Witherow, Engrs., Keystone Bldg., for the construction of a three-story factory, 119x100 ft., for the United Oil Co.

Washington, Penn.—The Lord Baltimore Motor Car Co., Baltimore, Md., is having plans prepared for the construction of a steel and concrete factory, 225x255 ft., at Washington.

Baltimore, Md.—Levenson & Zenitz, manufacturers of furniture, 3 North Gay St., has purchased property at the southeast corner of Gay and Frederick Sts., upon which they will erect a new factory, estimated to cost $100,000.

Hagerstown, Md.—The Western Maryland Ry. has announced that it will erect new car shops in Hagerstown for the repair of locomotives. The estimated cost is $330,000. J. M. Fitzgerald is Pres.

Kingston, N. C.—The Casewell Cotton Mills are considering the erection of an addition to its factory. The proposed building will be two stories, 100x100 ft.

Wendall, N. C.—R. B. Whitely and others are considering the erection of a knitting mill at Wendall.

Greeneville, S. C.—The F. W. Poe Mfg. Co., Greenville, is considering the erection o fan addition to its mill. F. W. Poe is Pres.

Camilla, Ga.—The farmers in the vicinity of Camilla are planning the erection of a canning factory. Information may be obtained from the Secretary of the Board of Trade.

Chickamauga, Ga.—Preliminary plans have been prepared to construct a cotton mill at the plant of the Crystal Springs Bleachery Co., Chickamauga, to be equipped with 15,000 spindles and 800 looms.

Columbus, Ga.—The Atlantic Compress Co., Columbus, will rebuild its cotton compress recently destroyed by fire at a loss of $100,000.

Dalton, Ga.—The Crown Cotton Mills are planning the erection of a new mill for the manufacture of duck and osnaburgs.

Seville, Ga.—The Louis Werner Stave Co., Shreveport, La., has purchased 6000 acres of land near Seville, Ga. He plans to establish a lumber plant.

Jacksonville, Fla.—The Seminole Rubber Co. has purchased a site on which it proposes to erect an automobile factory. Work will start on the construction of the first unit of the plant as soon as the necessary details have been completed.

Tuscaloosa, Ala.—J. W. Coor, Gordo, Ala., is considering the construction of a planing mill at Tuscaloosa, Ala. A site of three acres has been purchased adjoining the plant of the Ruggles Machine Co. The mill is estimated to cost $25,000

Baxterville, Miss.—The Coney Lumber Co., organized with a capital of $100,000, has purchased a site near Baxterville, and will build a circular sawmill with a daily capacity of 40,000 ft. A planing mill will probably be built later.

Houlka, Miss.—The Ferguson-Palmer Co., Paducah, Ky., will build a plant at Houlka, to include a 40x200-ft. sawmill, a 38x46-ft. boiler room, a 20x52-ft. engine room, and a 36x45-ft. machine shop and filing room. The estimated cost is $50,000.

Moorhead, Miss.—The John Dulweber Co. will build a band mill of 50,000 ft. daily capacity, at Moorhead. Estimated cost, $25,000. F. L. Gill, Moorhead, is Arch., and B. F. Dulweber is Pres.

Glenmora, La.—The Louisiana Sawmill Co., Glenmora, is planning the erection of a mill with a capacity of 125,000 ft. daily.

Sequatchie, Tenn.—The citizens are considering the erection of a cotton or hosiery mill. A plant of moderate capacity will be erected and additions made as the growth of the business warrants.

Cincinnati, Ohio—The Eagle White Lead Co., Cincinnati, will erect a large new factory. The cost has been estimated at about $40,000.

Cleveland, Ohio—The Electric Controller & Mfg. Co., Cleveland, plans the erection of a four-story addition to its plant on East 79th St. The structure will be of steel and concrete 51x81 ft. The plans are being prepared by G. S. Rider & Co., Cleveland.

Columbus, Ohio—The capital stock of the West Jefferson Creamery Co. has been increased from $50,000 to $300,000. The enlargement of the plant is contemplated.

+Logan, Ohio—Plans have been prepared for the construction of a plant for the Snyder Mfg. Co., a furniture manufacturing concern, to replace the plant which was destroyed by fire recently. The contract, it is reported, has been awarded to L. C. KRIEG, Logan.

Toledo, Ohio—The Perfection Spring Co., Cleveland, Ohio, has decided to remove its plant to Toledo and has acquired a tract of 5½ acres of land adjoining the Willys-Overland

Co. on which the plant will be constructed. Plans and specifications have been prepared and the contract will be awarded soon.

Toledo, Ohio—Bids will be received by the Board of County Commissioners at the office of the County Auditor until 10 a.m., Apr. 17, for the installation of an ammonia-compression, direct-expansion system of refrigeration, and ice-making machinery, to be placed in the cold-storage building at the Lucas County Infirmary. Charles J. Sanzenbacher, Toledo, Ohio, is County Audr.

Port Huron, Mich.—The Port Huron Paper Co., Port Huron, has under consideration the erection of an addition to its plant, to cost $100,000.

Chicago, Ill.—The Chicago Mission Furniture Co., Chicago, is considering plans for the rebuilding of its factory, recently destroyed by fire. Estimated cost, about $75,000.

The West Side Door & Sash Co., Chicago, is considering the erection of a two-story brick factory. The building will be 30x125 ft.

Decatur, Ill.—The Decatur Coffin Co., Decatur, is having plans prepared for the erection of an addition to its factory. Estimated cost, $100,000.

The Decatur Brick Mfg. Co., Decatur, is having plans prepared for the erection of a new factory. Estimated cost, $100,000.

✦Moline, Ill.—The Deere Harvester Co., Moline, has awarded the contract to H. W. HORST, Rock Island, Ill., for the erection of three new shop buildings at East Moline.

Naperville, Ill.—The Naperville Lounge Co., Naperville, is planning to rebuild that portion of its factory recently damaged.

Delavan, Wis.—The Bradley Knitting Works, Delavan, is planning the erection of an addition, to cost about $30,000.

Merrill, Wis.—A two-story, 40x75-ft. factory building is contemplated by the Merrill Knitting Co., on Second St. It will be of solid brick construction, and foundation for future additional stories will be provided. G. C. Torkelson is Arch. Cost, $12,000. John Rehfeld is Secy.-Treas.

Racine, Wis.—The Wallis Tractor Co. is planning to establish a large manufacturing plant in this city. Temporary quarters are now located at Cleveland, Ohio.

Two Rivers, Wis.—The Electrical Fire Alarm Co. has been incorporated here to manufacture a new patent fire alarm device, the invention of Joseph Scheuer. Other incorporators are William C. Boehringer and Arnold Zander. Capital, $25,000. A factory will be erected shortly.

St. Paul Minn.—The Rock Island Co. will expend about $500,000 this year for new roundhouses, shops and terminals at St. Paul.

Fargo, N. D.—The Great Northern Ry. will construct new repair shops at Fargo.

Fort Smith, Ark.—The Fort Smith Iron & Steel Co. plans to build a plant for the manufacture of bar iron and steel. J. M. Arnold is Pres.

El Paso, Tex.—Dr. F. S. Pearson, 115 Broadway, New York, N. Y., head of what is known as the Pearson Syndicate, operating lumber mills and railroads in Mexico, has acquired a site at El Paso, and will erect a large woodworking plant. The estimated cost is $3,000,000.

Somerset, Tex.—The Farmers Union Gin Co., Somerset, will build a new cotton gin. L. S. Morrison, Charles F. Fisher and A. L. Byron are interested.

Anacortes, Wash.—The Apex Fish Co., Anacortes, will improve its plant to the extent of about $300,000.

Everett, Wash.—The Weyerhauser Lumber Co., Everett, is having pans prepared for the construction of two sawmills and a shingle mill at Everett. The estimated cost is $700,000. George S. Long, Tacoma, is Mgr.

Georgetown, Wash.—Albert Kelly, Seattle, Wash., has leased a site in the King County Industrial Tracts, Georgetown, upon which a ship-building plant will be located.

Morton, Wash.—J. A. Fuller, Toledo, Ohio, is considering the erection of a plant at Morton, for the manufacture of tiling for sewerage and drainage purposes.

Spokane, Wash.—J. L. Vadham, Duluth, Minn., states that his company is contemplating the erection of a plant at Spokane, for the manufacture of matches and toothpicks.

Tacoma, Wash.—The American Wood Pipe Co., Tacoma, Wash., has purchased a three-acre site on the tide flats, and will erect a plant for the manufacture of wire wound rope.

The Dennett Co., Tacoma, has purchased a site at Ainsworth and Hood Sts., and will erect a plant for the manufacture of fancy grades of patent flour.

Albany, Ore.—The Holly Lumber Co., Albany, has been incorporated with a capital of $15,000 by Lee Collins, Harry M. Pearce and E. A. Knapp. The company will erect a saw-mill plant on the South Santiam River, about nine miles from Lebanon, Ore.

Hood River, Ore.—The Friday Mfg. Co., Hood River, will build a plant for the manufacture of electric cookers and spray nozzles.

La Grande, Ore.—Leroy and J. W. Spencer, Grande Ronde Valley, Ore., are interested in a project to erect a plant at La Grande, for the manufacture of a patented grain header.

Klamath Falls, Ore.—The Big Basin Lumber Co., Klamath Falls, will remove its sawmill plant from its present location on Lake Ewauna, to the Upper Klamath Lake. The capacity of the plant will be increased from 80,000 to 100,000 ft. per day. Robert A. Johnson is Mgr.

Tropico, Calif.—The Wells Ornamental Brick & Roof Tile Co., San Fernando Road, Tropico, plans to erect a plant for the manufacture of its specialties.

Wilmington, Calif.—The Monarch Canning Co., Los Angeles, has been incorporated by G. L. Hogan, C. F. Holland and A. P. Scudder for the purpose of building a fish canning plant at Wilmington, near Los Angeles. The plant will cost approximately $25,000.

Sherbrooke, Que.—The Canadian Connecticut Mills Co., a branch of the American Connecticut Mills Co., has been granted a free site by the city, and will erect a plant costing $175,000. It will employ about 100 hands.

Brantford, Ont.—The Watrous Engine Works plans the erection of a large factory to manufacture all kinds of motor fire apparatus. About $100,000 will be spent on buildings and equipment. D. J. Watrous is Mgr.

Chatham, Ont.—The Chatham Auto Wheel Co. plans the construction of a new factory, to cost about $40,000.

Fort Francis, Ont. The George Irish Paper Corp., Buffalo, N. Y., is having plans prepared for a branch mill at Fort Francis for the manufacture of book and wrapping paper.

Ottawa, Ont The Dominion Wire Cloth Co. is having plans prepared for a $25,000 addition to its factory on Armstrong St. J. R. Buchanan is Mgr.

Peterborough, Ont.—The Vermont Marble Co., Proctor, Vt., will establish a Canadian branch. The cost of plant and equipment will be about $20,000.

✦Thorold, Ont.—A contract has been awarded by Pilkington Bros., St. Helens, England, to the SAMUEL AUSTIN & SON CO., Cleveland, Ohio, for the erection of a plant for the manufacture of window glass at Thorold. Noted Jan. 9.

Toronto, Ont.—The John Inglis Co., Ltd., has been incorporated with a capital stock of $1,000,000. A plant for the manufacture of engines, boilers and machinery will be erected; also a brass and iron foundry will be built later. Among the directors are William Case and James Taylor.

Articles of incorporation have been filed by the Dominion Fireless Cooker Co., which will build a plant for the manufacture of fireless cookers and aluminum ware. The capitalization of the company is $40,000. The directors are Harris E. Wallace, Lowell W. Wood, and Eric R. Thomson.

Windsor, Ont.—The Swedish Crucible Steel Co., Detroit, Mich., will build a branch plant here. The construction of the initial building, which is to be 60x125 ft., will be begun at once, and later a gray-iron foundry will be erected.

A site of three acres has been purchased by the Vincent Steel Process Co., Detroit, Mich., which will establish a Canadian branch plant, for the manufacture of steel castings. Work on the buildings will be commenced this spring.

FEDERAL GOVERNMENT WORK

★Ledge Excavation—Portland, Maine. Bids will be received until noon May 1, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., for ledge excavation in the Saco River, Maine, South Bristol, Maine and Sullivan Falls, Maine.

Ledge Excavation—Portland, Maine.—Bids will be received by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, until noon, May 1, for ledge excavation in Portland Harbor.

Post Office—Bennington, Vt.—Bids will be received until 3 p.m. May 15, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Bennington, Vt.

Roadway—Chelsea, Mass.—Bids will be received until 11 a.m., Apr. 26, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for construction of a roadway at the naval hospital, Chelsea, Mass., at an estimated cost, of $15,000. H. R. Stanford is Ch. of Bureau.

★Cement—New York, N. Y.—Bids will be received by Col. W. M. Black, Corps Engrs., U. S. A., Room 710, Army Bldg., 39 Whitehall St., New York, until noon, Apr. 28, for furnishing and delivering portland cement.

Dredging—Philadelphia, Penn.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the U. S. navy yard at Philadelphia.

Dredge—Wilmington, Del.—Bids will be asked soon by Maj. R. R. Raymond, Corps Engr., U. S. A., Wilmington, for the construction of a dredge for Wilmington Harbor.

Bridge—Annapolis, Md.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., May 3, for the construction of a highway bridge over Dorsey Creek at the U. S. Naval Academy, Annapolis.

✦Gas Buoys—Baltimore, Md.—Bids were received by the Lighthouse Inspector, Baltimore, for 16 buoys and appurtenances for Fort Henry Channel, Md.: U. S. Marine Signal Co., $24,720. American Gas Accumulator Co., Philadelphia, $28,116. SAFETY CAR HEATING & LIGHTING CO., New York, $28,161 (awarded contract).

Dredging—Norfolk, Va.—Bids will be received by Lieut.-Col. E. Evdeth Winslow, Corps Engr., Norfolk, until noon May 1, for the dredging of Thimble Shoals.

Dredging—Fort Screven, Ga.—Bids will be received by the Constructing Quartermaster, U. S. A., Fort Screven, for the dredging required in the vicinity of the government wharf.

★Wharf and Pierhead—Fort Barrancas, Fla.—Bids will be received until noon, Apr. 30, by the Constructing Quartermaster, U. S. A., Fort Barrancas, for repairs and reconstruction of wharf and pierhead at Fort McRee.

Repairs to Wharf—Fort Dade, Fla.—One bid was received May 15 by the Depot Quartermaster, U. S. A., Fort Dade, for wharf repairs at Fort Dade. The bid exceeded the appropriation and new bids will be asked at once.

Sand, Gravel, Etc.—Vicksburg, Miss.—Bids will be received by Maj. J. A. Woodruff, Corps Engrs., U. S. A., Vicksburg, until noon, Apr. 14, for furnishing sand, gravel or broken stone near Little Callao Landing, Big Sunflower River, Miss.

Riprap—Memphis, Tenn.—Bids will be received by Maj. E. M. Markham, Corps Engrs., U. S. A., Memphis, until noon, Apr. 26, for furnishing and loading about 25,000 cu.yd. of riprap stone on government barges.

Riprap—Memphis, Tenn.—Bids will be received by Maj. E. M. Markham, Corps Engrs., U. S. A., Memphis, until 11 a.m., Apr. 28, for furnishing about 35,000 tons of riprap stone, rail delivery.

★Dredging—Alpena, Mich.—Bids will be received until noon, May 1, by Lieut.-Col. Mason C. Patrick, Corps Engrs., U. S. A., 337 Federal Bldg., Detroit, Mich., for dredging Alpena Harbor, Mich.

★**Crib and Pile Pier**—Manistique, Mich.—Bids will be received by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Milwaukee, Wis., until 3 p.m., May 8, for the construction of a crib an dpile pier with concrete superstructure, and concrete superstructure on the old breakwater at Manistique.

✚**Post Office**—Waukesha, Wis.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Waukesha to the GENERAL CONSTRUCTION CO., Milwaukee, Wis., at $68,780. Noted Mar. 20.

✚**Post Office**—Denison, Iowa—Oscar Wenderoth, Superv. Arch., Treasury Washington, D. C., has awarded contract for the construction of the post office at Denison, Iowa, to JAMES CORSE, Racine, Wis., at $47,100.

Post Office—Ottawa, Kan.—The date of opening bids for the post office at Ottawa has been postponed from Apr. 4, to Apr. 11. Oscar Wenderoth is Superv. Arch., Treasury Dept., Washington, D. C.

★**Canal**—Newell, S. D.—Bids will be received by the U. S. Reclamation Service, Newell, until 4 p.m., May 8, for the construction of about four miles of the North Canal and about 10 miles of laterals, Belle Fourche Project, S. D. The work involves the excavation of about 147,000 cubic yards of material and is situated north and west of Newell, S. D. For particulars address the United States Reclamation Service, Washington, D. C., Denver, Colo., or Newell, S. D.

Post Office—Casper, Wyo.—Bids were received as follows, Apr. 7, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Casper: (a) Limestone; (b) sandstone: J. H. Wiese, Omaha, Neb.: (a) $69,295; King Lumber Co., Charlottesville, Va., (a) $76,000; (b) $80,000. J. F. Jenkins & Co., Ocala, Fla., (a) $60,750; (b) $61,750; W. D. Lovell, Minneapolis, Minn., (a) $61,000.

Steam Shovels—Babb Mont.—Bids will be received by the U. S. Reclamation Service, until Apr. 28, Babb, for two 70-ton steam shovels for use on the Milk River Project, Mont.

Electric Shovels—Great Falls, Mont.—Bids will be received by the U. S. Reclamation Service, Great Falls, until Apr. 30, for furnishing two electric power shovels for use on the Milk River and Sun River Projects, Mont.

★**Canal**—Great Falls, Mont.—Bids will be received by the U. S. Reclamation Service, Great Falls, until 2 p.m., Apr. 30, for the construction of the Pishkun Reservoir Supply Canal, the Sun River Slope Canal and Tunnels No. 2 and No. 3 of the Pishkun Reservoir Supply Canal, involving the excavation of about 2,400,000 cu.yd. of material and the construction of about 3215 lin.ft. of concrete lined tunnel. The work is situated on the north side of Sun River 25 to 70 miles west of Great Falls, Mont., and near the line of the Sun River Branch of the Great Northern Ry. For particulars address the U. S. Reclamation Service, Washington, D. C., Helena, Mont., or Fort Shaw, Mont.

Drainage—Fallon, Nev.—Bids will be received by the U. S. Reclamation Service, Fallon, for the drainage work of the Truckee-Carson Project, Nev. The work consists of the first east and first southwest drains. There will be about 20,000 cu.yd. of open outlet ditch and about 20,000 lin.ft., of 10-inch tiling in trenches of 7 to 10 ft. in depth. These contracts will be followed by extensive improvements of the same character.

Cranes—Bremerton, Wash.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., May 3, for furnishing four electric traveling-bridge cranes and two electric wall cranes for the general foundry, navy yard, Puget Sound, Bremerton. Plans and specifications can be obtained at the Bureau or from the commandant of the navy yard named.

Dump Cars—Hawaii—Bids were received as follows Apr. 5, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing dump cars, knocked-down, at the Naval Station, Pearl Harbor, H. T.: item 1, 30 cars; item 2, 15 cars: William J. Oliver Mfg. Co., Knoxville, Tenn., (1) $65,-890; (2) $33,310; Western Wheeled Scraper Co., Aurora, Ill., (1) $72,000; alternate, $65,200; Orenstein-Arthur Koppel Co., Koppel, Penn., (1) 24-ft. bed, $26,000; 30-ft. bed, $2800; (2) 26-ft. bed, $28.30; 30-ft. bed, $2873.

MISCELLANEOUS

✚**Floating Grain Elevator**—Boston, Mass.—Bids will be received by the Directors of the Port of Boston for the purchase or lease of one or more floating grain elevators to be ready for use not later than May 28. Address James T. Mcdonald, Clk., 40 Central St., Boston.

Borings and Soundings—Boston, Mass.—Bids will be received by the Directors of the Port of Boston until April 6 for making 65 water jet borings and 113 soundings in the Commonwealth Flats at East Boston. F. A. Hodgdon is Ch. Engr.

✚**Coal Handling Machinery**—Boston, Mass.—The contract has been awarded to FRED T. LEY & CO., Inc., Springfield, Mass., for the installation of coal-handling machinery at the plant of the Mead-Morrison Co. Noted Mar. 6.

Elimination of Grade Crossings—Quincy, Mass.—The city and the New York, New Haven & Hartford R.R. Co. are negotiating regarding the proposed elimination of grade crossings in the city. A. S. Tuttle, South Station, Boston, is Engr. Const.

Fire Apparatus—Springfield, Mass.—The city has decided to appropriate $24,000 for the purchase of motor fire apparatus. E. A. McClintock is Chn. Fire Comrs.

Retaining Wall—Woonsocket, R. I.—The contract for the construction of a retaining wall here has been awarded by the New York, New Haven & Hartford R.R. Co., to the EASTERN CONSTRUCTION CO., Woonsocket. It will be about 100 ft. long and 50 ft. high.

Fire Alarm Telegraph System—Brooklyn, N. Y.—Bids will be received by Joseph Johnson, Fire Comr., 157 East 67th St., Boro. Manhattan, until 10:30 a.m., Apr. 15, for the labor and materials required for establishing and equipping an extension to the fire alarm telegraph system in the Borough of Brooklyn.

Char Kills, Etc.—Brooklyn, N. Y.—We are officially advised that bids will be received in about two weeks by Robert S. Kent, Consult, Engr., Mechanics Bank Bldg., Brooklyn, for furnishing and delivering 15 char kills, 3 copper vacuum pans and 59 steel tanks, 12x9x7 ft., at the new plant of the Atlantic Sugar Refineries Ltd., of Montreal, Que., now under construction at St. Johns, N. B.

Trap Rock—Brooklyn, N. Y.—Bids will be received by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan, until 3 p.m., Apr. 17, for furnishing and delivering crushed trap rock and trap rock screenings to parks and parkways, Boro. Brooklyn; furnishing and delivering Hudson River road gravel to parks and parkways, Boro. Brooklyn; furnishing and delivering limestone screenings to the gravel pit, Boro. Brooklyn.

White Lead—New York, N. Y.—Bids will be received by Arthur J. O'Keeffe, Comr. of Bridges, Boro. Manhattan, until 2 p.m., Apr. 17, for furnishing and delivering whfite lead for the Manhattan Bridge.

Trenching and Draining—New York, N. Y.—We are officially advised that the only bid received by the Department of Parks, Fifth Ave. and 64th St., on Apr. 3, for trenching and draining the salt meadow lands in Pelham Bay Park was that of the United States Drainage & Irrigation Co., 17 Battery Place, at $6000.

✚**Alterations to Fire Station**—New York, N. Y.—We are officially advised that Joseph Johnson, Fire Comr., 157 East 67th St., has awarded a contract to JOSEPH BALATAN, 156 Fifth Ave., at $4960, for furnishing all the labor and materials required for additions and alterations to the quarters of Hook and Ladder Co. No. 127, Union Ave., Jamaica, (L. I.), N. Y.

✚**Fire Alarm Telegraph System**—New York, N. Y.—We are officially advised that Joseph Johnson, Fire Comr., 157 East 67th St., has awarded the contract to HENRY E. FOX, 81 East 135th St., at $50,500, for furnishing all the labor and materials required for installing and equipping an extension to the fire alarm telegraph system in the Borough of Manhattan. Bids were received Mar. 31.

Shelter Building, Etc.—New York, N. Y.—We are officially advised that the following bids were received, Apr. 2, by the Commissioners of the Palisades Park, 31 Nassau St., New York, for (a) the construction of the north wing of the shelter house, including the water supply and outlets; (b) the construction of the toilet building, including the water supply, outlet sewers and a sewage disposal plant; (c) the construction of the kitchen and laundry building, all at Bear Mountain, New York: Phillipsburg Construction Co., 16 North Broadway, Yonkers, (a) $27,200. (b) $10,900, (c) $7700; Robert W. McCready, Tuxedo Park, (a) $24,500, (b) $9650, (c) $8450; Harriman Industrial Corporation, Harriman, N. Y., (a) $22,630, (b) $12,180, (c) $8918; Michael Staub, 14 Ward Ave., Mamaroneck; (a) $25,960, (b) $9765, (c) $8475; William H. Egan, 147 East 125th St., New York, N. Y., (a) $22,450, (b) $11,715, (c) $9451; A. V. Johnson & Co., 1123 Broadway, New York, N. Y., (a) $23,773, (b) $8877, (c) $7821; Joseph Balatan Co., 156 Fifth Ave., New York, N. Y., (a) $22,246, (b) $11,452, (c) $10,583; Thomas J. Buckley Engineering Co., 103 Park Ave., New York, N. Y., (a) $17,509, (b) $9806, (c) $8556; Merrick Fireproofing Co., 1 Broadway, New York, N. Y., (a) $21,970, (b) $9590, (c) $9228.

Road Oil Etc.—New York, N. Y.—We are officially advised that the following bids have been received on Mar. 14, by Cyrus C. Miller, Pres. Boro. The Bronx: for furnishing road oil; Standard Oil Co., 26 Broadway, $10,500; United States Asphalt Refining Co., 90 West St., $10,300; for furnishing trap rock, stone and screening, New York Trap Rock Co., 17 Battery Place, low bidder at $27,440.

Dam—Palmers Falls, N. Y.—The International Paper Co. has decided to begin at once the reconstruction of its dam at Palmers Falls, which was partially destroyed by recent floods. The work will cost about $100,000.

Pier—Tarrytown, N. Y.—The city of Tarrytown has decided to construct a public dock. The cost has been estimated at $15,000.

Pier—Camden, N. J.—Plans have been prepared for the erection of two modern piers on the Delaware River by the Joseph Campbell Co. The work, it is estimated, will cost $1,500,000.

Air Compressor—Blairsville, Penn.—Bids will be received by the Borough of Blairsville until 7:30 p.m., Apr. 15, for an air compressor of the stage type that will develop 100 cu.ft. of air per min. with an r.p.m. of not more than 125. Bids must be addressed to H. R. Wiley, Secy., Blairsville.

✚**River Work**—Chester, Penn.—The contract has been awarded to JAMES KELLEY, Philadelphia, Penn., for straightening the Chester River above Ninth St., at about $18,630.

✚**Stable**—Reading, Penn.—The contract has been awarded to C. H. SCHIEGEL, Reading, for the erection of a two-story stable, 15x150 ft.

Stable—Pittsburgh, Penn.—The E. E. Reick Co., Forbes St., Pittsburgh, is considering the erection of a four-story brick stable, 125x125 ft. at a cost of about $50,000.

✚**Filling**—Miami, Fla.—The contract for 3,200,000 cu.yd. of sand filling at Miami, to reclaim the waterfront has been awarded to C. G. FISHER, Indianapolis, Ind.

Levee Work—Greenville, Miss.—No contracts were awarded by the Mississippi Levee Commissioners, Mar. 25, for the construction of the Wakefield Loop Levee.

✚**Levee Work**—Greenville, Miss.—The contract has been awarded to STACEY & CRITTENDEN, Greenville, for the construction of about 528,000 cu.yd. of levee work, at 19.75c. per cu.yd. The work is to be done for the Mississippi Levee Commissioners. W. J. Shackleford, Greenville, is Ch. Engr.

✚**Ditch**—Senatobia, Miss.—Bids were received Mar. 26 by the county for constructing a ditch near Senatobia, Sect. 1, 65,000 cu.yd.; Sect. 2, 55,000 cu.yd.; depth, 4 to 6 ft.; bottom, 4 ft.; top, 18 ft.; wide; 8 ft. clear berm each side. Contract has been let to P. N. YOUNG, Smithfield, Va.

Subway—Ashtabula, Ohio—The City Council has accepted the revised plans for the construction of the Main St. Subway. Bids will be asked at once. The cost of the city's portion will be $32,000.

River Work—Cleveland, Ohio—The Harbor and Wharf Committee has recommended the straightening of the lower Cuyahoga River.

Canal—Gary, Ind.—The city is considering the construction of a ship canal from Gary Harbor to the Little Calumet River. The cost of the work has been estimated at $2,000,000.

Stable—Battle Creek, Mich.—The Battle Creek Hack & Bus Line, Battle Creek, will erect a two-story and basement stable, 66x170 ft. The work will be done by day labor.

Stadium—Madison, Wis.—The University of Wisconsin, Madison, will construct a stadium to cost $60,000.

Docks—Oshkosh, Wis.—The Board of Public Works will ask for bids for the construction of docks and outlet sewers in connection. George H. Randall is City Engr.

+Docks—Sheboygan, Wis.—The contract has been awarded to the WISCONSIN DREDGE & DOCK CO., for the construction of docks for the Goodrich Transit Co. and also for the dock at the Keenan yard, where S. Blocki & Co. will erect a new plant.

+Ditch—Shlocton, Wis.—Bids were opened Mar. 20 for constructing a town ditch 19,200 ft. long. Contract has been awarded to the AJAX DREDGE CO., Glencoe, Minn., at 11.75c. per cu.yd.

Ditch—Des Moines, Iowa—Bids will be received until Apr. 28, by H. B. Frase, County Audr., Des Moines, for constructing Ditch No. 14, Lincoln and Crocker Townships, consisting of the excavation of 1100 cu.yd. of earth, digging trenches, laying tile and back filling ditch and laying 46,280 lin.ft., 10 to 22-in. tile, average depth 5.4 to 6.4 ft. Length, 8.75 miles.

+Ditch—Jackson, Minn.—The Jackson County Commissioners have awarded the contract to R. SCHMIDT, Lakefield, Minn., for the construction of Judicial Ditch No. 22. The cost of the work will be about $10,000.

Ditch—St. Cloud, Minn.—Plans are being prepared for the construction of Ditch No. 32. It will be about 24 miles in length and will pass through the towns of Lake George, Getty, Raymond and North Fork. The cost has been estimated at about $26,000.

Excavation—Jonesboro, Ark.—Guy W. Cobb, Engr and Surv., Jonesboro, will probably award the contract next month for the construction of Drainage District No. 10. The work will involve the excavation of about 220,000 cu.yd. of main ditch, nine miles long. The ditch runs down what is known as Purcell Slough.

Ditch—East Houston, Tex.—Bids will be received until Apr. 19, by the Commissioners of Drainage District No. 6, East Houston, for the construction of drainage ditches in the district. J. S. Burke, 304 Commercial Bank Bldg., Houston, Tex., is Drainage Engr.

Wharf—Houston, Tex.—The Peden Iron & Steel Co., Houston, has secured a permit for the construction of a wharf on the north side of Buffalo Bayou.

+Wharf—Blaine, Wash.—The contract has been awarded to O. HALL, Blaine, by the city, for the construction of the proposed wharf at E St. at $11,895. Bids for the work were received Mar. 17.

Recreation Pier—Portland, Ore.—The Commissioner of Public Docks is receiving bids for the construction of a recreation pier at the foot of Stark Street to cost about $17,000. For further information address official named.

Pipe Line—Bakersfield, Calif.—A 52-mile pipe line will be laid by the General Petroleum Co. from Lebac to Mojave. The capacity will be about 25,000 bbl. daily. The cost has been estimated at $1,500,000.

Dredging and Filling—Los Angeles, Calif.—Bids have been received as follows by the city for dredging and filling Slips 1 and 6: San Francisco Bridge Co., 17c. per cu.yd. for dredging and 17.4c. for filling; Standard American Dredging Co., 13.25c. and 14c.; N. R. Harris, 16.375c. and 17.25c.; Russell-Greeneo Foell Co., 17.75c. and 18.4c.

Pier—Venice, Calif.—The city is considering the construction of a municipal pier at the foot of Mildred Ave. It will be of reinforced concrete.

+Locks and Dam—Quebec, Que.—The contract has been awarded by the Department of Public Works, Ottawa, Ont., to QUINLAN & ROBERTSON, Montreal, Que., for the construction of two locks and a dam in Quebec River.

+Wharf—Ville Marie, Que.—The contract has been awarded by the Department of Public Works, Ottawa, Ont., to M. R. BREWDER, for the construction of a wharf at Ville Marie, at $17,972.

Vessel—Selkirk, Man.—Bids will be received by Alex. Johnston, Deputy Minister, Dept. Marine and Fisheries, Ottawa, until noon, Apr. 25, for the construction of a steel wood-sheathed, twin-screw patrol steamer to be delivered at Selkirk.

Comfort Station—Winnipeg, Man.—The Board of Control is considering the erection of a public comfort station at Main and Portage Ave.

Fire Station—Winnipeg, Man.—Bids will be received soon by the Fire, Water, Light and Power Committee for the erection of a fire station, No. 14, at Westminster Ave. and Ruby St. H. N. Ruttan is City Engr.

Ferry Terminal—Cape Tormentine, N. B.—Bids will be received until Apr. 15 by L. K. Jones, Asst. Deputy Minister and Secy., Dept. of Rys. and Canals, Ottawa, Ont., for constructing a car ferry terminal at Cape Tormentine. This is an extension from Apr. 8. Noted Mar. 20.

+Char Fillers—St. Johns, N. B.—We are officially advised that the Atlantic Sugar Refineries, Ltd., of Montreal, Que., has awarded a contract to the PAYNE & SOUBERT MACHINERY & FOUNDRY CO., 258 Broadway, New York, N. Y., for furnishing 720 tons of cast iron char fillers at its plant which is now under construction at St., Johns, N. B. Robert S. Kent, Mechanics Bank Bldg., Brooklyn, N. Y., is the Consult. Engr.

+Drydock—Prince Rupert, B. C.—The U. S. STEEL PRODUCTS CO., 30 Church St., New York, N. Y., has been awarded the contract for the structural and reinforcing steel required for the construction of the drydock for the Grand Trunk Pacific Ry. Co., at Prince Rupert. The dock will cost $3,000,000.

BUILDINGS

Stratsford Springs, Vt.—Plans have been prepared by F. W. Stickney, Arch., 50 Hildreth Bldg., Lowell, Mass., for the construction of a hotel at Stratsford Springs. The estimated cost is $150,000.

Boston, Mass.—An eight-story mercantile building will be erected at 231 Friend St. A. R. Whittier, 15 Exchange St., is Agent.

+The contract for the erection of the Massachusetts Ante Club building at Stuart and Clarendon Sts., has been awarded to BENJ. FOX, 15 Exchange St.

Cambridge, Mass.—A building for the Harvard Coöperative Society will be erected in Harvard Sq. It will be three stories, of brick, and to extend from Palmer to Brattle Sts. Newhall & Bleones, 9 Park St., Boston, are Archs.

Clinton, Mass.—A state armory is to be built here by the State Armory Commission. The estimated cost is $60,000. Gardner W. Pearson is Adjt. Gen.

Holyoke, Mass.—A three-story brick building, 75x122 ft., is planned for the Knights of Columbus, at Suffolk and Chestnut Sts. Oscar Beauchemin, 30 High St., Holyoke, is Arch.

Leominster, Mass.—A town hall is planned, and a committee is soon to be elected to arrange for erection. P. H. Killelea is in charge.

Milford, Mass.—A $75,000 school building is in contemplation and a special town meeting will soon be held to consider the matter.

+Springfield, Mass.—Contracts for a six-story building at Worthington and Chestnut Sts. for the McIntosh Co. have been awarded as follows: Mason work, W. D. MACKENZIE; carpenter work, L. S. WOOD; cast iron, SPRINGFIELD FOUNDRY CO., all of Springfield, Mass., and structural steel work, BERLIN CONSTRUCTION CO., Berlin, Conn. The building will be of brick and steel, 101x52 ft. Noted Feb. 20.

Plans have been completed by Shattuck & Hussey, Archs., Chicago, Ill., for the construction of an eight-story 156x106 ft. Y. M. C. A. building, on Chestnut St. The estimated cost is $200,000.

Plans have been completed for a new railroad Y. M. C. A. building at West Springfield by Arch. G. Wilton Lewis, Boston Mass. It will be a three-story structure 72x126 ft. of brick. The estimated cost is $50,000.

Williamsburg, Mass.—Archs. E. C. & G. C. Gardner, 53 Lymon St., Springfield, Mass., have completed plans for a school house which Mrs. L. D. James will present to the town. It will be a two-story brick building, 106x70 ft. Rev. John Pierrepont is Chn. of building committee.

Newport, R. I.—Bids are being received by Horace Trumbauer, Arch., Land Title Bldg., Philadelphia, Penn., for the construction of a villa for Mrs. George D. Widener. The estimated cost is $250,000.

Bridgeport, Conn.—Plans have been completed by Frederick A. Cooper, 412 Meigs Bldg., for a theater and business building at State St. and Colorado Ave. for Vincent Bros. The building will be 116x60 ft., of brick, two stories high with the theater in the rear.

Derby, Conn.—A hotel will be built at Elizabeth and Fourth Sts. by a syndicate of Derby business men. It is the site of the old Bassett House which was destroyed by fire some time ago. Estimates are now being received for a building, 76x130 ft. of brick, four stories high. George H. Scranton, Conn., is Chn. of the Business Men's Committee in charge, and L. W. Robinson, 42 Church St., New Haven, Conn. is Arch.

Hartford, Conn.—Whiton & McMahon, Archs., 49 Pearl St., Hartford, are receiving estimates for a 20-room school to be built in the rear of Main St. for St. Peter's R. C. Society. It will be of brick, with sandstone trim, steel trusses and concrete roof, iron and slate stairways, and concrete, tile and composition floors. Rev. Paul F. McAlenney is pastor.

New Britain, Conn.—Plans are being drawn by Brazer & Robb, 1133 Broadway, New York, N. Y., for a church for St. Mark's of which the Rev. Harry I. Bodley is Rector. The structure will be brownstone. The estimated cost is $80,000.

New Haven, Conn.—An isolation pavilion will be erected at the New Haven Hospital on Davenport Ave. Plans have been completed by L. W. Robinson, 42 Church St., New Haven and estimates are being received. The building will be of brick and stone, 150x50 ft., three stories high, and of fireproof construction. An elevator will also be installed. The estimated cost is $100,000.

Waterbury, Conn.—The city is planning the erection of a 24-room school house at Division and Walnut Sts. Joseph T. Smith, 36 North Main St., is Arch.

Brooklyn, N. Y.—Plans are being prepared by W. S. Timmis, Engr., 1328 Broadway, New York, N. Y., for the construction of a six-story reinforced concrete warehouse, 100x75 ft., on Front St., for the Boorum & Pease Co., manufacturers of blank books, 109 Leonard St., New York, N. Y. The estimated cost is $100,000.

Brooklyn, N. Y.—Plans have been prepared by Shampan & Shampan, Archs., 772 Broadway, for the construction of a two-story theater, 108x98 ft. at Bath Ave. and 20th Ave., Bath Beach, for I. Nevick & Co.

Buffalo, N. Y.—Chas. R. Wilson and Philip S. Smith, 515 Mutual Life Bldg., contemplate the erection of a six-story brick building, 100x100 ft., at 331 Washington St.

Bids will be received until 11 a.m., Apr. 11, by Francis G. Ward, Comr. Pub. Wks., for the construction of a school building on Sears St. near Broadway.

✦Elmira, N. Y.—The contract has been awarded to BALENTINE C. SMITH, for the construction of the theater on State St., to replace the Amusu Theater.

Ithaca, N. Y.—The Lehigh Valley R.R. will erect a station at Ithaca. The estimated cost is $100,000. A. L. Roberts is Mech. Engr., South Bethlehem, Penn.

Lockport, N. Y.—Plans have been completed for the Court House addition and bids for construction will be received by the building committee of the Board of supervisors on Apr. 14. The estimated cost is $75,000.

Chester R. Phelps, Arch., Geuck Bldg., Niagara Falls, N. Y., has completed plans for the Niagara County Almshouse to be erected here. These have been approved by the State Board of Charities. Bids will be asked about Apr. 15. The estimated cost is $75,000.

New York, N. Y.—The George A. Plimpton Co., 70 Fifth Ave., is having plans prepared by Charles A. Rich, Arch., 320 Fifth Ave., for the construction of a 13-story office building, 125x26 ft., at Fifth Ave. and 13th St.

Plans have been filed by George Weister, Arch., 12 West 31st St., for the construction of a twelve-story loft and a three-story theater building at Broadway and 37th St., for the Times Square Improvement Co., World Bldg. The estimated cost is $350,000.

Plans have been filed by Neville & Bagge, Archs., 217 West 125th St., for the construction of a 12-story loft building at 329 Fourth Ave., for the Polo Construction Co., 1133 Broadway. The estimated cost is $200,000.

Plans have been filed by Neville & Bagge, Archs., 217 West 125th St., for the construction of a nine-story apartment house, 85x68 ft., on the south side of 81st St., east of Amsterdam Ave., for the Wesley Realty Co., 135 Broadway. The estimated cost is $175,000.

Plans have been filed by Brown & Almiroty, Archs., 220 Fifth Ave., for the construction of a 12-story store and loft building, 88x40 ft., at 130 West 29th St., for the 130 West 29th St. Co. Inc., 160 Broadway. The estimated cost is $150,000.

George F. Johnson, 165 Broadway, has purchased property at 77th St. and Park Ave., and will have plans prepared for the erection of a 12-story apartment house, 102 x155 ft., upon the site. The estimated cost is $700,000.

Niagara Falls, N. Y.—The Niagara University contemplates rebuilding the alumni building on Main St., recently destroyed by fire. The estimated cost is $100,000. Very Rev. E. F. Likly C. M., is Pres.

Oswego, N. Y.—The Board of Education contemplates the erection of a high school. The estimated cost is $250,000. M. T. Crimmins is Pres.

Rochester, N. Y.—George Eastman has donated $250,000 for a Y. M. C. A. building. An additional $500,000 will also be raised for the construction of the building.

Syracuse, N. Y.—Bids will be received until Apr. 21, by Secy. Halloran, of the Bd. of Contract & Supply, for enlarging the Elmwood School.

Bids will be received until May 5, by the Board of Education, for the construction of the Genessee School.

Bids will be received until Apr. 28, by the Board of Education, for enlarging the Bellevue Heights School.

Camden, N. J.—The City Council has authorized a bond issue of $200,000 for the erection of new schools, the acquirement of sites therefor, and for enlarging and improving existing public schools where necessary.

Hoboken, N. J.—A fund of $100,000 has been donated by citizens to St. Mary's Hospital, Willow Ave., for the erection of an additional wing to its present structure.

Newark, N. J.—We are officially advised that bids will be received in about two weeks, by Irving C. Hooper, Arch., 118 Market St., for the construction of a new public market at Mulbery, Commerce and Broad Sts. The estimated cost is $500,000. Noted May 6.

The Pennsylvania R.R. Co. will erect a freight station on River St. The building will be one-story, 46x225 ft. A. S. Vogt is Mech. Engr., Altoona, Penn.

New Brunswick, N. J.—State Arch. George S. Drew, Trenton, is preparing plans for a State College building to be erected here.

✦West Hoboken, N. J.—The contract has been awarded to E. C. HOLTN SONS New York, by the Rex Amusement Co. for the erection of a theater at Courtland St. and Summit Ave. The estimated cost is $125,000.

Derry, Penn.—Bids will be received until 7:30 p.m., Apr. 24, by J. H. Patterson, Secy., of School Bd., for the construction of a brick school building at Derry. W. G. Eckles is Arch., New Castle, Penn.

Marysville, Penn.—Bids will be received until 7 p.m., Apr. 14, by John L. Hain, Secy., School District Marysville, for the construction of additions to the Maple Ave. school. Hauer & Mowers are Archs., Philadelphia, Penn.

✦New Kensington, Penn.—William Edward Snaman, Arch., Empire Bldg., Pittsburgh, awarded to H. S. WHITE the contract for rebuilding the three-story terra cotta and hollow brick bank building for the First National Bank. Cost, $50,000. Noted Dec. 4.

✦Oil City, Penn.—The contract for the construction of the Y. M. C. A. building at Federal and North Seneca Sts. has been awarded to MEALS & JOHNSTONE, Oil City, at $71,-278.

Philadelphia, Penn.—Plans have been filed by William H. Hoffman, Jr., for the construction of a 2-story office building at 1426 South Penn Sq. for the Finance Co. of Pennsylvania.

✦The contract has been awarded to CRAMP & CO. Walnut and 4th St., Philadelphia, Penn., for the construction of the 17-story apartment building at 19th St. and Rittenhouse Square, for a syndicate headed by Samuel Wetherill. Noted Feb. 20.

Pittsburgh, Penn.—The Committee on Property and Supplies of the Board of Education has approved the site at Ruth, Eureka and Harwood Sts., for the South Hills High School. The estimated cost of the building is $300,000.

Pittsburgh, Penn.—The Board of Trustees of the Carnegie Institute have approved plans for the enlargement of the women's school of the Carnegie School of Technology, this action following one day after the new gift of Andrew Carnegie of $1,000,000 had been announced. There will be spent on the women's school $250,000, the work to be beugn soon.

It is probable that the plans for the new Masonic Temple, to be erected in Schenley Farms, will be completed by Janssen & Abbott, Arch., by May 1. The building will be a four-story stone, brick and terra cotta structure, 210x200 ft., with stone foundations and Spanish tile roofing, marble, hardwood floors, etc. The building alone will cost about $900,000. Noted Mar. 27.

J. A. Giesey, Arch., 514 Smithfield St., has plans in progress for a four-story brick laboratory to be constructed in O'Hara St., for the University of Pittsburgh. The estimated cost is $150,000.

Scranton, Penn.—E. H. Davis, Arch., Connell Bldg., has prepared plans for an addition to the Central High school. The estimated cost is $135,000.

Uniontown, Penn.—The Uniontown Methodist Episcopal Church congregation is having A. P. Cooper, Arch., prepare plans for a stone edifice, 85x138 ft. Bids will be asked about May 1. The estimated cost is $125,000.

The Board of Education is having plans prepared by Vrydaugh & Wolfe, Archs., Pittsburgh, for the construction of a school building at Stanton Ave. and Meadow St. The estimated cost is $250,000.

Wilmington, Del.—The lowest bidders for the construction of improvements to St. Paul's church were John E. Healey & Son.

✦Richmond, Va.—The contract has been awarded to the WISE GRANITE CO., Richmond, Va., at $74,780, for the construction of the school at 28th and Lehigh Sts. Other bidders were: Jas. Fox & Son, $74,987; E. C. Woodward, $82,000; A. M. Walkup, $90,525; J. T. Nuckoes, $76,987; J. T. Wilson, $84,450.

Berea, Ohio—Bids will be received until noon, Apr. 29, by J. S. Simpson, Clk., Bd. of Education, for the construction of a high school. Badgley & Nicklas, are Archs. 6110 Euclid Ave., Cleveland.

Cleveland, Ohio—Bids will be received until noon, Apr. 28, by Frank G. Hogan, Dir. of Schools, for the construction of a school building on Castlewood Ave., E. 123d St. and Chesterfield Ave.

Milwaukee, Wis.—A. C. Eschweiler, Arch., has completed plans for the construction of an edifice at Summitt and Hackett Aves., for the Plymouth congregational church. The estimated cost is $60,000.

✦Mankato, Minn.—The contract has been awarded to the J. E. NELSEN CONSTRUCTION CO., for the construction of the German Lutheran church at Spring and Second Sts.

Minneapolis, Minn.—Plans have been approved by the Board of Trustees, for the construction of a four-story, 40x90-ft. annex to the Swedish Hospital. The estimated cost is $65,000.

Dallas, Tex.—Bids will be received until Apr. 25, by G. K. Jorgensen, Calveston, Tex., for the construction of a theater, 50x100 ft. The estimated cost is $50,000. I. A. Walker, 901 Southwest Life Bldg., is Arch. Noted Apr. 3.

✦Phoenix, Ariz.—Arizona capitalists will organize a corporation for the purpose of erecting a seven-story reinforced-concrete hotel in Phoenix. The estimated cost is $450,000.

✦Phoenix, Ariz.—The contract for the construction of the church for St. Mary's Church has been awarded to the GEORGE H. GALLEGHER CONSTRUCTION CO.

Tacoma, Wash. The Board of Directors of Tacoma School District No. 10 will receive bids until Apr. 30, for the erection of the Lincoln Park high school on South G. St. between South 36th St. and Columbia Ave. Heath & Gove National Realty Bldg. are Archs.

✦Portland, Ore.—The contract has been awarded to the BAJOHN ARNOLD CO., Wilcox Bldg., for the construction of a reinforced concrete building at Third and Alder Sts. Noted Apr. 3.

✦The Pacific States Telephone & Telegraph Co. has awarded the contract for the steel work of an eleven-story telephone exchange and office building to the POOLE-DEANE CO. Noted Jan. 16.

✦The contract has been awarded to the HURLEY-MASON CO. Board of Trade Bldg., for erecting a four-story concrete apartment building for Harry Howard 415 Lumber Exchange Bldg. Fred F. Allerton is Arch.

Los Angeles, Calif.—Archs. Hunt & Burns, Story Bldg., have awarded the contract to J. F. ATKINSON at $45,000, for the construction of a five-story ? brick office and store building on Hill St. for Edward D. Silent.

Oakland, Calif.—Bids will be received until Apr. 21, for the construction of a two-story and a three-story reinforced concrete school building to cost about $650,000. A. L. Hanaford is Secy. of the Bd. of Education and J. J. Donovan, Security Bank Bldg. is Arch.

✦San Francisco, Calif. The following bids were opened for the pile foundation for the Transportation Building, which is to be erected on the Harbor View site for the Panama-Pacific International Exposition Co. Bids were opened by the Buildings and Grounds Committee. Figures were asked for on a unit price per lineal foot. The total amount of piling to be furnished is 205,000 lin.ft. The following bids were received. Pile Foundation Work: Foster-Voight Co., $0.26 3-8 per lin.ft.; J. Mott, $0.26 per lin.ft.; Pacific Construction Co., $0.24 3-8 per lin.ft.; Contra Costa Construction Co., $0.24 7-19 per lin.ft.; HEALY-TIBBITS CONSTRUCTION CO., $0.24 3-10 per lin.ft. (awarded contract.) Mercer-Fraser Co., $0.24 9-10 per lin.ft.; P. Rolandi, $0.29 7-8 per lin.ft.; Hyde-Hodges Co., $0.26 per lin.ft

Engineering News

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The South Eighth Street Viaduct, Allentown, Penn.

One of the most notable of the many large reinforced-concrete viaducts which are now being erected in this country is the South Eighth St. viaduct, which crosses the valley of the Little Lehigh River between the main portion of the city of Allentown, Penn., and the 12th ward, formerly known as South Allentown. A bridge at this location was projected as early as 1900, and in 1901 the foundations for a steel viaduct were laid and the contract let for the fabrication of the steelwork itself. Financial difficulties set in soon after, however, and the work was never continued. In 1911 the Allentown Bridge Co. was organized to take over the property of the old Allentown and South Allentown Bridge Co., which had projected the earlier bridge and in connection with the Lehigh Valley Transit Co., an interurban line running between Allentown and Philadelphia, financed the present viaduct. This new structure is to carry the heavy interurban trains of the transit company and is to provide also a highway toll crossing. The erection of so large a bridge as a commercial undertaking is out of the ordinary at this time.



FIG. 1. REINFORCED-CONCRETE VIADUCT ACROSS VALLEY OF LITTLE LEHIGH RIVER, ALLENTOWN, PENN.
[From architect's perspective.]

The viaduct connects South Eighth St. in Allentown to South Ninth St. in South Allentown, and deviates only slightly from a straight line connecting the termini of these streets at the valley. It crosses a valley about 125 ft. deep at its deepest part, through which runs the small stream known as Little Lehigh River, and the tracks of two railroads, as well as a number of city streets.

The viaduct, inclusive of approaches, is 2600 ft. long, the main part of which is made up of nine 120-ft. clear span arches and eight 52½-ft. girder spans arched for architectural effect. It carries a 32-ft. roadway, with two 7-ft. sidewalks, on a negative 8% grade which eases off into a positive 2.6% grade at the south approach.

MAIN ARCHES—The main arch spans are made up of two approximately semicircular arch ribs, spaced 26 ft. on center, 8 ft. wide, 4 ft. deep at the crown section, and about 11 ft. deep at the springing line. These ribs are each surmounted by spandrel walls extending over their full width and carrying longitudinal spandrel arches, and transverse semicircular arches upon which the floor slab rests. These transverse arches and the floor slab itself furnish the necessary bracing to the arch ribs. The sidewalk slabs overhang the parapet walls 5 ft. The details of one of the large arches are shown in Fig. 2, and a view underneath the arch in Fig. 5.

GIRDER SPANS—The short spans are 52½ ft. between faces of abutments, and consist each of four longitudinal reinforced-concrete girders in arched form. The details of the design are shown in Fig. 2. The main point of interest is that the floor slab was designed as a part of the compression flange making up the T-section, of which the girders form the web. Over these smaller arches, the sidewalk and balustrade overhang only 2 ft.

PIERS—The piers supporting the main arches are formed of two separate monoliths, one to each arch rib. These piers extend to bedrock and rise as single solid pedestals to the arch skewback, above which elevation a pilaster of hollow construction with 2-ft. walls is built to support the spandrel arches. The piers are spaced 18 ft. apart transversely for the 120-ft. span (Figs. 3 and 6).

The piers and abutments supporting the 52½-ft. girder span are of cellular construction, having 3-ft. walls in the longitudinal direction carried down to rock, and connected in pairs transversely by curtain walls 1½ ft. in thickness, extending just below the ground line so that they may brace properly the slender piers and add to the massive appearance of the combination. The smaller piers are braced by transverse arches in the same manner as the larger piers.

This arrangement of separate pedestals for each rib of the arches leaves a longitudinal opening on the line of the bridge, so that the view from either end is that of a long arcade. This general impression is shown well in Fig. 5. The old piers which were placed for the 1901 bridge were not utilized in the construction, but the abutments which were then built of stone masonry were utilized for a portion of the extreme abutments to the new bridge.

EXPANSION—The short spans are arranged in groups of two, separated by a wide pier on both sides of which expansion joints are placed. In the large spans, alter-

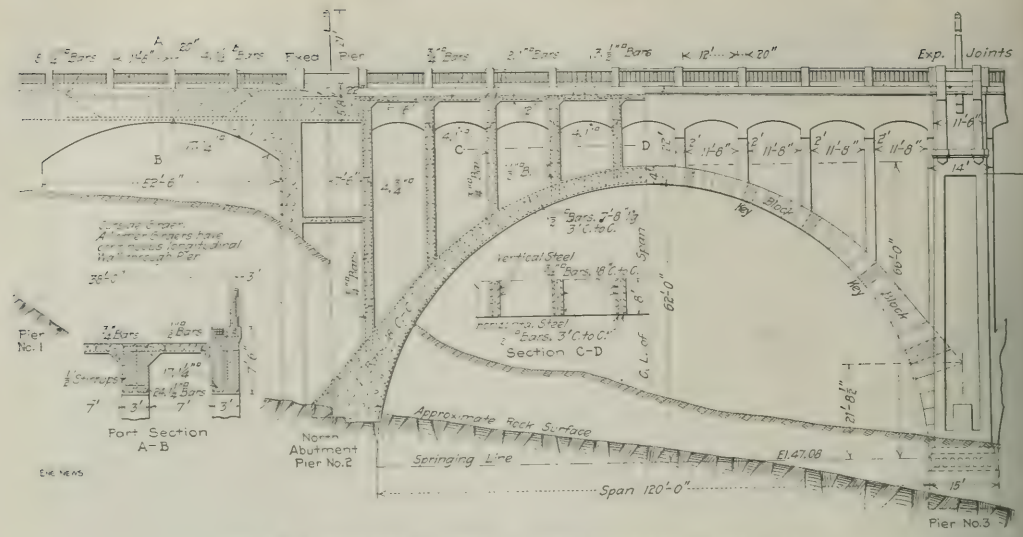


FIG. 2. DETAIL OF A 52½-FT. GIRDER SPAN AND A 20-FT. ARCH

nate piers are made expansion and fixed with somewhat different construction in the floor slabs, and in the upper parts of the pier.

At the expansion piers the floor slab across the pier is lowered so that the slab on the adjoining arch may slide upon it and small I-beams or old rails are placed at the upper portion of the pier slab and the lower portion of the span slab to form a grillage upon which the two slabs may slide.

In Fig. 3 sections through a fixed and an expansion pier are shown, and the difference in construction of the two piers made clear. It may be noted that the longitudinal spandrel arches are included in the expansion joint, and that they rest on a bench cut out of the main vertical wall of the pilaster of the pier.

ROADWAY—The roadway of the bridge is to be of vitrified brick laid on the regulation sand cushion and concrete base which is to be placed (Fig. 3) on a broken stone fill. The whole roadway is to be carried on the flat reinforced-concrete slab noted above. The street car tracks are to be laid on the ballast. The roadway is to be waterproofed with a patented waterproofing felt, according to the following specifications:

The waterproofing shall consist of four layers of felt applied as follows:

(1) A coating of asphalt compound of not less than 5 gal. to the square.

(2) Four layers of felt, or their equal, weighing not less than 14 lb. per square, placed on the compound while hot and each layer mopped with compound when laid.

(3) A final coating of hot compound protected by 2 in. of concrete.

The railings, balustrades and trolley and light posts are to be ornamental concrete, with a bush-hammered surface and with bronze fittings.

Under the sidewalk the proper conduits for wires and pipes are provided.

LOADS.—W. J. Watson's "Specifications for Class E Bridges" were followed both as to assumed loading and allowable working stresses in steel and concrete.

CONSTRUCTION

At the beginning of the work a low heavy trestle was laid along the center line of the bridge for the distance covered by the 120-ft. arches. On this trestle a track was laid upon which were run two heavy lo-

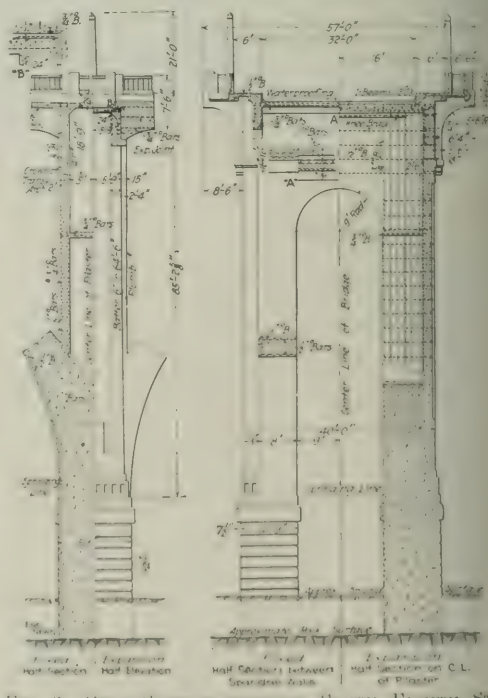


FIG. 3. CROSS-SECTION THROUGH SOUTH EIGHTH ST. VIADUCT, SHOWING PIER AND ROADWAY DETAILS



FIG. 4. UNDER SIDE OF A GIRDER SPAN



FIG. 5. LOOKING UNDER AN ARCH SPAN

comotive cranes. These cranes were used for all the work in constructing the piers up to a point about 25 ft. above springing line. They are used in excavating the pier sections, in building the monolithic section of the pier, and on account of their extreme strength and boom length were also used in the higher part of the pier work. One of these cranes at work is shown in Fig. 6.

To the east of the bridge there was erected at the same time a light trestle, shown also in Fig. 6, upon which run flat cars drawn by locomotives, which trains were used in bringing concrete and lumber to the piers and in removing all excavated material.

The concrete for the middle or main section of the bridge was mixed at a large central mixing plant located about the middle of the bridge, and equipped with a 2-cu.yd. mixer. All material was brought in by rail on a spur track from the main-line railroad which runs down the valley.

A clam-shell bucket, operated by a large stiff-leg derrick, unloaded the sand and broken stone from the cars into storage piles and was used to elevate these materials into the bins above the mixer. The cement was conveyed from the cement house to the elevated mining platform by means of a belt conveyor.

After the piers were completed to the point shown in Fig. 6, large 80-ft. derricks were mounted on steel towers resting on timbers spanning the opening between the two sections of each pier, Fig. 8, and the further work of construction, including a large part of the floor slab, was carried on by means of these derricks taking material from the light trestle along the east side of the bridge.

The final operation in the erection of the main spans was carried on by a traveling derrick moving along the completed portion of the floor system.

At the same time work was going on at the large arches, the construction of the piers of the approaches was being carried on by hand labor, assisted by portable mixers, which could be moved from one part of the work to another. At the south approach a wooden tower elevator, shown on the extreme right of Fig. 8, was erected to elevate the concrete to the floor level of the approach.

CENTERING—For the nine 120-ft. arches three full sets of steel arch centers were used, using each set for three of the arches.

Each set of centers consisted of two independent-trussed arches of the outlines shown in Fig. 7, each arch supporting one of the twin concrete arch ribs and being itself made up of two steel arch ribs interbraced with steel struts. Across the upper chords of these steel ribs, which were curved to the curve of the concrete arch, was

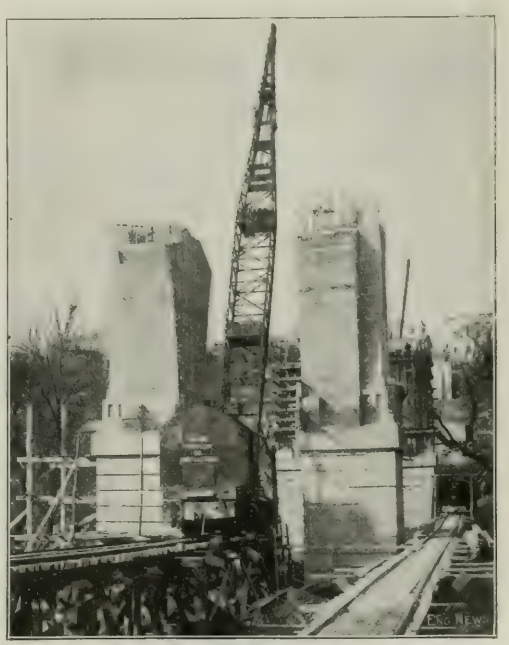


FIG. 6. PIER UNDER CONSTRUCTION, SHOWING TWO LINES OF CONSTRUCTION TRACKS

bolted the wooden lagging on which the concrete was deposited. The twin centering arches were held together by a timber cross-beam and diagonal steel rods.

The arch trusses were fabricated in six sections and riveted on the ground into semi-arches, which were lifted by derricks into place, to be bolted at the base to the supporting columns. At the crown it was riveted solidly in the bottom chord, but bolted through slotted holes at the upper chord, to insure the stress passing through the lower chord.

The centers were supported on inclined steel columns (Fig. 7) which footed on concrete steps purposely projected from the main section of the pier, and cut off after the centers were struck. The base plates of the columns rest on cast-iron wedges which in turn rest on I-beam grillages footing on the aforementioned concrete projection. Between the column base and the projection, 10-ton screw jacks are interposed to aid in the alignment and leveling of the centers; they are allowed to remain in place, though the load passes directly to the wedges, which are used for striking centers. A U-shaped clamp, made of a 1-in. bolt (not shown in the drawing), is passed around each pair of wedges to prevent any possible lateral motion. A similar bolt is used for the same purpose higher up on the main column.

The 52½-ft. spans were built on wooden centers of the usual design. Four sets were provided, each set being used twice.

CONCRETING—For the large arch spans the concrete was laid in alternate voussoirs of wide blocks and small keys in the order shown in Fig. 2. The large voussoir blocks were placed in pairs symmetrically distributed over the steel centering so that uniform loading might be carried down to the piers. All blocks were allowed to set seven days before the keys were poured. The work was carried on over three arches simultaneously, thus utilizing the three steel centers as described above. In order to care for any unbalanced stresses which might

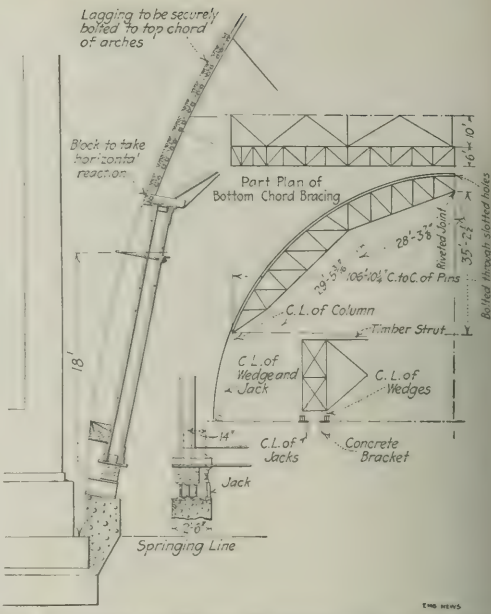


FIG. 7. DETAILS OF STEEL CENTERING, SOUTH EIGHTH ST. VIADUCT, ALLENTOWN, PENN.
(Designed and fabricated by the Blaw Steel Construction Co.)

come to the piers the third, sixth and ninth piers were each enlarged slightly at their footing, so that the unbalanced load would not affect their stability.

The centers for the large arches were struck 28 days after concreting the key sections. No appreciable deflection was noted in any of the spans. After the arch centers had been struck and the forms removed to the next



FIG. 8. VIEW OF ALLENTOWN VIADUCT UNDER CONSTRUCTION

set of arches, construction was started on the spandrel walls of the arches already completed.

In the smaller spans the girders were concreted as a monolith and continued over one intermediate pier. This at times required night work.

Materials—All the reinforced-concrete slabs, girders and main arch rings were made of 1:2:4 concrete, the broken stone passing a 1-in. ring. The remaining part of the work was made of a 1:3:5 concrete, made up of crushed rock, sand and broken stone passing a 2½-in. ring. The use of rubble concrete was permitted in the large masses of the main piers, but the contractors did not avail themselves of this privilege except in a very few instances. All reinforcement was made up of square corrugated bars.

Surface Finish—A smooth troweled finish was given to all sidewalk areas. The main portion of the bridge is to receive a carborundum rubbed finish, and the balustrades, posts, railings, lamp-posts and trolley poles are to be made of a special granolithic concrete, which is to be bush-hammered or tool dressed.

Personnel—W. W. Wysor, Chief Engineer of the Allentown Bridge Co. and of the Lehigh Valley Transit Co. is in charge of the construction of the viaduct, B. H. Davis, Consulting Engineer, New York City, prepared the plans and specifications for the structure and is acting as consulting engineer during its construction. The contract was let to the McArthur Bros. Co. of New York for $306,000, exclusive of the cement, which is furnished by the owners. About 40,000 barrels of cement is expected to be used on the contract. The contractors are represented in the field by F. C. Cullen of the contracting firm of Cullen & Freistedt, of Chicago. The steel centers were designed and fabricated by the Blaw Steel Construction Co., of Pittsburgh, Penn.

Construction was begun July 1, 1912, and the contract calls for the completion of the viaduct by Nov. 1, 1913, but present progress seems to promise an earlier opening.

❖

A Novel Plan of Collecting Fine Dust from a Copper Reduction Plant

In the Feb. 13 "Bulletin of the Institution of Mining and Metallurgy," there is published a series of interesting papers (the first of them by Dr. Jas. Douglas of Phelps, Dodge & Co., New York City) describing the conditions and methods of work employed at the Copper Queen mines in Arizona. Among other features, there is described a mechanical difficulty which was encountered in the reduction process at the Douglas (Ariz.) plant, and methods of overcoming it.

The smelting operations at this location have been carried on exclusively in blast furnaces, and the charge has been difficult to treat because of extreme fineness, the disintegration of pyrites and clay ores and of the fine concentrates, making great quantities of dust. The metal loss from the escape of this dust with the smoke and flue gases was discovered through the fact that the metal loss in the slag by analysis failed to cover by an appreciable amount the known total loss as determined by ore analyses.

To investigate the amount of metal loss in the smoke, an 8-in. pipe was run to the top of the stack, then over and down a short distance, and arrangement was made for the placing of the inlet at any point from the center to the side. The lower end of this pipe was connected to the intake of an exhaust blower, discharging through woolen bags. The fan speed was so regulated that the velocity of gases at the inlet to the pipe was the same as the velocity in the stack.

At first the amount of dust collected was small because the cloth was not of fine enough weave, but using very finely woven material a surprising amount of dust was recovered. It was later determined that 90% of this dust would pass a 200-mesh screen. Repeated experiments were made varying the conditions of draft, and of the number of furnaces in operation and it was found that between 0.06 and 0.16% by weight of the smoke consisted of dust, which contained approximately 9% copper, 8% lead and 5% zinc. The next problem was to devise a practical way to settle this dust on a commercial scale.

The method of bag filtration was eliminated from consideration because of the weakness of the fabric and of the quantity of smoke to be handled, over 1,000,000 cu. ft. per min. The experiment was then tried of passing the smoke at low velocities through a chamber of large cross-section, and it was found that, at velocities of 150 ft. per min. or less, the very fine dust would settle in comparatively short distances, and also that with transverse wire screens at 3 ft. intervals equally good results were obtained at twice that velocity, so that the cross-section of the chamber could be reduced.

Similar experiments to the above were conducted on the converted smoke. From 0.015 to 0.035% by weight of this smoke was found to consist of dust, containing about 4.5% copper, 16% lead, and 10% zinc.

The dust chamber mentioned above was designed with a steel frame and with floor, walls and ceiling of hollow tile. The wire screens were so placed that there were at least 10 obstructions to any passage through the chamber. No exact data are yet available as to the efficiency of this method of removing dust from the flue gases, but it is known that the greater proportion of the dust is removed.

Having removed the dust, in large measure, the next difficulty was to provide a way to get this dust in such shape that it could be handled and treated in the furnace. After extended experiments, a device was hit upon for mixing the dust with molten converter slag. A mixing tank of sheet-steel, with a cast-iron lining, and in shape a truncated cone with axis horizontal, is supported on riding-rings which turn on rollers with a movement similar to that of a barrel type converter. This mixer is turned by a chain and sprocket secured to the outside of the drum. The molten converter slag, poured from a ladle, and the flue dust, delivered by a pipe from the storage tank, are fed together into the small end of the cone, which revolves about five times a minute. By this action the slag and dust are rolled together making a porous, lumpy mixture admirably suited to blast furnace work. Control of the rates of flow of slag and dust and of the speed of the drum are brought to one position facing the large end of the cone. In this way one man is able to handle the mixing process. The proportions of slag and dust and the drum speed are determined by the operator's judgment as to the character of the finished mixture, which is in plain sight from the control position.

The 40,000,000-Gal. Direct-Acting Explosion Pumps at Chingford, England*

At the time H. A. Humphrey described his design of direct-acting internal-combustion pumps before the British Institution of Mechanical Engineers (see ENG. NEWS, Dec. 2, 1909) the Metropolitan Water Board (for the London district) was building a large reservoir at Chingford, where some 180,000,000 gal. a day were to be raised 25 to 30 ft. from the River Lea. On account of drainage works in the upper valley, the floods are now higher than before and of shorter duration; therefore, to impound the desired proportion of the waters, powerful pumping equipment is necessary. The Board had expected to use centrifugal pumps on account of low first cost and in spite of their low efficiency. The invention of Mr. Humphrey proved attractive to the Board on account of the very low first cost and high efficiency (Prof. Unwin had reported a record of 1.06 lb. coal per pump horsepower-hour). Tenders were invited for these explosion pumps in competition with centrifugal apparatus and, when opened, it was found that the cost for four 40,000,000-gal. and one 20,000,000-gal. pumps together with the gas producers, etc., was $95,000 less than for triple-expansion steam-engine centrifugal pumps. The fuel consumption was guaranteed to be not over 1.1

*In part from London "Engineering," Feb. 14, and the "Engineer," Mar. 14, 1913.

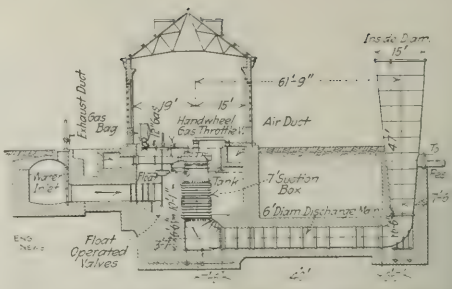


FIG. 1. CROSS-SECTION OF CHINGFORD PUMP HOUSE, SHOWING HUMPHREY EXPLOSION PUMP

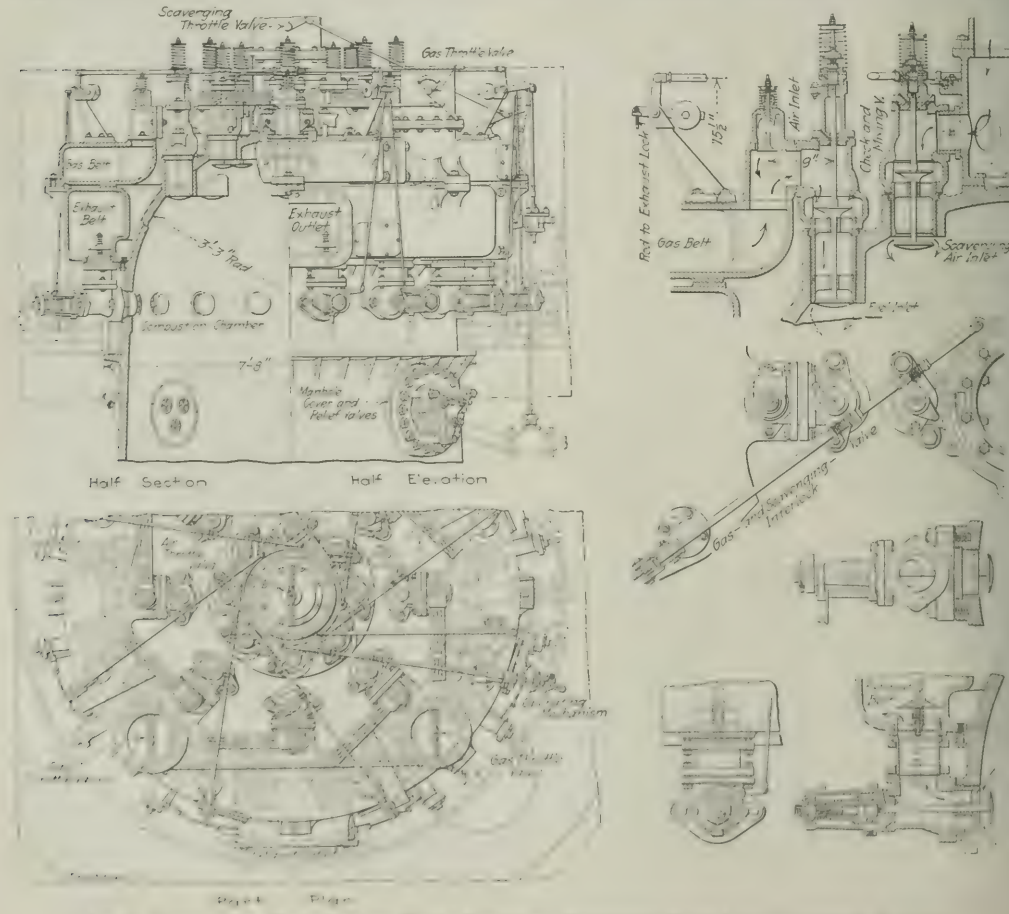


FIG. 2. COMBUSTION CHAMBER AND VALVE DETAILS, HUMPHREY PUMPS AT CHINGFORD STATION

lb. of anthracite per pump horsepower-hour (in gas producers) with a penalty of $5000 for each $\frac{1}{10}$ lb. in excess of that rate. The fuel consumption for the steam plant was estimated at from two to three times that. A penalty of $100,000 was also accepted for failure to provide a successful plant. The pump horsepower is about 250 for a large unit and 125 for the small one. Each is reported designed for about 25% overload capacity.

It will be recalled that this type of pump consists essentially of a U-tube with legs of unequal length. The short leg is connected near the bottom, to the source of supply and the long leg some ways above the bottom, to the higher reservoir. The closed top of the short leg forms the explosion chamber and has air- and gas-inlet valves and a scavenging valve. Admission check valves for the water are provided in this leg below the natural-supply level. A charge of gas and air trapped above the water in the short leg is ignited by an electric spark and this sets the water column in motion. The momentum of the column causes the water to flow until the pressure in the combustion chamber is reduced to atmospheric or lower, when the exhaust and scavenging valves and the water-inlet valves open. The lower part of the leg fills up with water and a pocket of pure air fills the top (above the spent gases). The water remaining in the high leg soon forces the U-column backward, expelling the spent gases through the exhaust valves which are then closed and locked so that the air in the top is compressed. On the following forward surge of the water column, the air and gas inlet valves open admitting a new charge of fuel. The water surges back the second time, compressing the charge and this completes the cycle of operations as the new charge is ignited.

The Chingford pumps differ from the early types by having in place of the large single admission, scavenging and exhaust valves, a number of small ones. A section through the explosion chamber of one of the 40,000,000-pumps is shown in Fig. 2. The chamber is surrounded with a gas-belt casting and, below this, an exhaust-belt.

The 8 inlet and 16 exhaust valves open communication with the gas and exhaust pipes respectively. An air inlet valve fitted with a silencer is fixed to the passage between the gas-belt and the fuel inlet valve of the chamber; a check valve serves to complete the mixing and prevents the backward passage of spent gases under explosion pressure. The eight scavenging valves are connected to a central air box on the top of the chamber, and this is connected to an air duct (Fig. 1) which may be kept under a pressure of $\frac{3}{4}$ to $1\frac{1}{2}$ lb. per sq.in. if overload capacity is needed (permitting use of a richer mixture).

The scavenger and gas valves are interlocked by catches and rods (Fig. 2). These eight rods are coupled to an oscillating ring which is moved by a relay connected to the water in the pump chamber. At the pressure rise due to the first return of the water column, the relay shifts the ring and moves the rods in the direction shown by the arrow in Fig 2, locking the scavenger valve by moving in an attached lever but unlocking the gas valve by moving out its attached lever; by a 90° bell crank and rod attachment the exhaust valve is also latched. On the second forward surge of a cycle, then, only the gas inlet can open. On the return surge (compressing the charge) the relay shifts the ring and rods to lock the gas inlet and to unlock the scavenger and exhaust valves so that they may open after the initial surge of the column.

The springs of the exhaust valve are adjusted so as to tend to hold it open while the springs on the scavenging valves would hold them closed. To prevent drawing back spent gases on the scavenging surge, a light check is fitted between the exhaust valve and the belt casting. To prevent hammering of the exhaust valves, the tail ends of the valve spindles project into dashpots. Water enters these chambers from a low-pressure ring line carried around the explosion head but is shut off by a small poppet on the end of the spindle, when the valve is nearly closed. The water trapped in the dashpot can escape only through a small hole and the seating blow is cushioned.

The ignition system has 16 spark plugs encircling the dome head of the explosion chamber and these are connected to induction ("trembler") coils. Current is supplied by storage batteries under the control of a make-and-break device operated by the compression stroke of the water column.

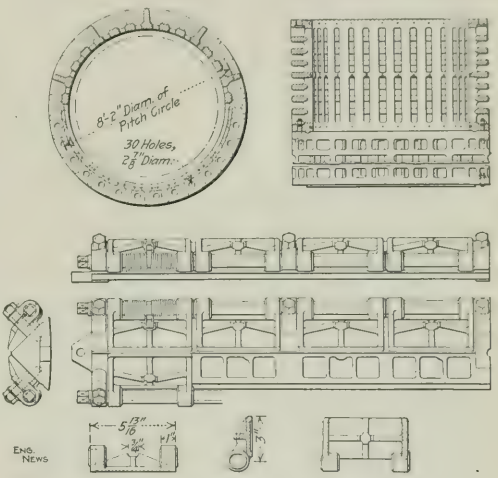


FIG. 3. WATER SUCTION BOX AND VALVES, CHINGFORD PUMPS

As may be seen from Fig. 1, the suction-valve box supports the combustion chamber and is in turn supported on a cast-steel pipe elbow and frame. The suction box is 7 ft. in diameter but the discharge elbow tapers its bore from 7 ft. to 6. Simple vertical flap valves are placed inside the box at the ports. Details of these are shown in Fig. 3. Each box stands submerged in an open pit which communicates with the intake canal by a cast-iron pipe 5 ft. in diameter. Sluice valves shut off each pump pit from the canal and a working platform surrounds each pump head. From a point about 23 ft. above the discharge main, a 4-ft. pipe discharges through the reservoir wall just above water level into baffle chambers in the reservoir.

A continuous stream is delivered from the outlet pipes, due to the steadying effect of the water towers. At first there was some splashing in these water towers but this was stilled by floating a wooden raft in each.

The first large unit was started up slowly but the sec-

ond was brought from cold condition to full load in 4½ min. after the initial explosion; the third unit was started in 3 min. and the last two in 2 min. This is claimed to be a record for first starts in power apparatus. At starting, the combustion chamber and play pipe are full of water up to the level of the penstock chamber; a mixture of gas and air is pumped into the explosion head and fired by hand closing of the ignition circuit. The resulting impulse sets up sufficient movement of the water column so that the pump drops into normal operation and soon assumes its regular period (nine cycles per second in this case).

The pumps have not yet been tested but it is reported that there is "ocular demonstration" that the pumps exceed the contract requirements as to capacity.

The designs shown above were made by the Pump & Power Co., of London, under direction of H. A. Humphrey; the units were built by Siemens Bros. Dynamo Works. Much credit is being given locally to W. B. Bryan, Chief Engineer of the Metropolitan Water Board for his initiative in this notable application of a novel form of prime mover.

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New Sedimentation Basin in Georgetown Reservoir, District of Columbia Water-Supply

The water-supply for the District of Columbia is taken from the Potomac River at Great Falls, about 18 miles above the center of the city, and passes through a conduit to its first storage at the Dalecarlia Reservoir, about 5 miles north of the city. After passing through this reservoir it goes into the Georgetown Reservoir just north of Georgetown, from which place it is taken by pipe line under the city to the new filtration plant just to the northeast of the city limits. The Potomac River water is very apt to be quite muddy, so muddy, in fact, that the ordinary processes of the slow sand filters will not remove the sediment. On this account in 1910 money was appropriated to construct a coagulating plant located between the Dalecarlia and the Georgetown reservoirs. As an adjunct to this plant it became necessary to provide in the Georgetown Reservoir a sedimentation basin, in which the coagulent could do its work. This reconstruction of the Georgetown Reservoir is described in the March-April number of *Professional Memoirs, Corps of Engineers and Engineering Department at Large*, in an article by Lieut. J. J. Bain, Corps of Engineers, U. S. A. From that article we have made the following abstract:

The Georgetown Reservoir is in shape almost a rectangle approximately 2250 ft. long and 850 ft. wide. Its area is about 42 acres. As originally designed, the reservoir was to have been divided into two sections, the upper containing about 24 acres and the lower about 18 acres. This provision was to have been made by an embankment, the top of which was to be at an elevation 2 ft. lower than the ordinary surface of water in the reservoir. According to this design, the upper section would have become a sedimentation basin and the lower section a storage basin where the pure surface water, flowing in a thin stream over the top of the dividing embankment, would be stored until drawn off from the opposite end of the lower section for consumption. As built, however, the dividing bank of the reservoir was made to the full height of the outside bank and a narrow cut lined with masonry and fitted with stop-plank openings was left in the middle of its length. Through this cut a 48-in. cast-iron pipe line was laid beneath the bottom of the lower section to the effluent gate-house. According to this arrangement, water could be drawn from the lower section after having passed through both sections, or it could be drawn direct from the upper section through the cast-iron pipe without passing through the lower section.

This arrangement served admirably for a number of years, but as the consumption of water in the city increased, the draft through the middle opening of the dividing embankment became so great that the greater part of the water which reached the city's mains was drawn in a comparatively narrow stream straight from the upper influent to the middle gate and then straight to

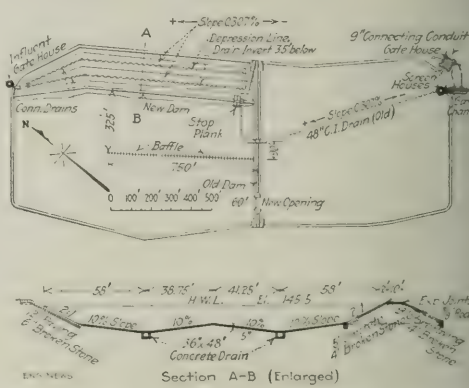


FIG. 1. PLAN OF REBUILT GEORGETOWN RESERVOIR, WASHINGTON, D. C., AND SECTION THROUGH SEDIMENTATION BASIN

the effluent gate. In times of turbidity the muddy water followed this stream and did not diffuse itself through the whole body of water in the reservoir as it should have done in order to produce the greatest amount of settling.

In the appropriation bills of 1912 and 1913, Congress provided $108,000 to be devoted to the reconstruction of the Georgetown Reservoir to provide sedimentation for the coagulated water. This appropriation is now being expended on the work, which, it is expected, will be completed by June next.

The approved project for the expenditure of the above appropriation requires in general the following changes to be made in the old reservoir (Fig. 1): (1) Stopping up the old opening or cut in the middle of the cross dam; (2) cutting a new opening near the extreme southern or right-hand end of this cross dam; (3) erection of an earthen dam at the northeast portion of the upper section, starting from the upper end of the reservoir near the influent gate and running in a general way parallel to the northeast side of the reservoir until it intersects the cross dam; (4) the construction of a gap or cut in the lower end of the new dam, containing eight sluice gate openings; (5) paving the top and sides of the new earthen dam with concrete or riprap; (6) the construc-

tion of two longitudinal concrete drains from the inlet to the outlet of the sedimentation basin; (7) paving of the sedimentation basin with concrete; (8) the construction of a reinforced-concrete baffle wall parallel to the new dam in the portion of the upper section outside of the new sedimentation basin, and (9) laying a new section of 48-in. cast-iron drain pipe to connect that already

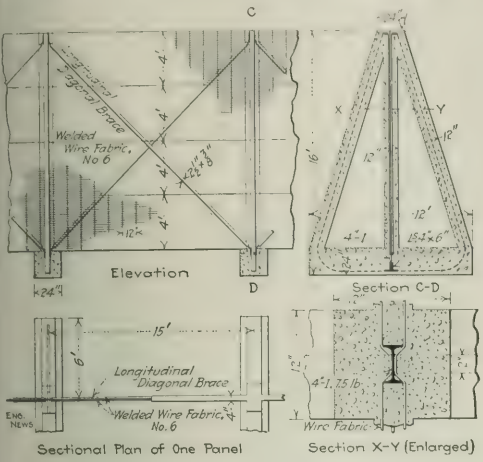


FIG. 2. DETAILS OF BAFFLE WALL

laid with the lower end of the concrete drain in the sedimentation basin.

The details of the new construction are shown in the plan and section in Fig. 1. As will be noted there, the old sidewall of the reservoir is utilized for the sidewall of the new sedimentation basin, but it is paved with 12-in. paving block set on a foundation of 6-in. broken stone. The inside wall of the new sedimentation basin is made of a new earth slope paved on top and sides with concrete resting on the top on the earth and on the sides on a base of broken stone. The basin itself is provided with

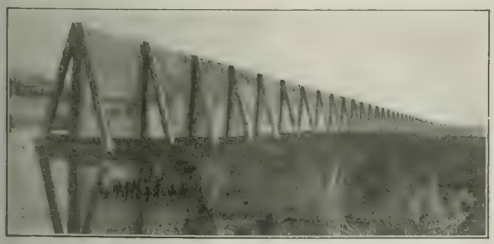


FIG. 3. VIEW OF CONCRETE BAFFLE WALL IN GEORGETOWN RESERVOIR

two gutters formed of concrete box drains with side slopes of 10% leading to them. This whole bottom is paved with a 5-in. concrete flooring.

The baffle wall consists of open reinforced-concrete triangular piers placed 15 ft. apart and connected by a thin concrete web, as shown in the view in Fig. 2. The detail of the construction is shown in Fig. 3. The piers were made by placing the steel reinforcement and concrete in the forms in the usual way and tying the reinforcement of the wall proper to the vertical members of the pier reinforcement. This wall was then made by shooting mortar, with a cement gun, against wooden forming placed behind the outer layer of wire fabric reinforcement until the web had been built up to about 4-in. thickness.

After the above-named changes are made, the coagulated water will enter the sedimentation basin through the influent gate, remain there long enough for the coagulating action to become complete, thus depositing the greater part of the coagulated matter upon the concrete floor of the basin. By means of the sluice gates the water may be drawn into that part of the north half of the reservoir outside of the sedimentation basin, either from near the surface or from near the bottom. Before reaching the effluent gate the water so drawn must travel in a tortuous path around the ends of the new baffle and the end of old cross dam which originally divided the reservoir into two parts. It is believed that by this arrangement the water will be given more time to complete sedimentation and will diffuse itself more thoroughly over the reservoir because, while its velocity is the same as before, it travels over a longer path.

For cleaning purposes, the sluice gates between the sedimentation basin and the remainder of the north basin will be closed and the one in the 48-in. drain opened. Such of the sediment which is not drawn out with the water then in the reservoir will be loosened and carried out by flushing with fire hose. By a new connection at the effluent gate-house the sediment-bearing water will be conducted back to the Potomac by way of an adjacent creek.

This work is under the direction of Lieut. Col. William C. Langfitt, Corps of Engineers, U. S. A., in charge of the Washington Aqueduct, assisted by the author of the paper which we have abstracted, Lieut. J. J. Bain.



Cobblestone Pavements in Albany, N. Y., have declined from 77.43% of the total in 1885 to 7.99% in 1912, and stone block not granite from 2.6 to 0.81% for the same period. Increased percentages have been: Granite, 17.62 to 33.76, from 1885 to 1912; vitrified blocks, 0.19 in 1894 to 39.32 in 1912; sheet asphalt, 0.81 in 1889 to 10.46 in 1912; macadam, 2.35 in 1885 to 6.73 in 1912. Less than a mile of block asphalt was laid from 1905 to 1912 and 0.07 mile of concrete with a bituminous surface in 1912. The mileage of paved streets of all kinds, based on an average driveway width of 30 ft., increased from 63.6 in 1885 to 95.6 in 1912. The foregoing figures were taken from the report of the Bureau of Engineering of Albany for the year ending Oct. 31, 1912—Frank R. Lanagan, City Engineer.

Supplying Untreated Delaware River Water to Consumers in Burlington, N. J., without notifying the State Board of Health, led the Board to order the Water Commissioners of that city to appear before the Board on on Apr. 8 and show cause why they should not be prosecuted for violating Chap. 317 of the Laws of 1912. The following statement has been received from R. B. Fitz Randolph, chief of the Division of Sewerage and Water-Supplies of the Board:

> This act requires persons in charge of water-purification plants to notify the State Board of Health, and the local board of health in the municipality which the water company serves, within six hours, of any change which is made in the operation of such plant which will tend to impair the quality of the water. The State Board regards this act as of the highest importance and is prepared to insist on strict compliance with its provisions as necessary for the protection of the public health. It appears that, because of a breakdown at the Burlington water-works, raw Delaware River water, which is dangerously polluted at the point from which it is taken by the Burlington water-works, was pumped into the mains and so supplied to the citizens of Burlington for a considerable time on Apr. 1, 1913, without any treatment whatever, and the State Board was not notified of this action until long after the statutory time had elapsed. It is to be hoped that this action on the part of the Board of Water Commissioners will not result seriously, but the use of untreated water from the Delaware River, taken at that point and at this season of the year, is attended by considerable danger.

Slings and Hitches for Handling Machinery*

By John Riddell†

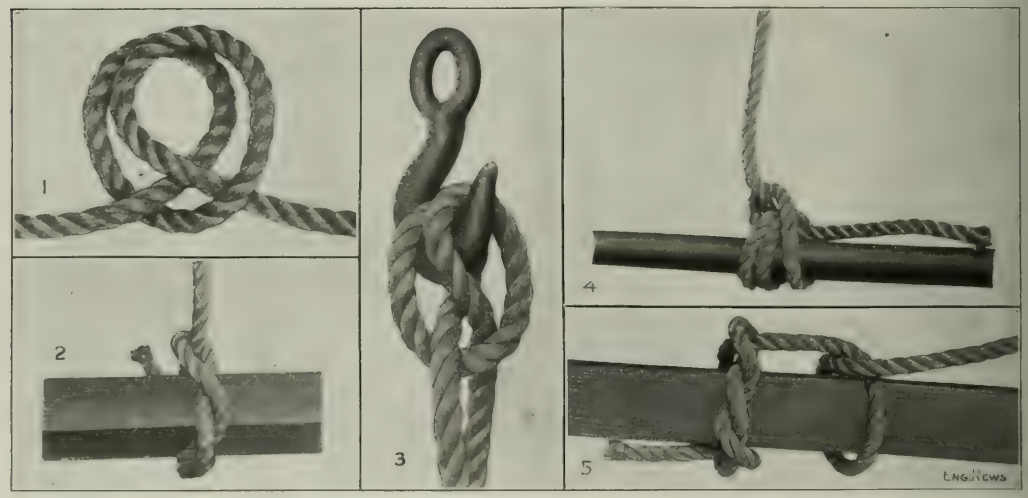
The handling of heavy machines and parts of machines in a large electrical factory is, of course, a matter of the greatest importance. The apparatus used includes travelling cranes, jib cranes and other machinery. The weights handled vary between wide limits. The different cranes may vary in capacity from, say, 3 to 100 tons; and the pieces handled may weigh anything from 100 lb. to 100 tons.

Accidents from Cranes—As a general rule, no particular trouble need be expected in handling the larger weights, since, owing to their importance, more care is exercised in making hitches and other preparations, and usually the foreman, or some other leading man, sees that every accident is guarded against. It is from pieces of medium weight and light weight, of which a great many are handled every day, that trouble more often results. The man handling so much of this class of work becomes thoughtless, the slings become chafed and worn, and the chains become crystallized by long use. The last is a frequent cause of trouble. There is a great difference between ropes and slings used for hoisting. In ropes the wear can always be seen by the strands becoming frayed, loose or cut. A chain, outside of a few bruises, will not show any signs of weakness; although actually it may be full of small cracks which cannot be seen by the naked eye, or it may be much crystallized by long use. A chain under these conditions is rapidly becoming weaker with each lift; until it finally gives way, letting something fall on the man who used it or, as is more frequently the case, on some innocent shop mate.

But whether anyone is hurt or not, there is always a loss to the factory. Sometimes it may only be a rough casting, but very often it is a piece of finished apparatus on which much time and labor has been spent; and worst of all there is usually urgent need for the apparatus at its destination, and disappointment to follow. Suitable racks should be provided for hanging chains and slings on, and when not in actual use they should be kept on these racks. When not following cranes and making hitches, the followers should be inspecting these slings to detect weaknesses and sorting out the bad ones to have them repaired. These racks also afford a ready means for the head rigger's inspection, who is in charge of all such apparatus, and who should always be consulted when anything of a doubtful character in relation to hoisting comes up.

Knots and Hitches—There are many varieties of hitches and many kinds of knots. A description will be given of the standard hooks, eyes, clevises, etc. used in general practice. Some knots and hitches will also be shown which are used in special cases, but which are not intended for everyday use in machine shops. They are useful, however, for riggers, millwrights and others handling special machinery and materials, and should be used only by men competent in such work. Figs. 1 and 3 show the method of making the clove or half hitch. This is useful in the hands of a trained rigger, but should not be generally used, except for hauling, when other slings are available. Fig. 2 is the timber hitch, used principally for hoisting rough timber. The studding sail hitch of Fig. 4 may be used very properly for hoisting timber, etc. Where timbers and shafts have to be hoisted in a vertical position the timber and half-hitch combination of Fig. 5 is useful. The blockwall hitch is exceedingly useful where material is to be drawn along the floor, or for drawing cars on a level, and where a hitch is to be made quickly or frequently.

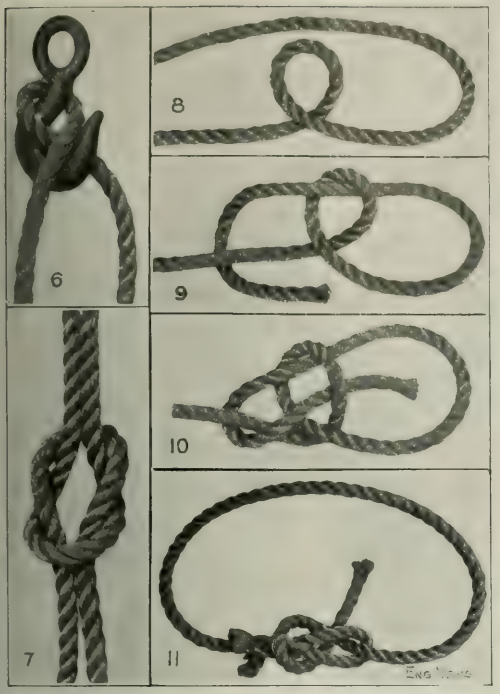
The square or reef knot (Fig. 7) is used only for joining two ropes together; it cannot slip. The bowline knot, when properly made, cannot slip; the three positions of the rope are shown in Figs. 8, 9 and 10. A sheet bend in eye is widely used for an adjustable sling.



Figs. 1 to 5. Common Hitches for Shop Use

*From the "General Electric Review," March, 1913.

†Mechanical Superintendent, General Electric Co., Schenectady, N. Y.



Figs. 6 to 11. Common Knots for Crane Slings

It can be changed quickly and is safe and useful in the hands of trained riggers.

The equalizer beam of Fig. 12 is used with two cranes of different load capacity when lifting a weight too great for one. For instance, in the case of a 9-ton weight to be lifted by a 60-ton and a 30-ton crane, the hooks of the equalizer should be located to bring the center of the weight one-third the length of the beams from the end attached to the 60-ton crane.

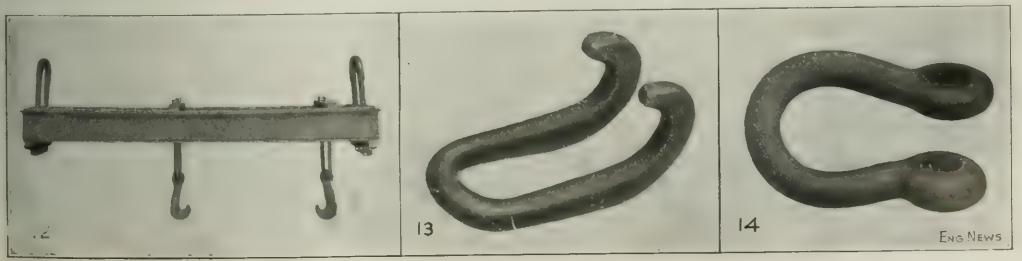
The double hook (Fig. 13) is used for flat disks and flanged pieces when a hook is proper. They should never be used on the inside of a hole or bore in a casting when liable to slip. It is preferable also to use three equally spaced around the circumference of the piece to be lifted. A shackle (Fig. 14) may be used when a bolt can be passed through a hole or opening in the piece to be lifted.

Wire Cable Slings—Wire cable slings occupy a very important place in hoisting, and have been found very satisfactory when carefully used. A wire cable sling should never be used singly when hooked by a spliced eye. When the weight is sufficient the cable is liable to untwist, thus allowing the splices to open and slip (see Fig. 17). Such slings should always be used double (except where it is impossible for untwisting, as in Figs. 27 and 28), and where sharp corners or rough castings exist the cable should be protected by pads (see Fig. 18). Another method of protecting the cable is by two loose metal blocks that should be perfectly free to adjust themselves and afford ample protection for the slings so used.

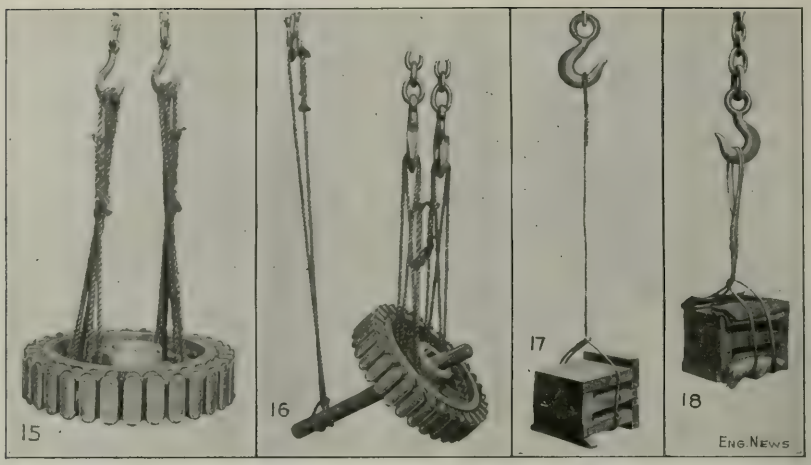
In using slings of any kind, especially rope, care should be taken to see that they are properly laid; i.e., to see that one rope does not lie on top of the other, as this will prevent proper equalization, putting an undue stress on the outer rope. It very often happens, when a rope sling is used double, that the ends of the rope are passed through the doubled part, as when placed around a casting; and, unless this is done carefully, instead of having the strength of two parts of a rope, as supposed, it can be so slipped around the casting, or other piece being lifted, as to actually only have the strength of one part.

Sudden Stops—Before lifting heavy crane loads, the crane brakes should always be tested to see that they are in good condition and will hold. Care must be used when lowering loads to limit the speed, which should not exceed the hoisting speed of the crane for the same load. Particular care must be taken to apply the brakes gradually when bringing the load to rest. The ordinary hoisting speed for a 30-ton motor-operated crane is about 18 ft. per min., and for a 50-ton crane about 12 ft. per min. with the rated load. Stopping the load at such speeds within a distance of ⅛ in. may double the stress on the slings and crane. *This point cannot be emphasized too strongly; as, in more than one instance, serious accidents have resulted from the sudden stopping of cranes while the load was being lowered.*

Stresses in Inclined Slings—When a weight is lifted by two or more slings connected to the crane hook and making an angle with each other, the increase in the stress of the individual slings must be considered. On account of this angle between the two sets of slings the stress on each set is greater than half the total load, and increases very rapidly as the angle between the sling and the work is decreased. An angle of 45° between the sling and the work makes the stress in each sling three-fourths of the total weight, and the collapsing force between the two points of attachment to the work is equal to one-half the weight. This collapsing force acts in a



Figs. 12 to 14. Equalizer Bar, Double Hook and Shackle



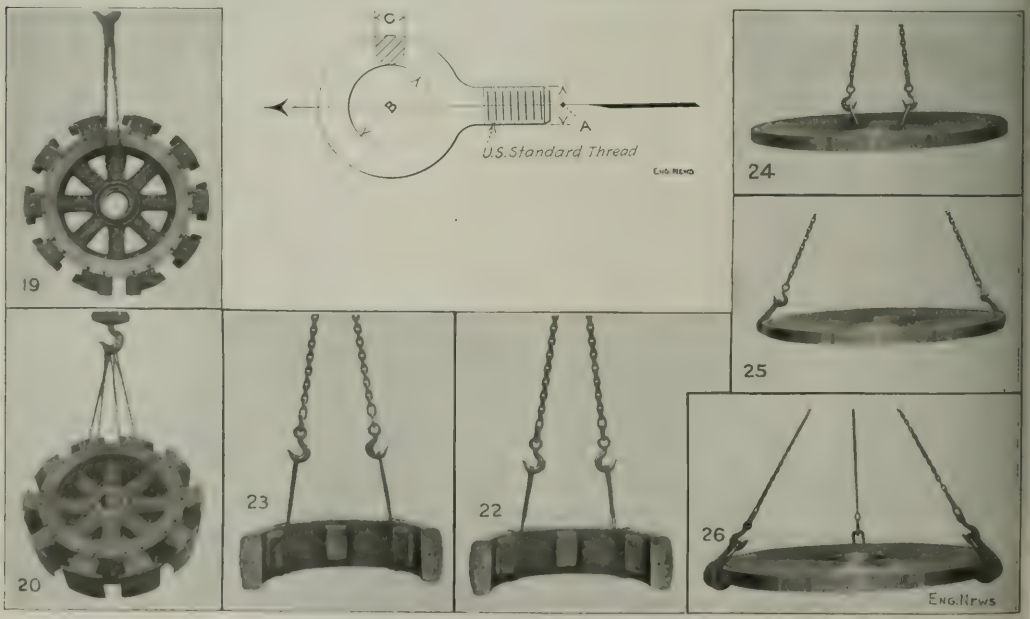
FIGS. 15 TO 18. GOOD AND BAD CRANE PRACTICE

direct line between the two points of attachment. If the work is ring-shaped, it would tend to deform the ring. A spreader of sufficient stiffness should be used between these two points to resist this collapsing force. It will be seen that eyebolts are not suitable for attaching the slings to the work unless a spreader is used to relieve them of this side pull, which would put a heavy bending moment on the shank of the bolt. Reducing the angle between the sling and the work to 30° makes the stress in each sling equal to the total weight, and the collapsing force is also equal to the total weight. Such a small angle should never be used if avoidable.

TABLE I. SAFE LOADS FOR EYEBOLTS
(See Accompanying Figure.)

	Inches A	Inches B	Inches C	Safe Load Lb.
Drop-forged steel	½	1¼	7/16	1,100
	5/8	1 5/16	11/16	1,500
	¾	1 11/16	1	1,800
	7/8	1 15/16	1	2,800
	1	1 15/16	1 1/16	3,900
	1	2 7/16	1 1/16	5,100
	1¼	2 7/16	1 7/16	8,400
	1½	2 7/16	1½	12,200
	1¾	3 7/16	1½	16,500
	2	3 7/16	1½	21,800
D.B.G. Iron E.L., 28,000 lb. per sq.in. welded	1½	3	1½	10,000
	1¾	4	1½	11,000
	2	5	1½	14,000
	2½	6	2	16,000

EYEBOLTS—When it is necessary to use eyebolts for



FIGS. 19 TO 26. GOOD AND BAD CRANE PRACTICE

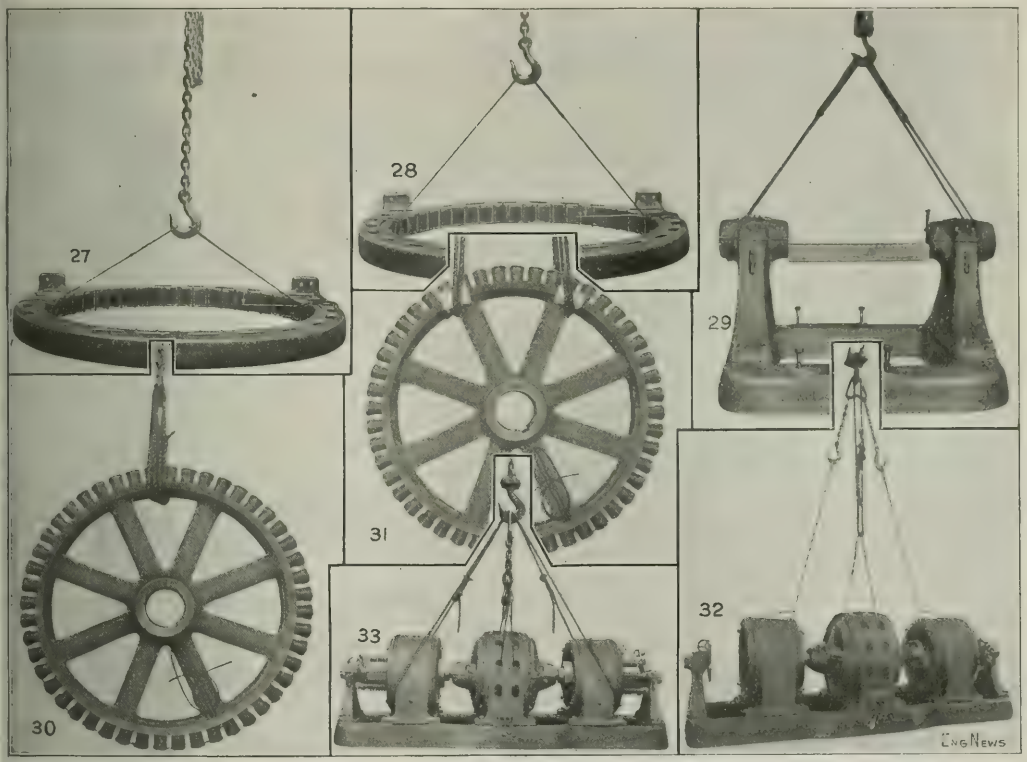
lifting loads, no greater strain should be allowed than given in Table I, which gives the safe load in pounds for bolts up to and including 2¼ in. diameter. It should be noted that the values given are correct only when the pull is in the direction of the arrow shown in Fig. 21, and when the bolt is in good condition.

It should be understood that, to obtain the greatest strength from an eyebolt, it must fit reasonably tight in the hole into which it is screwed, and the pull applied in a line with the axis of the screw. Eyebolts should never be used if considered the least faulty. They should never be painted when used for miscellaneous lifting, as paint is very apt to cover up flaws. They should be tested occasionally by tapping gently with a hammer, but not sufficient to bend or to otherwise injure them.

strain is carried by two ropes or chains, the loads given in the third column should be used. In a sling where four parts of the rope or chain carry the load, the figures in the fourth column should be used. Figures are in tons of 2000 lb.

TABLE II. SAFE LOADS FOR ROPES, CABLES AND CHAINS.

Manila rope — Diam. rope in.	Safe load in tons — Single rope	Two part	Four part	Wire cable — Diam. Cable in.	Safe load in tons — Single	Two part	Four part	Chains — Diam. Chain in.	Safe load in t — Single chain	Two part	Four part
½	¼	½	¾	½	1	2	3¾	¼	½	¾	1½
⅝	¼	½	¾	⅝	1¼	3¼	6½	⅜	1	1¾	3
¾	½	¾	1¼	¾	2½	4½	9	½	2	3½	6
⅞	¾	1	1¾	⅞	3¼	6	12	⅝	3	5	9
1	1	1½	2½	1	4	8	16	¾	5	9	15
1¼	1½	2	3	1¼	6	12	24	⅞	6	10½	18
1½	1¾	2½	4	1½	10	19	36	1	8	14	24
1¾	2	4	6	1¾	13	25	48	1¼	11	19	33
2	2½	5	8	2	16	32	60	1½	13	23	39
2¼	3½	6¾	11					1½	18	32	51
2½	4½	8	13								



FIGS. 27 TO 33. GOOD AND BAD CRANE PRACTICE

If it does not impart a good ring, one of two things is the reason. It may fit too loosely in the hole, or there may be a flaw.

Where a bolt is to be used for anything like its maximum load it should be screwed in tight with a bar and given a gentle tap with a bar or hammer to see if it imparts a solid feeling. If not, it should not be used.

ROPE AND CHAIN LOADS—Table II gives the safe loads which may be put on manila rope, wire cables, and chains. The first column gives the diameter of the rope or chain, the second column gives the safe load which the rope or chain is to carry singly. In a sling where the

The loads for manila rope should be used only when the rope is in fairly good condition; when badly chafed or worn the load should be reduced in proportion.

LAG SCREWS, ETC.—A wood or lag screw, when made in the form of an eyebolt, should never be used to hang any hoisting tackle on. Whenever possible the safest way to hang such tackle is by passing the shank of an eyebolt through the floor or beam, properly protecting the wood by a large plate washer and nut. It frequently happens that a chain or rope sling can be used by passing it over a properly secured timber.

There are several good ways of doing things, and many

wrong ways. Care should always be used to see that they are done in a good way. A few instances may be noted: (1) In turning over a casting like a flywheel or revolving field, a double set of slings should be used on the main hoist to lift the field high enough for turning, padding being used wherever necessary to protect the slings from sharp corners (see Figs. 15 and 16). The field having been hoisted high enough for turning, a piece of timber or scantling should be placed through the bore of the field, the other end of the scantling to be connected to the "small hoist" by the sling; then by lifting on the "small hoist" and lowering on the "main hoist" the work is turned over. Great care should be used, especially against chafing or cutting of the slings. (2) An improper method of making a hitch for such work is shown in Fig. 19. As the slings are liable to be of different lengths the whole or greater part of the load would come on one sling. Slings when used as shown in Fig. 20, permit of enough slip to equalize or give an equal pull on each part of the sling. (3) The method of making a hitch shown in Fig. 22 gives a one-part cable, due to sharp bend and loop in sling. The right way of making a hitch is shown in Fig. 23, the friction of the cable around the object giving approximately a two-part cable. (4) The double hook should never be used as shown in Fig. 24. The correct position when two double hooks are used is seen in Fig. 25. Where possible use three hooks as in Fig. 26. (5) Frequently a base and standard are lifted and no provision is made for any lateral strains that may occur; tending to place an unnecessary strain on the bolts fastening the standards to the base. When such a lift is to be made, a piece of timber should be placed between the bearings to relieve the strain, as shown in Fig. 29. (6) When the slings are used between two arms of a wheel, as in Fig. 30, the entire strain of lifting, coming in one segment, would, if the weight were great enough, crack or break the piece. Two or more double slings should be used, as in Fig. 31, depending upon the weight, the slings to be placed behind two adjacent arms and protected by padding. (7) In Fig. 32 there are a number of sharp corners unprotected while the manila rope sling passes through the loop of the wire cable, and the arrangement of the outside slings does not permit of an even distribution of the load. A better way is shown in Fig. 33.

Case after case might be enumerated; but enough has been said to enable any person entrusted with this work to be able to decide on a proper method and the proper slings or other apparatus to be used. Where he is in doubt as to the weights to be lifted or methods employed, he should seek advice from those qualified to give it. For the guidance of those engaged in handling or lifting pieces it is also suggested and urged that all irregular-shaped castings, and in fact all castings weighing over a ton, should have the gross weight marked in plain figures. It is always safer to over-estimate a weight than to under-estimate it; and it is always safer to use slings of ample lifting capacity than those about which one is in doubt.

Other defects besides those in lifting apparatus will occasionally be discovered, such as a cracked arm of a flywheel, or other similar piece. If this defect is discovered by the person originally handling the piece, he should call his superior's attention to it immediately upon making such discovery.

A reduction in the number of crane accidents can only be effected by extreme vigilance. The loss of material in the past has been very great. The suffering to humanity caused by thoughtlessness has been as great. If proper care is exercised such accidents can almost be totally avoided.

*

Carbon Dechlorination of Chlorinated Water Supplies in England*

By Alec C. Jarvis†

In the United States and Canada, so far as the writer is aware, no special means are provided for eliminating from a water treated with hypochlorite any surplus free chlorine which is may contain, except that time may be given (by means of storage) to allow the hypochlorite to become broken up and dissipated.

In England, except in a few cases of urgency [typhoid epidemics—Ed.] hypochlorite treatment has practically only been adopted combined with a patented process for eliminating the free chlorine from the water after the germicidal action is complete.

This process, which is patented and is controlled by a well known English firm of mechanical filter makers, consists of first dosing the water with the hypochlorite, allowing a definite time for it to destroy the bacteria, and then passing the water through a bed of prepared vegetable carbon‡ which has the property of entirely removing any taste or smell. The precise action of the carbon in this respect is not clear. It does not apparently collect any free chlorine gas; it may, however, assist in the breaking up of the unstable hypochlorite and absorb more or less of the free oxygen produced, but as will readily be understood the quantity of hypochlorite dealt with is so small that it is almost impossible to find out what does become of it, nor is the point of sufficient importance to warrant a thorough research, it being sufficient to know that the carbon will do the work.

In course of time, which may be as long as two years (continuous working) the carbon becomes exhausted and requires renewal. Heating to redness in the absence of air, however, revivifies it. This combined chlorination and dechlorination has been developed on both gravity and pressure lines. There are plants in operation on pumping mains direct to consumers and on gravity supply mains also. In some cases filtration is combined with it in the same plant.

There is one case where a town takes its supply from a small navigable river, the water from which in times of flood is turbid and colored. At the intake this water flows through some rough pre-filter chambers and is then raised by water-wheel driven pumps to the service reservoir. On the way it receives a dose of alumina and a dose of chlorine, and passes through a battery of pressure filters where it is filtered and allowed time for germicidal action. Lastly, it is dechlorinated, eventually

*Abstract of a paper read at the annual meeting of the Illinois Water Supply Association, at Champaign, Ill., Mar. 11, 12, 1913.

†Water Engineer, Honor Oak Park, London, England.

‡In a paper by A. Lederer and F. Bachman, of the Sanitary District of Chicago, presented at the same meeting, the use of charcoal for removing the taste was not favored; sodium bisulphite or sodium thiosulphate were recommended, the latter being preferable. That paper also supported Mr. Jarvis' opinion as to the relatively small amount of attention given in this country to the question of freeing treated water from taste.—Ed.

reaching the reservoir, clear, bright and almost sterile. There are no sedimentation basins and the filters run about five days between washings, working 24 hours per day. Of course after pre-filtration the turbidity is not great, and the quantity of alum used is small. Another interesting case is that of a town where the water from a stream gravitates through slow-sand filters and is then pumped to the consumers. The sand beds, with the greatest of care, would not produce a good water bacteriologically, and as polluted surface water enters the clear water basin (an old one) through cracks, which for various reasons it would be difficult to stop, it was decided to treat the supply on the pumping main. This has been done with success. The water passes from the pumps through a battery of cylinders, having dechlorinated beds in the lower portion, the upper portion giving the water "contact time." Hypochlorite solution is injected into the inlet main to the battery.

In the case of the town being threatened with a typhoid epidemic, the water is taken from a river, pumped through some old clarifying boxes containing gravel, into sand beds from whence it gravitates to a clear-water well and is pumped to the consumers direct, the surplus being received by high-level reservoirs. The supply even after filtration has always been more or less unsatisfactory, the river being sewage polluted and the sand bed area inadequate. The ubiquitous B. Coli were very much in evidence and when a serious typhoid outbreak occurred at a small town only 10 miles up the river, which discharged all its sewage into the river in an absolutely crude state, it was felt that the situation was somewhat alarming, especially as the threatened town formed part of a high-class seaside resort to which a typhoid epidemic would have meant ruin, or something near it. The Local Government Board called the water authority to take immediate action, which resulted in the author arriving on the scene at 3 a.m. one Friday morning last September to devise some scheme that could be carried out with the existing works in the least possible time, and to satisfy the eminent scientist who had been called in by the water authority.

The difficulty was not so much the chlorination as the dechlorination of the supply. Absolute freedom from taste or smell was insisted upon, as any suspicion of "flavor" in the water would have started a scare. Friday was spent in carefully examining the works and the conditions of working, and (having decided upon a plan of action) in telegraphing and telephoning to London for dechlorinating carbon and the various materials required. A start was made at 6 a.m. on Saturday, later in the day the consulting scientist arrived and approved the author's proposed method of treatment. Work was continued on the Sunday, Monday and Tuesday. Materials arrived slowly, delaying the work, but by Wednesday all was completed, the town safe from a waterborne typhoid outbreak and was enjoying a clean and wholesome supply.

It was decided to treat the water after filtration, and before it reached the clear water well. The first four sand beds are small and two of these were utilized. One of them was entirely emptied of material and cleaned, and another emptied down to the gravel and drains and washed clean. The first was used as a "contact" or "time" chamber, and timber baffle partitions were put in to insure the full capacity being utilized. A hole was cut through the wall near the top and a 10-in. pipe cemented in, to pass the water into the other bed. This latter was filled with carbon on the existing gravel to a depth of 2 ft. and a foot of grit and gravel was spread over it to keep it from floating up. All this grit and gravel had to be sifted and washed from the material removed from the first bed. A siphon of 8-in. cast-iron pipe (the largest available) was made up, connecting the filtered water chamber with the "contact" chamber. A small semi-rotary pump was rigged up to exhaust this syphon.

The sluice was dismantled and a sheet iron rectangular notch put in its place, with a hook gage to ascertain the flow and thus enable the chlorine to be regulated accordingly. The building containing the rough gravel clarifier boxes was used to house the chlorinating apparatus, which was made up with a double compartment tank found on the works, a small ball valve balancing tank, a special hand-grinding mill for mixing the bleach with water, and the necessary pipes, valves and fittings. The solution is regulated by a cock on the balancing tank (with an independent cock for shutting off) and runs by a funnel and wrought-iron piping to the chamber.

One compartment of the solution tank is in use while the contents of the other is settling ready for the following day. The quantity is one part of available chlorine per million. When all was ready, the sand-filtered water was sent to the contact chamber. Both the contact chamber and carbon bed had been partially filled previously. The air in the siphon was then pumped out, and the water duly flowed over, the chlorine was turned on, and the water run to waste until clean, when it was let into the clear water well.

The dirtiest sand beds were then rapidly run off, cleaned and put to work again to keep the loss of head down to a minimum as there is no fall, all the beds being on a level. The clear water well is the only exception, being 2 or 3 ft. lower than the sand beds. Since the treatment was commenced the water has been absolutely free from bacillus coli and the town has not had a single case of typhoid fever. The capacity of the pumping plant is 30,000 Imp. gal. per hour.

❋

A Record Waterwheel Efficiency of 93.7% is reported from tests of units recently installed in a plant of the Appalachian Power Co., at New River, Va. Here four single-runner single-draft-tube vertical-shaft Francis turbines, operating under 49-ft. head, each drive a 4000-kw. alternator at 116 r.p.m. A roller bearing on the top of the generator supports the rotor. As some 1200 sec.-ft. of water is required at full load, the quantity passed through a wheel under test, was measured by a sharp-crested weir across the tailrace, which is 12 ft. deep by 90 ft. wide in solid rock. The crest of this weir was 82 ft. long and tests showed the leakage at zero head to be 0.14 sec.-ft. Allowance for leakage was increased to 1 sec.-ft. to compensate for increased head on the weir and for leakage through the power station. The generator carried commercial load adjusted for a unity power factor. Head on the turbine was determined by a piezometer tube. The maximum efficiency rose to 76% at 2100 hp., and to 93.7% at 5600 hp., falling slightly to 91% at 6000 hp. (full gate).

A model runner of these turbines, tested in the Holyoke flume, gave results uniformly 3% or 4% less than the figures quoted. The station efficiency of a generator unit is considered to be about 88% at 4300 kw. and 83% at 4700 kw., with a figure above 80% from 0.6 full load. The performance of these units is credited to care in laying out the approaches and draft tubes so as to avoid eddies. The turbines were built by the I. P. Morris Co., of Philadelphia. The power station was designed and constructed by Viele, Blackwell & Buck, of New York, for H. M. Byllesby & Co., of Chicago. The tests are described at length in the "Electrical World," Mar. 20, 1913.

An Outfall Sewer of Corrugated Iron Pipe and Measurements of its Internal Friction

The use of corrugated pipe of noncorrosive "ingot-iron" for outfall sewers was mentioned in our issue of Mar. 13, and we have received recently from Herbert Nunn, City Engineer of El Paso, Tex., some information respecting a temporary sewer of this kind 3784 ft. in length. The information included a report by F. H. Todd, consulting engineer for the city, on a test made to determine the loss of head in this pipe.

The original outlet for the city's gravity sewer was a little above the bed of the Rio Grande at a point some distance south of the present sewage-disposal plant. After a cutoff was made (about 1898) to straighten the channel in order that the water at flood stage should not overflow the lower portions of the city, the river channel moved to the north, washing away not only the sewer outlet but nearly 1000 ft. of the sewer; the bed of the river was also raised so that the outlet was then nearly 2 ft. below the bed. In order to prevent serious trouble from the backing up of the sewage, especially at flood stage, pumps were installed at the last manhole above the highest water. In 1912 the channel of the river again changed to the south. In the meantime, however, a sewage-disposal plant had been built; but on account of the failure of this plant to perform the guaranteed purification, it became necessary to pump the crude sewage from the plant to the river channel. To do this without nuisance, a pipe was necessary.

The change in the river channel left a distance of 4000 ft. between the treatment plant and the point at which it was desired to discharge the effluent, the entire distance being in the old bed of the stream and the soil being a light sandy silt. In order to carry the effluent by gravity it was necessary to build the pipe line on a terre-plaine or old geological dike 2 to 4 ft. above the general level. The problem was to use a pipe that would stand in light soil subject to overflow, and that could be moved and saved in case the river changed back to its old channel. On account of the location of the international boundary and the laws governing permanent works in river channels, the work could not be protected. It was finally decided to use galvanized ingot-iron pipe 24 in. minimum diameter (25 in. at the convex corrugations). The pitch of the corrugations is 2½ in., and the metal is of No. 16 gage. This pipe line was built in June last. The pipe was laid in 30-ft. lengths with standard riveting and lug connections. Lug connections were used on account of facility in installation, and the ease with which they could be removed in case of emergency.

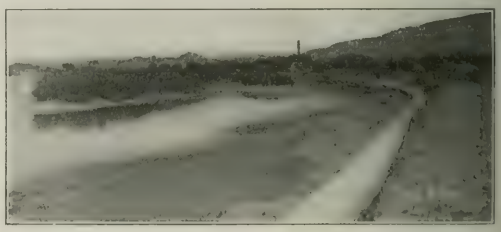
The sewage was turned in about Aug. 1, and the connections showed a light leakage. This was overcome by the use of a bag of wheat bran, and no leakage has since been noted. Some of the joints were asphalted during the installation, but it is found that this was unnecessary. Mr. Nunn states that this pipe line has been carrying about 2,000,000 gal. of crude sewage per 24 hr. for the past seven months, and a recent examination showed that the galvanizing had not tarnished and that the pipe is in good condition.

The construction being of a temporary character, no effort was made to lay the pipe to a perfectly true grade. The elevations are approximately 98.6 ft. at the head of the line, 95.25 and 94.6 ft. at the first two measuring stations (1038 ft. apart) and 92 ft. at the outlet (1770 ft. farther). The pipe begins about 136 ft. from the disposal plant, and is connected to the pumps by a 12-in. wrought-iron pipe. There are two right-angle turns, at one of which is a drop of nearly 3 ft. in the grade line; beyond this the pipe is laid about on the surface of the ground. The lower portion of the outlet is laid on a long curve in plan. In most cases the lengths of pipe are overlapped one corrugation.

As this pipe was laid in the summer of 1912, it has not been in use long enough to see if there is any corrosive action from the sewage, which has been so long in the sewers as to be somewhat septic. Comparatively little storm water or ground water is taken into the sewers, and consequently the domestic sewage is highly concentrated.

Measurements of Internal Friction of Corrugated Pipe

Some experiments were made to determine the loss of head in pipe of this kind, for which purpose three measuring stations were established, two on the straight portion of the pipe (1038 ft. apart) and one at the outlet



Temporary Outfall Sewer at El Paso, Tex.: 24-in. Ingot-Iron Corrugated Pipe

(1770 ft. below the second). The outlet was partially closed by a partition across the lower part, so that the pipe flowed full. There were no deposits in the pipe at this obstruction, and none were apparent in the pipe after the obstruction was removed. A weir and concrete approach channel were built in the river bed. The average velocity in this channel was about 0.5 ft. per sec. The weir notch was a rectangular opening 5 ft. long and 7 in. deep, cut in a sheet of No. 16 galvanized iron stiffened with boards on the downstream side.

Readings of the head of water flowing over the weir were taken at 15-min. intervals for 25 hours in order to determine the rate of flow of the sewage. The calculated result for the flow over the weir was about 2¾% less than is given in Trautwine's tables for weirs without end contraction.

The loss of head between measuring stations was determined by means of manometers showing the head at each station. These were made of ⅛-in. brass tubing, the inside end of the tube closed and a 1/64-in. hole drilled into the side of tube. This tube was placed horizontally and inserted in a hole drilled at the concave corrugation of the sewer pipe (its smallest internal diameter), a piece of rubber being used as a gasket. The horizontal tube was supported on a board, and from its outer end a rubber tube led to a vertical glass tube so

that the height of the sewage could be seen. Behind the upright tube was a paper scale graduated to $^1/_{50}$ in. the zero of which was set with a level, so that the relation of the manometers could be referred to the same plane.

At the different stations, simultaneous observations were made at intervals of 1 in. in the horizontal diameter of the pipe, thus observing the effect of the corrugation. While making the observations for this purpose the opening in the brass tube was against the current. The first readings at stations Nos. 1 and 2 (on the straight pipe) began at 1 in. inside the pipe and continued at 5-min. intervals for each additional inch as the tube was pushed in until it reached the center of the pipe. The readings showed a uniform increase in loss of head from the inside of the pipe to the center, and the loss of head between the first two stations (1038 ft.) was 1.46 ft. at 1 in. from the side and 1.72 ft. at the center.

Mr. Todd states that from the results of the observations it appears that for velocities approximating 1.5 ft. per sec. in 24-in. corrugated pipe, the coefficient n in Kutter's formula is between 0.0212 and 0.0222. The former is derived from the readings at the ends of 1038 ft. of straight pipe, and the latter from the readings on 2808 ft. of pipe, including the curved portion. The loss of head due to friction, for a flow of 5 cu.ft. per sec. was about 1.49 ft. for the 1038 ft. of straight pipe and 4.37 ft. for the length of 2808 ft.

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The Precise Level Net of the United States*

By William Bowie†

Precise leveling was defined in 1867 by the International Geodetic Association as that class of spirit leveling which had a probable error of not greater than 3.0 mm. per km. In view of the remarkable progress made in spirit leveling since then, the Conference of that Association, held at Hamburg, Germany, in September, 1912, decided to establish a new class of leveling to be called "leveling of high precision;" which should have a probable accidental error of not greater than 1.0 mm. per km., and a probable systematic error of not greater than 0.2 mm. per km. Such leveling should be run twice over a line in opposite directions and under different atmospheric conditions, if practicable. Practically all of the leveling added to the precise level net of the United States in recent years has the accuracy of this new class.

PRECISE LEVEL DATUM

The datum upon which all precise leveling is based is mean sea level, which varies within a very small range from year to year, as shown by long series of observations. Two to three years of continuous tidal observations are considered to be sufficient to establish the mean sea level at a given point, which may be considered as having a zero elevation in the precise level net.

The mean level of the sea at all points on the open coasts is supposed to define a level or equipotential surface. Deviations from this condition, if they exist, are not great enough to be detected by leveling. Where the mean sea levels at two tidal stations are connected by precise leveling the discrepancy is so small that it can easily be due to the accumulated errors of leveling.

The great advantage of having mean sea level as the datum for leveling is that the field work may start from many points; valuable checks on the results are obtained; and the leveling of neighboring countries may be joined to form a continuous net over a whole continent. These conditions would not be possible if each country adopted an arbitrary datum.

ADVANTAGES OF A PRECISE LEVEL NET

It is scarcely necessary to point out the great advantage of having accurate leveling extended over a country for the use of surveyors and engineers. It is absolutely necessary to know the elevation of benchmarks within a very small amount of error when extensive topographic surveys and canal work are undertaken, and where such operations will join other extended work.

Erroneous elevations on which contours are based are a source of great trouble. Much of the government surveying necessarily had to precede the precise leveling, but conditions are becoming better from year to year as the precise level net is extended.

THE PRECISE LEVEL NET OF THE UNITED STATES

Precise leveling in the United States has been done by the Coast and Geodetic Survey, the Corps of Engineers, U. S. A., the Geological Survey, the Pennsylvania R.R. and the Baltimore & Ohio R.R.

The first adjustment of the net, which was necessary to obtain the best values for the elevations of benchmarks and to eliminate the discrepancies shown by the several lines and closed loops, was made by the Coast and Geodetic Survey in 1899. The net at that time extended from the Atlantic to and including the Mississippi River. A second adjustment was made in 1903 with additions to the net extending to, and in some places beyond, the 98th meridian. A third adjustment was made in 1907 after the levels had been extended to Seattle, Wash., on the Pacific coast. The successive adjustments necessarily gave different values for the elevations and the changes in certain sections were of such amount that the older values could not be held.

There are now about 28,000 miles (45,000 kilometers) of precise levels in the United States run by the various organizations; 13,900 miles by the Coast and Geodetic Survey, 3500 miles by the Geological Survey, 8400 miles by the Corps of Engineers, U. S. A., and 1300 miles by the Pennsylvania and Baltimore & Ohio R. R. Co's. There are 900 miles classified as miscellaneous. In all about 10,700 permanent benchmarks have been established. The net traverses all the states except seven (five of these being in New England), and there are ten connections with the mean sea level, six on the Atlantic, two on the Gulf of Mexico, and two on the Pacific.

ADJUSTMENT OF ELEVATIONS

An adjustment made recently shows that the net is sufficiently extended and the leveling is of such strength and accuracy that the resulting elevations will be considered as standard and, so far as surveying and engineering purposes are concerned, they may be held for an indefinite period, or even for all time. Nearly all the elevations along the Mississippi River and to the Eastward were changed so little by this latest adjustment that the values in that area, as given by a previous adjustment, can be held as standard. In the future any new lines of precise leveling will be adjusted to fit into the net without in any way disturbing the previously adopted elevations.

As each new line added to the net may have some influence on all or nearly all the elevations, from time to time adjustments will be made which will give the theoretically best values of the junction points of the net, which will be of great scientific interest and value, but such adjustments will not interfere with the standard elevations.

A correction, known as the orthometric correction, made necessary by the nonparallelism of level surfaces at different elevations, is applied to the leveling as actually run on the field before the adjustment. This correction need not be applied to leveling in restricted areas, but it becomes important in extended operations when the country is elevated.

EXTENSION OF PRECISE LEVEL NET

The precise level net is being extended into new areas as rapidly as practicable, and it is planned that eventually each place in the United States will have precise level benchmarks within a short distance (say 100 to 150 miles). The spaces between the lines of precise leveling can have levels established by a lower grade for the control of detail required by engineers and surveyors. The important things are that all elevations should be referred to mean sea level as the datum and that they should be connected with the standard elevations.

*Presented before Sec. "D," American Association for Advancement of Science, December, 1912.

†Inspector of Geodetic Work, U. S. Coast and Geodetic Survey, Washington, D. C.

A Gasoline Rock Drill*

A self-contained rock-drill, which does not require a power plant and pipe line installations, has wide possibilities of usefulness. The gasoline drill which has been developed in recent years has a great opportunity in this field. A new gasoline drill which is the result of several years of investigation and experiment has been invented and patented by L. L. Scott, and is soon to be put on the market by the Scott Drill Co., 1013 Chestnut St., St. Louis, Mo. Mr. Scott's first gasoline drill, which was described in our issue of Nov. 26, 1908, was of the piston type, in which the drill rod has a reciprocating motion corresponding to that of the piston of the operating cylinder, as in a compressed-air drill. His new drill is of the hammer type, in which the drill steel has no reciprocating motion but receives a rapid succession of blows upon the end, these blows being transmitted from the piston of the operating cylinder.*

The drill is in effect a single-acting two-stroke cycle gas engine, and a crankshaft and flywheel are used to effect the return stroke of the piston. In order to permit the piston to deliver a fully effective and uncushioned blow, it is essential that it should be entirely free from connection to the crankshaft or other fixed part at the moment when the blow is struck. The way in which this is effected is one of the special features of the machine and can best be explained by reference to Fig. 1, which is a diagrammatic sectional elevation of the drill. Fig. 2 is a view of the drill in position for working.

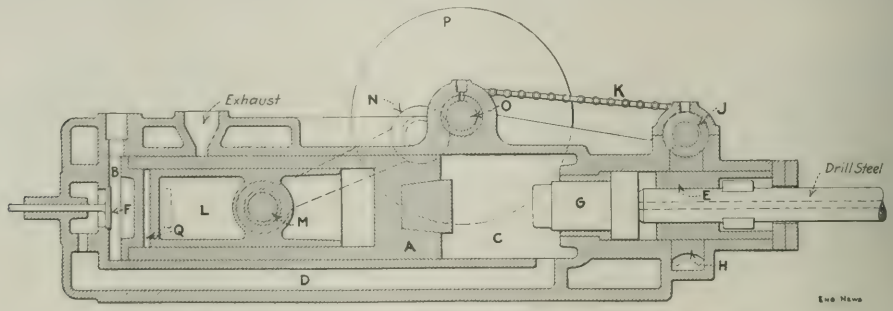


FIG. 1. SECTIONAL ELEVATION OF THE SCOTT GASOLINE ROCK DRILL
(Scott Drill Co., St Louis, Mo., maker.)

The cylinder has a long hollow piston, *A*, the space in the rear of which, at *B*, is the explosion chamber, while the space, *C*, at the forward end of the cylinder is the compression chamber in which the charge of air and gas is compressed to force it into the cylinder through a channel, *D*, outside the cylinder wall.

The front cylinder head forms a guide for the drill steel, and in it is mounted the chuck, *E*, for rotating the drill. In the rear head is the check valve, *F*, through which the explosive mixture is admitted to the chamber. The hammer piston is a long hollow plug, closed at both ends, having in its forward face a hammer-head designed to strike a sliding block, *G*, in the front cylinder head, through which block the blow is transmitted to the end of the drill steel. The rotating chuck has slots to receive lugs on the drill rod, and has a worm wheel, *H*, around its outer face, gearing with a worm, *J*, on a cross-shaft driven by a chain, *K*, passing around sprockets on the main and cross-shafts.

The hammer piston "floats" in the cylinder, having no fixed connections to limit its stroke or movement. Within this piston is fitted a second piston, *L*, of fixed stroke. On the side of this inner piston is a cross pin, *M*, which projects through a slot in the hammer piston and in the cylinder wall. This pin carries one end of a connecting rod, *N*, whose other end is fitted to the crank pin of the main shaft, *O*, which shaft lies above and across the cylinder. Upon this shaft is the flywheel, *P*. A port in the side of the main piston permits air to enter the space, *Q*, between the rear ends of the inner and outer pistons to provide a cushion. The exhaust opening is in the top of the cylinder, near its rear end.

During the backward stroke of the main or outer piston, the explosive charge is admitted to the space, *C*, in front of it, and with the next forward stroke this charge is compressed and forced through the passage, *D*, and admission valve, *F*, to the explosion chamber, or space *B*, at the rear of the piston. With the second backward stroke, this charge is compressed within the rear chamber and a second charge is admitted to the forward chamber. At the end of this stroke the compressed charge at *B* is fired, driving the piston, *A*, forward so that its hammer head strikes the block, *G*, which transmits the blow to the drill rod. This contact with the block occurs just before the crank of the main shaft reaches its dead center, and the momentum of the flywheel causes the crank to continue its motion so that the inner piston slides forward within the main piston, allowing the crank to pass the center without shock to its bearings. As this inner piston moves forward it uncovers the cushioning port above mentioned, and admits air at its rear, which is compressed within the space, *Q*, as a cushion on the return stroke of this inner piston until the pressure is such that the main or hammer piston is moved back with the other. With this arrangement the main or hammer piston is entirely free from the main shaft at the moment when it makes its blow on the striking block. Both the piston and the block are of vanadium steel. The cylinder slides in its mounting and has the usual screw-feed arrangement.

As will be seen from the above description, the drill

* Another gasoline rock drill of the hammer type was described in our issue of Apr. 13, 1905.

engine is of the single-acting two-stroke-cycle type, of simple construction. The inlet and outlet ports are not opposite each other, so there is no opportunity for backfiring. The speed can be as high as 3000 r.p.m., but can be regulated by the operator as desired. The machine runs with very little vibration when drilling. Cylinder lubrication is provided for by adding a small amount of oil to the gasoline (1 pint to 5 gal.). It will rarely be necessary to provide for carrying away the exhaust, and in fact gasoline locomotives with much larger engines work in mines and tunnels without causing trouble. In close ground the exhaust may be piped into a water sump or to the mouth of the shaft or tunnel, and if the exhaust pipe should be several hundred feet in length, a small suction blower may be put at the end in order to relieve back pressure. A tank located near the drill holds about 2 gal. of gasoline and 15 gal. of water for the cylinder jacket and for washing out the drill hole. Small hose lines run from the tank to the machine. The only other apparatus required is the small battery supplying current for the electric ignition apparatus.

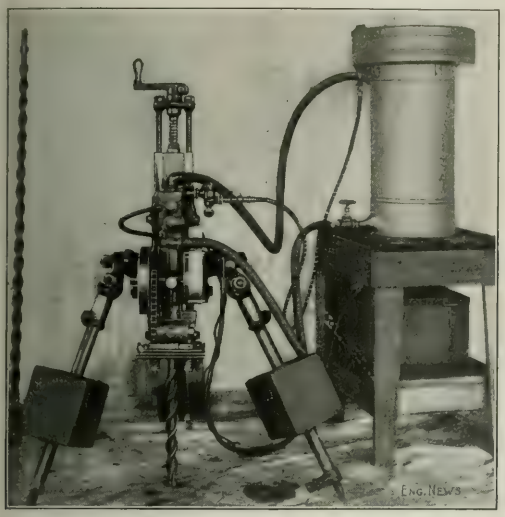


FIG. 2. PERSPECTIVE VIEW OF SCOTT GASOLINE ROCK DRILL

The Scott drill is made in four sizes. The smallest, which can be held in the hand and is adapted for such work as block holing, weighs 48 lb. The others are carried on mountings; one of these weighs 85 lbs., and drills holes 4 to 5 ft. deep. The next size weighs 140 lb. and drills holes 8 to 10 ft. deep. The largest size weighs 265 lb. and drills holes 16 to 20 ft. deep. These weights are exclusive of the tripod or column mounting. The cylinder diameter is 2 in., 2½ in., and 3½ in. in the three mounted sizes, respectively. The average gasoline consumption of the largest machine is 2 gal. for a 10-hr. run. In hard limestone (in the St. Louis quarries where the machine has been tried) it will drill 80 ft. of hole per day; for starting, a 2¾-in. bit is used, and the hole is finished with a 1½-in. drill. Two types of drill rods are used. One of these is a hollow cylindrical rod, and at each stroke a portion of the exhaust is used to force water to the end of the hole, thus removing chips and dirt and keeping a clean rock surface to receive the blows of the drill. The other rod is solid, but has a spiral thread on the surface which acts as a conveyor to remove the chips from the hole. It is claimed that the gasoline drill with 2 hp. has a capacity equal to that of an air-drill requiring some 20 hp. at the power house.

A Plan to Limit Unbalanced Bidding on City Contract Work

A plan to lessen the degree to which unbalanced bidding has been carried on contracts for extending water mains has been devised by the Department of Water Supply, Gas and Electricity, New York City. In brief, it is proposed to prohibit the use of any unit price in bidding which is below the figure set in the engineer's estimate, but to permit a total bid less than the total estimate by deducting a lump sum from the aggregate of the items, this lump-sum deduction to be computed as stated below.

This plan has aroused opposition from the General Contractors' Association (51 Chambers St., New York City) which has passed resolutions of disapproval (cited in Mr. DeVarona's letter below) and which has commented on it adversely in its *Bulletin*.

The Department of Water Supply recently issued the following memorandum on the proposed plan:

> In the schedule of quantities inserted for the information of bidders there is to be given a minimum unit price for each item, which, in general, would represent about 75% of the current market price for the material and labor called for, the sum total of the contract based upon such minimum unit price being given. The following paragraphs, which it is proposed to insert in the contracts, give the necessary information to the bidder as to how bids are to be submitted:
>
> No bid will be accepted in which the price bid on any item is less than the engineer's minimum unit price for that item, as given in the foregoing statement.
>
> If the bidder, however, wishes to submit a bid which will total less than the total estimate based upon the engineer's estimate of all the items and quantities, with their corresponding minimum unit prices (A), he may bid a lump sum to be deducted from his total estimate based upon the approximate quantities and the unit prices bid, but provided his total estimate shall not exceed (A + 20%), which is 20% more than the total estimate based on the engineer's minimum unit prices and approximate quantities. This lump sum deduction shall be inserted in the bid and will be used in the comparison of bids.
>
> From the final estimate there shall be deducted a lump sum equal to the lump sum bid to be deducted divided by (A), and multiplied by the estimated cost of the contract, based on the actual quantities and the engineer's minimum unit prices. Proportional deductions shall be made from the partial estimates forwarded for payment under the contract.
>
> From the above it will be seen that the bidder is not limited as to the maximum price he may place on any item, and he can unbalance his bid, but such unbalancing is limited owing to the minimum price that is fixed for each item. At present it is the general practice among the contractors to bid on water-main contracts, 1c. for the majority of the items and load their entire contract price on a very few items.

The *Bulletin* of the General Contractors' Association comments on the foregoing plan as follows:

> At the meeting of the Executive Committee, on the 5th instant [March?] this remarkable method was considered. All of the comments were not recorded in the minutes, but the consensus of opinion was that the famous puzzle regarding the age of Ann had been surpassed. **How much is A?**
>
> We confess it is about as clear to us as Croton water after a spring freshet. The engineer figures his cost price of the **material and labor** for each item, and then advertises 75% of this price as the upset figure which a contractor will be permitted to bid on that item. (Fallacy No. 1. The engineer has little, if any, reliable knowledge as to the actual cost of the work, so why take 75% of something that is wrong at the start?) The contractor may bid as high as he likes on any item, but if he wishes to bid a total less than the engineer's total, his total cannot exceed the engineer's by

more than 20%. In other words, the contractor's estimate of the work cannot exceed 90% of the actual cost of the work as determined by the engineer. And bear in mind that this is the engineer's opinion of cost of material and labor only—no profit taken into consideration at all.

The engineers of the Department of Water Supply, Gas and Electricity complain about the practice of contractors in that Department bidding 1c. on items. Just so long as this Department issues estimates with such outrageously unbalanced quantities as it has in the past, it must expect the contractor will unbalance his prices to meet the conditions as he knows they will be.

There is only one just way to prevent unbalanced bidding and that is to put a stop to the practice among engineers of issuing unbalanced quantities. Engineers take great pride in making public the fact that a contract has been completed at less than the bid cost, but those who are familiar with the game know that far from reflecting any credit, it is really due to a lack of faith in their investigations and the desire to play safe. Legal fraud, some people have called it; and that is expressing it very mildly.

On giving I. M. de Varona, Chief Engineer of the Department of Water Supply, Gas and Electricity an opportunity to explain the plan in more detail, as well as to comment on the criticism just cited, Mr. de Varona wrote us on April 1, 1913, as follows:

The desirability of avoiding the unbalancing of bids, in justice both to the contractor and the department, has been so fully recognized as to need no comment here, and it is equally well known that it is extremely difficult, if not impracticable, to completely prevent unbalanced bidding. The various municipal departments will bear witness to the soundness of this statement, amply borne out by their experience.

Assuming, then, that it may be out of the question to completely eradicate the evil complained of, our efforts should be limited to reduce it, as much as possible, and the method devised by this Department and now under consideration, is intended to effect this purpose. How well it may accomplish it remains to be seen after it has been tried.

A few statements seem pertinent in support of the same, as well as a discussion of the main reasons for unbalancing of bids, especially in the case of contracts for water mains, which are those now being considered. Those reasons may be thus summarized:

(1) The work under contracts for laying water mains, varying but slightly, the contractor desires to withhold from his competitors the knowledge of his true estimate of cost on any contract.

(2) The contractor, especially when limited in financial resources, is anxious of securing as prompt monetary returns as possible from the work. He, therefore, bids an excessive price on the items which will be included in the earliest estimate and thus bring him the speediest financial return.

(3) For reasons to be given hereafter, the engineer's estimates are generally larger than the quantity of work to be done and the percentage of increase in the items which may be called incidental, are normally greater than those on the main items. The contractor, therefore, naturally bids a nominal price on these incidental items.

(4) It is difficult to accurately estimate, in advance, the quantities of rock and earth, and the contractor's judgment in this case frequently differs from that of the engineer.

It is apparent from the above summary, that of the four reasons enumerated, the first two are entirely independent of the engineer's action, while the third and fourth are based upon the accuracy of his estimates and will, therefore, be further explained.

The charter of New York City requires that in every contract an item or items for all classes of work to be done, shall be included, and the corporation counsel advises that in each case the quantities shall be sufficient to cover, not only probable, but possible amounts of work, so that the final estimate shall not exceed any individual item by more than a certain percentage. The latter, in this department, has recently been fixed at 25%.

It follows, that where the known quantity of work is small and yet susceptible of increase during the progress of the work, the addition of an allowance depending on the judgment of the engineer is the only reasonable and safe means to cover unforeseen conditions. To adopt a fixed percentage for these increases is obviously impracticable, especially in the case of small quantities. In fact, in many cases the only practicable increase would be to double the quantities. Take, for instance, that in which it were known that one valve was required, evidently the only possible increase here would be to ask for two.

As to the fourth reason. The quantities of rock and earth to be met with can only be determined by previous tests, the expense of which, as well as the time required to complete them, would be unwarranted in almost all cases. The department, therefore, has to rely on the data secured by a field inspection and from excavations made in the street where the main is to be laid. Where no such excavations have been made, the data necessarily are based only on the field inspection. Furthermore, where rock exists, the general practice of the department has been to place the mains in the excavated sewer trench, and this excavation may be made between the date when the contract is completed by the engineers and forwarded for approval and execution and the date on which the contractor is ordered to begin work. Bearing in mind that this period represents somesix months, the opportunity for a change in actual conditions is evident.

An illustration of these changes, as well as of the motives a contractor has at times for unbalancing his bid and "gambling" on future conditions, seems pertinent here. Under the contract in question, the successful contractor bid 1c. for rock excavation and $2 for earth excavation, and his reason for doing so, as subsequently explained by him, was that while he knew there was rock in the street, he expected that there would be a sewer laid before he was called upon to begin his work and that this department would then change the approximate alignment shown on the plans and order him to lay the main in the sewer trench, in which case he would not only be saved the rock excavation, but would be paid at the rate of $2 a yard for excavating the refilled trench. As a matter of fact, the sewers were and are still being laid in the streets covered by this contract, but the department, of course, refuses to change the alignment and thereby enable the contractor to realize at the city's expense, the profit he anticipated. It is needless to comment on the contractor's disappointment, and on the fact that had the bid been balanced, a change in the alignment could be made in the interest of both contracting parties.

The method of bidding on a percentage basis to avoid unbalanced bids is well known, as are also the evils resulting therefrom, among which may be especially noted that while the contractor is strictly prevented from unbalancing his bid, no such restriction is placed on the engineer in preparing his estimates of quantities, and the contractor is, therefore, practically left at his mercy.

In framing the proposed plan, the following conditions had to be borne in mind:

(1) The contractor must be able to bid whatever total amount he chooses, even if it should be below the actual cost of the work.

(2) The contractor must be allowed sufficient latitude in fixing his prices for each unit of work, so that he may secure adequate compensation even if he believes the engineer's quantities are not accurately balanced.

(3) The contractor must not bid for any item materially below the actual cost thereof. He can accomplish the same end, if he so wishes, by reducing the amount of his total bid.

Our proposed plan conforms, in our opinion, to these requirements. We do not claim that in limiting the conditions we have accurately gaged their relative importance. Neither could, however, our critics at this stage. Like them, we also could see objections to our plan, but have simply done what we deemed best after careful consideration. Experience will determine the success of our efforts.

As to the form of, and objections to, the proposed contract: Were it not for the need of providing for the contingency, however improbable, of a bid lower than the cost of the work, the only modification to be made in the present contracts would be the setting up of the engineer's minimum price for each item to be followed by this paragraph (quoted in "The Bulletin"):

No bid will be accepted in which the price bid on any item is less than the engineer's minimum unit price for that item, as given in the foregoing statement.

The second and third paragraphs quoted in "The Bulletin" state the mode of procedure when the bidder desires to carry out the work at less than the estimated actual cost thereof. Assuming, however, that such case, however improbable, would occur, the bidder would find in the contract the total of the engineer's minimum estimate in place of the letter "A," quoted in "The Bulletin," and experience no difficulty in following the method prescribed.

The assertion made in "The Bulletin's" article, in the final paragraph, that the only just way to prevent unbalanced bidding is that the engineer stop issuing unbalanced quantities, is, in our opinion, in error. It certainly would not prevent the operation of Reasons 1 and 2, already given, as proved by the terms of the resolution adopted by the General Contractors' Association at the meeting of the Executive Committee on Mar. 5, referred to in "The Bulletin," which reads as follows:

Resolved, that the General Contractors' Association is

opposed to any form of percentage bidding and that this opposition is founded on two main objections, namely:

(1) It denies to the contractor the opportunity to arrange his bid in accordance with his own ideas as to the accuracy or probability of the quantities as estimated by the engineer.

(2) By its publication of cost of each item, it encourages laxity in estimating on the part of intending bidders, and makes bidding by incompetent persons much easier than under the unit system of bidding.

The desire of this department to do justice to both contracting parties, cannot, we think, be called into question, and as we see no practical way of avoiding the estimate of quantities somewhat in excess of actual computations, we believe that the method proposed is equitable and workable and feel warranted in so holding until results prove the contrary. Apparently, the underlying reasons for "The Bulletin's" criticisms seem to be that some contractors prefer gambling on the work to be done and disguising their prices, to submitting prices based on estimated actual cost. The resolution of the General Contractors' Association of Mar. 5, given above, tends to confirm this view, which, however, does not commend itself to our judgment.

In connection with this matter, it is pertinent to note that in the bids submitted for hauling and laying water mains and appurtenances in various streets in the Borough of Manhattan, received on Feb. 20, 1913, the majority of bidders submitted a price of 1c. or less on 20 out of a total of 34 items. In the case of the low bidder, there were 24 items on which 1c. or less was bid.

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Reports on the Organization of a Highway Department for the State of New York

About a month ago, as briefly noted in ENGINEERING NEWS, Mar. 6, 1913, a commission of 18 members was appointed by Governor Sulzer, of New York, to advise him on the reorganization of the state highway department under a new law enacted by the legislature, the commission serving without expense to the state. After a month of what are reported to be "lively conferences," ten members of the commission have joined in submitting a report. Eight of the members have not signed the report, but three of this minority have submitted individual reports. Also three of those signing the majority report have submitted additional individual reports, leaving five members thus far unheard.

The Majority Report

The majority report is very general but becomes specific in a peculiar way at points which relate to some details of the work which they expect the highway department will administer.

The report calls attention to the combinations of sharpcalked horse shoes, narrow steel tires and automobile wheels which introduce different requirements. It calls attention to the long and severe winter, low temperatures, frost, heavy snows, thaws, and heavy automobile trucks (in that order), showing how the various highway organizations heretofore established in New York have been confronted with the same peculiar problems.

The commission states that it has found it inadvisable to recommend any specific man for consideration for the position as commissioner of highways, the signers contenting themselves with describing the proper man as of "such character and standing as to command the repect and confidence of the public at large, of proven executive ability and capacity properly to organize and conduct the department, and preferably a man of experience in road building."

There are 23 numbered recommendations which we have summarized as follows:

(1) Extensive new construction should not be contracted for until the commissioner has ascertained which types have proved best in the state.

(2) The commissioner after organizing the department should cancel contracts and correct specifications or plans for constructions which do not prove to be among the best types which the commissioner should adopt as standard.

(3) Experimentation should be on short sections. Lengths of a few hundred feet, carefully built and observed, serve as well as stretches of several miles.

(4) Not more than 1000 miles of new work should be contracted for in a year.

(5) Contracts for extensive new work should be let in September, October and November with not more than 500 miles of road advertised for letting in one week.

(6) Bids should be advertised for four weeks instead of three. Plans and specifications should be completed and ready for bidders before advertising.

(7) Strict rules for completion of contracts should be enforced.

(8) Radical alterations in character of construction under contract should be avoided. Equitable supplemental contracts should protect the state when changes are necessary.

(9) Deputies and division engineers should be exempt from civil-service rules.

(10) Compensation of the first deputy should be increased from the present $6000 and he should have the powers of a chief engineer under the direction of the commissioner.

(11) The commissioner should bear in mind that roads are not constructed and improved for the benefit of owners of automobiles; he should give attention to the location, construction and improvement of farm roads and should build up connecting links to have a comprehensive continuous system.

(12) Specifications should be simplified and interpretations made uniform.

(13) Proper maintenance and repair should be almost equal in importance to new construction and should be constant, immediate and unremitting. Old macadam roads should be scarified and treated as a resurfacing job with additional stone rolled in place with proper binder. Side ditches should be cleaned out in early spring and late fall. Exuding material on bituminous roads should be covered with sand, stone or screenings. When roads are oiled, one side should be treated at a time; sand or screenings should be used. Trees, embankments and other obstructions to view of vehicles should be removed.

(14) Specifications for bituminous binders should grant no special privileges, but allow fair competition for proper material.

(15) Cement should be purchased by the contractor and paid for by the state instead of being paid for as concrete in place.

(16) Stone or gravel, and not stone alone, should be specified for concrete in all contracts.

(17) Local as well as imported stone should be permitted in the bottom courses of roads, under specified requirements.

(18) Partial payments should be made to a contractor for stone, asphalt, brick or other imperishable materials delivered at the site of work in winter seasons.

(19) The auditing department should be efficient and vigilant; inspection of construction should be constant and unremitting.

(20) The commissioner should have power to enforce provisions relating to traffic regulation.

(21) Damage to pavements or highways caused by rigid attachments to traction engines and such vehicles should be paid for by the owners.

(22) Prompt and better methods of securing rights of way and settling land damages should be adopted.

(23) Short connecting links, between improved roads and the cities or villages into which they lead, should be built without delay.

The report is signed by A. J. Parker, C. E. Treman, G. A. McGuire, W. D. H. Washington, D. B. Cushman, J. McGarvey, H. C. McCord, L. W. Kirwin, A. J. Deer, and J. F. McDonald.

A Minority Report

Mr. E. W. Stern, consulting engineer, New York City, a member of this commission, in submitting his individual report, stated that the majority report does not express with sufficient clearness and force his views on some matters taken up by the commission. It is believed that Mr. Stern has served, in a measure, as a representative

of the American Institute of Consulting Engineers and that his report has been reviewed by a number of well known engineers. A considerable portion is reprinted below.

ORGANIZATION AND ADMINISTRATION OF THE DEPARTMENT OF HIGHWAYS

It is a prevalent idea with the public that the construction and maintenance of roads is a very simple matter requiring only ordinary business ability. But in no department of Public Works is there greater opportunity for the exercise of sound engineering principles, technical knowledge of the subject, and true economy. A very great deal of money is being wasted every year by the road departments of many of our states in ignorant and useless experimentation on road materials, and methods that have been tried out and long ago abandoned by engineers experienced in this kind of work.

Highways in New York State will never be properly and economically constructed and maintained unless a thoroughly efficient engineering department be organized in conection therewith.

The Murtaugh bill, which reorganizes the department of highways, and which has just become law, unfortunately has **grave defects, both in the entire scheme of organization, and in the small salaries attached to the principal positions.** These defects, unless corrected, would seriously hamper any honest endeavor thoroughly to organize the department on an efficient basis.

My criticisms of the existing law are as follows:

The commissioner is not required to be a civil engineer, nor one who has had experience in the construction of engineering works, nor in the organization of engineering departments. The law would permit a layman to fill this very responsible position. If a layman were chosen, the engineering organization is not properly planned to be efficient, nor to attract to it the right kind of men. There should be, under the commissioner, a **chief engineer of the highway department** who should be directly responsible to the commissioner for all the engineering work, and therefore, **should have full charge and responsibility in the preparing of plans and specifications, execution of the contracts, and of the carrying out of the work, likewise of the maintenance of all roads which come under the jurisdiction of the department.**

The chief engineer should have the right to select his staff, consisting of three assistant engineers and nine division engineers, subject to the approval of the commissioner.

In such an organization, the commissioner would be able to hold the chief engineer entirely responsible. The latter could not then complain about the division of responsibilities which the law permits, in which the chief deputy is really no more than an engineering advisor to the commissioner, and has not any real responsibility or authority in the actual execution of the work, having absolutely no control over the division engineers, who are in actual charge of construction, nor over the second and third deputies, who have entire charge of the maintenance and repairs of all roads.

The bill as framed is not sufficiently exacting as regards the qualifications necessary for the so called **deputies,** and limits the selection from among **those who have had practical experience in construction and maintenance of highways.** The bill is very weak in the use of these qualifications, which would permit a man who had been in such a position as foreman over a gang of laborers employed on road work, to become a deputy, with all the great and highly important responsibilities which attach to the office. Furthermore, it would limit the field of selection to a small body of men.

I would recommend that railroad engineers be eligible for appointment, as the experience in grading, construction of bridges, foundations, drainage, etc., gained in railroad construction is applicable to the similar problems met with in highway construction, and a thorough knowledge of organization and of the handling of men, and of business methods, a thorough practical training in construction, and zeal and efficiency, are among the qualifications of a successful chief engineer of an important railroad. The only qualification he might be lacking in would be experience in the proper surfaces for highways, but given the power to obtain advice from consulting engineers who have had special experience on this subject, it is reasonable to suppose that a competent chief engineer from one of our prominent railroads might be an ideal selection.

The compensation for the heads is altogether inadequate to attract the proper kind of men to this department. The commissioner should receive a salary of about $15,000 a year, the chief engineer of about $12,000 a year, and each of the assistant engineers, $6000 a year. This increase over the salaries allowed in the Murtaugh bill, amounting in all to only $19,000 a year, ought to enable the state to obtain the services of men who are eminently qualified to fill such very responsible positions.

The law requires that inspectors of construction shall be selected from residents in the county in which the highway constructed or improved is located. While preference should be given to residents, we do not believe that this should be mandatory, as very often the appointment of non-residents might be found desirable, or necessary, and decidedly better for the efficiency of the service.

The chief engineer, the three assistant engineers, and the nine division engineers should not come under civil-service requirements, as these men should form part of the official family of the commissioner, and be removable by him at any time for the good of the service.

SELECTION OF A HIGHWAY COMMISSIONER

The selection of a proper person for the office of commissioner is most important. No matter how good the scheme of the reorganization of the department of highways may be, unless a wise selection for the position be made, radical reform will not be effected.

The commissioner should be a man of such high character and standing as to command the respect and confidence of the public at large. He should be of proven executive ability, with a thorough knowledge of how to organize such a department, and **chosen from the engineering profession if possible.** Otherwise he should be one who has had to do with the construction of engineering works.

TYPES OF ROADS

The particular kind of a road to use in a certain locality is a problem which depends for its proper solution on a number of important factors, such as the kind and amount of traffic, the sub-soil, the climatic conditions, the cost of construction and maintenance, and the amount of money available for construction and maintenance. It would be entirely out of place, therefore, to recommend any particular types of roads, beyond calling attention to the fact that there are two fundamental requirements accepted as axiomatic by all authorities in road building: (1) Perfect sub-drainage and (2) a rigid foundation.

There is no need for extensive experimentation in the near future on the part of the state as to what kinds of roads to build. So many methods have been tried, both at home and abroad, that intelligent investigation of what has been already done would be sufficient to indicate what types of roads and road surfaces should be eliminated from consideration, and what types are best suited for particular localities.

It will doubtless become advisable, from time to time, to experiment with new types, but this may be done on a small and inexpensive scale.

It is important that we recognize the fact that the difficulty of providing durable roads has been greatly augmented by the introduction of automobile traffic; the wear and tear resulting in their use being much greater than from horse vehicles. We must make up our mind to make much more durable types of roads than we have been accustomed to in the past.

There can be no doubt but that the rapidly moving automobile and auto-truck have come to stay. This method of transportation is yet in its infancy, and before another generation, if proper roads shall have been provided to take care of it, the economic benefit to the community, resulting from their use, will be great.

Another important consideration is the fact that the money to construct new roads in this state is raised by bond issues, maturing in 50 years from date of issue. Therefore it would be manifestly unfair to future generations to construct, with this money, roads that last only a few years, if more durable types requiring less annual expenditure for maintenance are economically practicable.

MAINTENANCE

The proper maintenance and repair of existing roads is just as important as the construction of new ones.

It is most important that the department of highways should be thoroughly organized for this purpose, so that repairs may be promptly, economically and efficiently made. By promptly repairing small defects, not only is the road made better for constant service, but also the cost of maintenance is decreased. The amount allowed in the budget for maintenance should be sufficient to avoid any delays in making immediate repairs.

The report closes with a few miscellaneous recommendations on contracts, changes in construction, specifications, short links, etc., quite similar to those noted in the majority report.

A Spring Wheel for Automobiles

One of the schemes over which a multitude of inventors have worked without success is the design of a "spring wheel" for use on vehicles. Many such wheels have been designed and built, but the universal experience has been that the wear of the joints, exposed as they necessarily are to dust, water and mud, has made such wheels impracticable.

The object of most inventors has been to substitute springs in the wheel itself in place of the ordinary vehicle springs. Such springs require, of course, a large range of motion and corresponding movement of the joints. In recent years, however, inventors have sought to devise spring wheels as a substitute for pneumatic tires. Such springs, of course, need have no greater range of motion than the tire itself, that is, a small fraction of an inch. In such wheels motion in the joints can be reduced to a minimum.

A spring wheel of this latter type was exhibited at the recent Motor Truck show in New York City and was briefly referred to in our issue of Feb. 20. At our request, the maker of the wheel, the Seaton Wheel Co., of Nashville, Tenn., has furnished us material from which the accompanying illustration and the following description have been prepared.

Fig. 1 shows a view of the whole wheel as applied to a motor car and in Fig. 2 views are shown of a single spring element. *A* shows the element in an unstrained state; *B*, the same element under stress. This element consists of a stout spiral spring with each straight end

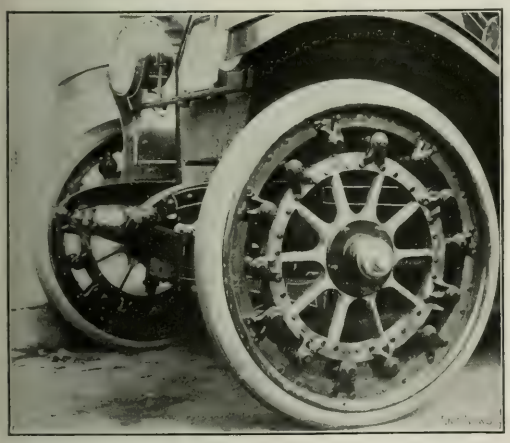


Fig. 1. A New Type of Spring Wheel Applied to an Automobile

terminating in a ball and socket joint, one of the socket bearings being attached to the wheel rim and the other to the extended hub. The inner and outer of these bearings are attached alternately to the rim of the wheel and to the inner wheel. The ball and socket joints are packed with grease.

Important points worth noting about this arrangement are that, since the rim and the extended hub are both rigid, the total stress due to the load is divided between all the springs on the wheel.

It is claimed also that when the wheel is running at high speed the centrifugal force acting upon the inner wheel, due to the fact that the center of gravity of the rotating rim is higher than the center of rotation of the hub, tends to offset the effect of the load and raise the hub toward the center of revolution of the outer rim.

The practical advantage claimed for this spring wheel is that it permits the use of solid tires on the wheels, while retaining the easy riding qualities of the pneumatic

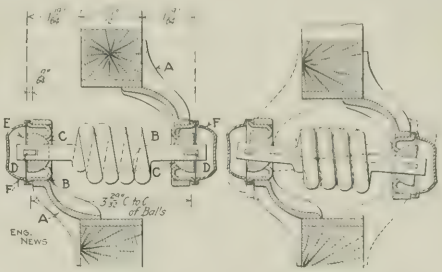


Fig. 2. Views of the Spring Element (B Unstrained, B Strained) from the Spring Wheel
(Seaton Wheel Co., Nashville, Tenn., makers.)

tired wheel. It is stated that a set of wheels has been run on a touring car over 45,000 miles with no perceptible wear.

❖

An Investigation of the Efficiency of Trusts was proposed by Hon. Wm. C. Redfield, Secretary of Commerce, in an address before the American Cotton Manufacturers' Association Apr. 9; extracts follow:

I wish to suggest a new subject of inquiry for the Bureau of Corporations. The air has been full for years past of discussion of the trusts. It is alleged upon the one hand that the trusts are necessary for our industrial efficiency. There has been discussion altogether too brief, on the other hand, as to whether the trusts are, as a matter of fact, industrially efficient or not.

A good many years ago the late Edward M. Shepard said to me that he believed the trust form of organization carried within itself the seeds of its own decay; that its economies were more apparent than real and that the serious difficulty in obtaining men who could manage efficiently, with firm grasp and thorough control, these great organizations, would result in ultimate segregation.

The point I now bring before you is this: That we do not know, from any mature and exact study, whether the so called trust form of organization is industrially efficient or whether it is not. We are dealing with it in a sense as a national menace, whereas the fact may be that it menaces chiefly itself and the people that are interested in its securities. Whether this is true or not, I do not pretend to say. It does seem to be sufficiently important to warrant a thorough study of the matter.

Certain economies are obvious in the formation of a trust. Are or are not these economies superficial, in the sense that the formation of a trust brings into action certain less visible but more potent elements that take away from economy? Is it or is it not true that the major motive in the forming of the trust is the profits of the promoters that organize it? Are the economies of centralized organization, of reduced competitive outlays, more than balanced by certain economic weaknesses which do not arise in the smaller concerns?

There is a point, as manufacturers well know, up to which, as product increases in quantity, cost is reduced, by reason of the distribution of the burden charge over a greater output and its consequent reduction per unit of that output. There seems to come a point where this process stops, and beyond which the increase of output is done at an increasing expense. This, of course, varies under different conditions, but there is what seems to be the shadow of a law here which should be more thoroughly understood.

Is it practically possible for men to guide with equal individual efficiency fifteen thousand men, five hundred men, and fifty men? Is there a point where the mere nerves and fibers of the industrial organization required to handle the larger force becomes so complex and delicate that the frictional transmission, so to speak, of the will and thought of the head becomes so great that it is weakened or lost? We hear that the personal relation between master and men is lost; that sometimes the separate units forming the trust operate on a somewhat individual basis, too little related to the policy of the central office. What the precise facts are we do not know. They need to be thoroughly investigated, for we may come to find that the remorseless law of economics is working its way irrespective of legislation, and that the light of economic truth, once found and fully turned upon the subject, may make clear a way which to many has seemed rough and hazardous.

Notes on the Pitot Tube

By John Airey*

Recently the writer became interested in the theory underlying the action of the Pitot tube. A few writers state that $h = \frac{v^2}{2g}$ but do not attempt to prove it as a rational basis. Those who attempt a proof approach the problem by considering the column of water to be sustained by the impact of a jet of water of cross-sectional area equal to that of the pipe. This leads to the result that $h = \frac{v^2}{g}$. The assumption made that the jet is deviated through 90° is admittedly inaccurate, therefore the result is written $h = c\frac{v^2}{g}$, where c is empirical. And then for a reason not very definite another empirical constant c' $(= 2c)$ is introduced and the result becomes

$$h = c'\frac{v^2}{2g} \qquad (1)$$

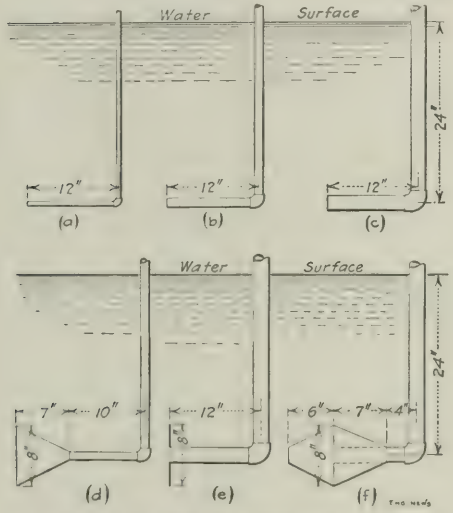


Fig. 1. Six Forms of Pitot Tube Tested

For substantiation and amplification of the above statements any standard textbook of hydraulics may be consulted; also a paper by G. S. Williams (Trans. Am. Soc. C. E., Vol. 27, Parts 1 and 2). In the last-mentioned reference claim is made to having constructed tubes such that c' in eq. (1) was greater than unity, although the tubes actually made use of had coefficients smaller than unity—some of them considerably so.

Church's "Mechanics" states that Weisbach verified $h = \frac{v^2}{g}$ for fine tubes with thick walls, and that Pitot had obtained $h = 1.5\frac{v^2}{2g}$ for a conical mouthpiece. Bazin has, however, obtained results in which the actual head differed from $\frac{v^2}{2g}$ by a small fraction of one per cent, only

*Department of Mechanical Engineering, University of Michigan, Ann Arbor, Mich.

The writer performed experiments with tubes (a), (b), (c), (Fig. 1), these being made of ½-in., 1-in., and 1½-in. gas piping respectively, and was surprised to find $h = \frac{v^2}{2g}$ to within experimental error, which was under one per cent. This suggested that the momentum theory was quite a misapplication, and that the logical basis was $\frac{v^2}{2g}$.

It is to be noticed that considerations of energy also lead to the statement that $h = \frac{v^2}{g}$, because the work done in erecting a column of water of height h, cross-section a, and density w, is $ahw\frac{h}{2}$. Also the energy previously stored in the same water in kinetic form was $ahw\frac{v^2}{2g}$. If we could assume these two to form an equality the result would be obtained that $ahw\frac{h}{2} = ahw\frac{v^2}{2g}$, or $h = \frac{v^2}{g}$.

The following proof was deduced as establishing $h = \frac{v^2}{2g}$ as the rational basis.

Proof—Fig. 2 shows a horizontal section of the pipe

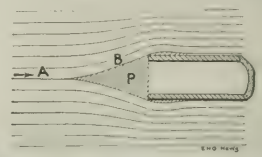


Fig. 2. Sketch of Stream Lines around Mouth of Tubes

with an approximation to the form of the stream lines. The water inside the pipe will clearly be dead, and this dead water will extend into some region outside the pipe as shown by the shaded area. The legitimacy of the proof depends in no way on the particular shape of this area. Assuming that smooth motion exists, i.e., no discontinuity of flow occurs, or, more definitely, the velocity of any stream line can not be more than infinitesimally different from the velocity of a stream line infinitesimally distant from it, then it follows that *the boundary of dead water must be a stream line of infinitesimal motion.*

As the preceding sentence is of fundamental importance in the following proof it may be desirable to discuss it more thoroughly. After a short time steady conditions will set in, i.e., at any point in space the successive particles of water pass this point in the same direction and with the same velocity. That steady conditions set in may be seen approximately from inspection, although this is seen to be no longer true as the water leaves the obstruction. As an excellent example of this principle observe the beautifully smooth motion of the water near the bow of a boat sailing on a calm sea; but eddies are usually found at the stern no matter how calm the sea. If it be conceivable let the water at the end of the pipe be bounded by water moving with a finite velocity. Then as water is a *fluid* (i.e., a substance that will yield with time to the smallest shearing stress) and is not a mathe-

matically frictionless fluid, it follows that the bounding stream lines will drag the dead water into motion and so the surface dividing dead water from moving water will be moving inwards—or in other words conditions are not yet steady. Granted that steady conditions set in, then if a path be followed from dead water, keeping always at right angles to the stream lines, the velocity will change from zero to a finite quantity by a gradual variation, or the *boundary of dead water is a stream line of infinitesimal motion.* There will be some particular stream tubes which remote from the pipe have a velocity v (= velocity of stream) and then as they approach the mouth of the pipe gradually spread out, the speed meanwhile decreasing until they skirt the dead water and the speed has become infinitesimal.

If Bernoulli's equation be written out for points A and B, these being points on a stream line which skirts the dead water, we obtain,

$$\frac{v_A^2}{2g} + h_1 + atmos.\ press. = \frac{v_B^2}{2g} + \frac{p}{w} + atmos.\ press. \qquad (2)$$

in which h_1 = depth of point A below the surface.

p = pressure in dead water, which will, of course, be constant at all points in a horizontal plane.

Also, if h is the height to which the water in the tube rises above the level of the water surface, and a is the cross-sectional area of the pipe, then

$$pa = (h_1 + h)wa \qquad (3)$$

Now, v_A is the velocity of the stream, and v_B is infinitesimally small:

Therefore

$$\frac{v_A^2}{2g} + h_1 = \frac{p}{w} = h_1 + h \qquad (4)$$

Hence

$$h = \frac{v^2}{2g} \qquad (5)$$

Note: This proof applies equally well to cases (*d*), (*e*) and (*f*) of Fig. 1, merely an alteration to Fig. 2 being required.

The only part of this proof at which caviling might be legitimate is the part given in italics. If stream-line motion is broken up, if turbulence occurs, then discontinuities may occur plentifully, with the consequent invalidating of the proof. In this case v_B would be greater than zero, from which it follows that the height actually obtained would be less than that given by eq. (5). If the above theory is correct it is quite impossible to obtain a height greater than $\frac{v^2}{2g}$, for the greater the turbulence the greater is v_B and correspondingly smaller is h.

In order to throw some possible light on the above results the writer by the kind permission of Prof. H. C. Sadler made further use of the Naval Tank at the Michigan University to test Pitot tubes with (1) a bell mouth opening, (2) a mouth diverging inwards, (3) a circular disk fastened to the end of the pipe. These types were chosen as representing extreme cases of all possible variations. In each case the results were again within 1.5% of $\frac{v^2}{2g}$ and always below. Case (*f*) gave $\frac{v^2}{2g}$ as nearly as measurements could be made. This is as would be expected from the proof given, as case (*f*) is the one least likely to cause turbulence.

The disparity between these results and experiments where a height greater than $\frac{v^2}{2g}$ has been obtained requires explanation.

The Naval Tank is an ideal means of performing these experiments, because no uncertain knowledge of speed exists as does in measuring the quantity of water delivered from a pipe and assuming an accurate knowledge of how the velocity is distributed over a cross-section. Also, the change of velocity due to the introduction of the Pitot tube is avoided in using the tank.

The writer would be extremely interested in a discussion of above, especially from those who have made experiments which are in disagreement with his own, and to facilitate that discussion gives the following summary of his views:

(*a*) The momentum theory is untenable, as the assumptions made are too wide of the mark.

(*b*) If stream-line motion exists then the equation $h = \frac{v^2}{2g}$ is rigidly correct both in practice and in theory.

(*c*) The greater the disturbance to stream-line motion the greater the discrepancy between the experimental head and $\frac{v^2}{2g}$, h always being less than $\frac{v^2}{2g}$.

(*d*) If the obstruction is small compared to the cross-section of the waterway, e.g., a Pitot tube in a tank or a canal, but not necessarily a Pitot tube in a pipe, then the height both theoretically and practically cannot be greater than $\frac{v^2}{2g}$.

(*e*) As speed increases (*c*) becomes more pronounced, though at 10 ft. per second the effect of this was only about 1%.

(*f*) Experiments where the height differed widely from $\frac{v^2}{2g}$ are probably, in a great many cases, accounted for by inaccurate measurement of the static head by the second leg of the Pitot tube.

Geared Steam Turbines for ship propulsion were described by Sir Charles Parsons in a paper read before the Institution of Naval Architects in London, on Mar. 13. He stated that the aggregate power of the vessels which are now in service equipped with steam turbines driving the propellers through gearing is about 26,000 hp. These represent cargo steamers, cross-channel steamers and warships. There is under construction at the present time turbine machinery and mechanical gearing for vessels representing an aggregate of over 120,000 hp. Included in this are two vessels of over 20,000 hp. each. The two Channel steamers, plying between Southampton and Havre, which have about 5000 hp. with a speed of about 18 knots, show a fuel economy of about 40%, compared with similar vessels driven by turbines mounted directly on the propeller shaft. A cargo steamer, the "Cairncross," recently built by Messrs. William Doxford, of Sunderland, is equipped with steam turbines with a normal speed of 1700 r.p.m. geared to the propeller shaft with a speed reduction such that the propeller shaft runs at 63 r.p.m. The coal consumption trial of this vessel compared with that of a sister ship equipped with triple-expansion reciprocating engines showed a saving of 15% for the geared turbine installation. An improved method of cutting the teeth of the helical gears has been developed in the Parsons shops and enables the teeth to be finished with a much higher degree of accuracy. The results of this improved tooth-cutting machine is to greatly reduce the vibration and noise in the operation of the gearing.

Another twin-screw geared turbine steamer to run to the Isle of Man has recently been equipped with 8000-hp. engines.

Present Status of the Telephone Industry in the United States

The 1912 report of Theodore M. Vail, president of the American Telephone & Telegraph Co., shows that there are 7,456,000 subscriber stations in 70,000 places of the country (besides some 4,000,000 stations of independent companies). This figure is to be compared with 65,000 post offices, 60,000 railroad stations and 25,000 regular telegraph offices; 2,503,000 of these subscriber stations were operated by local, coöperative, or rural concerns having connection rights with the Bell system. The total length of wire in use by this company was 14,611,000 miles, of which 1,678,000 miles were added during the year 1912. Of this total length some 2,200,000 miles is in toll lines. These figures do not include the wires operated by the connecting companies noted above. The daily average of total telephone conversations reached the figure of 26,310,000, of which 738,000 were toll-line connections. Comparison with similar statistics for Europe shows that all foreign countries combined have only about 40% the telephone traffic of the United States, though showing 3½ times the telegraph traffic and twice the first-class mail traffic.

The total capitalization (including duplications) of the Bell system is $1,294,835,000, of which $568,977,000 is owned and in the treasury of the system. The stocks, bonds and notes outstanding in the hands of the public at the close of the year aggregated $725,900,000. Adding $25,300,000 in current accounts payable, and subtracting $73,400,000 of liquid assets, cash and current accounts receivable, a figure of $677,800,000 is given as the net permanent capital obligation of the whole system outstanding in the hands of the public. Appraisals of the physical property of all the companies of the Bell system have been made by the company's engineers and it is announced that the book cost of Aug. 1, 1912, is about $736,000,000 with a cost of reproduction of $797,000,000, not including anything for intangible assets of any sort.

The steady increase in operating expense per subscriber's station, which has been a striking feature of previous years' operations, was checked in 1912 with a slight improvement over 1911. A small increase in the investment per station has brought this up to $143, which sum, however, is only half the figure for 1895. The net revenue per station was $9.29 in 1912 compared with $23.52 in 1895, due to a 50% decrease of rates and gross revenue following a reduction of nearly 50% in maintenance, depreciation and similar expenses. The percentage on plant investment, required for maintenance and depreciation, is nearly the same throughout this period since investment, maintenance and depreciation have been reduced together. It is contended that the company, by improvements in operation and organization during these years has cut in half those expenses not varying directly with the physical plant and, by improvements in its art and business, has cut in two the investment per subscriber station. The claimed result is that the average net profit is but slightly decreased although the cost to a subscriber is about one-half. Incidentally, the service is more reliable and more comprehensive.

In the engineering department, an important feature of the work has consisted in putting into effect, in the plants and services of the various associated companies about the country, the numerous improvements which have very recently been developed and standardized. The success with devices and methods (Pupin "loading" system) employed for improving transmission and extending the talking distances on the New York-Denver line (see ENGINEERING NEWS, May 25, 1911) has led to a systematic introduction of these improvements throughout the country, so that at the end of 1912 a total of 54,750 miles of heaviest-gage wire had been equipped with these improvements, doubling their transmission efficiency and securing, without expenditure for new wires, "phantom circuits" equivalent to 12,600 miles of heaviest-gage wire.

Places heretofore too remote for intercommunication have been brought together and improvement in the service of distant cities has been made. The plans in hand contemplate extension of four heavy wires from Denver to San Francisco, so as to permit conversation across the continent.

Specifications have been prepared for a new type of cable carrying 900 pairs of wires in the space formerly required for 600 pairs, the latter number being the largest which it has been heretofore feasible to employ. Trouble has been found from vibration from overhead cables resulting in crystallization of the lead alloy of the sheath. An improved (but less expensive alloy) has been successfully developed and this will also save $300,000 per year in first cost of overhead cable construction. Improvements in local operating efficiency, toll-line efficiency, switchboard apparatus, etc., represent savings estimated (conservatively, it is claimed) at over $1,000,000 per year. Although such savings are real and accrue from year to year, it is held difficult or even impossible to trace them in the books of the company, since they are offset by increases in the cost of other materials entering into construction. The effect of such savings, therefore, lies in preventing the total costs from rising as high as they would otherwise.

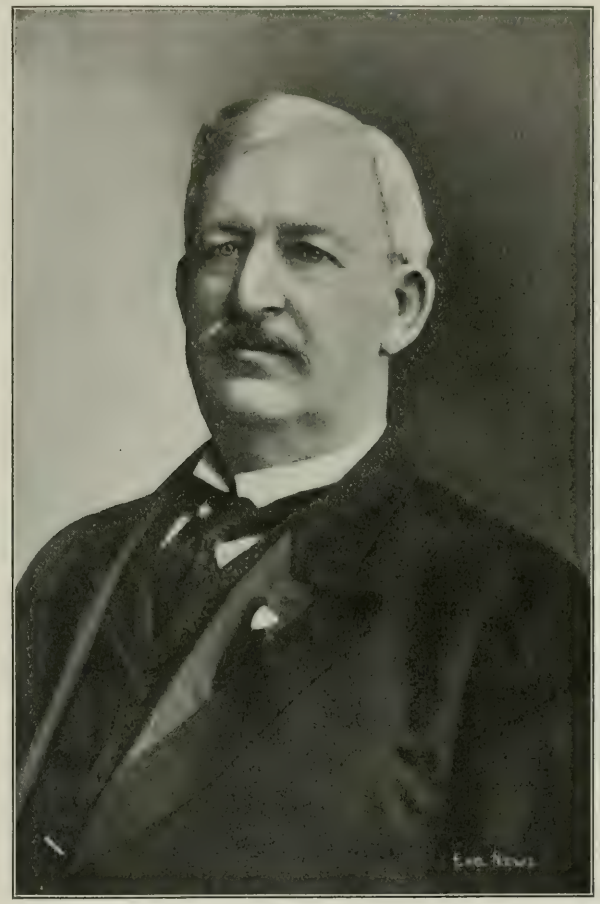
The president's report concludes with many expressions of the company's willingness to coöperate with government regulating commissions everywhere and particularly with the Interstate Commerce Commission, which recently has been charged with the investigation of the American Telephone & Telegraph Co., leading to the formulation of a national policy towards this utility, which openly aims towards a monopoly of telephone and telegraph service and believes in the benefits arising from such a situation.

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Census Costs and Methods—In the annual report of the Director of the Bureau of the Census for the fiscal year ending June 30, 1912, it is stated that the 13th decennial census (1910) has cost to date $15,171,593, about half of which, or $7,223,385, was expended for field work. The census bureau had much difficulty in getting competent enumerators and the results obtained were in many cases very unsatisfactory. The director states that there is reason to believe that the actual number of inhabitants was ascertained with "approximate accuracy" and that the principal interrogatories on population and agricultural schedules were answered with "a fair degree of accuracy," but he emphasizes the need of trained enumerators and suggests that part of this work in the future be performed by mail carriers. The director states further that there is no way of measuring precisely what the margin of error is in any case; it is sufficient evidence of the need of improved methods that in multitudes of cases interrogatories which are properly applicable are not answered at all, and that statistics on several subjects as tabulated show relationships which are obviously wrong.

James Dix Schuyler*

The death of James Dix Schuyler, last September, closed an admirably developed career. Trained from youth in the rough school of hard work he was, among men of eminence in his profession, a most truly representative Western engineer.



James D. Schuyler

The son of Phillip Church Schuyler and Lucy M. (Dix) Schuyler, James Dix Schuyler was born at Ithaca, N. Y., May 11, 1848. Of distinguished ancestry, his early education at Friends College was representative of the best American traditions and ideals and unquestionably had a powerful influence in the formation of his character.

His years at Friends College, from 1863 to 1868, gave an intellectual foundation eagerly and soundly built upon, although it would seem that his experience there could have included but little of the so called "higher education." Yet James Dix Schuyler was notable as a man of the broadest culture, of scholarly attainments and cultivated taste. His mind was active, orderly and well balanced, with a vast capacity for selective assimilation and sustained effort.

Shortly after leaving school in 1869, Mr. Schuyler joined a railway survey party in Colorado. Those were rough days in the West, and railway preliminary surveys, and even location surveys, were matters of considerable hazard. The Indians were constantly giving trouble, and the youngster from the East was likely to get a good deal of experience not of a strictly professional character. That it had its value, however, is indicated by the remark credited to the late Howard Schuyler, elder brother of James Dix Schuyler, that he owed his position as Chief Engineer to the fact that he could run a railway survey and fight Indians at the same time.*

From the quiet old college Mr. Schuyler stepped directly into the stern and picturesque life of the West. Many times during his early experiences in Kansas and Colorado on the location surveys for the Kansas Pacific and with the Denver & Rio Grande Rys., the field parties were compelled to take cover from the Indians; sometimes the instruments were abandoned in the urgency of retreat, so sudden would be the alarm, and on one occasion, in the thick of a hot fight, Mr. Schuyler was shot through the leg.

All his life alert to the call of wild places, those first years of young manhood, filled as they were with hardship, danger, and engrossing work, bound him to the West, and he was a part of the West to the end.

From 1873 on Mr. Schuyler lived in California. There his first professional work was as Division Engineer of the North Pacific Coast R.R., from Ross Valley to San Rafael. In 1874 he was appointed Chief Engineer of the Stockton & Ione R.R., but when this project failed financially, he took up, for the time being, work as a newspaper writer on the Stockton *Independent*.

It is probable that with this experience began the development of a literary style that was always admirable and highly characteristic of the man. Without pedantry, he was a master of English, and in his personal correspondence there was always an inimitable ease and charm, so truly his own that it expressed the very essence of his personality. Even his professional papers and technical articles exhibited this same fluent and

*Contributed by request by George Sydney Binckley, Consulting Engineer, Los Angeles, Calif.

*Those who have read a letter narrating one of Howard Schuyler's adventures, published in our issue of July 20, 1911, will be ready to believe this.—Ed.

graphic use of language. He was one of the few who speak and write their language in the same terms. This capacity for expression was beyond doubt of great importance to Mr. Schuyler in his broad engineering practice, and his lucid and pleasing style was an important factor in the presentation of his conclusions as embodied in professional reports.

In 1878 Mr. Schuyler was appointed Assistant State Engineer of California; and in this capacity he was placed in charge of the irrigation investigations then being conducted by the State Engineering Department. These investigations, made during the early period of irrigation development in the West, covered a large part of the great central valley of California.

During the four years that he was in charge of this work, as a man of broad and comprehensive imagination, he could not fail to grasp the enormous future importance of irrigation. Although from 1882 to 1884 he was Chief Engineer and Superintendent of the Sinaloa & Durango R.R. in Mexico, he must already have felt his life work to lie in the field of hydraulic engineering, and from that time forward he departed but little from his chosen specialty.

Following a very unprofitable venture as contractor for a section of the seawall on the water front of San Francisco in 1884, he was placed in charge of the completion of the Sweetwater dam*, near San Diego, Calif.

The history of this interesting work is well known, especially to Western engineers; but it is worth while to recall that the original design of the dam, as projected, was by F. E. Brown, who designed and supervised the construction of the famous Bear Valley dam†, that slender granite arch which has defied time, water, ice and critics for a good many years, and still stands although (according to some) a mathematical impossibility.

Rejecting as too radical the original plans of Mr. Brown, Mr. Schuyler designed for the Sweetwater site an arched dam with what was, at that time, a very bold cross-section, by giving (in the face of the disapproval of some very learned authorities) due weight to the element of support provided by the arched form of the structure. This takes little courage nowadays, but at the time when the Sweetwater dam was built precedents for such a design were few, and the weight of authoritative disapproval was heavy.

Although by no means comparable even in boldness with some of his later engineering work, Mr. Schuyler found in the Sweetwater dam his opportunity. Here was a chance to demonstrate his courage and faith in himself, and he made good use of it. It is interesting to consider that although he himself could never have doubted for an instant the perfect security of this dam, the fact that it stood when the reservoir filled made his reputation in California. It is still more curious that when through insufficient spillway capacity the dam was overtopped by an unprecedented flood that poured over the entire crest and thundered on the footings 90 ft. below, he received additional credit because the dam stood, instead of the natural, even though unmerited, criticism of the insufficiency of the spillway.

After having undergone several changes of original plan as to height, the Sweetwater dam was finished in 1888. From that time Mr. Schuyler's advance in his profession was rapid. By curious fitness, the last important work carried out under his personal direction was the recent extension to the Sweetwater dam,* in itself an unusual and interesting problem; so this, his first really great engineering work was also, in its final extension, his last—with it his career as a hydraulic engineer began and ended.

Much of Mr. Schuyler's work was in the West and Southwest. As Consulting Engineer to the Lake Hemet Water Co., he designed and supervised the construction of the Lake Hemet dam, a high masonry structure. Two concrete dams of his design form distributing reservoirs for the city of Portland, Ore., and he did important work in connection with the water-works systems of Denver, Colo., Ogden, Utah, and many other cities in the West and Southwest. He was retained on the Bear River Canal in Utah, and designed the extensive works comprising the Twin Falls irrigation development in Idaho. The Zuñi dam† in New Mexico, the Lake Frances dam in California and the Terrace dam in Colorado, are representative of his activity in this country.

His engagements as an advisor took him to many remote places, and much of his most important work was abroad. He was called to Hawaii as Consulting Engineer to the Territorial Government to report on the Nuuanu dam, to Brazil to design the great Santo Amaro dam, and to Mexico to design a system of reservoirs which included that formed by the Necaxa dam‡, greatest of all the hydraulic-fill type. He was called to Japan to pass upon the feasibility of a proposed storage reservoir for a power project involving the construction of a dam 320 ft. high.

The hardships of this Japanese trip left him with a broken constitution. The dam site to be examined was difficult of access, and a natural pride in his remarkable strength led him to attempt exertions too great for a man of his years. After an unusually hard day, climbing the rain-drenched trails of remote Japanese mountains, he suffered a sudden and alarming illness, and had to be taken at once to the coast.

A wild trip in a flimsy Japanese skiff, through the rapids of roaring mountain rivers, brought him at last into touch with civilization, but even under the best of care his recovery was slow and never complete.

It was characteristic of the cheerful optimism that was part of the man, that when lying practically helpless in the skiff, he kept his camera busy, and that frantic rush through tumbling white waters was quite completely recorded; and when he could do nothing else, he studied with keen interest the twisting, flexible, ribless boat that slid and leaped under him as it shot toward the coast.

To merely enumerate the important works in connection with which Mr. Schuyler was retained would make a long list. Bold and original, his conclusions were little influenced by precedents merely as such; yet he had a goodly share of caution, and it would be hard to find in his record an example of rashness.

His reports on irrigation or water-supply projects are numberless and bear witness to an indefatigable industry and care in the collection and weighing of data and an orderliness of arrangement that was a life-long habit. Possessing one of the best engineering libraries in the

*See Eng. News Oct. 27, 1887, Aug. 15, 1895, Mar. 30, 1911.
†See Eng. News Apr. 7, 1888, June 23, 1888, Nov. 23, 1889, Nov. 20, 1902.

*Eng. News, Mar. 30, 1911.
†See Eng. News, Dec. 7, 1909.
‡See Eng. News, July 15, 1909.

West, he made liberal use of its resources, and his exceptional acquaintance with the literature of his profession was of very substantial benefit to his clients.

In his later years, Mr. Schuyler was the recipient of high honors. A member of the American Society of Civil Engineers, he served one term as Vice-President, and was twice awarded the Thomas Fitch Rowland Prize. He was a member of the Institution of Civil Engineers of London, and of various other societies and clubs.

He was retained as one of the board of three consulting engineers on the Los Angeles Aqueduct, and suggested the changed location and plan by which 10% of distance and 12 to 15% of cost were saved. He was one of the Board of Consulting Engineers sent by President Roosevelt to Panama in 1909 to report on the Panama Canal and the Gatun dam. His book on reservoirs is as well known and as highly appreciated abroad as in this country, and his recognition as an engineering authority is international.

A critical estimate of Mr. Schuyler's work as an engineer must give high place to his development of the principles and methods of hydraulic-fill dam construction. No more radical, or indeed revolutionary, advance in the art of impounding water has been made in recent times. Mr. Schuyler, although not the originator of the hydraulic-fill dam, certainly stands alone in reducing construction methods to a system and applying them to an extensive practice.

The little dam, built in 1894, at Tyler, Tex., the first of the hydraulic-fill type, was the beginning of a long list. Such work as the Santo Amaro dam, the Necaxa dam, the Terrace dam, the Gatun dam and others too many to even enumerate demonstrate the utility of this method of construction. Few important dams of this type were undertaken during Mr. Schuyler's lifetime without his advice being sought, and little advance over the methods developed by him has been made by other engineers.

His almost intuitive perception of the vast importance of this simple and natural method of constructing a watertight embankment, the courage with which he employed it on great works, and the indefatigable industry with which he constantly broadened the scope of its application and perfected the details of its technique, are all worthy of high admiration.

Tactful and considerate always in his rare criticism of others, he was not spared a very free and at times almost savage criticism of his own work during the earlier years of hydraulic-fill development. Yet the accident to the Crane Valley dam, by which some of the core material was lost, was practically the only failure of moment in the history of this class of construction until that at the Necaxa dam; and this latter was a construction accident purely. Himself wholly blameless in this matter, Mr. Schuyler felt very keenly the position it placed him in, yet he forebore to avail himself of legitimate opportunity to place the blame for this disastrous accident where it properly belonged. Sensitive as he was to injustice, his restraint in this matter must have been very difficult to maintain.

Few engineers unfamiliar with the West realize to what an extent the unusual conditions encountered there have controlled the development of its engineering practice and standards. Several generations of engineers, in the professional sense, have carried on the work of building one of the great masonry dams of the East; but the Western engineer must often take up his problem with a mind free from the trammels of custom or even precedent, and generally he must deal with its elements, great and small, under the strictest limits of cost and time. So it comes that much bold work has been done, and many untried methods have been put to the test. Prompt and original solution of problems is the rule rather than the exception. Results must be accomplished under the most severely adverse conditions and wholly unexpected obstacles overcome as they arise. Hence few of the earlier engineering works in the West leave nothing to regret in design or execution, even while reflecting high credit upon the bold and able men who directed them.

Mr. Schuyler rarely enjoyed the luxury of a perfectly free hand and unlimited funds for the embodiment of his best ideals in practice; yet even where the exigencies of economical design and construction were paramount, he had little or nothing to reproach himself with, and his record of uniform success was enviable.

Trained in a hard school of economic limitations, an optimism which sometimes led him to under-estimate the cost of work, was accompanied by a caution and foresight that guarded him from the pitfall of unsafe design. Structural necessities he never neglected, but the strictly utilitarian character of most engineering work led him, unconsciously, to minimize the importance of the monumental or architectural features of works of such importance as to justify broader treatment in the æsthetic aspect, treatment such as would be given structures of equal importance in Europe. This was by no means due to lack of artistic perception, but only to a conscientious regard for the interests of his clients.

Mr. Schuyler's valuable work on reservoirs is not more remarkable for its wide range and practical treatment and comment than for the total absence of any theoretical or mathematical discussion whatever. In this characteristic it is comparable with Ewbanks' old treatise on hydraulics—long out of print, but still of great value.

It may perhaps be regretted that a tact and consideration habitual with Mr. Schuyler should have so restrained his criticism that we are not given the full benefit of his own knowledge in studying certain failures. In his book on reservoirs he has reduced adverse criticism almost too far for full justice to his reader, and has thus denied the student assistance that would have been of great value. Certain instructive facts have been, out of a kindly personal charity, suppressed or so lightly touched that they do not carry the lesson they should. Even where defective work resulting in failure is shown in pitiless photographs, his own comment avoids censure, although at times the temptation to frank and merited condemnation must have been very strong.

To make an unbiased estimate of James Dix Schuyler as a man is impossible for one who knew him for many years as friend, traveling companion, and professional associate. His faults were few and very human—little faults to smile at, for they harmed no one except himself, and hurt him but little. Tact and culture were coupled with a charm of personality that disarmed those prepared to be his enemies, and bound his friends to him for life.

A tall and powerful man, his strong features suggested his Dutch ancestry, and the fine head, firm jaw, and aquiline nose made him a man of notable presence. Genial, of keen but kindly wit and lively humor, he was

a delightful companion, whether in the home, or on the trail in surroundings of hardship and discomfort. Kindly and placid, unhurried of speech, he was a man of great intellectual energy and a tremendous worker. Leisure found little place in his life, yet in the midst of his exacting professional work he found time for broad and varied reading, and his interests were of wide scope.

Mr. Schuyler was married in July, 1889, to Mrs. Mary Ingalls Tulliper of San Diego, who survives him. He lived in Los Angeles and Ocean Park for many of the later years of his life, and he had made final arrangements for at least partial retirement from active practice only a short time before his death.

Seemingly well on the way to recovery from an exhausting illness of months, Mr. Schuyler passed away at his home in Ocean Park, Sept. 13, 1912. A sudden relapse that even his indomitable courgea could not conquer followed the excitement incident to the great fire in Ocean Park early in September; and after as gallant a fight as a man could make, the end came. Ripe in years, James Dix Schuyler was still in his intellectual prime, and his loss was of moment to his profession. But to his friends and associates it was more, for it falls to the lot of few to know two such men.

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Frank Soule*



Frank Soulé, Emeritus Professor of Civil Engineering at the University of California, whose death was briefly noted in our issue of Feb. 27, was born at Woodville, Miss, in 1845. He came of New England ancestry, tracing his lineage direct to John Alden and Priscilla Mullins of the "Mayflower's" company. Frank Soulé's father as early as 1861 was a settler in California, where later he became well known as a journalist and as one of the authors of the "Annals of San Francisco."

Frank Soulé attended the U. S. Military Academy at West Point where he was graduated in 1866 and was assigned to duty as Assistant Ordnance Officer. In 1867 he was ordered to West Point as Instructor in Ordnance and Gunnery and later was Assistant Professor of Mathematics.

In 1869 he resigned from the Army to join the faculty of the University of California, as Assistant Professor of Mathematics. When, in 1872, the Board of Regents established the chair of Civil Engineering they appointed Prof. Soulé to that chair and also added the teaching of astronomy to his responsibilities.

The records of the University of California for the period ending 1880 show how prominent was the work of Prof. Soulé in those early days. He not only gave his time to mathematics, astronomy and engineering but was the father of the Military Department. In 1886 the Students' Astronomical Observatory was designed and built by him with special state appropriations. In the next ten years, under his direction and with the coöperation of the late Prof. George Davidson many important astronomical observations were made and measurements performed. He inaugurated the Weather Bureau Record, which later was distributed by the Department of Astronomy and now is reported by the Department of Geography.

In 1890 the exacting demands of the rapidly growing Civil Engineering College forced Prof. Soulé to relinquish his interests in astronomical work. In the early '90's, after a visit to the prominent Eastern and European technical schools, he built and equipped a testing laboratory which from a modest beginning has grown into the present Civil Engineering Department Experiment Station.

Prof. Soulé continued in the active service of the University as Professor of Civil Engineering and as Dean of the College of Civil Engineering until the summer of 1907, a period of 38 years. In 1907 he spent his sabbatical year in foreign travel, visiting Egypt and most of the countries of Europe. On his return to California in 1908 he was retired on the Carnegie Foundation, becoming Professor Emeritus of Civil Engineering. Though his active work had ceased, he still retained a deep interest in the welfare of the college which he had organized. It is given to few men to serve an institution for a span of 44 years and in such varied capacities.

*Prepared by request by C. Derleth Jr., Dean of the College of Civil Engineering, University of California.

He was a man of multifarious tasks and of many-sided usefulness. No one had closer touch with the students than he, both by virtue of his one-time office as Commandant of the Cadets and by his own interest in their welfare. He was a military man in bearing and in thought. He believed in discipline and in authority. He laid upon himself the heavy hand of self-control. He was always kind and thoughtful of others, and above all things a man of unfailing courtesy.

During the last ten years of his service it was his deserved pleasure to witness the great expansion of the Engineering Colleges of the University. From 1870 to 1900 his school, like the city of San Francisco, developed slowly. It was about 1895 that the University began to grow with leaps and bounds. In his immediate Civil Engineering College there was established a department of irrigation. Courses related to forestry and public health were planned. The relations between agriculture and engineering were defined. Sanitary studies began to form a vital part of the curriculum. Instructors in municipal and sanitary engineering were called upon to coöperate with the Medical Department, with bacteriology, animal industry and hygiene.

The professors of sanitation and irrigation are now concerned with the practical Agricultural School at Davis. The structural departments are associated with the Department of Architecture no less than with that of Engineering. The Testing Laboratory is in touch with state problems. Surveying courses lead to instruction in geodesy, through which channel the students are brought in contact with the Department of Astronomy. Through railroad work they deal with economics; by the writing of contracts and specifications they lean upon the Law Department; in the design of buildings they become interested in fireproof construction, fire protection and prevention, and study in the Departments of Economics and Insurance. All these relationships are daily bringing civil engineering into closer sympathy and bond with the whole University.

Prof. Soulé lived to see his University start from the humblest beginning and grow into one of the most powerful institutions in the country; a University which in 1913 in number of students is second in the United States. Moreover, as an instructor in engineering, he lived through eventful years in the development of engineering education, from the pioneer days of instruction in applied science to the present technical school with all its special branches.

Prof. Soulé was always interested in the public affairs of the community in which he lived. Whatever movement looking to a betterment in politics and community life had arisen in California in recent years, that movement found in him a ready helper. In earlier days his active interest was in Oakland, later in Berkeley, where recently he was a member of the committee which framed the now famous city charter.

Since Prof. Soulé gave much of his energy and life to community interests and problems, it was only natural that he should be associated with many societies. He was a member of the Association of Graduates of the U. S. Military Academy; a member of the Loyal Legion, U. S. A.; Colonel in the California National Guard; life member of the Geographical Society of the Pacific; member of the Society of Mayflower Descendants; member of the American Society of Civil Engineers; life member of the Society of California Pioneers. For many years he was a member of the Athenean Club of Oakland, of the University Club and of the Bohemian Club of San Francisco.

The Hearing on the Bill to License Engineers in New York

A hearing on Bill No. 1126, introduced into the New York assembly by Mr. Larrimer and entitled "An Act to Amend the Education Law in Relation to Licensing of Civil Engineers and Surveyors," was held by the Assembly Committee on Education, Hon. Ralph R. McKee, chairman, on Apr. 1, 1913.

State Engineer Bensel said he was in favor of licensing engineers but opposed to the present bill. He showed that the definition of Civil Engineer was improper and suggested that the requirements for the adoption of this title be fixed by the American Society of Civil Engineers. In answer to a question by Mr. Larrimer he stated that he and several members of the American Society of Civil Engineers had promised, at the time of the consideration of the McGrath Bill and the Hoff Bill two years ago, that the Society would draw a bill for this purpose. This he regretted had not been done.

R. D. Mershon, President of the American Institute of Electrical Engineers, spoke against the bill as a representative of the Institute. Engineers, from the nature of their occupation, are constantly moving from one place to another and this bill would require eminent engineers to submit to examination when called in consultation from another state. He stated that no notice of the bill had been sent to his society.

Arthur M. Greene, Jr., spoke for the American Society of Mechanical Engineers, and for the Society of Engineers of Eastern New York. The Executive Committee of the Council of the American Society of Mechanical Engineers believes the bill to be poorly drawn and pernicious in its effects. They authorized the statement, however, that the Society would join with other interested organizations in preparing a bill for the next legislature provided the present bill be tabled. The Society of Engineers of Eastern New York is opposed to the bill as shown by a letter ballot, 171 members voted against the bill and 17 in favor. Mr. Greene pointed out defects in the bill in the definition of Civil Engineer, in the matter of compensation of the examiners and in giving the fines collected for the violation of the act to any incorporated society which should make the complaint.

Dr. Whitney, in charge of the research laboratory of the General Electric Co., spoke against the bill as affecting the Chemical Engineer.

Mr. Betts, of the Board of Water Supply of the City of New York, presented a brief against the bill.

F. J. Molitor, representing the Society of Consulting Engineers, spoke of the hardships this bill would work on the engineers of other states. He showed how the engineer was constantly sent from one state to another and even to other countries. Two states were mentioned by him as having license laws, Florida and Louisiana. These laws were very simple and provided principally for the payment of ten dollars per year. Several Western states licensed land surveyors and irrigation engineers. He thought it would be better to license designs than the engineer. He commended the excellent work of the correspondence schools, but did not believe that they should be classed with the other institutions of learning.

Prof. O. H. Landreth spoke against the bill for the Engineering School of Union College and for the American Society of Mechanical Engineers. The points he made were as follows: There was no call for the bill; the bill is being pushed by a small organization and not by engineers in general; at present the profession and public are protected by civil service examination, which differentiates between the various classes of engineers and by the necessity for state approval of plans of public works; if these two methods were strengthened, all that is necessary would be accomplished; the requirements for membership in the national societies and graduation from our technical schools are sufficient protection. Results will not be made better by the bill; mistakes will be the same. He clearly showed the difference between the lawyer and the doctor and the engineer who is usually called in for work which demands the expenditure of much money so that care is exercised in selecting him.

Mr. Sprague, Past-President of the A. I. E. E., and Vice-President of the Society of Consulting Engineers, read letters from Alfred Noble and W. H. Burr, stating that they were opposed to this bill, although favoring the licensing of engineers. Mr. Sprague emphasized the inadequate definition of

a civil engineer given in the bill, and showed how for three years any man who had practiced, no matter what his ability, could demand a license. He was opposed to the licensing of engineers, but said he would be willing to aid in drafting a suitable bill should there be any real demand for such legislation.

Walter G. Eliot, J. H. Weinberger, Mr. Zartman, L. Schonmaker and Mr. Seeley were present to speak in favor of the bill.

Mr. Eliot stated that Canada required licenses and a number of states had bills now pending before their legislatures. He stated that most of the National Societies of Engineers were afraid to submit the question of licenses to their members because most of them would be in favor of it. This statement was questioned by representatives of the societies.

J. H. Weinberger merely stated that he was in favor of the licensing of engineers and of the bill. Mr. Zartman, of the Park Commission, was in favor of the bill. L. Schonmaker, of the Topographical Department, stated that it was the sentiment of the men in his office that the bill should be passed and that he personally thought the arguments against the bill were defective.

Mr. Seeley, of the Department of Sewers of New York, saw no specific objections to the bill. He referred to certain clauses to answer objections to the bill, but did not read them. He attempted to show how the bill would protect contractors and how defective sewer systems would not be designed if the bill were in operation. The examples quoted, however, could occur under the bill as well as without it. There was no argument presented by those favoring the bill demonstrating any advantage to accrue from it.

Most of those appearing against the bill were opposed to any form of license for engineers, but they promised that they would aid in drawing a proper bill if requested to do so by the Committee on Education or any member of the committee. Many pointed out the saner method of professional service as a prerequisite for the license. The present bill, except for the dates in it, is reported by those who have compared it to be the same as the McGrath bill, introduced in the legislature of 1911.

NOTES FROM THE ENGINEERING SCHOOLS

LEHIGH UNIVERSITY—Announcement has recently been made of a gift from Charles L. Taylor, of Pittsburgh, former partner of Andrew Carnegie, president of the Carnegie Hero Fund, and vice-chairman of the U. S. Steel and Carnegie Pension Fund, for a large gymnasium and stadium. Compulsory athletics for all students has been in force at Lehigh for over a year, and the new equipment is intended to afford complete facilities for the work thus assumed.

It is also announced that the late John Fritz has left his residuary estate, amounting to about $150,000, to Lehigh primarily as an endowment fund for the maintenance of the John Fritz engineering and testing laboratory, which was given in 1910 and the construction and equipment of which was personally supervised by Mr. Fritz.

UNIVERSITY OF PITTSBURGH—It is announced that Andrew W. and Richard B. Mellon have founded and endowed an "Institute of Industrial Research and School of Specific Industries" for this university, it being a development of the Industrial Research Laboratory which was organized some three years ago and has since been housed in a temporary two-story frame structure. The new school is dedicated in general to "the application of contemporary science to industrial processes," and in particular will provide opportunities for the training of men (1) for high industrial positions, (2) for advanced chemical engineering and (3) for applying industrial chemistry to specific industries.

The founders have provided for the erection of a suitable building to cost $150,000, with equipment and initial supplies to cost $60,000, and with a scientific library to cost $20,000. The architect will be Henry Hornbostel, of Pittsburgh. A further sum, not to exceed $200,000, has been provided for the first five years' maintenance, to assure pursuit of important researches and to permit immediate entrance to a wide field of activity. After five years it is expected that the institution will be self-sustaining.

Robert Kennedy Duncan, Director of the Industrial Research Laboratory, has been chosen first Director of the new Institute.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY—President Maclaurin has announced a gift of $25,000 (in annual instalments of $5,000) from the American Telephone & Telegraph Co. to be devoted to the cataloging, maintenance, and replenishing of the Institute's electrical engineering library.

William Welles Bosworth has been selected as architect for the new group of buildings which will house the Massachusetts Institute of Technology at Cambridge. With him will be associated James Knox Taylor, former supervising architect of the U. S. Treasury, and now head of the Department of Architecture at the Institute.

A new method of teaching mechanical drawing is being is being tried in this Institute. The students are first taught to make a drawing in perspective or in isometric projection. They are then given an orthographic projection of some simple piece and required to redraw it in perspective or in isometric projection. After that, a working drawing of some fairly complicated casting is redrawn in perspective. This course is followed in the belief that a student who has made a number of such drawings is believed to visualize the drawing more quickly so that any print will be easily recognized as something more than a series of lines in one plane.

A summer course in Qualitative Analysis is to be given by the Department of Chemistry and Chemical Engineering for five weeks. This corresponds to the summer school of the other engineering departments and the work will be mainly in the laboratory, with little outside study. The time, for the course in chemistry, will be devoted to additional analytical chemistry and the development of existing subjects. For the course in chemical engineering, the time will be allotted mainly to work in the division of mechanic arts, in drawing, and in the problems of chemical engineering.

Work done by the Department of Electrical Engineering in connection with the Edison Electric Illuminating Co., of Boston, in the investigation of the economic field for electric commercial vehicles, and in a similar investigation for the New York, New Haven & Hartford and Boston & Maine R.R. companies into the adequacy of facilities for handling inbound and outbound freight at the Boston terminals, has led to the recommendation that, in the near future, there should be established a department of business engineering in which students will be trained to apply engineering methods to economic problems that arise in various lines of business. The instructing staff of this department at first would be formed by representatives from the various other engineering departments, and they would devote such portions of their time to this work as necessity required.

EDITORIALS

Sane Advice on Flood Control

It is important that the engineering profession should hold sound ideas on the important questions of river regulation and flood control which are at this time attracting such wide attention. We earnestly commend to our readers' attention, therefore, the admirable address delivered before the National Drainage Congress last week by Col. C. McD. Townsend, President of the Mississippi River Commission, which is printed elsewhere in this issue. Col. Townsend applies the inexorable logic of figures in discussing the possibilities of forest planting and reservoir construction as a means of controlling floods.

The newspapers nowadays are teeming with talk from men in high places to the effect that floods must be controlled by reservoirs at the headwaters of the rivers; but Col. Townsend shows by quoting actual records that had there been a reservoir at Pittsburgh big enough to take the entire flow of the Allegheny and Monongahela, another at St. Paul big enough to take the entire flow of the upper Mississippi, and a third at St. Joseph taking the entire flow of the Missouri, the height of the flood at Cairo during the first week in April would have been lessened *by only six inches.*

Probably the advocates of reservoirs would fall back upon the proposal that reservoirs should also have been built on the headwaters of the Wabash and Miami and Scioto and Muskingum Rivers in Ohio. It is one thing to talk about such a project, however, and quite another thing to find practicable reservoir sites on the headwaters of those streams where any considerable part of the flood could have been stored. The fact may as well be squarely faced that when a rainfall of three inches to nine inches or more comes down on a drainage area within a short time, it is idle to talk of storing it by any means within the power of feeble man to construct.

We have said that it is important to the public welfare that the engineering profession should hold intelligent ideas upon this subject. It is important because it is "a little leaven that leavens the whole lump." If engineers everywhere hold sound ideas on this subject, they can wield an influence in the guiding of public opinion. As we have pointed out in recent issues and as the pages of every daily paper and of the popular weekly journals bear testimony, the public has the vaguest ideas concerning the possibilities of flood control. Wise leadership may direct present public agitation so that useful legislation will result, perhaps creating a National Department of Public Works, as recommended by the Drainage Congress last week, or a Federal organization for river control.

In urging such an organization, however, we would not be by any means understood as advocating that the expense for local works for river regulation should be borne by the Federal government. As Col. Townsend well points out, such a plan would start a new competition among Congressmen. Each would aim to get the largest possible appropriation for his district, and, most unfortunate of all, the voters of his district would judge his usefulness as a legislator by this standard.

An Admirable Opportunity to Experiment in State Railway Ownership

We have several times referred in these columns to the agitation in New England over the abandonment by the Grand Trunk Railway Co. of its projected extension to Providence, R. I. The Grand Trunk Co. has declared that its abandonment of the work was due to its inability to raise money for completing the work, and it offered recently to go ahead and complete the line provided the State of Rhode Island would guarantee payment of the bonds to be issued for the construction. The terms of the guarantee were to be such that the State would not be obligated unless the road itself failed to earn the interest on its bonds and unless in the second place the Central Vermont Ry. Co., which was to make the first guarantee of the bond, was unable to meet its obligations.

The State of Rhode Island, however, rejected this offer. It was ready enough to assail the Grand Trunk Co. and all its officials and attack them with civil and criminal proceedings because of their failure to finish the Providence extension; but it was unwilling to risk to any extent whatever its own credit, even to becoming a second guarantor on the bonds for the work, in order that the line might be completed.

President Chamberlain, of the Grand Trunk Co., has therefore come back with a new offer to the State of Rhode Island. New England has been seething with talk concerning the desirability of government ownership of railways during the last six months. President Chamberlain, therefore, offers to the State of Rhode Island a chance to embark on State railway ownership under most favorable terms.

He offers to present to the State as a free gift the Southern New England R.R. now partially completed between Palmer, Mass., and Providence, R. I., and on which nearly two and a half million dollars have already been expended. The only condition attached to the gift is that the State shall complete the construction work so that the road may be put in operation.

If the State desires to go into the business of railway operation as well as railway ownership, President Chamberlain offers to grant to the trains which the State may operate over this road, running rights on reasonable terms over the New London Northern R.R. from Palmer to Brattleboro, Vt., so as to make the line sufficiently long to constitute an economical operating division. He will also make a traffic agreement between the Central Vermont and the State-owned railroad whereby through rates may be divided between the two roads on a mileage basis with a reasonable additional allowance for terminal expenses.

If, however, the State does not wish to engage in the business of railway operation, the Central Vermont Ry. Co. will lease the State-owned railroad for a rental equivalent to 5% interest on the actual cost to the State of completing the whole line.

It is difficult to see how anything could be fairer than this last-named proposition. If the city of Providence and the State of Rhode Island are really desirous of having this new railway outlet completed, they have only to find the money for the work. They are assured in advance of a 5% return on the money, which would pay the interest on State bonds at 4% issued for the cost of construction with 1% per annum additional for a sinking fund which would eventually retire the bonds.

The only risk attendant upon this financial transaction is the risk that the present wave of public regulation and labor union control of railway operations will destroy the revenue earning power of railways generally. If and when this comes to pass, the public as a whole will have to suffer; and if the taxpayers of the State feel that they have a financial stake in continued railway solvency, it may lead them to take a saner view of the railway situation.

If, however, the State is not willing to accept as a free gift the partially completed railway under either of the plans named above and is not willing, either, to back with its own credit the railway company in obtaining capital to complete the line, then President Chamberlain says definitely that the road will be abandoned entirely about the middle of April.

It will be of interest to see what reply Rhode Island will make to this latest offer. We earnestly hope that the State will take advantage of the Grand Trunk Company's offer and will go ahead and complete the road. The experiment of State railway ownership could hardly be tried under more favorable auspices, and with all the talk of State railway ownership and management now current, it is well worth while to have the experiment actually tried by some State on a moderate scale.

Why Not Apply Engineering Methods of Scientific Analysis to Engineer's License Legislation?

We have given much space in this and preceding issues of ENGINEERING NEWS to letters discussing the proposed legislation requiring engineers to be examined and licensed. As our readers will notice, while we have in our editorial columns opposed such legislation, we have given space to letters from engineers who favor it. We have even broken the usual rule which obtains in practically all publications and have printed some communications which came to us anonymously but which were apparently sent in good faith.

In our editorial discussion of the subject, it should be distinctly understood that we do not in any way question the sincerity of those members of the profession who believe in and favor the enactment of licensing laws. From correspondence and conversations with a number of these men, it is evident to us that they are filled with an honest desire to what they believe will be of benefit to the profession.

It ought to be clearly recognized, however, that good intentions cannot save a work from failure in law or in morals any more than they can in engineering. What seems to be the weak point in the argument of those who favor engineers' license laws is the lack of any logical demonstration as to just how these laws are going to produce any tangible beneficial results to the engineering profession as a whole.

When a competent engineer undertakes the design of a machine or a structure, it is his business to foresee the result which is going to be produced. Therein lies the difference between the competent engineer and the man who works by rule of thumb. The engineer, for example, plans out in advance where each detail part is to be placed and how it is to be operated. He builds the machine first in his head, and then on paper before it assumes material form at all. The old rule-of-thumb designer who attempted to build a machine without any preliminary detailed drawings, very often found when he came to put his work together that one part interfered with another part, and the machine was inoperative.

The engineering profession has before it the proposition to create a piece of legislation which will restrict the practice of engineering. Surely, before the profession estableshes this machine or permits it to be established, a very careful investigation should be made to see how the machine is going to work.

One of the stock arguments of those who are working to obtain the enactment of state license legislation is that since doctors and lawyers require a state license to practice their profession, the same rule should apply to engineers. Those who use this argument would do well to take a further step, however, and inquire whether the state regulation of these professions of law and medicine has prevented their becoming overcrowded. They will find on investigation that in both law and medicine the surplus of unemployed is much greater than it is in engineering.

We are all of us too prone in considering matters of this sort to give attention to the successful and prominent men whom we know about rather than to the many who fail and of whom we hear very little. The famous surgeon with his enormous fees and the corporation lawyer with his high repute are made known to everyone through the public prints, but we hear little concerning the hundreds of medical students who, after spending years of time and thousands of dollars on their education, fail to secure practice enough for a living. The facts and statistics have been spread abroad, however, by the Carnegie foundation and it is logical to conclude that if state examinations and licenses have not prevented the enormous over-crowding of the legal and medical professions they will not help the overcrowding of the engineering profession.

It is easy to see that the underlying idea of those who are promoting this license legislation, in New York at least, is to prevent anyone engaging in engineering practice unless he has graduated from an engineering school. At the start, of course, in order to secure the enactment of the law, they are obliged to open the gates very wide, but the proposition is that later on no one but graduates shall be eligible for a license.

Suppose now this ideal was realized, would this cut down the supply of men looking for positions sufficiently to cause a radical increase in salaries through the operation of the law of supply and demand? To those who think so we suggest a perusal of the catalogs of a dozen

or a score of the prominent engineering schools and of the statistics showing the enormous number of engineering graduates which are turned out yearly now in comparison with the mere handfuls of a dozen years or so ago.

Suppose, however, that the hopes of these men were realized, so that it would be possible for the average graduate of an engineering school to get a position promptly at graduation, paying, say, $60 to $80 per month, with assured promotion after two to four years' experience to a position paying $150 to $250 per month. Suppose that by the passage of some sort of engineers' license legislation, it was possible to establish such conditions. How long would such conditions last? The answer is easy. They would last only long enough to enable a new and enlarged crop of graduates to come in from the engineering schools sufficient in number to bring down the compensation by the inexorable law of supply and demand to a rate more in harmony with what young men of similar capacity at a similar age and with similar expenditure on preparation can earn in other occupations.

The fact is that the only sound ground on which the proposed license bills can be defended is the ground that they will raise the quality of engineering work by driving out incompetent men, so that the competition of these incompetent men will be done away with, and that the public will be induced to employ engineers more because it will be assured of reliable work.

If the proposed license laws really gave any assurance of distinguishing between the competent and the incompetent, they might be defended; but the proposition to issue one broad state-wide license to a civil engineer as competent to do any class of civil enginering work is absurd on its face to any man who knows what the term engineering today comprehends.

On one point, at least, we are in hearty agreement with the promoters of the engineers' license laws; that there is need for great improvement in the status of the profession; but the only hope that we see for such improvement is through the intelligent and organized action of the profession itself. State legislation, unless very carefully planned, will prove a curse instead of a blessing.

A Birdseye View of Conditions in the Ohio Flood Districts

(Editorial Correspondence)

Cleveland, Ohio, Apr. 8—The railroad feature of the flood situation in Ohio is more important and more serious than the outside world realizes. At this time, two weeks after the flood, the Baltimore & Ohio is not yet working its line from Cleveland to Akron or the Pennsylvania its line from Columbus to Zanesville, and so on in a large series of important lines which are still entirely out of service.

The Lake Shore maintained traffic on its main line throughout and, in fact, carried the traffic of all other roads for several days. However, its Norwalk branch was interrupted by a 40-ft. washout near Fremont on Mar. 26, which was closed on Mar. 29. It is a curious fact that some of this line's worst trouble antedated the rain storm, practically all wire communication being broken on Friday, Mar. 21, by a sleet storm.

The Big Four was hard hit. A concrete culvert at New London washed out on Mar. 25, interrupting the Cleveland-Columbus line, which was not closed till Apr. 5, but the passengers were bypassed on foot in the meantime. A three-span, high-level girder bridge on the Springfield branch of the same line crossing the Olentangy River at Delaware had its middle span shoved out by a house; no attempt has been made to close the gap. The Indiana division had washouts at Larue, Ohio, and Muncie, Ind. There was trouble at Terre Haute and Lafayette and just now much trouble at Cairo.

The Nickel Plate got through well. They were interrupted by wash of a bank at the end of a bridge near West Leipsic, Ohio, over Little Auglaize River, another west of Erie and ballast washing near Arnolds, near Fort Wayne. They have been troubled during the past week with water in Bellevue yards flooding most of the yard tracks. The Pennsylvania has been sending much traffic over this line.

The Erie reports no bridge span lost, but several pier foundations were scoured and the piers settled. Extensive trouble with ballast washing developed from near Corey to near Meadville, Penn., west of Meadville nearly to Youngstown, this side of Youngstown and also near Cleveland some banks back of bridge abutments washed out; a bridge at Old Forge west of Kent had abutment washed out and span settled; in the Akron district tracks were under water and ballast washed extensively; thence toward Mansfield at Galion, at Marion and on to Lima almost continuously. There was no trouble west of Lima. From Marion south to Dayton practically all is gone. The three worst points were Aurora, where the lake of the City Ice Delivery Co. broke and washed out the entire roadbed 300 ft., the Old Forge bridge and the Marion-Dayton section. Except for these the line was open Mar. 26, having been interrupted Monday. The Old Forge gap was closed Apr. 3 and the Aurora washout Mar. 31.

On the northern Ohio lines of the Baltimore & Ohio, water on tracks and later landslides blocked the Akron line early Monday evening, Mar. 24, and a work-train was held up just outside of Cleveland by water over the track before midnight. The Wheeling line had slight trouble Monday night by water on track, but the real interruption came on Tuesday morning, when water became too deep to run trains. Tools and men were got ready for Tuesday morning and the work-train was sent out from Lorain via South Brooklyn yard repairing line to Sterling, where water stopped progress. By work south of Sterling, the westbound track was opened to Warwick Mar. 30 and then, by using the Pennsylvania and the Cleveland, Akron & Columbus line a route was opened between Akron and Warwick. In this way the New York-Chicago line was opened Monday evening, Mar. 31. The first train through to Wheeling was on Apr. 5. Canal Dover and Beach City were bad points, as spans of 100 to 120 ft. had to be trestled because of scouring out of abutments and settling of spans, or approach washouts. On the Cleveland-Akron section, the first work-train started out on Wednesday noon, Mar. 26, and worked toward Akron, clearing slides and repairing washouts (mainly of ballast). The dynamiting of four locks of the Ohio Canal at Akron caused a large washout. The trouble on the whole section can be judged from the fact that the line is not yet open. Canton to Valley Junction was restored Mar. 3 and Canton to

Akron Apr. 6. All restoration was on virtually temporary roadbed.

It is remarkable that practically no railway culverts went out. This agrees exactly with the highway bridge reports collected by J. H. Marker's office at Columbus.

The City of Cleveland was really little affected. The high water in the Cuyahoga River, of course, reached few city interests on account of the elevation of everything above the narrow valley bottom. No sewers or other public services were affected.

As already reported in ENGINEERING NEWS, the lower West Third St. swing span was knocked off its turntable into the water by a vessel. It is now being hauled out by a derrick scow and cut up with oxyacetylene torches. The east channel is clear and the west channel will be soon.

Two city bascule bridges at Middle West Third St. and Jefferson Ave. are out of service because of wetting of the motors. These have been shipped to the factory to be baked, so that the bridges will not be working for some days longer. All other drawbridges are working and undamaged except that one of the railway lifts is reported a trifle out of line. Some old timber bulkhead was ripped out and the soil washed out behind. R. Hoffman estimates dock damage and bridge loss at less than $500,000.

The quality of the water supply is just now under public criticism and the immediate adoption of filtration is being agitated. Mayor Baker is firmly against filtration now. The matter is interesting, however, because the old æsthetic argument comes up again; that is, the question whether water is satisfactory when its bacterial count is low but its history bad. The councilmen ask how long the public is expected to be satisfied with liquid mud flavored with chlorine? The city has been working with chlorination for a year, and they increased the dosage during the flood because much sewer deposit, river sludge, etc., was washed down. The water is said to be roily still.

Columbus, Ohio, Apr. 10—In this city the Town, State, Broad and Mount St. bridges were washed out. Two of these bridges were owned by the county and two by the city. The city's bridge at Rich St., a rather old structure, just cleared the flood level and is safe. Just below is a former bridge of the Toledo & Ohio Central Ry., which is now city property, and after the flood was fitted with a 10-ft. timber deck. All communication between the city and West Side goes over these two bridges. A temporary water connection and gas connection were made over the Rich St. bridge.

Active and extensive work has been done since the flood waters subsided in restoring living conditions on the West Side. Practically nothing could be done until Thursday, Mar. 28, even in the way of rescue work, on account of the strong current, and practically nothing in the way of restoration or sanitation until Saturday. Dr. Louis Kahn took matters of sanitation in hand very energetically and the results are excellent. A volunteer force of physicians was drafted from the East Side as soon as possible and sent through the West Side for general medical service and relief. As soon as the first difficulties had been taken care of, a medical force was organized from the West Side doctors and the region divided into 18 districts, with one man in each, temporarily a medical employee of the City Health Department.

The break in the water service led to immediate notice all over the city to boil all water, which notice, as pressure was soon restored on the East Side, was then limited to the West Side. The small connection across the Rich St. bridge did not carry pressure to all parts and left the water unsafe, which it really is considered up to the present. When the 36-in. main was restored, a flushing flow through it was kept up for some time to clear the system, but of course this could not reach all parts of the system, especially in the extreme west district on high ground. Mr. Dittoe has maintained regular examination of the water, and the reports are beginning to be good; when they are quite satisfactory Dr. Kahn will at once issue general notice throughout the West Side to use only city water and that the water is safe without boiling. The situation was complicated a little by the existence of wells, especially in the few districts lacking city supply. It seems that the danger from these was avoided and the strong warning to boil water for all uses has been largely heeded.

The sewer system of the West Side was, of course, completely put out of service. There were not many cesspools or privies, but there were many non-flush outside toilets with simply a siphon bend. Immediate provision had to be made for public conveniences before any sewers could be restored and the Health Department built rough board privies all through the district in pairs, at first as nearly one every two blocks as possible and later, I think, more.

Immediate steps were taken by the City Engineer's office when the water went down for partial sewer restoration. This part of the city has a separate system. The storm sewers were left intact, only the street catch basins being filled with earth wash. The main sanitary sewer coming east from the higher district was cut into the storm sewer and service over part of the district was thus restored. The remaining sanitary sewers are being opened up through to the interceptor as rapidly as possible. The sewage-purification plant is operated only in summer, the discharge the rest of the year going direct into the river.

Of course, street cleaning has gone on steadily, there being 4 to 6 in. of mud nearly everywhere. The soldiers from the local barracks help greatly in general clearing.

There are two proposals for correcting the channel of the Scioto River to give sufficient cross-section for carrying floods. One proposal is to make an entirely new channel for the river, starting in the northern part of the city and running through the West Side close to the bluffs. The chanel would be nearly five miles. The other proposal is to straighten the present channel of the river making cutoffs at some sharp bends and widen the channel at various points.

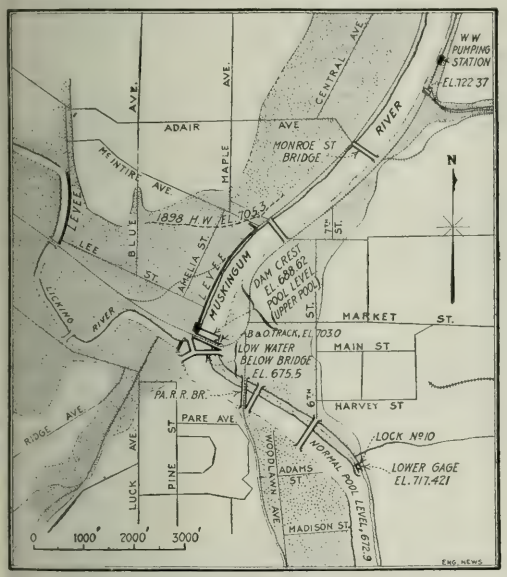
While a careful engineering investigation is really needed to determine which of these two plans would be best for the city to undertake, prompt decision is necessary, as reconstruction of the bridges which have been washed away cannot be undertaken until it is known which of the two propositions will be adopted.

Zanesville, Apr. 12—The Ohio Electric and the Baltimore & Ohio are operating to Zanesville, the latter since Apr. 2 and the former a little longer, because of having its line somewhat higher, down the Licking. The Baltimore & Ohio has splendid track to New-

ark, but thence to Zanesville most of it was overflowed, and suffered considerable wash.

I came down one tributary of the Muskingum, the Licking, and without then fully realizing it, I entered into an area of very exceptional flood phenomena. The flood here at Zanesville was radically different from the others, as may be judged from the fact that it crested here on Thursday, over two days later than the Scioto and Miami. The Licking gave evidence of enormous flow volume, as it had filled its narrow lower gorge full to the railway tracks on the hillside, and, though unobstructed by bridges, dams or encroachments, flowed along at perhaps three times normal depth and evidently with great velocity, as several hillside slides indicate.

Zanesville is a remarkable flood point. With almost no loss of life (only two or three dead), it experienced a flood of enormous volume, height, and speed of flow, which wrought vast destruction. The city's internal problems are easier and simpler than those at Columbus, but the railway isolation and the damage, present and prospective, are great. (See accompanying map.)



MAP OF ZANESVILLE, OHIO
(Showing in shaded portion the flooded district.)

The Fifth St. bridge at the north end of the city is standing. The reinforced-concrete Y-bridge in the middle of the town is intact, except for the balustrade. Two large railway and two highway bridges in the city were swept out, and below the Y-bridge clear to the Ohio at Marietta not a bridge stands. The Muskingum River at Zanesville drains an area of some 7900 sq.mi. the largest gathering-ground in Ohio, reaching up to near Akron, where the surface is 250 ft. higher than Zanesville.

The Muskingum and the Licking both have low timber dams, just above their junction, built by the Federal Government many years ago to establish slack-water navigation. These dams were no factors in the flood heights as the high water was about 29 ft. above the dam crest. Though the several bridges over the Muskingum had doubtless some effect in obstructing the flow and raising the flood level, the amount of this is hard to approximate.

The previous record flood at Zanesville occurred in 1893. At that time the depths of water on the lower gage (miter sill of Lock 10) reached 36.8 ft. In the 1913 flood the water went to 51.8 ft. on the same gage. Three-quarters of a mile above, at the Pennsylvania station, near the dam (the lock gage was here submerged) the flood of 1898 reached the floor of the main waiting room. This year it went up into the offices on the second floor, 15½ ft. higher. The slope between these two points is not yet determined, but from U. S. Engineer Office records the 1898 flood just above the dam, but northwest of the rivers went to 705.30 (sea level datum), whereas the 1913 reading on the lower gage was 717.42. The 1913 slope across the whole town is given approximately by comparing this latter figure with a level-reading said to have been obtained (by C. V. Martin) near the mouth of Mill Run, 7300 ft. above the dam, El. 722.37. This means practically 5-ft. slope in two miles.

Other elevations of interest are:

Normal upper pool, 688.62 (dam crest).

Lower pool during 1913 flood, 722.

Baltimore & Ohio track, about 703.

Low water below Y-bridge, about 675½.

Levee tops, 707.

The deck of the Y-bridge is at its summit, about 713. The flood height here was probably 719 to 721.

Several guesses at velocity of flow range from 15 to 22 mi. per hr. at maximum stage, 10 to 15 mi. per hr. during the following week. No topographical map exists, and all records of the City Engineer's office were burned last December.

The Muskingum and the Licking flow between high bluffs, except for the flat-sloping tongue of bottom land occupied by the main part of the city, a narrow strip (Putnam) along the west bank below the Licking, and portions along the Licking. Levees had been built on two short stretches, and their tops were placed 3 to 4 ft. above the 1898 flood level. The street undercrossing under the Baltimore & Ohio R.R. just west of the bridge was open for backwater, but the levees were expected to protect the northwest district from the rapid currents of the Licking.

The upper levee along the Licking was overflowed Tuesday evening, Mar. 25; water in the Muskingum was not yet high, and the lower gage showed 28 ft., or about Elev. 693.6.

Telegraphic warning was received from the Weather Bureau Tuesday morning that 5 in. of rain had fallen over the whole drainage area in the 24 hours ending Tuesday, 8 a.m., and "Look out for high water," the ordinary flood warning. No citizens believed the 1898 flood level would be passed. The Muskingum rose Wednesday morning and soon the Baltimore & Ohio bridge just below the dam was carried away (two middle spans out of four and later the east span, one still remaining). Probably the Pennsylvania bridge and the Third and Sixth St. bridges went at about the same time. The water supply failed Mar. 26, the pumping station being flooded. Rain continued and the crest of the flood was reached Thursday. On Wednesday afternoon the

water began flowing over the highest point of the Y-bridge balustrade, although on the downstream side the balustrade still showed 5 ft. above water (Tanner). At the highest stage it flowed about 18 to 24 in. over the top of the lamp-post pedestal on the upstream side (or about 5 ft. over the top of the balustrade); on the downstream side the top of the crown pedestals could just be seen.

The Y-bridge approaches being submerged after Tuesday, the city was cut into three parts without communication by person or wire. A signal service was established with large blackboards for writing messages and transits to read them. The Western Union maintained direct wire connections with New York and Pittsburgh, but took no press messages; besides, the Associated Press correspondent was marooned, which accounts for the little news that reached the outside world.

The county officials have ordered cables by express for a suspension bridge and have directed the county surveyors to prepare plans and specifications for such a bridge. Of course, the suspension bridge is to be temporary.

Main St. forms a ridge of the flat peninsula. The water flowed over it with much force, but only one serious street washout occurred, at the corner of Third St. Here a store building was wrecked; a large hole was dug by the current breaking a sewer. (Fig. 3).

The wrecking of the bridges is remarkable. Beginning at the north, the Pennsylvania bridge at Ellis, 8 mi. above Zanesville, had three deck-truss spans carried out; the west span, over the channel, was raised a few years ago and is now a through span. This west span remains, with the pier somewhat damaged. These were 133-ft. spans. There is a high earth embankment beyond both abutments; some 350 ft. at the east end and 500 ft. at the west end was washed out 40 ft. deep.

Below this is the Monroe St. county bridge. The three river spans, at high level, are standing, but of the long steel viaduct approach on the west side a 150-ft. section just back of the abutment is gone.

Fifth St. bridge, below Monroe, is still standing intact, the only one besides the Y-bridge. It has three long spans and approaches; total length about 1500 ft.

The Baltimore & Ohio bridge (entrance to Zanesville station of the Columbus-Zanesville line) consisted of four through-truss spans about 125 to 150 ft. long. That the three easterly spans were carried away is not surprising, as the track level was about 18 ft. under highest water. The westerly span stood this head, but the others went out a day before the crest stage was reached.

We are told the two middle spans gave way first. These spans now lie on their sides in the river, 50 to 100 ft. downstream. The spans appear quite square and upright. The east span went out after the middle two raised, and was swept under the Y-bridge, where it now lies.

The Y bridge seems to be intact. A small washout of pavement and fill near the middle of the main crossing at the upstream side occurred, and most of the balustrade of the main crossing is gone, as is also some on the branch crossings. All of the city's traffic now goes over this bridge. The Baltimore & Ohio ends at a temporary station west of the river; the Pennsylvania terminates at Putnam station; both are reached by this bridge alone, except for an improvised ferry.

The Pennsylvania bridge just below had four 150-ft. through Pratt spans, and all four are out. The east span lies a little below the site, almost intact; the next two are under the Third St. bridge and against its piers, all wrecked; the fourth span is missing. The lower sides of the piers are torn away, back nearly to the center line at the top and running off down to the original downstream edge at the low-water line. This bridge is said to have stood the impact of houses and all kinds of floating débris until some lumber piles came along, and these, banking against the bridge and disintegrating, carried it out. The track level is practically the same as that of the Baltimore & Ohio, 703, so that the bridge was submerged more than 15 ft. over the bottom chords.

Adjoining this bridge east were a 22-ft. girder span and a 110-ft. swing span, over the canal, etc. Both were thrown off the piers. The canal furnished a short-cut for the floodwaters and they rushed down it at great velocity.

Below this were the Third St. and Sixth St. city bridges. The Sixth St. bridge has a swing span on the east end still standing, though pushed out of place; the Third St. bridge was a wooden-truss bridge of four 120-ft. spans which were destroyed. The Sixth St. bridge, of steel, comprised three main river spans, a south approach span, and a north swing span, a total length of about 600 ft. Its two easterly river spans were wrecked by a large abandoned mill striking them. The west river span went out when the Third St. bridge came against it. The approach span hung on for a time in wrecked condition, and fell down later.

All the bridges were wrecked Wednesday, which, as already said, was a day before highest stage. All of them, apparently, were wrecked by the pressure of drift accumulation or collision of large objects.

Bridge repair has hardly progressed as yet. The Baltimore & Ohio for two days has been building a trestle of framed bents, set on rock bottom, with solid blocking fitted to the broken pier tops, and will have rail connection restored to the main part of Zanesville tomorrow (Saturday, Apr. 13). The Pennsylvania has today lifted the swing span of Bridge 20 back to place and will be able to use it; the river crossing will be restored by eight 68-ft. girder spans on trestle towers, which spans happened to be available. For permanent work, both Bridge 12 and Bridge 21 will be replaced by new through truss bridges on wholly new piers, using practically the present span-lengths.

The problems of city administration involved first, of course, relief for some 2500 persons. Absence of loss of life or serious local conditions saved much time which attention to these matters would have consumed. The condition of the public services, it soon developed, was also surprisingly good.

The water-distributing system was found practically uninjured, no mains being broken. As soon as the river dropped 2 in. below the grate-bars in the pumping station, the boiler fires were started, and the pumps began to work before they were out of the water (the pump room being a few feet lower than the boiler room). Thereafter both high-service (standpipe) and low-service (reservoir) systems were operative. This was Monday, Mar. 31, water having then been off since Mar. 26. In the interim water from springs in the higher districts was used.

Some sewers were clogged, others partly clogged, many clear. As a whole the sewer system was available as



Fig. 1. Looking east on Main St. from canal lift-bridge, Mar. 30, 1913 (practically no cleaning work started).
Fig. 2. Corner South and Fourth Sts., Mar. 26 (view taken from post-office building).
Fig. 3. Street blowout from overloaded sewer (after flood went down).
Fig. 4. Looking south from Fifth St. Bridge, Mar. 28 (flood at height).

VIEWS IN ZANESVILLE DURING AND AFTER THE FLOOD

soon as the water left it. Zanesville has had many "dry-wells," closed cesspools below ground, in the gravel.

In a number of sections it was necessary to establish public privies; where possible these were built over sewer manholes. Work is proceeding in restoration of the entire sewer system.

Electric-light service is still practically non-existant, except for small private plants. Telephone service is fragmentary as yet. Street cars are operating on most of the lines.

The clearing of streets was, of course, a task taken early in hand. Mud everywhere, and débris plentiful, required to be removed. The city had and still has a large force at this work. Removal of mud and débris put on the street by householders is done by the same force.

Sanitation efforts were directed against disease: handling sick cases and watching closely for new cases. There had been some smallpox, and naturally this did not decrease. There is much chickenpox, quite a bit of measles, normal scarlet fever and diphtheria, and a considerable amount of typhoid, though the health officer, Dr. McCormick, claims it is not in excess, the normal rate being high. (Zanesville uses raw river water, has no milk inspection and no food inspection.) About Apr. 3 five cases of typhoid were reported in one day. Doubtless in part on this account the state health authorities then ordered the installation of a hypochlorite dosing plant, to supply 25 lb. hypochlorite in 10% solution per million gal. of water. This is being put in by the City Engineer, and should be operating by Apr. 12.

Zanesville is paved almost exclusively with brick. Of the 40 miles of paved streets, only about 2500 sq.yd. brick pavement was washed out or damaged.

LETTERS TO THE EDITOR

Auxiliary Flood Channels for Rivers

Sir—In reading the description of the awful havoc wrought by the recent floods in Ohio and Indiana and the various remedies proposed to prevent a recurrence of such a disaster, it struck the writer, that there has been overlooked a very effective remedy—that of constructing artificial auxiliary channels to the main river at numerous points starting near the source.

These canals could be so constructed that their bottoms at the junction with the river would be at a level a little higher than the ordinary water level in the main stream, thus they would hold water only in time of flood. The bottoms could be made so as to grade down to the river, and when the flood period is over, the water would recede and empty back into the river.

The location of these channels and their distances apart, as well as their cross-sectional area and length, would depend on their proximity to the source of the river, that they were meant to relieve.

There is no doubt, that this scheme would entail a vast expenditure of money, both for excavation of the canals and for bridges crossing them.

Nevertheless, this method of handling the flood problems appears to the writer quite practicable and worthy of further study.

H. M.

Hoboken, N. J., April 8, 1913.

[We give space to the above letter because it offers an opportunity to show by figures what such a scheme would involve.

According to the figures of Mr. Julian Griggs, the maximum flow of the Scioto River through the City of Columbus, Ohio, in the recent flood was in the neighborhood of 140,000 cu.ft. per sec. Suppose this flow is to be carried in a channel with an average depth of 15 ft. and at an average velocity of four miles an hour. Greater depth would seldom be practicable and higher velocities would cause serious erosion of the channels, banks and bottom. Computation shows that with such depth and velocity a channel would have to be nearly 2000 ft. in width to carry the flood that recently visited Columbus. If an auxiliary channel were designed to carry only a quarter of the flood it would still have to be 500 ft. in width, that is to say, *nearly double the width of the Panama Canal through Culebra Cut.*

And the Scioto River is only a single tributary of the Ohio. How big a channel would our correspondent dig to relieve the recent Ohio River flood? Where would he put his channel? It would have to follow the valley of the river for water is loth to run up hill. As the Ohio flood filled its whole valley from bluff to bluff last week, any auxiliary channel would have been submerged. —Ed.]

The Status of the Engineer

Sir—A wealth of thought has been brought home to many minds since articles with the above caption have been published in Engineering News, but if the Editor's patience has not been exhausted, permit the writer to add a little comment to that much triangulated subject. The general reader of today finds himself beset by a variety of terms in defining what constitutes an engineer. This condition doubtless arises from the effort of modern progress to generalize, and to specify the life work for the individual without comprehending his fitness for the vocation.

The ethical side of the engineer has been pretty well written up, his scholastic requirements ditto, the pros and cons of bureaucracy dwelt upon, also the shortcomings of the politician, so there is about only one point in the discussion that has not been touched upon, viz: The commercialized side of an engineering education.

Fifty years ago an engineering education was made a specialty in a very few schools. Such education was developed, to a certain extent, by the regular college course and by the school of experience.

Today we have institutions galore all over the country, making engineers to order, graduating classes by the

hundreds, so there is a plethora in the market and disappointment for the result.

Many young men with no aptness by nature, or fitness, otherwise than is shown by a diploma, are looking for results of time spent, and money wasted. They seek legislation as an opiate for their condition, or bank on the influence of the political boss who is found in nearly every municipality, and sell their birthright like Esau of old, for a mess of pottage. Some struggle along, having some of this world's goods to fall back upon, others ally themselves with some railroad or manufacturing interest, and succeed in a measure.

Many high engineering positions in the United States are filled by able engineers from other countries, which lessens opportunities. So much for the diagnosis, now for the remedy. Stop this prevalent idea of making the human element to order in any department of life, and particularly in the engineering profession. Study fitness when choosing a vocation. An army of young men will then learn to look more carefully at the future prospects and will better understand how to win success.

AN ONLOOKER.

Burlington, Iowa, Apr. 2, 1913.

License Laws for Engineers

Sir—Several people have their little hammers out and are using the same on the proposed Engineering License Bills now pending before the different State Legislatures and against everything else which might tend to promote better conditions among those who depend on engineering work for a livelihood, be it classed as a trade or a profession.

One gentleman who signs himself N. A. Y. objects to being classed with "Veterinarians, Undertakers and Nurses." Now I think if these professions do not feel insulted over the classification, that an engineer should not object, as most of them with less training and by producing less wealth for Society are getting more compensation, both as to money and social position than at least a large part of those who class themselves as Engineers.

To believe this for one moment would be unthinkable for many Engineers; but if they will take off their colored glasses and look at things as they really are it will do them good.

The gentleman who signs N. A. Y. wrote better than he knew; for N. A. Y. is about all there is to the objections which are used against progress for Engineers along social lines.

Those who say Nay to a license law will give no common-sense reasons for their opposition; they will not attempt to substitute something else for that which they oppose; they will not try to see things from more than one viewpoint. They stand as mute rocks in the pathway of progress, content in their false pride and contempt for anything which savors of a labor union.

The Engineer will sometime recognize himself, as he really is, a hired man. Then he will be for a labor union, unless he is lifted to a higher plane by being recognized by the law of the land as a man of education with fixed standards which must be met by those who would call themselves Engineers.

Legislation will not cure all the troubles of the struggling engineering graduate. He must work out his own success, but it is a step in the right direction. Why oppose?

R. L. S.

Urbana, Ohio, Apr. 8, 1913.

The Study of Foreign Languages in Technical Schools

Sir—You have devoted much space in recent issues to the study of foreign languages in technical schools. The writer has spent some time in the study of two foreign languages and has had occasion in several instances to use his knowledge of these to good advantage, and therefore does not look upon the matter with prejudice.

In a short life of fifty to a hundred years a man cannot advance very far. If he were going to live a thousand years he could afford to equip himself with many accomplishments which under present conditions are a waste of time. Therefore in the consideration of the study of a foreign language the question should be asked, will it enable one as an engineer to know more about the principles of mechanics, mathematics, physics, geology, meteorology, astronomy, chemistry, biology, hygiene, etc., than if these subjects were studied directly with the aid of one mother tongue?

It takes much time to learn a foreign language sufficiently well to be of practical value, and the question is when thus engaged whether we are not missing something of vastly more importance. It is true some men have a fondness and aptitude for the acquirement of these languages and therefore to them it is a pleasant relaxation, which is also necessary in any educational curriculum. But there are many good engineers who may not have any more ability in the acquisition of a foreign language than in the learning of music or painting, but their material accomplishments are nevertheless of just as high character.

In the writer's judgment, the technical colleges should not require the study of foreign languages, but should afford facilities for their study to any student who considered them necessary.

The writer fully agrees with the ideas of Mr. Rudolph Hering as to the best method of studying these languages.

It would seem, too, that the time necessary to learn any foreign language could much more effectively be devoted to the mother tongue.

J. W. LEDOUX.

112 No. Broad St., Philadelphia, Apr. 7, 1913.

NOTES AND QUERIES

A few small inaccuracies are to be noted in connection with the article "Growth of a Commercial Research Laboratory," in our issue of Apr. 10. The new quarters being provided, will have twice the present floor space, which is 20,000 sq.ft. instead of the 16,000 sq.ft. noted. Compressed air is furnished (with water, illuminating gas and hydrogen) in all of the laboratory rooms instead of the few having also nitrogen, oxygen and steam and suction. Among the department adjuncts, a liquid-air plant should have been noted. The Saturday morning "colloquiums" of the staff usually consist of an informal lecture on some subject of general scientific interest, and not necessarily along the lines of work of the department. Among the important products developed was noted the magnetite-arc lamp, which a typographical error made to read "magnetic."

The Problem of Flood Control*

By Col. C. McD. Townsend†

The subject of land drainage is intimately associated with that of river improvement. A discussion of the means of preventing floods in the Mississippi Valley is therefore particularly appropriate at this meeting. In a paper read before a levee convention in Memphis last September, I briefly discussed the various means of flood control which had been suggested to the Mississippi River Commission. This afternoon I propose to confine my remarks to the three methods in which the public appears most interested, i.e., reforestation, reservoirs and levees.

Sources of Floods

As you will recall, the great Mississippi Valley is bounded on the east by the Appalachians and on the west by the Rocky Mountains. The winds blowing from an easterly direction deposit most of the moisture they absorb from the Atlantic Ocean on the eastern slope of the Alleghenies, and therefore cause little rain in the Mississippi Valley; the Rocky Mountains intercept the moisture from the Pacific Ocean. While showers occur from winds blowing over the Great Lakes, the original source of the *floods* of the Mississippi is to be sought in the Gulf of Mexico.

In all cases there is a tendency for the greatest rainfall to occur near the coast, and gradually to decrease as the wind currents travel inland. Thus the average annual rainfall at New Orleans is 60 in.; at Memphis, 52 in.; at Cincinnati, 42 in.; at Pittsburgh, 36 in.; and at St. Louis, 40 in. At the headwaters of the upper Mississippi it is but 25 in., and at the headwaters of the Missouri but 13 in.

Though floods do not arise from mean conditions but from exceptional rainfall, these figures are good indices of flood volumes. The flood discharge of the upper reaches of the Missouri is about 1 sec.-ft. per sq.mi. of drainage area; measurements at St. Paul give an extreme flood discharge for the upper Mississippi of slightly over 2 sec.-ft. per sq.mi. In the Ohio it is about 6 sec.-ft., and in the Ouachita, St. Francis and Yazoo Rivers from 8 to 10.

The maximum discharge of the upper Mississippi River is estimated at 450,000 sec.-ft.; the Missouri, 900,000; the Ohio, 1,400,000; the Arkansas, 450,000; and the Red, 220,000. There is also a large discharge from the Yazoo, St. Francis, White, Tensas and Ouachita Rivers. The maximum discharge of the Mississippi during the flood of 1912 was about 2,000,000 second-feet at Cairo, and 2,300,000 at the mouth of Red River. It overflows its natural banks when the flow exceeds 1,000,000 second-feet.

Reforestation

While the influence of forests on stream flow has received little attention in this country until recently, the scientists of Europe have discussed the subject pro and con during the past forty years. While I consider this discussion valuable, my objections to reforestation are not based solely on a scholastic argument.

It requires from twenty to fifty years to produce a good forest growth, and over a century for the leaves of that forest to decay in sufficient quantities to produce the humus which will be satisfactory as an absorbent of rainfall. We cannot afford to delay the drainage of the Mississippi Valley even to produce the forest growth, without taking into consideration the time required for the humus to form. We are more vitally interested in the height that the river will attain in the next few weeks than in what will occur in the year 2013.

It is also pertinent to this discussion to determine what would be the extent of the forest reservation, which would be required to reduce the flood heights on the Mississippi River a given amount. To solve this problem it is necessary to make certain assumptions, and for purposes of argument we will assume that reforestation would reduce the flood discharge of a stream one-half. The Mississippi flood of 1912 attained the greatest height of any then recorded, at all gage stations except at Vicksburg. That of January and February, 1913, while five feet lower at Cairo, was the next highest flood at Memphis, and for a considerable distance along the river. We will endeavor by reforestation to reduce the flood of 1912 to the heights attained in the winter of 1913. For this purpose it will be necessary to reduce the maximum discharge of the river by 500,000 sec.-ft. It will also be necessary to distribute this reduction among the tributaries, reducing the maximum discharge of the Missouri River from 900,000 to 700,000 sec-ft., that of the upper Mississippi from 450,000 to 350,000, and that of the Ohio River from 1,400,000 to 1,2000,000.

As stated above, the flood discharge of the Missouri River at its headwaters is about 1 sec-ft. per sq.mi. of drainage area, and if the reduction in discharge of one-half is to be secured by reforestation, two square miles of forests would be necessary for every second-foot of reduction of flood discharge, or 400,000 square miles of forests to reduce the discharge of the Missouri River 200,000 sec.-ft.

At the headwaters of the upper Mississippi, the ratio of flood discharge to drainage area is about 2 sec.-ft. per sq.mi. A reduction of this discharge by one-half would require a forest reservation of 100,000 square miles to reduce the floods of the upper Mississippi 100,000 sec.-ft. On the Ohio River the ratio is 6 to 1, and it would therefore require forests at the headwaters of the Ohio having an area of 66,000 square miles to reduce its flow 200,000 sec.-ft.

In other words in order by reforestation at the headwaters to reduce the height of a flood at Memphis from that of 1912 to the next highest on record, it would require a forest reservation of about 566,000 square miles, an area exceeding that of the portions of Montana and Wyoming drained by the Missouri River and the entire states of North and South Dakota, the portion of Minnesota drained by the upper Mississippi River, and the states of Iowa, Wisconsin, Illinois and Indiana.

But even such a forest reservation would afford only partial protection against floods and large expenditures for levees would still be required. Under even the above extreme assumptions, to prevent any overflow of the rivers by reforestation would necessitate a practical abandonment of the Mississippi Valley for agricultural purposes, and the development of an extensive irrigation system to produce tree growth in the arid region of the West.

*Condensed from an address before the National Deep Waterways Convention, St. Louis, Apr. 19.

†Corps of Engineers, U. S. A., President of the Mississippi River Commission.

It is therefore apparent that even under the most extravagant claims of forestry advocates, reforestation as a means of reducing flood heights on the Mississippi River requires the conversion of too much farming land into a wilderness to be practicable.

Reservoirs

To have retained the Mississippi flood of 1912 within its banks would have required a reservoir in the vicinity of Cairo, Illinois, having an area of 7000 square miles, slightly less than that of the state of New Jersey, and a depth of about 15 ft., assuming that it would be empty when the river attained a bank-full stage. If the site of such a reservoir was a plane surface, the quantity of material to be excavated in its construction would be over 100,000,000,000 cubic yards; and its estimated cost from fifty to one hundred thousand million dollars. Such a volume of earth would build a levee line 7000 miles long and over 150 feet high.

Cairo is the logical location for a reservoir to regulate the discharge of the lower Mississippi. It would not only control the floods from the Ohio but also the discharge from the Missouri and upper Mississippi. But if the reservoirs be transferred from the mouths of the tributaries to the headwaters, their capacity must be largely increased. No two Mississippi floods have the same origin. If the prevailing winds in the early spring are from the southwest, the southern tributaries of the Ohio furnish the crest of the year's flood; if more nearly from the south, reservoirs will be required on the streams of Ohio, Indiana and Illinois; a slight varying of the wind will produce a flood in the upper Mississippi, while if it blows from the southeast the principal sources of trouble will be the Red, Arkansas and Missouri Rivers.

To control the flow of every stream in the Mississippi Valley by reservoirs is a pretty large job, even for the United States Government; but that is what the control of the Mississippi during floods by reservoirs signifies.

The advocates of the control of the floods of the Mississippi by reservoirs do not, however, have in mind any such radical control as is above indicated. They limit the control to the headwaters of the various tributaries, and while every stream that flows in the valley may be considered a headwater of some tributary, I judge from the discussions of the reservoirs and their proposed employment for power purposes, which requires a considerable height of dam, that by headwaters is meant the sources of the rivers in mountainous countries as distinguished from the more level plains, and more specifically the sources of the Missouri above the mouth of the Yellowstone, those of the upper Mississippi in the state of Minnesota, and those of the Ohio in the Appalachian Range.

The flood which is now devastating the country affords data for determining the effect of such a system of reservoirs; and its lessons are the more valuable because no effort is necessary to refreshen the memory. When on Apr. 2 the gage at Cairo attained a height of 54 ft. there was flowing by it down the Mississippi River at least 2,000,000 cu. ft. of water per second.

It requires about eleven days for a flood wave to travel the 966 miles between Pittsburgh, Penn., and Cairo; on Mar. 22 the Pittsburgh gage read 5.3 ft., which is produced by a flow in the Ohio River at that locality of about 15,000 sec.-ft. In ten days a flood travels the 858 miles between St. Paul, Minn., and Cairo; on Mar. 23 the reading of the St. Paul gage was 0.5 ft. corresponding to a discharge of the Mississippi of about 2500 sec.-ft. In eight days the effect of a flood at St. Joseph, Mo., is felt at Cairo; on Mar. 25 the gage at St. Joseph read - 0.1 foot, representing a discharge of the Missouri River of about 17,000 sec.-ft.

If a system of reservoirs had been constructed which would have prevented all flow from the Allegheny, the Monongahela, the Mississippi above St. Paul, and the Missouri above St. Joseph, it would have reduced the 2,000,000 sec.-ft. discharged by the Mississippi River at Cairo on April 2 less than 35,000 sec.-ft.

The water which passed Cairo on the 2d of April came principally from the White and Wabash and the lower tributaries of the Ohio, and after the water of these rivers started to subside, the flood from Cincinnati, though increasing from 57 ft. to 69 ft. on the gage at that place, could increase flood heights at Cairo less than one foot. The flood of 30 ft. at Pittsburgh on Mar. 28 produced its effect on the Cairo gage day before yesterday (Apr. 8). It has prolonged the flood without increasing its height.

Such a proposed system of reservoirs would have cost hundreds of millions of dollars and its effect on this year's flood height of the lower Mississippi could not possibly have exceeded six inches.

Neither the rain nor snow which falls upon the mountainous portions of the Mississippi watershed has much effect upon the floods of the lower river. The principal source of the floods is the great alluvial plain between the mountains. As I have pointed out, excepting the southern tributaries of the Ohio, the rainfall is relatively slight at the upper sources of the tributaries and their maximum flood discharge does not usually coincide with that of the mid-valley.

Great floods do not arise from average conditions, but from exceptional variations such as are caused by a series of heavy rains rapidly succeeding one another. Each rainstorm starts down a stream a flood the volume of which can be absorbed by a reservoir with comparatively little trouble, but if a second storm sweeps over the valley, the reservoir to be effective must be emptied or its capacity doubled. To hold all the excess rainfall till low water, would require reservoirs of enormous capacity. Economic considerations usually require that the reservoirs should be emptied as soon as the crest passes, in order to utilize the same space for a second rainfall: so that while reducing the crest of a flood at a given locality, they necessarily prolong the period during which the river remains at a high stage.

The water which is abstracted from the Gulf of Mexico is usually precipitated in the Mississippi Valley within a period of two days. The return flow extends over a period of two or three months. The sum of the maximum discharges of the various tributaries of the Mississippi River is nearly 4,000,000 sec.-ft., while the greatest measured discharge of the river itself is about 2,300,000. This apparent discrepancy arises from the fact that the floods of the tributaries do not reach the Gulf at the same time. The crest of the Ohio River flood usually passes down the river in March or April, that of the Missouri in May or June. Moreover, the same law applies to the tributaries of a tributary. The waters of the southern branches of the Ohio tend to discharge

into that river before those in Ohio, Indiana and Illinois.

By the construction of reservoirs this beneficent law of nature is deranged. Instead of the crest of the flood of one stream passing down the river before that of another reaches it, two prolonged high stages will obtain, which will tend to synchronize, and the resultant combination may be higher than either flood would have been by itself.

A system of flood control designed to be satisfactory for one city may be most disastrous to another locality further downstream. If a system of reservoirs had been in operation in the Allegheny and Monongahela Rivers during last January, it would have protected Pittsburgh from overflow and diminished the flood at Cincinnati when it was 50 ft. on the gage, but only to increase it when it attained a height of 60 ft. And this effect would have been propagated to the Gulf.

Pittsburgh, moreover, would never consent to such a manipulation of reservoirs on the upper tributaries of the Ohio as would insure the reduction of floods at Cincinnati or on the lower Mississippi. Source stream control on the Mississippi River and its tributaries would, therefore, soon reduce itself to the question whose ox is to be gored.

Levees

While the use of forests or reservoirs as a means of flood control is still in an experimental stage all over the world, the employment of levees for this purpose has been tested for centuries. The Po, the Rhine, the Danube, the Rhone and other rivers of Europe have been successfully leveed. The laws governing the flow of water in a confined stream have been carefully studied and the construction of levees is just as susceptible of mathematical analysis as other engineering problems.

There is an element of uncertainty in all the forces of nature. No one can say positively, for instance, that St. Louis may not at some future time experience an earthquake, or a tornado of greater intensity than that which swept over the city in 1896. There is also a possibility that there will be some combination of meteorological conditions which will create a flood of greater volume than has heretofore occurred in any drainage area. But the height to which levees should be constructed is as susceptible of determination as the strains to be permitted in an office building due to wind presure, or the moving load allowable on a bridge. The city engineer solves a similar problem whenever he constructs a sewer to carry off the storm water from the city streets.

Nor is there any evidence either that floods have been increasing in recent years due to the cutting off of forests or that the beds of our main rivers are rising as they are lowered. The records at London, Paris, St. Petersburg and other localities where the rain has been recorded for long periods fail to show any tendency to an increased fall in recent years.

The meteorological records of the United States have not been maintained a sufficient length of time to be of much value in solving the problem but such data as we possess indicate that the flood discharge has not increased in recent years. The greatest flood of the Mississippi at St. Louis occurred in 1811, the next largest in 1785. On the Great Lakes the high water of 1838 is the greatest on record. In the Ohio, the flood of 1884 exceeded that of 1913 at Cincinnati, and that of 1832 while five feet lower at Cincinnati was five feet higher at Pittsburg than this year's flood. The gage records at the bridges over the upper Mississippi which cover a period of thirty years would indicate that the flow from Minnesota and Wisconsin where the forests have been most extensively destroyed during the period, has been slightly improved, though the river shows signs of deterioration where it receives the flow from the prairie lands of Iowa and Illinois. They appear to confirm the conclusions of the German Forestry authorities that the influence of forests on drainage is concealed by other causes more powerful in their effects.

There is not the remotest connection between deforestation and the disasters which have just occurred at numerous cities in Ohio and Indiana. The flood of 1832 was similar to that of 1913 but it was discharged by streams of the dimensions the Creator intended they should have. Since then cities have sprung up and land has become so valuable that riparian owners have encroached upon the waterways. Where the floods formerly flowed untrammeled, factories and dwellings have been constructed, and numerous bridges have further restrained the stream's discharge. When His laws are violated, though slow to anger, the Creator occasionally asserts His might and the works of man crumble before Him. If it would accomplish any useful purpose, I could name other cities where conditions are as dangerous as at Dayton or Columbus, but the lessons of the flood will be forgotten with the burial of its dead.

The question of the rise of the river bed by levee construction has been exhaustively investigated. On the Rhine the maximum effects were observed at Düsseldorf where the same discharge at low water appears to attain a height 8 in. greater today than it did 100 years ago, while the same discharge at high water has lowered about one foot in a century. On the Po, the maximum observed change in low-water conditions was 0.02 of a foot per year, but it is by no means proved that even these small changes have resulted from levee construction. They may have arisen from the improvements in the river bed which were made simultaneously with levee construction. The observations of the Mississippi River Commission agree with the Düsseldorf observations in that the Mississippi River appears to be slightly enlarging its section, at least at mid-stages.

The present contents of the adopted levee line of the Mississippi River is about 243,000,000 cu.yd. It has been computed that with an addition of 200,000,000 cu. yd. at an estimated cost of $57,000,000 this line would be safe against any flood which has occurred in the Mississippi River. This sum, though large, is less than $4 per acre of land protected from overflow, and appears insignificant when compared with the amounts which are being expended per acre for irrigation purposes in the arid west. The increase in the value of land or the damage caused by one overflow like that of 1912 would pay for the completion of the levee system.

When a levee line contains but one-half the material that safety requires, crevasses afford no argument against levee construction. During the flood of 1912 hundreds of miles of levees were topped with earth in sacks to a height of from two to four ft., to prevent the water flowing over them, and water was seeping through their narrow bases in copious streams which was unheeded until

mud began to flow. The levee which failed at Beulah, Miss., this winter was held till the pile of sacks exceeded 20 ft. in height.

The holding of 1525 miles of such levees through the flood of 1912, even though 13 miles failed, is a powerful argument in favor of a properly constructed levee line. There was no failure where levees were built to a suitable grade and adequate dimensions as in the upper Yazoo District.

Conclusion

While I am of the opinion that levees afford the only practicable method of controlling the floods of the Mississippi River, I desire to state that I am strongly in favor of both reforestation and reservoir construction, but limited to the purposes for which they are adopted, just as I am in favor of reinforced concrete for small bridges though not considering it applicable to one spanning the lower Mississippi River.

The price of lumber today is a sufficient argument for planting trees, without attempting to associate forestry with the climate or with the flood conditions on our rivers. If the Federal government or the states do not conserve the forests, the time will soon come when the farmer will raise his crop of timber just as now he plants a field of wheat, and for the same reason, because it will pay him to use his waste land for the purpose.

Reservoirs are necessary for municipal water supplies, for purposes of irrigation, for the development of power, and for feeders to canals. They can be successfully employed on small streams to diminish floods or increase the low-water flow. The trouble arises when an attempt is made to utilize them for too many purposes at the same time. There must be a paramount issue to which the others will be subsidiary.

If the main purpose is to supply a city with water, only the excess can be used for power development. If the dams are constructed to produce power, the reduction of floods and the improvement of river navigation must be subordinate thereto. Water required for irrigation can only be used to develop power when the dam of the storage reservoir is given a greater height than is necessary for its flow over the land to be reclaimed.

During the next decade there will be an enormous development of reservoirs both for irrigation and for power purposes, which I hope will be utilized to correct man's folly and prevent many disasters similar to those which have recently occurred in Indiana and Ohio. While the control of the lower Mississippi by reservoirs is impracticable, there are numerous smaller streams where they can be used with excellent results.

It is questionable, however, whether such reservoirs should be built with the control of our rivers the first object of consideration. It will, to be sure, saddle the cost on the United States Treasury, but to close down a power plant and stop the growth of crops every time that the navigation of a minor stream is interfered with, I do not consider would be a wise proceeding.

I am also sceptical of government ownership. It may have worked satisfactorily in irrigation projects, but my experience with government ownership of water-power makes me suspicious. I have found that when the government buys water-power, the power companies consider it worth $25 per horsepower per year, but when conditions are reversed and an attempt is made to lease it, the price drops to ten cents.

The systematic conservation and regulation by the Government of a river from its source to its mouth sounds most attractive, suggesting a scientific solution of every problem of river hydraulics, but instead I greatly fear that it is the voice of a siren luring the people to an open pork barrel for every stream in the United States.

The Flood at Indianapolis

By Dewitt V. Moore*

During the week beginning Sunday, Mar. 23, 1913, Indianapolis suffered the most disastrous flood in the history of the city.

Following the first destructive wind storm of the previous Friday night, rain began to fall Sunday morning at 6:10. The rainfall at Indianapolis as shown by the reports of the weather bureau from 6.10 a.m., Mar. 23, to and including Mar. 25, amounted to 5.59 in. The detailed report for the entire week is as follows:

	In.
Mar. 23	1.27
Mar. 24	2.76
Mar. 25	1.56
Mar. 26, snow, rain and sleet	0.34
Mar. 27, snow	0.08
Total	6.01

This rainfall was general as is evidenced by the floods at other points.

On Monday it was evident that Indianapolis could expect a disastrous flood and by early Tuesday morning it was certain that the water would surpass any before experienced.

After eight or nine o'clock Tuesday morning events happened so fast that it was impossible to keep in touch with conditions. The first to suffer were the lowlands along the river insufficiently protected by levees. About nine o'clock on Tuesday morning traffic was suspended on several of the bridges across the river and every effort was being made to protect property and lives against the overtopping of the levees.

The accompanying map of the city, prepared from one furnished by the courtesy of the Indianapolis Traction and Terminal Co., shows the principal structures affected by the flood and the extent of the high water. The various bridges and localities referred to below are noted on the map by numbers in parentheses.

At 11:20 a.m., Tuesday, the Power House of the Indianapolis Traction & Terminal Co. was under water and the traffic on all city car lines was suspended. This shutting down of power of the local Traction Co., applied not only to the new plant at West 10th St. (13) and the river, but also to the old plant on West Washington St. (20). The two plants being put out of service at practically the same time.

The Indianapolis Water Co. was compelled to shut off all water supply at 10:30 p.m., Tuesday, and the city was without fire protection until 7 a.m., Friday, Mar. 28.

Tuesday afternoon the water from Fall Creek overtopped the west bank and entered upon the lowlands west and north of 30th St. bridge (14), the main flow being across 28th, 27th and 26th Sts., reëntering the creek at Pennsylvania St. just east of Meridian St., as noted on the map. The flood water swept over the bottom lands adjacent to Fall Creek west of Capitol Ave., and on down

*Consulting Engineer, Merchants' Bank Bldg., Indianapolis, Ind.

to Northwestern Ave. bridge (8) and again widened out below until the creek joined the river at West 10th St., opposite the Traction Terminal Co., new power plant. The Indianapolis Gas Co., on the south bank just west of Northwestern Ave., was one of the public utilities first to suffer.

The excessive flow of Fall Creek in connection with the breaking of the levee on the south bank of White River west of the Belt R.R. bridge (17), resulted in the backing up of flood water at the Traction Terminal Co.'s plant at 10th St. and the washing out of the Belt. R.R. from 10th St. to the bridge.

As a matter of fact, illustrating the railroad situation, the Belt R.R. suffered washouts from the crossing of White River mentioned above, northwest of the

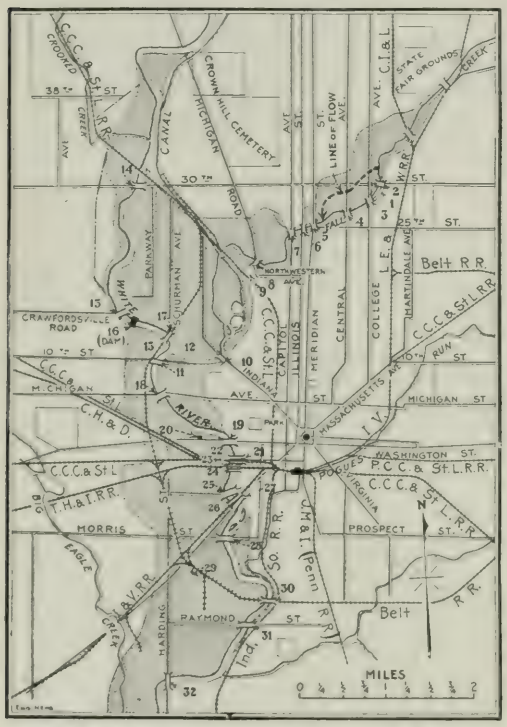


FIG. 1. MAP OF INDIANAPOLIS, SHOWING FLOODED DISTRICT SHADED

city, to the second crossing of White River almost directly south.

The advance of the flood was so rapid and the breaks in the levees so numerous that it is not worth while to express an opinion as to where the first break occurred, but it is sufficient to say that almost the entire west and southwest portion of the city was one seething, rushing flow of water without any opportunity being offered to the main portion of the city on the east and north, to assist the sufferers or gain an adequate idea of the damage.

One man standing on the top of a box car on the Big Four overhead crossing of West Washington St. (19) just beyond the Power Station of the Traction Co., stated that as far as he could see to the south and southwest it was nothing but water submerging practically all the territory, houses in some cases being entirely submerged, and the only visible land being the embankments for the railroads and levees. It is hard to estimate the depth of water in this submerged territory, but it is probably safe to say that it was on an average of 10 to 12 ft. with a maximum depth much greater.

At a point just north of College Ave., on the south bank of Fall Creek, the rush of water undermined Sutherland Ave. and the tracks of the Union Traction Co. The bank beneath the track was completely washed away and the tracks dropped into the creek. Above this point and on the west side the water gained entrance to the lowlands west and north as previously mentioned. The 30th St. bridge (2), a reinforced-concrete structure, withstood the flood as also did College Ave. bridge (3), and the Central Ave. bridge (4). Between Central Ave. and Capitol Ave. (7), the south bank of the creek is protected by a boulevard with a permanent roadway which was laid out on a sinous line with a very decided curve approaching the south abutment of the Meridian St. bridge (5). This curve projected out into the stream and to a large extent obstructed the flow through the south span. At this point we also have the bypass current, entering above 30th St., reëntering the creek opposite this curve in the boulevard.

Congestion of water and the complex currents resulted in the undermining of the upstream end of foundations of this bridge, causing the failure shown in Fig. 2. It will be noted that this is a collapse of the upstream one-half of the bridge on a longitudinal line.

The appearance is almost as clean cut as a sectional drawing. The west half of the bridge appears to have suffered no harm but the current swinging again to the north caused a large slide in the gravel fill of the boulevard improvement on the north bank west of the bridge.*

Next below the Meridian St. bridge is the Illinois St. bridge (6). (The Meridian St. and Illinois St. bridges were built the same year from the same plans.) This bridge withstood the flood although on account of the anxiety of the moment the bridge was closed to traffic. Both the Illinois St. and Meridian St. bridges just referred to were of Melan construction using I-beams for reinforcement. In the photograph of the Meridian St. bridge (Fig. 2), several of the ribs may be seen in their present fallen condition, no doubt caused by the lack transverse reinforcement. These two bridges were constructed about 1900 and were the first of the better class of bridges crossing Fall Creek and White River. Neither bridge was on piles and the foundations were no doubt affected by the large amount of dredging during the last five years by gravel companies and contractors in the construction of the boulevards on each side of the stream.

The Capitol Ave. bridge constructed in 1912 of reinforced-concrete design and one of the finest bridges in the city passed through the flood in perfect condition, although the waterway of this bridge was insufficient. This bridge was for a long time the main means of communication between the north and south sides of the creek.

The Northwestern Ave. bridge (8) withstood the flood. Just west of this bridge on the south side (9) is the

*The Meridian St. and Illinois St. Bridges were described in "Engineering News," Apr. 11, 1901, p. 258.



FIG. 2. PARTIAL FAILURE OF MERIDIAN ST. BRIDGE

plant of the Indianapolis Gas Co., which was flooded early in the day. The Indiana Ave. bridge (10) suffered to some extent but a complete report cannot be made at this time.

There was considerable damage done between this point and the West 10th St. bridge (11), the roadway and the bottomland being entirely submerged, flooding the pumping station of the Indianapolis Water Co. (12), and contributing to the damage at the West 10th St. station of the Traction Terminal Co. (13). The water is reported as having been two feet over the 10th St. bridge (11), a steel truss with wood floor. It was reported that this bridge had failed but notwithstanding the extreme conditions the bridge is apparently in good condition outside of washouts of approaches. The West 30th St. bridge over White River (14), the Emmerichville bridge (15) both of which were elaborate reinforced-concrete designs of considerable cost seem to have withstood the flood with little damage notwithstanding some reports to the contrary.

Next below the 10th St. bridge is the W. Michigan St. bridge (18), across which travel was suspended about 9:00 a.m. Tuesday. This bridge, however, passed through the flood without damage. The suspension of traffic was due to the low ground on the east approach, this ground being entirely submerged. At this point numerous houses were removed from their foundations and the current across these bottoms is described as being tremendous.

The next crossing at W. Washington St. (19) was a deck plate-girder bridge with a concrete floor. This



FIG. 3. WRECK OF VANDALIA R.R. BRIDGE

bridge began to fail Tuesday evening and by Wednesday was a complete failure. At 10 o'clock Tuesday the east bank was rapidly crumbling and at this time the water had already flooded Washington St. west of the power house of the traction company (20).

The next bridge, the property of Kingan & Co. (21), was wrecked.

Immediately adjacent is the new Vandalia R.R. bridge (23), which was apparently not damaged. Next is the old Vandalia R.R. bridge (24), which is a complete wreck (see Fig. 3).

The Oliver Ave. bridge (25), a through-girder construction with concrete pavement and stone railing, passed through the flood successfully although the waterway was entirely closed. The old I. & V. R.R. bridge (26) is almost a complete wreck.

Next is the Kentucky Ave. bridge (27), a bow-string steel truss of two spans which was seriously affected by the undermining of the foundations. From the Washington St. bridge down to the Kentucky Ave. bridge and beyond, the west side of the river is protected by a levee which was soon overtopped, resulting in the inundation of West Indianapolis and this flow was supplemented by the water bypassing across West Washington St. west of the Traction Co. power house. Below the Kentucky Ave. bridge the Morris St. bridge (28), a reinforced-concrete bridge, withstood the flood. The water spread out in the bottom below Morris St. and supplemented by the flow through West Indianapolis attacked the Belt R.R. fill between this point (29) Stock yards and the Belt R.R. bridge (30), causing an almost complete washout of this part of the Belt R.R. embankment.

Below the Belt R.R. the Raymond St. bridge (31) was partially destroyed and the Harding St. bridge (32) was damaged.

The nearest approach to this flood was in 1904 when the gage read 21.3 ft. The gage was destroyed by the recent flood, but the height has been determined by the Weather Bureau as 25.7, an increase of 4.4 ft. The unexpected happened and the restricted channels of Fall Creek and White River were not capable of such a tremendous flow, neither were the levees of sufficient strength or height.

⁂

A Railway Accident in Congo, Africa, is reported to have caused the deaths of 23 persons on Apr. 5. According to press dispatches an entire train fell from a bridge into the Congo River, near Bonca, Belgian Congo.

A Rutting Collision between an express passenger train and a freight train is reported to have caused the deaths of 33 passengers and several railway employees, on the Austrian State Rys., near Karlstadt on Apr. 6.

The Derailment of a Passenger Train on the Mexican Central R.R., near Tula, Hidalgo, Mex., is reported to have resulted in the deaths of 20 passengers on Apr. 10. According to newspaper reports the engine-driver was speeding to escape a band of rebels.

A Report on the Ohio Valley Floods is to be made by a Board of Engineer Officers appointed by Secretary of War Garrison. It's members are as follows: Lieut.-Col. Francis R. Shunk, Pittsburgh; Lieut.-Col. Henry Jervey, Cincinnati; Maj. Charles S. Bromwell, Cleveland; Maj. John C. Oakes, Louisville; Maj. Frederick W. Alstaetter, Wheeling; Maj. Louis H. Rand, Cincinnati.

The Capsizing of a Stranded Ship on the beach of Nehalem Bay on the coast of Oregon caused the drowning of 18 men on Apr. 6. The wrecked ship was the German bark "Mimi," which went ashore on Feb. 13. The ship had not been seriously injured and the underwriters had made arrangements with the Fisher Engineering Corporation, of Portland, Ore., to float the vessel. Mr. Fisher and eight of his employees, a representative of the underwriters, the captain of the "Mimi" and 11 of the crew were on board the vessel Apr. 6, when a storm came up and made it impossible to take them off. Later Mr. Fisher, the captain and two sailors were rescued, but the remaining 18 men were drowned.

Plans for the Infirmary Group of Buildings for the Chicago Municipal Tuberculosis Sanitarium have been completed and with specifications will be ready for bidders about Apr. 21, 1913. The buildings, which are estimated to cost about $600,000, will include an administration building 98 ft. long, and two wings each 430 ft. long, the whole H-shaped in plan and two stories high. The exterior and interior walls will be of brick, minor partitions of tile, floors and roofs mainly of reinforced concrete, with floors surfaced largely with tile. Heating, refrigerating and compressed air (for future vacuum cleaning system) plants will be provided. The infirmary will provide for 250 patients in single and double rooms and in six-patient wards. Frank E. Wing, Fort Dearborn Building, Chicago, is general superintendent of the sanitarium.

A Freight Subway on the west side of Manhattan Island, New York City, will be built for the readjustment of the freight tracks of the New York Central & Hudson River R.R. and their removal from the streets of the city, according to a proposition now before the Board of Estimate and Apportionment (devised by a committee of that board and reported accepted by the mayor and the railroad company).

The older proposal for an elevated freight terminal railway to be owned by the city and available for all railways, as advanced by the then Commissioner of Docks, Calvin Tompkins (see Engineering News, Apr. 13, 1911), would be superseded by this plan which requires no cash from the city (so long as the service is wholly for the New York Central). The plan involves an expenditure of some $50,000,000 by the railroad and city, of which the city contributes $7,322,413 in the form of real estate and easements. The city is to receive from the railroad $163,888 for various parcels of land in the northern part of the island.

The plan includes all the west-side tracks from the city line, on the north, to Cortlandt St., on the south, these being in a tunnel or subway, and on elevated structures, variously alternating with certain open stretches and river side freight yards. A two-track subway would be built by the railroad from its enlarged 30th St. yards down Tenth Ave., Washington, Canal and Varick Sts., to its St. John Place yards.

The railway company asks an option to substitute for the Canal St. subway a continuation of the Washington St. line as far as Barclay St. As this line would be exclusively for the New York Central, the committee has secured an option for the purchase of the railroad's rights and the construction of these facilities below 30th St., making them open to all railroads on equal terms and giving a chance for a joint terminal railroad.

The Architectural Design for a County Court House in New York City, submitted by Guy Lowell, has been selected in the competition which recently closed. In all, 22 sets of plans were submitted to the board of judges by eminent architects of the United States, 10 by invitation and 12 after a preliminary competition. The building is notable on account of its great size and cost, and Mr. Lowell's design is novel in that it shows a circular plan and has a faint resemblance to the Roman Coliseum. There will be a central lobby with passageways to portals on the north, east, south and west. Mr. Lowell is reported as stating that the circular plan was developed, not on account of the appearance of any Roman prototypes, but because of the necessity of economical construction and of securing the maximum amount of light and air, together with the elimination of long corridors. On the ground floor, adjoining the entrances will be the non-litigation offices which are most used, so that it will not be necessary to crowd the elevators with people bent on the more easily dispatched business. Above, there will be one complete floor for the city-court rooms and four floors for the various supreme-court session chambers. Above these still, will be the library and dining rooms for the justices and over this the justices' chambers, making eight stories in all. Separate elevator service is proposed for the public and the justices, juries, etc. The building will cover about 120,000 sq.ft. and will cost approximately $10,000,000, of which sum the architect will receive a fee of 6%. The north-south axis of the building will coincide with the line of the present Center St. bridge-loop subway; it is expected that novel foundation problems will have to be solved on account of the subway and because of this location on the site of the old Collect Pond.

PERSONALS

Mr. T. R. Atkinson, M. Am. Soc. C. E., State Engineer of North Dakota, has resigned to engage in private practice.

Prof. Edward L. Nichols, M. Am. Inst. E. E., has been made Dean of the College of Arts and Science, Cornell University. Prof. Nichols is now Professor of Physics.

Mr. Alfred E. Kornfeld, Assoc. Am. Soc. C. E., late Business Manager of "Engineering News," has been elected Vice-President of Bischoff's Bank, New York City.

Mr. Frederick Palmer, M. Inst. C. E., has resigned as Chief Engineer to the Port of London Authority to become a Consulting Engineer and partner of Sir Alexander Rendel, M. Inst. C. E.

Mr. C. R. S. Kirkpatrick, M. Inst. C. E., has been appointed Chief Engineer to the Port of London Authority, succeeding Mr. Frederick Palmer, M. Inst., C. E., resigned, as noted elsewhere.

Mr. H. C Donecker, Secretary of the American Electric Railway Association, has resigned, effective July 1, to accept the position of Assistant General Manager of the Public Service Ry., Newark, N. J.

Mr. George H. Aykroyd, for the past 10 years Chief Draftsman of the roll department of the Lackawanna Steel Co., has been appointed Superintendent of the roll departmnt of the Pittsburgh Crucible Steel Co., Midland, Penn.

Mr. G. M. Rice, Assistant Engineer of the Chicago, Milwaukee & St. Paul Ry., has been promoted to be Division Engineer at Spokane, Wash., succeeding Mr. A. G. Holt, M. Am. Soc. C. E., promoted to be Assistant Chief Engineer, as noted in our issue of Feb. 13.

Mr. W. D. Jenkins, former Secretary to the Vice-President and General Manager of the Denver & Rio Grande R.R., at Denver, Colo., has been appointed Inspector of Transportation of the International & Great Northern and the Texas & Pacific Rys., at Houston, Tex.

Mr. Nicholas F. Brady, Assoc. Am. Inst. E. E., Vice-President of the New York Edison Co., has been elected President, succeeding his father, Mr. Anthony N. Brady, who becomes Chairman of the Board of Directors. Mr. Brady is 34 years old and a graduate of Yale University, class of 1905.

Mr. Charles Whiting Baker, M. Am. Soc. M. E., Editor-in-Chief of "Engineering News," has been appointed by Governor Fielder, of New Jersey, and Governor Sulzer, of New York, a member of the Palisades Interstate Park Commission, which has control of the Palisades along the western bank of the Hudson and of the large tract of land given by Mrs. Harriman.

Mr. B. S. Josselyn has resigned as President of the Portland (Ore.) Railway, Light & Power Co., which position he has filled for the past six years. During Mr. Josselyn's term of office several large hydro-electric power plants have been constructed and many miles of electric railway have been added to the company's system—involving a total expenditure of $24,000,000.

Mr. J. W. Small, formerly Superintendent of Motive Power of Morgan's Louisiana & Texas R.R. and Steamship Co., Assistant General Manager, mechanical department of the Galveston, Harrisburg & San Antonio Ry., Houston, Tex., has been appointed Superintendent of Motive Power of the Seaboard Air Line Ry., with headquarters at Portsmouth, Va., succeeding Mr. A. J. Poole, resigned.

Mr. Frederic H. Betz has been appointed City Architect of Cleveland, Ohio, at a salary of $2500 per annum. It is announced that hereafter street-cleaning sheds, water towers, sewage- and garbage-disposal plants and all other public works will be designed from an æsthetic as well as a utilitarian standpoint. The City Architect is also to be consulted in the preparation of plans for all bridges erected by the city.

Mr. L. C. Bradley, of Galveston, Tex., has been appointed Assistant District Manager of the Stone & Webster public-service corporations in Texas, with headquarters at Dallas, Tex. Mr. Bradley was formerly Vice-President of the Houston Electric Co. and the Galveston-Houston Electric Ry. and Manager of the Galveston Electric Co. He becomes the executive head of public-service corporations in Galveston, Dallas, Fort Worth, Beaumont, Port Arthur, Houston and El Paso, relieving Mr. M. M. Phinney, District Manager, who will hereafter spend most of his time in Boston, Mass.

Mr. William F. Hunt, Assoc. Am. Soc. M. E., has resigned as First Vice-President of the C. W. Hunt Co., New York City, to enter private practice as a Consulting Engineer with offices at 115 Broadway, New York City. Mr. Hunt is a graduate of Cornell University and for many years has been in charge of the design, construction and installation of storage and mechanical freight-handling machinery. He will specialize in planning the arrangement of railway and steamship terminals, power plants, factories, etc., and the selection of suitable freight and material-handling apparatus.

Mr. C. A. Seley, Mechanical Engineer of the Chicago, Rock Island & Pacific Ry., has resigned, effective May 1, in order to engage in a manufacturing business. Mr. Seley has been engaged in railway work since 1879, when he entered the employ of the St. Paul, Minnesota & Manitoba Ry. as a draftsman. In 1886 he was made Chief Draftsman of the St. Paul & Duluth R.R. From 1892 to 1895 he was in the railway-supply business, but returned to railway work in March, 1895, as Chief Draftsman of the Chicago Great Western Ry. In 1899 he was appointed Mechanical Engineer of the Norfolk & Western Ry., and in 1902 to the same position with the Chicago, Rock Island & Pacific Ry.

Mr. Mason D. Pratt, M. Am. Soc. C. E., Consulting Engineer, of Harrisburg, Penn., has been appointed Engineer of the United Railways & Electric Co., of Baltimore, Md., under Mr. J. M. Hood, Jr., M. Am. Soc. C. E., Consulting Engineer of the company. Mr. Pratt is a graduate of Lehigh University, class of 1887, and was for several years employed by various Pennsylvania steel companies. He was Designing Engineer on the new mill buildings of the Lorain Steel Co., at Moxham, Penn. Later he was engaged in street railway work at Lancaster, Penn., and municipal engineering work at Dubuque, Iowa. For a number of years he was connected with the street railway and track department of the Pennsylvania Steel Co. Since 1904 he has been in private practice in Harrisburg.

OBITUARY

A. D. Avery, a civil engineer of San Francisco, Calif., died at Sydney, Australia, Feb. 12.

Colin Campbell Simpson, M. Am. Soc. M. E., Assistant Secretary and General Superintendent of Distribution, Consolidated Gas Co., New York City, died at his home in Montclair, N. J., Apr. 7.

Albert G. MacFarlane, Assoc. M. Can. Soc. C. E., District Engineer of the National Transcontinental Ry. of Canada, died in a hotel at Ottawa, Ont., Apr. 4. He was 52 years old and was formerly with the engineering department of the Canadian Northern Ry.

James Doull, Construction Engineer for the W. A. Clark mining interests at Butte, Mont., died at his home in that city on Apr. 6, from pneumonia. He was born at Kincardin, Ont., in 1863. He went to Butte 28 years ago and since then had been identified with construction of numerous mine works owned or controlled by ex-Senator Clark.

Prof. Adolf Slaby, co-inventor of the Slaby-Arco system of wireless telegraphy and teacher of electrical and mechanical engineering at the Institute of Technology in Charlottenburg, Germany, died Apr. 6. He was born in Berlin, Germany, Apr. 18, 1849. Prof. Slaby was the author of many books and articles on electrical engineering subjects. He was also Honorary Professor at the University of Berlin.

Robert Daniel Fisher, for more than a score of years a correspondent of "Engineering News," in Indianapolis, Ind., died Mar. 10. He was born at Amerigus, Ind., Oct. 20, 1849, and in 1881 moved to Indianapolis where he was deputy clerk of the Supreme Court of Indiana, afterward being appointed state librarian, combining with this work that of corresponding for a number of legal and technical journals.

Dr. James A. Egan, Secretary of the Illinois State Board of Health for the past 16 years, died at Springfield, Ill., Mar. 30. He was born in Massachusetts in 1860. In 1887 he went to Chicago and later graduated from the Chicago Medical College. For some time he was connected with the health department of Chicago. In 1897 he was appointed Secretary of the State Board of Health, and in 1901 he became also a member of the board.

Oscar Sanne, Bridge Engineer, Chicago, died at his home at Glen Ellyn, Ill., on Apr. 4. He was at one time in the bridge department of the Chicago, Milwaukee & St. Paul Ry., and later was Structural Designer in the Bridge Department of the city of Chicago. The latter position he resigned a few

months ago to take up private practice. He was specially interested in designing important bridges with due regard to the æsthetic features. He became a member of the Western Society of Engineers in 1898.

Philip H. Diehl, M. Am. Inst. E. E., founder of the Diehl Manufacturing Co., Elizabeth, N. J., died at his home in Elizabeth, Apr. 7, aged 66 years. He was a native of Germany and came to this country in 1868. He was first employed by the Singer Sewing Machine Co., and soon became known as an inventor. In 1879 he invented an electric arc lamp, and later a small battery motor, which embraced the principle of varying the air gap for speed control, and a dynamo. In 1887 he founded the firm of Diehl & Co., which has now become the Diehl Manufacturing Co.

Anton Burchard, a consulting mechanical engineer of Cleveland, Ohio, died Apr. 4, at Ocean View, Va. He was educated in Germany and for some years was employed by William Cramp & Sons, Shipbuilders, of Philadelphia, Penn. Later he was with the construction department of the United States Navy. Mr. Burchard was Consulting Engineer for the American Fork & Hoe Co., the Peck, Stow & Wilcox Co., the Upson Nut Co., the Osborn Manufacturing Co., and other industries in Cleveland. He was a member of the Cleveland Engineers' Club and of the University Club of Cleveland.

Charles E. Pugh, former First Vice-President of the Pennsylvania R.R., died Apr. 8, at Old Point Comfort, Va., following a stroke of apoplexy, on Apr. 6. He was born Feb. 25, 1841, at Uniontown, Penn. At 18 years of age he entered the service of the Pennsylvania R.R. as agent at Newport, Penn. Later he served as passenger conductor, train dispatcher and general agent at Philadelphia, Penn. In 1879 he was appointed General Superintendent of the Pennsylvania R.R., and in 1882 became General Manager. In 1893 he was elected Third Vice-President and four years later Second Vice-President. This position he held for 12 years, being the head of the operating department. Mr. Pugh was elected First Vice-President in 1909, and retired under the company's pension rules on Mar. 1, 1911, after having faithfully served the Pennsylvania R.R. for 52 consecutive years.

Amos D. Caryl, an old-time railway contractor, died Apr. 4, at his farm in Factoryville, Penn., aged 83 years. He was born in St. Lawrence County, N. Y., in 1830, and began his career as a railway contractor at Syracuse, N. Y., when he was 21 years old. Later he went to Scranton, Penn., where he took a contract for the construction of a part of the Delaware, Lackawanna & Western R.R., then being extended from Scranton to Washington, N. J. During the Civil War he served in the construction corps of the army where he found ample opportunity to utilize his knowledge of railway building. After the close of the war he returned to Scranton and continued his work as a contractor on the Delaware, Lackawanna & Western R.R. He afterward held contracts for the building of parts of the Delaware & Hudson R.R., the West Shore R.R. and the New York, Ontario & Western Ry. About 10 years ago he retired and bought himself a farm.

ENGINEERING SOCIETIES

COMING MEETINGS

SOUTHERN GAS ASSOCIATION.
Apr. 18-20. Annual meeting at Charlotte, N. C. Secy., E. D. Brewer, Atlanta, Ga.

NATIONAL GOOD ROADS FEDERATION.
Apr. 24-25. Annual convention. Secy., J. A. Countree, Birmingham, Ala.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.
Apr. 24-26. Annual convention at Waterloo, Iowa. Secy., H. E. Weeks, Davenport, Iowa.

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Schurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION.
May 6-10. Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL, AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 7-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN WATER-WORKS ASSOCIATION.
Annual meeting at Minneapolis, Minn., June 23-28. Secy., J. M. Diven, Troy, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

Brooklyn Engineers' Club—The annual exhibition of engineering materials and processes was held Apr. 15-19.

Montana Society of Engineers—At the annual meeting held in Butte, on Apr. 10, the following officers were elected: President, John H. Klekinger, of Great Falls; Secretary, Clinton H. Moore, of Butte; and Treasurer Samuel Barker, Jr., of Butte.

Canadian Society of Civil Engineers—The offices of the society have been moved from 413 Dorchester St. West, to the Society's new house at 176 Mansfield St., Montreal, Que. The monthly meeting scheduled for Apr. 10 has been postponed to Apr. 24.

County Road Engineers of Kentucky—A convention was held in Louisville, Ky., Apr. 7-9, inclusive, which was attended by about 100 engineers. A. N. Johnson, State Highway Engineer of Illinois, and M. O. Eldridge, of the United States Office of Public Roads, made addresses.

An Association of Purchasing Agents—The formation of a purchasing agents' association, to be known as the Buyers' Club of America is proposed by H. E. Gilman, of the Marathon Motor Works, Nashville, Tenn. It is proposed to have the headquarters of the club in New York. Those interested can obtain further information by addressing Mr. Gilman.

Railway Materials Association—This association is the outgrowth of a meeting of the Railway Storekeepers' Convention held in Milwaukee, Wis., in May, 1911, when some 60 railway supply men met and made arrangements for a permanent organization to be known as the Railway Materials Association. The object of the organization is to promote a friendly interest between the two associations. The annual convention will be held at the Hotel Sherman, Chicago, Ill., May 19-21. The secretary-treasurer is George H. Porter, 1258 McCormick Bldg., Chicago, Ill.

Iowa District Gas Association—The ninth annual meeting will be held at the Burlington Hotel, at Burlington, Iowa, May 7-9, inclusive. Among the papers of interest to engineers to be presented are: "Recent Developments in Industrial Appliances," by E. C. Weisgerber; "Improving Operating Conditions for Small Works," by H. G. Stillson; "Reducing Boiler Fuel in Water-Gas Manufacturing," by T. B. Genay, and "Some Distribution Experiences," by W. H. Merritt. On May 8, the members will go by steamer to Keokuk to inspect the new dam and power plant. The secretary is G. I. Vincent, Des Moines, Iowa.

Associated Engineering Societies of St. Louis—A regular meeting was held on Apr. 2, under the auspices of the St. Louis Section of the American Institute of Electrical Engineers. The paper of Prof. A. S. Langsdorf on "Surges and Oscillations in High Potential Circuits" was read and discussed. The paper dealt with the subject from the physical standpoint, without the use of mathematics. The meanings of current and voltage were described in terms of the electron theory, and the relations between the constants of an electrical circuit were compared with those of corresponding mechanical systems. Conditions were discussed which gave rise to heavy surges of current and power, dangerous rises of potential, traveling and standing waves, and other interesting features of high-power, high-voltage transmission systems.

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CORRESPONDENCE

Comments on Review of "Transmission-Line Construction"

Sir—In the Engineering Literature section of your issue of Mar. 13, there is a criticism of Lundquist's "Transmission-Line Construction," in which appears the remarkable statement that Mr. Lundquist in specifying poles by top and butt diameter and length is not following usual practice.

I cannot believe that you intended to make the statement that the type shows but if so, I would suggest consulting the pole specifications of any of the larger companies using poles; for example, the American Telephone & Telegraph Co., Western Union Telegraph Co., or the report of the Committee on Standard Overhead Construction of the National Electric Light Association, or bulletins of the General Electric and Westinghouse companies on line construction, specifications of the various lumber associations, etc. In fact, I cannot now recall ever having seen a pole specification that did not prescribe a butt diameter and as a matter of interest I should appreciate a reference to such specification.

CHARLES RUFUS HARTE,
Asst. Engr., N. Y., N. H. & H. R.R. Co.

New Haven, Conn., March 18, 1913.

[The chance omission of a couple of words from the statement in question leaves it open to the extreme interpretation of our correspondent. It should have read

* * * * * he **always** would specify wood poles according to top and butt diameters and length, whereas it is a common practice to specify length and top diameter only.

Obviously yellow-pine poles, which are sawn and have no natural taper like natural poles, must be specified according to both diameters or by some equivalent scheme. On p. 71 of Mr. Lundquist's book is seen the following paragraph:

In buying poles many companies consider the top diameter only, specifying, for instance, "so many 7-in. top, 35-ft. cedar poles in accordance with the Northwestern Cedarmen's Association Specifications," no mention being made of the butt; this method of purchasing is akin to calling for a 9-in. I-beam, 16 ft. long, without specifying its weight per foot. This "scientific" method of buying poles is not confined altogether to small companies either * * * * *

It is interesting to note that the Specifications of the Committee on Overhead Line Construction of the National Electric Light Association (1911) include such paragraphs as:

When the dimension at the butt is not given, the poles shall be reasonably well proportioned throughout their entire length.

This appears to be in recognition of the claims of those engineers who seem to feel that their interests are better served by omitting butt figures, on account of the growing difficulty of securing wood poles conforming to rigid size specifications.—Ed.]

REVIEWS AND NOTES

A Study of Fuel

Reviewed by WALTER T. RAY*

AN INTRODUCTION TO THE STUDY OF FUEL—A Textbook for Those Entering the Engineering, Chemical and Technical Industries. By F. J. Brislee, D. Sc., Chief Chemist of the British Insulated and Helsby Cables, Ltd.; Late Assistant Lecturer in Physical and Electro-Chemistry in the University of Liverpool. New York: D. Van Nostrand Co. Cloth; 5x9 in.; pp. xxii + 269; 61 text figures. $3. net.

It is seldom one has the pleasure of reading a book so thoroughly practical and so accurately scientific as in this one. The author has pretty well succeeded in his purpose "to bridge the gap that exists between the ordinary elementary textbooks of chemistry, and the large treatises dealing with fuel which enter into minute details of the chemical composition of fuels, the design of coke ovens and producers, and other purely descriptive matter." But there is no royal road to learning, and the student and old practitioner who takes up this book may as well understand on starting that although this book contains exceptionally nourishing food and a great deal of it, the digestion will be a long and difficult process. Prefaces are usually written after their books, and if the reader will follow this order, reading last Guy D. Bengough's preface to the series of books of which this book is one, he will smile; for although it is stated that only a slight acquaintance with chemistry is assumed, nothing is said about physical chemistry.

The scientific use of fuel is by far the over-shadowing problem in applied physical chemistry. This remark need not scare any reader away from this excellent book, for chemistry never was a connected and simple science until the application of physics made it clear. Of recent years combustion engineers have realized that little new light could be shed on their troubles excepting by physical chemistry; this book is the best connected and homogeneous treatise the reviewer has seen.

The first chapter deals clearly with old chemical factors in combustion, and contains paragraphs on reaction velocities, catalysis and dissociation. The second chapter gives much useful information not easily available elsewhere on the weight and volume of air required for combustion, but contains two unfortunate slips. At the bottom of page 21 is this note: "The water is assumed to be in the form of a vapor, and the volume it would occupy at 0° C. and 760 mm., if it could exist as a gas at that temperature, is calculated." Now water vapor does exist below freezing temperature, in one sense, for frozen wet clothes will dry slowly out doors. From a remark at the bottom of page 27 one might get the impression that any carbon monoxide in boiler-flue gases re-

*Clinchfield Fuel Co., Spartanburg, S. C.

sulting from the reduction of carbon dioxide to monoxide by the absorption of carbon is the cause of the loss of more heat than would result from the burning of carbon to carbon monoxide only. The point is that a given mass of the monoxide represents the failure to develop some certain fixed quantity of heat, no matter what the source of the monoxide.

The third chapter is a concise explanation of fuel and flue gas and the fourth treats of the heating value of fuels in a clear but usual way. The next chapter contains a good résumé of present easily available methods for the pyrometric measurement of high temperatures; a useful feature is the table of accurate melting points of easily available substances such as common salt, lead, sulphur, etc. Chapter 6 gives about as simple instructions as possible for calculating theoretical combustion temperatures, a very important subject, for in studying it we see how surprisingly far we fall short of the best performances.

The chapter on natural solid fuels (wood, peat, lignite and various coals) contains nothing especially new, but the information has been carefully grouped. With reference to the chemical classification of coals, some persons might have slightly varying opinions as to what constituted good "bituminous furnace coal," on the analogy that since all whiskey is good to drink all coal is good to burn; but nevertheless the table given is about as satisfactory as could be agreed upon.

Chapter 8 is the best elementary summary the reviewer has seen of the chemical results of coking coals in various kinds of ovens at various temperatures. Much of the information is not easily available in English and it is scattered. An interesting generalization in this chapter is that made from the fact that the calorific value of a fuel as determined in a calorimeter is nearly always different from the value calculated from the ultimate analysis—the generalization being that in order to convert the coal into gas and coke by dry distillation "the heat necessary for the gasifying of the coal is equal to the difference between the heat of formation of the coal and the heat of formation of the products of distillation from their elements." Perhaps this truth can be made plainer by saying that some coals tend to fall down hill into coke and gas, while others have to be pushed up.

On page 157 are given some of the findings of the United States Geological Survey as to the comparative performances of briquettes and run-of-mine coal; part of these findings were later reversed by tests made by the same Survey, which goes to show that the matter is more complicated than was at first thought. These latter tests are given in a bulletin of the United States Bureau of Mines named "Tests of Briquetted and Run-of-Mine Coal in a Locomotive Boiler."

The ninth chapter is a good exposition of the chemical reactions taking place in a gas producer, especially as to how these reactions are affected by different temperatures and different velocities of the gases through fuel bed. It is made plain that relatively slight elevations of temperature of the fuel bed result in a surprisingly large increase in the amount of air and steam which can be blown through a producer, still getting out the same composition of gas. Probably the best work which has been done in laboratory investigations of this subject was done by J. K. Clement and others at the University of Illinois and in the fuel-testing plant of the U. S. Bureau of Mines, at Pittsburgh, Penn.; but unfortunately the commercial bearing of their work still awaits translation into engineering English. Application of these physico-chemical principles may yet result in making the gas producer available for large power-plant work through reducing the heavy fixed charges and heavy labor costs. When gas producers are thus worked at high temperatures and high outputs, the consequential liquefaction and draining out of the ash of the coal will be a merely incidental advantage.

The two following chapters treat of the construction and operation of producers and of the theory of producer- and water-gas reactions by means of higher mathematics. The mathematical discussion cannot well be reviewed, but its detailed perusal will richly repay any student.

Chapter 12 applies some physical chemistry to the gas engine in an instructive way. Chapter 13 treats of air supply, the measurement of "draft," etc. in a clear way, but one cannot but wonder why the author went into such mathematical depths in some preceding chapters and did not avail himself, for the sake of his readers, of some recent simplifications of the puzzling and mysterious subject of drafts, as is done in some of the publications of the U. S. Bureau of Mines.

The two chapters which follow treat clearly but conventionally of heat generation and the various furnace and boiler losses and the final chapter treats of liquid fuels, giving on page 254 a good classification of the various petroleums, coal tars, etc.

The book as a whole is a good one.

Mechanics

Reviewed by H. T. EDDY*

RATIONAL AND APPLIED MECHANICS—By Calvin Milton Woodward, Ex-Dean of School of Engineering and Architecture; Professor Emeritus of Mathematics and Applied Mechanics, Washington University, St. Louis, Mo. St Louis: The Author, 3013 Hawthorne Boulevard, or Nixon-Jones Printing Co., 215 Pine St. Cloth; 6x9 in.; pp viii + 517; 486 text illustrations. $4.

This textbook is the work of an able teacher of unusually long and varied experience in giving instruction in this central and fundamental subject of engineering education, and in dealing with its theoretical aspects.

The treatise is an excellent one, well arranged and well written. As was to be expected and as it should be, it exhibits on the part of the author an ever present sense of the physical reality and actual relations of the structures and materials under investigation, such as the would-be engineer needs to have instilled into his consciousness. It is a good book and so thought out in its developments as to render the presentation of the various theoretical developments easy to grasp, by joining them closely to the range of experience already familiar to the student and by making rather intricate and abstruse principles appear reasonable to his relatively untutored apprehension. Having gladly conceded all this the reviewer must claim the privilege of all teachers to disagree with the author as to the general idea underlying his book, respecting the field which such a book should be designed to fill.

The subject of Mechanics in all its branches is the one that affords the undergraduate engineering student more difficulty in its mastery than perhaps all other subjects together. This is the common experience alike of faculty and student, and it behooves those who arrange the curriculum and administer the work of an engineer to see to it that every care be exercised to smooth the way to the mastery of this essential basis of all engineering design. One of the first requisites seems to be to separate the difficulties inherent in mechanical principles from those of the mathematics employed, as well as from the application of those principles sufficiently to bring it about that they be met and mastered successively and not attempted all at once.

The most successful way of doing this that has come to the attention of the present writer is to have the student take a course in elementary mechanics, beginning in his freshman year, or sooner, in which no calculus or analytical geometry shall be used, but which shall treat the simpler ideas of mechanics in great detail by the numerical solution of so large a number of problems in application of these principles as to really cultivate an engineering sense of the reality of the objects treated by this form of applied mathematics. This should be followed in the sophomore year by the mastery of the methods and processes of calculus.

The attempt to take up the more advanced mechanics by calculus methods during this time is certain to greatly increase the difficulties of mechanics, not merely by adding those of calculus to those of mechanics, but more nearly by multiplying those of mechanics by those of calculus. The work in advanced engineering mechanics should be deferred until the junior year when such due mathematical preparation would have been made by the student that it would then be possible for him to study for use the very professional books he would wish to use in after life.

Now this text of Dr. Woodward's is written to be studied in the sophomore year during the time the student is engaged in mastering calculus. It is not the intention of the author that it shall be the student's direct basis and reference book for professional work, but that he shall depend upon more advanced treatises for that. And yet the author hopes that no teacher will attempt to rush a class through the work in any period of forty weeks. That is practically a year's work. How much time should a student spend on a confessedly preliminary or secondary text?

It is possibly the idea of the author that this treatise gives all the training in applied mechanics needed by an undergraduate. With that view of the question the present reviewer cannot agree, especially as the text is almost entirely didactic and illustrative. It would seem to him that any text in applied mechanics at all adequate for embryo engineers should embody such applications in the shape of problems to be worked as are not mere illustrations but of such wider scope that the student after solving them and arriving at results indicated in the text could be certain that he understands how to apply the principles and formulas of the text. The author says he has not cared to multiply problems. He has not done so, and it would seem to the r

*Professor of Mathematics and Mechanics, University of Minnesota, Minneapolis, Minn.

viewer that he perhaps has done wisely in view of the degree of maturity, or rather immaturity, of the student for whom the book is primarily intended.

Applied Mechanics would seem to be a professional subject, and one to be attempted at a time when the student feels that he is actually entering upon professional studies in applying theories and principles to actual or assumed structures and materials. Most of the standard textbooks on that subject today are written from that standpoint. It may not be the correct point of view. Nevertheless the present reviewer subscribes to it, and from that point of view alone offers the foregoing criticism of this textbook.

⁂

Part II of Unwin's and Mellanby's "Machine Design"

Reviewed By JOHN J. FLATHER*

THE ELEMENTS OF MACHINE DESIGN—Part II. Chiefly on Engine Details. By W. Cawthorne Unwin, F. R. S., LL. D., Formerly Professor of Engineering at the Central Technical College, and Professor of Hydraulic and Mechanical Engineering at the Royal Indian Engineering College, and A. L. Mellanby, D. Sc., Professor of Engineering at the Royal Technical College, Glasgow. New and revised edition. New York, Bombay and Calcutta: Longmans, Green & Co. Cloth; 5½x9 in.; pp. xxiii+422; 311 illustrations in text. $2.50.

For the past quarter century students of engineering and practicing engineers and draftsmen have been using Unwin's textbooks of Machine Design. The present volume is a revision of Part II, first published as a separate volume in 1891 and revised in 1902. It deals chiefly, although not exclusively, with steam-engine details, arranged in definitely related groups embracing most of the mechanical problems which occur in machinery for generating power; problems which, on the whole, are more complex than those discussed in Part I (reviewed in these columns Jan. 13, 1910). In Part I the general phenomena of the strength of materials and the laws affecting straining actions are considered; but in the various cases to which these laws are applied the straining actions are usually statical or may be treated as such. On the other hand, in the design of transmissive machinery, both strength and kinematic relations are involved. In the design of machines which are intended to supply mechanical energy for doing work, the members are subjected to varying forces and move at various speeds which produce stresses best determined by the application of dynamical principles—the present treatise is devoted chiefly to a consideration of these problems.

In the revision before us Prof. Unwin has delegated the main responsibility for the additions and modifications to Prof. Mellanby, an engineer especially well qualified for the work, both by experience and technical training. Over one hundred new illustrations have been added and much new material has been presented throughout the book. The chapters on governors and condensers have been written for this edition and other parts have been rewritten.

A treatise such as this serves a two-fold purpose: (1) It consists in part of a collection of designs, data and rules for use in the drafting office; but it is not merely a collection of designs from which rules of thumb have been deduced for the use of the designer; rather it consists of the application of scientific principles to examples in practice from which simple rules have been deduced in the less complicated instances. Where the conditions are not exactly amenable to theory, or are too indefinite for exact determination, the limitations are indicated, and the practical engineer must draw upon his experience guided by the limitations suggested. (2) The other purpose of such a treatise is to serve as a textbook for engineering students and others. The practical problems presented and their discussion from a theoretical standpoint is of great value in familiarizing the student with the requirements involved in machine construction, and the considerations which guide an engineer both indirectly and empirically in designing machines. A critical examination of the present text shows that the latter purpose has been kept prominently in the foreground and many of the problems are worked out systematically and in detail, from the viewpoint of the teacher of engineering students.

The captions of the 19 chapters forming the book indicate the character and scope of the work under review:

On Pipes and Cylinders; Arrangement and Proportions of Steam Engine Cylinders; Indicator Diagrams; On Some Kinematical and Dynamical Problems in Engine Designing; Balancing; Cranks, Levers and Eccentrics; Pistons and Piston Rods; Connecting Rods; Crossheads and Slides; Stuffing Boxes; Flywheels, The Steam Engine Governor; Valves, Cocks and Sliding Valves; Condensers; Steam Engine Valves; Valve Diagrams; Expansion Valves; Link Motions and Reversing Gears; Lubricators.

As will be noted, the topics treated cover the field of steam-engine design very fully but it is to be regretted that the limitations imposed by the requirements of a handy textbook have led to omissions which the present reviewer would prefer to have seen incorporated in the text. Notably among these is the entire absence of any consideration of shaft governors. Ten pages of new material are devoted to governors but the entire discussion is given over to ball or pendulum governors.

As would be expected, the illustrations of constructive details relate almost entirely to English practice, but this is not a serious objection to the American designer; rather it is an advantage in illustrating foreign construction. The fact that the proportions indicated are based on sound theoretical principles, modified as required by practical considerations, must appeal both to the student and designing engineer.

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Clark's Gas Engines Revised

THE GAS, PETROL AND OIL ENGINE—Vol II. The Gas, Petrol and Oil Engine in Practice. By Dugald Clerk, M. Inst. C. E., and G. A. Burls, M. Inst. C. E. New and revised edition. New York: John Wiley & Sons. Cloth; 6x9 in.; pp. vii+838; 481 text figures. $7.50, net.

It is 26 years since Dugald Clerk's treatise on the gas engine was first puslished. A second edition, largely rewritten, was published in 1896. Since that time a technical and commercial development of the internal combustion motor has occurred far exceeding all that had taken place previously.

For a number of years Mr. Clerk has been engaged in rewriting his treatise and it is now published in two volumes, the first of which appeared four years ago, and was devoted to a general study of the internal combustion engine, its theory, thermodynamics, etc. The second volume now issued deals with the practical problems of design, construction and operation of internal combustion engines and is nearly twice as bulky as Volume I. G. A. Burls, M. Inst. C. E., who was formerly associated with Prof. Unwin, has assisted Mr. Clerk in the preparation of this second volume.

Mr. Clerk's first treatise was devoted to the gas engine and while the second and the present editions include matter on gasoline and oil engines, the gas engine still receives chief attention. The first two very long chapters, with a combined length of over 250 pages, are devoted respectively to the development of four-stroke cycle gas engines and of two-stroke cycle gas engines. Curiously enough, the author refers to the former as "the four-stroke cycle" and the latter as "the two-cycle" engine.

Notwithstanding the large space given to this subject, one looks in vain in these two chapters for any such concise and clear statement of the relative advantages of the four-stroke cycle and the two-stroke cycle as is given for instance in Güldner's well known work.

Much space in Clerk's chapter on two-cycle engines is given to descriptions of his own early work and of such curiosities as the old Atkinson engine, material which is now of only historical value. In this chapter, and also throughout the book, large space is given to detailed reports of tests of engines, most of which have little significance at the present time. Some criticism must be made also of the classification adopted by the author in treating the subjects of "petrol (or gasoline) engines," of "heavy oil engines" and of "marine engines," each in separate chapters. Anything on two-stroke cycle engines contained in these chapters is not included under the two-stroke cycle gas engines in Chapter 2. We do not find that the author has anywhere described the notable two-stroke cycle engine developed by Junkers, in Germany, and considerable of the work of prominent Continental builders of Diesel engines, which has attracted wide attention during the last few years, finds no mention here.

Among the other subjects to which special chapters are devoted we may mention the following: Igniting Arrangements; Speed Regulation; Gas and Fuels; Petroleum, Petrol and Paraffin Oils; Carburetors. The concluding chapter is devoted to the future of internal combustion motors.

Notwithstanding the above minor criticisms with reference to scope, arrangement and treatment, the book represents an enormous amount of labor in collection and compilation; and it will continue to rank as a standard work on internal combustion engines. The distinguished author of the book is undoubtedly among the most prominent of English engineers who have contributed to the present development of the internal combustion engine. His book bears testimony both to his industry and his ability.

*Professor of Mechanical Engineering, University of Minnesota, Minneapolis, Minn.

Psychological Engineering

PSYCHOLOGY AND INDUSTRIAL EFFICIENCY—By Hugo Munsterberg. Boston and New York: Houghton-Mifflin Co. Cloth; 5x8 in.; pp. 315. $1.50, net.

Such of the efficiency engineers as are really engineers know that to attain success in a shop or factory they must master the laws governing the action of machines. Only a few of these engineers seem to realize that it is equally necessary for them to understand the action of the human mind. This lack is in large measure excusable, for it is not long that the science of the mind has been much more than a pure abstraction. Quite recently, thanks to a most practical broadening of the work of the modern psychological laboratories, psychical studies have been combined with physical studies of man and still more recently these psychophysical studies have been practically applied to the solution of a number of grave industrial problems.

It does not seem too much to say that we are now on the eve, if not at the dawning, of a great industrial era—the psycho-technical. The best of the efficiency engineers have pointed the way toward this era, though mostly by intuitional and cut-and-try methods; the mediocre efficiency engineers and the sheer imposters (who together far outnumber the real efficiency engineers) have done much, with their high-sounding generalities and ridiculous claims, to befog the way and to lead the more intelligent, but as yet ill-informed public to believe that most of the current "efficiency" talk is pure gammon.

Prof. Hugo Münsterberg, of Harvard University, seems to have done more than any other one man to prepare the way for the psycho-technic era. His first book on the application of psychology to industrial problems was published in 1912, with the title "Psychologie und Wirtschaftsleben: Ein Beitrag zur angewandten Experimental-Psychologie" (Leipzig: J. A. Barth). This was soon followed by the volume now before us, "which is not a translation," the author says, "as some parts of the German volume have been entirely omitted and other parts have been enlarged and supplemented. Yet the essential substance of the two books is the same."

No one interested in human or industrial efficiency should be kept away from this book by fear that its pages abound in technical terms beyond their understanding, for the book is notably free from technicalities.

After a short Introduction the author devotes about a hundred pages each to The Best Possible Man and to The Best Possible Work, which form Parts I and II of the book. In Part I chapters on Vocation and Fitness, Scientific Vocational Guidance and Scientific Management are followed by one on The Methods of Experimental Psychology. This leads up to three chapters which detail some interesting psychological experiments made by the author in the interests of the electric railway, ship and telephone services. These chapters are forcible illustrations of the aid which the science of the mind can render to the industrial arts. Other chapters in Part I give some experiences and opinions of men of affairs as to the human efficiency problems and discuss individual and group differences.

Part II, The Best Possible Work, takes up still other practical problems, such as The Adjustment of Technical to Psychical Conditions, motion, monotony and attention and fatigue studies. A more general subject is Physical and Social Influences on the Working Power.

The third and final Part, The Best Possible Effect, has as its text the idea that even the best man and the best work combined may not give the highest economic results, unless they are utilized for The Satisfaction of Economic Demands. After this opening chapter the author seems to wander somewhat from both the text just mentioned and the general subject of his book, although there is some warrant for including in this volume accounts of experiments on the effects of advertisements and on illegal imitation, as well as a chapter on Buying and Selling.

The closing chapter, on The Future Development of Economic Psychology, is brief but interesting and suggestive. The author had previously spoken of the "consulting economic psychologist." We quote a few sentences as to the training of industrial psychologists and the possible uses which could be made of them—and of what Prof. Münsterberg goes so far as to call psychological laboratories.

[illegible] special laboratories could be created which are really adjusted to the special practical needs and to which a suitable group of persons could be drawn by the [illegible] The best solution for the United States would be a psychological laboratory for applied psychology with special reference to the psychology of commerce and industry, similar to the model agricultural stations all over the land under the Department of Agriculture. . . .

[illegible] schooled experimental psychologist to their staff. And yet his observations and researches might become economically the most important factor. Similar expectations might be justified for the large department stores and especially for the big transportation companies. In smaller dimensions the same real needs exist in the ordinary workshop and store. It is obvious that the professional consulting psychologist would satisfy these needs most directly, and if such a new group of engineers were to enter into industrial life, very soon a further specialization might be expected. Some of these psychological engineers would devote themselves to the problems of vocational selection and appointment; others would specialize on questions of advertisement and display and propaganda; a third group on problems of fatigue, efficiency and recreation; a fourth on the psychological demands for the arrangement of the machines; and every day would give rise to new divisions. Such a well-schooled specialist, if he spent a few hours in a workshop or a few days in a factory, could submit propositions which might refer exclusively to the psychological factors and yet which might be more important for the earning and the profit of the establishment than the mere buying of new machines or the mere increase in the number of laborers.

No one can deny that such a transition must be burdened with difficult complications and even with dangers; and still less will anyone doubt that it may be caricatured. One who demands that a chauffeur or a motorman of an electric railway be examined as to his psychical abilities by systematic psychological methods, so that accidents may be avoided, does not necessarily demand that a congressman or a cabinet minister or a candidate for marriage be tested too by psychological laboratory experiments, as the witty ones have proposed. And one who believes that the work in the factory ought to be studied with reference to the smallest possible expenditure of psychical impulses is not convinced that the same experimental methods will be necessary for the functions of eating and drinking and love-making, as has been suggested.

That our author has no lack of common sense and that still rarer quality, a sense of humor, is shown by the last paragraph of our quotation.

Such a book as this should make an appeal to a large proportion of our readers for it has a message for everyone interested in either industrial or human efficiency, even though its human efficiency message may chiefly concern one's own self.

❧

ELEMENTS OF WESTERN WATER LAW—By A. E. Chandler, Irrigation and Water Right Specialist; Assistant Professor, Irrigation Institutions, University of California; Secretary, American Engineering Corporation, San Francisco. San Francisco: Technical Publishing Co. Cloth; 5x9 in.; pp. 150. $2.

Water law in those parts of the western United States where irrigation is paramount follows the doctrine of prior appropriation for beneficial use as contrasted with the riparian rights doctrine of the eastern United States and of England. In the semi-arid region the riparian principle controls to a greater or less extent.

The volume before us reviews the history and present status of both the doctrines named, as regards the western states, citing decisions and summarizing legislation. Such subjects as water rights on interstate streams, rights-of-way over public lands, commercial irrigation enterprises, the Carey and Reclamation acts and irrigation districts are also treated.

It is interesting to note that 13 states have passed legislation authorizing irrigation districts, although only nine had district projects completed or under construction in 1910, while most of the land under water in such districts was located in California, Colorado, Idaho and Nebraska.

The book is an abbreviation of part of a course of lectures given by the author to advanced students of agriculture and civil engineering at the University of California. Its contents have previously appeared in the "Journal of Electricity, Power and Gas."

❧

SEWAGE POLLUTION OF INTERSTATE AND INTERNATIONAL WATERS, with Special Reference to the Spread of Typhoid Fever—By Allan J. McLaughlin. Hygienic Laboratory Bulletin 83, Public Health and Marine Hospital Service of the United States. Paper; 6x9 in., pp. 296, 91 charts in text and 32 maps.

After an interesting and instructive comparison of typhoid-fever rates in the United States and in Europe and a further study of typhoid fever, enteritis and infant mortality as related to water-supply in the United States, the author presents the results of a survey of water pollution and typhoid in the cities on the four Great Lakes and their connecting or outlet rivers, as named in the sub-title. Tables, diagrams and maps are freely used. The conclusions drawn are that much more attention should be paid to the purification of the water-supplies of the cities on these interstate waters, and that water purification should take precedence over sewage treatment. An earlier report dealt with Lake Erie. The author deserves commendation for his sane views on the relation between sewage disposal, water pollution, water purification and sewage treatment.

The Framework of American City Government

THE GOVERNMENT OF AMERICAN CITIES—By William Bennett Munro, Ph. D., Professor of Municipal Government, Harvard University. New York: The Macmillan Co. Cloth; 5¼x9 in.; pp. 401. $2, net.

It is a striking fact that of the many books on municipal government published in the last dozen years nearly all deal with the framework, machinery, or organization of cities and few with administration or operation. This is directly in line with the American tendency to work reforms through legislation rather than through administration. When reforms in administration are attempted they generally stop short with a change in the machinery of putting men into and out of office or at most with the displacement of one set of men selected with little or no regard for fitness by another set chosen in the same way, both alike being subjected to no real control which will insure efficient public service.

Prof. Munro, in the book before us, has purposely limited himself to the "framework" rather than "the functioning mechanism of the municipal organization," but we are glad to note that he proposes "to deal fully" with administration in a later volume. Within the limits set the author has produced a useful book—a fit companion to his excellent "The Government of American Cities" (noticed in these columns May 13, 1909).

After reviewing the history and social structure of the American city and its relation to its creator (and sometime destroyer), the state, the author takes up in succession the powers and responsibilities of cities, the electorate and its actions through nominations and elections, and then municipal parties and politics. This brings the reader to the human machinery of government, selected by the voters or their bosses, as embodied in the mayor, the council, and the various administrative departments. The personnel is then taken up more specifically in a chapter on "Municipal Officials and Employees." Chapters follow on the commission plan, the initiative, the referendum and the recall, and finally a well pointed chapter on "Municipal Reform and Reformers," which is one of the best in the book.

The general plan followed is first to present the chapter subject in a historical and descriptive manner, and then, where conditions warrant it, to sum up the advantages and disadvantages of rival plans, such as administrative boards as against single commissioners, the commission plan compared with the independent mayor and council and direct legislation as opposed to legislation by a representative body. The treatment is judicial, although the author does not hesitate to approve or to disapprove where, in his judgment, reason and experience are conclusive one way or the other.

As is almost inevitable in a book of so wide a range, not all the data given are uptodate. A minor lapse is the inclusion of Pittsburgh with cities having a bi-cameral council. A more notable deficiency and one which might easily have been avoided occurs on page 40, where death rates by five-year periods are given for New York, Chicago, Philadelphia and Boston, ending with 1901-5. While this table serves to illustrate the declining urban death rate, it could have been made still more striking by adding the period 1906-10, and the single year, 1911. This omission is not so important, however, as the over emphasis placed upon the low death rate of rural as compared with urban communities. The author says:

> The city, as is well known, has a death rate per thousand very much above that of the country, a social phenomenon which seems to have held true in all periods and in all countries.

Although the context, as well as the table just mentioned, shows the rapid decline in the urban death rate in the past three decades the author does not point out the very significant fact that the urban death rate has declined and is declining more rapidly than is the rural. This disparity would be all the more marked, it seems certain, if the line between urban and rural (placed by the U. S. Census at 8000 population) were raised so as to come more nearly to the real dividing line between communities which have and those which have not been benefited by those "enormous advances made by" medicine, sanitation, personal hygiene and "preventive medical science generally," which the author notes as instruments in reducing the urban death rate. The rural districts and a large percentage of the population in the smaller and even in many of the middle-class cities have the benefit of relatively few of these advantages. Moreover, the rural districts and the smaller cities by their health-protective deficiencies are actually retarding the remarkable fall in the death rates of the more progressive cities, large and small.

A questionable line of argument is advanced (page 255) in support of administrative boards as against single commissioners, on the score of economy. While this argument is in qualified terms and is limited somewhat to the smaller cities yet it is not so full a presentation of both sides of the case as the author generally gives. It should perhaps be added that the author assumes that these boards would serve without pay and that under them there would be well qualified subordinates chosen by the merit system. Of course the real test, as the author would himself say, had he carried the discussion further, is the relative efficiency of the board and of the single commissioner plan, rather than the salary drain upon the city treasury.

Finally, although Prof. Munro's book does not claim to add materially to the mere volume of data of municipal government, yet it does bring many of the later data together in convenient and readable form, interprets and weighs these data and draws from them many valuable deductions. As we have already intimated, the volume well complements the author's earlier work on "The Government of American Cities." There remains now for him the task of producing his third volume, on municipal administration; a work, as may be inferred from our opening paragraph, more needed than was another volume on the framework or machinery of municipal government, welcome as the present volume is, and much more difficult to produce without falling into many errors of commission. If Prof. Munro succeeds in his third task, as we have no doubt will prove to be the case, he will indeed have produced a remarkable trilogy in municipal literature.



Revision of Webb's "Railroad Construction Economics"

Reviewed by WALTER W. COLPITTS*

THE ECONOMICS OF RAILROAD CONSTRUCTION—By Walter Loring Webb, M. Am. Soc. C. E., Assistant Professor of Civil Engineering (Railroad Engineering), University of Pennsylvania, 1893-1901. Second edition, thoroughly revised. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. viii + 347; 34 text figures. $2.50 (10/6), net.

The first edition of this work, which appeared in 1906 and was noticed at length by the writer of this note in "Engineering News" of April 18, 1907, was regarded as an excellent epitome of a subject that covers a very wide range. The need for an authoritative statement of the correct value of the economic factors upon which a scientifically designed railroad should be based was felt by all engineers, and this need has been supplied in a marked degree by Professor Webb's book. The new edition brings the data comprised in the tables and diagrams down to date and adds new material on matters that have been subjects for experimentation since the publication of the first edition.

A STUDY OF IOWA POPULATION AS RELATED TO INDUSTRIAL CONDITIONS—John E. Brindley, A. M., Ph. D., Associate Professor of Economics and Political Science. Bulletin 27, Engineering Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa. Paper; 5¾x8¾ in.; pp. 64; 4 folding charts.

After presenting studies of Iowa population from 1840 to 1910 and discussing the "Causes and Remedies of a Declining Population" (illustrated by graphical freight-rate data) the author draws a series of conclusions of particular interest to engineers. He recommends an extension of the instruction already offered by the state in the way of higher technical education, including research work; "Secondary instruction in the industrial and mechanic arts" for "the many rather than the few"; a survey of the natural resources of the state; and various reforms in legislation. The final conclusion is that an Engineering Extension Division should be added to the Engineering College at Ames, to render ser- Agricultural Extension Division.



A little manual of first aid in electrical accidents ("Electrical Injuries," by C. A. Lauffer, M. D.; John Wiley & Sons; 50c., net) has been prepared by the medical director of the Westinghouse Electric company. It is a simple discussion of the effects of shocks and burns, principally, and of the immediate measures that must be taken if life is to be saved or intense suffering alleviated. Therefore it should be read by everyone who is likely to face such situations in the shop or field. The book explains the utility and simplicity of the "prone pressure" (Schaefer) method of resuscitation, which a joint commission of doctors and engineers has recommended as superior to the older Sylvester movements.

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*Vice-President, W. H. Coverdale & Co., 66 Broadway, New York City.

An Elementary Text on Steam Engineering

Reviewed by WINSLOW H. HERSCHEL*

STEAM ENGINEERING—A Text book. By William R. King, U. S. N., Retired; Principal, Baltimore Polytechnic Institute. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6×9 in.; pp. viii + 450; 177 illustrations. $4, net.

No book of 439 pages could possibly cover all forms of apparatus connected with the use of steam. Therefore it is not surprising to find the less common subjects, such as chimney design, feed water purifiers, refrigeration and air compressors omitted from the volume before us. Nor is it to be expected that the treatment of the apparatus considered should be exhaustive. The steam turbine suffers most through lack of completeness, though the latest developments of this important prime mover are as well brought out as could be done in 32 pages.

Thus the book is mainly an elementary textbook on the steam boiler, reciprocating engine and accessories, including among the latter, feed water heaters, pumps, economizers, injectors, condensers and other appliances. The main idea of the book is to present the subject with such simple but complete explanations in regard to the thermodynamics and kinematics involved that the student will not need to have previously studied these subjects. A knowledge of calculus is not absolutely necessary, as very sparing use is made of it. In Chapter X, on Expansion of Gases, the integration sign is used only seven times, and in Chapter XIII, on the Carnot Cycle, it is used but twice. Those who have suffered under Rankine and his followers will appreciate what a marked innovation this is for a book on thermodynamics.

A few points might be noted which could cause trouble to the student. On page 5 it does not seem to be clearly enough stated that "V" in thermodynamics always means the volume per pound, and not the total volume that happens to be considered in a problem.

If the formula for "I.HP." on page 240 were written without the "2" and "N" defined as the number of power strokes per minute, there would be less danger of confusion in applying the formula to two-and four-stroke-cycle gas engines and single-acting steam engines.

The author has used the Marks & Davis steam tables in all but the first two chapters of the book, and might better have used them throughout. The reviewer believes it would have been preferable to have gone farther and eliminated all data and formulas not in accord with the most recent determination of the properties of steam, as for example the value of 0.48 given on page 297 for the specific heat of superheated steam, and the formula given on page 20 showing the relation between pressure and volume of saturated steam: "$p\sqrt{v} = 482$."

As regards simplicity of treatment and sequence of subjects the author has been most successful. The book might be used to advantage either in a short course where time was limited, or in a longer course with the idea of taking up the subject more fully later on. This latter method would have great advantages over the usual practice, because when an advanced text of thermodynamics is used, the subject is notoriously distasteful to the student, who realizes only that he has encountered a difficult course about the practical value of which he has the gravest doubts. If the student approached the subject as in Steam Engineering, learning the thermodynamics no faster than was necessary to explain the construction of the apparatus considered, he would be sure to regard a subsequent course in advanced thermodynamics in an entirely new light.

ANLEITUNG ZUR DURCHFUEHRUNG VON VERSUCHEN AN DAMPFMASCHINEN, DAMPFKESSELN, DAMPFTURBINEN UND DIESELMASCHINEN—Zugleich Hilfsbuch fur den Unterricht in Maschinenlaboratorien technischer Lehranstalten. By Franz Seufert, Ingenieur, Oberlehrer an der Kgl höheren Maschinenbauschule zu Stettin. Third edition. Berlin: Julius Springer. Flexible linen; 5×8 in.; pp. viii + 105; 43 text illustrations. 2.20 marks.

As indicated by the complete title of Mr. Seufert's German work, his book is not a compilation of the results of tests, but a very elementary handbook for use in mechanical laboratories and by testing engineers. Of the subjects mentioned, testing steam engines occupies 55 pages, steam boilers, half as much; while Diesel engines are treated in 16 pages. In the five pages devoted to steam turbines, very little is contained that would not apply equally well to steam engines.

For steam or Diesel engines, the objects of a test are said to be the determination of indicated horsepower, brake horsepower and consumption of heat units per horsepower-hour. In addition, under steam engines, water rate and valve setting are considered, and under Diesel engines, the consumption of combustible.

It is evident from the section on boilers, that here the German code is unlike the American. The weight of water evaporated per hour, per unit area of heating surface and per unit area of grate are determined, together with the ratio of weight of steam to weight of coal, both under actual conditions of test and reduced to "normal steam." Normal conditions are not, however, from and at 212° F., but steam is supposed to be generated at atmospheric pressure from feed water at a temperature of 32° F. The method of finding the calorific value of fuels is considered, and the indicator, Prony brake, Orsat apparatus, draft gage and Ringelmann's smoke chart are described with illustrations.

Besides giving instructions for carrying out tests, the author pays some attention to the interpretation of results, and in this connection gives a page to defective indicator diagrams and explains how the valve setting should be changed in each case. That the book fills a certain need for those who do not desire a more comprehensive work, is shown by the fact that it appeared in 1906, has been translated into Russian, and is already in its third German edition.

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AMERICAN MINE ACCOUNTING—Methods and Forms Employed by Leading Mining Companies. By W. H. Charlton, P. A., Member, Lake Superior Mining Institute. New York and London: McGraw-Hill Book Co. Cloth; 6¾×9½ in.; pp. viii + 367; 250 text figures. $5, net.

In his preface, the author states that he has had twelve years' experience as an accountant with various copper-mining companies in the Lake Superior district, and that in this capacity he has felt the need of a technical work on mine accounting.

The book he has given us is a compilation of material, including specimens of a great many blank forms, which illustrate in detail the practical working systems of companies representative in their particular fields of mining.

The book is divided into six chapters: The first on mining iron ore, which gives the practice of the Oliver Iron Mining Co.; the second on mining and milling native copper and the practice of the Ojibway Mining Co.; the third on mining copper ore, Utah Consolidated Mining Co., and smelting copper ore, Calumet & Arizona Mining Co.; the fourth on mining coal and making coke, Utah Fuel Co.; the fourth on mining and milling gold ore, the Portland Gold Mining Co.; and the last chapter deals with various mehods of recording engineering and geological data.

The text consists of straightforward explanations of the selected practice and of the use of the forms illustrated. In general, theoretical discussions are avoided. The typography and illustrations are excellent, and show much painstaking work.

The definitions, descriptions and explanations give a great deal of information on mine management and operation, as well as on mine accounting. A mining library could hardly be considered complete without such a reference work, although the average mining engineer may not care to master the principles of mine accounting.

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SMALL WATER SUPPLIES—Being a Practical Treatise on the Methods of Collecting, Storing and Conveying Water for Domestic Use in Large Country Mansions, Estates and Small Villages and Farms, for the Use of Engineers, Estate Agents and Owners of Country Property. By F. Noel Taylor, C. E.; Member of the Institute of Municipal Engineers, Author of "A Manual of Civil Engineering; Practice." London: B. T. Batsford. New York: D. Van Nostrand Co. Cloth; 5×8 in.; pp. viii + 174; 126 text illustrations. $2, net.

Water-supply and water-works for country houses and estates, while involving no very intricate engineering problems, is to some extent a specialty for which there is a good excuse for a textbook. While there is little in Mr. Taylor's book which an engineer is not supposed to be acquainted with, or at least could find in other words in his library on hydraulics and engineering construction, it does give in concise form the parts of those subjects of most value to the builder of a small water-works system. Indeed the book is not written for engineers only, but for estate agents and owners of country property.

The subject matter is clearly and logically presented, beginning with a discussion of water, its impurities, testing and treatment; the various sources of water-supply, treating particularly the sources of small supplies, such as wells and springs, the flow of water in channels and pipes, and the meas-

*Associate Professor of Mechanical Engineering, University of Maine, Orono, Me.

urement of water by weirs. There is an excellent chapter on small pumps and power-generating devices, including the hydraulic ram, gasoline engine and windmill. The chapter on storage and distribution gives enough of the principles of dam and masonry construction to aid in the building of small reservoirs, storage tanks and water filters.

The book is sufficiently technical to furnish the engineer with standard formulas and working data and yet is popular enough to be of real service to the average estate owner; if not in designing a water-works system, at least in preventing his making radical errors in selecting the source of supply and distribution equipment.

Alternating-Current Generators, Motors and Converters

Reviewed By B. A. BEHREND*

DESIGN OF POLYPHASE GENERATORS AND MOTORS—By Henry M. Hobart, M. Inst. C. E., Consulting Engineer, General Electric Co. New York and London: McGraw-Hill Book Co. Cloth; 6¼x9½ in.; pp. viii+265. 125 text figures. $3, net.

SYNCHRONOUS MOTORS AND CONVERTERS: Theory and Methods of Calculation and Testing—By André E. Blondel, Hon. M. Am. Inst. E. E., Professor in National School of Bridges and Highways of France. Translated from the French by C. O. Mailloux, Consulting Electrical Engineer, with additional chapters by Comfort A. Adams, Professor of Electrical Engineering in Harvard University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xviii+295; 148 text illustrations. $3, net.

Mr. Hobart has written a most useful treatise. It is fortunate that he can bring to his task the erudition of a scholar and the experience of an engineer trained both in Europe and in the United States. He thus happily avoids the Scylla of academic treatment as well as the Charybdis of crude practical empiricism, and he steers his course between these perils in a most successful manner. The reader is taken through the simple fundamentals of the design of alternating-current machinery by being shown how to arrive at the number of poles, and at the approximate size of a machine by figuring the output coefficient and the ampere conductors per inch of periphery—called by the author the "peripheral loading." The dimensions of the slots, the space factor, and the insulation, as well as the general distribution of windings, are simply and lucidly discussed and are illustrated by good diagrams. Then follows the design of the magnetic circuit, in which the author shows how to dimension the different parts and how to compute the magneto-motive forces which are plotted in the saturation curve. The regulation of alternating-current generators is then discussed and the principles of design are illustrated by a complete calculation of a 2500-kv.a. generator.

Turbo generators are somewhat superficially adverted to in chapters on generators with distributed field windings. Subsequent chapters deal with the squirrel cage and slip ring induction motors, in which the circle diagram, so essential to a clear comprehension and calculation of the characteristics of induction motors, is explained and outlined. In another chapter he treats of the relative advantages of synchronous motors and induction motors and shows the proper respective spheres of these types. An example of induction generators and examples for practice in designing conclude the book. An appendix contains a valuable bibliography, which is unfortunately limited to the Transactions of the two great English-speaking electrical institutions.

It is a rare exception to find men, with the experience necessary for the writing of such a treatise, and with the ability to present their subject clearly, who are willing to undertake the wearisome task of writing such a book and seeing it through the press. This book is a compliment, not only to Mr. Hobart's engineering ability, but also to his character and his ideals, as few men possessing his experience would be willing to take the pains to write such a work. In the hands of the student, the electrical engineer, the designer, the consulting engineer, and the operator, the book will prove helpful and suggestive, and it will give those who are merely in superficial touch with the electrical profession an idea of fundamental principles and experimental data, which could not easily be obtained elsewhere.

In 1895 Prof. André Blondel published a little pamphlet on synchronous motors, which contained in a condensed form his theoretical investigations in connection with the parallel operation of alternating-current generators and synchronous motors, originally published in the volumes of "Lumiere électrique in 1892 under the title, "Sur le couplage des alternateurs." These papers in "Lumiere électrique" formed one of the greatest contributions to the theory of alternating-current phenomena and, while only imperfectly known, they contained the solution of all the fundamental problems in relation to parallel operation. "Lumiere électrique" was discontinued on account of commercial difficulties and these important papers, already difficult of access, had thus become buried in the tomes of a defunct journal. When Prof. Blondel republished part of these papers, in a condensed and simplified manner, in a little book on synchronous motors, his lucid presentation of this complicated subject was heartily welcomed by the student. However, the wider membership of the American electrical engineering fraternity never learned of the existence of this book, and they obtained their knowledge of the theory of synchronous motors from other works whose authors had been chary of giving to André Blondel the credit which so amply belonged to him. C. O. Mailloux, who has translated for us the works of other French authors, has again obtained our gratitude by presenting to us Blondel's little treatise in English form, and he has added to the value of the book by having Prof. Comfort A. Adams write additional chapters on rotary converters, supplementing Prof. Blondel's papers on that subject. Prof. Blondel's treatment of the stability of operation of rotary converters is one of the most interesting chapters of the book. The chapter on voltage ratio in synchronous converters with special reference to the split-pole converter, written by Prof. Comfort A. Adams, is another valuable adition to the book. The concluding part of the book deals with the calculation of armature reaction, and is taken substantially from a paper by Prof. Blondel before the International Congress at St. Louis in 1904.

Mr. Mailloux's translation of Prof. Blondel's book represents more than a mere addition to English electrical engineering literature. It is an entering wedge to show the American student and engineer of this country that almost all the fundamental scientific work which forms the foundation of the theory of alternating-current generators and motors is the work of great European scholars and that, of this work, a large moiety was done by Prof. Blondel before the opening of this century. Thus Mr. Mailloux has rendered a real service to all those who are interested in the true origin of the theories which they employ in their engineering and commercial labors.

An Elementary Book on Gas Power

GAS POWER—By C. F. Hirshfeld, M. Am. Soc. M. E., Professor of Power Engineering, and T. C. Ulbricht, M. Am. Soc. M. E., Instructor, Department of Power Engineering, Sibley College, Cornell University. [Being part of the "Wiley Technical Series," edited by J. M. Jameson]. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. x+209; 60 text illustrations. $1.25, net.

The preface of this little book states that the treatment has been made as simple and non-mathematical as possible to adapt it to the needs of students in the higher classes of manual training schools and other institutions devoted to industrial education. The authors think the book should also be useful to those who wish to obtain information in this field, but who have not had the advantages of a broad technical education

There is no more difficult sort of technical writing, we believe, than that which is required to fulfill the conditions above set forth. In writing the ordinary treatise on an engineering subject, the author can assume that his readers are at least reasonably familiar with chemistry and physics and elementary mathematics; but when the task is to make a subject clear to a reader who has not this elementary knowledge, or who may have it only in part, the task becomes vastly more difficult.

It is, in fact, a common failing of all writers of technical literature to forget for the moment that the reader has not the knowledge which they themselves possess. The key to clear writing for any author, anywhere, at every page and every paragraph, is for the author to put himself in the reader's place and attempt to make the meaning so clear that the reader cannot fail to comprehend what is meant.

It is, we are aware, a difficult matter to judge just what should be put in and what should be left out of a book designed for the needs of such students as those described in the preface. It would seem to us, however, that a smaller amount of space devoted to theory and greater spact to the problems of practical operation would make the book more useful.

The authors throughout the book refer to the Diesel engine cycle as if it were essentially different from the cycle of the ordinary gas or oil engine. While this is true of the

*John Hancock Bldg., 200 Devonshire St., Boston, Mass.

theory originally promulgated by Dr. Diesel, the Diesel engine as actually built today cannot be said to differ in its cycle of operation from the ordinary oil engine in which the oil is delivered at the end of the compression stroke. In fact, except for explanation of the difference between the four-stroke cycle and the two-stroke cycle, we believe it is much the simpler way, in an elementary work at least, to consider all internal combustion engines of the present day as operating in the same manner and emphasizing the fact that all alike depend upon the combustion of fuel and air in an inclosed space and the expansion of the resulting gases against a piston.

We would not be understood as being unduly critical of the book before us, for as we have said, the task of presenting an elementary statement of all the main facts regarding the operation of internal combustion engines in such limits of space as this book makes available is one of extreme difficulty. We have no doubt that in many schools it will be found useful.

Heating and Ventilation

Reviewed by REGINALD PELHAM BOLTON*

THE ELEMENTS OF HEATING AND VENTILATION—A Textbook for Students, Engineers and Architects. By Arthur M. Greene, Jr., Professor of Mechanical Engineering, Russell Sage Foundation, Rensselaer Polytechnic Institute; Some time Junior Dean, School of Engineering, University of Missouri. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi+324; 223 text illustrations. $2.50.

Although not fulfilling all the hopes as to comprehensiveness held out by the Preface, this volume concisely presents the main considerations entering into the computation and proportioning of heating and ventilating apparatus, the subject matter being arranged in a more logical and consecutive order than in the majority of works devoted to these subjects.

The matter is also presented in a commendably simple form, the makeup of the book and its outline illustrations being clear and understandable, though the illustrations of furnaces bear the earmarks of trade publications.

Little material is devoted to some of those considerations which at the present time are of great concern and interest to heating engineers and information upon which is being sought eagerly by all students of the art. Thus, the important subject of district heating receives scant attention, much less than in Prof. Hoffman's "Handbook for Heating and Ventilating Engineers" and the question of humidity in conditioning air for ventilating purposes is not completely presented. The thorough student of this subject is sure to demand some information on the physiological side of ventilation and heating, but no light is thrown on this side of the subject.

The subject of boiler ratings and capacities could have been greatly benefited by the presentation of some of the facts brought out by the work, of Prof. Busey, in place of the restatement of manufacturers' ratings.

It is perhaps not to be expected that the large matter which is now agitating the profession, as to the fundamental requirements of ventilation, should be analyzed in a work intended for the student of the art, since the subject is one which at present is in the controversial stage. Still, it would be well that all students should receive some indication of the strong probability of a change of standards and accepted data, upon which the proportions and even the methods of ventilation may in future be based. As to this matter, the author says:

The presence of 11 parts of CO_2 per 10,000 in air when the increase has been due to respiration is found to be oppressive and harmful. In cases of gatherings of healthy persons this may reach 15 parts while with sick it should be kept as low as 7 parts. When the 15 parts limit is about 7 parts to 10,000, there is no evidence of discomfort and this may be taken as the limit for proper ventilation.

The student gains nothing positive from these figures and no indication that, in view of the negative results of recent experiments, it must apparently be conceded that the carbon dioxide content is no longer the determinate basis of the [illegible] of ventilation as it has hitherto been considered.

In designing apparatus for practical purposes, the student will be directed with advantage to the results effected by heating and ventilating appliances under operating conditions, and the variations of practical use, on which [illegible] has hitherto been written, and hints of it in such form as to reach the student.

In the treatment of the methods for proportioning heating apparatus the formulas by experiment and recommended heating [illegible]

*Consulting Engineer, 55 Liberty St., New York City.

are re-stated in the empirical form of additions by 10 to 50% for various fixed conditions, such as appear in so many prior publications, instead of applying the determinate elements of wind effect and the results of recent experiments in the infiltration of air.

The subject of steam heating would gain by having more attention given to the question of vent-lines and the effects producible by the location of air valves in various positions.

It is perhaps too much to expect that every branch of a subject of so wide and complex a character as the design of heating and ventilating systems can be comprehensively presented within the covers of a single volume, but it is unfortunate if the limited space available is utilized for mere trade publication matter, which is the case with some parts of the subjects herein presented. Accompanied by an analytical discussion, such matter may become instructive, but this is lacking in such descriptions as those devoted to the ozonating apparatus and hot-air furnaces. These detract from the average quality of the contents, which nevertheless, shows a high percentage of intelligent presentation.

With these exceptions, the work of Prof. Greene may be considered a compact re-statement of the principles of the art of heating and ventilation. Special commendation is to be applied to the treatment of the subject of radiating surface and also to the methods of computation for indirect heating.

The systematic method offered of recording the facts and figures for the heating requirements of buildings can be commended as a substitute for the haphazard memoranda frequently used by engineers.

The variety of circumstances which now surround the subject of heating make the presentation of the whole of the elements entering into the art almost impracticable within the space of a single volume. The presentation of many of its main elements in so clear and well arranged a form as in this volume by Prof. Greene is a useful addition to the literature of heating and ventilation.

PRACTICAL MATHEMATICS, Being the Essentials of Arithmetic, Geometry, Algebra and Trigonometry. Part III. Algebra with Applications—By Claude Irwin Palmer, Assistant Professor of Mathematics, Armour Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 4½x7¼ in.; pp. xi+178; 31 text figures. 75c., net.

Success in mastering the study of algebra must be preceded by a thorough understanding of the axioms and of the four simple operations, for all the more complicated processes are merely special variations and combinations of these. The author has evidently had this fact in mind in the preparation of this book, for particular attention has been paid by him to giving a clear and thorough treatment of these fundamentals.

Algebra does not lend itself naturally to graphical explanations in the same way as geometry, but in spite of this fact a number of illustrations have been introduced as an aid to the text. Also, as in the previous books on arithmetic and geometry (see these pages for Dec. 12, 1912), the attempt has been made to improve on the older methods of dry, impersonal instruction by illustrating the various principles with practical examples along the line of every-day application in shop and office.

Among other attractive features is an explanation of the operation of the slide-rule, rank heresy in a textbook on mathematics, according to the old standards of teaching. Another feature that stands out in the book is the portion which treats of graphics and their various applications in engineering work, such, for instance, as the study of indicator cards. In short, the book may be said to embody an attempt to instruct, interest and help the prospective student rather than merely to give him some abstract "mental training."

THE LAWRENCE SURVEY. Report of Studies in Relation to Lawrence made in 1911 by Robert E. Todd and Frank B. Sanborn, under the Advice of Frances H. McLean. Lawrence, Mass.: Trustees of the White Fund. Cloth. 6x9-in.; pp. 263; illustrated.

Housing, the water, milk and ice-cream supplies, sewage and garbage disposal and the general work of the local board of health were the main subjects included in the Lawrence Survey, as reported in this volume. It is expected that further investigations will be made later on.

The report on housing shows woeful neglect on the part of the city and, in the opinion of the investigator, great need for effective state legislation and supervision of housing in Massachusetts cities. Notwithstanding the large area included within the city limits, there is great congestion of population in Lawrence, and worse still the congestion is largely within four-story wooden tenement houses. A feature which partly relieves the situation is the thorough [illegible]

with which water-supply and sewerage facilities have been provided, including water closets for nearly every family.

Aside from the housing investigation, the details of this survey were entrusted to an engineer, Frank B. Sanborn. The local milk supply was given a thorough investigation by Mr. Sanborn, who also made a careful analysis of the work of the local board of health. Recommendations for improving the milk supply and also for improving the general health administration of the city are given. The report also contains useful information on the water-supply and on sewerage and garbage-disposal service of the city. The work of the survey as a whole is highly commendable, and it is to be hoped that it will be continued in Lawrence—particularly as regards the economic conditions which affect housing. Similar surveys might well be made in many other cities in Massachusetts and in other states.

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Heat Power Engineering

Reviewed by LIONEL S. MARKS*

ELEMENTS OF HEAT-POWER ENGINEERING—By C. F. Hirshfield, M. M. E., Professor of Power Engineering, and Wm. N. Barnard, M. E., Professor of Steam Engineering, Sibley College, Cornell University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xiii + 811; 480 text figures. $5 (21s.), net.

There is but one satisfactory standard by which to judge a textbook, namely, that which the author or authors have set for themselves. In many cases the author does not take the reader into his confidence as to his purposes, but leaves him to derive them from the contents of his book; in such cases the reviewer may fail to grasp the author's full intention and may make the mistake of regarding as errors of omission or of commission, any departures from a complete fulfillment of his conception of the author's purpose.

In the preface to the book under review, the authors make their intention abundantly clear. They have attempted to include in a single volume not only the elementary thermodynamic theory of gases and vapors and of their cycles, but also the consideration of the sources of heat, the methods of making it available for useful purposes, its utilization in the various types of heat-driven prime movers and their auxiliary apparatus, together with a discussion of the fundamental theory, the ideal and actual performance and the practical considerations connected with such apparatus. The book, moreover, is stated to be prepared primarly for the use of students in Mechanical Engineering in their junior and senior years, after they have completed college courses in physics, chemistry, analytical and applied mechanics, and empirical machine design. The text is supposed to be supplemented by lectures, lantern slides, a study of trade catalogs and collateral reading, but as it is prepared primarily for students who will take separate courses in mechanical laboratory practice and in the economic problems connected with heat-power engineering, little attention is paid to these subjects.

A list of the subjects covered in the 42 chapters of the book will further show the scope of the work. They are as follows: heat; elementary laws of heat energy; the heat-power plant; the laws of gases; expansions and compressions of gases; reversibility; entropy; gas cycles; vapors; properties of steam; volume changes of vapors; vapor cycles; power, efficiency and performance; the theoretical steam engine; action of steam in real engines; methods of decreasing cylinder condensation; steam engines; steam engine governors; the valve gears of steam engines; conventional indicator diagrams; performance of steam engines; steam turbines; external combustion gas engines; methods of operation of internal combustion engines; their mechanical features; their efficiency, performance and power; fuels; combustion; furnaces, stokers and oil burners; boilers; superheaters; draft and draft apparatus; gas producers and producer gas; utilization of waste heat; heat transfer; feed-water heating; condensers and their auxiliaries; water purification; power plants; flow of gases and vapors through orifices and nozzles; compressed air; and refrigeration.

This is a formidable list of topics, but it should be possible to handle them all with some thoroughness in the 748 pages devoted to their exposition. An examination of the book discloses considerable irregularity in the degree of thoroughness with which the various subjects are handled. Much of the treatment is informational rather than analytical. Of the analytical portions, some are treated very superficially, while others, notably the chapter on heat transfer, seem to be aimed at students with much more preparation than is suggested by the rest of the book.

The reviewer finds it difficult to place the use of this book for junior and senior students of Mechanical Engineering. It seems an excellent book for the "general culture" student or for the student of civil or electrical engineering who is seeking general information on heat-power engineering, with some general knowledge of the elementary theory. It might serve also as an introductory course in what one of the colleagues of the authors has termed a concentric scheme of study. But junior and senior students should have passed already the outermost ring of a concentric course of study of one of their main subjects. Moreover, the detail in which many of the topics are considered is too much for a general introduction, but not sufficient for a thorough study. This is true, for example, of the treatment of thermodynamics or of valve gears. The book seems to fail of maximum utility by endeavoring to cover two fields, that of general information and that of detailed study of heat engines.

Accepting the book as it is, the reviewer finds it uniformly accurate. The expositions are notably painstaking and exhaustive and should make the subject clear to any student. The authors have followed the very desirable procedure of using the main part of the book in pamphlet or book form as a text for the past four years with their classes, and consequently the published book appears to be without any of the typographical and other errors which always creep into a new book.

It is to be regretted that the authors have not been satisfied to accept the current terminology in a number of instances. For example, the word "isovolumic" is a barbarism without any justification. "Progressive specific heat" is a particularly unfortunate name for the actual or instantaneous specific heat of a substance at any temperature. "Associated heat energy" is another unfortunate term, particularly as the context suggests at one time internal or intrinsic energy of a body (p. 9), and at other times the heat supplied to a body (p. 45). Then again, there does not seem any good reason for calling what is commonly known as a "hot-air engine" by the new name of an "external combustion gas engine." These are but minor defects, but with the rapid growth of new ideas and new inventions requiring a rapidly increasing scientific and technical terminology, there does not seem to be any justification for changing the accepted terminology unless the terms are misleading or otherwise unsatisfactory.

*Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

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A Defense of the New York Stock Exchange

THE STOCK EXCHANGE FROM WITHIN—By W. C. Van Antwerp. Garden City and New York: Doubleday, Page & Co. Cloth; 5x8 in.; pp. 457. $1.50, net.

In view of the numerous attacks upon the Stock Exchange and the current proposals to regulate its operations by law, this book is timely. It is written in an entertaining style and a large part of it is devoted to the recording of reminiscences and incidents which have little relation to the serious discussion of economic problems.

Something of the scope of the book may be gained from the titles of some of the chapters as follows: I, The Functions of the Stock Exchange; II, The Uses and Abuses of Speculation; III, The Bear and Short Selling; VI, Panics and the Crisis of 1907; VII, A Brief History of Legislative Attempts to Restrain or Suppress Speculation; X, The Paris Bourse, A Monopoly of the Government. An appendix contains the report of the Commission appointed by Governor Hughes, which made an investigation of stock-exchange methods.

The author is a stock broker and, as would naturally be expected, his book is a defense of the Stock Exchange as a legitimate part of the nation's business and of legitimate speculation in securities and commodities as a valuable means of steadying prices.

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THE NEW COMPETITION—An Examination of the Conditions Underlying the Radical Change That Is Taking Place in the Commercial and Industrial World—The Change from a Competitive to a Coöperative Basis. By Arthur Jerome Eddy, author of "The Law of Combinations." New York: D. Appleton & Co. Cloth; 5½x8½ in.; pp. 374. $2 net. $2.14, postpaid.

The spirit of this book could hardly be better stated, in brief, than in the following quotation from the chapter on "Harmony:"

Coöperation stands midway between the rank selfishness of individualism and the ultra-altruism of socialism; it offers a practical middle ground between the two extremes; rightly developed, it will suppress the evils of the one and yield the benefits promised by the other. In a sense it is the only refuge against Socialism.

The author discusses in clear, simple and impartial terms the economic and ethical changes that are taking place in the present transition period between the old competitive standards in business and industry, and the new spirit of coöperation which is daily growing in strength. Throughout

the book emphasis is placed on the advantages of complete publicity in every form of business and industrial relations.

The arrangement of the topics is logical and natural. Starting with an explanation of the old competitive system, its various laws and phases, and the conditions which fostered its growth, the author takes up the question of present changed economic conditions which lead to abuses under this system and explains how these abuses are to be remedied by publicity and coöperation. The subjects of relations between buyers and sellers and the relations of both to the general public, fair prices, trusts, labor problems, class and constructive legislation are treated at some length. Interesting matter is given on the subject of different forms of combinations of industrial and labor forces.

Where does the interest of engineers lie in a book of this nature? There is hardly a field of human activity where engineers and engineering methods have not been introduced to advantage. But too often the engineer has been the tool for these changes rather than the director. It has been the exceptional engineer who has been able to take a place with the statesman and financier in shaping public opinion and public policies. Engineers like to claim that it is their innate modesty which has held them in the background. However that may be, it is to be hoped that in the future the engineer will sufficiently overcome this "modesty" to enable him to take his rightful place in political and commercial life. Before most engineers can do this they must gain a wider horizon. A book of this kind may be made one means to that end.

Hoisting from Deep Mines

Reviewed by E. T. SEDERHOLM*

WINDING ENGINES AND WINDING APPLIANCES—Their Design and Economical Working. By George McCulloch, Inspector of Machinery, Department of Mines, West Australia, and T. Campbell Futers, M. Inst. M. E., author of "The Mechanical Engineering of Collieries." New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 6x9 in.; pp. viii + 452; 175 illustrations. $6, net.

The authors of this book have filled a want felt for many years by all engineers who have had to deal with the problem of hoisting from deep mines. Their work deals entirely with mine hoists, more especially hoists for deep mines, but it is in this field that the available information has been so scanty. Much of the book is devoted to descriptions of types not used in this country, and which probably would not be desired here, yet the work deals in such an admirable manner with the whole theory of hoisting, and brings out so much that is little known in practice, that besides its usefulness as a work of reference, it is well worth reading from beginning to end.

The introductory chapter is one of the most important, dealing as it does with the manner of attacking any new problem of hoisting that may present itself. There are few fields in engineering where there are more different considerations that need to be reckoned with than in hoisting, and the writers show very clearly how the calculations should be made in an orderly manner. An American engineer might take exception to some of the coefficients used, like that of 25% for engine friction, but this detracts but little from the value of the discussion since the principles explained after all are the main thing.

The chapters on styles and types of hoisting engines are of great interest, and describe different drums as well as engines. Then follows a large amount of information regarding tests made to determine the economy of hoists in actual work, a subject that heretofore has been dealt with only in isolated reports and in articles in technical papers. The authors compare the different types and weigh their respective advantages and disadvantages. In subsequent chapters the difference in requirements for hoists intended for ore and those for coal is set forth. The coal hoists especially are almost entirely according to British practice, and they differ quite a little from those used in this country.

Electric hoists are fully described, at least those of the larger kind. Many appliances are described that are but little known outside of the somewhat limited circle of men connected directly with this branch of the work. A comparison, though rather partial, is made between steam and electric hoists, but it loses considerably in value from the fact that while in the case of the steam hoists the economy is based on actual performance, for the electric hoists reliance has been placed mostly on mere assumptions.

The chapters on engine details contain little of American practice, but drums, brakes and clutches show more that is familiar even though some of the forms have been changed from the originals without being improved—as, for instance, the band clutch that has had its band cut in two, thereby losing one of the chief advantages of this form of clutch, that of great friction with little exertion of power for operation. One looks in vain for any form of clamping clutch, such as are so successfully used here on the best types of large hoists. In the same way parallel operated post brakes are not even mentioned. In contrast, there is a fund of information regarding safety devices, especially automatic stops to prevent overwinding, a subject that has heretofore received but scant attention.

In dealing with hoisting ropes the writers have used as a basis the excellent work on this subject by Prof. Hrabak. It is unfortunate, however, that the writers should have allowed themselves to be misled by the fact that the first part of the professor's book contains information which he in the latter part retracts, because he then found that it applied only to new ropes, and that the bending strains in ropes that had been in use even only a little while were much more severe. Many readers of this work on "Winding Engines" are apt to be misled in turn thereby, which is so much more unfortunate since the subject of strains in hoisting ropes is but little understood anyway.

In the last chapters, cages, skips, landing devices and headgears are described in detail. Much of this is foreign to American practice, yet much is also of considerable value to us. And, as throughout the volume, even that which cannot be made directly useful here, is at any rate extremely interesting. In fact, there is very little in the work which does not deserve careful attention or would fail to interest any engineer that has anything to do with the hoisting problem.

*Assistant Chief Engineer, Nordberg Mfg. Co., 405 Logan Ave., Milwaukee, Wis.

Radioactivity

Reviewed By CHARLES BASKERVILLE*

PRACTICAL MEASUREMENTS IN RADIOACTIVITY — By W. Makower, Lecturer and Demonstrator in Physics, and H. Geiger, Lecturer in Physics, University of Manchester, England. New York and London: Longmans, Green & Co. Cloth; 5x9 in.; pp. ix + 151; 61 text illustrations. $1.60, net.

The authors say: "Although researches into the nature of radioactivity have proved one of the most fruitful means of investigating atomic phenomena, a study of the methods employed for making radioactive measurements has not come to be regarded as an essential part of a course of practical physics, or chemistry." These researches are usually mentally associated with elaborate (hence expensive) apparatus. This book shows this idea not to be true and gives very specific directions for laboratory work on the part of students; yet furthermore it is of help to investigators as well. Experiments designed by Rutherford for careful measurements, methods for isolating radioactive products worked out by Boltwood, theories of instruments—for example, the quadrant electrometer, as given by Beattie—are incorporated. The theory of each experiment is usually given. The book is a splendid contribution to pedagogic literature, a laboratory manual par excellence.

PANAMA, PAST AND PRESENT—By Farnham Bishop. New York: The Century Co. Cloth; 5x8 in.; pp. xvi + 271; 90 illustrations; 75c., net.

Of the sixteen chapters which the book contains only one is devoted to the work being done on canal construction under the Americans. A chapter which follows, however, is entitled "How We Live On the Isthmus Today" and the next chapter is entitled "How Colonel Goethals Has Made Good." The remainder of the book is essentially a history of Panama. The author has succeeded in making this history as entertaining as a novel, in fact considerably more entertaining than the average novel of the present day.

The author of the book is a son of Mr. Joseph Bucklin Bishop, who has been the secretary of the Isthmian Canal Commission practically since its organization. The author modestly says in his preface that he hopes his book will appeal to the average boy; but he has told his story in such an interesting way that we believe his book will appeal quite as much to mature readers. Many of the facts related in this little history are common talk among the engineers employed on the canal, but the author has unearthed many others from his searches in libraries and official records. Such chapters as that on the Panama railroad contain many bits of forgotten engineering history which were well worth

*Professor of Chemistry, College of the City, New York City.

the finding and recording. The book is just the sort of present-day literature that should be on the shelves of every public library.

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The Mathematics of Electricity

Reviewed by H. H. NORRIS*

THE MATHEMATICS OF APPLIED ELECTRICITY.—A Practical Mathematics. By Ernest H. Koch, Jr., Instructor in Mathematics, School of Science and Technology, Pratt Institute, Brooklyn, N. Y. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth, 5x8 in.; pp. xvi+651; 316 text illustrations. $3 (12 6), net.

There is a growing interest in promoting the use of mathematics in engineering work. Teachers of mathematics are attempting to bring the subject down out of the clouds so that the everyday man may have the benefit of it as a tool. At the same time the disciplinary value of the subject is being kept in mind, for all agree that the mental processes necessary in the solution of problems by mathematical means are the same as those required in all analysis of however practical a nature. Under these circumstances every contribution in the field of the mathematical instruction of engineering students is welcome.

Mr. Koch's book is an attempt to correlate mathematical principles with their application to electrical and allied problems. Like many other textbooks, it has been "tried out" on the author's students, in this case at the Pratt Institute in Brooklyn. In his judgment "the book has demonstrated its usefulness as a powerful and interesting presentation which has promoted the student's fidelity, poise, common sense and tact in his applied work and in subsequent success in foremanship, superintendence and in other executive and administrative positions." How Mr. Koch has developed his course to accomplish these results is outlined below.

The general plan involves a division into three parts: (1) The transformation and interpretation of formulas, and direct-current problems, (2) the graphs of formulas and the formulation of graphs, and (3) vectors and vector diagrams and alternating-current problems. There is a mass of information on these subjects, the whole being a curious assemblage of lower and higher mathematics, mechanics, physics of electric circuits and apparatus, construction and theory of electrical machinery, electrical measuring instruments and measurements.

The first quarter of the book is taken up with a review of elementary arithmetic, algebra, trigonometry and geometry, evidently intended as a basis for a rapid and practical review of the fundamentals. This part is non-electrical. Then follow nine chapters dealing largely with electric and magnetic circuits. These chapters are virtually collections of problems which can be solved by means of the fundamental operations previously illustrated. Part I ends with chapters on mensuration, quadratics and problems on the strength of materials. Part II contains chapters on mathematical subjects, particularly showing the nature of graphs and operations upon them. The topics covered are: The use of squared paper, linear graphs, non-linear algebraic equations, eccentricity of conics, the formulation of graphs, the use of polar paper, solving formulas by charts, measurement of angles, harmonic motion, rates, derivatives, integrals and experimental curves. This section makes little use of electrical illustrations. It ends with a chapter on electrical measurements and measuring instruments. Part III, which treats of alternating-current problems, consists almost entirely of illustrative electrical problems and is more of a treatise on electricity than mathematics.

Mr. Koch's book illustrates what is almost sure to result when the teacher of mathematics attempts to apply his mathematics to engineering problems in the class-room. That is, he teaches more physics than he does mathematics. In this book, of somewhat more than 600 pages, the whole field of electrical engineering is covered. Some of the electrical problems are of most advanced character. It is true that problems must be made interesting to have them appreciated, but it is doubtful if mathematics can be taught as an adjunct to physics and engineering. In this case many of the problems which appear near the end of the book and which, therefore, would be assumed to be advanced from the mathematical standpoint, involve practically no mathematics. They do, however, require for their solution a knowledge of the construction of electrical apparatus and of its characteristics. It seems to the reviewer preferable to treat mathematics, electrical physics and electrical engineering in separate courses and in the order given. Illustrations drawn forward into a course in mathematics tend to confuse the main purpose of the instruction. Mathematics can be made tangible and interesting without loading it with advanced electrical theory, the physics of which is far more difficult for the student to understand than is the mathematics. If this point of view is the correct one, Mr. Koch's book, which gives evidence of careful preparation and which is copiously illustrated with problems and diagrams, should be more useful to the advanced student and the engineer for reference and review than to the student of elementary mathematics. It is to be commended for the consistent attempt to make every statement tangible and concrete. The author's italicized "observations," which are inserted at frequent intervals, state fundamental principles in concise language.

*Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

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How To Build a Railroad

Reviewed by H. R. PRATT*

RAILROAD CONSTRUCTION.—By Charles Lee Crandall, M. Am. Soc. C. E., Professor of Railroad Engineering, and Fred Asa Barnes, M. Am. Soc. C. E., Assistant Professor of Railroad Engineering, Cornell University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. viii + 321; 79 illustrations. $3, net.

Railroad construction has made vast strides in the last few years, and heavy and complex work is being accomplished in a skillful and permanent manner, under efficient engineering direction and supervision, by contractors with competent field organizations, handling a plant that is designed and so distributed as to obtain its maximum working capacity. On railroad construction of magnitude, embracing large quantities of concrete masonry, deep cuts, high fills and extensive and complicated tunnel building, the largest percentage of the work is done by machinery and transportation equipment, and the character of construction that formerly required years to complete is now reckoned in months.

The book before us touches practically all the principal steps in the construction of a railroad from the location of the line to laying the track and completing the railroad ready for operation, and gives a good general idea of the details required in properly executing such an undertaking.† It brings down to date facts about building railroads that are very useful, not only to the young engineer, but also to those who have constructed miles of railroad. It treats in a plain and practical manner the essentials of railroad construction and gives examples of standards that are the product of years of experience on various railroads.

In dealing with unit contract price for grading, however, the authors seem to lean toward classification of materials, while in work of any magnitude there is a rapidly growing tendency toward unit prices without classification, and with keen competition among contractors a reasonable unit price is obtained, the work expedited and controversies avoided.

As a whole "Railroad Construction" is a useful book for any engineering library or technical school, as it treats of the actual and real work in railroad construction and is not filled out with fine-spun theories that are useless to engineers of action who accomplish lasting results in railroad construction.

*Chief Engineer, Western Maryland Railway Co., Baltimore, Md.

†After a general introduction a chapter is given to each of the following subjects: Earthwork, Rock Excavation, Tunneling, Masonry, Foundations, Culvert and Bridge Masonry, Trestles and Bridges, Track Material and Roadbed, and Estimates and Records.

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An interesting bulletin on "Sand Available for Filling Mine Workings in the Northern Anthracite Basin of Pennsylvania" has been issued by the Bureau of Mines (Washington, D. C.). The report does not describe engineering methods, but is devoted chiefly to available sand deposits for use for the purpose stated. It may be explained that the object of filling coal-mine workings with sand or waste materials by some hydraulic means is to make it possible to reduce the volume of coal left for pillars. The following paragraph from the prefatory note is of sufficient interest to be worth quoting:

This small bulletin by Mr. Darton is not intended as a contribution to the engineering features of the methods of flushing. What Mr. Darton was requested to do, and endeavored to do, was to bring together in as short a space as practicable the results of his own observations and the observations of others concerning the general character and distribution of the unconsolidated materials available for filling the mine workings in the northern anthracite field of Pennsylvania. It is hoped that this volume may be of some service to the engineers who are endeavoring to work out in detail the problems that must be solved before it will be possible to determine definitely the extent to which it may be practicable, under the economic conditions existing at the present time, to use the flushing system in filling the mine workings of the anthracite region.

An Exhaustive Book on Worm Gearing

Reviewed By JOHN J. FLATHER*

WORM GEARING—By Hugh Kerr Thomas, A. M. Inst. M. E. New York and London: McGraw-Hill Book Co. Cloth; 6x9 ins. pp. ix—86, 33 illustrations. $1.50, net.

Notwithstanding the fact that worm gearing and spiral gears have come into extensive use of late years with certain classes of machinery, the opinion is still prevalent that worm gearing is necessarily short lived and inefficient. Much has been written in the technical periodicals concerning this little understood subject, but the material is not generally available to the designer. The subject has also been treated in the various books on machine design, but as might be expected in any treatise which covers the whole field of machine design the presentation of any portion, such as worm gearing, must of necessity be brief. Halsey's little book on "Worm and Spiral Gearing," published ten years ago, has been used by designers with a good deal of satisfaction but the present work is believed to be the first of its kind to deal exhaustively with worm gearing.

Primarily the subject has been treated in its application to automobiles, in which use the author has had a wide experience. However, the principles of design based on complete analyses of the problem are applicable to any case where worm gearing may be employed.

As the author points out, "since the early days of experiments so much actual experience in daily use with worm gears of all sizes has been possible that it can now be said that something approaching finality has been reached, and the art of making worm gearing has been placed upon a substantial foundation."

It is probable that the method of construction of worm gears has as much, if not more, to do with the high efficiency obtained than the application of exact theory. In this respect the discussion of choice of materials and method of manufacture constitutes a valuable part of the book. Efficiencies of 99.5% and over are only obtained by the employment of extra rigid machinery and the exercise of the greatest care; but where such precautions are taken the above efficiencies will result under favorable circumstances, provided the mounting be equally rigid.

In discussing the efficiency of worm gears the author shows that for the usual lead angles the efficiency may be obtained with sufficient accuracy for all practical purposes from $\eta = \frac{1-\mu}{1}$ where μ is the coefficient of friction. For automobile gears running in an oil bath μ is assumed at 0.002, from which an efficiency of 99.8% is obtained. This high value appears to be corroborated by various tests. In these cases it is assumed that the sliding friction of worm gear is substantially the same as the sliding friction of a journal in its bearing; and further, that the tooth pressure and velocity are such as will permit the inclusion of a film of oil between the sliding surfaces.

It seems rather illogical to deduce an expression for the included angle of worm thread based on the angle of lead, as shown in Chapter V, pp. 22-26, and then adopt a uniform angle of 60° for all gears; this does not agree with the deductions determined on the theory of reversibility; however, in explaining this divergence the author states that the practical advantages of a uniform included angle are numerous, and that the perfection of workmanship obtained in modern worm gears affects neither the reversibility nor the efficiency.

There appears to be a slight confusion in the use of the symbols for tooth pressures in which the torque is used as a force in pounds instead of as a moment in inch-pounds. Other minor inaccuracies of statement are noted but the intent is evident and no serious difficulty should be encountered in laying out a worm-gear drive in any case which might arise in practice.

This book will be received as a welcome addition by the machine designer for it carries with it the stamp of authoritative statement.

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A MANUAL OF CEMENT TESTING—For the Use of Engineers and Chemists in Colleges and in the Field. By William Mills Ketchum, B. S. in M. E., Instructor in Civil Engineering at Cornell University, and Henry Briggs North, Jr., Sc. D., Associate Professor of Chemistry, Rutgers College. New York: D. Van Nostrand Co. Cloth, 5x8 in., pp. vii—137, 54 text illustrations. $1.50, net.

The requirements of cement testing are fully set forth in the Standard Specifications adopted by the American Society of Civil Engineers and the American Society for Testing Materials, but the technique of testing that is the precise methods and apparatus needed, varies somewhat with the different laboratories. The manual before us outlines standard methods and describes standard apparatus, the adoption of which has been shown to satisfy the specification requirements noted above.

The book describes briefly the nature of portland cement, takes up in sequence the methods of making the various standard tests, describes the necessary laboratory equipment and finishes with a section of 27 pages on the chemical analysis of cement.

*Professor of Mechanical Engineering, University of Minnesota, Minneapolis, Minn.

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Some British Municipal Engineers

THE CIVIC ENGINEER'S WHO'S WHO—Compiled by the Editor of "The Surveyor and Municipal and County Engineer." London: The St. Bride's Press. Paper; 4x6 in.; pp. 120. 2/6, net.

Commendable enterprise has been shown by the publishers of "The Surveyor and Municipal and County Engineer" in gathering and publishing a series of about 200 biographical sketches of the leading municipal engineers of England and Wales. Besides what we should here call city engineers, and a few engineering heads of water departments, the list includes a leading official chemist or two, and the secretaries of some of the principal engineering societies of Great Britain.

The editor states in the foreword: "Obviously it has been necessary to ask the subjects of most of the biographies to supply the facts incorporated, but for the comments in some cases added the editor is solely responsible." This plan has its advantages, but in reading some of the sketches one would like to know what part of the statements made came from the subjects of the sketches, and what from the editors.

It is charitable to suppose that such words as those quoted in the next paragraph were written by the editor, but one cannot help having a suspicion that the subject of the sketch had a hand in the neat little advertisement for a proprietary article, which appears in the opening sentence. We quote as follows:

Probably Mr. —— —— name will be longest preserved as the inventor of "Tarmac," a special form of tar-macadam, which has been widely adopted, with most satisfactory results, as an almost ideal form of impervious road construction. Not only is the material itself a boon to the road engineer, but its invention, and the special study Mr. —— —— has for long made of the science of road construction generally, have undoubtedly given to the better roads movement an impetus for good, the full benefit of which has not yet been seen. Personally, Mr. —— —— is immensely popular with all who know him. Neither the wear due to his almost reckless indulgence in work nor the toll exacted by occasional severe illness has impaired the natural cheeriness of his disposition. Many a young engineer can testify that he is ever a sane counsellor and a ready helper.

As a contrast to the foregoing advertisement and tribute to Mr. —— —— popularity and cheerful disposition, we quote from a sketch of Lieut.-Colonel Alfred Stowell Jones, for many years manager of the Aldershot Military Sewage Farms:

While serving as a Lieutenant in the 9th Lancers he passed the examinations of the Public Works Department, India, in 1857, for employment as a Civil Engineer, and graduated at the Staff College in 1860. He was present at the battle of Budleekeseral, and at Delhi throughout the siege operations, and served with the 9th Lancers in Greathed's turning column, being present in the actions of Bolundshuhur and Allyghur and the battle of Agra, where he was dangerously wounded, receiving a musket-shot wound and twenty-two sabre cuts. He was mentioned in the despatches of Sir Hope Grant on three different occasions (Brevet of Major, Victoria Cross, medal with clasp). He was awarded the Victoria Cross for a gallant action while serving with the 9th Lancers. "The cavalry charged the rebels and rode through them. Lieut. Jones, ——, with his squadron, captured one of the guns, killing the drivers, and with Lieut.-Col. Yule's assistance turned the gun upon a village occupied by the rebels, who were quickly dislodged. This was a well-conceived act, gallantly executed."

As to the character of this "Who's Who," it may be stated further that the sketches are in narrative form, and range from two to three lines to as many pages in length. A good general idea is often given of the personal and professional history of the subject of the sketch, together with information regarding his society and club memberships and also his authorship of books and papers. The publishers may perhaps be excused, all things considered, for apparently having referred to any and every important article written by the subject of their sketches for publication in their own journal.

The plan of depending upon each author for the preparation of his sketch, and the apparent unwillingness of the publishers to blue-pencil as freely as might be expected, leads to the inclusion of a considerable number of trivial incidents and to the recording of minor pieces of work. As examples we may note the following statements: "He revised the design for a 4,000,000-gallon [Imp.] brick-covered service reservoir, thereby reducing the estimated cost by £7000 [what could the original estimate have been?—Ed.], and reported

on the designs of three more such reservoirs of 1,000,000 gallons capacity each." This same engineer we are told, has checked (not merely once) "at different times the whole of the stresses in some steel railway bridges, including a swing bridge 146 ft. long, and three Niagirder bridges 350 ft., 570 ft. and 360 ft. long, respectively"—and he lived to tell the tale. However, it is only fair to quote the explanation which follows: "The chief interest in these was the different methods of erecting them, which caused ties to act as struts and vice versa, besides other complications."

Doubtless some of these small items of professional work will be cut out of future editions. Most of the subjects of sketches have had too good a sense of proportion, and of humor as well, to go into such minutiae.

The "Who's Who" as a whole is a creditable production, which we hope will be continued and at the same time extended to include many more names. A little systematizing would save enough space to make it possible to include many brief sketches. As a matter of utility, only a few lines are really needed in the case of a majority of the names which might properly be included in such a volume. The briefer sketches could be gradually expanded year by year, as opportunity or occasion arose.

DD. Eng. Lit. Set Jan. 24

Drawing and Descriptive Geometry

Reviewed by ROSSITER R. POTTER*

MECHANICAL DRAWING—A Treatise on Technical Drawing as Expressed through the Medium of the Graphic Language. By Otho M. Graves, Assistant Professor of Graphics, Lafayette College; author of "Orthographic Projection." Easton, Penn.: The Chemical Publishing Co. Cloth; 6x9 in.; pp. vi + 138; 98 text figures and 22 plates. $2.

DESCRIPTIVE GEOMETRY—By Adam V. Millar, Assistant Professor of Drawing, and Edward S. Maclin, Instructor in Drawing, University of Wisconsin. New York and London: McGraw-Hill Book Co. Cloth; 5x8 in.; pp. vii + 131; 78 text figures. $1.50, net.

Mr. Graves has given to the world an orthodox elementary textbook on mechanical drawing, no worse and no better than a number of its predecessors. After the inevitable opening chapters on the use of instruments and on general instructions, comes one on lettering. This is followed by chapers on the construction of the conic sections, orthographic projection, working drawings, bolts and screw threads, and a final chapter on tracing cloth and blueprinting. A refreshing feature of the chapter on lettering is the generous acknowledgment given to the work of Charles W. Reinhardt as the originator of the system of lettering presented. Many authors who have drawn more heavily on Mr. Reinhardt's book on lettering have been less honorable. In the chapter on orthographic projection is a long list of problems consisting of orthographic drawings to be made by the student of objects represented in the text by dimensioned isometric drawings.

The conventional representations of screw threads given in the chapter on bolts and screws include the method in which the thread is represented by a series of light lines drawn completely across the projection of the screw alternating with a series of heavier lines drawn only half way across. The author, however, was apparently ignorant that this method can be made to add clearness to the drawing by serving as a form of shade lining, for the illustrations repeatedly show the short heavy lines drawn on the wrong side. Another error and one which reflects not only on the author, but the publisher as well, is the systematic misspelling of the word "frustum" both in illustrations and text.

The appendix outlines an elementary course in drawing and lettering and concludes with a set of instructions for 22 plates for such a course. These instructions are supplemented by illustrations consisting for the most part of sketches, partly completed drawings, etc., to assist the student in preparing the plates.

The excuse given by Messrs. Millar and Maclin for adding to the long list of textbooks on descriptive geometry already on the market is the endeavor "to make the subject easier for the student, to help the student visualize magnitudes in space and to present the subject more nearly in accord with commercial practice." These three things are accomplished, it is claimed, at one fell swoop by the omission of the ground line. It is pointed out that the relative distances from each other of the vertical projecvtions or the horizontal projections of a group of points, and not their distance from the ground line, is the thing to be emphasized. The ground line is, of course, understood in all cases to be at right angles to the line joining the horizontal and vertical projection of any given point, but it is not drawn in on the diagrams. This omission is expected to center the student's attention on the object in space instead of on the planes of projection. As a further step toward bringing the subject into accord with commercial practice, the authors use third-quadrant projections instead of first-quadrant.

There will be some difference of opinion in regard to the efficacy of omitting the ground line as a means for making the subject easier for the student and as an aid in developing his powers of visualization. The authors state, however, that this method has been used at the University of Wisconsin "for some time" and that the results have been most satisfactory. Apart from the omission of the ground line, the book is chiefly distinguished by its conciseness and by the generously long lists of problems given in connection with each chapter.

*Shop Engineer, Blood Bros. Machine Co., 933 West Lovell St., Kalamazoo, Mich.

A Remarkable Book on Steam Turbines

Reviewed by H. E. LONGWELL*

STEAM TURBINES. THEIR THEORY AND CONSTRUCTION By H. Wilda. Translated from the German by Chas. Salter, and revised and adapted to English practice. [Being Vol. V of the "Broadway Series of Engineering Handbooks."] New York: D. Van Nostrand Co. London, Scott, Greenwood & Son. Cloth; 4x7 in.; pp. ix + 191; 104 text illustrations. $1.25 (3/6), net.

One is inclined to suspect that this book, which is one of "The Broadway Series of Engineering Handbooks," was written to order in accordance with rigid specifications covering only the size and the price. The first two chapters (71 pages) are devoted to a theoretical consideration of the subject. The four remaining chapters are taken up with descriptive matter of the most superficial and inadequate character. The book has no preface. It gives no information regarding the author and the translator other than their names. Whether or not it was a reasonably sane work in the original German, it is impossible to conjecture. As done into English, it is nothing short of delirious.

As an index to the quality of the book, the following extracts—which are by no means exceptional—will suffice (black-faced type mine):

The theoretical work done in a turbine is determined by **the available loss of heat.**

The velocity of the steam at its outlet from a reaction turbine must be less than at its outlet from an impulse turbine, energy being given up continuously.

Since in reaction turbines the loss of heat in the exhaust steam is usually only about one-half of that in the impulse turbine—on the assumption of equal peripheral speeds—it follows that the reaction turbine must have about twice as many pressure stages as an equivalent impulse turbine.

Clearance Losses: In single impulse turbines (De Laval, Fig. 15), the steam which flows through the nozzle, but does not impinge upon the wheel, possesses no useful kinetic energy. A reduction of the wheel friction can be brought about by superheating the steam in the turbine casing, and by giving the laterally escaping steam a rotary movement in the direction of the rotor. The gain in power attained in this way is, however, immaterial in comparison with the clearance loss.

In turbines with a single pressure stage and several velocity stages, the clearance losses are always fairly large **on account of the increase of volume of steam flowing through.**

A characteristic feature [of the Zölly turbine] is the radial widening of the rotor vanes, this giving a delivery angle smaller than the entering angle. Owing to the outwardly increasing sectional area between the vanes of the rotors, the steam expands, and although there are no expansion nozzles, the Zölly turbine must be regarded as a multiple-stage impulse turbine without velocity staging.

All of this, and much more of a like nature, is hopeless gibberish, devoid of any gleam of intelligence.

On page 62 is the following:

The indicated steam consumption C_i may be set down for impulse turbines at

$$C_i = \frac{2544.6}{H_0 - H_1} \text{ lb.} \qquad (46)$$

per theoretical or "indicated" horsepower-hour, and for reaction turbines as

$$C_i = \frac{1{,}980{,}000}{778\,(H_0 - H_1) - \frac{U_2^2}{2g}} \qquad (47)$$

Equation 46 is correct for determining the steam consumption of an impulse turbine of 100% efficiency, but one wonders why it does not apply equally well to any other type of turbine of 100% efficiency.

Speaking of the use of turbines for driving centrifugal blowers, the author gives us the following interesting information:

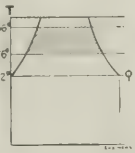
*Consulting Engineer, Westinghouse Machine Co., East Pittsburgh, Penn.

Thus a 10-in. blower driven by the first named [De Laval] turbine at a speed of 335 revolutions per second and a water gage pressure of 224 in. delivered 1 cu.ft. of air, 4 hp. being required for a working pressure of 145 lb. per sq.in.

As in the case of centrifugal pumps, it is possible by coupling several blowers together, to deliver air at a pressure of 90 lb. per sq.in., with an expenditure of 350 hp.

It is a pity that the limited size of the volume did not not allow the author to explain how the blower driven "at a water gage pressure of 224 in." succeeded in delivering 1 cu.ft. of air at a working pressure of 145 lb. per sq.in., and how long it required to accomplish this feat. The average reader would also be interested to know why there is no apparent limit to the quantity of air that may be delivered against a pressure of 90 lb. per sq.in., with an expenditure of 350 hp.

Naturally the author dallies a little with the temperature-entropy diagram, which in some instances he interprets in a way that is surpassingly grotesque. For example, on the conventional diagram for saturated steam (reproduced herewith) the hatched portion is said to represent "a product of temperature and entropy, **and, therefore, the amount of heat in B.t.u. which must be spent in converting saturated steam at 176° into saturated steam at 356°**" (black-face type mine).



The book throughout tells so plainly its own story of pitiful incompetency, that to offer it as a serious work on an important branch of engineering, is an imposition on the confidence of the public. If, however, anyone should be desirous of getting a real bargain in "piffle," the book can be recommended unhesitatingly, as containing the largest amount of this commodity that has ever been offered for the modest sum of one dollar and twenty-five cents.

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High-Tension Line Calculations

Reviewed by C. D. GRAY*

TRANSMISION LINE FORMULAS FOR ELECTRICAL ENGINEERS AND ENGINEERING STUDENTS. By Herbert Bristol Dwight, Assoc. Am. Inst. E. E. New York: D. Van Nostrand Co. Cloth; 5x8 in.; pp. vi + 137; illustrated. $2, net.

The author of this book has appreciated the lack of a collection of easily applied formulas for the calculation of the electrical characteristics of high-tension lines, and has attempted to produce a collection that would be useful, not only to the practicing electrical engineer, but also for the use of students in the classroom. He has appreciated the fact, too often lost sight of, that the shorter and lower voltage lines do not need the same refined method of calculation as those of moderate length and voltage; while at the same time he has included the more complicated formulas for use on lines of greatest length and highest voltage. The author has inserted in the various chapters actual examples, so that the application of the formulas is easily learned, and one who uses them infrequently should not find any difficulty in securing correct results.

The author has also realized that in many cases it is necessary for an engineer to secure approximate results quickly with but little calculation, and so he has included a very good chart by means of which one can easily obtain results that are close enough for the purpose of making preliminary calculations and estimates on high-tension transmission lines, which method is explained in Chapter III.

In Chapter IV are given the formulas for short lines, in case one wishes more careful results than the chart would give. These formulas are easily understood, and are to be used for lines up to twenty miles in length. For longer lines, where the capacity of the line must be considered, the "K" formulas, Chapter V, are to be used, and sufficiently good results can be obtained for lines up to two hundred miles in length. As stated, these do not take into account the losses from corona or insulator leakage, which factors do not become serious until a voltage of 100,000 or over is used.

Chapter VI takes up the solution of the problem by means of the convergent series, in case a very careful calculation is desired, which will involve the leakage conductance of the line, including corona loss and insulator leakage. These are applicable for lines of any length and voltage and will give as great accuracy as is possible.

Part II gives the theory used in making up the formulas and tables and is useful to a good understanding of them. It takes up the usual topics of temperature effects, reactance, capacity, skin effect, etc. Part III is a solution of the formulas condensed into working shape, tables of resistance, reactance, susceptance, etc., needed in using the various formulas.

In general, this book seems to supply a want long felt by busy engineers for a collection of easily understood and applied formulas for high-tension transmission-line calculation. It is unfortunate, however, that the author has not included a chapter on corona, with tables showing critical voltage for various-sized wires at different spacings and losses per mile of circuit, based on some formulas which are now being accepted by engineers as correct, as far as experiments to date show, such as Peek's Formulas, given in the Transactions of the American Institute of Electrical Engineers, June, 1911, and 1912.

*Electrical Engineer, The J. G. White Engineering Corporation, 43 Exchange Place, New York City.

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Tracing Old Survey Lines

BOUNDARIES AND LANDMARKS—A Practical Manual. By A. C. Mulford. New York: D. Van Nostrand Co. Cloth; 5¼x8¼ in.; pp. vii + 89; 19 text illustrations. $1, net.

We can give no better and clearer conception of this instructive and exceedingly interesting little book than the author himself has ingenuously written in the final chapter on the "Responsibilities of the Surveyor." Mr. Mulford writes:

This very brief treatise is not intended as a handbook for surveyors in any way; it is not didactic—it is suggestive only. It is intended to give a little light to men thrown, for perhaps the first time, on their own responsibility, or brought face to face with problems which they have not met in their previous experience. For the solution of these problems no general rules can be laid down; each man must work out his own salvation. All that I hope to do is to give a few suggestions from hard won personal knowledge which may make the road a little easier.

The problems of boundary lie at the foundation of all surveying, for one must know where a line is before he can measure it, and the solution of these problems calls for the same powers of accurate observation and of consecutive and logical thought that are demanded for successful work in any branch of modern science. It is needless to say that the successful surveyor must be accurate in his instrument work and in his computation; yet, if he would really succeed, he must go beyond this. He must add to this the patience to collect all the evidence which can be found bearing upon the case in hand, together with the ability to weigh this evidence to a nicety and to determine clearly the course pointed out by the balance of probability. The watchwords of the surveyor are Patience and Common Sense.

We doubt not that many a young technical graduate has been "stumped" as completely on some property or lot survey as on any other problem he has ever encountered, at least in the East, where the original property lines are very old and notoriously indefinite. All the college textbooks on surveying in the world are not worth a fraction of the advice and counsel of an experienced land surveyor. What are landmarks and how are we to recognize them if we see them; how are the landmarks to be used provided we think they are recognized? These are questions upon which the book before us throws many a ray of light, which can come only from one who has gleaned much from personal experience.

The subdivision of property into house lots, how it is commonly done and the problems arising therefrom, are too well known to every experienced surveyor to need emphasis; in such cases the theory and practice of surveying are secondary to other considerations when it comes to straightening out and adjusting the problems of irate lot owners. As the author states, "there are no fixed rules which can be laid down for the accurate handling of old lot layouts. Satisfactory results can be obtained only through care, patience and common sense and, above all, honesty."

The book is free from all mathematical formulas, it does not pretend to instruct in the theory of surveying; but it would from a most valuable appendix to any textbook on surveying. To the young and inexperienced land surveyor it will prove an unfailing source of consolation and instruction.

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MINING ENGINEERS' EXAMINATION AND REPORT BOOK. By Charles Janin, Consulting Mining Engineer. San Francisco, Calif.: Mining & Scientific Press; London: The "Mining Magazine." Part I, Flexible leather; 5x8 in.; pp. 94, illustrated. Part II, cardboard; 8x5 in., pp. 32. [Fitted in envelope on back cover of Part I.] Complete, $2.50, postpaid, or Part II, 50c.

This is a pocket-book designed as a guide for mining engineers in the examination and report of mining properties. Part II is a separately bound book of blank forms for recording the data gleaned from examination. The directions and suggestions for the examination of mines, placers, and mining claims and titles occupy about 30 pages, while the other two-thirds of the book is composed of miscellaneous suggestions and information—classification of igneous rocks, study of ore deposits and several pages of cost data, tables of weights, measures, money, hydraulics, etc.

A Survey of the United States in 1910

ABSTRACT OF THE CENSUS—Statistics of Population, Agriculture, Manufactures and Mining for the United States, the States and Principal Cities. Thirteenth Census of the United States, Taken in 1910. Washington, D. C.: Bureau of the Census. Cloth; 10x12 in.; pp. 569.

Previous abstracts of the Census have been published as tables only, in octavo form. This one contains text as well as tables and is uniform in size and style with the other volumes comprising the Thirteenth Census. Interest and convenience alike have been served by combining tables and text on each of the subjects treated. Maps and diagrams are used to advantage .

The volume is in four divisions: Population, Agriculture, Manufactures, and Mines and Quarries. Besides the detailed contents there is an Index to Tables, which will be appreciated by those wishing to look up special figures.

It is interesting to note in passing that "the population living under the American flag" was "approximately" 110,100,000 in 1910. In the United States proper (excluding Alaska and all outlying possessions) there were 91,972,666 people in 1910. Of these, 46.3% are classed as urban (living in places of 2500 or more) and 53.7 as rural, as compared with 40.5 and 59.5%, respectively, in 1900, and 29.5 and 70.5 in 1880.

Under Agriculture, 12 pages are devoted to Irrigation and Irrigated Crops (for the year 1909). The total area reported as irrigated was 13,738,485 acres (not including rice irrigation), which was 1.2% of the total area of land in the states where irrigation was practiced, 3.5% of the land in farms and 7.9% of the improved land in farms. Irrigation works were available for supplying water to 19,334,697 acres in 1910, while the acreage covered by works completed or in progress was 31,111,142 acres. The irrigated areas included in these figures were located in 17 states.

The manufactured products of the United States (excluding Alaska, etc.) in 1909, were valued at $20,672,052,000 and were produced in 268,491 establishments by 7,678,578 wage earners, salaried employees, proprietors and firm members. Meat-packing houses, foundries and machine shops, lumber plants and steel-rolling mills led in value of products, in the order named.

Mines, quarries, petroleum and gas wells gave a product valued at $1,238,410,322 in 1909, or only some 6% of the value of manufactured products.

Finally, it may be noted that the Abstract, as here briefly noted, will be published in as many editions as there are states. Each State-Abstract will contain all the information given in the present volume, plus all the information gathered for that state except as to occupations. As there will also be groups of volumes on the four main divisions of the Census—Population, Agriculture, Manufactures, Mines and Quarries—it will be seen that the wants of most individuals and many libraries will be served by one or at most a few volumes, thus saving a large amount of shelf room in libraries and effecting no small economy to the government in printing, binding, storage and distribution.

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MANUAL OF WIRELESS TELEGRAPHY AND TELEPHONY—By A. Frederick Collins. Third edition, revised and enlarged. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xv+300; 129 illustrations, $1.50.

Rapid progress in the art of electric-spark communication has necessitated frequent revision of all handbooks that aim to be guides to the practical manipulation of apparatus in service. That situation, probably as much as any universal acceptability which this work may have, explains the rapid succession of three editions. To many, the inclusion of wireless telephony in the title will appear a bit unfortunate. The section on this development is very short and almost exclusively describes Mr. Collins' work—which is under a shadow—because of association with unfortunate business manipulations.

For beginners in wireless telegraphy this manual is seemingly acceptable as it lives up to the self-imposed limitations of a rudimentary informational text of practical nature. First the simplest possible system is described and the theory of operation explained—largely by analogy. Then the apparatus seen in commercial stations is described and followed by notes on the necessary elevated structures which radiate the energy of signals. Wiring diagrams for sending and receiving circuits are interposed before some further theoretical discussions, of the actions in the several parts of sending and receiving systems. The proper adjustment and operation of these several instruments is later briefly set forth, previous to describing the different makes of equipment. This last named chapter has a historical outline of the development of the systems now seen in commercial form. The Marconi and Telefunken systems are described and the Lodge-Muirhead, Branly-Popp, Rochefort, Tissot, Popoff, Cervera-Bavaria and DeForest systems are mentioned, but nothing is said of the Poulsen and Fessenden schemes, which are notable in some ways and more important, probably, than some of those above noted, though not developed to the extent of the Marconi and Telefunken. Under "Suggestions to Operators" is a lot of miscellaneous information on rates for messages, location of stations, signal alphabets and codes, company and government service instructions, etc. After the brief chapter on telephony, is a concluding glossary of terms and phrases.

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ON THE FEASIBILITY OF CONSTRUCTING A RESERVOIR IN PYMATUNING SWAMP, CRANFORD COUNTY, PENN.—Report of the Water-Supply Commission of Pennsylvania. Harrisburg, Penn.: Water-Supply Commission. Paper; 6x9 in.; pp. 79; maps and halftones.

As a result of surveys made by E. E. Haslam, under the direction of Farley Gannett, chief engineer, the commission concludes that a large part of the swamp named could be turned into a storage reservoir, 24.7 miles in area and 8,182,000,000 cu.ft. in gross capacity by building an earth dam with an average height of 27 ft. and a length of 2910 ft. A draft of 4.3 ft. in an average year and of 9 ft. in the driest year of the last 35 years, would give a minimum discharge of 450 sec.-ft. (against an actual 20 sec.-ft.) of low-water flow in the Shenango River, at Sharon. This would more than supply all the present industrial demands on the stream. The reservoir would also, the commission says, "eliminate any considerable contribution to floods from the 150 sq.mi. of territory tributary above the dam, which constitutes one-quarter of the area above shown and 18.7% of the area above New Castle. The reservoir would add about "2000 primary horsepower" on the Beaver River, and would increase the value of the river water for cooling purposes by reducing the high summer temperatures which now prevail. In addition the sanitary condition of the river would be improved. The estimated cost of the project is $1,600,000. A bill authorizing the Commission to construct the reservoir and appropriating $400,000 for taking land which would be flooded, has been introduced in the Pennsylvania legislature. The report is particularly interesting in view of the floods in the Shenango and Beaver rivers in March, 1913. (See also note on proposed flood protection work at New Castle, Penn., p. 756, "Eng. News," Apr. 10, 1913).

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The "Journal" of the American Institute of Architects is to be edited by C. H. Whitaker, who has been especially engaged for that service. In "Engineering News," March 13, 1913, p. 547, it was stated that the "Journal" was under the editorship of D. Knickerbacker Boyd. This was not entirely correct. Mr. Boyd served only in an advisory editorial capacity, the editing, up to the enlisting of Mr. Whitaker's services, having been in charge of Frank C. Baldwin, chairman of the Committee on Publications, and Glenn Brown, Secretary of the Institute.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AARDEN RESERVOIRDAMMEN—By A. A. Meyers, Ingenieur der le klasse bij den Waterstaat in Nederlandsch-Indie. Bijlage van het Archief voor de Suiker-industrie in Nederlandsch-Indië. Batavia, Nederlandsch-Indië: Algemeen Syndicaat van Suikerfabrikanten. Cardboard; 7x10 in.; pp. vii+90; 45 illustrations.

ANALYTICAL MECHANICS—For Students of Physics and Engineering. By Haroutune M. Dadourian, Instructor of Physics, Sheffield Scientific School, Yale University. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xii+353; 148 text figures. $3, net.

BEANSPRUCHUNG DER BAUSTOFFE IN STAUMAUERN NACH NEUEREN FORSCHUNGEN—By k. k. Baurat, Ziv.-Ing. Wilh. Plenker, Bauunternehmer in Prag. Wien: R. v. Waldheim, Jos. Eberle & Co. Paper; 7x11 in.; pp. 150; 21 text figures. 6 marks.

BRUCKEN IN EISENBETON—Ein Leifftaden für Schule und Praxis. By C. Kersten, Oberingenieur und Oberlehrer a. D. Teil II: Bogenbrucken. Berlin: Wilhelm Ernst & Sohn. Paper; 7x10 in.; pp. viii+236; 504 text illustrations. 6.20 marks.

CANADIAN FORESTRY AND IRRIGATION—Report of Director of Forestry for 1912. Ottawa, Can.: Department of the Interior. Paper; 7x10 in.; pp. 130; illustrated; 9 maps and plans in envelope.

CANADIAN RAILWAY, EXPRESS AND TELEPHONE STATISTICS, for Year Ended June 30, 1912. Ottawa: A. W. Campbell, Deputy Minister of the Department of Railways and Canals. Paper; 6x9 in.; pp. 173, 16 and 59, respectively; 11 maps in envelope.

THE CLASSIFICATION OF THE PUBLIC LANDS—By George Otis Smith and Others. Washington, D. C.: United States Geological Survey. Paper; 6x9 in.; pp. 197; illustrated.

COST REPORTS FOR EXECUTIVES, As a Means of Plant Control—By Benjamin A. Franklin. New York: The Engineering Magazine Co. Cloth; 6x9 in.; pp. 149; with numerous record forms. $5.

DATA FOR USE IN DESIGNING CULVERTS AND SHORT-SPAN BRIDGES—By Charles H. Moorefield, Highway Engineer. Washington, D. C.: Office of Public Roads. Paper; 6x9 in.; pp. 39; illustrated.

THE DESIGN OF ALTERNATING CURRENT MACHINERY.—By James R. Barr, A. M. Inst. E. E., Late Lecturer in Electrical Engineering, Heriot-Watt College, Edinburgh, and R. D. Archibald, A. M. Inst. E. E., Head of Electrical Engineering Department, Dundee Technical College. New York: The Macmillan Co. London: Whittaker & Co. Cloth; 6x9 in.; pp. xvi+496; 340 text illustrations and 17 plates. $3.75, net.

DIAGRAMS FOR THE SOLUTION OF THE KUTTER AND BAZIN FORMULAE FOR THE FLOW OF WATER—Providence, R. I.: Prepared by Karl R. Kennison, 815 Grosvenor Bldg. Paper; 8x11 in.; pp. 4. $1.

DYNAMO LABORATORY OUTLINES FOR Students in Electrical Engineering—By John Fay Wilson, Department of Electrical Engineering, University of Michigan. New York and London: McGraw-Hill Book Co. Cloth; 5x8 in.; pp. ix+129; 84 text illustrations. $1, net.

EARTHWORK HAUL AND OVERHAUL, Including Economic Distribution—By J. C. L. Fish, M. Am. Soc. C. E., Sometime Division Engineer, Lake Shore & Michigan Southern Railway, Professor of Railroad Engineering, Leland Stanford Junior University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xiv+165; 66 text figures. $1.50 (6/6), net.

ECONOMICS IN BRICKYARD CONSTRUCTION AND OPERATION—By Ellis Lovejoy, Ceramic Engineer. Indianapolis, Ind.: T. A. Randall & Co. Cloth; 6x8 in.; pp. 72. $1.

ELECTRICAL ENGINEERING FOR MECHANICAL AND MINING ENGINEERS—A Series of 20 Lectures Prepared for and Delivered to the Resident Mechanical Engineers of the Mines on the Witwatersrand, South Africa. By H. J. S. Heather, M. Am. Inst. E. E., Late External Examiner in Electrotechnics to the University of the Cape of Good Hope and the South African School of Mines and Technology. [Being part of "The Electrician" Series.] New York: D. Van Nostrand Co. London: The Electrician Printing & Publishing Co., Ltd. Cloth; 6x9 in.; pp. ix+332; 184 text illustrations. $3.50, net.

ELECTRICAL INSTRUMENTS AND METERS IN EUROPE—By H. B. Brooks, Commercial Agent of the Department of Commerce and Labor. [Special Agents Series No. 66.] Washington, D. C.: Bureau of Foreign and Domestic Commerce. Paper; 6x9 in.; pp. 88; illustrated.

AN EXPENSIVE EXPERIMENT—The Hydro-Electric Power Commission of Ontario. By Reginald Pelham Bolton, M. Am. Soc. C. E., author of "Building for Profit" and "Elevator Service." New York: The Baker & Taylor Co. Toronto: McClelland & Goodchild, Ltd. Cloth; 5x8 in.; pp. 281; illustrated. $1.25, net.

A FIRST BOOK OF ELECTRICITY AND MAGNETISM. For the Use of Elementary Science and Engineering Students, and General Readers—By W. Perren Maycock, M. Inst. E. E. Fourth edition, revised and enlarged. New York: The Macmillan Co. London: Whittaker & Co. Cloth; 5x7 in.; pp. xxii+351; 162 text illustrations. 90c., net.

FOUNDATIONS AND MACHINERY FIXING—By Francis H. Davies, A. M. Inst. E. E., author of "Electric Power and Traction" and "The Commercial Engineer's Pocket Book." New York: D. Van Nostrand Co. Cloth; 4x7 in.; pp. 152; 52 text illustrations. $1, net.

THE GAS TURBINE: Theory, Construction, and Records of the Results Obtained from Two Actual Machines—By Hans Holzwarth. Translated by A. P. Chalkley, A. M. Inst. C. E. Cloth; 6x9 in.; pp. viii+140; 142 text illustrations. $2.50.

GEOLOGIC STRUCTURE OF THE PUNXSUTAWNEY, CURWENSVILLE, HOUTZDALE, BARNESBORO AND PATTON QUADRANGLES, CENTRAL PENNSYLVANIA—By George H. Ashley and M. R. Campbell. Washington, D. C.: United States Geological Survey. Paper; 6x9 in.; pp. 23.

HANDBUCH DER INGENIEURWISSENSCHAFTEN. Part III: Der Wasserbau. By Th. Rehbock, P. Gerhardt, K. E. Hilgard and E. Matton. Leipzig: Wilhelm Engelmann. Paper; 8x11 in.; pp. xi+522; 502 text illustrations; 14 fold ing diagrams. 26 marks.

INSTRUCTIONS TO INSPECTORS OF STREET PAVING.—New York: E. V. Frothingham, Commissioner of Public Works, 13 Park Row. Cloth; 4x6 in.; pp. 42.

AN INTRODUCTION TO THE MATHEMATICAL THEORY OF HEAT CONDUCTION, With Engineering and Geological Applications—By L. R. Ingersoll, Associate Professor of Physics, and O. J. Zobel, Formerly Fellow in Physics, University of Wisconsin. Boston, Mass.: Ginn & Co. Cloth; 5x7 in.; pp. vi+171, 24 text illustrations. $1.60.

JOHNSON'S FIRST AID MANUAL—Suggestions for Prompt Aid to the Injured in Accidents and Emergencies. Edited by Fred B. Kilmer, Instructor in First Aid, Member American Public Health Association. Fifth edition, revised. New Brunswick, N. J.: Johnson & Johnson. Cloth; 6x9 in.; pp. 147; illustrated.

A combination of a first-aid manual and a descriptive price list of medical and surgical supplies for first aid, disinfection, etc. The catalog feature is subordinated to the other parts of the book, which latter are well worked out for use in industrial establishments. The illustrations are a valuable feature of the Manual.

MACHINE DESIGN—By Charles H. Benjamin, Dean of Schools of Engineering, Purdue University, and James D. Hoffman, Professor of Mechanical Engineering and Practical Mathematics, University of Nebraska. New York: Henry Holt & Co. Cloth; 6x9 in.; pp. x+342; 205 text illustrations. $3.

MECHANICAL PROPERTIES OF WESTERN HEMLOCK—By O. P. M. Goss, Engineer in Forest Products. Washington, D. C.: U. S. Forest Service. Paper; 6x9 in.; pp. 45; illustrated.

MECHANICAL PROPERTIES OF WESTERN LARCH—By O. P. M. Goss, Engineer in Forest Products. Washington, D. C.: U. S. Forest Service. Paper; 6x9 in.; pp. 45; illustrated.

MINERAL RESOURCES OF THE UNITED STATES FOR 1911 Part I, Metals. Washington, D. C.: United States Geological Survey. Cloth; 6x9 in.; pp. 1018.

NEW HAVEN RAILROAD STATION APPROACH AND HARBOR FRONT IMPROVEMENTS—Report by Frederick L. Ford, City Engineer, New Haven, Conn. Paper; 6x9 in.; pp. 32; illustrated.

NOTES ON METHODS OF DIFFERENTIATING SOILS FOR SEWAGE PURIFICATION—By Gilbert J. Fowler and William Clifford, Assoc. M. Inst. C. E. (Read before the Association of Managers of Sewage Disposal Works, at Wolverhampton, England, July 6, 1912.) Paper; 6x9 in.; pp. 22; illustrated.

OHIO LIGHTING RATES—Compiled by the Ohio Electric Light Association. Greenville, Ohio: Secretary, D. L. Gaskill. Paper; 6x9 in.; pp. 58.

THE PRODUCTION OF COAL AND COKE IN CANADA DURING 1911—By John McLeish, Chief of Division of Mineral Resources and Statistics. Ottawa: Canada Department of Mines. Paper; 7x10 in.; pp. 35.

PRINCIPLES AND METHODS OF MUNICIPAL TRADING—By Douglas Knoop, Lecturer on Economics in the University of Sheffield; Late Langton Fellow of the University of Manchester. London: Macmillan & Co., Ltd. Cloth; 5x9 in.; pp. xvii+409; $3.25 (10/), net.

RAILWAYS AND AGRICULTURE (1900-1910)—Washington, D. C.: Bureau of Railway Economics (Logan G. McPherson, Director). Paper; 6x9 in.; pp. 31.

REGULATION, VALUATION AND DEPRECIATION OF PUBLIC UTILITIES—By Samuel S. Wyer, M. Am. Soc. M. E.; author of "Treatise on Producer Gas and Gas Producers." Columbus, Ohio: The Sears & Simpson Co. Flexible leather; 6x9 in.; pp. 313; 47 illustrations. $5, net, postpaid.

RIVERS AND ESTUARIES, OR STREAMS AND TIDES—An Elementary Study. By Henry Hunter, M. Am. Soc. C. E. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. 69; illustrated. $1, net.

SAMPLING COAL DELIVERIES and Types of Government Specifications for the Purchase of Coal—By George S. Pope. Washington, D. C.: Bureau of Mines. Paper; 6x9 in.; pp. 68, illustrated.

THE SOCIAL CENTER—Edited by Edward J. Ward, Adviser in Civic and Social Center Development, University of Wisconsin. [Being part of the National Municipal League Series.] New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. x+359. $1.50, net.

SUPERINTENDENT OF THE COAST AND GEODETIC SURVEY—Report for 1912 of O. H. Tittmann. Washington, D. C.: Department of Commerce and Labor. Cloth; 6x9 in.; pp. 106; 9 folding "progress" sketches in folio.

A SYMPOSIUM ON SCIENTIFIC MANAGEMENT AND EFFICIENCY IN COLLEGE ADMINISTRATION, Comprising Among Others the Papers Presented at the Efficiency Session of the Twentieth Annual Convention of the Society for the Promotion of Engineering Education. Ithaca, N. Y.: Prof. H. H. Norris (Cornell University). Cloth; 6x9 in.; illustrated. $1, net.

THE THEORY AND PRACTICE OF MECHANICS—By S. E. Slocum, Professor of Applied Mathematics, University of Cincinnati. New York: Henry Holt & Co. Cloth; 6x9 in.; pp. xiii+442; 328 text illustrations. $3.

TRANSPORTER BRIDGES—By Henry Grattan Tyrrell, Bridge and Structural Engineer; author of "Mill Building Construction, 1900," "Concrete Bridges and Culverts," etc. Toronto, Can.: The University of Toronto Engineering Society. Paper; 6x9 in.; pp. 14; 6 illustrations.

UNDERGROUND WATER RESOURCES OF IOWA—By W. H. Norton, W. S. Hendrixson, H. E. Simpson, O. E. Meinzer, and others. Prepared in coöperation with the Iowa Geological Survey. Water-Supply Paper 293. Washington, D. C.: U. S. Geological Survey. Paper; 6x9 in.; pp. 994; illustrated.

UNIVERSITY OF ILLINOIS ENGINEERING EXPERIMENT STATION—Vols VI and VII, Bulletins 43 to 57, for Years 1910, 1911 and 1912. Urbana, Ill.: The University. Leatherboard, 6x9 in.; illustrated.

VEREINFACHTE BERECHNUNG EINGESPANNTER GEWOLBE—By Dr.-Ing. Kögler, Stadtbaumeister und Privatdozent in Dresden. Berlin: Julius Springer. Paper; 6x9 in.; pp. 48; 5 text figures. 2 marks.

WATER RESOURCES INVESTIGATION OF MINNESOTA (1911-1912)—Report of George A. Ralph, Chief Engineer, State Drainage Commission, St. Paul, Minn. Cloth; 6x9 in.; pp. 602; illustrated.

WORKMEN'S COMPENSATION AND INDUSTRIAL INSURANCE, Under Modern Conditions. In two volumes. By James Harrington Boyd, Chairman, Ohio Employers' Liability Commission, member of the Toledo Bar; author of "Ohio Workmen's Industrial Insurance Law." Indianapolis, Ind.: The Bobbs-Merrill Co. Cloth; 6x9 in.; pp. xviii +324, and xii +276, respectively, and an appendix giving text, in English, of German Workmen's Insurance Code of 1911. A set, $9.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

✚New York—Pennsylvania R. R. This company has awarded contracts as follows for changing the single-track line to double-track on its Buffalo Division: To the JAMES McGRAW CO., Philadelphia, Penn., for Sect. 1, to the DUQUESNE CONTRACTING CO., Pittsburgh, Penn., for Sect. 2. Alex. C. Shand, Philadelphia, Penn., is Ch. Engr.

New York—New York Central & Hudson River R.R.—The Public Service Commission has approved the application of the New York Central; the Rome, Watertown & Ogdensburg; the Utica & Black River; the Oswego & Rome; the Carthage, Watertown & Sackets Harbor, and the Niagara Falls branch and the Little Falls & Dolgeville Railroad companies for permission to consolidate under the name of "The New York Central & Hudson River Railroad." The capital stock of the corporation is $225,581,100

New Jersey—Pennsylvania R.R. This company plans to double-track its line from Phillipsburg to Belvidere, N. J., a distance of about 23 miles. Alex. C. Shand, Philadelphia, Penn., is Ch. Engr.

Maryland—Central R.R. of Maryland—This company has been incorporated by Blair T. Scott, William J. Gascoyne and William J. O'Brien, Jr., of Baltimore, and Charles R. Foutz, of Westminster, Md., and Carl R. Hatch, of New York, D. Princeton Buckey, of Frederick, Md., and E. O. Weant, of Westminster, and has filed its charter at Annapolis. It is proposed by the incorporators to construct a line from Union Bridge westward to a connection with the York, Hanover & Frederick Ry. near Keymar, about 15 miles. Capital stock, $125,000.

Mississippi—Nashville, Shiloh & Corinth Ry.—See item under Tennessee.

Tennessee—Nashville, Shiloh & Corinth Ry.—This company, it is reported, plans to construct a line from Nashville, Tenn., to Corinth, Miss., through the counties of Davidson, Williamson, Hickman, Lewis, Perry, Wayne and Hardin, Tenn., and Alcorn County, Miss., about 150 miles. J. H. Carpenter, J. W. Ross, J. B. Walker and G. A. Hazzard are interested.

Kentucky—Chesapeake & Ohio Ry.—This company has awarded the contract for the construction of a 22-mile railroad down Beaver Creek into Lloyd and Pike Counties, Ky. The line will pass through a coal and timber section. F. I. Cabell, Richmond, Va., is Ch. Engr.

✚Kentucky—Chesapeake & Ohio R.R.—This company has awarded the contract for the construction of its proposed extension from the mouth of Beaver Creek to Steele's Branch, Ky., a distance of 22 miles, to BALLARD, HERRING & SEVERER, Catlettsburg, Ky.

Indiana—Chicago, Indianapolis & Louisville Ry.—This company is considering an expenditure of $110,000 for the construction of improved terminal facilities at Michigan City, Ind. A new freight yard will be laid out near the southerly limits of the city. A. S. Kent, Chicago, Ill., is Ch. Engr.

Illinois—Wabash R.R.—The receivers of this company, Apr. 2, filed plans in the U. S. District Court at Chicago, Ill., for the expenditure of $7,489,500 in improvements on the railroad. The road has been in receivers' hands since Dec. 20, 1911. The largest single group of expenditures contemplated is for engines and rolling stock. It is planned to expend $3,525,000 for this. For new rails and upbuilding of tracks, $1,010,000 is to be spent. For track elevations and double tracking, $2,954,500 is asked. A. O. Cunningham, St. Louis, Mo., is Ch. Engr.

Wisconsin—Pigeon Valley Ry.—This company has been granted a charter for the construction of a railroad from Pigeon Falls, Trempealeau County, to Hay Creek in the town of Bridge Creek, Eau Claire County, a distance of about 20 miles. J. S. Donald, Madison, Wis., is Secy. of State. O. A. Olsen, Northfield, Wis., is interested.

✚Iowa—Chicago, Milwaukee & St. Paul Ry.—This company has awarded contracts to the WALSH CONSTRUCTION CO., Davenport, Iowa, for the grading necessary for second-track work between Elberon and Tama, Iowa, 16 miles, and between Dunbar and Capron, Iowa. The work involves handling about 625,000 cu.yd. of earth.

North Dakota—Canadian Pacific Ry.—This company will probably award contracts soon for grading for the construction of its proposed extension into Dunn County, N. D. J. G. Sullivan, Winnipeg, Man., is Ch. Engr.

Montana—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company is completing arrangements for the construction of its proposed line through Montana to a connection with the Canadian Pacific Ry. The State Land Board has granted its application for a right-of-way through state lands in Sheridan County for nearly 100 miles along the Canadian border. C. N. Kalk, Minneapolis, Minn., is Ch. Engr.

Missouri—St. Louis & San Francisco R.R.—(Frisco Lines)—This company will reolace the 45-lb. rails on the branch line between Springfield and Kansas City Mo., with 85 lb. rails. Work will commence as soon as the material can be secured. F. G. Jonah, St. Louis, Mo., is Ch. Engr. Const.

Missouri—St. Louis, Afton & Sunset Ry.—This company is making financial arrangements for the construction of its proposed line from St. Louis, Mo., to Fenton, Mo. V. J. Miller, 619 National Bank of Commerce Bldg., St. Louis is interested.

Texas—Pecos Valley Southern Ry.—This company is planning for the extension of its line from Toyahvale to Alpine, Tex. L. W. Anderson, Pecos, is Gen. Mgr. and Ch. Engr.

Colorndo—San Luis Valley Sugar Beet Co. This company, located at Monte Vista, Colo., has awarded the contract for the construction of its proposed line from its plant at Monte Vista, to Center, Colo. The work will include the construction of about 16 small bridges.

Idaho—Lewiston-Clarkston Valley Ry.—This company is considering the construction of an extension of 18 miles. It will run from Lewiston to Clarkston and Asotin, Wash., and Lewiston Orchards. P. P. Oehler Clarkston, Wash., is Ch. Engr.

Benewah Valley Ry.—This company has been incorporated for the purpose of constructing and operating a railroad in Kootenai County, Idaho. It will be about 24 miles long. M. S. Parker, St. Maries, Idaho, is one of the incorporators.

✚Washington—Northern Pacific Ry.—This company has awarded the contract to the KEASEL CONSTRUCTION CO., Tacoma, Wash., for the construction of the section of its line between Kirkland and Woodinville, Wash. W. L. Darling, St. Paul, Minn., is Ch. Engr.

Oregon—Oregon-Washington R.R. & Navigation Co.—This company, it is reported, will soon award the contract for the construction of its proposed branch line to the North River line, Ore. F. L. Pitman, Spokane, Wash., is Ch. Engr.

California—Atchison, Topeka & Santa Fé Ry.—This company, it is reported, is planning for the construction of an extension of its Wahtoke Branch into the mountains from Piedera, Calif., its present terminus. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

Quebec—Glengarry & Stormont R.R.—The Canadian Parliament, Ottawa, Ont., has been petitioned to incorporate this company to build railway lines from the Canadian Pacific Ry. at St. Polycarp Junction, Que., southwest through Lancaster Township, Ont., and Charlottenburg Township, and Cornwall Township to Cornwall. Pringle, Thompson & Burgess, Ottawa, Ont., are interested.

Ontario—Glengarry & Stormont R.R.—See item under Quebec.

Alberta—Canadian Northern Ry.—This company has requested the Legislature of Alberta to authorize the construction of the following lines in the province: Northeasterly from Taber to Consort; from the Canadian Northern Saskatoon-Calgary line northerly to the Canadian Northern main line in range 6 or range 9, west 4th meridian; from the Canadian Northern Saskatoon-Calgary line northeasterly to the eastern boundary of the province; from Cardston westerly to the western boundary of the province, and from Metting Creek on the Canadian Northern Vegreville-Calgary line to Wetaskiwin, and thence westerly via Pigeon Lake to the Canadian Northern Strathcona-Pincher Creek line. These lines are in addition to those authorized in the company's charter, which include a line from Edmonton or Strathcona to the western boundary of the province, near the Pine or Peace River Pass, and from a point on the line between Edmonton and Calgary to Rocky Mountain House, thence to the Brazeau and Macleod Rivers, and continuing to a junction with the Canadian Northern main line west of Edmonton. M. H. MacLeod, Winnipeg, Man., is Ch. Engr.

ELECTRIC RAILWAYS

Presque Isle, Maine—The Aroostook Valley R.R. Co. is preparing plans for the construction of an electric railway from Carson to Caribou. A. R. Gould, Presque Isle, is Pres. and Gen. Mgr.

McGregorville (Manchester post office), **N. H.**—The Manchester St. Ry. Co. is making preliminary arrangements for double-tracking its lines on the West Side of McGregorville. J. E. Smith, 46 Hanover St., Manchester, is Gen. Mgr. and Pur. Agt.

Jamestown, N. Y.—The Jamestown St. Ry. Co. contemplates double-tracking its line on Winsor St. and the construction of an electric line on Willard St. G. E. Maltby, Jamestown, is Gen. Mgr. and Pur. Agt.

Tottenville, (S. I.) **N. Y.**—The Staten Island Rapid Transit Co. is planning for the double-tracking of its system from Prince Bay to Pleasant Plains, and the installation of an electric automatic signal system through such section of line.

Clementon, N. J.—The Public Service Co., is considering the extension of its Camden-Clementon electric railway system across Clementon Lake. R. E. Danforth, Newark, is Gen. Mgr.

Port Murray, N. J.—The Easton & Washington Traction Co., has entered into an agreement with Michael P. McGrath, Contractor, for the construction of its proposed extension from Port Murray to Hackettstown, a distance of about 10 miles.

Trenton, N. J.—The Trenton St. Ry. Co. has been granted permission by the Board of Public Utility Commissioners to issue bonds for $100,000 for improvements in its system on South Broad St., North Broad St. North Clinton Ave., and Center St. These lines are operated by the Trenton & Mercer County Traction Co. William H. Hitchcock is Supt.

Hershey, Penn.—Plans are being prepared by the Hummelstown & Campbellstown St. Ry. Co. for the construction of about four miles of new track in Hershey this spring. W. H. Lebkicker, Hershey, is Gen. Mgr. and Pur. Agt.

Linfield, Penn.—Preliminary arrangements are being made by the Pottstown & Reading St. Ry. Co. for the construction of its proposed extension from Linfield to Spring City. Harry F. Swinehart, Pottstown, is Gen. Mgr. and Pur. Agt.

Norfolk, Va.—The Virginia Passenger & Power Co., T. S. Wheelwright, Pres., will double-track its line from Effingham St., along High St., to the Belt Line.

Richmond, Va.—The City Council has passed the ordinance authorizing the Virginia Ry. & Power Co. to extend its lines in the western part of the city and also for the Richmond & Henrico Ry., to build the extension from 35th and Marshall Sts., to Oakwood Cemetery. T. S. Wheelright is Pres. of the Virginia Ry. & Power Co., and W. S. Forbes, of the Richmond & Henrico Ry.

Orlando, Fla.—The Orlando Interurban Traction Co. is making preliminary arrangements for the construction of an electric railway to connect Orlando, Kissimmee and Sanford, about 45 miles in all. W. C. Temple is Pres.

+Laurel, Miss.—The Laurel Light & Ry. Co. has awarded the contract for (a) grading and (b) constructing its proposed line from Laurel to Ellisville, as follows: (a) M. H. THOMASSON, (b) HEWES CONTRACTING CO. Noted Jan. 30.

Akron, Ohio—Plans are being made by the Northern Ohio Traction & Light Co. for double-tracking about seven miles of its system in Akron. Charles Currie, Akron, is Gen. Mgr.

Quincy, Ill.—The Chicago, Peoria & Quincy Traction Co. has been granted permission to construct and operate an electric railway in Quincy. L. Soebbing is Pres.

Madison, Wis.—Surveys are being made by the Rogers Park Engineering & Construction Co. for the proposed interurban line to connect Janesville, Indiana Ford, Edgerton, Stoughton and Madison.

Milwaukee, Wis.—The Milwaukee Traction Co. is being organized for the purpose of constructing an electric railway on Green Bay Ave., for a distance of three miles. Lorenz Wagner, Milwaukee, is interested.

Lincoln, Neb.—Plans are being prepared by the Belmont & Northern Traction Co. for the construction of an electric railway from 13th to P St., about three miles.

Kingston, Mo.—The Kingston-Excelsior Electric Ry. Co. is making preliminary surveys for the construction of its proposed line from Kingston to Excelsior. Stevens Rogers, Kingston, is interested.

Brownsville, Tex.—Plans are being prepared by the Brownsville St. & Interurban Ry. Co. for the extension of its line to the Country Club grounds, about two miles. S. A. Robertson is Pres.

Bryan, Tex.—Work will soon be started by the Bryan & College Interurban Ry. Co. on the construction of its proposed electric railway from Bryan to Stone City, about 35 miles. O. E. Gammill, Bryan, is Gen. Mgr. Noted Jan. 10.

Matador, Tex.—The Motley County Ry. Co. has been organized to construct and operate an electric railway from Matador to White Flat and Memphis, Tex.

Moore, Okla.—The Oklahoma Ry. Co. is preparing plans for the extension of its line from Moore to Norman. George W. Knox, Oklahoma City, Okla., is Vice-Pres. and Gen. Mgr.

St. Maries, Idaho—The Benwah Ry. Co. has been incorporated to construct and operate an electric railway through Benwah County for a distance of about 30 miles. The incorporators are William A. Monroe, Spokane, Wash., and S. Parker and H. H. Boomer, of St. Maries.

Salt Lake City, Utah—The City Council has granted a franchise to the Utah Light & Ry. Co. to extend its line on Beck St., from Warm Springs to the county boundary line. Joseph S. Wells, Salt Lake City, is Gen. Mgr.

Seattle, Wash.—The state of Washington has purchased $200,000 in bonds voted by the city some time ago for constructing a municipal electric street railway.

Medford, Ore.—The franchise which was recently granted M. T. Minney, of Oakland, Calif., to construct and operate an electric interurban railway from Medford to Ashland, has been transferred to F. B. Waite and associates of Roseburg. The new company will carry on the proposed work of the old company.

Corona, Calif.—The Pacific Electric Ry. Co. has applied to the City Council of Corona for a franchise to construct and operate an electric railway on Third St. F. W. Taylor, Los Angeles, is Gen. Pur. Agt.

+Martinez, Calif.—The Oakland & Antioch Ry. Co. has awarded a contract for the building of seven miles of electric line from Walnut Creek to Danville, to PALMER, McBRYDE & QUAYLE, Hooker and Lent Bldg., San Francisco. Work is to be commenced at once.

Tulare, Calif.—The Big Four Electric Ry. Co. is making plans for the construction of its proposed electric line to connect Porterville, Lindsay, Tulare and Visalia, about 45 miles.

Hamilton, Ont.—The Hamilton Incline Ry. Co. is considering plans for the construction of an incline railway from Hamilton to the top of the mountain.

Ottawa, Ont.—The Ottawa Electric Ry. Co. is planning to build about four miles of new track this spring. F. D. Burpee, Ottawa, is Supt. and Pur Agt.

Portage la Prairie, Man.—The Portage Radial Ry. & Canal Co. has been organized to construct and operate an electric railway from Portage la Prairie to Winnipeg; from Portage la Prairie to Delta. The directors are H. Stephens, W. Richardson, F. G. Taylor, of Portage la Prairie, and A. H. Oakes, of Winnipeg.

Battleford, Sask.—F. P. Alywin, of Ottawa, Ont., is interested in the proposition to construct an electric railway from Battleford to North Battleford.

Saskatoon, Sask.—Bids will be received by the City Commissioners until noon, Apr. 24, for double-tracking the municipal electric railway on several streets. Plans and specifications are on files at the office of E. Hanson, Supt. of St. Ry. F. E. Harrison is Mayor and Chn. of Comrs.

Edmonton, Alta.—The Edmonton, Stony Plain & Wabamun Ry. Co. has been incorporated to construct and operate an electric railway from Edmonton to Stony Plain, and Lake Wabamun. The incorporators include A. Boileau, E. S. McQuade and A. V. Pujebet.

The East Edmonton property owners have organized a company for the construction of a seven-mile electric railway from Watt St. to the Alberta College grounds.

Lethridge, Alta.—The Municipal Ry. Co., of Lethridge, is considering plans for the construction of a four-mile extension to its line.

Vancouver, B. C.—The International Ry. & Development Co. has made surveys for the construction of an electric railway through the Delta district to New Westminster. G. R. McDuff is Engr.

LIGHT, HEAT AND POWER

Chelmsford, Mass.—Plans are being considered for the construction of a municipal electric-light plant.

Chicopee, Mass.—Plans are being prepared by the Amherst Power Co. for the construction of a substation at Chicopee.

Paxton, Mass.—An election will be held Apr. 11 to vote on the proposition to construct a municipal electric-light plant.

Pawtucket, R. I.—The Blackstone Valley Gas & Electric Co. has received permission to construct an addition to its electric power plant. Estimated cost, $65,000. Clement R. Ford, Boston, Mass., is Secy.

+Troy, N. Y.—The contract for the installation of an electric system in the Samaritan Hospital has been awarded to BARNES & TAYLOR, Troy, at $16,000.

Camden, N. J.—The Municipal Electric Lighting Committee of the City Council will receive bids for the construction of a municipal electric lighting plant until June 16, according to plans and specifications by Runyon & Carey, Engrs., 122 Market St., Newark, N. J. Frederick A. Finkeldey is Chn. of the Com. Noted Nov. 7.

Chatham, N. J.—Bids were received by the Common Council, Apr. 7, for improving the municipal electric-light and water plant, as follows: William M. Sheehan & Co., $34,810; Blackall & Baldwin Co., $34,890; Portland Engineering Co., $36,000; for individual items the following were received: two 150-hp. water-tube boilers, E. Keeler & Co., $5200; tandem-compound Corliss engine, and three-phase generator, Ridgeway Dynamo & Engine Co., $8956; engine only, Jersey City Iron Works, $7929; steam-turbo-generating set, 100-kw., Westinghouse Electric & Mfg. Co., $5996; steam-generating set, George D. Atwood Co., $4973. Noted Apr. 3.

Freehold, N. J.—The Board of Public Utility Commissioners has granted the Standard Gas Co. and the Atlantic Highlands Gas Co., permission to merge interests under the name of the former concern. The new company has applied for authorization to issue bonds for $630,000, of which issue $83,000 is to be used for extensions and improvements in its system.

Millville, N. J.—The Millville Gas Co. has made application for franchises for the installation and operation of new gas systems at Minetola, Landisville and Buena Vista.

Newark, N. J.—The annual report of the Public Service Co., announces the acquirement of a large tract of land on the Passaic River, in the meadow section of Newark, as a site for a new electric power station for its service in Essex and Union Counties. Dudley Farrand is Mgr.

The Public Service Gas Co. has been granted permission by the Board of Freeholders to lay new 12-in. gas mains in Sanford Ave., Irvington and in Grove St., Montclair; new 10-in. gas mains on Bloomfield Ave., from Watsessing Ave. to Heckel St.; and new 6-in. mains in Bloomfield Ave., Bloomfield, and South Orange Ave., Vailsburg.

Nutley, N. J.—The Town Commission has authorized A. R. Carr, Dir. of Sts., to enter into contract with the Public Service Electric Co. for the installation of new arc and tungsten lamps to double the present lighting capacity.

Point Pleasant, N. J.—The Commonwealth Water & Light Co. has acquired the Point Pleasant Electric Light & Power Co., operating at Point Pleasant, Bay Head and vicinity. The company has increased its capital from $1,000,000 to $3,000,000 to provide for extensions.

Trenton, N. J.—The Trenton Gas & Electric Co. will build an addition to its power plant on New York Ave., to cost about $9000.

New Castle, Penn.—The Common Council has passed an ordinance authorizing an election to be held June 3 to submit to the voters the proposition to issue $200,000 of bonds for the construction of a municipal electric-light plant. Noted Jan. 2.

Philadelphia, Penn.—The Philadelphia Rapid Transit Co. is considering plans for the construction of an addition to its power plant at Beach and Poplar Sts. Estimated cost, $250,000. W. L. Maize, Eighth and Dauphin Sts., Philadelphia, is Pur. Agt.

McMechen, W. Va.—The construction of an electric-light plant at McMechen, is under consideration by the Brook Electric Co., of Warwood.

Spencer, N. C.—An election will be held May 6, at which the proposition to issue $50,000 in bonds for the construction of a municipal electric-light plant and water-works system, will be submitted to the voters. Noted Mar. 20.

+Whitney, N. C.—The Southern Aluminum Co., Whitney, N.

Co. has awarded a contract to the HARDAWAY CONTRACTING CO., Columbus, Ga., for the erection of its hydro-electric plant on the Yadkin River, having purchased its site of 3000 acres, and the unfinished electrical development of the old Whitney Co. The contract calls for excavating the factory site and spillway, and erecting a dam and power house, the former to be about 200 ft. high and develop a 177-ft. head, generating 220,000 hp. About 600,000 cu.yd. of masonry will be required. The contract for all the electrical apparatus has been awarded to Ferranti, General Electric Co. at a reported cost of about $400,000, as noted Oct. 3. Seven vertical waterwheel-type electric generators will be installed, each to have a rating of 5000 kw., delivering 20,000 amp. at 250 volts, and operating at a speed of 170 r.p.m. The Southern Aluminum Co. will have an annual capacity of 25,000 tons of aluminum. It is controlled by French capitalists, and is under the personal supervision of Dr. Paul Heroult, a recognized expert on the manufacture of aluminum. The estimated cost of the entire plant, including homes for the operatives, is $6,000,000. It is hoped to have it in operation during the summer of 1914.

Whigham, Ga.—The citizens of Whigham will vote Apr. 18 on the proposition to issue $6000 in bonds for the construction of a municipal electric-light plant.

Hawthorne, Fla.—Plans are being prepared by the Hawthorne Mfg. Co. for the construction of an electric-light plant in connection with its establishment at Hawthorne.

Florence, Ala.—The Secretary of War has directed that bids for the Muscles Shoals development be received for a period of 50 years and of 20 years in addition to that stated in the item appearing Mar. 27 of 100 years.

Plans of this work, showing the property, surrounding country, proposed dam, run-off data, and estimates for power development, are on file at the office of Engineering News and may be consulted by interested parties.

Lexington, Ky.—The Central Kentucky Natural Gas Co. will soon award contracts for the construction of a pipe line from Lexington to Paris, Ky., where it recently secured a franchise. Noted Jan. 23.

Louisville, Ky.—H. M. Byllesby & Co., of Chicago, Ill., who have just closed a deal with the city of Louisville, for the merger of all of the gas and electric companies, are letting contracts for the construction of a pipe line from the wells of the Hope Gas Co. in West Virginia. A feature of the work will be the erection of power plants at various points along the line to maintain the pressure. The equipment of these plants will cost $700,000; the pipe line, about $3,000,000.

Coshocton, Ohio—The United Service Co., Coshocton, will build a new power plant to cost $150,000. C. H. Howell, Coshocton, is Supt.

+Toledo, Ohio—The contract for the installation of a 1200-kw. turbo-generator set in the Water St. plant of the Toledo Traction, Light & Power Co., has been awarded to the GENERAL ELECTRIC CO., Schenectady, N. Y.

Centerville, Ind.—At a recent election the proposition to issue bonds for the construction of a municipal electric-light plant was voted on. W. A. Butsch is Town Clk.

Elkhart, Ind.—Plans have been prepared for the installation of an ornamental street-lighting system on Main St. Estimated cost, $6000. James Leicester, Jr., is Chn. of the Lighting Com.

Melrose Park, Ill.—See item under Water Supply—Irrigation.

Racine, Wis.—The proposition to expend $6000 for the installation of an ornamental lighting system of State St., is under consideration.

Waumandee, Wis.—Plans are being considered for the construction of an electric-light plant at Waumandee.

Weldon, Iowa—The Council is making preliminary arrangements for the installation of an electric system in Weldon. Bonds were recently voted for the purpose.

Whiting, Iowa—Bids will be received by B. L. Foss, Town Clk., until Apr. 21 for the construction of an electric-light and power plant. Plans have been prepared by the Alamo Engine & Supply Co., Omaha, Neb. Estimated cost, $10,000. Noted Dec. 26.

Crookston, Minn.—The City Clerk has been authorized to call for bids for the installation of an ornamental street-lighting system in Crookston.

East Grand Forks, Minn.—The citizens are considering plans for the construction of a new electric-light plant.

Fertile, Minn.—The proposition to construct a municipal electric-light plant at Fertile, is under consideration.

Grand Meadow, Minn.—Plans are being prepared for the construction of an electric-light plant at Grand Meadow.

Herman, Minn.—At a recent election it was voted to install an electric system at Herman. A transmission line will be constructed from Fergus Falls to supply the necessary electricity.

+Miltonvale, Kan.—The contract for the construction of a municipal electric-light plant, according to plans by E. P. Archer & Co., New England Bldg., Kansas City, Mo., has been awarded to BROOKS & SONS CO., Scarritt Bldg., Kansas Cit. Mo. Estimated cost, $32,000. Noted Feb. 6.

Hildreth, Neb.—An electric-light system will be installed in Hildreth. Bonds were recently voted for the purpose. C. E. Sturtevant, of Holdrege, is Consult. Engr.

Lansford, N. D.—The Council has appointed a committee to investigate the feasibility of installing a municipal electric-light plant at Lansford. C. A. Adams is Chn. of the Com.

Lisbon, N. D.—An expenditure of $40,000 is contemplated for the construction of a municipal electric-light plant at Lisbon. The installation of an ornamental street-lighting system in the business district, in connection with the plant, is planned.

New Salem, N. D.—A franchise has been granted to the New Salem Electric Light Co. to construct and operate an electric-light plant in New Salem.

Reynolds, N. D.—We are officially advised that bids will be received until Apr. 30, for the construction of a municipal electric-light plant. Plans and specifications are on file at the office of M. N. Braithwaite, City Audr. Estimated cost, $5000. Noted Nov. 21 and Mar. 13.

St. Thomas, N. D.—An election will be held Apr. 28 at which the proposition to issue bonds for the construction of a municipal electric-light plant, will be submitted to the voters.

Cut Bank, Mont.—See item under Water Supply—Irrigation.

Helena, Mont.—The Mountain States Telephone Co. will improve its system here at a cost of $140,000. The cable system will be reconstructed and doubled in capacity. Of the sum to be expended $45,000 will be used in extending the underground system covering the business and portions of the residence districts, E. M. Burgess, Denver, Colo., is Vice-Pres. and Gen. Mgr.

Alice, Tex.—The Council has granted a franchise to P. A. Prisnal to construct and operate an electric-light plant at Alice.

+Denison, Tex.—See item under Buildings.

Texas City, Tex.—Plans are being prepared for the installation of an ornamental street-lighting system in the business section of the city.

Enid, Okla.—An expenditure of $7000 is planned for the improvement of the plant of the Enid Electric & Gas Co. Lincoln Beerbower, Enid, is Secy. and Mgr.

Burlington, Wash.—Plans are being considered for the installation of an ornamental street-lighting system in Burlington. Estimated cost $7000.

Chelan, Wash.—According to press reports the construction of a dam and power plant on the Chelan River, a small neck of water connecting the Columbia River and Lake Chelan, is being planned by the Great Northern Ry. The project is the culmination of the company's scheme to propel trains over the Cascades by electricity. Estimated cost, $10,000,000. R. D. Hawkins, St. Paul, Minn., is Supt. Motive Power.

Ephrata, Wash.—It is reported that a $10,000 municipal lighting plant will be installed this spring at Ephrata.

White Salmon, Wash.—It is reported that the Northwestern Electric Co. will erect an electric plant on a site recently purchased on the White Salmon River near Husum Falls. B. C. Condit, Portland, Ore., is Mgr.

Oregon City, Ore.—A franchise has been granted to the Beattie Gas Co. to install a plant here.

Portland, Ore.—Plans have been prepared by J. H. Cunningham, Engr., Portland, for the construction of a municipal electric-light plant on the Clackamas River, near Portland. Estimated cost, $2,500,000.

Union, Ore.—Green Bros., of Spokane, Wash., have agreed to construct a municipal lighting plant here and take city bonds in payment. The plant will cost $72,000.

Burbank, Calif.—See item under Water Supply—Irrigation.

Fresno, Calif.—The San Joaquin Light & Power Co. will spend $1,250,000 on improvement of its plants in the San Joaquin Valley. The improvements will be made at Bakersfield, Santa Maria, North Fork, Tulare River and Kern River, Calif. A. G. Wishon, Fresno, is Gen. Mgr.

+Los Angeles, Calif.—The contract for the installation of an ornamental lighting system on Sixth St., between Hill and Alameda Sts., and on Eighth and Ninth Sts., between Main and Figueroa Sts., has been awarded to the LLEWELLYN IRON WORKS, Los Angeles, at $14,725. Bids were received by the Board of Public Works, Mar. 31. Noted Mar. 20.

Oakland, Calif.—The Pacific Gas & Electric Co. will expend $15,000 for the construction of an addition to its power plant at First and Jefferson Sts., in Oakland. J. H. Hunt, San Francisco, is Pur. Agt.

San Francisco, Calif.—See item under Buildings.

Vallejo, Calif.—Bids will soon be received for the installation of an ornamental lighting system on Georgia St. Plans have been prepared and approved by the City Council.

Berwick, N. S.—Plans are being considered for the construction of a municipal electric-light plant to cost, $15,000.

Aylmer, Que.—The Town Council will secure estimates at once for a new electric lighting system to cost about $30,000.

Montreal, Que.—Bids will be received by L. N. Senecal, Secy. of the Bd. of City Comrs., will be received at the offices of the Commissioners, City Hall, Montreal, until noon on Apr. 25, for the construction of a system of underground conduits, main and service manholes, transformer chambers, etc., in, upon, and adjoining that portion of St. Catherine St., between Guy St. and Papineau Ave.

Glencoe, Ont.—Plans are being considered by George Cook for the construction of a dam and power plant at Battle Creek.

Ottawa, Ont.—The Ottawa Electric Co., Sparks St., Ottawa, is having plans prepared for an electrical conduit system to be installed as soon as possible. A. A. Dion, Ottawa, is Gen. Supt. and Ch. Engr.

Winnipeg, Man.—M. Peterson, Secy. Board of Control, will receive bids until May 15 for 2 three-phase generators, 500 kw., 60-cycle, 6000-volt for the new power house at Point du Bois.

Moose Jaw, Sask.—The City Council has authorized an expenditure of $75,000 for the installation of a fire-alarm system, and $135,000 for extensions and improvements to the municipal electric-light and power system.

+Taber, Alta.—The contract for the construction of a municipal electric-light plant has been awarded to H. T. LLOYD, of Taber, at about $25,000.

+Vancouver, B. C.—The Western Canadian Power Co. has awarded a contract to ESCHER, WYSS & CO., Montreal, Que., for furnishing two 13,000-hp. turbines and two inlet drum gates. The company also contemplates raising its dam at Stave Falls.

Waneta, B. C.—The Waneta Development Co. is preparing plans for the construction of a new hydro-electric plant on the Salmon River. Estimated cost, $75,000.

BRIDGES

+Bridgeport, Conn.—The contract for the construction of a concrete bridge over the Rooster River at the Mountain Grove Cemetery has been awarded to the SPERRY ENGINEERING CO., New Haven, Conn., at $8195.

+South Norwalk, Conn. Contracts have been awarded for the construction of the Washington St. Bridge as follows: McHARG, BARTON & Co., 165 Broadway, New York, N. Y., reinforced-concrete superstructure. D sign A, $204,000; SCHERZER ROLLING LIFT BRIDGE Co., 220 Broadway, New York, steel bascule lift spans, $32,927; DANIEL F. TOOMEY, 42 Stevens St., Norwalk, Conn., paving bridge roadway and approaches, $14,000. Noted Apr. 10.

Glens Falls, N. Y.—Preliminary plans have been prepared for the construction of a bridge extending from the canal bridge to River St., South Glens Falls. It will cost approximately $200,000.

West Vienna, N. Y.—Plans have been prepared by the State Highway Dept., Albany, for the construction of a steel lattice truss bridge with concrete floor, two spans 50-ft., long and one 160 ft. long, and 18 ft. wide. The estimated cost is $20,000. A. O'Brien, Utica, N. Y., is Supt. of Highways.

Perth Amboy, N. J.—The Board of Freeholders has approved plans and will soon ask bids for the construction of a new concrete arch bridge over Ambrose Brook, on the New Bound Brook Road, Piscataway Township. Alvin B. Fox is the County Engr.

Easton, Penn.—The Central R.R. of N. J. plans to erect a large concrete bridge across its tracks on Main St., to replace the present iron bridge. J. O. Osgood, New York, N. Y., is Ch. Engr.

Pittsburgh, Penn.—Bids will be received at the office of R. J. Cunningham, County Controller of Allegheny County, until noon, Apr. 25, for the construction of bridges No. 6 and 7 over Plum Creek, No. 5 over Bull Creek No. 4, Robinson's Run, North Branch and No. 1, Giffney's Run. Plans and specifications are on file at the office of the County Engineer, Room 308, Court House, Pittsburgh.

Pittston, Penn.—Bids for the removal of the wood and steel superstructure of the present bridge over the Susquehanna River at Pittston, alterations to the piers and abutments, constructing five pin-connected spans each 202 ft. long, with 25-ft. roadway and two 8-ft. sidewalks, have been received as follows: United Construction Co., Albany, N. Y., $112,978; Owego Bridge Co., Owego, N. Y., $107,985; Penn Steel Co., Steelton, Penn., $119,500; York Bridge Co., York, Penn., $111,900; Penn Bridge Co., Beaver Falls, Penn., $113,472; Nelson Merydith Co., Chambersburg, Penn., $124,750; Lumfer Renick, Buffalo, N. Y., $117,700; McClintock-Marshall Co., $136,485. Noted Mar. 13.

Valley Forge, Penn.—The construction of a concrete bridge over the Schuylkill River, near Valley Forge, is planned. The estimated cost is $250,000. The Valley Forge Commission has charge of the work.

Baltimore, Md.—We are officially advised that on or about May 2, the Sewerage Commission will advertise for bids for the construction of a viaduct to carry the new roadway over the inclosed Jones Falls. The bids will be received until May 21. The viaduct will be of reinforced concrete, 1600 ft. long and 75 ft. wide, and is estimated to cost $250,000. Calvin W. Hendrick is Ch. Engr. of Comn.

Baltimore, Md.—The Board of Awards has approved plans and specifications for the proposed Fallsway Viaduct over the tracks of the Northern Central Ry. It will be built of concrete and will extend from Madison to Biddle Sts. The estimated cost is $300,000. Plans were prepared by Calvin W. Hendricks, Ch. Engr. of the Sewerage Comn.

+Clarksburg, W. Va.—The contract for the steel work on the steel viaduct, 535 ft. long, 24 ft. wide and 80 ft. high, has been awarded to the RIVERSIDE BRIDGE CO., Wheeling, W. Va., at $29,320 and for the masonry to the FERRIS BRIDGE CO., Charleston, at $7500.

Greenville, S. C.—Bids will be received by the Commissioners of Greenville County until Apr. 23, for bridge work in Greenville County.

HIGHWAY BRIDGES DAMAGED IN OHIO

Staff Correspondence

The State Highway Department has been busy with the work of estimating the flood damage to roads in the state, for the information of the governor and the legislature. An inquiry circular as to the loss in road bridges—the most important item—was sent to county officials all over the state, and full reports therefrom have just been compiled. A remarkable state of affairs is reported.

The total number of highway bridges in the state which were destroyed or suffered material loss is over 1000; the accompanying table gives an estimate of the loss, but these returns often cover only the large structures. The estimated number of bridges lost totals about 2,500,000. To this must be added about $1,250,000 loss on ridges not definitely reported, making a total of over $7,500,000. The figures do not include Montgomery and Lawrence counties, which will add materially to the number and value of bridges lost.

The striking fact in the details of the returns—which give specific figures in most cases—is the high average bridges were destroyed or damaged. Very few bridges of small as 20-ft. length are included. Other information corroborates this in showing that few culverts or small bridges were lost in the state; and this conclusion applies equally to the railways, which had almost no culvert washouts. Indeed, it is stated that the small runs and brooks, of a size to be taken care of by ordinary culverts, did not flow as full by a considerable margin; as they do in severe summer storms, and of course the fact that culvert losses are rather frequent in the extreme summer storms that occur every year corroborates this.

As to the highway bridges, the average loss per bridge is seen to be about $6500. Recent studies of the State Highway Department made for other purposes (it was sought to obtain by a kind of statistical estimate the bridging cost per average mile of highway) show that this amount corresponds to a bridge approximately 100 ft. long. In other words, the average length of the 1000 highway bridges lost or damaged in the state is about 100 ft.

James R. Marker, State Highway Commr., sent to the surveyor, auditor, and board of commissioners of each county a request for a report on damage to highway structures. The information received has been tabulated by the Highway Department and forwarded to the General Assembly.

The report of damage by counties is as follows:

Counties	Total No. structures reported	Damage to structures reported	Estimated damage structures not heard from	Total damage
Adams	...	...	...	...
Allen	20	$18,350	$61,250	$79,600
Ashland	12	69,200	40,000	109,200
Ashtabula	7	105,000	...	105,000
Athens	6	26,300	....	26,300
Auglaize	28	32,300	....	32,300
Belmont	8	8,900	2,000	10,900
Brown	8	24,000	25,000	49,000
Butler	10	565,000	...	565,000
Carroll	....	...	...	...
Champaign	10	443,850	...	443,850
Clark	17	24,115	...	24,115
Clermont	3	150,000	50,000	200,000
Clinton	6	7,200	...	7,200
Columbiana	2	610	5,000	5,610
Coshocton	11	175,000	...	175,000
Crawford	...	...	...	40,000
Cuyahoga	3	35,500	10,000	45,500
Darke	...	...	75,000	75,000
Defiance	1	50,000	...	50,000
Delaware	23	324,000	...	324,000
Erie	...	...	...	1,000
Fairfield	6	19,000	6,000	25,000
Fayette	3	8,600	...	8,600
Franklin	11	787,500	...	787,500
Fulton	9	17,500	...	17,500
Gallia	....	...	...	25,000
Geauga	11	9,800	1,500	11,300
Greene	12	25,900	...	25,900
Guernsey	....	...	2,500	2,500
Hamilton	7	550,000	...	550,000
Hancock	2	7,700	2,000	9,700
Hardin	28	25,264	20,000	45,264
Harrison	...	...	300	300
Henry	25	25,350	...	25,350
Highland	...	...	1,000	1,000
Hocking	12	7,600	...	7,600
Holmes	12	35,000	8,000	43,000
Huron	15	25,600	...	25,600
Jackson, storm last year washed out 140 structures, no damage this year				
Jefferson	8	22,500	2,500	25,000
Knox	12	197,000	30,000	227,000
Lake	...	...	...	...
Lawrence	...	...	...	...
Licking	4	11,800	20,000	31,800
Logan	62	36,385	...	36,385
Lorain	23	56,625	...	56,625
Lucas	8	16,300	33,700	50,000
Madison	23	87,000	25,000	112,000
Mahoning	9	50,000	...	50,000
Marion	4	9,400	50,600	60,000
Medina	12	21,010	...	21,010
Meigs	6	22,500	8,000	30,500
Mercer	6	7,000	...	7,000
Miami	13	231,917	18,083	250,000
Monroe	2	7,000	...	7,000
Montgomery	...	...	...	...
Morgan	33	143,300	...	143,300
Morrow	12	27,900	12,600	40,500
Muskingum	15	432,600	...	432,600
Noble	...	...	...	...
Ottawa	...	...	...	...
Paulding	6	16,200	4,000	20,200
Perry	14	2,900	...	2,900
Pickaway	7	214,300	...	214,300
Pike	...	...	50,000	50,000
Portage	3	16,500	32,500	49,000
Preble	7	18,900	3,600	22,500
Putnam	1	500	3,000	2,500
Richland	24	37,900	10,000	47,900
Ross	10	...	...	270,000
Sandusky	7	55,500	10,000	65,500
Scioto	...	...	300,000	300,000
Seneca	17	162,000	30,000	192,000
Shelby	14	55,150	20,000	75,150
Stark	...	...	150,000	150,000
Summit	30	262,000	38,000	300,000
Trumbull	1	39,000	111,000	50,000
Tuscarawas	5	97,000	53,000	150,000
Union	7	38,500	20,000	58,500
Van Wert	3	5,400	...	5,400
Vinton	...	...	...	...
Warren	8	116,000	8,000	124,000
Washington	9	56,000	9,000	65,000
Wayne	60	37,800	12,170	50,000
Williams	11	7,900	...	7,900
Wood	...	...	25,000	25,000
Wyandot	13	11,500	15,000	26,500

Akron, Ohio—Bids will be received by the Board of County Commissioners until Apr. 24, for the construction of North Howard St. Bridge over the Cuyahoga River. The estimated cost is $78,000. C. B. Brower is the County Clk. Noted Feb. 6.

Cincinnati, Ohio—The City Council is considering the construction of a viaduct from Elberon and State Aves., to Sixth and Baymiller Cts. The proposed viaduct will be about 7000 ft. long, and will cost approximately $1,000,000.

Columbus, Ohio—A new bridge about 250 ft. long will be built over the Big Darby on the National Road, to replace the one recently washed out by the flood. It will be built jointly by Franklin and Madison Counties.

Zanesville, Ohio—Bids will be received at the office of the county Auditor until 11 a.m., May 3, for repairing the Monroe St. Bridge. H. H. Kennedy is the County Clerk.

✚Champaign, Ill.—The contract for the construction of a concrete bridge in Condit and Newcomb Townships has been awarded to the DOGGAN CONSTRUCTION CO., Arcola, Ill., at $11,083. The bridge will be 256 ft. long, will be constructed of concrete and will have five arches.

Fairfield, Ill.—The citizens of Mound Township have voted in favor of issuing bonds for $10,500 for the purpose of constructing concrete bridges.

Moline, Ill.—The sum of $7000 has been appropriated for the purpose of repairing the Rock River Bridge. Lyle Payton is the City Engr.

Ottawa, Ill.—Bids will be received by A. E. Bach, County Clk., Ottawa, until 1 p.m., Apr. 30, for the construction of a concrete bridge over Hulinger Creek, in the town of Deer Park.

Eau Claire, Wis.—According to press reports, the citizens voted Apr. 1, in favor of issuing bonds for $75,000 for the construction of a bridge over the Chippewa River.

Janesville, Wis.—The Common Council has authorized plans for the construction of a new concrete bridge over the Rock River. The estimated cost is $75,000. James Fathers is the Mayor. C. V. Kerch is the City Engr.

Milwaukee, Wis.—Plans are being prepared for the erection of a steel and concrete bridge over the Milwaukee River on the Port Washington Road. It will be 285 ft. long and 60 ft. wide. The estimated cost is $80,000. Louis G. Widule is the County Clerk.

Forest City, Iowa—We are officially advised that the contract for the construction of the steel and concrete bridge across Lime Creek has been awarded to the IOWA BRIDGE CO., Des Moines, Iowa, at $3488. The other bidders were: Minneapolis Bridge Co., Minneapolis, $4797, and the Miller-Hey Construction Co., Waterloo, $3668. C. K. Nelson is the County Audr. Noted Apr. 3.

Albert Lea, Minn.—According to press reports, the proposition to erect a 60-ft. span bridge is under consideration. William Barneck is City Engr.

✚Manhattan, Kan.—We are officially advised that the contracts for bridge work in Riley County have been awarded to JOHN P. BLAIR, Manhattan, Kan., CANTON BRIDGE CO., Kansas City, Mo., and B. CLARK, Keats, Kan. Noted Mar. 20.

Yates Center, Kan.—The Misouri Pacific Ry. is considering the construction of a 90-ft. steel bridge, one 60-ft. and one 30-ft. span, over a branch of the Neosho River at Durand, about four miles west of this place. E. P. Mitchell, St. Louis, Mo., is the Ch. Engr.

Selby, S. D.—We are officially advised that the contract for bridge construction during the year, has been awarded to the HENNEPIN BRIDGE CO., Minneapolis, Minn. H. A. Taylor, Selby, is County Audr. Noted Mar. 27.

Dickinson, N. D.—The proposition to erect a steel and concrete bridge to cost approximately $7000 is under consideration. J. E. Hughes is the County Audr.

✚Conway, Ark.—The contract for the construction of a new steel bridge across the Codron River, near Mt. Vernon, 20 miles northeast of Conway, has been awarded to the JOLIET BRIDGE & IRON CO., Joliet, Ill. The bridge will be about 160 ft. long.

Pocatello, Idaho—The Board of County Commissioners of Bannock County will receive bids until 1 p.m., Apr. 18, for the removal of the present 324-ft. steel bridge at or near Vaughn's ford, to a site about 900 ft. up stream, erecting five sets of piers and constructing an additional 108-ft. span. Plans and specifications are on file at the office of E. G. Gallett, County Clk.

Aberdeen, Wash.—Bids will probably be asked some time in May for the construction of a steel bascule bridge over the Washkah River. It will be about 150 ft. long and 60 ft. wide. The estimated cost is $95,000. P. S. Clark is the City Clerk. Noted Apr. 3.

Kennett, Calif.—The Kennett Chamber of Commerce has applied to the Board of Supervisors for an appropriation of $30,000 for the purpose of building a new bridge.

Modesto, Calif.—Press reports state that the concrete bridge over the Tuolum River near Modesto was recently damaged by the floods. The estimated cost of repairs is $5000.

Olive, Calif.—The Board of Supervisors has made an appropriation of $60,000, for the construction of a new concrete bridge over the Santa Ana River at Olive.

San Diego, Calif.—Bids will soon be asked for the construction of a concrete bridge over the San Diego River at Old Town. D. K. Adams is Supt. of Sts. and W. M. Rumsey is City Engr. Noted Apr. 3.

San Francisco, Calif.—The Atchison, Topeka & Santa Fé Ry. Co. will construct a single-leaf trunnion bascule bridge across Islais Creek at Kentucky St.

Victoria, B. C.—Bids will be received by J. E. Griffith, Engr. Pub. Wks., until May 7, for the construction of a steel and concrete bridge over the Thompson River.

✚Toronto, Ont.—The contract for the construction of the concrete piers, abutments and floor of the St. Clair Ave. Bridge, east of Bathurst St., has been awarded to SCOTT & LAW, Toronto, at $27,000. Noted Mar. 20.

Lytton, B. C.—Bids will be received by the Minister of Public Works, Victoria, B. C., until May 7, for the construction of a concrete arch across the Thompson River at Lytton.

WATER SUPPLY—IRRIGATION

New Durham, N. H.—We are officially advised that the bill chartering the New Hampshire Water Supply Co. to take water from Merrymeeting Lake, to supply Rochester, Somersworth, Dover, Portsmouth and other cities and towns, was passed by the State Legislature, Apr. 2. It is intended to sell water at wholesale meter rates to municipalities now inadequately supplied. The season will be contracted for this season, but the date for receiving bids has not yet been determined. The system will involve the construction of 38 miles of 16- to 24-in. mains, and is estimated to cost $1,000,000. Dudley & Sawyer, Manchester, N. H., are Consult. Engrs.

★✚Amherst, Mass.—The contract to furnish about 140 tons of 8-, 12- and 16-in. c.i. pipe has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Philadelphia, Penn. Bids were opened Mar. 29. Noted Mar. 27.

Boston, Mass.—Bids will be received by the Departmentof of Public Works until Apr. 18, for laying 1375 lin.ft. of 10- and 12-in. water pipe in Arlington, Claredon and Stuart Sts., and for relaying 5350 ft. of 12-in. water pipe in West River and Readville Sts. L. K. Rourke is Comr. Pub. Wks.

Boston, Mass.—We are officially advised that the contract to furnish 2,730,000 lb. of iron castings has been awarded to DAVIS & FARNUM, Waltham, Mass., at $85 per ton. The only other bid received was submitted by the Warren Foundry & Machine Co., at $62, for No. 1 castings, and $60 for No. 2. Bids were opened by the Supply Department, Apr. 6. Noted Apr. 3.

✚Easthampton, Mass.—We are officially advised that the contract to furnish about 150 tons of c.-i. water pipe has been awarded to R. D. WOOD & CO., Philadelphia. The contract to furnish 1½ miles of clay sewer pipe has been awarded to J. P. RYAN, Easthampton. Bids were opened Mar. 25. Noted Mar. 20.

Fall River, Mass.—The Water Department plans to purchase a steam or electricaly operated pump of 6,000,000 gal. daily capacity. J. A. Kay is Mayor.

Greenfield, Mass.—We are officially advised that the Water Department contemplates the construction of a pumping station, an open well, 2600 ft. of 16-in. force main, and a small diversion dam on the Green River. George F. Merrill is Supt. Noted Apr. 3 and Apr. 10.

Middleboro, Mass.—According to press reports, bids will be received by the city until Apr. 21, for constructing a concrete aërator, a covered, slow, sand filter and filtered water basin, with appurtenances. Estimated cost, $14,000. R. Spurr Weston, 14 Beacon St., Boston, is Consult. Engr. Noted Feb. 27.

North Andover, Mass.—Charles E. Johnson, Supt. Pub. Wks., will probably soon ask bids for furnishing water pipe. The pipe will be laid by day labor. Estimated cost, $6000.

Randolph, Mass.—The Water Department contemplates the installation of a high duty pump and boiler, estimated to cost $15,000. W. F. Barrett is Chn. Water Comn.

Fayetteville, N. Y.—The Village Board contemplates extending its water mains to the Onondaga Golf and Country Club, supplying property owners along the way. Estimated cost, $6000.

Honeoye Falls, N. Y.—Bids will be received by the Board of Village Trustees until 8 p.m., Apr. 24, for constructing a municipal water system, according to plans and specifications on file with A. M. Neal, Village Clk. The plans provide for 5½ miles of mains, a pumping station and an elevated tank. White & Getman, Mutual Life Bldg., Buffalo, N. Y., are Consult. Engrs.

Little Falls, N. Y.—C. J. Dempster, City Engr., recommends the construction of a filtration plant for the water system. Estimated cost,$20,000.

★New York, N. Y.—Bids will be received by the Board of Water Supply until 11 a.m., Apr. 29, for Contract 91, furnishing, delivering and installing racks, stop shutters, screens, lifters and other apparatus in gate chambers along the Catskill Aqueduct. Charles Strauss is Pres.

For bids on Contract 105, Catskill Aqueduct, see table under Contract Prices.

Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., Apr. 21, for the following: Section 1, for furnishing, delivering and laying highest pressure fire service mains and appurtenances in 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32d, 33d and 34th Sts., and in Madison, Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, 11th, 12th and 13th Aves. Section 2, furnishing, delivering and laying high-water pressure fire-service mains and appurtenances in Bayard, Baxter, Broome, Bowery, Elizabeth, Elm, Houston, Hudson, Mott, Mulberry, Prince, Spring, Stone, West and Worth Sts., and West Broadway, including furnishing, delivering and installing motor operated valves, waterproof valve vaults and subsidiary ducts on the Bowery, Hudson St. and Stone St., and subsidiary ducts and service boxes at the Oliver St. and the Gansevoort St. high-pressure pumping stations. Specifications are on file at the office of Engineering News, 505 Pearl St., New York. This letting has been postponed from Apr. 9. Noted Mar. 27.

See item under Buildings.

✚West Winfield, N. Y.—We are officially advised that the contract to construct a municipal water system here has been awarded to JOHN SIEGRIST, Utica, N. Y., at $6447. Bids were opened by the Village Trustees, Apr. 1. Noted Mar. 6.

Chatham, N. J.—The Common Council has received the following bids for additions and alterations to the municipal electric-light and water plant: William M. Sheehan & Co., New York, $34,810; Blackall & Baldwin Co., New York, $34,890; Portland Engineering Co., $36,000; for individual items the following were received: Two 150 hp. water tube boilers E. Keeler & Co., $5200; J. D. Dranger Co., $5420; Heincke Co., $5608; Jersey City Iron Works, $5653; tandem-compound Corliss engine, and three-phase generator, Ridgeway Dynamo & Engine Co., $8955; engine only, Jersey City Iron Works, $7929; steam turbo-generating set, 100 kw., Westinghouse Electric & Mfg. Co., $5990; 150 kw., $6792; steam generating set, George D. Atwood Co., $4973; 500,000- and 750,000-gal.

pumps, with motors, Gould Mfg. Co., $7220; chimney, Berman & Lehman, $1570. Noted Apr. 3.

Garfield, N. J.—Bonds for $85,000 were voted, Apr. 3, for improving the municipal water system, and purchasing 16 acres of land, installing wells, pumps, machinery and pipe lines. A. L. Pettersen, Post Office Bldg., Passaic, N. J., is Consult. Engr. Frank Romondia is Boro. Clk. Noted Apr. 3.

New Brunswick, N. J.—The Common Council has appropriated $8000 for extensions to the water system.

Lebanon, Penn.—According to press reports, the Lebanon Valley Consolidated Water Supply Co. will issue bonds for $600,000 to pay for proposed improvements and extensions. C. David Gring, Perry County, is Pres.

Washington, D. C.—Bids will be received by the Commissioners of the District of Columbia until May 1, for furnishing and delivering 10,000 ⅝-in. water meters. Cuno H. Rudolph is Chn.

Goldsboro, N. C.—Bids will soon be asked for laying about 6000 ft. of 6-in. water mains and 5000 ft. of sanitary sewers. W. E. Gehres is City Engr. Noted Jan. 16.

Washington, N. C.—According to press reports, an election has been called for May 5, to vote on a bond issue of $150,000, for installing water and sewer systems.

Atlanta, Ga.—At a recent meeting of the City Council the members discussed a proposition to bring a water supply from the mountains of Hall County. The city obtains its present supply from the Chattahoochee River, but it is thought that this supply will soon be inadequate owing to the city's growth. W. Z. Smith is Gen. Mgr. Water Bd.

Marshallville, Ga.—The proposition to issue bonds for $20,000, for the installation of a water system here was defeated at the recent bond election. J. O. Boonton is Mayor. Noted Mar. 27.

Tuscaloosa, Ala.—The City Commissioners have accepted the plans prepared by Morris Knowles, Consult. Engr., Pittsburgh, Penn., for the installation of a filtration plant, estimated to cost from $15,000 to $20,000. Noted Nov. 7.

Georgetown, Miss.—Bonds for $7500 have been voted for the installation of a water system here. Noted Mar. 20.

Richton, Miss.—The town contemplates the installation of a water system. For particulars address the Mayor.

Rayville, La.—The city is receiving bids for a franchise for a water system and electric-light plant here. C. A. Smith, Secy. of the Progressive League is interested in the matter.

✦Arlington, Tenn.—The contract to construct a water system here has been awarded to the WEST TENNESSEE CONSTRUCTION CO. Goodwyn Institute Bldg., Memphis, Tenn., at approximately $15,000. Bids were opened Mar. 7. R. C. Huston & Co., Exchange Bldg., Memphis, Tenn., are Consult. Engrs. Noted Apr. 13.

Rockwood, Tenn.—Pollard & Ellms, Consult Engrs., Miles Greenwood Bldg., Cincinnati, Ohio, are investigating the water system here, and will make recommendations for improvements.

Madisonville, Ky.—We are officially advised that bids will be received by the Board of Public Works until Apr. 30, for constructing water and sewer systems here. These contracts were to have been awarded Apr. 2, but were deferred on account of the floods. C. H. Jenks, Union City, Tenn., is Consult. Engr. W. J. Dulin is Secy. of Bd. Noted Mar. 13.

Canton, Ohio—The Water Department contemplates the installation of a 2,000,000-gal. pump. P. H. Weber is City Engr.

Oberlin, Ohio—Plans have been prepared for extending the water system, relaying the conduit and purchasing new pumps. Estimated cost, $12,000. W. F. Schickler is Supt. Water Dept.

Willoughby, Ohio—Bids will be received by the Board of Public Affairs until noon, May 10 for furnishing two raw water pumps, according to plans and specifications to be obtained from the Clerk of the Board of Affairs. Plans and specifications are on file at the office of Burgess & Long, Consult. Engrs., Columbus, Ohio.

Youngstown, Ohio—According to press reports, bids will be received by D. J. Jones, City Audr., until 2 p.m., May 5, for the purchase of $72,000 water-works bonds.

LeClair, Ill.—According to press reports, bids will be received by the City Clerk until Apr. 17, for constructing water and sewer systems here.

Melrose Park, Ill.—Bids will be received by the Village Board until Apr. 21, for constructing a municipal electric-driven pumping plant for the water system, to consist of two complete air-lift systems, three horizontal single-stage turbine pumps and motors, switchboard, transformers, piping, wiring, etc. C. C. McLain, Melrose Park, is Engr. John Engbrecht is Clk. Village Bd.

Dodgeville, Wis.—The Water Committee of the City Council has recommended the construction of a 150,000-gal. reservoir.

Guthrie Center, Iowa—Bids will be received by the Town Clerk until 1 p.m., Apr. 22, for extending the water system, according to specifications on file at the office of the City Clerk.

✦Miles, Iowa—We are officially advised that the contract to construct a water system here has been awarded to W. D. LOVELL, Minneapolis, Minn., at $9365. The other bids were: Moffatt Co., Des Moines, $9573; Des Moines Bridge & Iron Co., Omaha, Neb., $10,415; C. W. Boland Co., Des Moines, $10,619. Bids were opened by the city Apr. 10. Charles P. Chase, Clinton, Iowa, is Consult. Engr. Noted Apr. 3.

Sioux City, Iowa—Fred Smith, City Engr., is preparing plans and specifications for the Perry Creek conduit. Estimated cost $75,000. Bids will probably soon be asked on this contract.

Walters, Minn.—The village has voted to install a water system and wishes to communicate with contractors in that line. Address the State Bank of Walters.

Jewell, Kan.—Bids will be received about Apr. 20, for the construction of a water system here. Estimated cost, $40,000. E. E. Harper, Grand Ave. Temple, Kansas City, Mo., is Consult. Engr. O. E. White is City Clk. Noted Jan. 23.

Scott, Kan.—The Alamo Engine & Supply Co. is preparing plans for the construction of a water system and an electric light plant here. Estimated cost, $35,000. J. A. Hollister is Mayor. Noted Jan. 7.

Topeka, Kan.—E. B. Stotts, Comr. Pub. Wks., has completed plans for the installation of a water system with drinking fountain attachments, for Westlawn Park.

Billings, Mont.—Bids will be received until June 3, for purchasing $575,000 bonds for the proposed water system, for which plans are being prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo. The system will include a 5,000,000-gal. pump, 37 miles of mains, 326 hydrants, and ten 500,000-gal. filters.

Cut Bank, Mont.—The Gerharz-Jacqueth Engineering Co., Billings, Mont., has been retained to prepare plans for a municipal water system and electric-light plant here. Estimated cost, $50,000.

Fromberg, Mont.—An election will probably soon be called to vote on a bond issue of $12,000 for the installation of a water system.

Maryville, Mo.—Bids will be received by H. L. Flynt, Supt. W.-Wks., until Apr. 28, for improving the water system. Plans as prepared by Hiram Phillips, Liggett Bldg., St. Louis, Mo., provide for the following: Furnishing one high-duty 90,000,000-ft.-lb. compound-condensing, horizontal duplex pump, two low-service pumps, centrifugal, two 100-hp. boilers, one 50,000-gal. pressure filter, one feed-water heater, one feed pump; repairing the standpipe and a concrete dam.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until Apr. 22, for the following: Furnishing and delivering at the City Pipe Yard, c. i. coated water pipe, 240 tons c. .i coated special castings, 296 3-, 4-, 6-, 12-, 20- and 36in. stop valves, and 20 6-in. special tapping valves, 175 fire plugs and 500 post fire-plug top arts; also making excavations, hauling and laying 71,030 ft. of 6-, 12-, 20- and 36-in. water pipe. Edward E. Wall is Water Comr.

✦Clarksville, Ark.—The contract to construct water and sewer systems here has been awarded to the FOUNTAIN SHAW ENGINEERING CO., Dallas, Tex. Estimated cost, $45,000. Bids were opened Mar. 28. Noted Mar. 13.

Fort Worth, Tex.—Bonds for $300,000 have been voted for improving the water system. Noted Mar. 13.

Richardson, Tex.—Tentative plans have been prepared for installing a municipal water system and electric-light plant here.

Port Arthur, Tex.—The Port Arthur Rice & Irrigation Co. has adopted plans for extensive improvements to its irrigation pumping plant near here. The proposed work will cost about $40,000.

Grandfield, Okla.—E. R. Kerby, Consult. Engr., Lawton, Okla., is preparing plans for improving the water system here.

Salt Lake City, Utah—The City Commission has adopted a resolution authorizing Sylvester Q. Cannon, City Engr., to make an investigation of the various possible methods of increasing the city's water-supply, and to report his findings, and submit plans and recommendations to the Commission. W. H. Korns is Comr. W.-Wks. Noted Mar. 20.

Ephrata, Wash.—L. H. Pruitt has been granted a 50-year franchise to install and operate a water system here.

North Yakima, Wash.—According to press reports, the Pacific Power & Light Co. contemplates improvements and extensions to its system here, estimated to cost $250,000.

Seattle, Wash.—A. H. Dimock, City Engr., has filed plans and specifications for the construction of a dam at Camp No. 2, Cedar River Watershed. Bids will soon be asked on this contract.

Burbank, Calif.—Bonds for $70,000 have been voted for installing a municipal water system and electric-light plant here. Noted Jan. 16.

✦Fullerton, Calif.—A contract to furnish machinery for the pumping plant of the municipal water system, has been awarded to the HENRY R. WORTHINGTON CO., Los Angeles, Calif., at $10,250.

Monrovia Calif.—The city contemplates constructing a 1,500,000-gal. reservoir on North Ivy Ave. to cost about $8000.

Planada, Calif.—The Planada Development Corp. is preparing to lay two miles of 12-in. concrete pipe. J. F. Lambert is Supt.

Tulare, Calif.—Bids will be received by E. Oakford, City Clk., until 8 p.m. May 5, for constructing a hemispherical bottom steel tank and tower with accessories, a system of water mains and accessories. Sloan & Robson, Nevada Bank Bldg., San Francisco, are Consult. Engrs. Noted Apr. 13.

Woodland, Calif.—The city contemplates an expenditure of $30,000, for improving the water system. Sloan & Robson, Nevada Bldg., San Francisco, are Consult. Engrs.

London, Ont.—Bids will be received by the Board of Water Commissioners until noon, May 1, for furnishing the following: 1450 tons of 4-in., 6-in., 8-in. 10-in. 12-in. c. i. pipe, 94 valves and 20 tons of special castings; 75,000 lb. pig lead; 64,000 lb. lead pipe; 3000 lb. Russian jointing hemp. Specifications and blank forms may be obtained from H. J. Glaubitz, Gen. Mgr., Ed Water Comrs.

SEWERS

Waterville, Maine—The Water Department contemplates the construction of approximately 600 ft. of 66-in. trunk sewer, estimated to cost $7000. John H. Burleigh is City Engr.

South Royalton, Vt.—According to press reports, bids will be received by A. G. Whitham, Town Treas., until Apr. 19 for constructing a sewer system here, estimated to cost $5000. Walker, Walker & Goodrich, Montpelier, Vt., are Consult. Engrs.

Acushnet, Mass.—The town has voted an appropriation of $5000 for constructing sewers in Slocum and Nye Sts. James H. Hathaway is a member of the Sewer Com.

Amherst, Mass.—A contract has been awarded to ALLEN, WOODWARD & CO. to furnish the tile pipe required for the new sewer system. W. C. Taunatt, Jr., Easthampton, Mass., is Engr. Noted Mar. 20.

✚Boston, Mass.—We are officially advised that the contract to construct a 24x36-in. concrete sewer in Winchester, has been awarded to TONY ROSS, 43 Oak St., Winchester, at $37,555. The other bids were: J. H. Ferguson, Boston, $39,-116; McCarthy & Walsh, East Boston, $41,077; Michael Russo & Son, Boston, $46,567; The Conners Bros. Co., Lowell, $50,-$10; Colemas Bros., Boston, $50,690; A. G. Tomasello, Boston, $52,292; G. M. Bryne Co., Boston, $53,583. Bids were opened by the Metropolitan Water and Sewerage Board, Mar. 28. W. N. Davenport is Secy. Noted Mar. 20.

Bids will be received by the Department of Public Works until Apr. 22, for constructing sewers in Neponset Playground, Dorchester District. L. K. Rourke is Comr.

Fitchburg, Mass.—We are officially advised that the sewage disposal plant to be installed in South Fitchburg is estimated to cost from $200,000 to $300,000. The plant will be of the Imhoff type. Plans are being prepared by Metcalf & Eddy, Consult. Engrs., 14 Beacon St., Boston. David A. Hartwell is Ch. Engr., Sewerage Comn. Noted Apr. 3.

✚Northbridge, Mass.—The contract to construct the Linwood extension of the sewer system has been awarded to C. E. TRUMBULL & CO., Boston, Mass., at $14,143. The other bids were: N. S. Brock, Boston, Mass., $19,051; Robert C. Allen, Worcester, Mass., $15,382; McCarthy & Walsh, East Boston, Mass., $17,335; John E. Palmer, Boston, Mass., $16,-823. The contract to furnish pipe was awarded to the R. D. WOOD CO., Philadelphia, at $25.95 per ton for c.i. pipe and 2½c. per lb. for fittings.

South Hadley, Mass.—We are officially advised that plans have been prepared and submitted to the township authorities, by Waring, Chapman & Farquhar, Consult. Engrs., 874 Broadway, New York, N. Y., for the construction of a system of pipe sewers throughout the town. The plans call for a system about ten miles long. Bids will be received as soon as the necessary action has been taken by the township. The estimated cost is $50,000.

★Westfield, Mass.—Bids will be received by the Board of Selectmen until 11 a.m., Apr. 23, for furnishing about 12,000 lin.ft. of 6- to 18-in. sewer pipe. John L. Hyde is Town Engr.

Ansonia, Conn.—Plans are being prepared for constructing sewers in Division, Factory and Holbrook Sts. Estimated cost, $6000. V. E. Clarke is City Engr.

✚Bridgeport, Conn.—Contracts for constructing sewers here have been awarded by the Paving and Sewer Commission, as follows: to Fairfield Ave., to ANGELO CONTI & CO., 60 Temple St., Hartford, at $5900; in Sherman St., to B. D. PIERCE, Jr., 122 Bank St., Bridgeport, at $1162. Noted Mar. 27.

Hartford, Conn.—Roscoe N. Clarke, City Engr., is preparing plans for constructing sewers in the Maple Ave. District. Estimated cost, $55,000. See also item of Apr. 3.

Plainville, Conn.—At the recent annual meeting of the Sanitary and Sewer District, plans were presented for extensive additions to the sewer system. Joseph N. McKernan, 95 West Main St. is Engr.

Binghamton, N. Y.—Bids will probably soon be asked for the construction of a salt-glazed, vitrified sewer in Broad Ave. Estimated cost, $5325. F. M. Hopkins is City Clk.

New York, N. Y.—Bids will be received by George Cromwell, Pres. Boro. of Richmond, until Apr. 22, for constructing sewers in various streets.

✚Palatine Bridge, N. Y.—The contract to construct a sewer system and sewage disposal plant here has been awarded to MARTIN & MILLER, Passaic, N. J. Bids were opened Mar. 22. Morrell Vrooman, Gloversville, N. Y., is Consult. Engr. Noted Mar. 6.

Scarsdale, N. Y.—We are officially advised that the plans prepared by Waring, Chapman & Farquhar, Consult. Engrs., 874 Broadway, New York, N. Y., for the construction of an entire new sewer system have been accepted by the town. Bids for the work will be advertised as soon as the necessary legal steps are taken. The estimated cost is $65,-000.

✚Schenectady, N. Y.—The lowest bid received by the Board of Contract and Supply, Apr. 2, for laying about 30,000 ft. of sewers, was submitted by the Kellam & Shafer Co., Schenectady, at $63,716. The bids have been held over for further consideration. It is possible that all bids will be rejected as too high, and the contract readvertised. Noted Mar. 27.

East Orange, N. J.—We are officially advised that the following bids were received by the Essex County Park Commission, 810 Broad St., Newark, for the construction of a storm water drainage system on Park Ave., in East Orange: D'Amato & Stefanellifi 74 Summer Ave., Newark, $11,794; George P. Olcott & Co., Metropolitan Bldg., East Orange, $12,-518; Harrison & Craig, 837 Broad St., Newark, $13,098; Thomas J. Schriver, 28 Boyden St., East Orange, $131,64; Tony Costa, 108 Henry St., Orange, $13,190; James A. Christie, 38 Thomas St., Newark, $15,625; Joseph Befinino & Co., 13 Stenten St., East Orange, $13,829; Charles Ippolito, Montclair, $14,473; Robert W. Smith Corp., 136 Liberty St., New York, N. Y., $16,132; Pasquale Manvillo, 3 Hurlburt St., Orange, $17,696. Bids were received Apr. 8.

✚Jersey City, N. J.—We are officially advised that the contract to construct a sewer in Wales Ave., has been awarded to CHARLES O'NEILL, 62 Wegan Pl., Jersey City. Bids were opened by the Board of Street and Water Commissioners, Apr. 7. Noted Apr. 3.

★Newark, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., Apr. 29, for constructing the three portions of Section 6 of the main intercepting sewer in the city of Newark. The contract involves the following: Central portion. Item 1, earth excavation and refilling in trench, for 150-in. sewer, 1400 lin.ft. Item 2, concrete masonry, in trench, portland cement mortar, 4500 su.yr. Item 3, brick masonry, in manholes, laid with portland cement mortar, and appurtenant work, 50 cu.yd. Item 4, rock excavation, in trench, 300 cu.yd. Northerly portion. Item 1, earth excavation and refilling in trench, for 150-in. sewer, 1600 lin.ft. Item 2, concrete masonry, in trench, portland cement mortar, 4600 cu.yd. Item 3, brick masonry, in manholes, laid with portland cement mortar, and appurtenant work, 50 cu.yd. Item 4, rock excavation, in trench, 300 cu.yd. Item 5, furnishing, placing and maintaining steel and timber sheeting, etc., between Station 26 + 75 and 28 + 76. Lump Sum. Southerly portion: Item 1, earth excavation and refilling in trench, for 150-in. sewer, 1700 lin.ft. Item 2, concrete masonry, in trench, portland cement mortar, 5500 cu.yd. Item 3, brick masonry, in manholes, laid with portland cement and mortar, and appurtenant work, 100 cu.yd. Item 4, rock excavation, in trench, 7000 cu.yd. Drawings, form of contract and specifications, and blank form for proposal may be obtained at the commissioners' office from William M. Brown, Ch. Engr.

✚Trenton, N. J.—We are officially advised that contracts for constructing sewers in various streets have been awarded as follows: Roosevelt and Indiana Aves, and Liberty St. sewers, to GIBBS & MORGAN; Ellsworth and Logan Ave. sewers, to ANTONIO DEBUCIA; Wayne Ave. sewer, to McGOVERN CONTRACTING CO. Bids were opened Apr. 4. Noted Apr. 3.

Westmont, N. J.—The Town Council contemplates the installation of a municipal sewer system and sewage disposal plant.

Beaver Falls, Penn.—We are officially advised that bids will be received by the Town Council until 8 p.m., Apr. 22, for purchasing $10,000 bonds issued for constructing a sanitary sewer system and appurtenances. Thomas McKee is Pres. and W. F. Rayle Secy. of Council. Noted Sept. 5.

✚New Kensington, Penn.—The contract to construct a storm sewer in Stanton Ave. has been awarded to TONY MARTIN, New Kensington, at $12,073. The other bids were: William J. Paine, $15,648; M. O'Herron Co., $15,601 and Ott Bros. Co., $15,243.

Lewiston, Penn.—According to press reports, George A. Flink, Consult. Engr., Commonwealth Bldg., Harrisburg, Penn., is preparing plans for a sewage disposal plant here, estimated to cost $30,000. J. H. Saxton is Boro. Clk.

Pittsburgh, Penn.—Bids will be received by Joseph G. Armstrong, Dir. Pub. Ser., until Apr. 18, for constructing sewers in Ellsworth Ave. and other streets.

✚Scranton, Penn.—A contract to construct a sewage disposal plant at Hillside Home, has been awarded to LATHROP, SHEA & HENWOOD, New York, at $20,250. The other bids were: New York Sewage Disposal Co., New York, $22,767; Hagen Lumber Co., Scranton, $28,500. Bids were opened by Willard Matthews, Pres. Scranton Poor District, Apr. 1. Noted Mar. 20.

✚Somerset, Penn.—We are officially advised that the contract to construct a sewage disposal plant at the County Home and Hospital for the Insane has been awarded to PITT CONSTRUCTION CO., Pittsburgh, Penn., at $43,000. Bids were opened by the Commissioners of Somerset County, Apr. 3. Noted Mar. 27.

Uniontown, Penn.—We are officially advised that Chester & Fleming, Hydraulic Engrs., Union Bank Bldg., Pittsburgh, Penn., have been retained to prepare plans for a sewage treatment plant at the Fayette County Home in Uniontown.

✚✚Baltimore, Md.—A contract has been awarded by the Board of Awards, to McCARTHY & O'HERRON, 121 Pearl St., Baltimore, for the construction of storm-water sewers, under contract 26, at $241,247, requiring 3000 lin.ft. of 78x38-in. to 54x36-in. rectangular masonry drains, 11,200 lin.ft. 48-in. to 30-in. circular masonry drains, 365 lin.ft. 30-in. to 20-in. c.-i. pipe drains, 26,500 lin.ft. 24-in. to 22-in. terra-cotta pipe drains, 10,300 ft. 18- to 12-in. inlet connections, 215 manholes, and 420 inlets. Noted Mar. 20.

✚Charlotte, N. C.—The contract to construct about 18,221 ft. of 8- to 24-in. sewers and drains here has been awarded to DABBS & MYERS, Charlotte, at $15,049. Bids were opened by the Executive Board, Apr. 2. Noted Mar. 27.

Goldsboro, N. C.—See item under Water Supply—Irrigation.

Washington, N. C.—See item under Water Supply—Irrigation.

Americus, Ga.—Bonds for $10,000 have been voted for constructing sewers here.

Orlando, Fla.—Bids will be received by the Sewerage Committee until 8 p.m., May 1, for constructing a sewer system, according to plans and specifications on file at the office of G. R. Ramsey, City Engr. The system will comprise 26½ miles of sanitary sewer and 3000 ft. of storm sewer, also Imhoff tanks and appurtenances. George W. Fuller, New York, is Consult. Engr. Noted Mar. 13.

Ruston, La.—Bids will be received by the city until May 15, for constructing a complete sewer system here. Bonds for $40,000 were voted for this work, last year. Noted Nov. 14.

Cleveland, Tenn.—The Solomon-Norcross Co., Atlanta, Ga., is preparing plans for the installation of a sewer system here, estimated to cost $75,000. T. E. Thatch is Mayor. Noted Apr. 13.

Park, Tenn.—Tentative plans are being considered for installing a sewer system here, estimated to cost $10,000.

Madisonville, Ky.—See item under Water Supply—Irrigation.

Barberton, Ohio—The city contemplates the construction of about ten miles of storm sewers in Storm Sewer District No. 3. Estimated cost, $45,000.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, Apr. 25, for constructing main and lateral sewers and drains, with appurtenances, in Montana Ave.

✚The contract to construct sewers and drains in Glenway Ave., has been awarded to WELLING & FRANZ, Cincinnati, at $71,616.

Cairo, Ill.—Bids will be received by the Board of Local Improvements until 10 a.m., Apr. 17, for constructing sewers according to plans and specifications on file at the office of G. F. Dewey, City Engr.

Fostoria, Ohio—We are officially advised that the proposed Improvements to the sewage disposal plant, for which R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, is preparing plans, is estimated to cost $40,000. Charles Latshaw is Ch. Engr., Dept. of Sewers. Noted Mar. 6.

Springfield, Ohio—Bids will be received by E. D. Seggerson, City Clerk, until noon, Apr. 30, for laying sewers in and paving several streets.

Shelby, Ohio—Bids will be received by the Village Clerk until noon, Apr. 21, for constructing a storm sewer.

Toledo, Ohio—Bids will be received by the Commissioners of Lucas County until noon, Apr. 29, for constructing Main Sanitary Sewer No. 2 of Subdistrict No. 3 in Lucas County. Plans and specifications are on file at the office of William H. Plate and specifications are on file at the office of William H. Gould, Sanitary Engr., Toledo. Charles J. Sanzenbacher is County Audr.

According to press reports, plans are being prepared by G. W. Tonson, City Engr., for constructing an intercepting sewer along Swan Creek. The sewer will be from 5 to 6 ft., of brick, concrete or interlocking tile, and is estimated to cost $400,000.

Marion, Ind.—The city proposed to construct a combined storm and sanitary sewer from the Canton Glass factory to the Mississinewa River.

Lansing, Mich.—The City Engineer has been instructed by the City Council to prepare plans for the construction of sewers in Garden and other streets.

Mount Clemens, Mich.—Bids will be received by the Board of Public Works until Apr. 18, for constructing trunk sewers in North Ave., Clemens and Church Sts. Estimated cost, $50,000. John W. Irwin is City Engr. Noted Feb. 6.

✚**Champaign, Ill.**—We are officially advised that the contract to construct the Fountain Head storm sewer has been awarded to ARTHUR BIRT, Decatur, Ill., at $11,249. The other bids were: J. W. Stipes, Champaign, $11,590; George C. Farrelo, Champaign, $11,811. Bids were opened Apr. 8. Noted Apr. 3.

Fulton, Ill.—Bids will be received by the Board of Local Improvements until 9 a.m., Apr. 19, for constructing about 25,000 lin.ft. of vitrified clay-pipe sewers, ranging from 8 to 30 in. diameter, also 71 manholes, 46 catch basins, four flush tanks and 446 cu.yd. rock excavation. Edward G. Hills is Engr. Noted Apr. 10.

Minooka, Ill.—Bids will be received by the Village Trustees until 7:30 p.m., Apr. 24, for constructing a sewer system, according to plans and specifications on file at the office of James S. Gwynne, Village Clk. The contract involves the following: 4200 lin.ft. 15-in. sewer pipe; 4200 lin.ft. excavation; 3000 ft. 15-in. tile; 960 ft. 12-in. tile; 3890 ft. 10-in. tile; 2275 8-in. tile; 2522 ft. excavation under 6 ft.; 5144 ft. excavation, 6 to 8 ft.; 2359 ft. excavation, 8 to 10 ft.; 100 ft. excavation, 10 to 12 ft.; 2 flush tanks; 21 manholes; 23 catch basins.

Wheaton, Ill.—An election will probably soon be called to vote on a bond issue of $50,000, for constructing a sewage disposal plant. A. L. Webster is City Engr.

✚**Fond du Lac, Wis.**—We are officially advised that the contract to construct sewers and a sewage disposal plant here has been awarded to the E. R. HARDING Co., Racine, Wis., at $63,338. Noted Apr. 13.

Jefferson, Wis.—Bids will be received by the Board of Public Works until 2 p.m., Apr. 26, for constructing storm sewers and appurtenances.

West Allis, Wis.—Bids for laying 300 ft. of 8-in and 19,000 ft. of 6-in. sewers have been received by the Board of Public Works as follows: Herman Hohensee, 8-in. pipe, $1.32, and 6-in. pipe, $1.29; George Zimmerman, $1.30 and $1.09; Beerstoll & Gribbins, $1.52 and $1.32; L. W. Schmith, $1.35 and $1.19.

Burlington, Iowa—According to press reports, bids will be received by the City Council until Apr. 24, for constructing about 23,000 ft. of 8- to 24-in vitrified pipe sewers.

Charlton, Iowa—The city contemplates the construction of approximately 20,000 ft. of 12- to 24-in. sewers. F. W. Trost is City Engr.

Sioux City, Iowa—The City Council contemplates the construction of storm sewers in 21st and Myrtle Sts. Estimated cost $25,000.

✚**Albert Lea, Minn.**—A contract to construct sewers in the Third Ward has been awarded to HLLSTRUP & OLSEN, Minneapolis, Minn., at $15,437.

St. Paul, Minn.—Bids will be received by the Board of Public Works until 5 p.m. Apr. 17 for constructing sewers in Goodrich and Hudson Aves. Walter L. Lemon is Pres.

Anthony, Kan.—Bids will be received about May 1 for constructing a sewer system and sewage disposal plant here, estimated to cost $60,000. E. E. Tibbetts is City Engr.

York, Neb.—The city contemplates an expenditure of $40,000 for construction of storm sewers. A. E. Codding is City Engr.

St. Joseph, Mo.—The Board of Public Works contemplates recommending to the City Council an appropriation of $200,000 for constructing additional sewers. Charles W. Campbell is City Engr.

✚**Clarksville, Ark.**—The contract to construct a sanitary sewer system and sewage disposal plant here has been awarded to the FOUNTAIN SHAW ENGINEERING CO., Dallas, Tex., at approximately $20,000. Winters & Dove are Consult. Engrs. Noted May 13.

Conway, Ark.—Plans have been completed for the construction of a sewer system here, estimated to cost $45,000, and bids will probably be asked early in June. G. H. Burr is Engr., Sewer Dist. Noted Sept. 19.

Vinita, Okla.—Bids will be received by the city until 8 p.m., Apr. 21, for constructing about 7700 lin.ft. of 15-in. vitrified sewer and a reinforced-concrete disposal tank, 41x40x20 ft. Nagel & Petersen, Muskogee, Okla., are Consult. Engrs. J. C. Starr is Mayor.

Salt Lake City, Utah—The City Construction has authorized an expenditure of $34,500, for constructing sewers and paving streets. Richard P. Morris is Street Comr.

The Dalles, Ore.—Bids will soon be asked for furnishing and laying 18,000 ft. of 6- and 12-in. lateral sewers. C. L. White is City Engr.

Santa Ana, Calif.—Bids will be received by J. C. Burke, City Clk., until 5 p.m., Apr. 21, for constructing a sewer system. Specifications call for vitrified salt glazed pipe.

San Diego, Calif.—Bids will probably soon be asked for furnishing about 34,000 lin.ft. of sewer pipe.

Peterborough, Ont.—T. Aird Murray, Consult. Engr., Toronto, Ont., has prepared plans for a sewage disposal plant here, estimated to cost $60,000.

Simcoe, Ont.—Bids will be received by W. C. McCall, Town Clk., until Apr. 23, for constructing sewers, sewage force main, pumping station, pumping machinery, and a sewage disposal plant. Estimated cost, $40,000. Chipman & Powers, Toronto, are Consult, Engrs. Noted Feb. 6.

Sutherland, Sask.—The contract to construct a sewage disposal plant here has been awarded to EDMUND T. SYKES, Neepawa, Man., at $45,000. Noted Feb. 6.

STREETS & ROADS

Boston, Mass.—Bids will be received until Apr. 21 by the Department of Public Works for the construction of tar-macadam roadways in Don and Lithgow Sts., Dorchester, Clement Ave., West Roxbury, and for an asphalt pavement in Lowering Place. L. K. Rourke is Comr.

✚The contract for the construction of 6500 lin.ft. of macadam road in Taunton was awarded by the State Highway Commission to the HORNE-LOWE CONSTRUCTION CO., Worcester, at $11,118. Other bids were: A. Williams & Co., Boston, $11,632; Z. C. Caneden, Lakeville, $12,000, Anthony Corchia, Boston, $12,233, Jos. McCormick, Providence, R. I., $12,715 and T. J. Quinn, Ashton, R. I., $13,695. Arthur W. Dean is Chief Engr.

Bridgeport, Conn.—Bids will be received by the Board of Public Works until 7:30 p.m., Apr. 18, for building a section of highway on the Richmond Road. Plans may be seen at the office of Alfred H. Terry, City Engr., City Hall, Bridgeport.

✚The Paving and Sewer Commission has awarded a contract to the CONNECTICUT HASSAM PAVING CO., 902 Chapel St., New Haven, Conn., for 13,270 sq.yd. of wood block paving on various streets. Bids were received Mar. 31. Noted Mar. 27.

Waterbury, Conn.—Plans and estimates have been prepared by the City Engineer for paving portions of Bank, Meadow, North Elm, Willow and Water Sts., and Exchange Place. The total cost is estimated at $34,050. R. A. Cairns is City Engr. Noted Jan. 2.

New York, N. Y.—The Board of Estimate has appropriated $200,000 for repaving Riverside Drive from 72nd to 110th St., and $100,000 for repaving the West Drive and parts of the East and Middle Drives in Central Park. Chas. B. Stover is Park Comr.

New York, N. Y.—Bids will be received until 2 p.m., Apr. 25, by the President of the Borough of Manhattan, for regulating and repaving Abingdon Sq. and Eighth Ave., from Abingdon Sq. to Columbus Circle. George McAneny is Pres.

New York, N. Y.—We are officially advised that the following are the low bids received by the Dept. of Pub. Wks. on Apr. 8, for paving in various streets: 55th St. from Ninth Ave. to Tenth Ave., and from 11th Ave. to 12th Ave. with granite. Rafferty Bros., 624 West 52nd St., at $24,983; 56th St., from 10th to 11th Aves. with granite, Rafferty Bros., $13,284; 57th St., from First Ave. to Third Ave., with asphalt, Dayton Hedges, 1451 Broadway, at $17,015; 176th St., from St. Nicholas Ave. to Wadsworth Ave., with asphalt, Barber Asphalt Paving Co., Woolworth Bldg., $3127; Broadway, from 92nd to 110th Sts., with sheet asphalt and special granite, Asphalt Construction Co., Madison Ave. and 137th St., at $139,467.

Niagara Falls, N. Y.—The Department of Public Works has ordered the City Engineer to prepare plans and estimates for paving Lockport St. from Main St. to the N. Y. Central R.R. tracks. F. S. Parkhurst, Jr., is City Engr.

Bloomfield, N. J.—We are officially advised that bids for the improvement of Essex Ave. in the town of Bloomfield and borough of Glen Ridge were received as follows: Petro Siola, Glen Ridge, N. J., $6700; Robt. Dorcley, 168 Ridge St., Newark, $6972; Jos. Cestone, Montclair, N. J., $7606; the Consolidated Public Works Co., 2 Rector St., New York, $8014; Alfred Price, Ridgefield Park, N. J., $10,674. The contract will be awarded Apr. 21. Noted Apr. 3.

✚**Jersey City, N. J.**—We are officially advised that contracts for furnishing and delivering road materials were awarded by the Boulevard Commissioners as follows: To the NEW JERSEY OIL WORKS, 292 Summit Ave., Jersey City, at 55c. per gal. for 100,000 gal asphalt road oil, for asphalt road binder-material A in bbls. 0.06½c. in wagons 0.06½c. per gal., material B in bbls. 0.06c. in wagons 0.06c. plus 0.02c. per gal. for delivery and spreading. For stone and sand, sections 1 and 2 were awarded to JOS. MURPHY & SON, 308 Charles St., West Hoboken, N. J., at $1.92 per cu.yd. for stone and $1.75 for sand. For crushed stone, sections 3 and 4, the contract was awarded to AUGUST THIEL, 324 22nd St., Guttenberg, N. J., at $1.62 per cu.yd. The contract for tar road binder was not awarded. J. C. Sweeney is Clk. Noted Mar. 27.

✚We are officially advised that a contract has been awarded to MATTHEW A. CULLEY, 508 Pavonia Ave., Jersey City, for the improvement of Wegman Place. C. A. Van Keuren is City Engr. Noted Apr. 3.

New Brunswick, N. J.—The Common Council has passed a resolution notifying the property owners of its intention to pave portions of about 20 streets this year.

✦Newton, N. J.—We are officially advised that a contract has been awarded by the Board of Freeholders of Sussex County for improving about 3550 lin.ft. of the Newton Stanhope Road to SALMON BROS., at $8566. R. L. Slater is Clk. of the Bd. Noted Mar. 27.

Paterson, N. J.—Bids will be received until 2 p.m., Apr. 23, by the Road Committee of the Board of Chosen Freeholders of Passaic County for repairing and macadamizing various county roads, and for paving various other highways with Tarvia "B." William H. Mason is Chn. of Road Com.

The Board of County Freeholders is planning to macadamize Lakeview Ave., from Crooks to Clifton Aves.

Perth Amboy, N. J.—The City Council has adopted resolutions to authorize the paving of Oak St., Cortlandt St., and Mechanic St., with 2-in. asphalt blocks.

Trenton, N. J.—The City Commission has authorized the paving of sixteen city streets at a cost of about $95,000, and the re-paving of other thoroughfares to the extent of $16,000. Bituminous concrete or sheet asphalt will be called for on the first mentioned; and vitrified brick, Belgian block, and sheet asphalt in the second. The Commission has also authorized the repair of county roads recently placed under its jurisdiction with macadam, bituminous concrete or asphalt. This latter work is estimated to cost about $7000.

✦Chambersburg, Penn.—The Borough Council has awarded a contract to the CENTRAL CONSTRUCTION CO., Harrisburg, at $2.19 per sq.yd. for approximately 15,700 sq.yd. vitrified brick paving and 70c. per lin.ft. for curbing. R. M. Huber is Boro' Engr. Noted Feb. 27.

Dravosburgh, Penn.—Bids as follows were received Apr. 2 by the Street Committee of the Borough Council for the improvement of various streets: Rich Bros., Pittsburgh, $62,429, the J. B. Sheets Co., Pittsburgh, $54,428, Bowman Bros., McKeesport, Penn., $59,196, Thos. Cronin, Pittsburgh, $75,198, Charles Pianting, Trafford City, Penn., $75,721. S. M. Morrison is Chn. of the Com. Noted Mar. 27.

Pitcairn, Penn.—Bids will be received until 8 p.m., Apr. 21, by the Borough Council for the improvement of various streets. The approximate quantities are: 32,500 cu.yds. excavation, 31,600 sq.yds. brick paving, 24,100 lin.ft. curbing and 1000 lin.ft. rough curb. F. H. Travis is Boro. Secy.

Pittsburgh, Penn.—Bids will be received until 10 a.m., Apr. 18, by the City Controller for brick paving on portions of Princess Ave., Aspen and Saline Sts., Canoe and Jordan Alleys; asphalt paving on Ridgeville, Elwood, Fingal and McDonald Sts., Hamilton Ave., asphalt and brick paving on Melvin St.; blockstone and brick paving on Kathleen St.; blockstone paving on Travella Blvd. Jos. G. Armstrong is Dir. Dept. of Public Wks.

Reading, Penn.—Bids will be received until 10 a.m., Apr. 23, by Commissioners of Berks County, for paving the east and west approach of the Lancaster Ave. Bridge and the east approach of the Schuylkill Ave. Bridge. D. H. Hoch is County Controller.

Scranton, Penn.—Bids are being asked by the Director of Public Service for paving portions of Mulberry, Pine, Lafayette, Electric, Maple, New Luzerne, Moosic and Front Sts., Taylor and Prescott Aves., Mahon Court and Ridge Row at an estimated cost of $117,657. William Scheink is City Engr.

Sewickley, Penn.—Bids will be received until 5 p.m., Apr. 21, by the Borough Council for paving Nevin Ave. from Hill St. to the Borough line with vitrified block, about 3035 sq.yds. Minott M. Baker is Acting Engr.

Sharpsburg, Penn.—Bids will be received by the Borough Clerk until 8 p.m. Apr. 21, for grading, paving, repairing and otherwise improving portions of Linden Ave., Clay and Middle Sts. T. J. McGivern is Boro' Clk.

✦Wilkes-Barre, Penn.—A contract has been awarded by the Street Committee to the WARNER-QUINLAN CO., at $2.12 per sq.yd., for 6000 sq.yd. paving on South Washington St., from Northampton to Hazle St. B. K. Finch is City Engr.

Willet, Penn.—Bids will be received until 1 p.m., Apr. 19, by the Supervisors of Washington Township for construction of a road, about 2150 ft. in length. S. M. Fleming, Creekside, Penn., is Secy.

✦Baltimore, Md.—Contracts have been awarded as follows, by the State Roads Commissioners: L. C. MOLLER, Muirkirk, Md., for the construction of 1.37 miles of road in Carroll County, on Meadow Branch Road, at $17,634. To same firm 2:12 miles in Montgomery County, Cedar Grove northward toward Damascus, at $25,732, both to be macadam construction. HASSAM PAVING CO., Worcester, Mass., 2.71 miles of road in Sommerset County, Crisfield to Hopewell, to be of concrete construction at $30,425. To same firm 1.72 miles in Carroll County Tannevtown toward Frizzleburg, of concrete, at $16,853; 2 miles in Talbot County, Easton to Wye Mills, of concrete, at $19,536; 4.80 miles in St. Mary's County, Mechanicsville to Oaks, concrete, at $53,156; and 2 miles in Montgomery County, at $26,852, from southern end of improved road from Ridgeville toward Damascus. To the ELDER PAVING & CONTRACTING CO., Montebello Ave. and Jenkins Lane, Baltimore, Md., for the construction of .49 miles of York Road through Towson, to be bituminous concrete, at $18,348. To LITTLE & SPENCER, Darlington, Md.; .91 mile of road in Harford County, at $7921, from Belair to Conowingo, of macadam construction; RICH & JUSTI, 612 Equitable Bldg., Baltimore, at $17,702 for the construction of 1.46 miles of State Road No. 1. Washington Boulevard, from Sulphur Springs Road to Philadelphia, Washington & Baltimore R.R. at Wimans, to be of macadam construction.

Bids will be received until Apr. 22, by the State Roads Commission, 534 N. Howard Street, Baltimore, Md., for the construction of 3 miles of local and limestone road in Alleghany County, Contract No. 145B; 2.73 miles of gravel road in Charles County under contract No. S-7; 81 mile of gravel road under Contract No. 9153; 8.20 miles of concrete and gravel road Contracts No. 9154 A and B, also in Charles County, 1.63 mile concrete of macadam road in Carroll County, Contract No. 9295-A; 3 miles of local and tunnel-ore road in Garrett County, Contract No. 9165; 5.60 miles of local stone in Harford County, Contract No. G-11. Plans and Specifications obtainable at the office of the State Road Commissioners. Wm. L. Marbury is Secy.

✦Wheeling, W. Va.—The Board of Control has awarded contracts as follows for various street improvements: L. C. HALLOCK & SON CO., at $16,710; COSS & MYERS, $11,561, and WARD & PATRICK, $8876. C. B. Cooke is City Engr. Noted Mar. 13.

★Charleston, S. C.—Bids will be received until 8 p.m., May 6, by the City Council, for about 30,000 sq.yd. wood block, sheet asphalt or other standard pavement on various streets. J. H. Dingle is City Engr.

Atlanta, Ga.—Bids will be received until 3 p.m., Apr. 18, by the Street Committee for the improvement of various streets. The approximate quantities are: 40,000 sq.yd. rock and chert, 19,000 sq.yd. vitrified brick or wood block, 10,000 yd. rubble gutters. R. M. Clayton is Ch. of Const.

Valdosta, Ga.—The City Council plans the construction of about 35,000 sq.yd. of street pavement, of which Savannah Ave. and Ashley St. will be of brick, the remainder will probably be of asphalt.

✦Montgomery, Ala.—We are officially advised that the Board of Revenue of Montgomery County has awarded a contract to SUPPLE BROS. for grading three miles of the Federal Road, and one to L. W. HUNTER, for graveling 2½ miles of the Hunter Road. There were four other bidders. Thos. H. Edwards is County Engr. Noted Mar. 27.

New Iberia, La.—We are officially advised that bids will be received until 4 p.m., May 5, by the Mayor and City Council, for 71,572 lin.ft. curb, and about 322,110 sq.ft. concrete sidewalk. J. S. Power is Mayor. Edwin P. Robb is City Engr. Noted Mar. 27.

Canton, Ohio—Bids will be received until 10 a.m., Apr. 28, by the Board of Commissioners of Stark County for improvement of 5.66 miles of the Canton-Cairo or North Market St. Road by grading, curbing, draining and paving with vitrified brick. J. H. McConnell is Audr.

✦The Board of Control has awarded a contract to GEORGE GARAUX, at $16,772, for paving Casilly St., from Tuscarawas to Summit St.

Cincinnati, Ohio—Bids will be received until noon, Apr. 25, by the Director of Public Service, for the improvement of Knox St., from Thompson Ave. to Saturn St., by grading, curbing and paving with brick from Thompson Ave. to Scully St., and with bituminous macadam from Scully St. to Saturn St. V. T. Price is Dir.

Cleveland, Ohio—Bids will be received until 11 a.m., Apr. 26, by the Commissioners of Cuyahoga County for paving with brick the No. 3 Improvement Richmond Road, Euclid Township, at an estimated cost of $38,012. James R. Marker is State Comr. Noted Apr. 3.

Bids will be received until noon, Apr. 24, by the Director of Public Service for two sections of concrete or asphaltic concrete paving in Shaker Heights Park, Sec. 1, South Shaker Blvd., from Lee Road to South Woodland Road, Sec. 2, a portion of the Park Blvd. W. H. Kirby is Secy.

Cleveland, Ohio—Bids will be received until 11 a.m., May 14, by the Board of Commissioners of Cuyahoga County for improvement of Taylor Road, No. 2, East Cleveland and Cleveland Heights Townships. John F. Goldenbogen is Clk.

Columbus, Ohio—Bids will be received until 2 p.m., Apr. 25, by the State Highway Commissioner for the following road improvements: For grading and paving with bituminous surface treated concrete, one mile of the Columbus Road, Scioto Township, Perry County, at an estimated cost of $10,390, or as an alternative bid, with brick at an estimated cost of $18,902; for grading and paving with brick 1.93 miles of the Akron Canton Road, Springfield Township, Summit County at an estimated cost of $34,360, for grading and paving with waterbound macadam with bituminous surface treatment, one mile of the New Lexington and Logan Road, Pike Township, Perry County, estimated cost, $11,841; for grading and paving with bituminous macadam, 1.12 miles of the Central Ave. Extension Road, Richfield Township, Lucas County, estimated cost $11,702; for grading and paving with waterbound macadam 3.5 miles of the New Market Road, Franklin and Washington Townships, Brown County, at an estimated cost of $20,828. James R. Marker is Comr.

Bids will be received until 10 a.m., Apr. 29, by the State Highway Commissioner for grading and paving with concrete 0.65 miles of the Wadsworth Wooster Road, Wadsworth Township, Medina County, at an estimated cost of $9782; for grading and paving with waterbound macadam 0.66 mile of Section 1 of the Medina Wooster Road, Montville Township, Medina County, at an estimated cost of $5526.

Bids will be received until 2 p.m. Apr. 30, for grading and paving with concrete with bituminous surface treatment, 1.10 miles of the Scotland Station Easterly Road, Chester Township, Geauga County, at an estimated cost of $12,319.

Girard, Ohio—Bids will be received until noon, May 5, by the Village Council, for grading, draining, curbing and paving Broadway, from State St. to its termination. James E. Stotler is Village Clk.

Greenville, Ohio—Bids will be received until noon, May 1, by Commissioners of Darke County, Ohio, and Jay County, Ind., for construction of a gravel road on the line between the two counties. L. L. Morgan is Audr. of Darke County, Ohio. John Bonifas is Audr. of Jay County, Ind.

Lancaster, Ohio—The City Council has authorized the Director of Public Service to advertise for bids for the paving of Porter, Locust and Perry Sts. and Sixth Ave. with vitrified brick on asphalt blocks. C. H. Sexauer is Mayor. D. R. Tidd is Clk. of Council.

Palgesville, Ohio—Bids will be received until noon, Apr. 23, by the Director of Public Service for improving Mentor Ave. from Hayes St. to the west corporation line by grading, draining, curbing and paving with brick. About 10,622 sq.yd. will be required. E. L. House is Dir. F. P. Pratt is Clk.

+Ravenna, Ohio—We are officially advised that the Director of Public Service has awarded a contract to MORGAN BROS. Ravenna, at $7211 for improvement of North Chestnut St., and $13,982 for improving Cleveland Ave. W. H. Linton is Dir. Noted Mar. 13.

Springfield, Ohio—See item under Sewers.

Indiana—Bids for road improvements in Indiana will be received as follows:

May 5, at Newport, by Commissioners of Vermillion County, for construction of a gravel road in Vermillion Township. Roy Slater is Audr.

May 6, at Vincennes, by Commissioners of Knox County, for gravel roads in Johnson, Vincennes and Vigo Townships. John T. Scott is Audr.

May 6, at Wabash, by Commissioners of Wabash County, for construction of four roads in Noble Township. Daniel Showalter is Audr.

May 6, at Winamac, by Commissioners of Pulaski County, for a gravel road in Harrison Township. Wm. Munchenberg is Audr.

May 6, at Delphi, by Commissioners of Carroll County, for a road on the line between Adams and Jefferson Townships. M. G. Haun is Audr.

May 6, at Sullivan, by Commissioners of Sullivan County, for a stone and gravel road in Hamilton Township. Wm. S. Bickwell is Audr.

May 6, at Monticello, by Commissioners of White County, for a road in Prairie Township. A. G. Fisher is Audr.

May 6, at Logansport, by Commissioners of Cass County, for a road in Washington Township. J. E. Wallace is Audr.

May 6, at Marion, by Commissioners of Grant County, for construction of a stone road in Center Township; also stone roads in Van Buren Township. E. H. Kimball is Audr.

May 6, at Princeton, by Commissioners of Gibson County, for construction of two gravel roads in Union Township, and two in Montgomery Township. William T. Roberts is Audr.

May 7, at Shelbyville, by Commissioners of Shelby County, for construction of a gravel road in Union Township. Frank W. Fagel is Audr.

+Angola, Ind.—We are officially advised that bids as follows were received by the City Council for 7930 sq.yd. street paving; the Northern Construction Co., Elkhart, Ind., $17,295 for Metropolitan block, $17,057 for Hocking blocks; the Brooks Construction Co., Fort Wayne, Ind., $17,116 for Metropolitan block, $17,274 for Hocking block; Childs & Sawyer, Kendallville, Ind., $19,400 for Metropolitan block, $19,400 for Bessemer block, $13,453 for Dolarway; W. W. Hatch, Goshen, Ind., $20,216 for Metropolitan, $19,423 for Hocking, $19,265 for Marion block; W. M. Torrence & Co., Muncie, Ind., $19,676 for Metropolitan, $19,042 for Hocking and $18,724 for Marion blocks, $12,143 for macadam. The W. J. Sherman Co., Toledo, Ohio, is Engr.-in-Charge. Noted Mar. 27.

+Covington, Ind.—We are officially advised that the Commissioners of Fountain County have awarded a contract to FRED CUNNINGHAM, Hillsboro, Ind., at $14,376 for improvement of a road in Shawnee Township, 15,760 ft. in length. The other bidder was E. E. McKee at $14,409. W. B. Gray is Audr. Noted Apr. 3.

Hartford City, Ind.—Bids will be received until May 5 by Commissioners of Blackford County for the construction of two roads in the county. James Cronin, Jr., is Audr.

Indianapolis, Ind.—The following low bids were received by the Board of Public Works for paving West Washington St., from White River to Belmont Ave.: Brick paving, George W. McCray, $3.94 a lin.ft., $8300 for street and alley intersections; asphalt, the Union Asphalt Construction Co., $3.59 a lin.ft. $3800 for alley intersections; wood block, the Republic Construction Co., $5.58 a lin.ft. and $9700 for intersections. Charles A. Schrader is Pres. of the Bd.

+The Board of Public Works has awarded the following contracts for asphalt roadways to the REPUBLIC CONSTRUCTION CO.: 29th St. from Central to Fall Creek Blvd., $3.43 per lin.ft., Ashland Ave. from 13th to 14th, $2.44 per lin.ft., Ashland Ave. from 28th to Bellefontaine, $3.34 per lin. ft., Broadway from 32nd to 34th, $3.05 per lin.ft., 28th St. from Sutherland to Bellefontaine, $3.88 per lin.ft.

Jeffersonville, Ind.—Bids will be received until 10 a.m., May 5, by Commissioners of Clark County for the construction of two public highways. George W. Stoner is Audr.

New Albany, Ind.—We are officially advised that bids will be received until 7:30 p.m., Apr. 25, by the City Clerk for improvement of East Eighth St., the work to be let in two contracts, the roadway to be 38 and 28 ft. wide in different parts. The estimated cost is $8170 and $6458 respectively. Bituminous macadam, using Sarco or its equivalent, is the material specified. Chas. Troup is City Clk. Chas. W. Appleby is City Engr. Noted Apr. 10.

+Champaign, Ill.—We are officially advised that the Board of Local Improvements has awarded contracts to STIPER & PILCHER, Champaign, for the improvement of West Park, West University and East University Aves. at $19,145, $22,504, and $45,450 respectively. L. N. Sizer is City Engr. Noted Apr 3.

Mattoon, Ill.—Bids will be received until 2 p.m., Apr. 21, by the Board of Local Improvements, for improving portions of Edgar and Oklahoma Aves., South Sixth and South 16th Sts., by grading, draining, curbing and paving with brick. The approximate quantities are: 9090 cu.yd. excavation, 23,270 sq.yd. brick paving, 14,902 lin.ft. combination curb and gutter, 1000 lin.ft. concrete marginal curb, 710 ft. 8-in. sewer pipe, 24 inlets for storm water. S. C. McDuffie is Street Supt. C. L. James is City Engr.

Waukegan, Ill.—We are officially advised that all bids were rejected for paving Grand Ave. and new bids will be received until 8 p.m. Apr. 21 by the Board of Local Improvement for 14,750 sq.yd. brick pavement on Grand Ave. and 3400 sq.yd. on St. James St. M. J. Douthitt is City Engr. Noted Mar. 27.

Milwaukee, Wis.—Bids for paving the Grand Ave. district with creosoted wooden blocks were received by the Department of Public Works as follows: D. M. Sneddon, $116,494, the Ranlff Co., $113,002, the White Construction Co., $109,338, the R. F. Conway Co., $104,860, L. W. Schroth, $95,281. Noted Mar. 6.

State St. will be paved with creosoted block from 27th to 35th Sts., 6355 sq.yd. required. Folsom Pl. and Kinnickinnic Ave., will be partly paved with permanent brick pavement with sand cushion and concrete foundation, requiring about 11,500 sq.yd. Permanent asphalt pavement having a concrete foundation will be laid on several blocks of Cherry, Galena, 49th, 34th, Chestnut and 25th Sts., and Bartlett and 11th Aves., requiring about 30,000 sq.yd. asphalt, with curbing and concrete sidewalks. About 19,000 sq.yd. of permanent brick pavement with sand cushion and concrete foundation and permanent limestone pavement having a concrete foundation in amount of about 11,600 sq.yd. will be required for alley improvements. Bituminous macadam of about 5500 sq.yd., with grading and concrete walks and gutters, will be used on Auer and Fifth Aves. On Milwaukee St., about 10,335 sq.yd. of sandstone, and on Eighth St., about 843 sq.yd. of granite, sandstone, pavement will be laid. Fred G. Simmon is Com. Pub. Wks.

+Superior, Wis.—A contract has been awarded by the Board of Public Works to E. A. DAHL at $34,983 for paving Baxter Ave. from North Third to North 21st St. with concrete. Other bidders were: P. McDonnell, $42,911, Alex Holm, $41,408; Russel Construction Co., $41,210; Mangus Peterson, $40,963; P. E. Bergman, $40,696; S. A. Riches, $37,603; John Diffor, $38,300; E. B. Banks is City Engr. Noted Mar. 20.

+Clarence, Iowa—We are officially advised that the Town Council has awarded a contract to M. TSCHIRGI & SONS, Cedar Rapids, at $12,434, for 7300 sq.yd. concrete paving. Other bidders were: Frank K. Hahn, Cedar Rapids, at $12,542; Garland & Shacer, New Hampton, Iowa, at $12,976. Scott McNeil is Town Clk. The Iowa Engineering Co., Clinton, Iowa, is Engr. in Charge. Noted Mar. 13.

Clear Lake, Iowa—We are officially advised that bids will be received until Apr. 23, by the City Clerk, for concrete, brick, Dolarway or asphalt paving on various streets. The estimated quantity is 19,000 sq.yd. H. D. Keerl, South Main St., Mason City, Iowa, is Engr. in Charge.

Independence, Kan.—We are officially advised that all bids received Apr. 3 for pavement, curb and gutter on Maple and Earl Sts. were rejected and new bids will be received Apr. 17. G. H. Krienhagen is City Clk. Noted Mar. 27.

+Fremont, Neb.—A contract has been awarded by the Board of Public Works to PARKS & LEFLER, South Omaha, Neb., at $41,778, for paving Irving Ave., Main and Sixth Sts., with Buffalo paving blocks.

+St. Joseph, Mo.—A contract has been awarded by the Board of Public Works to the METROPOLITAN PAVING CO. for paving Mary St. from Sixth to Ninth with asphaltic concrete. Joel E. Gates is City Clk.

Pueblo, Colo.—The City Council plans the construction of about 170,000 sq.yd. macadam pavement with curb and gutter on various streets. D. R. Gaymon is City Engr.

Boise, Idaho—The City Council is considering the construction of about 63,375 sq.yd. paving on various streets. C. C. Stevenson is City Engr.

Salt Lake City, Utah—Bids will be received until 10 a.m., Apr. 22, by the Board of Commissioners for the construction of concrete sidewalks in Sidewalk Extension Nos. 160 and 162. Noble Warrum is City Recdr.

Salt Lake City, Utah—See item under Sewers.

+Aberdeen, Wash.—The KEASEL CONSTRUCTION CO., 2312 A St., Tacoma, was awarded the contract for paving West Heron St. with asphalt at $20,177.

Bellingham, Wash.—Bids will be received until Apr. 25 by the Commissioners of Whatcom County for improvement of 8400 ft. of the Northeast Diagonal Road, and 9800 ft. of the Northwest Diagonal Road. The pavement is to be of concrete, and concrete culverts are required. C. M. Adams is County Engr.

Seattle, Wash.—The Street and Sewers Committee of the City Council has ordered street improvements as follows: Grading Leary Ave. from Fremont to Third Ave. at an estimated cost of $34,693; College St. and connecting thoroughfares at $12,033, Avalon Way at $13,900, and construction of wood walks on Alki Ave., $4238. A. L. Valentine is Supt. of Public Utilities.

+The Dalles, Ore.—The City Council has awarded a contract to the AMEROSE-BIRDSELL CO. at $1.35 per sq.yd. for about 49,332 sq.yd. of asphaltic concrete pavement. C. L. White is City Engr. Noted Mar. 13.

Gilroy, Calif. The City Council and Chamber of Commerce are planning the paving of Monterey St. for a distance of 7879 ft. at an estimated cost of $33,692. Walter G. Fitzgerald is City Atty.

Los Angeles, Calif.—Albert H. Beach, 214 Douglas Bldg., will receive bids on development work including grading streets and constructing sidewalks, curbs, etc., laying water pipes in Beachwood Heights. The work is estimated to cost about $10,000.

+W. W. ATKINSON, 1922 Oxford Ave., was awarded the contract at $48,781 for grading the Pellissier Tract at Western and Wilshire Blvd.

Manhattan Beach, Calif.—This city contemplates doing street improvement work at an estimated cost of $350,000. The pavement will be concrete base with ¾-in to 1-in oiled screenings surface. Wilkie Woodard, Consolidated Realty Bldg., Los Angeles, is Engr.

Pasadena, Calif.—We are officially advised that the City Council has awarded contracts to ANDREW HOLLOWAY, Pasadena, for the improvement of Walnut St. at $26,463; Hillcrest Ave. at $17,556, and Lake and Oak Knoll Aves. at

$42,547. Other bidders were: The Barber Asphalt Paving Co., $26,928, $19,045 and $43,835, respectively. Fred Osburn, $17,875 for Hillcrest Ave., and $43,495 for Lake and Oak Knoll Aves. Lewis E. Smith is City Engr. Noted Apr. 3.

Sacramento, Calif.—Bids will be received until 2 p.m., Apr. 21, by the State Highway Commission, 515 Forum Bldg., for construction of the following highways: Seven and one-half miles in Ventura County, between the southern boundary and Newbury Park, Div. 7, Route 2, Sec. B. The work consists of the following approximate quantities: 16,980 cu.yds. earth excavation, 5040 cu.yds. rock excavation, 234 ft. 12-in. corrugater-iron pipe, 88 ft. 18-in. corrugated-iron pipe, 112 ft. 24-in. corrugated-iron pipe, 45.3 cu.yds. class "A" concrete in culverts, 35.7 cu.yds. class "B" concrete in culverts, and monuments, 7180 cu.yds. class "B" concrete in pavement, 1110 tons screenings, 760 bbls. asphaltic oil, 2744 ft. guard rail, 18 monuments hauled and placed. A section of oiled concrete highway in Stanislaus County, from Turlock to Ceres. Completion work, repair of bridges, on the section in Yuba County, between Morrison's Crossing and Marysville. Two miles of asphaltic oil and concrete in San Mateo County, between San Mateo and Beresford. Four and one-half miles of asphaltic oil and concrete in Santa Clara County, between San Jose and Edenvale. Austin B. Fletcher is State Engr. Noted Apr. 10.

San Fernando, Calif.—Bids will be received about May 1 by the City Clerk for about 40,000 sq.yd. asphalt pavement, and 18,000 ft. concrete sidewalks and curb. Estimated cost $50,000. H. C. Caldwell is City Clk.

+Venice, Calif.— BRAUN, BRYANT & AUSTIN were awarded the contract at $13,775 for improving Fifth Ave. from San Juan to Rose Aves.

New Westminster, B. C.—The Board of Public Works has recommended that approximately 20,000 yd. of streets be macadamized at a cost of about $94,000.

Vancouver, B. C.—Resurfacing of Cordova St. at a cost of about $30,000 and paving of Seaton St., with creosoted wood blocks at an approximate cost of $31,000 has been authorized by the City Council. Asphalt will probably be used on Cordova St.

INDUSTRIAL WORKS

+Attleboro, Mass.—The contract for the addition to the plant of the Watson Co. Mechanic St. has been awarded to HARTWELL & KINGSTON, Industrial Trust Bldg., Providence, R. I. The structure will be of brick, four stories, 60x185 ft., to cost $60,000. F. P. Sheldon & Son, 603 Industrial Trust Bldg., Providence, R. I., are the Archs. and Engrs.

+Boston, Mass.—The contract for the construction of a factory building to be erected on Gold St., for C. I. Brink, of 400 Atlantic Ave., has been awarded to JOSEPH NICHOLSON & SONS, 101 Tremont St., Boston. The structure will be of brick and stone, two stories, 81x92 ft. Estimated cost, $12,000. G. Henri Desmond, 15 Beacon St., is Arch.

+Haverhill, Mass.—Press reports state that the contract for the construction of a seven-story shoe factory on Locust St., for the Merrimack Associates, has been awarded to KELLY BROS., Haverhill, at $45,000.

Holyoke, Mass.—The Holyoke Valve & Hydrant Co. has purchased a site on Race St., for the construction of its proposed four-story factory.

+Worcester, Mass.—The Matthews Mfg. Co. has awarded the contract for the construction of a three-story building 40x75 ft., on Hammond St., to the E. D. WARD CO., of Worcester.

The Crompton-Knowles Wool Works have awarded the contract for the construction of an addition, 270x214 ft., one story, to its plant, to the E. D. WARD CO., Worcester, at $45,000.

+Warren, R. I.—The Warren Worsted Mills, of Warren, R. I. has awarded contract for its new factory to the J. W. BISHOP CO., Providence, R. I. The building will be of brick construction 60x300 ft. one story and basement. All machinery is to be operated by electric motors with all shafting beneath the floors. Walter A. Guile, is Pres. and Mgr. of the new company.

Waterville, Conn.—The Chase Rolling Mill Co. is planning the erection of another building at its factory on Thomaston Ave. It will be one story of brick and steel, 60x180 ft. D. L. Summery, is Ch. Engr.

Albany, N. Y.—The J. B. Lyon Printing Co. is receiving bids for the construction of a five-story factory, 108x120x88 ft., which it will erect on Beaver St. The estimated cost is $35,000.

Binghamton, N. Y.—The Standard Oil Co., 26 Broadway, New York, N. Y., has had plans prepared for the construction of a two-story building, to be erected here for oil plant purposes.

Buffalo, N. Y.—The Hewitt Rubber Co. has had plans prepared by Lockwood, Green & Co., Archs., Boston, Mass. for the construction of a three-story factory addition, 460x90 ft., to its plant at Kensington Ave. and the New York Cenral R.R. It will be of reinforced-concrete construction. Considerable machinery and equipment will be installed. Walter C. Mullett, Fidelity Trust Bldg., is Secy. Noted Mar. 6.

Bids are being received by Lansing, Bly & Lyman, Archs., Prudential Bldg., from plans prepared by them for the construction of a two-story machine shop, 116x45 ft., at the plant of the E. & B. Holmes Machinery Co., Chicago St.

Extensive additions will be made this spring to the plant of the Atlas Steel Castings Co., at Elmwood Ave. and the Erie R.R. Three buildings, which will double the capacity of the plant, will be built for basic openhearth steel casting.

Bids are being received by Colson & Hudson, Archs., Dun Bldg., for the construction of two factory additions to the plant of the Cyphers Incubator Co., Dewey Ave. One will be one story high, 300x160 ft., and the other one story high, 120x380 ft. The estimated cost is $250,000. G. M. Curtis is Pres. Noted Feb. 27.

Kingston, N. Y.—The Art Silk Yarn Co. is having plans prepared for the construction of a new one-story silk mill, 338x225 ft. The structure will be of brick, stone and structural steel. R. W. Wilkins, 38 East 25th St., New York, N. Y., is Gen. Mgr.

Newburgh, N. Y.—The Du Pont de Nemours Co., Wilmington, Del., will construct a one-story addition, 150x50 ft., to its fabrikoid works at Newburgh. Further improvements will be made later.

Poughkeepsie, N. Y.—The Moline Plow Co. has announced that it will build a four-story manufacturing plant, 320x80 ft. C. H. Carver is Gen. Mgr.

Philadelphia, Penn.—The Philadelphia Rapid Transit Co. has been granted permission to demolish the present tsructures on the property bounded by 58th, 59th, Vine and Callowhill Sts., upon which a car barn and shops will be erected. The estimated cost is $250,000.

Pittsburgh, Penn.—The Model Gas Engine Co., Peru, Ind., contemplates purchasing a portion of the Carr property at Lexington Ave. and the Pennsylvania R.R., and building a new plant there. The estimated cost is $200,000.

Richmond, Va.—The Export Leaf Tobacco Co. has secured a permit for the erection of an addition to its factory, to cost $25,500.

Webster, W. Va.—The Webster Woolen Mills Co. will rebuild its mills recently destroyed by fire. Estimated cost, $75,000.

Wheeling, W. Va.—The Wheeling Traction Co. contemplates the construction of a building at Wheeling for cutting and bending rails.

Burlington, N. C.—The Whitehead Hosiery Mills Co. plans to erect an additional factory, 50x150 ft., and install machines for knitting hosiery. The new structure and the equipment will cost about $75,000.

Gastonia, N. C.—The Dunn Mfg. Co. will build a 75x44-ft. addition to its mills and install new machinery.

Raleigh, N. C.—The Agricultural & Mechanical College will build a mechanical engineering shop to contain machine shops, woodworking shops, foundry, forge and laboratories. Estimated cost, $50,000.

Barnesville, Ga.—The Collier Mfg. Co. contemplates the construction of a factory at Barnesville, to manufacture underwear. Estimated cost, $40,000. C. J. Collier is Pres.

Kissimmee, Fla.—The Smalley Motor Car Co., Lincoln, Neb., plans to build an automobile factory here.

Tampa, Fla.—The Sure Lock Nut Co., recently incorporated with a capital stock of $250,000, contemplates establishing a plant at Tampa.

Village Springs, Ala.—According to press reports, the Blount Mountain Cement Coal & Lime Co. has been organized at Village Springs, with a capital stock of $2,000,000. The concern plans to build the following plants: Klin building, 44x90 ft.; four upright kilns; a stock house, 52x90 ft.; a hydrator building, 44x64 ft.; all of steel and concrete construction, estimated to cost $750,000, and to have a daily capacity of 1500 bbl. portland cement; a plant to cost $100,000, with a daily capacity of 50 tons of hydrated lime; and a plant, to cost $50,000, with a daily capacity of 1000 tons fluxing stone. Richard K. Meade, 202 North Calvert St., Baltimore, Md., is Engr.

New Orleans, La.—The Stern Foundry & Machine Co. has taken out a permit for the construction of a brick and steel building at Annunciation and Richard Sts. Estimated cost, $15,000. Diboll, Owen & Goldstein are Archs. Noted Dec. 19.

Guthrie, Ky.—The factory of Evans & Son, at Guthrie, which was recently destroyed by fire, will be rebuilt.

Louisville, Ky.—The Louisville Tin & Stove Co. contemplates enlarging its plant at Louisville.

Paducah, Ky.—The Young Aëroplane Co., Kansas City, Mo., contemplated establishing a branch factory at Paducah.

Amherst, Ohio—The United States Automatic Co., Amherst, is considering the erection of an addition to its factory, 50x200 ft.

Cincinnati, Ohio—Bids will be received soon by the Tool Steel Gear & Pinion Co., Cincinnati, for the erection of a machine shop and foundry. The cost has been estimated at $30,000.

Cleveland, Ohio—The Union Paper & Twine Co., Cleveland, is considering the erection of a new plant.

The W. S. Tyler Wire Co., Cleveland, is planning the erection of a three-story addition to its plant at Cleveland.

The plant to be erected by Parish & Bingham Co., Cleveland, has been estimated to cost $120,000. It will be one story, 100x900 ft. The type of construction will be monitor type. E. McGeorge is Arch. The company is located at 5363 Hamilton Ave.

The Grabler Mfg. Co., Cleveland, has taken out a permit and is planning for the erection of a factory on Broadway.

+F. U. Mehling, Cleveland, will erect a large factory, 130x130 ft. at Paris Ave. and Fulton Road. The contract has been awarded to the HUNKIN-CONKEY CONSTRUCTION CO., Cleveland. Cost, about $40,000.

The Zerk Mfg. Co., Cleveland, Ohio, is having plans prepared for the erection of a one- and two-story factory 450x150 ft. Adolph Zerk, Columbia Bldg., Cleveland, is Vice-Pres.

The Friedman, Blau, Faerber Co., Cleveland, is having plans prepared for the erection of an addition to its factory. The proposed building will be 70x120 ft.

The Blackburn Specialty Co. Cleveland, plans to erect a factory at East 35th St. and Perkins Ave. Richardson & Yost, Cleveland are Archs.

Fremont, Ohio—The Safe Storm Shield Co., Fremont, is having plans prepared for the erection of a large addition to its factory.

Toledo, Ohio—The Toledo State Hospital, Toledo, is having plans prepared for the erection of a two-story laundry, 60x125 ft.

Zanesville, Ohio—The Weller-Thomas Co., Zanesville, is planning for the erection of a plant at Zanesville. The company is capitalized at $1,000,000.

Evansville, Ind.—The Evansville Brewing Association, Evansville, is considering the erection of a large bottling plant.

Detroit, Mich.—Plans are being prepared by Albert Kahn and E. W. Wilby, Trussed Concrete Bldg., Detroit, for the erection of a two-story factory, 80x363 ft., for James N. Smith & Co., 41 Woodbridge St., West. Estimated cost, $150,000.

+Detroit, Mich.—We are officially advised that the general contract has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., by the American Agricultural Chemical Co., for the erection of a new factory at its Detroit Works. The building will be three stories, 150x40 ft., of reinforced concrete throughout. A. H. Nickerson is Engr. and Arch. Work will start at once.

Grand Rapids, Mich.—The National Brass Co., Grand Rapids, is having plans prepared by F. P. Allen & Son, Archs., Grand Rapids, for the erection of a new factory on Madison Sq., between Eugene St. and Silver Creek.

+Hamtramck, Mich.—The contract for the erection of a factory for Dodge Bros., Hamtramck, has been awarded by Smith, Hinchman & Grylls, Archs., Detroit, Mich., to BRYANT & DETWILER, 510 Hammond Bldg., Detroit, at about $100,000.

Saginaw, Mich.—The Germain Mfg. Co., Saginaw, has acquired a site at Saginaw. Plans are being considered for the erection of factory buildings as soon as the weather permits. W. M. Germain is Secy.

Chicago, Ill.—The United Breweries Co., Chicago, plans to erect an addition to its brewery. The building will be four stories and will cost about $20,000.

The Barrett Mfg. Co., Chicago, is considering the erection of a brick factory at 29 South Sacramento Ave. It will be two stories, 70x120 ft.

The Gross Printing Press Co., Chicago, is considering the erection of a brick addition to its plant at 1560 South Ashland Ave. The building will be one story, 50x125 ft.

The W. J. Hughey & Son Co., Chicago, will erect a factory at Prairie Ave. and 33d St., Chicago, for the manufacture of automobile bodies. The estimated cost is $100,000.

Plano, Ill.—The Independent Harvester Co., Plano, is receiving bids for the erection of a new foundry, 208x136 ft., and a mill room, 136x80 ft., three stories. The foundry will be of modern steel construction and the mill room of reinforced concrete. These are the first buildings of a plant which the company proposes to erect and equip during the next three years at a cost of $3,000,000.

Milwaukee, Wis.—The Bradley & Metcalf Co., 207 East Water St., Milwaukee, is considering the erection of a factory on a site 200x100 ft., at Broadway and Erie St.

The Fisher Furniture Co., Milwaukee, is planning for the erection of an addition to its factory on Wells St. The cost has been estimated at $12,000.

+Sheboygan Falls, Wis.—Contracts have been awarded by the Falls Machine Co., Sheyboygan Falls, for the erection of its proposed two-story addition: To the WORDEN-ALLEN CO., Milwaukee, for the structural steel; carpentry, to A. F. SCHNEIDEWENT; masonry, to A. C. MALLMAN. The building will be 140 ft. long and will be used for motor and gas engine assembly and erection.

Sioux City, Iowa—The Cedar Rapids Oil Co., Cedar Rapids, Iowa, has acquired a site at Sioux City, and will build a distributing plant, to cost approximately $50,000.

Virginia, Minn.—The Mfg. & Supply Co., Virginia, plans to erect a brass foundry.

Wichita, Kan.—The Western Iron & Foundry Co. has taken out a permit for the construction of an addition to its plant.

Lewiston, Mont.—The Montana Elevator Co., Lewiston, plans to build grain elevators at Roy, Winifred, Denton, Arrow Creek, Kolin, Hossalc, Geraldine and other towns in Montana.

Brookfield, Mo.—The Young Portable Device & Mfg. Co., recently incorporated with a capital of $50,000, will establish a plant for the manufacture of patented devices. Frank R. Young, Ernest R. Lucas and H. W. Roloff are the incorporators.

Joplin, Mo.—The Swan Machine Co., Joplin, recently incorporated, will erect a machine shop in Joplin.

Fort Smith, Ark.—The W. R. Matthews Co., Fort Smith, will erect a mill for the manufacture of spokes and staves. The estimated cost is $40,000.

Brownsville, Tex.—The Anheuser-Busch Brewing Association, St. Louis, Mo., will erect a large ice plant and cold-storage warehouse at Brownsville.

Dallas, Tex.—The Oriental Oil Co will construct a cotton-seed oil mill at Dallas. The estimated cost is $100,000.

Del Rio, Tex.—The Galveston, Harrisburg & San Antonio Ry. will erect an 18-stall roundhouse and repair shops at Del Rio.

New Castle, Tex.—The Brazos River Briquetting Co., recently organized with a capital of $50,000, will construct a plant at New Castle for the manufacture of briquetts from coal. L. C. Kinney, M. B. Kinney and S. W. Scott are interested.

Yorktown, Tex.—C. B. Lutcher-Yorktown will build a plant at Yorktown, for the manufacture of cement brick.

Lewiston, Idaho—The Idaho Ice & Cold Storage Co., Lewiston, will soon begin the construction of an additional cold-storage plant.

Everett, Wash.—The plant of the Sumner Iron Works, which was recently destroyed by fire at a loss of about $200,000, will be rebuilt.

Georgetown, Wash.—The Seattle Iron Works, Georgetown, near Seattle, Wash., is planning to make extensive improvements and additions to its plant. About $100,000 will be expended.

Seattle, Wash.—The Ford Motor Car Co., Detroit, Mich., will soon ask bids for the construction of a new five-story factory of concrete at Seattle. The estimated cost is $250,000.

Tacoma, Wash.—Schmidt & McMahon, McKinley Ave., Tacoma, will build a sheet-metal shop on the tide flats, Tacoma. New machinery will be installed and the expenditure will be about $10,000. Merrill & Mahon, Savage-Scofield Bldg., are the Archs.

Vancouver, Wash.—The Beaver Automobile Co., Portland, Ore., recently incorporated with a capital of $150,000, will erect a plant in Vancouver, for the manufacture of automobiles.

Los Angeles, Calif.—The Los Angeles Motor Truck Co. will erect five new buildings of reinforced concrete. The buildings and equipment will cost approximately $300,000.

The Pacific Electric Ry. Co., Los Angeles, plans to erect a large car barn and shop building on Seventh St. The building will be 70x250 ft. M. C. Halsey, Pacific Electric Bldg., Los Angeles, is preparing the plans.

Richmond, Calif.—The Pacific Sanitary Mfg. Co. plans to add a brass foundry to its plant. A mill for the manufacture of wooden crates will also be added.

Aylmer, Ont.—The Aylmer Shoe Co., Myrtle St., plans to double its output, and will install modern shoe-making equipment.

Grimsby, Ont.—The Grimsby Electrical Car Co. has plans for a new $40,000 factory, on which work will soon be begun. Modern equipment will be installed. Thomas J. Bailey is Mgr.

Port Stanley, Ont.—T. Hall & Co., St. Thomas, Ont., will establish a machine shop at Port Stanley, which will be equipped for marine repair work.

Toronto, Ont.—The American Watch Case Co. will erect a four-story factory on King St.

Wallaceburg, Ont.—Plans are being prepared by Albert Kahn and E. Wilby, Trussed Concrete Bldg., Detroit, Mich., for a one-story structure, 48x152 ft., to be erected for the Sydenham Gas Co. at Wallaceburg. It will cost $40,000.

The Wallaceburg Iron & Brass Works are having plans prepared for a large addition to the present plant.

Calgary, Alta.—The Robertson Western Brass Co. plans the erection of an addition to its plant, costing about $80,000. Bids will be asked for the building as soon as possible, and new machinery will be purchased.

FEDERAL GOVERNMENT WORK

+Buildings—Portsmouth, N. H.—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of officers' quarters at Portsmouth, N. H., to the C. H. HOLMES CO., Portsmouth, at $11,488.

★Dredging—Hartford, Conn.—The bid of the Hartford & New York Construction Co., Hartford, has been recommended for acceptance for dredging in the Connecticut River, below Hartford, at 11c. per cu.yd. Bids were opened Apr. 12, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn. The amount to be dredged is 68,000 cu.yd.

Reconstruction of Stable—Fort Totten, N. Y.—Bids will be received by Capt. A. J. Cooper, Coast Artillery Corps, U. S. A., Fort Totten, until 2 p.m., May 1, for the reconstruction of the quartermaster's stable at Fort Totten.

Repairs to Launch—Fort Totten, N. Y.—Bids will be received by Capt. A. J. Cooper, Coast Artillery Corps, U. S. A., Fort Totten, until, Apr. 15, for repairs to the U. S. launch, "Lieut. Hazlett."

Boats—New York, N. Y.—Bids will be received until 10 a.m., May 8, by M. Gray Zalinski, Q. M., U. S. A., Army Bldg., New York, for the construction and equipment of from one to 20 life boats.

Jetty Work—Washington, D. C.—Bids were received by Lieut.-Col. W. C. Langfitt, Corps Engrs., U. S. A., Washington, for repairing and extending riprap jetties in Urbana Creek and Milford Haven, Va.: McClenahen Granite Co., Port Deposit, Md., Urbana Creek, $4.53 per cu.yd.; Milford Haven, $4.93. Columbia Granite and Dredging Co., Washington, D. C., $4.18 and $4.51.

Wire—Washington, D. C.—Bids will be received by Maj. W. A. Clark, Signal Corps, U. S. A., Disbursing Officer, Washington, until Apr. 24, for furnishing 528,000 ft. of outside distribution wire under Circular 649.

Locomotive Cranes—Washington, D. C.—Bids were received as follows, Apr. 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing nine 15-ton locomotive cranes for Pearl Harbor, H. T., and two for Puget Sound navy yard: Bremerton, Wash.: Browning Engineering Co., Cleveland, Ohio, $10,000 each for Pearl Harbor; $9000 each for Puget Sound; Brown Hoisting Machinery Co., Cleveland, Ohio, $102,325, alternate, $98,955. McMylar Interstate Co., Bedford, Ohio, six, $70,000; seven, $81,700; eight, $93,400; nine, $105,100; ten, $116,800; eleven, $128,500.

Post Office—Monroe, N. C.—Bids will be received until 3 p.m., May 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches), of the U. S. post office at Monroe, N. C.

★Dredging—Charleston, S. C.—Bids were received as follows, Apr. 10, by Maj. G. P. Howell Corps Engrs., U. S. A., Charleston, for dredging Anchors Creek, S. C.: Joseph F. O'Brien, Savannah, Ga., 16.9c. per cu.yd.; total, $16,900; Simons-Maynard Co., Charleston, 19 1c.; $19,100; P. Sanford Ross, Jersey City, N. J., 19.9c.; $19,900.

+Post Office—Crowley, La.—Oscar Wenderoth, Superv. Archt., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post office at Crowley to DANIEL T. McCARTHY, 411 Walnut St., Philadelphia, Penn., at $46,000.

+Levee—New Orleans, La.—Bids were received Mar. 31, by Capt. C. O. Sherrill, Corps Engrs., U. S. A., New Orleans, for constructing about 210,000 cu.yd. of levee work in Lower

Tensas and La Fourche Levee Districts: Item (1) Ingelfield Levee, 140,000 cu.yd. Lower Tensas Levee District, (2) Louisa Levee, 70,000 cu.yd., La Fourche Levee District. W. M. STOTT, Tallulah, La., Item (1) 25.39c. per cu.yd. (awarded contract). J. W. Nobel, Fayette, Miss., (1) 19.55c., Hamilton & Howell, St. Francisville, La., (1) 31.97c.; (2) 21.99c. John Reiss, New Orleans, La., (2) 21c. J. M. Sullivan, Montgomery, Ala., (1) 23.40c. cu.yd.; (2) 19.39c. Lambert Bros., St. Rose, La., (2) 22.48c. R. T. CLARK & CO., Natchez, Miss., (1) 21.89c. cu.yd.; (2) 17c. cu.yd. (awarded contract). Montz & Kearney, New Orleans, La., (2) 25.79c. F. T. Constant, Alexandria, La., (1) 36.70c. cu.yd.; (2) 20c. cu.yd.

Post Office—Lawrenceburg, Ky.—Bids were received as follows, Apr. 8, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Lawrenceburg, Ky.: (a) Limestone; (b) standstone. Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $53,254; (b) $53,654; James Devault, Conton, Ohio, (a) $49,200; (b) $49,530; Thomas W. Cissell, Elwood, Ind., (a) $58,400; R. S. Moore, Lafayette, Ind., (a) $58,178; (b) $59,000; Daniel T. McCarthy, Philadelphia, Penn., (a) $52,800; (b) $51,300; Alt & Gaun, Louisville, Ky., (a) $49,732; (b) $49,912; George Becking, Chattannooga, Tenn., (a) $56,331; (b) $56,831; Danville Construction Co., Danville, Ill., (a) $53,000; InterState Construction Co., Saginaw, Mich., (a) $53,940; (b) $54,500.

✚Post Office—Bowling Green, Ohio—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Bowling Green, to JAMES DEVAULT, Canton, Ohio, at $56,550.

✚Post Office—Dayton, Ohio—Oscar Wenderoth, Superv. Arch., Treas. Dept., Washington, D. C., has awarded the contract for furnishing the mechanical equipment for the post office at Dayton to S. FAITH & CO., 2427 Pennsylvania Ave., Philadelphia, Penn., at $58,357.

✚Mechanical Equipment—Dayton, Ohio—The contract has been awarded to S. FAITH & CO., Philadelphia, Penn., for the installation of mechanical equipment in the U. S. post office and courthouse at Dayton, at $58,357. Bids were received Mar. 19 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C.

★Dredging—Sheboygan, Mich.—Bids will be received by Lieut-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, Mich., until noon, May 10, for dredging in Cheboygan Harbor.

★Building—Fort Sheridan, Ill.—Bids will be received by Maj. F. H. Sargent, Constr. Q. M., U. S. A., Fort Sheridan, until 10 a.m., Map 7, for the complete construction of one quartermaster corps barrack.

✚Post Office—Concordia, Kan.—Bids were received as follows, Apr. 9, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Concordia, Kan.: (a) Limestone; (b) sandstone: Rogers & Kaiser, Chicago, Ill., (a) $61,884; (b) $65,884; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $65,334; (b) $64,834; George H. Shane, Seneca, Iowa, (a) $67,186; Inter State Construction Co., Saginaw Mich., (a) $67,900; (b) $72,000; Tom Lovell's Sons, Enid, Okla., (a) $62,770; (b) $64,-334; Joseph B. Betts, Kansas City, Mo., (a) $69,000; (b) $70,000; W. D. Lovell, Minneapolis, Minn., (a) $61,500; Frank H. Latimer, Kansas City, Mo., (a) $64,247.

Post Office—Ottawa, Kan.—Bids were received as follows, Apr. 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Ottawa: (a) limestone; (b) sandstone. Tom Lovell's Sons, Enid, Okla., (a) $55,566; (b) $56,166. Frank A. Latimer & Sons, Kansas City, Mo., (a) $59,685. Rogers & Kaiser, Chicago, Ill., (a) $56,418; (b) $59,558. Interstate Construction Co., Saginaw, Mich., (a) $62,740; (b) $66,500. W. D. Lovell, Minneapolis, Minn., (a) $57,890. Alexander H. Beeler, Ottawa, Kan., (a) $59,840; (b) same. C. W. Benning, Kansas City, Mo., (a) $56,875; (b) same.

Post Office—Boonville, Mo.—Bids were received as follows, Apr. 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Boonville: George W. Stiles Construction Co., Chicago, Ill., (sole bidder, limestone, $56,335; sandstone, $61,000.

Post Office—Brookfield, Mo.—Bids will be received until 3 p.m., May 24, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits, and wiring, interior lighting fixtures, and approaches), of the U. S. post office at Brookfield, Mo.

✚Post Office—Rolla, Mo.—Bids were received as follows, Apr. 8, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Rolla, Mo.: (a) Limestone; (b) sandstone: Rogers & Kaiser, Chicago, Ill., (a) $48,763; (b) $49,000; Hiram Lloyd Building & Construction Co., St. Louis, Mo.,, (a) $48,173; (b) $48,273; Interstate Construction Co., Saginaw, Mich., (a) $48,182; (b) $49,000; King Lumber Co., Charlottesville, Va., (a) $48,500; (b) $49,500; Thomas W. Cissell, Elwood, Ind., (a) $49,000; (b) $50,000; W. D. Lowell, Minneapolis, Minn., (a) $50,000; Globe Construction Co., St. Louis, Mo., (a) $50,445; (b) $50,651; Harry R. McCaw, Rolla, Mo., (a) $52,701.

✚Pier—Bremerton, Wash.—The contract has been awarded to the ERICKSON CONSTRUCTION CO., Seattle, Wash., for the construction of Pier No. 4 at the navy yard, Puget Sound, Bremerton, at $166,332.

Roads and Walks—Fort Stevens, Ore.—Bids will be received by Lieut. R. F. Cox, U. S. A., Portland, Ore., until 11 a.m., Apr. 24, for the construction of roads and walks at Fort Stevens.

★Lock Gates—Portland, Ore.—Bids will be received by Maj. J. J. Morrow, Corps Engrs., U. S. A., Portland, until 11 a.m., May 24, for constructing and erecting 11 pairs of metal lock gates for Dallas-Celilo Canal.

Barracks—San Francisco, Calif.—A barracks building to cost about $689,000 is to be erected at the Lombard St. entrance of the Presidio. Plans are being prepared in the Constructing Quartermaster's office at Fort Mason, San Francisco, Calif.

Buildings—Guantanamo, Cuba—Bids were received on Apr. 5, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of buildings at the radio station, Guantanamo, Cuba. Henry Monk, Guantanamo was sole bidder at $13,300

MISCELLANEOUS

Shelter Houses—Boston, Mass.—Bids will be received by the Park and Recreation Department until Apr. 18, for the construction of concrete sanitary and shelter houses at Copp's Hill Park. D. Henry Sullivan, 33 Beacon St., is Chn.

Dredging—Boston, Mass.—Bids will be received by the State Harbor and Land Commissioners, Boston, for dredging about 6000 cu.yd. for a channel from Woods Hole to Eel Harbor, Falmouth. William F. Williams is Ch. Engr.

Stadium—New Haven, Conn.—Plans have been accepted for the construction of the proposed new stadium for Yale University. Bids will be asked at once. The sum of $251,-000 has been subscribed toward the work. C. A. Ferry, New Haven, is Engr.

Canals—Albany, N. Y.—The Governor, Apr. 7, signed the bill introduced by Senator Thomas Willmot, appropriating $35,000 for making surveys for extending the Black River Canal, reconstructing the Chemung Canal, converting the Glens Falls feeder into a canal and constructing a canal between Flushing River and Jamaica Bay, and a canal from Newtown Creek to the Flushing Bay Canal. Duncan W. Peck, Albany, is State Supt. Pub. Wks.

✚Subway—Corning, N. Y.—The contract has been awarded to the J. J. HIGGINS CO., Waverly, N. Y. for the construction of the subway to carry Columbia St. and East First St. under the Erie R. R. tracks. The work will cost about $60,000.

Piles—New York, N. Y.—Bids will be received by R. A. C. Smith, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, until noon, Apr. 21, for furnishing and delivering about 600 piles, Contract 1373.

Lumber—New York, N. Y.—Bids will be received by R. A. C. Smith, Comr, of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, until noon, Apr. 21, for furnishing and delivering about 1,013,595 ft. B. M. of sawed new yellow pine lumber.

Brick Walls—New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, Park Ave. and 59th St., Boro Manhattan, until 11 a.m., Apr. 20, for erecting brick fence walls at Public Schools 16, 33, 45, 50, 112 and 120, Boro. Manhattan.

Rope—New York, N. Y.—Bids will be received by William H. Edwards, Comr. St. Cleaning, Boro. Manhattan, until noon, Apr. 22, for furnishing and delivering manila rope.

Floating Bath House Work—New York, N. Y.—Bids will be received by George McAneny, Pres. Boro. Manhattan, until 2 p.m., Apr. 25, for furnishing all the labor and materials required for repairing and recaulking old pontoons in various free boating baths for the Borough of Manhattan.

Subway—New York, N. Y.—The Public Service Commission, Apr. 8, laid out a new connecting route between the present subway and the Lexington Avenue line in Manhattan Boro. The original plan called for a connection at 42d St., between the two roads, and this was changed to provide for the connection at 40th St., which will be less expensive.

Ferryboat—New York, N. Y.—Bids were opened Apr. 10 by the Dock Department for the construction of a ferryboat: Bath Iron Works, $387,000; Newport News Shipbuilding Co., $339,000; New York Shipbuilding Co., Camden, N. J., $337,000.

Retaining Walls—Rochester, N. Y.—The city is considering the construction of retaining walls along the west side of the river as a protection against floods. Edwin E. Fisher is City Engr.

Fire House—Camden, N. J.—The City Council is considering the erection of a new fire house in the eastern section of the city. The cost has been estimated at $25,000. L. E. Farnham is City Engr.

Pier—Camden, N. J.—The Victor Talking Machine Co., Camden, plans to construct a pier into the Delaware River about 450 ft. long to provide increased shipping facilities for its plant. The work is contingent on the granting of an extension to the present pier head line by the U. S. government.

Jetties—Trenton, N. J.—Bids will be received by H. B. Kummel, State Arch., Trenton, until May 8, for constructing reinforced-concrete jetties at Shark River Inlet, Shark River Improvement. Bids for this work were received Feb. 27 and rejected. List of bidders noted Mar. 6.

Piers—Philadelphia, Penn.—The city is considering the construction of two reinforced concrete piers. The cost has been estimated at $1,200,000. The Pennsylvania R. R. Co., and the Philadelphia & Reading Ry. Co. will also erect new piers near the proposed site of the piers to be constructed by the city.

Retaining Walls—Pittsburgh, Penn.—The city is planning to construct retaining walls in places where landslides threaten to damage buildings for which the city would be liable. The cost of the work has been estimated at $250,000. W. E. Gelston is City Engr.

Tunnel—Baltimore, Md.—The city is considering the construction of a tunnel for traffic purposes under Franklin St., from Calvert to Howard Sts. The cost of the proposed work has been estimated at $200,000. H. K. McKay is Engr.

Tugboat—Washington, D. C.—Bids will be received until 2 p.m., Apr. 21, by the Commissioners of the District of Columbia, Washington for furnishing and delivering one tugboat and four barges, which may be new or second hand.

Baseball Park—Norfolk, Va.—The Norfolk Baseball Corporation is planning for the construction of a baseball park, including the erection of grandstands to seat 2000 and bleachers to seat 8000. The cost has been estimated at $50,-000.

✚Levee—Augusta, Ga.—The city has awarded the contract to A. J. TWIGGS & SONS, Augusta, for the construction of a levee from Hawkes Gully to Washington St., at $101,000.

✦Drainage Pumping Machinery—New Orleans, La.—The contract has been awarded to A. BALDWIN & CO., LTD., New Orleans, for the pumping machinery for the pumping station for the Jefferson and Plaquamine Drainage District. The station will have a capacity of 900,000,000 gal. in 24 hrs. The contract includes four pumps, with a capacity of 192,000,000 gals. and two pumps with a capacity of 64,000,000 gals.

✦Canal—Shreveport, La.—The contract has been awarded to the D. B. GORE CO., INC., New Orleans, La., for the improvement of Kelly Bayou Drainage Canal, Caddo, Parish. Bids were opened Apr. 12 by the Board of Commissioners of Caddo Levee District.

Drainage Ditch—Henderson, Ky.—The Fiscal Court, Henderson, has authorized the construction of a large drainage ditch from Reed Pond to the Green River.

Dike—Louisville, Ky.—The city is considering the construction of a dike around the northeastern section of the city, at present exposed to the floods of the Ohio River.

Subway Work—Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, Apr. 30, for the construction of the approaches to the subway under the Lake Shore & Michigan Southern Ry., at East 79th St.

Dock—Lorain, Ohio—The city will readvertise for bids for the construction of the proposed municipal dock. The bids received Apr. 1 were rejected as excessive. C. M. Osborne is City Engr.

Ditch—Salem, Ohio—Bids were received as follows by the County Commissioners, Salem, Apr. 1, for constructing a county ditch 7000 ft. in length, to include 1700 ft. 24-in. vitrified pipe, 28,250 cu.yd. earth excavation, 24,926 cu.yd. earth and rock excavation, 789 cu.yd. sewer excavation, etc., as follows: W. H. Ralston, Mt. Vernon, $26,160; Wright & Morris, Lisbon, $27,031; Jas. H. Offutt, Greensburg, Penn., $32,905; Buell & Baker, Salem, $27,579.

Levee—Muncie, Ind.—The city is considering strengthening the levee along the White River as a protection against floods. The work will consist of making the levee higher. B. F. Deardorf is City Engr.

✦Drain—Charlotte, Mich.—The contract has been awarded to the WOOLMAN CONSTRUCTION CO., Sandusky, Mich., for the construction of the Indian Creek state drain, at $3.65 per rod. The work will require 4384 rods of dredge work.

Drainage—Warrensburg, Ill.—Bids will be received until Apr. 22 by Illini Drainage District, Warrensburg, for the construction of a drainage system. The work will require 12,500 ft. of 14- to 24-in. tile.

Breakwaters—Kenosha, Wis.—The citizens, Apr. 1, voted in favor of issuing $30,000 of bonds for the construction of breakwaters.

Ditch—Mauston, Wis.—Bids will be received until Apr. 19 by H. H. Sherwood, Secy., Cutler Drainage Dist., Mauston, for constructing 11.6 miles of main ditch and 36.7 miles of lateral ditch.

Bath House—Milwaukee, Wis.—The city is preparing to take the necessary steps for the construction of the proposed bath house, to cost $75,000. H. E. Briggs is Comr. Pub. Wks.

Ditch—Waupaca, Wis.—Bids will be received until Apr. 18 by the Commissioners of Millard Drainage Dist., Waupaca, at the residence of E. H. Tesch, near Welcome, for constructing a ditch 24,800 ft. in length, requiring about 50,000 yd. of earth removed. Estimated cost, $50,000.

Channel—Topeka, Kan.—Campbell & Griggs, Topeka, have made surveys for the straightening of the channel of the river from Oakland to Tecumseh. The work will cost $12,000.

Ditch—Glenwood, Mo.—The Supervisors of Chariton Drainage District have rejected all bids for the construction of a drainage ditch in the district. Bids were opened Mar. 20. The work called for 250,000 cu.yd. of excavation. No date for receiving new bids has been set. A. E. Berry, Glenwood, Mo., is Secy.

Levee Work—Palmyra, Mo.—Bids will be received until Apr. 26 by Frank G. Bier, Secy., Marion County Drainage District, for constructing levees, involving the placing of about 450,000 cu.yd. of earth and excavating and filling about 7000 cu.yd. muck ditch; also constructing canals and ditches, involving the excavation of about 100,000 cu.yd. of earth. E. T. Perkins is Engr., Chicago, Ill.

✦Ditches—Newport, Ark.—Bids were received as follows, Apr. 4, by the Overcup Drainage District of Jackson and Woodruff Counties at Newport for the construction of 30 miles of ditches, requiring the excavation of 590,000 cu.yd. in Contract No. 1, and 350,000 cu.yd. in Contract No. 2; (a) Contract 1; (b) Contract 2; (c) with two machines; (d) with one machine: T. L. Gatke, (a) 8.47c.; (b) 8.47c.; (d) 8.20c.; C. H. Sternberg & Son, (a) 8.77c.; (b) 8.99c.; Forrestal & Feyen, (a) 7.50c.; (b) 8.50c.; (c) 7.87c.; (d) 7.71c.; Northern Construction Co., (a) 8.35c.; (b) 8.35c.; Canal Construction Co., (a) 8.35c.; (b) 8.35c.; (d) 7.90c.; Horton & Mosley, (a) 8.70c.; (b) 8.70c.; R. H. & G. A. McWilliams, (c) 7.94c.; Middle States Dredging Co., (d) 7.38c.; Moffett & Co., (c) 8.25c.; (d) 7.75c.; Oscar Kochtitzky, (a) 8c.; (b) 9c.; (c) 8.25c.; Crumpecker & Adams, (a) 7.74c. The contract has been awarded to FORRESTAL & FEYEN, St. Paul, Minn.

Seawall—Port Angeles, Wash.—The city is considering the construction of a seawall in connection with the proposed waterfront improvements. The cost has been estimated at about $150,000.

Drydock—Seattle, Wash.—The Heffernan Drydock Co., Seattle, has had plans prepared for the construction of a floating dry dock to cost $750,000.

Ferryboat—Seattle, Wash.—The Port Commission will ask for bids for the construction of a ferryboat to cost $500,000. Arthur R. Edgcomb is City Engr.

Mausoleum—Portland, Ore.—The Portland Mausoleum Co., Portland, is planning the erection of a mausoleum near Riverview, to cost $150,000.

Fences and Gates—Los Angeles, Calif.—Bids will be received by the County Commissioners, Los Angeles, for the construction of fences and gates at the Juvenile Detention Home at Los Angeles. H. J. Lelande is County Clk.

✦Dredging—Los Angeles, Calif.—The contract has been awarded to the STANDARD AMERICAN DREDGING CO., Central Bldg., Los Angeles, for dredging 1,300,000 cu.yd. of material from Slips 1 and 5 and filling adjoining lands, at $177,125. Noted Apr. 3.

Tunnels—San Francisco, Calif.—The City Engineering Department has been authorized to prepare plans and specifications for the construction of the Fillmore St. and Twin Peaks Tunnels. M. M. O'Shaughnessy is City Engr.

✦Piling—San Francisco, Calif.—The contract has been awarded to the HEALY-TIBBITS CONSTRUCTION CO., 8 Main St., San Francisco, for the construction of the piling for the Transportation Building for the Panama-Pacific Exposition Co., at $49,815.

Fire Stations—San Francisco, Calif.—Bids will be received by the Panama-Pacific Exposition Co., San Francisco, until Apr. 22, for the construction of three fire stations in the exposition grounds.

Wharf—Yuba City, Calif.—The Business Men's League of Yuba City is considering the construction of a wharf near the foot of B St.

Wharf and Roadway—Kingston, Ont.—Bids will be received by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, until 4 p.m., Apr. 30, for the construction of a combined wharf and roadway across Cataraqui River, and for dredging in Kingston Harbor.

Barges—Ottawa, Ont.—The contract has been awarded to the THOR IRON WORKS, Toronto, Ont., for the construction of two steel barges and two scows, at $18,500.

Harbor—Toronto, Ont.—Plans for the improvements to be made at the harbor of Toronto have been completed and approved. Final specifications are now being prepared. The cost has been estimated at $19,000,000. E. P. Cousins is Engr. Toronto Harbor Comn.

Seawall—Vancouver, B. C.—The city is considering the construction of a seawall west of Main St., along False Creek.

Docks—Vancouver, B. C.—E. H. Heaps, Vancouver, will construct docks along the entire waterfrontage of his property on both sides of Cambridge St., at Cedar Cove. The docks are to be capable of accommodating deep sea vessels.

BUILDINGS

Windsor, Vt.—The Board of Trade is contemplating the erection of a hotel at Windsor. The estimated cost is $150,000.

Athol, Mass.—A town hall is being considered, and a special town meeting has been called in relation to the matter.

Grafton, Mass.—Archs. Fuller & Delano, Chase Bldg., Worcester, Mass., have completed plans for the new buildings for the state asylum at Grafton, and will receive bids until May 5. The plans call for two buildings 178x36 ft. each, with a wing 100 ft. long, to be built of brick, stone and concrete, and two stories high with basement. The administration building will be 142x47 ft., with a 16-ft. wing in the front and rear, three stories high and of the same general construction as the other two buildings. There will also be an infirmary building 175x38 ft. with small wings in the front and rear, and of the same construction. The plans also provide for a new boiler house 50x150 ft., in which will be placed three new boilers. Noted Mar. 6.

Methuen, Mass.—James E. Allen, Arch., 283 Essex St., Lawrence, Mass., is preparing plans for the construction of a school on Ashford St. The estimated cost is $40,000.

Millbury, Mass.—Plans have been prepared for the construction of the high school. The estimated cost is $50,000. Ira N. Goddard, Elm St., is Town Clk.

✦New Bedford, Mass.—The general contract has been awarded to the J. W. BISHOP CO., Worcester, Mass., for the construction of the Hutchinson Block on Union St. It will be four-stories of brick and steel.

Oakdale, Mass.—Plans are being prepared by Cutting, Carleton & Cutting, Archs., Chase Bldg., Worcester, Mass., for an addition to the Worcester County Training School, at Oakdale. The building will be of brick, 40x40 ft., one story high.

Hartford, Conn.—Plans have been prepared by A. Raymond, Ellis, Arch., 36 Pearl St., for the construction of an isolation hospital. The estimated cost is $98,210. Noted Feb. 27.

Albany, N. Y.—Hopper & Koen, Archs., 244 Fifth Ave., New York, are preparing plans for the construction of the Albany County court house on Eagle St. The estimated cost is $700,000.

Brooklyn, N. Y.—We are officially advised that the low bid received by the Department of Water Supply, Gas & Electricity, 13 Park Row, New York, N. Y., on Apr. 8, for the construction of buildings at the East New York Pipe Yard, Brooklyn, was that of Thomas J. Carlin Inc., 95 Garfield St., at $26,899. The remainder of the bids are as follows: Hansen & McHugh, $29,679; Peter Cleary, $35,500; Frank J. Pelgenbauer, $30,892; Neptune B. Smythe Inc., $34,382; Harry McNally, $43,500; J. M. Knapp, $38,337; Wisner & Bartells Co., $38,482; Kelly & Kelly Inc., $33,340; Edmund D. Broderick, $36,746; Otto Metz, $32,899; Richard E. Heningham, $37,388; Concor Const. Co., $38,967; Wm. D. Moore, $33,263; Jos. Balabon Co., $28,515; Hardgroove & McDermoot, $31,285; Wm. H. Egan, $32,800; John T. Williams Co., $32,400; B. Diamond, $34,444; Wm. Flanagan, $35,500; Durkin & Laas, $34,977; Harry Britton, $32,490; Thos. McKeown Inc., $33,333; Frymeir & Hanna Co., $29,900.

The low bid for the construction of buildings at the Gowanus Pipe Yard, Butler and Nevins St., Brooklyn, was that of the Mitchell Construction Co., 4 Court Square, at $17,947. The other bids as follows: John Kennedy & Co., $71,058; Thos. G. Caden Inc., $73,747; Jos Balaban Co., $53,764; Hardgroove & McDermoott, $53,210; Richard E. Heningham, $72,292; Concord Const. Co., $73,587.50; Wm. Flanagan, $58,216; Wm H. Egan, $64,746. The Marble Arch Co., $63,930; Wisner Bartells Co., $90,708; Neptune B Emyth Inc., $59,118; Durkin & Laas, $63,200; Peter Cleary, $69,762.50.

Plans for the steel construction of a reinforced concrete and steel warehouse to be erected in Brooklyn are being prepared by Gunvald Aus, Engr., 11 East 24th St., Manhattan, for Henry O. Havemeyer, Jr., 129 Front St. Cass Gilbert, 11 East 24th St., Manhattan is the Arch. The estimated cost is $1,700,000.

Plans are being prepared by Shampan & Shampan, Archs., 772 Broadway, for the construction of a high-class apartment house, 100x50 ft., on the west side of East 159th St., north of Burrly Road, for the Merchants Lloyd Realty Co.

Bids will probably be received about June 1, from plans which are now being prepared by William Higginson, Arch., 21 Park Row, New York, for the construction of a five-story ward building, 210x38 ft., at Lewis and Amity Sts., for the Long Island College Hospital. Miss M. Bodine is Supervisor.

We are officially advised that L. & A. Pincus, 501 Fifth Ave., will soon select an architect to prepare plans for the erection of a theater on Fulton St., at the junction of Grand and Putnam Aves. The structure will be 150x150 ft., and is estimated to cost $250,000.

+Buffalo, N. Y.—A contract has been awarded to the RAYMOND CONCRETE PILE Co., New York, and Chicago, for placing the foundation of the Hutchinson High School. The Durolithic Co., general contractors. Noted Mar. 20.

New York, N. Y.—A 32-story structure is projected in a part of Manhattan Island several miles north of the skyscraper zone. This will be devoted to professional purposes. A syndicate has recently been organized to take over five lots owned by W. E. D. Stokes, West End Ave. and 72d St., upon which plot is contemplated a unique structure which will be designed to be occupied largely by doctors and dentists. Speial facilities will be provided for these professions, such as operating rooms, ambulance elevators, nurses' quarters, and all the requirements which go to make up a doctor's complete office equipment. It will not be a hospital, but rather a place where consulting specialists will have their offices. Francis H. Kimball, 71 Broadway, is the arch.

Guy Lowell has been appointed architect of the Court House Board, and will design a new Court House for the County of New York. It is proposed to locate this building in a civic center bounded by Lafayette, White, Baxter and Park Sts., in which area is now located the Criminal Courts Building and the City Prison. The jury of awards selecting the architect is composed of Robert F. Peabody, Frank Miles Day and John Lawrence Mauran. The design submitted by Mr. Lowell may not necessarily be the type of structure that will finally be constructed. It provides for a circular court house, Roman style. The building will have a diameter of approximately 500 ft. The height from the curb to the cornice will be 200 ft., above which there will be a three-story addition. The estimated cost is $10,000,000. The expense of a site is approximately $6,000,000.

New York, N. Y.—Plans have been filed by Jacob H. Schiff, 355 West End Ave., for the construction of a 12-story hotel, 113x33 ft., at the northeast corner of Broadway and 94th St. Schwartz & Gross, 346 Fifth Ave., are the Archs. The estimated cost is $200,000.

Plans have been filed by J. F. Burrowes, 410 West 34th St., for the construction of a five-story store and loft building, on the east side of Fifth Ave., south of 33rd St., for W. W. Astor. The estimated cost is $100,000.

Plans have been filed by Sommerfeld & Steckler, Archs., 31 Union Square, for the construction of a 12-story loft building, 88x47 ft., on the north side of 28th St., east of Seventh Ave., for the Gross Realty Co. The estimated cost is $350,000.

Plans have been filed by F. Freeman, Arch., 132 Nassau St., for the construction of a three-story chapel and Sunday School building, on the north side of 105th St., east of Amsterdam Ave., for the West End Presbyterian Church. The estimated cost is $65,000.

Boortman & Braun, Archs., 114 East 28th St., have completed plans and will receive bids shortly, for the construction of a five-story apartment house, 119x50 ft., at the northwest corner of Nagle Ave. and Arden St., for Brown Bros., 33 East 20th St. The estimated cost is $100,000.

Bids are now being received by the Solon Construction Co., 507 West 115th St., for the construction of a six-story apartment house, 111x89 ft., on the south side of 129th St., between Edgecomb and St. Nicholas Aves. Sommerfeld & Steckler, 31 Union Square, are the Archs. The estimated cost is $200,000.

Plans have been filed by the Peoples Vaudeville Co., 260 West 42nd St., for the construction of a four-story theater and store structure, 194,x86 ft., at the northwest corner of Seventh Ave. and 123rd St. T. W. Lamb, 844 Eighth Ave., is the Arch. The estimated cost is $600,000.

(Boro. the Bronx)—Plans have been filed by Moore & Landseidel, Archs., 148th St. and Third Ave., for the construction of a five-story apartment house, 113x50 ft., on the south side of Sherman Ave., west of Academy St., for the Bondheim Construction Co., 128 Broadway. The estimated cost is $250,000.

Olean, N. Y.—Emile M. Uhlrich, Arch., 1900 Euclid Ave., Cleveland, Ohio, is receiving bids for the construction of a stone and brick church, 176x65 ft., at Henley and Irving Sts., for St. Mary's Catholic Church. The estimated cost is $100,000.

Rochester, N. Y.—Dr. J. William Graves has purchased a site at Chestnut and Elm Sts., upon which will be erected an office building for physicians. The estimated cost is $50,000.

The Rochester Club will erect a club house on Gibbs St. The estimated cost is $500,000. William Bausch is Pres.

Plans for the construction of a two-story building, 77x93 ft., at 562 East Main St., have been completed by the Joseph Knopf Clothing Co., St. Paul St. The estimated cost is $40,000.

+Sloan, N. Y.—The masonry contract for the school building to be erected at Sloan, has been awarded to BRISEBERG & SANSOM, 204 Genesee St., Buffalo, N. Y., and carpentry, to STOKES BROS., 50 Brayton St.

Syracuse, N. Y.—Bids will be received until Apr. 17, by Russell & King, Archs., 601 Snow Bldg., Syracuse, for the construction of a warehouse on West Willow St. for T. Snow & Co. The estimated cost is $70,000. Noted Apr. 3.

Arlington, N. J.—The New York Telephone Co. will erect a central exchange station on Midland Ave., near Kearny Ave. The building with new equipment is estimated to cost $50,000.

Belleville, N. J.—Thomas Barwick, 21 Park Row, New York City, is preparing plans for the construction of a town hall at Washington Ave., and John St., for the Town Council. The estimated cost is $50,000.

Dundee Lake, N. J.—The School Board will receive bids until Apr. 26, for the enlargement of school No. 4, and alterations including the installation of a new boiler. o The architect of the board has prepared plans.

Hopewell, N. J.—The First National Bank has acquired property on Broad St., and Greenwood Ave., and will have plans prepared for a new three-story brick and stone bank building.

Montclair, N. J.—A 12-day campaign to raise $300,000 for the Mountainside Hospital has been started by a committee headed by Jason Rogers. It is for the purpose of erecting new buildings.

Newark, N. J.—The Maxwell Realty Co., Philadelphia, Penn., has purchased a site at 828 Broad St., Newark, upon which will be erected a 16-story office building by Philadelphia capitalists.

Summitt, N. J.—Warren & Wetmore, Archs., 16 East 47th St., New York, have prepared preliminary sketches for the construction of a hotel on the site of the old Oliver J. Hays homestead. The estimated cost is $300,000.

Crafton, Penn.—Plans are being prepared for the construction of a three-story high school, 96x135 ft. The estimated cost is $100,000.

Dickerson Run, Penn.—Supt. of Motive Power L. H. Turner, of the Pittsburgh & Lake Erie R.R. Co., Pittsburgh, is designing a building 90x100 ft., two stories and basement, for Y. M. C. A., purposes. The estimated cost is $50,000.

Duquesne, Penn.—Carlisle & Sharrer, Jenkins Arcade Bldg., Pittsburgh, have plans in progress for the two-story brick and terra cotta fireproof school building to be built in Third St. for the Board of Education. The estimated cost is $180,000. Noted Feb. 20.

Easton, Penn.—Bids for the school to be erected on Reeder St., College Hill, were received as follows: F. J. Lerch & Co., Easton, $89,277; H. J. Wenzelberger, Phillipsburg, $91,770; Peter J. Rogers, Paterson, N. J., $98,850.

Kersey, Penn.—Bids will be received until noon, Apr. 21, by C. H. Straessley, Secy., Bd. of Education, for the construction of a school at Kersey.

McKees Rocks, Penn.—The Pittsburgh & Lake Erie R.R. Co. will rebuild the two-story Y. M. C. A., building at McKees Rocks at a cost of about $40,000. The plans are being designed by L. H. Turner, Supt. of motive power.

Philadelphia, Penn.—Harry H. Wehmeyer, Arch., 1004 W. Lehigh Ave., Philadelphia, will receive bids until Apr. 24, for the construction of barracks at the League Island Navy Yard.

Bids will be received until Apr. 24, by J. Horace Cook, Arch., Bd. of Education, Philadelphia, for the construction of a school building at Race and 59th. Sts. and another at 13th St. and Grange Ave.

Plans are being prepared by McIlvain & Roberts, Archs., Land Title Bldg., Philadelphia, for the construction of a 12-story apartment house 62x125 ft. at 18th and Walnut Sts. The estimated cost is $350,000.

+Philadelphia, Penn.—The contract has been awarded to SMITH-HARDIGAN & CO., for alterations to the five-story brick building at 619 Ranstead St., for D. L. Ward & Co. Sauer & Hahn are Archs.

+The contract has been awarded to EDWARD FAY & SONS, Philadelphia, Penn., at $40,000, for the construction of a bank building for the First National Bank. Noted Apr. 3.

Hewitt, Granger & Paist, Archs., 671 Hewitt Bldg., are preparing plans for the construction of the Jewish Maternity Hospital at Fourth and Spruce Sts. The estimated cost is $50,000.

Plans have been filed by Borie & Medary, Archs., Philadelphia, for the construction of the 36-story office building at Broad and Locust Sts. The estimated cost is $3,000,000. Noted Jan. 9.

Pittsburgh, Penn.—Vrydaugh & Wolfe, Archs., 347 Fifth Ave., are preparing plans for a two-story brick school building at Stanton Ave. and Meadow St. for the Board of Education. The building will cost $250,000.

+The contract has been awarded to H. MILLER & SONS, Union Bank Bldg., Arch., Charles Bickel, May Bldg., for the construction of a three-story brick, and terra cotta club house at Bayard and Matilda Sts., Schenley Farms, for the Concordia Club. The building will cost about $100,000. Noted Mar. 6.

+Tarentum, Penn.—The contract has been awarded to GEORGE SCHENCK & CO., Butler, Penn., for the construction of the Second Presbyterian church.

+Wilmington, Del.—The contract has been awarded to J. A. BADER & CO., Wilmington, for the construction of the Du Pont Theater, on Eleventh St. Noted Apr. 3.

+Baltimore, Md.—The contract has been awarded to CHARLES L. STOCKHAUSEN, Marine Bank Bldg., Baltimore, Md., for the construction of a warehouse. Owens & Sisco, Arch., Continental Bldg., Baltimore, for Wm. G. Scarlet & Co. It will be six stories and basement, steel construction on pile foundation.

Plans have been completed by P. O. Keilholtz, Arch., 1602-1603 Continental Bldg., for the construction of an addition to the Bee-Hive Building, on Preston St. near Greemount Ave., for the Industrial Building Co. It will be seven stories and basement, conforming with present structure, 244x118 ft. The estimated cost is $500,000.

The site of the Present Eutaw House, recently destroyed by fire, has been purchased by the Hippodrome Co., of Baltimore, recently incorporated by Marion S. Pearce, Philip J.

Schneck, both of Pearce & Schneck, 414 E. Baltimore, St., and W. Stuart Symington, Maryland Trust Bldg., with a capital stock of $400,000. It is contemplated to erect a Hippodrome Theater on part of the site and on the other a hotel.

+Baltimore, Md.—The contract has been awarded to EDWARD BRADY & SON, 1109 Cathedral St., Baltimore, for the construction of the academic building for the John Hopkins University. Noted Mar. 27.

Towson, Md.—Parker, Thomas & Rice, Archs., Union Trust Bldg., Baltimore, have prepared plans for the construction of the State Normal School. The estimated cost is $600,000. Noted Jan. 9.

Washington, D. C.—Nathan C. Wyeth, Arch., 1517 H St., N. W., has prepared plans for the construction of an eight-story brick hospital, 100x107 ft., for the District Commissioners. The estimated cost is $300,000.

+Washington, D. C.—The steel-frame contract has been awarded to BARBER & ROSS, 614 11th St., N. W., for the 12-story office building to be erected at 14th and H Sts., for the Real Estate Trust Co. Noted Feb. 27.

+The contract has been awarded to the P. F. GORMLEY CO., Union Trust Bldg., for the construction of the addition to the House of the Good Shepherd.

+Milburn, Heister & Co., Archs., awarded contract to C. A. BARKER for the bank and office building for the Security Savings and Commercial Bank, at 9th and G Sts.

Milburn, Heister & Co., Archs., Washington, D. C., are preparing plans for convention hall for the Conventions Committee of the Chamber of Commerce. Bids will be called for shortly.

The Catholic University, is planning the erection of three buildings. The estimated cost is $1,000,000. Thomas J. Shahan is Rector.

+The contract for the construction of the office building for the National Geographic Society has been awarded to the GEORGE A. FULLER CO., Munsey Bldg., at $100,500. Noted Jan. 30.

Charleston, W. Va.—Bids will be received until Aug. 1, by Rev. G. W. Banks, Pastor, Methodist Episcopal Church South, for the construction of a church edifice 80x90 ft. The estimated cost is $75,000. H. Rus Warner is Arch., Charleston.

Weber, Werner & Adelkin, Cincinnati, Ohio, have prepared plans for the construction of a church edifice, for the First Presbyterian Church. The estimated cost is $100,000.

+Christiansburg, Va.—The contract has been awarded to MORRIS C. MILLER, for the construction of a jail. G. R. Ragan is Arch., 613 Matt Bldg., Roanoke, Va.

+Norfolk, Va.—The contract has been awarded to the RICHARDSON CONSTRUCTION CO., Norfolk, for the construction of the Spotswood apartments on Shirley Ave. between Colonial Ave. and Stockley Gardens. H. W. Simpson, Paul Gate Greenwood Bldg., is Arch.

Clarksburg, W. Va.—Bids will be received until 4 p.m., Apr. 24, by James N. Hess, Secy., Bd. of Education, for the construction of a high school. William B. Ittner is Arch. Bd. of Education Bldg., St. Louis, Bo. Noted Mar. 27.

Harpers Ferry, W. Va.—Holmbol & Lafferty, Archs., Clarksburg, W. Va., have prepared plans for the construction of a hotel, 80x40 ft., for T. S. Lovett. The estimated cost is $40,000. ??

Wheeling, W. Va.—Caldwell & Drake, Youngstown, O., contractors, who have the work of erecting the four-story hotel building here for the Windsor Hotel Co. will take sub-bids soon. The building will be 40x100 ft. and will cost $400,000.

+Durham, N. C.—The contract has been awarded to J. T. SALMON, for additions to Durham Union Station. Milburn, Heister & Co. are Archs., Washington, D. C.

+Hendersonville, N. C.—The general contract has been awarded to JOSEPH McCRARY, Hendersonville, for the construction of a hospital. Sayre & Baldwin are Archs., Anderson, S. C.

Raleigh, N. C.—The Raleigh School Board contemplates erecting a school building for the Glenwood section of the city. The estimated cost is $100,000.

+Bishopville, S. C.—The contract has been awarded to W. LEE HARBIN, Sumter, S. C., for the church edifice for the Methodist Episcopal Church. Wheeler & Stern are Archs., Charlotte, N. C.

Atlanta, Ga.—All bids have been rejected for the construction of the nurses dormitory at the Grady Hospital. New bids are being received by Blair & Adams, Archs., Forsyth Bldg., Atlanta.

Atlanta, Ga.—The Negro Odd Fellows of Atlanta contemplate erecting an auditorium on Auburn Ave., between Bell and Baker Sts. The estimated cost is $100,000.

Atlanta, Ga.—Walker & Chase, Archs., Candler Bldg., Atlanta, are receiving bids for the construction of a three-story and basement warehouse, 60x200 ft. The estimated cost is $15,000.

+Columbus, Ga.—The contract has been awarded to the KREBBS CONTRACTING CO., Birmingham, Ala., for the construction of the building for the Southern Bell Telephone & Telegraph Co.

Macon, Ga.—Bids will be received until June 2, by Blair & Adams, Archs., Macon, for the construction of a high school. The estimated cost is $100,000. Noted Apr. 3.

Madison, Fla.—Bids will be received until Apr. 25, by Bishop & Greer, Arch., Candler Bldg., Valdosta, Ga., for the construction of the Madison County courthouse. The estimated cost is $50,000. Noted Apr. 3.

Birmingham, Ala.—The contract for the construction of the four-story addition to the court house has been awarded to the CARROLL-BLAKE CONSTRUCTION CO., Birmingham, at $48,000. Other bidders were: H. A. Stockman, $53,455; Frank H. Conner $51,500; Evans Bros. Construction Co., $49,-295; Richmond Construction Co., $52,872; P. E. Bostle, $52,000; C. C. Ard, $55,866. Noted Apr. 3.

Alexandria, La.—The Board of Administration of the Pineville Hospital for the Insane has decided to erect two brick buildings. William Drago, Arch., 512 Audobon Bldg., New Orleans, will receive bids.

New Orleans, La.—The Phi Delta Theta chapter of Tulane University has purchased a site on St. Charles Ave. and will erect a chapter house.

Knoxville, Tenn.—The Trustees of the Lawson McGhee Library have purchased a site at Commerce Ave. and Prince St. upon which will be erected a library. The estimated cost is $50,000.

+Memphis, Tenn.—The Bank of Commerce & Trust Co., (not Commercial Trust & Savings Bank as recently noted) has awarded the contract to the CONSOLIDATED ENGINEERING CO., 61 Gunther Bldg., Baltimore, Md., for the construction of a 15-story bank and office building. Noted Apr. 3.

Charles O. Pfeil, Arch., 1403 Tennessee Trust Bldg., Memphis, is preparing plans for the construction of a 21-story bank and office building for the Commercial Trust & Savings Bank. The estimated cost is $500,000. (Contract erroneously noted awarded Apr. 3.)

+Milligan College, Tenn.—The contract for the construction of the three-story dormitory, 56x108 ft., and the three-story science hall, 50x80 ft., has been awarded to W. H. ALLEN, Elizabethton, Tenn. Noted Feb. 6.

Lexington, Ky.—The Phoenix Hotel Co., Lexington, Ky., is considering the erection of a 6-story reinforced concrete addition.

Columbus, Ohio—The Dawson Construction Co., Pittsburgh, was the low bidder, at $93,000, for the construction of a botany building for the Ohio State University. They will probably be awarded the contract. Noted Mar. 27.

A number of changes have been made in the plans and specifications for the Crestview school. The estimated cost has been cut from $203,000 to $161,000. Bids for the construction of the building will be asked for soon.

Sandusky, Ohio—Bids will be received until May 10, for the erection of a $300,000 stone high school. Howard & Merriam, Columbus, are Archs.

Wellsville, Ohio.—Howard & Merriam, Archs., Columbus, have been selected to prepare plans for a school. The estimated cost is $100,000.

Burgersville, Ind.—Bids will be received until 10 a.m., Apr. 19, by Jacob J. Clary, trustee of White River Township, for the construction of a school for School District No. 11.

Detroit, Mich.—Esenweine & Johnson, Archs., 781 Ellicott Square, Buffalo, N. Y., have completed plans for the construction of a 12-story hotel at Lafayette Ave. and Wayne St., for Charles H. Clements, Hotel Metropole. The estimated cost is $800,000.

+Detroit, Mich.—John Scott & Co., Archs., 1605 Ford Bldg., awarded contracts for the construction of a warehouse at Jefferson and Adair Aves., for the Michigan Stove Co., as follows: Mason and concrete, FRAND GODDARD, Inc., 516 Fralin St.; steel, RUSSEL WHEEL & FOUNDRY CO., carpenter, VINTON & CO., 270 Woodbridge St.; painting and glazing, WM. DEIDRICH, 680 Gratiot Ave.

Lansing, Mich.—Judson N. Churchill, Arch., is receiving figures for a brick and stone school building for the Board of Education. Bids close Apr. 15.

+Chicago, Ill.—The general contract has been awarded to J. P. & J. W. O'CONNER, 189 W. Madison St., for the construction of the three-story 118x242 ft. office building for Peter C. Brooks.

Chicago, Ill.—A. L. Alschuler, Arch., 28 East Jackson Blvd., has prepared plans for the construction of a mercantile building at La Salle and Van Buren Sts., for B. I. Greenebaum. The estimated cost is $800,000.

Bids will be received until May 10, by Myer J. Sturm, Arch., 120 North La Salle St., Chicago, for the construction of a seven-story brick warehouse for the Empire Express & Van Co. The estimated cost is $60,000. Noted Apr. 3.

The Chicago Motor Club Auxiliary Association will erect a hotel and club building. The estimated cost is $500,000. Holabird & Roche are Archs., 1618 Monadnock Block.

East St. Louis, Ill.—Plans have been accepted by the Building Committee of East St. Louis Elks Lodge, for the construction of a home at Ninth St. and Illinois Ave. The estimated cost is $150,000.

Appleton, Wis.—The First National Bank will erect a two-story bank building 43x110 ft. on Appleton St. The estimated cost is $100,000. Childs & Smith are Archs.

+Beloit, Wis.—The general contract for a Masonic Temple has been awarded to SCHNEIBERG BROS. Sub-contracts awarded: F. M. STEVENS, carpentry; GEORGE F. SOUTHWICK, painting; SANITARY PLUMBING CO., heating and plumbing. The building will be of concrete, brick and stone construction and cost $65,000. Noted Jan. 30.

+Janesville, Wis.—The general contract has been awarded to E. PAUTZ for a German Lutheran church at Nort Bluff and Pease Court. It will be of colonial style brick, with concrete and tile foundation. Cost. $40,000.

Milwaukee, Wis.—Plans are being prepared for the construction of a ten-story hotel at 406 Wells St. for Dr. J. H. Sure, Milwaukee, Wis., and Abraham Epstein, Berlin, Wis.

Dermott, Ark.—Bids will be received until Apr. 21, by Albert Ahrems, Secy., Bldg. Com. of the Dermott Hotel Co., for the construction of a hotel. John R. Scott, is Arch., 321 Southern Trust Bldg., Little Rock, Ark.

+Denison, Tex.—Contracts for the construction of the high school have been awarded as follows: General contract, RHINEHART & DONOVAN, Oklahoma City, Okla., at $74,175; plumbing and wiring, CRIS WALTZ, at $6310; heating, TEXAS HEATING & VENTILATION CO., Fort Worth, Tex. Noted Mar. 20.

Waco, Tex.—The Amicable Life Insurance Co. contemplates

erecting a 12-story addition, 47x100 ft. The estimated cost is $175,000.

+Chickasaw, Okla.—The contract has been awarded to the LISLE-DUNNING CONSTRUCTION Co., Oklahoma City, for the construction of a theater, for J. D. Sugg.

Phoenix, Ariz.—Judge E. W. Wells, of Prescott, Ariz., is planning the construction of a seven-story fireproof hotel at Second Ave. and Adams St., to cost $200,000. The George H. Gallagher Construction Co. is preparing the plans.

Olson & Graft, of Phoenix, were the lowest bidders and will be awarded the contract for the construction of a three-story brick business building on First Ave. The cost will be $75,000.

+Los Angeles, Calif.—The general contract has been awarded to WEYMOUTH CROWELL, Story Bldg., at $92,400, for the erection of the seven-story and basement addition to the I. W. Hellman Bldg., on Spring St., for Isaias W. Hellman. The total cost is estimated at $180,000. The building will be 39x160 ft. It will have concrete foundation and basement, steel frame, brick walls, reinforced-concrete floors and roof, matt finish and ivory terra cotta facing and terra cotta cornice. Morgan, Walls & Morgan, Van Nuys Bldg., are Archs.

+The general contract has been awarded to the J. C. KUBACH CO., Pacific Electric Bldg., at $35,000, for the erection of a three-story and basement reinforced-concrete building, on Spring St., adjoining the Alexandria Hotel, for the Realty Fireproof Building Co. It will be 24x150 ft. and have reinforced-concrete frame, and walls, terra cotta trim. Parkinson & Bergstrum, Security Bldg., are Archs.

Oakland, Calif.—Bids will be received until Apr. 21, by J. J. Donovan, Arch., for the construction of a manuel training and commercial high school, at 45th St. and College Ave. The estimated cost is $400,000. Noted Apr. 3.

+San Diego, Calif.—The general contract has been awarded for the construction of the six-story reinforced-concrete hotel building for the Rice-Landswick Co., at First and D St. Oliver G. Bowen is Arch.

San Francisco, Calif.—The following bids were received, Apr. 1, by the Buildings and Grounds Committee of the Panama-Pacific International Exposition Co., for the construction of the Food Products Building, to be erected in the Exhibit Building section of the Harbor View site: General Construction, Commary-Peterson Co., $256,600; Strehlow, Freese & Peterson, $233,900; J. Monk, $276,647; Lang & Bergstrom, $235,655; Reese & Roundtree, $239,900; F. Rolandi, $270,000; McLaren & Peterson, $241,000; Neil A. McLean, $219,800; James L. Brown, $290,000; D. B. Farouharson, $390,000. Plumbing: Peterson-James Co., $19,900, highest bidder; John G. Sutton Co., $16,350, lowest bidder.

Bids will be received by the Board of Public Works until Apr. 30, for the general construction of the Academic Building, Polytechnic High School, on city property bounded by Willard, Frederic, Carl Sts., and Arguello Boulevard; also for the furnishing and installing of boilers, boiler auxiliaries and piping, and electric work.

Vancouver, B. C.—Bids for the construction of a four-story club building for the Street Ry. Co. will be called for shortly. The plans are nearly completed. The building will cost approximately $40,000.

Vancouver, B. C.—A. Williams, Arch., is preparing plans for the construction of a Creche on Haro St. The estimated cost is $40,000.

+The general contract has been awarded to SKENE & CHRISTIE, for the construction of a 15-story hotel for the Canadian Pacific R.R.

+The Board of Public Works, have awarded the contract for the excavating of the foundation of the city hall to the CONTRA COSTA CONSTRUCTION CO., at $23,950.

The Woodward Department Store, Ltd., will erect a 10-story building at Hastings and Abbott Sts. The estimated cost is $500,000.

+The contract has been awarded to the CANADIAN-FERRE-CONCRETE CO. for the construction of the 15-story Weart building. The estimated cost is $800,000.

+Toronto, Ont.—The contract for the construction of St. Alban's Cathedral has been awarded to ELIGIE & PAGE.

+Toronto, Ont.—The contract for the construction of the Cathedral of St. Alban the Martyr, to be erected on Howland Ave., has been awarded to ELGIE & PAGE. The estimated cost is $500,000.

IMPROVING FREIGHT TERMINALS IN NEW YORK

If the plan proposed by the Terminal Committee of the Board of Estimate and Apportionment of New York for the improvement of the terminal facilities of the New York Central & Hudson River R.R. is adopted by the board, it will mean a modernization of the railroad's freight handling and new construction commensurate with the passenger transit facilities.

The New York Central at present brings freight into New York City over two main-line tracks from the Harlem River Ship Canal to the Sixtieth St. yard. From that point, part of the tonnage is floated to waterside stations at Desbrosses St. and Barclay St. The remainder is carried by rail over the surface of public streets to terminal yards at Thirtieth St. and at St. John's Park, Hudson and Beach Sts. To secure an adequate freight terminal it is expected that the New York Central will increase the number of main-line tracks giving access to its yards, to modernize existing yards at Sixtieth St. Thirtieth St. and St. John's Park; and establish subsidiary yards between Sixtieth St. and the northerly city line to relieve the pressure on more important terminals and above all, to eliminate surface operation through city streets.

The plans reported favorably to the Board of Estimate provide for numerous changes in the trackage, beginning immediately north of the Harlem Ship Canal; these include a new high-level bridge with a clearance of 26 ft. above mean high-water mark to be submitted for the present bridge across the entrance to the canal. The new bridge is to carry four tracks, leading into a tunnel along the brow of Inwood Hill, emerging directly north of Dyckman St. South of Dyckman St a new freight yard is to be established in connection with the port of call of the State Barge Canal. The yard will serve as a receiving and distributing depot for northern Manhattan and southern Bronx. The tracks will continue south as a four-track main line to the northern end of Fort Washington Park. At this point, the railroad company will abandon the present open cut, and carry its tracks slightly to the east of the present right of way and, through a tunnel, to the southern boundary of the park. The line will continue from this point with six tracks to 145th St. From 145th St. to 137th St. the plans propose the establishment of an extensive distributing and classification yard served by piers and float bridges.

From a point near 144th St., the plans provide for the elevation of the six main tracks on a viaduct to carry them with a clearance of 14 ft. over the Manhattanville Valley to the western side of Claremont Hill at 129th St., nearly opposite Grant's Tomb. At this point a covering will be built over both new and existing tracks to the extreme westerly edge of the railroad's right-of-way. The roof will be of steel and concrete with a solid deck supported in such a manner that it will carry 2½ ft. of earth for parking purposes, a drive and an esplanade. The roof will extend the entire length of Riverside Drive, forming an important addition to it.

At Eighty-sixth St. the tracks are widened to ten. The ten tracks continue to Seventy-ninth St., where they begin to fan to furnish drilling leads to the Sixtieth St. yard. At Seventy-second St., which is the entrance to the yard proper, the tracks are 26 in number. The roof structure is carried over all these tracks to the southerly boundary of Seventy-second St. It is to have a clearance over the base of rail just sufficient to allow passage of cars, except that in the throat of the yard, it is to be increased to 22 ft. to permit men to stand on the tops of cars during switching operations. The only openings will be through arcades in the western wall.

It is proposed to change the present dead end layout of the Sixtieth St. yard to the circulating type, carrying all important tracks through the entire length of the yard. The company contemplates the possibility of double-decking the yard in the future if the requirements of traffic make it necessary. The existing piers outshore of this yard are to be lengthened and improved, and a new pier constructed between Seventy-first and Seventy-second Sts. New stock yards are planned in connection with the pier 90 at Fifty-ninth St. A new milk station and markets and stores are provided for along West End Ave. between Fifty-ninth St. and Sixty-fifth St. From Fifty-ninth St. to Forty-fourth St. the City's plants for port development provide for the construction of trans-Atlantic steamship piers with a possible length of 1200 ft. These piers are to be provided for by cutting inshore through the present bed of Twelfth Ave. It is proposed to establish a new Twelfth Ave., directly back of the long pier development. The New York Central is to be allowed to use a portion of the subsurface of the new street for a four-track line, upon the construction by the company of an elevated street 100 ft. in width, extending from Fifty-ninth St. to Forty-fourth St. This street is to be connected with all cross streets between Fifty-ninth St. and Forty-fourth St. by ramps the full width of the streets. The topography of the section is such that cross streets can be carried out practically at grade without extending the ramps back more than one block in distance. Provision will be made for direct connection between the elevated street and the second docks of the projected piers. Access will also be secured to the lower levels of piers by ramps from the westerly side of the new street to the marginal way.

At Forty-fourth St. the company's tracks will rise reaching a clearance of 14 ft. at Forty-second St. It will continue along Twelfth Ave. as an elevated structure across the yard of the Pennsylvania R.R. Co. to a connection with the rearranged freight yard between Thirty-seventh and Thirtieth Sts., Tenth and Twelfth Aves. The new yard will be on two levels. It will be operated in connection with four piers from Thirty-third St. to Thirty-sixth St. All streets between Thirty-first St. and Thirty-seventh St. will have direct access to both levels of the new yard.

The original plans of the railroad company provided for an elevated structure four tracks wide from Sixtieth to Thirtieth Sts., and a two-track structure along Twelfth Ave. and the marginal way between Thirtieth St. and Cortlandt St., with a two-track spur through Canal St. to connect with the St. John's Park yard. The City Dock Department prepared similar plans for an elevated structure between Sixtieth St., and Fulton St., the difference being that the Dock Department's plan contemplated the construction of a municipal road open to all railroads. The Committee of the Board of Estimate rejected both plans. It decided that it was unwise to allow an elevated road along the marginal way, both because of inherent objections to any elevated structure, and because it was believed that an elevated would create an insuperable barrier to what it considered the normal development of the New York terminals of the New Jersey railroads. The Committee tried to secure coöperation by the New Jersey railroads in the establishment of a joint municipal subway between Thirtieth St. and a southerly terminal to be agreed upon. The railroads, without exception, declined to consider such a plan upon the ground of prohibitive expense. The same objection was made to a joint elevated road. The Committee was convinced that without direct tunnel connection to New Jersey any joint marginal railroad was economically impossible.

The approved plans provide for a two-track subway exclusively for the use of the New York Central from the Thirtieth St. yard through Tenth Ave. to Fifteenth St., thence under city property forming the Gansevoort market site to Washington St., and down Washington St. either to St. John's Park or to Barclay St., at the option of the New York Central Co. This change of line from the waterfront to Washington Street was insisted upon by the city in order to keep the marginal way free for a possible terminal road in the future. The plans provide that the entire scheme be operated by electricity.

CONTRACT PRICES

Paving—Grand Haven, Mich.—Bids were received by the city, Mar. 3, for paving Fourth and Howard Sts., according to plans prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio. The bids were as follows: (A) Harry Vander-Vean, Houseman Bldg., Grand Rapids, Mich., (B) A. J. Ward, Grand Haven; (C) E. H. Thomson & Co., Grand Haven; (D) McDermott & Cooper, Widdicomb Bldg., Grand Rapids; (E) Wierenga & Ruiter, Grand Haven.

PAVING, GRAND HAVEN

	A	B	C	D	E
3436 ft. 6x18-in. concrete curb	$0 30	$0 27	$0 30	$0 32	$0 29
260 ft. 6x14-in. concrete headers	0 20	0 25	0 25	0 25	0 27
12 c.i. inlets	25 00	5 00	15 00	7 00	10 00
5 catch basins	50 00	30 00	35 00	35 00	30 00
1 manhole and cover	50 00	40 00	45 00	40 00	30 00
1 new cover on old catch basin	9 00	6 00	10 00	11 00	10 00
1 old cover reset	2 00	2 50	2 50	2 00	1 00
2 c.i. monument covers in place	15 00	6 00	1 00	7 00	6 00
10 ft. combined catch basins and inlets	0 20	10	04	.10	.05
250 ft. 3-in. farm tile	50	50	35	60	.70
30 ft. sew. sewer connecting pipe	60	60	45	.80	.80
10 cu.yd. 15-in. sewer connecting pipe	50	25	30	50	.30
10 cu.yd. extra excavation	1 25	1 25	1 25	1 30	1 30
5 cu.yd. concrete	5 00	4 75	5 00	5 00	5 00
5794 sq.yd. concrete pavement	98	.97	1 10	1 12	1 11
10 hours common labor	30	25	225	25	23
10 hours skilled labor	40	35	50	50	35
10 hours team labor	50	50	50	50	50
Totals	$7601	$7077	$8038	$8210	$8072

Channel—Chicago, Ill.—Bids were received by the Sanitary District of Chicago for the excavation and construction of Contract Section 10 of the Calumet Sag Channel, Apr. 3, from (A) Shnable & Quinn, 30 N. La Salle St., Chicago; (B) Lorimer & Gallagher Co., 209 S. La Salle St., Chicago; (C) Yale and Reagan, Chicago; (D) Carter Construction Co., 42 Broadway, New York; (E) D. A. Foley & Co., Aitkin, Minn. The item bids follow:

CHANNEL, CHICAGO, ILL.

	A	B	C	D	E
670,000 cu.yd. excavation, glacial drift	$0 326	$0 31	$0 39	$0 38	$0 57
300,000 cu.yd. excavation, solid rock	.69	.675	.71	.70	.62
72,000 sq.yd. riprap slopes	.77	1 10	1 00	1 25	1 15
2500 lin.ft. roadway construction	1 20	3 00	1 50	1 50	13 00
800 cu.yd. concrete	8 44	10 00	12 00	7 00	6 00
20,000 lb. reinforcing metal	.04	.03	.035	.05	.07
Erection of Forty-eighth Ave. Bridge, lump sum	4000	8500	4000	7000	7000
Totals	$495,412	$514,000	$564,350	$571,950	$696,400

Viaduct—St. Louis, Mo.—Bids for removing the present bridge at Twelfth St., and constructing the foundations and superstructure of a reinforced-concrete viaduct on Twelfth St., from Spruce St. to Cliteau Ave., were received by the city, Mar. 21. L. R. Bowen is Bridge Engr. The bids were as follows: (A) Fruin-Colnon Construction Co., Laclede Bldg., St. Louis; (B) Hannon-Hickey Construction Co.; (C) William P. Carmichael Co.; (D) John Hill Construction Co.; (E) John R. Scott Construction Co.:

TWELFTH STREET VIADUCT, ST. LOUIS, MO.

	A	B	C	D	E
Removal of present bridge, lump sum	$3,500	$3,000	$3,000	$4,000	$3,500
311,250 cu.ft. excavation	0 05	0 05½	0 05	0 055	0 06
Sewering and drainage, lump sum	7,000	7,709	5,330	7,366	11,400
54,350 lin.ft. concrete piling	1 25	1 10	1 07	1 28	1 38
Steel girders, lump sum	6,000	6,520	6,265	5,791	6,393
Steel castings, lump sum	10,000	8,500	12,970	8,960	9,684
170,800 cu.ft. Class A concrete	0 25	0 23	0 21	0 34	0 25
47,700 cu.ft. Class B concrete	0 30	0 34	0 30	0 36	0 31
260,000 cu.ft. Class C concrete	0 37	0 40	0 40	0 37	0 34
2900 lin.ft. hand railing	1 50	2 00	2 10	2 25	2 00
2,202,400 lb. steel reinforcement	0 0275	0 0275	0 031	0 026	0 031
For present bridge allowed	$4,000	$2,500	$3,000	$3,370	$1
Total	$327,601	$328,475	$329,614	$347,006	$347,406

Sewers—Tipton, Iowa—Bids for constructing ten miles of 8- to 15-in. pipe sewers, according to plans prepared by the Iowa Engineering Co., Clinton, Iowa, were received by the city, Feb. 26, as follows: (A) J. W. TURNER IMPROVEMENT CO., Des Moines, Iowa (awarded contract); (B) J. O. Severins, Oklahoma City, Okla.; (C) E. T. Webster, St. Paul, Minn.; (D) Fraser & Danforth, St. Paul, Minn.; (E) Lang Construction Co., Council Bluffs, Iowa; (F) Lytle Construction Co., Sioux City; (G) Independent Construction Co., Davenport, Iowa.

SEWERS, TIPTON, IOWA

	A	B	C	D	E	F	G
2420 lin.ft. 15-in. vitrified pipe laid	$3 [illegible]	$2 75	$3 71	$4 25	$2 50	$3 90	$4 00
1550 lin.ft. 12-in. vitrified pipe laid	3 [illegible]	2 25	2 72	2 80	2 50	3 30	4 00
10,550 lin.ft. 10-in. vitrified pipe laid	1 30	1 70	1 36	1 80	2 00	1 72	1 25
34,500 lin.ft. 8-in. vitrified pipe laid	[illegible]	1 15	97	75	75	1 22	1 25
48 lin.ft. 12-in. c.i. pipe laid	1 [illegible]	5 00	3 35	3 00	4 00	5 00	4 00
12 double 10-in. c.i. pipe laid	3 [illegible]	1 00	2 88	2 00	3 00	4 00	3 75
48 lamp sew. c.i. pipe laid	2 [illegible]	2 00	2 10	1 50	2 00	3 00	2 50
85 manholes	17 [illegible]	60 00	55 00	50 00	35 00	40 00	40 00
53 flush tanks	6 [illegible]	90 00	160 00	90 00	60 00	65 00	55 00
Totals	$ [illegible]	387,874	$83,357	$78,080	$78,880	$71,713	$80,119

INDUSTRIAL NOTES

High Rates for Railway Capital—Two important announcements were made by the leading trunk line of the country that stockholders would be permitted to subscribe for new stock at par to the extent of 10% of their holdings. This would mean an issue of approximately $43,400,000 of stock. The Chicago, Milwaukee & St. Paul Ry. has sold to Kuhn, Loeb & Co. and the National City Bank $30,000,000 general mortgage bonds bearing 4½% interest. Temporary certificates are now selling at 99½. These bonds have the same lien and were previously issued at 3½%. The proceeds will be used for general development work; also to pay for the electrification of about 240 miles of line which has been previously announced.

The Kennicott Co., Chicago Heights, Ill., was recently awarded the John Scott legacy medal on the Kennicott water weigher or measurer device. This measure is designed to measure the water used in steam boilers. The device may be briefly described as consisting of a cylindrical steel shell, the lower half of which is divided into two measuring or weighing compartments. Water enters through the top and passes directly to a tilting box where a small portion is intercepted, the remainder passing directly to the weighing or measuring compartment below. This compartment is filled, tilts the box automatically, discharging the water contained therein into the measuring compartment, completing a unit charge which starts the siphon. Measurement is made by a counter so designed that it cannot be tempered with by unauthorized persons.

The Strauss Bascule Bridge Co., Chicago, Ill., has been awarded the contracts for the erection of the following bridges: A 3-track bridge over Mystic River, Boston, Mass., for the Boston Elevated Co., a bridge across the East Chicago Canal, East Chicago, Ill., for the Baltimore & Ohio Ry. Co., a 202-ft. double-leaf bridge for the Sanitary District of Chicago over the south branch of the Chicago River at Jackson Blvd., Chicago, two bridges for the City of Green Bay, Wis., one across East River and the other across the Fox River, a highway bridbe over Eby Slough, Wash., for Snohomish County, a 171-ft. double-leaf highway bridge across the Red River for the City of St. Boniface, Manitoba. The following bridges are of the Strauss Direct Lift type and are similar in design to the two bridges of this type already being constructed by the Grand Trunk Pacific Ry. and by Van Buren County, Arkansas, being operated without cables or other flexible connections. A bridge across the Illinois River at La Salle, Ill., for the Chicago, Burlington & Quincy R.R., and a bridge across Steilacoon Creek, Wash., for the Northern Pacific Ry. Co.

The Pennsylvania Pneumatic Co., Erie, Penn., builders of the Barr unit compound air compressor, has appointed James J. Hart, New England representative for the company. His office will be at 131 State St., Boston, Mass.

The Federal Signal Co., Albany, N. Y., has purchased of the Cleveland City Forge & Iron Co. all the materials, special machinery and appliances formerly owned by the American Railway Signal Co., Cleveland, Ohio.

John S. Metcalf Co., of Chicago, Ill., has recently completed the drawings for a 1,600,000-bushel reinforced-concrete addition to the 1,000,000-bushel plant designed by the same company and built in 1905, for the Atchison, Topeka & Santa Fé Ry. Co., at Argentine, Kan. An office building, carpenter shop and dust-packing plant are also included in the permanent improvements, together with such changes in machinery of the present plant, as may be necessary. The total estimated cost of improvements is about $300,000. The work on the addition is already under way and the Armour Grain Co., who are operating the house, hope to have the use of the new tanks for the next grain crop.

The Pacific Flush Tank Co., Chicago, announces that it has taken the exclusive handling of Jointite, a compound for joining sewer pipes. It has made arrangements also with the Blaisdell Machinery Co. for the exclusive control of the Blaisdell sewage ejector (Woodall patents).

The Receiver of the Dayton Globe Iron Works Co., Dayton, Ohio, which company is the successor of the old firm of Stout Mills & Kemple, water-wheel manufacturers, reports that the company has a complete record of work done, patterns of machines, joints, etc., and it has been demonstrated that there is a paying business in making repairs alone. The business is now for sale by the receiver.

The Taylor-Wharton Iron & Steel Co. announces that H. A. Johann and Martin O'Shaughnessy, who have been in charge of the Chicago and Middle West Territory, having resigned effective Mar. 31, to engage in other business. The Chicago Office of the Taylor-Wharton Iron & Steel Co. will be in charge of Geo. R. Lyman and J. R. Bolgiano, with Guy H. Bergen, representing the company in the Mesaba Range District.

James B. Petley, has resigned his position as assistant treasurer and purchasing agent with the National Brake & Electric Co., Milwaukee, Wis., to become associated with L. R. Robbs, Manufacturers' Agent, Milwaukee.

Plans have been accepted by the Abbington Hospital Building Committee, composed of Leon H. Gilbert, Chm., of Noble, George W. Elkins, Jr., of Rydal, Treas., for the construction of a hospital, to be located on the Old York Road.

Paving—Cleveland, Okla.—Bids for paving various streets, according to plans prepared by the Bebtam Engineering Co., Oklahoma City, were received by the city, Mar. 24, as follows: (A) Swatek & Parker, Oklahoma City; (B) Connelly Construction Co., El Reno, Okla.; (C) R. R. Fuller, Oklahoma City, (D) Dudley Paving Co., Stillwater, Okla.; (E) Cleveland-Trinidad Co., Cleveland, Ohio

PAVING, CLEVELAND, OKLA.

	A	B	C	D	E
18,200 sq.yd. vitrified brick block pavement, on 4-in. concrete base with 1½-in. sand cushion and cement filler	$1 82	$1 83	$1 97	$1 97	$2 20
6800 cu.yd. earth excavation	30	.40	20	35	35
100 cu.yd. rock excavation	70	2 50	20	2 00	50
4400 lin.ft. straight concrete curb	19	16	10	50	60
500 lin.ft. radius concrete curb	65	.50	10	55	65
32 crossing covers in place	15 00	14 00	8 00	20 00	15 00
650 lin.ft. 3-in. oak header	15	22	15	15	30
Totals	$39,955	$40,762	$41,357	$43,435	$41,682

Catskill Aqueduct—New York, N. Y.—Bids for Contract 105 of the Catskill Aqueduct, which calls for furnishing, delivering and installing bronze river valves and appurtenances for the city tunnel, were received by the Board of Water Supply, Apr. 8, as follows: (A) Exeter Machine Works, 30 Church St., New York; (B) Pittsburgh Valve, Foundry & Construction Co., 30 Church St., New York; (C) American Manganese Bronze Co., 99 John St., New York; (D) Bethlehem Steel Co., 111 Broadway, New York:

CATSKILL AQUEDUCT, CONTRACT 105, NEW YORK, N. Y.

	A	B	C	D	E
25 48-in. riser valve bodies	$2,370 00	$2,415 00	$4,821 00	$5,245 00	$3,712 75
6 72-in. riser valve bodies	5,460 00	5,143 00	8,697 00	11,366 00	7,666 50
25 48-in. riser valve plugs	4,560 00	4,481 00	4,821 00	9,016 00	5,719 50
6 72-in. riser valve plugs	8,670 00	9,035 00	8,697 00	18,979 00	11,342 75
10 48-in. riser valve plug installations in shafts	250 00	1,268 00	400 00	500 00	604 50
4 72-in. riser valve plug installations in shafts	500 00	1,363 00	400 00	500 00	684 00
75,000 lb. rise valve operating rods	31	45	25	314	331
26,000 lb. steel castings	.075	.077	.0675	.084	.076
2000 lb. lead	08	06	05	06	002
4000 lb. miscellaneous bronze	28	45	35	66	435
2000 lb. miscellaneous iron and steel	06	.10	.10	.10	.09
Amount of bids	$289,130	$313,364	$373,219	$574,229	

Paving—Clinton, Iowa—Bids for paving Elm St. and Second Ave. were received by the City Council, Mar. 11, as follows: (A) KAW PAVING CO., Topeka, Kan., (awarded contract); (B) Ford Paving Co., Cedar Rapids, Iowa; (C) Thomas Carey & Sons, Clinton, Iowa; (D) A. Korneman & Co., Muscatine, Iowa:

PAVING SECOND AVE., CLINTON, IOWA

Bituminous

	A	B	D
16,900 sq.yd. vitrified top-coat	$1 18	$1 17	$1 45
560 sq.yd. vitrified brick paving	.90	1 25	1.10
4500 lin.ft. concrete curb 6x18-in.	29	40	.30
3300 lin.ft. of old curb relined	10	30	.08
8 catch basins	25 00	30 00	20.00
180 lin.ft. of 10-in. vitrified catch basin pipe	50	1 00	50
200 cu.yd. rock excavation	1 00	5 00	3 00
2 adjacent pavements adjusted	10 00	25 00	11 00
Totals		$22,591	$24,703	$27,607

Concrete

	A	B	C
16,900 sq.yd. concrete paving	$1.26	$1 45	$1.17
500 sq.yd. vitrified brick paving	.90	1.25	1.00
4500 lin.ft. concrete curb 6x18-in.	.29	40	.40
3300 lin.ft. of old curb relined	.10	30	.10
8 catch basins	25 00	30 00	25.00
180 lin.ft. 10-in. catch basin pipe	.50	1 00	.40
200 cu.yd. rock excavation	1.00	5 00	3.00
2 adjacent pavements adjusted	10.00	25 00	10.00
Totals		$23,943	$29,465	$23,355

PAVING ELM ST., CLINTON, IOWA

Bituminous

	A	B
10,900 sq.yd. bituminous top-coat	$1 18	$1.17
265 sq.yd. vitrified brick paving	90	1.25
3800 lin.ft. concrete curb 6x18-in.	29	40
400 lin.ft. of old curb relined	10	30
10 catch basins	25 00	30 00
310 lin.ft. of 10-in. vitrified catch basin pipe	50	1 00
2 adjacent pavements adjusted	10 00	25 00
100 cu.yd. of excess grading	50	60
Totals	$14,717	$15,444

Concrete

	A	B	C
10,900 sq.yd. of concrete paving	1 26	1 45	1 35
265 sq.yd. vitrified brick paving	90	1.25	1.00
3800 lin.ft. of concrete curb 6x18 in.	29	40	.40
400 lin.ft. of old curb relined	.10	30	10
10 catch basins	25.00	30 00	25.00
310 lin.ft. of 10-in. vitrified catch basin pipe	50	1 00	40
2 adjacent pavements adjusted	10 00	25 00	10.00
100 cu.yd. of excess grading	50	60	60
Totals	$15,589	$18,496	$16,984

EXAMINATIONS

Washington, D. C.—A new policy is shown by the announcement of an examination to be held by the Civil Service Commission on May 12, for irrigation managers and assistants. Heretofore these positions have been filled by the advancement of men connected with the construction of the works. It is now desired to call in men of experience from the outside and get new blood into the organization.

The applicants will not be brought together at any one point for the examination but each man will write out his application on blanks provided for the purpose. These papers will then be examined and the relative qualifications will be determined by a board expert in irrigation affairs designated for this purpose.

From the resulting list of eligibles it is expected to select managers and assistants to take charge of the various government irrigation projects which are nearing completion, and to make available for the benefit of the water users and the Government the experience of men who have spent the greater part of their lives in the irrigated West on the private irrigation systems.

The salaries offered range from $1800 to $2500 a year for managers, and from $1500 to $2000 a year for assistants. The qualifications required are at least three years' experience in the management of irrigation works or in clerical duties in connection with irrigation works. The age of the applicants must be between 25 and 50 years, and the competition is open to all men who are citizens of, or owe allegience to, the United States.

Washington, D. C.—The United States Civil Service Commission announces an open competitive examination for associate physicist, qualified in metallurgy, for men only, May 12. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position in the Bureau of Standards, Washington, D. C., at a salary of $2200 a year. Competitors will not be required to appear at any place for examination, but will be rated on the following subjects, which will have the relative weights indicated: General education and scientific training, 30; practical experience and fitness, 50; publications or thesis, 20. An educational training equivalent to that required for the bachelor's degree from an institution of recognized standing is a prerequisite for consideration for this position. Under subject 3 if a thesis is submitted it must represent the results of original investigational work on the part of the applicant in some phase of metallurgy. Persons who meet the requirements and desire this examination should at once apply for Form 304 and special form to the United States Civil Service Commission, Washington, D. C.; the Secretary of the Board of Examiners, Post Office, Boston, Mass.; Philadelphia, Penn.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; Customhouse, New York, N. Y.; New Orleans, La.; Honolulu, Hawaii; Old Customhouse, St. Louis, Mo.; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, P. R. No application will be accepted unless properly executed and filed with the Commission at Washington, with the material required, prior to the hour of closing business on May 12, 1913.

Washington, D. C.—The United States Civil Service Commission announces an open competitive examination for irrigation managers and assistants, on May 12, for men only. From the register of eligibles resulting from this examination certification will be made to fill vacancies in the position of irrigation managers at salaries ranging from $1800 to $2500 a year, and vacancies in the position of assistant manager at salaries ranging from $1500 to $2000 a year, in the Reclamation Service. At least three years' experience in the management of irrigation work or in engineering or clerical duties in connection with irrigation work is prerequisite for consideration for this position. The qualifications and fitness for this position will be determined by a board expert in irrigation affairs designated by the Commission for the purpose. Persons who meet the requirements and desire this examination should at once apply for Form 304 and special form to the United States Civil Service Commission, Washington, D. C.; the Secretary of the Board of Examiners, Post Office, Boston, Mass.; Philadelphia, Penn.; Atlanta, Ga.; Cincinnati Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; Customhouse, New York, N. Y.; New Orleans, La.; Honolulu, Hawaii; Old Customhouse, St. Louis, Mo.; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, P. R. No application will be accepted unless properly executed, and with the material required, filed in complete form with the Commission at Washington prior to the hour of closing business on May 12, 1913.

Electro-Metallurgist—The United States Civil Service Commission announces an open competitive examination for electro-metallurgist, for men only, on May 7. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position in the Bureau of Mines, Department of the Interior, for service in the field, at a salary ranging from $1500 to $1800 a year. Competitors will be examined upon the following subjects, which will have the relative weights indicated: Practical questions in electro-metallurgy, 40; general education and scientific training, 30; professional experience and fitness, 30. An educational training equivalent to graduation from a college or university of recognized standing, such training to include courses in geology, chemistry, physics and metallurgy, and actual experience in electric furnace work, are prerequisites for consideration for this position. Applicants possessing a thorough knowledge of metal mining and metallurgical work, including smelting operations, will receive additional credit under subject 3. Applicants must have reached their twenty-fifth but not their fortieth birthday on the date of the examination. Persons who meet th requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place mentioned in the list printed hereon, for application and examination Form 1312.

Architectural and Structural Steel Draftsman—The United States Civil Service Commission announces an open competitive examination for architectural and structural steel draftsman, for men only, on May 7 and 8. From the registér of eligibles resulting from this examination certification will be

made to fill vacancies as they may occur in this position in the Lighthouse Service, at a maximum salary of $1500 a year, and vacancies requiring similar qualifications as they may occur in any branch of the service. Competitors will be examined in the following subjects, which will have the relative weights indicated: Mathematics, pure and applied, 20; topographical and hydrographical surveying, 15; general building and steel construction and drawing, 40; training, experience and fitness, 25. Two days will be required for this examination. Subjects 1 and 2 will be given on the first day and Subject 3 on the second day. Five years' experience in engineering work or drafting is a prerequisite to eligibility for appointment from this examination; of these five years a technical school training will be considered equivalent to three years. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place mentioned in the list printed hereon, for application and examination Form 1312.

Chicago, Ill.—The Civil Service Board of the West Chicago Park Commissioners will hold the following examination on the date and at the place given. Application blanks may be obtained at the office of the Board in Union Park or at the West Park playgrounds. Building inspector, Class A, Grade II, pay $100 to $125 per month. Original Entrance. To be held Apr. 23, 1913, at 9 a.m., at the Garfield Park Pavilion. Subjects Special subject, weight of 1; experience, weight of 3; educational, weight of 1. Special subject, to include written and oral questions on the proper methods of concrete, brick, cut stone, steel and timber construction, on the installation of plumbing and heating equipment, on reading building plans, making sketches and estimates and on interpreting building specifications. The duties of building inspector are to inspect the construction of park building, swimming pools and other structures. Applications for the above given examination must be filed in the office of the Board in Union Park before 5 p.m., Apr. 22. Fred G. Heuchling is Supt. of Employment.

CONTRACT PRICES

Sewers—Brooklyn, N. Y.—Bids for constructing sewers in various streets were received by the Bureau of Sewers, Apr. 2, as follows: (A) John J. Creem Co., 688 Green Ave., Brooklyn; (B) John F. Cogan Co., 280 Broadway, New York; (C) Cranford Co., 52 Ninth St., Brooklyn, N. Y.; (D) Ryan & Reilly; (E) Newman & Carey Co., 215 Montague St., Brooklyn; (F) Rogers & Haggerty, Inc., 152d St. and Harlem River, New York; (G) Degnon Contracting Co., 60 Wall St., New York; (H) E. E. Smith Contracting Co., 71 Broadway, New York; (I) McCauley Manton Co., Brooklyn, N. Y.; (J) Leo E. Kelly, Inc., 89 Montague St., Brooklyn; (K) Pethick Bros & Co., Brooklyn:

SEWERS IN VERNON AND TOMPKINS AVES., BROOKLYN, N. Y.

	A	B	C	D	E	F	G	H	I
5074 lin. ft. 186-in. sewer, Section A	$98 25	$100.00	100.00	$107 84	$91 00	$113.40	$132.00	$137.50	$153.23
2085 lin.ft. 180-in. sewer, Section B	98 25	99.00	100.00	111 30	93.00	113.49	135.00	145.00	153.23
1 connecting drop, Section A	1,100 00	1,500.00	2 500.00	3,100.00	2,500.00	2,691.78	2,000.00	4,250 00	3,460 38
1 connecting drop, Section B	4,000.00	5,000.00	17,300.00	8,250.00	7,000.00	6,575.01	61,500.00	11,500.00	8,544 75
52 lin.ft. 30-in. brick sewer	7.00	6.50	7.00	13.00	6.00	12.00	15.00	8.50	8 75
340 lin.ft. 24-in. pipe sewer	4.00	4.25	4.50	4.10	11.00	4.81	560.00	6.75	4 61
500 lin.ft. 18-in. pipe sewer	3.25	3.00	4.00	5.29	11.00	4.02	4.65	5.50	3 30
1 lin.ft. 15-in. pipe sewer	3.00	2.90	3.50	3.84	10 00	3.56	4.40	4 25	2 89
2750 lin.ft. 12-in. pipe sewer	2.50	2.50	3.00	3.60	9.50	3.12	4.00	3.50	2 44
160 house connection drains reconstructed	5.00	7.50	15.00	10.00	5.00	1.30	15.00	6.50	6 25
25 sewer basins reconnected	58.00	25.00	50 00	60 00	25.00	65.00	40.00	17.50	31 25
1 sewer basin, rebuilt	150 00	90.00	150 00	130 00	75.00	195.00	160.00	67 50	187 50
1 manhole, class A	500 00	250 00	500 00	350.00	700.00	520.00	180 00	135.00	464 94
2 manholes, class C	800 00	40 00	1,400 00	1,500 00	1,300 00	1,196 00	400 00	1 050 00	1,549 13
5 manholes, class D	55 00	50.00	70 00	75 00	64 00	78 00	66 00	67 50	62 50
8 manholes, class E	66 00	70.00	200.00	210.00	115.00	97 50	105 00	120.00	81.25
1 manhole, class G	215 00	50.00	500.00	750.00	250.00	390 00	1,000 00	600 00	1,200 00
1 overflow manhole, H	70 00	75.00	300 00	100 00	125 00	78 00	150 00	90 00	117 82
2 overflow manholes, J	50.00	65.00	200 00	100 00	150 00	78 00	125 00	90 00	132 32
1000 M ft. sheeting and bracing	01	37.50	35 00	33.00	45 00	39.00	30.00	33 00	38 75
350 M ft. foundation planking	01	35.00	28 00	1 00	35 00	39 00	45 00	50 00	28 13
200 cu.yd. class B concrete	6.00	7.00	7.00	8.00	8 00	7 80	20.00	8 00	10 00
10 cu.yd. brick masonry	10 00	12 00	12.00	15.00	15 00	15.60	30 00	14 50	18 75
100 bbl. portland cement	1.50	1.50	1.60	2 00	3.00	1.82	1.80	2 00	2 00
Totals	$414,373	$8 8,345	$406,992	$419,781	$421,783	$414,757	$496,417	$523,416	$554,439

SEWERS IN HEWES ST., CLASSON AND PARK AVES., BROOKLYN, N. Y.

	A	B	C	E	I	F	G	K	H
Outlet section of 186-in. sewer, lump sum	$42,000	$40,000	$45,000	$40,800	$62,800	$52,841	$49,000	$10,000	$66,000
794 lin.ft. 186-in. twin sewer	123 00	95.00	125 00	125 00	140 00	122 45	160 00	164 00	250 00
186-in. sewer connecting section, lump sum	3,000 00	2,000.00	5,000.00	2,700.00	5,000 00	5,250.00	1,800 00	4,000.00	6,200 00
280 lin.ft. 186-in. concrete sewer, conduit section	85 00	83.00	125.00	99.00	125 70	108 04	120 00	143 00	139 50
1000 lin.ft. 186-in. brick sewer, conduit section	99 50	103 50	125.00	121.00	31.25	145 31	110 00	174 00	160 00
1 inverted siphon	1,000 00	1,250.00	2,500.00	1,500 00	4,000 00	1,665 56	1,550 00	8,000 00	1,750 00
1 drop manhole and connection	1,000 00	950 00	2,250 00	1,000.00	3,000 00	390 00	1,000 00	600 00	1,200 00
25 lin.ft. 54-in. brick sewer	15 00	10.00	25 00	14 00	18 50	19 50	38 00	20 00	18 00
12 lin.ft. 36-in. vitrified pipe sewer, laid in concrete	8 00	9 00	10 00	16 00	18 50	11.70	18 00	10 00	25 00
782 lin.ft. 30-in. brick sewer	6 00	6 50	7.00	16 00	9 00	13 00	16 00	6 00	17 00
45 lin.ft. 24-in. vitrified pipe sewer, laid in concrete	5.00	5 00	7.00	11 00	10 00	5 72	7 50	5 00	9 00
734 lin.ft. 24-in. vitrified pipe sewer	4 00	4.25	4.50	9 00	6.25	4.81	6 00	5 00	7 75
737 lin.ft. 18-in. pipe sewer	3 00	3.00	4.00	7 00	4 50	3.90	5 00	4 00	5 75
2037 lin.ft. 12-in. pipe sewer	2.50	2.50	3.00	7.00	4 00	3.12	4 50	2 50	3 50
1 manhole, class A	100 00	250 00	300.00	300 00	275.00	520 00	360 00	60 00	110 00
6 manholes, class B	50 00	50 00	150 00	50.00	60 00	104 00	110 00	60 00	100 00
2 manholes, class C	50 00	35 00	100.00	33.00	25 00	104 00	85 00	60 00	1,000 00
10 manholes, class D	60 00	45 00	50.00	65 00	60 00	78 00	70.00	60 00	65 00
15 sewer basins reconstructed	50 00	30.00	50 00	25.00	80 00	65 00	40 00	50 00	20 00
115 house connection drains reconnected	4 00	7 50	15 00	5 00	7 00	1.30	15 00	10 00	6 50
1000 M ft. sheeting and bracing	30 00	37 50	35.00	45 00	30 00	39 00	30 00	5 00	33 00
215 M ft. foundation plank, pile capping and stringers	10 00	35.00	28 00	35 00	30.00	39 00	45 00	65 00	35 00
75 M lin.ft. bearing piles	10	30	35	45	15	15	25	70	10
200 cu.yd. class B concrete	7 00	7 00	7 00	8 00	8 00	7 80	20 00	10 00	9 00
10 cu.yd. brick masonry	10 00	12 00	12 00	15 00	25 00	15 60	35 00	20 00	16 00
100 bbl. portland cement	2 00	1 50	1 60	3 00	2 00	1.82	1 80	2 50	2 00
Totals	$290 545	$291,608	$479,446	$495,823	$541,467	$526,171	$538,491	$616,415	$678,827

SEWERS IN SKILLMAN ST., MYRTLE, NOSTRAND AND VERNON AVES., BROOKLYN, N. Y.

	A	B	C	G	E	F	H
1142 lin.ft. 186-in. sewer, conduit section	$142 60	$105 00	$98 00	$130 00	$132 00	$143 80	$175 00
2157 lin.ft. 180-in. sewer, conduit section	105 60	90 00	98 00	119 00	115 00	122 56	162 00
1 connecting regulator A, complete	1200 00	1500 00	2500 00	1500 00	1500 00	1806 74	2150 00
1 connecting regulator B, complete	1800 00	2000 00	2500 00	1300 00	1200 00	1950 00	1900 00
1 connecting regulator C, complete	900 00	1000 00	2000 00	1300 00	1200 00	910 00	1150 00
1 inverted siphon	1000 00	1250 00	4000 00	3750 00	3800 00	1712 50	4950 00
495 lin.ft. 24-in. pipe sewer	4 00	4 25	4 50	5 50	12 00	4 81	7 75
1500 lin.ft. 18-in. pipe sewer	3 25	3 00	4 00	5 00	10 00	4 03	5 75
1000 lin.ft. 15-in. pipe sewer	3 00	2 90	3 50	4 25	9 00	3 58	4 75
2075 lin.ft. 12-in. pipe sewer	2 50	2 50	3 00	3 50	9 00	3 12	3 60
100 bbl. portland cement	1 50	1 50	1 60	1 80	3 00	1 82	2 00
7 manholes, class A	500 00	600 00	300 00	425 00	110 00	585 00	125 00
46 manholes, class D	55 00	50 00	50 00	66 00	67 00	78 00	65 00
5 manholes, class F	65 00	70 00	150 00	180 00	300 00	110 50	105 00
245 sewer basins reconstructed	5 00	7 50	15 00	2 50	5 00	1 30	6 50
3 sewer basins rebuilt	150 00	90 00	150 00	160 00	60 00	195 00	67 50
14 house drains reconstructed	50 00	30 00	50 00	40 00	25 00	65 00	20 00
1700 M ft. sheeting and bracing	01	37 50	35 00	30 00	15 00	39 00	33 00
100 M ft. foundation plank	01	35 00	28 00	45 00	35 00	39 00	55 00
200 cu.yd. class B concrete	6 00	7 00	7 00	16 00	8 00	7 80	9 00
10 cu.yd. brick masonry	10 00	12 00	12 00	35 00	15 00	15 60	15 00
Totals	$481,795	$418,662	$431,486	$509,405	$544,241	$511,575	$662,865

Engineering News

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The Recent Standpipe Failure at Cairo, Ill.

By G. C. Habermeyer*

The standpipe of the Cairo Water Co. fell at about 2:15 a.m., Feb. 11, 1913, as noted in Engineering News of Feb. 20, 1913. The standpipe was close to the pumping station and filter house, as shown in Figs. 1 and 2. It was built in 1885 by W. B. Maitland & Son, contractors, at that time of Peoria, Ill.

There were 37 courses of side plates ranging in height from 47 in. to 49½ in., built stovepipe fashion. In 1898, five courses of 5 ft. height each were added to the standpipe, making a total height of 175 ft. All vertical seams were double riveted and all horizontal seams single riveted.

The soil on which the standpipe was built consists of clays of varying composition for the first twenty feet from the surface and below this for a great depth it is a very fine sand. In constructing the standpipe foundation earth was excavated to a diameter of 24 ft.; piles about 35 ft. in length were driven on 2-ft. centers and cut off at the original ground surface and concrete was placed in the excavation between the piles to their tops. On top of the concrete six courses of Bedford stone about 15 in. thick were laid, the top course being 19 ft. in diameter.

The standpipe was anchored with eight 2-in. diameter anchor rods each having a loop eye at the bottom through which was placed a 2-in. bar. These bars were bedded near the top of the lowest course of stone and one bar found was 3 ft. 6 in. long. Dimensions of the standpipe are given in Fig. 3. It is stated that the standpipe was painted two coats at least once every two years, using mineral and oil on the outside and red lead and oil on the inside.

The standpipe fell to the northeast and in falling separated into several sections. One section wrecked the machine shop of the water company. One section fell



Fig. 1. General View of Wrecked Standpipe, Cairo, Ill.

*Associate in Municipal and Sanitary Engineering, University of Illinois, Champaign, Ill.

across the Illinois Central R.R. tracks, blocking traffic for several hours and wrecking a freight car. The top section fell along the bank of the Ohio River and wrecked a small house boat. The bottom plate was detached from the side plates and left lying on the foundation. The location of the fallen standpipe is shown in Figs. 1 and 2. The section falling on the tracks was moved west of the tracks before the photograph reproduced as Fig. 1 was taken. Water from the standpipe, which was full at the time of the accident, was deflected by the foundation and formed two main currents, one to the south and the other slightly south of west. Many of the stones of the foundation were washed a considerable distance away. The stream of water to the south and the stones carried by it wrecked part of the pumping station, as shown in Fig. 1. The stream to the west struck a house, 20×10 ft. in size, of light construction, moving it 7 to 12 ft., as shown in Fig. 2. The upper 3 ft. of the clear-water well was badly damaged. The heaviest damage was the breaking of a water pipe that carried wash water to the filters. This compelled the water company to furnish unfiltered Ohio River water for more than two weeks. The condition of the foundation and plates just after the fall is shown by Figs. 1, 3, 4, 5, 6, 7 and 8.

The standpipe was examined by the writer several days after scrapping had begun. The washing away of the stonework had left the tops of a few piles exposed at the location shown in Fig. 5. Those numbered 1 and 2 in the figure were fairly solid on top, but the tops of all other piles exposed were badly decayed. Measured to the highest point of each the distances down from a level with the top of pile No. 1 were: No. 2, ½ in.; No. 5, 3½ in.; No. 6, 5 in. The piles along the opening provided for the inlet pipe were 1½ in. or more lower than pile No. 1.

The upper part of the concrete of the foundation was very poor. A piece of wood molding was driven with a brick under the edge of the stone at an angle of about 30° with the vertical to the depth of 30 in. When withdrawn it was covered with black mud and grease. In the stonework there were some large spaces between the stones not entirely filled with mortar. The condition

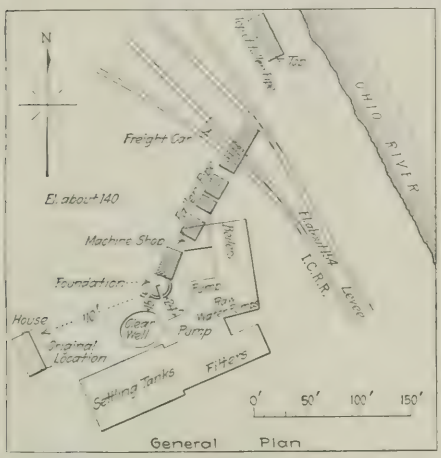
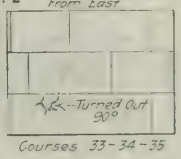


FIG. 2



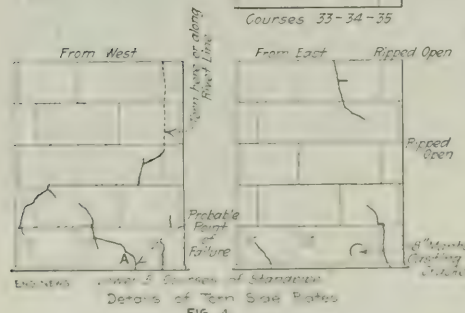
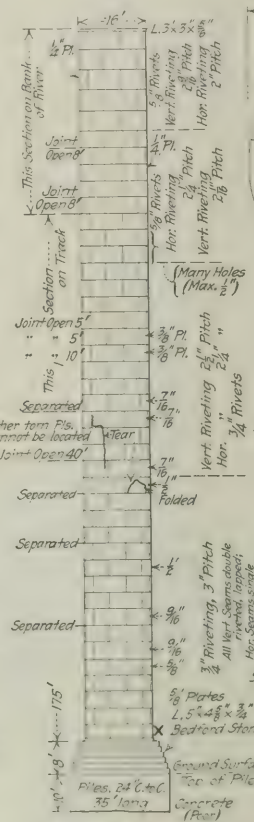
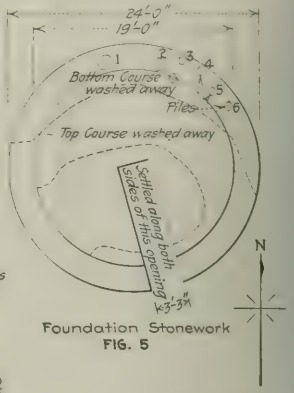


FIG. 4



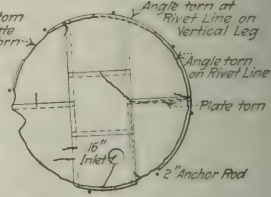
Standpipe from West, Showing Breaks and also Plate Thicknesses

FIG. 3



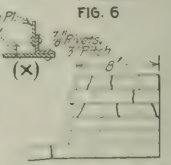
Foundation Stonework

FIG. 5



Bottom Plate of Standpipe, Seams Double Lap Riveted, 3" Centers

FIG. 6



West Side of Inlet Opening Showing Condition of best of remaining Stonework

FIG. 7

FIGS. 2 TO 7. DETAILS OF WRECKED STANDPIPE AT CAIRO, ILL.



FIG. 8. LOOKING TOWARD FOUNDATION ACROSS CLEAR WELL—SEE PLAN, FIG. 2.



FIG. 9. LOOKING TOWARD FOUNDATION AND PARTLY WRECKED PUMPING STATION



FIG. 10. GENERAL VIEW OF FALLEN STANDPIPE AND OF PUMPING STATION

FIGS. 8 TO 10. VIEWS OF WRECKED STANDPIPE AT CAIRO, ILL.

of the best of the stonework remaining in place after the fall of standpipe is indicated in Fig. 7. The west part of this remaining stonework was the highest, being 2 in. higher than the center.

The bottom plate of the standpipe was torn in several places, as shown in Fig. 6. The angle joining the bottom and side plates of the standpipe was of very poor steel and it was badly corroded in several places along the surface of contact with the bottom plate. The bottom edge of the lowest side plate was 2 in. above the bottom plate, bringing extra stresses on the angle joining the two. Views of pieces of the angle are given in Figs. 11 and 12.

Where sections separated in the fall it was by shearing of rivets excepting a few tears 1 or 2 ft. long and a tear about half way around the standpipe where the section that fell on the tracks separated from the section below. A number of the plates of the standpipe were torn

as shown in Figs. 1, 3, 4, 8, 9 and 10. Of the torn plates most of the damage must have been caused by the fall. The hole in Course 33, counting from the bottom, may have been caused by striking a corner of the house boat wrecked by the standpipe. In addition to the tears shown in Figs. 1 and 4 there were small tears in the lower courses of some sections evidently caused by striking the ground, a tear caused by striking the freight car, and some tears in plates not possible to locate in the sketch.

The inside of the lower plates was almost entirely covered with pits. The plates towards the top had small areas comparatively free from pits. In general, the maximum depth of pitting was $\frac{3}{16}$ in., even in areas which were comparatively free from pits. In Courses 30, 31, and 32, counting from the bottom, and to a limited extent in other places, the depth of pitting was ¼ in., entirely through the plate. The maximum diameter of the hole formed by the pitting was ½ in. Most of the holes were in the Course 31 from the bottom. In one space 3 ft.sq. there were nine open holes, and as many more had been plugged. No tests were made of the metal of the tank plates but they appeared to be of good steel or at least of fair quality.

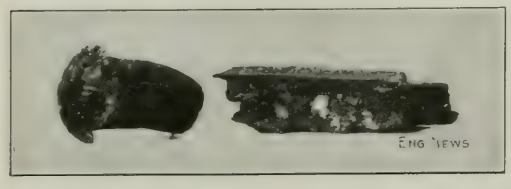


FIG. 11. RIVET AND PIECE OF ANGLE JOINING BOTTOM AND SIDE PLATES, CAIRO STANDPIPE, SHOWING CORROSION

That the thickness of metal had been reduced materially by corrosion was shown at a fracture 130 ft. from the base, where for a distance of 6 in. the average thickness was ⅛ in. Some rivet heads were eaten almost away, the damage being greatest in the courses where pits were deepest. A photograph of a rivet is shown by Fig. 11. In general, the plates were better at the lap than at other parts and where rivets failed in the fall it was by shear.

In determining the probable cause of the failure several possible causes may be considered. Few people had noticed any perceptible leaning of the standpipe. One person who passed it every day thought it had leaned in the direction opposite to that in which it fell. In painting the standpipe a few months before the fall, no lean was noticed. The city engineer, George Dewey, was quite positive the standpipe had leaned to the northeast for some time. No excavating had been done near the standpipe since twelve years ago, when the clear-water well was built. As stated, the west part of the foundation in place after the fall was 2 in. higher than the center, though this may not have been true before the fall. When water from the standpipe overflowed it ran over between north and east. All evidence considered, there can be no doubt that the standpipe leaned slightly to the northeast, but not enough to be noticeable to the average person or to be of itself dangerous to the safety of the standpipe.

At the time of failure the wind was blowing four miles per hour from the northwest and the maximum velocity for February had been 24 mi. per hr., so the wind could have had little part in the immediate cause of failure.

The temperature for February had been somewhat below freezing to Feb. 9, but the minimum for Feb. 10 was 35°, so ice could have had little to do with the failure.

There is a possibility that the first failure was in Course 33 from the bottom, where a plate was torn, and that the resulting reaction threw the standpipe to the west and increased the strain on the bottom plates on the west side, but it is more probable that this hole was caused by striking the house boat. The largest hole torn in the standpipe was on the west side, near the base, and it is probable the failure was at Point *A* as indicated in Fig. 4.

As stated before, the concrete of the foundation was very poor, and the tops of many of the piles had decayed. This resulted in a settlement around the opening left in the stone foundation for the inlet pipe and undoubtedly there was some settlement on the northeast side. This unequal settlement could cause considerable strain in anchor rods and side plates without allowing the standpipe to lean any great distance. The water which overflowed the standpipe and that leaking below this angle or through the bottom plate may have been a factor in the destruction of the foundation.

Rupture beginning on the west side would account for the location of the fallen parts, the bottom being carried a little to the east, but the fall of the upper sections being governed more by the leaning of the standpipe than was the lower section. The ladder which was attached on the west side of the standpipe was well under the fallen sections, indicating some rotation in falling. This might be caused by the holding of the anchor bolts on



FIG. 12. BREAK THROUGH BOTTOM PLATE AND ANGLE AT RIVET, CAIRO STANDPIPE
(Bottom plate below, angle above.)

east and southeast. A point which is interesting, though it aids little in determining the cause of failure, is the location of the top section of the standpipe. When the falling standpipe struck the freight car a glancing blow, as indicated in Fig. 2, it would tend to throw the standpipe to the north and if the bottom of the pipe were rotating to the south it would help this throw. As the upper part fell on ground probably 30 ft. below the top of the car there was time during the fall for considerable movement to the north.

To sum up: The bottom angle of the standpipe was of very poor steel and at the time of the failure, due to fracture and corrosion, probably had almost no strength. The large opening left for the inlet pipe was a source of weakness, especially when the stones along the edge of this opening settled. The foundation was in poor condition. The settling of the foundation gave the standpipe a slightly leaning position and the uneven surface caused by the unequal settlement produced higher stresses in some anchor rods and side plates than would be indicated by the amount of leaning. The west side of the foundation was probably highest and at this point the original rupture probably occurred. Some plates, especially those about 50 ft. from the top, were seriously weakened by corrosion. Some rivet heads were eaten almost away. It is concluded that unequal bearing, slight leaning and the weakness of the bottom angle caused a rupture at the base.

The standpipe had deteriorated seriously before the failure. A careful inspection would have revealed its critical condition. It would be of great advantage to water companies if standpipes and elevated tanks were inspected by competent persons at regular intervals.

[The impression in Cairo seems to have been that the standpipe had leaned for some time, as is shown by various local reports, including a statement to that effect in a letter which we have received from the city engineer, as given below. Assertions to the contrary are made by the water company (as noted in Mr. Habermeyer's article). Such an assertion will be found in the following excerpts of a letter on the failure sent to this journal by C. M. Ross, successor to T. W. Gannon, manager of the Cairo Water Co.

The impression that the standpipe has been leaning for a considerable length of time is without authority. From observations which we have made at our plant from time to time, the position of the pipe had not changed in the least for several years.

It appears to have simply broken from the very bottom, tearing away from the bottom steel plate, which remained intact on the foundation, and the entire pipe fell without collapsing until it struck the ground. It fell in such a position that it broke into several pieces when it struck, but not a single ring or joint showed evidence of having given way until after it had fallen.

The standpipe was full of water at the time of accident, which was our usual pressure. The condition of the steel is excellent, considering the length of time it had been used, which is due largely, of course, to the fact that it was always kept well painted and cleaned.

As stated in our previous letter, we account for the failure of the foundation, only through the long-continued high water, which must have weakened it.

A theory or explanation of the initial cause of the failure which is not mentioned by Mr. Habermeyer is given in a letter which we have received from George F. Dewey, city engineer of Cairo. This explanation, together with remarks on the alleged leaning of the structure, follows:

The site of the standpipe was only about 150 ft. from the bank of the Ohio River. This bank has been eroding for some time, as the channel of the river hugs the Illinois shore and the first pier of the Illinois Central bridge, which is only about five or six hundred feet north of the waterworks and about a hundred feet out in the stream, has caught a large amount of drift on the upstream side which throws the stiff current directly into the bank. This erosion to the bank keeps the stratum of sand open and during the high stages of river causes sand boils on the inside of the levees where the same sand stratum comes in close proximity to the surface. A large number of these sand boils developed last spring in the south edge of the ridge on which the waterworks are located, these boils being about from 1200 to 2000 ft. west of the works and near the center of town. I am of the opinion that the water from them came from the river bank in the neighborhood of the water-works, and that from that cause the weakening of the standpipe foundation occurred.

The lean had been noticeable for some time, and, I believe, had become more pronounced during the last high water. The lean was in a northerly direction, and it is remarkable that it did not do any more damage than it did. The bottom plate did not leave the masonry foundation, but was detached from the wall plates as if cut off and the bottom plates forming the wall were torn in two, in various ways.

The water was nearly all discharged near the bottom with great force, demolishing the masonry base and throwing the large stones as much as 150 ft. distant. Some of the large foundation stones were thrown in such a way as to demolish the walls of the pump house. The new Allis-Chalmers pumping engine, installed this last summer at a cost of $40,000, was covered with débris, and one of the large discharge pipes was broken. As soon as the débris was cleared away and a new pipe put in the old pump was put to work and the water service resumed. Had the standpipe fallen in any other direction, especially east or south, the loss would have been much greater and the city water-supply cut off indefinitely.

How much the failure was due to foundations weakened by saturation of the ground and how much it was due to the deterioration of the metal it is, of course, impossible to state.—Ed.]

⁂

The Good-Roads Year Book, just issued by the American Highway Association, states that there are now over $400,000,000 bonds outstanding, which have been issued by states and counties to pay for good road construction. Of the entire mileage of public highways in the United States, it is now estimated that 10.1% have been improved to a greater or less extent.

⁂

The Potash Deposits of Death Valley, California, are reported on in a preliminary bulletin of the U. S. Geological Survey, which has recently studied the general locality for the possibility of deposits here. A vast amount of saline material has accumulated on and beneath the floor of the low-lying desert on the southeastern borders of California, known as Death Valley and it was logical that this area should have been one of the first to attract attention in the country-wide search for soluble potash salts (much needed in the manufacture of commercial fertilizer, which has to rely on the product of German mines). The locality examined comprises a central area of crusted salts extending for many miles from north to south in the lowest part of the basin. At the very lowest part is a circular area, several miles across, which is usually a smooth field of snowy white salt. Occasionally this is flooded by storm waters, which subsequently evaporate and leave the surface white again. Beyond this smooth area, to the north and south, are fields of rough salt, differing principally in that the salt crust has been gradually broken into cakes and tilted up at various angles and has not been inundated.

Three test wells were placed in the area of smooth salt in the lowest depression of the valley and a fourth in the area of rough salt twenty miles north of the others. The records of all are very much alike and show that the valley is underlain by an alternation of layers of silt or clay with layers of rock salt. Salt brines were encountered at several horizons, but no one of these was under such pressure as to cause it to rise and flow out the well.

The potash content was not unusual in any way, being close to the average generally found in natural basins of desert regions. No shore markings or evidence of deep submergence of this valley have been discovered, and the deposits are supposed to have been built up layer by layer, a process that is still going on. A vast amount of saline material is accumulated at the bottom of the valley, but the mode of deposition is not favorable to selective crystallization on a large scale. Segregation of potash perhaps has occurred in the several layers, but on a scale so small as to be of doubtful importance. Unless a vast body of material has been deposited at one time during a single period of dessication, there is little chance for the various dissolved constituents becoming segregated on a large scale. There is no record of the drying up of a single large lake in this valley. Such a condition, however, is found further west, at Searles Lake, and others may occur in the Western desert regions, although not now exposed at the surface.

Replacing a High Timber Trestle with a Steel Viaduct

The Fort Dodge, Des Moines & Southern Ry. is an electric road (with about 170 miles of line) formerly operated by steam. In 1906 it adopted on a part of its line, the trolley system with 600-volt direct-current for operating its passenger service (the freight service being still handled by steam locomotives), and in 1912 it adopted 1200-volt direct-current for both passenger and freight service. Its main line is between Des Moines and Fort Dodge, Ia., a distance of 86 miles. About 2½ miles north of Boone, Ia., the line follows the east bank of the Des Moines River, running along the high bluffs at a considerable height. These bluffs rise about 300 ft. above the river and are cut by a series of deep ravines so that the line alternately cuts through a bluff and spans a ravine. There are five ravines in the course of a mile, and these are crossed by timber trestles which range from 40 to 156 ft. in height and from 200 to 800 ft. in length. These were built in 1903. During recent years it has been considered wise to eliminate these trestles, both for the safety of operation and as a permanent improvement to the line. The smaller ones were filled in with solid embankments and the largest has been replaced with a steel viaduct. This trestle was 800 ft. long and 156 ft. high at the deepest point. It was supported on oak piles and built of frame bents with 12x12-in. posts and 12x12-in. caps, and was well braced with 6x8-in. struts and sways. The bents were spaced 16 ft. apart. The trestle contained a total of 860,330 ft. b. m. of timber, 5968 lin.ft. of piling and 22.4 tons of iron. This trestle is shown in Fig. 1. The new steel structure is a plate-girder viaduct, 784 ft. long and 156 ft. high, with spans of 32 and 80 ft. It was designed by W. M. Hughes, of Chicago, as Consulting Engineer for the railway ,and was built and erected by the American Bridge Co. To that company and Mr. Hughes we are indebted for information and plans. The description of the construction work has been furnished us by C. J. Steigleder, Assistant Engineer of the Ft. D., D. M. & S. Ry.

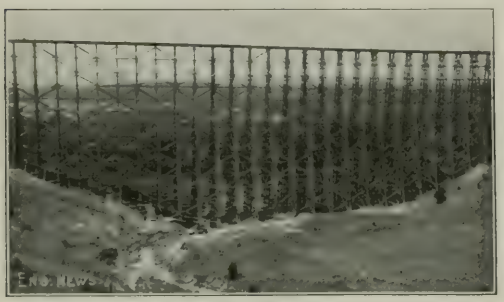


Fig. 1. Timber Trestle 800 Ft. Long and 156 Ft. High

(Now replaced by a steel viaduct. Fort Dodge, Des Moines & Southern Ry. (electric).)

General Design of Steel Viaduct.

With a regular train service at two-hour intervals it was necessary to plan the reconstruction work so as to avoid interference with traffic. Several preliminary surveys were made to determine the amount of grading necessary on different locations, and it was decided to locate the new structure alongside of the old one (and upon the inner or up-hill side of the latter), with its center line 14 ft. from that of the old structure. This left the deck and track of the trestle undisturbed and open for traffic, although the steel towers encroach upon the lower part of the trestle. This arrangement effected an improvement in alignment, as at the north end it enabled a reverse curve of 2½° to be rectified although at the south end it gave a curve of 5° 15′ instead of 5°. A preliminary design for the viaduct, which apparently overlooked the conditions of erection, included 36-ft. spans. But this would have involved great difficulty in placing the foundations and towers, as some of the steel bents would have been close to or coincident with the positions of the trestle bents. In Mr. Hughes' design the spans are all multiples of 16 ft. (the spacing of the trestle bents) so that the foundations all come in open spaces and the tower legs interfered only with the bracing of the trestle. The tower spans are 32 ft. and the intermediate spans 80 ft., with a 48-ft. span at one end.

The design of the viaduct is shown in Fig. 2, and on this is shown the arrangement of the concreting plant, which is described below. Fig. 3 shows the typical tower design. To the girders are attached bracket frames for the trolley poles, there being a bracket at one end of each 80-ft. girder and the 48-ft. girder. The batter for the sides of the towers is 1 : 6. The girders are spaced 7 ft. c. to c., and the 48-in. girders of the tower spans have end pedestals to bring their tops level with those of the 90-in. girders of the longer intermediate spans. The structure is designed for the live load of Cooper's E-45 classification (two 156-ton engines followed by a train load of 1500 lb. per lin.ft. of track). While this is heavier than would be required for the present equipment, using 40-ton and 70-ton electric locomotives in the freight service, it was considered that the size and weight of such engines is likely to increase, as has been the case with steam locomotives. The dead load is taken as 1400 lb. per lin. ft. of track for the 80-ft. spans, 1000 lb. for the 32-ft. spans and 1200 lb. for the 48-ft. end span. The specifications followed were those of the American Railway Engineering Association, except that the columns are not figured for traction stresses and that the impact allowance is only 50% of that given in those specifications. An interesting feature of the steel structure is the extensive duplication of parts, in the towers as well as in the spans. There are six 80-ft. spans, seven 32-ft. tower spans, and two end spans of 48 ft. (at the south end) and 32 ft. (north end). The 80-ft. girders were riveted up complete in the shops, and the 48-ft. and 32-ft. girders were riveted complete and assembled in pairs with bracing, for shipment as completed spans. The upper sections of the bents (Nos. 5 to 10 inclusive) were all made alike, the difference in height of bent being made in the bottom section. Each column is composed of two 15-in. channels with an 18-in. cover plate over the flanges of the outer face, and a 4-in. reinforcing bar on each of the flanges of the inner face.

The nature of the ground at the side of the bridge is complex, being composed of several formations which range from soft yellow and blue clay to rock. At the bottom of the ravine and in the bed of the stream, it consists of large loose boulders and gravel. Beneath this

is a blue joint-clay such as is commonly found over coal measures. The yellow clay, being the upper formation, is very hard when dry, but when water is present, it becomes very slippery and evidences of slip can be seen

this gave a bearing area of 100 sq. ft. The safe bearing on hard clay is from 4 to 6 tons per sq. ft., thus giving an allowable pressure of from 400 to 600 tons. The largest pier placed was No. 9 (east), having a footing

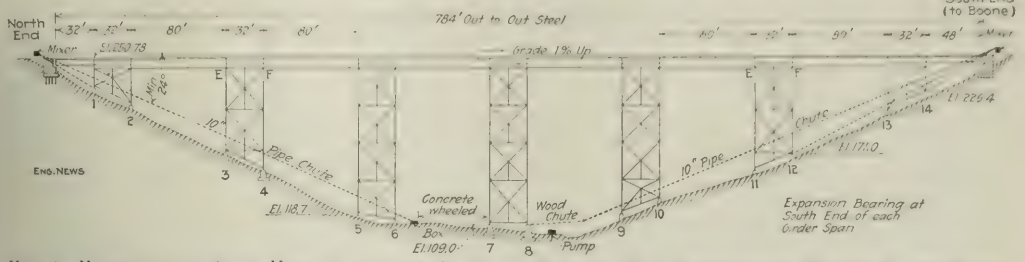


Fig. 2. Elevation of Steel Viaduct for the Ft. D., D. M. & So. Ry.; Showing the Maximum and Minimum Inclination of Pipe Chutes for Delivering Concrete to the Pier Forms

in several places on the hillside. It was thought at first that it would be necessary to drive piling for the footings of the abutments and pedestals, with the exception of those pedestals at the bottom of the ravine. Upon excavating at the site, it was found that by going deeper with the foundation, a good bearing could be obtained

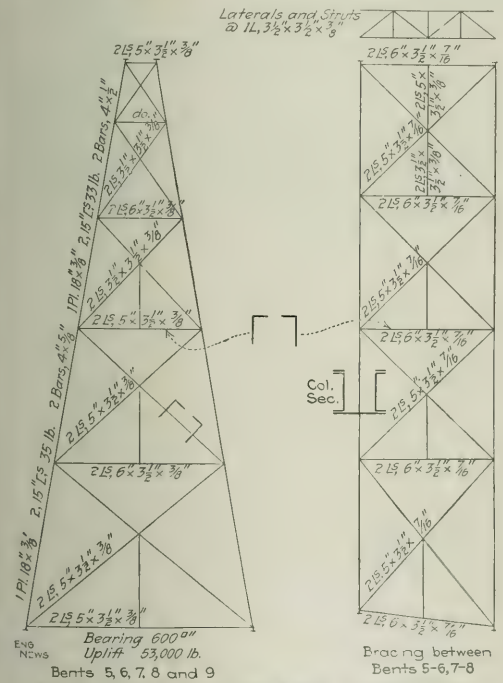


Fig. 3. Tower Bents for Steel Viaduct: Fort D., D. M. & So. Ry.

without piles. This was done and the excess concrete used over the original plans only amounted to 211 cu. yd. The piers (with one or two exceptions) were designed with a footing 10 ft. square and 3 ft. deep, and a pedestal 7 ft. high, 4x4 ft. on top, having a batter of 2 in. per ft. on the sides. For the majority of the piers, 12x12 ft., 7 ft. deep and a pedestal 11 ft. high, the total weight being approximately 90 tons.

Forms and Concrete Work.

The forms for the pedestals were made of 2x8-in. lumber, dressed on one side. They were built in four sections, each section forming one side of the pedestal. Two sections were cut to the exact dimensions of the pier, while the others were made to overlap the inside section, giving room for a 2x4 in. stop. The upright studding was of 2x4 in. sticks, one placed in the middle of the form section and one at each edge. Where forms higher than 7 ft. were used, they were wired across the inside to keep from bulging. Strap bolts were fastened to the inside corner and the cracks were battened with lath on were bored in the outside section to receive the threaded ends of the bolts, and hand nuts were used to keep the sides in place. A ¼-round molding was placed in each inside corner and the cracks were battered with lath on the outside. Six forms were used on the work, four 7 ft. high and two 9 ft. high. Where forms of other heights were needed, they were made by splicing on or cutting off from those already made. Fig. 4 shows the detail of the forms, including the strap bolts and hand nuts.

The specifications called for 1 : 3 : 6 concrete, except for the coping course, which was considered the top of the pedestal (12 in. thick) and was made 1 : 2 : 4. The stone used with the 1 : 3 : 6 mixture was from 1 to 2 in. in largest dimensions, and for the 1 : 2 : 4 mixture not more than 1 in. in largest dimensions. All stone was screened, no crusher run being used. It was a good grade of limestone rock. The sand was taken from the Des Moines River about five miles up from the site of the bridge, using a standard brand of cement. The water was secured from a creek in the ravine, a 7-hp. gas-engine pump being used to force the water up the hill through a 1½-in. pipe into storage barrels at the mixer. The concrete was made with a batch mixer, driven by a 6-hp. engine mounted on the same frame.

Distributing the Concrete.

An interesting feature of this work was the manner of placing the concrete. Owing to the steep slope of the hill, it was impracticable either to move the mixer down the slope, or to wheel the concrete into place. The most efficient way was to spout it and this was the method

used. Half of the piers were poured from the north end of the bridge, and the other half from the south end. The mixer was mounted on blocks and a platform, built around it so that the hopper was above the platform, just about the height of a wheelbarrow. The chute used to convey the concrete was of No. 23 sheet steel, circular in form, 10 in. diameter, and in lengths of 10

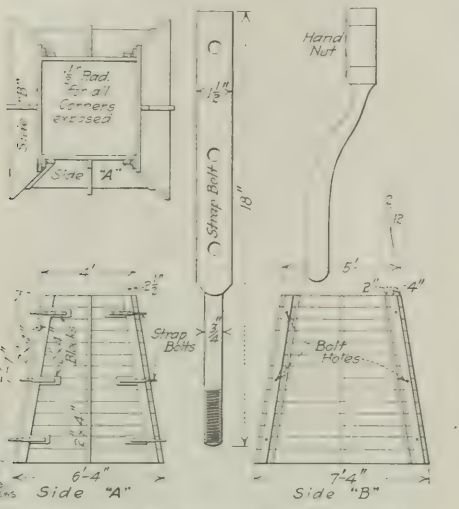


FIG. 4. FORM CONSTRUCTION FOR CONCRETE PEDESTALS OF VIADUCT

and 12 ft. The pipe was attached to a small wooden chute at the end of the hopper, and from here run to any desired point. It was supported at joints by wooden cross frames, or by brackets tacked to the batter posts of the trestle. At the end of the pipe, a curved connection was used to turn the concrete down into the forms. The spouting is indicated on Fig. 2, and the concrete



FIG. 5. CONCRETE MIXING PLANT, WITH STEEL PIPE CHUTE TO FORMS FOR PEDESTALS

mixer and spout are shown in Fig. 5. For bent No. 8, the concrete was delivered through a wooden chute from the end of the pipe chute just beyond bent No. 9. For bent No. 7, the concrete was wheeled into place from a wooden box placed at the end of the pipe chute just beyond bent No. 6 (See Fig. 2). This type of pipe spouting proved satisfactory where the distance was not greater than 250 ft. and the grade not less than 24° with the horizontal (about 1 ft. vertical to 2.3 ft. horizontal). When on a less grade than this, the concrete clogged in the pipe and caused considerable trouble. If it clogged so that any amount of weight would come between supports, the pipe would buckle and break, making it worthless for use again. Mr. Steigleder considers that a better type would be a chute made of similar material, 10 or 12 in. wide, 16 or 18 in. deep, open at the top and with a small angle running along each edge. Occasional spacer angles could be used to stiffen it. This pipe or chute would be easy to handle and it would give access to the concrete flowing in it. Another good type of spouting for this kind of work would be a wooden chute in 12- or 16-ft. sections, lined with sheet iron. The advantage of this chute would be the saving on the investment, as after the job was completed the lumber could be used for some other purpose.

The concrete gang was composed of 12 men and a foreman. Two men were used in spading the concrete as it was placed, one on water and dumping cement, one taking care of the mixer, six on sand and rock, and two carpenters. As far as possible, the concreting on a foot-



FIG. 6. PLACING AN 80-FT. GIRDER ON THE BOONE VIADUCT FOR THE FT. DODGE, DES MOINES & SOUTHERN RY.

(The erection was done by a derrick car on the viaduct and a locomotive crane on the old trestle alongside the viaduct.)

ing or pedestal was continuous, and only in one or two cases were joints made in either. From four to six footings were run at a time. As soon as the first two of these footings had set, the forms for the pedestal were placed and securely braced. After being braced, the template for the anchor bolts was centered and tacked to the top of the pier form. The anchor bolts were then placed in the template, plumbed and wired to the form. The total amount of concrete in the foundations was 932 cu. yd. The time required to place this was 40 days.

ERECTION OF STEEL STRUCTURE.

The cut at the north end of the bridge was excavated with a steam shovel, and about 300 ft. of track was laid on the new alignment. This track was used for unloading the steel and for the derrick car during erection, also as a siding when necessary to clear the main line for traffic. The erection was started at the north end and carried through to the south. The first 32-ft. span and the first bent of tower No. 1 were erected by the derrick car, which had a 40 ft. boom. The rest of the towers were erected with a locomotive crane which worked from the old trestle. The tower was first erected

and then the girders were placed, the ties and rails being laid as the work progressed. The material for the towers was first lowered through the side of the trestle by the derrick car (the bracing being removed as necessary), and was then picked up by the crane and brought into place. After a tower was completed, the derrick car placed the 80-ft. girders. These girders weighed approximately 16 tons each but no special apparatus was needed to place them, as the boom on the derrick car was kept straight ahead. Fig. 6 shows the derrick car placing an 80-ft. girder on the third span.

No difficulty was experienced in keeping the line open for traffic. The track was cleared ten minutes in advance of all regular trains, and in case of extra trains the foreman on the work was notified of their approach by the dispatcher. In order to protect the locomotive crane from the 1200-volt current on the trolley wire, a breaker was put on the wire and the current was cut off while the crane was working. The only trouble that was encountered during the erection of the steel was that caused by the bracing of the trestle interfering with the columns or braces of the steel towers. At the expense of the railway company, a carpenter gang of six men and a foreman was kept busy cutting away the old woodwork as required. The sway braces and struts that were cut were not replaced. When it was necessary to move a post, the cap was jacked up and the post cut and then moved and blocked into place. The trestle is to be wrecked but the contract for this work has not been let. The best of this timber will be milled and then disposed of, while some of it will be used in repairs to other bridges.

The deck of the viaduct has yellow-pine ties 8x8 in., 10 ft. long, sized to 7½ in. Hook bolts are placed on every other tie and the rails spiked to all ties. The guard rail is 6x8 in., boxed 1 in. over each tie. Three steel guard rails are laid between the track rails. The third guard rail is placed in the center of the track and provides an extra precaution in case a motor casing should drop as a car is crossing the bridge.

The riveting was done with compressed air, the power for the compressor being supplied part of the time by the engine on the derrick car and the rest of the time by a gas engine. From 12 to 18 men were used during erection, and from 10 to 12 during riveting. The bridge was erected complete before the riveting was started. From three to four gangs were used to drive the rivets, the greatest number driven in one day being 1020, with three gangs working. The time required to unload the steel and erect the bridge complete (including the placing of the ties and rails) was 95 days. The contract for the foundation was let to A. W. Merrick, at Boone, Ia. The excavation was done by the railway company. The painting was included in the contract for the erection.

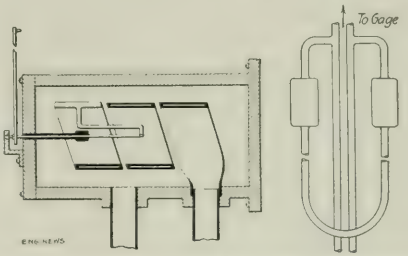
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Painting of the Panama Lock Gates is noted in the "Canal Record," Mar. 6, 1913. At present the work is confined to the interior surfaces of leaves. There is a preliminary washing of the steel to make the paint adhere better. Then there is the application of a "bitumastic enamel" to an average thickness of $\frac{1}{8}$ in. This type of paint has been used on the interior of the sea-going section dredges "Culebra" and "Caribbean" and has worn well during six years of service. This interior painting is being done by the lock-gate contractor under a sub-contract. The exterior paint has not been fixed and will be purchased by the commission but applied by the contractor.

A New Recording Differential Pressure Gage*

Design of a line of recording differential pressure gages has recently been completed by Prof. W. H. Bristol, of Waterbury, Conn., to meet the demand for service with Venturi meters, pitot tubes, orifices, etc., in the measurement of flows of steam, gas and air, as well as water and other liquids.

The mechanism employed is a development of earlier arrangements of hollow springs or diaphragm chambers bearing pressure on the interior and showing pressure changes by changes in shape, which movements are communicated to a pointer or pen arm. With a differential gage, it is desired to measure the difference in pressure between a greater and a lesser pressure. The one is applied to the interior and the other to the exterior of the hollow spring or diaphragm chamber; the corresponding movement of spring or diaphragm is proportional to the difference between the two pressures. Various attempts have previously been made to accomplish this end by inclosing the hollow spring or chamber in a casing and communicating its movement mechanically to the exterior through the casing walls, but the differences in pressures have been small to render negligible the friction of stuffing boxes or equivalent devices. Prof. Bristol has used this type of movement, but has devised for the casing



Diagrammatic Arrangement of Working System and Safety Attachment; Bristol Recording Differential Gage

a practically frictionless sealed bearing for the pointer or pen-arm shaft. As shown in the accompanying figure, a small shaft bearing the arm passes through a long fixed tube or sleeve and, fitting closely therein, oil or other liquid may be used to fill the annular interstice This supports the shaft and renders the joint very nearly frictionless to rotation while capillary forces make it also pressure tight.

Where there is danger of applying the full pressure to one side or other of the hollow spring or chamber, which might result in wrecking the gage, a safety appliance is attached. As shown in the accompanying figure, the two pressure leads carry outlets which are joined by a U-tube. Near the top of the U-tube are chambers, either of which has sufficient capacity to hold all the liquid contained in the U. When pressure is communicated to one lead and not to the other, the U-tube is cleared of liquid and full pressure is communicated to both sides of the spring or diaphragm chamber.

*From information furnished by the Bristol Co., Waterbury, Conn.

Stream Gaging Stations as Component Parts of Water-Power and Other Hydraulic Works

By John C. Hoyt*

Until recently stream-flow data have been used principally in determining the feasibility, the capacity and the design of various types of hydraulic plants whose successful operation must depend on the flow of streams. There is now a large and growing demand for these data for use in connection with the operation of such plants.

In the production of hydro-electric power full data in regard to the quantity and distribution of the water-supply are at all times essential. These data not only form the basis for the operation of the wheels and for estimating their working efficiency, but are also necessary for the equitable distribution of a supply of water that must be utilized by several plants. On irrigation projects records of stream flow, both for the source of supply and for the various distributing canals, are fundamental to the equitable distribution of the water and the determination of the seepage and other losses which affect the successful and economic operation of the system. For municipal water-supplies, navigation, storage, and other hydraulic works, records of flow are becoming more important, and with the present intensive development of surface waters these data will be essential to the operation of all types of hydraulic plants.

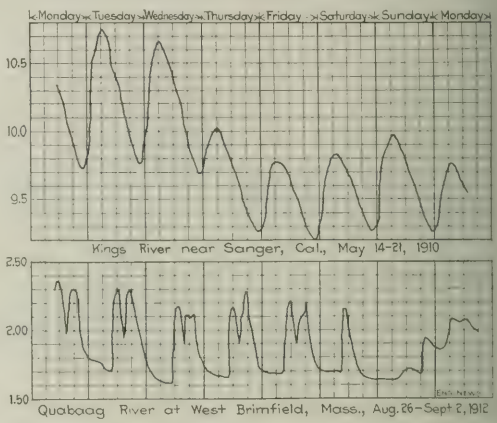
The need for stream-flow data in connection with hydraulic operations has been met in various ways. At power plants data have been obtained from records computed from wheel ratings, and from flow over dams and through waste channels, and some estimates have been based on electrical output; at irrigation projects headgates and other existing structures have been rated; and for other uses various expedients have been adopted, the choice depending on the character of the plant. Data obtained by any of these methods will always be more or less unsatisfactory on account of the many uncertain and changing conditions which affect their accuracy, and they can never replace records derived from observations at properly selected current-meter gaging stations, which at all times afford data sufficiently accurate to determine any of the various factors involved in hydraulic operations.

In designing hydraulic plants stream-flow data are used to determine the quantity and distribution of the water which will be available when the plant is in operation. In such designs a liberal factor of safety must be allowed to provide for the wide variations which occur both in the total flow and in its daily distribution from year to year. The total annual flow of a stream may be 50 to 75% greater or smaller than the mean annual flow for a series of years and extreme floods and droughts may vary as much as 100% from the average high and low waters. Therefore, so great refinement in data is not essential when the records are to be used for design as when they are to be used for operation.

In operating a plant it may be necessary to know precisely the conditions of flow that exist at any time during the day. Gaging stations to obtain data for operation must, therefore, be equipped and maintained to provide records of a high degree of accuracy.

The gage heights must be recorded by an automatic gage so that the record may be available at any time and errors due to diurnal fluctuation in stage eliminated. Not uncommonly the difference between estimates of discharge determined from hourly readings on a recording gage will vary 75% from those obtained by one or two gage readings a day, as shown on the typical gage height curves reproduced herewith. The discharge measurements must be made with exceptional care in order that no appreciable errors may be introduced into the rating table.

Special care must also be taken in selecting the point for making the measurement and, as a rule, it will be found necessary to install a cable and car from which the measurements can be made. The cost of such a station with the most modern equipment will range from $1000 to $1500, the exact amount depending on



Fluctuations in Stream Flow within Daily Periods

local conditions, and is small compared with the total cost of most hydraulic plants and the importance of these records in its operation.

That the average engineer does not appreciate the importance of stream-flow data in connection with the operation of hydraulic works is evident from the fact that only exceptionally is suitable provision for stream measurement made in the design and original construction. Among the requests received by the Water Resources Branch of the Geological Survey for coöperation in the collection of stream-flow data for operative purposes, requests for data for determining the efficiency of wheels at power plants are common, and in practically every case a gaging station must be established, to determine the quantity of water available with any reasonable degree of accuracy. If such a station had been considered in designing the plant much more satisfactory results could have been obtained at a much less expense, as in the construction of most plants, a gaging section can be provided for with but little extra work.

The same lack of provision for collecting stream-flow data is found in connection with the operation of various irrigation projects. The designing engineers have evidently overlooked the fact that the success of a plant de-

*Engineer-in-charge Investigation of Surface Waters, U. S. Geological Survey.

pends largely on the readiness with which the works may be operated and the burden of this oversight must be borne by the operating engineer. With the increased development of the water resources of the country the value of water has risen rapidly, so that supplies which were formerly considered abundant now have to be conserved and used with discretion. Legal difficulties frequently occur and the adjudication of water rights is one of the difficult problems which many communities must now solve. In order to be prepared for any contingency the owners of all plants and projects which depend on the flow of water in streams for their successful operation should keep both for their present and future needs accurate water-supply records, while provision for the collection of stream-flow data should be considered both by the designing and the constructing engineer.

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Algae in the Water-Works Reservoir at Quincy, Ill.*

By W. R. GELSTON†

There was published in "Engineering News," June 9, 1898, an interesting article by Dow R. Gwinn ["Covering a Storage Reservoir at Quincy, Ill."]. I quote from Mr. Gwinn's article:

The reservoir was constructed in 1881-2, and is 415x317 ft. at the top and 26 ft. deep. The excavation made the embankments. The inside slope was puddled to a depth of 9 in. and a dry limestone wall 1 ft. deep was laid on the puddle. The bottom, which is sandy clay, was puddled to a depth of 1 ft.; the leakage, if any, is extremely small.

A vegetable growth has given us considerable trouble during the summers, especially since we began filtering the water before pumping it into the reservoir. The character of the vegetation was not always the same; one year it was a mossy growth, but the last two summers the growth was about the size of the head of a pin, nearly globular and light green in color.

A wooden roof was built over the reservoir, presumably in 1897 or 1898. This was removed in 1906, because the wood was becoming badly decayed and dropping into the water, giving it a disagreeable taste.

In July, 1907, the gate valve controlling the flow of water into the reservoir was closed and the water was treated with copper sulphate in the proportion of 1 to 365,000 parts of water. It was allowed to stand 30 hours and was then drained through a pipe provided for that purpose. An attempt was made to clean the interior, but it was not very satisfactory on account of the mud in the bottom. No trouble, due to algae, occurred during this season.

Beginning in the spring of 1908, we adopted the policy of treating the reservoir with copper sulphate (1 to 5,000,000 parts) and repeating the treatment every four weeks during the warm season. There were eight or nine treatments each year, the first being given in March or April and the last in October or November. These treatments were always given as early in the day as possible, after the pumps were started, and without shutting off the reservoir from the distribution system. The pumping plant was then kept in operation about 36 hours, so as to hold the treated water in the reservoir until there was no danger of the consumers noticing an unusual taste.

This method of treatment has been very satisfactory and until the latter part of the summer of 1912 there was no evidence of any objectionable growths of any kind. The first indication of such growths came in August and September when there were a few small patches of floating vegetable matter (none larger than 3 or 4 sq.in.), and the rip-rapped slopes were covered just under the water with a thin layer of green moss from which bubbles were rising to the surface. At this time the water had no disagreeable taste or odor. We continued the regular treatments and detected no change in the condition until a week after a treatment which was given Oct. 8. At this time there was a distinct odor which was quite noticeable in the street adjacent to the reservoir and the surface of the water had an oily appearance. Another treatment was given Oct. 18, and conditions were much improved. The odor was eliminated and the latter was quite palatable. There were very few, if any, complaints because of the condition of the water. It is possible that only the water near the surface was affected and that none of the algae-laden water was drawn out into the distribution system. During this period we were pumping 12 to 14 hours each day, not much water was used from the reservoir and the stored water did not reach all portions of the city.

Our serious trouble came during the holidays, when the consumption of water decreased considerably and we were not obliged to keep the pumps running full time to maintain the supply. After a shutdown of one day, complaints began to come in from all sections of the city. Some of the complaints were due to a taste of bleaching powder, but most of them were undoubtedly due to some other cause. The water in the reservoir looked good and tasted good. We therefore decided that the mains needed flushing. A very thorough flushing of the mains in a certain district south of the reservoir only increased the disagreeable taste and odor. A sample of water was then obtained from near the bottom of the reservoir and it had a very disagreeable taste. There was some ice in the reservoir, but this was broken up and the water was given a dose of one part copper sulphate (1 to 3,000,000 parts). This put the water in excellent condition again and all complaints ceased after flushing the mains thoroughly around the edge of the system to draw out the dead water in the mains.

Since our treatment of the reservoir was essentially the same in 1912 as during the four previous years when we had no indications of algae growths, we have been unable to explain satisfactorily the reason for this trouble. Perhaps the weather conditions were more favorable for such growths in 1912 than in previous years. Perhaps a water coagulated with sulphate of alumina is more susceptible to such growths than a water coagulated with sulphate of iron and lime. If this is true, we have probably found the reason, because we discontinued the use of the iron and lime treatment in March, 1912, and (with the exception of a few days) have used alum ever since. It is also quite possible that this trouble came from organisms in the river water, which found their way through the filters and eventually reached the reservoir. As we do not have the necessary equipment for making the microscopic examination, no attempt was made to identify any organisms. Our filter wash records for the year, however, indicate an unusual clogging of the filters from some cause, during the latter part of October, November, and the first 15 days of December. During a part of this period, the average length of time of operation between washes, was reduced over half and it was necessary to wash some of the filters, which contain fine sand, every three hours. During the five years covered by this paper the reservoir has been well stocked with fish. It is possible that the spawn is killed, but even the recent heavy dose of 1 part of copper-sulphate to 3,000,000 parts of water did not kill the fish. From our experience, we believe that we can safely increase the copper to 1 part in 4,000,000 parts of water.

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The Purchase of Street-Railway Power has been undertaken by the Cleveland (Ohio) Ry. Co., which is giving up the generation of its own electrical energy. It is under contract now to purchase 11,000-volts, three-phase, 60-cycle power from the Cleveland Electric Illuminating Co. This will be supplied to four substations equipped with rotary converters of special design, and storage batteries. The initial equipment of these stations will aggregate 15,500 kw. converter capacity with a possibility of increasing this to 25,000 kw. Graphical and numerical records are to be kept by the substation employees, and forwarded to the railway company's power department each day for totalizing. As an aid to efficient operation the substation records will also show plotted the capacity of machines running at each hour, so that it will be evident what approach is obtained to full load on the equipment in service.

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Screening the Sewage and factory wastes discharged into the "Bubbly Creek" arm of the Chicago River by the stock-yards and packing houses is to be tried as a means of avoiding the deposit of solid matter in the river and the drainage canal. Chemical and sedimentation treatment have been proposed by the Sanitary District of Chicago, in order to improve the character of the discharge from a sanitary standpoint, but at present only the screening will be tried. There will be two rotary screens of the Weand type; one will handle the sewage from four of the larger packing houses, and the other will handle that from the pens of the stock-yards. This installation is experimental, and if it proves successful it is probable that all of the sewage will be treated in this way. No plans have been made as yet for the disposal of any large body of solid matter removed by the screens.

*Abstract of a paper read at the annual meeting of the Illinois Water Supply Association at Urbana, Ill., Mar. 11, 12, 1913.

†Superintendent, Citizens Water Works Co., Quincy, Ill.

The Wabash River Flood, March 21-April 2, 1913

By R. L. Sackett*

A series of heavy rains, extending over the entire drainage area of the Wabash River, commenced Mar. 21 and continued at intervals until Mar. 26, raising the river to unprecedented heights, causing the loss of many lives and the destruction of several million dollars of property.

Previous floods which did much damage occurred June 11, 1858, Aug. 5, 1878, Feb. 17, 1883, and Jan. 20, 1907. The flood just passed reached a mark 22 in. higher than the record of 1883 at Lafayette, Ind., and exceeded all records at Peru and Logansport by as high as 8 ft. The

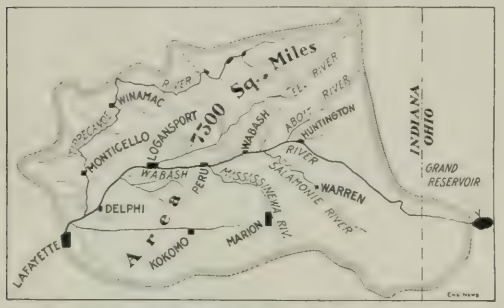


Fig. 1. Drainage Area of the Wabash River above Lafayette, Ind.

flood of 1883 was produced at Lafayette by an ice jam which formed about a mile below the city. The damage done was due to slack water, while the present flood caused the partial destruction of three large steel bridges by extraordinary erosion of the river bottom in the restricted sections.

One student lost his life in an attempt to rescue men marooned on the Brown St. levee, when the latter washed out on the west of them and the bridge fell on the east of them. High water closed the gas works, the two waterworks pumping stations, the city heating and lighting plant and many industries; one light and power plant continued in operation although its condensers and pumps were under 7 ft. of water.

The drainage area with its tributaries above Lafayette, as shown in Fig. 1, includes an area of about 7300 sq.mi., of which 400 are in Ohio. The whole of this area is in a glaciated area, the depth gradually decreasing east of this point until near Logansport, Ind., the bed of the river is in rock. East of that point the deposit varies in thickness.

The drainage area is practically clear of forests and under cultivation. The average fall of the river is about 18 in. per mile here and increases in the upper portions. There are numerous islands and sand bars which form and are swept away in periods of high water. The soil wash is high and the loss therefrom is a matter of great moment. The high turbidity is, of course, a factor in the erosive action which is so characteristic of the rivers of the Mississippi Valley.

The elevation of the head waters above M. H. T., New York harbor, is about 1000 ft; at Huntington, 699 ft.; at Logansport, 583 and at Lafayette, 500 for low water.

Rainfall data preliminary to the hydrograph, Fig. 3, are given in Table I.

TABLE I. RAINFALL DATA OVER WABASH RIVER DRAINAGE AREA
(Measured by Experiment Station at Purdue University)

Date	Inches
Average annual precipitation	50
Greatest annual precipitation, 1909	55
Greatest monthly precipitation June, 1902	11.37
Greatest precipitation in 24 hr., Aug. 12, 1912	4.30
Rainfall for March, 1913	7.05

The hydrograph shows a remarkable relationship between rainfall and runoff for a watershed of this area—7300 sq.mi. From Mar. 1 to Mar. 20 inclusive, only 0.94 in. of rain fell. From Fig. 3 it is apparent that according to the government rain gage at Purdue, and a private

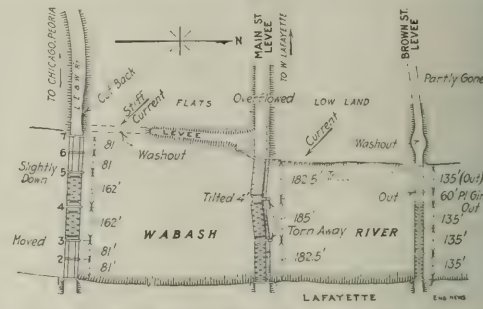


Fig. 2. The Three Bridges across the Wabash at Lafayette

gage, about 1 in. of water fell preceding the 23d, enough to thoroughly saturate the soil. On the 23d, 1.75 in. of rain fell; another inch on the 24th; 1.35 on the 25th-26th and snow on the 26th, which did not immediately melt. While there are no other rain gages on the watershed above this point from which records were obtainable, it is quite probable that the diagram represents average conditions. (See Table in Engineering News, Apr. 3, 1913, p. 381.)

The daily maximum temperature during the flood period is also shown on Fig. 3. While there had been no

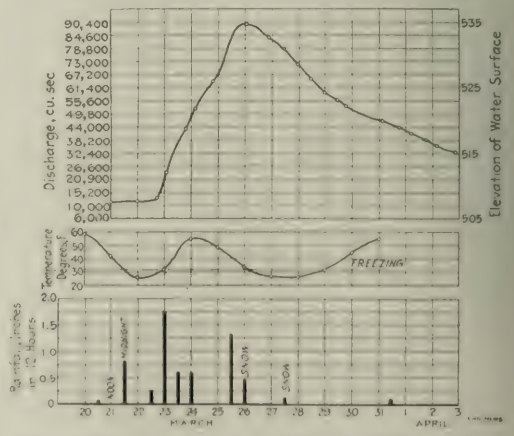


Fig. 3. Hydrograph of the Wabash River, Lafayette, Ind., Mar. 20—Apr. 2, 1913

*Professor Sanitary and Hydraulic Engineering, Purdue University, Lafayette, Ind.

snow the saturated condition of the ground, which was free from frost, the temperature and the distribution of rainfall caused the highest known stage of the river.

Damage to Bridges

Fig. 2 shows the location of the three bridges at Lafayette, Ind., all of which suffered damage.

The upstream bridge, the oldest, was a through, highway, Pratt truss with a concrete-slab floor. Originally a covered wooden structure stood on these piers four spans of which were of about 135 ft. in length, but the



Fig. 4. The Brown St. Bridge from the East

second from the west was a short span originally designed to carry a jacknife type of open draw for steamboats. The pier on the west of the short span was washed out in the recent flood and the steelwork of one of the two spans destroyed now shows above the water lying parallel with the west bank and near it. The levee about one-half mile in length leading across the bottoms was overtopped Tuesday afternoon, Mar. 25, and two washouts occurred in it approximately 100 and 50 ft. wide.

The Main St. bridge approach on the west was of about the same height as the Brown St. levee but was paved with excellent sheet asphalt with a street-car track on the upstream side and a concrete walk on the south side. A hole was washed out at the foot of the hill in West Lafayette and the water flowed over the levee to a depth of several feet for almost its entire length. The Main St. bridge consists of three through Pratt trusses of 182.5, 185- and 182.5-ft. span and was built by the Lafayette



Fig. 6. Showing Settled West Pier

Engineering Co., 24 years ago. It has been neglected and as a result is badly rusted. Following the settling of the west pier, one counter and one diagonal of the top system failed. Each of them showed signs of old fractures.

The abutments and piers are built of a rather soft limestone and rest on piling reported by the inspector as being driven "from 12 to 16 ft. below low water." The masonry was later extended upstream to carry a light truss and street-car tracks. The new work was bonded to the old. In the fall of 1912, new wing walls were



Fig. 5. The Lake Erie & Western Ry. Bridge at High Water, Mar. 26

built on the upstream side and the piers were extended the second time but with concrete. It was stated that the distance from top to street-car rail to bottom of piers was about 36 ft. The flood dislodged all of the concrete additions to the piers and these took with them a portion of the limestone masonry which formed the first first addition.

Soundings made Apr. 7, 1913, show that the depth from the top of the street railway rail to bottom of river is now 46.5 ft. on the west side of the west pier and 41.6 ft. on the east side at the upstream end and 51.5 ft. and 46.5 ft. respectively at the downstream end which is settled. At the east pier the corresponding depths at the upstream end are 46.6 and 40.6 ft. At the downstream end the corresponding depths are 46.8 and 41 ft. As the distance to base of masonry is 36 ft., and to point of piling not over 52 ft., the river bottom was eroded well below the bottom of the masonry.



Fig. 7. Showing Sag in Asphalt Paving

Figs. 6 and 7. The Main St. Bridge

After the Brown St. levee overflowed and was partly washed out, a strong cross-current formed, just above the Main St. levee, as shown in Fig. 2, which may have been a factor in the greater depth of erosion on the west side of the piers, except that such influence could not have ex-

tended to the middle of the center span, where the depth is 52.8 ft. or to the east pier, where the same difference in soundings occurs. The west pier of the Main St. bridge settled about three courses at the downstream end, very little at the upstream end. Now the downstream end is about 4 ft. below grade and the other end about at grade (see Fig. 6). The old masonry seems intact.

As the northwest end post was partly embedded in the new concrete wing wall, the west span swung on this point as a hinge, as the rumpled asphalt at the bridge portal shows in Fig. 7. The west pier has also listed to the west about 6 in.

On the south is the L. E. & W. Ry. bridge (Fig. 5), consisting of two through double-track riveted spans of 164 ft. each and four plate-girders of 82-ft. span, the old piers and abutments being used but extended upstream for the double-track bridge built in 1907 and the first piers from each end are new. A long fill, upgrade, leads to the west.

The fill was eroded by the strong current caused by the overflow of the Main and Brown St. approaches just above. The north track was undermined; for practically its width in places, but the railway forces were able to prevent the failure of the fill, which is made around an old timber trestle.

At the highest stage the water did not overflow the highway bridges above, although the tilted end of the Main St. span did rest in the water. The flood arose a few inches on the bottom chord of the railway bridge and banked against the plate-girders to a depth of 3 to 4 ft.

Loaded coal cars were kept on the north or upstream track continuously, and traffic was stopped from Tuesday till Friday, Mar. 28.

The water reached its maximum stage Wednesday about 1 p.m., and receded about one foot a day for a week following. No appreciable effect on the railway bridge was noticeable until after traffic was resumed. First, the track was found to have shifted down stream at pier 3 (see Fig. 2) about an inch. This continued to increase until it reached a maximum of 5⅝ in. on Apr. 5. This pier also began to settle and is now down 6 in. at the downstream end, and is above grade ⅜ in. at the upstream end. This end has varied its elevation slightly from time to time.

Piling is being driven at Pier 3 and falseworks will be placed under the through span adjoining. Chief Engineer Atwood of the L. E. & W. Ry. states that steel-sheet piling will be driven around this pier to prevent repetition of scouring.

The accompanying data (Table II) concerning the depth at the piers in 1907 and after the flood are of moment:

TABLE II

Depths from base of rail to river bottom

Pier No.	1	2	3	4	5	6	7
In 1907	31 3	10 7E	41 9	41 7	39 4	30 2	17 7
After flood	37 0	11 6E 26 0W	51E 47W	38 0E 41 8	39 4E 48 1W	38 4E 38 5W	19 0

E indicates the East side of pier and W the west side. These data are from the Chief Engineer's Office.

The plans of the railway bridge show that at Pier 3 it is 43 ft. 11 in. from base of rail to bottom of masonry and 62 ft. 2 in. to point of piling. The pier is, therefore, entirely undermined and is supported by the piling alone. Pier 4 is 39 ft. 6 in. to base of masonry and 57 ft. 6 in. to point of piling. The other piers are of similar construction.

Soundings made by the writer on Apr. 7, show that the river bed is washed out between piers to even greater depths than those given in the table above. Between Piers 3 and 4 there are three depths of 50.49 and 48.5 ft. Between Piers 4 and 5 there are three depths of 49 ft. each, measured from base of rail. From the data at hand it seems no exaggeration to say that the bottom of the river has been excavated here nearly ten feet.

The river bends slightly here and the current swings slightly toward the east shore. At flood stage a strong current swept out of the bottoms just above the railway fill and helped to cause the marked erosion on the west side of Piers 5 and 6. Pier 4, in midstream, seems to have been least affected by the scour.

The railway telegraph and telephone cables fell and quantities of débris lodged against the plate-girders, partly held perhaps by the cables, which deflected the currents downward and caused the extraordinary erosion.

The river was a half-mile wide on the average except when restricted. At the Brown St. (Fig. 4) bridge the clear waterway, between abutments, was about 560 ft.; at the Main St. bridge about 520; and at the railway bridge about 600 ft. The maximum discharge was near 100,000 cu.ft. per sec., and the surface velocity about 10 ft. per sec.

The flood was not caused by an unprecedented rainfall but by a conjunction of conditions, as stated in your editorial of Apr. 3, 1913, and may easily recur, once in ten or twenty years. "Rainfall came at a time when the ground was well saturated by previous rains and at a time of year when evaporation is nil."

The Lake Erie and Western Ry. has nearly completed driving its piling and will soon have traffic in motion. Pier 3 will be entirely rebuilt. No move has yet been made toward repairing or rebuilding the Brown St. or Main St. bridges. Traffic is at present dependent upon ferries.

If a repetition of the present conditions is to be met it would seem necessary to increase the width of waterway by another span at the Main St. bridge and correspondingly at the railway bridge.

Soundings and gagings have been taken at a section of the Wabash River above the Brown St. bridge for six years by students in the Civil Engineering College, at Purdue. There is nothing to indicate any general changes in the river bottom where it is not restricted, other than might be expected in a river of this type. It is not probable that soundings soon to be made will indicate any such general deepening of the river as has occurred beneath the bridges.

⁂

Accidents in Metal Mines of the United States have been studied by A. H. Fay, mining engineer of the U. S. Bureau of Mines. He reports that of the 165,979 men employed during the calander year 1911, 695 were killed, representing a rate of 4.19 per 1000, as compared with 3.78 per 1000 for the coal mines of the country in the same period. The serious injury cases amounted to 4169, or 25.12 per 1000 persons, and the slight injuries were given as 22,408, or 135.01 per 1000. Of the total fatalities, 532 were underground (at the rate of 5.18 per 1000 persons) and 153 were on the surface (at a rate of 2.49 per 1000). Of the fatal accidents, 32.5% were due to falls of ore or rock from roof, wall or back, 11.23% were due to explosives, 15.39% to falling down stopes, shafts or winzes, and 5.32% to fire. Of the serious accidents, 28.86% were due to falls, 19.05% to car and hauling systems, 12.19% to machinery, and 6.41% to timbers and hand tools. Among the slight accidents, 28.86% were due to falls, 15.52% to car and hauling systems, 7.10% to machinery, and 8.02% to timbers and hand tools.

Proposed Highway Bridge and Highway Tunnels across the Hudson at New York

Public agitation for a number of years past on the subject of highway communication across the Hudson River, and the resulting appointment of commissioners by the states of New York and New Jersey to form a joint commission for studying the subject of bridges and more recently also the subject of highway tunnels have finally produced the recommendations and designs noted below. Boller, Hodge & Baird, as consulting bridge engineers to the commission, studied the subject of bridge location and made designs for bridges; Jacobs & Davies, Inc., similarly dealt with the subject of tunnels.

Prior reports on bridges by the Interstate Commission were based on tentative recommendations from its engineers, which recommendations involved the assumption that suitable foundations could be obtained in the river channel for spans of moderate length. Subsequent borings proved that foundations in the channel could not be had, as rock was at unattainable depth; this made it clear that long spans exceeding 2000 ft. would be necessary. Under these circumstances the engineers changed their earlier recommendation for a bridge at 179th St. (Fort Washington Point) to a location at 57th St., and worked out the design shown by the sketch drawings (Figs. 1 and 2) herewith, for this particular location.

The subject of tunnels naturally comes up for consideration in this matter because the great bulk of the vehicle traffic between New York and New Jersey across the Hudson is carried on at the lower part of the city several miles south of 50th St. At any southerly location, however, a bridge is practically out of the question as the shores are low. The commission, therefore, recently took the question of building one or more highway tunnels, instead of a bridge, under serious consideration. The successful operation of highway tunnels in London, Glasgow, and Hamburg, and the completion and successful operation of several railway tunnels across the Hudson River at locations between Cortlandt St. and 32d St. remove doubt as to the engineering practicability and operating feasibility of highway tunnels through the Hudson silt.

The magnitude of the vehicle traffic across the Hudson River is often not appreciated. A very heavy freight trucking intercourse goes on between lower New York and New Jersey, using the existing railway ferry lines. The most northerly ferry, that at 130th St., Manhattan, to Edgewater, N. J., carries chiefly automobile traffic. A traffic census shows that about 6,000,000 vehicles cross the river per year. The distribution among the different ferries is as shown by the accompanying table. In comparison, the Rotherhithe highway tunnel under the Thames at London (ENGINEERING NEWS, Dec. 19, 1907) carries about 1,000,000 vehicles per year, and the Blackwell tunnel about as many.

Incidentally it may be noted that about 158,000,000 passengers cross the Hudson River per year, counting those carried by ferries and those going through the Hudson & Manhattan and Pennsylvania tunnels.

To accommodate the trucking traffic, which is vital to the commercial life of the New York and New Jersey communities, a tunnel in the southern part of the city would unquestionably be of far greater utility than a bridge in an uptown location. The New Jersey Interstate Bridge and Tunnel Commission, in reporting to the Legislature of the State of New Jersey, has therefore reported that it considers the construction of both a bridge and a pair of tunnels necessary:

> Your commission has thoroughly investigated the feasibility of building and operating tunnels for vehicular traffic and is satisfied that this method of connecting highways of this state with the city of New York is practicable and the most economical for the section south of 50th St. in New York.
>
> Your commission is also satisfied that the construction of a bridge at about 58th St., New York, to a point on the Palisades in the town of West New York, is a necessary improvement for the accommodation of vehicular and trolley traffic, connecting that section of New York with the northerly part of the county of Hudson, and the county of Bergen, and serving also a large portion of the counties of Passaic and Essex. This would also connect the city of New York with that portion of the state of New York lying west of the Hudson River.
>
> The preliminary estimate of Boller, Hodge and Baird, the engineers on bridges, shows that the construction of such a bridge with a single span of about 2800 ft., with a width of 204 ft. and a height above the river of 170 ft., and accommodating all classes of vehicular traffic as well as trolley, subway, elevated railroad and foot passengers, would cost $42,000,000.
>
> The estimate of Jacobs and Davies of the cost of construction of a pair of tunnels, one tunnel for westbound and one for eastbound traffic, providing for slow-going and more rapid-moving vehicles, would cost $11,000,000.
>
> Your commission is, therefore, satisfied that both tunnels and a bridge are practicable and necessary to provide for the vehicular traffic which is constantly growing between the points mentioned.

PROPOSED 57TH ST. BRIDGE

As the drawing Fig. 1 shows, rock has been found at the sites selected for piers and anchorages of the 57th St. bridge. The depth of rock surface below mean high water at the main piers is 180 ft. in the maximum. In view of the general subsoil conditions along the river Hudson, this is a fortunate circumstance and makes the construction of suitable foundations for a large bridge appear quite practicable. The topography of the two shores is such that, with river clearance 170 ft. at midchannel, the ground on the New York side can be reached with an approach of moderate length at a gradient of 2.48% while the New Jersey side involves no grade, as a level approach would lead directly to the top of Bergen Hill.

The unprecendented span, 2880 ft. center to center of piers, led the engineers to select a wide bridge with large traffic capacity as being the only justifiable construction under the circumstances. They have provided for two four-line roadways, two sidewalks, and eight lines of railway track, these latter being intended for trolley car and rapid transit service. Stated in terms of load, the design

VEHICLE TRAFFIC OVER HUDSON RIVER FERRIES AT NEW YORK CITY

Ferry	Average vehicles per day
Fort Lee—Edgewater to 130th Street	816
Weehawken to Cortlandt and 42d Street (West Shore R.R.), divided about equally between Cortlandt and 42d Streets	2,536
Hoboken Ferry—14th Street to 23d Street (D. L. & W. R.R.)	1,400
Ferry Street, Hoboken, to Barclay, Christopher and 23d Streets (D. L. & W. R.R.)	4,206
Pavonia Avenue, Jersey City, to 23d and Chambers Streets (Erie R.R.)	2,995
Exchange Place, Jersey City, to Desbrosses and Cortlandt Streets (Pennsylvania R.R.)	5,207
Communipaw to 23d and Liberty Streets (C. R. R. of N. J.)	2,500
Total per day (both directions)	19,660
Total per month 25 days	491,500
Total per year 300 days	5,898,000

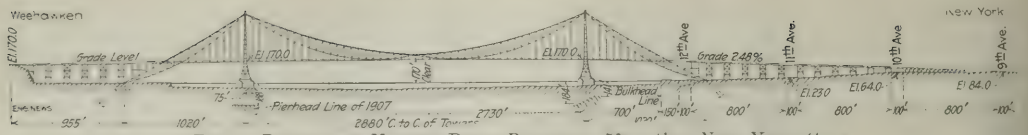


FIG. 1. DESIGN FOR HUDSON RIVER BRIDGE AT 57TH ST., NEW YORK CITY

(Boller, Hodge & Baird, Consulting Engineer.)

has been made for a loading of 20,000 lb. per lin.ft. of bridge. The width of the deck is 204 ft.

The suspension type was chosen for the supporting structure of the bridge and instead of a cable design the Lindenthal eyebar design for the Manhattan Bridge (described in ENGINEERING NEWS, Feb. 26, 1903, p. 183, *et seq.*; not built) was followed closely. The towers are of steel. Both the tower construction and the suspender arrangement are indicated in a general way in the drawing Fig. 2.

The bridge is located with axis halfway between 57th and 58th Sts., New York City, and on the center line of 6th St., Weehawken. For the New York approach, which is the critical one, it is proposed by the engineers that the block between 57th and 58th Sts. from the river front to Ninth Ave. be acquired and cleared of buildings to accommodate the bridge approach, leaving the space under the approach to be utilized for various public purposes subsequently.

The total estimated cost of the bridge is tabulated below. The time of construction is estimated at six years.

ESTIMATED COST OF 57TH ST. BRIDGE

River span and anchor spans	$27,100,000
Approaches	1,900,000
Total structure	$29,000,000
Engineering contingencies	2,900,000
Real estate	4,800,000
Interest during construction	5,300,000
Total cost	$42,000,000

As already stated, the report of the bridge engineers is based on a series of borings which were made during January and February of the present year at the direction of the bridge commission. Water-jet wash borings were put down to rock and diamond-drill core borings put 10 ft. in the rock as assurance that bedrock and not boulders had been struck. Four borings were made on the site of the New York pier, four on the site of the New Jersey pier and six at the site of the New Jersey anchorage. These borings showed that rock is from 176 to 184 ft. below mean high water at the New York pierhead line, sloping up to 134 ft. and 141 ft. at 150 ft. back of the pierhead line, while at the site of the New Jersey main pier the surface of bedrock is practically horizontal at 187 ft. below mean high water. At the site of the New Jersey anchorage also satisfactory bottom for the anchorage was found. On the New York side the anchorage would come practically on surface rock.

CANAL STREET HIGHWAY TUNNEL

The sketch design of Jacobs & Davies, Inc., for highway tunnels under the Hudson River is shown by Fig. 3. These are 30-ft. iron-lined shield-driven tunnels, preferably built as a pair, giving one tube for eastbound and one for westbound traffic. The size of tunnel is practically the same as that of the Blackwall and Rotherhithe Tunnels in London, respectively 1170 ft. and 5200 ft. long between portals (6200 ft. and 6883 ft. with approaches), but the English tunnels are single tubes carrying traffic in both directions.

The difficulty of ventilation has been urged against highway tunnels. The Blackwall and Rotherhithe Tunnels, however, are operated without artificial ventilation although the former was fitted for ventilation; their operation is not found objectionable. In the present case, however, the engineers recommend providing ventilating ducts and ventilating machinery.

The question of best location for highway tunnels was studied with considerable care. The location finally selected is described in the following:

In view of the requirements of the traffic and the physical conditions, we recommend as a location for the first tunnels a line from the foot of Canal St., Manhattan, to intersect the shore line of Jersey City at approximately the extended line of 12th Street, Jersey City, which is the line of division between the properties of the Erie and Lackawanna Railroads, and extending thence to a portal in the block between 12th and 13th St. and Provost and Henderson St., so that the surface of the street is reached at Henderson St., which is the first continuous street parallel to the river connecting Jersey City and Hoboken. This location will not interfere with the various projected rapid-transit tunnels or subways; or with the developments and improvements con-

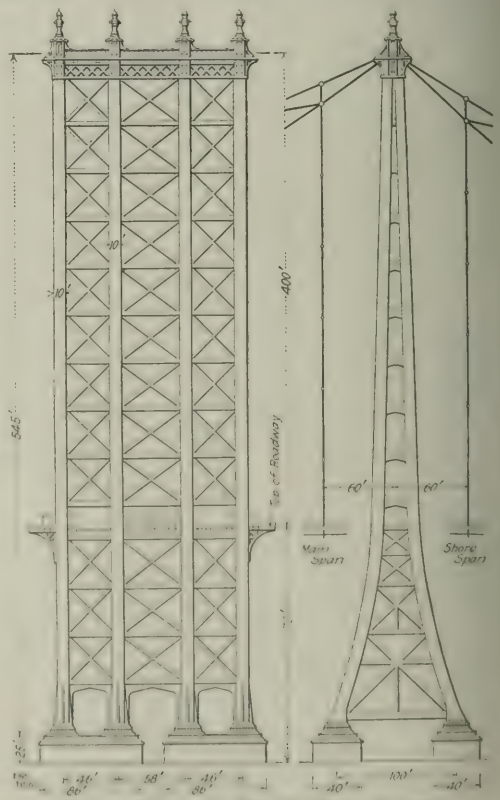


FIG. 2. TOWER OF HUDSON RIVER BRIDGE

templated by the railroads or by the cities, and will not obstruct or interfere with public streets or private property other than in its outlet upon Canal St., where the widening of the street for one block would be necessary. The approach would reach the grade of the street at the line of the new extension of Seventh Ave., and widening of Varick St. This location permits of direct connection along Canal St. to the Manhattan Bridge and is in close proximity to the Williamsburgh and Brooklyn Bridges; to the new 1000-ft. steamship piers; and to the main arteries to uptown Manhattan. Canal St. is the widest crosstown street in the downtown district, and its surface is also the lowest, making the approaches shorter than they would be in any other street. The maximum adverse gradients eastbound would be 3.7% and westbound 3%, these being practically the same rates that prevail on the East River bridges.

On the New Jersey side this location gives immediate access to either the low sections of Jersey City and Hoboken or to Jersey City Heights by the 13th St. viaduct. There is consequently no reconstruction of any of the highways in New Jersey required to give access to this tunnel. This location is in immediate proximity to all railway yards and freight stations, to the warehouse and manufacturing district, and to the steamship piers.

The cost of the pair of tunnels located and constructed as described is estimated at $11,000,000. This includes

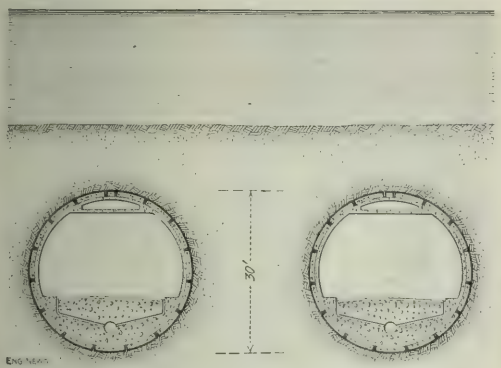


FIG. 3. SKETCH OF DESIGN FOR PAIR OF HIGHWAY TUNNELS UNDER HUDSON RIVER AT CANAL ST., NEW YORK
(Jacobs & Davies, Inc., Consulting Engineers.)

cost of right-of-way, cost of approaches, interest during construction, engineering and contingencies. A time of three years is set for the construction, with the possibility of doing the work in materially less time.

❖

Tests of a Diesel Engine, built by the Busch-Sulzer Bros. Diesel Co., of St. Louis, Mo., for the Hugo, Oklahoma, Ice & Light Co., were recently made by A. T. Scott, of Dallas, Tex. The engine is a three-cylinder machine rated at 225 net b.hp. direct connected to a generator. The fuel consumption in various rates of output was as follows:

Net brake hp.	Oil burned per net brake hp.-hour, lb.
49.7	0.769
111.39	0.482
162.97	0.454
219.63	0.441
245.6	0.444

The air compressor furnishing the air for starting the engines and injecting the fuel supply was driven by power from an independent source. The current used to drive this compressor was deducted from the output of the generator to obtain the net brake horsepower. The engine tested had been in operation for six months. The oil used showed on analysis 18,986 B.t.u. per lb. of oil; the specific gravity was 0.8531 and it had a viscosity at 92° F. of 1.63. Analysis of the exhaust gases showed that no combustibles remained in them. A complete report of the tests has been issued by the builders of the engine.

Damage to Movable Dam, Yosts, N. Y.

Between Little Falls and Schenectady the Mohawk River, as canalized for the New York State Barge Canal, is provided with eight movable dams, the gates of which can be raised in times of high water to prevent structural damage and overflow of adjacent land by excessive pondage. These dams were described in ENGINEERING NEWS, Dec. 8, 1910, p. 611, where views of two dams and complete structural details may be found. Briefly, the type of dam adopted consists of a series of ordinary bridge trusses, upon concrete piers, carrying, hinged from the downstream lower chord, a series of steel frames which swing down into the river and there butt against concrete and cast-iron blocks embedded in the concrete paving of the river bottom. On these frames are lowered two sets of gates, an upper and a lower, to control high or low flow as needed. The gates are controlled by small hoists which travel back and forth across the bridge.

Dam No. 9 of this type of dam, across the river at Yosts, N. Y., consists of two spans. The gates were down during the night of Mar. 26 and the rising flood



MOVABLE DAM NO. 9, AFTER RECENT FLOOD OF MOHAWK RIVER

brought down so much drift which lodged against them, that it was impossible in the morning to raise the hanger beams, though it appears that the gates themselves were raised sufficiently to let some of the flood water pass under them. The drift continued to accumulate against the hangers and the pressure became so great as to force some of the hangers back out of vertical and to twist and strain the cross-bracing. One set of hangers (two hangers with cross-bracing) was so badly twisted that the attendants drove out the hanger pins and the set was allowed to drop down into the river, but on the whole the damage was not as great as at first reported.

While the river is still too high to permit of a thorough investigation, it is thought that the hanger beams did not buckle, but that rather they lifted by moving along the slotted hole provided for the hanger pins, and were thus allowed to slide over the buffer blocks in the river bed.

The accompanying view, taken on Mar. 28, after the water had receded about 3 ft., shows the bent hangers on the north span.

So far as can be learned, none of the other similar bridge dams on the Mohawk were injured by the high water in the recent flood.

FIELD AND OFFICE

Pole-Truss Highway Bridges on Mountain Roads in Washington

By C. R. Ege*

In order to eliminate some dangerous fords of the American River and one of its small tributaries, the State Highway Commission of Washington built five small bridges on State Road No. 1, in Yakima County. As only a small expenditure was justifiable, and the cost of freighting material from the railroad at Natches was very high, the haul being from 40 to 47 miles, it was decided to build small combination trusses, using for the wood members hewed timbers which could be secured from the forests along the river.



Fig. 1. A 60-Ft. Span Pole-Truss Bridge, Yakima County, Wash.

A contract was accordingly let for one 40-ft. span, three 60-ft. spans, and one 75-ft. span, at the following prices:

Timber in place	$60.00 per M. ft. bm.
Steel, wrought iron and spikes in place	0.07 per lb.
Rock filling for log-crib abutments	1.60 per cu. yd.

No special plans for the work were drawn, but standard plans and specifications were used which were drawn up for the construction of similar bridges at points where sawed timber was available. The clause in the specifications covering the use of round or hewed timbers reads as follows:

> Round or hewed timbers may be used when specified by the Highway Commissioner, and shall be of cross-section equal to that of sawed timber shown on the drawings, exclusive of sap or wane.

The specifications covering quality and defects were the same as are applied to sawed timbers for structures of this class.



Fig. 2. A View of a Pole-Truss Bridge, Showing Available Timber for Building

The bridges were designed for a uniform load of 80 lb. per sq.ft. of floor surface, and the working stresses for timber, in lb. per sq.in., were taken as follows: tension, with the grain, 1200; compression in end bearing 1100, in columns under 15 diameters 1000, across the grain 350; transverse fiber stress, 1200; shearing with the grain 150, across the grain 1250.

The 40-ft. span was carried by two king-post or A-trusses, made of sticks equal in size and strength to 12x12-in. timbers. The bottom chords were single sticks. A 12x14-in. floorbeam at the center of the span was car-

*Chief Draftsman, Washington State Highway Commission, Olympia, Wash.

ried by two 1-in. round rods in each truss, which took bearing on a ½x6x12-in. plate at the apex of the truss. The floorbeam was extended 5 ft. beyond the trusses and 350; transverse fiber stress, 1200; shearming with the trusses to support them laterally.

The 60-ft. spans were 3-panel queen-post trusses, similar in design to the 40-ft. span, except for counterbraces in the center panel. The bottom chords were single



FIG. 3. DETAILS OF A 75-FT. SPAN, POLE-TRUSS HIGHWAY BRIDGE

sticks 68 ft. over all. These were cut and dragged into place by teams so as to span the river between the abutments, and the light staging to carry the upper chords during erection was carried by these sticks.

No castings were used at the joints in either the 40- or 60-ft. spans. The timbers were cut to bear on each other evenly and make an exact joint, the line of the joint bisecting the angle between adjacent members. The end posts transferred the thrust to the lower chords through scarf-joints, reinforced by thrust-blocks bolted to the lower chord over the end bearings.

The 75-ft. span was a 5-panel Pratt truss, with steel eyebars for the lower chords, and rigid upper and lower lateral bracing. Standard Howe-truss castings were used at the joints. The timbers were cut to exact length, peeled and left round except at the joints where they were adzed to exact dimensions to fit the castings. Falsework staging was anchored to each abutment and built out into the river far enough to carry one panel, reducing the span for erection to about 40 ft.

The bridges have 14-ft. roadways, with 4-in. hewed plank floors, and railings of light smooth poles spiked to the end posts and verticals. The floor stringers were peeled logs, flattened on two sides to a minimum thickness of 12 in. Four such stringers carried the roadway. The abutments were rock-filled log cribs.

The contractor sublet the work of getting the timber out of the forests at 6c. per lin.ft., for sticks peeled only; and at 8c. per lin.ft. for sticks peeled and hewed.

A skilled workman can fell, peel, and hew about 90 lin. ft. of timber per day of 8 hours. The workmen were paid 5c. per lin.ft. for felling, peeling and hewing. Laborers and carpenters on the framing and erection received $3 and $3.50 per day; teams and drivers cost $7 per day; the foreman received $6 per day. The price paid for freighting materials from the railroad at Natches was $0.56 per ton-mile.

The quantities of material and costs at the contract prices for these bridges, exclusive of abutments and earth approaches, were as follows:

One 40-ft. span:	
7900 ft. b.m. of timber at $60 per M	$474.00
200 lb. of metal at $0.09 per lb	26.10
Total	$500.10
One 60-ft. span:	
12,360 ft. b.m. of timber at $60 per M	$741.60
780 lb. of metal at $0.09 per lb	70.20
Total	$811.80
One 75-ft. span:	
13,700 ft. b.m. of timber at $60 per M	$822.00
5,540 lb. of metal at $0.09 per lb	498.60
Total	$1320.60

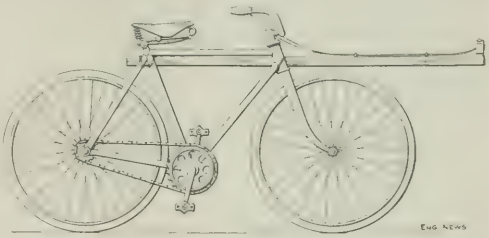
Will T. Cavanaugh was superintendent for the contractor, J. W. Quigg & Co., of Wenatchee and Tacoma. The work was commenced under the direction of Highway Commissioner Henry L. Bowlby, and was completed by his successor, W. J. Roberts, the present Commissioner.

Method for Calibrating Anemometers

By E. F. Learned*

A method of calibrating an anemometer, which was used in connection with recent tests of a heating and ventilation plant, consisted in attaching the instrument to a projecting support on a bicycle and in riding the wheel over a definitely marked course at different rates of speed.

A piece of wood 1 in. thick, 3 in. wide and about 8 ft. long was fastened horizontally to the frame of the bicycle, as shown in the accompanying figure, with the forward end projecting about 5 ft. beyond the wheel. The anemometer was attached to an upright block screwed on to the outer end of the board and was far enough in advance of the wheel not to be affected by the air eddies caused by the rider and machine in motion. Two strong



BICYCLE RIGGED FOR CALIBRATING ANEMOMETER

threads fastened to the starting lever of the instrument were carried back along the top of the board through wire loops to the handle bars, thus enabling the rider to start and stop the anemometer at will.

An exhibition hall was used as the place for the tests. A chalk line about 280 ft. long was drawn on the floor and two short lines, 200 ft. apart, were laid out at right angles to the main line. One of these, placed about 40 ft. from the end, served as the starting point and the other was the finish of the measured course. All windows and doors were closed permitting the calibrations to be made in still air.

The bicycle was started at the end of the chalk line, which was sufficiently distant from the starting point to enable the rider to maintain the wheel at uniform speed

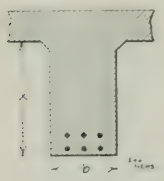
*33 Irving St., Watertown, Mass.

before entering the 200-ft. course. At the instant of crossing the mark, an assistant took the time by a stop watch and the rider pulled one of the threads thereby starting the registering mechanism of the anemometer. When the finish line was reached the time was taken by the assistant and the mechanism stopped. The course was covered in both directions and the average time taken, thus eliminating errors due to the possible movement of the air in either direction. The observations for different speeds were recorded in tabular form with the following headings: (1) time in seconds, (2) anemometer readings, (3) anemometer velocity in feet per minute, and (4) true velocity in feet per minute. A chart was made with anemometer readings in feet per minute as abscissas, and true velocities in feet per second as ordinates. A line was drawn through the points representing the conditions as equitably as possible. This method can be easily followed when a large hall or building with a sufficient amount of floor space is available.

Economical Depth of T-Beams

By R. W. Stewart*

The writer submits below the criterion for economical depth of reinforced-concrete girders in slab-and-girder construction, which, as will be noted, is very easy to apply.



Let the accompanying figure represent a section at the center of a T-beam which has been correctly reinforced to resist a given bending moment. It is desired to know whether an increase or decrease in the depth of the stem, with the corresponding change in the size of the steel rods, would result in economy.

It is evident from the shape of this beam that a change in the depth of the stem would have very little effect on the position of the center of gravity of the compressive stresses, and that the distance from the steel rods to the center of gravity of the compressive stresses will always be nearly equal to the depth of the stem of the beam.

Since the quantity of concrete in the stem of the beam varies directly as the distance x, the cost of concrete in the stem for any depth may be represented by gx, where g is a constant and x is a variable. Since the area of the steel varies inversely with x, its cost may be represented by $\frac{a}{x}$ where a is a constant. The total cost of the stem of the beam is then represented by the equation:

$$\text{Cost} = gx + \frac{a}{x}$$

To determine the value of x, which makes this cost a minimum, put the first derivative equal to zero or,

$$g - \frac{a}{x^2} = 0$$

from which we get $x = \sqrt{\frac{a}{g}}$

Substituting this value of x in the equation for the cost above, we get for the cost of the steel $\frac{a}{\sqrt{\frac{a}{g}}}$ which reduces to $g\sqrt{\frac{a}{g}}$, which, it will be noted, is equal to the cost of the concrete.

The criterion for minimum cost is, therefore, that the *cost of the concrete in the stem shall be equal to the cost of the longitudinal steel.* The cost of the vertical legs of the stirrups should be included as part of the cost of the concrete in the stem.

It will occur in connection with this criterion that for buildings of several stories it will be desirable to use a lesser depth of girders than that given above in order to reduce the total height for a given clearance between floors and ceilings. Provision for this feature is readily introduced into the criterion by simply adding to the cost of the concrete stems of all the T-beams under consideration the cost of a portion of the walls and partitions of the building equal in height to the stem depth of the T-beams, the criterion then being that this sum shall equal the cost of the longitudinal steel in the T-beams.

In order to apply this criterion conveniently in working out a design it is necessary to determine the values of the constants a and g in the equation: Cost $= gx + \frac{a}{x}$ in terms of known functions of the beam.

Let

M = Bending moment;
A = Area of steel;
f_s = Fiber stress in steel;
b = Width of stem;
c = Cost per cubic unit of concrete;
q = Cost per cubic unit of steel;
$r = \frac{q}{c}$.

Cost of stem concrete per lineal unit of beam is

$$cbx = gx$$

from which

$$g = cb.$$

Bearing in mind that the lever arm of the steel about the center of gravity of the compressive forces is substantially equal to x, the area of the steel

$$A = \frac{M}{xf_s}$$

And the cost of the steel per lineal unit is

$$qA = \frac{qM}{xf_s}$$

Equating this to $\frac{a}{x}$ we get

$$a = \frac{qM}{f_s}$$

Using these values of a and g in the general equation

$$x = \sqrt{\frac{a}{g}}$$

we get

$$x = \sqrt{\frac{qM}{bcf_s}} = \sqrt{\frac{rM}{bf_s}}.$$

This equation is given in Turneaure & Maurer's treatise

*Engineer of Bridge Department, Los Angeles, Calif.

on reinforced concrete, being derived by a different method.

To compute the ratio r, the same unit of volume must be used for both the steel and the concrete, but not necessarily the same unit in which d, x and M are expressed. Since r and f_s for any particular design remain constant, the value of $\frac{r}{f_s}$ may be determined and treated as a single constant quantity for the work in hand, so that when the bending moment in the beam has been found, the economical depth is given by a single setting of the slide-rule.

In order to include the effect of walls and partitions in the formula $x = \sqrt{\frac{rM}{bf_s}}$ first determine the total horizontal area covered by the stems of the T-beams under consideration and the total horizontal sectional area of the walls and partitions at the level of the beams.

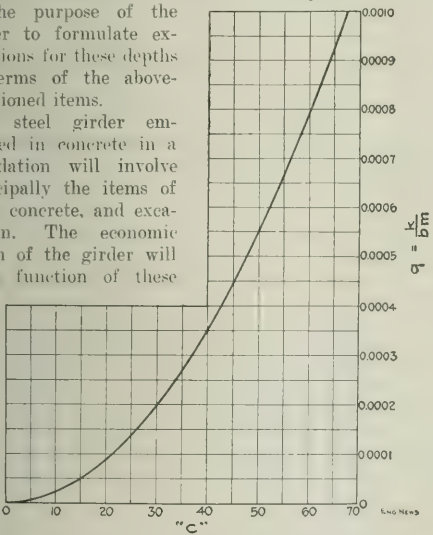
If the cost per cubic foot of the walls is greater or less than the cost per cubic foot of the T-beam stems increase or decrease their area in proportion to the difference in cost. Then increase the cost per cubic foot of the T-beam stems in the ratio which the total corrected area bears to the area of the T-beam stems in order to obtain the unit cost c which is used to determine the ratio r. Also the cost per cubic unit of the steel should be corrected to provide as nearly as possible for excess length of the rods due to laps and bends.

Economical Design of Steel Girders Embedded in Concrete

By George Paaswell*

In the design of subsurface structures, the economic depths of embedded steel girders are dependent upon the costs of excavation, concrete, steel shapes, etc.; and it is the purpose of the writer to formulate expressions for these depths in terms of the above-mentioned items.

A steel girder embedded in concrete in a foundation will involve principally the items of steel, concrete, and excavation. The economic depth of the girder will be a function of these items as well as of the required section modulus.



The items of concrete and excavation will vary together since an increase in the amount of concrete required (due to an increased depth of girder) will involve the same increase in the amount of excavation required. Hence the individual costs per cubic yard of concrete and excavation may be added and one price used. If concrete alone is involved this price will be the price of concrete; likewise if excavation alone is involved.

Let

S = Required section-modulus of girder;
d = Depth out to out of girder;
A = Area of girder;
r = Radius of gyration;
I = Moment of inertia.

Now

$$S = \frac{2I}{d} = \frac{2Ar^2}{d}$$

and

$$r \text{ (approximately)} = 0.4\ d$$

Hence

$$S = 0.32\ Ad \text{ or } A = \frac{3.13\ S}{d}$$

Taking a depth of concrete and excavation of d a width of b and a length of one foot the item involved in cubic yards will be

$$\frac{bd}{12 \times 12 \times 27} = 0.000257\ bd$$

The amount of steel will be $3.4\ A = \frac{10.63\ S}{d}$; adding 10% for details the total amount $= \frac{11.69\ S}{d}$.

Let

k = Cost of steel in cents per lb.;
m = Cost of concrete and excavation in cents per cu.yd. (or of either if the other is not involved).

The total cost of steel concrete and excavation is then:

$$\frac{11.69\ Sk}{d} + 0.000257\ mbd$$

To obtain a minimum value of this expression equate the derivative to zero:

$$\frac{11.69\ kS}{d^2} = 0.000257\ bm$$

$$d = 213 \sqrt{\left(\frac{kS}{bm}\right)}$$

Let $q = \frac{k}{bm}$ then $d = 213 \sqrt{qS}$.

Let the constant $213 \sqrt{q} = c$ then $d = c\sqrt{S}$.

A curve is shown herewith giving the value of c for various values of the ratio $\frac{k}{bm}$.

Needless to state the slide-rule gives sufficiently accurate results.

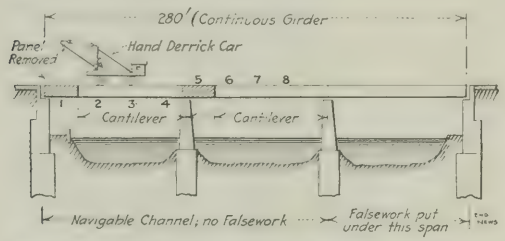
*Public Service Commission of New York, First District, 154 Nassau St., New York City.

The Dictagraph in Aviation—According to a recent note in the "Army and Navy Gazette," a new device is under trial to enable reconnoitering and recording observations to be carried out by the pilot of an aëroplane, without the necessity of carrying a passenger. As the pilot has both hands occupied he cannot take notes, but he can speak into the mouthpiece of a dictagraph, a commercial recording phonograph, which records the words on a disk or cylinder. It is reported that an attempt was made to mount the instrument on the steering wheel, but the vibration gave trouble, so a special machine was provided to be strapped to the pilot's back.

A Novel Method of Removing an Old Bridge

Removing an old girder bridge by cutting off successive panels from one end, and lifting them away by a derrick car standing on the remaining portion (this acting as a cantilever of decreasing length), is an unusual method of procedure carried out on the Northern Ry. of France, and described in the March number of the "Révue Générale des Chemins de Fer" (Paris) by Mr. Bouchard, Engineer of Maintenance-of-Way of the Northern Ry.

The bridge in question is across the Oise River, on the line between Paris and Creil. It has three double-track spans of about 93 ft., but the superstructure to be removed was built with continuous girders 280 ft. long, resting on the abutments and three piers. Falsework for the removal could not be used under two of the spans, as the river had to be left open for navigation. Traffic was diverted to one track, and along the stretch of abandoned track was established a plant for stacking and loading the old ironwork and another plant (on the opposite side of the river) for erecting the new structure in position for moving longitudinally into position. The cross-tie girders between the girders of the two tracks were cut, to avoid putting any torsional strains upon the structure.



METHOD OF REMOVING THE OLD SPANS OF THE BRIDGE OVER THE OISE RIVER; NORTHERN RY. OF FRANCE

Beginning at one end, as shown in the accompanying cut, panel lengths of about 19.7 ft. were detached and raised by a hand-operated derrick car, which then carried the detached panel to the loading yard on the bank. The heaviest load on the cantilever portion was in cutting and raising panel No. 1 on the first span and panel No. 5, on the second span, the cantilever lengths being then 74.5 and 82.6 ft. respectively. For removing the third span, falsework was erected on piles driven in the bed of the river.

The superstructure being removed, the masonry piers were altered as required for the new structure, which is a continuous parallel-chord deck lattice-truss bridge. This was moved longitudinally into position, the bottom chord being lengthened temporarily so as to take a bearing on the timber bents and blocking on the piers, and so reduce the cantilever length of the structure while being launched. When this new structure was in position, it was gradually lowered to position on the piers. Track was then laid and traffic diverted to the new structure, so that the same operations could be repeated for the other track.

For cutting loose the panel lengths, experiments were made with cutting out the rivets and cutting the metal with chisels. This proved to be much too slow, and all the work was done by cutting the metal with oxyacetylene torches. The entire work on each track occupied about three months, and between the two periods a week was occupied in changing the single running track from the old to the new structure. Work was commenced about the end of December, 1911, and completed in July, 1912, double-track traffic being resumed in August. The cost was about $70,000, distributed as follows: grading to improve profile, $1000; track and ballasting, $3200; temporary switches and signals and their operation, $2400; masonry, $8000; steel superstructure, $56,000.

Fieldwork and Computations for Laying Out Subdivisions on Curved Street Lines

BY J. H. ANDERSON*

The first step necessary to properly subdivide a tract of rough ground into building lots is to prepare an accurate topographic map showing 5-ft. contours, on a scale of not less than 100 ft. = 1 in., and preferably 50 ft. = 1 in. Upon this map the proposed street and subdivision lines are first sketched, and then accurately located.

Before the subdivision lines can be calculated it is necessary that a closed traverse be run around the tract to be subdivided. All distances and angles of the traverse and the closure of the traverse are checked by computation.

It was found in making a traverse of the particular tract to be described that the angular error was 30″, while the error in distance was about 1 in 3300. The ground was very broken and there was considerable underbrush, and on many of the hillsides it was necessary to "break chain" six or seven times, so that the error mentioned was considered allowable under the conditions.

After the exterior traverse was finally closed and had been accurately laid out on the map, the work was ready for computation. In this particular case the south line of the tract was also the quarter-section line running east and west, and a line perpendicular to this line was taken as the meridian to which all of the computed courses were referred. The intersection of the quarter-section line and this meridian was the origin of the coördinates.

It is not possible in the scope of this article to describe all of the steps necessary in computing and laying out the work, but a few examples will be given which will serve to illustrate most of the problems arising in such work.

The map should be very carefully drawn so that it can be used to check computations by scaling. To facilitate this work, light red lines may be drawn on the paper in North and South, and East and West directions. All such lines will have known latitudes and departures, and being drawn parallel to the axes they will be found very convenient in scaling the check distances. It is also important to use the best grade of detail paper so as to avoid shrinkage as far as possible.

FIELDWORK.—From the office computation the notes

*1025 14th St., Rock Island, Ill.

are furnished for laying out the work in the field. The most satisfactory way of furnishing these notes for the use of the field parties is to trace the layout on conveniently sized sheets, referring such sheets if necessary to the general map of the tract drawn on a smaller scale. On these tracings are shown the degree, central angle, chord and arc lengths of each lot front, and the deflections for each lot corner on the curved lines.

In order to check the progress of the work and to know each night the extent of the completed work, the chief of the field party marked in red upon the blueprint map of the subdivision each lot corner staked, so that it was possible to tell by a glance at the map just how much of the work had been completed.

In laying out work of this character, it is not possible to run in the curves by the ordinary methods used

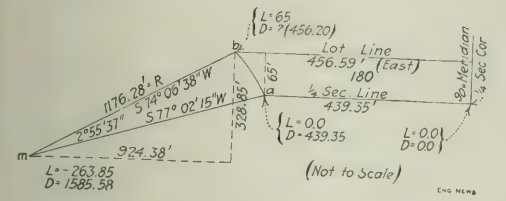


FIG. 1.

in railway work; viz., defining the degree of curve as the angle subtended at the center by a 100-ft. chord. Chords should be computed so that the distance shown is the exact distance along the curve. In other words, the degree of curve should be defined as the angle subtended at the center by a 100-ft. arc.

It is desirable to mark the corners of lots in a more permanent manner than by ordinary wood stakes, and it will be found much easier to drive iron rods or pipes into hard or frozen ground than to set wooden stakes. An iron bar, while it makes a very substantial monument is difficult to center, and it was found preferable to use short lengths of gas pipe about 1 in. in diameter. In set-

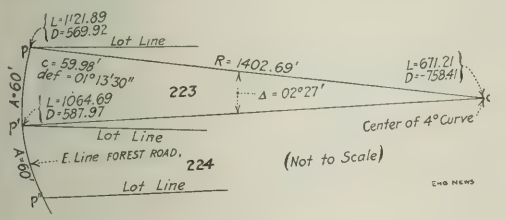


FIG. 3.

ting these pipes they were driven flush with the ground, and before the final center was taken a small wooden plug was inserted, in which a tack was set to mark the line. This method was found rapid and satisfactory.

The work described covered a tract of about 70 acres, and was laid out under the direction of Wm. H. Kimball, M Am. Soc. C. E. The writer was in charge of the office work and computation, and the fieldwork was done under the direction of R. P. Hayes as chief of party. The entire work was completed in less than six weeks.

COMPUTATIONS—As before mentioned, the quarter-section corner was taken as the origin of latitudes and departures (see Fig. 1). The quarter-section line forms the south line of lot 180 as shown. The distance from quarter-section corner along the south line of lot 180 to the east line of Forest Road is 439.35 ft., which gives to the first lot corner on this street coördinates of $L = 0.0$, $D = 439.35$.

The tangent to the center line of the road at this point makes an angle of 76° 41′ 33″ with the quarter-section line, thus giving it a bearing of N 13° 18′ 27″ W. The radius to east line of the road at this point has then a bearing of S 77° 02′ 15″ W; and since its length is 1176.28 ft., the coördinates of the center of the curve are, $L = -263.85$, $D = 1585.58$.

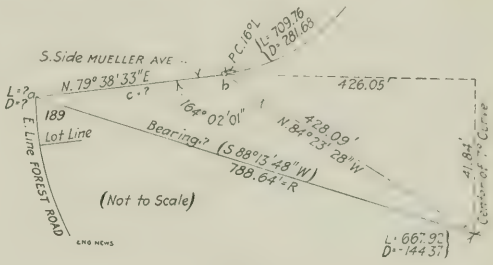


FIG. 2.

The lots adjacent to the quarter-section line were laid out with sides parallel to this line and with a width of 65 ft. along the meridian. To calculate L and D for lot corner b (Fig. 1) we proceed as follows: Since the lot is 65 ft. along the meridian, the L of b is 65 ft. The difference in L between b and m is 328.85 ft., which gives one side of a right triangle. The length of the radius to b, which forms the hypotenuse of the triangle, is 1176.28 ft. Solving for mn gives 929.38 ft.: 1385.58 − 929.38 = 456.20 ft., the D of corner b.

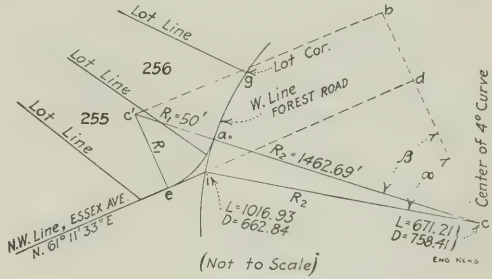


FIG. 4.

The bearing of the radius to b is found to be S 74° 6′ 38″ W, thus giving a central angle of 2° 55′ 37″. One-half of this central angle gives the deflection angle to be turned from the tangent at a to locate b.

The arc ab can be calculated from $A = R \frac{\Delta}{57.296}$, where A = arc, R = radius, and Δ = the central angle. The chord ab can be calculated from $C = 2R \sin \frac{1}{2} \Delta$, or from $C = \sqrt{(D_2 - D_1)^2 + (L_2 - L_1)^2}$, where D_2 L_2 and D_1 L_1 are the latitudes and departures of b and a respectively.

In like manner L and D can be calculated for any of the remaining lot corners of this group by adding 65 ft. to the L of the corner next below. Knowing the L and D of the front and rear corners, the length and bearing (in this case due east) of the line joining them can be calculated.

Fig. 2 shows the problem of calculating L and D for the intersection of the south line of Mueller Ave. with the east line of Forest Road. Forest Road at this point

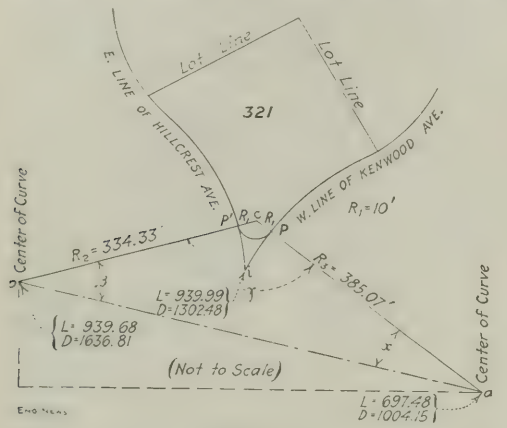


Fig. 5.

runs on a 7° curve, the coördinates of the center of which are as shown in Fig. 2. The south line of Mueller Ave. bears S 79° 38′ 33″ W an unknown distance from the P. C., whose coördinates are, $L = 709.76$, $D = 281.68$.

The radius to the curve on Forest Road intersecting the south line of Mueller Ave. has a length of 788.64 ft. and runs at an unknown bearing from the center of the curve whose coördinates are, $L = 667.92$, $D = 144.37$.

Knowing the L and D of points b and c, the bearing and length of the line joining them can be calculated. Knowing the bearing of ab and bc, the angle between them (164° 2′ 1″) is known (see Fig. 2). Three parts of the oblique triangle abc are now known, hence the bearing of ac and the length of ab can be computed. Knowing the bearing of ac the coördinates of a become, $L = 643.33$, $D = 643.89$.

In like manner the length, and the L and D of the end of any line having a known bearing and running from a point of known L and D can be calculated.

This corner was, of course, rounded off afterward by a curve but the L and D of the intersection was useful in checking the total arc along the street.

Fig. 3 illustrates the method of computing the L and D of the corners of lots to which definite arc frontages have been assigned. Corner p of lot 223 is one whose coördinates are known. Forest Road at this point runs on a 4° curve, the coördinates of the center of which are as shown in Fig. 3.

Knowing the coördinates of c and p, the bearing of the radius joining them is known. Since the arc was assumed to be 60 ft., by means of $\frac{A}{R} = \frac{A}{57.296}$, we solve for A. Knowing A, the angle between cp, the bearing of which is known, and cp' we can readily ob-

the L and D of p'; in like manner the L and D of p'' can be obtained after assigning an arc frontage to lot 224.

The L and D of the rear corners of these lots, which lie on a straight line, are easily calculated, and hence the length and bearings of the lines connecting them.

For the case where both ends of a lot terminate in a curved street, proceed as above by assigning arc frontages along each street and calculating the L and D for each corner. The frontages assigned to each street must, of course, be such as will fit the topography and give an economical layout.

The intersections of street lines are, of course, rounded off by means of a curve. The intersection of the northwest side of Essex Ave. with Forest Road was rounded off by means of a curve of 50-ft. radius. To calculate the length of this connecting curve and the L and D of its ends, proceed as follows:

From Fig. 4 it is apparent that $cd = cb - db$ or $R_2 \cos \alpha = (R_2 + R_1) \cos \beta - R_1$. Solving for $\cos \beta$ we get, $\cos \beta = \dfrac{R_2 \cos \alpha + R_1}{R_2 + R_1}$.

The L and D of c are known as are also the L and D of i. The calculation of the L and D of i was previously described in connection with Mueller Ave. Knowing the coördinates of both ends of ci we can determine its bearing. Since the bearing of ed is known, the bearing of cd is readily determined therefrom.

Knowing the bearing of cd and ci, the angle α is determined; whence, substituting in the above formula, we determine $\cos \beta$ and β. Knowing β gives the bearing of cc'. The L and D for points a, c' and c can now be calculated. The arc $ae = R_1 \frac{\beta}{57.296}$. The arc ai can likewise be calculated: $gi - ai = ga$; g is a lot corner previously computed.

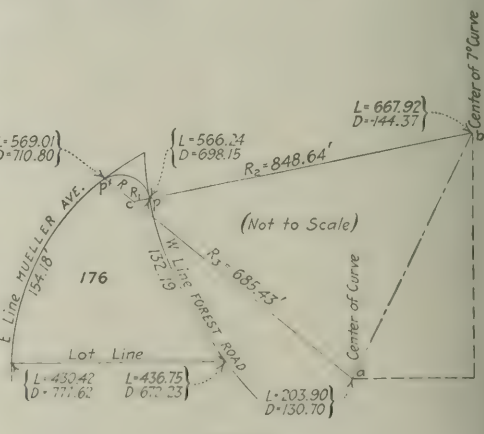


Fig. 6.

The intersection of Hillcrest and Kenwood Ave.'s was to be rounded off by means of a curve 10 ft. in radius: required the L and D of the center and of the P. R. C.'s and the arc length (Fig. 5).

The coördinates of a and b are known; therefore the length and bearing of ab can be determined; $bc = 334.33 + 10 = 344.33$; $ac = 395.07$;



FIG. 7. SUBDIVISION OF A 70-ACRE TRACT IN BUILDING LOTS

$$Cos\ \tfrac{1}{2}\ a = \sqrt{\frac{S\,[S - (R_2 + R_1)]}{(R_3 + R_1)\ ab}}$$

where S equals $\frac{1}{2}\ [(R_1 + R_2) + (R_1 + R_3) + ab]$. Knowing a the bearing of R_2 is determined from the bearing of ab, and consequently the L and D for p and c;

$$\frac{R_2 + R_1}{sin\ a} = \frac{R_3 + R_1}{sin\ \beta}$$

whence

$$Sin\ \beta = \frac{R_3 + R_1}{R_2 + R_1}\ sin\ a$$

The bearing of bc is now known and L and D for p' are readily determined. Knowing a and β, we find γ by $\gamma = 180° - (a + \beta)$. Arc pp' equals $R_1 \frac{\gamma}{57.296}$. The lengths pi and $p'i$ can likewise be calculated, if desired.

At the intersection of the east line of Mueller Ave. west of Forest Road with the west line of Forest Road, a joining curve of 10-ft. radius was first used. This gave lengths of 144.18 ft. and 122.19 ft. to the west and east lines of lot 176 respectively. Later on it was decided to increase these lengths by 10 ft. each, making them 154.18 ft. and 132.19 ft. as shown on the map. The problem was to calculate the new radius of the joining curve. The procedure was as follows (see Fig. 6):

The coördinates of a and b were known, therefore the length and bearing of ab was determined. The L's and D's of p and p' were determined from the fact that the corners were at a fixed arc distance from the south line of lot 176, and the bearings of ac and bc were known: $\overline{ac}^2 = (R_1 + R_2)^2 + \overline{ab} - 2\ (R_1 + R_2)\ ab\ cos\ \beta$. Solving for ac we get 678.56 ft.; $R_1 = 685.13 - 678.56$ ft. $= 6.87$ ft., which is the required radius.

The Computation of Simple Turnouts

By Anders Bull*

The generally adopted formula for computing the radius of a turnout from a circular curve (see Searles, pp. 161-164) being rather unwieldy, a simpler expression may perhaps be of interest.

The following symbols will be used:

R = radius of main curve;
r = radius of turnout;
g = gage of track;
L = angle of lead;
F = angle of frog;
n = number of frog.

In Fig. 1, showing a diagram for an inside and an outside turnout, radii are drawn from the centers of curvature of the turnout and main track to the frog

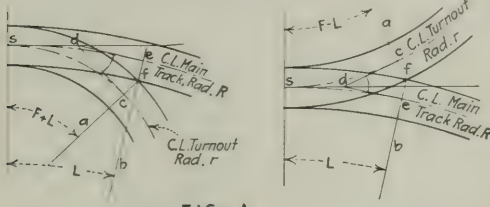


FIG. 1

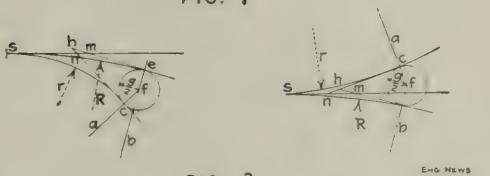


FIG. 2

point. Tangents drawn to the center lines of track opposite the frog point will then intersect the common center-line-tangent in one and the same point d. If this were not true, i.e., if they cut it in two points n and m (Fig. 2), we would have:

$$\overline{sm} = \overline{em} \text{ as tangents to circle of radius } R \quad (1)$$

$$\overline{sn} = \overline{cn} \text{ as tangents to circle of radius } r \quad (2)$$

$$\overline{cm} + \overline{mh} = \overline{cn} \pm \overline{nh} \text{ as tangents to circle of radius } \frac{g}{2} \quad (3)$$

the upper sign referring to the left-hand diagram. Substituting (1) and (2) in (3) gives:

$$\overline{sm} + \overline{mh} = \overline{sn} \pm \overline{nh}$$

which cannot be true unless

$$\overline{mh} = \pm \overline{nh} = 0$$

From Fig. 1 it will then be evident that:

$$\overline{sd} = \overline{ed} = \overline{cd} = \frac{g}{2} \cot \frac{F}{2} = gn \quad (4)$$

$$\tan \frac{L}{2} = \frac{\overline{cd}}{R} = \frac{gn}{R} \quad (5)$$

$$\tan \frac{F \pm L}{2} = \frac{\overline{cd}}{r} = \frac{gn}{r} \quad (6)$$

which latter equation gives

$$r = \frac{gn}{\tan \frac{F \pm L}{2}} = \frac{gn\left(1 \mp \tan \frac{F}{2} \tan \frac{L}{2}\right)}{\tan \frac{F}{2} \pm \tan \frac{L}{2}} \quad (7)$$

By substituting the values of $\tan \frac{F}{2}$ and $\tan \frac{L}{2}$ obtained from (4) and (5) in (7), and reducing, we finally have the simple algebraic relation:

$$r = \frac{gn^2 (2R \mp g)}{R \pm 2gn^2}$$

the upper signs referring to inside, the lower signs to outside turnouts.

Although the above expression may be used without aid of tables, it will prove convenient to tabulate values of $2gn^2$ and $\log gn^2$ for the various frog numbers. The expression is then brought into a logarithmic shape by two simple summations.

RADIUS OF TURNOUT FROM CURVE: TABLE FOR $2gn^2$ AND $\log gn^2$

(For Standard gage, 4 ft. 8½ in.)

Frog No.	$2gn^2$	$\log gn^2$	Frog No.	$2gn^2$	$\log gn^2$
4	150.667	1.8769872	8½	680.354	2.5317051
4½	190.687	1.9792922	9	762.750	2.5813522
5	235.417	2.0708072	9½	849.854	2.6283144
5½	284.854	2.1535926	10	941.667	2.6728872
6	339.000	2.2291697	10½	1038.188	2.7152458
6½	397.854	2.2986939	11	1139.417	2.7556526
7	461.417	2.3630633	11½	1245.354	2.7942629
7½	529.687	2.4229897	12	1356.000	2.8312297
8	602.667	2.4790472			

A Dredge-Cutter Recording Device

An ingenious device designed to indicate and record the movements of the cutter-head of a hydraulic dredge has been invented by Uldric Thompson, a member of the senior class of Cornell University, and H. S. Taft. The device, which they call the "standard dredge director," is described in the March issue of the *Sibley Journal of Engineering*, from which we have made a brief abstract.

The purpose of the device is to show on a diagram representing a cross-section of the canal prism, placed in front of the dredge operator, the location of the cutter-head, and also to make a chart, automatically, of the excavation done on the cross-section.

The apparatus consists of a device for combining the horizontal and vertical motions of the cutter-head so as to show its resultant movement reproduced on a horizontal plane. This is done by applying the horizontal

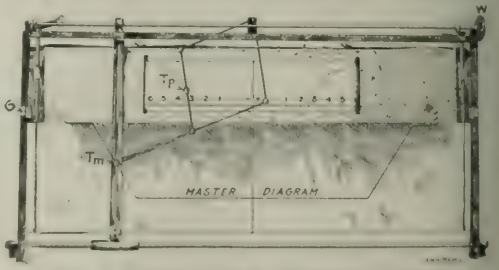


Fig. 1. Dredge-Cutter Recording Device

component to a sliding guide, and the vertical component to a pointer T_m (see Fig. 1). The vertical movement of the pointer is actuated by running a wire from a point on the cutter-arm around a differential pulley mounted on the projecting A-frame, the other end of the wire

*Designer, Public Service Commission, 154 Nassau St., New York City.

being attached to a weight. Another wire, similarly weighted, is wound around the smaller circumference of the differential pulley and is then run back and connected to the director. In this way all vertical movements of the cutter-arm are reduced and transferred to the pointer.

The horizontal component of the cutter movement is reproduced as follows: A metal quadrant is pivoted at its center, on a vertical axis located midway between the spuds, on the rear deck, or on the ceiling of the boiler-room. Wires are fastened from the ends of the arc and then run around the arc to pulleys on the opposite side and thence forward to the director (see Fig. 2).

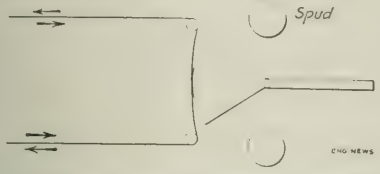


FIG. 2. DIAGRAM SHOWING DEVICE FOR TRANSFERRING CUTTER-HEAD MOVEMENT TO RECORDING DEVICE

The center line of the quadrant is then lined up with the center line of the river or canal. This may be done by sighting along the line to some distant point in the canal center line. During operation the quadrant may be kept in line either by hand or by a gyroscope mounted on the quadrant. In either case the quadrant will remain stationary as the boat swings. Hence, as the relative positions of the boat and quadrant change, the wires will be pulled through distances proportional to the swinging of the dredge. By selecting the proper radius for the quadrant, the horizontal component is reduced to the same scale as the vertical component.

A proposed improvement is to locate the quadrant and gyroscope in the wheel house and thus make the apparatus more compact. The gyroscope would keep the center line of the quadrant always parallel to the center line of the canal or river prism. Hence, the relative movements of the boat and quadrant would be the same as with the quadrant placed between the spuds. This arrangement could not be used if the centering were done by hand. In case the canal is curved, the apparatus must be recentered at short intervals.

A pantagraph mechanism is used to trace the path of the cutter; a pointer for the "master-diagram" and a stylus for recording diagram. T_m is the master tracer or pointer and T_p the stylus on the recorder. (See Fig. 1.) As may be seen from the illustration, the pointer moves behind a plate of glass upon which has been drawn a master-diagram of the section to be cut out.

It is the duty of the dredge operator first, to dredge to the cross-section roughly and then to finish off the edges by manipulating the cutter so that the pointer follows the line of the master-diagram.

Change of water level may be allowed for by raising or lowering the glass plate by turning the wheel W; G shows a gage for this regulation.

The director is equipped with a mechanism for automatically making charts of the work done by the dredge. A new section of a continuous chart is rolled into place every time the spuds are shifted. This is accomplished by means of simple electrical connections. In this way a chart of the cross section dredged is made for each new position of the dredge.

The blank charts may have a master-diagram drawn on them so that an easy comparison may be made between the actual cut and the cross section called for. The recording mechanism is locked and sealed, and the chart thus gives the government or canal company an absolute check on the work done by the contractor.

NOTES

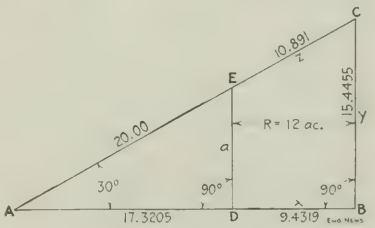
A River Survey made on the Ice was described by A. L. Webster, County Surveyor, Wheaton, Ill., in a paper presented at the annual meeting of the Illinois Society of Engineers and Surveyors at Chicago, Jan. 22-24. The survey was for a drainage district on the DuPage River, which stream is mainly a series of sloughs in its upper reaches. It was found to be almost impossible to make complete surveys to determine the proper location of the proposed channel, and necessary profiles, etc., on account of the swampy conditions existing. Therefore the plan was adopted of running the lines in winter, taking soundings for profiles and making careful and complete references of all points. All tangent lines were run to an intersection, and all points of intersection and points of curve, etc., were carefully referenced to permanent marks along the shore. Occasional measurements were made along property lines from the proposed line to stakes or other marks, and such measurements taken as will be useful in plotting the wet lands for the purpose of assessing their owners. The center thread of the river was frequently the dividing line of ownerships, and it was often difficult to determine it, although important, owing to high values of land. Besides these references, holes were chopped in the ice and long stakes driven which will help later in picking up the lines quickly, as well as to define clearly the proposed route. These will be safe, as the ice goes out slowly.

This work was done in this manner in a third of the time required if done at any other time of the year, and the results were far more satisfactory. The work had its difficulties and trials. Once when the thermometer registered below zero, the party was working next to the tracks of the Chicago Great Western R.R. when a train passed, and at the psychological moment a flunky in the dining car saw fit to empty a pan of dish water out of the window, drenching one of the boys thoroughly. Another day the transit-man broke through an air hole into the water up to his arm pits, smashing the transit. This happened when the ice was 18 in. thick on the average, but the river is fed largely by springs and great care had to be used, especially when snow covered the ice.

⁂

Lots Between Non-Parallel Lines—A correspondent in Australia, A. G. Little, writes as follows: In your issue of Jan. 23, 1913, p. 173, appears an interesting problem under the heading above. I think the method of solving the problem adopted by Mr. Dinsmore a rather laborious one and suggest the following simple formula:

Referring to the accompanying figure, given, say a = 10 ch. A = 30°. R = 12 acres = 120 sq.ch.



$$y = \sqrt{a^2 + 2R \tan 30°} = 15.4455 \text{ ch.}$$

$$a = \tfrac{1}{2}\left(y - \frac{2R}{y}\tan 30°\right) = 10.0000 \text{ ch.}$$

$$x = \frac{120}{\tfrac{1}{2}(a + y)} = 9.4319 \text{ ch.}$$

$$z = x \sec 30° = 10.8910 \text{ ch.}$$

Compressed-Air Apparatus for Dislodging Anchor Ice—An apparatus for utilizing compressed air to dislodge the anchor ice which forms in the ports of the water-works intake cribs during the winter was installed at the Two Mile crib of the Chicago, Ill., water-works during the fall of 1911. It is arranged as follows: A new 10x8x10-in. Westinghouse air compressor was installed and arranged to discharge into a receiving tank of about 50 cu.ft. capacity. The operation of the compressor is arranged to give a maximum of about 80 lb. pressure in the receiving tank. When any of the ports show signs of being blocked by anchor ice a standpipe running down into the center of the port is connected with the air-receiving tank by means of a 2½-in. hose. After the hose and standpipe are in place the full load of air under 80 lb. pressure is discharged through the hose and into the port by operating a quick-opening valve at the air tank. By giving the full head of air through the port and from expansion of the air in the water the force to dislodge the ice which has formed on the walls of the port is secured. In former years the anchor ice was dislodged by using water under pressure in practically the same manner as described above. It was found, however, that the water would not give the same result as a like quantity of air under the same pressure, and after making tests of the use of water as compared with air the change was made to the air apparatus. [From a recent report of the Department of Public Works, Chicago, Ill.]

A Sunny Hour Chart is a simple device for determining in which window of a building the sun will shine at any season of the year, and how long it will shine (provided, of course, it is on a cloudless day). The chart consists merely of a circular diagram with a circumference graduated into 24 parts, numbered from 1 p.m. to 12 p.m., and 1 a.m. to 12 a.m., and having radial lines drawn from the center of the circle to the times of sunset and sunrise for the different months of the year. Through the diameter of the circle, 12 a.m.—12 p.m., is a meridian.

The plan of the building used must also have a meridian drawn upon it in its correct relative position. The chart is placed on the plan of the building with the two meridians parallel. To find at what time of day the sun begins or ceases shining through any window, a straight-edge is laid on the chart in such a way that it passes through the center of the circle and is parallel to the wall in which the particular window is built. The sun will begin or end shining through the window at the hour indicated where straight-edge intersects the circle. If the wall runs westerly of the south, the sun will begin to shine in at the hour indicated, and if the wall runs easterly of the south the sun will cease to shine in at the hour indicated.

In case it is desired to apply the chart to an existing building in order to determine in what rooms the sun will shine at any hour of the day, the chart is laid upon a table and properly oriented by means of a pocket compass. If no compass is available the chart may be oriented by turning it so that the point on its circumference which corresponds with the time of day as read from a watch is in line between the sun and the center of the circle.

The standard chart is approximately correct for all latitudes between 35° and 45° and special charts may be obtained for higher or lower latitudes. The "sunny hour chart" is copyrighted and published by Williams, Brown & Earle, Inc., Philadelphia, Penn. Printed on tracing cloth it sells for 50c., and on celluloid for $1.

Diamond Drilling to investigate the rock conditions for a dam and outlet tunnel on the Little River in Alabama, is described in "Mine and Quarry" (Sullivan Machinery Co.) by A. B. Cudebec,* who was resident engineer for the Little River Power Co. The dam will be about 2900 ft. long with a spillway of 350 ft. The tunnel will be a mile in length, leading to the pressure pipes, which give a working head of 535 ft. The contract for the core-drilling was given to the Sullivan company and five machines were used: two with screw feed and friction escapement, of 500 ft. capacity, two hydraulic-feed drills of 1500 ft. capacity, and one hydraulic-feed drill of 3000 ft. capacity. This last machine was equipped to take a 2-in. core while the others used a 1⅝-in. bit. As the formation was firm it was decided later to use the smaller bit on all machines. The work is described by Mr. Cudebec as follows:

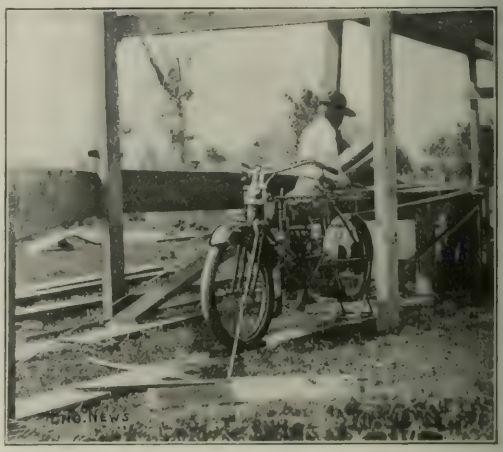
Three parallel lines of holes were drilled upon the dam site at right angles to the stream. The holes were staggered to form diamond-shaped figures approximately 100 ft. on a side. A line of holes was drilled along the tunnel line; also down the pipe line location, and at the power house, as well as along the extensive tail race location. All the holes were carried down to a depth where 20 ft. of bed-rock core had been taken. In addition to this depth, the holes on the middle line at the dam site were carried to 100 ft., and two holes were sunk in the reservoir to the limestone foundation, a depth of 550 ft. A total of 74 holes were sunk, and 6400 ft. of drilling completed. The drilling proved that the proposed bed of the reservoir was watertight and safe for a dam foundation.

All holes were sunk in the dry except eight in the river bed, which were handled from timber cribs. The usual depth of water was about 6 ft. The ordinary practice was to sink standpiping through the overburden, gravel, etc., of the bank or river bottom, until rock was struck. The core fittings and diamond bit were then placed in position and drilling resumed for 20 ft., or until the core demonstrated that not a boulder, but solid rock (free from cavities) was being penetrated. The machines were operated day and night, and the job completed in 78 days, including Sundays. Several sudden floods delayed the worwk.

The cores from the holes bored along the line of the tunnel showed that the rock was a series of hard sandstone and conglomerate, laid down in water-tight layers, with the exception of one small vein of coal, which was not continuous. No timbering will be needed, and under a water pressure of 125 lb. no leakage was developed. It is proposed to line the tunnel with concrete about 18 in. thick.

*Engineering Department, Utah Power & Light Co., Salt Lake City, Utah.

An Improvised Sawmill Motor—A correspondent in the Philippine Islands sends us the accompanying photograph, which shows an F. & N. motorcycle belted to a circular saw in use on the construction of an Albay Province school



A Motorcycle-Operated Sawmill

house. B. F. Mills, a former District Engineer of the Bureau of Public Works of the Philippine Islands, is the contractor for the building and the originator of the scheme.

A Eulogy of the Land Surveyor—The vocation of the Civil Engineer has always been invested with a dignity of its own. But it seems to me that of late years, in paying him the honor which is his just due, we are apt to fix a little too wide a gap between him and his humbler brother, the Surveyor. We give engineering the chief attention in our technical schools, but surveying we are wont to relegate to the freshman class. Yet the profession of the surveyor deals with one of the oldest and most fundamental facts of human society—the possession and inheritance of land. Fire, flood and earthquake wipe out the greatest works of the engineer, but the land continueth forever.

Curiously enough the surveyor is isolated in his calling, and therein lie his responsibility and his temptations. The lawyer comes nearest to understanding the work, yet of the actual details of a survey most lawyers are woefully ignorant. The business man who can judge to a hair the fulfillment of a contract has no eye for the shortened line or the shifted landmark.

Dishonesty in ordinary business life cannot long be hid, and errors in accounts quickly come to light, but the false or faulty survey may pass unchallenged through years, for few but the surveyor himself are qualified to judge it. I maintain that in the hands of the surveyor, to an exceptional degree, lie the honor of the generations past and the welfare

of the generations to come; in his keeping is the Doomsday Book of his community, and who shall know if he is false to his trust? Therefore I believe that to every surveyor who values his honor and has a full sense of his duty the fear of error is a perpetual shadow that darkens the sunlight.

Yet it seems to me that to a man of active mind and high ideals the profession is singularly suited, for to the reasonable certainty of a modest income must be added the intellectual satisfaction of problems solved, a sense of knowledge and power, increasing with years, the respect of the community, the consciousness of responsibility met and work well done. It is a profession for men who believe that a man is measured by his work, and not by his purse, and to such I commend it. [From "Boundaries and Landmarks," by A. C. Mulford.]

Cost of Maintaining Horses—The following data are compiled from the annual report of the Public Works Department of the City of Boston, Mass., and refer to horses maintained by the highway division for street cleaning, watering and oiling service. This division of the Public Works Department has the care of 135.6 miles of paved streets and 114.4 miles of macadam road. The total area of streets cared for is 3,345,200 sq.yd. For this work the city expended a sum of $614,658 for the year ending Jan. 31, 1912.

The accompanying table is based on a year of 365 days and a total average number of horses kept of 154. The data are based on the expenses of six municipal stables located in South Boston, East Boston, Charlestown, Roxbury, South End and West End. The average number of horses per stable varied 12 to 58. The labor at the various stables was the most variable item, ranging from $165 per horse per year at Roxbury to $240 per horse per year in East Boston. About $^1/_{10}$ of the total number of horses were driving horses for use of the officials of the bureau, and the remainder were cart horses.

COST OF MAINTAINING HORSES, BOSTON, MASS.

Items	Total Cost	Cost per Horse per Day	Cost per Horse per Year
Labor	$29,805	$0 529	$193
Hay and grain	29,391	0 523	190
Shoeing	6,567	0 117	42 50
Veterinary services and medicine	908	0 016	5 90
Stable rent, lighting, heating, repairs, etc	12,039	0 214	77 75
	$78,710	$1.399	$508 25

The amount of feed consumed was as follows:

	Amount used Lb	Price paid Highest	Lowest
		Per ton	
Hay	1,033,160	$24 50	$16 50
Straw	66,369	19	11
Shorts	23,900	29	26
		Per bushel	
Oats	24,451 bu.	$0 58	$0 39

In the sewer bureau of the same city the cost of maintaining 48 horses and the average cost per horse were as follows:

Items	Total Cost	Average Cost per Day	Average Cost per Year
Labor	$11,803 69	$0 67	$246
Hay and grain	7,744 07	0 44	161
Shoeing	1,806 50	0 10	37 50
Veterinary services, medicine and clipping	225 00	0 01	4 75
Stable goods	219 30	0 01	4 25
Totals	$21,798 56	$1 23	$453.50

A Convenient Rule for Pipe Sizes is given by L. B. Lent, as follows: The velocity of flow in water pipes is very commonly taken at 3 ft. per second. This does not produce excessive friction loss even in comparatively small pipes. With this velocity: Diameter of Pipe (in inches) is equal to the Square Root of the Quantity of Water flowing (in cubic feet per minute).

The rule is not exact, but involves an approximation of something less than 1%. The rule, of course, merely expresses the relation between area, velocity and volume of flow, and involves no hydraulic relations or laws.

The rule can be used with gallons per minute after dividing by 7.5 (more exactly 7.48) to get cubic feet per minute. It can be used with a velocity of flow other than 3 ft. per second by first solving the problem for the 3-ft. velocity, then dividing by the square root of the correct velocity and multiplying by the square root of 3.

A Dragline Excavator for Side Track Construction was very successfully employed on the Chicago, Milwaukee & St. Paul Ry., at Turkey River, Iowa. The track runs on a fill parallel to the Mississippi River and the dragline excavator worked along the bottom land between the river and the old embankment.

The side or passing track is 1000 ft long, and the crown of the fill is 25 ft wide, varying in height from 10 to 22 ft. The fill was all made from one cut. The excavation amounted to 10,000 cu.yd., consisting of mud, sand and gravel. The digging was made extremely hard by the severe weather, in fact the machine had to dig through a foot of frost. In order to get a hold with the bucket to move ahead, it was necessary to shoot holes in the frozen ground.

During the last ten days the work was further complicated by the fact that in order to borrow sufficient material for the 22-ft. fill, the machine had to dig below river level and freezing weather made this a very difficult job. The dragline excavator completed the work in spite of many difficulties in one month and ten days. [From the April issue of "The Excavating Engineer."]

Vitrified Paving Block Tests—The city of Albany, N. Y., has 37.6 miles of vitrified brick pavements; over 39% of all the pavement laid in 1912 was of this type. The following summary taken from a recent report of the Department of Public Works gives the results of different tests made during the year 1912:

Make of Brick	Absorption of water Per cent	Modulus of rupture Lb per sq in	Transverse strength lb	Impact Test Loss in lb	Per cent
Clearfield	2 11	2045	10,035	13 98	18 92
Watsontown	2 28	2031	11,935	15 00	19 36
Allegany Valley	1 77	2117	13,333	15 34	18 49
Allegany Valley	2 03	2201	12,168	12 84	15 69
Allegany Valley	2 05	2179	12,897	16 53	19 67
Bradford	1 24	2102	15,408	15 88	17 33
Watsontown	2 54	1909	11,175	15 00	19 80
Clearfield	3 03	2077	10,970	14 05	19 11
Corning	1 15	2390	13,185	12 28	16 87
Corning	0 93	2135	11,122	10 31	14 09
Bradford	1 00	2045	13,345	16 15	17 79
Corning	1 83	2192	12,925	12 38	16 40
Corning	1 29	2246	11,725	11 75	19 17
Allegany Valley	1 84	2038	12,150	13 31	18 34
Clearfield	1 57	2032	10,720	13 31	18 13
Bradford	1 47	2071	13,625	16 55	18 46
Allegany Valley	1 88	2521	14,010	13 04	15 92

Requirements of specifications for paving blocks:
Shall not sustain a loss of weight of more than 20% in the impact or abrasion test.
Shall not absorb more than 3% of their weight of water.
Modulus of rupture shall not be less than 2000 lb. per sq.in.

The Cost of Sewers Constructed by Contract in Chicago, Ill., during 1911, is given in the recent annual report of the Department of Public Works as follows:

PIPE SEWERS

Length in ft.	Internal diameter in ft	Average cut in ft.	Amount	Cost per ft.
4,427	3/4	7 3	$4,830 46	$1 09
167,430	1	8 7	225,598 10	1 35
83,963	1¼	10 0	125,970 88	1 50
24,150	1½ d. s.	11 0	47,343 11	1 97
4,056	1½ d. s	10 8	10,238 19	2 52
514	2 d. s	13 2	1,799 10	3 50
284,540			$415,775 74	

BRICK SEWERS

8,618	2 s r	12 4	$21,784 40	$2 88
9,394	2 d r	12 8	30,158 29	3 22
1,200	2 d. r.	19 0	5,400 00	4 50
5,458	2½ d r	13 6	24,617 75	4 51
4,847	2½ d r	12 5	18,417 17	3 80
8,988	3 d r	12 7	44,897 80	5 00
5,282	3½ d r	15 7	28,938 90	5 48
2,681	3½ d r	15 0	14,745 50	5 50
2,651	4½ d r	14 0	13,255 00	5 00
4,004	4½ d r	14 5	20,020 00	5 00
2,663	5½ d r	18 0	18,641 00	7 00
1,350	6 d r	19 0	12,150 00	9 00
351	6¼ 3 r	17 5	3,159 00	9 00
57,487			$259,184 81	

Initial Strains in Boilers—"When the Pennsylvania R. R. intended to change its specifications for boiler plate many years ago, it was the custom, as far back as 31 years ago, that from all worn-out boilers testpieces were taken and retested. Original duplicate testpieces from the new sheets were laid away, and when the worn-out firebox sheets were returned to the testing department the original duplicates were searched for and tested in comparison with the worn-out plate. This practice was carried on for 13 years, and these tests invariably have shown (1) That, as far as it can be traced, the effect of the heat on the boiler sheet reduced any internal stresses due to the rolling; and (2) that whatever defects are found could almost invariably be traced to mechanical defects in the shop, in bending in flanging, in riveting, in drifting the rivet holes cold, and these effects then made their appearance by and by through overstrain." (P. Kreuzpointner before Sixth Congress of International Association for Testing Materials, 1912.)

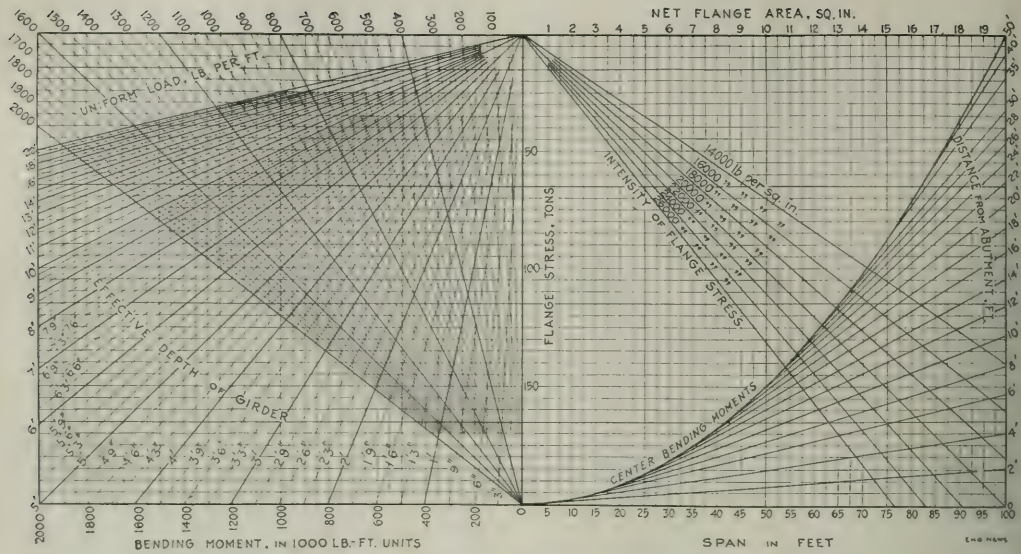


FIG 1. DEAD-LOAD BENDING MOMENT DIAGRAM FOR PLATE-GIRDER DESIGN

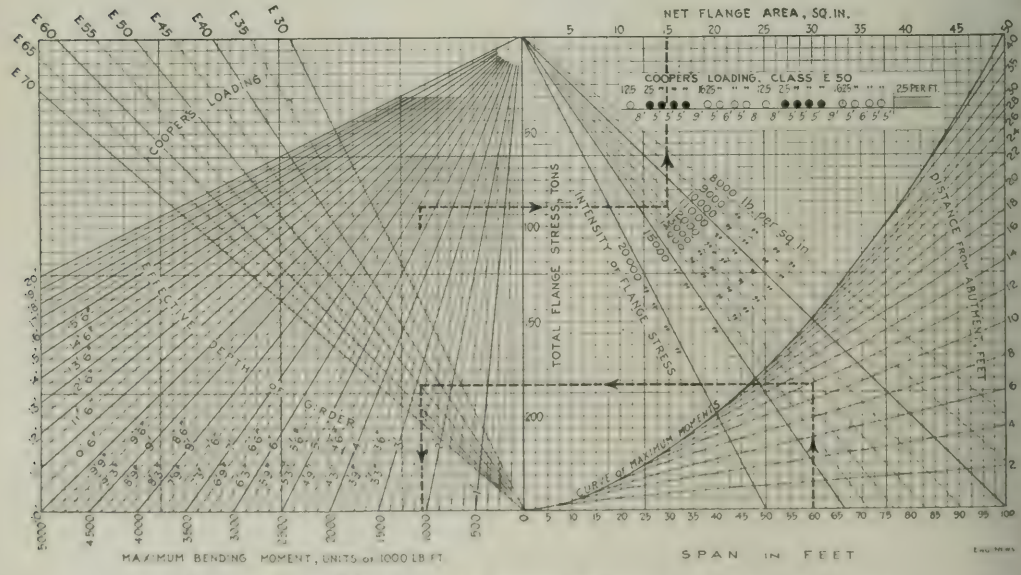


FIG. 2. RAILWAY LIVE-LOAD BENDING MOMENT DIAGRAM FOR PLATE-GIRDER DESIGN

[Cooper's E-30 to E-70 Loadings.]

To use Fig. 1 or Fig. 2: Find length of span (ft.) on right-hand bottom scale; thence follow vertically to the diagonal giving the distance out from the abutment to the point of girder in question (ft); thence follow horizontally to left, to the diagonal giving the intensity of bending. (In Fig. 1 lb. per sq. in.; in Fig. 2, Cooper's class of engine and train loading); thence follow vertically downward to the bottom scale and read bending moment (units of 1000 lb.-ft.); also follow vertically upward to diagonal giving effective depth of girder (ft. and in.); thence follow horizontally to right, and on middle vertical read flange stress (tons total); follow farther to right to diagonal giving allowed unit-stress in flange (lb. per sq. in.); thence follow vertically to top scale, and read required flange area (sq. in.).

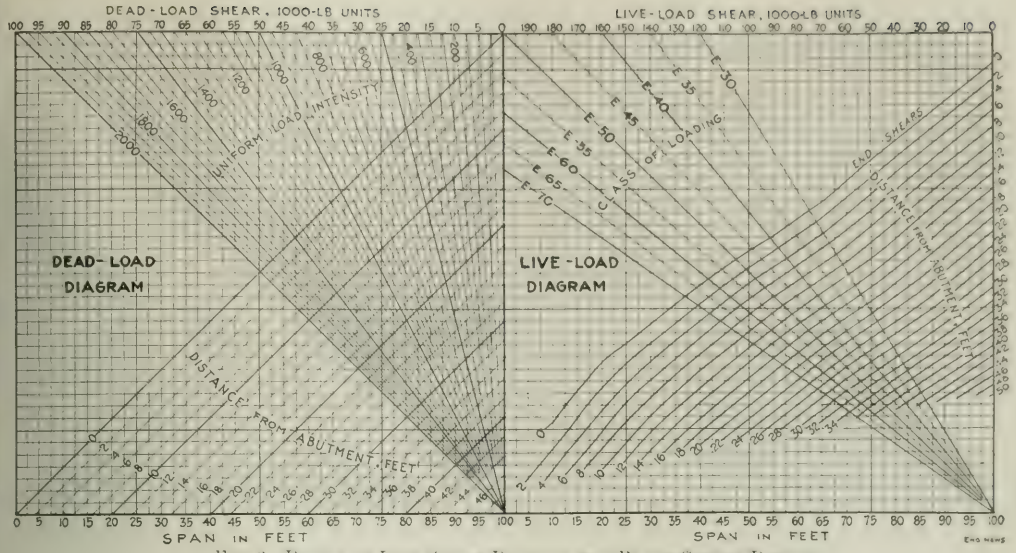


FIG. 3. DEAD AND LIVE SHEAR DIAGRAM FOR PLATE-GIRDER DESIGN

(Left half for dead-load shear; right half for live-load shear.)

Find length of span (ft.) on bottom scale; thence follow vertically to the diagonal giving the distance (ft.) from abutment to point considered, thence follow left or right horizontally to diagonal giving intensity of load (lb. per lin.ft. for diagram at left; Cooper's classes E-30 to E-70 for diagram at right); thence follow vertically to scale at top, and read shear (1000-lb. units) at point of girder considered.

Charts for Designing Plate-girders

BY GILBERT D. FISH*

The three diagrams herewith (two moment diagrams, one shear diagram) were designed as a means of finding the principal stresses in plate-girders due to dead-loads and moving loads, and the required flange areas at various sections. By use of these diagrams the bending moments and shears due to own weight and to superimposed uniform load are readily obtained for all varieties of simple beam, from the rolled I-beams of a floor to the plate-girders of a railroad bridge.

The train loadings given in Theodore Cooper's "Specifications for Steel Railroad Bridges and Viaducts" are the basis for the live-load stresses (Figs. 2 and 3).

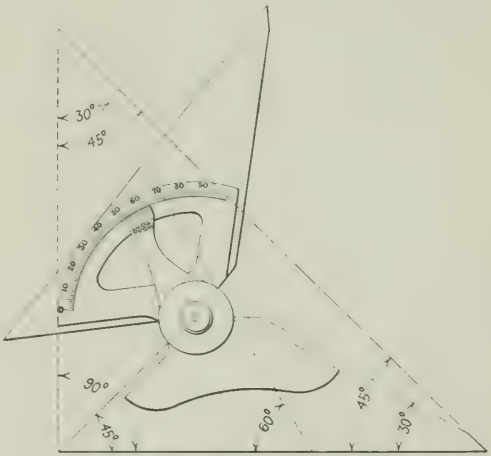
The net flange area required at any section of the girder is the sum of the areas found separately for dead-loads and live-loads. Various assumptions may be made as to depth of girder and allowable intensity of stress in the flanges.

The complete design of a plate-girder is made easy by the use of these charts in connection with the cover-plate tables given in ENGINEERING NEWS of Jan. 25, 1912.

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Combination Drafting Instrument

The accompanying illustration shows a combination protractor and triangles for the use of draftsmen. The protractor has an arc 4 in. in diameter, graduated to degrees and reading by a vernier to 5 min., though it is probable that the accurate setting of the instrument cannot be made to such minuteness. The clamping screw serves not only to hold the triangles in position but as a thumb-knob for handling the instrument. The instrument is claimed to be particularly convenient in setting off angles, dividing circles, drawing oblique parallel lines and perpendiculars to oblique parallel lines, transferring angles and for laying off angles on each side of a line without changing the setting. The protractor is steel and the triangles have transparent blades, the longest edge of which is 7 in.



COMBINATION DRAFTING INSTRUMENT INVENTED BY EDWIN Z. LESH

The instrument was invented by Edwin Z. Lesh, and is manufactured by the "3-in-1" Manufacturing Co., Hartford, Conn. It sells for $1.50.

*Columbia University, New York.

A Guide for Close Estimating on Cost of Power Plants

Engineers are frequently called on to submit estimates of cost on construction of various works before accurate of sufficient information is at hand of details of anything but the principal apparatus involved. Sometimes this has to be done before drawings and specifications are available, and yet the estimates may cover the expenditure of large sums, so that the need of close approach to the actual expense is needed. F. W. Gay, chief mechanical engineer of J. G. White & Co., New York City, in an article in the "Journal of the Worcester Polytechnic Institute" March, 1913, shows a method of checking these estimates and confining the greatest chances of error to minor parts of the installation.

According to his scheme, the first work is in the determination of the relative importance of the various items to be covered by an estimate. From his experience, he has compiled data and prepared diagrams covering power plants from 2000 to 40,000 kw. in capacity.

The diagrams show that: *engines and foundations* constitute from 33.6% to 61% of the total equipment cost; an average of 50%. *Boilers, settings and foundations,* from 17.25% to 31.5%, average about 25%. *Piping, complete,* from 7% to 17%, averages about 11%. *Condensers, complete with foundations and auxiliaries,* 10% to 15%, average at 11%. *Circulating-water system,* 4.5% to 8%, averages 6.5%. Thus in these five groups is a minimum of 72.35% of all apparatus items, leaving the remainder, 27.65%, to be divided among at least eleven groups, including "miscellaneous." If, therefore, the greater part of the allowable time is spent on these five groups he believes that the result will justify the expenditure of time and money.

Boilers, foundations and settings can be estimated closely, as can also the condensing apparatus. Engines, foundations, piping and circulating-water systems present greater difficulties, relatively, about in the order named. He finds it possible to estimate as close as 3% on *boilers, installed; on engines, installed,* as close as 5%; *on engine foundations,* as close as 10%; on *circulating-water systems* as close as 15%; *on piping systems,* as close as 20%; *on condensers, auxiliaries and foundations,* as close as 3%.

Applying these percentages of error to the minimum percentages of the whole, he has the total probable error on 72.35% of the apparatus as follows:

Boilers	17.25 x 0.03 = 0.52% (plus or minus)
Engines	33.60 x 0.06 = 2.01% (including foundations)
Piping	7.00 x 0.20 = 1.40%
Condensers	10.00 x 0.03 = 0.30%
Circ.-water system	4.50 x 0.15 = 0.68%
Total	4.91%

He assumes, for discussion, that one must estimate on the total cost as close as 15%, which percentage ordinarily includes 5% for contingencies and errors. By concentrating attention on the five principal groups, he thinks he can come as close as 5% on the larger items, and has then a leeway of about 13.5% on the remaining items. He believes it possible, in almost every case, to come within 20% on these items, and then the total estimate is within 8.5%, as against the 15% assumed.

Buildings for this apparatus vary from 6% to 16% of equipment costs, an average, say, of 10%. Using unit prices, *on a square- and cubic-foot basis* as well as, for *hp. and kw. bases,* checking each against the other, he thinks enables him to keep his error within 10 to 15%, or 1% or 1.5% on the total.

In his practice he has used the minimum percentages for the principal items. In some cases this is as high as 85%, and by analyzing this in the same manner as for the 72.35% the total estimate may be within 6.5%.

In order to secure accurate costs for the principal items, his concern has spent some considerable money and time. These data are kept up to date, in the form of curves, tables, charts, etc., which show total and unit costs for each item and for the whole. The advantages derived from the use of these data are claimed to have paid many times over for this expense. Referring to one contract recently finished, he states that the final figures from the cost analysis show that the estimate was in error less than 2.5%.

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Steel and Concrete Fence Posts*

Only two railways make mention of having used metal posts, and these but to a limited extent. In one case bar iron ¼x2 in. was used, and in the other old boiler tubes. We believe, however, that a number of roads, are trying a metal post. Several styles of steel right-of-way fence posts are on the market. Their exploitation has just begun in the last year or two. Greater experience may demonstrate their utility, but thus far we have no data upon them.

Concrete Posts—The concrete post seems at present to offer the only solution of the problem of a substitute for wood posts. In order to secure a post of such weight that it can be handled readily (practically as easy as wood), steel reinforcement is necessary to allow a reduction in the bulk of concrete. It has been demonstrated that while concrete posts are not as strong as wood posts, yet they are sufficiently strong to meet all practical conditions. Wood posts are stronger than necessary, rather than that concrete posts are not strong enough. Furthermore, there is quite a period of time in the case of wood posts before they have decayed to such an extent as to actually require renewal, during which they are no stronger than, in fact, not as strong, as a properly designed concrete post. Not more than a dozen railroads are using concrete posts at this time in large quantities, but a large number are pursuing the subject with a view to their extensive use.

CONCLUSIONS—1. Concrete posts are practical, economical and a suitable substitute for wood.

2. Reinforcement should be placed as near to surface of post as possible; ½ in. from surface is best location.

3. Post should taper from base to top.

4. Post should not be less than 5½ in. at base and 4 in. at top.

5. Concrete should consist of 1 cement to 4 run-of-pit gravel, or 1 cement, 2 sand and 4 parts screened gravel or crushed rock of low absorption. Gravel or crushed rock not to be smaller than ¼ in. nor larger than ½ in. Concrete should be of a quaking consistency.

6. Molds should have a vibratory motion while concrete is being introduced to compact it and smooth up surface.

7. Posts should not be made out of doors in freezing weather. They should not be exposed to sun, and should be sprinkled with water the first eight or ten days after being made to aid curing.

8. Molds should be carefully oiled or soaped to provide a smooth finish and to prevent concrete sticking to mold.

9. Posts should be cured for not less than 30 days (when cured naturally) before being set or shipped.

10. Posts should be carefully handled and be packed in straw, sawdust or other suitable material for shipment.

⁂

Crushing Tests of Steel Balls at the German testing laboratory in Gross-Lichterfelde showed an ultimate strength of 21,500 lb. for ¾-in. balls and 49,500 lb. for ¾-in. balls, the former were somewhat harder than the ¾-in. balls. The tests were made to compare English and German balls, the tests showed them to be of equal quality. The Rudeloff method of testing was used, three balls being superimposed between the platens of the testing machine.

*From the report of the Committee on Signs, Fences and Crossings, presented at the annual convention of the American Railway Engineering Association, Chicago, Mar. 18-21.

EDITORIALS

A Revival of Old-Time Railway Promotion Methods

Many of the old-time readers of ENGINEERING NEWS can recall the palmy days of the railway-promoting business; and the eloquent orators of the Col. Sellers type whose business it was to secure local aid from cities and towns along the route of a proposed road. Sometimes the aid given was merely the giving of a free right-of-way and depot grounds; sometimes an outright gift of cash was made. Rival towns were induced to compete with each other in the offer of bonuses to obtain the road. Most often the town raised the money to aid the railway by a bond issue and sometimes received stock of the railway in return; but the cases are very few where the stock received ever became worth anything.

We are reminded of this practice by a press dispatch from Wilson, N. C., reporting that a proposed railway in that section is being promoted after the old-time fashion. The dispatch states that the township is being asked to vote bonds to the amount of $30,000 in aid of the railway, to be given in exchange for the company's second-mortgage bonds. Other towns along the line will be asked to vote on a similar basis.

It is years since any case of railway promotion by soliciting local aid has been brought to our attention; and it seems worthy of special notice as a proof that the old idea of the railway as a great public benefaction is not yet wholly extinct. It might, indeed, lead to juster views by the public of its relations to the railways, were it to reflect upon what the coming of a railway means to a community which has hitherto been isolated.

Mechanical Devices That Imitate Nerve Action

One is continually surprised nowadays by the variety of novel problems which engineers are tackling and which are often far removed from the ordinary activities of engineering. A remarkable illustration of this is furnished by a recent pamphlet written by S. Bent Russell, the well known St. Louis engineer, formerly connected with the St. Louis Water Department, which describes and illustrates some mechanical devices that Mr. Russell has worked out to imitate the action of the nervous system. Mr. Russell's own statement of what his devices will accomplish is as follows:

> We have a mechanism that can be trained, that can acquire habits, that will move either forward or back at a given signal according to experience, that will make one, two or three responses to a given signal according to experience.
>
> In other words we have shown a practical arrangement of mechanical transmitters and receivers that will respond to signals and control movements like a nervous system and that possesses associative memory as it can learn by experience.

We shall not attempt to illustrate Mr. Russell's ingenious device or to describe it further than to say that it consists of a combination of pistons and valves controlled by springs, weights, etc., and designed to be operated by hydraulic or air pressure. His purpose is to present a complete mechanical reproduction of the action of nervous impulses and thus enable them to be clearly understood. It is, of course, not pretended that the wonderful physiological mechanism of the nerve cells operates in such a way. The pamphlet is a reprint from a contribution by Mr. Russell to the *Journal of Animal Behavior* for January-February.

The thing of chief interest in the pamphlet is the extent to which engineers are attacking new problems. It must be a very difficult road indeed, and with "no thoroughfare" plainly marked across it, but some engineer will come forward and bravely endeavor to traverse it.

Fatal Electric Shocks from Lighting Fixtures

From time to time we note the recurrence of fatal accidents wherein persons come in contact with electric-light fixtures within their reach and necessarily so placed. A year ago (May 9, 1912) we showed that the number of serious accidents possibly would then total 400, with 250 fatalities, and showed how simple and inexpensive was the remedy. We have been but one of the many who have called attention to the dangers and the remedy, yet recently two men were killed in Oakville, Ont., while reaching for drop lights. During a reported three-day local reign of terror, a large number of residents received more or less severe shocks and injuries in a similar manner, so that it was necessary completely to disconnect the local distribution systems from the transmission lines in order to protect the townspeople. Five engineers were retained by the mayor to ferret out the trouble, but they were not able during the first few days of their examinations to find the sources of high potentials which resulted so disastrously and, in the last reports received, the town continued without street lights and electric service.

It is evident that in all such cases the high-tension alternating-current lines some way must be grounded and in more or less perfect contact with the low-voltage house wires, in order that a victim's body may complete the circuit for the flow of high-voltage current. We have pointed out that if the low-tension lines were grounded in accordance with the recommendations of the American Institute of Electrical Engineers and the National Electric Light Association, then no heavier potentials could possibly be impressed on any person than those carried normally by the low-tension system and even these could be guarded against.

It is criminal negligence, in view of all the studies which have been made of these recommendations, that companies should still refuse to put them into effect and continue to impose on customers this danger to life. As

we have said before, it is the duty of legislatures, commissions and councils to require this simple protection. The Washington state legislature recently demanded it.

There is one force which we have not yet heard of being applied and this may be the most effective one since it brings risk of financial ruin to the smaller concerns which probably are the most numerous offenders: this is the effect of suits for monetary damages in the civil courts, based on grounds of criminal negligence.

Indicting High Railway Officers for Manslaughter

We commented in these columns several months ago on the flagrant injustice of indicting for manslaughter the chief operating officials of a railway company when there was nothing to show that the conditions which produced the accident on which the indictment was based were brought about by their negligence. Additional force to what we then said is furnished by the indictment last week of President Mellen and Vice-President E. H. McHenry, of the New York, New Haven & Hartford R.R., for manslaughter because of the wreck at Westport, Conn., last fall.

As our readers will recall, this wreck was due to an engineer of a fast passenger train, who was endeavoring to make up time, running past a danger signal and taking a crossover switch at a speed so high that the train was derailed. The only conceivable theory on which the president and vice-president of the company could be held in any degree morally or legally responsible for the accident, is on the ground that they were criminally culpable in not having installed crossover switches of easier angle; but it is an open question, on which different opinions are held by experts, as to whether crossover switches of easier angle, which may be taken at higher speed by trains, are really conducive to safety in operation as compared with ordinary switches.

It is true that the New Haven road, in obedience to the recommendation of the Interstate Commerce Commission, is now undertaking the lengthening of all its crossovers used by high-speed trains, involving the rebuilding of 78 crossovers, the reconstruction of 12 important switch leads which are not included in crossovers, the remodeling or rebuilding of 36 interlocking plants, and changes in signal apparatus made necessary by the above, all at a total expense estimated at $1,100,000. The new crossovers will use No. 20 frogs, over which it is estimated that trains can be run with reasonable safety at a speed of 30 to 40 miles an hour.

The New Haven officials authoritatively deny, however, that this change is being made in the belief that any greater safety will be secured by the longer crossovers. The sole advantage they expect is that somewhat higher speeds will be possible, since the train speed will not have to be slackened as much at a crossover. It is questionable whether there is not an absolute reduction in safety in permitting engineers to take the crossover of easier angle at higher speed. A wreck is still possible at either crossover if too high speed is attempted; but a wreck on a long crossover at 60 miles per hour would be more disastrous than one on a short crossover at 30 miles an hour.

We cannot too emphatically condemn the injustice in the indictment of President Mellen and Vice-President McHenry. If by holding a responsible executive position in railway service, a man is rendered liable to criminal indictment, not merely for mistakes in judgment in connection with the use of safety appliances and methods of operation, but for what legislators and lawyers who know nothing about the science of railway operation may conceive to be errors in judgment; if railway officers are to be subject to such risk, then few men of ability will care to accept such positions. Indeed, one hears the opinion frequently expressed by railway officers nowadays that they will put their sons into any other line of business in which an honest living may be earned rather than bring them up to the work which they themselves have followed.

The point which deserves most emphasis, however, is that public safety in railway travel is actually being jeopardized by such misuse of the processes of law. The officers of railways are just as much engaged in serving the public as any judge, or legislator, or district attorney, or congressman, or governor of a state and we believe the average railway officer is more competent to perform his job than the average legislator is to perform his.

As we have often insisted in these columns, progress toward greater safety in railway or industrial operations can only be secured by working with the aid of expert knowledge. Amateur meddling with the matter is likely to create ten new dangers for every one that it removes. An example of such amateur meddling by legislators is the bill just passed in New York and New Jersey fixing the number of brakemen which railways must employ on trains. This bill is enacted under color of protecting the public safety. But every railway officer knows that a train's liability to accident is not reduced by increasing the number of brakemen on the train. The air brake, which placed the control of the brakes in the hands of the engine runner, did away with any excuse for such legislation.

Another example of meddling legislation threatening public safety is a bill which was introduced in the recent New Jersey legislature forbidding railways to test the fidelity of their engine-runners in the observance of signals without giving the engine-runners notice beforehand when the test was to be made. It has been said that it would be quite as sensible to require by law that a cashier or bookkeeper must be given previous notice before his cash was counted or his books inspected.

A "Fair Rate of Return" for Public Utilities as Affected by "Unearned Increment"

In regulating by public authority the rates charged by public utilities, there has been an evident attempt to follow as a fundamental guide the rulings of the United States Supreme Court (given in a long line of decisions well summarized in the famous Consolidated Gas case) that there should be a fair return on the property actively and necessarily employed for the public convenience.

The interpretation of "fair return" or "actively and necessarily employed" has proved in each case a specific problem and a delicate task. However, it has involved the study of business details, rather than fundamental principles, and whenever an open-minded and consci-

entious commission has been secured, seemingly all parties have eventually been satisfied that a sufficiently close approach to real justice has been secured.

But there has remained still a basic problem for those who were inclined to make a literal application of the principle laid down by the Supreme Court. This is such a fundamental problem that no mere scrutiny of business or evaluation of property has thrown light on it. So long as the capitalization of a public utility company was greater than the value of its property (including certain intangible elements, like cost of franchises and organization, engineering and contingencies, bond discounts, etc.) the regulative bodies could proceed with relatively easy minds, for fair value on the property merely meant a somewhat reduced return on the more or less inflated capital.

But when the value of the property has greatly exceeded the capitalization, the question has arisen as to the justice of fixing rates which would yield a dividend of perhaps ten or twenty per cent, or more to the holders of the stock. The opinion of the Court above noted is plain; but there can be no doubt that public opinion, which cannot be ignored, would generally oppose such rulings as unduly favorable to capital.

Recently the Massachusetts Board of Gas & Electric Light Commissioners has attacked this problem and the result is shown in two decisions now at hand. In the earlier opinion, that in the case of the Haverhill Gas Light Co., dated Dec. 31, 1912 ,the pronouncement was somewhat hesitant and reserved, but still prophetic of the more emphatic statements to follow in the second case—that of the Attleboro Gas Light Corporation, dated Feb. 7, 1913.

Following are a few extracts from the Haverhill decision:

The company contended that a fair price should cover its operating expenses, an allowance for depreciation and a fair return upon the value of its property at the time the controversy arose, including its franchise and privilege, that such value may be proved by actual cost and reproduction cost of its property and amount and market value of its stock and bonds; and that the fixing of a price which will not afford a fair return upon such value amounts virtually to a taking from its owners. Taking the actual cost of manufacture and distribution at 62c., allowing 8c. for depreciation and a return of 22c., or 6% on $900,000, for the value of its property, and annual sales of 250,000,000 ft., the company claimed that a fair present price for gas would be 92c., and that the reduction in cost which might come with an increased output was already anticipated in the price of 85c., which it had offered.

The city urged that the fair price for gas depends upon (1) the cost at the burner (including a proper allowance for repairs, renewals and depreciation), and (2) a capital charge based upon the capital stock, and not necessarily upon the value of the property owned by the company. Using the figures of cost stated above and allowing 3½c. a thousand, or a return of 10% upon the capital stock outstanding, it suggested that 60c. was a fair and liberal price.

The questions of law and public policy raised by these claims are of great importance, and were argued on both sides with conspicuous ability.

It will be noted that the city's claim makes no provision for a return upon the debt to be incurred for the admittedly necessary reconstruction and extension of plant by the present owners. A fair allowance for this, however, fails to reconcile the difference between the parties. This difference seems to rest primarily on a radically different conception of the law applicable to a case where there is such an exaggerated disparity of capital stock to assets, and in which these assets have been accumulated in such large measure from earnings. Based only upon the existence of the unusual surplus and the comparison of its former prices with those now prevailing, the city alleged that the company for many years charged excessive prices, and that this extortion should not go unpunished. The company denied that its prices had been excessive, and claimed that its surplus was built up because the company retrained for many years from dividing all the earnings which might have been legally and properly declared in dividends.

Much was said of Massachusetts' policy with respect to public regulation, and as this policy is disclosed primarily in legislative acts, it is, perhaps, desirable to review briefly the laws by which this policy has been expressed. . . .

This review of the acts of the Legislature indicates an early recognition of the business as a virtual monopoly, and imposes upon it a considerable measure of restraint, supervision and regulation. The legislative purpose to prevent the issue of stock for anything besides cash, or, in the earlier years, property actually contributed by the stockholders, is plain. The prohibition of stock dividends and the provisions for the sale of additional stock at auction, or its distribution to the stockholders at its market value, or, as now, at a price not so low as to be inconsistent with the public interest, are also indications of an early and consistently maintained purpose to prevent surpluses accumulated out of earnings becoming the basis, directly or indirectly, for the issue of stock.

On the other hand, it is equally to be noted that no specific limitation has ever been placed upon rates or dividends, with a view possibly of rewarding zeal in the skillful and intelligent conduct of the business, and imposing upon the directors, subject to the check of public opinion, a consideration of the welfare of the shareholders and the equities of consumers in the surplus to which they had contributed.

As market value is influenced by the rate of dividends declared, the requirement that additional stock shall be issued at a premium seems also an acknowledgment that dividends may be paid on the par of the stock at a rate in excess of the return ordinarily required by investors for the use of their money. The fact that this last feature of the law has been preserved long after an express authority was granted to this Board to reduce the price of gas is significant, too, of a legislative view that these two methods of regulation are not inconsistent. This body of legislation is plainly designed to allow no capital stock to be issued save for physical property necessary for proper corporate purposes, to keep the authorized increase of capital stock as low as market and other conditions warrant, to compel publicity of corporate affairs, and, on the other hand, to secure the community from the wasteful effects of competition by the exclusion of others from territory already adequately and efficiently supplied, and to provide, upon complaint, a compulsory reduction in price, and so to create a status favorable to low rates and adequate service. There is nothing in this legislative policy which violates or countenances the violation of the company's constitutional right to "a fair return upon the value of that which it employs for the public convenience."

In deciding a complaint as to prices, the Board is bound to consider all the facts which may seem to have a bearing upon the company's affairs and the way in which it performs its public duty, but the Board is not, in its judgment, in the consideration of a proper return, required to exclude any property of the company necessary for the welfare of the public and actually used therefor, although it may have been provided by the investment therein of surplus earnings accumulated in past years; nor is it required, in order to escape the charge of confiscation, to ignore the company's history the limitations, legal or otherwise, under which its property has been acquired, or, in effect, to capitalize that property upon the same basis as if it had reached its present status under different conditions. . . .

The Board believes that the price hereinafter named is fair and reasonable, and will be sufficient to cover all reasonable operating costs, a reasonable allowance for depreciation and a fair return upon the value of the property which the company is actually and necessarily employing for the public convenience. . . .

The Board recommends that on and after the first day of February next the net price for gas sold by the Haverhill Gas Light Co. shall not exceed 80c. per M. cu.ft.

The second report shows that the Attleboro Gas Light Company Corporation was organized in 1898 under the general law and took over the property and business of an unincorporated association. The old association had been organized in 1859 and had taken over the property and business of a bankrupt earlier company. It began with a capital stock of $6000, which was variously increased to $16,400, although a part of the capital increase was made through a stock dividend, which was not specifically forbidden by statute. The original capital

stock of the company supplanting the association was also $46,400. In 1906, to provide for additions to plant, it increased its capital stock by the issue of 116 shares, par value $100, at a price of $225 a share, yielding in all $26,100. Although deductions amounting to $37,732 had been made for depreciation, the books show a net increase since January, 1899, of $63,582 in excess of the amount realized from the additional capital stock. The book value of the plant was then $157,373, with current assets of $35,759, or a total of $193,122, against which there were no outstanding liabilities other than the $46,400 capital stock. During this period 12% dividends were regularly paid, and in 1910 an extra dividend of 10%, claimed to represent income accumulated from the rent of land not used in its business.

In discussing the rate which is reasonable in this case, the Board makes the following comments:

> Since a company must make rates in advance, in attempting to provide for dividends and a reasonable strengthening surplus, it is impossible to see clearly and with certainty at the time what the company's business may develop. Surplus earnings so obtained have, however, quite different characteristics from those where rates are made in advance for the express purpose of providing out of profits plant investment which otherwise would come from the contribution of the shareholders. A prudent management will seldom distribute in dividends all of a company's apparent profits. Where in a brief term of years a large percentage of the plant investment appears to have been procured out of profits, or exceptionally large dividends have been declared, a suspicion naturally exists that prices have been unreasonably high, and a belief arises that the consumer has, therefore, acquired some equitable interest in such surplus.
>
> Where a company performs a public service with a proper conception of its public duty, surpluses of this character are not likely to develop. While an investment made for the public benefit may prove of public advantage from whatever source it is derived, no company ought to profit by conduct based upon a false notion of its public relations. These statements must, of course, be taken as applying to an actual and not a merely apparent surplus, although this distinction can often be correctly made only by a thorough knowledge of the company's affairs. While such surplus may be due in some measure to skill and foresight in the management, it may be and often is due in part to the general growth and prosperity of the community in which the company is located. . . .
>
> There is a growing recognition of the truth of the proposition that a public-service company is not entitled to a return upon the unearned increment in value of its real estate; but investment out of profits which it has been able to make solely through the general growth of the community which it serves has many similar attributes. It will commonly be found that a company's surplus is based on managerial skill and foresight, needlessly high rates or the general prosperity of the community, or, more frequently, on two or more of these combined; and while it may be difficult to determine what proportion is justly attributable to any one of these causes, there can be little question that the general growth of the community is an important factor.
>
> Whether because of a recognition of this principle or due to some other, it has been unlawful for many years in this state for a corporation of this class to represent its surplus in new capital by a stock dividend. It is difficult to see why the reasonable amount of return or the reasonable rate of return based upon the full value of a company's property should not be affected in the same manner by that portion of the investment made from what may be termed the unearned increment in its profits as by the unearned increment of value in its real estate. In other words, the reasonable rate of return upon a company's entire investment is lower where an appreciable part is derived from the two sources described than where it is entirely derived from the contributions of the shareholders in their payments for its stock. . . .

Accordingly the board reduced the price of gas from $1.10 per thousand cubic feet to $1. The apparently small amount of this reduction is in part explained by the commission's recognition that the present plant of the company was practically inadequate for the service and that it was under the necessity of removing its works to an entirely new site where equipment would have to be provided of a capacity which would not be completely utilized for many years.

From the foregoing it is seen that the Massachusetts Board has now gone on record as assenting to the proposition that a rate may be reduced lower than that which a fair return on the value of the company's property would require, where such a value is far greater than the par value of the capital stock outstanding. Whether that view is contrary to the Supreme Court ruling that the owners are entitled to a fair return on the actual value of their property is a question on which there may be difference of opinions.

A more direct and logical way of securing the same result would be to reduce the valuation of the property in some degree where it can be shown that the present value is to a considerable extent due to excessive rates in the past, the profits from which have been invested in the property instead of distributed as extra dividends.

It is interesting to note that in the well known case of Smith vs. Ames (160 U. S., 466), decided in 1898, Justice Harlan stated that "fair value" of property being used for public convenience was to be estimated after due consideration, among other things, of (1) "the present as compared with the original cost of construction," and (2) "the amounts of bonds and stock." If these two items showed that a valuable plant has been built up by earnings rather than wholly from investments by stock and bond holders, who had meanwhile received steadily a fair return on their investment, some deductions from the book valuation of the company's property as a basis for rate fixing would be apparently in agreement with the Court's decision.

The New York Public Service Commission for the 1st District has also made a ruling recently which is worthy of note. It will be recalled that in the Consolidated Gas case (212 U. S., 19), while the ruling was that the actual value of the property at the time (including increase in value of property since acquired) was to be the basis of rates, the Court was careful to state that there might be exceptions not seen from the facts in the case at issue. The New York Commission ruled in the Kings County Gas Light Co. case (see ENGINEERING NEWS, Nov. 16, 1911) that this decision was not found to give that company the right to base earnings on an increment of value in pipe lines due to new pavements having been built over them at the city's expense.

There are other cases which might be cited to show that not only is the fair value for rate-making purposes not necessarily the complete actual value at the moment, but that among the reductions properly made is such a one as is above proposed.

In dealing with all these matters it must be remembered that a reasonable "statute of limitations" must be applied. It will be unwise and impracticable in nearly every case to attempt to unravel the complicated financial operations of the past. We cannot justly demand that the gas and water and street-railway companies, which reaped big profits in the days when all these industries were conducted as a private enterprise, shall now make accounting for those profits or shall today be content to do business on lower rates because they invested extra profits in their plant instead of distributing them like their neighboring companies as extra dividends.

LETTERS TO THE EDITOR

A Heavy Rainfall at Richmond, Ind., During the Recent Flood Period

Sir—Relative to the Ohio and Indiana floods, you may be interested in the following rainfalls observed by the Richmond Water Co., at Richmond, Ind., on Mar. 23 to 27, 1913.

Richmond is located near the headwaters of the Indiana and Ohio streams on which the greatest damage was caused by the recent floods.

	Inches
Mar. 23, 7 a.m. to 5 p.m.	0.88
Mar. 24, 3 a.m. to 12 midnight	5.30
Mar. 25, midnight till p.m.	4.17
Mar. 26, noon tomidnight	0.76
Mar. 27, midnight to 4 p.m.	0.04
Total	11.15
Total for the month of March	12.89

As will be noted, the result of the excessive rainfalls on Mar. 24 and 25 was accentuated by a heavy rain on the 23d. Up to the 23d the rainfall for the month had been slight, and it is said that there was no frost in the ground at Richmond at this time, and very little during the entire winter.

CHAS. B. BURDICK.

Hartford Bldg., Chicago, Ill., Apr. 7, 1913.

Azimuth by Direct Solar Observations

Sir—I was pleased to see the article by Mr. Ross, in the issue of Mar. 6, advocating a more general use of direct solar observations for checking the azimuths of a survey. Such suggestions as this coming from men in practice are likely to have more weight with the practicing surveyor than when they come from the text-books.

I have used direct solar observations for many years and appreciate their value in dealing with long traverses. For this reason I can heartily indorse Mr. Ross's claim for the method. The particular manner of making the observations or of working up the results is to some extent a matter of taste. A judicious combination of natural and logarithmic functions has always seemed to me desirable. The more common formulas are intended for logarithmic computation only.

In discussing the matter of sun observations the question has often been raised whether it is sufficiently accurate to bisect the sun's disk with both cross-hairs rather than to take separate pointings on the edges. I have often used the bisection method, taking but one pointing when pressed for time, and have always been satisfied that the result was within 1′ of the true value, judging from the checks on the azimuths of the survey. I never really tested the matter, however, until last spring. On May 24, 1912, I took several readings of altitude and azimuth with a transit reading to 1′, bisecting the sun's disk each time with the vertical and horizontal cross-hairs, having no stadia or other hair as a guide. The readings are as follows:

	Horizontal	Vertical	Deviations in horizontal
(1)	56° 51½′	44° 50½′	0.1′
(2)	57° 10½′	44° 34′	0.0′
(3)	57° 23½′	44° 23½′	+1.0′
(4)	57° 34½′	44° 15′	0.0′
(5)	57° 46½′	44° 02½′	−0.2′
(6)	58° 00′	43° 50′	1.0′
(7)	58° 11′	43° 42′	+0.8′
(8)	58° 21′	43° 30′	0.0′
(9)	58° 35½′	43° 19½′	−0.7′
(10)	58° 47′	43° 10′	0.0′

Plotting these on cross-section paper and drawing a straight line so as to fairly represent the points (neglecting the small correction for curvature), the deviations from this line for the separate horizontal circle readings are given in the column on the right.

The mean is less than 0.4′ and the maximum is 1.0′. This would seem to indicate that if the azimuth is desired only within 1′ the bisection method is sufficiently accurate. These pointings were made under average conditions and consequently represent what might fairly be expected in practice. I have usually hesitated to recommend this method to beginners as it seemed liable to lead to careless habits of observing. The results, however, seem to show that it is worthy of consideration.

GEO. L. HOSMER.

Massachusetts Institute of Technology.
Mar. 15, 1913.

Rate of Rainfall for Storm-Sewer Calculations: Experience of Pawtucket, R. I.

Sir—Referring to the article entitled "Rates of Rain fall for Storm-Sewer Calculations" by J. A. Cushman, in ENGINEERING NEWS of Apr. 10, 1913, the undersigned is very much afraid that the engineer who, today, designs storm-water sewers for a maximum rainfall rate of 0.5 in. per hr., is going to get into serious difficulty and will later be called to account for having constructed sewers of insufficient capacity.

The writer feels that Mr. Cushman has confused two entirely independent facts, namely the *total quantity* of rain falling within 1 hour and the *rate of precipitation* expressed in inches per hour, but lasting only a fraction of that time. It is these latter figures, the *rate of precipitation* in inches per hour, lasting for periods of perhaps 10, 20, 30 or 40 minutes, that are of vital interest to the engineer in the design of storm-water sewers.

Mr. Cushman states, in the article referred to: "a rate of over 1 in. of rain falling in an hour is an exception * * * and that a storm of over 1¾ in. per hr. is a rarity."

The writer has made observations of rainfall, extending over a period of eleven years, studying the rates of precipitation of each storm by means of an automatic record of the storm itself. During these eleven years the records show that there have been only 7 storms with a total precipitation of 1 in. or more within an hour, but that there have been more than 90 storms during the

same period that have given *rates of precipitation* greatly in excess of a rate of 1 in. per hr.

No less than 19 of these storms recorded rates in excess of even 2 in. per hr. and a maximum record is a rate of 5.2 in. per hr., lasting for a period of 10 minutes. During this same eleven years only 3 storms gave a total precipitation of over 1¾ in. of rain within an hour, but 20 showed a *rate of precipitation* of over 1¾ in. per hr., lasting, of course, much less than 60 minutes.

Mr. Cushman writes that "engineers are using McMath's formula which, although it takes the rate of rainfall into account, is based on a rate of 2.75 in. per hr. and leaves no opportunity to reduce or correct this rate." While the writer much prefers the so called "rational formula," $Q = Acr$, used in connection with a rainfall curve, he feels that the McMath formula *does* afford an opportunity for the engineer to exercise his judgment and discretion in the assignment of values for r and S.

GEORGE A. CARPENTER,
City Engineer.

Pawtucket, R. I., Apr. 12, 1913.

Lessons and Opportunities of the Recent Floods

Sir—As the mighty flood of last month coursed down the river channels of the northern half of the Ohio valley, leaving naught but ruin and disaster in its wake, it carried on its yellow bosom the secret of many floods of years long past. Knowing no law save that of gravitation, it followed the broad, well beaten path of its ancient predecessors, and at all points where this path had not been modified and constricted by the works of man, it did little harm and wrought little change. But wherever a road, a bridge, a house, a city, a town or other work not harmonizing with the topography, had been built, the waters at once proceeded to exert their strength and make manifest their energy. As in the case of a lightning discharge, the greatest damage was done along the line of greatest resistance.

The topography of the valleys of these streams bears eloquent evidence that there have occurred in the past greater floods than the one which is now uppermost in the minds of all, and, moreover, the testimony written on the hillsides is clear that there have been many such floods. How many centuries ago and how often they have occurred we know not. Of only one thing are we certain, and that is that the flood plains on which most of the larger and many of the smaller cities and towns throughout this region are built, were themselves laid down by many floods. And when the manifestations of this most recent of them all are carefully examined, one cannot help stopping and wondering whether, after all, it is necessary to go back to glacial times in order to find a source and supply of water sufficiently great for producing many of the effects which have generally been attributed to the melting of the great ice sheet. It seems almost as though present-day agencies of themselves, if they occur only in proper combination, are amply sufficient to account for some at least of the dynamic effects which are usually ascribed to the waters of the melting glaciers. Consider for a moment what proportions the flood might have assumed had there been a foot of snow on the ground when the rains came, and had the ground been frozen!

It is of importance for the future to know whether other floods perhaps of even greater magnitude are likely to occur and in order to make the most of every shred of evidence, it behooves the engineer to look about him and read the signs. Before the white man went into the Ohio valley, it was inhabited by the North American Indian who bequeathed to posterity no records and few legends. But before the Indian, this same country was occupied by the Mound Builders, who left behind them many traces of their civilization and many works of large magnitude. Baldwin's "Ancient America" speaks of these works as follows:

> None of the works, mounds and inclosures are found on the lowest formed of the river terraces which mark the subsidence of the streams, and as there is no good reason why their builders should have avoided erecting them on that terrace, while they raised them promiscuously on all the others, it follows, not unreasonably, that this terrace has been formed since the works were erected.

May it not have been, however, that these peoples had a better knowledge of these streams than do we of the present, and so took good care to build their works above the floods? Or if they did build on the lower terrace, may not all of the structures so built have long since been washed away?

In this connection, it has occurred to the writer that valuable information may be gathered by the engineers of Ohio and Indiana if they will but look into and examine the relation between the high-water marks of this recent flood and the mounds and structures which antedate all other works of man of which we have knowledge in this region. If this flood reached up to and into these old mounds and inclosures, and did damage to them where before there had been none, it would necessarily follow, all other things being the same, that this flood was greater than any which occurred since their construction. On the other hand, however, if the waters did not reach the mounds, it would seem as though this last high-water did not rise to an elevation as great as that which these architects of olden days considered necessary for the safety of their structures, and consequently it may well be inferred that many higher waters than those of the present have flooded these valleys since the days of the activities of that great but long since extinct people who were the first on this continent to leave behind them works of an enduring nature.

To the people of the present it is of the greatest importance whether their residence on the flood plains of these streams is one of permanence and safety, and for this reason it may well be that evidence of this nature from the distant past may serve for them a most useful purpose. It is the hope of the writer that examinations of the kind suggested will be made and that the results thereof will be set forth in the columns of your valuable paper.

JUPITER PLUVIUS.

New York, Apr. 16, 1913.

Wind Stresses in Buildings

Sir—I have read with interest the article in your issue of Mar. 13, 1913, "Wind-Bracing without Diagonals for Steel-Frame Office Buildings," by Mr. R. Fleming. The subject is one phase of structural steelwork on which there has been too little published, and it is a distinct service to the profession to make public the methods in use in good practice.

The writer has been giving his students in "Tall Build-

ing Design" a slight modification of Method III for the past seven years.

The statement of the author at the end of his description of Method III that "The horizontal shears taken by the columns will vary as their section moduli," should read "moments of inertia" instead of "section moduli." The proof is as follows:

Fig. 1 herewith represents the elastic lines of one story of a steel-frame building with rigid joints, under wind loads only. It is assumed, as in Mr. Fleming's article, that the longitudinal deformations of the members may be neglected and that the points of contraflexure are at the mid-lengths of the members, or, stated differently, that the tangents to the elastic lines at the two ends of each member are parallel to each other. Fig. 2 shows the elastic line of Col. No. 1 for any story.

H_1 = The shear in the column;

M_1 = Bending moment at the ends;

M_x = Bending moment at any point whose coördinates are x and y, the origin being taken at the bottom of the column.

The differential equation of the elastic line is

$$E I_1 \frac{d^2 y}{dx^2} = M_x = M_1 - H_1 x \qquad (1)$$

Integrating this twice we get

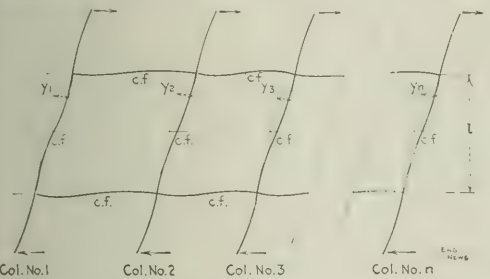


FIG. 1

$$E I_1 y = \tfrac{1}{2} M_1 x^2 - \tfrac{1}{6} H_1 x^3 \qquad (2)$$

When $x = l$, $y = y_1$, which is the deflection of the top of the column with respect to the bottom (see Fig. 1)

$$E I_1 y_1 = \tfrac{1}{2} M_1 l^2 - \tfrac{1}{6} H_1 l^3 \qquad (3)$$

Taking moments about the point of contraflexure in Fig. 2 we get $M_1 = \tfrac{1}{2} H_1 l$, which substited in equation (3) gives

$$E I_1 y_1 = \tfrac{1}{12} H_1 l^3 \qquad (4)$$

Similarly, the deflections of the other columns may be written

$$E I_2 y_2 = \tfrac{1}{12} H_2 l^3$$
$$E I_3 y_3 = \tfrac{1}{12} H_3 l^3$$

and

$$E I_n y_n = \tfrac{1}{12} H_n l^3$$

From the original assumption that the longitudinal deformations are negligible, i.e., that the shortening of the girders due to the direct compression in them may be neglected, we know that

$$y_1 = y_2 = y_3 = y_n \qquad (5)$$

Then,

$$\frac{y_1}{y_2} = 1 = \frac{\frac{H_1}{I_1}}{\frac{H_2}{I_2}}$$

which gives

$$H_2 = H_1 \frac{I_2}{I_1}$$

Similarly

$$H_3 = H_1 \frac{I_3}{I_1}, \quad H_n = H_1 \frac{I_n}{I_1}, \text{ etc.}$$

But $H_1 + H_2 + H_3 + \ldots + H_n = S$ = total shear in all the columns of that story.

Substituting the values of the H's

$$S = H_1 + H_1 \frac{I_2}{I_1} + H_1 \frac{I_3}{I_1} + \ldots + H_1 \frac{I_n}{I_1}$$

$$= \frac{H_1}{I_1} (I_1 + I_2 + \ldots + I_n)$$

Hence

$$H_1 = S \frac{I_1}{I_1 + I_2 + I_3 + \ldots + I_n} = S \frac{I_1}{\Sigma I}$$

Similarly

$$H_2 = S \frac{I_2}{\Sigma I} \text{ and } H_n = S \frac{I_n}{\Sigma I}$$

It is the writer's opinion that Method III is more rational than either of the others, although all of them are open to the criticism that the assumptions made are not in accord with the facts.

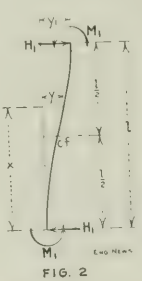


FIG. 2

Mr. Cyrus A. Melick, D. C. E., made a complete investigation of this subject, both analytically and by extensometer measurements on a 16-story building, as a thesis for his doctor's degree at the Ohio State University in 1909 and 1911. This thesis has been published as a Bulletin of the College of Engineering. The conclusions of Mr. Melick were that the rigid solution was entirely too long and cumbersome for use in practice and that some such approximate method as is given by Mr. Fleming must be used.

Mr. Fleming's note that "Special attention should be given the column splices and the connections of the floor girders to the columns," should be given special emphasis, for many buildings are built in which these details are entirely inadequate to develop the strength of the main part of the member and to give the required rigidity at the joints. It must be remembered that frequently the maximum bending moments in the girders occur at their connections to the columns.

CLYDE T. MORRIS.
Professor of Structural Engineering, Ohio State University.
Columbus, Ohio, Mar. 22, 1913.

Federal Control of River Regulation

SIR: I have read with great interest, in ENGINEERING NEWS of the issue of Apr. 10, your editorial and Rudolph Hering's communication on the subject of river control and the prevention of floods, and in the main agree with what was said therein.

Any project of this kind would be of enormous magnitude, complication and importance, and should not be entered upon without great deliberation and the most careful study and consideration. There is danger that

the recent great calamities from floods, and the public sentiment created thereby, may incite the National Government to ill-considered undertakings that are not warranted by sound engineering, economic and financial reasons.

The new Secretary of War, whose high character and signal ability in his own professional field no one questions, is reported to have said that the Government must undertake immediately remedies against a recurrence of these disasters. If this means that Congress is to be urged to authorize at once such work, and to make adequate appropriations to begin and carry out the physical improvements that it may hastily judge to be necessary, it will almost certainly be unfortunate, and will probably result in the squandering of enormous sums of money.

The only rational and safe way to proceed in the matter is that suggested by you and by Mr. Hering—the most careful and deliberate study of the problems involved, by the ablest talent in the country, and the formulation of the best measures to meet each individual locality and case. If Congress could be induced to make at once a rational beginning by the creation of a commission composed of able engineers and others, and to provide it with the necessary authority and means to prosecute its work, we might expect to make real, and in the end, most rapid progress toward the solution of the various problems involved.

I use the word problems intentionally. The engineering, economic, governmental and financial questions involved have not, in this country, advanced beyond the problematic stage. Nor are these problems so simple here as one might infer they are abroad, from Mr. Hering's rather optimistic statements. While the questions that must be considered are primarily of an engineering nature, they involve different problems of constitutional law, economics and statesmanship that cannot be ignored.

The question, how far the National Government is authorized or warranted under our Constitution to undertake work of this character is, alone, one of tremendous importance, and one which there seems to be a strong tendency, in these days, to ignore. The only authority conferred upon the National Government for undertaking public works, for other than military purposes, found in that fundamental instrument, is contained in Section VIII, and reads: "To regulate commerce with foreign nations and among the several states and with the Indian tribes." It is generally accepted that this implies the right and duty of the National Government to undertake the development of physical projects necessary to provide for and to facilitate foreign and interstate commerce; but up to the time of the Civil War the opinion was quite generally and consistently held that it does not authorize or permit the National Government to engage in improvements that are of purely intrastate or local character, having no tangible connection with interstate commerce. The earlier Presidents generally vetoed measures of this questionable character passed by Congress, and the unanswerable reasons and arguments advanced in these vetoes are well worth reading and pondering today.

More recently the Government has either read into this provision more than it was evidently intended to mean, or has ignored it; and there exists today an alarming tendency for Congress to authorize and provide for, and for presidents to approve, projects that are wholly intrastate and local, such as the construction of highways, the drainage of swamp lands, etc., and now we shall probably have bills passed to undertake the local protection of cities and towns from floods. Before we engage in such a stupendous enterprise, with all that it involves, should not this question be considered and decided by authorities more competent to judge, and more disinterested than the members of Congress?

Other important questions involved are: If the cost of such improvements is to be partly met by the national and partly by the state governments, how is the relative amount to be paid by each to be determined? What part of the cost shall be met by the municipalities directly affected? Who shall design and construct the necessary works, and be afterward responsible for their care, maintenance and police control?

From the economic standpoint, to what extent is protection warranted against floods that occur only at long intervals and who shall decide this question? Outside of towns and cities, and excluding the lower reaches of the great rivers, flood damages are comparatively insignificant. To what extent may these towns and cities reasonably be required to work out their own salvation?

Consider the upper Ohio River and its tributaries. It is still an open question whether adequate storage reservoirs to control floods are practicable or even possible. Any scheme of channel enlargement that would greatly reduce the flood heights, except at a cost that would be absolutely prohibitive, is easily shown to be futile. Might it not be cheaper and better to construct local levees; or even to condemn and abandon the urban property subject to destructive floods, rather than to attempt any effective project for reducing flood heights? If so, shall the National Government undertake to do such local work, and bear the cost of it?

These are only a few of the questions outside of engineering questions proper that must be considered and decided before any general scheme of river regulation and flood protection can be safely adopted. They involve work for the engineer, the constitutional lawyer and the economist, who should all be represented on the Commission suggested.

S. WHINERY.

95 Liberty St., New York City.
Apr. 15, 1913.

NOTES AND QUERIES

In the article on "The Flood of March-April, 1913, on the Ohio River and Its Tributaries," by John C. Hoyt, in our issue of Apr. 10, 1913, the last sentence in the first paragraph on p. 753 should have read:

For the 10-day period from Mar. 26 to Apr. 1, about 12,100,000 (instead of 12,100) acre-feet passed Cincinnati.

A correspondent raises a question as to the correctness of the statement in the foot note to p. 506 (Mar. 13, 1913, article on "Surplus Waters of the Los Angeles Aqueduct") that a California miner's inch is equivalent to 12,960 gal. a day. While it is true, as our correspondent states, that the statutory miner's inch in California is 1.5 cu.ft. per min., we understand that in the Los Angeles Aqueduct calculations, a value of 1.2 cu.ft. per min., which is commonly used in southern California, is employed.

Dayton After the Flood

(Editorial Correspondence)

Dayton, Ohio, Apr. 15—Dayton is excessively dirty. It seems as though little progress had been made in cleaning up, though of course much has been done. Only the main business streets are cleaned fully (except for muddy gutters), and the secondary business streets are so full of débris and dirt outside the street-car and driveway width as to make it necessary to walk in the middle of the street in many places. There is a general smell in the city, and the food seems to taste almost as slimy and creosoty as the smell smells. The water was about 9 ft. deep on the sidewalk here at Third and Main.

The breaks in the levees have all been patched up temporarily to hold a 15-ft. stage in the river. The tops of the levees were at +23, new city datum. The flood-crest elevation has been given by the Engineering Department as 29. The flood record of 1898 was stated as 20.2, and

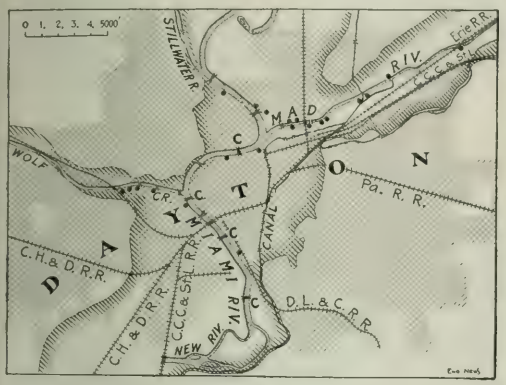


Fig. 1. Map of Dayton, Ohio

(Built-up area hatched and the flooded area outlined by cross-hatching. Levee washouts shown by small black circles. Concrete bridges by letter C. The second bridge below Mad River, at Monument Ave., is also of concrete, though not so marked in the cut.)

the idea was to raise the levees to an elevation of 3 ft. above that flood. Low water is about 3.25. The levee tops were *supposed* to follow the high-water slope of the 1898 flood, but I do not find that anyone knows what this was. Surveys are now being made by the Relief Commission's office to get high-water elevations, slope, etc.

No topographic map of the city, except the 20-ft. contour, U. S. Geological Survey map, appears to be in existence and no longitudinal profile of the valley. Apparently, there is no definite basis on which to estimate the volume of flow in the recent flood. All are content to leave this in the hands of the newly-appointed board of U. S. Engineer officers, and they expect from that board the direction of their future work as to levees and flood protection. The sentiment is in favor of submitting to and accepting whatever this board determines.

The river is on the average about 600 ft. wide between its banks here in Dayton, and its maximum flood depth was about 28 or 30 ft. Its slope was probably nearly the same as that of the Muskingum at Zanesville.

For the present the engineering department of the emergency city government is going to repair the levee washouts to the original height, and will do nothing farther in levee work. Many of the levees had riprap or stone revetting, but of course this was on the water side only. The fact that overflow occurred all along the levee, as indicated by the breaching, probably does not suffice to show close agreement of the 1898 and 1913 flood slopes.

The Dayton Union Ry. Co. bridge piers, which were in part washed out, were founded about 7 ft. below river bed on grillage on gravel. The piers of the city bridges went somewhat deeper, about 10 to 13 ft. below river bed, most of them on gravel, but one or two on hardpan; and a few of the deeper ones had to be carried down to get below sand into gravel. None of the city bridge piers in the Great Miami scoured out, while the railway bridge lost at least two of its piers in this way. One



Fig. 2. High-Water in Downtown Dayton

pier of the Helena St. bridge over the Stillwater has disappeared; this was a light road bridge giving access to a city park.

The county (Montgomery) lost several large and many small bridges or culverts. The loss of the large bridges is appraised at $700,000. The largest bridge lost is the lower Miamisburg bridge, three 200-ft. steel-truss spans. None of the county's reinforced-concrete bridges went out; the largest of these was 120 ft. long, two 56-ft. spans. Under date of Apr. 8 the report of County Engineer E. A. Moritz stated "The Commissioners contemplate replacing with concrete steel structures, as all concrete bridges in the county withstood the flood." But since then the people of Miamisburg have objected to a concrete bridge, and want a suspension bridge to get all the waterway possible. Two bridges went out at that town, and one is to replace them.

As an idea of the behavior of some bridges that stood, it is stated that at Preble, on the Warren County line, a through truss bridge over Twin Creek with two 150-ft. spans had water 4 ft. over the floor but did not go out. A post of this bridge was bent upstream, it is said, by a log turning over and hitting it backward.

The only highway bridges left over the Big Miami below Dayton are said to be at Franklin, Poasttown and Trenton.

The sewer system of Dayton was not much damaged, but in some districts the sewers appear to be clogged and have not yet been opened. No breaks in the sewer system are reported. The house connections were very extensively destroyed, and on this account public privies were built over sewer manholes, to the number so far of 101. Major Rhoads states that a very large number of privies existed in Dayton, probably 10,000 to 12,000 (including a certain number of abandoned ones). Under these circumstances the absence of disease is remarkable.

The city's water-supply was cut off by the flood until Sunday, Mar. 30. It was then restored by the opening of the pumping station (which draws its supply from wells in the Mad River valley). It is still considered unsafe, on account of pollution of the mains, though good at the pumps. Tests are made regularly.

The sanitary administration has been under U. S. Army Medical Corps Major Rhoads since Mar. 28 (ordered here by Garrison). The state and local health boards are subsidiary to him, at Gov. Cox's orders. When he got here, a general relief bureau was already in operation, by the Citizens' Relief Committee, including some medical relief. He organized 16 districts with a local physician as district sanitary officer in charge of each, with authority to appoint assistants, set to work men and teams to clean up, etc. The districts were subdivided into zones, with an Assistant Sanitary Officer to each; 64 Red Cross nurses assisted in work of inspection, sick service, etc. A house-to-house inspection was made over the whole flooded area by these zone organizations, and all sick were sent to the two public hospitals, abolishing all local hospitals. Subsequently, also, all suspicious sick were sent to hospitals, there being no house quarantine permitted even in the dry area, with the idea of getting the sick away from the well.

The work of cleaning-up the streets is in charge of the Engineering Department of the Citizens' Relief Committee, and the cleaning of houses and premises under direction of the Sanitary Organization by the householders, or, where these are unable to do so, by the organization forces. Some 2800 men were put to work at the cleaning right at the start. Major Rhoads states that about seven-eighths of the houses in the flooded areas are now cleaned. Schools and public buildings, etc., are cleaned out by the organization forces. Formaldehyde fumigation and disinfectant washing with cresol and chloride of lime are required, the latter being done by the householders with material furnished from United States supplies; fumigation is done by an official squad.

Garbage collection (once daily) was reëstablished Apr. 12 by Major Rhoads. Prior to that, garbage was ordered to be burned by the householders. The reduction plant has been running since the week of the flood.

The central organization was made up of a Chief Sanitary Inspector (having charge of the district organizations) and a Superintendent of Sanitation and Plumbing. The latter's first duty was to discover and stop leaks in the water house connections as soon as water was pumped, and to put up privies, etc. A supply bureau (for tools, boots, disinfectants, etc.) was also part of the central office. The Secretary of the State Board of Health is the Superintendent of Sanitation. The local health board looks after quarantine, fumigation, etc.

Two refugee camps were set up, taking care of 300 each. No more seem to need housing and feeding in these tent camps.

The sickness record today is: Diphtheria, 20 cases; scarlet fever, 8 cases; measles, 11 cases; chickenpox, 7



FIG. 3. VIEW ON SOUTH MAIN ST.



FIG. 4. VIEW LOOKING EAST ON FIFTH ST.



FIG. 5. LOOKING EAST FROM MAIN ST. ALONG THIRD ST. ON MAR. 26

VIEWS OF DAYTON DURING AND AFTER THE FLOOD

cases; smallpox, none; typhoid, none; mumps, some, but not reported.

Major Rhoads can offer no explanation of the absence of typhoid, as there has always been typhoid in the valley, and the washing out of privies would tend to spread it.

No hypochlorite treatment has been applied to the water; reliance is placed on the emphatic and widely published warnings to boil all water. I will write more fully in a few days.

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Railway Damage and Railway Reconstruction in the Ohio Flood Districts

BALTIMORE & OHIO SYSTEM

(From J. Hampton Baumgartner, Publicity Representative.)

The damage to the railways by the March flood in Indiana, Ohio and sections of West Virginia and Pennsylvania was without precedent in the history of transportation service. Never before had there been so complete an interruption to traffic between the East and the West.

Without exception, all of the railways in the flood districts were badly damaged. It was only the resoureefulness of present-day railroad management that made it possible to restore service on something like regular schedules within two weeks after the flood.

Railroad tracks, sidings, heavy bridges of steel, concrete and stone construction; stations, shops and terminal buildings, rolling stock, lumber and expensive materials of every sort were caried off by the torrents; and interlocking machinery, signal apparatus, telegraph lines and other property had a similar fate.

The restoration of the railways so that they could again handle passenger and freight traffic was most urgent. Famine threatened millions of people in the stricken states whose homes had been lost in the floods and whose means of livelihood had been cut off. The first efforts of the railroads were therefore directed toward relief work. As soon as temporary service had been restored, hundreds of carloads of food, clothing, medicine and other donations were rushed to the relief. Government and State troops were also taken in to maintain order.

In this emergency the railways were operated as if they were one system. The stretches of track which had escaped the trouble were used jointly by the various roads in the localities, for detouring repair gangs and operating trains as best they could. It was extremely difficult to arrange for repairing the damage to the railroads, owing to the severance of telegraph and telephone communication which made it is impossible to obtain accurate knowledge either as to the extent of the destruction or its nature. Many reports were received by way of farmhouses and, in some instances, by couriers.

The financial loss to the Baltimore & Ohio System in the floods will probably be between $2,500,000 and $3,000,000, in the belief of President Daniel Willard, Vice-President A. W. Thompson, the chief operating officer, and Chief Engineer F. L. Stuart, who have completed a tour of inspection of their lines in the flood districts.

On Wednesday, March 26, the Baltimore & Ohio announced that it would handle free all relief shipments for the sufferers and give such consignments preference. The stations, shops and other railroad buildings available were also thrown open to the sufferers for their shelter. Railroad restaurants also dispensed food gratis to those who were hungry.

When reports of the serious situation in Ohio reached Baltimore, large forces of workmen were assembled with material for repairing tracks, bridges, stations and equipment. By the time the floods had reached their crest an army of 6000 men was waiting east of the Ohio River, between Parkersburg and Pittsburgh, ready to enter the flood districts.

A conference between President Willard, Vice-President Thompson, Chief Engineer Stuart and other executives was held and an emergency organization was made effective.

Fearing that various officials would be marooned and cut off from communication with headquarters, instructions were sent out for the heads of the operating and engineering departments in the respective territories to remain at their offices and direct the handling of the workmen and material. The arrangement was carried out as to the operating department under the direction of Vice-President Thompson, General Manager Galloway, of the Baltimore & Ohio (Baltimore), and General Manager Loree, of the Baltimore & Ohio Southwestern-Cincinnati, Hamilton & Dayton lines (Cincinnati).

An emergency organization was likewise put into effect by the engineering department, with Chief Engineer Stuart in charge. The railroad was divided into districts and placed under the supervision of the engineering staff, as follows:

Paul Didier, Principal Assistant Engineer, Pittsburgh; Zanesville territory and rebuilding Zanesville bridge.

A. M. Kinsman, Engineer of Construction, Cincinnati; Indiana division, B. & O. SW., west from Cincinnati.

J. T. Wilson, District Engineer, Baltimore; B. & O. SW. east from St. Louis.

L. G. Curtis, District Engineer, Chicago; Indianapolis division, C., H. & D., including Hamilton yards and bridge.

J. D. Carothers, Special Engineer, Baltimore; Columbus district.

F. E. Lamphere, Assistant Engineer, Chicago; Louisville district and Lawrenceburg bridge.

D. R. Hundley, Assistant Engineer, Chillicothe; Chillicothe district and yards.

Claude Brown, Assistant Engineer, Chicago; Toledo division, C., H. & D., and Dayton district.

W. S. Bouton, Engineer of Bridges, Baltimore, assumed charge of the preparation of plans for the new bridges and the assembling of needed material. M. A. Long, Assistant to Chief Engineer, Baltimore, was placed in general charge of architectural matters and the designing of buildings. Besides the foregoing organization, Resident Engineers at various points on the lines have been assigned to special work in the flood districts.

The working forces are organized into day and night shifts and with 18 pile-drivers, numerous steam shovels, derricks and other machinery in operation, all double-crewed, rapid progress is being made in rebuilding the road. The floods carried away 12 bridges on the Baltimore & Ohio System, the most important being at the following places:

Zanesville, over the Muskingum River; Marietta, over the Muskingum River; Washington, Ind., over the west fork of the White River; Lawrenceburg, Ind., over the Big Miami River; Hamilton, over the Big Miami River; Brownsville, Ind., over the east fork of the White River, and Morristown, Ind., over the Blue River. Options were taken on large quantities of bridge steel several days before the water began falling and the work of restoration was further augmented by the awarding of contracts for rebuilding bridges that were lost.

The financial loss sustained by the Baltimore & Ohio System, by Districts, was approximately as follows:

Pittsburgh District	$25,000
Northern Ohio District, between Youngstown and Tiffin on the Chicago Main line	150,000
Cleveland District	200,000
Lake Erie District, between Chicago Junction and Newark, O.	100,000
Central Ohio District, including Zanesville terminals and bridge	300,000
Ohio and Little Kanawha District, between Zanesville and Marietta, including Marietta bridge	150,000
Shawnee Branch	25,000
Ohio River District, between Wheeling and Kenova, W. Va.	200,000
Southwestern District, between Parkersburg and Vincennes, on St. Louis main line, including Chillicothe terminals and bridges at Lawrenceburg and Vallonia	650,000
Columbus District	100,000
Cincinnati, Hamilton & Dayton main lines and branches including Hamilton terminals and bridge, Dayton terminals and bridge, bridges at Brownsville and Morristown, Ind., Wellston and Delphos divisions	1,000,000

In the Central Ohio District, the most serious loss was at Zanesville. The Zanesville terminals were practically destroyed, including the shops, freight station and other terminal buildings; a large quantity of high-grade lumber and other railroad supplies and material. The bridge over the Muskingum River at Zanesville was lost notwithstanding the fact that it was weighted down with 20 loaded freight cars which went down with the bridge. The loss of the Zanesville bridge resulted in a break in the main line, necessitating a transfer. A temporary bridge will be erected and traffic resumed over it pending the completion of a new steel bridge which has been contracted for.

The Ohio and Little Kanawha line between Zanesville and Marietta was badly washed at several places. The bridge at



TRACK WASHED, BETWEEN DAYTON AND MIAMISBURG



TRACK CONDITION SOUTH OF NEW RIVER BRIDGE



DESTRUCTION OF ROADBED NEAR MIAMISBURG



ROADBED WASHOUT AT CARLISLE



CROSSING OF OHIO ELECTRIC RY. OVER C. H. & D., BETWEEN TRENTON AND MIDDLETOWN

(Both abutments undermined and broken; C. H. & D. temporary track run through on S-shaped alignment after hoisting wrecked span out of the way.)



NEW RIVER BRIDGE OVER BIG MIAMI NORTH OF HAMILTON, INTACT

(Plate-girder spans, about 10 ft. depth of web. Water flowed 2-3 ft. over the tops of the girders. The L. H. & I. Ry. bridge, 2 mi. south, went out by undermining of the piers.)



AT HAMILTON PASSENGER STATION, A FEW HOURS AFTER THE CREST OF THE FLOOD, LOOKING WEST

(The water flowed south through the city and returned southwestward to the river, which passes around Hamilton with a large westerly bend.)



SOUTH HAMILTON YARD, AFTER THE FLOOD

(Roadbed under tracks scoured out some 15 ft.)

FLOOD DAMAGE ON THE LINE OF THE CINCINNATI, HAMILTON & DAYTON R.R. (B. & O. SYSTEM)

Marietta was carried away, as were also a number of small stations on the division. A temporary bridge will be put in operation until the steel bridge can be replaced; and owing to the fact that the county bridges at Marietta were lost, the railroad has arranged to lay flooring and permit the public to use the structure.

In the Ohio River District, tracks were badly washed, stations carried away and other railroad facilities destroyed. The Ohio River reached a stage of 50 ft. 9 in. at Parkersburg, the highest on record. No bridges were lost in the Ohio River District nor was there any loss of freight on the division, all shipments having been taken to high ground before the flood became serious.

The main line of the Baltimore & Ohio Southwestern, between the Ohio and Wabash Rivers, was badly damaged. Two spans of the bridge across the Miami River at Lawrenceburg were carried away, breaking the main line between Cincinnati and St. Louis. Similar damage occurred at Vallonia, over the west fork of the White River. Temporary structures will be used for train operation until new bridges, which have been contracted for, can be put into place.

The most serious damage on the Baltimore & Ohio System was sustained on the Cincinnati, Hamilton & Dayton. Sections of the line were almost entirely destroyed. At Hamilton, Ohio, the yards were washed out, rails twisted and broken by the water, equipment destroyed and general havoc wrought. The bridge at Hamilton over the Big Miami River was lost and it is estimated that the damage to Cincinnati, Hamilton & Dayton property totaled $500,000.

The Dayton terminals were flooded and the railroad yards were undermined and washed away. The damage to the C., H & D. terminals at Dayton will probably be about $250,000. On the Indianapolis division the losses will approximate $150,000 from the loss of bridges at Brownsville and Morristown, Ind., and washouts.

BIG FOUR SYSTEM

(From J. Q. Van Winkle, General Manager.)

The damage to the lines of the C., C., C. & St. L. Ry., Peoria & Eastern Ry. and Cincinnati Northern R.R. was heaviest in the territory between Columbus, Ohio, and Indianapolis, Ind. Within the above territory, about 40 permanent bridges across the Miami, Olentangy, Mad, White Water, White and Blue Rivers and their tributaries were washed out and either totally or partially destroyed. Besides these bridges, there were numerous washouts of embankment and tracks aggregating 25 to 30 miles in length. The damage to these lines west of Indianapolis was confined to three crossings of the Wabash River at Terre Haute, Ind., and St. Francisville and Mt. Carmel, Ill. At Terre Haute and St. Francisville, the embankment approach at the west end of the bridge was washed out in each case and at Mt. Carmel, some of the pile trestle approaches and trestles across the bottom lands east of the river were washed out, but at none of these three places was the river bridge damaged.

Of eight crossings of the Miami River by these lines, five were washed out. Of four crossings of Mad River, two were washed out, and of three crossings of White Water River, all were washed out.

Of the 40 permanent bridges damaged, 19 will require replacement with steel superstructures, aggregating about 7000 tons. The remainder will be repaired or replaced with concrete structures.

The methods of restoring traffic were confined to those which promised the quickest results, regardless of expense. In cases of washed out embankments where the drop below the grade line did not exceed about 10 ft., the temporary track was laid on the ground and connected with the permanent grade by temporary steep grades and the tracks raised on embankment as soon as possible after the traffic was restored. In cases where there was water to be crossed, or the holes were too deep for the above method, pile trestles were driven. The total length of pile trestle thus driven and in progress at the time of this writing, will be about 5000 ft., much of this requiring piles from 65 ft. to 80 ft. long. Of course, the material required for these trestles far exceeded the amount of emergency material carried in stock, and timber and piling were obtained in the markets wherever available. In one case, a track was laid for four miles on an abandoned grade from Franklin to Miamisburg, Ohio, the right-of-way being obtained within three days from the owners to whom it had reverted when abandoned for the new cut-off line about three years ago.

The largest single structure destroyed was the White Water River bridge west of Cincinnati, consisting of two double-track 165-ft. through-truss spans, built in 1906. The masonry and foundations, however, were much older than the superstructure. The pier and one abutment were washed out and the spans landed fully 200 ft. down stream. A double-track girder bridge across the Miami River in the same vicinity was washed out and seven spans out of eight lost. Only one pier and one abutment remained standing.

On the Miami River crossing north of Middletown, Ohio, consisting of eight spans double-track deck girders, four spans were lost and three piers washed out and one pier tipped over. On another crossing of the Miami River south of Miamisburg, Ohio, consisting of seven double-track 100-ft. plate girder spans, four piers and one abutment were washed out or tipped over so that they must be taken down and one girder span was lost. Both these bridges were built in 1906 and had concrete piers with foundations in gravel extending six to eight feet below the bed of stream.

In one or two cases, the superstructure was swept off the masonry by the force of drift lodged against it, and the masonry was uninjured; but in most cases the damage resulted from scouring of foundations or the destruction of defective, old stone masonry. In at least two cases, the masonry, presumably on rock foundation, was destroyed. In a number of cases, the breaking or overtopping of adjacent embankments by the water saved the bridge from destruction.

The lesson to be learned from the results of the flood points toward deeper foundations and more ample waterway. The widespread character of the devastation comprehending Railroad, County and City bridges, indicates that no one particular structure or one method is at fault, but simply that engineers must take into consideration weather conditions not heretofore considered possible.

TOLEDO & OHIO CENTRAL AND ZANESVILLE & WESTERN RAILWAYS

(From H. E. Speaks, Gen. Superintendent.)

About 10 a.m., March 25, the Scioto and Olentangy Rivers at Columbus overflowed the levees and caused them to break at five points within a distance of two miles, the breaks in the levee being approximately 800 ft., 600 ft. 120 ft., 2000 ft. and 250 ft. This turned the water into the freight yards and stations and the passenger station located on West Broad Street, the water in the passenger station and freight station being 4 ft. deep, overturning 19 freight cars in the freight-house yard and covering the tracks with mud and gravel to a depth of from 2 to 4 feet. In all 88 freight cars, 11 passenger cars and 2 engines were derailed. Approximately 50 freight cars were overturned and piled up in a tangled mass over the main tracks and yard tracks. There was about 15 ft. of water over the yard and it was impossible to get into the yard to begin making repairs until the afternoon of March 30. Between Broad Street Station and West Columbus, both main tracks were washed off the fill for a distance of three-quarters of a mile.

The most serious damage to the T. & O. C. Railway tracks and structures occurred in Columbus but the tracks were damaged at many points on all divisions. No steel bridges were lost, but the masonry was damaged at three important bridges, not so seriously, however, as to delay traffic for any considerable length of time. Trestle bridges suffered considerable damage at all points.

The Zanesville & Western tracks were very seriously washed between Thurston and Zanesville. About 1800 ft. of track in the neighborhood of Mt. Perry was swept off the fill into the creek. The passenger station at Zanesville stood in 12 feet of water and the walls were so damaged that the building was condemned by municipal authorities.

As soon as the waters subsided repair gangs were started at various points on the line. All the regular forces and all extra laborers that could be employed were put to work. We had in all about 1100 men at work. The repair work at Columbus was rendered especially difficult on account of the fact that the bridges connecting the East and West sides were all damaged but one. Military and police took charge of the situation and it was very difficult to get men and supplies through the lines. Men once employed were obliged to stay on railroad property and the Railroad Company was obliged to provide food and shelter for all men employed. Ballast and filling material was shipped in from distant points, a large amount being hauled as far as 200 miles, until such time as it was possible to put the steam shovels at work in the neighborhood of Columbus. The effects will be felt for the next two years and the maintenance-of-way expenses will necessarily be above normal.

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Sleeping Cars on an Electric Railway System are still sufficiently out of the ordinary to attract attention. The Illinois Traction Co., an electric traction system, doing steam railroad work, under a steam railroad charter, has carried 40,000 passengers, during the past year, in its electric sleeping cars and is ordering new cars of this type to meet the demands of an increased traffic.

Damage to Structures in the Indianapolis Flood

By DeWitt V. Moore*

In the writer's article in last week's issue of ENGINEERING NEWS, a general description was given of the conditions during the week of the Indianapolis flood and a brief statement of the damage. The present article is a more complete account with especial reference to the damage to structures. In connection with the points of principal damage an approximate estimate is given but it should be understood that this has been made without definite surveys and is only a rough approximation.

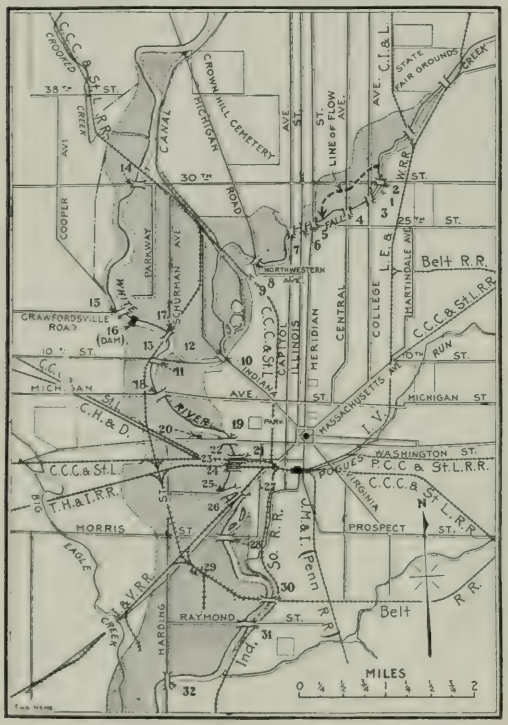


FIG. 1. MAP OF INDIANAPOLIS, SHOWING FLOODED DISTRICT SHADED

[Reprinted from "Engineering News," Apr. 17, 1913, p. 804]

RAINFALL—The report of the Weather Bureau, as previously given, only included the City of Indianapolis, as the flood conditions prevented complete reports from other stations. As a matter of record, explaining the reasons for the abnormal conditions of Indianapolis, it is necessary to give the complete information which is now available from the other stations within the drainage area of White River.

According to the Bureau the rainfall in Indiana for the month of March exceeded all records of the Bureau. The records show 8.91 in. for the month, which exceeds the previous record of April, 1893, by 0.45 in. The rainfall at Indianapolis of 6.01 in., as given in detail in the previous article, was the greatest recorded in the last 42 years, except in July, 1872, when 6.43 in. fell in four days. It is presumed, however, that this latter fall was local in character.

The greatest previous recorded flood in Indianapolis occurred in the latter part of March, 1904, and resulted in large damage, especially to the bridges over Fall Creek and White River. As a result of this previous flood there was much agitation for better bridges and stream improvement which will be mentioned more in detail later in this article. In this flood of 1904 rain began to fall on Mar. 24 and continued for two days with a rainfall of 5.44 in. extending in a general way over the drainage area of White River. The average rainfall over the drainage area of the west fork of White River, which is the "Indianapolis White River," was, in this 1904 flood, as reported from seven stations, 4.97 in. These same seven stations reported for the recent flood an average of 7.81 in., an increase of 2.84 in. The average rainfall over the east fork of White River in 1904 was 4.19 in. and in the recent flood, 8.41 in.

In 1904 the highest point reached by the flood, according to the Indianapolis Weather Bureau gage, was 21.3 ft. This gage was destroyed by the recent flood but the height of the water has been determined by the Weather Bureau as 25.7, an increase of 4.4 ft. At Anderson, Ind., the highest record was 22.1 ft. or 3.3 higher than in 1904. At Shoals, Ind., on the east fork of White River, the gage recorded 22.2 or 8.1 ft. higher than in 1904.

This exceptional rainfall, in connection with the fact that the ground was saturated by previous rains, gave a rapid run-off and it is estimated that the recent flood was 50% greater on the area of the west fork of White River.

FLOOD DAMAGE

In the following detail description, reference should be had to the map (Fig. 1) and to the figures marked thereon. The damage in Sutherland Ave. (1) is shown in part by photograph (Fig. 6). Sutherland Ave. extends along the east bank of Fall Creek between College Ave. and 30th St. and the main track of the Union Traction Co. was located therein. Almost this entire length of street, including track, was washed out and disappeared in the flood. In the background of the view (Fig. 6) can be seen a part of the east span of the 30th St. bridge (2) which is undamaged. About 900 ft. of track was carried down and the main damage to the street was in two sections, one of 300 ft. and one of 600 ft., with a washout of 40 to 50 ft. in width. The bank at this point is approximately 25 ft. in height. The entire length of the street between College and 30th, approximately 1300 ft., was damaged with the main washout as just described. The southeast wing wall of the College Ave. bridge, about 50 ft. long by 8 ft. high, formed a part of this damage. Opposite this point on the north side of the stream there is a small washout of about 150 ft. long by 20 ft. in width. It is estimated that the damage at this point will amount to $50,000 or $60,000 so far as the municipality is concerned and $3000 to $5000 for the Union Traction Co.

As an illustration of how far ranging the flood dam-

*Consulting Engineer, Merchants' Bank Bldg., Indianapolis, Ind.



FIG. 2. RUINS OF WASHINGTON ST. BRIDGE
[No. 19 on Fig. 1.]

age extends and how hard it is to estimate the cost, attention is called to the condition in which the Union Traction Co. finds itself at this time. For a long time the property owners have been seriously objecting to the use of Sutherland Ave. by the Union Traction Co. The Board of Public Works, in meeting this question, proposed that the traction company enter the city by way of Martindale Ave., a north and south street east of the Lake Erie & Western and Monon Rys., thence by way of Massachusetts Ave, passing through the undergrade crossing of these railroad tracks. This would remove the traction line from College Ave., one of the better residence streets of the city. Objections have been made to the Martindale Ave. line on account of the Belt R.R. crossing and the fact that there is not sufficient head room beneath the undergrade crossing. The traction company is, at present, entering by way of a temporary track in order to reach College Ave. The flood damage at this point will no doubt result in a settlement of this controversy. The cost to the traction company will therefore be greatly increased if the new route is taken.

The College Ave. bridge (3) suffered but little damage, except in connection with the washout just mentioned, which destroyed the southeast wing wall. The Central Ave. bridge (4) suffered no damage.

Between Central Ave. and Capitol Ave. (7) the boulevard and permanent roadway on the south bank with the decided curve joining the south abutment of the Meridian St. bridge (5) projected out into the stream and obstructed the flow through the south span. Opposite this point the flood water, as previously mentioned, broke through the bank and reëntered the creek. These conditions resulted in the undermining of the upstream end of the foundations and a setttlement of about 6 ft. in the piers of the bridge. That portion of the boulevard extending into the stream was seriously damaged for a distance of 230 ft., including 200 f'. of wall. It is estimated that the cost of temporary work, removal of the old bridge and reconstruction will cost the city $150,000 to $200,000 and this amount will be increased if, as a result of this flood, the length of the bridge is increased. Reference should be had to the general view of the collapse of this bridge (Fig. 2 of previous article) and the detail view of the damage to the bridge (Fig 4) and the general view of the washout in boulevard (Fig. 3) in this issue. This bridge, which was constructed in 1900 consisted of three spans of about 75 ft. each, with a rise of about 10 or 12 ft. The piers were 10 ft. in width with the foundation approximately 15 ft. below low water. As before mentioned there is no doubt the foundations of the piers were effected by the dredging of the creek to obtain gravel for the constructing of the boulevards, but just how much wash occurred has not been determined by the writer. The bridge was of concrete with stone facing. The thickness of concrete at the crown of the side spans was 15 in. and of the center



FIG. 3. WASHOUT OF RETAINING WALL AND EMBANKMENT ALONG BOULEVARD ON FALL CREEK

span 16 in. The reinforcement consisted of 10-in. I-beams of 25 lb. per ft., spaced 3 ft., c. to c. The plans for this bridge* were made under date of Sept. 11, 1899, by the City Engineer and the Illinois St. bridge (6) was constructed from the same plans, the only difference being in minor particulars.

The Illinois St. bridge passed through the flood successfully, no doubt as a result of the angle of crossing. Neither bridge was on piling. The Meridian St. bridge collapsed on a longitudinal line, being practically the upstream half of the bridge. The west half of the bridge appears to have suffered no harm and by the construction of a temporary railing along the line of fracture, this bridge may be placed in service until such time as plans can be prepared and appropriation made for the complete reconstruction. The current swinging again to the north caused a slide in the gravel fill of the boulevard improvement on the north bank of the creek west of the bridge.

In connection with the boulevard work the south bank of Fall Creek is protected by a concrete wall 5 ft. high from Central Ave. to Capitol Ave. and on the north bank from Central Ave. to Illinois St. These walls were built on piling and were injured very little, except as just mentioned. Some of the older part of the wall was built with separate facing of concrete which has peeled off in a good many cases but this cannot be attributed to the flood.

The Capitol Ave. bridge (7) was not damaged, but there has been considerable criticism on account of the insufficient waterway and the damming of the stream. West of Capitol Ave. the water spread out over the low ground until it was approximately 3000 ft. in width and extended to the west until it met the flood water from White River. This portion of the city was practically all flooded, with a width in all directions of approximately 1½ miles. The Northwestern Ave. bridge (8) was not damaged to any great extent.

The Indianapolis Gas Co. (9), located just west of this bridge and on the south side of the creek, was flooded to the extent of interruption of service only. During this period of interruption gas was supplied through the mains of the Indianapolis Gas Co. by the Citizens' Gas Co., which was so located in the southeast part of the city that there was no interruption in their operation. As a result there was no shutting off of the gas supply, although the quality of gas furnished was not equal to the standard ordinarily available. This statement applies generally, although there were certain cases where, on account of local damage to mains, the gas supply was cut off.

Between this gas plant and the Indiana Ave. bridge (10), a little over a mile directly south, is located the filtration plant of the Indianapolis Water Co. This plant is on both sides of the creek from about 15th to 21st Sts. The water is brought from White River by means of a canal, from a point about nine miles north and then by gravity conduits to the main pumping station (Riverside) (12) and to the secondary station at West Washington St. and White River. On account of the flooded condition and the breaks in the bank of the canal and Fall Creek, the filtration plant was out of the question. Emergency intakes are provided in Fall Creek and White River but these were of no value on account of the breaking in the levees and the flooding of the Riverside Pumping Station, which it will be noted, is directly at the junction of the creek with the river.

At the time of the flood of 1904 the water company was out of commission and it was apparent that better protective work in the way of levees was absolutely necessary in order to avoid a repetition. It is interesting to note that on Mar. 26, 1904, the water company issued a bulletin to its patrons, stating that on account of the breaking of the levees the water had flooded its station to a depth of 3 ft., putting out all fires of boilers. On the same day the water company wrote the Board of Public Works to the same effect, but stating the conditions somewhat more in detail. It is evident that this warning was not heeded as the recent flood resulted in the same conditions but to a greater extent. Indianapolis was fortunate in having no fire of any consequence during this interruption of the water supply, which lasted from 10:30 p.m. Tuesday, till 7 a.m. Friday, Mar. 28.

Between the Indiana Ave. bridge (10) and the West 10th St. bridge (11), there was large damage. On the south side of the creek, 10th St., which is constructed on embankment, was practically entirely washed out for a length of about 3500 ft. In 10th St. was located the high-tension feeder lines of the Indianapolis Traction Terminal Co., which were destroyed for a length of about 4000 ft. This condition contributed to the suspension of street car traffic and had a serious effect on the resumption thereof. On the north side of the creek 2500 ft. of levee, protecting the Riverside Pumping Station (12) was badly damaged, there being numerous breaks. It is estimated that the damage at this point will aggregate $50,000 to $75,000, which should include some repairs to the 10th St. bridge (11), which is damaged on the northwest wing of the west abutment. In this latter case it would seem that the abutment would require reconstructing as there is a crack 6 in. wide at the top and an apparent sliding at the bottom of 2 in. The bridge is apparently in good condition outside of this damage. While the actual property loss at the Power Station was not so large, probably not over $5000 to $10,000, still the loss to the community through the interruption of the transportation service, was beyond calculation.

In the northwest corner at the crossing of the Belt R.R. and West 10th St., is located this new power plant of the Indianapolis Traction Terminal Co. (13). As previously mentioned, the water from White River broke through the levee on the south bank directly north of this point and also through a secondary levee located about half way. These breaks were approximately 1000 ft. in length. This water, in connection with the flood water of Fall Creek, washed out the entire single-track embankment of the Belt R.R. from 10th St. to White River, approximately 1100 ft., and flooded the power house. No damage resulted to the power plant except in the flooding of the machinery and the washing out of the coal supply, siding, etc.

The West 30th St. bridge over White River (14) and the Emerichsville bridge (15) suffered no damage as has been previously reported. Riverside Dam* (16) was previously in bad condition so far as abutments and washouts, but was not further damaged. The Belt R.R. bridge (17) is in good condition, no doubt as a result of the breaking of the levee on the south bank west of the bridge as before mentioned.

*"Engineering News," Apr. 11, 191, p. 258.

*"Engineering News," Nov. 7, 1912, p. 852.



Fig. 4. Wreck of Meridian St. Bridge.
Fig. 5. Railway Embankment at South of City.
Fig. 6. Bank Cutting on Fall Creek near College Ave. Bridge.
Fig. 7. Displaced Abutment. Harding Ave. Bridge.

FIGS. 4 TO 7. VARIOUS DAMAGE DONE BY FLOOD AT INDIANAPOLIS

From 36th St. to 30th St. on the west side of White River and from 30th St. south to the Emerichsville bridge on both sides of the river lies Riverside Park, the pride of Indianapolis. North of 30th St. on the west side is the permanently improved portion of the Park, including the Shelterhouse, Zoo, Golf Links, etc. Serious damage was here experienced. At the east approach of the 30th St. bridge is the Amusement Park or Midway. All of these attractions were under water, and there is no means of knowing how much damage resulted. From 30th St. south along the east bank and some little distance back from the river was located the most beautiful section of the boulevard system. This boulevard was entirely on embankment with improved roadway the entire length of about 7000 ft. with lights on both sides at intervals of approximately 50 ft. Four sections of this embankment were entirely washed out; one of 600 ft.; one of 900 ft. and two of 40 ft. each. The improved roadway was practically all destroyed. Between this boulevard and the river a large number of young trees, recently set out, were uprooted. It is estimated that the damage to the Park in connection with this boulevard construction and the Park Improvements, will amount to from $75,000 to $100,000. This damage is not only of many dollars but of serious inconvenience in access to the park and as a pleasure drive that will be greatly missed the coming season.

The Michigan St. bridge (18) suffered no damage of any consequence. It will be noted that below Michigan St. the entire territory from White River to a line west of the Belt R.R. was entirely under water, the width ranging from a mile to a mile and one-half. It was in this territory that the personal suffering was experienced to the greatest extent. It is almost impossible to estimate the damage to buildings and property including, as it does, residences destroyed together with mercantile and manufacturing establishments. It has been estimated that there are 3000 homes in this territory which demand rehabilitation and this does not take into account those properties which were entirely destroyed nor the manufacturing plants.

The Washington St. bridge (19) over White River was entirely destroyed as previously reported. A good idea of the failure under present conditions is shown by photograph (Fig. 2). This bridge was constructed in 1905 and consisted of a deck girder with concrete floor and stone abutments, piers and railing. Plans for this bridge cannot be located. Part of the recent developments, as a result of the flood of this year, has been the appropriation by the County Council of $200,000 for the rebuilding of this bridge. There is, however, a hitch at this time in proceeding under this appropriation, inasmuch as the County Council has asked that the Indiana Traction & Terminal Co. pay one-fifth of this amount, inasmuch as they occupy one-fifth of the bridge.

In connection with this reconstruction there has been, for some time, agitation for a new bridge crossing White River at New York St., 1500 ft. to the north and 1000 ft. upstream from the Washington St. bridge. In connection with the appropriation for Washington St., $150,000 has been appropriated for New York St. It is doubtful is this latter appropriation will be sufficient.

The next bridge across White River is that known as Kingan's (21). This bridge was the old railroad bridge used by the Big Four R.R. for the St. Louis and Chicago Divisions, the P. & E. R.R. and the old I. D. & W. R.R. When the new Big Four bridge (22), constructed just south of the Kingan bridge, was completed all traffic of these railroads was transferred thereto and the old bridge was used simply for switching purposes and as a cattle bridge for Kingan & Company connecting their plants on both banks of the river. This cattle pass was constructed by brackets or cantilever construction on one side of the bridge. This bridge was entirely destroyed.

The Big Four bridge and the new Vandalia bridge suffered but little damage. Just below is the old Vandalia Main Line bridge (24). This bridge was a complete wreck and piling is now being driven to reconstruct the bridge. Both the new Vandalia and the Big Four bridges extend beyond the river to form an overhead crossing with Perry Ave. No damage existed at this crossing but Perry Ave. was badly washed out and damaged for a distance of 1500 ft.

Immediately south of the new Vandalia bridge and on the west bank of the river a large section of levee was removed by the flood. The Oliver Ave. bridge (25) suffered no damage but the levee on the west side of the river, down to and including a washout of 30 ft. back of the west abutment of the Kentucky Ave. bridge, was entirely washed out and it was through this break that a large part of West Indianapolis was first submerged.

The old I. & V. R.R. bridge, now the Vincennes Division of the Vandalia (26) was practically destroyed, two spans being down and the west span being washed down the river some distance. Next down stream the Kentucky Ave. bridge (27) which, as just mentioned, suffered a damage by the washout of the west abutment.

The Morris St. bridge (28) was not damaged but on the west bank of the river immediately upstream 250 ft. of levee was washed out and there was also some damage to both approaches on the upstream side.

It is estimated that the damage to bridges and levees in this section, from Washington St. to Morris St., a distance of about one mile and located the nearest to the business district of the city and including a crossing of all west and east bound tracks, was damaged, $300,000 to the city and $150,000 to $200,000 to the railroads and Kingans.

The Raymond St. bridge at the City Limits, south, was washed out; 500 ft. of the west approach; 700 ft. of levee on the west bank and a loss of the west span and abutment.

The Harding St. bridge south of the stock yards suffered no damage except the washing out of the north abutment. It is estimated that the damage to these two bridges amounts to from $40,000 to $50,000 (Fig. 7).

Passing from the actual damage along the streams, the damage to the railroad lines within the liimts of the submerged area should be noted.

The Big Four R.R., St. Louis Division and the Main Line of the Vandalia R.R. cross the Belt R.R. on the west side of this flooded district. In both cases the roads are connected by double wyes. All the railroads suffered a large amount of damage at these points (Fig. 5). At the Big Four crossing the Belt R.R. had 1000 ft. of washout of three-track embankment and the Big Four, 450 ft. of two-track embankment on west wye and 350 ft. of single track on east wye. These embankments would probably average 12 or 15 ft. in height. Practically the same condition existed at the crossing of the

Vandalia, the Belt, however, losing only 30 ft. of the three-track embankment, while the Vandalia lost approximately 900 ft. of three-track embankment. The west wye, a two-track embankment, was entirely washed out for a length of 900 ft. These embankments were approximately the same height as just mentioned. The Belt R.R. again suffered a 500-ft. washout at Oliver Ave. about 1500 ft. south of the Vandalia, the height of embankment, however, being much less. The Belt R.R. again suffered a 1500-ft. washout of a four-track embankment 15 ft. in height beginning at the stock yards and extending southeasterly towards the crossing of White River. The railroads experienced a large damage to equipment, the extent of which, however, is not obtainable.

The Illinois Central R.R. tracks are located on the east bank of White River from a point 1500 ft. north of the Belt to a point a mile south. Along the line of the Illinois Central, just north and south of the Belt, the main line was washed out for about one-half mile, but as the construction was low grade, the damage was not heavy. Twelve hundred lineal feet of levee between the railroad and the river was entirely washed away and approximately one-half of the heavy embankment of the Belt R.R. connection was entirely destroyed. On the old I. & V. Railroad at a point one-half way between the river crossing and the Belt R.R., 800 ft. of single track embankment was entirely washed out.

It is estimated that the cost of construction of these main line railroads in connection with sidings, wyes, etc., will cost $150,000 or more and this estimate does not include the loss of equipment. The Belt R.R. reports a loss of $100,000.

The foregoing description is given considerably in detail for the purpose of placing on record definite information. In addition to the damage mentioned there were many miles of streets and sidewalks which were either destroyed or badly damaged and regarding which, information will not be available for a long time. However, roughly estimating this latter damage in connection with estimates above, it is probable that the cost to the City will run from $1,250,000 to $1,500,000.

It is estimated that the loss to the property owners, house-holders and industries throughout the flooded section will approximate $2,000,000.

It is estimated that the loss to the railroads and public utilities within the city limits will amount to $500,000 to $1,000,000.

No consideration has been given in this estimate to any damage in Marion County outside of the City of Indianapolis. The damage, therefore, as just estimated, will range from $3,750,000 to $4,500,000.

Repair and Improvement Work

Immediately following the flood of 1904 there was much agitation with respect to the encroachments on the streams by individual property owners and this agitation led to the passing of an ordinance prohibiting such practice and the instruction that a survey be made and definite bank lines established. The agitation, however, subsided and, probably due to the change of administration, the making of this survey was overlooked. In the course of a short time the encroachment on the streams proceeded as before. Part of this trouble was a result of the question as to whether or not the west fork of White River is a navigable stream. In 1787 the river was declared to be navigable but 37 years ago the Indiana Supreme Court handed down a decision adverse to this law. The result was that the property lines extended to the center of the stream. This question is now again receiving attention and to a greater extent than before. The City Engineering Department is making a comprehensive survey of all the streams within the city limits and as a result bank lines are to be established. This will, no doubt, result in certain cases in the condemnation of much property. The city officials have evidenced a disposition to not trifle any more with the situation but instead to make a careful survey and then enforce the requirements. It is stated that the law passed by the recent assembly prohibiting the filling of streams beyond a line fixed by the Park Commission is a source of relief, without regard to the question of the navigability of the stream.

Immediately after the flood the City Council appropriated $50,000 for emmergency work and afterwards increased this amount by bond issue to $150,000. This money is to be expended for the purpose of repair of levees and construction of temporary bridges and repairs, without regard for the ultimate improvement of the streams.

The General Citizens Committee received voluntary subscriptions closely approximating $100,000. A second form of relief for the flood sufferers was obtained by the voluntary subscription of three thousand persons contributing $100 each for the refurnishing of three thousand homes, or an ultimate amount of $300,000. The city, therefore, is expending $500,000 for immediate relief.

Annual Convention of the National Drainage Congress

The third annual meeting was held at the Planters Hotel, St. Louis, Mo., on Apr. 10 to 12, with an attendance of about 300 from more than 30 states. Addresses of welcome were made by Mr. Lazarus (President of the City Council) on behalf of the city, and Governor Major, on behalf of the state. The latter referred to the establishment of the State Reclamation Commission, which (in conjunction with the State Waterway Commission) will investigate the reclamation of some 4,000,000 acres of swamp-lands and low-lands subject to floods.

The purposes of the Congress are two-fold: (1) The reclamation of swamp and wet lands by drainage; (2) the prevention of floods. It was noticeable that a large number of those in attendance showed more active interest in papers dealing with specific and "practical" subjects than in those relating to general policy. This was indicated by the discussion which followed the papers on "Tile Drainage," "Excavating Machinery" and "Road Improvement."

The proceedings occupied seven sessions. On the afternoon of the last day there was an excursion by special train to the East Side Levee and Sanitary District. This district includes the city of East St. Louis, Ill., and the surrounding bottom lands, and it is being protected against flood by a long line of high levees, with an outlet or diversion channel for the waters of Cahokia Creek. In addition, a large area of land along the river is being

reclaimed by filling in sand pumped from the river by an electrically operated hydraulic dredge. Mr. Edmund T. Perkins, Consulting Engineer, Chicago, was elected President, and Sir William Willcocks, the eminent British irrigation engineer, was elected Honorary Vice-President. The next meeting will be held at Savannah, Ga., in 1914.

National Administration of Public Works

Two systems for the control of rivers by the Federal Government were advocated at this meeting: (1) By a special commission, as provided in the Newlands bill; (2) by a government "Public Works Department," the head of which (or Secretary of Public Works) would be a member of the Cabinet. This latter plan was suggested in a paper by Isham Randolph (Chicago), who proposed that all the constructive engineering work of the government should be in the hands of this department, leaving to the U. S. Corps of Engineers (under the War Department) all works for military purposes. A resolution was adopted strongly recommending this latter plan, and recommending that it should be put into effect as soon as possible. The matter has already been submitted to the President, and steps will be taken to urge the matter upon him and upon Congress.

The Mississippi River

A good deal of attention was given to the control of the Mississippi River, and to the prevention of floods. Both Isham Randolph and M. O. Leighton, of the U. S. Geological Survey, approved of the reservoir system for the Ohio, but pointed out that in many river basins there are no reservoir sites available.

The levee system as applied to the Mississippi River received strong commendation. The address of Col. C. McD. Townsend, U. S. A., President of the Mississippi River Commission, was printed in our last issue. Mr. Fox, Secretary of the Mississippi River Levee Association, declared that as this river is the outlet of waters from many states, it is not right that the people living along it should have to protect themselves from floods. Such protection should be afforded by the general government. So far, $60,000,000 has been expended by the people of the flood areas, and $27,000,000 by the Federal government; the latter expenditure has been chiefly for dredging and bank revetment.

He stated that the levee system of control had been proved sufficient beyond all doubt, but the people of the locality affected had not money enough to complete the system or to make the levees of the size and strength requisite for safety. It is estimated that $58,000,000 will suffice for this work, and he approved the Humphreys-Ransdell bill now before Congress which provides for an annual expenditure of $12,000,000 for five years ($60,000,000); 75% of this is to be for levee work and 25% for bank protection. Mr. Perkins (Chicago) expressed some opposition to this bill, as dealing with only one detail of flood protection work, and he thought this class of individual legislation should give way to a comprehensive control of the river systems by the government.

Mr. Leighton (U. S. Geological Survey) gave an illustrated lecture on the Mississippi basin, showing its varied character, the varied character of engineering works needed for conservation and regulation of its waters, and showing also its great possibilities for agricultural and industrial development if the floods can be controlled and the wet lands drained. Other speakers also dealt with this latter point, showing the enormous area which would thus become available for settlement.

When the resolution was submitted calling for government control of the rivers (as noted above), Mr. Oliver (Cape Girardeau, Mo.) made a motion to include in it an indorsement of the proposed plan for improving the Mississippi River and appropriating funds for completing the levees. This was strongly opposed, not on the ground of opposition to the project in itself, but on the ground that the Drainage Congress should deal with matters of principle and policy, and not weaken its position by seeking to support or encourage individual projects. Furthermore, it was urged that this "pork-barrel" system of promoting appropriations for individual projects is one of the things the Drainage Congress is opposing, since it stands for a system of river regulation on a broad and comprehensive plan, leaving the question of the relative merits of individual projects to the consideration of the men who administer this system. After rather heated discussion and some "impassioned oratory" urging the indorsement of the Mississippi River project as a matter of sentiment, the amendment was rejected by a large majority vote.

Land Reclamation by Drainage

Several papers related to the possibilities of great development by the drainage of wet lands, in both small and large areas. Mr. Morgan (Memphis), in a paper on "The St. Francis Basin," questioned whether the government should assume control of such work, and considered that drainage is already keeping pace with the demand for land. In this basin most of the territory has been organized into drainage districts, while a certain part of the territory cannot be reclaimed profitably until the market value of land is much greater than it is at present. On the other hand, he thought the government could assist very materially in two ways: (1) By supervising the engineering work and working out the hydraulic features, instead of undertaking to promote individual projects; (2) by assisting drainage development by guaranteeing the bonds (under proper regulations) so that a lower rate of interest could be obtained.

Dr. Pratt (State Geologist of North Carolina), presented a paper on "Reclamation of Swamp Lands in North Carolina," and H. M. Cottrell (Rock Island Lines) discussed the opportunities for the investor and the farmer in reclamation projects, laying stress upon this as a means of checking the emigration to Canada.

A paper on "Tile Drainage and Its Relation to Floods," by C. G. Elliott (U. S. Department of Agriculture) received special attention and was followed by a brisk discussion in the shape of questions upon specific points.

A paper on "Excavating Machinery" by Prof. A. B. McDaniel (University of Illinois) described in brief a variety of machines used in excavating canals, ditches and trenches, and covered much the same ground as a paper in our issue of Feb. 23, 1911. He was of the opinion that carelessness is too often evident in construction and repair of the machines, parts being made of insufficient strength until repeated breaks lead to these parts being made a little stronger, a practice which is expensive and unsatisfactory. In regard to trench machines of the chain type it was suggested that they might be so ar-

ranged as to deliver the excavated material behind the machine (as backfilling) instead of along the side of the trench, and in the discussion it was shown that such machines have been built. While the ladder dredge is little used in this country (except for placer mining), a case was mentioned where such a machine had been used in a drainage canal or ditch in Iowa. Reference was made to the lack of complete and reliable information as to the cost of work done by excavating machinery, and greater attention to the keeping and use of cost data was advocated.

THE RELATION OF DRAINAGE TO PUBLIC HEALTH

This aspect of the subject was dealt with by Dr. Evans (Chicago), who pointed out that one of the most serious effects of a flood is the aftermath of sickness and disease, resulting both in death and in temporary or permanent loss of efficiency. Thus in a flood in the Wabash Valley the flooding of privy vaults caused the pollution of wells, with a resultant epidemic of typhoid. The address dealt more especially, however, with the so called malarial condition of swamp and wet lands; and the enormous aggregate loss of human energy and efficiency due to this. The work of the United States authorities on the Panama Canal and in Cuba shows what can be done, and as far as the disease-spreading work of the mosquito is concerned this could be practically eliminated in a period of five years. As to the industrial value of such work, it would not only open up large areas of land for settlement, but in districts now known as malarial, the value of land would increase as soon as it became known that malaria had been eliminated.

A National Malarial Congress was organized during the meeting by representatives of a number of state and other health and sanitary associations, for the purpose of taking steps to wipe out this cause of disease and inefficiency. It is to hold meetings annually, in connection with those of the drainage congress. Dr. Dowling, of the State Board of Health of Louisiana, was elected President.

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Tile Drainage and Its Relation to Floods*

BY C. G. ELLIOTT†

Importance of tile drainage is recognized by eminent foreign agriculturists and rural economists, and its extension has been promoted and substantially fostered by European governments.

England, under the Public Moneys Drainage Act of 1829, appropriated $20,000,000 to be loaned to owners of estates at a low rate of interest for tile draining their lands, the work being performed under government supervision. The fund was exhausted in a few years, and private land improvement companies were authorized to grant loans for the same purpose. France granted similar substantial aid about 1850, and as a result the popularity of the improvement outgrew the government funds in that country also, and was afterward carried on by private enterprise.

Tile drainage was introduced into Belgium and Germany where it produced as happy results as in England and France. These governments actually established factories for the manufacture of tile, and appointed stations for its sale at low rates so as to place them within the reach of practically every tenant and landholder. Experiments conducted by the government at various times convinced even the most skeptical of the great advantages to be derived by underdraining.

The progress of this art, which has everywhere proved so valuable to agriculture, has been somewhat intermittent in the United States, but the results have been most satisfactory. From 1835, when tiles were first laid by John Johnston in the refractory clay soils of his farm near Lake Geneva, N. Y., the movement has been passing westward through the level lands of the great corn belt, and is now extending southward.

DRAINAGE AND RUN-OFF

The assertion has been made that underdrainage will make land more susceptible to drought. The prediction has been made that if the surplus water were withdrawn by underdrains, the soil would become too dry for the support of crops during seasons of light rainfall. This has been shown to be a fallacy, particularly in clay and other retentive soils. The writer gathered data from various parts of the country upon this point during the abnormally dry season of 1901, and learned that the crops on well drained land better maintained their freshness and made a greater yield than those upon adjoining similar land which had not been drained.

When tile drainage began to be extensively practiced in England, mill owners became alarmed and asserted that draining the land would dry up the streams and ruin their water power. Careful measurements of the run-off from a certain drained tract were made under the direction of J. Bailey Denton, the eminent drainage engineer, for a period of two years, and the results were given by him in a paper read before the Institution of Civil Engineers in 1877. The deductions were that the annual discharge from the drained area was in no instance decreased by the method of draining, but rather slightly increased. This was explained as being due to the decreased amount of evaporation from the drained land as compared with land which carried water upon its surface. The paper became the subject of discussion by members of the society, who became convinced that tile drainage did not materially change the volume of run-off, but that it distributed the flow over a longer period. The question appears to have been settled to the satisfaction of the English engineers and has never provoked discussion since that time.

With reference to the opposite phase of the question, the opinion that underdrainage increases the flow from outlying areas into the arterial streams, prevails to some extent. This is based upon the theory that the removal of water in sufficient quantities to make land arable will necessarily increase the volume of flow in a unit of time. The writer, who is acquainted with many of the level tile-drained areas of Illinois and Indiana, and with the streams which receive their waters, dissents from this view. No measurements of flow before and after the drains were installed have been made. Any evidence upon the matter is derived from personal observation and the memory of those who have been closely associated with the lands and their streams. The area lying at the head of the Big Vermilion River in Illinois may be taken as an example. These lands have been changed from wild prairie into cultivated and well improved farms, and in order to bring them into a high state of cultivation nearly the entire area has been tile drained. As nearly as can be learned, the floods of the river are not as great as they were in the early days when the land was native prairie, through which flowed the sluggish drains provided by nature. Owners of bottom-land contend that they suffer no more from high water than they did 20 years ago. The writer distinctly remembers certain shallow sloughs and watercourses, which became boating streams during March and June floods under original natural conditions, but which are now cultivated fields, the drainage being carried underground by a few tile drains of moderate size.

The action of tile drains upon the land is quite different from that of the open ditch, both with respect to the soil itself and the flow from it. The former remove the surplus water uniformly from the several portions of the field down to the horizon at which the drains are laid. Under such conditions the soil becomes permeable and is placed in a condition to receive the rain as a reservoir would receive it. Before the entire soil becomes saturated the water begins to flow from the drains and continues to do so until the surplus is removed from the several zones of depth. The volume is that distributed over a considerable time instead of accumulating upon the surface and moving off in a flood volume, as is the case where there is no underdrainage. Where tiles have been substituted for an open-ditch system, it has been noted that the outfall ditch never carries the volume of water per unit of time that it did when the open ditch system was in operation.

The use of tile drains is not limited to level lands, but they are equally efficient on wet lands which have abundant slope, where the soil is a stiff clay. They not only affect

*Abstract of a paper read before the National Drainage Congress, at St. Louis, Mo., April 10, 12.

†Chief of Drainage Investigations, U. S. Department of Agriculture, Washington, D. C.

the physical condition of the subsoil, but effectually prevent the rapid flow of water over the surface and into the near-by streams. Drainage results in conserving the soil water as well as in removing the surplus water.

The terracing of hillsides is another method of checking the rapid discharge of rainfall down the slopes, and in a measure accomplishes for the hills what drain tiles do for the level lands. Tile drainage of wet lands, terracing of hills and slopes, together with the intelligent management and cultivation of lands, are practical and valuable methods of lessening the severity of stream floods and the overflow of valuable creek and river bottom lands.

The scope of the work in underdrainage is widening each year. Waste lands are being eliminated from farms, to the great advantage of their owners and to the community in which they are located. Instead of being limited to small fields, as was once the case, large areas are included in systems which involve the use of tiles as large as 36 in. diameter. The quality of tile is being investigated, trenching machines are used to diminish the cost of ditching, and factories for the manufacture of tile are kept in constant operation.

It should be understood, however, that there are limitations to the use of tile drains. They require the preparation of adequate outlets, without which they cannot be used successfully. They should not be used in places where large open canals are required to carry the water.

The depth of drains is limited by the character of the soil, and the size by the amount of rainfall, the physical structure and slope of the land, and the grade upon which they may be laid. In some cases silt wells, surface inlets and automatic gates are required. In some soils it is not practicable to lay drain tile without costly and careful preparation of the bottom of the trench.

Thousands of miles of drain tile have been laid without previous plans or surveys, but the losses due to such careless work only prove that the best work is none too good and is worth its additional cost.

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Flood Prevention, and a Government Department of Public Works*

By Isham Randolph†

The people of the United States are paying a tribute of millions of dollars to the voracity of floods. We now demand that Congress pay millions for a defense which will shield the people from these floods. What is the remedy? This great government of ours needs a new department, the Cabinet a new portfolio.

Our national defense is cared for by two departments (War and Navy), each headed by a Secretary. State-craft has its portfolio. The vital importance of agriculture is recognized. Our fiscal system is administered by the Secretary of the Treasury. Through the Postmaster General, our President keeps in touch with the needs and the accomplishments of our postal service. An Attorney General represents the strong arm of the law. Labor has a voice in all of the intimate councils. The Secretary of the Interior looks after the nation's wards and is a watchful guardian of what is left of the public domain.

But what of our public works? Who cares for them? The answer is that they are parceled out among the departments, whose chiefs have enough resting upon them to burden the greatest minds in the right discharge of the duties which are legitimately theirs. Public buildings come within the jurisdiction of the Secretary of Treasury. Why? Is a mind trained in the school of finance peculiarly fitted to pass upon the architectural design or structural fitness? Our internal improvements, other than architectural construction and reclamation of arid lands, are entrusted to military engineers. The War Department controls them. Why is this? Does a training in the art of war fit a man to plan and execute the public works of peace? We need a National Department of Public Works, and its executive head should be a member of the President's cabinet. This belief does not minimize my appreciation of the army engineer and the U. S. Corps of Engineers. But West Point does not graduate men enough to supply the engineering needs of a land like ours. The natural consequence is that they seldom work together, one engineer in a place is the rule and one West Point graduate cannot single handed, do the engineering work of the job to which he is assigned. Hence he must secure the services and surround himself with men educated in the school of experience or in one or other of our great civil engineering schools. The result is apt to be, and too commonly is, that the West Pointer becomes the executive officer; the civilian does the engineering and the officer approves it.

The number and rank of army engineers in service are as follows: One Chief of Engineers with rank of Brigadier-General, 12 Colonels, 19 Lieutenant-Colonels, 39 Majors, 51 Captains, 47 First-Lieutenants and 19 Second-Lieutenants. All told, 118 men. Numerically, not enough to conduct the engineering operations of the Pennsylvania R.R.

Of these, 11 are engaged in building the Panama Canal, two are in the Philippines, one in Hawaii and 14 are detailed as instructors at West Point and other training schools. This leaves 90 men to cope with all the engineering requirements of the United States and its territorial possessions, an aggregate area of 3,742,583 sq.m. with a coast line of 48,881 miles and a navigable river system in the United States proper of 26,410 miles.

With 75,000 sq.m. of swamp land to be drained and protected, and 1,200,000 sq.m. of arid lands to be reclaimed by irrigation, my argument for a National Department of Public Works rests upon the facts recited. For lack of such a department some of the gravest problems confronting our fullest material development and welfare of our people have gone too long unsolved.

[The proposition for a U. S. Department of Public Works, headed by a cabinet officer, as put forward by Mr. Randolph was embodied in a resolution presented to and adopted by the National Drainage Congress. In this resolution no attempt was made to outline the organization of such a department, but a proposed bill accompanying the paper quoted above set forth that the Secretary of Public Works (to be appointed by the President) should appoint a Commissioner of Public Works who should be an engineer of recognized ability and experience. The purposes of the department would be as follows: 1, to carry out all constructive works, such as public buildings, levees, dams, roads, bridges, etc., authorized by Congress; 2, to secure physical data as to rivers, swamps and arid regions, to make topographical surveys, and to study meteorological data with a view to determining flood expectancy; 3, to select sites for flood-water reservoirs and water-power development, and to study problems of drainage and irrigation. It should consider first works whose importance or necessity has been demonstrated by disasters.—Editor.]

*Extract from an address before the National Drainage Congress at St. Louis, Mo., April 10. Mr. Randolph's suggestion was embodied in a resolution adopted at the meeting, as noted at the end of this article.

†Consulting Engineer, Chicago.

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The Status of the Engineer

At the meeting of the American Institute of Consulting Engineers on Mar. 11 the subject of the professional relation of the engineer, which was considered at the January meeting, was further discussed. Following are brief extracts from the remarks of the various speakers:

LINCOLN BUSH—If the engineer be required to limit himself to purely professional functions with elimination from commercial problems, he will fall far short of that great usefulness which his education and efforts would otherwise accomplish. Good engineering, from the inception and design of work through to its finish and on to its management, has opened up a decidedly greater and broader field for the engineer than has ever existed heretofore. While engineering as a profession may in time be overshadowed by this broader field, the engineer will never cease to exist. If engineering becomes more of a commercial asset, I believe the engineer and the community will be better off for it. The measure of an engineer's qualifications for better remuneration and position is gaged by his ability to accomplish efficient, economical results. I am not in favor of bolstering him up by any license system or legal enactment. Such legislation should be for the protection of the weak and the restraint of the unscrupulous. Neither of these conditions apply to the engineering profession.

J. E. GREINER—It seems to me that the laudatory phrases of engineering indulged in by lecturers and professors to inspire enthusiasm in engineering students indicate that their optimistic authors see the ring of the doughnut but not the hole, while the pessimistic engineers who believe we are doomed as professional men see only the hole in the doughnut and not the ring. If we set off one side against the other we will have a middle course. The engineer is neither a co-partner with the gods nor a member of a skilled trade; but the real engineer is an educated and experienced man, above all endowed with good

common sense. The man who is practicing engineering in the sense which real engineers understand the term is beyond question a professional man.

There are a large number of people who call themselves engineers simply because they may have had engineering schooling and because they may have held a leveling rod, or inspected materials, or maybe made detailed drawings for engineers. Again, there are a large number of men who were educated as engineers but who are simply salesmen. Others have gone into corporation management and all kinds of industrial business. Many of these men may be engineers and good ones, but they are not practicing engineering. They abandoned this to become business men.

Neither are inspectors, draftsmen, country surveyors, chainmen, rodmen and levelers on an engineering corps in the practice of engineering. They are simply on the outer borders, doing work connected with engineering. Those in such occupations are not necessarily engineers, though there is nothing to prevent them assuming the title if they so desire.

It seems to me that instead of the engineering profession being on the down grade, it is on the up grade; and if it is passing through a transition period, the transition will simply mean the separation of the professional from the commercial engineer.

It still remains for the national engineering societies or our own Institute to adopt regulations which will establish a man's standing either as a professional or a commercial engineer. Our own Institute is limited to independent or consulting engineers. Some other Institute will have to take care of those other professional engineers who are not in independent practice, but who are just as much professional engineers as any member of this Institute. Whether the licensing of engineers will be the solution of the question or not, I am not prepared to say, but I would be in favor of an association which would have full legal authority to determine who shall and who shall not be entitled to practice as engineers.

EUGENE W. STERN—I do not believe that the consulting engineer in connection with building construction is any more the middle man who should be eliminated than that the architect is the middle man, the one being just as necessary as the other. Some, who call themselves consulting engineers, prepare only the design and then throw all the responsibility of the execution of the work on the architect. The service they thus give is no more than that which a draftsman with a knowledge of design in that particular question could give, and the rendering of such perfunctory service has unfortunately lowered the status of the engineering specialist in the minds of many prominent members in the architectural profession and even among contractors.

The conscientious architect will see to it that the client's interests are properly safeguarded by himself employing competent specialists, but in far too many cases this it not done and the client's interests suffer, for either the specialist's work is indifferently done in the architect's office or he employs so called specialists, or calls on the contractor to loan him the services of his engineer.

An architect is doing his client's interests grave injustice when he allows himself to be under such obligations to the contractor. Furthermore, he is placing the contractor's engineer in a false and difficult position when he asks him to serve two masters.

A firm of well known contractors made the structural design for a large building for an architectural firm which was so obviously padded with unnecessary metal that after the plans had been issued for bids suspicion was aroused and I was called in to check over the work. A new set of plans were made and a saving effected of between $40,000 and $50,000, almost 10% of the total cost of the work.

I feel that I am making a perfectly safe statement when I say that were the loss of life and property and waste of material which occurs in reinforced-concrete and steel construction in this country annually capitalized it would pay the fees of all the competent consulting engineers in this country one hundred fold.

S. WHINERY—The great majority of the reputable engineers of the country will welcome a project for the official recognition of the profession of engineering and for the reasonable regulation of professional engineering practice. Any such scheme should be broad enough to embrace all the different branches of professional engineers; it should provide for the largest degree of control within the profession itself of practical measures and methods for regulating professional organization, conduct and practice. There should be a minimum of statutory enactments and a maximum of administrative authority within and by the profession. In short, the state law should permit a large measure of what may be called the home rule in the profession.

Such a proposed law might create a state board of, say, five members to be appointed by the governor in the following manner: Each of the four great national engineering societies would nominate three men from among whom the governor would select and appoint one member of the board, the fifth member to be selected by the governor upon his own initiative. This board should be empowered by law to exercise general supervision and control over the professional practice of engineering.

The board would divide the whole field of engineering into such branches, and these branches into such subdivisions or grades as deemed necessary. Applicants for registry would be examined in one or more of these branches and certificates issued accordingly. Thus, a civil engineer might be registered to practice either one or several specialties, or in the grade of junior engineer, assistant engineer, senior engineer, or consulting engineer.

The board would be empowered to formulate codes of ethical conduct for the control of engineering practice and the protection of the public and to cause the arrest and prosecution of persons practicing the profession without authority or transgressing the ethical codes. Such a scheme would establish the profession of engineering upon a well defined basis and give it a character and standing with the public that is impossible under present conditions.

It might reasonably be expected that if a wide, comprehensive scheme of this kind were worked out and applied in a great state like New York, other states would from time to time adopt practically identical measures.

L. C. HOLDEN—Perhaps the greatest difficulty that presents itself to engineers in their ambition to establish themselves as a purely professional body is the absolute need of engineering draftsmen by the great manufacturing and contracting concerns. A young man graduates from a technical school and finds himself thrown upon the world with the necessity of self-support. He follows the line of least resistance and becomes a corporation employee with the expectation and hope that conditions will change and enable him to practice his profession individually. In the great majority of cases these men become settled and dependent upon their positions, lose courage and initiative, and allow themselves to be used in any capacity desirable from their employer's standpoint. They cease to become engineers as they hoped to be and are draftsmen or salesmen. When one thinks of the vast interests that are operating under these conditions, it makes the fight of the professional engineer appear one of great difficulty.

OWEN BRAINARD—A law is pending in New York for the registration of architects. Personally, I am not in accord with this proposition and I am quite positive that any similar law for the registration of engineers or the licensing of them would not help you in the general effort to protect the profession and the public from incompetent men.

I suggest that it may be possible to secure better protection for the profession and the public by some sort of control through the official scrutiny of design, as we have in municipal work in building inspection. I have felt for some time that the design for a bridge or for foundations for any structure should be scrutinized either by a municipal bureau or a state bureau.

ALLEN HAZEN—I have felt very strongly about this matter of state control. If the state licenses every engineer, then every man who performs some useful function in the profession, however small, is entitled to recognition and to license. No one can be refused. Thus the way will be open for men of small experience who are licensed to use their license as a means of getting important business that they may not be qualified to handle.

GUSTAV LINDENTHAL — Concerning registration and licensing, I share the opinion of Mr. Hazen, that it would do more harm than good. You will have to let anyone in. You cannot exclude anyone without giving a good reason and the country surveyor cannot be rejected, because he is a man who is highly regarded by his neighbors.

This is a time of transition in the engineering profession. We have overlooked the relation of the beginner to the master. Everybody wants to be the master. There is a feeling that one man is as good as another. Why should he not be if he has passed through an engineering school?

I do not think relief lies in the direction of legislation. Things will settle down eventually to a more stable condition, but it will not be by legislation or the aid of Regents or titles, but it will be by standing together and a small number can do that better than a large number. It is well known that the large engineering societies shun the question of the status of the engineering profession for fear of offending members.

The Derailment of an Excursion Train on the Montreal-Chambly branch of Central Vermont Ry., about 4½ miles from St. Lambert, Que., resulted in the deaths of seven persons on Apr. 13. The telescoping of the ends of the derailed coaches is reported to have been the cause of most of the fatalities. The train was crowded and many passengers were riding on the platforms.

The Derailment of an Electric Car on a pile trestle across the Patapsco River at Baltimore, Md., caused the death of one passenger and injuries to 25 others on Apr. 8. The trestle was about 12 ft. high and the water but 4½ ft. deep so that most of the passengers were able to escape with slight injuries.

An Express Passenger Train Was Wrecked by a Snowdrift on the Union Pacific R.R., 2½ miles west of Cheyenne Wells, Colo., on Apr. 10. The train, known as the St. Louis-Colorado Limited, was drawn by two large locomotives. The wreck is said to have been due to the striking of a drift of heavy snow while the train was moving at about 20 miles per hour; the pilot of the leading engine was torn loose and fell under the forward trucks, throwing the locomotive over on its side. The second locomotive was also overturned and thrown about 30 ft. to one side of the track. The first three cars were derailed but remained upright. The driver of the second locomotive was killed and several mail clerks and passengers more or less injured.

A Premature Explosion of Dynamite being used to fill some 90 drill holes in the excavation between the Miraflores and Pedro Miguel Locks, Panama Canal, caused the deaths of 3 laborers and injuries to 23 others on Apr. 19, according to press dispatches. Reports state that the accident occurred in the afternoon after about 21,000 lb. of the explosive had been placed in the drill holes and warning was about to be given the workmen to retire to a safe distance.

The Explosion of the French Army Balloon "Zodiac," near Noisy-le-Grande, on Apr. 17, caused the deaths of four army officers and a civilian. According to newspaper reports the five occupants of the car were considerably shaken up before the explosion occurred, for the car had been thrown successively against a chimney, a house and some telegraph wires.

The Explosion of an Ammonia Tank at one of the plants of the Moore Ice Co., Pensacola, Fla., caused the death of four men on Apr. 10. The tank is said to have contained approximately 2000 gal. of ammonia.

Steel Sheet-Piling for use in emergency protection of Mississippi River levees, has been furnished to the amount of 750 tons. The Carnegie Steel Co. received an order at its Pittsburgh office on the night of Apr. 7, for 1250 pieces of sheet-steel piling. As not all of this material was in stock, the beam department put on every available man to facilitate the rolling of the order, and it was loaded on twelve cars at noon, Apr. 10. A special train left Pittsburgh at 5:13 p.m. the same day, and because of washouts was detoured through West Virginia, arriving in Cincinnati at 8:19 a.m., Apr. 12. The shipment reached New Orleans at 3:15 a.m., Apr. 14, and is now being driven.

The State Department of Efficiency and Economy of New York, referred to in our editorial columns of Feb. 20, has been provided for in a bill signed by Governor Sulzer on Apr. 15. The New York "Times," of Apr. 16, quotes the Governor as saying that his Commission of Inquiry has "fully demonstrated that the business and the financial affairs of the state have been conducted without system, extravagantly, and with divided responsibility, in a manner which would bring bankruptcy and ruin to any business not having the resources of the state." A commissioner of the new department is to be appointed by the Governor at a salary of $12,000 per annum, for a term of five years. The commissioner is to have the power to investigate any other state department having to do with the business methods of the government. The commissioner is to report to the Governor and to the heads of the departments plans for improvement in the administration of their offices. The commissioner is empowered to appoint his necessary assistants and to fix their salaries.

Another bill the Governor signed on the same day creates a State Board of Estimate, the duties of which are similar to New York City's Board of Estimate and Apportionment. It is to prepare the annual budget for submission to the Legislature. The board will be composed of the Governor, Lieutenant Governor, President pro tem of the Senate, Chairman of the Senate Finance Committee, the Speaker of the Assembly, the Chairman of the Assembly Ways and Means Committee, the Controller, the Attorney General and the Commissioner of Efficiency and Economy.

The Bill Giving the Minnesota State Board of Health supervision of water-supplies and sewage disposal, commented on editorially in our issue of Mar. 27, 1913, has been withdrawn from the legislature by H. H. Harrison, of Stillwater, the introducer of the bill. We are not informed as to the reason for its withdrawal, but assume that it was because of so much opposition that the bill seemed certain of failure. Apropos of our suggestion in the editorial named that the support of the local engineering societies at St. Paul and Minneapolis might have been or might be secured for the bill, we have been informed that some two years ago the bill, or one substantially like it, was taken up in conference with a committee of the Engineers Society of St. Paul, which committee made no objection to the bill. It was also laid before members of the Engineers Society of Minneapolis, who did not see fit to support the bill. We are also informed that the bill and our editorial comments upon it were scheduled for discussion before the Engineers Society of St. Paul on Apr. 14—the program very likely having been arranged before the withdrawal of the bill from the legislature.

The Commission Plan of City Government was adopted at Jersey City, N. J., on Apr. 15, by a vote of 11,422 for to 7116 against, giving a majority of 4306. On the same date Bayonne and three other New Jersey cities in Hudson County voted against the plan. Bayonne defeated the plan by a majority of 295; Hoboken by a majority of 403, and Union Hill by a majority of 824. Candidates for the five commissionerships at Jersey City will be nominated at a primary to be held on May 13 and the election will be held on June 10 following. In 1911 the Commission Plan was defeated at Jersey City by a vote of 13,068 to 11,585. The adverse vote in 1911 was slightly less than the favorable vote in 1913, but the adverse vote this year dwindled considerably.

Seventeen Amendments to the Charter of Los Angeles, Calif., were passed on by popular vote on Mar. 24, and all but five were carried. Of the four defeated amendments one was designed to make the park commission largely independent of the city council, one provided for a return to ward representation, with 15 ward councilmen and 6 elected at large, in place of the present 9 at large, and one fixed the salaries of councilmen so elected. Another defeated amendment would have created an electric harbor board, largely independent of all other city officials, and with power to grant 40-year franchises. In opposition to this harbor-board amendment one was carried which provides for three harbor commissioners, appointed by the city council, and with franchise safeguards in the interests of the people; and with a provision that no single person or corporation should be granted more than 3000 ft. water frontage unless the grant be authorized by a referendum vote, and even then the limit is to be 5000 ft. Other amendments enlarge the city's municipal ownership powers and permit the city to exercise any power within the right of any other California city "and to engage in any business that may be specifically authorized by a vote of the electors"; limit all franchises to 21 years, except that under certain conditions subways and elevated railroads may be given 40-year franchises, with possible 10-year extensions; give the city council ordinance control over all appointive boards and officers except the civil service commission, and charge each councilman to keep posted on one of nine branches of the city business, but with no administrative powers; require daily sessions of the council and fix the salary of the mayor at $4500 a year and the other councilman at $2400 each; call for a new election of mayor and councilmen in June of this year; and abolishes the "Los Angeles Municipal Newspaper."

The City of Chicago's Share of Street-Railway Profits for 1912, is reported to be $2,500,992, which is $695,048 more than it received in 1911, and in excess of any year's apportionment during the six years the present ordinance has been in force. The total amount which the city has so far received, including the present year's allowance, is $10,334,200 which, with accrued interest of some $400,000, makes the city's special traction fund now approximately $10,730,000.

The Chicago settlement ordinances were described in "Engineering News," Mar. 10, 1910, and Sept. 19, 1912. It will be remembered that the companies are allowed 5% on an agreed book valuation of their property, after their operating expenses (including maintenance, renewals, accidents reserves and taxes) have been paid. Then the net return is divided, 55% going to the city and 45% to the companies. The city's share is placed in a fund for the purchase and construction of railways.

An Unusual Amount of Typhoid Fever at Zanesville, Ohio, has been reported since the recent floods in that city. The following information has been kindly supplied to us by W. H. Littoe, Chief Engineer of the Ohio State Board of Health, en-

der date of April 17: During the past three weeks 27 cases of typhoid fever have been reported at Zanesville. It is believed that not all cases have been reported. Most of these reports have been received since the floods. Even the number reported is larger than the normal for the city. Regardless of flood conditions, the water-supply at Zanesville is of such unsatisfactory quality as to cause a rather steady high typhoid rate. A plant for treating the water-supply, which is drawn from the Muskingum River, was nearly ready for operation on Apr. 17. It will consist of a dissolving tank and three 1200-gal. solution tanks, connected with a constant-head orifice feed tank. The solution will be discharged from the feed tank through a grid into the suction well of the pumps. The plant will be capable of treating as much as 11,000,000 gal. per day. The provisional rate of treatment will be 25 lb. of bleaching powder per 1,000,000 gal., or one part per million available chlorine.

Flood Flows in New York State during the month of March, 1913, established new high records at many points. The following table gives preliminary results of the maximum discharge at various points determined by the Water Resources Branch of the U. S. Geological Survey:

Station	Max. discharge	Drainage area	Sec.-ft., sq.mi.
Hudson, Spier Falls	100,000	2,800	35.8
Hudson, North Creek	28,200	804	35.1
Sacandaga, Hadley	29,000	1,060	27.4
Cattaraugus, Versailles	25,000	467	53.6
Genesee, Rochester	50,000	2,360	21.2
Genesee, Jones' Bridge	17,700	1,410	12.6
Salmon, Pulaski	10,800	260	41.6
Ausable, Ausable Forks	22,000	487	45.2
Chemung, Chemung	52,500	2,440	21.5

Levels are now being run by U. S. Geological Survey to determine the elevation of the crest of floods at the various gaging stations.

The Flood in the Mississippi is passing down the river at a slightly higher stage than the record flood of 1912, but so far the levee breaks have been comparatively few and the damage by overflow slight. On Apr. 21, the stage at Natchez, Miss., well below the flood crest, was 51.6 on a rising river. The previous high water there was 51.4 in 1912.

Motor Vehicle Accidents resulted in 967 deaths in New York State in the two years 1911 and 1912, according to the report made by the Secretary of State to Governor Sulzer on Apr. 19. Besides this number killed, 6107 persons were reported seriously injured. In the Borough of Manhattan, New York City, alone, 585 persons have been killed outright and 4068 seriously injured since 1911.

Eight Proposed Los Angeles Bond Issues totaling some $16,000,000, were subjected to popular vote on Apr. 15. Only two issues were carried: $1,500,000 for a pipe line from the end of the Los Angeles Aqueduct to the city and $2,500,000 for harbor improvements. The defeated issues were for conduits to carry the surplus waters of the Los Angeles Aqueduct for sale for irrigation purposes (see long article in our issue of Mar. 13, 1913); for distribution of electric current generated by the aqueduct hydro-electric plant; for a municipal railway at the harbor; for a city hall and for buying a piece of land for municipal purposes. The power bonds had a heavy actual majority, but it was just under the legal two-thirds. The other issues that failed were badly beaten.

Two Very Large Steamships for the transatlantic trade were launched during the past fortnight. The "Vaterland," hitherto announced as the "Europa," of the Hamburg-American line, was launched on Apr. 3 at Hamburg, and the "Aquitania" of the Cunard line, was launched at Glasgow on Apr. 21. These two ships are to be the largest vessels in the world and, with the Hamburg-American liner "Imperator," which is due to reach New York on her maiden voyage some time in May or June of this year, will be the only vessels over 900 ft. in length entering New York harbor. It will be remembered that the present agitation in New York for 1000-ft. piers is based entirely on the coming of these vessels.

Below is given a tabular statement of the dimensions of these three ships, the White Star liner "Olympic," the present largest ship in service, and the "Mauretania," only recently the record holder

Ship	Gross tonnage	Length, ft.	Breadth, ft.	Date
"Mauretania"	32,000	760	88	1907
"Olympic"	45,000	882	92	1911
"Imperator"	50,000	900	96½	1913
"Aquitania"	50,000	901	97	Building
"Vaterland"	50,000+	950	100	Building

The Cunard liners "Mauretania" and "Aquitania" are much faster than any of the other three ships noted in the table.

PERSONALS

Dr. Willis L. Moore, Chief of the United States Weather Bureau, has been removed by President Wilson

Mr. H. F. Porter, Jun. Am. Soc. C. E., and a graduate in civil engineering of Cornell University, Class of 1905, has been elected Alderman in Chicago, Ill.

Mr. Julian Griggs, M. Am. Soc. C. E., formerly Chief Engineer of the Lancaster Traction & Power Co., Columbus, Ohio, has been made City Engineer of Lancaster, Ohio.

Mr. Ira L. Burlingame, for several years General Superintendent of the Terminal Railroad Association of St. Louis, Mo., has been promoted to be General Manager.

Mr. Paul D. Cook, Assoc. M. Am. Soc. C. E., announces that he has opened an office for general practice as a consulting engineer, with offices at 513 United Bank Bldg., Sioux City, Iowa.

Mr. F. M. Bisbee, M. Am. Soc. C. E., Engineer of the Western Lines of the Atchison, Topeka & Santa Fé Ry., at La Junta, Colo., has been promoted to be Chief Engineer of the Western Lines.

Mr. S. W. Greenland, Assoc. Am. Inst. E. E., Assistant General Manager and Purchasing Agent of the Fort Wayne & Northern Indiana Traction Co., has been promoted to be General Manager.

Mr. Henri Camp, Civil Engineer, has been appointed Secretary of the International Association of Tramways and Light Railways, with offices at Brussels, Belgium. He succeeds the late Paul t'Serstevens.

Mr. W. R. Roof has been appointed Engineer of Bridges and Buildings of the Chicago Great Western R.R., with headquarters at Chicago, Ill., succeeding Mr. C. Chandler, resigned, as noted elsewhere.

Mr. C. E. Douglas, formerly Special Engineer in charge of construction and betterments of the Northwestern Pennsylvania Railway Co., Meadville, Penn., has been promoted to be Chief Engineer of the track and roadway department.

Mr. Thomas W. Walsh, formerly Assistant Superintendent of the Oregon-Washington R.R. & Navigation Co., at Spokane, Wash., has been promoted to be Superintendent of the newly created division with headquarters at La Grande, Ore.

Mr. A. M. Hunt, M. Am. Soc. M. E., Consulting Engineer, San Francisco, Calif., has been appointed Chief of the department of machinery of the Panama-Pacific International Exposition. Mr. G. W. Danforth is Assistant Chief of the department.

Mr. Hugh Wilson, Assistant Superintendent of the Northwestern Pacific R.R., has resigned to become Inspector for the California State Railroad Commission. Mr. Wilson graduated in civil engineering from the University of Nebraska and was at one time Assistant Engineer on the Missouri Pacific Ry.

Mr. Waldo Arnold Layman, F. Am. Inst. E. E., President and General Manager of the Wagner Electric Co., St. Louis, Mo., has been elected President of the National Metal Trades Association. Mr. Layman graduated from Rose Polytechnic Institute in 1892, and has been with the Wagner Electric Co. ever since.

Mr. L. B. Wickersham has been appointed Chief Electrical Engineer of the Oregon Electric Ry. and the United Rys., Portland, Ore. The other engineering duties of Mr. Wickersham, who has hitherto been Chief Engineer, will be assumed by Mr. A. M. Lupfer, M. Am. Soc. C. E., Chief Engineer of the Spokane, Portland & Seattle, the Oregon Trunk and the Spokane & Inland Empire Rys.

Mr. R. A. Rutledge, formerly Assistant Chief Engineer of the Gulf, Colorado & Santa Fé Ry., at Galveston, Tex., has been promoted to be Chief Engineer of the Eastern Lines of the Atchison, Topeka & Santa Fé Ry. System, with headquarters at Topeka, Kan., succeeding Mr. C. F. W. Felt, M. Am. Soc. C. E., whose appointment as Chief Engineer of the entire Santa Fé System was announced in our columns of Apr. 3.

Governor S. M. Ralston, of Indiana, has appointed the following members of the newly created State Public Utility Commission: Mr. Thomas Duncan, of Princeton, Ind., a former attorney of the Southern Ry.; Mr. James L. Clark, of Danville, Ind., a land owner and stock raiser, of Brookston, Ind., who graduated in civil engineering from Purdue University in 1893; Mr. John F. McClure and Mr. [illegible], Ind., a former attorney of the New York Central Lines;

Frank E. Payne, members of the present State Railroad Commission, which is to be replaced by the Public Utilities Commission on May 1.

Mr. C. Chandler, formerly Engineer of Bridges and Buildings of the Chicago Great Western R.R., has been appointed Assistant Bridge Engineer of the Illinois Central R.R., at Chicago, succeeding Mr. Marco Johnson, Assoc. M. Am. Soc. C. E., promoted as noted in our issue of Apr. 10. Mr. Chandler was educated at Swarthmore College and began railway work in 1897 as a draftsman in the bridge and building department of the Illinois Central R.R. In 1902 he was promoted to be Chief Draftsman, which position he held for eight years, resigning in 1910 to become Engineer of Bridges and Buildings of the Chicago Great Western R.R.

Mr. William B. Fuller, M. Am. Soc. C. E., of Johnson & Fuller, Consulting Engineers, New York City, who since November, 1911, has been Chief Engineer of the Mexican Northern Power Co., Ltd., with headquarters at Santa Rosalie, Chihuahua, Mexico, is a captive in the hands of Mexican bandits and is being held for a ransom of several thousand dollars, according to press dispatches. Mr. Johnson has as yet been unable to confirm the report as it is impossible to get in telegraphic communication with Mexico. Readers of "Engineering News" will remember Mr. Fuller's very interesting article, printed in our columns of May 23, 1912, on "Dam Building and Bullet Dodging" in Mexico.

Mr. L. F. Lonnbladh, former Chief Engineer and Superintendent of the Tennessee Central R.R., has been appointed Engineer of Maintenance-of-way of the Missouri, Kansas & Texas Ry., with office at Parsons, Kan., succeeding Mr. F. Ringer, promoted as noted in our issue of Mar. 20. Mr. Lonnbladh was born in Sweden, 1877, and graduated from the Boras Technical College of Sweden in 1898. For four years following he was on railway location and construction work in Sweden, coming to the United States in 1902. He was Office Engineer during the building of the Tennessee Central R.R. He was promoted through the grades of Assistant Engineer and Engineer of Construction to that of Chief Engineer in 1904. For a short time he was Assistant Superintendent of Construction of the Southern Ry., but returned to the Tennessee Central R.R., where in addition to his duties of Chief Engineer he also assumed those of the operating department as Superintendent, in 1912.

Mr. D. L. Turner, M. Am. Soc. C. E., for several years Chief of the Bureau of Transit Inspection and Engineer of the 7th division of subway construction, has been promoted to be Deputy Engineer of Subway Construction of the Public Service Commission of New York, First District. Mr. Turner graduated from the Rensselaer Polytechnic Institute in 1891, and from 1893 to 1901 he was Instructor in surveying, railway location and construction and hydraulics at Harvard University. He also inaugurated the Harvard Engineering Summer Camp and established and conducted the present camp at Squam Lake, N. H. During the same period he was engaged in the general practice of engineering. From 1901 to 1907 he was attached to the engineering staff of the New York City Rapid Transit Commission, first as Assistant Engineer and finally as Division Engineer on the executive staff of the Chief Engineer. From 1907 to date Mr. Turner has been attached to the engineering staff of the Public Service Commission. As Chief of the Bureau of Transit Inspection he originated and formulated methods of supervising the operations of the various street railways under the Commission's jurisdiction, and as Division Engineer he was to have direct charge of subway work aggregating about $30,000,000 in estimated cost.

OBITUARY

William M. Douglas, M. Am. Soc. M. E., of Allentown, Penn., died Apr. 11, aged 61 years. Mr. Douglas was formerly Assistant General Superintendent of the American Steel & Wire Co.

Jacob Friday, founder and for many years President of the Friday Construction Co., of Pittsburgh, Penn., died at his home in that city on Apr. 16. He was born in the canton of St. Gall in Switzerland in 1842. He came to America when he was 22 years old and soon entered business as a contractor on municipal work in Pittsburgh. Later he took contracts for work under the United States Government, his last large undertaking being the construction of harbor jetties at Charleston, S. C. A few years ago he organized the Friday Construction Co.; three sons associated with their father have since died. He leaves a widow and three daughters.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Schurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION.
May 6-10 Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

Engineers' Society of Western Pennsylvania—The ninth anniversary of the founding of the society was celebrated by a large and enthusiastic gathering on the evening of Mar. 29, at Harrisburg, Penn. The principal aim of the meeting was to raise further funds toward the purchase of new quarters. The subscription for this purpose at the end of the meeting amounted to well over $5000.
Eng. Soc. Proc. N.R.

American Society of Mechanical Engineers—The spring ballot for new members contains 605 names, the largest on any ballot list in the history of the Society. Of the total number, 320 are for election to membership, 58 for promotion to the Membership grade from lower grades, 40 for election as Associates and 187 for election as Juniors.

American Institute of Electrical Engineers—A convention, which was attended by over 300 members, was held in Pittsburgh, Penn., Apr. 18-19. A demonstration of first-aid-to-the-injured in cases of electrical shock was given by A. B. Kiser, of the Pittsburgh Coal Co. Papers were read by H. C. Eddy, Contract Agent of the American Gas & Electric Co., of New York City; J. S. Jenks, Assistant General Manager of the West Penn Traction & Water Power Co., of Pittsburgh; H. H. Clark, of the United States Bureau of Mines, Pittsburgh; J. W. Hopwood, Master Mechanic of the United Coal Co., Pittsburgh; C. W. Beers, Electrical Engineer of the Lehigh Valley Coal Co., Wilkes-Barre, Penn., and F. B. Crosby, of the General Electric Co., Schenectady, N. Y. President R. D. Mershon presided at the opening session, but later surrendered the chair to George R. Wood, Consulting Engineer of the Berwind-White Coal Co., of Philadelphia, Penn.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

★**Pennsylvania**—Chambersburg & Shippensburg Ry.—Bids will be received at the office of the President, Chambersburg & Shippensburg Ry. Co., Chambersburg, Penn., until 8:30 p.m., May 12, for the graduation, track laying and ballasting, masonry and culverts for the extension from Red Bridge Park, Franklin County, Penn., to Shippensburg, Cumberland County, approximately 8.4 miles. Plans and specifications can be seen at the office of the Engineer, Bard Bldg., East Market St., Chambersburg. Noted Apr. 10.

Pennsylvania—Moshannon Central R.R.—This company has been incorporated for the construction of a railroad in Rush Township, Centre County. C. H. Rowland, Phillipsburg, N. J., is interested.

✚Pennsylvania R.R.—This company has awarded the contracts for the construction of its proposed cutoff from near Glyndon to Lovell's Station. The McGRATH CONSTRUCTION CO., Philadelphia, Penn., secured the contract for the south half of the work, and the DUQUESNE CONTRACTING CO., Pittsburgh, Pen., for the north half. The cutoff will be about 11 miles in length.

West Virginia—Baltimore & Ohio R.R.—This company, it is reported, will construct 10 miles of railroad from Orleans to Paw Paw, W. Va. The work has been estimated to cost $8,000,000. Several tunnels, one 3500 ft. in length, will be built and two concrete bridges will be constructed across the Potomac River. F. L. Stuart, Baltimore, Md., is Ch. Engr.

✚**West Virginia**—Chesapeake & Ohio Ry.—The contract has been awarded to BALLARD, HERRING & SEVERER, Catlettsburg, Ky., and Huntington, W. Va., the contract for the construction of a 22-mile extension of the Chesapeake & Ohio Ry. from the mouth of Beaver Creek to Steel's Branch in Jackson County, at $300,000.

North Carolina—Seaboard Air Line Ry.—This company has appropriated $2,500,000 for improvements to its system. The most important work to be done is the double-tracking of its North Carolina Division from Raleigh to Hamlet, N. C. Improvements will also be made at the yards at Raleigh, Richmond, Va., and Monroe, N. C., and at Tampa and Fernandina, Fla. W. D. Faucette, Portsmouth, Va., is Ch. Engr.

Georgia—Greene County R.R.—This company is considering the extension of its line from Bostwick, Ga., to Monroe, Ga., and from Monroe to Loganville, Ga. The company now operates a line from Appalachee to Bostwick. W. G. Branan, Atlanta, Ga., is Vice-Pres. and Gen. Mgr.

Bainbridge & Northeastern Ry.—We are officially advised that this company's application to issue $1,500,000 of bonds for the construction of a railroad to connect Pelham, Bainbridge and Hardaway, Fla., has been denied by the Railroad Commission of Georgia. Campbell Wallace, Secy.

Georgia—Brinson Ry.—This company is planning for the extension of its line. L. B. Ackerman, Springfield, Ga., is Ch. Engr. As planned the line will be extended to Washington, Ga., through Thomson.

Florida—A company with a capital of $350,000 is being organized for the purpose of constructing a railroad in Lee County. It will be 13 miles in length. W. G. Langford, Fort Myers, Fla., is interested.

Alabama—Illinois Central R.R.—This company, it is reported, has started surveys for the construction of a line from near Red River Bridge to Montgomery, Ala., about 107 miles. As planned the line will pass through Monroe, Wilcox, Lowndes and Montgomery Counties and run through the towns of Camden and Hayneville, Ala. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

✚Gulf, Florida & Alabama Ry.—This company has awarded the contract to J. T. McCARTHY CO., Gainesville, Fla., for the grading for the construction of its proposed 20-mile extension from Local north into Monroe County.

Louisana—Monroe, Louisana & Gulf Ry.—This company has filed its charter for the construction of a railroad from Monroe, La., to Winnfield, La. The company is capitalized at $1,000,000. Financial arrangements have been made, it is reported, for the completion of the new line. J. M. Parker, New Orleans, La., is Pres.

Louisiana—Southern Pacific Co.—This company is considering the construction of a branch line from Lafayette to Abbeville, La. W. Hood, San Francisco, Calif., is Ch. Engr

✚**Kentucky**—Elkhorn & Beaver Creek R.R.—This company has awarded the contract to W. W. BOXLEY & CO., Roanoke, Va., for the construction of the first seven miles of its line. The road is owned by the Elkhorn Fuel Co. J. A. Clarke, Fairmont, W. Va., is Pres.

Kentucky—Rockcastle R.R.—This company has decided to construct its proposed line from McKee to East Bernstadt, a distance of about 20 miles, instead of from McKee to Livingstone. The former route will give an easier grade. C. C. Williams, Mount Vernon, Ky., is interested.

Iowa—Chicago, Milwaukee & St. Paul Ry.—This company has awarded the contract to the Walsh Construction Co., Davenport, Iowa, for the necessary grading for second-track work between Elberon and Capron, Iowa. The work will require the removal of about 750,000 cu.yd. of earth. C. F. Lowell, Chicago, Ill., is Ch. Engr.

Arkansas—R. Carnahan, Louisville, Ky., who plans the development of a timber property in Arkansas, will arrange for the construction of a railway into his land from the main line of the St. Louis Southwestern Ry. Co. His office is in the Kenyon Building, Louisville, Ky.

Texas—Abilene & Southern Ry.—This company is considering the construction of an extension of its line from Hamlin to Matador, Tex., a distance about 100 miles. Percy Jones Abilene Tex., is Ch. Engr.

Texas—Witchita Falls & Southern Ry. (Missouri, Kansas & Texas Ry.—This company, it is reported, has started surveys for the construction of its proposed extension south from Newcastle to Cisco, Tex. A. M. Acheson, Wichita Falls, Tex., is Ch. Engr.

Texas—The construction of a railroad from Aransas Pass to San Antonio, Tex., is under consideration. Jesse Gandy, Broken Bow, Neb., is interested.

Oklahoma—Oklahoma, New Mexico & Pacific Ry.—This company will probably award contracts for the construction of its proposed line west from Ardmore west through Lone Grove, Hewitt, Cornish and Waurika to Byers, Tex., connecting with the short line from Byers to Wichita Falls. Jake L. Hamon, Lawton, Okla., is Pres.

Colorado—Denver & Rio Grande R.R.—This company has completed and submitted to its directors the plans for the following improvements: The extension of the Salt Lake Division from Helper, 131 miles; the extension from Minturn to Salida, 86 miles, and the electrification of the lines of Tennessee Pass and Soldier Summit. C. A. Blake, Salt Lake City, Utah, is Div. Engr.

Washington—Willapa Bay Eastern Ry. (Oregon-Washington R.R. & Navigation Co.)—This company has been incorporated to construct a line from Lincoln Creek, four miles west of Centralia, Wash., to Raymond and South Bend, on Willapa Harbor. The capital is $2,000,000. The incorporators are W. H. Boyle, F. T. Merritt and C. P. Bisset, all of Seattle, Wash.

Washington—Anacortes & Eastern Ry.—This company has been organized for the purpose of constructing a railroad from Marches Point, opposite the city of Anacortes, Wash., to Mount Vernon, Wash. Capital, $1,000,000.

California—Stockton Terminal & Eastern Ry. Co.—This company has been granted permission to issue $345,000 of bonds for the purpose of extending its line from the present terminus in Stockton to Stockton Channel; for the improvement of the line from Stockton to Bellota; and for the extension of the line from Bellota to Jenny Lind.

Mount Tamalpias & Muir Woods Ry.—This company is considering the construction of its proposed line from West Point to Bolinas at a cost of about $500,000.

British Columbia—Kettle Valley Ry.—This company will soon ask for bids for the construction of a section of its railway between the summit of the Hope Mountains down the valley of the Coquehalla River to Hope. A 1600-ft. tunnel will be driven at a point 20 miles east of Penticton, B. C. A. M. McCulloch, Penticton, B. C., is Ch. Engr.

✚**Canada**—National Transcontinental Ry.—This company has awarded the contract to T. DALY, Montreal, Que., for the completion of the Levis-New Brunswick section of this company's line. The section is about 190 miles in length.

California—Atchison, Topeka & Santa Fé Ry.—This company, it is reported, has secured right-of-way for the construction of its proposed 150-mile line to branch off near Visalia, Calif., and connect with Bakersfield, Calif. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

ELECTRIC RAILWAYS

Bangor, Maine—The Bangor Ry. & Electric Co. has been granted a 25-year renewal of its truckage rights in Bangor and will at once proceed to expend about $300,000 on extensions of and improvements to its system. C. H. Johnson, Bangor, is Supt. Ry.

Fitchburg, Mass.—The Fitchburg & Lowell St. Ry. Co., which has 19 miles of track from Ayer to Lowell, has been taken over by a syndicate of Fitchburg men. The new owners plan extensive improvements on the line from Ayer to Lowell. H. I. Wallace and George N. Proctor are interested.

Ansonia, Conn.—The Connecticut Co. has been granted a franchise to double-track its line in Ansonia. J. K. Punderford, New Haven, is Gen. Mgr.

Collingdale, Penn.—The Philadelphia & Garrettford St. Ry. Co. is considering the extension of its line from Collingdale to Folcroft and the Darby Creek. H. H. Aikens, Upper Darby, is Vice-Pres.

Baltimore, Md.—The United Rys. & Electric Co. has applied to the City Council for a franchise to extend its Monument St. line to Orangeville. T. A. Cross, Continental Trust Bldg., is Gen. Mgr.

Hagerstown, Md.—The Hagerstown Electric Ry. Co. is considering plans for the extension of its line to Mont Alto, Penn., and eventually to Gettysburg, Penn. Franz von Schilling, Hagerstown, is Gen. Mgr. and Pur. Agt.

Plans are being considered by L. O. Davis, of Harrisburg, Penn., and John R. Bear, of Philadelphia, Penn., for the construction of an electric railway from Hagerstown to Clear Springs, about 12 miles.

Fairmont, W. Va.—The Buckhannon & Northern Ry. Co. has applied to the City Council for a franchise to construct

and operate a street railway in the First Ward of Fairmont. S. D. Brady is Ch. Engr.

Homestead, Fla.—Steps are being taken toward the organization of a company for the purpose of constructing an interurban railway from Homestead to Palm Beach. Frederick H. Rand, Nathan A. Cole, H. G. Ralston and R. E. McDonald have been appointed to secure franchises and right-of-way.

Abbeville, La.—The Louisiana Traction & Power Co. and the Southwestern Traction & Power Co. have been granted franchises by the City Council for rights of way over a number of streets of Abbeville for their proposed electric railway lines.

Milton, Ky.—The Louisville & Interurban R.R. Co., Louisville, is considering the extension of its traction line from Lagrange to Milton, Ky.

Nelsonville, Ohio—The Hocking-Sunday Creek Traction Co. is preparing plans for the construction of a six-mile extension to its line. E. B. Young, Nelsonville, is Pres. and Gen. Mgr.

Anderson, Ind.—Preliminary arrangements are being made by the Union Traction Co. for extensive improvements to be made on its Third St. line. H. A. Nicholl, Anderson, is Gen. Mgr.

Highland Park, Mich.—The Detroit United Ry. Co. has applied to the City Council for a franchse to extend and doubletrack its lines in Highland Park. F. W. Brooks, Detroit, is Gen. Mgr.

Hillsboro, Ill.—The Hillsboro Electric Light & Power Co. has started surveys for the construction of an electric railway from Hillsboro to Nokomis. J. J. Frey, Hillsboro, is Pres. and Gen. Mgr.

Beloit, Wis.—The Beloit, Clinton & Delavan R.R. Co., of Beloit, has applied for a charter to build an interurban electric railway from Beloit to Delavan by way of Turtle and Clinton in Rock County, and Darien and Delavan in Walworth County, a distance of 30 miles. Charles F. Lathers, Joel B. Dow and A. N. Bort are interested.

Kenosha, Wis.—Negotiations are under way, it is reported, for establishing a Chicago, Kenosha, Racine and Milwaukee electric railway. Frank R. Grover, of Evanston, Ill., is said to be promoting the interests of the company seeking a right of way through Waukevan, Ill.

Milwaukee, Wis.—Press reports state that plans are being prepared by the Milwaukee Electric Ry. & Light Co. for the extension of its Watertown line, through to Fort Atkinson. James D. Mortimer, Milwaukee, is Pres.

Cedar Rapids, Iowa—Plans are being considered by the Cedar Rapids & Iowa City Ry. Co. for the construction of an electric railway from Cedar Rapids, to Mount Vernon, about 15 miles. J. D. Wardle, Cedar Rapids, is Supt. Ry. Dept. and Ch. Engr.

Dubuque, Iowa—The City Council has granted a franchise to the Union Electric Co. to extend its lines in Dubuque. A. H. Smith, Dubuque, is Supt. Ry. Dept.

Indianola, Iowa—A. N. Oldaker, W. A. Adams and J. W. Taggard are interested in the construction of an interurban railway from Indianola to Hopeville.

Arkansas City, Kan.—The Interstate R.R. & Traction Co. is preparing plans for the construction of an interurban railway to connect Arkansas City, Kan., and Ponca, Okla., and eventually to Guthrie, Okla. O. L. Brown, Arkansas City, is interested. Noted Apr. 10.

Hutchinson, Kan.—Plans are being prepared by the Arkansas Valley Interurban Ry. Co. for the construction of its proposed electric railway to connect Halstead and Hutchinson, about 24 miles. Charles D. Bell, Wichita, is Supt., Pur. Agt. and Ch. Engr.

Pittsburg, Kan.—The Fort Scott & Pittsburg Ry. Co. has made preliminary surveys for the construction of its proposed electric railway from Scott to Pittsburg. The company contemplates also the extension of this line to Olathe. Noted Nov. 21.

Ellendale, N. D.—The citizens of Ellendale are considering plans for the construction of an electric railway from Ellendale to Oakes.

Texarkana, Ark.—The City Council has granted a franchise to Rollinw W. Rodgers and associates to construct and operate an electric railway from Texarkana to Clarksville.

+Beaumont, Tex.—The Stone & Webster Engineering Corporation, Boston, Mass., has awarded the contract for grading its proposed electric railway from Beaumont to Fort Arthur, to STUART NICHOLS, of Beaumont. Noted Jan. 2.

Bryan, Tex.—The Bryan & Central Texas Interurban R.R. Co., which was recently organized here has taken over the Bryan-College Interurban Electric line that connects Bryan and College. This road will be immediately extended to Wilcox in Burleson County, a distance of 32 miles. An extension of the line north from College is also under consideration, it is stated.

Dallas, Tex.—The Dallas Eastern Interurban Ry. Co. and the Dallas Western Interurban Ry. Co., which are owned by the same interests, have placed surveyors in the field to locate the route of their proposed interurban electric lines. The Dallas Eastern Interurban Ry. Co. will build a line from Dallas to Gainesville via Denton. The Dallas Western Interurban Co. will build a line from Dallas to Glenrose via Cleburne. E. P. Turner is promotor of these two lines. Noted Feb. 2.

Houston, Tex.—Plans are being considered by the Houston Electric Co. for the extension of its lines into the Houston Harbor addition. David Daly, Houston, is Gen. Mgr. and Pur. Agt.

San Antonio, Tex.—The survey for the line which the San Antonio & Gulf Interurban Ry. Co. is to construct between San Antonio and Austin, about 85 miles, will be finished about June 1 and the construction work will be started soon thereafter according to the preliminary statement of W. P. Tuttle, Gen. Mgr. It is estimated that the cost of constructing and equipping the road including power plant and rolling stock will be approximately $2,100,000.

Seguin, Tex.—F. C. Weigert and associates have under consideration the proposition of constructing an interurban electric railway between Seguin and Staples, about 18 miles. The project is also being agitated by business men of Staples and the land owners along the route of the proposed line.

Uvalde, Tex.—The Uvalde & Leona Interurban Ry. Co. will extend and improve its line. It is reported that one of the extensions it has under consideration will run to Batesville, about 30 miles.

Fallon, Nev.—Plans are being prepared for the construction of the Fallon Belt R.R., the electric line which is to circle the valley for the purpose of hauling sugar beets to the factory and for the accomodation of the residents of the valley. The line connects Stillwater and Fallon. The following officers have been elected by the board of directors: A. R. Merritt, Pres.; Scott Harmon, Secy.; E. E. Winters, Treas.; Dr. C. A. Hascell, Gen. Mgr.

Globe, Ariz.—The Stone & Webster EngineeringC Corporation, of Boston, Mass., has been investigating the situation here with a view of constructing an interurban electric railway between Globe and Miami and Like Oak. It is stated that the survey for the proposed line will soon be made and that construction work will be started within a short time after the preliminary arrangements have been finished.

Vancouver, Wash.—A franchise has been applied for by I. S. Putman, of this city, for constructing street railway lines on several streets. It is also presumed to be the intention of those in authority, to build several interurban lines from the city.

Portland, Ore.—The Portland Ry., Light & Power Co. will at once electrify its line between Gresham and Bull Run, a distance of about 12 miles. C. J. Franklin, Portland, is Supt. Ry. Dept.

San José, Calif.—Preliminary arrangements are being made by the San José Rys. Co., for the construction of its proposed electric railway on Empire St. F. E. Chapin, San José, is Gen. Mgr.

Redwood, Calif.—The Redwood City Harbor Co. will construct an electric road from the waterfront to Woodside and through Redwood. The estimated cost is $200,000. George A. Merrill is Pres.

+Tulare, Calif.—The Big Four Electric Ry. Co. has let a contract to W. M. HAHN & CO., of Fresno, for the construction work on its line to connect Tulare, Visalia and Porterville. Noted Apr. 17.

Port Colborne, Ont.—The Niagara Falls, Welland & Lake Erie Ry. Co. has started surveys on its proposed extension from Fort Erie to Port Colborne, about 36 miles. C. J. Laughlin, Jr., Welland, Ont., is Gen. Mgr. Noted Feb. 6.

Toronto, Ont.—Plans are being prepared by the Toronto & York Radial Ry. Co. for double-tracking its Yonge St. line. W. H. Moore, Toronto, is Gen. Mgr.

LIGHT, HEAT AND POWER

Concord, Mass.—At a recent meeting of the Town Council an appropriation of $15,000 was authorized for the purchase of new additional equipment for the municipal electric plant. A. W. Lee is Mgr. of the plant.

Fall River, Mass.—The Fall River Electric Co. is planning to spend $200,000 on improvements, extensions and equipment for its plant at Fall River. A. H. Kimball, Fall River, is Gen. Mgr. and Pur. Agt.

+Springfield, Mass.—The Amherst Power Co. has awarded the contracts for the construction of two substations, at Chicopee and Agawam, respectively, to the FRED T. LEY CO., of Springfield. Noted Apr. 17.

The United Electric Co. is planning the erection of a new transformer station as an auxliary to its present plant, and may purchase current from the Amherst Power Co. R. W. Day is Pres.

+Worcester, Mass.—See item under Buildings.

Bids were received by the Mayor for the installation of a heating system in the Tuberculosis Hospital on Belmont Hill, as follows: A. Burlingame Co., $17,885; M. D. Holmes, $18,135; O. S. Kendall & Son, $19,237; Edward Hawes Co., $19,604; Central Supply Co., $19,827. All bids were rejected Apr. 12 as they exceeded the estimate of $14000.

Warwick, R. I.—The Kent County Gas Co. contemplates the erection of a gas-making plant at West Warwick. Judge Herbert is the representative of the company.

+Brooklyn, N. Y.—We are officially advised that the contract for the installation of a heating and ventilating system in public school No. 28, Boro. of Brooklyn, has been awarded to GRIMSHAW & STURGIS, at $34,797. Bids were received Apr. 14 by C. B. J. Snyder, Supt. School Bldgs.

Brooklyn, N. Y.—Bids will be received by C. B. J. Snyder, Supt School Bldg., until 11 a.m., Apr. 28, for installing electric equipment in new Public School 99, on East Ninth and Tenth Sts., about 80 ft. south of the corner of Ave. K and East Tenth St., Boro. of Brooklyn, and installing heating and ventilating apparatus in new Public School 172, on the eastern side of Fourth Ave., between 29th and 30th Sts., Boro. of Brooklyn.

Corning, N. Y.—The Corning Light & Power Co., which recently acquired the property of the Corning Gas & Electric Co., will construct a new power plant this spring.

Hudson, N. Y.—Plans are being prepared for the installation of an ornamental street-lighting system.

Malone, N. Y.—The Franklin County Hydraulic Power Co. is being organized at Malone, for the purpose of constructing a dam and power plant to develop 4000 hp., on the Salmon River, near Chasm Falls.

New York, N. Y.—Bids will be received by Joseph Johnson, Fire Comr., 157 East 67th St., Boro. of Manhattan, until 10:30 a.m., Apr. 28, for installing and completing the steam-heating system in a new building for an engine and a hook and ladder company on the east side of Seventh Ave., 165 ft. north of 16th St., Whitestone, and in the new building for an engine company on the west side of Benedict Ave., 2446 ft. North of Fulton St., Woodhaven.

Syracuse, N. Y.—The Syracuse Lighting Co. has made application to the Public Service Commission for permission to

issue $200,000 in bonds, the proceeds of which will be used for extending its gas mains.

Lakewood, N. J.—The Board of Public Utility Commissioners has granted the Commonwealth Water & Light Co. permission to issue bonds for $20,000, the proceeds of which are to be used in extensions to the electric-power plant of the Lakewood Water, Light & Power Co., a subsidiary organization.

Penn Grove, N. J.—The Board of Public Utility Commissioners has granted the Penn Grove Electric Light, Heat & Power Co. permission to install systems and operate in Upper Penns Neck and Oldmans Townships.

Dauphin, Penn.—Preliminary arrangements are being made by the Harrisburg Light & Power Co., for the installation of an electric street-lighting system. C. H. Kinter, Harrisburg, is Mgr.

Philadelphia, Penn.—Plans have been prepared for the construction of a power plant at 19th St. and Allegheny Ave., for the Storage Battery Co.

Washington, N. C.—An election will be held May 5, at which the proposition to issue $20,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters.

Abbeville, Ga.—The citizens have voted bonds for $8000 for the construction of a municipal electric-light plant. Noted Mar. 27.

LaGrange, Ga.—We are officially advised that plans are being prepared by James Nesbit Hazlehurst, Chandler Bldg., Atlanta, for the construction of a gas plant and water-works system, to cost $190,000. See item also under Water Supply—Irrigation.

Quitman, Ga.—Plans are under consideration for the improvement and extension of the municipal electric-light plant.

Gainesville, Fla.—Preliminary arrangements are being made for the installation of an ornamental street-lighting system in the business district. Noted Mar. 6.

Tampa, Fla.—Plans have been prepared for the extension of the ornamental street-lighting system.

Roanoke, Ala.—The citizens are considering the proposition to issue $20,000 in bonds for the improvement of the municipal electric-light plant.

Estherwood, La.—Plans are under consideration by the City Council for the construction of a municipal electric-light plant.

Henderson, Tenn.—The State Legislature has authorized the City Council to issue $50,000 in bonds for the construction of a municipal electric-light plant and water system.

✚Lindsey, Ohio—The contract for the installation of an electric-light system in Lindsey has been awarded to the WHIPPLE STRUB CO., Toledo. Noted Apr. 10.

Oakley (Cincinnati post-office), **Ohio**—The Factory Power Building, Oakley, is planning the construction of an addition to its plant for the purpose of supplying 500-hp. in addition to the energy now produced. Zettel & Rapp are Archs.

Paulding, Ohio—Bids will be received by the Board of Trustees of Public Affairs until Apr. 29, for the installation of new equipment in the municipal electric-light and water plant. J. F. Morrisey is Pres. of the Bd. Noted Jan. 2.

National Military Home, Ind.—Bids will be received by J. W. Sanderson, Treas. of Marion Branch of the National Home for Disabled Volunteer Soldiers, until May 2, for the installation of new equipment and improvement of the power plant.

Alton, Ill.—The city authorities are considering the proposition to construct a municipal electric-light plant. J. F. Schwaab is City Engr.

The Piasa Light & Power Co. will construct a substation at Alton. Roy Holden is Mgr.

Chicago, Ill.—According to press reports, the People's Gas Light & Coke Co. is considering plans for the construction of a new gas plant. The plant, which will manufacture coal gas, will cover a tract of 200 acres and will cost when complete $30,000,000. The first section will consist of eight buildings and will be completed within the next two years. Edward G. Cowdery is Vice-Pres.

De Kalb, Ill.—Jacob Haish has applied to the City Council for a franchise to construct and operate an electric system in De Kalb for commercial and lighting purposes.

Springfield, Ill.—Bids will be received by John S. Shnepp, Mayor, until Apr. 28, for the improvement of the municipal electric-light plant. Plans are on file at the office of Arthur M. Morgan, Consult. Engr., Harris Trust Bldg., Chicago, Ill.

Deer Park, Wis.—Plans are being considered by the Village authorities for the construction of an electric-light plant.

Madison, Wis.—Plans are being considered by the State St. Improvement Association for the installation of an ornamental street-lighting system. F. W. Huels is Secy.

Carson, Iowa—Preliminary arrangements are being made for the reconstruction of the local electric-light plant, which was recently destroyed by fire. Joseph A. Bortenlanger is Mgr.

Fontanelle, Iowa—At a recent election the citizens voted to issue $10,000 in bonds for the construction of a municipal electric-light plant. H. J. Stuhlmiller is Town Clk. Noted Sept. 5.

LeClaire, Iowa—The citizens, at a recent election, voted to install an ornamental street-lighting system.

Crosby, Minn.—The installation of an ornamental street-lighting system is under consideration. For further information address the Commercial Club.

✚East Grand Forks, Minn.—The contract for the construction of a substation at East Grand Forks has been awarded to KENNEDY & McCOY, Fargo, N. D. Noted Apr. 17.

St. Paul, Minn.—Plans are being considered by the West End and Seven Corners Commercial Clubs for an expenditure of $34,000, for the installation of an ornamental street-lighting system in the West End district and business section of St. Paul.

Augusta, Kan.—At a reeent election the citizens voted to issue $5000 in bonds for the construction of a municipal electric-light plant. J. R. Switzer is City Engr. Noted Mar. 13.

Benkelman, Neb.—Bonds to $5000 for the construction of a municipal electric-light plant have been voted.

Mayville, N. D.—We are officially advised that plans will be completed about Apr. 28 by the Oscar Claussen Engineering Co., St. Paul, Minn., for the construction of a municipal electric-light plant at Mayville. Noted Mar. 20.

Big Springs, Tex.—The West Texas Electric Co. will install additional machinery and equipment in its electric-light and power plant here.

Dallas, Tex.—Press reports state that bonds for $400,000 have been voted for the construction of the proposed municipal electric-light plant. J. M. Preston is City Engr. Noted Apr. 3.

Paris, Tex.—A company has been organized with headquarters here for the purpose of constructing a large hydro-electric plant, water-works reservoir, and pumping plant on the Mountain Fork River in Oklahoma. It is proposed to supply a number of towns in Oklahoma, Fort Worth, Dallas and Paris with electric power and water.

McLoud, Okla—Bonds for $8000 for the construction of a municipal electric-light plant have been voted.

Wanette, Okla.—The proposition to issue $5000 in bonds for the construction of a municipal electric-light plant, was defeated at a recent election. Noted Feb. 13.

Rocky Ford, Colo.—The Arkansas Valley Ry., Light, Heat & Power Co. is making preliminary arrangements for the construction of a transmission line from Rocky Ford to Ordway, about 11 miles. Estimated cost, $10,000. W. F. Raber, Pueblo, is Gen. Mgr.

Hood River, Ore.—Plans are being prepared for the construction of a municipal electric-light plant, to cost $50,000.

Redmond, Ore.—The Light Committee of the City Council is considering plans for the construction of a municipal electric-light plant. The installation of a street-lighting system is also contemplated.

✚Oakland, Calif.—The Board of Trustees Masonic Homes of California has awarded a contract to ROBERT DALZIEL, Jr., 218 First St., San Francisco, for the erection of a steam-power plant, to cost $20,265.

Ontario, Calif.—Preliminary arrangements are being made by the City Council for the installation of an ornamental street-lighting system. B. B. Manor is City Engr.

Redding, Calif.—The Sierra Electric Co. has been granted a franchise to construct an electric-power line through Shasta County.

San Francisco, Calif.—The Building and Grounds Committee of the Panama Pacific International Exposition have received bids as follows for the construction of the electric conduit system in the exhibit section: Mahoney Bros., $46,828; Ampere Smih & Co., $47,000; G. M. Gest, $52,000; M. R. Flyle and A. E. Needham, $57,000; J. Monk, $65,000.

Winnipeg, Man.—The City Council has authorized an expenditure of $7500, for the installation of an ornamental lighting system on Colony St. M. Peterson is City Engr.

✚Regina, Sask.—We are officially advised that contracts for (a) six 500-hp. boilers and superheaters, erected on foundation, (b) two 1330-cu.ft.-per-min. stacks and fans, have been awarded as follows: (a) BABCOCK-WILCOX CO., at $5315; (b) J. C. McTAGGART CO., at $7100. Bids were received Mar. 15. Noted Mar. 13.

South Vancouver, B. C.—The following equipment will be placed in the $90,000 substation to be erected here by the British Columbia Electric Ry. Co. three motor-generator sets of 1000 kw. each and transformer equipment of 7000 kw. capacity. W. H. Hazlitt, Vancouver, is Pur. Agt.

BRIDGES

Boston, Mass.—An appropriation ogf $75,000 has been made for the construction of the Chelsea Bridge, South. L. R. Rourke is the Comr. of Public Works.

Pittsfield, Mass.—We are officially advised that the appropriation for the new reinforced concrete bridge at Merriam St., is $20,000 instead of $200,000 as previously published. Bids will not be received until later in the year. A. B. Farnham, is the City Engr. Noted Apr. 10.

✚Albany, N. Y.—The contract for the reconstruction work on the Cotton Factory Hollow Viaduct has been awarded to L. N. GROSS, Brooklyn, N. Y., at $18,100.

Glens Falls, N. Y.—It will probably be a month or six weeks before anything definite as to receiving bids for the construction of a bridge extending from the canal bridge to River St. will be given out. The estimated cost is $200,000. L. F. Goodson is the City Clk. Noted Apr. 17.

West Vienna, N. Y.—Bids will be received until Apr. 24, for the construction of the new steel lattice truss bridge with a concrete floor, two spans 50 ft. long and one 160 ft. long and 18 ft. wide at West Vienna. A. O'Brien, Utica, N. Y., is the Supt. of Highways. Noted Apr. 17.

Belleville, N. J.—The engineers of Essex, Bergen and Hudson Counties have been instructed to revise plans and specifications which were prepared last year for the new bridge over the Passaic River at Belleville. The estimated cost of the structure is $175,000.

✚Bridgeton, N. J.—The contract for the construction of the new bridge at Nortonville, has been awarded to the BRIDGETON CONSTRUCTION CO., Bridgeton, at $29,850.

★Camden, N. J.—Bids will be received by the Board of Chosen Freeholders at the Court House in Camden, until 10:30 a.m., May 12, for the construction of a bascule bridge over Newton Creek, on Broadway, Camden, also separate plans and specifications for a tumbling dam and bridge combined, also for two concrete bridges on the same creek. Plans and specifications are on file at the office of F. W. George, Clk. of the Bd. J. J. Albertson is the County Engr.

Conshohocken, Penn.—The County Commissioners of Montgomery County have decided to build a new bridge connecting Conshohocken and West Conshohocken.

McKees Rocks, Penn.—The erection of a bridge from McKees Rocks to Woods Run is under consideration. L. R. Cochrane in the Chn. Bd. of County Comrs.

Mount Carmel, Penn.—Bids will be received by the Board of County Commissioners, at the Court House, Sunbury, Penn., until May 2, for the construction of a bridge over Shamokin Creek at Vine St., in Mount Carmel.

Wilkes-Barre, Penn.—Bids will be received by F. R. Hendershot, County Controller, Court House, Wilkes-Barre, until 10 a.m., May 3, for the construction of a steel girder bridge with a concrete floor, over the tracks of the Central R.R. of N. J., where they are crossed by Bear Creek or Laurel Run Blvd. Plans and specifications are on file at the office of the County Commissioners.

Wilmington, Del.—A bond issue of $250,000 has been authorized, for the purpose of constructing a bridge over the Christiana Rivr at Third St.

Jackson, Miss.—See item under Sewers.

Chillicothe, Ohio—The County Commisioners have ordered plans prepared and will soon ask bids for the construction of a new concrete arch bridge at Main St., to replace the one washed away by the recent floods.

Cleveland, Ohio—Bids will be received by the Board of Commissioners of Cuyahoga County until May 21, for the construction of bridge work according to report No. 3078, concrete arch, Station Road, Brecksville Township, and report No. 3098, concrete sulvert, Barrett Road, Middleburg Township, and report No. 3098, concrete culvert, Barrett Road, Middleburg Township. Plans and specifications are on file at the office of the County Engineer, at the Court house, Cleveland. John F. Goldenbogen is the County Clk.

Mt. Blanchard, Ohio—It is proposed to replace the Krause Bridge on the Bishop Farm, near Mt. Blanchard, which was washed away by the recent flood, with a new bridge. It will have two 880-ft. spans.

✚New Philadelphia, Ohio—The contract for the construction of the new bridge on the road leading to Tuscarawas, has been awarded to GEORGE BOCK & SON, Coshocton, Ohio. It will be a three-span steel structure, 118 ft. long.

✚Newport, Ind.—We are officially advised that the contract for the construction of a steel and concrete bridge at Newport, has been awarded to J. P. VAN FOSSON & NOBLE, Rockville, Ind., at $9000. Roy Slater is the County Audr. Noted Mar. 27.

Jackson, Mich.—According to press reports, bids will be received by the Board of Public Works until May 2, for the construction of a new bridge over the Grand River, at Milwaukee St. A. W. D. Hall is the City Engr.

Chicago, Ill.—A. J. Hammond, Supt. of Bridges, has applied to the Secretary of War for a permit to construct a new bascule bridge at Madison St. The estimated cost is $250,000. Bids will probably be asked about July 1.

Plans have been prepared for the construction of a new bridge at Irving Park Blvd., to cost approximately $65,000. L. E. McGann is Comr. of Public Works.

Milledgeville, Ill.—Bids will be received at the office of J. E. Miller, Town Clk., until 9 a.m., Apr. 25, for finishing one reinforced concrete bridge and building three other reinforced concrete bridges in Wysox Township, Carroll County.

Milwaukee, Wis.—Repairs to cost approximately $10,000 will be made to the Grand Ave. Bridge. F. G. Simmons is Comr. Pub. Wks.

Des Moines, Iowa—The City Council has approved plans for the construction of a new bridge over the Raccoon River at Des Moines. The estimated cost is $230,000.

Hutchinson, Kan.—Plans are being prepared and bids will soon be asked for the construction of two new bridges, one on First Ave. and the other on Ave. B. G. L. McLane is the City Engineer. Noted Mar. 13.

Roseberg, Ore.—Bids will be received by E. H. Lenox, County Court Judge, until Apr. 26, for the construction of the Dillard Bridge. It will have three 126-ft. steel spans.

Los Angeles, Calif.—Bids will be received by the Board of Supervisors until 2 p.m., Apr. 28, for the construction of a reinforced concrete bridge on the La Canada-Verdugo Road. near Devil's Gate.

WATER SUPPLY—IRRIGATION

★Claremont, N. H.—We are officially advised that bids for laying about 3000 ft. of 8-in and 10,000 ft of 20-in cast pipe, 500 ft. of 8-in. tile pipe, placing about 1000 cu.yd. of concrete and 40 tons of steel, and moving and placing about 27,000 cu.yd. of earth, were received by the Board of Water Commissioners, Apr. 18, as follows: Daniel O'Connell, Holyoke, Mass., $40,130; Conner Brothers, Lowell, Mass., $52,441; English & Construction, Island Pond, Vermont, $47,452; New England Construction Co., Springfield, Mass., $42,158; Michael Little, Leominster, Mass., $43,855; Pasturo Brothers, Hartford, Conn., $43,173; Ricci Brothers, Rutland, Vt., $39,915; Werd & Walch, Mechanicsville, N. Y., $35,969; Osgood Construction Co., Nashua, N. H., $35,[illegible]; Edward E. Roberts, Boston, Mass., $30,167; Joseph Iorio & [illegible], Leominster, Mass., $41,460; Marcello Construction Co., Portsmouth, N. H., $31,560; John E. Fulmer, Boston, Mass., $40,868.

✚Boston, Mass.—Bids for laying water [illegible] in various streets in West Roxbury, Dorchester and Hyde Park, were opened by the Department of Public Works [illegible] as follows: DE Silva & Co., $2,240 (awarded contract); A. Valente & Co., [illegible]; John T. Shea Jr., $27,944; Thomas Hayes, [illegible]; E. Corrigan, $29,945; Antony Orlando, $13,120; [illegible]; $29,160. Noted Apr. 10.

Bids will be received by the Supply Department until Apr. 30 for furnishing 20 tons of 2-in. 75 tons of 16-in and 50 tons of 20-in. water pipe, all with flexible joints. J. Edward Mullen, Treasurer and Supt. of Supply.

✚The contract for furnishing six 6-in. fifty 8-in. three hundred 10-in. one hundred 12-in. one hundred and twelve 16-in. sectional and eight 16-in horizontal valves for the use of the high-pressure fire service was awarded by the Public Wks. Dept. to the KENEDY VALVE CO., at the following prices, following the above items: $3275, $34.20, $34.20, $79.80, $163.75, $163.75. Other bids were: Chapman Valve Mfg. Co., $39, $48, $48, $110, $198, $190; Pittsburg Valve Foundry & Construction Co., $56.30, $53.05, $54.10, $101, $170, $170; Roe-Stephens Mfg. Co., $45, $60, $60.50, $125, $225, 225; Coffin Valve Co., 30.50, $41.30, $40.50, $76.75, $168.50, $170. L. K. Rourke is Comr.

Fall River, Mass.—Bids will be received by the Watuppa Water Board until 10 a.m., Apr. 30, for furnishing a 6,000,000-gal. steam or electric water pump J. A. Kay is Mayor. Noted Apr. 17.

Southbridge, Mass.—The town contemplates purchasing the water system of the Southbridge Water Supply Co. It is estimated that the plant will cost about $100,000.

✚South Egremont, Mass.—A contract to construct a dam across Goodale Brook, about three miles from the village, has been awarded by the South Egremont Water Co., to H. I. PEER, South Egremont.

✚Buffalo, N. Y.—We are officially advised that a contract to place 600 piles for the foundation of the Venturi meter and valve house at the Porter Ave. pumping station, has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York. Noted Mar. 20.

Dunkirk, N. Y.—The Board of Water Commissioners has decided to take up the water mains in various streets, and lay larger pipe. This work will be done to afford better fire protection.

Honeoye Falls, N. Y.—According to press reports, the date of receiving bids for the municipal water systems to be constructed here has been extended to May 1. The contract will include about 5½ miles of mains, a pumping station and elevated tank. A. B. Neal is Village Clk. Noted Apr. 17.

★Mexico, N. Y.—Bids will be received by the Board of Water Commissioners until 2 p.m., May 7, for furnishing materials and constructing a water system. The contract involves the following: 860 tons c.-i. pipe, 78 fire hydrants, 71 valves and boxes, 9 miles of water mains, pumping station, impounding well, etc., two power pumps and gasolene engines or electric motors, 2 steel pressure filters, steel stand pipe, etc. Witmer & Brown, Chapin Block, Buffalo, N. Y., are Consult. Engrs. George W. Johnson is Clk. of Bd.

Mount Morris, N. Y.—The Board of Trustees will probably soon call an election to vote on purchasing and improving the Mills Water System, and installing sewers. It is estimated that the system can be bought for $5000. The Board is also considering a plan to install a new municipal system, the supply to be obtained from Silver Lake. William Mate is Mayor.

Troy, N. Y.—We are officially advised that bids for constructing a reinforced concrete overflow conduit for the Oakwood Reservoir, from Cragin and Glen Aves. to the Hudson River, were received by the Board of Contract and Supply, Apr. 15, as follows: E. L. Grimes Co., $38,367; Whiting, Turner Co., $51,888; Martin Murray Co., $44,677; Leary & Morrison Co., $49,652; Kellam & Schafer Co., $50,866; Kennedy & Hamilton Co., $53,081; Concrete & Foundation Co., $54,430; Henry Golden, $54,594; Edward Walsh, $57,706; George Broderick, $63,191; Rob Roy Construction Co., $66,828. Noted Apr. 13.

Watervliet, N. Y.—A law was passed by the State Legislature of New York, Apr. 9, permitting the financing, construction and operation of water systems to serve several municipalities in combination. Under this law, a proposition by Richard W. Sherman, Ch. Engr. of Conservation Commission of New York State, has been put before the Municipal Improvement League of Watervliet, for the construction of a reservoir near Charlton on the Alpiaus Kill, seven miles north from Rexford Flats and about twenty miles distant from Watervliet. The full flow line elevation of such a reservoir could be made at 520 ft. above tide, reservoir to hold 2,000,000,000 gal. of water. The water from the area of 25 square miles would flow into it. This is estimated would give a flow of 15,000,000 gal. per day the year round, allowing a run off a little over one foot deep per annum. This would give adequate water service for Watervliet, Green Island, Waterford and Cohoes, Watervliet having at present very poor service from a reservoir constructed in 1876; Cohoes has at present a distributing reservoir at an elevation of 300 ft. above tide, which serves both Cohoes and Waterford. Cohoes now uses 7,000,000 gal. per day, Watervliet and Green Island about 3,000,000 gal. per day and would use more if water was of good quality. With the proposed reservoir built and Cohoes using 8,000,000 gal. per day, there would be 7,000,000 left for Waterford, Green Island and Watervliet, which would prove sufficient for the localities for many years to come. The head between the proposed reservoir and the distributing reservoir of Cohoes is 220 ft. and if water in Charlton Reservoir were drawn down 40 ft., there would still be ample head under which to deliver 15,000,000 gal. to distributing reservoirs at Cohoes and Watervliet at an elevation of 300 ft. To deliver the 15,000,000 gal. per day would require 105,000 ft. or about 20 miles of 36-in. pipe and 11,000 ft. or about two miles of 20-in. pipe. The estimated cost, which is very preliminary, is as follows: Land and 2,000,000,000-gal. reservoir near Charlton, $200,000; 36-in. pipe line, $861,000; 24-in. pipe line, $41,000; tunnel under Mohawk River near Dunsbach's Ferry, $80,000; gate houses and regulating works, $50,000, or a total of $1,212,250 to which should be added 15% for engineering and contingencies, $181,837, or a total in round amount of $1,400,000.

Roughly outlining a works for same service of supply near Charlton for supplying 6,000,000 gal. per day to Watervliet and Green Island only, we have approximately the following figures: Land and reservoir at Charlton, $100,000; 111,000 ft. or about 22 miles of 24-in. pipe, $532,800; tunnel under Mohawk River near Dunsbach's Ferry, $80,000; regulating work, $30,000; 15% for engineering and contingencies, $105,120 total, $831,920.

The three Commissioners which compose the Conservation Commission are George E. VanKennen, of Ogdensburgh,

Chairman; James W. Fleming, of Troy and John D. Moore, of New York. Commissioner Moore has charge of matters in the division of inland waters. It was suggested that the officials and interested citizens of Watervliet, together with those of Green Island, Cohoes and Waterford should take up the subject of water supply with Commissioner Moore without delay, the Commission now having funds available from which it can, if it is deemed advisable, pay for a preliminary survey and investigation for a joint water supply for Watervliet, Green Island, Cohoes and Waterford.

Grove City, Penn.—The city contemplates an expenditure of $10,000, for extending water mains, constructing a new standpipe, and adding another unit to the electric-light plant. L. E. Burnside is City Engr.

Harrisburg, Penn.—Bids will be received until 3 p.m., Apr. 30, at the office of the Water Department, for furnishing the following supplies for the year ending June, 1914: C.-i. pipe, valves and fittings; brass fittings, lead, jute, sulphate of aluminum and hypochlorite of lime, etc. John A. Affleck is Pres.

✦Rehoboth, Del.—The contract to furnish and lay c.-i. pipe, construct a 200,000-gal. water tower, and furnish and install engines and pumps, has been awarded to CHARLES OWENS, Bridgeville, Del. Estimated cost, $30,000. Bids were opened by the Board of Public Works, Apr. 15. Noted Mar. 27.

Alexandria, Va.—We are officially advised that bids for constructing a concrete masonry dam fro the Alexandria Water Co. were received as follows, Apr. 15, by David J. Howell & Son, Consult, Engrs., Washington, D. C.: R. J. Malone, 1341 Clifton St., Washington, D. C., $121,281; Winston & Co., American National Bank Bldg., Richmond, Va., $167,413; Hoge-Luebkert Co., 617 14th St. N. W. Washington, D. C., $163,482; Warren F. Brenizer Co., 141 Q St. N. W. Washington, D. C., $153,905; Thomas Sheahan, Richmond, Va., $134,272; King-Ganey Contracting Co., 2 Rector St., New York, $172,105; Piedmont Construction Co., University, Va., $124,611; MacArthur Bros. Co., 11 Pine St., New York, $154,979; Oscar Daniels Co., 38 Park Row, New York, $178,323; Whiting-Turner Construction Co., Sexton Bldg., Baltimore, Md., $148,169; National Fireproofing Co., Fulton Bldg., Pittsburgh, Penn., $160,992; Alsop & Pierce, Newport News, Va., $149,238.

Norfolk, Va.—The Board of Aldermen is considering a plan to improve the water system which involves an expenditure of approximately $25,000. William T. Brook is City Engr.

Cherryville, N. C.—An election has been called for May 6 to vote on a bond issue of $25,000 for installing a water system. Noted Feb. 13.

Albany, Ga.—The city contemplates an expenditure of $15,000, for improvements to the water system. R. J. Edgerly is City Engr.

Lagrange, Ga.—We are officially advised that $190,000 has been appropriated for the installation of a water system and a gas plant here. Plans for these improvements are being prepared by James Nesbit Hazlehurst, Consult, Engr., candler Bldg., Atlanta. Noted Apr. 3. See also item under Light, Heat and Power.

Louisville, Miss.—The city contemplates the instalation of water and sewer systems at an estimated cost of $30,000. For particulars, address the Mayor.

Dresden, Tenn.—Henry A. Mentz, Consult. Engr., Randolph Bldg., Memphis, Tenn., has been retained to prepare plans and specifications for a water system here. Estimated cost, $15,000.

Henderson, Tenn.—See item under Light, Heat and Power. Noted Apr. 13.

Nashville, Tenn.—Bids will be received by W. L. Murray, City Recdr., until Apr. 28, for purchasing $200,000 bonds. These bonds were voted to repair the reservoir which was damaged last year. George W. Stainback is Chn. Ed. Pub. Wks. Noted Feb. 27.

Corbin, Ky.—The city has purchased a site for the pumping station of its new water system and will contract for the work in the near future. Thomas J. Young is City Clk. Noted Feb. 20.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 2, for laying c.-i. water pipe with valves and special castings, in various streets.

Cleveland, Ohio—The Water Department is investigating the advisability of extending both water tunnels to a point about six miles from the shore of Lake Erie. Under this plan, the new West Side crib will be used as a working crib, and the intake for the tunnel will be placed from one to two miles further north. The new crib is 4⅞ miles from the shore. The East Side intake is four miles from shore. W. H. Kirby is Clk. Pub. Ser. Noted Apr. 13.

Lima, Ohio—We are officially advised that bids will be received by the city until noon, May 1, for the following: One 6,000,000-gal. horizontal, cross-compound condensing pump, two boilers, each of 150 hp., damper regulators, water alarms, and all fittings, steam header, bends, etc., 2550 ft. of 6-in. and 830 lin.ft. of 20-in. water mains, valves, tees, reducer, hydrants, etc. James R. Morris is Dir. Pub. Ser.

Youngstown, Ohio—According to press reports, the filtration plant of the municipal water system will be entirely reconstructed. The plant will contain 28 filters, with a daily capacity of 24,000,000 gal. The entire cost of the plant will be $170,000. F. M. Lilly is City Engr.

Decatur, Ind.—According to press reports, bids will be received by H. M. De Voss, City Clk., until noon, May 6, for constructing a reinforced-concrete reservoir with a capacity of 230,000 gal.

Evansville, Ind.—The date of receiving bids for furnishing equipment for the water-pumping station has been extended to Apr. 28. The contract includes a 300-hp. water-tube boiler, one mechanical stoker for same, and three mechanical stokers to be installed on 225-hp. boilers now in place. Noted Mar. 20.

Highland Park, Mich.—Bids will be received by R. M. Ford, Village Clk., until Apr. 28, for furnishing 3567 pieces of 6-, 8-, 12- and 16-in. water pipe, in all about 955 tons.

Reading, Mich. See Item under Light, Heat and Power.

Chicago, Ill.—Bids will be received by the Board of Local Improvements until 11 a.m., Apr 28, for laying water mains in various streets. Edward J. Glackin is Secy.

Appleton, Wis.—The contract for the new filtration plant and pumping station awarded to the Jewell Water Improvement Co., Chicago, has been sublet to the BLACKWORTH CONSTRUCTION CO., Milwaukee. The filtration plant and building will cost $50,000, pumping station and foundations, $16,000, pumps and engines, $35,000, lead pipe, $2500, sites, $6000. The plant will occupy the site of the old buildings of the Appleton Mfg. Co., and will have a capacity of 4,000,000 gal. daily. water to be 97½% pure and to be taken from above the upper dam in the Fox River.

Appleton, Wis. Bids will be received by E. L. Williams, City Clk., until 9 a.m., Apr. 23, for constructing a pumping station for the water system, according to plans and specifications on file at the office of the City Clerk.

Deerwood, Minn.—We are officially advised that bids will be received by J. O. Hage, Village Recdr., until 8 p.m., Apr. 29, for purchasing $15,000 water bonds. Noted Mar. 27.

Maple Lake, Minn.—We are officially advised that J. F. Druar, of the Oscar Claussen Engineering Co., St. Paul, Minn., has been retained to prepare plans and specifications for the installation of a municipal water system here. Bids will probably soon be asked for this contract.

✦Turon, Kan.—The contract to construct a water system here has been awarded to EVERETT & BURT, Hutchinson, Kan., at $19,100. Bids were opened Apr. 4. Rollins & Westover, Kansas City, Mo., are Consult. Engrs. Noted Mar. 27.

Glenrock, Wyo.—We are officially advised that bids will be received until May 5, for constructing a water system here, according to plans and specifications prepared by C. C. Carlisle, Consult. Engr., Cheyenne, Wyo. A. R. Kimball is Town Clk., and G. W. Thomas, Mayor. Noted Feb. 20.

Livingston, Mont.—We are officially advised that the proposition to issue bonds for $225,000 for the installation of a water system, and filtration plant, was carried at the election, Apr. 14. Plans and specifications for this work have been completed, and bids will be asked some time in June. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult, Engrs. Noted Apr. 10.

Monroe City, Mo.—We are officially advised that an election has been called for Apr. 28, to vote on a bond issue of $78,000 for the construction of water and sewer systems here. Plans and specifications have been completed by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo. Noted Mar. 13.

Cameron, Tex.—The Cameron Water Power & Light Co. will erect a pumping station and make other improvements to its water system.

Cotulla, Tex.—The Cotulla Reservoir & Irrigation Co. will construct dams and build a complete system of irrigation in the valley of the Nueces River near here at a cost of about $1,500,000. It is planned to irrigate 60,000 acres of land.

Okmulgee, Okla.—The city plans to lay about two miles of 6-in. water pipe this year. James G. Lyons is City Engr.

Columbus, N. M.—C. E. Cook, El Paso, Tex., has been granted a franchise by the City Council to construct a water system and install an electric-light and power plant here.

✦Winslow, Ariz.—The Atchison, Topeka & Santa Fé Ry. Co. has awarded a contract to JOHNSON & BECK, Winslow, to lay eight miles of 8- and 12-in. water pipe from Clear Creek Cañon to the roundhouse at Winslow.

Endicott, Wash.—H. C. Green & Co., Consult, Engrs., are preparing plans for the installation of a municipal water system here, estimated to cost $10,000.

Lafayette, Ore.—Bids will be received by J. A. Wells, City Recdr., until Apr. 28, for the purchase of bonds issued for the installation of a water system.

Nyssa, Ore.—All bids received recently for the installation of a water system here, have been rejected. The work will be done by city labor. The system is estimated to cost $20,000. Noted Apr. 10.

Portland, Ore.—Bids will soon be asked by the Water Board for laying 24- and 28-in. water mains across the Willamette River.

Clovis, Calif.—Bids are being received for the construction of a water system here, estimated to cost $25,000, and a sewer system estimated to cost $24,000. Chris P. Jensen, City Engr., Fresno, is Consult. Engr. L. E. Weldon is City Clk.

Los Angeles, Calif.—F. C. Finkle, Consult. Engr., Hellman Bldg., has prepared plans and specifications for the construction of a water distributing system in the townsite of Montrose, the work to include between four and five miles of riveted steel mains ranging from 4 o 10 in. in diameter.

Monrovia, Calif.—The City Engineer has completed plans and specifications for the construction of a reservoir of 1,500,000-gal. capacity, on North Ivy Ave. Estimated cost, $8000. Bids for construction will soon be asked. Noted Apr. 17.

Riverside, Calif.—We are officially advised that bids will be received by H. C. Cree, City Clk., until May 19, for the purchase of $1,160,000 bonds issued for improvements to the water system. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Feb. 20.

San Francisco, Calif.—The Pacific Gas & Electric Co. is planning to enlarge the Bear River Canal in Placer County at an estimated cost of $590,000. The water will be used for irrigation purposes.

Hull, Que.—J. A. Laforest, Engr., is preparing plans for a water system here, estimated to cost $20,000.

★Montreal, Que.—Bids will be received by the Board of Water Commissioners until noon, May 16, for enlarging the city aqueduct. The work comprises about 2,350,000 cu.yd. of earth excavation and about 436,000 cu.yd. of rock excavation. The transporting of the excess excavated material; the construction of reinforced and plain concrete retaining side walls containing about 203,000 cu.yd. of concrete, the con-

struction of syphon culverts, etc., the whole according to plans, cross-sections and specifications to be seen at and obtained from the office of the Superintendent of Water Works. L. N. Senecal is City Secy.

+Brighton, Ont.—We are officially advised that the contract to furnish pipe for water extensions at Brighton has been awarde dto I. G. MILL, Toronto, at $50,000. Bids were opened Apr. 7. Noted Mar. 27.

St. Thomas, Ont.—The Commissioner of Water Supply has asked an appropriation of $100,000, for improving the water system. James A. Bell is City Engr. Noted Mar. 27.

Winnipeg, Man.—Bids will be received by H. N. Ruttan, City Engr., 223 James Ave., until Apr. 28, for furnishing 2500 water meters.

SEWERS

★Amherst, Mass.—Bids will be received by the Sewer Commissioners until 7:30 p.m., May 1, for the construction of a sewer system. The contract involves the following: Excavating, laying, etc., 14,380 ft. vitrified sewer pipe in sizes from 8 to 18 in. inclusive; excavating, laying, etc., 2600 ft. c.-i. pipe in sizes of 12 and 16 in., building 40 manholes, depths of excavation from 5 to 22 ft. Plans and specifications are on file at the office of John Mullan, Chn. of Comrs. W. C. Tannatt, Easthampton, Mass., is Consult. Engr. The contract to furnish pipe has already been awarded. Noted Mar. 20.

+Boston, Mass.—We are officially advised that bids for constructing sewers in various streets were received by the Department of Public Service, Apr. 11, as follows: in South St.: ANTONY CEFALO, $5591 (awarded contract); John McCourt & Co., $7158; William L. Dolan, $7218; George J. Regan, $7346; Peter W. Hill, $7522; Anthony Baruffaldi, $7555; McCarthy & Walsh, $7698; M. De Sisto & Co., $8345; James H. Ferguson, $8902. In Montclair Ave., WILLIAM L. DOLAN, $4199 (awarded contract); Antony Cefalo, $4347 George J. Regan, $4953; Anthony Baruffaldi, $5075; R. Cartullo, $5085; McCarthy & Walsh, $5131; John McCourt & Co., $5142; James H. Ferguson, $5646; M. De Sisto & Co., $6034; Daniel Di Pietro, $6751. In Vetta Road, etc., GEORGE J. REGAN, $2381 (awarded contract); James F. Murphy, $2423; Peter W. Hill, $2546; R. Cartullo, $2564; M. De Matteo, $2790; M. De sisto & Co., $2877; Timothy Coughlin, $2964; John McCourt & Co., $3302; James H. Ferguson, $3302; D. E. Lynch. Noted Apr. 10.

An appropriation of $600,000 has been made for sewer construction. L. K. Rourke is Comr. Pub. Wks.

Westfield, Mass.—The Board of Selectmen has decided to lay by day labor the sewer pipe for which bids were received Apr. 23. Estimated cost, $18,000. John L. Hyde is Town Engr. Noted Apr. 17.

+Hartford, Conn.—The Board of Contract and Supply, Apr. 15, awarded contracts for building sewers as follows: Cheshire St., T. H. & F. B. O'NEILL; Capitol Ave., DIMARCO & BERNARDINO; Jefferson & Madison Sts., PETROSSI BROS. CO. all of Hartford.

+Torrington, Conn.—We are officially advised that the contract to furnish and lay about 2500 lin.ft. of 8- to 18-in. tile sewers, nine manholes, five catch basins, etc., has been awarded to the ANDREANI & GELORMINO CO., 54 Louis St., Torrington. Bids were opened Apr. 14. Noted Apr. 10.

Waterbury, Conn.—Bids will be received by the Board of Public Works until 4 p.m., Apr. 29, for constructing sewers in Beacon, North Beacon, Willow, Pine, Fleet, Rose and Fiske Sts. Plans and specifications are on file at the office of Robert A. Cairns, City Engr.

Albion, N. Y.—We are officially advised that bids for constructing a sewer system and sewage disposal plant at Albion were received by the Board of Sewer commissioners, Apr. 15, as follows: Hager & George, Newark, N. Y., $148,321; Ripton & Murphy, Rochester, N. Y., $150,768; Vang Construction Co., Cumberland, Md., $157,419; Barrally & Ingersoll, Rochester, N. Y., $159,266; W. S. Cooper Co., Albion, N. Y., $166,574; Jos. S. Cox & Co., Buffalo, N. Y., $169,324; Flower City Construction Co., Hochester, N. Y., $171,774; Sam. Bonn, Syracuse, N. Y., $184,205; S. M. Neff, New York, $199,964; F. J. Munn C., Buffalo, N. Y., 216,126. R. R. Fernow is Engr. of Bd. Noted Apr. 3.

Binghamton, N. Y.—The State Department of Health has approved the plans of the city to construct sewers in Schiller and Carroll Sts., and Broad Ave. F. M. Hopkins is City Clk.

Corning, N. Y.—The Common Council has voted to accept the recommendations of the Public Improvement Committee to protect the city water supply. It is proposed to fill in Denison Park Lake, construct a sewer to replace the present tile sewer, and repair other sewers in the vicinity. Estimated cost, $10,000. Alfred Maltbie is Chn. of Com.

Eastwood, N. Y.—Plans are being prepared for a sewer system for the village of Eastwood. About nine miles of pipe will be laid, and work will probably commence during the summer.

+New York, N. Y.—Boro. The Bronx. We are officially advised that the President of the Boro. of the Bronx has awarded a contract to GEORGE M. DUNN, at $7,111 for the construction of sewers in West 254th St. between Broadway and Riverdale Road. Bids were received on Apr. 16.

Plattsburgh, N. Y.—Bids will be received by the Board of Public Works until 7:30 p.m., May 2, for constructing sewers, according to plans and specifications on file at the office of Henry J. Langdon, City Engr.

+Schenectady, N. Y.—The contract to lay about 30,000 ft. of sewer here has been awarded to CHARLES HEDLUND, Orange St., at $62,016. The only other bid received was submitted by John Alley, Schenectady, N. Y., at $70,000. Bids were originally received on Dec. captioned on Apr. 2, but these bids were rejected as too high and the contract readvertised. Noted Apr. 17.

+Troy, N. Y.—Bids for constructing a reinforced concrete overflow conduit for the Oakwood Reservoir, from Oregon and Glen Ave. to the Hudson River, were received by the Board of Contract and Supply, Apr. 15, as follows: E. L. GRIMES CO., $38,367; Killam-Shaffer Co., $50,886; Martin Murray Co., $44,677; Whitney-Turney Co., $51,883; Rob Roy Contracting Co., $66,828; Concrete and Foundation Co., $54,430; Henry Golden & Son., $54,594; Leary & Morrison Co., $49,652; Edward Walsh, $57,706; Kennedy-Hamilton Co., $53,081; George J. Broderick, $63,191. Noted Apr. 3.

+Cliffside Park (Cliffside post office) **N. J.**—We are officially advised that contracts to construct a trunk sewer here have been awarded as follows: Sections 2 and 3, to F. G. MAY & B. E. BRADY, Palisade, N. J., at $19,386 and $12,500, respectively; Section 4, to LUIGI DI SCIASCIO, Cliffside, at $10,089. Bids were opened by the Mayor and Borough Council, Apr. 14. Noted Mar. 27.

Elizabeth, N. J.—See item under Streets and Roads.

+Helmetta, N. J.—A contract to construct a sewage disposal plant here has been awarded to WILLIAM HORN & CO., at approximately $15,000.

Jersey City, N. J.—Bids will be received by the Board of Street and Water Commissioners until Apr. 3, for constructing a reinforced concrete arch culvert under the Delaware, Lackawanna & Western R.R. embankment of the Boonton section being the outlet of the Manhattan Ave. sewer, also for laying about 200 ft. of 54-in. c.-i. pipe through the culvert. Edward B. See is Clk.

★Newark, N. J.—We are officially advised that bids for Section II, main intercepting sewer, were received by the Passaic Valley Sewerage Commissioners, Apr. 15, as follows: J. F. Shanley Co., Newark, N. J., $437,300; Robt. W. Smith Corp., New York, N. Y., $385,375; Bruno & Petitti, Belleville, N. J., $379,600; McCauley-Manton Co., Newark, N. J., $324,350; Whiting-Turner Construction Co., Baltimore, Md., $319,075; Dock Contractor Co., Hoboken, N. J., $16,970; Pethick Bros. & Co., Inc., New York, N. Y., $314,800; Oscar Daniels Co., New York, N. Y., $312,050; Ryan & Reilly Co., Baltimore, Md., $303,050; Patrick McMeel, Passaic, N. J., $294,600; Concrete & Foundation Co., New York, N. Y., $281,600; Union Building & Construction Co., Passaic, N. J., $281,300; Culp Co. Inc., Brooklyn, N. Y., $259,055; Harrison & Craig, Newark, N. J., $237,300. Noted Mar. 27.

Allentown, Penn.—We are officially advised that bids for constructing storm-water sewers and appurtances in 17th and other streets, were received by the City Council, Apr. 15, as follows: (a) Weaver Contracting Co.; (b) George H. Hardner; (c) Butz & Clader; (d) Allentown Construction Co. Vitrified pipe, (a) $13,472, (b) $12,139, (c) $13,326, (d) $13,197; vitrified clay segment block, (a) $10,945, (b) $9846, (c) $15,338, (d) $9396; reinforced concrete (seg. Con.), (a) $10,408, (b) $9268, (c) $15,483, (d) $8821; reinforced concrete unit con. (Parmley), (a) $11,212, (c) $15,626; reinforced concrete unit con. (Lock Joint), (a), $10,719, (b) $10,218, (c) $9205; monolithic concrete, (a) $12,196, (b) $8757, (c) 16,468.

Highland Park, Va.—An election has been called for May 15, to vote on a bond issue of $50,000 for constructing sewers and paving streets. G. W. Bahlke is Mayor

Plainfield, N. J.—See item under Streets and Roads.

+Winston-Salem, N. C.—A contract to construct about three miles of intercepting sewer has been awarded to the CRAWFORD PLUMBING & MILL SUPPLY CO., Winston-Salem, at $25,517. Noted Dec. 26 under Winston.

+Mobile, Ala.—According to press reports, a contract to construct sewers here has been awarded to SULLIVAN, LONG & LAGERTY, Bessemer, Ariz., at $45,000.

Jackson, Miss.—The City Commission will probably soon call an election to vote on a bond issue of $60,000 for constructing storm sewers and a concrete bridge across Town Creek. B. H. Klyce is City Engr.

Ruston, La.—We are officially advised that bids will be received by S. D. Pearce, Pres. Sewer Board, until noon, May 15, for constructing a complete sewer system here, estimated to cost $40,000. Plans and specifications were prepared by X. A. Kramer, Consult. Engr., Magnolia, Miss. Noted Apr. 17.

Louisville, Miss.—Surveys are being made, and a report will soon be submitted for the installation of sewer-water systems here. It is estimated that both systems can be built for $30,000, and an election will probably soon be called to vote on a bond issue for that amount.

Louisville, Ky.—Bids will be received by the Board of Public Works until May 2, for constructing sewers in the following streets: Mai nSt. from Wenzel to Preston, from First to Second, from Third to Fourth, from Fifth to Twelfth, from 14th to 16th, from 17th to 18th, from 20th to 21st, from 22d to 23d, from 25th to 28th. Market St., from Shelby to Campbell, from 12th to 13th, from 16th to 20th. Jefferson St., from Floyd to First, from 18th to 21st. Green St., from 12th to 15th. Walnut St., from 14th to 15th. Beech St., from Woodland to Virginia. Bismarck Ave., from 32d to 34th. Virginia Ave., from 32d to 34th.

Chicago Junction, Ohio.—We are officially advised that the W. J. Sherman Co., The Nasby, Toledo, Ohio, is preparing plans for a sewage purification plant here.

Celina, Ohio—Bids will be received by James K. Carlin, Village Clk., until noon, Apr. 29, for furnishing pipe for a complete sewer system. Bids will be received on reinforced concrete, segmental concrete, monolithic concrete, segmental vitrified and vitrified pip, according to plans and specifications on file at the office of the Clerk.

★+Cincinnati, Ohio—We are officially advised that the contract to construct main and lateral sewers and drains in the section of the city known as Evenston, has been awarded to McCARTHY BROS., 2910 Woodburn Ave., Cincinnati, at $39,976. Bids were opened Mar. 10. Noted Apr. 3.

Cincinnati, Ohio—Bids will be received by V. T. Peter, Dir. Pub. Ser., until noon, Apr. 28, for constructing main and lateral sewers and drains with appurtenances in various streets.

+Cincinnati, Ohio—A contract to lay sewers in Glenway

Ave. and Price Hill has been awarded to WELLING & FRANZ, Cincinnati, at $71,610. Bids were opened Apr. 10. Noted Apr. 10.

✚Toledo, Ohio—Contracts for constructing sewers were awarded by the Board of Control, Apr. 7, as follows: In the vicinity of Lagrange St. and the Manhattan Road, to ALBERT GRYSDOWSKI, Toledo, at $14,946; in South St. and the boulevard in Highland Park, to the TOLEDO CONTRACTING CO., at $2177. Noted Apr. 3.

New Berlin, Ohio—Preliminary plans and estimates are being considered for the installation of a sewage-disposal plant here. John H. Holl is Town Engr.

Ravenna, Ohio—Bonds for $30,000 have been voted for extending and improving the sewer system here. F. D. Marble is Pres. City Council.

Bloomington, Ind.—U. S. Hanna, City Engr., is preparing plans for extensions to the sewer system, estimated to cost $10,000.

Booneville, Ind.—Plans for the proposed sewer in the northern part of the city, are now on file at the office of the City Clerk. The sewer is estimated to cost $85,000, and bids will probably soon be asked. Noted Apr. 10.

Cadillac, Mich.—An appropriation of $30,000 has been voted for the construction of a combined sanitary and storm sewer.

★Flint, Mich.—Bids will be received by D. E. Newcombe, City Clk., until 3 p.m., May 2, for constructing sanitary sewers as follows: on Baker St. from Saginaw St. to Ave. A; on Taylor St. from Saginaw St. to Ave. A; on Dort Ave. from Rankin St. to Rix St.; and on Young St. from Crapo St. to Avon St., in accordance with plans and specifications adopted by the Common Council now on file in the office of the City Engineer. Noted Apr. 10.

Grosse Pointe Park, Mich.—A bill has passed the legislature authorizing the village to vote $140,000 bonds for the construction of an 8-ft. sewer, which will connect with the Fairview sewer of Detroit. It is expected that the villages of Grosse Pointe Farms, Grosse Pointe and Grosse Pointe Shores will also issue bonds for this purpose. The total cost of this improvement is estimated at $500,000. Louis N. Hilsendegen is Village Pres.

★✚Iron Mountain, Mich.—We are officially advised that the contract to construct about 1650 ft. of 48-in. Jackson pipe reinforced-concrete sewer has been awarded to PHIL O. SHERIDAN & CO., Roughton, Mich., at $10,725. The other bids were: J. R. Holfelt Co., $12,500; Pastoret Construction Co., $12,198; R. J. Nilson & Sons, $13,650. Bids were opened Apr. 12. Sol Beauparlant is City Clk. Noted Mar. 13.

Port Huron, Mich.—An appropriation of $10,500 has been made for constructing a storm sewer to drain the section of the city between 15th and 24th Sts., south of Lapper Ave. The sewer will be of concrete, egg shaped, the inside diameter to be 33x50 in.

Clinton, Ill.—An ordinance has passed the City Council for the construction of sewers in South Jackson, South Elm., White and Park Sts. Estimated cost, $15,0000.

Evansville, Wis.—Bids will be received by F. W. Gillman, City Clk., until May 6, for constructing 1900 ft. of storm sewers and 6198 ft. of sanitary sewers.

✚West Milwaukee, Wis.—We are officially advised that the contract to construct a sewage-disposal plant here has been awarded to the CODDINGTON ENGINEERING CO., North Milwaukee, Wis., at $5764. Bids were opened Apr. 15. Noted Apr. 3.

★Davenport, Iowa—Bids will be received by the Board of Public Works until 2 p.m., May 3, for constructing a sanitary sewer system in the 13th Ward, comprising outfall, trunk drainage, and main sewers, being sections 1, 2, 3, 4, 5, 6, 7 and 8, as shown on general plan now on file, and consisting approximately of the following quantities: 2400 ft. of 96-in. drainage conduit, 3000 ft. of 24-in. sewer, 2400 ft. of 18-in. sewer, 3500 ft. of 15-in. sewer, 2400 ft. of 12-in. sewer, 2900 ft. of 24-in. sanitary invert. Plans and specifications may be obtained at the office of the Board of Public Works. A. M. Compton is Comr. Pub. Wks. Noted Mar. 13.

Austin, Minn.—Bids will be received by the City Recorder until Apr. 25, for constructing 3700 ft. of 10- to 20-in. storm sewers, and 6400 ft. of 8- and 672 ft. of 18-in. sanitary sewers.

Council Grove, Kan.—A. J. Smith, Consult. Engr., Emporia, Kan., is preparing plans for a sewer syste mhere, estimated to cost $25,000. Arthur E. Smith is City Engr.

Great Bend, Kan.—We are officially advised that bids will be received until Apr. 28, for constructing a 21-in. outfall sewer. R. A. Rowland, McPherson, Kan., is Conscult. Engr. Noted Mar. 27.

California, Mo.—We are officially advised that bids will be received by the city until May 7, for constructing about four miles of lateral sewers. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs.

Hermann, Mo.—We are officially advised that bids will be received by the city until 8 p.m., Apr. 28 ,for constructing about 4½ miles of sewer laterals. Plans and specifications may be obtained from Burns & McDonnell, Consult. Engr., Scarritt Bldg., Kansas City, Mo. Noted Apr. 3.

Monroe City, Mo.—See item under Water Supply—Irrigation.

Springfield, Mo.—Bids will be received by the city until Apr. 25, for constructing two sewers in the First Ward. The city plans to lay abiut 10 miles of sewers this year. C. E. Phillips is City Engr.

Bishop, Tex.—Bonds for $75,000 have been issued for purchasing and improving the local sewer system and paving various streets.

Clovis, Calif.—See item under Water Supply—Irrigation.

Gridley, Calif.—W. H. Castner, Jr., City Engr., is preparing plans and specifications for completing the sewer system here, and bids for construction will probably soon be asked.

Los Gatos, Calif.—F. A. Nykirk, City Engr., has submitted plans to the City Council for the proposed sewer system and sewage disposal plant. Noted Mar. 20.

San Bernardino, Calif. The City Council has ordered the construction of a sewer system in the northwest section of the city. Estimated cost, $30,000.

GARBAGE

Springfield, Mass.—Plans are being prepared by C. M. Slocum, City Engr., for the erection of a rubbish incinerator.

Etna, Penn. Bids will be received by J. C. Armstrong, Boro. Clk., until Apr. 28, for the collection and disposal of garbage in the borough.

Akron, Ohio—The city is considering the erection of a new garbage incinerator. R. M. Pilmore is Dir. Pub. Ser.

✚Dallas, Tex.—The contract has been awarded, it is reported, by the city to the R. S. WINN CO., for the erection of a three-unit addition to the garbage crematory at $6500.

✚Pasadena, Calif.—The city has awarded the contract to A. B. COFFMAN, Pasadena, for all work in connection with the sprinkling of the city's streets.

STREETS AND ROADS

Boston, Mass.—The Department of Public Works has appropriated $600,000 for street work this year. L. K. Rourke is Comr.

The contract for the construction of 4100 lin.ft. of macadam roadway in Littleton for the State Highway Commission was awarded to BURPEE & BLAKELY, Boston, at $8288. Other Bids were: H. W. Tarbell, Lowell, $9439; M. W. Leahy, Littleton, $9812, and Antony Corchia, Boston, $10,661. Arthur W. Dean is Chief Engr.

Bids will be received until Apr. 25, by the Department of Public Works, for paving West First St., South Boston.

Bids will be received until Apr. 28, for construction of tar macadam roadways in Dawes St. and Playstead Road, Dorchester. L. K. Rourke is Comr.

Hartford, Conn.—Commissioner Bennett has inaugurated an important change in bid bonds. Heretofore common bonds have been accepted with bids, but hereafter all bids must be accompanied by either a surety-company bond or certified check. Another change has been made in that contractors may obtain sets of specifications and blueprints upon reasonable notice, and the payment of the actual cost of preparation.

Hartford, Conn.—The Board of Contract and Supply has recommended to the City Council laying about four miles of concrete sidewalks, a total of about 72,000 sq.ft. The estimated cost is $18,000. Roscoe N. Clark is City Engr.

Waterbury, Conn.—Bids for laying permanent pavements on various streets will be received by the Board of Public Works until 4 p.m., Apr. 29, as follows: Wood blocks on a concrete base, Exchange Place and Bank St., to Grand St., about 5000 sq.yd.; granite blocks, Meadow St., from Bank to Field St., about 4000 sq.yd.; North Elm St., from Kingsbury to Water St., about 3000 sq.yd.; Water St., from North Elm to Brown St., about 1000 sq.yd.; bitulithic Willow St., from Clover's Terrace to Roseland Ave., about 4000 sq.yd. Robert A. Cairns, 9 Leavenworth St., is City City Engr. Noted Apr. 17.

✚Albany, N. Y.—The Board of Contract and Supply has awarded contracts for improving the following streets: Broadway, from Columbia St. to Livingston Ave. (pavement undecided), UNION PAVING CO., Schenectady, N. Y., at $45,619; Park Ave., from Main Ave. to Erie St., with vitrified brick on concrete foundation, M. F. DOLLARD, Albany, at $14,455. Other bidders were: Robert Dumary, Albany, $15,578, and P. W. Mulderry, Albany, $14,853; Bensen St., from Ontario to Quail St., with vitrified brick on concrete foundation, to ROBERT DUMARY, Albany, at $11,524. Other bidders were: J. S. Champion, Albany, $11,668; Kennedy Construction Co., Albany, $12,934; M. F. Dollard, Albany, $11,678; P. W. Mulderry, Albany, $11,828; South Hawk St., from Morton Ave. to Third Ave., vitrified brick on concrete foundation, to J. S. CAMPION, Albany, at $11,045. Other bidders were: Kennedy Construction Co., Albany, $12,042; P. W. Mulderry, Albany, $10,692; Robert Dumary, Albany, $11,308; Elizabeth St., from Alexander St. to Eagle St., P. W. MULDERRY, Albany, at $7924. Other bidders were: M. F. Dollard, Albany, $8467; J. S. Campion, Albany, $8631; Kennedy Construction Co., Albany, $8810; Robert Dumary, Albany, $8627. Isadore Wachsman is Secy.

Brooklyn, N. Y.—Bids will be received until 11 a.m., Apr. 30, by the President of the Borough, Borough Hall, for improving parts of the following streets: Lafayette St., De Bevoise Place, Prince and Duffield Sts., Norman, Central, Division, Albany, Gates and Fifth Aves., Havemeyer, Halsey, and Dean Sts. Alfred E. Steers is Pres.

We are officially advised that the following bids were received by the President of the Borough of Brooklyn, Apr. 16, for paving various streets with asphalt: (a) Dean St., from Nostrand Ave. to New York Ave.; (b) Park Place, from Sixth Ave. to Vanderbilt Ave., and Sterling Place, from Fifth Ave. to Sixth Ave.; (c) St. Johns Place, from Albany Ave. to East New York Ave., and East New York Ave., from St. Johns Place to Rockaway Ave.; (d) St. Marks Ave., from Flatbush Ave. to Vanderbilt Ave., and from Rogers Ave. to Nostrand Ave.; Barber Asphalt Paving Co., Woolworth Bldg., Manhattan, (a) $8033; (b) $25,660; (c) $74,876; (d) $27,696; Cranford Co., 52 Ninth St., (a) $7707; (b) $25,207; (c) $79,065; (d) $26,883; Uvalde Contracting Co., Broadway, Manhattan, (a) $7866; (b) $25,594; (c) $80,145; (d) $27,193; Borough Contracting Co., 186 Remson St., (a) $8027; (b) $25,809; (c) $69,654; (d) $27,193. On section (c) the Topeka Asphalt Paving Co., 147 Fourth Ave., Manhattan, was low bidder at $68,410. Noted Apr. 10.

Buffalo, N. Y.—We are officially advised that bids were received on Apr. 15, by the Department of Public Works for street improvements as follows: (a) German Rock Asphalt & Cement Co., asphalt; (b) Erie Contracting Co., brick; Beckwith St., (a) $7770, (b) $6933; Fell Alley, (a) $4210, (b) $3500; Weyand St., (a) $15,270, (b) $12,700; Frank Ave., (a) $9600, (b) $7800. George H. Norton is Deputy Engr. Comr. Noted Apr. 10.

Dunkirk, N. Y.—We are officially advised that the low bidder for paving portions of six streets was the Lake Shore Construction Co., Dunkirk, at about $35,000. Other bidders were: P. B. Colgan, Dunkirk, the Dunkirk Construction Co., Dunkirk, P. H. Goggin, Fredonia, N. Y., E. B. Osborne, Binghamton, N. Y. R. H. Heppell is City Clk. Noted Apr. 3.

New York, N. Y.—Bids will be received until 3 p.m., May 1, 1 by the Department of Parks, Arsenal Bldg., Fifth Ave. and 64th St. for the construction of asphalt tile walks in Linden Park, Boro. of Queens; for repairs to macadam pavement on Crotona Ave., Boro. the Bronx; for constructing gutters on City Island Road, and extending said road at Bartow Station, Pelham Bay Park, Boro. the Bronx. Chas. B. Stover is Pres. Park Comrs.

New York, N. Y.—(Boro. of Richmond)—We are officially advised that the following bids were received on Apr. 15, by the President of the Boro. of Richmond, Borough Hall, St. George, S. I.: for repaving, with redressed granite blocks, Broadway, from Henderson to Castles Ave., Joseph Johnson's Sons, $11,973; Cornelius Vanderbilt, $8512; John E. Donovan, $12,870; Tarpy Construction Co., $21,654; for relaying the present granite block pavement on the south wing of Richmond Terrace, from Davis Ave. to John St., B. J. Doyle and Fred Leedecke, $2332; Joseph Johnson's Sons, $2507; Tarpy Construction Co., $2952; John E. Donovan, $3703; Cornelius Vandervilt, $2711. George Cromwell is Pres. Noted Apr. 10.

New York, N. Y. (Boro. The Bronx)—We are officially advised that the following are the low bids received on Apr. 16, by the President of the Bronx, for paving various streets: West 179th St., from Osborn Place to Acqueduct Ave., Sapidero Contracting Co., $16,458; Tremont Ave., from Webster Ave. to Third Ave., John Farrell Contracting Co., $15,940; East 150th St., from Third Ave. to Melrose Ave., Harris & Rose, $9196; Brook Ave., from East 156th St. to Third Ave., John Farrell Contracting Co., $15,899; Fox St., from 165th St. to Intervale Ave., Barber Asphalt Paving Co., $10,065; Cauldwell Ave., from Westchester Ave. to East 161st St., Barber Asphalt Paving Co., $11,494; West 231st St., from Corlear Ave. to Bailey Ave., Barber Asphalt Paving Co., $19,340; Ogden Ave., from West 169th St., to Acqueduct Ave., Asphalt Construction Co., $7277. Cyrus C. Miller is Pres. Noted Apr. 10.

Niagara Falls, N. Y.—We are officially advised that bids will be received until May 20, by the Board of Public Works for paving Lockport St. from Main St. to the N. Y. Central tracks. The estimated cost is $70,000. F. S. Parkhurst, Jr., is City Engr. Noted Apr. 17.

Olean, N. Y.—Bids will be received until 8 p.m., Apr. 28, by the Commissioners of Public Works, for paving Irving St., from Union St. to South Fourth St. The approximate quantities are: 900 cu.yd. excavation, 3400 sq.yd. brick pavement, 2420 lin.ft. straight curb, 75 lin.ft. circular curb. George Luther is a Comr.

✚We are officially advised that contracts have been awarded to M. APPLEGATE, SON & CO., Bradford, Penn., for vitrified brick paving on Wayne St. at $17,942, Green St., $2003, and Fourth St., $5759. H. E. Bunce is City Engr. Noted Apr. 3.

✚**Syracuse, N. Y.**—The Board of Contract and Supply has awarded contracts for street improvements as follows: For paving Beverly Road from Stolp to Crossett with asphalt to GUY B. DICKISON, at $7632; to FRED J. BAKER, at $10,570, for paving North Franklin St., from Noxon St. to the Erie Canal with vitrified block; to the WARNER-QUINLAN CO., at $5129 for sheet asphalt pavement on Livingston Ave. from Euclid to Clark St. George J. Metz is City Clk. Noted Mar. 27.

Elizabeth, N. J.—Bids will be received until 8:30 p.m., May 1, by the City Council, for curbing and paving Vine St., from De Hart Place to Grove St., and for laying sewers in parts of Fourth Ave. and Myrtle St. Wm. P. Neafsey is St. Comr.

Hillsdale, N. J.—Bids will be received until 8:30 p.m., May 5, by the Township Committee, for grading and macadamizing the Woodcliff Heights Road, for a distance of about 2166 ft. H. G. Hering is Township Engr. George W. Saul is Chn. of the Com.

Jersey City, N. J.—The Board of Finance has granted an appropriation to pave Warren St., from Montgomery to First St., and Van Vorst St., from York to Grand St., with wood block pavement.

✚**Newark, N. J.**—The Board of Public Works has awarded contracts for street improvements as follows: To the J. J. HUGHES CONSTRUCTION CO., at $10,456, for granite block pavement on Crawford St. from Washington to High St., and at $26,014 for granite pavement in Bowery St., from Market to Ferry; to RALPH SANGIOVANNI, at $8239 and $10,831 respectively for granite block in Bank and Spruce Sts., the HASTINGS PAVEMENT CO., at $9928 and $7052 for asphalt block in North Twelfth and Paterson Sts., the McMAHON CONSTRUCTION CO. at $7831 and $4586 for granite paving on Alpine St. and Marie Place. M. R. Sherrerd is City Engr.

✚**Newton, N. J.**—The Board of Freeholders has awarded a contract to GEORGE & CONLON, Newark, N. J., for macadamizing 655 lin.ft. of the Franklin-Stockholm Road, at a cost of $1066. Noted Mar. 27.

Plainfield, N. J.—The City Street Commission is planning to lay new macadam streets to cost about $25,000. Extensions to the sewer system are also being considered, at a cost estimated at $5200. Andrew J. Gravell is Street Comr.

Ridgewood, N. J.—Bids will be received until 8 p.m., Apr. 29, by the Board of Village Commissioners, for about 3300 sq.yd. brick street pavement. F. W. Simonds is Village Engr. Wilbur Morris is Clk.

✚**Westfield, N. J.**—We are officially advised that the Town Council has awarded a contract to HUMPHREY & BENTLEY, Hackensack, N. J., at $7601 for improving various streets under Contract No. 3, other bidders were: Weldon Contracting Co., $7602; Burke & Denham, $7,565; the W. H. Blackwell Contracting Co., $7778, the Kelley-McFeely Co., $8538; the C. H. Winans Co., $8550; the Hassam Paving Co., $8599, Liddle & Pfeiffer, $9630. A. W. Vars is Engr. Charles Clark in Town Clk. Noted Mar. 27.

Ashland, Penn.—Bids will be received until 7 p.m., May 7, by the Street Committee of the Borough Council, for grading and paving on Oakland Road and Center St. About 15,000 sq.yd. will be required. J. Wm. Ritz is Boro. Secy.

✚**Dravosburg, Penn.**—We are officially advised that the Borough Council has awarded a contract to the J. B. SHEETS CO., Pittsburgh, at $54,428 for improving various streets. R. C. Bayne, McKeesport, Penn., is City Engr. Courtney L. Whitaker is Boro. Secy. Noted Apr. 17.

Harrisburg, Penn.—Bids will be received until 10 a.m., May 13, by the State Highway Department, for the reconstruction of 24,105 lin.ft. of road in Warwick Township, 20,235 lin.ft. in Manheim Township, and 9951 lin.ft. in West Earl Township, all in Lancaster County, and all to be of bituminous macadam construction, penetration method. Edward M. Bigelow is State Highway Comr.

★**Philadelphia, Penn.**—Bids will be received until noon, May 1, by the Bureau of Highways, Department of Public Works, for surfacing macadam roads under Schedule A, five contracts aggregating 16,495 sq.yd. of waterbound macadam; for resurfacing macadam roads under Schedule B, 12 contracts aggregating 71,657 sq.yd. of bituminous macadam, 18,630 sq.yd. of waterbound macadam. M. L. Cooke is Dir.

Uniontown, Penn.—Bids will be received until noon, May 1, by the Controller of Fayette County, for the construction of about one mile of brick and Telford road in Bullskin Township, and about 8200 ft. of brick and Telford road in South Union Township. Thomas H. Hudson is County Solicitor.

Denton, Md.—The lowest bid received by the Commissioners of Caroline County, for construction of 1.63 miles of State highway from Denton to Willowpond was that of the Holt Construction Co., Federalsburg, Md., at $15,831. For concrete approaches to the bridge, its bid was $17,403. Other bids were: Chesapeake Construction Co., $17,248; Juniata Paving Co., $17,117. E. L. Micheau, Baltimore, bid $21,901 for the concrete approaches. The only bid for the draw was from the Shertzer Rolling Lift Bridge Co., $14,800. Noted Apr. 10.

Towson, Md.—We are officially advised that the only bid received for construction of a highway along the Falls Road north from Beaver Dam Run was from J. Frank Parks, Towson, at $8371. This was rejected as above the estimate. Noted Apr. 3.

Danville, Va.—Bids will be received until Apr. 29, by the City Engineer for construction of 37½ miles of soil road, and 6½ miles macadam road in Dan River District, Pittsylvania County. J. O. Magruder is City Engr.

Petersburg, Va.—Dinwiddie County will gravel Jerusalem Plank Road from city limits for five miles into Prince George County. Address County Supervisors, Dinwiddie, Va.

✚**Portsmouth, Va.**—The City Council has awarded a contract to the McGUIRE CONSTRUCTION CO., Norfolk, Va., at about $60,000 for paving High St.

✚**Charlotte, N. C.**—We are officially advised that the City Council has awarded a contract to the SOUTHERN PAVING & CONSTRUCTION CO., Chattanooga, Tenn., for paving various streets, and to A. H. McDANIEL, Augusta, Ga., for construction of concrete sidewalks and curb. Joseph Firth is City Engr.

Greenville, S. C.—Bids will be received until Apr. 29, by the Commissioners of Greenville County, for construction of about 1.52 miles of the Greenville-Henderson Highway. W. S. Peden is Chn. of the Comrs.

✚**Washington, Ga.**—The City Council has awarded a contract to the WEST CONSTRUCTION CO., Chatanooga, Tenn., at about $60,000 for 20,000 sq.yd. of asphalt paving on Main St. The H. S. Jaudon Engineering Co., Atlanta and Savannah, Ga., is Engr.-in-Charge. Noted Mar. 6.

Jacksonville, Fla.—Bids will be received until 10 a.m., May 9, by the Commissioners of Duval County for paving various roads in South Jacksonville with vitrified brick or concrete on a sand foundation. E. P. Holmes is Chn.

Palatka, Fla.—Bids will be received until May 6, by the City Council, for constructing about three miles of concrete sidewalks. S. C. Stallings is City Engr.

Pensacola, Fla.—Bids will be received until noon, May 13, by the Board of Bond Trustees for street improvements consisting of 22,000 sq.yd. concrete pavement and 14,400 lin.ft. concrete or granite curb. John A. Merritt is Chn. of the Bd. Geo. Rommel, Jr., is Ch. Engr.

✚**Collins, Miss.**—We are officially advised that the Commissioners of Covington County have awarded a contract to M. H. THOMASON, Laurel, Miss., at $18,335 for construction of 26½ miles of earth and sand clay roads in District No. 2. A. L. Smith is Highway Engr. Noted Mar. 27.

Jackson, Miss.—Hinds County has voted to spend an additional $200,000 on good roads. Contracts will be let by the County Commissioners.

Magnolia, Miss.—The Supervisors of the Fourth District have voted to issue $200,000 in bonds, the proceeds of which will be spent in improving the main highways of the district.

✚**Memphis, Tenn.**—The City Commissioners have awarded a contract to the MEMPHIS ASPHALT & PAVING CO. at $16,777, for surfacing Marshal Ave. with asphalt. J. E. Weatherford is City Engr.

Georgetown, Ky.—The Fiscal Court of Scott County will expend $16,000 in the repair and construction of roads in the county.

Cincinnati, Ohio—A special correspondent advises us that on account of a lack of bidders, much of the Hamilton County road work must be readvertised. There were no bids received for the improvement of the state road in Crosby Township, and only one for improving the Mill Road, Springfield Township, which was rejected as being above the estimate of $22,283.

Columbus, Ohio Bids will be received until 2 p.m., Apr. 30,

by the State Highway Commissioner for grading and paving with waterbound macadam 2.21 miles of the Galion-Mansfield Road, Sandusky Township, Richland County, at an estimated cost of $13,174; for grading and paving with brick 2.51 miles of the Ashland-New London Road, Ruggles Township, Ashland County, at an estimated cost of $31,537. James R. Marker is Comr.

✦Elyria, Ohio—We are officially advised that a contract has been awarded by the Board of Commissioners of Lorain County to WILLIAM STEWART, Wabash, Ind., at $17,366, for contruction of a new floor in Erie Ave. Bridge No. 1. F. L. Ellenberger is Commrs.' Clk. Noted Mar. 27.

Girard, Ohio—Bids will be received until noon, May 5, by the Village Council, for improvement of Liberty St., from State St. to its termination, and for construction and repair of sidewalks, crosswalks and street intersections in various streets. James E. Stotler is Village Clk.

Lima, Ohio—The City Council has adopted a resolution declaring it necessary to improve Franklin Ave., from Elm St. to Lakewood Ave. G. A. Crayton is City Engr.

Middletown, Ohio—Bids will be received until 11 a.m., Apr. 25, by the Director of Public Service, for sidewalks, curb and gutter on portions of Cleveland, Lefferson, Queen, Sixth, Garden and Clark Sts., and Askew Ave. John Lloyd is Dir.

Paulding, Ohio—Bids will be received until 2 p.m., Apr. 25, by the Commissioners of Paulding County, for the improvement of five sections of the Hofacker Pike, aggregating 28.21 miles and a section of the Greiger Pike, 5292 ft. in length. Howard Mouser is Audr. Charles C. Duckwall is County Engr.

Toledo, Ohio—Bids will be received until 10 a.m., May 6, by the Board of Commissioners of Lucas County, for grading, draining and macadamizing roads in Wildwood Addition, a subdivision of Adams Township. Charles J. Sanzenbacher is Audr.

✦The Board of Control has awarded contracts for street improvements as follows: Forsyth St., from Navarre to Stillman, to PETERS BROS., at $10,112; to same company, at $4442 and $8311, respectively, for Elmwood and Woodland Aves.; to H. P. STREICHER, at $12,406, for Lawrence Ave., from Detroit to Central Ave. T. R. Cowell is Dir.

Uhrichsville, Ohio—The Trustees of Mill Township have had plans prepared for paving about two miles of the Park Valley Road at an estimated cost of $29,407. Mr. Snyder is Township Clk.

✦Warren, Ohio—We are officially advised that the Director of Public Service has awarded a contract to FRED L. GEIGER, 7 School St., Warren, Ohio, at $13,042 for repaving North Park Ave. with Metropolitan brick. Bert C. Smith is City Engr. C. L. Craig is Dir. Noted Mar. 27.

Indiana—Bids for road improvements in Indiana will be received as follows:

May 5, at Rockport, by Commissioners of Spencer County, for construction of a road in Ohio Township. John T. Stevenson is Audr.

May 5, at Danville, by Commissioners of Hendricks County, for a crushed stone and gravel road in Lincoln Township. Lewis W. Borders is Audr.

May 5, at Laporte, by Commissioners of Laporte County, for construction of a macadam road in Pleasant, Lincoln and Washington Townships, 18.33 miles long. Fred A. Hausheer is Audr.

May 6, at Washington, by Commissioners of Daviess County, for three roads in Harrison Township. Leo S. Core is Audr.

May 6, at Decatur, by Commissioners of Adams County, for macadam roads in Washington, Kirkland, Wabash, Marion and Hartford Townships. T. H. Baltzell is Audr.

May 7, at Bloomington, by Commissioners of Monroe County, for production of a road on line between Richland and Bean Blossom Townships. W. F. Kinser is Audr.

May 7, at Muncie, by Commissioners of Delaware County, for a gravel road in Harrison Township; a crushed stone road on line between Harrison and Washington Townships and on line between Union and Hamilton Townships. Francis M. Williams is Audr.

May 8, at New Albany, by Commissioners of Floyd County, for road in New Albany Township. Julian T. Miller is Audr.

May 6, at Kokomo, by Commissioners of Howard County, for gravel and stone roads in Harrison Clay and Center Townships. E. B. Swift is Audr.

May 7, at Columbus, by Commissioners of Bartholemew County for macadam roads in Hawcreek and Harrison Townships. Philip J. Sater is Audr.

May 7, Crown Point, by Commissioners of Lake County, for gravel road in Calumet Township. Chas. A. Johnson is Audr.

May 10, at Franklin, by Commissioners of Johnson County, for construction of two gravel roads.

Corydon, Ind.—Bids will be received until 2 p.m., May 8, by Commissioners of Harrison County for the construction of gravel roads in Franklin and Spencer Townships. J. L. O'Bannon is Audr.

✦Elkhart, Ind.—The Board of Public Works has awarded a contract to the NORTHERN CONSTRUCTION CO., for paving three blocks of South Second St. The bids were as follows: Northern Construction Co., Metropolitan or medal block, cement filler, $7112; sand filler, $7016; asphalt or pitch filler, $7683. Henry Cripe, Metropolitan or medal block, cement filler, $7697; sand filler, $7393; asphalt filler, $8092. Daniels, List & Douglas, Metropolitan block, cement filler, $7697; sand filler, $7634; asphalt filler, $8332.

Evansville, Ind.—Bids will be received until 10 a.m., May 8, by Commissioners of Vanderburg County for the construction of three roads in Armstrong Township. C. P. Beard is Audr.

✦Richmond, Ind.—We are officially advised that the Commissioners of Wayne County have awarded a contract to SISK, SPRINKLE, LEAVELL & CO., Portland, Ind., at $47,029 for construction of a road in Richmond Township. Other bidders were: Hall & Barnard, $47,687; James B. Little, $53,925; Tripper & Son, $51,234; John F. Hipskind, $52,900; F. G. Johnson & Co., $48,998; the Ohio Construction Co., $51,400. L. C. Peacock is County Engr. L. S. Bowman is Audr. Noted Apr. 10.

Terre Haute, Ind.—Plans have been completed for about 10,800 sq.yd. of paving on various streets, and bids will soon be asked. The Board of Public Works is also considering the paving of Poplar St. with brick or bitulithic, about 11,350 sq.yd. R. M. Burns is City Engr.

Belleville, Ill.—We are officially advised that bids will be received until 10 a.m., Apr. 26, by the Board of Local Improvements for paving Church St. The work includes 6759 sq.yd. vitrified brick pavement, 3900 cu.yd. excavation and grading, 4680 lin.ft. sandstone curb, sewer pipe, manholes, etc. Fred J. Kern is Pres.

✦East Moline, Ill.—We are officially advised that the Board of Local Improvements has awarded a contract to the WESTERN IMPROVEMENT CO., Racine, Wis., at $7261 for paving portions of High St., Eighth Place and Sixth Ave. The other bidder was John Klehin & Son, Moline, Ill., at $7460. H. G. Paddock is City Engr. Noted Apr. 10.

Joliet, Ill.—We are officially advised that bids for resurfacing Eastern Ave. with asphaltic concrete were received as follows: The Conway Paving Co., Chicago, $13,325; H. B. Streicher, Chicago, $12,300, the Western Improvement Co., Racine, Wis., $12,210. C. D. O'Callahan is City Engr. Noted Apr. 10.

✦Peoria, Ill.—The Board of Local Improvements has awarded a contract to JOHN W. BUSHELL at $11,196 for resurfacing Fayette St. from North Adams St. to Knoxville Ave. with asphalt. L. D. Jeffries is City Engr.

✦Appleton, Wis.—The City Council has awarded a contract to the WHITE CONSTRUCTION CO., Milwaukee, at $1.97 per sq.yd. for about 30,989 sq.yd. asphalt pavement. Noted Feb. 6.

Delavan, Wis.—Bids will be received until 10 a.m., May 2, by the Committee on Streets and Alleys, for grading, curbing and paving Walworth Ave., from Main to Fourth Sts., with brick on a concrete foundation. W. H. Horton, E. D. Fiske, E. H. Gorney form the Com.

Jefferson, Wis.—Bids will be received until Apr. 26, by the Board of Public Works, for paving Main St. with vitrified block, creosoted wood block or reinforced concrete. About 8520 sq.yd. pavement, and 3480 lin.ft. curb and gutter will be required.

✦Milwaukee, Wis.—We are officially advised that the Department of Public Works has awarded the contract for paving Grand Ave. with sandstone to L. W. SCHRUTH at $95,281. A. A. Frymark is Record Clk. Noted Apr. 17.

✦Waukesha, Wis.—The Common Council has authorized the Board of Public Works to purchase 30,000 gallons of tarvia to be used on local streets this summer. The price is not to exceed 5½c. per gal. Hawley Wilbur is Mayor.

✦A contract for improving 12,913 lin.ft. of streets was awarded the ADVANCE CONSTRUCTION CO., Waukesha, at $54,982. Park Place will be improved with brick.

West Allis, Wis.—Permanent improvement of Burnham St., from 47th to 51st Aves. and 44th to 47th Aves.; 45th Ave., from Burnham to Rogers Sts.; Greenfield Ave., from 66th to 69th Aves. and 69th to 74th Aves.; and 71st and 72d Aves., from National to reenfield Aves., is contemplated this summer. L. F. Fish is City Clk.

Anamosa, Iowa—The City Council has decided to pave First St. The material to be used has not yet been selected.

✦Des Moines, Iowa—We are officially advised that the City Council has awarded a contract to JAS. HORRABIN & CO., Des Moines, at $1.99½ per sq.yd. for paving on Enos Ave., 14th and 31st Sts. Horace Susong is City Clk. Noted Apr. 10.

Minneapolis, Minn.—The Paving Committee of the City Council has ordered the paving of Blaisdell Ave., from 24th to 25th Sts., and Eighth Ave., from Seventh to 10th Sts. F. W. Cappelen is City Engr.

Missoula, Mont.—The City Commissioners have passed resolutions creating six new paving districts aggregating 20 blocks to be paved during the coming summer. W. H. Smith is City Clk.

Fayetteville, Ark.—We are officially advised that the Commissioners of District No. 1 will receive bids until 2 p.m., May 8, for about 20,000 sq.yd. paving at an estimated cost of $45,000. The work includes grading, draining and curbing. Jay Fulbright is Secy. E. A. Kingsley, Southern Trust Bldg., Little Rock Ark., is Engr. Noted Apr. 10.

Corsicana, Tex.—Road District No. 1 of Navarro County plans the construction of 100 miles of highway for which a bond issue of $400,00$ was recently voted. The engineer has not yet been selected. The County Commissioners may be adddresse.

...**Denver, Colo.**—The new State Highway Commission has apportioned $328,000 among the five distriets to be used for the construction and repair of roads. The appropriation for each county must be supplemented by an equal amount from the county commissioners. John M. Kuykendall, Denver, is a Comr.

Phœnix, Ariz.—We are officially advised that bids will be received about May 10, for construction of about three miles of the Central Ave. Blvd. Bids will be accepted for either concrete or oiled macadam. Horace A. Cook, Monihon Bldg., Phœnix, is Engr.-in-Charge.

Bellingham, Wash.—The City Council has ordered concrete paving laid on C St., at an estimated cost of $9105.

Ellensburg, Wash.—The time for receiving bids for paving approximately 11,000 sq.yd. of Permanent Highway No. 2, Kittitas County, adjoining this city, has been extended from Apr. 8 to May 6. Charles T. Jordan is County Engr.

✦Seattle, Wash.—Contract for paving Bayview St. and others has been awarded by the Board of Public Works to F. McCLELLAN, at $86,524.

Resolutions have been passed by the Board of Commissioners of King County for improving permanent highways 10A and 4. Plans are before the State Highway Commissioner for approval.

✦Spokane, Wash.—The City Council has awarded a contract to the SPOKANE BITU-MASS CO. at $9400 for paving 25th and 26th Aves. from Arthur St. to Grand Blvd. with Spokane bituminous No. 2. D. C. Coates is Comr. of Public Works.

Tacoma, Wash.—The Commissioner of Public Works has received bids as follows for paving North 26th St., from Union Ave. to Proctor St., and North Proctor St., from 26th to 28th Sts.: Joseph Warter, bitulithic concrete, $22,800; asphalt, $23,800; Keasal Construction Co., $23,700; George P. Wright, $26,500; Washington Paving Co., $24,573; McHugh Contracting Co., $27,860. Owen Woods is Comr.

Tacoma, Wash.—Bids will be received by the Board of Commissioners of Pierce County until Apr. 26, for construction of Permanent Highway No. 3, five miles in length, work to consist of grubbing, grading, concreting, etc. Specifications on file with M. Roy Thompson, County Engr.

✦The Dalles, Ore.—The City Council has awarded contract for laying 49,332 sq.yd. of bitucrete paving to the LINDEN-KIBBE CONSTRUCTION CO., Selling Bldg., Portland, at $71,246, instead of to Lambose-Birdsall Co., for asphaltic concrete as first voted. Noted Apr. 17.

J. G. BAKER, the Dalles, has been awarded contract for paving 9000 sq.yd. with Dolarway at $1.17 per sq.yd.

✦Portland, Ore.—The following paving contracts have been awarded by the Street Committee of the City Council; Upper Drive in Smith's Addition, GIEBISCH & JOPLIN, $8554; East Burnside, JEFFREY & BUFTON, $7107; 42d St., COCHRAN, NUTTING & CO., St. John, Ore., $17,654; Rodney Ave., WARREN CONSTRUCTION CO., $36,671; E. Lincoln St., PACIFIC BRIDGE CO., $19,968. Thomas M. Hurlbut is City Engr.

Coronado, Calif.—The City Trustees have decided to grade and pave all streets west of Orange Ave., which will cost approximately $175,000. The paving will consist of oiling and graveling.

Los Angeles, Calif.—Bids will be received about May 1 for subdividing and improving a 100-acre tract at Ocean Park Heights. E. T. Wright, Pacific Electric Bldg., is Engr.-in Charge.

Bids will be received by the Board of Supervisors until 2 p.m., May 5, for grading and the construction of an oiled macadam pavement on Lexington and Gallatin Roads, Fasson Blvd., Rivera and Los Nietos Roads from Whittier Road to Topeka St., Rivera, in Road District No. 17.

National City, Calif.—We are officially advised that the Board of Trustees will receive bids about May 5, for 13 blocks of asphalt pavement on National Ave. About 300,000 sq.ft. pavement, 60,000 sq.ft. granite block gutters with culverts and catch basins will be required. H. F. Atwater is Street Supt. H. A. Kuehmsted is City Engr.

Pasadena, Calif.—Bids as follows were received by the City Council for paving East Orange, Grove Ave. from Los Robles to Lake Ave.: J. Montgomery, $11,888; the Highway Construction Co., $13,280; W. A. Dontanville, $12,572; E. J. Hart, $11,760; Cox & Matthews, $12,557; Geo. Weigand $14,550. Lewis E. Smith is City Engr.

Redwood, Calif.—Bonds have been voted by San Mateo County for road improvements, to cost $1,500,000. More than 100 miles of county roads will be constructed. James V. Neuman is County Surv.

✦Saskatoon, Sask.—We are officially advised that the City Commissioners have awarded contracts to the BITULITHIC & CONTRACTING LTD., at $2.90 per sq.yd. for 28,277 sq.yd. bitulithic pavement with 18- and 14-in. concrete gutter at 45c. and 40c. per lin.ft. respectively; to FIELDING & SHEPLEY, INC., St. Paul, Minn., at $3.55 per sq.yd. for 13,723 sq.yd. creosoted wood block pavement, and 38c. per lin.ft. for concrete gutter. F. E. Harrison is Mayor. Noted Mar. 20 and Apr. 10.

INDUSTRIAL WORKS

Northampton, Mass.—An addition is to be built to the factory of the Florence Mfg. Co., of brick and concrete, 37x145 ft., four stories. Samuel M. Green Co. is Arch.

Springfield, Mass.—The Bay State Elevator Co., 51 Taylor St., Springfield, has purchased a tract of land in East Springfield, about 11 acres, and is planning to build a factory on it at once. A one-story building, about 200x200 ft., of heavy mill construction, will be built first.

Bridgeport, Conn.—Estimates are being received on plans prepared by Lockwood, Greene & Co., 320 Fifth Ave., New York, N. Y., for a factory at the West End, for the Blue Ribbon Auto & Garage Co. Two buildings will be built. The main building will be 52x155 ft., three stories, and the second 56x82 ft., three stories, both of heavy mill construction. A number of elevators and a large amount of skylight work will be required. The cost is estimated at $80,000.

Bristol, Conn.—Estimates are being received on plans prepared by Underbach & Perry, 162 Main St., New Britain, for an addition to the plant of the C. J. Root Co., on Church St. The structure will be 40x120 ft., three stories, of brick, mill construction, with first two floors of concrete. Noted Apr. 3.

Estimates are now being received for a factory building on Main St. for the Wallace Barnes Co. It will be of brick, mill construction, 50x120 ft., four stories high, and will contain a fireproof vault. Underbach & Perry, 162 Main St., New Britain, Conn., are Archs.

✦Waterville, Conn.—The American Pin Co. has awarded a contract to the TORRINGTON BUILDING Co., 157 Water St., Torrington, Conn., for an addition to its factory on Thomaston Ave. The structure will be of brick, mill construction, four stories and basement, 25x50 ft., with steel truss roof and freight elevator. Theodore E. Beck, 65 Bank St., Waterbury, Conn., is Arch.

✦Arlington, N. J.—The Hart Machine Co. has awarded a contract to FERRIS & CO., Paterson, N. J., for the construction of a new plant.

Buffalo, N. Y.—Plans have been filed by the Atlas Steel Casting Co. for the construction of a three-story steel factory addition to its plant at Elmwood Ave. and the Erie R.R. The estimated cost is $20,000. Noted Apr. 17.

Buffalo, N. Y.—The K. J. Waters Co., manufacturers of cleaning compounds, has purchased a site at the Pennsylvania R.R. and Dorothy St., 124x46 ft., and will erect a 2-story factory and warehouse of concrete. R. J. Waters, 819 Iroquois Gas Co. Bldg., is Gen. Mgr.

Fredonia, N. Y.—The Cudahy Packing Co., Chicago, Ill., has secured a site in Fredonia and is having plans prepared for the construction of a factory for the extraction and botteling of grape juice.
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Gates, N. Y.—The Yawman & Erbe Mfg. Co., Rochester, is having plans prepared by G. C. Wright, Arch., Rochester, for the erection of an addition to its plant at Gates. The structure will be three stories high, 360x84 ft., with a wing, 240x84 ft., of reinforced concrete, and will be used for the manufacture of office furniture. The estimated cost is $200,000.

✦Rochester, N. Y.—The E. Kirstein Co., manufacturers of optical supplies, 242 Andrew St., has awarded a contract to AFFOPEMAN & SONS, for the erection of a four-story factory, 121x63 ft. The estimated cost is $30,000. Leon Lempert is the Arch.

Alliance, Penn.—The Weybrecht Planing Mill Co. has had plans completed for the reconstruction of its plant which was recently destroyed by fire. The estimated cost of the new structures is $100,000.

Burgettestown, Penn.—The American Metal Co., 52 Broadway, New York, N. Y., which has plants operating in Bartlesville and Collinsville, Okla., and at Altoona, Kan., has purchased from John A. Bell, of Pittsburgh, 2500 acres of Pittsburgh vein coal and 350 of surface land at Burgettstown. On this surface land the company will commence the building of its zinc and sulphuric acid plant. A subsidiary company, known as the American Zinc & Chemical Co., is being organized.

What is known as a one-unit plant will be erected and will have a capacity for producing 40,000 tons of sulphuric acid and 20,000 tons of zinc annually. A shaft will be sunk and coal mining operations will be commenced coincident with the opening of the plant. The initial investment in this new plant will be not less than $2,000,000, and it is expected that when the entire plant is completed it will represent an investment of approximately $5,000,000.

✦Conway, Penn.—The Pennsylvania R.R., Union Station, Pittsburgh, has awarded a contract to W. F. TRIMBLE & SONS, Pennsylvania Ave., Pittsburgh, for the construction of a two-story machine shop extension at its Conway shops.

Winston-Salem, N. C.—W. C. Northup, Arch., Winston-Salem, is preparing plans for the construction of a garage, general salesroom and service station for the Carolina Cadillac Co. The building will be 65x150 ft., of brick and concrete, mill construction. Estimated cost, $15,000.

Florence, S. C.—Plans have been completed for an addition to the Universal Plow Works. Work will probably start immediately, and it is planned to complete the work in August.

Palmetto, Fla.—A. G. Sylvester will be in charge of a crate factory to be built at Palmetto. A company capitalized at $25,000 has been organized to finance this project.

Tampa, Fla.—The Haney Fire Fighting Apparatus Co. has purchased a site at Tampa, and will build three factories and install equipment for manufacturing its specialties. Estimated cost, $50,000. Edward H. Haney, Stockton, Calif., is Pres.

Anniston, Ala.—J. B. Carrington, of the Woodstock Iron & Steel Corp., and S. F. Morris, of the Union Foundry Co., are organizing a company at Anniston, which will be capitalized at $150,000. A plant will be erected for the manufacture of iron for structural purposes. It is expected that the new plant will be in operation by next fall.

According to press reports, the city of Birmingham contemplates the construction of a rendering plant at 40th St. and 15th Ave. Walter K. Kirkpatrick is City Engr.

Florence, Ala.—J. D. Mitchell, Spring Valley, Ala., is interested in a proposition to establish a cottonseed-oil mill, a fertilizer plant and a cotton compress at Florence. The plants, which will be operated jointly, are estimated to cost $50,000.

St. Joseph, La.—The Texas Cotton Oil & Mfg. Co. will rebuild its mill at St. Joseph, recently destroyed by fire at a loss of $60,000. E. Steinhardt, New Orleans, La., is Pres.

Shreveport, La.—The Meridian Fertilizer Co. will build a new plant at Shreveport, La., at a cost of $150,000, the plant to have an annual capacity of from 40,000 to 50,000 tons of fertilizer. Address the manager, at Shreveport, La., for information.

Georgetown, Ky.—The grain elevator of Gano & Smith, Georgetown, Ky., was destroyed by fire, Apr. 12, with $30,000 loss. The owners are considering rebuilding.

Guthrie, Ky.—The carirage factory of Evans & Son, at Guthrie, recently damaged by fire at a loss of $15,000, will be rebuilt.

Hazard, Ky.—Mowbray & Robinson, Cincinnati, Ohio, have purchased a tract of timber in Perry County, near Hazard, and will establish a sawmill.

Akron, Ohio. The Quaker Oats Co. has had plans prepared for the construction of an addition to its factory at Akron.

Cleveland—The Blackburn Specialty Co., Cleveland, is planning the erection of a factory. It will be four stories, 70x100 ft.

The S. Barkers' Sons, printers, 523 Superior Ave., Cleveland, are having plans prepared for the erection of a new building. The cost has been estimated at $85,000.

The Winton Gas Engine Mfg. Co., Cleveland, Ohio, has purchased a site of nine acres. It is proposed to enlarge the present plant. Alex Winton is pres.

R. H. Marshall and Morgan Howell, East Liverpool, Ohio, incorporators of the Morgan & Marshall Co-operative Tire & Rubber Co., will erect a factory in East Liverpool for the manufacture of automobiles and tires. The company is capitalized at $500,000.

Lorain, Ohio—The Troike Muffler & Mfg. Co., Lorain, has been incorporated with a capital of $20,000 to manufacture gas and gasoline engine mufflers. A factory will be erected adjoining that of the Hoffman Heating Co., on Washington Ave. The operation of the plant will be in connection with this company.

Columbus, Ind.—The Orinoco Furniture Co., Columbus, Ind., will receive bids soon for the erection of its proposed chair factory.

The Hanna Paint Co., Columbus, is considering the construction of a reinforced-concrete paint factory on West Long St. The building will be six stories, 72x120 ft.

Indianapolis, Ind.—The American Creosoting Co. has decided to erect a plant at Indianapolis, to cost $500,000.

The Inland Electric Co. has been incorporated for the purpose of erecting a factory and warehouse at 1022 East Michigan Ave.

The Rockwood Mfg. Co., Indianapolis, is receiving bids for the erection of a two-story machine shop.

The National Motor Vehicle Co., Indianapolis, is planning for the erection of an addition to its plant. The building will be three stories, 83x97 ft.

Mishawaka, Ind.—The Rubber Regenerating Co., Mishawaka, is considering the erection of a factory at Mishawaka during the summer.

Battle Creek, Mich.—The Grand Trunk Ry. Co. is considering the construction of a large roundhouse at Battle Creek. The cost, with other improvements, will be about $250,000. J. C. Garden, Battle Creek, is Master Mech. Locomotive Shops.

Detroit, Mich.—The Lozier Motor Co., Detroit, will increase its capital from $3,000,000 to $5,000,000. The additional capital is to provide for increasing the capacity of the plant.

The F. P. Elby Handle Co., Detroit, has purchased a site at 12th and Antoinette Sts., and will erect a wood-working factory.

The Universal Motor Truck Co., Detroit, is considering the erection of a new factory to cost $250,000. The company was recently incorporated with a capital of $1,200,000.

Sandusky, Mich.—The Bay View Foundry Co., Sandusky, has increased its capital from $75,000 to $200,000. The company has purchased a site in the western section of Sandusky on which to erect a plant. The company at present operates a plant on McDonough St.

Chicago, Ill—The Monighan Machine Co., Chicago, is receiving bids for the erection of an addition to its machine shop, two stories, 25x123 ft. Estimated cost, $16,000.

Cribben, Sexton & Co., Chicago, are planning for erect a one-story brick addition to their stove foundry. The building will be 120x140 ft.

Milwaukee, Wis.—The Standard Bedding Co., Milwaukee, is planning for the erection of a factory on Chicago St., between Broadway and Milwaukee St. The cost has been estimated at $50,000.

Racine, Wis.—The American Skein & Foundry Co., Racine, will erect an addition to its plant at Racine.

Clinton, Iowa—The Chicago & Northwestern Ry. will erect two new machine shops at Clinton, one 164x224 ft., and the other 104x201 ft. E. C. Gardner, Chicago, Ill., is the Ch. Engr.

Jeserson, Tex.—The Jefferson Oil & Fertilizer Co. will erect a plant for the manufacture of cotton-seed oil fertilizers and other products. John W. Taylor is the Gen. Mgr.

Grand Junction, Colo.—The Denver & Rio Grand R.R. Co. will build repair shops in Grand Junction. The estimated cost is $200,000.

Dayton, Wash.—Bateman, Walla Walla, Wash., plans to erect aplant in Dayton, for the manufacture of his patent harrow.

Everett, Wash.—The Everett Fish Co., Everett, will build a salmon cannery with a daily capacity of about 2000 cases.

El Centro, Calif.—John Higham and associates, Los Angeles, Calif., contemplate the erection of a precooling plant at El Centro.

Los Angeles, Calif.—The Kenen Motor Truck Co., Los Angeles, has leased a site adjoining its present plant and will erect additions which will greatly increase its capacity. C. Kenen is interested.

Bentel & Mackay, Los Angeles, will soon erect a large automobile plant on Grand Ave. It will be equipped to take care of all kinds of motor-car work. There will be a mechanical department for the overhauling of motor cars, a blacksmith shop, body-building department, a top factory and paint shop.

Monterey, Calif.—The Brille Automatic Sealer Co., Humboldt, Calif., contemplates the erection of a factory in Monterey, for the manufacture of a fruit jar and automatic sealer. L. King, Humboldt, is the Sales Mgr.

Richmond, Calif.—The contract for the construction of a new plant for the Pacific Carbon Products Co. has been awarded to W. A. STRATTON, at $20,000. The plant will consist of three buildings.

London, Ont.—H. J. Jones, 311 Wolfe St., is having plans prepared by McBride & Gilbert, Edge Blk., for a new $75,000 lithographing plant to be erected as soon as possible. The latest machinery will be installed.

North Bay, Ont.—The Canadian Pacific Ry. Co. will build large additional shops here for the manufacture and repair of locomotives and cars. The estimated cost of buildings and equipment is $250,000.

Ottawa, Ont.—The Campbell Steel & Iron Works are having plans prepared for doubling their plant. Work will start shortly on new buildings and entire new equipment will be needed.

The Lowe Martin Printing Co., Albert St., is preparing plans for a new five-story plant, to cost $50,000. Modern machinery will be installed.

Port Dover, Ont.—Carpenter Bros., Winona, Ont., are having plans prepared for a new $30,000 canning factory to be equipped with the latest apparatus.

Toronto, Ont.—The Christie-Brown Co. has taken out a permit for the erection of an eight-story addition to its biscuit factory at Frederick and King Sts. The estimated cost is $200,000.

✦Toronto, Ont.—The National Drug & Chemical Co. Ltd. has awarded a contract to the H. G. CHRISTMAN CO., Hamilton, for the erection of a factory building, 60x150 ft., 5-story of reinforced concrete construction.

FEDERAL GOVERNMENT WORK

✦Buildings—Portsmouth, N. H.—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of offices, quarters at Portsmouth, N. H., to the C. H. HOLMES Co., Portsmouth, at $11,488.

Fire-Protection System—Chelsea, Mass.—Bids will be received by the Bureau of Yards and Docks, Navy Dept, Washington, D. C., until 11 a.m., May 10, for the installation of a fire-protection system at the naval hospital at Chelsea.

Dredging—Lynn, Mass.—Bids will be received by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston, Mass., until noon, Apr. 29, for dredging in Lynn Harbor, Mass.

✦Dikes and Revetment—New London, Conn.—The E. S. Belden & Sons Co., Hartford, Conn., submitted a bid of $70,929, Apr. 18, to Maj. G. H. Pillsbury, Corps Engrs., U. S. A., New London, for the construction of riprap dikes and revetment along the Connecticut River.

✦Post Office—Auburn, N. Y.—Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Auburn to the KING LUMBER CO., Charlottesville, Va., at $46,770.

Dredging and Rock Removal—New York, N. Y.—Bids will be received by Col. W. M. Black, Corps Engrs., U. S. A., Room 710 Army Bldg., 39 Whitehall St., New York, until noon, May 13, for dredging and rock removal in Portchester Harbor, N. Y.

Vaults—Washington, D. C.—The date of opening bids for the construction of vaults in the new building of the Bureau of Engraving and Printing, Washington, D. C., has been postponed from Apr. 3 to Apr. 10. Oscar Wenderoth, is Supervy. Arch., Treasury Dept., Washington, D. C.

★Dredge—Wilmington, Del.—Bids will be received by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, until 11 a.m., June 2, for the construction of the seagoing suction dredge "Miniquas."

★Building Work—Washington, D. C.—Bids will be received by the Department of the Interior, Washington, until 2 p.m., May 12, for furnishing all materials and performing all labor required to complete plumbing, cement, marble, and tile work; roofing, waterproofing, etc., in Howard Hall and Dix Buildings Nos. 1, 2 and 3, at the Government Hospital for the Insane, Washington, in accordance with the plans and specifications for the work, copies of which can be obtained upon application to the department. Lewis C. Lavlin is Asst. Secy.

Boilers—Washington, D. C.—Bids will be received by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, until 3 p.m., May 28, for two new high-pressure water-tube boilers, etc., at the Bureau of Engraving and Printing building.

Lighting Fixtures—Washington, D. C.—Bids will be received by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, until 3 p.m., May 15, for furnishing and delivering special lighting fixtures for the new U. S. post office at Washington.

✦Vault Equipment—Washington, D. C.—Bids were received as follows, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, for the construction of vaults and furnishing vault equipment for the new building for the Bureau of Engraving and Printing: Construction: P. F. GORMLEY CO., Washington, D. C., $120,859; Inter-Urban General Construction Co., New York, $124,900; National Fire-Proofing Co., Washington, D. C., $138,580; York Safe & Lock Co., York, Penn., $162,992. Equipment: YORK SAFE & LOCK CO., York, Penn., $47,929 (awarded contract); Van Dorn Iron Works Co., Cleveland, Ohio, $60,000.

Bridge—Washington, D. C.—Bids were received by the Commissioner of Indian Affairs, Washington, Apr. 14, for the construction of a steel highway bridge across the Deschutes River: (a) riveted bridge; (b) pin-connectel bridge: Midland Bridge Co., Kansas City, Mo., (a) $4,760 and $12,625; (b) $14,177 and $12,035. Illinois Steel Bridge Co., St. Paul, Minn., (a) $14,940 and $13,940; (b) $14,740 and $13,740; extra concrete, $10 and $14 per cu.yd. Clinton Bridge Works, Clinton, Ohio, (a) $20,940; (b) $21,600; extra concrete, $13 and $10 per cu.yd. Coast Bridge Co., Portland, Ore., (a) $14,248; (b) $13,580; Omaha Structural Steel Works, Omaha, Neb., (a) $14,985; (b) $14,225; Albert L. Smith, Spokane, Wash., (a) $7,800; (b) $17,400. Northwest Steel Co., Portland, Ore., (a) $14,985; E. G. Perham, Marshfield, Ore., (a) $14,900; (b) $14,400.

Vessel—Washington, D. C.—Bids were received as follows, Apr. 21, by the Secretary of the Navy, Washington, D. C., for the construction of destroyer tender No. 2, to be named the "Melville": New York Ship Building Co., Camden, N. J., (sole bidder) offers to deliver the vessel in 24 months at Camden, N. J., for $1,310,000 in case the contractor is to furnish and install machine tools and shop outfit, and for $1,260,000 in case the above are furnished by the government and installed by the contractor. The vessel is to be constructed upon bidders' design using machinery with steam turbines with reduction gears. It will have a displacement of 7150 tons on trial and a speed of 15 knots.

Cement—Wilmington, N. C.—Bids were received Apr. 5, by Maj. H. W. Stickle, Corps Engrs., U. S. A., for furnishing and delivering portland cement. The bids follow: Carolina Portland Cement Co., Charleston, $1.80 and $1.82; Alpha Portland Cement Co., Easton, Penn., $1.80; Atlas Portland Cement Co., New York, $1.90; Southeastern Lime & Cement Co., Charleston, $1.75. The sum of 10c. is to be allowed for each sack returned.

✦Post Office—Tifton, Ga.—Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post office at Tifton, to JAMES DEVAULT, Canton, Ohio, at $46,500.

✦Post Office—New Orleans, La.—The contract has been awarded to the NORMAN KER CO., Kalorama Road, Wash-

ington, D. C., for the interior finish of the post office at New Orleans at $364,950. Bids were opened by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington. List of bidders noted Mar. 20.

Post Office—Morristown, Tenn.—Bids will be received until 3 p.m., May 29, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post offic at Morristown, Tenn.

Post Office—Defiance, Ohio—Supplementary bids were received as follows, Apr. 14, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Defiance, Ohio.: (a) limestone; (b) sandstone: Rogers & Kaiser, Chicago, Ill., (a) $56,434; (b) $60,430. George W. Stiles Construction Co., Chicago, Ill., (a) $56,577; (b) $61,577. James Devault, Canton, Ohio, (a) $60,000; (b) $63,575. R. S. Moore, Lafayette, Ind., (a) $56,310; (b) $62,205. Conners Bros. Co., Lowell, Mass., (a) $57,000; (b) $61,500. Moore & Danner, Kokomo, Ind., (a) $58,787.

Post Office—Harrisburg, Ill.—Bids were received as follows, Apr. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Harrisburg, Ill.: (a) limestone: (b) sandstone. M. Yeager & Sons, Danville, Ill., (a) $57,345; (b) $59,221. Central Concrete Construction Co., Louisville, Ky., (a) $58,750; (b) $61,000. George W. Stiles Construction Co., Chicago, Ill.. (a) $57,448; (b) $62,700; James Devault, Canton, Ohio, (a) $53,702; (b) $55,800; Daniel T. McCarthy, Philadelphia, Penn., (a) $59,430; (b) $61,430; Hiram Lloyd Bldg. & Construction Co., St. Louis, Mo., (a) $58,929; (b) $62,929; Rogers & Kaiser, Chicago, Ill., (a) $55,980; (b) $58,750; R. S. Moore, Lafayette, Ind., (a) $54,726; (b) $57,537; N. H. Shields, Danville, Ill., (a) $52,657.

+Post Office—Brookings, S. D.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for he construction of a post office at Brookings, to the GENERAL CONSTRUCTION CO., Milwaukee, Wis., at $68,973.

Post Office—Douglas, Wyo.—Bids were received as follows, Apr. 12, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Douglas: (a) limestone; (b) sandstone: W. D. Lovell, Minneapolis, Minn., (a) $84,000; J. F. Jenkins & Co., Ocala, Fla., (a) $89,500; (b) $94,500.

+Hydraulic Lift Plant—St. Louis, Mo.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract to the OTIS ELEVATOR CO., New York, for installing a hydraulic lift plant at the St. Louis post-office, at $9433.

Post Office—Marlin, Tex.—Bids will be received until 3 p.m., May 27, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wirin, interior figxtures and approaches) of the U. S. post office at Marlin, Tex.

Cement—Portland, Ore.—Bids have been received as follows, by Maj. J. J. Morrow, Corps Engrs., U. S. A., Portland, for 100,000 bbl. portland cement: (a) per bbl.; (b) total cost, (c) brand; (d) weight per bbl.; (e) allowance for sacks returned; (f) location of mill: Union Portland Cement Co., Ogden, Utah, f.o.b. mill, (a) $1.45; (b) $145,000; (c) Red Devil; (d) 380 lb.; (e) 10c.; (f) Devil's Slide, Utah. Three Forks Portland Cement Co., Ogden, Utah, f.o.b. mill, (a) $1.55; (b) $155,000; (c) Red Devil; (d) 380 lb.; (e) 10c.; (f) Trident, Mont. F. T. Crowe Co., Portland, Ore., f.o.b. Celilo or The Dallas, Ore., (a) $2.54, (b) $254,000 (c) Santa Cruz, Calif.; (d) 376 lb.; (e) 10c.; (f) Davenport, Calif. F. T. Crowe & Co., Portland, Ore., f.o.b. Celilo or The Dalles, Ore., (a) $2.54; (b) $254,000 (c) Standard; (d) 376 lb.; (e) 10c.; (f) Napa Junction, Calif. Riverside Portland Cement Co., Riverside, Calif., and Portland, Ore., f.o.b. Celil or The Dalles, Ore., (a) $2.48; (b) $248,-600; (c) Riverside; (d) 380 lb.; (e) 10c.; (f) Riverside.

Engineering Materials—Panama—Bids were received as follows, Apr. 15, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing the following engineering supplies under Circular 769: Class 1, 56 induction motors, squirrel-cage type; various horsepowers, one to 50; 37 auto-starters or compensators, and three automatic oil switches: General Electric Co., Schenectady, N. Y., $26,945; lump sum, $25,815; Class 2, 40,000 ft single-conductor copper cable, 500,000 circular mils: General Electric Co., $29,600 alternate, $25,900; United States Steel Products Co., New York, $24,000; Class 3, 1,400,000 lb. pig iron, low phosphorus: H. C. Hoffman Co., Baltimore, Md., $18,200; Class 10, 525,000 ft B.M. lumber, long-leaf yellow pine or Douglas fir: Chicago Lumber & Coal Co., St. Louis, Mo., $14,910; G. Elias & Bro., Buffalo, N. Y., $15,480; William D. Gill & Sons, Baltimore, $17,165; J. K. Jones, Chicago, Ill., $18,900; Poston Lumber & Supply Co., St. Louis, Mo., $17,454; Bainwater Lumber Co., New Orleans, $16,975; W. R. Grace & Co., San Francisco, Calif., $15,619 (on Douglas fir delivered Ancon; other bids on pine delivered Colon).

Coal Handling Plant—Panama—Bids will be received until May 14 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, for coal handling plants at the termini of the Isthmian Canal.

Steel Dump Barges—Panama—Bids are asked until 10:30 a.m. May 19 under Circular 771 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C. for six 1000 yd steel dump barges, capacity taken when level full with top of hopper coamings. The specifications as drawn are more or less general in order to allow individuality of construction. The barges are to be of heavy construction for rough service. Their length is to be not more than 160 ft. and depth molded not more than 12 ft., 6 in. They are to have 20 in. freeboard when fully loaded with 1000 yd of coal figured at 140 lb. per cu. ft. Top of hatch coaming to be not more than two feet above the deck. Barges to be rectangular in shape, with rake at each end. The hoppers are to be not more than four in number, with water-tight bulkheads between them, extending to the deck; the bulkheads to extend entirely across the barge, framed to floor, deck and side beams, and to be water-tight. The minimum width of each hopper should be 12 ft., and the doors must open to the full size of the bottom of the hopper. The barges may be delivered on the Isthmus, either by Jan. 1, 1914, or at an Atlantic or Gulf port by Dec. 1, 1913, or at a Pacific port by Nov. 15, 1913.

+Floating Cranes—Panama—The contract for two floating cranes for use on the Panama Canal was awarded, Apr. 18, to NEUMEYER & DIMOND, 82 Beaver St., New York, N. Y., agents for the Deutschen Maschinenfabrik, a German company, at $837,500.

+Dump Cars—Hawaii—The contract has been awarded to the WILLIAM J. OLIVER MFG. CO., Knoxville, Tenn., for furnishing 15 dump cars with a capacity of 20 cu.yd. each, for delivery at the naval statjon at Pearl Harbor, H. T., at $33,310. List of bidders noted Apr. 10.

Cranes—Hawaii—The Bureau of Yards and Docks, Apr. 12, received bids for eleven 15-ton locomotive cranes with grab-bucket equipment, naval staion, Pearl Harbor, and navy yard, Puget Sound, Wash.: (a) 11 cranes complete; (b) six cranes and for each crane additional up to a total of 11; Browning Engineering Co., (a) $16,226; Waterloo Rd., Clepeland, Ohio, (b) $10,000 each; Pearl Harbor, $9000 each; Puget Sound, Brown Hoisting Machinery Co., Cleveland, (a) $102,-325 and $98,955, omitting counterweight and superintendence; (b) $55,700 for six cranes, each additional crane to 11, $9325; (b) $53,585 for six cranes, each additional crane, omitting counterweight and superintendence, $9075; McMyler Interstate Co., Bedford, Ohio, (b) $70,000 for six cranes, $81,700 for sefen cranes, $93,400 for eight cranes, $105,100 for nine cranes, $116,800 for 10 cranes and $128,500 for 11 cranes.

+Buildings—Guantamo, Cuba—The contract has been awarded to HENRY MONK, Guantanamo, Cuba, by the Bureau of Yards and Docks for the erection of buildings for the radio station at Guantanamo at $13,300. Bids were received Apr. 5.

PROPOSED PANAMA COAL-HANDLING PLANT

The bids to be opened on May 14, under Circular 763, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., call for a most elaborate system for coal handling at the termini of the Isthmian Canal. The Atlantic plant will be located on the north end of the island formed by the old French canal, the American Canal and the Mindi River, with its storage basin opposite Dock No. 13, at Mount Hope. A bridge built by the Panama R.R. over the French Canal south of the drydock shops will connect the plant with the mainland. The Pacific plant will be on the quay wall south of the entrance to the large dry dock, to be constructed at Balboa. In each case the wharves will be constructed upon concrete cylinders resting upon hard rock, with the exception that at the Pacific end the unloading wharf will be a gravity section concrete wall resting upon hard rock.

The plant at Cristobal will be the larger, with a capacity of 290,000 tons as compared with 160,000 tons at the Balboa plant. It is the plan to store half the coal under water for emergency use in case of war, the balance being stored above water available for use in coaling government and commercial vessels. It may be later arranged to lease parts of the coaling basins to private interests for their own business on the Isthmus.

It is not the intention of the Government to hold the bidders down to any but general specifications, alliowing each to devise methods of construction. The Cristobal plant, which will be capable of unloading 1000 tons and loading 2000 tons per hour, will call for the following equipment to be furnished by the contractor:

Four unloading towers, two duplex stocking and reclaiming bridges, or their equivalent, four reloaders, one conveying system and power substation.

The Balboa plant, of half the capacity, will call for half the equipment including a smaller conveying system and power substation.

This equipment will be located by the Government upon the substructure or storage bin, which will be constructed by the Government, at a cost which will exceed the cost of the equipment. The exact design of this substructure will not be determined until after the most satisfactory design for the equipment shall have been accepted.

The specifications call for cranes that will unload coal from ships by a combining system of transferring it to bridges which will span the storage basin and dump it at any desired place. For loading, a system of buckets is to be provided to lift coal from the storage basin and by means of conveyors raise it to loading machines that will dump it into colliers or lighters. Vessels requiring bunker coal will not be compelled to go alongside the wharves of the plant, but will be coaled from barges lying alongside the storage basin and will be loaded by means of the reloaders mentioned above. If, however, the vessels are alongside the wharves, they can be loaded direct by means of the reloaders.

In the case of the Cristobal plant, it remains to be determined whether to accept a layout in which the loading and unloading wharves occupy opposite sides of the basin parallel with one another with the coal piles between them, or one in which the unloading wharf will be at right angles to the loading wharf.

At the Pacific side, the unloading wharf will be situated at the outer end of the dry-dock slip, while the line of the loading wharf makes an angle of about 45° with that of the unloading wharf, running out toward the canal prism from the end of the unloading wharf.

The Cristobal basin will be 1000 ft .long by 250 ft. wide, with the bottom 19 ft below mean tide and the elevation of the decks of the wharves 10 ft above mean tide. The Balboa basin will be 500 ft by 250 ft., with the bottom 18 ft. below mean tide and the elevation of the decks of the wharves 16½ ft above mean tide.

It is the desire of the Commission to have the work completed within 18 months after date of award of contract. Ow-

ing to the amount of work involved In canvassing the bids that will be submitted, it is likely that award will not be made for some time after the date of opening, May 14, 1913. Plans and specifications may be obtained upon application to the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C.

MISCELLANEOUS

Grandstand—Burlington, Vt.—The contract will soon be awarded by the University of Vermont for the construction of a concrete grandstand. Estimated cost, $10,000. Dr. C. H. Beecher, Burlington, Vt., is Chn.

Steel Sheet Piling—Albany, N. Y.—Bids were received as follows, Apr. 15, by Duncan W. Peck, State Supt. Pub. Wks., Albany, for Contract No. 112, Erie Canal, Sections 9 and 10, for driving steel sheet piling in the embankment of the canal at certain localities within the limits of Contracts Nos. 60 and 66: (a) 145,000 lin.ft. 12-in. steel piling; (b) totals: John Young, 3113 South Salina St., Syracuse, (a) 90c.; (b) $120,350; J. Ellwood Baird Co., 638 South Division St., Buffalo, (a) 83c.; (b) $124,700; Lathrop, Shea & Henwood Co., 428 Ellicott Sq., Buffalo, (a) 86c.; (b) $126,150; Great Lakes Dredge & Dock Co., Buffalo, (a) 87c.; (b) $137,750. Engineer's estimate, (a) 95c.; (b) $130,000.

Lumber and Piles—Albany, N. Y.—Bids were received as follows, Apr. 15, by Duncan W. Peck, State Supt. Public Wks., for Contract No. 113, for furnishing and delivering lumber and wooden piles at Bushnell's Basin, N. Y., and at Holley, N. Y.: Lupfer & Remick, Buffalo, 22,139; John Murphy, Holley, N. Y., $24,820; W. J. Dowdie, Oswego, N. Y., $21,964; Engineers estimate, $26,452.

Barge Canal Work—Albany, N. Y.—The State Legislature has passed the bill appropriating $150,000 for repairs and improvements of existing mechanical and other structures along and connected with the state canals.

Channel Work—Albany, N. Y.—The Governor has signed the bill appropriating $60,000, for continuing the improvement of the West Canada Creek Channel.

Floating Bath Work—Brooklyn, N. Y.—Bids will be received by Alfred E. Steers, Fores. Boro, Brooklyn, until 11 a.m., Apr. 30, for repairs and alterations to the four free floating baths, Boro. Brooklyn.

Fire Alarm Telegraph System—Brooklyn, N. Y.—We are officially advised that the following bids were received by the Fire Dept., 157 East 67th St., Manhattan, on Apr. 15, for establishing and equipping an extension to the fire-alarm system, in the Borough of Brooklyn: National India Rubber Co., 30 Church St., Manhattan, $67,475; Safety Insulated Wire Cable Co., 114 Liberty St., Manhattan, $60,700. Joseph Johnson is Comr.

Retaining Wall—Buffalo, N. Y.—Plans are being completed by the city engineering department for the construction of the proposed retaining wall to be located between Georgia and Jersey Sts. The wall will be about 500 ft. in length. Francis G. Ward is Comr. Pub. Wks.

Zoological Building—Buffalo, N. Y.—Eisenwein & Johnson, Archs., 781 Ellicott Square, have completed plans for a lion House, to be erected by the city at the Park Zoo, 104x112 ft., of stone, steel ,terra cotta and brick. David A. Seymour, Supt. Park Dept., will ask for bids about May 1.

Dam—Fort Edward, N. Y.—The International Paper Co., Fort Edward, has decided to build a new dam to take the place of the one damaged by the recent floods.

Dock—Newburgh, N. Y.—The city has decided to construct a public dock at an estimated cost of $10,000.

✚Terminal Posts—New York, N. Y.—We are officially advised that the Fire Dept., 157 East 67th St., has awarded a contract to the MT. CARMEL IRON WORKS, Mt. Carmel, Penn., at $39,476, for purchasing terminal posts for the fire-alarm telegraph system. Bids were received on Apr. 14. Joseph Johnson is Comr.

Ferry Boat—New York, N. Y.—Bids were received by the Department of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, Apr. 10, for Contract No. 1323, which provides for the construction and delivery of one steel, screw-propelling ferry boat. The contract has been awarded to the NEW YORK SHIPBUILDING CO., Camden, N. J., at $337,000. List of bidders noted Apr. 17.

Fire Alarm Telegraph—Syracuse, N. Y.—The city is planning for the completion of the fire-alarm telegraph system. The Board of Estimate and Apportionment has passed an ordinance which provides for a bond issue of $65,000 for the purpose.

✚Subway—Utica, N. Y.—Bids were received Apr. 8, by the Board of Contract and Supply, for the construction of an extension to the city subway in Blandina St., from Union St. to Charlotte St. The contract has been awarded to W. D. PETERS & CO., Utica.

Deepening Inlet—Atlantic City, N. J.—The State Senate has passed the bill appropriating $50,000, for deepening Absecon Inlet.

Ferry Slips—Fort Lee, N. J.—The contract has been awarded to the Stillman, Delehanty Ferris Co., New York, N. Y., by the Public Service Ry. Co. for new slips, bridges and overhead construction for the Fort Lee ferry across the Hudson River. The work will include the construction of the slips at Edgewater and West 130th St., Manhattan, and is part of the improvements projected on the Bergen Division of the trolley road, formerly the Hudson River line.

✚Pipe Lines—Chester, Penn.—The Suburban Gas Co. has awarded the contract to CAPT. J. J. WILLIAMS, Chester, for laying a 48-in. c.-i. pipe 530 ft., also a 20-in. c.-i. pipe line with flange and flexible joints, to extend into the Delaware River 620 ft.; also, the Geo. C. Hetsel Co., Chester, has awarded the above contractor the contract for a 14- and 10-in. pipe line with flange and flexible joints, running from foot of Delaware 963 ft. These suction lines will have a concrete crib on the outer end and will be laid in 26 ft. of water.

✚Piling—Baltimore, Md.—The contract has been awarded to the SANFORD & BROOKS CO., Baltimore, for placing piles along the water front. The work involves the placing of about 6000 concrete piles, and is to be done for the Tin Decorating Co. Estimated cost, $1,000,000.

Stable—Richmond, Va.—Plans are being prepared by P. P. Pilcher, Mutual Bldg., Richmond, for the erection of a stable. The Southern Express Co. will occupy the structure.

Drainage—Albany, Ga.—The city is considering draining the government pond at Albany. It is estimated that the work will cost about $13,000.

Drainage District—Lawrenceville, Ga.—The County Commissioners of Gwinnett County, Lawrenceville, are considering the establishment of Sweetwater Drainage District to reclaim lands along Sweetwater, Beaver Run and Jackson Creek.

✚Terminals—Savannah, Ga.—The contract has been awarded to JAMES STEWART & CO., 30 Church St., New York, N. Y., for the construction of terminals for the Merchants & Miners' Transportation Co., at about $300,000.

Ditches—Arcadia, Fla.—The time for receiving bids for the construction of about 48 miles of ditches has been extended to May 6. Bids were to have been received Apr. 8. The work will require 600,000 cu.yd. of excavation. The bids will be opened by the County Commissioners of Desoto County, Arcadia. Cravens & Kimmel, Arcadia, are Engrs. Noted Mar. 20.

Drainage—Selmer, Tenn.—John L. Williams, Jackson, Tenn., is making surveys for the construction of a drainage district to be known as White Oak Drainage District of McNairy County. The work to be done will require the excavation of 311,721 cu.yd. The cost has been estimated at $35,755.

Ditch—Henderson, Ky.—The Fiscal Court, Henderson, will receive bids at once for the construction of the Double Dam and Swan Pond Ditch. The cost has been estimated at $25,000.

Mausoleum—Clyde, Ohio—The American Mausoleum Co., Clyde, is asking for bids for the erection of a stone and granite mausoleum, 40x150 ft., to cost $60,000. The structure will be one story, with bronze doors and bronze interior fittings.

Creek Work—Toledo, Ohio—Bids will be received until Apr. 25, by J. R. Cowell, Dir. Pub. Ser., for furnishing the labor and material for the diversion of Swan Creek at St. Clair St. and the removal and reërection of St. Clair St. Bridge over Swan Creek.

Dredging—Indianapolis, Ind.—The Park Commissioners, Apr. 11, received bids for the dredging of Fall Creek. The bids follow: Mansfield Engineering Co., cost plus 15% profit, with a guarantee daily operation expense will not exceed $100, the company to pay the city 10c. a cu.yd. for all gravel removed that will not be required in boulevard construction work; North Side Sand & Gravel Co., cost plus 12% profit, with a guarantee daily maximum operating expense will not exceed $185, company to pay 6c a cu.yd. for excess gravel; Indiana Excavating Co., cost plus 45% profit, with a guarantee maximum daily operating expense will not exceed $60, company to pay the city 10c. a cu.yd. for excess gravel. Specifications call for the dredging of the stream for a depth of from 8 to 16 ft. Most of the gravel that will be removed will be used in boulevard construction work.

Drain—Princeton, Ind.—Bids will be received until 10 a.m., May 3, by H. C. Morrison, Drainage Comr., at the office of the County Surveyor at Princeton, for the construction of the Bozeman Drain in Gibson County; also until the same time and date by B. F. Wieler, Drainage Comr., at the office of the County Surveyor at Princeton for the construction of two drains in Gibson County.

Cement—Manistique, Mich.—Bids will be received by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Milwaukee, Wis., for furnishing about 5000 bbl. of portland cement.

✚Channel—Chicago, Ill.—The contract has been awarded by the Sanitary District of Chicago to GREEN & SONS' CO., Chicago, for Section No. 6 of the Calumet-Sag Channel, at $471,900.

Drainage—Quincy, Ill.—The cost of making improvements in the Indian Grove Drainage District has been estimated at about $300,000. The Harman Endineering Co., Peoria, Ill., is Engr.

Drain—Algona, Iowa—Bids will be received by the County Supervisors of Kossuth County until 2 p.m., May 1, for the construction of Drain No. 69. The work will require the following: 27,300 ft. of open ditch, 8-ft. base and slope of 1 to 1, average depth 7.09 ft., yardage, 111,500 cu.yd., tile, 88,826 ft., ranging in size from 26 to 6 in. B. E. Norton is County Auditor, Algona.

✚Drain—Dakota City, Iowa—The contract has been awarded to KJAR & JENSEN, Humboldt, Iowa, for the construction of Drain No. 45, at $25,254. Bids were received Apr. 9, by the County Auditor. All bids opened Apr. 9, at Dakota City, for the construction of Drain No. 54, have been rejected. J. L. Parsons, Humboldt, Iowa, is Engr.

✚Drainage Ditch—Sioux City, Iowa—The contract has been awarded to DONALD GRANT & CO., Faribault, Minn., for the construction of Little Sioux drainage ditch, at 12c. per cu.yd. The ditch will be about 12 miles in length and will require the excavation of about 483,000 cu.yd. Bids were received by the County Auditor, Sioux City, on Apr. 8.

Coal and Water-Supply Station—St. Cloud, Minn.—The Northern Pacific Ry. Co. has secured a site on which it proposes to construct large coal docks. The property is to be used as a coal and water-supply station. W. J. Bohan, St. Paul, Minn., is Mech. Engr.

Drainage—Geneva, Neb.—Bids will be received by F. R. Ashton, Secy., Geneva and West Blue Drainage Dist., Geneva, until May 12, for 4000 ft. of 36-in. reinforced-concrete pipe, with necessary excavation and backfill. Grant & Fulton, Security Mutual Bldg., Lincoln, Neb., are Engrs.

Drainage Districts—Jonesboro, Ark.—The Commissioners of Craighead County, Jonesboro, have organized two drainage districts to be known as Big and Little Slough drainage districts.

Levees—Austin, Tex.—The State Levee and Drainage Com-

mission, Austin, is preparing to construct levees and drainage canals to protect from overflow the Clemens State Farm, which contains about 10,000 acres.

★**Ditch and Road Work**—Houston, Tex.—A responsible contractor is wanted to take approximately 75,000 cu.yd. ditch and road work in vicinity of Houston, Tex. Owners of land letting work, reside Chicago, wish to close contract immediately. Cash estimates monthly. Ditches must be dug with perfectly uniform slopes such as dug by Austin ditcher with bank sloping attachment. Land practically dry, level, with no stumps. Address P. 656, Eng. News.

Drainage—Houston, Tex.—Drainage District No. 7 of Harris County is considering the issuance of $140.000 of bonds for the construction of a drainage system to reclaim 55,000 acres. The work will require the excavation of about 70 miles of ditches. J. S. Burks, Commercial National Bank Bldg., Houston, is Engr.

Docks, Etc.—Aberdeen, Wash.—The Port Commission, comprising W. J. Patterson, Aberdeen, Frank Lamb, Hoquiam, Wash., and A. C. McNeil, Montesano, Wash., are considering plans for Gray's Harbor, which involve municipal docks between Aberdeen and Hoquiam, slips at other points, fresh water basin and deepening of channels.

Dock—Astoria, Ore.—The Port of Astoria Commission is considering the establishment of a public dock.

Protection Work—Los Angeles, Calif.—The lowest bid for storm water protection work in San Gabriel Protection District has been submitted by Grant Bros., at 27½c. per cu.yd., for 90,000 cu.yd. of excavation; and $200 for renewing piling.

Wharves—Redondo Beach, Calif.—The Pacific Electric Ry. Co. has applied for a franchise to construct two wharves at Redondo Beach.

Harbor Work—San Francisco, Calif.—The Western Meat Co. is considering an expenditure of about $1,000,000, for the improvement of South San Francisco Harbor. The company is a branch of Morris & Co., Chicago, Ill.

✦**Tunnel**—San Francisco, Calif.—We are officially advised that the Board of Public Works, Apr. 11, awarded the contract to the JACOBSON-BADE CO., Portland, Ore., for the construction of the Stockton St. tunnel, at $337,000. Other bidders were: R. C. Storrie & Co., $394,000; E. Malley, $418,000; State Construction Co., $419,000; Grant Smith & Co., $455,800; F. Rolandi, $487,950.

Lock and Dam—Kenora, Ont.—The Dominion Government, Ottawa, Ont., has decided to construct a lock and dam at Ash Rapids, Ont. A survey and estimate of cost will be made as soon as possible.

Dredging—Toronto, Ont.—Bids will be received until noon, May 28, by the Toronto Harbor Commissioners for about 35,000,000 cu.yd. of hydraulic dredging.

Wharf—Kaslo, B. C.—Bids will be received by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., until May 5, for the construction of a pile bent wharf and timber-deck wharf at Kaslo.

BUILDINGS

Boston, Mass.—A coliseum is planned on Commonwealth Ave. near Naples Road. W. J. McDonald, 95 Milk St., is promoter. Clarence H. Blackall, 20 Beacon St., is the Arch.

✦The contract for the erection of the Oliver Wendell Holmes school has been awarded to the CARROLL CONSTRUCTION CO., Brookline. It will be of brick and stone, 67x116 ft., two stories, to cost $60,000. Chas. Logue is Chn. School House Comm. Jos. J. Driscoll, 7 Water St., is Arch. Noted Mar. 6.

Bids will be received until May 2, by the Public Library Department, for the construction of a library building in East Boston District. Jas. E. McLaughlin, 111 Devonshire St., is Arch. Josiah H. Benton is Trustee of Dept.

✦The contract for the erection of the East Boston Bank building on Meridian St., was awarded to the LEIGHTON-MITCHELL CO., 95 milk St. It will be of stone, 75x130 ft., to cost $100,000. Thos. M. James, 15 Ashburton Pl., is Arch.

The State Armory Commission will erect an armory for mounted troops on Commonwealth Ave., Allston District. The estimated cost is $100,000. Architects of Massachusetts are invited to submit their names and photographs of work done, in order to choose the designs. Gardener W. Pearson, State House, is Chn.

The Second Unitarian Church plans a church edifice with tower on Iroquois St. at Audubon Road. It will be of Ohio limestone and brick, Georgian style of architecture. A parish house is also planned. Francis H. Brown is Chn. of Com. Cram, Goodhue & Ferguson, 15 Beacon St., are Archs.

Holyoke, Mass.—A seven-story hotel is planned at Maple and Suffolk Sts. The estimated cost is $200,000. It will be 110x122 ft. Eisenwein & Johnson, of Buffalo, N. Y., and Geo. P. B. Alderman, of Holyoke, are Archs.

✦**Lynn, Mass.**—The contract for the construction of the four-story office building on Western Ave. for the General Electric Co., has been awarded to STROUT BROS.

Millbury, Mass.—John T. Simpson, Arch., Newark, N. J., is preparing plans for the construction of a high school at Millbury, Mass. The building will be three stories, 112x62 ft., of brick and concrete. The estimated cost is $50,000. Noted Apr. 17.

Rockland, Mass. Loring & Phipps, Archs., 1108 Exchange Bldg., Boston, Mass., are preparing plans for the construction of an addition to the Adams St. school. The estimated cost is $40,000.

Somerville, Mass. Bids will soon be asked for the temple for Mt. Benedict Council K. of C. to be built on Highland Ave. at Central St. It will be of brick, 98x170 ft. John W. Campbell, Pres. of Bldg. Com. Edw. T. P. Graham, 20 Beacon St., Boston, is Arch.

Springfield, Mass. The town is planning the erection of a 20-room school to replace present Hooker school. J. R. Dennison, is Mayor.

Westfield, Mass. The town, Apr. 8, appropriated $75,000 for the erection of a new school. Rev. Robert Keating Smith is Chn. of School Com.

✦**Worcester, Mass.**—Plans for a 25-room addition to the Classical High School, which will cost $200,000, are practically completed by Arch. Frost & Chamberlain, of Worcester, and bids will soon be called for. Geo. C. Halcott, Supt. Pub. Bldgs., has awarded contract for a heating and ventilating system for the addition to ALFRED S. KELLOGG, Boston, Mass.

✦**Providence, R. I.**—The contract for the erection of a storage building at the American Screw Co.'s plant on Stevens and Hewes Sts. was awarded to the J. W. BISHOP CO., 417 Butler Exchange Bldg. It will be 44x160 ft., four stories, of mill construction.

✦**Providence, R. I.**—The contract has been awarded to NORCROSS BROS. CO., Worcester, Mass., for the construction of the Y. M. C. A. building at Broad and Seedell Sts. The building will be nine stories high instead of 11 stories as originally planned. Shattuck & Hussey are Archs., Chicago, Ill. Noted Jan. 23.

Baltic, Conn.—F. G. O'Connell, Boston, Mass., has prepared plans on which estimates are being received for a brick school house for the Academy of the Holy Family. The estimated cost is $80,000.

Hartford, Conn.—The Hartford Electric Light Co. will erect a five-story building on Pearl St., 131x100 ft. The building will be of brick and steel, with limestone front and gray brick. It will be equipped with a vacuum cleaning system and a pneumatic tube system.

Waterbury, Conn.—Plans are being prepared by Archs. Freney & Jackson, 51 Leavenworth St., for an addition to the Clay St. School. The building will be of brick, two stories and basement, 70x78 ft.

Waterville, Conn.—Estimates are being received on plans drawn by Theodore B. Peck, 65 Bank St., Waterbury, Conn., for an office building on Thomaston Ave. for the American Pin Co. It will be of brick and steel with Indiana limestone trim, 46x123 ft., three stories and basement.

Brooklyn, N. Y.—The Department of Education, 500 Park Ave., Manhattan, propose to construct the following school buildings in Brooklyn, each with its estimated cost: New Public School 178, Dean St., $434,775; New School 179, Avenue C, $434,775; New School 48, 60th St., $317,050; New School, Sixth and Stewart Aves., $317,050; New School 169, Seventh Ave. and 43rd St., $317,050; New School 95, Neck Road and Van Sicklen St., $239,550; Addition to School 18, Leonard and Manjer Sts., $157,700; Addition to School 36, Stagg St., $131,900; New school 100, West Third St., Coney Island, $239,550; Addition to school 18, Willard St., $112,300. C. E. J. Snyder is Supt.

Brooklyn, N. Y.—Plans are being prepared by Shampan & Shampan, Archs., 772 Broadway, for the construction of a five-story apartment house, 62x100 ft., on the south side of 19th St., east of Fifth Ave., Brooklyn, for the Rogers Improvement Co.

★**Buffalo, N. Y.**—Bids will be received until 3 p.m., Apr. 30, by T. E. McCarr, Secy. State Hospital Commission, Capitol, Albany, N. Y., for the construction of a tuberculosis pavilion, including heating, plumbing and electric work, and additions to bakery, including plumbing work; remodeling cold-storage building, including electric work, at Buffalo State Hospital. Charles A. Sussdorf is Acting State Arch., Capitol, Albany, N. Y.

✦**Buffalo, N. Y.**—The general contract has been awarded to the GEO. A. FULLER CO., 111 Broadway, New York, for the erection of a stone, steel and brick theater, 65x115 ft., at Pearl and Huron Sts., for the Columbia Amusement Co. The estimated cost is $250,000. Noted Mar. 13.

✦**Jamestown, N. Y.**—The National Biscuit Co. has awarded a contract to the JAMESTOWN CONSTRUCTION CO. for the erection of an office building and warehouse, 54x100 ft., on River St. and the Erie R.R.

Middleport, N. Y.—The Odd Fellows will erect a temple 45x310 ft., three-story and basement, of brick, stone and steel construction, for which bids are being received by Archs. Dunning & Dunning, Henkel Bldg. Estimated cost, $35,000.

New York, N. Y.—Plans have been filed by Townsend, Steinle & Haskell Inc., Archs., 1328 Broadway, for the construction of a 12-story store and loft building, 100x43 ft., at the southeast corner of Broadway and 12th St., for the 824 Broadway Co., 31 Nassau St. The estimated cost is $225,000.

✦The Charles I. Weinstein Realty Co., 17 West 120th St., has awarded a contract to the MARCUS CONTRACTING CO., 310 Front St., Brooklyn, for the excavation work for a six-story apartment house which the company will erect at 308 West 14th St. Charles B. Meyers, 1 Union Sq., is the Arch.

Plans have been filed by Gronenberg & Leuchtag, Archs., 303 Fifth Ave., for the construction of a four-story loft and store building, 120x79 ft., at Fourth Ave. and Lafayette Place, for C. Lane, 39 Fulton St. The estimated cost is $75,000.

Plans have been filed by G. F. Pelham, Arch., 507 Fifth Ave., for the construction of a four-story school, 75x84 ft., on the north side of 85th St., west of Lexington Ave., for the Yorkville Jewish Religions School, 123 East 85th St. The estimated cost is $100,000.

Plans have been filed by R. T. Lyons, Arch., 505 Fifth Ave., for the construction of a 12-story apartment hotel, 92x74 ft., on the south side of 38th St., east of Madison Ave., for the Sutherland Realty Co., 505 Fifth Ave. The estimated cost is $400,000.

Plans have been filed by Rouse & Goldstone, Archs., 38 West 32nd St., for the construction of a 12-story apartment house, 110x102 ft., for the F. A. L. Holding Co., 505 Fifth Ave., at the southeast corner of Park Ave. and 72nd St. The estimated cost is $800,000.

Plans have been filed by Cross & Cross, Archs., 527 Fifth Ave., for the construction of an eight-story apartment house, 85x55 ft., at 113 East 53rd St., for the 112 East 54th St. Co., 516 Fifth Ave. The estimated cost is $160,000.

✦We are officially advised that the Dept. of Education, Park Ave. and 59th St., has awarded a contract to the T. A. CLARKE CO. at $253,300, for the construction of Public School 115, Manhattan. Bids were received on Apr. 11. C. B. J. Snyder is Supt.

Moore & Landsiedel, Archs., 118th St. and Third Ave., have prepared plans for the construction of a five-story apartment house, 118x50 ft., on the north side of Sherman Ave., west of Hawthorne St., for the Vermilyea Realty Co., 3856 Tenth Ave. The estimated cost is $210,000.

Plans are being prepared by the Architectural & Building Co., 38 Marble Hill Ave., for the construction of a 12-story apartment house, 100x100 ft., at the southwest corner of 87th St. and Park Ave. The estimated cost is $700,000.

+Niagara Falls, N. Y.—The contract for the construction of the court house addition has been awarded to J. MOON, Lockport, N. Y., at $83,050.

+Oswego, N. Y.—The contract for the erection of a school building in the Eighth Ward has been awarded to PETER RABY, Oswego. The estimated cost is $40,000

Rochester, N. Y.—McKenzie, Voorhees & Gmelin, Archs., 1123 Broadway, New York, have completed plans for an addition to the Telephone Exchange Building at North Fitzhugh and Allen Sts., to be erected by the New York Telephone Co. It will be of brick, marble and terra cotta. The estimated cost is $150,000.

+Syracuse, N. Y.—The general contract has been awarded to DAWSON BROS., Union Bldg., for the construction of a brick church at Wilbur Ave. and Tompkins St., for St. John's Greek church. F. H. Armstrong, Seward Block, Auburn, N. Y., is Arch.

+Syracuse, N. Y.—The contract for the erection of the Eckel office and theater building on East Fayette St., Syracuse, has been awarded to the HEFFERNAN CONSTRUCTION CO.

White Plains, N. Y.—The Gedney Farm Co., White Plains, N. Y., will erect a 200-room hotel, with large grounds, golf links, etc., on the outskirts of White Plains, near the Burke Foundation Buildings on the old Willett Farm, to cost approximately $250,000.

+Atlantic City, N. J.—The contract has been awarded to the CHARLES McCAUL CO., Philadelphia, Penn., for the construction of a synagogue at Atlantic City, for Beth Israel congregation. The estimated cost is $60,000.

Belleville, N. J.—The Town Council will receive bids until May 14, for the erection of a new city hall building. Charles G. Jones is Arch., Belleville.

Bloomfield, N. J.—John F. Capen, 45 Clinton St., is completing plans for Knox Hall, to be erected at Franklin and Broad Sts., for the German Theological Seminary. Bids will be received about Apr. 25. The estimated cost is $65,000.

+Camden, N. J.—The Board of Education has awarded contracts for the erection of two new public schools as follows: Twenty-ninth St. School, general contract, GEORGE BACHMAN, Camden, $85,563; heating and ventilating, CAMDEN HEATING CO., $13,625; Mount Ephraim Ave. School, general contract, D. E. BOYER & CO., Camden, $89,584; heating and ventilating, CAMDEN HEATING CO., $11,975. Noted Apr. 3.

Cranford, N. J.—Bids will be received until Apr. 30, by D. C. Newman Collins, 29 Broadway, New York, for the construction of a three-story reinforced-concrete, 60x78-ft. school, for the School Board of Cranford.

Lambertville, N. J.—The State Board of Education has ordered the Common Council to appropriate $75,000, for the erection of a new high school.

Newark, N. J.—J. B. Snooks Sons, Archs., New York, have prepared plans for a seven-story warehouse, 50x100 ft., for the Merchants' Refrigerating Co., of Jersey City. The estimated cost is $100,000.

Rochelle Park, N. J.—Bids will be received until 8 p.m., Apr. 26, by Robert A. Smith, District Clk., Bd. of Education, of Saddle River Township, for the construction of an addition and alterations to School No. 4, Rochelle Park. Chas. E. Sleight, Romaine Bldg., Paterson, N. J.

+Allentown, Penn.—The contract has been awarded to the SAX & ABBOTT CONSTRUCTION CO., Hale Bldg., for the construction of the seven-story hotel for the Allentown Hotel Co. The estimated cost is $200,000.

+The contract has been awarded to F. GOLDSMITH & SONS, for the addition and alterations to the Third Ward school. Jacoby & Weishample, Archs., Allentown.

Butler, Penn.—Bids will be received until 5 p.m., Apr. 29, by C. C. & A. L. Thayer, Archs., Newcastle, Penn., for the construction of a four-story Y. M. C. A. building, at Butler. The estimated cost is $100,000.

Erie, Penn.—J. W. Yard & Son, Penn Bldg., are ready for bids on a three-story school building, to be erected at East Ave. and Sixth St., for the Board of Education. The estimated cost is $100,000. Noted Mar. 20.

+Harrisburg, Penn.—The contract for the construction of the Mechanics' Bank building at Harrisburg, has been awarded to the CHARLES McCAUL CO., Philadelphia. Noted Feb. 6.

+Philadelphia, Penn.—The contract has been awarded to J. A. BADER & CO., Ford Bldg., Wilmington, Del., for the construction of the theater at 2924 Richmond St., for William E. Butler, 2922 Richmond St.

William Henry Hoffman, Arch., is preparing plans for the construction of a two-story theater, 70x175 ft., at 1614 Market St. The estimated cost is $100,000.

Pittsburgh, Penn.—Henry Hornbostel, of New York and Pittsburgh, and W. M. Hood, local representative for Mr. Hornbostel, are preparing plans for a three-story brick and terra cotta building for the Carnegie Institute of Technology to be used by the faculty members. Plans will be ready by July 1. The estimated cost is $100,000.

Baltimore, Md.—Baltimore Lodge, No. 70, Loyal Order of Moose, contemplates erecting a lodge building. The estimated cost is $70,000. F. Friedmann is Secy., 410 West Fayette St.

Washington, D. C.—Bids will be received until May 1, by Millburn, Heister & Co., Archs., Washington, D. C., for the construction of the 12-story office building at 14th and H Sts. N. W. The estimated cost is $275,000.

Tazewell, Va.—Bids will be received until noon, May 13, by C. W. Greever, County Clk., for the addition to and remodeling of the court house at Tazewell. Andrew J. Bryan is Arch., Louisville, Ky.

Clarksburg, W. Va.—Bids will be received until noon, May 1, by H. W. Tiffany, Secy., Bd. of Trustees, of the First Baptist Church, for the construction of a church and parsonage. Edwin E. Pruitt & Co. are Archs., Columbus, Ohio.

Augusta, Ga.—Bids will be received until May 5, by G. Lloyd Preacher, Arch., Augusta, and W. L. Stoddart, New York City, for the construction of a 10-story building for the Augusta Chronicle. The estimated cost is $200,000.

Columbus, Ga.—Ludlow & Peabody, Archs., 12 West 21st St., New York, are preparing plans for the construction of an eight-story hotel of tile and concrete. The estimated cost is $200,000.

+Biloxi, Miss.—The contract for the construction of the Anniston Hotel has been awarded to W. O. THOMPSON, of Biloxi.

Waynesboro, Miss.—Bids will be received until May 5, by the Wayne County Commissioners, for the construction of additions and improvements to the jail.

Danville, Ky.—The Central University, Danville, Ky., has completed plans for two new buildings, a gymnasium and a library building, for which a large steam-heating plant will be needed. F. P. Hinitt is Press.

+Alliance, Ohio—The contract for the construction of the Elliott Hall for Women at Mt. Union College has been awarded to E. B. SILVER, Alliance, Ohio.

+Canal Dover, Ohio—The contract for the erection of the Canal Dover school was awarded to the WENTZ LUMBER CO., of Canal Dover.

Cincinnati, Ohio—Bids will be received about May 1, by Tietig & Lee, Archs., 510 Vine St., for the construction of the tuberculosis group of hospitals at Lick Run. The appropriation is $350,000.

Cincinnati, Ohio—A. Lincoln Fechheimer, Arch., Lyric Theater Bldg., is preparing plans for the construction of the Woman's Building at the University of Cincinnati. The estimated cost is $175,000.

Cleveland, Ohio—Plans have been completed by William C. Jansen, Arch., 403 O'Brien Bldg., for the construction of a convent at Superior Ave. and Ansel Rd., N. E., for the sisters of the Order of Notre Dame. The estimated cost is $175,000.

+St. Bernard, Ohio—Contracts for the construction of the school at Tower and Jackson Aves. have been awarded as follows: Excavating, FRED RITTER & SON, Cincinnati, Ohio; brick, tile and terra cotta, JOS. McDERMOTT, Cincinnati, $49,550; structural iron, L. SCHRIBER SONS CO., Cincinnati, $6228; carpentery, JOHN D. FITE, Hartwell, Ohio, $17,300. Noted Apr. 3.

Youngstown, Ohio—Charles F. Owsley, Arch., Youngstown, will receive estimates until May 7, for a brick and concrete school building to be erected at Grace and Hillman Sts., for the Board of Education. The estimated cost is $80,000.

Zanesville, Ohio—The Wheeling & Lake Erie R.R. will erect a freight and passenger building at Zanesville. R. C. Pattison is Mech. Engr., Brewster, Ohio.

Fort Wayne, Ind.—Bids will be received by the Board of Trustees of the Indiana School for Feeble Minded Youth, until May 13, for the construction of a hospital.

+Frankfort, Ind.—The general contract has been awarded to JOHN PADEN, for the construction of the Royal Theater, on South Main St. O. C. Collins & Co. are Archs., 57 North Clinton St.

+Gary, Ind.—The general contract has been awarded to the INDIANA IMPROVEMENT CO., Reynolds Bldg., for the construction of a store building at Fifth Ave. and Broadway, for the Philip Bldg. Co.

+Flint, Mich.—The general contract has been awarded to M. A. MAHONEY, for the construction of a reinforced-concrete warehouse, for George W. Hubbard. Noted Mar. 13.

Albion, Ill.—Bids will be received until 2 p.m., May 7, by W. R. Strawn, Secy., Bd. of Education, for the construction of a school building, at Albion. Spencer & Temple are Archs., Champaign, Ill.

+Chicago, Ill.—The masonry contract for the construction of the Lowell School has been awarded to JOSEPH I. CONNELLY, 4509 Washington Blvd., and the carpentry, to G. M. QUINN.

Chicago, Ill.—Bids are being received for the construction of the infirmary group of the Chicago Municipal Tuberculosis Sanitarium. The administration building will be two stories and basement, 98 ft. long, and the infirmary wings each two stories and 430 ft. long. Frank E. Wing is Gen. Supt.

Mundie & Fox, Archs., 38 S. Dearborn St., are preparing plans for the construction of a 21-story hotel, at West Madison and Clark Sts., to be known as the Morrison Hotel. Harry G. Moir is owner. The estimated cost is $13,000,000.

+The masonry and carpentry contract has been awarded to J. W. SNYDER CO., 122 South Michigan Ave., for the five-story brick, 49x100-ft. mercantile building, for Sol. Klein & Bros., 2018 S. Halstead St.

Peoria, Ill.—Bids are being received by D. H. Burnham & Co., Archs., 80 East Jackson Blvd., Chicago, for the construction of the 10-story bank and office building at Main and Adams St., for the Central National Bank.

Springfield, Ill.—The lowest bidder for the construction of the two-story, brick school for the Board of Education was D. A. De Vares, at $36,400.

+Milwaukee, Wis.—The general contract has been awarded to the RAULF CO., for the construction of the five-story, reinforced-concrete and brick office building on Second St., near Sycamore, for the Engineering Building Co.

+Milwaukee, Wis.—Contracts for the construction of the 11-story hotel at 172 Third St., for the Wisconsin Hotel Co., have been awarded as follows: General contract, the RAULFF CO., 428 Grand Ave.; roofing, SPRINKMAN & SON, 266 East Water St.; ornamental metal, WISCONSIN IRON & WIRE WORKS; terra cotta, NORTHWESTERN TERRA COTTA CO., 2525 Clyborne Ave. Holabird & Roche are Archs., 104 South Michigan Ave.

Des Moines, Iowa—The Des Moines School Board will expend over $300,000 for new school buildings.

+Minneapolis, Minn.—The general contract has been awarded to H. N. LEIGHTON, for the construction of a theater at First Ave. and Eighth St., for W. L. Harriss, New England Furniture Co., First and Sixth Sts.

+Minneapolis, Minn.—The contract for the construction of the chemistry building at the state university has been awarded to J. & W. A. ELLIOTT CO., Lumber Exchange, at $365,000. Other bidders were as follows: J. L. Robinson, $371,500; Pike & Cook, $399,254; H. N. Leighton Co., $399,004; R. J. Cheney & Co., $385,800; T. G. McMillan, $486,455; Olaf Swenson, $419,688; Chas. Skookhun, St. Paul, $388,864; Hennessey Construction Co., St. Paul, $419,500.

+Albion, Neb.—The contract for the construction of the high school has been awarded to ROBERTS & PARKER, Albion, at $41,000.

+Fargo, N. D.—The general contract for the construction of the jail and sheriff's residence has been awarded to T. POWERS CO., at $68,750, and the jail fixtures to the Stewart Iron Works, Cincinnati, Ohio, at $13,334.

★Dam—Alexandria, Va.—Bids for constructing a concrete masonry dam for the Alexandria Water Co. were received, Apr. 15, by David J. Howell & Son, Consult. Engrs., Washington, D. C., as follows: (A) R. J. Malone, 1341 Clifton St., Washington, D. C.; (B) Winston & Co., American National Bank Bldg., Richmond, Va.; (C) Hoge-Lusbkert Co., 617, 14th St., N. W. Washington, D. C.; (D) Warren F. Brenizer Co., 141 Q St., N. W. Washington, D. C.; (E) Thomas Sheahan, Richmond, Va.; (F) King-Ganey Contracting Co., 2 Rector St., New York; (G) Piedmont Construction Co., University, Va.; (H) MasArthur Bros. Co., 11 Pine St., New York; (I) Oscar Daniels Co., 38 Park Row, New York; (J) Whiting-Turner Construction Co., Sexton Bldg., Baltimore, Md.; (K) National Fireproofing Co., Fulton Bldg., Pittsburgh, Penn.; (L) Alsop & Pierce, Newport News, Va.

+Stanley, N. D.—The general contract for the construction of the court house has been awarded to Leighland, Kleppe & Co., Great Falls, Mont., at $46,998. Other bidders were: Dinnie Bros., Grand Forks, N. D., $57,500; A. C. Thomas, St. Paul, Minn., $51,238; Paul Steenburg Construction Co., St. Paul, Minn., $50,555; Ingeman Co., St. Paul, Minn., $52,520; Carl Bartleson, Minot, N. D., $51,000.

+Houston, Tex.—The contract has been awarded to BUCHANAN & GILDER, for the construction of the eight-story building at Capitol Ave. and Main St., for S. H. Kress & Co.

San Antonio, Tex.—The San Antonio Club will erect a four-story and basement club house. H. L. Drought is Pres. The estimated cost is $75,000.

+Bartlesville, Okla.—The contract has been awarded to the INLAND CONSTRUCTION CO., Chandler, at $94,750, for the construction of a court house and jail. Other bidders were: Heavenor & Co., Oklahoma City, at $124,200; Billings & Fielding, Guthrie, $108,800; McGregor & Hingle, Bartlesville, $111,961.

Denver, Colo.—Plans have been completed by Gove & Walsh, Archs., Boston Bldg., for the construction of a five-story and basement Y. M. C. A. building, on 18th Ave., between Lincoln and Sherman Sts. The estimated cost is $200,000.

St. Maries, Idaho—The general contract for constructing the high school has been awarded to GEORGE GROSHOFF, Spokane, at $59,874. H. G. Ellis, Realty Bldg., Spokane, is Arch.

+Ogden, Utah—Subcontracts have been awarded by the Dinwiddie Construction Co., for the construction of the building at Washington Ave. and 24th St., as follows: Ornamental iron work, JACKSON & RICHTER IRON WORKS CO., Denver, Colo.; mill work, ECCLES LUMBER CO.; terra cotta, GLADDING McBEAN & CO., San Francisco, Calif.

Aberdeen, Wash.—The Aberdeen Lodge, B. P. O. E., are planning the erection of a four-story lodge building on the site of the present building. The estimated cost is $100,000.

DAM, ALEXANDRIA, VA.

	A	B	C	D	E*	F	G	H	I	J†	K	L‡
16,000 cu.yd. earth excavation	$0 75	$1 00	$1.19	$1 00	$0 60	$2 00	$0 50	$0 90	$1 30	$1 00	$1 70	$0 75
1000 cu.yd. rock excavation	1 25	4 00	2 60	3 50	2 90	4 00	1 50	3 50	2 25	3 75	3 00	1 50
17,500 cu.yd. concrete masonry	5.50	7.00	7.39	6 50	6.20	7.00	5 95	7 00	8 00	6 50	6 50	7 00
3000 sq.yd. neat cement grout	0.10	0.15	0.07	0 10	0.20	0 20	0 25	0 20	0 30	0 10	0 25	0 50
135 sq.yd. finishing coat	1 75	0 25	0.45	1 50	0 50	1 00	0 25	2 02	0 80	0 40	0 50	2 00
2500 lb. reinforcement	0 08	0 06	0 03½	0 03½	0 04½	0 06	0 03½	0 05	0 03	0 05	0 07	0 04
1150 cu.yd. rubble stone masonry	7.50	12.00	7.29	13 50	8.25	6 00	5 20	6 75	8 00	8 10	10 00	6 50
Bridge over spillway exc. of railing, lump sum	100 00	200 00	126 00	150 00	150.00	1000.00	180 00	120 00	130 00	150 00	150 00	187 00
220 lin.ft. railing at top of dam	1.00	1.50	1.34	2.00	0.50	1.00	1 50	1 50	3 00	3 00	1 25	1 50
3 circular screens, lump sum	100 00	225 00	300 00	300 00	250 00	150 00	300 00	225 00	350 00	165 00	225 00	320 00
2 screens with c.i. guides and stop planks, lump sum	150 00	270 00	270 00	850 00	995 00	200 00	550 00	1200 00	900 00	150 00	700 00	730 00
2 wd. ladders in gate-house, lump sum	100 00	125 00	350 00	200 00	150 00	100 00	175 00	220 00	300 00	150 00	200 00	160 00
Caring for and setting pipes, valves and gates, lump sum	400 00	2000 00	525 00	900 00	750 00	750 00	1250 00	800 00	700 00	550 00	700 00	816 00
Superstructure of gate-house, lump sum	600 00	2500 00	350 00	400 00	300 00	1000.00	450 00	800 00	600 00	800 00	500.00	450 00
Totals	$121,281	$167,414	$163,483	$153,905	$134,273	$172,105	$124,611	$154,980	$178,323	$148,169	$160,993	$149,238

* Bid based on obtaining acceptable stone within one mile of work.
† Bid based on extension of time without penalty.
‡ Bid based on getting all stone from quarries on company's property within 1000 ft. of dam site.

CONTRACT PRICES

State Highways—Sacramento, Calif.—Bids for constructing highways were received by the State Highway Commission, Feb. 28, as follows: (A) J. Considine, Los Angeles; (B) Leigh G. Garnsey, Los Angeles; (C) Rogers Construction Co., Los Angeles; (D) J. M. Montgomery, Alhambra; (E) George Benson & Son, Los Angeles; (F) Rent & Pennebaker, Los Angeles; (G) John D. Marsh, Los Angeles; (H) E. B. & A. L. Stone Co., San Francisco; (I) Fairbanks & Baechtel, Willets; (J) David L. Sawyer & Charles White, Willets; (K) Raisch Improvement Co., San Francisco:

STATE HIGHWAYS, DIV. 1, ROUTE 1, SEC. C, SACRAMENTO, CALIF

	H	I	J	K
24,200 cu.yd. excavation, unclassified	$0 50	$0 65	$0 66	$1 00
454 lin.ft. 12-in. corrugated iron pipe	2 00	2 00	1 56	3 50
50 lin.ft. 18-in. corrugated iron pipe	3 00	2 25	1 92	4 50
102 lin.ft. 24-in. corrugated iron pipe	3 50	2 50	2 64	6 00
194 cu.yd. concrete, Class B	20 00	20 00	11 00	14 00
11,000 tons broken stone	2 75	2 90	2 10	3 50
7450 cu.yd. gravel	1 50	1 75	1 31	3 15
800 lin.ft. guard rail	0 50	0 25	0 33	0 30
3 miles property fences moved and reset	500 00	333 33	250 00	150 00
120 monuments, hauled and set	1 00	1 00	2 20	2 50
Totals	$60,810	$67,113	$54,311	$92,300

+Seattle, Wash.—The contract for the erection of a five-story hospital building at Seattle, Wash., has been let by St. Joseph's Hospital to P. A. BAILLARGEON, New York Bldg., Seattle, at $500,000.

+The Dalles, Ore.—The contract has been awarded to A. A. LAMBERT, of this place, at $53,537, for finishing the exterior of the court house here.

Los Angeles, Calif.—Bids for the construction of the normal school have been received by State Engr. W. F. McClure, as follows: Louis A. Hicks Co., San Francisco, $596,000; J. F. Atkinson, $612,700; C. J. Kubath Co., $613,000; Southwestern Construction Co., $638,948; McLaren & Peterson, $639,500; F. O. Engstrom, $664,495; Sound Construction & Engineering Co., $684,444; Somers & Lund, $953,000.

W. H. Judson, Arch., Albany Blk., is preparing plans for a six-story and basement, steel and reinforced concrete building, 80x100 ft., on Harrison St. The building will be known as the Arts and Crafts Building. The exterior will be of artificial stone. The interior will be finished in pine and oak. There will be a large amount of Germanstone used, the floors and wainscoating are to be of this material. The estimated cost is $180,000.

+Oakland, Calif.—The contract for the steel work to be used in the construction of the building at San Pablo Ave. and 16th St., for the First Trust & Savings Bank, has been awarded to the PACIFIC ROLLING MILL CO., San Francisco, at $25,834. Noted Mar. 13.

STATE HIGHWAYS, DIV. 7, ROUTE 2, SECTION B, SACRAMENTO, CALIF

	A	B	C	D	E	F	G
19,400 cu.yd. excavation (without classification)	$0 45	$0 56	$0 50	$0 80	$0 45	$0 45	$0 50
240 lin.ft. 12-in. corrugated iron pipe	1 15	1 60	1 50	1 20	2 00	1 10	1 40
211 lin.ft. 18-in. corrugated iron pipe	1 55	2 00	1 75	1 45	2 25	2 00	1 60
118 lin.ft. 24-in. corrugated iron pipe	1 95	2 50	2 50	2 03	2 75	2 50	1 90
20 lin.ft. 30-in. corrugated iron pipe	3 00	4 45	3 00	2 82	3 50	3 75	2 30
72 lin.ft. 36-in. corrugated iron pipe	3 50	1 00	1 00	3 80	1 00	4 50	2 60
60 cu.yd. concrete, Class "B" for culverts and monuments	8 00	10 00	9 00	9 00	12 00	15 00	9 50
960 cu.yd. concrete, Class "B" for paving	4 60	1 50	1 39	1 10	1 95	7 00	1 00
900 bbl. asphaltic oil, hauling and placing	2 00	1 50	2 00	1 50	3 00	2 00	0 80
1260 tons broken stone, crushings	1 75	2 56	2 25	2 27	3 00	2 25	2 40
2250 lin.ft. guard rail	0 40	0 38	0 50	0 40	0 60	0 25	0 30
127 monuments, hauled and set	1 00	1 00	5 00	1 00	4 00	2 00	0 90
Totals	$61,205	$62,999	$61,384	$62,990	$68,288	$85,732	$55,556

Millwain Bros., Archs., Delgar Bldg., awarded the contract to the LEWIS A. HICKS CO., Rialto Bldg., San Francisco, at $137,260, for the construction of the six-story reinforced-concrete office building on 15th St., for Robt. Dalziel Co., 218 First St., San Francisco.

Ottawa, Ont.—The American Bank Note Co. will erect an addition on Wellington St. The estimated cost is $100,000. J. Albert Ewart is Arch., Ottawa.

Ottawa, Ont.—Plans and arrangements for the erection of buildings in the city and vicinity of Ottawa involve an expenditure of over $4,000,000. Among these are: The Evening Journal Building, eight stories; Bryson Realty Co., Ltd., five stories; Chalmers Church, estimated to cost $130,000; A. G. Acres & Co., Albert Bldg., five stories; F. W. Carling, ten stories, new 16-room school house, to cost approximately $115,000; Lowe-Martin printing plant, five stories, to cost approximately $40,000; Ottawa College, new wing, estimated to cost $150,000; new school house at Woodruff, $12,000, Public School Board's new building, estimated cost, $97,000; new post office building, to cost $500,000; new government buildings on Wellington St. Ottawa, estimated to cost $2,000,000.

Overflow Conduit—Troy, N. Y.—Bids for constructing the Oakwood Overflow Conduit, were received by the Bureau of Water Supply, Apr. 15, as follows: (A) E. L. Grimes Co., (B) Whiting, Turner Co., Sexton Bldg., Baltimore, Md.; (C) Martin Murray Co.; (D) Leary & Morrison Co.; (E) Kellum & Schafer Co.; (F) Kennedy & Hamilton Co., (G) Concrete & Foundation Co., 104 West 42d St., New York; (H) Henry Golden; (I) Edward Walsh, 22 Clay St., Baltimore, Md.; (J) George Broderick; (K) Rob RoyConstruction Co.:

OAKWOOD OVERFLOW CONDUIT, TROY, N. Y.

	A	B	C	D	E	J	G	H	I	J	K
7450 cu.yd. earth excavation, less than 8 ft	$0 60	$1 80	$1 37	$0 80	$1 30	$1 03	$1 63	$1 17	$1 35	$1 50	$1 00
4300 cu.yd. earth excavation, 8 to 14 ft	0 80	1 80	1 37	1 17	1 80	1 03	1 63	1 70	1 75	1 80	1 00
1100 cu.yd. earth excavation, 14 to 20 ft	1 00	1 80	1 37	1 80	2 00	1 03	1 63	2 33	2 10	2 25	1 20
50 cu.yd. rock excavation, less than 8 ft	1 50	4 00	7 00	1 80	1 00	5 00	4 00	1 00	1 00	2 75	2 10
100 cu.yd. rock excavation, 8 to 14 ft	2 00	4 00	7 00	1 90	2 00	5 00	5 00	1 00	1 00	3 25	2 80
100 cu.yd. rock excavation, 14 to 20 ft	2 00	4 00	7 00	2 10	2 50	5 00	6 00	1 00	1 00	3 75	3 50
8 manholes	30 00	30 00	100 00	45 00	50 00	50 00	66 00	55 00	50 00	45 00	80 00
2061 cu.yd. 1:2:4 concrete	9 00	8 45	7 30	11 00	10 00	12 00	9 40	11 00	12 50	14 00	16 50
94,200 lb. ¾-in. reinforcing bars	0 04	0 04	0 04	0 05	0 03	0 05	0 05	0 04½	0 03	0 02	0 07
24,000 lb. 10-in. I beams	0 03	0 04	0 03	0 06	0 03	0 05	0 05½	0 053	0 03	0 03½	0 08
3100 lb. 3-in. concrete reinforcing	0 05	0 05	0 10	0 10	0 05	0 09	0 05½	0 04½	0 05	0 06	0 08
Connecting, lump sum	50 00	150 00	300 00	100 00	50 00	75 00	275 00	150 00	200 00	500 00	100 00
Totals	$38,367	$51,888	$44,678	$49,652	$50,866	$53,082	$54,430	$54,594	$57,706	$63,192	$66,829

Sewers—Newark, N. J.—Bids were received as follows, by the Passaic Valley Sewage Commissioners, Apr. 15, for Section 11 of the main intercepting sewer: (A) Harrison & Craig, Newark, N. J.; (B) Culp Co., Inc., Brooklyn, N. Y.; (C) Union Building & Construction Co., Passaic, N. J.; (D) Concrete & Foundation Co., New York; (E) Patrick McMeel, Passaic, N. J.; (F) Ryan & Reilly Co., Baltimore, Md.; (G) Oscar Daniels Co., New York; (H) Pethick Bros. & Co., Inc., New York; (I) Dock Contractor Co., Hoboken, N. J.; (J) Whiting-Turner Construction Co., Baltimore, Md.; (K) McCauley-Manton Co., Newark; (L) Bruno & Petitti, Belleville, N. J.; (M) Robert W. Smith Corp., New York; (N) J. F. Shanley Co., Newark. The item bids were as follows:

PASSAIC VALLEY SEWER, SECTION 11 NEWARK, N. J.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
6500 lin.ft. earth excavation and refilling in trench, for 120-in. sewer	$21 20	$26 27	$28 00	$26 00	$27 00	$29 50	$31 50	$32 00	$33 70	$32 25	$34 00	$40 00	$43 75	$42 00
13,000 cu.yd. concrete masonry in trench	7 50	6 60	7 50	8 50	9 00	8 40	8 10	8 00	7 34	8 25	7 75	9 00	7 60	12 50
100 cu.yd. brick masonry, in manholes and appurtenant work	15 00	20 00	15 00	16 00	15 00	16 00	15 00	20 00	15 00	17 00	20 00	20 00	16 00	15 00
100 cu.yd. rock excavation in trench	5 00	5 00	3 00	5 00	6 00	5 00	5 00	8 00	10 00	5 00	6 00	6 00	6 00	3 00
Totals	$237,300	$250,055	$281,300	$381,600	$294,600	$303,050	$312,050	$314,800	$316,970	$319,075	$324,350	$379,600	$385,375	$437,300

✦Dorchester Tunnel—Boston, Mass.—Bids for constructing Section B of the Dorchester Tunnel were received by the Boston Transit Commission, Mar. 25, as follows: (a) Rowe Contracting Co., Brighton, Mass.; (b) Jas. J. Coughlan Co., 43 Tremont St., Boston; (c) P. McGovern & Co., 6 Beason St., Boston; (d) Connors Bros. Co., 157 Plain St., Lowell; (e) Coleman Bros., 1 Marginal St., Chelsea; (f) HUGH NAWN CONTRACTING CO., 82 Savin St., Roxbury (awarded contract):

SECTION B, DORCHESTER TUNNEL, BOSTON, MASS

	A	B	C	D	E	F
49,000 cu.yd. earth excavation	$4 75	$4 20	$ 425	$3 85	$4 00	$3 50
1400 cu.yd. masonry removed	10 00	8 00	5 00	15 00	6 00	6 00
2000 sq.yd. concrete base removed	1 00	50	50	1 00	65	50
12,000 cu.yd. concrete masonry	12 50	11 15	10 50	10 50	10 00	10 50
1000 cu.yd. cinder concrete	9 00	6 00	9 00	6 00	5 00	5 50
200 cu.yd. mortar under flanges of beams	9 00	13 00	15 00	14 00	16 00	14 00
100 cu.yd. brick masonry	16 00	18 00	20 00	15 00	16 00	20 00
500 lin.ft. 6x12 in. vitrified pipe	50	1 00	75	1 00	50	75
700 lin.ft. 4-in. vitrified pipe	40	50	25	75	25	50
500 tons steel reinforcing, set	12 00	10 00	12 00	10 00	8 00	5
700 tons steel and iron, set	20 00	13 50	16 00	12 00	10 00	12 00
5000 sq.yd. portland cement mortar	50	40	40	60	40	40
20,000 cu.yd. prepared textile and asphalt	50	50	60	45	40	50
10,000 sq.yd. tarred felt and pitch	30	15	30	35	25	30
Other work and risks not covered by other items, lump sum	35,000	19,000	11,000	12 ,500	11,000	12,000
356 lin.ft. 3½x2-ft. c.i. pipe	3 50	5 00	4 00	5 00	4 50	1 00
513 lin.ft. 4½x3 ft. c.i. pipe	4 50	6 00	5 00	10 00	5 50	1 00
77 lin.ft. 30-in. c.i. pipe	2 00	4 00	3 00	' 2 00	3 00	2 07
Totals	$476,389	$407,766	$397,720	$389,739	$376,480	$350,048

San Francisco, Calif.—The following bids were opened by the Buildings and Grounds Committee of the Panama-Pacific International Exposition Co., for the foundations of the Manufactures Building, and for the pile foundation of the Agriculture Building, both of which are to be erected in the exhibit section of the harbor view site. Bids were taken on the basis of per lineal foot: Pile Foundation, Agriculture Bldg., Mercer-Fraser Co., 24¾c. per ft.; Foster-Vogt Co., 32½c. per ft.; Pile Foundation, Manufacturers' Bldg., Foster-Vogt Co., 33c. per ft.; Contra Costa Construction Co., 25c. per ft.

✦Walkerville, Ont.—The Canadian Bridge Co. has awarded contract to VICTOR WILLIAMSON for the erection of a 118x130-ft., one-story addition to its office building. Albert Kahn is Arch., Trussed Concrete Bldg., Detroit, Mich.

✦Winnipeg, Man.—The contract for the construction of the addition to the Royal Alexandra Hotel at Winnipeg has been awarded to the WESTINGHOUSE-CHURCH-KERR CO., 10 Bridge St., New York City.

✦Winnipeg, Man.—The contract for the construction of the Isaac Brock school at Clifton and Spruce Sts., has been awarded to the SUTHERLAND CONSTRUCTION CO.

CATALOG NOTICES

California Corrugated Culvert Co., Los Angeles, Calif. Catalog. American ingot iron corrugated culverts. Illustrated, 24 pages, 7x10 in.

Scott Drill Co., St. Louis, Mo. Bulletin No. 6. Gasoline rock drills. Illustrated, 12 pages, 8x11 in.

The Jeffrey Mfg. Co., Columbus, O. Bulletin No. 31-L. Swing hammer pulverizer. Illustrated, 5 pages, 6x9 in.

Sullivan Machinery Co., Peoples Gas Building, Chicago, Ill. Bulletin No. 66G. Hammer drills for mining and construction work. Illustrated, 32 pages, 6x9 in. Bulletin No. 65 A. Diamond core drills. Illustrated, 32 pages, 6x9 in.

The Metaline Co., 6 West Ave., Long Island City, N. Y. Catalog. Metaline and Metalined or oilless bearings. Illustrated, 24 pages, 5½x8 inches.

Pennsylvania Pneumatic Co., Erie, Penn. Folder. Barr "Unit-Compound" air compressor. Illustrated, 3½x6 in.

Koehring Machine Co., Milwaukee, Wis. Catalog No. 18. Concrete mixers, bar cutters, bar benders, water measuring tank. Illustrated, 78 pages, 6x9 in.

Roberts and Schaefer Co., Chicago, Ill. Reinforced concrete Holmen locomotive coaling stations. Illustrated, 32 pages, 5x7 in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3312. "Imperial XB" duplex power driven air compressors. Illustrated, 20 pages, 6x9 in.

Goulds Mfg. Co., Seneca Falls, N. Y. Bulletin No. 114. Centrifugal pumps. Illustrated, 4 pages, 7½x10 in.

CONTRACTS TO BE LET

Passaic Valley Sewerage Commissioners

NOTICE TO CONTRACTORS

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the twenty-ninth day of April, nineteen hundred and thirteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for the construction of the NORTHERLY PORTION OF SECTION 6 of the Main Intercepting Sewer, in the City of Newark.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES.
Northerly Portion of Section 6.
Station 40 - 00 to Station 56 - 00.

Item 1.—Earth Excavation and Refilling in trench, for 150-inch sewer..... 1,600 linear feet.
Item 2.—Concrete Masonry, in trench, Portland cement mortar..... 4,600 cubic yards.
Item 3.—Brick Masonry, in manholes, laid with Portland cement mortar, and appurtenant work ..... 50 cubic yards.
Item 4.—Rock Excavation, in trench..... 300 cubic yards.
Item 5.—Furnishing, placing and maintaining Steel and Timber Sheeting, etc., between Station 26 - 75 and 28 + 75 ..... Lump Sum

Drawings, form of contract and specifications, and blank form for proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOHN S. GIBSON, Clerk.
April 1, 1913.

Tenders for Dredging

Toronto, Canada.

The Toronto Harbor Commissioners have in preparation plans and specifications for the removal of approximately 25,000,000 cubic yards of material by hydraulic dredging.

Borings indicate seventy percent. of material to be sand and gravel, thirty percent. mixture of sand, silt and clay.

Each dredge must be capable of handling at least 600 cubic yards per hour at maximum length of discharge.

From source of supply to point of discharge maximum distance is about 6000 feet. Average length of delivery required about 4000 feet.

Direct line of discharge preferred, but consideration will be given to work being done in series or by relays.

Day and night operation required.

The plans and specifications will be ready on April 28th, 1913. Tenders for all or part of this work will be received up to 12 o'clock noon May 28th. Work to commence August 1st, 1913.

Borings, plans and specifications, tender forms, etc., and general information relating to the work can be seen at the Engineering Department of the Commission, 76 Adelaide St. West.

Communications relative thereto to be addressed to E. L. Cousins, Chief Engineer.

All tenders to be sealed and addressed to A. C. Lewis, Secretary, Toronto Harbor Commissioners.

The Commissioners do not bind themselves to accept the lowest or any tender.

L. H. CLARKE,
Chairman.

Notice to Paving Contractors

Ridgewood, N. J.

Sealed proposals will be received by the Board of Commissioners of the Village of Ridgewood, N. J., until 8 P. M., April 29, 1913, for about 7300 sq. yds. of brick pavement in said Village. Plan, specification and forms for bidding and contract are on file with the Village Clerk.

WILBUR MORRIS,
Village Clerk.

F. W. SIMONDS.

Passaic Valley Sewerage Commissioners

NOTICE TO CONTRACTORS

Notice is hereby given that the Passsaic Valley Sewerage Commissioners have designated Tuesday, the twenty-ninth day of April, nineteen hundred and thirteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for the construction of the CENTRAL PORTION OF SECTION 6 of the Main Intercepting Sewer, in the City of Newark.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES,
Central Portion of Section 6.
Station 26 + 00 to Station 40 + 00.

Item 1.—Earth Excavation and Refilling in trench, for 150-inch sewer..... 1,400 linear feet.
Item 2.—Concrete Masonry, in trench, Portland cement mortar..... 4,500 cubic yards.
Item 3.—Brick Masonry, in manholes, laid with Portland cement mortar, and appurtenant work ..... 50 cubic yards.
Item 4.—Rock Excavation, in trench..... 300 cubic yards.

Drawings, form of contract and specifications, and blank form for proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOHN S. GIBSON, Clerk.
April 1, 1913.

Passaic Valley Sewerage Commissioners

NOTICE TO CONTRACTORS

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the twenty-ninth day of April, nineteen hundred and thirteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for the construction of the SOUTHERLY PORTION OF SECTION 6 of the Main Intercepting Sewer, in the City of Newark.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES,
Southerly Portion of Section 6.
Station 9 + 00 to Station 26 + 00.

Item 1.—Earth Excavation and Refilling in trench, for 150-inch sewer..... 1,700 linear feet.
Item 2.—Concrete Masonry, in trench, Portland cement mortar..... 5,500 cubic yards.
Item 3.—Brick Masonry, in manholes, laid with Portland cement and mortar, and appurtenant work..... 100 cubic yards.
Item 4.—Rock Excavation, in trench..... 7,000 cubic yards.

Drawings, form of contract and specifications, and blank form for proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOHN S. GIBSON, Clerk.
April 1, 1913.

Proposals Invited for Pavement

STREET DEPARTMENT,
Charleston, S. C., April 5, 1913.

Sealed proposals, in duplicate, will be received at this Office until 8 P.M. Tuesday May 6th, for 30,000 square yards, more or less, of Wood Block, Vitrified Brick, Asphalt Block, Sheet Asphalt, or other suitable pavement for various streets in the City of Charleston, S. C. Specifications, etc., will be furnished prospective Bidders upon receipt of Ten Dollars ($10.00) as a guarantee for their safe return. For further information address the undersigned. The right is reserved to reject any or all bids.

J. H. DINGLE,
City Engineer.

Engineering News

VOLUME 69 MAY 1, 1913 NUMBER 1

The New Grand Central Terminal Station in New York City: An Underground Double-Deck Terminal

About the time the New York Central & Hudson River R.R. Co. was directed by the Legislature of the State of New York to introduce electric operation on its New York City terminal lines, in 1903, the railway company began also making plans for radical reconstruction and enlargement of its New York terminal station. The existing station and terminal yard were too small, in spite of recent modifications and enlargement. The site was hemmed in by buildings on all sides in such a way as to preclude further enlargement except by purchase of more ground at great expense; and if this were done the situation would naturally call for a complete replanning of trackage and facilities. With electric operation—that is to say on a completely modernized basis which provided for satisfactory operating conditions far into the future—it was also desirable to modernize the terminal plant and provide for more than the immediate year or two ahead.

The great increase of operating capacity which might be secured under electric operation could not be realized in the old terminal plant, whereas by a new, larger terminal the full benefit in this direction might be attained. At the same time, enlargement of the terminal would also take care of the equally important matter of increasing the capacity of the four-track approach (tunnel and viaduct) extending north from the terminal yard about four miles to near the Harlem River; for, under the existing conditions the capacity of the tunnel, in itself hardly more than enough, was further reduced by frequent delays to trains in the tunnel caused by the



FIG. 1. GENERAL VIEW OF NEW GRAND CENTRAL TERMINAL STATION, NEW YORK CITY, LOOKING NORTH

(Terminus of the New York Central & Hudson River R.R. and the New York, New Haven & Hartford Ry. See Fig. 6 for appearance when completed. The bridge connecting the elevated roadway around the station building with Park Ave. at 41st St. is shortly to be built by the city.)

inadequate entrance and storage facilities of the terminal yard.

The study of preliminary plans for reconstruction of the terminal was soon followed by start on actual construction. Widening of the throat of the yard and of the approach to the tunnel was begun in 1903. The main portion of the yard was taken in hand in 1907, by which time the plans for the whole improvement were in nearly final form. The six years from 1907 to the present time have seen the work brought to substantial completion; on Feb. 2, 1913, the new main passenger station was opened to traffic. The remaining construction, including the Incoming Station building, is likely to continue dur-

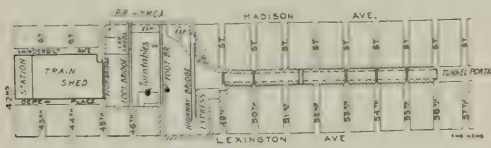


FIG. 2. TERMINAL. 1900-1905

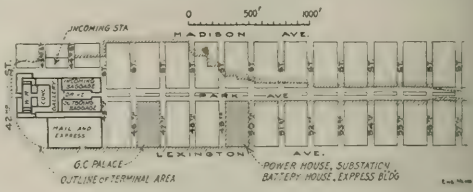


FIG. 3. NEW TERMINAL, 1913

FIGS. 2 AND 3. SKETCH PLANS OF SITE, GRAND CENTRAL TERMINAL, OLD AND NEW

ing the present year and the next, so that by the end of 1914 the entire terminal plant will be in service, after eleven years of building.

NEW FEATURES

The radically new elements of the terminal are:

1. Double-deck arrangement of tracks, both levels being below ground.
2. Separation of suburban from through-train traffic by placing them on separate levels.
3. Separation of incoming from departing traffic, by provision of a separate building for incoming traffic, straddling the arrival tracks, which are at the west edge of the terminal yards.
4. Provision of turning loops for both suburban and through trains, which will eliminate a large proportion of the shifting movements.
5. Utilization of nearly the whole yard space for building over, together with restoration of the full network of streets over the site except the area occupied by the main station and office-building.

Not all these features were contained in the plans first developed, but they resulted during the gradual process of change and improvement of plans.*

RELATION TO ELECTRIC OPERATION

The substitution of electric traction for steam operation in the terminal zones of the New York Central & Hudson River R.R.† and the New York, New Haven & Hartford R.R.‡ was completed in 1906, and since that time all trains for a distance of 10 to 30 miles out of New York on both railways have been hauled by electric locomotives or operated as multiple-unit electric trains (suburban service). This change of method of operation laid the foundation for great future changes in the character and amount of traffic, and in particular made available a great increase in traffic capacity of the

*This evolution went on throughout the construction period. As late as 1911, substantial revisions of the plans were made. The most important revision, that on which the main yard work was based, is that of 1907. It represented a great increase in yard space and a complete change in the track layout, as compared with the 1905 plan. An article describing the electric-traction equipment of the New York terminal division. "Engineering News," Nov. 16, 1905, pp. 499-509, showed a track plan of the new terminal as then designed. This may be compared with the plan shown in the present article, representing the work as built.

†"Engineering News," Nov. 16, 1905, p. 499.

‡"Engineering News," Mar. 22, 1906, p. 342; Sept. 5, 1907, p. 239; Dec. 31, 1908, p. 733.

STATISTICS OF OLD AND NEW GRAND CENTRAL TERMINAL

	Before improvement	After improvement — Suburban sta.	Express level	Street level and above	Total	Increase — Amount	Percent.
Area of terminal, acres	23.24	32.88	44.95		77.83	54.59	235
Miles of track							
Platform	2.91	2.23	5.05		7.28	4.37	150
Storage	1.54	3.94	2.81		6.75	5.21	338
Express	0.35		0.84		0.84	0.49	140
Mail	0.16		0.42		0.42	0.26	163
Running, etc.	5.88	7.95	9.82		17.77	11.89	202
Total	10.84	14.12	18.94		33.06	22.22	205
Car capacity of tracks							
Platform	214	143	297		440	226	106
Storage	640*	345	184		529	Decrease 111	17
Express	26		62		62	36	139
Mail	11		26		26	15	136
Total	891*	488	569		1057	166	19
No. of platform tracks							
Areas:	19	17	33		50	31	163
Building, acres	5.90			10.09	10.09	4.19	71
Offices, sq.ft.	129,500			475,000	475,000	345,500	266
Restaurant, sq.ft.	44,000			127,050	127,050	91,050	285
Waiting rooms, sq.ft.	12,443	1,920	17,456†		19,076†	6,633	53
Retiring and toilet rooms, sq.ft.	1,391	1,699	10,092		14,791	13,400	963
Restaurant, etc., sq.ft.	2,847	21,909				19,262	728
Train sheds, sq.ft.	1,441	2,088	2,516		4,604	3,160	219
Express, mail, sq.ft.	507	1,502	1,750		3,342	2,835	559
Baggage rooms, sq.ft.	34,435	1,350	2,000	67,376	70,726	37,411	112
Concourses, sq.ft.	14,814	35,808	46,224		82,122	67,308	454
Ticket lobby, sq.ft.	1,490						
Cab stands, sq.ft.	2,952		18,315	40,312	58,627	55,675	1886
Street viaducts, sq.ft.				754,459	754,459	754,459	

* Includes 325 car capacity of Mott Haven yard.
† Express level includes 3552 sq.ft. in Incoming Station.

railways. To utilize this, and especially to develop it properly by the greater frequency of service possible under electric operation, required a very much larger terminal than the old one to provide for both the increased amount and the changed character of traffic. The Grand Central Terminal site did not afford space for the necessary expansion *on one floor*. The double-deck scheme, which of course is possible only with electric operation, solves the problem. It incidentally gives the

Under these circumstances the terminal yard is radically transformed from its usual outdoor character, and becomes simply a special occupancy of two basement floors of a building.

Relation to Prior Conditions

The New York terminus of the New York Central and predecessor lines moved northerly with the gradual growth of the city, beginning some 80 years ago when the

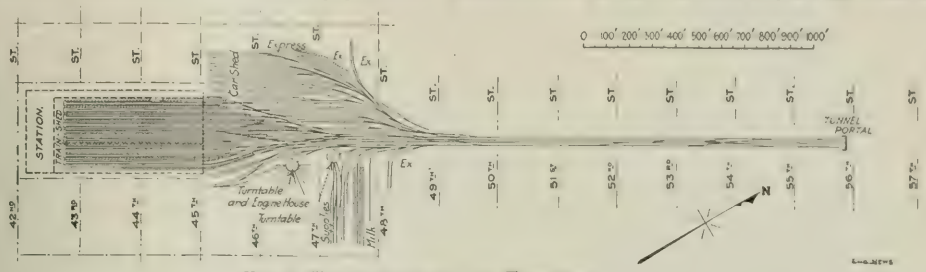


Fig. 4. Track Plan of Old Terminal

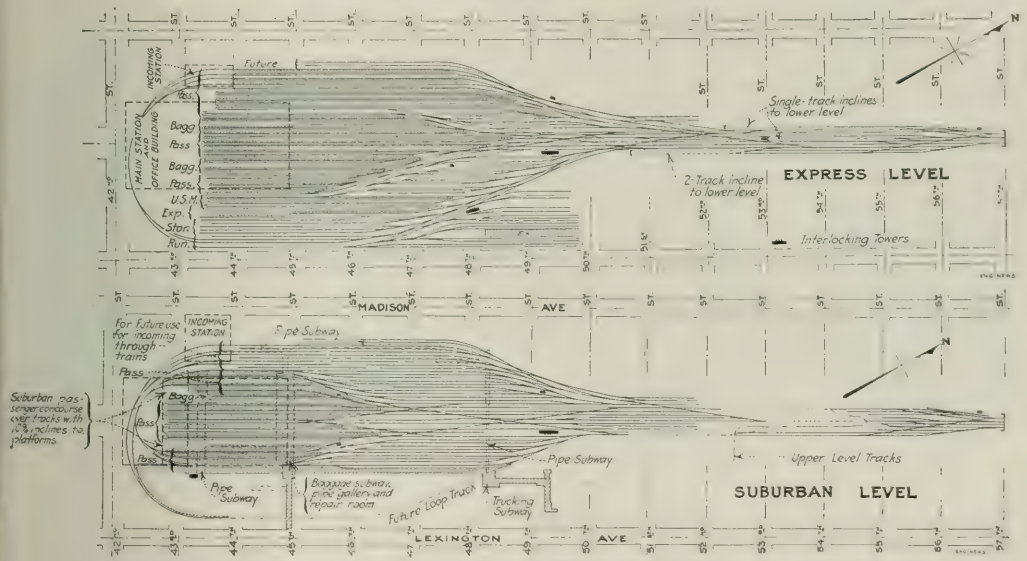


Fig. 5 Track Plans of Express (Upper) and Suburban (Lower) Levels, New Terminal

Figs. 4 and 5. Condensed Track Plans of Grand Central Terminal, Old and New

very great advantage of separating the suburban from the through traffic, an advantage both to the passenger and to the railway company. Loop tracks for turning trains develop this scheme to its fullest extent by increasing the effective capacity of the terminal tracks.

A steam-railway terminal is necessarily of outdoor character, as the locomotive smoke and gases must have free escape. Electric operation allows of complete covering. In the New York Central terminal this possibility is fully utilized in the lower level, and (at present) partly in the upper level. When the open areas between streets are fully covered with commercial buildinges (as is expected to be the case in a few years) the upper level also will be completely inclosed.

terminus was located about three miles south of the present location. The station was moved north to 26th St. (the site of the present Madison Square Garden) in the fifties of the last century, although after 1857 steam operation below 42nd St. was prohibited, and cars were hauled south of there by horses. In 1871 the station at 42nd St. was built. It was enlarged and altered repeatedly, and especially in 1898 was considerably improved by increasing the trackage and by raising the station building three stories.

The 42nd St. station and terminal made a very serious break in the city's street system in an important region, as illustrated best by the fact that prior to the present improvements there were but two street-crossings for

vehicles over the railway terminal tracks between 42nd and 56th Sts., three-quarters of a mile. The seriousness of this condition and the past history of the northward movement of the railway terminal doubtless helped to impress the directors of the railway company with the need of such a reconstruction of the terminal as would be proof against the growth of hostile public sentiment, which might in time compel a further northward removal of the terminal to suit the needs and convenience of the city. At any rate, the result of the work is such as would have been produced under the stimulus of a motive of this kind.

Traffic

The traffic of the Grand Central station has in recent years amounted to some 400 trains per day, i.e., about 200 each way. The station serves two railways, connecting points between Boston and St. Louis. Both lines have a fairly heavy suburban traffic. The traffic of the terminal in 1900, 1905 and 1910, was about as follows:

Total for year	1900	1905	1910
Trains	106,000	128,000	130,000
Cars	575,000	695,000	755,000
Passengers	13,600,000	18,100,000	20,150,000

The six-mile section of road immediately north of the terminal is a four-track line in tunnel and on elevated structure; beyond this the two railways total 8 to 12 tracks. The railway lines can readily bring in more trains than the four-track section can accommodate, unless the movement of trains in the tunnel is regulated with great precision and is free from all delays and interruptions. The old terminal yard was too small to insure this condition, as its ladder tracks could not always be cleared rapidly enough for incoming trains, so that trains frequently were held in the tunnel and thus the capacity of this narrow part of the line was throttled.

In the period of steam operation, i.e., prior to 1906, there was an unusually large proportion of waste or idle movements of locomotives and trains in the terminal and through the tunnel, partly because the engines of incoming trains had to be turned before they could take their trains out and partly because the lack of storage space in the terminal yard made it necessary to return empty trains and light engines to the Mott Haven yards. These conditions were much ameliorated by the introduction of electric motive power. The natural growth of traffic soon neutralized this improvement, however.

The new terminal, with greatly increased area and extensive storage tracks, reduces the idle movements considerably and (by eliminating all holding of trains in the tunnel) allows the full capacity of the tunnel to be developed. Even so the capacity of the tunnel will be much less than that of the terminal, and the latter in fact will be able to take care of a possible future two-track line connecting with the New York Central's double-track branch now extending along the east bank of the Hudson River from Spuyten Duyvil down to 30th St.

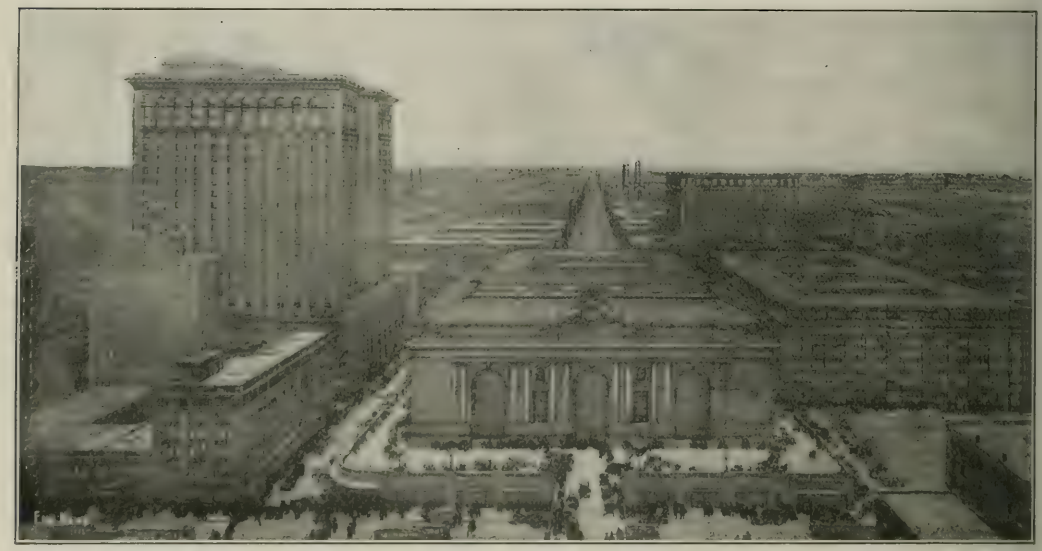


Fig. 6. The New Grand Central Terminal As It Will Appear When Completed

(Buildings are shown on the block areas over the yard. The tall building at the left, the Biltmore Hotel, containing the Incoming Station in its lower part, is now being erected. The tall building at the right is the new Grand Central Palace, and behind it at 50th St. is the Service Plant, whose brick smokestacks are surrounded with steel tower framing for architectural effect.)

The New Terminal

Figs. 2 and 3 show comparative sketch plans of the terminal site under the old and the new conditions. The principal buildings or parts of the site used for various terminal or auxiliary purposes are noted in these sketches. Attention is drawn to the complete street connection over the new terminal, due to the underground location as already noted. The extent to which the old terminal

interrupted the east-west lines of communication (Fig. 2) will be understood better upon considering that, since the tracks were nearly at street grade, all bridges over the tracks had to rise by steep inclines or stairs.

That the new site is much larger than the old (apart from the matter of double-decking) is not so readily seen on comparing Figs. 2 and 3 as on noting the figures:

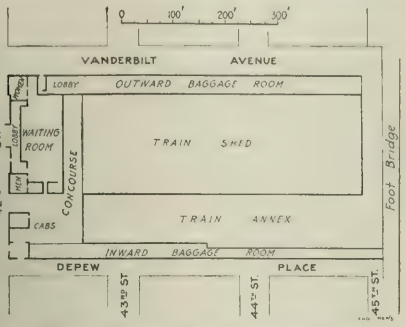
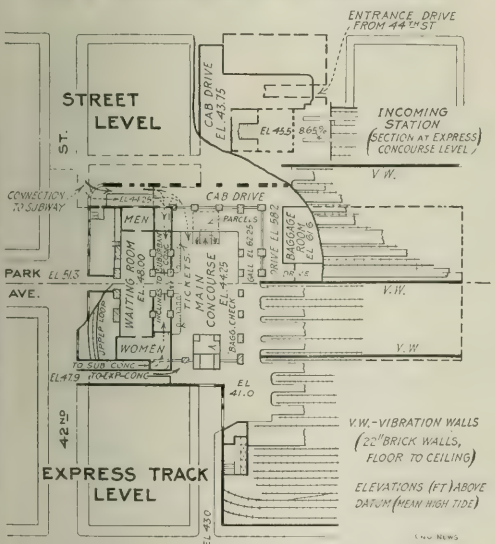


Fig. 7. Station after 1900 Reconstruction



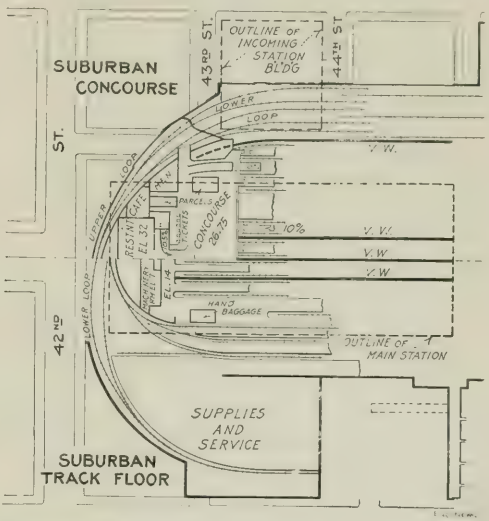


Fig. 8. New Main and Incoming Stations

Figs. 7 and 8. Diagram Plans of Old and New Passenger Stations, Grand Central Terminal

From 42nd St. to tunnel portal, area actually occupied by yard, station and facilities, 47 acres in the present terminal against 23¼ acres in the old; passenger platform track capacity, 440 cars against 214; storage track capacity, 529 against 115. The increase is due to widening of the yard (chiefly on the east side), widening of the approach to the full width of Park Ave., and elimination of waste space and facilities now unnecessary, besides the double-decking.

The buildings of the new terminal include: Main Station (maximum height 6 stories), the northerly half of which is used as office-building above the first story, and houses part of the railway offices; Incoming station (under Biltmore Hotel, 43d to 44th Sts., Vanderbilt Ave. to Madison Ave.); Postoffice and office-building, which also provides accommodation for the American Express Co.; Substation for traction current, transforming the incoming 11,000-volt current to 660-volt direct current for third-rail supply and 300-volt current for signal supply; Storage-battery house for traction current; Service Plant, supplying steam for heating and electric current for lighting the entire terminal area.

A wareroom and exhibit building (corresponding to the old Grand Central Palace, but several blocks further north) has been built on the Lexington Ave. frontage of the terminal by the railway company. This building, and the Biltmore Hotel, the Adams Express Co. building, the Railroad Y. M. C. A., and the United Cigar Stores building (42d St. and Vanderbilt Ave.), are the only buildings of commercial nature which the railway company has erected on the terminal area at present.

Ultimately all spaces between streets are to be used for commercial or private buildings, the railway company probably leasing the area with restrictions on height of building and column locations. The architectural scheme of the terminal contemplates that the buildings between Depew Place and Vanderbilt Ave. shall be limited to six stories in height (except for a possible future building around the station concourse), and those outside this width to twenty stories. The steel framing of the track levels is designed for such building loads.*

Terminal Yard

Comparative track plans of the old and the new terminal are shown in Figs. 4 and 5. The latter is double, representing separately the upper level (for through trains) and the lower level (for suburban trains). The northern end of the yard is now at 57th St., the south

*Except that along the west side of the terminal independent building columns were provided wherever possible, i.e., columns passing through the track framing and independent of it.

portal of the Park Ave. tunnel (formerly at 56th St.), and the total length of the terminal from this point south to 42nd St. is about ¾ mi. Between 52nd and 54th Sts. are located three track-inclines (one double-track, two single-track) with four tracks leading down to the lower level. The gradients of these inclines are 2.7% and 3.0%. Just south of the inclines the principal ladder tracks begin, commanding the whole width of the terminal. The length available south of the ladders is not sufficient for straight platforms of the desired length at the extreme east and west edges of the yard, and some of the platforms extend well out along the curves.

The track layout was made the primary feature in

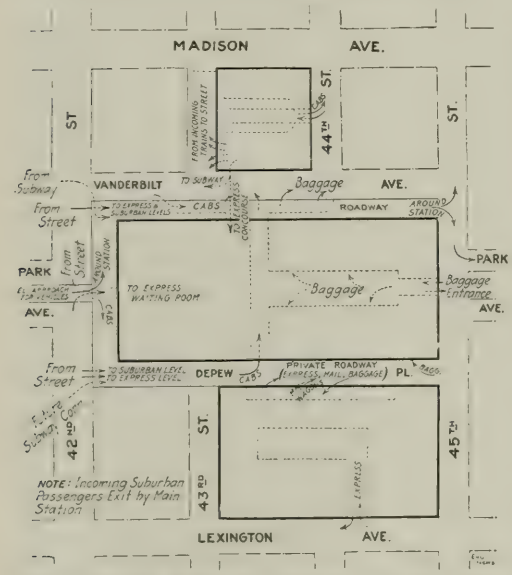


FIG. 9. SKETCH INDICATING PRINCIPAL TRAFFIC CONNECTIONS OF NEW GRAND CENTRAL STATION

the design of the terminal. Column locations, property limitations, etc., were not considered in making the layout, but the tracks were arranged to give the best terminal which the general nature of the site and the operating conditions permitted.

The westerly five tracks on each level are for incoming through trains. The platforms here are among the longest platforms in the terminal, one being 1525 ft. long. On the suburban level these arrival platforms have not yet been built, intermediate tracks being laid in their place, as the upper-level arrival tracks are adequate for the present through-train service. The suburban business does not require the use of the long platforms.

The arrival tracks come directly under the Incoming Station. They are connected by spiraled semicircular loop tracks with the easterly edge of the yard, so that incoming trains can, after unloading, be brought around the loop and set either in the storage yard or on departure tracks. That portion of the lower-level loop which is intended to be used by through trains has not been completed at present, as part of it must be tunneled under the express-level tracks (built previously), and it is not desired to do this until the use of the lower-level arrival tracks becomes necessary.

The platform tracks of both floors are generally arranged in pairs between platforms. A few baggage tracks are placed singly between platforms. On the suburban level several loop tracks are provided connecting the three westerly with the three easterly platform tracks, thus permitting some of the incoming suburban trains (multiple-unit equipment) to reach a different track for departure without backing through the yard ladders. These loop tracks are inside the larger loop of the five main arrival tracks intended for through-train service.

Some figures as to the tracks are given in the adjoining table "Grand Central Terminal Statistics." A similar table was given in our issue of Nov. 16, 1905, p. 503, which gave data for the terminal plans as developed at that time; comparison of the two tables indicates the growth of the scheme.

Briefly summarized, the upper level contains 21 pas-

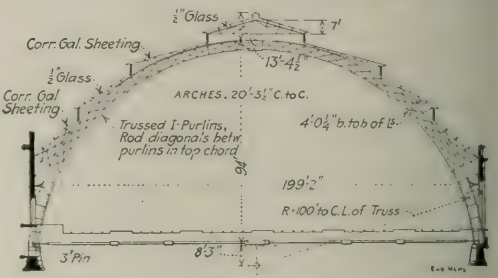


FIG. 10. TRAINSHED OF THE OLD GRAND CENTRAL TERMINAL

(Compare with lower drawing in Fig. 11, which is a cross-section through the train rooms of the new station.)

senger-train tracks, 6 baggage tracks, 2 mail tracks, 3 express tracks, 5 storage tracks, and 4 running tracks, a total of 41 tracks. The lower level contains 13 passenger tracks, 4 baggage tracks, and 8 storage tracks, a total of 25 tracks.

The platforms (see Figs. 12 and 13) are 14 ft. 4 in. to 27½ ft. wide, and have their floor 4 ft. to 4 ft. 3 in. (baggage platforms) above top of rail. They follow the grade of the tracks longitudinally. All platforms are hollow reinforced-concrete structures comprising side walls and a floor slab; the hollow space below is in most cases occupied by ducts, piping, etc. Where a platform comes over a longitudinal expansion-joint of the steel floor-framing, one of the side walls is made with a horizontal sliding joint just above track level; a steel plate forms one face of this joint. These joints are said to be working satisfactorily.

The platforms are connected to the concourse floors by inclines generally of 10% slope. The suburban concourse, located above track clearance height on account of the loop tracks, has very long inclines, while those of the express-level concourse are short (see longitudinal section, Fig. 11). Inclines are used quite generally throughout the station on the lines of movement of passengers, and stairs are largely eliminated.

TRACK CONSTRUCTION—The suburban tracks rest on the rock bottom of the excavation. The upper-level tracks rest on the steel-frame concrete-filled roof of the

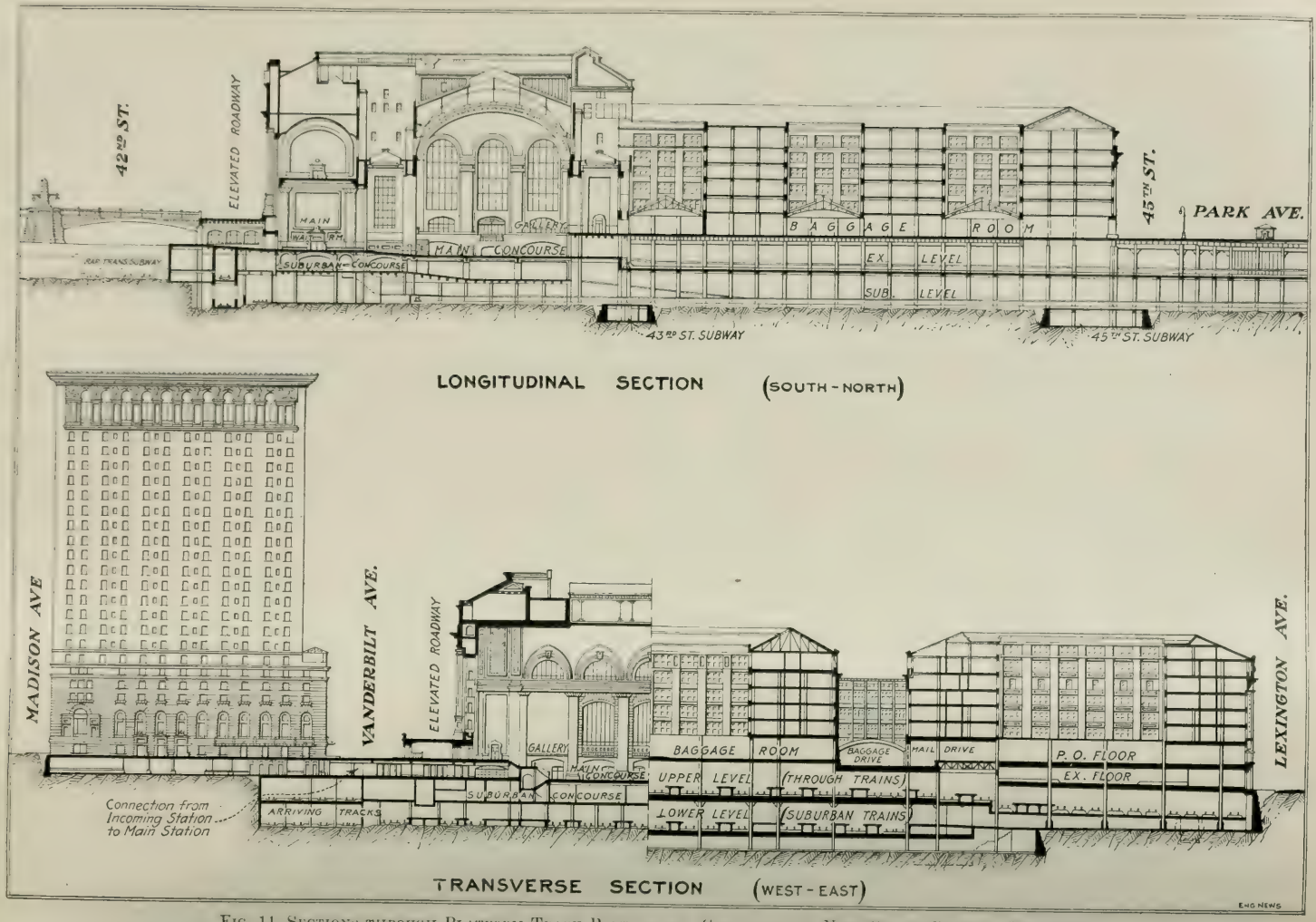


FIG. 11. SECTIONS THROUGH PLATFORM TRACK PORTION AND CONCOURSE OF NEW GRAND CENTRAL TERMINAL

suburban level, except where the upper level extends beyond the limits of the lower level.

The roadbed of all platform tracks is of concrete with wood-block supports for the rails and screw-spike fastening, while elsewhere the roadbed is of conventional stone-ballasted crosstie construction. The blocks are creosoted yellow pine (in the loop tracks creosoted white oak). The concrete roadbed is shown in Fig. 13. It was constructed by assembling rails and blocks as a finished track, supported by suspending from timbers resting on the platforms, and then pouring the concrete under and around the blocks. The taper in width of the blocks permits their removal and replacement; the space between the blocks of the two rails is ample for sliding a block out from under its rail. The blocks for supporting the third-rail are independent of the regular blocks, but continue on the same taper, and can therefore be removed after removal of the latter.

To test the service given by the concrete roadbed in the yard tracks, part of one ladder track and a turnout will be laid with this roadbed instead of ballast roadbed.

The rails are of the New York Central 105-lb.-per-yd. section, and, except on the loop tracks, are of normal 0.65-carbon composition, but the frogs, switches, running and guard rails of the loops are of rolled manganese-steel. All other frogs and switch points are faced with manganese-steel. Guard rails are used at turnouts and on the loops, and on the latter the construction is continued through the switches by using housed-in switch points.

The turnouts in the main yard are generally of about 600-ft. radius; No. 8 frogs are used, except in the earliest part of the new yard, where No. 6½ frogs were put in. The loops are of course much sharper than the turnouts; they are spiraled.

Where tracks cross transverse expansion-joints in the steel floor-framing, expansion splices are used in the rail. One of these is shown in Fig. 12.

Station Building

The new Grand Central Station occupies the same site as the previous one, 42nd to 45th Sts. and Depew Place to Vanderbilt Ave., and has an annex west of Vanderbilt Ave., in part of the ground floor and basement floor of the Biltmore Hotel. This annex is the Incoming Station. Though continuous with the main station on the three underground levels, it brings about an effective separation of the streams of station traffic pertaining to departing trains and incoming trains respectively. It provides facilities separate from those of the main station as follows: Waiting-room, train platforms and concourse, cab stand, passageways, exits, and passages to rapid-transit subway, besides giving the incoming passenger direct access to Madison Ave., a street not used by the traffic of the main station.

The dimensions of the main station and office-building are 301x722 ft. in the first story, and 290x670 ft. above. The south, east and west faces are set back about 50 ft. from the building line above the second floor, making a terrace which is occupied by an elevated roadway.

The elevated roadway is an important item of the entire scheme, as it virtually makes Fourth Ave. (Park Ave.) continuous through the station site by bypassing it around the west side of the building, whereas the old station completely interrupted Park Ave. from 42nd to 48th Sts. The roadway leads to the transverse viaduct carrying 45th St. across the yard at the north end of the station. North of this point Park Ave. and all cross-streets extend over the yard in full width and without detour or interruption. The only gap in the street network, therefore, is the suppression of 43rd and 44th Sts. from Lexington Ave. west to Vanderbilt Ave.

The general nature of the new main station building as an architectural monument may be seen from the view on the first page.* The architect describes the exterior as being an expression of the idea that this station is a gateway, which is given as the reason for the three arch openings in the front of the building. These arches are 33 ft. wide by 60 ft. high in the clear. The building is a steel-frame structure faced with granite and Indiana limestone and finished in the interior in marble, Caen stone, and concrete. Though 125 ft. high, it is essentially a one-story building. The height of the concourse fixes the general height of the building; this in turn determines the height of all future buildings on the width between Vanderbilt Ave. and Depew Place for the entire north-south extent of the terminal, as already noted. The framing around the concourse, however, is designed for future building over.

The outline floor-plans Fig. 8, and the sections Fig. 11, give some idea of the arrangement of the station. The main concourse, of dimensions 120x375 ft. by 125 ft. high in the clear, extends transversely across the station and is the central feature of the building. South of it is a waiting-room with adjoining auxiliary rooms. Ticket offices and all other service provisions are in the concourse. The connection of waiting-rooms to concourse, concourse to track platforms, etc., is made by inclines, the main concourse being about 10 ft. below street level at front or about 20 ft. below street level at rear of the building.

Stairs are eliminated in nearly all cases in the station (so far as passengers are concerned) and inclines are substituted. These vary from 6% to 11.6% in slope. The inclines connecting the concourse floor on express and suburban levels with the track platforms are examples of the use of these inclines; the former handle a few feet difference of elevation, while the suburban-platform inclines descend about 14 ft.

The arrangement of the station with regard to the movement of passengers, baggage, etc., is indicated in the sketch Fig. 9. The design of the station and the arrangement of the different facilities is such as to separate conflicting streams of movement and to make the routing of the passengers or baggage as direct as possible. For the same purpose direct connection by underground passageways will be made from the station to the present rapid-transit subway, the new Broadway-Lexington Ave. subway, the Hudson & Manhattan tunnel extension (if built), and the Belmont tunnel which crosses under the East River to Long Island City, these four structures being at different levels.

Incoming Station

The Incoming Station is relatively simple, consisting merely of a waiting-room over the express tracks and an

*The plans of 1905 were quite different architecturally; see a view of the station then planned. In "Engineering News" Nov. 16, 1905, p. 499.

adjoining cab driveway with an incline to the street. Its waiting-room floor is nearly level with the express concourse of the main station, and directly adjoins and communicates with it under Vanderbilt Ave.

As already noted, this station is located in the Biltmore Hotel, which is being built by the railway company. About a third of the ground-floor area and about two-thirds the basement area of the hotel building are occupied by the station.

Structural Arrangement

The sketches Fig. 11 (cross-sections of the building) and Fig. 12 (a few special plans and sections of framing) show the characteristics of the steel framing which supports the track and buildings.

Generally, the structure consists of a normal grouping of steel columns, main girders, closely spaced secondary beams or girders, and plain concrete floor-arches of short span. However, numerous complications and variations arise from the provision for buildings over the track levels. On the one hand this resulted in very heavy concentrated loads, and on the other hand it required many columns to be supported on girders, since the columns in the suburban story had to be located between the suburban tracks, while those in the express story had to be set between the express tracks, the track layout of the two yards being quite different. Where the columns of a 20-story building are thus supported on girders, remarkably heavy girder construction results.

In the design of the earliest steelwork where buildings cover tracks, viz., in the main station, no attempt was made to keep the building columns independent of the track-floor framing. When the office portion of the building was completed and trains were operating on the girder-supported express level, perceptible vibration developed, and it was subsequently thought well to reduce this disturbance by building several longitudinal walls between columns of the track levels (these walls are marked *VW* in the plans, Fig. 8). In all further steel designing, the principle was followed of keeping *building columns independent of the track-floor framing wherever possible.*

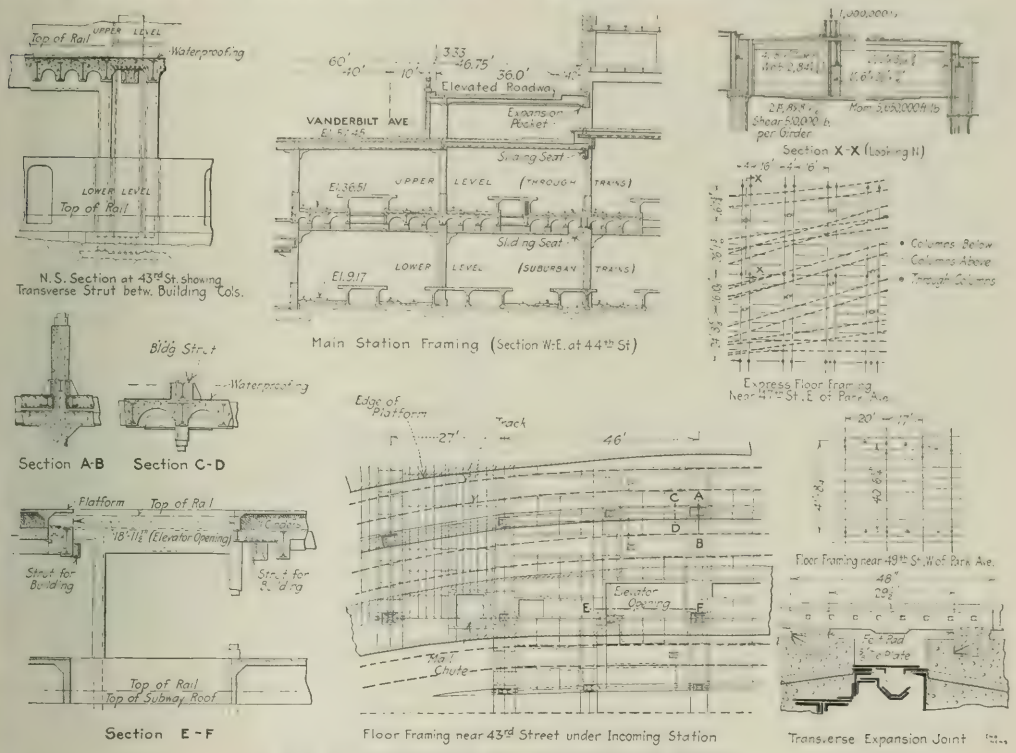


Fig. 12. Sketches of Framing in Track Levels

The fullest application of this principle was made in the area west of Vanderbilt Ave., which will be occupied by high-class buildings (Biltmore Hotel, now being built, and Yale Club, about to be built; future buildings north of 45th St. are likely to be similar). In Fig. 12 is shown a part plan of the express-floor framing under the southern part of the Biltmore Hotel. All columns are in groups of three; the outer two take the girders of the track floor, while the middle one goes through the floor with clearance, and supports the frame of the building above. For rigidity the building columns are connected by portal-strut beams, either just above or just below the express floor and clear of that floor. Several vertical sections are shown to illustrate the construction further.

A perfected form of this construction is used farther

north in the same strip, as illustrated by a diagrammatic plan from the block between 48th and 49th Sts. Here the building columns are located halfway between the track-floor columns, and thus they do not interfere with normal arrangement of the floor framing. The floor columns in consequence are single instead of double. The

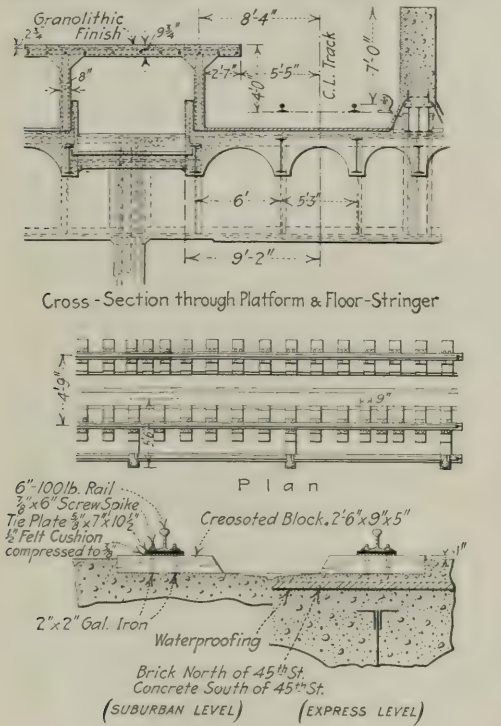


FIG. 13. TERMINAL-TRACK DETAILS

(Platforms and platform tracks. The rail blocks are of white oak in the loop tracks, yellow pine elsewhere.)

block is vacant for the present, and the building columns are not yet placed; they will be set through holes cut in the floor concrete when the erection of a building in this block is proceeded with.

The support of the main station shows the opposite solution for practically the same conditions (i.e., track arrangement such that the building columns can continue down to the footings without offset). The designers did not think it necessary to isolate the track floor and the building frame, and therefore the girders of the track floor are framed directly into the building columns. The framing is illustrated by a vertical section in Fig. 12.

Difficulties introduced by the track arrangement required the columns of street viaducts and buildings to be supported on girders of the express floor, at many points. A typical piece of the framing is shown by diagrammatic plan in Fig. 12, from the block between 46th and 47th Sts. east of Park Ave., in the main ladder-tracks of the express level. Here are seen independent columns for building and track floor, columns carrying both track girders and building loads, and building columns supported on track-floor girders. A vertical section show-

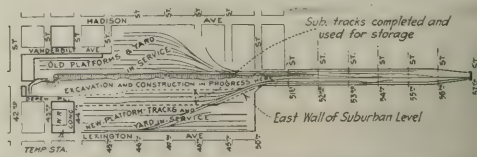


FIG. 14. PLAN OF TERMINAL DURING CONSTRUCTION WORK, JULY 1, 1909

ing a track girder and the support upon it of the building column is also shown.

As illustrated by the sketches above referred to, the general type of track-floor framing in the terminal comprises transverse (east-west) main girders extending between columns, and longitudinal secondary girders or



FIG. 15. CONSTRUCTION WORK NEAR NORTH END OF GRAND CENTRAL TERMINAL YARD

(View north from 50th St., Dec. 5, 1908, showing at left old tracks, at right new suburban, express and street level. Street level at middle of picture.)

stringers, between which latter are formed the concrete arches of the floor. The stringers are framed into the webs of the girders, to minimize the floor depth. The girders are single or duplex plate-girders (in some cases two box-girders), 8 to 10 ft. deep, spaced usually about 20 ft. apart. The stringers are I-beams or built I-sections, 30 to 36 in. deep, spaced 4 to 6 ft. apart. The duplex-girder arrangement is used where columns rest on the girders, and a grillage of I-beams placed across the top flanges of the girders (the girders of the pair being 1 to 5 ft. apart) supports the column base.

A different arrangement is used in part of the northerly end of the yard. The main girders are longitudinal, and transverse beams rest on their top flanges. The longitudinal girders naturally are below the ceiling, but are between the tracks, where they do not infringe on the railway clearance. As the girders must follow the tracks,

the beam connections are often skewed, whereas few skew connections occur in the other arrangement.

The terminal area slopes up both to the west and to the north, but the steelwork is set level, in stepped arrangement. The floor slope is worked out in the concrete.

The chief peculiarity of the main-station framing is that the columns supporting the roof (and suspended ceiling) around the main concourse are made strong enough to carry a future 20-story superstructure surrounding the concourse. On account of the width of the concourse, very heavy loads would come on the columns (outside only) under this condition. These columns are constructed as braced towers of four columns each. At present only the light roof-trusses of the concourse roof rest on these columns.

The steel framing throughout the terminal was designed for railway loadings on track floors, highway-bridge loadings fixed by the city on the street viaducts, and city building-code loadings on the columns of buildings. Roughly stated, the load above the track floor (where buildings occur) amounts to about 1800 lb. per sq.ft. except at walls, and here it amounts to about 45,000 lb. per lin.ft. of wall.

The express-track floor has an average thickness of 8 to 10 ft. south of 48th St., and about 2 ft. north of 48th St., varying considerable with local design, however. The dead-load averages about 450 lb. per sq.ft. of express-track floor, and from 200 to 415 lb. per sq.ft. on the street viaducts. The live-load of the express floor varies considerably (i.e., as equivalent uniform load); its highest value is about 950 lb. per sq.ft. north of 50th St. and about 525 lb. per sq.ft. south of 50th St. These figures are for track area not interrupted by platforms; averaged over tracks and platforms the live-load is about 400 lb. per sq.ft.

The steel columns of the suburban story average 50 to 60 sq.in. each, and are generally of box section with reinforced corners. They support floor areas of 250 to 950 sq.ft. (spacing 14½ to 50 ft. east-west, 13½ to 27½ ft. north-south). The maximum column load from track-floor and street loadings (i.e., excluding building loads) is about 800,000 lb. live-load, plus dead-load. The absolute maximum of column loading (live and dead, building loads included) is 3,700,000 lb.

The columns of the express story are much wider spaced where they carry viaducts. The floor area per column ranges from 600 to 1320 sq.ft., and in one case in Park Ave. even up to 1720 ft. The maximum live-load is 650,000 lb. These viaduct columns are generally made up of four Z-bars with web, except that under Park Ave. all forms of section are used: Z-bar, channel, box, and built I with corners reinforced by angles.

The heaviest column load supported by a girder is 1,920,000 lb. The greatest bending moment in the paired girders supporting columns is about 8,000,000 ft.-lb. These girders weigh up to 1750 lb. per lin.ft., or for a girder length of 40 ft. about 35 tons.

The horizontal steelwork is divided by expansion joints, longitudinal and transverse, spaced about 200 ft. apart. The construction where tracks cross the joint is illustrated by a detail in Fig. 12. Where possible a "high-type" joint was used, for example at longitudinal joints at collision walls between tracks; this required no steel construction (except expansion seats for the girders on one side of the joint), and the waterproofing was simply carried up along the wall about 30 in. and turned into a horizontal separation in the concrete, the upper part of the wall being separately footed on the opposite side of the framing.

The column foundations are rock, practically everywhere; a few points were found where soft ground dipped down below the yard floor level and here caissons were sunk or concrete piles driven. The fact that the entire yard excavation was in rock (the tough mica-schist of Manhattan Island) eliminated all difficulties in the way of foundation.

The columns between tracks are housed in concrete piers for protection. Where regular running tracks adjoin, these piers extend to a height of 7 ft. above rail, while at storage tracks they are only 4½ ft. high. The upper parts of the columns are protected generally with



Fig. 16. Looking South on Line of Park Ave., Dec. 5, 1908



Fig. 17. Looking North on Line of Park Ave., Jan. 19, 1909

Figs. 16 and 17. Excavation on West Portion of Office-Building Site

(Old platform tracks in service on upper level, construction track on bench, pits for column-footing grillages on lower level in Fig. 17, frame of east portion of office building erected. In Fig. 16 the dome in the background marks the east tower of the old station; to the right is the Belmont Hotel, S. W. corner 42d St. and Park Ave. In the same view the end of the new steelwork is between 43d and 44th Sts., and south of it is the area now covered by the station part of the new building. In Fig. 17 the Howe truss at 45th St., carrying foot traffic across the excavation, forms the connection between the completed east portion of the new 45th St. viaduct (back of the building steel) and the remaining part of the old 45th St. footbridge. The integral character of express floor support and building support is evident from the views.)

concrete on wire mesh. All steelwork throughout is fireproofed with concrete.

Construction: Temporary Station

The construction of the new work in the place of the old without disturbing or interrupting the dense terminal traffic of the two railroads depended upon first clearing the eastern part of the site and building the new trackage and a temporary station here, and then gradually working westward with the reconstruction across the old station, crowding the traffic of the old tracks toward the west and expanding the new trackage westward from the first tracks laid into the temporary station.

It was possible to do this most conveniently by utilizing the ground story of the existing Grand Central Palace building lying between Lexington Ave. and Depew Place, 43rd to 44th Sts., as a passenger station in conjunction with the new building erected in the block just north of this and the yard tracks at the express level which were constructed here under the general plan.

Construction work was begun in the entrance stem of the yard, between 50th St. and the tunnel portal, the latter being at the same time moved north from 56th to 57th St. The old four-track entrance occupied only the middle part of Park Ave., while the new entrance was to extend from building line to building line. Before excavating down to the new (lower) track level, the approach was widened on the west side on the old level (autumn, 1903), and two tracks added. Then widening was started on the east side of the street (1904), carried down to new suburban level, three tracks laid at new grade, and a corresponding width of the framework for express floor and street was built, including the double-track incline connecting the express with the suburban level. Thus an entrance was obtained to the east side of the yard for handling work trains and for connecting with the finished tracks at new level as soon as laid. Excavation along the Lexington Ave. edge of the yard was begun the same year (1904) between 50th and 45th Sts. By 1906 the work on the excavation, steel erection and tracklaying had progressed far enough westward that the temporary station could be established and suburban traffic diverted to it. Shortly after, some of the through trains also were handled in and out of the temporary station.

The shifting of traffic from the old station to the temporary station went on progressively, as excavation advanced westward across the terminal, reducing the number of tracks in the old yard and adding to the available tracks on the new levels. On June 4, 1910, the old station was finally abandoned; only two platform tracks of the old yard then remained, and 20 platform tracks on the upper (express) level of the new terminal were in use. Work immediately began at demolishing the old station and excavating the site, followed by erection of steel for the new station. By Oct. 27, 1912, the new building was completed so far that its suburban floor could be put in service, and on Feb. 2, 1913, practically all remaining facilities (express concourse, waiting-room, etc., but not the Incoming Station) were opened to public use.



Fig. 18. Looking North from 45th St. Bridge, Oct. 1, 1909

(Old yard at left, excavation in progress along rock face, work tracks on suburban level, completed portion of express level with ballasted tracks and temporary platforms, and at right a part of 46th St. viaduct.)

The plan Fig. 14 shows in outline the conditions existing some time before the old station was closed. The drawing brings out clearly the general course of procedure. The views Figs. 15 to 18 show different parts of the terminal yard during construction.

The size of the work may be represented by these figures: Total excavation, 3,000,000 cu.yd., of which rock 2,000,000 cu.yd.; steel framework, 95,500 tons, of which 29,000 tons in the main station, and 51,000 tons in the express floor (suburban roof) of the terminals. Some 38,000 tons of steel in addition are required for the framework of other buildings on the terminal area already built or being built.

The terminal construction was begun as a contract undertaking, the O'Rourke Engineering Construction Co. being the contractor. The uncertain conditions of the work led to a change in the system, however, after several years of construction, and the larger part of the

work was done by the railway direct. Building erection was done wholly by contract.

Miscellaneous

Signaling—The interlocking plant of the terminal comprises a number of towers, indicated in Fig. 5. The two main towers total 762 levers, of which the suburban-level tower has 400 levers and the express-level tower 362. The system is all-electric, using motor-operated switches and signals.

Drainage—A sewer was built under the terminal at 46th St., continuing on to the East River. This sewer is independent of the city system. It takes all surface drainage and sanitary sewage from all parts of the terminal area except parts of the main station, which are drained to city sewers. The drainage of the pipe and trucking subways (below sewer level) is handled by automatic motor-driven pumps.

Lighting and Power—The service plant at 50th St. (see site plan Fig. 3) furnishes direct current for lighting and power over the whole area. The lighting supply is at 120 volts, the power supply at 240 volts. They are fed from the incoming 11,000-volt transmission-line current in summer, and the Service Plant serves as standby. In winter, however, when much steam is required for heating, the Service Plant is in full operation and generates current for lighting and service power. Traction current is produced from the high-tension line current throughout the year.

The station lighting is done by incandescent lamps almost exclusively. The train rooms are lighted by large-unit tungsten lamps suspended directly under the ceiling, one per panel, at about 20-ft. spacing.

The piping system of the terminal yard, carried to all tracks, includes cold water, hot water, compressed air, steam, and vacuum (for cleaning cars). The train rooms and the main station and office-building are ventilated by air supply and exhaust systems handled at various local centers by motor-operated fans. Some of the heating is done through the ventilation supply, indirect radiation being inserted in the ducts.

Fire-Protection—A fire-protection piping system extends all through the terminal. It has about 300 hose connections. There is a station fire department, called by an alarm system having 125 call boxes, with connection also to the city fire department.

Cost—No information as to the cost of the terminal is given by officials of the railway.

Design and Construction

The design of the terminal was begun under W. J. Wilgus, Vice-President and Chief Engineer of the New York Central & Hudson River R.R., and developed under his personal direction until he resigned, in 1907. The constructional engineering was in charge of A. B. Corthell, Terminal Engineer, until 1906. Since then it has been under the jurisdiction of G. A. Harwood, Chief Engineer of Electric Zone Improvements, by W. L. Morse as Terminal Engineer, with W. J. Thornton, Designing Engineer, and E. D. Sabine, Resident Engineer. The electric equipment was worked out under E. B. Katte, Chief Engineer of Electric Traction. Architectural problems were handled by Reed & Stem and Warren & Wetmore, in association, under C. A. Reed, until the latter's death in 1911, since which time Warren & Wetmore have carried on the architectural work. Signal installation was directed by W. H. Elliott and Azel Ames, Jr., and since 1909 by H. S. Balliet. W. E. Jordan has been manager of construction work in the terminal since the railway took over the execution in preference to continuing under contract.

The design of the terminal has been subject to joint approval of a vice-president of the New York Central and a vice-president of the New York, New Haven & Hartford Ry. Both railways, also, operate the terminal (through a manager appointed jointly), and share the expense of operation, maintenance, and fixed charges. The terminal is, however, constructed exclusively by the New York Central & Hudson River R.R. Co.

A New Street Traffic Regulation at Los Angeles, Cal.

By Charles K. Mohler*

The congestion of vehicle traffic in the business districts of large cities has been increased enormously by the use of automobiles and motor-driven trucks. In Los Angeles, Calif., the number of motor-driven vehicles is probably larger in proportion to population than in any other city. In addition to the danger and confusion, the roadway space actually occupied by vehicles has produced very serious problems.

The indiscriminate occupancy of the roadway by vehicles standing at the curb is not only very wasteful of roadway space, but becomes a source of delay and danger to other traffic. This is particularly true of vehicles standing at the curb at points where street cars have to stop. As Chief Engineer of the Railway Department of the Board of Public Utilities of Los Angeles, the writer recommended to the Board that an ordinance be passed to prohibit vehicles standing at such points. The question was taken up with the head of the traffic bureau of the Police Department, and such an ordinance was prepared (under the supervision of Lieut. J. L. Butler).

Under the old conditions, vehicles were allowed to stand not less than 40 ft. from the intersection. Under the new ordinance the distance is from 80 to 150 ft., and the Board of Public Works is directed to place signs at the points designated by the Board of Police Commissioners. Between the sign and the street intersection vehicles may stop only long enough to receive or discharge passengers and goods.

There is still another good reason for keeping standing vehicles well back from the approach to a crossing, which is that here is always the point of congestion for moving vehicles on account of the inevitable crossing delays. To provide additional roadway space for moving vehicles and remove the obstruction of standing vehicles at these points, would be reason enough of itself for the new regulation. The ordinance went into effect the latter part of April, 1913.

Freedom of Panama Canal Laborers from Sunstroke—The third case of sunstroke or thermic fever on the Isthmus, reported by the Canal physicians during the 8½ years of American work, occurred on Dec. 5, at Miraflores locks. An Italian laborer, who had been on the Isthmus only 10 days, was stricken at 4 o'clock in the afternoon after he had completed 10 hours of work.—["Canal Record."]

*Chief Engineer of the Railway Department, Board of Public Utilities, Los Angeles, Calif.

Double-Gage Track on an Electric Railway

Although a majority of city and interurban electric railways are built to the standard gage of 4 ft. 8½ in., there are numerous lines of narrower and wider gage, and in case where lines of different gage meet, or when they enter the same city, there are special difficulties and problems to be encountered. This condition exists at Wheeling, W. Va., and for the accompanying information as to the track construction we are indebted to W. A. Underwood, Superintendent of Maintenance-of-Way of the Wheeling Traction Co. The traction company operates lines of 5 ft. 2½ in. gage and 4 ft. 8½ in. gage, and has approximately 9½ miles of mixed or double-gage track. The wider gage is used on all the lines of the system entering Wheeling, except the Pan Handle Division, which is a standard-gage interurban line 17 miles long, operating between Wellsburg and Wheeling. To allow

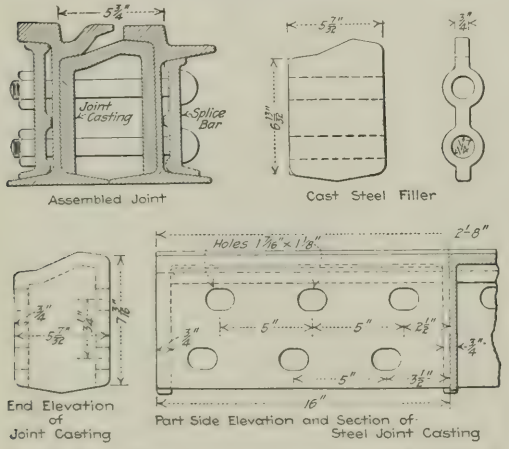


FIG. 1. TWIN RAIL CONSTRUCTION WITH 9-IN. GIRDER RAILS FOR DOUBLE-GAGE TRACK (4 FT. 8½ IN. AND 5 FT. 2½-IN. GAGE); WHEELING TRACTION CO., WHEELING, W. VA.

cars of this division to enter the heart of the city, it became necessary either to bring all tracks to a uniform gage or to use the double-gage construction. The latter plan was adopted.

The straight track work is of two types. The first type has 9-in. girder rails, the two rails on one side of the track being bolted together by 1-in. bolts at intervals of 6 ft. and adjusted to position by cast-steel fillers on these bolts, so as to maintain the 6-in. distance between gage lines. The bases of the two rails being in contact, the rails are spiked on the outside only, like a duplex rail. The joints are spliced by two outside splice bars and an inside filler of cast steel; this filler is 32 in. long, with oval holes $1\frac{7}{8} \times 1\frac{1}{8}$ in. cored for the bolts. The casting is of channel or trough section, fitted to the heads and bases of the rails; it is of ¾-in. metal, and is closed at the middle and ends by diaphragms of the same thickness. This track construction, with the spacing blocks and joint fillers, is shown in Fig. 1.

The other type of track has 70-lb. T-rails of the Am. Soc. C. E. section, and here each rail is spiked on both sides, their bases being far enough apart to admit the spikes. The joints are spliced with the Continuous splice bars as made for use with frogs, having the base plate extending under the full width of the rail. Between the rails is a filler shaped to form the flangeway for the outer rail; this filler is 30 in. long, and is stiffened by diaphragms at the middle, the ends and two intermediate points. This construction of track and joints is shown in Fig. 2.

With the close spacing of the twin rail or double rail,

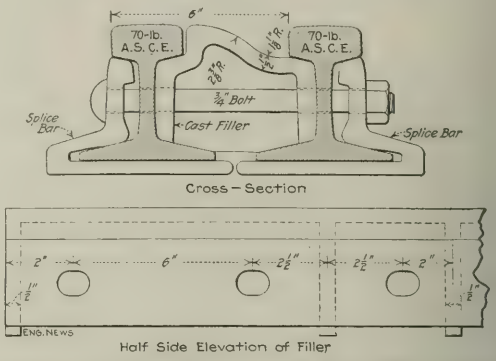


FIG. 2. TWIN RAIL CONSTRUCTION WITH 70-LB. RAILS FOR DOUBLE-GAGE TRACK; WHEELING TRACTION CO.

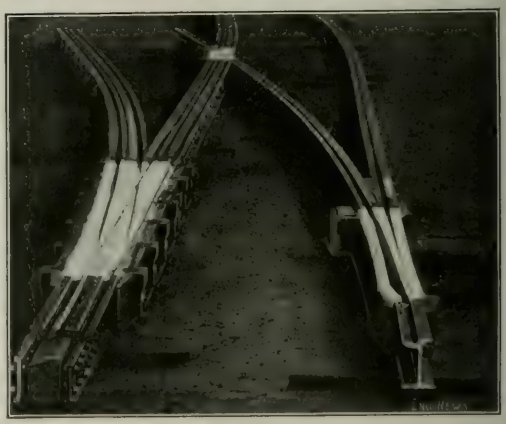


FIG. 3. TURNOUT ON DOUBLE-GAGE TRACK, WITH TONGUE SWITCH-RAIL AND DOUBLE-POINT FIXED MATE; WHEELING TRACTION CO.

and the use of the inside filler blocks at rail joints, it was not practicable to use an ordinary bond compressor to apply the electric bonds at the rail joints. For this reason the company adopted the pin-driven type of bond, outside of the splice plates. At all points where the 9-in. girder rails connected with the 70-lb. T-rails, the compromise joints were made by welding together short pieces of each section, to form a connecting rail, and then splicing these between the two types of track rails.

A specially interesting feature of this double-gage track is that it required several pieces of special work,

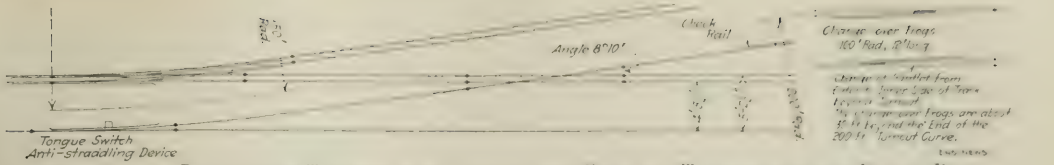


FIG. 4. PLAN OF DOUBLE-GAGE TURNOUT, WITH CHANGE-OVER FROGS FOR TRANSFERRING THE DOUBLE RAIL FROM INSIDE OF SECOND TRACK TO OUTSIDE OF TURNOUT; WHEELING TRACTION CO.

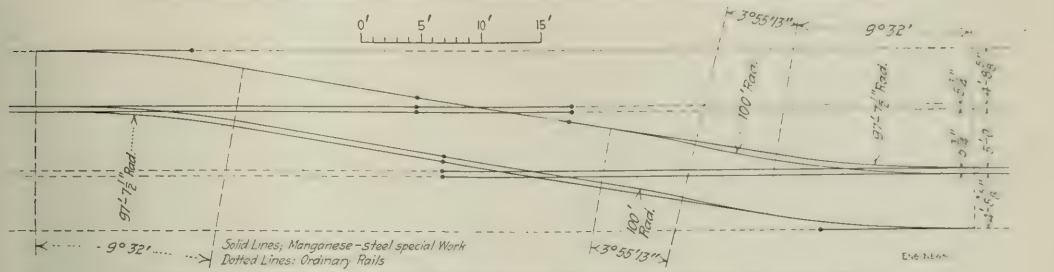


FIG. 5. PLAN OF CROSSOVER ON DOUBLE-GAGE TRACK; WHEELING TRACTION CO.

consisting of crossings, curves, turnouts, change-over mates and crossover. These are of hard-center construction, made with manganese steel, and some of the switch parts are said to be the heaviest pieces of this kind ever made. This work was built by the Pennsylvania Steel Co. The mate is the fixed switch point used in connection with the single-tongue switch employed in street-railway work, and the change-over mates are used to change the double rail from one side of the track to the other. Fig. 3 shows a turnout assembled, with the tongue switch at the right, the double mate at the left, and the three-way frog at the intersection of the single and double rails. Fig. 4 shows the turnout at Glenova at the end of double track on the double-gage line. The turnout necessarily puts the double rail on the outer side of the second track, but on the double-track part of the line this rail is on the inner side of each track. A pair of change-over frogs is therefore put about a rail length from the end of the turnout curve, where the two tracks are parallel. This, as will be seen from the diagram at the right of Fig. 4, transfers the double rail from the inner side to the outer side to conform to the turnout-rail arrangement of the turnout. This turnout and track are laid with 70-lb. rails.*



FIG. 6. END OF CROSSOVER FOR DOUBLE-GAGE TRACK; WHEELING TRACTION CO.

The crossover, Fig. 5, has the change-over mates embodied in it. This saves having a pair on each end of the crossover on one track, which would be required in any other arrangement of a double-gage crossover. This scheme Mr. Underwood believes to be original with the Wheeling Traction Co. Fig. 6 shows one end of this crossover.

⁂

Oxyhydrogen-flame Working Under Water is said to be accomplished successfully by means of a special form of burner recently invented. This burner consists of an ordinary oxyhydrogen burner with the addition of a bell or hood shielding the gas orifice from the water, and a compressed-air supply. A. Heckt, of Kiel, Germany (12 Lübecker Chaussee) is marketing the apparatus, and also carries out subaqueous metal-cutting work. Information from him tells of successful demonstrations where a bar of iron 2½ in. square was cut through in 30 sec. at a depth of 16 ft. under water, a 12-in. slot was cut in ⅜-in. plate in 1½ min., etc.

⁂

Flood Tests of Concrete Bridges, Philippine Islands—Severe tests were given the three reinforced-concrete bridges recently completed in Occidental Negros, P. I. On the Imbang bridge, a 2-span (25 m. each) reinforced-concrete arch bridge, the flood waters completely filled the arches and several hundred logs became jammed above the bridge, causing the water to overflow the surrounding country. One log some 3 ft. in diameter was lodged in one of the small spandrel arches and was not removed until the flood had subsided. The jam remained in place three days before it could be removed. No damage was done to the bridge except that the water scoured out the foundation around the north abutment to the top of the foundation piles, and cut into the clay bank on the north side of the river some 25 ft. The second bridge was the Matabang bridge, a 2-span (21 m. each) reinforced-concrete arch bridge. Here a jam of bamboo raised the water, and in order to relieve the strain on the bridge, the two approaches to the bridge were cut. The water subsided without any damage to the bridge. On the Tanalao bridge, a reinforced-concrete slab-and-girder bridge, having four spans of 12 m. each, the water rose 1 m. above the balustrades. The north approach of the bridge was washed out, but no damage done to the bridge itself. Strange to relate, this is a tidal stream and the bridge is located not over one kilometer from the ocean. It would seem scarcely possible that the water should rise to this elevation above the ocean, the elevation reached being 5.4 m. above low tide. ["Quarterly Bulletin" of the Bureau of Public Works, Philippine Islands, Jan. 1, 1913.]

*Double-gage turnouts on the Panama R.R. and for mine tracks were illustrated in our issues of Nov. 23, 1911, and Jan. 25, 1912, respectively.

The Effect of the Omaha Tornado on Structures

By Albert C. Arend*

The tornado which passed through Omaha on Mar. 23, 1913, at about 5:50 p.m., followed a direct northeasterly direction, through the residential section of the city and passed on across the Missouri River into Iowa. Its path averaged nearly 1000 ft. wide and was 5½ miles long. Its direct effects have been officially summarized as follows: Property loss, $5,000,000; deaths, 139; injured, 322; houses demolished, 642; additional houses and other buildings damaged, 1027; churches wrecked, 11; schools damaged, 8.

There are other effects, however, of a scientific interest, and, as the stresses produced were of such a definite and consistent nature, some valuable engineering conclusions are suggested which might be utilized to make structures proof against such forces.

The writer has carefully traversed the path of the tornado and examined the effects, and in addition has collected the testimony of many other eye-witnesses as to the attendant phenomena.

The cloud formation was of the typical funnel type, seemingly about 600 ft. high with the point touching the earth. From some points of vantage this point was a lurid fiery mass, while from others it was described as like a large roll of dark paper rolling along rapidly, with ragged edges or ends flashing out spasmodically. Its passage was preceded for several minutes by a roar like that of many railway trains. It probably traveled at the rate of 30 to 40 miles per hour. It was followed or attended by a mass of flying débris which traveled always endwise and at an angle of about 10° to the ground for such articles as studs, plank and brick. Such débris had sufficient momentum to penetrate sod-covered ground from 15 in. to 24 in., and when these plank struck shingle roofs laid on ⅞-in. boards, or frame-house sides, they often went right through. Such light débris as shingles, lath, mounted photographs and wearing apparel was carried from Omaha to the vicinity of Denison, Iowa, a distance of over 60 miles!

The continuous mass of flying débris was particularly well defined and was about 200 ft. wide, where it crossed a sodded field 500 to 600 ft. away from the nearest building. Many heavy articles, such as automobiles, trunks, pianos, washing machines, iron beds and people, were picked up and deposited at distances of 50 to 300 ft. from their starting point. All kinds of household contents in buildings were often "blown" or sucked out through the roof and window openings, and in turn similar articles and débris in general were brought in and deposited in their place by the inrushing wind. It should also be noted that the sensations of those actually in the path of the storm were that it was bearing down upon them like a wall of black smoke attended by a rumbling clatter likened to acres of sheet iron being dragged over cobble stones. Generally speaking, everybody was sufficiently warned to get to their basements just before the storm reached them. This accounts for the miraculously small loss of life, for there were over 6000 people in the houses which were damaged.

The tornado had been preceded by a rapidly rising temperature and a falling barometer, which had fallen two inches during the preceding 24 hours and recorded as low as 27.93 in.* at the weather bureau, which was 1½ miles from the storm. It had been raining, with the wind from the northwest for probably an hour before, but the rain had ceased and the wind changed in direction to the southwest, when the tornado approached. It was immediately followed by a general moderate rain, accompanied by a splattering of mud in the path of the tornado.

The storm did not follow any well defined lines of streams or valleys. It entered the city by way of the Saddle Creek valley, and followed the Missouri Pacific Ry. tracks to Leavenworth St., when it swung off to the east for a block and then traveled in a comparatively straight line, going up hill to the Medical College Laboratory building and then down a 10% grade for about 300 ft. to 42d and Harney Sts., where the damage was intense, then advancing up the side of a 10% slope to 40th and Farnam Sts., and thence across a depression and up the side of a 5% slope, etc. In this manner it continued on across the city, without ever leaving the ground once, to 14th Ave., then down a 50-ft. embankment to the Missouri Pacific roundhouse and railroad tracks, and cutting its way through the Illinois Central Ry. trestle, it proceeded on across the Missouri River. It seemed to be particularly partial to groves of trees, etc., and often widened its path to take them in and down.

The great similarity in most features to the St. Louis tornado (Engineering News, June 4, 1896, and June 11, 1896, pp. 374 and 388) seems remarkable, and the intensity of the stresses was evidently almost identical. In this connection it should be noted that there were probably no examples of reinforced-concrete construction in the St. Louis storm in 1896, and that if there had been, the sentiments expressed in the editorial (Engineering News, June 11, 1896, p. 384) on that occasion would have been somewhat modified. It is now at least practicable for engineers and architects to provide against the destruction of buildings and the attendant loss of life; and it remains only for their clients to decide whether they will "stand for" such special features of design and moderate additional costs as may be essential.

The well defined and consistent stresses which were observed are as follows: There was a whirling or twisting motion which turned every house, that was moved upon its foundation at all, in a direction opposite to the travel of the hands of a clock; there were but few exceptions noted to this rule, and they were probably caused by the way the onrushing wind and débris happened to strike the house as this force released it.

As the storm approached, the sudden relief of atmospheric pressure on the outside caused anything containing air to explode unless it could resist the stresses or be otherwise relieved, and as the pressure was less above than at the surface, it tended to lift or float things; windows blew out, roofs blew off entirely or lifted up to equalize the air pressure and dropped back again; sides of buildings blew off, doors and partitions buckled or fell and many frame houses were picked up bodily and carried distances from a few inches to a hundred feet. As the tornado cloud passed on and the onrushing wind restored the air-pressure equilibrium, these were dropped

*Consulting Engineer, Brandeis Building, Omaha.

*29.85 in. is normal.

from the particular height at which they happened to be, resulting in the necessity for a house-mover in some cases and a mass of wreckage in most cases.

Second-floor windows blew out more often than first-floor windows. Porch roofs lifted just enough to permit the columns to be carried away, and then dropped. Where roofs were well secured to cap plates and brace tied to ceiling joists, or where the space under the roof was cut up into rooms with partitions tied into the roof joists, the roof structure was not lost; but the paper, tile,



FIG. 1. RUINS OF THE PLYMOUTH CONGREGATIONAL CHURCH AT 20TH AND SPENCER STS., NEAR EDGE OF STORM BELT
(Heavy damage due to large auditorium)



FIG. 3. MEDICAL COLLEGE BUILDING OF NEBRASKA STATE UNIVERSITY
(See "Engineering News," Apr. 10, 1913, p. 740)

STRUCTURAL DAMAGE IN OMAHA TORNADO

slate, or shingle covering was partly blown off to relieve the air pressure and then shattered by the rain of débris which followed in the wake of the storm.

Some frame houses withstood the full force of the storm with the loss of only windows, roof, weatherproofing and chimney. Bedford coping stones 4x14 in.x4 ft. long were picked up from a wall which was laid in cement mortar and remained intact. Coping walls generally proved a particular hazard. All large undivided areas, such as church auditoriums and the second floor of a garage building without partitions, caused more complete wrecks than the surrounding buildings suffered.

Brick and stone walls laid up in lime mortar usually failed. Where facing brick had not been bonded into the backing walls with header courses and where air spaces existed, they exploded off. Concrete basement walls remained intact and did not injure the refugees in the basements when the house blew off; but there were many instances where brick walls did drag or tear off and cause injuries. Cement stucco on metal lath showed very little damage.

A four-story and basement medical college laboratory building, which was L-shaped in plan, with a frontage



FIG. 2. VIEW ON LAKE ST., BETWEEN 23D AND 24TH STS.
(This was at the center of the storm, but these well built frame houses were not moved from their foundations.)



FIG. 4. A LIGHT FRAME HOUSE PICKED UP, EXPLODED AND DROPPED

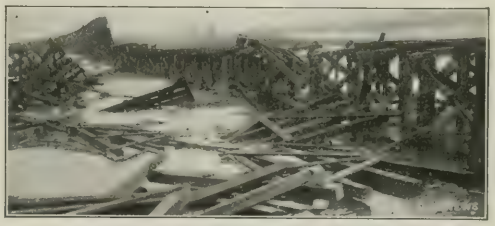


FIG. 5. WRECK OF ILLINOIS CENTRAL R.R. TRESTLE

of about 102 ft. on both the north and the east and was located on the center line of the storm, was uninjured excepting as to the 4-in. thick gypsum-block partitions; this building had concrete foundation walls, brick bearing walls laid up in cement mortar, and reinforced-concrete slab floors and saw-toothed roof supported on concrete-incased steel beams and columns, the beam centers averaging 10 ft., the floor slabs being 5 in. thick and the roof slabs 4 in. thick. The window openings, amounting to nearly 50% of the wall space, were regularly spaced and covered with muslin, as the sash were not in and the building had not yet been trimmed.

In striking contrast with this building was a two-story and basement new garage building about 66x120 ft., with brick-bearing walls, laid up in weak lime mortar, steel beams and wood floor and roof joist. The windows were irregular and limited in area and the roof blew off and walls blew down to about the second-floor line. This building was probably a 50% loss.

The Illinois Central R.R. trestle was badly damaged by the storm, 250 ft. of it being blown down to the westward of the plate-girder span over the C. & N. W. tracks, and 500 ft. of it to the eastward of same span. The easterly portion was supported on piles which projected out of the lake 10 or 12 ft.; this trestle was 28 ft. high from sill to cap, and of standard construction with 12x12-in. posts, two tiers of sway bracing per bent and two tiers of girts, besides the track stringers, each of which consisted of three 8x16-in. timbers. The bents were on 14-ft. centers with a base width of about 18 ft. for the outside posts, and the posts each had a ¾-in. drift bolt into the sill. The trestle was thrown over to the northeast almost bodily, with the rails and ties intact and at a distance of about 75 ft. from their original location. The pile bents located in the Lake were so twisted and broken that they may be properly termed demolished.

Conclusions

A reinforced-concrete building will withstand the stress of an ordinary tornado without structural damage. Well-built frame houses may withstand an ordinary tornado.

Windows are desirable relief valves, and should be regularly arranged and of liberal total area.

Large and unbroken areas should be avoided as far as practicable.

Brick walls should be laid up only in cement mortar, and face brick should be bonded into and laid solid with backing wall.

Gypsum blocks and hollow tile are undesirable for partitions and walls.

Sills should be well anchored to foundations and roofs to stud plates, and diagonal and knee braces are essential.

Roof weatherproof coverings should be actually fastened on and should not be of a brittle nature.

Partitions should be utilized to act as ties and braces.

All studs and joists should be amply strong and should be secured at ends against internal and external stresses.

❖

Turpentine. satisfactory for general use, can be made from western yellow pine as well as from long-leaf southern pine, which furnishes the bulk of the present supply, according to reports of the U. S. Department of Agriculture. The Forest Service has been studying the oils of the western yellow, pifion, digger, sugar and lodge-pole pines as sources of rosin and turpentine. A product very similar to turpentine can be obtained from the western pifion which is a short scrub pine scattered throughout the Southwest.

A New Design of Electric Locomotive for the New York Terminal Zone of the New York Central Railroad*

The changes gradually introduced in the construction of the 600-volt direct-current locomotives, used by the New York Central & Hudson River R.R., in its Grand Central Terminal electric zone, have resulted in a design showing important new mechanical features. The company has in service 35 locomotives built in 1906 (see Engineering News, Nov. 17, 1904, for a detailed description of the type), 12 built in 1908, and one of the new type. The oldest units have been reconstructed in accordance with the 1908 design, so that these 47 are all of the same 115-ton 4-8-4 type, carrying four gearless bipolar motors.

The one experimental unit of this latest design was given a series of tests and trial runs on the Harlem division, after which it was immediately placed in the service of the terminal zone. A contract was thereupon given the makers, the General Electric Co., for nine more and these are now under construction.

This new type is lighter than the older one, weighing

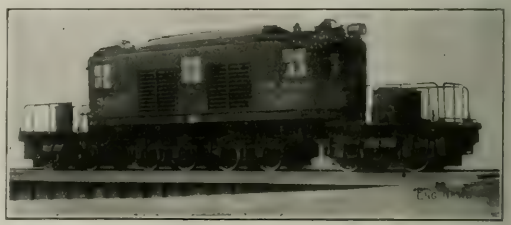


Fig. 1. The 4-4-4-4 100-Ton Electric Locomotive of the N. Y. C. & H. R. R.R. For New York Terminal Service

100 tons against 115; at the same time it is more powerful, developing 1400 hp. continuously, with a short-time maximum of 5000 hp. It is claimed to be able continuously to develop a tractive effort of 10,000 lb. at 60 mi. per hr. or sufficient to haul a 1000-ton train. The one-hour rating is 13,500 lb. at 54 mi. per hr. The motor equipment has 50% excess capacity over that of the older locomotive, and the speed capacity is raised 25%.

The original New York Central electric locomotives had guiding wheels in the form of a pony truck with 28,000 lb. load on the axle. There were four driving axles, each carrying the armature of a direct-current, bipolar, gearless motor. To improve the riding qualities, a guiding bogie truck having two axles was substituted for the pony truck. A further development in a subsequent type was to increase the distance between the guiding trucks and the rigid wheel base. The riding qualities were improved, but at a loss in the mechanical efficiency of the locomotive; for about 40 tons of surplus weight had been added and were carried by the bogie trucks for the sole purpose of guiding the locomotive. The addition of motors to the bogie trucks and the elimination of

*From information furnished by the General Electric Co., Schenectady, N. Y.

ineffective weight was the next trial step. A still greater separation of the fixed wheel base and the guiding trucks lengthened the machine so as to necessitate splitting the main frame into two articulated parts, supporting an independent cab structure. A number of minor changes necessarily accompanied the important ones noted.

In general, the locomotive may be described as a 4-4-4-4 type, having an articulated frame with bogie guiding (but driving) trucks at each end. The cab, containing the engineman's end compartments and that for the operating mechanism, is swung between the two parts of the frame on center pins. Each frame section rests on two two-axle trucks having a driving motor mounted on each axle. These cannot be distinguished as "main-driving" or "leading" trucks, since all the axles are driving axles; but they are termed for clearness "rigid trucks" and "swivel trucks," respectively.

The rigid truck is built up of heavy steel castings, the side frames being of a truss pattern with heavy top and bottom members and pedestal tie bars. The end frames and center cross frames are steel castings securely bolted to the side frames and supporting the motor fields. The whole weight of the truck is carried on coil and semi-elliptic springs resting on the journal boxes and side equalized.

The main half frame, of the locomotive, just above the trucks, is a broad box girder built of 10-in. channels with ¼-in. top and bottom plates. It is approximately 10 in. deep by 36 in. wide and 22 ft. long. The frame is bolted to the top member of the rigid truck, and extends forward over the center plate of the leading truck and backward to the heavy hinge, or knuckle, which connects the two half frames. Each half frame carries in its top plate the center pin which holds the cab in place, with the weight on broad bearing plates. All center pins are center pin and is connected to the main frame through a center pin instead of being bolted rigidly to it.

This design affords a long flexible wheel base with eight driving axles, but restricts the length of any rigid portion to not more than 6 ft. 6 in.

The cab, carried on bearing plates and center pins as stated, has its weight divided between the two halves

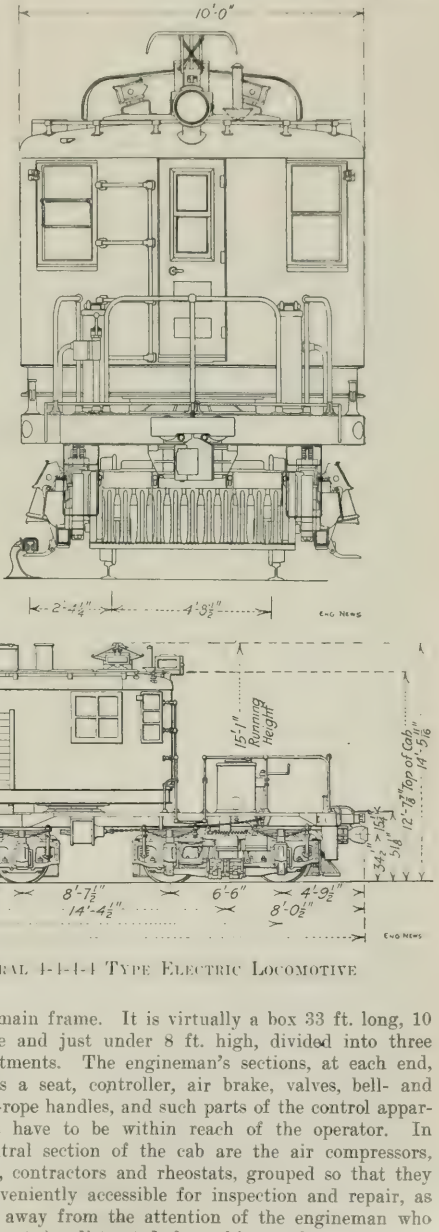


FIG. 2. SIDE AND FRONT ELEVATIONS OF NEW YORK CENTRAL 4-4-4-4 TYPE ELECTRIC LOCOMOTIVE

hollow and serve as air passages, the main box-girder frames acting as distributing reservoirs for the air delivered from the blower in the upper cab through the upper center pins and conducting it to the eight motors below. Changes in distance between cab center pins are accommodated at one bearing plate of the cab platform by room for a small longitudinal movement. The weight of the cab on the bearing plate, together with the lubrication, gives a sufficiently tight joint so that there is no leakage of the low-pressure cooling air.

The construction of the swivel or leading truck is similar to that of the rigid truck, except that it carries a

of the main frame. It is virtually a box 33 ft. long, 10 ft. wide and just under 8 ft. high, divided into three compartments. The engineman's sections, at each end, contains a seat, controller, air brake, valves, bell- and whistle-rope handles, and such parts of the control apparatus as have to be within reach of the operator. In the central section of the cab are the air compressors, blowers, contractors and rheostats, grouped so that they are conveniently accessible for inspection and repair, as well as away from the attention of the engineman who should not be distracted from his regular duties. A rather long platform is thus left at either end of the lo-

comotive; access to the cab is by doors opening out on the platforms.

A motor armature is mounted on each axle, but the magnetic circuits of two motors are combined so that there is but one magnetic system for each truck. Another way of viewing the arrangement leads to the statement that each truck carries, and is a part of, a double-armature motor. It will be remembered that the older type used in this road's service has the magnetic systems of all its four motors so combined, resulting in a rigid four-armature motor unit.

The magnetic flux path on each truck passes in series horizontally through the fields and armature of one motor, through the truck center transom and the fields and armature of the second motor to the truck end frame, and then returns to the starting point divided through the two side frames and a reinforcing magnet bar lying parallel with the side frames.

The motor is practically inclosed, and the field coils are waterproofed and armored. Each field coil is wound in a brass shell, the windings being in two decks of flat ribbon copper laid side by side. The outside turn is covered with insulation and a sheet-steel armor is clamped over it, filling the space between the sides of the shell in such a way as to protect the windings from water or mechanical injury. End shields are provided for each motor, which render it dust-tight and as nearly water-tight as is possible in any motor designed with necessary outlets for forced ventilation. As in the older locomotives, the pole faces are flattened to permit vertical play of the armatures.

Each pair of motors on a truck is permanently connected, electrically, in parallel. The pairs can be connected in running groups of series, series-parallel and parallel. They are insulated for 1200 volts, so that if, at some future time, it should be desired to operate on 1200 volts, the pairs of motors could be changed from parallel to series with the same speeds and control steps as now.

The control is by the familiar multiple-unit system with switch groups electrically operated by a small master controller. There are the usual three combinations of (1) series, (2) series-parallel, and (3) parallel, with nine, eight and seven steps in each stage, respectively. The resistances used in the various steps are mica-insulated cast-iron grids, assembled in the monitor deck of the cab.

Smooth transition between all speed points is claimed and the motors are operated close to the slipping point, which is relied upon to prevent damaging overloads. Any pair of motors may be cut out of circuit and the locomotive will then operate during the series steps with only two pairs of motors, but will have three pairs in service on the parallel-connection steps.

Current is collected by eight underrunning third-rail shoes or, when on gaps in the third rail as at crossovers, by two pantograph trolleys pneumatically operated. They can be raised for service by an engineman's foot-operated valve. As this trolley is for intermittent use, it is held raised only while the valve is held open. As protection against effects of short circuits there are main fuses (copper-ribbon magnetic-blowout type) near the third-rail shoes and pantographs, and fuses for each pair of motors.

In each engineman's compartment is an ammeter (showing current in one motor unit) and an air gage with a small gage lamp in the headlight circuit. There are two other lamps in this compartment and six in the machinery section. The lamps in one end compartment and half those in the middle compartment lamps are controlled from that end. Each engineman's space also has two electric heaters.

The motor-driven blower for cooling the motors has a capacity of 24,000 cu.ft. of free air per minute. The air compressor is a two-stage type of 100-cu.ft. per min. displacement, and pumps against a tank pressure of 135 lb. per sq.in. Between stages, the air is passed through cooling pipes under the cab platform to condense the moisture burden. The supply is stored in four 16x90-in. tanks connected in series and hung under the cab floor. Pneumatic sanders and bell ringers are used. All wiring is in steel conduit.

The leading data of this design are tabulated below:

Length inside of knuckles	55 ft. 2 in.
Length over cab	33 ft.
Height over cab	12 ft. 8 in.
Height with trolley down	14 ft. 6 in.
Height with trolley running	15 ft. 1 in.
Width overall	10 ft.
Total wheel base	45 ft. 7 in.
Rigid wheel base	5 ft. and 6 ft. 6 in.
Total weight	200,000 lb.
Weight per axle	25,000 lb.
Dead weight per axle	6,395 lb.

Sewage Treatment Plant for the Julietta Insane Hospital, Indiana*

By Charles Brossmann†

A sewage treatment plant consisting of a modified Imhoff tank, contact beds and sand filters was built for the Julietta Incurable Insane Hospital of Marion County, Ind., in 1912. The asylum has about 200 inmates at present, with an estimated sewage flow of 50 to 100 gal. per capita. The plant has been built large enough for future increase in population. The layout of the plant is shown by Fig. 1.

IMHOFF TANK.—This tank (Figs. 2 and 3) which is the first one of the kind to be built in Indiana, is 8 ft. wide, 14 ft. long and 13 ft. deep. The settling chamber has an average width of 6 ft., a length of about 12 ft. and a depth of 5 ft. The rate of flow through this chamber is about 4 ft. per hour. The width of the settling chamber is greatest at its outlet end.

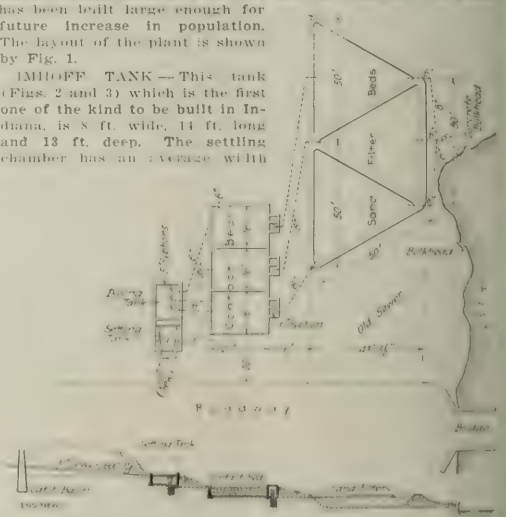


Fig. 1. Layout of Sewage Works, Julietta Insane Hospital, Indiana

* Somewhat rearranged from a paper on "Sewage Disposal," read before the Indiana Sanitary and Water Supply Association, Indianapolis, Ind.

† Consulting Engineer, Merchants Bank Building, Indianapolis, Ind.

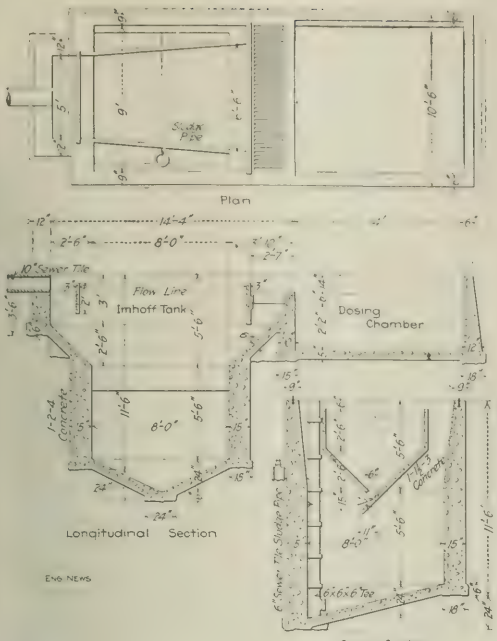


FIG. 2. PLAN AND SECTIONS OF IMHOFF TANK AND DOSING CHAMBER, JULIETTA HOSPITAL

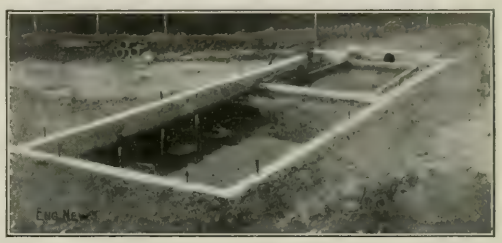


FIG. 3. VIEW OF SEPTIC TANK AND DOSING CHAMBER, JULIETTA HOSPITAL

The sewage, on coming in, passes a baffle at the front end, and at the rear end of the settling chamber a baffle is also thrown across.

The sewage flows upward and out through an adhesion screen made of ¾x10-in. plank, ¾-in. apart. The top of the screen is submerged about 2 in. below the sewage level. The purpose of this screen is to prevent anything being carried over into the dosing chamber, and thence into the contact beds, and also to serve as an adhesion rack to catch any minute floating material until it has attained sufficient weight to slide off, when it will drop to the sludge chamber below. To what extent this screen will serve its purpose cannot be said until the plant has been longer in operation, but already a considerable amount of matter adheres to it.

The portion of the sludge chamber below the settling tank has a capacity of about 350 cu.ft., which should ordinarily take care of about six months' run before blowing off, but the writer does not believe that this will serve that long, owing to the large amount of foreign matter, such as vegetable wastes and paper, which seem to be discharged in considerable quantities.

The sludge chamber extends up to the open air on each side of the settling chamber and the sludge is forced up at the top, probably 10 in. higher than the water level of the settling chamber.

A blowoff pipe of 8-in. vitrified tile is placed on one side of the sludge chamber, the bottom part being a 6x6x6-in. tee, with side outlet open. The tanks slope toward this tee, which is placed in the bottom, and the sludge can be drawn off by opening the sludge valve, which is placed on the out side and about 1 ft. below the top of the tank.

A small sludge bed is to be built later on to care for the sludge.

The plant has been in operation about four months, and at the present time (Feburary, 1913) a thick heavy scum, over a foot in depth, has formed at the top of the sludge chamber. No scum or mat has yet formed on the surface of the liquid in the settling chamber.

The effluent from the tank is fairly clear and contains but little suspended matter. The odor is very slight and is not noticeable in the road, which is 50 ft. away. It is the intention to construct a roof over the tank.

DOSING CHAMBER—At the rear of the Imhoff tank there is a 2500-gal. dosing chamber (Figs. 2 and 3) provided with three 5-in. Pacific siphons.

CONTACT BEDS—The dosing apparatus discharges the tank effluent into three 16x22-ft. contact beds (Fig. 4) filled to a depth of 33 in. with ½ to 2-in. broken stone, the bed being retained by reinforced concrete.

The sewage is distributed over the beds by means of heavy plank, painted with asphaltum. The underdrains are of 4 and 6-in. vitrified tiles, laid with open joints.

The contact beds stand full for about two hours and stand empty some six hours. The effluent of each contact bed is discharged to the sand filters by means of a 6-in. Pacific timed siphon.

SAND FILTERS—There are three sand filters (Fig. 5), triangular in shape, each side being 50 ft. in length. The depth of sand is 30 in., and below this is placed gravel ranging in size from ⅛ to 1 in. The underdrains are of vitrified tile, laid with open joints, and are covered with large broken stone. The distributors are made of 1½-in plank, painted



FIG. 4. CONTACT BEDS



FIG. 5. SAND FILTERS

FIGS. 4 AND 5. VIEWS OF CONTACT BEDS AND SAND FILTERS, JULIETTA HOSPITAL

with asphaltum, and have notches cut out every 6 or 8 ft. Around these notches on the outside is placed broken stone (Fig. 3) so that the surface of the sand will be disturbed as little as possible.

The effluent from the sand filters is discharged into a small creek or run. The effluent is perfectly clear and without odor and no deposit of any kind has as yet been noticed.

GENERAL—Before the plant was built, the sewage had been retained in the creek immediately below the outlet until a regular septic tank had been formed which on warm days had been very offensive, a constant ebullition being always present. The appearance of the creek at this point was a black bubbling mass which if stirred with a stick would give off such a stench that it was impossible to remain near by. Further down the creek everything was coated, and small septic pools could be found for some distance below. Ducks swimming in this water died and the farmers below took the matter up with the State Board of Health, which ordered that the sewage be disposed of in some suitable manner. Since the plant has been started all nuisance has disappeared and the water in the creek is now fresh and clear. The pool just below the plant, which was formerly a nuisance, is now perfectly clear.

A large part of the construction work was done under the supervision of Dr. Potter, superintendent of the institution, by means of the inmates of the asylum who did all such work as excavation, grading, sodding and handling of material.

The plant was designed, erected and superintended by the writer.

Studies of Coefficient of Friction in Reinforced-Concrete Pipe, Umatilla Project, Oregon

By Herbert D. Newell*

The reinforced-concrete pressure pipe in use on the Umatilla Project of the U. S. Reclamation Service was described by the writer in an article in Engineering News of Feb. 16, 1911. The present article will report the results of some of these pipe lines in service.

Reinforced-concrete pipe in use are generally of two sizes, having an inside diameter of 46 and 30 in. respectively. The thickness of shell is 3 in. in each case. Both sizes were cast in a pipe yard at Hermiston, Ore., and hauled to the location of the various pipe lines. Sections of 46-in. pipe were 8 ft. long; sections of 30-in. pipe were 4 ft. long. Table I gives facts about the more important pipe lines:

TABLE I REINFORCED-CONCRETE PIPE LINES ON UMATILLA PROJECT, OREGON

Name	Length, ft	Maximum head, ft	Total cost per lin ft laid	Date laid
46-in. inside diameter				
M	4080	55	$6 14	Winter 1907-8
O²	5312	36	4 51	Winter 1908-9
R²	1284	15	4 04	Winter 1908-9
R¹	9831	110	5 17	Winter 1909-10
30-in. inside diameter				
D²	5330	45	2 69	Winter 1909-10
D	1724	22	2 68	Winter 1907-8
D	1395	35	3 51	Winter 1907-8
O²	3556	26	2 92	Winter 1908-9
R²	3645	25	2 43	Winter 1908-9
B	932	55	4 24	Winter 1908-9
Z	1622	18	2 31	Winter 1909-10
T¹	1398	8	2 67	Winter 1910-11
T²	2495	18	2 83	Winter 1910-11

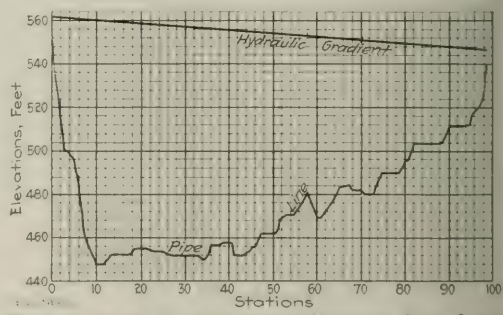
In addition, fully 8800 ft. of 12-in., 17,000 ft. of 16-in., and 4600 ft. of 20-in. cement pipe have been laid in various short pipe lines acting under moderate heads. Generally the pipe lines listed have been in use each irrigation season since they were laid. They have shown great structural strength and have proved thoroughly satisfactory. Expense for maintenance has been small.

*Project Engineer U. S. Reclamation Service, Hermiston, Ore.

During 1911 and 1912 a number of experiments were made to determine the coefficient of friction. The R_1 pipe seemed best adapted for experiments on 46-in. pipe, and the D_1 and R_3 pipes the most favorably situated for experiments on 30-in. pipe. A profile of the R_1 pipe is reproduced herewith. The quantity of water was generally determined by meter measurements. Differences of water surface elevation between the inlet and outlet ends were determined from bench marks carefully established on the inlet and outlet structures.

The quantity of water flowing through the R_1 and D_1 pipes was so small that they were not filled for some distance beyond the intakes. In order to determine the elevation of the water surface at the inlet end a ¾-in. valve was attached to the pipe and by means of a rubber hose the elevation was determined at which the water surface came to a level in a pail. This method was used in all experiments carried on in 1911. No difficulty was experienced in determining the water surface elevation at the inlet of the R_1 pipe. The determination was less exact for the D_1 pipe.

During 1912 a testing gage was substituted for the rubber hose and its readings were used to determine the elevation of the water surface. On July 27 the elevation of the water surface at the intake of the R_1 pipe was found to be 556.44 when determined by the hose and pail and 556.36 when determined by the pressure gage. The close agreement seems to check the accuracy of both methods. No difficulty was found in determining the water surface elevation at the intake of the R_3 pipe. The top of the pipe was submerged, and on account of



Profile of 46-in. Reinforced-Concrete Pipe Line, Umatilla Project, Ore.
(Bottom of pipe)

the low velocity water entered the pipe quietly, there being no boils or eddies.

46-in. Concrete Pipe

The R_1 pipe has an inside diameter of 46 in., a total length of 9831 ft., and is subjected to a maximum head of 110 ft. It was first filled on Feb. 28, 1910. Two hours and 40 minutes after water first entered the pipe it passed out of the far end. The line was in constant use from April 1 to the end of October. During the winter water was out of the pipe except in the lowest depressions. Water was admitted into the pipe the latter part of March, 1911, and the pipe was in service until the end of October. Water was again admitted in the pipe on April 1, 1912, and the line was constantly in use until Oct. 25, 1912. Conditions are favorable for a good meter meas-

urement within 100 ft. of the intake of the R_1 pipe. Tests of observation data follow:

The cross-sectional area of a 46-in. pipe is 11.541 sq.ft.; the wetted perimeter 12.043 ft.; and the hydraulic radius, 0.96.

July 31, 1911:
Quantity of water entering pipe 46.15 sec. ft., single meter mensurement
Water surface elevation at intake..... 554 37
Water surface elevation at outlet. 545 84
Difference... 8 53
Charge friction loss against 9800 lin.ft.
Slope, 0.00087.
In formula $v = c\sqrt{rs}$ c was found to be 138; n in Kutter formula was 0.011.
Conditions were favorable while experiment was in progress.

August 23, 1911:
Quantity of water entering pipe 45.90 sec.ft.; average of two meter measurements, 45.63 and 46.12 sec ft., respectively
Water surface elevation at intake..... 553.50
Water surface elevation at outlet 545 82
Difference..... 7 68
Charge friction loss against 9800 lin.ft.
Slope, 0.00078.
In the formula $v = c\sqrt{rs}$ c was found to be 145; n in Kutter formula was 0.0106.
Conditions were favorable while the experiment was in progress.

June 13, 1912:
Quantity of water entering pipe 48.16 sec.ft.; average of three meter measurements, 48.84, 48.16, and 47.49 sec. ft., respectively.
Water surface elevation at intake..... 556 93
Water surface elevation at outlet..... 546.32
Difference..... 10.61
Charge friction loss against 9800 lin.ft.
Slope, 0.00108.
In the formula $v = c\sqrt{rs}$ c was found to be 130; n in Kutter formula was 0.0117.
Conditions were favorable while the experiment was in progress. It is probable the flow was obstructed somewhat by a small deposit in the first low depression.

July 27, 1912:
Quantity of water entering pipe 48.59 sec.ft.; average of three meter measurements, 48.32, 49.82, 47.66 sec.ft., respectively.
Water surface elevation at intake..... 556.40
Water surface elevation at outlet..... 546.37
Difference..... 10 03
Charge friction loss against 9800 lin.ft.
Slope, 0.00102.
In the formula $v = c\sqrt{rs}$ c was found to be 135; n in Kutter formula was 0.0113.
Conditions were favorable while experiment was in progress. Efforts made between June 13 and July 27 to remove some of the deposit by means of a fluctuating flow appear to have improved conditions.

30-IN. REINFORCED-CONCRETE PIPE

8. The cross-sectional area of a 30-in. pipe is 4.909 sq.ft.; the wetted perimeter, 7.854 ft.; and the hydraulic radius, 0.625.

July 31, 1911—D_1 Pipe:
Quantity of water entering pipe, 17.70 sec.ft., weir measurement.
Water surface elevation at intake..... 490.24
Water surface elevation at outlet..... 484.76
Difference..... 5.48
Charge friction loss against 5130 feet.
Slope, 0.00107.
In the formula $v = c\sqrt{rs}$ c was found to be 140; n in Kutter formula was 0.0103.

August 23, 1911—D pipe:
Quantity of water entering pipe 16.62 sec.ft., single meter measurement, 17.04 weir measurement.
Elevation of water surface at intake..... 490.55
Elevation of water surface at outlet..... 485.15
Difference..... 5.40
Charge friction loss against 5130 feet.
Slope, 0.00105.
Using Q = 16.62, c = 132; n = 0.0108.
Using Q = 17.04: c = 135; n = 0.0106.

June 6, 1912—R_3 pipe:
Quantity of water passing out of pipe 13.38 sec.ft., average of three meter measurements, 13.42, 12.76, 13.02 sec.ft., respectively; +.32 sec.ft., discharge over weir.
Water surface elevation at intake..... 543.42
Water surface elevation at outlet..... 540.29
Difference... 3 13
Charge friction loss against 3658 lin.ft.
Slope, 0.00086.
In the formula $v = c\sqrt{rs}$ c was found to be 118; n in Kutter formula was 0.0119.
It is not unlikely that there is a considerable deposit of sand in the first low depression. Definite report cannot now be made on account of the presence of water inside the pipe.

16-IN. CEMENT PIPE

Certain experiments were also made to determine friction loss in pipe, made in sections 2 ft. long, having an inside diameter of 16 in. The data secured were:

The cross-sectional area of a 16-in. pipe is 1.396 sq.ft.; its wetted perimeter 4.189; and the hydraulic radius, $\frac{1}{3}$.

June 11, 1912—Z_a pipe.
Quantity of water entering pipe 3.71 sec.ft.; average of two meter measurements, 3.78 sec.ft. and 3.70 sec.ft.
Elevation of water surface at intake..... 539 14
Elevation of water surface at outlet... 536 47
Difference... 2 67
Charge friction loss against 700 lin.ft
Slope, 0.0038
In the formula $v = c\sqrt{rs}$ c was found to be 75, n in Kutter formula was 0.0154.

Aug. 22, 1912:
Quantity of water entering pipe 4.87, average of three meter measurements, 4.97, 4.78 and 4.86 sec.ft.
Water surface elevation at intake 539 60
Water surface elevation at outlet..... 536 44
Difference..... 3 16
Charge friction loss against 700 lin.ft.
Slope, 0.0045.
In the formula $v = c\sqrt{rs}$ c was found to be 90, n in Kutter formula was 0.0134.

Aug. 22, 1912—C_c:
Quantity of water entering pipe 3.42 sec.ft.; average of two meter measurements 3.65 and 3.19 sec.ft. Difference between water surface elevation at intake and outlet is 1.71 ft.
Charge friction loss against 909 lin.ft
Slope, 0.00188.
In the formula $v = c\sqrt{rs}$ c was found to be 98; n in Kutter formula was 0.0125.

Discussion of Measurements

Examination of the R_1 pipe at the end of the season showed the interior to be smooth and generally in good condition. There was a small deposit of gravel just beyond the first depression, possibly one-half cubic yard of material was removed. There was a little gravel at other places, but in general the interior presented an excellent appearance.

In the D_1 pipe beyond the first depression there was a deposit about 75 ft. long and 0.5 ft. thick. About 1.5 cu.yd. of material were removed from the deposit. There were a few other small deposits, but generally the interior of the pipe was smooth and presented an excellent appearance.

There is probably some deposit in the R_3 pipe. An examination is not yet practicable because of the presence of water, which it is not feasible to remove. No information exists as to whether or not the 16-in. pipes are somewhat obstructed by deposits near the bottom of depressions.

It will be noted that the 16-in. pipe show discharges relatively much smaller than the 30- and 46-in. pipe. The 16-in. pipe are made by the dry process and have joints every 2 ft. At every joint there is unavoidably a slight irregularity in the cross-section. The mixture used in making the 30- and 46-in. pipe is distinctly a wet mixture. All sizes are grouted on the inside, but the grouting on the large sizes is more smooth, as a man can work inside the pipe and it is possible to do a better job. A summary of results is shown below:

TABLE II. SUMMARY OF RESULTS OF FRICTIONAL STUDIES OF REINFORCED-CONCRETE PIPE, UMATILLA PROJECT, OREGON

Description	Date of experiment	Slope	Velocity	c	n	Remarks
R^1 pipe.....	July 31, '11	0.00087	4.00	138	0.0111	Cond. favorable
Dia., 46 in.....	Aug. 23, '11	0.00078	3.98	145	0.0106	Cond. favorable
Length 9831 ft...	June 13, '12	0.00108	4.17	130	0.0117	Cond. favorable
Max. hd. 110 ft..	July 27, '12	0.00102	4.21	135	0.0113	Cond. favorable
D^1 pipe.....	July 31, '11	0.00107	3.61	140	0.0103	Cond. fair
Dia., 30 in.....	Aug. 23, '11	0.00105	3.39	132	0.0108	Cond. fair met. meas.
Length 5330 ft..	Aug. 23, '11	0.00105	3.47	135	0.0106	Cond. fair weir meas.
Max. head 45 ft..						
R^3 pipe:						
Dia., 30 in.....						
Length 3645 ft..	June 6, '12	0.00086	2.73	118	0.0119	Cond. favorable
Max. head 25 ft .						
Z_a pipe*:						
Dia., 16 in.....	June 11, '12	0.0038	2 68	75	0 0154	Cond. fair
Length 700 ft....	Aug. 22, '12	0.0045	3.49	90	0.0134	Cond. fair
Max. head 9 ft...						
Z_c pipe*:						
Dia., 16 in.....						
Length 909 ft...	Aug. 22, '12	0.0019	2.45	98	0.0125	Cond. favorable
Max. head 18 ft..						

* Cement pipe.

Twin-Screw Motor-Ship "Hagen"—A New Krupp Two-Stroke Type Diesel-Engine Tank Vessel of 2,400 B.Hp.

By J. Rendell Wilson*

The highest-powered two-stroke-cycle Diesel-engine vessel yet launched, the new Krupp-engined motor-tank ship "Hagen," which has just carried out successful trials, should have particular interest for all connected with engineering, especially as the difficulties in connection with the design and construction of high-powered marine Diesel engines have been enormous, and more especially because the evolution has all practically been carried out in a couple of years and not the half-century taken to develop the marine steam engine.



Fig. 1. The Largest Diesel Oil-Engine Vessel Afloat. The Tank Ship "Hagen." Built for the German-American Petroleum Co., by Fried. Krupp, Kiel, Germany

Although there are now three other motor ships in service of equal power, all are driven by Diesels of the four-stroke type and the next in size to the two-stroke motor ship "Hagen" is the Hamburg-American Co's ship "Monte Penedo," which is fitted with two Sulzer-Diesel engines each of 850 b.hp. Seeing that each of "Hagen's" motors have given as much as 1500 brake horsepower on test, the advance is noteworthy considering the present stage of the development and she may thus be called the highest-powered motor ship afloat.

There is much doubt among shipowners and their marine superintendents as to which is the superior type of Diesel motor for merchant vessels. At the present moment there are 33 motor vessels building, with four-stroke engines having a total power of 61,500 b.hp., as against 20 ships with a two-stroke engine-power of 34,250 b.hp., while out of 75 vessels in service only 30 have two-stroke motors. I am speaking now only of craft of over 100-ft. length.

There are, however, now twice as many engineering firms constructing two-stroke Diesels as there are building four-stroke Diesels, so it is rather difficult to see as yet what the future type will be. For naval work there can be no doubt that the two-stroke Diesel will be adopted as the standard engine. The auxiliary engines of all motor ships in service are of the four-stroke class—a noteworthy point.

Although the "Hagen" is the first large motor ship turned out from Messrs. Krupp's Germania Yard at Kiel-Gaarden, it must not be thought that this vessel is purely an experiment, as for years they have been building Diesel engines for submarines and other naval craft, and only recently they succeeded in obtaining as much as 2700 b.hp. on the experimental test bed from a single-cylinder double-acting two-stroke motor, the highest power yet obtained from one cylinder.

The "Hagen" is the first of three vessels (two sister ships and one of 15,000 tons) building for the German-American Petroleum Co., and by the time this appears in print she should be in American waters on her maiden voyage. Her trials were carried out on Mar. 12, and were very successful, a speed of well over 12 knots being attained, the contract speed being 11 knots. She is 400 ft. long between perpendiculars, by 49 ft. beam, with a molded depth of 32 ft., and her deadweight carrying capacity is 8350 tons on a draft of 23 ft., while her gross tonnage is 7770 tons. She has been built by Krupps to the English Lloyds' 100 A. 1. Class, and to the German Lloyds' 100 A. 4. Class, and will be used for carrying oil in bulk, the oil being divided into a number of tanks by transverse bulkheads subdivided by a longitudinal bulkhead extending the whole length. Partly to conform with freeboard rules, which vary with the seasons, and partly to increase the loading capacity when cargo capacity of a lower specific weight is being carried, there are what are termed "summer" tanks arranged alongside the expansion hold, which runs the entire length. The engine exhaust gas is carried to a slender funnel.

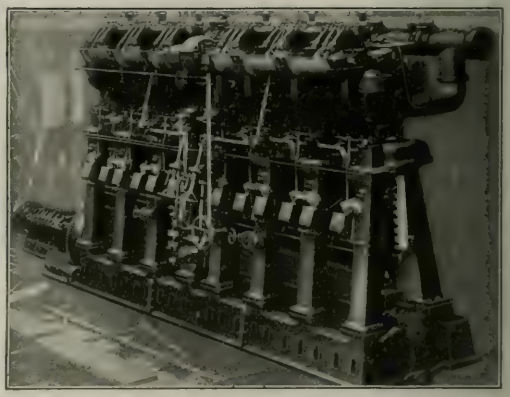


Fig. 2. One of the Six-Cylinder Two-Stroke-Cycle Diesel Oil Engines for the Tank Ship "Hagen"

But it is the machinery and not the hull which forms the most interesting part of the ship. There are two main engines, and two auxiliaries, the latter being of 250 b.hp. each, and an oil-fired donkey boiler and steam engine for driving a spare compressor set. The total weight of the machinery, shafting and propellers is 580 tons, of which the main engines represent 280 tons, or less than half. Each of the main engines is of the two-stroke, single-acting, direct-reversible type, and has six

*65a Great Portland St., London, England.

cylinders 19-in. bore by 32-in. stroke and develops 1200 b.hp., or about 1500 i.hp. at 135 rev. per minute. The rated horsepower is 1125 b.hp. Each engine is grouped into sets of three cylinders for the purpose of easy control, so that any three cylinders can be kept running under load, and the others "cut out," thus reducing the engine speed to about 30 r.p.m. This, of course, is a valuable feature when navigating crowded harbors, as the speed of the vessel is then very low.

The general operation of the two-stroke Diesel engine is now so well known that it hardly needs dealing with here; but perhaps the mechanical details of the Krupp engine can be followed easier if this is briefly given. On the upstroke of the piston, atmospheric air is compressed to about 450-500 lb. per sq.in. in the cylinder head, generating an enormous heat, and just before the top of the stroke a charge of oil-fuel is injected by an air blast of 850-950 lb. per sq.in., which also thoroughly atomizes the fuel. Combustion instantly takes place and lasts as long as the fuel is being injected. At the bottom of the stroke the exhaust ports are uncovered by the piston, and at the same time the scavenging valves open and a charge of air from a pump delivering at about 4 lb. per sq.in. clears the cylinder of all exhaust gases, leaving it filled with pure air to be compressed on the next upstroke and then this cycle is repeated.

The port engine of the "Hagen" has all its controls arranged on its starboard side, and the starboard engine has its on the port side, so that the two engines form a gangway, between which are arranged the controls and the telegraphs. On the opposite side to the control side

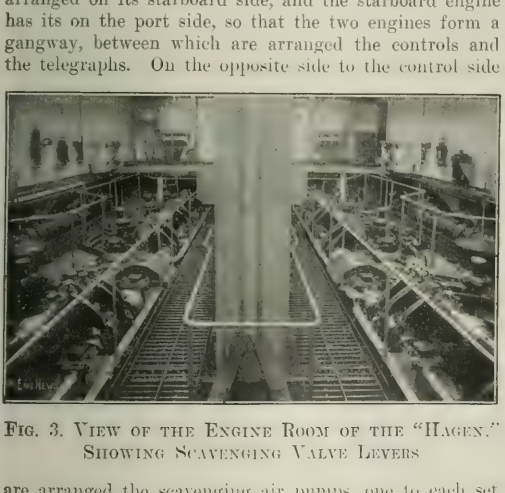


FIG. 3. VIEW OF THE ENGINE ROOM OF THE "HAGEN." SHOWING SCAVENGING VALVE LEVERS

are arranged the scavenging air pumps, one to each set of three cylinders. They are driven by means of levers off the connecting-rods of the engines. It will be seen that the motors are of the open type, with crossheads and guides; but have trunk pistons, which are water cooled, while the cylinders are mounted on cast-iron box columns set at an angle to each other. This arrangement differs somewhat from the Werkspoor-Diesel marine engines, which have vertical steel columns. In the "Hagen's" engines the lower ends of the columns are bolted to a heavy box-type cast iron bed-plate, which is made in three sections.

The scavenging air enters through two valves in each cylinder head. There is a tendency among marine oil engine designers to dispense with scavenging valves altogether, as too many valves weaken the cylinder head, also the valves give trouble. The Junkers-Diesel engine has only air-starting and fuel-injection valves—scavenging and exhaust being entirely by ports in the cylinder. There are two other valves in the cylinder head, one for admitting air for starting and reversing, the other for the injection of fuel. All valves are of the mushroom type and are operated by rocking levers mounted on the cylinder heads by means of cams on a camshaft running the length of the engine. The camshaft is, however, constructed in two lengths, and can be disconnected should a breakdown occur to one set of three cylinders. The rocking levers operating the valves, are mounted eccentrically on a steel shaft in order that their rollers can be lifted clear of the cams when reversing, etc. A hand wheel controls the lifting of the rocking levers when maneuvering.

Reversing is simply carried out by shutting off the fuel, raising the valve-rocking levers clear of their cams, sliding the camshaft endwise, bringing in another set of cams into action. Then compressed air is admitted to the pistons on the upstroke through the starting valve, thus reversing the motion of the crankshaft, when the fuel valves again come into operation. A small hand-controlled compressed-air engine is used for carrying out the maneuvering, but hand controls are also fitted. When maneuvering, three cylinders are generally allowed to run on air until the other three have taken up the load on fuel, in reality a brief operation. When starting, air pressure in the cylinders is relieved by an independent lever holding up the air valve.

Fuel is supplied to the injection valves by means of six plunger pumps to each engine, the suction valves of which are controlled by levers from the control platform, thus the engine speeds are easily varied, or entirely shut off as desired. The suction valves are also controlled by a governor. The fuel consumption is 6.35 oz. or just short of 0.4 lb. per b.hp. per hour, or about $5\frac{1}{10}$ tons per 24-hr. day per engine.* Lubrication of the engines is by a number of pumps which supply the cylinders, bearings, etc. Too much lubricating oil is a thing to be avoided with Diesel engines, and the consumption is very low. The water circulating pumps are driven off the main engines as is a two-stage compressor for supplying air to the steering engine. There are two three-cylinder Krupp Diesel engines of the non-reversible four-stroke type, each of 275 b.hp. which drive the auxiliary plant, including the main air compressors, which charge large steel storage bottles. This machinery is arranged at the forward end of the engine room. On the trials the fuel used was gas-oil, but, of course, much heavier oil could be used if necessary. The fuel-tank capacity is 500 tons. Her engine-room staff consists of twelve men and no stokers, as against 24 engineers and greasers in a steamship of the same size.

*This consumption is higher than that of the motor ship "Selandia," whose two 1250-b.hp. four-stroke engines together consume 9½ tons per 24-hr. day.

The Total Income of American State Universities and colleges during 1912, is placed at about $35,000,000 in a recent bulletin of the Federal Bureau of Education. These figures embrace only the 87 institutions which are in part or wholly supported by government funds. Of the above sum $5,000,000 was contributed by the federal government, $18,000,000 by the state governments and the balance by private subscription. The institutions having the largest income are the state universities of Illinois, Minnesota, Wisconsin, Michigan, Ohio and California, and Cornell University in New York State.

Western (Asphaltic) Oils not Effective Waterproofing Agents for Concrete

Some two years ago Logan W. Page, Director of the U. S. Office of Public Roads, announced* a series of tests, made by his office, which tended to show that certain petroleum residuüm oils will mix uniformly with concrete or cement mortar, forming what may be termed an emulsion, and that concretes and mortars thus mixed with certain percentages of oil are "absolutely watertight under pressures as high as 40 lb. per sq.in." and "under low pressures, both are waterproof." In a paper† before the American Society of Civil Engineers, Messrs. Arthur Taylor and Thomas Sanborn, of Leland Stanford, Jr., University, present the results of some tests which show that the watertight properties of oil-mixed concrete do not extend to concretes mixed with the western oils which are high in asphaltum. While Mr. Page's paper did not state that these high asphaltum oils would not give the results which he noted, it did state that certain specifications (to which the California oils would not conform) give good results.

We give below Mr. Page's specifications and some extracts from the later paper. The main point to note is that any mineral oil is not necessarily a safe or desirable material to mix with concrete.

EXTRACT FROM L. W. PAGE'S PAPER

For oil-mixed concrete, petroleum residuum oils conforming to the specifications given below have been found to give good results in both laboratory and service tests.

(1) The oil shall have a specific gravity of not less than 0.930 nor greater than 0.940 at a temperature of 25° C.

(2) It shall be soluble in carbon disulphide at air temperature to at least 99.9%.

(3) It shall contain not less than 1.5 nor more than 2.5% of bitumen insoluble in 86° B. paraffin naphtha.

(4) It shall yield not less than 2.5 nor more than 4% of residual coke.

(5) When 240 c.c. of the material is heated in an Engler viscosimeter to 50° C. and maintained at that temperature for at least 3 min., the first 100 c.c. which flows out shall show a viscosity of not less than 40 nor more than 45.

(6) When 20 grams of the material is heated for 5 hours in a cylindrical tin dish 2½ in. in diameter by 1 in. in height, at a constant temperature of 163° C., the loss in weight shall not exceed 2%.

EXTRACTS FROM PAPER BY MESSRS. TAYLOR AND SANBORN

It was found, as stated by Mr. Page, that the western (asphaltic) oils will also readily emulsify with wet cement, cement mortar, or concrete, and can become mixed so thoroughly in the mass that on examination with a reading glass no unassimilated globules of oil are visible. The mixture has a rich glossy appearance; the oil, apparently, has spread itself out in a thin film enveloping each particle of sand and rock. Even a very thick oil—one which is so viscous that when cold it cannot be poured—will mix and disappear in concrete or mortar when it is heated and mixed with hot aggregates. The amount of mixing was found to be a principal factor in determining whether or not the oil is incorporated completely and uniformly with the other ingredients of a mortar or concrete. The consistency of the concrete or mortar also governs the degree of emulsification; the wetter the mixture the better the oil emulsifies.

The oils used were commercial products having trade names as indicated at the top of the next column.

The following conclusions are drawn from the results of the investigations:

1. Oil-mixed concrete containing 5, 10, or 15% of oil, by weight of cement, is more permeable under pressures from 20 to 60 lb. per sq.in., than concrete without the incorporated oil, and oil-mixed mortar containing 10% of oil

MECHANICAL ANALYSIS OF OILS

Name	Baumé gravity	Flash point, deg. F.	Burns, deg. F.	Asphaltum %
Boiler fuel	17°	174°	....	42
Richmond Road Oil No. 6	13°	260°	400°	75
Richmond fuel	16°	210°	300°	52
Star fuel	24°	195°	245°	21
Liquid asphalt	0°.9	....	....	92

is more permeable than plain mortar under pressures of 10 and 20 lb. per sq.in.

2. Oil-mixed mortars containing percentages of oil up to 25 show slightly les absorption of water than plain mortar, except that with the most viscous oils the water becomes more absorptive, and absorption is not an index of the permeability. The absorption decreases with the increase in the quantity of oil.

3. The tensile strength of oil-mixed mortar is decreased considerably below that of plain mortar. The strength decreases with the increase in the quantity of oil.

4. The compressive strength of oil-mixed mortars follows lines similar to those of the tensile strength, but with a greater decrease in the strength with the quantity of oil.

5. The strength decreases with the viscosity of the oils, and with the most viscous oils it requires considerably more water to keep a mixture at normal consistency than is required in the fluid oil mixtures.

6. The relative decrease in strength with the increase in the quantity of oil in mortars is less in 50 than in 28 days.

*Engineering News, Oct. 12, 1911, p. 440.

†"Some Experiments with Mortars and Concretes Mixed with Asphaltic Oils," by Arthur Taylor and Thomas Sanborn. "Proceedings," American Society of Civil Engineers, March 1913, p. 355. Presented April 16, 1913.

❖

Progress in San Francisco Transportation Improvements

The Board of Supervisors of San Francisco recently invited B. J. Arnold, who has been retained to report on the improvements needed in the entire transportation system of the city, to sum up the results of his investigations prior to making a final report. In Mr. Arnold's absence this was done in an address by his resident engineer, J. R. Bibbins.

It was first reviewed how the deficiencies in San Francisco street plan and the topographical difficulties to reaching the outlying peninsular districts were responsible for restricting population to about one-half the total city area. This had resulted in a development of suburban territory across San Francisco Bay in the cities of Oakland, Berkeley and Alameda. Through the construction of the Twin Peaks Tunnel and other outlets (see ENGINEERING NEWS, June 20, p. 1203 and Dec. 5, p. 1054, 1912), the 30-minute zone would be extended to include land now available for such residential districts.

The city's street railway lines were held to be 6 years behind in extensions so that it was necessary to follow some program for the construction of 70 miles of single track. These extensions had been carefully planned after a study of every grade in the city, and its relation to the location of the population and possible transit lines. The program mapped out calls for about 15 miles of track to be laid per year up to 1920, and from 40 to 50 additional cars per year.

Statistics showed that the average inhabitant of San Francisco pays twice as much for street railway transportation per annum as in other cities of this class. This amount ($20 per capita) exceeds the taxes assessed for municipal government.

The city has more than regained the population it had before the recent fire and earthquake, and the exodus to the trans-bay cities has ceased, so that the peninsular communities will continue their rapid growth. It was recommended that all the cities on the peninsula should be united as a metropolitan district for the control of

such matters of common interest as transportation, water, police, etc.

Mr. Arnold has predicted a population of 1,000,000 for San Francisco within 25 or 30 years. The purchasing power of the city, based on its present debt limit, will not keep pace with the necessary investment for transportation facilities; and the disparity is so great that, even were the city now entirely free from debt, it would require about one-third of the city's entire bonding power continually. This point proves the necessity of encouraging the investment of private capital in street railways unless the city can raise its debt limit. The possibility of assessing on the cost of real estate traction extensions was mentioned.

It was reported that the traffic manager of the Panama Pacific Exposition has confirmed the ideas of Mr. Arnold on the facilities needed for this project. The expected peak load of 50,000 passengers per hour exceeded the total outbound traffic from the business section during the evening rush hours. Principal among the features of any plans proposed, uninterrupted and rapid service should be provided during the most congested periods by leaving a free way for vehicles to pass between cars and any vehicles standing along the curb.

In comparing types of cars, the new municipal equipment (Geary St. line) was held to combine comfort with capacity, quick loading, and increased safety. This type of car can accommodate double its seating capacity, or a maximum of 100 to 110 passengers, without interfering with passenger movement. It was held that the present equipment of the United Railroads could be improved 25% by modifications in platform arrangement such as the removal of bulkheads, straightening of guide railing, and the conversion of earlier types into prepayment forms.

Much of the congestion around the city was found to be due to slow loading on Market St. and at the ferry, and to inadequate terminal facilities.

It was reported that the inner tracks of the four-track system on Market St. had about reached their capacity, so that future additional traffic must be diverted from this street and loops and subterminals provided elsewhere in the vicinity of the ferry. The use of tandem stops, with two cars crossing intersecting streets together, had already produced improvement.

The adoption of a resettlement plan with indeterminate franchises, as exemplified in Chicago Charter Amendment 34, was urged for the ultimate organization of transit facilities in San Francisco. In accordance with such a plan it was held that both tangible and intangible values would be retired by the company, adequate service would be continuously secured, extensions would be built as required, the lines would be continuously maintained at the highest standard, and the city could take over the property when ready to do so at far less cost than it could build an entirely new system.

⁂

Collapse of a Large Steel Pipe

A steel pipe, 14 ft. in diameter, connecting two reservoirs of the Balleville Hydroelectric Co., near Fremont, Ohio, recently collapsed, while being filled with water. The views herewith show the nature of the failure and give some idea of the construction and arrangement of the pipe. Examination of the design shows that the pipe was entirely inadequate to withstand the distorting effect of the weight of water contained in the pipe, and that it was bound to fail.

The construction of the pipe is described in *Power* of Mar. 18, 1913. The pipe sheet was $\frac{5}{16}$ in. thick. The individual rings were 6 ft. 8½ in. long, and over the joints were stiffening rings, each consisting of one 6x4x⅜-in. angle (presumably with 6-in. leg outstanding).



FIGS. 1 AND 2. TWO VIEWS OF COLLAPSED 14-FT. STEEL PIPE AT BALLEVILLE, OHIO

These angle rings were spliced at the horizontal diameter by splice plates 15 in. long.

The pipe was supported every 14 ft. along its length by two concrete piers 2x2 ft., spaced 6 ft. apart transversely, capped with steel shoes.

When the pipe was about full, a length of some 600 ft. collapsed in the way the views show, starting at a point 200 or 300 ft. below the headgate. The angle stiffening rings broke at the splice on the horizontal diameter and the outstanding legs buckled at the top of the pipe.

The pipe is about 3000 ft. long, extending along the west bank of the river. It is required to carry only a small hydrostatic head. The power plant which it supplies is equipped to generate 6000 kw. from the flow of the Sandusky River, stored by a dam at Balleville, about three miles above Fremont.

⁂

The River Harbors of Europe are the subject of a report just submitted to the City Planning Commission of Pittsburgh by its consulting engineer, Kenneth C. Grant. Mr. Grant spent the summer of 1912 studying the principal water terminals on the chief rivers of Europe. His report to the Commission includes plans and recommendations for the development of the Pittsburgh waterfront along the Monongahela and Allegheny Rivers to secure the combined ends of flood protection and terminal facilities.

An Articulated Street Car

The Boston Elevated Ry. Co. has two articulated surface cars of the type shown in Fig. 1 in service on a crosstown line, which lies almost entirely within a residential district, containing a few small shops and a number of schools and halls. There were several transfer points on this line and these cause a heavy short-haul traffic. It was thought possible to design a car which would hold as many people as the standard cars of the company and still run on narrow streets and around sharp

ing his fare, has to take a second step of 10 in. to approach either riding section. The second platform he then stands on has a rise of 2 in. between its outer edge and the final step up (5 in.) into the car proper. On the ends of the old frames are fastened the bolster shown in Fig. 3, and this has rollers on which the bearing plate of the intermediate frame rests. The channel-section center sills of this frame drop below the bolster-frame level and carry the side-sill angles through three channels, resting on the bottom flange, held in place with reinforcing plates and stiffened with diagonal angles.



Fig. 1. Articulated Type of Surface Car; Boston Elevated Ry. Co.



Fig. 2. Center Section of Boston Articulated Car

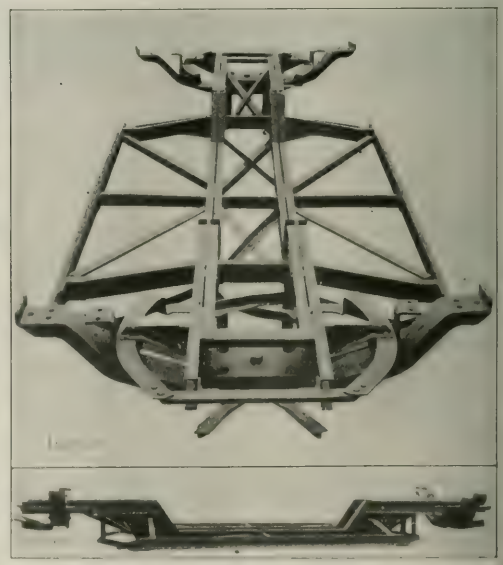


Fig. 3. End and Side Views of Center-Section Frame; Boston Articulated Car

curves without objectionable overhang. The designers sought to find some use for the 1100 odd small cars which the company possessed, and considerations of convenience and safety to entering passengers also had weight.

As is evident from Fig. 1, one vestibule and platform were removed from two of the old 20-ft. closed cars which were then connected by an intermediate section to form a single unit 62 ft. 10 in. long over bumpers. The car shown has the intermediate-section floor 14 in. above the roadway giving a "stepless" exterior design. As may be seen from Fig. 2, the entering passenger, after deposit-

A flexible waterproof curtain incloses the passageway between the center and end compartments. The roof extensions of the end sections, which project over the en-

trances from the center section, have a horizontal hinge and rest on the center section roof.

The conductor's station, of course, is on the center section. Near the fare box are push-buttons governing bells in the front and rear vestibules to signal the motorman in whichever end happens to be forward. In the center section are four 500-watt electric car heaters. All passengers, of course, have to enter by the center section, but the passengers in the forward section leave through the four vestibule doors which are opened by the motorman. A folding step drops with the opening of the vestibule doors. The car has semi-automatic air brakes with an emergency valve at the conductor's station. The center doors are operated by compressed-air cylinders near the roof instead of at the floor as is common. The company reports that the average boarding and leaving time on these cars is about 2 sec.

The Westinghouse-Leblanc Water Vapor Refrigerating Machine

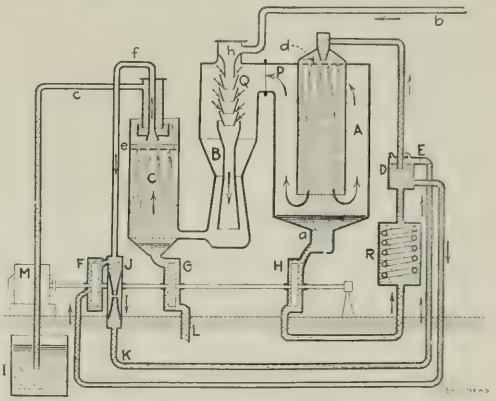
By H. J. Macintire*

Mechanical refrigeration has shown great progress in the last decade and now is used in almost every industry where rapid cooling is required. A number of refrigerants have been used for mechanically securing low temperatures. In the early days air was employed, the approximate adiabatic expansion of which gave the desired low temperature. The air machine, however, is bulky and has a low efficiency so that recourse is made to the use of a vapor of suitable boiling temperature. Of the number of theoretically possible refrigerating vapors carbon dioxide, sulphur dioxide and ammonia alone are used; the last being the favorite in America.

In America, ammonia is employed for about 95% of the total refrigeration, whereas, in England, France and Germany, carbon dioxide is used to a much greater extent. Refrigeration on board ship, in mines, hotels and other confined quarters, where the liberation of a noxious gas would be serious, makes the problem of selecting an appropriate refrigerant of even greater importance. None of the three vapors mentioned are innocuous to man, although carbon dioxide is most nearly so However, the pressures carried with this last, frequently 1000 to 1200 lb. per sq. in., are excessive and explosions are not unknown. This danger is recognized in the French navy, which has limited the size of the units used in their ships. The U. S. Navy is still using a dense-air machine which carries a suction-line pressure of 65 lb. gage, the gas being used continuously, but these machines are never built in any but very small sizes and trouble due to freezing of the lubricating oil is encountered daily.

The most logical medium to use, the one costing least and the one which would be perfectly harmless, is water vapor. The difficult problem here is, however, in caring for the vast increase in the specific volume of steam at low temperatures; at 50° it is 1702, at 40° it is 2438, and at 32° it is 3294 cu.ft. per lb. of steam. If a compressor with a piston were used for compressing the vapor the necessary displacement of the machine per pound of vapor would have to be absurdly great. Fortunately, the same end may be obtained with high-speed rotary apparatus, or its equivalent, as is shown in the design of the Westinghouse-LeBlanc water-power machine.

The accompanying figure shows diagrammatically the arrangement of this machine. At B are the refrigerating coils which may be arranged to carry the cooling agent within them in the usual manner, or to allow the brine or cold water to fall in the form of a spray in contact with the air to be cooled. In the latter case some moisture is absorbed from the air, which partially neutralizes the loss of vapor in the evaporating chamber A. The warm brine now passes into the reservoir D which is subject to atmospheric pressure, and is then siphoned into the evaporator A, into which it falls in the form of a fine spray, after having passed the perforated plate d. The jet-condenser chamber is at C, the condensing water coming in from the cold-water supply I through a perforated plate e at the top of C. The condensing water and condensate are removed by means of a turbine-type pump G and the air and water vapor by means of the



Diagrammatic Arrangement of Westinghouse-Leblanc Water-Vapor Refrigerating Machine

rotary pump with water pistons at F and J. A vacuum of 1 lb. absolute may be obtained at C with cooling water of usual temperature, and in order to obtain $\frac{1}{10}$ pound absolute in A (corresponding to an evaporating temperature of 28-30° F.) work must be done on the vapor from A to compress it to the pressure in C. This is accomplished by means of the ejector cones Q, through which steam passes at high velocity, dragging with it the vapor evaporated in A. Either high-pressure or exhaust steam may be used, and in the latter case the electric motor M is replaced by a small steam turbine, and the pipe b conveys the exhaust to the chamber B. As shown, all the pump motors are on the same shaft. The level of the reservoir D is maintained constant by means of some kind of float and valve, which admits water at the temperature of the supply I.

So far in America, this machine is in but an experimental stage; its actual use has been confined to marine work abroad for the most part, a large number of installations having been made in the French Navy. For stationary work, however, its possible applications are many, and there is every reason to believe that it will soon become more widely known. Although temperatures

*Carnegie Institute of Technology, Schenley Park, Pittsburgh.

of 32° F. and lower may be obtained, its special sphere of usefulness is for temperatures of from 35° to 50°. With these latter temperatures, the economy is high, being about 400 B.t.u. of refrigeration per pound of steam supplied to the ejectors, whereas only about 200 B.t.u. is obtained at a refrigerating temperature of 25° F. As air cooling in auditoriums, banks, hotels, chocolate factories, etc., seldom requires temperatures lower than 50°, and as the installation has no element of danger on account of the harmless refrigerant, a field will probably soon open for it along these lines.

So far little information is available about the space required, but it will not be greater than that necessary for the ammonia compressor and condenser. The design is so simple that the first cost will be small and, for the uses cited, no brine should be necessary as the temperatures are safely above 32° F. There is no practical limit of size to this machine, the largest in Europe being about 350 tons, and in America about 200 tons of refrigeration.

In comparing the relative efficiencies of the water-vapor and ammonia machines, only approximate values can be given, as too many specific factors come in for a general statement. Roughly the horsepower of the ammonia compressor per ton of refrigeration varies from 0.5 to 1.2 or more which would correspond to from 15 to 30 lb. of steam per ton of refrigeration or to from about 300 to 600 B.t.u. per ton per minute, a value which is nearly, if not quite, the economy of the water-vapor machine. Considering (1) that the modern small impulse steam turbine and centrifugal pump may be run for days without attention, the cost of maintenance and operation being reduced accordingly, and (2) that the element of danger is lowered to a minimum, then this water-vapor machine would seem to compare favorably in economy with older types of refrigerating machines.

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The Maine Public Utility Law, recently passed and signed by the governor, abolishes the present Board of Railroad Commissioners and the State Water Storage Commission. There will be instead three commissioners to be appointed by the governor with the advice and consent of the Council. The salary of the chairman is to be $5000 a year and that of each other member $4500. The first chairman will hold office for seven years, and the other members respectively for five and three years; appointments after the first board are to be for seven years. The commission is given authority over railways and electric railways, express companies, gas, electric light and power companies, telephone and water companies, etc. The right to require books, records and witnesses is given, and corporations are required to furnish such information as is necessary. Uniform accounts are imposed under the prescriptions of the commission. Schedules of rates are to be filed and such ones as the commission orders are to be printed and opened to public inspection. Unreasonable preferences or rebates are prohibited, and competition in utilities is prohibited except where the commission deems the second one a public convenience and necessity. The commission has power to make physical valuations of property and authorize the issue of stocks, bonds and notes; no such evidences of indebtedness can be issued without the commission's permission. Selling, leasing or mortgaging public-utility property and acquiring the stock of other companies is not permitted without commission sanction. Accidents are to be reported and the commission is to investigate and make such recommendations as seem reasonable. The law fixes the details of procedure in connection with complaints before the commission. The burden of proof is placed on the party adverse to the commission or seeking to set aside a commission order. Appeal to the courts is provided on questions of law.

The governor has appointed the following members: L. B. Deasy, of Bar Harbor (Chairman), W. B. Skelton, of Lewiston, and Joseph Williamson, Jr., of Augusta. They are all lawyers with experience in corporation work.

A Rational Culvert Formula

By W. W. Horner*

The following formula for culvert size is based on the data used in sewer design in St. Louis.

Rainfall—The rainfall curve for St. Louis as used by the Sewer Department (described in Engineering News, Sept. 29, 1910, p. 326) was expressed by the formula $I = \frac{56}{(t+5)^{0.85}}$, where I is the rate of rainfall in inches per hour and t is the duration of the downpour in minutes. The runoff in cubic feet per second per acre was shown graphically and is the product of values of I for any certain time by a coefficient p (also a function of the time) the values of which were fixed arbitrarily, using the best experimental data then available.

For use in the culvert design, the rainfall curve was slightly changed to fit the simpler formula $I = \frac{30}{t^{\frac{3}{4}}}$, and the value of p was taken as, $p = 0.2t^{\frac{1}{4}}$. The runoff per acre is then $pI = \frac{6}{t^{\frac{1}{2}}}$. Values of I, p and pI for certain values of t, as computed by this formula, are shown below:

t, minutes	I, inches per hour	p	pI, cu.ft. per sec. per acre
5	8.5	0.30	2.55
10	5.4	0.36	1.95
15	4.0	0.40	1.60
20	3.2	0.42	1.35
30	2.3	0.47	1.08
45	1.7	0.52	0.88
60	1.4	0.56	0.78
90	1.03	0.62	0.64
120	0.82	0.66	0.54
180	0.61	0.73	0.45

These values of I approximate closely those given by the above-mentioned rainfall curve for St. Louis, and should hold for Central Mississippi Valley conditions. The values of p are slightly high for open agricultural country on moderate slopes and normal soil conditions; they are too high for loose sandy soil and too low for hard-packed clay.

Derivation of Culvert Formula—It was decided that the culvert formula should be expressed in terms of the drainage area A in acres, the length of watercourse L in feet, and the average slope of the stream bed S in rate of grade (total fall divided by length of stream).

To attain this result, the following equations were used:

$$\textit{The total runoff } Q = ApI = \frac{6A}{t^{\frac{1}{2}}} \qquad (1)$$

Assume the cross-section of the channel to be a semicircle of radius r, the channel being at all points along the stream just sufficient to carry the flow. Using the exponential formula for flow of water $V = CR^{0.67}S^{0.54}$ in the simplified form $V = CR^{\frac{2}{3}}S^{\frac{1}{2}}$ where R will be $\frac{r}{2}$ and C is taken as 80 (for fairly uniform natural channels).

$$V = 50.0\, r^{\frac{2}{3}} S^{\frac{1}{2}} \qquad (2)$$

and

$$Q = 78.5\, r^2 S^{\frac{1}{2}} \qquad (3)$$

If the value of Q is taken as the total runoff at the culvert, then V is the velocity at that point.

*Civil Engineer, St. Louis Sewer Dept., 5842 Julian Ave., St. Louis, Mo.

The mean velocity of the whole stream length is assumed to be two-thirds of the outlet velocity, or $V_m = \frac{2}{3}V$; and the time (in minutes) of flow from the upper end of the watercourse to the culvert will be

$$t = \frac{L}{60\,V_m} = \frac{3}{2}\frac{L}{60\,V} = \frac{L}{40\,V} \qquad (4)$$

From these four formulas the required culvert area may be determined. Eliminating r from (2) and (3) gives

$$Q = \frac{78.5\,I^4}{(50)^4\,S^2} \qquad (5)$$

Eliminating V from (4) and (5) gives

$$Q = \frac{78.5\,L^4}{(2000)^4\,t^4\,S^2} \qquad (6)$$

Eliminating t from (1) and (6) gives

$$(Q)^7 = \frac{(2000)^4\,(6)^8\,A^8\,S^2}{78.5\,L^4}$$

or

$$Q = 320\frac{A^{\frac{8}{7}}S^{\frac{2}{7}}}{L^{\frac{4}{7}}} \qquad (7)$$

or approximately

$$Q = 320\left(\frac{A^2}{L}\right)^{\frac{4}{7}}S^{\frac{2}{7}} \qquad (8)$$

This is the total runoff of the valley, or the amount of water to be carried through the culvert, in cubic feet per second.

If the culvert is laid on approximately the same grade as the stream, and the approach is well designed, it may be assumed that the velocity through the culvert is the same as that in the stream immediately above. Then if a is the area of culvert opening in square feet, $a\,V = Q$, or (from (5)

$$a\left(\frac{50^4\,S^2\,Q}{78.5}\right)^{\frac{1}{4}} = Q$$

and substituting Q from (7)

$$a = 4.5\left(\frac{A^2}{L}\right)^{\frac{1}{7}}\frac{1}{S^{\frac{1}{4}}}$$

or approximately

$$a = 4.5\left(\frac{A^2}{L}\right)^{\frac{1}{7}}\frac{1}{S^{\frac{1}{4}}} \qquad (9)$$

In actual practice, the values of L and S are as easily obtainable as that of the acreage A, either from contour maps or from actual traverse of the watershed, and these values add greatly to the flexibility of the formula.

For approximate work, values of S may be taken as 0.005, 0.01, 0.015, 0.02 and 0.04 (that is, 5, 10, 15, 20 and 50 feet per thousand), corresponding to slopes from very flat to steep.

Then for

$S = 0.005$ $\quad a = 13.0\left(\frac{A^2}{L}\right)^{\frac{1}{7}}$

0.01 $\quad a = 11.3\left(\frac{A^2}{L}\right)^{\frac{1}{7}}$

0.015 $\quad a = 10.4\left(\frac{A^2}{L}\right)^{\frac{1}{7}}$

0.02 $\quad a = 9.8\left(\frac{A^2}{L}\right)^{\frac{1}{7}}$

0.04 $\quad a = 8.6\left(\frac{A^2}{L}\right)^{\frac{1}{7}}$

Also L may be reduced to a function of A by assuming the shape of the valley, or ratio of length to breadth: thus if the area is approximately square, $\frac{L^2}{43{,}560} = A$, or $L = 208\,A^{\frac{1}{2}}$; for $S = 0.005$, a becomes $1.3\,A^{\frac{6}{7}}$ or approximately $a = 1.3\,A^{\frac{1}{2}}$; for length twice the width of the valley $a = 1.14\,A^{\frac{1}{2}}$.

In general, the formula may be written $a = C\,A^{\frac{1}{2}}$. Values of C for various slopes and various ratios of length to width of the drainage area are tabulated below:

VALUES OF C IN FORMULA $A = C\,A^{\frac{1}{2}}$

Slope S	0.001	0.005	0.01	0.015	0.02	0.04
L = w	1.76	1.32	1.15	1.06	1.00	0.87
L = 2w	1.52	1.14	0.99	0.91	0.86	0.75
L = 3w	1.39	1.04	0.91	0.83	0.79	0.69
L = 5w	1.24	0.93	0.81	0.75	0.71	0.62
L = 10w	1.06	0.80	0.70	0.64	0.61	0.53

In the preceding, the cross-section of the high-water channel was assumed to be a semicircle. The error in this assumption will not be great where the slope of the stream is 1% or more, as such watercourses usually have compact sections and are not subject to overflow to any great extent. For flat grades, however, the cross-section at high water usually consists of a small channel flanked by wide overflow areas in which the velocities are low, and the mean velocity may possibly be as much as 25% less than that given by equation (2). Assuming such condition, for example a flat triangular channel having a width ten times the depth, it is found that the discharge a would be

$$Q = 271\left(\frac{A^2}{L}\right)^{\frac{4}{7}}S^{\frac{2}{7}}$$

or about 16% less than that of the formula, while the required culvert area would be

$$a = 5.3\left(\frac{A^2}{L}\right)^{\frac{1}{7}}\left(\frac{I}{S}\right)^{\frac{1}{4}}$$

or 18% greater than the value of equation (9).

In general, when applying the formula to channels on very flat slopes and subject to overflow, the values of the constant C in the table should be increased 10% to 15%.

It should be noted also that the discussion assumes the velocity of the stream above the culvert to continue through the opening, and it is important that the shape of the culvert should approximate the cross-section of the stream and that well designed wing or approach walls be used in order to prevent disturbance to flow, or eddy action, as far as possible. Where this is not practicable, as in the case of shallow channels, the values in the table should be regarded as minimum, and the area of the opening increased, or else it must be permissible that the water level of the stream rise above the top of the culvert in order, in acquiring the head necessary, to overcome that lost in change of section.

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Property Owners on a Public Highway cannot be compelled to pay for a pavement, if the pavement is notoriously unsatisfactory, according to a recent decision in an Oklahoma court. The cases decided were those of three citizens of the city of Bartlesville, who succeeded in obtaining a permanent injunction against the city to prevent the collection of assessments for an asphalt pavement in Johnstone Ave. It is claimed that the surface of the pavement came off a few weeks after it was laid, and the taxpayers refused to meet further assessments. The city's motion for a new trial was overruled, and the injunction was sustained.

An Installation of Freight-Handling Machinery for Increasing Dock Capacity*

An overhead freight-handling system has been recently installed at one of the docks and storehouses of the New York Dock Co., in Brooklyn.† Here is a six-story brick structure 211x68 ft. which is used solely for sorting and storing export and import cargos. The freight is what comprises the usual miscellaneous ocean burden, with every kind and size of box, barrel, keg, crate, bale flask, sack, and even metal bars and sheets. It has to be carried directly to and from lighters, wagons, trucks and railway cars, as well as into and out of storage buildings.

The equipment noted consists of a single-runway bridge on the adjacent wharf extending to the warehouse; two I-beam (15-in.) tracks through this ware house; a double-runway bridge over railway tracks to a freight house, and two traveling hoists. The wharf bridge (Fig. 1) extends from the warehouse door to

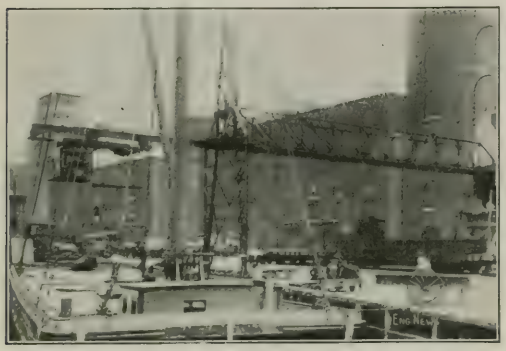


FIG. 1. WHARF BRIDGE WITH RISING APRON FOR UNLOADING LIGHTERS; NEW YORK DOCK CO.

the dock face, 76 ft., spanning two railway tracks and the wharf. At the end is a rising apron, with I-beam track, which can be lowered after a lighter has docked so that the trolley hoists may be run out over the deck for loads.

The track from the wharf bridge, runs into the second story of the warehouse and, just inside, branches into two tracks with a switch worked by hand chains from the floor. These two suspended tracks run to the rear of the building, turn to the right past an elevator and leave the building, passing on a structural bridge 105 ft. long, over a railway yard (Fig. 2) to a freight house. This bridge is supported on two shear legs and the freight-house roof.

The trolley hoists have a capacity of 2½ tons. Each has two four-wheel trucks swiveled to take curves of 15-ft. radius. The wheels travel on the lower flange of the I-beam, and two wheels of each truck are driven through spur gears by the travel motors. The hoisting motor is carried on the main trolley frame and geared to two drums. There is a two-part hoisting cable for each drum and these carry an intermediate frame through sheaves as shown in the accompanying figure. The limiting height of hoist is 30 ft. The hoisting speed is 50 ft. per min. loaded, or 120 ft. empty. The travel speed varies from 450 ft. per min. loaded to 550 empty. Mechanical and solenoid brakes control the hoist loads. Direct current at 220 volts is obtained through spring and wheel collectors running on wires strung along the tracks. Current is purchased from the local electricity-supply company.

For gathering miscellaneous freight, there are 12 two-ton trucks (Fig. 2) with two 10-in. ball-bearing wheels at one end, and two two-wheel swivel casters on the other end. At each end is a steel frame to hold in the load, with a hook plate for hoisting. Each truck is 8½x3½ ft. over all, and can easily be pushed around



FIG. 2. TWO-TRACK BRIDGE FOR FREIGHT TRANSFER; NEW YORK DOCK CO.

when fully loaded. For carrying bars and plates the intermediate hoisting frame carries a center hook.

Ocean steamers dock at the various piers and unload to piers and lighters. On the piers, this freight is distributed by hand trucks. The loaded lighters are towed under this equipment (as in Fig. 1) and the freight carried to the freight house, if for land transfer, or to the warehouse, if for reshipment by water. Lighters and vessels are also loaded by a reverse process. In the warehouse, the trolleys work in connection with an elevator and a chute for distributing and assembling freight. When a trolley leaves a truck load, it picks up another truck without waiting for unloading and loading.

While this plant is not yet running to full capacity, it has already replaced 12 laborers. There are claimed (1) a greater promptness in shipments, with decrease in demurrage costs; (2) elimination of wagon congestion about this dock, and (3) 50% reduction in cost of handling freight. The equipment shown was built by the Brown Hoisting Machinery Co., of Cleveland, Ohio, under the direction of F. R. Lackey, general manager of the New York Dock Co., and J. W. Galbreath, consulting engineer.

*From information furnished by the Brown Hoisting Machinery Co., Cleveland, Ohio.

†This company has docks along about 2½ miles of the Brooklyn shore of New York Bay with some 300 acres of land for warehouses and railway tracks. The company has its own tracks above the water front and to the warehouses, using dinkey locomotives for handling the cars. The only connection with the various transportation lines is by car lighters and a ferry slip. Ocean steamers may dock at 27 piers on which the railroad tracks do not run, so that the freight has to be handled by lighters or wagons.

EDITORIALS

Do Civil Engineering Graduates Practice Engineering?

In a recent address Prof. Chas. L. Crandall, of the College of Civil Engineering of Cornell University, stated that a canvass of the 1303 living graduates of that college showed the following classifications:

Chief engineers	40
Consulting engineers	64
Practicing engineers	953
Contractors	34
Teachers	69
Presidents of companies	27
Miscellaneous	116

In this classification the "presidents of companies" includes the President of the Republic of Cuba and the "miscellaneous" group includes business men, farmers, lawyers, ministers, doctors and dentists.

It will thus be seen that 1057, or 81% of the entire number of living graduates, are engaged in the direct practice of the profession for which they were educated; and if the contractors and the teachers are included, the total rises to 1160, or 89% of the whole.

The percentages are certainly much larger than current discussions of the status of the profession would lead one to infer. These figures would indicate that, for the graduates of one college at least, the attractions of the engineering profession are sufficient to engage the services of by far the greater number of those who were led by youthful ambition to a four years' study of its elements.

It is to be assumed that almost all of the men who study civil engineering follow it a few years after graduation, so that the percentage of outside businesses or professions should be greater among the older men. While the number of graduates in the College of Civil Engineering of Cornell has increased materially each year for the past ten or fifteen years, as it has in most of the colleges, still the number of graduates who left the University ten years or more ago is quite large, and the record noted above would be more interesting if the same classification could be given for the older graduates only.

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More Offers of Commissions to Engineers

In every professional code of ethics written or unwritten, one rule invariably found is that a professional man holds a trust relation toward his client and that this trust relation is vitiated by the acceptance of any compensation, direct or indirect, coming from any person other than the client, upon work in which the client's interests are involved.

It seems strange that this rule should not be universally understood; but at a recent meeting of the Institute of Consulting Engineers a member of the Institute reported the receipt of offers from a patent attorney to give a commission on such fees as might be received from any client which the engineer might recommend to him.

We are also in receipt of a letter from a well known architect and consulting engineer, inclosing a copy of a card sent out by a reputable dealer in a certain line of builders' supplies. The card, which is intended to be signed and returned by the architect, contains the following over the blank for signature:

> In cases where a sale of your ——— are a direct result of our specifying them and such sale does not conflict with your agents, and where our code of ethics will permit us to accept it, we leave to your discretion and liberality any commission you may allow us on such sales.

It is obvious that the architect who should be foolish enough to sign such a card, would at once place his reputation at the mercy of the concern holding the card.

We can but believe that the use of such methods for obtaining business is generally due to the advent into the business department of a concern of some green hand with more shrewdness than principle or experience. It ought to be obvious that the circulation by any business concern of such offers among architects or engineers would be sufficient to absolutely prevent any reputable architect or engineer from using the concern's goods. Such a concern would at once and very properly be placed upon a black list, since to specify its products would lay him open to the charge of having accepted its offer of a commission.

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Is Man Responsible for Floods?

In hundreds of newspaper editorials and doubtless as many more pulpit discourses, during the past month, it has been learnedly explained that the recent great floods were caused by changes which have been brought about by the hand of man. It is repeated everywhere that such great floods are a direct result of the wanton destruction of the forests, the cultivation of the soil, the drainage of swamps, the paving of streets and roads. All these things, it is said, cause the water which falls from the skies to run quickly off into the streams instead of soaking into the ground.

Such ideas are so widespread and one hears them so often expressed, even by engineers, that it seems worth while to inquire what scientific foundation this theory has.

Let us say at once that we shall not at this time take up again the much discussed subject as to the general effect of forests on the runoff from drainage areas. We wish to refer only to the effect of a forest cover or a forest mulch upon the rate of runoff from drainage areas subjected to extraordinary rainfall. Here, it seems to us, the case is so clear that engineers of all shades of opinion can come to unanimous agreement. It may be admitted that under favorable conditions an inch or even two inches of rainfall may be absorbed like a sponge by the deep mulch of decayed vegetable matter covering the floor of a primeval forest. After this mulch is once saturated, however, further soaking in of additional rain-

fall is extremely slow. If then the rains still continue, the additional water flows off from the flooded ground surface very rapidly.

Take the conditions which existed in the territory of heaviest rainfall in northern Ohio during the last week in March. Nearly a foot in depth of water fell from the skies within a period of four days. It is obvious that such conditions mean a rapid rate of runoff and enormous discharge even in a forest where the ground is covered deep with leaf mold.

And this is not mere theory but is what actually happens and has been many times observed. We doubt not that every engineer who has had occasion to observe stream flow and runoff in different parts of the country, has many times seen brooks and rivers flowing from densely forested regions which were swollen to great flood volume by heavy rainfall or melting snow.

Official flood records tell the same story. Many of our readers noticed, without doubt, that the recent great flood in the Hudson River at Troy was after all less in volume and in flood height than the flood recorded in the same river in February, 1857. But nearly all the waters of the Hudson River above its junction with the Mohawk come from the Adirondack region, which in 1857 had hardly been touched by lumbermen. Moreover, as those who know the Adirondack plateau are well aware, it contains an extraordinary number of natural reservoirs in the form of lakes and ponds, and great areas of swamp and comparatively level land. If the theorists who ascribe the present-day floods to the removal of the forest and the drainage of the swamps were correct, then the drainage area of the Hudson in 1857 could not possibly have produced such a record-breaking flood.

It will doubtless be admitted that if the removal of the forest and its mulch covering the soil has had no part in producing great floods, then no changes brought about through the cultivation of the soil, the building of roads or cities, or the drainage of swamps has had any more effect.

It is of interest, however, to refer here to the flood records quoted by Col. Townsend in our issue of Apr. 17, where he showed that the highest water ever recorded in the Mississippi River at St. Louis was in 1844 and the next highest in 1785. At the later of these dates as well as the earlier, the entire territory drained by the upper Mississippi and Missouri was practically untouched by man and in a state of Nature. These records of early great floods in the Mississippi are sufficient comment on those who hold the common theory that the breaking up of the prairie sod has increased the rate of rainfall or the rate of runoff.

Doubtless the fact that a great flood occurred in the lower Mississippi last year and has been followed by one of almost equal magnitude this year will form a convincing argument in the minds of some millions of people that floods are increasing in frequency. The engineer, however, who is at all familiar with records of weather, rainfall and stream flow, covering an extended period of years, knows that cycles of dry years and of wet years are apt to follow one another. Apparently the cycle of dry years which caused such great distress and damage by drought and failure of city water supplies all through the Eastern states during 1910 and 1911 has come to an end, and we are entering upon a cycle of wet years of unknown duration. This does not at all mean, as many fancy, that weather conditions are changing. There is little, if any, evidence to show that anywhere on earth any noticeable climatic change has occurred important enough to be noticeable within recent historic times.

We know of no reason, therefore, for believing that the floods which have caused such devastation during the present Spring are anything different from what has occurred before and may occur again; and they are no more likely to recur next year or the year after than they were twenty-five years or fifty years or a century ago.

The only qualification to be made to this statement is the alterations which have been introduced by man upon the river channels themselves, which have at certain points reduced their capacity to carry off high floods. These changes, the encroachment upon the river channel and its obstruction by bridge piers, dams, etc., have already been discussed fully in our columns in connection with the recent floods.

A word may be said, however, concerning the alleged injury to the channels of streams due to their being filled up by sediment, etc., carried into them. There are undoubtedly certain locations such as the American River in California, whose channel has been filled up by the débris from mining operations, where great injury has been done to stream channels through man's agency. There are also, probably, localities where erosion of the soil due to cultivation has carried a material amount of sediment into the streams, more than would have been discharged there under natural conditions.

When, however, we contrast the quantities of such sediment which can be traced to man's agency with the huge quantities which the river has brought down in its natural condition, the part that man has played is seen to be puny indeed. The Missouri River, for example, was known as the "Big Muddy" from the vast amount of sediment it carried long before any farmers were tilling the land draining into it.

Furthermore, as every engineer who has studied elementary geology is aware, erosion of lands by streams and rivers is a process which is all the time going on. The alluvial bottom lands along the course of every stream, great and small, are in fact a deposit which is in itself conclusive proof of the vast amount of sediment, gravel, sand, etc., brought down by the stream during long centuries past. Except for such local cases as the injury of streams by mine discharge, therefore, there is little reason to suppose that the agency of man has played any appreciable part in filling up the beds of rivers with deposits and lessening their flood capacity.

It seems to us that these scientific facts should be understood and appreciated by engineers at this time when so much pseudo-science is afloat and when the public particularly needs correct information on matters of this sort. The danger is that the public, which has hitherto been blind to the need of any engineering responsibility for river regulation, will now swing to the opposite extreme and expect the engineer to accomplish impossibilities.

We have already emphasized in these columns the need of the establishment of scientific river regulation in this country under proper government direction. The present year's floods serve to awaken the public to an appreciation of this need, but it is well that the public should understand at least the essentials of what can be and what cannot be accomplished.

The Meaning of the Los Angeles Bond Election.

The defeat of bond issues totalling $11,000,000 for the completion of work accessory to the Los Angeles Aqueduct at an election held on Apr. 15 should not be considered as in any sense a condemnation of that great project, on which the city has already expended or pledged itself to expend some $28,000,000. Instead, the defeat should at least raise the question as to the wisdom of the plans proposed for utilizing the surplus water of the aqueduct and also for utilizing the power which it is proposed to develop by the water drop at the lower end of the aqueduct.

Taking up first the utilization of the surplus waters, those interested in the details of two alternative plans which have been considered in the past may refer to a lengthy article on this subject published in our issue of Mar. 13. Suffice it to say here that the people did not vote on the very ingenious and sensible plan worked out some time ago by William Mulholland, chief engineer of the Los Angeles Aqueduct, and further developed and heartily approved by a commission of engineers, which reported upon the subject soon afterwards (See ENGINEERING NEWS, Dec. 29, 1910, and Oct. 26, 1912). Mr. Mulholland proposed to utilize the surplus waters of the aqueduct in areas near the city now devoted or susceptible of being devoted to intensive agriculture by means of irrigation. His proposition involved the bearing of the expense of a distribution system, or at least a large part of such a system, by the land owners. The Mulholland plan was founded on the fact that substantially the same amount of water is required in southern California for use on land devoted either to irrigation or to urban purposes. Mr. Mulholland, as explained in the article of Mar. 13, already mentioned, would have supplied this water to purchasers substantially at cost with the understanding that the area so supplied would eventually come into the city and that in the course of time the water-supply would change from that of an irrigation system to that of a regular city water-works system. The transition would be gradual and without any shock. Subsequently, there was substituted for this plan by a member of the board having supervision over the construction of the Los Angeles Aqueduct a plan of a far different sort. This plan involved carrying the water at city expense for considerable distances and there supplying it at its highest market value to irrigated lands, or lands to be put under irrigation, which in the nature of things could not be expected ever to be brought within the city. When years hence the city needed this supply for its own purposes it would have to cut off the water from these irrigated lands and leave their owners to shift for a water-supply as best they could. It was this latter plan, instead of the Mulholland plan, which was voted down by a very heavy majority on Apr. 15. The plan involved an expenditure of $4,500,000 for two different pipe-line systems.

Of course no one knows what the popular vote would have been had there been a choice between the so called Graham plan, just outlined, and the original Mulholland plan. There seems reason to believe, however, that the Mulholland plan would have been indorsed, particularly since, as we understand the case, it would have involved a comparatively small outlay.

The people of Los Angeles did approve, by a very hearty vote, a proposition to issue $1,500,000 bonds for bringing from the end of the aqueduct to the city a sufficient amount of water to supplement the present sources of supply for a number of years. This, however, will take only one-tenth of the total supply made available by the aqueduct. In other words, it will dispose of 2000 miner's inches (1 miner's inch in southern California equals 1.2 cu.ft. per min.) and will leave 18,000 miner's inches for which no use can be provided. (The aqueduct capacity is some 258,000,000 gal.)

This is far from being all. It is stated that unless some means is provided for utilizing the remaining 90% of the water there will be no power to utilize and thus the power plant now under construction at the end of the aqueduct will be useless. An Eastener might think that the surplus water might be wasted after dropping through the power plant, but besides the fact that water in southern California is too valuable to waste, if it was thus discharged it would be liable to appropriation by public or private users below.

The whole aqueduct scheme since its early stages has contemplated the development of a large amount of power, which would be of great aid to the city in taking care of the capital expenditure for the water-supply developed under such conditions as to make it almost necessary to build an aqueduct now large enough to supply the city for many years to come.

It was for the reasons just outlined that there was inserted among the proposed bond issues voted on at the last election one for an issue of $6,500,000 for completing the power development now underway and for conveying that power to the city and distributing it there. This proposition got an absolute majority of almost 10,000 out of a total vote of a little over 51,000, but as a two-thirds majority was necessary the proposition was lost. (For the vote on each proposed bond issue, see table on p. 931.)

So close a vote as this where two-thirds majority is required, combined with the large actual majority given, cannot be accounted as a condemnation of either municipal ownership in general, or of this particular municipal ownership proposition; especially not when some local factors are taken into account. Chief of these, it appears, was the intense opposition of the local light and power companies, which have fought the whole aqueduct scheme, and particularly power development, since its inception but heretofore have never been victorious.

It should be noted that an economic principle was involved here, but whether or not it was really taken into account by the voters, or at least how fully it was taken into account, we cannot say. The proposed bond issue contemplated, as we understand it, a duplication of the existing system for distributing electric current for light and power within Los Angeles. All disinterested persons whose economic reasoning is sound know that such duplications are to be avoided wherever possible. The local light and power companies made some sort of offer to make unnecessary this duplication, by buying power from the city, or, we understand, by leasing their distribution system to the city. Circular letters, it appears, were sent out by the local light and power companies to their consumers, urging them as taxpayers to vote against the proposed power distribution bonds on the ground of heavy and unnecessary increased taxation. These letters urged

that the companies were willing to buy power from the city at a price which would materially reduce the taxes and that if the city distributed the power itself it would have to materially increase the tax rate, so that putting the two together they claimed a difference of some 50 or 60c. on the tax rate in favor of having the city lease the aqueduct power to the company instead of distributing the power at municipal expense.

It is claimed by those who were ardently in favor of full municipal ownership of the electric light and power systems that the companies would not, in the proposed alternative of leasing the company systems to the city, insert an option providing for municipal purchase. It looks from this as though, had the companies been willing to make more concessions or had they in common with other public-utility corporations in California not been so drastic in the past, an altogether different outcome of the election might have resulted. Anyway, as we have already intimated, this vote on the aqueduct power distribution bonds cannot be interpreted either as a condemnation of the aqueduct scheme or of municipal ownership. Now that the election is over it seems to be quite possible for the private and public interest to get together and effect a settlement of the controversy which would be fair to all concerned and a material economic gain over the duplication of distribution systems.

Another phase of the subject which may be mentioned in passing is that although the State of California passed a fairly strong public-utilities commission law a year or two ago, it left the rate regulation of local light and other public-utility companies to the city, in accordance with a long standing constitutional provision to that general effect. This has always been a bone of contention between the cities and various public-service companies, especially as rates are or may be established yearly. If the regulation of municipal public-service rates in California were in the hands of a state commission, such a situation as now exists in Los Angeles might be very much ameliorated, since the people would be in a much stronger position when able to choose between municipal ownership on the one hand and reasonable rate regulation by an outside state commission having experienced experts at its command.

Still another bond issue which was voted down, and which may, perhaps, be interpreted as disapproval of just that kind of municipal ownership, was for $1,000,000 to build a municipal railway from the business section of the city to and around the new harbor being developed by Los Angeles in the old settlement known as San Pedro, now a part of the city. The advocates of the railway claimed that municipal ownership of such a railway line is an absolute necessity if the city is to reap to the full the advantages of the harbor developments which are being carried out. Evidently, the large majority of the voters of Los Angeles thought differently. Certainly, in the light of American practice, such an expedient is far more doubtful than municipal ownership of some other public utilities.

Why the voters threw down the city hall ($1,000,000) the civic center ($600,000) propositions we will not undertake to say; unless it was that the proposed total bond issue of $17,600,000 at a time when capital charges on outstanding bonds already make up a large part of local taxes was altogether more than the people cared to indorse. The city seems to be in need of a modern and capacious city hall, but perhaps it needs other things more just at present. The proposed purchase of a commanding site for a civic center appears to have been an issue almost forced to a vote by its enthusiastic supporters—apparently against the judgment of a considerable portion of the city fathers.

The Los Angeles bond election, as well as the charter election some three weeks earlier at which 17 charter amendments and one initiative ordinance were voted upon, both go to show that in western cities at least the people can vote discriminatingly on even a large number of propositions at one time. At both elections nearly all the votes were decisive either one way or the other; even the $6,500,000 bond issue for adequate power developmnt had a very actual though not a legal majority, as we have already stated.

It is interesting to note that in the charter election the vote went almost wholly as advised by a number of civic organizations which acted together on the subject, as well as by two newspapers of the city, while in the bond election most of the adverse decisions were contrary to the advice of the same newspapers and also to a number of civic organizations. Curiously enough, too, the public-service corporations were represented as being dead against a number of the charter amendments, which went through with good majorities, just as they were against, with success, most or all of the proposed bond issues voted upon three weeks later.

The net result of the Los Angeles situation, while perplexing in some respects, is on the whole hopeful. People voted strongly in favor of carrying on the harbor improvement and of bringing water needed for city purposes to the city at once. They defeated the surplus water distribution and the power development distribution bonds, but, as we have pointed out, they were not permitted to vote on alternative propositions which the majority of the people may perhaps have favored and which would not in any way have sacrificed the principle of municipal ownership—except to a possible minor extent in connection with the full operation of the electric light and power distribution system.

The votes were scarcely counted before the leading city officials were at work on plans for meeting the situation developed by the election. In fact, the possible failure of the bond issues had been discounted and formulation of plans had been begun long before the election.

We have every reason to believe that the magnificent aqueduct scheme conceived by Wm. Mulholland and others and so successfully carried out by Mr. Mulholland Mr. Lippincott and scores of other engineers, assisted by Mr. Scattergood as to power utilization, will come to a full and satisfactory fruition without any material loss of time. The water-supply, irrigation and power development associated with the aqueduct taken together constitute one of the most remarkable pieces of municipal enterprise ever yet undertaken in any part of the world. We are sure that the people of Los Angeles will not let any part of these grand schemes fail. We trust that in their zeal for municipal ownership they will not go so far as to enter into any such economic waste as the duplication of power distribution systems, unless the local companies are so uncompromising as to make something of the kind absolutely necessary in the protection of the interests of Los Angeles.

LETTERS TO THE EDITOR

The Study of Foreign Languages for Engineers

Sir—It is a significant fact that all the discussions in ENGINEERING NEWS about the study of foreign languages for engineers, mention not one word about the value of general literature.

Is general culture not worth even mentioning by the present American engineer? It is superfluous to argue the necessity for a cultured person to read and know literature. Where is there a richer literature than the German or French? Think of Goethe, Schiller, Heine, Lessing, Zuderman and Hauptmann, or Balzac, Victor Hugo, Maupassant, Flaubert, Anatole France and Maeterlinck. For these few alone, it is worth while to be able to read them in their own tongue and not in some translation which can reflect but little of the richness of their minds.

While in Europe, I was told that some German engineers studied English for the sole purpose of reading Shakespeare, while a French engineer had studied German to read, in the original, Goethe and Heine; another German engineer studied the Russian language to be able to read Turgenieff's and Tolstoi's books.

From the point of view of the American engineer, who has only fifty or sixty years to live and who in that short time must cram in a few dozen engineering books and build a few dozen railroads, the act of the last named German would be a sign of a high order of insanity. From the European point of view it is the sign of a high degree of culture.

Can it be a fact that the American engineer has not yet reached the standard level of culture of the twentieth century?

S. RESWICK.

N. Y. State Barge Canal,
Fulton, N. Y., Apr. 21, 1913.

A Reinforced-Concrete Dam That Has Safely Passed Its Second Flood

Sir—A reinforced-concrete dam of the Ransome type was constructed during 1912 in the Gorge of the Cuyahoga River, by the Northern Ohio Power Co. During the recent unprecedented floods in Ohio, this dam was subjected to an exceptionally unusual condition.

The dam is about 450 ft. long at the crest, and the spillway at about the center of the dam is only 119 ft. long, the crest being 5 ft. above the spillway.

The highest rate of flow in this stream which had been recorded prior to March, 1913, amounted to 2920 sec.-ft. and this spillway was designed to carry a maximum of 4400 sec.-ft. During the recent flood, however, the maximum flow rose to about 14,500 sec.-ft., not only completely filling the spillway but rising to a height of some 3 ft. above the crest.



FIG. 1. AT NORMAL FLOW

FIG. 2. FLOOD FLOW, LOOKING UPSTREAM

FIG. 3. SAME FLOOD, LOOKING ACROSS STREAM

FIGS. 1 TO 3. VIEWS OF REINFORCED-CONCRETE DAM OF NORTHERN OHIO POWER CO., AKRON, OHIO, UNDER NORMAL AND RECENT FLOOD CONDITIONS

Fortunately, this dam was founded upon solid rock and securely tied into the rock at the sides of the gorge at both ends. Since the water has gone down the writer has made a personal examination of this dam and has been unable to find any sign that the slightest damage was caused by the flood. The stream bed is of solid rock or shale and was deepened 2 or 3 ft. for a mile or so below the dam by the scouring action of boulders which were moved by the water. Some boulders equivalent to a 6-ft. cube were moved several hundred feet.

This dam was also subjected to an unusually severe test during construction, as described in your issue of Nov. 14, 1912, p. 917.

The accompanying photographs show normal conditions and conditions during the height of the flood.

J. C. LATHROP,
Of the Northern Ohio Power Co.

Akron, Ohio, Apr. 10, 1913.

Repairs to the So. Halsted St. Lift Bridge over the Chicago River

Sir—Will you be good enough to let me know from whom I con obtain a clear, accurate and unbiased statement regarding the So. Halsted St. lift bridge, Chicago, from its inception up to the present date.

I have been informed by one party that the repairs to that bridge during a period of nine years came to $60,000, of which $8000 were spent in renewing the cables. From another source I have been informed that the original cables are still in use, and that the heavy cost of maintenance was due to substituting electric for steam power in connection with the hoisting apparatus.

F. C. GAMBLE.

Chief Engineer, Department of Railways, British Columbia.

Victoria, B. C., Feb. 26, 1913.

[We made inquiry as to the above from Mr. Hammond, Engineer of Bridges and Harbor, Department of Public Works, Chicago, and he gives the figures of cost of maintenance and repairs of this bridge for the period 1905 1912 (both inclusive) as follows:

1905	Steam operated	$4,628
1906	Steam operated	6,728
1907	Steam operated 10 months	15,461
1907	Electrically operated 2 months	
1908	Electrically operated	5,481
1909	Electrically operated	7,722
1910	Electrically operated	6,369
1911	Electrically operated	6,369
1912	Electrically operated	17,093
	Total	$69,551

Prior to 1907 the bridge was operated by steam, and the cost of coal for one year amounted to $2000; whereas with the present electric power the cost of current for one year amounts to but $600. It will be noted also that there was considerable expense in changing over the plant from steam to electricity in 1907, but the actual power cost for electricity was considerably less than for steam. The operating cables were renewed in 1912 and this will account for the high cost of maintenance for that year. Mr. Hammond states that this was the first renewal of the operating cables since the completion of the bridge. The counterweight cables, however, were renewed several years ago. When the operating cables were renewed it was necessary to renew the anchor bolts which were attached to the counterweight cables. These anchor bolts had rusted so badly that one or two bolts having an original diameter of approximately 2 in. had been reduced to nearly 1 in.

In regard to an accident which occurred to this bridge on June 8, 1911, the bridge tender's report was as follows:

> The bridge was being raised to allow a steamer and tug to pass, and when the span was about 20 ft. from the top, an eye-bolt holding the counterweight broke, allowing one tier of weights at the northeast corner to fall. The bridge began to come down but was checked by the brakes when about half way down and was then slowly let down.

The damage done to the bridge was the loss of the row of counterweights and the eye-bolt.

⁂

A Flood From Underground Waters at Bellevue, Ohio

Sir—We are inclosing herewith an article from the Athens, Ohio, *Messenger*, under date of Apr. 11, describing interesting conditions at Bellevue, Ohio.

For some weeks past this town of 6000 people has been flooded with waters coming largely from the overflow of an underground stream known as "Cold Creek," which is supposed to have its principal outlet at Castalia, some miles to the north.

Bellevue is unique in possessing perhaps the only system of vertical sewers to be found in the country. There is no surface drainage. There are no horizontal sewers, and the town depends entirely for drainage upon the artificial drilled holes and the natural sinkholes leading down into the caverns underneath the town.

W. J. SHERMAN.

The Nasby, Toledo, Ohio, Apr. 18, 1913.

[The article inclosed states that parts of Seneca, Sandusky, Erie and Huron counties, in Ohio, have no surface streams of consequence, the runoff being mostly through underground channels in the limestone. Bellevue is within this area and relies upon perforations to these channels for the removal of both sewage and storm water. The story continues:

> There have been failures in this plan on one or more occasions, and the late flood conditions in Ohio developed the most conspicuous failure in all the history of the place. As long as the sinkholes took the water and carried it to some outlet, all was well, but with the torrential rains of the past few weeks, the underground passages filled to overflowing, and instead of a drainage outlet your sinkhole became a spouting geyser. Today, when all rivers and creeks have sought their natural channels, many of the sinkholes of Bellevue and vicinity continue to pour out upon the earth a flood of water.
>
> But the flowing of the sinks is not the most peculiar part of the present phenomenon. One would suppose that the water flowing from the sinks would be flood water admitted to the underground passages at a higher level and discharged at a lower one. This supposition seems to be disproved, because the water flowing from the sinks in many instances is wholly different from the flood water, in that it is crystal clear and impregnated by mineral deposits resembling the water coming from the immense Blue Hole spring at Castalia, seven miles north of Bellevue, or the famous Green Spring at Greenspring, twelve miles to the west.
>
> Sinkholes in Bellevue, right in the midst of lakes of flood water are spouting aqua pura from unknown underground reservoirs. Unquestionably there exists an underground water channel under the section of the state referred to, but all attempts to locate its place of discharge have met with failure. Corks and cork dust and other material of buoyancy have been introduced in the sinks at Bellevue in an effort to locate the mouth of the underground river, but nary a sign of any of these telltales has been found either in the Blue Hole at Castalia or in Sandusky bay.
>
> Bellevue has had the worst flood in her history, although the water in but few places would measure over two or three feet deep. The only damage done has been the flooding of cellars and the low places in streets. In the country near-by many acres of land are submerged and will be until the water in the underground passages is lowered and the sinks that disgorged the water reverse themselves and carry it down below.
>
> This is perhaps the most peculiar flood situation in Ohio, and while no lives were endangered some considerable loss has been experienced. While other cities and towns are now relieved from flood conditions, Bellevue's flood still maintains and probably will continue for another week.

It is lucky for Bellevue that this is not a case of sewage regurgitation.—ED.]

⁂

Stereophotographic Surveying

Sir—Otto Lemberger's history of stereophotographic surveying, in ENGINEERING NEWS of Mar. 27, is a very complete summary of the application of photography to surveying. The principles of the new process of stereophotogrammetry, as yet little known in America, are

clearly explained; its latest developments are described and its advantages well brought out.

After reading the article, the question which naturally arises is why, if photogrammetry offers so many advantages, is it not more extensively used? This is due to several causes. In the first place, photographic surveys require very efficient direction. Ordinary topographic surveys, whether executed by plane table, stadia, or otherwise, are largely a work of routine: in Europe, they are mostly executed by noncommissioned officers and privates of the engineering corps after a short and rudimentary training.

The surveyor knows that he has to collect certain data: his notebook or plans show him when these data have been secured. The photographic surveyor, on the other hand, has nothing before his eyes to show the progress of the work or the gaps that may exist in it. His undeveloped plates are his records: every time he exposes one, he must have present in his mind what it will give, what amount of information he can extract from it, what geometrical constructions he will apply, what further views are necessary and how they will combine.

Under no circumstances has a surveyor to display more skill and ability than when using the camera: he requires not only experience but a combination of the faculties which make an accomplished topographer. These acquirements are not the lot of every topographer and unless a man is well qualified, his attempts at photographic surveying cannot be successful.

The purely photographic part of the work affords other causes of failure. The views wanted, if they include distance, are the most difficult to obtain; they cannot be taken on ordinary plates and orthochromatic plates although suitable, present difficulties of their own. Views with great contrasts in the lights and shadows, or against the direction of the light are another source of trouble. Taking all this into consideration, what chance is there that a surveyor, at a first trial, generally with an extemporized apparatus, will be successful? A failure is almost inevitable and it is quite natural that he should discard the method as unreliable.

It must also be recognized that the photographic method has its limitations. For instance no combination of stations and views will enable the surveyor to plot a narrow road through tall woods. A flat country and a wooded country are equally unsuitable.

When, however, the conditions are favorable, results are obtained by photogrammetry which no other process can give. The latest photographic survey in Canada may be cited as an instance. It is a survey of the Mt. Robson region; it was made in 1911 by A. O. Wheeler, President of the Alpine Club of Canada, in the course of an expedition organized by the Club for the exploration of the Mt. Robson group of mountains and of the country adjacent to the Grand Trunk Pacific Ry. at the Yellowhead Pass. The expedition received a little assistance from the Grand Trunk Pacific Ry. Co. and from the provinces of Alberta and British Columbia. The instruments were loaned and the photographic plates furnished by my office The expedition started in July and came back in September: the survey, which was only one of its objects, covers about 50 miles in length with an average width of 20 miles. The map, which is published in the *Canadian Alpine Journal* for 1912, is a very fair one. Without photophy, nothing but a sketch of such an extensive tract could have been produced within the time available and with the limited resources at Mr. Wheeler's disposal.

Stereophotogrammetry has not yet been employed on Canadian surveys although it has engaged my attention for a long time. While Dr. Pulfrich was devising his well known instruments, I was working on the same problem. The solution which I proposed is described in a paper read in May, 1902, before the Royal Society of Canada: it is a Wheatstone stereoscope so arranged as to plot the plan automatically.

After the publication of Dr. Pulfrich's methods, I readily recognized that his solution was preferable to mine, and I did not continue the investigation further. Capt. Ritter von Orel's stereoautograph greatly facilitates the plotting of the plan and removes one of the objections most frequently urged against photogrammetry, viz., the length of time required for plotting.

The only difficulty that I can foresee is in finding suitable spots for camera stations. Let it be assumed for instance that from one place views have to be taken covering 180° in azimuth, the range of the plate being 60°. It will be necessary to find around the place three bases nearly horizontal, each in a definite azimuth and neither too long nor too short. It may not always be easy to find six spots suitable for camera stations when so many conditions have to be fulfilled; in a rough mountainous country it may be impossible.

Where stereophotogrammetry scores is for coast surveys: with a pair of cameras installed at the two ends of a ship, the survey of the coast is the acme of convenience, rapidity and simplicity. It is the ideal method for surveying uncharted coasts like those of Hudson Bay.

Speaking generally, it does not seem open to doubt that provided suitable camera stations can be had, the method will, when other conditions are favorable, prove the cheapest, quickest and often the most accurate of all topographical methods. It will also permit to make easily and conveniently surveys which otherwise are either very difficult or impossible, such as those of inaccessible spots or of objects in motion.

At the time the division of the waters of Niagara Falls was being considered by the International Waterways Commission, I was asked whether an accurate plan of the crest of the falls could be made: stereophotogrammetry alone could do that.

E. Deville,
Surveyor General of Canada.
Dept. of the Interior, Ottawa, Ont., Apr. 7, 1913.

ADDENDUM AND ERRATUM—In our article of Mar. 27, Dr. Deville's name was erroneously spelled Seville. A stereophotographic method of surveying was also devised independently by H. C. Fourcade, Forest Engineer, Capetown, South Africa, and was described by him in 1901 in the "Transactions" of the South African Philosophical Society His ideas originating independently of those of Dr. Pulfrich, are based on practically the same principles. A third independent experimenter was F. Vivian Thomson, Captain of the Royal Engineers of the British Army, who invented an instrument in 1908, which he called the 'stereoplotter." The readings of the three movements of the stereocomparator were reduced to a single reading on a spirally graduated drum reading to yards, which gave the perpendicular distance of the observed point from the base line, which Thomson called the "projection of range." This distance was scaled off by an adjustable straight-edge and the point located in a manner similar to that employed in the stereoautograph of Capt. von Orel.—Ed.

The Cuyahoga River in the Flood of Mar. 25-26, 1913

By Edgar B. Thomas*

The area of the Cuyahoga River watershed is about 740 square miles. This area as a whole and as compared with other river watersheds of this country is of a "rolling" nature. Although both steep and flat slopes exist they are only in rather small amounts. Probably two-thirds of the surface is under a state of cultivation. This cultivation has a tendency to slightly increase the runoff, but its most costly affect upon Cleveland's inner harbor and the shipping interests and industries located in the Cuyahoga Valley and within the City of Cleveland is to deposit sediment in large quantities in the navigable channel. The dredging of this deposit is not only expensive, but its removal cannot be accomplished until after the opening of navigation on the Great Lakes, thereby causing river-bound vessels to lighter their cargo on the lake front or Ship Channel. This lightering involves delay and considerable additional expense to the shipper. In the case of extremely high water such as occurred last week, the deposit, reducing the cross-section of the channel, causes the water to rise higher, resulting in more damage.

When the rain began about 11 a.m. on the 23d, the frost was entirely out of the ground, but there had not been a sufficient rainfall to compact the soil. This condition had the effect of increasing the erosion and resulting in greater deposits in the river channel. Soundings taken since the flood indicate that the amount of maintenance dredging required this year will exceed 300,000 cu.yd., which is approximately twice the yardage removed in 1912.

The Cuyahoga River

The river from its source about 5 mi. north of Burton to its outlet at Lake Erie near Cleveland is about 90 mi. in length and has a total fall of about 700 ft. The upper 10 mi. of this stream has an average grade of about 5½ ft. per mi., while the fall at and near Cuyahoga Falls is about 200 ft. The 25 mi. of channel above the upstream limits of navigation in Cleveland has an average fall of about 3½ ft. per mi. The remaining 5½ mi. of navigable portion of the channel is dredged to a depth of 22 ft. and maintains practically lake level, except during high-water periods. The upstream 1½ mi. of the navigable channel, or that portion above the Erie Ry. bridge (from *C* to *D* in sketch map herewith) has a width

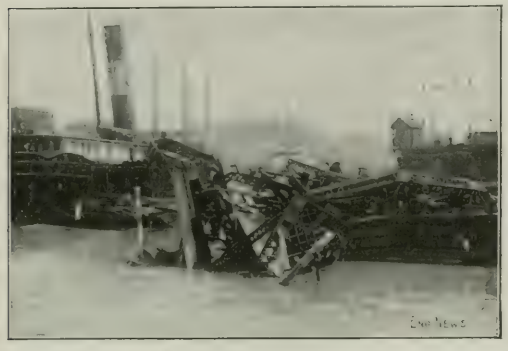


Fig. 1. Stern of Steamer "Wm. Henry Mack"

[Center pier of West 3rd St. Bridge No. 1 and portion of wrecked superstructure. Probably 90% of the wreck is under water.]



Fig. 2. West 3rd St. Bridge No. 2, Showing Position of Bridge When Motors Were Flooded

[The clear channel opening is about 110 ft., but, owing to the sharp bends immediately downstream, large vessels cannot pass through the bridge in its present position.]



Fig. 3. Lumber Boat "C. C. Barnes" on Wrecked Dock near Cincinnati Slip. About 5 Ft. Out of Water at Bow



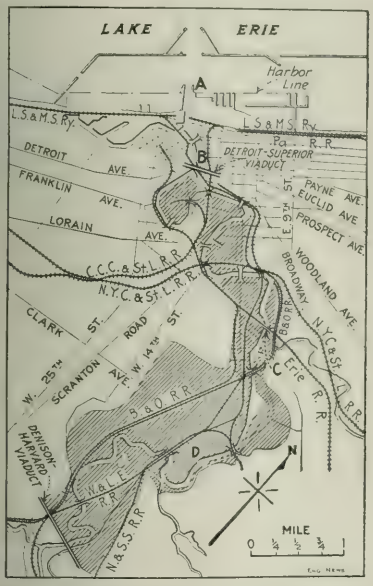
Fig. 4. View Showing Erie Ry. Co.'s Scranton Road Dock and Switch Tracks

[Long building is Scranton Rd. freight house. High-water mark is about 1 ft. above floor of cars standing on high track.]

Views along the Cuyahoga River in Cleveland, Ohio, after the Flood

*Asst. Engr. in charge of River & Harbor Department in the Engineering Division of the Department of Public Service, Cleveland, Ohio.

of 200 ft. and a depth from the dock level of about 31 ft., and is sufficiently straight for the navigation of the largest lake freight vessels. The bends are but few in number and offer but slight resistance to flow. The minimum width at bridges is about 140 ft. The ¾ mi. of channel from the Government pier heads in the lake to the Superior Viaduct (from *A* to *B*) has an average width of 280 ft., and the channel has a depth from the top of the docks of about 30 ft. At the Lake Shore & Michigan Southern Ry. bridge (the bridge nearest the lake) the channel is contracted to 130 ft. The remaining navigable portion of the channel, i.e., between the Superior Viaduct and the Erie Ry. bridge (from *B* to *C*) has an average width of 145 ft., a depth of 30 ft. from the top of docks, and a minimum width at bridges of about 110 ft. It is this portion of the river that caused



Map of Cuyahoga River in Cleveland
(Hatching shows area flooded Mar. 25-26, 1913.)

practically all of the damage in Cleveland during the flood of Mar. 25-26.

Channel Choked by Bends and Bridges

The result of the flood was largely due to the existance of 12 sharp curves or bends having radii (to the center of the channel) and total deflections (exterior angles) as indicated in the following table:

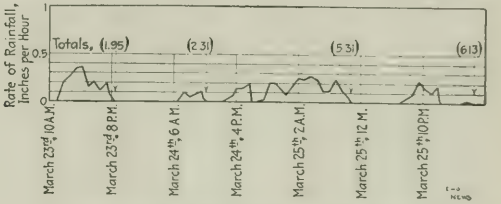
Location of bend	Radius ft	Deflection Deg.	Min.
Dry Dock St.	372	108	
Mahoning Ave.	305	51	45
Walworth Run	520	46	
Cincinnati Slip	1250	21	15
West 6th St.	1110	39	45
Collision Bend	350	147	
Big Four Ry. Passenger Bridge	665	27	
B. & O. Freight Station	540	76	45
Girard St.	530	45	30
Columbus Road	405	92	05
Irishtown	772	81	30
Superior Viaduct	295	81	
Total		817	35

Between the Dry Dock St. bend and the bend at Superior Ave., the channel is contracted and obstructed in varying degrees by 13 bridges which cross the channel, five of which have center piers. From the above table it is apparent that the channel makes total deflections, in a distance of 2.85 mi., of considerably more than two complete circles, and the radii in most cases are extremely short. And, unfortunately, in four cases the bridges are located at or near bends.

After considering the number and character of the bends in the channel, the contraction at bridges and the obstruction caused by the center piers, it is evident that a mathematical computation to determine the flow in this channel would not only be difficult, but the result would be very unsatisfactory. Galileo said he "found less difficulty in the discovery of the motion of the planets, in spite of their amazing distances, than in his investigation of the flow of the water in rivers, which took place before his very eyes." It would be of considerable interest to know what the ancient philosopher and mathematician would say had he had placed upon him the responsibility of determining mathematically the capacity of the Cuyahoga River channel as it exists today.

Rainfall and Flood Runoff

Observations were made with a current meter at the Center St. bridge and at the Jefferson St. bridge, the



Curve of Rainfall Rate at Cleveland.
Mar. 23-25, 1913.

distance between these bridges being about 3 mi. Three readings were taken at each location, one at the center and two midway between center and either dock. Assuming that the average velocity throughout the entire cross-section was 87½% of the average of these three readings, it is calculated that the runoff per square mile when the flood was at its maximum height was about 45 cu.ft. per sec. per square mile. The runoff cannot be determined with absolute accuracy for the reason that the cross-section of the channel when the water was high can only be approximated.

According to the rain gage of the U. S. Weather Bureau at Cleveland, rain began falling about 11 a.m. Mar. 23, and up to 8 p.m. 1.95 in. had fallen, the maximum rate being 0.35 in. per hour, which maximum rate lasted for about one hour. From 8 p.m. until 6:30 a.m. of the 24th there was no rain, but from 6:30 a.m. of the 24th until 11 a.m. 0.36 in. fell. The storm began again about 2 p.m., and ended at 10 a.m. on the 25th, the fall for this period of 20 hours being 3 in. An analysis of the above figures indicates that the two preliminary rains, amounting to 2.31 in., saturated the ground, thereby causing the 3 in. which fell during the 20-hr. period beginning at 2 p.m. on the 24th to produce a high runoff. In about 6½ hr., beginning about 6 p.m. of the 25th, 0.82 in. rain fell, but this did not reach the outlet until after the crest of the flood had passed, and produced a rise in the river of only a few inches.

The highest water at the outlet occurred about 9 p.m. on the 25th, or about 11 hr. after the rain had subsided. If the rain was uniform over the entire Cuyahoga watershed, it is evident that it requires 11 hr. to charge the entire Cuyahoga system.

Looking into the Future

While this flood was a little higher than any flood which has occurred for thirty years, it is very probable that another such flood will occur long before the expiration of the next 30-yr. period, for the reason that an analysis of the above figures shows that the 3 in. of rain which fell from 3 p.m. of the 24th until 10 a.m. of the 25th is the portion of the rain which caused the flood. According to the rain-gage readings which have been taken in Cleveland since 1879 a rainfall of 3 in. in 20 hours is likely to occur once every 11 years. The only other condition necessary to cause high water is the thorough saturation or freezing of the ground.

The flood of Mar. 25th was merely another of Cleveland's decennial object-lessons. This case is somewhat more aggravated, however, for the reason that property values and developments in the river valley have been greatly increased since the last high-water. The total submerged area (including both developed and undeveloped property) below the Denison-Harvard Viaduct was 2470 acres. It is impossible to reduce the damage to dollars and cents, but the suspended blast furnaces, submerged railroad tracks, flooded machinery, lost lumber and other miscellaneous items of damage should create and apparently have created considerable sentiment in favor of preventing, if possible, such damage in the future.

The problem of preventing damage by high water along the Cuyahoga River in Cleveland is comparatively simple, unless it be for the matter of creating sufficient public sentiment to insure the financing. If the river is straightened from the Erie Ry. bridge to the Superior Viaduct, as recommended recently by the Cleveland River & Harbor Commission,* the channel would have a capacity sufficient to provide for the recent high-water with a factor of safety of almost two. When the upper river is straightened and deepened this factor of safety will apply to the channel as far south as the Denison-Harvard Viaduct. The estimated cost of the lower river improvement is $4,800,000. The improvement of the upper 1½ mi. of channel from the present upper limits of navigation to the Denison-Harvard Viaduct is being carried out by interested property owners.

⁂

Bridge Damage on the Scioto River was described in the article of Julian Griggs in our issue of Apr. 10, 1913, p. 748. Three statements in that article should be corrected and supplemented as follows:

The Norfolk & Western Ry. bridge over the Scioto at Chillicothe did not have its channel spans destroyed, but lost its north approach.

The bridge approach of the Scioto Valley Traction Co. at Chillicothe across the river had the tracks and stringers carried away completely, but only 13 pile bents of the approach were entirely destroyed.

The county bridge at Portsmouth was entirely lost, not merely the east span. The bridge consisted of two spans 242 ft. and one span 160 ft. Apparently the pile foundations of the piers were undermined. The east abutment slid out as already stated, and part of the west abutment was destroyed.

*[This straightening was described in "Engineering News," Mar. 20, 1913, p. 593.—Ed.]

Notes from the Miami Valley

(Editorial Correspondence)

Piqua, Ohio, Apr. 17—Some of the interurban electric lines in this part of Ohio were as badly hit by the flood as the steam railways. Probably the worst destruction occurred on the Ohio Electric Ry. between Cincinnati and Dayton. Large sections of this line are wrecked as to tracks, wiring and structures. The two lines that run from Dayton north to Piqua were little injured beyond

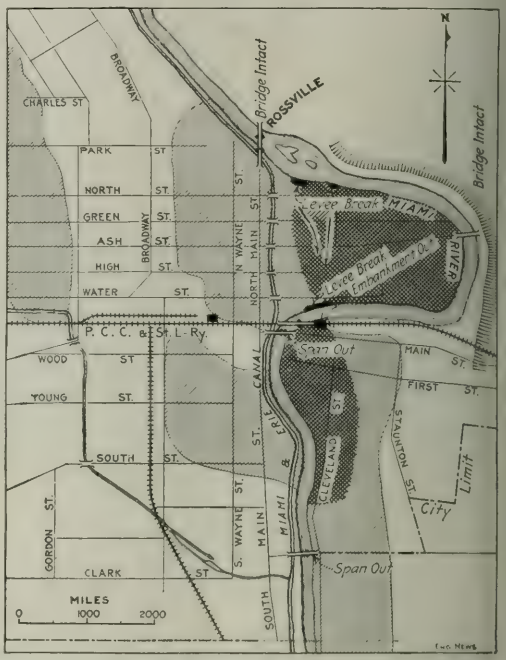


Fig. 1. Sketch Map of Piqua

(Flooded area shown single hatched. Regions of destructive currents shown double hatched. Levee and embankment breaks shown black.)

washouts of culverts and 10-ft. to 20-ft. bridges, as they are on fairly high ground all the way. Yet each of these lines had a bad washout which interrupted traffic for some little time.

The Dayton, Covington & Piqua Ry. runs up the Stillwater Valley and crosses the Stillwater by a two-span truss bridge alongside a trestle crossing of the Wellston division of the Cincinnati, Hamilton & Dayton Ry. The bridge probably was wrecked by drift. It is said a road bridge was carried down from above. The C., H. & D. trestle just below is also gone; a hundred feet of embankment at the north abutment is still there, but beyond this again a 500-ft. length of fill is out.

Work is now going on in closing the Cincinnati, Hamilton & Dayton gap by trestle. The electric line is running cars to the gap on either side and transferring passengers across on an interesting little improvised suspension bridge. Two wire ropes were slung across the piers and abutments, about 4 ft. apart, and drawn up fairly tight (5 or 6 ft. of sag), the ends being anchored to deadmen buried in the ground, and on the ropes are

cross-timbers 8 or 10 ft. apart, which support the plank flooring and handrails. The bridge seems a little flexible when a carload of passengers walks over it, but it is protected by a sign at the entrance which states that the use of the temporary bridge is at the passenger's own risk.

Piqua

At Piqua the P., C., C. & St. L. Ry. crosses the Big Miami. The river just above the bridge makes a long loop to the eastward, surrounding a straggling residence

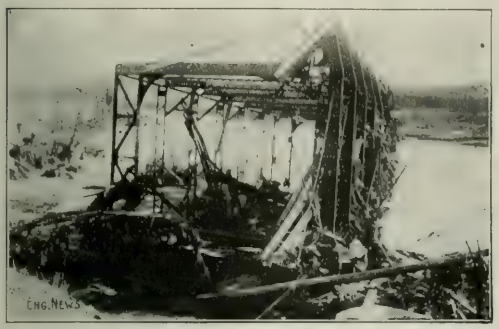


Fig. 2. A Wrecked Highway Span at Piqua, Not Much Injured by Its Fall

district. The main part of the city lies to the westward. The East Piqua section is protected by a levee on the right-hand bank of the river, extending from Rossville Bridge all around the bend to the abutment of the Panhandle bridge; see sketch map herewith (Fig. 1). The main part of Piqua lies a little higher, and is not so much exposed to overflow as East Piqua.

The Miami rose to levee height Monday evening, Mar. 24, and soon overflowed the levee along the bend around East Piqua, cutting through the levees at three places. The maximum height was reached about midnight Monday, and then the water was 4 or 5 ft. over the top of the levee, and 11.7 ft. higher than in 1898, the prior record flood. The levee washouts permitted water to short-circuit across the peninsula of low ground. Several houses were destroyed by the rapid current, or carried far off their foundations. The flood also washed out a piece of the east embankment approach of the Panhandle bridge, leaving the two through-truss spans and the abutment and pier intact, as also the new concrete piers which have been built for a new bridge at higher level (the railway is being elevated through Piqua). South of here the easterly of two spans of a street bridge was washed away, and some distance below the east span of another highway bridge. Houses on the low ground along the left-hand bank of the river between the bridges suffered considerable damage. On the sketch I have marked the sections where the current had destructive action, by crossed hatching. Some 25 to 30 persons were killed, I hear.

The river began to recede about Tuesday noon and by Thursday morning was generally off the streets. The city is supplied with water from ponds in the northwest part of the city, and the operation of the system was not interrupted at all by the overflow. The principal damage in the city was the destruction in the two outlying districts above mentioned and the general dirtying of streets and buildings and running of furniture, store stocks, etc.

The river at Piqua is about 300 ft. wide at the narrow points. Its depth at high water may have been about 22 to 25 ft. The elevation of high water at the southern part of the city is given as about 866, sea level datum (Albert Schroeder, City Engr.).

The crossing of the Panhandle Ry., above described, is blamed by many of the people for the flood damage, or at least for making the damage worse than it otherwise would have been. It is claimed that the two-span crossing did not provide enough waterway, and by backing up the water caused the overflow of East Piqua. As proof of the damming-up action of the railway bridge and its long east embankment approach, they point to the break of the east embankment just adjacent to the abutment. This embankment, however, had been cut into for the construction of the east abutment of the new bridge, which was to be a three-span structure, and the cut undoubtedly weakened the embankment so that it failed more easily when the water rose against it. The overflow and damage done below the Panhandle embankment also indicate that the river channel itself was entirely unable to care for the flow.

The question of the way in which obstruction of streams and valleys by bridges, railway embankment, etc., contributed to the damaging effect of the flood is a more or less general matter of discussion in the valley. All the railway crossings I have yet seen in this region provide for bridges over the actual low-water channel only and afford no channel across the river's flood plain, the approaches always being of solid fill. This is bound to have some injurious effect in a flood like that of last month, when the water covers the whole valley. But it is going to be a hard job to determine just where this condition was responsible for increased destruction; it does not seem likely that the Piqua situation is such as to put much blame on the railway embankment.

Troy

Troy, Ohio, Apr. 17—While a large part of Troy was overflowed by the Big Miami, the damage done was comparatively small. Alva W. Scott, City Engr., states that some four-fifths of the city area was covered by water. Destruction of houses took place practically only in a little outlying dwelling section north of the bend of the river, and in the southwest part of the city, resulting in a loss of about 15 lives.

Water came into the western part of the city Monday night, Mar. 24, and by 2 a.m. Tuesday the river stood as high as the canal. The water rose 3 or 4 ft. in the city between 4and 4 a.m.; the crest stage was not pasesd until Tuesday afternoon.

The city lies entirely on the valley bottom of the Miami, and there are indications that part of it occupies a former channel of the river, along the west edge of the valley. When the water got over the river bank on Monday night, Mar. 24, it started to flow right down this westerly low ground. A sketch map herewith shows the flooded area. Unfortunately the old channel (if it is such) has been completely blocked below the city by a railway embankment of the Big Four, about 10 or 15 ft. high above ground level. This has a 30-ft. opening

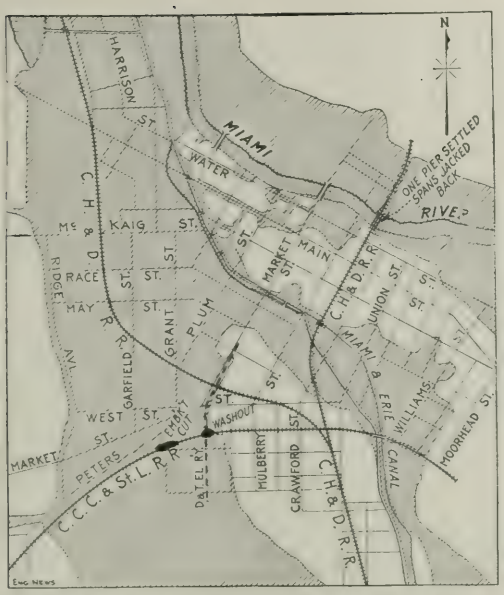


FIG. 3. MAP OF TROY, SHOWING PATH OF FLOOD WATER DOWN LOW GROUND ALONG WEST EDGE OF VALLEY

which takes the drainage from some 8000 acres of upland via the McKaig St. storm sewer, and east of this opening a short bridge over the Dayton & Troy electric railway south of the lower end of Market St. When water accumulated back of the Big Four embankment it did not find adequate discharge capacity in the two openings, and was dammed up several feet. At the crossing over the electric line the scour was so great as to undermine the east abutment and wash out some embankment east of it, leaving the tracks supported on the old fill piling. (see View A). Even this gap did not relieve the accumulation sufficiently, and the people of the neighborhood finally made a cut in the embankment a short distance west of the crossing, which soon resulted in a washout 300 or 400 ft. long.

Troy has no levees except along some farm lands. The main part of the town lies at an elevation a few feet above the westerly part, and, as the sketch plan shows, the central part was less flooded. However, it is traversed by the Miami and Erie Canal and a hydraulic race, and these, while they did not bring down a destructive water flow, made a certain amount of trouble by piling up drift and by helping to overflow the town.

No pavement was destroyed, although some unpaved streets were scoured out (at Piqua also practically no street damage was done). The work of cleaning up the streets and carrying away the house rubbish was prosecuted pretty actively, some 45 teams and 100 men being at work nearly two weeks. At this time the town looks well cleaned up.

The river dimensions and velocity, slope, etc., are not known. The elevation of high water is given as about 833, sea level.

The principal people here are strongly of the opinion that the Big Four embankment had distinct influence in contributing to the seriousness of the flood. They intend to present the facts to the Board of Army Engineers with a view to getting relief, but I do not understand just what relief is expected, whether it is to consist in a large pass through the embankment or closure of the overflow channel by a suitable levee at the upper end.

The C., H. & D. bridge in the northern part of Troy also suffered injury. This is a plate-girder through bridge of six spans, and was affected by settling of the two northerly piers, one of which is quite considerably tipped. The railway, however, managed to jack these spans back to level.

There are two highway bridges over the Miami a short distance west of this, the Market St. bridge, consisting of two steel through spans, and west of here a concrete arch bridge of three spans, recently built. Both these bridges are uninjured.

DAYTON

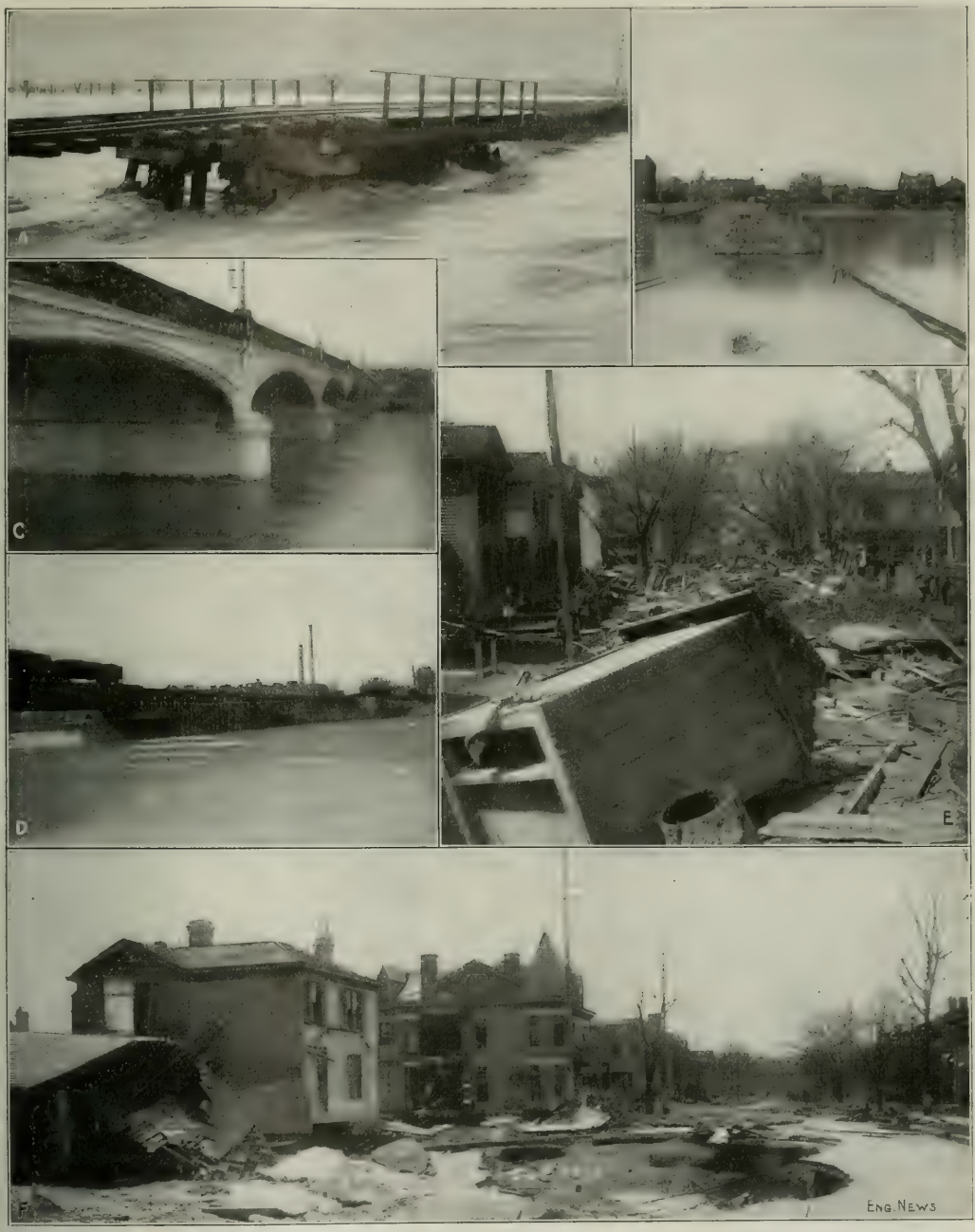
Dayton, Ohio, Apr. 19—Dayton's flood distress, which is much more severe than the Eastern newspaper reports indicate, seems to have been essentially due to submergence rather than to destruction. With the hasty notes I sent on the 15th I inclosed a sketch map showing the extent of the flooded area and marking the location of the levee washouts (ENGINEERING NEWS, Apr. 24, p. 865). The river got up to the levee top (which was nominally 3 ft. above the 1898 record-height water mark, but actually somewhat irregular) about 9 Tuesday morning, Mar. 25. The overflow quickly cut gaps in the levees, first near the upper end of the city but later also below. The middle half of the city is on the valley bottom, which is fairly well represented by the submerged area. As in the whole Miami valley, the river meanders from side to side, and the valley can be roughly outlined by drawing two lines touching the extremities of the river's bends; however, at Dayton the tributary streams make the valley rather irregular.

This valley bottom being 5 to 15 ft. below the levee tops, it is easy to imagine the effect when the water ran over the levees and started cutting crevasses through them. Where the first breaks occurred, great destruction was done; many scores of houses were washed away, wrecked or overturned, or smashed by floating objects.

It is estimated that something less than half the city's area was inundated. A more significant figure would be that representing the number of people and the number of houses directly involved in the flood, but these figures are at present subject to much guesswork. The Citizen's Relief Committee estimates that 90,000 persons were "in" the flood (total population about 120,000). H. E. Talbott, Chief Engineer to the committee, estimates that 15,000 to 20,000 buildings were in the flooded area, and from this number the magnitude of the distress produced can be judged.

The river banks are practically uninjured, except for the levee washouts and the washing and weakening of the land faces of the levees at many other points by the water overflow. The bed is probably not much scoured out, as sandbanks have again appeared above the water here and there. The scour at the time of highest water, however, must have been very great, as is shown by the washing out of some bridge piers.

The damage to the bridges is relatively slight. The city's five concrete bridges went through the flood without



A. Washout of Big Four crossing over Ohio Electric Ry., in Troy.

B. Piers of Fifth St. Bridge, Dayton, with corners ripped out.

C. Washington St. Bridge, after the flood, intact.

D. Dayton Union Ry. Bridge restored by trestling the washed-out west half.

E. Dirt and rubbish in Hanover St., Hamilton; cleaning-up work proceeding.

F. Street washout in Hamilton.

SIX VIEWS IN THE MIAMI VALLEY FROM TROY TO HAMILTON

injury, except breaking of the concrete balustrades. A number of steel bridges also passed through uninjured, (e.g., Ridge Ave. over the Stillwater, Keowee St. over the Mad, Herman Ave. over the Miami), but one railway and three highway bridges were partly wrecked, two by loss of piers and two by pushing off of the superstructure. All the bridges had water flowing over the decks.

The Helena St. bridge over the Miami just below the mouth of the Stillwater, a light highway bridge leading to an amusement park, had two spans of four carried away, and the pier supporting these two spans is gone, which might indicate that the washing out of this pier caused the spans to fall. A single-span bridge over the Stillwater at Ridge Ave., a half mile above, is intact, though water flowed over its floor. About the same distance below is the Herman Ave. bridge of five through-truss spans, near which a severe levee washout took place on the east bank, which was responsible for most of the damage in North Dayton. The bridge was subjected to a current strong enough to bend a section of both railings flat downstream, but no other damage is apparent.

The Webster St. bridge over the Mad River and nearest its mouth, consisting of two through-truss spans, was carried out, though the pier and abutments remain in slightly damaged condition. The curious thing about this is that an old single-span bridge a short distance above at Keowee St. is intact, though it has very much less waterway than the two spans at Webster St. The street bridges over the Miami in Dayton below this point are at Main St., Monument Ave. and Third St. (reinforced-concrete arch bridges of six or seven spans of 60 to 80 ft. each), Fifth St. bridge (a steel through-truss bridge whose three spans were carried off their piers), and Washington and Stewart St. (concrete arch bridges like the upper three). All five concrete arch bridges are uninjured, except for railing damage.

The most notable bridge failure in Dayton is that of the Dayton Union Ry. bridge, whose destruction cut off three railways entering from the south (Panhandle, Big Four and C., H. & D.). It was a modern deck plate-girder bridge of six spans, the three westerly of which went out. One pier is washed away and one is badly tilted. One span, intact, was carried 300 ft. downstream and lodged against the west levee, causing it to scour out part way. The failure of the bridge is possibly due to the fact that its piers did not go as deep as those of the city bridges.* The gap in the bridge was closed by trestle on Apr. 13, and trains run over it since Apr. 14.

The buildings which were wrecked seem to be in most cases such as were of light construction, as sheds, frame dwellings, etc. Where more substantial buildings were wrecked it is charged to special conditions. Thus, the North Dayton freight-house of the C., H. & D. Ry was destroyed, being struck by floating houses it is said. A foundation washout which caused the collapse of part of a corner tower of the Steele High School, at the river front on Main St., is attributed to scour of the current deflected by a bronze lion.

Building inspection has covered some 1500 buildings so far, but this is not all of those damaged. Probably 500 of these were found seriously damaged. Only a small number of "unsafe" notices was issued.

*East Main St. Bridge, described in our issue of May 19, 1904, has its piers only 5-6 ft. below river bottom.

The department has found no evidences of settlement, except where local scour occurred. The collapse of one or two buildings during the flood (e.g., Beckel building) is supposed to be due to scour, though the causes have not been investigated. A few cases of peculiar damage were found. In the Cooper Manual Training School the swelling of the interior framing pushed out the brick walls several inches. Similar effects were found in the Colonial building, but here they are attributed to expansion of the floor boarding!

When municipal functions were resumed in Dayton, it was under martial law. But there seem to be several independent authorities. (1) The Citizen's Relief Committee, which Gov. Cox made official and which has J. H. Patterson of "Cash Register" fame at its head and H. E. Talbott as Chief Engineer, is in charge of most activities. City officials seem to be under command of this committee, and the city engineer has charge of one division of work in the engineering department. (2) The sanitary administration is independent, under Major Rhoads, U. S. Medical Corps. The local board of health works under his direction as does also the officer of the State Board of Health who was sent here; both handle assigned subdivisions of the sanitary work. (3) The Red Cross organization works independently, on the problem of helping those citizens who lost all their possessions to get a new start, by supplying trades tools, the primary elements of household equipment, etc. Also, a large squad of Red Cross nurses was assigned to health work under Major Rhoads. (4) The militia is independent, being the policing authority, and apparently in critical cases the supreme authority. (5) The State Building Inspector's office has worked on the inspection of buildings suspected of being dangerous.

The Relief Committee has exercised soverign power, backed by the militia. Men, teams, wagons, motor-cars, etc., were impressed into service. The ordinary citizen was thereby much delayed in getting goods moved, new stuff brought in, etc., and at this time the signs "We Are Open for Business" are still few enough to attract attention as you go along the street. Rigid "curfew" rules, shutting everybody indoors after 6, also made the recovery slower.

The cleaning-up problem was and is enormous. The flood water deposited several inches of soft mud everywhere. This was, at the same time, a big sanitation problem, in spite of the fact that the water and sewer services were not badly disorganized and were in service from Saturday, Mar. 29. The water system was lamed by the breaking off of many street fire-plugs, and the water-works department set to work to shut off the hydrant connections just as soon as it got the pumps started. The street-car system and some parts of the electric-light service were put in service almost as quickly. Most of the schools have been cleaned out and are running again, and a public market is just opened.

Street-cleaning has been handled very largely by wagons, though a few railway cars served by locomotive cranes handling grab buckets were employed. This method is going to be used much more extensively, it is stated.

The street dirt and rubbish has been dumped partly in vacant areas, partly into the river. Dumping platforms were built on the bridges, and the wagons drive up and

tip everything overboard. Protest was made against this a few days ago, and now the order is that only pure mud is to be dumped into the river, to avoid the chance of filling the river with débris. Rubbish and the like, other than mud, is to be burned.

Railway service started up pretty well this week, but freight movement is now hampered by congestion of the freight-houses, consignees being unable to remove their goods rapidly.

The Federal government is blamed for not taking care of the river and making it safe against flooding. It is asserted here and elsewhere in the valley that the Miami was long ago declared navigable, though I heard the contrary from Major Rand of the U. S. Engineer Office at Cincinnati. Straightening the river through Dayton is much discussed, and the Relief Committee has been considering the possibilities in this direction. The location of Dayton on the valley bottom, which has doubtless always been submerged by high floods, is not mentioned.

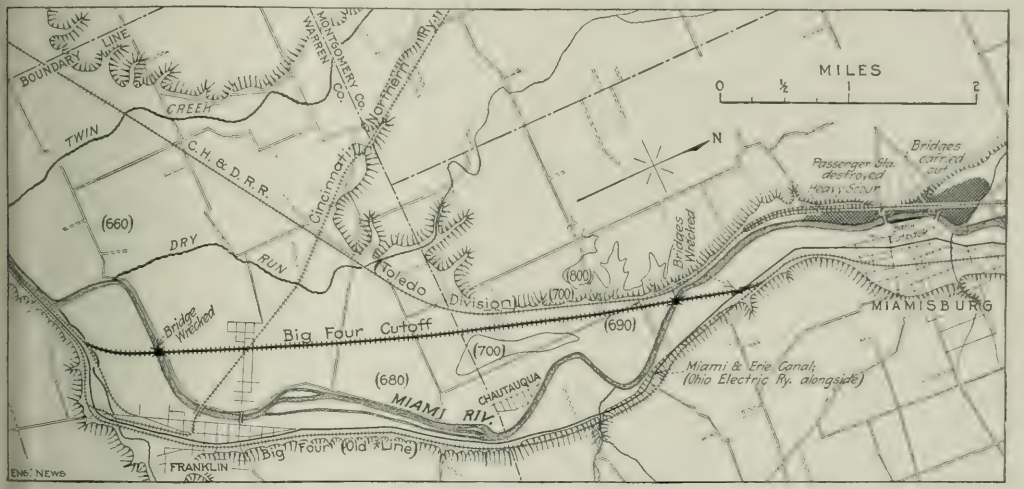


FIG. 4. VALLEY OF BIG MIAMI RIVER FROM FRANKLIN TO MIAMISBURG

(Shows approximate location of cutoff of C. C. C. & St. L. Ry. and its three wrecked bridges; and areas of damage at Miamisburg. The sides of the valley are generally of gentle slope; the hachures, at elevations 680-720, give the approximate line of the edge of the flat valley bottom.)

MIAMISBURG

Hamilton, Mar. 20—Destructive scour of the river banks occurred 11 mi. below Dayton, at Miamisburg, in spite of the absence of bends or obstruction by embankments, etc. The location appears at the right in the sketch plan (Fig. 4). Two county bridges, each three spans of about 200 ft., were carried out; both had formerly consisted of two spans, the west span being added after the 1898 high-water, with reconstruction of the old west abutment into a pier but without excavation of the bench under the new span. The reconstructed pier of the lower bridge was undermined in the present flood, and went out of sight. The west bank was subjected to intense scour, which cut the foreshore (about 300 ft. wide) down nearly to low-water level. A twine mill near the west end of the old bridge was destroyed, and the C., H. & D. passenger station, at the lower bridge and just east of the railway embankment, was swept away. Even the freight-house west of the track was torn apart and shoved off its footings, leaving only a small piece of the building standing. About two miles of track was washed off the roadbed and the latter partly scoured away. There was even more destructive though not so extensive scour on the east bank, for 1000 ft. north of the lower bridge. The river ate into the bank, and cut it back some distance, destroying a whole row of houses and the land they stood on. The east bank was submerged back to Fifth St., east of the tracks of the Big Four. Miamisburg suffered fully as much as Dayton, both in submergence and in destruction, in proportion to its size.

The highest water here was Tuesday afternoon, Mar. 25; it stood 10 ft. 1 in. higher than the 1898 flood level. It flowed about 11 ft. deep in Main St., or about 30 ft. in the river channel. Flood flow in the Miami & Erie canal, on the east bank, carried drift which did some damage. As the canal is no longer used, the people want it filled up. Altogether ten or twelve houses in the city were destroyed, and one man drowned.

Practically no sewer or pavement damage resulted. The water-works pumps were stopped by the flood. Saturday, Mar. 29, water and electric-light service were restored.

The city was cut off from the west side and the C., H. & D. Ry. by the destruction of the two bridges. A ferry was rigged up, at the instigation of the local business people. It is a small flatboat propelled by a motor-boat hitched alongside, and is guided by pulleys running on a wire rope stretched across the river (see photo).

BIG FOUR CUTOFF

One of the most unfortunate pieces of railway destruction occured a short distance below Miamisburg, on the Big Four. Three years ago the alignment of the Cincinnati-Dayton line was straightened by a cut-off extending across a bend of the river, leaving the old line on the east bank south of Franklin and rejoining it a mile below



FIG. 5. PONTOON BRIDGE IN HAMILTON

(The only way to cross, all bridges having been carried out by the flood.

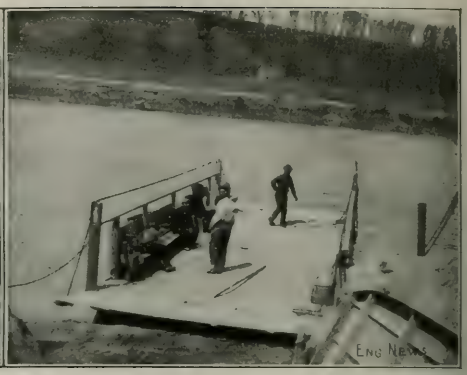


FIG. 6. EMERGENCY FERRY AT MIAMISBURG

Miamisburg. The cutoff, as roughly sketched in Fig. 4, crossed the entire river valley twice, and as it is on embankment 20 to 25 ft. high it forms two barriers across the valley, interrupted only by the two river bridges and by a bridge over the Miami & Erie Canal and the Ohio Electric Ry. at the north end of the cutoff. When the flood-flow filled the whole valley bottoms, the current was so rapid through the three openings that it scoured them out and wrecked the three bridges, besides washing off short pieces of roadbed. The cutoff was impassable, and to restore communication the railway went back to the abandoned bank location; the right-of-way, having reverted to the former owners, was secured anew, ties and rails laid, and the north end connected to the existing track by new embankment.

The three bridges were modern and of imposingly heavy appearance. The canal crossing, a skew through-truss bridge with plate-girder approach spans, was dropped by collapse of the undermined concrete abutments, and is completely ruined. The river-crossings were deck plate-girder bridges of some six or seven spans each, crossing the river on a skew; the upper one lost no spans but has several piers badly tipped, while the lower one further lost several piers and their abutting spans.

The city of Middletown fared relatively better than many other places along the river. You will be interested in two pieces of flood action, however. The forebay of a hydraulic race was cut into and the dam bypassed, leaving the risk that a flood might pass down the canal and do extensive damage; this requires emergency repair work by the state canal department. The paved causeway leading from the city to the West Middletown railway station was considerably damaged, had its river bridge carried out and much pavement destroyed; at its westerly end several houses and the railway station were wiped out. Perhaps the road tended to dam the valley and cause heavy scour through and over it.

The Ohio Electric Ry., which was very badly damaged from Miamisburg south, crosses the river valley diagonally from the southern edge of Middletown to the west bank on fill, with a river bridge and a plate-girder span over the track of the C., H. & D. Ry. Both these bridges were wrecked, and several large sections of the embankment are gone; the case reminds one somewhat of the Big Four cutoff farther upstream, as to its circumstances and the results.

The small span over the C., H. & D. Ry.* had its substantial and fine-looking concrete abutments entirely wrecked; each broke into two or three large fragments when underwashed, and these fell, with the span over them, so as to block the C., H. & D. track. Traffic on the latter was restored by hoisting the span out of the way, and laying a temporary track on sharp reverse curve winding its way through between the fallen blocks of abutment concrete. Quite a while is likely to elapse before the electric railway is again in running shape.

HAMILTON

Hamilton, Ohio, Apr. 21—Probably more destruction was done in Hamilton than in any other Miami valley city, for its size at least. The lay of the land here has a distant resemblance to that at Troy, the city being



FIG. 7. MAP OF HAMILTON

(Single hatching indicates flooded area. In the double-hatched area at the bend of the river about 150 houses were destroyed by the flood currents. Much damage was done in several other areas, one of which is shown by double hatching.)

built on the flat ground inside a bend of the river. But the Hamilton situation is complicated by an old river loop above the city, and a sharp bend of the channel just above this, with a railway bridge crossing at the bend. It seems possible that in earlier times the course of the

*Illustrated in our issue of Apr. 24, p. 868.

river may have been on the inside of the present curve of the river, and south through the land now occupied by the city, along the east slope of the valley; see the accompanying sketch map (Fig. 7). People here believe that the railway bridge—the New River bridge of the C., H. & D. Ry.—was responsible for damming back the river and diverting it southward through the city. It is a fact that this plate-girder bridge, some 10 ft. deep, was overflowed about 2 ft. over the tops of the girders (and yet the piers were not undermined!). The levels which have been taken show a very steep flood slope through the city; but at the same time the river channel was full over its banks even below the railway bridge, full enough to submerge the decks of all the bridges, and rapid enough to scour out bridge piers. If the flow which went through the city had been added to the channel flow, the damage to the city might have fully as bad as what actually occurred. There was simply an unprecedented quantity of water that had to be carried off.

The crest of the flood was 10.1 ft. above the 1898 stage, which was the maximum recorded previously. (Earlier high floods were 1866, 1884, 1897 and 1898.) No estimates of the flow in cubic feet per second have been made here, so far as I can find out. The only data remotely

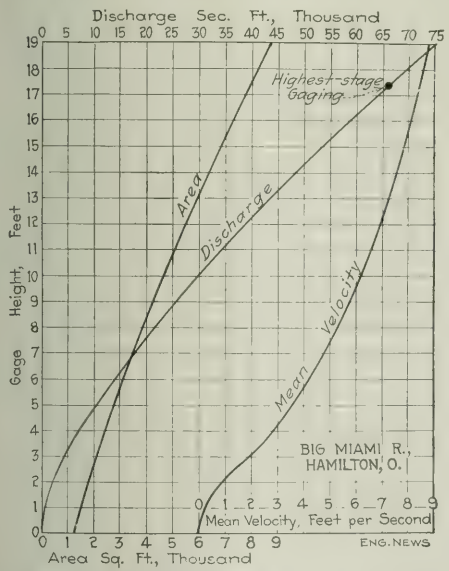


FIG. 8. RATING CURVES FOR BIG MIAMI AT HAMILTON, FROM GAGINGS UP TO 17-FT. STAGE (A. H. HORTON)
(The stage reached by the 1913 flood was 33.)

bearing on the subject are some gagings made under A. H. Horton, of the Water Resources Branch, U. S. Geological Survey (Newport, Ky.). Mr. Horton furnished the accompanying plot of these gagings (Fig. 8).

Water came down Old River Tuesday morning about 10. Maximum stage was reached at 3 a.m., Wednesday, Mar. 26, and then it fell at about half the rate of rising. The river bridges went out about noon Tuesday, i.e., long before the crest of the flood. They went out in order from upstream: Black St. (city bridge), High-Main St. (one 440-ft. span; county bridge), C., H. & D. Ry. bridge (plate-girder spans, pier went out), and Columbia bridge (county bridge). It was necessary after the flood to operate ferries and also to build a pontoon bridge; the first pontoon bridge was torn out by a slight rise in the river after the first recession, and a stronger one was then built.

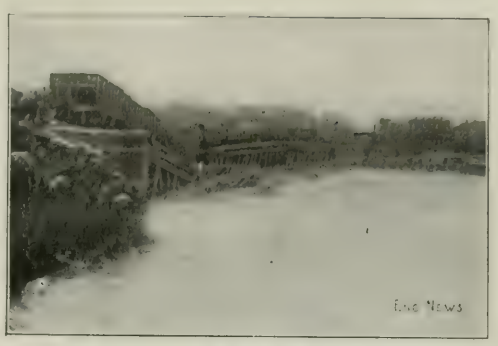


FIG. 9. FAILURE OF C., H. & D. RY. BRIDGE AT HAMILTON
(The plan of holding a bridge down by loading with freight cars, which succeeded in saving many bridges from being carried out did not protect against pier undermining.)

About 300 houses in Hamilton were totally destroyed, and many more damaged. Nearly a hundred lives were lost. The loss of life was equal to that at Dayton, a much larger city. Pavement was ripped up in many places. Some asphalted streets had the sheet-asphalt simply stripped off in sheets and fragments, while the concrete base was left in place uninjured. A similar action was noted in Dayton.

Sewers and the water-system were not seriously injured, but deposit in the sewers gave some trouble, and many of the sanitary sewers were clogged. Work at opening them is now going on actively. The outfall sewer at the pumping station (used in high-water periods) was destroyed, and the sanitary sewers were cut into the river for temporary discharge. The water system had its main across the river, supplying the west side, put out of service; the west side has been supplied by the Champion Coated Paper Co. since the flood. Generally, the water, sewer and electric services were in operation by Sunday, Mar. 30.

The Recent $17,600,000 Bond Election at Los Angeles.

BY BURT A. HEINLY*

The City of Los Angeles at a special election held Apr. 15, voted $2,500,000 for constructing docks and wharves and opening and improving the municipal harbor of San Pedro together with $1,500,000 for the construction of the City Trunk Line, a 76- to 64-in. pipe line, tunnel and conduit system to carry the water of the Los Angeles Aqueduct from the aqueduct outlet a distance of 25 miles into the city. These were the only issues out of a proposed total bond issue of $17,600,000 which received the necessary two-thirds vote to carry. The proposed bond issue of $6,500,000 for building a power distribution system and for the completion of the aqueduct power plant, with a capacity of 37,500 hp., for

*636 South Hill St., Los Angeles, Calif.

which $3,500,000 was voted in 1910, was defeated, as was the proposal to vote $2,000,000 for the construction of irrigation trunk lines through the Fernando Valley as a part of the plan to put 18,000 miner's inches of surplus water of the aqueduct to practical use. The Graham High Line plan for which the Board of Public Service Commissioners asked $2,500,000 as an initial expenditure to carry 11,000 miner's inches into the San Gabriel Valley was also defeated by a two to one vote. (See ENG. NEWS, Mar. 13, 1913, for the various plans for disposing of the surplus water of the Los Angeles Aqueduct).

The city trunk line, in anticipation that the people would approve of the action of the Board of Public Service Commissioners, owing to the urgency of its need, has been under construction since October, 1913, and much of the steel for the 13-mile inverted siphon across the San Fernando Valley is on the ground, funds for carrying on the work being advanced from the revenues of the water-works.

The action of the voters in refusing to authorize additional funds for power development and distribution has hampered severely the completion of this phase of the aqueduct project.

To save the work now underway on Power Plant No. 1 from deterioration, the Department of Public Service will advance up to $200,000, and six months hence the people will be asked to vote bonds for the completion of the plant and transmission lines to the city limits. Undoubtedly money for this purpose would have been voted at the election just held but there was no separation of expenditures for completion of the plant and the building of a distribution system. Over the latter subject there has been a great deal of discussion. The allied power companies of the city have made overtures for the purchase of the power and waged a most earnest campaign to defeat the bonds.

The aqueduct system will be turned over by the Board of Public Works to the Bureau of Water-Works and Supply of the Department of Public Service on May 1, but the formal dedication of the 235 miles of new system will not take place until June 17. Los Angeles is preparing for an elaborate celebration of the event at that time.

Meanwhile the vital problem of disposing of the surplus waters of the aqueduct, not only that the aqueduct may be made a financial success but also that hydro-electric energy may be developed from the plant now nearing completion, is presented to city officials. Three all-day conferences of officials have been held and while no definite program has been given out it appears to be the belief of the public press that the conference will determine, substantially if not entirely, upon the Mulholland plan of distribution.

Of other bond proposals having more than a local interest was that of $1,000,000 for the construction and equipment of an 18-mile railroad from the municipal harbor at San Pedro to the heart of the city's manufacturing district. The vote on this was: yeas, 8003; nos, 11,132. (The accompanying table at head of next column gives the votes on all the projects.)

A canvass of the vote on the foregoing described municipal enterprises might and probably will be used to give the impression that Los Angeles, foremost among the cities of the United States in undertaking enterprises along the lines of public ownership, has found them unsuccessful and is willing to return to private ownership of public utilities. Such an interpretation of the returns will be very far from correct. In almost every instance there were phases of each proposed issue quite removed from the question of municipal ownership and which were distinctly local.

RESULT OF LOS ANGELES MUNICIPAL BOND ELECTION, APRIL 13, 1913

(Two-thirds vote required to carry; deciding vote given in black-face type.)

	Yes	No
(1) $6,500,000 for completing Los Angeles Aqueduct Power Plant, bringing electric current to city and distributing same for light, heat and power	30,615	**20,800**
(2) $1,500,000 for Los Angeles City Trunk Line to bring water from end of Los Angeles Aqueduct to city for various city uses	**46,792**	4,987
(3) $2,000,000 for Chatsworth, Mission, Fernando and Glendale Irrigation Lines to convey surplus waters of Aqueduct to users outside city	21,912	**27,812**
(4) $2,500,000 for Pasadena-Glendora and San Dimas Irrigation High Line ("Graham High Line") to convey surplus Aqueduct waters to users outside city	15,835	**32,819**
(5) $2,500,000 for Harbor Improvements	**47,141**	5,390
(6) $1,000,000 for City Hall, including site	8,003	**41,432**
(7) $1,000,000 for Municipal Railroad from center of city to and around Harbor	22,935	**24,740**
(8) $600,000 for old State Normal School Site near Grand Ave., and W. 5 St., for site for municipal auditorium, art gallery, library, recreation, educational, amusement and other municipal purposes	10,248	**34,953**

⁂

A Traction Engine Went Through a Highway Bridge across Crum Creek on the Baltimore turnpike, near Media, Md., on Apr. 20. The bridge is said to have been over 70 years old, and had been continually complained of as unsafe for automobile traffic.

The Dynamiting of a Dam in the Napanee River, near Parham, Ont., caused a flood which swept away a highway bridge below the dam and drowned a man driving in a carriage across the bridge. The parties who wrecked the dam are unknown.

A Powder Explosion in the packing house of the Atlas Powder Co., near Larding, N. J., caused the death of three workmen on Apr. 21. The three men were killed while engaged in packing shot-gun shells with black powder. It is reported that the building contained 2100 lb. of black powder.

A Ferryboat Was Swept Over a Dam across the Hudson River, at Troy, N. Y., on Apr. 24. A fog confused the pilot. About 3 ft. of water was flowing over the crest of the dam and the ferry-boat was swept over and turned upside down. Three women passengers were drowned, but four men passengers, the pilot and the owner were later rescued from an island 1500 ft. below the dam.

The Railway Accident Caused by a Derailment on the Central Vermont Ry., near St. Lambert, Que., on Apr. 13, and noted in our issue of last week, has been investigated by a coroner's jury. Testimony showed that the roadbed was in good condition and the speed of the train not excessive. The coroner's jury verdict is summarized by the Montreal "Star," as follows:

> These eight people were killed as a result of the tender being pushed in advance of the engine instead of behind the engine, but we are of the opinion that there is no crime, because, unfortunately, it is usual for this to be done, and we are of the opinion that it should never be done again.

The Proposed Schedule of Salaries for engineering employees of the City of New York (see "Engineering News," Jan. 16, 1913, p. 110), recommended by a special committee of the society known as the Municipal Engineers of the City of New York, and discussed by the society for several months, past, has been defeated by a letter ballot. The society had previously agreed that if more than 100 votes were cast against the adoption of the committee report, it should be rejected, whatever the majority vote should be. At the regular monthly meeting of the society on Apr. 23, a motion to withdraw copies of the report which had previously been furnished to the city comptroller and the Board of Estimate and Apportionment was lost.

A Mine Explosion in the Cincinnati Mine of the Monongahela River Consolidated Coal & Coke Co., at Finleyville, Penn., on Apr. 23, caused the death of from 90 to 115 men; on Apr. 26, 88 bodies had been recovered. Regarding the explosion the "Coal Age" of Apr. 26 says in part:

> This mine is located near the Town of Monongahela, about 15 miles in a straight line south of Pittsburgh. It is one of the oldest mines in the Monongahela River Valley. The Monongahela River Consolidated Coal & Coke Co. is a subsidiary of the Pittsburg Coal Co., the latter owning practically all of the preferred and 94% of the common stock of the former. The Monongahela Co. has been for the most part independently conducted, although a portion of the operating staffs of both companies is the same for economic reasons.

The mine is a drift operation and has three principal openings. Having been in operation for such a long period of time, the workings are quite extensive. It has evidently been considered dangerous from a dust and gas standpoint, reference being found in the Pennsylvania Mine Inspector's report for 1909, where the dust was being laid by a water wagon. In later reports of the Pennsylvania inspectors the mine is also rated as gaseous.

It is ventilated by an electrically driven Capell fan, which in 1911 was furnishing 129,000 cu.ft. of air per min., at a developed water gage of 3 in., the fan running at 157 r.p.m. The inspector's report for 1910 shows that the air was divided into 12 splits, but this was reduced to eight in 1911, a portion of the mine evidently having been closed off during the intervening period.

The ventilation in the mine, according to the Pennsylvania Mine Inspector's report for 1911, was considered good in some portions and fair in others. The report further states that the defects were not due to lack of adequate power, or the most advantageous arrangement of openings and airways, but rather to a lack of attention to details and over-splitting the air. It appears that brick and concrete stoppings were freely used, there having been some 70 installed during the year 1911, together with three brick overcasts. The slope at the second opening was enlarged at this same time, a 10-ton locomotive put in service, and a Morgan-Gardner longwall electric mining machine installed.

Up to the present moment, the information available as regards the cause of the explosion is meager and entirely unreliable. It was, however, evidently of great force, press reports stating that windows in buildings several hundred feet from the mine mouth were shattered and a 15-ton locomotive completely turned over. The fan house and fan were also seriously damaged, and the ventilation of the mine badly crippled. It is evident, however, that the explosion was not general throughout the entire mine, as some 70 men made their escape. From the information now at hand, most of the fatalities have been caused by afterdamp rather than by the force of the explosion itself.

The Proposed Mechanical Filtration Plant at the Jerome Park Reservoir, New York City, has been approved by an Advisory Commission of Engineers in a report to a committee of the Board of Estimate and Apportionment, of which Comptroller Wm. A. Prendergast is chairman. Bids for this plant were received by the Department of Water Supply on Jan. 23, 1913, after an eleventh-hour protest from Mr. Prendergast and the New York Bureau of Municipal Research and the Citizens' Union (see our issue of Feb. 6, 1913, p. 283). It was agreed that an award should not be made until there had been an opportunity for investigation. The commission appointed to report on the project consisted of two engineers in the employ of the city: Nicholas S. Hill, Jr., Chairman, 100 William St., and John H. Gregory, 170 Broadway; E. P. Goodrich, consulting engineer to the Borough President of Manhattan; Amos L. Schaeffer, consulting engineer to the President of the Borough of The Bronx, and John Frazee, assistant engineer, Department of Finance, New York City. The first four agree that while the filtration of Croton water is not imperative, it is highly advisable for the improvement of its physical quality and as a safeguard against potential danger. Mr. Frazee disagrees as to the present need for filtration, but agrees as to the preference for mechanical rather than slow sand filtration, and as to the reasonableness of the lowest bid. We hope to give further particulars of these reports in a later issue.

PERSONALS

Dr. W. D. Bigelow, Assistant Chief of the Bureau of Chemistry, U. S. Department of Agriculture, has resigned.

Mr. W. S. Basinger has been appointed Division Engineer of the Atchison, Topeka & Santa Fé Ry., at Chanute, Kan.

Mr. W. D. Manchester has been appointed Chief Engineer of the Manistee & North Eastern R.R., at Manistee, Mich., succeeding the late J. J. Hubbell.

Mr. L. C. Maxwell has been appointed Engineer of Maintenance-of-way of the Algoma Central & Hudson Bay Ry., with headquarters at Sault Ste. Marie, Ont.

Mr. William Mosby has been appointed Superintendent of Transportation of the St. Louis Southwestern Ry., at Tyler, Tex., succeeding Mr. F. J. Hawn, promoted.

Mr. J. W. Walter has been appointed Acting Division Engineer of the Atchison, Topeka & Santa Fé Ry. at Clovis, N. M., succeeding Mr. W. J. Lank, transferred to San Marcial, N. M.

Mr. H. L. Ingersoll, recently Assistant to the General Manager of the New York Central & Hudson River R.R., has been appointed Assistant to the Senior Vice-President, New York City.

Mr. Thomas Berry, M. Am. Soc. C. E., has become associated with Mr. Wilhelm K. Winterhalter, Consulting Engineer and Agriculturist, with offices in the Hearst Bldg., San Francisco, Calif.

Mr. H. H. Couzens, Assoc. M. Inst. E. E., formerly General Manager and Electrical Engineer of the Corporation of Hampstead, London, England, has been appointed General Manager of the Toronto, Ont., hydro-electric department.

Mr. T. R. McLeod, formerly Master Mechanic of the Halifax & Southwestern Ry. at Bridgewater, N. S., has been appointed Master Mechanic of the Canadian Northern Ontario Ry., with headquarters at Parry Sound, Ont., succeeding Mr. C. L. Webster, resigned.

Mr. Charles J. Farley, Chief Clerk of the Department of Docks and Ferries, New York City, has been appointed Deputy Commissioner of Docks and Ferries, succeeding Mr. B. F. Cresson, Jr., M. Am. Soc. C. E., resigned, as noted elsewhere in these columns. The salary of the Deputy Commissioner is $5000 per annum.

Prof. Charles E. Van Barneveld, head of the College of Mines, University of Minnesota, has been appointed Director of the Department of Mines and Metallurgy of the Panama-Pacific Exposition. Prof. Van Barneveld is a native of Holland and is a graduate of McGill University, Montreal, Que. He has been associated with the Minnesota College of Mines for the past 14 years.

Mr. Wm. B. Fuller, M. Am. Soc. C. E., Chief Engineer of the Mexican Northern Power Co., Ltd., whose capture by Mexican bandits was noted in our issue of last week, has regained his freedom by the payment of a ransom. We are informed by the office of Johnson & Fuller, Consulting Engineers, New York City, that the power company work is now proceeding uninterruptedly.

Mr. E. H. Darling, Assoc. M. Can. Soc. C. E., formerly Assistant Engineer of the Hamilton Bridge Works Co., Hamilton, Ont., has become a member of the firm of McPhie, Kelly & Darling, Architects and Engineers, Toronto, Ont. Mr. Darling is a graduate of Toronto University and for several years has been in charge of the drafting department of the Hamilton Bridge Works.

Mr. A. G. Wells, General Manager of the Atchison, Topeka & Santa Fé Ry., Coast Lines, has been granted six months' leave of absence, and Mr. I. L. Hibbard, General Superintendent, has been appointed Acting General Manager, with headquarters at Los Angeles, Calif. Mr. J. R. Hitchcock, Superintendent of the Los Angeles division, has been appointed Acting General Superintendent.

Mr. Thomas H. Johnson, M. Am. Soc. C. E., Consulting Engineer of the Pennsylvania R.R., Lines West of Pittsburgh, Penn., has been appointed Chief Engineer of the new Chartiers Southern R.R., which is to be constructed as a feeder line to the Pittsburgh, Cincinnati, Chicago & St. Louis Ry., the Pittsburgh & Lake Erie R.R. and the Baltimore & Ohio R.R. Mr. Johnson was formerly Chief Engineer of the Pittsburgh, Cincinnati, Chicago & St. Louis Ry.

Governor Elliott W. Major, of Missouri, has appointed four of the five members of the new Public Service Commission as follows: Mr. John M. Atkinson, of Doniphan, former Assistant Attorney General of the state; Mr. John Kennish, of Kansas City, a former Supreme Court justice; Prof. H. B. Shaw, Dean of the engineering department of the University of Missouri, and Mr. Frank A. Wightman, of Monett, a member of the present Railroad Commission. The salary of each commissioner is $5500 per annum.

Mr. J. R. Taft, Assoc. M. Am. Soc. C. E., formerly Superintendent of W. H. Coverdale & Co., Inc., New York City, has become a member of the firm of Emory & Eisenbrey, Civil, Chemical and Industrial Engineers, Philadelphia, Penn. A New York City office of the firm will be opened at 50 Church St., and besides the various branches of engineering work previously carried on the firm will add railway-engineering work, including reports, appraisals, preliminary and location surveys and supervision of construction.

Messrs. J. G. Jackson, Chief Engineer of the Toronto (Ont.) hydro-electric department; J. C. Smith, General Superintendent; A. G. Lang, Engineer of Distribution; A. C. McCallum, Engineer of Operation, and six other employees have been dismissed by the Mayor, following some trouble in the accounting division of the department. The ten men dismissed had previously offered their resignations in a memorial to the Mayor, protesting against the reappointment of Mr. P. W. Ellis as Chairman of the Hydro-Electric Commission, and the summary dismissal of Mr. W. R. Sweany, Acting Manager of the department.

Mr. B. F. Cresson, Jr., M. Am. Soc. C. E., has resigned as First Deputy Commissioner, Department of Docks and Ferries, City of New York. Mr. Cresson received his engineer-

ing education at Lehigh University and the University of Pennsylvania, 1890-'94. He began engineering work in July, 1894, as a chainman with the Lehigh Valley R.R. In 1900 he became Assistant Engineer for the firm of Jacobs & Davies, Consulting Engineers, New York City, and had charge of many important parts of the work of building the Pennsylvania R.R. and the Long Island R.R. terminals, tunnels, etc., in and around New York City. At the time of his appointment as First Deputy Commissioner of Docks and Ferries in 1910, Mr. Cresson was Resident Engineer of the Pennsylvania R.R. Tunnels and the Pennsylvania Tunnel & Terminal R.R.

Mr. W. S. Murray, F. Am. Inst. E. E., Electrical Engineer of the New York, New Haven & Hartford R.R., has resigned. Mr. Murray will enter a partnership with Mr. E. H. McHenry, M. Am. Soc. C. E., until recently Vice-President of the New York, New Haven & Hartford R.R., to engage in private practice as a consulting engineer. The new firm will be known as McHenry & Murray, with offices in the Second National Bank Bldg., New Haven, Conn. The firm will take over practically the entire electrical engineering staff of the New York, New Haven & Hartford R.R. and will hereafter have charge of all the railway's electrification work, including the completion of the electrification of the main line from Stamford to New Haven. However, the firm will also undertake work for other railways and is already engaged to advise on important electrification projects in the West.

Mr. W. H. Alderson, Assoc. M. Am. Soc. C. E., recently Chief Draftsman in the bridge department of the office of the Consulting Engineer of the Union Pacific and Southern Pacific Rys., New York City, has been appointed Bridge Engineer of the Oregon-Washington Railroad & Navigation Co., with headquarters in Portland, Ore. Mr. Alderson was born in Healsburg, Calif., in 1880 and graduated in civil engineering at the University of California in 1904. His service with the Southern Pacific Ry. began in the fall of 1904 as a chainman on the relocation of the Sacramento Southern Ry., later he was a bridge and structural draftsman in the maintenance-of-way department at San Francisco. In 1907 he was engaged for a short time in survey work for the Union Oil Co. In October, 1907, he was made Chief Draftsman, Office of the Consulting Engineer of the Union Pacific-Southern Pacific Ry. System, at Chicago, Ill. The office was later moved to New York City.

OBITUARY

Jeremiah J. Coakley. Superintendent of the Terminal Railroad Association of St. Louis, Mo., and of the St. Louis Merchants' Bridge Terminal Ry., died at his home in St. Louis, Apr. 21.

William B. Reed, Jr., Assoc. M. Am. Soc. C. E., Treasurer of the Miller-Reed Co., New York City, died at his home in Brewster, N. Y., Apr. 4. He was 37 years old and graduated from Princeton University in 1896.

C. H. Baumgartner, City Engineer of Dubuque, Iowa, died Mar. 20, aged 37 years. He was a graduate of Lima College, Ohio, and was at one time engaged in Mississippi River surveys under the U. S. Government engineers.

William H. Frost, a pioneer railroad contractor, who helped to build parts of the Boston & Maine and Illinois Central Railroads, died at his home in Independence, Kan., on Apr. 18. In recent years he had been a banker.

Franklin Butler Crosby, a graduate of Stevens Institute of Technology, class of 1909, was killed in an automobile accident in Taunton, Mass., on Apr. 20. Mr. Crosby was employed in the engineering department of Gunn, Richards & Co., New York City.

Horatio A. Foster, F. Am. Inst. E. E., a consulting electrical engineer of Yonkers, N. Y., died in the subway station at the Grand Central Terminal, New York City, on Apr. 27. Mr. Foster was formerly with the engineering staff of J. G. White & Co., Inc. He was the author of a well known electrical engineering pocketbook and of a recent book on the appraisal of public-utility properties. He was also a member of the American Society of Mechanical Engineers.

E. B. Wakeman, former Superintendent of the Minneapolis Union Ry., died at his home in Hollywood, Calif., on Apr. 23. He entered the railway service in 1861 as a telegraph operator of the Illinois Central R.R. He was promoted through the operating department of various Middle Western railways to by General Superintendent of Transportation of the Great Northern Ry. in 1892. From 1895 to 1904 he was Superintendent of the Minneapolis Union Ry., after which he retired and made his home in California.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL CONFERENCE ON CITY PLANNING.
May 5-7. Annual conference at Chicago, Ill. Secy., Flavel Schurtleff, 19 Congress St., Boston, Mass.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.
May 6-8. Annual convention at Oklahoma City, Okla. Secy., H. V. Bozell, Norman, Okla.

AIR BRAKE ASSOCIATION
May 6-10. Annual convention at St. Louis, Mo. Secy., F. M. Nellis, 53 State St., Boston, Mass.

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
May 20. Annual business meeting at New York City. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL, AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL DISTRICT HEATING ASSOCIATION.
May 27-29. Annual convention at Indianapolis, Ind. Secy., D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th. St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Utah Society of Engineers.—The annual meeting for election of officers was held on Apr. 18 in Salt Lake City. The membership during the past year has increased from 80 to 150. The constitution has been revised to include Associate and Junior membership. The officers elected for the coming year are: President, A. S. Peters, Division Engineer of the Mountain States Telephone & Telegraph Co.; Treasurer, L. H. Krebs; Secretary, Fred Ulmer.

PRICES OF ENGINEERING MATERIALS

PRICE CHANGES AND THE BUSINESS OUTLOOK

Prices are tending toward lower levels and business is not as active as last month. Both pig iron and semi-finished steel are lower in price, the expected boom in cement did not materialize, building materials are not especially active and while advances have been made and there is urgent request for some classes of materials, such as lumber, tile and pipe, this is due to a special cause.

The financial situation seems to be of more importance than any other one thing. Railways with the best of credit have been unable to obtain funds for improvements except at high rates of interest for long-term bonds, or by the questionable device of short-term securities. This latter form of financiering has grown so with some railways that one company alone has about $70,000,000 outstanding in this form of indebtedness.

It is not alone in railroad bonds that the offerings have been disappointing, but municipalities have been unable to dispose of 4½% issues, and one suburb of New York will undoubtedly have to issue 5% bonds. The city of Philadelphia which had intended to put on the market $7,000,000 4 per cent. bonds for general improvements has deferred the date of offering because it is evident that these cannot be sold at par. On the Pacific Coast proposals that cities take over public utility concerns have been defeated by overwhelming vote. With all the demand for new schools there are constantly being put forward which will call for the expenditure of stupendous sums. The city of New York in addition to spending a quarter of a billion dollars for new transportation lines and broaching a scheme for bridges or tunnels costing $50,000,000, comes forward with a new sewage disposal scheme, the first part of which will cost $25,000,000, and other projects to build new docks and terminal railways the expense of which is the matter of conjecture. Developments in outlying sections of the city are calling for enormous expenditures. The tariff bill introduced in Congress is more drastic concerning the manufacture of textiles than the steel or metal schedules. In fact, there is little likelihood of its having any important effect on the importation of any of the finished forms of steel. Neither is there any likelihood of there being importation of machinery, even though the tariff is reduced to 15%. As far as the metal schedule is concerned, it will have absolutely no effect except in spelter, and there has been a revision in its price. It must be remembered, however, that spelter has been selling out of line with other metals for more than a year.

The general consumption of iron and steel is large, but the railroads are not buying. It was proved very satisfactorily during the past few years that the steel industry could get along and not go into bankruptcy even if the railroads did not buy theenormous quantity that the did previous to the panic of 1907, so there is not likely to be any startling price readjustment except the disappearance of premiums. Railways bought cars at the rate of 1000 a day in 1912, and have not been buying half that number this year. Little new bridge material has been purchased and practically none to replace the damage due to the floods in Ohio and Indiana.

It is now possible to take a more sane view of the damage done in the flooded Ohio districts. While it will take years to replace the damaged structures, still when they are renewed they will be made stronger, of greater capacity and of more permanent character. At present there is an urgent demand for laborers, and materials, and a little later skilled laborers will be wanted. Some kind of legislation is proposed which will permit Ohio cities to spread their expenditures, as far as taxpayers are concerned, over a number of years, and other legislation is expected whereby the cities will be permitted to issue a class of bonds more attractive to investors. It is a lamentable fact that the losses in Ohio chiefly fall on those least able to bear them.

The unfilled orders of the U. S. Steel Corporation on Mar. 31 amounted to 7,468,000 tons, a decrease of 187,000 tons compared with the end of the previous month. This is a decline of half a million tons compared with the end of December, which was the last high record. Reports of the Copper Producers' Association showed that during March, for the first time since last August, there was an appreciable reduction of stocks. These now amount to 104,000,000 lb. compared with 123,000,000 lb. at the end of January. In June of last year, however, they were only 44,000,000 lb.

LABOR

In the flooded districts of Ohio and Indiana, there is a phenomenal demand for any workmen who can handle a pick or shovel. While there will be plenty of work for them for the next six months, the most urgent need in the flooded district will be over within a month. There is a general demand for carpenters and all other classes of mechanics. The principal difficulty in Ohio is securing deliveries of freight. All the freight houses are congested far beyond their capacity, while the yards are filled with carload lots, and less than carload lots, awaiting some means of transportation from the freight houses.

Strikes have been frequent. Labor unrest is rampant in all parts of the country. In Auburn N. Y., some of the poorer paid workmen in twine mills struck, and finally the International Harvester Co. announced its intention of dismantling its shops, and moving its machinery to Germany. We have no sympathy with high-handed methods for labor, neither have we for any bluff on the part of manufacturers. Such an attitude is not likely to help laboring conditions, nor is it conducive to putting the company in a good light before the public. To say the least, it is a childish proceeding. The Industrial Workers of the World are attempting to force renewed disturbance in Paterson, and have a great many workmen out, but the American Federation of Labor is working in the same district, and the two antagonistic labor organizations have made more bitterness between the laborers and their employers. The award in the case of the locomotive firemen concerns the employees on 54 railroads east of the Mississippi and north of the Potomac and Ohio. It grants increases of 10 to 12% in wages, and provides for a working day of 10 hours or less, or not more than 100 miles. In the East there is not as much highway work as a year ago, neither is there an equal amount of building, but labor continues well employed, and common labor commands $2 per day.

CEMENT, LIME AND BRICK

Portland Cement—Business is active, but there is not the likelihood of a runaway market as some of the dealers professed to believe two months ago. One reason for this is that the large work in New York and elsewhere will be extended over a longer time than at first seemed possible. There is not enough labor to do all the work as fast as many would like. Then, and a very potent reason, is the fact that building is slowing down. The banks which, for the last five or six years, have been aiding all kinds of building operations, are not so enthusiastic over this aspect as they were a year ago. One reason for this is that mercantile loans are paying a much better rate of interest than they did formerly, and another reason is that bankers are too heavily loaned up on buildings. Stocks of cement are low in comparison with the demand, but there is still sufficient to meet any inquiry which is likely to appear within the next month. The floods in Ohio will have no effect on the eastern markets for the present at least.

In New York, quotations are without change at $1.58 per bbl. This is equivalent to a price of 98c. per bbl. in bulk at the mill. An allowance of 10c. per bag is made by the manufacturers for each bag returned, but most dealers allow only 5c.

In Boston, portland cement in wood is $1.72 less 40c. for bags returned. In paper, $1.42.

In Pittsburgh, the price is $1.58, less 10c. for bags returned.

Natural Cement—Business is fairly active, and prices are unchanged at 95c. per bbl. in New York, and $1.10@1.15 in Boston.

Lime—The market is steady and without change from last month as follows: State common, 200 lb. net, 97c. per bbl.; the former brand Rockland-Rockport, special, 300 lb., has been succeeded by the brand "300 Star," $1.37; finishing 300 lb., $1.55, an advance of 15c.; finishing 200 lb., $1.10, an advance of 8c.; 350 lb., $1.72, an advance of 10c.

Plaster Blocks—Prices are without change, and the market is fairly active, quotations being as follows:

	Weight, per sq.ft., lb.	Price, per sq.ft., cents
2-in.	7	6
3-in.	8½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13⅓ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

Plaster boards, ⅜ in. thick, are 16c. per sq.yd.

Brick—Brick manufacturers are hopeful that the present season will be a profitable one and result in a large demand, but from present indications this is more hope than anything else. The stock of brick on hand is fairly large, and most of the plants have resumed operation. It is evident that building work in New York will be much less this year than last, and in consequence the demand for strictly city trade should fall off. A strike among the workers in the yards at Perth Amboy in the Raritan River district will have comparatively little effect on the New York market in the present season, for the supply is bound to be greater than the demand. Prices are steady at $7@7.25 for Hudson River common; Raritan River brick is nominally quoted at $7. Brick from yard in Newark are held at $8.25.

STONE

Blue Stone—Business has recovered somewhat from its winter dullness, though trade is not what might be called brisk. Prices are steady and no unusual fluctuations are expected. Quotations in New York are at 19@20c. for flagging 3 in. thick delivered alongside of dock or f.o.b. cars, New York. Sewer bottom, 5 ft. square and 3 in. thick, are sold at 25c. per sq.ft. for large quantities. Curbing, 5x1b in., is 45c.; 5x20 in., 50c.; 6x16 in., 53c.; 5x24 in., 65c.; 6x24 in., 70c., f.o.b. New York. These prices are per lin.ft.

Promiscuous shapes of building and foundations stone sell at 70@75c. per cu.ft.

Granite—Inquiry is falling off and there seems to be little work in sight that will call for granite. Prices continue steady at 40@50c. per cu.ft.

Limestone—The demand is small and new business in sight is less. Prices continue steady and unchanged at 80c.@$1 per cu.ft. for limestone in the rough delivered alongside of dock New York. Dressed stone in New York is quoted at $1.25@1.50 per cu.ft.

Interior Stone—Slate flooring, 1 in. thick, can be had at 20c. per sq.ft. for the common or ribbon variety. Clear black sells at 35@40c., and the same price is asked for Vermont. A combination of slate and marble flooring is 30c. per sq.ft.

Marble floor, finished ready to lay, of Vermont marble, is 50@70c. per sq.ft.; Italian marble, 70@90c. Tennessee marble can be had at 65c. Ordinary stair work, such as state steps, is quoted at 24c. per sq.ft.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—The rush of spring business was delayed during April on account of unsettled weather conditions which prevented the handling and shipping of material. Almost everyone connected with the trade felt the effects of this delay. During the last week in April, however, numerous large orders were received by dealers, which portends that the expected demand will surely materialize. Prices are quoted at 85@95c. per cu.yd. for 1½-in. stone, 90c.@$1 for ¾-in. stone, and 90c.@$1 for screenings. These quotations are for full cargo lots of 500 cu.yd., delivered alongside of dock, New York.

Sand—Shipments of spring orders are now being made with regularity. Business is coming up to expectations and increasing trade is predicted. The price now quoted for full cargo lots, delivered alongside of dock, New York, is 50c.

Gravel—Spring construction work is now beginning to make heavy demands for this material. More and more gravel is required each succeeding year and present conditions point to even a far greater call this year than ever before.

Quotations are 85@90c. per cubic yard alongside of dock. Prices are quoted for full cargo lots of 500 cu.yd.

IRON AND STEEL

Pig Iron—A further decline in pig-iron prices occurred during the month, numerous reductions of 50 and 75c. a ton being noted. This was chiefly in foundry iron, but steel-making irons also declined, due to over-production. Toward the latter end of the month, there seemed to be more snap to the market, and one sale of 40,000 tons of basic was made to an independent steel manufacturer in the Eastern market. This, however, was at prices 50c. a ton below the last purchase made by the same interest. The soil pipe interests in the East have purchased small quantities. The general buying, however, has been of small lots for nearby shipment, and indicated that buyers were in haste to secure supplies, as stocks at their foundries were running low. The production of pig iron, according to figures of "Iron Age" during March, aggregated 2,798,600 tons, a falling off as compared with the preceding month.

Quotations for lots of 100 tons and over, from the points named, are as follows: Cincinnati, Southern Foundry No. 2, $15.25 to $15.75, a decline of $1 following a decline of 50c. in the preceding month; Southern Foundry No. 4, $14.75 to $15.25, which is also a decline of $1 per ton; Northern Foundry No. 2 is $16.75 to $17.25. In Philadelphia, Eastern Pennsylvania No. 2 plain is $17 to $17.25; Virginia No. 2X Foundry, $17.75 to $18. In Chicago, No. 2 Northern Foundry is $16.75 to $17.25 and No. 3 Foundry is $16.25 to $16.75. In New York, Northern Foundry No. 2 plain is $16.50 to $17, and Northern Foundry No. 2X is $16.75 to $17.25. In Pittsburgh, basic iron is $16.75, and bessemer $17.90. These prices are lower compared with last month. They include the 90c. freight rate from the valley to Pittsburgh. In Birmingham, prices are again lower and iron can be had on contract at $12.50 to $13.

Steel Rails—The mills are working to capacity on old orders, and new orders have been rather more plentiful this month than last. Early in the month, railroads bought 65,000 tons, and toward the latter end, the Atlantic Coast Line closed for 7000 tons; Baltimore & Ohio for 5000 tons, the St. Paul 2000 tons, while the Missouri Pacific order for 35,000 tons including 10,000 tons for the Denver & Rio Grande, went to a Colorado mill. Some fair export orders are in sight.

Prices are unchanged on a basis of $28 for standard sections of bessemer rails, and $30 for openhearth rails. Girder rails in 30-ft. lengths are $36.40 per gross ton, and 60-ft. lengths $38.40 per gross ton, f.o.b. New York. Other quotations, f.o.b. Pittsburgh, are as follows: Standard sections, 16 and 20 lb., $1.30; 12 and 14 lb., $1.35; 8 to 10 lb., $1.40. In New York, relaying rails are held at $22@22.50, and Chicago standard section relaying rails are held at $24.

Track Supplies—Laying of rails and rail replacements began much earlier this year than before due to the shortage of labor, and the knowledge that when the harvest season comes, the western railroads will be unable to hold the laborers. One northwestern road began rail replacements about Apr. 1. The demand is steady, but new buying is rather light, as most of the railroads covered their requirements several months ago. Quotations are as follows: Spikes in large lots to railroads, Pittsburgh, are $1.80; small contracts, $1.90@2. In Chicago, spikes are $1.95@2.05; track bolts with square nuts, $2.30@2.40 and angle bars $1.50. All of these quotations are per hundred pounds. In Chicago, tie plates are quoted at $33@35 per net ton. The extras on railroad and boat spikes are unchanged as follows:

Railroad spikes	Cents
2, 2½, 4, 4½ and 5x½	Extra 10
3½ and 4x⅝	Extra 20
2¾, 4 and 4½x¾	Extra 30
2½x⅞	Extra 40
2½, 3 and 3½x⅞	Extra 60
2x1	Extra 80

Structural Materials—Business is much less active than it was a month ago to all parts of the country. Shops in the Middle West expected a great deal of work as a result of the floods but so far little has been most disappointing, the Big Four being the only road which has bought any considerable quantity of material. From all parts of the country complaints are heard regarding the lack of activity in general building, and prices for fabricated work have declined from $6 to $10 per ton. The demand for cars and equipment is not as great as two months ago, still there is much of this work yet on the books of the steel companies.

Quotations are easier, especially future deliveries, the premium disappearing, as fairly prompt shipments are made. Prompt shipments of angle beams in Pittsburgh can be had at 1.65@1.70c. Orders for later delivery are 1.45c. Other quotations for deferred deliveries, are as follows: I-beam over 15-in., H-beams over 18-in., angles over 6-in., $1.55. Deck beams and bulb angles, 1.75c. The following extras are made for cutting the specified length. Under 3-ft., 25c. per hundred pounds. Under 2-ft. and more than 1-ft., 50c. per hundred pounds. Less than 1 ft., $1.55 per hundred pounds. No charge is made for cutting special lengths 3 ft. and over. No charge is made for cutting special lengths 3 ft. and over. The base price for beams and angles, Chicago delivery, is 1.63@1.68c. Base price for jobbers' stock in that center is $2.05.

Cast-Iron Pipes—Contracts amounting to approximately three-quarters of a million dollars for section 1 of the high-pressure fire main will be let in New York in the near future. The lowest bidder has not placed orders yet for this pipe. Market changes are relatively small, but on account of the lower prices for pig iron a reduction in pipes is expected. Quotations for cast-iron pipes per net ton of 2000 pounds are as follows:

Chicago, 4-in., $29.50; 6-12-in., $27.50; 16 in. and larger, $26.50.
Birmingham, Ala., 4-in., $23.50; 6-in., $21.50.
New York, 6-in., $23.50@25.
Gas pipe is higher in all markets.

Pipe—The heavy inquiry for pipe is a reflection of the good business transacted by the oil companies. Most of the orders for pipe are from oil producing companies, and while no especially large orders have been received, numerous orders for fair quantities are in prospect. The largest order placed recently was by the Philadelphia Co., of Pittsburgh, which included 30 miles of 16-in., 15 miles of 12-in., and 35 miles of 3- to 8-in. Mills can readily take care of the demand at present. On Apr. 12, discounts were revised which made an advance of approximately $1 a ton in the price of pipe, or a reduction of one-half point in the discount. New discounts, which are well maintained, are as follows:

	Black	Galvanized
¾- to 2-in. steel butt welded	79½%	71%
2½- to 6-in. steel lap welded	78½%	70%
7- to 12-in. steel lap welded	75½%	65%

At these discounts the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.35	3.35	5-in.	31.80	44.50
1-in.	3.50	4.90	6-in.	41.50	58.50
1¼-in.	4.73	6.57	7-in.	58.00	83.50
1½-in.	5.56	8.00	8-in.	61.00	87.50
2½-in.	12.60	17.50	10-in.	$1.00	$1.44
3-in.	16.50	22.10	11-in.	1.14	1.62
4-in.	23.30	32.80	12-in.	1.24	1.81

Piling, Sheet Steel—Excellent orders have been taken by manufacturers of sheet-steel piling within the month. A rush order of 750 tons was sent by special train to New Orleans as a protection against expected high water. About 5000 tons will be required for the New York Barge Canal, and it is expected that 2000 tons will be used in the government dam at Troy, N. Y. Prices are firm at 1.60c. Pittsburgh.

Sheets—Practically all the mills that were put out of commission by the high water have been able to resume, and many of them have done so, although probably 15% additional capacity could be put to work if it were possible to secure a sufficient supply of sheet bars or the semi-finished material. The leading interest is operating its mills to 75% of capacity. As a rule, most of the manufacturers of sheets are from 12 to 14 weeks behind specifications. Quotations are unchanged from last month and are as follows, f.o.b. Pittsburgh, or f.o.b. Chicago in cents per pound:

Nos.	Cents per pound—Carload lots, Pittsburgh Black	Galv.	Small lots, Chicago Black	Galv.
10 and 11	2.00	2.50		
12	2.00	2.60	2.70	3.35
13 and 14	2.05	2.60	2.75	3.35
15 and 16	2.10	2.75	2.85	3.45
17 to 21	2.15	2.90	2.90	3.60
22 and 24	2.20	3.05	2.95	3.75
25 and 26	2.25	3.20	3.00	3.90
27	2.30	3.35	3.05	4.05
28	2.35	3.50	3.10	4.20
30	2.50	3.80	3.50	4.60

Rivets—Manufacturers of rivets have caught up with their orders, and are now in a position to ship promptly. The demand has fallen off to quite an extent. Quotations are unchanged at 2.20c. for structural rivets, and 2.30c. for cone head boiler rivets. These prices are per keg of 100 lb. in carload lots f.o.b. Pittsburgh.

Castings, Gray Iron—Business is not as active as it was a month ago, although prices are fairly well maintained. Some consumers who expected to get lower quotations on account of the reduction in the price of pig iron have been unable to do so. General building castings are held at 1.75@2 to 2.25c. per lb. Rough castings for footings, manhole covers, and other outside work are 1.65@1.90c. per lb. Castings for heavy machinery and lock gates, where the amount of material is large, the order, if desirable, can secure castings at 2.25@2.35c. per lb.

Plates—Manufacturers continue to catch up with orders and shipments are much more satisfactory. New business is coming in slowly, and there is a dearth of new orders, espe-

cially from car builders. Railroads are not buying cars in any quantity. The largest recent order was for 3000 cars from the Grand Trunk, the Frisco has an inquiry in for 1000 cars, while the Wabash is attempting to buy 1000 cars. The largest order that has been received in a long time, if not the largest single order ever placed by any company, was booked on Apr. 13, when the Standard Oil Co. bought 100,000 tons of plate for tank work and pipe-line work. Shipbuilding continues active, and there is a prospect that more bottoms will be laid down later in the year. Rumor has it that the Hill interests in the Great Northern expect to build four new boats for use through the Panama Canal.

Quotations are slightly easier, prompt shipments from Pittsburgh being obtainable at 1.60c., and contracts at 1.45c. In New York, future deliveries are 1.61c., while prompt shipments are 1.76c. Extras are unchanged from last month as follows:

	Cents per lb.
Gages under ¼-in. to and including $\frac{7}{16}$-in. on thinnest edge	.10
Gages under $\frac{5}{16}$-in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40

Old Materials—Markets have been quiet, and, on the whole, there has been a great deal of pessimism, but it is worthy of note that price changes have been comparatively few. In the New York market, there have been declines of 25c. a ton each, in heavy-melting steel scrap and in wrought turnings, while No. 1 railroad wrought is 50c. a ton lower than a month ago. Other quotations are unchanged, but the New York market seems to be relatively steady, and quotations are as follows per gross ton:

Heavy-melting steel scrap	$10.75@11.25
No. 1 railroad wrought	13.25@13.75
Pipes and flues	10.75@11.25
Cast borings	8.00@ 8.50
Machinery cast, broken up	11.25@11.75
Stove plate	8.75@ 9.25
Malleable castings	11.00@11.50
Wrought turnings	8.00@ 8.50
No. 1 yard wrought long	12.00@12.50

In Chicago, there has been some encouragement, and the price of railroad malleable and heavy-melting steel scrap are both higher. Despite this fact, railroad offerings have been large. There will be several more offers by railroads during the coming month. Quotations in Chicago are as follows:

	Per gross ton
Heavy-melting steel scrap	$12.00@12.50
	Per net ton
No. 1 railroad wrought	$12.25@12.75
No. 2 railroad wrought	11.50@12.00
No. 1 cast scrap	12.50@13.00
Pipes and flues	9.25@10.75
Agricultural malleable	11.50@12.00
Railroad malleable	13.25@13.75

In the Pittsburgh market, while there is a great deal of pessimism, prices compared with last month are unchanged. There is a better demand for foundry scrap than a month ago. In Pittsburgh all quotations are per gross ton and are as follows:

Heavy-melting steel scrap	$14.25@14.50
Rerolling rails	16.25@16.50
No. 1 cast scrap	14.25@14.50
Old car wheels	15.75@16.00
Machine-shop turnings	8.50@ 8.75
Stove plate	10.50@11.00

Wire Rope—Prices are without change. The discount to the larger trade is 42½ and 5% from list, for galvanized, and 50 and 5% for bright.

The net prices of wire rope are as follows:

Diameter in.	Price per ft.—Cast steel	Crucible steel	Plow steel
2½	$1.05	$1.24	$1.46
2¼	.85	1.05	1.22
2	.57	.65	.76
1¾	.55	.54	.64
1½	.32	.39	.45
1¼	.23	.28	.32
1	.15	.18	.21
¾	.10	.11	.13
⅝	.07	.09	.10
½	.06	.07	.07

Steel Shapes—Jobbers and distributors have been accumulating a stock for the last few weeks and now have a very fair assortment. Quotations are unchanged and the following prices prevail from store, either New York or Chicago:

	Per lb.
Refined iron:	
1 to 1⅞ in., round and square	2.10c.
1½ to 4 in. x ¾ to 1 in.	2.10c.
1½ to 4 in. x ¼ in. to ½ in.	2.30c.
Norway bars	3.60c.
Soft steel:	
¾ to 3 in., round and square	2.05c.
1 to 6 in. x ⅜ to 1 in.	2.05c.
1 to 6 in. x ¼ and $\frac{5}{16}$ in.	2.20c.
Rods—$\frac{5}{16}$ and ½ in.	2.15c.
Bands—1½ to 6 x $\frac{5}{16}$ in. to No. 8	2.35c.
Beams and channels—3 to 15 in.	2.15c.
Angles:	
3 in. x ¼ in. and larger	2.15c.
3 in. x ⅜ in. and ½ in.	2.55c.
1½ to 2½ in. x ⅛ in.	2.30c.
1½ to 2¾ in. x $\frac{5}{16}$ in. and thicker	2.20c.
1 to 1¼ in. x ⅛ in.	2.30c.
1 to 1¼ x $\frac{5}{16}$ in.	2.35c.
Tees:	
1½ to 2½ x ¼ in.	2.25c.
1½ to 2½ x ⅜ in.	2.35c.
3 in. and larger	2.25c.

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

⅜ in.	$7.50
½ in.	4.95
⅝ in.	3.95
¾ in.	3.40
⅞ in.	3.29
1 and 1⅛ in.	3.00
1¼ and 1⅜ in.	2.90
1½ and 1⅝ in.	2.80
1¾ and 2 in.	2.70
1 to 1¼ in.	2.60

Extras for BB:

⅜ in.	1.50
½ in.	1.50
⅝ and larger	1.25

Extras for triple B (BBB)

⅜ and ½ in.	2c.
⅝ and larger	1.75c.

Freight Rates—The freight rates on finished-steel products, from the Pittsburgh District, including plates, structural shapes, merchant steel and iron bars, pipe fittings, plain and galvanized wire, nails, rivets, spikes and bolts (in kegs), black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandaigua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Switch Points—The following prices are named f.o.b. mill, for switch points in lots of ten or more pairs: for 60-lb. rail, 10-ft. points, $16.25; 15-ft. points, $17.50; for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25; for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points, $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 50, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter in in.	Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete: Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	16	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.19	74.22
10	14	66.42	71.08	96.15
11	14	71.20	76.57	102.24
12	14	83.75	89.15	118.30
13	14	89.67	96.55	127.98
14	14	99.14	105.51	138.85
15	14	108.05	114.89	151.92
16	14	117.53	124.92	166.53
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	301.32	314.89	395.37
30	10	324.81	399.15	430.64

*Made in both lighter and heavier gages at corresponding differences in price.

Lag Screws—The net price of lag screws has been advanced. Quotations per 100 lb. f.o.b. Pittsburgh are as follows:

Length in.	Diameter in inches—½ in.	¾ in.	1 in.
3½	$1.14	$2.24	$4.50
4	1.21	2.36	4.76
4½	1.20	2.50	5.02
5	1.35	2.57	5.28
6	1.50	2.92	5.80
7	1.69	3.20	6.32
8	1.78	3.48	6.84
9	1.93	3.76	7.36
10	1.97	4.04	7.88
11	2.21	4.32	8.40
12	2.36	4.69	8.92

Nails—Very little new business has been placed since the advance in the middle of March. This was expected, for consumers have had an intimation for a long time that an advance would probably be made and placed a great many orders for future delivery. Later in the year it is expected that purchases will be somewhat larger, but, on the other hand, building is not as active as two months ago. New prices are as follows: Wire nails, $1.80, f.o.b. Pittsburgh. In Chicago, carload lots to retailers are $2.03; less than carload lots, $2.08. In New York, wire nails from store are $2.10. Cut nails are $1.75 to $1.80 in Pittsburgh and $2.10 in New York. All these quotations are per keg of 100 lb.

Coke—The demand has moderated to quite an extent, but operators are refusing to make any contracts below $2.50 net at oven. There has been a few sales of coke already loaded on cars at $2.25. This by no means establishes a market. Shipments are practically normal and the interruptions due to the floods have to a large degree disappeared. Foundry

coke is in fair demand and prices are slightly easier at $3 per net ton at oven, although $2.50 has been quoted.

Wire—Most of the orders for wire were placed prior to the advance, and mills are now making their shipments on contracts. Specifications are fairly good and shipments are made with reasonable promptness. Quotations are unchanged as follows: Paved barbed wire in large lots, Pittsburgh, $1.80; galvanized, $2.20; annealed fence wire in carload lots, $1.60; galvanized, $2. In Chicago annealed fence wire is $1.78; galvanized, $2.18. Barbed wire in that market is $1.98 and galvanized, $2.38. All these quotations are per 100 lb.

REINFORCING MATERIAL

Bars, Concrete Reinforcing—Manufacturers and distributors are catching up with their orders. Buying has been larger during the last few weeks, and despite a weakness in the price of bars for general manufacturing, prevailing quotations are for immediate acceptance only. Stocks in warehouses show a decided improvement, but premiums are still demanded and paid for prompt shipment.

The base price in Pittsburgh is 1.50c. for mill shipments. Other quotations are as follows in cents per pound:

	Mill shipments f.o.b. Pittsburgh	From warehouse Pittsburgh	From warehouse New York
½-in. and larger	1.50	1.95	2.25
⅝-in.	1.55	2.05	2.30
¾-in.	1.60	2.15	2.35
⅞-in.	1.70	2.25	2.45
1-in.	2.00	2.50	2.75

Bars from stock, Pittsburgh, are usually cut to the required length, without extra charge.

Triangular Mesh—Manufacturers of this reinforcing material make shipments from warehouse promptly, but direct shipments from the mill are subject to a delay of approximately two weeks. Stocks are fair, the demand is seasonably large but not record breaking, and prices f.o.b. Pittsburgh continue steady and unchanged from last month as follows:

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material: Carload lots	Plain material: Less than car lots and over 10,000 sq.ft.	Galvanized: Carload lots	Galvanized: Less than car lots and over 10,000 sq.ft.
*4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 150, 300 and 600 ft.

METALS

Copper—Buying on a large scale by both foreign and domestic consumers of copper developed early in April. Before the movement spent its force producers' books were well filled with orders running up to the end of May. The prices of the several brands advanced ½c. per lb. while the active accumulation was in progress. Toward the end, leading sellers marked up an additional ⅛c. making electrolytic 15.75c. delivered 30 days, lake 15.87½@16c., and casting 15.50c., but these levels remained practically nominal during the latter part of the month, while other sellers supplied a rather light demand at ⅛c. below. The export movement continued heavy up to the close of the month. According to Custom House returns up to April 25, 30,900 tons had been shipped to Europe. Since March 1, 73,338 tons of copper have been exported. While it is pretty generally conceded that the requirements of the foreign manufacturing trades are not as great as implied by such a large total of shipments, the excess is not regarded as entirely out of proportion to European prospective needs.

Tin—The extent of pig tin price fluctuation during the month of April represents a value of 1½ per ton in London and 2c. per lb. in the domestic market. Due to heavy deliveries to interior points during March, and light arrivals of fresh supplies up to April 15, stocks became rather scarce in New York and sellers demanded a premium for prompt metal. This condition was followed by an advance in London from £215 to £231 which the local market failed to fully reflect, and at the close of the month domestic quotations were slightly under parity with these abroad. The rapid advance caused buyers to reduce purchases to a minimum, resulting in small sales during the latter part of the month. Tin for near-by delivery sold at 50 12.25c.

Arrivals since April 1 aggregate 3590 tons and there are 2100 tons afloat.

Lead—With a good volume of business in pig lead, the price held firm all through the first half of the month. On April 22, the American Smelting & Refining Co. advanced its quotation on fifty ton shipments to 4.50c. in New York and the general producing trayel followed with like increases. Buyers have shown less interest since the advance but there is no pressure to make sales under the general market.

Spelter—The price of spelter declined from 5.85c. to 5.60c. during April, and met with very little support, even at the low figure. It is the general opinion that producers' stocks accumulated during the open winter, hence the constant desire to sell that has prevailed in the face of rather light demand. The hesitancy among buyers can also be connected with pending tariff changes.

Miscellaneous Metals—Small lots of metals and metal produced are sold at the following quotation:

	Per lb.
Bismuth	$2.25
Brass tubes, iron-pipe sizes:	
½-in.	.23
¾- to 3-in.	.22
3½-in.	.23
4-in.	.23
Brass rods	.18¼
Brass sheets	.18½
Solder, half and half guaranteed	.32
Zinc sheets	.10¼
Manganese bronze rods	.18¾
Manganese bronze in crucible form	.16¾

Old Metals—The market is steady and prices are firm. Dealers, in New York buy small lots at the following price:

	Cents
Copper, heavy and crucible	14.25
Copper, heavy and wire	14.00
Copper, light and bottoms	12.50
Brass, heavy	9.00
Brass, light	7.50
Heavy machine composition	12.50
Composition turnings	11.00
Lead, heavy	4.00
Lead, tea	3.75
Zinc scrap	4.50

CLAY PRODUCTS

Sewer Pipe—Prices have stiffened considerably and in almost every part of the country show a sharp advance. This situation has arisen during the latter part of April, though on Apr. 26, several dealers in New York were still selling at winter prices, but with no certainty as to how long they could continue to do so. The advance of quotations just at this time of the year is attributed to many causes, chief among them being the scarcity of sewer pipe, there being hardly any procurable at the present. This shortage is due to the unusual demand experienced during the past winter months and which took all the factories could produce. Other causes are the car shortage, which hampers the transportation, and the cost of producing has gone up. As the summer months come on, prices are expected to stiffen still higher, but no radical change is looked for. The following prices are quoted with a decided higher tendency. Discounts applying to the Eastern list, delivered in New York, are as follows: 3 to 4 in., inclusive, 72%; for 7 to 30 in., 64%, and for 33 and 36 in., 59%. Factory discounts are quoted at 78% for 3 to 24 in.; 70% for 27 to 30 in., and 65% for 33 and 36 in. At those discounts the net prices per foot are as follows:

SEWER PIPE, PER FOOT

Size	Delivered N. Y.	Factory	Size	Delivered N. Y.	Factory
3 in.	$0.07	$0.045	20 in.	$0.63	$0.405
4 in.	0.07	0.045	21 in.	0.84	0.54
5 in.	0.112	0.072	22 in.	0.84	0.54
6 in.	0.112	0.072	24 in.	0.91	0.585
8 in.	0.154	0.094	27 in.	1.62	1.35
10 in.	0.224	0.144	30 in.	1.98	1.65
12 in.	0.28	0.18	33 in.	2.56	2.18
15 in.	0.378	0.243	36 in.	2.87	2.45
18 in.	0.532	0.342			

Flue Linings—Prices are quoted with no change. The discount from list, delivered New York, in carload lots, is 75%.

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x 8½-in.	14	$0.075	12x16-in.	45	$0.25
4½x13-in.	20	0.1125	13x18-in.	57	0.30
6 x12-in.	22	0.125	14x16-in.	60	0.2725
7 x 7-in.	15	0.875	16x16-in.	65	0.40
8½x 8½-in.	18	0.1125	16x20-in.	80	0.50
8½x13-in.	28	0.1625	18x18-in.	75	0.50
8½x18-in.	45	0.02225			

Hollow Tile—Prices are firm with a steady market. Quotations, f.o.b. Perth Amboy, N. J., are as follows:

Size	Price per block: Hollow wall tile	Size	Interior partition block
4x12x12-in.	$0.06	2x12x12-in.	$0.018
6x12x12-in.	0.084	3x12x12-in.	0.048
8x12x12-in.	0.102	4x12x12-in.	0.052
10x12x12-in.	0.12	6x12x12-in.	0.072
12x12x12-in.	0.15	8x12x12-in.	0.096

Roofing Tile—Prices are steady with usual orders of varying lots. Business is reported quiet throughout the West. The best grade of promenade roofing tile in flat blocks for high-grade roofs is sold at $25 per M. for run of kiln and $35 per M. for selected. A cheaper form of tile with a smooth surface may be had at about $12, but it is not suitable for roof gardens. These prices are f.o.b. New York.

Roofing tile, unglazed, of the French and Spanish type, plain, is sold at $9 per 100 sq.ft. of roof surface, f.o.b., New York. Glass tiles are sold at 60c. each.

LUMBER

Prices are now being quoted with a higher tendency. This is due mainly to the return of better and steadier weather conditions, which allows construction work to be started and also enhances shipments from all parts of the country. It is expected that in all lines a heavy demand will be noted and which, with present conditions remaining normal, will far outrun the supply.

Spruce—A stiff demand is noted with prices steady. Yard prices in New York are as follows:

2x10-in. } 3x10-in. } 4x10-in. }	12 to 16 ft.	$35
2x12-in. } 3x12-in. } 4x12-in. }	12 to 16 ft.	$37

For 18 and 20 ft., $37; for all lengths over add 50c. for every additional foot.

Flooring—The demand for flooring is steady, the winter months seeming to have no lessening effects.

Quarter-sawed oak flooring, A1, is $88 per M. Selected white-oak or red-oak flooring is $55 per M., and common flooring, red or white, is $30 per M.

Maple flooring, 13/16x2¼-in., is $55 for clear; $50 for No. 1, and $28 for factory. Long-leaf yellow-pine flooring, 13/16x1½-in. face, is $60@65 for A heart rift; $50@55 for sap rift; $36 for No. 1 flat; $32 for No. 2, and $30 for No. 3.

Hemlock—The demand is large with prices quoted with a higher tendency.

Price per M., f.o.b. cars, New York:

	Length			
	10 ft.	12 ft.	14 ft.	16 ft.
2x4-in.	$27	$25	$25	$27

Long Leaf Yellow Pine—Pine of all grades is in very good demand with prices above normal. The opening of heavy outside construction work during the coming months is expected to call for large quantities.

Prices per Thousand Feet in Yard, New York.

	Length			
	20 ft. base	21 to 25 ft.	26 to 30 ft.	31 to 35 ft.
2in. thick and under by 8 in. wide and under	$36	$36	$36	$38
10 in. wide by 10 in. thick and under	42	42	40	45
12 in. wide by 12 in. thick and under	42	42	43	45
14 in. wide by 14 in. thick and under	47.50	48	50	50
16 in. wide by 16 in. thick and under	50	52	54	60

Shingles—Weather conditions, for the first time this year, are allowing the handling and shipment of shingles from the South, but even with favorable procuring facilities the demand, in the estimation of leading dealers, will far exceed the supply. Even the record of last year, when at the end of the season not a shingle could be had, will be exceeded during the coming months. Present quotations are as follows, but higher prices will probably be quoted toward the middle of the month: Cypress shingles, New York: 7x24-in., rived and shaved, $23.50@24 per M.; 21-in., promiscuous widths, rived and shaved, $8 4-in. basis; 6x20-in., sawed $12 per M.; 6x18-in., sawed, $8.50 per M.; 5x18-in., sawed, $7.50 per M.

Piling—Conditions are unchanged with a firm market. In New York, the price of oak piling is 22@25c. per lin.ft. Oak piles 14 in. in diameter, 2 ft. from butt with a 6-in. top, and 40 to 45 ft. long, are held at $10.50@11.50; 50 ft. long, 25c. per lin.ft. Pine piles, 25 ft. long, 12 in. in diameter, 2 ft. from butt, with a 7-in. top, held at 17c. per lin.ft., while those 25 ft. long are 16c. In general, pine piles can be had at 16@17c.; oak piles, 55 to 60 ft., are quoted at 23c. per lin.ft.

Cross Ties—Business is quite regular while a heavy demand still continues. Prices are still quoted at a high mark. The following quotations are now being given by G. S. Baxter & Co., 15 William St., New York, for all orders:

	Cents each
7x9 in. by 8 ft. 6 in.	88
6x9 in. by 8 ft. nominal	83
6x8 in. by 8 ft.	78

OILS AND PAINTS

Linseed Oil—Due to a continued advance in the price of flaxseed and large takings of linseed oil, prices moved upward and city raw in New York is now held at 50c. per gal., and out-of-town raw at 49c. per gal. In Chicago, raw oil is held at 47c. per gal., and boiled oil at the usual advance of 1c. per gal. over raw.

Paints—Business is larger than at the corresponding time last year, and bids fair to continue very satisfactory throughout the season. Prices are steady, and in New York, are as follows: White lead in oil in 100-, 250- and 500-lb. kegs is 7¼@7½c. per lb.; in 25- and 50-lb. kegs, 7¾c. per lb. Red lead and litharge in 100-lb. kegs is 7@7½c. per lb.

Hydrex preservative paint is 75c. per gal. in bbl. lots, New York City.

Colors in oil are quoted at the following prices per lb.: Lamp black, 12@14c.; Chinese blue, 36@46c.; Prussian blue, 32@36c.; Van Dyke brown, 11@14c.; Chrome green, 12@16c.; raw or burnt Sienna, 12@15c.; raw or burnt Umber, 11@14c.

Petroleum Products—The market is very much excited over a reported strike of new oil fields in Southern California. Reports are to the effect that gushers have brought in the producing from 1200 to 1600 bbl. of light oil.

The prices of crude petroleum at the wells continue to advance and are quoted as follows: Pennsylvania Second Sand and Tiona, $2.50; Mercer black, New Castle and Corning, $2; Illinois, $1.30; Kansas and Oklahoma, 88c.

Prices from tank-wagon delivery in New York are as follows: Auto naptha and stove gasoline, 21c. per gal.; kerosene, 9c. per gal.

Turpentine—Prices show an advance compared with last month, the lower quotations at that time being due to the failure of a large concern handling turpentine. Jobbers' prices are 42½c. per gal. in New York. In Savannah, turpentine is held at 37½c. per gal.

MILL SUPPLIES

Belting—Many hurry-up orders have been received for belting from the flooded districts in Ohio, but, aside from these orders, business is quiet and not especially active. Discounts continue unchanged, those on leather belting being as follows: Extra heavy, 50 to 50 and 5%; heavy, 50 and 10 and 5 to 60%; medium, 60 and 10 to 60 and 10 and 5%; light, 60 and 10 and 10 to 70%. Standard, 70 to 70 and 10%.

Discounts in lines of rubber belting are likewise without change, the best grades being held at 40 and 10 to 50%; Standard 50 and 10 to 60%, and competitive grades are 60 and 10 and 10% to 70%. The following net prices per foot of rubber belting are computed at the above discounts.

The net prices per foot of rubber belting figured at the above discounts are as follows:

RUBBER BELTING, NET PRICE PER FOOT

Width, inches	2-ply	4-ply	6-ply	8-ply
3	$0 16	$0 22	$0 33	
4	0 21	0 30	0 45	
5	0 26	0 14	0 55	
6	0 30	0 51	0 65	$0 87
7	0 36	0 55	0 75	1 01
8	0 40	0 57	0 87	1 15
9	0 46	0 64	0 96	1 30
10	0 51	0 72	1 01	1 44
12	0 60	0 86	1 39	1 70
14	0 72	1 01	1 53	2 01
16	0 83	1 17	1 76	2 35
18	0 93	1 34	2 00	2 65
20	1 04	1 49	2 25	2 98
22	1 17	1 67	2 50	3 33
24	1 30	1 85	2 76	3 70
26	1 42	2 04	3 06	4 08
28	1 58	2 22	3 33	4 45
30	1 69	2 40	3 60	4 80
34	1 94	2 79	4 16	5 54
38	2 22	3 15	4 70	6 30
42	2 46	3 50	5 30	7 00
46	2 75	3 88	5 80	7 72
50	3 02	4 25	6 40	8 50
56	3 40	4 80	7 20	9 60
60	3 67	5 20	7 80	10 40

Shafting—Specifications are coming in freely and although the automobile manufacturers seem to have contracted for all the material they will need this year, there is some very fair business. A slight revision has been made in the price of shafting, and new discounts are 58% from list in carload lots and 53% from list in less than carload lots. Business is fair. The following net prices per foot are based on the discount of 53%:

Diameter in inches	Cents per foot	Diameter in inches	Cents per foot
¾	4 25	2¼	31 50
1	6 85		
1¼	10 80	2½	39 30
1½	14 05	2¾	48 00
1¾	19 20	3	56 50
2	25.00	3¼	84.00

MISCELLANEOUS

Corrugated Roofing—The net extras on roofing above the price of flat sheets are as follows: Corrugating, 2-in., 2½-in., 3-in., 5-in., 5c. per 100 lb.; single V-crimped, without sticks, 5c. per lb.; corrugating, 1½-in., 10c. per 100 lb.; painting roofing, 5c. per 100 lb. for 12 to 18 gage; 10c. per 100 lb. for 19 to 24 gage, and 15c. per 100 lb. for 25 to 28 gage.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; 4c. per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x40 in. It varies in thickness from 1/32 to ½ in., and in weight from 2 to 27 lb. per sheet. The net price in 100-lb. lots is 5c. per lb.

Transite, asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in standard sheets, 36x48 in., 42x48 in. and 42x96 in. The prices, f.o.b. factory, Nashua, N. H., are as follows:

Thickness	Weight, pounds	Price
1/32-in.	1	$0 08
1/16-in.	1½	0 12
¼-in.	2	0 16
5/16-in.	2½	0 20
⅜-in.	3	0 28
7/16-in.	3½	0 28
½-in.	4	0 32
9/16-in.	4½	0 36
⅝-in.	5	0 40
¾-in.	6	0 44
⅞-in.	7	0 48
1-in.	8	0 52
1¼-in.	10	0 56
1½-in.	12	0 64
1¾-in.	16	0 72
2-in.	16	0 80

Slate—Quotations are as follows, f.o.b. quarry.

	Prices per 100 sq ft.
Vermont, sea green	$3.00@ 4.00
Pennsylvania, Bangor Ribbon	3.50@ 4.00
Maine, Brownsville No. 1	5.00@ 7.75
Maine, Brownsville No. 2	4.50@ 6.00
No. 1 red	7.50@10.00
Unfading green	4.00@ 5.50
Genuine Bangor	4.25@ 6.50
Pen Argyle	4.00@ 6.00

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Pennsylvania—Central R.R. of New Jersey—This company is considering the construction of its line from Saylorsburg to Stroudsburg, Penn. The extension will be about 10 miles in length. J. O. Osgood, New York, is Ch. Engr.

Pennsylvania—Northern Central Ry.—This company has decided to spend about $400,000 for improvements in the vicinity of York, Penn. J. H. Nichol, Williamsport, Penn., is Prin. Asst. Engr.

Virginia—Atlantic Coast Line R.R.—See item under North Carolina.

West Virginia—Baltimore & Ohio R.R.—This company has awarded contracts as follows for the construction of its proposed cutoff between Orleans Road and Little Cacapon, W. Va.: Sections 2, 3 and 4 to H. S. KERBAUGH, INC., New York; Sections 5 and 7 to BENNETT & TALBOT, Greensburg, Penn., and Section 6 to SMITH, McCORMICK CO., Easton, Penn.; contracts for Sections 1 and 8 have not been awarded. The work includes drilling a tunnel about 3000 ft. long, with three smaller tunnels. The cost of the work is estimated at $6,000,000. The cutoff will be 11 miles in length, and is to be known as the Magnolia cutoff.

Buckhannon & Northern R.R.—This company is considing the construction of seven additional miles to its line. This section will complete the line. S. D. Brady, Fairmont, W. Va., is Ch. Engr.

North Carolina—Montgomery Lumber Co.—This company, located at Springhope, N. C., is preparing to construct its proposed line from Bunn to Raleigh, N. C.

Atlantic Coast Line R.R.—This company has awarded contracts for the construction of its proposed line from Pleasant Hill, N. C., to Richmond, Va., about 75 miles. E. B. Pleasants, Wilmington, N. C., is Ch. Engr.

Georgia—Louisville Construction, Land & Development Co.—This company, it is reported, is considering the construction of a railroad from Louisville, Ga., to St. Clair, Ga. The line will be about 20 miles in length. William W. Abbott, Louisville, Ga., is interested.

Alabama—Alabama, Tennessee & Northern R.R.—This company has been organized with a capital of $25,000,000 to take over the Alabama, Tennessee and Northern R.R., the Tombigbee Valley R.R., and the Mobile Terminal & Ry. Co. John T. Cochrane, of Mobile, is Pres. of the new company; William G. Cochrane, Mobile, is Vice-Pres.; Joseph A. Caviezel, Mobile, Secy.; William Goodman, New York, Asst. Secy.; R. K. Guthrie, Mobile, Treas., and E. J. Buck, Mobile, Asst. Treas. The directors are the same with the addition of Frederick J. Lisman, of New York.

Illinois—Lomax Terminal R.R.—This company has been incorporated for the construction of a line of railroad from Nauvoo, Hancock County, to Stronghurst, Henderson County. The capital stock of the company is $250,000, and the incorporators are William T. Love, J. F. Smith, C. H. Kisner, H. W. Beardsley and L. O. Beardsley, all of Lomax, Ill.

✚**Kentucky**—Chesapeake & Ohio Ry.—This company has awarded the contract for the construction of its proposed line from Beaver Creek Station to the mouth of Steele Creek, a distance of about 21 miles, to the C. D. LANGHORNE CONSTRUCTION CO., Beaver, Ky.

Ohio—Fort Wayne & Northwestern Ry.—See item under Indiana.

Indiana—Fort Wayne & Northwestern Ry.—This company has been incorporated with a capital of $1,000,000, for the purpose of constructing a line of railroad from Fort Wayne, Ind., to Huntertown, Garrett, Auburn, Waterloo, Avilla and Kendallville, thence west to Brimfield, Wawaka, Ligonier, Millersburg and Goshen, connecting with other nearby terminals. From Waterloo a branch of the line will go to Butler, Dekalb County, and to the Ohio State line. The directors are: W. L. Taylor, E. Leonard, H. Rose, F. E. Zollars and L. M. Pritchard.

Illinois—Chicago, Burlington & Quincy Ry.—This company has received bids for the construction of third-track work on its line between Galesburg and Wataga, Ill. T. E. Culvert, Chicago, Ill., is Ch. Engr.

Wabash R.R.—This company has decided to lay about 30 miles of new track in the vicinity of Granite City, Ill. A. G. Cunningham, St. Louis, Mo., is Ch. Engr.

Iowa—Minneapolis & St. Louis R.R.—This company is considering the electrification of its line from Fort Dodge, Iowa, to Humboldt, Iowa. R. G. Kenly, Minneapolis, Minn., is Ch. Engr.

Missouri—Missouri, Kansas & Texas Ry.—The State Public Utilities Commission, Apr. 17, approved the bond issue proposed by this company. The proceeds will be used for new equipment and refunding part of a mortgage of $25,000,000 planned on the property for various improvements to the system. S. B. Fleisher, St. Louis, Mo., is Ch. Engr. Const.

Texas—Asherton & Gulf R.R.—This company, it is reported, is planning for the construction of an extension to Eagle Pass, Tex., a distance of about 75 miles. Asher Richardson, Asherton, Tex., is Pres. and Gen. Mgr.

Atchison, Topeka & Santa Fé Ry.—This company has completed surveys for the construction of its proposed extension from Lamesa, in a southerly direction to Sterling City, Tex., a distance of about 100 miles. C. F. W. Felt, Topeka, Kan., is Ch. Engr. Noted Mar. 23.

Houston & Texas Central R.R.—This company, it is reported, will construct an extension from Llano to Brady, Tex., a distance of about 60 miles, as soon as the extension from Giddings to Stone City, Tex., is completed. W. L. Bisbee, Austin, Tex., is Supt.

✚**Washington**—Great Northern Ry.—The contract has been awarded to GRANT, SMITH & CO., by this company, for driving a tunnel through the Cascade Mountains. It will be about 1200 ft. in length.

Oregon—Mount Hood R.R.—This company has awarded the contract for the construction of a line of railroad from Dee, Ore., into the Lost Lake District of the state. The construction work will start at once. W. H. Eccles, Mount Hood, Ore., is Pres.

Ontario—Lake Huron & Northern Ontario Ry.—This company, it is reported, will soon award the contract for the construction of its proposed line. R. A. Lyon, Toronto, Ont., is interested.

Manitoba—Intermarine Ry. & Navigation Co.—Authorization has been given to this company by the legislature of Manitoba for the construction of its proposed line. The road will run from a point near the head of Lake Winnipeg northeasterly for 122 miles to a junction with the Dominion Government railway to Hudson Bay at Mile 191 from Pas, Man. The provisional directors include W. J. Robertson, P. J. Gordon, W. D. Boyd, K. Clemes, C. F. Just, Winnipeg, Man.

British Columbia—Canadian Pacific Ry.—This company has filed plans for the construction of its proposed tunnel under the city of Vancouver, B. C., connecting the inlet and False Creek waterfronts. It will be about one mile in length. The cost of the work is estimated at $1,000,000. F. W. Peters, Vancouver, B. C., is Gen. Supt., British Columbia Division.

ELECTRIC RAILWAYS

Jamestown, N. Y.—The Jamestown St. Ry. Co. has been granted a franchise for a period of 50 years to construct and operate an extension to its Willard St. line. C. E. Maltby, Jamestown, is Gen. Mgr.

Niagara Falls, N. Y.—The Frontier Electric Ry. Co. is making preliminary arrangements for the construction of an electric railway to connect Niagara Falls, Buffalo, Tonawanda and North Tonawanda. James E. Simmons, Niagara Falls, is Gen. Mgr. Noted Nov. 2, 1911.

Schenectady, N. Y.—The Schenectady Ry. Co. is planning the extension of its line for a distance of about 12 miles, into the central section of Schenectady. James F. Hamilton, Schenectady, is Gen. Mgr.

Freeland, Penn.—The Lehigh Traction Co. has started surveys on its proposed trolley line from Freeland to Drifton. C. B. Houck, Hazleton, Penn., is Vice-Pres. and Gen. Mgr.

Pottstown, Penn.—Plans are being prepared by the Pottstown & Reading St. Ry. Co. for the construction of an extension from Pottstown to Spring City, about six miles. Harry F. Swinehart, Pottstown, is Gen. Mgr. and Supt.

✚**Titusville, Penn.**—The Erie & Central Pennsylvania Ry. Co. has awarded a contract for the construction of about 17 miles of track on its proposed line from Titusville to Cambridge Springs, to the P. A. VELOTTA CONSTRUCTION CO., Cleveland, Ohio.

Washington, D. C.—The Shenandoah Valley Ry. Co. is making preliminary arrangements for the construction of its proposed electric railway from Washington, D. C., to Winchester, Va. Clarence W. Watson is interested in the project.

Wheeling, W. Va.—The Pittsburgh, Steubensville & Wheeling Ry. Co. is making preliminary arrangements for the construction of a trolley line to connect Pittsburgh, Penn., Steubensville, Ohio and Wheeling, W. Va. W. E. Hildebrand is interested in the project.

Albemarle, N. C.—The Albemarle & Whitney St. Ry. Co. has been incorporated to construct a system of electric railways within a radius of 50 miles of Albemarle. The incorporators are T. H. Vanderford, J. H. Moss and L. L. Cotton.

Atlanta, Ga.—The County Commissioners have granted a franchise to the Georgia Ry. & Power Co. to extend its line on Howell Mill Road to Collier Road. G. W. Brine, Electric and Gas Bldg., Atlanta, is Vice-Pres. and Gen. Mgr. Noted Apr. 10.

Valdosta, Ga.—The Valdosta St. Ry. Co. will soon be ready to award contracts for the construction of its proposed three-mile extension in Valdosta. T. J. Christa, Valdosta, is Gen. Mgr. and Pur. Agt.

Arcadia, Fla.—The construction of an electric interurban railway from Arcadia to Lake Okeechobee, about six miles, is contemplated by E. Prouty and associates.

New Orleans, La.—The New Orleans Ry. & Light Co. is preparing plans for the construction of about two miles of

new track in New Orleans. D. A. Hegarty, New Orleans, is Mgr. Ry. Dept.

Columbus, Ohio—The Middleport & Northeastern Ry. Co. has been incorporated to construct and operate an electric railway from Columbus to Marietta. The incorporators are: Charles P. Outhwaite, S. P. Outhwaite, D. N. Postlewaite and J. C. Nickert.

Youngstown, Ohio—The Poland St. Ry. Co., recently organized, is making preliminary arrangements for the construction of an electric railway from Poland to Youngstown, about five miles. G. E. Rose is interested. Noted Feb. 6.

Fort Wayne, Ind.—The Fort Wayne & Northwestern R.R. Co. has been incorporated to connect Fort Wayne, Garrett, Auburn, Waterloo, Avilla and Kendallville. From Waterloo the line is to extend eastward through Butler in Dekalb County to the Ohio state line, and westward from Kendallville through Brimfield, Wawaka, Ligonier, Millersburg and Goshen. The incorporators are William L. Taylor, Elmer Leonard, J. H. Rose, F. E. Zollars and L. M. Pritchard.

Muskegon, Mich.—The Muskegon-Casnovia Land & Development Co. is planning the construction of an interurban line from Muskegon to Kent City and Casnovia, about 27 miles. James L. Smith, Muskegon, is Secy.

Alton, Ill.—Plans are being prepared by the Alton Granite & St. Louis Traction Co. for the extension of its line to Bethalto and Fosterburg. A. J. Furinten, East St. Louis, is Gen. Supt.

Nauvoo, Ill.—The Lomax Terminal R.R. Co. has been incorporated to construct and operate an interurban electric railway from Nauvoo to Stronghurst. The incorporators are: H. W. Beardsley, C. H. Kisner, J. F. Smith, William T. Love and L. O. Beardsley, all of Lomax, Ill.

Davenport, Iowa—Preliminary arrangements are being made by the Tri-City Ry. Co. for double-tracking its line on Warren St. J. G. Huntoon, Davenport, is Gen. Mgr.

Bassett, Kan.—The City Council has granted permission to the Union Traction Co. to construct and operate an electric railway through Bassett. D. H. Siggins, Coffeyville, Kan., is Pres. and Gen. Mgr.

Lawrence, Kan.—The Kansas City, Lawrence & Topeka R.R. Co. is making arrangements to extend its line to Lawrence this spring. F. P. Dickson, Gumbel Bldg., Kansas City, Mo., is Pres. and Pur. Agt.

Butte, Mont.—Contracts will soon be awarded by the Butte Electric Ry. Co. for the extension of its Bryn Mawr and Emmet St. lines. J. R. Wharton, Butte, is Vice-Pres. and Gen. Mgr.

Kansas City, Mo.—Plans are being considered by the Metropolitan St. Ry. Co. to construct an electric railway through the business section of Kansas City to the new Union Station. James E. Gibson, Kansas City, Mo., is Supt.

Pine Bluff, Ark.—Plans are being prepared by the Pine Bluff & Sulphur Springs Interurban Ry. Co. for the construction of an electric railway from Pine Bluff to Sulphur Springs, about eight miles. A. G. Russell, Pine Bluff, is Pres.

+Brownsville, Tex.—The Brownsville St. & Interurban R.R. Co. has awarded the contract for the construction of an extension of its line to the Country Club, to the HILDALGO CONSTRUCTION CO., San Benito, Tex. Noted Apr. 17.

Houston, Tex.—F. F. Eversole and associates are promoting the construction of an interurban electric railway from Houston to La Porte via South Houston. They have obtained a franchise from the City Council of La Porte for the use of certain streets of that town and will soon complete the work of obtaining the right-of-way for the entire distance between the two terminals. It is stated by Mr. Eversole that construction of the line will be started in a few weeks and the work carried on as rapidly as possible.

Madisonville, Tex.—Plans are being considered by W. H. Krehlman and associates for the construction of an electric railway from Houston to Madisonville and Paris, Tex.

Texarkana, Tex.—F. W. Offenhauser and associates are promoting the construction of an interurban electric railway from Texarkana to Clarksville, about 61 miles. At a recent meeting of the City Council of Texarkana they were granted a franchise for the use of certain streets of the city and the work of obtaining the right-of-way through the country is now in progress. The route of the proposed road is through the towns of New Boston, Hooks, De Kalb and Blossom.

Artesia, N. M.—It is reported that the General Electric Co. has taken over the proposition of constructing an interurban electric line from Artesia to Cloudcroft, 125 miles. W. Morgan Hand, representative of the company at Kansas City, Mo., will soon make a reconnoissance of the route of the proposed line and upon his report the question of its construction will be determined. It is planned to erect a hydro-electric plant at the falls on the Pensocalo River and to operate the road by means of this power. The route under consideration runs from Artesia to Hope, thence to Elk, thence through the James Canyon to Cloudcroft.

Lewiston, Idaho—Specifications for the cars, rails, substation equipment, etc., of the proposed line of the Lewiston-Clarkston Valley Ry. Co. are complete and work is to be started at once and completed as far as Clarkston, Wash., by Aug. 1. At that time the contract will be let for extending the line to Asotin, Wash. F. L. Sturm is Pres.

Ogden, Utah—The Ogden Rapid Transit Co. has been authorized to double-track its line on Washington Ave. J. W. Bailey, Ogden, is Supt. and Pur. Agt.

Portland, Ore.—It is announced that the Portland Ry. Light & Power Co. will start work soon on the construction of proposed three-mile crosstown line. C. J. Franklin, Portland, is Supt. Ry. Dept.

Los Angeles, Calif.—The Los Angeles Ry. Co. is making preliminary arrangements for the extension of its 54th St. line to the western city limits and its 10th St. line to a point near the city limits. C. A. Henderson, Los Angeles, is Asst. Gen. Mgr. and Pur. Agt.

+San Francisco, Calif.—We are officially advised that the Board of Public Works has received bids for the extension of the municipal electric railway from 33rd Ave. to the ocean beach as follows: T. H. Mullin, $35,900; Mahoney Bros., $44,710; Contra Costa Construction Co., $53,880; Grant Smith & Co., $77,760; Central California Construction Co., $47,540; P. ROLANDI, $48,295 (awarded contract). F. E. Hulmer, $39,340; Healy, Tibbitts o., $34,450; Gorrill Bros., $51,187. F. J. Churchill is Secy. of the Bd. Noted Apr. 10.

Edmonton, Alta.—The City Council has granted a franchise to the Edmonton Interurban Ry. Co. to construct and operate a 10-mile line in Edmonton.

+Saskatoon, Sask.—The contract for the construction of a municipal electric railway on Eighth St. has been awarded by the City Council to the SASKATOON & SUTHERLAND CONTRACTING CO., Saskatoon.

LIGHT, HEAT AND POWER

Laconia, N. H.—Plans are being considered by the Laconia Gas & Electric Co. for the extension of its transmission lines to Sanbornton. F. T. Brockington, Laconia, is Supt.

Attleboro, Mass.—The Attleboro Steam & Electric Co. will build an addition to its boiler plant, one story, 55x80 ft., of brick construction, tar and gravel roof, to cost $15,000. Edgar Tregoning is Mgr.

+Boston, Mass.—The contract for the electric lighting and power generating plant in the City Hall Annex was awarded to the RIDGEWAY DYNAMO & ENGINE CO., of 57 State St., at $16,748. Other bids were, A. L. Ide & Son, $14,750; Ball Engine Co., $16,764; Ames Iron Works, $16,950; Lord Electric Co., $17,250.

Lenox, Mass.—The Town has voted to grant a franchise to the Lenox Electric Co. to install and operate a street-lighting system in Lenox. An underground wire system will be installed for about 75 lamps.

Webster, Mass.—The Webster & Southbridge Gas & Electric Co. will expend $16,000 to improve the lighting system according to plans prepared by the Whitall Engineering Co., Boston, Mass.

Providence, R. I.—We are officially advised that the Gorham Mfg. Co. contemplates the construction of a gas-producer plant in connection with its establishment at Providence. C. E. Fairbanks is Master Mech.

+Providence, R. I.—The contract for the additions to the Manchester power house of the Rhode Island Co. has been awarded to WM. H. HAMLYN & SONS, 86 Weybosset St. One addition will be 35x100 ft. on the north side, and a second 72x150 ft. will be erected on Eddy St. The latter will house two turbines to cost $340,000. The additions will cost $740,000. Noted Feb. 27.

Danielson, Conn.—Plans are being considered by the Burgesses for the installation of an ornamental lighting system throughout the borough.

+Brooklyn, N. Y.—We are officially advised that the Department of Education, Park Ave. and 59th St., Manhattan, has awarded a contract to JOHN F. DALTON, at $38,567, for the installation of the heating and ventilating apparatus in new Public School No. 99, Brooklyn. Bids were received on Apr. 21.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until 11 a.m., May 5, for the installation of a heating system in public school No. 50, Vyse and Bryant Aves., Boro. The Bronx, and altering and repairing the heating systems in public schools Nos. 1, 20, 62, 120 and 147, Boro. Manhattan.

New York, N. Y.—Bids will be received by Henry S. Thompson, Comr., Water Supply, Gas & Electricity, until 2 p.m., May 12, for the installation of electric-light equipment in the West New Brighton, Clove, New Bulls Head and New Springville pumping stations.

+Schenectady, N. Y.—Press reports are to the effect that the Mohawk Gas Co. has awarded a contract to the BARTLETT-HAYWARD CO., Baltimore, Md., for constructing a 2,000,000 cu.ft. gas holder and another contract to the ISBELL PORTER CO., Newark, N. J., for the construction of a gas-generating plant.

Pennington, N. J.—The Common Council has granted the New Jersey Northern Gas Co. a franchise to install and operate a gas system here. J. A. Riggin is Pres.

Tuckahoe, N. J.—The Board of Public Utility Commissioners has approved of an ordinance granting the Tuckahoe Light & Fuel Co. permission to install new gas lines in certain portions of Cape May County.

Harrisburg, Penn.—Bids will be received until noon, May 13, at the office of the Superintendent of Public Grounds and Buildings, State Capitol, for furnishing all engineering supplies, light, heat and power supplies, etc., for the year ending May 31, 1914. Samuel B. Rambo is Supt.

Royalton, Penn.—Bids will be received by the Borough Council until May 15 for the installation of a new street-lighting system in Royalton.

Charlottesville, Va.—Plans are being prepared by the Charlottesville & Albemarle Ry. Co. for the construction of a power plant near Charlottesville. Neff & Thompson, Norfolk, Va., are Engrs.

+Wheeling, W. Va.—The West Penn Water & Power Co. has awarded the contract for the construction of an addition to its power plant to JOHN F. GALLAGHER CO., at about $30,000.

Cherryville, N. C.—Plans are under consideration for the construction of a municipal electric-light plant to cost, $5000.

Chipley, Fla.—Bids will be received by A. A. Myers, Pres. Chipley Light & Power Co., until 2 p.m., May 20, for the construction of an electric-light plant and system at Chipley for the company. Plans and specifications are on file at the office of the Solomon-Norcross Co., Engrs., Candler Bldg., Atlanta, Ga.

Jacksonville, Fla.—The Pablo Pier Investment Co. is preparing plans for the construction of an electric-light plant at Jacksonville. Marcus Conant is Pres.

+Lafayette, La.—The contract for the improvement of the electric-light and water plant at Lafayette has been awarded by the City Council to ANDERSON & OFFUTT, New Orleans, La., at $24,675. Noted Jan. 30.

Harrodsburg, Ky.—Plans are being considered for the improvement of the municipal electric-light plant at Harrodsburg.

Cincinnati, Ohio—According to press reports plans are being prepared for the construction of a new gas generating plant for the Union Gas & Electric Co. Estimated cost, from $3,000,000 to $4,000,000. E. W. McClintock, Cincinnati, is Ch. Engr.

Columbus, Ohio—Bids will be received by the Board of Trustees of the Ohio State University, until May 12 for additional equipment for the power plant in connection with the institution. Carl E. Steeb is Secy. of the Bd.

Defiance, Ohio—The Auglaise Power Co., located two miles south of this city, has decided to build a 322-ft. solid concrete extension to its dam, which makes the total length of the structure 792 ft. B. A. Sloan, Defiance, is Supt.

Loudonville, Ohio—Bids will be received by the city until May 7 for improving the municipal electric-light and water plant. The Capitol Engineering Co., Union National Bank Bldg., Columbus, Ohio, is Consult. Engr.

+Put-in-Bay, Ohio—The Put-in-Bay Improvement Co. has awarded a contract to FAIRBANKS, MORSE & CO., Cleveland, Ohio, for the installation of equipment in its new power plant. A contract was awarded to the ELECTRIC EQUIPMENT CO., Sandusky, Ohio, for the wiring and erection of poles. Estimated cost of the project $15,000.

Vanburen, Ohio—The Village Council has accepted the proposition of the North Baltimore Service Co. to install an electric street-lighting system in Vanburen.

Reading, Mich.—Bids will be received until May 20 for the construction of a new power plant and the installation of additional equipment. Edgar G. Doud is Village Clk. and B. K. Goodman is Ch. Engr. Noted Apr. 3.

Chicago, Ill.—The installation of an ornamental lighting system on State St. is contemplated. About 200 lamps will be required. Ray Palmer is City Elecn.

Hoopeston, Ill.—Plans are being considered by the Hoopeston Gas & Electric Co. for the extension of its transmission line from Hoopeston to Ambia, Ind. R. D. Jennison, Hoopeston, is Gen. Mgr.

Jacksonville, Ill.—The proposition to issue $50,000 of bonds for the improvement of the municipal electric-light plant was defeated at a recent election. Noted Feb. 27.

Warsaw, Ill.—The local electric-light plant has been purchased by the Stone & Webster Engineering Corporation, Boston, Mass. An expenditure of $20,000 for improvements is contemplated by the new owner. It is planned to build a substation to cost $5500 and install an ornamental street-lighting system in the business district.

Antigo, Wis.—The Common Council is agitating a central steam-heating plant for the high school and another school building. A boiler room and fuel room, with heating and ventilation system including a return vacuum pump and air ejector, heat regulation system, repair work and additional flues will cost $13,800 according to plans by W. T. Liebert.

Fond du Lac, Wis.—The Common Council has accepted the proposition of the Eastern Wisconsin Ry. & Light Co. to install an ornamental street-lighting system.

Green Lake, Wis.—Bids are being received by J. R. Stewart, Ripon, Wis., who was recently granted a franchise to construct and operate an electric-light plant at Green Lake, for the proposed plant.

Lone Rock, Wis.—The proposition to issue $5000 of bonds for the construction of a municipal electric-light plant carried at a recent election.

Cedar Falls, Iowa—Plans are being prepared by the City Engineer for the construction of a municipal electric-light plant to cost $50,000.

Cumberland, Iowa—The citizens are considering plans for the installation of an electric-light system in Cumberland.

DeSoto, Iowa—Plans are being prepared for the installation of an electric-lighting system in DeSoto.

Humboldt, Iowa—The installation of an ornamental street-lighting system in the business district is under consideration.

Van Meter, Iowa—The citizens are considering the proposition to issue bonds for the construction of a municipal electric-light plant.

+Whiting, Iowa—We are officially advised that the contract for the construction of an electric-light plant at Whiting has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb. Estimated cost, $10,000. Noted Apr. 17.

Hardwick, Minn.—Bids are being received by the Village Council for the installation of an electric-light plant.

Renville, Minn.—A franchise has been granted to the Lethert Electric Co., of St. Paul, to construct and operate an electric-light plant in Renville.

Hartle, Kan.—Plans are being prepared for the reconstruction of the local electric-light plant which was recently destroyed by fire. Harry D. Hockman is owner.

Kansas City, Kan.—The proposition to issue $150,000 of bonds for improving the municipal electric-light plant is under consideration. W. M. Barkley is City Engr.

Scott, Kan.—See item under Water Supply—Irrigation.

Oxford, Neb.—Bids will be received by the Board of Village Trustees until May 9 for the construction of a municipal electric-light plant. Estimated cost, $10,000. Plans and specifications are on file at the office of W. T. Pettyjohn, Village Clk.

Steinauer, Neb.—Bonds for $7000 have been voted for the construction of a municipal electric-light plant at Steinauer.

Western, Neb.—Plans are being considered for the construction of an electric-light plant at Western.

Armour, S. D.—Bonds for $15,000 have been voted for the construction of a municipal electric-light system at Armour.

Frankfort, S. D.—Plans are being prepared for the installation of an electric-lighting system in Frankfort.

Tripp, S. D.—The local electric-light plant and system has been purchased by Vetter Bros. The new owners contemplate extensions and improvements.

Albany, Mo.—The proposition to issue $19,000 of bonds for the construction of a municipal electric-light plant is under consideration.

Alice, Tex.—W. McAshan, of Houston who recently purchased the electric-light plant and ice factory here will make enlargements and other improvements to the property.

Burnet, Tex.—The Commercial Club of Burnet is promoting the construction of an electric-light and power plant.

Humble, Tex.—The municipal water and light plant which was recently destroyed by fire will be rebuilt.

Mission, Tex.—See item under Water Supply—Irrigation.

+Mount Pleasant, Utah—The contract foa the construction of a municipal electric-light plant has been awarded to LYMAN & SAMUELS, Salt Lake City, Utah, at $25,312. Other bids were, Lynch Cannon Engineering Co., Salt Lake City, $30,000; Capital Electric Co., Salt Lake, $29,985; R. S. Lund, Salt Lake City, $28,501; Owen H. Gray & Co., Salt Lake City, $27,645; C. E. Sandstrom & B. R. Hansen, Mt. Pleasant, $26,248.

Virginia City, Nev.—The United Comstock Pumping Association is preparing to install a power plant to furnish electric power to operate the machinery in the deep mines of the Comstock. A. M. Welsh, is Supt. and Engr. A. F. Coffin is Pres.

Alhambra, Calif.—Bids will be received by the City Trustees until 9 a.m., May 3, for installing an ornamental lighting system on Commonwealth Ave. O. M. Calk is City Clk.

Cloverdale, Calif.—The California Telephone & Light Co. contemplates purchasing the Cloverdale Light & Power Co., and will spend $17,000 for improvements.

+Long Beach, Calif.—The Southern California Edison Co. has awarded the contract to the F. O. ENGSTROM CO. Fifth and Seaton Sts., Los Angeles, for the construction of the foundations for the boiler and generator buildings and for 16 boilers at its steam plant here.

+Los Angeles, Calif.—The Los Angeles Gas & Electric Corporation has awarded the contract to C. H. WHEELER MFG. CO. Philadelphia, Penn., for the construction of a steel cooling tower 30x65x34 ft. at its plant here, at $16,900.

San Francisco, Calif.—Temporary lighting, wiring and fixtures will be installed during the Portola festival celebration next October, the cost to be about $30,000. Otto F. Schiller, is Engr. for the Portola Festival Com.

Santa Monica, Calif.—Plans are being prepared for the installation of an ornamental street-lighting system on San Vincente Boulevard. Estimated cost, $5000.

+Montreal, Que.—The Cedar Rapids Power & Mfg. Co., a subsidiary of the Montreal Light, Heat & Power Co., has awarded a contract to FRASER, BRACE & CO., 1328 Broadway, New York, N. Y., to install 100,000-hp. in connection with its hydro-electric development at Cedar Rapids, near Montreal.

Hamilton, Ont.—E. I. Sifton, Elec. Engr., Hamilton, is preparing plans for a new substation. Work will start shortly and new machinery will be installed.

BRIDGES

Yarmouth, Mass.—Bids will be received by the County Commissioners of Barnstable County, Barnstable, Mass., until May 11 (readvertisement), for the construction of a reinforced-concrete girder bridge between Yarmouth and Dennis, Mass. The estimated cost is $15,000. F. C. Wales, 1150 Tremont Bldg., Boston, is the Engr. Noted Feb. 20.

+New Brunswick, N. J.—The contract for the construction of a reinforced concrete bridge at South Bound Brook, has been awarded to the FERRO CONCRETE CO., Harrisburg, Penn., at $6895. Other bidders were: Arthur Smith, Plainfield, $7223; F. W. Schivers, Jr. Co., New York, N. Y., $7432; McGovern & Meyers, New Brunswick, $8405; Abraham John, New Brunswick, $7488; O. P. Steelt, Milltown, $8494.

Paterson, N. J.—The Board of Chosen Freeholders has approved plans submitted by the Delaware, Lackawanna & Western R.R. Co., for three new overhead railroad bridges, to be used in eliminating grade crossings at Union Ave., Singac, Mountainview Station, the Newark and Pompton Turnpike over the Morris Canal, and on the Ratzer Road.

River Edge, N. J.—Bids will be received by the Board of Freeholders at the Court House, until 2 p.m., May 9, for the construction of a new bridge at River Edge. The estimated cost is $12,000. Noted Nov. 28, 1912.

★Toms River, N. J.—Bids will be received at the office of Arthur C. King, Engr. in Charge, Toms River, until May 17, for the construction of a road bridge across Barnegat Bay from Island Heights to Sea Side Park. The proposed bridge will consist of 7212 ft. of timber trestle, 24 ft. wide and 3150 ft. of earth fill, 24 ft. wide, bulkheaded. Plans and specifications are on file at the office of the Engr. in charge. Noted Apr. 10.

+Pittsburgh, Penn.—We are officially advised that the contract for the construction of bridges No. 6, over Plum Creek, No. 5, over Little Bull Creek, No. 4, over Robinson's Run (North Branch), and No. 1 over Griffey's Run, has been awarded to C. M. DRIVER, 3452 Petteysville Ave., N. S., Pittsburgh; and the contract for the construction of bridge No. 7, over Plum Creek, has been awarded to J. L. POLI, 597 North Bellefield Ave., Pittsburgh. R. J. Cunningham is the County Controller. Noted Apr. 17.

★Pittsburgh, Penn.—Bids will be received at the office of the City Controller, Municipal Hall, until 10 a.m., May

6, for the removal of the present bridge and the construction of a reinforced-concrete arch bridge on the line of Butler St., over Haights Run. Plans and specifications are on file at the office of J. G. Armstrong, Director of Public Works, 432 Oliver Bldg.

✦Reynoldsville, Penn.—The contract for the construction of a concrete arch bridge over the Sandy Lick Creek, between Reynoldsville and West Reynoldsville, has been awarded to the CURWENSVILLE CONSTRUCTION CO., at $12,490. Noted Mar. 13 and 27.

★Baltimore, Md.—Bids will be received by the Board of Awards until 11 a.m., May 21, for the construction of the Fallsway Viaduct above the foundation level according to plans and specifications on file at the office of Calvin W. Hendricks, Consult. Engr., Room 904, American Bldg., Baltimore. The estimated cost is $250,000. James H. Preston is Pres. of the Board. Noted Apr. 17.

Warm Springs, Va.—Bids will be received by the Board of Supervisors of Bath County at Warm Springs, until noon, May 13, for the construction of a steel bridge across Cowpasture River, four miles west of Millboro, Va., also alternate bids for a wooden structure. It will be 175 ft. long. E. L. LaRue is County Clk.

Lewisburg, W. Va.—Bids will be received by the County Court of Greenbrier County until May 2, for the construction of two bridges, one across Mill Creek at Blakers, and the other across Wades Creek on Stanton Pike, near White Sulphur Springs. John E. Dougher is the County Road Engr.

Newman, Ga.—Bids will be received by the Viaduct Committee of the City Council of Newman, until noon, May 5, for the erection of 210 ft. of timber approaches and 240 ft. of reinforced, earth-filled approaches to the proposed La Grange St. bridge. E. D. Fouse is the City Clk. Noted Mar. 27.

Akron, Ohio—We are officially advised that no bids were received for the construction of the North Howard St. bridge extension, on Apr. 14, and the work will be readvertised. The estimated cost is $78,000. C. B. Brower is County Clk. The Wilbur J. Watson Co., Cleveland, Ohio is Consult. Engr. Noted Apr. 17.

✦Cincinnati, Ohio—We are officially advised that the contract for the construction of a concrete culvert on Shawnee Run, near Wooster Pike in Columbia Township, has been awarded to PETER KRAECHTER, Girard, Ohio, at $17,887. Albert Reinhardt, is County Clk. Noted Apr. 3.

Cleveland, Ohio—Bids will be received by the Board of Commissioners of Cuyahoga County, until 11 a.m., May 28, for the construction of bridge work per reports Nos. 3108, 3109, 3110, according to specifications on file at the office of Frank R. Lander, County Surv. John F. Goldenbogen is the County Clk.

Columbus, Ohio—Bids will be received bythe County Commissioners of Franklin County until May 23, for bridge work according to Engineers Estimates No. 489, 490, 491, 492 and 493. Plans and specifications are on file at the office of F. M. Sayre, County Audr., Columbus.

McConnellsville, Ohio—Bids will be received by the Board of Commissioners of Morgan County until 1 p.m., May 12, for the repair of the Muskingum River Bridge at Malta, and McConnellsville, according to plans and specifications on file at the office of J. E. Patterson, County Audr., McConnellsville.

New Philadelphia, Ohio—Bids will be received by the Commissioners of Tuscarawas County until May 26, for the construction of a new steel bridge over the Tuscarawas River in New Philadelphia. It will be a three-span structure, 372 ft. long. W. C. Shott is the County Audr.

New Philadelphia, Ohio—Bids will be received by the Commissioners of Tusarawas County until 1 p.m., May 19, for the substructure for the lower bridge at Newcomerstown and the substructure for the Gnadenhutten River Bridge, according to plans and specifications on file at the office of W. C. Shott, County Auditor.

Springfield, Ohio—The County Commissioners of Clark County plan to rebuild 20 bridges which were damaged by the recent floods. The estimated cost is $30,000. G. I. Notts is County Surv.

Preliminary plans and specifications will soon be prepared for rebuilding the bridge at Bechtle Ave. The abutments and superstructure will be of reinforced concrete. M. J. Bahir is City Engr., and E. D. Segments is Clk. Dept. Pub. Wks.

Indianapolis, Ind.—Press reports state that the County Council has authorized a bond issue for $50,000 for the construction of bridges over the White River, one at Washington St. and the other at West New York St., and for the repair of other bridges.

Logansport, Ind.—The County Council of Cass County has appropriated $60,000, for the purpose of building bridges at Third St. and Burlington Ave.

✦Urbana, Ill.—The County Board of Supervisors, Urbana, has awarded the contract for the construction of a highway bridge across the Sangamon River, about 1½ miles south of Fisher, Ill., to the GOGGIN CONSTRUCTION CO., Arcola, Ill., at $11,083. Noted Apr. 3.

✦Milwaukee, Wis.—The contract for repairs to the Grand Ave. Bridge over the Milwaukee River has been awarded to the C. H. STARKE DREDGE & DOCK CO., Milwaukee, at $9693. E. G. Simmons is Comr. Pub. Wks. Noted Apr. 24.

River Falls, Wis.—The Board of Supervisors is receiving bids for the construction of a new concrete bridge on the River Falls-Prescott Road, to replace the structure recently damaged by the floods. The estimated cost is $12,000.

Sheboygan, Wis.—The lowest bid submitted for the construction of a new steel bridge at New Jersey Ave., was that of the Worden-Allen Co., Milwaukee, at $22,500. C. N. Roby is the City Engr. Noted Oct. 17, 1912.

Des Moines, Iowa—The City Council has authorized the City Clerk to advertise for bids for the construction of a bridge over Four Mile Creek, at Scott St. It will be a three-30-ft beam span, including steel work and hand railing and floor upon present piers. Horace Sussong is the City Clk.

✦Grand Island, Neb.—We are officially advised that the contract for the construction of 11 steel bridges has been awarded to the GEER-HARRISON CO., Grand Island, at about $16,000. G. E. Neumann is the County Clk. Noted Apr. 3.

★Kansas City, Kan.—Bids will be received by the Board of County Commissioners of Wyandotte County until 10 a.m., May 19, for reconstructing and building the Argentine Wagon bridge over the Kansas River, according to plans and specifications on file at the office of Frank L. Holcomb, County Clk.

★Fort Worth, Tex.—The contract for the construction of a bridge on Fourth St., has been awarded to the TARRANT CONSTRUCTION CO., Fort Worth, at $51,927. Berkeley-Fay Engineering Co., St. Louis, Mo., Consult. Engrs. Noted Mar. 27.

The contract for the construction of a viaduct over Samuels Ave., has been awarded to the McKENSIE-WILLIAMS CO., Webb City, Mo., at $51,339. Noted Mar. 27.

★Houston, Tex.—The contract for the construction of a reinforced-concrete bridge on San Jacinto St. across the Ship Canal has been awarde dto the WILLIAM B. CARMICHAEL CO., at $128,211. Noted Apr. 3.

We are officially advised that the contract for the construction of the reinforced-concrete bridge over the Buffalo Bayou at Capital Ave., has been awarded to H. C. GASS, 12 St. James Flats, Houston, at $88,500. F. L. Dormant is the City Engr. Noted Feb. 20.

✦San Angelo, Tex.—The contract for the construction of a new viaduct over the North Concho River at South Chadbourne St., has been awarded to the MIDLAND ENGINEERING & CONSTRUCTION CO., Fort Scott, Kan., at $46,888. Noted Apr. 3.

Tacoma, Wash.—The School Board has ordered a bond issue for $50,000 for the purpose of constructing the proposed memorial pioneer foot bridge to connect the Lincoln High School with G. St. It will be a concrete arch structure.

Vancouver, Wash.—James P. Stapleton, Chn. of the Vancouver Bridge Committee, has received a detailed estimate from Wadell & Harrington, Consult. Engrs., Kansas City, Mo., which places the cost of the proposed Pacific Highway Bridge, across the Columbia River, at $1,161,000. The bridge over the main channel will be 3440 ft. long, with two 4-ft. walks, two 10-ft. roadways for slower traffic and one 22-ft. roadway for street cars and faster traffic. Noted Feb. 20.

Salem, Ore.—W. W. Lucious, Lewis Bldg., Portland, Ore., Consulting Engr., has been retained to prepare plans for the construction of a number of reinforced-concrete bridges over the North Mill Creek. H. C. Tillman is the City Engr.

Dunsmuir, Calif.—The Board of Supervisors plans to erect a new bridge across the Sacramento River at Dunsmuir, to accommodate the new state highway. The estimated cost is $25,000.

Los Angeles, Calif.—According to press reports, bids will be received by the Board of County Supervisors at Los Angeles, until May 5, for the construction of a concrete girder bridge over Eaton Wash, on Colorado St., in the Lamanda Park District. H. J. Lelande is the County Clk.

Willows, Calif.—We are officially advised that bids will be received by W. H. Sale, County Clk., until May 5, for the construction of a bridge over Stony Creek near Orland, Calif. It will be of reinforced concrete and will have 13 spans, from 70 to 100 ft. The estimated cost is $146,000. Luther C. Stiles is the County Engr. Noted Apr. 10.

Cayuga, Ont.—The Town Council of Cayuga plans to build a concrete arch bridge with four wings and iron rail, 16x8 ft. Bids will soon be asked. J. W. Sheppard is the Town Clk.

North Vancouver, B. C.—The City Council has decided to build a culvert at McCartney St. to cost approximately $15,000.

Victoria, B. C.—The Dominion of Public Works contemplates the erection of a 200 ft. span bascule bridge at Johnson St.

WATER SUPPLY—IRRIGATION

✦Boston, Mass.—The contract for relaying 5350 lin. ft. of 12-in. water pipe in West River and Readville St., Hyde Park District, has been awarded to ANTHONY BARUFFALDI at $5345. Other bids were: M. Di Sisto & Co., $5517; J. H. Ferguson, 5870; M. DeMatteo, $6268; Thomas Burke, $7730; John T. Shea, Jr., $8485. L. K. Rourke is Comr. Pub. Wks. Noted Apr. 17.

North Attleboro, Mass.—We are officially advised that bids will be received until 1 p.m., May 12, for laying water mains in High St., Lake Ave., Try St., Peck St., Ralph St., Lafayette St. William Plattner is Engr.

✦Meriden, Conn.—Contracts for three sections of the proposed reservoir and pipe line for the new Broad Brook water system, bids for which were received by the Board of Contract and Supply, March 25, have been awarded. The bids for the dam and highway work are still under consideration. The details are: (a) Building Broad Brook dam and grading highways in the town of Cheshire, involving 4500 cu.yd. of excavation for dams and culverts, 12,000 cu.yd. excavation for highways, 1200 cu.yd. rock excavation, 6100 cu.yd. concrete, 3000 sq.yd. rip rap, $500 bbl. Portland cement, 43 ft. pipe railing, 250 ft. wire fence, and all materials and work in connection with building the gate house. (b) Cleaning up site of proposed storage reservoir in town of Cheshire, embracing 160 acres of earth grubbed and cleaned, 100,000 cu.yd. of material removed in deepening reservoir, 100 sq.yd. rip

rap. (c) building a distributing reservoir on Johnson's hill, Meriden, involving 17,000 cu.yd. excavation, 5000 cu.yd. concrete, 7000 bbl. Portland cement, 84,000 lb. steel for reinforcement, 250 ft. 15-in. vitrified tile pipe., 1700 lin.ft. wire fencing, 85 ft. pipe railing and all work in connection with building the gate house. (d) Laying a c.-i. water main from proposed Broad Brook dam in Cheshire to Broad and Main Sts., Meriden, involving 9500 ft. 30-in. main, 11,500 lin.ft. 24-in. main and 3000 lin.ft. 20-in. main, 2000 cu.yd. rock excavation, 10 cu.yd. concrete and 10 manholes. The bids were as follows: R. H. Newell Co., Uxbridge, Mass. (a) $73,991, (b) $75,550. Nathan S. Brock, 14 Walnut St., Boston, Mass., (a) $70,255, (b) $76,500, (c) $54,921. Petrossi Bros., 39 Woodbridge St., Hartford, Conn., (a) $104,839. Pierson Engineering & Construction Co., Hartford, Conn., (a) $59,684, (b) $73,000, (c) $49(964, (d) $43,240. Ward & Tully, Inc., Browns Station, New York, (a) $83,864. The Coöperative Engineering & Contracting Co., Park Row Bldg., New York, (a) $59,-295, (c) $56,528. The Amanda & Patrizio Co., 2254 Bosford Ave., New York, (a) $59,968, (c) $53,035. Lathrop & Shea Co., New Haven, Conn., (a) $77,622.25, (b) $72,750, (c) $73,-533.75 (d) $45,455. Briggs Engineering & Construction Co., 75 Westminister St., Providence, R. I., (a) $81,693, (c) $65,-181. Joseph S. Barbar., 90 Franklin St., Waterbury, Conn., (a) $93,112. Concrete & Foundation Co., 104 West 42nd St., New York, (a) $99,816, (c) $84,320. C. W. BLAKESLEE & SONS, 58 Waverly St., New Haven, Conn., (a) $73,089, (b) $58,020, (c) $59,864, (d) $52,115 (awarded contract) for the Daniel O'Connell's Sons, Holyoke, Mass., (a) $70,402, (c) $53,-423. Petrossi Co., Inc., 284 Asylum St., Hartford, Conn., (a) $95,166, (c) $64,046. Sperry Engineering Co., 82 Church St., New Haven, Conn., (a) $62,769, (c) $59,854. Lawrence & Gaynor, Bridgeport, Conn., (a) $80,828, (c) $66,333. Clifford Construction Co., 335 Fulton St., Jamaica, N. Y., (c) $49,382. Angelo Conti, 60 Temple St., Hartford, Conn., (c) $97,387, (d) $53,885. Edward T. Egleston, Yonkers, N. Y., (c) $46,036. SMITH BROS., Pelham, N. Y., (c) $45,824, (d) $37,805 (awarded both contracts) Donato Cuozzo, 21 Park Row, New York, (c) $64,267. Frazer & Burchenal, 1 Madison Ave., New York, (c) $94,886. Slonn & Stone, Hartford, Conn., (c) $72,845. (d) $66,725. Sompson Bros. Corp., 166 Devonshire St., Boston, Mass., (c) $56,835. Silvestro Berardino & Angelo, 19 Dartmouth St., Hartford, Conn., (c) $110,-135. Joseph Long & Co., Leomister, Mass., (c) $53,791. (d) $56,965. Michael Little & Co., Leomister, Mass., (b) $100,000. Framingham Contracting Co., South Framingham, Mass., (b) $73,540. Edward J. Orton Corp., 519 Park Ave., Auburn, Bridgeport, Conn., (a) $88,255. Leonard Suzio & F. Arrigoni & Bro., Meriden, Conn., (a) $63,328, (b) $140,750, (c) $57,992. Noted Mar. 6.

New Canaan, Conn.—Plans are being prepared for the construction of a filtration plant for the New Canaan Water Co. Albert B. Hill, 100 Crown St. New Haven, Conn., is Engr.

★**Jamestown, N. Y.**—The contract to furnish the 6,000-000-gal. reciprocating pumping engine was awarded by the Water Commissioners, Apr. 10, to the EPPING CARPENTER CO., Pittsburgh, Penn., at $18,980. Bids were opened Feb. 17. Noted Feb. 27.

Lockport, N. Y.—The Common Council contemplates an expenditure of $20,000 for laying a feed main to carry water from the standpipe at South Transit and Summit Sts., for distribution to consumers.

New York, N. Y.—We are officially advised that bids were received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, Apr. 21, as follows: Section 1, for furnishing, delivering and laying high-pressure fire service mains and appurtenances in 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 33d and 34th Sts., and in Madison, Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, 11th, 12th and 13th Aves: Beaver Engineering & Contracting Co., 182 Broadway, $814,342; Conners Bros. Co., 17 West 42d St., $824,434; Muicahy & Williams, 168 Madison Ave., $754,397; Joseph T. B. La Marsh, 487 Pearl St., $1,006,265; Council Contracting Co., 170 Broadway, $763,154; Louis D. Gregory, $962,151; A. L. Guidone & Co., Inc., 131 East 23d St., $979,200; Joseph Burns, 147 East 125th St., $1,158,198. Section 2, furnishing, delivering and laying high-water pressure fire-service mains and appurtenances in Bayard, Baxter, Broome, Bowery, Elizabeth, Elm, Houston, Hudson, Mott, Mulberry, Prince, Spring, Stone, West and Worth Sts., and West Broadway, including furnishing, delivering and installing motor operated valve chamber of valve vaults and subsidiary ducts on the Bowery, Hudson St. and Stone St., and subsidiary ducts and service boxes at the Oliver St and the Gansevoort St. high-pressure pumping stations: Beaver Engineering & Construction Co., $47,276; Connors Bros., $54,613; Knight & De Micco, $48,927; Carfagno & Dragonett, 417 East 118th St., $41,262; F. N. Lewis, $47,738. Noted Apr. 17.

Bids will be received by Henry S. Thompson, Comr. Water Supply, Gas and Electricity, until 2 p.m., May 9, for laying water mains in various streets.

★**Plattsburgh, N. Y.**—A contract to lay 6000 ft. of 8-in. water mains in Summer School St has been awarded to McCOMBLY & COSTELLO, Plattsburgh, at $1.14 per ft. Bids were opened Apr. 18. Noted Mar. 20.

★**Walden, N. Y.**—We are officially advised that the contract to construct a steel standpipe, 16x50 ft., has been awarded to TIPPETT & WARD, Phillipsburg, N. Y. Noted Mar. 27.

★**Atlantic City, N. J.**—We are officially advised that the contract to lay a 24-in. and a 20-in. water-main in Arctic Ave. from Missouri Ave. to Maine Ave. was awarded by the Board of Commissioners, Apr. 14, to EDWARD L. BADER, Bartlett Bldg. Atlantic City, at $14,781. Bids were opened Mar. 13. L. Van Gilder is Engr. and Supt., Water Dept. Noted Apr. 3.

★**Camden, N. J.**—A contract to construct a 60-000-gal. water tower, 32x32 ft., and 140 ft. high, for the Armstrong Cork Co., has been awarded to TIPPETT & WOOD, Phillipsburg, N. J.

Keyport, N. J.—The Borough Council has awarded a contract for all lateral sewer connections to P. ANTICO, Keyport, at the following price: 55c. per ft. for distance of 250 ft., 50c. per ft. for 300 ft., and 43c. per ft. for 400 ft.

★**Lebanon, Penn.**—A contract to construct a reservoir in the Catawissa Valley, near Lebanon, for the Girard Estate, has been awarded to BENNETT & RANDALL, Greensburg, Penn. The reservoir will have a capacity of 260,000,000 gal., will cover an area of 37 acres. The contract also includes laying a pipe line to Reservoir No. 3.

Troy, Penn.—Henry W. Taylor, Engr., has prepared plans for a water system here.

★★**Alexandria, Va.**—We are officially advised that the contract to construct a concrete masonry dam for the Alexandria Water Co. has been awarded to the PIEDMONT CONSTRUCTION CO., University, Va., at $124,611. Bids were received by David J. Howell & Son, Consult. Engr., Union Trust Bldg., Washington, D. C.,. Apr. 15. Noted Apr. 24.

Basic City, Va.—It is reported that bids will be received by E. H. Heatwole, Mayor, until May 5, for extending water mains and constructing a reservoir with a capacity of 200,-000 gal. Estimated cost, $10,000. D. C. Humphreys, Lexington, Va., is Consult. Engr.

Gala, Va.—The town contemplates the installation of a water system.

Huntington, W. Va.—According to press reports, bonds for $1,000,000 were voted recently for municipal improvements. Of this, $80,000 will be expended for the installation of a municipal water system, and $20,000 for paving and laying sewers. A. B. Maupin is City Engr.

Ravenswood, W. Va.—The Town Council has granted a franchise to J. Mentor Caldwell, Ravenswood, to install a water system here. The terms of the franchise provide that construction work must start within 60 days.

Cornelia, Ga.—Bids will be received by the City Clerk until May 5, for the purchase of $15,000 water bonds, and $5000 sewer bonds.

Guyton, Ga.—Bonds for $15,000 were voted, Apr. 15, for installing a water system and electric-light plant here. Plans have been completed by the J. B. McCrary Co., Empire Bldg., Atlanta, Ga., and bids for construction will probably soon be asked. G. T. Haywood is Mayor. Noted Apr. 13.

Zebulon, Ga.—Bonds for $10,000 were voted, Apr. 18, for installing a water system here. Noted Apr. 13.

★★**Pensacola, Fla.**—We are officially advised that the contract to construct a reinforced concrete reservoir here has been awarded to the C. H. TURNER CONSTRUCTION CO., Pensacola, at $6823. The other bids were: W. P. Kennedy, Pensacola, $7200; John Gerken, Pensacola, $9450; S. F. Fullam & Co., Pensacola, $9687; C. M. Ward & Co., Pensacola, $9998; Blomel Construction Co., Pensacola, $10,989. Bids were opened Apr. 22. Noted Mar. 27.

Tallahassee, Fla.—Bonds for $13,000 have been voted for extending and improving the water system and the electric-light plant. D. M. Lowry is Mayor. Noted Jan. 30.

Jackson, Miss.—An election has been called for June 7 to vote on a bond issue of $100,000 for improving the water system. It is proposed to install a filtration plant and reservoir, and to lay a 36-in. supply main. The cost is estimated at $160,000. Noted Sept. 24.

★**Lafayette, La.**—The contract to furnish and install pumping equipment for the water system has been awarded to ANDERSON OFFUT, New Orleans, La., at $24,675. Bids were opened Apr. 9. Noted Apr. 3.

Louisville, Ky.—The Louisville Water Co. will soon be ready to construct the proposed addition to its filtration plant. The addition is estimated to cost $300,000 and will increase the capacity from 30,000,000 to 70,000,000 gal. per day. Theodore A. Leisen is Ch. Engr. Noted Nov. 21.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 6, for cleaning c.-i. pipe, specials and valves, and other miscellaneous work in connection therewith.

Cleveland, Ohio—The City Council has asked the State Board of Health to investigate the purity of the city water supply. It has been proposed to install a filtration plant here, and whether the plant is installed or not will probably depend on the report of the Board. It is estimated that a plant to adequately serve the city would cost about $2,000,000.

Loudonville, Ohio—Bids will be received by the City Clerk until May 7, for improving the water system and the electric-light plant.

New Lexington, Ohio—An election has been called for June 16, to vote on a bond issue of $50,000 for purchasing the water system of the Lexington Water Co.

New Philadelphia, Ohio—The contract to install a water system here has been awarded to HERMAN SNUDER, New Philadelphia, at $5456.

Toledo, Ohio—Bonds for $150,000 have been voted for completing the work of enlarging the pumping station, and building connections. George W. Tonson is City Engr.

Port Huron, Mich.—Bids are being received by the city for furnishing 6000 ft. of 20-in. and 3000 ft. of 16-in. c.i. water pipe, with the necessary sleeves, valves, crosses, elbows, etc. Gordon Ross is City Clk.

★+Anna, Ill.—We are officially advised that the contract to construct a water system near Anna, was awarded by the Board of Administration, Springfield, to the PUBLIC SERVICE CONSTRUCTION CO., Omaha, Neb., at $89,323. The contract for the filtration plant was awarded to the ROBERTS FILTER CO., Darby, Penn., at $5500. F. D. Whipp is Fiscal Superv. Bids were opened Apr. 21. Noted Mar. 27.

★+Evanston, Ill.—Bids for constructing a 12,000,000-gal. mechanical filtration plant and appurtenances, were received by John H. Moore, Comr. Pub. Wks., Apr. 14, as follows: Roberts Filter Mfg. Co., Darby, Penn., $209,734; Norweed Engineering Co., Florence, Mass., $192,309; L. K. Sherman Contracting Co., 327 Milwaukee Ave., Chicago, Ill., $254,923; Pittsburgh Filter Mfg. Co., Pittsburgh, Penn., $231,223; New York Continental Filtration Co., New York, $217,979; William A. Pope, 26 North Jefferson St., Chicago, Ill., $219,274. Plans and specifications were prepared by George W. Fuller, 170 Broadway, New York, and Langdon Pearse, 76 West Monroe St., Chicago, Ill. Noted Mar. 27.

Grayslake, Ill.—William H. Studer, Consult. Engr., Libertyville, Ill., is preparing plans for a water system here, estimated to cast $11,000. D. G. White is Village Clk.

Cherokee, Ill.—Bids will be received by the City Council until 8 p.m., May 6, for furnishing and laying 7685 ft. of 6-in., and 1765 ft. of 4-in. c.i. pipe, seven fire hydrants, and 10 valves and boxes. William Shardlow is City Clk.

Boscobel, Wis.—We are officially advised that bids will be received by H. J. Jonnson, City Clk., until 8 p.m., May 9, for laying 10,523 ft. of 8-in., 7011 ft. of 6-in. and 1359 ft. of 4-in. c.-i. water pipe, setting 15,000 lb. special castings; 43 hydrants; 13 8-in., 6-in. and 4-in. valves and boxes; laying 1865 ft. of 12-in., 3325 ft. of 10-in. and 10,576 of 8-in. vitrified pipe sewers, 38 manholes, 5 flush tanks and the construction of a sewage-treatment tank, 14x42x7 ft., of reinforced concrete. W. G. Kirchoffer, Engr., Madison, Wis., is Consult. Engr. Noted Feb. 27.

★+Milwaukee, Wis.—According to press reports, the contract to construct a water-works tunnel 12 ft. in diameter, for a distance of 4000 ft. out into and under Lake Michigan, has been awarded to JOSEPH HANREDDY, 127 North Dearborn St., Chicago, Ill., at $420,300. Other bid received was from Nash Bros., Chicago, at $613,275. Bids were opened by the Department of Public Works, Apr. 24.

Wauzeka, Wis.—We are officially advised that bids will be received by J. C. Feldman, Village Clk., until 7:30 p.m., May 8, for furnishing and laying 6128 ft. of 6-in. c.-. pipe, 4800 lb. specials, setting 14 hydrants and five valves and boxes and the construction of a reinforced-concrete tank 16 ft. in diameter by 30 ft. deep. Bids for the laying of the water pipe will be taken separately from the bids on the materials. W. G. Kirchoffer, Madison, Wis., is Consult. Engr.

+Guthrie Center, Iowa—We are officially advised that the contract to extend the water system here has been awarded to the C. W. ROLAND CO., Des Moines, Iowa, at $7721. The other bids were: W. D. Lovell, $7900; Des Moines Bridge & Iron Works, $7950; Lana Const. Co., $8500. Bids were opened Apr. 22. Noted Apr. 17.

Fontanelle, Iowa—At a special election, Apr. 12, it was decided to install a water system and electric-light plant to cost $22,000.

Mankato, Minn.—H. F. Blomquist, City Engr., has prepared plans for laying water mains in various streets. A. G. Meyer is Mayor.

Maple Lake, Minn.—We are officially advised that bids will be received by E. P. Scanlan, Village Recdr., until 8 p.m., May 12, for constructing a complete water system here. Plans and specifications are on file at the office of the Village Recorder, or may be obtained from the Oscar Claussen Engineering Co., Commercial Bldg., St. Paul, Minn. Noted Apr. 24.

Lawrence, Kan.—We are officially advised that Worley & Black, Consult. Engrs., Reliance Bldg., Kansas City, Mo., have been retained to appraise the value of the water system here.

Madison, Kan.—According to press reports, bids will be received about May 15, for constructing a water system, according to plans prepared by Rollins & Westover, Consult. Engrs., Kansas City, Mo.

Scott, Kan.—We are officially advised that bids will be received by the city until 8 p.m., May 27, for constructing a complete water system and electric-light plant. The contract involves the following: Brick building, 50,000-gal. tank and tower, 10,000-gal. fuel oil tank, 60-hp. special electric oil engine, 35-hp. special electric oil engines, 35-kw., 220-volt, 3-wire d.c. generator, 18-kw., 220-volt, 3-wire, d.c. generator, 35-amp. for 8-hour 62 cell 8 counter cell storage battery, two S.A. 6¾x24-in. deep-well pumps, two 8-hp. motors for pumps, two hose carts, 1000 ft. of hose, 10,500 lb. approximately W.P. copper wire, 300 cedar poles, 16 c.-i. street electroliers, cross arms, guy wires and all pole line material, 456 ft. of 8-in. c.-i. pipe, 1344 ft. of 6-in. c.-i. pipe, 16,272 ft. of 4-in. c.-i. pipe, 39 hydrants, gate valves, specials, etc The system is estimated to cost $35,000. Plans and specifications are on file at the office of O. D. Card, City Clk., and at the office of the Alamo Engine & Supply Co., Omaha. Noted Apr. 17.

+Ralston, Neb.—The contract to construct a water system here has been awarded to DRAKE, WILLIAMS & MOUNT, Omaha, at approximately $15,000. Noted Apr. 10.

Hannibal, Mo.—The city is considering the purchase of the private water system, as recommended by the Water Committees recently appointed by Mayor C. T. Hays. The plant is valued at approximately $300,000.

+St. Louis, Mo.—We are officially advised that the contract for furnishing new filters, Letting No. 10,879, has been awarded to the McCORMACK-COMBS BRAINERD CONSTRUCTION CO., Columbia Bldg., Mo., at $223,948. The other bids were: William P. Carmichael Co., Fullerton Bldg., $251,052; Fruin-Colnon Contracting Co., Laclede Bldg., $282,500; Hoggman Hogan Construction Co., $265,630. The bids &receive on the intake tower, tunnel and screen chamber, estimated to cost $450,000, were all rejected. Bids were opened by the Board of Public Improvements, Apr. 18. Edward E. Wall is Water Comr. Noted Mar. 13.

Bids will be received by the Board of Public Improvements until noon, May 6, for Letting No. 10,895, which consists of constructing an intake tower, tunnel and screen chamber at the Chain of Rocks pumping plant. Plans, specifications and form of contract may be obtained at the office of Edward E. Wall, Water Comr.

St. Louis, Mo.—See item under Streets and Roads.

Van Buren, Ark.—B. C. Grove & Co., St. Louis, Mo., have purchased the water system at Van Buren for $75,000, and contemplate various improvements.

Bryan, Tex.—Bonds for $35,000 have been voted for constructing a water tower, and improving various streets. George Wecker is City Secy.

Corpus Christi, Tex.—The City Council has decided to construct a concrete reservoir of 165,000 gal. capacity, and install a relay pumping station. Estimated cost $20,000.

Jacksonville, Tex.—See item under Sewers.

Jacksonville, Tex.—The town contemplates an expenditure of $35,000 for extending the water system and installing a sewer system. Nazel & Peterson, Muskogee, Okla., are Consult. Engrs. J. E. McFarland is Mayor. Noted Jan. 9.

+Mission, Tex.—A contract to install a water system, an electric-light plant and ice plant here, has been awarded to R. M. McCANDLISH, Kansas City, Mo., at approximately $50,000. The franchise to install this system is held by W. C. Duncan, Bay City, Tex.

Cushing, Okla.—The city plans to drill a well at the Cimarron River, and pipe the water to the city. Bonds for $15,000 were recently voted for this improvement.

Grand Junction, Colo.—Plans are being prepared by E. R. Romberg, City Engr., for laying two miles of water mains. Estimated cost, $10,000.

Phœnix, Ariz.—The Gila Water Co. is arranging to construct a system of irrigation in the valley of the Gila River, to reclaim about 100,000 acres of land. It is stated that a dam will be constructed across the Gila River and that the cost of the proposed system will be about $750,000. The American Mortgage Co., of Chicago, will finance the enterprise.

Tucson, Ariz.—The city contemplates an expenditure of $130,000 for installing new pumps for the water plant and laying a 30-in. gravity main. W. H. Thompson is City Engr. Noted Mar. 6.

Chehalis, Wash.—The Washington-Oregon Corp. plans to improve its water system at Chechalis, at an estimated cost of $15,000. Preliminary plans provide for reconstructing the reservoir, and laying new main line pipes. H. C. Coffman is Mgr.

Endicott, Wash.—Plans are being prepared by C. H. Green & Co., Consult. Engrs., Spokane, Wash., for a municipal water system here, estimated to cost $10,000.

Port Angeles, Wash.—The Puget Sound Mills & Timber Co. has been granted permission to lay a private water main to its mill. The company plans to expend $8000 for improving its private water system.

Eugene, Ore.—Plans are being prepared for constructing two new reservoirs for the water system, and laying several miles of mains. Bonds have been voted for this improvement.

+Linnton, Ore.—The contract to construct a water system here has been awarded to the JAMES KENNEDY CONSTRUCTION CO., Fargo, N. D. Bonds for $100,000 were recently sold for this improvement. Louis C. Kelsey, Selling Bldg., Portland, Ore., is Consult. Engr. Noted Mar. 13.

Escondido, Calif.—The Escondido Mutual Water Co. will expend $25,000 for improvements to the distributing system, and will also construct a new concrete dam and reservoir.

Nordhoff, Calif.—The Ojai Power Co., Nordhoff, has been granted a franchise to construct and maintain a system of water mains on county roads.

Perris, Calif.—A municipal water system estimated to cost $20,000 will be installed here. Bonds for that amount were voted at a recent election. Noted Dec. 12.

+Suisun, Calif.—The City Trustees have awarded a contract to the LYNCHBURG FOUNDRY CO., at $10,964, for supplying pipe for new water mains, and to W. B. CONNOLLY, Suisun, for laying the pipe.

Tulare, Calif.—Dr. Charles W. Bryson, Los Angeles, Calif., contemplates the construction of an irrigation system on his ranch near Tulare. Estimated cost, $50,000.

Regina, Sask.—Bids will be received by the City Commissioners until noon, May 12, for laying water mains in various streets. J. M. Mackay is Supt. W.-Wks.

SEWERS

Brunswick, Maine—The village has voted to construct a sewer from Belmont St. to Main St., at an estimated cost of $15,000. John W. Riley is Village Clk.

Bellows Falls, Vt.—Bonds for $20,000 have been voted for improving and extending the sewer system. Noted Mar. 27.

St. Albans, Vt.—C. J. Renner, City Engr., has prepared preliminary plans and estimates for the proposed sewage-disposal plant. An election has been called for May 29 to take final action on the proposition to issue bonds for this improvement. Selden C. Greene is Mayor. Noted Apr. 3.

+Boston, Mass.—The contract to construct sewers in Neponset Playground, Dorchester, has been awarded to McCARTHY & WALSH, Boston, at $21,550. The other bids were: Antony Cefalo, $22,164; J. H. Ferguson, $22,318; Anthony Baruffaldi, $22,457; Peter W. Hill, $23,830; William J. Barry,

$23,863; George J. Regan, $23,997; M. Russo & Son, $24,903; J. D. Kelly, $26,319. L. A. Rourke is Comr. Pub. Wks. Noted Apr. 17.

Bids will be received by the Department of Public Works until May 2, for constructing sewers in Donner Ave., Tesla and Durmah Sts., Edgewater Drive, Dorchester District, and in Wood Ave., River, Baldwin and Blake Sts., Hyde Park District. L. K. Rourke is Comr. Pub. Wks.

★**Fitchburg, Mass.**—Bids will be received by the Sewage Disposal Commissioners until 2 p.m., May 15, for constructing a sewage disposal plant. The work includes the construction of five Imhoff settling tanks, two acres of sprinkling filters 10 ft. deep, four secondary settling tanks, sludge beds, a laboratory building, sludge pump building and appurtenant structures. Some of the principal items in the estimate of work are as follows: Earth excavation, 68,000 cu.yd.; roadway construction, 2900 lin.ft.; concrete masonry, 3000 cu.yd.; false floor system for sprinkling filters, 9400 sq.yd.; three coat cement plaster on ribbed metal reinforcing lath, 5600 sq.yd.; steel reinforcing bars, 78 tons; structural steel, 68 tons; c.-i. pipe laying sizes 4 to 30 in., total 11,600 lin.ft.; crushed stone for sprinkling filters, 22,700 cu.yd. David A. Hartwell is Ch. Engr., and Harrison P. Eddy, 14 Beacon St., Boston, is Consult. Engr. Noted Apr. 17.

Malden, Mass.—The city has decided to expend $100,000 for municipal improvements, the larger part to be used for improving and extending the sewer system. Henry W. Estey is City Engr.

Northbridge, Mass.—Tentative plans have been prepared for extending the sewer system from Linwood to Whitinsville, south of the Mumford River. Estimated cost, $30,000.

★✦**Westfield, Mass.**—The contract to furnish about two miles of sewer pipe has been awarded to WARNER, MILLER CO., New Haven, Conn., at 71⅔% of list price. Noted Apr. 17.

Worcester, Mass.—It is proposed to connect the sewer system of the Worcester State Hospital, with the municipal system of Worcester. Estimated cost, $7500.

Cheshire, Conn.—Bids will be received by A. B. Hill, Engr., 100 Crown St., New Haven, Conn., until noon, May 5, for the construction of a sewage-disposal plant at the State Reformatory at Cheshire. The work will comprise in part about 13,000 cu.yd. of earthwork, 1500 ft. of 8-in. vitrified pipe sewer, 1500 ft. 6-in., 2200 ft. 5-in., 27,000 ft. 4-in. octagonal farm tile, two raw sewage siphons, 3500 lb. c.-i. specials and valves, 1400 lb. reinforcing steel, 125 cu.yd. concrete, 1200 cu.yd. broken stone or screened gravel and 11,000 ft. B. M. creosoted plank. Plans and specifications are on file at the office of A. B. Hill.

✦**Alblon, N. Y.**—The Board of Sewer Commissioners has awarded the contract for the sewer system and sewage disposal plant, to HAGER & GEORGE, Newark, at $148,321. Noted Apr. 24.

★**Fairport, N. Y.**—Bids will be received by the village until May 10, for purchasing sewer bonds for $40,000. George G. Mulliner is Village Treas.

Perry, N. Y.—We are officially advised that the proposition to install a sewer system here has been indefinitely postponed. The system is estimated to cost $25,000. C. J. Loan is Secy. Chamber of Commerce. Noted Mar. 6.

Verona, N. J.—Tentative plans have been prepared for the construction of a sewer system and sewage-disposal plant here. Estimated cost, $130,000.

North Braddock, Penn.—Bids will be received by George W. Siefers, Boro. Engr., until 3 p.m., May 8, for constructing sewers in various streets.

North East, Penn.—Bids will be received by J. H. Leet, Boro. Secy., until 8 p.m., May 5, for constructing a sewer system, according to plans and specifications on file at the office of the Borough Clerk.

✦**Pitman, Penn.**—A contract to construct a storm water sewer here has been awarded to PUGH & HUBBARD, Philadelphia, Penn., at $10,279. Noted Mar. 27.

West Chester, Penn.—Bids will be received by the Borough Council until May 5, for constructing sewers in the southeastern section of the borough. Plans and specifications are on file at the office of N. R. Rambo, Boro. Engr.

★**Baltimore, Md.**—Bids will be received by the Board of Awards until 11 a.m., May 14, for constructing lateral sewers and house connections in District 16 A, Sanitary Contract No. 111. The contract involves about 15,500 lin.ft. of vitrified pipe house connections, and 19,000 lin.ft. of 8- to 22-in. vitrified pipe sewer. Calvin W. Hendrick is Ch. Engr., Sewerage Comr.

Bids will be received by the Board of Awards until 11 a.m., May 7, for the construction of miscellaneous lateral sewers, Contract 108. The contract involves furnishing and laying 6600 ft. of 8- to 10-in. vitrified pipe sewer, and 1900 ft. of vitrified pipe-house connections. Noted Apr. 3.

★✦**Baltimore, Md.**—The contract to construct sanitary sanitary lateral sewers and house connections in District 16 B, Sanitary Contract 110, has been awarded to McCARTHY & OTTERSON, 121 Hearl St., Baltimore, at $146,833. Bids were opened Apr. 16. Noted Mar. 27.

Huntington, W. Va.—See item under Water Supply & Irrigation.

Atlanta, Ga.—We are officially advised that bids for constructing five groups of sewers were received by the Chairman of the Sewer Committee, on May 15, as follows: Group 1 Case & Cothran, $15,950; E. F. Meeks Construction Co. $14,930; Cement, Stone & Tile Co., $15,676; F. D. Harvey & Co., $14,455; Dysard Construction Co., $15,110; Group 2: Cement, Stone & Tile Co., $22,568; F. D. Harvey & Co. $17,933; Dysard Construction Co. $18,267. Group 3 Case & Cothran, $14,824; Cement, Stone & Tile Co., $15,441; F. D. Harvey & Co., $15,077; Dysard Construction Co., $14,666; L. T. Duke, $14,795. Group 4 Case & Cothran $10,861; E. F. Meeks Construction Co., $10,531; F. D. Harvey & Co., $9718; Dysard Construction Co. $10,109. Group 5 F. D. Harvey & Co. $8612. Dysard Construction Co. $8667. W. A. Hansell is Asst. Chief of Construction. Noted Apr. 10.

Jackson, Miss.—An election has been called for June 7 to vote on a bond issue of $60,000 for constructing storm sewers and a concrete bridge across Town Creek. B. H. Klyce is City Engr. Noted Apr. 24.

Paris, Tenn.—Bonds for $65,000 have been voted for improving the sewer system and electric-light plant. Noted Dec. 5.

Park City, Tenn.—We are officially advised that bids will be received by W. R. Johnson, Mayor, until 1 p.m., May 1, for purchasing $10,000 sewer bonds and $8000 school bonds. Noted Mar. 6.

Lexington, Ky.—The City Commissioners have ordered the construction of a sewer in North Upper St., from Church to Short St., and from Maple to Walnut St. J. W. Guyn is City Engr.

Shelbyville, Ky.—Plans are being prepared for constructing sewers in various streets, and for laying pavements. J. H. Kendell is City Engr.

✦**Ashtabula, Ohio**—A contract to construct a sewer in connection with the Main St. subway has been awarded to THOMAS FITZGERALD, Ashtabula, at $5726.

Bexley, Ohio—Bids will be received by George E. Frye, Village Clk., until noon, May 13, for constructing a municipal sewage treatment plant, according to plans and specifications on file at the offices of A. Elliott Kimberly, Consult. Engr., 8 East Long St., Columbus. Noted Apr. 10.

Canton, Ohio—The lowest bid received for constructing the last section of the Liberty St. storm sewer, was submitted by P. Campbell, Canton, at $26,847. The contract will probably soon be awarded by the Board of Control.

Celina, Ohio—Bids will be received by James K. Carlin, Village Clk., until noon, May 7, for constructing storm and sanitary sewers and a sewage disposal plant, according to plans and specifications on file at the office of the Clerk. Plans were prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio. Noted Apr. 24.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, May 8, for constructing sewers in various streets.

✦**Mansfield, Ohio**—The Board of Control has awarded a contract to PERRY & NICKELS, Canton, at approximately $10,000, to construct eight sanitary sewers.

Mantua, Ohio—The Village Council is considering a proposition to install a sewer system and sewage disposal plant, and to pave Main St. The improvement will cost about $60,000.

✦**Painesville, Ohio**—We are officially advised that a contract to construct sewers here has been awarded to HULLARI, BRANT & KASKI, Ashtabula, Ohio, at $11,952. The other bids were: Thomas P. Egan, $17,458, and C. H. Stacking, $14,300.

Salem, Ohio—Plans have been prepared by the City Engineer for constructing a main intercepting sewer in Newgarden, Railroad, Depot and Filbert Sts., Broadway, and other streets. Estimated cost, $25,000.

✦**Wooster, Ohio**—We are officially advised that the contract to construct sanitary sewers here, has been awarded to HASKELL & BATTLES, Painesville, Ohio, at $17,559. The other bids were: Griest, Marley & Miller, $19,046; Kohbarger & Hoyles, $20,684. Bids were opened Apr. 14. T. P. Brown is City Engr. Noted Apr. 10.

Gary, Ind.—The Board of Public Works has adopted a resolution providing for the construction of District Sewer No. 18, which is designed to connect the sewer system of the south side with the system at Tolleston, and to drain the section near the new Froebel School. The system is estimated to cost $76,000.

★**Knox, Ind.**—Bids will be received by the Town Clerk until 2 p.m., May 8, for constructing a sewer system here, estimated to cost $24,000. Plans and specifications may be obtained from the Town Clerk.

Kalamazoo, Mich.—The Sewer Committee has submitted a report to the City Council recommending the extension of sewer in 23 streets, at an estimated cost of $15,966. Andrew Lerderink is City Engr.

Ottawa, Ill.—The Board of Local Improvements contemplates the construction of a trunk sewer in the northern part of the city, to drain into the Fox River.

Bangor, Wis.—Bids are being received by the town for the construction of 9300 lin.ft. of sewer, with 40 catch basins and the necessary manholes. George P. Bradish, La Crosse, Wis., is Consult. Engr.

Menomonie, Wis.—Plans are being prepared for the construction of a sewer system to serve the south side. Estimated cost, $15,000.

Racine, Wis.—Bids will be received by the Board of Public Works until 10 a.m., May 3, for laying sewers in various streets. P. H. Connolly is Chn.

Burlington, Iowa—H. C. Vollmer, City Engr., has prepared plans for the construction of a 14x10-ft. horseshoe sewer to extend from Seventh and Valley Sts., to the river. The sewer will be 2400 ft. long, of reinforced concrete.

Bids will be received at the office of the City Clerk until 9 a.m., May 1, for the construction of a sewer in Gnann St., with branches in adjacent streets and alleys. H. G. Vollmer is City Engr.

Eldora, Iowa—See item under Streets and Roads.

Riceville, Iowa—A. F. Kemman, County Engr., New Hampton, is interested in a proposition to install a sewer system and septic tank here.

✦**Sibley, Iowa**—We are officially advised that the contract to construct sanitary sewers and a sewage disposal plant here has been awarded to the ARTHUR A. DOBSON CO., Lincoln, Neb., at $19,250. Bids were opened Apr. 15. Noted Apr. 10.

New Ulm, Minn.—Bids will be received by Albert J. Meyer, City Clk., until 5 p.m., May 6, for laying sewers in various streets.

Wabash, Minn.—According to press reports, J. E. Ingar, of the Oscar Claussen Engineering Co., St. Paul, Minn., has outlined a plan for a sewer system for the town, which is estimated to cost $7500.

Dodge City, Kan.—Fred Eckert, City Engr., of Kinsley, Kan., has been retained by Dodge City to prepare plans and specifications for a sewer system, estimated to cost $15,000. Noted Feb. 27.

+Valley City, N. D.—The contract to construct an intercepting and outfall sewer here has been awarded to the HAGGERT CONSTRUCTION CO., Fargo, N. D., at $61,374. Noted Mar. 27.

Butte, Mont.—Bids will be received by the City Council until 5 p.m., May 7, for constructing a reinforced-concrete storm sewer in the Second Gulch. The contract involves about 8490 lin.ft. of sewer, 1960 cu.yd. of excavation and 128 cu.yd. of fill. W. A. Willis is City Clk.

Memphis, Mo.—The City Council has decided to submit to the voters the proposition to install a sewer system here. It is estimated that a system will cost about $12,000. Noted Dec. 19.

++Poplar Bluff, Mo.—We are officially advised that the contract to construct sanitary sewers in Sewer District No. 3 has been awarded to the BELL HUDSON CONSTRUCTION CO., Popular Bluff, at $16,692. The other bid received was from the Plumber Adams Co., Springfield, Mo., at $17,643. Edward C. Thomas is City Engr. Noted Apr. 13.

Little Rock, Ark.—A committee has been appointed by the Mayor to organize a sewer district in the section near Spring St., from the river to Eighth St. It is estimated that a system of sewers for this section will cost about $100,000. W. L. Hemingway is a member of the committee.

+Pine Bluff, Ark.—We are officially advised that the contract to lay about 12,000 ft. of 6- and 8-in. vitrified clay pipe sewers here has been awarded to ROBINSON BROS., Pine Bluff, at $7173. The only other bid received was from W. J. Parkes, at $7745. Bids were opened Apr. 19. Noted Apr. 3.

+El Paso, Tex.—A contract to construct a concrete sewer here has been awarded to the CONCRETE PRODUCTS CO., Chicago, at $22,250.

Jacksonville, Tex.—Bonds for $35,000 have been voted for constructing a sanitary sewer system and extending the water system.

+Houston, Tex.—According to press reports, the contract to construct the Second Ward storm sewer has been awarded to FREUND & QUAY, Houston, at $108,557. Noted Apr. 3.

Salt Lake City, Utah—Bids will be received by Noble Warrum, City Recdr., until 10 a.m., May 6, for constructing pipe sewers in Sewer Extension No. 315.

+Aberdeen, Wash.—A contract to construct a trunk sewer and lateral sewers, has been awarded to CAMP & CHEATHAM, Spokane, Wash., at $25,986 and $13,247, respectively.

Sumner, Wash.—Bids will be received by the city until May 7, for constructing a trunk sewer in Local Improvement District No. 8.

Woodburn, Ore.—Bids will be received by G. H. Beebe, City Recdr., until May 6, for constructing sewers in West Cleveland, Montgomery and Arthur Sts.

Los Angeles, Calif.—Mlagenovich & Gillespie were low bidders at $5500 for the construction of a sewer in Fries St., from Bryant to Seventh St. Other bids were: Wm. Smith, $6973; J. Mohan, $11,581.35; J. C. Wukojevich, $17,790; H. Sorrell, $15,350; J. J. Veselich, $10,225; B. Yeaco, $14,000; J. Sualo, $10,944.; W. J. Eggert, $13,900.

+San Francisco, Calif.—We are officially advised that the contract to complete Contract No. 37, which involves the construction of sewers and appurtenances in Golden Gate aPrk and 48th Ave., has been awarded to F. ROLANDI, 55 Montgomery St., San Francisco, at $185,767. Other bid received was: State Construction Co., $190,309. Bids were opened Apr. 10. Noted Apr. 10 and Apr. 3.

★Hamilton, Ont.—Bids will be received by John Allan, Mayor, and Chn. Bd. of Control, until 10 a.m., May 6, for constructing reinforced-concrete sewage tanks, conduits, sludge drying beds, pile foundations and all other structures required for the construction of the West End sewage disposal plant. Plans and specifications may be obtained from the City Engineer. S. H. Kent is City Clk.

+Regina, Sask.—We are officially advised that contracts for furnishing and delivering c.-i. pipe, lead pipe, couplings, valves, cocks, have been awarded as follows: Contract E, CANADIAN IRON CORPORATION, $253,426; Contract C, JAS. ROBERTSON & CO., Winnipeg, all lead goods, $15,435; Contract C, J. H. ASHDOWN CO., Winnipeg, pig lead, $11,880; Contract D, DRUMMOND-McCALL CO., Montreal, gate valve, $19,260.

New Westminister, B. C.—Plans are now on file at the office of the City Engineer for the first two sections of the Sapperton sewer system. Bids will probably soon be asked for these contracts.

GARBAGE

Schenectady, N. Y.—Bids were received by the Board of Contract and Supply Apr. 16, for a garbage disposal plant, apparatus and equipment, as follows: C. O. Bartlett & Snow Co., Cleveland, Ohio, $62,420; the D. Connelly Boiler Co., Cleveland, Ohio, $66,250.

+Tiffin, Ohio—The Board of Health has awarded the contract to DAVID HAVERSTICK, Tiffin, for the removal of garbage for a period of one year.

+Berkeley, Calif.—The contract has been awarded to the REFUSE DISPOSAL CO., San Francisco, Calif., for the construction of a garbage disposal plant, at $61,250.

STREETS AND ROADS

Augusta, Maine—The Legislature has appropriated $20,000, and expects to obtain $10,000 additional from the Federal Government for improving about 50 miles of rural delivery road from Riverton to Fryeburg through Westbrook, Windham, Raymond, Casco and Bridgton. P. L. Hardingson is State Highway Comr.

Boston, Mass.—Bids will be received until May 5 by the Department of Public Works for sidewalks and for macadam roadways in Evelyn, Minot, Tyndale and Woolson Sts. Dorchester, and in Walworth St, West Roxbury. J. K. Rourke is Comr.

+The contract for laying bitulithic pavement in Norfolk St., Dorchester, was awarded to JAS. DOHERTY at $58,096; Other bids were: Michael Meehan (informal) $55,889; Warren Bros. Co., $63,798. Noted Apr. 10.

Providence, R. I.—The State Legislature has ordered a special election June 3, to vote on a bond issue of $700,000 for state highways.

Hartford, Conn.—Bids for road work were received by the State Highway Commissioner, Apr. 21, as follows: Town of North Branford, 4290 lin.ft. macadam-telford on (3) rubble drain; (4) concrete walls; (5) masonry walls; (6) dry rubble walls: Lawrence Bruce, North Haven, Conn.: (1) $1.69 per lin.ft.; (2) $2.06 per lin.ft.; (3) $1 per lin.ft.; (4) $10 per cu.yd.; (5) $7 per cu.yd.; (6) 6 per cu.yd.; F. Arrigoni & Bro., Middletown, Conn.: (1) $1.98; (2) $2.98; (3) $1.25; (4) $8; (5) $7; (6) $5.50; Town of Middletown, 6090 lin.ft. macadam-telford or gravel-telford construction on the Newfield road; (1) macadam; (2) macadam-telford; (3) gravel; (4) gravel-telford; (5) rubble drain; (6) concrete walls; (7) masonry walls; (8) dry rubble walls: McDonald & North, Middletown, Conn.: (1) $1.97 per lin.ft.; (2) $2.29 per lin.ft.; (3) $1.49 per lin.ft.; (4) $1.94 per lin.ft.; (5) 95c. per lin.ft.; (6) $8 per cu.yd.; (7) $7 per cu.yd.; (8) $6 per cu.yd.; Frank Arrigoni & Bro., Middletown, Conn.: (1) $2.27 (2) $3.10; (3) $1.89; (4) $2.75; (5) $1.25; (6) $8; (7) 7; Town of Trumbull, 5400 lin.ft. native stone macadam or gravel construction on the Wells Hollow Turnpike: (1) gravel; (2) gravel-telford; (3) macadam; (4) macadam-telford; (5) rubble drain; (6) cobble gutters; (7) concrete walls; (8) masonry walls; (9) dry rubble walls: Goodman & Trumbull Co., Litchfield, Conn.: (1) $2.75 per lin.ft.; (2) $3.75 per lin.ft.; (3) $2.75 per lin.ft.; (4) $3.75 per lin.ft.; (5) $1.25 per lin.ft.; (6) 70c. per sq.yd.; (7) $9 per cu.yd.; (8) $5 per cu.yd; (9) $4.50 per cu.yd.; B. D. Pierce, Jr., Co., Bridgeport, Conn.: (1) $2.07, (2) $2.78; (3) $2.47; (4) $2.97; (5) $1; (6) 80c.; (7) $10; (9) $8; (9) $6; Town of Morris, 6436 lin.ft. graded or gravel construction on the Bantam Lake road; (1) gravel; (2) gravel-telford; (3) grading; (4) grading-telford; (5) rubble drain; (6) concrete walls; (7) masonry walls; (8) dry rubble walls. Goodman & Trumbell Co., Litchfield, Conn.: (1) $2.15 per lin.ft.; (2) $3.15 per lin.ft.; (3) $1.25 per lin.ft.; (4) $2.25 per lin.ft.; (5) $1.25 per lin.ft.; (6) $9 per cu.yd.; (7) $5 per cu.yd.; (8) $4.50 per cu.yd.; L. Longhi & Bro., Torrington, Conn.: (1) $1.68; (2) $2.93; (3) $1.61; (4) $2.55; (5) $1.35; (6) $10; (7) $9; (8) $7; Torrington Construction Co., Torrington, Conn.: (1) $1.57; (2) $2.57; (3) 98c.; (4) $1.98; (5) $1.25; (6) $6; (7) $5.50; (8) $4.50; B. D. Pierce, Jr., Co., Bridgeport, Conn.: (1) $1.58; (2) $2.28; (3) 98c.; (4) $1.75; (5) $1; (6) $10; (7) $8; (8) $6: Town of Coventry, 8027 lin.ft. gravel construction on the Manchester-Coventry Road; (1) gravel per lin.ft.; (2) gravel-telford per lin.ft.; (3) rubble drain per lin.ft.; (4) concrete walls per cu.yd.; (5) masonry walls per cu.yd.; (6) dry rubble walls per cu.yd.: Peter Suzio, New Britain, Conn.: (1) $2.24; (2) $3.24; (3) $1.25; (4) $8; (5) $6.50; (6) $5.50; Ahern Construction Co., Willimantic, Conn.: (1) $1.77; (2) $2.57; (3) $1.25; (4) $8; (5) $6; (6) $5. Town of Sharon, 1840 lin.ft. gravel construction on the Sharon-Amenia road; (1) gravel per lin.ft.; (2) gravel-telford per lin.ft.; (3) rubble drain per lin.ft.; (4) concrete walls per cu.yd.; (5) masonry walls per cu.yd.; (6) dry rubble walls per cu.yd.: Goodman & Trumbull Co., Litchfield, Conn.: (1) (1) $2.39; (2) $3.39; (3) $1.25; (4) $9; (5) $5; (6) $4.50: Torrington Construction Co., Torrington, Conn.: (1) $1.69; (2) $2.69; (3) $1.25; (4) $6; (5) $5.50; (6) $4.50; L. Longhi & Bro., Torrington, Conn.: (1) $2.15; (2) $3.30; (3) $1.40; (4) $10; (5) $9; (6) 7. Town of Preston, 5177 lin.ft. native macadam construction on the Norwich-Westerly road; (1) macadam per lin.ft.; (2) macadam-telford per lin.ft.; (3) cobble gutters per sq.yd.; (4) rubble drain per lin.ft.; (5) concrete walls per cu.yd.; (6) masonry walls per cu.yd.; (7) dry rubble walls per cu.yd.: Ahern Construction Co., Willimantic, Conn.: (1) $4.49; (2) $5.20; (3) 80c.; (4) $1.25; (5) $8; (6) $6; (7) $5; Charles W. Tryon, Meridan, Conn.: (1) $3.15; (2) $4.15; (3) 80c.; (4) $1.35; (5) $8; (6) $6.50; (7) $5; Robert G. Miller, Bloomfield, Conn.: (1) $5.25; (2) $5.85; (3) $1; (4) $6; (6) $5.50; (7) $5; Torrington Construction Co., Torrington, Conn.: (1) $3.59, (2) $4.59; (3) 75c.; (4) $1.25; (5) $6; (6) $5.50; (7) $4.50: Town of Berlin, 3963 lin.ft. macadam construction on the Torrington road: (1) macadam-asphalt per lin.ft.; (2) macadam-asphalt-telford per lin.ft.; (3) cobble gutters per sq.yd.; (4) rubble drain per lin.ft.; (5) concrete walls per cu.yd.; (6) masonry walls per cu.yd.; (7) dry rubble walls per cu.yd.: B. Silvestri & Co., Hartford, Conn.: (1) $2.19; (2) $2.74; (3) 60c.; (4) 80c.; (5) $7.50; (6) $6, (7) $5; Robert G. Miller, Bloomfield, Conn.: (1) $2.90; (2) $4; (3) $1; (6) $7; (7) $6.50; Torrington Construction Co., Torrington, Conn.: (1) $1.88; (2) $3; (3) $1; (4) $1.50; (5) $7; (6) $6; (7) $5; Leonardo Suzio, Meriden, Conn.: (1) $1.80; (2) $2.90; (3) 75c.; (4) $1.10; (5) $8; (6) $6; (7) $4.50; H. E. Hall & Co., Hartford, Conn.: (1) $2.70; (2) $3.60; (3) 60c.; (4) $1.65; (5) $7; (6) $3.50; (7) $2.55: Town of Stafford, 5530 lin.ft. bituminous-macadam construction on the West Stafford road: (1) bituminous macadam; (2) macadam-telford per sq.yd.; (3) rubble drain per lin.ft.; (4) cobble gutters per sq.yd.; (5) concrete walls per cu.yd.; (6) masonry walls per cu.yd.; (7) dry-rubble walls per cu.yd.: Cornelia Bros., Winsted, Conn.: (1) $1.79; (2) $2.79; (3) $1; (4) $1; (5) $8; (6) $6; (7) $4.50; B. Silvestri & Co., Hartford, Conn.: (1) $1.24; (2) $1.89; (3) $1; (4) 60c.; (5) $7.50; (6) $6; (7) $5; A. D. Bridges' Sons Co., Hazardville, Conn.: (1) $1.73; (2) $2.19; (3) $1; (4) 60c.; (5) $10; (6) $7; (7) $5: Town of Old Lyme, 5536 lin.ft. graded construction on the Neck Road: (1)

grading per lin.ft. for 2585 ft.; (2) grading per lin.ft. for 3061 ft.; (3) telford base, per lin.ft.; (4) rubble drain per lin.ft.; (5) concrete walls per cu.yd.; (6) masonry walls per cu.yd.; (7) dry rubble walls per cu.yd.; F. Arrigoni & Bro., Middletown, Conn.; (1) $1.19; (2) $1.57; (3) $2.75; (4) $1.25; (5) $8; (6) $7; (7) $5.50; Framingham Construction Co., Framingham, Mass.; (1) $1.22; (2) $1; (3) $1.10; (4) $1.30; (5) $8; (6) $6; (7) 4; Robert G. Miller, Bloomfield, Conn.; (1) $2.25; (2) $3.25; (4) $3.75: Town of Prospect, 3771 lin.ft.; (2) telford per lin.ft.; (3) rubble drain per linft.; (4) cobble gutters per sq.yd.; (5) concrete walls per cu.yd.; (5) masonry walls per cu.yd.; (7) dry rubble walls per cu.yd.; Goodman & Trumbull Co., Litchfield, Conn.; (1) $1.54; (2) $2.54; (3) $1.25; (4) 75c.; (4) $9; (6) $5; (7) $4.50; L. Longhi & Bros., Torrington, Conn.; (1) $1.75; (2) $2.75; (3) $1.38; (4) $1.25; (5) $10; (6) $8; (7) $6: Town of West Hartford, 7567 lin.ft. bituminous macadam or concrete construction on the Part Street road: (1) water bound macadam per cq.yd.; (2) water bound macadam-telford per sq.yd.; (3) macadam-asphalt per sq.yd.; (4) macadam-asphalt-telford per sq.yd.; (5) bituminous macadam per sq.yd.; (6) bituminous macadam-telford per sq.yd.; (7) concrete per sq.yd. (8) bicomac surface concrete base per sq.yd.; (9) extra culvert width per lin.ft.; (10) rubble drain per lin.ft.; (11) cobble gutters per sq.yd.; (12) concrete walls per cu.yd.; (13) masonry walls per cu.yd.; (14) dry rubble walls per cu.yd.; F. B. & W. H. O'Neil, Hartford, Conn.; (7) $2.16; (9) $1.50; (10) $3; (11) $1.25; (12) $9; (13) $6.25; (14) $5; H. E. Hall & Co., Hartford, Conn.; (1) $1.60; (2) $2.14; (3) $2.07; (4) $2.61; (5) $2.58; (6) $3.30; (7) $2.84; (8) $3.11; (9) $90; (10) $2.65; (11) 75c.; (12) $7.75; (13) $5; (14) $3.85; Town of West Hartford, A. C. Sternberg, Jr., First Selectman: (7) $1.71; (8) $1.83; (10) $1.25; (12) $8; (13) $6; (14) $5; Piersen Engineering & Construction Co., Hartford, Conn.; (1) $1.45; (2) $2; (3) $1.54; (4) $1.98; (5) $1.64; (6) $2.10; (7) $1.58; (8) $1.55; (9) $50; (10) $1.25; (11) 75c; (12) $8; (13) $6; (14) $4. Charles J. Bennett is Comr.

Bids will be received by the Board of Contract and Supply until 11 a.m., May 6, for furnishing and laying concrete base and granite block wearing surface of about 1850 sq.yd. on Spruce St.; furnishing and laying concrete base and sheet asphalt surface of about 9300 sq.yd. on Front, Morgan and Pleasant Sts. In this connection the trolley company will lay about 675 sq.yd. on Morgan St., and relay about 14,100 sq.yd. of asphalt surface on Main St. and Farmington Ave. Roscoe N. Clark is City Engr.

+Albany, N. Y.—The Board of Contract and Supply received the following bids for improving New Scotland Ave.: Warren Bros., Boston, $45,309; Union Paving Co., Schenectady, $60,370; M. F. Dollard, Albany, $49,765; Kennedy Construction Co., Albany, $53,092; T. Henry Dumary, Albany, $48,798. All bids were rejected. The following bids were received for improving Dove St., from Sheridan to Clinton Aves.; BENJ. F. MULDERRY, Albany, $7223 (awarded contract); M. F. Dollard, Albany, $7560; Kennedy Construction Co., Albany, $7585; Patrick W. Mulderry, Albany, $7766. Isidore Wachsman is Secy. of the Bd.

Auburn, N. Y.—Bids will be received until 8 p.m., May 6, by the Mayor for about 25,000 sq.yd. paving on James St. Elbert C. Aldrich is City Engineer, J. S. Hanlon is City Clerk, Thos. H. O'Neill is Mayor.

Batavia, N. Y.—The City Council has decided to pave Summit St. with brick, for a distance of 2500 ft. The approximate cost will be $25,000.

Brooklyn, N. Y.—Bids will be received until 11 a.m., May 7, by the President of the Borough, Borough Hall, for grading, curbing and laying sidewalks on Amboy, Erasmus Hemlock, Story and West Sts.; Gardner and Howard Aves.; for regulating and grading 66th St.; for regulating and paving portions of Ashford, Elton, Erasmus, Montgomery, Shaeffer, 51st and 79th St., Church, Kingston and 13th Aves., and Ave. F. Alfred E. Steers is Pres.

+Cedarhurst, L. I., N. Y.—The Village Trustees have awarded a contract to the STANDARD BITULITHIC CO., at $1.82 per sq.yd. for about 15,000 sq.yd. paving on Washington and Cedarhurst Aves., Spruce and Chestnut Sts.

New York, N. Y.—We are officially advised that the following bids were received on Apr. 25, by the President of the Borough of Manhattan, for paving on various streets (low bids only): For paving Abingdon Square and Eighth Ave., from Abingdon Square to Columbus Circle, with granite, W. J. Cunningham, $428,669; for repaving with wood and granite Abingdon Square and Eighth Ave., from Eighth Ave. to Columbus Circle, W. J. Fitzgerald, $365,649. Noted Apr. 17.

New York, N. Y. (Boro of Richmond)—Bids will be received until noon, May 6, by the President of the Borough of Richmond, Boro. Hall, St. George, New Brighton, for regulating and repaving with wood block Jersey St. from Fifth St. to Castleton Ave. George Cromwell is Pres.

+Belvidere, N. J.—The Board of Freeholders of Warren County has awarded a contract to SALMON BROS., Nutong, N. J., at $44,569 for the construction of about five miles of stone road between Blairstown and Columbia.

+Bloomfield, N. J.—We are officially advised that the contract for improving Essex Ave. was awarded to PETITO SCOLA, Glen Ridge, N. J., at $4,700. Ernest Bacchin is City Engr. R. F. Davis is Town Clk. Noted Apr. 17.

Camden, N. J. The Board of Freeholders will receive bids until 10 a.m. May 12, for 30,000 to 50,000 gals. of asphaltum road coat according to specifications on file with P. W. George, Court House. J. P. Laul is Chn. of Roads Com.

+Long Branch, N. J.—We are officially advised that the City Council has been awarded a contract to M. C. BURNS at 12.50 per sq.yd., for 23,000 sq.yd. vitrified brick paving on Second Ave. The contract for 5000 sq.yd. on Rockwell and Third Aves. was awarded to the STANDARD BITULITHIC CO., New York, N. Y., at $2.14 per sq.yd. J. Wesley Seaman is City Engr. Noted Apr. 3.

Newark, N. J. The Board of Works will receive bids until May 5 for wood block paving on Broad St. The contract will be awarded in four separate parts. Specifications call for 20 lb. of wood preservative per cu.ft. of blocks. Morris R. Sherrerd is City Engr. Noted Mar. 20.

Plainfield, N. J.—Bids will be received until May 5 by the Street Commission for about 28,000 sq.yd. of waterbound macadam paving and 6000 cu.yd. of excavation. Andrew J. Gavett is St. Comr. Noted Apr. 24.

★Rahway, N. J.—Bids will be received until 8 p.m., May 13, by the Common Council, for paving Irving St., from Poplar to Grand St., with vitrified brick. About 8742 sq.yd. will be required.

Westfield, N. J.—Bids will be received until 8 p.m., May 5, by the Town Council for completing the improvements on various streets. The estimated quantities are: 2600 cu.yd. excavation, 3200 sq.yd. waterbound macadam to be completed, 2900 sq.yd. old macadam resurfaced, 150 tons crushed stone. Charles Clark is Town Clerk.

★Erie, Penn.—Bids will be received until 8 p.m., May 5, by the City Council, for approximately 8500 sq.yd. of brick or sheet asphalt pavement, work to be let under five separate contracts. B. E. Briggs is City Engr.

+Ferndale, Penn.—The Borough Council has awarded a contract to the BAKER-OWEN CONSTRUCTION CO., Johnstown, Penna. at $1.85 per sq.yd. for 7700 sq.yds. brick paving on concrete base.

Franklin, Penn.—The Common Council will shortly advertise for bids for repaving two blocks of Liberty St.

Monessen Penn.—Bids will be received until 8 p.m. May 1 by the Borough Council for grading, curbing and paving various streets. The approximate quantities are: 10,200 cu.yd. grading, 12,500 lin.ft. curbing, 19,100 sq.yd. paving. A. W. Johns is Borough Engr.

Patton, Penn.—Bids will be received by the Borough Council until 8:30 p.m., May 5, for grading, curbing and paving Sixth Ave. from Beech to Palmer Aves. D. G. Dumm is Boro. Secy.

+Reading, Penn.—We are officially advised that the Commissioners of Berks County have awarded a contract to JOHN E. WEIDNER, Reading, Penn., at $1 per sq.yd. for paving the east and west approaches of the Lancaster Ave. Bridge and the east approach of the Schuylkill Ave. Bridge. D. H. Hoch is County Controller. Noted Apr. 17.

Romansville, Penn. (R. D. from Embreeville, Penn.)—Bids will be received until 6 p.m., May 5, by the Supervisors of West Bradford and Newline Townships for grading and macadamizing a public road 5661 ft. in length. R. E. Ramsey, Romansville, is Secy.

Scranton, Penn.—Bids will be received until noon, May 14, by the Controller of Lackawanna County for completing three sections of an unfinished macadam road in the county. Charles R. Savage is County Controller.

+Sewickley, Penn.—We are officially advised that the Borough Council has awarded a contract to McPHERSON BROS., Edgeworth, Penn., at $6583 for about 3036 sq.yd. brick paving on Nevin Ave. Other bidders were: Ridge Bros., $7254; J. G. McGuire & Co., $7088; D. W. Challis & Sons, $6617; the Holmes Construction Co., $6935. M. M. Baker is Borough Engr. Noted Apr. 17.

+Baltimore, Md.—Contracts have been awarded by the Board of Awards to the F. E. SCHNEIDER PAVING CO., Lorman and Monroe Sts., Baltimore, for paving under Contracts 106, 109 and 111, at $37,099, $6542 and $13,367, for bituminous concrete paving. Under contract 110 to P. FLANIGAN & SONS, 120 East Lexington St., Baltimore. Eugene E. Grannann, Pres. of Comrs. Noted Apr. 10.

+Baltimore, Md.—We are officially advised that the Paving Commission has awarded a contract to THOMAS MULLAN, York Road and Dumbarton Ave., Baltimore, for street paving under Contract No. 52; to the EASTERN PAVING CO., 55 Baxter Bldg., Philadelphia, for Contract No. 54. All bids on Contract No. 53 were rejected as excessive, and its readvertisement ordered. J. Meyers Hedian is Secy. of the Com. Noted Mar. 27.

+Denton, Md.—The Commissioners of Caroline County have awarded a contract to the HOLT CONSTRUCTION CO., Federalsburg, Md., at $33,234, for the construction of 1.63 miles of road from Denton to Willowpond and the concrete approaches to the bridge. The only bid for the drawbridge was rejected. Noted Apr. 24.

+Rockville, Md.—A contract has been awarded by the Commissioners of Montgomery County to FORSYTH & SMITH, Belair, Md., at $24,807, for the construction of three miles of road along the River Road from Cohasset to District of Columbia.

Virginia, Va. Bids will be received until May 6 by the Street Committee for the construction of about 5000 sq.yd. of concrete sidewalks. W. W. Tuck is Chn.

Waynesboro, Va.—Bids will be received until May 7 by the State Highway Commission and South River Road Board of Augusta County at the County Engineer's office, Waynesboro, for macadamizing about 33 miles of county roads as follows: Sect 1, Waynesboro to Stouart's Draft, 9.6 miles; Sect. 2, Waynesboro to Laymans, 5.2 miles; Sect. 3, Waynesboro to Hermitage, 4.9 miles; Sect. 4, Waynesboro to Fishersville, 5.7 miles; Sect. 5, Stuart's Draft to Fishersville, 6.9 miles; Sect. 6, Rockfish Gap to Waynesboro, with portions in Basic, and bituminous paving in Basic and Waynesbore. P. St. John Wilson, Richmond, Va., is State Highway Comr.

Huntington, W. Va.—See item under Water Supply—Irrigation.

+Decatur, Ga. We are officially advised that the City Council has awarded a contract to the NICHOLS CONTRACTING CO. at about $8000 for paving Candler St. Atlanta Stone Co. also bid on the work.

West Point, Ga. The City Council will ask bids for the construction of concrete sidewalks on various streets, for which the sum of $10,000 is available. J. T. Johnson is Mayor. Heyman Hagedorn is Engr.-in-Charge.

+Tampa, Fla.—The Board of Public Works has awarded a contract to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., at approximately $32,000 for 18,830 sq.yd. of asphalt block paving on Bayshore Blvd. F. F. Warren is City Engr. Noted Apr. 3.

Montgomery, Ala.—Bids will be received until May 19 by the Board of Revenue of Montgomery County for grading and graveling six miles of the Ramer-Grady Road from Ramer to the Pike County line. Thos. H. Edwards is County Engr.

New Decatur, Ala.—Bids will be received until May 12 by the City Council for curb, gutter and asphaltic concrete and bituminous concrete paving on various streets. Henry Hartung is City Clk.

Monroe, La.—Bids will be received until May 16, by the Mayor for paving Walnut St., from Jefferson to Pine Sts. The work requires 6544 sq.y. of wood block paving, 384 sq.yd. of brick, and 2880 lin.ft. concrete curb. A. A. Forsythe is Mayor.

New Orleans, La.—Bids will soon be asked for paving Fern St., from Commercial to Mobile Sts. This is a readvertisement as all bids were rejected the first time as excessive. A. A. Lafaye is Comr. of Pub. Property.

+Shreveport, La.—We are officially advised that the Police Jury of Caddo Parish has awarded a contract to the HEALY CONSTRUCTION CO., Meridian, Miss., at approximately $65,000, for the construction of 9½ miles of road; to the LOUISIANA PETROLEUM PETROLITHIC CONSTRUCTION CO., New Orleans, La., at approximately $46,500, for the construction of five miles of Parish roads. J. T. Bullen is Parish Engr. Noted Mar. 20.

+Blountville, Tenn.—A contract has been awarded by the Commission of Sullivan County to OLIVER & HILL, Maryville, Tenn., at approximately $200,000 for the improvement of county roads.

Union City, Tenn.—The City Council will soon ask for bids for street improvements, estimated to cost $40,000. C. H. Jenks is Engr-in-Charge. J. A. Cobe is Mayor.

Bowling Green, Ky.—We are officially advised that bids will be received until 10 a.m., May 5, by the Fiscal Court of Warren County for the construction, repair and maintenance for one year of turnpike, gravel and dirt roads in the county. About $25,000 has been appropriated by the county and nearly as much by vicinities through which the roads run. W. H. Crump is County Road Engr.

Akron, Ohio—Press reports state that the Director of Public Service will receive bids until May 7 for paving East Market St. The contract will be awarded in two parts to expedite the work. Ira A. Priest is City Clk.

+Cincinnati, Ohio—We are officially advised that a contract has been awarded by the County Commissioners to WILSON & SQUIRES, Hamilton Ave., Cincinnati, at $6354 for the improvement of about 4000 lin.ft. of Oak Ave. Albert Reinhardt is Clk. Noted Apr. 10.

Cleveland, Ohio—Bids will be received until 11 a.m., May 14, by the Board of Commissioners of Cuyahoga County for furnishing material for repairing Miles Ave., Dunham, Fenkell, Canal, Mayfield, Brecksville, Schaaf, Euclid, Berea, Wooster, Lorain, Columbia and Coe Ridge Roads and the Denison-Harvard Bridge. John F. Goldenbogen is Clk.

Cleveland, Ohio—Bids will be received until noon, May 9, by the Director of Public Service, for grading, draining, curbing and paving with brick portions of Adams Ave. and East 92d St. W. J. Springborn is Dir.

Columbus, Ohio—Bids will be received until May 14, by the Commissioners of Franklin County, for the improvement of the following roads: Thrush Road, Groveport Road and Richardson Road, all in Madison Township; Atcheson Road, Clinton and Griffin Township; Pack Road, Sharon Township; Livingston Ave. Road, Truro Township; Scioto Riverway, Franklin and Jackson Townships.

Bids will be received until May 15, by the State Highway Commissioner, for grading and paving with concrete with bituminous surface treatment, 0.71 mile of the Lancaster Road, Madison Township, Franklin County, at an estimated cost of $7832; for grading and paving with waterbound macadam, 1.03 miles of the Devaul Road, Sect. 2, Union and Paint Townships, Fayette County, at an estimated cost of $6914. James R. Marker is Comr.

+We are officially advised that the Commissioners of Franklin County have awarded contracts for road improvements as follows: To W. O. JEWETT, Worthington, Ohio, at $94,154 for 12.35 miles of macadam on the New Albany and Reynoldsburg Road, to W. O. JEWETT, at $40,566, for 5.02 miles of the Boehm Road; to JAY KEYS, Westerville, Ohio, at $33,161 for macadamizing 4.22 miles of the Kidner and Taylor Road; to R. W. McCOY, at $5027, for 9.64 miles of the Godown Road, Perry Township. Hugh K. Lindsey is County Surv. Noted Apr. 10.

+Contracts have been awarded by the Director of Public Service for street improvements as follows: To B. F. PATTERSON for paving Wrexham Ave., to BENTZ BROS., at $14,538 and $28,704, respectively, for paving Wheatland and Eureka Aves.; to S. T. KNIGHT, at $3480 for Tallmadge St., $6313 for the alley north of Bryden Road, $1040 for alley west of 21st St.; the ANDREWS ASPHALT PAVING CO., at $6432 for Indianola Ave.; D. E. SULLIVAN & CO. at $67,084 for paving Mound St.; to GEIEGLE, GARNES & CO., at $8133 for Davis Ave.; $12,387 for Esper St.; $22,469 for Bruck St.; $1593 for Almond Alley. S. T. KNIGHT was also awarded a contract for paving Sixth St. S. A. Kinnear is Dir. of Public Service. Noted Mar. 20.

+Columbus, Ohio—Contracts for road improvements have been awarded by the State Highway Commissioner as follows: To H. E. HUNT, Jackson, Ohio, at $34,300 for 1.93 miles of the Akron-Canton Road, Springfield Township, Summit County; to PETRIE & LONG, Logan, Ohio, at $11,300 for one mile on the New Lexington and Logan Road, Pike Township, Perry County. James R. Marker is Comr. Noted Apr. 17.

Dennison, Ohio—Bids will be received until noon, May 9, by the Village Council, for grading, curbing and paving Center St. and Miller Ave. John A. Fouts is Village Clk.

+Elyria, Ohio—The Board of Commissioners of Lorain County has awarded a contract for repaving the East Erie Ave. Bridge No. 1 with creosoted wood block, to WILLIAM STEWART, Wabash, Ind., at $11,266. Other bidders were: W. C. Traxler, Lorain, $16,590; Workloop McCormick Co. $16,894; the Creighton Construction Co., Fremont, $14,978; Modern Construction Co., Fremont, $16,000; Capital Construction Co., $15,740; C. B. Ramsey, $15,500, and H. R. Klippenes, $15,765. F. L. Ellenberger is Clk. Noted Mar. 27 and Apr. 24.

Euclid, Ohio—Bids will be received until noon, May 26, by the Village Council for the construction of sidewalks on Dille Road from Euclid Ave. to the New York, Chicago & St. Louis Ry. tracks. The E. A. Pease Engineering Co., 508 Marshall Bldg., Cleveland, Ohio, is Engr. in Charge. Fred H. Shoaff is Village Clk.

Lima, Ohio—We are officially advised that the Director of Public Service will receive bids until noon, June 3, for about 4028 sq.yd. of brick or asphaltic macadam pavement on Jameson Ave. Jas. R. Morris is Dir. G. A. Crayton is City Engr.

Middlefield, Ohio—Bids will be received until noon, May 8, by the Village Council for improvement of High, Elm, Main and State Sts. by grading, draining and paving with bituminous macadam. B. F. Hewit, Jefferson, Ohio, is Engr. in Charge. Joseph White is village Clk.

Uhrichsville, Ohio—Bids will be received until noon, May 29, by the Trustees of Mill Township, Tuscarawas County, for the improvement of about two miles of the Park Valley Road. Henry O. Snyder, City Bldg., Uhrichsville, is Township Clk. Noted Apr. 24.

+Wauseon, Ohio—We are officially advised that the Village Council has awarded a contract to H. G. ZELLER, Swanton, Ohio, at $15,859 for the improvement of North Chestnut St. from Fulton to Brannel St. Other bidders were: H. S. Enck, Lima, Ohio, $19,249; Joseph Karsh, Celina, Ohio, $17,604; Johnson & Ritz, Napoleon, Ohio, $17,862. John Grim is City Engr. L. H. Deyo is Village Clk. Noted Apr. 10.

West Park, Ohio—Bids will be received until noon, May 5 by the Village Clerk for the construction of sidewalks on Lorain St., Settlement and Triskett Roads, Highland, Vernon, Lakota and Leland Aves. Fred Feuchter is Clk.

Indiana—Bids for road improvements in Indiana will be received as follows:

May 9, at Tipton, by Commissioners of Tipton and Hamilton Counties, for the construction of a gravel road on the line between the two counties. J. H. Cranbarger is Audr. of Tipton County. George Griffin is Audr. of Hamilton County.

May 12, at Bedford, by Commissioners of Lawrence County, for the construction of gravel or macadam roads. Ezra W. Edwards is Audr.

May 15, at Fort Wayne, by Commissioners of Allen County, for a gravel road in Monroe Township. Calvin H. Brown is Audr.

Anderson, Ind.—Bids will be received until 10 a.m., May 21, by the Commissioners of Madison County for the construction of 3 gravel roads. Joel B. Beneﬁel is Audr.

Beech Grove, Ind.—Bids will be received until 8 p.m., May 6, by the Town Board for improving portions of Fifth, 13th, 14th, 15th and 16th Aves. at an estimated total cost of $38,542. M. H. Johnson is Town Clk.

Bluffton, Ind.—Bids will be received until May 7, by Commissioners of Wells County for construction of a stone road on the Wells-Huntington County line. L. A. Williamson is Audr. Wells County.

Indianapolis, Ind.—The Board of Public Works has adopted a resolution authorizing the paving of English Ave. from the Cleveland, Cincinnati, Chicago & St. Louis Ry. tracks to Keystone Ave. The estimated cost for wood block pavement is $25,644, but bids will be asked on four standard materials. Chas. A. Schrader is Pres.

+Muncie, Ind.—The Board of Public Works has awarded a contract to the WESTERN CONSTRUCTION CO., Lafayette, Ind., at $45,894, for paving East Washington St. from Mulberry St. to the Pennsylvania R.R. tracks with creosoted wood blocks. B. F. Deardorff is City Engr.

Flint, Mich.—Bids will be received until 3 p.m., May 9, by the Common Council for construction of approximately 37,000 sq.yd. paving on various streets. D. E. Newcombe is City Clk.

+Cairo, Ill.—The Board of Local Improvements has awarded a contract to ROY L. WILLIAMS at $53,241, for paving with vitrified brick and otherwise improving Holbrook Ave., Fourth, Sixth, 10th and 12th Sts. George F. Dewey is City Engr. Noted Apr. 3.

+Dixon, Ill.—We are officially advised that a contract has been awarded by the Board of Local Improvements to the GUND-GRAHAM CO., at $32,632, for the improvement of Third St. Blake Grover is Secy. of the Bd.

+Joliet, Ill.—We are officially advised that the Board of Local Improvements awarded the contract for resurfacing Eastern Ave. to the H. B. STREICHER CO., Memphis, Tenn., at $12,300. C. D. O'Callahan is City Engr. Noted Apr. 24.

Kankakee, Ill.—The Board of Local Improvements has received bids for brick paving on West Ave. and Station St. from the West Side Quarries Co., Kankakee, and A. D. Thompson & Co., Peoria, Ill. Both bids were rejected as excessive. The City Engineer's estimate was $44,840.

+Mattoon, Ill.—We are officially advised that the Board of Local Improvements has awarded a contract to THORNTON & MICHAEL, Mattoon, at $19,500, for the improvement of various streets. Other bidders were: A. C. Loomis, $20,000; Bresee & Brown, $20,197. C. L. James is City Engr. Noted Apr. 17.

Waukegan, Ill.—We are officially advised that the Board of Local Improvements has received bids for street improvements as follows: For paving Grand Ave., McCugo Bullock Co., Waukegan, at $35,523 for Marion brick; $35,954 for Barr brick; paving St. James St., Chas. Payne, Waukegan, $8557 for Boston brick; the White Construction Co., Milwaukee, Wis., $8245 for Marion brick. M. J. Douthitt is City Engr. Noted Apr. 17.

Marinette, Wis.—Bids will be received until May 15 by the Department of Public Works for improving Ogden St., from Starkweather to Bayshore Sts., with 9-in. macadam, concrete curb and gutter; and Starkweather St., from Alimeda to Ogden Sts., 9-in. macadam, concrete curb and gutter.

+Milwaukss, Wis.—Contracts for street paving have been awarded by the Department of Public Works as follows: State St., 27th to 35th Sts., creosoted block, to L. W. SCHRUTH, $18,690; Folsom Place, Oakland Ave. to Downer Ave., brick, to BADGER CONSTRUCTION CO., $13,771. Milwaukee St., Detroit to Erie Sts., $34,961, and 8th St., Chestnut to Winnebago Sts., $2819, both stone, BADGER CONSTRUCTION CO.; Kinnickinnic Ave., Wegner to Oklahoma Aves., brick, D. M. SNEDDEN CO., $15,022; 5th Ave., Harrison to Cleveland Aves., bituminous macadam, $4712. Fred G. Simmons is Comr. Noted Apr. 17.

Superior, Wis.—Bids will be received until 1 p.m., May 6, by the Board of Public Works, for improving and repaving Grand (or Lamborn) Ave., from North Third to Belknap Sts. Bids will be accepted on reinforced concrete, sheet asphalt or asphaltic concrete. E. B. Banks is City Engr.

+West Allis, Wis.—We are officially advised that the Board of Public Works has awarded a contract to the WHITE CONSTRUCTION CO., Milwaukee, Wis., at $65,554 for improvement of various streets. L. F. Fish is City Clk. Noted Apr. 3.

Eldora, Iowa—We are officially advised that bids will be received about June 1 by the City Clerk for 6000 sq.yd. of concrete paving, sewer improvements, estimated to cost $15,000, and water extensions costing about $5000. L. J. Stout at $12,300. S. B. Gardner is City Engr. Noted Apr. 24.

Iowa Falls, Iowa—We are officially advised that bids will be received until May 12 by the City Clerk for the construction of 20,129 sq.yd. paving and 10,800 lin.ft. curb. J. O. Gregg is City Clk. S. B. Gardner, Eldora, Iowa, is Engr. in-Charge.

+Duluth, Minn.—The City Commission has awarded contracts for street improvements to R. McDONNELL, as follows: East Fourth St., from Sixth to 14th Aves., $46,281; 22d Ave. East, from Third to Fifth Sts., $4055; 17th Ave. East, from Fourth to Seventh Sts., $10,002; Sixth St. from 18th Ave. East, to Woodland Ave., $12,322; Victoria St., from Woodland Ave. to Hartley Road, $14,348.

+Independence, Kan.—We are officially advised that the City Council has awarded a contract to HOMER GREEN, Independence, Kan., at $6820 for curb, gutter and pavement on Maple and Earl Sts. F. P. Dellone & Co. bid $7001. G. H. Kreinhagen is City Clk. Noted Apr. 17.

Norfolk, Neb.—We are officially advised that bids will be received until 5 p.m., May 26, by the City Clerk for 47,000 sq.yd. of asphaltic concrete paving at an estimated cost of $97,000. P. F. Stafford is City Clk. H. H. Tracy is City Engr.

Watertown, S. D.—Bids will be received until 8 p.m., May 12, by the City Auditor for about 45,000 sq.yd. pavement on various streets. Bids will be accepted for Portland cement concrete, vitrified brick, asphaltic concrete or creosoted block. Orin M. Lane is City Audr.

Helena, Mont.—The City Council has approved plans for the Park Ave. Paving District at an estimated cost of $8000. The Council has passed a resolution for the Jackson St. Local Improvement District for sidewalks and curbs, estimated cost $15,500. J. A. Mattson is City Clk.

St. Louis, Mo.—The Board of Public Works is having plans prepared for about 12,000 sq.yd. of street paving and some extensions to the present water system. The Smith & Boulay Co., Toledo, Ohio, is Engr.-in-Charge.

Alvin, Tex.—At an election of precinct tax-payers, Apr. 18, the question of issuing $300,000 of good roads bonds was carried.

+Anderson, Tex.—A contract has been awarded by the Commissioners' Court of Grimes County to the TEXAS GRADING CO., 708 Carter Bldg., Houston, Tex., at about $140,000, for the construction of 40 miles of macadam and sand clay roads in the Navasota District. Reid Rikard is County Judge. Noted Mar. 27.

Bryan, Tex.—See items under Water Supply—Irrigation.

Cameron, Tex.—At a recent election of the precinct taxpayers, the question of issuing $150,000 in bonds for road improvements was carried.

Fort Worth, Tex.—The Comissioners' Court opened bids, Apr. 21, for the construction of a proposed new highway system in Tarrant County, the cost of which will aggregate about $830,000. The contracts will be let May 1. The following bids were received and are under construction. Section "A": Grapevine Road: Texas Building Co., Fort Worth, $66,144; Tarrant County Construction Co., Fort Worth, $89,956. Section "B": Grapevine Road: Cobb & Gregory, $90 417, Texas Building Co., $61,328; Dallas Road: Texas Building Co., $101,210; Austin Bros., $108,519; H. K. McCollum, $113,789; Mansfield Road, section "A": D. H. Purvis, $57,378. Mansfield Road, section "B": Texas Building Co., $61 328; H. K. McCollum, $66,708. Burleson Road: Texas Building Co., $49,358. J. H. Madox and Dennis & Pagan, $56,457. West Cleburne Road: Texas Building Co., $48 943. Weatherford Road: H. K. McCollum, $74,397. Texas Building Co. $68,192. Azle Road: Texas Building Co., $6,965. Keller Road: Texas Building Co., $74 179. W. T. Montgomery, $82,421. J. O. Travilla, St. Louis, Mo., is Engr. in Charge. Noted Apr. 3.

Nacogdoches, Tex.—Bids will be received until May 8 by the City Council for about 16,000 sq.yd. of paving on various streets. Bids will be accepted on creosoted wood blocks, vitrified brick, asphaltic concrete on concrete or macadam foundation, rock asphalt or concrete on macadam foundation, Uvalde rock asphalt or Dolarway. J. R. McKinney is City Secy. Noted Mar. 27.

Walnut Springs, Tex.—A bond issue of $10,000 has recently been voted, the proceeds of which will be used for street improvements. The Mayor may be addressed.

Marietta, Okla.—The City Council has passed resolutions authorizing about 12 blocks of paving on Main St. Plans are being prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla.

Denver, Colo.—The Board of Public Works is planning improvements at an estimated cost of $67,169, in Harman Improvement District No. 1; also the South Capitol Hill Surfacing District No. 1 will be improved at a probable cost of $18,928. Bids will probably be asked about June 20. Seth B. B. Bradley is Pres. of the Bd.

Olympia, Wash.—Estimates for grading, paving, concrete sidewalks, sewers, etc., on Columbia St., were made as follows by the City Engineer: Brick, $25,814; asphalt, $22,094; total cost for connecting streets, using brick, $43,433, and asphalt, $37,134.

Ritzville, Wash.—The Board of Commissioners of Adams County has changed date of receiving bids for the construction of Permanent Highway No. 3 from May 5 to May 6.

Seattle, Wash.—Low bids for the improvement of the Pine St. District were received by the Board of Public Works from A. J. Baumgartner, at $56,168, for brick, and the Barber Asphalt Paving Co., at $50,468, for bitulithic pavement. Arthur H. Dimock is City Engr.

Portland, Ore.—The low bid for the improvement of the East Stark St. District was that of the Oregon Independent Paving Co. at $69,008 for asphaltic concrete pavement. Thos. M. Hurlbut is City Engr.

+Salem, Ore.—A contract has been awarded by the City Council to W. D. PUGH, Salem, Ore., at $21,997, for paving Marion St. with concrete.

Alhambra, Calif.—Bids will be received by the City Trustees until 9 a.m., May 3 for improving San Mario Ave. from Adams to Fourth Sts. The work consists of grading, oiling and installing an ornamental lighting system. O. M. Caulk is City Clk.

Bakersfield, Calif.—The Supervisors of Kern and Ventura Counties plan the construction of a road to the coast from Maricopa. Kern County's share of the expense will be between $20,000 and $30,000.

Colton, Calif.—We are officially advised that bids will be received by the City Trustees until May 12, for approximately 1½ miles of oiled macadam and asphalt pavement. Charles H. Wondries is City Engr.

Hanford, Calif.—The City Trustees will order the improvement of about four miles of streets. Oil and gravel will be used.

Los Angeles, Calif.—Bids will be received by the County Supervisors until 2 p.m. May 5 for constructing a portion of the Long Beach-Naples Road. The work consists of the following quantities: 3772 cu.yd. of excavation, 11,895 lin. ft. of shaping roadbed, 23,790 sq.ft. of concrete paving with bituminous wearing surface, 25.3 cu.yd. of Class A concrete, 435 ft. of 18-in. reinforced concrete pipe, 100 ft. of guard fence. A. M. McPherron is Deputy Clk.

San Diego, Calif.—David H. Ryan has purchased 20 acres for subdivision purposes in East San Diego and will spend about $45,000 in grading streets, laying water, gas and sewer mains, and constructing curbs, and walks.

Sausalito, Calif.—A bond issue for $100,000 has been voted for street improvements. A thoroughfare will be built to connect with the State Highway.

San Fernando, Calif.—We are officially advised that bids will be received until 7:30 p.m., May 5, by the City Clerk for 1300 lin.ft. of oiled and graveled roadway, 2600 ft. concrete curb and 1000-ft. sidewalk at an estimated cost of $5000; also for 33,555 sq.yd. of asphalt pavement, 15,100 lin.ft. concrete walk and curb at an estimated cost of $50,000. S. G. Chamberlin is City Engr. H. C. Caldwell is City Clk.

Orillia, Ont.—The City Council plans the construction of sidewalks at an approximate cost of $30,000. C. E. Grant is Clk.

INDUSTRIAL WORKS

Portland, Maine—The Portland Billiard Ball Co. contemplates the construction of a factory at Portland, for the manufacture of pool and billiard balls. Alonzo Burt, Albany, N. Y., is Pres., and W. W. Cole, Portland, is Gen. Mgr.

+Manchester, N. H.—The contract for the construction of a shoe factory for the W. H. McElwaine Co., has been awarded to FRED T. LEY & CO., INC., Springfield, Mass. The structure will be of reinforced concrete, 44x460 ft., five stories. French & Hubbard, 88 Pearl St., Boston, are the Engrs.

+Boston, Mass.—The contract for the factory to be built for the Henrici Laundry Machine Co. on Delhi St. Dorchester District, has been awarded to R. P. RYAN, 70 Freeman St., Auburndale. It will be two stories, brick, 50x100 ft. G. Bertram Washburn, 6 Beacon St., is Arch.

Farmington, Conn.—The Charles W. House & Sons Co. will soon award contracts for a three-story addition to its factory. The building will be 65x120 ft., of brick, mill construction, with concrete foundation and electric power.

+Waterbury, Conn.—Contracts for a tube mill at the Benedict & Burnham branch of the American Brass Co., on South Main St., have been awarded as follows: Steel work, AMERICAN BRIDGE CO., 30 Church St., New York, N. Y.; mason and carpenter work, TRACY BROS. CO., 52 Benedict St., Waterbury; four electric traveling cranes, SHEPARD CRANE & HOIST CO.

+Buffalo, N. Y.—We are officially advised that the Hewitt Rubber Co. has awarded a contract to the TURNER CON-

STRUCTION CO., 11 Broadway, New York, N. Y., for the construction of a reinforced-concrete factory, three stories high, 460x90 ft., with an ell, 61x30 ft. It will be built at the company's plant at Kensington Ave. and the New York Central R.R. Considerable equipment will be installed. Lockwood, Greene & Co., Boston, Mass., are the Archs. Noted Apr. 17.

+Buffalo, N. Y.—The A. Schrieber Brewing Co., Fillmore Ave., has awarded a contract to W. J. WIERZBOWSKI, 1627 Broadway, for the construction of an engine room, water tower and wash house at its plant. W. H. Zawadski, 798 Fillmore Ave., is the Arch.

Buffalo, N. Y.—A three-story piano factory, 70x50 ft., is to be erected by M. Lindner, manufacturer of pianos, on East Genesee and Hickory Sts. Plans for the structure are now being prepared by Jacob Oberkircher, 46 Orange St. Bids will be received very shortly.

Canastota, N. Y.—The D. S. Watson Co., maker of fire shields, is now having plans prepared for the construction of a manufacturing plant which it will build this summer. The first building to be erected will be 100x50 ft., two stories, with a boiler house, 64x34 ft.

+Geneva, N. Y.—The Vance Boiler Works has awarded a contract to the AMERICAN BRIDGE CO., Elmira, N. Y., for the construction of a one-story factory, 160x75 ft., in Geneva.

Fulton, N. Y.—The W. W. Spunswick Mfg. Cor. is having plans prepared for the construction of a two-story knitting mill, 102x40 ft., to be built this summer.

+New York, N. Y.—The contract for demolishing and excavating at 521-523 West 26th St., for a six-story addition, 100x40 ft., to the plant of the Harris V. Uris Iron Works, 525 West 26th St., has been awarded to the WHITE CONTRACTING CO., 181 Chrystie St.

Poughkeepsie, N. Y.—Plans have been completed for the construction of a four-story factory, 320x80 ft., to be erected by the Moline Plow Co., at its plant in Poughkeepsie.

Rochester, N. Y.—A site of three acres on Lydell Ave. has been purchased by F. L. Heughes & Co., Inc., 190 South Ave., upon which new iron works will be built. A structural-steel plant, 160x100 ft., one story high, will be erected at once, at an estimated cost of $75,000. Later a foundry and machine shops will be built.

Schenectady, N. Y.—It has been announced that a machine-shop extension, 166x54 ft., two stories, will be added to the plant of the General Electric Co. at once. The estimated cost is $40,000.

+Bayonne, N. J.—The Tidewater Oil Co., 11 Broadway, New York, has awarded a contract to O. W. SHELLY, 1123 Broadway, New York, N. Y., for the construction of a one-story barrel factory at Constable Hook, Bayonne. The estimated cost is $100,000.

Harrison, N. J.—The Drivir Harris Wire Co. is having plans prepared for the erection of a new factory, 200x60 ft., to be used for the manufacture of wire specialties.

+Philadelphia, Penn.—Harrison Bros. & Co., Inc., have awarded a contract to CRAMP & CO., Denckla Bldg., for the construction of a new factory building at its property at 35th St. and Gray's Ferry Road. The new structure will be three stories high, 122x86 ft., of reinforced concrete. Ballinger & Perrott, 1112 Arch St., are the Archs.

Philadelphia, Penn.—Bids are being received by the Saxonia Dress Goods Mills, Hope and Palmer Sts., for the construction of a group of factory buildings, to be erected at Allegheny Ave. and C St. The plant will consist of a one-story power house, 45x38 ft.; one-story weave shed, 167x97 ft.; a five-story main mill building, 174x58 ft., and a one-story building to contain men's and women's dining-rooms and other departments, 127x27 ft.

Washington, Penn.—The Barnes Safe & Lock Co., Pittsburgh, has purchased a site in Tyler Ward, Washington, and will remove its works to that city. Plans for the new plant have been prepared by John W. Vester, Arch., Washington, Penn. The main building will be of steel, brick, and concrete, 300x60 ft.

Wellsboro, Penn.—The Holmes Silk Co., of Paterson, N. J., has decided to locate a plant at Wellsboro. The city of Wellsboro will erect the building at an approximate cost of $35,000.

Frederick, Md.—Bids are being received by the Lord Baltimore Motor Car Co., B. & O. R.R. and Harford Road, Baltimore, for the construction of an automobile factory, 200x385 ft., of concrete and steel construction, fireproof. Estimated cost, $40,000.

Newport News, Va.—The Chesapeake & Ohio Ry. Co. plans to build car repair shops at Newport News. Estimated cost, $11,000. M. Flanagan, Richmond, Va., is Master Mechanic.

Norfolk, Va.—The Virginia Odorless Ventilator Co., recently organized, contemplates establishing a factory at Norfolk, Va., for the manufacture of a galvanized-iron ventilator. Willard R. Cook is Pres. and A. H. Hodgskin, Gen. Mgr.

The Norfolk City Gas Co. contemplates the construction of a one-story building, 140x60 ft., of brick, steel and concrete, at Norfolk. The building will contain a machine shop, meter repair shop, and storage room.

Petersburg, Va.—The contract for the erection of the addition to the plant of the British-American Tobacco Co. at Brown & Perry Sts., will be awarded soon. Plans call for a five-story structure of steel and concrete.

Warrenton, Va.—The Warrenton Planing Mill Co. contemplates rebuilding its mill at Warrenton, recently destroyed by fire at a loss of $10,000.

Martinsburg, W. Va.—Rothwell & Co. contemplate improving and enlarging their cold-storage and ice plant at Martinsburg. The improvements are estimated to cost $35,000.

Kingston, N. C.—The Caswell Cotton Mills will construct a 100x50-ft., two-story addition to the plant at Kingston.

Batesburg, S. C.—The Bates Cotton Oil Co. contemplates building a dry house, lumber shed and installing two planing machines, at its plant at Batesburg. Estimated cost, $15,000.

Columbus, Ga.—The Silent Salesman Co., recently incorporated at Columbus, contemplates establishing a plant for the manufacture of an automatic sending device.

Birmingham, Ala.—The Birmingham Paper Co. has completed plans and will be awarded contracts for its new addition, which will be 100x175 ft. Estimated cost, $50,000. William L. Walton is Arch.

Sullligent, Ala.—The Kentucky Lumber Co., Cincinnati, Ohio, has acquired a tract of timber at Sullligent, and will establish a sawmill with a capacity of 50,000 ft. per day.

Tuscaloosa, Ala.—The Sanders Cotton Mill Co., Tuscaloosa, contemplates the construction of an ice plant here. The plant will have a daily capacity of 30 tons.

Hattiesburg, Miss.—The Petrous Mfg. Co. will build a new plant at Hattiesburg, to which it will move its present plant from Biloxi. H. E. Latimer, of Biloxi, is interested.

Pearl River, La.—Fire, Apr. 16, destroyed the sawmill of A. D. Crawford, at Hills Switch, about three miles from Pearl River. Loss, $10,000. The plant will be rebuilt.

Memphis, Tenn.—The Bellgrade Lumber Co., Memphis, will establish a sawmill at Isola. T. M. Cather, Pres. of the company, is in charge of purchases of equipment for the new mill, which will have an 8-ft. bandmill with 12-in. saws.

Akron, Ohio—The Summit Foundry Co., Akron,, secured a permit, Apr. 19, for theconstruction of a foundry to cost $10,000. The building will be erected on Kelly Ave.

Akron, Ohio—The International Harvester Co., Apr. 22, took out permits for the erection of two new additions to its plant at Akron, Ohio. Each addition will be six stories, of fireproof construction. Estimated cost, $150,000.

Alliance, Ohio—The Davies-Bach Mfg. Co., Alliance, has increased its capital from $300,000 to $600,000. Extensions and improvements to the plant at Alliance are being planned.

Cleveland, Ohio—The National Quality Division of the General Electric Co., Cleveland, will erect an addition to the company's group of buildings on East 152d St. It will be three stories and basement, 83x279.

+Columbus, Ohio—The contract has been awarded to M. P. STREET, Columbus, by Ohio State University, Columbus, for the construction of a shop building, to cost about $10,000.

Mount Carmel, Ohio—The Snider Preserve Co., Cincinnati, will erect a factory at Mount Carmel. Estimated cost, $40,000.

Springfield, Ohio—The Lagonda Mfg. Co., Springfield, is having plans prepared for the erection of an annex, two stories, 60x100 ft. Estimated cost, $15,000. Bids will be asked soon. W. K. Shilling, 124 Bushnell Bldg., Springfield, is Arch.

Toledo, Ohio—The Ohio Electric Car Co., Toledo, has prepared plans for the erection of two additions to its plant. The capacity of the plant will be doubled.

+Terre Haute, Ind.—The contract has been awarded to the P. C. FINTZE SONS CO., Terre Haute, by S. J. Frank & Sons, for the construction of a factory. Estimated cost, $50,000.

+Detroit, Mich.—The contract has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York, by the American Agricultural Chemical Co., for the construction of a new factory at the company's works at Detroit. The building will be three stories, 150x40 ft., of reinforced concrete throughout. Work will start at once. A. H. Nickerson is Engr. and Arch.

Detroit, Mich.—The J. E. Bolles Iron & Wire Works, 5359 Porter Ave., Detroit, will erect an addition to its plant to cost $35,000. It will be two stories, 60x180 ft., of concrete and steel, mill construction.

Detroit, Mich.—Bids will be received by Albert Kahn, Arch., Trussed Concrete Bldg., Detroit, until May 4, for the construction of a service building for the Goodrich Rubber Co., Detroit. The structure will be of reinforced concrete.

+Grand Rapids, Mich.—The contract has been awarded to WILLIAM BAKER & SON, 427 Curtis Ave., Grand Rapids, by the National Brass Co., for the construction of a brass foundry, to cost about $10,000. Noted Apr. 17.

+Chicago, Ill.—The contract has been awarded to E. L. SCHEIDENHELM, 111 West Monroe St., Chicago, by Reid, Murdoch & Co., Chicago, for the construction of a factory and warehouse. The building will be 10 stories and basement, 322x191 ft. Estimated cost, $1,000,000.

The contract has been awarded by T. A. Kennedy, Chicago, to the McLACHAN BUILDING CO., 11,201 Cottage Ave., Chicago, for the erection of a two-story and basement laundry. Estimated cost, $16,000.

Kewanee, Ill.—The Boss Mfg. Co., Kewanee, will probably award the contract to V. Jobst & Sons Co., Peoria, Ill., for the construction of a two-story and basement factory, to cost $40,000.

+Peoria, Ill.—The contract has been awarded to V. JOBST & SON, Peoria, for the construction of a two-story factory addition, to cost $20,000.

+Silvis, Ill.—The contract has been awarded to the T. S. LEAKE CO., 537 South Dearborn St., Chicago, Ill., by the Chicago, Rock Island & Pacific Ry. Co., for the construction of an eight-stall roundhouse at Silvis.

Manitowoc, Wis.—The Manitowoc Malting Co. is considering the erection of an addition to its plant at Lake and South Sixth Sts. William Rahr is interested.

Washburn, Wis.—The E. I. Dupont de Nemours Powder Co., 10th and Market Sts., Wilmington, Del., is considering the erection of 10 new buildings at Washburn, for the manufacture of low pressure explosives.

Great Falls, Mont.—The Great Falls Artificial Ice & Cold Storage Co., Great Falls, recently incorporated with a capital of $40,000, will erect a large ice and cold-storage plant on Ninth Ave. The incorporators are: D. Chaffee, J. D. Ross and Ernest Downing.

Kalispell, Mont.—The Potato Food Milling Co., recently incorporated with a capital of $250,000, will erect a large plant near Kalispell, for the manufacture of potato foods. The estimated cost is $50,000.

St. Joseph, Mo.—The Endebrock Trunk Co. contemplates the erection of a three-story addition to its factory on 14th St. The estimated cost is $10,000.

Austin, Tex.—D. Walker and associates, Austin, will erect a large meat-packing plant at Austin, to cost about $100,000. A factory will also be erected for the manufacture of barrels and boxes.

Fort Worth, Tex.—The Planters' Fertilizer & Chemical Co., recently organized with a capital of $450,000, will erect a large plant for the manufacture of fertilizers and chemicals. The incorporators are Frederick W. Croll and De Witt Brown.

Goliad, Tex.—T. C. Black and associates, Goliad, will erect a plant for the manufacture of wooden paving blocks and building materials.

Hamlin, Tex.—The Kansas City, Mexico & Orient Ry. Co. is planning to erect new shops and to make other improvements at Hamlin, including a new roundhouse. The estimated cost is $150,000.

Artesia, N. M.—The United States Land & Sugar Co., Garden City, Kan., is considering the erection of a large beet-sugar factory at Artesia.

Cœur d'Alene, Idaho—E. J. Ludwig, St. Louis, Mo., is interested in a project to construct a cannery at Cœur d'Alene, to cost aproximately $50,000.

Everett, Wash.—The Clough-Hartley Shingle Co., Everett, plans to make extensive improvements and additions to its shingle-mill plant.

South Bend, Wash.—J. S. Scribner, Minneapolis, Minn., is interested in a project to erect a large pulp mill on Chetlo Harbor near South Bend.

Tacoma, Wash.—The St. Paul & Tacoma Lumber Co. is planning to build a large addition to its machine shops in Tacoma.

Longbeach, Calif.—The California Woolen Mfg. Co., Los Angeles Investment Bldg., Los Angeles, plans to build a factory at Longbeach, for the manufacture of woolen goods. Alfred Rea, 720 Black Bldg., is the Arch.

Los Angeles, Calif.—John A. Meeks, Vice-Pres., and B. F. Taylor, Gen. Mgr. of the Lincoln Motor Sales Co., Los Angeles, are planning the erection of a plant for the manufacture of the Lincoln half-ton trucks.

Salinas, Calif.—The Crown Cordial & Extract Co. will erect a new cannery to cost approximately $10,000.

San Francisco, Calif.—The Presto-Lite Co. has purchased a site covering about five acres at South San Francisco, and will erect a factory. The preliminary structures will cost approximately $50,000.

Santa Ana, Calif.—The Iowa Furnace Co. contemplates the erection of a plant at Santa Ana, for the manufacture of furnaces. W. H. Calhoun is Pres.

Montreal, Que.—The Canadian Pacific Ry. has had plans prepared for new car shops at Montreal. The estimated cost is $130,000.

Berlin, Ont.—C. H. Doerr & Co., 138 Weber St., are having plans prepared for a three-story addition to their candy and biscuit factory. New machinery will be required.

Blenheim, Ont.—The British American Canners, Ltd., have plans for a two-story and basement factory, 110x80 ft., stone foundation, brick walls. One freight elevator will be installed. Watt & Blackwell, Lister Bldg., Hamilton, Ont., are Archs.

Hamilton, Ont.—The Bell Thread Co., 185 Yonge St., is having plans prepared for a two-story factory of brick and structural steel construction. It will cost about $14,000. New machinery will be installed.

Paack & Perrine, Archs., 36 James St., South, will receive bids for the erection of a pattern and machine shop for the Canada Steel Co. It will have concrete foundation, one-story pressed brick and structural-steel construction. The estimated cost is $10,000.

Iroquois Falls, Ont.—The Abitibi Pulp & Paper Co. has awarded a contract to MORROW & BEATTY, Toronto, for the erection of a 180-ton pulp mill at Iroquois Falls, where 21,500-hp. will be developed. The pulp mill will use 16,000 hp.

Toronto, Ont.—The Smart Bag Co. will erect branch factories in Saskatoon, Sask., and Vancouver, B. C.

Windsor, Ont.—The Detroit Steel Products Co., Detroit, Mich., has purchased a site at Windsor, and is having plans prepared for a factory costing about $10,000.

Mission City, B. C.—The Empress Mfg. Co., Vancouver, B. C., has purchased a site at Mission City, and will erect a large fruit-canning plant.

Newport, B. C.—The West Coast Shingle & Mill Co., Ltd., is having plans prepared for a combination saw and shingle mill plant to be erected on Howe Sound, near Newport. Estimated cost, $15,000. M. L. Taylor, Dominion Bldg., Vancouver, B. C., is the Arch.

Victoria, B. C.—The Canadian Explosives Co., Ltd., plans to spend $1,000,000 for the construction of new plants on James Island. New equipment will be required.

Amherst, N. S.—The Amherst Piano Co., Ltd., is having plans prepared for a large new factory. J. A. McDonald, 46 Barrington St., Halifax, N. S., is the Arch.

Port Hawkesbury, N. S.—The plant of the North Atlantic Fisheries, recently destroyed by fire, will be rebuilt immediately. The charred machinery has been disposed of, and entirely new equipment will be purchased.

FEDERAL GOVERNMENT WORK

Roadway—Chelsea, Mass.—Bids were received as follows on Apr. 26 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a roadway in the grounds of the Naval Hospital, Chelsea, Mass.: Antony Cefalo, Roslindale, Mass., $16,324; Rowe Contracting Co., Brighton, Mass., $18,682; D. Robinson's Sons, Parkway, Everett, Mass., $17,990; Coleman Bros., Chelsea, Mass., $14,277; C. M. Leach, Boston, Mass., $14,973; James N. Ferguson, Dorchester, Mass., $17,679; International Construction Co., Boston, Mass., $16,950. Noted Apr. 10.

Removing Stone Dike—Hartford, Conn.—Bids were received as follows, Apr. 21, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for removing the riprap dike in the Connecticut River, above Hartford: S. A. Bailey, 175 East 85th St., New York, $10 per ton for removing dike and placing material on a second dike; Springfield Navigation Co., Springfield, Mass., $9.17, $11 and $13.75.

Dikes—New London, Conn.—Bids were received as follows, Apr. 19, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, for the construction of timber and brush spur dikes at Press Barn Bar, Connecticut River, Conn.: (a) Furnishing and driving 8200 lin.ft. piling; (b) furnishing and placing 21,750 ft. B.M., lumber; (c) furnishing and placing 7700 lb. iron rods, bolts, etc; (d) furnishing and placing 780 lb. c.-i. washers; (e) furnishing and placing 280 cords of brush; (f) furnishing and placing 160 long tons of stone; (g) totals: S. A. Bailey, 175 East 85th St., New York, (a) 30c.; (b) $100; (c) 10c.; (d) 5c.; (e) $12; (f) $2.50; (g) $9204.

Dredging—New York, N. Y.—Bids will be received until noon, May 21, by Col. W. M. Black, Corps Engrs., U. S. A., Army Bldg., 39 Whitehall St., New York, for deepening Battery Reef, East River, N. Y., by dredging.

Engines and Generators—Philadelphia, Penn.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of two new engines and generators in the U. S. post office and court house at Philadelphia.

Marine Barracks—Philadelphia, Penn.—Bids were received as follows, Apr. 26, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of the Marine Barracks at Philadelphia: Edward Fay & Son, $159,-985; E. W. Van Loon, $173,723; Guernsey & O'Meara Co., $176,-977; Mitchell Bros., $194,109; C. M. Leach, Boston, Mass., $173,-773; Thomas Reilly, $158,799; B. Ketcham's Sons, $171,707; W. E. Dotts & Co., $173,993; Edward F. Fonder, $164,400; Wells Construction Co., $187,000. Interstate Construction Co., Saginaw, Mich., $172,130; Turner Concrete Construction Co., $174,900. All above bidders of Philadelphia unless otherwise specified.

Dredging—Philadelphia, Penn.—Only one bid was received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the navy yard, Philadelphia: American Dredging Co., Philadelphia, Penn., unti, 24½c., total, $18,750.

Removal of Wreck—Baltimore, Md.—Bids will be received by Col. Lansing H. Beach, Corps. Engrs., U. S. A., Baltimore, until 1 p.m., May 27, for the removal of the wreck of the steel steamship, "Alum Chine," sunk in the Patapsco River, Md.

Dredging—Wilmington, Del.—Bids were opened as follows, Apr. 15, by Maj. R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging Little River, Del.: River & Harbor Improvement Co., Philadelphia, Penn., 8c.; Atlantic Dredging Co., Philadelphia, 8.72c.; Rickards Dredging Co., Philadelphia, 8.9c.

Riprap—Washington, D. C.—The Columbia Granite & Dredging Corporation, Washington, has submitted a bid of $1.37 for furnishing riprap on the Anacostia River flats.

Cranes—Washington, D. C.—The contract has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, to the BROWN HOISTING MACHINERY CO., for two cranes at the navy yards at Puget Sound, Wash., and Pearl Harbor, H. T., at $74,350.

Dredging—Fort Caswell, N. C.—No bids were received Apr. 14, by the Quartermaster, U. S. A., Fort Caswell, for dredging in the creek at the fort.

Post Office—Oxford, N. C.—Bids were received as follows, Apr. 26, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Oxford: (a) Limestone; (b) sandstone: A. C. Moses Construction Co., Washington, D. C., (a) $55,650; (b) $57,200; J. L. Crouse, Greensboro, N. C., (a) $50,890; (b) $52,990; Daniel T. McCarthy, Philadelphia, Penn., (a) $48,796; (b) $49,856; Alt & Guan, Louisville, Ky., (a) $55,900; (b) $57,040; J. F. Jenkins & Co., Ocala, Fla., (a) $53,987; (b) $57,000; C. M. Leach, Boston, Mass., (a) $49,863; (b) $51,373; James Devault, Canton, Ohio, (a) $49,199; (b) $53,000; Westchester Engineering Co., New York City, (a) $48,872, (b) $52,000; Algernon Blair, Montgomery, Ala., (a) $52,282; (b) $53,550; W. J. Brent Construction Co., Norfolk, Va., (a) $51,915; (b) $52,715; Morrell & Waters, Llanroch, Penn., (a) $45,300; (b) $46,700.

Post Office—Winston Salem, N. C.—Bids will be received until 3 p.m., June 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the extension (including plumbing, gas piping, heating apparatus, electric conduits and wiring and approaches) of the U. S. post office at Winston-Salem. The extension will be two stories and basement, and has a ground area of approximately 14,150 sq.ft.

Dredging Canal—New Orleans, La.—Bids will be received until 11 a.m., May 26, by Maj. Edward H. Schulz, Corps. Engrs., U. S. A., New Orleans, for dredging a canal between Calcasieu River and Sabine River, La.

Stone—New Orleans, La.—Bids will be received by Maj. Edward H. Schulz, Corps Engrs., U. S. A., New Orleans, until 11 a.m., May 8, for furnishing and delivering about 8000 cu.yd. of stone.

Pump House—Louisville, Ky.—Bids were received Apr. 17, by the Commissioner of Fisheries, Dept. of Commerce and Labor, Washington, D. C., for the construction of a pump house at the fisheries station at Louisville, Ky.: Alfred Struck Co., Louisville, $7278. A. E. Doering, Louisville, $6683.

Concrete Dam Work—Cincinnati, Ohio—Bids were received as follows, Apr. 15, by Maj. L. H. Rand, Corps Engrs., U. S. A., Cincinnati, for reconstructing in concrete the top of Dam No. 4, Muskingum River, Ohio: J. A. Swingle Contracting Co., Zanesville, Ohio, $39,616; G. T. F. Fogle & Co., St. Albans, Vt., $31,238; Newton Engineering Co., Milwaukee, Wis., 53,990.

✚Post Office—Defiance, Ohio—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post-office at Defiance, at $56,434, to ROGERS & KAISER, Chicago, Ill.

Post Office—Le Mars, Iowa—Bids were received as follows, Apr. 22, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Le Mars: (a) Limestone; (b) sandstone: J. W. Miller, St. Paul, Minn., (a) $49,900; (b) no bid; W. D. Lovell, Minneapolis, Minn., (a) $51,000; (b) no bid.

✚Post Office—Salina, Kan.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of an extension to the post-office at Salina, Kan., to HIRAM LLOYD BUILDING & CONSTRUCTION CO., St. Louis, Mo., at $59,043. Noted Jan. 23.

✚Post Office—Weatherford, Tex.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post-office at Weatherford, at $62,594, to T. LOVELL'S SONS, Enid, Okla.

Cement—Portland, Ore.—All bids opened by Maj. J. J. Morrow, Corps Engrs., U. S. A., Portland, for furnishing 100,000 bbl. of portland cement, have been rejected. Noted Apr. 24.

Wire Fence—Fort Baker, Calif.—Bids will be received by Lieut. R. W. Pinger, Q. M., U. S. A., Fort Baker, for the construction of a five-strand, woven-wire fence, requiring about 8000 ft.

✚Incinerator—Monterey, Calif.—The contract for the installation of a garbage incinerator at the Presidio of San Francisco, Monterey, has been awarded by the U. S. Government to CHARLES F. WALTHERS, Pittsburgh, at $5000.

Coaling Plant—Panama—Maj. F. C. Boggs, Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., has postponed the opening of bids for two coaling plants at Balboa and Cristobal, respectively, from May 14, until 10:30 a.m., June 14. (Circular 763).

Coal-Hoisting Towers—Hawaii—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., May 3, for two coal-hoisting towers for the naval station at Pearl Harbor, H. T.

Steel Towers—Porto Rico—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., June 14, for the construction of two steel towers at the naval radio station at San Juan, P. R.

MISCELLANEOUS

Subway—Buffalo, N. Y.—Contracts will be awarded soon for the construction of the proposed subway at Military Road. The cost has been estimated at $55,000. The Grade Crossing Commission has the work in charge.

✚Dam—Fort Edward, N. Y.—The contract has been awarded to the H. P. CUMMINGS CO., Ware, Mass., for rebuilding the crib dam of the International Paper Co., at Fort Edward.

Pier Work—New York, N. Y.—Bids will be received by R. A. C. Smith, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Boro. Manhattan, until noon, May 3, for a new floor and gutters on the promenade deck of the recreation building on the pier at the foot of Third St., East River.

Seawall—New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, Park Ave. and 59 St., Boro. Manhattan, for the construction of a seawall at the Astoria Athletic Field on Munson and Orchard Sts. and the East River front Astoria, Boro. Queens.

Bath House Work—New York, N. Y.—Bids will be received by George McAneny, Pres. Boro. Manhattan, until 2 p.m., May 2, for furnishing all the labor and materials for foundation piling to be done at the public bath building, 324 Rivington St., Boro. Manhattan.

White Quartz Grit—New York, N. Y.—Bids will be received by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan, until 2 p.m., May 8, for furnishing and delivering washed white quartz grit in Forest and Highland Parks, Boro. Queens.

Bath Building—New York, N. Y.—Bids will be received by George McAneny, Pres. Boro. Manhattan, until 2 p.m., May 6, for item "A," furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St., Boro. Manhattan, in accordance with specifications without consideration of any alternative; item "B," for furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St., Boro. of Manhattan, in accordance with specifications (page 63), calling for ceramic-mosaic tile for swimming pool; and item "C," for furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St., Boro. of Manhattan, in accordance with specifications (page 56, note), and with specifications (page 63).

Fences and Gate—New York, N. Y.—Bids will be received by the Park Board, Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Boro. Manhattan until 3 p.m., May 1, for furnishing and erecting iron fences and gate, including concrete seats, gate posts, brick piers, concrete copings, etc., around the triangular plot bounded by Lafayette St. Cleveland Place and Kenmare St.

Pier—Atlantic City, N. J.—The construction of another great pier in the heart of the Chelsea section is under consideration by local and out-of-town capitalists, at a cost approximating $500,000. The unrestricted beach front known as the Fishblatt property, occupying the entire square between Chelsea and Montpelier Aves., is the prospective site for the enterprise. Capt. John W. Young, Atlantic City, it is reported, is interested.

Pier—Camden, N. J.—The Armstrong Cork Co., Camden, has secured government permission to construct a new pier in the Delaware River connecting with its plant. Plans and specifications have been prepared for a structure with wood piling and reinforced-concrete bulkhead. Charles W. Russ is Gen. Mgr.

Dredging—Jersey City, N. J.—The city is considering the dredging of the harbor. J. S. Smith, Tenafly, N. J., is Pres. New Jersey Harbor Comn.

Signal Tower—Philadelphia, Penn.—The Pennsylvania R.R. Co., is preparing plans for the erection of signal tower.

✚Mechanical Equipment—Baltimore, Md.—Bids were received by the Board of Awards until Apr. 16, for additional equipment to be installed in the new Polytechnic Institute, North Aves., Calvert and 20th Sts. The contract has been awarded to the WILSON-MALTMAN ELECTRICAL CO., 30 South Charles St., Baltimore, at $94,321. C. E. Stubbs is Inspector of Bldgs.

Tunnel—Richmond, Va.—The city is considering the construction of a municipal tunnel as part of the proposed harbor improvements. The tunnel will parallel that of the Atchison, Topeka & Santa Fé Ry. Co., and by a short roadway and an open cut will connect with an 800-ft. wharf on the main channel of the inner harbor.

Levee—Memphis, Tenn.—The city is considering the construction of a new levee system to cost about $1,500,000. It will be built along the western river front. In connection with the system it is proposed to construct a hydraulic pumping system to lift the bayou water over the levee into the river. E. M. Douglas is City Clk.

Retaining Wall—Catlettsburg, Ky.—The War Department, Washington, D. C., will construct a retaining wall at Catlettsburg to protect the town from the floods of the Big Sandy River.

Barge—Cleveland, Ohio—Bids will be received by the city until noon, May 9, for the construction of a steam barge for the use of the Water Department. W. J. Springborn is Dir. Pub. Ser.

Greenhouse, Etc.—Columbus, Ohio—Bids will be received until noon, May 12, by the Board of Trustees of Ohio State University, for the construction of an insectary and greenhouse at the university at Columbus. Carl E. Steeb is Secy.

Tunnel—Columbus, Ohio—Bids will be received by the Trustees of the Ohio State University, Columbus, until noon, May 12, for the construction of a tunnel about 653 ft. in length. Carl E. Steeb is Secy.

Ditch—Lancaster, Ohio—The County of Fairfield is considering the construction of a ditch to cost $50,000. E. E. Shopp is County Audr., Lancaster.

Ditch—Marion, Ohio—Plans are being prepared for the construction of about 30 miles of ditch work. Bids will be asked soon. J. W. Scott, Marion, is County Engr.

Ship Canal—Gary, Ind.—A. P. Melton, City Engr., is making surveys for the construction of the proposed ship canal to connect Lake Michigan with Gary's proposed second inland harbor.

✚Ditch—Hillsdale, Mich.—The contract has been awarded to the WOLMAN CONSTRUCTION CO., Sandusky, Mich., for ditch construction in Hillsdale County, at $18,000.

✚Dock—Chicago, Ill.—We are officially advised that the Sefton Mfg. Co., Chicago, has awarded a contract to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York and Chicago, for constructing a 600-ft. reinforced concrete bulkhead dock at its plant on the south bench of the Chicago River, Chicago. The dock is to be built from plans submitted by the Raymond Concrete Pile Co., but the work will be done under the supervision of Postle & Fischer, Arch.

✚Dock Work—Green Bay, Wis.—The contract has been awarded to the WISCONSIN DREDGE & DOCK CO., Green Bay, for the completion of 550x400 ft. dock front for the C. Reiss Coal Co. New machinery will be installed and the storage capacity will be increased by 250,000 tons.

Ditch—Oshkosh, Wis.—Bids will be received until May 2, for the construction of a ditch in Millard Drainage District. This is a postponement from Apr. 18.

Drainage Work—Randolph, Wis.—Bids will be received until May 14 by the Comr. of Blaen Y. C. Drainage Dist., at the office of Royal F. Clark, Attorney, at Randolph, for drainage work, comprising approximately 94,000 sq.yd. of marsh soil underlaid with clay and 5050 yd. mixed granite and lime rock.

Sewer Tunnel—Burlington, Iowa—See item under Sewers.

Drain Tile—Clarion, Iowa—Bids will be received by F. E. Osler, County Audr., Clarion, until 2 p.m., May 5, for the furnishing of drain tile for ditch work in the county.

✚Walls—Des Moines, Iowa—The contract has been awarded to the CAPITAL CONSTRUCTION CO., Des Moines, for the construction of river walls from Locust St. to Grand Ave., and for the construction of a wall from Grand Ave. to Center St., at about $25,000.

Drainage District—Nevada, Iowa—Bids will be received until 1:30 p.m., May 2, by C. A. Batman, County Audr., Nevada, for the labor and material necessary to construct and complete Warren Township Drainage District No. 49, Story County. Plans and specifications are on file at Nevada.

Park—Eveleth, Minn.—Bids will be received until May 10, by the city, for the construction of Central Park of Eveleth.

Fire Station—Horton, Kan.—The city is considering the construction of a fire station. The cost is estimated at $10,000.

Drainage—Tecumseh, Neb.—The County Commissioners, Tecumseh, are planning to construct a drainage system for the county.

Dock—Texas City, Tex.—The construction of a drydock to cost about $200,000 at Texas City, is under consideration. J. H. W. Steele, Galveston, Tex., is interested.

+Docks—Seattle, Wash.—The Port of Seattle Commission has awarded the contract to J. A. McEACHERN, Bailey Bldg., Seattle, for the construction of docks and a warehouse at the foot of Bell St., Seattle.

Boat Landing—Portland, Ore.—The lowest bid submitted to the Port Commission for the construction of a motor boat landing was that of Lewis Hicks & Co., Worcester Bldg., at $121,000.

Harbor Work—Los Angeles, Calif.—The citizens, Apr. 15, voted in favor of issuing bonds for the following harbor improvements: Construction docks, wharves and warehouses, the opening, improving, constructing and maintaining of streets and highways to navigable waters, the constructing and maintaining of canals and waterways, and the acquisition of necessary lands for said improvement.

Tunnels—Los Angeles, Calif.—Plans are being prepared for the construction of six tunnels as follows: One on Second St., paralleling that of Third St.; one on Second St., parallel also to the present Third St. tunnel; Hill St. tunnel No. 2, to begin about a block north of the northern end of the Hill St. tunnel now being completed and extending through to Castelar St.; one to extend from near California St. to Sunset Blvd. which will also make connections with the present Hill St. tunnel, the lowering of the present Broadway tunnel, and the proposed railway tunnel for Broadway, to be built by the side of the present Broadway tunnel.

Rebuilding Pier—Santa Monica, Calif.—The States Investment Co., Santa Monica, has been granted a permit for the construction of the Fraser pier. Estimated cost, $20,000.

+Pier—Cape Tormentine, N. B.—The contract has been awarded to ALBERT MACKIE, Toronto, Ont., by the Department of Public Works, Ottawa, Ont., for the construction of a pier in connection with the Prince Edward Island car ferry, at $571,590.

+Bolts and Spikes—Fort William, Ont.—The contract has been awarded to the UNITED STATES STEEL PRODUCTS CO., 30 Church St., New York, N. Y., for furnishing the necessary bolts and spikes for the proposed street railway extension, at about $30,000.

Wharf—Victoria, B. C.—The British Columbia Electric Co., Victoria, is planning to construct a wharf at Brentwood Bay. The cost is estimated at about $75,000.

+Dredging—St John, N. B.—The contract has been awarded to the MARITIME DREDGING CO., Ltd., St. John, N. B., for dredging at Point of Foul Ground, main entrance channel to St. John Harbor.

BUILDINGS

Keene, N.H.—The Keene Masonic Building Association has purchased a site on West St. 72x216 ft., and will erect a Masonic building of brick, three stories and basement. G. M. Rossman is Chn. of Directors.

Boston, Mass.—The Alumni Council of the Massachusetts Institute of Technology, recommend the construction of two buildings to be known as the Walker Memorial. The estimated cost is $600,000.

Holyoke, Mass.—Oscar Beauchemin, Arch., 30 High St., Holyoke, has completed plans for a five-story building to be erected on Walnut and Essex Sts. for Lucien Chretian. It will be 70x110 ft. The estimated cost is $65,000.

Malden, Mass.—The Malden Y. M. C. A. building recently damaged by fire is to be repaired at once at an expenditure of $40,000, under the supervision of Peter Graffan, an official of the association.

Marblehead, Mass.—Bids are being received for the erection of a high school on Pleasant St. It will be of brick and stone, two stories, 85x150 ft., and cost $85,000. Frank G. Goodwin is Chn. of Com. Peare & Quiner, 6 Beacon St., Boston, are Archs. R. D. Kimball Co., 6 Beacon St., Boston, are Engrs.

Medford, Mass.—The Mayor has selected a site at High St. and Gouvernor Ave. for the erection of the new city hall. The estimated cost is $150,000.

Millbury, Mass.—Bids will be received until May 10, by John T. Simpson, Arch., 1224 Essex Bldg., Newark, N. J., for the construction of the high school at Millbury. F. W. Monte is Secy. Bd. of Education. Noted Apr. 24.

+Pittsfield, Mass.—The contract has been awarded to the C. S. LODGE CO., Cambridge, Mass., for the erection of the union passenger station which will cost $350,000.

+Springfield, Mass.—S. Z. Poli has awarded the contract for the erection of a new theater on Worthington St. to the T. J. PARDIE CONSTRUCTION CO., Bridgeport, Conn. It will be 138x102 ft. and 60 ft. high, of brick, concrete and steel to cost $100,000.

+Webster, Mass.—The contract for the erection of a church edifice for St. Josephs Parish, has been awarded to SAMPSON BROS., Springfield, Mass. Noted Mar. 29.

Worcester, Mass.—Plans are being prepared by Edwin P. Fitzgerald, Arch., 705 State Mutual Bldg. for a school building to be erected on Lovell St. The estimated cost is $40,000. Bids will be called about May 1.

Providence, R. I.—The special commission appointed by the Legislature to consider the necessity of enlarging the State Courthouse or building a new one, has reported in favor of a new building to accommodate the Supreme and Superior Courts, the State Law Library and the court records. It will be erected on Francis St. opposite the State House, upon recommendation of Norman M. Isham, Arch., 1013 Grosvenor Bldg., Providence, who was selected as expert by the Rhode Island Chapter of Architects. The estimated cost is $2,000,000. Presiding Justice Willard B. Tanner, of Superior Court is Chn.

Woonsocket, R. I.—The special committee on the new High School has approved plans of Walter F. Fountaine, Arch., Woonsocket, and are preparing to receive bids. The estimated cost is $100,000. Dr. Wm. F. Barry, is Chn. Bldg. Com.

Hartford, Conn.—The Rossi Insurance Co., of St. Petersburg, Russia, whose headquarters in the United States are at Hartford, will erect a building, 95x135 ft. at Farmington Ave. and Broad Sts. The estimated cost is $250,000. E. T. Hapgood is Arch., 36 Pearl St., Hartford, Conn.

Waterbury, Conn.—The Board of Education will receive bids until 7:45 p.m., May 5, for a school building at Division and Walnut Sts. It will be two stories and basement, of brick, 77x120 ft. Joseph T. Smith is Arch., 36 N. Main St. Noted Apr. 10.

Brooklyn, N. Y.—The plans which have been prepared for the construction of the new Brooklyn Municipal Bldg. have been sent to the Municipal Art Commission for final approval. As soon as this is received bids will be asked for the construction work. The estimated cost of the structure is $3,300,000. McKenzie, Voorhees & Gunlin, 1123 Broadway, Manhattan, are the Archs.

Buffalo, N. Y.—H. H. Little, Arch., 56 Norwood Ave., has completed plans and is taking bids for a four-story and basement store and loft building, 49x90 ft., to be erected at 568 Washington St., for A. E. Little. It will be of steel and brick.

The High School Commission has approved the plans of Green & Wicks, Archs., 110 Franklin St., for the South Side High school, at South Park Ave., Josie Place, Taylor and Macamley Sts. It will be 192x180 ft., three stories and basement of gray brick and structural steel. Bids will be asked soon. The estimated cost is $700,000.

New York, N. Y.—Plans are being prepared by Charles C. Haight, Arch., 452 Fifth Ave., for the construction of a 12-story parish house to be erected by the Church of the Holy Communion on property adjoining its present location at the northeast corner of Sixth Ave. and 20th St. The estimated cost is $500,000. Rev. Henry Mottet is Pastor.

Plans have been prepared by Neville & Bagge, Archs., 217 West 125th St., for the construction of a ten-story apartment house, 125x78 ft., at Lenox Ave. and Cathedral Parkway, for John A. Sontag, 2 Lenox Ave. The estimated cost is $450,000.

+(Boro. The Bronx)—The Corn Exchange Bank, 15 William St., Manhattan, has awarded a contract to the R. S. POLLOCK CO., 118 East 28th St., Manhattan, for the erection of a one-story bank building, 74x25 ft., at 375 East 149th St. Albro & Lindeborg, 2 West 47th St., are the Archs.

Montclair, N. J.—The Montclair Board of Education has decided to erect a high school, 500x500 ft., on Chestnut St., between Park St. and Midland Ave. The estimated cost is $450,000.

+Newark, N. J.—Joseph Okin has awarded the following contracts for the erection of a theater at 99-101 Springfield Ave.: Mason work, DOMESTIC CONSTRUCTION CO., $15,800; iron and steel work, GOELLER IRON WORKS, Newark, $13,300. Charles Simpson, Newark, is Arch.

+Newark, N. J.—The general contract for the construction of the eight-story and basement reinforced concrete cold storage warehouse, on River St., for the Merchants Refrigerating Co., has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York. Noted Apr. 24.

+Derry, Penn.—The contract for the construction of the proposed school here has been awarded to CUTHBERT BROS. Co., Jessemer Bldg., Pittsburgh, Penn., at $39,619. Other bidders were as follows: W. L. Johnson, Lycippus, Penn., $44,397; Ley Construction Co., Pittsburgh, Penn., $41,208; Dushane & Lewis, Carnegie, Penn., $46,900; E. Overdorff, Johnstown, Penn., $47,480; T. H. Fellabaum, Pittsburgh, Penn., $43,257; Walker & Curley, Pittsburgh, $44,000. Noted Apr. 10.

Grove City, Penn.—W. G. Eckles, Arch., New Castle, Penn., is preparing plans for the three-story and basement dormitory for the Grove City College. The building will be 63x264 ft., and will cost about $75,000.

+Philadelphia, Penn.—The contract has been awarded to METZGER & WELLS, 441 Heed Bldg., Philadelphia, for the construction of the 12-story apartment house at 18th and Walnut Sts. for McIlvain & Co. Noted Apr. 17.

+The contract for the construction of the Julia Ward Howe School at 13th and Grange Sts., has been awarded to THOMAS REILLY, Philadelphia, at $169,286.

+The contract for the construction of two wings to the Barry School at 59th and Race Sts. has been awarded to the CHARLES McCAUL CO., Philadelphia, at $74,400.

Bids are being received by the Penn Mutual Life Insurance Co., for the construction of an addition to its building at Sixth and Walnut Sts. It will be 10 stories, 220x123 ft. of stone construction. The estimated cost is $2,000,000.

Pittsburgh, Penn.—M. Jacob, Arch., 113 Fourth Ave., has completed plans for the three-story brick store and loft building to be erected at 514-516-518 Wylie Ave., for B. & George Gelder, 106 Smithfield St. Estimated cost is $40,000.

Charles Bickel, May Bldg., is preparing plans for a six-story addition to the store of Boggs & Buhl, North Side 90x120 ft. The estimated cost is $250,000. The owners may award the contract without competition or may take separate bids for the work.

+The contract has been awarded to J. CHARLES WILSON, 541 Wood St., for the construction of the four-story brick store and loft building at 209 Wood St., for the Fidelity Title & Trust Co. The estimated cost is $50,000.

+Swarthmore, Penn.—The contract for the construction of the telephone exchange building for the Bell Telephone Co. has been awarded to F. W. VAN LOON, Denckla Bldg. J. T. Windrim is Arch., Commonwealth Bldg.

+Wilmington, Del.—Contracts for the construction of the church edifice, on Jackson St., for St. Paul's congregation have been awarded as follows: General contract, JOHN E. HALEY & SON $52,700 terra cotta, FEDERAL TERRA COTTA CO., New York cut-stone work, J. L. MALONE CO., Wilmington; plastering, TOGNARELLI & VOUGHT, Philadelphia, Tyrone marble, GIFFENS & MARBLE CO., Trenton, N. J.; electric work, E. F. HIGGINS & Co.

Baltimore, Md.—Bids will be received about June 1, by Pearce & Schenck, Inc., 445 East Baltimore St., for the construction of a theater on the site of the Eutaw House, at Baltimore and Eutaw Sts. The estimated cost is $200,000. Noted Apr. 17.

Petersburg, Va.—Bids will be received until 10 a.m., May 20, by S. Dalley Craig, Arch., Petersburg, Va., for the construction of the Y. M. C. A. building. The estimated cost is $65,000. W. M. Rucker is Chn. Bldg. Com. Noted Mar. 20.

✦Roanoke, Va.—The contract has been awarded to HEIS-KELL & NORFOLK, for the construction of the printing and office building for the Roanoke Times Co., to cost $60,830. It will be three stories and basement, of brick and structural steel, 100x166 ft. Frye & Chesterman, 15 Lynchburg National Bank Bldg., Lynchburg, are Archs.

✦Clarksburg, W. Va.—The contract for the construction of the high school for the Board of Education, has been awarded to HIRAM LLOYD BUILDING & CONSTRUCTION CO., 803 Odd Fellows Bldg., St. Louis, Mo., at $117,777. Noted Apr. 17.

Meadville, Miss.—Overstreet & Spencer, Archs., Scutter Bldg., Jackson, Miss., are preparing plans for the construction of the Franklin County court house. Bids will be received until July 1. The estimated cost is $40,000.

Pineville, La.—Bids will be received until May 15, by William Drago, Arch., 512 Audubon Bldg., New Orleans, La., for the construction of two dormitories for the Louisiana Hospital for the Insane. The estimated cost is $65,000. Noted Apr. 17.

✦Cleveland, Ohio—The contract for the construction of the art museum has been awarded to the CROWELL & SHERMAN CO., 1951 East 57th St. The estimated cost is $1,000,000.

The W. Bingham Co., Perry-Payne Bldg., will erect an eight-story store and ware house on West Ninth St. It will be of brick, steel and concrete, 100x500 ft. The estimated cost is $1,000,000.

✦East Liverpool, Ohio—The general contract for the construction of the high school has been awarded to the POTTERS LUMBER CO., East Liverpool, at $114,500. Other bidders were as follows: International Construction Co., Michigan, $126,300; Kerr Lumber Co., East Liverpool, $135,207; Morgan & Co., West Homstead, Ohio, $135,624; D. F. Nellis, East Liverpool, $115,118; Shultz, Shreiner & Clyde, $142,300.

Hamilton, Ohio—Plans have been prepared by Frank L. Packard, Arch., Hayden Bldg., Columbus, Ohio, for the construction of a high school. The estimated cost is $300,000.

✦Kenton, Ohio—The contract for Hardin County's court house has been awarded to the STEINIGER-TALYOR CONSTRUCTION CO., St. Louis, Mo., at $251,000. Noted Mar. 13.

Marysville, Ohio—Plans have been prepared by Frank L. Packard, Arch., Hayden Bldg., Columbus, Ohio, for the construction of a high school. The estimated cost is $80,000.

Springfield, Ohio—The Bushnell Stock Co., Harry B. Kissell, Secy., 732 Fairbanks Bldg., Springfield, Ohio, will erect a six-story hotel, 84x150 ft., at a cost of $500,000. The Allyn Co., Second National Bank Bldg., Cincinnati, will take bids about Aug. 1.

Detroit, Mich.—C. Howard Crane, Arch., 1124 Ford Bldg., will receive bids until May 10, for the construction of a brick and steel theater on Monroe and Bates Sts., for the Palace Theater Co.

Detroit, Mich.—Louis Kamper, Arch., 701 Fine Arts Bldg., Detroit, will receive bids until May 10, for the construction of a brick and stone bankbu ilding on Grand River and the Boulevard for the Central Savings Bank.

✦Grand Rapids, Mich.—The contract for the construction of the Pantlind Hotel has been awarded to the GEO. A. FULLER CO., Chicago, Ill. Noted Feb. 6.

Belvidere, Ill.—Bids will be received until 10 a.m., May 6, by Wm. Bowley, County Clk., for the construction of an alms house. Frank A. Carpenter is Arch.

Chicago, Ill.—Henry J. Schlaks, Arch., 10 South La Salle St., Chicago, has prepared plans for the construction of a church edifice, at Sheridan Rd. and Buena Ave. for the St. Marys-of-the-Lake Parish. The estimated cost is $180,000.

Chicago, Ill.—Bids will be received until noon, May 16, by Otis & Clarke, Archs., 105 South Dearborn St., Chicago, for the construction of the infirmary group of the Chicago Municipal Tuberculosis Sanitarium. The estimated cost is $600,000. Noted Apr. 24.

✦Appleton, Wis.—The contract for the construction of the bank building for the First National Bank, has been awarded to CHARLES GREINKE. Noted Apr. 17.

✦Madison, Wis.—The contract has been awarded to the WISCONSIN CONSTRUCTION CO., Chippewa Falls, for erecting the Wisconsin High School of the state university here. Estimated cost, $150,000.

✦Des Moines, Iowa—The contract for the construction of the seven-story warehouse at Fifth and Tuttle Sts., has been awarded to CHARLES WEITZ SONS CO., Des Moines, by the Hawkeye Transfer Co.

✦Jefferson City, Mo.—The contract for the construction of the foundation for the state capitol, has been awarded to T. H. JOHNSON & SON, Sedalia, Mo., at $91,321.

✦Kansas City, Mo.—The contract for the construction of the Benjamin Harrison School at Independence Rd., and Wallace Ave., has been awarded to J. O. LEA, at $56,874.

St. Louis, Mo.—The Board of Public Improvements will receive bids until May 23, for the construction of the city jail. The estimated cost is $212,000. Maxime Reber is Pres.

Dallas, Tex.—Bids will be received until May 6, by L. A. Walker, Arch., 901 Southwestern Life Bldg., Dallas, for the construction of a three-story brick and steel theater at 1610 Elm St., for G. K. Jorgensen. The estimated cost is $50,000. Noted Apr. 3.

Dallas, Tex.—The Commissioners Court has authorized the advertising for bids for the excavation of the foundation of the new county jail building. The estimated cost is $200,000. Noted Apr. 3.

San Antonio, Tex.—Plans are being prepared by Atlee B. Ayres, 626 Bedell Bldg., for the construction of a three-story and basement Y. M. C. A. building, 104x175 ft. The estimated cost is $150,000.

Phoenix, Ariz.—Lescher & Kibbey Archs., Phoenix, have drawn plans for a two-story reinforced-concrete freight depot and office building to be erected for the Arizona & Eastern R. R. Co. It will be 70x200 ft. with cement and pine floors, composition roof. The estimated cost is $40,000.

Seattle, Wash.—Robert M. Fouts will erect a six-story reinforced-concrete apartment house on Southeast 16th Ave. and East Madison St., to cost $125,000. W. P. White is Arch. Central Bldg., Seattle.

Seattle, Wash.—The County Commissioners will receive bids until May 14, for the construction of a court house. Amount available, $950,000. Noted Apr. 3.

✦Spokane, Wash.—The contract for the ornamental iron and bronze, for the Davenport Hotel has been awarded to the FLOUR CITY ORNAMENTAL IRON Co., Minneapolis, Minn. Noted Feb. 27.

Portland, Ore.—The Title & Trust Co. will erect an eight-story building to cost approximately $100,000 on Fourth St. It will be of reinforced concrete and steel construction. MacNaughton & Raymond are Archs., 47 Concord Bldg., Portland.

Los Angeles, Calif.—The Bensinger Estate, of Chicago, Ill., will erect a five-story and basement loft building on Los Angeles St. between Eighth and Ninth Sts. A. F. Rosenheim, 615 N. W. Hellman Bldg., Los Angeles, is Arch.

The contract has been awarded to the INDEPENDENT SEWER PIPE CO., 235 South Los Angeles St., at $33,990, for furnishing the terra cotta for the 12-story Class A bank building to be erected at Sixth and Spring Sts., for the Merchants' Fireproof Building Co.

The Brent Investment Co., 320 Story Bldg., will erect a 13- or 14-story building to cost $100,000 at 825-29 South Spring St.

H. E. Huntington will erect a 12-story and basement steel frame office building at Twelfth and Main Sts. Myron Hunt, Hibernian Bldg., is Arch.

✦Los Angeles, Calif.—A contract has been awarded to F. L. SPAULDING, 1460 Dana St., for the construction of a five-story and basement reinforced concrete hotel on East Fifth St. near Crocker St. for F. R. Tousley.

Oakland, Calif.—J. J. Donovan, Arch., Security Bank Bldg., Oakland, has completed plans for the $500,000 auditorium which is to be erected on 12th St. and Lake Shore Drive.

Pasadena, Calif.—Bids for the general construction of the additions to the high school were received as follows: Long Beach Construction Co., Long Beach, $51,889, David Irvine, Los Angeles, $53,245; J. S. Atkinson, Los Angeles, $55,000; Hanson & Co., Los Angeles, $55,267.

Sacramento, Calif.—Charles S. McKaiser, Arch., Mechanics' Institute Bldg., has been notified to proceed at once with the working drawings for the 10-story Class A commercial building to be erected by George W. Peltier and associates in Sacramento. Construction will be fireproof throughout with a complete steel frame and exterior walls faced with pressed brick and terra cotta. The estimated cost is $200,000.

Sacramento, Calif.—The West End Merchants' Association will build a 10-story building at Fourth and J Sts. to cost about $350,000. C. S. Kaiser, 57 Post St., San Francisco, is Arch.

The Capital-Sacramento Van & Storage Co. will erect two concrete storage warehouses to cost between $50,000 and $100,000. John F. Cooper is Pres.

✦San Francisco, Calif.—The contract has been awarded to LANGE & BERGSTROM, at $253,523, for the construction of the Palace of Agriculture on the Panama-Pacific International Exposition grounds. The lumber will be furnished by the Exposition Co. Noted Apr. 24.

Bids will be asked at once for the construction of the municipal auditorium at Hayes, Polk, Grove and Larkin Sts. The estimated cost is $1,000,000, and about 3500 tons of steel will be required. J. S. Dunnigan is City Clk.

The Southern Pacific Co. plans to erect a new depot, and make the improvements to its tracks, etc., in San Francisco, amounting to about $1,700,000.

The Emporium Department Store will erect a three-story addition to its present store on Market St. The estimated cost is $200,000.

South Pasadena, Calif.—The following bids were received by the Board of Education for the general construction of two brick schools from plans of Norman F. Marsh, Arch., Broadway Central Bldg., Los Angeles: Long Beach Construction Co., $51,889; David Irvine, $53,395; J. F. Adkinson, $55,000; G. Hanson & Son, 55,327; W. Simpson Construction Co., San Diego, $56,107; M. N. Yesberg, $57,140; Furlow & Pollock, South Pasadena, $57,759; G. H. Whyte, Pasadena, $58,852; Thee & Dix, $62,876.

✦Stockton, Calif.—The following contracts have been awarded by Glen Allen, Arch., Phelan Bldg., San Francisco, in connection with the construction of a four-story brick apartment house at Pershra & El Dorado Sts. for the Home Builders Security Co.: Brick work contract awarded to A. M. COWELL, 1231 Sptter St., $12,125; structural-steel work, RALSTON IRON WORKS, 20th and Indiana Sts., San Francisco, $6859; electric work, LEONARD F. YOUDALL and D. C. RUSSELL, 1319 N. Harrison, Stockton, $2280; Mill work, TOTTEN & BRANDT, 102 W. Main St., Stockton, $12,398; painting, GEORGE FOX, 625 W. Flora St., Stockton, $3100; sheet-metal work, EDWARD L. GNEKOW, Main and Stanislaus Sts., Stockton, $15,922.

The Commercial and Savings Bank will erect an eight-story steel bank building on N.W. Sutter and Main Sts. The estimated cost is $250,000.

Edmonton, Alta.—C. S. Burgess, Arch., University Alberta has completed plans for a dormitory. The estimated cost is $180,000. Final plans for the $500,000 arts building are to be selected soon by the Board of Directors.

CONTRACTS TO BE LET

Sewage Disposal Works

Fitchburg, Mass.

Sealed proposals for building a sewage disposal works for the City of Fitchburg, Massachusetts, addressed to the Sewage Disposal Commissioners and endorsed "Proposal for Sewage Disposal Works," will be received at the office of the Commission, No. 352 Main Street, until 2 o'clock P.M. on Thursday, May 15, 1913, at which place and time said proposals will be publicly opened and read.

The work includes the construction of five Imhoff settling tanks, two acres of sprinkling filters 10 feet deep, four secondary settling tanks, sludge beds, a laboratory building, sludge pump building and appurtenant structures.

Some of the principal items in the estimate of work are as follows:

Earth Excavation, 68,000 cubic yards
Roadway Construction, 2,900 linear feet
Concrete Masonry, 3,000 cubic yards
False Floor System for Sprinkling Filters, 9,400 square yards
3 Coats Cement Plaster on Ribbed Metal Reinforcing Lath, 5,600 square yards
Steel Reinforcing Bars, 78 tons
Structural Steel, 68 tons
Cast Iron Pipe laying sizes 4" to 36", Total 11,600 linear feet
Crushed Stone for Sprinkling Filters, 32,700 cubic yards.

Proposals for doing the work must be made upon the form furnished for the purpose and must be accompanied by a certified check, drawn upon a National Bank or Trust Company established in the City of New York or some city in the State of Massachusetts, in the sum of fifteen thousand dollars ($15,000) made payable to the City of Fitchburg.

A bond in the sum of sixty thousand dollars ($60,000) acceptable to the Sewage Disposal Commissioners, will be required for the faithful performance of the contract.

Detailed plans of the work may be seen and form of contract and specifications may be obtained at the office of the Commissioners in Fitchburg, or at the office of their Consulting Engineers, Metcalf & Eddy, 14 Beacon Street, Boston, Mass., after May 1st.

A deposit of ten dollars ($10) will be required on plans taken from either of the above offices.

The right is reserved to the Sewage Disposal Commissioners to reject any or all proposals or to accept the one deemed for the best interests of the city.

ARTHUR H. LOWE
DAVID M. DILLON
DANIEL A. BOYLE
Board of Sewage Disposal Commissioners

DAVID A. HARTWELL,
Chief Engineer
HARRISON P. EDDY,
Consulting Engineer

Electric Plant

Port of Valparaiso, Chile.

Tenders for supplying and erecting a plant for the electric illumination of the new port works at Valparaiso, Chile, will be received in the office of the "Comision de Puertos" in Santiago, Chile, September 10th, 1913.

Full information in regard to the above, can be obtained at the Consulate General of Chile, Room 431, 2 Rector Street, New York, from 12 M. to 3 P.M., excepting Saturdays.

Pavement

Erie, Pa., April 23, 1913.

Proposals are requested by the City of Erie, Penna., for laying approximately 5,500 yards of pavement, brick or sheet asphalt as may be designated by City Councils, said work to be let under five separate contracts. Proposals will be received by City Councils, May 5th, 1913, at 8:00 o'clock P.M. Prospective bidders are required to examine streets before submitting proposals. A certified check or bidders' bond for 10 per cent on each street must accompany each bid. The right is reserved to reject any or all bids.

B. E. BRIGGS
City Engineer.

Advertisement of Sanitary Contract No. 111 Lateral Sewers and House-Connections in District 16-A

OFFICE OF THE SEWERAGE COMMISSION
OF THE
CITY OF BALTIMORE.

Baltimore, April 22nd, 1913.

Sealed proposals, indorsed "Proposals for Constructing lateral Sewers and House-connections in District 16-A, Sanitary Contract No. 111," addressed to the Board of Awards of Baltimore City, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 A.M. Wednesday, May 14th, 1913, for constructing sanitary lateral sewers and house-connections in District 16-A, as shown on plans on file in the office of Mr. Calvin W. Hendrick, Chief Engineer of the Sewerage Commission.

Specifications and plans can be obtained upon application at the office of the Secretary of the Commission, Room 904 American Building, Baltimore, Md., on and after Saturday, April 26th, 1913.

A charge of $10.00 will be made for each set of specifications and blueprints, which charge will be refunded upon the return on or before May 14th, 1913, of the unused specifications and plans in good condition, or upon the return of the General Specifications and plans, in case a bid is submitted.

A certified check of the bidder, on a clearing-house bank, made payable to the order of the Mayor and City Council of Baltimore, in the sum of $3,500.00 will be required to be deposited with each bid.

Approximate Quantities.

15,500 lin. ft. vitrified pipe-house-connections.
19,000 lin. ft. vitrified pipe sewer, 8" to 22" in diameter.

The successful bidder on this contract will be required to give bond and comply with the City Charter respecting contracts.

The Board of Awards reserves the right to reject any and all bids.

By order of the Sewerage Commission.

CHARLES ENGLAND,
Chairman.

HARRY W. RODGERS,
Secretary.

Approved: April 23, 1913.
JAMES H. PRESTON,
President, Board of Awards.

Tenders for Dredging

Toronto, Canada.

The Toronto Harbor Commissioners have in preparation plans and specifications for the removal of approximately 35,000,000 cubic yards of material by hydraulic dredging.

Borings indicate seventy percent. of material to be sand and gravel, thirty percent. mixture of sand, silt and clay.

Each dredge must be capable of handling at least 600 cubic yards per hour at maximum length of discharge.

From source of supply to point of discharge maximum distance is about 6000 feet. Average length of delivery required about 4000 feet.

Direct line of discharge preferred, but consideration will be given to work being done in series or by relays.

Day and night operation required.

The plans and specifications will be ready on April 28th, 1913. Tenders for all or part of this work will be received up to 12 o'clock noon May 28th. Work to commence August 1st, 1913.

Borings, plans and specifications, tender forms, etc., and general information relating to the work can be seen at the Engineering Department of the Commission, 76 Adelaide St. West.

Communications relative thereto to be addressed to E. L. Cousins, Chief Engineer.

All tenders to be sealed and addressed to A. C. Lewis, Secretary, Toronto Harbor Commissioners.

The Commissioners do not bind themselves to accept the lowest or any tender.

L. H. CLARKE,
Chairman.

Engineering News

VOLUME 69 MAY 8, 1913 NUMBER 19

The Loetschberg Railway in Switzerland

The accompanying views show some of the notable high masonry viaducts on the new Lötschberg Ry., Switzerland, which has just been opened for traffic. As our readers will recall, from previous descriptions of this railway line in this journal, this new line gives a direct connection from Berne, the capital of Switzerland, southward to a junction in the upper part of the Rhone valley with the main line to Italy through the Simplon tunnel.

The new line begins at Spiez on Lake Thun (which is seen in the background in the photograph showing one of the electric locomotives used on the line). The first section from Spiez to Frutigen has been in operation for several years. From Frutigen the line follows the left side of the Kander, a swift current which descends a narrow valley on either side of which lofty snow-covered peaks seem to overhang. The ascent becomes steeper as the head of the valley is approached. The highway up the valley zigzags back and forth seven times at one point, and on the railway line much development was necessary and a loop was introduced at one point. At Kandersteg the line enters the nine-mile tunnel under the great Alpine Mountain mass of which the Jungfrau, only a few miles further west, forms a part. This tunnel is noted not only for its great length, but because of the terrible accident which occurred during its early construction, by which a long stretch of the tunnel was filled by an influx of sand and gravel from a mountain torrent above.

At the southern end of the tunnel the line emerges into the wild and precipitous Lötscher valley, where avalanches are so frequent that barriers were built at various points on the mountain-side above the line to break their force. From the Lötscher valley the line emerges into the broad valley of the Rhone, but at an elevation of 1000 ft. above the river, and it runs for a long distance along the precipitous mountain side, until it makes a junction with the Simplon line near the entrance of the Simplon tunnel.

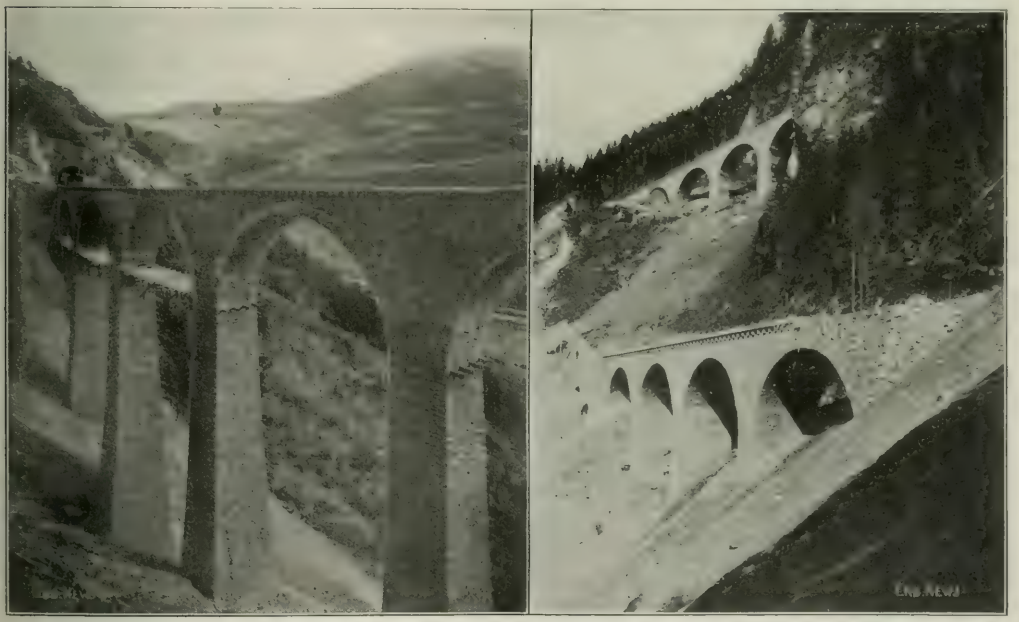


FIG. 1. MASONRY VIADUCTS ON THE LOETSCHBERG RY., SWITZERLAND

The electric locomotives which are used on this line resemble in general design the electric locomotives used on the Pennsylvania R.R. terminals in New York City, having their driving wheels connected by parallel rods as in steam locomotive practice. They are probably the largest electric locomotives in Europe, developing approximately 2000 hp., and being capable of hauling a train of 310 tons weight on a grade of 2.7% at a speed of 26 mi. per hr.

The Elimination of Taste in Water Treated with Calcium Hypochlorite*

By Arthur Lederer† and Frank Bachmann‡

It is surprising that the problem of removing the taste from waters treated with chlorinated lime has received such scant attention in this country. More water-supplies are treated with chlorinated lime in the United States than in any other country of the world, yet while we frequently hear complaints about the taste of treated waters, which very often are justified, we have heard practically nothing about the remedies. We even know of cases where high concentrations of chlorinated lime accompanied by a taste have been accepted as an unavoidable evil, which could not be remedied except by decreasing the efficiency of the disinfection process.

The first experiments on the removal of taste due to chlorinated lime were made almost 20 years ago by Traube[1], who also was the first one to recommend chlorinated lime for the disinfection of water-supplies, although its germicidal action was known before. Traube applied 4.26 mg. of chlorinated lime containing 1.06 mg. of available chlorine to 1 liter of water and added after two hours contact 2.09 mg. of sodium sulphite. He claimed that an excess of sulphite up to 50% over the required quantity does no harm for the reason that the salt is quickly oxidized in the water to sodium sulphate, which cannot be tasted in such low concentrations. For 1,000,000 gal. of water Traube recommended 35.7 lb. of chlorinated lime and 16.8 lb. of sodium sulphite. The quantity of chlorinated lime applied may seem abnormally high in the light of more recent observations and experiences in this country, but it explains why the early observers were forced to look for means to remove the repugnant aftertaste in waters thus overdosed.



Fig. 2. One of the Loetschberg Electric Locomotives

The need for remedial measures grew still more pronounced when later observers like Bassenge[2], Sickenberger and Kaufmann[3], and Lode[4] were led by laboratory tests to employ still larger quantities of chlorine in the form of chlorinated lime or sodium hypochlorite. Sickenberger and Kaufmann disinfected the turbid Nile water at Cairo with sodium hypochlorite equivalent to 2 mg. of available chlorine per liter, which corresponds to about 50 lb. of chlorinated lime per million gallons of water.

Bassenge recommended for disinfection on a large scale the enormous quantities of 2445 lb. of chlorinated lime for a ten-minute contact period down to 270 lb. of chlorinated lime for two hours contact. To eliminate the taste a quantity of calcium bisulphite somewhat higher than the quantity of chlorinated lime employed had to be added. Bassenge decided on the use of calcium bisulphite for the neutralization of the excess-chlorine with the advice of Dr. Proskauer. Calcium bisulphite is a saturated solution of calcium sulphite in sulphurous acid. It has the strong odor of that acid. On standing it decomposes, forming calcium sulphite and water. The reason Bassenge did not make use of sodium sulphite, as did Traube, was that it forms sodium sulphate in sufficiently large quantities to have a marked therapeutic effect which would not be the case with calcium bisulphite. An additional reason was that the free acid present would more readily combine with the chlorine than would the neutral sulphite. No definite quantity of bisulphite was recommended since it rapidly changes on storage. The quantity had to be determined each time by actual trial. Lode likewise used excessive quantities of chlorinated lime and advised the use of either sodium or calcium sulphite for the neutralization of the chlorine after 5 to 10 min. contact. In a later publication [5] he goes quite thoroughly into the question of removing the taste by various chemicals, of which he prefers the neutral sodium sulphite but still recommends for disinfection quantities of chlorinated lime as high as 1250 lb. per million gallons of water.

It is also interesting to note, in connection with the early disinfection experiments, that acids were brought into contact with the water after the chlorinated lime has been added in order to liberate the active chlorine which otherwise would not enter into the reaction. Lode adds for each pound of chlorinated lime about 1.2 lb. of concentrated hydrochloric acid. Citric acid likewise has been used in quantities of approximately 15 grains per gallon of chlorinated water for the same purpose. It is said that the taste was not influenced by the addition of the citric acid.

From the foregoing it must be apparent that even if the taste was effectively removed by the addition of various chemicals, the treatment of water-supplies at that time must have proved too expensive to be considered anything more than a temporary relief measure in times of epidemics. As such the Traube-Lode process was employed during a typhoid epidemic at Pola (Austria) in the fall of 1896 and the winter of 1896-97 by Dr. Meerans[6] on the recommendation of v. Kusy. A total of 45,000 gal. of treated water was supplied during that period and sodium thiosulphate served for the elimination of the taste. The consumers became eventually used to the water in spite of its high turbidity resulting from the chlorinated lime treatment. Lode criticized the use of sodium hyposulphite in Pola and assumed that it had been used by mistake, since in his, earlier writings, he called the sodium sulphite "antichlor" which as a matter of fact is the trade name for sodium thiosulphate. The uncertainty of the quantity of chlorinated lime to be added to different waters and the almost general introduction of safer ground-water supplies led the Germans to abandon altogether this treatment as a permanent procedure.

There are, however, industrial regions in Germany where similar conditions exist in regard to water-supplies as in this country, which have caused renewed interest in the hypochlorite treatment. Such conditions are met with in the coal mining region of the Ruhr watershed and disinfection of more than a dozen water-works supplies carried by on H. Bruns' with quantities somewhat smaller than those originally employed by Traube gave, with two exceptions, very satisfactory results. The quantities of chlorinated lime varied between 12.5 to 25 lb. (containing approximately 33% of available chlorine) per 1,000,000 gal. While complaints were frequent when the treated water was used by the consumers, the complaints ceased as soon as sodium thiosulphate was added as a routine measure. The compound was added 15 to 30 min. after disinfection in quantities equivalent to 50 to 70% of the weight of the chlorinated lime. As noted above, the disinfection was a failure in two cases. In one case the organic contents of the water expressed as "oxygen consumed" reached as high as 30 p.p.m. (parts per million) and in the other case the water contained 2 p.p.m. of iron.

The good results obtained on adding taste-removing chemicals induced us to believe that like results could be obtained in our "hypo" plants where the amount of chlorinated lime approaches the limit of recognizable taste. In some of our former [illegible] we found that 0.6 p.p.m. of available chlorine (equivalent to 15 lb. of chlorinated lime per 1,000,000 gal.) was about the smallest quantity which could be readily tasted, but it is a fact that even smaller quantities are discerned by sensitive non-smoking consumers, particularly when the temperature of the water is high. We should remember that in plants where

*Abstract of a paper read at the annual meeting of the Illinois Water Supply Association March 11 and 12, 1913.

†Chemist and Bacteriologist, the Sanitary District of Chicago, Chicago.

‡Assistant Chemist, The Sanitary District of Chicago.

[1] Hyg. Rundschau, 1895, p. 227.

[2] Hyg., 1895, p. 227.

[3] La Désinfection de l'eau par l'hypochlorite de sodium. Le Progrès Sanitaire, Bulletin Quotidien, paraissant au Caire, Dec. 13, 1904.

[4] Arch. Hyg., 1895, p. 236.

[5] Hyg. Rundschau, 1899, p. 861.

[6] Die Typhusepidemie in Pola im Herbst 1896 und im Winter 1896-1897. Oesterr. Sanitätswesen, Beil. zu No. 52, Dec. 29, 1898.

[7] J. Gasbel., 1912, pp. 649-56.

†Paper read before the Illinois Water Supply Association, Urbana, Ill., March 5, 1912.

smaller quantities, such as 6 to 8 lb. per 1,000,000 gal., are employed, accidental overdosing followed by a flood of complaints is frequent.

W. H. Dittoe and R. F. MacDowell[1] in reporting on the result of an inquiry among a large number of cities in United States and Canada, in which "hypo" treatment is installed, state that a taste is not often noticed when chlorinated lime is applied in quantities of 7 lb. per 1,000,000 gal. or less, but that there is often complaint on using larger quantities. With certain waters even smaller quantities may produce tastes and odors, however. It would then seem an advantage to apply a remedy if this can be done without materially influencing the cost of the treatment.

Our tests have been made on Lake Michigan water and while the relation of the chlorine to the chemicals applied theoretically remains the same, it is possible that the actual quantities would require adjustment with different water-supplies.

We know that storage of chlorinated waters by itself is a simple method by which to rid the water of the taste depending on the time allowed for this purpose. The chlorine taste in lake water treated with 12.5 lb. per 1,000,000 gal. disappeared, at room temperature, in a little over 3 hr. Simple aeration will hasten the disappearance, reducing the time to something like 2 hr. with the same quantity of bleach. The amount of air applied was 0.3 cu.ft. per gal. of water. It may also be stated here that the elimination of the taste coincides well with the disappearance of the potassium iodide-starch reaction. There is no definite chemical reaction taking place on aeration which would account for the speedier elimination of the taste; the chlorine seems to be carried off by the air bubbles passing through the liquid. On a large scale a prolonged storage period or storage with additional aeration would be in most cases not a practicable procedure. Contact of chlorinated water with wood charcoal will quickly do away with the chlorine taste, but the water in our experiments absorbed certain ingredients from the charcoal which by themselves resulted in a pronounced taste. Whether other carbonaceous material will give like results we do not know, but it is certain that sedimentation or filtration would be subsequently required to rid the water of the matter in suspension.

The chemicals which seemed of value for the purpose of removing the chlorine taste from waters are sodium sulphite and sodium thiosulphate, both of which are strong reducing agents and form tasteless compounds when brought into contact with chlorine. The calcium sulphite and calcium bisulphite which have been employed by some early observers have not been utilized by us for the reason that they are not readily obtainable and too expensive for practical application even when bought in bulk.

Our experiments on the neutralization with sodium sulphite were made on lake water treated with chlorinated lime as well as free freshly generated chlorine and practical tests coincided well with the theoretical quantities of chemical as determined by calculation. For 0.01569 gm. of bleach containing approximately 33% of available chlorine 0.01815 gm. of crystalline sodium sulphite were required, or 1.2 lb. of sulphite for each pound of chlorinated lime. One pound of liquid 100% chlorine would necessitate the addition of approximately 3.6 lb. of crystalline sodium sulphite for neutralization. An important point to keep in mind is that it takes as much sulphite for the free chlorine as for the total available chlorine in chlorinated lime to remove the taste of treated waters. The reaction between the sulphite and the chlorine takes place instantaneously, thus removing the taste as well as the odor at the same time. No harm can be done with a reasonable overdose since the sulphite could not be detected in such low concentrations. Furthermore it would take but a very short time for the dissolved oxygen in the water to convert the sulphites into sulphates.

Medicinally the sulphites are of low toxicity and fairly strong antiseptics on account of their ability to withdraw oxygen from organic matter but they are rarely used nowadays for that purpose. The average medicinal dose is 15 grains. Supposing we overdose a treated water containing 10 lb. of chlorinated lime per 1,000,000 gal. with 50% of the quantity of sulphite required, which would be an excess of 6 lb., one would have to drink about 370 gal. of the water to get a single medicinal dose, not considering any oxidation into sulphates at all. Since the medicinal dose of the sodium sulphate, which is formed in the reaction, is 240 grains its therapeutic effect is surely negligible.

The wholesale price of crystalline sodium sulphite is approximately 4c. per lb. in 100-lb. lots. This would add about 125% to the cost of the chlorinated lime, assuming that the market price of lime (containing 33% of available chlorine) is 2½c. per lb. Considering the benefit to be derived in many cases from the use of the sulphite the additional cost would not seem unreasonable. There are, however, serious drawbacks to the continued use of sodium sulphite, one of which is the fact that it deteriorates readily, forming sulphates which of course are completely inert as far as the taste-removing property is concerned. Weak solutions in particular will change from day to day.

The sodium thiosulphate as first applied in Pola and recently recommended by Bruns has striking advantages over the sodium sulphite. It is commercially used very extensively as "antichlor." When sodium sulphite comes into contact with chlorine the reaction taking place is the same as with iodines. With thiosulphate the oxidation is more complete and this therefore alters materially the proportions of chlorinated lime and thiosulphate necessary to do away with the taste and odor. The acids formed in the nuetralization process immediately combine with bases to form neutral salts.

Lode stated that in his experimenta he found it impossible to establish quantitatively corresponding values of chlorine and thiosulphate and he recommended 0.8 to 0.9 of the quantity of the chlorinated lime for the purpose of taste removal. Bruns recommends values of 50 to 70% of the quantity of chlorinated lime applied. As a matter of fact it seemed impossible in our experiments to obtain checks when a chlorinated lime solution was titrated with a thiosulphate solution under addition of potassium iodide and starch in the absence of acid. Of course when acid was added and all of the available chlorine became liberated checks were readily obtainable. This was likewise the case when the same definite quantity of potassium iodide was added each time without acid and the solution immediately titrated. We have found, however, that the theoretical quantity of thiosulphate necessary to complete the reaction and remove the taste as well as odor coincided always with the amount necessary to satisfy the total available chlorine in the chlorinated lime employed. For one pound of chlorinated lime containing approximately 33% of available chlorine the theoretical quantity would be 0.28 lb. of crystalline thiosulphate or approximately 30% of the weight of the chlorinated lime. One need not be afraid to add an excess since even 100 lb. of thiosulphate in 1,000,000 gal. of pure water cannot be tasted. As a matter of fact we should strongly recommend the application of thiosulphate in quantities of half of the quantity of the chlorinated lime to be on the safe side at all times and to take care of all reasonable overdosing with chlorine.

The commercial sodium thiosulphate is about 98% pure. It is a colorless, odorless salt possessing a cooling taste, afterwards bitter. It is very stable in air below 92° F., but loses moisture above that temperature. It greatly exceeds the chlorinated lime in stability. The salt is readily soluble in water and neutral or faintly alkaline in reaction. The medicinal dose of thiosulphate is the same as that of the sodium sulphite. Formerly it has been used to a limited extent as a weak antiseptic. The price of the commercial preparation is about 1.85c. per lb. in 100-lb. lots; it is therefore cheaper than chlorinated lime.

To summarize the advantages of the sodium thiosulphate over the sodium sulphite we would say that it is much more stable, much cheaper and that it requires less in actual weight to accomplish the same result. The combined cost of the treatment is within easy reach of a community since it adds but 40% to the cost of the chlorinated lime and the advantage of its application will best be appreciated in places where taste troubles are frequent. Even when less than the theoretical quantity of thiosulphate is added it is bound to lessen the frequency of complaints. A very important point to keep in mind when such treatment is resorted to is that the thiosulphate stops the germicidal action of chlorine the moment it comes into contact with the treated water. This is not of serious consequences, however, since we know positively that the destruction of bacteria by the chlorine is extremely rapid and in most cases practically completed in the first five minutes. We should recommend, however, at least 10 to 15 minutes as a safe margin or even more when conditions warrant. When the chlorinated water is stored, the simple addition of the thiosulphate in solution will suffice, care only being required to obtain a fair distribution. There is not much chance for the thiosulphate to unite with substances other than chlorine, since those compounds have a pronounced chemical affinity. Where the treated water is directly discharged into the mains, without previous storage, provisions will have to be made to dose the treated water continuously with thiosulphate at a point where disinfection has been practically completed. The thiosulphate does not attack metals and therefore would not cause trouble in the dosing chamber as does the chlorine. Where quantities like 2 to 5 lb. of chlorinated lime are applied and the dosing can be made reasonably automatic the application of thiosulphate will hardly seem necessary. However, where larger quantities are required and taste troubles ensue our observations would lead us to recommend the application of sodium thiosulphate as a permanent procedure.

[1] Monthly Bulletin, Ohio State Board of Health, October, 1912.

Dredging Problems in Wilmington Harbor, Delaware

By R. R. Raymond*

When Wilmington was originally settled, the first firm land encountered by vessels sailing from the Delaware River into what is now Wilmington harbor was called "The Rocks," and this point is now marked by a monument near the Fourth St. wharf. The land lying upstream from this point and stretching northward and westward is high and hilly, while that on the south side of the river is low, marshy and formerly was washed by high tides (Fig. 1).

Except where the high land touches the Christiana River within the city limits, the valley of the Christiana is low and level. The Brandywine River, however, flows through a deep and rocky valley and reaches the marshes only after passing the city. Its slope is so great that tide water reaches only to the Market St. bridge; so that the Brandywine has comparatively little share in the tidal volume of the whole system. Eastward from the junction of the two streams, in early colonial days, was an open anchorage.

Physical Conditions in Wilmington Harbor

The tidal range at the mouth of the Christiana River is about 6 ft., which formerly caused an enormous flow into the stream to fill the channel and cover the broad marshes stretching for many miles along the stream. On the falling tide the return of the waters to the channel from the marshes was so retarded by the vegetation, and the great dispersion of the waters over the marshes, that the ebb flow was prolonged; and the last of the ebb was very swift and powerful, scouring out the river bed and producing ample depths for navigation.

Today these conditions are changed. The open anchorage near the mouth of the river has filled up and is practically dry land. The city has extended to the south of the Christiana, reclaiming the land by filling and by excluding the tides with banks. A considerable part of the shore line is bulkheaded or revetted. Thus the tidal prism is now only a fraction of what it once was, and in addition several bridges restrict the channel to some extent, reducing the tidal range in the upper part of the river.

The result is a very great reduction in the tidal flow through the harbor and a great loss in the scouring power of the currents. It is probable that if natural forces were left to themselves under the present conditions, the harbor would shoal rapidly so that no vessel drawing more than 8 or 10 ft. could enter it and reach the wharves.

The very growth of the city, which has caused the deterioration of the harbor, demands that the harbor shall be kept open to commerce and at the same time justifies a considerable regular expenditure for that purpose. The problem is to do the work for the smallest expenditure possible compatible with an effective depth for navigation.

It has been determined that a mean-low-water depth of 21 ft. and a minimum width of 200 ft. are necessary for the proper use of the harbor for commerce. In 1896, when this project was first proposed, it was estimated that 1,400,000 cu.yd. of material would have to be removed to secure the proposed dimensions in the channel. Since that date, however, over 5,500,000 cu.yd. of material has been dredged. The excess over the estimated quantity is the amount deposited in the harbor by natural means. The amount dredged has averaged 260,000 cu. yd. annually, and comes from surface washings from the land throughout the watershed, from eroded banks, etc., and especially from the Delaware River whose waters are heavily charged with sediment at certain times of the year.

If we could maintain the harbor by simply dredging out 260,000 cu.yd. a year, the problem would be an easy one; but this amount represents the actual shoaling during a time when the channel dimensions were much less than they are desired to be; and the enlargement of the channel bears a remarkable relation to the rate of shoaling.

A very slight checking of the current produces a comparatively great reduction in the silt-carrying power of the water. This will be seen at once when it is remembered that the carrying power varies with the sixth power

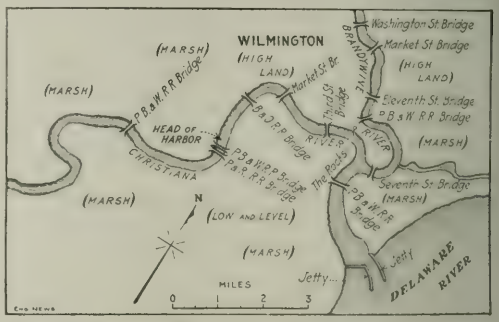


Fig. 1. Map of Wilmington Harbor, Delaware

of the velocity of the current. Thus a decrease in velocity of 1% produces a loss of carrying power of about 5%, while a loss in velocity of 5% produces a loss of about 46% in carrying power.

The velocity of the tidal currents in Wilmington harbor will be very materially checked by the proposed enlargement of the channel. Since the tidal prism of the harbor is the volume required to fill the harbor from the low-water level to the high-water level, it is not changed by dredging from the bottom of the channel, except in a small degree due to the slightly increased tidal range in the upper harbor caused by the freer flow of the tide in the enlarged channel. The total amount of tidal flow will not be materially increased and the tidal cycles, being controlled by those in the Delaware River, will require the same time as heretofore. Since we have about the same quantity of water flowing in the same time through a *larger* channel, the average velocity of flow will be correspondingly decreased.

From the above considerations and from the dredging records the writer estimates that when the channel has once been dredged to its full projected dimensions and is maintained, the rate of shoaling will be considerably over 400,000 cu.yd. annually.

Plans Proposed to Reduce the Rate of Silt Deposit

Various plans have been proposed to reduce the rate of deposit. Regulation works in the way of dikes and

*Major, Corps of Engineers, U. S. A., Wilmington, Del.

training walls are chief among these. The progressive building of bulkheads, wharves, etc., for commerce will cause the confines of the harbor to approach the established harbor lines and will thus tend to produce the same effect as training walls built for that purpose alone. They will require no congressional appropriation and for that reason are preferable to special walls.

Training walls, however, have no effect on silt deposit during slack water. Their chief effect is to prevent sudden changes in the current velocity throughout the length of the channel, thus diminishing local shoaling; and since shoaling distributed over a large area is much harder to remove by dredging than the same amount of material assembled in a few localities, this property of training walls does not appeal very strongly to the practical mind.

The only way to stop the shoaling entirely is to keep the water moving at a sufficient velocity to prevent sedimentation, and this is clearly impracticable.

Regulating dikes intended to contract the ebb flow have been suggested as a means of increasing its velocity and scouring power so as to wash out the sediment deposited during the period of slack water. Such works, however, would restrict the flood currents as well as the ebb currents and reduce the tidal range in the upper river, so that the full effect expected during the ebb flow by advocates of the plan would not be realized.

In addition to this objection, it must be observed that the silt is deposited when the current is reduced below a certain velocity, but a restoration of that velocity will not pick it up again. Once deposited, the silt acquires considerable cohesion and cannot be picked up by any slight increase of velocity.

Impounding basins to retain a part of the tidal flow until late in the ebb and then let it go with a rush have been advocated. Such basins would necessarily occupy valuable space and would themselves be rapidly filled with sediment, as the conditions in them for settling would be ideal. It would probably require so great a rush of water to sweep out the harbor effectively that the shipping might join the sediment in a grand procession, and this might occur without that deliberation which is essential for passing drawbridges.

Harbor Maintenance by Dredging

All systems of improvement suggested with the idea of preventing or reducing silt deposit are found upon examination to require the assistance of dredging as the only certain means of positively removing the deposits which would still occur to some extent. Dredging, therefore, has been studied with a view to the possibility of maintaining the desired depth by that means alone, and this has been considered the most economical as well as the most satisfactory means available.

In many harbors, dredging involves the removal of a definite amount of material to obtain the desired channel, and thereafter, perhaps, occasional work to remove accidental deposits. But in Wilmington harbor a continuous deposit is in progress. The harbor can never be completed so as to require no further work. It must be continuously maintained.

We are accustomed to such conditions in many directions. For instance, cleanliness of person, home, premises, municipalities, etc., involves continuous removal of objectionable matter and we make the necessary effort or expend the required funds as a matter of course, provided the result in each case is thought to be worth the cost. Fortunately for Wilmington, the cost of continual dredging in the harbor is very small compared to the great value of the resulting commerce.

The above considerations lead us not to the final solution of the problem but merely to its beginning. It is still to be determined how the dredging can be accomplished best, and this question involves many factors.

Character of Material.—The character of the material is of the utmost importance. It is almost entirely a very soft silt, readily cut from the bottom and raised to the surface of the water; but there presenting difficulties. If dredged in masses, as by means of a clamshell or dipper dredge, it can be placed in a scow very conveniently; but where and how can the scow be unloaded?

The mud cannot be dumped again into the river, for there is no place where it would not obstruct the harbor. Neither can it be dumped in the Delaware River, which presents a problem somewhat similar to that of the Christiana River but on a much greater scale. It cannot be placed ashore at a reasonable cost by mechanical means now available except by hydraulic dredging, and would require that it be dumped for rehandling, which is out of the question owing to the large proportion of the soft mud which would thus be allowed to return to the channel.

By far the best method of handling is by pumping the mud from the bottom directly ashore upon the neighboring marshes. The fluidity of the material after passing through the hydraulic dredge pump prevents its deposit in scows or bins on account of the time required for it to settle; but this same fluidity enables it to be forced through long pipes and distributed over the marshes where it fills all the small ditches and forms a nearly level and smooth surface.

Objections to Hydraulic Dredging—This has been the method employed heretofore, but it is becoming less and less applicable as the city grows and the marshes nearest the city are filled up and reclaimed. It has other disadvantages. For instance, a dredge moored in a channel only 200 ft. wide, with cables stretched out on both sides and a floating pipe-line connecting the vessel to one bank, presents a great obstruction to navigation.

Such a condition might be endured for a temporary job of short duration, but as a continuous performance it becomes absolutely intolerable. This objection applies to all types of plant that anchor in the narrow channel, especially when pipe-lines, pontoons, scows, tugs, moorings, etc., are used as auxiliaries.

Hydraulic pipe-line dredges possess the power of handling large quantities of material at very low cost when the material can be had fast enough without much shifting of position for the plant; but when the material is scattered and the pump cannot work to its full capacity and frequent shifting of the moorings and the shore pipe is necessary, the cost of the dredging runs up at a great rate. In dredging a channel with such plant, economy demands that the dredge shall move slowly and make a deep cut.

Channel Maintenance Problems—Let us suppose, however, that it is desired to maintain a channel in a harbor where continuous shoaling takes place uniformly throughout the harbor and that a dredge

of suitable capacity is used which removes the sediment just as fast as it it is deposited. Fig. 2 represents an ideal longitudinal section of the harbor from deep water to the head of navigation. The dredge starts at *A* and cuts the full cross-section as it goes. Deposit begins immediately behind the dredge. As the rates of dredging and deposit are assumed to be equal, we see that when the dredge has completed the cut to *B* the resulting bottom will be not as shown by the line *AB* but as shown by the line *aB*. It will be seen also that at no time will the depth available for navigation exceed the natural depth.

The cycle may be repeated as many times as desired without the slightest useful result to navigation, but to

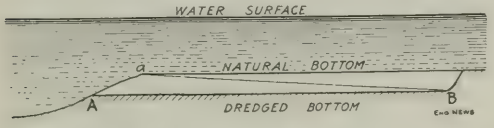


FIG. 2. DIAGRAM ILLUSTRATING SILT-REMOVAL PROBLEM IN WILMINGTON HARBOR

the great gain of the contractor who has an inexhaustible mine created for his sole benefit.

This illustration is roughly representative of the existing conditions at Wilmington, except that shoaling is not actually uniform throughout the harbor.

The dredging in recent years has been done by one of most effiicient concerns in the United States and with excellent equipment. The unit price has been very low. The contractor has undoubtedly "made good," complying fully with the terms of his contracts, and it is without the slightest criticism of him that the conclusion is inevitably reached that, so far as attaining the projected depth in the harbor is concerned, the work has been a failure. A certain amount of relief has, however, been afforded to navigation because of late the dredging has been faster than deposit.

Under the last contract the harbor was dredged throughout to a depth of 18 ft. at mean-low-water and the greatest resulting navigable depth was 14 ft. The present contract is for dredging to the full projected depth depth of 21 ft., and an available depth as great as 18 ft. may result.

Returning to our illustration (Fig. 2), we see that if we replace the dredge by one of greater capacity we can cut through to *B* while the depth at *A* decreases by less than the depth of the cut. In other words, we can approach the projected depth throughout by increasing the capacity of the plant above the rate of shoaling; but dredging in this way we can never reach the full projected depth throughout and the nearer we approach it the more uneconomical becomes the dredging, because the dredge must make a shallow cut and keep shifting its position.

The only possible way in which the full projected depth can be maintained throughout is by dredging to a greater depth so that shoaling will proceed only far enough to begin to encroach upon the projected depth at *A* by the time the cut is completed to *B*. But we must not forget that, according to the principles we have already discussed, the rate of shoaling for an overdepth is certain to be greater than for the projected depth, and this in its turn increases the magnitude and cost of the improvement.

It is manifest that the quicker a cut can be made from *A* to *B* the less will be the shoaling during the cut. If a dredge of just sufficient capacity to remove the sediment as fast as it is deposited could be designed to work economically when making a *shallow* cut, then it could work more rapidly from *A* to *B* than a dredge of the same capacity making a deeper cut. The value of this may be seen from the following illustration:

Suppose the average annual shoaling amounts to 3 ft. (This rate is approximate to that at Wilmington harbor for the full depth of 21 ft.) If a dredge making a cut 3 ft. deep is used, dredging must be done to a depth of 24 ft. in order to maintain a depth of 21 ft. for navigation; but if the dredge can work at the same rate of output when cutting only 1 ft., then only a 22-ft. depth need be dredged.

The gain will be very great, for the rate of shoaling in a 22-ft. channel will be very much less than that in the 24-ft. channel, and a smaller and cheaper dredge of less capacity can keep pace with it. Further gains will be found in the flatter side slopes and the less depth to which water- and gas-mains and electric cables, which cross the river in considerable number, can be laid without interfering with the dredging and suffering damage.

TYPE OF DREDGE ADOPTED—A type of dredge has been adopted for Wilmington harbor which is intended to work without obstructing the channel more than other vessels of the same size. This is to be accomplished by working the dredging apparatus while the vessel moves along the channel. The material is to be pumped from the river bed and deposited in hoppers within the vessel, special appliances being provided to take this material in the form of a thick paste having very little water mixed with it.

Without these appliances the bins would be filled with a fluid containing little solid matter and dredging would have to cease as soon as the bins were filled, in order to prevent the escape of the silt with the overflow. Of course, sand or gravel would settle rapidly in the bins and the excess of water be wasted in the overflow, but with the silt of Wilmington harbor, once well diluted with water, settlement would hardly take place at all while the contents of the bins were agitated by continued pumping.

By constructing the special dredge, this difficulty can be reduced so as to make the dredging of the silt practicable at a reasonable cost. Once pumped into the bins, the silt will not be dumped into the river for rehandling but will be pumped directly ashore upon the marshes. This will be done wherever convenient and the only pipe-line needed will extend from the shore to the nearer edge of the channel, and no more space in the harbor will be taken up by the dredge while unloading than by any other vessel of the same size unloading or loading at a wharf.

The dredge will not be designed in detail by the United States Engineer Department, but competitive designs will be invited, the general requirements, dimensions, capacity and specifications for material and workmanship being stated in terms sufficiently exact to insure a first-class vessel, and to secure bids which may be intelligently compared, but so broad as to permit considerable latitude to the designer.

Adaptability of the Frühling Type of Dredge—It is expected that the accepted design will embody the well known advantages of the Frühling type of suction dredge,* as this appears to be the only type able to meet the specified requirements. In this type of dredge the suction head is dragged along the bottom from the stern at the desired depth very much as a giant hoe might be used to scrape the material from the river bed. The motion of the head, as the vessel moves forward, drives the scraped-up material into the hoe head, which is made hollow, where it is mixed with a suitable amount of water and is sucked up the hollow handle to the dredging pump within the vessel.

By keeping the head well filled with mud, the river water is excluded and the material flows to the pump nearly as thick as it lies in the river bed. Inlet jets at the cutter-head are the only source of dilution, and these are so controlled as to prevent an excess of water over that actually needed to make the mass flow.

This system of dredging is not applicable to material which is too hard or compact, but it is very efficient in removing silt for maintaining a channel already completed by dredges which are able to cut the hard bottom.

The cutter-head can be made from 8 to 16 ft. wide (in fact it is adjustable in width by adding or removing sections) and is thus able to develop the full capacity of the pump when making a broad, shallow cut. The shallower the cut, the faster the vessel moves ahead while dredging, thus fulfilling the requirements of the case as previously explained. A further advantage lies in the ability to re-dredge wherever needed to remove shoaling without waiting for the shoaling to proceed to a depth of several feet, as is necessary in order to use the ordinary type of suction dredge economically.

The hoppers or bins will have no doors or outlets through the bottom of the hull. Thus the only water to enter them will be that pumped in with the mud, and by skillful handling the bins can be filled with material containing a very large percentage of solid matter.

When the Frühling dredge "New Orleans" was tested before her departure for the mouth of the Mississippi River, she went to the entrance of Wilmington harbor and pumped up a couple of thousand yards of mud. In this material she made a remarkable showing, filling her hoppers with such a thick paste that a pailful dipped from the discharge and given ample time to settle showed no water on its surface, but remained just plain mud.

The expectation that in the same material a similar dredge can repeat this performance under like conditions seems reasonable.

The device for pumping the mud out of the hoppers consists of a system of valves and ducts by means of which the mud is led into the suction of the dredging pump and thence is forced ashore through a discharge pipe. To increase the distance to which the mud can be forced, as well as to assist it in flowing to the pump, sluices are provided which admit river water into the hoppers to the desired extent. Thus the dilution of the mud is under control, and the material may be delivered thick for making a solid fill or thin for spreading over an area.

A scow equipped for the purpose will construct temporary trestles for carrying the pipe-line ashore from the nearest navigable channel, so that provision can be made at several different places in order that the dredge may always have a pipe-line available to discharge her material. By this means it is expected to accomplish considerable reclamation of low land bordering on the river. The ability of the dredge to deliver the mud thick will avoid, in some cases, the need for special levees or banks to retain the fill and for sluices to drain off surplus water.

The method of employing this dredge will not be strictly as outlined in our illustration above, for the actual conditions differ from the ideal ones assumed. In practice, the shoaling will not be uniform throughout the harbor but will be most rapid at certain places where the current velocities are checked by the form of the channel or by some obstruction.

The greatest benefit to navigation can be secured by dredging each day wherever the depth in the channel is least. With a dredge of the type adopted, this can be easily managed. With the ordinary pipe-line plant, which has been the most efficient type heretofore available, it is quite impossible.

*Described in our issues of Mar. 5, 1908, p. 237, and Apr. 23, 1908, p. 466.

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Baking Paint on Steel Passenger Cars is being tried experimentally by the Pennsylvania R.R., according to a paper by C. D. Young, engineer of tests, P. R.R., before a meeting of the American Society of Mechanical Engineers at New York City, Apr. 8. The gums and artificial driers, used in shortening the time of ordinary painting, continue their action so that the paints and varnishes increase in hardness and brittleness and more easily crack and chip—action which is aggravated by excessive expansion and contraction of the steel surfaces. Equipment painted by old methods, in service as little as four months had shown serious varnish cracks and chips on the interior surfaces.

Experiments were undertaken to secure a more elastic covering and this has finally resulted in the baking of the applied paint and varnish after its application. First a priming coat is given both exterior and interior of the car which is then run into the oven and baked for three hours at temperatures rising from 160 to 250°. Then the car is withdrawn and after being sufficiently cooled to work on, the surfaces are glazed and puttied. It then receives a first coat of surfacer and is again baked for three hours. Two or three additional coats of surfacer are applied as each case may require. After the last coat has been applied and baked, the outside surface of the car body is rubbed down with emery and oil to produce a flat and smooth surface. Then the various color coats are applied, tuscan red on the outside and green and bronze on the inside. Two coats are required for standard shades and each coat is baked. The car then is lettered and striped. Afterward the outside and inside surfaces get three coats of high-grade finishing varnish especially adapted for baking. Each coat is baked for three hours at temperatures rising from 120° to 150° F. Finally the interior surfaces are rubbed with pumice and oil to give a desired flat finish.

All the work noted, may be accomplished in six to eight days—a saving of about ten days over the old air-drying processes. Exact formulas for the mixtures can be obtained so that final uniformity is effected. The advantages of this system are: (1) Longer life of coating, (2) improved general appearance, (3) decreased cost of material, without increasing labor cost, (4) saving of shop time for cars, (5) complete sanitation of old cars. The disadvantages are in the initial cost of equipment and the operating cost of the oven.

The oven in use is 90 ft. 3 in. long, 13 ft. wide and 15 ft. high, and is housed in a light corrugated-iron building. The The framework is made up of 3-in. I-beams on 5-ft. centers. The roof frame is of the same sections and curved to conform closely to the car contours. Each end has two large doors which may be readily opened and closed. The whole oven is lined on the inside with ⅛-in. steel plate and on the outside with galvanized iron of 0.22-in. gage. The 3-in. interspace is filled with magnesia lagging and the doors are similarly insulated. Coils of steam pipe along the walls and manifold castings along the floor and close to the walls furnish 2000 sq.ft. of heating surface; steam at 100-lb. gage is used. Rectangular openings near the floor line admit the air necessary for circulation and four 8-in. ventilators are spaced at equal distances from the roof.

Depreciation and Public Service Regulation*

By Robert H. Whitten†

SYNOPSIS—A main theme discussed is whether in a rate-regulation proceeding there should be a deduction from cost-new on account of accrued depreciation due to age and wear and tear though such depreciation does not interfere with the present efficiency of the plant. Depreciation is concerned with the maintenance of the integrity of the investment at a uniform annual cost. The annual investment cost includes interest on investment and repairs and replacements. Tested by this rule the following methods are compared: (1) Straight-line method of estimating accrued depreciation and the annual depreciation allowance; (2) Straight-line method of fixing the annual depreciation allowance—accrued depreciation not deducted; (3) Sinking-fund method—no deduction from cost-new; (4) Uniform investment-charge method—accrued depreciation deducted from cost-new. The last method is approved. The same rule as to deduction for accrued depreciation and as to annual depreciation allowance is applicable in the case of a heretofore unregulated utility, as in the case of utility that has been subject to such regulation.

With the development during the past five years of control over the rates and service of public service companies, there is no problem that has been more puzzling than that of the proper treatment of depreciation. In order to determine just rates of charge it is usually necessary to determine accurately the cost of production, including in such cost both proper annual operating costs and a fair allowance for interest or profit on investment. The proper treatment of depreciation has been a chief source of contention both in the determination of the proper annual operating charges and in the fixing of investment cost upon which a return is to be allowed. The approval of a high annual allowance for depreciation may so increase operating expenses as to render impracticable a proposed reduction in rates. The finding of a large accrued depreciation may so reduce the investment cost as to allow a somewhat lower rate of charge than would otherwise be practicable. This being the case, it is natural that in a hotly contested case the energies of one side should be directed toward the seemingly contradictory ends of establishing a low annual allowance for depreciation and a large deduction for accrued depreciation, while the energies of the other side should be similarly directed toward a high annual allowance for depreciation and a small deduction for accrued depreciation. The entire problem is difficult and elusive but has been receiving the most careful and disinterested study of many students. It is clearly a problem in economics, with some ethical elements, and should be susceptible of fairly definite solution. Gradually the various factors of the problem are coming to light. There can of course be no real solution until all these factors are known and can be comprehended in their proper relation one to another.

Some of the moot points at present are:

(1) Should the straight-line method or the sinking-fund method be used in computing (a) the annual depreciation allowance and (b) the accrued depreciation?

(2) What consideration should be given to probable or possible future obsolescence and inadequacy in computing (a) the annual depreciation allowance and (b) the accrued depreciation?

(3) Should anything be deducted from cost-new on account of accrued depreciation due to age and use though such depreciation does not interfere with the present efficiency of the plant?

This paper will be devoted chiefly to a consideration of this last point, though in its discussion the first point also will be briefly considered.

Objection to Deduction of Accrued Depreciation

The United States Supreme Court in Knoxville vs. Water Co., 212 U. S. 1, decided Jan. 4, 1909, has laid down in unequivocal terms the principle that there shall be a deduction from cost-new on account of accrued deterioration due to wear and age. W. H. Winslow called attention to what he considered the fallacy of this decision in a communication to the *Electrical World*, Feb. 25, 1909, p. 509. Mr. Winslow argues that while purchase value is affected by age and wear, rental value in the absence of decreased efficiency is not. He states that the decision is on a par with a rule that the wages of a servant should be diminished as his age increases unless he has been able to lay aside adequate provision for old age, even though age has not diminished the quality or the amount of the work he performs. He sums up his argument very cogently as follows:

> I believe that failure to recognize the difference between sale and rental values, in public-utility cases, has been due to the false assumption that the purchaser at depreciated prices would need to consider only such prices in fixing rates of return, and that, therefore, there was no justice in allowing the owners to charge rates based on larger sums. This assumption fails to take into account the fact that the sum which must be accumulated for rebuilding is not the depreciated cost paid, but the original cost; and that, therefore, to escape loss, such a purchaser must either do one of two things: (1) At once place in a depreciation fund the difference beween the price paid and the cost of reproduction, new; or, (2) collect each year, in addition to the current depreciation, a further sum which will make up the past depreciation during the remaining life of the plant. In either case, in order to obtain the same net earnings, the rates charged must be equal to those charged on a new plant.

Mr. Winslow's argument evidently assumes the sinking-fund method of estimating the accrued depreciation and the annual allowance for depreciation. It is clear that if moneys in the depreciation reserve are assumed to accumulate at compound interest the annual payment into the fund cannot be considered an amortization of the investment. It does not return to the investor the money that he has put into the business. It earns not for the shareholder but for the depreciation fund. Under this theory, therefore, unless a company is allowed a return on cost-new, a certain portion of its property would seem to be confiscated for the benefit of the public. But under the sinking-fund theory, even if there is no fund in existence and the annual allowance that should have gone to the depreciation fund has actually been paid out in dividends, such amounts may possibly be considered not as a return of capital to the shareholder

*This study is in the main an elaboration of certain suggestions as to depreciation contained in the author's book on "Valuation of Public Service Corporations," reviewed in "Eng. News" Sept. 12, 1912.

†With New York Public Service Commission, First District, 154 Nassau St., New York City.

but as payments that the shareholder holds in trust and must return with compound interest whenever they are needed for renewals or replacements.

Straight-Line Method—Accrued Depreciation Deducted

Some authorities agree for the most part to the validity of the above reasoning, assuming the sinking-fund method, but deny that the sinking-fund method is a proper one to use for the purpose. Assuming the straight-line method of computing the accrued depreciation and the annual depreciation allowance, certain of the above difficulties are eliminated. Under this method it is not true that the investor will be compelled to accept a return on a smaller amount than he has actually invested without being reimbursed for such reduction in the amount of his principal. The straight-line method does not assume a payment in part but a payment in full. It is not a payment that is assumed to accumulate at compound interest but it is a payment that is assumed to cover the full amount of such depreciation. It may be invested in the business, thus reducing the amount that will need to be secured through the issue of stocks and bonds, or it may be returned to the shareholders and thus result in an actual or constructive reduction of the capital invested.

Let us assume a plant starting with an actual total capital investment of $1,000,000. This amount has covered the cost of land, structures and equipment, including promotion expenses and overhead charges and the necessary allowance for working capital. Assume that the annual depreciation on the depreciable property is estimated at 1½% on the total capital ($1,000,000). This estimate we will assume has been based on the probable efficient life and scrap value of the depreciable parts and verified by the actual experience of a long established plant of similar character. If 1½% on $1,000,000, or $15,000, is carried from revenue to depreciation reserve each year this reserve will be adequate to provide for renewals as they occur and in addition there will always be enough left to the credit of the depreciation reserve to make up the difference between the capital-cost and the capital-cost-less-depreciation.

Let us assume now that at the expiration of 20 years the amount in the depreciation reserve is $150,000 or 15% of the capital-cost. If the allowance of 1½% for depreciation was in fact a correct measure of the depreciation throughout this 20-year period, this $150,000 will exactly represent the difference between the original capital-cost and the original capital-cost-less-depreciation. If a business is experiencing a normal growth the most natural and profitable use that can be made of a depreciation reserve is to retain it in the business to meet the additional capital requirements for plant and working capital. We may assume, therefore, that this $150,000 will be invested in the business as additional capital outlay so that now the cost-new of the entire property is not $1,000,000 but $1,150,000. Of this amount $1,000,000 has been contributed by the shareholders and bondholders and the other $150,000 represents the depreciation reserve which is really the contribution of the consumers. If now in a rate-regulation proceeding the rate of return is based on $1,000,000 the investor will receive a return based on the full amount of all the capital he has ever contributed to the enterprise. This $1,000,000 is not cost-new but cost-less-depreciation. The depreciation amounts to $150,000 and the cost-new is $1,150,000. It seems clear that in this case cost-less-depreciation rather than cost-new is the fair value upon which the rate of return should be based.

James E. Allison, commissioner and chief engineer of the St. Louis Public Service Commission, in a valuable contribution to the study of this subject,* states that under certain conditions the accrued depreciation should not be deducted to obtain fair value. He apparently approves the straight-line method of fixing the annual allowance for depreciation. He states that "after depreciation charges have been established by legal regulation and are paid by the consumer, then for the future any accumulation which is or should be in the depreciation fund as a result of these charges is a repayment of investment by the consumer and should be deducted from gross value to determine the just amount upon which to base reasonable returns." But he states that it is not necessary that a company should have a depreciation fund equal to the amount of accrued depreciation indicated by the straight-line method. In large properties there is an approximately constant normal wear. The property is never brought back to new condition and there will consequently always be a constant theoretical depreciation that will not need to be offset by a depreciation reserve. He concludes (at p. 99):

> In a case of a heretofore unregulated property it cannot be shown that the company should have set aside depreciation charges to accumulate a fund equal to the Theoretical Depreciation, for such a fund would be needless. . . . .
>
> The conclusion seems clear then that in all ordinary cases of heretofore unregulated properties we cannot justly depreciate to obtain Fair Value unless we admit the justice of ex post facto laws or equivalent regulation, or unless we interpret Fair Value to mean Market Value and not Just Amount.

Depreciation is a problem in cost accounting. It is concerned with the allocation to each year's operating accounts of the waste in the instruments of production attributable to the year's operations. The cost of materials purchased and entirely consumed in the course of the year's operations is invariably included in ordinary operating expenses. The capital required to purchase and carry such materials during the turnover period is a part of the working capital. But some materials or instruments of production are not used up during the first year but have a life of 3, 10, 20, 50 or 100 years. They are consumed in operation just as surely as the former and constitute just as real a part of the cost of production. Their cost (exclusive of scrap value) must, however, be distrubuted over the full life period. The capital required to purchase and carry these long-lived consumable materials may also be considered a part of the working capital. It is this element of interest on capital that so greatly complicates the depreciation problem.

Cost-less-depreciation properly determined constitutes the real total *working* capital of the enterprise. It is the amount that under proper financial management the owners contribute to the enterprise. The depreciation reserve is properly speaking the contribution of the consumer and it directly reduces the amount of working capital that the owners must contribute to carry on the en-

*James E. Allison, "Should Public Service Properties be Depreciated to Obtain Fair Value in Rate or Regulation Cases?" Printed as Appendix A to the Report of St. Louis Public Service Commission on the United Railways Co. of St Louis, Sept. 11, 1912, pages 73-121.

terprise. Working capital in the narrow sense may be defined as the cost of stores and supplies on hand plus sufficient additional funds to bridge the gap between outlay and reimbursement. Working capital is not the full cost of labor, materials and supplies throughout the year but a balance of current outlay over reimbursement. Similarly, the *total working capital* of the physical plant may be conceived as the balance of outlay for plant over reimbursement through the depreciation reserve. It is cost-less-depreciation.

Uniform Annual Investment Cost Method

Depreciation is concerned with the maintenance of the integrity of the investment in depreciable property at a uniform annual cost. Such costs cannot be determined without some reference to interest on reserves and investment. The entire problem, therefore, may be simplified by considering depreciation as the adjustment necessary to secure a uniform investment cost. The supply of a public service must be considered a continuous process. Management or ownership may change but the plant and the service and the depreciation process are assumed to go on forever. The annual investment cost includes not only interest but also the repairs, renewals and replacements necessary to keep the property permanently in good working condition. The rights of the consumers using the supply at different periods demand that the annual charges attributed directly to the investment shall be as uniform as possible.

Disregarding for simplicity the element due to a possible fluctuation of the cost of repairs the above standard requires that the charge for interest plus depreciation per $1 of investment or cost-new shall be uniform. Cost-new is the factor that determines the capacity for production. If the percentage charge for interest plus depreciation per $1 of cost-new is made uniform, this part of the cost of production is most appropriately treated. Generally speaking, it seems fair that for each unit of total capacity there should be a uniform charge for interest and depreciation throughout the entire life of the utility. It may of course be urged that the aim should be not a uniform cost per unit of capacity or investment but a uniform cost per unit of product. This might have advantages but is impossible of practical application. Depreciation is an operating expense and like every other operating expense must be allocated to the year in which it actually accrues. It is true that a certain equalization of the per unit cost of output may be brought about through some method of capitalizing or reimbursing the cost of establishing the business. This, however, should be through an entirely distinct accounting process. Correct accounting requires that all operating expense, including depreciation, should be correctly stated in each year's accounts. There is one way, however, in which output may have a very direct bearing on depreciation. The life of a car wheel is properly measured in car miles rather than in years. The annual depreciation therefore depends on the number of car miles run. With the development of the traffic of a railway the annual depreciation on car wheels increases. This is also true of other items, such as rails. It is not true in any great measure, however, of a large proportion of the depreciable property of a public utility. Wear is substantially constant, or use and chance are controlling in fixing the probable life.

Comparison of Chief Methods

As a problem in cost accounting the accrued depreciation and the annual allowance for depreciation are interdependent. Our theory in regard to an annual allowance for depreciation will necessarily control that in relation to the amount of accrued depreciation and *vice versa*. The amount of the accrued depreciation depends on the method adopted for computing the annual payment to the depreciation reserve. If the straight-line method is used the accrued depreciation will be greater, as will also the annual payment out of revenue to the depreciation reserve. If the sinking-fund method is used the accrued depreciation will be smaller, as will also the annual allowance for depreciation.

In the following discussion the chief methods of allowing for annual depreciation and of fixing the amount, if any, of accrued depreciation to be deducted in fixing fair value for rate purposes, are examined with special reference to their conformity to the principle above discussed of a uniform annual investment charge, i. e., a uniform percentage on cost-new to cover both interest and depreciation. In order to test such conformity it is necessary to show the combined percentage for interest and depreciation throughout the life of a utility. But the lives of various utilities even of the same general class show very different records as to the amount of accrued depreciation. We know, however, that there is a tendency for all utilities to settle down after a time to a more or less uniform condition as regards the percentage amount of accrued depreciation and the annual requirements for renewals and replacements. After the various parts of a large public-utility plant have gone through complete cycles of renewals the plant settles down to a condition in which, except for extraordinary functional depreciation, expenditures for maintenance, repairs and renewals become practically constant. There is little fluctuation from year to year and the averages by five- or ten-year periods are practically identical. This settling down or equalizing process is very greatly hastened by the fact that all large systems are constructed by piecemeal.

Tables I to IV, used in comparing the different methods of depreciation, are based on the theory that the plant is built up piecemeal. By assuming that the additions to the plant are uniform in amount and come at uniform intervals and by assuming a uniform life for all such additions, the process by which a plant settles down to uniform condition can be approximately shown, as well as the condition as to accrued depreciation and the requirements for renewals after the plant has thus settled down.*

1. *Straight-line method of estimating accrued depreciation and the annual depreciation allowance.—Accrued depreciation deducted from cost-new in fixing fair value for rate purposes.* Under this method the combined percentage charge for interest and depreciation declines with the accruing depreciation until the plant settles down to a uniform amount of normal wear. Under the conditions assumed in Table I there is at the start a combined percentage charge of 8½% on cost-new (6% for interest and 2½% for depreciation). The percentage for depreciation remains uniform but with the accruing depreciation the 6% interest charge based on

*This method of illustration has been worked out by James E. Allison, in the report (pp. 73-121) mentioned in an earlier foot note.

cost-less-depreciation becomes a smaller and smaller percentage on cost-new until when the plant is settled down to permanent condition it is but 1½% on cost-new and the combined percentage for interest and depreciation is 7% on cost-new as against 8½% at the start. This appears to throw an undue burden upon the early years.

TABLE I. STRAIGHT-LINE METHOD—ACCRUED DEPRECIATION DEDUCTED FROM COST-NEW

Assumed conditions:
1. Non-depreciable property (including scrap value of depreciable property) equals 50% of cost-new.
2. Plant built piecemeal in 20 even annual increments of $10,000 each.
3. Life of each annual cost increment (obsolescence, inadequacy and casualty not considered) 20 years.
4. Fair rate of return 6% on cost-less-depreciation.
5. Annual straight-line ordinary physical depreciation 5% on depreciable property or 2½% on total cost-new.
6. Depreciation reserve invested in business, thus reducing the necessary contribution from the sale of stock and bonds.

Year	Cost-new	Cost-less-depreciation	Annual return: 6% on cost-less-depreciation	Annual depreciation: 2½% on cost-new	Return plus annual depreciation: Amount (col 4+5)	Return plus annual depreciation: Per-cent. on cost-new	Accrued depreciation: Amount	Accrued depreciation: Per-cent. of cost-new
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	$10,000	$10,000	$600	$250	$850	8.500	$250	2.50
2	20,000	19,750	1185	500	1,685	8.425	750	3.75
3	30,000	29,250	1755	750	2,505	8.350	1,500	5.00
4	40,000	38,500	2310	1000	3,310	8.275	2,500	6.25
5	50,000	47,500	2850	1250	4,100	8.200	3,750	7.50
6	60,000	56,250	3375	1500	4,875	8.125	5,250	8.75
7	70,000	64,750	3885	1750	5,635	8.050	7,000	10.00
8	80,000	73,000	4380	2000	6,380	7.975	9,000	11.25
9	90,000	81,000	1860	2250	7,110	7.900	11,250	12.50
10	100,000	88,750	5325	2500	7,825	7.825	13,750	13.75
11	110,000	96,250	5775	2750	8,525	7.750	16,500	15.00
12	120,000	103,500	6210	3000	9,210	7.675	19,500	16.25
13	130,000	110,500	6630	3250	9,880	7.600	22,750	17.50
14	140,000	117,250	7035	3500	10,535	7.525	26,250	18.75
15	150,000	123,750	7425	3750	11,175	7.450	30,000	20.00
16	160,000	130,000	7800	4000	11,800	7.375	34,000	21.25
17	170,000	136,000	7160	4250	12,410	7.300	38,250	22.50
18	180,000	141,750	8505	4500	13,005	7.225	42,750	23.75
19	190,000	147,250	8835	4750	13,585	7.150	47,500	25.00
20	200,000	152,500	9150	5000	14,150	7.075	47,500	23.75
21	200,000	152,500	9150	5000	14,150	7.075	47,500	23.75
22	200,000	152,500	9150	5000	14,150	7.075	47,500	23.75
23	200,000	152,500	9150	5000	14,150	7.075	47,500	23.75

2. *Straight-line method of fixing the annual depreciation allowance—Accrued depreciation not deducted in fixing fair value for rate purposes.* It is apparent that in a new plant the requirements for renewals and replacements are much less in the early years than they are later when the plant has settled down to a substantially uniform condition as to average age and wear of its various parts. If an allowance for depreciation on the straight-line basis is made from the start, a large depreciation reserve will be accumulated that will never be actually needed for renewals or replacements. This reserve will represent the difference between cost-new and cost-less-depreciation, but as the plant as a whole can never be brought back to new condition this reserve will never be drawn upon. If this is true it is argued that it is foolish to provide such a reserve. The depreciation allowance of the early years should be reduced to the amount necessary to meet actual renewals and replacements during the period while the plant is settling down. When the plant has finally settled down to a uniform condition as to average age and wear then only will the full depreciation allowance on the straight-line basis be requisite. This method will relieve the operating expenses of the earlier years. It is assumed that the consumer will secure the benefit of this reduced expense either in lower rates of charge during such early years or in a lower development expense to be reimbursed out of future earnings. It follows naturally from this method that there should be no deduction for accrued depreciation in fixing fair value for rate purposes. Since under this theory the accrued depreciation is not amortized and not placed in a reserve and devoted to the capital purposes of the enterprise, the full cost-new represents the real sacrifice of the owners and constitutes the most natural base on which to compute a fair return.

This plan, however, shows up badly under the test of a uniform combined percentage charge for interest and depreciation. Under the conditions assumed in Table II the combined percentage charge increases from 6% on cost-new to 8½% on cost-new. If a higher rate of straight-line depreciation were assumed, the difference would be even greater and might even amount to a doubling of annual combined charge for interest and depreciation. Assuming a uniform output per $1 of investment this would mean that rates of charge would have to be largely increased. Interest is the investment carrying charge. Depreciation is the charge required to keep the investment intact. Together they constitute the total investment carrying charge.

TABLE II. STRAIGHT-LINE METHOD—NO DEDUCTION FROM COST-NEW

Assumed conditions:
1-3. Same as in Table I.
4. Fair rate of return 6% on cost-new.
5. Same as in Table I, except that no allowance is made for annual depreciation until actually required for renewals in the twentieth year.

Year	Cost-new	Annual return: 6% on cost-new	Annual depreciation: 2½% cost-new	Return plus annual depreciation: % on cost-new
1	$10,000	$600	....	6
2	20,000	1,200	....	6
3	30,000	1,800	....	6
4	40,000	2,400	....	6
5	50,000	3,000	....	6
6	60,000	3,600	....	6
7	70,000	4,200	....	6
8	80,000	4,800	....	6
9	90,000	5,400	....	6
10	100,000	6,000	....	6
11	110,000	6,600	....	6
12	120,000	7,200	....	6
13	130,000	7,800	....	6
14	140,000	8,400	....	6
15	150,000	9,000	....	6
16	160,000	9,600	....	6
17	170,000	10,200	....	6
18	180,000	10,800	....	6
19	190,000	11,400	....	6
20	200,000	12,000	5000	8½
21	200,000	12,000	5000	8½
22	200,000	12,000	5000	8½
23	200,000	12,000	5000	8½

3. *Sinking-fund method—No deduction from cost-new.* For present purposes we may at once rule out the application of a sinking-fund method of estimating depreciation that would include a deduction of the accrued depreciation from cost-new in fixing fair value for rate purposes. We are trying now to find a plan that if applied to a public utility from the start would be suited to its purpose and equitable both to the public and to the company. It needs no extended argument to demonstrate that if the moneys paid into the depreciation reserve are assumed to accumulate at compound interest for the sole benefit of the depreciation reserve, they do not constitute a return to the owner of any part of his original investment. Unless, therefore, he is allowed to earn a return on cost-new, a part of his actual investment is confiscated.

Under the conditions assumed in Table III the sinking-fund method with no deduction for accrued depreciation shows a uniform combined annual charge for interest and depreciation of 7.68%. This method appears to conform exactly to our uniform-annual-investment-charge standard. There are, however, serious objections to the sinking-fund method of allowing for depreciation. It is assumed that a fund is set aside and made to accumulate at a prescribed rate of interest. Presumably it is to be invested in outside securities and kept as an entirely distinct fund. The assumption of a separate fund greatly complicates the accounts. It is usually merely an assumption both as to its existence and as to the rate at

which it accumulates. Business practice recognizes that ordinarily the most natural, the most secure and the most profitable use that can be made of a depreciation reserve is to retain it in the business to meet the additional capital requirements for plant and working capital. Fundamentally the depreciation reserve is a part of the entire capital needed to carry on the enterprise. There is no reason why a part of the total capital should be set apart and assumed to accumulate at a rate different from that earned on the entire investment. The entire enterprise is a unit and the profits, whatever they may be, are the earnings of the entire investment. One part of the investment should not be assumed to earn at an arbitrary rate and the rest at a different rate.

The investment of depreciation reserves as separate and distinct funds is liable to abuse in public-utility enterprises. Such funds may be invested in doubtful securities or used to further the private financial schemes of the directors. They may be used by the holding company to invest in other public-utility enterprises and may be made to earn for the holding company not 3% or 4% but 6% or 8%. If the 6% or 8% could have been earned by reinvesting in the business of the utility for which the reserve was created, the consumers of that utility have lost heavily by this method of financing.

The depreciation reserve is built up during the early years of the enterprise. It is during such earlier years that the payments into the depreciation reserve are normally greater than the annual expenditures for renewal. When a utility has settled down to a constant average of wear and age, the annual allowance for depreciation is, under the straight-line method, about equal to the annual expenditures for renewal, and, under the sinking-fund method, much less than such annual expenditures. As almost every utility is built somewhat on the piecemeal plan and as it particularly is true that there are normally a considerable number of additions to capital during the first twenty years of an enterprise, there would seem to be abundant opportunity for the investment of the entire depreciation reserve in such additions. It is also to be noted that a large part of this reserve may be invested *permanently* in the business. When a utility has settled down to a constant average of wear and age, the depreciation reserve remains at a constant percentage of cost-new. It is particularly appropriate, therefore, that this permanent reserve should be permanently invested in the business. And if this is done why should it be assumed to be earning for a depreciation fund at the rate of 4% while the business as a whole is earning 6%?

4. *Uniform investment-charge method—Accrued depreciation deducted from cost-new.* The uniform investment-charge method takes account of the fact that ordinarily the safest and best use that can be made of a depreciation reserve is to invest it in the business; that the reserve, therefore, becomes an integral part of the entire business and cannot be assumed to earn at a different rate from that of the business as a whole; that the expenditures for renewals in the earlier years are much less than later when the *average* age of the various units constituting the plant is at a maximum; that the depreciation reserve is for the most part accumulated from the excess of the depreciation allowance over the actual renewals during the earlier years; that investment of the reserve in the business decreases the amount of capital to be furnished by the owners and correspondingly decreases the percentage return *as based on cost-new.*

With a declining percentage return as based on cost-new the only way to secure a uniform combined annual charge for interest and depreciation is to so adjust the depreciation allowance that the increase in percentage charge for depreciation based on cost-new will exactly offset the decline in the percentage return.

TABLE III. SINKING-FUND METHOD—NO DEDUCTION FROM COST-NEW

Assumed conditions:
1-3. Same as in Table I.
4. Fair rate of return 6% on cost-new.
5. Annual allowance for ordinary physical depreciation on 4% sinking-fund basis, 3.358175% on depreciable property or 1.679087% on total cost-new.

Year	Cost-new	Annual return: 6% on cost-new	Annual depreciation allowance: 1.679087% on cost-new	4% interest on depreciation reserve	Accrued depreciation: Amount	Accrued depreciation: % of cost-new
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	$10,000	$600	$167.91	$0.00	$167.91	1.679
2	20,000	1,200	335.82	6.72	510.45	2.552
3	30,000	1,800	503.73	20.42	1,034.60	3.449
4	40,000	2,400	671.63	41.38	1,747.61	4.369
5	50,000	3,000	839.54	69.90	2,657.05	5.314
6	60,000	3,600	1007.45	106.28	3,770.78	6.285
7	70,000	4,200	1175.36	150.83	5,096.97	7.281
8	70,000	4,800	1343.27	203.88	6,644.12	8.305
9	90,000	5,400	1511.18	265.76	8,421.06	9.357
10	100,000	6,000	1679.09	336.84	10,436.99	10.437
11	110,000	6,600	1847.00	417.48	12,701.47	11.547
12	120,000	7,200	2014.90	508.06	15,224.43	12.687
13	130,000	7,800	2182.81	608.98	18,016.22	13.859
14	140,000	8,400	2350.72	720.65	21,087.59	15.062
15	150,000	9,000	2518.63	843.50	24,449.72	16.300
16	160,000	9,600	2686.54	977.99	28,114.25	17.571
17	170,000	10,200	2854.45	1124.57	32,093.27	18.878
18	180,000	10,800	3022.36	1283.73	36,399.36	20.222
19	190,000	11,400	3190.27	1455.97	41,045.60	21.603
20	200,000	12,000	3358.18	1641.82	41,045.60	20.523
21	200,000	12,000	3358.18	1641.82	41,045.60	20.523
22	200,000	12,000	3358.18	1641.82	41,045.60	20.523
23	200,000	12,000	3358.18	1641.82	41,045.60	20.523

Table IV shows a theoretical application of the uniform-investment-charge method. Under the assumed conditions a uniform annual charge of 7.36% on cost-new is adequate for interest and depreciation. The return on cost-less-depreciation as cost-less-depreciation is the amount that under the assumed conditions has been secured from the issue of stock and bonds. The annual allowance for depreciation is the difference between this uniform annual charge of 7.36% and the amount required to pay 6% interest on cost-less-depreciation. The depreciation allowance increases in amount

TABLE IV. UNIFORM-INVESTMENT-CHARGE METHOD—ACCRUED DEPRECIATION DEDUCTED FROM COST-NEW

Assumed conditions:
1-4. Same as in Table I.
5. Annual sinking-fund contribution compounded at 6% to equal 50% of cost-new in 20 years, 1.35923% on cost-new.
6. Depreciation reserve invested in business, thus reducing the necessary contribution from the sale of stock and bonds.

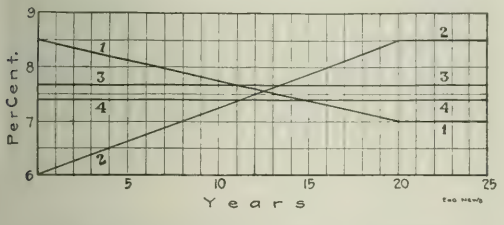
Year	Cost-new	Cost-less-depreciation	Return plus annual depreciation: 7.35923% on cost-new	Annual return: 6% on cost-less-depreciation	Annual depreciation (col. 4 less 5)	Accrued depreciation: Amount	Accrued depreciation: % of cost-new
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	$10,000	$10,000.00	$735.92	$600.00	$135.92	$135.92	1.359
2	20,000	19,864.08	1,471.85	1191.84	280.01	415.93	2.080
3	30,000	29,584.07	2,207.77	1775.04	432.73	848.66	2.829
4	40,000	39,151.34	2,943.69	2349.08	594.61	1,443.27	3.608
5	50,000	48,556.73	3,679.61	2913.40	766.21	2,209.48	4.419
6	60,000	57,790.52	4,415.54	3467.43	948.11	3,157.59	5.263
7	70,000	66,842.41	5,151.46	4010.54	1140.92	4,298.51	6.141
8	80,000	75,701.49	5,887.38	4542.09	1345.29	5,643.80	7.055
9	90,000	84,356.20	6,623.31	5061.37	1561.94	7,205.74	8.000
10	100,000	92,794.26	7,359.23	5567.66	1791.57	8,997.31	8.997
11	110,000	101,002.69	8,095.15	6060.16	2034.99	11,032.30	10.029
12	120,000	108,967.70	8,831.07	6538.06	2293.02	13,325.32	11.102
13	130,000	116,674.68	9,567.00	7000.48	2566.52	15,891.84	12.224
14	140,000	124,108.16	10,302.92	7446.49	2856.43	18,748.27	13.392
15	150,000	131,251.73	11,038.84	7875.10	3163.74	21,912.01	14.608
16	160,000	138,087.99	11,774.77	8285.28	3489.49	25,401.50	15.876
17	170,000	144,598.50	12,510.69	8675.91	3834.78	29,236.28	17.198
18	180,000	150,763.72	13,246.61	9045.82	4200.79	33,437.07	18.576
19	190,000	156,562.93	13,982.54	9393.78	4588.76	38,025.83	20.014
20	200,000	161,974.17	14,718.46	9718.45	5000.01	38,025.88	19.013
21	200,000	161,974.34	14,718.46	9718.46	5000.00	38,025.66	19.013
22	200,000	161,974.34	14,718.46	9718.46	5000.00	38,025.66	19.013
23	200,000	161,974.34	14,718.46	9718.46	5000.00	38,025.66	19.013

and in per cent. of cost-new each year until in the twentieth year when the plant has settled down to a uniform accrued depreciation of 19% and to a uniform requirement for renewals of $5000, or 2½% on new-cost, the depreciation allowance exactly meets this requirement.

In order to determine the percentage on cost-new that will provide a uniform annual charge for return plus depreciation, add to the fair rate of return the per cent. on cost-new that set aside annually and compounded at the same rate of interest as the fair rate of return, will within the equated life of the depreciable property exactly equal the cost-new of such depreciable property. In Table IV the fair rate of return is 6%, and 1.36% on cost-new compounded at 6% will in 20 years exactly equal $5,000. The depreciable property amounts to 50% of the cost-new, so that $5000, the assumed accumulation of the sinking-fund, is exactly equal to the depreciable part of the initial investment of $10,000.

Conversely to find the accrued depreciation in an existing plant under the uniform-annual-investment-charge method, find the amount that should be in the depreciation reserve assuming that the annual depreciation allowance had been set aside from the initiation of the enterprise in accordance with the method above described.

The accompanying diagram is a graphical comparison of the combined percentage for interest and depreciation



(1) Straight-line depreciation; accrued depreciation deducted from cost-new (Table I).
(2) Straight-line depreciation; no deduction from cost-new (Table II, modified).
(3) Sinking-fund depreciation; no deduction from cost-new (Table III).
(4) Uniform investment charge method; accrued depreciation deducted from cost-new (Table IV).

Diagram of Combined Interest and Depreciation Percentage under Each Method

under each of the four methods of depreciation illustrated in Tables I-IV. The straight-line method with a deduction of accrued depreciation starts with the highest percentage but has the lowest permanent combined percentage. Straight-line depreciation with no deduction for accrued depreciation starts with the lowest percentage but has the highest permanent percentage. The sinking-fund method with no deduction for accrued depreciation has a uniform continuous percentage which is about midway between the permanent percentages under the two straight-line methods. The uniform-investment-charge method has a uniform percentage somewhat lower than the sinking-fund method. It would be identical with that of the sinking-fund method if the sinking-fund were assumed to accumulate at the same interest rate as the rate of return, which in this case is 6%. The uniform-investment-charge method, however, has manifest advantages from an accounting and practical business standpoint.

Application to Heretofore Unregulated Utility

Assuming the adoption of the uniform-annual-investment-charge method, the straight-line method or the sinking-fund method as the proper method for the treatment of depreciation as regards a new enterprise or as regards the future of an existing enterprise, is it necessary to qualify such method as regards assumptions as to the past of a company that has heretofore not been subject to regulation? Can we assume that the theory that we apply to the future has been in operation since the initiation of the enterprise? If we determine that the sinking-fund method is upon the whole most just and practicable, can we assume that a fund has been accumulating on this basis and is now earning interest and that the amount of such interest may be deducted from the annual allowance that would otherwise be required to meet current renewals? Or if we adopt the uniform-annual-investment-charge method, can we assume that the depreciation reserve is equal to the amount that it should have reached had this method been applied from the initiation of the enterprise and that therefore, it is just to deduct this amount from cost-new to determine fair value for rate purposes? It seems that both these questions must be answered in the affirmative. There is no question that depreciation is an operating expense. There is no question but that it is an expense that must by some method be apportioned over the entire life of the depreciable property. There is no way that this can be done except by apportioning a fair share of the burden to the operating expenses of each year since the initiation of the enterprise. To be sure there may be cases where the past profits of an enterprise have been insufficient to pay a fair rate of return and at the same time set aside a proper depreciation reserve. The situation may demand that in prescribing regulations for the future the company be allowed to reimburse out of the earnings the amounts by which past earnings have failed to provide an amount adequate to pay operating expenses including depreciation and a fair return on the investment. It is important to note that this shortage is properly treated as a deficit to be reimbursed and not as additional outlay to be capitalized.

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Municipal Ownership of all local public utilities and of a short railway line as well is the proud boast of Guelph, Ont. Guelph is a city of 15,148 population (in 1911), located 48 miles west of Toronto. The city claims to be the first Canadian municipality to own and operate successfully all of its public utilities. These are managed by commissions. A small water-works plant was established in 1878, and has since been extended. Some years ago the city bought an electric street railway system, built by an individual who had not been able to make it pay. The city paid $78,000 for the system, including the franchise, and has since extended it, so that at present, with equipment, it represents $135,000. It is stated that the street railway has paid since the city took it over. The fare with transfers is 3c. The gas and electric-light works were bought by the city a few years ago at a cost of $155,000, and have been extended since then. Gas is sold to large consumers at 80c. per cu.ft., to consumers of medium amounts at 85c., and to small consumers at 90c. In 1907 the city secured hydro-electric power from Niagara Falls. It sells electric-light and current at the rate of 6c. per 1000 watts. The city owns the Guelph Junction Ry., 15 miles in length, and leases it to the Canadian Pacific on a percentage basis. The city has sewerage systems, a system of garbage disposal, eight parks spreading over 100 acres in area, and three river-rowing courses. In order to make its advantages known, the city has an industrial department. R. McDonald is Industrial Commissioner, and to him we are indebted for the information given in the foregoing sentences.

A Test of Red-Lead Priming Paints

By Cloyd M. Chapman*

The use of red lead as a priming coat for structural steel has been common for a great many years. The popularity of this pigment for use in paint and particularly as a priming or shop coat seems amply justified by the good record it has usually made for itself.

Fillers in Red-Lead Paints

For many years it was the almost universal custom, when red lead was used, to mix the dry powdered pigment with the vehicle on the job as wanted, for the very good reason that if the lead and oil were mixed in advance and allowed to stand the lead would rapidly settle and gradually harden in the bottom of the package. The settling and hardening process continued to a point where it was very difficult or quite impossible to mix the paint again for use. This troublesome characteristic of the pigment makes it practically a necessity, where straight red lead and oil are to be used, that the mixing be done at or near the point of application and not long before the paint is to be used.

This made it almost impossible for the makers of ready-mixed paints to furnish a red-lead product which would pass the specifications of a "pure red-lead and oil paint." The result has been that ready-mixed products have for many years been on the market which contain in addition to the red lead a "filler" or "suspender" such as china clay, silica, chalk, or asbestine, as a means of retarding or preventing the settlement and hardening of the lead. The addition of these fillers or suspenders has accomplished the desired result as regards the settling and hardening, and has also materially reduced the cost of manufacture of ready-mixed red-lead paints.

Effect of Fillers

As far as the effect that these added materials have upon the wearing and protective qualities of the paint is concerned, there seems to be an honest difference of opinion even among those well qualified to judge. There is no doubt that pure red lead and oil make a good protective priming coat for structural steel. There is equally no doubt that china clay, silica, chalk, and asbestine, with oil, make much poorer coatings for the same purpose. It is claimed, however, by the advocates of ready-mixed red-lead paints, that the addition to red lead of a sufficient quantity of one or more of these fillers or suspenders does not reduce the protective or wearing qualities of the paint.

Tests of Paints with Fillers

In order to gather further information on this question for guidance in specifying the paint to be used on the steel going into the various construction work in their charge, Westinghouse, Church, Kerr & Co. have made an extended series of tests of both ready-mixed and straight red lead paints. These tests were made in connection with and as a part of the very extensive line of paint tests made by this company, and described in detail in the proceedings of the American Society for Testing Materials for 1910† and 1911.

The method of testing, briefly outlined, was as follows:

Samples of the ready-mixed red-lead paints were secured from paint manufacturers, and samples of dry red lead from pigment manufacturers. Plates of mild steel of uniform size and shape were pickled in sulphuric acid to remove the mill scale, cleaned and numbered. In the case of the ready-mixed paints they were applied to the plates as received, after thorough mixing. In the case of the dry pigments they were mixed with pure raw linseed oil shortly before applying.

As red lead is considered most effective when used as a priming coat only, or with an outer or finishing coat of some other paint over it, these tests were made with the red-lead paint applied directly to the metal and with a second coat of another kind of paint applied over it. Inasmuch as the durability and protective qualities of the two-paint combinations might be more or less affected by the second coat it was thought inadvisable to select any one class of paint for this use. Instead of using one paint for second coat, four varieties were applied over each red-lead primer. The four second coaters chosen were: Iron oxide, artificial graphite, carbon,

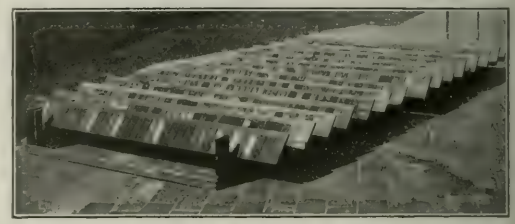


Fig. 1. Exposure-Test Rack on Roof of Maritime Bldg., New York City

and a tar product. These paints, with the exception of the tar paint, were prepared in the laboratory by grinding the dry pigments in pure raw linseed oil to a stiff paste and thinning as used with raw linseed oil to which has been added about 6% of turpentine linoleate dryer. In the case of the carbon paint a somewhat higher percentage of dryer was used.

The pigments used for second-coat paints were all of well known standard brands. They were mixed with the oil in such proportions as to give a paint of full, even, smooth-flowing consistency with good body. The tar product was a medium-priced black paint of fair quality. When tested alone, i.e., without a red-lead or other primer, it showed very fair protective qualities for this class of paint.

Six steel plates were used for each red-lead paint tested: One of these plates was given only one coat of the red-lead paint; a second plate was given two coats; the remaining four plates were each given a first or priming coat of the red-lead paint and a second coat of one of the four kinds of paint mentioned above.

Sufficient time was allowed between coats for thorough drying. Great care was taken to insure uniform brushing and even thickness of coats on the plates. All painting was done by one person experienced in this line of work.

After the second coats had thoroughly dried the plates were exposed to the weather on the roof of the Maritime

*Engineer in charge, Westinghouse, Church, Kerr & Co., 37 Wall St., New York City.

†"Engineering News," Aug. 18, 1910, p. 178.

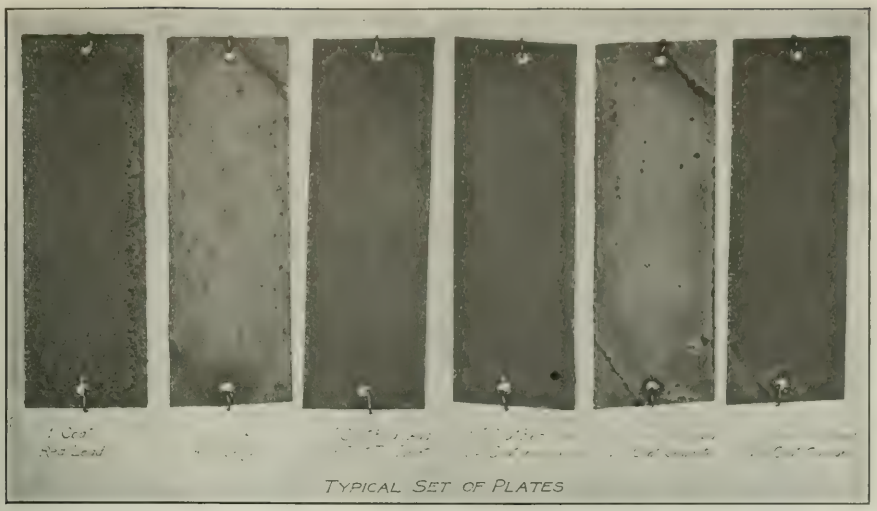


FIG. 2. TYPICAL SET OF PLATES WITH PRIMER ALONE AND WITH PRIMER COVERED BY SECOND COAT

Building on the southern extremity of Manhattan. Fig. 1 shows the method of exposing the test plates. Examinations of the plates were made at regular intervals of three months, and a record made of the condition of each plate at each inspection. Fig. 2 shows a set of six plates which are fairly representative of the present condition of the test plates.

Some 53 red-lead paints were tested, making a total of 318 plates. Of these 53 paints, 42 were ready-mixed samples submitted by the makers, and the remaining 11 were mixed from the dry pigment in the laboratory. There were also tested 8 samples of litharge paints for comparison with the red leads.

Another feature which also received attention was the relative effect of asbestine and china clay, when mixed with red lead to keep it in suspension, upon the protective value of the lead. The asbestine and china clay were added to the red-lead paints in two ways: As a dry powder added to the dry red lead and then mixed with the oil, and as a pulp or paste added to the red-lead paint after they had first been ground in oil and stood as a paste a considerable length of time. They were added in two proportions: 3½ parts by weight of red lead to one part by weight of the suspender (which is about equal parts by volume), and one part of red lead to one part of the suspender by weight.

Tests were also made of the four second-coat paints by themselves, i.e., without a red-lead coat under them. The ratings of these four paints at the end of one year and of 21 months, for both one-coat and two-coat samples, are given in Table I. These plates have now been exposed for about 24 months, having been placed in their present position in April, 1911.

RESULTS OF THE TESTS

The results so far are very instructive, and would be much more so if complete analyses of all the ready-mixed paints could be included in this report.

Table 2 gives the averages of the results obtained with the various kinds of paints. The first group includes the entire number of red-lead paints tested, namely 53, and includes both the ready-mixed samples and also those mixed in the laboratory; the ratings given are the averages of all the tests. The second group is composed of the 42 ready-mixed paints (all of which are included in the first group). In the third group are the 5 straight red-lead paints mixed from the dry pigments in the laboratory. The fourth group includes the 6 red-lead paints mixed in the laboratory, to which either china clay or asbestine had been added. The next group, the fifth, is

TABLE I. RATINGS OF SECOND-COAT PAINTS BY THEMSELVES (WITHOUT PRIMING COAT)

Kind of paint	Ratings 1 coat 1 yr.	1 coat 21 mo.	2 coats 1 yr.	2 coats 21 mo.
Tar product	70	65	80	65
Iron oxide	80	70	90	80
Graphite	0	0	75	70
Carbon	0	0	80	70

TABLE II. RESULTS OF EXPOSURE TESTS OF PRIMERS

Group No.	1st coat	2d coat	Ratings 1 year 1 coat	1 year 2 coats	21 mo. 1 coat	21 mo. 2 coats
1	53 RED LEAD Paints both ready-mixed and mixed from dry pigments.	Same as first....	47.4	70.3	38.5	62
		Tar product...	....	90.7	.	86.8
		Iron oxide....	....	85.7	.	72.8
		Graphite.....	.	80	.	69.8
		Carbon.....	.	83.1	.	74.2
2	42 RED LEAD ready-mixed paints.	Same as first..	45	68.3	38.6	60
		Tar product...	.	90	.	87
		Iron oxide....	.	84	.	72.5
		Graphite.....	.	79.8	.	70.4
		Carbon.....	.	81.8	.	74
3	5 RED LEAD Paints mixed from dry pigments.	Same as first..	51	74	21	68
		Tar product...	.	94	.	83
		Iron oxide....	.	80	.	76
		Graphite.....	.	78	.	65
		Carbon.....	.	85	.	72
4	6 RED LEAD Paints, mixed from dry pigments with ASBESTINE or CHINA CLAY suspenders.	Same as first..	61	80	52.5	70
		Tar product...	.	96	.	87.5
		Iron oxide....	.	93.3	.	73.3
		Graphite.....	.	83.3	.	69
		Carbon.....	.	91.7	.	76
5	8 LITHARGE paints mixed from dry pigments, both straight litharge and combined with suspenders.	Same as first..	64	82	60	73
		Tar product...	..	95.6	.	86.9
		Iron oxide....	....	90	.	69.4
		Graphite.....	....	86.9	.	72
		Carbon	.	84.4	.	69.4
6	2 straight LITHARGE pastes mixed from dry pigments.	Same as first..	67.5	85	62.5	77.5
		Tar product...	....	92.5	.	77.5
		Iron oxide....	....	92.5	....	65
		Graphite.....	....	85	.	72.5
		Carbon.....	....	85	.	70
7	6 LITHARGE paints mixed from dry pigments with ASBESTINE or CHINA CLAY suspenders.	Same as first..	63.3	80.6	59.2	71.7
		Tar product...	....	96.7	....	90
		Iron oxide....	....	89.2	.	71
		Graphite.....	....	87.5	.	71.7
		Carbon.....	....	84	.	69.2

composed of 8 litharge paints, two of which are straight litharge, and the other 6 contain a suspender in the form of china clay or asbestine. The sixth group contains the two straight litharge paints. The seventh and last group is made up of the 6 litharge paints which had had a suspender added.

All the figures given are averages of all the paints in the group and represent the relative protection afforded by the paints on an arbitrary scale, 100 being perfect.

It may be interesting to note what these results mean.

First: Note the ratings of each of the first four groups, which are all red leads, after one year exposure with one coat only. The average of all tests was 47.4, the ready-mixed group averaged 45, the straight red leads (third group) averaged 51, and the group of pure red leads with suspenders added averaged 61, *or 10% better than the straight red leads without suspenders.*

paint as the first coat. It will be found that what has been pointed out above in connection with one-coat results applies also to the two-coat averages, namely, (a) the straight red leads (third group) are better than the average ready-mixed, (b) the fourth group or pure red leads with a suspender added are better than either, and (c) the litharge groups show higher averages than the red leads.

The general result of this series of tests indicates that the addition of sufficient filler or suspender to prevent the settlement and hardening of red lead in the package is not detrimental to red-lead paint as a protector of steel exposed to the weather.

Comparison of Second-Coat Paints

It is also interesting to compare the results obtained with the four kinds of second-coat paints over the various priming coats. The one thing that stands out most

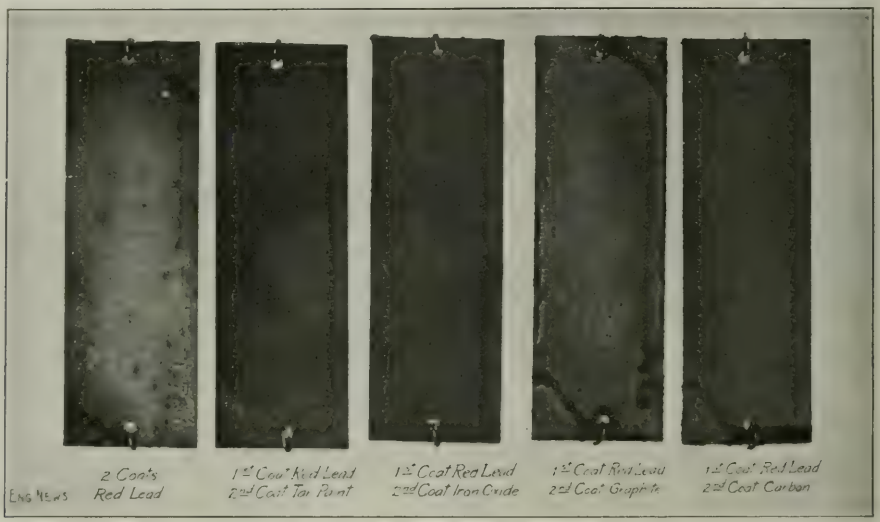


Fig. 3. Typical Specimens (Not from Same Set), Showing Manner of Failure of the Paints Tested

Second: Note that for one-coat specimens exposed 21 months the straight red leads of the third group have fallen off much more rapidly than the ready-mixed paints of the second group, having dropped from 51 to 21 while the ready-mixed fell from 45 to 38.6.

Third: The pure red leads with a suspender added (fourth group) are showing up to much better advantage after 21 months than they did at the end of the year, being 14% above the average of all tests (group one) and 31.5% ahead of the straight red leads of the third group.

Fourth: Pass now to the last three groups, which are litharge, and compare the one-coat averages for 1 year and 21 mos., with those of the red leads in the first four groups. In all cases the advantage seems to be on the side of litharge. The addition of the suspenders does not seem to increase the durability of the paints as in the case of red lead.

Fifth: Examine the two-coat averages at 1 year for those specimens which have a second coat of the same

prominently and consistently is the superiority of the tar paint over the other three. In every case the tar paint showed up superior to the iron oxide, graphite or carbon groups.

This result should not be interpreted to mean that *any* tar paint is better than an iron-oxide paint or a graphite or carbon paint. As a matter of fact the general run of hydrocarbon paints offer poor protection to steel exposed to the weather. Of the many hundreds of samples of paints tested by Westinghouse, Church, Kerr & Co., no class shows much poorer results than the hydrocarbons (tar and asphalt), but there are a few paints in this class which stand up very well indeed, thus demonstrating the possibility of making a good paint from these materials even though the very great majority of those on the market are very poor.

In Fig. 3 are shown five plates selected from the entire series with a view to showing the typical appearance of the failure of the different paints. In this connection attention may be called to the tendency of graphite

TRAIN-MINUTE DETENTIONS ETC., OF THE NEW YORKCENTRAL & HUDSON RIVER R.R., NEW YORK TERMINAL ZONE UNDER ELECTRIC TRACTION; FOR YEAR 1912

	Electric power troubles										Train-minute detention — Electric locomotives										Train-minute detention — Multiple-unit cars										Mileage			Average miles per minute detention		
	Power stations	Substations	10,000-volt trans. line	6,000-volt trans. line	Third-rail	2,200-volt signal line	Total	Fuses	Contactors	Reversers	Misc. Elec.	Brakes	Misc. mech.	Total	Fuses	Contactors	Relays	Control jumpers	Misc. elec.	Brakes	Hot boxes	Misc. mech.	Total	Total for all causes[1]	Electric locos.	Total	Electric zone	Mult.-unit cars	Total	Electric locos.	Elec. delays	Mult.-unit cars	Mech. delays	Total for all causes[2]
January	4					63	67	1	31	14	4	12	62	7		13			39	18	9		86	215	113,072	113,072	366,652	422,347	1,858	1,858	6,214	15,642	2,494
February		9					9		11		11	8	30	6	3	4				8		22	43	82	103,171	103,171	338,787	390,375	3,439	3,439	26,060	13,012	6,019
March			7			2	9	3	2			14	19	2		11			15	13	29	7	77	105	108,952	108,952	363,883	419,413	5,587	5,587	12,996	5,559	3,008
April						25	25	5	6				61	3	5	7			19	8	3	5	50	137	115,177	115,177	376,538	491,472	1,888	1,888	10,441	25,592	3,849
May		11			18		29		17											6			6	174	137,714	137,714	417,458	555,172	3,618	3,618		7,210	4,041
June						3	3			9	6	9	5	31		13	10	9	7	31	4		74	108	112,167	112,167	350,737	417,458	3,618	3,618	9,224	11,047	4,041
July						7	7			11	2	5		20	5		7	5	20	11	19	57	144	172	113,149	113,149	350,351	421,166	5,519	5,519	6,250	4,841	3,196
August						7	7			11	2	5	3	20	5				14	15		9	44	69	115,548	115,548	341,124	400,127	16,219	16,219	17,056	16,072	7,439
September						17	23		2	5				2	5		3		8		15		23	39	115,157	115,157	338,900	397,520	6,079	6,079	42,362	26,501	12,979
October								13			3	5		16	5				37		15		55	70	116,575	116,575	369,877	426,600	11,657	11,657	9,247	28,340	7,759
November						5	5	5		2		3		10					10	6	5		15	39	110,790	110,790	355,894	409,785			22,212	21,508	13,338
December						4	4												6	11	14		31	206	112,716	112,716	371,068	428,112	10,247	10,247	4,470	5,439	2,625
Total		4	25		42	143	214	5	30	57	27	5	48	5	83	287	35	5	23	73	5	80	186	194	108	100	800	1301	5	1,351,577	4,279,033	3,974,487	4,709	10,798	12,374	4,861

[1] Does not include delays to New Haven trains. [2] Based on total mileage of locomotive and multiple-unit cars. ("Multiple-unit cars" signifies trailer and motor cars.)

and carbon to start rusting at the edges of the plates and over the stamped numbers, while red lead tends to start on the body of the plate while the numbers and edges are quite free from rust spots.

⁂

Results of Electric Traction on the New York Central Railroad at New York City

Reliability of electric traction at Grand Central Terminal was discussed by E. B. Katte before the New York Railway Club, on Mar. 20. He reported that the Hudson division of the New York Central was now operating 56 electric trains a day equivalent to 7000 multiple-unit-car miles, and that the Harlem division was running 72 trains a day equivalent to 7800 car miles. The average number of trains operated in and out of Grand Central Terminal was 525 a day and a new record of reliability had been made, compared with previous years. The electric locomotives had operated 8691 miles and the multiple-unit cars, 10,798 miles for each minute of detention due to electrical causes. The locomotives had run 10,277 miles and the multiple-unit cars 12,374 miles per minute of detention due to mechanical causes. Details of these data are given in the table reprinted herewith.

The equipment has now been in operation for more than six years. During 1912 the cost for maintenance of locomotives, including shop expenses, painting, etc., was 3.34c. per mile, compared with 3.2c. in 1910 and 3.08c. in 1911. Similar maintenance expenses in the multiple-unit cars were 1.08c. per car mile in 1912, 2.1c. in 1911, and 1.9c. in 1910.

⁂

Hypochlorite Water Disinfection in Flooded Districts is being recommended by officers of the U. S. Public Health Service on duty at Evansville, Ind., Cairo, Ill., Louisville, Ky., and Memphis, Tenn., under directions from the Service. Where no public water-supplies are available, it is to be recommended that a hypochlorite solution be distributed free to homes for use in water treatment. "Public Health Reports" for Apr. 18, 1913, stated that "a satisfactory solution may be made by adding 1 teaspoonful of chlorinated lime to 1 pint of water. Of this solution 1 teaspoonful may be added to 2 gal. of drinking water, which should then be allowed to stand for at least one-half hour before being used." The officers named have also been instructed to recommend disinfection of cesspools and privies with quicklime or chlorinated lime, and also to give instructions designed to check outbreaks of various communicable diseases.

The Abatement of Smoke in Cincinnati, Ohio, is being studied by a commission of citizens known as the United Smoke Committee. A recent conference was held by a subcommittee on smoke from locomotives and engine houses, with representatives of the railroads entering the city. From the discussions it became evident that the kind of fuel which must necessarily be used by any road was that which could be most cheaply and conveniently obtained in the territory covered by that line. Oil fuel was not easily obtained and there was no surety of continuance of supply. Coke had been tried, but proved too bulky. The use of steam jets in the firebox over the fuel bed produced marked improvement in the emission of smoke, and nearly all the roads were reported as having equipped or equipping a considerable number of their engines with this device. Careful operation was necessary, however, and constant inspection. Mechanical stokers were discussed, but were not conceded to be applicable for yard service, on account of the cost of installation and the irregularity of operation. The responsibility of firemen and engineers in reducing smoke was brought up. Much depended on the way the engineer handled his engine and on the laziness of some firemen in firing large amounts at one time instead of distributing smaller amounts over a longer period.

Track Elevation at Joliet, Ill.

SYNOPSIS—Track elevation for the elimination of street crossings at grade has been recently carried out at Joliet, Ill., at a cost of about $2,000,000. Four railway companies were involved, their lines intersecting the city in both directions, and intersecting each other (with a railway crossing at grade) in the heart of the city, so that the work and its execution had to be planned as a whole. The general plan of the work and the detailed design of the bridges and subways at street crossings are of interest to engineers engaged on similar work.

The railway track elevation at Joliet, Ill., which has been completed recently, presented somewhat exceptional problems, owing to the fact that two groups of railways crossed the city in opposite directions and that passenger stations, freight yards and industrial facilities were involved. All the tracks were at the street level and there was a grade crossing of the two groups of lines. The tracks and facilities were close to the business district of the city, so that the trains and the switching service caused considerable interference with street traffic. The removal of the tracks from the street surface, and the rearrangement of the track layout in the city, involved difficult and interesting work, some features of which are described below. The information is taken largely from a paper on "The Track Elevation of the Chicago & Alton R.R. at Joliet, Ill.," read before the Illinois Society of Engineers and Surveyors by R. A. Cook, Assistant Engineer of the Chicago & Alton R.R., who was in charge of the work for that railway, and to whom we are indebted for drawings of the structures.

The entire cost of the work has been borne by the railways, with the exception of property damages, which were borne by the city. The total cost to the railways has been about $2,000,000. The railway traffic at Joliet is very heavy for a city of its size. This is owing to its being largely a manufacturing and industrial center and only 38 miles from Chicago, to which it is connected by three railways. The population of Joliet is given as nearly 35,000 by the census of 1910, but the residents usually give a higher figure owing to the fact that there is a considerable population just outside the city limits.

The work of elevating the tracks was begun in 1908 as a result of an ordinance which was passed by the City Council on Jan. 22, 1906, and was accepted by the railways. The railways affected were the Chicago & Alton, the Atchison, Topeka & Santa Fé, the Chicago, Rock Island & Pacific, the Michigan Central, and the Elgin, Joliet & Eastern. This last named road has nearly all of its tracks outside of the track elevation territory, and therefore it decided to abandon those within the territory rather than to elevate them.

The other lines may be divided into two groups. The first comprises the Chicago & Alton R.R. and the Atchison, Topeka & Santa Fé R.R., whose tracks and right-of-way extend through the city in a north and south direction and adjacent to each other, being located two blocks east of the business district. The second group comprises the Chicago, Rock Island & Pacific R.R. and the Michigan Central R.R., whose tracks and right-of-way extend through the city in an east and west direction, being located about two blocks south of the center of the business district. Prior to the track-elevation period, the tracks of the Michigan Central R.R. did not extend west of the Chicago & Alton R.R., but the company has now extended its line west to the city limits and beyond. For this it used the same roadbed with the Rock Island tracks, which have been located on a new right-of-way two blocks south of the old location.

The work of the Atchison, Topeka & Santa Fé R.R. was under the direction of C. A. Morse (then Chief Engineer), with G. W. Vaughn in charge as Engineer of Track Elevation. The work of the Chicago, Rock Island & Pacific R.R. was under J. B. Berry, Chief Engineer, and that of the Michigan Central R.R. under G. H. Webb, Chief Engineer; the work of these two roads was done jointly and was in charge of G. H. Harris and A. T. Hopkins (at different times), Assistant Engineers

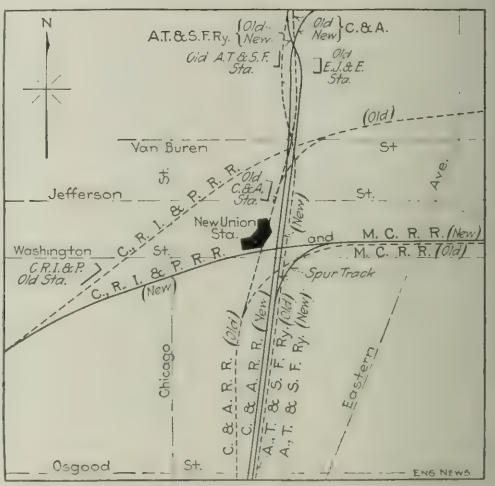


FIG. 1. TRACK PLAN OF THE OLD SURFACE LINES AND THE NEW ELEVATED LINES OF THE RAILWAYS TRAVERSING JOLIET, ILL.

of the Michigan Central R.R. and representing both roads. The work of the Chicago & Alton R.R. has been successfully under the jurisdiction of the former Chief Engineer, the late W. D. Taylor; the Assistant Chief Engineer, E. L. Crugar, and the present Chief Engineer, H. T. Douglas, Jr. R. A. Cook, Assistant Engineer, was in charge of the work.

THE OLD AND NEW TRACK PLANS

The general situation of the old and new lines is shown in Fig. 1. From the dotted lines representing the old arrangement it will be seen that originally there were two adjacent lines running north and south, but having a "scissors" crossing, the lines being parallel (but in reversed position) on either side of this crossing. A third line crossed the other two at grade and ran southwest across the city, while a fourth coming in from the east extended only as far as the north and south lines. The passenger stations were widely separated, and the entire arrangement was unsystematic and inconvenient.

The complicated grade crossing required all trains on the three roads to come to a full stop when in the busiest portion of the city, and frequently a train on one road would delay trains on the other roads until it had cleared the crossing. Probably the busiest street involved is Jefferson St., and this was crossed by all three roads, so that the chances of obstructing it were threefold.

The tracks of the Alton and Santa Fé railways crossed 14 streets at grade, the distance between the two outside streets being 1½ miles. The track-elevation ordinance, however, provided only for the elimination of the 11 south crossings (seven streets to be provided with subways and four to be closed), and it did not provide for the elimination of the three north crossings. The distance between the first and seventh streets to be provided with subways is ⅞ mile. The length of the Chicago & Alton R.R. which has been elevated, including approaches, is 1½ miles.

Under the old arrangement of tracks at grade, the Alton and Santa Fé railways each had independent tracks, those of the Santa Fé being west of the Alton tracks, north of the Rock Island crossing, and on the east side south of the crossing. The two companies now have a joint four-track line from Cass to Osgood Sts., a distance of 3200 ft., but each has its own double-track line north and south of these streets. The position of these separate double-track lines has not been changed essentially from the old alignments, but their crossing (north of the Rock Island grade crossing) has been improved. The joint tracks, however, do not coincide with either of the old alignments, being situated for the most part between them. The length of the Alton main tracks which have been elevated, including those on approaches, is 1.84 miles, and of the Alton and Santa Fé joint tracks 2.42 miles.

The profile of the elevated tracks between the outside subways is very nearly level, and the amount which the tracks have been raised within the same limits varies between 9 ft. and 16½ ft. At the north end of the work there is an ascending grade southward of 0.78% to the level of the new elevated line. At the south end, however, the old grade is ascending southward, so that the new elevated line runs into it on an ascending grade of 0.13%.

Subways

In addition to raising the tracks, the streets were also depressed, the amount of depression varying from nothing at Osgood St. to 6.6 ft. at Fifth Ave. (at the south end of the work). The most important streets (Cass St. and Jefferson St.) were depressed 3.4 and 2.8 ft. respectively. The rate of grade of the street approaches is in all cases 3.5%. The width of roadway in the subways is 36, 42 or 50 ft. All the streets are 66 ft. wide, and no contraction in width has been made except at Washington St., where a small subway 24 ft. in width was provided. The overhead clearance in all subways is 12 ft., except at Cass St., Jefferson St. and Fifth Ave., where it is 13.5 ft. on account of the electric street-car lines. The drainage of all subways is taken care of by sewers previously constructed, except that a new sewer had to be built for the Cass St. and Clinton St. subways. In all the subways the roadways are paved with brick on a concrete base, and the sidewalks are of concrete. The pavements, sidewalks, catchbasins, etc., are constructed according to the city's specifications, the work being under the direction of H. A. Stevens, then City Engineer.

Bridges

On the Chicago & Alton R.R., the bridges over the streets are of three types: reinforced-concrete deck bridges, steel deck bridges, and steel through bridges. Deck bridges were provided wherever possible in order to eliminate girders between the tracks. The bridge at Washington St. is of reinforced-concrete, with a clear span slightly under 25 ft. The depth of the slab is 37 in. The concrete is a 1:2:4 mixture, reinforced with 1-in. corrugated bars.

Deck steel bridges were provided at four of the subways. In three of these, rows of columns were permitted along the curb lines and along the center line of the street. These columns support cross-girders, which in turn support 16-in. I-beams placed longitudinally with the tracks. The length of the roadway span of these bridges is either 21 or 25 ft. One subway bridge (Fig. 2) is similar to the above except that there are no columns on the center line of the street, and consequently 30-in. plate girders were used instead of I-beams for the roadway span of 36 ft. The two remaining bridges are

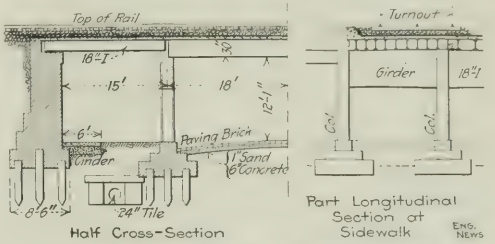


Fig. 2. Deck Bridge over the Osgood St. Subway at Joliet, Ill.; Chicago & Alton R.R.

of through-girder type, with transverse 12-in. I-beams (Fig. 4). The roadway span of one is 36 ft. and of the other 42 ft. All the steel bridges have a 4-in. reinforced-concrete floor, over which a 1½-in. layer of waterproofing is placed. This waterproofing consists of a coat of asphalt paint, three layers of burlap, and one layer of saturated felt, each layer being thoroughly mopped with hot asphalt before the next one above was applied. These are covered with an asphalt mastic for purposes of protection. The track is laid over this floor, with 6 to 9 in. of stone ballast under the ties.

Limestone bedrock is found at depths below the ground surface varying from 4 ft. at the north end of the work to about 11 ft. at Osgood St. and 22 or 23 ft. at the south end. All foundations north of Osgood St. were carried to bedrock, the material above the rock being gravel, clay and filling. South of Osgood St. the masonry was built upon coarse gravel and boulders which overlie the rock. All abutments and retaining walls are of 1:3:6 concrete. Either crushed limestone or crushed and washed gravel was used in the concrete, the latter being preferred. The aggregate length of retaining walls is 2200 ft., and the heights vary from about 6 to 22 ft. All are built upon bedrock. Both retaining walls and abutments are of gravity section.

As to the use of gravel for concrete on this work, although Joliet is the center of the limestone industry, it

appears that the former cost 33% less than the latter, while it was easier to handle and therefore preferred by the foremen. The gravel also was harder than limestone. In cinder pits, it was found that the heat affected limestone concrete, but had no visible effect on gravel concrete.

Fig. 2 shows the deck bridge at Osgood St., and Fig. 3 shows its floor construction. This bridge crosses the street at an angle of 83°. It carries six tracks, with switches and crossovers, and therefore an unobstructed deck was necessary. There are two rows of columns, forming a 36-ft. roadway span and two 15-ft. sidewalk spans. The columns are spaced 14 ft. 4½ in. longitudinally, there being six in each row and the width of the bridge being about 75 ft. Between the columns are framed two lines of 5-ft. girders, the tops of which carry the 30-in. longitudinal girders of the roadway span and the 18-in. longitudinal I-beams of the sidewalk spans.

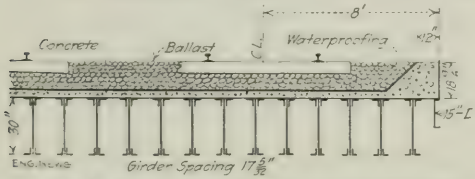


Fig. 3. Floor Construction of Deck Bridge

The girders and beams are spaced uniformly $17\frac{5}{32}$ in. under the tracks and 34¼ in. between two groups of tracks.

A concrete-slab floor is laid upon the beams and girders, and has a curb wall at each side to retain the ballast, there being a 15-in. channel as a facia girder under the curb wall. Upon the concrete is the waterproofing course, and the ballast over this bridge is 6½ to 7½ in. deep under the ties.

The through plate-girder bridge at 4th Ave., shown in Fig. 4 carries only the double-track line of the Chicago & Alton R.R. It has but three columns in each row, and these are directly under the girders, spaced 13 ft. apart. The floor system consists of 12-in. I-beams 16 in. apart, resting on the bottom chords of the girders. Upon these is a concrete slab reinforced with two layers of ½-in. longitudinal bars 6 in. apart. The concrete is carried up against the girders to form a trough for each track, and is covered with a waterproofing course. Upon this is the ballast, which has a depth of 9 in. under the ties at one end of the bridge and 5 in. at the other end.

On the work of the A., T. & S. F. R.R., the bridges are of steel, with ballasted floors. The deck bridges have transverse plate-girders placed on the tops of steel columns at the curbs and centers of streets, and the girders carry 15-in. longitudinal I-beams about 18 in. apart. Upon these is the floor slab of reinforced-concrete. The through bridges have plate-girders with transverse 15-in. I-beams carrying a concrete floor slab.

On the new east and west elevated line (the relocated line of the Rock Island and Michigan Central Rys.), most of the subways have longitudinal girders with transverse I-beams carried either by the bottom flanges of the girders or framed against the girder webs with vertical angle-bracket connections. In the former case, a steel plate deck 10 ft. wide is riveted to the top of the I-beams, and a reinforced-concrete curb or guard is built at each side of the deck, having its top sloped up to the flange angles of the girders and covered with a waterproofing course. The concrete is anchored to the girders by bolts through the webs of the outside girders and by short rods through those of the intermediate girders (between the tracks). On this steel deck is laid about 6 in. of stone ballast under the ties. In the latter case (with the half-through spans) the I-beams carry a reinforced-concrete floor slab covered with waterproofing, the concrete being carried up over the tops of the girders. Stone ballast is laid in the trough thus formed.

A connecting track on a 15° curve, opposite the new union station, provides an interchange connection between the two sets of elevated tracks. This is carried across the intersection of Washington and York Sts. by a viaduct having eight spans of reinforced-concrete slabs, and three plate-girder spans at the north end where the angle of skew was too great to permit the use of concrete. The concrete slabs are about 24½ ft. long, 13½ ft. wide and 4 in. thick, the thickness being increased to 61 in. at the sides so as to form curb walls to retain the ballast. On one side, the top of the curb wall is extended to form a 4½-ft. cantilever sidewalk (5 in. thick), with brackets from the side of the slab. The slabs (which were cast

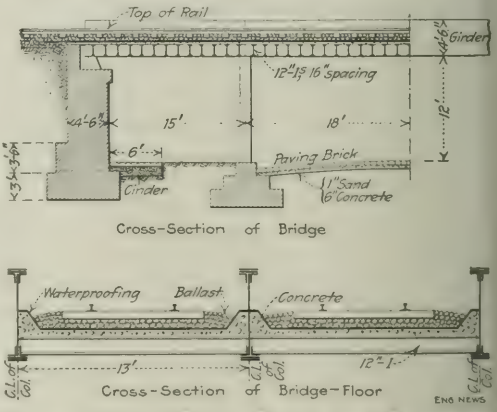


Fig. 4. Through-Girder Bridge over Subway at Fourth Ave., Joliet, Ill.; Chicago & Alton R.R.

in place) rest on reinforced-concrete bents composed of four columns and a cross girder, the columns resting on a continuous footing wall.

Method of Elevating the Tracks

In carrying on the work of the two parallel and adjacent lines of the C. & A. R.R. and the A., T. & S. F. R.R., each road had its own independent forces, the former road undertaking the south half of the work and the latter taking the north half. Owing to there having been two sets of tracks, it was possible to do nearly all the work without having to run trains over it at the same time. This was a great advantage both from the operating and the construction standpoint. All trains were first operated on the east tracks (comprising the Chicago & Alton tracks north of and the Santa Fé tracks south of the Rock Island crossing) while the west elevated tracks were being constructed. Traffic was then

changed to these latter tracks, after which the east surface tracks were taken up and the east elevated tracks constructed.

Traffic was first run over the Alton and Santa Fè elevated tracks in July, 1910, while the Rock Island railway continued to operate its surface tracks until November, 1912. This condition made it necessary for the Alton and Santa Fè companies to construct a temporary hump in the elevated tracks at the Rock Island crossing, of sufficient height to carry their trains over those of the Rock Island. This was due to the greater clearance height required in crossing a railway, and the hump was about 8 ft. above the permanent elevation of the elevated tracks. This portion of the work was built on trestle.

The filling material used by the Chicago & Alton R.R. was mainly fine sand which was obtained from a deposit on the line of the road about 20 miles south of Joliet, at Braidwood. The sand was loaded with a steam shovel and unloaded mainly with power-operated unloader plows. Very nearly all the filling was put in without the use of trestles, except across the streets. The sand was covered with a layer of dirt or cinders to prevent the wind from blowing it onto adjacent property. Concrete was made in a 1½-yd. mixer. To supply the mixer and deposit the concrete, small steel dump cars on narrow-gage industrial tracks were used wherever practicable and with satisfactory results. The materials were handled directly from cars into the mixer. All work of every description carried on by the Chicago & Alton R.R. (except the moving of large buildings) was done by the company's forces.

Auxiliary Works

In addition to the track-elevation work proper, there has been a very considerable amount of other work occasioned by it. The Chicago & Alton R.R. owns a large piece of land between the old Rock Island tracks and Osgood St. On this were situated the main tracks, the passenger station, freight station and other buildings; the main freight yard, team tracks, a seven-stall brick roundhouse with turntable, cinder pits, etc. There also were stock pens and various industries.

The transformation of this piece of property has been most complete. The industries have been moved to new locations by the Rock Island R.R., in connection with obtaining the right-of-way for its new line. The passenger station was torn down and the freight station moved to a new location. The roundhouse, turntable, cinder pits and the main yard were torn down or taken up, and were rebuilt at South Joliet, two miles south of the city. New industries were brought in and an entirely different arrangement of tracks has been made, including ample provision for team tracks and driveways. In fact, with the exception of two or three tracks, every structure on the Alton company's right-of-way within the city limits of Joliet has been taken up and rebuilt or has been moved.

One feature of the work which has not yet been completed is an interlocking plant which will govern all train movements at and near the crossing of the north and south with the east and west lines. There will be four main tracks for the Alton and Santa Fè railways, and four for the Rock Island and Michigan Central railways; also numerous switches and crossovers, and a transfer connection between the two lines. The total train movements will be about 200 per day.

Union Station

A noteworthy feature of this improvement is the union passenger station which has been constructed by the Alton, Santa Fè and Rock Island railways at the intersection of the north and south with the east and west lines, and fronting on Jefferson and Scott Sts. This was opened on Nov. 1, 1912, and represents an expenditure (including foundations) of about $300,000. It is a two-story building. The ticket office, ticket lobby, and baggage and express rooms are on the ground floor. The main waiting room, women's room, and toilet rooms are on the second floor, which is at the track level. The platforms are of concrete and brick, with canopy shelters, and are of sufficient length to accommodate ten-car trains. The track spacing at the platforms is 28 ft. for the north and south lines, and 26 ft. for the east and west lines. There is a subway giving an entrance under the tracks from Michigan St. on the east side, and providing a means of access (without crossing tracks) to the island platforms.

The building is faced with Bedford stone laid in ashlar masonry and backed with brick. The foundations are of concrete and some of the columns and the roof trusses are of steel. The roof is a concrete slab covered with slate. Reinforced concrete has been used very largely throughout the building. In the design, the architectural features were given more attention than has been customary for railway stations in cities of the size of Joliet. The architect was Jarvis Hunt.

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The City Manager Plan has been adopted by Hickory, N. C., as a part of a new charter. It seems likely that an engineer will be selected and it is possible that applicants for the position will be invited by advertisement, but neither of these points will be determined until after the election of the new city council, on Apr. 28. The population of Hickory was 3716 in 1910. We are indebted to H. S. Gilbertson, assistant secretary of the National Short Ballot Organization, 383 Fourth Ave., New York City, for the foregoing information and also for the following extracts from the new charter for Hickory:

Sec. 9. He [the city manager] shall have power to revoke licenses pending the action of the City Council.

Sec. 10. He shall have authority and charge over all public works, the erection of buildings for the city, the making and construction of all improvements, paving, curbing, sidewalks, streets, bridges, viaducts, and the repair thereof; he shall approve all estimates of the cost of public works, and recommend to the City Council the acceptance and rejection of the work done or improvements made; he shall have control, management and direction of all public grounds, bridges, viaducts and public buildings; he shall have control of the location of street-car tracks, telephone and telegraph poles and wires; he shall have charge of the watersheds from which the city takes its supply of water, pumping stations, pipe lines, filtering apparatus, and all other things connected with or incident to the proper supply of water for the city; and shall secure all rights of way and easements connected with the water-works or sewerage systems or the extension of the streets, etc.

All the powers enumerated, however, shall be exercised subject to the supervision and control of the City Council.

Other cities which have already engaged city managers are Staunton, Va. ("Eng. News," July 8, 1909, pp. 32 and 42), and Sumter, S. C. ("Eng. News," Oct. 24, 1912). Proposals for its adoption elsewhere, with editorial comments on "The City Manager Plan" were noted in our issue of Mar. 13, 1913. Mr. Gilbertson informs us that the plan is now being advocated for Wisconsin cities of the second to fourth classes and that a bill to that end has been introduced in the Wisconsin legislature.

We are also informed by Mr. Gilbertson that there were some 150 applications for the city managership of Sumter, S. C. (unlike Hickory, N. C., a commission plan city), largely from engineers. The first city manager selected by Sumter, we understand, accepted a better position elsewhere, before assuming office. In January, 1913, M. M. Worthington, a civil engineer, was chosen city manager of Sumter, at $2400 a year.

A Method of Proportioning Concrete

By William B. Hunter*

The writer submits herewith the results of studies as to a simple method of proportioning the ingredients of concrete so as to insure a satisfactory quality of concrete and at the same time to avoid the use of an excessive amount of cement.

Several methods for proportioning concrete have been proposed and are in use. These may be outlined as follows:

(1) A careful mechanical analysis of the aggregates and the grading of the same so as to get small percentages of voids, thereby reducing the amount of cement required to a minimum. This may be called the ultra-scientific method.

(2) Arbitrarily fixing the proportions of cement to the aggregates; as one part cement, two parts fine aggregate and four parts coarse aggregate, commonly spoken of as 1 : 2 : 4 concrete.

(3) Adopting a given cement factor; i.e., the number of barrels of cement to be used per cu.yd. of concrete; as a cement factor of 1.80 or 2.10, etc., and adjusting the proportions of the aggregates from time to time to fulfill these conditions.

(4) Determining the amount of cement in excess of the voids in the fine aggregate required to make an acceptable mortar and the amount of mortar in excess of the voids in the coarse aggregate required to make an acceptable concrete, and then after determining the per cent. of voids in the aggregates, proportioning the ingredients so as to fulfill these requirements.

Method 1 may be dismissed without further consideration on the ground of its impracticability.

Methods 2 and 3 are usually satisfactory and, where the character of the aggragates remains constant, obtain practically the same results as the fourth method. With very little experimenting and the exercise of good judgment, satisfactory results can be obtained. There are, however, objections to these methods, where the aggregates are variable, especially in the percentages of voids contained. For example, assume a 1 : 2 : 4 mixture, which is usually expected to give a rich mixture with a considerable excess of cement and mortar over the voids in the fine and coarse aggregates respectively.

With 40% voids in both fine and coarse aggregate, which may be considered as a fair average, with 1 part cement, 2 parts fine aggregate and 4 parts coarse aggregate there is an excess of 0.2 parts cement over the voids in the fine aggregate and an excess of 0.6 parts mortar over the voids in the coarse aggregate, which gives 4.6 parts concrete.

On a basis of 3.62 cu.ft. of cement per bbl., this gives a cement factor of 1.62. This mixture would give good results, and the cement factor is about what is ordinarily expected.

But, with 50% voids in fine and coarse aggregate, again with 1 part cement, 2 parts fine aggregate and 4 parts coarse aggregate, there is no excess of cement or of mortar and there results four parts concrete.

It is evident that it would be very difficult to get satisfactory results with this mixture in many structures, such as conduits, thin walls, etc., where the ratio of the superficial area to the volume of concrete is large and smooth surfaces are required, and yet the cement factor would be 1.86, which would ordinarily be expected to give excellent results.

Again, with 30% voids in aggregates and 1 part cement, 2 parts fine aggregate and 4 parts coarse aggregate there is an excess of 0.4 parts cement over the voids in the fine aggregate and an excess of 1.2 parts mortar over the voids in the coarse aggregate, which gives 5.2 parts concrete.

It is easily seen that with these last conditions, satisfactory results would be obtained, but the cement factor in this case is only 1.43.

From the above it is apparent that a high cement factor does not necessarily insure a good concrete, nor does a low cement factor necessarily result in an inferior quality of concrete.

The fourth method is the result of the writer's endeavor to formulate a method which will meet the objections to the second and third, and could be used in conjunction with the first, if it were practicable to impose the conditions of that method. For the purpose of illustrating the use of this method three diagrams are herewith presented.

Diagram 1 is based on the assumption that it is desired to obtain a concrete in which the quantity of cement remaining after filling the voids in the fine aggate will be 20% of the gross volume of the fine aggregate and the quantity of mortar remaining after filling the voids in the coarse aggregate will be 20% of the gross volume of the coarse aggregate.

Diagram 2 is prepared on the assumption that it is required to have 30% excess of cement, as previously described, after the voids in the fine aggregate are filled, and 20% excess mortar after the voids in the coarse aggregate are filled.

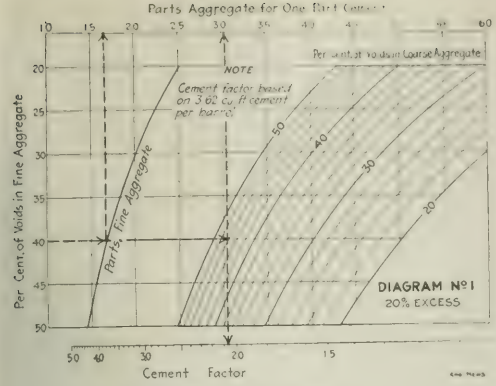
Diagram 3 is submitted to indicate the application of this principle where the voids in the fine aggregate can be considered as constant, as is often the case, and the voids in the coarse aggregate are variable. In this case one diagram can be made to cover all percentages of excess mortar over the voids in the coarse aggregate for a given percentage of excess cement over the voids in the fine aggregate. The diagram is based on the assumption that the voids in the fine aggregate are 40%, and is computed to give an excess of cement after filling the voids in the fine aggregate of 30% of the gross volume of the fine aggregate and 0 to 30% excess mortar after filling the voids in the coarse aggregate, the voids in the coarse aggregate varying from 20% to 50%.

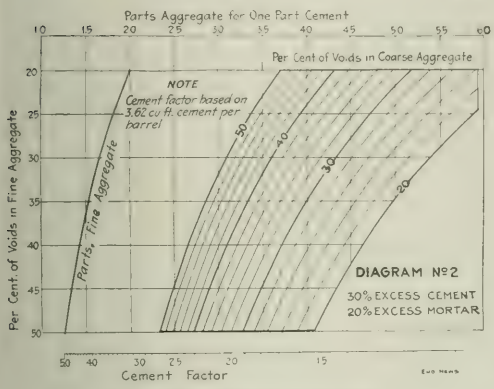
In Diagrams 1 and 2 the curve "parts of fine aggregate" can be used alone where a single aggregate is used.

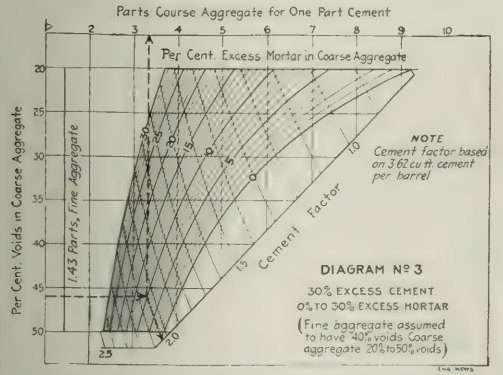
The accompanying tabulation shows the comparison of results by this method, using Diagram 1, with the standard proportions 1 : 2 : 4, frequently used where a rich concrete is required.

	Proportion	Percent voids F. agg.	Percent voids C. agg.	Percent excess Cement	Percent excess Mortar	Cement Factor
Fixed proportions	1 :2 :4	50	50	0	0	1.86
20% excess	1 :1.13 :2.45	50	50	20	20	2.53
Fixed proportions	1 :2 :4	40	40	10	15	1.62
20% excess	1 :1.67 :3.33	40	40	20	20	1.86
Fixed proportions.	1 :2 :4	40	30	20	30	1.43
20% excess.....	1 :2 :4.8	30	30	20	20	1.30
Fixed proportions.	1 :2 :4	40	30	10	25	1.49
20% excess.....	1 :1.67 :4	40	30	20	20	1.55

*Assistant Engineer Board of Water Supply, City of New York; 709 W. 181st St., New York City.







DIAGRAMS FOR THE DETERMINATION OF A SUITABLE CONCRETE MIXTURE

[Prepared by William B. Hunter.]

From this table it will be seen that concrete proportioned on the basis of a given percentage of excess gives uniform results as to the quantity, the proportions and the cement factor varying with the percentage of voids in the aggregates. Whereas, with arbitrarily fixed proportions, the quality of the concrete and the cement factor varies with the per cent. of voids in the aggregates.

Using Methods 2 and 3 (fixed proportions and fixed cement factor, respectively) proportions are usually used which in many instances give mixtures much richer than necessary, in order to guard against getting inferior results from time to time when the aggregates run bad.

The diagrams submitted are merely illustrative of the principle involved and are not necessarily expected to meet the requirements of any particular class of work, although the 20% excess diagram would probably give as good results as a 1 : 1½ : 3 mixture or a cement factor of 2, and would in most cases require less cement.

USE OF DIAGRAMS

Example 1.—To find proportions to give 20% excess cement and mortar after filling voids in fine and coarse aggregate respectively, when voids in fine aggregate are say 40% and in coarse aggregate are 46%. On Diagram 1 on the left side find the line representing 40% voids in fine aggregate: follow this line to its intersection with the curve marked "parts of fine aggregate"; from this intersection follow up to the scale marked "parts of aggregate"; this gives 1.67 parts of fine aggregate.

On the line for 40% voids in fine aggregate follow to the right to the intersection of this line with curve for 46% voids in coarse aggregate; from this intersection again follow up to the scale of "parts of aggregate." This gives 3.03. The proportions are then 1 : 1.67 : 3.03.

To find the cement factor: Read on cement factor scale directly below the last found intersection, and we have cement factor 2.06+.

Diagram 2 is used in the same way as Diagram 1.

Example 2.—To find proportions for 30% excess cement and 10% excess mortar, with the voids in aggregates the same as above, i.e., 40% and 46% respectively, use Diagram 3. The proportion of fine aggregate is constant in this diagram at 1.43. To find parts of coarse aggregate: On the left side of diagram on line marked "per cent. of voids in coarse aggregate" find horizontal line for 46% voids; follow this line to the right to its intersection with curves for 10% excess mortar; from this intersection go to the top of the diagram to the scale of parts of aggregate for one part cement; this will give 3.31. The proportions are then 1 : 1.43 : 3.31.

For the cement factor: from the intersection of the 46% void line with the 10% excess curve, follow parallel to the cement factor curves and read the cement factor—2.04+ on the cement factor scale.

METHOD OF COMPUTATION

In advocating the employment of the percentage of voids contained in aggregates as an agency in determining the proportions of aggregate to the cement in concrete, the writer is aware that he is proposing a method which has been cast aside by some of the concrete experts. Notwithstanding, he believes that the method herein described is sound in theory and practicability. The writer would further state that in the preparation of the accompanying diagrams he has neglected some small indeterminate coefficients which would not materially affect the results, but which would considerably increase the labor of preparation.

The basis of the computation follows:

1. The effect of the amount of water required to give the mixture a proper consistency in increasing or decreasing the volumne is neglected.

2. For the purpose of volumetric determination the

gross volume of the cement is considered as the absolute volume.

3. The volume obtained from given proportions is assumed to be the *gross* volume of cement and the *absolute* volumes of the aggregates.

4. The volume of one barrel of cement is considered to be 3.62 cu.ft.

The principal effect of these assumptions is that the cement factors are only approximate, but are believed to be close enough for all practical purposes, and inasmuch as all coefficients are more or less unreliable unless based on experiments with the particular ingredients to be used, it seems best to use none.

Some Radical Reforms in the Conduct of Patent Litigation

By Gilbert H. Montague*

The chief criticism directed against the existing patent system has always been that in patent litigation testimony was ordinarily taken, not in court before a judge, whose good offices could be relied upon to expedite the trial, but out of court before an examiner, who was powerless to control the length of the examination or the prolixity of the testimony. Thus, it was possible to expand the testimony to unseemly lengths and impose intolerable delay, and well-nigh prohibitive expense upon the weaker litigant.

How far this grievance has underlain the entire agitation for radical changes in the patent laws appears from the report submitted to the House of Representatives last August accompanying the Oldfield Patent Revision Bill (H. R. 23,417):

> The time and money wasted in having testimony given orally before the examiner who does not listen to it then written out by the reporter and ultimately printed for submission to the judge who often does not have time to read all of it is necessarily great. Days or weeks may be honestly consumed with the introduction of evidence on points which the judge, if present, would declare to be clearly immaterial or if material to be adequately established in the absence of evidence to the contrary.
>
> The fact that no means exists for determining the materiality, propriety or necessity of introducing material evidence in the course of the taking of testimony results inevitably in great waste of time and money. But the fact that the proceedings before the examiner are practically uncontrolled affords also unequaled opportunity for serious abuse of legal processes—opportunities which are unfortunately availed of all too frequently. The immediate result is often a triumph of might over right followed by a rankling sense of injustice and a deep-seated contempt for the law.

Finally, there was always the possibility that even after this enormous bulk of testimony had eventually been passed upon by the court and a decree made thereon, the Appellate Court might reverse the decree and send the whole cause back for a new trial involving a repetition of the same tedious performance.

This was the condition confronting Chief Justice White, of the United States Supreme Court, when he and his colleagues set out last spring to revise the Rules of Practice for the Courts of Equity of the United States. How resolutely the Supreme Court dealt with this condition appears from the new rules themselves.

Rule 46, relating to trials, requires that testimony shall, except in extraordinary cases, be taken in open court and reads as follows:

> In all trials in equity the testimony of witnesses shall be taken orally in open court, except as otherwise provided by statute or these rules. The court shall pass upon the admissibility of all evidence offered as in actions at law. When evidence is offered and excluded, and the party against whom the ruling is made excepts thereto at the time, the court shall take and report so much thereof, or make such a statement respecting it, as will clearly show the character of the evidence, the form in which it was offered, the objection made, the ruling, and the exception.

What may be expected of this rule is intimated in the report above quoted, submitted to the House of Representatives last August:

> The evidence should be introduced in open court before the judge who is to hear the argument as soon as the evidence is concluded. The judge is thus in a position to deal promptly and effectively with the whole proceeding. The amount of evidence introduced is greatly lessened because immaterial issues, irrelevant inquiries, impertinent questions may be ruled out. The value of the evidence also may be properly determined because the judge hears and sees the witnesses and may infer from their behavior, intonation, and appearance, as well as from the words spoken, their relative credibility.
>
> Litigation which now takes years would, through such a trial, be disposed of in as many months, and where desired could even be disposed of in a few weeks. In the presence of an able judge armed with power to exclude evidence or to enforce its production, and instructed, through his continued presence, in the merits of the controversy, that abuse of the legal process which has become the scandal of the patent practice and one of the most potent instruments of oppression would cease. Justice, swift and more certain, would prevail.

According to Rule 47, no exception to the foregoing rule will be allowed except in very unusual cases, incontrovertibly proved under oath, and even then only under the strictest conditions as to the time within which depositions must be taken and filed. The rule is very explicit:

> The court, upon application of either party, when allowed by statute, or for good and exceptional cause for departing from the general rule, to be shown by affidavit, may permit the deposition of named witnesses, to be used before the court or upon a reference to a Master, to be taken before an Examiner or other named officer, upon the notice and terms specified in the order. All depositions taken under a statute, or under any such order of the court, shall be taken and filed as follows, unless otherwise ordered by the court or judge for good cause shown; those of the plaintiff within sixty days from the time the cause is at issue; those of the defendant within thirty days from the expiration of the time for the filing of plaintiff's deposition; and rebutting depositions by either party within twenty days after the time for taking original depositions expires.

Rule 48 deals directly with the sorest subject of patent practice, namely, the testimony of expert witnesses in patent and trade-mark causes.

> In a case involving the validity or scope of a patent or trade-mark, the district court may, upon petition, order that the testimony in chief of expert witnesses, whose testimony is directed to matters of opinion, be set forth in affidavits and filed as follows: those of the plaintiff within 40 days after the cause is at issue; those of the defendant within 20 days after plaintiff's time has expired; and rebutting affidavits within 15 days after the expiration of the time for filing original affidavits. Should the opposite party desire the production of any affiant for cross-examination, the court or judge shall, on motion, direct that said cross-examination and any re-examination take place before the court upon the trial, and unless the affiant is produced and submits to cross-examination in compliance with such direction, his affidavit shall not be used as evidence in the cause.

The result of these rules, in spite of the shortening of litigation which they will effect, will be to increase the labors of the judges. In districts where the court calendars are already crowded, this may make necessary the creation of additional judgeships. No one, least of all any litigant or lawyer having to deal with the courts,

*Counsellor at Law, 10 Wall St., New York City.

will deplore this possibility. Indeed, simply as an additional argument to induce Congress to create additional judgeships in many of the districts, the new rules will justify themselves. When the attention of Congress is thus directed to the subject, it is confidently hoped that it will see also the necessity of providing at the same time for a Court of Patent Appeals, to hear appeals in patent causes from the nine Circuit Courts of Appeal, over which the Supreme Court, under the existing practice in respect to patent causes, has scarcely any appellate powers or opportunity to correct or reconcile conflicting decisions. These improvements in the courts dealing with patent matters have become more imperative, and probably nearer to accomplishment, as the result of the new rules.

The zeal of the Supreme Court of the United States to prevent prolixity of testimony and undue expansion of the record appears throughout the new rules.

Depositions before an examiner are expressly permitted to be in narrative form instead of in question and answer (rule 49). No transcript of evidence before the examiner can include argument or debate (rule 51). "The evidence to be included in the record (on appeal)," says rule 75, "shall not be set forth in full, but shall be stated in simple and condensed form, all parts not essential to the decision of the questions presented by the appeal being omitted and the testimony of witnesses being stated only in narrative form, save that if neither party desires it, and the court or judge so directs, any part of the testimony shall be reproduced in the exact words of the witness."

The determination of the Supreme Court to stamp out the common devices by which patent litigation has heretofore been made burdensome is notably expressed in Rule 76:

> In preparing the transcript on an appeal, especial care shall be taken to avoid the inclusion of more than one copy of the same paper and to exclude the formal and immaterial parts of all exhibits, documents and other papers included therein; and for any infraction of this or any kindred rule the Appellate Court may withhold or impose costs as the circumstances of the case and the discouragement of like infractions in the future may require. Costs for such an infraction may be imposed upon offending solicitors as well as parties.

The way of the procrastinator in patent litigation will hereafter be hard.

"After the time has elapsed" says rule 56, "for taking and filing depositions under these rules, the case shall be placed on the trial calendar. Thereafter no further testimony by deposition shall be taken except for some strong reason shown by affidavit. In every such application the reason why the testimony of the witness cannot be had orally on the trial, and why his deposition has not been before taken, shall be set forth, together with the testimony which it is expected the witness will give."

"After a cause shall be placed on the trial calendar," says rule 57, "it may be passed over to another day of the same term, by consent of counsel or order of the court, but shall not be continued beyond the term save in exceptional cases by order of the court upon good cause shown by affidavit and upon such terms as the court shall in its discretion impose. Continuances beyond the term by consent of the parties shall be allowed on condition only that a stipulation be signed by counsel for all the parties and that all costs incurred heretofore be paid. Thereupon an order shall be entered dropping the case from the trial calendar, subject to reinstatement within one year upon application to the court by either party, in which event it shall be heard at the earliest convenient day. If not so reinstated within one year, the suit shall be dismissed without prejudice to a new one."

Finally, the probability of having to endure a new trial simply because the Appellate Court may reverse the decree on the ground that the Trial Court improperly excluded certain evidence is reduced to a minimum.

"If the Appellate Court" says rule 46, "shall be of opinion that the evidence should have been admitted, it shall not reverse the decree unless it be clearly of opinion that material prejudice will result from an affirmance, in which event it shall direct such further steps as justice may require."

Under this rule the Appellate Court, instead of directing a new trial involving a repetition of the tedious performance of assembling all the proofs and witnesses and presenting the evidence again before the Trial Court, may let the decree stand, if it appears that no material prejudice resulted from excluding such evidence; and if it is satisfied that prejudice did result from excluding such evidence, it may simply direct that the lower court open the case for the sole purpose of receiving such evidence together with such further evidence as may be offered in opposition thereto, and then reconsider its decision in the light of such new evidence.

These rules went into effect February 1, 1913. Alone, and without the necessity of any amendment in the law, they have removed what probably has been the chief ground for the recent criticism of the patent system. Taken in conjunction with the report of the President's Commission which investigated the Patent Office, they point the way to improvements which, without any act of Congress, can be effected, in the administratiion of the patent laws, and illustrate the futility of seeking, by fundamental changes of the patent system and radical abridgment of the rights of patent owners, to accomplish reforms that so easily and so completely can be attained without resort to legislation.

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A Very Heavy Truck Load was hauled through New York City streets by a motor truck on Mar. 18. The hauling was done by a La France hydraulic transmission motor truck, which uses the Manly variable-speed hydraulic drive, the advantages of which in perfect speed control and exertion of a slow powerful steady pull in starting are similar to those of the Pratt hydraulic transmission described in our issue of Oct. 31, 1912. The load to be hauled consisted of a door frame for the safety deposit vaults to be installed in the basement of the new Clearing House Building. The door frame was made by the York Safe & Lock Co., and was delivered on a lighter at Pier 11, East River. The frame was 7 ft. 6 in. wide, 9 ft. long, and weighed 52,600 lb. It was loaded upon a very substantial four-wheel wagon, which weighed empty 16,400 lb. A span of horses were attached to this wagon to guide the pole and steer the wagon, but the traction was furnished by a La France hydraulic motor truck, weighing 4½ tons, which was itself loaded with five steel plates for the vault weighing together 12,100 lb. The total load to be moved, therefore, was 90,100 lb., or substantially 45 tons. The load per wheel on the truck carrying the door frame was 17,250 tons. The Street Department refused to permit the load to be hauled through Wall St. on account of possible injury to pavement. It therefore proceeded to its destination by way of Front St. to South Ferry and then up Whitehall St. and Broadway. The truck was hauled up the 4½% grade at Bowling Green without difficulty, and to demonstrate its starting power was stopped on this grade and started again. The load was moved without injury to the pavement, except the breaking of one manhole cover on Whitehall St.

A New Locomotive Testing Plant*

By Edward C. Schmidt†

SYNOPSIS—Determinations of the efficiency of locomotive performance can be made to best advantage for scientific accuracy in a laboratory or testing plant, where the load and speed can be adjusted and varied or kept uniform at will, and where the engine is free from the varying and disturbing influences of weather, track conditions and traffic conditions. Road tests, of course, still have their uses, but there are many tests and investigations which cannot be made satisfactorily with an engine on the road. In the laboratory, the engine is anchored by its drawbar to a dynamometer, and its driving wheels rest on wheels which are revolved by the friction of the engine wheels. Hydraulic brakes applied to the axles of the supporting wheels enable the load or resistance to be applied or varied as desired. This country has taken the lead in the construction and use of testing plants of this kind, and three engineering colleges include them among their equipment. The accompanying article describes the latest of these, which presents some special features of novelty and importance.

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The locomotive testing plant has placed at our disposal a means for studying the locomotive which has made good the deficiencies of road testing. The first locomotive testing plant was built 21 years ago at Purdue University. It was designed by Dr. W. F. M. Goss, who was at that time in charge of the schools of engineering at that institution. Not the least of the good influences of this plant is the encouragement which its success has offered to other experimenters to establish similar laboratories. At present there are four such testing plants in this country and two in Europe.* An addition to the small number of existing plants is of interest, and the present article describes the new plant of the University of Illinois, which will be put in operation in April. The Illinois legislature at its last session included among its appropriations for the university $200,000 for new buildings for the College of Engineering, and it was decided to use this for a transportation building and a locomotive laboratory for the department of railway engineering. The plant has been designed with the intention of making it suitable to test new designs of locomotives as they appear, in the confidence that the railways and builders would be willing to keep upon the plant locomotives of recent design, concerning whose performance information is desired. Figs. 1 and 2 show the general arrangement of the plant.

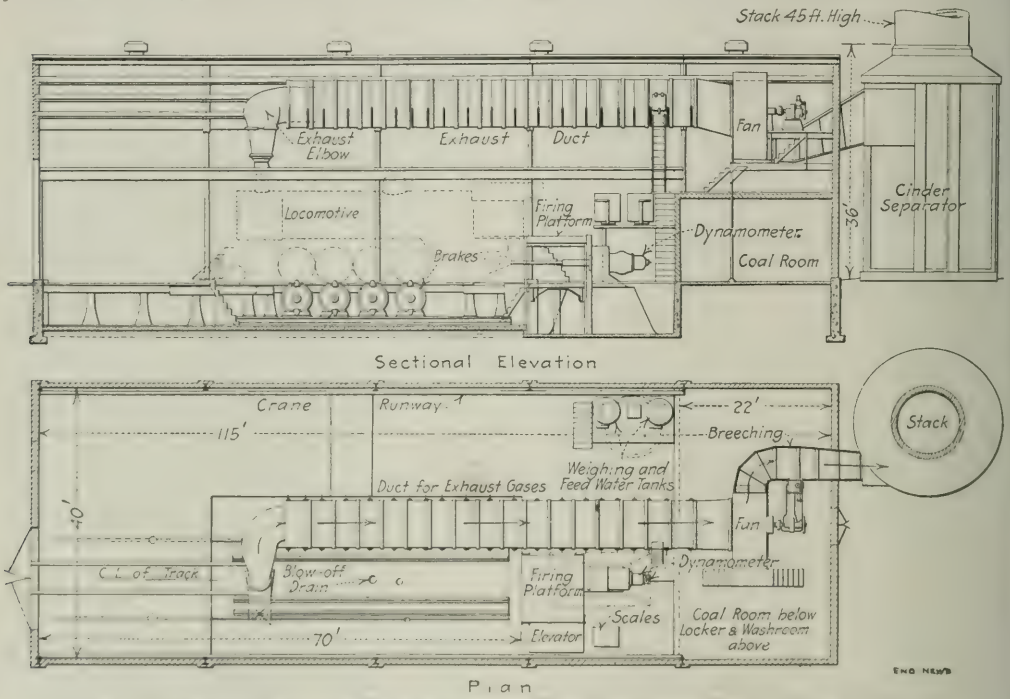


Fig. 1. Sectional Plan and Elevation of the New Locomotive-Testing Plant at the University of Illinois

*Paper before Western Railway Club Chicago Mar 18, 1913

†Professor of Railway Engineering, University of Illinois, Urbana, Ill

*The Purdue plant, erected in 1891, was followed in 1894 by a temporary plant, at South Kaukauna, Wis., on the Chicago & Northwestern Ry., designed under the direction of Mr. Quayle. This was succeeded in 1895 by a permanent plant, designed by Mr. Quayle and erected at the C. & N. W. Ry. shops in Chicago. In 1899, Columbia University, having been given a locomotive by the Baldwin Locomotive Works, provided for a testing plant which is erected in the mechanical engineering laboratory. In 1904, the Pennsylvania R.R. installed at the St. Louis Exhibition what was at that time the largest and most elaborate plant yet built. This later was removed to Altoona, Penn., where it has been in almost constant operation since. In 1904, there was also erected in the Putiloff Works at St. Petersburg, Russia, a similar plant designed by M. V. Cobbholoff and S. T. Smirnoff. The following year there was erected in England a plant under the direction of Mr. Churchward of the Great Western Ry., at the Swindon works of that company.

SUPPORTING WHEELS AND HYDRAULIC BRAKES

Any locomotive testing laboratory consists essentially of (1) a means for so supporting the locomotive that its wheels may be rotated and that the power developed may be absorbed and either dissipated or transferred, (2) a means for anchoring the locomotive when so mounted and for measuring the tractive effort developed, (3) means for supplying and measuring coal and water, and (4) means for disposing of the gases and exhaust steam. The supporting mechanism in this plant (as in all others) consists of wheels whose position may be varied to conform to the spacing of the locomotive's driving wheels. The supporting wheels are 52 in. diameter, provided with plain tires and mounted on 11⅛-

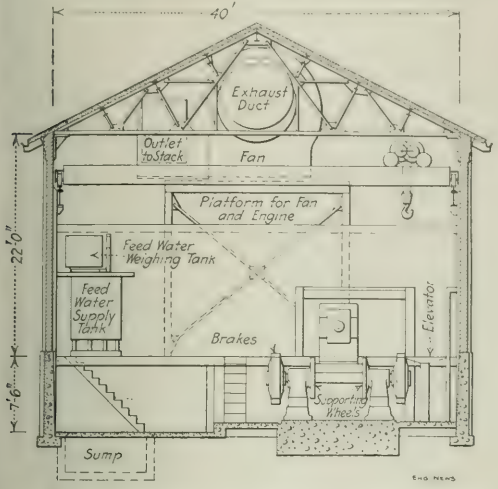


FIG. 2. CROSS-SECTION OF LOCOMOTIVE-TESTING PLANT

in. axles, the axles and tires being of heat-treated carbon steel.

The use of 52-in. supporting wheels involves rotating speeds as high as 500 r.p.m. in testing high-speed locomotives. Such speeds may give rise to difficulty in the operation of the bearings although they have been designed with regard to these conditions. However, provision has been made (in the design of the bearing pedestal) for using 72-in. wheels, if it proves desirable. The axles are supported at each end just beyond the wheels, in bearings 9½x20 in., which are provided on the under side of the journal only. These bearings are carried in self-aligning shells which are supported in pedestals of exceedingly heavy construction. Oil is provided at two points in the bearing cap, where it is supplied under head from an elevated supply tank. The bearing pedestals rest on massive cast-iron bed plates which run the entire length of the testing pit, and as the bolt heads are held in slots running the length of the bed, the pedestals may be shifted to any desired position on the bed.

Hydraulic brakes on the axles provide means for absorbing the power developed at the driving-wheel rim, as shown by the cross-section in Fig. 2. These are of the type used in all other American testing plants, and were designed by Prof. G. I. Alden, of Worcester, Mass., under general specifications prepared by the designer of the plant. One of these brakes is mounted on each end of each supporting axle. Each brake (Fig. 3) consists essentially of three cast-iron disks, A, which are keyed to the supporting axle, and which rotate between water-cooled copper diaphragms B, carried in a stationary casing C. The cast hub D and the three disks form an integral rotating element which is keyed to the axle and turns with it. The casing and its diaphragms are prevented from rotating by means of links attached to the bed plates. The diaphragms form within the casing three compartments within which the cast-iron disks rotate. The surfaces of the disks and of the diaphragms are lubricated by oil fed in at the periphery of the disks and taken off at the hub. The diaphragms form also within the casing four water compartments which have no communication with those within which the disks rotate. Water is fed into these water compartments at E, and is taken off at F. The pressure existing in these water spaces may be varied at will by means of suitable valves in the brake piping.

The operation of the brakes is as follows: Power received from the driving wheels of the locomotive is transmitted through the supporting wheels and axle to the cast-iron brake disks; these in turn transmit it by friction to the surfaces of the copper diaphragms against which they rub. By varying the water pressure, the friction between the disks and the diaphragms may be varied in accordance with the amount of power to be absorbed. The entire power of the locomotive is thus dissipated at the surface of the diaphragms and carried away as heat in the water which circulates through the brakes. Each brake is designed to develop a resisting torque of 18,000 lb.ft., which is more than is likely to be transmitted to it by the most heavily loaded locomotive driver.

The above machinery, which serves to support the locomotive and to absorb its power, is all carried on a slab of reinforced concrete 93 ft. long and 12 ft. wide, varying in thickness from 3½ ft. at the front to 5 ft. at the rear. It is surmounted at the rear end by a pyramidal pedestal which serves as the anchorage for the dynamometer.

TRACTION DYNAMOMETER

The locomotive is anchored by a massive drawbar to a dynamometer of the Emery type, which consists essentially of a weighing head and a weighing scale. Within the head is an oil chamber with a flexible wall, which receives and balances any force transmitted from the locomotive. The pressure of the oil in this chamber varies with the load and is transmitted through a copper tube of small bore to a similar smaller oil chamber, the pressure within which moves the beam of a substantial but very sensitive scale. The force transmitted to the dynamometer is thus weighed. In design this instrument is very similar to that of the original dynamometer furnished for the Purdue university plant. Its capacity, however, is about four times as great, namely 125,000 lb.* Up to this limit it will measure with great accuracy any force transmitted to it from the locomotive. One feature of special interest is that the adjustment of the poise weight on the scale beam is accomplished automatically. This has permitted (for the first time in this type of instrument) the development of a device whereby the amount of the force weighed on the scale is autographically recorded.

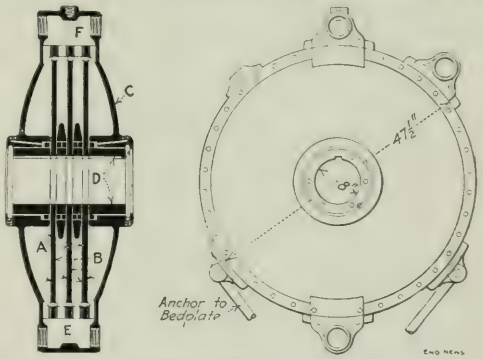


FIG. 3. THE ALDEN HYDRAULIC ABSORPTION BRAKE FOR LOCOMOTIVE-TESTING PLANTS

The capacity of this instrument is about 15,000 lb. in excess of the greatest tractive effort which could be imposed upon it by even the most powerful Mallet locomotive now in existence. The plant can test the largest of these Mallet engines; and at the same time all the equipment and the building itself have sufficient margin in size and capacity to allow for a very considerable increase in size, weight and power of locomotives.

DETERMINING EXHAUST GASES AND CINDERS

In providing means for disposing of the exhaust gases, new problems were presented and new solutions have been reached. In view of the importance of determining accurately the total fuel lost in the exhaust gases, it was de-

*The maximum capacity of the dynamometer used in the Pennsylvania R.R. plant at Altoona is 80,000 lb.

cided to try to incorporate some means for entrapping all of the solid matter contained in the gases passing from the smoke-stack. This purpose has been served previously by collecting in a sampling tube the solid matter which passes a small section of the exhaust-gas stream, and pro-rating the loss of solid fuel thus determined over the entire stream section. This method is not always convenient, and under certain conditions its results are open to doubt.

A spark trap or cinder collector which would pass the total volume of gas and exhaust steam from the largest

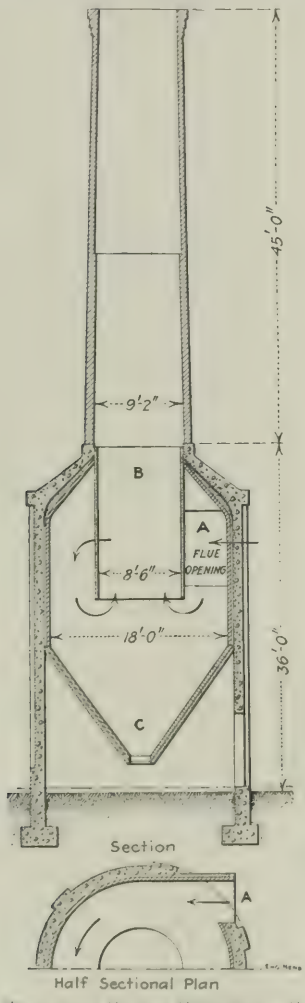


FIG. 4. STACK AND CINDER-COLLECTING CHAMBER

modern locomotive when working at high power would be too large to be located conveniently within the building. A second fundamental consideration in designing the exhaust system was the necessity of providing a stack of sufficient height to insure that the gases would be discharged at such a height as to prove inoffensive to occupants of neighboring residences and university buildings. It was decided that this would require a stack about 8 ft. diameter and at least 80 ft high. Further study made it apparent that these two features could be embodied in one structure. This has been accomplished by the combined cinder separator and smoke-stack which is shown in Fig. 4 and is located outside of the laboratory.

The exhaust gases as they emerge from the locomotive stack are discharged into a steel exhaust elbow which carries the gases up and over to a horizontal duct running through the roof trusses. The gases are drawn through this elbow and duct by an exhaust fan. Probably the heaviest cinders will be dropped in this duct, but the velocity within it is such that all but the heaviest particles will be carried through the fan. Whatever does accumulate here may be removed through traps provided in the bottom of the duct, and weighed.

The gases and solid matter passing through the fan are delivered by a breeching or flue to the separator. They enter this at A, and in order to leave they must pass downward and around the sleeve B. In so doing they are given a whirling motion which causes the cinders to move toward the wall, along which they drop to the hopper C, while the gases pass downward and out to the stack through the mouth of the sleeve. The cinders collecting at the bottom of the hopper are drawn off and weighed. This separator is surmounted by a 45-ft. radial-brick stack.

The corrosive nature of the mixture of exhaust gas and steam has made it necessary to avoid the use of metal. The exhaust elbow within the building necessarily has been made of steel, and will need occasionally to be renewed. The duct and fan breeching, however, are of asbestos board which will resist corrosion. The duct is 7 ft. diameter, and made up of separate sections so that its length may be varied. The fan has a runner 6 ft. diameter, and will pass, at maximum speed, 140,000 cu.ft. of gas per minute. The breeching has a minimum cross-sectional area of about 24 sq.ft.

The outer shell of the separator is built of reinforced-concrete, lined with hard-burned red brick (as is the hopper). Between the lining and the shell is a 2-in. air space to protect the shell from undue heating. Any leakage of gas into this space is vented to the outside air through openings in the shell, which serve also to circulate cool air through the air space. The inside sleeve and hopper are of reinforced concrete. The stack is unlined, but is laid up in acid-proof cement.

[We are informed by Dean W. F. M. Goss that the first locomotive to be tested was received at the plant Apr. 11. This is No. 958 of the Illinois Central R.R.—a modern consolidation-type freight engine with eight drivers, weighing 182 tons.—Ed.]

Repairs to a Reinforced-Concrete Chimney

BY C. E. SMITH*

In 1903 a reinforced-concrete smoke-stack was built for the power house of the Kansas-Missouri Elevator Co., at Kansas City, Mo. The smoke-stack has a total height above the ground of 160 ft. The lower 60 ft. is composed of a double shell and the upper 100 ft. of a single shell, the entire chimney being reinforced horizontally and vertically by mild-steel T-bars. The horizontal bars are 1x1x⅛-in. bent circular and the vertical bars are $1\frac{1}{4}$x$1\frac{1}{4}$x¼ in.

The inner shell of the lower portion is 4 in. thick and has an internal diameter of 5 ft. It is reinforced by horizontal circular T-bars 18 in. apart and vertical T-bars 16 in. apart. The outer shell of the lower portion is separated from the inner shell by a 4-in. air space. The outer shell is 8 in. thick and has an external diameter of 7 ft. 8 in. It is reinforced by horizontal circular T-bars 3 ft. apart and vertical bars spaced approximately 3 in. apart at the bottom of the chimney, the space increasing by decreasing the number of bars until the bars are 6 in. center to center for the upper portion of the outer shell. At the top of the double-shell section of the chimney the inner and outer shells merge, vents being left in the inner shell for purposes of expansion.

Above this portion extends 100 ft. of chimney having a single shell with an external diameter of 6 ft., the thickness of shell being 6 in. for the lower 45 ft., 5 in. for the next 30 ft. and 4 in. for the top 25 ft. The horizontal reinforcement consists of circular T-bars 3 ft. apart

*Bridge Engineer, Missouri Pacific Ry. Co., St. Louis, Mo.

throughout the entire height and vertical reinforcing bars approximately 3 in. center to center near the bottom of the single shell and 18 in. center to center at the top of the chimney.

On account of the extremely thin shell, especially near the top, the outstanding edges of the reinforcing bars come very close to the surface of the concrete.

In the fall of 1912 it was noticed that during severe winds the chimney gave out a grinding sound and chunks of concrete fell from its outer surface, creating considerable alarm among the employees having duties near the base of the stack.

Close inspection from the iron ladder attached to one side of the chimney and by telescope of the remaining surface, indicated that the entire upper portion, 100 ft. high, was cracked vertically and horizontally into a large number of rectangular slabs, the cracks being located along the lines of the reinforcement and that the cracks

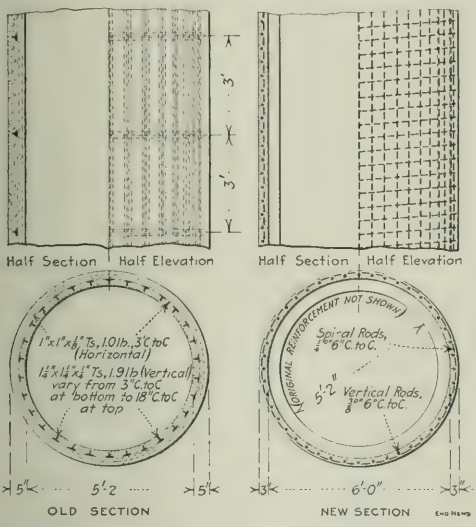


FIG. 1. DETAILS OF UPPER PORTION OF CHIMNEY BEFORE REPAIRS

FIG. 2. DETAILS OF UPPER PORTION OF CHIMNEY AFTER REPAIRS

would soon become so large as to permit corroding influences to reach the thin reinforcing members, which would have resulted in the early collapse of the chimney.

On account of the fact that the elevator is almost continually busy and for the further reason that the necessity for the repairs became apparent at a very busy season, it was decided to make repairs without taking the chimney out of service.

The upper edge of the chimney had deteriorated so badly and the concrete there was so shattered and loosened that it was considered unsafe to suspend a swinging platform from the top, so a temporary timber staging resting on the ground was erected around the chimney reaching to the top and the bracing was so arranged that platforms could be placed at intervals of about 6 ft. From these platforms a very careful examination of the entire chimney was made.

It was found that the cracks were much larger and more open, and the chimney in much worse condition than was indicated by the preliminary examination. In many places the reinforcement was entirely exposed and had already deteriorated considerably by corrosion. The ease with which concrete was knocked off the reinforcement by blows of a small hammer indicated that T-bars are entirely unsuited to use for this purpose in thin layers of concrete. It was apparent that the expansion and contraction of the chimney, together with the strains caused by the wind, cracked the concrete along the lines of the horizontal circular bars and that the sections later cracked along the vertical bars. The outstanding edges of the T-bars were in many places only ½ in. from the surface of the concrete. It is difficult to understand why deformed rods were not used.

It was decided to cover the entire 100-ft. upper portion with a reinforced-concrete shell 3 in. thick, and repairs were started immediately. As there were no signs of failure in the lower double portion, no repairs were made, but it was given a coat of grout applied as a paint, both to secure a uniform appearance and to make the surface better able to resist the adverse weather conditions.

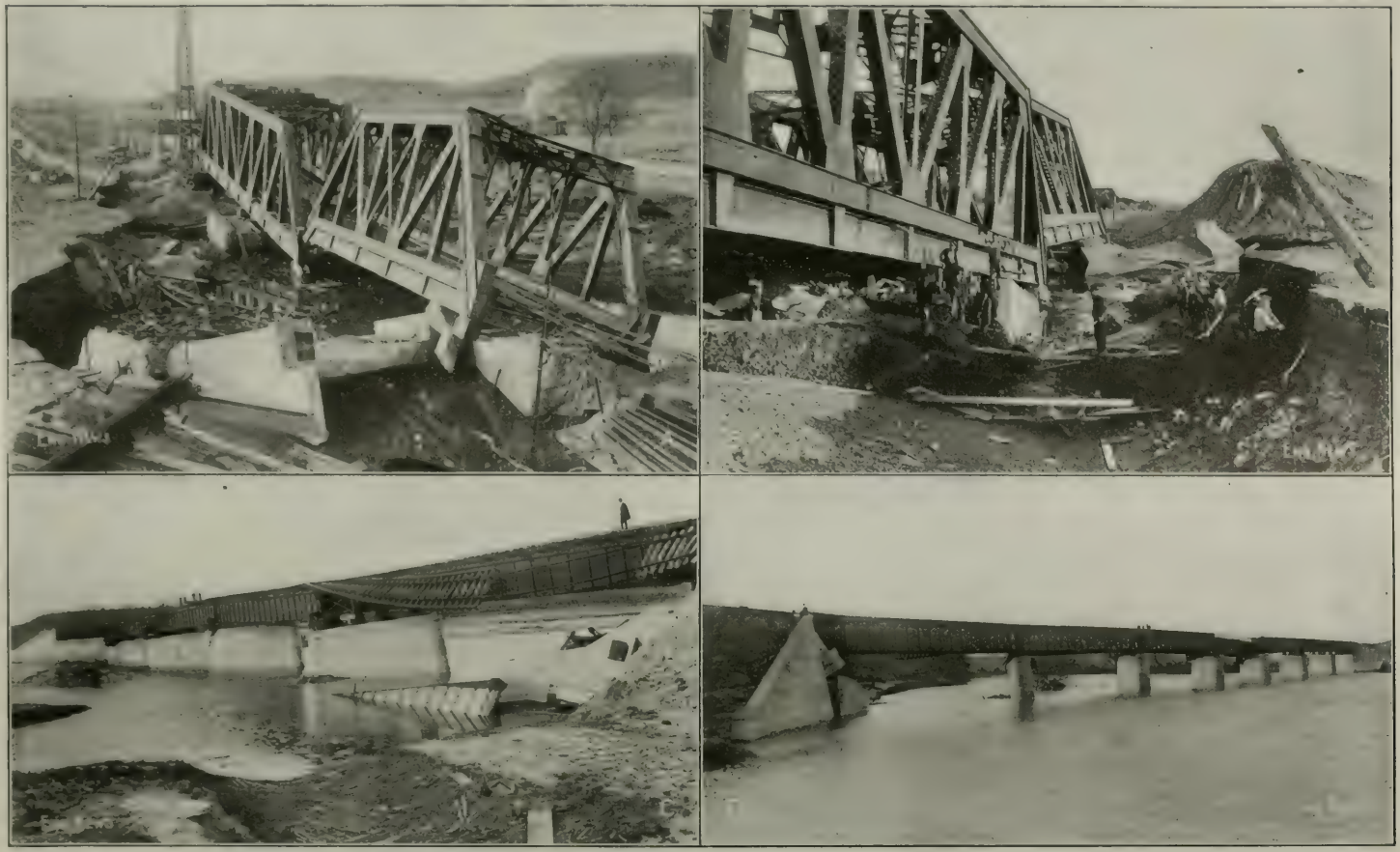
Before placing the reinforced-concrete shell all loose concrete that could be readily dislodged by a hand hammer was removed, the cracks and exposed reinforcement were brushed clean and all openings and cracks filled with grout. Deformed rods ⅜ in. in diameter were placed vertically 6 in. apart entirely around the chimney, the lower ends of these rods being set and grouted in holes drilled in the outer shell of the lower portion of the chimney. Deformed bars ⅜ in. in diameter were also bent around the chimney to form a spiral from top to bottom with 6-in. pitch. The rods were placed as nearly as possible 1½ in. from the outer surface of the chimney.

Four lifts of steel forms were used. Each lift consisted of two half-cylinders of No. 10 steel plates 3 ft. high, stiffened top and bottom and at the ends by small angle irons in which bolts were placed to hold the sections together. The inside diameter of the forms when set up was 6 ft. 6 in.

The concrete was mixed "dry," in order to permit early removal of the forms, and was thoroughly tamped in place. Most of the concrete was placed when the temperature was slightly below freezing but no precautions were taken to prevent freezing. As the chimney was in use throughout the work, having an external temperature of about 80° F., the new concrete set rapidly and permitted the removal of the forms after 24 hours which permitted the placing of about 12 ft. in height each day.

The former weight of the chimney was 467,000 lb. and the overturning moment of the wind about the base, assumed at 50 lb. per sq.ft., 2,293,500 ft.-lb., making the maximum pressure on the base 2300 lb. per sq.ft. The reinforcement added approximately 75,000 lb. weight which increased the base pressure to 2600 lb. per sq.ft. As the base is 20 ft. square, 10 ft. deep in the ground, and no settlement had ever been experienced, no fears were felt of the stability of the chimney under the increased load.

The work was carried out on a force account basis under the direction of the engineering force of the Missouri Pacific Ry. Co., by Flanagan Brothers, of Kansas City, Mo., and cost about $2500.



A. Bridge over canal and electric line, looking NE from embankment beyond south abutment. B. Same bridge, looking S or downstream from a point near north abutment. C. Miami River Bridge, south of canal bridge. View looking E, showing north or upstream face of bridge. D. Downstream side of same bridge, seen looking NW.

TWO RAILWAY BRIDGES DESTROYED BY THE MIAMI FLOOD. (C. C. C. & ST. L. RY. CUTOFF SOUTH OF MIAMISBURG, OHIO)

Two Heavy Railway Bridges Wrecked by the Miami River

The four views on the opposite page illustrate strikingly one important element of the recent Central States floods—the amazing extent of bridge destruction. Two structures of most modern design are shown, both completely wrecked. The substructures are washed out, or underscoured and tipped, and the excellence of the superstructures then could not save them. To get a general idea of what the flood period meant throughout Ohio and Indiana it is only necessary to multiply these pictures several scores of times, and to realize that practically all railways south of the Erie-Ohio divide were reduced to the condition of that shown.

The cutoff of the C., C., C. & St. L. Ry. on which these bridges occur was mentioned in our last issue, and a sketch map was shown. The upper two pictures on the opposite page show the bridge over the Miami & Erie canal, the Ohio Electric Ry. and a highway, just south of Miamisburg, Ohio; the lower views show the Miami River bridge some distance south (the northerly of the two river crossings of the cutoff). While the river bridge has 7 spans, it is on skew location, so that the clear channel width is much less than the bridge length. The piers tipped upstream, and the broken abutment, prove the intensity of current action. At the canal bridge (upper views) the scouring action is even more evident; this bridge is at a distance of a quarter mile or more from the river.

The Status of Engineering*

Engineers as a body are duly esteemed by others, and are themselves proud of their profession. It is only when they come asking for recognition that anyone is in the least degree inclined to look down on them, and then it is their attitude rather than themselves that merits contempt. The status of engineering as a profession is secure, the status of the individual members of the profession seems to be more doubtful, and the reason assigned is that men with neither the education nor the experience necessary to a proper professional standard are yet recognized by the public as engineers.

We may pass over the complaint that the word "engineer" is used to include artisans in engineering works. There are many ambiguities in the English language which are yet easily recognized, and no one hearing of "an engineers' strike" supposes that Great George Street has closed its doors, nor thinks that the engineer responsible for the design and construction of a reservoir is merely a skilled workman.

The complaint, however, of incompetent and defective education among young engineers is more plausible, and to whatever extent it may be true, to that degree does it tend to lower the status of engineers, if not of engineering. The difficulty is said to arise from the fact that the engineering profession draws its recruits from every class of the community, and that the social status of a profession depends on the class from which its recruits are drawn. The remedies proposed are State recognition and a State examination sufficiently stringent to exclude the incompetent.

Now if it be true that the lowering of the status is due to an inordinate leavening from the lower strata of society, no State recognition can alter that. Status is an individual matter dependent on birth, character, and upbringing; and the State cannot control the private judgment of the community nor force it to call a sow's ear a silk purse.

State examinations would do something to keep the profession select, as it keeps the Indian Civil Service and the Army select, not by raising the standard, for it lowers it, but by making the preparation for the examination too expensive for any but the well-to-do. It would keep out just those who should be let in easily, the men of brains and personal character sufficient to raise them from the ranks despite their lack of any liberal education.

It has been well said that the Stephensons could neither of them have passed the examination of the Institution of Civil Engineers. Men who rise from the ranks are likely to have sufficient sense and adeptability to make their own status, and to adopt, easily and naturally, the manners and conventions of their new surroundings.

But for men who are lifted from the ranks, State recognition can do nothing. Some have urged the adoption of trade-union methods to raise, not status, but salaries. We have always understood that trade-union methods aim at putting the good and bad worker as near as may be on an equality, and discouraging individual effort. But individual effort is the life-blood of engineering, and there can be no surer means of degrading the profession than to discourage it. By all means keep out the incompetent, but let the engineers themselves do it; not rely on the State, which means, in effect, on a number of men ignorant of engineering.

*Extracts from an editorial in the "Contract Journal," London, April 16.

Notes on the Flood in the Lower Mississippi

By A. L. Dabney*

The maximum rate of discharge at Cairo in this year's flood is, in the writer's opinion, very nearly the same as in last year's. It is true that the stage at Cairo was 0.7 ft. higher this year than last, but it seems probable that less water escaped through breaks in the levees on the west side of the river near Cairo. Definite information on both these points is lacking, however.

Nearly all of the water that escaped through the breaks opposite Cairo returned to the river a short distance below, so that these breaks which gave some relief to Cairo gave much less relief to Memphis and points below.

It was estimated that last year's flood would have reached about 47.5 or 48 ft. gage height at Memphis if there had been no breaks. Indications are that it might have reached about 47 this year, even after the occurrence of the breaks near Cairo, had no breaks occurred in this vicinity.

The lower St. Francis levees were designed to withstand a stage of 42 or 43 ft. at Memphis, *and were only 60 per cent. complete by this standard*; yet they held the 1912 flood up to a stage of 45. Several breaks occurred in that district last year, when that stage was reached at Memphis, allowing about 2½ ft. of the flood crest to escape into the St. Francis Basin. Here was a *reservoir* just in the right place to lower the gage at Memphis. By filling several million acres to a depth of about 10 ft., the stage at Memphis was kept down these 2½ ft. The highest stage at Memphis last year was 45.3.

This year a stage of 46.5 was reached at Memphis. The crest of the flood had almost reached here before a break occurred that gave material relief at this point. The first break in the Lower St. Francis levees occurred on the afternoon of Apr. 8, at a point about 23 miles below Memphis. The gage at Memphis read 45.5 ft. when this break occurred. The rise of the river at Memphis was not materially interrupted by this break, an excellent illustration of the fact that an *outlet* will give little relief to points upstream beyond a very short distance.

The following afternoon, Apr. 9, during a heavy wind and rain storm, when the gage read 46.4, two breaks occurred in the St. Francis levee about 40 miles above

*Memphis, Tenn.

Memphis. I believe these last breaks would not have occurred, even with the heavy odds against the flood fighters, if the weather had not made it impossible to hold the laborers on the work.

The result of the three breaks was a fall at Memphis of about 2 ft. in the first 48 hours and 2½ ft. in the first 72 hours. The lower half of the St. Francis basin was an empty reservoir, in a very good place. After it was filled, there was still a stage at Memphis 4 ft. higher than was ever recorded before 1912.

Had the levees of the Lower St. Francis Levee District been 4 or 5 ft. higher than they were, they would probably have been held. Had they been 6 or 7 ft. higher with commensurate base, they would have been reasonably secure.

The St. Francis levees were reported by the Chief Engineer of that district *before the 1912 high water,* to be only 60% complete; yet their giving way under 4 ft. more water than they were designed for, is taken as evidence that levees are a failure! As well say that a bridge is a failure if it breaks under twice the specified test load.

It is of interest to compare the precipitation chart for the March storms of this year (ENG. NEWS, Apr. 10), with the chart for March, 1912, published with Prof. Frankenfield's paper in ENGINEERING NEWS of Apr. 18, 1912. The heavy rains did not fall in the same place. Perhaps the reservoir advocates can design us a reservoir that can be moved about on short notice to where it is most needed!

The faddists are under full steam again, and there seems to be serious danger that they will create confusion in the minds of Congressmen.

I would like to see a National Board of River Control created with General Bixby or Colonel Townsend at its head and with Colonel Goethals on the Board because he is an able man and also to satisfy those who think that no one knows just what to do with the Mississippi River if he has not built the Panama Canal. It would be a misfortune, however, if this Board were entangled by the intricate web that Senator Newlands has succeeded in spinning. It would also be unfortunate if any change should be made in the present policy of providing the Mississippi River Commission with funds to continue the valuable work that they have been accomplishing. The National Board should have had ample time to study the question of river control thoroughly and then recommend to Congress the organization, methods, etc., which it believes should be adopted; but the work of the Mississippi River Commission should not be interrupted meantime.

Reverting to the leveees: From 1897 to 1913, sixteen years, the Upper Yazoo levee district, with an area of about 2 million acres, has had no Mississippi River water in it. From 1903 to 1912, nine years, no levee district on the lower Mississippi had a single break. Yet had the levees not existed, practically the entire lower Mississippi valley would have been inundated several times during that interval.

During an ordinary high-water season when the levees show no weakness, the residents in the valley go about their daily business and a large number of them do not know that the river is above its banks. When, about once in ten years, an unusual flood comes and some of the levees (incomplete because the money has not been provided to complete them) give way, a cry goes up that the levees are a failure. This cry does not proceed, however, from those with the heaviest interests behind the levees. Certain organizations with ends to subserve which the "levees only" system (as they term it) stands in the way of, make as much capital as they can of the few breaks in the levees.

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The Troy Dam, across the Hudson River at Troy, N. Y., is about to be put under construction by the Engineer Corps of the United States Army. As has been noted in previous issues of "Engineering News" (Feb. 1, 1912, p. 220; May 18, 1911, p. 604; Jan. 23, 1913, p. 182), this dam has been the subject of considerable controversy between the authorities of the State of New York and of the United States. Briefly stated, some three years ago the State of New York, through its then constituted officials, transferred all rights which it could be supposed to hold in the water powers at the Troy Dam, to the United States, in return for the building of the dam by the federal government. Some two years later another administration in the state attempted to revoke this contract and for a short period the federal authorities ceased work on the project. In February, 1912, Secretary of War Stimson decided that the State of New York had no authority to annul its previous contract and ordered the Corps of Engineers to proceed to the construction of the dam.

The Spring and Summer of 1912 were occupied in the purchase of property rights at the dam site. In September, 1912, bids were opened for the construction of the dam, but they were all rejected on the ground of too high price. Thereupon the Corps of Engineers decided to proceed to the construction of the dam with day labor. This construction is about to commence, as soon as it is possible to get into place the proper constructing equipment. The construction is in the immediate charge of Capt. Roger D. Black, U. S. A., stationed at Albany, and in the general charge of Col. William M. Black, U. S. A., stationed at New York City.

The new Troy Lock and Dam is to be located across the Hudson River at Troy, N. Y., about 1400 ft. above the old timber crib Troy Dam, which has been in service for many years. It is to be a concrete gravity dam of ogee section, with a maximum height above foundation of 35 ft., and an average height of 20 ft., the difference being due to the variations in the river bottom, which is of Hudson River limestone. The dam is zigzag in plan to provide a longer spillway than the width of the river would provide. There is a single-stage lock on the Troy side of the river; comprising an upper chamber 338 ft. long and a lower chamber 182 ft. long, both between hollow quoins, giving an available lock length of from 300 to 310 ft in the upper chamber and about half that length in the lower chamber. The lock is 45 ft. wide and will provide 16 ft. over the miter sills at the lowest low water, which is 4 ft. greater than the greatest depth provided over the sills of the typical locks in the New York State Barge Canal, for which this lock forms an exit into the Hudson River.

On the west side of the river there is to be made provision for future water power, with immediate power provided for the operation of the locks. It is estimated that 4000 hp. can be developed at this site by the new dam in contrast to about 1800 hp., which is developed at the present Troy Dam.

The controversy between the state and the federal government as to the ownership of future power remains in statu quo. State Engineer Bensel recommended in his last report that the Legislature make some arrangement whereby the State would be benefited by this power, and it has been indicated by previous Secretaries of War that the federal government will be willing to make such an arrangement.

❋

A New Type of Rubber Cushion Tire for automobiles, which is claimed to be as elastic and easy riding as the pneumatic tire, has been developed by the Overman Tire Co., 250 West 54th St., New York City. The tire has dovetailed recesses cut into it from each side alternately. These recesses allow the rubber between them to expand laterally when the weight comes upon each section, so that the total range of motion given by the tire approximates that given by a pneumatic tire. The tire is made of a high grade of solid rubber and is more expensive in first cost than the pneumatic tire. It is guaranteed for a service of 10,000 miles, however, which makes its cost per mile less than ordinary pneumatic tires, while it has the advantage of reliability and freedom from punctures, and it is claimed also that it has a grip on the road surface which makes unnecessary the use of tire chains.

EDITORIALS

A Solution of the Silt-Removal Problem in Harbor Maintenance

Wilmington, Del., as a seaport, had a commerce during the calendar year 1911 amounting to 859,736 tons, valued at $68,647,051.

The amount of money expended on the improvement of the harbor and its connecting channels since 1836, is $1,107,985, of which the sum of $705,363 has been expended since 1896 on the present project for a channel 21 ft. deep. Dredging by ordinary methods has proved a failure so far as maintaining the projected 21-ft. channel depth is concerned, due to the constant and rapid deposition of silt. Practically four times the amount of excavation, originally estimated, has been already removed and, instead of a 21-ft. channel, only an 18-ft. channel has resulted. And, owing to the accumulation of silt, a navigable depth of only 11 ft. has been maintained.

As the problem of preventing the harbor from rapid shoaling by silt deposits is not unique for the case of Wilmington, Major Raymond's article, printed in this issue, will very likely be found of value in solving similar problems elsewhere. That the economical solution of the problem by dredging has been made possible only by the use of a special type of suction dredge, which has not as yet been very extensively employed in the United States, but whose merits for this class of work have long been appreciated in Germany where it has been used for several years, will be of interest to engineers in charge of harbor maintenance work.

The peculiar advantages of the Frühling type of dredge for just this kind of harbor work were set forth at length in our columns more than five years ago by John Reid, Naval Architect, of New York City, and the ability of this type of dredge to cope with the conditions at Wilmington tends to substantiate the statement then made by Mr. Reid that "the Frühling system of suction dredging will revolutionize present practice in submarine excavation in soft materials, such as sand and mud."

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Amateur Engineering in the Newspapers

In a recent letter to the editor of New York *Times* a correspondent writes that he has a valuable suggestion to make. He had long observed that asphalt pavements were very satisfactory, indeed they seemed to him to have but one drawback; they were slippery in wet weather. Happy idea! why not prevent them from being slippery. How? Why so easy it is strange no one ever thought of it before. He would put grooves in the surface by rolling the new pavement with a cleated steam-roller! He hoped the city engineering officials would consider this.

It is unfortunate that one so well qualified to suggest improvements in asphalt pavements did not go more into detail as to how a corrugated steam-roller was going to be managed so as to go back and forth over the pavement always in the same grooves. Nor did he explain how his grooved pavement would have any advantages over a stone block pavement in which the joint filling is worn away.

It would be wasted time, probably, to try to explain to this genius that engineers have for years been trying to eliminate the joints in block paving so far as possible, so as to secure a perfectly smooth surface which offers least resistance to traction and has the least wear.

Again in a later issue of the same newspaper is an article headed in large type "To End Flood Perils by Diverting Water," which begins as follows:

> Carroll L. Riker, the civil engineer who proposed last year that the Government guard Atlantic ship routes from ice by building a jetty across the Grand Banks of Newfoundland, announced yesterday that he had devised a plan by which the Mississippi Valley could be protected from floods.

Mr. Riker's "plan," briefly described, is to create a new channel for the surplus flood waters of the Mississippi, extending from Cairo to the Gulf on the west side of the river. The new channel is to be ten miles in width, and Mr. Riker glibly remarks that the land within this channel "has only one or two minor villages upon it and could no doubt be obtained by the Government for less than $5,000,000 under condemnation proceedings."

Considering that these delta lands are sold at $40 to $200 an acre, Mr. Riker's estimate is perhaps a little sanguine. Not more so, however, than his statement that

> The most difficult engineering job of the problem would be the simple task of forcing some steel tubes through the soft alluvial soil under the Red River.
>
> The tunnel under the Red River is really the secret of the whole proposal. You repeat that tunnel under the Arkansas when you get up that high.

To an ordinary engineer, building tunnels under a river to carry the volume of water delivered by a flood channel ten miles wide might seem a bit herculean; but to a transcendental engineer like Mr. Riker it is merely "a simple task."

If Mr. Riker has any claim whatever to the title Civil Engineer, he would do well to consider that article in the code of ethics, in force in some of the national engineering societies which prescribes that new inventions or projects in engineering work should be spread before engineering societies, or in the technical press before publicity is sought in the newspapers. The contrary course may tend to seriously injure the reputation of the profession in the public mind.

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Lending City Credit to Aid Railway Projects

We commented recently in these columns on the revival, by a North Carolina railroad promoter, of the old scheme of obtaining local aid from towns along the route of a proposed railway, in the shape of bonuses or subscriptions to stock. There has since come to our notice an appeal for local aid on a larger scale which is

being made to the city of Denver. The Denver, Northwestern & Pacific R.R., partially built by the late D. H. Moffatt, has been reorganized as the Denver & Salt Lake Ry., with Newman Erb as President. The City of Denver is asked to aid in the construction of the tunnel under James Peak on the line of this road, which is necessary to its economical operation. As the present charter of Denver makes no provision for a loan of the city's credit for such a purpose, an amendment of the charter is to be submitted to popular vote on May 20, under which, if the amendment is approved by the voters, the city may legally pledge its credit to aid in the building of the tunnel.

As to what the terms are under which the city is asked to lend its credit to aid this enterprise, we have no information, but it may be safely said that with the present-day need for expenditure for regular municipal purposes, there are very few cities anywhere which can safely undertake to borrow money to aid railway or other corporations outside their own borders.

We referred in our recent note, to the fact that many towns and cities are today paying interest on money borrowed many years ago to aid promoters of railway construction schemes. In not a few instances where such local aid was given by towns and cities, the road was never built.*

There are a number of counties in the South and West, where the people have repudiated payment of interest and principal on bonds issued under such conditions. A recent press dispatch reports the case of Dallas County, Mo., which issued bonds to the amount of $235,000 over forty years ago, in the aid of the projected Fort Dupont & Laclede R.R. The road was never built, and the interest which has accrued on the County bonds then issued makes the total amount outstanding over $2,000,000. Holders of the bonds have been for over thirty years endeavoring to enforce payment of principal and interest through the Federal courts, but the state judges in the local county courts have defied the Federal court orders requiring the assessment of a tax levy upon the county, to make a payment on the bonds. Through their failure to obey the Federal Court's orders, these judges have been held in contempt, and warrants have long been outstanding for their arrest and confinement. The judges, however, so far have successfully eluded the Deputy United States Marshal's attempts to arrest them, and are, of course, supported in their position by the public sentiment of the county. There are other counties, we believe, where for years the judges elected to office have been at once arrested and imprisoned, and have accepted their election with the understanding that this would be the case.

Such conflict between the Federal and the State judiciary comes dangerously near to anarchism. It has been well said that evil begets evil. The voting of local aid to railway companies in the period of active railway promotion, 25 to 50 years ago, more often than not was accompanied by corruption on a huge scale. The interests which sought to obtain a vote of city or town or county in favor of local aid, more often than not purchased the support of influential men by every possible means, and upon election day, bought votes by the wholesale at so much a head.

It is no wonder that the present generation repudiates its obligation to pay debts incurred under such circumstances, a quarter of a century or more ago.

It will be well for Denver, or any other city or town, which today is asked to lend its credit in the aid of a private enterprise of any sort, outside its own borders, to consider carefully the disastrous results which have in the past almost without exception followed such misuse of public credit.

*The total county and town aid to railway construction prior to the entire country probably amounted to several hundred million dollars. Johnson's "American Railway Transportation."

New Haven Railroad Financiering

That tangled web of corporation finance which has been revealed to the public in the investigation now being conducted by the Interstate Commerce Commission of the New York, New Haven & Hartford R.R. Co.'s affairs will have great influence in alienating the intelligent public opinion whose support the railways so much need at the present time. We have spoken so recently and so emphatically in these columns regarding the injustice of indicting the chief officers of the New Haven company on the charge of criminal responsibility for railway accidents, that we may the more freely express disapproval of the work which has been done by those in control of the New Haven Co. in complicating its finances.

It is not merely the railway travelers and shippers of New England who are criticizing the officers of the New Haven Co.; it is thousands of its stockholders. These stockholders can recall the time, not many years ago, when the stock of the New Haven, and Boston & Maine, and Boston & Albany, and half a dozen other high-class railways of New England was regarded as a gilt-edged investment. Their dividends were considered as certain a reliance for income as the earnings of bank stock or of conservative New England manufacturing corporations.

Since that time a consolidation craze has swept over New England and its entire railroad system has come under the control of the New York, New Haven & Hartford Co. and the New York Central lines. Coincident with this change has come a steady fall in the prices of these gilt-edged stocks and a drop in the dividend rate or its entire disappearance. Stockholders are not satisfied with the explanation that this is all because railway profits have fallen off because of the increase in railway wages and in the prices of railway materials. They know very well that during the past ten years the capitalization of the New Haven has been enormously increased. The burden of proof lies upon the officers and directors who have been responsible for this increase to show that it was wisely and honestly made.

In view of the revelations made before Interstate Commerce Commissioner Prouty last week, we fear some of the New Haven stockholders will conclude that the company made use of the money raised by its increased capital to purchase cats and dogs. They may have been cats and dogs with a fancy pedigree, but there is such a thing as purchasing them at too high a price.

There are many old-fashioned people who still believe that the best way to run a railroad is to stick to the railroad business and who insist that the stockholders and patrons of the New Haven system would have been better off today if its management had been contented to

do this instead of loading itself up with trolley roads and hotel companies and steamboat lines and all sorts of side enterprises. There are those who contend also that the millions which have been poured like water into the work of converting the main line from New York to New Haven to electric operation has been a bad investment for the New Haven stockholders.

All this tangled web of corporation finance may be capable of explanation; but any such maze of financiering is in itself sufficient to arouse the suspicion that the web has been woven to cover and make impossible of detection the looting of the company's treasury. To put it plainly, the New Haven financial tangle is strongly reminiscent of the malodorous financial jugglery by which thousands of investors in New York street-railway lines were fleeced a few years ago.

We know of business men at the head of large corporations who believe that the abuses of the holding-company system are so flagrant that corporations should be forbidden by law from holding other corporation's stocks. There is no doubt that such sweeping legislation would be a hardship in many cases, since it often becomes desirable for perfectly proper purposes that one corporation should own an interest in another. This much may be said and said emphatically, however, that the abuses of the holding-company system and of intercorporate relations have become so serious that any honestly managed corporation should endeavor to reduce its financial relations with other corporations to the lowest possible limit. The aim should be to keep the business of a corporation so simple that its stockholders can have a reasonable understanding of what their property consists. Those who weave such financial webs as now entangle the New Haven's affairs lay themselves open to the suspicion that they have deceived the people whose property they hold in trust.

Grouting Gravel in River Beds

Some of the older readers of ENGINEERING NEWS may recall articles published in this journal in the early '90's by Robert L. Harris, who died in 1896, describing a system of forcing cement grout under pressure into permeable ground, such as sand or gravel, for the purpose of making it watertight or to add to its sustaining power. Mr. Harris, who was a well known engineer of that time, made a number of experiments and we believe took out patents on the system and carried out successfully engineering works on this plan. A somewhat similar process was described about the same time, in various papers, by W. R. Kinipple, an English engineer who built breakwaters and other structures by dumping riprap or artificial blocks into the sea and then filling the interstices with grout.*

This experimenting and early work was done at a time when cement was comparatively an expensive material. With cement at present prices it would be possible to bury a lot of it in permeable ground, according to this method, if the desired results could be thereby secured. It must be said, however, that neither in dam construction nor in foundations has this grouting system ever been adopted to any considerable extent. The reason can be summed up in a few words. It is that the engineer is never quite certain of these results. When a man's reputation is at stake he is not inclined to run risk for the sake of saving a certain amount of money.

This attitude is entirely proper. Even if in nine cases out of ten, pumping grout into a gravel stratum below the foundation course of an important dam would shut off the flow of water beneath it and make it secure, no engineer will wish to take the risk that in the tenth case water may find its way through between the grouted strata and cause a washout which may wreck the structure. Similar conditions obtain in the case of a bridge pier. Every engineer responsible for the safety of a bridge structure would prefer to see the bed rock laid dry under the piers and the concrete and masonry laid on it in the dry rather than build any other type of foundation. Of course it is in many locations not possible to do this; but pile foundations or cylinder piers will be the recourse of the engineer rather than any experiments on forcing cement into the underwater strata, to go he knows not where.

Nevertheless the grouting process has its field of usefulness; and experiments with it continue to be made. A notable recent case was the work on the Hale's Bar lock and dam, near Chattanooga, Tenn., where it was attempted to fill up the cavities in the limestone strata along the line of the dam site across the river by pumping in grout. According to our best information, the experiment was a failure and it was decided to adopt more certain methods of making the foundation watertight.

In our issue of Apr. 3, Mr. D. W. Cole described the use of the grouting system for closing seams in deep strata under the Lahontan Dam in Nevada on the Truckee-Carson project of the United States Reclamation Service. Here a double line of 2⅜-in. holes was drilled through seamy rock to a depth of 30 to 70 ft. below the trench bottom, the holes being spaced 3 ft. apart in each row, and the rows being 2 ft. apart. The holes were first tested with water under a head of 127 ft. and the grout was then forced in under a pressure reaching 100 lb. per sq.in. until the hole was filled. With such careful and thorough work it may be admitted that small likelihood exists that any unfilled crevices could remain between the drill holes through which water in any dangerous amount could ever find its way.

On the other hand when work is done thus thoroughly, the saving by the grouting process is not great. On the Lahontan Dam, the estimate of the saving made was only $3300 compared with the cost of trenching and filling with concrete to the same depth. Many engineers would prefer the trenching method where the difference in cost is so small.

*Some additional examples of the use of this system are as follows: At the International Engineering Congress held in Chicago, in 1893, a paper by E. Neukirch, of Germany, described a method of solidifying submerged sand or gravel by forcing dry cement through a pipe by compressed air, the agitation caused by the air serving to mix the cement with the mass of material. This process was actually used in some sewer construction.

A more general practice is to use liquid cement grout, and a process of this kind used in France for shaft and tunnel work in water-bearing gravel was described in our issue of June 1, 1911. A similar process used for converting sand and loose stone into monolithic masses in English harbor work was described in our issue of Oct. 17, 1912. A recent application of the same process was at the La Salle St. tunnel under the Chicago River ("Engineering News," Aug. 10 and Sept. 21, 1911). The river tunnel is a twin-tube steel shell sunk in a dredged trench, and a cofferdam was built over each end to cradle the connections to be made with the land or approach tunnels. To make the coffer-dams water-tight at the bottom and around the curved sides of the tunnel shell, before pumping out the water, loose stone was deposited, in which vertical pipes for grouting were embedded. When the stone had been filled to the desired depth, cement grout was forced in by compressed air. The result proved very satisfactory.

It should be emphasized that the Lahontan work was the grouting of cavities in seamy rock. This is a safer and more certain proposition than pumping grout into sand or gravel.

In a paper published elsewhere in this issue are described some quite elaborate experiments recently carried out for the Louisville & Nashville R.R. to determine the possibilities of applying the grouting system to the formation of pier footings in the gravel bar of a river. The experiments are reported in considerable detail and are well worth putting on record for the benefit of any engineers who may wish to investigate the possibilities of this process. We are of the opinion, however, that those who carefully follow this record of experiments will not be favorably impressed with the process as a method of providing foundations for a permanent structure. Even if it be taken as demonstrated that in the hands of an engineer of sufficient experience and judgment a fairly thorough cementation of the underlying gravel can be secured, there is always a chance that carelessness at some point of the job or the presence of a stratum of pure clay or silt instead of gravel may result in a weak place in the structure which may eventually give serious trouble.

The best and most certain results with the grouting system have been obtained where it was applied to seamy rock or to filling the interstices of clean broken stone previously deposited.

But if it is a question of saving cost in making a deep foundation in water-bearing material, most engineers would prefer to dredge out the material and then mix the concrete in the desired proportions and deposit it through the water with a tremie, rather than take the chances of forcing grout into the strata in place.

LETTERS TO THE EDITOR

Some Results of the Cannon Firing on Buildings in Mexico

Sir—Your readers may be interested to see some of the photographs of buildings in the City of Mexico which were subjected to heavy cannon fire during the recent street fighting in that city. Fig. 1 is a reinforced-concrete apartment hotel on the Paseo de la Reforma, built in 1912. The Madero troops occupied the roof of this building and some of them are seen in the picture guarding the windows on the first floor. The windows on the top floor were boarded by barrels and the surface of the concrete wall, which had an excellent smooth finish, was pitted by machine gun fire, otherwise the building was not injured.

Figs. 2 and 3 show the results of 10 days' cannonading on the reinforced-concrete Y. M. C. A. building in Balderas street. This building was erected about 1910. It has a metal cornice with a low parapet of hollow tile above. The exterior of the building was badly pitted by the shots, but the structure received comparatively little injury considering the heavy fire to which it was exposed for several days. The building was occupied by the troops of Felix Diaz, and cannon were mounted on the roof, which did effective work. Fig. 4 shows the damage done in a very short time by Diaz' cannon on the rubble masonry walls of Belem prison, and on the wall surrounding the prison yard, which was built of large pieces of soft stone. The Madero cannon, which were located here, were quickly silenced. Fig. 5 shows the field gun which did this effective bombardment on Belem prison. The gun was placed half a block from the prison at the corner of Balderas St. It is fair to say that the gunners who worked this and other Diaz artillery were under direction of a Mexican officer who received his military education in France and they did remarkably accurate shooting. Fig. 6 shows the cannon lined up before the National Palace. The gunners in charge of these pieces stayed in position behind them for five days after the capture of Madero.



Fig. 1. Apartment Hotel of Reinforced Concrete.





Figs. 2 and 3. The Reinforced-Concrete Y. M. C. A. Building.

R. B.

City of Mexico, March 10, 1913.

The Dayton Flood

Sir—Since returning from Dayton, I have read with interest your accounts of the flood, and they are very accurate. A great deal of thinking is going on as to what caused the flood and how such floods can be prevented.

The daily papers of Mar. 26 and 27 claimed the high water at Dayton was caused by broken reservoirs. It was later found that none of the reservoirs had broken or even overflowed their banks.

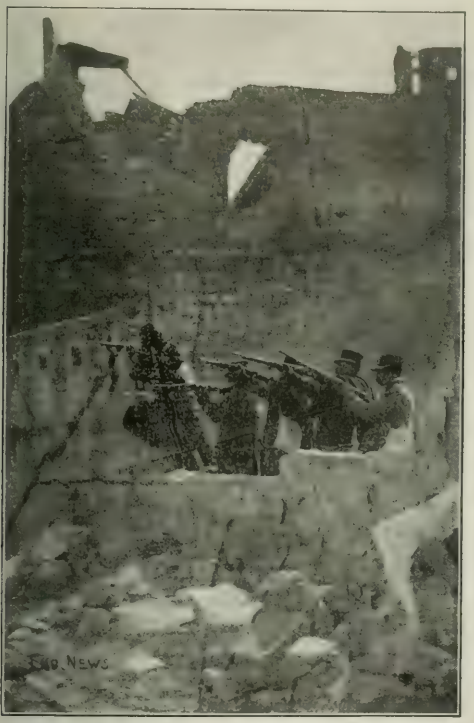


FIG. 4. RESULT OF CANNON SHOT ON BELEM PRISON WALLS



FIG. 5. FIELD GUN TRAINED ON BELEM PRISON

The newspapers told of a "wall of water" which was sweeping down the Miami, in spite of the fact that Dayton and Hamilton, where the worst damage occurred, are over a hundred miles by the river from the reservoirs. It is evident that the reservoirs at their remote location and with their low banks could not create flood conditions even should their banks give way.

This then answers one of the schemes presented for the prevention of floods, for if the reservoirs could not hold enough water to create destruction, they could not reserve enough water to prevent it.

Claims have been made that the flood resulted from encroachments on the river channel and not enough clearance under the bridges. Both of these conditions increased the disaster but cannot be accepted as the main cause.

The flood resulted from the excessive rainfall. The average rainfall in this district is some 50 in. per year. The Miami River drains some 2500 square miles and the contour of the land is such that the water flows off rapidly. The rainfall over this whole watershed averaged 7 in. for the two days preceding the flood and in some places as much as 11 in. fell. The ground was saturated at the start so practically all this rain ran off.

Many wild plans are proposed to remedy the trouble. Agitation of remedies will mean votes for Congressmen. One plan now is to dig a new channel through Dayton two miles long, 30 ft. deep, and 800 ft. wide. It is argued as being feasible in that the "dirt excavated can be used to refill the old channel and so replace building sites destroyed." Of course no mention is made of the buildings that would be wrecked or the cost of the undertaking. Some minor changes in the river channel, of course, will be made.

The damage done is indescribable. The one miracle is the relatively small loss of life. The telephone companies did wonderful service in spreading the alarm but the warning to the poorer people came from an unofficial source. The engineer at the Platt Iron Works left word Monday evening to be called in case the river rose so as to throttle the discharge water from his condensers. He was called before midnight and before 4 a.m. it was evident that the river was going over the levees. He accordingly tied down the factory whistle and let it sound till daybreak. This alarm aroused many people who were thus enabled to reach safety. The water overflowed the levees shortly after 7 a.m.

Prevention of a similar catastrophe, should rainfall



FIG. 6. ARTILLERY IN POSITION IN FRONT OF NATIONAL PALACE

conditions be duplicated, is absolutely impossible on account of expense. However, the levees should be made strong enough for ordinary floods and then trust that this will be the last cloudburst.

H. C. WIGHT.

Commonwealth Bldg., Philadelphia, Penn.
Apr. 26, 1913.

The Bill to License Engineers in New York and the Technical League

Sir—As an old subscriber and one who is interested in the improvement of the status of the civil enginering profession, I wish to defend the bill for the licensing of engineers introduced in the New York legislature, by quoting from your issues of Mar. 27, p. 639, and Apr. 3, p. 680 and 697.

In the first place this bill was introduced by Assemblyman Jesse P. Larrimer, himself an engineer and constructor. Knowing the responsibilities of engineers upon construction work, it is but natural that he should introduce such a measure. The records of collapsing structures that fill your present news columns should be eloquent and convincing proof of the need of such a measure in more states than New York.

The Technical League of Engineers has given this bill the closest of study and it meets with their unqualified approval. The League, it is stated, has a membership of about a thousand engineers in all parts of the country, a large majority being residents of New York. Naturally they see great merit in Mr. Larrimer's bill. They are desirous of seeing proper safeguards placed over public works, for the public benefit, and of having all such civil engineering and surveying work done or supervised by men competent to qualify under the regulations of the State Board of Regents.

Many eminent engineers appeared before the Committee on Public Education, including our worthy State Engineer and Surveyor, Mr. John A. Bensel, advocating the principle of licensing, yet your published articles, above referred to, do not so state nor aim to give this additional truth. Your chief aim appeared to be to belittle the Technical League of Engineers (which you cannot do) and to create false issues to befog the merits of the bill.

Again, is seems strange that you argue "that the proposal to place the whole engineering profession under State control means no benefit to the profession, but a serious injury," when the sentence you quote from the bill says only "——in the designing, construction and engineering inspection of *public works* which require engineering experience," etc., etc., as civil engineer or surveyor.

Again, no greater misstatement of fact can be made than that "the bills which have been introduced and pushed in the New York Legislature appear to be solely due to an organization of which nothing but the name is definitely known, its list of members and its officers being kept a secret." If you refer to the Technical League, it has for some time been incorporated under the New York law. Is that secret? Whoever saw tabulated for the use of unscrupulous politicians or for a list of names of the members of *any* organization? The membership in such a case *must* be confidential lest the list be used to the possible injury of some member not personally at fault in any detail of his work but whose beliefs were in sympathy with the "under dog."

To show the absurdity of your above quoted statement, you say a little further on, "There are, for example, sound arguments in favor of the proposition that those who engage in the work of land surveying should be examined and licensed. Such a thing is entirely practicable and has in fact been carried out in many cities."

Yet this is the very provision and purpose of the present bill, you so badly misquote and attack, viz.: to make it state-wide. The very bill of which you previously stated "there is no public demand whatever for the passage!" Did that result also come about through the "secret" efforts of that organization known as the Technical League of Engineers?

JOHN C. LOCKE.

1880 West Seventh St., Brooklyn, N. Y.
Apr. 10, 1913.

[We give space to the above letter in accordance with our long established policy of giving fair space to both sides of a disputed question. We forbear comment upon it further than to say that so far from misrepresenting the attitude of the various parties at the Albany hearing, our report specifically said:

> State Engineer Bensel said he was in favor of licensing engineers, but opposed to the present bill ("Eng. News," Apr. 17, p. 789).

We may add further that our correspondent *assumes* that the bill which he so energetically defends is a measure for the best interests of engineers. He has a perfect right to his opinion, but he should remember that many other engineers whose years and experience entitle their opinion to great weight and who are as solicitous for the profession's welfare as he can be are convinced that the proposed measure would be wofully disastrous to the engineering profession, and just as much so to the "under dogs" as to the men of higher rank.—ED.]

Sir—I wish to make a few suggestions regarding the criticisms against the Licensing of Engineers expressed in your valuable journal. The fact that the Bill is promulgated by the Technical League, a secret organization and is not desired by the profession at large, is not only untrue but beside the point. The Technical League is *not* a secret organization and the rank and file of the profession have now come to feel that in a License Bill lies the only hope for the future of the profession.

But this is all beside the point; what difference does it make who fathers the Bill? Why not criticize it upon its merits and upon that only?

Again: The object of the Bill is to protect the *Public*, its benefit to the profession is secondary and is a point not considered from a legislative standpoint.

In your editorial of April 3, it is stated that examination of the plans and inspection of the construction of an engineering work would be a greater safeguard to the public than would be the examination of the engineer thereof.

Assume that they were of equal value as safeguards, would it not be better to do both? Is there any objection to having two or even more safety devices on an elevator car? Would not your sense of safety grow stronger in proportion to the number of such devices on the car in which you rode?

But are they of equal value? The examination of plans and specifications also is practiced to a greater or less degree almost universally and yet enormous errors creep through. It is a simple matter to criticise what appears on the plans and in the specifications, but it is quite a different matter to discover such vital points that the engineer, if he be incompetent, fails to consider and here is where most of the trouble lies.

It is more important that a competent engineer lay out the work than that it be checked—and by whom? *Another unlicensed engineer?* The same applies to the inspection of the construction of the job.

MONTAGUE PALMER.

1032 Jackson Ave., New York City.
Apr. 14, 1913.

Sir—I should like to sound a warning note to the profession in respect to the general subject of licensing engineers, and more particularly in respect to the licensing bill introduced in the Assembly of the State of New York and at this writing under consideration by the Committee on Education. The writer appeared before the Committtee on Apr. 1 in opposition to this bill, as one of a Committee of the American Institute of Consulting Engineers and in so doing became acquainted with its objects.

An abstract of this bill was made in your issue of Mar. 27, 1913, which will serve to enlighten those not familiar with it. As is perhaps generally known, this measure or one very similar to it has been actively indorsed, if not presented, by what is known as the Technical League of America, an organization whose membership is presumably secret, but which is understood to contain principally employees of the various engineering bureaus of the City of New York.

In the hearings before the committee, those in favor of the bill were ably represented by competent and experienced counsel, so that it is fair to presume that an energetic and faithful effort is being made by a branch of engineering to secure the passage of this bill, but just for what specific purpose I am unable to suggest. Perhaps it emanates in the thought that the licensing of so called civil engineers will restrict the number engaged in practice in the State of New York, and thereby raise the salaries and better the conditions of those who are now urging the passage of the act.

It seems to the writer that this branch of engineering, which we may safely presume contains a majority of the younger element, is pursuing a false hope. Does not their endeavor tend to lower the dignity and worth of the profession in the "public eye"? It must be remembered in this connection that the general public, and I mean by this the people who have not been brought into business contact with engineers, do not know the difference between an engineer and a rodman or draftsman. In the public mind, anyone is an engineer nowadays who can draw a pen along a straight-edge, do plane surveying, inspect pavements, or tap rivets.

Now, if the bill before the New York Assembly becomes a law, it will permit any person with a slight acquaintance with construction work and preliminary ideas of engineering to obtain a license as a "civil engineer." From the public standpoint, therefore, the young student of a correspondence school or a rodman of three years' experience will become under a state indorsement the equal of the chief engineer of a large enterprise. The result will be that the public will have no means of knowing or judging between the competent engineer who is able to design and construct large works and his youngest and lowest-grade employee.

It appears to me, therefore, that the Technical League of America is acting most unwisely in their efforts to regulate the civil engineering profession. Instead of depending upon individual effort to attain responsible positions through their superior officers and confining their efforts to the discussion and solution of the municipal engineering problems that they are daily undertaking, they are endeavoring to bring about their advancement by legislation.

In the opinion of the writer, if they succeed in passing their license bill, they cannot hope to attain the ends that they seek. Their promotion and their compensation will still depend upon individual merit, experience and ability to hustle, and this evidence will always be interpreted and reviewed by an older and experienced engineer who has risen by such means from their own ranks. The writer speaks from a broad experience in practical work covering many parts of this and other countries in which he has worked as an assistant and as a chief. His experience is now expressed with the most kindly and paternal feeling for the young graduate as well as for the apprentice and others who are not fortunate enough to pursue their preliminary studies in an engineering school. He desires now to remind the younger and rising generation of engineers that there is always "plenty of room at the top" which is gained only by hard work, application to the fundamentals of civil engineering, and the acquired aptitude to handle men, and to warn them that these qualities cannot be obtained by legislation.

Many able and interesting discussions have appeared in your columns on this subject, and reference is frequently made to the fact that other professions are licensed, namely, medicine and law. There is no parallel between these professions and that of civil engineering because in the first place medicine, law and kindred professions are generally, if not always, practiced in one locality. Mistakes made in law and medicine by their practitioners are buried in the court and the grave, and the public never know of them. On the other hand, the engineering profession is country wide and world wide. It is not bounded by a given locality. It is interstate and not intrastate. The mistakes of an engineer are plainly seen, are reported upon by the press, and the public know about them. Engineers, therefore, perform their work knowing that mistakes and even errors of judgment cannot be hidden, and knowing their plans and acts are subject to public view and criticism.

If there is no parallel between the professions, the licensing of civil engineers can only mean one thing and that is lowering the already questionable dignity of the profession. Plumbers, chauffeurs, engineers of steam plants and boilers are now licensed by the state, and if the civil engineering profession is licensed, it tends to put it on the same plane.

The Larrimer bill now before the New York Assembly is of vital interest to engineers outside of New York State. It is with this particular purpose in mind that I am taking up your space, knowing that in no better manner can the engineeers of the United States be brought to a realization of these facts.

The Larrimer bill provides for licensing the civil engineer of "public works." Railroads, private water, gas, electric, hydraulic, irrigating and other plants are quasi-public works. They are recognized as public utilities. If the court should interpret these works built by private capital, together with the steam and electric railroads of the country as public works, the bill means that no engineer from outside of New York State can be employed upon them without obtaining a license from the State of New York. It is true that provision is made in the bill allowing engineers from another state to practice in the State of New York, provided such state licenses engineers and that its requirements for license are not less than the requirements for obtaining a license in New York State. Only a few states at present license engineers, and these states generally license a particular branch of civil engineering such as surveying, or irrigation works. Again the Chief Engineer of the Panama Canal (were he not a military engineer who is exempt from this act) could not practice in the State of New York without a license, nor could an employee of the Panama Canal, or of any of our colonies obtain employment or practice civil engineering in the State of New York, before obtaining a New York license.

I point to only a few glaring objections to this specific bill, with the single hope that all members of the profession both young and old may see the objections to a bill respecting the general subject of licensing engineers and to show why a statute for such purpose should be drawn with the greatest care through the aid of the older engineers, and not by the employees of a City Bureau.

The writer recognizes that perhaps the time has come when public opinion demands the licensing of civil engineers, especially in this state. He does not for a minute admit that the public who employ civil engineers or who come in contact with them so demand, but he does recognize that public opinion probably does demand that civil engineers be licensed, as evidenced by several state legislatures in their efforts to legislate for and against everything and everybody, and by the dissatisfied who appeal to the legislatures. Such being the case, it is quite evident that the engineering profession must awake to the demand of these legislatures and forestall adverse and improper legislation by suggesting legislation of its own.

The engineering profession is represented by the four large national societies, the Civil, the Mechanical, the Mining and the Electrical, in which are incorporated the best minds and characters in the profession admitted only under restricting qualifications. There is also the American Institute of Consulting Engineers, containing among its members the Past-Presidents of several of these societies as well as others of influence and experience in the four branches of engineering. It seems to the writer that these five societies could, through a joint committee, prepare a model bill for the licensing of civil engineers. After the adoption or approval of such a bill by the Societies, it should be placed in the hands of a committee in each state in the Union with instructions to present such a bill to their respective State Legislatures and urge its passage. This procedure would result in a bill molded to best suit the requirements of the many branches of civil engineering. (When the writer here speaks of civil engineers he refers to all engineers except military engineers.) This procedure would also result in a uniform law and stop the possibilities of a different law for each state. The licensing of civil engineers, because of their interstate duties and practice, should be done by a federal law if such procedure were possible.

There is today probably a need for the licensing of land surveyors and irrigation engineers who are employed usually by farmers whose experience does not fit them to properly judge of the qualifications of a surveyor or an irrigating engineer. The stamp of state approval upon these men would be a great advantage to such employers. The writer here only admits the public necessity of licensing only such branches of civil engineering work. He believes and advances the suggestion to the profession that broad civil engineering should be licensed only upon the same terms and qualifications as exist in the National Engineering Societies. He suggests that the licenses should be in two or three grades.

The first grade to be a probationary license to cover the first year's practice in the profession after graduation or apprenticeship. The second grade to cover a junior license with qualifications akin to Associate Members of the American Society of Civil Engineers. The third grade Senior and full license to be granted upon qualifications equal to full membership in the American Society of Civil Engineers.

In the case of two grades, the probationary period might be made longer and the full license given after such period. The writer believes that written examinations for a license are not advisable because of the fact that the younger mind, not burdened with the general responsibilities incident to the profession, can probably pass a better examination than the older and experienced engineer, or again the man with the photographic mind but without practical aptitude may pass such an examination more easily than the older members of the profession.

This may bring before the profession the suggestion that it would perhaps be wiser to have the qualifications for licensing merely that the applicant must be a corporate member of one of the four national engineering societies. This is already done in the province of Quebec and while it may not appeal to the public at large, as tending toward discrimination, nevertheless, it has the distinct advantage of throwing the responsibility of licensing an engineer as competent entirely upon the profession where it should belong.

Finally, I would make a direct appeal to those engineers who have hoped to better their position by legislation to heed the old railroad sign, STOP, LOOK AND LISTEN and depend upon their profession to assist them instead of state legislation.

The writer is in the most hearty sympathy with those civil engineers who feel that the engineering societies, and especially the American Society of Civil Engineers has done little or nothing to advance their interests. The writer is well aware that the American Society of Civil Engineers needs an awakening in its management and in the conduct of its affairs so far as they relate to the assistance of the profession at large and its individual membership.

It is truthfully said that the only benefits of membership in the American Society of Civil Engineers is the receipt of a few publications, the value of which is yearly deteriorating, and the honor connected with membership.

This is the oldest and richest society of all, and that it should do something to assist and benefit its entire mem-

bership is evident to many of its members. It could work in no better cause than in the accomplishment of beneficial legislation in behalf of the engineering profession.

As evidence of its supineness in the particular instance above suggested, it is enough to say that the Society was not even represented at any of the hearings held in Albany on the above bill. The writer is of the opinion that if the American Society of Civil Engineers will interest itself in assisting its members, not only in legislation in the various states but also in the general problem of maintaining ethical standards and a code of fees and compensation, bills such as the Larrimer bill in Albany would never be presented. We have passed the age of individual effectiveness and we are in an age where organized efforts of an association can alone accomplish results.

F. A. Molitor.

35 Nassau St., New York City.
Apr. 10, 1912.

Sir—There has been much discussion of late on licensing engineers and I would also like to express my ideas upon the subject. The agitation for licensing engineers has been started and backed by an organization composed entirely of engineers under the civil service. These men, not being satisfied with their "hard labor" of six hours a day at fat salaries, are trying to get up a sort of barrier in the form of this license system so that they will have as few competitors as possible in the future. They claim that they want to help the engineers and bring them onto the same level as the doctor or lawyer; but can any of these men say that the medical, dental or legal profession is not overcrowded? It is stated on good authority that the average income of a lawyer is $600 per annum.

If one of the men backing this bill had a sudden toothache or headache he would go to the nearest dentist or doctor, not waiting to find out his reputation; but if that same man were about to build a bridge or a steel-frame building, he would stop long enough to find out, either through recommendation or reputation, the kind of engineer this or that man is before he would entrust to him the design of a structure costing hundreds of thousands of dollars. The engineer who got that contract would get it not on account of his license but on account of his experience and reputation.

The license system does not fit the engineering profession for another reason; and that is because 90% of the engineers are hired and not only hired by the week or month or year, but there are reputable civil engineers who hire men by the hour. The profession will not be helped a bit by a license, it will only add an extra burden of taxation on a man who is trying to earn his living. In the design and building of large engineering structures, especially in New York City, the engineers who are depended upon are usually men of long experience and a license is not needed to protect the public.

Morris Whinston.

Brooklyn, N. Y., Apr. 30, 1913.

Sir—Please allow me to express my opinion in regard to the advisability of licensing civil engineers.

My understanding is that the object of state licensing is to protect the people from inferior engineering work by allowing only licensed engineers to practice independently or in an advisory capacity.

To secure a license a man must graduate from college and work under some licensed engineer for two or three years. He will then have the idea that it is below his dignity to be a hireling and will open an office as a consulting or contracting engineer. But will he be any more qualified just because he holds a state license?

At present, a man continues to do good work and employs conservative methods while working under the supervision of a competent engineer; at the same time he is better fitting himself for complete responsibility and is not bringing the chances of an inexperience often dangerous to life and property.

I think licensing engineers would only increase this danger of lack of experience and lower the standard of the engineering profession instead of raising it as is the hope of the license advocates.

The practice of licensing doctors of medicine is often mentioned. They spend the same time to secure a license as will be required of the engineer. But is every licensed doctor fully competent to practice? Should not many still be under the supervision of older heads?

Are all lawyers competent to decide questions of note just because they have been admitted to the bar of the state and hold a license?

Bruce L. Cushing.

Kenmore, N. Y., Apr. 26, 1913.

Sir—The discussion, both editorially and by communications in the technical press, relating to legislation intended to regulate the practice of engineering seems to be largely based upon the assumption that the object of such legislation is mainly sordid, intended to protect the engineer from improper competition, and the public from imposition. Perhaps this trend of the discussion is due to the fact that most of the legislation that has been proposed or enacted in this and other states seems to be predicated upon such motives.

In so far as this is true, opposition to such legislation is warranted by engineers who have at heart the best interests of what we like to call our "profession." We cannot afford to ask or accept legislation that savors of what is usually associated with trade-union ideas or methods.

Furthermore, we do not need legislation of this character. The number of engineering pretenders and quacks is not large enough to seriously affect the business of the legitimate engineer. Nor does the actual loss caused to the public at large through the employment of quacks justify legislation of this kind. The fact is, that the greater part of such loss is due to the incompetence of those whom most of the proposed laws would "license" as engineers.

The fact that the measures so far proposed are unsatisfactory does not prove, however, that proper legislation for the recognition and regulation of the practice of engineering is not needed and would not result in great benefit to the profession and to the public. But to be acceptable to the better element in the profession it must be cast upon a high plane, free from sordid or mercenary motives, and have as its main object the elevation and honor of the profession, and its highest usefulness to the public. Its leading motives should be:

the legal recognition of Engineering as a profession, the establishment and maintenance of high professional standards, provision for the control and regulation of professional practice in accordance with the best moral and ethical ideals, and the clear definition and establishment of the relations of engineers to each other and to the public. These objects cannot, it is true, be attained by legislative enactment; they can only be brought about by the efforts of the profession itself. But the law may confer the necessary authority and provide the machinery that will enable the profession effectually to work toward these ends.

The legislation necessary for this purpose would be brief and simple. It should be confined to the creation of a body or board, composed of members of the profession, and the clothing of this board with power to devise, ordain and enforce a system of internal government and control by and for the profession; together with the necessary details for the appointment, organization and operation of the board. The members of the board, while nominally appointed by the Governor, would be nominated by the profession itself through suitable methods and machinery. It would thus be a representative body actually selected and controlled by the profession.

Subject to the constitution and laws of the State, this representative board would prescribe the terms of admission to practice, enact rules and regulations controlling professional practice and conduct, and define the relations of practicing engineers to each other and to the public. It would prescribe and enforce proper penalties for professional misconduct, and initiate and promote the public trial and punishment of professional offenders against the laws or good morals. It would be the recognized official head of the profession in its dealings with the State and the Public, thus establishing a responsible relation between them that is not possible under present conditions.

Since the members of this board would be selected by, and amenable to the profession itself, and would undoubtedly be men of the highest personal and professional character, chosen with special reference to the duties that would devolve upon them, such a board could be confidently depended upon to organize and administer the affairs of the profession along broad, wise and prudent lines, and to adapt its action to the conditions that might arise from time to time.

This would be difficult if not impossible if the law itself undertook, as most of those proposed do, to establish rigid rules of admission, practice and conduct. It would be particularly difficult if the administration of the law were placed in the hands of a body of men who were not engineers, and therefore incapable of judging what is best for the interests of the profession. As well might the State enact a law placing the control of the medical profession in the hands of a body of lawyers.

Time and space does not permit more than this brief outline of the writer's idea of a scheme for the public recognition, organization and administration of engineering as a *bona fide* profession. He has devoted a good deal of thought to the subject and believes that it would be found workable, adequate, and highly beneficial to the profession and, incidentally, to the public. Of course, its details would have to be worked out with great deliberation and care. We can well afford to take the necessary time to do this. The thing of most immediate importance is to oppose and defeat any attempt at hasty and ill-considered legislation that would, almost surely, be an obstacle in the way of real progress.

S. WHINERY.

95 Liberty St., New York City, Apr. 14, 1913.

The Organization and Functions of a City Planning Commission*

BY WILLIAM A. MAGEE†

Perhaps the chief handicap to a city planning commission in its early days is its undeveloped relation to other forces engaged in the management of the public business. Besides the city officials (with their powers well defined by statute and ordinance), there are the public-service corporations, solidly intrenched behind their legal rights; and also those important adjuncts to civic advance, the many organizations composed of public-spirited citizens devoted to particular reforms and improvements.

The location and design of public works are initiated by the executive department but are subject to the veto of the legislative branch of the city government. But the responsibility for their economic and efficient coördination is not assumed by either department, except in a nominal sense, although abstractly speaking it undoubtedly rests upon both.

Difficult aspects of the problem present themselves in the consideration of the relations of a city-planning commission with the public-service corporations. The passenger railways must be extended and the service improved; rapid transit introduced, the facilities for freight transportation increased, and the cost of the same reduced by the competition that will result from the extension of additional trunk lines to the city. The terminals of all kinds of transportation agencies, whether by rail or by water, must be enlarged and bettered. If these developments are not in harmony with all other physical reforms the city plan will be considerably marred. The corporations, however, are engaged in business for profit and most other considerations are subordinated thereto in the minds of their managers. But they can be induced to submit to this conception of local government embraced in the ideals of city planning.

Turning now to such subjects as playgrounds and recreation centers, bath houses, libraries, industrial and model dwelling sites and buildings and city ornamentation. Whatever progress any locality has made in this field is due to that new class of social forces which embraces what we call civic improvement associations. These pioneers are rapidly leading the way to a vast extension of municipal policy. In the spirit of public philanthropy or other sentiment they are able to construct and even maintain useful and ornamental public works.

The city planner is embarrassed also by a territorial division of powers. Besides the sovereign state there are counties, cities, boroughs, villages, towns and townships. The entire area both within and without the corporate limits must be planned as a whole regardless of the number of governmental units now contained within it. Sooner or later, either through annexation and consolidation or through the medium of a metropolitan district, there will be essentially a unified government. In the meantime thoroughfares must be connected, transportation extended and improved, wasteful duplications in water-supply and sewage discharge reduced. All this is for the alleviation of present conditions and to avoid as far as possible the expense of correction when the day of the single government arrives.

The central idea of city planning must be comprehensiveness of design and coördination in execution. If this is lost sight of, the city planning commission and its purpose are in danger. In its early days let it not specialize, except where it must do so; let it not originate where a beginning has been made by some other body, official or unofficial; let it not investigate so much as stimulate others to investigate; and let it not criticize so much as sympathize.

The commission must have the respect and become essentially a part of the bureaucracy and therefore should receive its appointment from the executive. Since it must have the respect of the public-service corporations, of the voluntary societies and of the authorities of neighboring precincts, it should receive its powers from the legislature. Public

*Abstract of a paper read at the City Planning Conference, at Chicago, May 5-7.

†Mayor, Pittsburgh, Penn.

opinion must be moved to cause the enactment of laws, therefore the membership should be composed of citizens of influence. The number of commissioners and the subordinate force employed need not be large. Although the commission in the main will be composed of laymen, a member trained in civil engineering and one in the law would be of very great value.

After the organization of a city planning commission the first step should be to obtain the aid of a professional adviser. Then survey the whole situation and catalog all the elements involved; the public officials, the corporate officials, the civic societies, the municipal finances, and the required legal powers. After this survey is completed certain forces must be set in motion to lay the ground for the exercise of the functions of the commission on a broad scale. The first aid to the commission will be the public and personal interest aroused in its favor. Therefore, it would be advisable to carry on a well organized campaign of publicity.

Unless the economics of city planning are well developed in its early stages the plans will come to nothing, and therefore as rapidly as possible the enactment of laws should be procured containing the principle of local assessment, public ownership, and the use of the municipal credit in the construction of public works and self-supporting public utilities; and lastly, at the proper stage of development, the commission must obtain the veto power over all plans and designs.

The planning commission will have difficulty is establishing relations with the suburban officers, who are suspicious of annexation and possess inferior financial resources. The solution of this situation seems to lie in the metropolitan district, although it is not an easy accomplishment. In the meantime, representation in the membership of the commission may to a considerable extent open the door to co-operation.

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Lighting the Operating Tunnels and Machine Rooms of the Panama Canal Locks

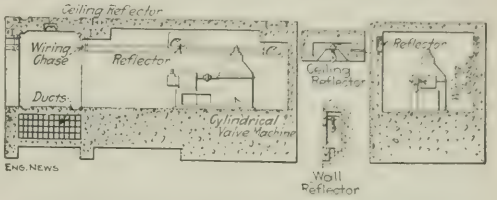
In the *Canal Record* of Feb. 26, 1913, is outlined the progress of work in the design of equipment for lighting the operating tunnels and machine rooms in the canal locks. Recent experiments at the Pedro Miguel locks are reported to show the superiority of the arrangements adopted. Five points were studied in particular: (1) The feasibility of concrete reflectors; (2) the general arrangement of lamps and reflectors for the sort of illumination needed in the inspection and cleaning of machinery; (3) advantage of tungsten-filament lamps; (4) the advantage of whitewashed walls; (5) general character of illumination.

When concrete reflectors were first proposed it was urged that the steel reflectors, covered with vitreous enamel,, could be secured in the United States and would be better. Bids were received on such equipment, but the proposals were unsatisfactory (1) as to price and (2) as to the arrangement of lamps in the shades, so that the concrete reflectors were reverted to.

Difficulty in the tunnel lighting was occasioned by a low head room of 7 ft. Lamps have been placed on 15-ft. centers along the longitudinal axis with alternate lamps on different circuits for economy in operating service. The reflector is simple, consisting of inclined surfaces at the four sides to throw the light flux in proper directions. They are fastened into recesses in the ceiling, as shown in the accompanying figure. About 2100 of these are required.

The machine rooms are individual chambers opening into the operating tunnel. Each houses special remote-controlled motor-operated trains of gears, etc, and the lamps could not be placed at the most desirable points in the ceiling on account of the large covers and manholes which permit hurried access for cranes through the decking. Side-wall illumination was necessary and every effort was made to shade the eyes of the workmen from direct rays. A concrete reflector somewhat similar to the ceiling type is grouted into the wall recess. The front shade, however, has a semi-circular opening at the bottom, which permits the reflection of flux outward, but sufficiently shades the direct vision of the lamp.

On trial it was found that the tungsten-lamp illumination with expenditure of 100 watts power per room



Arrangement of Tunnel and Machine-Room Lamps, Panama Canal Locks

was superior to carbon-filament illumination with 220 watts.

By whitewashing the walls of sections of the tunnel and of the machine rooms it was found that diffusion of light was improved and sharp shadows were eliminated. All of the reflectors are now whitewashed but it is expected that this will be changed to a more durable white enamel later.

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A Coöperative Forest Demonstration and Experiment Farm is to be operated jointly by the New York State College of Forestry and the Agricultural Department of the New York Central R.R. The experiment will be carried on at the New York Central Experimental Farm No. 2, which is located along the right-of-way of the railroad at North Chittenango, N. Y. The work will begin in the spring of 1913, by the planting of some 15 acres of lowland to white ash, tulip or white wood, Norway spruce, bald cypress, American tamarack and other varieties of trees. Some of the varieties were chosen for general experimental purposes. In a bulletin issued by the College of Forestry, which it should be understood is connected with Syracuse University, attention is called to the fact that European railways are now depending largely upon softwoods or conifers for ties. These softwoods grow rapidly and the ties are treated with preservatives before being used. It is thought that the treated softwood ties rapidly grown as outlined may be cheaper in the long run than hardwood ties, even though it is necessary to use tie plates and screw spikes with the softer wood.

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Capitalization of Franchises seems to be permitted in a recent decision of the Public Service Commission of Maryland. The case is that of the Consolidated Gas, Electric Light & Power Co., of Baltimore, requiring it to put into effect a net rate for gas of 80c. per 1000 cu.ft. and a primary rate for electric energy of 8.5c. per kw.-hr. with a minimum charge of $1 per month. In fixing these rates the Commission did not accept the valuation of the company's property by the company's experts (Ford, Bacon & Davis, of New York), $27,485,102, nor the valuation made by the commission's expert (Prof. E. W. Bemis), $15,512,610. A deduction of $5,133,576 was made from the company's figures, and the Bemis figure of $2,016,056 for depreciation was allowed, making the final accepted valuation $20,335,430. Additions of $1,081,984 were allowed to bring the valuation to June 30 last, and $5,000,000 for "easements," making the grand total $26,417,414. Against this is outstanding approximately $44,000,000 in securities. This figure was allowed for "easement" since the company was taxed that amount for the same, and the Commission ruled that it had to value them at such a figure. The Commission recommended that the company adopt a sliding scale for the future adjustment of rates.

Government Aid in Land Drainage*

By Arthur E. Morgan†

In considering whether the federal government should assist in reclaiming swamp and overflowed lands, it is difficult to arrive at a sound conclusion by discussing the subject in the abstract. We can clarify the situation by determining how this policy will work out in a typical case. The St. Francis basin, in Missouri and Arkansas, has frequently been cited as an example of the need for government assistance. Let us consider the matter with reference to this territory.

The St. Francis basin covers about 2,500,000 acres in southeastern Missouri and northeastern Arkansas. Some of the most fertile and highest-priced lands are located here, and there are several hundred thousand acres which now produce crops and which have a market value ranging from $75 to $200 an acre. The remainder is mostly covered with hardwood timber, the timber alone having a market value of from $10 to $40 an acre, depending upon the extent to which the land has been cut over. The greater part of the land on which crops can be raised without further drainage is now in cultivation, and the development of the remainder must wait for the completion of extensive drainage systems.

If the federal government is to pay for the construction of these drainage systems, several serious problems are to be considered. First, there is the question of ownership. Wealthy companies own tracts of approximately 100,000 acres each and probably 75% of the lands now needing reclamation are held in large tracts varying from a few thousand to 100,000 acres. If the lands are to remain in the same ownership, it is doubtful whether Congress will authorize spending millions of dollars in reclamation work, the principal result of which will be to increase the profits of these large owners.

On the other hand, it is doubtful whether these landowners will be willing to relinquish ownership of their lands for the sake of having them drained by the Government. In the St. Francis valley the complete reclamation of all of the swamp lands will cost (on an average) somewhat less than $10 an acre, exclusive of the cost of the Mississippi River levees. Most of the lands which are held in large tracts were purchased by the present owners at from $1 to $5 an acre. After thorough reclamation, and before being put into cultivation, they have a market value of $20 to $50 an acre, withdh the purchaser still to pay the cost of drainage, which (as a rule) is left as a tax or mortgage on the land. Under these conditions there is a clear profit of $15 to $40 an acre to the owners.

ARGUMENTS AGAINST DRAINAGE WORK BY THE GOVERNMENT

This brings us to the question whether it is feasible for the U. S. Government to undertake this work, taxing the cost against the lands which will be benefited. The first difficulty is that the U. S. Government has no authority to take such action, this power being delegated entirely to the States. This difficulty can be obviated, in theory at least, by coöperation between the federal and state governments.

The question next arises as to who shall decide whether certain lands shall be reclaimed. Under practically all State drainage laws it is left to the landowner to determine whether he considers drainage feasible under the existing physical and economic conditions. Practically all drainage projects are initiated upon petition of landowners. If the Government is to pay the cost in the first instance and to collect it later from landowners, we must decide whether drainage projects are to be undertaken at the request of landowners, or when some Government official decides that it is time to drain the land and to assess the cost against the owners.

In the St. Francis basin, practically all the territory in Missouri and a large part of that in Arkansas, has already been organized into drainage districts, and contracts for the construction of reclamation works have been let. What is to become of these existing organizations should the U. S. Government undertake the reclamation?

Taking the country as a whole, the drainage of swamp lands is keeping pace with the actual demand for these lands when drained at the prices which are charged for them by the owners. If the Government were to undertake the reclamation of those tracts where reclamation by state agencies has not been commenced, it will be found that the Government will be left with many of the poorest and least profitable projects. For instance, at the extreme lower end of the St. Francis basin there is a territory which cannot profitably be reclaimed until the market value of land is much greater than it is today. The same is true along the lower Red River in Louisiana, and along the outlet of many of the smaller streams which empty into the Mississippi River. In some other parts of the country, as in parts of northern Minnesota, the cost of drainage is small, but the soil when drained is almost worthless.

It has been stated that the U. S. Government must undertake the drainage of the St. Francis basin because it is an interstate problem and cannot be handled otherwise. The best answer to this is an examination of the conditions as they exist. The eastern part of the basin is in the watershed of Little River, which covers somewhat more than a million acres. All of this territory in Missouri is now organized into drainage districts and the reclamation has been completed or contracts for its construction have been let. In Arkansas, likewise, nearly all of the Little River watershed is organized into drainage districts or is in process of organization. The plans for the improvements in Missouri and Arkansas are worked out in such a manner that they will coördinate without conflict of interests. Of the lands overflowed by the St. Francis River itself, almost the entire area has been organized into drainage districts, and contracts for the greater part of the work have been let. Of the land along the state line, concerning which there might be interstate problems, over half is owned by the American Sugar Refining Co. (through the Great Western Land Co.), and most of the remainder is owned in fairly large tracts. There is little if any conflict between the projects on the two sides of the line.

It may be noted that this tendency toward coöperation in the case of land lying along state borders is general. Where the overflowed lands of Texas and Arkansas meet along the Red River there has been complete coöperation between the interests of the two states. The district on the Arkansas side is paying about half the cost of the improvement in Texas, that being an approximately equitable apportionment of the expense.

If it should be held that it is the policy of the U. S. Government to promote drainage projects where small ownerships predominate, it will be found that this leads to taking part in inumerable small drainage projects in all parts of the country.

THE PROPER FIELD FOR GOVERNMENT ASSISTANCE

There is a large and very profitable field, however, in which the U. S. Government can coöperate to the very great benefit of the landowners, and at comparatively small expense to the nation. A critical examination of drainage developments which have been carried leads to the conclusion that a vast amount of money is being wasted because the engineering principles have been very imperfectly developed. There are two or three departments of the U. S. Government which could be engaged very profitably in working out by experiment the hydraulic principles upon which our reclamation plans must rest.

Up to the present, these departments have limited their efforts largely to promoting particular drainage projects, and the attention of some branches of the Government service has been directed largely to complying with requests of Congressmen for assistance in their districts. If half of the money spent in this manner were well spent in working out experimentally the principles of drainage engineering, and in securing engineering data (such as the run-off of drainage areas, the capacities of channels, and economic types of construction) the information secured would enable reclamation works to be planned with much greater efficiency.

Moreover, it seems possible for the U. S. Government to be of great financial asistance to drainage development, without great cost. As drainage districts are usually financed, one of the greatest burdens to the landowner lies in the tax due to interest charges on bond issues. Drainage bonds usually bear interest at 6%. If such bonds were guaranteed by the Government, the rate of interest would be reduced to 3% or less, and the landowner would thereby be relieved of about a fourth of the total cost of the improvement.

If such a plan were adopted, it would be necessary for Government engineers to pass upon and approve the plans of any district desiring aid in this manner. And as it is frequently impracticable to plan the drainage of isolated tracts he would be desirable to make complete surveys of large areas, the greater part of which requires reclamation. It would probably be desirable also for arrangements to be made with state governments, whereby in return for guaranteeing the interest on reclamation bonds, the U. S. Gov-

*Abstract of a paper read before the National Drainage Congress at St. Louis, Mo., April 10-12.

†Morgan Engineering Co., Memphis, Tenn.

ernment should take a first lien on the lands to be reclaimed. By this method of coöperation, the U. S. Government would be enabled to give very material assistance, which would in fact amount to bearing one-fourth of the total expense of reclamation, as it is at present carried on, and this could be done with reference to drainage improvements in all parts of the United States with absolute impartiality, and the cost to the United States Government would be nothing beyond the cost of administering the service. Even in this respect the service could be made self-supporting. Such a plan would be a practicable application of a system of rural credits.

Not the least benefit of such coöperation would lie in the examination of drainage plans. While the Government engineer cannot have the same intimate knowledge of local conditions and factors entering into the preparation of plans as has the efficient local engineer, yet in passing on such plans, engineering errors can to a very considerable extent be eliminated. There is probably no field of construction in the United States where so large a part of the investment is usually lost through faulty engineering, as in the construction of drainage improvements. The engineering supervision here outlined would eliminate a large part of that loss.

If any community can have its land drained without cost, by bringing sufficient influence to bear on the Government, the demand for assistance will bear practically no relation to the merit of the situation. On the other hand, if the landowner must pay the bill, and if the assistance of the Government lies simply in reducing the rate of interest on a loan by guaranteeing the bonds, the reclamation of swamp lands will be held to a business basis.

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Tests of Grouting Gravel in River Beds

By H. H. Cartwright*

SYNOPSIS—The injection of cement into sand and gravel to form concrete in place has been suggested many times and has been employed in some cases. The accompanying article describes some interesting experiments made with such a process for the purpose of ascertaining the possibility of its use for forming foundations of bridge piers, etc., in river beds composed of sand and gravel deposits. They are perhaps the most extensive experiments of the kind that have been made.

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In the whole field of civil engineering construction there probably is no greater opportunity of effecting economy than by reducing the cost of masonry foundations, where solid rock cannot be found at a suitable depth. The customary caisson and coffer-dam methods are expensive, as is also the spread-footing method, where only soft material can be found. A process experimented with at Nashville, Tenn., during 1912, was that of forming a foundation stratum at the proper depth by forcing cement grout into the soft foundation material by means of compressed air.

The Foster-Creighton-Gould Co. was fulfilling its contract to build a new bridge, about 2800 ft. long, across the Cumberland River at Nashville for the Louisville & Nashville R.R. The location is at a point on the river known as the "Nashville Island." This island is a gravel bar, which during low water has an area of about eight acres. The thickness of gravel is from 12 to 24 ft. to bedrock. It was decided that this point would be an excellent place to carry on investigations to determine whether gravel in place could be solidified sufficiently to support heavy structures. Therefore the above contractors were requested by the railroad company to do the work and the writer was instructed to supervise and report.

Before attempting any experiments, all the information that could be obtained readily was studied, but this information was scarce. It was found that in possibly two or three instances successful jobs had been made by forcing cement into crushed stone under a head of water, where it would have been impossible to have deposited concrete in the usual way, due to the inaccessibility of the work. In all cases perforated pipe had been buried in the stone and enough cement grout had been injected to fill the voids, thereby making a solid concrete. But as far as known, to make concrete by forcing cement through pipe driven into a natural gravel bar had not been attempted.

Knowing that the theory of making good concrete is to thoroughly fill all voids in the aggregate, the problem was to find out how nearly this could be approached by the proposed method when the voids in the gravel are already filled or partially filled with silt and fine sand, as is nearly always the case in a sand and gravel bar. It was also desired to determine under what head of water it would be possible to eject grout from the pipe, and to compare the concrete formed at the various depths.

One foreman and his gang, with the necessary machinery and other equipment were kept on the experiments 3½ months. Every possible condition was tried out in nine experiments. Several of these were minor tests made simply to gain sufficient working knowledge to proceed with those made on a larger scale.

Equipment

The equipment essential is that for mixing the cement, conveying it and forcing it out, driving the discharge pipe and pulling the pipe. On the first test the outfit was rather crude, but was constantly varied as we proceeded and as improvements suggested themselves. An air compressor capable of supplying 100 cu.ft. of air per minute and an air reservoir of 30 cu.ft. capacity furnished air for mixing, conveying and forcing the grout.

The grout was mixed first in mortar boxes, and later in a MacMichael pneumatic concrete machine.† For the first test, an air drum, made at a local shop, was used. This consisted of a 36-length of 12-in. pipe, capped at the bottom, with flap door at top operated by hand, and having in the drum three openings (one discharge and two inlets). The grout, having been mixed, was poured into the drum, the flap raised and air turned on for forcing out. A pressure indicator was attached so that it would be possible to note by the action of the needle whether the batch had been discharged. The drum was later used in connection with the pneumatic mixer, which did the mixing while the drum provided for the conveyor. The pneumatic mixer is a drum of 8 cu.ft. capacity, having a discharge opening at bottom and two air inlets, one for mixing and the second for discharge pressure; the former inlet is located at the bottom of the machine and the latter near the top. When the flap door at the top is open the air entering at the bottom of drum causes

*Assistant Engineer, Louisville & Nashville R.R., Winchester, Ky.

†"Engineering News," Aug. 10, 1911.

the cement and water to "boil" violently, thereby thoroughly mixing the ingredients. Later on, the small drum was discarded when it was found that the MacMichael machine would do both the mixing and conveying. This machine is shown in Fig. 1.

Black pipe, of 2-in. diameter, was used for driving into the bar. A standard well point, Fig. 2, screwed into the lower end of the pipe, served as a drive shoe and the perforations in the point afforded discharge area. The pipe is objectionable due to its inability to withstand the driving and pulling strains. This was supplemented



FIG. 1. PNEUMATIC DEVICE FOR MIXING CEMENT GROUT AND FORCING IT INTO GROUTING PIPES

FIG. 3. DRIVING 2-IN. GROUTING PIPES WITH A HAND-OPERATED HAMMER

by a set of hollow steel drill rods which were stiff enough to be driven with a 1000-lb. hammer. With this outfit the driving problem was solved, but the inside bore of the rods was so small that the grout could not be forced through rapidly enough to make their use practicable, therefore the 2-in. pipe was again resorted to. For pulling the pipe, long timber levers were used at first, but as this was a slow method, a derrick and hoisting engine were substituted. The best rig used for driving the pipe was a 175-lb. wooden hammer in leads. The hammer was operated by men pulling a line attached to the hammer and run through a sheave on the derrick boom overhead, as shown in Fig. 3.

FIRST EXPERIMENT

The following experiment was made at a point on the bar where bedrock was 23 ft. below the surface and where water level was 8 ft below. In order to be able to view the concrete, the grouting was done on the circumference of a circle, and the center core of gravel afterwards excavated. By this method a buried hollow cylinder of concrete was formed. An analysis of the gravel indicates the following proportions: coarse gravel, 12%; very fine gravel, 34%; sand, 44%; silt, 10%. This shows that the conditions were very severe. Since concrete of fair quality was made from the above described aggregate, there is no doubt that very good concrete can be formed in the average gravel bed.

As shown in Fig. 4, 16 pipes (2-in. black pipe), approximately 3 ft. apart, were driven into the bar on the circumference of a 15-ft. circle. Each pipe was in four sections, each section 5 ft. long with a standard well point 2.5 ft. in length screwed into the lower end. The pipes were all driven to rock, and were kept open while being driven by means of water and air hose. Water was turned into the pipe through one of the hose and forced out by the other hose carrying air from the drum. Cement grout was supplied to each pipe on the assumption that around each one should be formed a cylinder of concrete 4 ft. in diameter. The perforations in each well point covered a length of 1.7 ft., therefore to inject five sacks of cement each time the pipe was raised 1.7 ft. should have given a solid wall of good concrete.

Around the drum was built a 10x10-ft. platform, 4 ft. high, on which were placed mortar boxes. This method of mixing was very tedious so we connected an air line to the MacMichael machine and used it as a mixer, conveying the grout to the drum by air. An indicator on the air machine served to tell whether the batch of grout was being discharged, or whether the drive pipe was clogged. An average pressure of 20 lb. was sufficient, but often 60 lb. would not clear the pipe. In this case it was necessary to insert into the drive pipe a small water hose and jet the well point. One batch of grout was made of 1 sack of cement and 3½ cu.ft. of water, which mixed almost instantaneously in the pneumatic machine to a consistency of rich cream.

With all the pipes driven to rock, the grout hose was attached to each successively and the proper amount of cement shot in. Then each pipe was raised. This process was followed until all the pipes were extracted from the ground, except those that could not be pulled and had to be abandoned. When any pipe was left open at the top and air was turned into another, water was forced out of the open pipe, sometimes 40 ft. high. This indicated that there was good underground communication. This would occur at a pipe 10 ft. from the one through which air was being admitted.

There were 582 sacks of cement used with this test. It took eight men five days to deposit roughly 120 yd. of concrete, because the minor difficulties were many. Pulling the pipe gave more trouble than anything else. Four men using a 20-ft. lever (a 6x6-in. timber) pulled the

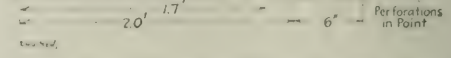


FIG. 2. WELL POINT ON END OF GROUTING PIPE

pipe, but the process was slow. Several pipes were broken off due to threads stripping.

The ground water level was 8 ft. below the surface of the bar. After the pipe was raised to this elevation it took only about 15 lb. pressure to eject the grout. It could be seen that the grout was covering the entire area of the circle, as the gravel near the center quaked noticeably. Injecting the grout below the water level had compacted the sand and gravel, which had sunk, leaving at the water level a very porous layer that could be easily

penetrated. At this level was found the best concrete. When excavation was started, practically no concrete was struck until a depth of 1 ft. was reached, and from four to eight feet was solid clear across. It was very hard to break this out with picks. The concrete was in reality a cemented gravel and was not very well bonded, due to a film of mud surrounding each stone of the

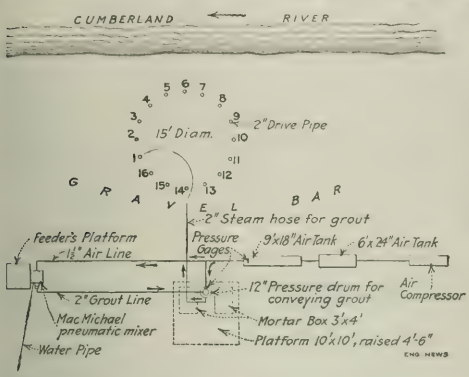


FIG. 4. PLAN OF PIPES AND PLANT FOR GROUTING GRAVEL IN PLACE

gravel. However, it set very hard later, and would have made a strong foundation. Below the water level the concrete was not nearly so good, but was irregular and resembled large clinkers. Many leaks sprung in the walls, but with a pulsometer the water could be pumped down within 2 ft. of the rock.

The test was of value, in that it showed that cement could be forced out at a depth of 23 ft. below the surface

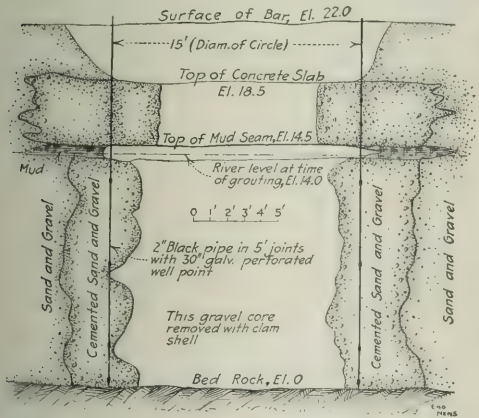


FIG. 5. TYPICAL CROSS-SECTION OF CONCRETE CYLINDER FORMED BY THE CIRCLE OF GROUTING PIPES

of the bar. But the difficulty was, that the grout would take the path of least resistance, which was upward, and would not spread laterally far enough to make a very tight wall. Fig. 5 shows the conditions approximately as they were after the hole was excavated, and Fig. 6 illustrates the results of the test.

SECOND EXPERIMENT

The next experiment attempted was to work under a head of 57 ft. of water. Since the maximum depth of gravel was 15 ft. below the river level, it was necessary to erect a steel tank and fill it with sand and gravel. Therefore a concrete base was made and a tank 6 ft. square and 60 ft. high was erected on it. The tank was made of Gould sheet piling, seven channels on each side.

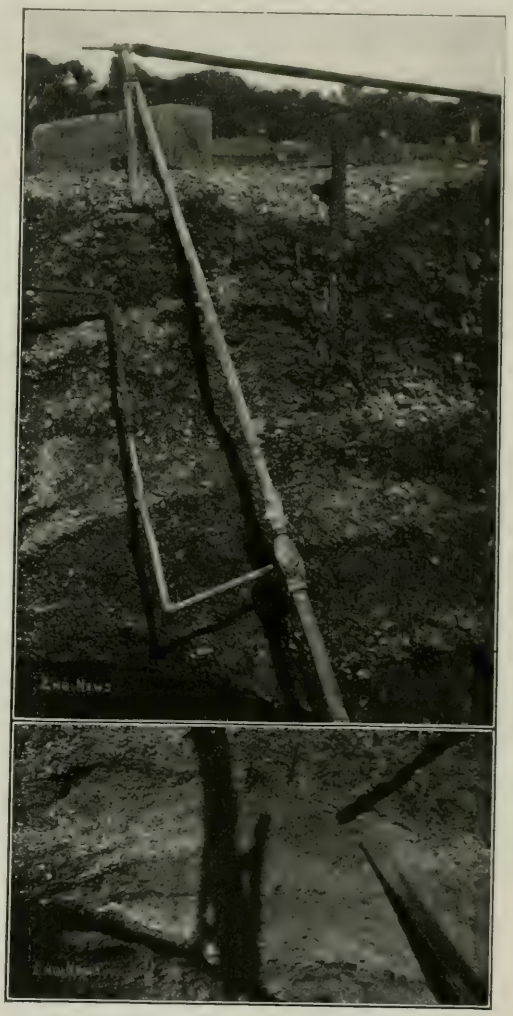


FIG. 6. FACE OF GRAVEL AFTER GROUTING

(The upper view shows the top of the pit, with grouting pipes. The lower view shows a patch of dense grout, also the ordinary grouted gravel and a seam.)

Concrete was placed inside on the bottom to seal the tank so that it would hold water. Sand and gravel, excavated from the bar near-by, was placed in the tank until it was half filled. Before filling, five 2-in. pipes 60 ft. long, with well points screwed into the lower end, were placed in the tank, arranged as shown in the left-hand view in Fig.

7. These were spaced uniformly so that each pipe could grout the same quantity of sand and gravel. The tank after completion is shown in the right-hand view in Fig. 7.

Three water lines were turned into the tank, one 1½-in. and two 2-in. It took several days for the wood packing in the piles to swell sufficiently to prevent leakage, but it finally became watertight, then the water level was kept within 3 ft. of the top. There were 40 cu.yd. of sand and gravel in the tank. Five sacks of cement were forced through each pipe, then they were all lifted 2½ ft. and the grouting repeated. This was continued until 200 sacks of cement had been used. It was computed that 40 lb. pressure should clear the pipe at a depth of 60 ft., but it took from 70 to 80 lb. Every blow brought cement to the surface of the water and caused it to boil up and occasionally splash out of the tank. Before quitting for the night, the pipes were all raised several feet above the last shot of grout. Then 48 hours elapsed before work was resumed. On returning, all of the pipes were stopped up and could not be pulled. All water was let out of the tank and the pipes were unjointed at the top of the gravel. For 10 ft. above the gravel, cement was set up solid in the pipes.

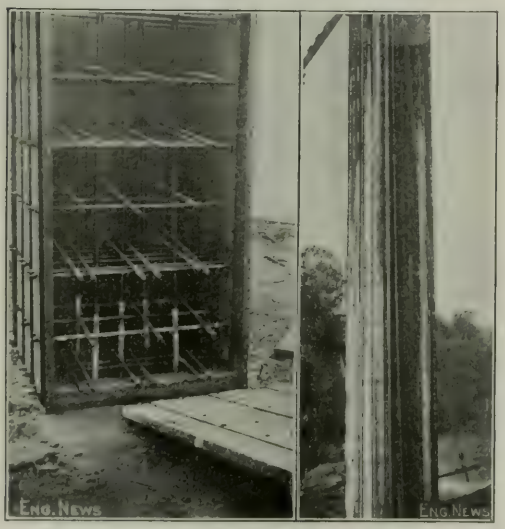


FIG. 7. EXPERIMENTAL 60-FT. STEEL TANK (6x6 FT.) FOR TESTING THE GROUTING OF GRAVEL AND CEMENT

(At the left is the interior of the bottom of tank, with one side removed to show the grouting pipes and well points. The horizontal rods are stay-bolts holding the sides of the tank together. At the right is the completed tank.)

After the cement in the water had precipitated, it was found that the tank contained 33 ft. of material. An 18-in. layer of gravel was put in; then 7 ft. of clean sand, 4 ft. of gravel, 21½ ft. of sand and 5½ ft. of gravel, as shown in Fig. 8. Only one pipe was driven into this material, and this was in the center of the tank. Much trouble was had in keeping the pipe open, since the sand would cave into the well point through the perforations. When it did so, a ¾-in. hose was lowered into it and the sand removed; however, this operation was necessary so often that the entire pipe was taken out and the point wrapped with No. 10 mesh wire screen which remedied the trouble.

There were 25 sacks of cement in grout placed at 27 ft. below the top of the tank; 25 at 24½ ft., 15 at 22 ft., 10 at 19½ ft. and 20 at 17 ft. Finally 3½ ft. of crushed stone was placed in the tank; 47 sacks of cement were injected into the stone, 35 being in the center and six at the north and south sides. The stone possessed 37% of voids, which were completely filled with cement.

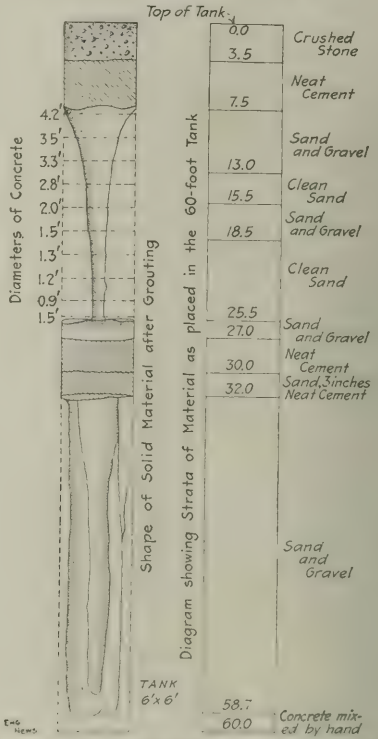


FIG. 8. SECTIONS OF MASS OF CONCRETE FORMED BY INJECTING CEMENT GROUT INTO TANK FILLED WITH SAND AND GRAVEL

The last cement was placed in the tank on Sept. 27 and on Oct. 9 the tank was thrown over by jacking up one side. As the sides were removed, it appeared that very little of the material was solid, except the stone concrete at the top, and that neat cement had found its way to the sides in thin veins. After the sides were removed all loose material was stripped off and only the solid stuff left. The lower half of the tank contained good concrete, about 66% of its volume. Above this was a layer of neat cement 3 to 5 ft. thick. Through the sand, where only one pipe was used, the concrete was only 12 in. in diameter, and increased in size toward the top. Fig. 9 illustrates the shape of the concrete in the entire 60-ft. length of the tank and in its upper portion; also a portion of the cement skin and good concrete against the steel side of the tank. The stone concrete was perfect, and became very hard after it had set awhile. All the concrete in the tank set and was very difficult to blast to pieces. The stay-bolts of the tank

were embedded in the concrete and reinforced it to such an extent that it was hard to blast off the concrete so that the bottom side of the tank could be removed.

From this test it was learned that cement could be forced into gravel under a head of 57 ft., with no more difficulty than at a depth of 10 to 20 ft.; that in a small tank, there is no way for the air to escape laterally, but it must go up and consequently carry with it much cement. Comparing results in stone, in sand and gravel,

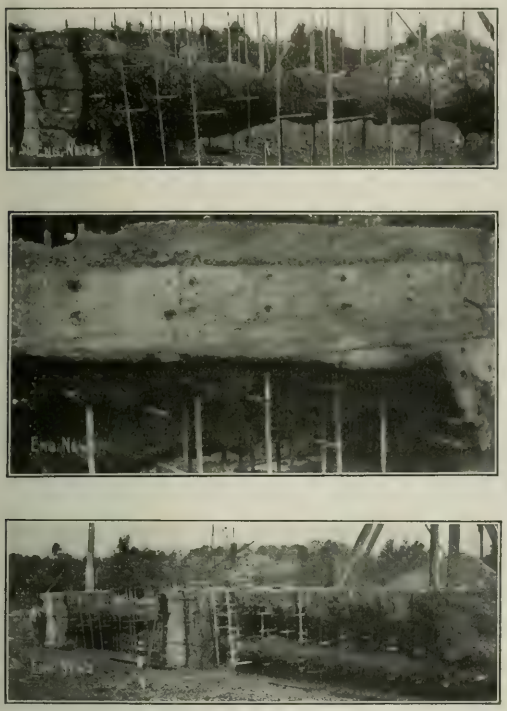


FIG. 9. CONCRETE FORMED IN TANK; AFTER REMOVAL OF THE SIDES AND THE LOOSE MATERIAL

(The top view shows the concrete of the entire 60-ft. height of tank, the tank having been thrown on its side. The middle view shows the concrete in the upper 25 ft. of the tank. The bottom view shows part of the cement and concrete against the steel side of the tank.)

and in sand, the best results are obtained where the per cent. of voids is largest.

THIRD EXPERIMENT

Following the experiment just described, two tanks of the same cross-section but only 20 ft. high, were erected and filled with sand and gravel from the bar. Grout pipes were driven on closer centers and a larger quantity of cement per yard of gravel was used, thereby more nearly filling the tank with concrete. Fig. 10 shows the results.

METHODS OF WORKING

In practice, success will be attained with this process by overcoming the many minor difficulties which arise, so that work may be done accurately and rapidly; assuming, of course, that the material to be grouted is fairly suitable. Otherwise, the cost cannot be reduced and the results will not be so good as by the present practice.

Since it is necessary to fill the voids in the material to be solidified, with the solid contents of the grout, it requires about three times the quantity of grout that it would be necessary if the voids were to be filled merely with grout itself, because 75% of this is liquid. The principal difficulty with the whole process is to get rid of the excess water required, without, at the same time, washing the cement out of the gravel. In the tanks there was no way to prevent this water from flowing over the top, since they were watertight. It seems that the grout working its way upward through the gravel on the river bed would lose its cement and come to the surface as water, but in the tanks 6 ft. square it did not, but came out as rich as it was in the mixer. There is no reason, in a large sheet-pile enclosure, why the excess water should not be taken care of through the bottom, because there is sufficient room for the air to leave the water quickly and lose its energy laterally through the voids of the material in the dam, thereby allowing the water to seep out gradually, following the air and not being pushed upward with it as in a small enclosure.

In the open bar, the cement spreads out in wide thin ledges, taking what paths of least resistance it can find. Therefore, the gravel should be inclosed by piling or by grouting a wall around the proposed foundation and later working forward the center. After a pipe is driven below the water level, the air coming out vertically starts

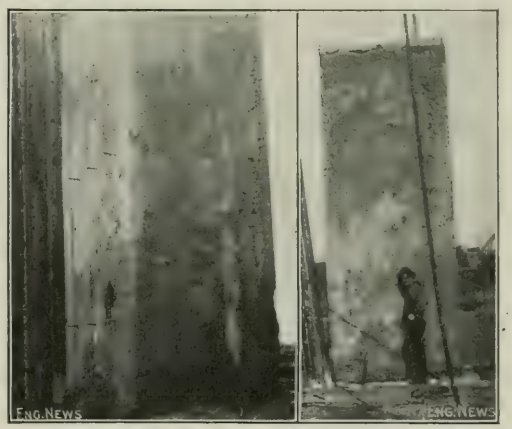


FIG. 10. CONCRETE FORMED IN TANK 20 FT. HIGH (6x6 FT.) BY INJECTING CEMENT GROUT INTO THE GRAVEL FILLING

the ground-water circulating upward, which will bring with it to the water level some of the mud and silt in the bar. A mud seam always results, if the material to be grouted is dirty.

Excessive air pressure is damaging, because it removes a large quantity of the cement already deposited and forms a concrete that is irregular in structure, resembling clinker. When the pipe clogs, instead of using a high pressure to open it, it is better to lower a water hose into the pipe and jet out what stuff is in the way. It is best to have a compressor large enough to keep in the air

reservoir a minimum pressure of 80 lb. so that a strong jet of air will always be playing through the mixing line at the bottom of the drum. If not, cement will get into the orifice of the mixing jet and set, decreasing the size of opening until there is not enough current to cause a violent ebullition in the drum. Then the grout will not be thoroughly mixed and cannot be forced out.

The size of the perforations in the grouting point should be governed by the quality of material to be grouted. In coarse gravel there should be large openings, and in sand small ones; they should be just small enough to prevent the sand or gravel from falling through to clog the point. Unless it is absolutely certain that the cement and sand are free from large stuff, it should be screened to prevent anything going into the grout that will stop up the perforations in the well point.

A strong current of air should be held through the mixer and pipes while driving the pipe down into the bar, in order to keep out the finer material that otherwise would crowd into the point. The drive pipe should be heavy enough to stand driving with a big hammer. Much time was lost in driving because of the pipe bending and the threads stripping.

Conclusion

The results of the experiments show concrete from the poorest grade to that as good as class A. The worst is a cemented gravel, very poorly bonded. The best is a very hard concrete, so perfectly bonded that when fractured the siliceous gravel stones or pebbles are broken along with the mortar. Not a single perfect job was made with any of the nine experiments. There were noticeable defects in all; some could not be avoided on account of the dirty material; the others could have been avoided but for the lack of knowledge which was gained on the later experiments.

There is no doubt but that safe foundations can be made by this process. Test borings should be made at the site of the proposed structure to determine the quality of the material. If it is found to be clean and coarse, there is nothing to prevent an excellent foundation being made. After the grouting is finished, in order to be assured that the job is good, borings should be made into the concrete to determine its solidity.

Since from the results of the experiments, it appears feasible to form hard foundation strata on which to found masonry structures, this process should also prove of value in solidifying the river bed around piers and dams already constructed, where scour from the stream is damaging.

NOTES FROM THE ENGINEERING SCHOOLS

University of Georgia—The following notes on the good-roads winter school recently held have been received.

The only charge was a registration fee of $1. The courses given were as follows: (1) Methods of determining the suitability of local road-building methods (sand and clay); (2) principles of road location and relocation; (3) selection of proper materials for concrete construction; (4) best methods of constructing permanent culverts; (5) methods of mixing and placing concrete for piers, abutments, etc., and best proportions to use; (6) construction and maintenance of earth, sand-clay, and top-soil roads, and the utilization to best advantage of local materials.

Ten counties were represented, some by three and most by two delegates. Much interest was manifested in the school, and it is expected to become an annual event. The sessions extended in 55-minute periods from 9 a.m. to 1:50 p.m., and in one laboratory period from 3:10 to 5 p.m. On one day the entire school was taken over the top-soil roads east of Athens; the trip concluded by the re-location of nearly one-half mile of road to replace a mile of wretched washed-out road, with mud holes, 10% grades, etc. First an approximate line was run with the planetable; then it was readjusted, levels were taken and the road was staked out for construction.

Columbia University—Radical departures have been made in the development of courses in chemical engineering of the School of Chemistry (which now, with the Schools of Mines and Engineering, is a post-graduate department requiring a college degree for admission). The organization of the new course and the work attempted were described at length by Prof. M. C. Whittaker before the New York section of the American Chemical Society, Mar. 7, 1913.

It was believed at this institution that modern manufacturing processes, based on chemical phenomena, were advancing at a rapid rate and were calling for men trained to develop and direct work which was as much engineering as chemistry. It was felt that most schools had not approached, in the best way, the problem of producing the needed men. Under the advice of Prof. Whittaker, himself formerly a practising chemical engineer, it was decided to teach directly the use of engineering methods and processes in the solution of chemical problems rather than to confine students to the manipulation of the usual chemical laboratory equipment. This was held to be in line with the development of modern mechanical- and electrical-engineering laboratories, where commercial equipment was employed rather than apparatus typical of the pure-physics laboratory which would allow the investigation of basic principles only.

The new industrial laboratories for this course occupy now the whole lower floor of Havemeyer Hall, and only a beginning has been made. Besides a general laboratory, there are now electro-chemical, textile, paper, fuel and several research laboratories, as well as a machine and a pipe shop, a grinder and a furnace room, etc. The general industrial chemical laboratory contains typical commercial equipment such as filter presses, pressure and vacuum pumps, siphons, solution tanks, agitators, samplers, vacuum dryers, pot and column stills, steam-jacket evaporators, condensers, centrifugal dryers, clarifiers, gasholders, and gas-welding apparatus. A dye laboratory has a calico printing machine, among other things and an equipment of microscopes and ultra-microscopes. The paper laboratory has an iron soda digester, a bronze sulphite digester, a pulp beater, mechanical stirrers and drum dryers.

The student's work is done in squads of four or five, with one man acting as foreman. The problems assigned involve cyclic processes as far as possible in order to reduce cost and to avoid the accumulation of end products. In research work, such problems are given as are

met with in transferring operations from the test-tube and beaker stage to a factory scale. So far as possible, the work is on a quantitative basis with accounting for all losses at each stage. The squad foreman has to prepare in advance a general preliminary report on the chemistry and practical procedure of an assigned problem. Each man, however, has to present a detailed final report of the entire work covered. The instructors assign work and supervise processes, but do not arrange the work for students in detail or assist them in it. It is reported that the men soon learn the limitations of the necessary commercial apparatus and acquire engineering judgment and facility of application. No attempt, however, is made to develop skilled operators.

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An Earthquake extending from Ottawa to Montreal in Canada and through Western New York occurred on Apr. 28. The shock was felt principally in Ottawa, but little or no damage was done in any locality.

A Butting Collision between an extra freight train and a passenger train on the Chicago, St. Paul, Minneapolis & Omaha Ry., at Baldwin, Wis., caused the deaths of two railway employees on Apr. 27. The wreck is reported to have been due to a misunderstanding of train orders.

The Explosion of an Oil-Fuel Tank on the new Hamburg-American steamship "Imperator" is reported to have killed two workmen and caused fatal injuries to three others on Apr. 22. The explosion is said to have been caused by one of the workmen's cigar lighters.

A Blasting Accident at the quarries of the Riverside Portland Cement Co., Riverside, Calif., on Apr. 23, caused the deaths of 12 men, including the powder foreman. It is reported that two 500-lb. charges of dynamite were prematurely exploded in some unknown way. Six other charges in the same hill were not exploded.

An Explosion of Fulminate of Mercury at the United States Arsenal in Philadelphia, Penn., caused the death of a workman and completely wrecked the drying house, on Apr. 28. The workman was the only person in the building at the time, and it is supposed that he dropped a tray of loaded detonators.

The U. S. Wireless-Telegraph Licenses, issued during the first four months of operation under Federal regulation (to Apr. 13, 1913) number 3407 for both operators and stations. There are 46 American ship stations and 18 coast stations, with 685 amateur stations. The first-grade commercial operators number 1279, second-grade, 186; there are registered 1185 amateurs and eight operators of experimental and instructor grades.

A Railway Valuation Committee has been organized by the Norfolk & Western Ry., for the purpose of devising a plan of valuation of the company's property under the Act of Congress approved in March. The committee will afterward carry on the work of valuation, and as this will extend over a considerable period of time the officers composing the committee have been relieved from their present duties. These officers are the following: Charles S. Churchill, Chief Engineer; W. S. Battle, Jr., General Claim Agent, and J. M. Rodgers, Statistician. Their regular duties will be assumed by Jos. E. Crawford, Acting Chief Engineer; J. B. Baskerville, Acting General Claim Agent, and W. B. Moss, Acting Statistician.

In the Flood Cleansing Work at Portsmouth, Ohio, the city authorities agreed upon a plan to facilitate the cleaning of rented houses which was thus stated in an order issued by Dr. S. B. McKenihan, health officer:

> All persons occupying property as renters will be allowed one-half month's rent free, and if living off the commissary, will be compelled to clean their premises at once. Failure to comply with this will be sufficient cause for ejectment. . . . . All property owners collecting rent and failing to agree with this arrangement will be required to clean their premises themselves or subject themselves to arrest.

Assistance for Electric-Supply Companies in flooded districts is being extended by the National Electric Light Association. A special committee, of which C. L. Edgar, of Boston, Mass., is chairman, has been appointed and given full power to assist member companies in the troubled regions by placing at their disposal men and material needed for the prompt restoration of service. The committee is not undertaking the general relief of employees, but states that it wishes to be advised of special cases in which it could be of particular service even for the lowest-paid employees.

A Reinforced-Concrete Building Survived the Flood in Dayton, Ohio, according to information received from W. W. Smith, Special Field Agent for the Association of American Portland Cement Manufacturers. The building was exposed to the fire of closely adjacent buildings while the water was at its height, and served as refuge to several hundred persons. Its windows, not wire-glass, were much damaged, but all combustibles were removed from the exposed side by the people in the building in time to avoid transmission of fire. The building is interesting because it was the first reinforced-concrete building constructed in Dayton. It is the Beaver Light & Power Bldg. No. 1, and is 170x201 ft. in plan, five stories high. Schenck & Williams, of Dayton, were the designers and O. P. Hazen & Co., Dayton, the builders. Much difficulty was found at first in renting it, on account of its novelty. During the flood the water was 14 ft. above ground at the building, and flowed through the first story with such rapid current as to tear out the Mackolite partitions and carry away the contents of the first story, including a 2-ton safe.

Highway Bridge Damage in Indiana has been summarized by the Bridge Committee of the Indiana Engineering Society (ch., Alex. R. Holliday, Indianapolis). The estimate is that about $1,000,000 worth of damage to highway bridges was done by the floods of Mar. 24-27. This figure is based on returns to letters of inquiry from 41 out of 92 counties, these 41 counties returning a total of $716,135. Out of the 41 counties, 16 report no damage, while four report damage slightly over or under $100,000. The summary as to kinds of bridges indicates that numerous concrete bridges went out as well as many steel bridges, but the concrete bridges are of considerably smaller span, on the average.

9 wooden bridges	$25,300
79 steel bridges	641,400
2 stone bridges	7,000
20 concrete bridges	42,435
Total	$716,135

DAMAGE TO INDIANA HIGHWAY BRIDGES, EASTER FLOOD, 1913

County	Kind of Bridge: Wooden	Steel	Stone	Concrete	Amt. Damage
Adams		1			$3,000
Bartholemew		7		2	19,400
Benton		2		2	5,500
Boone		2		3	8,485
Clay		1			300
Cass	1	3			85,000
Delaware	2	7		5	26,850
Elkhart				none	
Fountain		3			2,000
Franklin				1	10,000
Grant		5			30,000
Hamilton	1				1,000
Hancock		19		1	25,000
Hendricks		1			900
Huntington		1		1	10,000
Jackson				none	
Johnson			1	2	8,500
Lake				none	
LaPorte				none	
Marion		3		1	190,000
Marshall				none	
Montgomery				none	
Miami		3			50,000
Morgan		1			2,000
Madison	1				4,000
Noble				none	
Ohio				none	
Orange				none	
Owen				none	
Parke		1		1	4,950
Pike		6			4,350
Porter				none	
Putman				none	
Pulaski				none	
Randolph	3	3			5,400
St. Joseph				none	
Shelby	1	3	1	1	125,000
Tippecanoe		2			90,000
White		5			1,500
Whitley				none	
Washington				none	
41 Counties					$716,135

The Ohio Canal at Cleveland—The Ohio Canal suffered extensive damage in the Cuyahoga River valley between Akron and Cleveland. While it has had little or no navigation use in recent years, the question of its official abandonment is quite uncertain, on account of sentiment against closing the state canals. At Cleveland, where the canal extends along the east bank of the river, a long stretch of the canal is an obstruction to the best development of the valley lands. The two-mile length below the Denison-Harvard viaduct lies between the river and a broad area of low-lying land valuable for industrial development if contiguous to the river. Various uses of the canal water at Cleveland bring the state a revenue

of several thousand dollars annually: the canal is now being repaired, at least sufficiently to maintain these water services.

River improvement at Cleveland as part of the canal connection from Lake Erie to the Ohio River was put in prospect by Congressional action of two years ago, authorizing a survey of the river for its improvement to a connection with the Ohio Canal. A report has been rendered, but no further action has been taken as yet, pending the establishment of a coöperative arrangement between the Government and the city.

A New 1000-Ft. Municipally Built Pier is to be erected on the Hudson River at the foot of West 46th St., in Manhattan Borough, New York City. The estimate of the cost of this pier is $2,735,000. Similar piers are called for by the present plan at the foot of West 44th and at the foot of West 46th Sts., but they are not to be immediately built. Hearings on the condemnation proceedings in connection with the new work will be held May 21.

Bids for Enlarging the Power Canal of the Montreal Water-Works will be received until May 16 by the Board of Commissioners of Montreal, P. Q. The canal (locally known as the aqueduct), forebay and tailrace will be widened and deepened for a length of about 31,000 ft., involving some 2,350,000 cu.yd. of earth excavation, 436,000 cu.yd. of rock excavation, and the construction of about 203,000 cu.yd. of concrete retaining side walls, some of which will be reinforced. We are unofficially informed that the estimated cost of the work is $2,000,000, besides which the city has already spent and is engaged in spending some $4,000,000 for a conduit paralleling he aqueduct, a pumping plant and a filtration system. T. W. Lesage is chief engineer and superintendent of the Montreal Water-Works, and L. N. Senecal is secretary of the board of commissioners.

A Water-Power Plant under a 5412-ft. Head is under construction near Martigny, Switzerland, according to a bulletin from the firm of Thyssen & Co., Mülheim a. d. Ruhr, Rhenish Prussia. This plant is being designed by M. Boucher, of Lausanne, for the Société d' Electrochimie, of Paris. Water is taken from Lake Fully; this is near the valley of the Rhone, where the mountain sides descend precipitously to the river valley.

The pipe line will be about 2¾ miles long, having inside diameters of 19½ in., and 25⅝ in., with thicknesses of from ⅝ in. to 1⅝ in. The upper section will be of lap-welded pipe, while the lower sections will be of seamless drawn tube. The construction of the pipe line has been placed with Thyssen & Co. Turbines, for 15,000-hp. capacity, will be built by Piccard, Pictet & Co., of Geneva.

An Engineering Commission on Electric Traction for steam railways was again proposed by Frank J. Sprague, of New York City, before the New York Railway Club on Mar. 21. He stated that if such a commission was organized, with engineers of the highest standing and without need of limiting the time to be devoted to their studies on this question, then the electrical interests of the country would pay part or all of the expenses. He expected that the electrical manufacturing and supply companies would combine in financing some organization which would furnish rolling stock and energy on a basis of payments in accordance with the use of the former and the metered electrical loads.

Electric Traction Will Supplant Steam on a mountain section of the Norfolk & Western Ry., it is announced. This step is to be taken to relieve congestion on 30 miles of line over the Alleghany summit, between Bluefield and Vivian, W. Va. While it is not announced whether alternating or direct current will be used, yet it is reported that overhead trolley wires will be necessary on account of large yards and lines at grade through several mining towns. Locomotives will be used and the equipment will be designed more for freight than passenger service on account of the great excess of the former.

A Comprehensive Rapid-Transit Subway System is planned for Philadelphia by Transit Commissioner A. M. Taylor. There is at present in service a single two-mile east and west line through the center of the city along Market St., from the Delaware River to the Schuylkill, with an elevated extension for three miles beyond. There would be according to the new plans also (1) a four-track line from the center of the city, running north on Broad St. some 3¼ miles to Allegheny Ave., with a two-track extension three miles to Olney Ave., with chance for extension to League Island, 1½ miles, (2) a two-track line south on Broad St., 2½ miles to Oregon Ave., with chance for extension to League Island, 1½ miles, (3) a two-track terminal loop through the heart of the city, (4) elevated lines to Frankford (six miles northeast of City Hall) and Darby (seven miles southwest). The cost of construction is placed at $30,000,000, and that of equipment at $8,000,000 more. Enabling legislation to permit of financing the project through taxation, assessment and bond issues, is being sought from the legislature by the city administration.

PERSONALS

Mr. John N. Carlisle, a lawyer, of Watertown, N. Y., has been appointed Commissioner of Highways of the State of New York.

Mr. Charles D. Lay has resigned as Landscape Architect of the Department of Parks, Borough of Manhattan, New York City.

Mr. Lawrence Hanlon, for some years Assistant Superintendent of Municipal Ferries, New York City, has been promoted to be Superintendent, succeeding the late W. J. Sears.

Mr. F. W. Stevens, Chairman of the Public Service Commission of New York State, Second District, has resigned. He has been Chairman since the organization of the commission in 1907.

Mr. R. R. Potter, former Assistant Editor of "Engineering News," has been promoted from the position of Asssitant Superintendent to be Production Engineer of the Blood Bros. Machine Co., Kalamazoo, Mich.

Mr. P. Coniff, formerly Master Mechanic of the Baltimore & Ohio R.R., at Cumberland, Md., has been promoted to be Superintendent of Shops at Mt. Clare, Baltimore, Md., succeeding Mr. J. W. G. Brewer, promoted, as noted elsewhere.

Mr. A. J. Wharf, M. Am. Soc. C. E., recently Superintendent of Construction for J. E. & E. C. Wharf, Chicago, Ill., has been appointed Chief Engineer of the Peoria & Pekin Union Ry., with headquarters at Peoria, Ill., succeeding Mr. W. E. Emery.

Capt. Robert S. Griffin, U. S. N., has been appointed Chief of the Bureau of Steam Engineering, Navy Department, to succeed Lieut.-Com. H. I. Cone, who has been ordered to sea at the expiration of his four-year term on May 18. Capt. Griffin has been Assistant Chief of the Bureau of Steam Engineering for several years.

Mr. Lewis F. Pilcher, M. Am. Inst. Arch., has been appointed State Architect of New York. Mr. Pilcher was born in Brooklyn, N. Y., in 1871. He is a graduate in architecture of Columbia University. For a number of years was Instructor in architecture at Pennsylvania University and later Professor of Art at Vassar College. For the past two years he has practiced architecture in New York City.

Mr. John H. Delaney, former Business Manager of the "Morning Telegraph," of New York City, has been appointed Commissioner of Efficiency and Economy of the State of New York at a salary of $15,000 per annum. Commissioner Delaney has begun his work by appointing Mr. H. G. Lynn, of New York, and Mr. Matthew T. Horgan, of Brooklyn, Deputy Commisisoners, at salaries of $5000 per annum each.

Mr. E. A. Kingsley, Assoc. M. Am. Soc. C. E., recently County Highway Engineer, Pulaski County, Ark., has been appointed State Highway Engineer of Arkansas. Mr. Kingsley is a native of Indianapolis, Ind., and graduated from Purdue University in 1893. He has had experience with the city engineering department of Indianapolis and with the Great Northern and Chicago, Rock Island & Pacific Rys. For seven years following April, 1904, he was City Engineer of Little Rock, Ark.

Mr. J. W. G. Brewer, formerly Superintendent of Shops of the Baltimore & Ohio R.R., Mt. Clare, Baltimore Md., has been promoted to be Assistant District Superintendent of Motive Power of the main line district, with headquarters at Baltimore. Mr. Brewer entered the railway service in 1895 as a shop apprentice with the Baltimore & Ohio R.R. In 1905 he was a machinist in the Mt. Clare shops. In October, 1908, he was promoted to be foreman of the machine shop. He was made Assistant Master Mechanic in January, 1910, and Master Mechanic the following April. Since last September he had been Superintendent of Shops at Mt. Clare.

Major Cassius E. Gillette, of Philadelphia, Penn., has been appointed superintendent of construction of the Perry Memorial monument, which is to be built at Put-in-Bay, Ohio. The estimated cost of the monument, for which designs have been adopted, is about $1,000,000. A bill has recently been introduced in Congress to reinstate Major Gillette in the Corps of Engineers. Major Gillette resigned from the Corps a number of years ago at a time when he had been detailed by Secretary Taft to aid a reform administration in Philadelphia in its work of municipal house cleaning. Interests which were at that time influential in Congress introduced bills to prevent such a detail of an officer, and those in charge of municipal reform in Philadelphia persuaded Major Gillette

to resign his commission in order to continue in the Philadelphia work.

The Interstate Commerce Commission has announced the following members of the board of engineers who will supervise the work of making a physical valuation of the railways of the United States, provided for by recent Act of Congress: Mr. R. A. Thompson, M. Am. Soc. C. E., Chief Engineer of the California Railroad Commission; Prof. W. D. Pence, M. Am. Soc. C. E., Chief Engineer of the Wisconsin State Board of Assessment and the Railroad Commission of Wisconsin; Mr. J. S. Worley, Assoc. M. Am. Soc. C. E., Consulting Engineer, of Kansas City, Mo.; Mr. Howard M. Jones, M. Am. Soc. C. E., Consulting Engineer, of Nashville, Tenn.; and Mr. E. F. Wendt, M. Am. Soc. C. E., Assistant Engineer of the Pittsburgh & Lake Erie R.R. It is announced that it is the intention of the commission to add an officer of the Corps of Engineers, U. S. A., to the board later.

OBITUARY

John H. Weller, of Dayton, Ohio, former Superintendent of the Dayton & Michigan R.R., now a part of the Cincinnati, Hamilton & Dayton Ry., died Apr. 22, aged 83 years. His death was indirectly due to exposure during the recent flood.

J. Dwight Ripley, a retired railway contractor, of New York City, died in Denver, Colo., Apr. 27. He was contractor for parts of the Union Pacific R.R., the Delaware, Lackawanna & Western R.R. and the New York Central & Hudson River R.R. He retired from active business about 20 years ago.

Patrick Cahalin, a foreman on the construction of the first Panama R.R. during the days of the California gold rush, in 1854, died at Longbeach, Calif., Apr. 28. For many years he made his home in Deer Lodge, Mont., and was well known throughout the state and in Utah as "Panama Pat." He was 96 years old.

A. W. Quackenbush, formerly Master Mechanic of the Quincy, Omaha & Kansas City Ry., died at his home in Kansas City, Mo., Apr. 19, aged 68 years. He began as a machinist apprentice with the New York Central & Hudson River R.R. in 1862, and was promoted through various positions to that of Master Mechanic of different Eastern railways. Later he was Master Mechanic and Superintendent of Motive Power of several railways in the Middle West. He retired from active work in 1911.

George Harvey Fairchild, a consulting engineer, of San Francisco, Calif., died Apr. 21, while en route from Central America on the S.S. "City of Para." At one time Mr. Fairfield was Chief Engineer of the Omnibus Cable Co. and of the Market Street Ry Co., of San Francisco. Later he was connected with the engineering staff of the Pacific Mail Steamship Co. A short time ago he went to Guatemala to supervise the salvage of the steamship "Sesostris," which had gone ashore. He was 54 years old and is survived by a widow and two sons.

Gustave Wilhelm Wolff, for many years a member of the firm of Harlan & Wolff, famous British shipbuilders, died at his home in London, England, Apr. 15. He was born in Hamburg, Germany, in 1834. He was sent to England to Liverpool College, and to fulfill his father's desire that he become an engineer he was apprenticed to the firm of Joseph Whitworth & Co., of Manchester. After his apprenticeship was expired he became a draftsman in a small shipbuilding yard on Queen's Island, Belfast. Shortly afterward, in 1859, the business was purchased by Mr. (afterward Sir) Edward Harlan, who commenced work with a staff of 44 employees. Mr. Wolff was appointed Manager of the enterprise. The business of the firm grew tremendously, and in 1874 three more partners were added. Mr. Wolff severed his connection with the firm in 1908, when he sold out all his interests. At that time the number of employees was 12,000.

Charles Henry Tisdale, Assoc. M. Am. Soc. C. E., U. S. Junior Engineer in charge of the construction of Hales Bar Dam, Tennessee River, at Guild, Tenn., died in Mercy Hospital, Chicago, Ill., Apr. 30, from a trephining operation. Mr. Tisdale was stricken with apoplexy exactly one year before his death, and while he regained his health sufficiently to discharge his duties, he was frequently bothered with a recurrence of the disease. Thinking that he might get relief, Mr. Tisdale went to Dr. Murphy, the famous brain specialist, at Mercy Hospital, for an operation, which proved fatal. He was 38 years old and a man of exceptionally high standards and untiring energy. He was married in March, 1906, to Miss Lucy Vaughan, of Brusly, La., who died at Hales Bar the following year. Mr. Tisdale had been in the government service about 15 years, and had been in local charge for the government at Hales Bar for seven years. In his death the engineering profession loses a valued and esteemed member.—(Contributed by Roger B. McWhorter, U. S. Junior Engineer.)

James Tangye, M. Inst. M. E., who died in Cornwall, England, on Apr. 4, was born at the little village of Hogan, near Redruth, on Oct. 6, 1825. He was one of the ablest of a remarkable family of brothers, of whom George Tangye now alone survives.

It is said of James Tangye by one of his brothers that, though he inherited some of the genius from his father, he had most of it from his mother, who came of a long line of Cornish engineers. Her father, Edward Bullock, had been chosen by William Murdock to take charge of the largest engine made up to that time by Boulton and Watt, and it was with Bullock that young Tangye obtained his first acquaintance with steam engines and pumps. Bullock owned a smithy, and it was to the mutual satisfaction of grandfather and grandson that the boy spent all his leisure time when not at school in his smithy. The former recognized the growing abilities of the youth, and the latter found his chief delight in life in being among engines and in being connected with anything to do with engineering matters.

In those early days lads were not kept long at school, and we find James Tangye at the age of 12 installed as Molliwig—or boy at everyone's call—at the Copperhouse Foundry at Hayle, near St. Ives, in Cornwall. Here he first came in contact with Brunel to whom later on he was destined to be of material assistance, and whose every movement he had observed with awe when, as an unimportant Molliwig, he himself was working at the Copperhouse Foundry.

Later on young Tangye spent a short time working for a wheelwright at Pool, principally, it is said, in order to build himself a tricycle! On leaving the millwright the youth found plenty to which to turn his hand at home without immediately seeking another situation. His father was a farmer, and there were wheels and plows and other things which had to be made or which needed repair. These accomplished, he struck out in another direction, which had to do with mining. Edward Wilkins was at the time engaged in developing and setting to work an improved method of dressing tin ore in the mines. This method was the invention of William Brunton, Sr., who was also the inventor of a walking locomotive for steep gradients. For some time James Tangye assisted Mr. Wilkins, and it was about this time that he constructed and put to work a waterwheel 18 ft. in diameter and 20 in. wide for driving a stamping mill. This wheel worked successfully for many years.

These and other such odd jobs kept the youth busy for some time, during which his retentive mind was continually storing up experience. A little later on William Brunton engaged him to construct some hydraulic pumps at Pool, and then he was for a year at the Redruth foundry, during which time a locomotive called the "Redruth" was built for the West Cornwall Ry.

In 1848 James went to Devonport in order to enter the service of Messrs. Distin & Chafe, who employed him in many urgent and important repair works with which they were entrusted by the Dockyard authorities. Here his foreman was a brother of Samuel Smiles, the biographer, and the tale is told of how that once when Smiles was absent a difficulty arose concerning the design of the parallel motion of a beam engine which was in course of erection. Apparently neither of the partners knew sufficient about engines to solve the problem themselves, and matters would have had to stand till Smiles' return had not young Tangye come forward and offered to undertake the work.

Later on Tangye was asked by Distin & Chafe to become their works manager, but he had made up his mind to return home so as to work together with his brother Joseph, who was then employed by William Brunton, Jr., in designing machinery for the quicker and better manufacture of blasting fuse.

The association between the two brothers, James and Joseph, was of the most cordial description, and, having now begun, it was destined to continue till the death of the latter, James being the designer and Joseph being the one to carry out the designs. The brothers remained with Brunton for some years, eventually becoming working managers and purchasing a small share in the business.

In 1858, James Tangye combined with his four brothers, Joseph, Richard, George and Edward, under the firm name of James Tangye & Bros., Machinists, Birmingham. The time was propitious. There was then in progress a tremendous advance in mechanical engineering. New problems were continually having to be faced, and James Tangye was just the man for the work. He had a wonderful gift for overcoming difficulties, and he rejoiced to meet and conquer them. He was endowed with a keen perception of the ultimate value

of anything which was brought to his notice. It was, it is understood, on his initiative that the firm undertook the manufacture of Weston pulley blocks, and he it was that made this apparatus a success.

He was exceedingly quick in coming to a decision, as the following—one instance of many—will show. An American who had invented a direct-acting steam pump had come to England to find someone to undertake its manufacture in this country. He tried numberless firms, but no one would listen to his proposals. Happening to pass the Tangye works, he went in, had a short interview with James, and before he left arrangements had been made by which the firm was granted the sole rights of making the pump, which, we may say, went by the name of the "Special" pump, and was an immediate success. [Condensed from "The Engineer" (London), Apr. 11.]

ENGINEERING SOCIETIES

COMING MEETINGS

SOUTHWESTERN WATER WORKS ASSOCIATION.
May 12-14. Annual convention at Ft. Worth, Texas. Secy., E. L. Fulkerson, Waco, Tex.

NATIONAL FIRE PROTECTION ASSOCIATION.
May 13-15. Annual meeting at New York City. Secy., F. H. Wentworth, 87 Milk St., Boston, Mass.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
May 20. Annual business meeting at New York City. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

AMERICAN RAILWAY ASSOCIATION.
May 21. Spring session at New York City. Secy. W. F. Allen, 75 Church St., New York City.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION.
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 405 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS.
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.
Mar. 20-23. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 834 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL, AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL DISTRICT HEATING ASSOCIATION.
May 27-29. Annual convention at Indianapolis, Ind. Secy., D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 111, C. & N. W. Ter. Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy. Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

AMERICAN WATER WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 25-28. Congress at London, England. Secy. W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Boston Society of Civil Engineers—The annual banquet of the societies of local members of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers and the Boston Society of Civil Engineers was held at the Boston City Club on Apr. 29. One of the objects of the meeting was to celebrate the appointment of Prof. Ira N. Hollis, of Harvard University, to the presidency of the Worcester Polytechnic Institute. Dr. R. C. MacLaurin, President of Massachusetts Institute of Technology, Dr. A. L. Lowell, President of Harvard University, and Prof. Wm. H. Hooper, Acting President of Tufts College, were guests. Following the dinner George W. Kittredge, Chief Engineer of the New York Central Lines, read a paper on "Some Phases of the Development of the Grand Central Terminal"; and Mathew C. Brush, Second Vice-President of the Boston Elevated Ry., read a paper on "Problems in Local Transportation."

International Road Congress—Special preparations are being made by the corporation of the City of London, England, for the entertainment of the members of the Permanent International Association of Road Congresses, to be held June 23-28. The meetings are to be held in ancient and famous Guildhall, which will be thrown open to all the visitors for the inspection of its art treasures and historic records. A dance will be given in the famous library and a concert in the council chamber. W. Rees Jeffreys is Secretary; address, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

National District Heating Association—Among the papers to be read at the annual convention to be held at Indianapolis, Ind., May 27-28, are the following of particular interest to engineers: "District Heating on the Pacific Coast," by C. F. Murphy, of the United Light & Power Co., San Francisco, Calif.; "Appraisal of Heating Properties," by Harold Almert, of H. M. Bylesby Co., Chicago, Ill.; "Station Designs with Special Reference to Overload Capacities," by B. J. Denman, of the Edison Illuminating Co., Detroit, Mich.; "Operating Economics in Heating Large Factory Buildings," by E. L. Wilder, Assistant Industrial Engineer, Rochester Railway & Light Co., Rochester, N. Y. The secretary is D. L. Gaskill, Greenville, Ohio.

American Society of Mechanical Engineers—The program for the Spring meeting at Baltimore, Md., May 20-23, includes the following reports and papers: Reports of special committees on Myriawatt, Involute Gears, Standardization of Catalogs, Code of Ethics and National Museum; papers, "Tests of a Hydraulic Buffer," by Carl Schwartz; "The Present Condition of the Patent Law," by Edwin J. Prindle; "Shading in Mechanical Drawing," by Theodore W. Johnson; "Cost of Upkeep of Horse-Drawn Vehicles Against Electric Vehicles," by W. R. Metz; "Present Operation of Gas Engines Using Blast-Furnace Gas as Fuel," by Charles C. Sampson; "The Baltimore High-Pressure Fire Service," by James B. Scott; "National Standard Hose Couplings and Hydrant Fittings for Public Fire Service," by F. M. Griswold; "Department of City Conflagrations," by Albert Blauvelt; "Allowable Height and Area in Factory Buildings," by Ira H. Woolson; "The Protection of Main Belt Drives with Fire Retardant Partitions," by C. H. Smith; "The Fire Hazard in Crowded Buildings Due to Inadequate Exits," by H. F. J. Porter.

American Water Works Association—The 33d annual convention will be held at the West Hotel, Minneapolis, Minn., June 23-27. The convention will be opened with a reception on Monday evening, and business sessions will commence at 10 a.m., Tuesday morning. The list of papers expected includes the following: "The Diesel Engine for Water-Works," by Edward S. Cole; "Water-Works Special Franchises," by Henry De Forest Baldwin; "Reforestation and General Care of Watersheds," by Ermon M. Peck; "The Bacterial Count on Gelatin and Agar Media and Its Value in Controlling the Operation of Water Purification Plants," by James M. Caird; "The Tuscaloosa, Ala., Water-Works," by Prof. Edgar B. Kay; "Filtration," by George W. Fuller; "Charges for Public Water Service to Private Fire-Protection Systems," by W. E. Miller; "A Reasonable Basis for the Determination of Charges for Private Fire Protection," by Leonard Metcalf; "Metering Private Fire Services at Kenosha, Wis.," by August Bulzer; "How a Private Fire Service Polluted a Public Water-Supply and Some of the Consequences," by Robert J. Thomas; "Modern Filter Practice," by N. S. Hill, Jr.; "Gravity Water Supply at the City of Manila, P. I.," by H. E. Keeler; "Power for Pumping Derived from Refuse," by E. H. Foster; "Pumping Engine," by L. E. Strothmann; "Ground Water-Supplies," by Charles B. Burdick; "Rates and Rate Making," by Halford Erickson. On Tuesday and Thursday evening, illustrated lectures will be given by Edward Wegmann, Consulting Engineer, New York City, and Dr. William P. Mason, of Rensselaer Polytechnic Institute, Troy, N. Y. The secretary is J. M. Diven, 47 State St., Troy.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Maine—Sandy River & Rangley Lakes R.R.—This company is considering the construction of an extension to Stratton, Maine. The State Railroad Commission has granted this company permission to expend $200,000. Of this sum $40,000 will go for new equipment, $65,000 for permanent repairs and the remainder for the extension. M. McDonald, Portland, Me., is Pres.

New York—Lehigh Valley R.R.—This company has received bids for the construction of an extension of its Seneca Falls branch in an easterly direction from Seneca Falls to Cayuga Junction, N. Y. E. B. Ashby, New York, is Ch. Engr.

Pennsylvania—Lehigh & New England R.R.—This company will soon start work on the construction of its proposed line from Snyders to Catasauqua, Penn., a distance of about nine miles. F. W. Gilcreast, Mauch Chunk, Penn., is Ch. Engr.

Maryland—Pennsylvania R.R.—This company, it is reported, is making surveys preliminary to sinking concrete tubes under the Potomac and Patapsco Rivers, near Baltimore, Md., to be used in connection with the construction of a north and south cut-off on the western shore of Chesapeake Bay. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

✚**Georgia**—Carolina & Georgia R.R.—This company has awarded the contract to MICHAEL P. McGRATH, Worcester, Mass., for the construction of its line from Augusta to Columbia, Ga., about 75 miles. G. E. Shand, Augusta, Ga., is interested.

South Carolina—Lancaster & Chester Ry.—This company is considering the construction of an extension of its line from Chester, S. C., to Manchester, S. C., a distance of 29 miles. The capital of the company has been increased from $50,000 to $600,000. Leroy Springs, Lancaster, S. C., is Ch. Engr.

Kentucky—Illinois Central R.R.—This company, it is reported, is considering the construction of a line between Elizabeth, Ky., and West Point, Ky. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Ohio—Lorain, Ashland & Southern R.R.—This company has awarded the contract for the completion of its line. The contract covers 23 miles. The length of the road is 65 miles, 42 miles of which are in operation. J. P. Ramsey, Wellington, Ohio, is Ch. Engr.

Ohio—Middleport & Northwestern Ry.—This company has been incorporated to construct a line of railroad from Middleport through Meigs, Athens and Washington Counties, Ohio, to the city of Marietta, Ohio. Among the incorporators is D. N. Postalwaite, Marietta.

✚**Illinois**—Chicago, Burlington & Quincy Ry.—This company, it is reported, has awarded the contract for team work in connection with the construction of a third track from Galesburg to Wataga to J. J. McCAUGHEY, Chicago, Ill. The steam shovel work will be done by the railroad. Estimated cost, about $250,000. T. E. Calvert, Chicago, Ill., is Ch. Engr.

✚**North Dakota**—Fairmont & Veblen R.R.—See item under South Dakota.

The following work will be sublet by Condon Bros., Woodmen of the World Bldg., Omaha, Neb.: 1,200,000 yd. of machine and fresco work on the Northern Pacific Ry. in North Dakota and Montana, and 700,000 yd. of team work, mostly side borrow, on the Chicago, Milwaukee & St. Paul Ry. in Iowa.

✚**South Dakota**—Fairmont & Veblen R.R.—This company has awarded the contract to WHITTIER & BROLANDER, for the construction of a 46-mile railway from Veblen, S. D., to Fairmont, N. D. The work will include the construction of three trestles, and about 500,000 cu.yd. of grading. J. S. Thomas, Minneapolis, Minn., is Ch. Engr.

Montana—Northern Pacific Ry.—This company has started surveys for the construction of the eastern end of its proposed Glendive-Helena cut-off. W. L. Darling, St. Paul, Minn., is Ch. Engr.

See item under North Dakota.

Texas—Gulf, Colorado & Santa Fé Ry.—This company has classified the appropriation of $797,670 that has been made for improvements to its system during 1913 as follows: Right of way, and station grounds, $745.50; bridges, trestles and culverts, $28,561; sidings and spur tracks, $180,684; grade revision and protection of banks, $30,388; fencing right-of-way, $21,469; interlocker and other signal apparatus, $24,012; telegraph and telephone lines, $22,029; station buildings and fixtures, $29,323; shop machinery and tools, $35,672; shops, engine houses and turntables, $109,662; water and fuel stations, $23,559; miscellaneous structures, $24,404.84; rails, $79,856; equipment, $346.26; tie plates, $99,514; increased weight of frogs and switches, $30,443. F. Merritt, Galveston, Tex., is Ch. Engr.

Nevada—Oregon Short Line R.R.—This company is considering the construction of a line south into Nevada, and connect with the Southern Pacific Co. Carl Stradley, Salt Lake City, Utah, is Asst. Gen. Mgr.

Washington—Chicago, Milwaukee & St. Paul Ry.—This company has completed surveys for the construction of its proposed line from Helsing Junction on the main line between Seattle and Aberdeen, Wash., southwest to Raymond, on Willapa Harbor. The line will run through a timber country and will cost about $3,000,000. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Oregon—Oregon R.R.—This company is preparing to award contracts for the construction of a portion of the roadbed at once of its proposed line to construct a road from Salem to Bend by way of Stayton and through the Minto Pass. J. H. McNary, Salem, is interested.

Oregon—Corvallis & Eastern Ry.—This company, it is reported, is considering the reconstruction of its line for 140 miles. D. W. Campbell, Portland, Ore., is Gen. Supt.

✚**Canada**—The contract has been awarded, it is reported, to M. P. McGRATH, Worcester, Mass., for the construction of about 406 miles of railroad from Montreal, Que. to Ottawa, Ont., and the Great Lakes.

New Brunswick—The construction of a railroad from Bristol, N. B., in a easterly direction, to some point on the National Transcontinental Ry. at or near Juniper Brook, is under consideration. D. H. Lamont, Glassville, N. B., is interested.

Mexico—It is reported that the Mexican Government has renewed the concession granted to Eduardo Hartmann and others, of Durango, Mex., during the administration of Pres. Diaz, for the construction of a railroad across the northern part of Mexico, between Chihuahua and Monclova, a distance of about 450 miles. Arrangements to start work will be completed as soon as possible.

British Columbia—Canadian Pacific Ry.—Bids will be received until May 10 by F. F. Busteed, Engr. Grade Revision, Canadian Pacific Ry., Kamloops, B. C., for clearing grubbing and grading on three contracts, embracing nine miles of line west from Kamloops, 25 miles of line east from Kamloops and 24 miles of line west from Revelstoke, B. C.

ELECTRIC RAILWAYS

Asbury Park, N. J.—Preliminary arrangements are being made by the Ttlantic Coast Electric Ry. Co. for double-tracking about one mile of its track is Sea Girt. S. F. Hazelrigg, Asbury Park, is Gen. Mgr. and Pur. Agt.

Easton, Penn.—Plans are being prepared by the Easton Transit Co. for the construction of about one mile of new track in Easton and 1½ miles in Freemansburg. Harrison R. Fehr, Easton, is Pres. and Gen. Mgr.

Lansdale, Penn.—Preliminary arrangements are being made by the Lehigh Valley Transit Co. for the construction of an electric railway from Lansdale to Souderton, about 14 miles. R. J. Pike, Allentown, is Pur. Agt.

✚**Linfield, Penn.**—Press reports are to the effect that the Pottstown & Reading Ry. Co. has awarded the contract for the extension of its line from Linfield, to STEIR, MARCH & CO., Philadelphia. Noted Apr. 17.

Scranton, Penn.—Preliminary arrangements are being made by the Scranton & Binghamton Traction Co. for the construction of an electric railway from Nicholson to Montrose, about 17 miles. R. W. Day, Scranton, is Gen. Mgr.

Valley Forge, Penn.—The Phoenixville, Valley Forge & Strafford St. Ry. Co. has started surveys on its proposed electric railway from Valley Forge to Bridgeport.

Baltimore, Md.—A franchise has been granted to the United Rys. & Electric Co. to extend its Monument St. line to Orangeville. T. A. Cross, Continental Trust Bldg., Baltimore, is Gen. Mgr. Noted Apr. 24.

Parkersburg, W. Va.—The Charleston, Parkersburg & Northern R.R. Co. has been organized to construct and operate an interurban railway from Charleston to Parkersburg. The incorporators are J. E. Fowler, A. H. Geiger, of Washington, D. C., and K. B. Stephenson, of Parkersburg.

Newbern, N. C.—Plans are being considered by the Newbern-Ghent St. Ry. Co. for the extension of its electric railway from Newbern to Trenton and Pollocksville.

Fort Myers, Fla.—A company has been organized at Fort Myers for the purpose of constructing an electric railway from Fort Myers to a point, one mile above Everglade, a distance of about 13 miles. W. G. Langford, Fort Myers, is interested.

Chattanooga, Tenn.—A franchise has been granted to J. W. Adams and associates for the construction of an electric railway through Bradley County from Chattanooga to Cleveland, Tenn., about 30 miles.

Cleveland, Ohio—The City Council has granted a franchise to the Cleveland Ry. Co. for the extension of its St. Clair line into Gordon Park. George L. Radcliffe, Cleveland, is Gen. Mgr.

Detroit, Mich.—Plans are being considered by the Detroit United Ry. Co. for the construction of an electric railway from Romeo to Almont. F. W. Brooks, Detroit, is Gen. Mgr.

Holland, Mich.—The Grand Rapids, Holland & Chicago Ry. Co. is considering plans for the construction of an electric railway along Lake Michigan to Saugatuck. Charles A. Floyd, Grand Rapids, is Gen. Mgr.

Freeport, Ill.—Plans are being considered by the Freeport Ry. & Light Co. for the construction of an electric railway from Freeport through Florence and Harlem. A. J. Goddard, Freeport, is Pres.

Hillsboro, Ill.—The City Council has granted a franchise to the Springfield & Central Illinois Traction Co., to construct and operate an electric railway in Hillsboro.

Pigeon Falls, Wis.—The Pigeon Valley Ry. Co. is making preliminary arrangements for the construction of its proposed electric railway from Pigeon Falls to Hay Creek, about 20 miles. Ole A. Olson, H. A. M. Steem and B. M. Slettland are interested. Noted Apr. 10.

Cedar Rapids, Iowa—The Cedar Rapids & Marion City Ry. Co. has applied to the City Council on Second St. F. L. Diserens, Cedar Rapids, is Gen. Supt. and Pur. Agt.

Dubuque, Iowa—A franchise has been granted to the Union Electric Co. to construct and operate an extension to its line on West Locust St., in Dubuque. A. H. Smith, Dubuque, is Supt. Ry. Dept.

Muscatine, Iowa—Plans are being considered by the Davenport-Muscatine Ry. Co. for the extension of its line in Muscatine. R. Schadelee, Grand Rapids, Mich., is Vice-Pres.

✦Grand Forks, N. D.—The Grand Forks St. Ry. Co. has awarded the contract for the extension of its line in Grand Forks to DINNIE BROS., Grand Forks.

Georgetown, Tex.—The Commercial Club of Georgetown has accepted the proposition of the Southwestern Traction Co. for the construction of an extension of its interurban electric railway from Temple to this place. It has appropriated $1000 for the through this part of Williamson County. It is stated by A. F. Bentley, Pres. of the company, that the extension will run to Austin and will be about 75 miles long. The route is via Jerrell, Georgetown and Round Rock.

Seguin, Tex.—Plans are being considered by F. C. Weinert and associates for the construction of an electric railway from Seguin and Staples, about 18 miles.

Waxahachie, Tex.—The Southern Traction Co. is taking steps toward the construction of an electric street railway system here. It will include four miles of track. R. B. Stichter, Dallas, is Gen. Mgr.

Webb, Tex.—The construction of an electric railway to connect Webb, Dallas, Glen Rose and Mansfield, is contemplated by Nathan Lowe, K. S. Rayne and C. W. Duke.

Henryetta, Okla.—Preliminary arrangements are being made by C. H. Kellogg and associates for the construction of an electric street railway in Henryetta.

Tulsa, Okla.—Herbert H. Clark, Kansas City, Mo., and R. S. Morely, Tulsa, are interested in the construction of an electric railway from Tulsa, Okla., to Kansas City, Mo.

Vinita, Okla—The Vinita Interurban Ry. Co. has been incorporated to construct and operate an electric railway from Vinita to the Eastern Hospital for Insane, about three miles. The incorporators are: J. T. Ratcliff, M. F. Knight, Seymour Riddle, John A. Wise and Paul F. Mackey, all of Vinita.

Centralia, Wash.—The Willapa Bay & Eastern R.R. Co. has been incorporated to construct and operate an electric railway from Centralia to Willapa Harbor, about 51 miles. The incorporators include, F. Merritt, W. H. Bogle and C. P. Bissett.

Kennewick, Wash.—The Oregon-Washington R.R. & Navigation Co. is considering plans for the construction of an electric railway from Kennewick through Richland. J. P. O'Brien is Vice-Pres.

Empire, Calif.—The Modesto & Empire Traction Co. is planning the extension of its line from Empire to Waterford, about eight miles. T. K. Beard, Modesto, is Pres. and Gen. Mgr.

Eureka, Calif.—Plans are being considered by Richard H. Tingely and associates for the construction of an electric railway from Korbel to several Eel River Valley towns.

Richmond, Calif.—Plans are being prepared by the San Francisco, Oakland Terminal Rys. for the extension of its line on Market St., Richmond. William R. Alberger, Oakland, is Vice-Pres. and Gen. Mgr.

LIGHT, HEAT AND POWER

Lee, Mass.—The Berkshire St. Ry. Co. will build a new substation which must be completed before the new line from Lee to Huntington can be operated. C. L. Richmond, Pittsfield, is Gen. Mgr.

Chatham, Mass.—A franchise has been granted to the Buzzards Bay Electric Co. to construct and operate an electric-light plant at Chatham. H. H. Taylor, Falmouth, is Supt.

✦Springfield, Mass.—The contract for the substation for the United Electric Light Co. on Elm St. has been awarded to FRED T. LEY & CO., 499 Main St. The structure will be of reinforced concrete, 25x44 ft., two stories.

✦Brooklyn, N. Y.—We are officially advised that the Department of Education Park Ave. and 59th St. Boro Manhattan has awarded a contract to EUGENE FRANK 22 East 21st St. Manhattan at $7566 for installing electric equipment in new public school 99, Borough of Brooklyn. Bids were received Apr. 28.

✦We are officially advised that the Department of Education Park Ave. and 59th St. Boro Manhattan, has awarded a contract to R. J. McKINNON, 217 West 125th St., Manhattan, at $2600 for installing heating and ventilating apparatus in new public school 172, Borough of Brooklyn. Bids were received Apr 28.

Malone, N. Y.—A company has been organized at Malone and will soon be incorporated under the name of the Franklin County Hydraulic Power Co. for the construction of a dam on the Salmon River near Chasm Falls and the erection of a power plant which will develop about 2500 hp. The company it is understood will take over the Malone Light & Power Co. and in addition to furnishing electric light for the town of Malone it will also furnish power for the Malone Paper Co.

New York, N. Y.—Bids will be received until 11 a.m. May 12, by the Department of Education, Park Ave. and 59th St., for installing electric equipment in new public school 56, on Vyse and Bryant Aves., Boro the Bronx. C. B. T. Snyder is Supt.

Bids will be received by the Department of Water Supply, Gas & Electricity, 21 Park Row, until 2 p.m., May 9, for furnishing all the labor and material for the installation of the complete electric lighting system and gas fitting in the 98th St. Pumping station. Henry S. Thompson is Comr.

Oswego, N. Y.—Preliminary arrangements are being made by the People's Gas & Electric Co. for the construction of a transmission line from Fruit Valley to West Oswego, about three miles.

Chatham, N. J.—Bids will be received by the Common Council until 8 p.m., May 12, for improving the municipal electric-light and water plant. Bids for this work were received Apr. 7 and rejected. Noted Apr. 3 and 17.

Newark, N. J.—The Board of Public Works has adopted resolutions to change the present style of flaming arc-lighting system on Broad St., to a new system that will render the same efficiency in service at a reduced cost of operation.

Chambersburg, Penn.—The City Council is considering the proposition to appropriate $30,000 for improving the municipal electric-light plant and installing new equipment.

Eagle Rock, Va.—J. E. McInnis is interested in the construction of an electric-light plant at Eagle Rock.

Graham, W. Va.—Plans are being prepared by the Appalachian Power Co. for an expenditure of $8000 for remodeling the entire electric-light system in Graham. P. M. Walizer, Bluefield, is Mgr. and Supt.

Newton, N. C.—The Conover Light & Power Co. has been granted a franchise to construct and operate transmission lines on the public roads of Newton.

Columbia, S. C.—Bids will be received by the Building Committee of the Board of Trustees of the University of South Carolina until May 15 for the installation of a central heating plant at the institution. Plans and specifications are on file at the office of Wilson & Sompayrac, Main St., Columbia.

✦Abbeville, Ga.—The contract for the construction of a municipal electric-light plant at Abbeville has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at about $8000. Noted Apr. 24.

✦Rochelle, Ga.—The city has awarded the contract for the construction of a municipal electric-light plant and water system to the J. B. McCRARY CO., Third National Bank Bldg., Atlanta, at $19,000. Noted Mar. 20.

Jacksonville, Fla.—An expenditure of $15,000 for the installation of additional equipment in the municipal electric-light plant has been recommended to the Board of Bond Trustees. R. E. Wheeler is interested.

Citronelle, Ala.—A franchise has been granted to Daniel E. Smith and associates to construct and operate an electric-light plant at Citronelle. Estimated cost, $30,000.

Hattiesburg, Miss.—Plans are being prepared by the Hattiesburg Traction Co. for the installation of an ornamental street-lighting system in Hattiesburg. C. Z. Stevens, Hattiesburg, is Gen. Mgr. and Pur. Agt.

Dresden, Tenn.—Bonds for $10,000 for the construction of a municipal electric-light plant have been voted. Plans are being prepared by Henry A. Mentz, Randolph Bldg., Memphis, Tenn. Noted Apr. 10.

Auburn, Ky.—The Auburn Mills will install an electric-light plant, having secured a franchise from the City. A street-lighting system will be installed and operated.

Fulton, Ky.—The Fulton Electric Light & Power Co. is contemplating the enlargement of its plant. It recently increased its capital stock from $10,000 to $60,000.

Hickman, Ky.—Extensions to the plant of the Hickman Ice & Coal Co. are contemplated. The company has increased its capital stock from $20,000 to $80,000 and changed its name to the Hickman Electric, Ice & Water Co.

✦Louisville, Ky.—Press reports state that the Seelbach Hotel Co. has awarded the contract for the installation of a power and heating plant to the NATIONAL CONCRETE CONSTRUCTION CO., Board of Trade Bldg., Louisville. Estimated cost, $65,000.

✦Cincinnati, Ohio—The contract for the installation of a heating plant in the new Lippencott Bldg., on Main St., has been awarded to the W. H. CRANE ESTATE CO., Cincinnati, at $9000.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Serv., until noon, May 10, for constructing the concrete foundations for the municipal electric-light plant.

Findlay, Ohio—Plans have been prepared by John S. Riegle, Elec. Engr., for the construction of a power distributing plant and system at Findlay. Estimated cost, $70,000. J. E. Edie is City Clk. Noted Feb. 20.

Galion, Ohio—Plans are being prepared by F. B. Ray, Cleveland, for the installation of an ornamental street-lighting system in Galion. Henry Hocker is Dir. Pub. Serv.

Lebanon, Ohio—Plans are being prepared by the Reliance Engineering Co., Cincinnati, for the improvement of the local gas plant at Lebanon.

✦Lima, Ohio—We are officially advised that the Board of Education received bids Apr. 15 for the installation of a heating system in the Lima High School as follows: AMERICAN WARMING & VENTILATING CO., Toledo, $10,990, (awarded contract). Lewis & Kitchen, Chicago, Ill., $9366. Clark & Jones, Lima, $8300. Noted Mar. 27.

Toledo, Ohio—Bids will be received by the Board of Commissioners of Lucas County until May 19 for the construction of a power plant for the Lucas County Infirmary and Hospital for Tuberculosis.

Indianapolis, Ind.—Preliminary arrangements are being made by the Indianapolis Light & Heat Co., for the construction of a boiler house at Mill and 19th Sts. Estimated cost, $80,000. C. C. Perry, Indianapolis, is Pres.

Waynetown, Ind.—The Council is considering plans for the installation of an electric-light plant.

Quinnesec, Mich.—Plans are being prepared by the Oliver Iron Mining Co. for the installation of a hydro-electric plant to furnish electricity for the operation of its mine at Chapin.

Carlinville, Ill.—Plans are being prepared by the Carlinville Utilities Co. for the installation of a new street-lighting system in Carlinville. W. L. Monts, Carlinville, is Pres. and Supt.

Farmington, Ill.—Preliminary arrangements are being made by the Farmington Light & Power Co. for the extension of its transmission lines to Flatt. Theodore Bass is Gen. Mgr.

Marcus, Iowa—Preliminary arrangements are being made by the Marcus Electric Co. for the construction of an electric-light and power plant at Marcus. K. C. Gaynor of Sioux City, is interested. Estimated cost, $15,000. Noted Jan. 9.

Tipton, Iowa—Plans are being prepared by the Tipton Light & Heating Co. for the construction of a substation. John T. Moffitt, Tipton, is Secy. and Mgr.

Winona, Minn.—The Commercial Club is interested in the proposition to install an ornamental street-lighting system in Winona.

Augusta, Kan.—Plans are being prepared by Worley & Black, Consult. Engr., Kansas City, Mo., for the construction of a municipal electric-light plant at Augusta. Estimated cost, $5000. Joseph R. Switzer is City Engr. Noted Apr. 24.

Garden City, Kan.—Plans are being prepared by Worley & Black, Reliance Bldg., Kansas City, Mo., for the construction of a municipal electric-light plant at Garden City, to cost $40,000.

Herington, Kan.—The citizens are considering the proposition to issue $40,000 of bonds for the improvement of the municipal electric-light and water plant. Burns & McDonnell, Scarritt Bldg., Kansas Co., Mo., are Consult. Engr.

Rulo, Neb.—Bonds for $10,000 have been voted for the construction of a municipal electric-light plant in Rulo.

Silver Creek, Neb.—At a recent election the citizens voted to issue bonds for the construction of a municipal electric-light plant and water system.

Elgin, N. D.—The proposition to construct an electric-light plant in Elgin is under consideration.

Malta, Mont.—Preliminary arrangements are being made by R. J. Moore, for the construction of an electric-light plant at Malta, to cost $10,000.

Wellston, Mo.—The Business Men's Association is considering plans for the extension of the ornamental street-lighting system throughout Wellston.

Cotter, Ark.—Press reports state that the Dixie Power Co. is making preliminary arrangements for the construction of its proposed hydro-electric plant on the White River, near Cotter. The work includes the construction of a dam and power plant capable of developing 15,000-hp., and is estimated to cost $2,000,000. Walker V. Powell, of Little Rock, is Pres. Noted Mar. 3, 1912.

Floresville, Tex.—H. B. Harmon and O. A. Sims, of Beeville, Tex., have been granted a franchise by the City Council to erect an electric-light and power plant here.

Petrolia, Tex.—The Lone Star Gas Co. will lay a gas-pipe line from Petrolia to Electra.

Yorktown, Tex.—The Yorktown Light & Ice Co. will install additional equipment in its electric-light plant here.

†San Francisco, Calif.—The Panama-Pacific International Exposition Co. has awarded to AMPERE-SMITH & CO. the contract for the installation of the electrical conduit system in the exhibits section of the exposition grounds at $32,000.

Marietta, Okla.—Plans are being prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, for improving the municipal electric-light plant and water system at Marietta.

McCurtain, Okla.—Press reports state that plans are being considered by T. N. Taylor and B. A. Little, of Okemah, Okla., for the improvement of the local electric-light plant. It is proposed also to install a street-lighting system.

Wakita, Okla.—A franchise has been granted to P. F. Wright and associates to construct and operate an electric-light system in Wakita.

Port Angeles, Wash.—The City Engineer has been authorized to secure estimates of the cost of constructing a municipal electric-light plant.

Lafayette, Ore.—Bonds for $10,000 have been voted for the construction of a municipal electric-light plant and water system.

Pasadena, Calif.—Bids will be received by Herman Dyer, City Clk., until 11 a.m., May 13, for furnishing one water tube boiler capable of operating working pressure of 200 lb. per sq.in containing not less than 3000 sq.ft. heating surface, and to be equipped with a superheater, gage, blow-off, etc., also for furnishing a 100-ft. stack 40-in. in diameter and induction feed regulators.

San Bernardino, Calif.—The Empire Water Power Co. will erect a hydro-electric plant near Coyote Creek in the San Jacinto Mountains. Henry Bloomenberg, of Los Angeles, is Pres. of the company. Bonds of $200,000 will be issued for the purpose.

Berlin, Ont.—The City Council is considering an expenditure of $25,000, for the improvement of the municipal electric-light and gas plants.

Hamilton, Ont.—We are officially advised that bids will be received by the Hamilton Hydro-Electric Department, about May 20, for the construction of a substation, to cost $40,000, and the installation of a conduit system, to cost $150,000. E. I. Sifton is Consult. Engr. Noted May 1.

†Langham, Sask.—The contract for the installation of an electric-light plant at Langham has been awarded to the BRITISH CANADIAN ENGINEERING & SUPPLY CO., Winnipeg. Estimated cost, $12,000.

Strassburg, Sask.—Bids will be received by L. A. Smith, Secy.-Treas. of Strassburg, until May 20, for the construction of an electric-light plant.

Prince Rupert, B. C.—According to press reports the City Council has authorized an appropriation of $550,000 for the construction of a hydro-electric plant.

BRIDGES

Ft. Edward, N. Y.—The towns of Ft. Edward and Moreau are considering the proposition to rebuild the bridge over the Hudson River which was recently washed away. The estimated cost is $10,000.

†Livingston Manor, N. Y.—We are officially advised that the contract for the construction of a bridge and foundations over the Willowemoc River, State Route No. 4, Livingston Manor, has been awarded to the GOOD ROADS MACHINERY CO., Marathon, N. Y., at $9000 Noted Apr. 10

New York, N. Y.—Bids will be received until 2 p.m., May 22, by the Department of Bridges, Municipal Bldg., for the improvement of the Brooklyn Plaza of the Manhattan Bridge. Arthur J. O'Keefe is Comr.

Camden, N. J.—Bids will be received by the Board of Chosen Freeholders until 11 a.m., May 12, for the construction of two concrete arch culverts on the road between Clementon and Blackwood, according to plans on file at the office of J. J. Albertson, County Engr. F. W. George is the Clk. of the Bd.

New Brunswick, N. J.—Bids will be received by the Board of Chosen Freeholders until May 19, for the construction of a steel and concrete bridge over Brown's Brook, Blair Road, Woodbridge Township. Plans and specifications were prepared by Alvin Fox, County Engr., Perth Amboy. Peter H. S. Hendricks is Dir. of the Bd

Paterson, N. J.—Bids will be received by the Board of Chosen Freeholders until May 14, for the construction of a new reinforced concrete bridge over the Peckman River at Little Falls; also for widening to present bridge on the Newark-Pompton Turnpike, near the Erie R.R., according to plans and specifications on file at the office of the County Engineer. Joseph Masdonald is the Chn. of the Bd.

Brownsville, Penn.—The Commissioners of Fayette and Washington Counties will receive bids about June 1 for the construction of the proposed bridge over the Monongahela River at West Brownsville. George Porter, Uniontown, Penn., is the Consult. Engr. Noted Feb. 20.

Annapolis, Md.—See item under Federal Government Work: Bridge.

Denton, Md.—Bids will be received by the Commissioners of Caroline County until May 15, for the construction of a lift bridge over the Choptank River on the Denton-Willow Road. Plans and specifications are on file at the office of the State Road Commissioners at 534 North Howard St., Baltimore, Md.

Washington, D. C.—Bids will be received by the District Commissioners until June 24, for the construction of a reinforced concrete bridge over Rock Creek, connecting Q St. in Washington, with Q St., in Georgetown. The estimated cost is $275,000. D. E. McComb is District Engr., of Bridges.

★Washington, D. C.—See item under Federal Government Work: Bridge.

Washington, D. C.—Bids will be received by the Commissioners of the District of Columbia until June 24, for the construction of a six-span masonry bridge across Rock Creek on the line of Q St. Noted Feb. 13.

Lewisburg, W. Va.—Bids will be received by the County Courts of Greenbrier and Monroe Counties at Lewisburg, until June 3, for the construction of a bridge across Second Creek at the Clarence Dickson Ford. John E. Dougher is the County Road Engr. of Greenbrier County.

Lexington, Ky.—Bids are being received by the Louisville & Nashville R.R. for the construction of two reinforced concrete viaducts in Lexington. W. H. Courteney, Louisville, Ky., is the Ch. Engr. Noted Mar. 6.

†Walbridge, Ky.—The contract for the erection of a bridge over the Big Sandy River at Wlabridge for the Chesapeake & Ohio Ry., has been awarded to LANGHORN & LANGHORN, Louisa, Ky. The contract for the concrete piers has been awarded to the LOUISA CONTRACT CO. The estimated cost of the structure is $200,000.

Chillicothe, Ohio—Bids will be received by the Board of Commissioners of Ross County until noon, May 26, for the construction of a bridge across the North Fork of Paint Creek, in Scioto Township. Robert D. Alexander is the County Audr.

Cincinnati, Ohio—The City Council is considering the erection of a reinforced concrete bridge on Grand Ave., over the Bassett Road. The estimated cost is $12,000. Simeon M. Johnson is Pres. of the Council.

Cleveland, Ohio—Bids will be received by the Board of Commissioners of Cuyahoga County until 11 a.m., June 4, for the construction of bridge work per reports No. 3116 and 3117. Plans and specifications are on file at the office of the County Engr., at the New Court House, Lakeside Ave., Cleveland. John F. Goldenbogen is the County Clk.

†Middletown, Ohio—The contract for the construction of the temporary bridge between Middletown and West Middletown, has been awarded to ARPP & SIMPSON, Middletown, at $12,552.

Sidney, Ohio—Bids will be received by the Commissioners of Shelby County until 10 a.m., May 10, for the construction of two 50-ft. arches with a 16-ft. roadway, for the Rumley Bridge in Van Buren Township over Loramie Creek. Plans and specifications are on file at the office of H. T. Ruese, County Audr.

Urbana, Ohio—Bids will be received by the Commissioners of Champaign County until noon, May 14, for the construction of bridge work. R. F. Darnell is the County Engr.

Crawfordsville, Ind.—Bids will be received by the Board of Commissioners of Montgomery County until 10 a.m., May 13, for the construction and repair of bridges in Montgomery County. Bennett B. Engle is the County Audr.

Fort Wayne, Ind.—Bids will be received at the office of Calvin H. Brown, County Audr. of Allen County, until 10 a.m., May 14, for the construction of culverts and for furnishing the material for the repair of bridges.

Muncie, Ind.—The County Council of Delaware County has authorized a bond issue fo $81,500 for the construction of new bridges and lengthening the present ones.

Greenfield, Ind.—Press reports state the County Commissioners will receive bids until May 23, for the construction and repair of 19 bridges. Lawrence Wood is the County Audr.

Atchison, Kan.—The Atchison, Topeka, & Santa Fé Ry. and the Missouri Pacific Ry. have entered into an agreement with the city officials to construct a viaduct over their tracks at West Atchison. The estimated cost is $60,000.

Salina, Kan.—Plans for a reinforced concrete bridge at Iron Ave., have been submitted to the County Commissioners of Salina County, by the Heddrick & Cockran Engineering Co., Kansas City. The estimated cost is $26,000.

Hiawatha, Kan.—According to press reports bids will be received by C. H. Dawley, County Clk., until May 12, for the construction of a five-span steel bridge at Hiawatha.

Cavalier, N. D.—Bids will be received by the County Commissioners until May 14, for the construction of steel bridges during the ensuing year. William W. Felson is the County Audr.

✦Hallettsville, Tex.—The contract for the erection of three steel bridges in Lavaca County has been awarded to M. F. LEONARD, Bowie, Tex.

Paris, Tex.—Press reports state that bids will be received by the County Commissioners until May 10, for the construction of an 88-ft. span steel bridge over Townsend Creek, on the Paris and Cynthiana Turnpike. G. K. Redman is Chn. Comrs.

✦Grants Pass, Ore.—The contract for the construction of a bridge over the Rouge River on Gallce Road, has been awarded to E. G. PERHAM, Medford, Ore., at $6828.

✦Santa Cruz, Calif.—The contract for the construction of a bridge over the Soquel Creek near the Littlejohn place, has been awarded to the T. K. BEARD CO., Modesto, Calif., at $6840. The structure will be 187 ft. long and 21 ft. wide.

WATER SUPPLY—IRRIGATION

Brewer, Maine—The city has granted a franchise to the Brewer Water Co. to furnish water for a period of 20 years, the supply to be taken from Hatcase Pond, ten miles from the city. The system will be installed immediately.

✦Boston, Mass.—A contract to lay water mains and set hydrants in various streets has been awarded by the Department of Public Works, to THOMAS BURKE, Boston, at $15,476. The other bids were: J. H. Ferguson, $20,507; Hugh McNulty, $22,828. L. K. Rourke is Comr.

Bids will be received by the Department of Public Works until May 9, for laying water mains in Linden and Ashford Sts., Brighton District. L. K. Rourke is Comr.

Middleboro, Mass.—Bids for constructing a concrete aërator, a covered, slow sand filter and filtered water basin, with appurtenances, were received by the city, Apr. 21, as follows: Briggs Engineering and Construction Co., Providence, R. I., $13,253. John E. Palmer, Boston, $14,880; Simpson Bros. Corp., Boston, $16,107. C. E. Trumbull Co., Boston, $19,344; Charles R. Gow Co., Boston, $14,000; M. W. Allen Construction Co., Walpole, $16,961; John T. Scully Foundation Co., Cambridge, $17,884.

Somerset, Mass.—A committee has been appointed to investigate the advisability of installing a water system here. D. B. Davis is Town Clk.

Springfield, Mass.—The Water Department is preparing plans for improvements at the Ludlow Reservoir. A new steel tank to hold filtered water will also be built and a new pump installed. F. H. Clark is Supt. Engineering Dept.

Worcester, Mass.—The City Council Committee on Water has recommended the installation of 1000 ft. of 12-in. high-service pipe on Franklin St., to cost $3345; 4008 ft. of 48-in. pipe on Olean and Pleasant Sts., to cost $68,000; and various small jobs amounting to $9500. George W. Batchelder is Water Comr.

Worcester, Mass.—Bids for furnishing water meters have been received by G. W. Batchelder, Water Comr., as follows: 1000 ⅝-in. meters, National Meter Co., N. Y., $7; Union Water Meter Co., Worcester, $5.75. Hersey Mfg. Co. of So. Boston, $5.95. For 50 ⅝-in. meters, bidders in same order, $10, $10.55, $9; 25 1-in., $30, $21.95, $22.50. For 12 1½-in., $50, $37.35, $37.50. For 12 2-in., $65, 556.25, $48.75. For 12 3-in., $125, $92.25, $92. For 12 4-in., $225, $182.25, $168.75. Also for ⅝-in., Neptune Water Co., of New York, $8, and for ¾-in., $12.

★Providence, R. I.—Official bids will be received by the Board of Contract and Supply until 2:15 p.m., May 21, for installing a 30,000,000-gal. pumping unit at the Pettuconset Pumping Station, Cranston, R. I. Bids will be received on (a) high duty steam engine and plunger pumps, with boilers, (b) electric motor driven centrifugal pumps, (c) steam turbine driven centrifugal pumps, with boilers. Plans and specifications may be obtained at the office of the Chf. Engineer. William C. Pelkey is Clk., Bd. Contract and Supply. Noted Jan. 24.

Hartford, Conn.—Bids will be asked about June 1 for laying approximately nine miles of 12-in water mains. Caleb M. Saville is Ch. Engr.

Binghamton, N. Y.—Bids will be received by the Board of Water Commissioners until 10 a.m. May 15 for constructing a filtration plant according to plans and specifications prepared by Frederic E. Beck and on file at the office of the Commissioners. The contract is subdivided as follows: (A) Earth excavation, reinforced concrete substructure, 30-in suction and discharge lines, sewer and miscellaneous work as shown on plans. (B) Brick building complete. (C) Furnishing and erecting complete, all materials, tools, labor and appliances for the equipment of nine filters, of a total capacity of about 9,000,000 gal. per day, also furnishing and erecting two low-lift pumps steam-driven. Noted Feb. 13.

East Syracuse, N. Y.—The Water Department has appointed a committee to consider the advisability of extending the water reservoir. Estimated cost, $10,000. Fred Shepp is Pres.

★New York, N. Y.—We are officially advised that bids for Contract 91 of the Catskill Aqueduct, which consists of furnishing racks, stop shutters, screens, lifters and other apparatus in various gate chambers along the aqueduct, were received by the Board of Water Supply, Apr. 29, as follows: Vulcan Rail & Construction Co., 35 Meserole Ave., Brooklyn, N. Y., $34,675; Joseph Balaban Co., 156 Fifth Ave., New York, $40,250; Howard H. Peterson Co., Inc., $42,195; Bartolicius Star Iron Works, Inc., Park Ave., New York, $51,131; Exeter Machine Works, Pittston, Penn., $71,985. Noted Apr. 17.

✦Utica, N. Y.—(Official)—The Consolidated Water Co. has awarded a contract to H. K. CORBIN, 170 Broadway, New York, N. Y., to lay 29,100 ft. of 24-in. c.-i. water mains.

★Atlantic City, N. J.—(Official)—Bids will be received by the Board of Commissioners until May 15, for hauling and laying about 6000 ft. of 48-in. c.-i. water pipe, furnishing and driving about 70,000 lin.ft. of piles, and constructing about 750 cu.yd. of reinforced-concrete caps and incidentals. Harry Bacharach is Dir. Parks and Pub. Property.

★✦Belleville, N. J.—The contract to furnish water pipe and castings here has been awarded to the FLORENCE IRON FOUNDRY CO., Florence, N. J., at $7839. Bids were opened by the Town Council, Apr. 16. Noted Apr. 3.

Chatham, N. J.—Bids will be received by the Board of Water Commissioners until 8 p.m., May 12, for extending and improving the water system and electric-light plant. The contract involves the following: Item 1, alterations and additions to power house. Item 2, one 100-kw. turbo-generator unit. Item 3, one 150-hp. condenser. Item 4, two 150-hp. water tube boilers and breeching. Item 5, one 75-kw. 2300-volt, 3-phase generator and exciter. Item 6, one switchboard complete. Item 7, one 500,000-gal. motor-driven pump. Item 8, one radial brick chimney. Item 9, industrial railway complete with charging car and scales. Specifications may be obtained from C. E. Hewitt, Consult. Engr., Durham, N. H., or from W. S. Angell, Boro. Clk., Chatham. Bids for this work were received and rejected, Apr. 7. Noted Apr. 17.

Lambertville, N. J.—The Lambertville Water Co. contemplates laying a fire service main from its reservoirs to the city.

Moorestown, N. J.—(Official)—Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., has recommended that the town purchase the present private water system, at an approximate cost of $80,000, and expend $60,000 for improvements. Action will be taken by the Council shortly. Noted Dec. 12.

Passaic, N. J.—An advisory committee has been appointed to make a report on the proposition to install a new water system. Colin R. Wise is City Engr.

★Danville, Penn.—(Official)—Bids will be received by the Board of Water Commissioners until noon, May 20, for the construction of a reinforced concrete settling basin, coagulant apparatus, connections and appurtenances. Plans and specificatios may be obtained at the office of Chester & Fleming, Consult. Engrs., Union Bank Bldg., Pittsburgh, Penn. Frederick Ploch is Chn. of Bd. Noted Mar. 13.

Lawrenceville, Penn.—The village contemplates the installation of a water system.

✦Phoenixville, Penn.—(Official)—The contract to equip a 3,000,000-gal. filtration plant for the borough has been awarded to the ROBERTS FILTER MFG. CO., Philadelphia, Penn. The concrete work and buildings will be done on force account, and work will begin June 1. Chester & Fleming, Union Bank Bldg., Pittsburgh, Penn., are Consult. Engrs.

Scranton, Penn.—Bids will be received by the Department of Public Safety until 10:30 a.m., May 12, for furnishing and delivering fire hydrants. W. G. O'Malley is Dir.

★Baltimore, Md.—(Official)—Bids for Contract 11 of the water improvements, which provides for the construction of 32 mechanical filter units, two coagulating basins, one mixing basin, and two earth dams and appurtenances, were received by the Board of Awards, Apr. 30, as follows: Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, Penn., $971,187; New York Continental Jewell Filtration Co., 15 Broad St., New York, $982,563; Oscar Daniels Co., 38 Park Row, New York, $1,016,521. Noted Apr. 10.

Round Hill, Va.—Preliminary plans are being considered here for the installation of a water system, estimated to cost $12,000.

Goldsboro, N. C.—Bids will be received by the city until noon, May 28, for purchasing $83,000 of bonds. Of this issue, $36,000 were voted for installing a water system according to plans prepared by Gilbert C. White, Consult. Engr., Charlotte, N. C. D. J. Broadhurst is City Clk. Noted Apr. 17.

✦Conyers, Ga.—The contract to install water and sewer systems here has been awarded to the J. P. McCRARY Co., Third National Bank Bldg., Atlanta, Ga., at approximately $40,000. Noted Feb. 27.

Royston, Ga.—An election has been called for May 19, to vote on a bond issue of $45,000, for the installation of a water system.

Thomaston, Ga.—An election has been called for May 21, to vote on a bond issue of $15,000, for the installation of water and sewer systems.

✦High Springs, Fla.—According to press reports, a contract to install a water system and electric-light plant here has been awarded to the J. P. McCRARY CO., Third National Bank Bldg., Atlanta, Ga., at approximately $65,000.

Jennings, Fla.—The J. B. McCrary Co., Third National Bank Bldg., Atlanta, Ga., is preparing plans for a water system here, estimated to cost $20,000.

★Tuscaloosa, Ala.—(Official)—Bids will be received at the office of the Water Commission until 2 p.m., May 16, for the construction of four reinforced-concrete filters and appurtenances. Plans and specifications are on file at the office of the commission, and at the office of Morris Knowles, Consult. Engr., Oliver Bldg., Pittsburgh. Noted Apr. 17.

Ville Platte, La.—The village contemplates the installation of a water system.

Henderson, Tenn.—At the election of Apr. 26, it was voted to expend $50,000 for the installation of a water system and electric-light plant. J. I. Galbraith is Mayor. Noted Apr. 24 and 10.

Tiptonville, Tenn.—The town contemplates the installation of a water system estimated to cost $20,000. An election will probably soon be called to vote on a bond issue. F. A. Lockhart is Town Clk.

Harlan, Ky.—The town is ready to grant a franchise for the installation of a water system to serve a population of 3000. A. M. Gregory is Chn. Water Com.

★Madisonville, Ky.—Official—Bids will be received by the Board of Public Works until 2 p.m., May 20, for laying about ten miles of water mains and four miles of sanitary sewers, constructing an earth and concrete dam 620 ft. long, and furnishing electric motors, turbine and triplex pumps. C. H. Jenks, Union City, Tenn., is Consult. Engr. Noted Apr. 17.

Akron, Ohio—We are officially advised that no bids were received Apr. 17, for the Cuyahoga River Dam, Water-Works Contract No. 24. This was due to the fact that the floods have given the contractors in the vicinity of Akron so much work at remunerative prices, that they refused to compete on this work. Work may be resumed later in the year, but nothing definite has been settled. F. A. Barbour, Boston, Mass., is Consult. Engr. Noted Apr. 10.

Bonds for $1,250,000 have been voted for extending, enlarging, improving and repairing the water system of the city. George C. Jackson is Pres. of Council.

Euclid, Ohio—The Village Council has ordered the laying of a 6-in. water main in Imperial Road, from Euclid Ave. to Roseland Ave. Louis Harms is Mayor and Pres. of Council.

Fostoria, Ohio—Charles A. Latshaw, City Engr., has completed a survey for the proposed new reservoir, and is preparing a topographical map, which is to be submitted to the City Council for approval. According to press reports, bids will be asked on this contract about June 1.

Ironton, Ohio—The State Board of Health has ordered the installation of a filtration plant for the water system, and the city is now making surveys and estimates for the plant.

Norwood, Ohio—A new election will probably be called to vote on the proposition to issue bonds for $140,000, for improving the water system, installing a water-softening plant. This proposition was defeated at an election held Apr. 25.

Painesville, Ohio—Official.—R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, has been retained by the city to prepare detail plans for a new water-supply pump station, rapid sand filter plant and a new crib and intake extending about 1500 ft. into Lake Erie.

Pleasant City, Ohio—Bids will probably be asked soon for improving the water and sewer systems. Estimated cost, $15,000. Plans were prepared by H. L. Maddock, Consult. Engr., Newark, Ohio. M. L. Devine is Village Clk. Noted Mar. 20.

Sandusky, Ohio—R. L. Wager, Engr., has prepared plans for laying 18,600 ft. of 48-in. c.-i. intake pipe into Lake Erie. The plans are now being considered by the Water Improvement Committee. John Bing is Dir. Pub. Ser.

Logansport, Ind.—According to press reports, bids will be received by the Board of Public Works until May 20, for the construction of the proposed filtration plant. Estimated cost, $60,000. Plans were prepared by the American District Steam Co., First National Bank Bldg., Chicago, Ill. William Pickett is City Clk. Noted Feb. 13.

Roanoke, Ind.—The Roanoke Water Co. has been incorporated here with a capital stock of $15,000, and will supply the town with water. N. D. Richards is one of the directors.

St. Louis, Mich.—Smith & Bouley, Consult. Engrs., The Nasby, Toledo, Ohio, are preparing plans for laying water mains in various streets, and for 12,000 sq.yd. of paving.

★Moline, Ill.—(Official)—Bids will be received at the Council Chamber until 2 p.m., May 26, for furnishing and erecting at the pumping station, a reinforced-concrete raw water well and pump pit, complete with piping and appurtenances. The work will involve about 1200 cu.yd. of excavation, 230 cu.yd. of concrete, 19,500 lb. of reinforcing steel, 411 lin.ft. of hub and spigot pipe, ranging from 6 to 30 in.; 168 lin.ft. of flanged c.-i. pipe, ranging from 10 to 20 in., and sundry gate valves, check valves, specials, fittings and appurtenances. Dabney H. Maury, Monadnock Block, Chicago, is Consult. Engr. L. O. Jahns is Comr. Pub. Property.

Appleton, Wis.—The lowest bid received by E. L. Williams, City Clk., Apr. 23, for constructing a pumping station for the water system, was submitted by F. Hoffman & Son, at $10,975. Noted Apr. 24.

Mosinee, Wis.—The Village Board has decided to secure plans and estimates for the installation of a water system.

Turtle Lake, Wis.—Bids will be received by the village until 8 p.m., May 20, for constructing a water system. The contract includes a wooden tank and steel tower, 36,000 gal. capacity, one 32-hp. engine and pump, 430 ft. of 4-in. and 4822 ft. of 6-in. water mains, and 10 fire hydrants. Plans and specifications are on file at the office of F. G. McKenzie, Village Clk., and A. T. Thompson, Consult. Engr., Colfax, Wis.

Des Moines, Iowa—The Des Moines Water Co. plans an expenditure of $75,000 for improving and extending its water system. The plans provide for laying ten miles of mains, and the installation of automatic stokers and a new stack at the water plant. C. S. Denman is Gen. Mgr.

Eldora, Iowa—Bids will probably soon be asked for extending the water system, according to plans prepared by S. B. Gardner, City Engr. L. J. Stout is City Clk. Noted Apr. 3.

Perry, Iowa—The City Council is considering a proposition to rebuild the water system, at an estimated cost of $20,000. An election will probably soon be called to vote on a bond issued for this amount. Adrian Cross is City Clk.

Herington, Kan.—Official—The election to vote on a bond issue of $50,000 for improving the water system has been extended from May 1 to May 15. The issue will be used for extending the water mains, constructing a concrete storage reservoir, and developing springs. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Apr. 3.

✦Jewell, Kan.—(Official). The contract is install a water system here has been awarded to T. C. BROOKS & SONS, Jackson, Mich., at $24,571. Bids were opened Apr. 20. Noted Apr. 17.

Tescott, Kan.—Rollins & Westover, Consult. Engrs., Midland Bldg., Kansas City, Mo., have been retained to prepare plans and specifications for a water system and electric-light plant here. Estimated cost, $25,000.

Ralston, Neb.—According to press reports, the contract to construct a water system here has not been awarded, as 5noted in our issue of May 1, but bids are being readvertised to be received until 10 a.m., June 3. The system will cost about $15,000. C. M. Skinner is Chn. Bd. of Trustees. Noted Apr. 10.

Waterloo, Neb.—It is proposed to install a water system here at an estimated cost of $14,000. W. J. Mack is Village Clk.

Carter, S. D.—Bonds for $7600 have been voted for installing a water system. Edward Haisch is Mayor.

Belfield, N. D.—Preliminary plans are being considered here for the installation of a water system, estimated to cost $10,000.

Glenrock, Wyo.—Bids are being received by the town for the installation of a water system, according to plans prepared by C. C. Carlisle, Consult. Engr., Cheyenne, Wyo.

Manville, Wyo.—C. C. Carlisle, Consult. Engr., Cheyenne, Wyo., has been retained by the town to prepare plans and specifications for a water system and electrical-light plant here.

Albany, Mo.—The city contemplates an expenditure of $19,000 for improving the water system and electric-light plant. C. E. Gibbany is City Clk.

Monroe City, Mo.—Bonds for $78,000 were voted at the election, Apr. 28, for constructing water and sewer systems. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Apr. 24.

St. Louis, Mo.—Official—Contracts have been awarded by the Board of Public Works, as follows: Furnishing 3030 tons of c. i. coated water pipe, to the AMERICAN CAST IRON PIPE CO., at $74,462. The only other bidder was the U. S. Cast Iron Pipe Co., their total bid being $77,113; furnishing 240 tons of c. i. coated special castings to the BESSEMER FOUNDRY & MACHINE CO., $44.30 per ton. The other bidder was the U. S. Cast Iron Pipe Co., its price being $47.59 per ton; furnishing 296 stop valves, to the A. P. SMITH MFG. CO., total bid $4950. The other bidders were the Roe-Stephens Mfg. Co., $5129, and the American Foundry & Machine Co., $5367; furnishing 675 fire hydrants, to the AMERICAN FOUNDRY & MACHINE CO., $44.30 per ton. The other bidder was the A. P. Smith Mfg. Co., $16,500; laying 71,030 ft. of 6-, 12-, 20- and 36-in. water pipe, to JOHN O'DONNELL, total bid $25,523. There were seven other bidders for this work and the bids ranged from $29,860 to $38,942. Bids were opened Apr. 22. Edward E. Wall is Water Comr. Noted Apr. 17.

Kingsville, Tex.—(Official)—Alexander Potter, 50 Church St., New York, N. Y., has been retained by the town of Kingsville to prepare plans and specifications for the construction of complete sewer and water systems designed to serve a population of 5000.

Howe, Okla.—The City Council is considering a proposition to install a municipal water system here.

Marietta, Okla.—(Official)—The Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., is preparing plans and specifications for improving the water system and the electric-light plant here.

Watonga, Okla.—(Official)—The Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., has been retained by the city to prepare plans and specifications for the improvement of the water system and electric-light plant.

✦Fountain, Colo.—According to press reports, the contract to construct a water system here has been awarded to J. R. GORDON & SON, Pueblo, Colo., at approximately $45,000. Plans for the system were prepared by Albert W. Payne, Jr., Consult. Engr., Century Bldg., Denver, Colo. Noted Dec. 26.

East Las Vegas, N. M.—The National Trust & Savings Co., Salt Lake City, Utah, has taken over the Canfield Irrigation Project near here and will complete the dam and canal system. The cost of the proposed work is estimated at $500,000. Lloyd Sigler is V.-Pres. and Gen. Mgr.

Winslow, Ariz.—The St. Lodis & San Francisco R.R. Co., which owns 500,000 acres of land situated between Winslow and Holbrook, is having plans prepared for the construction of an irrigation system, which will water about 250,000 acres of the tract, according to the statement of A. S. Greig, St. Louis, Mo., V.-Pres. of the company. Engineers recently finished the preliminary survey of the property and the construction work will soon be started.

Byrum, Utah—It is proposed to install a water system here, estimated to cost $60,000. Bonds for $22,000 were recently voted for this work.

✦Parson, Utah—A contract to construct a water system here has been awarded to A. A. CLARKE & CO., Salt Lake City, Utah, at approximately $45,000. The new system involves the construction of a main pipe line six miles long, and about 1½ miles of distributing main.

Centralia, Wash.—Bids will probably be asked in August for the construction of the proposed new municipal water system, which is estimated to cost $300,000. The supply will be obtained from the North Fork of the Newaukee River, 16 miles from the city. Stanley Macomber is City Engr. Noted Jan. 16.

Amity, Ore.—An election will soon be called to vote on the proposition of bonding the city for $15,000, to be used in the construction of a water system. A cement reservoir, with a capacity of 300,000 gal. and several miles of steel mains are included in the improvement.

Dayton, Ore.—Jones & Flagg, Consult. Engrs., McMinnville, Ore., have been retained to prepare plans for a gravity water system here. About 32,000 ft. of wood pipe will be used. Noted Mar. 27.

Lafayette, Ore.—See item under Light, Heat and Power.

Pendleton, Ore.—According to press reports, bids will be received by the city until May 14, for the purchase of $14,000 bonds issued for the construction of a water system. Frank C. Kelsey, Consult. Engr., has made a report on three different types of water system. Noted Apr. 10.

Angels Camp, Calif.—The Utica Co. will rebuild the flume carrying the water from the reservoirs in the mountains east of here to the distributing reservoirs near the city. The main flume to be rebuilt is about six miles long, starting at the Stanislaus River leading westward, to be 7 ft. wide and 4 ft. high. In addition to this main flume, shorter ones will be built, making in the aggregate about seven miles. The flume when finished will carry a continuous stream of between 2000 and 3000 miner's inches of water every 24 hours.

Palmdale, Calif.—The Palmdale Land Co. contemplates the construction of one and possibly two dams which will store from 10,000 to 12,000 acre-ft. of water at the headquarters of Little Rock Creek.

Stockton, Calif.—W. G. Hunter, City Engr., is preparing plans for a high-pressure fire-protection system here. An election will probably soon be called to vote on a bond issue of $200,000 for this and other improvements to the water system.

Watts, Calif.—Frank A. Lathrop, Consult. Engr., Higgins Bldg., Los Angeles, Calif., has completed plans and specifications for the proposed water system here. The City Trustees are arranging to call an election to vote on a bond issue of $100,000 for this improvement.

Fort William, Ont.—Bids will be received by A. McNaughton, City Clk., until noon, May 29, for constructing three tunnels in Hudson Shale, as follows: Tunnel under Kaministikwia River, 1275 ft. long, 7 ft. wide, 8 ft. high, 119 ft. deep; tunnel under Mission River, 677 ft., 5 ft., ft., 95 ft.; tunnel under McKellar River, 29 ft., 5 ft., 6 ft., 91 ft. Plans and specifications may be seen and forms of proposals may be obtained at the office of T. Aird Murray, Consult. Engr., Lumsden Bldg., Toronto, Ont.

New Hamburg, Ont.—Plans are being prepared for the installation of a water system here, estimated to cost $25,000. The plans provide for three miles of pipe, an elevatd concrete water tower of 50,000 gal. capacity, 90 ft. high, turbine pumps, electric motor, covered concrete reservoir, hydrants, valves and meters. J. F. Katzenmuir is Town Clk.

✦North Battleford, Sask.—(Official)—Contracts for improving the water system have been awarded by the city, as follows: Contract D, c.-i. pipes, U. S. CAST IRON PIPE CO., Chicago; steel pipes, CANADA FOUNDRY CO., Toronto; specials, JOHN EAST IRON WORKS, Saskatoon. Contract E, hydrants, CANADA IRON FOUNDRY, Toronto; valves, KERR ENGINE CO., Walkerville, Ont.; Contract S, sewer pipes, MALCOMB SEWER PIPE CO., Malcomb. Noted Mar. 27.

SEWERS

Biddeford, Maine—Plans are being prepared for laying a sewer in Alfred St. James G. C Smith is Mayor.

★Charleston, N. H.—(Official) Bids will be received by the Board of Selectmen until 1 p.m., May 15, for laying about 30,000 lin.ft. of 6- to 12-in. sewers, with about 80 flush tanks, manholes and catch basins. Plans and specifications are on file at the office of E. E. Davis, Consult. Engr., 78 Main St., Northampton, Mass. Noted Mar. 27.

New Bedford, Mass.—The Committee on Roads Bridges and Sewers has recommended an expenditure of $20,000 for the construction of a sewer system to serve the northwestern section of the city. Gustav H Nye is City Engr.

Williamstown, Mass.—William N. Tuller, Consult. Engr., North Adams, Mass., has been retained by the Sewer Commission to prepare plans and specifications for a sewer system.

✦✦Worcester, Mass.—(Official) The contract to furnish cement for sewers for the period from May 1, 1911, to May 30, 1911, has been awarded to the PENNSYLVANIA CEMENT CO., New York, at $1.32 per bbl. The other bids were: Alpha Portland Cement Co. $1.42; B. F. Mach Co., Worcester, $1.33; F. E. Powers Co., Worcester, $1.35; South Coast Co., $1.39; Edison Portland Cement Co., $1.38. Bids were opened May 1. Noted May 6.

The Committee on Sewers of the City Council has recommended the construction of sewers in various streets, at an estimated cost of $29,000. V. H. McClure is City Engr.

Pawtucket, R. I.—It is proposed to expend $50,000 for improving the filtration plant of the sewer system. Isaac Gill is Supt. of Sewers.

★Stamford, Conn.—(Officially) Bids will be received by the City Clerk until 8 p.m. May 15, for constructing sewers as follows: About 1700 lin.ft. of 10-in. pipe on Bell St. from Hill St. to the pipe in Bell St. at the rear of Bell St. No. 2; about 1000 lin.ft. of 8-in. pipe in Bell St. from the present terminus of pipe at Bell St. No. 2 to Bell St. No. 22; manholes and flush tank. Specifications may be obtained from the City Clerk.

✦Albion, N. Y.—The contract to construct a sewer system and sewage disposal plant has been awarded to RIPTON & McNEIL, Lexington Bldg., Rochester, N. Y., at $150,000. The bid of Hunter & George, Syracuse, which was the lowest received, was withdrawn. Noted Apr. 24.

Brooklyn, N. Y.—We are officially advised that the following bids were received on Apr. 29, by the President of the Borough of Brooklyn, for the construction of sewers in various streets: West 25th St., from Neptune Ave. to Surf Ave., Newman & Cary, 215 Montague St., $16,555; Murphy Bros., $17,501; Vachus & Ghelardi, $18,065; John C. Schrade, $21,285; in East 37th St., from Avenue G to Avenue H, etc., John C. Schrade, Inc., 2132 Beverly Road, $13,407; D. Donegan Co., $13,707; Murphy Bros., $14,125; Albert F. Koch, Inc., $14,751; Culp Co., Inc., $15,109; Carmine Carrabura, $15,137; James J. Gorman, $15,184; Newman & Carey, $15,512; A. B. Nichols, Inc., $16,258; in 12th Ave., from 36th St. to 38th St., Eusebio Ghilardi, $7174; A. B. Nichols, Inc., $7583; Culp Co., Inc., $7669; Angelo Palit., $7695 Albert F. Koch, Inc., $7862; Tony Lapadula, $7838; Frank Merindins, $7879; Joseph Jennings, $8655; in Union St., from Classon Ave. to Bedford Ave., Carmine Carrabura, $7155; Murphy Bros., $7185; A. B. Nichols, Inc., $7230; Joseph Jennings, $7785; Frank Merindino, Inc., $8199; James Glen, $8274; John C. Schrade, Inc., $8357; Culp Co., Inc., $8870. Alfred E. Steers is Pres.

New York, N. Y.—(Borough The Bronx)—Bids will be received until 10:30 a.m., May 14, by the President of the Borough of The Bronx, Municipal Bldg., 177th St. and Third Ave., for constructing sewers and appurtenances in portions of Pugsley Ave., McGraw Ave., Raymond Ave., Zerega Ave., MacClay Ave., Seddon St., St. Lawrence Ave., Merrill St., Tinton Ave., East 165th St., Watson Ave. and Theriot Ave. Cyrus C. Miller is Pres.

New York, N. Y.—(Boro. of Richmond)—Bids will be received until noon, May 13, by the President of the Borough of Richmond, Borough Hall, St. George, S. I., for constructing temporary combined sewers, with the necessary appurtenances, in Charles St., from St. Marys Ave. to Chestnut Ave.; in Smith St., from St. Marys Ave. to Wall St.; in Oak St., from St. Marys Ave. to Wall St.; in Wall St., between Reynolds St. and Charles St., and in Reynolds St., from Wall St. to a point about 400 ft. south of St. Marys Ave. George Cromwell is Pres.

New York, N. Y.—Official—Bids for constructing sewers were received by the President of the Borough of Queens, Apr. 23, as follows: Liberty Ave., from Nebraska Ave., Jos. L. Sigretto, $116,395; Jos. Benedetto, $126,640; Henry R. Asserson, $128,300; Pethick Bros. & Co., Inc., $139,338; Leo Kelly, Inc., $148,317; Bunbar Contracting Co., $149,939. Beaufort Ave., from Lefferts Ave. to Maure Ave., Green Contracting Co., $11,987; Peace Bros., $12,337; Clancy & Van Alst, $12,506; Joseph Di Benedetto, $13,495; George Marshall, $13,534; Jos. L. Sigretto & Co., $14,369; Tony Lapadula, $13,064. Liberty Ave., from Ovean Ave. E. S. to Oxford Ave., Jos. L. Sigretto & Co., $10,321; Peace Bros., $10,567; Clancy & Van Alst, $10,802; Js. Di Benedetto, $11,633. Jerome Ave., from Lefferts Ave. to Maure Ave., Green Contracting Co., $16,656; Clancy & Van Alst, $16,789; Peace Bros., $16,977; Joseph Di Benedetto, $17,318; Jos. L. Sigretto & Co., $18,379; Tony Lapadula, $24,124. Test pits in 51st St., Second Ward, John J. Hart, $2648. Redfred Ave., from McNell Ave. to Beland Pl., William Grovell, $23,550. Jerome Ave., from Greenwood Ave. to Lefferts Ave., Harry Briton, $20,378.

★Norwich, N. Y.—Official—Bids will be received by the Board of Sewer Commissioners until 11 a.m., May 15, for constructing sewers. Plans and specifications may be obtained from C. E. Harris, City Engr.

Olean, N. Y.—Bids will be received by Thomas Troy, Supt. of Streets, until 7:30 p.m., May 19, for constructing a 10-in. sewer in North 14th St.

Oswego, N. Y.—Bids for constructing sewers in West Seneca St. were received by the Board of Public Works, Apr. 29, as follows: James Fennell, $10,927; R. M. Barnett, $12,209.

★Audubon, N. J.—The Borough Council has received the following bids for the installation of a complete sewage disposal plant and sewer system, and alternate estimates for a disposal plant without the system: Central Construction Co., Philadelphia, $79,260; $21,696; Sutton & Corson Co., Ocean City, N. J., $88,665; $20,292; Abraham & Belcher, Hackensack, N. J., $89,998; $20,000; Sun Dredging & Construction Co., Philadelphia, $93,979; $19,219; Atlantic Construction & Supply Co., $135,399; $25,000. Bids were opened Apr. 21. Noted Mar. 27.

★Newark, N. J.—(Official)—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., July 1, for furnishing and erecting a pumping plant for the Newark Bay Pumping Station, in the city of Newark. The bid must be for furnishing and erecting complete and ready to operate three pumping engine or sets of engines directly connected with and to operate three submerged centrifugal pumps, each capable of raising 100,000,000 gal. of sewage per 24 hours to a maximum lift of 37 ft. Each pump and engine must also be capable of pumping at as low a rate as 50,000,000 gal per 24 hours against a lift of 20 ft., and at all rates between. John S. Gibson is Clk.

★Official)—Bids for Section 6 of the main intercepting sewer were received by the Passaic Valley Sewerage Commissioners, Apr. 29, as follows: Northerly portion: Nash Bros., Chicago, Ill., $312,800; Donlon Contracting Co., Brooklyn, N. Y., $243,301; Booth & Flinn, Ltd., Pittsburgh, Penn., $229,050; Union Building & Construction Co., Passaic, N. J., $172,800; Pethick Bros. & Co., Inc., New York, N. Y., $149,300; Central Portion: Nash Bros., Chicago, Ill., $181,300; Donlon Contracting Co., Brooklyn, N. Y., $171,500; Concrete & Foundation Co., New York, N. Y., $145,495; Pethick Bros. & Co., Inc., New York, N. Y., $129,200; Southern portion: Nash Bros., Chicago, Ill., $220,500; Concrete & Foundation Co., New York, N. Y., $186,890; Donlon Contracting Co., Brooklyn, N. Y., $182,-070; Whiting-Turner Construction Co., Baltimore, Md., $180,-250; Union Building & Construction Co., Passaic, N. J., $178,-150; William Horne Co., New York, N. Y., $174,380; O'Gara & Maguire, Inc., Newark, N. J., $173,600; Culp Co., Inc., Brooklyn, N. Y., $172,820; Pethick Bros. & Co., Inc., New York, N. Y., $150,300.

Paterson, N. J.—See item under Streets and Roads.

★Ridgewood, N. J.—(Official)—Bids will be received by the Board of Village Commissioners until 8 p.m., May 20, for altering and improving the sewage disposal plant of the village. Fred rick Pfeiffer is Comr. Sts and Pub. Imprvts.

Harrisburg, Penn.—Bids will be received by the Highway Department until noon, May 9, for constructing sewers in various streets. Elmer E. Fritchey is Comr.

Mount Carmel, Penn.—(Official)—Plans and specifications have been completed by Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., for the construction of a new sewerage pumping station for Mt. Carmel. The estimated cost is $14,000. W. W. Robertson is City Engr.

✚Pittsburgh, Penn.—(Official)—The contract to construct about 11 miles of pipe sewers in the Painters Run, Big Sawmill Run and Little Sawmill Run Districts of Mount Lebanon Township, has been awarded to the OTT BROS. CO., 414 Washington Ave., Pittsburgh, Penn., at $67,119. Bids were opened by the McCully Engineering Co., Township Engrs., Apr. 17. Noted Apr. 3.

Pottstown, Penn.—Bids will be received by the Sewer Committee until May 27, for constructing Section A of the proposed new sanitary sewer system. The contract will comprise about 13⅓ miles of 6- to 30-in. sewers. Charles R. Collins, Drexel Bldg., Philadelphia, Penn., is Consult. Engr. Noted Apr. 10.

✚Reading, Penn.—The contract to construct sewers in various streets has been awarded to FEHR & O'ROURKE, Reading, at $67,638. Bids were opened Apr. 22. Noted Apr. 3.

★Baltimore, Md.—(Official)—Bids will be received by the Board of Awards until 11 a.m., May 21, for constructing lateral sewers and house connections in District 22d, Sanitary Contract No. 116; and for bulding Section 8 of the High level intercepter, Sanitary Contract No. 114. For particulars, see advertisement in this issue. Calvin W. Hendrick is Ch. Engr., Sewerage Comr.

Washington, D. C.—Asa E. Phillips, Supt. of the Sewer Dept. has prepared plans for a sewer system to serve the northeastern portion of the city. Estimated cost, $40,000.

Huntington, W. Va.—An election will probably soon be called to vote on a bond issue of $200,000 for municipal improvements. The proceeds of the issue will be used as follows: Trunk sewer in 24th St., $117,000; miscellaneous sewers, $25,000; recinerator, $18,000; paving, $40,000. A. B. Maupin is City Engr.

Ravenswood, W. Va.—The city has granted a franchise to J. Mentor Caldwell, Union Trust Bldg., Parkersburg, W. Va., to install a sewer system here. Plans are now being prepared.

Conyers, Ga.—See item under Water Supply—Irrigation.

Baton Rouge, La.—At a recent election, it was voted to expend $39,000 for improving the sewer system. B. Swarty is City Engr.

✚Barberton, Ohio—The contract to construct storm sewers in West Barberton has been awarded to J. P. O'NEILL, Akron, Ohio, at $41,000. Noted Apr. 17.

Cincinnati, Ohio—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 16, for laying main and lateral sewers and drains, with appurtenances, in various streets. Plans, specifications and blanks may be obtained at the office of the Chief Engineer of the Department.

★Columbiana, Ohio—(Official)—Bids will be received by the Village Council until noon, May 15, for constructing a complete sewer system and sewage disposal plant, according to plans and specifications on file at the office of Harry A. Inman, Village Clk.

East Palestine, Ohio—C. E. Vaughn, Village Engr., and L. E. Chapin, Consult. Engr., have been commissioned to prepare plans and specifications for a sewer system and sewage disposal plant for the village.

Lancaster, Ohio—Bids will be received by R. F. Brown, Dir. Pub. Ser., until noon, May 16, for constructing eleven sewers or laterals in Storm Water Districts 1 and 4. Profiles and specifications are on file at the office of the director.

Mount Vernon, Ohio—An ordinance has been introduced in the City Council providing for the construction of a sewage disposal plant for the city, estimated to cost $40,000. The City Engineer has been authorized to prepare plans.

New Philadelphia, Ohio—The Director of Public Service has been directed to advertise for bids for the construction of a system of sanitary sewers. O. C. Powleson is Mayor. Noted Apr. 10.

Sandusky, Ohio—R. I. J. Wager, City Engr., has submitted to the City Council, plans, profiles and estimates for improving the sewer system. The plans provide for a sewer in the South End, an intercepting sewer from Meigs to Mills St., and a sewage disposal plant near Mills St. Estimated cost, $200,000.

★Shelby, Ohio—(Official)—Bids will be received by Bert Fix, Village Clk., until noon, May 29, for extending and altering the municipal sewage treatment plant in accordance with plans and specifications on file at the office of the Village Clerk, and at the office of A. Elliott Kimberly, Consult. Engr., 8 East Long St., Columbus, Ohio.

Crawfordsville, Ind.—According to press reports, bids will be received by the Board of Public Improvements until May 19, for constructing a 36-in. sewer in Lafayette Ave., and a 24-in. sewer in Mill St. F. G. McIntyre is Chn.

Logansport, Ind.—H. H. Thompson, City Engr., has prepared preliminary plans and estimates for the construction of a sewer in the West Side, to be built along Front St., from the Wabash River to Sycamore St. Estimated cost, $18,500.

Ironwood, Mich.—Bids will be received by the City Council until May 13, for the construction of a sewer in Pine St. Oscar E. Olson is City Engr.

✚Fulton, Ill.—The contract to construct a sewer system here has been awarded to JAMES KELLY, Morrison, Ill., at $28,298. Bids were opened by the Board of Local Improvements, Apr. 19. Noted Apr. 17.

✚Minooka, Ill.—(Official)—The contract to construct a sewer system here has been awarded to the EMBARKMENT CO., Joliet, Ill. Plans for the system were prepared by C. O'Callahan, Consult. Engr. Noted Apr. 17 and Oct. 24.

Rockford, Ill.—Edwin Main, City Engr., has prepared tentative plans for the construction of a sewer in the West End. Estimated cost, $33,600.

✚Sterling, Ill.—A contract to lay about 25,000 lin.ft. of pipe sewer in Fulton St. has been awarded to JAMES KELLY, Sterling, at $28,000.

Bangor, Wis.—Press reports state that bids will be received by S. E. Webber, Village Clk., until May 12, for furnishing and laying about 10,000 lin.ft. of 10- to 24-in. pipe sewers, 26 manholes and 20 catchbasins.

Berlin, Wis.—Plans have been prepared for the construction of trunk sewers in Spring St., south to Union St., thence east to State St.; also in State St., from Huron St., to the Fox River; and in Washington St., from Lafayette St. to the outlet for sewers, south from Elm St. Henry Morman is City Clk.

Milwaukee, Wis.—The Committee on Sewers of the Common Council has recommended the construction of sewers in various streets at an estimated cost of $165,000. F. G. Simmons is Comr. Pub. Wks.

Racine, Wis.—The County Board Committee on Sewers will soon advertise for bids for constructing a septic tank at the County Insane Asylum and the Sunny Rest Sanitorium, the outlets to be connected and run together into a natural waterway. Cost, $15,000. W. S. Schield, Chicago, is Consult. Engr.

Chisholm, Minn.—The City Council is considering the plans prepared for the proposed sewage disposal plant.

Larned, Kan.—Bids will probably soon be asked for the installation of sewer system here, estimated to cost $15,000. Plans for the system have been approved by the State Board of Health.

Howard, S. D.—Bruce & Standevin, Consult. Engrs., Omaha, Neb., are preparing plans for a sewer system and sewage disposal plant here, estimated to cost $23,000. Jesse Gass is Mayor.

✚Herman, Mo.—(Official)—The contract to construct about 4½ miles of sewer laterals here has been awarded to the TONKAWA CONSTRUCTION CO., Tonkawa, Okla., at $11,400, Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Bids were opened Apr. 28. Noted Apr. 24.

★Pecos, Tex.—(Official)—Bids will be received by the City Council until 11 a.m., May 26, for constructing approximately 10 miles of sanitary sewers and sewer laterals, according to plans and specifications on file at the office of C. L. Heath, City Clk., and at the office of Jennings & Woods, Consult. Engrs., Roberts-Banner Bldg., El Paso, Tex. Noted Feb. 20.

Temple, Tex.—(Official)—Bids will probably soon be asked for the construction of about 10 miles of sewers and a sewage disposal plant. Estimated cost, $35,000. Plans for the improvement are being prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City Mo. Noted Apr. 10.

Caddo, Okla.—Bids will be received by the Bard ofT rustee until 8 p.m., May 15, for the construction of a sewer system. The system will comprise 25,500 ft. of 6-in., 3600 ft. of 8-in., 3500 ft. of 10-in., 1200 ft. of 12-in. and 2100 ft. of 15-in. vitrified sewer pipe; 58 manholes, 27 lampholes and six automatic flush tanks; one septic tank. Plans and specifications and on file at the office of the City Engineer. W. W. Boone is Chn. of Bd. Noted Mar. 27.

Watonga, Okla.—(Official)—The Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., has been retained by the city to prepare plans and specifications for the installation of a sanitary sewer system here estimated to cost $35,000. An election has been called for May 16 to vote on a bond issue.

Garfield, Wash.—It is proposed to make an appropriation of $15,000 for the construction of a trunk sewer in the central part of the city.

✚Seattle, Wash.—A contract to construct sewers in 44th St., has been awarded to V. RAMAGLIA, 6505 Third Ave., at $10,102. The other bids were: N. Fiorito Bros. & Sauro, $12,563; Erickson Bros., $12,575; James Marina, $13,342; Frasco & Coloccio, $13,926; Ferguson, Cole Co., $12,918; George W. Walker, $13,574; Meisner & Nordstrom, $13,213.

Toppenish, Wash.—The City Council has authorized the City Engineer to prepare plans for the construction of a septic tank at the outlet of the sewer system. Estimated cost, $5000.

✚Carlton, Ore.—The contract to construct a sewer system here has been awarded to DENNIS & CHRISTENSON, Portland, Ore., at $14,879. The other bids received were: Jacobson-Bates Co., Portland, $15,258; George Gordon, Portland, $14,940; Consolidated Contract Co., $15,943; James Kennedy Construction Co., Portland, $15,471.

✚Dinuba, Calif.—The contract to construct a sewer system here has been awarded to HALL & HUNT, San Francisco, at $32,470. The other bids were: Coalinga Tank & Pump Co., $39,000; Redman & Bier, $33,434; Cowden & Glacklin, $36,614; Chambers & Heafy $33,818. Noted Mar. 13.

Long Beach, Calif.—Olmsted & Gillelen, Wright & Callender Bldg., Los Angeles, are preparing plans for an outfall sewer and a sewage disposal plant here.

✚Pasadena, Calif.—A contract to construct about four miles of 7- to 14-ft. storm sewer on the East Side has been awarded to the J. M. MONTGOMERY CONSTRUCTION CO., Alhambra, Calif., at $88,500.

Richmond, Calif.—The City Engineer has completed plans and specifications for the construction of a main and outfall sewer. Bids for construction will probably soon be asked.

San Diego, Calif.—The lowest bid received for the construction of sewers here was submitted, Apr. 22, by the Engineering & Contracting Corp., San Diego, at $37,933. Noted Apr. 17.

STREETS AND ROADS

✚Boston, Mass.—The Commissioner of Public Works has received bids for street improvements as follows: Bituminous macadam roadway in Bynner St., from South Huntington Ave. to Day St. Roxbury, J. C. COLEMAN & SONS CO., $4288 (awarded contract); James Doherty, $4280; William J. Rafferty Co., $4407; John McCourt & Co., $4488. L. K. Rourke is Comr.

Boston, Mass.—Bids will be received until May 12, by the Department of Public Works for the construction of asphaltic macadam pavement in Mountfort St., City, Greenock and Hansborough Sts., and West Station Road, Dorchester; Washington St., Brighton. L. K. Rourke is Comr.

Bids will be received until May 13, by the State Highway Commission, 15 Ashburton Place, Boston, for about 8100 lin.ft. of surfacing on Main and School Sts., Athol, and for the construction of 10,000 lin.ft. highway in North Andover. W. W. Woodward is Chn. Rd. Comrs. Arthur W. Dean is Ch. Engr.

✚The following contracts have been awarded by the State Highway Commission: For building 4200 lin.ft. of macadam road in Amherst, awarded to LANE CONSTRUCTION CO., at $7935; for building 4000 lin.ft. of oil macadam road at Seekonk; awarded to THOS. J. QUINN, Ashton, R. I., at $8275.

✚The contract for the construction of a bituminous macadam roadway in Bynner St., Roxbury District, was awarded to J. C. COLEMAN & SONS CO., at $4264. Other bids were: James Doherty, $4280; William J. Rafferty Co., $4407; John McCourt & Co., $4488. L. K. Rourke is Comr. of Pub Wks.

Danvers, Mass.—Bids will be received until May 12, by the Engineer-in-Charge for the construction of bituminous macadam pavement on Water and Liberty Sts. Thos. H. Appleton, 237 Essex St., Salem, Mass., is Engr.-in-Charge.

Northampton, Mass.—The committee on improving Main St. has decided to resurface the macadam roadway with asphaltic concrete. Estimated cost, about $17,000. W. H. Telker is Mayor.

Springfield, Mass.—The Road Commissioners have recommended the paving of State St., from the end of the present wood-block paving, for a distance of about 4¾ miles at an estimated cost of $200,000 to $225,000. The material to be used is not yet selected. F. H. Clark is Comr.

Hartford, Conn.—Contracts for state road work have been awarded as follows:

Town of Sharon, 1840 lin.ft. gravel construction on the Amenia Road, to the TORRINGTON CONSTRUCTION CO., Torrington, Conn., at $1.69 per lin.ft. for gravel, $2.69 for telford, $1.25 per lin.ft. for rubble drain, $6 per cu.yd. for concrete walls, $5.50 for masonry walls, $4.50 for dry rubble walls; town of West Hartford, 7567 lin.ft. special construction on Park St., to the PIERSON ENGINEERING & CONSTRUCTION CO., Hartford, Conn., at $1.55 per sq.yd. for Bicomac surfacing over a 5-in. concrete base, $1.25 per lin.ft. for rubble drain, 75c. per sq.yd. for cobble gutters, $8 per cu.yd. for concrete walls, $6 for masonry walls, $4 for dry rubble walls; town of Kensington, 3963 lin.ft. macadam construction on the Kensington Road, to LEONARDI SUZIO, Meriden, Conn., at $1.80 per lin.ft. for macadam-asphalt, $2.90 for telford, 75c. per sq.yd. for cobble gutters, $1.10 per lin.ft. for cobble gutters, $8 per cu.yd. for concrete walls, $6 for masonry walls, $4.50 for dry rubble walls; town of North Branford, 4290 lin.ft. macadam construction on the Fair Haven Turnpike, to LAWLOR, LANE & Co., North Haven, Conn., at $1.69 per lin. ft. for macadam, $2.06 for telford, $1 per lin.ft. for rubble drain, $10 per cu.yd. for concrete walls, $7 for masonry walls, $6 for dry rubble walls; town of Trumbull, 5400 lin.ft. macadam construction on the Wells Hollow Road, to B. D. PIERCE, JR. CO., Bridgeport, Conn., at $2.47 per lin.ft. for macadam, $2.97 for telford, $1 per lin.ft. for rubble drain, 80c. per sq.yd. for cobble gutters, $10 per cu.yd. for masonry walls, $8 for masonry walls, $6 for dry rubble walls. Chas. J. Bennett is Highway Comr. Noted May 1.

New Haven, Conn.—The Paving Commission has decided to repave Congress Ave. from Howard to Columbus Aves., with wood block, and has instructed the City Engineer to advertise for bids. Cassius W. Kelly is City Engr.

Brooklyn, N. Y.—We are officially advised that the following bids were received on Apr. 30, by the President of the Borough of Brooklyn, Borough Hall, for paving in various streets: Lafayette St., from Flatbush Ave. to Hudson Ave.; Debevoise Place, from Lafayette St. to Flatbush Ave.; Prince St., from Myrtle Ave. to Fleet St.; Duffield St., from Johnson St. to Myrtle Ave., with asphalt: Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., $17,279; Barber Asphalt Paving Co., $17,609; Cranford Co., $17,411; Uvalde Contracting Co., $17,732; for paving Norman Ave., from Lorimer St. to Moultrie St. Central Ave., from Suydam St. to Hart St., Division Ave., from Berry St. to Bedford Ave., Havemeyer St., from South Fourth St. to Broadway, Albany Ave., from Dean St. to St. John Place, and from Eastern Parkway to Montgomery St., Gates Ave., from Patchen Ave. to Nostrand Ave., from Wyckoff Ave. to Thomson Ave., Halsey St. from Bedford Ave. to Nostrand Ave., Dean St., from Bedford Ave. to Nostrand Ave., with asphalt: Cranford Co., 52 Ninth St., $43,278; Barber Asphalt Paving Co., $43,714; Uvalde Contracting Co., $43,060; for repaving with permanent granite the roadway of Fifth Ave. from 39th to 60th Sts.: Freeman-Hess Co., Inc., $52,536; Sea-board Construction Co., $79,67; Bartholdi Turecamo, $77,022. Alfred E. Steers is Pres.

Bids will be received until 11 a.m. May 14, by the President of the Borough of Brooklyn, Borough Hall, for regulating and repaving with asphalt pavement the roadway of Berry St., from North 14th St. to North Fourth St., and from Graham St. to Division Ave., and Lorimer St., from Noble St. to Nassau Ave., for curbing and flagging, granolithic and laying sidewalks on Douglass St., from Dumont Ave. to Riverdale Ave., for regulating, paving and repaving the roadway of Flatbush Ave. extension, from Fulton St. to Concord St., and repaving the roadway of Bedford St. from Flatbush Ave. extension to Gold St., with permanent granite block pavement on a concrete foundation, and for all work and labor in connection therewith. Bids will be received until 11 a.m. May 14, by the President of the Borough of Brooklyn, Borough Hall, for paving Classon Ave., from Park Place to Eastern Parkway, with asphalt pavement on a concrete foundation, and for all work and labor in connection therewith. Alfred E. Steers is Pres.

Buffalo, N. Y.—Bids will be received until 11 a.m. May 5, by the Department of Public Works for repairing portions of Hudson St. paving and Perry St. and Bailey Ave. for paving Cattle and Congress Sts. and laying concrete base on Stone St. Edward G. Ward is Comr.

✚**Hastings-on-Hudson, N. Y.**—We are officially advised that the Board of Contract and Supplies has awarded a contract to the HASTINGS PAVING CO. for improving Warburton St.

✚**Herkimer, N. Y.**—The Board of Village Trustees has awarded a contract to the WARREN BROS. PAVING CO., at about $25,000 for paving Bellinger St. and Bellinger Ave. with bitulithic on a crushed stone base.

Hornell, N. Y.—At a recent special election the taxpayers voted to pave East Ave. at a probable cost of $16,000.

★**Hudson, N. Y.**—Bids will be received until 10:30 a.m., May 20, by the Public Works Commission for resetting about 4975 lin.ft. old curb, and paving approximately 13,600 sq.yd. of street with vitrified brick. Henry M. James is Secy. of Com. M. J. O'Hara is City Engr.

New York, N. Y.—We are officially advised that the following bids were received by the Department of Parks, Fifth Ave. and 64th St., on May 1: For the repair of the macadam pavement on Crotona Ave., from Crotona Park south to Crotona Park North, Boro. The Bronx: M. F. Odell, 190th St. and Jerome Ave., The Bronx, $8368; Dunbar Contracting Co., 444 East 68th St., $9985; Asphalt Construction Co., 205 Broadway, $10,100; Watson Contracting Co., Aqueduct Ave., near Kingsbridge Road, The Bronx, $7885; for constructing asphalt tile walks in Linden Park, Borough of Queens, Hastings Pavement Co., 25 Broadway, $5454; Barber Asphalt Co., 233 Broadway, $5840. Charles B. Stover is Comr.

Bids will be received until 3 p.m., May 15, by the Department of Parks, Fifth Ave. and 64th St., for paving where required, with bituminous pavement, the west drive of Central Park, from 110th St. and Eighth Ave., southerly to 102d St., and from the Webster Monument southerly to 59th St. and Fifth Ave. Charles B. Stover is Comr.

New York, N. Y.—(Borough The Bronx)—Bids will be received until 10:30 a.m., May 14, by the President of the Borough of the Bronx, Municipal Bldg., 177th St. and Third Ave., for regulating and paving portions of Walton Ave., Bathgate Ave., East 222d St., West 172d St., Van Nest Ave., Randolph Ave., Westchester Ave. and Webster Ave. Granite or asphalt will be used as required. Cyrus C. Miller is Pres.

New York, N. Y.—(Boro. of Richmond)—Bids will be received until noon, May 13, by the President of the Borough of Richmond, Borough Hall, St. George, S. I., for paving or repairing the sidewalks with either natural or artificial stone wherever the same are not now paved or are out of repair on Third St., between New Dorp Lane and Locust Ave., and other streets. George Cromwell is Pres.

✚**Olean, N. Y.**—We are officially advised that the Commissioners of Public Works have awarded a contract to D. D. DUGAN, Olean, at approximately $8000 for the improvement of Irving St. from Union to South Fourth St. H. E. Buntz is City Engr. George H. Luther is Comr. Noted Apr. 24.

✚**Oxford, N. Y.**—Bids as follows were received Apr. 22 for resurfacing about 6800 sq.yd. of waterbound macadam with bituminous bound limestone surface. (A) Nash Robinson & Griffin, Norwich, N. Y., (B) John H. Gordon, Albany, N. Y., (C) WINSOR BROS. (contract awarded), Guilford, N. Y., (D) Paddleford & King, Sherburne, N. Y.

	A	B	C	D
Limestone, per ton.....	$2.45	$3.50	$2.85	$2.80
Bituminous material, per gal..	0.225	0.17	0.14	0.12
Cleaning old surface, per sq.yd.	0.02	0.02	0.01	0.01
Building up shoulders, per lin.ft.	0.06	0.05	0.01	0.01

C. E. Harris, Norwich, N. Y., is Engr.-in-Charge.

★**Poughkeepsie, N. Y.**—Bids will be received until 4:30 p.m., May 12, by the Board of Public Works for approximately 20,000 sq.yd. of vitrified brick pavement, 25,000 sq.yd. sheet asphalt pavement, 25,000 lin.ft. new bluestone curb, and 3000 lin.ft. curb reset. R. J. Shields is Clk. of the Bd.

Camden, N. J.—The City Council has approved of ordinances providing for the paving of the following streets: Lawrence St. (concrete); Vine, Pear, Clover and Locust Sts; (asphalt), Haines St. and Coates Alley (Belgian blocks). W. D. Brown is Clk. of Council.

Elizabeth, N. J.—(Official)—Patrick Farghman was low bidder at $7284, for paving Vine St. The bid was referred to the Committee on Paving. W. P. Neafsey is Street Comr. Noted Apr. 24.

✚**Jersey City, N. J.**—We are officially advised that the Board of Street and Water Commissioners has awarded a contract to WM. VAN KEUREN, for repaving Warren St., from Montgomery to First Sts. E. B. See is Clk.

Merchantville, N. J.—At a special election, the citizens approved a bond issue of $100,000 for street improvements.

New Brunswick, N. J.—Bids will be received until 8 p.m., May 19, by the Common Council for regulating, grading, curbing and paving portions of Nelison, John, Morris, Welton Redmond and Harvey Sts. John J. Curran is St. Comr.

Newton, N. J. The Board of Freeholders has approved of resolutions authorizing the improvement of the road between Newton and Sussex, about 14 miles, with branches to Branchville, about three miles, and Lafayette, about one mile. A second resolution adopted calls for the improvement of the road from Newton to Odgensburg, via Sparta, about 13 miles. Surveys of the roads will be ordered and bids for the work asked.

Paterson, N. J. The Board of Works will recurb and lay improved paving on sections on Main St., Market St., Spruce St., Temple St., Arch St. and Broadway. A new sewer system will be installed in Burlington Ave., between Crosby and Totowa Aves.

Ridgefield Park, N. J.—Bids will be received until 8 p.m., May 13, by the Board of Village Commissioners, for improving a portion of Christie St. The approximate quantities are: 1475 cu.yd. of excavation, 3775 lin.ft. curbing, 6165 sq.yd. bituminous concrete paving and four catch basins. Miller D. Starker is Clk.

Trenton, N. J.—The Board of City Commissioners has passed ordinances providing for the paving of the following streets: Peace St. (vitrified brick), Evans Ave. (bituminous concrete), Asbury St. (vitrified brick or bituminous concrete), Ashmore Ave. (bituminous concrete), Quarry St. (bitu-

minous concrete), Hermitage Ave. (bituminous concrete), Sherman Ave. (vitrified brick), Riverside Ave. (bituminous concrete), Atterbury Ave. (bituminous concrete), and Howell Alley (bituminous concrete). The Department of Streets will prepare schedules of the work.

★Trenton, N. J.—Bids will be received until 11 a.m., May 19, by the Commissioner of Public Roads for road making machinery and materials, and for car load lots of various standard road binders. E. H. Stevens is Comr.

Ingram (Pittsburgh post office), **Penn.**—Bids will be received until 8 p.m., May 8, by the Borough Council for grading portions of Noll, Sampson, Warren, Cobb and Maple Aves. John S. Murry is Boro. Engr. D. H. Hainer, 54 McKee St., Ingram, Penn., is Boro. Clk.

McKees Rocks, Penn.—Bids will be received until 8 p.m., May 12, by the Borough Council, for grading, curbing and paving Church, Alice, Kennedy, Dohrman, Locust, Grant, Linden McKee and Railroad Sts., Front, Union and Gillen Alleys. The approximate quantities are 5100 cu.yd. of excavation 26,000 cu.yd. of fill, 14,000 lin.ft. curbing, 17,000 sq.yd. paving and 30 sewer drops. George H. McGinness is Boro. Engr.

✦Ridgway, Penn.—The Borough Council has awarded a contract to MINNS BROS., Du Bois, Penn., at $23,331, for brick paving on portions of Euclid, Elk and East Aves., and South St.

South Brownsville, Penn.—Bids will be received until 4 p.m., May 12, by the Borough Council, for grading, curbing and paving Shady Ave., from Bank to Jackson Sts. L. G. Moslener is Boro. Engr.

Uniontown, Penn.—Bids will be received until noon, May 17, by the Controller of Fayette County for road construction as follows: About one mile of brick and macadam road in Redstone Township; two miles of brick and macadam road in Luzerne Township, and about 10,202 ft. of brick and macadam road in Jefferson Township. Thos. H. Hudson is County Solicitor.

Uniontown, Penn.—Bids will be received until noon, May 14, by the County Engineer of Fayette County for the construction of about 3500 lin.ft. of road in German Township, either brick or asphaltic concrete pavement to be used. Willard O. White, 524 First National Bank Bldg., Uniontown, is Engr.

Wilkes-Barre, Penn.—Bids will be received until 6 p.m., May 28, by the Board of Commissioners of Hanover Township, Luzerne County, for improving portions of Luzerne and Wyoming Sts., both in the Lee Park District, and Shawnee St., Christopher District. Harrison & Butts, Davidow Bldg., are Township Engrs. Frank C. Rowe is Secy.

Baltimore, Md.—We are officially advised that the following bids were received by the City Water Department for the construction of Road No. 3: Thomas Mullan, Baltimore, Md., $49,149; D. V. Ault & Co., Baltimore, Md., $69,933; the Piedmont Construction Co., Baltimore, $72,297; Mason Hilton & Co., New York, N. Y., $74,490; King-Ganey Contracting Co., New York, N. Y., $76,704; the Whiting-Turner Construction Co., Baltimore, $83,574; the Hassam Paving Co., Worcester, Mass., $95,076. Ezra B. Whitman is Water Engr. Noted Apr. 10

Baltimore, Md.—Bids will be received until 11 a.m., May 14, by the Board of Awards for grading, curbing and paving with granite block various streets under Contract No. 53; also for improving various streets under Contract No. 55, vitrified block paving. R. Keith Compton is Chn.

Bids will be received by the Board of Awards until May 14, for paving with bituminous concrete on macadam base, Edmondson Ave., from the west end of the bridge over Gwynn's Falls to the western city line; Charles St., from north of University Parkway, 2350 ft. northward. Plans and specifications are obtainable at the office of H. K. McCay, City Engr., City Hall.

Denton, Md.—Bids will be received until May 20, by the Commissioners of Caroline County, for the construction of 2.92 miles of state highway along the Preston-Grove Road. Plans and specifications are on file with the State Roads Commissioners, 534 North Howard St., Baltimore, Md.

✦Elkton, Md.—The contract has been awarded by the State Roads Commissioners, 534 North Howard St., Baltimore, for the construction of 4.6 miles of macadam road between Elkton and Chesapeake City, to the ALLEN ENGINEERING CO., Newark, N. J., at $47,561.

✦Danville, Va.—The contract has been awarded by the State Roads Commissioners to J. J. BATTERSHELL, at $88,700, to construct 37½ miles of soil road and 6½ miles of macadam road. P. St. J. Wilson, Richmond, is Comr.

✦Petersburg, Va.—The City Council has awarded a contract to the COLEMAN CONSTRUCTION CO., at approximately $25,000 for paving West Washington St., from West St. to the corporation limits. R. D. Budd is City Engr.

Florence, Ala.—Lauderdale County has been awarded $100,000 Federal aid in road building, and will add $20,000 to that sum for the building of 50 miles of post road. Jas. F. Koonce is Probate Judge.

✦De Ridder, La.—(Official)—A contract has been awarded to DELATTE & LAGRANGE, Lake Charles, La., at 13c. a sq.ft. for sidewalks ,and 28c. per lin.ft. for curb for improving various streets. McCorkle & Baylis are Engrs.-in-Charge. Noted Apr. 10.

New Orleans, La.—(Official)—Bids will be received until noon, May 26, by the Highway Department of the Board of State Engineers for the improvement of about 14 miles of public highway extending from Baton Rouge to Hope Villa, East Baton Rouge Parish. Frank M. Kerr is Pres. of the Bd. W. E. Atkinson is State Engr.

✦Union City, Tenn.—The City Council has awarded a contract to KOEHLER BROS., Memphis, Tenn., at approximately $30,000, for the construction of sidewalks. J. A. Coble is Mayor. Noted May 1.

Covington, Ky.—The General Council has authorized the paving of Madison Ave. from 24th to 26th St. with granite. H. G. Meiners is City Engr

✦Newport, Ky. The City Commissioners have awarded the following contracts, for street improvements: Robert St., from Sixth to Eighth Sts., to H. J. KNEPLE, $4455; Tenth St. from Washington to York Sts., $15,102, to E. J. KNEPLE; York St., from Ninth to 12th Sts., $8266, to DANIEL TRAPP.

Ashtabula, Ohio Bids will be received until noon, May 20, by the Director of Public Service, for grading, draining, curbing and paving Lake St. from Aunger Ave. to Erie St., with shale block. About 23,653 sq.yd. of pavement and 15,460 lin.ft. curbing will be required. M. H. Turner is Dir.

Canton, Ohio We are officially advised that all bids for paving 5.66 miles of the Canton-Cairo Road with vitrified brick were rejected as being above the estimate, and no time has been set for the readvertisement of the work. J. H. McConnell is Audr. Noted Apr. 17.

✦The Board of Commissioners of Stark County has awarded a contract to WM. H. VOGT & SON, Massillon, Ohio, at $36,423, for paving two miles of the Canton-Louisville Highway with brick, stone curb.

Cincinnati, Ohio—Bids will be received until noon, May 13, by the Director of Public Service for improving Highpoint Ave., from its northern terminus to Wardell Ave. by grading, curbing and paving with brick. V. T. Price is Dir. M. J. Keefe is Clk.

✦Contracts have been awarded by the Board of Commissioners of Hamilton County, as follows: Improvement of the Batavia Pike, R. E. CASH, $41,352; improvement of Shaker Road, NUGENT & HINES, $15,910 improvement of the Rapid Run Pike, JOHN NICKESON, $11,076; improvement of the Country Club Road, J. L. RADABAUGH, $12,439. Stanley Struble is Pres. of Comrs. Noted Apr. 10.

Cleveland, Ohio—Bids will be received until 11 a.m., June 4, by the Commissioners of Cuyahoga County for the improvement of the Lindadale Rd., from the west limits of the city of Cleveland to the Ridge Road, Brooklyn Township. John F. Goldenbogen is Clk.

Cleveland, Ohio—We are officially advised that the following bids were received by the Board of County Commissioners for improvement of the Solon Road Extension: J. W. Didhum, Chagrin Falls, Ohio, $18,314; Enterprise Paving Co., Cleveland, $18,739; Geo. B. Herring & Son, Cleveland, $18,485. Frank R. Lander is County Surv. Noted Apr. 10.

✦Columbus, Ohio—The State Highway Commissioner has awarded a contract to W. H. RINGWALD & SON, Chillicothe, Ohio, at $9671, for paving one mile of the Columbus Road, Scioto Township, Ross County, with bituminous surface treated concrete. James R. Marker is Comr.

✦Greenville, Ohio—(Official)—A contract has been awarded by the Commissioners of Jay County, Ind., and Darke County, Ohio, for the construction of a road on the line between the two counties to LUTTMAN & FENNING, Portland, Ind., at $18,296. J. E. Kline is Deputy Audr. of Darke County, Ohio. Noted Apr. 17.

✦Middletown, Ohio—We are officially advised that the Director of Public Service has awarded a contract for sidewalks, curb and gutter on various streets to FRED KESTING and the JOHN ARPP CO., at approximately $9000. Other bidders were: Karl Hanson, Connersville, Ind., Yount & Jackson, Dayton, Ohio, and Deckard & Son, Columbus, Ohio. H. Duane is City Engr. J. Lloyd is Dir. Noted Apr. 24.

An ordinance has been passed by the City Council authorizing the Director of Public Service to advertise for bids for paving Curtis Ave., from Third St. to Yankee Road, with vitrified brick, sheet asphalt, block asphalt, concrete, bitulithic, macadam, broken stone, macadam or creosoted wood block. John Lloyd is Dir.

✦Norwalk, Ohio—The Trustees of Fitchville Township have awarded a contract for the construction of about 5½ miles of concrete road to F. L. RICE & SON, Shelby, Ohio, at approximately $46,000. Other bidders were: Buckeye Engineering Co., Norwalk; Snilling Construction Co., Youngstown, Ohio; Modern Construction Co., Fremont, Ohio.

✦Paulding, Ohio—We are officially advised that the Commissioners of Paulding County have awarded contracts for improvement of the Hofacker Pike as follows: Section 1, WARREN BROS. $24,593; Sections 3 and 4, BIBENNING, SHERRARD & RANDOLPH at $19,069 and $26,932 respectively; Section 5, GOETSCHIUS STONE CO., $14,146. Chas. C. Duckwall is County Engr. Howard Mouser is Audr. Noted Apr. 24.

✦Evansville, Ind.—We are officially advised that bids as follows were received by the City Council for paving parts of Grand Ave., Michigan & Chestnut Sts.: Weston Construction Co., $1.95 per sq.yd. for asphalt; Grace Construction Co., $1.99 per sq.yd. for asphalt; Bedford & Migent, $1.74 per sq.yd. for brick pavement. The contract was awarded to the WESTERN CONSTRUCTION CO., at $66,000. August Pfaffin is City Engr.

Fowler, Ind.—Bids will be received until 1 p.m., May 13, by the Commissioners of Benton County, for the construction of a limestone road on the line between Benton and Tippecanoe Counties. Warren Mankey is Audr.

✦Gary, Ind.—The Board of Public Works has awarded a contract to YEOGY & BUTLER, at $8472, for the improvement of Alley No. 4, South; to the GARY CONSTRUCTION CO., at $14,817, for improvement of 16th Ave., from Broadway to Madison St. A. P. Melton is City Engr.

✦New Albany, Ind.—The City Council has awarded a contract to W. C. DORSEY, Terre Haute, Ind., for repaving East Eighth St. with sarco macadam. Chas. Trouy is City Clk. Noted Apr. 17.

✦Newcastle, Ind.—The City Council has awarded a contract to JAMES GARVEY at $1.84½ per sq.yd. for brick pavement on Church St. from 11th to 15th Sts., Race St. from 11th to 12th and Livery Alley, from 11th to 15th Sts.

✦Bay City, Mich.—The Board of Works has awarded contracts to F. F. RYAN at $26,047 for paving Farragut St. with brick, and to THEODORE M. GAFFNEY at $7285 for a brick pavement on Henry St. from Union to Hart Sts. Wm. J. Schindehette is City Engr.

Caro, Mich.—Bids will be received until 2 p.m., May 16, by the Village Board, for grading, draining, curbing and paving portions of State, Almer and Frank Sts. J. W. Earle is Village Clk.

St. Louis, Mich.—See item under Water Supply—Irrigation.

+Belleville, Ill.—We are officially advised that the Board of Local Improvements has awarded a contract to REEB BROS., Belleville, at $16,002 for paving Church St. Other bidders were: Meyer & Thomas, $16,237; Hoeffken Bros., $16,866; Wm. Ziedmert is City Engr. Noted Apr. 24.

+Cairo, Ill.—We are officially advised that the bidders for brick paving on Holbrook Ave., Fourth, Sixth, 10th and 12th Sts. were: ROY L. WILLIAMS, $53,180, (awarded contract); W. R. Halliday, $56,572; Hanes & Son, Jerseyville, Ill., $55,935; George F. Dewey is City Engr. Noted Apr. 3 and May 1.

Moline, Ill.—Plans and estimates have been completed for the construction of approximately 102,000 sq.yd. of street paving, at an estimated cost of $260,468. Bids will be asked during the summer. Lyle Payton is City Engr.

Ottawa, Ill.—The City Engineer is preparing plans for brick pavement on the West and South Sides, at an estimated cost of $281,332 and $142,427, respectively. G. L. Farnsworth is City Engr. E. Bradford is Pres. Bd. of Local Imprvts.

+Peoria, Ill.—The Board of Local Improvements has awarded a contract to A. D. THOMPSON at $21,694 for paving Thrush Ave. from Knoxville to Wisconsin Ave., with brick. L. D. Jeffries is City Engr.

Jefferson, Wis.—We are officially advised that G. H. Stanchfield, Fond du Lac, Wis., was low bidder, and will probably be awarded the contract, for the improvement of Main St. G. J. Luetz is City Clk. Noted Apr. 24.

Madison, Wis.—Contract will be awarded, May 20, for the following street improvements: Brooks St., 2800 lin.ft.; West Lawn St., 1450 ft.; Garfield St., 1700 ft.; Chadbourne St., 1950 ft.; Hoyt St., 750 ft.; Kendall St., 600 ft.; St. James Court, 800 ft.

+The contract for improving Park St., from Dayton to Mound St., was awarded to MITCHELL BROS., at $14,897.

+Clear Lake, Iowa—We are officially advised that the City Council has awarded a contract for about 19,000 sq.yd. of portland cement concrete pavement to GARLAND & SHAFFER, New Hampton, Iowa, at $1.26 per sq.yd. H. D. Keeri, Mason City, Iowa, is City Engr. Noted Apr. 17.

Corning, Iowa—The City Council has ordered the improvement of 22 blocks of streets, upon which work will soon begin. W. C. Chubb is City Clk.

Davenport, Iowa—Plans and estimates have been prepared for the grading, curbing and paving of various alleys at a total cost of $32,253, and for paving portions of Sylvan Court and Fourth St., estimated to cost $1333 and $4395 respectively. Hugo Moeller is City Clk.

Muscatine, Iowa—The City Council has passed a resolution authorizing the expenditure of $90,000, for street paving. Bids will soon be asked.

West Union, Iowa—The City Council has decided to pave the principal business streets of the town, a total of about three-quarters of a mile.

Virginia, Minn.—The Street and Alley Committee plans to improve portions of Virginia Ave., First and Hemlock Sts., during the summer at an estimated total cost of $48,000. E. F. Johnson is City Engr.

+McPherson, Kan.—We are officially advised that the City Council has awarded a contract to J. R. RAMSEY, Topeka, Kan., for paving East Euclid St. with asphaltic concrete. The work includes 17,000 sq.yd. of pavement, 11,000 lin.ft. concrete curb and gutter. H. A. Rowland is City Engr. Noted Mar. 13.

+Paragould, Ark.—The Commissioners of Street Paving District No. 1 have awarded a contract to the POUNCEY PAVING CO., Memphis, Tenn., at approximately $90,000 for 42,000 sq.yd. brick or concrete paving on various streets.

+Salt Lake City, Utah—We are officially advised that the City Commission has awarded a contract for Sidewalk Extension No. 160 to G. A. HEMAN, St. Louis, Mo., at $39,217. Other bidders were: P. J. Moran, $46,394, the James Kennedy Construction Co., $50,053; Heuser & Sim, $53,779.

The contract for Sidewalk Extension No. 163 was awarded to W. M. HARMON, Salt Lake City, at $3129. Other bids were: Ryberg Bros., $3185; Kennedy Construction Co., $4134. S. Q. Cannon is City Engr. Noble Warrum is City Recdr. Noted Apr. 17.

+Phoenix, Ariz.—A contract has been awarded to the GOOD ROADS CO., of Arizona, at $13,720 for construction of the McDowell Road. Other bidders were: Barber Asphalt Paving Co., $17,088; R. Teuber & Son, $17,880.

Bids will be received until May 10, by the Trustees of Special Road District No. 1, Maricopa County, for the construction of a concrete pavement with oil and sand surface, or oiled macadam as an alternative. E. M. Lamson, 11 North First St., Phoenix, is Clk.

Aberdeen, Wash. The City Council has passed a resolution for paving M St., from Heron St. to Fourth St., with concrete, asphalt or asphaltic concrete pavement.

+Bellingham, Wash. (Official) The Commissioners of Whatcom County have awarded a contract for improving 4400 ft. of the Northeast Diagonal Road to K. SOUSET at $21,900. Other bidders were: Eagle Paving Co., Seattle, $22,942; West Coast Construction Co., $23,452; Cascade Construction Co., $24,667; Skagit Construction Co., $25,057; D. H. Traphagen, $25,080. The contract for improving 4800 ft. of the Northwest Diagonal Road was awarded to the EAGLE PAVING CO. at $22,177. Other bidders were: K. Souset $25,200; West Coast Construction Co., $25,265; Cascade Construction Co., $26,970; Skagit Construction Co., $30,038; D. H. Traphagen, $27,200. C. M. Adams is County Engr. Noted Apr. 17.

Seattle, Wash.—(Official)—Bids will be received about May 23 by the Board of Public Works, for grading Leary Ave. and other streets; estimated cost, $34,693;; and grading and constructing watermains on College St. and connecting streets; estimated cost, $12,038; grading Avalon Way; estimated cost, $13,900; constructing an elevated wood walk on Alki Ave., estimated to cost $4238. W. H. Tiedeman is Prin. Asst. City Engr. Noted Apr. 17.

+Seattle, Wash.—THE BARBER ASPHALT PAVING CO., Henry Bldg., has been awarded the contract at $16,623, for paving 15th Ave., West. Other bidders were: D. H. Traphagen, $18,366; Inland Asphalt Paving Co., $17,022; P. J. McHugh, $17,544; McQuade & Moore, $17,450.

The INDEPENDENT ASPHALT PAVING CO. has been awarded the contract by the Board of Public Works at $98,938, for regrading and paving Sixth Ave., West. The BARBER ASPHALT PAVING CO., at $50,468, received the contract for bitulithic paving on Pine St.

Bids will be received until May 30, by the Board of Commissioners of King County, for the construction of Permanent Highway No. 2, near Bothell. Max Wardall is County Clk.

Spokane, Wash.—The City Council has passed a resolution calling for the improvement of Trent Ave., from Division St. to East Olive Ave., by grading, paving and sidewalks. Engineer's estimate of cost, $28,300. Bids will be asked soon.

Tacoma, Wash.—The Commissioner of Public Works has been instructed by the City Council to advertise for bids for paving North 12th St., from Steele to Pine Sts., and North Oakes St., from Sixth Ave. to North 17th St., with asphalt. City Engineer's estimate of cost, $47,125. Owen Woods is Comr.

+Tacoma, Wash.—(Official) The Department of Public Works has awarded a contract for paving portions of North 26th and North Proctor Sts., to the KELSAL CONSTRUCTION CO., Tacoma, Wash., at $23,700. W. C. Raleigh is City Engr. A. F. Metzger is Ch. Clk. Noted Apr. 24.

+Wenatchee, Wash.—A contract has been awarded by the City Council to J. J. McNERNY, at $109,502, for paving Wenatchee Ave. with creosoted wood block, and various cross streets with vitrified block. This contract was awarded several months ago, and later annulled because of legal irregularities, and the work readvertised. Noted Jan. 16.

Baker, Ore.—The City Commissioners have passed an ordinance providing for the improvement of Washington St. by grading, hard-surfacing and parking, for a distance of 22 blocks.

+Pendleton, Ore.—A contract has been awarded to the WARREN CONSTRUCTION CO., Portland, Ore., at $40,567, for paving Webb St.

Fresno, Calif.—The WORSICK STREET PAVING CO. was awarded the contract at $11,256, for improving Cherry Ave.

+Lordsburg, Calif.—The following bids were received for the construction of concrete paving on Fort Hill Blvd. and Third St.: H. L. KUNS, Lordsburg, $32,255 (awarded contract); E. A. Simmons, Upland, Calif., $32,696; George C. Paonessa, Los Angeles, $32,915; Taylor & Berliner, Los Angeles, $34,424.

+Los Angeles, Calif.—The City Trustees have awarded contracts to W. F. PECK at $8388 for improving Virgil Ave. from Fountain Ave. to Santa Monica Blvd., and to the FAIRCHILD-GILMORE-WILTON CO., Los Angeles, at $5698 for improvement of Benton Blvd. from Sixth to Wilshire Blvd.

Bids will be received by the Board of Supervisors until 2 p.m., May 12, for constructing sidewalks, curbs and gutters on Colorado St., in Lamanda Park, east of Pasadena, Road District No. 18, at an estimated cost of $50,891. The work includes the following estimated quantities: 14,800 lin.ft. of general grading; 13,048 lin.ft. grading in parkings, $1,596 lin.ft. 12-in. cement curbs, 3383 lin.ft. 22-in. cement curbs, 121,843 sq.ft. cement gutters, 216,533 sq.ft. sidewalks. L. A. Bartlett, Pasadena, is Engr. in Charge.

Bids will be received until 2 p.m., May 12, for constructing oil-macadam pavement in Road District No. 16, a distance of two miles on New York Ave., from Santa Anita to Lake Aves., east of Pasadena, the work estimated to cost $18,000 and consisting of 5000 cu.yd. excavation, 7400 tons of crushed rock, 46 cu.yd. concrete, 2000 lb. steel, eight manhole covers and 700 bbl. of oil. L. A. Bartlett, of Pasadena, is the Engr.

Ontario, Calif.—(Official) Bids will be received until May 25 by the City Trustees for street paving at an estimated cost of $15,000. B. B. Mann is City Engr.

+Pasadena, Calif.—(Official) The City Trustees awarded the contract for paving East Orange Grove Ave., from Los Robles to Lake Ave. to E. J. HART, Pasadena, at $11,760. R. V. Orbison is Deputy City Engr. Noted Apr. 24.

Essex, Ont.—Bids will be received until May 20 for construction of a permanent roadway. W. D. Bramen is Town Clk.

Regina, Sask.—Bids will be received until noon, May 15, by the City Clerk for the construction of sidewalks and pavements. Plans and specifications are on file with F. McArthur, City Engr.

+Nanaimo, B. C.—The City Council has awarded a contract to the CANADIAN MINERAL RUBBER CO. for the paving of Wallace, Front and Haliburton Sts., Stewart Ave. and Comox Road.

Vancouver, B. C.—An appropriation of $605,000 has been made for the construction of roads and sidewalks. It is also announced that the Board of Works will spend $1,197,119 for street paving. H. L. Fellowes is City Engr.

INDUSTRIAL WORKS

+New Britain, Conn.—The contract for the construction of two additions to the plant of the New Britain Machine Co. has been awarded to the GEORGE S. CHATFIELD CO., 73 Canal St., Waterbury, Conn. One structure will be 36x258 ft., five stories, and the other 50x90 ft., one story.

Stamford, Conn.—Bids will be received by the Yale & Towne Mfg. Co. until May 12, for the construction of two new buildings in connection with its plant. One will be 245x296 ft., three stories, and the other 50x200 ft., six stories. J. A. Thorne is Supt. Noted Mar. 13.

Torrington, Conn.—Plans are being considered by the Standard Co. for the construction of a new factory on Laurel St. The structure will be 42x144 ft., three stories, of brick, mill construction. William H. Dayton is Engr.

+Boston, Mass.—The contract for the construction of a factory in the Neponset section for the Hallett & Davis Co. has been awarded to the WALES LINES CO., 134 State St., Meriden, Conn. The structure will be 80x150 ft., one story.

+Gloucester, Mass.—The Russia Cement Co. has awarded the contract for the construction of a new factory, 120x60 ft., four stories, to the ABERTHAW CONSTRUCTION CO., Boston, Mass.

Greenfield, Mass.—Plans are being prepared by Charles C. Russell and Whitman Russell for the construction of a manufacturing plant on the Green River at Greenfield.

+Northampton, Mass.—The contract for the construction of a 37x145-ft., four-story factory for the Florence Mfg. Co. has been awarded to the ABERTHAW CONSTRUCTION CO., Boston, Mass. Noted Apr. 24.

+Buffalo, N. Y.—(Official)—The Cyphers Incubator Co., Dewey Ave., has awarded a contract to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for the construction of four reinforced-concrete factory buildings, as additions to its plant. The structures will all be one story high, 401x146 ft., 80x57 ft., 301x122 ft., and 146x50 ft., respectively. A power house, two stories high, will also be built. The estimated cost is $200,000. Colson & Hudson, Dun Bldg., are the Archs. Noted Apr. 17.

Plans have been filed for the construction of a large addition to be made to the plant of the Stuhlmiller Mantel Works, on East Delavan Ave. and the New York Central R.R. Considerable new machinery and equipment will be required.

The Albert Dickinson Co., of Chicago, Ill., has established a branch at Buffalo and will erect an extensive seed-cleaning plant, with an elevator, warehouse and office building, at Gansen St. and the Buffalo River. The site upon which the plant will be located is 235x554 ft.

Bids will soon be received by Ely & Lyman, Archs., Prudential Bldg., for the construction of a two-story machine shop, 116x45 ft., for the E. & B. Holmes Machinery Co., 59 Chicago St.

Kingston, N. Y.—Bids are about to be received by the Art Silk Yarn Co., 38 East 25th St., New York, N. Y., for the construction of a new mill at Kingston. The plant will consist of 17 one-story buildings on a site, 225x338 ft. Frederick W. Fisher, 32 Union Sq., New York, N. Y., is the Arch.

New York, N. Y.—Bids are now being received by Ross & McNeill, Archs., 39 East 42d St., for the construction of a six-story factory, 95x75 ft., for the Automatic Pneumatic Action Co., 5st St. and 12th Ave. The estimated cost is $40,000.

Oswego, N. Y.—A foundry is to be built at once by the Oswego Machine Works on the site which it recently purchased on West Second St.

Peekskill, N. Y.—Bids will soon be received by A. Quick & Son, Archs., 18 South Broadway, Yonkers, for the construction of a three-story factory in Peekskill, for the Standard Oil Cloth Co., 320 Broadway, New York, N. Y. The estimated cost is $75,000.

Newark, N. J.—The Hudson Hat Co., Hoyt and New Sts., is having plans prepared by R. Bottelli, Arch., 189 Market St., for the construction of a two-story factory addition, 35x30 ft., and 95x45 ft. The estimated cost is $15,000.

Marcus Hook, Penn.—Bids are being received by the United Roofing & Mfg. Co., Morris Bldg., Philadelphia, for the construction of a two- and three-story factory, 200x67 ft., at Marcus Hook. The estimated cost is $40,000.

+Philadelphia, Penn.—The J. G. Brill Co., car manufacturer, has awarded a contract to HENRY F. BATON, 10th and Sansom Sts., for the construction of an assembling shop, on the south side of Woodland Ave., near 60th St. It will be one story high, 240x78 ft., of corrugated iron. The estimated cost is $35,000.

Pittsburgh, Penn.—Plans have been completed by H. S. Estep, Arch., Publication Bldg., for the erection of a 125x75-ft. laundry, on 40th St., for the Fort Duquesne Laundry Co., 4117 Liberty Ave.

+St. Clair, Penn.—The Philadelphia & Reading Ry. Co. has awarded a contract to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia, for the erection of large car-repair shops at St. Clair. The plans call for a heavy and medium shop, and an intermediate shop, which are designed to be steel skeleton structures, 83x604 ft. and 53x464 ft., respectively. The buildings will be of brick with liberal provision for light and ventilation. Traveling cranes of 15 and 40 tons capacity will be installed to facilitate the handling of cars and material. The buildings will be equipped with a blower system, distributing the heat uniformly by concrete ducts under the floors.

Louisville, Ky.—The Standard Sanitary Mfg. Co. will erect a new building for the enameling department of its plant at Louisville, and will install six additional furnaces.

Charlotte, N. C.—Press reports state that the Harmon Engineering Co. will erect a plant to cost $125,000, for the manufacture of engines, compressors, pumps, boilers, etc.

Henderson, Ky.—The Brandes Fireplace Heater Co. has been formed at Henderson, with $25,000 capital stock, and will erect a plant for the manufacture of stoves. R. A. Harness is Pres.; A. H. Abbott, V.-Pres.; W. C. Cooper, Secy., and Von P. Pritchett, Treas.

Alliance, Ohio—The Davies-Bauch Mfg. Co. has increased its capital from $300,000 to $600,000. It is expected to erect a sheet-metal and enamel plant soon.

+Bryan, Ohio—The contract has been awarded to JOHN FINN & CO., Bryan, for the construction of a factory for the Bryan Show Case Co., Bryan. The structure will be two stories, 106x75 ft.

Cincinnati, Ohio—The Illinois Leather Co., Cincinnati, has purchased a site and will erect a new plant, 138x198 ft., on McLean Ave., Cincinnati. Estimated cost, about $50,000.

Cincinnati, Ohio—A. S. Boyle Co., Cincinnati, will erect a new factory on a site recently acquired on the north side of Langdon Ave., east of Montgomery Rd. Estimated cost, $30,000. A. S. Boyle is Pres.

Cleveland, Ohio—The H. E. Mills Mfg. Co., Cleveland, is considering the erection of an addition to its factory, to cost about $10,000.

Cleveland, Ohio—The Guggenheim Co., Lakeside Ave. and Ninth St., Cleveland, has purchased a site on which it will erect a new plant.

The Cleveland Speed Indicator Co., Cleveland, has purchased a site and will erect a factory on West 112th St., Cleveland. Geo. S. Rider & Co. are the Archs.

The National Lamp Co., Cleveland, has taken out a permit for the erection of a plant on 153d St., Cleveland, to cost $35,000.

The Cleveland Heater Co., Cleveland, is having plans prepared for the erection of a new factory on West 112th St., Cleveland. Leo. Friedman is Pres. Geo. S. Rider & Co. are Archs.

Ivorydale (Cincinnati post office), Ohio—The Emery Candle Co., Ivorydale, is planning to spend $60,000 for the enlargement of its plant.

+Middletown, Ohio—The contract has been awarded to the CULLEN & VAUGHN CO., Hamilton, Ohio, for the erection of the new paper mill for the Charles H. Wright Paper Co., at about $50,000.

Sandusky, Ohio—George J. Bing, Sandusky, is receiving bids for the erection of a carriage shop and garage. The structure will be two stories, 67x70 ft.

Toronto, Ohio—The plant of the Toronto Fire Brick Co., Toronto, recently destroyed by fire, will be rebuilt. Estimated cost, $50,000.

Anderson, Ind.—Frank & Perry Bros., Anderson, are considering the construction of a factory at Anderson, to cost about $25,000.

Indianapolis, Ind.—The Crawford Locomotive & Car Co., Streator, Ill., has decided to move to Indianapolis. A large factory will be erected.

+Peru, Ind.—The contract for the erection of the new plant of the Model Gas Engine Co., Peru, which will locate in this city, has been awarded to the NICOLA BUILDING CO., Pittsburgh, ePnn. The main building will be 187x208 ft., two stories, and of brick and steel construction. The office building will be 40x46 ft., and the testing building 46x120 ft.

South Bend, Ind.—The South Bend Spring Wheel Co., South Bend, recently organized, is planning to erect a factory.

+Terre Haute, Ind.—The contract has been awarded to C. J. KINTZ, Terre Haute, by Samuel J. Frank & Sons, for the erection of a factory, to cost about $50,000.

Kalamazoo, Mich.—The C. K. Williams Co., Easton, Penn., will locate in Kalamazoo, Mich., on the north side. A factory to cost $30,000 will be erected. The company has a capital of $200,000.

Chicago, Ill.—Miller & Hart, Chicago, are considering the erection of a five-story brick refrigerating plant. The cost is estimated at $50,000. W. F. Miller is Arch.

The Haggard & Marcusson Co., Chicago, is asking for bids for the erection of a two-story and basement boiler house, 40x80 ft. The estimated cost is $12,000.

The Kee & Chopell Dairy Co., Chicago, is considering the erection of a two-story brick dairy. The building will be 100x125 ft. The cost is estimated at $50,000. F. W. Shock is Arch.

The Chicago Steel Products Co., Chicago, has purchased a site on which to erect a new plant. The company has been incorporated recently. John G. Kreer is Pres.

+Madison, Wis.—The contract has been awarded to MORGAN & MORGAN, Madison, by the Teckemeyer Candy Co., Madison for the construction of a three-story factory, 34x40 ft., at about $15,000.

+Merrill, Wis.—The contract has been awarded to TORKLESON & HESTERMAN, Merrill, for the construction of the factory for the Merrill Knitting Co., Merrill. It will be two stories, 40x75 ft.

Sheboygan, Wis.—The American Engineering Co., Sheboygan, is considering the erection of a welding plant. The company has been incorporated recently with a capital of $50,000.

Paul Klumb, Sheboygan, is considering the construction of a gasoline-engine factory, 150x80 ft.

+Sheboygan, Wis.—The contract has been awarded to CHRISTIAN ZELLE & SON, Sheboygan, for the erection of an addition to the plant of the Phoenix Chair Co., Sheboygan. The owner will furnish the material. The structure will be 50x112 ft., five stories, of brick veneer construction.

+West Bend, Wis.—The masonry contract has been awarded to GEORGE HERON, West Bend, for a 32x38-ft. boiler house, a 14x20-ft. engine room and a 50x128-ft. warehouse.

Argenta, Ark.—The Rose City Oil Co., Argenta, plans to rebuild its plant which was recently destroyed by fire. The estimated cost is $200,000.

Seattle, Wash.—The Zimmerman, Deagan Shoe Mfg. Co., is planning to double the capacity of its shoe factory on Ewing St., Seattle. About $100,000 will be expended.

Longbeach, Calif.—The Los Angeles Cotton Mill Co., Los Angeles, Calif., recently incorporated with a capita of $750,000, has acquired 15 acres of land near Longbeach, and will erect a large cotton factory. The estimated cost is $500,000. F. M. White, Charlotte, N. C., is interested.

The Crown Motor Car Co. is being organized in Louisville, with $500,000 capital stock, for the manufacture of a two-passenger, four-cylinder automobile. The company is now securing a site for its factory. The officers are V. F. Lambert, Pres.; N. V. Lambert, V.-Pres., and C. H. Lambert, Secy. and Treas.

Montreal, Que.—The Canadian-Fairbanks-Morse Co., Ltd., plans several improvements soon. It will erect an eight-story building, which will be the head office of the company. A new warehouse will be built in Vancouver, B. C. Henry J. Fuller is Pres.

Brantford, Ont.—The Lake Erie & Northern R.R. will build machine shops and car repair buildings here.

Niagara Falls, Ont.—The B. F. Goodrich Rubber Co., Akron, Ohio, contemplates the building of a Canadian plant. It is reported that a site has been secured near Chippewa just above the Falls. The plant is to be completed within a year, and, it is said, will give employment to about 1800 men.

Ottawa, Ont.—The American Bank Note Co., New York, N. Y., will build an addition to its present building. The estimated cost is $100,000.

Preston, Ont.—The Dominion Bronze Mfg. Co. will erect a plant. J. W. Patterson, New Castle, Penn., Supt., is in charge.

Toronto, Ont.—The Pink, McVeity Blackburn Co., Ltd. has been incorporated, capitalized at $150,000, to manufacture and deal in automobiles and other vehicles. John F. Orde, Montague G. Powell and Norman W. Lyle are directors of the company.

Bids are being received for the erection of the factory to be built by the National Cash Register Co. on Christie St., Page & Warrington are furnishing specifications and receiving the bids.

Newport, B. C.—The West Coast Shingle & Mill Co., Ltd., is having plans prepared for a combination saw and shingle mill plant to be erected on Howe Sound, near Newport. Estimated cost, $15,000. M. L. Taylor, Dominion Bldg., Vancouver, B. C., is the Arch.

Vancouver, B. C.—W. H. White and Thomas White, Boyne City, Mich., and W. O. King, Chicago, have organized a company to be known as the White Bros. Lumber Co., of Canada. The company has acquired 90,000 acres on the Clianche River and tributaries, in the Rupert District, Vancouver Island, B. C., and will erect a large sawmill plant with a daily capacity of 500,000 ft. Thomas White will be Mgr.

FEDERAL GOVERNMENT WORK

Dredging—Portland, Maine—Bids will be received until noon, May 26, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Portland Harbor.

Ledge Excavation—Portland, Maine—Bids were received, May 1, as follows, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for ledge excavation in Portland Harbor: G. H. Breymann & Bros., Toledo, Ohio, $18 per cu.yd.; Eastern Dredging Co., Boston, Mass., $16.92. Johnston & Virden, Lewes, Del., $18.90; Geo. W. Beeman, Hyde Park, Mass., $17.45.

Ledge Excavation—Portland, Maine—Bids were received as follows, May 1, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., for ledge excavation in the Saco River, South Bristol Harbor and Sullivan Falls: Saco River, Eastern Dredging Co., Boston, Mass., $19.70 per cu.yd.; Geo. W. Beeman, Hyde Park, Mass., $24.50; South Bristol Harbor: Frank W. Carlton, Bath, Maine, $11.30 per cu.yd.; Eastern Dredging Co., Boston, Mass., $15.70; Geo. W. Beeman, Hyde Park, Mass., $22.75; Sullivan Falls: Gilbert H. Harries, Boston, Mass., $36.90 per cu.yd.; Frank W. Carlton, Bath, Maine, $40; Eastern Dredging Co., Boston, Mass., $39.70.

Coaling Plant—Boston, Mass.—Bids will be received until 11 a.m., May 31, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a coaling tower and alterations and improvements at the coaling plant in the navy yard at Boston.

✚Roadway—Chelsea, Mass.—The contract has been awarded to COLEMAN BROS., Chelsea, by the U. S. government, for the construction of a roadway at the U. S. Naval Hospital, Chelsea, at $14,277. Bids noted May 1.

Dredging—New London, Conn.—Bids will be received until 2 p.m., May 31, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, for dredging in the Mystic River, Conn.

★Building—Fort Totten, N. Y.—Bids will be received by the Quartermaster, U. S. A., Fort Totten, until 2 p.m., May 30, for constructing isolation ward, complete, including plumbing, heating and electric wiring.

Dredging—New York, N. Y.—Bids were received as follows, Apr. 18, by Col. W. T. Rossell, Corps Engrs., U. S. A., New York, for dredging as follows: (a) Woodbridge Creek, (b) Matawan Creek, (c) Shoal Harbor and Compton Creek, (d) Shoemaking River, (e) John & Joseph McSpirit (3 Weeks St., Jersey City, N. J., (a) 29c., (b) 43c.; John H. Gerrish, 81 New St., New York, (b) 52c., (c) 68c.; Miller & Field Co., 68 Grand St., Newburgh, N. Y., (d) 40c.

Steel Trusses, Etc.—New York, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., May 24, for steel trusses, purlins, bracing columns, corrugated siding, mill work, etc., for the naval magazine at Iona Island, New York Harbor.

Paving—New York, N. Y.—Bids will be received until 11 a.m. May 31, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for wood block paving at the Navy Yard, New York, N. Y. The estimated cost is $15,000. Wm. M. Smith is Acting Chief.

Highway Bridge—Annapolis, Md.—Bids were received May 1 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a highway bridge across Dorsey Creek at the Naval Academy, Annapolis, Md. The bridge is to consist of 12 fixed spans and one draw span, the substructure of cylindrical piers of concrete supported on piles. The superstructure and roadway floor is to consist of reinforced-concrete girders, joists and floor slab, the latter supporting a roadway of tar macadam to consist of the roadway there shall be a reinforced concrete wearing surface 3 in. thick. Provision is to be made for a pipe railing shall extend along each side of the bridge. The superstructure of the draw pier shall consist of steel-plate girders and I-beams with a plank floor and timber wheel guards. The draw shall be hand operated and of the center-bearing swinging type with rack and pinion and roller bearing wheels. The bridge shall be protected at the draw opening by cement piles and timber work. Distance between piers would be 20.2 ft. width of opening of draw, 12 ft. The bids follow: Sanford & Brooks, Baltimore, Md., $39,620; Edward S. Micheau, Baltimore, $43,500; W. W. Lindsey & Co., Philadelphia, $44,800; Penn Bridge Co., Washington, D. C., $47,900; alternate, $45,900; Nelson Merydith Co., Chambersburg, Penn., $49,900; alternate, $45,000.

Cranes—Washington, D. C.—Bids were received as follows, May 3, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing four electric traveling bridge cranes and two electric traveling wall cranes at the general foundry, Navy Yard, Washington, D. C.: Northern Engineering Co., Detroit, Mich., $28,700; Niles-Bement-Pond Co., New York, $27,650.

Wire—Washington, D. C.—Bids were received as follows, Apr. 24, by the Chief Signal Officer, U. S. A., Washington, for furnishing 528,000 ft. of outside distributing wire, under Circular No. 649: Safety Insulated Wire & Cable Co., New York, $21 per M. ft.; 90 to 120 days; National India Rubber Co., Bristol, R. I., $20.90; 120 days; Hazard Mfg. Co., 50 Dey St., New York, $22.12; 200 days; Atlantic Insulated Wire & Cable Co., 120 Liberty St., New York, $24; 90 days; Western Electric Co., 463 West St., New York, $10.50 (alternate bid).

★Bridge—Washington, D. C.—Bids will be received until 2 p.m., May 20, at the office of the Superintendent of the National Zoological Park, Washington, for the construction of a rough stone-faced bridge across Rock Creek in the National Zoological Park under the direction of the Smithsonian Institution, Washington. Charles D. Walcott, Secy.

Post Office—Covington, Va.—Bids were received as follows Apr. 29, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Covington: (a) limestone; (b) sandstone: E. Hart, Norfolk, Va., (a) $44,800; (b) $46,400. A. C. Moses Construction Co., Washington, D. C., (a) $55,000; (b) $56,200; Morrell & Waters, Llanroch, Penn., (a) $46,600; (b) $48,100; Central Concrete Construction Co., Louisville, Ky., (a) $45,250; (b) $46,800; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $53,777; (b) $56,277; Westchester Engineering Co., New York, (a) $49,116; (b) $53,000; C. M. Leach, Boston, Mass., (a) $49,300; (b) $51,000; George Leigh & Bros., Louisa, Va., (a) $54,049; (b) $56,400.

Quarterboats—Norfolk, Va.—The only bid for furnishing and delivering two wooden quarterboats, bids for which were opened at U. S. Engineer Office, Custom House, Norfolk, Va., was that of Smith & McCoy, Norfolk, Va., at $5866 each, or a total of $11,732.

✚Removal of Wreck—Norfolk, Va.—Bids were received as follows, Apr. 10, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S., for the removal (a) by explosives; (b) bodily, of the wreck, "Florida," from Hampton Roads: (a) John B. Whealton, Jr., Norfolk, Va., $12,500; Hanbury & Blix, Brooklyn, N. Y., $10,850; Johnston & Virden, Lewes, Del., $10,800; Eugene Boehm, Atlantic City, N. J., $8922. (b) Merritt & Chapman Derrick & Wrecking Co., New York, N. Y., $22,450. The contract was awarded to EUGENE BOEHM.

Removal of Wreck—Norfolk, Va.—Bids were received by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for the removal of the wreck of the steel whale-back barge, "Bangor," sunk in Hampton Roads, Va.: (a) Bodily; (b) by use of explosives and raising pieces; (c) by sinking the wreck into the bottom so that the depth after it is sunk will be 40 ft.: W. H. French, Norfolk, (b) $8235. Coastwise Dredging Co., Norfolk, (c) $6950; King & Wotherspoon, 149 Broadway, New York, (a) $15,000; (b) $12,000; Johnston & Virden, Lewes, Del., (b) $11,900.

Boats—Norfolk, Va.—Bids will be received until noon, June 2, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for the construction and delivery of three motor survey cruisers.

Reservoir—Fort Caswell, N. C.—Bids will be received until 2 p.m., May 26, by James R. Campbell, Const. Q. M., U. S. A., Fort Caswell, for constructing a 400,000-gal. concrete reservoir.

Water Supply—Fort Caswell, N. C.—Bids will be received by James R. Campbell, Const. Q. M., U. S. A., Fort Caswell, until 2 p.m., May 26, for the following projects; bidders being informed that from these projects the Government intends to select one which it will decide upon as being the best for the purpose: (1) Constructing an 8-in. water main, pump house, necessary machinery, and power-transmission line; (2) constructing an 8-in. water main to Southport side of river, and furnishing water to Southport end of main; (3) for all the material, labor, machinery and accessories necessary to install a complete distilling and preliminary water-softening plant, including brick or reinforced-concrete building, with slate roof, and the necessary boiler, tanks, piping and accessories needed to furnish not less than 3000 gal. per hour, or 70,000 gal. daily, of good, potable distilled water; bidders must submit complete plans and specifications, and must state in bids the guaranty with proper security that they will furnish coverings the durability and operation of the apparatus; water will be taken by the plant from a salt-water suction pipe to be installed by the government. For information and all necessary papers apply to James R. Campbell, C. mst. Q. M., U. S. A.

Post Office—Hickory, N. C.—Bids will be received until 3 p.m., June 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring interior lighting fixtures and appurtenances) of the U. S. post office at Hickory. The building is to be two stories high with a basement and will have a ground area of approximately 4800 sq.ft.; fireproof construction to top of second floor stone and brick facing and tin roof. Drawings and specifications may be obtained from the custodian of site at Hickory, or at Washington, at the discretion of the Supervising Architect.

Stone or Gravel—Wilmington, N. C.—Bids were received by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for furnishing crushed stone or gravel (a) 8700 tons of 1½-2½ in.; (b) 6200 tons ⅝-2½ in.; (c) 1100 tons ½-¾ in.; (d) ballast. Hanes Granite Quarries Co., Salisbury, N. C., (a) $8.80 per ton; (b) $2; (c) $2.30; (d) $30,590. North Carolina Granite Corporation, Mount Airy, N. C., (a) $8.80, (b) $1.90, (c) $2.30, (d) $29,970.

Post Office—Cynthiana, Ky.—Bids will be received until 3 p.m., June 17, by Oscar Wenderoth, Superv., Arch., Treasury Dept., Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the U. S. post office at Cynthiana, Ky. The building is one story, basement and mezzanine, and has a ground area of approximately 3750 sq.ft.

Lumber—Jeffersonville, Ind.—Bids will be received until 10 a.m., May 23, by Capt. H. R. Perry, Q. M., U. S. A., Jeffersonville, for 325,000 ft. of seasoned cypress lumber, No. 1 boxing, also 21 pieces of oak lumber, 1300 ft. of white pine lumber and 20 pieces of oak lumber, firsts.

Dredging—Detroit, Mich.—Bids will be received until noon, May 10, by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., for dredging Cheboygan Harbor, Mich. Erroneously noted, Apr. 17, as Sheboygan.

Post Office—Petoskey, Mich. Bids were received as follows, May 1, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Petoskey, Mich.: (a) Limestone; (b) sandstone: William Dieter & Son, Holland, Mich., (a) $71,841; (b) $73,-041; Rogers & Kaiser, Chicago, Ill., (a) $63,994; (b) $66,994; M. Yeager & Son, Danville, Ill., (a) $67,372; (b) $68,872; Richard Collins, Alpena, Mich., (a) $56,953; (b) $59,453; Interstate Construction Co., Saginaw, Mich., (a) $63,885; (b) $66,000; Northern Construction Co., Milwaukee, Wis., (a) $71,000; (b) $73,500; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $69,579; (b) $71,579; Charles Hoertz & Son, Grand Rapids, Mich., (a) $69,076; (b) 073,076; Charles W. Thayer, Detroit, Mich., (a) $60,850; (b) $62,500; Pettibone, Jenson Co., Muskegon, Mich., (a) $79,096; (b) $82,096.

Dredging—Chicago, Ill.—Bids will be received by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Chicago, until 10 a.m., May 27, for dredging in the Chicago River.

Post Office—Rochelle, Ill.—Bids will be received until 3 p.m., June 16, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Rochelle, Ill. The building will be one story, basement and mezzanine, and has a ground area of approximately 4000 sq.ft.

Post Office—South Chicago, Ill.—Bids were received as follows May 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at South Chicago, Ill.: (a) Limestone; (b) sandstone; Hiram Lloyd Building & Construction Co., St. Louis,)a) $137,207; (b) $141,207; Conners Bros, Co., Lowell, Mass., (a) $135,822; (b) $141,822; Interstate Construction Co., Saginaw, Mich., (a) $142,246; (b) $145,900; Dieter Wenzel, Wichita, Kan., (a) $159,920; (b) $162,420; Moore & Danner, Kokomo, Ind., (a) $147,860; M. Yeager & Sons, Danville, Ill., (a) $132,417; (b) $136,300; William H. Maxwell, Auburn, N. Y., (a) $156,522; J. P. Cullen Co., Janesville, Wis., (a) $134,857; George W. Stiles Construction Co., Chicago, Ill., (a) $139,664; (b) $149,-664.

Building—Milwaukee, Wis.—Bids were received as follows, Apr. 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for construction of a building for appraiser's stores at Milwaukee: (a) Limestone; (b) sandstone: Interstate Construction Co., Saginaw, Mich., (a) $94,-694; (b) $95,500; F. W. Taddey & Son, (a) $89,850; (b) $90,-400; Paul Riesen's Sons, (a) $99,000; (b) $99,500; Dahlman Construction Co., (a) $114,955; (b) $115,455; H. Schmitt & Son, (a) $91,424; (b) $94,394; American Construction Co., (a) $91,-900; (b) $92,500; General Construction Co., (a) $94,568; (b) $94,968. Above bidders of Milwaukee, Wis., unless otherwise specified.

Building—White Earth, Minn.—Bids will be received until 2 p.m., May 26, by the Commissioner of Indian Affairs, Dept. of the Interior, Washington, D. C., for the erection of a brick dormitory and brick mess hall, and for the installation of acetylene-lighting extension at the White Earth School, in the erection of a laundry at the White Earth Agency, Minn. Further information may be obtained from the Superintendent of the school at White Earth.

+Post Office—Beloit, Kan.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post-office at Beloit, to the KING LUMBER CO., Charlottesville, Va., at $45,930.

Building—Wahpeton, N. D.—Bids will be received until 2 p.m., June 2, by the Commissioner of Indian Affairs, Dept of the Interior, Washington, D. C., for the erection of a brick hospital at the Wahpeton Indian School. Further information may be obtained from the Superintendent of the school, Wahpeton, and at Washington.

Cement—Dallas, Tex.—Bids were received by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, for furnishing and delivering 9000 bbl. of portland cement at Port Arthur, Tex.: Southwestern States Portland Cement Co., Dallas, $1.95 per bbl. "Trinity" brand; delivered by rail; F. R. Bissell, trustee Texas Portland Cement Co., Dallas, $1.95 per bbl., "Lone Star" brand; by rail; Atlas Portland Cement Co., New York, $2.05 per bbl. "Atlas" brand; by vessel. The sum of 10c. in each case is allowed per sack for each sack returned.

Pump—Fort Sill, Okla.—Bids will be received by A. U. Faulkner, Const. Q. M., U. S. A., Fort Sill, for constructing wooden storage tank and installing motor-driven triplex pump with necessary piping, etc., at Fort Sill.

★Canal—Grand Junction, Colo.—Bids will be erected by the U. S. Reclamation Service, Grand Junction, until June 2 for earth-work on the first five miles of the main canal, Grand Valley Project, Colo. This work involves the excavation of approximately 365,000 cu.yd. of material, and is situated near the main line of the Denver & Rio Grande R.R. and Colorado Midland Ry. and between two and seven miles northeast of Palisade, Colo.

Dredging—Oakland, Calif.—Bids were received Apr. 14 for dredging in Oakland Harbor, about 1,038,450 cu.yd.: Standard American Dredging Co., Merchants Exchange Bldg., San Francisco, 15½c. per cu.yd.; San Francisco Bridge Co., Nevada Bank Bldg., San Francisco, 12.8c.; N. R. Harris, 21 California St., San Francisco, 13.48c.

Stone—Portland, Ore.—Bids will be received by Maj. J. F. McIndoe, Corps Engrs., U. S. A., Portland, until 11 a.m., May 15, for furnishing and delivering stone for jetty construction at the mouth of the Columbia River, Ore., and Washington.

Electric-Light System—Fort Mason, Calif.—The lowest bid submitted to Capt. E. S. Walton, Corps Engrs., U. S. A., Fort Mason, for installing an electric light system was that of the Newberry-Hendheim Co., Humboldt Bank Bldg., San Francisco, Calif., at $15,700.

+Oil Burners—Fort Mason, Calif.—The contract for the installation of oil burners at Fort Mason and Fort Winfield Scott has been awarded to the AMERICAN HEAT & POWER CO., at $20,000.

Oil Tank—Hawaii—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., May 24, for the construction of one steel oil-storage tank at the naval station at Pearl Harbor, H. T. Estimated cost, $20,500.

+Dump Cars—Hawaii—The contract has been awarded to the WILLIAM J. OLIVER MFG. CO., Knoxville, Tenn., for furnishing 5 dump cars, 20 yd. capacity, for delivery at the naval station, Pearl Harbor, H. T., at $33,310. Bids were opened by the Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Coal Hoisting Towers—Hawaii—Bids were received as follows, May 3, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the installation of two coal-hoisting towers at the Pearl Harbor, H. T., Navy Station: McMyler Interstate Co., Bedford, Ohio, $99,200; Robbins Conveyor Belt Co., New York, one, $41,000; two, $75,000; C. W. Hunt Co., West New Brighton, N. Y., one, $38,700, alternate, $42,400; two, $70,500, alternate, $77,600; Mead-Morrison Mfg. Co., 149 Broadway, New York, one, $75,058, alternate, $60,-480; two, $116,398, alternate, $94,650. Exeter Machine Works, Pittston, Penn., one, $45,200; two $84,950. These towers will be self-propelling steeple coal-hoisting towers of steel framing erected upon 65-lb. rails on a coaling wharf trestle. Each tower will be capable of handling a grab bucket holding 2½ tons of coal. The tower rails are 30 ft. center to center. The arms of the towers are to be capable of raising and lowering, and allowing the center of the bucket to travel 62 ft. beyond the center of the outboard tower rail. The towers are to be steam operated and the fuel will be coal.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids were received as follows by the State Harbor and Land Commissioners, Boston, for dredging at South River: Bay State Dredging Co., Boston, 39¾c. per cu.yd. and $5 per cu.yd. for boulders; J. P. O'Riordan, Charlestown, 49c. and $15. Both bids were rejected, as were the bids for Woods Hole the preceding week, all being considered excessive. Wm. T. Williams is Ch. Engr.

Bulkhead—Boston, Mass.—Bids were received by the Directors of the Port of Boston, Apr. 30, for the construction of a bulkhead at East Boston: (a) 3300 lin.ft. of oak piles and hard pine timber; (b) 7220 lin.ft. of spruce piles and hard pine timber; (c) 980 lin.ft. of spruce piles and spruce timber; (d) 11,500 ft. of platform; (e) totals: Lawlor Bros., (a) $14.18; (b) $12.49; (c) $12.49; (d) $1.25; (e) $163,587; Rendle & Stoddard, (a) $15.76; (b) $12.24; (c) $12.24; (d) $1.20; (e) $166,176; John Cochran & Sons Co., (a) $15.32; (b) $13.04; (c) $13.50; (d) W.68; (e) $177,352; W. Ellis, (a) $13.09; (b) $14.24; (c) $12.63; (d) $3.09; (e) $214,345; Great Lakes Dredge & Docks Co., (a) $30; (b) $25; (c) $25; (d) $1.50; (e) $221,250; H. P. Converse & Co., (c) cost + 7½%.

+Signal Towers—Lynn, Mass.—The contract has been awarded to the C. A. DODGE CO., Cambridge, Mass., for the erection of three signal towers for the Boston & Maine R.R. Co. The towers will be of reinforced concrete, three stories, 20x40 ft.

+Barge Canal Work—Albany, N. Y.—The contract has been awarded to JOHN YOUNG, Syracuse, N. Y., for the construction of Barge Canal Contract No. 112, at $120,350. This contract calls for the driving of 145,000 lin.ft. of sheet steel piling for the protection of the embankments of the canal at various points in Niagara and Monroe Counties. List of bidders noted Apr. 24.

+Barge Canal Work—Albany, N. Y.—The contract has been awarded to WILLIAM H. DOWDLE, Oswego, N. Y., for the construction of Barge Canal Contract No. 113, at $21,964. The contract provides for furnishing and delivering lumber and wooden piles at Bushnell's Basin and Holley. The other bidders were Lupfer & Remick, of Buffalo, $22,139, and John Murphy, of Holley, $24,820. List of bidders noted Apr. 24.

+Fire Alarm Telegraph—Brooklyn, N. Y.—The contract has been awarded to the SAFETY INSULATED WIRE & CABLE CO., 114 Liberty St., New York, N. Y., for the installation of an extension to the fire-alarm telegraph system in the Borough of Brooklyn, at $60,700. Bids were opened Apr. 15, by Joseph Johnson, Fire Comr. List of bidders noted May 24.

Bath House—Buffalo, N. Y.—Bids will be received until 11 a.m., May 9, by the Department of Public Works, for the erection of a public bath house. Separate bids must be submitted for the following: (a) Masonry, concreting, cutstone, plastering, etc.; (b) structural iron and steel work, stairways, etc.; (c) fireproofing, floors, partitions, roof, etc.; (d) carpentry, mill work, painting, glazing, hardware, etc.; (e) roofing, sheet-metal work, etc.; (f) marble, slate, tile work, etc.; (g) electric wiring, lighting fixtures, etc.; (h) plumbing, drainage, gas fitting, etc.; (i) heating, ventilating, radiation, etc.

Road Surfacing Material—New York, N. Y.—Bids will be received until noon, May 13, by the President of the Borough of Richmond, Borough Hall, St. George, S. I., N. Y., for furnishing and delivering 40,000 gal. of bituminous road surfacing material, tar base, in tank cars at any railroad station in the Borough of Richmond. George Cromwell is Pres.

+Fire Engine House—New York, N. Y.—We are officially advised that the Fire Department, 157 East 67th St., has awarded the following contracts from bids received on Apr. 28: For the construction of a new engine house on Benedict Ave., north of Fulton St., Woodhaven, to W. D. MOORE, 2029 East 15th St., Brooklyn, at $35,527; for the construction of a

new engine house on Seventh Ave., north of 16th St., Whitestone, to HANSON & McHUGH, 47 West 34th St., at $17,879. Joseph Johnson, is Engr.

Subway—Rochester, N. Y.—The Eastman Kodak Co., Rochester, is considering the construction of a subway from the Buffalo, Rochester & Pittsburgh Ry. tracks to its plant, a distance of about three-quarters of a mile. The cost of the proposed work is estimated at about $1,000,000.

Coal Pockets—Athenia, N. J.—The Meier & Thorburn Coal Co. is having plans prepared for a series of modern coal pockets at Athenia.

Recreation Piers—Camden, N. J.—The city is considering the construction of recreation piers. L. E. Farnham, City Engr., has been ordered to prepare plans and specifications for the proposed work.

✦Cement—Atlanta, Ga.—The contract has been awarded to V. H. KRIEGSHABER, Atlanta, for furnishing cement for the city for the year at $1.78¾ per bbl.

Engine House—Cincinnati, Ohio—Bids will be received until noon, May 12, by the Director of Public Safety for the erection and completion of the proposed engine house on Main St. Harry Hake and Carles H. Kuck, 802 Provident Bank Bldg., Carthage and Archs. John H. Druffel is Secy.

Stable—Cincinnati, Ohio—Bids will be received by the Director of Public Safety until noon, May 12, for t' e remodeling of patrol station No. 8 and converting it into a stable for traffic. John H. Druffel is Secy.

✦Filing Cases—Cincinnati, Ohio—The contract has been awarded to the ART METAL CONSTRUCTION CO., Cincinnati, for metal filing cases for the Union Central Life Insurance Co.'s new offices, at about $30,000.

Bank and Channel Work—Dayton, Ohio—Plans have been submitted to the City Council for strengthening the Great Miami River banks and deepening the channel to protect the city against floods. Estimated cost, $4,675,000. G. C. Cummin is City Engr.

Repairs to Dam—Middletown, Ohio—John I. Miller, State Supt. of Pub. Wks., Columbus, Ohio, has estimated the cost of repairing the state dam and locks north of Middletown, at about $50,000.

✦Drainage Ditch—Boonville, Ind.—The contract has been awarded to FRED C. MORGAN, Vincennes, Ind., for the construction of the Homer E. Totten ditch, at $28,034. Other bidders were: T. Foohey Dredging Co., Fort Wayne, Ind., $31,700; Hilbert Bennet, Richland City, Ind., $37,990; J. G. Berger, South Bend, Ind., $29,500; H. G. Roetzel & Co., Rockport, Ind., $24,282. The ditch to be constructed is about five miles long and is along the Warrick and Spencer County line.

★Road Roller—Grand Rapids, Mich.—Bids will be received by the Board of Public Works until May 15, for furnishing a 20,000 lb. steam road roller of the macadam type, according to the specifications on file at the office of the board.

Levees—Illinois: Appropriations of about $600,000 for reconstructing and strengthening levees along the Mississippi River at Cairo and Mound City, Ill., weakened by the recent flood, were proposed Apr. 29 by Representative Hill, of Illinois. The bill would appropriate $500,000 for work at Cairo and $100,000 for work at Mound City.

✦Drainage—Belleville, Ill.—The contract has been awarded to R. A. BROWN, Washington, Ind., by Richland Creek Drainage District for drainage work in the district at about $10,000.

Grandstand—Chicago, Ill.—The Chicago American League Baseball Club is planning to increase the capacity of its South Side baseball park. According to the plans, the grand stand will seat 25,000, the 50c. pavilion 10,000, and the 25c. bleachers 10,000. The improvements will cost $150,000.

Ditch—Monee, Ill.—Bids will be received until May 17, by the Commissioners of Drainage Dist. No. 5 at the office of Wm. Cellarius, Town Clk., Monee, for constructing an open ditch, about three miles, requiring 30,000 cu.yd. of excavation and laying 700 ft. of tile 22 in. in diameter; also by the Commissioners of Dist. No. 1, town of Monee and Will for constructing an open ditch, about three miles, requiring 20,000 cu.yd. excavation and laying 1200 ft. 24-in. tile.

✦Coaling Plant—Green Bay, Wis.—The Chicago & Northwestern Ry. has awarded the contract to ROBERTS & SCHAEFER, McCormick Bldg., Chicago, Ill., for the construction of a 32-ton, counterbalance bucket, Holmen type locomotive coaling plant at Green Bay.

Shed—Milwaukee, Wis.—The Illinois Steel Co. will build a steel shed 200 ft. long, 80 ft. wide and 50 ft. high, at the Lincoln Ave. plant. Estimated cost $18,000.

✦Coaling Plant—Prairie du Chien, Wis.—The contract has been awarded to the ROBERTS & SCHAEFER Co., McCormick Bldg., Chicago, Ill., by the Chicago, Burlington & Quincy R.R. Co. for the construction of a coaling plant at Prairie du Chien.

✦Drainage Ditch—Des Moines, Iowa—The contract has been awarded to J. C. ANDERSON for the construction of the Lincoln and Crocker Township drainage ditch at $15,454.

Drainage—Eldora, Iowa—Bids will be received until May 10, by E. L. Mardesen, County Audr., Eldora, for the construction of drainage ditch No. 29. S. B. Gardner, Engr., Eldora.

Drainage—Sibley, Iowa—Bids will be received until May 12 by the County Supervisors, Sibley, for constructing drains in Dist. 14, 25,400 ft. 6- to 18-in. tile and Dist. 15, 8200 ft. 6- to 15-in. tile. V. A. Burke is County Audr. L. A. Wilson, Engr., Sibley.

✦Drain—Billings, Mont.—The contract has been awarded to HUGH McDONALD for the construction of the old McCormick drain west of Billings, at about $10,000.

Ditch—Billings, Mont.—Surveys are being made for the construction of Coon Ditch. It is estimated that 2000 acres will be reclaimed.

Levee Bonds—Marion, Ark.—Bids will be received until May 12, by the Board of Directors of St. Francis Levee District, Randolph Bldg., Memphis, for $1,500,000 levee bonds. Bids will be opened at Marion, Ark.

★Lock, Dam and Canal—Beaumont, Tex.—Bids will be received by the Navigation and Canal Commissioners of Beaumont Navigation District of Jefferson County, Tex., at the office of James F. Weed, Engr., Alamo Block, Beaumont until noon, June 16, for the construction of a lock, dam and canal in Taylors Bayou in Jefferson County, Tex., about one-half mile above West Port Arthur. The contract will include furnishing all material and labor for the construction of a canal approximately 1000 ft. long, 10 feet depth, 30 ft. bottom width, 60 ft. top width, one lock with chamber 250 ft. long, minimum depth of water over sills 10 ft., grates 30 ft. wide, gate walls and foundation to be of reinforced concrete construction; also the construction of a dam across Taylors Bayou, approximately 160 ft. wide, with seven sections of drop gates of 20 ft. each. Detailed plans and specifications may be seen at the office of James F. Weed, Engr., Beaumont.

Port Work—Seattle, Wash.—Bids will be received until May 15 by the Port of Seattle Commission for port work providing for the construction of superstructures, marine railways and roadways, of Salmon Bay Improvement, Port of Seattle, and for the construction of the substructure of Smith's Cove Improvement, Port of Seattle.

Cement—Seattle, Wash.—The contract will be awarded by the County Commissioners the latter part of this month for 20,000 bbl. of portland cement.

Wharf Extension—Eureka, Calif.—The Northwestern Pacific Ry. Co. considers the construction of 300 ft. of additional wharfage on the west end of the railroad wharf, erecting 100 ft. of additional warehouse and the opening of Commercial St. through from the bay to Second St.

Fountain—Los Angeles, Calif.—A fountain is to be placed in Exposition Park. It will cost approximately $500,000. Martin C. Neuner is Chn of Fountain Com.

Dump Cars, Locomotives—Los Angeles, Calif.—Bids will be received until May 23 by the Bd. Pub. Wks., of Los Angeles, for furnishing f.o.b. cars, San Pedro, 40 six-yard, two-way dump cars, 12 ten-ton industrial flat cars, and four 18-ton industrial locomotives. W. B. Ferris is Secy.

Tunnels—Los Angeles, Calif.—The Council has adopted plans prepared by the City Engineer for the construction of the First and Second St. tunnels. Estimated cost, $25,000.

Wharf—Martinez, Calif.—A franchise has been granted to the Associated Oil Co., for the construction of a wharf in Suisin Bay, near Avon Station. Estimated cost, $10,000.

Embankment—Oakland, Calif.—Bids will be received until May 15 by the San Francisco-Oakland Terminal Rys. Co. for the construction of a solid embankment about 9300 ft. long, in San Francisco Bay. The project involves the following work: 15,800 lin.ft. of temporary railroad trestle; 14,700 lin.ft. of sheet pile bulkhead; 165,000 cu.yd. rock excavation; 20,000 cu.yd. earth excavation, and 1,250,000 cu.yd. hydraulic dredging.

Filling—Oakland, Calif.—Bids will be received until May 15 by the San Francisco-Oakland Terminal Rys. Co., for dredging about 1,000,000 cu.yd. from the harbor and filling in behind the wall which the company will construct. W. P. Alberger, Oakland, is Vice-Pres. and Gen. Mgr.

Tunnel—Oakland, Calif.—Plans for the construction of a tunnel under the estuary between Oakland and Alameda have been prepared and submitted to the Supervisors by the County Surveyor. Three plans are outlined for the tunnel, one costing $10,000,000, a second costing $6,800,000, and the third costing $3,400,000. The more comprehensive plan proposed, which costs $10,000,000, consists of two separate tunnels, one at the foot of Madison St., and the other at the foot of Jefferson St. That the Jefferson St. alignment tubes be dispensed with and only the Madison St. tunnel constructed is proposed in a substitute plan. This would cost $6,800,000. If satisfactory arrangements with the street railway company and the suburban electric system cannot be made, the construction of a single large tube on the Madison St. alignment is proposed. It will carry a 20-ft. driveway for vehicles and two 6-ft. suspended sidewalks for pedestrians. This would cost $3,400,000.

✦Drainage Ditch—Pomona, Calif.—LOUIS FERRILL, Pomona, was awarded the contract for the construction of four miles of drainage ditch 15 ft. wide and 6 ft. deep, at 18c. per cu.yd. for excavation and $500 for grubbing and clearing for the Pioneer Drainage District.

✦Pile Foundations—San Francisco, Calif.—The Panama-Pacific International Exposition Co. has awarded the contract for the driving the pile foundation for the Exposition Palace of Fine Arts to the CONTRA COSTA CONSTRUCTION CO., Seventh and Berry Sts., San Francisco, at 24⅞c. per lin.ft. for about 200,000 ft.

Fire Houses—San Francisco, Calif.—The following bids were opened by the Buildings and Grounds Committee of the Panama-Pacific International Exposition Co., for the construction of three frame fire houses to be erected on the exposition grounds at Harbor View: M. M. Finlayson, $63,213; M. Sheehy Bros., $49,116; Commary-Peterson Co., Inc., $54,900; Newson, Wold & Kohn Co., $54,495; H. Chase, $37,573; Fred Flacher, $48,727; Thomas M. Lindsay, $62,871; L. Bergen & Son, $57,457; O. C. Holt, $55,540; J. Windering, $51,250; J. Monk, Norfolk, Va., $47,500; Howard S. Williams, $50,950; Peter N. Schmidt, $56,500. Jas. Furlong, $54,700.

Bath House—Santa Barbara, Calif.—H. Alban Reeves, Arch., Chamber of Commerce Bldg., and E. Russell Ray, Arch., Santa Barbara, Calif., have been commissioned to prepare plans for a new bath house to be erected in Santa Barbara, to replace the one recently destroyed by fire. The contract will be let by Southern California Edison Co. The building will probably be of reinforced concrete and will contain a plunge, dressing rooms and other accessories.

Wharf—Evandale, N. B.—Bids will be received until May 12, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a high water wharf at Evandale.

Timber—St. John, N. B.—Bids will be received until May 12, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for furnishing creosoted timber for Northern and Eastern New Brunswick.

Wharf, Dredging—Belleville, Ont.—Bids will be received until May 20 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a wharf and dredging at Belleville.

✚Wire and Cable—Toronto, Ont. The Board of Control has awarded the contract to the CANADA WIRE & CABLE CO., Toronto, for the wire and cable for the Danforth Ave. car line, at about $24,000.

BUILDINGS

Boston, Mass.—Andrews, Jacques & Rantoul, Archs., State Mutual Life, Bldg., Boston, are preparing plans for an addition to the State Mutual Bldg., at 50 Congress St. The building will be 10 stories, and will occupy the block between Congress and Kilby Sts. The estimated cost is $500,000.

Bids will be received until May 19, for the construction of additions to men's dormitory, hospital pavilion, nurse's building, etc., at Long Island, Boston Harbor. Jas. H. Dorsey is Acting Chn. of Armary Bd.

A nine-story hotel is to be erected on the site of the Hotel Thorndike, at Boylesston and Church Sts. Densmore & Le Clear, 88 Broad St., are Engrs.

Two business buildings 10 and 11 stories, are planned at Washington and Winter Sts. Alonzo W. Perry & Geo. A. Carpenter, 373 Washington St., are in charge.

Brookline, Mass.—Bids will be received until May 15, by Killam & Hopkins, Archs., 9 Park St., Boston, Mass., for the construction of a school on Harvard Ave., near Coolidges Corner. Franklin W. Hobbs, Town Hall, is Chn. of School Com. Noted Mar. 27.

Brookline, Mass.—Bids will be received by the School Committee until 4 p.m., May 15, at the Selectmen's office, Town Hall, for the erection of a school on the Edward Devotion school lot. Separate bids will be received for construction, ventilating, plumbing and electrical work. Killian & Hopkins are Archs., 9 Park St., Boston, Mass. Edward A. McEttrick is Secy. of Selectmen. Noted Mar. 27.

Fitchburg, Mass.—A seven-story hotel to contain 100 rooms is to be built for John Moran. It will be of brick, 75x80 ft. Geo. P. B. Alderman & Bro., Holyoke, Mass., are Archs.

Fitchburg, Mass.—The Trustees of the Burbank Hospital, Fitchburg, Mass., have voted to enlarge the hospital by the erection of a new building and by making alterations to the present buildings. The estimated cost is $42,000.

Gardner, Mass.—The Boston & Maine R.R. Co. will erect a new passenger station opposite Monmouth Park. A. B. Corthell is Ch. Engr., Boston, Mass.

✚Holyoke, Mass.—The School Board has accepted plans for a new high school and gymnasium to cost $150,000. Chas. O'Donnell is Chn. of School Bd.

Leominster, Mass.—Frost & Chamberlain, Archs., Worcester, Mass., have been engaged to prepare plans for the prised new town hall. Everett B. Richardson is Chn. Bldg. Com. Noted Apr. 10.

Lowell, Mass.—Garfield Baker, of the Realty Associates, of Lowell, has recently purchased a site of about 23,000 ft., upon which will be erected an apartment house. This building will front on Nesmith St., and the preliminary plans call for a six-story structure.

✚Northampton, Mass.—The contract for the erection of an addition to the high school has been awarded to D. A. SULLIVAN, Northampton, at $53,360.

Salem, Mass.—The Masonic orders will erect a masonic temple at Washington and Lynde Sts.

Springfield, Mass.—The Buckingham School will be enlarged. B. Hammett Seabury is Arch.

Providence, R. I.—The Providence Lodge, B. P. O. E., is having plans prepared for a new building to be erected at Green and Washington Sts.

Hartford, Conn.—Bids will be received by the Building Committee of the Washington School District, Alexander Angus, Chn., until 8 p.m., May 20, for the erection of a two-story brick addition to the Wilson St. school, as follows: (a) masonry, carpenter, sheet metal, steel and iron, painting and electrical work; (b) plumbing work; (c) heating plant. Whiton & McMahon are Archs., 49 Pearl St., Hartford, Conn.

✚Brooklyn, N. Y.—The Weinboro Realty Co., 47 West 34th St., Manhattan, has awarded a contract to the MARCUS CONTRACTING CO., 310 Front St., Manhattan, for the excavation, shoring, sheath piling, underpinning, for the 12-story bank and office building, which it will erect at Joralemon and Court Sts., Brooklyn. William E. Lehman, 738 Broad St., Newark, N. J., is the Arch. The estimated cost is $400,000.

Plans have been filed by W. B. Tubby, Arch., 26 Brevoort Place, for the construction of a new Public Library at Stone ad Belmont Aves. The structure will be two stories high, 90x63 ft., and is estimated to cost $90,000.

Buffalo, N. Y.—The Enos & Sanderson Co., Ellicott and Carroll Sts., has purchased a site at Bushnell Sts. and the Erie R.R. track, upon which will be erected a warehouse.

Delhi, N. Y.—The Board of Education contemplates erecting a school. The estimated cost is $60,000.

Fonda, N. Y.—W. J. Beardsley, 49 Market St., Poughkeepsie, N. Y., has prepared plans for the construction of a jail at Fonda. The estimated cost is $50,000.

✚Lockport, N. Y.—The general contract for the construction of the courthouse at Lockport has been awarded to JOHN MOON, Lockport, at $83,850. Noted incorrectly under Niagara Falls, Apr. 24.

Lockport, N. Y.—Plans for the Niagara County Almshouse prepared by C. R. Phelps, Arch., Niagara Falls, have been approved by the State Board of Charities, and bids for construction work will soon be called for. The plans show six large buildings, including two men's dormitories accommodating 100; one women's dormitory accommodating 60; a hospital to care for 35, and administration and service buildings. All will be joined by arcades. The estimated cost is $75,000. The buildings will be located on a farm of 176 acres at the easterly limits of the city.

New York, N. Y.—Efforts to prevent the construction of a skyscraper office building on the site of the old Equitable Bldg., have been frustrated by the fact that T. C. Du Pont has taken title to the property and assumed the mortgage for the construction of the building. The contractors, the Thompson-Starrett Co., of 49 Wall St., have been advised to construct a 36-story office building and operations will be started at once. Details will be in the hands of the Equitable Life Assurance Society now located at 165 Broadway. Noted Jan. 2 and Aug. 15.

✚Harry Schill, 355 West End Ave., has awarded a contract to RAPPOLD BROS., 1182 Broadway, for the steel construction work for the 12-story hotel, 114x34 ft., which he will erect at the northeast corner of Broadway and 94th St. Schwartz & Gross, 347 Fifth Ave., are the Archs. The estimated cost is $200,000. Noted Apr. 17.

Plans have been completed by C. P. H. Gilbert, Arch., 1123 Broadway, for the construction of a four-story bank building, to be erected by the Lincoln Trust Co., 208 Fifth Ave., at 204 Fifth Ave., through to Broadway. Alexander S. Webb is Pres.

For the purpose of erecting a 12-story addition to the Martha Washington Hotel, at 29 East 29th St., the Women's Hotel Co. has purchased two dwellings on property adjoining the present hotel site, 45x98 ft.

Plans have been prepared by Ross & McNeill, Archs., 39 East 42d St., for the construction of a six-story loft building, 100x 99 ft., at Eleventh Ave. and 51st St., for Henry Astor, 11 East 42d St. The estimated cost is $60,000.

Plans have been completed by Charles B. Meyers, Arch., 1 West Union Sq., for the construction of a six-story apartment house, 107x97 ft., at St. Nicholas Ave. and 190th St., for the 190th St. Holding Co., 85 West 119th St. The estimated cost is $150,000.

Plans are being prepared by Gronenberg & Leuchtag, Archs., 303 Fifth Ave., for the construction of a five-story apartment house, 100x72 ft., in 111th St., west of Fifth Ave., for the Tillmill Construction Co., 132 Nassau St.

Plans have been filed by Gronenberg & Leuchtag, Archs., 303 Fifth Ave., for the construction of a five-story tenement, 115x80 ft., at the southwest corner of Sherman Ave. and Arden St., for the Gibraltar Realty Co., 475 Fifth Ave. The estimated cost is $125,000.

(Boro. The Bronx)—The Lederer Construction Co., 1341 Southern Blvd., has purchased property on the east side of Southern Blvd., south of Jennings St. The site is 100x75 ft., and plans will be prepared for the construction of two five-story apartment houses upon it.

Plans have been filed by Trowbridge & Livingston, Archs., 527 Fifth Ave., for the construction of a five-story dwelling, 75x25 ft., at 49 East 68th St., for Mrs. J. W. Clark, 51 East 75th St. The estimated cost is $60,000.

Plans have been filed by A. C. Jackson, Arch., 346 Fourth Ave., for the construction of a four-story dwelling, 70x33 ft., on the northside of 78th St., east of Madison Ave., for A. Rathbone, 130 East 65th St. The estimated cost is $80,000.

✚The Bernheimer Estate, care of W. Walter, 52 Broadway, has awarded a contract to FLEISHMAN BROS., 507 Fifth Ave., for the construction of a four-story theater and office building, at Broadway and 81st St. Thomas W. Lamb, 644 Eighth Ave., is the Arch.

Maximillian Zipkes, Arch., 220 Fifth Ave., is preparing plans for the construction of a 12-story loft building at 108 West 25th St., for the 108,110 West 25th St. Co. Inc. The estimated cost is $200,000.

Bids are now being received by Macklin Arbuckle, Secy. The Lambs Club, 130 West 44th St., for the construction of a 12-story annex to the present club building. It will be 90x40 ft., and is estimated to cost $350,000. Freeman & Hasslemen, 42nd St. Bldg., are the Archs.

Niagara Falls, N. Y.—W. H. Zawadski, Arch., Buffalo, has completed plans and is taking bids for a three-story and basement school building 64x126 ft. to be erected by the Church of the Holy Trinity. Rev. Alex. Pitass is Pastor, 1347 Falls St. It will be of stone, brick and structural steel. The estimated cost $60,000.

Olean, N. Y.—The Board of Education has accepted the plans of E. E. Jerolemon, Arch., of Buffalo, for an addition to be made to Public School No. 2 at Eleventh and State Sts. Bids will be received until May 12. The estimated cost is $40,000.

Schenectady, N. Y.—Plans have been completed for a gymnasium, two stories and basement, 70x200 ft., for Union College, by George B. Post & Sons, New York. It will be of steel, stone, brick and stucco construction.

✚Syracuse, N. Y.—The contract has been awarded to EDWARD K. FENNO, Rosenbloom Bldg., Syracuse, for the construction of the warehouse on West Willow St., for C. W. Snow & Co. Noted Apr. 17.

✚Atlantic City, N. J.—The contract has been awarded to ALEXANDER CHAMBLEY, for the construction of a four-story brick school, at Massachusetts and Atlantic Aves. Noted Apr. 3.

Bayonne, N. J.—The Y. M. C. A. of Bayonne contemplates the erection of a brick and reinforced-concrete building on Broadway, between 38th and 39th Sts. The estimated cost is $100,000. A. W. Forman is Pres.

Bloomfield, N. J.—Bids will be received until May 15, by John F. Capen, 45 Clinton St., Newark, for the construction of a school at Franklin and Broad Sts. for the German Theological Seminary. The estimated cost is $70,000.

Elizabeth, N. J.—Hyman Rosensohn, Arch., 785 Broad St., Newark, N. J., prepared plans for a theater 46x60 ft., and 200 ft. deep, at Elizabeth, for L. M. Finger. The estimated cost is $40,000.

The Board of Education of Union Township has authorized a bond issue of $45,000, for the erection of additions to the public school buildings at Unionville and Connecticut Farms.

Irvington, N. J.—The lowest bidder was the B. & W. Concrete Co., Newark, N. J., at $41,657, for the construction of the school on Augusta St.

Morristown, N. J.—W. H. McElfatrick, 701 Seventh Ave., New York, has prepared plans for the construction of a two-story brick addition to the theater for A. Esposito. The estimated cost is $100,000.

Passaic, N. J.—Alex Seebas, 85 Quincy St., is preparing plans for the construction of a three-story brick theater, 60x145 ft., to be erected in Main St., for the Passaic Realty & Amusement Co., People's Bank Bldg. The estimated cost is $50,000.

Trenton, N. J.—Kleman & Fowler, Archs., First National Bank Bldg., Trenton, are preparing plans for the construction of a 10-story hotel. The estimated cost is $500,000.

The New Jersey State Appropriation Bill, recently signed by Gov. Fielder, authorizes the construction of an addition to the State Normal School at Trenton, at a cost of $85,000.

West New York, N. J.—Gregory B. Webb, 104 West 42d St., New York, is preparing plans for the construction of a three-story school on Hudson Ave., between 10th and 11th Sts., for the Board of Education. The estimated cost is $150,000.

Bellefonte, Penn.—Preliminary plans for the new penitentiary to be constructed for the state have been completed by John T. Windrin, Arch., Commonwealth Bldg., Philadelphia. The estimated cost is $1,250,000.

+Coatesville, Penn.—The contract for the construction of the two-story brick school at Coatesville, has been awarded to W. J. ELLIOTT, Coatesville.

Crafton, Penn.—Bids will be received until May 19, by L. F. Wentz, Secy., Bd. of Education, for the construction of a high school at Crafton. The estimated cost is $100,000. Noted Apr. 17.

Donora, Penn.—C. C. Compton, Arch., Post Office Bldg., is revising plans for the school building to be erected by the Board of Education. Plans will be ready for bids about May 15. The building will be 130x165 ft., two stories and basement, of brick and steel. It will cost about $80,000.

+Erie, Penn.—The contract for the addition to Hamot Hospital has been awarded to CONSTABLE BROS. Co., Erie, Penn. The estimated cost is $160,000.

+Llanerch, Penn.—The contract for the construction of the two-story stone school at Llanerch, has been awarded to P. J. HURLEY, 1233 Cherry St.

Morristown, Penn.—Benjamin R. Stevens, Arch., Norristown, is preparing plans for the construction of a one-story bank building on Main St., 52x80 ft., for the Montgomery Trust Co. The estimated cost is $40,000.

New Castle, Penn.—Frank Foulk, Arch., Pearson Block, has preliminary plans in progress for a three-story brick and stone lodge building for the New Castle B. P. O. E. The estimated cost is $50,000.

+Oil City, Penn.—E. E. Bailey Co., Arch., awarded to E. M. CROUCH the contract for building a stone church for the Second Presbyterian Congregation in West First St. Cost, $80,000.

Philadelphia, Penn.—Ralph E. White, Arch., 918 Penn Bldg., is preparing plans for a 21-story office building to be erected near the center of the city.

**+The contract has been awarded to the WELLS BROS. CO., New York, for the construction of two additional buildings for the Home for Feeble-Minded, at Southampton and Bensalem turnpike, Byberry. One building to be 228x53 ft., two stories, and the other 144x54 ft., two stories. Philip E. Johnson is Arch. The estimated cost is $140,000.

Sauer & Hahn, Archs., 1112 Chestnut St., are receiving bids for the construction of a loft building at 13th and Vine Sts., for Samuel Sternberger. The estimated cost is $400,000.

Anderson & Haupt, Archs., 820 Drexel Bldg., have prepared plans for the construction of a church at Sixth and Spring Garden Sts., for the Russian Greek Orthodox Church of St. Michael the Archangel. The estimated cost is $80,000.

Plans have been completed by Furness & Evans, Archs., Philadelphia, for the construction of an addition to the Arcade Bldg., at 10 South Broad St. It will be of steel, 12 stories. The estimated cost is $500,000. Noted Apr. 3.

Sauer & Hahn, Archs., 112 Chestnut St., are preparing plans for the construction of a five-story cold-storage building and warehouse at 712 South Second St., for Sklaroff & Sons. Bids are being received.

+Pittsburgh, Penn.—MacClure & Spahr, Archs., Keystone Bank Bldg., have awarded to JOHN EHRLINGER, 1840 Fifth Ave., the contract for remodelling the store building at 342 Fifth Ave., for Frank & Seder. The work will cost about $50,000.

Carlton Strong, Arch., Union Bank Bldg., is preparing sketches for the proposed science hall, chemistry and engineering buildings for the Duquesne University, to cost $250,000.

Plans are now being prepared by Kiehnel & Elliott, Archs., Publication Bldg., for a one- and two-story brick, terra cotta and tile tuberculosis hospital, to be built on the Leach farm, near Highland Park, for the city. The group of buildings will cost $150,000.

+Pittsburgh, Penn.—The contract has been awarded to the GEORGE HOGG CO., Philadelphia, Penn., for the construction of the apartment house at Ellsworth and Maryland Aves. The estimated cost is $75,000.

+Uniontown, Penn.—The contract has been awarded to the SOUTH PENN BUILDING CO., for the construction of a two-story brick and steel theatre on East Main St. A. P. Cooper is Arch. First National Bank Bldg.

+Baltimore, Md.—The contract for the construction of the addition to the Industrial building at Preston St. and Clifton Place has been awarded to JOHN WATERS, 23 East Water St., Baltimore. Noted Apr. 17.

Cambridge, Md.—The state has approved the plans and specifications prepared by Parker, Thomas & Rice Archs., Union Trust Bldg., Baltimore, for the construction of the Eastern Shore Hospital for the Insane to cost $175,000. Jas. Rush Marshall, of Hornblower & Marshall, Consult. Engrs., Washington, D. C., is in charge.

+Washington, D. C.—The contract has been awarded to F. L. WAGNER, 1413 H St. N. W., Washington, D. C., for the construction of the Home for the Blind, on E St., between 20th and 21st Sts. Charles Mason Remey, 1527 New Hampshire Ave., N. W., Washington, is Arch.

Charleston, W. Va.—Weber, Werner & Adkins, Archs., Perin Bldg., Cincinnati, Ohio, have been commissioned to prepare plans for the home for the First Presbyterian Church. The estimated cost is $100,000. Estimates will be received in about two weeks.

+Charleston, S. C.—The contract has been awarded to the MELTON CONSTRUCTION CO., 11th and H Sts., N. W., Washington, D. C., for the construction of the library for the Charleston Library Society. McGoodwin & Hawley are Archs., 34 South 16th St., Philadelphia, Penn.

+Augusta, Ga.—The contract has been awarded to the MACKLE-CRAWFORD CONSTRUCTION CO., Atlanta, Ga., at $136,000, for the construction of an administration building, dormitory and chapel, for St. Joseph's College.

+Tampa, Fla.—The Tampa Drug Co. has awarded a contract to LEVICK & MOBLEY, Tampa, for the construction of the four-story warehouse, 98x52½ ft., at Florida Ave. and Washington St. F. M. Curtis is Arch., Tampa.

+Birmingham, Ala.—The contract for the construction of the warehouse at Ave. E and 21st St., for the Birmingham Paper Co., has been awarded to CHARLES M. ALLEN, Birmingham.

Huntsville, Ala.—C. K. Colley, Arch., Nashville, Tenn., is preparing plans for improvements and additions to the court house. The estimated cost is $65,000.

Starkville, Miss.—The Agricultural & Mechanical College contemplates erecting a Y. M. C. A. building. The estimated cost is $60,000.

New Orleans, La.—Charles Janvier, Chn. of the Board of Trustees of Tulane University, announced that plans for the new Newcomb College will be completed by James Gamble Rogers, 11 East 24th St., New York, in about a month. Three weeks then will be allowed to submit bids. The cost is to be $800,000 at first, and the total will run to about $2,000,000. Noted May 1.

The Cotton Exchange has decided to erect a 13-story building on the site of the present one, at a cost of approximately $600,000.

The B. P. O. E. announce they will receive from architects during May, the plans for the erection of their new home.

Cincinnati, Ohio—Bids will be received until noon, May 26, by the Clerk of the Board of Education, City Hall, for alterations and additions to the Carthage Public School on Fifth Ave.

The W. H. Thole Co., commission merchants, 1442 Main St., Cincinnati, are having plans drawn by Philip Pfeiffer, Archs., 10 East McMillan St., for a three-story warehouse, to be built in the rear of their present location. It will be 28x38 ft.

+Cincinnati, Ohio—The foundation and underpinning contract has been awarded to the E. LID CONCRETE CONSTRUCTION CO., for the Gwynne Bldg., to be erected at Sixth and Main Sts. Ernest Flagg is Arch., 109 Broad St., New York.

Cincinnati, Ohio—Plans have been prepared for the construction of the Manufacturers' Permanent Exhibit building, at Vine and Third Sts., on the site of the Burnet House. Luke W. Smith is Chn. of the Ways and Means Com. of the Chamber of Commerce.

Cleveland, Ohio—Walker & Weeks, Archs., Cleveland, are preparing plans for the construction of a 12-story mercantile building at Euclid Ave. and East 14th St.

Cleveland, Ohio—The Union Paper & Twine Co., 112th St. and Clair Ave., Cleveland, has purchased land on Lakeside Ave., at the Pennsylvania R.R. tracks, as a site for a large warehouse. The building will cost approximately $75,000.

Columbus, Ohio—Bids will be received until noon, May 19, by J. T. Adams, 810 Columbus Savings & Trust Bldg., Columbus, Ohio, for the construction of a stone church to be known as the Northminister Presbyterian Church. The estimated cost is $60,000. Marriot, Allen & Hall are Archs., Hayden-Clinton Bank Bldg.

Plans are being prepared by Richards, McCarty & Bulford, Archs., 61 Ruggery Bldg., Columbus, for a club house, to be erected on East Broad St., for the newly organized Columbus Athletic Club. The estimated cost is $450,000.

+Chicago, Ill.—The contract for the construction of the nine-story warehouse on the river front, between Clark St. and La Salle Ave., has been awarded to C. L. SCHIEDENHELM. Noted Mar. 6.

Chicago, Ill.—Ralph C. Otis and others will erect an apartment house at North State and East Schiller St. The estimated cost is $200,000.

Klein's Department store at South Halstead and West 14th Sts., Chicago, Ill., will erect a four-story addition. The estimated cost is $175,000.

Merrill, Wis.—The Merrill Mercantile Co. will erect a 50x150-ft., two-story and basement brick store building at Stuyvesant and Main Sts.

Milwaukee, Wis.—The Catholic Order of Sisters of Mercy is contemplating a new home for girls. J. P. Carney, City Treas., is Chairman of the committee in charge. The estimated cost is $60,000.

Milwaukee, Wis.—The United Theater Co. is contemplating the construction of a new theater on lower Grand Ave. Senator Wm. J. O'Brien, Chicago, is Pres. of the company. It is said a 10-story office building will be erected and part of it used as a theater. The estimated cost is $450,000.

Oshkosh, Wis.—A three-story and basement, 100x50-ft. office building will be erected by the Fraternal Reserve Association at Washington and State Sts.

+Racine, Wis.—The County Board of Supervisors has ratified all actions of the special building committee and the awarding of contracts for the new county building. The action has been pending for a year involving several legal complications. C. E. Bell, Minneapolis, Minn., is Arch. Cost, $165,000. The general contract was awarded to the GENERAL CONSTRUCTION CO., Milwaukee.

Des Moines, Iowa—The People's Popular Monthly, publishers, will erect a four-story concrete building, 72x100 ft., at West Second and Center Sts. The contract has been awarded to C. W. ENNIS, Toledo, Iowa.

+Waterloo, Iowa.—The contract for the construction of the Russell Lanson Hotel has been awarded to the DUNPHY-FRIDSTEIN CO., Milwaukee, Wis., at $365,000.

Minneapolis, Minn.—The Flour City Fuel & Transfer Co. will erect a four-story warehouse, and coal elevator on the Hastings & Dakota line of the Chicago, Milwaukee & St. Paul Ry. between Nicollet and Blaisdell Aves. The estimated cost is $100,000.

Naushwauk, Minn.—The Trustees of the Naushwauk High School contemplate erecting an addition to the school, estimated to cost $100,000.

St. Paul, Minn.—Granger & Frost, Archs., 806 The Temple, Chicago, Ill., are preparing plans for the construction of a 20-story office building at Fourth and Jackson Sts., for James J. Hill.

✦Topeka, Kan.—The contract for the interior of the memorial building has been awarded to LEEPER & SMITH, Topeka, at $70,000, and the GEORGIA MARBLE CO., the contract for furnishing the marble wainscoting and floors in the halls and stairways.

✦Wichita, Kan.—The contract has been awarded to the McLEAN CONSTRUCTION CO., Chicago, Ill., for the construction of the five-story building at Rock Island Ave. and Second St., for the United Sash & Door Co.

✦O'Neill, Neb.—The contract for the construction of the proposed school here has been awarded to the MID-WEST CONSTRUCTION CO., Lincoln, Neb.

Poplar Bluff, Mo.—Bids will be received until June 2 by M. J. Armstrong, Clk., School Bd., for the construction of a two-story high school, 115x115 ft. L. B. Walker is Arch., Poplar Bluff. The estimated cost is $70,000.

✦Dermott, Ark.—The contract for the construction of the hotel for the Dermott Hotel Co., has been awarded to W. A. PRATHER, Memphis, Tenn. Noted Apr. 17.

Heber Springs, Ark.—The Commissioners of Public Buildings, J. L. Little and J. H. Kinsey, will receive bids until May 12, for the construction of a court house. Clyde A. Ferrel is Arch., 210½ Louisiana St., Little Rock, Ark.

Hot Springs, Ark.—The building committee for the Leon H. Levi Memorial Hospital has raised $80,000 for the construction of the proposed building.

✦Dallas, Tex.—The contract has been awarded to the TRINITY CONSTRUCTION CO., Dallas, at $51,975, for the construction of the Fred Douglass School. William Nichols is Arch., Dallas.

Fort Worth, Tex.—The Chamber of Commerce is promoting the erection of an auditorium building. It will cost about $100,000.

Palestine, Tex.—E. V. Smith, Anderson County Judge, will receive bids until May 19, for the construction of a three-story and basement court house, 138x182 ft. C. H. Page & Bro. are Archs., Austin and Houston, Tex. Noted Apr. 3.

✦Muskogee, Okla.—The contract for the construction of a $60,000 Carnegie Library has been awarded to E. C. COSBY, of Muskogee.

✦Salt Lake City, Utah—The contract for the ornamental iron work to be used in the construction of the Eccles Building—Washington Ave. and 24th St., has been awarded to the JACKSON & RICHTER IRON WORKS CO., Denver, Colo. Noted Apr. 24.

Portland, Ore.—Whitehouse & Foulhoux, Archs., Lumberman's Bldg., have completed plans for the construction of a building at Oak and Park Sts., for the Balfour-Guthrie Co. For the present the building will be two stories high, but will have a foundation of sufficient strength to support additional stories. The estimated cost is $50,000.

Berkeley, Calif.—H. K. Lovell, Arch., 1617 Felton St., Berkeley, has completed plans for a five-story hotel and store building, to be erected at Sixth and Jessie Sts., for Mrs. Barker. A contract for this work has been awarded to P. H. WALKER, Monadnock Bldg., San Francisco.

Long Beach, Calif.—E. P. Dewey, City Engr., has prepared preliminary plans of the proposed new city hall for which bonds for $200,000 will be voted. It will be a two-story structure, of reinforced concrete, and will cover an area of 100x300 ft.

✦Los Angeles, Calif.—The Westlake Hospital has awarded the contract to WEYMOUTH CROWELL, Story Bldg., for the construction of a three-story brick and concrete hospital at Alvarado and Orange Sts. Frank L. Stiff is Arch. Estimated cost, $35,000.

Nance & Phelps, Ferguson Bldg., were the lowest bidders and will probably be awarded the general contract for the erection of a three-story and basement Class "C" brick apartment house at 1316 South Los Angeles St., for J. R. Lane, Union Oil Bldg. It will contain about 66 rooms, and will be 48x125 ft. Kysor & Biggar, Wright & Callender Bldg., are Archs.

✦A contract has been awarded to HARRY JOHNSON at $20,000 for the brick work in the 12-story Class "A" office building being erected at Seventh St. and Grand Ave. for John Brockman. The VAN EMON ELEVATOR CO. secured the contract for furnishing and installing the elevators at about $20,000. The W. A. SCHUMACHER CONSTRUCTION CO. is the general contractor. Barnet, Haynes & Barnett, 717 Wright & Callender Bldg., are Archs.

✦Los Angeles, Calif.—The contract has been awarded to J. F. ATKINSON, 1118 Story Bldg., Los Angeles, at $451,166, for the construction of the group of nine buildings for the Los Angeles State Normal School on Vermont Ave., between Willowbrook and Monroe Aves. Noted Apr. 24.

Los Angeles, Calif.—Neher & Skilling, Archs., Pacific Electric Bldg., are preparing plans for a four-story and basement brick hotel to be erected on Hope St., for W. H. Wagner, 814 South Hope St. It will have concrete foundation, 60x156 ft., artificial stone facing marble and tile entrance composition roofing.

Frederick Noonan, Arch., Wright & Callender Bldg., has completed plans for a four-story and basement Class "C" brick apartment house to be erected on Orange St., for the William McCartney Co. It will contain 138 rooms, lobby, will have concrete foundation and basement, 75x197 ft., plastered front, artificial stone porch, marble and tile entrance.

Morgan, Wells & Morgan, Archs., Van Nuys Bldg., have completed plans for a three-story and basement brick store and loft building to be erected at 1047 South Grand Ave., for S. M. Newmark, 341 East First St. It will have concrete foundation, 50x152 ft., cement basement, structural steel, pressed brick facing.

Oakland, Calif.—The following bids were opened for the structural steel for the Oakland Auditorium: Judson Iron Works, $222,082; Pacific Rolling Mills, $203,059. Noted May 1.

The following bids were received by the Board of Education for the general construction of the Commercial High School, on Broadway: WILLIAMS BROS. & HENDERSON, $148,000; Newsom-Wold & Kohn, $127,125; Lewis A. Hicks & Co., $126,500; Christenson Bros., $435,222; Van Sant-Houghton Co., $162,841; McLeran & Peterson, $150,000; Thurston & Co., $139,500; Continental Fireproofing Co., $144,500.

Palms, Calif.—A seven-story reinforced-concrete hotel will be erected at Ocean View Heights between Palms and Venice, Calif. J. Martyn Haenke, 1114 Story Bldg., Los Angeles, is Arch.

✦San Diego, Calif.—The contract has been awarded to T. M. RUSSELL, 30th and Redwood Sts., for the seven-story reinforced-concrete hotel to be erected at First and D Sts., for the Rice-Landswick Co. It will be 50x100 ft., with concrete walls and floor slabs, and hollow tile partitions. The cost will be $125,000. W. S. Keller is Arch.

San Francisco, Calif.—Charles J. Rousseau, Arch., Phelan Bldg., is preparing plans for a seven-story hotel, which will be 52x137½ ft. There will be a steel frame, exterior walls of reinforced concrete faced with cement plaster. A hot-water system will be installed. Plans are nearly completed and bids will be asked shortly. The estimated cost is $750,000.

M. Mattanovich, Arch., at David Hewes Bldg., has working drawings nearly complete for the construction of a seven-story and basement reinforced-concrete hotel at Geary and Williams Place.

Cunningham & Politeo, Archs., First National Bank Bldg., will shortly award a contract for the construction of a three-story and basement reinforced-concrete automobile building for E. L. Goldstein & Co., at Olive and Van Ness Aves. The building will be 120x109 ft. There will be two mezzanine floors, making the building practically five stories in height. Construction will be fireproof. Exterior of the building will be faced with cement plaster. Separate contracts will be let. When completed the building will cost in the neighborhood of $80,000.

San Francisco, Calif.—Bids were received for the construction of the academic building, Polytechnic High School, as follows: Grant Fee, $156,000; Commary-Peterson Co., $174,400; Sound Construction & Engineering Co., $182,765; Newsom, Wold & Kohn, $168,308; Cornahan D. Mulford, $193,600; F. Rolandi, $215,000; Chas. Wright, $172,571; O. E. Brady & Son, $176,000; Thurston & Co., $193,989.

✦San Fracisco, Calif.—The following contracts have been awarded by Smith O'Brien, Arch., Humboldt Bank Bldg., in connection with the construction of the two-story Class "C" store and office building, for the MacDonough Estate Co., at Bush and Dupont Sts.: Granite and brick work, MEALEY & COLLINS, 185 Stevenson St., $6385; concrete and asphalt work, J. J. LEONARD, 2843 Howard St., $3300; clearing, excavating, etc., same contractor, $1,675; carpenter work, WARD & GOODWIN, 981 Guerrero St., at $16,033; cast-iron and steel work, CENTRAL IRON WORKS, 654 Florida St., $7720; electrical work, awarded to BUTTE ENGINEERING & ELECTRICAL CO., 685 Howard St., at $1195.

Prince Rupert, B. C.—Morley Davidson, Vice-Pres. Grand Trunk Pacific Ry., announces that a $2,000,000 hotel will be built at Prince Rupert. F. M. Rattenbury, Five Sisters' Blk., Victoria, B. C. is Arch.

Vancouver, B. C.—Plans have been prepared by the Westinghouse, Church Kerr Co., 10 Church St., New York for a store building for the Canadian Pacific Ry. on False Creek. The estimated cost is $70,000.

FOREIGN

Railway—Brazil—Final plans and estimates, it is reported, have been approved for the construction of a section of the Coroata-Tocantins Ry. The section will be 65½ miles in length.

Railway—Portugal—Bids will be received by the Administracao dos Caminhos de Ferro do Estado, Lisbon, Portugal, for the construction and operation of a railway from Toma to Nazare, with a branch line to Leiria. Bids will be received until May 28.

Pumping Station—Egypt—Bids will be received until July 1 at the office of the Minister of Public Works, Cairo, Egypt, for furnishing, delivering and installing the machinery and plant required for the complete equipment of a pumping station, at Baltim, Province of Gharbia, for the purpose of discharging drainage water into the sea.

Harbor Enlargement—Germany—The city of Dantzig is considering the enlargement of its harbor, owing to the increase of railway traffic in the free harbor at the port.

INDUSTRIAL NOTES

Joseph T. Ryerson & Son, Chicago, announce that John H. Craigie (formerly of the Boston & Maine R.R.) and Edgar N. Easton are now associated with the firm's railway sales department, having headquarters at Boston, Mass., and New Haven, Conn., respectively.

The Firm of R. W. Hebard & Co., Inc., Engrs. and Contractors, now building the Panama Tramways system at Panama, R. P., have been awarded a contract by the Republic of Panama for extensive steam and electric railway studies, including port development and examinations of possible hydro-electric power, in the interior provinces of the republic. It is understood that the work in question is really a modified project of the proposed Panama-David R.R. proposed by the last government.

Hiram J. Slifer, Consulting and Civil Engineer, specializing in steam railway practice, has moved his office to Room 861, The Rookery, 209 South La Salle St., Chicago.

The Riter-Conley Manufacturing Co., Pittsburgh, has taken an order for 140 galvanized transmission towers, to be shipped early next month to the Salmon River Power Co.'s work, directed by the Erie Construction Co. Also 150 galvanized transmission towers for the United Gas & Electric Co., of Lancaster, Penn., and an export shipment of 200 towers for the Pierce Engineering Corporation and 100 for the Ebro Irrigation & Power Co.

The Platt Iron Works Co., Dayton, Ohio, promises that it is prepared to fill all orders promptly. While much damage was done to the plant during the recent floods, the buildings were practically unhurt, and since Apr. 21, the plant has been operating all its departments

CONTRACT PRICES

Filters—St. Louis, Mo.—Bids for furnishing filter equipment, Letting 10,878, were received by the Board of Public Improvements, Apr. 18, as follows: McCORMICK-COMBS CONSTRUCTION CO. (awarded contract); (B) William F. Carmichael Construction Co.; (C) Fruin-Colnon Construction Co.; (D) Hoffman-Hogan Construction Co.:

FILTERS, ST. LOUIS, MO.

	A	B	C	D
1750 cu.yd. earth excavation	$ 50	$1 18	$3 00	$2 00
270 sq.yd. masonry removed	5 47	3 17	10.00	20.00
23,000 sq.ft. steel sheet piling	95	82	1.25	1 00
340 cu.yd. 1:7 concrete in basin floor	5.20	10.60	9.00	8 00
1850 cu.yd. 1:5 concrete in grouted arches	7.00	5 92	11.50	10 00
2300 cu.yd. 1:5:4 concrete in piers and ground arches	9 80	15 00	13 00	12 00
10,400 cu.yd. 1:3:4 reinforced concrete more than 2 in. thick	9 68	10 44	11 00	13 00
290 cu.yd. 1:2:4 reinforced concrete 3 in. thick	29 00	18 50	30 00	40 00
552 cu.yd. 1:2:4 concrete backing	36	40	60	1.00
2000 bbl. additional portland cement	1 50	1 50	2 00	2 00
2 tons asphalt waterproofing	40 00	322 00	100 00	100 00
Sewer valves, flump gates	2500	2,960	2,500	2,500
Sluice gates, flump gates	5072	10,640	5000	10,000
Stop planks, stop gates	270 00	247 00	200.00	300.00
15,200 lb. miscellaneous iron and steel	0633	06	12	.21
10,800 lb. miscellaneous cast iron	06	06	.10	.21
400 lb. miscellaneous bronze	30	.45	.50	.75
Engineer's office, lump sum	900 00	1141 00	1200 00	2000 00
Total	$223,947	$251,052	$282,500	$305,650

Mystic Sewer—Boston, Mass.—Bids for constructing Section 70, Contract 103, of the Mystic Sewer, North Metropolitan System, Winchester, were received by the Metropolitan Water and Sewerage Board, Mar. 28, as follows: (A) G. M. Bryne & Co., 166 Devonshire St., Boston; (B) A. G. Tomasello, 69 Gibson St., Dorchester; (C) Coleman Bros., Boston; (D) Conners Bros. Co., Lowell, Mass.; (E) Michael Russo & Son, 240 North St., Boston; (F) McCarthy & Walsh, 454 Saratoga St., East Boston; (G) J. H. Ferguson, 22 Parkman St., Dorchester; (H) Tony Ross, 13 Oak St., Winchester.

MYSTIC SEWER, SECT. 70, CONTRACT 103, BOSTON, MASS.

	A	B	C	D	E	F	G	H
3535 lin.ft. earth excavation and refilling in trench for 21x36-in. sewer	$7 25	$5 50	$7 00	$6 00	$6 00	$4 50	$3 50	$3 50
60 cu.yd. brick masonry, portland, manholes and special structures	18 00	20 00	17.00	15 00	17.00	18 00	15 00	16 00
2050 cu.yd. concrete masonry, portland, in trench	8 50	9 00	8 50	9 00	9 00	8.50	7.40	7.25
600 lin.ft. spruce guard piles	75	1.00	.50	1 50	80	.50	40	60
1800 cu.yd. rock excavation in trench	5 00	7 00	4.00	4.75	6 00	5 50	4 50	5.00
Totals	$53,584	$52,203	$50,600	$50,100	$46,658	$41,078	$89,117	$87,555

Water Mains—Claremont, N. H.—Bids for laying water mains and other work were received by the Board of Water Commissioners, Apr. 18, as follows: (A) Daniel O'Connell, Holyoke, Mass.; (B) Conners Bros., Lowell, Mass.; (C) Engineering & Construction Co., Hartford, Conn.; (D) New England Construction Co., Springfield, Mass.; (E) Michael Little, Leominster, Mass.; (F) Pastene Bros., Hartford, Conn.; (G) Reed Bros., Portland, Me.; (H) Wood & Welch, Mechanicsville, N. Y.; (I) Osgood Construction Co., Nashua, N. H.; (J) Edward E. Roberts, Boston, Mass.; (K) Joseph Long & Co., Leominster, Mass.; (L) Melville Construction Co., Portsmouth, N. H.; (M) John B. Palmer, Boston, Mass.:

WATER MAINS, CLAREMONT, N. H.

	A	B	C	D	E	F	G	H	I	J	K	L	M
2660 6-in. cast-iron pipe laid 4 to 6 ft. deep	$0 40	$0 51	$0 47	$0 45	$0 50	$0 40	$0 32	$0 75	$0 30	$0 26	$0 35	$0 32	$0 32
2660 8-in. cast-iron pipe laid 4 to 6 ft. deep	90	1 00	1 00	85	1 10	1 00	85	1 50	70	1 17	90	65	85
4430 10-in. cast-iron pipe laid 6 to 7 ft. deep	1 50	1 00	1 10	85	1 10	1 20	1 00	1 60	88	1 30	1 10	70	1 00
400 1-in. lead pipe laid 4 ft. deep	40	90	....	32	37	25	20	50	24	26	30	25	22
600 2-in. lead pipe laid 4 ft. deep	45	95	35	35	44	30	26	55	25	26	30	25	25
300 3-in. lead pipe laid 4 ft. deep	50	48	42	40	62	40	30	65	26	26	35	30	30
240 4-in. lead pipe laid 4 ft. deep	85	60	56	65	81	95	45	95	37	52	45	50	50
10 6-in. cast-iron gate valves	6 00	6 00	5 00	5 00	6 87	10 00	4 00	10 00	3 50	1 30	6 00	2 00	2 00
2 8-in. gate valves	6 00	6 00	10 00	7 00	9 75	5 00	4 00	10 00	3 00	1 30	3 00	8 00	5 00
750 6-in. cast-iron pipe	10	32	10	35	15	25	10	40	15	26	30	10	15
500 8-in. cast-iron pipe in trench	3 50	3 00	1 00	1 00	1 00	5 00	4 00	3 50	4 00	1 00	3 50	3 25	1 00
100 10-in. cast-iron pipe in trench	2 00	2 10	3 00	2 50	4 00	4 00	3 00	1 00	3 50	2 00	3 00	1 75	3 00
100 12-in. cast-iron pipe in trench	9 75	14 00	12 50	10 00	10 12	6 75	10 00	11 25	11 50	11 70	9 80	8 00	8 50
40 6-in. cast-iron special castings	80	90	70	80	1 00	1 20	65	75	65	78	80	60	90
2200 cu.yd. earth excavation in Dale Brook	74	90	77	70	65	62	65	70	48	91	66	49	63
2000 cu.yd. earth excavation in Stevens Brook	70	72	55	....	75	50	50	50	38	52	45	40	50
3500 cu.yd. earth excavation in Stevens Brook	40	48	45	40	38	40	40	40	30	52	40	40	42
200 cu.yd. paving	1 00	1 20	1 00	2 50	1 25	1 50	1 00	2 50	60	1 50	1 70	55	1 00
1 new connecting pipe with Sugar River	900 00	900 00	900 00	900 00	900 00	9000 00	400 00	600 00	525 00	750 00	750 00	400 00	2000 00
Testing new pipe for 1 hr.	01	05	005	02	01	02	03	03	01	03	01	005	03
Testing 12-in. pipe for 1 hr.	02	05	005	02	03	02	04	04	01	03	005	005	05
Total	$40,129	$52,111	$45,662	$42,178	$43,877	$44,173	$39,915	$48,671	$45,009	$60,701	$41,160	$31,560	$40,805

The Nevada-California Power Co., the Southern Sierras Power Co. and the Sierras Construction Co. have removed their general offices from the Title Insurance Bldg., Los Angeles, to the First National Bank Bldg., Riverside, Calif. This move is deemed expedient in order to be nearer its transmission and distributing lines.

The Bethlehem Steel Co. has purchased the Fore River Shipbuilding Co., of Quincy, Mass. It will be recalled that Mr. Schwab, the leading factor in the Bethlehem company, has taken a great deal of interest in the coastwise trade and recently purchased some ore mines on the west coast of South America. This latest move means that the company is going to extend its manufacturing plant still farther, and make the finished products from the iron ore. At the Fore River ship yards there is now in course of construction 23 vessels, the contracts aggregate $20,000,000. The company has for several years transacter an annual business of six to twelve million dollars.

The Liebel-Binney Construction Co. is the name of a recently organized firm of general contractors and builders. The company is located at Erie, Penn.

CATALOG NOTICES

Sternberg Mfg. Co., West Allis, Milwaukee, Wis. Catalog. Motor trucks. Illustrated, 5x7 in.

The Central Foundry Co., 90 West St., New York. Booklet. Universal pipe in high pressure fire system. Illustrated, 3½x6 in.

National Fire Proofing Co., Fulton Building, Pittsburgh, Penn. Catalog. Natco imperishable silo. Illustrated, 46 pages, 6x9 in.

Foster Engineering Co., Newark, N. J. Catalog No. 20. Valves, pump governors, etc. Illustrated, 112 pages, 6x9 in.

Blaw Steel Construction Co., Westinghouse Building, Pittsburgh, Penn. Bulletin No. 58. Steel forms for tunnel and shaft construction. Illustrated, 36 pages, 6x9 in.

The Baldwin Locomotive Works, Philadelphia, Penn. Record No. 74. Gasoline locomotives. Illustrated, 24 pages, 6x9 in.

Cross Engineering Co., Carbondale, Penn. Booklet. Simplex rivetless chain. Illustrated, 8 pages, 6x9 in.

The Good Roads Machinery Co., Kennett Square, Penn. Catalog M.C.M. Monarch tandem rollers. Illustrated, 16 pages, 7x10½ in.

Dolarway Paving Co., Whitehall Building, New York. Catalog. Dolarway concrete pavement. Illustrated, 32 pages, 6x9 in.

Guarantee Construction Co., 140 Cedar St., New York. Pamphlet. Economic Handling of Coal and Ashes in Power Plants. Illustrated, 40 pages, 6x9 in.

Asbestos Protected Metal Co., Beaver Falls, Penn. Bulletin No. 16. Asbestos protected metal for roofing and siding. Illustrated, 16 pages, 4½x7 in. Bulletin No. 17. Estimated data on asbestos protected metal. Illustrated, 24 pages, 4½x7 in.

G. M. Davis & Son, Palatka, Fla. Catalog No. 8. Cypress tanks, steel towers. Illustrated, 32 pages, 6x9 in.

Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo. Bulletin. Diesel engine. Illustrated, 8 pages, 8x10½ in.

Trussed Concrete Steel Co., Detroit, Mich. Circulars. Trus-Con armor plate and curb bar. Illustrated.

The Babcock & Wilcox Co., 85 Liberty St., New York. Catalog. Stirling water-tube boiler. Illustrated, 64 pages, 7½x10 in.

The Knickerbocker Co., Jackson, Ich. Catalog. Coltrin concrete mixer. Illustrated, 48 pages, 6x9 in.

Trussed Concrete Steel Co., Detroit, Mich. Second Edition, Hand Book. Truss-Con waterproofings, dampproofings, technical paints. Illustrated, 96 pages, 5x7½ in.

Goodall Rubber Co., Inc., 19 N. Seventh St., Philadelphia, Penn. Catalog No. 10. Mechanical rubber goods for railway contractors. Illustrated, 86 pages, 6x9 in.

CONTRACT PRICES

Sewers—Louisville, Ky.—Bids for constructing sewers in various streets were received by the Board of Public Works, Mar. 14, as follows: (A) W. H. Koppelman, New Albany, Ind.; (B) Edwin G. Larson; (C) L. R. Figg & Co., Louisville; (D) Henry Bickel Co., Louisville; (E) A. W. Cole; (F) James Ferry & Son, 2111 Madison Ave., Baltimore, Md.; (G) J. H. Cahill; (H) Frank Shefold; (I) Guild & Co.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin 3H28. Duntley track drill. Illustrated, 8 pages, 6x9 in. Circular No. 143. No. 1 electric signal bonding outfit. Illustrated. Circular No. 145. No. 3 triple ignition Rockford motor car.

National Reinforced Concrete Corp., Monadnock Building, San Francisco, Calif. Bulletin. Reinforced hollow concrete poles. Illustrated, 8x11 in.

Simpson Bros. Corp., 166 Devonshire St., Boston, Mass. Booklet. Reinforced-concrete standpipes and reservoirs. Illustrated, 18 pages, 5x8 in.

Edgar Allen American Manganese Steel Co., McCormick Building, Chicago, Ill. Bulletin No. 57. Stag brand manganese steel sheaves. Illustrated, 16 pages, 6x9 in.

Standard Oil Co., 26 Broadway, New York. Pamphlet. Standard refined Mexican asphalt for sheet asphalt paving. 3½x7½ in.

Lansing Co., Lansing, Mich. Catalog No. 11. Concrete mixers, hoists, wheelbarrows, trucks, scrapers, carts, etc. Illustrated, 192 pages, 6½x10 in.

SEWERS IN BURNETT AND CAMP STS., LOUISVILLE, KY.

	A		D		I		G		F		
	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a
10 cu.yd. earth excavation	2 00	2 00	1 00	1.00	2 00	2 00	2 00	2 00	2 00	2.00	2 00
10 cu.yd. gravel refill	2 00	2 00	1.25	1.25	2 50	2 50	2 50	2 00	2 00	2 00	2.00
10 cu.yd. concrete masonry (class A)	8 50	8 50	5.75	5 75	10.00	10 00	10 00	10 00	10 00	12 00	12 00
10 cu.yd. concrete masonry (class B)	7.00	7.00	4.50	4.50	8 50	8.50	8 50	7 00	7 00	11 00	11 00
162 concrete manholes	4 25	....	6 00	6.00	5 00	5 00	5 00	5 20	5 20	5 00	5 00
162 brick manholes	4 00	4 00	6.00	6.00	4 00	4.00	4.00	5 00	5 00	5 00	5 00
50 lin.ft. 6-in. sewer	1 00	1.00	1.00	1.00	0 50	.50	.50	.75	.75	1 00	1 00
2704 lin.ft. 15-in. sewer	1 65	1 65	2.30	2 30	2.16	2 16	2 16	2.55	2 55	2 63	2 63
848 lin.ft. 18-in. sewer	2 05	2.05	3 50	3.50	2.99	2.99	2 99	3 70	3.70	3.27	3 27
1440 lin.ft. 24-in. sewer	....	2 87	....	4.00	....	5.24	5 24	....	4 72	....	5 62
50 15-in. catch basin leads	2 00	2.00	2.00	2.00	1.50	1.50	1.50	2 00	2 00	2 50	2.50
100 lin.ft. 6-in. underdrain	.35	.35	.35	.35	.10	.10	.10	.30	.30	.35	.35
14 15-in. drop inlets	2 00	2.00	5.00	5.00	3.00	3.00	3.00	1.00	1.00	3.00	3.00
180 15x6-in. Y's	1 25	1.25	1.08	1.08	1 25	1.25	1.25	2.00	2.00	2 00	2.00
9 15x15-in. Y's	3 00	3 00	2.40	2.40	3.00	3.00	3.00	4.25	4.25	4.00	4 00
57 18x6-in. Y's	1 50	1.50	1.65	1.65	1 50	1.50	1.50	3.25	3.25	3.25	3.25
6 18x15-in. Y's	3.50	3 50	4.06	4.06	3.75	3 75	3.75	5.95	5.95	6 50	6 50
96 24x6-in. Y's	3.50	3.50	4.00	4.00	2 00	2.00	2.00	6.50	6.50	6 00	6 00
6 24x15-in. Y's	8 50	8 50	7.26	7.26	8.50	8.50	8 50	12.50	12 50	15 00	15 00
3 15-in. bends	1.00	1.00	96	.96	2.00	2.00	2.00	1.80	1 80	2.50	2 50
1 18-in. bend	1.50	1.50	1.60	1.60	2.50	2.50	2.50	2.75	2.75	3 00	3.00
3 15x15-in. T's	3.00	3.00	2.47	2.47	2.75	2.75	2.75	4.25	4.25	4.50	4.50
1 24x18-in. T	8.50	8.50	4.50	4 50	8.50	8 50	8.50	12.50	12 50	20 00	20.00
	Type c	Type b	Type c	Type b	Type c	Type b	Type c	Type c	Type b	Type c	Type c
1440 lin.ft. 24-in. sewer	2 87	....	4 00	....	4 94	....	....	4 52	....	5 55	....
1114 and 1149 lin.ft. 30-in. sewer (plain)	4.30	4.50	5 25	5 25	6.25	7 96	8 26	5.58	6.08	6.60	7.00
35 lin.ft. 30-in. sewer (vit. brick lining)	....	5 30	....	6.50	....	8.26	....	....	10.75	....	....
512 and 591 lin.ft. 48-in. sewer (plain)	7 40	7.75	9.00	9.00	10.14	12.55	15.00	9.70	12.15	9.90	10.50
79 lin.ft. 48-in. sewer (vit. brick lining)	....	8.75	....	12.25	....	15 00	....	....	19.52	....	....
212 6-in. slants	.55	.55	1 25	1.25	.30	.50	.30	.50	.50	.75	.75
15 15-in. slants	2 65	2 65	5.60	5 60	1.30	1.50	1.30	1.70	2.70	3.50	3.50
1 18-in. slant	3.50	3.50	8.80	8 80	1.75	1 90	1.75	4.08	4 08	4.50	4.50
Totals	$21,630	$22,173	$28,786	$29,087	$30,406	$34,477	$36,020	$31,389	$34,445	$33,901	$35,104	$35,762

SEWERS IN GRAY, FINZER AND LAMPTON STS., LOUISVILLE, KY.

	A		B		I		C		D		F		G	
	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a	Type a
10 cu.yd. earth excavation	1 75	1.75	2.00	2.00	2.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00
10 cu.yd. gravel refill	1 75	1.75	2.00	2.50	2.50	2.00	1.25	1.25	2.00	2.00	2.00	2.00
50 cu.yd. class A concrete	8 50	8 50	8.00	10.00	10.00	5.50	5.75	5.75	12.00	12.00	10.00	10.00
10 cu.yd. class B concrete	7 00	7 00	2.00	8.50	8 50	5 00	4 50	4.50	11.00	1 00	7.00	7.00
348 concrete manholes	4 25	4.25	1.00	5.00	5.00	5 00	6 00	6 00	5 00	5 00	5 20	5.20
348 brick manholes	4 00	4 00	1.00	4 00	4 00	3.00	6 00	6 00	5 00	5 00	5 00	5.00
50 lin.ft. 6-in. sewer	1 00	1 00	.50	.50	.50	.20	1.00	1.00	1 00	1 00	.75	.75
7400 lin.ft. 15-in. sewer	1.53	1.53	1 70	1 73	1 73	1 60	2 05	2 05	2 27	2 27	2 52	2.52
550 lin.ft. 24-in. sewer	2 80	2 80	3 00	3 77	3.77	3.15	3 50	3.50	3 90	3.90	3.62	3 62
50 15-in. catch basin leads	2 00	2 00	1 00	1 50	1.50	2 30	2 00	2 00	2 50	2.50	2 00	2.00
100 lin.ft. 6-in. underdrain	.35	.35	.10	.10	.10	.20	.30	.30	.35	.35	.30	.30
10 15-in. drop inlets	1 75	1.75	3.00	3.00	3.00	.50	5.00	5.00	3 00	3.00	1.00	1.0
495 15x6-in. Y's	1 25	1 25	1.00	1.25	1.25	1.15	1.08	1.08	2.00	2.00	2.00	2.0
11 15x15-in. Y's	3 00	3.00	2.50	3.00	3.00	3.10	2.40	2.40	4 00	4.00	4 25	4 25
35 24x6-in. Y's	3 50	3 50	3 00	2 00	2 00	3 50	4.00	4.00	6 00	6 00	6.50	6.50
1 24x15-in. Y	8 50	8 50	5.00	8.50	8 50	9.25	7 26	7.26	15.00	15.00	12.50	12.50
4 15-in. bends	1 00	1 00	2.00	2 00	2 00	1 80	.96	.96	2 50	2.50	1 80	1.80
4 15x15-in. T's	3.00	3 00	3.00	2 75	2.75	3.10	2 50	2.50	4.50	4.50	4 25	4.25
	Type c	Type b	Type c	Type c	Type c	Type b	Type c	Type b	Type c	Type b	Type c	Type b
550 24-in. sewer	2 80	....	3.20	3.49	....	5.00	3.50	....	3 75	....	3.42	....
585 27-in. sewer	4 95	5.15	5.00	4.87	5.59	8.00	5 25	5.25	5 30	5.75	5.40	5.90
598 30-in. sewer	5 10	5.35	7 30	5.14	7.24	10 00	5.50	5.50	6.35	6.60	5.90	6.40
115 6-in. slants	.55	.55	.50	.30	.50	.60	1.25	1.25	.75	.75	.50	.50
9 15-in. slants	2 65	2.65	1.00	1 30	1.50	2 70	5 60	5.60	3 50	3.50	2 70	2.70
Totals	$21,817	$22,084	$23,162	$23,601	$25,457	$26,629	$27,044	$27,044	$29,893	$30,388	$31,126	$31,827

SEWERS IN BRECKENRIDGE AND JACOB STS., LOUISVILLE, KY.

	A	B	C	D	E	F	G	H
10 cu.yd. earth excavation	1.79	2 00	1 00	1 00	3 00	2 00	2 00	2 00
10 cu.yd. gravel refill	1.79	2 00	2 00	1 25	3 00	2 00	2 00	2.00
35 cu.yd. concrete masonry (Class A)	8 90	8 00	5 50	5.75	15 00	12 00	10 00	6 00
10 cu.yd. concrete masonry (Class B)	7 00	2 00	5 00	4.50	12 00	11 00	7.00	10 00
210 concrete manholes	....	....	....	6 00	....	....	5.20	6.00
210 brick manholes	4 00	1.00	3 50	6 00	3 30	5 00	5.00	....
50 lin.ft. 6-in. sewer	1 00	.50	.20	1 00	2 00	1.00	.75	1.00
4500 lin.ft. 15-in. sewer	1 71	2 20	2 30	2 55	2.75	3 04	3.07	2 40
489 lin.ft. 18-in. sewer	2 35	3 60	2 40	3 60	3 50	3.60	4 05	2.60
50 15-in. C. B. leads	2 00	1.00	2 30	1 90	2 50	2 50	2 00	2.20
100 lin.ft. 6-in. underdrain	.35	.15	.20	.30	.30	.35	.30	.25
20 6-in. drop inlets	1 75	4 00	.50	5 00	4 00	3 00	1.00	3.00
6 6-in. slants	2 60	2 00	2 70	5.60	2 00	3 00	2.70	1.60
300 15x6-in. Y's	1 25	1 00	1.15	1.08	1.50	2 00	2 00	3 20
18 15x15-in. Y's	3 00	4 00	3.10	2.40	3 30	4 00	4.25	2 00
33 18x6-in. Y's	1 50	3.00	3.10	1.65	2 05	3 25	3 25	4 00
3 15x15-in. Y's	3 65	6.00	3.00	4.06	4 00	6.50	5.95	1.45
6 6-in. bands	1 75	2.00	1.80	.96	2.05	2.50	1.80	2 20
5 15x15-in. T's	3 00	4.00	3 10	2 47	5 30	4 50	4 25	3 20
1 18x15-in. T's	3.65	6.00	5 00	3.95	6 00	6 50	5.95	4 00
Totals	$10,840	$12,919	$13,245	$15,528	$16,465	$18,191	$18,348	$13,449

SEWERS IN SHELBY AND KENTUCKY STS., LOUISVILLE, KY.

	C	A	B	D	G	F
10 cu.yd. earth excavation	1 00	1 75	2 00	1 00	2 00	2 00
10 cu.yd. gravel refill	2 00	1 75	2 00	1 25	2 00	2 00
10 cu.yd. concrete masonry (Class A)	5 50	8 50	8 00	5.75	10 00	12 00
10 cu.yd. concrete masonry (Class B)	5 00	7 00	2 00	4 50	7 00	11 00
134 concrete manholes	5 00	4 25	1 00	6 00	5 20	5 00
134 brick manholes	3 00	4 00	1 00	6 00	5 00	5 00
50 lin.ft. 6-in. sewer	20	1 00	50	1 00	75	1 00
2455 lin.ft. 12-in. sewer	1 60	1 38	1 70	2 30	2 18	2 32
245 lin.ft. 18-in. sewer	2 25	1 93	2 00	3 25	3 55	3 33
578 lin.ft. 24-in. sewer	3 50	2 82	3 75	4 45	4 92	5 31
543 lin.ft. 30-in. sewer	4 50	6 25	7 35	6 35	8 29	8 08
50 12-in. C.B. heads	2 15	1 75	1 00	2 25	2 00	2 50
100 lin.ft. 6-in. underdrain	20	35	15	30	30	35
8 6-in. drop inlets	50	1 75	3 00	5 00	1 00	3 00
5 6-in. stacks	2 50	2 65	2 50	5 00	2 70	3 50
164 15x9-in. Y's	1 15	1 25	1 50	1 08	2 00	2 00
8 15x15-in. Y's	3 10	3 00	4 00	2 40	4 25	4 00
17 18x9-in. Y's	3 10	1 50	3 00	1 65	3 10	3 25
1 18x15-in. Y's	3 00	3 50	6 00	4 08	5 95	5 50
39 22x9-in. Y's	3 50	3 50	5 00	4 00	6 50	6 00
4 22x15-in. Y's	9 25	8 50	11 00	7 26	12 50	15 00
36 24x15-in. Y's	11 00	6 00	6 00	6 02	15 00	15 00
1 24x9-in. Y's	16 00	13 00	15 00	7 08	25 00	25 00
1 6-in bend	1 80	1 00	2 00	.96	1 80	2 50
1 15x15-in. T's	3 10	3 00	4 00	2 50	4 25	4 50
Totals	$10,323	$10,493	$11,991	$14,329	$15,931	$16,446

Sewers—Atlanta, Ga.—Bids for constructing sewers were received by the Chairman of the Sewer Committee, Apr. 15, as follows: (A) Case & Cothran, (B) E. F. Meeks Construction Co., (C) Cement Stone & Tile Co.; (D) F. D. Harvey & Co.; (E) Dysard Construction Co.:

SEWERS, GROUP 1, ATLANTA, GA.

	A	B	C	D	E
115,000 brick	$15.00	$15.25	$15.00	$15.80	$13.75
10 cu.yd. rubble masonry	2.00	5.00	6.00	4.25	2.00
10 cu.ft. cut stone	1.00	2.00	2.00	1.00	1.80
15 sq.ft. cut flagging	.60	1.00	1.00	1.00	.75
2 M.ft. B.M. lumber	14.00	16.00	18.00	22.00	16.00
15,000 cu.yd. excavation and backfilling, 10 ft	.49	.49	.47	.35	.55
3000 cu.yd. excavation and backfilling, 15 ft	.60	.64	.63	.62	.61
600 cu.yd. excavation and backfilling, 20 ft	.70	.85	.85	.84	.80
200 cu.yd. excavation and backfilling, 25 ft	1.00	1.00	1.10	1.11	1.25
200 cu.yd. solid rock excavation	2.75	2.25	4.00	3.00	2.75
1000 cu.yd. semi-decomposed rock excavation	1.00	1.10	1.15	2.00	.55
10 cu.yd. plain concrete	5.00	7.00	7.50	7.00	5.00
34,000 ft 6-in. and 8-in. pipe-laying	.04	.03	.04	.04	.03
5000 ft. 10- and 12-in. pipe-laying	.05	.03½	.05	.05	.04
5000 ft. 15- and 18-in. pipe-laying	.06	.05	.10	.08	.05
100 ft. 20- and 22-in. pipe-laying	.07	.06	.10	.09	.07
100 ft. 24-in. pipe-laying	.10	.08	.15	.11	.10
10 cu.yd. broken stone	1.00	3.00	3.00	3.00	3.00
Total	$15,059	$14,930	$15,676	$14,455	$15,110

SEWERS, GROUP 2, ATLANTA, GA.

	C	D	E
125,000 brick	$15 00	$15 50	$13 35
10 cu.yd. rubble masonry	6 00	4 50	2 00
10 cu.ft. cut stone	2 00	1 10	1 80
15 sq.ft. cut flagging	1 00	1 00	75
2000 ft. B.M. lumber	18 00	22 00	16 00
15,000 cu.yd. common excavation and backfilling, 10-ft	.60	.33	.50
3000 cu.yd. excavation and backfilling, 15 ft	1 00	65	60
1000 cu.yd. excavation and backfiling, 20 ft	1 25	84	80
300 cu.yd. excavation and backfilling, 25 ft	1 50	1 10	1 00
200 cu.yd. solid rock excavation	4 50	2 85	3 00
2000 cu.yd. semi-decomposed rock excavation	1 50	2 00	50
10 cu. yd. plain concrete	7 50	7 00	5 00
34,000 ft 6- and 8-in pipe-laying	.05	.04½	.03
5000 ft. 10- and 12-in. pipe laying	.05	.06	.04
3000 ft. 15- and 18-in. pipe-laying	.10	.07	.05
100 ft. 20- and 22-in. pipe-laying	.10	.09	.07
100 ft. 24-in. pipe-laying	.15	.11½	.10
10 cu.yd. broken stone	3 00	3 00	3 00
Total	$23,586	$17,933	$16,267

International Motor Co., Broadway and 57th St., New York. Catalog. Mack gasoline trucks. Illustrated, 64 pages, 8x10½ in. Catalog. Hewitt motor trucks. Illustrated, 6x9 in. Catalog. Sauer motor trucks. Illustrated, 32 pages, 9x12 in.

The Goulds Mfg. Co., Seneca Falls, N. Y. Bulletin No. 113. Rotary pumps. Illustrated, 16 pages, 8x10 in.

The Kettle River Co., Minneapolis, Minn. Catalog. Creosoted wood block flooring. Illustrated, 24 pages, 6x9 in.

GARBAGE

+Schenectady, N. Y.—The contract has been awarded to the C. O. BARTLETT & SNOW CO., Cleveland, Ohio, for furnishing and installing the machinery and other equipment for the garbage disposal plant at $52,000.

Steubenville, Ohio—Bids will be received until noon, May 12, by James P. Gavin, Dir. Pub. Ser., for the collection and removal of garbage and depositing it at the city garbage furnace; also for the removal of dead animals for a period of five years.

Zanesville, Ohio—The city has appropriated $10,000 for cleaning the streets of the city, since the subsiding of the flood.

EXAMINATIONS

Testing Machine Operator—The U. S. Civil Service Commission announces an open competitive examination for testing machine operator, for men only, June 4. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position at $1800 a year, and vacancies in the position of assistant testing machine opertor at salaries ranging from $1200 to $1600 a year, in the Bureau of Standards, Washington, D. C., and vacancies as they may occur in positions requiring similar qualifications. Certification to fill the position of testing machine operator at $1800 a year will be made only from those who attain the highest average percentages in the examination.

Competitors will be examined in the following subjects, which will have the relative weights indicated: 1. Practical questions, 50; 2. Training, experience and fitness, 50.

Practical experience in the construction or operation of an Emery testing machine is a prerequisite for consideration for these positions.

Persons named in application and examination Form 1800 as references will be communicated with.

This examination is open to all men who are citizens of or owe allegiance to the United States and who meet the requirements.

Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for Form 1800. No application will be accepted unless properly executed and filed with the Commission at Washington. In applying for this examination the exact title as given at the head of this announcement should be used.

Associate Physicist—The U. S. Civil Service Commission announces an open competitive examination, June 2, for associate physicist, qualified in mechanical or civil engineering, for men only. From the register of eligibles resulting from this examination will be made to fill vacancies in this position as they may occur in the Bureau of Standards, at Washington, D. C., at salaries ranging from $2000 to $27000 a year, the salaries actually paid depending upon the qualifications of the eligibles selected.

It is desired to secure eligibles having a thorough scientific and engineering training and several years' practical experience in mechanical or civil engineering. They should have training and experience in the investigation and testing of engineering and structural materials, the operation of testing machines, and the interpretation of the results of investigation.

Competitors will not be required to appear at any place for examination, but will be rated on the following subjects, which will have the relative weights indicated: Subject 1. General education and scientific training, 35; 2. Practical experience and fitness, 40; 3. Publications or thesis, 25.

An educational training equivalent to that required for an engineering degree from an institution of recognized standing is a prerequisite for consideration for this position.

Filtration Plant—Evanston, Ill.—Bids for constructing a 12,000,000-gal. mechanical filtration plant, with appurtenances, were received by John H. Moore, Comr. Pub. Wks., Apr. 14. George W. Fuller, 170 Broadway, New York, and Langdon Pearse, 76 West Monroe St., Chicago, are Consult. Engrs. The bids were as follows: (A) Roberts Filter Mfg. Co., Darby, Penn.; (B) Norwood Engineering Co., Florence, Mass.; (C) L. K. Sherman Contracting Co., 327 Milwaukee Ave., Chicago; (D) Pittsburgh Filter Mfg. Co., Pittsburgh, Penn.; (E) N. Y. Continental-Jewell Filtration Co., New York; (F) W. A. Pope, 26 N. Jefferson St., Chicago:

FILTRATION PLANT, EVANSTON, ILL.

	A	B	C	D	E	F
25,200 cu.yd. earth excavation	$0.68½	$0.90	$1.00	$0.80	$0.75	$0.75
1,000 cu.yd. rock excavation	3.00	3.00	3.00	3.00	3.00	3.00
Mixing tank, coagulating basins, filtered-water reservoir and filter tanks, lump sum	76,000	60,000	101,500	83,400	84,390	79,290
Filter equipment, filter piping, connecting piping, chemical apparatus and piping, laboratory equipment, including elevator, lump sum	57,800	53,800	58,000	57,890	54,476	61,843
All outside piping, including sewer lines, drains and chemical lines, lump sum	16,980	16,646	17,600	17,500	17,500	19,700
Heating, including all plumbing, lighting and steam heating, lump sum	14,300	17,100	19,000	19,000	15,935	14,260
Laboratory fittings, lump sum	3,500	2,080	1,800	2,700	1,575	1,949
Low-service pumps and appurtenances, noncondensing, lump sum	12,000	9,200	18,000	16,100	11,500	
Low-service pumps and appurtenances, condensing, lump sum	10,400	10,450	17,900	19,000		16,000
High-service pumps and appurtenances, turbine driven, lump sum	11,400	12,550	14,000	14,000		11,800
Wash-water tower, lump sum	7,524	5,100	6,200	6,500	6,800	7,050
6-in. cast-iron pipe, cement lined	.02½	.03	.03½	.03	.03½	.30½
20-in. reinforced concrete, Class A	10.00	12.75	20.00	15.25	11.50	7.50
24-in. reinforced concrete, Class B	9.75	12.25	16.00	14.00	8.50	6.50
1-in. cement floor tile	70.00	.50	.45	.50	.50	.45
2-in. oak floor tile	80.00	.70	1.00	.65	.70	.65
1-in. oak wainscoting	70.00	.65	.80	.75	.70	.80
3/8-in. plastered partitions	40.00	.25	1.00	.35	.27	.30
Hardware, stamped bronze, lump sum	50.00	80.00		100.00	80.50	100.00
Hardware, solid bronze, lump sum	100.00	100.00		125.00	105.65	100.00
Ornamental work, finish, lump sum	500.00	300.00		500.00	400.00	700.00
1,500 cu.ft. concealed brick	.40	.60	1.00	.75	.65	.75
Totals	$209,734	$192,300	$251,923	$231,223	$217,979	$210,274

Engineering News

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Construction of the Kachess Dam, Washington

By E. H. Baldwin*

SYNOPSIS—The author has presented an unusually complete and well illustrated account of the construction of an earth dam 65 ft. high and 1400 ft. long, built by the U. S. Reclamation Service across the Kachess River, a short distance below the lake of the same name, to increase the storage capacity of the lake for irrigation purposes. Features of the work were the dredging of a channel from deep water in the lake toward the dam, the construction of a reinforced-concrete conduit from the lower end of the dredged channel to a point near the dam; an intake tower; a reinforced-concrete conduit through the dam; a spillway far to one side; the use of dump cars and a high trestle for bringing the earth to the embankment; and the use of a high timber concrete elevating tower in building the outlet tower.

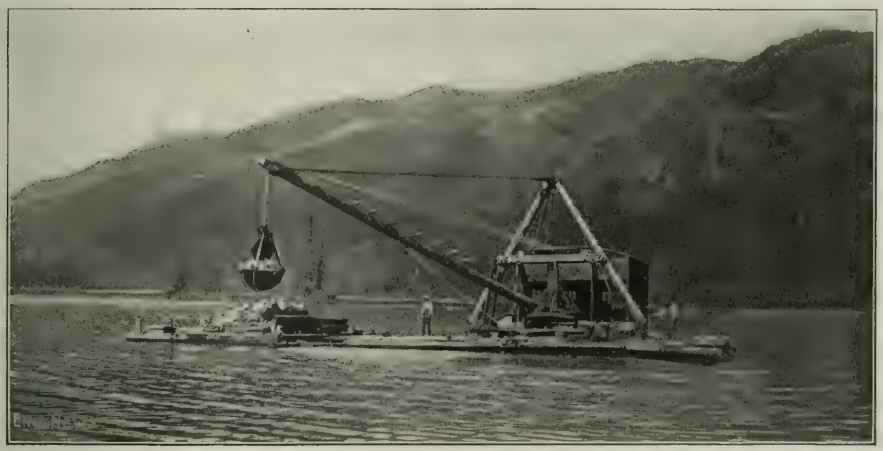


Fig. 1. Orange-Peel Dredge Digging Lake-Outlet Channel above Kachess Dam, Yakima Irrigation Project, Washington

Ultimate irrigation development in the valley of the Yakima River, Washington, by the United States Reclamation Service will require the storage of practically all the runoff tributary to the Yakima River. Present irrigation requirements necessitate the storage of a large portion of the runoff to supplement the natural flow of the river from June 15 to Oct. 1, approximately. Nature has fortunately provided, on the easterly slope of the Cascade mountains, a number of natural reservoirs in the form of lakes, the three larger of which are Lakes Cle Elum, Kachess and Keechelus, having at their normal elevations a combined surface area of 7,500 acres and being supplied by a drainage area of 325 sq.miles. The mean annual runoff from this drainage area for the past eight years is 1,120,000 acre-feet. Near the lower end of these lakes the United States Reclamation Service contemplates the construction of storage dams that will impound or make use of the entire runoff. One of these dams, at Lake Kachess, is practically completed and work preliminary to the construction of a dam at Lake Keechelus was commended in August of this year.

Lake Kachess is the middle lake of the three. It is very regular in shape, about ten miles long, and has a maximum width of one mile. It is situated in the Wenatchee National Forest and discharges, through the Kachess River, into the Yakima. The mean annual runoff from its drainage area of 63 sq. miles, based on records for eight years, is 209,000 acre-feet. The maximum recorded runoff in 1909-10, was 277,000 acre-feet. The capacity of the completed reservoir is 210,000 acre-feet.

The Kachess River is very crooked, making four complete bends in a distance of two miles, but progressing only 2800 ft. in a straight line from the lake. The river drops some 35 ft. in the two miles. The irregular course of the river afforded an excellent opportunity for handling it during construction and the depth of

*Construction Engineer, U. S. Reclamation Service; now at Elephant Butte, N. M.

the lake and rapid fall of the river, within a reasonable distance, suggested the feasibility of tapping the lake at an elevation about 30 ft. below its normal outlet, thereby giving some 76,000 acre-feet of sub-storage.

The Kachess Dam is built across the Kachess River, about 1800 ft. below the most southerly point of the lake (Fig. 2). It is of the earth and gravel type, 65 ft. high and 1400 ft. long. Its crest is at Elev. 2268 and has a top width of 20 ft. The upstream slope of the dam is 3 to 1 and the downstream slope 2 to 1. To prevent percolation a wide cutoff trench about 20 ft. deep was excavated parallel with the axis of the dam and from 20 to 60 ft. upstream from the center line. In the bottom of this trench a narrower trench was excavated to a depth of from 35 to 75 ft. below the original ground surface and in it a concrete core-wall, 2 ft. thick, was built, extending up to the original surface of the ground.

Accessory features are the outlet works and spillway. The outlet works consist of an open channel about 1200 ft. long, extending from deep water in the lake to a point where a covered conduit was found to be more economical. This conduit is of reinforced concrete, about 1400 ft. long, horse-shoe type, 9x10 ft., and discharges into a paved open channel of large section, about 300 ft. long, immediately in front of the dam.

The conduit through the dam is of reinforced concrete, also of the horse-shoe type, 12x12 ft. in cross-section and 300 ft. long. It discharges into a paved open channel about 500 ft. long which empties into the Kachess River. The flow is controlled by three sets of two sluice gates, each 4x10 ft., placed at the intake of the dam conduit and operated by power from the gate tower. The maximum capacity of the outlet works is 5,000 cu.-ft. per sec.

The spillway, which is constructed at a low point in the rim of the reservoir one-half mile east of the dam, has a crest length of 250 ft. and is designed to carry 7,200 sec.ft., with a head on the weir of 4 ft. The elevation of the weir is 2258, with provision for 2 ft. flash boards.

Construction of the dam was authorized in February, 1910, and actual work commenced two months later. The first season's work was intended to be preliminary to the main development and was primarily to obtain, at the earliest possible date, additional storage of about 40,000 acre-feet. With this idea in view the 1910 work contemplated the partial dredging of a channel from the lake, the construction of a temporary dam with temporary control at the intake of the small conduit and the diversion of the river preliminary to the construction of the outlet works. It was intended to let the balance of the work by contract but the proposals received were rejected and the entire work was done by force account at a cost considerably less than the price of the lowest bidder.

Clearing, grubbing and stripping of the different areas were carried on intermittently, as proved to be necessary and convenient. The clearing and grubbing were unusually heavy. The areas were first cleared over the brush and down stuff piled ready to burn; then trees under 12 in. were cut and stored for construction purposes. The larger timber was mainly used for fuel. Powder was freely used in removing the larger stumps, the smaller ones generally being pulled by a donkey engine, which was also used in piling for burning. At the spillway the timber was generally small and all grubbing was done by teams. Stripping was mainly confined to the dam-site, from the entire area of which all soil and vegetable matter were removed. In the upstream portion of river section all coarse material was removed to a depth of several feet.

Excavation for Outlet from Deep Water in Lake

One of the most interestaing possibilities of the work was that of obtaining additional storage capacity by placing the outlet at the lowest feasible elevation. At the time of commencing operations a low crib dam at the lake outlet controlled the lake between the gate sill, Elev. 2226, and what was considered a safe storage limit, Elev. 2231.5, thus impounding water to a depth of 5.5 ft., which furnished storage capacity for 16,000 acre-feet. The economical depth to which the lake could be feasibly drawn was governed by the course and grade of the river below the proposed dam. It was found impracticable to

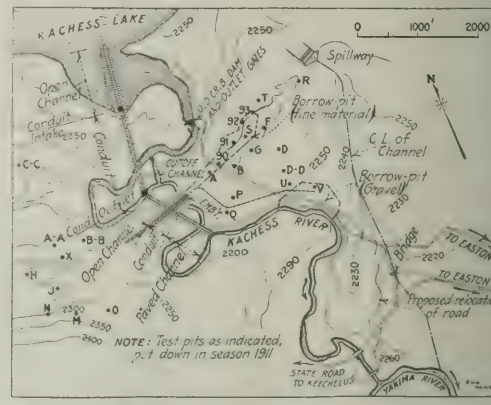


Fig. 2. General Plan of Kachess Dam and Vicinity

carry the outlet works below Elev. 2190, on account of the flat grade of the river beyond this point, which is about 4000 ft. distant from deep water in the lake. To obtain sufficient grade to discharge an amount equal to the minimum irrigation demand of 400 sec.ft. from this lake, the bottom of the dredged channel was placed at Elev. 2194. This permits of drawing the lake surface down to Elev. 2200, at which elevation it will discharge the required flow.

After clearing and grubbing operations were sufficiently advanced team work was started at the lake end of the outlet works, excavating material from the intake and using it in constructing a coffer dam to hold back the lake while the first 200 ft. of conduit, temporary dam and temporary control works were being constructed. While this work was in progress equipment was being received and erected. To excavate the material in the lake an orange-peel dredge was used; the balance of the excavation for outlet trenches was done with teams, steam shovel and drag-line excavator.

Numerous soundings in the lake bottom indicated that a grab-bucket dredge would be suitable for excavating this material and as the project owned the essential parts of an orange-peel skid excavator it was decided to use

this machine. A raft about 30x60 ft. was built of cedar logs, from 2 to 4 ft. at the butt, tied together with 12-in. cross logs, and on it was bolted the skid excavator (Fig. 2). For handling the material two bottom dump scows were made. These scows were built with a center compartment, with doors in the bottom held up by chains winding on a shaft which has a dogging device to hold the load. When ready to dump the dog is knocked out with a hammer and the load falls through the bottom. For operating the scows a 30-ft. gasoline launch with a 25-hp. engine was used. The haul for the scows was from 1000 to 2000 ft. and it took from 20 to 30 minutes to make the round trip.

The dredged channel is about 1000 ft. long. Its bottom is from 30 to 35 ft. below normal water surface and the depth of excavation was about 27 ft. It has a bottom width of 12 ft. and side slopes of 3 to 1. The material is a blue clay, soft and oozy on top and gradually growing dryer and harder with the depth.

At the outer end of the channel there was a ridge covered with several feet of loose boulders, many of which had to be broken with powder. It was found necessary to drill and blast the greater portion of the clayey material. A 3-in. well drill was first tried but was unsuccessful. It was then found that the material could readily be bored with an auger, after driving a casing ahead.

In putting down a hole a piece of 3-in. casing about 3 ft. longer than the depth of water was driven to within 1½ ft. of the water surface. The material was then bored out to the required depth with augers attached to ¾-in. pipe of convenient length and turned with Stillson wrenches, which were also used to lift the auger to clean it. As the holes would not stand any length of time it was necessary to load them soon after they were finished; they were generally from 16 to 24 ft. deep and 20 to 25 ft. apart. About one box of 20% stumping powder was used in each hole. The holes were not sprung and great care was necessary to get the powder to the bottom of the hole, as it had a tendency to float up. Water tamping alone was used and from one to four holes were set off at once. The blasting was very effective, more than doubling the output as compared with excavation before blasting in the same location.

The total volume removed by dredging was 105,000 cu.yd. With the exception of a short time during the season of 1911 one shift only was used. In fair digging the output for an 8-hr. day was 500 cu.yd., the maximum being 630 cu.yd. The output was at times erratic on account of high wind and rough water or the necessity of working against a strong current when releasing storage water. The cost of drilling and shooting this material was close to 4c. per cu.yd. of total excavation.

The intake and trench for the small conduit, from the lake to the open channel in front of the dam, was practically all excavated with a Lidgerwood-Crawford drag-line excavator. This work was commenced Sept. 26, 1910, carried with three shifts and during that season completed between the coffer dam and Sta. 14-00. The intake excavation was somewhat difficult, as the material at the lake end and sides was mainly a plastic blue clay, similar to that in the lake bed, and was removed during the rainy season. It was intended to carry a portion of the excavation to a 2 to 1 slope but on account of the oozy material and wet weather much of it assumed a much flatter slope and at times it was difficult to prevent the machine from sliding with it. At the intake, where concrete was to be placed, it was necessary to put in considerable heavy crib-work to hold the material. The grade of the intake was 36 ft. below the lake level and water came in so freely that an 8-in. centrifugal pump was kept going continuously to handle it. In order to have the temporary dam and control works on a suitable foundation it was necessary to place them some 80 ft. south of the point originally selected.

The soft material gave out a short distance from the lake and beyond that point the trench material was all that could be desired, so far as sliding was concerned. In digging the trench the excavator was kept on the center line, digging from the end and dumping to either side. On account of the deep cutting, from 30 to 55 ft., the machine was fitted with a 70-ft. boom, but this was not sufficient in the deeper cuts. The trench was taken out to a bottom width of about 15 ft., with slopes as steep as they would stand. The material was a cemented gravel, containing a comparatively small amount of clay, but so firmly cemented that in places the sides would stand almost vertical, even with water dripping over them, and so hard that it was necessary to loosen the entire cut by blasting.

The drilling was done with a 3-in. Cyclone well drill. Three rows of holes were put down, the row through the center being carried to grade, while the rows on either side of center line and about 20 ft. from it were only carried about half-way down. The center shots loosened the bottom and the side shots the upper material sufficiently to enable the excavator to remove it to a slope that was safe to work under. Many of the holes were put down to a depth of 48 ft. The total depth of drilling was 2000 lin. ft. The cost of drilling was 57c. per lin.ft. of hole and the cost of drilling and blasting 4.4c. per cu.yd. of material.

In excavating the deeper portion of this cut great difficulty was experienced in disposing of the material and in taking out the bottom five feet. The excavation was made in one cut, the machine working from the end, but to dispose of the material necessitated the construction of crib work at the edges of the trench to retain the material thrown out, and it was further necessary to sluice the excess material back from the edge. It was found that the finer material could be sluiced to a 7 to 1 slope. On account of considerable water in the cut, necessitating pumping at all times, the dragging of the bucket over the bottom would stir the material up into a thick mud that would neither pump nor remain in the bucket at the angle incident to such deep cutting. Various schemes were tried but the most successful seemed to be to leave about five feet in the bottom until the machine had gone ahead several hundred feet, then, with the aid of a haul-back fastened at the temporary dam, to drag this material into a pile directly in front of the excavator, allow the water to drain from it and throw it out. Fig. 3 shows the machine dragging the bottom. For cuts of 40 ft. or less there was no trouble in digging or disposing of the material when it it was sufficiently shot. The daily output of the machine on this work was small on account of the depth of cutting and other difficulties mentioned. The length of this trench was 1400 ft. and from it were taken 85,000 cu.yd. of material. When the excavator reached the open channel, near Sta. 26, it removed the wide upper part of the

cut, leaving the deep and narrow excavation for the steam shovel.

It may be advisable to insert here a paragraph describing the manner in which the river was handled during construction. When work was commenced the only outlet from the lake was at the crib dam, shown on the general map (Fig. 2), about 1500 ft. northeast of dam-site. During the first season a channel 20 ft. wide was excavated to the east of the conduit trench cutting off a long bend in the river. At the lower end of this cutoff channel a timber drop was built to take up the difference in grade, about 18 ft., and to allow the river to pass through it without cutting. By the time the drag-line excavator,



FIG. 3. LIDGERWOOD-CRAWFORD DRAG-LINE EXCAVATOR WORKING IN BOTTOM OF INTAKE-CONDUIT TRENCH. KACHESS DAM

(A cable from a donkey engine is pulling the bucket back.)

operating in the conduit trench, reached the first river crossing this channel was ready for use and at the proper time the excavator dumped its material into the river bed, forming an immense dam at no expense, which diverted the river through the new channel. This carried the river entirely away from the outlet or other works, interfering only with the construction at the east end of the dam, which caused no delay or expense as it was not necessary to work in that portion until the flow could be turned through the conduit.

It was intended to make the excavation for the conduit through the dam and for the open channel below the dam, with teams. The work was started by that method early in the season of 1911 but the material was so hard and stony that it was decided to take it out with a steam shovel, there being one on the project. In order to have no interference from the river, and to carry on the work so as to avoid excessive pumping, a narrow ridge 50 ft. high extending across the outlet trench near Sta. 39-00 was taken out with the teams. The material was generally cemented gravel and the slopes were so steep that teams could not work on them. Eearly in May a "coyote hole" was dug into the middle of the ridge from the lower side just above water level and 160 kegs of black powder exploded in it. The shot broke the hard crust, flattened the inaccessible slopes and rendered easy the team work that followed.

The steam shovel, a 45-ton Bucyrus, was started about this time and operated between Sta. 26 and 39. The bottom of the channel was to be as narrow as 15 ft. in places and as the maximum cut was 35 ft., with 1½ to 1 slopes, it was necessary to make 5 separate cuts. On the last cut the shovel went down the river 500 ft. below the end of the outlet, running on blocking as it was working in 2 ft. of water, to excavate a channel in river bed and insure a good grade. The material was all loaded into 1½-cu.yd. dump cars, hauled on track by teams and wasted. The final trimming of the conduit and open trenches was done by teams and by hand.

CUTOFF TRENCH FOR DAM.

The wide cutoff trench was excavated with teams and the drag-line excavator. The portion west of dam conduit was done wholly with teams and was pushed to permit the starting of the core-wall trench. The higher portion of the trench, east of the dam conduit, was done by teams. When water was encountered it was left for the excavator. The drag-line excavator deposited the material at the upstream toe of the dam, making an excellent footing for the riprap, also disposing of the material with one handling.

CORE-WALL TRENCH FOR DAM

The excavation of the core-wall trench was commenced early in July, 1911, west of the dam conduit. The upper few feet were shoveled into wheelbarrows and wasted. Shafts were excavated ahead of adjacent portions of the trench, then the excavation was carried in horizontal benches about 7 ft. high. One or two men worked on each bench, loading the material into wheelbarrows, wheeling it along the bench to the side of the shaft and dumping it into a vertical chute that carried the material to a wood bucket of ¾-cu.yd. capacity, heavily ironed and operated from the head frame. When filled, the bucket was hoisted to the head block, where a simple device dumped the muck into a 1½-cu.yd. car, in which it was hauled by one horse to waste dump. A double drum hoist was used which enabled two shafts to be worked by one hoisting engineer. This method allowed a number of men, working at different levels, on platforms laid on trench bracing, to work from each shaft.

It was intended to carry this trench to bed rock but the entire excavation was in such uniformly good material that it was considered unnecessary to go so deep. The maximum depth reached was near the westerly end which was carried to Elev. 2153, or 75 ft. below the original ground surface. The material stood so well that generally the excavation could be carried about 10 ft. without sheeting. This greatly facilitated the work. Sheeting of

2-in.x10-ft. plank was used, with 4x6-in. walings and bracings of round timber. The sheeting could usually be placed without driving.

As the core-wall was to be only 2 ft. thick, and it was difficult to carry the excavation narrower than 4 ft., the downstream side was carried true to line, so that the sheeting on that side could remain, and also to give room to remove the forms from the upstream side.

Concrete Work.

On Dec. 15, 1910, about 200 ft. of conduit trench nearest the lake was practically ready for concrete. As the conduit must be in place before the temporary dam could be built over it and the temporary tower and gates installed, all of which were necessary to control the water for the next season's work, and since the trench was about 50 ft. deep and would probably fill with water, causing the sides to sluff in, it was decided to construct the conduit regardless of season and weather conditions. The aggregate had previously been hauled and forms, built in sections, were on the ground.

A convenient plant was erected at the top edge of the trench, which enabled all materials to be handled by gravity. A trestle was erected sufficiently high to clear the structure and on it was placed a track for carrying the concrete cars. The weather was quite favorable for that time of year but the temperature was below freezing practically all the time and there were frequent snowfalls of one foot or more. All materials were heated, the work was practically enclosed, fires were kept going continually, and steam generously applied to old concrete before placing the new. There was considerable form work and the structure was heavily reinforced, which somewhat hindered the work. Caving banks frequently damaged the forms and caused delay. The work was generally carried in three shifts, with small crews, and was not only successfully completed but the concrete is perhaps better than the average.

During the following season, 1911, the conduits were completed under more favorable conditions. Eearly in May a mixing plant was erected on the downstream slope of the temporary dam, arranged so that all materials and concrete could be handled by gravity. As before, a trestle was erected over the proposed structure, carrying a 2-ft. gage track on which the side dump concrete cars operated. This plant was fairly economical but being at the end of the trench the haul soon became an important item and the limited room around the mixer considerably restricted the output. As the drag-line excavator completed a section of trench it would be trimmed by hand and the material dumped ahead where the excavator could reach it. The concreting followed closely. Within one week of the time the excavator completed the excavation of the trench, 1400 ft. long, the conduit was finished.

When the excavation of the trench had sufficiently advanced, the mixing plant was moved to Sta. 20-25. As this plant proved very economical of operation and contained some novel features a description of it may be of interest (Fig. 4). A Ransome mixer of 1 cu.yd. capacity was set up at the west side of the trench, sufficiently high to dump into steel side dump cars of equal capacity, placed on a trestle over the conduit. At the top of the natural bank above the mixer, a storage bin, with three compartments (total capacity 80 cu.yd.) was built. It was connected to the mixer with a chute in which measuring devices and a batch hopper were introduced. Three gates at the entrance to the chute, leading from the different compartments in the storage bin, allowed the different grades of aggregate to pass into measuring boxes; then, by opening one gate below, the measured aggregate passed into the batch hopper ready to go into the mixer.

The obtaining of aggregate had been a difficult problem from the time work started. There was no suitable gravel within a mile of the work and the pits located at even that distance were heavily timbered and covered with a layer of from 4 to 6 ft. of soil and clayey material; furthermore, this gravel was in private ownership. In sluicing the cemented gravel thrown out by the excavator, from the edge of the trench excavation, it was noticed that the material remaining after sluicing seemed satisfactorily graded for concrete work. Mechanical analysis of the washed material demonstrated the feasibility

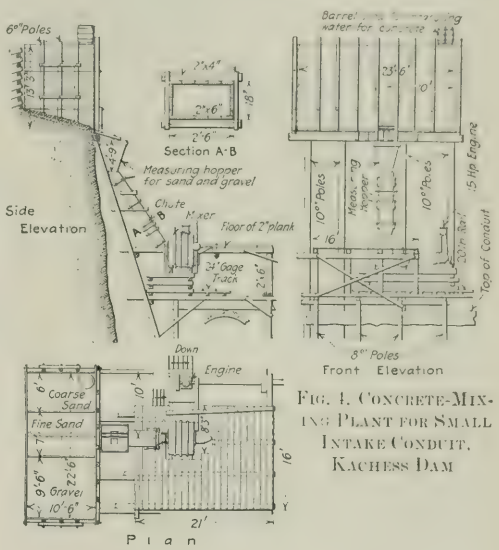


Fig. 4. Concrete-Mixing Plant for Small Intake Conduit, Kachess Dam

of using it providing a satisfactory washing and screening plant could be devised.

Suitable bins were built, a revolving screen with elevator erected and the scheme given a trial which proved successful. The unwashed material was hauled with teams and drag-scrapers to a platform having an open hopper through which it passed to the elevator which carried it to the revolving screen. A small stream of water delivered inside the screen, and playing continually on its entire length, washed the gravel, removing practically all the dirt. At first there was some difficulty in retaining the finer sand but by using extra screens of very fine mesh, suspended beneath the revolving screen, and by introducing additional troughs and pipes to carry off the silt, very little of the fine sand was lost, though it was necessary to obtain a small quantity elsewhere, which was the purpose of the third compartment in the storage bins.

The storage bin was located with reference to this screening and washing plant, the grade being such that

one horse could haul the prepared aggregate to the storage bin in 1½-cu.yd. dump cars, running on a track. When working to its best advantage the force employed was two teams hauling to the elevator, two men at the screen and two men and one horse hauling from the screen to the storage bin. The cost of aggregate delivered in the storage bin was 85c. per cu.d. of concrete. The cement was received from the opposite bank. To turn out 100 cu. yd. of concrete in 8 hours required, in addition to the above, one man gaging aggregate, one man handling cement and one man running the mixer and engine.

Owing to the cramped and wet quarters in which this conduit was built (in a trench from 30 to 55 ft. deep and 15 ft. wide and often confined to a stretch 150 ft. long, the sides sluffing in, knocking out forms and so much water that two pumps were running much of the time), the work had to be crowded day and night in order to allow water to pass through it by Sept. 1, on which date it would be needed for irrigating purposes. At one time there were eleven distinct gangs in a 24-hour day, each having its independent duties, working in tween the core-wall and the side of the trench was carefully filled and puddled.

The portion of the core-wall east of the dam conduit was put in from a plant located at the east abutment of the dam. This plant consisted of a ½-cu.yd. Smith mixer and a gravity arrangement for handling materials with a storage hopper of about 80 cu.yd. capacity for aggregate. Gravel from a pit opened for embankment construction was excavated by the drag-line excavator, loaded onto cars and hauled by teams to the hopper. An interesting feature in connection with this plant was the behavior of the chute leading from the hopper to the mixer. This chute was of planed lumber, 10 in. deep, 24 in. wide and about 30 ft. long, with gates near the bottom that controlled the flow and measured the aggregate. The chute was built on a slope of 1.6 to 1 but it was found that the gravel would not run. The bottom and a few inches on the sides were then lined with thin sheet iron, which caused the gravel to run, keeping the chute just even full without slopping over, although it was open on top.

From this plant a trestle was erected over the proposed

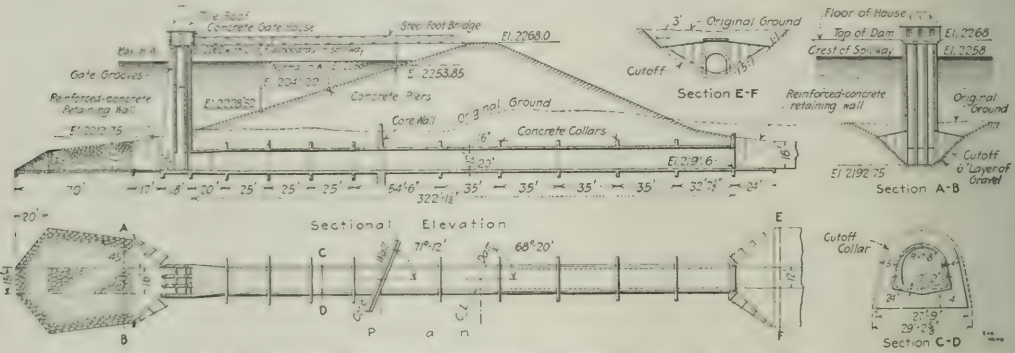


FIG. 5. GENERAL PLAN AND SECTIONS OF OUTLET WORKS, KACHESS DAM

a stretch 200 ft. long. These gangs were divided into shifts, excavating and trimming, placing and removing forms, placing steel and placing concrete. The conduit was sufficiently completed on Aug. 23, when the work was suspnded, to permit of water passing through it on Sept. 1.

It was planned to construct the dam conduit from the plant described above but on account of the necessity of drawing substorage water during September it could not be built until the close of the irrigation season. As there was considerable concreting ready in the core-wall trench it was decided to move the mixing plant to Sta. 28-50 on the east bank of conduit trench where it would be handy to the dam conduit, tower, etc., also suitably located for building the westerly portion of core-wall. The plant erected was not quite as economical as the preceding one but everything was handled by gravity and was quite satisfactory. The aggregate was hauled from the combined washing and screening plant. The dam conduit trench was bridged and a track laid across it to the core-wall trench. The bottom 4 ft. of the trench was concreted without forms, making a foundation about 4 ft. wide; above this forms were used on the upstream side and later removed. The sheeting of the trench on the upstream side was also removed and the space between the core-wall and the side of the trench was carefully filled and puddled.

wall sufficiently high to just clear the finished work. A track was laid and end dump cars of ¾-cu.yd. capacity built. Beneath the track short vertical chutes with wide tapering openings were suspended about 50 ft. apart. Below these, light portable chutes were used to deflect the concrete, as dumped from the cars, into all parts of the forms. The concrete was worked over in the trench to insure thorough mixing and as many plums were incorporated as the concrete would stand. The core-wall was carried up the end abutments of the dam in steps to within 5 ft. of probable high water.

At the close of the irrigation season the temporary gates were closed and the dam conduit constructed. No difficulties were encountered. The ribs for the forms had all been prepared, the transition forms were built in sections ready for use, reinforcing steel had all been cut and bent to proper shape while water was being delivered. As in other concrete construction on this work a trestle was built over the conduit and concrete delivered to all parts by gravity. The invert was first built, except a gap of about 20 ft. at the junction with the core-wall. Then the side walls and lastly the arch were constructed. The arch was carried up about 3 ft. on each side, the day's work finished to a radial plane, then the balance di-



FIG. 6. GATE TOWER OF KACHESS DAM NEARING COMPLETION

(The view also shows the concrete mixer at the ground level on the left, the hoisting tower and the concrete chute leading from the concrete car. Beyond the tower is the dumping trestle used in building up the dam.)

vided into sections equivalent to a day's work and each section completed in a continuous run. The slope walls of the intake and the foundation for the gate tower were constructed at the same time as the conduit. As shown in Fig. 5 numerous cutoffs in the form of collars are provided to prevent seepage along the branch of the conduit. Those upstream from the core-wall are 15 in. thick, extend 4 ft. outside the conduit and are spaced 25 ft. apart, while those below the core-wall are 15 in. thick, extend 4 ft. beyond the conduit and are spaced 35 ft. apart. The core-wall itself acts as a very effective cutoff, as the section immediately around the conduit was built at same time as the conduit and connected with it by reinforcing steel. This conduit is 322 ft. long and contains 1390 cu.yd. of concrete.

The construction of the gate tower was commenced on May 30, 1912, from the plant near Sta. 28-50. All the concrete used in the construction of this feature and in the gate house was handled in side dump cars, which were run onto an elevator operating in an 8x8-ft. wooden tower 110 ft. high, built just east of the gate-tower (Fig. 6). The car was stopped at the elevation desired, the concrete dumped into light movable chutes which conducted it directly into the forms or into boxes from which the concrete was shoveled into place. The form work and placing of reinforcing steel was done by an extra crew, usually working as a second shift, which enabled the concrete crew to work without interruption.

In plan the gate-tower is in 3 sets of 3 compartments each (Fig. 7). The upstream compartments contain the emergency gates, the downstream compartments contain stop plank grooves, while the interior compartments contain the regulating gates. The operating mechanism, installed on the floor of the gate house, is so arranged that the gates can be operated either by hand or by power. Power is obtained from a small turbine installed in the west stop plank compartment. To prevent drift from reaching the gates an ample grillage of structural steel is provided. It has an effective area of 1200 sq.ft., or 10 times the area of the gates, and extends from the floor of the intake to 4 ft. above spillway level. The gatehouse is 15x23 ft., of concrete, in pilaster and curtain-wall construction, with tile roof. Access to the gatehouse from the dam is by means of a steel foot bridge 161 ft. long supported on three steel bents.

THE SPILLWAY

There being no occasion to crowd the spillway (Fig. 8) work, and as it presented no construction difficulties and required no fixed plant, it was used as a knitting job and worked on intermittently as men and teams were available from other features. Clearing and grubbing, which was comparatively light, was commenced the latter part of May, 1911. Excavating amounting to 33,500 cu yd., of which 7000 was Class 2 and 3, was done wholly with teams. Paving of the bottom was commenced in September, 1911, and completed in September, 1912. The paving was from 12 to 18 in. thick, laid almost entirely from rock obtained from the excavation. It consisted of both dry and mortar paving, there being 1250 cu.yd. of the former and 250 cu.yd. of the latter.

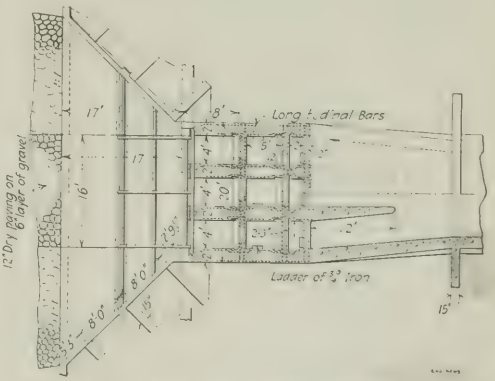


FIG. 7. PLAN OF GATE TOWER, KACHESS DAM

The concreting was all done in the season of 1912. The mixing plant was very efficient and unusually cheap for a small piece of work, possible on account of the topographic conditions. Advantage was taken of the high ground at the west end of the spillway and sloping toward it; a log bulkhead was built to retain the gravel aggregate, which was hauled by dump wagons. In the lower portion of the middle of this bulkhead a chute was placed, through which the aggregate passed to a rectangular steel car on a short track. This car was used as a measuring

device as well as to transport the aggregate to the 1-cu.yd. Ransome mixer, which was only a few feet in front of it. From the mixer, the concrete was dumped into steel side-dump cars, running on a track over a trestle, parallel with the weir, and sufficiently high to deliver the concrete through chutes to practically all parts of the work. From this plant 1400 cu.yd. of concrete were placed, the cost of the plant being 11c. per cu.yd. of concrete. The weir was constructed in alternate sections, 25 ft. long, and the floor in alternate sections, 12½ ft. square.

Placing and Riprapping the Embankment.

The preliminary investigations for borrow pits indicated that there were two locations from which tight material could be obtained. One of these was located within 1000 ft. of the east end of the dam while the other was about 1500 ft. from the west end. The subgrade of the easterly pit would be at the same elevation as the crest of the dam, while that of the westerly pit

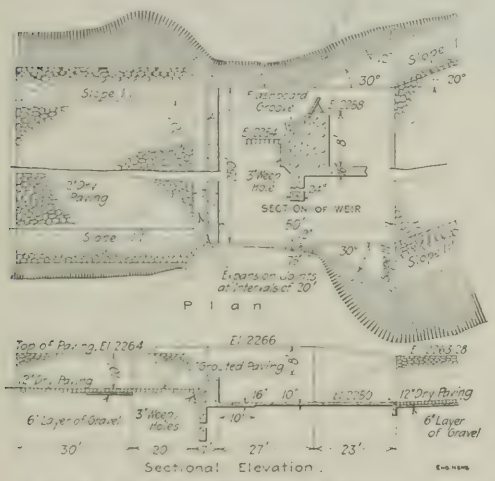


Fig. 8. Plan and Sectional Elevation of Spillway of Kachess Dam

would be 20 ft. below it. There was no choice in the location of a pit for loose material as the only available material of this kind, suitable for the work, was found at a distance of some 2500 ft. from the east end of the dam.

In order to decide between the pits for tight material, to determine their fitness for the work and to be sure that no better material was available, also to determine the method of placing it in the embankment, a careful and extensive investigation was made during the season of 1911. Fig. 2 shows the number and location of the test pits finally selected but does not indicate the borings and pits put down prior to the commencement of construction operations, to determine the feasibility of the dam site and its exact location; of these there were about 30 test pits, from 10 to 35 ft. deep and 25 drill holes, from 26 to 92 ft. deep.

A classification of the material was made and mechanical analyses made of samples taken from different depths. In all about 50 samples were tested. A complete set of screens from No. 3/4 to 200 were used. These tests indicated that the material in the east borrow pit was fully as good for the work intended as that in the westerly pit and better than from any other available location; moreover, it was much more accessible to the dam, a level or downhill haul and adjacent to the borrow pit for loose material, which was a great advantage on account of ability to concentrate water-supply, fuel, track and repair work, within a much smaller area than if the pits were more widely separated; for these reasons the easterly pit was selected.

The material in this borrow pit proved even better than the tests indicated. The upper 3 ft. consisted of top soil light in weight and containing a large amount of fine earthy material and, with the exception of scattered boulders of large size, this layer contained about 50% of the boulders found in the pit. Below this, hardpan was found consisting of clay, sand and approximately 35 to 40% of gravel, both coarse and fine. This layer was so hard as to require shooting, but below it, while the material contained about the same ingredients, with possibly a larger percentage of clay, it was not so firmly cemented. The screening tests of Pit *T* (Fig. 2) made from a mixture of samples from different depths, may be considered fairly typical of the material used for the tight portion of embankment and ran as follows:

Screen No	¾	¾	1	1¼	2	3
Per cent. passing	98.3	94.7	91.6	83.6	74.9	68.9
Screen No.	4	10	20	40		60
Per cent. passing	60.3	47.3	38.3	31.3		26.1
Screen No.	80	100	165	200		
Per cent. passing	23.3	21.3	18.0	16.7		

Careful consideration was given to a determination of the method by which this dam should be constructed; whether by the customary rolling method or by hydrauli-cking the material into place from the slopes of the embankment, which was the method used in constructing the Bumping Lake dam, about 60 miles northwest of North Yakima, Wash. The rolling method was finally decided upon. Early in March, 1912, the construction of a timber trestle from which to dump the material was commenced. The trestle was 800 ft. long, of which 300 ft. averaged 60 ft. high. It was built of round timber, saved from the clearing; except the caps and stringers, which were of sawed timber, to save time in erection. The bents were 20 ft. apart, three posts to a bent. The trestle was located practically on the center line of the dam, with the base of rail at the proposed crest. It was double tracked with 30-lb. steel rails, 24-in. gage. A double track was laid to the borrow pit for tight material and a single track, with sufficient turnouts, to the borrowpit for loose material. From the west end of trestle a single track was extended about 300 ft. on a road-bed made with teams and beyond this point the material was hauled by teams.

While the trestle was being constructed, the borrow pits prepared and track laid, the cutoff and conduit trenches were backfilled. The hand work of filling in cramped quarters had been done the previous season. The steam shovel was moved to a 25-ft. bank of fine material just east of the outlet of the small conduit. Temporary tracks were laid and the filling was done by loading 1½-cu.yd. cars with steam shovels and hauling them by teams. The trenches contained some water. The material was dumped, then worked into the water and pud-

dled. When the fill got sufficiently dry to permit of using teams, the spreading was done with slips and fresnos.

About May 1 the trestle was ready for use, the shovel was moved to the borrow pit east of the dam and the construction of the embankment proper commenced. The pit had previously been cleared and some blasting done. The material from this pit was loaded into trains of 15 1½-cu.yd. side-dump cars, hauled by 9-ton steam locomotives. It was dumped from the upstream side of the



FIG. 9. DUMPING EARTH FROM TRESTLE, KACHESS DAM

trestle, falling to the ground below. At first the material fell inside the outer posts, but the addition of a deflecting apron 7 ft. long, covered with sheet iron, caused it to fall just outside the posts (see Fig. 9). Spreading was done with fresnos of four-horse size, but usually drawn by three large horses or mules. It was found after the work became systematized that one fresno would distribute about 115 cu.yd. of the tight material in eight hours. The gravel or loose material was loaded by the drag-line excavator into a specially constructed hopper, of 40-cu.yd. capacity, mounted on skids for moving and fitted with two chutes and controlling gates, which enabled two cars to be loaded at a time. It was hauled in trains of twelve cars, dumped from the downstream side of the trestle and spread with four-horse fresnos. One fresno would spread from 150 to 175 cu.yd. of gravel in eight hours, the haul being much shorter than for the tight material and the gravel more easily loaded.

On account of the small working space of the embankment, difficulty was at first experienced in spreading the material as fast as it came in, but while the capacity of the machines was never taxed, a system was soon devised whereby it was kept pretty well cleaned up. About ten trains would be dumped in one pile, then another pile of ten train loads would be made, near the first pile, leaving only room for a roadway between, then a third pile adjacent to the second. While the second pile was being made, the first pile would be spread and stones picked from the second pile; then while cars were dumping on the third pile, the stones would be picked from it and the second pile spread. In this way there was no waiting and no confusion, the roller working on the area previously spread. The tight material occupied the upstream two-thirds of the dam (Fig. 10) and the gravel in the downstream third; it was handled in the same way except that it spread much easier, and the piles did not require plowing, which was necessary with the tight material, the impact from falling, particularly in the lower levels of the embankment, compacting this material very tightly.

The tight material was spread in 8-in. layers and all stones exceeding 4 in. picked out, loaded into one-horse dump carts, and placed on the upstream slope (Fig. 11). A road grader was on the work but the fresnos spread the material so evenly it was not used. The layer was then sprinkled by a 2-in. hose with ¾-in. nozzle, the amount of water varying greatly and depending on the weather and the material. The tendency at first was to use too much water, which produced a kneading motion in front of the roller. Carefully watching conditions and reducing the amount of water, sprinkling often with a rather fine spray, corrected this condition. The rolling was done with an ordinary 16½-ton traction engine. Extension rims on the driving wheels gave a rear wheel base of 56 in. Assuming that they carried two-thirds of the weight, the pressure per lin.in. was about 400 lb. This engine seemed about the right weight for the materials and an excellent embankment was obtained.

It was found that the compacted layer was slightly less than 6 in. in thickness. Test pits were put down frequently and at predetermined points, in order to have a complete record of the behavior of the material, to determine whether or not the proper amount of water was being used, and, in general, to indicate whether there was anything to be guarded against or improved. No stratification was apparent; the only adverse criticism to be made was that certain layers that had been exposed to rain showed a little too much water.

The gravel was spread in a similar manner except that small stones were not so carefully picked out. The rolling was done by a grooved roller drawn by four horses and more water was used than on the upper side. The stones picked out were placed on the downstream slope. The junction of loose and tight material was approximately at the downstream posts of trestle bents. To place the large amount of material in the short season available, the small area of the dump preventing the crowding of the machines, the shovel and embankment work was carried in two 8-hr. shifts, but as only half as much material was required from the excavator it only operated one shift. The best run of the shovel was 1105 cu.yd. and of the excavator 1000 cu.yd. in eight hours.

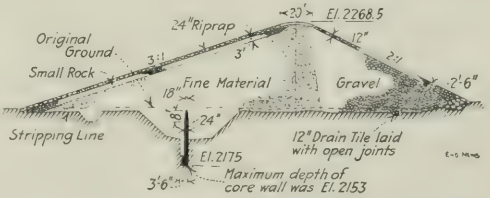


FIG. 10. TYPICAL SECTION OF KACHESS DAM, YAKIMA IRRIGATION PROJECT, WASHINGTON

The embankment was practically all placed in four months. All trestle bracing was taken out as the fill advanced, nothing being left in but the posts. When within 8 ft. of the top, the gravel portion was brought up about 6 ft., one track thrown on it, the balance of the trestle removed and the remainder of embankment completed.

DRAINAGE—A very complete drainage system was pro-

vided to lead off harmlessly any water that may find its way into the dam. At the downstream toe is a generous trench from 6 to 10 ft. wide in the bottom, from 6 to 8 ft. deep, extending the entire length of the dam, backfilled with stone, which filling is also carried some distance up the slope. From 30 to 60 ft. upstream from the toe is a 12-in. tile drain, laid with open joints in a trench and surrounded with 2 ft. of small stone; this drain has frequent outlets to the main drain at the toe. Should water succeed in passing through the tight material it will drop in the gravel portion, which contains practically no clay, and escape through the drains.

RIPRAP—The upstream slope is protected from wave action by a 2-ft. layer of riprap placed on a bed of small stones 3 ft. thick, thus making a thickness of 5 ft. of rock between the embankment material and the waves. The smaller stones are generally against the embankment while the outer stones are practically all at least 2 ft. thick, many of them being of derrick size. The downstream slope requires no protection, but to prevent raveling and to better hold the material, it is faced with a layer of small stones picked out of the loose material. This layer is thicker at the bottom than at the top and will average 3 ft.



FIG. 11. UPSTREAM RIPRAPPED SLOPE OF KACHESS DAM, YAKIMA IRRIGATION PROJECT, WASHINGTON
(The outlet tower or gatehouse shows on the extreme right, also the concrete hoisting tower used in constructing the gate tower.)

WORK ACCOMPLISHED

The principal work accomplished was as follows:

Clearing	50	acres
Grubbing	16	"
Excavation	550,000	cu.yd.
Concrete	8,635	"
Dry paving, 12-in.	1,600	"
Grouted paving, 12- and 18-in.	1,250	"
Gravel under dry paving	625	"
Backfill	32,000	"
Rockfill	2,700	"
Pipe up	1,000	"
Embankment	[illegible]	[illegible]
Steam pipe, 12-in.	[illegible]	[illegible]
Drain pipe, 8-in.	1,000	"
Reinforcing steel	[illegible]	lb.

CONSTRUCTION PLANT AND CAMP

The plant used was fully adequate. Much of it had seen service at Running Lake Dam and was well suited to the work. In addition to the machines already mentioned, there was sufficient rolling stock to handle the combined output of the excavating machines, a large supply of equipment for team work, hoisting engines, derricks, stationary engines, pumps, boilers, small electric light plant and the small equipment usually associated with a large excavating and masonry contract. The machine shop was unusually well fitted up for handling large work. In addition to the customary equipment there were a steam hammer, drill press, cutoff and band saw, lathe, etc., all operated by power. There was very little repair work that could not be done in the shop and its excellent facilities saved many delays and their incident cost.

A very comfortable camp, with ample accommodations for 400 men, was erected. It was regularly laid out on a topographic map of the site before commencing its construction; the different buildings and quarters were arranged with respect to their relation to each other. Such buildings as the office, warehouse, mercantile store, mess and repair shop were located where they would be the most central to those using them and to the work. The quarters for foreman, clerks, mechanics, etc., were regularly spaced and at a uniform distance from the road. The laborers' quarters were similarly spaced but on a different thoroughfare.

One of the most popular features of the camp was the club house, a building 24x48 ft., conducted for the benefit, amusement and welfare of the men. It was in charge of a Y. M. C. A. Secretary who gave his entire time to the work. The building contained a variety of games, was well supplied with reading matter and writing material. The men were encouraged to use its literary features and there were classes for those who wished to improve their education. It very successfully served its purpose of entertaining the men and keeping them from a neighboring town which was not a "dry" town.

A well equipped hospital with a resident physician in charge, who also had oversight of the sanitary condition of the camp, was in operation during the season of 1911 and 1912. Convenient to the different portions of the camp were toilets and bath-houses, the latter containing a sufficient number of bath tubs and shower baths.

Running water was placed in all the principal buildings, while numerous hydrants, scattered through the camp, made it accessible to all. The water-supply was

excellent but somewhat expensive, as it was all pumped from deep water in the lake to a tank on the hill above the camp.

There were six corral tents with accommodations for 168 head of stock. The largest number of animals, mostly mules, working at one time was about 150. The largest force employed was 110 men.

The Kachess dam was built under the direction of Chas. H. Swigart, supervising engineer, United States Reclamation Service, with the writer in direct charge. R. E. Post, assistant engineer, was superintendent of construction and John R. Sherman, assistant engineer, in charge of engineering.

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An Opportunity and a Purpose for a Local Organization of a National Engineering Society*

By Chas. B. Wing†

In 1887, William E. Worthen, in the presidential address of that year before the American Society of Civil Engineers, said: "The Engineer must know not only what to learn, but how to learn and reciprocate for the information and pleasure of others."

Would it not be well for us who are intimately connected with the engineering work of this portion of the world to study carefully the work that has been done here in the past; and thus learn to appreciate the achievements of the pioneers in Pacific Coast engineering?

Geo. H. Benzenberg, in his presidential address in 1906, truly said, "The respect and esteem which a community entertains toward any profession or its members is always in proportion to that which the members of such profession entertain toward one another."

The community as a whole is more or less familiar with the material results of the engineering work of this section, but how many even among ourselves know much of the names and much less of the personalities of the engineers to whose devotion and labor these achievements are due, or of the difficulties which they encountered in doing their work?

Would not the esteem of the profession in the community be enhanced if we should honor these men, not only among ourselves, but also in public?

The building of the Central Pacific R.R. during and immediately following the Civil War was one of the greatest feats of engineering this country has seen. It is true that many of the problems connected with grades, curvature, track and motive power had already been settled by the experience of the previous 25 years of railroad building in the East.

The work accomplished, however, is comparable to that of building the Panama Canal—the overcoming of material obstacles and not the solving of new scientific problems. One point of difference, however, existed. The Panama Canal has had the whole wealth and financial strength of the United States back of it. The builders of the Central and Union Pacific railroads had only a gift of supposedly valueless lands and a chance to use "I. O. U.'s" with which to build thousands of miles of railroad across the great American Desert, and over a mountain range 7000 ft. high, whose eternal snows had held back and destroyed the Donner party.

Looking back today, it is hard to realize the magnitude at that time of the difficulties confronting this enterprise. And yet to one man in large measure belongs the credit for carrying this work through to completion—the engineer whose broad-minded, far-seeing judgment and capacity enabled him to convince his principals and the leaders of the government of the wisdom and ultimate worth of undertaking this apparently impossible task.

All of us today are familiar with the names of those who reaped the financial rewards accruing from the ultimate success of the enterprise, but how many of the younger generation know the name of Benjamin P. Judah, the engineer to whom the success of this great work [illegible] due, and who practically gave his life to its achievement?

Surely it is our duty to the present, to see that the history of this enterprise is known to the younger generation and that to them the name of its engineer becomes as familiar as the names of those who lived to receive the financial rewards.

This in brief is the story of but one Pacific Coast enterprise. We might well ask who developed the first hydraulic mines, who built the Tehachipi loop, the first hydraulic-fill earth dams, arched dams, cable railways, hydro-electric installations, impulse waterwheels, centrifugal pumps, and so on through a list of engineering developments which, if not originated by Pacific Coast engineers, have all received their greatest development here.

A series of properly illustrated papers on such topics as those outlined would not only prove entertaining to us for our evening meetings, but would also entertain audiences made up of others than engineers, and afford an excellent opportunity for some of our members to honor themselves by honoring those members of our profession to whom credit is due for conceiving and carrying through to commercial success these great works.

Geo. S. Morrison, in his presidential address in 1895, said, "The engineer must measure himself with others and must stand to be measured . . . . . The profession can only do its future work by trained minds working together."

Perhaps in learning to appreciate more fully the work of those who have preceded us, we shall be led to value more the work of our contemporaries, and by working together achieve still greater success than has been obtained in the past.

How can this Association of ours best serve our needs and help us in our preparation for the work to be done? In 1902, Robert Moore, in his annual address said: "Engineering should be one of the learned professions . . . . . The special function of the Society is to aid in the higher education of the engineer."

I fear some of our younger members are inclined to place undue emphasis secretly, if not openly, upon the fact that they have been educated at such and such a place, or that they have worked under so and so. Perhaps some of our older members are inclined to expect too much from the preliminary training that is now quite generally accepted as necessary for those hoping to become engineers.

To a certain extent, engineers are born, not made. The head of a college of engineering in one of our leading universities has said: "We cannot be expected to turn out engineers . . . . . We can merely help to train men with great capacity for becoming engineers."

It would seem that one function of an Association such as ours should be to encourage and help those young men with "great capacity for becoming engineers"—to help them to help themselves. Perhaps no better way can be suggested to help them than by giving them an opportunity to "measure themselves with others and stand to be measured."

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The Chingford Storage Reservoir, recently completed by the Metropolitan Water Board, London, England, has a storage capacity of 3,600,000,000 U. S. gal. and is wholly in excavation and embankment. The reservoir has an area of 416 acres and is about a third of a mile wide and two miles long. The total length of the embankment is about 4½ miles, involving 2,060,000 of material, all excavated from within the reservoir. A novel feature of the contract was that the contractor (Messrs. Charles Wall, of London) was given a free hand as to excavation and embankment, provided only he supplied the designated capacity and left the bottom so it sloped toward the outlet from every point. The bank is some 28 ft. high, 15 ft. wide on top, with an outer slope of 2½ to 1 and an inner slope of 3 to 1 on the upper and lined portion and 4 to 1 below that. A clay puddle wall extends from above the water level to and 3 ft. into the London clay. This wall is 5 ft. wide on top, and tapers uniformly for a depth of 23½ ft., where the width is 9 ft. From this point to within 2½ ft. of the original ground surface the width of 9 ft. is maintained; the rest of the way the wall is 6 ft. thick. The 15-ft. width of the top of the bank includes a vertical parapet wall of concrete and brindled brick, the concrete going down 4 ft. At a little over 2 ft. from the top the brickwork curves to a junction with the slope and continues to rest on concrete for a slope distance of 19½ ft., beyond which a thinner layer of concrete (in slabs here) extends for 20 ft. To lessen wave action it is divided about halfway in its length by an embankment. The reservoir is filled from the River Lea by means of the Humphrey direct-acting explosion pumps described in issue of Apr. 17, 1913. An illustrated description of the reservoir is given in London "Engineering," Mar. 14, 1913.

*From the presidential adress to the San Francisco Association of Members of the American Society of Civil Engineers.

†Professor of Structural Engineering, Leland Stanford, Jr., University, Calif.

Mechanical Oil Burners*

By E. H. Peabody†

SYNOPSIS—In most oil burners hitherto used the oil is sprayed by steam or compressed air to obtain perfect combustion. To burn oil under marine boilers such a system is objectionable, as the amount of steam required to spray and atomize the oil may be 2% to 4% of that generated by the boilers and such a waste of fresh feed-water could not be afforded. To establish an air-compressing plant large enough to spray the oil would also be an objectionable complication and the demand arises, therefore, for a burner which will spray the oil by mechanical means. Mr. Peabody's paper describes the latest make of these burners and the principles on which they are designed.

The "mechanical atomizer," so called, is understood to mean a device which sprays or atomizes oil or other liquids by means of pressure alone, without the use of compressed air or steam or other exterior atomizing agent. Owing to its simplicity and to the fact that no fresh water is wasted, it is being extensively used in the merchant marine, and it has possibilities which may ultimately bring about its adoption on shore. That this change has been and will be slow is not to be wondered at, awaiting, as it must, the growth of the oil-producing industry, but with the increased supply of oil its use as a fuel has spread,

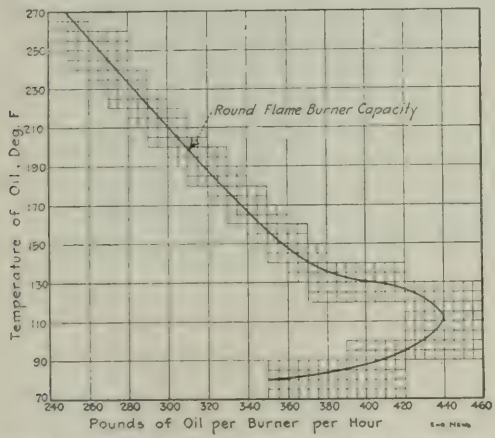


Fig. 1. Curve Showing Variation of Capacity of an Oil Burner with Change of Temperature of the Oil Handled

and with the increased use of oil has arisen the need of better methods of handling. Following the necessity, the better methods have been developed, first in naval practice, and now in wider fields.

Commodore Isherwood's conclusions of some forty years ago hold good today, namely, that atomization of the oil, as distinguished from vaporization or gasification in the burner, is the only method that has been attended with success. There are not wanting those who still claim advantage for those forms of apparatus which, by various methods of treatment of the oil, admit the fuel to the furnace in the form of vapor. These systems, while successful in metallurgical work, have no standing in boiler practice for the reason that they show no gain in efficiency, but, on the contrary, result in very poor capacity, the latter feature alone making them undesirable for marine use.

The well known Koerting process patent, taken out in this country in 1905, contains a claim which covers heating the liquid oil unmixed with air or other gases to a point above its normal boiling-point, maintaining the oil in a liquid state by pressure and delivering the superheated oil into a combustion chamber supplied with air, whereby the rapid disintegration and vaporization of oil in the presence of air are secured. The idea here, as is more fully pointed out in the patent specifications, is that the heat stored in the oil at high pressure will cause the liquid to flash into vapor when released at low pressure, exactly as water, heated above 212° F. under pressure, would flash into steam if released to the atmosphere. This is an exceedingly ingenious way of converting at least part of the oil into vapor without atomizing it, but as a matter of fact no gain results from this partial gasifying of the oil. This question has been tested out experimentally and what is more to the point, nobody is doing it, not even the users of the Koerting apparatus itself. The dangerous expedient, therefore, of heating oil above its flash-point at atmospheric pressure is not found necessary.

The real value of heating the oil is rather a mechanical one,

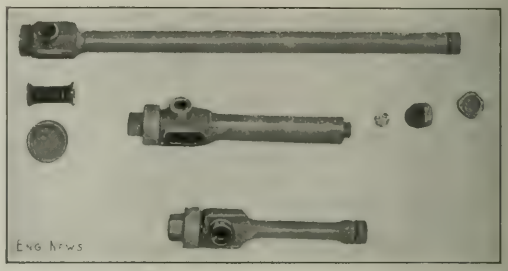


Fig. 2. Parts of the Peabody Mechanical Atomizer for Burning Oil Fuel

namely, to reduce the viscosity of the liquid so that it can be forced through the small passages of the burner and given a rapid whirling effect, sufficient in the more limpid condition of the oil to reduce it to a fine spray through the action of centrifugal force when liberated from the tip. It will be found from a study of fuel oils that, while the viscosity is tremendously affected by changes in temperature at the lower ranges, very little difference in viscosity results from heating or cooling as the temperatures approach the flash-point.

With all ordinary oils it may be considered that heating to within 50° F. of the flash-point will be sufficient to render the oil suitable for use with the mechanical burner, and in the case of many of the lighter oils even this heating is unnecessary, the oil being sufficiently limpid at ordinary atmospheric temperatures.

Several methods of spraying oil by mechanical means have been suggested, such as forcing the liquid through a very fine aperture, forcing a jet of oil at high velocity against some object or against another oil jet, throwing the oil off from a rapidly revolving table or disc, or giving the liquid itself a whirling motion and reducing it to spray by centrifugal force.

In 1902 the writer tried the first idea and succeeded in making a very poor flat-flame mechanical atomizer by forcing the oil between two flat surfaces pressed closely together, and in 1907, when in answer to the Navy's call we took up the matter of mechanical atomizing seriously, we tried some of the other schemes. The experiment of making two round jets of oil strike each other on the principle of the acetylene burner, resulted very interestingly in flat spray—not fine enough, however, with heavy oils to be practicable. A mechanical atomizer, or, as it was called, a "self-atomizer," consisting of eight small jets meeting at a central point, was patented in England in 1904 by Charles Ferdinand de Kierskowski Steuart. It is a good example of spraying by forcing jets of oil to strike each other, but otherwise has attained no importance in the art.

The only method of atomizing fuel oil mechanically which has attained any practical success is that wherein the oil is given a whirling motion inside the burner tip. There are two distinct means for doing this, first, by forcing the oil through a passage of helical form, like a screw thread, and second, by delivering the oil tangentially to a circular chamber from which there is a central outlet. Examples of the first form are shown in the

*Abstract of a paper presented before the Society of Naval Architects and Marine Engineers at its annual meeting, November, 1912.

†Mechanical Engineer, Marine Dept., Babcock & Wilcox Co., 85 Liberty St., New York City.

spraying burners perfected by Schutte and by Howden and illustrations of the second form are given in those perfected by Jones and by Stringham and Elmendorf.

The matter of adjustability of an oil burner, that is, the ability to change the quantity of oil delivered in a given time without changing the oil pressure or the velocity of the liquid through the tip, while attractive in idea and perhaps well sustained in theory, has no particular value in practice. It is a fact that in regular operation on shipboard, the simpler forms of burners which do not possess this feature are quite as successful, if not more so than those possessing it. The manipulation of the oil pressure acting on all burners at once presents in itself a simple means for the control of output through a wide range. A good burner will atomize moderately heavy oil with an oil pressure as low as 30 lb. per sq.in. and from that up to 200 or above. If this range is insufficient to meet the variable steam requirements, then it is easier and better to shut down a portion of the burners entirely than to attempt to adjust each

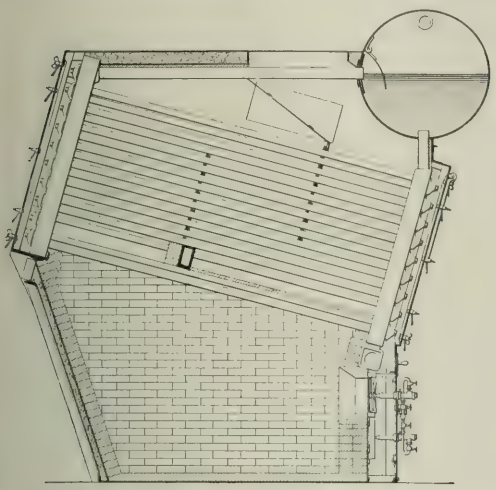


FIG. 3. CROSS-SECTIONAL SIDE ELEVATION OF A MARINE BOILER FITTED FOR BURNING OIL FUEL

individual burner separately, particularly as it is important to regulate the quantity of air admitted to the furnace for combustion, at the same time the quantity of oil is varied.

This air supply can be easily controlled for all burners by regulating the draft pressure, and the air can be closed off entirely when a burner is shut down. This puts the question of proper air supply more into the hands of the designer, requiring the operator to determine only the proper conditions of draft pressure for the plant as a whole, at the required capacity.

Another means of varying the quantity of oil delivered by all burners in addition to alteration of oil-pressure is available in alteration of oil temperature. Generally speaking, under working conditions any increase in temperature of the oil results in decreased capacity of the burners, the pressure remaining the same. The reverse is the case at low temperatures, the critical point depending on the relationship between viscosity and specific volume of the oil in question.

This law is shown graphically in the diagram in Fig. 1, giving the results of a test on a sample of Texas oil of 18° gravity (degrees Baumé) and a flash-point of 240° F. The oil pressure was maintained constant throughout the test at 200 lb. per sq.in and the temperature was raised by stages from 80° F. to the flash-point. The burner capacity increased rapidly up to a temperature of 110° where it reached a maximum. With continued heating it began to fall off and continued to do so throughout the range of the experiment.

It will be obvious, if oil is to be atomized by centrifugal force, that the best spray will be obtained by giving the oil the maximum whirling motion and reducing to a minimum the friction in the burner so that the whirling motion once obtained shall not be diminished before the oil is liberated. These are axiomatic principles, recognized by all, and no doubt each inventor believes he has best met the requirements. Probably these three questions are the controlling factors in the "survival of the fittest."

(1). How heavy an oil will a burner thoroughly atomize?

(2). What pressure and temperature are necessary?

(3). What degree of simplicity has been attained in the design?

It may be said here that any apparatus which will not handle heavy oil will have a very limited usefulness. Already the market is beginning to be supplied with very heavy oils from Mexico, there is a considerable amount of crude oil in California below 15° gravity, and the tendency will be more and more to use the heavier residuums. Probably in a few years we will be using oils of 12° to 15° Baumé as commonly as we are consuming oil of 27° to 30° gravity today.

There was recently received, for experimental purposes, some Mexican crude oil having the following characteristics:

Specific gravity at 60° F.	0.981
Degrees Baumé at 60° F.	12.6
Moisture and silt	3.5%
Flash-point	310° F.
Burning point	347° F
B.t.u. per pound (oil as received)	17,551

In appearance this oil was black and at temperatures of about 80°, very sticky and viscuous. On heating to 212° it turned to foam owing to the presence of so much water, and this failed to separate out, a sample of the oil being thinned down with ether to determine the percentage. Ordinary settling tanks would have been practically useless, as the oil was so near the specific gravity of water. This oil was, however, successfully sprayed and burned under natural draft, on being heated to 270° at a pressure of 165 lb. per sq.in. A slight amount of smoke was formed which disappeared on a slight increase in the furnace draft above 0.12 in. of water. The most noteworthy feature of the experiment was that the capacity fell off about 40% from that obtained with the same apparatus with oil of 18° gravity. This sample of oil was the worst the writer has ever seen, but it is a specimen of what we may have to handle in the near future.

In the light of some experiments begun in 1907 we have come to believe that the best rotative effect on the oil is produced by the tangential delivery method, and it seems plain that the best way to reduce friction is to reduce the amount of surface to which the oil is exposed in its travel through the burner after it begins to whirl and until its exit from the tip. We have also come to attach great importance to simplicity in everything connected with oil burning and to believe that the oil burner itself should be of simple construction, easily taken apart, and

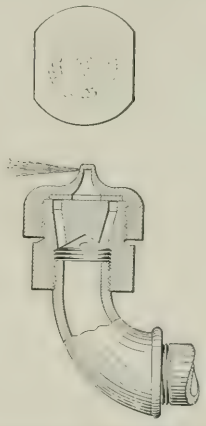


FIG. 4. PROPOSED FORM OF FLAT-SPRAY MECHANICAL ATOMIZER FOR USE WITH OIL FUEL

so designed that when taken apart all the small passages and wearing surfaces will be exposed for inspection, cleaning and repair.

The results of the writer's efforts to construct a burner to meet these requirements are shown in Fig. 2. Oil is delivered under pressure to an annular channel cut into the face of a nozzle upon which is screwed a tip having a very small central chamber communicating with a discharge orifice. Between the nozzle and the tip a thin washer or disc is inserted and held firmly in place. This has a hole in its center corresponding with the diameter of the central chamber of the tip, and small slots or ducts extend tangentially from the edges of the central opening outward toward the periphery of the washer, long enough to overlap the annular channel of the nozzle and put it

in communication with the central chamber. When this burner is assembled with the washer in place, oil is delivered through the ducts tangentially to the central chamber where it revolves rapidly and is almost immediately discharged through the orifice in the tip.

In order to correct a popular fallacy, attention should be called here to the fact that no mechanical atomizer produces a revolving spray, but the particles of oil fly off in straight lines under the influence of centrifugal force, thus forming a hollow, conical spray. The fineness of this spray, that is, the minuteness of the particles forming it, has a most important bearing on the results obtained in the furnace. It is possible with some forms of steam atomizers to atomize oil so finely that no flame at all will be produced, the incandescent combustion chamber being filled merely with a clear, invisible gas and every brick being discernible. It is doubtful if this condition of flameless combustion can be produced with mechanical atomizers and heavy oil, nor is it desirable under any circumstances for the simple reason that it costs too much.

With the production of flame, however, furnace design assumes an added importance, for the flame must be distributed evenly and without localizing on the heating surfaces of the boiler, and the gases must be given time and space in which to expand and burn as nearly as possible to completion before being cooled and the flame extinguished by contact with the tubes of the boiler. These points become exceedingly vital when the boiler is forced to the requirements now demanded in naval service.

Having an atomizer, therefore, that will produce a fine spray with heavy oil and which is simple, reliable and easily handled, the problem becomes one, not of oil burner, but of furnace design and air distribution. Our work has been carried on, until recently, entirely with the Babcock & Wilcox marine boiler, a design having a furnace ideally suited for any volatile fuel and particularly for oil. A longitudinal section through this boiler fitted with mechanical atomizers is shown in Fig. 3. It will be seen that the characteristics of this furnace are: large volume in proportion to the heating surface of the boiler; upward slope of the roof toward the rear, resulting in increase in height and volume in the direction of the entering oil spray and thus providing room for the expansion and diffusion of the gases; small amount of boiler heating surface exposed, and, on the contrary, large exposed surface in incandescent refractory material, thus tending to maintain high furnace temperature and promote complete and rapid combustion of the oil; tubes almost parallel with the path of the oil spray injected into the furnace from the front, thus promoting proper distribution of the gases along the tubes and preventing local overheating; outlet from the furnace at the point most remote from the location of the atomizers, thus insuring long travel of the gases; and, finally, means for bringing the heated products of combustion into the closest possible contact with the entire amount of heating surface of the boiler, discharging the waste gases into the uptake at temperatures but little above that of the steam generated. These conditions combined to relieve us of any worry about furnace design.

The experiments therefore developed principally into a search for the best method of admitting the air for combustion, in which process great delicacy is required. Very slight changes affect the results in unsuspected ways and while almost any method may result in smokeless combustion, maximum economy and capacity can only be secured by careful and intelligent design. It is not necessary to give the air a whirling motion, but judging from our rather exhaustive experiments better gas analyses are secured, lower air pressures are required and less refinement of adjustment is needed if the air is brought into contact with the oil spray with the right sort of twist.

Mention has already been made of the special advantages of flat spray atomizers, and the many forms of successful steam atomizers which give a flat flame, warrant the belief that there is a wide field awaiting a thoroughly satisfactory flat spray mechanical atomizer. Reference has also been made in a previous [illegible] pressed together, and to another consisting of two round oil jets striking together. Neither of these schemes seems to promise [illegible] er form which does seem to possess some merit, however, is illustrated in Fig. 4. This consists of a means for giving the oil a rapid whirling motion as in the case of the round flame burner [illegible] in a plane at right angles with the axis of revolution instead of through an orifice concentric with the axis. It is apparent that centrifugal force will here come into action as an atomizing [illegible]

The only practical flat flame mechanical atomizer which has [illegible] limitation which has been discovered in this burner is the fact that at anything over about 100 lb. of oil delivered per hour, the spray loses its finely diffused character.

An effort has been made to show that while the problem of oil burning presents some difficulties, particularly as regards admission of air, there is very far from being any mystery about the matter. A strong leaning toward simplicity, "horse sense" and some experience, are a combination reasonably sure of giving good results, without depending very much on abstruse reasoning or higher mathematics. Improvements will be required and will be forthcoming, particularly in connection with spraying the heavier oils and the flat spray atomizer has a promising field for development. Meanwhile the results already attained are certainly encouraging.

Air as a Stimulator of Corrosion in Refrigerating Systems

By M. B. Smith*

The paper on "The Design of Hot-Water Supply Systems, especially to those parts of the apparatus which con- NEERING NEWS, Feb. 13, presents many valuable suggestions for the proper design of such equipment so that the danger of accelerated corrosion by the action of air (oxygen) may be minimized.

The suggestions contained in this very timely paper are equally applicable to the design of refrigerating systems, especially to those parts of the apparatus which contain or transmit brine or ammonia, in either gaseous or liquid form.

As early as 1905, the danger due to the acceleration of corrosion by the action of air, either entrained as gaseous particles or in solution in the brine, was pointed out by the writer after a very thorough investigation of a severe case of corrosion throughout the refrigerating system in one of the large office buildings at Pittsburgh. The system in this building furnished refrigeration to a café on the ground floor, to a restaurant, and to a club on the top floor, 22 stories above ground. There was also cold drinking water running on every floor.

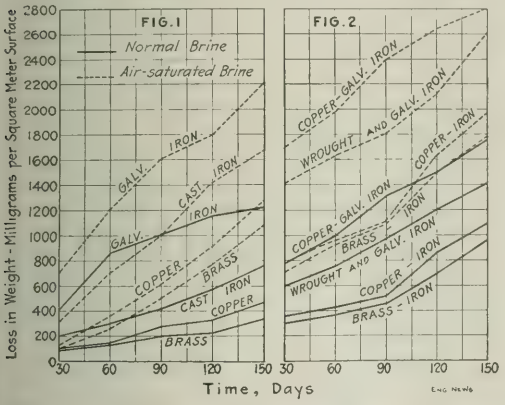
All of this large system was more or less affected by corrosion, the corrosion appearing almost without exception at fittings, valves and pumps. The corrosion was more or less localized at these places and always appeared within the piping or fittings and at the top. All conditions, excepting only the electrical differences of potential found on measurement, pointed to the presence of air either entrained in the apparatus or in solution in the brine itself. Experiments were then started to determine whether or not air was entrained in the apparatus, the first step being to locate the highest point of the apparatus. This being done holes were drilled through the piping and pet-cocks were placed at these points. When the drills broke through the piping there was invariably a rush of air from within. It was proven beyond a doubt that the apparatus had never since its installation been filled completely with brine. The system then was filled completely with brine after placing pet-cocks at all high points throughout the entire refrigerating system. These cocks were then closed but remained in readiness to vent the apparatus periodically, and to make it possible thoroughly to fill the brine-carrying parts of the installation.

It is a very significant fact that the worst corrosion by far was manifest at the very topmost part of the system, showing that air, when entrained as such, works

*Chief Chemist and Combustion Engineer, Detroit United Rys., Detroit, Mich.

along to high points and that it is perfectly feasible to vent such apparatus and prevent accelerated corrosion at such places. In this case there is absolutely no doubt that corrosion was greatly diminished by remedying this fault.

There was still another phase of this question of air in this particular system, namely, that held in solution in the brine. Examination of the brine-carrying parts, especially the return-brine lines, showed that there was an excellent opportunity afforded for the liquid to become thoroughly saturated with air. The brine returning to the main supply tank in the lowest basement fell through air a distance of some 5 to 6 ft., churning up the brine in the tank and being itself more or less sprayed during its fall. Examination of the brine showed that it carried an abnormal content of dissolved air and showed plainly that something must be done at once to minimize this absorption. Accordingly the return pipe was lengthened so that the brine discharged about 8 in. below the surface of the liquid in the tank. This did not put sufficient back-pressure on the system to be noticed at all in the operation. Examination of the brine after some weeks of operation showed a content of air not over a tenth of



FIGS. 1 AND 2. RESULTS OF CORROSION TESTS OF SINGLE- AND TWO-METAL TEST PIECES IN ORDINARY AND AIR-SATURATED BRINE

that before making the above change in the piping. The thought came at once that experiments along this line should develop data of value as confirmatory evidence of the facts noted in practice.

Experiments were started in which single metals and combinations of dissimilar metals were partially immersed (⅝ only) in a commercial brine, consisting of calcium chloride, of a strength equivalent to 1.2 specific gravity. The temperature of the tests was from 20° to 25° (room temperature). The duration of the tests was 150 days, sufficiently long to establish the general behavior of the metals. One set of test pieces were placed in normal brine; the second set being placed in the same brine after saturating it with air.

The writer believes that the results are typical for the conditions maintained; he realizes that such results are purely comparative, not absolute, for a change in the metals used would undoubtedly alter the results and other factors are to be considered, such as auto-electrolysis, etc., which would have their effect in experiments of this sort.

The fact is established, however, that air-saturated brine is relatively much more corrosive than brine carrying only a normal amount of air in solution. It is, therefore, highly probable that if refrigerating apparatus were designed to remove air from the system, just as far as is practicable, one of the most highly corrosive agents known will have been eliminated and corrosion undoubtedly minimized.

The experiments were carried out with various metals partially immersed in brine. Test pieces were 6 in. long, 3 in. wide and ¼ in. thick. These were polished smooth at the start before weighing. At certain intervals the test pieces were removed from the brine, rubbed in hot water with a soft brush to remove any easily loosened oxide and weighed after drying in alcohol. The pieces were only partially immersed since this simulates a condition always found in practice. It is also more severe than complete immersion would be under identical conditions. The results are tabulated in the accompanying table and plotted in the accompanying figures. Losses are expressed in milligrams per square meter of surface immersed.

RESULTS OF EXPERIMENTS ON THE ACTION OF BRINES ON METALS

(Loss in Milligrams per Square Inch)

Single Metals

	Normal brine					Air-saturated brine				
Days	30	60	90	120	150	30	60	90	120	150
Copper	100	150	280	330	470	130	360	605	905	1270
Iron (cast)	200	300	420	575	760	310	700	1080	1420	1686
Brass	80	130	198	230	340	100	260	500	765	1080
Iron (galv.)	400	860	1000	1150	1220	700	1200	1605	1890	2210

Combinations of Dissimilar Metals

	Normal brine					Air-saturated brine				
Days	30	60	90	120	150	30	60	90	120	150
Copper / Iron	360	430	520	860	1090	786	962	1110	1636	1980
Brass / Iron	300	365	465	695	960	710	925	1090	1492	1785
Wrought iron / Galv. iron	600	760	970	1200	1410	1410	1625	1810	2130	2605
Copper / Galv. iron	780	1000	1310	1500	1760	1700	1980	2400	2650	2810

The increased rate of corrosion, due to air-saturation of brine, is marked in both single metals and in combinations of dissimilar metals. The figures for the combinations of dissimilar metals cover the loss of both metals but it is probable that this was very largely confined to the iron or galvanizing (zinc) on account of active local electrolytic action.

In so far as was possible conditions were maintained alike in all experiments excepting only the amount of air in solution in the brine. The widely different results in the case of normal and of air-saturated brine may be laid to the different amounts of air in solution in the brine. The writer is of the opinion that the designers of refrigerating apparatus should make an earnest effort to so design their apparatus that the amount of air entrained in the apparatus or in solution in the brine may be kept at a minimum constantly. In bringing the results of this investigation forward the writer hopes that the data contained therein may be of practical value to those engaged in the design of operation of refrigerating apparatus.

Purchase of Street Railway Power has been arranged by the Scranton Ry. Co. with the Scranton (Pennsylvania) Electric Co., the arrangement becoming effective Oct. 1, and running for 20 years. The present load runs from 5000 to 6000 kw. The electric company will take over the existing station (1500-kw. noncondensing) of the railway company on lease, together with a culm bank owned by the latter. The cost of railway energy at the switchboard of the old plant was about 0.8c. per kw.-h., with fuel from the culm bank costing 50c. per ton at the station.

Smoke-Washers for Roundhouses

SYNOPSIS—The smoke nuisance is an important factor in the relations between railways and municipal authorities, and the accompanying article describes a plant which has been put in service to reduce this nuisance by washing the smoke discharged from locomotives in the engine house.

One phase of the smoke-reduction problem in cities is the nuisance caused by smoke discharged from locomotives in the engine houses, especially when the engine fires are being lighted. This nuisance is of special importance when the roundhouse is adjacent to a residence district. The ordinary arrangement is to place a smoke-jack or short smoke-stack over each pit or engine track, the engines being spotted with their smoke-stacks immediately under the flaring hood which forms the lower end of the jack. In this way the smoke is discharged at an elevation little above the roof of the engine house, so that it is much more liable to be a nuisance than smoke discharged from a tall chimney.

The use of smoke-ducts with exhaust fans, delivering the smoke from all the jacks to a single flue and chimney has been proposed (ENGINEERING NEWS, Oct. 24, 1912), but we are not aware of any such installation. Even this arrangement, however, would only reduce the nuisance, and would not eliminate it. The plant described below is intended to practically eliminate the nuisance. In brief, it consists in connecting the individual jacks to a single flue with branches leading to exhaust fans from which the smoke and gases are delivered to washers, beyond which is an escape chimney (one to each set of washers). The number of fans and washers will depend upon the number of engines. This system is the invention of O. M. Foster, Master Mechanic of the Lake Shore & Michigan Southern Ry., and for information regarding it we are indebted to Mr. McBain, Superintendent of Motive Power. It has been installed at a 30-stall engine house at Chicago, this engine house being at Englewood, a residential district. It is estimated that it will remove practically all of the unconsumed carbon and 75% of the acids and gases in the smoke.

From the general plan in Fig. 1 it will be seen that two branch flues are to be connected to the main smoke

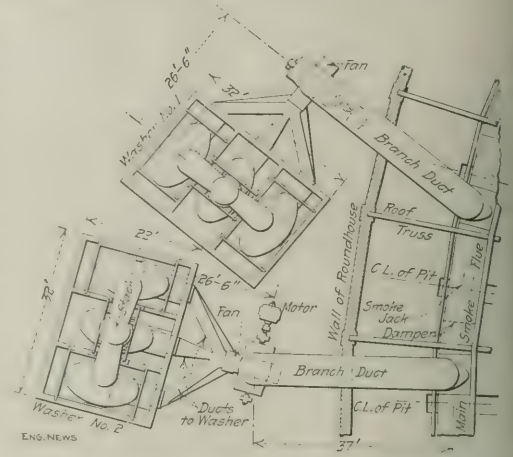


FIG. 1. PLAN OF SMOKE-EXHAUSTING AND SMOKE-WASHING PLANT AT THE ENGLEWOOD (CHICAGO) ROUNDHOUSE OF THE LAKE SHORE & MICHIGAN SOUTHERN RY.

flue, each branch leading to a motor-driven fan and a pair of three-compartment washing tanks. The smoke is drawn from the main flue by the fans and is discharged through a three-leg discharge pipe sloping downward to the washer compartments. Across the base of each compartment extends a horizontal flue, from the inclined dis-

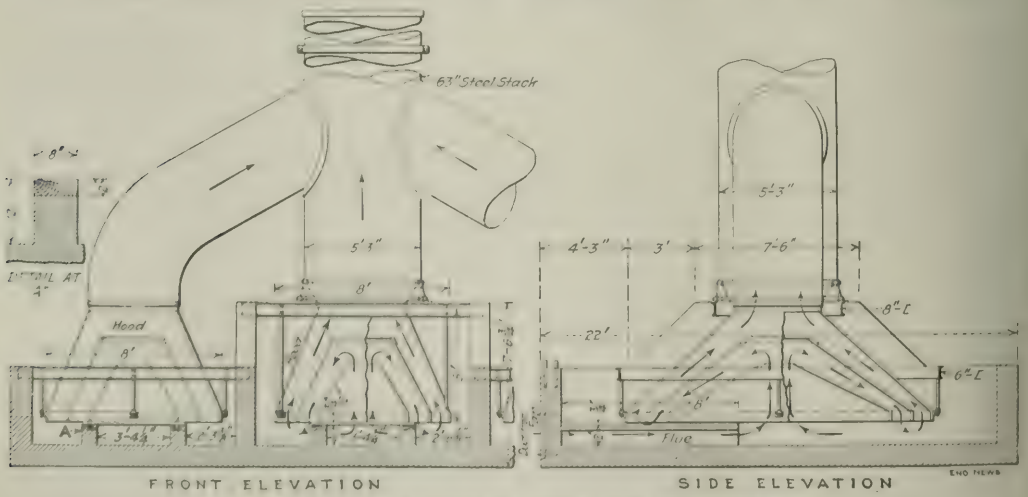


FIG. 2. SECTIONAL ELEVATIONS OF SMOKE WASHER FOR ENGINE HOUSE

charge pipe, and the compartment is filled with about 13 in. of water, the water level being about 1 in. above the top of the flue. At present, only one branch, fan and washer have been installed since the scheme is still on trial.

The smoke is discharged into this body of water, the velocity being sufficiently low to prevent undue agitation. It passes up through the water and escapes into the inner hood, from the top of which it passes into a duct leading it again into the water, from which it arises a second time into an outer hood. This is connected to the exhaust duct, which leads to a steel-plate chimney 63 in. diameter and 64½ ft. high above the ground. There is one chimney to each washer. The water in the washers is intended to be kept in constant circulation.

The hoods in this case are of steel, the plant being somewhat experimental as to details, but it is proposed to have the permanent plant built of concrete, in order to resist the corrosive action of the sulphurous gases. The ducts are of asbestos board and partly of steel. The fans are of ordinary steel-plate construction, 72-in. diameter, and are driven by constant-speed motors, the fans

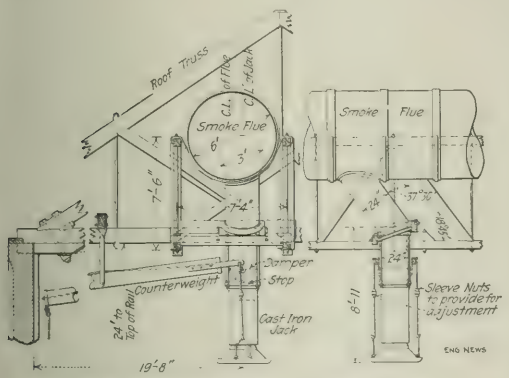


FIG. 3. SMOKE-JACK AND CONNECTION TO SMOKE-EXHAUST FLUE

making about 1120 r.p.m. The capacity of each fan and washer is estimated at about 60,000 cu.ft. of air or gas per minute. At some point between the fan and the tank, a jet of steam is introduced into the discharge pipe, the jet blowing in the direction of the flow of gas. This is found to aid materially in the washing process, as when the smoke is mingled with the steam, the particles of unconsumed carbon are removed by the water much more readily.

In the engine house, it is necessary to have smoke-jacks fitting closely to the engine stacks, to prevent any escape of gas and smoke. These smoke-jacks are shown in Fig. 3. They are of the drop or telescopic type, and have allowance for a slight swinging motion at the bottom, so that the jack can be connected to the engine smokestack without the necessity of spotting the engine directly under the center of the jack. The smoke-jacks are of cast iron, and it will be seen that they are supported independently of the smoke flue, which is of asbestos board and not designed to sustain appreciable loads.

The Washington Workmen's Compensation Act and the Results of Its First Year of Adminstration

BY L. R. W. ALLISON*

As the writer believes that results attained in a twelve-months operation of the Washington Workman's Compensation Act show the possibilities of an adequate law for the protection of employer and employee properly administered, the following notes have been arranged from studies made while on the Pacific Coast.

The Industrial Insurance Commission (a body of three appointed by Governor Hay to carry out the act) has, through the thorough provisions of the law, been enabled to render effective service at minimum cost. The advantages evident are (1) increased safety in industrial operations, (2) sure and determinate relief for injured workmen and their families or dependents, and (3) the elimination of extended litigation with the consequent saving of retaining fees, court expenses, and the like.

This compensation law, authorized by the legislature in 1911, became operative Oct. 1 of that year; it applies particularly to extra-hazardous occupations, segregating such under 47 distinct classifications. These in general include such activities as railroading (steam and electric), general building, electric-light and power service, telegraph and telephone service, steamboat transportation, manufacturing (with machinery), founding, quarrying, mining, powder-making, smelting, hoisting, docking, dredging, logging, lumbering, ship-building, brewing, printing, and miscellaneous engineering.

The following important provisions, bearing particularly upon the effective operation of the act, are given as initially incorporated and covering the creation of an accident fund for indemnity to injured workmen as well as the schedule of such payments.

Each industry shall contribute a certain percentage of its pay-roll to compose an accident fund. Such premium is different for each class and is established therefor. This is payable to the State monthly until such time as there is a sufficient amount on deposit with the State to provide for the accidents in that particular class; at such time the assessments cease until the accidents occurring therein deplete its fund. Each industry is responsible only for the accidents in its class, and the accident fund is arranged to be neither more nor less than self-supporting; no money from this fund is used for the expenses of the Commission, a State appropriation of $150,000 for a specified time providing for such expense. The assessment rates are subject to revision and readjustment, depending upon the number of accidents and the consequent compensation demands for injured workmen.

The Commission is empowered to increase the rate of premium of a particular industry or firm which operates its business in a notably careless or negligent manner, compelling by such means a closer observance of factory laws and regulations on the part of the offender.

No part of any premium can be deducted from the wages of the workman; a violation of such by the employer is made a gross misdemeanor, punishable by one year in the county jail or a fine of $1000, or both.

Employers are required to report accidents promptly, and their books, records and pay-rolls must be open for inspection by the Commission at all times; refusal to permit such inspection is made a misdemeanor, with a penalty of $100 for each offense. Any misrepresentation in his pay-roll makes the employer liable to ten times the difference between the correct and incorrect figures. If an employer refuses or fails to pay his monthly assessments, a workman injured in his service may sue in the courts with the employer's defenses of "fellow-servant," "assumption of risk," and "contributory negligence" abolished.

Injured workmen, their families or dependents, may re-

*170 Roseville Ave., Newark, N. J.

cover by law only where the injury is caused by the intent of the employer, in which case not only may the sums due under this Compensation Act be recovered, but suit may be brought for excess of damage over such amounts.

Where the injury to a workman comes as a result of negligence of the employer to observe safeguards as required by law or by the regulations of the department, the employer must pay 50% more than the fixed amounts. Where the workman intentionally injures himself he receives no benefit.

The schedule of payments for various injuries is as follows: In event of death, expenses of burial, $75; payments to widow or invaid widower, $20 per month while unmarried, $240 in lump sum on remarriage of widow; for each surviving child under 16, $5 per month, monthly total limited to $35; if no widow or widower survives, $10 per month to each child under 16 years of age. A like rule obtains to children who become orphans by death of surviving parent, with monthly limit of $35. Dependents will be paid 50% of the average monthly support formerly received from the deceased, limited to $20 per month. Parents of deceased unmarried workmen receive $20 per month up to the time deceased would have been 21 years of age.

Total disability, loss of both arms or one leg and arm, sight, paralysis, or other injury preventing work, entitles the workman to $20 per month if unmarried; if supporting wife or invalid husband, $25 per month; if husband is not an invalid, $15. For each child under 16, $5 per month additional is allowed up to a total of $35 per month. In case of death of the totally disabled workman, the widow or widower receives $20 per month until death or remarriage, and $5 per month additional for each child under 16. Orphan children receive $10 per month.

Partial disability, loss of one foot, leg, or hand, eye or fingers, entitles the workman to a certain cash lump sum up to $1500. The loss of one arm at the elbow is made the maximum injury, and the payment for other injuries is scaled down in accordance. Should the injured workman reside or move out of the State, the Commission may lump the monthly payments to a sum not to exceed $4000, based on the American mortality table.

Any decision of the Commission is subject to an appeal in the superior courts.

WASHINGTON INDUSTRIAL INSURANCE COMMISSION.
EXPENSE ACCOUNTS

Mileage:		
Commissioners	$1,298 10	
Auditors	1,248 23	
Railroad fare:		
Commissioners	1,022 84	
Auditors	3,147 88	
Hotel account:		
Commissioners	1,638 44	
Auditors	4,722 34	
Incidental expenses:		
Commissioners	36 60	
Auditors	221 18	$13,378 61
Salaries:		
Commissioners	14,190 00	
Auditors	25,499 47	
Physicians	4,653 55	
Office	28,499 51	72,842 53
Miscellaneous:		
Stationery	6,251 13	
Postage	4,454 53	
Telephone	716 93	
Telegraph	110 66	
Office equipment	7,371 58	
General expenses	1,032 61	
Rent	1,849 50	21,686 94
Total expenses for period		$107,868 08
Accident payments		445,527 51
Total		$553,395 59
Total state Appropriation for 22 mo		150,000 00
Allowable average monthly expense		6,818 18
Actual average expense for 16 mo		6,741 75
Allowable total expense for 16 mo	$109,090 88	
Actual total expense for 16 mo	107,868 08	
Saving over allowable average	1,222 80	
Average allowable to accident fund		7,021 99
Actual total expense for September (last month of 16 mo.)		6,437 77
Total receipts, accident fund	$980,445 75	
Total expense	107,868 08	
Total fund		$1,088,313 83
Cash in Gen. St. Fd.	290,944 29	
Bonds in fund, 22	243,984 95	
Claims paid, 10 %	445,527 51	
Expense paid, 9 %	107,868 08	
100%		$1,088,313 83

First Year of Operation of Act

The accompanying table of accounts covers the total expense of the administration of the compensation law by the Industrial Insurance Commission for a period of 16 months, four of such being for preliminary work previous to the perod of active operation. The data has been obtained from the recent report of Howard L. Hindley, secretary of the commission.

From this statement it will be seen that the Commission is administering the law at a cost of 9.9%, obtaining such a low operation cost during its initial year despite the expense of inaugurating the system, the contingent cost of permanent office equipment, and the necessarily heavy traveling expenses.

The assessments against the various classified industries netted the accident fund during the first four months of active operation, $428,057.42; by a resumption of logging and mill enterprises in April, 1912, this was increased to $640,951.30, while the close of the first fiscal period effected a gross total collected of $980,445.75.

The first year's records show a gross expenditure of $689,512.46; of this, the sum of $445,527.51 was paid out directly to injured workmen and their dependents, with the elimination of litigation expense or excessive cost to the State at large; and $243,984.95 was invested in State school, county and municipal bonds, and the like, bearing an average rate of interest of 5¼%, to guarantee the payment of pensions now being distributed monthly to injured workmen.

A comparison of these figures with available statistics of private casualty insurance in the state is interesting. Against the expense of 9.9% as cost of operation to the state, the private casualty company is estimated to expend 60%; under such a private system of insurance, about $600,000 was collected annually from the manufacturing interests in the state with an average return of less than $100,000 to injured employees.

Insurance Cost to Employers

Continued Assessment of Contractors—In the first eight groups of classified industries, dealing with contractors and contracting, no insurance rates have been extended, but assessments are continuously made. Such system prevails for the following reasons:

(1) The extreme hazard of all operations in these classes demands a wide margin of safety.

(2) Among these classes there is none which has a sufficient balance to allow a point of reasonable safety in connection with a series of fatal accidents.

(3) Without continuous assessments the small contractor might easily escape payment on his short-term contracts.

(4) Accidents in these classes have been continuous, and assessments would necessarily have been levied finally to defray accident costs. With such conditions, the larger contractor, being well established and readily accessible, would have been compelled to bear the cost of not only his own accidents but also those occurring on the work of the smaller contractor who might have escaped assessment.

(5) The placing of contractors on the same plane for the purpose of bidding for contracts, demands that every contractor shall be assessed on every job.

(6) The general contractor is found listed in several classes—big work, small work, public work secured by

law, private work where the owner may be subjected to loss, and the like. Hence the equitable system appears to be that of continuous assessment until the fund may reach that figure where all can consistently be relieved.

The law, providing as it does for a readjustment of accounts each year, makes possible the correction of inequities or over-payments with but slight delay.

The need of legislation to cover "casual employment in contracting" has become evident. All such operations, as the erection of a barn, the construction of a temporary grand stand, the painting of a house, etc., are now difficult to list and assess, while additionally, the Commission rarely learns of them until an accident occurs, at which time both employer and employee make haste respectively to contribute and to demand compensation.

A typical instance of this is shown in the contribution of $3.85 by an employer, after a carpenter had lost his eye through a flying nail, while the accident cost the employers of that class $1,064.60.

Insurance Cost in Principal Classes—In the main, active classified industries of the state the cost of insurance to employers during the first fiscal period has been as follows:

Industry	Rate per $100 fixed by law	Rates per $100 assessed	Rates per $100 necessary
Class 10, logging, lumbering, etc	$2 50	$1 45	$1 45
Class 14, street railroading	3.00	0.75	0.23
Class 16, coal mining	3 00	1 50	1 23
Class 33, fish canning	3 00	0 75	0 14
Class 35, brick making	2 00	0 50	0 13
Class 38, textile manufacturing	1.50	0.38	0.12
Class 39, food-products manufacturing	1.50	0.38	0.09
Class 40, butter and cheese making	1.50	0.38	0.05
Class 41, printing	1.50	0.38	0.07
Class 44, ice making	2.00	0.50	0.27
Class 47, creosoting	2.50	0.61	0.18

Class 10; Logging, Lumbering—The fund obtained through a seven months' assessment of this class ($324,102.86) has been depleted by the payment of claims amounting to $206,146.50, and the investment in reserves has been $117,366.32, leaving a net balance of but $590.04. The size and activity of this industry make an early replenishing of this fund possible, and a second assessment call is now in progress.

Class 46; Powder Mills—The funds of this class have been overdrawn, due to the noncollection of assessed contributions. A rate of 5% of total payrolls instead of the 10% assessed would have been sufficient, with proper collection, to defray the compensation for accidents in this industry, including the disaster at the plant of the Imperial Powder Co., Chehalis, on Nov. 1, 1911. A statement of this class will show a balance when paid as below:

Ten per cent. of payrolls, Oct., Nov., Dec	$3,956.49
Deficit, Jan. 1, 1912	4,302.86
Ten per cent. of payrolls, Jan. 1 to Oct. 1	11,811.99
Total	$20,071.34
Less pension reserves, and burial allowances	8,259.35
	$11,811.99
Penalty on Imperial Powder Company for employing two girls under lawful age	1,297.16
Balance (when collected)	$13,109.15

Number of Pensioners

The pension roll has increased from the first pensioner in October, 1911, a widow and her son with a monthly income of $25 guaranteed by the state, to 235 persons at the end of the first fiscal year, including widows, helpless parents, and fatherless children with a total monthly distribution of $2,364.50.

The death claims brought to the attention of the Commission are in process of settlement as follows:

Pensions awarded	121
Suspended and rejected (no dependents)	191
In state of investigation	38
Incomplete	22
Total	372

Statistics on approximately 1000 cases brought before the Commission show that less than 3% of the accidents reported under this Workman's Compensation Act would be applicable to liability under the former law, effecting a total of about 97% of all the above cases probably uncompensated under the casualty-insurance system.

During the first year of operation, 11,896 formal reports of accidents were received by the Commission. The monthly average of such has been on the increase since the inception of the law, owing to the resumption of business in certain lines and a more complete understanding of the compensation act and its province. In February, 1912, the accidents reported totaled about 800, while in September of the same year the reports reached nearly 1000.

Appeals

Only twenty-one appeals have been taken to the courts from the decisions of the Commission on the 11,896 accident reports mentioned. Three of these were later withdrawn, three were tried, and the balance are now pending. One appeal is by an employer, three are by dependents of workmen, and the remainder by the workmen themselves. In but two cases have permanent disabilities been found by a jury in contradiction to the Commissioner's decision.

Forty-three suits have been instituted against defaulting employers to collect premiums due to the accident fund. Of such number, 17 were settled previous to judgment, four subsequent to judgment, and in seven cases judgments have been awarded but not yet collected. Eliminating two cases discontinued (one because the plant was not in operation after Oct. 1, 1911, and the other for the reason that the employer had no one in his employ after that date) 13 of the suits are still pending.

Nonhazardous Class Protection

Under Section 19 of the Workman's Compensation Act, mutual protection is provided for a nonhazardous class, by which employer and employee may jointly elect to come within the jurisdiction of the law, although technically excluded by the nature of their business. The mutual protection provided is at a rate of $1.35 per $100 as fixed by the law.

Employers who took advantage of this "elective adoption" feature of the act paid a three-months' premium at the rate of 34c. per $100, effecting a total sum collected of $1,092.30. Of this fund only $83.95 was required for meeting accident-loss, making a necessary rate of but 3c. per $100.

During this period of administration of the act, the Industrial Insurance Commission has been composed of George A. Lee, of Spokane, Chairman (representing the legal profession), C. A. Pratt, of Tacoma (representing the manufacturers and employers), and J. H. Wallace, of Seattle (representing the workingmen). The writer is indebted to a recent report of the secretary of the commission, Howard L. Hindley, for data relating to the first year's work and from which the foregoing statistics have been summarized.

The Cost of Irrigation Works per Acre Supplied with Water

In the early days of irrigation in the arid West, the work was carried on at a very small outlay by the farmers and ranch owners themselves by the simple process of turning the natural flow of the streams upon their land. All such easily appropriated water, however, was utilized a score of years or more ago. Practically all the recent irrigation work has had to be done, either by bringing water from a long distance in large canals, tapping good sized rivers, or by building reservoirs to store the flow of the flood season. In this class of work again, however, projects involving the least outlay were taken up first. There has been, therefore, a tendency to a constant increase in the cost per acre of irrigated land in the new enterprises undertaken year after year.

Another reason for the increased cost of irrigation work is the advance which has taken place in the cost of both labor and material. Hon. F. W. Mondell, Congressman from Wyoming, stated two years ago in the discussion concerning the proposed authorization of a $20,000,000 loan for the U. S. Reclamation Service work, that the prices of common labor in the West advanced 20 to 50% in the period from 1903 to 1911, and that the efficiency of such labor fell off in greater proportion.

TABLE I. COST OF PRIVATE IRRIGATION PROJECTS

Name of project or company	Acreage in project	Cost of water right charge per per acre (a)
COLORADO:		
Amity Canal	80,000	$100 (b)
Beaver Land & Irrigation Co.	20,000	175 (b)
Catlin Canal	25,000	100
Colorado Cooperative Co.	5,200	60
Denver Reservoir & Irrigation Co.	200,000	45
East Palisade Irrigation District	645	63
Fort Lyon Canal	70,000	100 (c)
Grand Valley Canal	40,000	60 (d)
Greely Poudre Irrigation Co.	125,000	45
Mesa County Irrigation District	2,568	73
Orchard Mesa Irrigation District	9,122	119
Otero Irrigation District	20,000	40
Palisade Irrigation District	6,000	41
Paradox Valley Irrigation Co.	30,000	45
Pueblo-Rocky Ford Irrigation Co.	100,000	150 (e)
Redlands Irrigation & Power Co.	5,000	100 (f)
Routt County Development Co.	39,000	45
South Palisade Heights Irrigation District	700	127
MONTANA		
Conrad Land & Water Co.		40
Great Falls & Irrigation Co.	36,000	50
NEBRASKA:		
Belmont Canal & Irrigation District	20,000	25 (g)
Tristate Canal	60,000	42
NEW MEXICO		
French Land and Irrigation Co.	40,000	50
OREGON:		
Bonanza Project	20,000	30
Eagle Valley	21,700	80
Furnish	6,000	60 (h)
Paradise	100,000	60
Willamette Valley	20,000	50
SOUTH DAKOTA		
Red Water Irrigating Association	4,000	40
UTAH		
Provo Reservoir	12,000	80
Utah Lake Pumping	8,000	40 (i)
WASHINGTON		
Cascade Canal Co.	10,000	50
Congdon Canal Co.	4,200	121
Kennewick Canal	14,000	163
Lower Yakima I. Co.	12,500	129
Selah Moxee	7,000	86
Sidney Valley Development Co.	10,000	150
Union Gap Irrigation Co.	5,000	135
Washington Irrigation Co.	50,000	16

(a) Engineers' estimate where project is proposed or incomplete.
(b) Estimated at from $75 to $150 per acre. Includes land.
(c) Estimated at from $75 to $150 per acre.
(d) Pre-emptor's right.
(e) Includes land.
(f) Estimated at from $50 to $150 per acre.
(g) For power rights only. Purchase of Pathfinder Reservoir water will increase this to $35.
(h) Estimated at from $50 to $70 per acre.
(i) Estimated at from $10 to $50 per acre.

To give a general idea of the cost of supplying water per acre, the U. S. Reclamation Service has recently compiled three tables, the first showing the cost per acre for water on private irrigation projects, the second the cost of the private irrigation projects carried out under the Carey act by various companies, and the third

TABLE II. COST OF CAREY ACT IRRIGATION PROJECTS

Name of project or company	Acreage in project	Cost of water right charge per acre (a)
COLORADO:		
Great Northern Irrigation & Power Co.	2,121	$35
Colorado Realty & Security Co.	45,875	45
Toltec Canal Co.	14,853	40
Colorado Land & Water Supply Co.	16,278	45
Two-Butte Irrigation & Reservoir Co.	22,000	35
Valley Investment Co.	24,000	60
IDAHO:		
American Falls Canal & Power Co.	57,242	40
Big Lost River Irrigation Co.	78,242	40
Birch Creek Irrigation Co.	20,000	50
Blackfoot North Side Irrigation Co.	22,280	
Black Canyon Irrigation District	98,492	72
Blaine County Irrigation Co.	14,720	40
Boise City Carey Act Project	151,000	
Bruneau Irrigation Co.	40,000	60
Emmett Irrigation District	5,800	50
Grandview Extension Irrigation Co.	1,000	65
Grassmere Irrigation Co.	47,500	65
Hansen, C. V., Mackay Project	3,456	40
Hegsted, Victor, Project	3,410	40
High Line Pumping Co., Ltd.	3,860	45
Houston Ditch Co., Ltd.	1,884	35
Idagon Irrigation Co., Ltd.	9,000	60
Idaho Irrigation Co., Ltd.	130,000	50
Keating Carey Land Co.	15,597	30
Kings Hill Extension Irrigation Co.	9,655	65
Kings Hill Irrigation and Power Co.	13,359	65
Lembi Irrigation Co.	3,500	50
Little Lost River Land & Irrigation Co.	20,000	30
Marysville Canal & Improvement Co., Ltd.	6,134	20
Owsley Carey Land & Irrigation Co.	8,600	35
Owyhee Land & Irrigation Co.	29,535	55
Owyhee Irrigation Co., Ltd.	3,296	45
Pahsimerai Project	6,000	30
Portneuf-Marsh Valley Irrigation Co.	11,914	35
Pratt Irrigation Co., Ltd.	4,674	40
Snake River Irrigation Co., Ltd.	6,500	50
Thousands Springs Land & Irrigation Co.	6,300	30
Twin Falls Land & Water Co.	244,000	25
Twin Falls North Side Land & Water Co.	207,144	45
Twin Falls Oakley Land & Water Co.	45,000	65
Twin Falls Raft River Irrigation Co.	99,668	50
Twin Falls Salmon River Land & Water Co.	127,707	40
West End Twin Falls Irrigation Co.	46,000	50
MONTANA:		
Billings Land & Irrigation Co.	27,000	40 (j)
Big Timber Project	17,194	60
Valier Project	115,100	40
OREGON:		
Central Oregon Irrigation Co.	139,204	40
Central Oregon Irrigation Co.	74,198	60
Columbir Southern Co.	27,000	50 (k)
Deschutes Land Co.	31,082	26
Deschutes Reclamation & Irrigation Co.	1,280	40
Desert Land Board	27,000	
Portland Irrigation Co.	12,000	46
Powder Land & Irrigation Co.	65,000	100 (l)
UTAH:		
Mosida Pumping Plant	8,000	150 (m)
WYOMING:		
Big Horn County Irrigation Co.	20,411	50
Boulder Canal	6,120	30
Burch Canal	35,887	50
Carbon County Land & Irrigation Co.	7,793	30
Cody and Salsbury Canal	77,199	
Cody Canal	26,429	50
East Fork Irrigation Co.	4,901	30
Eden Land & Irrigation Co.	95,658	30
Elk Canal	2,724	30
Fisher Ditch	320	10
Green River Land & Irrigation Co.	75,257	35
Hammitt Canal	6,295	60
Hanover Canal	10,682	50
Hawk Springs Project	12,238	50
Hubbard Canal	38,604	40
Jamee Lake Irrigation Co.	11,554	35
La Prele Ditch & Reservoir Co.	18,558	50
Lovell Irrigation Co.	11,320	25
McDonald Canal	15,159	50
Medicine Wheel Canal Co.	22,000	
North Laramie Canal Co.	4,133	50
North Platte Canal & Colonization Co.	14,424	30
Big Horn Basin Development Co.	204,650	50
Paint Rock Canal	53,162	50
Platte Valley Canal	18,171	30
Rock Creek Irrigation Co.	11,696	45
Sahara Ditch Co.	7,920	50
Sidon Canal and extensions	20,559	30
Tensleep-Bonanza Canal	10,886	40
Uinta County Irrigation Co.	26,000	35
Wheatland Industrial Co.	33,115	45
Wyoming Land and Irrigation Co.	4,526	50

(a) Engineers' estimates where project is proposed or incomplete.
(j) Estimated at from $20 to $60 per acre.
(k) Estimated at from $50 to $60 per acre.
(l) Estimated at from $75 to $200 per acre.
(m) Estimated at from $100 to $250 per acre, including land.

TABLE III. COST OF U. S. RECLAMATION SERVICE PROJECTS

State	Project	Approximate acreage	Cost per acre From	To
Arizona-Cal.	Yuma	131,000	$55	$66
Idaho	Minidoka	118,700	22	30
Montana	Sun River	216,346	30	36
Montana-North Dakota	Lower Yellowstone	60,116	45	
Nebraska	North Platte	129,270	45	55
Nevada	Truckee-Carson	206,000	22	30
New Mexico	Carlsbad	20,277	32	45
Oregon	Umatilla	25,000	60	70
Oregon	Klamath	72,000	30	
South Dakota	Belle Fourche	100,000	30	35
Washington	Okanogan	9,900	55	
Washington	Sunnyside	102,824	52	
Washington	Tieton	34,613	93	
Wyoming	Shoshone	164,122	45	50

the cost of water rights on some of the U. S. Reclamation Service projects which have been so far completed that charges for water rights have been fixed.

The figures in the tables have been obtained from published reports of state engineers and other published data. It appears from Tables I and II that on some 90 modern irrigation works built by private enterprise the cost of water rights per acre averages about $53. It will be understood, of course, that this sum does not include the annual charge for operation and maintenance of the works.

On most of these private irrigation projects, settlers pay for their water rights in installments, the deferred payments bearing interest at a rate of at least 6% and often more. On the various irrigation projects built by the Federal government under the Reclamation Act, the average cost of the water right is a little over $41 per acre, or about $12 an acre less than on the recently built private works of a comparable size. The difference in cost to the settler is even larger than this, because while a settler on a Reclamation project also pays for his water right in annual installments, the deferred payments bear no interest.

It will be agreed without doubt by those who are familiar with the relative character of the engineering construction work on the government irrigation projects and on irrigation works built by private companies, that the government work is on the whole superior in permanence and thoroughness. In fact, one of the most common criticisms of the Reclamation Service has been that the engineers were spending more money in making the work substantial than the settlers could reasonably afford to pay.

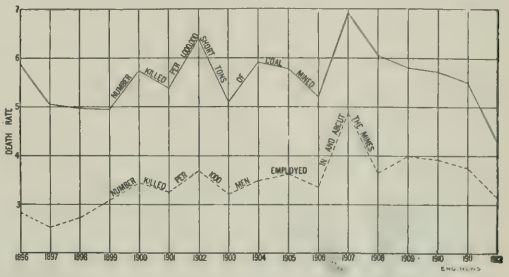
It will be appreciated, however, that to build substantial and permanent works makes the settlers' water rights so much the more secure and also reduces the annual charge for maintenance.

It is fair to add also that the investigations to determine the sufficiency of the water supply have generally been more thorough on the government irrigation works than on most private projects.

Of course these are the conditions which ought to obtain. The government engineers have had the advantage of plenty of money to work with and have not been hampered with insufficient capital as have many of the engineers employed by private companies. This consideration, with the fact that the capital advanced by the government bears no interest as does the money raised by bond issues for private irrigation works, gives sufficient reason why the work carried out by the government should be much more advantageous for the settlers than the work which the private companies have been able to do, as is shown by examination of the tables printed herewith.

The Decrease of Coal-Mine Accidents in the United States*

The coal-mining accidents of the United States for the year 1913 have been recently compiled by S. W. Horton, of the U. S. Bureau of Mines and a bulletin is being prepared showing statistics of accidents from 1896 to 1912. In 1912, 2360 men were killed in the coal mines of the country. With an output of 550,000,000 short tons, produced by 750,000 men, the number killed for each million tons of coal mined was 4.29, and the death rate per thousand employed was 3.15. The actual number of men killed was the smallest since 1906 and, as shown by the accompanying diagram, the rate per thou-



Death Rates in Coal Mining for Years 1896 to 1912

sand employed was the lowest since 1899, while the deaths per million tons mined were the fewest yet.

It is claimed that while the exceptionally mild weather in the last few months of 1912 decreased the likelihood of disastrous coal-dust explosions, yet there has been a progressive improvement in mining safety. This improvement is attributed first to more efficient mine inspection of the various state mining departments throughout the country, in part to the greater care on the part of operators and miners and, in part, to the investigations and educational work of the U. S. Bureau of Mines.

*From information supplied by the U. S. Bureau of Mines, Washington, D. C.

Portable and Stationary Car-Dumping Machines have been developed in Germany for dumping end-door coal cars. In one design the machine is a small four-wheeled truck carrying curved girders (in a vertical plane), whose chord is at about 45° from the horizontal. The upper end is supported by a tower or bent on the truck. The lower end reaches within a few inches of the rails, having hinged rails to lie on the track and connect with the rails on the inclined girders. The track carries a hoist, with a cable passing over a sheave at the head of the girder frame. The machine stands just beyond a dumping pit or hopper beneath the track, and hauls the coal car up the incline, so that when the lower end door is removed the coal will flow into the pit. In another design, a double-truck flat car carries a turntable with pedestals supporting the trunnions of a tilting platform. Portable inclines extend from the car deck to the track. The platform is tilted to register with the incline and a coal car is hauled upon it. The platform is turned 90° and the car dumped endwise at the side of the track. The platform is then turned 90° more, and the empty coal car is run off at the opposite end of the flat car.

In the same plan as applied to permanent or fixed plants, a steel or masonry tower beyond the hopper supports the inclined track. A more important development has a long incline, the upper end being over hoppers, which are at such a height above the ground as to allow cars to be run beneath them. The coal car is hauled up the incline, which ends in a steep vertical curve on which the car stands while dumping into the hoppers. The coal cars handled by these machines are four-wheel cars of 10 to 12 tons capacity.

The City Waterway Bridge, Tacoma, Washington

The accompanying figures show two views of the new City Waterway Bridge at Tacoma, Wash., which has just been opened for traffic. The view on the left, Fig. 1, shows the west approach to the main structure and the closed drawbridge. The view to the right, Fig. 2, shows the drawbridge open, and the east approach truss. The bridge connects the business center of the city on the hill to the west, with the manufacturing center on the tidal flats at the east. It occupies the line of 11th St. and consists of a main deck with a 50-ft. clear roadway and two 10-ft. clear sidewalks, and a lower deck on the west side of the waterway, having a 19-ft. 4-in. roadway and one 10-ft. sidewalk, carrying 11th St. down to the water level.

The approach on the east side of the bridge consists of about 100 ft. of reinforced-concrete retaining wall, and about 575 ft. of steel-girder and column viaduct. The other approach consists of timber trestle, and the main bridge has two 190-ft. fixed truss spans and a 220-ft. vertical lift span, affording a clear waterway 200 ft. wide. The vertical clearance beneath the lift span at high tide is 60 ft. when the span is down, and 135 ft when the span is up. There being about 20 ft. of tide here, the clearance at low tide is 80 ft. with the span down, or 155 ft. with the span up. A 16-in. water main is carried from the ground, up the shore piers, and over the tops of the trusses of the fixed spans, then up the back of the towers and over the lift span on the light truss shown in the view. The bridge is paved with wood blocks and planks, and a double-track street railway is carried in the center of the roadway.

The piers are made up of the frustums of two cones connected by a reinforced-concrete web, the main solid portion of each cone being of mass concrete. They are carried in open coffer-dams to a footing of piles which have their heads about 35 ft. below low water and their points in some cases as deep as 115 ft. below low water.

The lift span is of the Waddell & Harrington type of design, each span consisting of a simple truss span suspended at its four corners by wire ropes which rise over cast-steel sheaves at the top of the towers and connect to concrete counterweights to balance the span. The operating machinery located in the house on the top chord of the suspended truss is actuated by motors connected to the street-railway circuit. Electrically driven gates operated from the motor house close each of the approach spans before the bridge can be raised.

During the construction of the new bridge, traffic was maintained across the waterway by building a trestle on the south side of the west half of the bridge, and the north side of the east half of the bridge, and connecting these two trestles by an old low-level swing span, which was part of an old bridge on the line of 11th St. The remainder of the bridge was taken down to allow for the construction of the new bridge. The trestle and old drawbridge were removed on completion of the high-level bridge.

The bridge was built by the City of Tacoma, under the direction of W. C. Raleigh, City Engineer, and Owen Wood, Commissioner of Public Works. The bridge was designed and its construction was supervised by Waddell & Harrington, Kansas City, Mo. The machinery and metal work for the superstructure were furnished by the American Bridge Co., and the International Contract Co., of Seattle, constructed the substructure and erected the superstructure.



Fig. 1. West Part of Bridge, Showing Drawbridge Closed



Fig. 2. East Part of Bridge, Showing Drawbridge Open

Figs. 1-2. The City Waterway Bridge, Tacoma, Wash.

Street Accidents in London, England, cost the lives of 538 persons and injuries to 16,651 more in the year 1912, according to statistics issued by the British Home Office. The greatest number of fatal accidents from any one class of street traffic was 182 deaths caused by motor omnibuses; electric cars caused 37 deaths; motor vehicles, 171; horse-drawn vehicles, 143, and horse-drawn omnibuses, 5. More than half the nonfatal accidents were due to motor omnibuses and other motor vehicles.

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Grade-crossing Abolition in New Jersey must be done hereafter at the sole expense of the railways concerned, according to an act passed by the legislature near the close of the session. In a protest to Governor Fielder urging that the bill be vetoed, President Samuel Rea, of the Pennsylvania R.R., said:

It is important that the public should understand that in the passage of this bill a grave injustice has been done the railroads.

In the last 20 years the Pennsylvania R.R. has removed 110 crossings in the State of New Jersey alone, at an expense to the company of about $8,000,000, of $73,000 per crossing. There are very few crossings of its railroad at grade in any of the cities. The company is now engaged in the work of track elevation through the city of Rahway, and eastward. There remain, however, some 1200 grade crossings on the Pennsylvania system in this state, the removal of which at $50,000 per crossing would cost $60,000,000, an expenditure which would neither produce additional revenue, nor decrease expenses.

The removal of grade crossings should unquestionably continue. The need is for some impartial tribunal, which shall have authority to arbitrate between the municipality and the railroad company and to bring them into coöperation if they cannot agree. Power should be vested in some administrative board, acting judicially, to take up, on the application either of a municipality or a railroad company, or on its own initiative, the case of any grade crossing, and after a hearing to direct the elimination of the crossing and the particular manner in which it shall be done and how the expense shall be proportioned.

Generally speaking, such is the arrangement in New York, Massachusetts, Vermont and Ohio. With so many crossings still to be eliminated it seems unfair and unwise to propose that the railroad companies should be burdened with eliminating grade crossings, many of which have been opened subsequently to the construction of the railroads, and against which the entire cost, or an undue proportion of the cost, of these strong protests

EDITORIALS

The Water-Filtration Question at Cleveland

The remarkably low typhoid death rate of Cleveland, Ohio, in 1912 (about 6 per 100,000) seems on its face to be wholly incompatible with the contention of the local board of health and certain members of the city council that the water-supply is so badly polluted as to make the immediate construction of a water-filtration plant imperative.

Some time ago a committtee of the Engineers' Club of Cleveland investigated filtration and made an adverse report which headed off a proposed bond-issue ordinance then before the city council. Early in 1912, D. D. Jackson, of New York City, made an exhaustive report on the Cleveland water-supply, with the conclusion that filtration would be chiefly of esthetic value, for the present, and that the wiser plan would be to carry out improvements which would continue still further the separation of the sewage discharges from the water intake. These improvements are now in progress or early prospect, and will result in lessening the volume and frquency of possible infection, both of which are held by Mr. Jackson and other competent persons to be relatively small. Meanwhile, it should be noted, the water-supply of Cleveland is being disinfected with hypochlorite.

Within the past few weeks the city council of Cleveland, or certain members of it, have tried to force the mayor, Newton D. Baker, into aquiescence with their advocacy of filtration. There has been much talk of an appeal to the State Board of Health for an investigation of the subject. In fact, the council did pass a resolution to that effect, but it appears that the resolution was not in such terms as would give the board authority to order filtration, since the resolution did not declare the water-supply to be a menace to health.

While we sympathize with every well considered effort to improve the quality of city water-supplies, we are not convinced by such of the arguments as have come to our attention that filtration at Cleveland is as vital to the health and as essential to the comfort and convenience of the people of that city as other objects of municipal expenditure. This, we understand, is the opinion of Mayor Baker, and we also understand that the officials in direct charge of the water-works are of the same opinion

The question of water filtration at Cleveland or elsewhere should be settled on the basis of whether the expenditure of a given sum for this or other purposes will yield the greatest benefit to the largest number of people. The city authorities have taken competent expert advice as to the need for filtration and they have also had the public-spirited advice of leading engineer-citizens. True, the board of health is strong for filtration, but its viewpoint (we may unwittingly do it injustice) seems to be the narrow medical one of advocating a counsel of perfection, with no careful weighing of the benefits to health which will ensue and with little or no regard for cost or for the other health and general welfare needs of the city.

Presumably Cleveland, like all other cities dependent upon surface water-supplies, will yet have a filtration plant. The question for it and other cities to consider is whether, in view of financial and other local considerations, filtration or something else should take precedence at a given moment. The evidence before us points to a delay in filtration at Cleveland.

The Responsibility of Engineering Societies to Their Members

An eminent scientist, resident in New York City, was employed by the Federal Government to perform certain expert scientific work. A Congressional Committee, in presenting a report of a recent investigation, made serious charges against this scientist. The report was given out to the press and was widely published.

The New York Zoological Society, of which the scientist referred to was a prominent member, took up the matter for investigation. The Executive Committee of the society found that the report of the Congressional Committeee referred to had been prepared by the chairman alone and had never been submitted to the whole committee for its adoption. Further examination of the testimony taken before the committee showed there was nothing whatever in it which cast any reflection on the honesty or honor of the scientist referred to. The Executive Committee therefore adopted resolutions reciting the result of its investigation and declaring that the scientist should be exonerated from all blame, and that the attack upon him was unjustifiable, malicious and untruthful.

It is, unfortunately, true that the injury done to a man's reputation when it is attacked by Government officials, either executive or legislative, cannot be wholly cured when a man's professional associates exonerate him from all blame. The newspapers give wide publicity to scandal; but small space to a man's defence of his reputation.

This is not a sound reason, however, why a professional society should refrain from doing what it can to protect its members when they are unjustly accused. Any engineer who has been in a position where he felt that every man's hand was against him, through no fault of his own, can appreciate how welcome at such a time is the knowledge that his own professional friends and associates have not lost faith in him and in his honesty.

It may be objected also that if an engineering society were to undertake to investigate in a judicial manner every case in which unjust accusations are brought against any of its members, its task would be a very large one. Good judgment would dictate, of course, that such investigations should be confined to the special cases where the prominence of the accused, or the impossibility

of resort to the ordinary methods of defending one's character make the case one meriting action by the society.

Care must be taken, of course, that a professional society shall not undertake the defense of its members when they are justly deserving of censure. The best rule to adopt would probably be to imitate the organizations in other professions. The cases are not at all infrequent where a local medical association, or clerical association, or bar association will take formal action for the investigation of some case where a prominent member of the organizations named has had his reputation assailed and will, after judicial investigation, bring the influence of the whole organization to the defense of the accused party.

We see no reason why organizations of engineers should not be equally ready to come to the refense of their members. It is, of course, evident that when an engineering society undertakes to defend the reputation of an engineer unjustly attacked, it is really defending the reputation of the profession as a whole.

Where Should the Money for Good Roads Construction Be Spent?

A recent headline in the automobile department of a metropolitan newspaper raises a very pertinent question as to the location of good roads. The headline reads as follows:

"Roads that Go Somewhere Is the Cry—Various Plans for National Highways—One Would Connect All State Capitals."

Even a cursory examination of the literature which is being widely circulated to further the building of good roads shows clearly that what the manufacturers and owners of pleasure automobiles chiefly desire are roads from city to city for the use of automobile tourists. It is not to be denied that these people constitute a large and very influential portion of the population, and that they pay by reason of their wealth an amount of taxes far greater than their importance numerically.

On the other hand, it is a very serious question how far the States are justified in expending money raised by general taxation in the construction of highways to be used chiefly for pleasure purposes by a comparatively small proportion of the taxpayers, especially when the money is to be raised by placing a mortgage on future generations, as happens when good roads are built by bond issues.

The stock argument in favor of good roads has long been that it would enable the farmer to haul his produce to market more cheaply. If this is reason for the construction of good roads, the money should not be spent in connecting city with city, but in building roads radiating from each city out to the country districts surrounding it. Up to the time when automobiles became numerous, a half-dozen years ago, such radial roads were in fact the only highways which carried a considerable traffic. Traffic over roads connecting one city with another was actually less in volume than it used to be a half century ago before railways, steam and electric, became supreme in the carriage of both freight and passenger traffic.

Massachusetts and New Jersey, which were the pioneers in State road construction, both confined their efforts in the earlier years of their work to the construction of radial roads. Notwithstanding the advent of the pleasure automobile and of the freight truck, we believe that this should still be the primary aim in the distribution of state appropriations for road construction. After such radial roads are completed, it will often be possible, especially in the thickly settled states of the East, by comparatively moderate expenditure to fill in short gaps so as to create the through roads which the automobilists naturally desire.

It is entirely clear, however, that the automobilists are not willing to take second place. They are concentrating their agitation, as stated above, on the construction of through roads. In doing this, however, they are incurring inevitably the opposition of the farmers and of the business men in the smaller cities as well. In more than one state legislature, the battle over road appropriations is turning upon the question whether the money is to be spent for the benefit of the public as a whole or for the automobile tourists.

It is not without interest in this connection to call attention to the fact that the through roads which the auomobilist desires will have a much higher rate of wear and will require larger sums for maintenance than the local roads which the general public desires. It is on these through, city-to-city roads that the motor-car tourist runs his car at 30 to 40 miles an hour, and high-powered automobile freight trucks go tearing along at a speed which is ruinous to the road which the taxpayers have to maintain. It seems to us, therefore, that the influence of the engineering profession should be exerted on the side of the local roads.

Control of Railway Operation by Organized Labor

As was predicted at the time, the demand made last year by the engineers and firemen employed by the railways e ast of Chicago for an increased rate of wages has now been followed by similar demands made by the conductors and trainmen. The railway companies have refused these demands but in view of the previous success of the engineers and firemen, there seems no room for doubt that the conductors and trainmen will demand arbitration under the Erdman Act as the alternative of a general strike.

In the event of a general strike covering all the railways of the country, or any large part of the country, it would be a practical impossibzility for the railways to obtain men competent to take the place of the striking workmen. This will be agreed to by all who realize the complicated and intricate character of modern railway operating conditions. It is an absolute necessity both for reasonable safety in train movement and to avoid congestion of traffic to have employees who are reasonably familiar with their duties.

In order to make the position of the railway labor unions absolutely impregnable, however, and to prevent the possibility of a railway replacing its striking workmen, even in the case of a strike on a single railway, a bill has been introduced and is being actively urged before the Pennsylvania legislature which would prevent any railway company in Pensylvania employing any conductor or engineman unless he has had 18 months pre-

vious experience in railway service. This experience must have been either as a brakeman or a switchman in the case of candidates for a conductorship, or as a fireman or engineman in the case of candidates for appointments as engine runners. The enactment of such a law would amount to insurance by the state that any strike of railway employees would be successful.

Such pending state legislation, together with the possible adoption of a federal law under which labor organizations will be exempt from prosecution under the Sherman law against monopolizing trade and commerce, furnish new reasons why Congress, in the interest of the public, should undertake at the present session the legislation which has been asked for by both railway officers and railway employees for better adjustment of their relations and the prevention of strikes.

LETTERS TO THE EDITOR

Unbalanced Bidding.

Sir—The article on Unbalanced Bidding, p. 777 of your issue of Apr. 17, seems to show that both parties to the controversy are wrong, inasmuch as each tries to bring the other to a false basis on which to canvass bids.

The trouble originates in the vicious regulation, practically making it a misdemeanor on the part of the engineer if the final quantity of any item exceeds the upset quantity given in the specification. My practice for many years has been to make the quantities of uncertain items in the bidding schedule 10% or so smaller than the actual estimated quantities, the reduction being as nearly symmetrical as possible. It has been my invariable experience that contractors are satisfied if the final measurement exceeds that on which they made their bid. On the other hand, if said measurement is much less, they invariably feel disappointed and frequently demand a remeasurement.

Occasionally, superior officers have criticized me for following this practice, but I prefer to deal with them rather than to pacify disappointed contractors. If it is possible to give the exact quantity of anything, as length of pipe or number of valves, as noted in the article, such quantities should, in all honesty, be given. Specifying two valves when it is known that but one is required, is certainly deception. It is manifestly impossible to give exactly correct quantities of most items of a contract. They must necessarily over- or underrun. Then why is it not as fair to make them small as to make them large if the former tends to harmony in settling with contractors? Unbalanced bidding schedules are certainly as vicious and indefensible as unbalanced bids. Both are sure to lead to trouble. The only excuse that can be offered for padding the bidding schedule is to insure that the final cost will not exceed the aggregate as shown by the bid. There are two reasons why this excuse should have no weight:

(1) This aggregate is not the engineer's estimate. It is entirely vicious for authorities to delay ordering the execution of work until bids are received, because for anything except the most unusual work, engineers can estimate the unit prices nearly enough so that the authorities can decide whether or not they wish to invest the capital involved. If such estimate is between the final cost based on the higgest and lowest bids received, it is certainly close enough and in fact much nearer the final cost than an unbalanced schedule multiplied by an unbalanced bid. Corporation lawyers have no right to consider the aggregate of the bidding schedule an estimate of the cost of the work.

(2) An engineer should not manipulate the work to make its cost match the estimate. I once knew a builder of odd lots of machinery who told me that he made a practice of never adding up his cost till the work was done for fear that he would be tempted to skimp if a loss was in sight. This is the true spirit. Do the work right whatever happens. The pride of matching one's estimate is mere vanity.

In localities where the drastic regulations of the New York charter and the corporation counsel do not prevail, there is generally no trouble between engineers and contractors if both intend to be fair. It is probable that the era of price competition between contractors is passing, as it has passed between transportation competitors. What will follow is uncertain. Reforms follow when conditions become unbearable. It would seem that this point is nearly reached when known quantities are doubled in the bidding schedule and 1c. per cu.yd. is bid for rock excavation in trench.

J. P. Snow.

Boston, Apr. 21, 1913.

Sir—I have read with interest the article in your issue of Apr. 17 entitled "A Plan to Eliminate Unbalanced Bidding on City Contract Work." This is a subject of great interest and importance. It is surprising that it has not already received more thorough discussion. By way of stimulating the present discussion, permit me to suggest another means of accomplishing the same end.

When it becomes necessary to let a contract for a piece of engineering work at public letting, let the engineer write into the contract the unit prices used in his preliminary estimate. Let these prices be sufficiently liberal to insure a good profit on the work, a profit that will compare favorably with the profits derived from other lines of business. Then let the bidder be required to state in his proposal the largest actual payment which he is willing to make to the party doing the work for the privilege of entering into the contract containing the unit prices from the engineer's estimate.

It will be an easy matter to recite offhand numerous reasons why this method would not be successful. The one which occurs first is that a considerable investment

might be required at the beginning of the work and that the funds for such an investment are not generally available. It is doubtful whether this objection is sound.

On the other hand it would effectually eliminate unbalanced bids, it would not require the bidder to disclose his knowledge of the cost of work, it would do much to eliminate irresponsible bidders and when the contract is finally executed the returns from the contractor's operations would at all times be sufficient to cover the cost of the work and leave a margin of profit sufficient to induce its completion by other parties if at any time the contractor should lose heart.

ALBERT J. HIMES.

Cleveland, Ohio, Apr. 24, 1913.

French and German Literature for Electrical Engineers

Sir—I have read with great pleasure Mr. Herschel's article, "The Study of Modern Languages in Technical Schools," in your issue of February 27. In expressing my appreciation therefore, I trust you will permit me to add a few remarks on this subject with especial reference to electrical engineering.

Mr. Herschel attacks a vital defect in American technical education when he writes that "the accumulation of facts is not the most important thing." Nevertheless, it continues to be regarded so in most of our universities, and graduates are turned out with plenty of facts but with very poor grounding in fundamental principles. Hence, the young graduate, while usually very fluent in the time-worn and classical, but often hopelessly out-of-date class-room problems, is lost when he gets off the beaten track.

This point is somewhat related to the question of the value of modern languages, since we find that German and French mathematical and technical literature is taken up more with the exposition of principles, whereas, the American and British is more on the order of accumulation of facts and solutions of particular problems.

With reference to the relative values of German and French for electrical work, there is little doubt that German is, on the whole, superior.

Some of the reasons for the general superiority of German over American technical literature are not far to seek. First, in Germany we find a very large number of research workers and advanced students who both create and demand a large supply of literature of high order, and this, in turn, has developed large and magnificent publishing interests. Second, for the most part the aim of German writers is to produce something readable, that is not a mere setting down of facts, but a connected account or expansion of a subject, presented in such manner as to require the least amount of time and mental effort on the part of the reader.

The vast amount of German technical literature and the field of operations covered by some of the large publishers is surprising to one acquainted with only American and British literature. Consider the enormous number of high grade books on mathematics, mathematical physics and technical subjects published by B. G. Teubner, and those on engineering subjects published by Julius Springer. The list offered by the former, both as regards number and quality, can scarcely be approached by any other publisher in the world, and when we find in this list a half dozen or so books printed in English and written by American mathematicians, we gain some idea of the enterprise of this publishing firm and the extent of its operations. One of these writers once explained to me that the American publishers were not so liberal and, what was more important, that a work published (even in English) in Germany by B. G. Teubner was assured of a much larger circulation than if published in America. Whether the language used be German, French or English (and indeed Italian) makes comparatively little difference to the European mathematician but it must be in English to have any sort of circulation in English-speaking countries.

When the American student has acquired a good reading knowledge of German, there is at once open to him a store of literature that would, otherwise, be closed. For the percentage of literature that is translated is small and much of the best is never translated at all. Moreover, translations are usually late in appearing and quite frequently the original excellence is lost.

A good example of a German electrical work, is "Die Wechselstrom technik" by Arnold and LaCour. This work is devoted exclusively to alternating currents and consists of six volumes containing in all about 4000 pages. While encyclopedic in dimensions, it is most carefully written and Arnold was not only well known as a writer but also as an investigator and inventor. (The Wagner single-phase motor, made in St. Louis, was originally manufactured under a patent issued to Arnold and has enjoyed a large and successful use in America.) The foremost American work on alternating currents is undoubtedly Steinmetz's two books, "Alternating Current Phenomena" and "Transient Electric Phenomena and Oscillations," containing together, a little less than 1400 pages. The best British work on this subject is probably Russell's "Alternating Currents" in two volumes with a total of less than 900 pages—about as much as the one volume of Arnold devoted to synchronous machinery.

I do not wish to be understood as detracting in the least from the value and worth of the two mentioned works in English, for their quality is quite as high as anything in any language and Steinmetz's "Alternating Current Phenomena" is considered a classic not only in this country but in many others. But the comparison illustrates quite nicely the fact that German scientific literature is considerably more extensive than American and British. Furthermore, our foremost writer on electrical subjects is of German birth and education—a writer whose numerous and excellent contributions have given American electrical literature a place immeasurably higher than it would have without them. I refer to Dr. Steinmetz.

Perhaps German is of more value to the electrical than the civil engineer, but let those who would deprecate too much the value of French and German remember that much of the value to be got from European scientific and engineering activity can only be obtained through a knowledge of these languages.

R. C. POWELL.

Superintendent of Electric Distribution, Oakland District, Pacific Gas & Electric Co., 518 Thirteenth St., Oakland, Calif., Apr. 15, 1913.

Sir—I have read with much interest the article by Prof. W. H. Herschel on "The Study of Modern Lan-

guages in the Technical Schools," and your editorial on the same subject, in the issue of Feb. 27.

The average teacher of languages makes his subject much more uninteresting to the student than is at all necessary. He lumbers up the study with a long list of rules of grammar, which few can understand and scarcely anybody remember, giving to each one a very imposing list of exceptions which are still more difficult to remember, and pays little attention to the vocabulary. The reading lessons are used largely as illustrations of the rules of grammar and consist mostly of extracts from classical authors, which are none too easy to understand, even after proper translation into English.

A reading knowledge of French technical literature can readily be acquired. The language used by French technical writers is generally very clear and simple. The construction of the French language differs but little from that of the English and nearly all the scientific and higher technical terms closely resemble in form the corresponding ones in English, although there is sometimes a shade of difference in the meaning. Technical dictionaries are sometimes useful but it is better for the specialist to start with elementary treatises in his line, in which the technical terms are defined. This, of course, is true of any foreign language.

So far as the rules of grammar are concerned, a reading knowledge of the German language also can be acquired without much difficulty, if the rubbish can be eliminated. The vocabulary is, however, more difficult to acquire than the French. Aside from the chemical terms, nearly all the words are derived from German roots, and the scientific and technical terms do not, as a rule, resemble those of corresponding meaning in English. Many common words have more than one meaning and this is perhaps the most serious difficulty the student has to contend with. The key to the language is a thorough understanding of the rules relating to derivatives, a subject which is strangely neglected by many teachers. The German writers are much inferior to the French in clearness and simplicity and some of them appear to take pride in the fact.

A knowledge of a foreign language is much more useful to some engineers than to others, but no young man can say in advance, even approximately, what his career is to be. I think that a man can hardly be considered well educated unless he has a good reading knowledge of either French or German or, better still, of both. It will almost certainly be useful to him at some period of his career. If he does not acquire it in his youth, it is doubtful if he ever does. It takes patience and hard work, but it pays. As in many other cases the difficulties diminish greatly, if resolutely faced.

As to the comparative value of calculus and German, most of the better classes of French and German technical books and periodicals are written for university graduates, use calculus freely and occasionally indulge in determinants, projective geometry and other branches of higher mathematics, besides chemistry, geology, etc.

Regarding the value of foreign technical literature; the further an engineer advances in his profession, the more his ingenuity and resourcefulness come into play and the more insistent becomes his search for ideas and information of many kinds from every possible quarter. The French engineers are brilliant, ingenious and artistic; therefore their works are worth studying. The Germans are patient, painstaking and wonderfully industrious and have a genius for profound investigation, which has produced epoch-making results. Their most exhaustive researches are seldom translated in full. They also produce many treatises on scientific and technical subjects, which are encyclopedic in character and contain many records of work which has been done in that line and which are extremely valuable sources of information for the engineer. None of these has been translated, so far as I know.

As to the best time to study this subject, the earlier the better. There are schools in New York City, in which children of newly arrived foreigners are taught English to prepare them for attendance at the public schools. A three months' course prepares them nicely. I see no reason why a high-school student could not learn to read understandingly in one year, if properly taught, ordinary literature in a foreign language. After such a course, a moderate amount of practice in college, to dissipate his dread of the undertaking, should start him on his way.

I know little of technical literature in either Spanish or Italian, but judging from the references in current literature, there seems very little of any value in Spanish, while the Italians are forging ahead a great deal in mathematics and are doing some excellent engineering work. They are, moreover, almost as artistic as the French. The Norwegians and the Swedes are doing excellent work, the records of which often get into print either in French or German. They are fully as able, man for man, as the Germans but are fewer in numbers. The Russians do some good work, which becomes known to the outside world through the enterprise of the Germans. The same may be said of the Hungarians, etc., in Austria. It is thus seen that the German language is the key to a much larger store of knowledge than the French, yet the latter language is so easily learned, that it is well worth while studying.

Looking into the future, the indications seem to be that, as a liberal education becomes more accessible a greater number will be able to read French and German, rendering it less necessary to translate the more advanced works into English. Hence the progressive engineers of the future, many of whom are now in college, will find it more useful to acquire a knowledge of those languages, than do those of the present generation.

WILLIS WHITED.
Engineer of Bridges.
State Highway Department, Harrisburg, Penn.
Mar. 31, 1913.

City Topographic Surveys

Sir—Your issue of Apr. 3 contains a valuable article on the Topographical Survey of Cincinnati, Ohio, and the reasons for deciding on certain methods of work and limits of error are clearly set forth.

It seems to the writer, however, that a scale of 400 ft. to the inch is rather small for the intended purpose, and that 200 ft. to the inch would be more suitable for designing and laying out drainage areas and sewer and street lines.

The use of a planetable for the field work is surprising, unless there was little detail to be shown. The

transit and stadia method, with no notes recorded in a book and plotted in the field as taken, gives all the advantages claimed for the planetable in avoiding blunders in plotting. That the former method is more rapid was proved by the writer on the Baltimore Topographic Survey and, including an extra man as plotter, it was as cheap, with the added advantage of a full set of notes ready for use in case the field map was destroyed and the possibility of calculating the stadia traverse closures instead of only scaling them.

The closing remarks as to the comparative cost of the Cincinnati survey and the Baltimore and Washington surveys may simply indicate that less work is given for less money. Gillette's "Cost Data" gives the cost of a number of such surveys, and the topographic work of two of those mentioned was under the direction of the same engineer, viz., St. Louis and Baltimore. But the amount of detail and the accuracy of the two differed considerably. The average number of shots per acre over 33 square miles of Baltimore was 10 and one ¼ square mile contained 840 houses requiring 21.7 shots per acre. Furthermore, the work in Cincinnati is being done by contractors who may work even more than the 9 hours per day worked in Baltimore.

R. A. MacGregor.

Assistant Engineer, Bureau of Highways, Manhattan, New York City.

New York City, Apr. 9, 1913.

[According to our usual custom we submitted proof of the letter above to Mr. Mitchell and have received the following reply.—Ed.]

Sir—There is no more vexed question in surveys for mapping purposes than that of scale. When that question has been satisfactorily settled, other questions such as methods and instruments are easily taken care of. But the scale itself depends largely on two things—the purpose of the map and the money available for its production.

In the uses being made of such sheets of the Topographic Survey of Cincinnati as have so far been produced it is clear that in that part of the preliminary work which comprises the laying out of drainage areas, the adopted scale (1 in. = 400 ft.) leaves little to be desired.

This must be understandable when one remembers that runoff coefficients are not exact quantities; neither are the adopted values for maximum storms. The uncertainty in either of these quantities is usually such as would almost immediately consume any added accuracy in the topography of the drainage areas secured by using larger-scale maps.

In the designing of the sewer lines the larger-scale map, if produced with a corresponding increase of accuracy, would undoubtedly facilitate the work. Whether this increase in facility and the natural increase in accuracy resulting from the use of the larger-scale map are such as to justify its added cost may well be questioned.

As regards the use of the planetable: the planetable method admits of any desired degree of accuracy and of any amount of detail. In the planetable work, notes are kept of all shots, and an error in closing a planetable traverse may at once be searched for, and if it be in either the computation or the distance-plotting it can be checked.

The notes, however, record no direction and are, therefore, valueless as insurance. (Is insurance needed?) On the other hand two readings of a horizontal circle are eliminated by the use of the alidade—and the chances of error thereby reduced.

Concerning cost it must be admitted that the absence of cadastral features from the Cincinnati map removes an element, the size of which it would be difficult to even estimate.

Hugh C. Mitchell,

Engineer in Charge of Topographic Survey.

Cincinnati, Apr. 29, 1913.

Panoramic Camera and Planetable vs. Stereophotography for Mapping Alaskan Topography

Sir—Mr. Lemberger's article in your issue of Mar. 27, has brought to our attention many possible applications of stereophotography. The method should be particularly interesting to topographers of this country. The instruments of Pulfrich and von Orel seem to reduce the office work of contour plotting to a point below which it is not likely soon to be carried.

Passing the various other types of surveys in which the method might be employed to advantage, I wish to consider it as a means for making a general service topographic map on a scale of a mile to the inch or smaller.

The prospective field which is most likely to furnish an immediate subject for a test, lies in the more rugged sections of the West and Alaska. Regions of great relief afford the most suitable types of topography for photographic surveying and are consequently the sections where the camera is quite certain to be employed first.

The area should be comparatively large, such as might be covered by a map in the conventional quadrangular form. A requirement of any photographic method is that the photographs be adequate to supply contours for all of the country within the map limits.

Probably the most serious handicap to the stereophotographic method is the necessity of obtaining the base. The most advantageous positions from which data for a topographic map can be obtained are naturally the commanding peaks. Many of these afford scant room for a single tripod, few would probably be broad enough in one direction to permit the laying out of a base 300 or 400 ft. long; while the mountains which would furnish room for four or five bases, combined with good positions for a set of panoramic views, would be rare. Difficulty, annoyance and loss of time would attend the selection of stations.

In the making of a map of the kind under consideration I do not believe the stereophotographs would greatly lessen the number of instrument stations, for the reason that transverse ridges cut off the vision to so great an extent that about as many positions would have to be occupied in the use of one method as another. The far side of the ridge must be seen that it may be properly represented on the map. To accomplish this the camera must be taken to many elevated points, the number of which would not differ materially in either case.

That objects can be more readily and rapidly identified on stereophotographs than on those taken from widely separated positions is a very great advantage. It is probably the greatest improvement in photographs so

taken. On the other hand it is not difficult to identify points in moderately good photographs of the most colorless of landscapes.

The office work would be very greatly lessened by the ingenious stereoautograph of Capt. von Orel. The office work, however, for Alaska maps seldom exceeds one-fifth the cost of the field-work; hence the expense of the map could not be very greatly reduced by its use. In cases of urgent need of the map the instrument would be of much greater value. Much honor is due the inventor for devising an instrument which so reduces the effort and tediousness of routine office work.

A brief comparison is attempted between the stereophotographic method and one in which a panoramic camera supplements the planetable. It is assumed that the results of either are of an accuracy comparable to that obtained by the common planetable method.

The timing of the exposures is undoubtedly the detail of all photographic methods which requires most attention. Films for duplicate views, when the proper exposure is uncertain, can be provided with much less additional weight than extra plates.

Three men will be required to pack to the stations and operate the stereophotographic instruments: two can handle the planetable and panoramic camera with ease. Three exposures, requiring 15 minutes, with the panoramic camera complete the horizon. To embrace the same field at least 14 exposures must be taken for stereoscopic use.

The panoramic camera can be operated in any place where the planetable can be used.. A dozen sights with vertical angles, the photographs having been taken, complete the operations necessary at the average station. The total amount of time for the work at a station need seldom be more than one hour, and is often less than half that time.

For the seven pairs of photographs and the laying out of the bases from two to three hours at each station would be necessary. If considerable difficulty were encountered in the selection of ground for the bases, the time might be increased to the point where little would be gained over the regular planetable method.

In a region of heavy fogs and mist the advantage of an instrument, which, if necessary, will enable the topographer to complete his work at a station in 15 minutes, has a value that can scarcely be calculated in comparison with others that might fail in so brief a time.

The film cartridge packed in a waterproof case, which is sufficient for a complete panorama, weighs 4 oz.. The equivalent in 5x7-in. plates (14) weighs 42 oz. Heavier materials require additional means of transportation. For a field season of three months three extra horses would be necessary to pack the plates. For work in remote regions one man and three horses would add about one-fifth to the cost of field-work.

Using the stereoautograph the examples mentioned in Mr. Lemberger's article indicate that the office work will take as much time as the field-work. With the panoramic method the time for office work is about double that for the field-work. The resulting ratio of costs is about as 11 to 12, in favor of the latter method. The first cost of instruments is not here taken into account. The cost of all instruments, field and office, for the panoramic method is approximately equal to the cost of the phototheodolite alone.

Emphasis should be put upon the gain to topographic surveying by the combination of the planetable and camera. In the use of the planetable for secondary control, the skeleton outline developed aids to a large degree in keeping before the topographer the progress made from day to day and gives him a diagram by which he can best follow the successive stages of the map which are chiefly recorded in the photographic negatives.

J. W. BAGLEY,
Topographic Engineer, U. S. Geological Survey.
Washington, D. C.
Apr. 11, 1913.

Shop and Mill Inspection of Structural Steel

Sir—Your editorial on "Engineering Work Which Pays" in ENGINEERING NEWS of Mar. 20, points to "the tendency toward the concentration of engineering work in the hands of large organizations." Concentration in fabrication and construction work has proved both efficient and economic. But as to the work of designing-engineers, such a tendency may bring very different results. It is not easy to see how it can be justified, either economically or professionally.

With $10,000,000 worth of bridges a year to design and supervise, it is certain that practically all of the engineering work must be left to salaried assistants, with comparatively little supervision from the "head of the concern." One concern in this class offers $40 per month to assistants one or two years after graduation from high-class engineering schools. Moreover, the "head" of such a concern is liable to become so engrossed in the commercial aspects of the business as to lose what efficiency he may once have had as a designer. This has been known to happen.

The economic gain from concentrating in one office the design and supervision of bridge work to a value in excess of $1,000,000 a year is not much, except it be at the expense of the quality or grade of work turned out. This statement takes account of all possibilities in standardization for the average run of work.

On the other hand, there is one branch of bridge work where concentration would make extraordinary improvements possible, but in which no very decided tendency that way is noticeable. That branch is the shop and mill inspection of structural steel. Perhaps the fact that some of the larger bureaus seem inclined to divide all of the economies made possible by large tonnage between reduction of price and increase of profits, instead of using a fair proportion of the savings to improve the grade of inspection, has operated to retard concentration in this line. As the cost of inspection, according to existing standards, is not much more for 20,000 tons than for 2000 tons, when all at one shop or mill, it is not difficult to figure how the bureaus make a profit at prices one-third the rate per ton they asked a few years back.

If the present tendency were more in the direction of improving the work of inspection instead of cutting prices in competitive bidding, there would be more hope of raising the standard without a radical change in the organization of the inspection business. So called inspection can be done at almost any price, but the purchaser rarely gets more than he pays for, and few have

any idea what first-class inspection is or what it is worth.

If the standard of inspection cannot be materially raised under the present competitive bureau system, there remain two alternatives, either one of which, it is fair to hope, could show better results: (1) A trust of inspection bureaus with a far-sighted and broad management; and (2) a coöperative inspection association formed by the larger purchasers of structural steel.

The minority report of the Committee on Iron and Steel Structures of the American Railway Engineering Association, briefly referred to in ENGINEERING NEWS of Mar. 27, was written to call attention to the very great advantages that could be realized by concentrating shop and mill inspection in one large organization, but your report of those proceedings seems to miss the point entirely. While this minority report was not discussed at the convention, there is evidence that it made a gratifying impression under the surface.

ALBERT W. BUEL.

15 William St., New York, Mar. 29, 1913.

[We realized the point and purpose of Mr. Buel's minority report, noted in the last paragraph of his letter, but as it was impracticable to do more than mention it in a review of the score of matters presented at the convention it was our intention to publish an abstract of it separately. We give such an abstract below, and the majority and minority reports of the Committee on Iron and Steel Structures are given in full in *Bulletin* 152 (December, 1912) of the American Railway Engineering Association (900 So. Michigan Ave., Chicago).—ED.]

The writer has suggested that an effort be made to outline some method or system which would promise improvement over existing mill and shop inspection. Also that a coöperative railroad bureau, combining the good features of "company inspection" with those of "bureau inspection," deserves consideration, particularly on account of the very great advantages which the consolidation of a great tonnage would give, permitting the subdivision and specialization of work to a high degree under competent and experienced resident or district engineers and managers.

On every hand complaint is heard that bureau inspection is unsatisfactory. For over 26 years the writer has had an intimate acquaintance with bureau inspection, both from the inside and outside, and in several respects the conditions are less favorable for good work now than formerly. At one time a considerable number of inspectors were men with some engineering training, but it is now rather exceptional to find an inspector who has had any such education or experience. Many are men who have worked in bridge shops in the "laying out" and similar departments, while formerly men with some experience in the drafting and computing departments found inspection jobs attractive.

In former years, when the bureaus were much smaller concerns, the inspectors frequently came in contact with the principals. Now the time of the head men is so taken up with soliciting business, office routine and correspondence, that they rarely see inspectors, hardly ever to give detailed or technical instruction.

The founders of the best bureaus were competent and experienced bridge engineers, who took a professional interest in their inspection work, and had been inspectors. Now, with two or three notable exceptions, one looks almost in vain for the name of a bridge engineer in the bureau organizations. Owing to division of territory and exchange of work sometimes a job taken by one bureau will be executed by an inferior one. Within the past five years the writer has come on to do personally a considerable amount of shop inspection, and was impressed with the change in conditions and shop practice that had occurred within a comparatively few years.

Company inspection is sometimes better, but often worse, than bureau inspection, and even all the work for a system of allied lines does not consolidate sufficient tonnage to permit such an organization with division of work and specialization as the writer has in mind.

As to mill inspection all who know the conditions agree that it is largely a farce. The test reports are only of value for file, to bring out if anything ever happens, or as exhibits in court. While more difficult to improve than shop inspection, consolidation of a great tonnage, as suggested, would permit of a very material betterment in the quality of mill inspection at little more than current costs.

On the other hand, the shop and mill practice and standards have been so greatly improved since [shop and mill] inspection by or for the purchaser became customary that there is nowhere near as great need for rigid inspection *in* each individual case. But unless the average inspection is kept up to a high standard there is danger of lowering the standard of quality for structural-steel work and material. Not only that, but an incentive to further improvement will be lost. The ideas suggested with the purpose of improving shop and mill inspection may be expressed as follows:

(1.) The shop and mill inspection of structural steel, to be efficient and satisfactory, should be done on a scale large enough to economically permit the employment at each shop or mill of a corps of men, who may be called checkers. Each one of these is specially fitted and trained for a certain part or detail of the work under a resident inspecting engineer, thoroughly familiar with all details of structural steel and its fabrication, competent to direct the corps of checkers and decide questions calling for the judgment of a man of experience and structural engineering training. Resident inspecting engineers should report to the district chief inspector or manager, who should be an expert in structural steel and its fabrication, as well as a competent bridge engineer, and he in turn should report to the executive head of what may be called the American Railway Inspection Association. On technical matters and with proper regulations, however, he may report to and receive instructions from the chief engineers and bridge engineers of the railway companies which are members of the association.

(2.) The American Railway Engineering Association should use its influence to induce the railway companies to delegate officials to meet and discuss ways and means and (if it appears practicable) to provide for establishing the American Railway Inspection Association as an organization to make a highly improved and standardized shop and mill inspection of structural steel, furnishing the same at cost to the railway companies which are members of or supporting such association. As this can hardly become effective without the support of railway companies representing about 75% of the annual railway purchases of structural steel, it would seem desirable to have the official delegates empowered, under proper restrictions, to pledge the adherence of their respective companies to the support of the project.

Later on, such an organization could be expanded to include the inspection of steel rails, but as this would require practically a separate corps—only the district chief and his office and probably a chemist, being common to the inspection of both structural and rail steel—it will no doubt be considered advisable to defer this question to a future time. However, as general officers and chief engineers are greatly interested in all matters respecting rails, it might aid in securing their coöperation to suggest the future possibility of the proposed American Railway Inspection Association taking up and standardizing rail inspection. The present status of rail inspection problems suggests that the time is hardly ripe to press this matter, but it would do no harm to refer to it as a future line.

The size of each shop corps should be about one man for each 10,000 tons annual capacity of the shop. The number of independent inspectors at present employed is probably equal to or greater than that. This would require that the inspection of about 50% of the shop capacity be done by the proposed organization. Otherwise the cost of inspection would be greatly increased, and my object is to try to show that a very superior inspection method can be devised without greatly increasing the cost.

The district chief, or manager ought to be a man worth at least $200 to $300 per month, depending on the importance of the district, and could cover a radius of, say, 100 miles from Pittsburgh, Chicago, Philadelphia or Cleveland. Each resident inspecting engineer should be worth not less than $200 or $250 per month at the larger shops, down to a minimum of, say, $150 at the smaller shops. The wages of the other men in a shop corps would range from about $1 per day for the scale boy to $4 per day for the men checking field fits, templets and laying out. This will work out to between 40 and 50c. per ton for shop inspection in average shops down to 30c. per ton in the largest shops.

Funds for Road and Bridge Construction and Repair in Louisiana may be raised hereafter by means of a per capita tax and vehicle licenses as a result of a recent constitutional amendment.

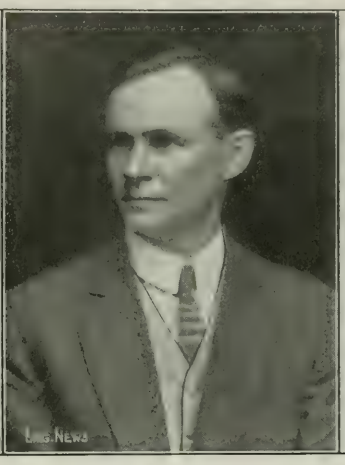
The Railway-Valuation Board of the Interstate Commerce Commission

The Railway Valuation Act, which recently became a law, provides for the appraisal not only of all the railway property in the United States, but of the property of every common carrier subject to the Interstate Commerce Law at the present time or which may be brought under its jurisdiction in the future, which includes steamship, express and all transportation companies doing an interstate business. As stated in our editorial of Mar. 6, this work will involve a larger amount of engineering work and a larger outlay of money for engineering services than any public work ever before undertaken.

This immense task is to be done under the general supervision of the Interstate Commerce Commission, who are authorized to employ such experts as are deemed necessary. It has been unofficially stated that no less than 20,000 applications were received for positions, and that all subordinate positions are to be filled through civil service examinations. As noted in our Personal columns of last week, the Commissioners have already announced the appointment of five engineers, who will have charge of the organization of the staff and later have the direction of the field and office work. We are now able to present short biographical sketches and portraits of the engineers who are to direct this gigantic engineering undertaking.



R. A. Thompson



H. M. Jones



J. S. Worley

R. A. Thompson

Robert Andrew Thompson was born at New Waverly, Walker County, Texas, on July 11, 1869. He graduated from the University of Texas with the degree of Bachelor of Science in 1892, the following year he received the degree of Master of Arts, and in 1900 the degree of Civil Engineer. He is a member of the honorary society Phi Beta Kappa.

Before his graduation he had had several summers' experience as a rodman and topographer with the Texas State Geological Survey. In 1895 he was appointed Assistant Engineer of the Texas Railroad Commission, but during the latter part of the year he resigned to take charge of the construction of the sewerage system of Palestine, Tex.

In December, 1895, he entered the railway service as a levelman on construction of the Kansas City Southern Ry. in Louisiana and Texas. Later he was draftsman for the same railway. For the year 1897-98 he was an instructor in civil engineering at the University of Texas. From this position he was appointed Chief Engineer of the Texas Railroad Commission, where he remained until 1909; during this period the Commission made a valuation of between 4000 and 5000 miles of railway.

Returning to railway construction work as Chief Engineer of the Wichita Falls & Northwestern Ry., Mr. Thompson had charge of the location and construction of some 300 miles of railway in Texas and Oklahoma. This railway is now a part of the Missouri, Kansas & Texas Ry. system.

Mr. Thompson was appointed Chief Engineer of the California Railroad Commission in October, 1911, and during the past year and a half has organized the engineering staff and begun the work of appraising the railways of the state; to date, some 1000 miles of the work have been completed.

Mr. Thompson is a member of the American Society of Civil Engineers.

William D. Pence

William David Pence was born at Columbus, Ind., Nov. 26, 1865. His first engineering work of importance was as Assistant Engineer and later as Resident Engineer of the Atchison, Topeka & Santa Fé Ry., 1886-1892. In 1892 he left railway work to become an instructor in civil engineering at the University of Illinois, where he was promoted successively to be Assistant Professor and Associate Professor. In 1895 he received the degree of Civil Engineer from the University of Illinois.

Prof. Pence was called from the University of Illinois to be Professor of Civil Engineering at Purdue University in 1899, and he remained at Purdue until 1906, when he was appointed Professor of Railway Engineering at the University of Wisconsin.

Besides his work as a teacher, Prof. Pence has always

been actively engaged in outside engineering work. He was a member of the United States Commission on the drainage of the Kankakee marsh region in Illinois, 1904-1906, and since 1906 has been Chief Engineer of the Wisconsin Railroad Commission and the Wisconsin State Board of Assessment.

As Chief Engineer of the Wisconsin Commissions, Prof. Pence's work in the valuation of railway and public-utility properties attracted wide attention. The Wisconsin law requires the valuation of all the physical property and all the property used and useful for the convenience of the public belonging to every public utility in the state. The Wisconsin work has been widely used as a model for similar work elsewhere, and is noted for its comprehensiveness, fairness and thoroughness.

Prof. Pence is a member of the American Society of Civil Engineers, the Western Society of Engineers, the Western Railway Club, the Society for the Promotion of Engineering Education and is a Past-President of the Indiana Engineering Society.



W. D. PENCE E. F. WENDT

JOHN S. WORLEY

John Stephen Worley is senior member of the firm of Worley & Black, Consulting Engineers, Kansas City, Mo. He was born at Oak Grove, Mo., in 1876. He received his technical education at the University of Missouri, where he spent two years, and at the University of Kansas where he graduated in 1903. He obtained a Master's degree at the University of Kansas in 1904.

Before entering the University of Kansas, Mr. Worley had obtained considerable experience in railway engineering work, and shortly after his graduation he was made Chief Engineer on the construction of the St. Louis & North Arkansas R.R. Later he left railway work to accept a position with the Riggs & Sherman Co., Consulting Engineers, Toledo, Ohio, as Principal Assistant Engineer on municipal improvement and appraisal work.

In 1909 Mr. Worley went to Kansas City, where he organized the J. S. Worley Co., with Ernest B. Black, who had also been with the Riggs & Sherman Co., as junior partner. Later the firm name was changed to Worley & Black. The work of this firm has included the design and supervision of construction of municipal improvements throughout the Central States, and during the past three years the firm has also handled appraisal work in connection with a number of public utilities. A part of Mr. Worley's recent work has been the preparation of evidence and the giving of expert testimony in various railway suits, and the examination of the physical properties of the Central of Georgia R.R. and the Buffalo, Rochester & Pittsburgh R.R. He has also served as Chief Engineer of the Kansas, Oklahoma & Southwestern Ry. and the Fort Scott & Pittsburgh Ry.

In 1912 Mr. Worley was Engineer in charge of an investigation of the methods of operation and accounting of the Delaware, Lackawanna & Western R.R., for the purpose of suggesting reforms and improvements to increase the efficiency of the railway organization.

Mr. Worley is an Associate Member of the American Society of Civil Engineers.

HOWARD M. JONES

Howard Murfree Jones was born in Murfreesboro, Tenn., Oct. 9, 1874. His early education was obtained in the public schools of his native city, and in 1891 he entered the civil engineering department of the Vanderbilt University, at Nashville, Tenn. After spending three years here, he went to Union College, Schenectady, N. Y., where he graduated in 1895, with the degree of Bachelor of Engineering.

The fall following his graduation he entered the service of the Nashville, Chattanooga & St. Louis Ry., at Nashville, as a clerk in the office of the Chief Engineer. He was promoted to be Chief Clerk and also served later as Assistant Engineer and Draftsman. In June, 1902, he left the railway to become Assistant Bridge Engineer with the Louisville Bridge & Iron Co., at Louisville, Ky., where he remained one year, after which he returned to the Nashville, Chattanooga & St. Louis Ry., being first appointed to the position of Chief Draftsman and later being promoted to the position of Bridge Engineer.

Mr. Jones opened an office for private engineering practice in Nashville, Jan. 1, 1907, making a specialty of bridge and reinforced-concrete design and construction. During the past six years he has designed and supervised the erection of two large reinforced-concrete bridges across the Cumberland River at Nashville, aggregating over a million dollars in cost, besides some 80 to 100 bridges of lesser importance. He has also designed and supervised the construction of a number of large reinforced-concrete buildings, and has acted as Consulting Engineer on several projects of considerable magnitude.

Mr. Jones is a member of the American Society of Civil Engineers and a Past-President and Director of the Engineering Association of the South. He also served the last named Society as Secretary and Treasurer for eight years.

The Typhoid Outbreak at Albany N. Y., Due to Flooded Filters

By Theodore Horton*

The typhoid fever outbreak which occurred at Albany, N. Y., in April, 1913, constitutes one of the most interesting and striking examples of an explosive epidemic due to a sudden, and, in some respects, accidental infection of a water-supply, resulting from the flooding of the slow sand filtration plant.

From Apr. 1 to May 5, inclusive, there were reported some 180 cases, certain detailed information concerning 175 of which I have been able to secure through the local Board of Health and show on the accompanying diagram. The first cases reported were on Apr. 21 and since that time additional cases have been reported daily

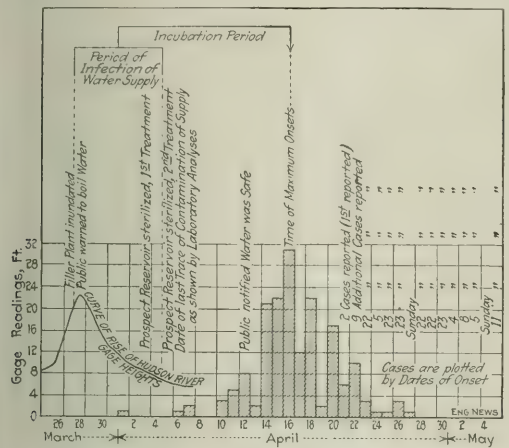


Diagram Showing Typhoid Outbreak at Albany, N. Y., Following the Flooding of the Water-Filtration Plant in March, 1913

until the number, as of May 5, reached about 180. Owing to the system adopted and in force by the Albany Health Department in reporting and investigating cases of communicable diseases, and to the unfortunate circumstances that Albany (with three other cities in this state) is exempt from the operations of the Public Health Law requiring that communicable diseases be reported to the State Department of Health, considerable difficulty was experienced in the beginning in getting closely in touch with the situation and in securing the necessary information to study and follow the progress of the epidemic.

Through the courtesy of the local Health Department, however, and upon special request and arrangements, the State Department of Health was able to secure without delay certain essential information of limited amount concerning nearly all cases reported. From these data it appears that of the 175 cases above referred to approximately 75% were among children and 25% among adults. Of the cases among children some 58% were males and 42% females; whereas of the cases among adults some 46% were males and 54% females.

*Chief Engineer, State Department of Health, Albany, N. Y.

The accompanying diagram shows more strikingly than I can describe the history of this epidemic which was, beyond a doubt, traceable to recent floods in the Hudson River which inundated and put out of service the filtration works located near the river just above the city. The events leading up to and immediately following the inundation of the filtration works were described in Engineering News of Apr. 10, 1913, which should be carefully read in order to understand intelligently the course, extent and relation of the present outbreak of typhoid fever to conditions during and immediately following the flood.

On the diagram have been plotted two curves or profiles: one showing the rise and fall of the Hudson River covering the period of the recent flood; the other, the number of cases of typhoid which have developed in the city up to May 5, inclusive, so plotted as to correspond with the dates of onset of the disease. On the diagram also appear a number of explanatory notes relating to water-supply and typhoid fever, arranged chronologically so as to show directly the relation between the two as to cause and effect. The vertical notes on the diagram explain important facts with reference to the flooding of the filter plant, notice to boil water, sterilization of Prospect Reservoir, the clearing up of all traces of pollution of the water-supply system; whereas the horizontal notes at the top of the diagram explain the relation between the incubation period, the period of infection of the supply and the time of maximum prevalence of typhoid fever.

This diagram strikingly pictures what occurred. It will be noticed that the maximum number of cases had their onsets on Apr. 16 and that the period of maximum prevalence covered a period of about one week. Allowing some two weeks for "incubation" and dating back on the diagram this period of time from Apr. 16, brings us directly to the period when infection of the water-supply took place. The diagram shows, therefore, at a glance, the close synchronous relation between the infection of the supply and the outbreak of cases.

Many things of unusual interest from an epidemiological standpoint occurred during the epidemic and appear on the chart that merit careful consideration and I will refer to them somewhat in detail:

The inundation of the filtration plant came with comparatively little warning and there was little time to notify the public to take precautions to boil the water. The city was substantially free from typhoid fever and the public mind was not, and could hardly be expected to be, aroused to the point of absolute necessity of observing precautions as it would have been had a typhoid fever epidemic been in progress, with the usual alarm that such a condition incites. It is, therefore, not surprising that in view of the warnings which appeared immediately in all the papers "to boil the water" these precautions were not strictly observed, as was obvious from the cases which developed later (see diagram).

Another feature in this connection is the large percentages of children which were stricken, 75%. This is also what would have been expected by anyone familiar with the juvenile mind. Children seem to have a particular aversion to boiled water, owing to its insipidity when not properly prepared and aërated. Contamination lingered in the water-supply system (due to raw river water getting into Prospect Reservoir) some days

after the high turbidity, at first apparent, cleared up. It is, therefore, easy to understand, as the records show, why children disregarded instructions and drank the more palatable water from the tap.

Another feature of much interest and importance, and referred to in detail in ENGINEERING NEWS of Apr. 10, was the sterilizing of Prospect Reservoir for correcting the contamination, and the institution of a series of laboratory analyses by the State Department of Health for the purpose of establishing a means whereby it would be possible to determine when the water-supply was safe and boiling of water unnecessary.

It will be recalled that the situation in the city was referred to the Department by the Governor in order that coöperation and counsel might be given the local authorities to avoid an epidemic. Although the damage had already been done the extent of it did not develop for two or three days. A close coöperation was, however, at once instituted between the city and state department of health. The filter plant was put in service as soon as the water receded sufficiently, the public having already been warned to boil all drinking water. A temporary hypochlorite disinfecting plant was installed, within 24 hours following. Flushing of water mains was immediately proceeded with. A plan was at once put into execution for systematically analyzing samples of water to be collected daily from the reservoirs and various taps over the entire city.

With the public already warned, and steps taken to put the filter plant into operation and thus furnish a pure supply to the city within a comparatively few hours of the time of recession of the flood, attention was immediately turned to investigating and clearing up the contamination which was known to have lingered in the distributing system. It was not for some two or three days, however, that the extent and seriousness of the contamination of one of the reservoirs was discovered and measures taken to correct it. The laboratory results revealed this and the local authorities were notified that the reservoir must be shut off or its sterilization undertaken without delay. Unfortunately, the piping arrangements made shutting off the reservoir impracticable. Sterilization was therefore resorted to and was undertaken first on Apr. 3. This was followed, two days later, by another treatment. I believe this is the first case on record of sterilization of a large open reservoir by the hypochlorite method and the results show that two treatments of about 1 part per million accomplished an entire elimination of B. coli type and acid colonies from the water in the reservoir.

The analyses from various parts of the distribution system in the city showed that whereas practically all traces of contamination disappeared from the central portion of the distributing system by Apr. 4, there still remained traces on the periphery of the system. The city was then requested to flush again the pipes in the outlying sections of the system. As a result, by Apr. 7 practically no trace of contamination was found in the reservoirs nor in any portion of the distributing system. Not until five days later, however, was the public notified that the water was safe to drink without boiling. This additional time was given as a factor of safety and with the idea that by waiting the full period of two weeks some indication might be obtained as to whether infection had occurred to any appreciable extent.

This brings me to one of the most important features in connection with the outbreak, namely, that although there were some 12 to 15 cases of typhoid fever actually in progress at the time that the people were notified that the water was safe, no cases were reported by the physicians until about Apr. 21 when, as shown by the diagram, over one hundred and fifty cases were in progress and the crest of the epidemic had apparently passed. In other words the epidemic, so far as the evidence now available indicates, had largely disappeared before the cases had begun to be reported. Of course some time is necessary for diagnosis but an important question apparently arises as to how much time is necessary for this purpose and especially as to whether in an emergency like this physicians cannot make their diagnoses more promptly and whether they should not err on the safe side and report even suspicious cases. A glance at the diagram would indicate that in the present instance there was considerable delay in the reporting of cases.

As an interesting sidelight on this particular feature, note on the diagram how few cases of onsets appear on Apr. 13, 17 and 19. The dates of onsets are by nature necessarily approximate and I am inclined to explain the low numbers on such dates as due to a possible psychological tendency, in reporting approximate dates of onsets, to select even numbered dates, with the exception, perhaps, of the fifteenth or middle of the month.

This epidemic is not devoid of a number of lessons which all such experiences seem to furnish. Among these may be mentioned in order the following:

(1) That in designing purification works situated under conditions as at Albany it is better to arrange them with a greater factor of safety against inundation (the recent flood having overtopped the tops of the filters a little over one foot).

(2) That sufficient available storage for a few days' supply might well be provided where there is any question as to inundation of purification works or other necessity for using impure raw water.

(3) That all reservoirs should be arranged so that they may be entirely shut off the distribution system in case of such emergency.

(4) That a mere *warning* to "boil water" when an epidemic is *not* in progress does not seem to deter a great many people from using contaminated water and makes all the more emphatic the necessity of maintaining at all times the integrity of purification works.

(5) That it is possible to sterilize effectively a large reservoir of water by hypochlorite treatment with fair success and that such emergency means should always be kept in mind by those responsible for its use in such cases.

(6) That physicians should be more prompt in reporting cases of typhoid fever, especially at a time when there is reason to fear that a water-supply has been infected. Time is necessary, of course, for diagnosis but even suspects should be reported in such an emergency.

(7) Local boards of health should be so provided with funds and facilities as to furnish at once the necessary information to follow closely from day to day the progress of an epidemic in order that they may take the necessary means for its suppression.

(8) The state after passing laws controlling the reporting of cases of communicable diseases should not by a series of exemptions make those laws applicable to only a part of the state.

(9) The people who drink water unboiled in an emergency like this in utter disregard of warnings from municipal and state authorities deserve to be severely criticized.

Fortunately, so far as the water-supply is concerned, this outbreak appears to have been largely if not almost entirely spent. With the water-supply free from contamination, if secondary cases can be avoided, and milk infection be prevented there would seem little to be feared from now on. The State Commissioner of Health has recently issued two letters of a general nature, one to each physician of the city of Albany urging all possible precautionary measures to prevent a spread through secondary infection; the other to all milkmen supplying milk in the city, instructing them how to prevent an infection of their supply by the sterilization of milk bottles by boiling water or steam, not leaving or taking milk bottles from houses containing typhoid patients, excluding typhoid cases or suspects from handling milk or milk utensils, and warning them that any infected supply found would be promptly excluded. In the letter of advice to physicians was the following suggestion:

> I venture to suggest that it would be well for you to administer typhoid vaccine to all of the members of every household in which you have under your care a case of typhoid fever. This department has a supply of this typhoid vaccine now on hand and will be pleased to furnish it upon request to all of the practicing physicians of the city for general use at this time.

No mention has been made of a consideration of other factors than water infection—nor in fact would any seem necessary. All such factors were, of course, carefully considered. Milk, from the considerable number of sources used by the different cases, showed no route in any particular way associated with the epidemic. Many spring and well waters were used during the flood when the city water was roily and these were peddled through the city from various sources outside the city. The possibility of these being a contributory cause of outbreak is not remote but on the face of it such waters could not have been polluted like the raw river water, nor could they all have been infected; furthermore, analyses which were taken of a number of them did not show any to be appreciably contaminated. None were associated with any "route."

Oysters were peculiarly a factor for consideration from the fact that one large hotel and one or two business places had oysters stored in the cellars which were flooded. No trace could be found, however, connecting these oysters with any case of typhoid fever in the city.

All of the cases have been plotted on a map of the city, which shows a fairly uniform distribution over the city—a typical *water infection* typhoid map, with, however, a preponderance of cases on the portion of the system connected with Prospect Reservoir. This fits perfectly the situation, since Prospect Reservoir was contaminated and contamination lingered and entered the portion of the system until this reservoir was sterilized. Of course contamination entered the other portion of the distribution system connected with Bleeker Reservoir and this contamination accounts for the cases on that system. The important point is, however, that the analyses showed that Bleeker Reservoir was not contaminated, as was the case of Prospect Reservoir (due to Bleeker Reservoir receiving a part of its supply from an upland gravity source, Rensselaer Lake, there being pumped into the distribution system connected with Bleeker Reservoir only an amount of water necessary to make up a deficiency in consumption), so that the infection disappeared rapidly from the system connected with Bleeker Reservoir as soon as the filtration plant was put into normal operation. The distribution systems of the Bleeker and of the Prospect Reservoirs are entirely separated, about one-half the city's population being served by Bleeker and one-half by Prospect. With, therefore, three-fourths of the cases on Prospect and one-fourth on Bleeker we have by comparison an indication of the relative significance of the contamination that entered Prospect Reservoir.

Although it is too early to say definitely that the epidemic is entirely over, the records of the local health department show that it has largely subsided. That is, the reported cases for the past four or five days show that only 4 or 5 cases have been reported each day as compared with the 22 to 25 cases of a week or more ago. It may also be stated that many of these cases reported within the past few days date back for onsets toward the middle of April, the time of maximum prevalence as shown by the diagram.

Additional cases must almost of necessity continue to be reported in the future but one would expect (I hardly dare express it more positively) them to be straggling reports either of cases with old onsets or else secondary cases from previous victims. It may at least be expected that with the full and explicit notices sent out by the State Commissioner of Health to the practicing physicians of the city and similar notices to the milkmen supplying milk that the avenues to these two sources of infection and further spread of cases will be effectually cut off.

⁂

A New Simple Engine for paper-mill use, has been developed by the American Engine Co., of Bound Brook, N. J. The most important features are (1) the use of four high-pressure cylinders in right-angle pairs, and (2) a close-regulating governor adjustable for engine-speed ranges of 10 to 1. Each pair of vertical and horizontal pistons drives a common crank pin, giving eight power impulses per revolution. A counterweight on each crank arm balances the thrust of the horizontal reciprocating masses on foundation and frame, while the vertical forces exerted by this counterweight are balanced by those of the vertical reciprocating parts. In this way, it claimed, smooth operation is secured so that the safe speeds can be pushed to as high as 500 r.p.m. The multiplication of power impulses per revolution also, it is held, results in sufficiently even torque for speeds down to 50 r.p.m.

Two throttling governors are used, one of which serves merely as an automatic safety speed-limit device. Close speed regulation, at each setting of the service governor, is required in paper-mill service or else breaking of the paper results. This governor is stabilized with springs and a dashpot between the throttling-valve stem and the governor balls. The latter are belt driven from the main engine shaft, but through two sets of friction disks and wheels. By changing the position of the wheels relative to the disks, the governor is made to operate at any desired engine speed. No attempt is made to vary the cutoff, since such a refinement is not needed where the exhaust is very largely used for heating. While accurate data on the performance of paper machines is not available, it is generally regarded by mill men and manufacturers that the power required varies directly with the speed, except at high and low extremes when similar extremes of power consumption would not be found. Accordingly, the builders believe that this engine has a straight-line speed-power diagram between the working speeds, though complete tests have not been made to show this. The torque is probably 25 to 50% greater at 50 r.p.m. than at 500.

The City Planning Conference at Chicago

The fifth National Conference on City Planning was held at the La Salle Hotel, Chicago, May 5 to 7. Only a few papers were presented, the purpose being to open up the subjects for discussion, and with this in view certain speakers were assigned to commence the discussions.

General Aspects of City Planning

A paper on "A City Planning Program" by Frederick Law Olmsted (Brookline, Mass.) dealt with the initiation and development of this work. An economic and financial survey must be made covering the city's present and prospective resources, the extent and rate of posisble expenditures for public improvements, and the probable future growth. The next steps must be to define the more important problems, and then to select and combine these into one definite, comprehensive and harmonious plan. The planning and execution must be done under complicated limitations and administrative conditions imposed by law, some of which serve mainly to block development and should be revised. As a future condition he predicted a permanent organization or authority in each large city, as follows:

> There will be some official body charged with the prime responsibility for the city plan. It will have records relating not merely to the physical aspects of the streets, public parks and buildings, but to the locations, grades, and other essential facts about all the sewers, conduits, pipes and subways beneath the surface of the streets. Also the poles and wires and other objects above the surface; railways and other means of public transportation; catchment areas and waterways, from the smallest gutters to the reservoirs and ponds, sewers, ditches, canals, and the rivers of the greatest flood capacity in the region. And finally records relating to every piece of land and every building and improvement, both public and private.
>
> As interpreter of the city plan, the office will report on every project under discussion as to whether it is or is not harmonious with the whole aggregation of accepted and approved projects. Its duty will be to recognize the march of unforseen events, whether fortunate or unfortunate, and if necessary alter the plan to meet the new conditions. One class of hard facts to be thus recognized will doubtless be the occasional disregard of the plan by the executive authorities of the city and the consequent establishment of permanent improvements.

The Committee on City Planning Study submitted a series of plans prepared by different landscape architects for a model section of 200 acres to be built within the limits of a city of 500,000 inhabitants, but four miles from the center of the city. The secretary, Flavel Shurtleff (Boston) made a report of progress for the year, showing what organizations exist and what work in this direction is planned by various cities.

A paper on "The City Planning Commission," by W. A. Magee (Mayor of Pittsburg), was printed in abstract in our issue of May 7, 1913, p. 976, and a paper on controversies regarding these utilities.

"The Land Tax System for Public Improvements," by George E. Kessler (St. Louis) described the assessment for benefit system of raising funds for construction and maintenance of streets, boulevards and parks as practiced at Kansas City, Mo. An abstract of this paper will be given in a later issue of this journal.

Transportation Facilities and City Planning

This subject received more active interest and discussion than any other on the program. A paper by M. R. Maltbie (Public Service Commission, New York) showed that passenger and freight transportation is one of the important factors to be considered, and that good results cannot be obtained by adjusing the transportation to a complete plan which has been prepared without regard for this factor. Some of the points made may be noted as follows:

(1) Main arteries should be straight lines.

(2) When the growth of traffic necessitates the provision of separate lines for (A) urban and (B) suburban and interurban traffic, the latter should not be permitted to stop at the outskirts and transfer to the urban system. They should be required to operate through or across the city and do their own distribution and collection of traffic, as far as practicable.

(3) Through lines should be adopted in preference to terminals.

(4) Elevated lines are less costly than subways and have many advantages.

(5) Freight should be delivered near the center of the city, and space utilized over and under freight yards. City and local electric lines can be used to distribute food products at night.

(6) The municipality should have perpetual control over transit facilities, so that their development may keep pace with that of the city.

Several speakers pointed out the disadvantages of subways in regard to cost and sanitation, and suggested that while they must be used in certain congested districts, the tracks should come to the surface as soon as possible and be carried on elevated structures. It was stated also that many European city-planning schemes are defective in failing to give proper weight to the transportation problem. In fact several of these foreign schemes give undue prominence to the artistic and æsthetic aspects of the problem. In this connection, a note of warning was sounded for American cities which have a tendency to imitate foreign developments and to consider city planning mainly on the basis of "the city beautiful," to the exclusion of matters which are really of greater importance.

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Dedication of New Buildings at the University of Illinois

The formal dedication of the new Transportation Building (with the Locomotive Laboratory) and the Mining Laboratory, at the University of Illinois, Urbana, Ill., took place May 8, 9 and 10, and was participated in by a large number of invited guests. On May 9, two special cars were run from Chicago for a party composed of members of the Western Society of Engineers and the Western Railway Club. A railway conference was held in the morning of May 9, and in the afternoon a tour was made of the several buildings of departments related to engineering work, ending with the three new buildings noted above. The Locomotive Laboratory was described in our issue of May 8, and the operation of a large Illinois Central R.R. freight locomotive of the 2:8:0 class was watched by the guests with great interest. The Mining Laboratory includes a chemical department, a drills and explosives department, a mine station and a coal-washing and dressing plant. Professors in the various departments gave brief explanations of the plant and work under their charge.

Following this tour, the meeting assembled at the University Auditorium, where Dr. W. F. M. Goss, Dean of the College of Engineering, presided. Addresses were delivered by Dr. Edmund J. James, President of the University; W. L. Abbott, President of the Board of Trustees, and Willard Smith, President of the *Railway*

and Engineering Review. The entire party, headed by the band, then marched to the Transportation Building.

RAILWAY CONFERENCE—At this meeting a number of papers were presented relating to railways and railway education. Some of these were as follows: "Problems of the Steam Railway," B. A. Worthington, President of the Chicago & Alton R.R.; "Problems of the Electric Railway," W. B. McKinley, President of the Illinois Traction System; "Problems of the Manufacturer," Charles B. Moore (Jacobs-Shupert Firebox Co.) and George R. Henderson (Baldwin Locomotive Works); "The Technical Society as an Influence in Education," Albert Reichmann, President of the Western Society of Engineers. Other speakers were D. F. Crawford, President of the American Railway Master Mechanics Association; T. H. Goodnow, President of the Western Railway Club; H. G. Hetzler, President of the Chicago & Western Indiana R.R.; W. L. Park, Vice-President of the Illinois Central R.R.; Robert Quayle, Superintendent of Motive Power, Chicago & Northwestern R.R.; Samuel O. Dunn, Editor of the *Railway Age Gazette,"* and H. E. Chubbuck, Manager of the Illinois Traction System.

Mining Conference—At two meetings held May 9 and 10, the papers dealt with the commercial, engineering, labor and practical mining points of view. The more technical papers included the following: "Concrete in Mine Construction," A. F. Allard, Chief Engineer of the Bunsen Coal Co.; "Steel in Mine Construction," by Carl Scholz, President of the Coal Valley Mining Co.; "Modern Steel Tipple Design," by John A. Garcia, Consulting Engineer, and "The Fireproofing of Mining Plants" by Herbert M. Wilson, National Fire Protection Association.

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Transportation Facilities and City Planning*

BY MILO R. MALTBIE†

In discussions of city planning there has been a noticeable lack of consideration of transportation facilities, with the exception of the public highway. The commuting zone is generally limited to the area which can be reached within 45 or 60 minutes from the heart of the city, and usually the great mass of population is within a half-hour radius. It is not so much a question of distance, as of time and convenience of travel. The area which may be reached varies with the square of the radius, so that if it is possible to go twice as far from the center in one city as it is in another during the same length of time, the available area is four times greater in the first instance. And with the same population the density of the area inhabited need be but one-fourth of what it is in the second case. Then single houses of two stories in height may house the same population that would in the second case of necessity be housed in tenements, solidly built, of from four to six stories.

Districts with attractive housing schemes may be planned, but people will not and cannot live there unless they are served with cheap and rapid transportation.

THE VALUE OF STRAIGHT STREETS

There is a marked tendency among city planners to use curved streets and streets that constantly change their direction. But the old statement holds true that the curved line is for pleasure and the straight line for business. On rapid transit lines with frequent curves operating expenses would be increased because the loss of energy (in acceleration and retardation) and the cost of maintenance and repairs would be heavy. Curves reduce speed; reduced speed means increased time in transit; this means a reduction in the area which can be served, which in turn is a cause of congestion.

Compare the elevated roads in Manhattan with those in Brooklyn. The former have few curves and hence good speed. In the central portion of Brooklyn, the lines are so crooked and complicated with numerous crossings and connections that trains must be operated slowly. As a result one can travel on the 3rd Ave. elevated line in Manhattan 50% further in the same length of time from City Hall Park than by any of the elevated lines over the Brooklyn Bridge.

The main arteries of traffic should be as nearly straight as the topography will permit. But in residential areas between main lines of traffic, there is ample room for exercise of ingenuity in street layouts which may be beautiful and attractive. But these areas ought not to be planted where they will interfere with the extension of through transportation lines.

RAPID TRANSIT LINES

It is obvious that as buildings increase in height, the demand for transportation increases. In the lower part of New York, the street plan is practically the same as it has been for generations. All of the available streets will soon be occupied by rapid transit lines for the transportation of passengers. Unless additional streets are to be cut through at enormous expense, it will be necessary to limit the height of buildings and thus diffuse congestion, or to construct subways on lower levels. In addition, provision must be made for the transportation of materials, and even now it is apparent that if they are to be handled economically, some provision must be made other than the distribution by truck from distant freight terminals.

Passenger terminal stations should be eliminated so far as possible. They are costly to acquire, expensive to maintain, and increase rather than decrease congestion. So far as possible, railway lines should be operated through a city and not terminate therein.

Through lines should not be permitted to unload their passengers at the outskirts of the city and to compel the urban lines to distribute their traffic. They should be obliged to operate lines through the heart of the city and so far as possible distribute their own business.

It is essential that the interurban and steam lines be so located that they shall have a relation to the purely urban facilities. The stations upon the through lines should coincide with express and local stops on the urban rapid transit lines, and the surface lines should radiate from local as well as express stations. Increased speed means increased capacity and a greater area of service. It is also cheaper to carry persons upon express trains than upon trains that make every stop, provided there is a sufficient number to fill these express trains and to utilize the tracks at some time of the day to their capacity. The tracks upon which trains make every stop should have stations at frequent intervals, but if the stations are too close together, the line ceases to be a rapid transit line. The proper adjustment of these facilities is one of the most difficult problems of city planning.

In the New York subway, the idea of local and express service on parallel tracks was worked out quite successfully and was a distinct contribution to the science of urban transportation. Experience has shown, however, that the relation of express to local stations was not so adjusted as to secure the greatest utility for every track. During rush hours the express tracks are loaded to their maximum capacity and trains of ten cars are run at intervals of 1¾ min. The service on the local tracks at no time of the day reaches the maximum capacity of those tracks. The maximum number of cars in a train is six and the minimum headway is about 1¾ min. The ratio of use between the local and express tracks is, therefore, about three to five. The explanation is that the express stations are not far enough apart to distribute the traffic properly. In the new lines an attempt has been made to remedy this condition by placing the express stations further apart.

SUBWAYS OR ELEVATED LINES

The question of cost is a factor which must not be overlooked. The success of subways in a few cities has given rise to the idea that every city should have subways and that all will be profitable. This is a mistaken notion. Subways are easily operated, but they are expensive to construct and this means large fixed charges. In order to offset this burden, there must be dense traffic or many persons riding short distances. Dense traffic, however, means congestion of population. Areas given over to private houses, each with its own grass plot and garden, cannot furnish a sufficient population to support a subway unless the ride is very short and the rate of fare high. But to have single houses, people

*Abstract of a paper read before the City Planning Conference, Chicago, May 5-7.

†Member of the Public Service Commission, New York, N. Y.

must go some distance from the center of the city and then the ride is long. If the fares are high, the great mass of the population cannot afford to pay them.

More attention should be given to reducing the cost of rapid transit lines. A subway is the most expensive kind that can be built. The old-style elevated road is much less expensive, and the solid-floor or so called "noiseless" type stands between the two. Elevated lines are more comfortable than subways, having better ventilation and light.

FREIGHT TRANSPORTATION

The transportation of property is not less important than that of passengers, and in every plan of city development provision should be made for a prompt and cheap method of distribution. Thus far the railways and steamship companies have assumed that their function ended with the provision of terminal facilities somewhere within the boundaries of the city. Not infrequently these terminals are located upon the periphery of the city and usually considerably removed from the consumer and the factory, so that products have to be transshipped and hauled long distances by wagon or motor truck. In metropolitan centers such a plan is quite unsatisfactory.

The maintenance of terminals in the heart of the city is very expensive, but thus far sufficient consideration has not been given to the correlation of various factors. The yards are commonly large areas where only the surface is utilized. No use is made of the space either above or below the tracks, and seldom has any attempt been made to bring warehouses and factories into close proximity. The distribution of food products represents a somewhat different problem. These must go to every home, and consequently the facilities for distribution must reach every part of the city. In this connection the country and city electric lines have not been fully utilized. During the night time and early morning hours these lines are practically unused. The cost of operating cars at these times would entail practically no fixed charge and the operating expenses would be small.

In the largest cities it will probably be necessary within the near future to provide special means for freight transportation. The situation has almost reached this stage in New York, and propositions have already been made for the construction of subways and elevated lines for this kind of service.

MUNICIPAL CONTROL OF TRANSIT FACILITIES

As long as the various transportation facilities are in the hands of private individuals and controlled by different corporations, it is obvious that they cannot be brought into correlation and each made to serve the public in a proper way without a superior force. Each one ought not to be permitted to carry out its own wishes regardless of its relations to other facilities. It is absurd that a company should locate a terminal removed from other transportation facilities and insist that the city should provide means for the distribution of the traffic which it brings to this inconvenient point. Moreover, conditions change and what is proper and adequate in one generation is often inadequate and ill suited to the demands of the succeeding generation. Consequently, there must be public control, not only over the first location or first scheme of development but over future development also. The city should always be in a position where it can dominate the situation.

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The Land-Tax System or Benefit Assessments for Public Improvements in Kansas City, Mo.*

By George Kessler†

The land-tax method [assessments for benefits.—Ed.] is applied in Kansas City, Mo., to provide funds for permanent improvements, inclusive of the establishment and maintenance of the park system. But little street improvement is made out of general revenue and only the principal trunk line sewers are paid for by general taxation or by bond issues. All else is done by means of special assessment against benefited land. In the case of special assessments for particular improvements, these assessments lie against the lands only, in no case taking the improvements thereon into account.

When a street or boulevard is to be established, widened or lengthened the city proceeds in the local civil courts to expropriate or condemn the necessary land. The cost of the land thus taken is then assessed against the private lands within a prescribed benefit district. In the case of streets this is usually abutting land. In the case of boulevards, custom has established the frontage upon the adjoining parallel street on each side as properly within a district specifically benefited by the establishment of such improved highways.

The grades are then established, and should there be great changes of ground surface opportunity is given to claim damages, the cost of which is assessed as a special land assessment against the properties in the benefited district. The highway is then graded, and the cost of this work assessed in proportion to the value of the property assessed and against the lands forming the normal frontage on the highway so improved. The cost of sewerage is assessed against the lands within the area to be served, on the basis of cost in proportion to its area.

The city then further proceeds to build the curbs, the paving and the sidewalks, assessing all of these elements against the abutting properties in proportion to the frontage.

The city may (but does not, as a rule) further assess the abutting properties with the cost of establishing the lawns on the sidewalk spaces. It does assess the cost of shade-tree planting and care upon the abutting property in the case of the streets. On the boulevards, the Park Commission provides for tree planting and lawns on the sidewalk spaces. The city does not assess for the establishment of water mains, and the installation of lighting equipment is an incident to the general contract for lighting, paid for out of the general revenue.

The park and boulevard system is administered by a Board of Park Commissioners. It has the exclusive power of selection, no powers of legislation, but exclusive powers of administration. It began 20 years ago to plan (under the writer's direction), but acquisitions were not accomplished until approximately 1896. Since that time to the middle of April, 1913, the expenditures have aggregated $11,680,000; 82.3% of this provided by special assessment and 17.7% by general taxation. The Park Department had no hope of aid from current revenue, and the city's debt-making power had reached its limit for the purchase of the water-works. In applying, therefore, the principle of benefit assessments for the creation, improvement and maintenance of this park system, there were established certain assessment districts used as unit areas of taxation. Provision was made for the collection of the special assessments in instalments, which have ranged from 10 to 20 years, generally the latter. In order that there should be no necessity for waiting until the end of the 20-year term to obtain the funds necessary to pay for the properties taken, provision was made for the issue and sale of securities known as park-fund certificates, which found favor with large investors and have always found prompt and ready sale, indeed always at some slight premium.

For the purpose of improving and maintaining the parks and boulevards, and in the absence of sufficient current revenue appropriated by the legislative body, there was established a power to assess annually within the limits of each park district (and for the sole benefit of that district) every parcel of private land within that district. It was found desirable also to assess annually a low maximum charge against the abutting private properties for the exclusive purpose of maintenance. As a low limit was finally placed upon the powers of the city to make the annual maintenance levies, the Park Department was given all of the vehicle-license tax collected by the city.

One difficulty of the maintenance levy is that the older park districts naturally contain the high-value business areas, thus obtaining ample revenues for improvement and maintenance, while the outlying and intermediate districts, having comparatively low values, obtain insufficient funds. Therefore, there must each year be obtained from the current general revenues a sufficient apportionment to the Park Department for the expenditures necessary in these districts beyond their local district revenues. This becomes particularly true of the large outlying park, the entire cost of improvement and maintenance of which must necessarily be borne out of current revenues.

In effect this system has placed the Kansas City Park Department in a semi-independent condition with reference to its funds, and has made it possible to accomplish results that would have been entirely out of the question under any other financial system in that city. In practice this entire procedure is an amplification of the theory of the single tax [on land only.]

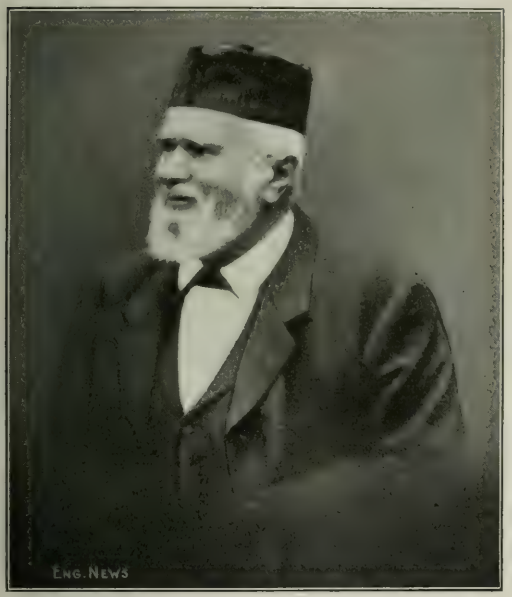
*Abstract of a paper read at the City Planning Conference, Chicago, May 7, 8.

†Landscape Architect, St. Louis, Mo.

Adolphus Bonzano*

Adolphus Bonzano, President of the Bonzano Rail Joint Co., and formerly a prominent bridge engineer, died at his home in Philadelphia, Penn., May 5. He was born at Ehingen, on the Danube, Wurttemberg, Germany, on Dec. 5, 1830. His early education was received at the gymnasia of Ehingen and Blönsdorf and at Stuttgart, but when still a boy his father emigrated to Texas, where, with others who emigrated about the same time, a considerable German colony was established.

In 1850 Adolphus and one brother went to Philadelphia, where he remained for two years to study and to perfect himself in the English language. He then went to Springfield, Mass., where he entered the machine shop of the American Machine Works as an apprentice. After



ADOLPHUS BONZANO

a few years he was made superintendent of the works, and in 1855 he was sent to New Orleans to take charge of the erection of the engines and machinery built at Springfield for the United States Mint.

For several years he was engaged with the mechanical departments of various railways and in machine shops. In 1865 he was made Superintendent of Construction of the Detroit Bridge & Iron Works at Detroit, Mich., and thereafter devoted the greater part of his life to bridge and structural engineering. While with the Detroit Bridge & Iron Works he had charge of construction of the great bridge over the Mississippi River at Quincy, Ill., of which the late Thomas Curtis Clarke was Consulting Engineer.

In 1868 Mr. Bonzano went to Phœnixville, Penn., to become associated with Mr. Clarke, who had organized the bridge building firm of Kellogg, Clarke & Co. Of this firm he was a prominent member and its Chief Engineer. In 1870 the firm was reorganized on the retirement of Mr. Kellogg, and became Clarke, Reeves & Co., with whom Mr. Bonzano remained as Chief Engineer.

Under his direction some of the most notable iron bridges in this country and Canada were constructed, including among many others, the Hudson River bridge for the New York Central & Hudson River R.R., at Albany, N. Y., the Girard Ave. bridge in Philadelphia, the Second, Sixth, Eighth and Ninth Ave. elevated railways in New York City and the famous Kinzua viaduct on the Erie R.R.

In 1881 the firm of Clarke, Reeves & Co. was dissolved and a stock company was organized under the name of the Phœnix Bridge Co., of which Mr. Bonzano was Vice-President and Chief Engineer until 1893. During these years the company built many now famous structures, including the Pecos viaduct for the Southern Pacific Ry. in Texas, the Red Rock bridge of the Atlantic & Pacific Ry. over the Colorado River Cañon, and the trainshed of the Philadelphia terminal of the Philadelphia & Reading Ry. From 1893 to 1898 he was associated with Mr. Clarke as a consulting engineer with offices in New York City. In 1898 he retired from active professional work to devote his entire attention to the development of his inventions of railway and engineering appliances, of which the well known rail joint, which bears his name, is one.

Mr. Bonzano was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the Canadian Society of Civil Engineers.

In addition to his accomplishments as an engineer, inventor and manufacturer, he was a talented musician, a skillful pianist, organist and choirmaster. His genial and kindly manner endeared him to his many friends in all walks of life. Few bore him greater love and loyalty than his former employees, in whom he kept up a lively interest all through the years after his retirement from active business life.

He is survived by two sons, Maximilian Ferdinand, a well known engineer of Philadelphia, and Hubert.

*From data furnished by John C. Trautwine, Jr., 257 S. Fourth St., Philadelphia, Penn., and by M. G. Lippert, Chief of Drawing Room, Phoenix Bridge Co., Phoenixville, Penn.

A Locomotive Boiler Explosion occurred on the Missouri Pacific Ry., near Tipton, Mo., on May 4. A brakeman and the fireman were seriously scalded, but no one was killed.

A Mississippi River Flood-Rescue Steamer, the "Concordia," collided with a railway bridge at Clayton, La., on May 2, and sank with 130 refugees on board. All but 22 persons were rescued. It is reported that the "Concordia" sank while engaged in similar work last year, but was raised and repaired.

Three Runaway Freight Cars collided with a passenger train on the Grand Trunk Ry., near Oxford, Mich., on May 1. The cars had run on a half-mile down grade when they met the locomotive of a passenger train coming in the opposite direction. The engineman was fatally injured and 25 passengers received more or less severe injuries.

An Explosion of Dynamite in the magazine of the Sunshine Coal & Coke Co., Mine 1, about 3 miles from Masontown, Penn., on May 10 practically obliterated the little mining settlement there. Three men were killed and about 40 persons were injured, half of them seriously. The cause of the explosion is not known.

A Hole in 12-Ft. Brick Sewer in Johnson Ave., Brooklyn, N. Y., caused a street cave-in on May 6. It is believed the failure was due to a leak in a 20-in. water main laid above the sewer. A 1½-in. pipe tap in the main had come out, and a stream of water under 50 lb. pressure had been directed against the haunch of the arch, and had forced a hole through it. The sewer was built about 25 years ago. Street cars had been passing over the cavity left by the washed-out material up to within a few minutes before the final cave-in.

The Collapse of a Temporary Sidewalk at Geary and Mason Sts., San Francisco, Calif., on May 2, caused serious injuries to a score or more people in a dense crowd just leaving a theater. The temporary plank walk had been erected earlier in the same day by contractors who had begun the excavations for an adjoining building. The structure is reported to have been 50 ft. long and 10 ft. wide and to have collapsed the entire length under the weight of some 200 people, who were crowded upon it. Howard C. Holmes, M. Am. Soc. C. E., Consulting Engineer, of San Francisco, is said to have been on the sidewalk at the time, and Mr. Holmes is quoted by the San Francisco "Chronicle" as follows:

> There was no swaying motion to the sidewalk, so I should judge that its collapse was not due to lack of sway bracing. We were right in the middle of the sidewalk and it seemed to me that it just gave way and sank vertically. That would indicate that the foundation on which the uprights rested was not firm.

Flood Damage to the Pennsylvania Lines. Northwest System and Central System (i.e., excluding the Panhandle) is stated by R. Trimble, Chief Engineer of Maintenance-of-Way, to be as tabulated:

	N W system	Central system
Bridges lost, No.	6	6
Bridges damaged, No.	15	6
Spans lost, No.	8	16
Spans damaged, No.	14	11
Bridges lost, length, ft. road	400	2,142
ft. single track	725	2,142
Bridges damaged, length, ft. road	941	1,230
ft. single track	1,675	1,230
Estimated cost of replacing bridges	$265,336	$351,920
Trestle, single track, mi.	0 06	1 13
double track, mi.	0 25	
Total mi. road	0 31	1 13
mi. single track	0 56	1 13
Estimated cost of trestles	$39,954	$119,560
Roadbed requiring repairs, single track, mi.	1.7	36 5
double track, mi.	16 5	0.7
three track, mi.	1 1	
four track, mi.	2.2	
Total mi. road	21 5	37 2
mi. single track	46 8	37.9
Estimated cost of repairs to road	$210,800	$542,885
Station and other buildings, damage	5,350	17,750
Equipment, damage	3,800	6,350
Telegraph lines, damage	28,305	17,500
All other damage	10,190	20,735
Total estimated loss	$563,735	$1,076,700

The Commission Plan of City Government was adopted at Portland, Ore., on May 3. An election will be held in June for five commissioners, including a mayor, and for an auditor.

The San Francisco Municipal Railway will soon be running cars from the Ferry to the Beach, under authority granted on Apr. 22, by a popular vote of 38,089 to 21,920. This vote was in ratification of an agreement between the United Railroads and the city, under which the city appears to be given trackage rights on lower Market St. and the company is to be permitted to run its Sutter St. cars down Market St. to the Ferry, instead of turning them on a loop at Sutter and Market St., as at present. The city will build two tracks for a short distance (Kearney to Sansome St.) on Market St., from the city end of its present Geary St. line, and will also build from 33d Ave. to the Beach, at the other end. Horse cars on lower Market St. will be abolished.

The Three Bids for a Water-Filtration Plant for Wilmington, Del., received on Apr. 30, 1913, have been rejected upon the recommendation of Ezra B. Whitman, water engineer. In readvertising, the work will be divided in the hope of securing more competition than resulted from including structural work and filter equipment in one contract. The three bids received on Apr. 30 were: Keystone State Construction Co., Pennsylvania Building, Philadelphia, $971,187; New York Continental Jewell Construction Co., 15 Broad St., New York, $982,563; Oscar Daniels Co., Woolworth Building, New York, $1,016,526. On filter equipment alone the bids, in the order above given, were $385,000, $367,600, $375,000. The detailed bids are given in our Construction News columns.

PERSONALS

Mr. A. N. Carver, Division Engineer of the San Benito & Rio Grande Valley R.R., at San Benito, Tex., has resigned.

Mr. K. A. Dumphy has been appointed Resident Engineer on the Alberta division of the Canadian Pacific Ry. at Calgary, Alta., succeeding Mr. J. Robertson.

Mr. Ralph W. E. Donges, of Camden, N. J., has been elected President of the Board of Public Utility Commissioners of New Jersey, succeeding Mr. Robert Williams, of Patterson, N. J.

Mr. George A. Ricker, M. Am. Soc. C. E., of Ricker & Minniss, Buffalo, N. Y., has been appointed First Deputy Highway Commissioner of New York State at a salary of $6000 per annum.

Mr. Joseph E. Crawford, M. Am. Soc. C. E., Bridge Engineer of the Norfolk & Western Ry., Roanoke Va., has been appointed Acting Chief Engineer, succeeding Mr. Charles S. Churchill, M. Am. Soc. C. E., assigned to special duty.

Mr. W. L. Huber, Assoc. M. Am. Soc. C. E., until recently District Engineer, U. S. Forest Service, has opened offices at 417 Foxcroft Bldg., San Francisco, Calif., for practice as a consulting engineer, specializing in water power and structural engineering.

Mr. Bernard L. Eaton, formerly Superintendent of Construction with the Porto Rican Irrigation Service, at Juana Diaz, Porto Rico, has been appointed Erecting Superintendent of the turbine department of the I. P. Morris Co., Philadelphia, Penn.

Mr. John D. Patterson, Superintendent of Terminals of the Louisville & Nashville R.R., at Atlanta, Ga., has been appointed Superintendent of the Panama R.R., with headquarters at Colon, Panama, succeeding Mr. B. M. Smith, resigned. For many years Mr. Patterson was a passenger conductor on the Southern Ry.

Messrs. H. B. Pullar, Assoc. Am. Soc. C. E., formerly Assistant Manager and Chief Chemist of the American Asphaltum & Rubber Co., Chicago, Ill., and C. H. Enzenroth, for some time associated with Mr. Pullar, have formed a partnership under the firm name of Pullar & Enzenroth, Engineering Chemists, with offices and laboratory at 378 Woodward Ave., Detroit, Mich.

Mr. Charles A. Ferry, M. Am. Soc. C. E., formerly associated with Mr. A. B. Hill, M. Am. Soc. C. E., Consulting Engineer, New Haven, Conn., has opened an office in the Benedict Bldg., New Haven, for the general practice of civil engineering. Mr. Ferry's design for the new Yale University football ampitheater has recently been adopted and construction work will be begun at once.

Prof. Daniel W. Mead, M. Am. Soc. C. E., of the University of Wisconsin, has been appointed Engineer to represent the interests of the city of Peru, Ind., in the reconstruction of the railway bridge over the Wabash River, which was destroyed by the recent floods. It is claimed by the city authorities that the old bridge acting as a dam was in some measure responsible for the flood conditions in the city.

Mr. Carmi A. Thompson, formerly Treasurer of the United States, has been appointed General Manager of the Great Northern Ry. ore properties in Minnesota. It is announced that after the expiration of the United States Steel Corporation's lease in 1914, the properties will be operated independently by Mr. James J. Hill and his associates who own them. The headquarters of the mining company will be in St. Paul, Minn.

Mr. W. H. Banck, formerly Junior Engineer of the U. S. Engineer Department and recently in charge of a survey for the proposed harbor of refuge at Cape Lookout, has opened an office in the Garrell Bldg., Wilmington, N. C., for the general practice of civil engineering. Mr. Banck is a graduate of the Agricultural and Mechanical College of North Carolina and has been engaged in work for the United States Government since graduation.

Mr. G. A. Rodman, formerly Inspector of Bridges of the New York, New Haven & Hartford R.R., has been appointed General Supervisor of Bridges and Buildings in charge of the inspection of all bridge and building work to be done by the maintenance-of-way department, with headquarters at New Haven, Conn. The office of Superintendent of Bridges and Buildings is abolished and duties hitherto performed by that officer are assigned to the Division Engineers.

Prof. Henry H. Norris, F. Am. Inst. E. E., head of the department of electrical engineering at Cornell University, has resigned to become a member of the editorial staff of the "Electrical World," New York City. Prof. Norris was born in Philadelphia, Penn., in 1873. He received an M. E. degree from Cornell University in 1896. He was made Assistant Professor of electrical engineering at Cornell in 1900 and Professor in 1905.

Dr. A. J. Orenstein, has resigned his position at Assistant Chief Sanitary Inspector, Panama Canal. He goes to Hamburg, Germany, to enter the Colonial Institute in that city, with the view of later entering the German Colonial Service in Africa. He entered the canal service on Nov. 6, 1905, was stationed for a time at the Colon and Ancon hospi-

tals. later was appointed district physician at Ancon, and Assistant Chief Sanitary Inspector in May, 1911.

Messrs. Edmund T. Perkins, M. Am. Soc. C. E., President and Chief Engineer of the Edmund T. Perkins Engineering Co., Chicago, Ill.; Isham Randolph, M. Am. Soc. C. E., Consulting Engineer, of Chicago, Ill., and Marshall O. Leighton, M. Am. Soc. C. E., Chief Hydrographer of the United States Geological Survey, Washington, D. C., have been appointed a State Engineering Commission to investigate and report upon the reclamation of the Florida Everglades by drainage.

Mr. A. R. Whaley, who was recently elected Vice-President of the New York, New Haven & Hartford R.R., in charge of operation, has been appointed to take charge of the engineering, construction and maintenance-of-way department also, succeeding Mr. E. H. McHenry, M. Am. Soc. C. E., resigned, as previously noted in these columns. Mr. Whaley has introduced a number of changes in the organization of the engineering department, which are noted elsewhere in these columns.

Mr. William R. Driver, Jr., formerly General Superintendent of the Bell Telephone Co., of Philadelphia, Penn., has been appointed General Manager of the New England Telephone & Telegraph Co., at Boston, Mass., succeeding Mr. Francis A. Houston, who has been appointed Treasurer of the company. Mr. Driver is 41 years old. He was born in Beverly, Mass., and educated at Harvard University. He entered the engineering department of the New England Telephone & Telegraph Co., in 1893.

Mr. J. W. Barrie, formerly Division Engineer of the Pennsylvania R.R. lines West of Pittsburgh, has been appointed Principal Assistant Engineer of Maintenance-of-way of the Florida East Coast Ry. Mr. Barrie was born in Dundee, Scotland, in 1875. He graduated from Ohio State University in 1897. After graduation he entered the service of the Pennsylvania R.R. as an assistant in the engineering corps of the Pennsylvania Co. For several years he was Engineer of Maintenance-of-way of the Toledo division.

Mr. Robert A. Cairns, M. Am. Soc. C. E., City Engineer of Waterbury, Conn., was the recipient of an honorary dinner by his friends and prominent citizens of Waterbury, on Apr. 29. The object of the dinner was to publicly express the appreciation of the city's business men of Mr. Cairns' decision to remain loyal to his city work rather than accept the Governor's offer of the position of State Highway Engineer of Connecticut. Mr. Cairns has been City Engineer of Waterbury for 22 years—through many changes in the city administration and through many changes of the dominant political party.

Mr. H. Gilliam, Electrical Superintendent of the New York, New Haven & Hartford R.R., will hereafter have charge of the maintenance, distribution and control of all electrical apparatus and high-tension wires from the crossarms outside the switch-house to the shoes of the locomotives, which includes the high-tension primaries of all transformers and switches connected with the distribution system. On all matters relating to operation he will report to the Division Superintendents. He will also act in an advisory capacity for all high-tension lines heretofore maintained by the Signal Engineer.

Mr. W. J. Backes, M. Am. Soc. C. E., former Chief Engineer of the Central New England Ry., has been appointed Engineer of Maintenance-of-way of the New York, New Haven & Hartford R.R. and the Central New England Ry. He will have charge of the maintenance of tracks, bridges, buildings and signals. The Division Superintendents are to report to the Engineer of Maintenance-of-way on all matters within his jurisdiction. The Division Engineers will report to and receive instructions from the Division Superintendents. They will report to the Engineer of Maintenance-of-way on matters pertaining to the inspection of physical property, construction and standards of maintenance other than signal standards, on which they will report to the Signal Engineer.

Mr. A. R. Whaley, Vice-President of the New York, New Haven & Hartford R.R., in charge of operation and construction, has made the following changes in the organization of his departments: Mr. Edward Gagel, M. Am. Soc. C. E., Chief Engineer, will have charge of the engineering department and will have jurisdiction over all matters pertaining to construction and standards; Mr. C. L. Bardo, General Manager, will have charge of all matters pertaining to transportation, maintenance of equipment, power stations, high-tension lines, track, signals, bridges and buildings. The Engineer of Maintenance-of-way, General Superintendent, Mechanical Superintendent, Electrical Superintendent, Signal Engineer, Superintendent of Telegraph, Contract Agent and Superintendent of Dining Cars will report to the General Manager.

Mr. Edward Gagel, M. Am. Soc. C. E., Chief Engineer of the New York, New Haven & Hartford R.R., has announced the following appointments to offices under the Chief Engineer at New Haven, Conn.: Mr. A. S. Tuttle, formerly Division Engineer of Construction, Boston, Mass., is appointed Construction Engineer in charge of grade-crossing elimination in Massachusetts; Mr. C. W. Lord is appointed Office Engineer at New Haven, in general charge of the drafting department; Mr. W. H. Moore, M. Am. Soc. C. E., formerly Engineer of Bridges is appointed Engineer of Structures in charge of the design of all bridges and structures. Mr. L. J. Cartmail, M. Am. Soc. C. E., formerly Engineer of Maintenance-of-way, is appointed Construction Engineer in charge of work on the Central New England Ry. The office of Assistant Chief Engineer of the Central New England Ry. is abolished.

The New York, New Haven & Hartford R.R. General Manager has announced the following changes in the mechanical department: Mr. G. W. Wildin is appointed Mechanical Superintendent, with office at New Haven, Conn.; Mr. George O. Hammond is appointed Assistant Mechanical Superintendent, and the position of Assistant to the Mechanical Superintendent is abolished; Mr. H. C. Oviatt is appointed Assistant Mechanical Superintendent, and the position of General Inspector is abolished; Mr. J. L. Crouse is appointed Superintendent of Shops, Electric Division, with headquarters at Van Nest, N. Y.; Mr. Joseph McCabe is appointed Master Mechanic of the Shore Line division at Harlem River, N. Y.; Mr. C. H. Reid is appointed Master Mechanic of the Western division at Waterbury, Conn.; and Mr. F. W. Nelson is appointed General Road Foreman of Engines, with headquarters at New Haven, Conn. The jurisdiction of the Mechanical Superintendent is extended to cover the maintenance of electric locomotives or multiple-unit cars, and the operation and maintenance of power stations up to and including the lines at the crossarms outside of the switch-house.

OBITUARY

Peter E. Bowman, a former Division Superintendent of the New York, New Haven & Hartford R.R., died at his home in New Haven, Conn., on May 9, aged 65 years.

Samuel L. Cooper, M. Am. Soc. C. E., City Engineer of Yonkers, N. Y., died at his home in that city May 8. He was born in New York City in 1858, and graduated from the College of the City of New York. For ten years he was with the engineering department of the City of New York, and for five years was Resident Engineer of the old Croton aqueduct. Later he was an examining engineer in the New York City finance department.

Alfred Brittain, M. Can. Soc. C. E., of Montreal, Que., died at his home in that city, May 6, from pneumonia. He was born in England 72 years ago, the son of James Brittain, also an engineer. Alfred Brittain went to Canada in 1866 as an officer of the Royal Engineers of the British Army. A short time later he resigned from the Army to become City Engineer of Montreal. During his 35 years' of service with the city a large part of the present sewerage system was planned and constructed under his supervision.

Frank O. Briggs, for many years connected with the firm of John A. Roebling's Sons Co., engineering contractors and suspension bridge builders, of Trenton, N. J., died May 8. He was born on Aug. 12, 1851, and graduated from the United States Military Academy at West Point, N. Y., in 1872. He resigned from the Army five years later to enter the employ of the John A. Roebling's Sons Co., builders of the Brooklyn Bridge. He had been Assistant Treasurer of the company since 1883. Mr. Briggs was Mayor of Trenton from 1899 to 1902, a member of the State Board of Education 1901-'02, State Treasurer of New Jersey 1902-1907, and in 1907 he was elected United States Senator from New Jersey.

Charles Walker Raymond, M. Am. Soc. C. E., Brigadier-General, Corps of Engineers, U. S. A., retired, died at his home in Washington, D. C., May 3. He graduated from the United States Military Academy at West Point in 1865. For some years he was an instructor in engineering subjects at the Academy, and later was in charge of the government scientific expedition to Northern Tasmania to observe the transit of the planet Venus. For two years, 1889-1890, he was Engineer Commissioner of the District of Columbia, and later was connected with many river and harbor improve-

ment projects on the Atlantic and Gulf coasts. He was a member of the board of advisory engineers of the Pennsylvania R.R. on the construction of the Hudson and East River tunnels at New York City. He was retired from the Army in 1904 at his own request.

James Cooper Bayles, Past-President of the American Institute of Mining Engineers, and for many years Editor of the "Iron Age," died in New York City, May 7, at the age of 68 years. He was born in New York in 1845 and obtained his early education in the public schools of the city. He served in the Union Army during the Civil War, and afterward joined the engineering staff of the Raritan & Delaware Bay R.R. From 1868-69 Mr. Bayles was Editor of the "Commercial Bulletin," of New York City, resigning this post in 1870 to become Editor of the "Iron Age," New York City. This position he held for 19 years, and during this period, in 1884-'85, he served as President of the American Institute of Mining Engineers and as President of the New York City Health Department. Mr. Bayles received the degree of Ph.D. from Rutgers College and was the recipient of many other honors. He was President of the New Jersey State Sanitary Association in 1884. He was a charter member of the American Society of Mechanical Engineers and a member of the Iron and Steel Institute of Great Britain. He is survived by two sons, both engineers, Lewis P. Bayles, of Easton, Penn., and Howard Bayles, a mining engineer in Chile.

Alexander Benjaminovich Bary, a famous Russian engineer and financier, died Apr. 19, at his home in Moscow, Russia. He was born in Russia and educated in the Voronieje Gymnasia (classical), but owing to the emigration of his family he was obliged to finish his studies at the Polytechnic Institute at Zurich in Switzerland. Soon after his graduation he came to the United States where he went through many interesting experiences. He was a fireman and laborer in iron works, draftsman, and finally Superintendent of Construction for buildings at the World's Fair in Philadelphia in 1876. He returned to Russia and became associated with the Russian promoter and financier, Ludvig Nobel, who employed Bary to organize some petroleum works in Baku. As manager of Lugvig Nobel's engineering work Bary developed extraordinary engineering and executive ability and he soon started in business on his own account. In Moscow he organized the Russo-American Co. for refining petroleum products, founded the Moscow Naphtha Trade Association, the Mitisctchensky Car Building Works and a large boiler manufacturing plant. He was also a builder of bridges, boats and locomotives. To the end of his life he retained the executive control of his many enterprises and even personally financed them. He was the contractor for all the buildings at the All-Russias Exhibition in 1896 at Nigni-Novgorod and for the enormous docks at St. Petersburg. Mr. Bary was the first Russian manufacturer to introduce a nine-hour working day for his laborers. He is said to have been plain in manner, sympathetic, and to have gained and held the friendship and loyalty of his many employees. He was a multi-millionaire and famous as a philanthropist. (From data furnished by Gustav Lindenthal, Consulting Engineer, New York City.)

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
May 20. Annual business meeting at New York City. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

NATURAL GAS ASSOCIATION OF AMERICA.
May 20-22. Annual meeting at Cleveland, Ohio. Secy., N. W. Gifford, 26 Central Square, East Boston, Mass.

AMERICAN RAILWAY ASSOCIATION
May 21. Spring session at New York City. Secy. W. F. Allen, 75 Church St., New York City.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION
May 21-24. Annual meeting at Galveston, Texas. Secy., H. S. Cooper, 105 Slaughter Bldg., Dallas, Texas.

NATIONAL ASSOCIATION OF MANUFACTURERS
May 19-21. Annual meeting at Detroit, Mich. Secy., G. S. Boudinot, 30 Church St., New York City.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS
May 20-22. Annual meeting at Chicago, Ill. Secy., A. G. Thomason, 821 Old South Bldg., Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
May 20-23. Spring meeting at Baltimore, Md. Secy., C. W. Rice, 29 W. 39th St., New York City.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.
May 21-24. Annual meeting at Chicago, Ill. Secy., C. G. Hall, 922 McCormick Bldg., Chicago, Ill.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL, AND STEAM ENGINEERS.
May 22-24. Annual meeting at Springfield, Ohio. Secy., F. E. Sanborn, Columbus, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL DISTRICT HEATING ASSOCIATION.
May 27-29. Annual convention at Indianapolis, Ind. Secy., D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St., New York City.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 411, C. & N. W. Ter, Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy. Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th. St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young, 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

American Institute of Mining Engineers—The annual convention will be held in Butte, Mont., Aug. 18-21. A stop will be made at Great Falls, Mont., on Aug. 16. The secretary is Bradley Stoughton, 29 W. 39th St., New York City.

Illuminating Engineering Society—The Philadelphia section of the society held a joint meeting on Apr. 23, with the Philadelphia Gas Works section of the National Commercial Gas Association and the Philadelphia Electric Co. section of the National Electric Light Association. The paper of the evening was on "Industrial Lighting," by Thomas W. Rolph, of the Telephone Works of the General Electric Co.

Concrete Institute—A report on algebraic symbols for use in structural calculations (on wood, steel or concrete) was submitted at the Apr. 24, 1913 meeting of the Concrete Institute by the Science Standing Committee, Chairman E. Flander Etchells. The report discusses various principles which should govern the choice and relative typographical characteristics and sequence of different symbols, i.e., letters standing for different quantities; it then presents a series of notation tables specifically designed for formulas and analyses in (a) structural engineering generally, (b) reinforced concrete, (c) structural steel, (d) brickwork and masonry, (e) timber. Most of the elements of the notation depart entirely from that customary in the United States. The presentation of the report was followed by discussion by F. E. Wentworth-Sheilds, Prof. Henry Adams, W. A. Green and H. K. Tyson.

International Meeting of Consulting Engineers—A congress or international meeting of consulting engineers and professional experts or referees is to be held during the Universal Exposition in Ghent, Belgium, July 17-22. It will be held under the auspices of the Belgian organization, Chambre Syndicale des Ingénieurs Conseils en matière d'Installations Industrielles, of which R. E. Mathot is President, and Chas. de Herbais de Thun is Secretary. Membership in the congress will be in two classes, paying respectively 100 francs and 20 francs, with no difference in rights. However, anyone may secure the publications of the congress, without taking membership, by the payment of 10 francs. The question of founding a federation of consulting engineers' associations will be touched upon. Other parts of the program schedule are allotted to discussions on organization, professional questions, fees and charges, and related subjects. Subscriptions for membership should be sent to Mr. de Thun, 18 Rue Marie-Thérèse, Brussels, Belgium.

ENGINEERING LITERATURE

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REVIEWS AND NOTES

Practical Working Cost Systems

Reviewed by ROSSITER R. POTTER*

COST REPORTS FOR EXECUTIVES, As a Means of Plant Control—By Benjamin A. Franklin. New York: The Engineering Magazine Co. Cloth; 6x9 in.; pp. 149; with numerous record forms. $5.

An introduction by the editor of the "Engineering Magazine" announces that this volume is made up from a series of articles by Mr. Franklin published in that journal in 1912. Unlike some books assembled from magazine articles, Mr. Franklin's has not suffered in the process. In fact it presents a coherence and logical sequence of chapters which suggests that ultimate publication in book form was contemplated when the articles were first written.

The author's aim is to discuss the value and uses of a practical cost system from the standpoint of the plant manager. He does not, therefore, enter upon any detailed explanation of how to build up a cost system, but points out what a cost system can be made to show when once successfully installed. In the opening chapter on "The Philosophy of Costs," he discusses the general requirements of an ideal cost system and the mental qualifications and viewpoint necessary to get the most out of it. Chief among the qualifications specified are imagination and what the author terms the practical instinct. Imagination comes into use in enabling the executive to visualize the shop conditions represented by the cost reports, while the functions of the practical instinct are to devise methods of improving these conditions and to prevent the compiling of masses of figures which can be put to no practical use.

The first requirement advanced by the author for an ideal cost system is that it shall be operated in connection with the regular bookkeeping. In this way the bookkeeping system can be made to afford a proof of the correctness of the cost figures. If, as the author puts it, the cost system is "put through the bookkeeping system," the trial balance can be made to prove the situation at the end of each month by showing in totals for the whole plant what the cost system shows in detail for separate articles or lots. Perhaps the chief feature of the specimen trial balance shown is a statement of the separate profit or loss on each class of goods manufactured. The author explains that such a trial balance is the final culmination of the cost system. The reader is assured, moreover, that such a trial balance can really be produced monthly without prohibitive expense. In line with his requirement that the cost system be proven through the regular bookkeeping system, the author advises against the practice of basing selling prices on costs estimated by building up from details, unless these costs are checked by working back from the total expense shown by the books. He repeatedly emphasizes the importance of working back from easily proven total costs to individual or detail costs, and warns against business failures due to unproven cost estimates.

Mr. Franklin's three chief subdivisions of cost are the usual ones of materials, direct labor and expense. He discusses in some detail the points to be brought out by cost reports on these three subdivisions, devoting a separate chapter to each. The specimen forms given in these chapters, and in fact throughout the book, are most helpful. They are of a general nature designed to be suggestive of forms suitable for any one of a wide range of businesses. However well arranged, cost reports are of no use, Mr. Franklin explains, unless they are intelligently interpreted and acted upon. He urges the advantage of making the reports accessible to all those of the business organization who can play a part in bringing about cost reductions. Coöperation of the whole executive force is best secured, he believes, in this way. To get the full benefit of the cost reports, statistics must be kept for purposes of comparison and record. In a chapter on this subject, the author discusses both statistics of costs and statistics of related subjects, such as volume of sales, salesmen's results and advertising results.

Mr. Franklin admits, even insists, that a cost system is not an easy thing to install. Plenty of persistence and time are necessary, and in fact "it takes from one to two years time, in a plant of any size, to build a good system." Cost systems may fail to be of any value through the indifference of the chief executive in neglecting to see that a thorough and complete system is installed and in neglecting to get an understanding of the system which will enable an intelligent use of the information revealed by it.

But the author is positive that a right cost system properly used is well worth the trouble. In his final chapter, the cost system is eulogized as the basic improvement for the scientific study of management methods. In this connection, one of the author's comments is worth quoting:

> One thing ought to be clearly understood, viz., that despite the constant talk of systems of all kinds, and their value, no business is made a success by them alone. Business success is made by policies, energy, enthusiasm, work and sagacity. In a struggle of brains versus system, brains will usually win. System * * * * * assumes importance only as intelligence, persistence, and energy wield it.

The adoption of a standard cost system (devised by Mr. Franklin) by the National Association of Machine Tool Builders may have suggested the Government Bureau of Industrial Research proposed in the concluding chapter. One of the tasks for this bureau would be the establishment of uniform cost systems for the various industries. The comparative costs obtained by the uniform systems would then be of use in the regulation of matters that have to do with prices and profits, for example in the adjustment of the tariff.

The chief fault of the book is one of rhetoric. Mr. Franklin not infrequently tries to make one sentence do duty for two or three, crowding in more ideas than can be absorbed by the average reader at one reading. There is never any ambiguity, however. The most complex of the sentences are plain enough when the meaning has been carefully traced through, and Mr. Franklin's ideas, like the cost system he writes of, are usually worth the effort.

In closing this review, the writer wishes to call the attention particularly of the younger engineers to the field open to them in the introduction and development of practical working cost systems. A very little study of the literature of the subject will enable the technically trained man to grasp the essential points. And when once the technic and terminology of costs is mastered, the engineer is in a far better position than the average accountant to arrange even the ultimate details of a cost system. This is because the design of a cost system requires the practical accuracy of the engineer rather than the laborious minuteness of accuracy habitual with accountants.

*Production Engineer, Blood Bros. Machine Co., Kalamazoo, Mich.; formerly Assistant Editor, Engineering News.

A preliminary outline of "A City Planning Classification," designed to meet the need of both city planners and librarians, has been prepared by Prof. J. S. Pray and Librarian Theodora Kimball, of the School of Landscape Architecture, Harvard University (Cambridge, Mass.; price 10c.). The com-

plete work will be published in June (50c.). The preliminary and shorter classification was published for the sake of obtaining criticism at the City Planning conference, held at Chicago, May 5 to 7.

The Holzwarth Gas Turbine

Reviewed by H. E. LONGWELL.

THE GAS TURBINE: Theory, Construction, and Records of the Results Obtained from Two Actual Machines—By Hans Holzwarth. Translated by A. P. Chalkley, A. M. Inst. C. E. Philadelphia: J. B. Lippincott Co. Cloth; 6x9 in.; pp. viii+140; 142 text illustrations. $2.50.

This work is not a general treatise on the gas turbine, but is limited strictly to an analysis and description of the particular type of gas turbine built after the author's designs. Before taking up the book itself a paragraph may be devoted to a description of this turbine.

The Holzwarth gas turbine has a series of combustion chambers arranged in a circle around the axis of the rotor. These combustion chambers have inlet and discharge valves operated hydraulically or mechanically. The combustible charge is introduced into the combustion chamber at a pressure only slightly above that of the atmosphere; it is ignited in the usual manner; and the pressure rises to 6 or 7 atmospheres. The exhaust valve opens, and the products of combustion expand through a nozzle which directs them against the blading of the turbine rotor. Fresh air is next blown through the combustion chamber for scavenging and cooling purposes, and the cycle is repeated. Each combustion chamber acts just like the cylinder of a reciprocating engine working on the Lenoir cycle, with air scavenging, but without a piston. While the action of the combustion chamber is intermittent, resulting in a series of puffs against the turbine wheel, the effect of a plurality of these chambers working in rotation is to produce a turning effort that is practically continuous. The air and gas may be delivered to the combustion chamber by low-pressure blowers, or the turbine may discharge through a rotary exhauster which maintains a slight vacuum in the turbine so that the charge may flow into the combustion chamber by atmospheric pressure. The auxiliaries — compressors or exhausters — are driven by steam turbines, the steam being generated by heat recovered from the exhaust of the gas turbine.

The book is divided into four parts, dealing respectively with the Theory of the Gas Turbine, the Construction of the Gas Turbine, a General Comparison with the Reciprocating Engine, and Results of Tests.

Part I occupies practically one-half of the text. It discusses, from a thermodynamic standpoint, the several processes which go to make up the cycle: charging, ignition, combustion, expansion, and scavenging. It also contains sections on the influence of the size of the combustion chamber, the utilization of exhaust heat, the principles of regulation and other kindred matters.

This part is intensely mathematical. It is decidedly hard reading, because: (1) The style is more or less obscure; (2) there are a considerable number of typographical errors; (3) the symbols used in the various equations are not systematically defined, and in many instances their significance has to be determined by inference from the equations themselves; and (4) on account of the confusion arising from a lack of continuity in the meanings attached to the symbols. For example, at the outset, H indicates the heat content of one kilogram of gas; further on it represents the head corresponding to the velocity of the expanding gases at the nozzle. The ratio of the specific heat at constant pressure to the specific heat at constant volume is represented indifferently by k, $\frac{1}{\kappa}$, and $\frac{1}{k}$. The latter symbol has also the added burden of representing the specific gravity of the gas and its specific heat as well.

In the opening paragraph of the work it is stated that "the foregoing theory of the gas turbine does not give the data for the construction of the turbine, but explains the principles of the various factors on the gas turbine process."

In making this statement, the author evidently does himself an injustice, as most of the important points and theorems seem to be the results of calculations made in accordance with the theory as developed, rather than results derived from actual experiment.

Part II, which purports to give the reader a clear and brief comprehensive idea of the construction of the 1000-hp. turbine now actually built and tested, deals with the first experimental machine built by the author. It illustrates and describes the several successive stages in the development of the machine, together with details of the combustion chambers, rotor, valves, governing mechanism, ignition apparatus and auxiliaries, including the waste heat boiler.

Part III, General Comparisons, contains an interesting defense of the Lenoir Cycle, and a table and some drawings showing the advantages of the 1000-hp. gas turbine over a reciprocating gas engine of equal power, in the matters of weight and space required for installation. The text also discusses the superiority of the turbine over the reciprocating engine from an operating standpoint.

It is in Part IV, Results of Tests, that the reader will experience the keenest disappointment. The first section (14 pages) is devoted to tests on the original gas turbine built in 1908 and tested in 1908-9. This entire section may be summarized in the statement that the cycle proved to be workable, and that the author succeeded in burning various liquid fuels, such as petrol, gas-oil, petroleum, benzol, tar-oil, etc., and that judging from the appearance of the exhaust, the combustion was complete.

There are six tabular reports of these tests (each of which lasted for approximately an hour) but in addition to remarks on the appearance of the exhaust, the data given are only the mean temperature in the combustion chamber, maximum pressure, stroke of fuel pump, fuel per charge, and r.p.m. of cam shaft, none of which seem to be particularly significant. Nothing is said about the speed of the turbine, the power developed, or the efficiency.

An unusually amusing error of translation appears in this section. For each of the several liquid fuels tested, there is a statement of the heat value of the fuel in calories per kg., cost in marks per 100 kg., and energy per hp. in calories. At first thought, this latter figure would appear to indicate the efficiency obtained. However, as the "energy per hp." varies all the way from 540 to 2320 calories, this would indicate —on the assumption that the energy per horsepower per hour was meant, that the efficiency varied between 26 and 113%.

On careful examination it develops that the figure is not energy per hp. at all, but is the energy per pfennig, calculated by dividing the calorific value of 100 kg. of the fuel by the price. The translator has evidently taken it for granted that Pf. (the abbreviation for 0.01 mark) was an abbreviation for Pferd, the German word for horse.

The succeeding 14 pages are taken up with a description of the experiments on the 1000-hp. turbine used for driving a dynamo. The only mention of operating results is given in a single paragraph on page 119:

> In February, 1911, the turbine was run on no load, with full excitation 4000 volts, at 3000 r.p.m., consuming only 250-300 cu.m. of gas per hour with a heat content of 1179 calories. This corresponds to an efficiency of over 20% (if the air resistance of the rotor be taken with that of the dynamo rotor). This was certainly a satisfactory starting point for the efficiency curve.

There are no tests of gas consumption under different loads, and there is indeed no direct statement that the turbine ever carried any load whatsoever. From a diagram on page 123, showing the hp. per combustion chamber in relation to the pressure, it might be inferred that determinations of the hp. per chamber indicated that if all ten chambers had been in operation, the total maximum power developed would have been as much as 450 hp. It was found, however, by experiment that with all of the chambers in action, the scavenging was imperfect, and the power developed per chamber was on that account considerably reduced.

The book closes with an Appendix discussing sundry questions raised by Dr. Stodola in a review of the German edition of this work. Table I in this Appendix gives elaborate data on performances and efficiencies under many different conditions of initial temperature and with loads ranging from 275 to 928 hp. It is a bit disheartening to find on referring to the text that this table does not set forth results of actual tests, but only the calculated probable results of purely hypothetical tests.

Over 40% of the illustrations are reproductions of indicator diagrams showing the intensity and duration of the explosions in the combustion chamber. These diagrams are not critically analyzed, and have such a monotonous similarity of appearance as to suggest mere padding rather than anything of essential interest.

While one might be inclined to suspect that this work was written more with the object of promoting sundry patents than with the object of making a serious contribution to the literature of the subject, it will nevertheless be interesting to those who wish merely to inform themselves regarding the nature of the theoretical cycle adopted by the author, and the mechanism which he devised for reducing it to practice. To those who are looking for specific information as to actual powers and economies, the book will prove disappointing.

The publication office of the Westinghouse Machine Co., East Pittsburgh, Penn.

Criticisms of the Ontario Hydro-Electric Power Commission

AN EXPENSIVE EXPERIMENT—The Hydro-Electric Power Commission of Ontario. By Reginald Pelham Bolton, M. Am. Soc. C. E., author of "Building for Profit" and "Elevator Service." New York: The Baker & Taylor Co. Toronto: McClelland & Goodchild, Ltd. Cloth, 5x8 in., pp. 281; illustrated. $1.25, net.

While the author gives this volume a modest title, yet he makes a most severe arraignment of the ideals and efforts of the Ontario Hydro-Electric Power Commission. This body, it will be recalled, was organized to study the wider general utilization of the water powers of Ontario, where fuel is scarce and costly, and has since put into service a huge transmission system from Niagara Falls besides three other minor developments.

The book aspires to be an engineering and economic study of the work of the Ontario Commission. The first seven chapters, comprising some 60% of the book, are intended to be broad discussions of hydraulics and economics involved in hydro-electric power developments in general and municipal projects in particular, together with a brief historical outline of the Ontario movement, and a discussion of the commercial value of scenic attractions like Niagara Falls.

Probably the interest of an engineer reader will largely lie in Chapters VIII and following, where the author more definitely analyzes the Commission's figures of building and operating the Niagara transmission system, and describes alleged conditions under which the three minor projects were started. Mr. Bolton secured his figures through a "public spirited Honest Man" of retiring disposition, who prefers to remain anonymous (an employee of the Commission perhaps). It is true that full and uptodate reports of the Commission's expenditures, etc., have only very recently been published, but that is the usual way with such documents.*

Mr. Bolton, in his preface, announces that he has "written impartially from the standpoint of an engineer, a property owner, a taxpayer and a citizen deeply interested in the general welfare of the public," in order to prevent, if possible, a similar threatened experiment by New York State. On the face of things, it would appear that the author is a bit disingenuous. His book seems to have been part of a well organized campaign of the electricity supply industry to head off the movement for a state owned hydro-electric system; notices of it occupied large and high-priced advertising spaces in the New York daily papers—a publicity that has been afforded only in the case of a few "best sellers" in the fiction line. Furthermore the author's contemporaneous work for one of the greatest steam-electric companies in the state may have subconsciously influenced his judgment against hydro-electric developments and the Ontario Commission; absolute fairness would have been aided by the acknowledgment of such professional affiliations or engagements in the preface.

Mr. Bolton's specific studies of depreciation, running expenses, rate contracts, character of competition, and adequacy of services will stand very much closer scrutiny than his general hydraulic and economic discussions. For instance, in the two chapters on economics and engineering of water-power development, the author claims that storage for hydro-electric power development reduces the minimum navigable depth of rivers, reduces the ground-water level, and cuts down the crops. For this to happen, it must be dry-season flow that is being impounded instead of the melting snows and unusual rainfalls. Actually, the only ground level reduced is that of early spring and there are over compensating benefits to navigation and agriculture by conserving parts of the flood waters that sweep out to sea, by reducing the devastation of high water, and by distributing river flow more uniformly through the year. This last, incidentally, is the ideal condition for power development.

The commercial value of a waterfall as a scenic display is used as an argument against hydro-electric development. A picture is drawn of a dry Niagara, due to heavy bypassing of water through the plants in dry season. To show such a sad sight, a photograph is reproduced of the Niagara bed unwatered by an ice jam above. Granting that despoiling Niagara would be infamous except in the case of dire necessity in maintaining life, yet why try to argue it in dollars and cents by claiming that the entire annual tourist trade of $20,000,000 would be lost if the beauty of this waterfall fades for two or three weeks in the dry season, just as it has disappeared nearly every winter, of late, through ice jams?

Mr. Bolton defines the most economic utilization of water power as that "by such industries as will utilize the continuous force of the falls for the greatest length of time." This sounds plausible and is true so far as it goes, but it is only a specific statement of a still more basic idea—that the most economic utilization occurs when the total cost of displaced prime power would be a maximum (and above the total cost of delivered hydraulic power). The further argument (based on the pseudo-fundamental idea) that hydro-electric power is not justifiable for the erratic load of personal-comfort and manufacturing service, must therefore fail, if we can determine that enough such services actually exist and will truly cost enough less by transmitted water power, so that the total saving is more than that expected from any and all of the less erratic users. Therefore, it is seen that the author's astonishing statement (page 79) is fallacious, as a broad complete generalization:

"The proposition to convert water power to electrical energy, for the purpose of its conveyance to long distances for general commercial and public purposes, is economically unsound."

That is not all; by a naive multiplication of high loss percentages and low load factors, the efficiency of generation and transmission is made to appear as about 25%—in contrast with the 40 to 60% that has been obtained. The author's idea evidently is that use of peak-load capacity and efficiency of operation are synonymous.

Further on, Mr. Bolton shows that the apparent gain in Ontario by decreased rates, so far, aggregates $652,000 per annum, with a net gain after the deductions for increased cost of street lighting and for sinking-fund payments, of $295,000, or $8 per customer per year. This has required a municipal debt of $14.60 per capita, equivalent to $58.40 per customer benefited. Mr. Bolton argues that this is thoroughly undesirable on broadest economic grounds. Looking at these figures closely, it is seen that the interest on the investment per customer, at 5%, would be only $2.40 per annum, giving an economic gain of $5.60 per annum per customer under the new, compared with the old, situation. It is not that such results as an economic entity are lamentable, but in their individual bearing upon the lives of the citizens—in that the cost of street lighting may have been increased, duplication of facilities permitted, benefits distributed unevenly, and a large public debt created for a service perhaps not demanded by the larger part of the people, together with an unscientific adjustment of rates, which permits of a growing deficit.

Looking at the book as a whole, it would seem that Mr. Bolton had taken the edge from his strictures on the Ontario Commission by his confusing hydraulics and doubtful economics. He would have done better to have stuck to his attack of this instance of municipal operation and not have tried to prove too much.

*See p. 1035 for brief notice of the two latest reports.

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River Engineering

RIVERS AND ESTUARIES, OR STREAMS AND TIDES—An Elementary Study. By Henry Hunter, M. Am. Soc. C. E. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. 69; illustrated. $1 net.

European engineers as a class have much more experience in river engineering than have their brothers in the United States, where such problems are the particular province of the Engineer Corps of the Army. This will explain why Mr. Hunter, one of the leading river and harbor engineers of England, has found it desirable to devote much of his valuable time to a series of elementary lectures on river and harbor control to students of engineering and to put more time and energy into the revision of these lectures for the little book which is noted above. So completely has this branch of engineering passed over to the military arm of the profession in America that we doubt if a similar set of lectures would be accepted in the curriculum of an American university. And yet the recent floods in the Middle West have thoroughly demonstrated that the river problem is one of the big ones of this country and one that must eventually be treated on a much larger scale than its present mere application to "navigable" streams, the adjective being a matter of court interpretation.

The introductory chapters of the book refer to the difficulties of the study of rivers and estuaries, attempt certain definitions and explain methods of approach to the examination of any particular river or harbor. The next chapters take up the question of flow, and the final ones describe river and estuarial works, in general and particular, using some of the noted works of the world as examples.

While Mr. Hunter's lectures, and his consequent book, are not applicable to any of these small river problems which are now of such concern to this country, they are so ad-

mirable a brief exposition of the fundamentals of river and estuary hydrology that we wish that they could be in the hands of every technical student in the United States, and further that they could be amplified to meet our own particular troubles. They are in a delightful literary style, complete in the general information they convey and clear in the presentation of that information. The subject is such a large one that a small book can give only the most cursory survey, but Mr. Hunter has made that survey as comprehensive as could be hoped for.

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Mechanics

Reviewed by LEWIS E. MOORE*

THE THEORY AND PRACTICE OF MECHANICS—By S. E. Slocum, Professor of Applied Mathematics, University of Cincinnati. New York: Henry Holt & Co. Cloth; 6x9 in.; pp. xiii + 442. 328 text illustrations. $3.

ANALYTICAL MECHANICS—For Students of Physics and Engineering. By Haroutune M. Dadourian, Instructor of Physics, Sheffield Scientific School, Yale University. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xii + 353; 148 text figures. $3, net.

The author's aim in the first of the books before us will perhaps be best understood by quoting the first two paragraphs of the preface as follows:

A course in theoretical mechanics often lacks the strength and vitality resulting from practical applications, whereas a course in applied mechanics is likely to be so technical and limited in its range as to obscure the meaning and scope of the fundamental principles involved. By properly combining theory and practice the efficiency of instruction is greatly increased, and mechanics also becomes a powerful instrument for coördinating mathematics and physics with technology.

In this text the aim is to present the fundamental principles of mechanics in such a way as to emphasize their actual significance and relationship, and at the same time make them a matter of intelligent interest to the average student of junior grade in colleges and universities, and in technical and engineering schools. In each article the explanation is given a body by direct application to some practical problem within the range of the student's experience or understanding.

The first 32 pages are given over to various tables of constants, properties of various plane and geometric figures, tables of logarithms and conversion tables, etc. The first chapter deals with the geometry of motion and the relation between velocities and accelerations in both linear and angular motion and closes with four pages on Kepler's Laws of Planetary Motion. The second chapter begins with Newton's Laws of Motion and follows the relations between mass, force and weight with the principles of work and energy, and impulse and momentum. It closes with a discussion of the units of time, weight and length which are in common use. Chapter 3 is headed "Statics," and takes up center of gravity, moment of inertia, composition and resolution of forces, virtual work, simple structures and flexible cords. Chapter 4 deals with friction and lubrication and would seem to fit better in a book on machine design than it does in one on mechanics. It takes up various types of bearings and of friction surfaces very much in detail both as to construction and computation. Chapter 5 takes up the kinetics of particles, harmonic motion, forced vibration, pendulums and the brachistochrone. Chapter 6 applies the principles of kinetics to solid bodies and treats of least work and transverse vibration in beams. Chapter 7 treats of the dynamics of rotation, flywheels, governors, balancing of engines and the gyroscope.

The book is smoothly written, but is extremely mathematical. The author has so arranged it that the principles of mechanics are subordinated to their mathematical treatment. The definitions throughout are expressed in mathematical language rather than in words, and the statement of principles is also made mathematically. This is unfortunate, as the average student is almost entirely lacking in the ability to translate the meaning of an equation into words. Consequently, in a book in which the treatment is so largely mathematical, the student is apt to gain the idea that mechanics is a branch of mathematics rather than of natural science. The fundamental conception of the free-body diagram, which is so invaluable as a means of attack for the student, is not mentioned so far as the reviewer could discover. The author's idea is an excellent one, but it is to be regretted that in his treatment he did not lean more to the physical and less to the mathematical side. The book will be found very useful by the teacher of mechanics who wishes to use it as collateral reading in connection with a course which defines more closely the elementary principles and emphasizes them from the physical rather than the mathematical side.

*Assistant Professor of Civil Engineering, Massachusetts Institute of Technology, Boston, Mass.

The second of these books is based, as so many textbooks are, upon a course of lectures and recitations which the writer has given, in this case, to a class in electrical engineering. The author has aimed, as stated in the preface, to present the subject in such a manner that the student will acquire a firm grasp of the fundamental principles and learn how to apply them to problems with a minimum amount of mental effort, that is, the author has aimed at economy of thought, but has not reduced the subject to a collection of rules and formulas.

The first chapter takes up the addition and resolution of vector quantities. The second chapter defines a force, and takes up the equilibrium of a particle. On account of the criticisms of Newton's Laws of Motion, which have been made in various quarters, the writer has based his text upon one law which is that "to every action there is an equal and opposite reaction, but the sum of all the actions to which a body or part of a body is subject, at any instant, vanishes." This chapter also takes up statics and kinetic friction and the stresses in strings and certain simple frames. The third chapter treats of motion or translation and rotation in connection with rigid bodies; instantaneous axis, torque, couples, rolling friction and journal friction.

Up to this point the treatment is simple and such as to be readily comprehended by the average student. From this point on it becomes more mathematical. Chapter 4 is headed "The Equilibrium of Flexible Cords." Chapter 5 takes up motion and the various units of force, mass, space and time used in that connection. The author takes up the C. G. S. system and also the British gravitational system, laying rather more stress upon the former than upon the latter, which perhaps is unfortunate in a book to be used by English speaking students. It would seem that his treatment of tangential and normal components of acceleration could have been somewhat simplified. Chapter 6 treats of the motion of a particle, kinetic reactions, the relation between mass and weight, falling bodies and simple harmonic motion. Chapter 7 is devoted to the center of mass and the moment of inertia, which are treated in the usual way. Chapters 8 and 9 are confined to work and energy. Chapter 10 takes up the question of fields of force and Newtonian potential. The next chapter is devoted to the motion of a rigid body in one plane and takes up both transverse and rotary motion. Chapters 12 and 13 treat of impulse and momentum. The treatment is not unusual, but the reviewer's attention was caught by the very simple mathematical demonstration of the reason why a pile-driving hammer should be considerably heavier than the pile. Chapters 14 and 15 take up the motion of a particle in a field of force and periodic motions.

The book contains a large number of good, illustrative problems. The treatment throughout leans more to the physical than to the mathematical side and the book is to be commended in this particular. The subject matter covered does not in general differ greatly from that covered in the usual textbooks on mechanics, and it would seem that the same course could be given from the existing books on the subject, such as Maurer or Church. It is a difficult matter to write a book on the subject of theoretical mechanics which presents the subject in a new way, and the author, while he has succeeded in producing a very creditable textbook, has not varied from what may be called the standard methods of treatment in any appreciable degree.

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A French Book on Steam Boilers and Steam Engines

CHAUDIÈRES A VAPEUR. MACHINES A VAPEUR—By L. Guillet, Professor of Mechanics, National School of Arts and Industries at Angers. Vol. 3, Cours de Mecanique. Paris (France): Ch. Beranger, 15 Rue des Saints-Pères. Cloth; 6x8 in.; pp. 410; 277 figures in the text. 15 francs.

Like other books of this series, this one is of a comprehensive character, dealing chiefly with principles involved and general types of construction. It is largely mathematical in character.

The section dealing with boilers (170 pages) discusses first the production of heat by different fuels, furnaces and draft appliances, and then the production of steam in various types of boilers. There is a chapter on apparatus for feed-water supply and on heating, circulation, mechanical stoking, condensing and superheating.

The section on steam engines opens with a brief historical statement, and a discussion of the mechanical principles of the utilization of steam, including the subject of superheating. It includes reference also to the Stumpf engine, in which the steam flows always in one direction, the exhaust being at the middle of the cylinder instead of at the ends.

Valves and valve gears in great variety are next considered, and 90 pages are occupied by a geometrical study of steam distribution by various gears. A short chapter is devoted to compound engines, mainly as to their steam economy.

The final chapter (50 pages) deals with steam turbines, which it traces back to de Laval (1883) and Parsons (1884). The main features of several types of machine are described.

Alternating-Current Machinery

Reviewed by ERIC A. LOF*

THE DESIGN OF ALTERNATING-CURRENT MACHINERY—By James R. Barr, A. M. Inst. E. E., Late Lecturer in Electrical Engineering, Heriot-Watt College, Edinburgh, and R. D. Archibald, A. M. Inst. E. E., Head of Electrical Engineering Department, Dundee Technical College. New York: The Macmillan Co. London Whittaker & Co. Cloth; 6x9 in.; pp. xvi+496; 340 text illustrations and 17 plates. $3.75, net.

Written by the late James R. Barr, this book has been revised for publication by Robert D. Archibald. It is intended to be a companion volume to Mr. Barr's book on "Direct-Current Electrical Engineering," and is primarily intended for designing engineers, although it should prove very useful to any one desiring a more intimate knowledge of this subject.

It does not, as the title would make one believe, cover the whole subject of alternating-current machinery, but merely alternators, transformers and rotary converters. These are, however, covered very comprehensively with an abundance of data and examples relating to the European design of such apparatus.

The book is divided into fifteen chapters, of which seven deal with alternators, three with transformers and three with rotary converters. The first chapter is devoted to the theory of alternating currents and deals with complex wave forms and harmonics, a number of examples on wave-form analysis being given.

The second chapter, and one of the most important of the book, takes up the subject of insulation. This subject has not in the past received the attention which it deserved, but with the rapid increase in high potentials, a great activity is now manifest in the research work on this subject. In the early days of electrical engineering the general practice was to consider only the ohmic or insulating resistance, and that insulating material, which by measurement, gave the highest insulation resistance was regarded as the best. This, however, was a wrong basis on which to make comparisons, because the insulation resistance depends largely upon the moisture contained, and in a given sample can be varied very greatly by simply putting the sample through a prolonged process of baking. The dielectric or disruptive strength of a material, rather than the insulation resistance, is now recognized as the true measurement of its usefulness as an insulator, the dielectric strength depending chiefly upon the molecular structure of the material.

The effect of the potential gradient and of specific inductive capacity upon the disruptive voltage of a compound dielectric is well illustrated and directions of tests for dielectric strength are given; the influence of the shape of the electrodes, mechanical pressure, wave form, frequency, etc., being taken up. The properties of a number of insulating materials, such as mica, pressphan, vulcanized fibers, impregnated paper and cloth, oils and varnishes, etc., are described, a number of curves being given showing the actual disruptive strength of these materials. In addition to this, methods of insulating generator and transformer windings, and thickness of insulation used are shown, and a table gives the usual values of testing voltages adopted by British manufacturers.

The subject of alternator design is covered very thoroughly, almost one-half the contents of the book being devoted to the same. Mechanical construction features of both slow-, medium- and high-speed machines are dealt with. This includes a short paragraph on the ventilation of high-speed turbo-alternators, but nothing is said regarding the provisions which nowadays are made in the design of slow- and medium-speed alternators to insure the best ventilation. This is at the present a very live subject and almost all modern alternators of large size are now constructed so that the path of the ventilating air is controlled and thus the best cooling effect obtained.

The theory of the electrical design is gone into thoroughly, numerous tables and curves being included, giving values of coefficients, etc., obtained from long experience. A large number of examples are also given outlining the procedure of actual designs and tests, while a whole chapter is devoted to the important subject of parallel operation.

*Power and Mining Engineering Department, General Electric Co., Schenectady, N. Y.

The subject of transformers begins with a review of the fundamental principles, the usual transformer diagrams being given. The text deals largely with core-type designs, the reason for this being the fact that this type is mostly used abroad while in this country the opposite is the case, especially for larger sizes. Not much new material has been added to this subject, although remarkable results have been obtained in the last few years, in that transformers are now being built for operating voltages as high as 150,000 volts and in capacities up to 14,000 kv.a. In order to accomplish this a number of novel features have been incorporated in the design, both electrical and mechanical. While formerly a close regulating transformer (one with low inherent reactance) was of prime importance, this is no longer so. Safety to withstand the severe mechanical strains imposed on short-circuits is now the chief consideration and in order to limit these strains to a safe value, the transformers are now generally being designed for much higher reactance than formerly, the regulation being taken care of by automatic voltage regulators. Improved methods of bracing the coils and of insulating the windings, and the provisions made for bringing out the high-tension leads belong also to the most difficult problems in transformer designs which now have been successfully solved, and which would have been an interesting addition to the matter covered in this book.

The chapters on rotary converters should be well received, as comparatively little has been written in English on the design of this type of machinery. The fundamental principles are described, including the transformation ratios and the factors which affect these ratios. The subjects of armature reaction, heating and output are also briefly covered, as is the subject of voltage regulation, although this latter should have been gone into more thoroughly. For example, nothing is said about the regulating-pole converter, which is now being successfully used to a very great extent in this country for variable voltage work.

A reference to the commutating-pole converter might also have been interesting, this type, with its large overload capacity, now being used to the greatest extent where the load is apt to fluctuate greatly, such as for railway work.

The subject of rotary converters ends up with an actual example of a design of a compound-wound machine.

Fifteen large plates are included with the book, showing construction of different types of alternators, transformers and converters of European design.

While the book undoubtedly will be of value to designing engineers, it can hardly be considered as good as some of the books which have recently been published in this country on similar subjects.

"The Need for a National Budget" and "A Budget for the Fiscal Year 1914," are the titles of two important recent Congressional documents (House No. 854, June 27, 1912, and Senate No. 1113, Feb. 26, 1913). Officially, the contents of each volume is a message from ex-President Taft to Congress, with supporting documents embodying a portion of the work done during the past two years or so by the President's Commission on Economy and Efficiency, of which F. A. Cleveland is chairman.

The first volume is a valuable monograph on the Budget in general and the need of the United States for one in particular. It shows how the United States has muddled along for a century and a quarter without a budget and what a valuable aid to economy, efficiency and administrative control a budget would be. Foreign budgetary practice is reviewed.

The second volume, as the title indicates, submits a real budget for the fiscal year 1914. As this budget was transmitted to Congress only a week before its final adjournment it was, of course, too late for action by that body.

We understand that there is good reason to expect that President Wilson, when the proper time comes, will support the federal-budget plan as heartily as did ex-President Taft. It is to be hoped that Congress will sanction the plan, so we shall no longer witness the spectacle of annual appropriations of a billion dollars being put through Congress piecemeal, in separate bills uncorrelated with each other or with available revenue, and with no adequate means of comparing appropriations with past expenditures, nor either of these two with the actual needs of the country, and with absolutely no means of testing the efficiency with which funds appropriated are expended. The United States, of all the civilized countries in the world, stands alone in this respect.

OIL AND GAS WELLS THROUGH WORKABLE COAL BEDS—Papers and Discussions. By George S. Rice, O. P. Hood and others. Washington, D. C.: Bureau of Mines. Paper: 6x9 in.: pp. 101; illustrated.

In discussing methods of protecting bore-holes for pur-

poses of safety, a number of sectional drawings are given to show how concrete may be used for sealing casings. Regulations for the protection of coal beds are suggested.

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Overhaul

Reviewed by S. S. ROBERTS*

EARTHWORK HAUL AND OVERHAUL, Including Economic Distribution—By J. C. L. Fish, M. Am. Soc. C. E., Sometime Division Engineer, Lake Shore & Michigan Southern Railway; Professor of Railroad Engineering, Leland Stanford, Junior, University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xiv+165; 66 text figures. $1.50 (6/6), net.

Mr Fish presents a comprehensive résumé of much of the literature on overhaul. The book is interspersed with numerous explanatory diagrams, and deals with the subject from the primary definition of haul to the application of the "economic haul distance" in the determination of proper distribution.

Three bases, or theories, for the computation of overhaul are demonstrated. Preference is given to the one set forth in the "Manual of Recommended Practice" of the American Railway Engineering Association (1911), as incorporated in the "Specifications for the Formation of the Roadway," under optional clause 48-a.† After the exposition of this basis, no other premise is considered. Under it eight methods of computing overhaul for a simple case, and five methods for a more complex condition are minutely analyzed and illustrated. Diagrams and a reproduction of a profile of work actually performed are used. The results are tabulated, showing the total overhaul given by each procedure, the difference in "station cu.yd." (cu.yd. hauled 100 ft.) and a comparison of the percentage of relative probable error.

Consideration is given to the accuracy of method consistent with the necessarily approximate cross-section data and the uncertainty of behavior of excavated material. Finally inferences are drawn as to the time and method justifiable in overhaul computations. The last three chapters of the book explain the "economic haul distance"; its application in connection with balancing lines and the mass diagram, or profile, to determine economic distribution.

The author quotes or refers to articles and publications by Allen, Fisher, Gillette, Molitor & Beard, Prelini, Raymond, Russel, Searles, Webb, "Engineering News," and the American Railway Engineering Association. There is nothing new or previously unpublished in the book, unless it is the idea of swell in excavated material reduced to swell and equating factors, which are employed to keep the balancing line always horizontal or level. The expediency of this refinement may be questioned by many; especially in preconstruction investigations. During construction, an experienced engineer will require the keeping of as full and accurate records of actual distribution of material as possible and will adjust overhaul computations accordingly. The author states in substance, all things considered, computation of overhaul by means of the mass diagram gives results within the limit of accuracy of the field data.

The unforseen and indeterminate exigencies of construction, such as unusual weather conditions, delay in completion of certain controlling structures, injunctions, change of line or grade, and even character of equipment, may materially derange or practically destroy any prearranged scheme of distribution. Therefore, without depreciating the value of distribution study, the less elaborate explanations and methods of some of the other authors, above mentioned, will generally prove satisfactory and sufficient for the requirements of practice. Molitor & Beard's method of computing overhaul, and Raymond's explanation of the mass diagram and its uses, give the succinct meat of the subject.

Mr. Fish's demonstrations are clear. Under his assumptions his reasoning and equations are correct. He gives both methods, where swell is considered and where it is not. His book as a treatise on its subject should prove a useful and valuable work of reference. To the reviewer there seem to be many repetitions of details and some near repetition of subject matter. The volume of the book might be reduced one-half by the rearrangement of some parts and the elimination of others without diminution of scope or usefulness.

As the book is, it brings out many more points in overhaul than many engineers at first thought might believe to exist.

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BUILDING CONSTRUCTION—By John H. Markham, Edwin Gunn, Alan G. James, Herbert A. Satchell, F. M. Simpson and J. D. Crace. Vol. II. [Being part of The Architects' Library.] New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. ix+360; 142 text illustrations. $4 (10/6), net.

The first volume of the series, of which the book before us is the second and last, was entitled "Building Construction" and was reviewed in the Engineering Literature supplement of "Engineering News," Mar. 16, 1911, p. 40. As stated then, the series is intended primarily for architects, and as such glosses over a number of points of design, particularly the mathematical analyses, which are required and desired by engineers. The second and last volume is devoted about equally to reinforced concrete and to the general treatment of the various fittings and finishings to buildings.

The reinforced-concrete portion, written by John H. Markham, is conventional in the treatment of the subject, making allowances for the more complicated methods at present in use in England. The succeeding portions are of more direct interest to American constructors, particularly of the architectural persuasion rather than the engineering. They are, briefly, sections on roof coverings, which include slate, tile, stone plate and hatches, by Edwin Gunn; external plumbing, which includes leads, flats, gutters, joints, etc., by Alan G. James; glazing, by John H. Markham; timber, mostly an exposition of the various building woods used in Great Britain, by H. A. Satchell; carpentry (called "joinery" in the book), by F. M. Simpson; plastering, by John H. Markham, and painting and decoration, by J. D. Crace. In the details of building fittings the European countries have the great advantage of many years of work, and American practitioners can gain much by studying the methods in use there. Next to studying these methods first-hand, the best thing is to get them from a well written book, such as the second volume of this "Architect's Library."

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CITY OF NEW YORK DEPARTMENT OF WATER-SUPPLY, GAS AND ELECTRICITY—Report on the Work Done for the Prevention of Water Waste, Cost of the Same and Results Accomplished Thereby (Oct. 1, 1912). Henry S. Thompson, Commissioner. 13 Park Row. Paper; 6x9 in.; pp. 35; illustrated.

Tells how 33,500,000,000 gal. of water were saved in Manhattan and the Bronx at a total expense of about $138,000, not allowing for $29,000 fines imposed. The saving was effected by house-to-house inspection, and its amount was estimated by pitometer gagings before and after district inspections. The portion of the work done in 1911, tided the city over a remarkable period of low rainfall (June, 1910, to August, 1911, lowest recorded for same period in 43 years). As a result of the work as a whole the water consumption of New York City was reduced to 101 gal. per capita. The work was done under I. M. de Varona, chief engineer, Bureau of Water-Supply, and Henry S. Thompson, Commissioner of the Department of Water-Supply, Gas and Electricity.

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SPECIFICATIONS FOR THE DESIGN, CONSTRUCTION AND OPERATION OF EXHAUST SYSTEMS FOR GRINDING, POLISHING AND BUFFING WHEELS—By William Newell, Mechanical Engineer, New York State Department of Labor, 381 Fourth Ave., New York City. Paper, 4x7 in.; pp. 8; illustrated.

In the preface to these specifications Mr. Newell explains that the department of which he is engineer has found that in very many cases exhaust systems in grinding and polishing rooms are so installed as to be ineffective for their work and to allow the room to become filled with dust to the injury of the workmen's health. Such defective work is due more to ignorance than to intention. It costs very little more in designing an exhaust system to make it so that it will properly do its work and effectively remove the flying

*Howard & Roberts, Civil and Consulting Engineers, Chicago.

†No payment shall be made for hauling material when the length of haul does not exceed the limit of free haul, which shall be ——— ft.

The limits of free haul shall be determined by fixing on the profile two points one on each side of the neutral grade point, one in excavation and the other in embankment, such that the distance between them shall equal the specified free-haul limit and the included quantities of excavation, and embankment of balance. All haul of material beyond this free-haul limit shall be estimated and paid for on the basis of the following method of computation.

All material within this limit of free haul shall be eliminated from further consideration.

The distance between the center of gravity of the remaining mass of excavation and center of gravity of the resulting embankment, less the limit of free haul as above described, shall be the length of overhaul and the compensation to be rendered therefor shall be determined by multiplying the yardage in the remaining mass, as above described, by the length of the overhaul. Payment of the same shall be by units of 1 cu.yd. hauled 100 ft.

Where material is obtained from borrow pits along the embankment and runways are constructed, the haul shall be determined by the distance the team necessarily travels. The overhaul on material thus hauled shall be determined by multiplying the yardage so hauled by half the round distance made by the team less the free-haul distance. The runways shall be established by the engineer.

dust and grit. These specifications are published for free distribution to encourage the installation of dust-removal systems in such a manner that they will work effectively.

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Precise Measurements

Reviewed by N. E. DORSEY*

ELEMENTS OF THE PRECISION OF MEASUREMENTS AND GRAPHICAL METHODS—By H. M. Goodwin, Professor of Physics, Massachusetts Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 104; illustrated. $1.25, net.

The author states that this book, which consists of three parts and an appendix of useful tables, is intended for students who are in the middle of their sophomore year and "have performed some six or eight experiments on fundamental measurements in Mechanics." He also says, "that the method of treatment has been kept as brief as possible."

Part I treats of the Precision of Measurements. Here errors are classified and described, the distribution of accidental errors is briefly considered, the formulas for computing the various deviation and precision measures are given and are applied to specific problems, the weighting of observations is discussed, and rules are given for the rejection of observations and of superfluous figures. For a more complete treatment of the subject and for the derivation of the formulas given, the student is referred to Holman's "Precision of Measurements" and to Bartlett's "Method of Least Squares," of which this part is essentially an abbreviation.

The notation and terminology are those used in the works just mentioned. To the reviewer, the terminology of this subject, by whomever treated, appears rather unsatisfactory. In the present case he cannot help wondering what physical significance the unassisted student will attach to the expression "deviation of the mean" as applied to the mean of a single set of observations. The difficulty is not reduced by the use of the abbreviation A. D., which, by analogy, suggests average deviation of the mean.

Fig. 1, which represents the observed distribution of shots in a certain target, and is taken directly from Bartlett, is an excellent illustration of the effect both of constant and of accidental errors. In not calling attention to the constant error involved and to the consequent shifting that is necessary in order to make the curve of error fit the observations, both authors seem to have failed to make full use of the figure. The statement that this figure indicates that plus and minus deviations are about equally frequent will scarcely be accepted by the thoughtful student.

Part II deals with Graphical Methods and is probably the most useful portion of the book. After a general discussion of the points that must be considered in order to obtain the most useful plot, the algebraic representation of a straight-line graph is considered. Then follow methods for the rectification of the graphs of trigonometric, reciprocal and logarithmic functions, with examples. It is probable that the unaided student will be mystified by the unerring precision with which the general shape of the curve "suggests" to the author the form of the function which best fits it.

The residual plot, interpolation formulas, and the construction and use of "normal equations" are also briefly considered.

In Part III are given 79 problems involving the methods discussed in the preceding parts. These are preceded by a detailed solution of four illustrative problems.

The book contains in a small compass much information and advice that will be of use to those engaged in experi-

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STEAM BOILERS, THEIR THEORY AND DESIGN—By H. deB. Parsons, M. Am. Soc. M. E., M. Am. Soc. C. E., Professor Emeritus of Practical Engineering, Rensselaer Polytechnic Institute. Fourth edition. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. xvii + 377; 156 text illustrations. $4 net.

The time was when Prof. Parsons' book on Steam Boilers was regarded by many teachers and students as the last word in boiler treatises. It was a concise summary of underlying theory, a clear exposition of the phenomena involved, and a compendium of latest practice and important data.

The fourth edition now at hand, being little more than a reprint of the earliest edition, preserves unimpaired the value of all the theoretical discussions and much of the description. But the revision has been so slight that necessarily it cannot be regarded as wholly modern in its treatment of some apparatus, or in its tables of performance data, or in its references.

The most notable additions are (1) a full-page familiar diagram showing the relative distribution of heat losses in a steam-power plant, (2) a new steam table reprinted from the Marks and Davis book of tables, (3) a few foot notes calling attention to recent articles in technical journals, etc.

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Hydraulic Diagrams

Reviewed by JOHN H. GREGORY*

DIAGRAMS FOR THE SOLUTION OF THE KUTTER AND BAZIN FORMULAE FOR THE FLOW OF WATER—Prepared by Karl R. Kennison, 815 Grosvenor Bldg., Providence, R. I. Paper; 8x11 in.; pp. 4. $1.

This small pamphlet contains two pages of text and two diagrams for solving certain classes of problems relating to the flow of water. One diagram is based on Kutter's formula and the other on the Bazin formula. Given any three of the four variables, velocity, slope, hydraulic radius and coefficient of roughness, the fourth can be obtained from the diagrams. For solving special problems these diagrams will be found of much service but they are not especially well adapted for solving quickly the ordinary problems relating to the flow of water in pipes or circular conduits. Scales are given on the diagrams so that metric as well as English units can be used.

PROVINCE OF ONTARIO HYDRO-ELECTRIC POWER COMMISSION—Third and Fourth Annual Reports for Year Ended Oct. 31, 1911. Toronto: W. W. Pope, Secretary. Paper; 6x10 in.; pp. 327; illustrated.

The third and fourth annual reports of the Hydro-Electric Power Commission of the Province of Ontario, bringing the account of this great project up to Oct. 31, 1911, has recently been received bearing a 1912 imprint. This is a large volume which contains the legislative acts of 1910 and 1911 affecting the commission, and the various agreements made for the purchase and sale of power. There is an account of the construction work done on the Niagara transmission project, and abstracts of the innumerable hydraulic investigations made for various towns and cities in regard to the feasibility of local power developments. As this report fails to bring authentic details of the Commission schemes at all up to date, one will look in vain for that illuminating data on cost of construction or operation which is so much desired in view of the recent charges of deficits and taxpayers' burdens on the 200-mile transmission line now in service out from Niagara.

CENTRAL PURCHASE AND DISTRIBUTION OF SUPPLIES FOR THE CITY OF NEW YORK, Together with All the Forms Necessary to Carry the System into Full Operation and Effect—Report of William A. Prendergast, Comptroller, 280 Broadway. Paper; 8x11 in.; pp. 72; illustrated.

Outlines a plan under which the mayor, comptroller and the president of the Board of Aldermen would become a Board of Purchase and a general purchasing agent and a general storekeeper would be chosen, with coördinate powers, subject to the Board of Purchase. The purchasing agents of the 18 largest city departments would work conjointly with the general purchasing agent, so far as supplies for their own department are concerned. It is estimated that the plan would effect a saving of $3,000,000 to $4,000,000 a year for New York City. The plan is modeled on the one in use by the Canadian Pacific Ry. Various blank forms for putting the plan into effect are included in the report.

MASSACHUSETTS STATE INSPECTORS OF HEALTH—Fifth Annual Report (1911). Boston, Mass.: State Board of Health. Paper; 6x9 in.; pp. 84; illustrated.

The work of the 14 State Inspectors of Health is summarized by its character rather than by the 14 districts into which the state is divided. The inspectors are physicians and it is pleasing to note that nearly all of them have served since 1907, the year when the service was started. Among other subjects, the inspectors deal with communicable diseases, nuisances, water-supply and sewerage, factories and workshops, laundries and slaughterhouses.

BIRTH REGISTRATION—Monograph No. 1, Children's Bureau (Washington, D. C.). Paper; 6x9 in.; pp. 24.

Only eight states (the six New England, Pennsylvania and Michigan) have sufficiently complete registration of births to bring them within the birth-registration area. Of the other states, 16 have enacted legislation, 20 need either new laws

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*Associate Physicist, Bureau of Standards, Washington, D. C.

*Consulting Engineer and Sanitary Expert, 170 Broadway, New York

or important amendments to old ones and Arkansas, Georgia, North Carolina and South Carolina have no laws for birth registration. The importance of birth registration is explained in this monograph and a model registration law is given.

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Consolidation of Two Machine-Design Texts

Reviewed by JOHN J. FLATHER*

MACHINE DESIGN—By Charles H. Benjamin, Dean of Schools of Engineering, Purdue University, and James D. Hoffman, Professor of Mechanical Engineering and Practical Mathematics, University of Nebraska. New York. Henry Holt & Co. Cloth; 6x9 in.; pp. x+342; 205 text illustrations. $3.

The present book represents the consolidation of two texts on this subject, Benjamin's Machine Design and Hoffman's Elementary Machine Design. As now arranged, the book serves a twofold purpose. It may be used as a text for classroom work embodying the theory and practice of design, or it may be used as a reference book in the drafting room, illustrating the design of complete machines.

An examination of the text shows that it covers a wide range of subjects which include practically all of the topics which previously appeared in the separate texts, to which has been added much additional matter. The chapter on materials has been rewritten and the work on cast-iron frames, which has always been a commendable feature, has been greatly augmented; in this portion of the work and elsewhere experimental data obtained by the authors and others are given in support of the principles deduced. The theoretical and experimental strength of steel tubes under collapsing pressures is quite fully discussed and additional data are presented on the failure of pipe fittings. Other subjects which receive fuller treatment in this volume than heretofore are flat plates, crane hooks, leaf springs, bearings, both plain and rolling, clutches, gear teeth and belting.

The material given in that part of the book between pages 235 and 309, which relates to the design of particular devices and machines, offers the student an excellent opportunity for acquiring proficiency in analytical methods of attack. There are to be found logical presentations of the design of simple machines, such as toggle-joint presses; this is followed by the design of punch presses, bevel and rotary shears and similar machines; then follow typical designs of air hoists and various forms of pneumatic and hydraulic riveters.

The concluding chapter of the book consists of studies in the Kinematics of Machines, which treat very briefly gear tooth outlines, cams, quick return motions; motion problems; mechanism of governors and the Stephenson and Walschaert valve gears. It would seem to the present reviewer that the thirty pages included in this portion of the work does not properly belong to the subject of machine design and should not have been given space in the present book. The subject matter and methods of presentation are sufficiently valuable to warrant a more elaborate treatment and publication in a separate volume.

The scope of the present volume will be seen from the following captions: Materials; Frame Design; Cylinders and Pipes; Fastenings; Springs; Sliding Bearings; Journals, Pivots and Bearings; Ball and Roller Bearings; Shafting, Couplings and Hangers; Gears; Pulleys and Cranks; Flywheels; Transmission by Belts and Ropes; Design of Toggle-Joint Press; Design of Belt-Driven Punch or Shear; Design of Air Hoist and Riveter; Studies in the Kinematics of Machines.

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One of our London contemporaries, "The Surveyor and Municipal and County Engineer," carries these lines at the head of its Correspondence columns each week:

> For every ill beneath the sun
> There is some remedy or cure;
> If there be one, resolve to find it;
> If not, submit, and never mind it.
>
> —Anon., circa 1843.

Either the same or another London paper devoted to municipal public works used to run this couplet in the same position:

> One man's word is no man's word,
> Justice is that both be heard.

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"The Wood Preserving World," a monthly journal to be devoted exclusively to wood preservation and wood block paving, made its first appearance in April, 1913. It is published in Minneapolis, Minn., and W. E. Wadsworth is given as business manager, and W. F. Goltra as contributing editor. The first number has very little original matter in it, but has the value of collecting between two covers matter all on the same subject.

*Professor of Mechanical Engineering, University of Minnesota, Minneapolis, Minn.

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Long-Distance Instruction in Steam Engineering

STEAM BOILERS—Prepared in the Extension Division of the University of Wisconsin by E. M. Shealy, Assistant Professor of Steam Engineering. New York and London: McGraw-Hill Book Co. Cloth; 6x9½ in.; pp. xiv + 356; 185 text illustrations. $2.50, net.

A textbook on boilers, with no mention of thermodynamics! If anyone doubts that a college teacher can come down from the clouds and plant his feet firmly on the earth, he would do well to read this book, which is intended as an instruction text in the extension courses of the University of Wisconsin. This work is largely carried on through correspondence. The men it is intended to help with this particular volume are the mechanics in the power plants. The book does not contain a single thermodynamic bugbear, and the adjective itself, a by-word on the college campus, is not seen.

The text is forcible, clear, and concise. The ground is well covered in a general way, though there are a few details in the way of specific apparatus and construction which might have been added, had completeness been desired. As one such, might be mentioned the Jacobs-Shupert stayless locomotive firebox, which ought to interest every fireman because of its novel construction and proven utility.

Many of the cuts are of catalog type, but as the text is admittedly descriptive of commercial practice, it might be finicky to object to them here. The author is to be commended for even briefly discussing the danger which exists with lap and single-strap butt joints, through the distortion produced by internal pressure. It would have been well, perhaps, had he even gone further and shown how the elastic limit is exceeded in the outer fibers of a plate at these joints, and how this may set up secondary deterioration by stimulating local corrosion.

To some engineers it will seem that the author has laid perhaps undue stress on the production of smoke by chilling the combustion-chamber walls. It has been shown that a certain amount of chilling does not materially increase the production of smoke and has a very appreciable effect in increasing the efficiency of operation. Tests have shown that the greater part of the total absorption of heat in a boiler comes from the energy radiation of the incandescent fuel bed; therefore it is wise to intercept this radiation by water-cooled metal surfaces, taking care, however, that the combustion space is still large enough so that excessive chilling is prevented.

A set of simplified steam tables is included in the book, but no mention is made of the source of the values. They do not check closely with the latest tables, like Marks and Davis', or with the revised Peabody tables, which are built up from the same fundamental data. They check closer with the older tables now generally discarded. The differences are small, however, and for the purposes of this book will cut no figure wherever employed.

The book does not confine itself entirely to boilers, for after it has outlined the different types and constructions in general and to considerable detail, it discusses the relations of heat and work (non-mathematically), the effect of heat, the properties of steam, the characteristics of available fuels, the processes of combustion, the better methods of firing as contrasted with the poorer, the factors which promote a smokeless combustion of coal, boiler auxiliaries and fittings, the construction of chimneys and the computation of draft, the production of artificial draft, the composition of boiler feed water, the inspection and care of boilers and auxiliaries.

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The Chicago Municipal Reference Library, will be operated hereafter as a branch of the Public Library of that city. The following statement regarding this and other municipal reference libraries is by Frederick Rex, Municipal Reference Librarian of Chicago.

The Chicago Municipal Reference Library is similar in purpose to the libraries of this character established in the cities of Baltimore, Kansas City, Milwaukee, Minneapolis and St. Louis. It is engaged in collecting, indexing and preserving all data obtainable relative to the operation and government of municipalities, such as reports, ordinances, statistics, books, bills, documents and magazines. This material, while chiefly intended for municipal officials, is also available to

any citizen, civic organization, representative of the press, and all who desire information on any function or phase of city government. It is located in room 1005, City Hall.

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The Railway Spiral

Reviewed by W. W. COLPITTS*

THE PRACTICAL RAILWAY SPIRAL—With Short Working Formulas and Full Tables of Deflection Angles: Complete Notes of Illustrative Examples. By L. C. Jordan, Principal of Civil Engineering Department, Heffley Institute, Brooklyn, N. Y. New York: D. Van Nostrand Co. Flexible leather; 4x7 in.; pp. viii+155; illustrated. $1.50, net.

The appearance of a new "Railway Spiral" is not likely to be met with immediate enthusiasm. Railroad engineers, in fact, have felt that the subject has already been over developed. It is not very long ago that spirals of any kind were regarded as an extreme refinement and on many of the older lines the curves are still without easement ends, except to the extent that they may have been crudely introduced by the section foremen. In latter years, however, with higher speeds and more rigid demands for comfort in travel, the spiral has become a real necessity. Because of the many practical limitations no form of spiral can attain scientific perfection even for fixed conditions of speed, though many have approximated theoretical requirements very closely.

The spiral devised by Professor Jordan may fairly be said to approach a step nearer theoretical perfection than any other in that the cubic parabola on which it, like many others, is based, is itself spiraled. The curve is designed to meet the practical conditions of the field for easy application and the tables are completely elaborated for rapid calculation. Appended to the book are the usual mathematical tables in convenient form.

In view of the large amount of railroad construction in Latin America it is believed that the book would have much wider usefulness were the tables and formulas converted to the metric system. The book is small, compact and well bound in morroco—features that commend it to the field man.

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SCHUBWIDERSTAND UND VERBUND IN EISENBETON-BALKEN auf Grund von Versuch und Erfahrung—By R. Saliger, ord. Professor der k. k. Technrschen Hochschule in Wien. Berlin: Julius Springer. Paper; 8x11 in.; pp. 66; 139 text figures. 5 Marks.

The question of shear resistance and bond stress in reinforced-concrete beams offers just as large a field for experimentation as for theoretical discussion. The difficulty of getting satisfactory results from experimental study of shear and bond makes all experiments on the subject valuable, since they add to the number of individual results and thus increase the reliability of the grand average. Mr. Saliger makes a notable contribution. He concludes:

Beam strength is limited by the yield-point strength of the steel, not by its ultimate strength. To secure adequate shear resistance, bent-up rods will suffice if they are at least 70% of the tension steel and if spaced closer than twice the beam lever-arm. Stirrups increase bond strength and shear resistance, by taking up tensile stresses not otherwise adequately resisted. Bond strength is greater with small than with large rods. Anchorage, hooping of beam ends, etc., keep the rods in action even after slip of the steel. If the reinforcing steel of a beam is properly arranged and distributed, the bond strength is adequate if the rod diameter is less than 0.006 to 0.008 of the span.

These dicta may not contain very novel matter; but even their confirmation of prior impressions or conclusions will be welcome, if borne out by the tests themselves. The book must be studied for the details.

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STRUCTURAL DETAILS OF HIP AND VALLEY RAFTERS—By Carlton Thomas Bishop, Assistant Professor of Civil Engineering, Sheffield Scientific School, Yale University. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 10x8 in.; pp. v+72; 43 text figures. $1.75, net (7/6, net).

HIP AND VALLEY DESIGN. DETAILS, FORMULAE AND GRAPHICS; ROOFS, HOPPERS AND PIPE LINES—By H. L. McKibben and L. E. Gray, Engineers with American Bridge Co. Edited and published by J. E. Banks [Engineer, Bureau of Standards], American Bridge Co., Ambridge, Penn. Stiff paper; 7x9 in.; pp. 30. $2, postpaid.

Both books record the methods and formulas required for detailing hip or valley framing in steel roof structures, i.e., for finding the angles or distances between the various lines and planes involved in the skew details. The two books differ in various ways, while both are closely adapted to the daily needs of the detailer and draftsman.

The work of McKibben and Gray appears to represent the American Bridge Co. in some way. Photographic views are shown of three types of connection of purlins to flange of hip, and two types of connection to web of hip; in the text the graphic layouts and the formulas for these cases are given, separately for hips and valleys; and there are tables, collections of formulas, etc., and the solutions for hopper problems and for bends of inclined pipes. The style is very condensed, notebook fashion. Prof. Bishop's book groups the principal cases of connections under the two headings Flange Connections and Web Connections, but under these heads he subdivides rather minutely. He covers the general derivation of formulas and the graphic determination of angles in separate chapters. The book is essentially more scholarly than the other, but does not for that reason have less practical value.

The reader's preference for one or the other book will depend largely on temperamental differences. The meat of the matter of skew roofwork is well presented in each.

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"Financial Statistics of Cities Having a Population of Over 30,000" for the financial year 1910, have just been issued by the U. S. Bureau of the Census (Washington, D. C.), under the supervision of Le Grand Powers, chief statistician for Finance and Municipal Statistics. The similar publication for 1909 appeared earlier in the present year. Each volume comprises about three hundred 9x12-in. pages, of which about a third are devoted to text and brief summary tables and the balance to detailed statistics for each city. The 1910 report covers 184 cities as against 157 in the volume for 1909, the 27 accessions following the 1910 census returns. The 1910 report is the ninth annual volume in this series, which was preceded by a less extensive yearly publication issued for a number of years by the Commissioner of Labor. It is a great pity that statistics like those given in these 1909 and 1910 reports should not appear until 1913. A large part of the delay in the present case was due t ocauses wholly beyond the control of the Census Bureau, chief among which, we understand, was the failure of Congress to supply money to prosecute the work. Before this failure occurred, we have been informed, the Bureau was gradually bringing these publications as nearly uptodate as could reasonably be expected.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AARDEN RESERVOIRDAMMEN—By A. A. Meyers, Ingenieur der le klasse bij den Waterstaat in Nederlandsch-Indie. Bijlage van het Archief voor de Suiker-industrie in Nederlandsch-Indie. Batavia, Nederlandsch-Indie: Algemeen Sundicaat van Suikerfabrikanten. Cardboard; 7x10 in.; pp. vii — 90; 45 illustrations.

A pretty full study of earth dams is summarized in this book. English (Indian) and American experience furnished practically all the material for the study. Seen from an outside standpoint, the chief features of American practice are perhaps judged more impartially than by our own authors. Those who have a command of Dutch will find the book worth their while.

AIR COMPRESSION AND TRANSMISSION—By H. J. Thorkelson, Associate Professor of Steam and Gas Engineering, University of Wisconsin. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii+207; 143 text illustrations. $2, net.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION—Proceedings of 22d Annual Convention, 1912. Chicago, Ill.: C. A. Lichty, Secretary, 226 W. Jackson Boulevard. Paper; 6x9 in.; pp. 295; illustrated.

AMERICAN TELEGRAPH PRACTICE—A Complete Technical Course in Modern Telegraphy, including Simultaneous Telegraphy and Telephony. By Donald McNichol, A. M., Am. Inst. E. E., Member of Engineering Staff, Postal Telegraph-Cable Co., of New York. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xvi+507; 421 text illustrations. $4, net.

ASPHALT CONSTRUCTION FOR PAVEMENTS AND HIGHWAYS—A Pocket-Book for Engineers, Contractors and Inspectors. By Clifford Richardson, M. Am. Soc. C. E.

*Vice-President, W. H. Coverdale & Co., 66 Broadway, New York City.

New York and London: McGraw-Hill Book Co. Leather; 4x7 in.; pp. ix+155. $2, net.

DIE BERECHNUNG DER WARMWASSERHEIZUNGEN—By H. Recknagel, Diplom-Ingenieur, Berlin. München and Berlin: R. Oldenbourg. Paper; 10x14 in.; pp. 71; 31 text figures. 6 Marks.

BOARD OF SUPERVISING ENGINEERS (CHICAGO TRACTION)—Fourth Annual Report for Fiscal Year Ended Jan. 31, 1911. Chicago: The Board. Cloth; 6x9 in.; pp. 523; 9 folding plates, 36 cuts and diagrams in text.

CALIFORNIA CONSERVATION COMMISSION—Report for 1912. Sacramento, Calif.: Louis R. Glavis, Secretary. Paper; 6x9 in.; pp. viii+502; illustrated; 6 maps in pocket.

CALIFORNIA DEPARTMENT OF ENGINEERING—Third Biennial Report, Dec. 1, 1910, to Nov. 30, 1912. Sacramento: W. F. McClure, State Engineer. Paper; 6x9 in.; pp. 263; numerous plates and maps.

CHEMICAL AND BIOLOGICAL SURVEY OF THE WATERS OF ILLINOIS—Report for Year Ended Dec. 31, 1911. By Edward Bartow, Director, State Water Survey. Bulletin No. 20, University of Illinois, Urbana, Ill. Paper; 6x9 in.; pp. 173; illustrated.

CHLORIDE OF LIME IN SANITATION—By Albert H. Hooker, Technical Director, Hooker Electrochemical Co. New York; John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; v+231. $3.

COMMISSIONERS OF THE (NEW YORK) STATE RESERVATION AT SARATOGA SPRINGS—Report for Year Ended March, 1913. Saratoga Springs, N. Y.: Frederick Edwards, Engineer for the Commission. Paper; 6x9 in.; pp. 52; illustrated.

CONNECTICUT PUBLIC UTILITIES COMMISSION—Report for Year Ended June 30, 1912. Hartford, Conn.: Henry F. Billings, Secretary. Cloth; 6x9 in.; pp. 768; railroad maps in pocket.

THE CONSERVATION OF WATER-POWERS—By Rome G. Brown. [Reprinted from the Harvard Law Review, Vol. XXVI, No. 7.] Cambridge, Mass.: The Harvard Law Review Association. Paper; 7x10 in.; pp. 630.

ENGINEERING THERMODYNAMICS—By Charles Edward Lucke, Professor of Mechanical Engineering, Columbia University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xxiv+1188; 328 text illustrations. $8, net.

THE ENRICHMENT OF SULPHIDE ORES—By William Harvey Emmons. Washington, D. C.: United States Geological Survey. Bulletin 529. Paper; 6x9 in.; pp. 260.

EXPERT EVIDENCE—A Discussion held at a Meeting of the American Institute of Consulting Engineers, Oct. 25, 1912. New York: Eugene W. Stern, Secretary, 101 Park Ave. Paper; 6x9 in.; pp. 58.

EXPORTERS' ENCYCLOPÆDIA (1913)—Containing full and authentic information relative to shipments for every country in the world. New York: Exporters' Encyclopædia Co., 9-13 Broad St. Cloth; 6x8 in.; pp. viii+1024. $7.50 per copy, including monthly corrections and the "Exporters' Review" for the calendar year.

GENERAL PLAN OF A PARK AND PLAYGROUND SYSTEM FOR NEW LONDON, CONN.—Report to the Municipal Art Society of New London by John Nolen, Landscape Architect, Cambridge, Mass. Paper; 6x9 in.; pp. 41; illustrated.

GEOLOGIC ATLAS OF THE UNITED STATES—Folios Nos. 184 and 186. Washington, D. C.: U. S. Geological Survey. Paper; 19x22 in.; pp. 21 and 17, respectively.

GEOLOGY OF THE COLUMBUS QUADRANGLE—By Clinton R. Stauffer, George D. Hubbard and J. A. Bownocker, State Geologist. Columbus, O.: Geological Survey of Ohio. Cloth; 6x9 in.; pp. 133; illustrated.

GREAT AMERICAN LEVEES—A Comparative Report on Flood Protection in the Mississippi and Sacramento Valleys, By Messrs. Haviland, Dozier & Tibbetts. Sacramento, Calif.: West Sacramento Co. Paper; 9x12 in.; pp. 33; 18 illustrations and 5 plates.

HANDBUCH FÜR EISENBETONBAU—By F. von Emperger, K. k. Oberbaurat, Regierungsrat im k. k. Patentamt in Wien. Vol. II: Vorschriften und Theorie des Eisenbetons. Berlin: Wilhelm Ernst & Sohn. Paper; 7x10 in.; pp. xix+655, 575 text illustrations.

The first edition of this volume has been revised quite extensively. Most important are the revisions of those chapters which summarize the principal tests of reinforced-concrete members. American treatises unfortunately do not give corresponding summaries in the same extent, and this fact will give the German work a particular value here.

HOCHOFEN - BEGICHTUNGSANLAGEN unter besonderer Berücksichtigung ihrer Wirtschaftlichkeit—Ing. Dr.-Ing. Friedrich Lürmann. Berlin: Julius Springer. Cloth, xvii in.; pp. iv+240; 96 text figures and numerous folding drawings. 22 Marks.

INVESTIGATION OF THE DANVERS RIVER AND ITS ESTUARIES—Report of the Massachusetts Board of Health (1912). Boston: The Board. Paper; 6x9 in.; pp. 24; illustrated.

MECHANISCHE GRUNDLAGEN DES FLUGZEUGBAUES—By A. Baumann, Professor an der Kgl. Technischen Hochschule Stuttgart. Vols. I and II. München and Berlin: R. Oldenbourg. Cloth; 6x9 in.; pp. 154 and 114; 36 and 28 text figures, respectively. 4 Marks per volume.

MINISTERIO DE ESTADO DA VIAÇÃO E OBRAS PUBLICAS DO BRAZIL—Relatorio do Dr. José Bazilio Gonçalves, 1911, e supplemento Portez do Brazil. Two volumes. Rio de Janeiro: Ministerio da Viação e Obras Publicas. Paper, 7x9 in.; pp. 462 and 292, respectively.

MODERN PUMPING AND HYDRAULIC MACHINERY, as Applied to All Purposes, with Explanations of the Theoretical Principles Involved, Considerations Governing and Relative Advantages. Being a Practical Handbook for Engineers, Inventors and Others. By Edward Butler, M. Inst. M. E., author of "Gasoline Motors, Vaporizers and Distributing Valves," "Evolution of the Internal Combustion Engine," etc. Philadelphia, Penn.: J. B. Lippincott Co. London: Charles Griffin & Co., Ltd. Cloth; 6x9 in.; pp. xvi+473; 345 illustrations. $6.50, net.

THE MOTOR AND THE DYNAMO—By James Loring Arnold, Professor of Electrical Engineering, New York University. Easton, Penn.: Chemical Publishing Co. London: Williams & Norgate. Cloth; 6x9 in.; pp. v+178; 166 illustrations. $1.50.

NEW YORK CITY DEPARTMENT OF BRIDGES—Annual Report for 1912, Embracing a Summary of Reports for Years 1905-1912, inclusive. Arthur J. O'Keefe, Commissioner of Bridges. Cloth; 7x10 in.; pp. 357; numerous plates and maps.

OHIO STATE BOARD OF HEALTH—Annual Report for Year Ended Dec. 31, 1911. Columbus, Ohio: James E. Bauman, Acting Secretary. Cloth; 6x9 in.; pp. 560.

POWER AND CONTROL OF THE GULF STREAM; How it Regulates the Climates, Heat and Light of the World—By Carroll Livingston Riker, M. E. New York: The Baker & Taylor Co. Cloth; 6x8 in.; pp. 102; illustrated. $2, net.

PRACTICAL MATHEMATICS, Being the Essentials of Arithmetic, Geometry, Algebra and Trigonometry. Part IV, Trigonometry and Logarithms—By Claude Irwin Palmer, Assistant Professor of Mathematics, Armour Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 4x7 in.; pp. xi+147; 68 text figures. 75c., net.

THE PRICE OF INEFFICIENCY—By Frank Koester, A. M. Am. Inst. E. E., author of "Hydro-electric Developments and Engineering," "Steam Electric Power Plants," "Electricity for the Farm and Home," "American City Planning," etc. New York: Sturgis & Walton. Cloth; 6x9 in.; pp. xxiv+439. $2, net.

PRINCIPLES AND METHODS OF MUNICIPAL TRADING—By Douglas Knoop, Lecturer on Economics in the University of Sheffield; Late Langton Fellow of the University of Manchester. London: Macmillan & Co., Ltd. Cloth; 5x9 in.; pp. xvii+409; $3.25 (10s.), net.

THE PRODUCTION OF COAL AND COKE IN CANADA DURING 1911—By John McLeish, Chief of Division of Mineral Resources and Statistics. Ottawa: Canada Department of Mines. Paper; 7x10 in.; pp. 35.

REVIEW OF FOREST SERVICE INVESTIGATIONS—Vol. II. Washington, D. C.: Forest Service. Paper; 6x9 in.; pp. 92; illustrated.

THE SANITARY CONDITION OF THE MERRIMACK RIVER—Report of the Massachusetts Board of Health (1913). Boston: The Board. Paper; 6x9 in.. pp. 47; illustrated.

SPECIFICATIONS FOR STREET ROADWAY PAVEMENTS, With Instructions on Street Paving Work—By S. Whinery, M. Am. Soc. C. E. Second edition, enlarged and entirely reset. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. x+116; illustrated. $1, net.

STEEL; ITS SELECTION, ANNEALING, HARDENING AND TEMPERING—By E. R. Markham. Fourth edition, fully illustrated. New York: Norman W. Henley Publishing Co. Cloth; 5x8 in.; pp. 367; 168 text illustrations. $2.50, net.

STEEL RAILS: THEIR HISTORY, PROPERTIES, STRENGTH AND MANUFACTURE, With Notes on the Principles of Rolling Stock and Track Design—By William H. Sellew, Principal Assistant Engineer, Michigan Central R.R. New York: D. Van Nostrand Co. London: Constable & Co., Ltd. Cloth; 7x10 in.; pp. xvii+559; 361 illustrations; 33 folding plates. $12.50, net.

ST. LOUIS CENTRAL TRAFFIC-PARKWAY—Reports of City Plan Commission of July 9, 1912, and Jan. 7, 1913. St. Louis, Mo.: Walter B. Stevens, Secretary. Cloth; 7x10 in.; pp. 31; illustrated.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES—Detroit, Mich.: U. S. Lake Survey Office. Bulletin No. 22. Paper; 8x10 in.; pp. 435.

SYNDICALISM, INDUSTRIAL UNIONISM AND SOCIALISM—By John Spargo. New York: B. W. Huebsch. Cloth; 5x8 in.; pp. 241. $1.25, net.

A TEXT-BOOK ON TRADE WASTE WATERS; THEIR NATURE AND DISPOSAL—By H. Maclean Wilson, Chief Inspector, and H. T. Calvert, Chief Chemical Assistant, West Riding of Yorkshire Rivers Board. Philadelphia, Penn.: J. B. Lippincott Co. London: Charles Griffin & Co., Ltd. Cloth; 6x9 in.; pp. xii+340; 74 text illustrations, including 22 plates. $5, net.

DIE WASSERKRAEFTE, IHR AUSBAU UND IHRE WIRTSCHAFTLICHE AUSNUTZUNG—Einschliesslich wirtschaftliches Lehr- und Handbuch. By Adolf Ludin, Preisgekrönt von der Kgl. Akadamie des Bauwesens in Berlin. Parts I and II. Berlin: Julius Springer. Cloth; 8x11 in.; pp. xvi+763 and 637, respectively; 1087 text illustrations and folding plates. 60 Marks.

WATER SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY—Washington, D. C.: Department of the Interior (George Otis Smith, Director). Paper; 6x9 in.; illustrated.

No. 297: Gazetteer of Surface Waters of California, Part III Pacific Coast and Great Basin Streams. By D. D. Wood. Pp. 211.

No. 300: Water Resources of California, Part III—Stream Measurements in the Great Basin and Pacific Coast River Basins. By H. D. McGlashan and H. J. Dean. Pp. 956.

No. 310: Surface Water Supply of the United States, 1911, Part X—The Great Basin. By E. F. Henshaw, H. D. McGlashan and E. A. Porter. Pp. 210.

No. 313: Water Powers of the Cascade Range, Part II—Cowlitz, Nisqually, Puyallup, White, Green and Cedar Drainage Basins. By F. F. Henshaw and Glenn L. Parker. Pp. 170.

No. 317: Geology and Underground Waters of the Wichita Region, North-Central Texas. By C. H. Gordon. Pp. 88.

WEST VIRGINIA FOREST, GAME AND FISH WARDEN—Report for 1911 and 1912 of J. A. Viquesney, Bellington, W. Va. Paper; 6x9 in.; pp. 106; illustrated.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

ENGINEERING WORK IN NEW ENGLAND

Boston and vicinity is the center of activity in New England engineering work, but there is less new work throughout the entire section than a year ago. Boston has recently appropriated $600,000 for street improvements, and a like sum for sewers. A new street, Broadway, now known as Pleasant St., is to be widened and extended to Park Square, the center of the large office-building district. A new thoroughfare from the South Station to the North Station has been projected for several years and cannot, within reason, be delayed much longer. Another plan, but more distant in the future, is the rebuilding of the North Station on the north side of the Charles River, at a cost of several million dollars.

The new piers and docks, in South Boston, are being fitted up, and extended for the reception of ocean steamships, and the New Haven is making railroad connections with this. With the completion of the new pier, a number of buildings in that area, estimated at about 300 acres, will be built. The city is actively at work on two subways, one to Brighton and the other to Dorchester. The Boston Elevated R.R. has begun work on an elevated structure to Malden, but it is now temporarily suspended, owing to objections from suburban property holders. The Boston & Eastern R.R. has completed the plans for a tunnel to East Boston, with connections for Lynn and Salem, eliminating the last grade crossing within the city of Boston, except four minor streets in Dorchester.

Activities in railroad construction are at low water mark, with the Grand Trunk work abandoned, and the New Haven under way, but with even it is four-tracking from Hyde Park to Providence, and from this fact it is probable that the electric line from Forest Hills to Providence, for which right-of-way was obtained two years ago, will be postponed.

A group of buildings will be constructed by the Massachusetts Institute of Technology in Cambridge. The burned section in Bangor, Maine, is being rapidly rebuilt, and Chelsea has fully recovered from the fire of 1908.

Numerous hydro-electric developments are in prospect, the F. T. Warren Paper Co. is building a dam 1400 ft. long at Dundee Falls, Maine, which will develop 2400 hp. There are several projects under way, one at Woodford of 300 hp., one at Sunderland of 4000 hp., and one at Bradbury. At Falls Village on the Housatonic, about 16,000 hp. will be developed, which will be distributed to various manufacturing parts within a radius of 40 miles.

The Massachusetts Highway Commissioners will have about a million dollars of state funds to expend on new construction this year. Sewage disposal plants, costing about a quarter of a million dollars, will be installed at Pittsfield, and an elaborate water-supply system is being projected in New Hampshire. This will supply the cities of Rochester, Somerworth, Dover, and Portsmouth with water from Merrymeeting Lake. The estimated cost is approximately $1,000,000.

Work on the Cape Cod Canal is still in progress, and it will take at least two years to finish the canal.

RAILWAYS

New York—Delaware, Lackawanna & Western R.R.—This company is planning to double-track its line from Solvay to Jamestown, N. Y. G. J. Ray, Hoboken, N. J., is Ch. Engr.

Hudson River Connecting R.R.—This company has applied to the Public Service Commission to issue $250,000 capital stock. Construction work will probably start at once. Noted Mar. 27.

✚**Lehigh Valley R.R.**—This company has awarded the contract to the JOHN F. DOLAN CONTRACTING CO., 50 Church St., New York, for the extension of its Seneca Falls Branch, from Seneca Falls to Cayuga Junction. Noted May 8.

✚**Pennsylvania**—Chartiers Southern R.R.—This company has awarded the contract for the construction of its proposed line to the BROCKLEHURST & POTTER CO., Providence, R. I. The line will be about 19 miles in length and will extend from Emman, Penn., to Marianna, Penn.

Virginia—Virginia-Carolina Ry.—This company has received bids for an extension of 40 miles. The line will pass through Washington County, Va., and Ashe County, N. C., to Todd, N. C. P. W. Early, Abingdon, Va., is Ch. Engr.

Virginia—Atlantic Coast Line R.R.—See item under North Carolina.

✚**North Carolina**—Atlantic Coast Line R.R.—This company has awarded the contract to the JOSEPH H. SANDS CONTRACTING CO., Roanoke, Va., for double-tracking its line between Pleasant Hill and Petersburg, Va., about 60 miles.

Hiawassee R.R.—This company, it is reported, will construct a standard-gage railroad from Andrews, N. C., to Hiawassee, Ga., by way of Hayesville, N. C., about 35 miles in length. J. Q. Barker, Andrews, is interested.

Georgia—Hiawassee R.R.—See item under North Carolina.

Alabama—Rome & Gadsden R.R.—This company has been organized for the purpose of constructing a railroad from Gadsden, Ala., to Rome, Ga. J. B. Wadsworth, Gadsden, Ala., is Pres. The line will be about 60 miles in length.

✚**Alabama**—Gulf, Florida & Alabama Ry.—This company has awarded the contract to the J. T. McCARTHY CO., Gainesville, Ga., for the grading for the construction of its extension from Local, Ala., north, 20 miles.

✚**Alabama**—The contract has been awarded to O. J. PRUITT, Montgomery, for the construction of a railroad from Alexander City, Tallapoosa County, to Kowaliga, Elmore County, a distance of 15 miles. Benjamin Russell, Alexander City, is interested.

✚**Ohio**—Lorain, Ashland & Southern R.R.—This company has awarded the contract to MacARTHUR BROS., 11 Pine St., New York, N. Y., for the completion of its line. Noted May 8.

Ohio—Fremont & Fostoria R.R.—Surveys will soon start for the construction of the proposed line of this company from Fremont to Port Clinton, Ohio. It is also reported that the company will construct an extension from Fremont to Tiffin, Ohio.

✚**Michigan**—Grand Rapids & Northwestern R.R.—This company has awarded the contract for the construction of its new line from Ludington, Mich., to Grand Rapids, to J. H. FLICK CONSTRUCTION Co., 37 West Van Buren St., Chicago, Ill. Work will be commenced at once. Walter S. Syrett, Post Office Bldg., Ludington, Mich., is interested.

Copper Range R.R.—This company has awarded the contract for the construction of a railroad extension of its main line from Painesville to Toivala, Mich. F. L. Batchelder, Houghton, Mich., is Ch. Engr.

Illinois—Peoria, Canton & Galesburg R.R.—This company has been incorporated for the purpose of constructing a railroad from Peoria, Ill., to Farmington, Moulton County, and thence to Galesburg. The directors include James A. Lyon, Horace Clark, W. B. Coleman, George C. Powers and George T. Page. Capital, $2,000,000.

Springfield & Central Illinois R.R.—This company is planning to construct its proposed line. It will run from Springfield to Duquoin through the counties of Sangamon, Montgomery, Bond, Clinton, Washington and Perry, and the cities of Pawnee, Raymond, Butler, Hillsboro, Greenville, Carlyle, Nashville and Pickneyville and from St. Louis, Mo., to Terre Haute, Ind., through the counties of St. Clair, Madison, Bond, Fayette, Clay, Jasper and Clark, and the cities of East St. Louis, Collinsville, Troy, Highland, Kinmundy, Louisville, Newton and Marshall. Isaac A. Smith, St. Louis, Mo., is Pres.

Minnesota—Northern Pacific Ry.—This company has made surveys for the construction of its proposed line from East Grand Forks, Minn., to Drayton, N. D. W. L. Darling, St. Paul, Minn., is Ch. Engr.

North Dakota—Northern Pacific Ry.—See item under Minnesota.

North Dakota—Dakota R.R.—Articles of incorporation have been filed by this company to construct and equip, either with steam or electricity, a line from Dickinson to Mott and north from Dickinson to connect with the Great Northern and the Milwaukee, St. Paul & Sault Ste. Marie Ry. and such other extensions as may be authorized.

Missouri—Moberly, Huntsville & Randolph Springs Ry.—Bids will be received until May 29, by this company, for grading its proposed line. Bids for this work were received May 1 and rejected. L. H. Dameron, Huntsville, Mo., is Pres.

Texas—See item under New Mexico.

Colorado—Missouri, Kansas & Texas Ry.—This company is contemplating the extension of a line through southeastern Colorado to Denver. Surveys have been made from Forgan, Okla., the northwestern terminal of the line in that state. S. B. Fisher, St. Louis, Mo., is Ch. Engr. Const.

New Mexico—The Empire Construction Co., Omaha, Neb., is promoting the construction of a railroad between Tucumcari, N. M., and Port Aransas on the gulf coast of Texas, about 650 miles. Work will soon be started. The division to be first constructed is between Tucumcari and Midland, about 250 miles. This part of the line will traverse a territory in eastern New Mexico and the middle and lower panhandle of Texas.

Idaho—Benewah Valley R.R.—This company is planning to construct its proposed line from St. Maries, Idaho, to Desmet, about 25 miles. M. I. Parker, St. Maries, is interested.

Nevada—Winnemucca R.R.—This company is making surveys for the construction of its proposed line. H. R. Sheldon, Winnemucca, is Ch. Engr.

Southern Pacific Co.—This company is considering the extension of its line from Thorne to Hawthorne, Nev. W. Hood, San Francisco, Calif., is Ch. Engr.

✚**Washington**—Northern Pacific Ry.—A subcontract has been awarded to G. O. FOSS & CO., Spokane, Wash., on the proposed double-tracking of this company's line through the Cascade Mountains. The general contractors are Guthrie, McDougall & Co.

Washington—North Bank Logging Co.—This company has filed articles of incorporation for the construction and operation of a logging, freight and passenger railroad between Uwaco and Kalama, Wash. The incorporators are John K. Koch, M. A. Zollinger and F. Winn.

California—California, Shasta & Eastern R.R.—Articles of incorporation of this company were filed May 3. The company recently bought the Anderson & Bella Vista R.R. The articles state that the purpose of the company is to build a railroad from Anderson through Bella Vista to Inset, a distance of 28 miles. The capital is $600,000. The Board of Directors are S. E. Brotherton, Felix T. Smith, W. T. Reed, P. Paul McCarthy, F. D. Madison, Platt Kent and V. W. Wood.

+Ontario—Canadian Pacific Ry.—This company has awarded the contract to WILLIAM MACKENZIE, for the construction of its Toronto-Stratford line.

Alberta—Dominion Northwestern Ry.—See item under Saskatchewan.

Saskatchewan—Dominion Northwestern Ry.—This company has been incorporated for the purpose of constructing a line from Regina, Sask., to Tuxford, on the Canadian Pacific Ry., and from thence to Red Deer, Alta., with a branch through Battleford, Sask., to Fort McKay. M. J. O'Connor, Ottawa, Ont., is interested.

++British Columbia—Canadian Pacific Ry.—Bids were received by J. G. Sullivan, Ch. Engr., Western Lines, Winnipeg, Man., Apr. 15, for clearing, grubbing and grading a diversion of the main line of this company in the Selkirk Mountains, from Six Mile Creek to Glacier, a distance of 17 miles. On this there is included a double-track tunnel approximately 28,000 ft. long. The contract, it is reported, has been awarded to FOLEY, WELCH & STEWART.

+British Columbia—Kettle Valley Ry.—This company has awarded the contract to GRANT SMITH & CO., Seattle, Wash., for the construction of its proposed line from Otter Summit to Hope, B. C. Estimated cost, $3,500,000. The road will be used jointly by the Kettle Valley R.R. and the Great Northern Ry.

Menzies Bay R.R.—This company is considering the construction of a railroad on Vancouver Island for the purpose of opening up its timber lands. The company is owned by the Ross McLaren Lumber Co., Vancouver, B. C.

ELECTRIC RAILWAYS

Holyoke, Mass.—M. A. Morse, Belchertown, Mass., is interested in the extension of the electric railway from Holyoke to Belchertown and Enfield.

Nahant, Mass.—Plans are being prepared by the Nahant & Lynn St. Ry. Co. for double-tracking its Flash Road line. J. E. Dozier, Lynn, is Gen. Mgr. and Pur. Agt.

Linden, N. J.—A company is being organized at Linden for the purpose of constructing a six-mile electric railway through Linden to connect with the Short Line of the Public Service Co. Frank R. Anderson, Linden is interested.

Morristown, N. J.—The Morris R.R. Co., affiliated with the Morris County Traction Co., is planning for the construction of a line between this place and Madison, about three miles, completing the company's system to Lake Hopatcong. The work is estimated to cost $150,000.

Trenton, N. J.—In accordance with formal notice tendered City Engineer, A. Swan, the Trenton & Mercer County Traction Co. will rebuild its lines on Broad St. between State and Perry Sts., on South Broad St. between Livingston and Center Sts., on Center St. between Broad and Ferry Sts. and on Ferry St., from Broad St. to the Raritan Canal. Wm. H. Hitchcock is Supt.

Fayette, W. Va.—Grading has been started by the Fayette Traction Co. on its proposed electric railway to connect Fayette and Fayetteville, about four miles. C. W. Dillon, Fayetteville, is Pres. Noted Mar. 20.

Miami, Fla.—The Miami & South Florida Ry. Co. has been organized to construct and operate an electric railway from Detroit, Fla., to West Palm Beach. H. C. Roome is Pres. and Nathan A. Cole is Vice-Pres.

Gadsden, Ala.—Surveys have been completed and preliminary arangements will soon be started for the construction of an electric railway to connect Gadsden Center, Cave Springs, Ala., and Rome, Ga., about 60 miles. J. B. Wentworth, Gadsden, is interested. Noted Dec. 12, 1912.

Nashville, Tenn.—The City Council has granted a franchise to the Nashville Ry. & Light Co. for the extension of its Buena Vista line. W. E. Beazel, Nashville, is Pur. Agt.

Ashland, Ky.—S. S. Willis, Ashland, is interested in the construction of an electric railway from Ashland to Russell.

Fort Wayne, Ind.—Plans are being prepared by the Fort Wayne & Springfield Ry. Co. for the extension of its line to Portland, Ind. W. H. Fiedderjohann, Decatur, is Pres., Gen. Mgr. and Pur. Agt.

Logansport, Ind.—The Laporte, Logansport & Southwestern Traction Co. is considering plans for the construction of an electric railway through the northeastern section of Cass County to Logansport.

Cheboygan, Mich.—The Cheboygan Electric Light & Power Co. proposes to start work soon on the construction of an electric railway to connect Cheboygan and Petosky. B. F. Spencer is Gen. Mgr.

Linden, Mich.—A franchise has been granted to Oliver H. Lau, Detroit, Mich., by the Town Council for the construction of an electric railway to connect Linden, Fenton and Holly.

Belleville, Ill.—Preliminary arrangements are being made by the Belleville & Mascoutah Traction Co. for the construction of its proposed electric railway to connect Belleville and Mascoutah, about 11 miles. David O. Thomas, Belleville, is Gen. Mgr.

Bloomington, Ill.—An expenditure of $199,627 for the improvement and extension of its system, is planned by the Bloomington & Normal Ry. & Light Co. M. G. Linn is Gen. Supt.

Peoria, Ill.—The Peoria, Canton & Galesburg Ry. Co. has been incorporated to construct and operate an electric railway to connect Peoria, Farmington and Galesburg. The incorporators are James A. Lyon, Chicago; Horace Clark, W. R. Coleman, Geo. C. Powers and Geo. T. Page, all of Peoria.

Ridge Farm, Ill.—John A. Johnson, Indianapolis, Ind., is interested in the construction of an electric interurban railway from Ridge Farm to Clinton, via Dana, Ind.

Springfield, Ill.—The Springfield-Taylorville & Pana Interurban R.R. Co. has been incorporated to construct and operate an interurban railway from Springfield through Taylorville to Pana. The incorporators are W. B. Adams, of Taylorville and P. F. Ballet, George H. Backer and H. V. Gehm, of St. Louis, Mo.

Faribault, Minn.—Plans are being considered by H. A. Knight and associates for the construction of an electric railway from Faribault to Wells and Sioux Falls.

+Minneapolis, Minn.—The Electric Short Line has awarded a contract to H. F. BALCH & CO., Minneapolis, for the construction of about eight miles of electric railway to Long Lake.

Kansas City, Kan.—(Official)—The Kansas City, Kaw Valley & Western Ry. Co. is considering plans for the construction of an electric railway from Kansas City to Lawrence. The main office of the company is at Bonner Springs, Kan.

Manhattan, Kan.—Plans are being prepared by the Manhattan Interurban Ry. Co. for the extension of its line from Manhattan to Topeka. Joseph T. West, Manhattan, is Gen. Mgr. and Pur. Agt.

Dickinson, N. D.—Plans are being considered by the citizens for the construction of an electric railway from Dickinson to Mott.

Huntsville, Mo.—Bids will be received by C. H. Damern, Pres. Moberly, Huntsville & Randolph Springs Ry. Co., until May 29, for grading the proposed line, which will connect Moberly, Huntsville and Randolph Springs, about 12 miles in all. John J. Mundinger is Ch. Engr. Noted Feb. 6.

St. Louis, Mo.—The County Court has granted a franchise for a period of 50 years to the St. Louis & Jennings Ry. Co. to construct and operate an extension to its line from Florrissant to Melrose Ave. David P. Leahy is interested.

Dallas, Tex.—Surveys have been started by the Dallas Western Interurban Ry. Co. for the construction of its proposed line to connect Dallas, Cleburne and Glenrose. E. P. Turner is interested.

Nowata, Okla.—Preliminary arrangements are being made by the Kansas-Oklahoma Traction Co. for the construction of its proposed line from Nowata, Okla., to Coffeyville, Kan.

Pryor, Okla.—Plans are being prepared by the Pryor, Salina & Eastern Ry. Co. for the construction of a 10-mile interurban railway to connect Pryor and Salina, Okla. J. A. Quinn, Pryor, is interested.

Lewiston, Idaho—The Nez Perce & Idaho R.R. Co. is making preliminary arrangements for the construction of its proposed electric railway to connect Forest, Waha and Lewiston. Z. A. Johnson, Lewiston, is Pres.

Wendell, Idaho—J. Stewart Clark, Twin City, is interested in the construction of an electric railway from Wendell to Buhl.

Ogden, Utah—The Ogden, Lewiston & Northern Ry. Co. has been organized to construct an interurban railway from Ogden, Utah, to Presto, Idaho. Fred W. Crockett, Logan, Utah, is Pres.

Wellsville, Utah—The City Council has granted a franchise to the Logan Rapid Transit Co. to construct and operate an electric railway through Wellsville. Robert Anderson, Logan, is Gen. Mgr. and Supt.

Aberdeen, Wash.—Plans are being considered by the Gray's Harbor Ry. & Light Co. for an expenditure of $30,000 for the extension and improvement of its system in Aberdeen. H. B. Zimmerman, Aberdeen, is Secy. and Gen. Mgr.

Tacoma, Wash.—The Tacoma Ry. & Power Co. is considering an expenditure of $315,000 for the improvement and extension of its system in Tacoma. L. H. Bean, Tacoma, is Gen. Mgr.

Los Angeles, Calif.—The Pacific Electric R.R. Co. has applied to the City Council for a 40-year franchise for a four-track elevated railroad from the present Main St. terminal east to San Pedro St. at an estimated cost of $600,000. J. McMillan is Gen. Mgr.

Miramar, Calif.—The Santa Barbara & Suburban Ry. Co. has been petitioned to extend its line to Miramar. W. E. Irwin, Santa Barbara, is Supt.

San Francisco, Calif.—According to press reports the Board of Supervisors is considering the proposition to issue bonds for $3,600,000 for the construction and equipment of municipal electric railways on Van Ness Ave., Potrero Ave., Union, North Point, Stockton, California and Church Sts. The proposition will be submitted to the vote of the citizens about July 1. M. M. O'Shaughnessy is City Engr.

San Rafael, Calif.—The Mill Valley & Mount Tamalpais Scenic Ry. Co. has been purchased by the Mount Tamalpais & Muir Woods Ry. Co. The new owners are considering plans for the extension of the line from West Point to Bolinas.

Pointe Aux Trembles, Que.—The Council has granted a franchise to the Montreal Tramway Co. to construct and operate an electric railway in Pointe Aux Trembles. J. E. Hutcheson, Montreal, is Gen. Mgr.

LIGHT, HEAT AND POWER

Rutland, Vt.—A development of a water power of 4000 hp. is about to be made by the Rutland Ry., Light & Power Co., on East Creek. This is one of a number of developments covering a large area to be controlled by the Western Vermont Power Co., of New York, N. Y. I. M. Frost, Rutland, Vt., is Mgr. of the company. Henry F. Bryant, 334 Washington St., Brookline, Mass., is Engr.

Groton, Conn.—The Town Council is considering plans for the installation of additional equipment in the municipal electric-light plant. T. A. Graves is Supt. of the plant.

Putnam, Conn.—Plans are being prepared by the Putnam Light & Power Co. for the extension of its transmission lines from Putnam to Arlington, about five miles. R. E. Thruston, Putnam, is Mgr.

Terryville, Conn.—Plans have been prepared by Sperry & Buell, Bristol, Conn., for the construction of a water power plant at Terryville for the Andrew Terry Co. Noted Apr. 3.

Binghamton, N. Y.—Plans are being considered by the Board of Trustees of the Binghamton State Hospital for the installation of a new power plant at the hospital. An appropriation of $60,000 has been made for the purpose.

Brooklyn, N. Y.—Bids will be received until 3 p.m., May 22, by the Department of Parks, Fifth Ave. and 64th St., Manhattan, for heating and ventilating work for a comfort station located in Prospect Park; for heating and ventilating work for a comfort station located in Linton Park. Charles B. Stover is Pres.

Lyons, N. Y.—Estimates are being prepared by Horace G. Sweet Utica of the cost of installing municipal electric-light plant at Lyons. Bonds for $10,000 have been voted for the purpose.

New York, N. Y.—(Boro. of Richmond)—Bids will be received until 2:30 p.m., May 22, by the Department of Public Charities foot of East 26th St., Manhattan, for furnishing all the labor and materials required for the steam-heating equipment of a dining-hall building, kitchen, service building and bakery at the New York City Farm Colony, Boro. of Richmond. Michael J. Drummond is Comr.

+New York, N. Y.—(Boro. The Bronx)—(Official)—The Department of Education, Park Ave. and 59th St., has awarded a contract to the RAISLER HEATING CO., 1968 Broadway, at $49,907, for the installation of heating and ventilating apparatus in the new public school No. 50, Boro. The Bronx. Bids were received May 5. C. B. J. Snyder is Supt. of School Bldgs

Hightstown, N. J.—The Borough Council is considering the establishment of a municipal gas plant at a cost of about $25,000.

Newark, N. J.—The Common Council will investigate the cost of installing a new 50-kw. generator and new engine at the City Hall lighting plant, to be used for supplementary service

Creighton, Penn.—The West Penn Rys. Co. contemplates extensive improvements to its power plant at Creighton. H. F. Banard, Pittsburgh, is Pur. Agt.

Ravenswood, W. Va.—Plans are being prepared for the installation of an electric-light plant at Ravenswood, for which J. Mentor Caldwell, Parkersburg, was recently granted a franchise

Star City, W. Va.—The Monongalia Electric Co. is considering the construction of an electric-light plant at Star City. R. W. Smith is Pres.

Walterboro, S. C.—The construction of an electric-light plant at Walterboro, is contemplated by the Walterboro Ice & Light Co. G. C. Brown is interested.

Marshallville, Ga.—Plans have been prepared by the J. B. McCrary Co. Atlanta, Ga., for the construction of a municipal electric-light plant at Marshallville. Bids for the work will be received about June 30. Noted Mar. 27.

+High Springs, Fla.—The contract for the construction of a municipal electric-light plant and water system at High Springs, has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at $65,000.

Lakeland, Fla.—The city is planning to make extensive improvements to the municipal electric-light plant.

Roanoke, Ala.—See item under Water Supply—Irrigation.

Lone Mountain, Tenn.—Plans are being considered by the Ball Creek Electric Co. to construct and operate an electric-light plant at Lone Mountain. Payne Bros., of Lone Mountain, are interested in the project.

Paris, Tenn.—Extensive improvements to the municipal electric-light plant are planned by the city. M. W. Younkin is Mgr. of the plant.

Elizabethtown, Ky.—The Kentucky Utilities Co., Lexington, Ky., has contracted with the city of Elizabethtown, for the enlargement of its electric-light plant so as to make current available for power as well as lighting purposes.

Findlay, Ohio—A special election will be held June 3 to submit to the voters the proposition to issue $57,000 of bonds for the construction of a municipal electric distributing system. John W. S. Riegle is Engr. J. E. Edie is City Clk. Noted May 8.

Marietta, Ohio—The Parkersburg, Marietta & Interurban Ry. Co. is planning to start shortly on the construction of dams and power houses along the Muskingum River in Ohio in connection with the hydro-electric power plants, which will supply hydro-electric power to the Muskingum, Little Kauawha, and a great part of the Ohio Valley. H. H. Archer, Parkersburg, W. Va., is Gen. Mgr. and Pur. Agt.

Jasper, Ind.—Bids will be received by J. A. Wucher, Clk. Bd. of Trustees, until May 26, for furnishing equipment for the municipal electric-light plant. Paul H. White, Union Trust Bldg., Indianapolis, is Consult. Engr.

Bloomingdale, Mich.—Lewis Hawk has been granted a franchise by the City Council to construct and operate an electric-light plant at Bloomingdale.

Alton, Ill.—It has been voted to change the present street-lighting system to an ornamental system. J. F. Schwaab is City Engr.

Belvidere, Ill.—According to press reports the Illinois Northern Utilities Co., Chicago, is contemplating the construction of a new power plant at Belvidere to cost $100,000.

Elgin, Ill.—Plans are being prepared by C. C. Chapman, Chicago, for the construction of a municipal electric-light plant at Elgin.

Murphysboro, Ill.—A committee has been appointed to investigate the cost of installing an ornamental street lighting system in the business and residential sections of Murphysboro.

Savanna, Ill.—The installation of an ornamental lighting system in the business district is contemplated.

Warren, Ill.—A franchise has been granted to George Loptein to construct and operate an electric-light plant at Warren.

La Crosse, Wis.—The gas-generating plant of the La Crosse Gas & Electric Co., will be remodeled at a cost of $125,000. The main building will be brick, concrete and steel, 153x33 ft. The coal sheds, office and meter room will be replaced. Capacity will be doubled with the new "water set" system. Modern machinery for securing the byproducts will be installed. Extension and replacing mains throughout the city will cost $20,000. Kelsey-Brown, Grand Rapids, Mich. are principal owners. Thurston Owens is Gen. Mgr.

+Wauwatosa, Wis.—The contract for the installation of electrical steam apparatus in the new power plant at the Milwaukee County Asylum for Chronic Insane, at Wauwatosa, has been awarded to the LANGSTAFT-MEYER CONSTRUCTION & SUPPLY CO., Appleton, Wis., at $7000. Bids were received Apr. 9. Noted Apr. 3.

What Cheer, Iowa—The new owners of the local electric-light plant are considering plans for the improvement of the plant and extension of the system.

Jackson, Minn.—Preliminary arrangements are being made for the improvement and installation of new equipment in the municipal electric-light plant. J. E. Barrett is Supt. of the plant.

Blair, Neb.—Preparations are being made for the construction of a transmission line from Altus to Blair, about 10 miles, to supply electrical service at Blair.

Albany, Mo.—Bonds for $19,000 were voted at a recent election for the construction of a municipal electric-light plant. W. E. Noonan is Supt. of the plant.

Rolla, Mo.—Preliminary arrangements are being made for the improvement of the municipal electric-light plant. O. W. Chapin is Supt. of the plant.

Argenta, Ark.—Plans are being considered for the installation of additional equipment in the municipal electric-light plant. S. J. Chapman is Mgr. of the plant.

Arkadelphia, Ark.—Plans are being prepared by the Arkadelphia Electric Light Co. for the improvement of its plant and entire system in Arkadelphia. W. C. Maguire is Mgr.

Conway, Ark.—An expenditure of $10,000 is planned for the improvement of the municipal electric-light plant. Bids for the work will be received about May 15. E. V. Leverett is Consult. Engr.

Marvel, Ark.—Plans for the construction of an electric-light and power plant at Marvel are being considered by the Marvel Light & Power Co. F. H. Webster has charge of the work.

Belton, Tex.—The City Electric Co. recently organized with a capital of $60,000, has taken over the holdings of the Belton Light & Power Co., and the Belton Ice & Electric Co. The property consists of two electric-light and power plants and an ice factory. Additional machinery will be installed and improvements will be made to the plants.

Nacogdoches, Tex.—The City Council has purchased the electric-lighting and power plant of the Nacogdoches Light & Power Co. Improvements will be made.

S. K. Slade, of Petrolia, Tex., is promoting a company for the purpose of laying a natural-gas pipe line from Petrolia to Waco, a distance of about 200 miles. In connection with the project it is proposed to construct a system of distributing mains in this city.

Hinton, Okla.—(Official)—Bids will be received by the Town until 8 p.m., May 19, for the construction of a municipal electric-light plant and water system. Plans and specifications have been prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted Feb. 27.

Supply, Okla.—The installation of an electric-light plant in connection with the proposed water system is under consideration.

Artesia, N. M.—The General Electric Co., represented by W. M. Hand, Kansas City, Mo., which has under consideration the construction of an interurban electric line to run between Cloudcroft and Artesia, is investigating the advisability of making Roswell the northern terminus. If it is decided to do this the line will be about 150 miles long. The hydro-electric plant, which will furnish the power for operating the road, will be situated at the falls of the Panasco River.

Santa Rosa, N. M.—C. R. Jones is promoting the erection of a hydro-electric plant near here. It is planned also to construct a system of power transmission lines. It is claimed that the Santa Rosa Rito River affords an abundant supply of water for generating the necessary electrical energy. Mr. Jones holds an option on the water rights of this stream.

Las Vegas, Nev.—Ira McFarland and eastern associates are interested in a power-plant project to supply light and power to Las Vegas and adjoining valleys. The waters from the Charlestown mountain range are to be used to develop several thousand horsepower. The cost will be about $500,000.

Phoenix, Ariz.—Bids will be received by the Salt River Valley Water Users' Association until 2 p.m., June 5, for the construction of the Crosscut power plant.

St. Johns, Ariz.—The Nebo Light & Power Co. and the St. Johns Electricity & Power Co. will erect hydro-electric plants near here for the purpose of supplying power for irrigation pumping plants and other industrial concerns of this section, as well as to provide lights for St. Johns. The two companies are closely affiliated in their management.

Colville, Wash.—Plans are being prepared by the Stevens County Power & Light Co. for the construction of a transmission line from Colville to Chewelah. Estimated cost, $23,000. It is proposed to construct substations in each city. H. R. Williams, Colville, is Vice-Pres. and Gen. Mgr.

Bakersfield, Calif.—The Midway Gas Co. has been granted permission to construct natural gas mains from the Midway fields to Los Angeles, a distance of about 200 miles.

Fresno, Calif.—The San Joaquin Light & Power Corporation has arranged with the J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y., for the engineering and construction of a 6000-kw. hydro-electric plant on the Tule River, near Springville, Calif. Also for the installation of a 3000-kw. generator at San Joaquin power house No. 2, a 3750-kw. generator and waterwheel at Kern River Cañon plant, installation of 6250-kw. steam turbine, boilers, auxiliaries and buildings at Bakersfield steam plant and installation of four 666-kw. transformer and necessary revision of switching arrangements for plant No. 3 of the company.

†Los Angeles, Calif.—The Los Angeles Gas & Electric Co. awarded a contract to the BABCOCK & WILCOX CO., 85 Liberty St., New York, N. Y., for one Stirling boiler at the Cos plant, at $15,975.

Midway, Calif.—The San Joaquin Light & Power Co. is preparing to double the capacity of its plant at McKittric and Midway. Jack Carter is Local Supt.

Sacramento, Calif.—The Sacramento Natural Gas Co. will spend $35,000 for a gas holder, $5400 for meters, $55,000 for extension of mains and service pipes, and $15,000 for a new gas well.

Sackville, N. B.—Plans are being considered by the Council for the construction of a municipal electric-light plant, to cost $70,000. Noted Mar. 27.

Lingan, N. S.—W. S. Fielding, Ottawa, Ont., is interested in the construction of an electric-power plant at Lingan.

Brantford, Ont.—Plans are being prepared by the Dominion Natural Gas Co., for the construction of a gas plant and system in Western Ontario. Estimated cost, $5,000,000. H. H. Powell, Brantford, is Mgr.

Peterborough, Ont.—The Canadian General Electric Co. is receiving bids for the construction of an addition to its transformer station.

†Calgary, Alta.—The contract for furnishing equipment for the new street-lighting system has been awarded to the CANADIAN WESTINGHOUSE CO., Toronto, Ont., at $15,452.

Montreal, Que.—Plans are being considered by the Board of Trustees of the Alexandra Hospital, for the construction of a power plant, to cost $50,000.

Regina, Sask.—The City Council is considering plans for the construction of a power plant, to cost $10,000.

Fernie, B. C.—An appropriation of $10,000 has been made for the installation of an electric-light system in Fernie.

Dawson (Yukon Territory), **Can.**—Plans are being prepared for the construction of a new power plant at Dawson to replace the plant which was recently destroyed, at a loss of $200,000.

BRIDGES

†Charlotte, Mass.—The contract for the construction of a concrete arch bridge over Cady Brook, in Charlton City, has been awarded to R. L. HUDSON, Melrose, Mass. Noted Mar. 6.

Rochester, N. Y.—Bids will be received by the Board of Supervisors of Monroe County at the office of the Supt. of Highways, until noon, May 26, for the construction of a steel truss bridge with concrete floor, 216-ft. span. Concrete abutments on pile foundations, approaches about 7000 cu.yd. of earth filling, with macadam and cube pavement. J. Y. McClinoock is the County Supt. of Highways.

Belleville, N. J.—(Official)—The engineers of Essex, Bergen and Hudson Counties, who have been instructed to revise the plans prepared last year for the construction of a new bridge over the Passaic River at Belleville, have begun preliminary drawings. These new plans are being made with the idea of reducing the cost of the structure to an amount which will not exceed $200,000. The structure will be built on the Belleville Turnpike between the town of Belleville, Essex County, the town of Kearny, Hudson County, and the town of Arlington, Bergen County. Bids were received for its construction on Oct. 1, 1912, and rejected. The lowest total of any bid at that time was $275,000. Noted Oct. 10. Arthur L. Reimer, Court House, Newark, is County Engr. of Essex County.

Hackensack, N. J.—Bids will be received by the Board of Chosen Freeholders of Bergen County until 2:45 p.m., May 16, for the construction of a concrete culvert on Westervelt Ave., east of the railroad, Tenafly, N. J.

†Mount Carmel, Penn.—We are officially advised that the contract for the construction of a bridge over Shamokin Creek at Vine St., has been awarded to NELSON-MERYDITH, Chambersburg, Penn., at $5174. J. C. Tressler, Sunbury, Penn., is the Clk. Noted Apr. 24.

New Castle, Penn.—The proposition to erect two new bridges to replace those destroyed by the recent floods, is under consideration, one at Gardner Ave., to cost $60,000, and the other at Grant St., to cost approximately $40,000.

Phillipsburg, Penn.—Plans are being prepared for the construction of a new highway bridge over the tracks of the Central R.R. of N. J. Bids will probably be received in two or three months. J. O. Osgood, New York, N. Y., is the Ch. Engr.

Pittsburgh, Penn.—The lowest bid received for the construction of the new bridge over Haights Run, on the line of Butler Ave., was that of the Cummings Structural Concrete Co., at $109,480. The Dravo Constructing Co. bid $136,000. Noted May 1.

Pottsville, Penn.—Bids will be received by J. E. Kantner, County Controller of Schuylkill County, until 10 a.m., May 20, for the construction of repairs on four county bridges.

Richmond, Va.—In the issue of Feb. 27, it was noted that competitive plans would be received for a concrete bridge across the James River. We are informed that a number of plans were received by the commission, but there is little likelihood of any actual bridge construction for some time.

Lewisburg, W. Va.—Bids will be received by the County Court of Greenbrier County, Lewisburg, until June 3, for the construction of a reinforced-concrete bridge over Kitchens Creek, at Cambell Bennetts, nine miles north of Alderson, W. Va. [illegible] Chamberlin is County Road Engr.

†Birmingham, Ala. [illegible] will be received by Walter G. [illegible] until June 2, for the construction of [illegible] over 25th St. (Village [illegible] the other at Ave. E [illegible] with Plans and specifications [illegible] Clk. Engr.

Mobile, Ala. [illegible] the Board of Revenue [illegible] for the construction of [illegible] from Station 290 [illegible] are on file at the [illegible]

Coshocton, Ohio—The County Commissioners of Coshocton County have decided to issue bonds for $100,000 for the purpose of rebuilding the Warsaw, Orange and Walhonding bridges.

Logan, Ohio—Bids will be received by the Board of Commissioners of Hocking County until 11 a.m., May 23, for the reconstruction and replacement of the Haydenville Bridge, according to plans and specifications on file at the office of the County Commissioners.

†Newark, Ohio—The contract for repairing the Monroe St. Bridge has been awarded to G. W. LANE, at $9800.

Steubenville, Ohio—Bids will be received by the County Commissioners of Jefferson County until noon, May 29, for the construction of the steel superstructure of the Rayland Bridge, according to plans and specifications on file at the office of the County Surveyor. John L. Means is the County Audr.

Lafayette, Ind.—The proposition to replace the Main St. Bridge, which was damaged by the recent flood, with a new bridge, to cost approximately $300,000, is under consideration.

†Milledgeville, Ill.—We are officially advised that the contract for finishing one reinforced-concrete bridge and building three other bridges in Wysox County, has been awarded to the NORTHERN STEEL & CONCRETE CO., Freeport, Ill., at $5142. The other bidders were: Miller Hay Construction Co., $6488; George A. Quinlan, $5640, and Milloy Construction Co., $6800. Noted Apr. 24.

Ottawa, Ill.—Bids that were to have been received Apr. 30, will be received until May 20, for the construction of a reinforced-concrete bridge over Hulinger Creek, in the town of Deer Park. Noted Apr. 17.

Milwaukee, Wis.—Bids will soon be asked for replacing the stone abutment on the west end of the Chestnut St. Bridge, over the Milwaukee River. The estimated cost is $10,000. J. C. Pinney, Jr., Supt. of Bridges, is preparing the plans.

Ulm, Mont.—Bids will be received by the County Clerk of Cascade County, at Great Falls, Mont., until 11 a.m., June 2, for the construction of a three-span steel bridge over the Missouri River at Ulm. Lee Dennis is the County Clk.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until noon, May 23, for the construction of two reinforced-concrete bridges over the tracks of the Missouri Pacific Ry. Co., one at Arsenal St., and one at Columbia Ave. William T. Findly is the Secy. of the Bd.

Meeker, Colo.—According to press reports, the County Commissioners of Rio Blanco County have appropriated $5000 for the construction of a new bridge to replace the one recently washed away at White River City.

Stevenson, Wash.—Bids are being received by H. Swisher, County Clk., for the construction of a bridge across the Kanaka Creek, on the East End of Second St. Plans and specifications are on file at the office of the County Engr. The estimated cost of the structure is $5000.

Spokane, Wash.—Plans are being prepared by the County Engr., of Spokane County, for the construction of a reinforced-concrete viaduct, to span the Spokane & Inland Empire R.R. Co. tracks, on the Trenton Road. Bids will soon be asked.

Vancouver, Wash.—Bids will probably be received in the fall for the construction of the proposed Pacific Highway Bridge across the Columbia River. James P. Stapleton, a lawyer of Vancouver, is the Chn. of the Vancouver Bridge Com. Noted May 1.

Portland, Ore.—The City Council has adopted plans for the construction of a reinforced-concrete bridge over Sullivan's Gulch on East 16th St. Bids will soon be asked. The estimated cost is $98,000. Thomas M. Hurlburt is the City Engr.

†Roseburg, Ore.—The contract for the construction of the Dillard Bridge has been awarded to the COAST BRIDGE CO., Railway Exchange Bldg., Portland. The estimated cost is $20,000. Noted Apr. 24.

Modesto, Calif.—Plans are being prepared for the construction of an 80-ft. steel span at the east end of the Crows Landing Bridge over the San Joaquin River, and a similar span with 200 ft. of trestle at the western end of the drawbridge. The County Surveyor is preparing the plans.

Willows, Calif.—We are officially advised that the bids received May 5, for the construction of a bridge across Stony Creek near Orland, were not opened, and the work will be readvertised. W. H. Sale is the County Clk. Noted May 1.

WATER SUPPLY—IRRIGATION

†Claremont, N. H.—The contract to construct a water system here has been awarded to the OSGOOD CONSTRUCTION CO., Nashua, N. H., at $35,969. Bids were opened by the Board of Water Commissioners, Apr. 18. E. E. Davis, Northampton, Mass., is Consult. Engr. Noted Apr. 24.

Boston, Mass.—Bids will be received by the Department of Public Works until May 16, for relaying water mains in Fairfield, Marlborough and Newbury Sts. L. K. Rourke is Comr.

Holyoke, Mass.—The Water Commission has voted to lay a 6-in. main in Fairmont St., a 6-in. main in Lexington Ave., and a 12-in. main in Northampton Ave. Patrick Gear is Supt of Water Dept.

Lowell, Mass.—It is proposed to treat the city water supply with a solution of lime. A lime-mixing tank and other apparatus will be needed at the Cook Wells.

Millbury, Mass.—The Millbury Water Co. is planning to extend its water system to the Greenwood Park District, near the Worcester line.

††Meriden, Conn.—The contract for constructing the dam in connection with the Broad Brook reservoir system, bids for which were received May 25, has been awarded to the PHILBRICK ENGINEERING & CONSTRUCTION CO., Hartford, Conn., at $59,684, the various items being as follows: 4500 cu.yd. earth excavation for the dam and culvert, $6750; 12,000 cu.yd. earth excavation for highways, $5400; 1200 cu.yd. rock excavation $1800; 6100 cu.yd. concrete $24,095; 3000 sq.yd.

riprap, $2400; 8500 bbl. portland cement, $14,450; 13 lin.ft. pipe rails, $64.50; 2500 ft. wire fencing, $525; material and work in connection with the gate house, $1200. Noted May 1 and May 6.

Albion, N. Y.—The State Conservation Commission has granted permission to the Albion Waterworks Co. to construct an 18-ft. dam in Otter Creek, and install a filtration plant.

Mount Morris, N. Y.—At a recent meeting of the Board of Trustees, it was decided to purchase the Mills Water System for $50,000, and install a supplementary system, the supply to be taken from Silver Lake. It is estimated that the improvements will cost about $70,000. Noted Apr. 24.

✦New York, N. Y.—(Official)—The Department of Water Supply, Gas & Electricity, Park Row Bldg., has awarded the following contracts from bids received on May 9: Furnishing and stacking c.-i. pipe and valve-box castings, for Manhattan and the Bronx, to JOHN FOX & CO., 253 Broadway, at $15,209; furnishing and stacking hydrants, for Manhattan and the Bronx, to A. P. SMITH MFG. CO.; furnishing and laying high-pressure fire-service mains and appurtenances in Atlantic, Fourth, Hudson and Myrtle Aves., Adams, Beard, Columbia, Court, Fulton, Halleck, John, Johnson Nassau and Wyckfok Sts., and Leo, Second and Tiffany Places, Boro. Brooklyn, to JAMES O'LEARY, 245 East 202d St., New York, at $120,836. The other bids received on this contract were: Cranford Co., $134,875; Murphy Bros., $130,387; Soraci Contracting Co., $125,820; Carfaqui & Dragonette, $138,827; Wm. F. Norton Contracting Co., $133,450; Beaver Engineering & Contracting Co., $127,523; Jos. J. B. Le Marsh, $179,379. Noted May 1.

Plattsburg, N. Y.—Bids for constructing a storage reservoir on West Brook were received by the Board of Public Works, May 2, as follows: Cunningham, Woodward Co., $71,876; Charles R. Lewis, $66,169; J. J. Fitzpatrick & Sons, $59,994; Gifford Construction Co., $62,152.50; George Cooke, $53,525.

Morganza, Penn.—(Official)—Bids will be received by the Board of Managers of the Pennsylvania Training School until May 20, for constructing a water-works dam, according to plans prepared some time ago by R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio. W. F. Penn is Supt.

Hamburg, Penn.—(Official)—Bids will be received by Samuel G. Dixon, State Comr, of Health, Harrisburg, Penn., until 2 p.m., May 28, for constructing a water system and a sewage disposal plant for the Pennsylvania State Sanitorium for Tuberculosis near Hamburg.

Milton, Del.—(Official)—The Town Council has engaged Charles E. Collins, Consult. Engr., Drexel Bldg., Philadelphia, Penn., to prepare plans and supervise the construction of the proposed water system, which will consist of about four miles of c.-i. pipe, fire hydrants, artesian wells, pumping plant and water tower. It is expected that bids for this work will be asked early in June.

★Baltimore, Md.—(Official)—All bids received for Contract 11 of the water improvements, which provide for the construction of 32 mechanical filter units, two coagulating basins, one mixing basin, and two earth dams and appurtenances, have been rejected. Bids were opened Apr. 3. Ezra B. Whitman is Water Engr. Noted May 8.

★(Official)—Bids will be received by the Board of Awards until 11 a.m., June 4, for constructing the filtration plant at Lake Montebello, Contract 11. The contract includes the construction of 32 mechanical filter tanks, two coagulating basins, one mixing basin, two earth dams and appurtenances. Plans and specifications may be obtained at the office of Ezra B. Whitman, Water Engr. The extent of the work is as follows: Excavation approximate, 110,000 cu.yd.; two coagulating basins, capacity each, 8,500,000 gal.; one mixing chamber, capacity, 3,000,000 gal.; 32 mechanical filter tanks, 4,000,000 gal. daily capacity, with complete equipment; filtered water basins with capacity of 2,500,000 gal.; two earth dams built from excavated materials. Noted May 8.

Cumberland, Md.—It is proposed to lay about 2500 ft. of 30-in. pipe to connect the Pop Sill Reservoir with the city mains. Estimated cost, $15,000. James Gaffney is City Engr.

Williamsport, Md.—Alfred M. Quick, Consult. Engr., Baltimore, Md., has submitted a report recommending that a water supply be obtained from Haw Spring and piped to Old Van Lear Mill, where a 100,000-gal. reservoir be built. Estimated cost, $20,000. Noted Jan. 30.

Huntington, W. Va.—At a recent meeting of the Chamber of Commerce, the proposition to issue bonds for $750,000 for the installation of a municipal water system was defeated. Noted May 1.

Cherryville, N. C.—(Official)—Bids will probably be asked about June 10, for the construction of a water system here, estimated to cost $25,000. D. P. McDonald is Mayor. Noted Apr. 24.

Orangeburg, S. C.—Bonds for $60,000 were voted, Apr. 29, for removing the water, light and power plants to a site near the Edisto River. Noted Apr. 13.

Thomaston, Ga.—The J. B. McCrary Co., Third National Bank Bldg., Atlanta, Ga., has been retained by the city to prepare plans for the proposed improvements to the water and sewer systems. H. Thurston is Mayor. Noted May 8.

✦Valdosta, Ga.—The contract to furnish and erect a Corliss cross-compound condensing pumping engine, of 3,000,000 gal. capacity, and a semi-rotative triple expansion duplex pumping engine of 3,000,000 gal. capacity, has been awarded to the PLATT IRON WORKS, Dayton, Ohio, at $8241. Bids were opened Apr. 24. Noted Apr. 13.

Dunnellon, Fla.—According to press reports, bonds for $50,000 have been voted for purchasing and improving the water system, and other municipal improvements. H. N. Boswell is Mayor.

Passagrille, Fla.—It is proposed to install a well-water system here. For particulars, address the Mayor.

Roanoke, Ala.—Bonds for $20,000 have been voted here for improving and extending the water system and electric-light plant. W. H. Mann is Mayor.

Richton, Miss.—Tentative plans and estimates are being considered for the installation of a water system here.

Shreveport, La.—About $100,000 will be expended by the Shreveport Waterworks Co. in the extension of its system to Queensborough, a new residential section of Shreveport. J. H. Goss is Supt of the Water Co and John McCullough Supt. of Pub. Utilities.

Cleveland, Tenn.—It is proposed to install a municipal water system here, estimated to cost $75,000. C. E. Carter is City Recdr.

Corbin, Ky.—Bids will probably soon be asked for constructing a water system here, according to plans prepared by the Southern States Engineering Co., First National Bank Bldg., Chicago. Estimated cost, $30,000. T. F. Young is City Clk. Noted Apr. 24.

Providence, Ky.—Tyler Stone, Providence, has been granted a franchise to install a water system for the town.

★Akron, Ohio.—(Official)—Bids will be received by the Department of Public Service until noon, May 23, for furnishing and erecting the following pumping machinery: One vertical triple expansion pumping engine of 15,000,000 gal. daily capacity; two turbine-driven centrifugal pumping units, each of 15,000,000 gal. daily capacity. R. M. Fillmore is Dir.

✦Alliance, Ohio.—(Official)—A contract to construct a storage reservoir for the water system has been awarded to J. C. DEVINE, Alliance. Plans were prepared by Chester & Fleming, Consult. Engrs., Pittsburgh, Penn. Noted Dec. 12.

Cincinnati, Ohio.—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 19, for furnishing, delivering and laying pipe and special castings for the water system during the year 1913. M. J. Keefe is Clk.

Marblecliff, Ohio.—Bids will be received by C. Newhouse, Village Clk., until noon, May 17, for constructing a water system here to connect with the system of Grandview Heights. Plans and specifications may be obtained from Burgess & Long, Consult. Engrs., Columbus Savings & Trust Bldg., Columbus.

Piqua, Ohio.—The Water-Works Committee recently appointed by the City Council has submitted a report recommending that the water system be repaired immediately. The system was seriously impaired by the recent floods. Harry D. Hartley is Chn. of Com.

Bloomington, Ill.—(Official)—Bids will be received by the Board of Local Improvements until 2 p.m., May 22, for constructing water mains as follows: 7110 lin.ft. of 20-in. c.-i. water pipe. 816 lin.ft. of 16-in. c.-i. water pipe. 84 lin.ft. of 8-in. c.-i. water pipe. 253 lin.ft. of 6-in. c.-i. water pipe. 14 fire hydrants. 28 gate valves. Elmer Folsom is City Engr. Noted Jan. 30.

Cuba, Ill.—Bonds for $12,000 have been voted for the installation of a water system here.

✦Melrose Park, Ill.—The contract to construct an electric-driven pumping plant for the water system has been awarded to W. T. McCASKEY & CO., Lansing, Mich., at $12,999. Bids were opened by the Village Board, Apr. 21. Noted Apr. 17.

✦Appleton, Wis.—The contract to construct a pumping station for the water system here has been awarded to F. HOFFMAN & SON, Appleton, at $10,975. Noted May 8.

Dodgeville, Wis.—Bids will be received by B. Thomas, City Clk., for laying water mains. John I. Hahn is Chn. Com. on W.-Wks.

★Neligh, Neb.—(Official)—Bids are being received by the City Council for the installation of a 700,000-gal. duplex pump, driven by an electric motor, and a standpipe, for the water system.

✦Ralston, Neb.—(Official)—Contracts for improving the water system here have been awarded as follows: Pump, pumphouse and motor, to the ALAMO SUPPLY CO., Omaha. Steel standpipe, to DRAKE, WILLIAMS & MANET, Omaha. Noted Apr. 17.

Lander, Wyo.—Press reports state that the Louis Lake Conservation Co., New York Life Bldg., Kansas City, Mo., is interested in the establishment of an irrigation system near Lander. Preliminary plans are being prepared by Barnett & Sturgis, Consult. Engrs., Kansas City Life Bldg., Kansas City. It is proposed to irrigate about 40,000 acres of land, and the work will include the construction of about ten miles of wooden pipe line, and two dams, one across Louis Lake, and the other across Popo Aquie River.

St. Louis, Mo.—(Official)—Bids will be received by the Board of Public Improvements until noon May 16, for Letting No. 896, furnishing all tools, materials and labor for the construction and completion of the Chain of Rocks filter equipment, in accordance with plans and specifications, approved by the Board of Public Improvements, and now on file in the office of the board. Edward E. Wall is Water Comr.

Clarendon, Ark.—Bonds for $60,000 have been voted for improving the water and sewer systems here. John W. Hooper is Town Clk.

Alpine, Tex.—J. F. Miles will construct a system of irrigation to water a tract of land near here.

Angleton, Tex.—The city is considering the installation of water and sewer systems. Guy Hoffman is City Clk.

El Paso, Tex.—Preliminary plans have been completed for the construction of a pumping plant to furnish water to the Alexander Addition and Highland Park, and for the construction of about 17,500 ft. of 16-in. water main from the Mesa pumping plant to the city limits. Estimated cost, $40,000. Herbert Nunn is City Engr.

Pecos, Tex.—The Pecos Irrigation Co. will construct a system of irrigation near here. W. M. Huggins, W. W. Wilson and J. D. Robinson are interested.

Hinton, Okla.—(Official)—Bids will be received by the town until 8 p.m., May 19, for constructing a water system and electric-light plant. Plans and specifications may be obtained from the Benham Engineering Co., American National Bank Bldg., Oklahoma City. Noted Feb. 27.

Lawton, Okla.—According to press reports, bids are being received by the city for constructing about three miles of 10-in. pipe line to connect Fort Sill with the city pipe line.

Ogden, Utah—(Official)—The plans prepared by the Ogden River Reservoir Co. will be used in building the proposed dam in South Fork Canyon, which is estimated to cost $350,000. The dam will be from 80 to 90 ft. high, and will impound 10,000 acre-feet of water. A. G. Fell is Mayor. Noted Apr. 10.

Puyallup, Wash.—A proposition to issue bonds for $100,000 to be used in constructing an 18-in. iron water main to replace wooden mains will soon be submitted for vote.

Amity, Ore.—(Official) Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland, Ore., has been engaged by the city to design and supervise the construction of a deep-well pumping plant and water system, for which it is proposed to issue bonds.

Arlington, Ore.—At a recent election, bonds were voted for the construction of a water system. Plans for the improvement were prepared by Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland, Ore. Noted Mar. 13.

Oxnard, Calif.—Bids will be received by the Board of Trustees until 8 p.m., May 27, for the construction of a municipal water system in accordance with plans prepared by Olmsted & Gillenen, Consult. Engrs., Wright & Callender Bldg., Los Angeles, Calif. The work will include laying 30,000 ft. of Class A 5-in. c.-i. pipe, 4600 ft. of 6-in. pipe, 9000 ft. of 8-in. pipe, 540 ft. of 12-in. pipe, 2000 ft. of 14-in. pipe, 40 double-nozzle fire hydrants, pipe fittings, two wells, hollow tile pump house, 150-gal. steel tank, 850-gal. reinforced concrete reservoir, two engines and pumps.

Pasadena, Calif.—Burdett Moore, of the city water department, recommends the construction of a high pressure system for the business district and west end. A 24-in. pipe line will be laid on Colorado St., from Pasadena to Marengo Ave., to be fed by mains from the Mountain at reservoir. The cost will be $20,000.

San Diego, Calif.—It is proposed to install a pumping outfit at the Chollas Reservoir, estimated to cost $8000.

San Francisco, Calif.—The City Engineer has advised the Board of Supervisors that steps should be taken at once to arrange with the Spring Valley Water Co. to install meters in order to conserve the water suply. About 50,000 additional meters would be needed.

The Pas, Man.—Bids will be received by H. H. Elliott, Secy.-Treas., until 6 p.m., May 20, for supplying and delivering approximately 4400 ft. of 12-in., 3500 ft. of 10-in., 4400 ft. of 8-in., and 2000 ft. of 6-in., steel or c.-i. pipe, 50 specials, 30 hydrants, 52 gate valves and boxes, and two pneumatic storage tanks. Murphy & Underwood, Saskatoon, Sask., are Consult. Engrs.

✚Dundas, Ont.—The contract to la. pipe for the new water system here has been awarded to J. W. DICKSON, Dundas, at approximately $11,000.

Port Arthur, Ont.—Bids will be received by J. J. Hackney, Corporation Offices, until 5 p.m., May 19, for furnishing three motor driven centrifugal pumps, meters, and all other apparatus.

St. Thomas, Ont.—Bids will be received by the Board of Water Commissioners until May 15, for laying about 16,000 ft. of water mains. George K. Crocker is Chn. Noted Apr. 24.

Regina, Sask.—Bids will be received by the City Commissioners until May 15, for furnishing one pair of vertical feed pumps, capacity 7500 gal. per hour, one combined open heater and meter, 125,000 lb. feed water per hour. E. W. Bull, is Supt.

SEWERS

Boston, Mass—Bids for constructing sewers in Tesla, Burmah, and other streets were received, May 2, as follows: J. H. Ferguson, $7341; George J. Regan, $7533; Antony Cefalo, $7546. Noted May 1.

Pittsfield, Mass.—The Board of Aldermen has adopted an order appropriating $18,500 for extending and improving the sewer system.

Reading, Mass.—The Sewer Commissioners elected here last year have been commissioned by the Town Council to report on the proposition to install a sewer system here. John Connelly, of the Finance Commission, is interested.

Worcester, Mass.—The City Council has ordered the construction of sewers, estimated to cost $25,000. F. H. McClure is City Engr. Noted May 8.

Central Falls, R. I.—The city has voted to install a sewage disposal plant estimated to cost $28,000. Plans were prepared by O. Perry Sarle, Consult. Engr., Providence. Noted Oct. 26.

Cheshire, Conn.—Bids were received at the office of A. B. Hill, Engr., 160 Crown St., New Haven, Conn., May 6, for the construction of a sewage disposal plant at the State Reformatory. The work comprises stripping, 8000 yd.; levelling, 900 cu.yd.; reloaming, 2700 cu.yd.; 1100 ft. 8-in. sewer, 400 ft. 8-in. distributing sewer, 300 ft. 6-in. distributing sewer, 2700 ft. 4-in. distributors, 1200 ft. 6-in. collecting sewer, 2200 ft. 5-in. collecting sewer, 11,000 bd ft. creosoted plank, set tanks and receptacles, distributing manholes, cutoff and headwalls. The bids were as follows: E. E. & W. H. O'Neil Hartford Conn., $26,309; William Horne Engineering & Construction Co., Hartford, Conn., $21,390; Berardina Silvestri & Co., Hartford, Conn., $20,193; Sperry Engineering Co., 82 Church St., New Haven, Conn., $19,849; Petrossi Bros., 39 Woodbridge St., Hartford, Conn., $18,915; Petrossi Co., Inc., 284 Asylum St., Hartford, Conn., $19,477; Delia Sozio, New Britain, Conn., $16,926; F. N. Lewis, 411 Manhattan Ave., New York, $16,380; H. E. Hall & Co., 18 Asylum St., Hartford, Conn., $16,071; Henry Spinach, Waterbury, Conn., $15,415; Thomas Leonard & Co., 504 Barrett St., New Britain, Conn., $12,228. Noted May 1.

Albany, N. Y.—Bids for constructing sewers in South Hawk and Chestnut Sts. have been received by the Board of Contract and Supply, as follows: John Degle, Albany, $8728; Kennedy Construction Co., Albany, $8534; J. S. Camplon, Albany, $8513. No awards have been made. Isidore Wachsman Secy. of Bd.

Brooklyn, N. Y.—Bids will be received until 11 a.m., May 21, by the President of the Borough of Brooklyn, Borough Hall, for constructing a sewer in Livonia Ave., between Ames St. and Douglass St.; an outlet sewer in Douglass St., between Livonia Ave. and E. 98th St., and a tributary sewer in Douglass St., between Dumont Ave. and Livonia Ave.; for constructing a sewer in Eighth Ave., from 62d St. to 66th St., and from 67th St. to Bay Ridge Ave., and a sewer basin on Eighth Ave., at the west corner of 61st St., and an outlet sewer in 68th St., from Eighth Ave. to Sixth Ave.; for constructing a sewer in Hopkinson Ave., from Riverdale Ave. to Lott Ave., and from Vienna Ave. to the sewer summit between Vienna Ave. and E. 98th St.; for constructing a sewer in 35th St., from 14th Ave. to West St., and outlet sewer in West St., from 35th St. to Avenue C; for constructing a sewer in Barrett St., from Sutter Ave. to Blake Ave.; for constructing a sewer in Montgomery St., between Coney Island Ave. and E. 8th St.; for constructing a sewer in Avenue F, between Gravesend Ave. and West St.; for constructing a sewer basin at the southeast corner of Newkirk Ave. and East 21st St. Alfred E. Steers is Pres.

Buffalo, N. Y.—The City Council has ordered the construction of a 5 ft. 6 in. by 9 ft. brick and stone sewer in Texas St., and 10-in. tile sewers in both sides of Havens St. and the north side of Genesee St.

Greece, N. Y.—Bids will be received by the Commissioners of Sewer District No. 2, until 3 p.m., May 16, for constructing sewers. Thomas Eddy is Secy.

New York, N. Y.—(Borough of Queens)—Bids will be received until 11 a.m., May 21, by the President of the Borough of Queens, Borough Hall, Jackson Ave. and Fifth St., Long Island City, L. I., for the construction of a sanitary sewer and appurtenances in Redfern Avenue, from McNeil Avenue to Leland Place, and a temporary sanitary sewer in Leland Place, from Redfern Avenue to the sewage purification plant, 5th Ward. Maurice E. Connolly is Pres.

★✚Oneonta, N. Y.—(Official)—The contract to construct a main line intercepting sewer from Rose Ave. to Lyman Ave., has been awarded to the INGALLS STONE CO., Oneonta, at $10,163. Bids were opened by Sheldon H. Close, City Clk., May 7. Noted Apr. 3.

★✚Oswego, N. Y.—(Official)—Contracts for constructing sewers here have been awarded by John Smith, Comr. Pub. Wks., as follows: Contract A, West Oswego sanitary trunk sewer, to R. M. BARNETT, Oswego, at $40,541; Contract B, lateral storm and sanitary sewer, West Seneca St., to SAMUEL BOND, Syracuse, at $6825; Contract C, West Bridge St. storm sewer, to R. M. BARNETT, Oswego, at $14,047; Contract D, West Oswego disposal plant, to GAIL & WILSON, Buffalo, N. Y., at $28,567. The lowest bid received on Contract E, East Oswego Creek storm sewer, was submitted by Leary & Morrison, Fairport, N. Y., at $80,343. Bids were opened May 2. Noted Apr. 13.

★Oswego, N. Y.—(Official)—Bids will be received by the Department of Works until 2 p.m., June 4, for contracts E, F, G and H of the proposed sewer system. The work to be done consists of the construction of approximately 9700 ft. of sanitary sewer, from 8 to 36 in. in diameter, and 5865 ft. of vitrified tile and reinforced-concrete storm sewer made in complete sections from 15 to 72 in. in diameter. The work will be done under two contracts. John Smith is Comr. of Works, and Charles H. Snyder, City Engr.

Poughkeepsie, N. Y.—The Board of Public Works has approved plans prepared by Robert J. Harding, Engr., for the construction of a system of intercepting sewers and a sewage disposal plant. It is probable that the disposal plant will not be installed at present.

Yonkers, N. Y.—Bids for constructing a sewer in Yonkers Ave. from Wilbur St. to Kimball Ave., and east to the Bronx River, were received by the Board of Contract and Supply, May 5, as follows: J. B. Pennell, $226,000; O'Rourke Contracting Co., $245,850; Nicola Mangini, $248,000. J. V. Mahoney is Secy. of Bd.

Watertown, N. Y.—Bids will be received at the office of E. W. Sayles, City Engr., until 8 p.m., May 16, for constructing sewers. Plans and specifications are on file at the office of the City Engineer.

★✚Audubon, N. J.—The contract to construct a sewage disposal plant and sewer system here has been awarded by the Borough Council to the CANTRELL CONSTRUCTION CO., Philadelphia, Penn., at $79,250. Bids were opened Apr. 21. Noted May 8.

New Brunswick, N. J.—The Common Council has passed an ordinance to bond the city for $24,000 for the construction of storm sewers.

Etna, Penn.—(Official)—Bids will be received by J. C. Armstrong, Boro. Clk., until 5 p.m., May 19, for constructing sanitary sewers in Greismer and Prospect Sts.

Hamburg, Penn. See item under Water Supply—Irrigation.

★Reading, Penn.—(Official)—Bids will be received by L. S. Ramsey, City Clk., until 2 p.m., June 4, for constructing two concrete storm sewers. Blank forms, bonds and specifications may be obtained from Edmund B. Ulrich, City Engr.

According to press reports, the lowest bid received Apr. 22 for constructing the West Elm St. sewer was submitted by Fehr & O'Rourke, Reading, at $62,000. The bid was rejected. Noted Apr. 8.

Washington, D. C.—Bids were received as follows, May 7, by the Commissioners of the District of Columbia for sewers in the District: (a) Whiting-Turner Construction Co., Baltimore, Md.; (b) Warren F. Brenizer Co., Washington, D. C.; (c) George Hyman, Washington, D. C.; (d) R. J. Malone, Washington, D. C.; (e) E. G. Cummel, Washington, D. C.; Maryland Ave. trunk sewer, Fifteenth St. to Seventh St., Sections 1 and 2: Ordinary excavation, (a) $1.70; (b) 67c.; (c) 64c.; (d) $1; (e) 82c.; concrete masonry "B": (a) $7.90; (b) $6.75; (c) $7; (d) $8.30; (e) $5.66; vitrified brick masonry: (a) $22; (b) $21; (c) $19; (d) $21; (e) $22. sewer brick masonry (a) $15; (b) $14; (c) 12; (d) $15; (e) $14; Piney Branch Sewer, 14th St. to Decatur St., Sections 5 and 6: Ordinary excavation: (a) 62½c.; (b) 10c.; (c) 30c.; (d) 90c.;

(d) $96 (e) $8. vitrified brick masonry: (a) $22; (b) $21; (c) $20; (d) $22; (e) $22; sewer brick masonry: (a) $15; (b) $14; (c) $14; (d) $16; (e) $14; substructure for popular point sub-station; ordinary excavation; (a) $1.58; (b) $2.50; (c) $1.50; concrete masonry "F": (a) $7.00; (b) $8.50; (c) $7.25; (e) 30c.; concrete masonry "F": (a) $9; (b) $7; (c) $6.65;

Appalachia, Va.—Bonds for $21,000 were voted, May 1, for the construction of a sewer system here. E. A. Collins is City Recdr. Noted Nov. 21.

Huntington, W. Va.—Plans and specifications have been approved by the City Commissioners for the construction of sewers in various streets. The Chamber of Commerce has recommended a bond issue of $200,000 for sewer construction and paving, and an election will be called about June 1, to vote on the proposition.

✦**Atlanta, Ga.**—Contracts for constructing sewers have been awarded by the Sewer Committee, as follows: Group 1 and Group 4, to F. D. HARVEY & CO., Memphis, Tenn., at $14,454 and $9717, respectively; Group 2, 3, and 5, to the DYSARD CONSTRUCTION CO., Atlanta, at $16,267, $14,666 and $8667, respectively. Bids were opened Apr. 15. Noted May 1.

✦**Orlando, Fla.**—(Official—Contracts to construct a sewer system and a sewage disposal plant here, have been awarded by the Sewerage Committee, as follows: Sewers, to F. D. HARVEY & CO., Memphis, Tenn.; septic tanks, to HAMILTON JOHNSON, Jackson, Mich.; wells, to the OHIO WELL DRILLING CO., Jacksonville, Fla., at $3500. Bids were opened May 1. George W. Fuller, New York, is Consult. Engr. Noted Apr. 17.

★**Birmingham, Ala.**—(Official)—Bids will be received by Walter G. Kirkpatrick, City Engr., until June 3, for constructing an extension of the South Side trunk sewer, with laterals. Estimated cost, $160,000. The contract includes the following: 4000 ft. 8x12 concrete sewer; 6000 ft. 8 to 5 brick sewer; 10,000 ft. pipe laterals. Noted Apr. 13.

★**Laurel, Miss.**—(Official)—Bids will be received by D. A. Scarborough, City Clk., until 2:30 p.m., June 5, for the construction of sanitary sewers as follows: 36 ft. 16-in. c.-i. pipe, 36 ft. 12-in. c.-i. pipe, 36 ft. 10-in. c.-i. pipe, 144 ft. 8-in. c.-i. pipe, 1227 ft. 15-in. vitrified sewer pipe, 2395 ft. 12 in. vitrified sewer pipe, 6270 ft. 10-in. vitrified sewer pipe, 18,514 ft. 8-in. vitrified sewer pipe, 54 manholes, 14 flush tanks, 7 drop manholes. Plans and specifications are on file at the office of the City Clerk. Noted Jan. 2.

Louisville, Ky.—The lowest bid received by the Board of Public Works, May 2, for constructing sewers, was submitted by L. R. Figg & Co., Louisville, at $41,000. Noted Apr. 24.

David R. Lyman, City Engr., is preparing plans for the construction of a sewer in Shelby St. Vitrified pipe will be used.

Marysville, Ohio—(Official)—Bids will be received by W. F. Brodrick, Village Clk., until noon, May 20, for constructing a sanitary sewer system, according to plans and specifications on file at the office of the City Engineer.

Toledo, Ohio—(Official)—R. Winthrop Pratt, Consult. Engr. Hippodrome Bldg., Cleveland, Ohio, has been appointed by John R. Cowell, Dir. Pub. Ser. of Toledo, in connection with the preparation of general plans for an intercepting sewer system and sewage treatment works.

Boonville, Ind.—(Official)—Bids will be received by William A. Schafer, City Clk., until 7:30 p.m., May 20, for the construction of the North Side main sewer system. Estimated cost, $83,033. The sewers will range from 15 in. to 7 ft., all sewers under 3 ft. to be vitrified pipe, and all sewers 3 ft. and larger to be of brick, concrete or segmental blocks. Plans and specifications are on file at the office of Louis Meyer, City Engr. Noted Apr. 24.

Ann Arbor, Mich.—Bids will be received by Ross Granger, City Clk., until May 21, for constructing one mile of 8-in. vitrified pipe sanitary sewer.

Hillsboro, Ill.—Bids will be received by the Board of Local Improvements until 7:30 p.m., May 16, for constructing a sewer system in Sewer District No. 1. The contract includes about 20,000 lin.ft. of 8- to 36-in. pipe. Henry C. Latham is Chn. of Bd.

✦**Pontiac, Ill.**—A contract to construct a sewer in Driving Park has been awarded by the Board of Local Improvements to JOHN CHERRY, Jacksonville, at $28,757.

✦**Chippewa Falls, Wis.**—A contract to construct sewers in Jefferson Ave., Main, Superior and Columbia Sts., has been awarded to the PASTORET-LAWRENCE CO., Duluth, Minn., at approximately $6600.

Belmond, Iowa—Bids will be received by G. J. Byers, Town Clk., until May 20, for constructing about 14,000 ft. of 6- and 8-in. vitrified sewers, 33 manholes and 12 flush tanks.

Davenport, Iowa—The lowest bid received by the Board of Public Works, May 3, for constructing a sanitary sewer system in the 13th Ward, was submitted by the Dan E. Keeler Construction Co., Davenport, at $64,000. Noted Apr. 24.

St. Louis, Mo.—(Official)—Bids will be received by the Board of Public Improvements until noon, May 28, for letting No. 10,897, for the construction of sewers in Rock Creek Sewer District No. 2, as authorized by Ordinance No. 26,791, embracing sewers of the materials, lengths and sizes as follows, to wit: Brick and portland cement mortar sewers: 1397 ft. of 7-ft., 679 ft. of 6½-ft., 273 ft. of 5¾-ft., 440 ft. of 5-ft., 528 ft. of 4¼-ft., 822 ft. of 3¾ ft., 402 ft. of 36x54-in., 315 ft. of 34x51-in., 736 ft. of 30x45-in., 82 ft. of 28x42-in., 315 ft. of 26x39-in.; vitrified clay pipe sewers: 701 ft. of 30-in., 2950 ft. of 27-in., 1765 ft. of 24-in., 4255 ft. of 21-in., 3410 ft. of 18-in., 7400 ft. of 15-in., 26,550 ft. of 12-in. William T. Findly is Secy.

✦**Springfield, Mo.**—The contract to construct two sewers in the First Ward has been awarded by the City Council to the PLUMMER-ADAMS CO., Springfield, at approximately $23,500. Bids were opened Apr. 25. Noted Apr. 24.

Clarendon, Ark.—See item under Water Supply—Irrigation.

Angleton, Tex.—See item under Water Supply—Irrigation.

✦**Vinita, Okla.**—The contract to construct 7700 lin.ft. of 15-in. vitrified sewer and a reinforced concrete disposal tank has been awarded to S. W. WEATHERS, Muskogee, Okla., at $12,210. Bids were opened Apr. 21. Noted Apr. 17.

Denver, Colo.—The Board of Public Works has ordered the construction of storm sewers in North Denver, estimated to cost $125,000. A. L. Fellows is City Engr.

Grand Junction, Colo.—The present sewer system here has proved inadequate, and it is proposed to install a new system, estimated to cost $75,000.

Arlington, Wash.—J. W. Morris, Consult. Engr., Yeon Bldg., Portland, has prepared plans for a sewer system to be constructed here.

Bellingham, Wash.—A resolution has been adopted by the City Council for a storm and sanitary sewer system, draining York Addition. An estimate of cost of improvement has not yet been made.

Cathlamet, Wash.—The City Council has directed the City Attorney to prepare resolutions and ordinances for the construction of sewers in Columbia, Second and Sprin; Sts.

Colfax, Wash.—At a recent election, approximately $15,000 $15,000 of bonds were voted for the construction of a sewer system, sewage disposal site and sewage disposal plant. It is reported that construction work will be ordered shortly.

Los Angeles, Calif.—Bids will be received by the Board of Public Works until 11 a.m., May 19, for constructing section 3 of the San Pedro storm sewer system, comprising 4-ft. 9-in. concrete sewer, 4-ft. 6-in., 3-ft. 9-in., 4-ft. reinforced-concrete pipe sewers, together with vitrified sewers, manholes, and other appurtenances.

San Bernardino, Calif.—The City Council will soon ask bids for the construction of the northwest sewer system. Estimated cost, $30,000.

San Diego, Calif.—(Official)—Bids will be received by the city until June 15, for constructing two septic tanks for the sewer system. William O. Sanford is City Engr.

★**Toronto, Ont.**—(Official—Bids will be received by H. C. Hocken, Mayor and Chn. Bd. of Control, until noon, May 27, for the construction of the East Toronto and Midway outlet, Sections 1 and 2, West Toronto outlet, Division 2, Keele St.

GARBAGE

New York, N. Y.—(Official)—Bids will be received until 11 a.m., May 21, by the President of the Borough of Queens, Borough Hall, Fifth St. and Jackson Ave., Long Island City, L. I., for the final disposition of garbage in the Fifth Ward of the Borough of Queens, during the months of June, July, August and September, 1913, and furnishing and operating the necessary dumps, scows, tugs, tools and appliances. Maurice Connolly is Pres.

✦**Shenandoah, Penn.**—The City Council has awarded the contract to WILLIAM H. FENSTERMACHER, Bethlehem, Penn., for the removal of garbage for a term of five years, at $5790.

STREETS AND ROADS

✦**Boston, Mass.**—The Department of Public Works has awarded contracts for bituminous macadam roadways in Tyndale and Walworth Sts., West Roxbury, to HUGH J. McGUIRE, at $10,703 and $6444, respectively. Other bidders were: West Roxbury Trap Rock Co., $10,936 and $6460; William J. Rafferty Co., $11,232 and $6531; Thomas F. Minton, $11,517 and $6736; J. H. Ferguson, $12,311 and $7177; John McCourt & Co., $12,694 and $7421. J. K. Rourke is Comr.

✦**Boston, Mass.**—The contract for repairing West First St., South Boston, from A St. to the railroad crossing, was awarded to JOHN E. QUINN at $5194. Other bids were: Northern Construction Co., $4433; Connolly & Diamond, $5451; Hugh J. McGuire, $5643; Boston Paving Co., $5893. L. K. Rourke is Comr. of Pub. Wks.

Bids will be received until May 19, for bituminous and asphaltic macadam roadways and stone sidewalks on Mills Ave. and Whitfield St., Dorchester District, in Priesing St., Roxbury District, and in Sleeper St., South Boston.

Bids will be received until May 20, by the State Highway Commission, Ashburton Place, for the construction of a section of highway in Wenham; also for 5300 lin.ft. in Wrentham, and for 1300 lin.ft. in Wilbraham. Chas. H. McQueeny is Chn. of Wenham Selectmen. Arthur W. Dean is Ch. Engr. of Highway Com.

Providence, R. I.—Bids will be received by the State Board of Public Roads until noon, May 16, for the construction of state highways as follows: 6461 ft. in Town of Tiverton, 4346 ft. in Town of Warren, 2300 ft. in Town of Bristol, and for resurfacing with asphaltic oil the following: 30,000 ft. in Town of Warwick, South Kingston 25,000 ft., East Providence, 5000 ft., Tiverton 7000 ft., Portsmouth and Middletown, 11,000 ft. John H. Edwards is Chn. of State Highway Bd.

✦**Hartford, Conn.**—The contract for the construction of 5177 lin.ft. of native macadam road on the Norwich and Westerly Turnpike in the town of Preston has been awarded by the State Highway Commission to CHARLES W. TRYON, Meriden, Conn., at $3.10 per lin.ft. for macadam, $4.15 for telford, 80c. per sq.yd. for cobble gutters, $1.35 per lin.ft. 4-in. rubble drain, $8 per cu.yd. for concrete walls, $6.50 for masonry walls, $5 for dry rubble walls. Chas. J. Bennett is Comr. Noted May 1.

Hartford, Conn.—Bids were received by the Board of Contract and Supply, May 6, for the following paving work: 1850 sq.yd. of granite blocks on concrete base on Spruce St., J. Harry Lloyd, Hartford, $2.75 per sq.yd.; Edward Balf Co., Hartford, $2.68; F. B. & W. H. O'Neil, Hartford, $2.48. 9300 sq.yd. of asphalt surface and concrete base on Front and Pleasant Sts.: Warren Bros. Co., Boston, Mass., $1.50 per sq.yd.; Union Paving Co., $1.14; Edward Balf Co., Hartford, $1.27. Relaying 14,100 sq.yd. of asphalt surface on Main St. and Farmington Ave.; Warren Bros. Co., $1.50 per sq.yd.; Union Paving Co., $1.24; Edward Balf Co., $1.39. Roscoe N. Clark is City Engr. Noted May 1.

†Waterbury, Conn.—(Official)—The Board of Public Works has awarded a contract to JOSEPH S. BARBARA, 90 Franklin St., Waterbury, at $21,000 for paving sections of various streets. R. A. Cairns is City Engr. Noted Apr. 24.

Albany, N. Y.—The Board of Contract and Supply received the following bids for improving streets: Repairing Sheridan Ave. from North Pearl to Lark St., B. F. Mulderry, Albany, $33,732. P. W. Mulderry, Albany, $32,602. M. F. Dollard, Albany, $28,954. Improving Spruce St. from Eagle St., westerly, P. W. Mulderry, Albany, $8021, Kennedy Construction Co., Albany, $8482; M. F. Dollard, Albany, $9701, B. F. Mulderry, Albany, $8544. No awards have been made. Isadore Wachsman is Secy. of the Bd.

Brooklyn, N. Y.—Bids will be received until 11 a.m., May 21, by the President of the Borough of Brooklyn, Borough Hall, for paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of Beverly Road, from Nostrand Ave. to Rogers Ave.; for paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of East 13th St., from Avenue J to Avenue K; for grading, curbing and laying sidewalks on East 18th St., from Avenue N to Avenue O; for curbing and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of East 21st St., from Beverly Road to Avenue C; for repaving with asphalt on a 5-in. concrete foundation the roadway of Gates Ave., from Myrtle Ave. to Wyckoff Ave.; for paving with a preliminary pavement of second-hand granite on a sand foundation the roadway of Hendrix St., from New Lots Ave. to Vienna Ave.; for paving with permanent asphalt pavement on a 6-in. concrete foundation the roadway of Jerome St., from Glenmore Ave. to Pitkin Ave.; for paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of Prospect St., from Erasmus St. to Beverly Road; for grading, curbing and laying sidewalks on Carroll St., from Kingston Ave. to Albany Ave.; for grading, curbing and laying sidewalks on Avenue I, from Flatbush Ave. to East 34th St., and from East 35th St. to Brooklyn Ave.; for grading, curbing and laying sidewalks on Lincoln Road, from Nostrand Ave. to a point about 500 ft. easterly, and on East New York Ave., from a point about 500 ft. east of Nostrand Ave. to Utica Ave.; for grading, curbing and laying sidewalks on 57th St., from New Utrecht Ave. to 14th Ave. Alfred E. Steers is Pres.

Brooklyn, N. Y.—(Official)—The following are the low bids received, May 7, by the President of the Borough of Brooklyn, for paving in various streets: 79th St., from 12th Ave. to 13th Ave., with iron slag, MacFarland Contracting Co., $8558; 79th St., from 11th Ave. to 12th Ave., with asphalt, Uvalde Contracting Co., $6858; regulating, paving and curbing West St., from Church Ave. to Fort Hamilton Ave., National Fireproofing Co., $5297; Montgomery St., from Washington Ave. to Franklin Ave., with iron slag, MacFarland Contracting Co., $7712; Avenue I, from Coney Island Ave. to East 15th St., with asphalt, Cranford Co., $9453; grading, paving and sidewalking Howard Ave., from East New York Ave. to Blake Ave., McAuliffe & Crowley, $8876; paving and sidewalking Gardner Ave., from Randolph St. to Grand St., Hugh L. Blake, $8136; Church Ave., from Ocean Parkway to Gravesend Ave., with asphalt, Brooklyn Alcatraz Asphalt Co., $13,173. Alfred E. Steers is Pres.

†Buffalo, N. Y.—The City Council has authorized the Commissioner of Public Works to award the following paving contracts: GERMAN ROCK ASPHALT & CEMENT CO., at $13,530 and $15,480, respectively, for Cumberland Ave. and Triangle St.; to LOUIS H. GRIPP, at $6853, for repaving Mortimer St. with brick; to the HENRY P. BURGARD CO., at $16,-121 for asphalt paving on St. Louis Ave.

The Council has directed that bids be asked for brick paving on Unger and Hamburg Sts., Knoerl and Roma Aves. Francis G. Ward is Comr. of Pub. Wks.

★Canastota, N. Y.—(Official)—Bids will be received until May 17 by the Board of Village Trustees for one mile of vitrified brick pavement with concrete curb and gutter. E. B. Roberts is Village Clk.

†Elmira, N. Y.—The Board of Public Works has awarded the following contracts for paving with brick to A. D. OSBORNE, Binghamton, N. Y.: Baldwin St., $10,169; Walnut St., $13,194; Lake and La Grange Sts., $5558; East Main St., $2258. E. St. Fifth St., $6013. T. A. Brown is City Engr.

†New York, N. Y.—[illegible] Borough of Richmond—(Official)—The President of the Borough of Richmond, Borough Hall, St. George, S. I., has awarded a contract to the UNITED STATES [illegible] for repaving with asphalt, regulating and repaving, with wood block, the roadway of Jersey St., from Fifth St. to Castleton Ave. Bids were received May 6. George Cromwell is Pres.

New York, N. Y.—Bids will be received until 2 p.m., May [illegible] for paving the following streets: 43rd St., from Sixth Ave. to [illegible]; 50th St., from Fifth Ave. to Third Ave., with asphalt; 60th St., from First Ave. 200 ft. [illegible] with asphalt; [illegible] with granite; Barrow St., from Hudson St. to Washington St., with granite; 64th St., from First Ave. to Second Ave., with granite; [illegible]

[illegible] May 21, by the President of the Borough of Queens, Long Island City, L. I., for regulating the sidewalk spaces and laying sidewalks (where not already laid) to grade and in good condition on the west side of [illegible]

[illegible] Ave. to Kelly Ave., in Ward, for regulating, grading, curbing and laying sidewalks and crosswalks, in Harold Ave., from Thurston Ave. to Skillman Ave., 1st Ward; for paving with asphalt blocks on a concrete foundation, in Wilson Ave., from Steinway Ave. to Jackson Ave., 1st Ward; for paving with asphalt blocks on a concrete foundation, in Wilson Ave., from Steinway Ave. to 15th Ave., 1st Ward; for paving with asphalt blocks on a concrete foundation, in Wilbur Ave., from William St. to Academy St., 1st Ward; for regulating and repaving with wood blocks or iron slag blocks on a concrete foundation, in Jackson Ave., from Woodside Ave. to Trains Meadow Road 2d Ward. Maurice E. Connolly is Pres.

New York, N. Y.—(Borough of Richmond)—Bids will be received until noon, May 20, by the President of the Borough of Richmond, Borough Hall, St. George, S. I., for repaving with old asphalt blocks on a new mortar bed and on a new concrete foundation where designated, the roadway of Central Ave., from Stuyvesant Place to Weiner Place; regulating and repaving with vitrified brick pavement on a concrete foundation the roadway of Jewett Ave., from the Boulevard to Richmond Turnpike; for repaving with napped granite blocks on concrete foundation the roadway of Richmond Terrace, from Bodine St. to the Staten Island Rapid Transit Railroad crossing, the area between the outer rails of car tracks on Richmond Terrace, from John St. to Van St., Pine between the rails of trolley tracks on Broad St., from Gordon St. to Van Duzer St. George Cromwell is Pres.

†Rochester, N. Y.—The Board of Contract and Supply has awarded a contract to the ROCHESTER VULCANITE PAVING CO., at $50,388, for bitulithic pavement on Lake Ave., from Lyell to Driving Park Aves. Edwin E. Fisher is City Engr.

Schenectady, N. Y.—The Board of Contract and Supply will soon ask bids for asphalt paving on parts of various streets, a total of about 100,000 sq.yd. The estimated cost is $150,000. Chas. A. Mullen is Comr. of Public Wks. Fred E. Johnson is Secy.

Sidney, N. Y.—(Official)—The Village Council will soon ask bids for paving Bridge St. for a distance of 1200 cu.ft. with brick, concrete curb and gutter. A. E. Corey is Pres. of Village Bd. E. F. Munson, 12 Sheldon St., Norwich, N. Y., is Engr.-in-Charge.

Waverly, N. Y.—Bids will be received until May 21, by the Village Council, for paving Broad St., north of Park Ave. to Park Place. Specifications call for a 5-in. concrete base with a 1-in. asphalt dressing.

Hackensack, N. J.—(Official)—Bids will be received until 2 p.m., May 16, by the Board of Chosen Freeholders of Bergen County for the improvement of the First Section of the Fort Lee Turnpike with asphalt macadam and block pavement. M. J. Ford is Chn. of Rd. Com.

†Hillsdale, N. J.—(Official)—The Township Committee has awarded the contract for grading and macadamizing 2166 ft. of the Woodcliff Heights Road to JOHN C. HALL, Haworth, N. J. H. G. Hering, Jr., is Township Engr. Noted Apr. 24.

Hoboken, N. J.—Bids will be received until 4 p.m., May 28, by the Mayor and City Council for repaving and otherwise improving Ferry St. from Hudson to Jefferson Sts. James H. Londrigan is City Clk.

★Merchantville, N. J.—(Official)—Bids will be received until 8 p.m. May 20, by the Borough Council for laying concrete gutters and macadamizing various streets. Sarton & Remington, 601 Market St., Camden, N. J., are Engrs.-in-Charge. W. F. McAllister is Boro. Clk.

Metuchen, N. J.—The Borough Council will receive bids until 8 p.m., May 19, for 3538 sq.yd. of 6-in. macadam pavement on Highland Ave. and Robbins Place. Plans at the office of Howard S. Wilson, Borough Clk., or Charles B. Carman, Engr.

Perth Amboy, N. J.—The Board of Aldermen has issued notices of its intention to pave Brighton Ave., First St. and Lewis St., with amiesite surface. George M. Adair is Supt. of Paving.

†Plainfield, N. J.—The Street Commission has awarded the contract for about 28,000 sq.yd. of waterbound macadam paving and 6000 cu.yd. excavation to BURKE & BONHAM, Plainfield, at $22,514. Other bidders were: Mabris Bros., Plainfield, $25,207; Humphrey & Bentley, Hackensack, N. J., $24,-906. Noted May 1.

†Trenton, N. J.—The City Commissioners have awarded a contract for paving West State St., from Willow to Calhoun Sts., with Saxon block to the GINDER CONSTRUCTION CO., at $1.58 per sq.yd., or a total of $7347. Frank Thompson is City Clk.

†(Official)—The City Commissioners have awarded contracts for paving Bellevue Ave. and Montgomery St. to RUSSELL KLOCKNER at $5887 and $4790 respectively. Frank Thompson is City Clk. Noted Apr. 17.

†Westfield, N. J.—(Official)—The Town Council has awarded a contract to HUMPHREY & BENTLEY, Hackensack, N. J., at $4838 for various street improvements. Other bidders were: Weldon Contracting Co., Rahway, N. J., $4992. Liddle & Pfeiffer, Perth Amboy, N. J., $5291. Schneider & Steele, New Brunswick, N. J., $5692. Burke & Bonham, Plainfield, N. J., $6112. A. W. Vars is City Engr. Noted May 1.

West New York, N. J.—Bids will be received until 8 p.m., May 20 by the Town Council for the improvement of Hudson Ave. from 22nd St. to the southerly city limits. James L. Wolfe is Town Clk.

†Harrisburg, Penn.—The State Highway Department has awarded a contract for the construction of 8½ miles of road between Ridgway and St. Marys, Elk County, to CHARLES T. EASTERDAY, Warriors Mark, Penn., at about 20[illegible]. The road is to be of asphalt. Edward M. Bigelow is Highway Comr.

Hastings, Penn.—(Official)—Bids will be received until 8:30 p.m., May 15, by the Borough Council for paving five blocks on Locust St. and two blocks on Fourth Ave. with vitrified brick. C. S. Hoyt is Boro. Clk. Chas. E. Schlichter, Spruce Ter., Ia. Engr. in Charge.

✚Ingram, Penn.—(Official)—The Borough Council has awarded a contract to the SAWDERS PAVING & CONSTRUCTION CO., Pittsburgh, for grading Sampson Ave., and a contract to the L. H. HILLMAN CO., Ford City, Penn., for grading portions of Maple, Noll, Warren and Cobb Aves. D. H. Hainer is Boro. Clk.

Meadville, Penn.—The City Council will shortly advertise for bids for more than five miles of street paving, to be laid on portions of 12 different streets. T. F. Miller, Jr., is City Engr.

✚Monessen, Penn.—(Official) The Borough Council has awarded the contract for various street improvements to BOWMAN BROS., McKeesport, Penn., at $55,936. Other bidders were. John W. Hallam, $58,773; J. G. McGuire & Co., $59,215; Ridge Bros., $59,432. A. W. Johns is City Engr. Noted May 1

★Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., May 16, by the City Controller for repaving Fifth Ave. from a point 220 ft. west of Brenham St. to Gist St., with blockstone. Jos. G. Armstrong is Dir. Dept. of Pub. Wks.

★(Official)—Bids will be received until 10 a.m., May 23, by the City Controller for improving various streets affected by the abolition of grade crossings over the Pennsylvania R.R. tracks and Homewood and Braddock Aves. Estimated cost, $75,000; for paving with asphalt and otherwise improving Braddock Ave., from Penn to Hamilton Aves., estimated cost, $37,500, and Hamilton Ave., from Lambert St. to Fifth Ave., at an estimated cost of $71,000. Jos. G. Armstrong is Dir. Dept. of Pub. Wks.

✚West Chester, Penn.—(Official)—A contract has been awarded by the Supervisors of West Bradford Township to W. P. DAVIS, West Chester, at $5884 for improving a road leading from Trimble's Mill to Northbrook. Other bidders were: Corfun & Austin Co., $6540; M. & T. Farrell, $6475. John E. Baldwin is Pres. of Supervisors. Noted Apr. 10.

Wilmington, Del.—A special correspondent advises us that all work on the du Pont Highway has been closed down on account of litigation concerning the desired franchise and right-of-way.

Baltimore, Md.—Bids will be received by the State Road Commissioners, until May 19, for building nine sections of State Highways as follows: Under Contract B-20, along the York Road between Towson and Texas, Md., about 4.56 miles, resurfacing macadam; Contract C-7, one section along the road from Indian Head to Mason Springs, about 2.71 miles of gravel, Charles County; Contract No. 0208-A, 1.63 miles along the road from Manchester toward Cranberry, Carroll County; Contract C-10, one section along the road from Port Republic to Lusby, about six miles, Calvert County; Contract No. 0248, five miles, resurfacing macadam along the Frederick Pike from Monocacy River Bridge to New Market, Frederick County; Contract F-12, 3.21 miles macadam along the Frederick Pike from New Market to Plane No. 4, Frederick County; Contract M-10, Montgomery County, one section of 1.25 miles of macadam or concrete along the road between Norbeck and Sandy Springs; Contract No. 0112, 2.94 miles of concrete, between Skipton and Wye Mills, Talbot County; Contract W-5, four miles of concrete between St. Martin's and Berlin, Worcester County. Wm. L. Marcy is Secy.

Bids will be received until May 21, by the Board of Awards for improving various streets under Contract Nos. 108, 109, 110 and 111. Eugene E. Grannan is Pres. of Com. for Opening Sts.

✚Elkton, Md.—A contract has been awarded by the State Road Commissioners, 534 Howard St., Baltimore, to the CHESAPEAKE CONSTRUCTION CO., Preston, Md., for the construction of 2.25 miles of road from Elkton toward North East, at $22,500.

Frederick, Md.—Bids will be received until June 9 by Commissioners of Frederick County, for the construction of about one mile of highway between Burkittsville and Knoxville. Lincoln G. Dinterman, Frederick is Pres. of Comrs. Plans and specifications are on file with State Roads Committee, 534 North Howard St., Baltimore, Md.

Washington, D. C.—(Official)—Bids will be received until 2 p.m., May 29, by the Commissioners of the District of Columbia, for furnishing the district government with granite and sandstone curbing, asphalt and vitrified brick paving blocks, vitrified invert sewer bricks, terra cotta sewer pipe, portland cement and miscellaneous castings during the fiscal year beginning July 1.

★(Official)—Bids will be received until 2 p.m., May 26, by the District Commissioners for paving various streets in the District of Columbia with sheet asphalt and bituminous concrete. C. H. Rudolph, John A. Johnston and Chester Harding are Comrs.

Stafford, Va.—Bids will be received until May 16 for the construction of gravel roads in Stafford County as follows: 7.54 miles of the Brooke-Aguia Creek Road, 4.72 miles of the White Oak Road, 5 miles of the River Road. Bids will be received by the Commonwealth's Attorney, G. B. Wallace, Fredericksburg, Va.

Waynesboro, Va.—(Official)—All bids received May 7 by the State Highway Commission and South River Road Board, of Augusta County, for improving 38 miles of county roads, have been rejected, and the work will be readvertised. Noted May 1

Huntington, W. Va.—Bids will be received until noon, May 23, by the County Court of Cabell County for paving with brick, 1½ miles of the Huntington and Hamlin Pike. F. F. McCullough is Clk. The Leete-Maupin Engineering Co., Huntington, is Engr. in Charge.

✚Palatka, Fla.—(Official)—The City Council has awarded a contract to C. B. WEBSTER, De Land, Fla., at 81⅞c. per sq.yd. for the construction of about three miles of concrete sidewalks. Other bidders were: Palatka Development Co., 96½c.; F. W. Long & Co $1.19; W. A. McNalley, 82c.; W. F. Cahill, 88½c.; John C. Heard, 99c. S. C. Stallings is City Engr. Noted Apr. 24.

Forest, Miss.—(Official)—Bids will be received until noon, June 3, by the Board of County Road Commissioners for the construction of five miles of improved highways at an estimated cost of $25,000. W. T. Kell is Dist. Engr. C. A. McElhenny is Secy. of the Comrs. Noted Sept. 5, 1912

✚Oxford, Miss. The Road Commissioners of Lafayette County have awarded a contract to GORDON & PHILLIPS for construction of 10 miles of road in Beat No. 1. C. S. Coon well is Ch. Engr.

New Orleans, La.—Bids will be received until May 20, by the City Council, for paving Magazine St. from Exposition Blvd. to Audubon Park. Bids will be accepted for any standard pavement or roadway construction. W. J. Hardee is City Engr.

Knoxville, Tenn. Bids will be received until May 16 by the Board of City Commissioners, for improving Forest Ave., from Fourth to Ninth Sts. The work includes 330 cu.yd. of excavation, 6650 sq.yd. paving, 4400 lin.ft. concrete curb and 800 lin.ft. storm sewer. D. G. Leahy is Recdr. J. E. Thompson is City Engr.

✚Nashville, Tenn.—The Board of Public Works has awarded a contract for paving a section of Capitol Blvd. to the SOUTHERN BITULITHIC CO., Nashville, Tenn., at $13,000. W. W. Southgate is City Engr.

Bowling Green, Ky.—(Official)—The Fiscal Court of Warren County will receive bids until May 19, instead of May 5, as previously noted, for the construction, repair and maintenance of county roads for one year. W. H. Crump is Rd. Engr. Noted May 1.

Hopkinsville, Ky.—The City Council is having plans prepared for about 15,000 sq.yd. of street paving, contracts for most of which will be awarded this spring. The kind of paving has not yet been decided upon.

✚Louisville, Ky.—Contracts for road improvements have been awarded as follows: To F. G. BRESLIN, 10 miles of River Road, $8400; 12 miles of the Preston St. Road, at $8240; 16 miles of the Dixie Hwy., $10,720; and six miles of the Lane Run Road, $4110; to the HOKE CO., 12 miles of the Brownsboro Road and 11 miles of the Bardstown Road, at $8100 and $6650, respectively; to the KENTUCKY ASPHALT & ROAD CO., at $10,350 for 18 miles of the Taylorsville Road and $8775 for 13 miles of the Shelbyville Road; to the SOUTHERN ASPHALTOLINE CO., at $4485 for 10 miles of the Third St. Road.

Akron, Ohio—Because of a technical error in advertising, the time for receiving bids for the paving of East Market St. has been extended from May 8 to May 20. Ira A. Priest is City Clk. Noted May 1.

✚Canton, Ohio—The Commissioners of Stark County have awarded the contract for paving about nine miles of the Alliance, Harrisburg and Louisville Road to W. H. VOGT & SON, Massillon, Ohio, at $150,000. J. H. McConnell is Audr.

Canton, Ohio—(Official)—No bids were received by the Commissioners of Stark County for the improvement of the Fairmont Home Road Extension. The contract will be readvertised. J. H. McConnell is Audr.

Chillicothe, Ohio—Bids will be received until noon, May 26, by the Board of Commissioners of Ross County for improving 1½ miles of the Richmondale Pike, Jefferson Township. Robert D. Alexander is Audr.

Cincinnati, Ohio—Bids will be received until noon, June 6, by the Board of Commissioners of Hamilton County for the improvement of the Mill Road from the Hamilton Pike to the Butler County line, Springfield Township. Albert Reinhardt is Clk.

✚Cincinnati, Ohio—(Official)—The contract for grading, curbing and paving on Knox St. was awarded to EVAN EVANS, 1226 3da St., Cincinnati, at $9592. Henry M. Waite is City Engr. C. H. Tuxworth is Asst. Clk., Dept. of Pub. Service. Noted Apr. 17.

✚Cleveland, Ohio—(Official)—The contract for the improvement of the Solon Road Extension was awarded to J. W. DIDHAM, Chagrin Falls, Ohio, at $18,314. Noted May 8.

Cleveland, Ohio—Bids will be received until 11 a.m., June 11, by the Board of Commissioners of Cuyahoga County for improving Brookpark No. 1 Road from Wooster Park to Settlement Road, Brooklyn, Parma and West Park Townships, for improving Brookpark No. 2 Road from Settlement to Berea Road, West Park and Middleburg Townships. Frank R. Lander is County Surv. John F. Goldenbogen is Clk.

Cleveland Heights, Ohio—Bids will be received until noon, June 10, by the Village Council for various improvements on Ardoon St., Wood Pl., Ave., Lee and Yellowstone Roads. H. H. Canfield is Village Clk.

Columbus, Ohio—Bids will be received by the State Highway Commissioner until May 23, for grading and paving with water-bound macadam, bituminous surface treatment, the Newark-New Lexington Road, Thorn Township, Perry County. The length is 1.86 miles and the estimated cost of construction is $18,726. James R. Marker is Comr.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., May 29, by the State Highway Commissioner for the following road improvements: Grading and paving with concrete 1.21 miles of the Port Clinton Road, Inter-County, Sandusky Township, at an estimated cost of $16,540; grading and paving with waterbound macadam, 2½ miles of the Bryan-Napoleon Road, Napoleon Township, Henry County, at an estimated cost of $16,723; grading and paving with brick one mile of the Steubenville-Cambridge Road, Cambridge Township, Inter-County, at an estimated cost of $16,858. James R. Marker is Comr.

Kenton, Ohio—(Official)—Bids will be received until 1 p.m., May 28, by the Board of Commissioners of Hardin County, for grading and paving with waterbound macadam 0.51 miles of the Kenton-Findlay Road (Section 1), Blanchard Township, at an estimated cost of $1788; for grading and paving 1.49 miles of the Kenton-Findlay Road (Section 2), estimated cost, $5064; for grading and paving with waterbound macadam, two miles of the Kenton-Mount Victory Road, estimated cost, $8638; for grading and paving with waterbound macadam, two miles of the Kenton-Forest Road, estimated cost, $6252. James R. Marker is Highway Comr.

The City Council has instructed the City Engineer to prepare plans and estimates for paving Carroll St.

Lorain, Ohio—Bids will be received by the Board of Commissioners of Lorain County until June 2, for grading, draining and macadamizing the Cemetery Road from South Main St., Wellington Village, easterly to the east side of the main entrance to the cemetery, a distance of 1100 ft.

Orrville, Ohio—(Official)—Bids will be received until noon, May 29, by the Village Council for the improvement of North Main, North Vine and Main Sts. A. Jenny is Clk.

+Toledo, Ohio—The Board of Control has awarded a contract to RUSSELL & JENNISON, at $40,500 for paving St. Clair St. from Monroe to Knapp St. with wood block, and at $7100 for paving St. Clair from Knapp St. to Emerald Ave., with asphalt. T. R. Cowell is Dir.

+Toledo, Ohio—(Official)—The Commissioners of Lucas County have awarded a contract to the WILTSIE REALTY CO., Toledo, Ohio, for various improvements in Wildwood Addition, a subdivision of Adams Township. Noted Apr. 24.

Indiana—Bids for road improvements in Indiana will be received as follows:

May 24, at Rensselaer, by the Commissioners of Jasper County for the construction of the Irwin and Oliver Roads, both in Barkley Township, and the Yeoman and Halstead Roads, both in Newton Township. Joseph P. Hammond is Audr.

May 26, at Richmond, by the Trustees of Wayne Township, Wayne County, for the improvement of a road. James Howarth is Trustee.

June 2, at Williamsport, by the Commissioners of Warren County for the construction of a gravel road in Washington Township. D. H. Mohtt is Audr.

June 2, at Jeffersonville, by the Commissioners of Clark County for the construction of a gravel road. George W. Stoner is Audr.

June 2, at South Bend, by the Commissioners of St. Joseph County for the construction of a gravel or macadam road in Lincoln Township. Clarence Sedgwick is Audr.

June 2, at Greensburg, by the Commissioners of Decatur County for the construction of a bituminous macadam binder road in Washington Township, and a macadam road in Marion Township. Linton W. Sands is Audr.

June 3, at Monticello, by the Commissioners of White County, for the construction of roads in Princeton and Jackson Townships. A. G. Fisher is Audr.

June 3, at Vincennes, by the Commissioners of Knox County for the construction of eight gravel roads in Vigo, Harrison and Washington Townships. John T. Scott is Audr.

June 3, at Crawfordsville, by the Commissioners of Montgomery County for the construction of a gravel road in Scott Township, and three in Franklin Township. Bennett B. Engle is Audr.

June 3, at Logansport, by the Commissioners of Cass County for the construction of roads in Eel and Deer Creek Townships. J. E. Wallace is Audr.

June 3, at Winamac, by the Commissioners of Pulaski County for the construction of a road in Harrison Township. W. E. Munchenbuger is Audr.

+(Official)—The Commissioners of Shelby County have awarded a contract for the construction of a road in Union Township to JAMES M. GOODRICH at $8000. Other bidders were: William Avery, $8275; Jasper Hester, $8315. Noted Apr. 17.

The Commissioners of Vanderburg County have awarded a contract for the construction of two roads in Armstrong Township to JOHN FRIDY, Evansville, at $22,000. Noted Apr. 24.

The Commissioners of Bartholemew County have awarded contracts for the construction of roads in Hawcreek and Harrison Townships to CHARLES NOBLET at $4440 and to G. W. CRIEST at $3595. Noted Apr. 24.

The Commissioners of Benton County have awarded road contracts as follows: Sewell Road to GAYAN & VAN NATTA at $7850; Smith-Hickman Road, to LEWIS & PARKER, at $10,497; Keller Road to HALL & BARNARD, at $8290.

The Commissioners of Montgomery County have awarded a contract for the improvement of the Connard Road, Franklin Township, to G. T. MILLER, Lebanon, Ind., at $26,839; and at $10,959 for the Scales Road, Scott Township.

The Commissioners of Gibson County have awarded contracts to JOHN G. BERGER, Branch, Ind., at $14,670, and S. R. ADAMS & CO., Princeton, Ind., at $10,506 for the improvement of county roads. Noted Apr. 17.

No bids were received by the Commissioners of Harrison County for road construction in Franklin and Spencer Townships. J. L. O'Bannon is Audr. Noted A. r. 24.

Bloomington, Ind.—(Official)—Bids will be received until 4 p.m., May 20, by the City Council, for about 19,000 sq.yd. brick pavement on various streets at an estimated cost of $27,000. U. S. Hanna is City Engr.

+Bluffton, Ind.—(Official)—The Commissioners of Wells County have awarded a contract to JACKSON & GORDON, Liberty Center, Ind., at $4500, for the construction of a stone road on the Wells-Huntington County line. L. A. Williamson is Audr. Noted May 1.

+Hartford City, Ind.—The Commissioners of Blackford County have awarded contracts for the construction of two roads to ALBERT CLAMME, Hartford City, at $14,400 and $8139, respectively. James Cronin, Jr., is Audr. Noted Apr. 17.

Kentland, Ind.—Bids will be received until 2 p.m., June 2, by the Commissioners of Newton County, for the construction of a road in Washington Township. S. R. Sizelove is Audr.

Laporte, Ind.—No bids were received by the Commissioners of Laporte County, for the construction of a macadam road in Pleasant, Lincoln and Washington Townships, 18.33 miles in length. Fred A. Hamsher is Audr. Noted Apr. 24.

+Monticello, Ind.—(Official)—The Commissioners of White County have awarded a contract to L. T. KENT, Brookston, Ind., at $18,849 for the construction of a road in Prairie Township. Paul Ward is County Engr. A. G. Fisher is Audr. Noted Apr. 17.

+Wabash, Ind.—Contracts have been awarded by the Commissioners of Wabash County, for four roads in Noble Township, to TABER & HULLIHAN, Wabash, Ind., as follows: Showalter Road, $6090, Summerland Road, $11,285; Long Road, $9250; Hill St. Extension, $23,295. Noted Apr. 17.

+Freeport, Ill.—The Board of Local Improvements has awarded contracts to the GUND-GRAHAM CO, Freeport, Ill., for the paving of Washington and Williams Sts., at $13,097, with brick, and for paving Cottonwood, Foley and Powell Sts., with macadam, at $13,096. Charles Hepner is City Engr.

+Monmouth, Ill.—A contract has been awarded by the Board of Local Improvements to the BURLINGTON PAVING CO., Burlington, Iowa, at $11,540, for paving Main St., from Seventh Ave. to the city limits.

Urbana, Ill.—The Board of Local Improvements has passed resolutions for paving Cottage Grove Ave. and East Illinois St., at an estimated cost of $35,836.

Waukegan, Ill.—(Official)—Bids will be received until 8 p.m., May 19, by the Board of Local Improvements, for 1535 sq.yd. of brick paving on County St., and 1370 sqyd. on Hickory St., also of brick. M. J. Douthitt is City Engr.

+Delavan, Wis.—(Official)—The contract for grading, curbing and paving Walworth Ave., from Main to Fourth Sts., with brick, has been awarded to the BURDSALL-GRIFFITH CONSTRUCTION CO., at $19,198. P. T. Hurtgen, Burlington, Wis., is Engr. W. R. Topping is City Clk. Noted Apr.24.

(Official)—Bids will be received until 10 a.m., May 16, by the Committee on Streets and Alleys, for the construction of concrete curbs and gutters on Racine, Eighth and North Fourth St. W. R. Topping is City Clk.

Superior, Wis.—The City Commission has ordered the Board of Public Works to advertise for bids for paving North Sixth St., from Tower Ave. to Banks Ave., and Ogden Ave., from First to Third Sts. E. B. Banks is City Engr.

Junction City, Kan.—(Official)—Bids will be received until 9 a.m., May 21, by the City Council for various street improvements. The work includes 26,250 sq.yd. of pavement, 9300 cu.yd. excavation, 12,100 lin.ft. combined curb and gutter, 2300 lin.ft. curb. W. Van Buck is City Engr.

Minot, N. D.—Bids will be received until May 19, by the City Commissioners for paving portions of Main and First Sts. E. J. Thomas is City Engr. Noted Nov. 28, 1912.

Mitchell, S. D.—Bids will be received until 1 p.m., May 28, by the Commissioners of Davison County for construction of 10½ miles of road in Mitchell, Prosper and Rome Townships, and six miles of road in Union Township. A. J. Curtis is Chn. of Comrs. R. A. Zingle is County Audr.

Missoula, Mont.—The City Commissioners will at once advertise for bids for paving Pattee and Stevens Sts., the work to be begun as early as possible. W. H. Smith is City Clk.

Jefferson City, Mo.—Bids will be received until 4 p.m., May 19, for grading, curbing and paving Chestnut St. from High to Atchison Sts. J. Frank Morris is City Clk. P. C. Harding is City Engr.

+Richmond, Tex.—The Commissioners' Court has awarded a contract to J. D. CAMERON, for the construction of shell and gravel roads in District No. 4, at a cost of $150,000.

Bellingham, Wash.—The City Council has passed ordinances for paving High and Cedar Sts. and Garden Terrace, estimated cost, $15,300; Monroe St., from Broadway to Cherry and Cherry St., from Monroe to Eldridge Ave., estimated cost, $34,900; for improvement of I St., from Holly to N St., with concrete sidewalk. Estimated cost, $6100. An ordinance has also been passed for paving of Humboldt St., from Champion to Lake St.

Blaine, Wash.—The State of Washington has appropriated $37,268 for the construction of the Pacific Highway, extending south toward Bellingham. Will R. White, Ch. State Engr., will supervise the work, which will be ordered shortly.

+Leavenworth, Wash.—The City Council has awarded a contract to the COLUMBIA ENGINEERING & CONSTRUCTION CO., Wenatchee, Wash., at $10,285, for grading three districts of the town. Other bidders were Seaman & Quigg, and Berry & Monary, both of Wenatchee.

+Seattle, Wash.—(Official)—The contract for paving the Pine St. District with brick was awarded to ANDREW J. BAUMGARTNER, 711 16th Ave., Seattle, at $56,168. Other bidders on brick paving were: Barker Asphalt Paving Co., $57,814; Russell & Gallagher, $58,798; D. H. Traphagen, $58,327; MacQuaid & Moore, $57,950; F. S. Misho & Co., $58,500; T. Ryan & Co., $56,643. Arthur H. Dimock is City Engr. Noted May 1.

Seattle, Wash.—W. F. Manney & Co., 7009 17th Ave. N. W., was low bidder for grading Division Ave. and other streets. Other bidders were: Henry Brice, $26,983; Holt & Jeffrey, $27,085; J. H. Cullum & Co., $29,081. Andrew Peterson, $31,385.

Shelton, Wash.—Bids will be received by County Commissioners of Mason County, E. L. Robinson, Audr., until May 16, for the construction of one mile of permanent road No. 2, Mason County; also for the construction of 9345 ft. of the Eberhart Road. Plans and specifications are on file at the office of the County Engineer.

+Tacoma, Wash.—The Commissioner of Public Works has awarded the contract for grading and the construction of sidewalks on Park St. and East 27th St. to W. H. HICKER, 1002 North Ainsworth Ave., for $23,793. The McHugh Contracting Co. was the only other bidder at $23,807. Owen Woods is Comr.

The City Council has ordered paving of North L, North Eighth, Ninth, 10th and 11th Sts. Engineer's estimate of cost, $36,249. Bids for construction will be called for soon. The Council has also ordered the improvement of Sheridan and O Sts., and North Sixth St., to cost $20,822, according to City Engineer's estimate. W. C. Raleigh is City Engr.

+Tacoma, Wash.—(Official)—The contract for the construction of five miles of Permanent Highway No. 3, Pierce County, has been awarded to the WASHINGTON PAVING CO., Savage-Seofield Bldg., Tacoma, at $43,843. Other bidders were: George P. Wright, Tacoma, $49,545; McHugh Construction Co., Tacoma, $51,161; Hans Pederson, Tacoma, $51,-

701; Jos. Warter, Tacoma, $52,633; Inland Empire Hassam Paving Co., Spokane, $56,900; D. H. Traphagen, Seattle, $58,-600; Chas. S. Schaefer, Tacoma, $59,961. M. Roy Thompson is County Engr. Z. E. Turner is Clk. Noted Apr. 24.

Wilbur, Wash.—The City Council is receiving bids for grading Main St., for a distance of one mile.

Pendleton, Ore.—The City Council has adopted resolution for the improvement of Raley St., from the west line of Bush St. to west line of Short Line Ry. by paving with graved bitulithic. Geary Gimbrell is City Engr.

Portland, Ore.—(Official)—The following bids were received by the City Council for paving the East Stark St. District: Bitulithic, Oregon Independent Paving Co., $81,-756; asphaltic concrete, Warren Construction Co., $81,870; Oregon Independent Paving Co., $69,008; Montague-O'Reilly Co., $69,969; asphalt, Montague-O'Reilly Co., $75,702. Barber Asphalt Paving Co., $81,335; hassam pavement, Oregon Hassam Paving Co., $81,885. The contract will probably be awarded to the Oregon Independent Paving Co., at $81,656 for bitulithic pavement. J. C. Sparks is City Statistician. Noted May 1.

+Los Angeles, Calif.—The BREASHEAR-BURNS CO., Trust & Savings Bldg., has been awarded the contract at $40,000, for the grading of streets and the construction of sidewalks, curbs and gutters in the Los Angeles Mesa Tract for the Angeles Mesa Land Co.

+Richmond, Calif.—The City Trustees have awarded a contract to G. W. CUSHING, at $55,000, for the improvement of A, B, and C Sts., Pennsylvania Ave. and 18th St. H. Chapman is City Engr.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., May 19, by the State Highway Commission, 515 Forum Bldg., for construction of about 7½ miles of highway in Ventura County, between the southern boundary and Newbury Park; construction of about 11¼ miles of road in Los Angeles County between Calabasas and the westerly boundary; constructing about one mile of road in Santa Clara County between Santa Clara and Lawrence Station Road. All construction to be of portland cement concrete with bituminized surface. Austin E. Fletcher is Highway Engr. Wilson R. Ellis is Secy. Noted Apr. 17.

+Sacramento, Calif.—Contracts have been let as follows for the improvement of the State Highway: San Mateo County, 2 miles, Oak Drive to Bellevue Drive, to CLARK & HISERY, $3668; one mile, north boundary to Daly City, FLINN & TREACY, $14,040; 1.8 miles, San Mateo to Beresford, to RAISCH IMPROVEMENT CO., $19,233; Santa Clara County, 4.3 miles, San Jose to Edenvale, to RICHARDS & KEATING, $17,819. Noted Apr. 17.

Sausalito, Calif.—(Official)—The Board of Town Trustees will receive bids about Sept. 1, for paving various streets with sheet asphalt on concrete base. The estimated cost is $100,-000. The work includes grading, concrete curb and gutter, street culverts, storm culverts and catch basins, 41,805 sq.yd. asphalt paving, and 5497 cu.yd. concrete base. H. W. Cadwell is City Engr.

Kingston, Ont.—The City Engineer will receive bids for about 6639 sq.yd. of street paving, 2150 lin.ft. concrete curb and gutter, and 1,500 lin.ft. concrete gutter. R. J. McClelland is City Engr.

INDUSTRIAL WORKS

Attleboro, Mass.—Edward Heaton, Roxbury, Mass., is planning to start a cotton waste factory at Attleboro, in a building to be erected for him by the Board of Trade. It will be two stories, 182x77 ft.

+Springfield, Mass.—The contract for the construction of a factory on Page Boulevard, East Springfield, for the Hendee Mfg. Co. has been awarded to N. E. RUSSELL, Springfield. The structure will be 184x324 ft. of brick, one-story, to cost $60,000. Noted Feb. 20.

+Worcester, Mass.—The contract for the construction of a four-story, 50x72 ft. addition to the abrasive plant of the Norton Grinding Co., has been awarded to the E. J. CROSS CO., 82 Foster St., Worcester.

+Bristol, Conn.—The contract for an addition to the factory of the C. J. Root Co. on Church St. has been awarded to CHARLES J. WALDO, 441 West St. Bristol. The building will be 40x120 ft., three stories, of brick, mill construction with one floor of concrete. Unkelbach & Perry, 162 Main St., New Britain, Conn., are Archs. Noted Apr. 3 and 24.

Plans are being prepared by Unkelbach & Perry, Archs., New Britain, Conn., for the construction of a factory for the Wallace Barnes Co. The structure will be four stories, 50x 120 ft., of brick, mill construction.

Hartford, Conn.—Plans have been prepared by Ford, Buck & Sheldon, Inc., 60 Prospect St., Hartford, for the construction of a three-story, 63x190-ft. plant for the Hartford Special Machinery Co., to be erected at Woodland St. and Homestead Ave.

+South Manchester, Conn.—The Orford Soap Co. has awarded contracts to J. M. WOOLEY, 756 Main St., for the mason work and the BURGESS CONSTRUCTION CO., 118 Asylum St. for the carpenter work, both of Hartford, Conn., on its three-story, 52x123-ft. building of mill construction with two story towers. The Walter Kiddle Engineering & Construction Co. 140 Cedar St., New York, N. Y. are Archs.

South Norwalk, Conn.—Plans are being prepared by C. R. Makepeace & Co., Providence, R. I., for the construction of a new factory on Union St., for Cluett, Peabody & Co. The building will be 80x100 ft., four stories.

Torrington, Conn.—The Kaiser Witch Hazel Co. contemplates the construction of a two-story, 60x120 ft. factory at West Torrington.

+Albany, N. Y.—The American Tobacco Co., 111 Fifth Ave., New York, N. Y., has awarded a contract to the W. S. HAMIL CO., Troy, for the erection of a four-story factory, at Arch St. and Trinity Place, Albany. The estimated cost is $80,000.

Buffalo, N. Y.—Bids are being received by Lansing, Pl. & Lyman, Archs., Prudential Bldg., for the construction of a two-story machine shop, 115x15 ft., at Ohio and Chicago Sts., for the F. & E. Holmes Machine Co.

+Gates, N. Y.—The Yawman & Erbe Mfg. Co. Rochester, has awarded a contract to ALEXANDER, SHUMWAY & UTZ Rochester, for the construction of an addition to its plant in Gates. The structure will be of reinforced concrete, three stories, 430x84 ft., and will be erected on Jay St. The estimated cost is $200,000. G. C. Wright, Rochester, is the Arch. Noted Apr. 24.

+Rome, N. Y.—The Rome Wire Works has awarded a contract to the ROME STONE & CEMENT CO. for the construction of a one-story factory, 200x135 ft., to be added to its plant. The contract for the structural iron work has been awarded to H. C. PENDORF, 529 Turin St.

Syracuse, N. Y.—Bids are being received by the Foster Machine Co. for the construction of a two-story factory, 76x 37 ft., on South West St. Sackett & Park, Syracuse, are the Archs.

Syracuse, N. Y.—Bids are being received by Edward Howard, Arch., Syracuse, for the construction of a one-story foundry, 76x50 ft., for A. S.Reddin, 410 Marcellus St.

Troy, N. Y.—Stanton P. Lee, Arch., Cameron Place, has awarded contracts for the construction of a new plant for the Thorn Hold Fast Co., to replace the old plant on Front St., which was recently destroyed by fire. The new structure will be three stories.

Camden, N. J.—The National Chewing Gum Co., 305 Walnut St., Philadelphia, Penn., has purchased a site at Haddon Ave. and the White Horse Turnpike, Camden, upon which it will erect a factory. The structure will be of brick, 190x68 ft.

Newark, N. J.—The Hudson Hat Co., Hoyt and New Sts., is having plans prepared by R. Bottelli, Arch., 189 Market St., for the construction of a two-story addition to its plant, 35x30 ft., and 95x45 ft. The estimated cost is $15,000.

Newark, N. J.—Lewis Bros., manufacturers of candy, will build a four-story brick addition to their plant, 110x25 ft., on Monroe St. The estimated cost is $20,000.

Philadelphia, Penn.—(Official)—The Vulcanite Cement Co., Land Tile Bldg., has retained Preston K. Yates, Consult. Engr., 30 Church St., New York, N. Y., to design a crushing plant for all rock taken from its quarries. The construction of the new work will be under the supervision of W. R. Dunn, Gen. Mgr., and will be in operation within three months.

Baltimore, Md.—The Western Maryland Ry. Co. has announced plans for the erection of a one-story engine-house, 36x32 ft., and a machine shop, 192x86 ft., on Hillen St. The estimated cost is $25,000. H. R. Pratt, Baltimore, is Ch. Engr.

Galax, Va.—J. H. Rhudy and J. H. Smith are considering the construction of a factory at Galax, for the manufacture of chairs. The building will be two stories, 60x100 ft., and is estimated to cost $10,000.

Wierton, W. Va.—The Wierton Plate, Structural & Construction Co. has purchased a site of four acres and will build a plant for the manufacture of heavy furnaces of all kinds, gas producers and tin house stacks. The main building will be 200x440 ft., of steel, brick and concrete construction. C. B. Chaney is Secy.

Aulander, N. C.—The Bertie Oil Co., will receive bids until May 15, for furnishing machinery for rebuilding its oil mill and fertilizer plant recently destroyed by fire. Estimated cost, $25,000. C. W. Mitchell is Pres.

Rome, Ga.—The Hanks Foundry Co. has bought a site of three acres at Rome, and plans to double the capacity of its plant.

Georgetown, Ky.—The Crosthwait Lock & Mfg. Co., recently incorporated at Georgetown, plans to establish a plant in that city for the manufacture of its specialties. The concern is capitalized at $35,000. G. M. Taylor is one of the incorporators.

Princeton, Ky.—The Illinois Central R.R. Co., is considering the establishment of repair shops at Princeton. M. K. Barnum is Gen. Supt. Motive Power.

+Akron, Ohio—The contract has been awarded to W. W. FRANKLIN, Akron, by the Buckeye Rubber Co., for the erection of its proposed factory, at about $20,000.

+The contract has been awarded to the CARMICHAEL CONSTRUCTION CO., Akron, by the International Harvester Co., for the construction of its proposed factory, to cost $110,000.

Alliance, Ohio—J. T. Waybrecht & Sons Lumber Co., Alliance, has taken out a permit for the erection of a planing mill and sheds to cost $10,000.

Cincinnati, Ohio—The Reif-Schoenug Tanning Co., Cincinnati, Ohio, is having plans prepared for the erection of an addition to its factory. The building will be two stories, 50x120 ft. Louis Reif is Pres.

The Thomas J. Nichols Co., Cincinnati, is planning to erect a factory to cost about $70,000.

McDonald, Ohio—It is reported that the Carnegie Steel Co., Pittsburgh, Penn., will start immediately on the construction of its proposed new plant at McDonald, north of the Ohio plant, where the company will build a new town. The slag plant for furnishing concrete for foundations has been completed, and the railroad built to the proposed site. The proposition will be one involving at least $10,000,000, and it is expected that the appropriation will be made shortly.

West Toledo, Ohio—The Lake Shore & Michigan Southern Ry., Cleveland, Ohio, has plans for a large roundhouse to be erected at West Toledo.

Evansville, Ind.—The Evansville Carriage Woodstock Co., Evansville, will erect a two-story factory, 60x160 ft. C. Shopwell, Evansville, is Arch.

The lowest bid for the construction of a factory for the Hercules Buggy Co., Evansville, was submitted by C. Kanzler & Son, Evansville.

Battle Creek, Mich.—The Grand Trunk Ry. Co., at Montreal, Que., has plans for shop improvements at Battle Creek, Mich., to cost $250,000, including also a large roundhouse and turntable.

Chicago, Ill.—The White Eagle Laundry Co., Chicago, is receiving bids for the erection of a two-story laundry, 50x125 ft. Estimated cost, $25,000.

Bernard Hienig, 1449 Webster Ave., Chicago, is receiving bids for the erection of a wagon shop. It will be two stories, 50x100 ft. Estimated cost, $15,000.

The White Eagle Laundry Co., Chicago., is receiving bids for the erection of a two-story laundry, 50x125 ft. The cost of the proposed building is estimated at $20,000.

Granite City, Ill.—The Wabash R.R. Co. is considering the construction of a round-house at Granite City. E. F. Needham, Springfield, Ill., is Supt. Locomotive and Car Dept.

Clintonville, Wis.—Contracts for additions to the Four Wheel Drive Auto Co.'s factory here have been awarded to PATTERSON & KROLL, Waupaca, Ohio. The work will include a brick addition, 100x120 ft.; and a boiler room, 40x40 feet. Estimated cost, $10,670.

Milwaukee, Wis.—Plans for a light manufacturing building at 344 Milwaukee St. have been completed for Radke Bros. & Kortsch, printers, by Robert Messmer & Bro., Arch., to cost, $32,000.

A three-story and basement, concrete and steel addition to the George Meyer Mfg. Co.'s plant will be erected on a 100x150-ft. site now being cleared on Clinton St., near Lapham St.

Prairie du Chien, Wis.—The Prairie City Canning Co., Prairie du Chien, is considering the erection of a canning factory at Prairie du Chien.

Sheboygan, Wis.—Plans are being prepared for the erection of a new plant for the Gas Repairing Co., on a recently acquired site on South 14th St., near Indiana Ave. A three-story brick structure will be planned for. E. M. Parmlee, D. D. Rowlands and W. B. Licas recently organized the company.

✚**Wausau, Wis.**—Bids have been received as follows by Nicholas Veeser, Arch., Wausau, for the construction of the brewery for the Wausau Brewery Co.: Anton Zwack, Dubuque, Iowa, $47,587; A. Andres, Wausau, $44,500; FRED W. KRAUSS, Wausau, $44,500 (awarded contract).

Cedar Falls, Iowa—The Iowa Gate Co., Cedar Falls, will erect a new factory. The company has a capital of $120,000.

Minneapolis, Minn.—The Crex Carpet Co., Minneapolis, plans to build a large plant on Como Ave. About $1,000,000 will be expended.

Dillon, Mont.—The Beaverhead Elevator Co., Dillon, recently incorporated with a capital of $25,000, will build a large grain elevator at Dillon. Craig Cornell, J. H. Roe and W. A. Jones are interested.

St. Louis, Mo.—The Lowell Bleachery Co., St. Louis, plans to erect a new plant on the site purchased in Carondelet some time ago. The estimated cost of the new building and equipment is $200,000.

Athens, Tex.—The Athens Firebrick & Tile Co., Athens, will erect a new plant at an estimated cost of $200,000.

Bardwell, Tex.—The Farmers' Cotton Oil Co. will erect a cotton-seed oil mill at Bardwell, to cost approximately $50,000.

Bay City, Tex.—The James W. Rugeley Gin Co., Bay City, will erect an addition to its cotton gin, to cost approximately $12,000. The capacity will be about doubled.

Plainview, Tex.—The Panhandle Silo Co. will erect a plant for the manufacture of silos.

Seattle, Wash.—The West Seattle Laundry Co. is considering the erection of a modern steam-laundry plant, to cost about $15,000. A. J. Willis is Mgr.

Tacoma, Wash.—Gillespie & Hanson, Seattle, Wash., have leased a site at Tacoma, and will erect a factory for the manufacture of dredges. The building will cost approximately $25,000, and the equipment about $6000.

Baker, Ore.—J. A. Gyllenberg, Baker, has leased the plant of the Baker Iron & Supply Co., and will add an acetylene welding plant to the shops.

Gold Hill, Ore.—The Portland-Beaver Cement Co., Portland, Ore., has been incorporated with a capital of $600,000, by J. C. Burch, William Schrump and C. S. Woody. The company will erect a large portland-cement plant at Gold Hill. The estimated cost is $500,000.

Portland, Ore.—The Modern Confectionery Co., Portland, will erect a two-story brick at East 11th and Flanders Sts. The estimated cost is $50,000. Root & Hoose, Commercial Club Bldg., are the Archs.

Roseburg, Ore.—The Tidewater Mill Co., Grand Rapids, Mich., will erect a large lumber manufacturing plant near the mouth of the Siuslaw River, near Roseburg, Ore. Johnson P. Porter, Jr., Eng.

Los Angeles, Calif.—The Western Excavating & Dredging Co. has recently been incorporated with a capital of $100,000 by W. Wetzel, L. S. Rees and J. C. de Turk. The company will erect a plant at Los Angeles for the manufacture of Western excavating and dredging machines.

San Diego, Calif.—The Coast Products Co. will erect a cold-storage plant at Eighth and K Sts. The building will be 75x100 ft., and will cost about $20,000. George B. Wright is Mgr.

Santa Barbara, Calif.—The Santa Barbara & Suburban Ry. Co. is having plans prepared for the construction of a reinforced concrete car barn and machine shop, to be erected at Santa Barbara. The building will be 80x120 ft. H. Alban Reeves, Chamber of Commerce Bldg., Los Angeles, is the Arch.

Stonyford, Calif.—F. M. Kisselring and Bruce Sutleff, Stonyford, are interested in a project to erect a creamery estimated to cost $10,000.

Terra Bella, Calif.—The Terra Bella Fruit Growers' Association has been incorporated with a capital of $10,000 by F. J. Hart, F. H. Roark and Tracey Abott. The company will erect a fruit-canning plant at Terra Bella.

Visalia, Calif.—The Central California Canning Co. plans to make improvements to its fruit-canning plant at Visalia. Ten additional cannery houses will be erected and a large addition to be used as a fruit room will be built to the main building.

Wilmington, Calif.—Garrett L. Hogan, Los Angeles, has taken out a permit to erect a fish-canning plant at Wilmington, near Los Angeles. The estimated cost is $20,000.

FEDERAL GOVERNMENT WORK

★**Dredging**—Portland, Maine—(Official)—Bids will be received until noon, June 7, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, Maine, for dredging in the Kennebec River, Maine.

★**Dredging**—Portland, Maine—(Official)—Bids will be received until noon, June 7, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Medomac River, Maine.

★**Dredging**—Portland, Maine—(Official)—Bids will be received until noon, June 7, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Carvers Harbor, Maine.

Rock Excavation—Boston, Mass.—Bids will be received until June 7 by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston, for rock excavation in the Mystic River, Mass.

✚**Dredging and Rock Removal**—Southport, Conn.—Bids were received as follows, Apr. 29, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging and rock removal in Southport Harbor: (a) dredging about 45,200 cu.yd.; (b) rock removal, about 136 cu.yd.; (c) totals; Maritime Dredging Co., 80 Broad St., New York, N. Y., (a) 24¼c.; $11,074; (b) $12, $1632; (c) $12,706; John A. Seely, 30 Church St., New York, N. Y., (a) 25¾c., $11,639; (b) $14, $1904; (c) $13,543; Atlantic Dredging Co., 81 New Street, New York, N. Y., (a) 26¾c., $12,091; (b) $13.50, $1836; (c) $13,927; George W. Beeman, Dyer Block, Hyde Park, Mass., (a) 25¾c., $11,639; (b) $24,50, $3332; (c) $14,971. The contract has been awarded to the MARITIME DREDGING CO.

Capstans—Philadelphia, Penn.—(Official)—Bids will be received until 11 a.m., June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing three electrically driven capstans at the navy yard at Philadelphia. Estimated cost, $9000.

Gun Forgings—Washington, D. C.—Bids will be received until noon, June 4, by the Chief of the Bureau of Ordnance, Navy Dept., Washington, for furnishing two, four or six sets of 12-in., 50-caliber steel gun forgings.

✚**Building**—Washington Barracks, D. C.—The contract has been awarded to GEORGE E. WYNE, Washington, D. C., for the construction of the U. S. engineer school building, at $88,900.

Electric Hoists—Washington, D. C.—(Official)—Bids will be received until 11 a.m., June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, for furnishing and installing three electric hoists at the U. S. Naval Radio Station, Radio, Va.

✚**Riprap**—Washington, D. C.—The contract has been awarded to the COLUMBIA GRANITE & DREDGING CO., Washington, for furnishing and placing riprap on the Anacostia Flats, D. C., at $1.37 per cu.yd.

Dredging—Norfolk, Va.—Bids were received as follows May 1 by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., for dredging Thimble Shoal, about 450,000 cu.yd. Coastwise Dredging Co., Norfolk, 17.85c. per cu.yd. scow measurement; Maryland Dredging & Contracting Co., Baltimore, Md., 17.3c.

★**Dredging**—Norfolk, Va.—(Official)—Bids will be received until noon, June 7, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for dredging the approaches to the harbor at Cape Charles City, Va.

✚**Post Office**—Grafton, W. Va.—Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded the contract to the WILLIAM H. FISSEL CO., New York, for the construction of the U. S. post office at Grafton.

✚**Oxford, N. C.**—Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post-office at Oxford to WORRELL & WATERS, Llanerch, Penn., at $46,054.

Sand and Gravel—Vicksburg, Miss.—No bids were received Apr. 14 by the U. S. engineer, Vicksburg, for furnishing sand and gravel and broken stone near Little Calloo Landing, Big Sunflower River, Miss.

Pump Houses—Louisville, Ky.—Bids will be received until 2 p.m., June 4, by the Commissioner of Fisheries, Department of Commerce and Labor, Washington, D. C., for the construction of two pump houses at the Louisville fisheries station.

Dredging—Alpena, Mich.—Bids were received as follows, May 1, by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, Mich., for dredging channels at Alpena Harbor, Mich.: Greilling Bros. Co., Green Bay, Wis., 17c.; John B. Freemann, Toledo, Ohio, 19½c.; Muir-O'Sullivan Dredge & Dock Co., Port Huron, Mich., 21½c.; Great Lakes Dredge & Dock Co., Cleveland, Ohio, 29c.

★**Excavation**—Detroit, Mich.—(Official)—Bids will be received until noon, June 16 by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, for excavating at Fighting Island, Detroit River.

Post Office—Duquoin, Ill.—Bids will be received until 3 p.m., June 12, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at Duquoin.

✚Post Office—Harrisburg, Ill.—Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Harrisburg, to H. H. SHIELDS, Danville, Ill., at $53,317.

Post Office—Iowa Falls, Iowa. Bids were received as follows, May 6, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Iowa Falls: Rogers & Kaiser, Chicago, Ill., $49,748; J. W. Miller, St. Paul, Minn., $51,752; James Corse, Racine, Wis., $47,250; W. D. Lovell, Minneapolis, Minn., $49,985; Charles W. Strayer, Detroit, Mich., $46,800.

✚Dredging—Duluth, Minn. (Official). Bids will be received until noon, June 3, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, for dredging in Portage River Harbor.

✚Dredging—Duluth, Minn.—(Official)—Bids will be receive until noon, June 3, by Capt. E. D. Peek Corps Engrs., U. S. A., Duluth, for dredging at Superior Entry, Duluth-Superior Harbor.

Post Office, Moorhead, Minn.—Bids will be received until 3 p.m., June 23, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures) of the U. S. post office at Moorhead. The building will be two stories and basement, approximately 4100 sq.ft. ground area, of brick, faced with wood, stucco, and stone trimmings, tin roof and nonfireproof construction, except the first floor.

✚Stable and Sheds—Fort Riley, Kan. The contract has been awarded to SPANGLER & HUNTER, Junction City, Kan., for the construction of a stable and two rigging sheds, at about $10,000.

Bakery—Fort D. A. Russell, Wyo.—Bids will be received until 11 a.m., June 2, by Maj. J. A. Cole, Const. Q. M., U. S. A., Fort D. A. Russell, for remodeling the bakery at the post.

★Canal—Babb, Mont.—(Official)—Bids were received by the U. S. Reclamation Service, Babb, Apr. 28, for the construction of 22 miles of the St. Mary Canal Milk River Project, Mont. The work involves the excavation of about 1,201,000 cu.yd. of material and extends along the St. Mary River from Lower St. Mary Lake to the North Fork of Milk River in the northwest portion of the Blackfeet Indian Reservation, Mont. The bids follow: (a) Schedule 1, including 267,000 cu.yd. excavation, Class 1; 10,000 cu.yd., Class 2; 500 cu.yd., Class 3; overhaul 16,500 sta. cu.yd.; (b) Schedule 3, including 496,500 cu.yd. excavation, Class 1; 10,000 cu.yd., Class 2; 10,000 cu.yd., Class 3; 1,170,000 cu.yd. sta. overhaul; (c) Schedule 4, including 428,000 cu.yd. excavation, Class 1; 5000 cu.yd., Class 2; 1000 cu.yd., Class 3; 281,000 cu.yd. overhaul; (d) grand totals: Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb., (a) $140,730; (b) $212,675; (c) $159,170; (d) $512,575; Winston Bros. Co., Minneapolis, Minn., (c) $120,150; Cardston Construction Co., Cardston, Alta, (c) $104,030.

★Cement—Dallas, Tex.—(Official)—Bids will be received until noon, June 6, by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, for furnishing about 3000 bbl. of portland cement, delivered at Crockett, Tex.

★Bulkhead—Port O'Connor, Tex.—(Official)—Bids will be received until noon, May 20, by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, Tex., for the construction of a creosoted pile bulkhead near Port O'Connor.

Roads and Walks—Fort Sill, Okla.—Bids will be received by the Constructing Quartermaster, U. S. A., Fort Sill, until 1 p.m., May 27, for the construction of roads and walks at Fort Sill.

Pump House and Pipe Line—Fort Sill, Okla.—Bids will be received until 10 a.m., June 2, by Capt. A. U. Faulkner, Q. M., U. S. A., Fort Sill, for the construction of a pump house and a 10-in. c.-i. water-pipe line, etc., at Fort Sill.

✚Post Office—McAlester, Okla.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of the post-office building at McAlester, to W. D. LOVELL, Minneapolis, Minn., at $123,000.

Post Office, Grand Junction, Colo.—Bids will be received until June 24, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Grand Junction. The building will be two stories and basement, with a ground area of approximately 5600 sq.ft.

Traveling Cranes—Bremerton, Wash.—The following bids have been received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for six electric traveling cranes for the navy yard, Puget Sound, Wash.: Northern Engineering Works, South Chene St., Detroit, Mich., $27,650; Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., $28,700.

★Rock Crushing Plant—Fort McDowell, Calif.—(Official)—Bids will be received until 11 a.m., June 4, by Capt. James Longstreet, Const. Q. M., U. S. A., Fort McDowell, for installing a rock crushing plant.

Wireless Station—Panama.—Bids were received as follows, May 10, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction and equipment of a high-power radio-station at the San Pablo site, Caimito, Canal Zone: (a) Construction of three towers; (b) wireless equipment; (c) work complete: Des Moines Bridge & Iron Co., Pittsburgh, (a) $123,941; August Mietze, 128 Mott St., New York, part only, $8340; Atlantic Communication Co., 47 West St., New York, (a) $293,200; (b) $178,950; $478,900; $245,450; $610,700; National Electrical Signalling Co., Farmers' Bank Bldg., Pittsburgh, (a) $146,950; (c) $278,500; Marconi Wireless Telegraph Co., Woolworth Bldg., New York, (a) $77,000; $74,091; $108,225; $83,668; $109,616; $66,198; $113,698; (b) $63,000; $120,000; Federal Telegraph Co., Merchants' Exchange Bldg., San Francisco, Calif. (a) $73,775, (b) $52,691, (c) $124,970. Brown Hoisting Machinery Co., 1103 St. Clair Ave., Cleveland, Ohio, (a) $107,800.

Buildings, Sewage Tanks—Hawaii.—(Official).—Bids will be received until 3 p.m., June 20, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction, complete, of latrine buildings, sewage purification tanks, and the connected piping at the quarantine station, Honolulu, H. I., in accordance with the specifications and the drawings, which may be obtained from the custodian of the station at Honolulu, or at the discretion of the Supervising Architect.

★Tower—Hawaii.—(Official).—Bids will be received until July 5 at the U. S. Engineer Office, Honolulu, H. T., for furnishing and erecting or for furnishing only, a 70-ft. steel searchlight tower of Scherzer type. Information may be obtained on application to Lieut.-Col. Thomas H. Rees, Corps Engrs., U. S. A., Custom House, San Francisco, Calif., or from Maj. W. P. Wooten, Corps Engrs., U. S. A., Honolulu.

Naval Hospital Buildings—Hawaii.—Bids were received as follows, May 10, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of the following buildings for the Naval Hospital at the Pearl Harbor Naval Station: An administration building, two ward buildings, subsistence building, laboratory, operating building, laundry, stable, mortuary, two quarters for officers, quarters for bachelor officers, hospital corps quarters, nurses' quarters, pharmacist's quarters, four civilian employees' quarters, connecting passages, servants' quarters and wash houses: W. N. Conoannon Co., San Francisco, Calif., $241,970; Spalding Construction Co., Chamber of Commerce Bldg., Portland, Ore., $237,939; Pearson Construction Co., 754 New York Block, Seattle, Wash., $297,828; Lord-Young Engineering Co., Ltd., Honlulu, H. T., $278,298.

Building—Hawaii—Bids will be received until 11 a.m., June 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of officers' quarters at the naval station, Pearl Harbor, H. T. Estimated cost, $23,000.

Building—Hawaii—Bids will be received until 11 a.m., June 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of gunners' quarters at the U. S. naval magazine, Kuahua Island, Pearl Harbor, H. T. Estimated cost, $14,000.

MISCELLANEOUS

Tunnels and Subways—Boston, Mass.—A bill was favorably reported in the State Senate, May 7, providing for the construction of a system of tunnels and subways from Sullivan Sq., Charlestown, through the cities of Everett and Malden, under the Mystic River, and calling for the removal of the present elevated railroad in this section, the cost to be assessed proportionately on the cities affected.

Dredging—Boston, Mass.—Bids were received as follows, Apr. 23, by the Harbor and Land Commissioners, Boston, for dredging a channel to Eel Pond, Falmouth: (a) Per cu.yd. for dredging, (b) per cu.yd. for removing boulders over one cu.yd.: J. H. Lettenety, Boston, Mass., (a) $1.39, (b) $11.80; J. S. Packard Dredging Co., Providence, R. I., (a) $1.49, (b) $24.

✚Stable—Springfield, Mass.—The contract has been awarded to BURGESS, LANG & CO., Boston, Mass., for the construction of a stable for the Springfield Warehouse Co. Estimated cost, $20,000.

Comfort Station—Providence, R. I.—Martin & Hall, Archs., Industrial Trust Bldg., Providence, have completed plans for the construction of a comfort station and waiting room on the Exchange Place Mall. It will be 28x21 ft., of iron and glass. W. F. Slade is Comr. Pub. Wks.

Barge Canal Work—Albany, N. Y.—The Governor has signed the bill providing for the reappropriation of about $775,000 for the improvement of Cayuga and Seneca Canals.

Bath Building—New York, N. Y.—(Official)—All bids received on May 6 by the President of the Borough of Manhattan, for the construction o a public bath and gymnasium, have been rejected. The following item "A," furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St., Boro. Manhattan, in accordance with specifications without consideration of any alternative; item "B," for furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St. Manhattan, in accordance with specifications (page 63), calling for ceramic-mosaic tile for swimming pool; and item "C," for furnishing all the labor and materials required for the erection and completion of a Public Bath Building and Gymnasium, to be located at 407 to 413 West 28th St. T. Kennedy & Co., (A) $137,845; (B) $136,629; (C) $131,864; William Flanagan, (A) $140,840; (B) $140,110; (C) $137,840; P. F. Kennedy Co., (A) $134,885; (B) $136,397; (c) $131,217; John H. Parker Co., (A) $142,750; (c) $138,250; Joseph Balaban Co., (A) $132,385; (B) $126,385; Thomas J. Buckley Engineering Co., (A) $132,959; (B) $132,959; (C) $129,959. George McAneny is Pres. Noted May 1.

White Quartz Grit—New York, N. Y.—(Official). The following bids were received May 8, by the Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., for furnishing and delivering washed white quartz grit, in Forest and Highland Parks, Boro. of Queens; Robert T. Boyd, 103 Park Ave., $1.95 per yd.; Cannon Engineering Co., 1397 Metropolitan Ave., Brooklyn, $2.39 per yd.; Peace Bros., Flushing, L. I., $2.65; Henry Steers, Inc., 17 Battery Place, $2.10 per yd. Charles B. Stover is Comr.

Cement, Sand, Etc.—New York, N. Y.—(Official)—Bids will be received until noon, May 22, by the Dept. of Docks and Ferries, Pier A, North River, for furnishing and delivering cement, sand, broken stone, cobblestone and rip-rap stone. R. A. C. Smith is Comr.

Road Oil, Sand, Repair, Etc.—(Official)—New York, N. Y.—Bids will be received until 3 p.m., May 15, by the Dept. of Parks, Fifth Ave. and 64th St., for repairs to the roof of the elephant house, in the Zoological Park, in the Borough of the

Bronx, furnishing and delivering 1000 cu.yd. of sand, and delivering 60,000 gal. of road oil for Boro. The Bronx. Charles B. Stover is Pres.

Channel Excavation—Riverhead, (L. I.) N. Y.—The Governor has signed the bill appropriating $25,000 for deepening and widening the channel of Peconic River from Indian Island to the Riverhead town dock.

+Fire Alarm Telegraph System—Syracuse, N. Y.—The contract has been awarded by the city to the INDIA RUBBER CO., Bristol, R. I., for the completion of the fire alarm telegraph system, at $52,656.

Park Work—Newark, N. J.—The Board of Chosen Freeholders is considering a bond issue of $275,000 for park work.

Road Machinery—Trenton, N. J.—E. A. Stevens, State Comr. of Pub. Rds., Trenton, will receive bids until 11 a.m., May 19, for road machinery and road binders, including three 3-wheel steam rollers, three 3-wheel gasoline rollers, six road machines, three scarifiers, six sprinkling wagons, 18 dump wagons, four underslung stone wagons, two tank wagons, road-working tools, blacksmith tools, carpenter tools, and camping outfits; standard Lignir road binders, in carload lots of not less than 4000 gal.; standard inorganic binders, in carload lots; and standard bituminous binders, in carload lots of not less than 4000 gal. Specifications are on file at the office of the Commissioner at the State House.

Harbor Work—Trenton, N. J.—The U. S. Government will soon ask for bids for the improvement of Trenton Harbor between Lalor St. and the Pennsylvania R.R. Bridge.

+Bath House—Baltimore, Md.—The contract has been awarded by the Board of Awards to C. HERBOLD & CO., for the construction of a concrete bath house at Gwynn's Falls Park.

Tunnel—(A correction)—Richmond, Va.—It was erroneously noted May 1 that a tunnel would be constructed in Richmond. The item should have been noted under Los Angeles, Calif.

Police Alarm System—Roanoke, Va.—The city has awarded the contract for installing a police alarm system to the GAMEWELL ELECTRIC Co., of New York, N. Y., at $10,000.

Excavation—Concord, N. C.—Bids will be received until May 24 by John A. Scott, Secy. Bd. Drainage Comrs., Concord, for excavating about 237,000 cu.yd. from Big Cold Water Creek.

Drainage District—Linden, N. C.—The plans and final report on Stewart Creek Drainage District have been approved by Harnett County. C. J. Smith, Down, N. C., is Atty. for the district. W. K. Allen, Wilmington, N. C., is Drainage Engr.

Fire Stations—Birmingham, Ala.—The city is considering the construction of two new fire stations, one to be located at Fairview and the other at East Birmingham.

Drainage Bonds—Belzoni, Miss.—Bids are being received by the Commissioners of Belzoni Drainage District, Belzoni, for $450,000 of drainage bonds.

Tunnel—Chattanooga, Tenn.—The County Finance Committee, May 1, authorized the County Judge to borrow $14,000, the amount necessary to finish the Missionary Ridge tunnel according to the County Engineer's estimate.

Wall—Chillicothe, Ohio—The city is considering the concrete wall along the river front. F. C. Arbenz is Chn. Com. in Charge.

Pier—Cleveland, Ohio—(Official)—Plans have been prepared for the construction of a large passenger-boat pier. The plans include the designs of office buildings, freight sheds. The designs have been prepared by William S. Lougee. E. B. Thomas, Cleveland, is Asst. Engr.-in-Charge of River and Harbor Improvement.

+Dredging—Lorain, Ohio—The contract has been awarded by the city to the TWO RIVERS DREDGING CO. for dredging from the end of the deposit caused by the recent floods. The estimated cost of the work is $15,275.

Dock Work—Sandusky, Ohio—The Pennsylvania Lines west of Pittsburgh plans to spend about $1,000,000 for improvements to its docks at Sandusky. E. G. Erieson, Pittsburgh, Penn., is Principal Asst. Engr.

Ditch—Upper Sandusky, Ohio—The Commissioners of Hardin, Wyandotte and Hancock Counties are planning to construct Potato Creek Ditch, about 10 miles in length. Elmer Hilty, Findlay, Ohio, is Engr.

Stable—Indianapolis, Ind.—H. McK. Landon, Hume Mansur Bldg., Indianapolis, is considering the construction of a stable to cost $10,000.

Pier—Holland, Mich.—The Graham & Morton Transportation Co. and the Grand Rapids, Holland & Chicago Ry. Co., Holland, will construct a new pier at Jenison Park, Holland, to cost $25,000.

Tile and Ditch Work—Assumption, Ill.—Bids will be received until May 24 by the Commissioners of Drainage District No. 5, at the City Hall, Assumption, for tile and ditch work.

+Channel Work—Chicago, Ill.—The contract has been awarded to SCHNABLE & QUINN, Chicago, for excavation and collateral work on Contract No. 10 Calumet-Sag Channel by the Sanitary District of Chicago, at $495,412.

Amphitheater—Chicago, Ill.—Plans have been completed by J. D. Yorke, Arch., Chicago, for the construction of the proposed amphitheater. The plans have been submitted to the West Park Commissioners. Estimated cost, about $35,000.

Drainage Pipe Line—Tingley Park, Ill.—Bids will be received until 2 p.m., May 24, by William Funk, Clk., Union Drainage District No. 4, Tingley Park, for laying a pipe line 5.6 mi. in length. Size of pipes follow: 1855 ft. of 30-in. pipe, 1900 ft. of 24-in. and 2100 ft. of 20-in. Plans may be seen at the office of William Funk, Drainage Clk., Tingley Park, and at the office of Francis A. Harper, Atty., Roanoke Bldg., Chicago, Ill.

+Drainage Ditch—Manitowoc, Wis.—The contract has been awarded to CAPT. CHARLES A. GREEN, Appleton, Wis., for the construction of a drainage ditch to cost about $100,000.

Drain—Jefferson, Iowa—Bids will be received until May 19, by B. S. McCully, County Audr., Jefferson, for the tile for Drain No. 84.

+Drain—Nevada, Iowa—The following contracts have been awarded by C. A. Batman, County Audr., Nevada, for the construction of Drain No. 49: Labor, to THOS. BLAKEMORE, Nevada, at $8273; tile, MONMOUTH MINING & MFG. CO. Monmouth, Ill., at $19,599. The work includes the following: 3500 ft. 33-in.; 3000 ft. 30-in.; 3500 ft. 28-in.; 2400 ft. 26-in; 1000 ft. 24-in.; 1500 ft. 22-in.; 800 ft. 20-in.; 3050 ft. 16-in.; 850 ft. 12-in.; 800 ft. 10-in.; 550 ft. 10-in.; 300 ft. 8-in.; 200 ft. 8-in.; 625 ft. 8-in.; 800 ft. 12-in.; 175 ft. 8-in.; and 400 ft. 8-in. tile; 4 cu.yd. concrete; six inlets. Bids were opened May 2.

Levee Work, Etc.—Oskaloosa, Iowa—Bids will be received until May 22 by the county for work in Drainage District No. 2 approximately 30,000 cu.yd. levee embenkment, reinforced concrete sluiceway, with sluice gate complete, 20,530 lin.ft. 4- to 16-in. drain tile. E. F. Bridges, is Engr., Askaloosa.

Coal Dock—Duluth, Minn.—The Clarkson Coal & Dock Co., Pioneer Bldg., St. Paul, Minn., is planning to construct an extension to its coal dock at Duluth.

Fire Station—New Duluth, Minn.—The city is planning to erect a fire station to cost about $10,000.

Ditch—Mankato, Minn.—(Official)—Bids will be received until 2 p.m., May 24, by J. C. Jensen, County Audr., Mankato, for the construction of Judicial Ditch No. 7.

Ditch—Warren, Minn.—Bids will be received until May 28 by A. G. Lundgren, County Audr., for constructing Ditch No. 28, requiring the excavation of 229,214 cu.yd., clearing right-of-way, 50 acres, and leveling 15 miles of roads. Estimated cost, $26,121.

Ditch—St. James, Minn.—Bids will be received until May 24, by J. C. Jensen, County Audr., St. James, for the construction and completion of Judicial Ditch No. 7. Estimated cost, $40,721.

Levees—New Madrid, Mo.—The city is considering the construction of levees. H. S. Riley is Chn. of the Com.-in-Charge.

Levee—Palmyra, Mo.—The Marion County Commissioners, Palmyra, are considering the construction of a levee along the bottom lands between North River and Dunsford.

Levee—Pocahontas, Ark.—The city is considering the construction of a levee along the Black River east of the city as a protection from floods.

Drainage—Bloomington, Tex.—The citizens have voted $54,000 of bonds for the construction of drains and ditches.

Ditches—Houston, Tex.—Bids will be received until May 24 by J. O. Ralston, Chn. Bd. of Drainage Comrs., District No. 6, 304 Commercial Bank Bldg., Houston, for the construction of drainage ditches. J. S. Burk, 304 Commercial Bank Bldg., Houston, is Engr.

Dock—Seattle, Wash.—The Northern Pacific Ry. Co. has been granted permission to repair its dock at 1201 Railroad Ave. Estimated cost, $20,000. A. R. Cook, Tacoma, Wash., is Price Asst. Engr.

Ditches—Tacoma, Wash.—M. R. Thompson, County Engr., Tacoma, has completed plans for reclaiming about 2000 acres of tide lands by the construction of eight miles of ditches. Estimated cost, $10,000.

Docks—Astoria, Ore.—The Port of Astoria Commission has passed resolutions to issue $800,000 of bonds for the construction of municipal docks.

River Improvement—Sacramento, Calif.—It is planned to spend $34,200,000 for the Sacramento River Improvement project.

Concrete Walls—San Ventia, Calif.—Mabry McMahan is preparing to ask for bids for the construction of six miles of concrete retaining walls and a swimming tank 600x100 ft. Howard Holmes, San Francisco, is Engr.

Pier—St. John West, ... B.—(Official)—Bids will be received until 4 p.m., May 20, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a pier at St. John West.

Drydocks—Ottawa, Ont.—The Canadian Government is considering the construction of three new drydocks to be located at Halifax, N. S., Quebec, Que., and Esquimalt, B. C. The docks will each be 115 ft. in length. R. C. Desrochers, Ottawa, is Secy. Dept. Pub. Wks.

+Dredge Machinery—Ottawa, Ont.—The Department of Public Works has awarded to F. H. HOPKINS, Montreal, Que., the contract for the machinery at the Hudson Bay terminal at $13,500.

Lock Gates—Peterborough, Ont.—Bids will be received until May 26 by L. K. Jones, Asst. Deputy Minister and Secy., Dept. of Ry. and Canals, Ottawa, for lock gates, Ontario-Rice Lake Division, Trent Canal. Plans may be seen at the office of the Superintending Engr., Peterborough.

BUILDINGS

Boston, Mass.—A Students' House is to be erected on the Fenway. It will be six stories, of brick. Kilbane & Hopkins, 9 Park St., are Archs.

Boston, Mass.—The proprietors of the Boston Athenaeum voted May 5 to enlarge the building by addition of three stories and also of a sub-basement to the present structure. Bigelow & Wadsworth, are Arch., 3 Hamilton Place. The estimated cost is $300,000. A. W. Longfellow, Geo. C. Cabot, and Wm. L. Putnam, Committee.

+The contract for remodeling the Adams St. School has been awarded to FREDERICK CURTIS. Cost $45,000.

Cambridge, Mass.—A large hotel and several apartment houses are planned by the City Realty Trust on the Charles

River Parkway, near the University Press. The estimated cost is $600,000. Wm. L. Mowll, 50 Bromfield St., Boston, is Arch.

Hopedale, Mass.—A large industrial colony is contemplated, the plan involving 300 double wood tenements. Estimated cost, $2,000,000. The Draper Mfg. Co. is having the plans prepared.

Leicester, Mass.—An eight-room brick school will be erected this year on Pleasant St. The estimated cost is $37,500.

Lynn, Mass.—C. E. Rolfe and L. W. Besse, of the Besse-Rolfe Co., Lynn, Mass., have purchased a site at 179 to 184 Oxford St., upon which will be erected an office building.

Lynn, Mass.—A reinforced concrete milk depot will be erected on Alley St., West Lynn, for H. P. Hood & Sons Co., Boston. It will be 183x214 ft. The estimated cost is $100,000.

Millbury, Mass.—The Building Committee of the new High School opened bids May 10. All bids were rejected as too high and bidders will be asked to revise their figures. Revised bids will be received until June 7. Ira M. Goddard is Town Clk. Noted May 1.

✦Plymouth, Mass.—The Plymouth Cordage Co. has awarded a contract to the BENJ. FOX CONSTRUCTION Co., 15 Exchange St., Boston, for a warehouse to be built east of the railroad tracks, at the North Plymouth plant. It will be of reinforced concrete, 100x400 ft., four stories.

Springfield, Mass.—The Samuel M. Green Co. is preparing plans for a grammar school at the North End to replace the present Hooker School. The estimated cost is $50,000. Noted Apr. 24.

Waltham, Mass.—An addition to the Hill School at Milk and Heard Sts. is contemplated. The estimated cost is $45,000.

✦Providence, R. I.—The contract has been awarded to WM. WILLIAMS, 86 Weybosset St., for the erection of the new St. Margarets Home on Foster St. It will be four stories and basement 36x58 ft. of brick and stone, with a laundry, dry room and steam heating plant in basement.

Woonsocket, R. I.—Bids will be received until June 10, by W. F. Fountaine, Arch., Commercial Bldg., for the construction of a high school. The estimated cost is $100,000. Noted May 1.

East Windsor, Conn.—Bids will be received until 6 p.m., May 17, by the Building Committee, Wm. J. Brewster, Chn., Warehouse Point, Conn., for constructing additions to the graded school. Plans and specifications may be obtained of Mr. Brewster and at the office of W. H. and Henry McLean, Archs., Studio Bldg., 110 Tremont St., Boston, Mass.

Hartford, Conn.—Plans have been completed for a new high-school on Broad St. The main building will be 80x280 ft. with two wings 35x70 ft. and 80x80 ft. all two stories high, of brick, with brownstone and terra cotta trimmings. Davis & Brooks, 49 Pearl St. Hartford, Conn., are Archs.

✦Hartford, Conn.—The Hartford Electric Light Co. has awarded to CHARLES B. ANDRUS & SON, Hartford, the contract for the erection of a five-story office building, 100x131 ft., on Pearl St., at a cost of approximately $300,000. The building will be of steel and brick. Noted Apr. 24.

✦The Rossia Insurance Co., of Petersburg, Russia, has awarded to CHARLES B. ANDRUS & SON, the contract for the erection of a home office building, 95x135 ft., on Farnington Ave., at an approximated cost of $200,000. The material used will be limestone and brick.

Brown & Von Behren, Archs., 865 Chapel St., New Haven, Conn., have prepared plans for P. M. D'Esopo for a theater at Gold and Main Sts., to be 127x90 ft. and 60 ft. high, of fireproof construction. The specifications will be ready for bids soon.

Seymour, Conn.—Plans have been completed for a building on Main St., for Nonawauk Tribe, Improved Order of Red Men. The front, 50x100 ft. three stories high and will contain stores, lodge and club rooms, etc. In the rear, a theater will be built. Griggs & Hunt, 111 West Main St. Waterbury, Conn., are Archs.

Windham, Conn.—The town of Windham has voted an appropriation of $150,000 for erecting a new high school to replace the one recently destroyed by fire. George T. Taylor, R. E. Mitchell, W. D. Grant, A. L. Gelinos and M. Eugene Lincoln, compose the building committee.

Amsterdam, N. Y.—The Y. M. C. A. will erect a building at Amsterdam. William M. Charles is Chn., Ways & Means Com., 100 East Main St.

Bedford Hills, N. Y.—The following bids were received by the Board of Managers of the New York State Reformatory for Women, Bedford Hills, N. Y., for the Inmates Cottage at Farm Group: Construction work, Peter Keeler Bldg. Co., Albany, N. Y., $23,833; Maurice Mead, Albany, N. Y., $26,880; A. C. Nelson, Bedford Hills, N. Y., $28,087; L. H. Kenney, Port Chester, N. Y., $28,625; M. Staub, Mamaroneck, N. Y., $31,700; M. Doherty, New Rochelle, N. Y., $32,700; J. Balaban, New York City, $33,390; F. Basmussen, Rockaway Beach, N. Y., $39,080. Heating, R. T. Ford Co., Rochester, N. Y., $1895; W. B. Armstrong Co., Albany, N. Y., $1600; Peter Keeler Building Co., $1643; J. A. Scolley, Brooklyn, N. Y., $1874. Plumbing, Peter Keeler Building Co., $2623; W. B. Armstrong Co., $2700; R. T. Ford Co., $3200. Electric, Peter Keeler Building Co., $698; New York Construction Co., New York City, $934.

Brooklyn, N. Y.—Bids will be received until 3 p.m., May 22, by the Department of Parks, Fifth Ave. and 64th St., Manhattan; for the erection and completion of the general contract and electrical work of a comfort station located in Prospect Park; for the erection and completion of the general contract and electrical work for a comfort station located in Linton Park. Charles B. Stover is Comr.

Bids will soon be received by W. H. McElpatrick, Arch., 701 Seventh Ave. Manhattan, for the construction of a brick and steel theater on the north side of Ninth St., running through to 300 Eighth St., for B. F. Keith, 1495 Broadway, Manhattan.

✦Buffalo, N. Y.—The contract for the bank building to be erected at Main and Swan Sts., for the Manufacturers & Traders Bank, has been awarded to ROBERT E. WILLIAMS, Buffalo.

Buffalo, N. Y.—Furness, Evans & Co., Archs., Provident Bldg., Philadelphia, Penn., are preparing plans and will soon be ready for bids for a 12-story bank building, 77x149 ft., of granite, steel and marble, to be erected at Main and Swan Sts., by the Manufacturers and Traders National Bank. Robert L. Flyer is Pres. The estimated cost is $250,000.

Colson & Hudson, Archs., 35 Dun Bldg., have completed plans and are ready for bids for a Social Building, 68x98 ft., two stories and basement, to be erected at 570 Delaware Ave., by the Congregation of the Temple Beth Zion, Adolph Spangenthal is Chn. Bldg. Com., Huron & Washington Sts. The estimated cost is $40,000.

George A. Dietel, 676 Riley St., is taking bids for a three-story and basement church and school, 57x110 ft., of stone, brick, steel and litholite, to be erected on Gelder St. by St. Bartholomus R. C. Church. The estimated cost is $40,000.

★Hudson, N. Y.—Bids will be received until noon, May 31, by Miss Mary Hinckley, Pres., Bd. of Mgrs., State Training School for Girls, Hudson, for the construction, heating, plumbing and electric work for a school building; also for the construction, heating, plumbing and electric work for Cottages 13 and 14, and branch and trunk conduits, at the New York State Training School for Girls, Hudson. Charles A. Sussdorf is Acting State Arch., Capital, Albany, N. Y.

★Letchworth Village (Thiells post office), N. Y.—Bids for construction, heating, plumbing and electric work for Cottages A, B, C and D, at Letchworth Village, Thiells, will be received until 1 p.m., May 23, by Frank W. Vanderlip, Pres., Bd. of Mgrs., Letchworth Village, Room 215, No. 55 Wall St., New York City. Charles A. Susdorff, Capital, Albany, N. Y., is State Arch.

New York, N. Y.—Goldwin, Starrett & Van Vleck, Archs., 45 East 17th St., have been selected by William H. Chesebrough, 115 Broadway, to prepare plans for the construction of a 20-story office building at the northwest corner of State and Whitehall Sts. It will be 130x87 ft.

Plans have been filed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a 12-story loft structure, 87x45 ft., on the north side of 28th St., east of Madison Ave., for the Fabian Construction Co., 37 East 28th St. The estimated cost is $175,000.

Beverly S. King, Arch., 103 Park Ave., has been commissioned by the Engineers Club, 32 West 40th St., to prepare plans for an addition to its present building. The new structure will be erected in the rear, at 23 West 39th St., and will be six and one-half stories high, 100x25 ft. The estimated cost is $100,000.

✦The contract for the construction of alterations to the building of the Training School for Women Nurses, 426 East 26th St., has been awarded to EDWIN OUTWATER, 208 Fifth Ave., at $80,000. Parish & Schroeder, 12 West 31st St., are the Archs.

Plans have been completed by Rouse & Goldstone, Archs., 38 West 32nd St., for the construction of a 12-story apartment house, 120x102 ft., at 755 Park Ave. and 102 East 72nd St., for the E. A. L. Holding Co., 505 Fifth Ave. The estimated cost is $800,000.

Plans have been completed by Rouse & Goldstone, Archs., 38 West 32nd St., for the construction of a 12-story apartment house, at Park Ave. and 77th St., for the 850 Park Ave. Corp., 220 Fifth Ave. The estimated cost is $500,000.

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of two eight-story apartment houses, 85x82 ft., on the south side of 87th St., east of Amsterdam Ave., for the Princeton Construction Co., 30 East 42nd St. The estimated cost is $500,000.

✦The PERLMAN WORKS INC., 1735 West Farms Road has been awarded the contract for all the ornamental iron work necessary for the 11-story automobile building, which the Aeon Realty Co., 17 Madison Ave., will erect at 247 West 55th St. The Hasco Construction Co., 17 Madison Ave., has the general contract. Walter Haefeli, 17 Madison Ave., is the Arch. The estimated cost is $250,000.

Plans have been filed by A. J. Bodker, Arch., 62 West 45th St., for alterations to two seven-story apartment houses at 24 to 28 West 59th St., owned by Alexander S. Cochran, 527 Fifth Ave. The estimated cost is $90,000.

Plans have been filed by Peabody, Wilson & Brown, Archs., 389 Fifth Ave., for the construction of a 12-story apartment house, 48x50 ft., at the southwest corner of 76th St., and Broadway, for W. W. Astor, London, England. The estimated cost is $400,000.

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a 12-story apartment house at Riverside Drive and 142nd St., for Newmark & Davis Inc., 435 West 119th St. The estimated cost is $500,000.

Schwartz & Gross, Archs., 347 Fifth Ave., have completed plans for the construction of a 12-story apartment house, at the southwest corner of 160th St. and Colonial Parkway, for Albert J. Schwarzler, 1150 Clay Ave. The estimated cost is $800,000.

Robert M. Silverman, builder, Convent Ave. and 149th St., will soon select an architect to prepare plans for the construction of a 10-story apartment house at the corner of Riverside Drive and 150th St. It will be 125x102 ft.

Plans have been filed by Lawlor & Hasse, Archs., 69 Wall St., for the construction of a five-story dwelling, 90x75 ft., on the north side of 120th St., east of Amsterdam Ave., for Mrs. Susan Devon, 220 West 105th St. The estimated cost is $100,000.

✦(Borough of Queens)—(Official)—The Department of Education, Park Ave. and 59th St., Manhattan, has awarded a contract to J. F. WALSH & BRO., 193 Lexington Ave., Manhattan, for the construction of new Public School 94, Boro. of Queens. The other bidders were: Frymier & Hanna Co., $77,700; Edward Stapleton, $98,700; Concord Construction Co., $91,875; Peter Chary, $84,342; William D. Moore, $80,513; T. A. Clarke, $93,330; Richard E. Himmingham, $88,808; James McArthur, $96,800; H. C. Stowe Construction Co., $95,500; Joseph Balaban Co., $77,577; Warner Bartels Co., $91,447; William H. Egan, $81,861. Bids were received May 5.

(Boro. of Richmond)—Bids will be received until 2:30 p.m., May 22, by the Dept. of Public Charities, foot of East 26th St., Manhattan, for furnishing all the labor and materials required for the construction and equipment of a dining hall building, kitchen, service building and bakery at the New York City farm colony, Boro. of Richmond. Michael J. Drummond is Comr.

Niagara Falls, N. Y.—The Board of Public Works is considering plans for a public market, to be erected by the city. Wm. Laughlin is Mayor.

+Rochester, N. Y.—Contracts have been let for a 4-story and basement warehouse, for the Co-Operative Foundry Co. as follows: Masonry, HENRY STALLMAN; carpentry, ANTHONY LINK. Jas. H. Oberlies is Arch., 838 Granite Bldg.

Syracuse, N. Y.—Chas. E. Colton, Arch., Kirk Bldg., is preparing plans for an 11-story hotel, 122x150 ft., of brick, stone and steel, to be erected at East Genesee and North Clinton Sts., by the Clinton-Genesee Realty Co. for Bassett & Neally, of the Vanderbilt Hotel. The estimated cost is $750,000.

Atlantic City, N. J.—J. Fletcher Street, Arch., Beverly, N. J., is preparing plans for alterations to the bank building of the National Union Trust Co.

Bloomfield, N. J.—Joseph Green is letting plans prepared by Frank Grad, Arch., 137 Springfield Ave., Newark, for a two-story brick and reinforced-concrete building 50x164 ft., to be erected on Bloomfield Ave., Bloomfield. The structure will be used as a moving-picture theater, and is estimated to cost $45,000.

+Englewood, N. J.—The general contract has been awarded to the W. H. WHYTE CONTRACTING CO., for alterations to the Liberty St. school. J. K. Ferry, 42 Brookside Ave., Englewood, and 1 Madison Ave., New York City, are Archs.

Jersey City, N. J.—St. Joseph's Home for the Blind contemplates the erection of a three-story home for the blind on Pavonia Ave., near Baldwin Ave. The estimated cost is $100,000.

+Jersey City, N. J.—A contract has been awarded to M. T. CONNOLLY CONTRACTING CO., Jersey City, for the erection of a four-story, brick club house, 75x100 ft., at Grand and Warren Sts., for St. Peter's Catholic Church, at $47,000.

+Kearney, N. J.—The New York Telephone Co. has awarded a contract to the E. E. PAUL CO. for the erection of an exchange building on Midland Ave., Kearny, at $26,995.

Newark, N. J.—The congregation of B'Nai Jeshurm, Louis Schlesinger, Chn. Bldg. Com., will erect a temple at High St. and Waverly Ave. The estimated cost is $165,000.

Newark, N. J.—Bids will be received until 8:30 p.m., May 26, by the Committee on Public Bldgs., of the Common Council, City Hall, Newark, for the construction of a public market on the Market Plaza, Commerce and Mulberry Sts. Hooper & Conover Archts., 115 Market St., Newark. Noted Apr. 10.

E. V. Warren, Arch., 22 Clinton St., is preparing plans for the construction of a church and dormitory for the United Presbyterian Assembly, at Dickerson and Fourth Sts. The estimated cost is $10,000.

Passaic, N. J.—It was erroneously noted in the issue of May 8, that Alex Seebas, Arch., 85 Quincy St., was preparing plans for the construction of a theater. The architect writes that no such work is contemplated.

Princeton, N. J.—Princeton University will erect a new infirmary to comprise three 4-story buildings, to be used as a general hospital, contagious disease hospital and domestic service departments respectively. The structures are estimated to cost $150,000.

South Bound Brook, N. J.—J. N. Pierson & Son, Archs., Perth Amboy, N. J., have completed plans for the erection of a new school here.

+Trenton, N. J.—The contract has been awarded to F. W. VAN LOON, Denckla Bldg., Philadelphia, Penn., for the construction of the five-story brick office building at 218 State St., for the Delaware & Atlantic Telephone & Telegraph Co. Noted Mar. 27.

West Orange, N. J.—At the annual school election, the citizens approved appropriations of $122,000 for the erection of a new high school and auditorium, and $20,000 for a new school in the southern section. The high school will be of hollow tile, fireproof construction.

+Apollo, Penn.—The contract has been awarded to ANDERSON & KRAMER, New Castle, Penn., for the construction of the two-story school building for the Board of Education.

Butler, Penn.—Bids have been rejected for the construction of the Y. M. C. A. building, on South McKean St. New bids will be received as plans are being revised. Noted Apr. 24.

Crafton, Penn.—Press C. Dowler, Arch., Arrott Bldg., Pittsburgh, Penn., is receiving bids for the construction of a three-story brick and terra cotta fireproof school at Noble and Ridge Aves., for the Board of Education. The estimated cost is $100,000. Noted Apr. 3.

Duquesne, Penn.—Bids will be received until 1 p.m., May 22, by L. L. Cannon, Secy., Bd. of Education, for the construction of a high school. Carlisle & Sharrer are Archs., 7119 Jenkins Arcade Bldg., Pittsburgh, Penn.

+East Pittsburgh, Penn.—The contract has been awarded to the E. A. GROTH CONSTRUCTION CO., for a three-story brick and cement plaster office building, to be erected in Lincoln Ave., for the Union R.R. Co. Thomas H. Scott is Arch., Machinery Bldg. The estimated cost is $65,000.

Glen Lyon, Penn.—C. L. Lathrop & Co., Archs., Peoples' Bank Bldg., are preparing plans for the construction of a school at Glen Lyon. It will be two stories of stone and reinforced brick. The estimated cost is $15,000.

Johnstown, Penn.—J. E. Lucas, Arch., is preparing plans for a three-story brick school addition at Clay and Market Sts., for the Board of Education. The estimated cost is $80,000.

+Harrisburg, Penn.—The contract has been awarded to WILLIAM S. MILLER, Harrisburg, for the construction of the Y. W. C. A. building. Zantzinger, Borie & Medary are Archs. 15th and Walnut Sts., Philadelphia, Penn.

+Monessen, Penn.—The contract has been awarded to the WESTMORELAND LUMBER CO., for the construction of the lodge building for the Loyal Order of Moose. Noted Mar. 27.

+Philadelphia, Penn.—The contract for the construction of the loft building at 1106 Arch St., for John J. McLoughlin, has been awarded to the BROWN-KING CONSTRUCTION CO. Ballinger & Perrot are Archs., 1211 Arch St., Philadelphia.

+The contract has been awarded to ARCHIBALD MACTAVISH, 1515 Pine St., Philadelphia, for the construction of the four-story reinforced-concrete building for the Home Life Insurance Co., at 506 Walnut St.

Thomas, Churchman & Molitor, Archs., 1309 Walnut St., are preparing plans for the construction of a brick and stone church at 51st and Spruce Sts., for the Church of the Mediator. The estimated cost is $60,000.

+The contract for the construction of the three-story high school for Girard College, has been awarded to J. S. CORNELL & SONS, 233 Land Title Bldg. It will be 130x190 ft. of brick. The estimated cost is $600,000.

+The contract has been awarded to FLEISCHMAN BROTHERS & CO., New York, for the construction of Nixon-Nirlinger-Loew Theater and hall at Germantown and Maplewood Aves.; the hall and lobby entrance to the theater will occupy the Germantown Ave. front, and the theater will stand on the rear of the lot. The entire lot is 75 ft. on Germantown Ave., with a depth of 240 ft., and a frontage of 125 ft. on Maplewood Ave. The estimated cost is $250,000. Thomas W. Lamb, Philadelphia, is Arch.

J. Horace Cook, Arch., Bd. of Education, City Hall, is preparing plans for the construction of the Kensington High School for Girls, at Ann and Tulip Sts.

Pittsburgh, Penn.—Bids will be received about June 15, by Kiehnel & Elliott, Archs., Publication Bldg., for the construction of the tuberculosis hospital at Leach Farm. The estimtaed cost is $175,000. Noted May 8.

W. G. Wilkins Co., Westinghouse Bldg., will soon have plans for an office and factory building, 45x116 ft., at 16th and Pike Sts., for the Standard Underground Cable Co. The estimated cost is $75,000.

+South Bethlehem, Penn.—The contract for the construction of the gymnasium building at Lehigh University, has been awarded to the CHARLES McCAUL CO., Philadelphia, Penn. Noted Mar. 6.

+Williamsport, Penn.—The contract has been awarded to METZGER & WELLS, 441 Heed Bldg., Philadelphia, for the construction of the seven-story, brick, stone and steel building, for the First National Bank.

Baltimore, Md.—The Board of Awards, James H. Preston, Mayor, will receive bids until May 21, for the construction and erection of an addition to School No. 83, at Lakewood Ave., and Lyons St. Plans obtainable at the office of Clarence E. Stubbs, Inspector of Bldgs., City Hall.

Cambridge, Md.—Bids will be received about Aug. 1, by Parker, Thomas & Rice, Archs., Union Trust Bldg., Baltimore, for the construction of the Eastern Shore Hospital for the Insane. The estimated cost is $165,000. Noted May 8.

Salisbury, Md.—Bids will be received until May 29, by Captain S. A. Douglass, Armory Comn., for the construction of an armory 100x160 ft. Brinckloe & Cannon are Archs., Easton, Md.

Richmond, Va.—The Richmond Trust & Savings Co. contemplates erecting a 12-story building at Seventh and Main Sts.

Charleston, W. Va.—H. Rus Warne, Arch., Capitol St., is asking bids on the construction of a four-story brick warehouse for the Hubbard Grocery Co. The building will be 100x153 ft.

Charleston, W. Va.—Frankenberger Bros., of Charleston, W. Va., have authorized Weber, Werner & Adkins, Archs., Perin Bldg., Cincinnati, Ohio, to prepare plans for a four-story, 43x140 ft., warehouse and storeroom.

+Charlotte, N. C.—The contract has been awarded to J. A. GARDNER, Charlotte, for the construction of a five-story and basement hotel for the Mecklenburg Hotel Co., Wheeler & Stern are Archs., Realty Bldg., Charlotte.

Huntsville, Ala.—Bids will be received about June 15, by C. K. Colley, 33 Life & Casualty Bldg., Nashville, Tenn., for the construction of a court house, 105x136 ft. The estimated cost is $65,000. Noted May 8.

Louisville, Ky.—The Seelbach Hotel Co., Louisville, Ky., will erect an eight-story annex. It will be of steel frame construction and will cost $100,000.

+Bellaire, Ohio—The contract has been awarded to the ABERNATHY-DOELKER CONSTRUCTION CO., for the city hospital at Bellaire. F. L. Packard is Arch., 1212 Hayden Bldg., Columbus. Cost, $50,000.

Brookville, Ohio—A. J. Bryan, of the Falls City Construction Co., Louisville, Ky., has been selected to draw the plans for the Bracken County courthouse, at Brookville, which is to cost $50,000.

Cincinnati, Ohio—The William Miller Estate, of Cincinnati, Ohio, has recalled its original plans for an eight-story mercantile building, on its Fourth St. property, and has now arranged for the erection of an 18-story addition to the Union Savings Bank and Trust Co.'s building adjoining. The plans for this building will be made by D. H. Burnam & Co., Chicago, Ill. The improvement will cost $300,000.

Elzner & Anderson, Ingalls Bldg., Cincinnati, Ohio, Archs., for the 12-story Procter & Gamble office building to be erected at Eighth and Race Sts., will receive bids this month.

Cleveland, Ohio—The Andrews Fireproof Storage Co., a new concern growing out of the Andrews Cartage Co., is to erect a six-story fireproof storage house on Hough Ave., near East 31st St.

+Contracts have been awarded for the construction of a school at Castlewood Aves., East 123rd St. and Chesterfield

Aves. as follows: Masonry, PHILIP KIRSCHNER & CO., Cuyahoga Bldg., $26,990; carpentry, JOHN MOORE, Lenox Bldg., $10,363; concrete and fireproofing, PEERLESS STRUCTURAL CONCRETE CO., Columbia Bldg., $14,000; steel work, NAT'L IRON & WIRE CO., $5795; metal studding and lathing, A. LAYER CO., $2865; plastering, EUCLID PLASTERING & CONTRACTING CO., Cuyahoga Bldg., $2415. Noted Apr. 10.

+Dayton, Ohio—The contract for the construction of the addition to the Stivers High School has been awarded to the STRUCTURAL CONCRETE CO., Dayton, at $181,000.

+Youngstown, Ohio—Contracts for the construction of the school at Grace and Hillman Sts., have been awarded as follows: Masonry, HELLER BROS., Youngstown, Ohio; carpentry, F. HOHLOCK. Noted Apr. 24.

Aurora, Ind.—Garber & Woodward, Archs., 905 Andrews' Bldg., have been retained to prepare plans by Dr. H. H. Sutton, Aurora, for the construction of a library at Aurora.

Peoria, Ill.—The Carr Adams Co. will erect a warehouse on South Washington St. It will be six stories, 50x176 ft. The estimated cost is $40,000.

La Crosse, Wis.—The construction of a temple is being considered by the Loyal Order of Moose of this city. J. T. Weart, Oyen Block, is in charge. The estimated cost is $50,000.

+Madison, Wis.—The State Capitol Commission has awarded a contract in connection with the new $6,000,000 capitol as follows: Granite for the approaches to the capitol awarded to the WOODBURY GRANITE CO., Hardwick, Va., at $194,000.

Milwaukee, Wis.—Plans for a public tuberculosis sanitorium for Milwaukee County have been prepared by Robert Messmer & Bros., Archs., 1004 Majestic Bldg., Milwaukee. A special committee of the County Board of Supervisors is having the plans approved by the State Board of Control at Madison, after which the County Board will issue bonds for $500,000 for this work. Construction work alone will cost approximately $450,000.

+Oshkosh, Wis.—The general contract for the construction of the home for the B. P. O. E., has been awarded to C. R. MEYER & SONS, Oshkosh. It will be erected on Jefferson St., north of the Federal Building, and will be 180x120 ft. Robert A. Messmer & Bros., Milwaukee, are Archs. The estimated cost is $60,000.

Superior, Wis.—Bids will be received until May 26, for the construction of an addition to the Carpenter School. L. A. Nichols is Secy. The estimated cost is $65,000. F. H. Irons is Arch.

Keokuk, Iowa—The Chicago Rock Island & Pacific Ry. will erect a freight depot and warehouse at Keokuk. The estimated cost is $50,000. J. B. Kilpatrick is Mech. Supt., First District, Des Moines, Iowa.

+Duluth, Minn.—The general contract has been awarded to CHARLES DANIELSON, for the construction of the hotel at Second Ave. West, and Superior St., for the Gopher Real Estate Co.

+Salina, Kan.—The contract for the construction of St. John's Catholic Hospital has been awarded to NELSON & SON, Salina, Kan., at $84,843. Noted Apr. 3.

Grand Island, Neb.—Bids will be received until 8 p.m., May 31, by Bayard H. Paine, Secy., Y. M. C. A. Bldg. Com., Grand Island, for the construction of a four-story and basement brick Y. M. C. A. building.

Bolivar, Mo.—Bids will be received until noon, May 19, by W. L. Stufflebaum, Secy., Bd. of Trustees, of South West Bantist College, for the construction of a college building, at Bolivar.

St. Louis, Mo.—Bids will be received until noon, May 23, by W. T. Findly, Secy., Bd. of Pub. Impvts., New City Hall, St. Louis, for the construction of the first section of the jail.

+Dallas, Tex.—The contract has been awarded to L. R. WRIGHT & CO., 106 Field St., Dallas, Tex., for the construction of a theater, for G. K. Jorgensen. Noted May 1.

Houston, Tex.—Houston Lodge No. 151, B. P. O. E., has purchased a site at San Jacinto St. and Walker Ave., upon which will be erected a lodge building.

Orange, Tex.—Bids will be received until June 1, by Harry Creighton Ingalls, 15 East 40th St., for the construction of a theater, office and arcade building, 81x224 ft. The estimated cost is $200,000.

Waco, Tex.—Bids will be received until May 20, by J. C. Lattimore, Secy., School Bd., for the construction of a two-story and basement brick school. T. Brooks Pearson, 1509 Amicable Bldg., Waco, is Arch.

+Seattle, Wash.—The contract has been awarded to C. F. MARTIN, 446 New York Block for the construction of a $75,000 reinforced concrete store and hotel building at First Ave. and Stewart St. for J. P. Jones, 704 Hamlin St.

Spokane, Wash.—The M. C. Weir Co. will erect a five-story and basement hotel at Second Ave. and Wall St. It will be 142x13 ft. The estimated cost is $250,000.

+Los Angeles, Calif.—A contract has been awarded to the BARBER-BRADLEY CONSTRUCTION CO., 1824 East 15th St., on a percentage basis, to erect a brick building on Main St., for Emil Olcovich, and associates. The building will be three stories, 130x100 ft., with a one-story brick moving picture theatre, 60x85 ft. in the rear. John F. Blee, Union League Bldg., is Arch.

Oakland, Calif.—L. B. Dutton Co., Archs., Chronicle Bldg., San Francisco, have completed plans for the construction of an 11-story Class A office building, to be erected at 16th and San Pablo Aves., Oakland, for the First Trust and Savings Bank. All work except structural steel will be awarded in a general contract. The construction will be fireproof throughout. The exterior will be faced with pressed brick and terra cotta. Noted Mar. 13.

Richmond, Calif.—The following bids have been received by J. Narbett, Arch., for the erection of a four-story brick lodge building, to be erected for the B. P. O. E.: Ward & Goodwin, $44,325; Flut & Morton, $44,333; J. O. Pierce, $45,678; Robinson & Place, $48,937; M. Leiter & Son, $46,877; Stockholm & Allyn, $46,877; Peterson & Wilson, $48,883; C. E. Doty, $46,568; Newsom, Wolf & Kahn, $47,530.

+San Diego, Calif.—A contract has been awarded to the JOHN ROBERTS CO., Lankershim Bldg., Los Angeles, and Union Bldg., San Diego, at $82,800, for the erection of a four-story, basement and sub-basement addition to the Union Bldg., at San Diego, for John D. Spreckles. The addition will be 50x100 ft., of reinforced-concrete construction. Harrison Albright, Los Angeles and San Diego, is Arch.

+San Diego, Calif.—The contract has been awarded to H. C. FENTON, for the construction of a hotel at Fifth and A Sts. Henry Lord Gay is Arch., 557 McKenzie Bldg. The estimated cost is $100,000.

Plans are being prepared by W. L. Barker, Arch., San Diego, for the construction of a six-story hotel at 10th and E Sts., for Dr. Fred Stauffer, of Salt Lake City. The estimated cost is $150,000.

San Francisco, Calif.—The following bids were opened by the Buildings and Grounds Committee of the Panama-Pacific International Exposition Co., for the construction of the Liberal Arts Building: (a) with lumber; (b) without lumber: Reece & Rountree, (a) $226,000; (b) $327,500; James L. Brown, (a) $286,000; (b) $386,000; F. Rolandi, (a) $265,650; (b) $360,000; Strehlow-Freeze & Peterson, (a) $247,700; (b) $332,020; Lange & Bergstrom, (a) $226,924; (b) $322,598; Commary-Peterson Co., (a) $251,300; McLeran & Peterson, (a) $245,000.

+Joseph Cahen, Arch., 45 Kearny St., awarded the contract to WM. VAN HENRICK, 218 23d Ave., for the construction of a three-story brick store building, on Bush St., for Lois Friedman. Amount, $112,850.

INDUSTRIAL NOTES

The American District Steam Co., of North Tonawanda N. Y., has announced the opening of its new Pacific Coast offices in the Hoge Bldg., Seattle, Wash. Mr. Eugene I. Barnes will be in charge as District Mgr.

The American Bridge Co., 30 Church St., New York, N. Y., has announced that after May 1 the Buffalo, N. Y., office of the company will be located in the Marine National Bank Bldg., Main and Seneca Sts.

The Exeter Machine Works, manufacturers of elevating and conveying machinery, Pittston, Penn., has opened a Pittsburgh office at 945 Olwin Bldg. Mr. S. C. Webb, formerly of the Diamond Machine Co., will be in charge as Sales Manager.

Steel Corporation Earnings—The report of the U. S. Steel Corporation for the quarter ending Mar. 31, shows net earnings of $34,426,801, against $35,185,557 for the preceding quarter, and $17,826,973 for the quarter ending Mar. 31, 1912.

The Denver, Northwestern & Pacific Ry.—The property of the Denver, Northwestern & Pacific Ry., popularly known as the Moffat Road, was sold Apr. 28 for $3,000,000, to the bondholders of the road, who were represented by Benjamin Strong, Jr., and George H. Burr.

A Receiver has been appointed for Ambrose B. Stannard, a contractor at 1790 Broadway, New York, N. Y. Henry A. Wise, former district attorney, has been appointed receiver. Most of the contracts on which Mr. Stannard worked were for the government, including post offices in Gettysburg, Penn., Bangor, Maine, Cordele and Waycross, Ga., as well as a power plant for an arsenal at Watertown, Mass. Some time ago he was awarded contract for the Museum of Fine Arts in Boston, but was unable to finance the operations.

CATALOG NOTICES

Roe Stephens Mfg. Co., Detroit, Mich. Catalog F. Fire hydrants, water gates, sluice gates, etc. Illustrated, 44 pages, 6x9 inches.

Ransome Concrete Machinery Co., Dunnellen, N. J. Catalog No. 13. Concrete mixers, buckets, bar cutters, etc. Illustrated, 76 pages, 6x9 inches.

North Western Expanded Metal Co., Old Colony Building, Chicago, Ill. Booklet. "Econco" expended metal. Illustrated, 12 pages, 6x9 inches.

Davis-Bouronville Co., Marion Station, Jersey City, N. J. Oxy-acetylene welding and cutting apparatus. Illustrated, 32 pages, 7x10 inches.

C. O. Bartlett & Snow Co., Cleveland, Ohio. Bulletin No. 40. Garbage disposal machinery. Illustrated, 20 pages, 6x9 inches.

The Cook Railway Signal Co., Gas and Electric Building, Denver, Colo. Catalog. Re Viv O dry storage battery. Illustrated, 3½x9 inches.

Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 101. Single line grab bucket. Illustrated, 12 pages, 6x9 inches.

Link-Belt Co., Chicago, Ill. Book No. 170. Portable wagon loaders. Illustrated, 12 pages, 8½x11 inches. Book No. 124. Steel chains. Illustrated, 50 pages, 6x9 inches.

The Stark Rolling Mill Co., Canton, Ohio. Text Book. Toncon metal. Illustrated, 70 pages, 5x8 inches.

National Tube Co., Frick Building, Pittsburgh, Penn. Booklet. Matheson joint pipe. Illustrated, 40 pages, 8x10 inches.

The United States Graphite Co., Saginaw, Mich. Catalog No. 19. Graphite products. Illustrated, 46 pages, 7x10½ inches.

The Toledo Pipe Threading Machine Co., Toledo, Ohio. Pamphlet. "A Pipe Threading Miracle." Illustrated, 48 pages, 5x7 inches.

American Sheet & Tin Plate Co., Pittsburgh, Penn. Pamphlet. "Copper in Steels—the Influence on Corrosion." Illustrated, 12 pages, 7x10 inches.

Detroit Steel Products Co., Detroit, Mich. Catalog V. Fenestra solid steel windows. Illustrated, 76 pages, 8½x10½ inches.

David Lupton's Sons Co., Philadelphia, Penn. Catalog No. 7. Steel sash, partitions, doors, sash operating device, metal windows, etc. Illustrated, 64 pages, 8½x11 inches.

Hoskins Mfg. Co., 453-71 Lawton Ave., Detroit, Mich. Bulletin No. 3. Thermo-electric pyrometers. Illustrated, 48 pages, 6x9 inches.

CONTRACT PRICES

Canals—Great Falls, Mont.—Bids for the constructing the Pishkin Reservoir supply canal and tunnels, and the Sun River Slope canal, Sun River Project, were received by the U. S. Reclamation Service, Apr. 30. J. B. Bond is Project Engr., and H. N. Savage, Superv. Engr. The bids were as follows: (A) Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb.; (B) Winston Bros. Co., Minneapolis, Minn.; (C) MacArthur Bros. Co., New York; (D) Charles Wilhite & Co., Malta, Mont.:

Filters—Baltimore, Md.—The following bids were received, Apr. 30, by the Water Department, Filtration Division, for Contract 11, filters, basin and grading: (A) Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, Penn.; (B) New York Continental Jewell Filtration Co., 15 Broad St., New York, N. Y.; (C) Oscar Daniels Co., Woolworth Bldg., New York, N. Y. Ezra B. Whitman is Engr. These bids have been rejected as too high, and the contract readvertised. The item bids received were:

FILTERS, BALTIMORE, MD.

	A	B	C
12 acres clearing and grubbing	$100 00	$90 00	$100 00
107,000 cu.yd. earth excavation	80	85	95
700 cu.yd. rock excavation	4 00	3 70	3 50
69,200 cu.yd. earth embankment	.30	.30	.35
57 sq.yd. rolled embankment	.50	.50	.45
230 sq.yd. rubble paving	2 00	1 90	1 75
6 acres seeding	60.00	50.00	60.00
254 cu.yd. concrete, Class A	38.00	37.50	35.00
3690 cu.yd. concrete, Class B	13.90	14.00	14.50
5339 cu.yd. concrete, Class C	11.80	12.00	13.00
15,576 cu.yd. concrete, Class D	12.20	12.60	13.00
3883 sq.yd. special surfacing of concrete	.72	.65	.70
1,839,250 lb. steel reinforcement	.045	.05	.05
53,000 lb. miscellaneous steel	.10	.09	.10
35,500 lb. iron castings	.07	.07	.065
50 lin.ft. 24-in. terra cotta drains	2.00	2.10	2.50
200 lin.ft. 10-in. terra cotta drains	1.00	1.00	1.00
200 lin.ft. 6-in. terra cotta drains	1.00	1.00	.90
200 lin.ft. 4-in. terra cotta drains	1.00	1.00	.80
Wash water pumps (lump sum)	8,000	8,800	7,800
Underwriters pump (lump sum)	3,000	3,000	2,800
Sluice gates (lump sum)	29,000	36,500	38,000
Wooden baffles (lump sum)	3,000	2,900	3,500
Miscellaneous equipment (lump sum)	5,000	4,600	4,800
Filter Equipment (lump sum)	385,000	367,699	375,000
Totals	$971,187	$982,563	$1,016,525

Water Mains—New York, N. Y.—Bids for laying high pressure water mains and appurtenances in various streets were received by Henry Thompson, Comr. Water Supply, Gas and Electricity, Apr. 21, as follows: (A) Beaver Engineering & Contracting Co.; (B) Connors Bros.; (C) Mulcahy & Williams; (D) Joseph J. B. LaMarsh; (E) Soraci Contracting Co. (F) Louis D. Gregory; (G) A. L. Guidone & Co., Inc.; (H) Joseph Burns; (I) Knight & DeMicco; (J) Carfagno & Dragonetti; (K) F. N. Lewis.

CANALS, SUN RIVER PROJECT, MONTANA

	A	B	C	
610,000 cu.yd. excavation, Class 1	$0.25		$0.23	
27,000 cu.yd. excavation, Class 2	0.40		0.40	
112,000 cu.yd. excavation, Class 3	0.99		0.75	
95,000 cu.yd. overhaul	0.02		0.02	
90,000 cu.yd. rolled embankment	0.07		0.12	
Totals, Schedule 1	$282,380		$247,800	
687,000 cu.yd. excavation, Class 1	0.26½		0.27	
56,000 cu.yd. excavation, Class 2	0 42½		0 40	
34,000 cu.yd. excavation, Class 3	1.00		0.75	
14,000 cu.yd. overhaul	0.02		0.02	
27,000 cu.yd. rolled embankment	0.07		0.12	
Totals, Schedule 2	$242,025		$236,910	
408,000 cu.yd. excavation, Class 1	0.21½	0.24	0.17	0.18
9,000 cu.yd. excavation, Class 2	0.37½	0.45	0.40	0.60
6,000 cu.yd. excavation, Class 3	0.95	1.00	0.75	1.00
7,000 cu.yd. overhaul	0.02	0.02	0.02	0.02
2,000 cu.yd. rolled embankment	0.07	0.25	0.15	0.04
Totals, Schedule 3	$97,075	$108,610	$77,900	$85,060
360,000 cu.yd. excavation, Class 1	0.21½	0.24	0.19	0.18
75,000 cu.yd. excavation, Class 2	0.37½	0.45	0.40	0.50
25,000 cu.yd. excavation, Class 3	0.96½	1 00	0.75	1.00
5,000 cu.yd. overhaul	0.02	0 02	0.02	0.02
Totals, Schedule 4	$130,588	$145,250	$117,250	$127,400
5,800 cu.yd. excavation in open cut, Class 1	0.25	0.45	0 25	
700 cu.yd. excavation in open cut, Class 2	0.40	0.45	0 50	
8,500 cu.yd. excavation in open cut, Class 3	0.99	1.00	0.80	
980 lin.ft. tunnel, including lining	60.00	63.00	47.00	
350 cu.yd. concrete in portals	15.00	15.00	20 00	
42,000 lb. placing reinforcing steel	0.03	0.03	0 02	
Totals, Schedule 5	$75,455	$79,675	$62,500	
6,400 cu.yd. excavation in open cut, Class 1	0.25	0.45	0.25	
100 cu.yd. excavation in open cut, Class 2	0.40	0.45	0.50	
3,000 cu.yd. excavation in open cut, Class 3	0.99	1.00	0 80	
2,235 lin.ft. tunnel, including lining	55.00	63.00	47 00	
320 cu.yd. concrete in portals	15.00	15.00	20 00	
38,000 lb. placing reinforcing steel	0.03	.03	0.02	
Totals, Schedule 6	$133,475	$152,670	$116 250	
Totals, individual bids	$960,998	$436,295	$858,615	$212,460

HIGH-PRESSURE WATER MAINS, SECTION 1, NEW YORK, N. Y.

	A	B	C	D	E	F	G	H
7450 tons c.i. pipe	$27 70	$26.55	$27.88	$32.50	$23.50	$29.50	$32 40	$35 50
1225 tons c.i. lug pipe	33 45	30.00	33.38	35.00	28.00	32.50	37.20	36 00
1075 tons castings, Class 1	65 65	64 52	62 38	80.00	55.00	68.00	70.00	79 00
340 tons castings, Class 2	59 90	49 00	51 38	60.00	50.00	68.00	60.00	79 00
310 tons miscellaneous castings	48.10	54 25	51.38	50 00	45.00	58.00	50 00	63 00
58 tons cast-steel specials	151 90	117.25	136.38	300 00	120 00	200 00	300 00	243 00
46 valves, 20-in.	405.15	254 00	281 04	400 00	275 00	360 00	400 00	365 00
40 valves, 16-in.	318 90	176 00	205.54	300 00	170 00	250 00	270.00	260 00
195 valves, 12-in.	224 00	91 50	312 20	200 00	88 00	150 00	150 00	156 0
579 valves, 8-in.	167 70	40 30	72 54	100 00	38 50	80 00	60 00	74 60
850 cu.yd. earth excavation	1.00	1 00	1.01	1 25	.95	1 50	1.20	1 15
8000 cu.yd. rock excavation	1.01	5 50	.01	8 00	3 00	3.50	4 60	7 50
6750 cu.yd. masonry excavation	1.30	5 75	.01	4 00	.95	.01	3 00	2 20
5700 lin.ft. 24-in. pipe, laid	.01	.99	.90	3 50	1 00	1.65	1 25	.90
8200 lin.ft. 20-in. pipe, laid	.01	.89	.80	2 75	1 00	1.40	1 15	1.40
10,000 lin.ft. 16-in. pipe, laid	.01	.61	.71	1.15	.75	1.25	1 05	1.35
75,000 lin.ft. 12-in. pipe, laid	.01	.50	.61	.90	.50	.95	.90	1.30
12,000 lin.ft. 8-in. pipe, laid	.01	.45	.01	.45	.50	.50	.50	.67
100 lin.ft. 30- and 18-in. low-pressure pipe, relaid	.01	5 28	1 58	.70	.01	2.00	5 00	5.00
200 lin.ft. 16- to 24-in. low-pressure pipe, relaid	.01	1 10	.86	.60	.01	1.00	4.00	3.00
4000 lin.ft. 12-in. low-pressure pipe, relaid	.92	.70	.53	.35	.35	.40	1.00	1.20
4000 lin.ft. 6- and 8-in. low-pressure pipe, relaid	.60	.65	.01	.30	.35	.01	.75	1.10
800 lin.ft. 4-in. low-pressure pipe, relaid	.50	.60	.01	.30	.01	.01	.50	.70
40 valves, 20-in., set	153 25	9 25	54 90	50.00	81.00	.01	10 00	43 00
40 valves, 16-in., set	118 15	8 95	50 87	45 00	81.00	.01	10 00	35 00
195 valves, 12-in., set	110 85	6 36	76 73	40.00	81.00	.01	10 00	32 50
579 valves, 8-in., set	136 05	4 80	18 11	35 00	81.00	.01	10.00	28 00
579 tie-beams, handled and set	145.25	6.85	75.17	40 00	81.00	35.00	20.00	46 00
7000 sq.ft. 1-in. lead-lined pipe	.40	.45	.01	.20	.01	.30	.40	.26
250 cu.yd. brick masonry	14 40	15.00	12 54	17.00	5.00	15 00	12 50	17 00
2,200 cu.yd. concrete	9 20	12.50	8 74	8 50	10 00	10 00	9 00	9 00
150 cu.yd. concrete	11.50	12.00	6.74	11.50	10.00	15.00	9 50	10 00
70,000 ft. b.m., lumber	.01	20 00	.01	16.00	.01	25.00	45 00	37 00
300 cu.ft. wrought iron and steel	.04	.05	.032	.05	.01	.07	.06	.06
1000 sq.ft. limestone flagging	.12	.12	.04	.05	.01	.01	.16	.05
2,000 sq.ft. concrete sidewalk	.23	.20	.18	.15	.10	.01	.20	.30
1000 sq.ft. excavating	.01	.22	.01	.60	.01	.50	.25	.10
500 sq.yd. asphalt pavement	.01	2 42	.01	3 00	3.00	3.50	3.50	4 85
500 sq.yd. asphalt pavement	.01	1 75	2 65	3 00	2.00	3.50	3 25	4 85
500 sq.yd. asphalt pavement	.01	2 80	2 65	3 55	.01	3.50	3 50	4 85
1200 sq.yd. asphalt pavement	.01	2 80	1 00	3 65	2 00	2.50	2 00	2 60
1500 sq.yd. asphalt pavement	.01	1 00	.30	.60	1.00	.01	1 00	1 60
900 sq.yd. asphalt pavement	.01	3 60	4 01	4 20	4.00	1 50	4.00	5 85
250 cu.ft. brick masonry	.30	.90	.20	.15	.50	.50	.30	.80
400 cu.yd. concrete	1 15	1 88	.70	.50	.01	1 00	1 00	4 00
70 lin.ft. pipe conduit	.01	3 00	3 00	3 00	.01	5 00	5 00	5 00
400 lin.ft. pipe conduit	2 90	1 50	2 50	2 00	.01	3 00	5 00	5 00
400 sq.yd. 4-in. pavement	1 75	1 50	.80	1 80	.01	2 00	1 00	5 00
800 cu.yd. concrete pipe	1 15	1 38	1 25	1 50	.01	.01	1 50	4 30
150 cu.yd. concrete pipe	2 30	6 60	2 00	2 50	.01	.01	1 50	9 30
1 cu.yd. lead pipe	.12	6 25	.01	.08	.01	.07	.07	.08
600 lin.ft. 16-in. piling	1.75	1 10	1 25	2 50	.50	2 00	2 50	3 00
120 lin.ft. 12-in. wrought iron pipe	6 90	4 68	11 25	3 50	.01	5 00	5 00	11 00
	$814,342	$821,434	$751,498	$1,105,263	$763,154	$902,152	$979,200	$1,158,198

HIGH-PRESSURE WATER MAINS, SECTION 2, NEW YORK, N. Y.

	A	B	I	J	K
310 tons cast-iron pipe	$27 70	$20 00	$25 50	$22 00	$30 00
78 tons cast-iron lug-pipe	33 45	32 00	30 50	25 00	35 00
65 tons castings, Class 1	65 65	70 00	60 00	50 00	65 00
7 tons castings, Class 2	59 00	53 00	52 00	40 00	65 00
22 tons miscellaneous castings	48 10	39 00	47 00	40 00	55 00
9 tons cast-steel castings	154 00	128 00	135 00	90 00	100 00
6 20-in. valves	692 00	279 00	250 00	450 00	350 00
3 16-in. valves	506 00	193 00	175 00	375 00	250 00
7 12-in. valves	122 00	95 00	90 00	325 00	150 00
4 8-in. valves	365 00	45 00	40 00	100 00	75 00
5000 cu.yd. earth excavation	.01	1 50	1 50	26	75
10 cu.yd. rock excavation	.01	10 00	5 00	.01	5 00
400 cu.yd. masonry excavation	.01	6 00	.01	.01	1 50
250 lin.ft. 24-in. pipe	.01	1 18	2 00	4 98	1 00
2500 lin.ft. 20-in. pipe	.01	1 06	2 50	4 98	.75
150 lin.ft. 16-in. pipe	.01	.73	1 00	3 50	.75
1200 lin.ft. 12-in pipe	.01	.60	1.75	3 50	.50
200 lin.ft. 8-in. pipe	.01	.54	1 06	.50	.40
50 lin.ft. 16- to 24-in. low-pressure pipe	.01	1.21	.01	.12	1 00
300 lin.ft. 12-in. low-pressure pipe	.01	.86	.01	.08	.50
300 lin.ft. 6- and 8-in. low-pressure pipe	.01	.70	.01	.05	.50
75 lin.ft. 4-in. low-pressure pipe	.01	.65	.01	.04	.25
7 20-in. valves	350 00	11 00	125 00	10 00	50 00
3 16-in. valves	345 00	10 74	250 00	10 00	50 00
8 12-in. valves	17 50	7 63	100 00	5 00	25 00
6 8-in. valves	12 65	5 76	10 00	5 00	25 00
6 high pressure hydrants, hauled and set	21 85	8 22	100 00	2 00	25 00
100 lin.ft. 1-in. lead-lined pipe	.01	.54	.01	.25	.25
30 cu.yd. brick masonry	14 00	14 90	.01	.01	15 00
150 cu.yd. concrete	.01	14 90	.01	.01	8 50
5000 ft. b.m. lumber	.01	20 00	.01	16 00	25 00
50,000 lb. wrought iron and steel	.001	.055	.07		.05
300 sq.ft. garden mold and sod	.40	.15	.01		.15
150 sq.ft. bluestone flagging	.12	.17	.01	.01	.15
500 sq.ft. cement concrete sidewalk	.25	.20	.01		.18
20 lin.ft. stone curbing	.01	.22	.01	.10	.50
1000 sq.yd. sheet asphalt pavement	.01	2.42	1.00		2 50
10 sq.yd. sheet asphalt pavement	3.00	1 84	1 00		2 50
1200 sq.yd. granite block pavement	.01	3 00	1 00		2 50
10 sq.yd. stone block pavement	.01	1 20	1 00		2 50
110 sq.yd. wooden block pavement	.01	4 00	4.00		4 00
200 lin.ft. 6-in. drain pipe	.30	1 20	.01		.50
75 lin.ft. vitrified sewer pipe	1.15	1 00	.01		1 00
25 lin.ft. pipe to insulate	.01	3 00	.01		1.50
75 lin.ft. pipe to insulate	.01	1 50	.01		3.50
200 sq.yd. 4-ply waterproofing	1 55	1 90	.01		3 50
100 house service pipes	1 15	5 26	1.50		3 50
5 house service pipes	2.30	7 92	2 00		5 00
2000 lb. lead pipe	.12	.0625	.06		.10
200 ton miles hauling	1.75	1.10	.01	.50	1.00
3 16-in. motor-operated valves	4000 00	620 00	1000 00	1200 00	750.00
50 cu.yd. water-tight concrete	11.50	17 00	.01	.01	10.00
800 lin.ft. 3 in. w. i. conduit	1.15	1.06	.01	.01	1 00
Totals	$47,276	$54,613	$48,927	$44,362	$47,738

Sewers—Newark, N. J.—Bids were received as follows, by the Passaic Valley Sewage Commissioners, Apr. 29, for Section 6 of the main intercepting sewer: (A) Pethick Bros. & Co., Inc., New York City; (B) Union Building & Construction Co., Passaic, N. J.; (C) Booth & Flinn, Ltd., Pittsburgh, Penn.; (D) Donlon Contracting Co., Brooklyn, N. Y.; (E) Nash Brothers, Chicago, Ill.; (F) Concrete & Foundation Co., New York City; (G) Culp Co., Inc., Brooklyn, N. Y.; (H) O'Gara & Maguire, Inc., Newark, N. J.; (I) William Horne Co., New York City; (J) Whiting-Turner Constructing Co., Baltimore, Md. The item bids were as follows:

SECTION 6, NORTHERLY PORTION, PASSAIC VALLEY SEWER, NEWARK, N. J.

	A	B	C	D	E
1600 lin.ft. earth excavation, in trench, for 150-in. concrete sewer	$60.00	$75.00	$108.00	$134.00	$152.00
4600 cu.yd. concrete masonry in trench	8.00	8.50	9.00	6.00	9 00
50 cu.yd. brick masonry, in manholes, and appurtenant work	20.00	16.00	15.00	20.00	20 00
300 cu.yd. rock excavation, in trench	5.00	3.00	3.00	1.00	4 00
Special steel and timber sheeting, etc., Station 26+75 to 28+75, lump sum	14,000	12,000	13,200	1.00	26,000
Totals	$149,300	$172,800	$229,050	$243,301	$312,800

SECTION 6, CENTRAL PORTION, PASSAIC VALLEY SEWER, NEWARK, N. J.

	A	F	D	E
1400 lin.ft. earth excavation in trench, for 150-in. concrete sewer	$65.00	$75.55	$95.00	$99.00
4500 cu.yd. concrete masonry, in trench	8.00	8.25	8.00	9.00
50 cu.yd. brick masonry, in manholes, and appurtenant work	20.00	16.00	20.00	20.00
300 cu.yd. rock excavation, in trench	4.00	6.00	5.00	4.00
Totals	$129,200	$145,495	$171,500	$181,300

SECTION 6, SOUTHERLY PORTION, PASSAIC VALLEY SEWER, NEWARK, N. J.

	A	G	H	I	B	J	D	F	E
1700 lin.ft. earth excavation, in trench for 150-in. concrete sewer	$49.00	$78.25	$73.00	$66.90	$64.00	$65.00	$80.00	$69.95	$83.00
5500 cu.yd. concrete masonry, in trench	8.00	6.95	8.00	7.50	8.50	8.70	8.00	8.25	9.00
100 cu.yd. brick masonry, in manholes, and appurtenant work	20.00	15.00	20.00	19.00	16.00	16.00	20.00	16.00	20 00
7000 cu.yd. rock excavation, in trench	3.00	.01	.50	2.50	3.00	2.90	.01	3.00	4 00
Totals	$150,300	$172,820	$173,600	$174,380	$178,150	$180,250	$182,070	$186,800	$220,600

Bulkhead—Boston, Mass.—Bids for constructing a bulkhead at East Boston were received by the Directors of the Port of Boston, Apr. 30, as follows: (A) Lawlor Bros.; (B) Rendle & Stoddard; (C) John Cashman & Sons Co.; (D) W. H. Ellis. H. P. Converse & Co. submitted a bid of cost +7½%. The bids were:

BULKHEAD, BOSTON, MASS.

	A	B	C	D	E
3300 lin.ft. oak piles and hard pine lumber	$14.18	$15.76	$15.32	$19.06	$30.00
7220 lin.ft. spruce piles and hard pine timber	12.49	12.24	13.04	14.34	25.00
980 lin.ft. spruce piles and spruce timber	12.49	12.24	13.60	12.63	25.00
11,500 lin.ft. of platform	1.25	1.20	1.68	3.09	1.50
Totals	$163,587	$166,176	$177,352	$214,345	$321,250

Road—Baltimore, Md.—Bids for constructing Road No. 1, Gunpowder Supply improvements, Contract 7, were received by the Water Department, Apr. 23. Ezra B. Whitman is Water Engr. The bids were as follows: (A) Thomas Mullon, Baltimore, Md.; (B) D. V. Ault & Co., Baltimore, Md.; (C) Piedmont Construction Co., Baltimore, Md.; (D) Mason Hilton & Co., New York, N. Y.; (E) King-Ganey Contracting Co., New York, N. Y.; (F) Whiting-Turner Construction Co., Baltimore, Md.; (G) Hassam Paving Co., Worcester, Mass.:

ROAD, BALTIMORE, MD.

	A	B	C	D	E	F	G
9 acres clearing and grubbing	$72 00	$350 00	$100 00	$200 00	$100 00	$200 00	$125 00
1000 cu.yd. stripping	15	25	16	.20	.15	.10	.40
13,210 cu.yd. earth excavation	39	85	45	.55	.50	.63	.69
12,000 cu.yd. loose rock excavation	.58	85	.85	.70	.75	.80	1.10
22,950 cu.yd. solid rock excavation	.69	85	1.10	1 30	2 00	1 61	2 00
400 cu.yd. rubble masonry	5 25	7.00	6.00	5.00	5.00	7 85	4 00
18 cu. yds. rock crusher	70 00	16.00	125.00	80.00	25 00	50.00	75.00
204 lin. ft. 24-in. reinforced concrete pipe	3 75	6.00	10.00	2 75	2 00	3.88	4 00
58 lin.ft. 48-in. reinforced concrete pipe	6 50	10 00	18.00	8.50	3 00	6 65	12 00
132 lin.ft. 72-in. reinforced concrete pipe	11 00	18.00	20.00	17.50	4 00	10.35	20 00
106 cu.yd. concrete in end walls	11 00	14.00	12.00	13.50	8 00	10.68	10 00
5597 sq.yd. macadam, 6-in. depth	1 00	1.10	1.38	1.40	.70	1.52	1.25
5597 sq.yd. macadam, 4-in. depth	.90	.90	1.20	1.10	.55	1.19	1.00
1000 lin.ft. underdrain, 6-in. terra-cotta pipe laid in broken stone	.60	.40	.80	.70	.40	.50	.70
200 sq.yd. paving	1 00	.90	1 50	.60	1.00	1.00	1.00
Totals	$47,650	$66,333	$70,017	$70,890	$74,904	$86,874	$91,701
Time of $15 00 per day	100 00	240 00	150.00	240.00	120.00	180.00	225.00
Grand totals	$49,156	$69,933	$72,297	$74,190	$76,704	$83,574	$95,576

Sewers—New York, N. Y.—Bids were received by the President of the Borough of Queens, Long Island City, Apr. 23, for the construction of sewers in Liberty Ave., from Lefferts Ave. to Nebraska Ave.: (A) Leo E. Kelly Inc.; (B) Henry R. Asserson; (C) Joseph L. Sigretto, Hunters Point Ave., Long Island City; (D) Joseph D. Benedetto; (E) Pethick Bros. & Co., Inc.; (F) Dunbar Contracting Co.:

LIBERTY AVE. SEWER, BOROUGH OF QUEENS, NEW YORK, N. Y.

	A	B	C	D	E	F
1197 lin.ft. 7 ft. x 8 ft. reinforced concrete sewer	$28.00	$23.63	$25 00	$26 00	$29 00	$28 20
538 lin.ft. 7 ft. 6 in. reinforced concrete sewer	29.50	23.63	18.87	23 00	26 00	26 54
1255 lin.ft. 7 ft. x 6 ft. reinforced concrete sewer	26.70	23.63	17.14	22 00	23 00	22 74
1063 lin.ft. 7 ft. x 5 ft. 6 in. reinforced concrete sewer	23.10	23.63	17.35	21 00	22 00	22 02
1196 lin.ft. 5 ft. reinforced concrete sewer	11 00	10.00	11.05	11.00	11 00	15.54
1014 lin.ft. 4 ft. 9 in. reinforced concrete sewer	10.90	7.00	9 51	10.75	9 00	13.52
21 lin.ft. 2 ft. 6 in. concrete sewer	10.00	5.00	8 08	8 00	7 00	8 40
Junction Chamber at Curtis Ave., lump sum	750 00	755 00	360.00	725.00	800 00	860 00
Junction Chamber at South View St., lump sum	850 00	480 00	280 00	375.00	600 00	600 00
Junction Chamber at Nebraska Ave., lump sum	750 00	373 00	300 00	350.00	500 00	490 00
Junction Chamber at Atlantic Ave., lump sum	750 00	650 00	290 00	550.00	800 00	860 00
380 lin.ft. 12 in. vitrified salt-glazed culvert pipe	1 50	1 80	1.25	1.50	4 00	2 25
60 lin.ft. 10 in. vitrified salt-glazed culvert pipe	1.50	0 80	1 25	1.00	3 00	2 25
80 risers for house connection	10 00	6.00	11 00	11.00	7 00	17 00
5 cleaning shafts	200 00	137.00	110.00	125.00	150 00	158 00
27 manholes complete	80 00	70 00	55.00	85.00	50.00	100 00
13 receiving basins	160 00	105.00	135.00	140.00	125 00	138 00
3 double receiving basins	300.00	175 00	90 00	225.00	250 00	232 00
10 cu.yd. concrete	8 00	10 00	8 00	0 01	10.00	7 00
1000 sq. feet for reinforcing	0 05	0 03	0 05	0 01	0 05	0 04
150M ft. B. M. timber for bracing	32 00	35.00	40.00	0 01	42 00	36 00
Totals	$148,317	$128,300	$116,395	$126,640	$139,336	$149,939

Sewer System—Albion, N. Y.—Bids for constructing a sewer system and a sewage disposal plant here, were received by the Board of Sewer Commissioners, Apr. 15, as follows: (A) Hagar & George, Newark, N. Y.; (B) Ripton & Murphy, Rochester, N. Y.; (C) Vanz Construction Co., Cumberland, Md.; (D) Barrally & Ingersoll, Rochester, N. Y.; (E) W. S. Cooper Co., Albion, N. Y.; (F) James S. Stabell & Co., Buffalo, N. Y.; (G) Flower City Contracting Co., Rochester, N. Y.; (H) Samuel Bonn, Syracuse, N. Y.; (I) S. M. Neff, New York; (J) F. J. Munn Co., Buffalo, N. Y.:

SEWER SYSTEM AND DISPOSAL PLANT, ALBION, N. Y.

	A	B	C	D	E	F	G	H	I	J
67 lin.ft. 9-in. vitrified pipe	$0 67	$0 676	$0.77	$0 72	$0 65	$0 60	$0 80	$0.75	$1 05	$0 97
2370 lin.ft. 10-in. vitrified pipe	81	.826	1.00	76	1 00	.90	.90	1.00	1 30	1 12
122 lin.ft. 12-in. vitrified pipe	1.00	1 06	1.10	86	1 25	1 00	1.10	1.35	1 15	1 20
550 lin.ft. 15-in. vitrified pipe	1.75	1 99	1.80	2 25	2 20	1 70	1.45	2 00	3 15	3 05
6460 lin.ft. 20-in. vitrified pipe	2.85	1 30	1 50	2 00	1 80	1 75	1.90	2 05	2 95	2 94
1000 lin.ft. 24-in. vitrified pipe	.53	.80	.85	1 25	1.50	1 50	1.60	.65	2 50	2 50
200 manholes	50 00	55 00	58 00	45 00	80 00	55 00	50.00	50.00	67 00	50 00
60 flush tanks	75 00	75 00	80 00	60 00	95 00	75 00	75.00	75.00	90 00	90 00
6000 cu.yd. rock in trenches	1.50	3 00	2.50	3.00	3 00	3.50	3.00	3.00	2 75	4 80
Engine and dynamo house complete	1500	1250	1300	1900	1855	2000	2855	3190	2550	3777
Pump house complete	1500	1250	1300	1900	1855	2200	2855	3190	2550	3977
1 set pump and engine foundations	.40	10	.55	10	.60	.58	.50	1.50	.40	.70
5 sets engine and dynamo foundations	2.50	2 50	2 00	2 00	2 40	2 20	2 00	3.00	2.75	2.75
3500 cu.yd. earth excavation	.25	.50	1 00	.20	.30	.55	.55	.50	.45	.55
1 gate house complete	100 00	100 00	100 00	20 00	280 00	125 00	50 00	20.00	60 00	45 00
1 gate house complete	.25	.50	.50	10	40	.35	.25	.90	.30	.45
2 sets gates complete	3 50	5 00	3 00	2 80	4 80	5 40	3.00	3.50	5 80	4 80
4 sets gates complete	2 75	3 75	3 00	2 40	5 00	10 00	3.00	5 70	4 70	10 00
2 sets gates complete	1 00	1 50	1 25	1 00	1 60	1 50	3.00	1 80	1 30	1 25
1 set gates complete	1 00	1 05	1 00	.80	1 20	1 50	2 75	2 00	2 30	2 00
1 set gates complete	1 25	1 50	1 15	.60	1 50	2 04	2 25	2.50	2 10	1 65
1 set gates complete	.90	1 00	1 00	1 50	1 00	1 50	1 00	1 55	1 10	1 35
5 sets gates complete	350 00	106 00	300 00	400 00	510 00	320 00	348 00	575 00	350 00	380 00
Connection to existing sewer	2 00	7500	8000	18 00	800 2	10,587	9002	7250	10,000	10,000
Drainage of tanks	1 00	2185	2100	2 00	1 35	1 50	1,200	1480	1290	1440
Grading	21 000	21 000	22,500	10,000	25,249	31,050	27 349	26,100	25,000	25,000
Sodding slopes	500 00	600 00	500 00	700 00	780 00	970 00	1,000	500	500 00	595 00
50 cu.yd. rubble masonry	2 00	10 00	10 00	10 00	12 00	10 00	8 00	12 00	10 00	10 00
1 fence	1 00	60 00	60 00	70 00	70 00	100 00	40 00	140 00	75 00	70 00
1 flagpole	00	5	50	00	1 00	1 00	1 00	50	80	60
2 signs	00 00	100 00	100 00	0 00	100 00	84 00	125 00	80.00	80.00	95 00
Totals	$445,491	$445,750	$447,420	$479 00	$466,575	$469,421	$471,774	$484,206	$499,965	$516,129

Catskill Aqueduct—New York, N. Y.—Bids for Contract 91, [illegible] were received by the Board of Water Supply, Apr. 20, and referred to Chief Engr. Hazen for tabulation. The successful bidder was Arthur Brothers Co., 25 Madison Ave., Brooklyn, N. Y.; [illegible] Industrial Co., 156 Fifth Ave., New York City; (C) Hedges & Hutchinson Co., Inc., 111 Broadway, New York City; [illegible]

CATSKILL AQUEDUCT, CONTRACT 91, NEW YORK, N. Y.

	A	B	C	D	E	F
240,000 lb. wrought iron, cast iron and steel	$ 0730	$ 10	$ 10	$ 1125	$ 16	$ 115
15,000 lb. bronze	31625	02	345	3125	685	906
1000 lb. copper	58	25	90	1.38	51	77
150M ft. B. M. timber and	150 00	100 00	118 00	145 00	150 00	134 00
Totals	$41,625	$40,250	$42,195	$51,141	$71,985	

Engineering News

VOLUME 69 MAY 22, 1913 NUMBER 21

The Hydro-Electric Development of the Braden Copper Co.

By C. G. Newton*

The Braden Copper Co., of Rancagua, Chile, built its hydro-electric plant on the Cachapoal River, in the Province of Colchagua, to furnish electric power for mining, ore hauling and for the concentrating and smelting establishment, etc.

Water is taken from the Cachapoal River, delivered through 7.9 miles of canal to the station forebay, and finally is passed through three 4-ft. steel pipe lines, under 150 ft. total head. The present installation consists of three 2000-kv.-a., three-phase, 2300-volt, 60-cycle, 600-r.p.m. alternators, directly connected to Francis-type turbines. There are two 100-kw., 125-volt, 720-r.p.m., direct-current exciters, direct connected to impulse wheels, and a 40-kw., 125-volt, 690-r.p.m. motor generator also direct connected to an impulse wheel.

The current is stepped up from 2300 to 33,000 volts, and transmitted 15.5 miles on a steel-tower transmission line to the mill substation, where it is stepped down to 2200 and 550 volts for distribution.



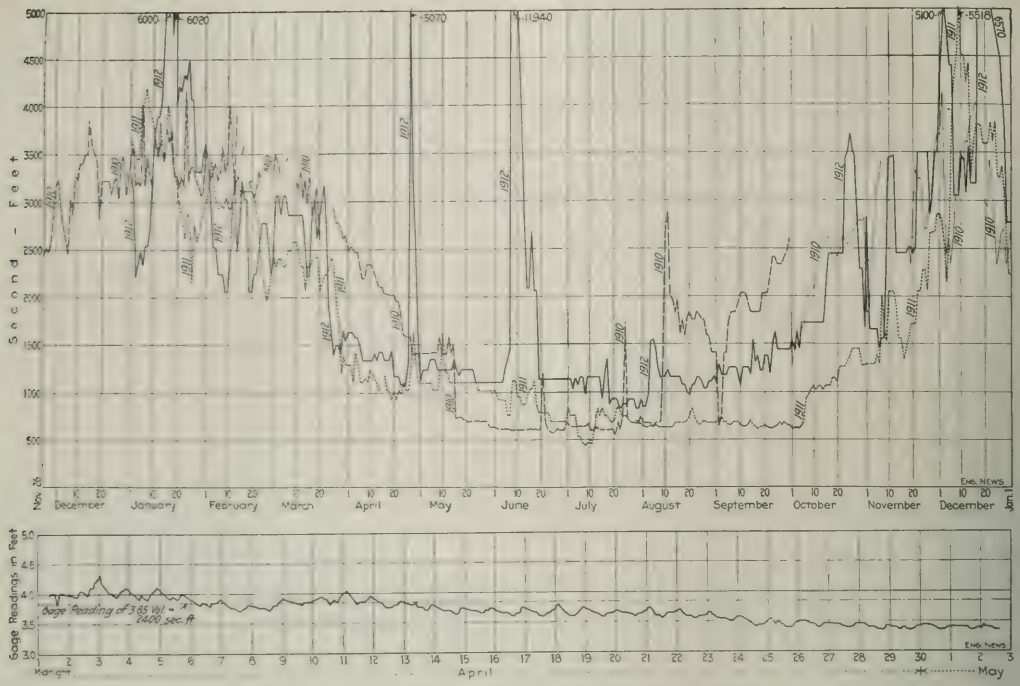
Dam and Headworks of the Braden Copper Co., Rancagua, Chile

Cachapoal River

The Cachapoal River has its source in the Andean Cordillera, which rises in this locality to 13,000 or 14,000 ft. The water supply comes from snow fields and, on most of the tributaries, from glaciers, some of them extensive. This source is apparent at the first inspection, as at all times the river carries a fine white sediment which requires days to settle, and which gives the water an appearance very similar to that of the glacier-fed rivers of Alaska.

The annual rainfall is from 15 to 27 in., practically all in the winter months of June to September. But the high-water period of the river is in the summer, December and January, when the flow of the Cachapoal amounts to from 5000 to 6000 sec.ft. In the winter low-water period, June and July, the flow falls to a minimum of about 500 sec.ft. At intervals of a few years, however, extraordinary floods occur, due to continued warm winds and rain on the snow fields. Last winter,

*Chief Engineer and Superintendent of Hydro-electric Construction, Braden Copper Co., Rancagua, Chile, S. A.



FIGS. 2 AND 3. HYDROGRAPHS OF THE CACHAPOAL RIVER

in June, 1912, a flood lasting a few hours only, passed 12,000 sec.ft. over the Braden dam and, as shown by driftwood and local records, a 100,000-sec.ft. flood passed the power-plant site a few years ago.

The river, having a slope of 60 ft. to the mile, is continually bringing down rocks and gravel of all sizes up to 10 or 12 in. in diameter, and also carries, in the summer high-water season, a considerable quantity of coarse, sharp sand, of first-class quality for concrete. It was necessary to make arrangements in the canal to eliminate these rocks and sands, otherwise the canal would have been rapidly filled up.

CANAL CONSTRUCTION

The canal was designed for a net capacity of 500 sec. ft. after wasting part of the water for sluicing out the rocks and sand and making allowance for filling up, vegetation, etc.

The intake works of the canal (see figure on preceding page) consists of a pudding-stone concrete dam, raised to a height of 12 ft. above the river bed and given an ogee curve on the apron. It has a reinforced-concrete intake structure with four steel inlet gates worked by hand gearing. This gearing is housed so as to not be carried away by floods. All material for the canal had to be hauled by ox-cart 25 miles from the railroad.

ROCK AND SAND OUTLETS.—For a distance of 1000 ft. below the intake, the canal has a grade of 0.003 (3.2 ft.), an average velocity of 8 ft. per sec. and a capacity of 1000 sec.ft. This was to allow for sufficient water for wastage at the rock outlet and sand-settling tank. This headrace is lined with masonry where necessary. At the end of the 1000 ft. headrace comes the rock outlet sluice (Fig. 4), regulated by two steel gates, set in concrete in the wall of the canal, one of which is always open 2 or 3 ft. The rocks are carried along by the swift current until they come to the rock outlet, where there is a drop of 2 ft. in the bottom of the canal, from whence they are discharged into the river.

One hundred feet below the rock outlet is the sand settling tank (Fig. 5) where the canal widens to 50 ft., for a length of 84 ft., and the average velocity decreases

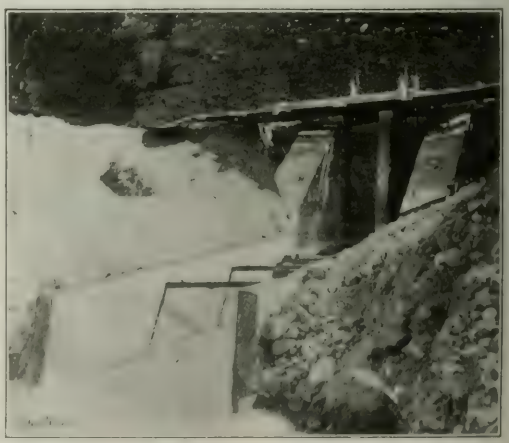


FIG. 4. ROCK-OUTLET SLUICE, BRADEN CANAL

SOME DETERMINATIONS OF THE VALUE OF THE COEFFICIENT [n] IN KUTTER'S FORMULA FOR THE FLOW OF WATER IN CANALS MADE FROM CAREFUL CURRENT-METER DETERMINATIONS OF THE FLOW IN BRADEN CANAL.

Condition of wetted surface	Depth of Water, ft	Top Width of Water, ft	Bottom Width of Canal, ft.	Grade of Canal	Volume of Water, ft per sec	Value of "n"
Sides are masonry walls with stones rounded, greatest projection of stones is 3 in. beyond joints. Bottom is fairly smooth cement over masonry floor.	7 4	18 0	10 2	0 00237	801 7	0 023
Sides are clay with few smooth rocks. Bottom half covered with rocks 3 to 8 in diam. Sides and bottom slightly uneven	6 0	17 48	11 48	0 0011	481 5	0 029
Loose Rock. Rock points project 3 to 6 in	7 0	16 39	11 16	0 0010	452 4	0 025
Section in medium hard rock. Few points project 3 to 12 in. Smooth section for rock	5 0	13 88	9 56	0 0011	277 7	0 024
Section in "adobe ground," sides water cut near water surface. In bottom some coarse gravel mixed with adobe	5 5	17 5	7 0	0 0010	396 6	0 022
Section in adobe ground with about 10% gravel. Sides are even and uncut	6 0	19 0	7 15	0 00092	292 2	0 026
Gravel section with about 30% earth. Sides are even and uncut	5 0	16 45	7 25	0 0010	255 7	0 022
Rock section. Rock is seamy and points project 3 to 12 in. Some holes in sides 12 to 15 in. deep	5 0	15 65	10 25	0 0011	230 7	0 029

from 8 to 1½ ft. per sec., thus dropping all the coarse sand, which is carried out through the bottom holes by a portion of the water. Below the sand tank, the water again acquires a velocity of 4½ ft. per sec., so that all sediment that is carried through the tank by a 1½-ft.

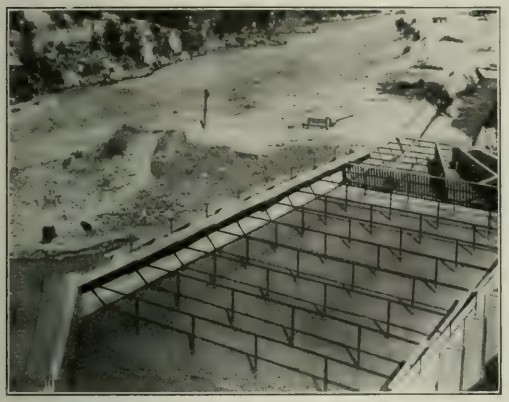


FIG. 5. SAND TANK, BRADEN CANAL

per sec. velocity is easily carried along the canal with no danger of deposition below.

The construction of the sand tank is shown by Fig. 6. There are 45 holes in the flat concrete bottom; they are arranged in nine rows of five each, which open into nine concrete pipes lined with old railroad rails, and tapered diverging towards the outlet, so as to maintain approximately the same velocity at all sections. These 45 holes are opened by horizontal steel-plate gates, sliding in cast-iron guides, and worked by hand wheels at the top of the side walls, which hand wheels drive bevel gears attached to the gate stems. The outlet holes are generally wide open, carrying out the deposited sand and a portion of the water flowing in.

The sand tank requires little attendance, and has worked very effectively for the first 18 months of operation, no sediment having settled in the canal, whereas the local irrigation canals, using the same water, have to be laid off in the winter in order to shovel out the sand which deposits in them.

BELOW THE SAND TANK—The canal and flumes (of which there are six and the longest is 730 ft.) have a grade of 0.001($\frac{1}{10}$%). The tunnels (of which there are four and the longest is 1485 ft.) have a grade of 0.0034.

The flumes (Fig. 7) have a bracing of tie rods, one on each side between the cap and sill of the collar, which serve the double purpose of eliminating racking and of preventing the 10x10-in. posts from rising out of the daps in the sills, something which frequently occurs if nothing is done to obviate it.

The canal is generally in tight gravel, with some adobe ground, some volcanic hardpan, locally called "tosca," and some solid rock. Careful flow-meter measurements were made to deduce (n) for Kutter's formula as shown in the accompanying table. All the canal excavation, which was hand work, was done by contracts let to small gangs of Chilian peons, 10 or 15 men to the gang. The junction of the canal with the flumes is made by a masonry collar, well winged into the earth. The tunnels are in solid rock, disintegrated rock and

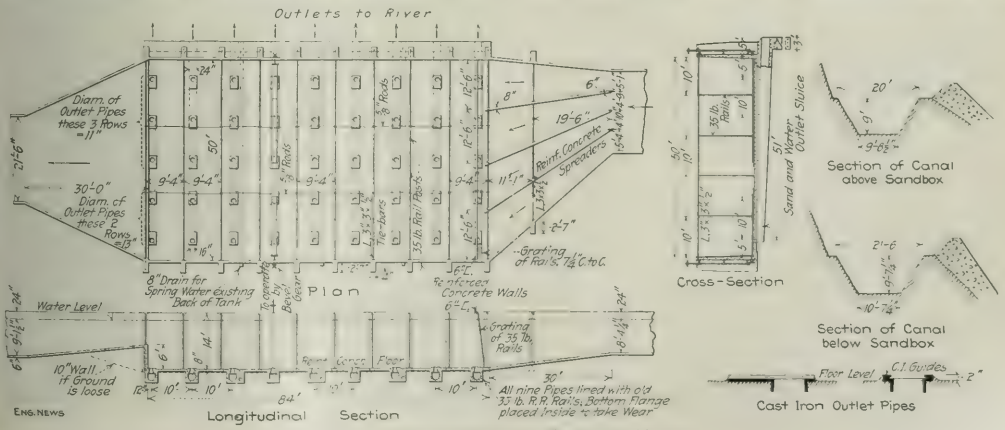


FIG. 6. DETAILS OF SAND-SETTLING TANK

gravel. About a third the total length of tunnels had to be timbered. Arched timber sets were used lagged outside a flume box was placed inside, similar to the standard flume type noted.

made with a 6-ft. drop in the bottom of the canal, 15 ft. long. Each is discharged by four steel gates set in reinforced concrete, and worked by hand gearing. One is shown in Fig. 9.

Besides the gate spillways there is just above the forebay, an over-top spillway, or waste wier, with a crest 76 ft. long and capable of passing the full capacity of the canal.

The forebay is widened to about 40 ft. and deepened to 18 ft., for a length of 100 feet, to give capacity for a

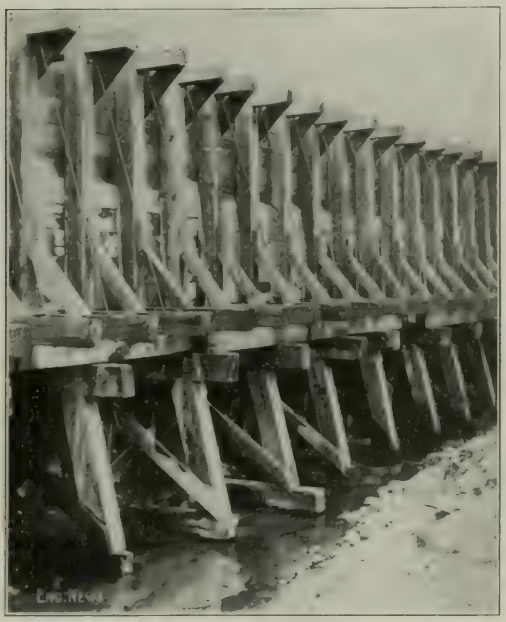


Fig. 7. Exterior of Braden Flume
(Showing tie rods and corner braces.)

small peak load. More is not required since most of the load is steady.

The forebay dam is masonry, in which are set the pipe entrances. These entrances are closed by flap gates worked by winches. Six-inch bypass pipes serve to fill the power pipes.

Power Plant

The steel pipe lines are approximately 1080 ft. long, have a total head, forebay to river, of 150 ft. They are set in masonry anchors at about 200 ft. intervals, and between anchors are bedded in gravel. Each pipe has an expansion joint just outside the forebay wall.

The power house building (Fig. 10) has concrete foundations carried well below river-bed level, the outside wall being anchored also by railroad-rail piles driven into the bed of the river. The outside wall is 25 ft. high to roof level, which is placed one foot above the highest flood level on record. The wall is pierced with weep holes, to prevent any hydraulic pressure, due to a high flood, from acting against the inside of the wall An inside toe at the foot of the wall, about 7 ft. wide, of concrete reinforced with rails, which carries the

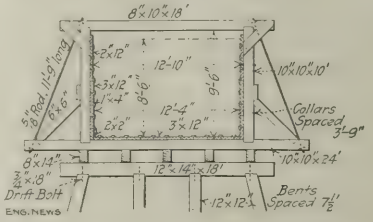


Fig. 8. Cross-Section of Braden Flume

weight of the gravel filling inside the wall, also adds to the stability of the wall.

The building frame is steel with corrugated-iron walls, wooden-sheeting, hand composition roof, concrete floors, and reinforced-concrete walls and barriers.

The water is controlled by an hydraulic operated valve, at the entrance to the turbine. The turbines are the inward-flow reaction type, with double discharge into twin draft tubes—what is usually called the "high-head Francis" type. It is probable that the conditions at this plant are not such as to insure the most satisfactory working or develop the very best efficiency of this type of turbine. The governors are of self-contained oil-pressure type, belt driven from the turbine shaft.

The transformers are set in banks of three, and are single-phase, oil-insulated, water-cooled types enclosed in concrete fireproof cells. The switching layout of the station is shown by the skeleton diagram (Fig. 11).

The transmission line is protected by choke coils in the building and by electrolytic-type of lightning arrestors outside. Electric storms are few in this part of the country, but seem to be increasing in frequency and violence. All busbars and leads inside the building are



Fig. 9. Gate Spillway in Braden Canal

shrouded in concrete barriers to make them foolproof and fireproof. They are not quite foolproof, however, as during the finish of construction, and while the first unit was in operation, one Chilian workman struck the high-tension bus a glancing blow with a nail held in his hand; later on, another one held his long whiskers up to the same bus "to see if it was hot." Both satisfied their curiosity, though neither was killed.

Transmission Line

The transmission-line towers are three-legged with compression members of old 35-lb. rails and round-iron tie rods. Towers are made standard from the top down, and cut off to fit the side hill. The legs enter the ground 6 ft., the bottom 2 ft. being set in concrete. The average span is 543 ft., and the longest span 917 ft., while the average height of tower is 57 ft. above the ground. The towers were made by the company, and cost about the same as structural-steel towers of the same height, made in the United States, would have cost delivered on the ground. But the erection was more ex-



Fig. 10. Power Station and Pipe Lines, Braden Copper Co.

pensive than that of the usual structural-steel towers on account of the greater comparative weight of the railroad-steel members.

The insulators are a suspension type, arranged for simple suspension on level ground or where the inclination is equal on both sides, and for dead-end or "strain" construction at the brow of a hill and at angle towers. All angle towers are guyed both ways in the line of the strain.

The line is arranged for two circuits, one on each side of the tower, each in a vertical plane, with cables spaced 5 ft. apart. One circuit only, of No. 2 stranded copper cable, is in place at present. The line is transposed six times in the 15.5 miles. In addition to the lightning arrestors at the power house and substation, the line is further protected by a ground cable of 3/8-in. galvanized steel, which is clamped at the heads of the towers, and is grounded by a copper wire and plate to the moist earth of creeks or springs at seven places in the length of the line.

The line runs from an elevation of 2600 ft. above sea level at the power house, to 6200 ft. at the substation. It follows approximately the line of the Company's railroad, on account of ease of construction, although the distance is somewhat increased over a straight line. A perfectly straight line would have been impracticable in any case, on account of the rugged mountainous character of the intervening country.

Substation

The substation is built with a steel frame, and concrete floors and barriers, similar to the power house. The

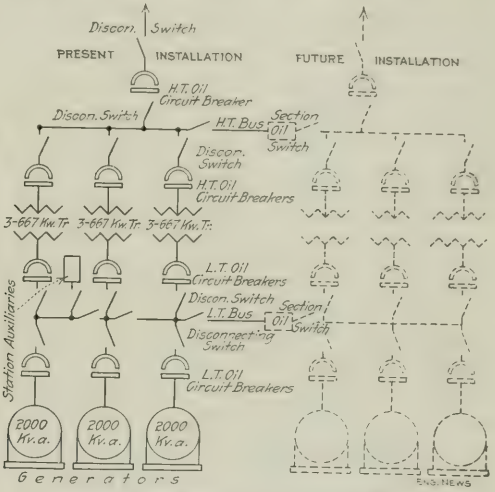


Fig. 11. Switching Diagram of Braden Power Development

current is stepped down to 2200 and 550 volts for secondaries running to the mining, milling and smelting establishments.

Construction Notes

The bulk of the work on the plant was done by Chilian peons, helped out by a few Spanish, English, and other European workmen. The Chilians are hard workers if they have the right handling, and are at their best when a contract on earthwork or masonry is given to a small gang of 10 or 15 men who know each other, and who have an accepted leader in the gang. On rough timber work they are not so good, as not many are accustomed to it, most of their carpenters being "joiners," used rather to making furniture by hand and not much else.

As machinists, they are poor and unreliable, probably due to the lack of proper training in good shops, which are few in Chile.

All the construction work except the contract work of excavation and masonry and contract oxcart and mule freighting, had to be done by day workmen under foreign foreman (generally English, American or Scandi-

navian), as the Chilian workmen and contractors were not familiar enough with such work to be trusted with it.

The following unit costs (U. S. currency) of construction work may prove interesting:

Canal excavation per cubic yard	$0 407
Canal excavation per linear foot of canal	6 33
Masonry construction per cubic yard	6 64
Concrete construction per cubic yard	27 04
Canal concrete lining 6 in. thick per square yard	2 39
Canal masonry lining 1 ft. thick per square yard	1 63
Flume construction complete per linear foot	33 91
Flue construction complete per M. ft. b.m.	85 68
Tunnel excavation per cubic yard	4 96
Tunnel excavation per linear foot	24 04
Steel pipe lines 48-in. diam. complete per linear foot	22 94
Power-house steel work erected per ton	148 17
Power-house building complete per square foot of floor space	19 53
Power-house machinery and electrical equipment complete per generated horsepower	18 88
Substation building per square foot	13 80
Substation equipment per horsepower output	5 71
Freighting by excart per ton mile	0 36

The location survey of the plant was begun in November, 1909, construction commenced in January, 1910,

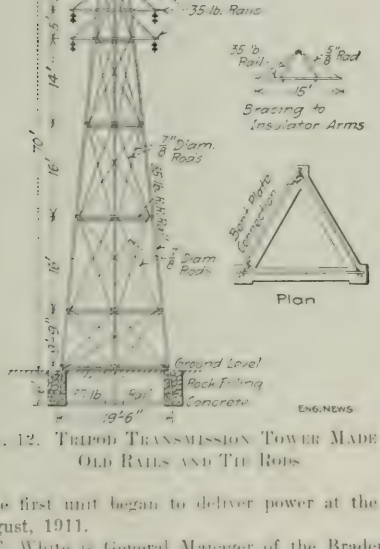


FIG. 12. TRIPOD TRANSMISSION TOWER MADE OF OLD RAILS AND TIE RODS

and the first unit began to deliver power at the works in August, 1911.

R. T. White is General Manager of the Braden Copper Co., and Pope Yeatman, Consulting Engineer. The plant above described was designed and built under the writer's direction as Chief Engineer.

To Secure Light-Weight Reciprocating Parts in high-speed gasoline engines for automobiles, aeroplanes, etc. experiments are being made in the use of magnalium, an alloy of aluminum and magnesium, with the very low specific gravity of 2.5 less than that of aluminum. According to a paper by Morris B. Mitchel read recently before the Society of Automobile Engineers in New York, magnalium pistons have been successfully used in such engines although the metal melts at only 1250° F. As the thermal conductivity of magnalium is fourteen times as great as that of iron, the heat is transmitted much more rapidly from the surface of the piston exposed to the heat of combustion to the water-jacketed cylinder wall. Magnalium has also been used for engine connecting rods. An advantage of the metal for both these purposes is that it is an excellent bearing metal. It is claimed to have a much lower coefficient of friction than either babbitt or bronze. A 14-cylinder radial aeroplane engine now under construction has cylinders 3½ x 4 in. made of steel tubing. Magnalium is used for cylinder heads, pistons, connecting rods, push rods and valve guides and for the crank case. The complete motor will weigh less than 200 lb.

Reinforced-Concrete Trolley Poles in Syracuse and Utica

Three years' trial use of reinforced-concrete poles for trolley and railway transmission-line work in Syracuse and Utica has proved so satisfactory that the New York State Railways Co. has installed at its Eastwood yard a plant having a capacity of 10 to 15 poles a day, according to an article in the *Electric Railway Journal*, Mar. 15, 1913.

The yard is 50x300 ft. and is at one end of the material-receiving yard adjacent to a steam railroad. A 36-ft. span gantry crane, equipped with a 3-ton hoist, travels on rails the length of the yard to handle the concrete hopper and the poles.

Four standard sizes are made at present: (1) One with a 7-in. top, 30 ft. long, the standard trolley pole for city construction with either brackets or spans; (2) with 7-in. top, 35 ft. long, for interurban work; (3) with 8-in. top, 30 ft. long, for heavy city construction; (4) with 8-in. top, 45 ft. long, for feeder lines. The reinforcement is as shown in Fig. 1, and has been designed for maximum economy of steel by calculation and test. The standard pole for city construction has four ⅝-in.x29-ft. 6-in., four ½-in.x23-ft., four ½-in.x16-ft., and four ½-in.x8-ft. twisted steel rods laid about one inch from the concrete surface as shown in Fig. 1. Poles with 8-in. tops have the same arrangement of rods but all of ⅝-in. size, and the long poles merely have the rods lengthened at the top.

The poles are cast in forms, such as are shown in Fig. 2, made from three 2-in. Georgia-pine planks. The side planks are clamped in position by notched 2x4-in. pieces above and below. Chamfered corners are provided by triangular corner strips. Pieces of round iron are inserted where holes in the pole are needed and gains for crossarms are made by blocks nailed to the form at proper places.

The concrete is hand mixed and is carried in a one-ton hopper from form to form. The following specifications are followed:

SPECIFICATIONS FOR FORMS:

This form to be built of hard pine and chamfer strips to be put on with screws and finishing nails. Side cleats to be bolted.

Chamfer strips to be placed on side sections of form. Gain block placed on bottom section, if chamfer strips come higher than gain block two small strips are to be placed on gain block as shown.

Forms should be oiled before using inside and out with raw linseed oil. Holes through pole for bolts made by blank bolts, same size as hole, embedded in concrete through form and pulled out two days after casting pole.

Bolts should be loosened by turning slightly six hours after pole is cast.

INSTRUCTIONS FOR CASTING CONCRETE POLES:

Before casting poles, oil form inside with a mixture of one part black oil and one part gasoline. This oiling to be done immediately before casting pole.

The concrete mixture to be formed from one part cement, two parts sand and two parts stone, measurement to be made by volume.

All stone used to be clean and free from loam or dirt. Thoroughly wet the stone in the pile before mixing.

Sand to be free from loam or dirt. Place the proper amount of sand on the mixing board and spread out to a thickness of 4 in. On this sand place the cement and turn both three times, after which apply the water and turn so that the mass is entirely wet. Spread out this mortar again in a 4-in. layer and dump the stone in another layer on top. Turn the mortar and stone until mortar and stone are thoroughly intermixed. The concrete mixture must not be left

on the board long enough to require retempering, but should be placed in the forms at once.

In placing the reinforcing rods great care must be used properly to locate the same and maintain in the proper position.

The time of removing of side forms and moving of pole to storage will vary with the weather, but in no case shall a pole be lifted until 96 hours have elapsed after casting. After removal from the forms the pole shall be painted with a mixture of one part cement and one part sand, the pole being wet before the application of this paint.

Remember that a crack formed in a pole by handling too green cannot be healed.

In the storage and shipping of poles 2-in. cleats must be placed between the separate horizontal layers of poles to allow attachment of clamps for handling.

The cost of the standard pole is from $9.50 to $12 each, with stone and sand at $1 per cu.yd., cement at $1.10 per bbl., and labor at 16 to 17½c. per hr., but not including overhead charges.

In the spring of 1911, tests were made on the 30-ft. type with 6-in. top, which was on trial. Two poles were

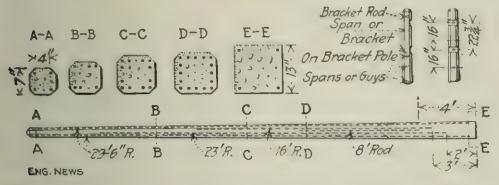


FIG. 1. STANDARD REINFORCED-CONCRETE TROLLEY POLES OF THE NEW YORK STATE RAILWAYS CO.

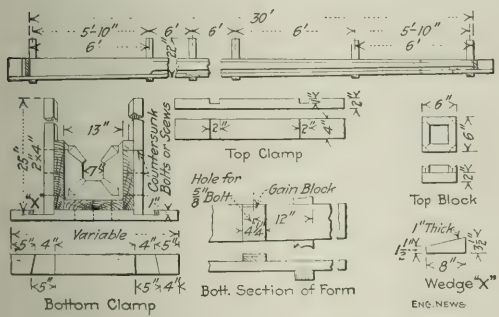


FIG. 2. FORMS FOR TROLLEY POLES; NEW YORK STATE RAILWAYS CO.

set 38 ft. apart with a 15-in. rake. A ring of concrete was placed at the butt of each pole on the ground line. A span wire was stretched between the two tops and pulled up to a tension of 1100 lb., which produced a deflection of 3 in. The span wire was then loaded at points corresponding to the center line of two tracks, to 1332 lb. On removal of this load a permanent set of 2¾ in. remained in the pole. The same load was again applied and the span wire was cut at the center, when the pole returned practically to its original position. Later tests with the 7-in. top pole, which was finally adopted, showed greater strength; this pole had a greater area of steel at the ground line where the old design showed signs of failure.

It was found that success with these poles depended on the facilities for erecting. At first a portable derrick made from an old road scraper was used, but later a special derrick wagon was built.

Hydraulic Excavation on Panama Canal Slides*

The Cucaracha slide and the slide immediately north of Gold Hill, on the east bank of the canal, have broken back so far from the canal center line that the slope of the earth at their outer edges is away from the prism. Gold Hill, which is between the two slides, rises to 652 ft. above sea level and presents a sheer face of dark, hard rock rising to 482 ft. above the canal bottom. This mass stands as firm as Gibraltar, while the soft material flanking it at the crest of the continental divide is involved in slides which are exceeded in volume only by the slide diagonally opposite, on the west bank at Culebra. No other breaks reach so high above the canal bottom.

Equipment used in the hydraulic excavation south of Miraflores locks is being installed for the purpose of sluicing material from the tops of the slides back into the valley toward which the earth slopes on the two sides and at the rear of Gold Hill. The surface over which it is proposed to waste the spoil is about 240 ft. above sea level. The construction of flumes on grades of 4.6 and 5% will allow the sluicing of earth down to an elevation of 330 ft. above sea level.

Sluicing will begin at the top of the slide to the north of Gold Hill. Under the original survey, it was estimated that 1,400,000 cu.yd. were to be removed from this area, but a later break of the earth, farther back, has rendered estimates of the extent of operations only approximate.

It is estimated that between 1,000,000 and 1,500,000 cu.yd. can be removed economically by hydraulic sluicing in the Cucaracha territory, in addition to that which will be sluiced down the slide into the canal, to be removed later by suction dredges. The material to be excavated is mostly soft earth, and includes a dump made from the French excavation.

Water will be supplied by damming the upper Obispo River and several of its tributaries, draining a watershed with a total area of 4.1 sq.mi. This will be accomplished without difficulty, because the course of the stream is already crossed by an American dump through which 20-in. pipes have been laid for drainage. The water can be dammed by merely raising the pipe intakes with vertical elbows.

Foundations and retaining walls for the pumping station have been built of concrete at a point near the relocated line of the Panama R.R., about four miles above Pedro Miguel, and 3000 ft. east of the canal, opposite Culebra.

The station is to be equipped with half of the Agua Dulce pumping plant, consisting of two 24-in. triple-expansion horizontal pumping engines and 500-hp. boilers.

Each unit was originally rated to deliver 7500 gal. per min. at 150 lb. pressure. In their worn condition, however, and in forcing water against a 100-ft. rise to the level of excavation, they will be counted on to furnish water at the monitors under pressure of only 80 to 85 lb. per sq.in.

The pipe line from the station to the top of the slide on the north side of Gold Hill is approximately a mile in length. When the excavation is extended toward the Cucaracha slide an electrically driven "booster" pump is to be installed on the northeast side of Gold Hill at elevation 425 ft., 200 ft. above the pumping station. The pipe-line approach to the Cucaracha slide will be made through a saddle between the main part of Gold Hill and an adjacent knob.

The pumping plant and machine shop are close to a spur extending from the relocated Panama R.R., and additional tracks render the area accessible to trains and locomotive cranes for the handling of heavy parts.

The foundation for a fuel-oil tank to hold 1000 bbl. is laid near the station.

It is expected that sluicing will begin about the middle of June, by the time the rainy season flow of the streams has accumulated a sufficient reserve supply of water at the pumping plant.

⁂

The Contract for Supply of Crude Petroleum by the Union Oil Co., of California, to the Isthmian Canal Commission and the Panama R.R. has been extended until June 30, 1914. This company has supplied crude oil since August, 1907, and in November of that year completed a pipeline across the Isthmus. At first oil was delivered at the rate of 90c. per barrel, but since 1909 a price of $1.10 has been obtained. The maximum amount that can be purchased in any one month at present is 100,000 bbl. The total annual barrels jumped from 6919 in 1907 (five months only) to 154,817 in 1908, and has steadily increased to 913,723 in 1912.

*From the "Canal Record" of Apr. 16, 1912.

A Year's Experience with the Boston Public Works Department Organization

The new organization of the city engineering departments of Boston, Mass., was described in our issue of Dec. 22, 1910. The whole service was reorganized at that time under one engineering head, and for this office the city secured the services of Louis K. Rourke, then Commissioner of Streets and for four years previous, Assistant and Acting Division Engineer on the Panama Canal.

After a year's trial, Mr. Rourke reports that the organization is a success.* From Mr. Rourke's recent report on this first year's work of the organization we take the following extracts, which give in greater detail than our original article, the organization and the work of its various branches. The accompanying chart shows the scheme of organization diagrammatically with the salaries of the various bureau heads.

General Organization

The primary reason for the creation of the Public Works Department was to secure greater efficiency in the work of the Engineering, Water and Street Departments. Each of these departments was under a separate head and frequently there was a clash of authority, overlapping and duplication of work.

The Public Works Department as now organized is divided into three divisions. At the head of each division is a competent Division Engineer. The functions of the three divisions are, briefly, as follows:

The Bridge and Ferry Division has the charge and care of all bridges used as highways, which are in whole, or in part, under the control of the city; the care and management of the ferries owned by the city, including boats, slips, drops and buildings.

The Highway Division has charge of the construction and maintenance of roadways and sidewalks; the collection and removal of ashes, garbage, refuse and street cleanings; the care of lamps and the lighting of streets, parks and alleys.

The Sewer and Water Division has charge of the construction of sewers, catch-basins and waterways; the care of the water supply owned by the city; the installation of meters, water services and the laying and relaying of water mains.

The accounting force of the department has been merged into one body under the charge of a chief clerk. An office has been opened where all complaints, such as defects in streets, the nonremoval of ashes and offal, watering and oiling of streets, etc., are received and from there forwarded to the proper person for attention.

Bridge and Ferry Division

The division is under the general charge of Division Engineer F. H. Fay and the staff is divided into five subdivisions, the head of each of these reporting directly to the Division Engineer. The subdivisions consist of three engineering divisions, namely, the designing staff, under the direction of the designing engineer, having to do with the design of bridges, foundations, etc.; the construction staff, under the engineer of construction, having the supervision of the construction and principal repair work of bridges, foundations and ferry landings; and a special engineering staff under the engineer of special work, which has charge of grade crossing abolishment work and engineering work of a general nature, both for this and other city departments. In addition there is the bridge maintenance force, under the supervisor of bridges, and the ferry maintenance force, under the general foreman of the Ferry Service.

The positions of Division Engineer, the heads of the three engineering subdivisions and supervisor of bridges are filled by civil engineers, all of whom had previously been connected with the former City Engineer's office.

The organization of the Bridge and Ferry Division has worked satisfactorily during the year and has already been productive of good results. In the Bridge Service there has been notable improvement in the methods of caring for the city bridges, owing to effective coöperation between the engineering and bridge maintenance staffs.

Under the system formerly existing the City Engineer was required to make inspections and report upon the safety of bridges as well as to supervise all repairs affecting the strength of these structures. The care and maintenance of the bridges rested with the Superintendent of Streets. The result of this arrangement was that, although the City Engineer repeatedly recommended repairs on bridges, he had no authority to put his recommendations in force. His recommendations were frequently ignored and bridges, particularly those over railroads, were allowed to suffer through neglect, until in some instances they became unsafe and extensive repairs and even rebuilding were made necessary.

Highway Division

The division is under the general charge of Division Engineer James H. Sullivan. The subdivisions of the bureau include a paving service, which looks after the maintenance of all street surfaces, the pavement of streets and the construction of new streets; a sanitary service which takes charge of the collection and disposal of ashes, garbage and refuse of all kinds; a street cleaning service; a street water and oiling service, and a street lighting service.

For convenience in handling the garbage and refuse collection and disposal problem the city is divided into nine sanitary districts, in four of which the work is done by contract, while in the other four the work is done by city day labor. The contract districts are the outlying sections of the city, East Boston, Brighton, West Roxbury and Dorchester, and the disposal in nearly every instance was by inland dumps. The cost of collection and removal in these districts per ton varied from $0.77 to $1.25, including ashes. The average for the four districts was $1.12 per ton, or $0.57 per capita per year.

In the five central city districts, where the collection and removal was done by city day labor, the methods of disposal were by inland dumps, dumping in the sea and by contracts with rendering companies. The average cost per ton varied from $1.82 to $2.76, including ashes. The average cost for the entire five districts was $2.04 per ton, or $1.32 per capita per year.

Sewer and Water Division

The division is under Division Engineer F. A. McInnes, who states that:

The work is seriously handicapped by the number of employees who are unable to perform a reasonable day's work by reason of age or physical inability, a majority of these men having grown old in faithful service to the city; an extension of the pension system to embrace the old and deserving employees of all grades would serve the ends of justice and would best promote efficiency.

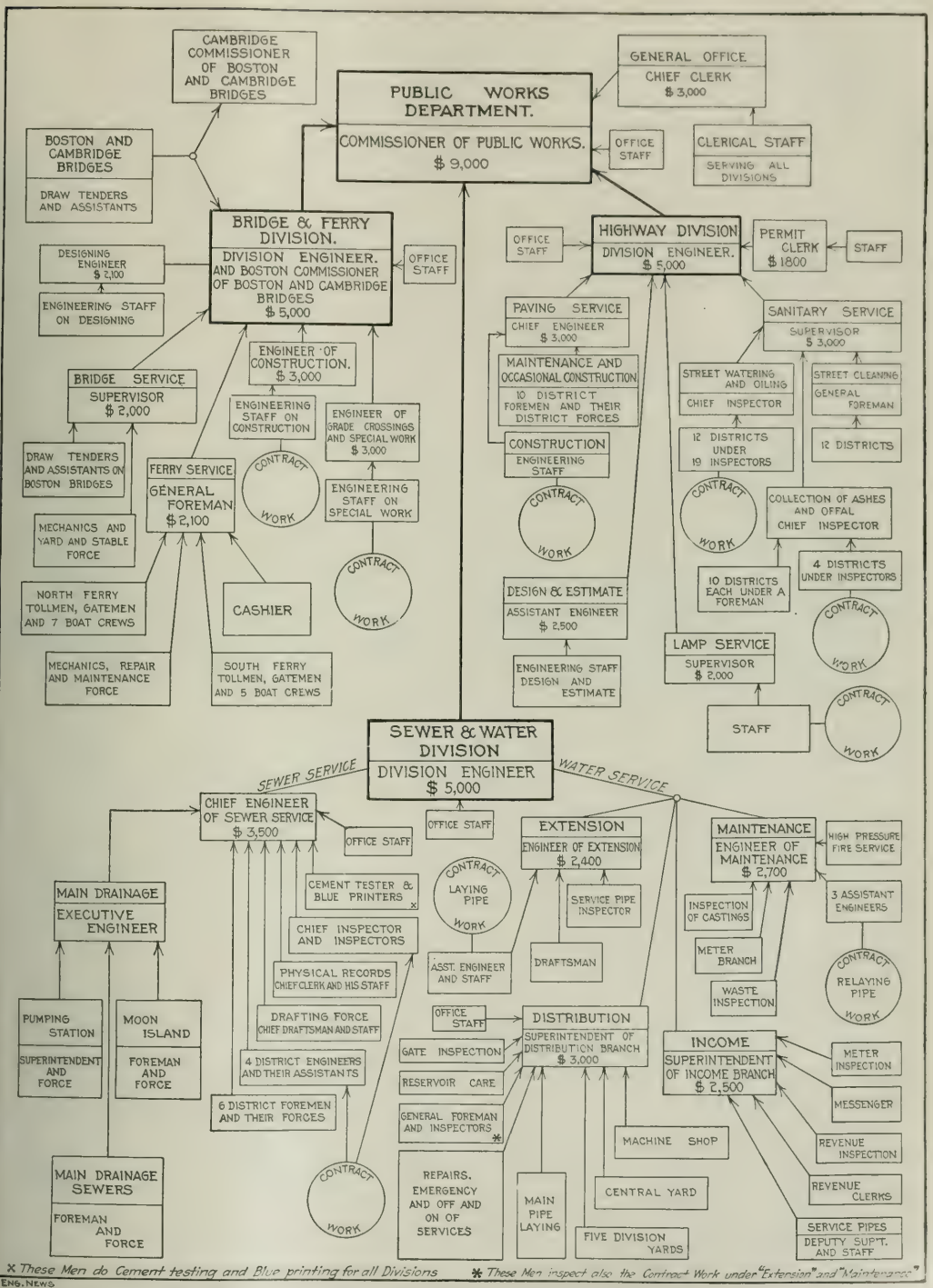
A part of the sewer work is also done by contract; this, however, amounted to only about one-eighth of the total construction work.

In the water service the work of laying and relaying pipe has been done almost entirely by contract, the award being made in each case to the lowest bidder. An innovation has been made in the manner of disposing of the old cast-iron pipes which are taken up in relaying and which, in the past, have been hauled by the city to the department yard, where they were broken up and sold for junk; the new system makes the disposal of the pipe a part of the contract by requiring the bidder to pay a stipulated price per ft. for it.

The work of waste prevention was carried on with a force of 13 men, substantial results being obtained in Dorchester, West Roxbury, Brighton, Charlestown and a part of Roxbury; in Charlestown the effect of the work was particularly noticeable, the consumption being reduced 1,500,000 gal. per day by two months' work of inspection.

The work of the Distribution Branch has been confined almost entirely to maintenance; that efficiency has increased is shown in the actual record of work done, the improvement being largely due to better discipline.

*Report of Public Works Department, Boston, Mass., 1911.



ENG. NEWS

ORGANIZATION CHART OF THE PUBLIC WORKS DEPARTMENT, BOSTON, MASS.; L. K. ROURKE, COMMISSIONER

Some Construction Features of the Substructure of the Cumberland River Bridge, L. & N. Ry.

By Howard M. Jones*

The Louisville & Nashville R.R. Co. is now building a new low-grade, double-track railroad, known as the Lewisburgh & Northern R.R., south from Nashville, Tenn., to Athens, Ala. The maximum grade is to be 0.4% compensated for curvature. Ten miles south of Nashville is a chain of hills, the summit of which is about 500 ft. above the low-water level of Cumberland River. To secure the desired grade between the river and the Brentwood hills it was necessary to make the bridge 135 ft. above the low-water line, and to have a cut at Brentwood 70 ft. deep through solid rock.

The bridge is to be for a single track, but the main line south is to be a double track. The total length from abutment to abutment will be 2807 ft. The north approach consists of 1179 ft. of girder viaduct approach; the main river is crossed by seven truss spans, three deck spans of 124 ft. 6 in., one through truss span 300 ft., three through truss spans 200 ft. and the south approach is also a girder viaduct approach 352 ft. 6 in. in length.

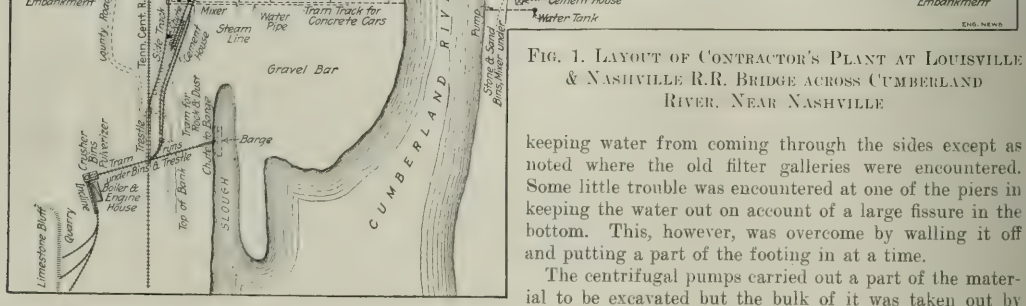


Fig. 1. Layout of Contractor's Plant at Louisville & Nashville R.R. Bridge across Cumberland River, Near Nashville

Piers 3 to 8 are all funded on rock, which is from 16 to 20 ft. below the low-water line. Pier 2 is on concrete piles and Pier 1 on clay. The pedestal footings on the north side rest on a compact yellow clay, and a part of those on the south side are on rock and a part on clay. At the ends of the approach are pier abutments of rather unusual type, built of reinforced concrete, so as to permit the earth fill to take a natural slope around them. All of the substructure masonry is of concrete; a total of 17,500 cu.yd. being used on the substructure.

The Foster-Creighton-Gould Co., of Nashville, Tenn., was awarded the contract in the spring of 1912 to build the substructure and to erect the steel superstructure. The time fixed by the railway for the completion of the masonry was Oct. 1, 1913. Work was begun Apr. 1, 1912, and the masonry was completed by Jan. 1, 1913, or in one-half the contract time. It is so unusual that a work of this magnitude is completed so far ahead of time that it is thought a description of the layout of plant and methods used by the contractors by which such a result was made possible will be of interest.

Fig. 1 shows a general plan of the entire work, the location of the masonry, the plant used, and the quarry from which the rock was obtained. Reference is made below to this sketch in describing the work.

To obtain the rock footings for Piers 3 to 7 inclusive, it was necessary to excavate the sand and gravel which overlaid the rock in depths from 14 to 22 ft. As will be seen by reference to the sketch, Piers 4 to 8 were on a gravel bar. To add to the ordinary difficulties the City of Nashville had in years past used this gravel bar as a natural filter and had placed a large number of open rock masonry and brick galleries underneath it. Although not now in use by the City they gave a great deal of trouble in excavating as it was difficult to get the sheet piling through them or to fit close enough against them to exclude the water. The Gould steel sheet piling were driven to rock at all piers from 3 to 7, inclusive. This piling proved its excellence for there was no difficulty in keeping water from coming through the sides except as noted where the old filter galleries were encountered. Some little trouble was encountered at one of the piers in keeping the water out on account of a large fissure in the bottom. This, however, was overcome by walling it off and putting a part of the footing in at a time.

The centrifugal pumps carried out a part of the material to be excavated but the bulk of it was taken out by derricks rigged with clam-shell buckets. Derricks were set up at each pier site for the purpose and work on several piers was carried on at the same time. The last few feet of the material overlying the rock was usually so compact it could not be handled economically with the clam shells and laborers picked it and shoveled it into skips which the derricks handled, all excavated material being dumped by the derrick on the gravel bar just outside the coffer-dams. Pier 8 footing was obtained without the aid of a coffer-dam, open cribbing being all that was necessary. Pier 2 was founded on concrete piles, which were manufactured and driven by the contractors. Pier 1 was founded on clay.

Construction Methods

The organization for the work was as follows: A general superintendent in charge with two assistant superintendents, one superintendent in immediate charge of Division 1, which extended from the north abutment to and including Pier 3, the other superintendent in charge of Division 2, which comprised all work from Pier 4 to the south abutment. The superintendent of Division 2 also had charge of the crusher plant. Each division superintendent had under him gangs of carpenters, laborers for excavations, and concrete mixing and placing crews.

*Consulting Engineer, Nashville, Tenn.

Division 2.—On Division 2, at the south side of the river, a derrick was set up on top of the bank near the railroad side-track and used as a general unloading derrick for form lumber, falsework poles, machinery, etc. This derrick also placed the concrete in Pier 8 and the four pedestal footings between the main track and side track. The cement house was so located on the side of the bank below the side track that the cement could be chuted down from the cars direct into the cement house. Cement was handled from the house to the mixer platform and tram cars. The mixer was located at a still lower elevation and fed from a receiving hopper. The platform over the mixer was covered in to enable the handling of cement in rainy weather without injury.

About 800 ft. to the east of the center line of the bridge a good quarry was located and a crusher plant was installed to make all the large and fine aggregate for the work, the limestone dust being used for sand. The crusher was elevated above the quarry so that after the product passed through the crusher it was handled by gravity through the screens into bins, from bins into tram-cars underneath the bins. These tram-cars were built to take one charge of crushed rock and limestone dust for a one-yard mixer, the car being divided into compartments so that the materials could be properly measured. As the ordinary run of crusher would not produce sufficient fine aggregate to furnish the sand content, a pulverizer was put in just beyond the end of the screen and the tailings from the screen were pulverized.

When a car had received its charge from the bins a mule was hitched to it and pulled it to the mixer. Four cars and two mules were found sufficient to keep the plant going to capacity. The cars were side-dump cars and emptied their load direct into a hopper which in turn fed the mixer, the cement being dumped into the hopper by a laborer located on the platform over the mixer. After the concrete was mixed it was emptied through a chute into a side-dump car which was carried out on the tram track to the pier wanted, then carried by elevator hopper to the height wanted. At Pier 6 an elevator was not used, but the concrete was handled by derricks, the upper part being built by a derrick located on the falsework which was put up for the steel erection. It will be seen by reference to the sketch that this tram track went from the mixer out to Pier 4.

The cars were handled both to and from the mixer by a haulage engine at the head of the tram track. This engine was geared so that it handled these cars with high speed. It was customary to work on two or more piers at the same time, placing the concrete alternately in them. While concreting was going on the carpenters were at work on other piers getting the forms ready for the next day's concreting. The piers were carried up in lifts of 6 ft., this being the safe height for one day's work.

The water for the mixing on this side was secured direct from the city supply. The pumping station of the City of Nashville happened to be located just west of the bridge site, and besides securing water from it, the steam supply for the mixer and the hoisting engines on this division during most of the time was secured from the power plant of the Station. The securing of this steam supply from the pumping station was a great convenience in that it avoided the trouble of having a great number of small boilers located where they would be difficult to handle if any sudden rise in the river occurred, and where coal loading was inconvenient. It also facilitated operations because there was never any time day or night when steam could not be had on a moment's notice.

Pier 8 and the four pedestals between the main and side track of the Tennessee Central R.R. were put in by the derrick shown in Fig. 1, the derrick taking the concrete direct from the mixer and placing it. The other pedestals on the south approach and the south abutment pier were put in by a smaller mixer ¼-cu.yd. capacity). This mixer was located at the south abutment pier and the concrete for the pedestals was elevated and carried by chutes to the points wanted. The materials for the concrete were hauled by wagon. At the south abutment pier the small mixer was located so that it discharged through chutes direct to foundations, and the pier brought up as far as possible in this manner. The upper part was put in by the use of an elevator.



Fig. 2. Panorama of Cumberland River Bridge Piers

This small mixer was afterwards moved out on the gravel bar at the site of Pier 4 and was there used to assist in pushing the work on that pier. While operating at Pier 4 the materials for the concrete were taken direct from barges by a derrick. In this way it assisted very materially in making rapid progress possible.

Division No. 1.—There was a natural slough on the south side of the river just about opposite the crusher plant. A tram track was run from the crusher plant down to this slough. The last 90 ft. of this tram was on trestle work. A barge would be brought up the slough to the end of the tram track and cars loaded with crushed rock would then be brought from the crusher plant and dumped through the trestle on chutes which emptied into the barges. After getting its load a tow boat would transfer the barge over to the north side of the river adjacent to the large derrick which was placed on the river bank for the purpose of handling all materials from the barges. This derrick was a steel derrick with a 108-ft. boom and bull wheel. It was founded on piles, for the bank at the point was not sufficiently stable to rest on.

It was found necessary to secure sand from the river for the work on the north side as the crusher and pul-

verizing plant could not produce limestone dust fast enough to keep the work on both sides going at the rate desired. Some gravel was also used on the north side work for the coarse aggregate. The pulverizer failed to produce the results guaranteed by the makers and for that reason alone was it necessary to get river sand.

A stationary mixing plant was located between Piers 2 and 3. Bins to contain rock and sand were located side by side over the mixer, and a double cement house with an open platform between was built just eastwardly from these bins. All were elevated so that the material was handled by gravity into the mixer. The large derrick took the material from the barges and placed it in the bins. It handled the cement in skips, taking up about 40 bags at a time and placing it on the open platform between the two cement houses. Laborers then handled the cement on trucks and stacked it in the houses.

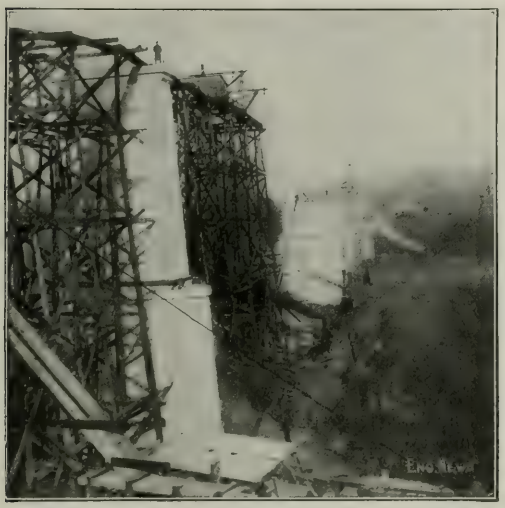


FIG. 3. VIEW FROM SOUTH ABUTMENT OF BRIDGE

The rock and sand were dropped into a measuring hopper and the cement emptied by hand into the hopper, the whole charge then being dumped into the one-yard mixer below. Leading from the mixer was the concrete tram track which was located on the center line of the bridge in order to facilitate the handling of the concrete to the pedestals on each side. This track was placed at sufficient elevation so that the concrete could be handled in chutes from the car to the place wanted. This tram track was also controlled by a haulage engine located at the end of the track. A derrick was placed at the north abutment pier to handle the reinforcing steel in this abutment pier and to also place the concrete. The abutment pier was first built and then the pedestals were built from north to south and the tram track shortened as the work progressed. Pier 1 was built by the aid of an elevator, as were also Piers 2 and 3. The derricks at Pier 2 was erected for the purpose of handling the leads for the pile driver used in driving the concrete piles in the foundation of Pier 2. A steam hammer was used. Pier 3 was brought up by the large derrick to about the height of top of bank, the derrick taking the concrete direct from the mixer in a bucket and dumping it in the pier. After it reached this height it was allowed to remain until the other work north of Pier 3 had been completed. The tram track was then extended out to Pier 3 and an elevator built there. The tram cars then handled the concrete to the elevator which in turn hoisted it to place wanted.

The Panorama view of the river piers (Fig. 2) was taken when the stage of river was such that the gravel bar was completely submerged. Fig. 3 is from a photograph taken looking northwardly from the south side and shows the gravel bar, location of tram tracks, elevators, hoists and some of the derricks.

There was no serious accident to men or equipment during the actual progress of the work. While the progress made was rapid, yet with the arrangements and organization of the work it could have been done much quicker if it had not been for the difficulty in getting the rock footing for two of the piers, which difficulties were fissures in the bottom, and the old galleries heretofore noted.

❖

Four-Cylinder Compound Locomotives of the 2:8:0 and 2:10:0 classes are being used by the Northern Ry., of France, for handling its heavy coal traffic. The former haul loaded trains of 950 to 970 tons on grades up to 0.8%, 750 tons on grades of 1.3%, and 1660 tons on practically level line. The latter can take trains of 950 tons on grades of 1.3% at a speed of 12 m.p.h. Their runs are about 155 miles in length. In order to get inside low-pressure cylinders of proper capacity (with the diameter limited by the space between the frames) the 2:8:0 engines have these cylinders made longer than the high-pressure cylinders. This is not sufficient, however, in the larger engines, and consequently the frame plates are cut away and replaced by steel castings which are offset so as to clear the inside cylinders, while at the same time they serve to carry the outside cylinders, which are made with flanges to bolt to the castings.

Piston valves are used for the outside (high-pressure) cylinders and balanced flat slide valves for the low-pressure cylinders, all valves being above the cylinders. The throttle valves are of the duplex type, each consisting of a cup-shaped or "wine-glass" shaped valve, with a smaller valve on the inside controlling ports through the cup. The first movement of the throttle lever (lifting the valve by the stem of the cup) raises the inner valve, and allows a small amount of steam to pass through these ports. The full throw of the lever lifts the main valve from its seat, and admits a full flow of steam beneath the cup. The two-wheel truck has a frame like the trail of a cannon, the extreme end of the trail or radius bar having a spherical bearing in a transom which is seated on the ends of the elliptic springs of the first driving axle. The point of support of the engine is a spherical bearing at about the mid-length of the radius bar and this has a lateral movement controlled by horizontal springs on each side. The dimensions of the engines are given below:

Type of Engine	2:8:0	2:10:0
Driving wheels (8)	5.08 ft.	(10) 5.08 ft.
Truck wheels (2)	3.40 ft.	3.40 ft.
Tender wheels (6)	4.10 ft.	4.10 ft.
Wheelbase, driving	19.55 ft.	25.00 ft.
Wheelbase, engine	27.75 ft.	33.20 ft.
Wheelbase, tender	10.16 ft.	10.16 ft.
Wheelbase, engine and tender	48.77 ft.	53.8 ft.
Weight on drivers	72 tons	88.3 tons
Weight of engine	82 tons	99.0 tons
Weight of engine empty	75 tons	90.0 tons
Weight of tender, loaded	38½ tons	38.5 tons
Weight of tender, empty	17 tons	17.0 tons
Boiler, diameter	6 ft. 6 in.	6 ft. 0 in.
Boiler, rail to center	8 ft. 6 in.	9 ft. 1 in.
Tubes (Serve type), (90)	2.8 in.	(90) 2.8 in.
Tubes, superheater; No. & diam. (24)	5.3 in.	(24) 5.3 in.
Tubes, length	14.76 ft.	19.68 ft.
Firebox (Belpaire)	10.6x3.26 ft.	10.6x3.26 ft.
Heating surface; tubes & superheat tubes, sq.ft.	2093	2506
Heating surface; firebox	186	186
Heating surface; total	2279	2692
Superheating surface	481	677
Grate area	34	34
Cylinders; hp., outside (2)	16.8x25.6 in.	19.6x25.6 in.
Cylinders; l.p., inside (2)	22.8x28 in.	27.2x28.0 in.
Rail to top of smokestack	13 8 ft.	13 8 ft.
Length over engine and tender	57.26 ft.	62.28 ft.
Water in tender	4500 gal.	4500 gal.
Coal in tender	8800 lb.	8800 lb.

A Street-Railway Valuation

SYNOPSIS—Bion J. Arnold's recent valuation of the street-railway lines of Kansas City, Mo., is of timely interest on account of the recent legislation for the valuation of all the railways of the United States. Mr. Arnold tested the fairness of the valuation made by comparing it with the value computed under four different methods.

In July, 1912, Bion J. Arnold, of Chicago, was appointed a special commissioner by the U. S. District Court for the Western District of Missouri to investigate and report to the court what in his opinion was a fair and reasonable sum to represent the capital value of the properties embraced in the Metropolitan Street Railway System of Kansas City for adoption in a contract for new franchises in the municipalities wherein the properties were operated, together with the various elements of such value and its apportionment between municipalities. This appointment followed a petition of the receivers of the Kansas City Railway & Light Co. for a disinterested valuation and data which would serve to determine all the work needed to establish this system in good physical condition and allow the company to give service commensurate with the city needs, taking into account the present and future necessary operating conditions.

Mr. Arnold's report is dated Feb. 3, 1913, and is contained in three volumes, the first giving the discussions of valuation principles, a history of the lines, franchises and ordinances, and a section on transportation requirements. This volume contains the matter of greatest engineering interest. The second and third volumes give details of the records of construction, equipment, expenditures, etc. None of the reports have been widely distributed.

Mr. Arnold first points out that the determination of value, under the court orders, for refunding and the question of rehabilitation, brought up by the receivers, are closely related. The proposition for refunding and securing additional money is actually covered by one future financing. He then proceeds to answer the specific questions of the court and follows this with a recommendation asked for by the receivers, noting that he was asked to determine other elements of value than the engineer is ordinarily asked to find and which are usually added to the engineer's value by the court or those to whom the report is made.

The discussion of principles behind Mr. Arnold's valuation and his application to the specific case in hand are given below *in extenso*. Necessarily no reprint of the detailed data which were built up is possible in these columns. The date of the valuation is of May 31, 1912, the end of the fiscal year of the Street Railway System.

THE PROPERTIES AND THEIR LOCATION

The Metropolitan System consists of the street-railway properties of the Metropolitan Street Ry., herein called the Metropolitan Company, including that which was formerly owned by and conveyed to it by the Central Electric Ry. Co., herein called the Central Company, and that of the Kansas City Elevated Ry. Co., herein called the Elevated Company, all operated under franchises from the different municipalities through which they operate. Intimately connected therewith, though strictly not part of the System and not in the hands of the receivers, is the property of the Kansas City and Westport Belt Ry. Co., herein called the Westport Company, the stock of which is, as is that of the Metropolitan Company, owned by the Kansas City Ry. & Light Co., and being operated in connection with the Metropolitan, is probably popularly regarded as part of the System. It operates an electric railway, heretofore outside of, but now mostly within, the recently extended limits of Kansas City, Mo.

The Metropolitan System, exclusive of the Westport Company, contains 259.81 miles of single track, of which 182.28 miles are in Kansas City, Mo., 5.26 miles in Independence, Mo., 9.73 in Jackson County, Mo., outside of cities therein, 58.17 miles in Kansas City, Kan., 4.37 miles in Rosedale, Kan. This System is a completed whole, having with the work in the report hereto attached mentioned, the requisite equipment and power for the operation of a practically perfect street-railway system. The Westport Company has 16.87 miles of track in the present limits of Kansas City, Mo., and 4.23 in Jackson County, outside of the city limits. Divorced from and operated wholly apart from the Metropolitan System, it has a very considerable future prospective value in addition to the present actual value of its physical property, a large portion of which is real estate and which has greatly increased in value by the growth of the city.

VALUES FOUND AND VARIOUS ELEMENTS THEREOF

In estimating the values of these properties, the same have been determined with reference to that which is just and reasonable in view of the special purpose for which the valuation is made, i.e., "for adoption in a contract for new franchises in the municipalities wherein the properties are located." The uses to which the properties are put have been carefully considered as well as those of which they are really capable and to which they will probably be put, the original cost of construction, the cost of actually duplicating same new today, the present condition, the advantages and economy in operating the property as a whole, the earning power (at minimum reasonable rates), the territory reached, the past and reasonable prospective growth of the communities in which the property is located, the transportation facilities established between these communities, the density of the territory served, and character of the improvements therein. There has also been taken into consideration the amount of bonded debt, its relation to the value of the present physical property, the market value of the bonds, the necessity for new money to make present improvements and future extensions, and the contractual relations that must exist between the company and the public in order that such new money may be secured at a minimum cost.

The conclusion reached based upon the above elements, as fully analyzed in the schedules hereto attached [but not here reprinted—Ed.], is that the fair and reasonable sum to represent the capital value for adoption in any new contract with the municipalities wherein the properties are located is as follows:

Metropolitan System, exclusive of the Westport Company	$35,000,000
Westport Company	1,700,000
Total for the two properties	$36,700,000

APPORTIONMENT OF VALUE

These values thus found should, in the judgment of your Commissioner, be apportioned as follows:

Metropolitan System	
In Kansas City, Mo.	$28,000,000
Independence, Mo.	350,000
Jackson County, Mo.	700,000
Kansas City, Kan.	5,600,000
Rosedale, Kan	350,000
Total	$35,000,000
Westport Company	
Kansas City, Mo.	$1,200,000
Jackson County, Mo.	500,000
Total	$1,700,000

There are many methods of making such apportionment, among which may be mentioned the following: On the track mile basis; on the basis of the car miles operated; on the basis of the appraised value of the physical property; on the actual money invested; and on the gross revenue originating in each division, which latter method is at this time used in apportioning the revenue paid to the cities under the 8% clause of the Peace Ordinance.*

*An ordinance of 1903, running to 1925, adopted as a basis of settlement of disputes then existing between city and company. Under it, large sums have to be paid for construction of bridges, etc., such as often are built by a city; 8% of the gross receipts is paid to the city, partly in lieu of taxes; certain light and power service has to be furnished the city; eight miles of track has to be constructed per year, which has resulted in an overbuilt system.—Ed.

An analysis shows that 81% of the appraised value, 83% of the investment value, 83.8% of the gross revenue, 79% of the car miles and 75.9% of the track miles are located or originate in Missouri. The true division of the recommended fair value cannot be determined by averaging the above percentages, but since the principal elements to be considered in such a division, namely, the actual investment and the gross revenue, are in substantial agreement, your commissioner believes that taking all the facts into consideration and so long as the property is operated as an entity, the division between Missouri and Kansas on a basis of 83% and 17%, respectively, is fair and reasonable.

The study of the various considerations affecting this apportionment has been further carried out so as to divide the value apportioned to Missouri between Kansas City, Independence City and Jackson County, and to divide the value apportioned to Kansas between Kansas City and Rosedale. As a result of this determination the complete apportionment is as follows:

Kansas City, Mo.	80%
City of Independence	1%
Jackson County	2%
Total Missouri	83%
Kansas City, Kan	16%
Rosedale	1%
Total Kansas	17%

Since the value returned for the Westport Company is practically that shown in the appraisal of that property, the apportionment of such value between Kansas City and Jackson County, Mo., is that shown by said appraisal.

The foregoing valuations contemplate (1), that the value fixed, and the new capital hereafter advanced, shall as an investment, be protected so as to secure the principal, so long as invested, with a reasonable return thereon, and (2), that the owners shall recognize and yield to the public the right, if it so desires, to amortize or retire, in some just way from future net earnings, the entire value or at least so much of the total actual value of the property herein given or as finally fixed as that value exceeds the value of the physical property then producing the service, thus giving the city the right either ultimately to buy the property at such decreased value or take the benefit in reduced fares or otherwise, if the income would then justify it. At that figure the security would be so ample that money could, for a street railway in a community like that about Kansas City, be borrowed thereon at the lowest rate of interest and the property acquired or the benefit of the excess taken in some other form by the public.

BASIS OF VALUATION ADOPTED

In thus determining the said values consideration has been given to the purposes for which the valuation is made, the uses to which the properties are put and to which they are reasonably adapted.

In ascertaining the fair value for the uses to which the properties are and can be reasonably put, there should be taken into consideration these elements of value, each one of which is important, but no one of which is controlling: The extent, character and present condition of the property, together with its actual cost in the past; the cost to reproduce it just as it now exists; the depreciation of the property because of its use and actual condition; its earning power, past and prospective; the amount of earnings and operating expenses; the value fixed by tax-assessing boards; the fact that it is a going concern operated as a whole, connecting various municipalities in different states and communities; the location and connections of its different lines with the probable permanency thereof, as compared with being upon other streets with other connections; the size and reasonably certain future growth of the communities, and the parts thereof served by the cars; the density of population and traffic, together with the nature and probable permanency thereof; the character and facilities of the property for rendering the kind of service to which the public is entitled both now and in the future, with the largest saving in the investment of new capital; and the amount and value of its stocks and bonded indebtedness, together with the financial history of the company. In this way, and by considering all such elements, the fair and reasonable value of the property can be ascertained.

Many methods have been adopted by courts, experts and students of the problem in valuing street-railway properties. Among these are, the ascertainment of, (1), the actual cash investment therein and the return actually had in the past thereon; (2), taking, as was done in Chicago and Cleveland, the actual cost of reproduction less depreciation and adding thereto a fair and reasonable allowance for future earnings, which latter sum is intended to cover the intangible value or various other elements which go to make up the real value; (3), the value based upon the deferred earnings upon the actual investment; and (4), the fair market value of the property. These methods will be considered in their order. Tested, in the light of any one of them it is manifest to your commissioner that the amounts hereinbefore fixed for the purposes aforesaid are reasonable.

(1) THE ACTUAL CASH INVESTMENT IN THE PROPERTY AND THE ACTUAL RETURN HAD THEREON

The actual cash investment in the properties of the Metropolitan System, exclusive of those of the Westport Company, is $34,298,061.45. This is wholly regardless of the bonds, liabilities or stocks outstanding. From this investment there have, since the existence of the property, been received over and above operating expenses, sums equaling only 5.36% annual interest thereon, out of which has been paid all interest charges and all moneys distributed to owners or stockholders as dividends or otherwise. One of the first things to which one naturally turns in a fair consideration of a situation of this kind, is the actual investment and return had thereon regardless of the amount of stock, bonds or debts outstanding. A company must, with actual cash investments, meet the changing demands of the public for improved methods of service with actual cash investments in much new property to take the place of property not yet worn out. When cable lines superseded horse cars, and electricity took the place of the cable, the company necessarily had to meet the changed situation. When extraordinary floods washed away bridges, new ones had to be substituted.

If after meeting such changes and others of like nature, the owners have drawn in returns considerably more than the ordinary rate of interest, there has, to the extent of that excess, been repayment largely, if not wholly, for the entire investment, including the losses thus sustained. If, however, the returns have not exceeded a reasonable interest rate, fairness demands that there be protection for the investment which was really made, provided the records show that the property has been efficiently managed.* A company which has, in excess of interest charges, paid annual dividends of 10, 20, or 30% is in a very different situation from one which has in good faith invested its money and received returns of less than 6%, out of which it has been compelled to pay interest upon its bonded indebtedness. In the case of the Metropolitan System there are records unusually complete as compared with roads as old throughout the country, covering all expenditures made throughout its entire life. While some books for certain periods are absent, and seem not to be in existence, yet books, vouchers and records (the vouchers for all the time) appear from which there can be determined satisfactorily and with reasonable certainty the actual cash investments in the property and the actual cash returns therefrom.

In arriving at the actual cash investment in the Metropolitan System from the above records there has been deducted from the total expenditure of $35,991,461.15, the sum of $1,693,400, now carried in its capital account, which amount represents the stock used in purchasing acquired properties and presumably for which no cash was invested, leaving the net cash cost of the Metropolitan System $34,298,061.15, upon which there has been a return of only 5.36% annual interest. The public has benefited by the changes necessitated on account of the supersession and abandonment of inadequate or obsolete property and the company should have the opportunity, in view of the exceptionally low rate of return it has received to date, of earning these losses back out of the property, especially if the owners concede the right to the public to retire or amortize a large portion of this value from future earnings.

None of the books, papers or documents of any of the former owners or operators appear to have been in the possession of the Westport Company, and it is not known that they exist. They would refer to transactions so far in the past that it is wholly unlikely they have ever been preserved. The cost of the property of the Westport Company and the returns thereon in the past seem therefore absolutely impossible of ascertainment.

*This is especially applicable where a company has spent large sums in the construction of municipal improvements and in extensions into new and comparatively unprofitable territory, which has later built up to the advantage of the city, and which ultimately would be to the advantage of the railway company, if it is allowed to continue to operate. That both these conditions exist in the Kansas City situation is evidenced by the large amount of money spent by the company for bridges and viaducts and by the excessive track mileage now in operation as compared with other cities.

(2) THE PRESENT COST OF REPRODUCTION LESS DEPRECIATION AND ADDING A FAIR AND REASONABLE SUM FOR THE INTANGIBLE ELEMENTS OF VALUE

In order to ascertain the cost of reconstruction, complete inventories have been taken and are returned herewith, unit prices representing the value at which the various items of property could be replaced today in like kind have been applied. In this way there has been found just what it would cost to reconstruct new the physical property as it exists today. It is manifest, however, that the property is not new, but is somewhat depreciated. The present value then of the physical property after it has been used, regardless of intangible or other value, is not the "cost to reproduce new," but that cost less depreciation.

The method of ascertaining this cost new is more fully stated in Schedule III hereto attached. [Not here reprinted. —Ed.]. This "cost new" value excludes promoters' profits or development expense and simply represents the investment that would be required to reproduce new today the physical property as it stands, no attention whatever being paid to any expenditures that may have been made, in the past years on account of horse-car lines, cable lines, or any portions of the electric lines which may have been constructed and later worn out in service or abandoned.

The present or depreciated value of the existing physical property has been arrived at by determining the depreciation which has occurred in the existing property between the time of its installation and the date of the appraisal. Certain items of the property, such as real estate, working capital and supplies, are not considered as depreciating in value, because their value for reproduction purposes is just what it is today. Other items of the property, such as power plant equipment, rolling stock, and buildings, are known to depreciate from the time when they are put into service. Estimates have been made as to the length of time which the various items of the property should be able to render efficient service, and depreciation rates have been determined based on such length of service, and these rates have been applied to the various items of the property to determine the remaining service value in the property or the total present value of the physical property. Such a present value measures the intrinsic value to the operating company today of the physical property, which it is using in the conduct of its business, regardless of the intangible elements of value hereinafter mentioned. The values of the property of the Metropolitan Company exclusive of that of the Westport Company, as determined on this basis, are:

Cost to reproduce new the physical property	$27,327,549 00
Less depreciation	5,792,514 77
Present value of the physical property alone	$21,535,034 23

The above value of the physical property is based upon the assumption that the investment is protected by fair ordinance stipulations and that as a result the cost of legal and general expense, as well as the cost of financing, would be kept at a minimum. Should the investment be unprotected as is the case at present, the combined cost of the above expense would be increased a total of about 5%, and on such basis the cost to reproduce the physical property would be as follows:

Cost to reproduce new	$28,643,733 02
Less depreciation	5,958,015 19
Present value of physical property	$22,685,717 83

These values, however, so far as the Metropolitan System is concerned do not represent the full value of the property, since they take no cognizance of the fact that the value of the physical property could not, at a place like Kansas City, represent the full value of the street railway as a large system. It is a going connected concern, already built, with the right to operate for a number of years in the future, and in many instances without limit of time. No matter how much, if anything, stockholders or bondholders may lose, or where the ultimate ownership may go, the property is there and will be operated by some one without again meeting the difficulty and expense of raising new money to duplicate it.

Moreover it is manifest that track and cars located and operated in a thickly populated community with the right to continue such operation are of greater value than similar tracks and cars located and operated in a sparsely settled community.

In Chicago and Cleveland this intangible value was ascertained by finding the probable future earnings during the period in which the companies had a right to operate under their unexpired franchises.

In lieu thereof, taking everything into consideration, it would be a fair thing to assume that the rights of the Metropolitan System, as they now exist, exclusive of those of the Westport Company, will in some form, in any event, continue until June 1, 1925, and the value of its earning capacity during that time dependent upon that right alone exclusive of anything on that account from the Westport Company, or other franchises extending beyond that date should be ascertained. When this is done if a fair, reasonable and just result follows such result may be said to stand for in lieu of and cover the intangible value, or the other various elements which enter into real value. This method of ascertaining the intangible value excludes any estimate of the value after 1925 of first, the permanent grants to the Metropolitan unlimited as to time from Independence, Mo., and from Jackson County, the latter including the parts of lines in the county taken into Kansas City by extension of its limits since 1902; second, the grants from Independence, Mo., one unlimited and others running to 1936 and 1941, respectively, and of Rosedale, Kansas, extending to 1929. Moreover, in this way, all future rights of any kind of the Westport Company are excluded, although it apparently has the permanent unlimited right to forever run over its own private right-of-way without any further municipal grant. The method of so calculating the value is substantially as follows:

Ascertain the net profits to be derived by the company each year till June 1, 1925, deducting from the gross earnings from operation, first, operating expenses, including proper allowances for maintenance, depreciation and taxes; second, fixed or interest charges upon the depreciated tangible value of the property as hereinbefore found, which is used to produce the gross receipts. After the net returns are thus estimated, ascertain the present value thereof by discounting same at the rate of 5% per annum. From the present value thus ascertained deduct the present value of future interest charges which must be met, to support the constantly increasing capital necessary to produce the future earnings. When this deduction is made, the balance left is the present value of the net profit if the company operates the Metropolitan system until June 1, 1925. Tested in this way the result on the basis of a protected investment is:

Present value of future net receipts	$25,832,411 32
Present value of future interest charge	12,340,870 05
Net intangible value to company	$13,491,541 27

On the basis of an unprotected investment the above intangible value would be as follows:

Present value of future net receipts	$25,832,411 32
Present value of future interest charge	12,881,126 50
Net intangible value to company	$12,951,284 82

This net or earning value then is the sum representing intangible or other elements of value to be added to the cost of reproduction less depreciation. The value of the property as determined by these methods is as follows:

On the basis of a protected investment:

Cost to reproduce new	$27,327,549 00
Less depreciation	5,792,514 77
Present value of physical property	$21,535,034 23
Net intangible value to company	13,491,541 27
Present value to company	$35,026,575 50

On the basis of an unprotected investment.

Cost to reproduce new	$28,643,733 02
Less depreciation	5,958,015 19
Present value of physical property	$22,685,717 83
Net intangible value	12,951,284 82
Total present value	$35,637,002 65

Either of these valuations substantially agree with the actual investment as determined by the preceding method and also as determined on the deferred earning basis with a 6% return hereinafter discussed.

(3) ASCERTAINING THE VALUE FROM THE BASIS OF DEFERRED EARNINGS UPON THE ACTUAL INVESTMENT

Another method, approved by some experts and adopted in some instances in Wisconsin, and by the French and Swiss Governments in the acquisition of steam railways for national ownership, is as follows: Ascertain each year the actual investment in the property, deducting the value of superseded property in the year it was superseded, and estimate a fair return on this net investment. Deduct from such return the net income after paying operating expenses, including maintenance, renewals and taxes, charging to operation, however, the cost of superseded property in the year when superseded. Then compound each year the de-

ficit or surplus, as the case may be, between the fair return and the said income. The result will show a sum representing the accrued loss estimated upon the basis of a return at a given reasonable rate or per cent. The total of the accrued loss, together with the actual investment in existing property, will then represent the fair value of the entire property.

Or under a modification of this method a fair return may be figured upon the total investment without charging to operating expenses the cost of superseded property, this method retaining in capital account, the investment in property which has been superseded. There have been prepared tables showing the value thus ascertained upon the basis of an assumed fair return of 6% and 7% respectively. The values thus ascertained are:

	6%	7%
1. Distributing superseded property in the year when abandoned	$36,044,214 14	$43,788,507 87
2. Retaining superseded cost in capitalization	36,040,312.69	44,201,927.05

This method allows the investor, wholly regardless of bond and stock issues, and liabilities outstanding, the actual amount invested, with a fair interest return thereon, charging him, however, with every dollar earned from the property. Tested by this method, and considering the purpose for which it is made, the value returned by your Commissioner is found to be conservative.

(4) THE FAIR MARKET VALUE

It has been said that a reasonable fair market value is that sum at which a fair buyer would buy and a fair owner would sell, both being willing to deal at a fair price. So testing and considering the question in the light of one's experience in and judgment of like properties in the large communities of the country, and taking into consideration the above mentioned elements as well as the entire situation and surrounding conditions, the fair and reasonable market value of the properties is in the judgment of your commissioner not less than the sums hereinabove given.

THE WESTPORT COMPANY

The actual reproduction cost of the property of the Westport Company less depreciation is $1,685,052.06, or practically the amount found as the value, $1,700,000. There is no way in which to calculate its value upon the basis of the actual investment and former returns therefrom, nor upon the basis of deferred earnings upon the actual investment. The appraised present value of $1,700,000 is nearly a million dollars in excess of the actual cost to the Westport Company. The depreciation, proportionate to the cost of reproduction, is much less than with the Metropolitan System. These things are accounted for by the large amount of real estate owned by the company which has greatly increased in value on account of rapid growth and development of the city south of Brush Creek. This growth is bound to continue in the future with further increase in the value of land. The estimate of $1,700,000 is conservative whether or not the property goes into the Metropolitan System. If it does go in, no consideration is taken of the value of its future rights, nor of the fact that it needs no franchise, but any extra value upon such account is treated as covered by the general value of the Metropolitan System. So upon the whole, its present value under all the conditions and for the purposes of representing part of the capital sum in a contract is fixed at substantially the cost of reproduction less depreciation. The detailed value of the physical property of this company has been determined in the same manner as that of the Metropolitan Company and is as follows:

Cost of reproduction	$1,807,331.66
Less depreciation	122,279 60
Present value of physical property alone	$1,685,052 06

SUMMARY OF VALUES AND RECOMMENDATIONS

The values of the property for the Metropolitan System, exclusive of the Westport Belt Ry., as determined by the methods discussed above, are in substantial accord, and have all been taken into consideration in arriving at the value returned for the Metropolitan System. These values are summarized as follows:

(1) Actual cash investment in the property:

Investment in the present property	$25,214,870 67
Investment in superseded property	9,083,190 18
Total investment	$34,298,061.15

(2) (a) Value as determined from the present value of the physical property alone and the intangible value on the basis of a protected investment:

Cost to reproduce physical property new	$27,327,549 00
Less depreciation	5,792,514 77
Present value of physical property alone	$21,535,034.23
Intangible values	13,401,541 27
Total value	$35,026,575.50

(2) (b) Value as determined from the present value of the physical property and the intangible values on the basis of an unprotected investment:

Cost to reproduce new	$28,643,733.02
Less depreciation	5,958,015.19
Present value of physical property	$22,685,717.83
Net intangible value	12,951,284.82
Total present value	$35,637,002.65

(3) Investment in property determined on premise that company is entitled to fair return on capital actually invested:

(a) Capital value obtained by adding to total investment the accrued deficit in operation below a fixed term, superseded property being retained in capitalization, using 6% and 7% as assumed fair rate of return:

	6%	7%
Total investment	$34,298,061.15	$34,298,061.15
Accrued loss	2,742,251.54	9,903,865.90
Total capital value	$36,040,312.69	$44,201,927.05

(b) Capital value obtained by adding to net investment the accrued deficit in operation below a fixed return—the superseded property being charged to operation in the year in which it was removed, assuming 6% and 7% rates of return:

	6%	7%
Total investment	$25,214,870.67	$25,214,870.67
Accrued loss	10,829,343.47	18,573,637.20
Total capital value	$36,044,214.14	$43,788,507.87

In determining the recommended value hereinbefore returned, the following consideration has been given to the above values:

By the first method the actual cash invested is shown to be $34,298,061.15. This amount taken from the records of the company, and adjusted to exclude all charges not represented by cash expenditures, does not, however, include certain expenditures for property that have been paid from time to time out of receipts and charged to operation, and which since the date of the receivership have been exceptionally large, as since that date over 21% of the gross receipts has been spent upon maintenance, renewals and betterments. For this reason the above amount is somewhat below the actual cash put into the property.

The second value, as determined by the appraisal of the physical and intangible value, on the basis of a protected investment, is $35,026,575.50, and on the basis of an unprotected investment is $35,637,002.65. Values by this method have been used in Cleveland and Chicago, and are generally conceded to be fair both to the company and to the public.

The value, as determined by the third method, based on the premise that the company is entitled to a fair return on the capital actually invested, is over $36,000,000, if 6% be used as the fair return, and is approximately $44,000,000, if 7% is used as a fair return. Since the amount of superseded property has been high, the values as determined by this method must necessarily be correspondingly high, and for this reason more weight is given to the value arrived at by the use of the 6% rate, although ordinarily, in the case of an unprotected investment, the 6% rate would be considered low, and a 7% interest rate would probably be used.

Taking into consideration all of these values, and all of the conditions as found, and as stated in the accompanying schedules, your Commissioner has returned the lump sum value of $35,000,000 for the Metropolitan System, and $1,700,000 for the Westport Belt Railway, proportioned as hereinbefore specified.

As these values are for the purpose of a municipal contract, the company should agree, if the public so desires, to retire or amortize out of earnings in some reasonable way, and during a reasonable time, such intangible value as may be finally determined upon, so that the public will eventually be called upon to pay a rate of fare which will be a fair return on the actual value of the physical property then producing the service after the intangible value has been amortized and retired.

PRINCIPLES GOVERNING FAIR ORDINANCE PROVISIONS*

An ordinance embodying efficient and economical contractual relations between a transportation company and a city should be based upon the following principles:

(A) The contract or ordinance should stipulate the agreed fair value of the property, which should be so determined as to protect the interests of those whose money is legitimately invested in the creation of the property, and in cases where the returns on the actual investment have not been excessive, as in the case of the Metropolitan System, should assure to the owners a fair return on such value.

*Part of Schedule I. -Ed.

(B) The ordinance should provide for supervision by the city or state of the capital expenditures to be made from time to time by the company, in order either to rehabilitate such portions of the property as may be found in need of rehabilitation, or to make such extensions as are necessary to give adequate service, such supervision of capital expenditures to be made for the purpose of assuring investors in the securities of the company that their investment is represented by money actually put into the property, thus tending to decrease the rate of return that will be demanded by investors, and at the same time for the purpose of securing the minimum capital investment, as well as the minimum rate of return, all of which serves to decrease the cost of transportation service in a given territory.

(C) The city or state should supervise not only the capital expenditures, but also the operation of the property to such an extent as may be necessary in order that the service maintained by the company shall be adequate and of as high a character as is consistent with the returns from operation.

(D) The surplus from operation that remains after the payment of operating expenses, including taxes, maintenance, and a proper reserve for depreciation, and after the payment of fixed charges, consisting of the agreed minimum fair return on the capital invested, should be devoted to the following purposes:

(1) A part to an amortization fund for the purpose of ultimately retiring any part of the capital investment that is not represented by physical property.*

(2) A part to the company as profit for efficient operation, unless it should be decided to limit the company to a fixed return upon its investment, which return should be somewhat higher than the minimum return referred to in paragraph (D).

(3) A part to the city as its share in the net profits, if the city so elects in the ordinance, although, for the best interests of the citizens, it is questionable whether the city should retain any portion of the profits from the transportation business, the better policy being that any such surplus, which in some cases has been paid to the city, should be utilized in improving the service, extending the system, or in establishing a pension or other fund for the benefit of the employees of the company.

(4) The reduction of fares after such time as the company has been able to decapitalize all that portion of its capitalization agreed to by the ordinance which is not represented by physical property, or for the decapitalization of the value of the tangible property, should this be deemed advisable.

If such amortization feature is incorporated in the ordinance, the period of time over which the amortization of such part of the capital as is to be retired takes place should be great enough so that the rate per annum is such that the company can set it aside without jeopardizing its legitimate fair return as stipulated in the ordinance, or without crippling the service. As the decapitalization proceeds the fixed charge will decrease a proportionate amount, thus increasing the amount available for service in the form of more cars or for increased wages or for a pension fund for employees; for extensions of the property without corresponding increase in capitalization; or for the reduction of fares.

Views upon how far decapitalization should apply and continue vary, some contending that not only the intangible but also all of the tangible property should eventually be amortized, so that the property would in time become possessed by the city without expenditure of money therefor on its part. Others contend that, in addition to amortizing the intangible value, there should be amortized only that portion of the value of the physical property which represents depreciation, and that such value as then remains in the property should be carried as a continuing investment by the company, in the case of a privately owned company, or by the municipality, in the case of a municipally owned property, and this investment is usually with present properties (owing to their comparatively recent construction and rapid development into new territory) about 75 per cent. of their cost to reproduce new value; although in properties restricted to certain districts and not requiring extensions, reconstruction or betterments, but only requiring maintenance and renewals, this value would be about 60 per cent. of their cost to reproduce new value. Therefore, if it is the policy of the city to retain the right to ultimately acquire the property of the company, the terms for so doing should be agreed upon and stipulated in the ordinance, and the character and extent and method of amortization therein provided for.

The adoption of the value shown in the report in an ordinance such as outlined above will substantially protect the investment of the Metropolitan Company, as it will assure to it in the future such a minimum rate of return on money actually invested in the property as will be determined by the new ordinance. It will not, however, fully reimburse it for any failure to earn such a fair return on the capital invested during the past years. This amount will be fair to the city, in that it limits the amount to be paid to the operating company in the way of fixed charges and profit to only a fair return on the money actually invested, thus providing the public with service at a minimum fair cost.

The decapitalization of the intangible values herein referred to cannot generally be accomplished economically by gradually retiring outstanding securities that have been issued for a fixed time. It can be accomplished, however, by increasing the physical property without correspondingly increasing the capitalization. The agreed portion of the net revenue from operation appropriated to the amortization fund should be used in the purchase of such additional physical property. Thus, the value of the physical property actually furnishing the service will ultimately equal the capitalization. The rate at which such intangible value can be eliminated from the investment is determined entirely by the rate of increase of the gross revenue and by the disposition of the net revenue agreed upon in the ordinance.

*Such values are known as development expenses, and usually consist of preliminary technical expense, legal expenses during formation of the company not connected with construction expense, cost of consolidation and reorganizations, sometimes a reasonable promoter's profit, supersession of equipment due to the rapid advance of the art, reconstruction due to unforeseen contingencies, brokerage, discount or premiums on securities, and sometimes franchises and going values, including losses during early operation, all of which should eventually be amortized and eliminated from the value of the property, upon which the public should be finally expected to pay a rate of return, although it is fair that the company should have time to earn and pay to itself this amortization fund out of the earnings of the company.

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The Marine Lighting Equipment of the Panama Canal*

The Panama Canal will be lighted throughout by automatic unattended lights, each having a distinctive characteristic. At the entrances and through Gatun Lake a double row of about 60 automatic acetylene lighted buoys will mark the channel. The channel will be further defined by powerful, rapid-flashing range-lights, one set at either end of each successive tangent.

The use of oil as an illuminant for lighted buoys is now obsolete, and the electric light is yet quite impracticable for this purpose, so that today buoys are lighted with gas only, either oil-gas or acetylene. In the case of the oil-gas buoy, the nature of the illuminant renders its light weak and inefficient unless aided by an incandescent mantle, which, of course, is an added source of unreliability to be avoided. Oil-gas also loses a considerable amount of illuminating power by compression, owing to condensation of the heavy hydrocarbons.

Acetylene, a product of recent years, is, in this country, rapidly superseding oil-gas, its properties rendering it especially well adapted for buoy lighting. Burned in a self-luminous burner without the use of a mantle the flame of acetylene gives an intensely concentrated white light. The illuminating power of pure acetylene is five times that of the richest oil-gas, and its efficiency remains unchanged by compression.

For buoy lighting acetylene must be perfectly dry and of absolute purity. As generated from ordinary commercial carbide, it contains moisture and impurities which, if not removed, would rapidly clog the flashing mechanism or carbonize the burner. The earliest type of buoy using acetylene as an illuminant is the "carbide buoy," a Canadian invention, in which calcium carbide is stored in a receptacle having free access to the surrounding water. This buoy has the objection previously cited, namely, that the gas thus generated is not dry nor sufficiently purified for the proper and continuous functioning of the burner and flasher. This fault, combined with its inherent wastefulness, has gradually led to the abandonment of the carbide buoy in favor of the simpler and more efficient type, using dissolved acetylene, and now adopted for lighting the Panama Canal.

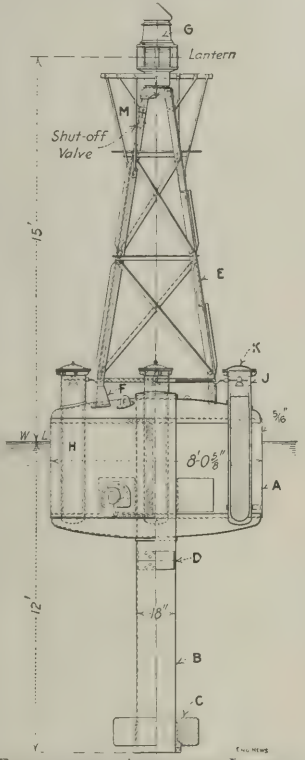
THE BUOYS FOR THE PANAMA CANAL

On following page is shown an elevation of the Panama buoy, in which A is the cylindrical body or chamber, 8 ft. in diameter, made of $\frac{5}{8}$-in. steel plate with dished heads riveted

*Abstract of a paper by James Pattison, of the American Gas Accumulator Co., read before the meeting of the Society of Naval Architects and Marine Engineers.

on. Through the center of the body passes the tube B, to which is bolted the counterweight C. This tube is made in two pieces, as indicated at D, for convenience in ocean transportation. The pyramidal skeleton tower E is bolted to the cast-steel foot-brackets F, and carries the lantern G at a focal height of 15 ft. The draft of the buoy is 12 ft. and the total weight without anchor chain 10,500 lb. Before painting and shipping the buoy is subjected to a hydrostatic test of 15 lb. per sq.in.

With reference to the gas supply and lighting apparatus, H represents the accumulators, of which there are four, filled with dissolved acetylene and inserted in the pockets J, which latter are furnished with hinged covers K for facilitating the removal and renewal of the accumulators. G is the lantern containing the pressure regulator or governor, as it is termed, and the flashing mechanism. The high-pressure gas is led from the accumulators to a manifold L, thence up the leg of the tower E, and through the shut-off valve M to the governor. The gas-piping is of special manufacture, made of solid drawn steel, 8 mm. outer diameter by 4 mm. inner diameter, with an outer protecting envelope of copper drawn thereon, which renders it completely rust-proof.



ELEVATION OF ACETYLENE-LIGHTED BUOY FOR MARKING THE CHANNELS OF THE PANAMA CANAL

The best materials and processes are employed for preserving the buoy from the severe corroding action of seawater and sea-air. The entire inside of the buoy is first given one coat of bitumastic solution applied cold, and then one coat of bitumastic hot in accordance with the manufacturers' formulas and processes. The exterior is given one coat of boiled linseed applied hot and two successive coats of best quality red lead mixed with best quality of boiled linseed oil.

METHOD OF STORING GAS

The system of storing acetylene in portable accumulators is known as Dissolved Acetylene and is based upon the properties of acetone in combination with a suitable porous substance. To Claude and Hess, two French chemists, is due the important discovery that acetone, a combustible organic liquid which boils at 56° C. (133° F.), possesses an extraordinary capacity for dissolving acetylene. At 15° C. (59° F.) a given quantity of acetone will absorb 25 times its own volume of acetylene at normal atmospheric pressure, and its solvent capacity is increased proportionately to the pressure, so that at a pressure of 12 atmospheres it can absorb 300 times its own volume of acetylene.

Important as this discovery was, it was not directly adapted for practical use. When absorbing acetylene, the liquid expands at the rate of about 4% of its volume for each added atmosphere of pressure. Accordingly, a vessel intended for acetone saturated with acetylene under pressure can in practice never be entirely filled with liquid. During consumption, there would gradually be formed a space which would become filled with gaseous acetylene compressed above its limit of safety. This danger was completely obviated by the invention of the porous substance described in the succeeding paragraph and thus the illuminant, dissolved acetylene, was made available for practical use.

If a gas in a state liable to spontaneous dissociation or explosion is stored in a vessel whose diameter is less than that in which the explosive wave can be propagated, it is impossible to produce an explosion. Advantage has been taken of this fact by filling such vessels with a very porous material, the minute crevices of which are almost of insensible magnitude. In a vessel prepared in this way it is quite impossible to produce an explosion. This fact has been demonstrated beyond doubt by a variety of tests, and is practically recognized by the permission now granted in all countries for the use of compressed acetylene in vessels prepared according to this method.

The first condition with regard to the porous substance to be used is that it shall completely fill the vessel, leaving no space excepting the capillary canals formed by the substance itself. Other practical requirements are that it shall be perfectly free from action upon the acetylene or the acetone, that it shall possess a maximum amount of porosity, and that its consistency shall remain unaltered.

THE GAS ACCUMULATOR

The accumulators are prepared in accordance with these principles. More specifically described, an accumulator is a steel cylinder tested to at least 50 atmospheres pressure (the type used on the Panama buoys, which is the most common size, is tested to 75 atmospheres), and completely filled with the porous mass, a solid material possessing a porosity of 80%. That is to say, although the cylinder is apparently filled quite full, only 20% of the space is really occupied by the solid body, the remaining 80% being available for holding the liquid. Half of this remaining space is occupied by acetone, which soaks into every pore of the porous substance, the other half, or 40% of the original volume of the cylinder, is thus available for the expansion of the liquid. The cylinder is closed by a reliable valve, through which the gas is pumped into the accumulator, and through which it flows out again when required for service.

As the acetone charge is equal to 40% of the original volume of the cylinder, and the solvent capacity of acetone is 25 times its own volume per atmosphere of pressure, the acetylene storing capacity of the accumulator is, accordingly, 10 times its own volume for each atmosphere. Therefore, at a pressure of 10 atmospheres an accumulator contains 100 times its own volume of acetylene; at 12 atmospheres 120 times, and so on; this being computed for a temperature of 15° C. (59° F.).

INFLUENCE OF TEMPERATURE—A notable feature of dissolved acetylene is that its usefulness is independent of the temperature. Acetone will not freeze and the gas accumulator can therefore be used in the coldest climates. For example, more than fifty dissolved acetylene lights have been installed in Alaska and some of the installations operate the year round. It should, however, be observed that changes of temperature, although in no way interfering with the usefulness of the gas-accumulator, cause corresponding changes of pressure inside the accumulator. The solvent capacity of acetone varies according to the temperature in such a manner that while it amounts to 25 times its own volume at 59° F. (15° C.) it grows less at higher temperatures, so that at 122° F. (50° C.) it will be 50 per cent. less, that is, only 12½ times its own volume, whereas it becomes greater at lower temperatures, so that at about —4° F. (—20° C.) it will be double, that is, 50 times its own volume. With a given quantity of gas in an accumulator, the change in the solvent capacity at various temperatures will reveal itself by correspondıng variations in the pressure; when the temperature rises the pressure will gradually rise, so that at 122° F. it will be twice as much as at 59° F.; when the temperature falls the pressure will gradually decrease so that at about —4° F. it will only be half of what it was at 59° F.

UPKEEP OF ACCUMULATORS—It will be readily understood that the accumulator is not a delicate thing. It will endure rough treatment or careless handling in transit. The strong steel cylinder cannot be easily dented. The valve is protected during transport by an iron cap. Inside, the iron is not affected either by acetone or by acetylene; outside, it only requires occasional painting to keep it from rusting. Neither will the porous mass cause trouble or require repair. As already stated, it has stood the test of time and, like the steel cylinder, it possesses practically unlimited durability. On the other hand, the acetone filling from time to time requires small additions. Minute quantities of it escape with the gas, and this loss will be noticeable after the accumulator has been recharged with gas a number of times. The acetone will be replenished, when necessary, at the government gas-charging station which it is understood will be located at Balboa at the Pacific entrance of the canal. These additions of acetone are made at an almost infinitesimal cost per accumulator and in connection with the foregoing it should be stated that the admixture of acetone vapor with the acetylene by no means detracts from the light efficiency of the gas, but in reality is of considerable practical value, as it causes the acetylene to burn more smoothly and

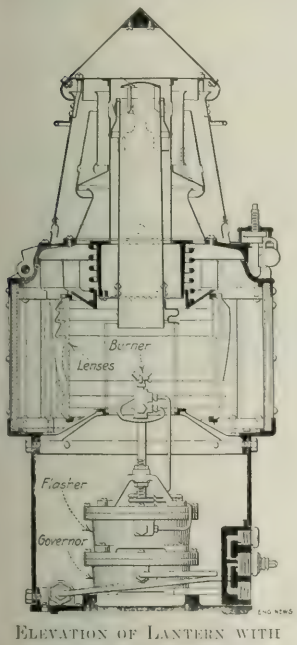
keeps the burner cooler. Replenishing of the acetone at intervals, together with occasional painting, are the only items of upkeep connected with the gas accumulators.

LIGHT APPARATUS

From the foregoing it will be seen that acetylene is stored in the accumulators under varying degrees of moderately high pressure while at the burner, a constant low pressure is required. Therefore the gas must be passed through a pressure regulator or governor, to reduce the high pressure to the required low constant pressure. The governor is the apparatus used for this purpose. Irrespective of the gas pressure in the accumulator, whether high or low, and of the gas consumption, whether large or small, the gas always issues from the governor at the constant low pressure suitable for the burner..

THE FLASHER—An entirely new principle in flashers permits the production of as many as 55,000 separate and distinct flashes from one cubic foot of acetylene. Older types of apparatus could not produce more than 1400 flashes from the same quantity of gas. The new flasher may be adjusted to give light periods of any desired length of time down to one-tenth of a second, or less, alternating with dark intervals of any desired length. Single, double or triple flashes, etc., can be produced with ease, in fact, any light character obtainable in lighthouses equipped with the most modern lens arrangements can be produced by the new flasher.

For lighting the gas as it flows out of the burner during the light periods, a special pilot burner is used. This continuously burning pilot flame consumes only $\frac{1}{3}$ of a cubic foot of gas an hour, or about one-third of a cubic foot per day, as compared with six cubic feet per day in older acetylene flashers.



ELEVATION OF LANTERN WITH FRESNEL LENSES FOR PANAMA CANAL BUOYS

The method of operation of the new flasher may be described as follows: the gas issuing from the governor passes into the flasher, through a valve which remains open during the whole dark interval. When a certain predetermined quantity of gas has flowed through the pipe into the flasher, so that the flexible leather diaphragm is at the top of its stroke, the inlet valve instantaneously closes, and simultaneously the outlet valve to the main burner opens, allowing the accumulated gas to pass through the pipe to the main burner where it is ignited by the constantly burning pilot flame. The pilot flame is fed through the bypass direct from the governor. The valve lever is magnetized so as to always maintain a tight joint with the valve seats and to produce the desired instantaneous cutoff. The gas outlet now remains open until the total gas quantity has been consumed in the main burner, whereupon the outlet closes and the inlet opens, remaining open until a similar quantity of gas accumulates within the flasher, when the cycle of operations is again repeated. Thus the light and dark intervals alternate automatically and produce a uniform flashing light. The pressure of the gas flowing from the flasher to the burner does not vary during the entire light period, regardless of the duration of such period. In the older makes of flashers, the gas enters the burner at a low pressure, which gradually rises to the maximum and falls again toward the end of the flash, thus wasting gas and making it difficult at long ranges to determine exactly the characteristic of the light.

LIGHT CHARACTERS—The principle of the flashing light as a valuable navigation signal has been taken advantage of in the highest degree by designing the new flasher to consume the least possible amount of gas per flash and to make the dark intervals when no gas is being consumed as long as is consistent with efficiency. It is naturally of the utmost importance for the safety of navigation that the light character (the ratio between light and eclipse) after having once been fixed must not vary in the slightest degree. Nearly all lighthouse authorities agree that flashes of short duration followed by relatively short, dark periods are much more distinctive and efficient than long flashes, and this view is borne out by the fact that, of the thousand or more dissolved acetylene lights in operation throughout the world, the majority are adjusted for short flashes. Of the light characters adopted by the army engineers for the lights on the Panama Canal, the flashes do not in any instance exceed 2 seconds' duration, and the majority of them will be set to 0.3 of a second.

The new flasher, although designed especially to suit short flashes, may easily be adjusted to give flashes of any desired length.

THE BUOY LANTERN—The Panama Canal buoys will all be equipped with sixth-order lanterns. This method of dividing lighthouse lanterns into various orders is based upon the focal distance of the optic, that is, half the diameter of the lens at the focal plane. The data for this method of classification are given in the following table.

Order	Focal distance mm.	Diameter of lens mm.
Hyper-radial	1330	2660
First order	920	1840
Second order	700	1400
Third order	500	1000
Third order (small type)	375	750
Fourth order	250	500
Fifth order	187.5	375
Sixth order*	150	300
Seventh order	100	200

With a 1-ft. burner (the size adopted for the Panama buoys), the efficiency of the light through the lens will be 400 Hefner cp. visible at a range of about 11¼ nautical miles. Such great candle-powers are obtainable on account of the high intrinsic brightness of the acetylene flame, which, being relatively small in size, permits of almost exact centering at the focus of the lantern lens.

DISCUSSION

In the discussion of this paper, H. A. Gillis, of the Safety Car Heating & Lighting Co. (Pintsch system), gave the average life of mantles on 2000 buoys as three months and noted that the loss of candlepower due to compression was about 10%. He gave the following figures for illuminating value: Acetylene (purified), 40 cp. per cu.ft. burner capacity; acetylene (dissolved in acetone), 38 cp. per cu.ft.; Pintsch gas (compressed to 12 atm.) in flat flame regenerative burner, 12 cp. per cu.ft.; Pintsch gas under large mantles at 2 lb. pressure, 60 cp. per cu.ft., and under small (buoy) mantles at 1 lb. pressure, 40 cp. per cu.ft.

The statement that the carbide-type of buoy had been abandoned was questioned, since the Canadian government uses nothing else yet, and the U. S. Government is still experimenting with them and has one at the outer end of Ambrose Channel in New York Harbor. There were cited as here, also six compressed-acetylene buoys, and 12 Pintsch-mantle buoys. In the Gedney channel are 12 Pintsch buoys; in the Delaware River are ten Pintsch and one compressed-acetylene buoys. The gas in the compressed-acetylene Ambrose-channel buoys (flashing 0.4 sec. light and 0.8 sec. dark with 40-cp. burner taking 300 cu.ft. per mo.) costs $4.50 per mo. The Pintsch buoys (fixed light with 30-cp. burner taking 630 cu.ft. per mo.) costs $3.30 per mo. plain or $3.45 with a mantle.

The statement of complete safety for dissolved acetylene in a porous holder was questioned by citing the number of actual explosions including one in which the patentee of the acetylene system described and two assistants were severely injured.

The flasher was claimed to be designed on the same lines as older apparatus except that coil springs had always been used instead of the magnets seen here. It was declared that mariners favored equal periods of flash and darkness, to satisfy which would reduce the service capacity of the Panama buoys to six months.

The design of lamp was criticized as weak, the vertical astregals not having the strength or rigidity of helical bars and triangular storm panes. It was claimed that not over 10% of the light was absorbed by the helix, while the loss of light by absorption of reflecting prisms equals that of the helical astregal.

Derrick Cars and Wrecking Cranes for Electric Railways

The equipment of nearly all electric railways, whether city or interurban, includes derrick cars and cranes for handling materials at the yards or on construction and maintenance work, and also for handling wrecked or derailed cars. Some examples of machines of this class are described below.

Derrick Car for the Third Ave. Ry., New York

The derrick car shown in Fig. 1 is of a rather unusual type, and consists of a steel-frame flat car carrying at one end a pillar crane having a horizontal boom upon which travels a hoisting trolley. The motorman's cab, with a bracket for the trolley-pole seat, is at the opposite end of the car, but the car can be operated from either end. The boom is of 20 ft. 8 in. radius, and the hoisting trolley has a capacity of 6 tons, with a maximum reach of 18 ft. and a lift of about 9½ ft. from the rail to the highest position of the hook. The derrick is handled by a man riding in a cage at the side of the boom. The hoisting is done by a motor of 11 hp., giving a speed of 13 ft. per min.; the cables for racking the trolley along the boom are operated by a 3 hp. motor, giving a speed of 40 ft. per min. A similar motor swings the crane at the rate of one complete revolution in 40 seconds.

To steady the car when making heavy lifts there is a 20-ton jack-screw under each corner of the car at the crane end. These jacks have the heads secured by pins to brackets under the sills and are swung up out of the way when not in use. The car can be used for transporting track material, paving blocks, broken stone, etc., the sides being fitted with removable sideboards to retain loose material. This machine was built by the McGuire-Cummings Mfg. Co., of Chicago, and is part of the equipment of the maintenance-of-way department of the railway.

The frame has side sills consisting of two 15-in. steel channels, riveted back to back (forming an I-section), and having top and bottom cover plates. Only one channel of each sill, however, extends from the front bolster to the end sill, under the cab. The body bolsters and end sills are of steel channels, and 6 in.-channels, framed between the sills, carry wood joists 4x6 in., to which the 2-in. floor planks are spiked. Five wearing strips of longitudinal flat steel bars are let into the floor. The removable sides are 2 ft. high, and in four sections 7½ ft. long, each section consisting of two planks secured to two inside T-bar stakes, which are bent to fit pockets inside of the sills. The car is 40 ft. long and 8 ft. 3 in. wide over the sills, with trucks of 4½ ft. wheelbase spaced 21½ ft. between centers.

Derrick Car: Brooklyn Rapid Transit Ry.

The derrick car shown in Fig. 2 is of a type more commonly used than that described above, and has a revolving crane with steel inclined boom whose reach can be varied by means of a topping lift. The boom is 18 ft. long, with a working reach of 20 ft. from center of car, and a maximum height of 20 ft. above the rail. Since the machine was built, a snatch block has been fitted near the middle of the boom, and the hoisting line is led back from the head sheave over this snatch block, so that for an ordinary reach the load is carried farther back on the boom. The hoisting capacity is 5 tons, and the hoist is operated by a 24-hp. motor giving a speed of 40 ft. per min., with maximum load. The capacity varies from 2½ tons at 20 ft. radius to 5 tons at 11 ft. radius. All motions for hoisting, swinging and topping are controlled by the operator riding in the cab of the crane.

The car is 40 ft. long and 7½ ft. wide, with trucks of 5½ ft. wheelbase, spaced 20½ ft. centers. For propelling, the car is fitted with four 40-hp. motors. The side sills consist of 10-in. channels, each reinforced for the greater part of its length by a 7-in. channel on the inner side. The frame is stiffened by a pair of truss rods which pass over the bolsters and have their ends anchored to cross-braces beneath the sills. The weight of the car complete is about 30 tons. The machine was built by the Brown Hoisting Machinery Co., of Cleveland, Ohio. It is used for handling rails and special work, both at the storage yards and on the track.

Derrick Car: Northwestern Elevated Ry., Chicago

In derrick cars for track-repair work, built at the company's shops, the derrick is immediately behind the cab. The timber boom is 20 ft. long, guyed from a post and A-frame not much higher than the cab. The hoisting line is operated by a 12-hp. motor, but the swinging is done



Fig. 1. Electric Derrick Car of the Maintenance-of-Way Department, Third Ave. Ry., New York
(McGuire-Cummings Mfg. Co., Chicago, Builders.)

by hand lines. The topping lift is not generally used, and is worked by hand or by carrying the line to a winch head on the hoist.

The motorman operates the hoist as well as the car movements, and in running position he faces the derrick. The trucks are equipped with powerful motors so that the car can keep out of the way of regular trains, running to the nearest crossover when necessary to allow a train to pass. The car is of timber construction, 46x8½ ft., with a 9-ft. cab at one end. Stakes are fitted to pockets on the side sills to support side boards when carrying loose material. The car is equipped with both contact shoes and trolley poles so that it can operate on the third-rail elevated lines and also on the overhead-wire system of the company's surface lines.

Wrecking and Yard Cranes: Illinois Traction System

The larger electric lines need equipment for handling cars, etc., in case of derailment or other accidents, and in most cases the derrick cars are utilized for work

of this kind. The Illinois Traction System, however, has a wrecking crane or wrecking car equipped with a boom of special shape for the handling of cars and car bodies. This is shown in Fig. 3, and it will be seen that the machine resembles ordinary wrecking crane practice, having a steel-framed platform mounted on a pair of trucks and carrying a revolving crane. But in this machine all movements (including propulsion) are effected through

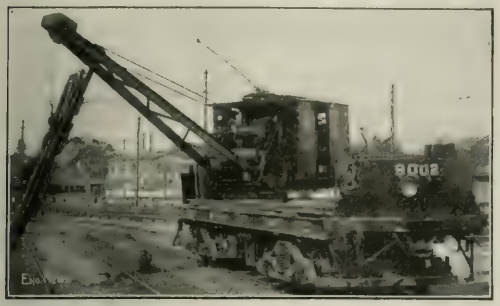


FIG. 2. ELECTRIC DERRICK CAR OF THE BROOKLYN RAPID TRANSIT RY., BROOKLYN, N. Y.
(Brown Hoisting Machinery Co., Cleveland, Ohio; Builders.)

bevel gears instead of chain gearing. Power is supplied by an electric motor of 100 hp.

The car is 13 ft. 6 in. long and 9 ft. 10 in. wide, with a 30 ft. goose-neck boom; and weighs about 65 tons in working order. It can lift 11½ tons at maximum reach and has a maximum hoisting capacity of 30 tons. It can hoist also at a distance of 20 ft. below the track. In addition to the main hoisting block, there is an auxiliary hoisting cable on the head sheave of the boom. The topping-lift cables pass over pulleys on long arms pivoted to pins in a bracket on the back of the boom, as shown.

A practically identical machine for work in the storage yards, etc., has a straight box-lattice boom 46 ft. long, with a hoisting capacity of 4 to 17 tons and a reach of 30 ft. below the rails. This machine is used also in handling coal from the submerged storage pits, and for this work it operates a 1½-yd. clamshell bucket. Both of



FIG. 3. ELECTRIC WRECKING CRANE OF THE ILLINOIS TRACTION SYSTEM
(Browning Engineering Co., Cleveland, Ohio, Builders.)

these machines were built by the Browning Engineering Co., of Cleveland, Ohio, to meet the requirements of J. M. Rosenbury, Superintendent of Motive Power of the railway. The electrical equipment is the same in both cases. The hoisting, swinging and propelling motions are all operated from one 650-volt 90-hp. motor, by means of a train of bevel gears. The controllers are of the reversible type, and there are 200-amp. fuse boxes and two 150-amp. circuit breakers. Both air brakes and hand brakes are applied.

LARGE STEAM WRECKING CRANES

Of a rather different class from the machines above described are some new wrecking cranes on the Norfolk & Western R.R., which have a hoisting capacity of no less than 150 tons. The platform of the car is 27x10 ft., of steel construction, mounted on a pair of four-wheel trucks, giving a total wheelbase of about 20 ft. To steady the machine for a side lift or on soft ground outriggers of steel I-beams can be extended about 7 ft. on each side. The plate-girder boom is attached to the end of a swinging platform which carries the engine and boiler, the platform being mounted on a turntable of large diameter. The boom is only slightly curved, and the distance from its heel to the topping lift attachment is about one-third of the length of the boom. The main hoist is at a distance of 17 ft. from the center of rotation, and there is another hoist at the extreme end of the boom. The maximum load (150 tons at a radius of 17 ft.) can be raised at a speed of 15 ft. per min., and the boom can be raised or lowered by the topping lift while carrying this load. The weight of the machine in working condition is about 120 tons. The cranes were built by the Industrial Works, Bay City, Mich.

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Progress of Excavation in Culebra Cut, Panama Canal—Excavation has advanced to the point where there is only about 8000 lin.ft. of distance left, exclusive of the drainage channel, in which the prism has not reached grade in some part. This section is confined to that part of the cut between the Cucaracha slide, and the northern limit of the slide on the east bank, opposite Culebra village. Between Gold Hill and Contractor's Hill, a part of the drainage cut is down to grade, and visitors are now able to get a fairly clear conception of the final depth of the summit cutting.

On Mar. 29, there were 32 steam shovels working in the canal prism in the Culebra cut section; 13 of these were working on slide material, and the remainder in removing material at the bottom. This number is exclusive of the steam shovels engaged in terracing the banks, and in miscellaneous operations. At the present rate of progress, it is estimated that about 5,500,000 cu.yd. of material may be removed by Oct. 1, the date at which operations by steam-shovels will probably be suspended. This leaves between 2,000,000 and 3,000,000 cu.yd., based upon the recently revised estimate, that will have to be taken out by dredges if the water is let into the canal on Oct. 1. The amount to be removed in this manner will probably be increased by slides at different points along the banks between now and the end of the year.

Work on the Cucaracha slide is progressing favorably, and the output from it has been increasing day by day for the past month, or more, the record output being made on Mar. 29, when five steam shovels removed 11,343 cu.yd. of material. This is the largest amount of excavation from a single slide in one day since the beginning of operations by the United States. The rock shoulder that formerly stood out prominently from this slide for two or three years before it renewed its activity, and which appeared to offer a stay to the mass of material behind it, joined the new movement, and has now moved into the canal for a distance of about 80 ft.

On Apr. 14, several of the steam-shovel crews were put to work on a 12-hr. shift. ["Canal Record."]

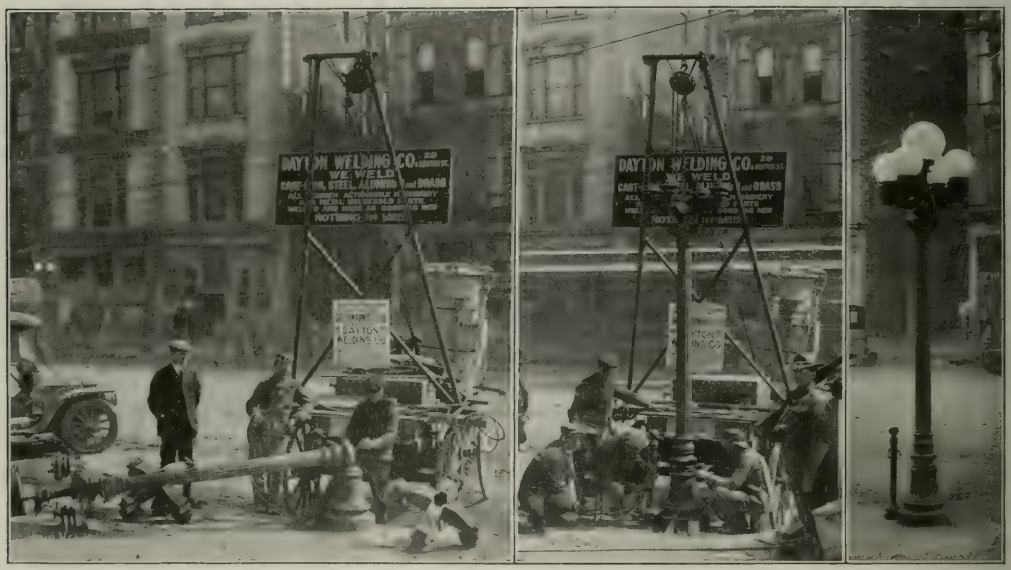
FIELD AND OFFICE

Oxyacetylene Welding and Cutting Operations

Repairing Lamp Posts in Dayton—During the recent floods in Dayton, Ohio, about 150 of the ornamental cluster lamp poles were broken off about 18 in. above the ground. The breaks were not due to defective castings but due to heavy objects being swept against the poles by the current through the streets. When the question of welding these poles, instead of erecting new ones, was first brought to the attention of the Dayton Power & Light Co., the officers of the latter did not think it possible to secure the required strength at the welds, since all of the work had to be done on the street. To take up the concrete and to reset the poles would have been a very expensive operation.

To demonstrate the possibilities of this sort of repair, six specimen poles were welded and tested, when it was found that they were as strong as new. They were probably stronger at the point of weld, as a ⅛-in. fillet was added on the outside during the process. The operations of making these repairs are shown in Figs. 1 to 3. A special derrick was fastened to the rear of the wagon which also carried the acetylene generator, the oxygen tank and the necessary tools. The wagon was backed up to the stub of each pole, and the broken part was raised to its original position; the old breaks were matched up and the joints were prepared for welding. No trouble was found in keeping the poles in alignment during the work. It is reported that this particular sort of perpendicular weld is considered by the workmen to be one of the most difficult manipulations, and many experienced men will not attempt it.

With the one portable outfit shown, and employing three men, the contractors were able to erect six to seven poles per day at one-half the cost of new poles, not including the probable cost of removing the broken stubs, resetting new poles and replacing the concrete about the bases. The work was done by the Dayton Welding company. We are indebted to Mr. W. L. Blackwell, president of that company, for the information and photographs presented.



Figs. 1, 2 and 3. Welding Ornamental Lamp Posts in Dayton, Ohio.
(Fig. 1, preparing the joint; Fig. 2, welding the broken edges; Fig. 3, the pole completed.)

Removing Wreckage in Indianapolis—Fig. 4 shows the use of an oxyacetylene cutting torch in use in removing the wreckage of a reinforced-concrete arch-span bridge in Indianapolis, Ind. Two important bridges were wrecked during the recent flood (Engineering News, Apr. 17 and 24, 1913). One was of concrete, faced with stone, and reinforced with I-beams, which hung between piers as strings of twisted junk. The wreckage of a plate-girder bridge with concrete floor was equally troublesome.

Tanks of dissolved acetylene and oxygen were mounted on trucks, hauled to the bridges and used with cutting torches. First, the I-beams were locally heated to a bright red, as shown in Fig. 4, and then a stream of pure oxy-



FIG. 4. CUTTING AWAY I-BEAM REINFORCEMENT OF WRECKED MERIDIAN ST. BRIDGE, INDIANAPOLIS

gen was directed against the hot metal. This caused the iron to burn away quickly so that the average time consumed in serving a beam was a little over five minutes. The work of cutting the beams and girders of the two bridges and placing them in a position for easier removal took a little over three days. The work was done by the Prest-O-Lite Co., makers of portable acetylene lighting systems and welding outfits.

Effect of Too Much Water in Mixing Concrete

In connection with the discussions as to the relative desirability of wet and dry concrete current some years ago a number of tests were made on concretes containing varying degrees of mixing water, but most of the tests had a maximum of 20% of water, that being then about the limit of wetness in practice. Of late, however, with the advent of much slushier concrete, doubt has been thrown on the ultimate strength and wearing qualities of the very wet mixes which have become common. As a contribution to this question, we present below the results of a limited test on the short-time strength of concretes mixed with percentages of water, varying from 20 to 42½%. The tests were made in the Sheffield Scientific School of Yale University, by Charles J. Robison, who prepared the accompanying tables and diagram.

The tests were made on a 1:2:4 concrete mixed with normal sand, cement and ¾-in. trap rock, cast as small beams and as cubes and broken in bending and in compression, respectively. The beams were 2x3½x36 in. in size, reinforced with two ⅛-in. rods in the lower part of the section, and designed to carry safely a load of 274.2 lb. placed at the center. The cubes were 6 in. on a side. The specimens were kept in the forms for 48 hours and kept moist for 10 days (except the 7-day cubes) and were tested up to a 60-day age, as shown by the accompanying tables and figure.

All material was dry before mixing and water was added in percentages from 20% to 42½%, according to the following method: As a minimum, enough water was taken to moisten the stone and sand, and then there

TABLE I. BREAKING LOAD ON REINFORCED-CONCRETE BEAMS MADE WITH VARIOUS AMOUNTS OF MIXING WATER.

(Center load in pounds.)

[2 x 3½ x 36-in. beams, reinforced with two ⅛-in. rods. 1 : 2 : 4 concrete.]

% Water	30-day Test*	60-day Test*
20	290 (1)	300
22½	398 (2)	410
25	473	550
27½	637	680
30	507	560
32½	461	500
35	118	150
37½	360	400
42½	313	340

* Average of three tests except as shown in parentheses.
† One test only.

TABLE II. COMPRESSION VALUES (LB. PER SQ. IN.) ON 6-IN. CONCRETE CUBES WITH VARYING PERCENTAGES OF WATER.

	7 days†	30 days*	60 days*
20%	2052	2777	3104
22½	2173	3132	3395
25	2277	3278	3488
27½	2500	3516	3597
30	1722	2871	3166
32½	1413	2416	2666
35	1222	1977	2388
37½	1097	1819	2173
42½	652	1500	1888

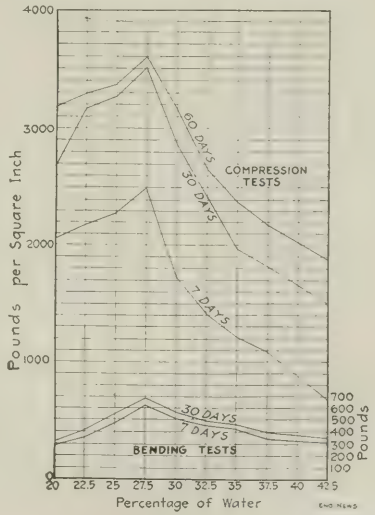
* Average of two tests.
† One test only.

was added 20% (of the amount of cement by weight) water. Each subsequent mixture was increased by 2½% water. It was noted that the 42½% mixture was about as wet as is used in the average wet mixer, though dryer than some slushy mixes.

Table I shows the results of the beam tests. It may be noted that keeping everything constant except the water, there is a gain in strength of 126% for a 27½% over a 20% water content at the end of 30 days, and 126⅔% at the end of 60 days. Although all the beams carried their designed load, in some cases the factor of safety is very small, particularly in the 42½% mixture, which is commonly used in practice.

Table II gives the results in the cubes; practically the same as on the beams. There is a gain of 282% with the 27½% water content over the 42½% at seven days, 138% at 30 days and 90% at 60 days, which may indicate that in time a drying out will take place sufficient to reduct the handicap of the very wet mix.

The accompanying curve is a graphical representation of the data in Tables I and II.



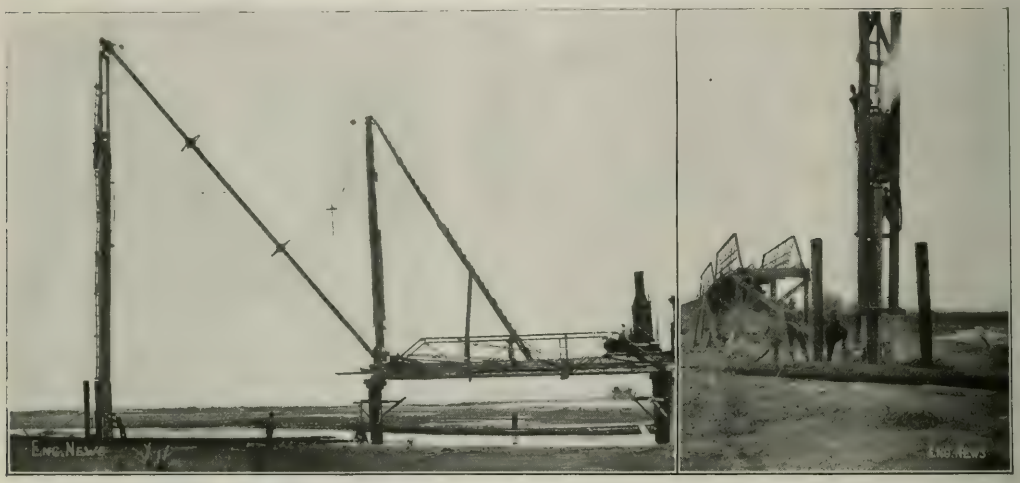
Bridging a River in Quicksand

In building light highway bridges over the Rio Grande at El Paso, Tex., pile bents were used as substructure. Driving the piles required a special rig, because the river bed is quicksand from bank to bank and therefore ordinary methods of temporary staging for the piledriver could not be used. The rig shown in the two views below was built to handle the work.

A pair of swinging driver-leads with steam hammer is carried at the end of a derrick boom. The derrick and engine are mounted on a timber bed-frame 54 ft. long, set on rollers, traveling on the roadway of the finished spans. An overhang of about 50 ft. is obtained, which enables the next pile-bent ahead to be driven ready for the truss seat. The derrick then sets the span, previously assembled.

The piles were 60-ft. yellow pine piles, averaging 3000 lb. weight. A penetration of 52 to 58 ft. was required. The hammer used weighed 5500 lb. The leads used were 68 ft. long. The derrick had a capacity of 8 tons; the mast is 48 ft. high and the latticed-steel boom 80 ft. long. About one hour continuous driving was required per pile, the hammer striking 130 blows per min.

The El Paso Bridge & Iron Co. erected the bridges. W. E. Robinson, manager of the company, gives the above data.



Driving Pile Bents for a Bridge from Span Last Erected; El Paso, Tex.

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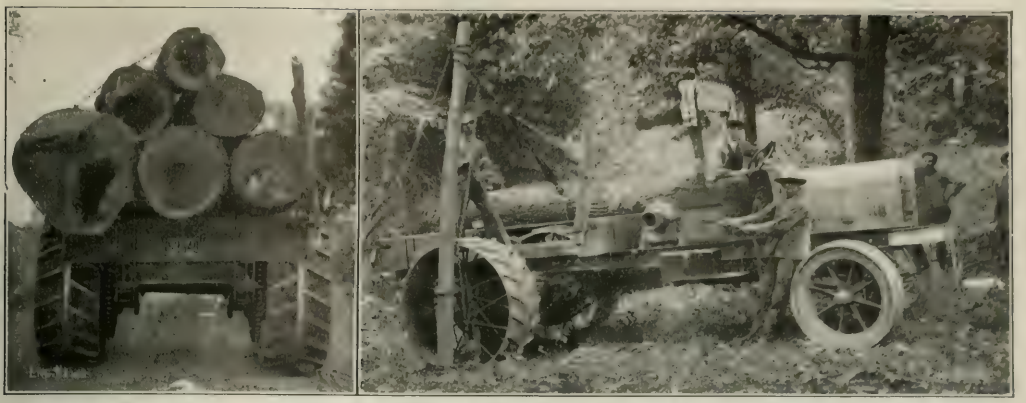
Motor-Operated Section-Cars on the Toledo & Ohio Central Ry.

For some years past there has been an increasing use of motor-operated cars for railway section gangs. They are found to have advantages in saving the time and energy commonly expended in "pumping" the hand-car to and from the work every day, and in enabling the length of the section to be increased (without increasing the force) owing to the greater speed and facility in getting over the work. We present below some information furnished by J. A. Stocker, Chief Engineer of the Toledo & Ohio Central Ry., in regard to experience with motor cars on that road.

In 1910 the company purchased two gasoline section cars for use where the section headquarters were at some distance from the section limits. The operation was carefully watched, and the results obtained were such that in 1912 it was decided to equip two light-traffic divisions with motor cars at all points, except in yards. These divisions had five-mile sections (the standard length on this road), and during the winter it had been customary to reduce forces to a foreman and two men on each section. This made the percentage of foremen high, and it was thought advisable to lengthen the sections to eight miles (except where track conditions prevented), and to make the minimum section force a foreman and three men. In June, 1912, 18 gasoline cars were installed on the two divisions, which have now sections 6 to 8 miles long. The grades range from 0.4% to 2.5%.

At each section headquarters, a small storage shed was constructed, this being placed a sufficient distance from other buildings to avoid danger from fire. An arrangement was made with an oil company to deliver gasoline by tank wagons. Each shed has a 30-gal. tank for gasoline, a 2-gal. can for lubricating oil, a 2-gal. measure to charge the car, a pint measure, and two funnels. This equipment cost $3.60. Each foreman is given a set of instructions, and is required to keep account of the fuel, supplies and repairs, and the number of miles run. He furnishes the supervisor with a performance report every month.

The results of the operation of 21 cars on 20 sections for the last six months of 1912 are summarized below. No charge has been made for inspection or for the labor of making repairs, as the inspection has been done by the manufacturer and the repairs by the foreman. For the future it is considered advisable to employ a repairman to make periodical inspection and repairs, with a view to standardizing the condition of maintenance of the cars and thus obtaining a more uniform performance. The records show wide variations in the cost per mile run, which bear no relation to the grades upon which the



A 5-Ton White Motor Truck with Power Winch for Logging Scattered Hardwood Timber

cars are operated, and it is thought those are due largely to the varying efficiency of the different foremen.

The average cost of fuel, supplies and repairs per mile run was 0.98c., with a minimum of 0.67c. (2418 miles run) and a maximum of 1.77c. (1312 miles). The latter was on a section having a 2½% grade. The miles run per car for the period mentioned ranged from 766 to 2816. The average mileage per car was as follows: miles run, 1653; 23 miles per gal. of gasoline, 315 per gal. of lubricating oil, 655 per lb. of grease, and 181 per battery cell. In computing this last, only those cars with battery ignition were considered. A few of the cars are equipped with magneto ignition and have given satisfactory results, but it is considered too early to determine which method is the better.

Among the principal advantages derived from the use of the motor cars are the following: (1) The men arrive at their work fresh and unfatigued; (2) less time is consumed going to and from work, the saving being estimated at 30 min. per day; (3) there is no disposition of the men to shirk before quitting time in order to rest for the long pull to headquarters; (4) if the supervisor desires to concentrate a number of gangs at one point, they are transported by the motor cars instead of by train. The question of safety of motor cars as compared with hand cars frequently arises. Usually while riding on hand cars, no one but the foreman is keeping a lookout for trains. While riding on the motor car, the men sit facing sideways; all are in position to watch for approaching trains and can readily jump off the car. Mr. Stocker says the indications are that motor cars are no more dangerous than hand cars, and that they are considered somewhat less dangerous. This experience has been entirely on single-track railway. He would not recommend motor cars for short sections, nor for lines with more than two running tracks.

Logging with a Motor Truck

The hardwood forests of Ohio and the Middle West, where Daniel Boone and other famous pioneers and Indian fighters used to ramble, are now mostly a matter of history, and whatever standing timber is left is scattered and not economically gotten out by ordinary means. The accompanying illustrations show how an enterprising lumberman of Cuyahoga County, Ohio, has solved the problem of lumbering these stray trees which have so long escaped the woodman's ax.

On a small scale the truck shown in the illustrations has done the work of a logging locomotive, skidder and donkey engine. A power winch driven from the transmission shaft is built near the middle of the truck body, and is controlled by a lever similar to those for the brake and transmission control. By a proper use of the winch and a simple rope-and-chain tackle the truck crew of four men has loaded 1000 ft., b.m., of timber in 20 min. The winch is made of further use in lifting logs out of gulleys and ravines and in unloading from truck to flat-cars.

The truck has a six-cylinder gasoline motor, and in all respects except the wheels is the standard 5-ton model truck made by the White Co., of Cleveland, Ohio. Both front and rear wheels are of special build. The driving wheels are steel with 22-in. treads corrugated in the maner of tractor wheels, which enables the truck to run over rough surfaces and on soft ground without serious difficulty even when away from all roads and paths. The front wheels are equipped with heavy ribbed steel tires.

Experience has proved that the truck can travel with its full load in practically all seasons of the year. The driving power is multiplied by the use of a gear ratio much lower than that used for trucks in normal service, which limits the speed to about 8 miles per hour.

While in no sense a rival of the logging railway for large-scale lumber projects, the truck has proved economical in culling fine specimens of oak, walnut, hickory and ash, which have hitherto been almost immune against the ordinary methods of getting out timber in such isolated groups.

A Suggestion for Small Cities—All cities of small size, or for that matter all cities, would do well to follow the example of Little Falls, N. Y., which puts this note in the Annual Report of the Board of Public Works:

The city is situated about in latitude 43° 0.03′ north, and longitude 74° 52′ west of the meridian of Greenwich. It embraces 2591.22 acres within the city boundaries. The lengths of streets and roads within the city limits approximate 25 miles. Population about 12,500.

Such data are often looked for, and hard to find. Elevation above sealevel might be added to the location data.

An Economical Sand and Gravel Plant

Perhaps few small engineering jobs offer better opportunity for originality in design and construction than the erection of a sand and gravel mining, screening, and sometimes washing plant. There are many ways of handling the material from gravel bank to the salable product in carts, cars or scows, and on the selection of equipment

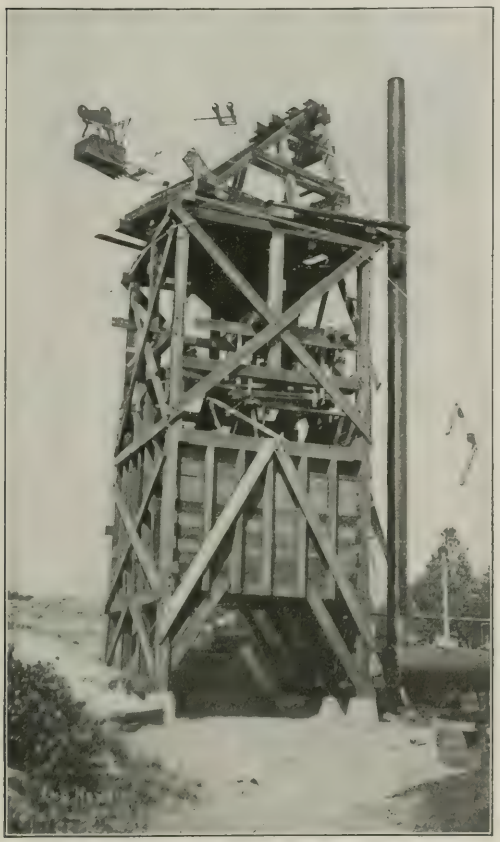


Fig. 1. Scraper-Bucket Excavator and Screening Tower, Waterbury Sand & Gravel Co.

best suited to the local conditions may depend the financial success of the plant.

The plant shown in the accompanying illustrations is located on a public highway in front of a gravel bank which, in general, has a downhill slope away from the roadway. Hence most of the sand and gravel has to be elevated not only the height of the tower, but up the sidehill as well.

The tower is 18 ft. square and 45 ft. high from ground level to base of quadrupod, or double A-frame, on top, and is guyed by wire rope from each corner. The corner timbers are 10x10-in. and the diagonal braces are 3x12-in. timbers. The top framework on which the quadrupod rests is built of 12x12-in. timbers. The quadrupod itself is made of 10x10-in. timbers and can be turned about a center pin so as to face in any direction. The bearing between the quadrupod and the tower framework is a 2-in. bar-iron circular track on which the steel-plated corners of the quadrupod rest.

The main 1-in. steel-wire cable on which the bucket travels is fastened to a dead man buried in the far end of the gravel bank. By moving this anchor to different positions it is clear that the cable may be hung over any part of the gravel bank. The main cable passes over a sheave in the top of the quadrupod to a pair of double-sheave blocks, the lower one of which is attached to another anchorage. The smaller cable from the pair of blocks passes over a sheave on the quadrupod and is wound on one of the drums of a 30-hp. hoisting engine located between the two A-frames of the quadrupod.

To the excavator bucket is attached a bridle and cable, which is wound on the other drum of the hoist, as with the ordinary cable excavator. By slacking off this draft cable the bucket is allowed to run down the incline of the main cable to any part of the bank; the main cable is then slacked off, and the bucket is filled by drawing up on the draft cable. The main cable is then tightened

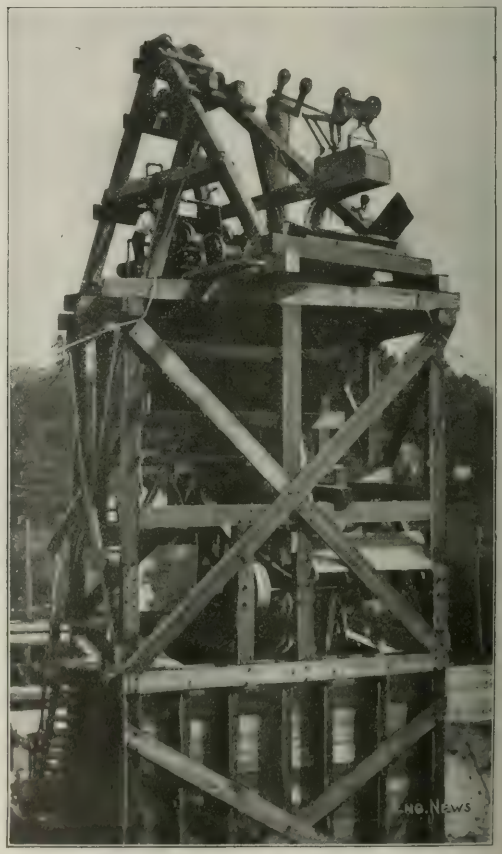


Fig. 2. View of Tower, Showing Arrangement of Machinery

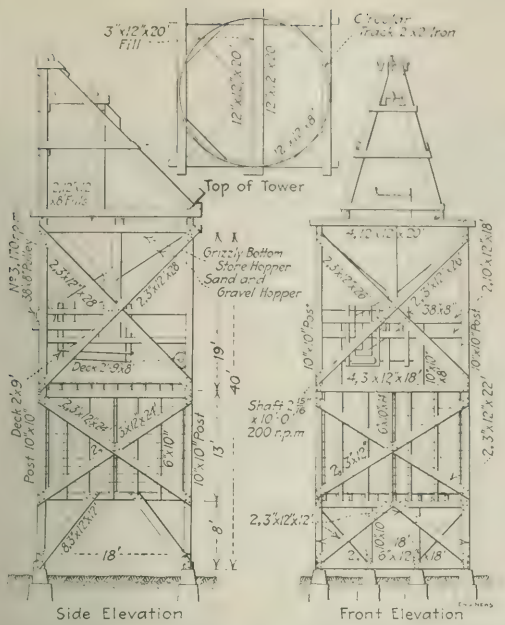


FIG. 3. DETAILS OF SAND AND GRAVEL SCREENING AND STORAGE TOWER

and the bucket run to the top of the tower where a trip automatically discharges the contents into a hopper.

Stones too big to pass the gravel screen are diverted to a small stone crusher which discharges to two shaker-screens below. The sand and gravel fall through a chute to the same screens. The shaker-screens are sufficiently inclined to allow the material to flow along on them. Each screen is divided into two parts with different sized meshes. The first half of the upper screen allows the coarse and fine sand to drop through to the lower screen, and the second half permits the fine gravel to pass, the coarse gravel being discharged at the end of the screen into a chute leading to one of the four storage bins. The first half of the lower screen passes the fine sand, and the second half the coarse sand, into separate bins, the fine gravel being discharged at the end into another bin.

Steam power is furnished by an 80-hp. horizontal boiler. The hoisting engine is a double-cylinder 8x10-in. Flory hoist. The scraper bucket has a capacity of ½ cu.yd. The plant has been operated so as to yield 150 cu.yd. of the required material per day of 8 hr. The outfit complete cost approximately $6500 and is operated for about $20 a day, including an allowance for interest and depreciation. The plant described was designed and erected by the Cable Excavator Co., of Philadelphia, Penn., for the Waterbury (Conn.) Sand & Gravel Co., to the President of which, E. C. Whitney, we are indebted for the data here given.

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Improving the Engineer's Status—A recent advertisement for a structural draftsman in a city engineer's office requires him to be competent to design bridges. This is in line with the practice of hiring rodmen and working them as instrumentmen.

Automatic Device for Rating Current Meters

BY GEORGE L. STROBEL*

An automatic device for rating current meters has been used with success for the past two years by the Bureau of Public Works, Philippine Islands. The unique feature of this device is that upon a piece of smoked paper there are automatically recorded simultaneously: (1) Meters of run of the rating car; (2) seconds of time, and (3) revolutions of the current meter.

A view of a portion of the mechanism is shown in the illustration, Fig. 1. Of the car proper only the platform is shown in the cut. The car operates on two rails laid upon opposite sides of the rating tank. The current meter is suspended from the center of the car into the tank below.

As the car is propelled forward the sprocket wheel *a* is driven by a chain which runs over a like sprocket wheel attached to the axle of the car. Sprocket wheels of motorcycles were employed, which is the reason that, in the illustration, the sprocket wheel seems unnecessarily large. The shaft to which the sprocket wheel is attached drives a worm gear as shown. This worm gear

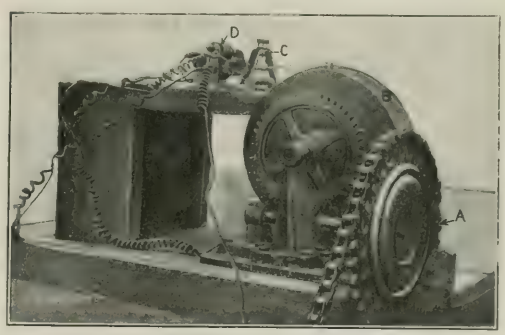


FIG. 1. AUTOMATIC DEVICE FOR RATING CURRENT METERS; BUREAU OF PUBLIC WORKS, PHILIPPINE ISLANDS

rotates the large drum *b* and the proportions of all parts are so adjusted that the drum *b* makes slightly less than one rotation while the car traverses the length of the tank, 50 m.

Upon the drum *b* is attached a piece of smoked paper, much in the same fashion that a paper record is attached to steam-engine indicators. As the drum rotates, three lines are drawn upon the smoked paper by the three pointers *c*, Fig. 1. These three pointers are capable of a slight sidewise motion which is induced by the three electromagnets *d*.

One of the three pointers *c* records upon the smoked paper meters of run of the car. To effect this, a copper wire is laid lengthwise of the track near one rail; this wire is placed on the underside of a board for 96 cm. and upon the upper side for 4 cm. A copper brush, attached to the car, runs along the board, and on contact of brush with wire the circuit is closed, and a projection is made upon the meters' line on the smoked paper record.

*Designing Engineer, Bureau of Public Works, Manila, P. I.

Another of the three pointers *c* records seconds of time. A clock with a second's pendulum is kept in the house in which the car is stored, and two trolley wires (not shown in the illustration) connect the car with the clock. An electric circuit is closed every second by the passage of the lower end of the pendulum through a dish of mercury, which records a projection upon the seconds' line on the smoked paper chart. The third pointer *c* is controlled by an electric circuit connected with the moving parts of the current meter in the usual way.



FIG. 2. SMOKED PAPER RECORD OF CURRENT-METER RATING: (1) METER OF RUN OF CAR. (2) SECONDS OF TIME. (3) REVOLUTIONS OF CURRENT METER

After the record of the test is made upon the piece of smoked paper, the paper is removed and shellacked to prevent injury to the markings. The smoking of the paper is done with a common kerosene lamp. To facilitate putting on and taking off the smoked paper from the drum *b*, this drum is made loose upon its shaft, but can easily be made tight by means of a screw which causes the drum to bear upon a shoulder machined upon the shaft.

A sample record is shown in Fig. 2. No matter what the speed, the projections on the meter line are uniformly spaced, giving a distance scale.

Native workmen are employed to push the car, although it could be easily made to be operated by an electric motor.

Credit for invention of this apparatus is due to Clarence G. Wrentmore, Engineer of the Philippine Department of Public Works.

Length of Crossover between Curved Parallel Tracks

BY R. W. STEWART*

While the geometry of railroad alignment has been almost exhaustively covered, the writer cannot find that the archives relating to this subject contain a satisfactory treatment of the crossover between parallel curved tracks.

There is a method published in various fieldbooks for laying out such a crossover with the frogs so located as to produce a reverse curve between them. This violates the principle that the alignment through any track construction should have as little total curvature and as small a degree of curvature as possible. Also the alignment of a crossover built in this manner has a kinky appearance which causes the track foreman who builds it to think that the engineer who laid it out made a mistake.

As a substitute for this the writer wishes to submit a method of computing the length between frogs of a crossover between parallel curved tracks which will give the minimum total curvature and the minimum degree of curvature between the frogs, this condition occurring when the curve in the crossover between the frogs is a simple circular arc extending from frog to frog.

In the annexed figure let *O* be the common center of the parallel tracks and let *A* and *B* be the points at which the center line of the crossover is intersected by the radii of the main track curves which pass through the frog points. The problem is then to so place the frogs that the curve in the crossover between *A* and *B* will be a simple circular arc, or, in other words, the tangents to the crossover curve at points *A* and *B* must intersect at point *V* equally distant from *A* and *B*.

In triangle *OAB* the difference in length between sides *OA* and *OB* may readily be computed, being the track spacing *p*, minus the track gage, minus the track gage divided by the cosine of the frog angle. Call this distance *m* and call the radius of the arc midway between the centers of the parallel tracks *R*.
Then

$$OA = R - \frac{m}{2}$$

and

$$OB = R + \frac{m}{2}$$

Let *Q* be the center of the crossover curve and Δ its intersection angle. Draw radii *QA* and *QB* and we have the following relations between angles:

$$VBA = VAB = \tfrac{1}{2}\,\Delta$$

and

$$OAQ = OBQ = \text{frog angle} = F$$

In triangle *OAB* we have

$$ABO = 90^\circ - F - \tfrac{1}{2}\,\Delta$$
$$OAB = 90^\circ + F - \tfrac{1}{2}\,\Delta$$

By applying the rule that the tangent of half the sum

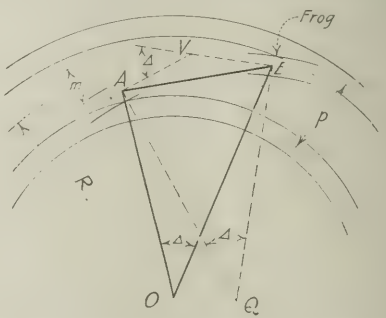


DIAGRAM FOR LENGTH OF CROSSOVER BETWEEN CURVED PARALLEL TRACKS

of two angles is to the tangent of half their difference as the sum of the opposite sides is to the differences between the opposite sides we get

$$\frac{\tan\frac{\Delta}{2}}{\tan F} = \frac{2R}{m}$$

*Engineer of Bridge Work, City Engineer's Office, Los Angeles, Calif.

from which

$$\tan\frac{\Delta}{2} = \frac{m}{2R\tan F}$$

From this last equation the value of Δ and the arc length between frogs measured along either of the parallel tracks may be computed.

Although the above equation is very easy to handle it may be transformed in such a way as to make the computation of the arc length between frogs still more convenient as follows:

By Maclaurin's Theorem

$$\tan^{-1} n = n - \frac{n^3}{3} + \frac{n^5}{5} - \frac{n^7}{7} + \ldots etc.$$

or,

$$\frac{1}{2}\Delta = \frac{m}{2R\tan F} - \frac{m^3}{24R^3\tan^3 F} + \frac{m^5}{160R^5\tan^5 F} \ldots etc.$$

from which we get

$$R\Delta = \frac{m}{\tan F}\left(1 - \frac{m^2}{12R^2\tan^2 F} + \frac{m^4}{80R^4\tan^4 F} \ldots etc.\right)$$

The series in the parentheses converges so rapidly that only the first two terms need be considered, and m is usually so small with reference to R that the second term can be neglected without appreciable error.

Note that the first term gives the distance between frogs (measured parallel to the main tracks) for *straight tracks*.

We may, therefore, say that for usual conditions the length between frogs of a crossover connecting parallel curved tracks, projected upon the arc midway between the parallel tracks, is substantially equal to the similarly projected length for straight tracks. If the radius of the curved tracks is short and an exact result is desired a correction to be subtracted from the straight track length may be computed from the second term of the above series. This need be computed only to one or two significant figures.

It may be noted that the tangent distances AV and BV of the crossover curve do not enter into this computation and therefore the length sought is in no way affected by the fact that the crossover curve ends at the heels of the frogs instead of at the frog points.

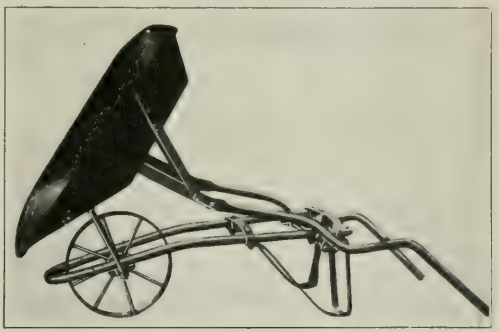
Credit for the expression of the crossover length in the form of an infinite series is due Mr. G. A. L'hommede of this office.

NOTES

The Hand Derrick Car used in the removal of a French railway bridge, as described in our issue of Apr. 24 (p. 846), was not of the mast and boom type as erroneously sketched by the draftsman. An inclined frame or boom, composed of two side timbers with lateral bracing, extended forward from about the middle of the floor of the car with sufficient overhang to carry the girder panels. This was supported near the middle by struts inclined in the same direction and seated near the front end of the floor. The hand hoist was mounted near the rear end of the boom frame, and at the rear end of the floor was a counterweight box. There was no swinging motion, as the car was simply pushed back to the adjacent yard to deposit each panel as removed, probably depositing it within reach of an ordinary crane. As the bridge acted as a temporary cantilever during its demolition, only a very light derrick car could be operated upon it.

Economy of Municipal Motor Vehicles—According to a report prepared by the General Purposes Committee of the Birmingham, England, City Council, the number of motor-cars used in the service of corporation departments is 28. They are of various types, seating from two to ten persons each, and their total cost, with accessories, was $58,500 an average of $2089 each. The annual depreciation is estimated at $296 per car and the approximate working cost per annum (including wages, uniform, etc.) at $24,000, an average of $860 per car, making with the depreciation a total of $32,400 per annum, an average of $1159 per car. The approximate car mileage run per annum is 264,150, an average of 9434 miles per car; and the cost per car mile is 12c. Seven men, six horses, and nine vehicles have been displaced, with an annual saving of $7600. The committee are unable to make any exact estimate of the saving effected by the use of the cars, but they are satisfied that the economics are very considerable, and that it would be impossible to carry on the work of the enlarged city from a single center without such provision. The city electrical engineer estimates that without the cars he would require additional inspecting officials, whose salaries would amount to over $10,000 per annum, while the city surveyor also considers that some thousands of dollars per annum in extra men and district offices have been saved by their use. [Engineering Supplement of the London "Times."]

Forward-Dumping Wheelbarrow—The Long self-dumping wheelbarrow is illustrated herewith in its dumping position. It is made and recommended primarily for concrete work, as in placing concrete for floor slabs, etc., where it is of great advantage to be able to dump the load forward over the wheel, that is, off the front of the runway on which the barrow rests. The barrow was patented less than a year ago, but is already in somewhat extensive use. However, it is a new tool, and should have just as much of a field in general

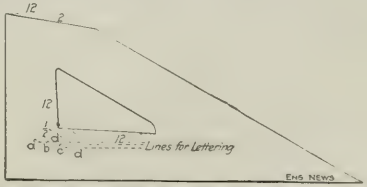


THE LONG FORWARD-DUMPING BARROW, IN DUMPING POSITION

work as in reinforced-concrete work, especially with the addition of locking lugs for throwing the self-dumping motion out of action when not wanted.

The tray of the barrow is made of No. 14 sheet steel pressed to shape, with wired edge. The main frame and handles are of steel tubing. The barrow weighs slightly more than the ordinary wheelbarrow; at the handles the difference amounts to 14 lb. lift, according to the makers. The capacity is about 3 cu.ft. level full. The barrow is made by Miller & Coulson, Pittsburgh, Penn., and is sold at $7 to $7.50.

Improving the Triangle—The adjoining sketch shows two ways to make the triangle a more convenient tool in the drafting room. The opening of the triangle and the obtuse corner are cut to frequently used bevels, as 2 in. per ft. for the flanges of structural shapes, ½ in. per ft. for masonry batters, etc. The bevels are laid out on paper, and the celluloid of the triangle is first cut away with a knife and then trimmed to the ruled line with a file.



A TRIANGLE WITH BEVELS AND WITH HOLES FOR GUIDE LINES FOR LETTERING

The holes a, b, c, etc., are for ruling guide-lines for lettering. They are cut large enough for the point of a big lead-pencil and are brought to a point in one corner. The lines are drawn by pressing the point of the pencil down in that corner and moving the triangle across the paper, along the edge of another triangle or the T-square. This device has been found very convenient. It has the advantage of drawing the lines always the same distance apart, which helps to improve the lettering. When a series of more than three lines is required, marks "d" scratched on the triangle show how far up or down to move the T-square.—Walter H. Dunlap, Roanoke, Va.

Tank Cars for Testing Bridges are used on the Swedish State Railways, thus enabling the load to be varied to suit different bridges. The tank is 10 ft. diameter and 24 ft. 3 in. long, carried on a steel frame composed of two plate sills and seven transoms. This is mounted on four axles spaced 4 ft. 3 in. apart, with 38½-in. wheels. Each axle has semielliptic springs over the axle boxes, each spring being attached to links on the sills, and no equalizers being used. The total wheelbase is 12 ft. 9 in., and the total length over spring buffers is 23 ft. 9 in. The capacity of the tank is 54 tons, and there is a graduated scale to show the weight of water at any level. The weight of the car with tank empty is 29 tons, so that the maximum loaded weight is 83 tons, or 20 tons per axle, and 3.1 tons per ft. of total length. The water for the tank is handled by a pump and benzine engine, mounted on the car.

Measuring the Gage of Track at frogs and adjusting the frog guard-rails in proper position relative to the gage is often done incorrectly by the section foremen, through the practice of giving a uniform width of flangeway between the track rail and guard-rail. As a matter of fact, the guard-rail position should be gaged from the frog and the track rails should be set to the same gage as the adjacent portion of the track. Thus, on curves the gage through the switch and frog will be slightly wider than standard, and the width of flangeway will be correspondingly wider if the rails are laid properly. This matter was discussed in connection with the report of the Track Committee at the recent annual meeting of the American Railway Engineering Association, and rules were adopted as follows:

1. Guard-rails must be so placed that the gage distance from the frog point to the flangeway side of the guard-rail shall be at the least 4 ft. 6¾ in., and the distance between the flangeway sides of the wing rail and guard-rail shall not exceed 4 ft. 5 in.

2. The installation of frogs upon the inside of curves is to be avoided where practicable. Where this is unavoidable, the gage of track at the frog should be standard.

Roller Case for Large Map—A large road-map of Ohio that is constantly in use for reference in the office of the State Highway Department (James H. Marker, Commr., Hartman Bldg., Columbus, Ohio) is preserved and made conveniently available by mounting in a glass-covered roller case. The map is about 7 ft. wide and therefore is hard to handle and easy to injure, if used in the ordinary way. The case is like a double-topped table, with the upper layer glass. Between the glass and the main top are mounted two horizontal rollers or shafts, on which the map is rolled. The shafts extend through one end wall of the case, and have knobs here by which they can be turned, thereby rolling the map on one roller or on the other. Every part of the map is made available instantaneously, and yet the map is never touched or rubbed, folded or crumpled. The case was designed in the office of the Highway Department, and is considered a very satisfactory device.

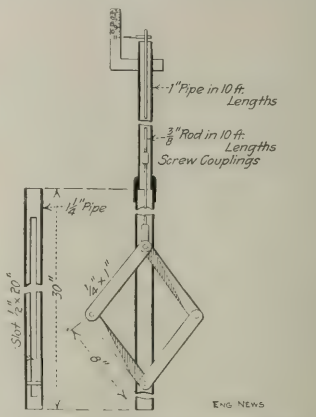
Women and Girl Road Laborers in the Philippine Islands—Women and girls are employed on road construction and even on bridge work as laborers in Cebu Province. In the construction of the Paoay-Currimao Road it is recalled that at one time there were approximately 500 women and girls employed daily. These feminine workers, receiving from 20 to 25 or 35 centavos per day, according to their strength and ability, are most efficient when materials for subgrade, surfacing or gravel and sand for concrete are to be carried a short distance. They tie up their skirts or "pandiling" to be less hampered a sthey work and wield shovels, load, carry and empty their baskets with a zeal that outclasses the men.

In the construction of subgrade, Paoay-Currimao Road, it was necessary to haul material about one-half a kilometer at one point. This was accomplished with women workers. Men loaded the baskets at the borrow-pits. Baskets hold about 1/50 cu.m. and are carried on the head. On a short haul a woman will carry from a meter to a meter and a half of material per day.

As may be imagined there is considerable talking done as the work progresses, especially in the afternoon, when the women begin to tire. Ignorance of the dialect may have caused the listener to misinterpret, but it is said that the capataces (men) use some very forcible arguments to convince the ladies that they should talk less and work more.

On concrete work women are used to advantage carrying sand, gravel and water. They are not strong enough to mix concrete for any length of time, so men are employed for that purpose. The "material" gang, having filled the barrels for the next batch, are used to pass the mixed concrete to the forms, in buckets. Later, the forms having been stripped and the concrete rubbed down, a couple of women suffice to carry water and keep the green concrete wet down. ["Quarterly Bulletin" of the Bureau of Public Works, Philippine Islands, Jan. 1, 1913.]

A Caliper for Drill Holes in Rock—In the work of drilling grouting-holes in the foundation in the cutoff trench of the U. S. Reclamation Service dam at Lahontan, Nev. (see "Engineering News," Apr. 3, 1913, p. 647), there was some speculation as to how much caving of the walls of the holes occurred, and what average diameter of hole resulted after the caving and raveling of the sides of the holes. To answer these questions a caliper was made, as shown by the drawing herewith. It was designed by H. S. Rands, Asst. Engr.,



CALIPER FOR DRILLHOLES IN ROCK, USED AT LAHONTAN DAM

and was made in the works shop at Lahontan. The caliper was lowered on 10-ft. lengths of pipe and rod. The rod inside the pipe enabled the folding blades to be moved in or out, the movement being read on the scale at the top. The largest spread of the blades is 12 in. diameter. Thus the holes could be gaged at any or all points, to a size about 5 times normal diameter.

Stresses in a Model Roof-truss.—An interesting large-scale experiment was made recently in the laboratories of the University of Manchester (England). It is reported by C. H. Lander, G. Cook, and J. E. Petavel in a paper recently read before the Institution of Civil Engineers. Since ordinary roof trusses have riveted joints, while stresses are calculated on the basis of frictionless joints, it was decided to measure the stresses in a truss, as a check on the theory. A truss was designed and built for the experiment, exactly like trusses in current use. A truss of 60-ft. span being about the smallest in which the members are proportioned strictly for their stresses (i.e., without excess for stiffness, etc.), this span was adopted. But as this was too large for the facilities available, a model was made on half scale, or 30-ft. span. This was large enough to permit using ordinary rolled shapes and ordinary methods of connection, and therefore did not introduce any "model" condition, or a quality of metal not used in regular practice.

The truss was of the ordinary triangular outline with bracing arranged after the Fink or French type. The roof pitch was 30°. The design was made on the following basis: Span, 60 ft.; spacing of trusses, 15 ft.; windload, 26 lb. per sq.ft. normal to the roof; dead-load, 17¼ lb. per sq.ft. of roof surface, excluding trusses; weight of 60-ft. truss, 3000 lb. (for stress calculation only). The tension members of the truss were made of flat bars, the compression members of pairs of angles for the top chord and single angles for the struts of the web; e.g. the top chord or rafter was made of

two angles 2x2x¼ in. (representing 4x4x½-in. angles in the 60-ft. truss), while the central panel of the bottom chord or tiebeam was a ⅝x⅜ flat bar (representing 1¼x¾ in.) The joints were made with ⅝-in. bolts, corresponding to ¾-in. rivets in the full-size original. The metal of which the model truss was made was subjected to tensile tests, giving an ultimate strength of 60,000 lb. per sq. in. and a yield-point of 47,000 lb. per sq.in., with elongation 25.8% in 8 in., and reduction of area 51.8%.

To test the truss, loads were applied by cords attached to individual weighted levers, one cord going to each panel-point. The truss was loaded uniformly at all panel-points in the vertical direction, and normal to the roof on one side to represent wind acting from one side. Stress measurements were made in most of the members. A micrometer gage 3 ft. long between gage-points, stated to be capable of reading to 0.0001-in., was used, with frequent check measurements on a standard bar kept alongside the truss under test. The first extensometer readings were taken at a load corresponding to one-fifth of the calculated ultimate load, and it was assumed that the deformations and stresses in the first one-fifth of total load above this first measurement would have been realized below that measurement, by which means the zero point of measurement was located.

The truss failed at a load slightly above the calculated ultimate load, by the rupture of a tension web member at a stress of nearly 55,000 lb. per sq.in. on the section through the bolt holes. This broken bar was then replaced by a slightly stronger one and the test repeated. At about the same load as the previous load the truss "suddenly failed and the free end jumped off the support. No bar was broken, the failure probably being caused by temporary buckling of the main rafter."

An important showing of the test was that the plotted curves of stress against load for the different members were in nearly all cases straight lines agreeing closely with the lines derived from calculation. For one or two members, however, the observed curves bent upward sharply near the outer end, i.e., for loads near the ultimate the elongation in such a member increased rapidly, out of all proportion to the load-increase. This occurred in the central part of the bottom chord, and in the upper section of the main tie-diagonal on the windward side. On the other hand some members showed opposite behavior, the elongation curve flattening out near the ultimate load; and the lower sub-tie on the leeward side had no tension throughout the test. These irregularities are not explained, and must be attributed to initial distortions and stresses, and to rigidity of joints. The general result that the stress curves agree closely with those calculated, and that the elongations are linear with the load even up to failure load, is not seriously affected by these minor phenomena.

Getting Good Specifications—"Citizens of New Carlisle, Ind., have just voted unanimously for the construction of 12 miles of concrete highway. The Blank Portland Cement Co. is to write the specifications, and the roadway will be 9 ft. wide with 3-ft. gravel shoulders." [Information received from Blank Portland Cement Co.]

the contractors to the builder of the trucks, the International Motor Co., reporting favorably on the work of the truck.

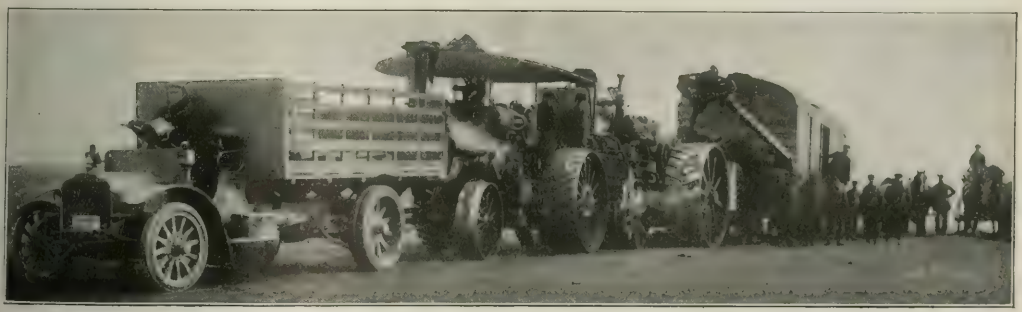
Congratulations in Bradford—"About the usual number of leaks in water mains occurred this year, some twenty of them, the most of them was on account of the lead coming out of the joints of cast-iron pipe, there were two joints of six-inch pipe that broke square in to, these joints were broken on account of the frost penetrating to the mains making an unequal pressure on them, we repaired these by using a Dresser split sleeve. The frost penetrated deeper last winter than it ever did in any previous winter in the history of the Bradford Water Works; there were some thirty consumers' service lines frozen up; they were thawed out by the Bradford Electric Light & Power Co.; they have a machine for that purpose which does the work very quick and easy. We were compelled to use extra precaution with a number of our hydrants or they would have frozen up, we of course can congratulate ourselves upon the theory that winters like last winter only come about once in every fifty years." [From the Annual Report of the Water Commissioners of Bradford, 1912.]

Rapid Method of Coloring Drawings—Every draftsman has has occasion at one time or another to color a drawing or a whiteprint. The use of colored inks is unsatisfactory; cross-hatching in colors obscures the details and is slow, while water colors have the disadvantage of slowness besides being difficult to apply evenly. A quick and satisfactory method of coloring involves the use of ordinary wax crayons and gasoline. Crayon of the color desired is applied and then rubbed with a piece of cloth, wet with gasoline, until the color is even, and extended to the limits desired. If it overruns the lines, it can be erased with a pencil eraser. Some colors, particularly the yellows, purples, greens and light blues, produce much better results than others. It is probable that the gasoline dissolves the wax from the crayon, leaving the pigment as an impalpable powder, which, when rubbed over the paper, colors it uniformly. The method is applicable with equal success to egg-shell and smooth drawing papers and to whiteprints on both paper and cloth. [H. P. Bowen, in the "Engineering and Mining Journal," for Feb. 8, 1913].

How They Do It in England—In our contemporary "Engineering," of May 2, 1913, we find the following record of a bit of "scientific management." It appears to have been written in a serious frame of mind:

According to the "Times," the attention of the employees at the Portsmouth Dockyard, who have declined to work overtime, has been called to the requirements of the Superannuation Acts, under which certain certificates as to conduct, qualifications, and length of service have to be produced by the head of each man's department when the Treasury is considering the award of pensions or bonuses. As far as can be ascertained, however, no attempt has been made to coerce the men by any threats that any pension or bonus may be withheld.

Paints for Tank Interiors—The experience of the Metropolitan Water-works, of Boston, Mass., indicates that red-lead paint applied to the interior of standpipes is one of the best, if not the best, protection against rusting. The paint now used is mixed in the proportion of 3 gal. of boiled linseed oil to 100 lb. of the best quality of red lead, to which is



HAULING A 70-TON STEAM SHOVEL 24 MILES OVERLAND IN MONTANA

Heavy Hauling with a Motor Truck—A 70-ton steam shovel was hauled over rough country roads a distance of about 24 miles last winter by the contractors for work on the Soo line in Montana, Siems-Carey Co. & E. A. Wickham Co. The temperature averaged 10° below zero. As the adjoining photograph shows the load was triple-headed, at least in parts of the haul. The leading engine is a 5-ton Saurer truck. The photograph accompanied a letter from

added 2½ lb. of litharge thoroughly beaten up with the linseed oil. This is the formula used by the United States Navy for paint used on the bottoms of ships. The litharge causes the paint to dry quickly and also hardens it.

The standpipe on Forbes Hill, in Quincy, 30 ft. in diameter and 64 ft. 3 in. high, was painted in 1902, at a cost of $427. The interior was first thoroughly cleaned of rust and loose paint by the use of putty knives and wire brushes. One coat

of red lead mixed with raw linseed oil and a little turpentine was then applied, and over this were applied two coats of Gilsonite paint, made by the Commercial Asphalt Co., of New York. The exterior was given two coats of white lead and linseed oil, tinted a light gray color. This standpipe is inclosed in a granite masonry tower and covered so that ice does not form to such an extent as it would if the standpipe were exposed directly to the weather. The interior of the standpipe has recently been given three coats of red lead, United States Government specification, with no covering of Gilsonite, and the exterior one coat of white lead and oil, at a total cost of $430.

At Arlington, there is a standpipe 40 ft. in diameter and 60 ft. high, with a conical steel roof and exterior spiral stairway, all exposed to the weather. The water pumped into both this and the Forbes Hill standpipe has a temperature of from 38° to 40° during the winter, and ice forms in this standpipe to a greater extent than in standpipes supplied with water drawn from ground water supplies, which does not ordinarily fall below 50° This standpipe was painted in 1906 at a cost of $425. The interior, after being thoroughly cleaned, was given one coat of red lead and two coats of Gilsonite. The roof trusses and under side of the roof were given two coats of red lead and oil, and the exterior of the standpipe and roof one coat of white lead and oil. In 1911, this standpipe was emptied and both exterior and interior repainted in the same manner as in 1906, at a cost of $475. [Dexter Brackett, Chief Engineer, Metropolitan Water-works, in discussion at New England Water-works Association meeting; printed in "Journal" of the society for December, 1912].

Acres Irrigated or Drained by Centrifugal Pumps

The accompanying tables show acres irrigated or drained in stated intervals of time based on the theoretical capacities of centrifugal pumps. Factors which assist or hinder the work of pumping, such as percolation, evaporation, seepage, runoff and waste, are not allowed for in the tables, for these depend almost entirely upon local conditions. When these are determined the pumping capacity should be decreased or increased proportionately and the acreages shown must be multiplied by the proper factor. The tables were prepared by R. C. Wise, Secretary of the Western Pump & Engineering Co., Chicago, Ill., and are copyrighted by him.

TABLES OF AREAS

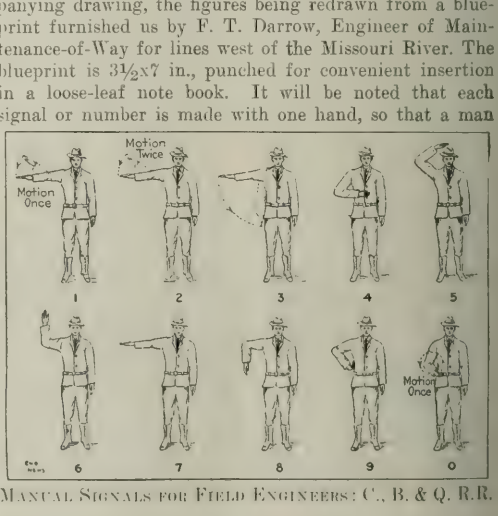
Diam. of discharge (in.)	Theoretical capacity of pump in gal. per min.	Acres, Irrigated or Drained in 10 hr — Depth — 1 in.	2 in.	4 in.	6 in.	8-in.	10 in.	12 in.
	25	0 55	0.28	0 14	0.09	0 07	0 05	0 05
	50	1 10	0.55	0 28	0 18	0 14	0.11	0 09
1¼	70	1 55	0.77	0 39	0 26	0 19	0 15	0 13
1½	90	1 99	0 99	0 50	0 33	0 25	0 20	0.17
2	120	2 65	1.33	0.66	0.44	0 33	0 27	0.22
2½	180	3 98	1.99	1.00	0 66	0 50	0 40	0.33
3	260	5.74	2.87	1.44	0.96	0 72	0.57	0 48
3½	330	7 29	3 65	1 82	1.21	0 91	0.73	0 61
4	470	10.39	5.19	2 60	1 73	1 30	1 04	0 87
5	735	16 24	8.12	4 06	2 71	2 03	1.62	1 35
6	1,050	23.20	11 60	5 80	3 87	2.90	2 32	1 93
7	1,500	33 14	16 57	8 29	5 52	4 14	3.31	2.76
8	2,000	44 27	22.10	11 05	7 37	5 52	4 42	3 68
10	3,000	66 29	33.14	16 67	11 04	8 29	6 63	5.52
12	4,200	92 80	46.40	23 20	15.47	11.60	9.28	7.74
15	7,000	154 62	77 34	38 66	25 78	19 33	15.47	12 89
18	10,000	220 96	110 48	55 24	36 83	27.62	22 10	18 41
20	12,000	265 15	132.57	66 29	44 19	33 15	26.52	22 10
24	15,000	331 44	165.72	82.86	55 24	41 43	33.14	27 62
30	22,000	486 12	243.06	121.53	81 02	60.76	48.61	40.51
36	32,000	707 08	353 54	176 77	117 85	88 39	70 71	58 92
42	44,000	972.23	486.12	243.06	162 04	121.53	97.22	81.02
48	60,000	1325.77	662.89	331.44	220.96	165.72	132.58	110.48
60	75,000	1657.21	828.61	414.30	276 20	207.15	165.72	138.10
60	100,000	2209.63	1104.81	552.40	368 27	276 20	220 96	184.13

Diam. of discharge (in.)	Theoretical capacity of pump in gal. per min	Acres, Irrigated or drained in 24 hr — Depth — ¼ in.	½ in.	1 in	2 in	4 in	6 in
	25	5 30	2 65	1 33	0 66	0 33	0 22
	50	10 61	5 30	2 65	1 33	0.66	0 44
1¼	70	14 85	7 42	3 71	1 86	0 93	0 62
1½	90	19 09	9 54	4 77	2 39	1 19	0 80
2	120	25 45	12 72	6.36	3.18	1.59	1.06
2½	180	38 18	19 09	9 54	4 77	2 39	1 59
3	260	55 15	27 57	13 79	6 89	3.45	2 30
3½	330	70 00	35 00	17 50	8 75	4 38	2 92
4	470	99 69	49 85	24 92	12 46	6 23	4 15
5	735	155 91	77.95	38 98	19 49	9 74	6 49
6	1,050	222 73	111 36	55 68	27 84	13 92	9 28
7	1,500	318 19	159 09	79 55	39 77	19 89	13 26
8	2,000	424 25	212 12	106 06	53 03	26 52	17 68
10	3,000	636 37	318 18	159.08	79 54	39 77	26 51
12	4,200	890 92	445 46	222 73	111 36	55 68	37 12
15	7,000	1484 86	742 43	371 22	185 61	92 80	61 87
18	10,000	2121 22	1060 61	530 30	265 15	132 58	88 38
20	12,000	2545 18	1272 74	636 37	318 19	159 09	106 06
24	15,000	3181 85	1590 92	795 46	397 73	198 87	132 58
30	22,000	4666 70	2333 35	1166 67	583 34	291 67	194 44
36	32,000	6788 0	3393 0	1697 0	848 50	424 25	282 83
42	44,000	9333 4	4666 7	2333 4	1166 7	583 34	388 89
48	60,000	12727 5	6363 7	3181 9	1590 9	795 46	530 30
60	75,000	15909 3	7954 6	3977 3	1988 7	993 32	662 89
60	100,000	21212 3	10606 1	5303.1	2651 6	1325 8	883 84

Diam. of discharge (in.)	Theoretical capacity of pump in gal. per min.	Acres, Irrigated or Drained in 30 days, pumping 24 hr. per day. — Depth — 6 in.	12 in.	18 in.	24 in.
	25	6 63	3 31	2.21	1.66
	50	13.26	6.63	4.42	3.31
1¼	70	18.56	9.28	6.19	4 64
1½	90	23.86	11.93	7.95	5 97
2	120	31.82	15.91	10.61	7.95
2½	180	47 73	23 86	15 91	11.93
3	260	68.94	34.47	22.98	17.23
3½	330	87.50	43 75	29.17	21.87
4	470	124 62	62.31	41.54	31.16
5	735	194.89	97.44	64.96	48.72
6	1,050	278 41	139 20	92 80	69 60
7	1,500	397 72	198 86	132 57	99 43
8	2,000	530 30	265.15	176.77	132 58
10	3,000	795 45	397 73	265.15	198 86
12	4,200	1113 63	556.82	371.21	278 41
15	7,000	1856 06	928 03	618.69	464 01
18	10,000	2651.51	1325.76	883 83	662.88
20	12,000	3181.81	1590 90	1060 60	795.45
24	15,000	3977.27	1988 63	1325 76	994 32
30	22,000	5833 32	2916 66	1944.44	1458 33
36	32,000	8484 83	4242 42	2828.28	2121.21
42	44,000	11666.6	5833 3	3888.9	2916.7
48	60,000	15909.1	7954 5	5303 0	3977.3
60	75,000	19886 3	9943 2	6628 8	4971.6
60	100,000	26515.1	13257 6	8838 4	6628 8

Manual Signals for Field Engineers

For survey work on the Chicago, Burlington & Quincy R.R. a special set of manual signals has been devised for signaling numbers, and these are shown on the accompanying drawing, the figures being redrawn from a blueprint furnished us by F. T. Darrow, Engineer of Maintenance-of-Way for lines west of the Missouri River. The blueprint is 3½x7 in., punched for convenient insertion in a loose-leaf note book. It will be noted that each signal or number is made with one hand, so that a man



MANUAL SIGNALS FOR FIELD ENGINEERS: C., B. & Q. R.R.

can hold his rod or other device while signaling. It is found very desirable for a rodman to carry a peg book and work with the levelman in checking turns and benchmarks. A self-reading rod is used, and figures are transferred between the men by means of these signals. Station numbers and plusses on transit work are explained in the same way.

EDITORIALS

For the sixth time since 1884, when the U. S. Geological Survey took up rented quarters in an office building in the City of Washington, a fire has seriously threatened the many valuable records it is the business of that bureau to collect. We trust that Congress will not further tempt Providence, but will immediately authorize the construction of the new building for which the last Congress provided the site. Under the usual procedure it will be many years before the Survey can move into a fireproof structure where the notes and results of its country-wide surveys will be safe. These many threatening fires and the irreparable loss of New York State records in the recent Capitol fire at Albany should rouse the federal legislators beyond their usual comfortable routine.

Co-operative Buying for Public-Service Employees

One of the notable industrial movements, aiming to break the vicious spiral of increasing cost of living and increasing wages, is the recent establishment of coöperative buying departments for the employees of public-service corporations. What seems to be one of the most successful examples of this is the procedure recently adopted by the Interborough Rapid Transit Co. of New York City and its allied concern, the New York Railways Co. These concerns operate the elevated and subway systems of Manhattan Borough in the City of New York, and a majority of the surface electric railways as well. These companies have established a system under which they buy and sell at cost, food supplies for employees and their families, maintaining at different points on company property stores through which the supplies are distributed (see ENGINEERING NEWS, Feb. 13, 1913, p. 309). This scheme is simple and, it is reported, effective.

Another plan has been put into operation by the Philadelphia Rapid Transit Co., which seems to have somewhat the same advantages for the men with less responsibility on the part of the company, but with the chance of unfairness toward some portion at least of the general buying public. The scheme at Philadelphia, according to a bulletin published by the company, involves a Coöperative Beneficial Association, so called, membership in which is open to male employees of the company at a cost of 50 cents admission fee and 25 cents per month dues. The company contributes an equal amount and pays all expenses of the association. This association, however, does not buy and sell supplies. It has, instead, closed contracts with one department store in Philadelphia and one coal company (and proposes to make other contracts) whereby special discounts are secured to members of the association—discounts which apply to "bargain" sales as well as to ordinary transactions. Coal can be purchased in tons of 2240 lb., and without the extra charge of delivery exacted for certain localities. Books of cash coupons are sold at a discount to members and these are accepted by the contracting mercantile houses in payment of purchases.

The chance of unfair discrimination between such special customers of these firms and the general purchasers, arises from the fact that there seems to be no separation of the two kinds of business and no assurance that each class pays for its own costs or contributes only its own share to the merchants' profits.

The plan does have the advantage that it secures for the employees a discount on their purchases of goods as well as food supplies. It is, however, open to the possible objection that giving rebates to one special class of customers may amount to a tax on the general buying public which has to pay the ordinary scale of prices. On the other hand, careful watching will be advisable to see that the employees receive the same quality of goods as those who purchase at the full rates.

Both these experiments in New York and Philadelphia will be observed with interest.

A Valuation of a Large Street-Railway System

We devote considerable space, elsewhere in this issue, to a report by B. J. Arnold on the value of the street-railway system of Kansas City. This is a good example of a thoroughgoing valuation by a man of large experience in work of this nature. Because of the recent legislation requiring valuation of the railways of the country, the report is of special interest at this time. It contains assembled in form for parallel comparison, three quite different principles of valuation, useful in establishing a proper basis for capitalization, and specifically applies the theories to the case in hand to test the fairness of the figure finally established. This concise presentation of theory and application is beyond the scope and treatment of the existing works on valuation and is, therefore, given nearly in full, but necessarily without the supporting data, which fill three volumes.

There are a number of matters, seen at different points in the report, which are of special independent interest. For instance, the railway companies in Kansas City, in years past, have suffered the unfortunate experience of having bridges washed away together with enforced supersession of various other property. Mr. Arnold advocates capitalizing the value of this lost and discarded property, together with a capitalization of the deficit which may have accumulated on such impaired investments. But he recommends that, in the reorganization of the company and the grant of new franchises, the amortization of such development costs, not now present in tangible plant, should be cared for.

Engineers and railway men who are worrying at this moment as to the problem of financing the enormous flood damage in the Middle West, will see that it is permissible and even desirable that this year's operating expenses should not be loaded with all of this unusual

burden, but that it should be temporarily included in capitalization and gradually repaid from net earnings.

In addition to establishing the value of the Kansas City system as a whole, the final value is distributed by Mr. Arnold among the communities served. This is done mostly in accordance with the origin of gross receipts and the actual local investments. To many interested in this work the question at once arises as to why this procedure was taken. Why should it be on such a basis rather than according to track miles or car miles for each locality, or any other unit which may be devised?

It is often illuminating in answering such questions to hark back to our elementary ideas of economics and civil government. We realize that for stability of business and the protection of property, municipal government is necessary. Where a public utility serves more than one community, a measure of its reliance on each local government, from the property standpoint, is found in the proportion to which the local investments (including a proportion of rolling stock in the case of steam and electric railways) bear to that of the whole system. Viewed from the service standpoint, the stability of local municipalities affects a concern's value in proportion to the factor that the local customers form of the entire business. Another way of expressing the same idea is by saying that the total capitalization value may be divided in proportion to the origin of gross business.

It is interesting to note that in many cases the apportionment of value is approximately the same under either scheme. The Kansas City railways present such an instance. As a general rule, however, the two ideas could be expected only to define limits within which the final value would fall.

The local assignment of capital value, moreover, is not necessarily a fair basis of taxation. Indeed, more often than not, local reduction from real to assessed values would be made on actual physical property with perhaps such treatment of intangible values as is found necessary under the conditions locally encountered.

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The Bourne Scheme for Federal Aid to Road Construction

Ex-Senator Jonathan Bourne, Jr., of Oregon, who was chairman of the Joint Congressional Committee on Federal Aid for Roads, has made public his scheme for Federal aid to road construction by the several States. Senator Bourne declares that Federal aid to roads is "the greatest and certainly the most important economic question now before the American people."

His scheme is substantially the lending of the Federal government's credit to the several States so that they may be able to borrow money for road construction at a lower rate than would otherwise be possible. According to the terms of a bill which Senator Bourne has drafted, the Federal government would issue and sell 3% bonds to the amount of $1,000,000,000, and the money realized from the sale of these bonds would be apportioned to the several States according to their land area, population, assessed valuation, and total mileage of public highways.

Each State, in order to obtain its percentage of this fund, would have to turn over to the Federal government its own bonds for an equal amount bearing interest at 4%, and would pay interest on these bonds annually to the government. These payments by the States would be made use of by the government to pay the 3% interest on its own bonds and the 1% remaining would constitute a sinking fund, which if invested at 3%, Mr. Bourne computes, would amount to sufficient to retire the bonds at the end of about 46 years.

The States would use this money for road construction in such manner as they pleased. Mr. Bourne does not propose that the Federal authorities shall interfere in any way with the States' right to build their highways as they see fit. He provides, however, that the Federal government shall also aid in the maintenance of highways, giving to each State annually, by direct appropriation from the Federal treasury, an amount equal to one-fiftieth of the amount allotted to it for road construction. Thus the Federal government would make a gift of $20,000,000 annually to aid the work of highway maintenance in the several States. There would be authority to withhold this gift, however, from any State which had not wisely handled its previous Federal fund for construction and maintenance, or had not spent at least an equal amount for maintenance of roads. This last provision, of course, means nothing, as every State is already expending in the work of highway maintenance far more than the proposed amount of Federal aid.

As a capstone to Senator Bourne's remarkable edifice, he proposes to establish in the District of Columbia a school of highway and bridge engineering. The school would have a two years' course, and every congressional district in the United States would be entitled to one student, who would be paid by the government four cents a mile for traveling expenses from his home to Washington and $50 a month during the period of his instruction.

It should be particularly noted that this scheme is simply the personal scheme of Ex-Senator Bourne, which has been offered for the use of the joint Committee, but has not been adopted by it. It will probably be held up, as a chief merit of the scheme, that it makes no draft on the Federal Treasury for road construction, although in the 50 odd years during which the bonds to be issued are to run, the Federal government would pay to the States for road maintenance, in the neighborhood of a billion dollars.

Whatever merit may attach to the scheme because the government lends only its credit to the several States, instead of making them an outright gift in cash, is more than offset, in our opinion, by the fact that the bill, if enacted, would have an enormous influence in inducing the States to undertake road construction work with money borrowed on long-time bonds.

As has been many times shown, to borrow money on long-time bonds, for building street pavements and roads, is little less than financial suicide. The present too common policy of states and cities, of relying wholly on bond issues for carrying on public works, cannot be too emphatically condemned.

When Mr. Bourne's scheme is analyzed, it will be seen that instead of the Federal government giving the States a billion dollars to spend on good roads, what it actually does is to induce the States to borrow this amount of money to build roads, which money must be repaid, principal and interest, by the State's taxpayers. In case any State should default in its payment of interest and principal, the deficiency would then fall on the taxpayers of the United States. It is a popular fallacy that by rais-

ing money on bond issues for public work, the public gets what it wants without having to pay for it. People forget that the payment must be made just the same, and not only the principal of the bonds but the interest must be met year after year until the burden of debt can be lifted. A large proportion of our American cities are today struggling under a huge burden of debt, and are constantly hampered in their desire to carry out improvements and new public works on account of the burden of debt which was loaded upon them by a past generation.

There is something to be said in defense of the issue of bonds by states and cities to construct public works which yield a revenue, from which revenue the bonds can eventually be repaid. Pavements and roads, however, yield no revenue. On the contrary, they involve a heavy annual expenditure for maintenance. Necessary and advantageous though they are, where the traffic and taxable wealth is sufficient to justify their construction, they should be built either from the proceeds of annual taxation or by the issue of bonds running for a short term of years, not greater than the life of the roads or pavements themselves.

It is evident that Senator Bourne, in common with a large proportion of the public, has been misled by the fallacious statements in good-roads literature, with the misleading statistics as to the cost of haulage over common roads and the saving which can be made by the substitution of paved roads. In the preface to his report, Senator Bourne says:

> A great system of rural transportation would be developed, with rates regulated by actual competition, open to poor and rich alike, as no expensive, privately owned terminals, roadbeds, tracks or equipment would be required.

The obvious inference from the above is that if the proposed network of good roads were built it would be possible to transport goods over them at less cost than the present cost of carrying goods by rail.

In contrast with this, we have recently had laid before us figures showing the actual cost per ton mile of carrying goods by the latest type motor truck running on good roads. These ton-mile costs were more than 20 times as great as the average ton-mile cost of freight transportation on railways. Further, these ton-mile costs of transportation by motor trucks were not more than 20 per cent. below the figures widely published by the Department of Agriculture a few years ago, as the average cost per ton-mile of hauling farm produce over ordinary dirt roads. This difference of 20 per cent. would be no more than sufficient to cover the interest and maintenance cost of the paved highways over which the motor trucks ran.

An excellent comment on the fallacies underlying Senator Bourne's schemes is contained in a letter from Mr. Walter C. Taylor, of Brookline, Mass., to the "New York Times" from which we quote as follows:

> Any road plan which wholly ignores the very existence of the real National "highways" of all modern times, namely, the railroads, is likely to be futile. There is not a word in the Senator's plan which recognizes the truth that the only modern economic use for wagon roads is local travel and the transportation of commodities to and from the nearest railroad.
>
> The chief owner of the great Pillsbury flour mills in Minneapolis once declared that he "could deliver a barrel of flour on the Liverpool docks cheaper than he could at half the homes in Minneapolis." That is, it cost him a thousand times as much to haul it over a local "highway" by wagon to the rim of Minneapolis as it cost per ton per mile loaded into a freight car and, with only one change to be made, in the trip by rail and ship to Liverpool.
>
> To the producer on the farm, as to the consumer in the city, the great question is, "How shall we get goods to and from the freight station?" And no system of road building is either scientific or of economic justification which does not view the wagon road in its proper aspect as being today (and for fifty years back) only a secondary auxiliary system, doing perhaps one-hundredth, perhaps one-thousandth, of our total of commodity transportation.

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The Water Filtration Hold-Up in New York City

The hold-up of the Croton filter-plant contract by the New York Board of Estimate has no apparent engineering justification. The arguments raised against the award have centered around claims that filtration is unnecessary, that further investigations are needed and that the specifications and contract are faulty.

It is late in the day to urge that filtration is not needed. That plea should have been made, if at all, long before receiving bids for a filter plant. The fact is, that the need for filtration has been urged by a host of eminent engineers and sanitarians, in and out of the city service, for ten years or more, to say nothing of the demand for it on the part of the medical profession and the public.

As to the need for further investigation, the subject of filtration has been studied diligently by New York City's own engineers for a half-dozen years or more. Experiments on a working scale have been made with the Croton water and New York City has had the benefit of the actual experience of many of the leading cities of the United States and Canada which have installed filtration works while it has been postponing like action.

The plans and specifications on which bids were received on Jan. 23, 1913, were prepared by a special staff of 25 to 30 filtration engineers, many of whom were selected because of their previous experience in designing and building the most notable filtration plants of this country.* Since the plans were completed they have been

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*In addition to Geo. W. Fuller, consulting engineer to the Filtration Division of the Department of Water-Supply, and Elmer G. Manahan, in direct office charge, both of whom have had long and varied experience in water filtration, the Filtration Division includes 32 employees, 15 of whom are of the grade of assistant engineer or higher. Of the latter the record of a half dozen are here given to show the range and variety of their experience:

T. C. Atwood, Division Engineer:
3 years with the Bureau of Filtration, Philadelphia, Penn., on the design and construction of the Torresdale filters.
3 years with the Bureau of Filtration, Pittsburgh, Penn., in charge of part of the design and construction of the Pittsburgh filters, and
Part of the time for 2 years upon preliminary work for the proposed Eastview filters for the Board of Water Supply of the City of New York.

Charles B. Buerger, Assistant Engineer:
5 years with the Bureau of Filtration, Philadelphia, Penn., at first on the preliminary filters for the Torresdale and Belmont plants and later in charge of the design of the Queen Lane filter plant.

F. H. Stephenson, Assistant Engineer:
2 years with Allen Hazen, consulting engineer, during a part of which time he had charge of the construction of the filter plant for Yonkers, New York, and during the remainder of the time was engaged upon filter work for other cities and towns.
4 years with the Commissioners of Water-Works of the City of Cincinnati, Ohio, during most of this time in direct charge of the construction of the Cincinnati filter plant.
1½ years at Evansville, Ind., in charge of the construction of the Evansville filter plant.

A. R. Holbrook, Assistant Engineer:
1 year in connection with the Pittsburgh, Penn., filtration plant.

A. V. Ruggles, Assistant Engineer:
2 years with Allen Hazen, consulting engineer, on various filter projects.
1 year on preliminary work for the proposed Eastview filters, for the Board of Water Supply, New York City.

E. Nuebling, Assistant Engineer:
During the years 1907 and 1908, employed upon the preliminary studies for the then proposed filter plant at

heartily approved by two boards of engineers and sanitarians, the members of which included a number of consulting filtration engineers, besides consulting and other engineers in the employ of the city but in no way connected with the water department. Altogether, it is safe to say that no other filtration plans bear the stamp of approval of so large a number of engineers as do these. The satisfactory character of the plans and specifications have been further attested by the number and standing of the bidders, the closeness of the bids to the original engineer's estimate, and the substantial agreement between the latter and the independent estimates made by the latest board of consulting engineers. Reference to alleged faults in the specifications will be made further on.

Perhaps the most remarkable feature of this hold-up is the claim that filtration is not needed. We shall not repeat here the convincing arguments of the many engineers who have strongly recommended filtration, since they are given at length elsewhere in this issue.* We do wish to point out that Comptroller Prendergast, who is the leading official opponent of awarding the contract, not only joined in all the preliminary steps of authorizing bonds for filtration, directing the water department to prepare plans, and giving it permission to advertise for bids, but he also took a part in summarizing and indorsing the arguments for filtration no longer ago than 1911. Joined with Comptroller Prendergast in signing the report authorizing bonds for filtration was the President of the Borough of Manhattan. The third signer, the President of the Board of Aldermen, declared for the contract award in a test vote taken not long ago, but it is reported that the opponents of filtration hope to win him over when the matter comes up for final action in the Board of Estimate on the date of this issue of ENGINEERING NEWS. To add to the mysteries of this last-minute hold-up, not only the borough president of Manhattan, as has just been stated, but also the borough president of The Bronx is also reported to be a party to the hold-up—which is all the more remarkable because the filtration of the Croton water-supply is solely for the benefit of the two boroughs named, and is favored, it is said, by the presidents of the other boroughs composing Greater New York. We bring out these points in a local controversy because of the importance of the contract at issue, both in size and in relation to the progress of water purification in America; and also to make it clear that quite other than engineering considerations underlie the hold-up.

In passing, we may note, as bearing upon the attitude of Comptroller Prendergast and the other opponents of awarding the contract, that the hold-up has been continued for some weeks since the board of engineers appointed to report on the objections raised against the contract unanimously indorsed the plans, specifications, engineer's estimate and the lowest bid for the work, and also reported 4 to 1 in favor of immediate filtration.

A surprising feature of this filtration controversy has been the part played in it by the Bureau of Municipal Research and the Citizens' Union of New York City, two closely related civic organizations. As appears elsewhere in this issue, each of these bodies has founded a large part of its criticisms of the filtration project upon misconceptions of the engineering problems involved. When a civic organization starts a crusade against a municipal department or contract it ought to be sure of its ground. There may be some excuse for uncertainty and error on the part of the ordinary civic organization, but for the pioneer Bureau of Municipal Research to make the technical errors it made last December and January and then trip itself up in correcting them was most unfortunate. Its good intentions in this matter and solid achievements in others will certainly lead its friends and well wishers to overlook these errors.

There remain, for brief notice, the allegations of the Bureau of Municipal Research and the Citizens' Union that the filter specifications and contract contain objectionable features, especially in that they provide for letting all the work in one contract, including patented devices which might better be contracted for separately, and that they are indefinite at some points and leave too much to the discretion of the engineers. Aside from the fact that these questions are ones which must be left largely to the experience and judgment of the engineers responsible for each individual contract, since there is no general agreement as to the details of the principles involved, it is sufficient to note: (1) That the consulting experts approved the specifications with these features included and that the objectors did not seem to fully grasp all the technical points involved. If the Citizens' Union obtains standing for its taxpayers' suit perhaps these points will be adjudicated, but we think we take no risk of being adjudged in contempt of court if we predict that unless the Citizens' Union has something more serious to contest than it has yet made public no court of final jurisdiction will give much weight to its contentions, which all seem to involve points wholly within the judgment and discretion of the city authorities.*

Before summing up this remarkable hold-up, attention may be called to the fact that Allen Hazen, chairman, and Geo. A. Johnson, secretary, of one of the boards of consulting engineers which approved the filtration plans, have no later than May 20 written strong letters reviewing the reasons for installing a filtration plant without delay. Extracts from their letters appear at the close of our review, elsewhere in this issue.

To sum up this controversy: The water and health authorities of New York City, its various engineering advisers, the press and the public generally, have persistently urged filtration for years; the Department of Water Supply has studied the subject for a half-dozen years, aided by eminent specialists; the Board of Estimate itself has authorized plans and specifications and the advertising for bids for a filter plant; plans have been

Jerome Park, and also upon the design and construction of the Oakland Lake filters, constructed at Bayside, Long Island, by the Department of Water Supply, New York City.

*First of all, to go back only ten years, Prof. Wm. H. Burr, Rudolph Hering and John R. Freeman (Providence, R. I.) advocated filtration. These were followed by J. Waldo Smith, Allen Hazen, Geo. C. Whipple. The first board of consulting engineers on the present plans included Mr. Hazen, Geo. A. Johnson, Frank A. Barbour (Boston), Prof. W. P. Mason (Troy, N. Y.), and James H. Fuertes. The second board of engineers included Nicholas S. Hill, Jr., and John H. Gregory, engineers in private practice, and E. P. Goodrich, consulting engineer to Borough President of Manhattan, Amos L. Schaeffer, consulting engineer to the Borough President of The Bronx, and John H. Frazee, assistant engineer, Department of Finance, New York City. All these except Mr. Frazee have agreed on the need for filtration, the last ten, including Mr. Frazee, have approved the filtration plans.

*In fairness, it should be mentioned here, as is brought out more specifically in our review of this case elsewhere in this issue, that the Citizens' Union cites Major Cassius M. Gillette, of Philadelphia, in support of some of its allegations as to faults in the specifications, and states further that he and other experts (no other names given) concur in its claims that filtration is unnecessary at present.

made by a notable force of filtration experts and approved by numerous eminent and competent consulting engineers; bids have been solicited, competition secured and a low bid received. At this happy consummation, the Board of Estimate, which has been party to the preliminary steps, is urged by some of its members to rescind its earlier favorable action, kill the project and deprive two or three million people of the disease-germ-free, clear, colorless, tasteless and odorless water to which they are justly entitled. To go back on its own action at this late day, to serve notice on the engineering and contracting world that New York makes plans and secures bids for great public works and then concludes that those works are quite unnecessary, to nullify a ten-year campaign for filtration and deny the citizens of Manhattan and the Bronx of a water-supply equal to that of the other leading citizens of the United States, needs other justification from the opposing members of the Board of Estimate than has yet been given or than we believe can be found.

LETTERS TO THE EDITOR

Effect of Sugar on Concrete

Sir—I have read with interest the recent letters from your correspondents, dealing with the action of sugar on cement. An instance of similar disintegratory action has recently come under my notice.

About four years ago, my company constructed a reinforced-concrete floor in a wholesale grocery establishment, in this city. The floor was finished with 1:2 mortar ¾ in. thick surface hardened with a wash of silicate of soda. This finish has disintegrated just by a raisin-seeding machine, where the floor is always to a certain extent moist with raisin syrup; and although the floor plate itself is still sound, the destruction of the surface finish indicates apparently that a destroying agent is slowly at work.

H. Gordon Jenkinson.

Resident Engineer, South Australian Reinforced Concrete Co., Ltd.

Adelaide, So. Australia, Mar. 14, 1913.

The Engineer's Need

Sir—In the current issue of Engineering News (p. 863), Prof. C. T. Morris calls attention to the fact that all rules for wind-stresses in structures are open to the criticism that they are based on assumptions not in accord with the facts, and further that it is Mr. C. Melick's opinion that analytical determination of stress is far too cumbersome for practical use and, therefore, some sort of empiricism is necessary.

Not only are both ideas true in this case—and in many other cases likewise—but also it is to be wished that both could be so indelibly engraved on every engineer's mind that neither could be lost sight of for an instant.

Scientific knowledge requires to be correlated for the practical activities of the engineer, and may be said to consist of two main parts. In popular language we may call these two divisions Research and Practice. Practice demands a codification of physical facts and laws, and a faith in their exactness and sufficiency. Research demands a less assurance, and an almost vacillating mind, alert and ready to accredit each newly found physical fact, a humble meekness leading to the laying aside of the code of the engineer, and an ever-readiness to view all sides of a subject and by properly weighing evidence to form a tentative judgment as to the correct procedure under the then existing state of knowledge.

At times we see these two sets of faculties both operating at one time in one person, but this is an unusual spectacle. More ordinarily we see the codifiers and the practitioners sharply separated, with almost an enmity between them. Witness for example, the estimation accorded a college professor in a steel mill. This is a condition that is sad, because these gentlemen often do the codifying from highly altruistic motives, although it must be confessed that they are at times driven to the effort by the need to piece out an entirely inadequate income. A little human kindness should be extended to them for unavoidable lack of practical knowledge, remembering that practical men often hand out to them not a little "bushwa" and that it is small wonder if one of our learned friends is misled at times to such an extent as to put into his book (or code) something that a fuller knowledge may show had been better omitted.

Business is a curious growth often based on ability to disseminate partial truths. We see it using the product of the codifiers' labor but exalting the formula above the physical facts which the formula (at best, only partially) expresses. Many of these formulas are based on an idea of perfection and thus are of practical utility only when modified into empirical rules that are of limited applicability.

Lord Kelvin has called especial attention to the need to hold the facts in mind, saying "Nothing can be more fatal to progress than a too confident reliance on mathematical symbols; for the student is only too apt to take the easier course, and consider the formula and not the fact as the physical reality."

John Austen.

McKeesport, Penn., Apr. 26, 1913.

Another Scheme to Rob Mississippi Floods of Their Terrors

Sir—Apropos of the discussion among "Civil Engineers" and others of methods for controlling the floods in the Mississippi River, the following solution, advanced by a brother in the electrical field, certainly deserves the same serious consideration afforded in the newspapers to the reforestation method, the reservoir method (both movable and immovable) and the more

recent plan for a channel ten miles wide from Cairo to the Gulf on the west side of the river.

Briefly, the plan is this. Confine the river in a concrete flume, say ten miles long and five wide. Cover the floor of this flume with a network of iron wires. Run transmission lines to all power plants within 1000 miles. Then, when a flood comes, let the government take control of these power plants for as long as necessary, and concentrate their entire output on heating these wires. In this way, the flood waters would soon be evaporated, and this vast volume of vapor could be directed by blowers, also run by electricity, against the Rocky Mountains, where it would be precipitated and rendered available for the irrigation of the entire arid West!

H. E. PHELPS, City Engineer.

Boulder, Colo., May 12, 1913.

Flange Width in T-Beams in Tile and Concrete Floors

Sir—In the many reports and regulations for reinforced-concrete design the subject of T-beams is dealt with in as many different ways. The National Association of Cement Users permits the width of flange, measured from the edge of the stem, to equal six times the flange thickness. The Report of the Joint Committee on Concrete and Reinforced Concrete limits the overhanging edge to four times the flange thickness. The Chicago building ordinance limits the width to be used in compression to three-fourths the distance center to center of ribs.

Apply these regulations to a combination tile and concrete floor. Assume a floor having a total thickness of 7 in., consisting of a 2-in. flange and 5-in. tile, with 4-in. wide stem. The distance center to center of stems, or ribs, is 16 in. Under the first rule above given, the width of the beam assumed as a rectangular beam is 28 in. Under the second rule above given the width is 20 in. Under the Chicago rule the width of the beam is 12 in. The question of shear must enter and if this is limited to 40 lb. per sq.in. on the cross section of the rib, $4 \times 7 = 28$ in., the resisting moment may be considerably less than if any of the foregoing rules be followed. That is, no matter what rule is given for the maximum flange width the unit shear really governs, for it is ridiculous to attempt to put stirrups for web reinforcement in such narrow stems.

All the reports mentioned, as well as all the building ordinances the writer has seen, are defective in their neglect to state specifically the application of their rules to combination tile and concrete floors. In Chicago, for example, if the ordinance is followed the extreme flange width to be taken into consideration on such a floor would be 12 in. and the maximum shear 40 lb. per sq.in. It is the practice of the architectural engineers who examine building plans to consider the whole width, center to center of ribs, and allow a shear on the rib section as high as 75 lb. per sq.in. This is done for the reason that the web of the tile adjoining the concrete section is counted on to furnish web strength. The unit shear on the tile and concrete is 40 lb., which occasionally means 75 lb. on the concrete rib alone. In addition to this, one bar must be turned up. The stand taken by the engineers is said to be due to a number of tests made on such floors. Personally the writer does not like it but on this point evidence is sought from such of your readers as may be inclined to give an opinion.

ERNEST MCCULLOUGH.

Monadnock Block, Chicago, Ill.

Mar. 12, 1913.

A New Move for Water Filtration at Cleveland, Ohio

Sir—In view of the editorial comment on the Cleveland water situation in your issue of May 15, it will probably be of interest to you to learn that Mayor Baker has this week in effect declared himself in favor of filtration and appointed a commission to investigate the best method of treatment and the cost involved. The mayor urges that the report be submitted as early as possible.

In the meantime the State Board of Health, to whom an appeal has been made by the local Board of Health for action under the "Bense Act," has decided to withhold investigation for the reason that apparently it believes that the local authorities will take care of the situation.

I might say that for the last two months the public water-supply of Cleveland has been continuously very objectionable, and a vast majority of the people, as well as a majority of the newspapers, have been urging filtration. The water, in fact, has not been fit to bathe in for two months, much less to drink. In addition the typhoid rate, although not excessive, has shown a very marked increase over that of 1912. The prospects are that the rate for May, 1913, will be two or three times that of May, 1912.

You see, therefore, there are hygienic as well as æsthetic reasons for purifying the supply. Furthermore, it is the general opinion that the removal of the extreme turbidity of the water is demanded by considerations of more importance than those covered by the word "æsthetic." In other words, we desire water clean enough for bathing purposes.

The inclosed clipping tells something about the commission, and also contains the Mayor's statement. I might add that at the first meeting of the commission yesterday, it was resolved: "That it is the sense of the commission that a filtration plant at Cleveland is necessary in order to secure a safe and satisfactory water-supply at all times."

At this meeting Prof. A. W. Smith, of Case School, was elected president, and the writer was elected secretary. This commission, with the assistance of Mr. C. F. Schulz, superintendent of water-works, expects to submit a general plan with a report and estimates of cost, within a month or two.

With the amount of study which has already been given Cleveland's water-supply, there are many data on hand which will be useful. In addition, the matter of studying the treatment of Lake Erie water by mechanical filters will be taken up first hand by an analyst in the employ of the city, who will make thorough investigations of the eight or nine plants now in operation in the vicinity of Cleveland.

R. W. PRATT,
Secretary Filtration Committee.

Cleveland, Ohio, May 16, 1913.

[Our previous comment on this subject was based on

the fact that the weight of such engineering testimony as was available to us when we wrote, put the burden of proof upon those who demanded immediate filtration. With conditions such as Mr. Pratt outlines we do not wonder that Mayor Baker has concluded that the time for filtration has come and that he has appointed a committee to decide what type of filter is best suited to the needs of Cleveland. Besides Mr. Pratt this committee includes Dr. A. W. Smith, professor of chemistry at the Case School of Applied Science; Dr. Hippolyte Gruner, Professor of Chemistry at Adelbert College, Dr. Wm. T. Miller (local), member of the Ohio State Board of Health and Roger C. Perkin, city bacteriologist.—ED.]

The Value of a Binder Course in Bituminous Pavements

Sir—The Association for Standardizing Paving Specifications, at its fourth annual convention held at Pittsburgh, Penn., Feb. 24 to 27, 1913, after careful consideration unanimously determined that fine bituminous mixtures like "Topeka" specifications should be laid on a binder course in the same way as other sheet-asphalt-sand mixture surfaces.

The report of the committee of the above association on bituminous concrete paving specifications, which was unanimously adopted by the association, referring to such fine mixtures under the heading "Binder Course" contains the following:

> The binder course for macadam base shall be composed of a layer of coarse clean stone of a size to pass a 2- to 2½-in. ring and be retained on a 1-in. ring; it shall be evenly distributed over the surface of the macadam base described above and 1½ in., or practically only one stone deep and rolled until the stones are practically level and forced partially into the macadam base. The rolling should be comparatively light, only enough to partially embed the stone and set them firmly in place without crushing them or forcing the fine material up from below to completely fill the voids. This rolling should be done while the macadam base is still moist and comparatively soft. The stone of the binder course may be laid on without any coating or application whatever or second, with an application of light bitumen after laying and rolling or third, coated with bituminous cement before being laid; when a concrete base is used the binder course shall be laid in accordance with the standard specifications for sheet-asphalt pavements.

The above association in standardizing and insisting upon the use of a binder course under all sheet-asphalt surfaces, including the fine mixture asphaltic concrete or so called "Topeka" specifications, are acting in accordance with what actual practice has demonstrated to be the most standard forms of street-pavement construction.

It has been my experience with the above type of wearing surface that creeping and shoving will take place even under moderate traffic unless a binder course is used. The binder not only prevents this displacement but adds support and stability to the wearing surface, which, owing to its composition being mostly sand, does not have the traffic-resisting qualities within itself.

The value of the binder course was brought out very clearly in a paper read before the American Society of Municipal Improvements in Dallas, Texas, by Mr. Isaac Van Trump, Engineering Chemist of Chicago, in which he says, in effect: "On streets where traffic is medium to heavy, sheet-asphalt pavements or even the fine stone asphaltic-concrete wearing surface now being laid in many localities will frequently creep and shove alarmingly when laid without a binder course."

The committee appointed by the League of California Municipalities to make a study of the best practices in pavement and roadway building made an exhaustive study of the merits of the binder course and reported strongly in its favor for the type of wearing surface now under discussion and so it appears to me that the practice of eliminating the binder course in asphaltic pavements in order to slightly reduce the first cost of the pavement is not in accordance with the best practice in street-pavement construction.

F. N. BINGHAM,
Engineering Chemist.
Merchants' Trust Bldg., Portland, Ore.
Mar. 17, 1913.

The Karns Tunneling Machine

Sir—I have been interested in the description in your issue of Mar. 6, of the Karns tunneling machine. Apparently this differs from most of the others in having actually bored a fair length of tunnel. The point of most interest, however, in all these schemes is the disposal of the muck and the method of accomplishing this is not even hinted at in your description. Most of the machines which have been previously proposed will advance a heading a foot or so, then they get clogged up.

F. LAVIS.

499 Cangallo, Buenos Aires, Apr. 12, 1913.

[We referred the above letter to the Karns Tunneling Machine Co. and append their reply.—ED.]

Sir—In reply to the inquiry as to the disposal of muck, we have always washed this out. Water is pumped in through pipes and at the heading under the machine at the proper points fixed nozzles are located and water is expelled from them under pressure. The rock as it is cut and falls is caught and washed back. Formerly we washed it all the way out of tunnel, nozzles being set in the pipe line at different points as the tunnel progressed, giving new impetus to the flowing water and muck. Later we washed the muck out through a 5-in. pipe line. A funnel shaped to the curvature of the tunnel was located under the machine and near the heading. This funnel was large and caught all dirt and water as it came back. The funnel was connected with our five-inch line and all was confined in it, thus giving much greater force to the flow of the water and cut rock it was carrying. This worked very satisfactorily and carried the muck out nicely. This plan was followed at Johnstown, Penn., back of our 6-ft. machine and did its work well.

Our new machine drives 12 ft. without stopping to move up the holding columns. The machine at Johnstown had to be moved up every 6 ft. of tunnel driven. The new machine also contains many improvements to facilitate operation, suggested by actual operation of previous machines.

In the matter of water available to wash out muck, there must be enough available to keep the dust down in the heading and to wash the muck back and free of the machine, where if sufficient water is not available to carry it on out, it can be loaded into cars or taken out by different methods. Even if a small amount of water is available it can be made to suffice by using the

same water over and over. This is accomplished by making two sumps. The water is pumped from the outer sump and the cut rock and water flows back into the first sump. Before starting the machine under such conditions, the pumps are started and when the water has reached the heading and has returned to the sump, overflowing out of the first into the second, the machine can be started, as the water has made the complete circuit and will flow into the sump as fast as it is pumped out. We adopted this plan at a point in Colorado and accomplished the results with a very small supply of water flowing naturally from the tunnel.

We expect to have one of our smaller sizes of machines in operation on contract work probably during August next. The shops manufacturing it are hurrying it through. The operation of our new and larger sized machine will follow later.

THE J. P. KARNS TUNNELING CO.,
SHIRLEY DAVIS, Secretary.
10410 Lake Ave., N. W., Cleveland, Ohio.
May 13, 1913.

Notes on Stream Gaging Stations

Sir—I have read with interest the article on Stream Gaging Stations by John C. Hoyt in your issue of Apr. 24, 1913.

He speaks of the cost of a station with the most modern equipment as being from $1000 to $1500. There are very few stations where I believe this expenditure would be justified. I have seen several stations equipped with a satisfactory self-recording device for less than $100.

Speaking of comparative runoff, it is pretty generally recognized that the minimum rainfall will be around one-half the average and the maximum runoff will be around twice the average. Under these conditions it is certain that the runoff will vary by nearer 200% than 100% above or below the mean annual average. Also consider two dry years coming together with (we will assume) the same amount of rain, the runoff of the second dry year will probably be nearer two-thirds of the first dry year, other things being equal, except that the watershed is a great deal drier the second year. On the other hand, if two wet years come together with the same amount of rain, the runoff of the second year may be one-third larger than the first, owing to the watershed being in better shape to turn the water off.

Last year I had a gage on a small stream draining about 14,000 acres of high, steep, rocky country which turned off 1.2 ft. in depth of water. Another and adjoining stream draining about 28,000 acres of lower, flatter country, largely covered with soil, only turned off 0.3 ft. in depth of water. The year was a dry one.

There is no question in my mind but what a self-recording gage or Nilometer makes, under ordinary conditions, the only reliable record of stream heights, unless hourly readings are taken, which is usually impossible. The ordinary practice is to take a reading in the morning and one in the afternoon. Usually these two are averaged and from this the discharge is taken from a runoff diagram; or the discharge is taken for each gage height and added together, which will give the discharge in acre-feet or half of it the mean discharge in second-feet. It is assumed that the diagram reads to second-feet. In checking over old records extending over a period of several years which were computed by the first method I have often found that the second method would give an increase of 15% to 50%, but there are conditions which would show a decrease. I believe that the second method is the most accurate.

Another trouble with depending wholly upon the morning and evening readings is that it is impossible to get the maximum and minimum gage heights and the length of time the stream stood around each point. If the station is near the source of a small watershed the crest may come in the middle of the afternoon. The station may be far enough downstream so the crest will come in the night, and the morning and afternoon reading will be about the same. All of the above conditions will give a "discharge" under the actual. If the crest came at the time of the morning or afternoon reading the discharge given would probably be more than the actual.

Again there may be lakes, interior drainage basins on canals taken out above the station, which may not be considered in making up the annual discharge, but which might be turned to account by a different plan of operations.

If the station is located near a house it is customary to employ one of the occupants as observer, at say $5 to $10 per month or 25c. to $1 per reading. Then there is a question if the observer will always take his readings on time or if it is not easier to guess at it. On the other hand, if a regular observer is employed to look after several stations, it is usual for him to make one round in the morning and another one in the afternoon. Almost invariably several hours will elapse between the time he takes his first and last reading on each round. This puts a difficult equation in the problem.

If a good self-recording gage is used it is possible to get a continuous record of the gage heights and as it only requires visiting once a week to change the paper and wind up the clock, it is possible to employ a better man, say, the hydrographer, who can do this in connection with his meter work. This all tends to give a better, more accurate and usually a cheaper record.

The ordinary specifications for a gaging station are:

(1) A fairly smooth and straight channel with fairly permanent banks and bed. The banks not liable to overflow. A place to put the gage where it is not apt to be washed out.
(2) A cross-section of channel fairly uniform for a reasonable distance above and below the gage, with no obstructions to cause backwater rapids, falls, marked eddies, cross currents or boils.
(3) A measurable and uniform velocity of current.
(4) The gage should be placed where suitable arrangements can be made for keeping the gage heights and rating the stream.

I have seen stations where some or most all of the above specifications were disregarded and new stations selected in the immediate vicinity showed very different results, sometimes varying by 100% from the old station records on which comparative records were kept.

Another source of errors is the current meters. They are very delicate and are used under trying conditions. They often receive hard raps. They should be frequently rated.

Very often the ripple on the gage causes an ordinary observer to add 0.1 ft. to the gage height.

I would suggest that in addition to just turning in the results of the observations the following be included in the reports:

(1) A map of the watershed, contoured if possible, show-

ing the locations of the gaging stations, rainfall stations, etc., forests, etc.

(2) A profile and contoured map to a large enough scale to show details of the immediate vicinity of the station.

(3) A good photo or two of each station, showing it at high and low water.

(4) A detailed statement of the methods employed in reading gage heights, current-meter reading and computations.

CHAS. KIRBY FOX.

Pomona, Calif., May 1, 1913.

The Status of the Engineer, A Suggestion from a Young One

Sir—The report, in your issue of Apr. 24, of the discussion at the meeting of the American Institute of Consulting Engineers of the status of the engineer was very interesting to me in showing the opinions the heads of the profession hold of us young "dubs."

There are a lot of us who "may have had engineering schooling, and * * * * * held a leveling rod, or inspected materials," who are anxious to learn what an engineer should be and know, and who have imagined that these small tasks were the beginnings on the road that leads as far as a man's ability will carry him.

If we didn't think so, it's a "cinch" we wouldn't take the jobs at the wages we do, when we could make twice as much with a brick-mason's trowel.

When our college chums, of a couple of years ago, in the "Medic. Dept." finished their schooling, they were Doctors—young, inexperienced, perhaps some of them "bonehead," but to the public—Doctors. But we are not Engineers, at least not "real Engineers," and hardly "young Engineers"; though I rather imagine that our school training was more valuable professionally.

Where lies the difference? Not in the fact that, almost to a man, we went to work on a salary; for many and many of them did the same, with insurance companies, railways, mining companies, or other large corporations. As for that, the entire membership of one profession, the clergy, work for salaries.

The retaining fee does not appear to make a professional man any more than belonging to a profession makes a man competent. And there are many objections to making the retaining-fee idea the criterion of membership in the profession. Military engineers who are an ornament to the engineering profession would be barred out, if acceptance of a salary were disqualifying.

It appears that the "one thing needful" is the one thing common to all the other professions, some definite method of admitting a candidate to membership in the profession. In my humble opinion it would be vastly better if this were managed entirely by "home rule," as with the clergy, rather than by the state, as in medicine and law.

Why could not a national organization of engineers hold annual state examinations similar in purpose to the bar and medical examinations, and formally admit the successful candidates to membership in the profession?

And as for these youngsters grabbing all the business by virtue of their titles—that is quite too good to be true. I presume that the men who have in hand the expenditure of large sums for engineering work are not so foolish as to let some greenhorn waste their money for them.

I cannot see how we youngsters would "get anything" by the organization of the profession except perhaps, a chance to pay some registry fees. It would probably have an effect in lowering our wages still more. But we'll stand the gaff, if it will raise the engineer, "real" or imaginary, in the estimation of the public.

F. YOUNG.

Hibbing, Minn., May 6, 1913.

The Pitot Tube Formula

Sir—Mr. John Airey gives some very correct notes on the Pitot tube in your issue of Apr. 17. This is a good time to lay bare some of the inaccuracies concerning the theory of this instrument which have appeared and still continue to appear in some of our best books. Bernoulli's Theorem applies to streamline flow, and even in practical cases the coefficient of the Pitot tube in the formula $h = \frac{v^2}{2g}$ is substantially equal to unity.

The writer is not certain as to the effect of turbulence upon the Pitot tube. He is inclined to believe that, on the average, the effect is to leave the coefficient practically unchanged. In 1911, during a series of turbine tests, about 100 velocity comparisons were made between simultaneous velocities determined by means of a Haskell current meter and Pitot tube in the tailrace (see current number of Trans. Am. Soc. C. E.). These velocities were observed at 60 points in the tailrace at 5 different depths, 12 points at each depth. The ratio of the sum of the velocities by the Pitot tube so that by the Haskell meter was 1.004, but the variations from unity in the ratio of corresponding individual velocities were in some cases as much as 5% or 6%, due to errors of observations and irregularities of flow. The observations were not conducted with laboratory precision, since the inequalities of velocity encountered caused vibrations of head and rendered it necessary to take twenty or thirty readings in order to eliminate accidental errors of this kind. It is, therefore, apparent that the coefficient of the tube employed in a very practical case was unity.

Further information on this interesting subject may be had by reference to a paper by W. M. White, entitled "The Pitot Tube: Its Formula," Journal of the Association of Engineering Societies, Vol. XXVII, 1901, p. 35. This paper confirms the work of a number of experimenters, among whom may be mentioned, Darcy and Bazin (1865), John R. Freeman, Gardner S. Williams and L. F. Moody.

It seems hardly proper to say that the momentum theory is untenable, since that theory is the rock upon which all engineers must build. In fact it is the basis of Bernoulli's Theorem itself. It would seem to describe the case better to say that errors have been made in the premises upon which to base reasoning concerning the theory of the Pitot tube with the result that the formula deduced required twice as much pressure as demanded by the nature of the case.

Mr. Airey's conclusion (f) is by all means very true. There are two parts to a Pitot tube, namely; the dynamic orifice and tube (Pitot tube proper), and the static orifice and tube. The coefficient of the former, *when of circular section and whether cylindrical, diverging, or converging, is unity.* But the latter, if improperly designed, may fail to indicate the true static pressure.

B. F. GROAT.

2402 Oliver Bldg., Pittsburgh, Penn.
Apr. 29, 1913.

Reports on Filtering the Croton Water-Supply

SYNOPSIS—A twenty-year campaign for improving the quality of the Croton water-supply, New York City, is reviewed, with particular reference to recent engineering and other reports on filtration plans and the need for filtration. An account is given of the action of the Bureau of Municipal Research and the Citizens' Union to prevent the award of a filtration contract to the lowest bidder of Jan. 23, 1913, and of Comptroller Prendergast to the same end. Of two boards of engineers who have passed on the present contract plans all approved them as to character and one only dissented as to the advisability of filtration—a question raised after bonds had been authorized, plans prepared and bids advertised.

The remarkable hold-up of the proposed contract for a 320,000,000 to 400,000,000-gal. mechanical filtration plant for the Croton water-supply, New York City, together with questions raised at the eleventh hour and fifty-ninth minute as to the need of a filtration plant anyway, involves many points of general interest.* We have, therefore, prepared a general review of the twenty-years' agitation for an improvement of the Croton water-supply, a summary of the main features of the controversy, and also abstracts of reports on filtration made in June, 1912, and April, 1913, by two boards of consulting engineers, headed, respectively, by Allen Hazen and Nicholas S. Hill, Jr.

In the early eighteen-nineties the New York State Department of Health made a detailed sanitary inspection of the Croton drainage area and published a voluminous report, illustrated by hundreds of pen sketches from photographs, showing gross pollution of the Croton supply. Since then immense sums of money (see statement near close of this article) have been spent in acquiring land for the sanitary protection of the Croton water-supply, considerable sanitary inspection has been carried on by the city authorities and other watershed remedies have been applied. Coincident with this and gaining strength with time, there has been a demand for the filtration of the Croton water-supply.

By way of statement of this growing demand, and of technical sanction for it, we cannot do better than to condense a statement made in 1911 by three members of the then and present Board of Estimate and Apportionment (the central governing body of New York City):*

The committee stated that there had been a practically unanimous opinion among "the authorities" that the Croton supply "should be filtered as a sanitary measure and to improve the appearance, taste and odor of the water"; that in 1903 the Burr-Hering-Freeman Commission had advised the immediate filtration of Croton water; that in 1904 J. Waldo Smith, then chief engineer of the Croton Aqueduct Commission, advised, and Prof. Wm. H. Burr indorsed, that work on the easterly basin of the Jerome Park Reservoir be suspended, awaiting the determination of the filtration question; that the city health department had repeatedly urged filtration; and that filtration of the Croton supply had been advised in a report [1904] by Hazen & Whipple, who stated that "the water-supplies of many cities formerly inferior to those of New York are now as good or better because of purification works."

On May 23, 1906, the Board of Estimate directed the Commissioner of Water Supply to select a site and prepare plans and specifications for a filtration plant. In March, 1907, an experimental or testing station was put in operation. On Oct. 30, 1907, John H. O'Brien, then Commissioner of Water Supply, and I. M. de Varona, Chief Engineer of the Department of Water Supply, reported to the Board of Estimate, submitting plans for a 400,000,000-gal. slow sand filtration plant operating at the rate of 10,000,000 gal. per acre at the Jerome Park site already mentioned. This report was indorsed by Hering & Fuller, of New York City. Wm. B. Fuller had been engaged on the plans and specifications thus indorsed. The experimental work mentioned consisted of tests of sedimentation, slow sand filtration without and with coagulants and ozone treatment of water which had been passed through a Hungerford mechanical filter. (See ENG. NEWS, Nov. 1, 1907, p. 561, for abstract of the report just mentioned, and pp. 556-7 for editorial comment on the report.)

It was urged upon the Board of Estimate at that time that if it would promptly make an appropriation, filtration works might be completed in 1909. Opposition to this program was made by H. A. Metz, then City Comptroller of New York, and the project was dropped—partly, perhaps, because of the financial stringency of 1907.

On July 29, 1910, the Board of Estimate authorized

*The hold-up began early in the present year, but bids were finally received on Jan. 23, with the understanding that no award would be made until after the opponents to filtration had had opportunity for investigation. The plant as designed would have a nominal capacity of 320,000,000 gal. and a maximum capacity of 400,000,000 gal. a day. Further particulars are given by the following extract from the specifications:

The filter plant consists of 80 filters of the mechanical type, a head house, a mixing chamber, settling basins, filtered-water reservoir and appurtenances.

The excavation is partly in earth and partly in rock. Much of the excavation for the basins and reservoirs has been done under a previous contract.

The filters are supported on the roof arches of a portion of the filtered-water reservoir, and are furnished with operating galleries, piping, wash-water reservoir and complete equipment. The filters have a net area of sand surface of about 2.7 acres. The superstructures over the filter galleries are not included in this contract.

The mixing chamber is a covered concrete reservoir having an area of about 0.9 of an acre, provided with interior baffles, flushing pipes, drains, etc. Its purpose is to thoroughly mix the chemicals with the water.

The setling basins consist of six covered concrete reservoirs having a total area of about 11.2 acres. Five are for removing the heavier sediment from the water before it passes to the filters, and are provided with baffles. One is for removing the sediment from the wash water if required. All are provided with flushing pipes and drains.

The filtered-water reservoir consists of a covered concrete reservoir having an area of about 55 acres in addition to the portion beneath the filters.

All the basins and reservoirs are covered with earth and grassed.

The head house is a reinforced-concrete building consisting of concrete foundation, frame and roof, about 100x160 ft. in size, part of which is three stories high and part two stories high. The outer walls and the partitions, plumbing, heating and lighting are not included in this contract. The head house contains bins, tanks and apparatus for the storage and handling of the chemicals to be applied to the water.

Two main gate chambers are located, one at the north and one at the south end of the settling basins. Thru gate chambers are located in the filtered-water reservoir. The superstructures of these buildings are not included in this contract.

*It is interesting to note that one of these men was Comptroller Prendergast, the present official arch-opponent of filtration; another President McAneny (Borough of Manhattan), who is reported to have joined Mr. Prendergast in his opposition; and the third, Mr. Mitchel, President of the Board of Aldermen, who has voted (test vote) in favor of filtration, but who the opponents hope to win over on the proposed day of final action, May 22. The three men reported in 1911, in favor of the very bond issue which Mr. Prendergast has been trying since January of this year to annul.

a bond issue of $2,200,000 for completing the easterly basin of the Jerome Park Reservoir, including foundations for a filtration plant to be built above the reservoir at some future time. On Nov. 18, 1910, the Board of Estimate appointed three of its own members a Committee on Filtration to consider both the filtration of the Croton water-supply and a proposition for disinfection, the latter having been submitted by Wm. B. Ellison, on behalf of the New Jersey Securities Co.

On Jan. 26, 1911, Commissioner of Water Supply, Thompson, requested the Board of Estimate to authorize $6,500,000 more bonds, in order that a filtration plant might be built in connection with the completion of the east basin of the Jerome Park Reservoir, authorized on July 29, 1910. This request was referred to the Committee on Filtration, already mentioned, and also to the Corporate Stock Budget Committee of the Board of Estimate. The last of these committees waited on the first one for a report on both disinfection and filtration, but as the Committee on Filtration failed to act it was discharged in April, 1911, at the request of Commissioner Thompson.

This action having cleared the field, the Corporate Stock Budget Committee (Wm. A. Prendergast, Comptroller, and Messrs. Mitchel and McAneny) reported to the Board of Estimate on Apr. 12, 1911, in favor of cutting the $2,200,000 loan previously authorized to $10,000 and granting a new joint loan of $8,690,000 for completing the east basin of the Jerome Park Reservoir and building a sand filtration plant in connection therewith. This recommendation was adopted by the Board of Estimate on May 11, 1911. At the same time the qualifying word "sand" was stricken from the resolution, thus leaving the type of plant open. On June 20, following, the Board of Aldermen concurred in this bond authorization, which has been the basis of action from that time until this.

In Commissioner Thompson's request of Jan. 24, 1911, in the Corporate Stock Budget Committee report of Apr. 12, 1911 (virtually approved by the Board of Estimate), and in a memorandum submitted to the Board of Aldermen by a committee of that body, the need for filtration of the Croton water-supply was stated in strong terms. The Board of Estimate authorized the filtration bonds without a dissenting vote and the Board of Aldermen by a vote of 50 to 1.

In view of Comptroller Prendergast's recent action in holding up filtration it is interesting to note the following statement in the report of Apr. 11, 1911, which bears his signature:

> Your committee believes that the Croton water-supply should be filtered and that the filter plant should be built as a part of the contract for the completion of the easterly basin of the Jerome Park Reservoir, if it is ever to occupy that site.

The committee also outlined the various earlier recommendations for filtration, as summarized at the beginning of this historical sketch.

Soon after the authorization of bonds on May 11, 1911, the Department of Water Supply engaged George W. Fuller, of New York City, as consulting expert for filtration and Elmer G. Manahan, formerly with Hering & Fuller, as division engineer in immediate charge of filter design. A force of twenty-five engineers and draftsmen was engaged and work actually prosecuted on designs and estimates for both slow sand and mechanical filtration plants. These special filtration engineers and I. M. de Varona, Chief Engineer of the Department of Water Supply, concluded that mechanical filtration would be cheaper than slow sand filtration, in construction cost, by some $3,000,000. It may be noted in passing that between 1907 and 1912, material advances were made in mechanical filtration and it may be further noted that the slow sand filtration estimates of 1907 were based upon a scheme of mechanical scraping of slow sand filters which has since been proved, by experience at Pittsburgh, to be less successful and economical, to say the least, than was expected.

In order to make assurance doubly sure a Consulting Board of Experts was appointed by Henry S. Thompson, Commissioner of Water Supply, to examine the 1912 filtration plans.* This board reported to Mr. de Varona on June 10, 1912, and on June 25, the report was transmitted to the Board of Estimate, which, through a committee, and after approval by its engineers, authorized the Department of Water Supply to advertise for bids.†

For reasons unknown to us, proposals were not invited until about Dec. 1, 1912. The advertisement for bids appeared to have attracted the attention of the Bureau of Municipal Research and the Citizens' Union and to have led them to look into the plans and specifications, whereupon they seemed very soon to have concluded that the specifications were not in the interests of the city in a number of respects, and that, moreover, there was serious question as to whether or not the particular plan of water purification proposed was the best one for the city. The latter opinion was based largely upon what the civic investigators regarded as a halting approval of the filtration plant by the Consulting Board of Experts. On Dec. 31, 1912, Henry Bruére, a director of the Bureau of Municipal Research, submitted objections to the project to Comptroller Prendergast.

On Jan. 8, 1913, Comptroller Prendergast reported to a meeting of the Board of Estimate and Apportionment a statement to the effect that the whole subject of these

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*Allen Hazen, chairman, George A. Johnson, secretary, Frank A. Barbour, Prof. Wm. G. Mason and James H. Fuertes; Mr. Barbour being of Boston, Prof. Mason of Rensselaer Polytechnic Institute, and the other three being of New York City.

†As some of the events connected with this committee investigation figured largely as reasons for the later hold-up of the filtration project, we summarize them in this footnote for the benefit of those who care for the details:

Vacation time being near, during which it would be impracticable to get together a majority of the Board of Estimate, and the Department of Water Supply being anxious to be in a position to advertise for bids for filtration work, the Board of Estimate on July 15, 1912, appointed five of its own members as a Committee on Filtration, with power to act in behalf of the full board. This board consisted of Mayor Gaynor, Comptroller Prendergast, and the Borough presidents of Manhattan, the Bronx and Richmond. On July 23 this committee referred the general question of the adequacy and sufficiency of the mechanical filtration plans and specifications to Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, and to Chandler Withington, principal assistant engineer, Department of Finance (the department presided over, we understand, by Comptroller Prendergast). On July 29, these engineers reported back to Mayor Gaynor a general indorsement of the plans and specifications, subject to minor changes in the latter.

On Aug. 1, Mr. Lewis reported to Mayor Gaynor that he had been informed by the Commissioner of Water Supply that some question had been raised as to the loss of head that would be caused by the proposed filters and after investigation he had concluded that this loss of head (5½ ft.) might be disregarded as being a minor consideration.

On Aug. 8, 1912, Mayor Gaynor wrote to the Commissioner of Water Supply to the effect that the special committee on filtration for the Board of Estimate had held three hearings and had approved the filtration plans and specifications, with the modifications suggested by Mr. Lewis. In effect, Mayor Gaynor also stated that all the formalities required from the Board of Estimate had been complied with and that the Commissioner of Water Supply was therefore authorized to advertise for proposals. In the same letter the Mayor stated that certain questions relating to patents had been given consideration and had been covered by a recommendation of the legal department of the city.

specifications, and of filtration as well, needed further study. His statement was accompanied by a resolution cutting down the appropriation of May 11, 1911, from $8,690,000 to the sum of $50,000, the latter to be used under the direction of the Commissioner of Water Supply for "making tests of various types of filters and filtration plants." This resolution was not passed. Instead, the Department of Water Supply was allowed to open the filtration bids on Jan. 23, 1913. The totals of these bids, as canvassed by Mr. De Varona, are given further on in this article; bids in tabular detail were published on page 42 of our Construction News section for Feb. 13, 1913.

At a later date a committee of the Board of Estimate appointed the Advisory Commission of Engineers already mentioned, a majority of which reported in favor of the filtration plans late in April, 1913.

On May 8, 1913, a committee of the Citizens' Union submitted a communication to the Board of Estimate, urging it that no contract for filtration be "awarded at this time" and that it annul the filtration appropriation. The committee also stated that it intended "to bring a taxpayer's action to test the legality of the proposed contract," which it instituted on the afternoon of the same day. On the following day Commissioner Thompson replied to the Citizens' Union brief and to the minority report of the advisory engineers. On May 13, the Board of Estimate, at a special meeting and on a test vote, voted 10 to 6 in favor of awarding the filtration contract to the lowest bidder, but when the matter came up for final action on May 15 the subject was postponed for a week.

Having reviewed the history of the filtration project, we will now take up the report of the Consulting Board of Experts submitted June 10, 1912. We will then give some of the specific allegations or objections of the Bureau of Municipal Research and of Comptroller Prendergast, an abstract of the reports by the recent Advisory Commission of Engineers, make further reference to the protest of the Citizens' Union, filed on May 9, and summarize reports submitted on May 20 by Allen Hazen and Geo. A. Johnson. Elsewhere in this issue editorial comment on the hold-up may be found.

Report of Consulting Board of Experts, June 10, 1912.

The report of the Consulting Board of Experts opened with a formal introduction and with acknowledgments to Messrs. Geo. W. Fuller, E. G. Manahan, D. D. Jackson and Geo. C. Whipple. The balance of the report was as follows:

We have taken up first a discussion of the general principles involved, but on account of engagements of the various members of your Board, and the short time allowed for the making of this report, we have not been able to push our inquiry along several lines as far as would reasonably be necessary in order to answer to our full satisfaction some of your questions.

We assume in making this report what we believe to be the case: that the work of preparing these plans and projects has been well and carefully executed; that the calculations are correct; and that the design is generally good as relating to all the many details which we have not had time to take up. We believe that your engineers are fully competent in this respect, and express at this time our confidence in the general results, which, owing to the limitations above noted, we have not been able to check fully.

From the memoranda submitted to us, it appears that the proposed filtration works are to be located at the Jerome Park Reservoir site as determined by the Board of Estimate; that the plant is to have a capacity of 320 million gallons per day and is to be capable of treating 400 million gallons at times; and that the filtered-water reservoir, when full, will have its flow line at Elev. 126 and will contain 365 million gallons. We understand that the scope of our duties is limited by these premises.

We also note that while the report and plans prescribe a system of sand filters, as well as a system of mechanical filters, the latter system has been adopted by your Department as most suitable for the local conditions.

We further note that it is proposed to apply regularly a sterilizing treatment to the filtered water, and that soda or lime will be added whenever desirable, in order to remove free carbonic acid, and thus lessen the corrosive action on iron pipes.

We have also been told that it is the intention to use copper sulphate systematically and thoroughly in Croton Lake, for the purpose of reducing and preventing growths that would otherwise cause objectionable tastes and odors.

We will now take up the questions and answer them in the light of our judgment and such evidence as we have been able to collect.

Mechanical Filters

(1) Are the mechanical filters as shown by the plans of the Department in accordance with modern practice?

Modern practice in filtration is variable and must be so because of the different conditions that have to be met. In this case some of the conditions imposed are unusual, and any plans that could reasonably be proposed to meet them would have unusual features.

Taking these matters into consideration, we answer by saying that the mechanical filters shown by the plans are in general accordance with modern practice.

(2) Will these mechanical filters properly purify the water and render it clear and colorless?

We believe they will.

Mechanical filters of the type that is proposed can be depended upon to remove all turbidity and color from Croton water.

We understand that it is part of the plan to treat continuously the effluent with hypochlorite of lime, and this will insure a high degree of bacterial purification.

We further understand that it is the intention, and must be considered as an integral part of the project, to treat the water of Croton Lake systematically and thoroughly with copper sulphate, with the idea of suppressing certain growths which otherwise would give rise to troublesome tastes and odors, which could not be sufficiently removed by the filters that are shown by the plans.

We are in doubt as to the possibility of using copper sulphate in Croton Lake and operating the proposed filters so as to produce at all times a water as free from tastes and odors as we believe the effluent should be, to satisfactorily serve the people of New York City.

We therefore suggest that an aërating plant, possibly near the Pocantico cut, might be of material assistance at times in reducing and removing tastes and odors. To carry this out it might be possible to utilize about 20 ft. of head as a minimum under ordinary circumstances for aëration, fixing in connection therewith the minimum ordinary level of Croton Lake 20 ft. below the spillway level. The question as to whether this 20 ft. would give sufficient storage capacity for the summer floods to be reasonably anticipated, thereby permitting the system to be used without substantial sacrifice of ultimate capacity, is one which we have not investigated, but which can easily be taken up by your engineers.

We believe that if it were possible to arrange the inlet so as to draw bottom water, and to aërate it at Pocantico cut or elsewhere, before going to the filters, that the project would be much improved from the standpoint of certainty of delivering water acceptably free from tastes and odors. It appears that the engineering difficulties of arranging an inlet to secure only bottom water and deliver it through the present tunnel are very great.

It is suggested that studies should be made to throw more light upon the character of water in Croton Lake at different levels and as drawn by the aqueduct through the various outlets that could be used; and that experiments upon the effect of aëration and treatment by the proposed process upon the different kinds of water that may be so encountered at all seasons of the year should be carried out while the works now proposed are under construction.

(3) Are the estimates of cost of constructing these mechanical filters reasonable?

We have not been able to check over these estimates in detail, but from our general experience it appears that they are reasonable.

(4) Is the estimated cost of operation of these mechanical filters reasonable?

We believe that the estimated cost of their operation is reasonable.

Sand Filters

(1) Will it be necessary to use coagulants in order to obtain clear and colorless filtered water at all seasons of the year?

We are of the opinion that in order to produce clear water, and water that is sufficiently colorless to be satisfactory at all times, with sand filters, it will be necessary to use coagulant for a portion of the time; that is to say, whenever the water is turbid and when the color is high.

(2) Are the sand filters as shown in the general plans of the Department in accordance with modern practice where coagulants are to be used?

We find this one of the most difficult of your questions to answer. The site that is proposed, if it had been left in its natural condition, would have been an excellent one for the construction of sand filters. It was excavated years ago for another purpose to a depth of 15 ft. or more below the natural foundations for such filters. To use it for sand filters at this time involves filling it up in some way so that the filters may be supported at the required elevation.

The method proposed by these plans for reaching this end is to build a system of concrete piers and arches. A structure of this kind is necessarily more expensive than anything ordinarily involved in the construction of sand filters. It also may represent an element of weakness, due to movements of the masonry from any cause, especially with unequal loading that is very difficult to avoid.

The use of the space underneath the filters as a part of the pure water reservoir is nominal only. The water stored cannot be used, because it is, all of it, lower in elevation than would suffice to make it available.

Passing all other questions of design, we feel that it is open to doubt whether the Jerome Park site can be considered at the present time as one permitting of suitable plans for sand filters of such type as we should be willing to call generally in accord with modern practice.

(3) Will these modified sand filters properly purify the water and render it clear and colorless?

The answer to this question would be in general the same as the answer to question No. 2 under mechanical filters. The filters will render the water clear and colorless. With the use of hypochlorite of lime in the effluent it will be of excellent hygienic quality. But the use of copper sulphate in Croton Lake to hold down the growths of organisms is a necessary and integral part of the project, and we are disposed to believe that even with copper-sulphate treatment carried out to the greatest possible extent there would be objectionable tastes and odors in the effluent at times.

As with mechanical filters, an aërating plant would be helpful in dealing with these tastes and odors.

(4) Are the estimates of cost of constructing these sand filters reasonable?

The ansyer to this question is to a considerable extent involved in the answer to question No. 2. We have no cause to doubt the estimates that have been prepared for these structures are reasonable. Compared with the cost of constructing sand filters upon more favorable sites, these estimates are very much higher.

(5) Is the estimated cost of operation of these sand filters reasonable?

We believe that the estimate is sufficient.

We are disposed to think, in the light of recent results obtained elsewhere, that it may be possible to considerably reduce the amount of coagulant required, and the cost of operation. This matter, however, in view of circumstances previously outlined, appears to have but little significance at the present time.

This completes, as we understand it, the answers to the questions you have propounded.

(Signed) ALLEN HAZEN, Chairman.
GEORGE A. JOHNSON, Secretary.
FRANK A. BARBOUR.
W. P. MASON.
JAMES H. FUERTES.

By some chance, or mischance, it appears that only Mr. de Varona's summary of the foregoing report went to the Board of Estimate, a point to which reference is made later on.*

*The full report did go to Messrs. Lewis and Withington, engineering advisers of the Board of Estimate and Finance Department. Mr. de Varona's summary was as follows:

They report that "the mechanical filters shown by the plans are in general accordance with modern practice."

That they believe they will properly purify the water and render it clear and colorless.

That the estimates of cost and operation appear to them to be reasonable.

That, "In order to produce clear water, and water that is sufficiently colorless to be satisfactory at all times, with sand filters, it will be necessary to use coagulants for a portion of the time."

That "it is open to doubt whether the Jerome Park site can be considered at the present time as one permitting of suitable plans for sand filters of such type" as they should be willing to call generally in accord with modern practice.

These conclusions fully establish those of the preliminary report made by me to you, in which the construction of mechanical filters was advocated.

The suggestions made by the Board as to aëration, use of sulphate of copper, etc., are in accordance with the views of this Bureau and will receive due and timely consideration.

Memorandum of the Bureau of Municipal Research Dec. 31, 1912.

In a letter of Henry Bruere, director of the Bureau of Municipal Research, to Comptroller Prendergast, already mentioned as having been sent on Dec. 31, 1912, Mr. Bruére first expresses the opinion that "the city has not made sufficient investigation of the relative merits of such a system of filtration to warrant its making the large expenditure now contemplated on a mechanical filter plant." He adds that there seems to be no "urgent need for immediate action in the construction of the plant" and asks if it would not be desirable to have filtration experiments made from which "a conclusion may be drawn as to the best type of plant for New York City use." He also alleged that the Board of Estimate had not "made an investigation through its own experts, as is customary in projects involving such a large expenditure."

Mr. Bruére then submitted various "objections to the present form of the Jerome Park filtration project." He first urged that there could not be fair and full competition for those parts of the filtration plant which were covered by patents, since, he alleged, "three of the most important features [central operating control, negative head and strainer system—Ed.] in any of the six types specified were patented." He also urged that the entire contract should not be let to one contractor, especially in view of the fact that patented devices were involved.

Other objections were that the specifications gave the engineer discretion regarding the relative amounts of sand and rock in concrete and that the selected site would cause a loss of head of 5½ ft.

After taking up the several points mentioned, Mr. Bruére went into the general question of the filtration of the Croton water-supply. He urged that in 1906 the Department of Water Supply and Chief Engineer Lewis, of the Board of Estimate, had recommended slow sand filtration at this same site and that through "investigation of the Comptroller this project was abandoned" because it was shown "that the estimate of the quantity of water which could be filtered in this way on this site was excessive." Notwithstanding this, Mr. Bruére urged, "now the same department and the same engineer recommend totally different types of filtration plants, namely, mechanical filtration involving the use of chemicals as follows: Alum, milk of lime, hypochlorite of lime, together with sulphate of copper to be used in Croton Lake."

Toward the end of this memorandum Mr. Bruére urged that the Board of Estimate "obtain independent engineering and scientific opinion with respect to this general subject prior to awarding this contract."

Report of Comptroller Prendergast, Jan. 8, 1913.

The so called report of Comptroller Prendergast to the Board of Estimate, dated Jan. 8, 1913, in which he advocated that the filter and reservoir appropriation be cut

down to $50,000 to be used in further investigation, consisted of very little except a brief recitation of the history of the plans and specifications on which bids were about to be received and the plea that owing to haste the filtration plant had been considered by a committee of the Board of Estimate instead of the whole board, and that recently there had been brought to his attention apparent expressions of doubt in the report of the Consulting Board of Experts as to its indorsement of the plans. The Comptroller also stated that he felt convinced that if the Committee on Filtration had read the full report of the Consulting Board of Experts it would not have failed to come to the conclusion that the subject had not been properly studied and that, therefore, it was not fitting to open bids and award contracts. The Comptroller then stated:

I believe in making an expenditure of such magnitude we should exercise extreme care. I believe everyone who has to drink Croton water wants the water filtered, not because it is dangerous, but chiefly because of the unpleasant taste and odor.

If the condition of the water-supply were such as to endanger health, I should not suggest any delay in the construction of the filtration plant.

However, in view of the fact that the public health would not be menaced by delay, I suggest the advisability of a more thorough study of the question of filtration.*

Canvass of Filtration Bids of Jan. 23, 1913.

Before proceeding to take up the report of the Advisory Commission of Engineers, appointed to give the Board of Estimate further light on the subject of purifying the Croton water-supply, it may be noted that nine bids were received for the proposed water filters on Jan. 23 and that these were about equally divided between being higher and lower than the Department of Water Supply estimates, but that the range of prices was remarkably small for a work of such magnitude. For the convenience of our readers we reprint Mr. de Varona's letter to Commissioner Thompson (Jan. 24, 1913), in which he canvasses the bids:

I have received and herewith return the summary of bids submitted on Jan. 23 for the construction of the Jerome Park filters. Nine bids were submitted as follows:

Keystone State Construction Co.	$5,139,015
Luke A. Burke Sons Co., Inc.	5,672,145
MacArthur Brothers & Mason Hanger Co.	5,783,170
Carter Construction Co.	5,885,875
J. F. Cogan Co.	5,934,955
Booth & Flinn, Ltd.	6,094,855
Oscar Daniels Co.	6,160,410
P. E. Smith Co.	6,619,960
The T. A. Gillespie Co.	6,752,500

I recommend the acceptance of the lowest bid, which is that of the Keystone State Construction Co.

The Keystone State Construction Co. are generally recognized as competent contractors for large work in connection with water-supply construction. They have under way, the Hill View Reservoir, under the direction of the Board of Water Supply, the bids for this work having been opened on Dec. 8, 1909, and the contract price being $3,269,280, which was the lowest of seven bids received. On Jan. 1, 1913, the engineers' estimate of work done on this contract was $1,957,782. Work completed on that date was 60% of the total, whereas under the schedule of progress called for in the contract, 50% was required.

While I am informed that these contractors have successfully constructed filters and other large works amounting to over $15,000,000, I recommend that you require the contractors to produce evidence of their resources, ability and experience to satisfactorily complete the filter plant in accordance with the provisions of the contract.

The engineers' estimate for this work was $5,916,700. Of the nine bids received four were lower than the engineers' estimate and five were higher, the average of the nine bids being $6,004,765, which is about 1½% higher than the engineers' estimate. The low bid, that submitted by the Keystone Construction Co., amounting to $5,139,015, is 13% below the engineers' estimate, while the high bid, that of the T. A. Gillespie Co., amounting to $6,752,500, is 14% above the engineers' estimate. For the Hill View Reservoir, which the Keystone State Construction Co. are sucessfully building, their bid was 28% lower than the engineers' estimate.

The bids, both in number and amount, confirm the sufficiency of the contract, specifications, and plans to accurately define and describe the work to be done and the reasonableness of the engineers' estimate for this work. They also show that there has been fair competition.

Report of the Advisory Commission of Engineers, April, 1913.

The report of the Advisory Commission of Engineers on the Jerome Park filter was submitted late in April, 1913, to Wm. A. Prendergast, comptroller, John P. Mitchel, president of the Board of Aldermen, and George McAneny, president of the Borough of Manhattan, these gentlemen being members of the Corporate Stock Budget Committee of the Board of Estimate. As has been already stated, the five engineers agreed on everything except the need of immediate filtration, which was made the subject of a dissenting report by one of the five.

The so called majority report, after discussing the meaning of water analyses, goes on as follows:

Quality of Croton Water

As at present delivered to the consumer the Croton water would be characterized by the water analyst as noticeably colored and slightly turbid, at times quite turbid; at other times containing numbers of microscopic organisms with an odor persistently vegetable and occasionally aromatic, grassy or even fishy; reasonably soft; a good boiler water and generally satisfactory for industrial purposes; ordinarily safe, but at times sufficiently polluted to indicate the possible danger of infection from water-borne diseases.

Physical Quality

While the color, turbidity and odors of a water are not deleterious to health they produce an unattractive water. The Water Department, owing to complaints relating to the Croton supply, issued and published a general statement in September, 1910, and again in March, 1912, for the purpose of assuring people that no harm would result from the disagreeable odors and tastes and the turbidity of the water of which they complained. Evidence of the unattractiveness of the Croton water as supplied to the consumer is found in the large number of local filter plants and in the common use of bottled water.

The microscopic organisms which are found in Croton water have an effect on the water-supply system, which ought not to be overlooked. They serve as food for the various organisms which dwell upon the inside of water pipes and which are often described under the head of "pipe moss." These growths materially clog the pipes and decrease their carrying capacity. They serve as a refuge for many small animals, such as snails, shrimps, crustacea, etc. Sometimes they become detached in tufts when they are liable to clog up the house services. These various pipe dwellers are dependent upon the microscopic organisms for food, not being found in ground water or in filtered water systems. The removal of the microscopic growths from the Croton water will in a large measure remove the objectionable growths from the distribution systems of the city. While the reduction in the pipe growths will not necessarily be immediate, there will eventually result an improvement in this respect due to filtration.

The physical qualities of the Croton water are inferior to the unfiltered supplies of Boston and Cleveland and to the filtered supplies of Philadelphia, Washington, Pittsburgh, Cincinnati, Louisville and many other of the larger cities and towns. Baltimore and St. Louis are about to let contracts for mechanical filtration plants, and upon their completion, will supply a very much better quality of water to the consumer

*The objections of the Citizens' Union, the Bureau of Municipal Research and Comptroller Prendergast, together with replies thereto by Commissioner Thompson, Chief Engineer de Varona and Consulting Engineer Fuller, and a history of the filtration project since 1906 were published early in the present year as a pamphlet of more than a hundred pages. Messrs. Thompson and de Varona pointed out that the objectors had overlooked the fact that filtration experiments had been made in 1906 and detailed studies of filtration from that time until 1912. They also pointed out what they regarded to be gross misconceptions of the engineering points involved in many of the allegations made by the civic objectors.

than is now supplied through the Croton system. Previous to filtration, however, the supplies in these places were probably inferior to the Croton supply.

Sanitary Quality

The Croton watershed has a population of approximately 25,000, a large proportion of which is grouped in small communities, towns and institutions. The majority is to be found in the lower reaches of the watershed, immediately adjacent to Croton Lake. The wastes from this population eventually find their way into the streams which are directly tributary to Croton Lake. There are many visual evidences of pollution in the Croton watershed. It will be instructive to see if the bacterial examinations indicate the effects of the visual pollution. Following is a table giving the results of bacterial examination of the Croton water as delivered at the 135th St. gate house [some distance above the Central Park reservoirs. —Ed.]:

	Bacterial Count				Per cent. of Positive Tests for B. Coli in 1 c.c.	
Year (1)	Annual average (2)	Maximum average for one month (3)	Maximum (4)	Micro-organisms annual average (5)	Average annual (6)	Maximum monthly average (7)
1903....	1848	.....	.....	.....	19 3	.....
1904....	1449	10,000	25,000	1058	11.7	36.7
1905.....	2337	12,000	50,000	729	16.0	33.4
1906.....	2084	11,000	33,000	1005	13.5	56.7
1907.....	572	2,000	26,500	1244	8.1	40.0
1908....	414	800	5,300	897	4.4	23.3
1909*.....	469	700	4,200	1918	11.6	36.6
1910.....	871	4,500	15,200	2348	23.5	93.4
1911.....	1709	5,000	29,000	2310	29.8	70.0
1912†.....	790	2,000	12,000	564	10.1	86.7
Average.....	1254	5,333	22,311	1267	14 8	52.9

* Hypochlorite of lime used since July, 1909.
† Method of making counts changed in 1912 to conform with new standard adopted by American Public Health Association.

An examination of this table shows that the average number of bacteria, according to the standard methods prescribed by the American Public Health Association, is about 1254 per c.c. Furthermore, it is found that for periods of 30 days' duration, the bacterial count is from 700 to 12,000 per c.c., the maximum bacterial count during the past seven or eight years having been as high as 50,000 per c.c.

Comparisons of the figures for Croton water at 135th St. Gate House with the average bacterial count of the water of White Pond and Lake Gilead, both situated in the upper Croton watershed and sources on which there is little or no tributary pollution and which may, therefore, be taken for the purpose of determining the normal bacterial content of the Croton water, show that the number of bacteria normally present in White Pond and Lake Gilead is much smaller than at the 135th St. Gate House. The average bacterial count at White Pond and Lake Gilead has ranged from about 270 to 300, compared with 1254 at the 135th St. Gate House. The increase in bacteria is suggestive of the increased pollution as the water passes down to the city.

For the purpose of outlining some standard of purity for a public water-supply, Prof. W. H. Horrocks, of the Army Medical School of Great Britain, offers the following classification, which he says gives the mean results of a long series of examinations:

Very good waters contain from 0 to 50 bacteria per c.c.
Good waters contain from 50 to 500 bacteria per c.c.
Mediocre waters contain from 500 to 3000 bacteria per c.c.
Bad waters contain from 3000 to 10,000 bacteria per c.c.
Very bad waters contain from 10,000 to 100,000 bacteria per c.c.

In the average filter plant, the object to be attained is to produce an effluent containing not over 100 bacteria per c.c. This figure may be exceeded at times when the filters are loaded with heavily polluted water, but the average results should fall within the figure stated.

The analyses further show that during the years 1910, 1911 and 1912 there were 30-day periods during which B. coli were present in 1 c.c. of the Croton water from 21 to 28 days out of the 30. Where this bacterium is present in 1 c.c. or less and for 70 to 93% of the time for periods of 30 days' duration, the water is not considered of good sanitary quality.

It must be remembered that the question is not whether on the average the water is good, or whether on the average it compares favorably with the average of some other water, but whether there are times when it is polluted. It is easy to see that by taking averages, good water—water above standard—delivered at one time may be used to cover up the averages of polluted water delivered at another time.

In addition to the evidence above outlined with regard to the pollution of the Croton water, qualitative bacterial studies which have been made from time to time indicate that sewage organisms, other than the bacillus colon, have been present in the Croton supply.

Where the pollution of a watershed is obvious, as it is on the Croton, and the bacterial results are such as to indicate the effects of this pollution, as is shown from the analyses at 135th St. Gate House, but one conclusion can be drawn and that is that the water as delivered to the consumer is at times more or less polluted. This condition suggests a potential danger which is a serious menace to any community, particularly to one in which so large a population is supplied from a single source, as in the case of the Croton system. The Croton system serves a larger population than any other single unfiltered supply in the world, and the results of a badly infected water might be appalling.

It has been suggested, owing to the tankage system which is in vogue in New York, that filtered water may become infected in the house tanks, which are very generally used in certain sections of the city, and that the quality of the filtered water will deteriorate therein. This, it occurs to us, is not pertinent to the question of filtration. The pressures in the distribution system of Manhattan are admittedly insufficient, and the City of New York should do as other cities—furnish water at sufficient pressure to remove the necessity for house tanks on all buildings five stories or less in height.

Effect of Storage Reservoirs

It is generally recognized that the consumer of Croton water has one great safeguard against danger from infection, and that is the large storage reservoirs. It is a fact that pathogenic bacteria do not multiply in water under natural conditions. They live sometimes for many months, but in ever decreasing numbers. In storage reservoirs, as time elapses, the number undergoes a rapid initial decline, followed by the continued life of the more hardy individuals and terminating in the death of all. The value of long storage is thus evident.

Unfortunately the reservoirs in the Croton watershed were not designed primarily for the purpose of purification. The period of storage is dependent entirely upon the amount of stream inflow. Rainfall and runoff records show that in times of flood the storage in Croton Lake is only sufficient to provide for a retention of the water flowing therein for from ten to fifteen days. As the time required for the water to flow through the aqueduct from Croton Lake to New York may be measured in hours, the period of detention in times of flood is not sufficient to give security against the introduction of an infected water into the City of New York, provided infection exists on the watershed.

Typhoid Fever as an Index of Pollution

The death rate from typhoid fever is commonly taken as one index of the quality of a water-supply. The death rate from this cause in the Boroughs of Manhattan and The Bronx, which are the only ones supplied with Croton water, are low when compared with other cities in the United States, even those supplied with filtered water, and has been falling gradually for the past decade.

The conclusion might be drawn from this statement that there is no evidence of typhoid infection from the water-supply, and it must be admitted that there is no strong evidence that the water-supply is responsible for even an appreciable proportion of the typhoid in these Boroughs. In March, 1907, however, following an unusual and sudden rise in the bacterial count in the Croton water, the typhoid rate increased by about 40 per 100,000, and the increased rate continued through the months of March and April. The result of this spring rise in the typhoid fever death rate is noticeable in the annual death rate in Manhattan for 1907, which was 17, as compared with 15 in 1906 and 11 in 1908.

During this outbreak of typhoid fever, the cases were quite uniformly spread throughout the Borough of Manhattan. The section of The Bronx supplied with Kensico water was not affected, but in those portions which were supplied with Croton water the increase was noticeable. It is also particularly interesting to note that the rise of 1907 occurred in the early spring, at which season the death rate from typhoid fever in New York is normally low, and it may be remarked that a low typhoid death rate in the early spring is generally considered indicative of a good water-supply.

While the 1907 typhoid outbreak may be more clearly associated with the water-supply than other noticeable changes in the typhoid-fever death rate, yet in September, 1909, there was in Manhattan a marked rise in the death rate from this cause, following a marked increase in the bacterial count in the Croton water. Again, in August, 1910, there was an increase in typhoid following a sudden rise in the number of bacteria in the water, and this same phenomenon may be noted in July, 1911.

The typhoid-fever rise in 1907 occurred previous to the introduction of the chlorination plant which was started in July, 1909, but the table shows that hypochlorite has not always been effective in the treatment of the Croton supply.

The reduction in the number of bacteria is not sufficient to insure a safe water at all times, and while there is an apparent decrease in the number of bacteria since the installation of the chlorination plant the number of positive tests for sewage organisms has increased.

It must not be forgotten that local filtration of water in hotels and apartment houses, and the widespread use of bottled waters, may to some extent mask the true typhoid death rate which would occur if raw Croton water were substituted for the treated or bottled waters. The typhoid-fever death rate in Manhattan cannot account for all of the typhoid which might originate there, due to the large transient population which is employed in the Borough, but resides in other Boroughs or in the environs of New York City, to which the vital statistics of Manhattan do not apply.

While great stress is laid upon the typhoid-fever death rate as an index of the probable pollution of a water-supply, it should not be forgotten that the death rate from this cause is not the only one which is reduced by the introduction of pure water. Experience in many cities has shown that coincident with the substitution of a pure for a polluted water there has been, not only the reduction of the typhoid-fever death rate, but also in the number of deaths from pneumonia, pulmonary tuberculosis, cholera infantum, dysentery, and other causes, so that the total reduction in the number of deaths has usually been from two to three times greater than that indicated in the typhoid-fever death rate. We believe that it is safe to assume that there will be some reduction in the general death rate following the introduction of the Jerome Park filter plant, which, while not normally great, will be appreciable.

When all is said, however, the typhoid-fever statistics of New York indicate that the Croton water is a reasonably safe supply from the sanitary viewpoint, except possibly for short intervals, as indicated by the typhoid outbreak in 1907.

The True Meaning of the Low Typhoid Death Rate

The low typhoid-fever death rate, contrasted with the watershed conditions and the bacterial results obtained from the examination of the Croton water, should be regarded as suggestive of the absence heretofore of conditions on the watershed which have been contributory to appreciable typhoid infection. The low typhoid-fever death rate does not, under the circumstances, indicate that the Boroughs of Manhattan and The Bronx are not liable at any time to the danger of infection.

Experience on various watersheds, and under various conditions, has shown that the purchase of land in the form of sanitary strips along the water courses, the sanitary patrol of the watershed, the use of hypochlorite of lime, and the other means which have been adopted by the Water Department to safeguard the Croton water-supply are not sufficient and satisfactory at all times. This fact is illustrated in the case of the Croton watershed by the gradual and steady increase in the presence of sewage organisms, notwithstanding the precautions which have been taken to prevent pollution of the watershed.

Filtration is the most obvious, and as far as known the most economical effective means of protecting a community from the possibility of an epidemic outbreak as a result of an infected raw water, whether such infection be spasmodic or continuous.

The Commission next reviews the various processes of water purification. It points out that hypochlorite is better suited to the disinfection of filtered than unfiltered water. It also explains the use of lime or soda to remove the increase of free carbonic acid in water treated with sulphate of alumina, the free carbonic acid giving rise to corrosion of pipes, particularly service pipes.

The Commission shows the impracticability of filtering the Croton supply and the new Catskill supply at one plant, owing to a superelevation of 160 ft. in the Catskill supply. It then approves the location of the proposed mechanical filtration plant in the east basin of the Jerome Park reservoir and states that mechanical filtration will be less costly than slow-sand filtration. Existing mechanical filtration patents, it says, "do not offer a serious menace of litigation which will involve the city in subsequent appreciable cost." Royalties on filtration patents thus far have been small, and all the "more important patents will expire within a year or so after the earliest date at which the proposed Jerome Park filters can be completed." The filter design and specifications are approved by the commission.

Under the heading "Economic Considerations," the Commission states that its own estimates of the cost of the filter plant check within 6% of those made by the Department of Water Supply, which it believes to have been reasonable, especially in view of the close bidding. The commission estimates annual operating and capital charges at $800,000 in place of the department's estimate of $742,000. It also states that the "lowest bid is so advantageous" as to warrant its acceptance unless filtration is to be postponed three years, which would mean a postponement of filtered water for six years. It then adds:

The population and pollution on the Croton watershed are gradually increasing. . . . . There is not sufficient evidence at hand to state that the needs for filtration three years hence will be appreciably greater than they are today, and hence the question of immediate construction resolves itself into a balancing of cost against the immediate necessity for filtration.

It finds that the annual cost of filtration will amount to about ¾c. per $100 of assessed valuation, increasing the present rate from $1.83 to $1.83¾, since under New York conditions this cost will all go into the general tax levy. Against this cost there will be savings to those who now treat the Croton water-supply privately or buy bottled waters, but it adds that the latter practice may continue to some extent after filtered water is available. The report continues and concludes, as follows:

We further believe that a clear, bright and colorless water-supply is a business asset to any city, possibly not measurable in dollars and cents, but a very valuable asset nevertheless.

The question, therefore, is whether the immediate necessity for filtration is sufficient to warrant an increase in the tax rate of 0.72c. per $100 per annum.

We recommend that independent of filtration the Water Department shall in no way diminish the present sanitary patrol, or the precautions taken to lessen the pollution of the sources of water-supply, and that the Board of Estimate and Apportionment should supply extra funds to provide for more complete and thorough protection of the sources of supply.

We further recommend that the experiments which have recently been conducted with a view to improving the quality of the Croton supply by drawing water at lower depths at certain seasons of the year be continued.

We further recommend that experiments be conducted to determine the value of aëration of the water drawn from Croton Lake prior to its delivery to the filtration plant.

We are also of the opinion that it will be advantageous to aërate the waters drawn from the upper reservoirs prior to discharging them into the streams tributary to Croton Lake, but before installing such aëration works, we recommend that careful experiments be made by the Water Department to determine the effect of aëration at the upper reservoirs upon the quality of the water delivered to Croton Lake. The cost of aëration will not materially affect the cost estimates already submitted.

We recommend the more regular and systematic use of copper sulphate, not only in Croton Lake, but in the upper reservoirs. The cost for the regular and systematic use of copper sulphate will not be measurable.

As a result of a full consideration of the quality of the Croton water, the environment of its sources and the economic questions involved, and all other pertinent questions which have been treated in this report, it is the opinion of this Commission that the filtration of the Croton water-supply is not imperative, but that it is highly advisable to filter the water at this time both with a view to improving the physical quality and as a safeguard against potential danger, and we so recommend with the exception of one member dissenting.

NICHOLAS S. HILL, Jr., Chairman, Consulting Engineer;
JOHN H. GREGORY, Consulting Engineer;
E. P. GOODRICH, Consulting Engineer to the Borough President of Manhattan;
AMOS L. SCHAEFFER, Consulting Engineer to the Borough President of the Bronx.

I concur with the majority opinion except on those points which have led to the conclusion that filtration is needed at the present time. The minority opinion on the question of

the need of filtration is discussed more fully in the minority report which is transmitted under separate cover.

JOHN H. FRAZEE, Assistant Engineer, Department of Finance.

The Dissenting Report

As has been noted, Mr. Frazee agreed with the majority report except as to the immediate need of filtration. In his minority report he bases his dissent upon personal experience as to the palatability and appearance of the water, upon the low typhoid fever rates of Manhattan and the Bronx, and upon the belief that remedial measures in the Croton drainage area should precede filtration and would in themselves be sufficient for some time to come.

Mr. Frazee presents two tables of typhoid statistics to show that Manhattan and the Bronx have lower typhoid rates without filtration, but with chlorination, than the other cities in the state and most of those outside the state have with filtration or with filtration and chlorination combined. As to the Manhattan and Bronx typhoid rates, those declined from 11.4 per 100,000 in 1908 to 7.4 in 1912, and were 50% lower in the first quarter of 1913 than in the first quarter of 1912. Cleveland, with chlorination since February, 1912, had a typhoid rate of less than 6 per 100,000 for that year.

As to various remedial sanitary measures in the Croton drainage area, the Central Park reservoirs, etc., Mr. Frazee, for the most part, merely amplifies the statements and recommendations of the main report (to which in these respects he agreed) except that he urges these as at least a temporary substitute for filtration. He states that "some six or seven miles of steam railroads cross this watershed in five lines or branches," and that about three miles of these railroads cross the waters of the various reservoirs and some six miles skirt the reservoirs and tributary streams. Moreover, whereas at one time it was reported that the railroads "kept the closets in the cars locked" while passing through the Croton drainage area "no control over the discharge of fecal matter into the reservoirs has existed for some time past" and at present "not even drip pans are provided under bridges and trestles." He urges that the "sanitary patrol of the 360 sq.mi. of watershed furnishing the Croton supply consisting of 16 men, ranking largely as laborers, under a foreman, supervised by Water Department Engineers" be improved in amount and in character; that wash into the reservoir from an exposed dirt bank and from loose highway bridge floors be stopped, that reforestation work, shrub and grass planting be undertaken to screen off and otherwise reduce dirt carried into the reservoirs and that swamp waters high in color and organic content be cut out.

Mr. Frazee next proceeds to build up an argument under the heading "Financial Advantages of Delay." The first basis for this argument is that sanitary protective measures in the drainage area would reduce the quantity of chemicals required in mechanical filtration when such a plant was established. He says:

> The corrective measures proposed appear, then, along the line of ultimately procuring from a purer, raw water, a filtered effluent with less bacteria than otherwise to be had.
>
> Further, if it be assumed that the less the color and turbidity to be overcome, the less the extent of chemical treatment necessary, operating economies in the filters, when to be constructed, will ensue. . . . . If the proposed ameliorative work on the watershed improves conditions to the extent of even 20%, a proportionate saving of the $175,000 worth of coagulating chemicals to be required otherwise, should be affected, or $35,000 annually.

By postponing filtration, Mr. Frazee states, $800,000 a year would be saved in capital and operating charges, or $400,000 net after allowing for the cost of additional sanitary protection in the Croton drainage area. This would make a total of $2,000,000 for a five-year delay, besides which there would be a further saving of first cost and of possible litigation through the expiration, meanwhile, of various filtration patents; also a possible gain through "new methods of treatment of operation" devised in the interval. Large additional saving, Mr. Frazee estimates, would result from delays, due to the release of a large storage-reservoir area for sale on the introduction of the Catskill supply [but a large part, if not all, of this saving would be possible in any event, as we understand the conditions.—Ed.]

Mr. Frazee's conclusions and recommendations were that filtration can be indefinitely postponed by correcting the conditions which he outlined in his report; that there should be delay at least until land at the Jerome Park Reservoir can be released for sale; that funds should be provided for watershed improvements, for aëration, for Central Park reservoir and city main improvements; and that action should be taken against railway nuisances in the watershed and to control the sanitary conditions of house tanks. Some of these recommendations, it will be seen, are identical with those offered by the whole committee, regardless of whether or not a water filtration plant is built.*

Action by the Citizens' Union

Mention has been made of a Citizens' Union report, submitted to the Board of Estimate on May 8, 1913. This was signed by a committee of four, with Wm. Jay Schieffelin as chairman. It consisted chiefly of a summary of the majority and minority reports just abstracted with general and specific indorsement of Mr. Frazee's conclusions.

Two points credited by the committee to Major Cassius M. Gillette, of Philadelphia, were: (1) Mechanical filters would increase the hardness of the Croton water; (2) filtering the water-supply of Philadelphia, in the opinion of Major Gillette, has had no appreciable effect on the amount of water filtered at private expense or on the purchase of bottled water.

Two other points either originating with or indorsed by Major Gillette were: (1) That the contract bonds required under the proposed filtration contract ($1,000,000 during and for one year after construction and $150,-

*Mr. Frazee's minority report, we understand, was a surprise to the other four members of the Advisory Commission of Engineers, who had supposed during the deliberations of the Commission that Mr. Frazee would simply dissent as to the need for immediate filtration. The minority report, therefore, led to a supplementary report by the majority, in which they urged: (1) that Mr. Frazee's personal experience as a water consumer should be given little weight as against the consensus of expert and laymen opinion that at times the physical qualities of the Croton supply are highly objectionable; (2) that the majority's opinion as to the quality of the Croton water is based on samples taken above the Central Park reservoirs and (3) that these reservoirs are soon to be cut out from the regular service, so their effect on the water-supply may be ignored, so far as the need for filtration is concerned; (4) that the majority as well as the minority urges increased sanitary supervision in the Croton drainage area, but the majority is convinced that sanitary supervision alone, in the Croton or other watersheds, would be impracticable as a safeguard against pollution, and would be far more expensive than filtration; (5) that real estate sales at the Jerome Park reservoir site may be made regardless of which basin is used as a filtration site, but that Mr. Frazee's proposition calls for an unsafe reduction in the amount of raw-water storage at this place. A second supplementary report, in reply to the first one, was issued by Mr. Frazee. Neither of the supplementary reports, nor lengthy appendixes accompanying the majority report, nor the letter transmitting that report were printed, and only small editions of the majority and minority reports were printed.

000 for six years additional, the former for faithful performance and the latter to cover possible filter patent complications) are excessive; and (2) that "there are several uncertain and ambiguous provisions" in the specifications. Of these two are mentioned and commented on:

The indefinite specification relative to clay in item 8 sect. 8.2 may cost an unfavored contractor $50,000; and the indefinite provision relative to loam contained in item 7 sect. 7.2, $100,000 over the cost of materials which would fill the actual requirements of the city. An unnecessary discretion in the selection of materials is given to the engineer. Unless the prospective bidder received advance information as to what grade of material would be required by the engineer, he would have to figure on furnishing the most expensive material. Provisions where the engineer must use his discretion are common in this contract.

The courts have held that where indefinite provisions of this nature are contained in a contract a suit by a bidder to whom the contract was not awarded will lie against the city.

The exact wording of the two cited sections is:

Sec. 8. 2. The puddle shall consist of a mixture of plastic clay with broken stone, or sandy gravel, or both. In general the proportions shall be one part of clay to one part of stone and one part of sandy gravel, but the relative amounts of stone and sandy gravel may be changed by the Engineer so as to obtain the best mixture **taking into account the amount of suitable sandy gravel found in the excavations.** [Blackface type ours.—Ed.].

The clay shall be plastic clay of good quality, free from sand, loam, mica or other foreign matter.

The sandy gravel shall be of sound, durable material, all of which will pass through screens having 1-in. mesh, and shall be graded from fine to coarse. The broken stone shall be the same as that specified for Item 10.

. . . . . .

Sec. 7. 1. Under Item 7 the contractor shall prepare the surface to receive the loam surfacing, and shall furnish and place loam upon the filling over the reservoir arches, upon the embankments, and upon other graded areas, as ordered, after settlement has taken place, to the lines directed, with allowance for shrinkage. He shall fertilize and seed, and roll the finished surface. In general, **the depth of loam shall be 4 in., but a greater depth may be required on certain areas.** [Black face ours; the reader should understand that the loam is to be paid for by the cubic yard.—Ed.]

Sec. 7. 2. The loam shall be a mixture of clay loam and organic mold taken from cultivated fields showing satisfactory cultural results. It shall be fine, free from stones, roots and weeds and shall be alkaline. Samples shall be furnished for testing a sufficient time before shipping.

Another specification requirement copied in an "Exhibit" submitted with the report, but not commented on, gives the engineer authority to change the relative amounts of sand and ballast in concrete aggregate, "in order to produce the best results for the purpose intended," with no extra expense to the city; also authority to change the "proportion of cement in the mixture," but "all additional cement so required will be paid for."

Commissioner Thompson's Review

On May 9, Henry S. Thompson, Commissioner of Water Supply, sent a long letter to Mayor Gaynor answering the objections of the minority report and of the Citizens' Union. Among other things the letter states that both Mr. Frazee and the Citizens' Union took typhoid death rates "as the sole index of the quality of water," overlooking its effect upon other diseases and the general death rate; and they also based conclusions on water analysis averages for a long period. As to the latter, Mr. Thompson states that the analyses for the year 1907 show less pollution than for any year of the ten from 1903 to 1912, except 1908, "and yet in 1907 there was a typhoid epidemic caused by the pollution of the Croton water."

Records of analyses and complaints alike show the need for filtration. By far the great majority of the citizens are unable to filter their water-supply in their houses or to buy filtered water, and those, Mr. Thompson urges, are entitled to have a safe, palatable and good looking water supplied to them by the city—especially as the added cost of filtration will not be over 25c. per capita and the water-works yield a handsome revenue.

A significant point made by Mr. Thompson related to the sanitary protection work in the Croton drainage areas as a substitute for filtration. The city already "owns *about 21,000 acres of land, or about 8% of the entire watershed, and these lands have cost over $12,000,000, while the taxes thereon are over $100,000 annually.*" A marginal strip along all streams would require "some 40,000 acres at an estimated cost of $25,000,000," with $300,000 taxes and $1,000,000 interest yearly. It is estimated that the cultivated lands, roads, etc., which contribute silt to the streams total 70,000 acres or 30% of the watershed.

Another significant point made by Mr. Thompson in reply to the Citizens' Union is that the amount of the bond required for faithful performance of the proposed filter contract has no relation to the premium which the contractor must pay, since that is based on the amount of the contract. In the present case the premium would be $26,000 a year (0.5% on about $5,200,000).

Mr. Thompson also alleged that the clay and loam specifications "are those customary and which hitherto have been sufficient," and that the "mechanical filters, as ordinarily operated," will not "increase the total hardness of the water in the slightest degree." He adds that either milk of lime or of soda will be used "at intervals, if required, to reduce the carbonic acid which tends to corrode metal structures." Soda will absolutely prevent increase of hardness and if lime be used the increase "would be hardly noticeable, in fact, would scarcely be detected by consumers."

Late Additional Reports

In view of the questions raised as to the need for filtration, Allen Hazen was asked by Commissioner Thompson to make a statement on that subject. His reply is dated May 20, and is particularly significant in view of allegations which have been made by the Citizens' Union regarding his attitude towards the project. Lack of time and space prevent our giving more than a general idea of his report. He declares:

It is my opinion that it is necessary to filter Croton water. It is necessary to filter it because in no other way can a supply of clean water of good quality, worthy of the city, be secured.

Filtration will do more to improve the quality of the water and protect those who use it from infections resulting from pollutions upon the catchment area, than has been accomplished by all the measures of sanitary inspection and prevention of pollution of every kind that have been applied up to the present time, and that can be reasonably applied in future.

It is also necessary to improve the physical characteristics of the water to make it acceptable for drinking water by the people of this city.

Mr. Hazen refers to the growth of population in the Croton watershed and reviews the limitations of storage, of hypochlorite treatment, of sanitary inspection and land purchase as safeguards without filtration. He declares that the physical qualities of the water can be improved "so easily and at so small relative expense that

there is no excuse for continuing to use the water in its present raw state." He urges that the cost of filtration can be met from the surplus revenues of the water department, and that every city department should pay its own bills. [Surplus revenues of the water department are now used, it is reported, to reduce the general tax rate.—Ed.]

Another member of the consulting board of which Mr. Hazen was chairman, Geo. A. Johnson, of New York City, also reported to Commissioner Thompson on May 20 that in his opinion "it is necessary to filter the Croton supply as promptly as is practicable," on account of the frequent muddiness, continuous color and frequent offensive taste and odor. "All other means" than filtration, "such as forestation, sanitary patrolling, sedimentation, sterilization of the partially clarified water as it leaves the reservoirs, are insufficient and unsatisfactory and filtration is required."

Finally, there has been brought to our attention the testimony of Dr. E. J. Lederle, health commissioner of New York City, in favor of filtration for both health-protective and sanitary reasons. Dr. Lederle speaks with authority, not only because of his present and his previous official position as health commissioner, but also because of his long period of service as assistant chemist and later as chief chemist of the Department of Health, during which he made and supervised many chemical and bacterial examinations of the Croton water-supply, besides making sanitary inspections of the Croton drainage area.

Dr. Lederle quotes a telling sentence from Dr. Jacobi, "dean of the medical fraternity of New York City," who, on having been asked to serve on Dr. Lederle's Typhoid Committee wrote: "If you filter your Croton water and boil your milk you won't have any typhoid; it would be a waste of time my serving on your committee."

Convention of the National Fire Protection Association

The 17th annual meeting of the National Fire Protection Association was held in the convention hall of the Metropolitan Life Insurance Co., New York City, May 13, 14 and 15. All the sessions of the meeting were given up to discussions of the Association's fire-prevention work; there were no entertainments. The first session disposed of the usual formal business and immediately proceeded to its heavier program. The address of the President, H. L. Phillips, of Hartford, Conn., was a plea for a broadening of the Association's field of activities and of membership. The secretary's report gave a brief account of the speaking tours made, to spread the doctrine of fire prevention, under the auspices of the Credit Men's Association and the American Institute of Architects. At the end of the convention the following officers were elected: President, R. D. Kohn, of New York; Vice-President, F. M. Drake, of Louisville, Ky. F. H. Wentworth, of Boston, was reëlected secretary and treasurer.

The work of this association is presented by committee reports of the year's activity rather than through individual papers. There were, however, two addresses, one by Miss Frances Perkins, Secretary of the New York Committee on Safety, and the other by D. Knickerbacker Boyd, Chairman of the Committee on Public Information of the American Institute of Architects. The first address was largely occupied by a description of the varied losses which the city of New York suffered as a result of the disastrous Triangle-factory fire in which 145 young women, factory operatives, lost their lives.* Investigations carried on since this fire to eliminate conditions which threatened to cause a similar loss of life were outlined. Mr. Boyd's address was a review of the possibilities which existed for educational work by coöperation between the National Fire Protection Association and other bodies; his ideas were illustrated from the experience of the American Institute of Architects, under whose auspices the Secretary of the National Fire Protection Association had made a tour of the country addressing chapters of the Institute on fire-protection equipment and methods.

Reports on Fireproof Construction—The Committee on Fireproof Construction (Ira H. Woolson, of New York, chairman) presented a report which was hailed as the first advance in defining standards of true fireproof building construction. The report fixed the general specifications for a so called standard building which would be truly fireproof with the most hazardous character of contents. The four general requirements for a building of this class were stated as follows:

(1) All material entering into its construction shall be incombustible and all structural parts shall resist fire for at least four hours at an average temperature of 2000° F. without severe damage.

(2) Ample and safe means of egress shall be provided for all occupants.

(3) The building shall be so constructed that a fire will be confined to the area in which it originates, and the building will be protected against exterior fire by approved doors and windows, etc.

(4) The building will be equipped with such apparatus that a fire can be extinguished in it in incipient stage.

Reinforced-concrete played a large part in the design of such a building according to the specifications presented. Some of the restrictions, such as the size and location of wall openings, were objected to by some of the architects in attendance, but after a long discussion of such details it was finally settled by regarding the proposed specifications as for a building with the most hazardous occupants in all respects and noting that a permanent decrease in some hazards migh permit deviation from the restrictions imposed.

The Committee on Safes and Vaults (H. W. Forster, of Philadelphia, chairman) presented some tentative specifications for the construction of large and small vaults of the better class. The chairman in presenting the report stated that since the specifications had been printed, the committee has continued its investigations and as a result they were prepared to recede somewhat from the rigid standards therein proposed. For instance, the specifications considered only fireproof qualities and the committee admitted that it was not possible to consider fireproof qualities without also considering at the same time the burglarproof construction, which increased fireproof qualities. The committee desired authority to present revised specifications to the executive committee for adoption and promulgation, but there was some objection to this procedure, in view of the lack of necessity for hasty action on specifications for this construction.

*See "Engineering News," Mar. 30, 1911, pp. 387 and 396; Apr. 6, 1911, p. 420; Apr. 13, 1911, pp. 458 and 464; Apr. 20, 1911 p. 493.

Model Laws and Ordinances—The report of the Committee on Laws and Ordinances was perhaps the most thoroughly discussed of all. There were presented a number of model ordinances to be recommended for villages and small towns, together with a suggested ordinance to regulate the use, handling, storage and sale of inflammable liquids and products. The list of the short ordinances comprised (1) one providing for regulation of the installation and operation of all devices and equipment for the generation, transmission and utilization of electric current; (2) one providing for the cleanliness of streets, alleys and premises; (3) regulating equipment and operation of picture machines and premises; (4) regulating automobile garages; (5) regulating the equipment, use and maintenance of heating apparatus; (6) regulating the manner of connecting gas heating devices, etc.; (7) prohibiting the discharge of fireworks; (8) prohibiting the erection of tile, terra-cotta, cement-block, brick-on-edge or metal flues; (9) regulating the burning of refuse; (10) regulating the storage of explosives; (11) two providing for fire limits and the construction of buildings, one originating with the National Board of Fire Underwriters and the other with the Kentucky Fire Prevention Association; (12) one regulating the use of fire-protection equipment, and (13) one providing for fire escapes.

The first important bone of contention was an item relating to automobile garages. The model ordinance contained a prohibition of flames of any sort (lamps, pilots, etc.) on motor cars inside garages, and the sponsors urged that the association should include this as a protest against a very unsafe practice. The objectors, however, held that it had been found utterly unenforcible and that the evil of enacting legislation admittedly unenforcible was worse than the trouble attacked. The prohibition was struck out. Objection was made also to having two ordinances on city fire limits and building construction, and the two were referred back for consolidation. It was reported by the committee also that it proposed to consolidate all the ordinances on related subjects into a code for small cities where there was no power to enforce detailed supervision of building construction.

About half the report was given up to a suggested complete ordinance to regulate the use, handling, storage and sale of inflammable liquids, etc. It was explained that this was the completed work of several former committees and that the ordinance was very much desired throughout the country. Inflammable liquids were classified in accordance with their flash point. Class 1, which was regarded as the most dangerous, comprised ether, carbon bisulphide, gasoline, naphtha, benzole, collodion, "hydro-carbon" (gas drips) and liquified petroleum gas. The least dangerous (Class 3) comprised kerosene, amyl alcohol, turpentine, whisky and brandy. Intermediate between these two were acetone, alcohol, amyl acetate and toluol, comprised in Class 2. Severe restrictions were placed on the storage of Class 1 and Class 2, although in a few minor ways Class 2 was to be treated like Class 3. Strong and long-continued objection to this classification on the basis of flash point alone was raised by men interested in the manufacture and sale of alcohol for commercial use. It was claimed that the actual fire hazard was not in proportion to the flash point, which placed alcohol in Class 1, but that it was greatly reduced through the lightness of alcohol vapor and its rapid diffusion in air to a noninflammable and nonexplosive mixture, together with its miscibility which prevented the burning and vaporizing liquid from being scattered by water. This ordinance was not adopted by the meeting, but was referred as a whole to the executive committee of the association with authority to continue the study of the disputed points and with power to promulgate such an ordinance as was deemed advisable without waiting for its submission to the next annual convention.

Closely related to the preceding report was one by the Committee on Uniform Test Specifications for Determining Flash Points of Oils (Irving C. Allen, of Pittsburgh, chairman). The committee announced that it had adopted as its report technical paper No. 49 of the U. S. Bureau of Mines, which represented studies made under the direction of the chairman by this Bureau.

Fire-Protection Equipment—The first report on automobile fire-fighting apparatus was brought in by the committee on that subject (George W. Booth, of New York, chairman). This described the present lines of new apparatus and the reconstruction of older horse-drawn vehicles. The committee believed that the use of a tractor, as a substitute for the front wheels of old fire apparatus, has a permanent and useful function. The committee stated that the triple-combination wagon which was being put out, having some of the equipment of chemical-extinguisher wagons, pumping engines and hose carts, could not be recommended for general adoption inasmuch as (1) it put too much apparatus out of service in case of accident to one vehicle and (2) valuable time was lost in putting the machine into service as a pumping engine after it was first tried as a chemical wagon. It was believed that the craze for speeds of 60 miles an hour was disappearing and that the limit now found desirable was 30 miles. The committee reported that the general saving in annual cost of automobile over horse-drawn apparatus was not remarkable in most cases, interest and depreciation charges being large factors of expense. The reported savings in 20 cities ran from 20 to 40%, the lower figure applying to engines and the higher to ladder trucks. The cost of fuel has been found to be about $5 per hour for the steamers and $2.50 per hour for the gasoline-driven pumps.

The Committee on Fire Pumps (H. O. Lacount, of Boston, chairman) made a brief report in which they brought in some revisions in the specifications for steam-pump stuffing boxes, and recommended the horizontal parting of the casings of centrifugal pumps.

The Committee on Hydrants and Valves (H. O. Lacount, of Boston, chairman) had found that available hydrants for mill yards were in need of redesigning and after conference with manufacturers, it had drawn up new specifications for these hydrants. They were designated as two-way, three-way, etc., according to the number of 2½-in. hose outlets. The specifications, in general, provided for greater clearances and free waterways.

The Committee on Standard Hose Couplings and Hydrant Fittings for Public Service (S. M. Griswold, of New York, chairman) reported on the continuance of its efforts to have standard hose fittings adopted by the whole country. It was reported that there were now 54% of the total municipalities using standard fittings or those adaptable to standard.

The Committee on Gravity Tanks (Gorham Dana, of Boston, chairman) brought in some general specifications

for concrete reservoirs, valve pits and tanks, which it was intended should be in addition to the present printed requirements on tanks, replacing some insufficient and inadequate sections thereof.

The Committee on Automatic Sprinklers (E. P. Boone, of New York, chairman) brought in a number of additions and improvements to the existing specifications for this type of fire-fighting apparatus. These points had to do largely with the installation of sprinklers.

The Committee on Signaling Systems (Ralph Sweetland, of Boston, chairman) brought in some additions to the rules and requirements for the construction and use of signaling systems. These related principally to suggestions for protection against lighting and the use of thermostats.

Tests of Protective Equipment—The Committee on Field Practice (C. H. Patten, of Cleveland, Ohio, chairman) presented the advance sheets of a pamphlet entitled "Field Practice Manual of Fire Protection, Inspection and Tests for Use of Inspectors, Laymen, Factory Superintendents and Fire Department Inspection Corps." The committee had arranged specific and detailed instructions, intelligible to all those named in the title, covering the more essential features to which special attention needed to be given in order that the efficiency of protective installations should be continually kept up. The pamphlet was presented to the members for their study and at the committee's request was held over for one year to be adopted at the next convention with an added section on inspection for fire hazards. However, on account of the demand for such a manual, it was voted to reprint the instructions (with an added section on hazards) for distribution as advance information.

Special Fire Hazards—The Committee on Explosives and Combustibles (C. A. Herkimer, of Philadelphia, chairman) continued its work of outlining the rules and requirements for fields of extreme hazard. This report took up the subjects of (1) construction and installation of gas shutoff valves outside buildings; (2) rules for the storage and use of fuel oils and oil-burning equipment, from the largest to the smallest installation; (3) the construction and installation of dip tanks for lacquers, etc.

The Electrical Committee (F. E. Cabot, of Boston, chairman) reported that it had completed and adopted a general revision of the so called National Electrical Code by rewording certain technical phrases which removed the few legal obstacles which had been encountered by various municipalities in adopting the provisions of the code for their building requirements. There were also some advances in the rules for rubber-covered wire, armored cable, and conduit. Perhaps the most important change was in making the grounding of alternating-current secondary circuits mandatory. This step was taken for the greater protection of life by removing the possibility of chance high potentials on low-voltage service lines.

The Committee on Blower Systems for Heating, Ventilating and Stock Conveying (A. Blauvelt, of Chicago, chairman) presented the unique statement that there was little that the committee could do further in the discussion of this subject or the improvement of existing conditions, and recommended that the committee be terminated. A short report was presented which briefly summed up the uses of this sort of apparatus, with the recommendation that while it was practically impossible to have a positive cutoff for fire between compartments connected by blower flues, yet the use of automatic sprinklers, automatic dampers and signals should be installed as the greatest approach to safety that could be arranged.

The Committee on Manufacturing Risks and Special Hazards (Benjamin Richards, of Boston, chairman) continued its work of studying the elimination of hazards in various special fields by reporting this year a pamphlet on the improvement of shoe factories. These brochures are merely of informational character, being sent out widely to all interested, as an effort to reduce the fire losses in these special fields.

Progress Reports—"General progress" was reported by Committees on Standards, Forest Fires, Mine Fires, Coverings for Window and Door Openings, Controlling Equipment for Electric Pumps, Hose for Hazardous Fluids, Private Fire Supplies from Public Water Mains, etc.

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Investigation of Prospective Hydroelectric Power Service for Reliability

By H. S. Knowlton*

The investigation of possible markets for power, in territory contiguous to water power which seems open to advantageous development, is a familiar phase of the preliminary work on hydroelectric projects. The common implication is that a prospective customer will jump at the chance to get cheaper power, provided the rates and representations of the new concern are satisfactory.

However, there is another side to the same question—the need of careful scrutiny by the prospective customer of the service which the power company can undoubtedly furnish.

Few problems are of greater interest or of more technical difficulty than the investigation on the part of the industrial plant owner or his representatives, of the reliability of the proposed service. In some communities transmitted water power has been in use long enough to establish the reputation of its distributors for supplying energy continuously and at good voltage regulation over very extended periods. In other cases, interruptions are frequent and fluctuations in electrical pressure severe; breakdowns in lines; shortage or excess of water at the wheels are troublesome; and operating conditions on the transmission system anything but stable. Finally, the manufacturer, seeking a cheap supply of reliable energy, may have to face the question of deciding how far it will pay to trust his requirements to the possibilities of a new or partially completed transmission and distribution system offering power, it is true, at low and attractive rates but, to some degree at least, uncertain as to the quality of service from month to month in season and out.

The solution of such problems is primarily a task for the consulting engineer, or at least is a process calling for the exercise of no small amount of technical as well as commercial ability. The fact that the economy of the proposed service at the rates offered has been demonstrated, does not for a moment free the prospective purchaser from investigating the reliability of the supply which he is likely to receive. In the administration of

*23 Richardson St., Newton, Mass.

large industrial establishments, whose daily fixed and operating costs are maintained on a great scale, something more than a fair certainty of good service must be considered even if the proffered contract contains stiff penalties for interruptions or allowances for bad regulation. In many such cases, the value of a rebate for lost service cannot adequately express the damage done by a prolonged shut-down; the necessity of continuous production transcends the benefits of any probable award by the courts to the consumer whose service has been defaulted. The reliability of electrical service everywhere in general has no great weight in such cases and the standards of hard-headed business acumen are the ones upon which the decision to buy or not to buy must be based. The rise of successful transmission systems, and their steady growth in acceptability throughout great areas economically tributary to their generating stations, is evidence enough that the exacting requirements of modern industry are, *in numerous instances,* being splendidly met by purveyors of hydroelectric power. But this foundation of general engineering achievement can support no project not found dependable after rigorous investigation of every important detail of its material quality; it permits no haphazard acceptance of prospectus data.

The importance of this question makes it desirable that the general method of attacking it shall be familiar to the industrial executive, even though he have the benefit of the best engineering advice. Any failure in the regular course of shop output due to insufficient earlier consideration of power requirements exacts a heavy toll if it occurs during a time when men and machines are being forced to meet rush orders upon which the reputation of the establishment depends. Contingencies must be anticipated and time devoted to the study of the hydroelectric power company's resources, including a minute study of the reports of engineering advisers, is well spent by the industrial executive who would limit the uncertainties which surround his business, to the smallest possible amount.

To illustrate the important factors in an investigation of service reliability, the writer will outline the procedure in a recent instance, where a manufacturing community was considering the wisdom of purchasing power derived from two interconnected hydroelectric systems under a common control. The investigation chiefly concerned the probable character of service which the hydroelectric companies could give and whether the manufacturers would benefit by competition between the former and a well-established central station. It appeared at the outset that, aside from the question of intelligent management, the character of the service would depend largely upon (1) the design and equipment of the power stations and transmission lines (2) the condition of the water-supply and (3) the character and amount of the load carried. Investigation soon showed that the plants and lines in operation and under construction were well-designed and apparently represented the best modern practice. This point having been determined by competent engineering inspection, the important question of generating capacity came up.

An examination was made of the number and rating of generating units in each station and, following the tabulation of these, a careful study of existing stream gagings available among the data of the U. S. Geological Survey. The point was brought out that the average output of the main generating station of the older of the two hydroelectric systems must be far below its rated capacity on account of the large fluctuations in the river discharge. A further disadvantage was emphasized in that the reservoir capacity above the dam at this station was only sufficient to store approximately the normal 12-hr. flow of the stream. At times also, the river flow was found to be almost negligible, so that under extreme low-water conditions only a small load could be carried by the station. High water was likewise a drawback. On one occasion during the investigation, when the water was high on account of spring floods although not at its highest, this plant was observed to generate only 35% of its rated capacity. At that time, the turbines were not up to normal speed, the frequency ranging about 3½% below normal.

This question of frequency is one of the most vitally important in the operation of a transmission and distribution network by alternating-current, and its influence upon production is so well recognized that the best managed transmission systems provide automatic alarms at their operating headquarters for the warning of load dispatchers in case abnormal values are attained. In such networks, much larger percentage changes in voltage may safely be permitted than can be allowed in the frequency, which bears so directly upon the speed of motors in plants served by the system. In any study of service reliability, therefore, ample observations of this factor are essential.

It was also shown that any plan for the increased storage of water in the river basin above this plant was of doubtful practicability on account of the many interests involved and the necessity for enormous storage to serve the various installations on the stream at the relatively low heads employed.

A similar examination was made of the flowage of the river upon which the second group of generating units was located, the Geological Survey reports showing the stream to be extremely variable or "flashy" in its characteristics. Large storage reservoirs were seen to be absolutely necessary to realize anything like approximately continuous and steady service. The development plans of the company included such reservoir construction with necessary dams capable of storing a total of about six billion cubic feet of water, and it appeared that if the complete project of utilizing the entire available fall of the river should be carried out, an average development equal to 48,000 kw., or the rated capacity of the generating stations, could be secured for 3600 hours per year, permitting 10-hr. runs and delivering 170,000,000 kw.-hr. per annum. There was some question whether, considering the requirements of vegetation and natural evaporation, the full capacity of one of the large reservoirs could be attained in a dry year, but on this system the existence of various steam auxiliaries at certain industrial plants formerly operated by mechanical power or steam-produced electricity was a factor in guaranteeing a reasonably reliable service.

The projected reservoirs were the key to the whole power situation. Without them the plants on the two rivers, even though interconnected for supplementary operation, could not give a normal service without serious difficulty and expense. With these storage facilities, the desirability of the power was readily established.

The plants were located as a rule from 150 to 200 miles from the market in question, and figures covering the total cost of construction for the entire project gave about $12,000,000 as the investment necessary to complete the developments. The engineers who investigated the situation estimated that the company could afford to deliver energy at the proposed market at about 1c. per kw.-hr. Operating expenses for the generating system were figured at $400,000 per year, fixed charges being estimated at $900,000. This made the cost of energy exceedingly attractive, and a high degree of reliability was further assured by the transmission-line arrangements proposed, which included a double-loop system connecting practically all the generating stations and large users of power.

Regarding the question of competition between the hydroelectric organization and the local central station company, the opinion from the manufacturers' viewpoint was that if the latter should establish a tide-water plant equipped with very high-powered turbines, it could probably afford to sell energy at as low a price as the transmission concern.

It is, perhaps, not generally realized that with the larger sizes of steam turbines, electric energy can be developed at a labor cost of not far from ¼ mill per kw.-hr. in the boiler-room and coal handling plant, with switch board work and supervision by the chief engineer. This is assuming a 20,000-kw.-unit run at full load say 20 hr. per day, with a 25% overload for four hours. Careful preliminary analyses of station costs to be expected, as very large plants of this sort develop, indicate that power can probably be placed upon the busbars of the generating station at from ⅛ to ¼c per kw.-hr., even with coal at $4 per ton. This means that a very large central station, and particularly one having a substantial power load during the daylight hours, can compete closely with transmitted water power, even when all the charges are taken into account.

In the case under investigation, the potential purchasers of service have a choice, speaking in a broad way, between two independent interests. The shorter distribution lines of the local company favor the latter on the score of service reliability, for a transmission system, covering many miles of country and running from county to county, is inevitably subject to hazards unknown in the administration of lower potential systems, many of whose lines may be located underground with increased safety and continuity of operation. This phase of the case selected is incidental to the main line of inquiry taken by the writer but, in passing, it may be noted that one opinion widely accepted is that the whole situation will be strengthened by a co-operative agreement between the two organizations. Under this the central station will attend to the local sale and distribution of the transmission company's energy (with the interchange of energy or not according to engineering and operating considerations beyond the scope of this article).

Summing up the points noted above, it appears (1) that the investigation of service reliability in hydroelectric systems is an engineering problem, but one with a decided commercial twist, (2) that it involves the determination of hydraulic capacities and quality of speed regulation, (3) that it includes the study of any available records of interruptions and their causes, (4) the scrutiny of the quality of old plants and systems, (5) the new designs and construction, (6) the consideration of need for duplicate and looped lines, (7) the auxiliary sources of power, (8) the existing costs of production and the reasonableness of the rates offered and (9) the standing of the concern as a business enterprise. More and more must the large consumer of power investigate the outside seller of such service with something like the thoroughness with which the purchaser of its securities requires a certificate of good business health.

In the case cited, it appeared that a single engineering feature was the cornerstone of the whole enterprise, so far as the reliability of future hydroelectric service on a normal scale was concerned. In other instances, it will be found that the presence or absence of an adequate operating organization, the provision of duplicate lines or some other similar element will be sufficient to turn the scale for or against the proposed service under the conditions then prevailing. Reliability is coming to be a more important industrial question than the mere contract price of service. Yet even an unreliable service may have a place of great value in specific instances under the name of secondary or casual power. The investigation of hydroelectric service in no sense implies that its general reputation is unfavorable. It is simply a precaution which increasing costs of doing business render desirable; it is only another case where a prudent executive would not offhand contract for the purchase of important supplies on receipt of a low quotation.

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The Government and Public Works of Delhi, India*

By Tom Salkield†

Delhi is a first-class municipality possessed of important powers for local self-government, which have always been exercised in a satisfactory manner for the benefit of the 250,000 inhabitants.

The municipality consists of 24 members, of whom 12 are elected and 12 nominated by the deputy commissioner. In order that the interests of the different communities may be safeguarded, the representation consists of 8 Europeans, 10 Hindus, and 6 Mohammedans.

The deputy commissioner is ex-officio president of the municipality, and is supported by two vice-presidents, one a Hindu and the other a Mohammedan.

All the important work of the municipality is first dealt with by small committees, who present their reports to the full body of members, a meeting of which is held weekly.

The city is divided into 15 wards, and each ward member is vested with minor powers, and has much influence in the final disposal of matters relating to his ward.

WATER-WORKS

The city possesses excellent water-works. The source of supply is the River Jumna.

The works were inaugurated in the year 1890, when the sole source of supply was from a chain of 84 infiltration wells sunk along the bank of the River Jumna, which were calculated to yield 1,750,000 [Imp.] gal. in 16 hours; but from the start there was trouble, as sand was drawn into them, and by the year 1893 the supply of water had considerably diminished. A second series of infiltration wells, 60 in number, was constructed; but in the year 1896 the yield had dropped to 611,000 gal. in 16 hours, and was so insufficient that direct pumping from the river had to be resorted to, when sedimentation tanks and sand filter beds were established. These infiltration wells are no longer used as a source of direct supply, but have recently been put to a use not originally intended. When the river is in flood during the monsoon period it carries a large quantity of silt in suspension, which gave much trouble by scoring the pump-rods and clogging up the filter-beds, but owing to the head of water in the river at such times, the infiltration wells

*Slightly condensed from the "Journal of the Royal Sanitary Institute" (London) for November, 1912.

†Engineer to the city of Delhi, India.

stand full of clear water, and from them water is drawn and passed through the filter-beds.

The head works have been further enlarged to provide an adequate supply of water for the recent great Durbar. The works are not finished, but on completion will consist of the following:

INTAKE.—There are three Worthington horizontal triple expansion multiple pumps, any two of which can be coupled together. Each pump is 13 i.hp, and capable of raising 80,000 gal. an hour through two 14-in. rising mains to the sedimentation tanks against a head of 32 ft., including suction and loss by friction.

MAIN PLANT—There are two Worthington horizontal triple expansion multiple pumps, each 90 i.hp., capable of lifting 108,000 gal. an hour; one Worthington horizontal triple expansion multiple high-duty pump capable of lifting 160,000 gal. an hour is now being installed. In each case the pump lifts water through either an 18- or 20-in. rising main 6100 ft. long to the service reservoir on the Ridge against a head of 155 ft., including suction and loss by friction.

The service reservoir has a capacity of 2,500,000 gal. The settling tanks are two in number, and each is divided into three compartments.

The original filter beds were six in number, each 113x80 ft., but the number is now being increased, and on completion will consist, in addition to the original six, of six filters, each 170x100 ft. Also there is one 17-ft. diameter Jewel filter, capable of dealing with 500,000 gal. in 24 hours. The consumption of water during the year 1911 was 10 gal. [12 U. S. gal.] per head per day.

The filters were designed to filter at the rate of 40 gal. per sq.ft. per 24 hours [about 2,100,000 U. S. gal. per acre], but prior to the extension of the plant, they had to be worked at a much higher rate.

To enable the settling tanks and filters to work continuously, a clear water reservoir has recently been constructed to collect the filtered water during the hours when the main engines are not working. This reservoir is divided into two compartments, each capable of holding 600,000 gal.

From time to time, samples of water are taken for analysis and the results have always been satisfactory.

The supply, in common with similar works in India, which draw water from a river, is liable to pollution from several sources, the most serious at Delhi being: (1) the placing of dead bodies in the river; (2) the washing of clothes near the intake; (3) the proximity of the villages Chandrawal and Wazirabad on the west bank of the river about ¾ mile and 2¼ miles respectively from the intake; (4) the Najafgarh Canal which, I have no doubt, receives drainage along its course and which discharges into the river about 2¼ miles above the intake.

It is of interest to record that throughout the city a gratuitous supply of filtered water is given by means of standposts. This has had a wonderful effect upon the health of the community, as diseases such as cholera, enteric fever and Delhi boils have ceased to be endemic.

Great waste of water, unfortunately, occurs at every standpost, owing to carelessness and improper usage. The Delhi inhabitant, in common with mankind generally, fails to appreciate blessings easily obtained.

Wells have been used for supply from time immemorial, and have been brought to a high state of efficiency in India, and to this day, although there is an adequate and cheap supply of pure water from the municipal mains, a large number of people prefer to obtain water for drinking purposes from certain wells which have a high reputation. In the hot weather the water from these wells is cold, which, perhaps, is the chief cause of their popularity.

Religious susceptibilities were at first responsible for a temporary boycott of the municipal water-supply; but as soon as the advantages were realized prejudices ceased to exist, and the acceptance of the municipal supply is now so general that large extensions of the works are necessary. The chief religious prejudices were that low caste people obtained their water from public standposts, and that leather washers* were inserted in private taps.

DRAINAGE

When the present city was designed by the Moghal Emperor Shah Jahan some time between the years 1635 and 1650, he provided a system of underground sewers, which were constructed of stone masonry, some with flat stone beds and others without any bed.

Many of these old sewers have, within recent years, been re-inverted, put into proper repair, and used as stormwater sewers.

So accurately were they laid that in many places the new system follows along the old alignments and with similar gradients.

*The fact that the cow is a sacred animal in India may explain this particular prejudice.—Ed.

In connection with the fortifications of the city, and as a further means of defence, walls were built, and a deep moat encircled them outside. Into this moat each old sewer emptied its quota of sullage water. This moat was, about the year 1898, converted into an open intercepting sewer. The invert, designed to take the dry-weather flow, is in brickwork of semi-circular section, and the benchings and the side retaining walls of stone.

This open sewer has a gradient of 1 in 500, and discharges sullage water onto a large tract of land about 1½ miles outside the south gate of the city, on which area crops, chiefly sugar cane, are grown.

In consequence of the rapidly growing importance of all land outside the city walls, and with the ultimate object of constructing a circular road around the city, outside the walls, the open intercepting sewer is now being arched over, and on the site thus made available it is hoped that the proposed road will be constructed and bordered with a continuous garden, which will add much to the beauty and sanitary amenities of the city.

In every street on which houses exist open side drains have been constructed to convey sullage water into the underground sewers, and thence into the large intercepting sewer which encircles the city wall.

Up to the year 1906 no serious attempt had been made to carry out the proper drainage of the city, although schemes had been prepared for the undertakings. At that time in almost every road of the third and fourth class, as defined under my note on roads, sullage water meandered along the sides or down the center. If the liquid was of sufficient volume it ultimately found an escape into an old sewer, but generally it was either absorbed into the earth or evaporated by the sun. This state of affairs no longer exists. Many streets in the city and suburbs took their name from their filthy surroundings, such as "ganda nalas," meaning dirty water-channels.

The levels of the city and all suburban areas, except one, allow the sullage water in the sewers to gravitate into the intercepting sewer without any intermediate lifting. The suburb where pumping is necessary is a small one, for which a plant consisting of a pump well, two 12 b.hp. Hornsby oil engines, and two 6-in. low-lift centrifugal pumps are now being installed. Each pump is capable of delivering 400 gal. per min. through an 8-in. rising main against a total head of 38 ft., including friction and suction.

The system of drains and sewers is designed for dealing with liquids only, and this of course makes the sanitation of Delhi a very difficult problem, as, in addition to the daily cleaning of 150 miles of open drains, the annual disposal of 1,250,000 cu.ft. of dry refuse, and upwards of 2,000,000 cu.ft. of domestic refuse and nightsoil is a big undertaking.

REFUSE COLLECTION AND DISPOSAL

The bulk of the clean dry refuse is disposed of to brick burners, but it is of low calorific value. The nightsoil is trenched. The trenching grounds are about two miles outside the city, and for this purpose 250 acres of land are required.

After trenching any area one year is allowed to elapse before such land is put under cultivation, and after six years of cultivation the area is again trenched. About 40 acres of fresh land per annum are required for trenching.

As the habits of Eastern people are frequently so different from those residing in the West, the lot of the English sanitary officer in most of the larger cities of India is a constant succession of disappointments, as all working under him have had no Western training in sanitary science.

Complaints are frequently made by wealthy Indians of dirty surroundings, but many of these people forget that cleanliness, like the proverbial charity, should begin at home.

One of the most extraordinary survivals of the old days is what is known in Delhi as "birat," the hereditary right of a family of Mehtars or sweepers to remove filth and rubbish from a number of private houses, for which they receive payment in kind (food and clothes) as well as cash.

The sweeper or Mehtar caste in the larger cities of India is rapidly decreasing in numbers, not through lack of virility, but in consequence of the spread of education and the efforts of the various missions, who secure low-caste people and raise their status much more easily than is possible with the higher castes.

As this caste alone will undertake scavenging work the problem of sanitation becomes yearly more and more difficult. The sweeper, knowing his value, has banded himself into a most powerful Trade Union, by means of which he is able to intimidate not only his hereditary employer, but also the municipality. He has learned that with British-made laws he can work or play as he thinks fit, and consequently the comfort, health, and even the lives of the people are to a very large extent at his mercy.

All solid refuse matter is received at depots known as a "Dalaos," from the Urdu word "Dalna," to deposit, and from such places it is taken by bullock-drawn carts to trenching grounds outside the city, which are cultivated in rotation.

This system leaves much to be desired, and, although to the land is returned that which comes from it, the cycle stands condemned when dealing with large communities.

Palliatives have been tried. I wanted to introduce a system of hoppers which obviated all handling of the refuse, but it was never seriously taken up. Mechanical traction for quickly removing the refuse matter from the city is now being considered, but the only solution will be the provision of a water-borne system of sewage disposal and the erection of refuse destructor.

Until these are introduced and the people have been educated to understand that the streets are not dumping grounds for refuse, and the open drains not elongated receptables for filth, the sanitation of Delhi will not be as perfect as the authorities desire it to be. The sanitary superintendent has a thankless task in keeping together his wayward and undisciplined battalion 1000 strong of city sweepers and bhishties.

STREETS AND ROADS

The roads inside the city may be summarized as follows: 1st class, 10.2 miles; 2nd class, 4.25; 3rd class, 11.2; 4th class, 40.4. Total, 66.05 miles.* The total length of roads in the Civil Station and the roads connecting the city with the suburbs (all first class roads) is 29.57 miles. The suburban roads are as follows: 1st class, 7.58 miles; 2nd class, .74; 3rd and 4th class, 24.4. Total, 32.72 miles. The grand total of roads is 128.34 miles.

The roads of the first three classes are constructed of either limestone, known as "Kunkar," or the local ridge stone, broken to proper size and known as "Rori."

The important roads are lighted by electricity, and a complete system of electric tramways traverses the city and links up the distant suburbs.

GENERAL FEATURES

Delhi is well provided with gardens, which, apart from their charm, form excellent lungs. They are owned by the municipality, and are in the charge of an English superintendent of gardens.

The Municipal Central Hospital is a large and important institution.

The work of medical relief is very extensive, as municipal dispensaries exist in many parts of the city.

A veterinary municipal hospital has recently been erected, where much excellent work has been done to relieve the sufferings of all kinds of domestic animals.

The slaughter-house, vegetable market and minor markets are under municipal control. With the rapid growth of the population and the increasing importance of the city, additional and more extensive markets must be provided, and the existing markets will have to be reconstructed on improved lines.

The municipality possesses much valuable land and many properties, including the central police stations and all other police substations throughout the city, fifteen in number.

As a safeguard against destructive fires, two of Messrs. Merryweather and Co.'s engines have recently been purchased and housed in a new central fire brigade station, in connection with which quarters for the engineers and the brigade have also been built.

The Town Hall is a very fine building, the Durbar Hall, in which the city fathers meet, being one of the finest in India. In front is a statue of the late Queen Victoria.

In front of the statue, and standing in the middle of the main street of Delhi, the world-famous Chandni Chowk, is a clock tower with four faces and a chime of bells.

Delhi of today has gone far along the road of municipal management and amenities, and has studied the health and comfort of her citizens; but the age of British administration has been one of efficiency and utility rather than of beauty, and we have added no great building of architectural pretensions which can stand beside the great masterpieces bequeathed by our predecessors.

Delhi is again to take her stand as an Imperial city, and Phoenix-like from the ashes and ruins of past cities the piles are to rise which are to hold the Viceroy of our sovereign, and the councillors and machinery by which the great continent of India, with its millions of inhabitants, is governed.

The task of the town planners of the Imperial capital would appear to be to build not only a city which will set the high-water mark for India for the tide of municipal perfection and sanitation, but one which in stately beauty will also outrival both the massive grandeur of old Tagiak's city and the inlaid magnificence of the Moghal palaces in the Fort.

*First-class roads comprise all the important thoroughfares within municipal limits. Second-class roads comprise all the narrow carriage ways linking up roads of the first class. Third-class roads comprise all narrow roads for wheeled traffic from roads of the second class, and leading chiefly to roads of the fourth class, which consist entirely of narrow roads, over which vehicular traffic is impossible. Most of the roads of the fourth class are paved with Delhi stone setts [blocks].

A Coal-Mine Explosion in the Imperial Mine, at Belle Valley, Ohio, caused the death of 15 men on May 17.

A Gasoline Explosion destroyed the plant of the Lapeer Gas & Electric Co., of Lapeer, Mich., on May 7.

The Bursting of a High-Pressure Cylinder of one of the engines of the German torpedo-boat "S. 148," while the vessel was participating in maneuvers near Helgoland, Germany, on May 14, killed four of the crew and seriously injured three others.

A Gas Explosion in a manhole at Fifth and Perry Sts., Dayton, Ohio, on May 7, caused serious injuries to five employees of the Dayton Gas Co. The men were in the manhole searching for a leak which had caused an explosion a few days previously. It is believed the gas was ignited by a spark caused by friction in removing a service-pipe connection.

An Explosion of Gasoline at the works of the Baker Castor Oil Co., Jersey City, N. J., caused the death of two employees and serious injuries to two others on May 13. Gasoline and naphtha were stored in five large tanks in a separate building from the other works. There is said to have been no fire or light in this building, and the cause of the explosion is unknown.

A Blast Containing 40,550 lb. of Powder was exploded at the quarries of the St. Louis Portland Cement Co., at Bellefontaine, Mo., on May 3. A safety zone of 1500 ft. from the quarry was established for spectators. The blast was successfully carried through without accident, although one of the mines failed to explode simultaneously with the others, and the explosives expert in charge came near losing his life in a premature examination of the results of the first explosion.

Windstorms in Nebraska, on May 14, killed eight persons in Seward and caused destruction to buildings over a strip one block wide and eight blocks long. The wind also did considerable damage in Tomaro and McCool Jc.

The Derailment of a Passenger Train on the Oregon-Washington R.R. & Navigation Co. tracks between Seattle, Wash., and Portland, Ore., near Lakeview, Wash., on May 12, caused the death of three passengers and a trainman. The train was running over a level track at a rate of about 65 miles per hour. The derailment is supposed to have been caused by the spreading of the rails.

A Typhoid Outbreak at Kenosha, Wis., is attributed to the water supply, which is from Lake Michigan. A hypochlorite plant is being installed. C. A. Jennings, of Chicago, is a charge.

Fire Destroyed a Grain Elevator of the Erie R.R. Co. at Buffalo, N. Y., on May 15. The elevator and some 700,000 bu. of grain were entirely consumed, and the total financial loss is estimated at $500,000. The fire spread across Buffalo Creek and destroyed 28 box cars loaded with grain on the Lehigh Valley R.R. tracks.

Life Saving Rules for British ships are contained in the Board of Trade regulations issued on Jan. 23, and operative Mar. 1. According to press dispatch from London, England, these rules may be summarized as follows: British seagoing ships shall carry life-boats and life-saving appliances for all on board; steamers carrying passengers on short excursions between Apr. 1 and Oct. 31, during daylight and in fine weather must be supplied with boats for 70% of their total certified passenger capacity, and finally passenger steamers on inland waters must have boats sufficient for 40% of their total certified passenger capacity.

Riprapping the Gatun Dam, Panama Canal—The lake side of Gatun dam will be riprapped with hard rock for a distance of 10 ft. above and below the normal level of the water, 85 ft. above sea level. About 175,000 cu.yd. will be required for this purpose, and a steam-shovel has been set at work in one of the borrow pits near Monte Liria to procure this rock. Earlier in the history of the canal work it was believed that the trap rock from the Bas Obispo dike of Culebra cut could be used for this purpose, and to that end a large amount of this rock was stored at Gatun. It soon developed, however, that it weathered rapidly and would not answer for the purpose, therefore it was used elsewhere in the work at Gatun. The rock from the borrow pit is hard and stands both air and water well. It will be dumped upon the south slope of the dam, without effort being made to place it regularly. Paving the slope would not be profitable, because the material in the dam is going through the process of shrinking, and the placed rock would not settle evenly.—["Canal Record."]

A Fire in the U. S. Geological Survey building at Washington, D. C., on Sunday afternoon, May 18, threatened for a while to destroy the building which houses all of the very valuable records of the Survey. The office is located in a rented building, the lower floors of which are given over to stores and storage rooms. The fire broke out in the cellar where was stored a great quantity of paper, and generated so much smoke and gas as to seriously discommode the efforts of the firemen, 25 of whom were overcome in fighting the fire. It was finally put under control, with a loss of about $40,000, $25,000 of which is charged to the Geological Survey for maps, atlases and stereotypes stored in the cellar. Fortunately the greater part of the very valuable records of the Survey were in the upper floors and were not damaged. This is the sixth fire in this building to threaten the Survey records.

Panama Canal Excavation during April totaled 2,653,995 cu.yd., a daily average of 102,077 cu.yd. for each of the 26 working days. The rainfall for the month was 1.89 in. The amount of concrete laid in April was 55,785 cu.yd., and 123,077 cu.yd. of fill was placed in dams.

The Municipal Freight Terminal Railway, mentioned in the article on the South Brooklyn freight-terminal improvements in "Engineering News," Mar. 7, 1912, p. 421, as a project is reported under way in the Broad of Estimate and Apportionment of the City of New York. Acting under authority conferred by the legislature in 1911, the city has adopted a plan providing for the construction of a municipal railroad extending along the entire Brooklyn water front from the Brooklyn Bridge south to 66th St. This road will tie together, for freight service, the various unconnected sections of water front and allow a free interchange of traffic between all points of this water front and provide for the assembling and distributing of freight cars at a central point for transshipment by various trunk lines. The territory to be occupied includes three important sections now distinct. First, the northern end from Brooklyn Bridge to the Atlantic basin forms one unit, the freight handling facilities for which are in the hands of the New York Dock Co.; this company has three unconnected sections of railroad in addition to its piers and warehouses. South from Atlantic basin to 28th St. is an undeveloped section with no railroad facilities, but which is adapted for manufacturing and industrial purposes with relatively cheap, unimproved water front. Here will be located one of the important terminals of the New York State Barge Canal now nearing completion. The third section extends south from 28th St. and is at present controlled by the Bush Terminal Co., which has seven large piers and a number of modern industrial buildings with an electric surface railroad connecting the upland plant with the docks and float bridges. At present it exchanges freight shipments with all of the railroads on a tonnage basis.

The city plan provides for the purchase of the railroad holdings of the New York Dock Co. and the Bush Terminal Co. The lines of the former would be rebuilt and connected to form a two-track main line from Brooklyn Bridge to the Atlantic basin. The rails would be on surface level, except for a short stretch of elevated line to avoid grade crossings at Atlantic and Hamilton Aves., two main traffic thoroughfares. New construction would be required south to a connection with the Bush company's tracks to 28th St. and 2nd Ave. As a part of this new construction would be a large classification yard, one-half mile long and 1800 ft. wide. Serving this yard would be eight float bridges.

The main line of this terminal road would continue through the classification yard and cross Gowanus Canal on a new bridge, probably of bascule type. South from the eastern side of the canal the tracks will run south over a private right-of-way 100 ft. west of Third Ave. To avoid crossing the present ferry entrance at grade the tracks would be carried on an elevated structure across the site of a proposed city market at 40th St. and brought back down to grade near 39th St. At the southern end of this municipal line a connection will be provided with the New York Connecting R.R., which is in course of construction between the New Haven and the Pennsylvania roads.

This municipal railroad will be constructed and owned by the city exclusively. At the present the city is negotiating a contract for operation by which all the trunk lines reaching the port of New York would unite in forming a corporation in which they would have equal stock interests. It is proposed to have this corporation lease the road at a fixed rental and assume the details of operation. The condemnation of land for the classification yard is under way and negotiations have been started with the Bush and New York Dock companies for their railway property.

PERSONALS

Mr. E. F. Harper has been appointed City Engineer of East St. Louis, Ill.

Mr. John W. Hoffman has resigned as General Manager of the Missouri, Oklahoma & Gulf Ry.

Mr. W. J. Hazeltine, of Bogota, N. J., has been appointed Assistant City Engineer of Mansfield, Ohio.

Mr. H. E. Myers has been appointed Superintendent of Shops of the Lehigh Valley R.R., at Packerton, Penn.

Mr. E. U. Smith has been appointed Bridge Engineer of the Wheeling & Lake Erie R.R. at Cleveland, Ohio.

Mr. C. M. Nye has been appointed Principal Assistant Engineer of the Great Northern Ry., at St. Paul, Minn.

Mr. C. L. Raymond, of the city engineering department of Rochester, N. Y., has been appointed Assistant City Engineer in charge of flood protection.

Mr. William Ziehnert, formerly City Engineer of Belleville, Ill., has been appointed Chief Engineer for the construction of the State Hospital at Alton.

Mr. G. H. Friend has been appointed Assistant Chief Engineer of the Western Maryland Ry., and the office of Principal Assistant Engineer has been abolished.

Mr. A. T. Enlow, former Manager of Sales of the Stark Rolling Mill Co., Canton, Ohio, has resigned to become associated with the Pedlar Metal Roofing Co., Oshawa, Ont.

Mr. T. J. Burke, formerly Divison Engineer of the Lehigh Valley R.R. at Auburn, N. Y., has been transferred to Hazleton, Penn., succeeding Mr. J. A. Zehner, resigned.

Mr. Daniel Breck has been elected Vice-President of the Missouri, Oklahoma & Gulf Ry., in charge of operation and traffic, succeeding Mr. J. W. Hoffman, General Manager.

Mr. Albert W. Bee, Jr., formerly Engineer with D. X. Murphy & Bro., Louisville, Ky., has accepted a position in the engineering department of the Leonard Construction Co., Chicago, Ill.

Mr. R. J. Windrow, of the Agricultural and Mechanical College of Texas, has been appointed Road Superintendent of McLennan County, Texas, at a salary of $2500 per annum.

Mr. Ernest McGeorge, formerly with J. Milton Dyer, Consulting Engineer, of Cleveland, Ohio, has opened an office in the Leader Bldg., Cleveland, for the general practice of engineering.

Mr. H. E. Barnes, Jun. Am. Soc. C. E., has resigned as Assistant Engineer, Board of Water Supply, City of New York, to accept a position with the Standard Engineering Co., Cleveland, Ohio.

Mr. J. H. Clark, recently Assistant Superintendent of floating equipment of the Baltimore & Ohio R.R., New York City, has been promoted to be Superintendent to succeed the late Walter Ancker.

Mr. C. E. Segrest, formerly General Foreman of Shops of the Louisville & Nashville R.R., at Anniston, Ala., has been promoted to be General Mechanical Inspector, with headquarters at Louisville, Ky.

Mr. John S. Kennedy, Secretary of the Public Service Commission of New York, Second District, since its organization in 1907, has resigned to accept a position with the New York Telephone Co., New York City.

Mr. R. J. Sullivan, formerly Division Superintendent of the Missouri, Kansas & Texas Ry., at Wichita Falls, Tex., has resigned to become General Superintendent of the Apalachicola & Northern R.R., at Port St. Joe. Fla.

Mr. H. W. Stanley, formerly Assistant General Manager of the Seaboard Air Line Ry., has been promoted to be General Manager. Mr. Stanley was born in 1874, and entered the railway service as a telegraph operator in 1890.

Mr. M. C. Blanchard, Division Engineer of the Atchison, Topeka & Santa Fé Ry., at Topeka, Kan., has been promoted to be Office Engineer at Topeka, succeeding Mr. K. B. Duncan, promoted as noted elsewhere in these columns.

Mr. E. D. Jackson, formerly Assistant Engineer of the Baltimore & Ohio R.R., at Baltimore, Md., has been appointed Division Engineer of Maintenance-of-Way, with headquarters at Philadelphia, Penn., succeeding Mr. C. C. Cook, transferred.

Mr. Alexander Legge, formerly Assistant General Manager of the International Harvester Co., of Chicago, Ill., has been

promoted to be General Manager, succeeding Mr. C. S. Funk, resigned to become General Manager of the Rumely Co., La Porte, Ind.

Mr. G. L. Mattice, M. Can. Soc. C. E., recently Assistant District Engineer of the National Transcontinental Ry. of Canada, has been appointed District Engineer of the North Railway Co., with headquarters in the Canadian Express Bldg., Montreal, Que.

Mr. E. F. Kearney, formerly General Superintendent of Transportation of the Missouri Pacific Ry., has been elected Vice-President in charge of operation of the Texas & Pacific and International & Great Northern Rys., with headquarters at New Orleans, La.

Mr. B. M. Hall, Jr., of the firm of Hall Bros., Consulting Engineers, Atlanta, Ga., has been appointed Assistant Hydrographer for the State Engineering Commission of Florida, recently appointed to investigate and report upon the reclamation of the Everglades swamp by drainage.

Mr. Charles F. Kerrigan, a Brooklyn, N. Y., newspaper man, has been appointed Secretary of the newly created Commission of Efficiency and Economy of New York, at a salary of $4000 per annum. The annual salary budget of the new department to date for four men amounts to $29,000.

Mr. K. B. Duncan, formerly Office Engineer of the Atchison, Topeka & Santa Fé Ry., at Topeka, Kan., has been promoted to be Assistant Chief Engineer of the Gulf, Colorado & Santa Fé Ry., at Galveston, Tex., succeeding Mr. R. A. Rutledge, promoted, as noted in our issue of Apr. 24.

Mr. W. H. Averell, formerly Assistant General Superintendent of the Baltimore & Ohio R.R., at Pittsburgh, Penn., has been transferred to the same position at New York City, where he will also become General Superintendent of the Staten Island Ry. and the Staten Island Rapid Transit Ry.

Mr. John Mitchell, of Mount Vernon, N. Y., former President of the United Mine Workers of America, has been appointed State Labor Commissioner of New York, at a salary of $8000 per annum. Mr. John Williams, until recently at the head of the department, has been appointed Deputy Commissioner, at a salary of $5000 per annum.

Mr. L. J. Putnam has been appointed Principal Assistant Engineer of the Chicago & Northwestern Ry., and Mr. M. E. Thomas succeeds him as Division Engineer at Boone, Iowa. Mr. W. J. Jackson has been transferred to Winona, Minn., as Division Engineer, in place of Mr. Thomas, and Mr. Lee Jutton has been appointed Division Engineer with office at Madison, Wis.

Mr. Gilbert C. White, Assoc. M. Am. Soc. C. E., of Charlotte, N. C., Mr. Benjamin M. Hall, M. Am. Soc. C. E., of Atlanta, Ga., and Judge Thomas J. Shaw, of Greensboro, N. C., as a board of arbitration, have recently appraised the Wake Water Co.'s plant at Raleigh, N. C., at $250,000, and the city has agreed to take over the water-works within 30 days from May 3.

Mr. William Downie, General Superintendent of the Atlantic division of the Canadian Pacific Ry., at St. John, N. B., has been granted a year's leave of absence. Mr. and Mrs. Downie will spend their vacation in Vancouver, B. C., and in Europe. Mr. H. C. Grout, Assistant General Superintendent will be Acting General Superintendent during Mr. Downie's absence.

Mr. Harold Parker, M. Am. Soc. C. E., former Chairman of the Massachusetts Highway Commission, of Worcester, Mass., and Mr. W. D. Washington, of New York City, have been appointed by the Commissioner of Highways of New York State, Mr. John N. Carlisle, as two members of an advisory board of engineers to make a thorough investigation of the highway problems of the state.

Mr. George D. Snyder, M. Am. Soc. C. E., M. Inst. C. E., of Jacobs & Davies, Inc., Consulting Engineers, New York City, has been awarded the George Stevenson Gold Medal of the Institution of Civil Engineers of Great Britain, for his paper entitled "Notes on City Passenger Transportation in the United States." Mr. Snyder was formerly Principal Assistant Engineer of the Hudson & Manhattan R.R. and is now a member and director of the firm of Jacobs & Davies, Inc.

Messrs. Julian N. Walton, formerly Chief Electrical Engineer of the Bradley Contracting Co., New York City, and Frederick M. Beer, formerly Assistant Civil Engineer of the company, have formed a partnership under the firm name of Walton & Beer, 1166 Bedford Ave., Brooklyn, N. Y., for the general practice of engineering, specializing, however, in efficiency engineering in connection with public-works contracts.

Messrs. Leonard Metcalf and H. P. Eddy, M.'s Am. Soc. C. E., Consulting Engineers, Boston, Mass., announce that they have taken into partnership Mr. Charles W. Sherman, M. Am. Soc. C. E., recently Principal Assistant Engineer of the firm, Mr. Wm. T. Barnes, M. Am. Soc. C. E., Engineer in charge of the Chicago office of the firm, and Mr. Almon L. Fales, until recently Superintendent of the Worcester, Mass., sewage treatment works.

Mr. B. C. Collier, M. Am. Soc. C. E., Resident Engineer for H. S. Kerbaugh, Inc., on the construction of the Kensico dam of the New York City water-supply, has resigned to accept the position of Engineer and General Superintendent for the Hassam Paving Co., of Worcester, Mass., and the Parker-Hassam Paving Co., of New York City. He will have supervision of all work outside of New England and New Jersey, with headquarters at 7 East 42d St., New York City.

Mr. Oscar S. Bowen, M. Am. Soc. C. E., Resident Engineer of the Great Northern Ry., at Spokane, Wash., has been transferred to the same position at Seattle, Wash., succeeding Mr. R. L. Beaulieu. Mr. Bowen will have jurisdiction of the Western district and Mr. P. S. Herrin, Resident Engineer at Minot, N. D., has had his jurisdiction extended to cover the Montana and Butte divisions and the Central district. The position of Resident Engineer at Spokane has been abolished.

Prof. H. O. Garman, Assoc. M. Am. Soc. C. E., of the department of civil engineering, Purdue University, has been appointed Chief Engineer of the newly created Public Utility Commission of Indiana. Prof. Garman was Consulting Engineer of the Railroad Commission from 1907 until it was recently superseded by the Public Utilities Commission. Prof. Garman graduated from Purdue University in 1902, and has ever since been associated with the faculty of civil engineering.

Mr. James E. Allison, member and Chief Engineer of the St. Louis, Mo., Public Service Commission has resigned to engage in private practice as a Consulting Engineer, specializing in public service valuation work and the examination of securities. Mr. Allison is a graduate of Harvard University. He has been Chief Engineer of the St. Louis Public Service Commission since 1909, and during the past four years has had charge of the valuation of public utility properties representing a total capitalization of $170,000,000.

Prof. C. J. Tilden, Assoc. M. Am. Soc. C. E., Consulting Engineer and Professor of engineering mechanics at the University of Michigan, has resigned to become Professor and head of the new department of civil engineering at Johns Hopkins University, Baltimore, Md. Prof. Tilden graduated from Harvard University in 1896 and for several years was structural draftsman and Assistant Engineer with the New York City Rapid Transit Commission. He was appointed Instructor in civil engineering at Cornell University in 1904, and the following year went to the University of Michigan as Assistant Professor of civil engineering.

Mr. N. E. Brooks, M. Can. Soc. C. E., formerly Division Engineer of the Alberta division of the Canadian Pacific Ry., at Calgary, Alta., and several times Acting General Superintendent of the division, has been promoted to be Engineer of Maintenance-of-way of the Western lines. Mr. Brooks was born at Sherbrooke, Que., in 1866. His engineering experience began in 1887 as a chainman with the Canadian Pacific Ry. Later he was promoted to be rodman and Resident Engineer on construction of the Atlantic & Northwest branch. From 1889 to 1893 he was transitman and Resident Engineer on surveys and construction of the Calgary & Edmonton and MacLeod & Crows Nest branches. For the following 10 years he was representative of the bondholders in connection with the Calgary & Edmonton branch, with headquarters at Calgary. In 1903 he was appointed Division Engineer of the Western division, and in 1910 he was appointed to the same position on the Alberta division.

Mr. William V. S. Thorne, formerly Director of Purchases of the Union Pacific R.R., with headquarters in New York City, has been elected Vice-President of the Union Pacific R.R., the Oregon Short Line R.R., and the Oregon-Washington R.R. & Navigation Co., at New York City. Mr. Thorne is a graduate of Sheffield Scientific School, Yale University, class of 1885, and for several years he was engaged in railway location and construction work with the engineering department of the St. Paul, Minneapolis & Manitoba Ry. He was transferred to the operating department as clerk to the General Manager. Later he was Assistant Purchasing Agent, Shop Superintendent and Division Superintendent. From 1895 to 1902 he was Vice-President and General Manager of the Pennsylvania Coal Co., Vice-President of the Erie & Wyoming Valley R.R. and President of the Delaware Valley & Kingston Ry. Mr. Thorne first became associated with the Union and Southern Pacific Rys. in 1902 as Assistant to the late E. H. Harriman.

OBITUARY

Nicholas Engel, at one time City Engineer of Milwaukee, Wis., died May 3, aged 83 years.

James R. Huber, Western Sales Representative of the Lumen Bearing Co., of Buffalo, N. Y., died from pneumonia at his home in Detroit, Mich., May 8.

Hugh Reid, senior member of the firm of Reid & Brown, structural steel and iron workers, of Toronto, Ont., died at his home in that city May 11.

Rudolph Francis Bartle, map engraver for the International Waterways Commission, died at Buffalo, N. Y., May 15. He was 45 years old and one of the foremost engravers in the federal employ.

Peter P. Johnson, a well known railway contractor of Spokane, Wash., died May 1, aged 67 years. He was engaged in the construction of a branch of the Great Northern Ry. from Bluestem to Peach. He was a native of Sweden.

Charles H. Pindell, Assistant to the President of the Warren Bros. Co., of Boston, Mass., died May 13, from heart trouble after an illness of only two days. He was 32 years old and well known to a host of municipal and highway engineers.

Clarence Deming, for many years an editorial writer with the "Railway Age-Gazette," died May 8. He was born at Litchfield, Conn., and graduated from Yale University in 1872. For several years he was a member of the staff of the New York "Evening Post."

Robert Wilson Sayles, M. Am. Soc. C. E., Principal Assistant Engineer with Chas. W. Leavitt, Jr., M. Am. Soc. C. E., New York City, died in Montclair, N. J., May 7. He was born in Chicago, Ill., in 1873 and attended Cornell University. In 1895 he left his college work to become an assistant with James Owen, M. Am. Soc. C. E., Consulting Engineer, of Newark, N. J. For a short time later he was Assistant Engineer for the Passaic Valley Sewerage Commission. He had been employed with Mr. Leavitt for over 15 years.

Henry William Vehrenkamp, M. Am. Soc. C. E., Chief Engineer of the Ferro Concrete Construction Co., of Cincinnati, Ohio, died Apr. 26. He was 36 years old, a native of Cincinnati and a graduate of the University of Cincinnati, class of 1899. He served for a time in the United States Coast and Geodetic Survey, as instructor at his alma mater and as inspector on the construction of new Cincinnati water-works. After some experience in structural steel work with the Fort Pitt Bridge Co., of Pittsburgh, Penn., he returned to the Cincinnati water-works as a structural designer. He was first employed by the Ferro Concrete Construction Co., in 1903, and two years later he was made Chief Engineer.

Stephen Dudley Field, F. Am. Inst. E. E., inventor of electrical devices, died at his home in Stockbridge, Mass., May 18, aged 68 years. He was born in Stockbridge and was a nephew of Cyrus W. Field, famous for having laid the first transatlantic submarine cable. Stephen Dudley Field invented a multiple call telegraph box in 1874 and an electric elevator in 1878; he was a pioneer experimenter and inventor of electric railway equipment, and in 1879 he made the first application of dynamo machines to telegraphy. The following year he invented a dynamo quadruplex telegraph, in 1884 a fast stock ticker, and in 1909 made the first application of quadruplex telegraphy to submarine cables on the line between Key West, Fla., and Havana, Cuba. Mr. Field was also a member of the Institution of Electrical Engineers of Great Britain.

John Saxby, M. Inst. M. E., inventor of the interlocking railway switch and signal, died recently at his home in Hassocks, near Hayward's Heath, England. He was born at Brighton in 1821, and began his career as a carpenter's apprentice. His attention was early drawn to the frequency of railway accidents and he took upon himself the problem of bettering the operating facilities of railways. He soon recognized a common cause of accidents in carelessness from independent operation of switches and governing signals. Mr. Saxby's first patent covering an interlocked switch and signal was obtained in 1856. The same year the signal installation at Bricklayers' Arms Junction on the Southastern Ry. was enlarged and reconstructed according to Mr. Saxby's system, the frame there controlling eight signals and six switches. The interlocking plants now in universal use are direct developments of this first installation. For 22 years Mr. Saxby was employed by the London, Brighton & South Coast Ry., and during these years he made many improvements in his apparatus. The success of his system was such that he went into business on his own account in the manufacture of switch and signal equipment under the firm name of Saxby & Farmer. Besides large works at Kilburn, in England, other plants were established in Belgium and France.

Horace G. Burt, former President of the Union Pacific R.R. and at one time Chief Engineer of the Chicago & Northwestern Ry., died May 19, at his home in Chicago, Ill. In April, 1911, Mr. Burt was appointed Chief Engineer for a committee composed of representatives from the leading commercial associations of Chicago to investigate the necessity of the electrification of the railways entering the city. Mr. Burt was born in January, 1849. He graduated from the Terre Haute, Ind., public high school in 1867 and from the University of Michigan in 1878. Before his graduation he had had several years' experience in railway location and construction. From 1873 to 1881 he was in the engineering department of the Chicago & Northwestern Ry., and then entered the operating department as Superintendent of the Northern Iowa division. In October, 1887, he was appointed Chief Engineer, and a year later left the Chicago & Northwestern Ry. to become General Manager of the Fremont, Elkhorn & Missouri Valley R.R. In 1896 he became General Manager of the Chicago, St. Paul, Minneapolis & Omaha Ry., and later in the same year he was elected Third Vice-President of the Chicago & Northwestern Ry. in charge of traffic. From Jan. 1, 1898 to Jan. 1, 1904, he was President of the Union Pacific R.R. After a trip around the world he returned to Chicago and again took up his engineering work as a consulting engineer. In 1909 he was Receiver for the Chicago Great Western Ry., and since 1911 had been Chief Engineer for the Chicago Association of Commerce smoke abatement committee.

ENGINEERING SOCIETIES

COMING MEETINGS

MASTER BOILER MAKERS' ASSOCIATION.
May 26-29. Annual meeting at Chicago, Ill. Secy., Harry V. Vought, 96 Liberty St., New York City.

NATIONAL DISTRICT HEATING ASSOCIATION.
May 27-29. Annual convention at Indianapolis, Ind. Secy., D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 411, C. & N. W. Ter. Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy. Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th. St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminister, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young, 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

American Society of Heating and Ventilating Engineers—The report of the committee appointed last year to formulate standards for ventilation of moving-picture theaters, presented at the last annual meeting of the society, has been approved by a letter ballot of the members. The report has been printed and the society will be glad to furnish copies gratis to all engineers, boards of health, town councils, ventilation inspectors and others interested. The secretary is E. A. Scott, 29 W. 39th St., New York City.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

New York—Albany Southern R.R.—This company, it is reported, will soon start work on the construction of its proposed line from Troy to Pittsfield, N. Y. G. H. Church, Albany, N. Y., is Supt.

✚**Pennsylvania**—Lehigh & New England R.R.—This company has awarded the contract to CURTIS & SHUMWAY, INC., Lynchburg, Va., for the construction of its extension from Catasauqua to Bath, Penn. The line will be 5¼ miles in length and will cost about $500,000. In connection with this line new coal docks are to be built along the canal at Catasauqua, which is to become headquarters of navigation of the Lehigh Canal. Surveyors are at work, and it is hoped to complete all the improvements, which will cost about $1,000,000, by October.

Philadelphia & Reading Ry.—This company is considering four-tracking its main line between Reading and Philadelphia, Penn., and laying out new routes by which the running time between certain points on branch lines and Philadelphia will be shortened. William Hunter, Philadelphia, Penn., is Ch. Engr.

Maryland—Washington, Chesapeake & Potomac Ry.—This company is considering the construction of an extension to its line. Length, about five miles. W. W. Earley, Brandywine, Md., is Gen. Mgr.

Virginia—Virginia-Carolina Ry.—This company has received bids for the construction of an extension of 40 miles. The line will run from Green Cove Creek to Jefferson and Todd, N. C. P. W. Early, Abington, Va., is Ch. Engr.

✚**West Virginia**—Virginian Ry.—This company, it is reported, is considering the construction of a 14-mile railroad to connect with the Norfolk & Western Ry., in New River Valley. The contract has been awarded to C. E. PRICE. H. Fernstrom, Norfolk, Va., is Ch. Engr.

✚**West Virginia**—Virginian Ry.—This company has awarded the contract to BOXLEY, GOODWIN & BRAY, Lester, W. Va., for the construction of a double-track tunnel about 900 ft. in length of the concrete arch type, and for double-tracking its line for a distance of about four miles, with additional side tracks for the storage of coal. The work will cost between $250,000 and $300,000. W. M. Rust is Engr.-in-Charge.

Georgia—Ocilla Southern R.R.—This company, it is reported, has completed surveys for the construction of its proposed line from Macon, Ga., to Jacksonville, J. A. J. Henderson, Ocilla, Ga., is Pres.

Alabama—Alabama, Tennessee & Northern Ry.—This company is considering the construction of a line from Calvert to Mobile, Ala., a distance of about 28 miles. J. T. Cochrane, Mobile, Ala., is Pres.

Mobile & Ohio R.R.—At a meeting of stockholders of this company, May 8, authority was given for the purchase of the St. Louis & Cairo R.R., running from East St. Louis to Cairo, Ill., 152 miles; the issuance of $3,000,000 of Mobile & Ohio St. Louis division 5% gold bonds, and the execution of a mortgage upon the property purchased to secure the bonds. The St. Louis & Cairo R.R. has heretofore been operated under lease. B. A. Wood, Mobile, Ala., is Ch. Engr.

Mississippi—Gulfport & Western Ry.—The City Commissioners of Gulfport, Miss., will call an election for May 31, for the purpose of voting on the proposed issue of $150,000 of bonds to aid this company. W. L. Hardy is Pres.

Louisiana—Midland Valley R.R.—See item under Colorado.

Kentucky—Cincinnati, Licking Valley & Virginia Ry.—This company has completed arrangements for the construction of its proposed line up the valley of the Licking River. Contracts will probably be awarded this summer.

Lexington & Eastern Ry. (Louisville & Nashville R.R.)—This company, it is reported, is considering the construction of a branch along Rockhouse Creek, into Knott County, a distance of about 30 miles. J. H. Peyton, Louisville, Ky., is Ch. Engr. of Const.

Ohio—Ann Arbor R.R.—This company has been granted permission by the Public Service Commission to issue $750,000 of bonds. Of this amount $150,000 will be used for the betterment and improvement of the line. L. S. Allen, Owosso, Mich., is Engr. M. W.

Illinois—Chicago, Burlington & Quincy Ry.—This company is preparing to expend over $700,000 in the construction of a large freightyard at Eola, Ill. Ten tracks will be completed this year, while other additions will be made during 1914. The yards are intended to relieve and in a way take the place of those in Aurora, Ill., which are to be elevated next fall. T. E. Calvert, Chicago, Ill., is Ch. Engr.

Illinois—Chicago & Northern Ry.—This company has been incorporated for the purpose of constructing a railroad from Chicago to Lake Geneva, Ill., by way of Palatine, Algonquin, Crystal Lake, Richmond and Genoa Junction. The survey has been completed. The proposed road is intended for both freight and passenger service.

Macoupin County Extension Ry.—This company has been incorporated for the purpose of constructing a railroad from Benld, Macoupin County, to a point in or near Section 11, Omphghent Township. It will be nine miles long. Spurs are to be built from the main line to all the coal mines and other industries in this county and also in Macoupin County. The road will handle only freight. The incorporators are: Marvin Hughitt, Chicago, Ill.; Wm. A. Gardner, Evanston; Richard A. Aishton, Evanston; H. R. McCullough, Lake Forest; John D. Caldwell, Oak Park; Lewis A. Robinson, Evanston and Josiah F. Cleveland, Oak Park, Ill.

✚**Iowa**—Chicago, Rock Island & Pacific Ry.—This company has awarded the contract to LITTIG BROS., Davenport, Iowa, for track work at Oxford, Victor and South Amana.

Iowa & Southwestern Ry.—This company is considering the construction of a line between Clarinda and Blanchard, Iowa. Length, about 17½ miles. The cost has been estimated at about $350,000. W. S. Farquar, College Spring, Iowa, is Pres. and Gen. Mgr.

Minnesota—Grand Marais & Northwestern R.R.—This company has been incorporated in Minnesota to construct a railroad from Marais west to a connection with the Duluth & Northern Minnesota R.R., a distance of about 50 miles; also to construct branch lines. J. Jenswold is Secy., Duluth, Minn.

Missouri—Gainesville, Trenton & Chillicothe R.R.—Surveys are being made for the extension of this company's line from Carrollton to Chillicothe, Mo., a distance of about 35 miles. W. R. Painter, Carrollton, Mo., is interested.

Hannibal & North Missouri R.R.—Surveys have been made for the construction of this company's line between Hannibal and Palmyra, Mo., a distance of about 12 miles. Col. H. Funk, Palmyra, Mo., is interested.

Memphis, Dallas & Gulf R.R.—This company, it is reported, has awarded the contract for the construction of a 10-mile extension between Hot Springs and Murfreesboro, Ark. W. P. Hart, Nashville, Ark., is Ch. Engr.

Texas—Mexico Northwestern Ry.—See item under Mexico.

Oklahoma—Muskogee & Missouri Connecting Ry.—This company has received a charter for the construction of a railroad from Muskogee, Okla., to connect with the Missouri Pacific Ry., two miles south of Fort Gibson. The line will be about eight miles in length. Joseph Hall, Muskogee, is interested.

Colorado—Midland Valley R. R.—The stockholders and directors of this company have voted a bond issue of $15,000,000 to pay all the present indebtedness of the road, to put it in first-class condition and also to provide funds for starting work on extensions to Denver, Colo., and Shreveport, La., the original terminals of the line. A. W. Lefeber, Muskogee, Okla., is Gen. Mgr.

Washington—Canadian Pacific Ry.—This company has had surveys made for the construction of a line from Metaline, Wash., to Trail, B. C., and for an extension of the Crows Nest Pass line west. F. W. Peters, Vancouver, B. C., is Gen. Supt.

✚**Ontario**—Lake Erie & Northern Ry.—This company has awarded the contract to SECORD & SONS for all the cement work on its lines. Estimated cost, about $250,000.

✚**British Columbia**—British Columbia Ry.—This company has awarded the contract to BROWN & SIMMONS for grading its Cloverdale-Burnside Loop.

British Columbia—Canadian Pacific Ry.—See item under Washington.

Alberta—Taber Transit R.R.—This company, it is reported, will award contracts soon for the construction of its proposed line from Taber to the coal mines at Bow City and Retlaw. V. O. Eastland, Calgary, Alta., is Ch. Engr.

Mexico—Mexico Northwestern Ry.—According to press reports as a result of the revolutionary disturbances in Mexico, plans for the construction of an extension of the Mexico Northwestern Ry. from El Paso to Plainview, Tex., a distance of about 350 miles, have been abandoned. The company is owned by a syndicate of English and French capitalists headed by Dr. F. S. Pearson, of New York, N. Y., and London, Eng.

ELECTRIC RAILWAYS

Miller's Falls, Mass.—Preliminary arrangements are being made by the Miller's River St. Ry. Co., for the construction of an electric railway from Miller's Falls to Orange. D. P. Abercrombie is Secy.

Waterbury, Conn.—John H. Cassidy, Waterbury, has been granted a franchise to construct and operate an electric railway from Waterbury to Marion.

Rome, N. Y.—Preliminary arrangements are being made and contracts will soon be awarded by the Rome & Delta Dam Electric Ry. Co., for the construction of its proposed line from Rome to Delta Dam, about six miles. DeWitt C. Hancock is Pres.

Syracuse, N. Y.—Plans are being prepared by the Syracuse, Watertown & St. Lawrence River R.R. Co. for the construction of an electric railway from Syracuse to Brewerton, about 12 miles. H. D. Brewster is Secy.

Troupsburg, N. Y.—Press reports state that a company is being organized to construct and operate an electric railway from Troupsburg, N. Y., to Knoxville, Penn.

Trenton, N. J.—The Public Service Ry. Co. plans the extension of its traction lines from Broad St. Park to Yardville and Groveville, Hamilton Township, and a branch line on the Mercerville Road to the Burlington County line.

Punxsutawney, Penn.—A company is being organized at Punxsutawney to construct an electric street railway line from Punxsutawney to Rossiter, about six miles.

Scranton, Penn.—Contracts will soon be awarded by the Scranton & Binghamton Traction Co. for the construction of an electric railway from Nicholson to Montrose, about 17 miles. R. W. Day, Scranton, is Gen. Mgr. Noted May 8.

Stroudsburg, Penn.—Plans are being considered by the Chestnut Ridge Ry. Co. for the extension of its line from Saylorsburg to Stroudsburg. C. R. Funk, Palmerton, Penn., is Ch. Engr.

Charleston, W. Va.—Plans are being considered by the Charleston, Parkersburg & Northern R.R. Co. for the construction of an electric railway from Charleston to the Jackson County line. K. E. Stephenson, Parkersburg, is Pres.

Grafton, W. Va.—Preliminary arrangements are being made by the Grafton, Fairmont & Clarksburg Traction Co. for the construction of an electric line from Grafton to Pruntytown. George L. Hartley, Grafton, is Gen. Mgr. and Pur. Agt. Noted Apr. 10.

Kanauga, W. Va.—A franchise has been granted to the Kanaugg Traction Co. to extend its line from Kanauga to Middleport. T. W. Jackson is interested.

Princeton, W. Va.—Surveys have been started by the Princeton Power Co. for the construction of its proposed electric railway from Princeton to Bluefield, about seven miles. S. J. Evans, Princeton, is Pres. Noted Feb. 13.

Winfield, W. Va.—A company is being formed to extend the electric railway from St. Albans to Winfield, about 12 miles. F. M. Littleton and John W. Miller are interested in the project.

Henderson, N. C.—Plans are being prepared by the Blue Ridge & Interurban Ry. Co. for the construction of an electric railway from Hendersonville to Saluda. George Ladshaw, Spartanburg, S. C., is Engr.

Memphis, Tenn.—The West Tennessee Traction Co. is making preliminary arrangements for the construction of an interurban line from Memphis to Jackson. The line will be 85 miles long and will cost, $2,000,000. B. G. Sargent, Memphis, is Vice-Pres. and Gen. Mgr.

Canton, Ohio—The Northern Ohio Traction & Light Co. contemplates the construction of an electric railway from Canton to Lisbon. Charles Currie, Akron, is Gen. Mgr.

Cleveland, Ohio—The Cleveland & Akron Short Line Ry. Co. has been incorporated to construct and operate an electric railway to connect Cleveland, Brooklyn, Independence, Ira, Everett, Portage and Akron. John C. Chapman, New England Bldg., Cleveland, is interested.

Rockwood, Mich.—The Arthur J. Greenway Co., Detroit, Mich., is planning the construction of an electric railway to connect Rockwood, Flat Rock, Dundee and Adrian.

Wilmot, Mich.—Plans are being prepared by the Detroit, Bay City & Western R.R. Co. for the extension of its electric railway from Wilmot to Sandusky, Mich. William N. Boyd, Bay City, is Ch. Engr.

Camp Point, Ill.—The Commercial Club of Camp Point is discussing the proposition to construct an electric railway from Camp Point to Hannibal, about 35 miles. Isaac Cutter is interested.

Hamilton, Ill.—The Tri-State Traction Co. has completed surveys for the construction of its proposed traction line from Hamilton to Quincy. R. O. Marsh, Warsaw, is Pres. and Ch. Engr.

Peoria, Ill.—Plans are being prepared by Peoria Ry. Co. for double-tracking its Main St. line. R. W. Bailey, Peoria, is Gen. Supt.

Springfield, Ill.—Surveys are being made by the Springfield, Taylorville & Pana Interurban Ry. Co. for its proposed electric railway to connect Springfield, Taylorville and Pana. W. B. Adams, Taylorville, is Vice-Pres. and Gen. Mgr.

Waukegan, Ill.—Plans are being prepared by the Chicago & Milwaukee Electric Ry. Co. for the extension of its North Ave. line in Waukegan to the golf grounds. Edward J. Bock, Highwood, is Gen. Supt.

Appleton, Wis.—The Wisconsin Traction, Light, Heat & Power Co. proposes to extend its line from Appleton to Hortonville. E. K. Ellis, Appleton, is Supt.

Beloit, Wis.—The Beloit, Delavan & Clinton Ry. Co. has been incorporated to construct and operate an electric railway to connect Beloit, Turtle, Delavan, Clinton and Darien, about 30 miles. The incorporators include: Thomas F. Fitzgibbons, A. N. Bort, W. H. Horton, W. G. Welrick, and B. F. Lyons.

Clarinda, Iowa—Plans are being considered by the Iowa & Southwestern R.R. Co. for the construction of an electric railway from Clarinda to Blanchard, about 17 miles. C. B. Judd, Clarinda, is interested.

St. Louis, Mo.—According to press reports the Springfield & Southern Illinois Traction Co. will construct an interurban line from St. Louis, Mo., to Terre Haute, Ind., with a branch line from Springfield, Ill., to Cairo, Ill. George W. White, St. Louis, is Vice-Pres.

Austin, Tex.—John Kinney, of Johnson City, and associates are promoting the construction of an interurban electric railway from Austin to Johnson City, a distance of about 30 miles. The proposition has been taken up by the Chamber of Commerce of Austin.

Gainesville, Tex.—The City Council has granted a franchise to E. P. Turner, Dallas, Tex., and associates for the use of certain streets of Gainesville by the interurban electric railway which is to be constructed through here.

Terrell, Tex.—The Stone & Webster Engineering Corporation Boston, Mass., has arranged to begin shortly the construction of its proposed interurban electric line which is to run between Dallas and Terrell. J. B. Townsend is Mgr. of construction. The survey for the proposed road has been finished and the right of way is now being secured.

Shawnee, Okla.—The Shawnee Electric Ry. Co. has completed surveys on its proposed line from Shawnee to Oklahoma City, about 41 miles. C. T. Edwards, Shawnee, is Pres.

Long Beach, Calif.—The Pacific Electric Ry. Co. is planning the construction of an electric railway from Long Beach to Redondo, about 18 miles. J. McMillan, Los Angeles, is Gen. Mgr.

Los Angeles, Calif.—The Los Angeles Ry. Co. is considering the extension of five of its lines into the Hollywood and Colegrove districts. John J. Akin, Los Angeles, is Supt.

San Francisco, Calif.—The Panama-Pacific International Exposition Terminal Ry. Co. has been incorporated to construct a 10-mile electric railway on the Exposition grounds at Harbor View for the transportation of exhibits and materials. The incorporators are Leon Sloss, William H. Crocker, J. W. McCarthy, James McNab, Henry F. Fortmann and I. W. Hellman, Jr.

Bridgeburg, Ont.—The construction of a traction line from Bridgeburg to Smithville, and from Hamilton to Toronto, is under consideration.

Cornwall, Ont.—The proposition to construct an electric railway from Cornwall, Ont., to St. Polycarpe, Que., about 28 miles is under consideration. Adam Beck, London, Ont., is interested in the project.

Lethbridge, Alta.—Plans are being prepared by the Lethbridge Municipal Ry. Co. for the extension of its line to Hardieville, about six miles.

Sidney, N. S.—The Cape Breton Electric Co. is considering plans for an expenditure of $350,000 for double-tracking its lines in Sidney. W. G. Ross, Sidney, is Gen. Supt. and Pur. Agt.

Fredericton, N. B.—The Fredericton St. Ry. Co. contemplates the construction of an electric railway from Fredericton to Gibson and Marysville, about five miles.

LIGHT, HEAT AND POWER

Milo, Maine—Preliminary arrangements are being made by the Milo Electric Light & Power Co. for the installation of additional equipment in its power plant. Julian d'Este, Milo, is Pur. Agt.

Rockland, Maine—Hollis M. Shaw has been granted a municipal franchise to construct and operate electric light and power lines in this city. Mr. Shaw has a plant in operation at Union, Maine.

Paxton, Mass.—At a recent election it was voted to install an electric-lighting system. Arthur W. Dwyer is interested. Noted Apr. 17.

+Shelburne Falls, Mass.—The Greenfield Electric Light & Power Co. has awarded the contract for the installation of additional equipment in its power plant at Shelburne Falls, to FRED T. LEY & CO., INC., Springfield. Estimated cost of the plant, $150,000.

South Williamstown, Mass.—H. H. Hodgeman, Pittsfield, Mass., who is acting for an electric company in Pittsfield is preparing plans for a power plant to furnish light for the town of South Williamstown.

+Hartford, Conn.—The Hartford Electric Light Co. has awarded a contract to CHARLES B. ANDRUS & CO., Hartford, for the construction of a new power plant on Pearl St., at $300,000.

Norwalk, Conn.—The installation of additional equipment in the municipal electric-light plant at East Norwalk, is under consideration. Fred H. Bergen is Supt. of the plant.

Cohoes, N. Y.—The Cohoes Electric Light Co. is planning the construction of a power plant in the Mohawk River bed, near Cohoes Falls, to cost about $1,000,000. Bids for the work will be received at the New York office of the company, 2 Rector St. Charles B. Samuels is Vice-Pres.

+New York, N. Y.—(Official)—The Department of Education, Park Ave. and 59th St., has awarded a contract to T. FREDERICK JACKSON INC., 94 John St., at $9784, for installing electric equipment in Public School 50. Bids were received May 12. C. B. J. Snyder is Supt. of School Bldgs.

Syracuse, N. Y.—The Syracuse-Suburban Gas Co., has been organized and permission has been obtained from the Public Service Commission authorizing the construction of a gas plant and the laying of the necessary mains. Work will be commenced soon.

Boonton, N. J.—The Board of Public Utility Commissioners has approved an ordinance granting the Boonton Electric Co. permission to install lines for transmission and distribution service in Hanover Township.

+Philadelphia, Penn.—The contract for remodeling the power plant of Nathan C. Lane, at 412 Cherry St., has been awarded to SHAUGHNESSY & WILER, Philadelphia, at $13,000.

Charlottesville, Va.—The Redland Power Co. will construct dam and powerhouse for developing 2000 hp. The plant will be of concrete, steel and brick construction, and will be constructed under the supervision of Neff & Thompson, Norfolk, Va. Estimated cost $100,000. F. C. Todd is Pres.

Murphy, N. C.—Plans are being prepared by the J. B. McCrary Co., Atlanta, Ga., for the construction of a hydro-electric plant on the Hiwassee River near Murphy. Bonds for $70,000 were recently voted for the purpose. D. W. Dewease is Mayor.

Orangeburg, S. C.—Preliminary arrangements are being made to reconstruct the municipal electric-light plant and water system. Estimated cost, $60,000. L. H. Wanamaker is City Clk.

Augusta, Ga.—See item under Buildings.

Statesboro, Ga.—Plans are being considered for the installation of additional equipment in the municipal electric-light plant. D. L. Gould is Mgr.

Waynesboro, Ga.—The installation of new equipment in the municipal electric-light plant is under consideration. J. C. Andrews is Supt.

Gainesville, Fla.—Preliminary plans are being considered by the Lighting Committee for the installation of an ornamental street-lighting system in the business district. J. E. Goodwin is Chn. of the Com.

Leesburg, Fla.—The Leesburg Ice Co. proposes to double the capacity of its electric-light plant by the installation of additional equipment. J. Y. Clark is Pres.

Panama City, Fla.—The citizens are considering the proposition to issue bonds for the construction of an municipal electric-light plant.

Vivian, La.—The Vivian Oil Co. will build a new power plant at Vivian to cost $50,000.

Monterey, Tenn.—J. T. Price and associates have been granted a franchise by the City Council to construct and operate an electric-light plant at Monterey.

Somerset, Ky.—The Kentucky Utilities Co. will install additional machinery in its power plant at Somerset. T. J. Spragle is Gen. Mgr.

Winchester, Ky.—Preliminary steps are being taken by the City Council for the installation of an ornamental lighting system in the business district.

Barberton, Ohio—An election will be held May 24 at which the proposition to issue $110,000 of bonds for the construction of a municipal electric-light plant will be submitted to the voters. W. S. Mitchell is Mayor.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Serv., until May 27, for furnishing generators and converters and a 40-ton electric traveling crane and a five-ton auxiliary crane for the municipal electric-light plant.

✦Columbus, Ohio—(Official)—The contract for the installation of automatic underfeed stokers in the power plant in connection with the Ohio State University at Columbus, has been awarded to the AMERICAN ENGINEERING CO., Philadelphia, Penn., at about $5000. Bids were received May 12 by the Board of Trustees. Noted May 1.

Cortland, Ohio—Plans are being prepared by B. F. Hewitt, Consult. Engr., Jefferson, Ohio, for the construction of a municipal electric-light plant and water system at Cortland.

Toledo, Ohio—The City Council is considering the proposition to construct a municipal ice plant. George W. Jonson is City Engr.

Cadillac, Mich.—Plans are being prepared by the Consumers' Power Co. for the improvement and extension of its system in Cadillac and vicinity. W. A. Foote, Jackson, Mich., is Pres.

✦Muskegon, Mich.—The contract for the installation of an ornamental street-lighting system has been awarded to the RODGERS ELECTRICAL CO., Muskegon, at about $5000. Noted Mar. 20.

Petoskey, Mich.—Plans are being considered for the purchase of additional equipment for the municipal electric-light plant. J. W. Lovelace is Mgr. of the plant.

Saginaw, Mich.—The City Council has appointed a committee to investigate the cost of installing an ornamental lighting system on various streets.

Aledo, Ill.—The Consumers' Light & Power Co. contemplates an expenditure of $50,000, for the improvement of its power plant and system at Aledo. W. A. Foote, Jackson, Mich., is Pres.

✦Clinton, Ill.—The contract for the installation of an ornamental street-lighting system has been awarded by the Board of Local Improvements to the CLINTON GAS & ELECTRIC CO., Clinton, at about $8000.

Girard, Ill.—The Central Illinois Public Service Co. has purchased the municipal electric-light plant at Girard. The new owners will improve the plant and extend the system. H. L. Jones is Local Mgr.

Paris, Ill.—Plans are being considered by the Chamber of Commerce for the installation of an ornamental street-lighting system in the business district.

Springfield, Ill.—Preliminary arrangements are being made for the installation of an ornamental street-lighting system. Estimated cost, $12,000. Wade Seely is City Engr. Noted Apr. 10.

La Crosse, Wis.—The property of the La Crosse Gas & Electric Co. has been purchased by Kelsey, Brewer & Co., Grand Rapids, Mich. An expenditure of $125,000 for improvements is planned by the new owners.

Alton, Iowa—The Town Council has granted a franchise to Mason & Mason, to construct and operate an electric-light plant at Alton.

Russell, Iowa—The proposition to construct a municipal electric-light plant is under consideration.

Aurora, Minn.—The Village Council is considering the proposition to construct a hydro-electric plant on the St. Louis River, near Aurora. Estimated cost of the project, $50,000.

✦Buhl, Minn.—The contract for the installation of new equipment in the municipal electric-light plant has been awarded to the NORTHERN ELECTRIC CO., Minneapolis.

Duluth, Minn.—The proposition to install an ornamental street-lighting system in West Duluth is under consideration. J. J. Frey is interested.

Argonia, Kan.—An election will soon be held at which the proposition to issue $25,000 in bonds for the construction of an electric-light plant and water system will be submitted to the voters. Rollins & Westover ,Midland Bldg., Kansas City, Mo., are Consult. Engrs.

Howard, Kan.—The proposition to issue $11,000 of bonds for the construction of a municipal electric-light and power plant is under consideration.

Aurora, Neb.—Plans are being prepared by the Aurora Electric Co., for the improvement of its electric-light plant. J. B. Harvey is Gen. Mgr.

Cook, Neb.—At a recent election bonds for $5000 were voted for the installation of an electric-lighting system.

Omaha, Neb.—The State Legislature has authorized an appropriation of $35,000 for the installation of a power plant at the Nebraska School for the Deaf at Omaha.

Kimball, S. D.—Plans are being considered by the Kimball Electric Light & Power Co. for the construction of an electric-light plant, to cost $12,000. Garret Ashley, Kimball, is Engr.-in-Charge.

✦Reynolds, N. D.—(Official) The contract for the construction of a municipal electric-light plant at Reynolds has been awarded to M. S. HYLAND, Fargo, N. D. Bids were received by M. N. Brathorde, City Audr., Apr. 30. Noted Apr. 17.

St. Thomas, N. D.—At a recent election the citizens voted to issue bonds for the construction of a municipal electric-light plant. C. Ganssle is Mayor. Noted Apr. 17.

Velva, N. D.—The construction of an electric-light plant at Velva is contemplated by O. S. Kaufmann, of Hillsboro, Wis.

Fulton, Mo.—Bids will be received by the Board of Managers of the Missouri School for the Deaf at Fulton,, until June 9 for the construction of a power plant in connection with the institution. Plans are on file at the office of M. F. Bell, Arch., Fulton.

Kansas City, Mo.—The Kansas City Electric Light Co. is considering plans for remodeling the Metropolitan power plant at Ninth St. and the Blue River. Estimated cost of the work, $50,000. Louis H. Egan, Kansas City, is Gen. Mgr.

Austin, Tex.—The Colorado River Power Co., headed by C. H. Alexander, Dallas, Tex., recently filed on the water rights of a section of the Colorado River above Austin, preliminary to the construction of a large dam and erecting a hydro-electric plant at a point about 40 miles north of here. Mr. Alexander and associates also have under consideration the construction of a dam over the Colorado River near Ballinger to cost approximately $1,000,000. This latter dam will be for the purpose of creating a water storage reservoir for irrigating about 75,000 acres of land in that section.

Denison, Tex.—The application of the Texas Power & Light Co. for a franchise for the construction of an electric-lighting system here will be voted on at an election to be held June 21. It is announced by representatives of the company that if the franchise is granted it will immediately begin the construction of a hydro-electric plant on the Red River north of here, to cost approximately $1,000,000.

Edna, Tex.—The Edna Electric Light, Ice & Water Co. will construct an electric-light and water-works plant and an ice factory here. L. E. Ward, W. W. McCrory and Rudolph Linnahtz are interested.

Taylor, Tex.—The City Council has granted a 30-year franchise to H. P. Ball, Ann Arbor, Mich., for the erection and operation of a gas manufacturing plant here.

West, Tex.—The local electric-light plant has been purchased by the Southern Traction Co. Extensive improvements to the plant and system are planned by the new owners.

✦Aline, Okla.—The contract for the construction of an electric-light plant has been awarded to PAUL SCHENBECK, at about $6000.

Parma, Idaho—The Beaver River Power Co. has been granted a franchise to construct a substation and distributing system in Parma.

Elko, Nev.—The Elko-Lamoille Power Co. has purchased the electric plant of the Elko Power & Water Co. from W. T. Smith, of Elko, and his associates. J. G. Serugham and F. O. Brolli, of Reno, have been retained as engineers to design a new plant and to remodel the old one. B. G. McBride is Mgr. of the company.

Benson, Ariz.—It is announced that the project of erecting a large hydro-electric plant and the construction of an extensive system of power transmission lines to cover parts of Arizona and New Mexico has been financed and that details of the organization of the company will soon be made public. Ralph Cameron is one of the promoters of this enterprise. The company will have a capital stock of $15,000,000. Surveys have already been made in a number of localities with a view of determining the best point for locating the hydro-electric plant. It is understood that it will be located at some central point, probably on the Gila River. It is planned to provide power for operating irrigation pumping plants in the San Pedro, Sulphur Spring, San Simon and other valleys.

Eatonville, Wash.—Evans & Dickson, Tacoma, have been retained by the City Council to prepare preliminary plans for the construction of the proposed municipal electric-light plant.

✦Oswego, Ore.—The contract for the construction of a substation at Oswego for the Portland, Eugene & Eastern Ry. Co. has been awarded to the PORTLAND ENGINEERING & CONTRACTING CO., Portland.

Hermosa, Calif.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system on various streets.

✦Los Angeles, Calif.—The contract for the installation of a heating system in the new building on Grand Ave., near Ninth St., erected for the Trinity M. E. Church, has been awarded to the MACHINERY & ELECTRICAL CO., 351 North Main St., Los Angeles, at $40,000.

Loyalton, Calif.—The Mountain Development Co. has completed plans for a reservoir and power-house near Sattley to cost $180,000. The reservoir will have a capacity of 185 acre-ft. and approximately 3500 hp. will be developed with a fall of 1385 ft.

✦Montreal, Que.—The contract for the construction of underground conduits on Catherine St., has been awarded by the Board of Control to G. M. GEST, Montreal, at $271,000.

South Edmonton, Alta.—A syndicate, of which J. M. Douglas, 155 Saskatchewan Ave., is Pres., plans to equip an independent plant for supplying light and power for factories.

Kamloops, B. C.—Bids will be received by J. J. Carment, City Clk., until June 12, for installing hydro-electric equipment in the new municipal power plant. Dutcher, DuCane & Co., Vancouver, are Consult. Engrs.

BRIDGES

Manchester, N. H.—Plans are being prepared for the construction of a bridge over the Merrimac River, south of the Granite Bridge. It will be 1000 ft. long and 50 ft. wide, and will cost from $110,000 to $135,000. S. J. Lord is the City Engr. Noted Feb. 13.

★**Woonsocket, R. I.**—Bids will be received by the Committee on Streets and Bridges, at the office of the City Engineer, until 4 p.m., May 28, for the construction of a reinforced-concrete arch bridge and appurtenant work on Harrison Ave., Woonsocket. Frank H. Mills is the City Engr.

Willimantic, Conn.—The Board of Selectmen has made an appropriation of $6000 for the construction of a bridge over the Natchang River on the North Windham Road.

Amsterdam, N. Y.—An election will be held by the taxpayers, May 22, to vote on the proposition to issue bonds for $100,000, for the purpose of building a new bridge over the Mohawk River, connecting the city proper with that section known as the Fifth Ward.

✚**Millville, N. J.**—The contract for the construction of a new drawbridge across the Maurice River, has been awarded to the OWEGO BRIDGE CO., Owego, N. Y., at $27,096.

Newark, N. J.—The Erie R. R. Co. has had plans prepared for the construction of a new bridge across the Passaic River, at Fourth Ave., and has applied to the War Department for permission. F. A. Howard, 50 Church St., New York, N. Y., is the Engr. of Bridges and Bldgs.

Butler, Penn.—Bids will be received by the County Commissioners at Butler, until May 28, for the construction of bridge work. W. B. Scott is the Clk.

Nanticoke, Penn.—Plans have been approved by the County Commissioners of Luzerne County at Wilkes-Barre, for the construction of a new bridge at Nanticoke, and bids will soon be asked. An appropriation of $350,000 has been made for the purpose. D. A. Keefe, Athens, Penn., is the Engr.

✚**Pittsburgh, Penn.**—The contract for the construction of the new bridge over Haights Run, on the line of Butler Ave., has been awarded to the CUMMINGS STRUCTURAL CONCRETE CO., Commonwealth Bldg., at $109,480. Noted May 15.

★**Jewel, Ga.**—Bids are asked for the construction of a steel bridge over the Ogeechee River at Jewel, between Hancock and Warren Counties.

Pass Christian, Miss.—The Commissioners of the Third District of Harris County are asking bids for the construction of a bridge and draw across Bayou Portage. Bonds for $15,000 have been issued for this purpose.

Kentucky—Bridges will be built as follows: Mercer County will build a two-span steel bridge about 80 ft. long over Buchanan Creek. Harrodsburg is the County seat. Lawrence County will build an 85-ft. steel bridge over Cat Creek, one with a 100-ft. span over Blain Creek, and a three-span structure, 276 ft. long over Blain Creek. Louisa is the County seat. Hopkins County will construct three bridges, one 50 ft. long, over Drake's Creek, and two over Clear Fork, one 100 ft. and the other 50 ft. Madisonville is the County seat. Martin County will erect a steel bridge 125 ft. long, over Rolling Fork. Lebanon is the County seat. Whitley County a 147-ft. steel bridge over Jellico Creek. Corbin is the County seat. Fayette County an 80-ft. steel bridge. Lexington is the County seat; and Bath County a 150-ft. steel bridge with 16-ft. concrete abutments, over Steel Creek. Owingsville is the County seat.

Alliance, Ohio—Bids will be received until May 27, for the structural steel for the superstructure of the Fifth St. Subway.

Ashland, Ohio—Bids will be received by the Board of Public Service until June 5, for the construction of the concrete abutments for the Holbrook St. Bridge. F. Edwards is the Dir. of the Bd.

Chillicothe, Ohio—Bids will be received by the Board of County Commissioners at the office of the County Auditor, until noon, May 26, for the construction of a bridge to be known as the Barnhart Bridge, in Green Township, Ross County. Robert D. Alexander is the County Audr.

Chillicothe, Ohio—Additional information received regarding the new bridge at Main St. is as follows: It will consist of five 150-ft. spans, and will be constructed of steel, with concrete foundations. Noted Apr. 24.

✚**Cincinnati, Ohio**—The contract for the construction of a concrete bridge over Muddy Creek on Lower River Road has been awarded to WILLIAM NICKSON, at $17,608. Noted Apr. 3.

Cincinnati, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County, Cincinnati, until noon, June 13, for alterations to the lift bridge over the Miami and Erie Canal, at Section Ave., Hartwell, in Springfield Township. Albert Reinhardt is the Clk.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Director of Public Service, until May 27, for the construction of the steel superstructure of a viaduct over the tracks of the Baltimore & Ohio, P. C. C. & St. L. and the C., C. & St. L. Rys., on North Fourth St.

Dresden, Ohio—Bids will be received by the Commissioners of Muskingum County, at Zanesville, Ohio, until 11 a.m., June 12, for the construction of the superstructure of a bridge across the Muskingum River at Dresden, to replace the suspension bridge recently destroyed by the floods. It will be 600 ft. long, with a roadway of 20 ft. H. H. Kennedy is the Clerk.

Hamilton, Ohio—The City Council of Hamilton contemplates the reconstruction of a part of the high level bridge at Hamilton. The estimated cost is $15,000. A. F. Macallum is the Engr.

Kings Mills, Ohio—Bids will be received by the Board of County Commissioners of Warren County, at Lebanon, Ohio, until June 9, for the construction of a steel high-truss bridge over the Little Miami River at Kings Mills. It will have one 150-ft. and one 190-ft. span. Also for the construction of one new concrete abutment and for facing and raising one old abutment with concrete, and rebuilding one pier with concrete for the above structure.

Loveland, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County at Cincinnati, by the Board of County Commissioners of Clermont, at Batavia, Ohio, and by the Commissioners of Warren County at Lebanon, Ohio, until noon, June 16, for the construction of the new superstructure and the repair of the substructure and approaches to the bridge over the Little Miami River, at Loveland. Albert Reinhardt is the Clk.

✚**McConnellsville, Ohio**—The contract for the repair of the Muskingum River Bridge at Malta and McConnellsville has been awarded to the OREGONIA BRIDGE CO., Lebanon, Ohio, at $46,400. J. E. Patterson, McConnellsville, is the County Audr. Noted May 1.

Mt. Vernon, Ohio—Bids will be received by the Board of County Commissioners of Knox County until 1 a.m., June 2, for the construction of the west abutment of the Banning Bridge and the west abutment of the Young Bridge, both of Morris Township, Knox County. Irvin Young is the County Audr.

Mt. Vernon, Ohio—According to press reports, the Commissioners of Knox County plan to construct 12 county bridges. The estimated cost is $150,000.

✚**Sidney, Ohio**—We are officially advised that the contract for the construction of the Rumley Bridge over Loramie Creek in Van Buren Township, has been awarded to the HACKEDORN CONTRACTING CO., Indianapolis, Ind., at $7990. Noted May 8.

White Cottage, Ohio—Bids will be received by the County Commissioners of Muskingum County, Zanesville, Ohio, until 10 a.m., June 7, for the reconstruction of part of the substructure, and for the whole of the superstructure of a highway bridge crossing the Jonathan Creek in White Cottage. It will be 106 ft. long over all. Plans and specifications are on file at the office of the County Commissioners. H. H. Kennedy is the Clk.

Youngstown, Ohio—Bids will be received by the Board of County Commissioners of Mahoning County until 11 a.m., May 28, for the construction of a steel bridge, 180 ft. in length, on the South Center Road, Youngstown Township. I. M. Hogg is the County Audr.

✚**Lincoln, Ill.**—The Supervisors of Logan County have awarded the contract for the construction of a steel and concrete bridge over Salt Creek, near Lincoln, to T. L. BLACKBURN, at $8250.

Altoona, Wis.—The city contemplates the erection of a bridge over Otter Creek, to connect with Eau Claire. Plans are being prepared. The estimated cost is $10,000.

✚**Clinton, Iowa**—The contract for the construction of a bridge across the South Fork of the Little Red River has been awarded to the VINCENNES BRIDGE CO., Vincennes, Ind., at $5000.

✚**Red Wing, Minn.**—According to press reports, the contract for the construction of the Pine Island Bridge has been awarded to the SECURITY BRIDGE CO., Minneapolis, Minn., at $9000.

Alma, Kan.—Bids will be received at the office of the County Clerk, at the Court House, Alma, until noon, May 23, for the construction of seven bridges in Wabaunsee County.

Garnett, Kan.—Bids will be received at the office of the County Clerk, in the Court House at Garnett, until noon, June 4, for the construction of a reinforced-concrete arch, 75 ft. long, with a 16-ft. roadway, in Monroe Township, four miles from Garnett.

Pine Bluff, Ark.—Bonds have been issued for $700,000, for the purpose of constructing a bridge over the Arkansas River, near Pine Bluff.

McAlester, Okla.—Bids will be received by the Board of Commissioners of Pittsburg County until June 9, for the construction of three bridges, one a steel span 50 ft. long, over North Boggy, near Kiowa, one 124-ft. steel span over Coal Creek near McAlester, and the other a 75-ft. steel span over Longtown Creek, near Brewer.

Belen, N. M.—We are officially advised that bids will probably be received by the County Commissioners at Los Lunas, N. M., until July 12, for the construction of a bridge across the Rio Grande River at Belen. It will be a wood-pile bridge with about 80-ft. steel spans, and will cost between $12,000 and $15,000. Plans are on file at the office of the State Engineer at Santa Fé. E. Hempenich is Chn., and John Becker, Jr., is the Secy. of the Road Bd.

✚**Seattle, Wash.**—The contract for the construction of the West Wheeler St. Bridge has been awarded to J. M. BRUCE & CO., at $206,422. Noted Apr. 1.

Hood River, Ore.—According to press reports, the Pacific Light & Power Co., Portland, Ore., will construct a steel bridge over the Hood River, to cost approximately $18,000.

Kennett, Calif.—The Board of Supervisors of Shasta County has ordered plans and specifications prepared for the construction of a steel bridge across the Sacramento River at Kennett, to cost approximately $30,000. Redding is the County seat.

✚**Los Angeles, Calif.**—The contract for the construction of a reinforced-concrete bridge, on LaCanada-Verdugo Road, near Devil's Gate, has been awarded to MONOZ & MONOZ, 929 Central Bldg., at $6146. Noted Apr. 24.

Monrovia, Calif.—A reinforced-concrete bridge, to cost approximately $6000, is to be built over Santa Anita, Wash., on Falling Leaf Ave., by the cities of Arcadia and Monrovia. H. S. Gerlich, Monrovia, is the Engr. in charge.

WATER SUPPLY—IRRIGATION

Essex Junction, Vt.—At a recent meeting, the village voted to extend and improve the water system. Bonds for $10,000 will be issued for the improvement.

Agwam, Mass.—The town contemplates the installation of a municipal water system, estimated to cost $100,000. E. A. Kellogg and John Merrill are interested.

Springfield, Mass.—The Water Department has awarded a contract for the construction of a standpipe at the Ludlow Reservoir, to the WALSH STEAM BOILER WORKS, Holyoke, Mass. Noted May 8.

Bristol, R. I.—The town contemplates purchasing the plant of the Bristol Water Co. The company has offered to sell for $713 125. J. J. Walsh is Chn. Water Com.

Central Falls, R. I.—Tentative plans have been submitted to the Common Council for improving the filtration plant. Estimated cost, $10,000. Silas Cumming is City Engr.

★**Providence, R. I.**—The Board of Contract and Supply has extended the time of closing bids for installing the proposed 30,000,000 gal. pumping station from May 21 to June 18. Noted May 8.

✚**Binghamton, N. Y.**—(Official)—Contract C of the proposed filtration plant, which provides for furnishing and erecting complete, with material, labor, tools and appliances, nine filters, of a total capacity of 9,000,000 gal. per day, and furnishing and erecting two low-lift pumps, steam driven, has been awarded to the NORWOOD ENGINEERING CO., Florence, Mass. Contract A, which consists of earth excavation, reinforced concrete sub-structure, suction and discharge lines, sewer and miscellaneous work, will be done by day labor. Contract B, which provides for a brick building, will be awarded later. Bids were opened by the Boaard of Water Commissioners, May 15. Noted May 8.

East Syracuse, N. Y.—The Water Department has had plans prepared for the construction of a reservoir of from 8,000,000 to 10,000,000 gal., estimated to cost $10,000. Fred Shepp is Pres. Noted May 8.

Ithaca, N. Y.—Plans have been prepared for laying about 8350 ft. of 6-in., 8100 ft. of 8-in., and 250 ft. of 4-in. water mains. The work will probably be done by day labor. Martin Conlon is Supt. Water Dept.

✚✚**Mexico, N. Y.**—Contracts for installing a water system here have been awarded by the Board of Water Commissioners, as follows: Construction, to the PUBLIC ENGINEERING & CONSTRUCTION CO., Buffalo; pumps and motors, to the RUMSEY PUMP CO., Seneca Falls; filters, to the AMERICAN WATER SOFTENER CO., Philadelphia, Penn.; standpipe, to the DES MOINES BRIDGE & IRON WORKS, Pittsburgh, Penn.; hydrants and valves, to R. D. WOOD & CO., Pittsburgh; pipe, to MILLAR SONS & CO., Utica. Estimated cost of system, $50,000. Bids were opened May 7. Noted Apr. 24.

New York, N. Y.—(Official)—Bids will be received until 2 p.m., May 28, by the Department of Water Supply, Gas & Electricity, 21 Park Row, for hauling and laying water mains and appurtenances in Tremont Ave., from Webster Ave. to Third Ave., Boro. the Bronx. Henry S. Thompson is Comr.

Yonkers, N. Y.—The Common Council has adopted plans for enlarging the water system, as prepared by Allan Hazen, Hydraulic Engr., and the Acting City Engineer. The plans provide for enlarging the Grassy Sprain Reservoir, constructing a reservoir in the Sprain Valley, and laying conduits and tunnels to Woodlands Lake, which is to be the new source of supply.

★**Newark, N. J.**—(Official)—Bids will be received by the Board of Street and Water Commissioners until 3:15 p.m., May 22, for furnishing 1965 tons of 36-in. c.-i. water pipe, and 50 tons of 36-in. specials. Specifications may be obtained at the office of Morris R. Sherrerd, Ch. Engr.

Rockaway, N. J.—In accordance with recent instructions from the Borough Council, the Water Committee has tendered a report of the following estimates: Increasing the capacity of the reservoir at Middletown to $10,000,000 gal., $15,000; new reservoir of from 30,000,000 to 40,000,000 gal. capacity, $25,000; pipe line from Bull Dam, Upper Hibernia, to main connection, $25,000. The committee is also investigating filtering and sterilizing plants.

Ambridge, Penn.—The town contemplates buying and improving the plant of the Harmony Water Co. Estimated cost, $125,000.

Colver, Penn.—The Colver Water Co. plans to construct a reservoir on one of the branches of the Blacklick River, and lay distributing pipes through Colver. P. J. Little is a member of the company.

Coudersport, Penn.—The Borough Council will probably soon call an election to vote on a bond issue of $50,000 for buying or constructing a municipal water system.

New Kensington, Penn.—According to press reports, the Kensington Water Co. plans to expend 200,000 for improving its system. T. A. Mellon is Pres.

Scranton, Penn.—The Delaware, Lackawanna & Western R.R. Co. has bought the old States Dam and grist mill on the south branch of the Tunkhannock Creek, and plans to build a reservoir to supply water to its local shops and yards. The water is now purchased from the Scranton Gas & Water Co. G. J. Ray, Hoboken, N. J., is Ch. Engr.

Burkittsville, Md.—The Burkittsville Water Co. has incorporated with a capital stock of $50,000, with H. P. Shafer, Frank G. House, Charles T. Meyers, Cecil D. Hightman and others. The company has purchased a tract in the South Mountains, including Cool Spring, about one mile from Burkittsville, and will construct a 500,000-gal. reservoir near the spring, and a 6-in. pipe line from the spring to the town, and lay about three-quarters of a mile of pipe in the streets.

Cumberland, Md.—The lowest bid received by the City Council for laying a 6-in. water main from the Fort Hill Reservoir to South Mechanic St., was submitted by the Thomas S. Kean Co., Cumberland, at $16,500. Noted May 15.

Harrisonburg, Va.—The city contemplates the construction of an additional reservoir for the water system, which will have a capacity of 5,000,000 gal. J. H. Downing is Mayor.

High Point, N. C.—Bonds for $50,000 have been voted for extending and improving the water system here. F. N. Tate is Mayor.

Weaverville, N. C.—It is proposed to install a water system here, estimated to cost $30,000.

✚✚**Tuscaloosa, Ala.**—(Official)—The contract to construct four reinforced concrete filters, with appurtenances, has been awarded by the Water Commission, to the FINNELL CONTRACTING CO., Tuscaloosa, Ala., at $14,200. Bids were opened May 16. Moultrie Knowles, Oliver Bldg., Pittsburgh, is Consult. Engr. Noted May 8.

Mile Platte, La.—W. B. Roberts, Consult. Engr., has been retained by the city to prepare plans and specifications for a water system. A. Deverege is Mayor. Noted Apr. 24.

★**Lexington, Ky.**—(Official)—Bids will be received by the Lexington Hydraulic & Mfg. Co., until noon, June 2, for constructing a reservoir dam. The contract involves about 46,000 cu.yd. of earth work, and 7840 sq.yd. of stone riprap.

Corbin, Ky.—(Official)—Bids will be received by the city until May 27, for constructing a municipal well-water system, according to plans prepared by the Southern States Engineering Co., First National Bank Bldg., Chicago, Ill. The contract includes about three miles of mains. Estimated cost, $30,000. Thomas F. Young is City Clk. Noted May 15.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 30, for relining the West Basin of the Eden Park Reservoir. The work will consist of the removal of present disintegrated concrete lining, screening and separating the broken stone from same, and constructing a new concrete lining, with a foundation of broken stone on slopes and underlying drains; broken-stone foundation to be covered with felt waterproofing, on which will be laid a concrete surface, divided into 15-ft. squares, with elastic composition in the joints; entire concrete lining properly waterproofed. Engineer's estimate, $120,000. Plans and specifications can be obtained at the office of the Superintendent of the Water Department.

(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 29, for cleaning c.-i. pipe, special castings and valves, and other miscellaneous work in connection therewith. Plans and specifications may be obtained at the office of the Superintendent of the Water Department.

Cleveland, Ohio—Bids will be received by W. H. Kirby, Secy. to the Director of Public Service, until noon, May 27, for furnishing boilers for the Water Department. Specifications are on file at the office of the Superintendent of the Water Department.

Cleveland, Ohio.—The city contemplates the construction of a 20,000,000-gal. reservoir on the Cooley Farms, at Warrensville. The reservoir will be lined with concrete, and will be 20 ft. deep and 650 ft. long. Estimated cost, $100,000. The work will probably be done by day labor. Robert Hoffman is City Engr.

Cleveland Heights, Ohio—Bids will be received by H. Canfield, Village Clk., Beckman Bldg., Cleveland, until noon, June 10, for laying an 8-in. water main in Yellowstone Road, from Mayfield to Noble Road. Plans and specifications are on file at the office of the F. A. Pease Engineering Co., Marshall Bldg., Cleveland.

Cortland, Ohio—See item under Light, Heat and Power.

✚**Lima, Ohio**—Contracts for improving the water system here have been awarded by the city as follows: Furnishing about 14,830 ft. of 20-in. pipe, to the MASSILLON IRON & STEEL CO., Massillon, at $23.40 per ton; pipe material, valves, tees, reducers and other fittings, to JAMES B. CLOW & SONS, Chicago, at $25.65, for 6-in. pipe, $90 for relief valves, $77.43 for reducers, $528 for hydrants, $1727 for fittings, and $84.50 for manhole covers; steam header to the AMERICAN FOUNDRY & CONSTRUCTION CO., Pittsburgh, at $2256; 6,000,000-gal. pumping engine, to the SNOW STEAM PUMP CO., Buffalo, N. Y., at $15,485 for pump, and $1728 for crane; two boilers, to the POWER EQUIPMENT CO., Toledo, Ohio, at $5770. Bids were opened by the city, May 1. Noted Apr. 24.

Norwood, Ohio—An election has been called for June 17 to vote on a bond issue of $105,000, for extending and improving the water system, and $35,000 for installing a water-softening system. Noted May 8.

Piqua, Ohio—The city has decided to expend $60,000 for improving and reconstructing the water system. The Board of Public Service will employ a consulting engineer to prepare plans and supervise the construction work. Harry D. Hartley is Chn. W.-Wks. Com. Noted May 15.

Richmond, Ind.—The Richmond Water Works contemplates an expenditure of $100,000 for improving the system, to include the installation of a 5,000,000-gal. pump. Alvord & Burdick, Chicago, Ill., are Consult. Engrs.

✚**Highland Park, Mich.**—(Official)—The contract to furnish 956 tons of water pipe has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., Chicago, Ill., at $24 per ton. The other bids were: American Car & Foundry Co., $25.35 per ton; R. D. Wood & Co., $25.10 per ton; Massillon Iron & Steel Co., $24.35 per ton; Standard Cast Iron Pipe & Foundry Co., $28.20 per ton; Glamorgan Pipe & Foundry Co., $25 per ton. Bids were opened Apr. 28. William G. Patterson is Water Comr. Noted Apr. 24.

✚✚**Evanston, Ill.**—The contract to construct a 12,000,000-gal. mechanical filtration plant has been awarded to the NORWOOD ENGINEERING CO., Florence, Mass., at $192,309. Noted May 1.

★**Galesburg, Ill.**—(Official)—Bids will be received by J. P. Evans, Chn. Water Com., until 2 p.m., June 5, for about 30,000 lb. of riveted steel plates and shapes for a pump pit and well strainer, and for sinking a well 9 ft. in diameter and 30 ft. deep. Plans and specifications are on file at the office of Dabney H. Maury, Consult. Engr., Monadnock Block, Chicago.

Dabney H. Maury, Consult. Engr., Chicago, Ill., has presented a report to the City Council recommending the construction of a reservoir at Haw Creek, estimated to cost $380,000.

✚**Riverside, Ill.**—Contracts for improving the water system here have been awarded as follows: Steel water tower, $10,140; masonry tower for water tank, to GEORGE HINCHLIFF, at $12,585; centrifugal pumping machinery, to the AMERICAN WELL WORKS, at $1950; piping, to JAMES W. CASTLE, at $2735; electrical work, to the RIVERSIDE ELECTRIC CO., at $1941. Bids were opened Apr. 14, and the contract awarded May 2. Dabney H. Maury, Monadnock Block, Chicago, is Consult. Engr. Noted Apr. 3.

+Boscobel, Wis.—(Official)—The contract to construct a water system here has been awarded to C. S. PHILLIPPS, Madison, Wis., at $23,791. The other bids were: C. B. McNamara & Co., Dubuque, $32,286; Thilt-Manning-Whelan Co., La Crosse, $29,742; J. N. Roberty, Madison, $24,272. Bids were opened by H. J. Johnson, City Clk., May 9. W. G. Kirchoffer, Madison, is Consult. Engr. Noted May 1.

Palmyra, Wis.—The village contemplates the installation of a water system estimated to cost $18,000. An election will probably soon be called to vote on a bond issue.

Kenosha, Wis.—The city will immediately install a plant for treating the supply taken from Lake Michigan, with a solution of hypochlorite. C. A. Jennings, Chicago, is in charge of the work.

Waukesha, Wis.—The Common Council has ordered water-mains laid in Albert St., from North to Meadow Sts., and in Beechwood Ave. between Oakland and Greenfield Aves. Harvey Wilbur is Mayor.

+Wauzeka, Wis.—(Official)—Contracts for constructing a water system here have been awarded as follows: Furnishing pipe, to the U. C. CAST IRON PIPE & FOUNDRY CO., Chicago, at $25.80 per ton; laying pipe, to J. N. ROHERTY, Madison, Wis., at 33c. per ft.; also for constructing a concrete tank, at $1550; furnishing valves and hydrants, to the LUDLOW VALVE CO., Chicago, at $37. W. G. Kirchoffer, Madison, Wis., is Consult. Engr. Noted May 1.

Cherokee, Iowa—Bids will be received by the City Council until May 22, for extending the water system. William Shardlow is City Clk.

Hedrick, Iowa—Bonds for $16,000 have been voted for installing a water system here.

Preston, Iowa—The city has purchased the holdings of the Creston Water Co. for $130,000. It is probable that the system will be improved and extended this season.

Waterloo, Iowa—The Board of Water Trustees contemplates extending the system to serve Prospect Hills. J. P. Berry is Supt.

Norfolk, Neb.—The city has decided to lay water-mains to the Edgewater Park Addition and East Norfolk. Estimated cost, $10,000.

Silver Creek, Neb.—Bruce & Standevin, Consult. Engrs., Omaha, Neb., have prepared plans and specifications for the installation of a water system here. D. F. Davis is Village Clk. Noted Mar. 6.

Carter, S. D.—According to press reports, bids will be received by the Town Board until May 27, for installing a water system estimated to cost $9500. J. R. Martin is Town Clk. Noted May 8.

+Glenrock, Wyo.—The contract to construct a water system here has been awarded to N. G. PETRY, Cheyenne, Wyo. Bids were opened May 5. C. C. Carlisle, Cheyenne, is Consult. Engr. Noted May 8.

Red Lodge, Mont.—Bonds for $30,000 have been voted and are now on sale, the proceeds to be used for increasing the capacity of the water system. Walter Anderson is City Clk.

+Jefferson City, Mo.—(Official)—The contract to furnish and install a vertical triple-expansion pumping engine for the water system has been awarded to the EPPING CARPENTER CO., Pittsburgh. Chester & Fleming, Pittsburgh, are Consult. Engrs. Noted Jan. 30.

+St. Louis, Mo.—(Official)—The contract for Letting No. 10,896, which consists of furnishing all tools, materials and labor for the construction and completion of the Chain of Rocks filter equipment, has been awarded to the PITTSBURGH FILTER CO., Farmers' Bank Bldg., Pittsburgh, at $398,200. The only other bid received was submitted by the New York Continental Jewell Filtration Co., 15 Broad St., New York, at $435,512. Bids were opened by the Board of Public Improvements, May 16. Edward E. Wall is Water Comr. Noted May 15.

(Official)—Bids will be readvertised in June for constructing an intake tower, tunnel and screen chamber at the Chain of Rocks pumping plant, Letting No. 10,895. Edward E. Wall is Water Comr., and Charles A. Cheney is Secy. Water Dept. Noted May 1.

Fort Smith, Ark.—The Board of Improvement contemplates an expenditure of $140,000 for improving the water system.

Austin, Tex.—See item under Light, Heat and Power.

Edna, Tex.—See item under Light, Heat and Power.

+Everett, Wash.—A contract to waterproof the reservoir here has been awarded to the PARAFFINE PAINT CO., Polson Bldg., Seattle, at $15,000.

Winlock, Wash.—A franchise to install a water system here has been granted to C. L. Leonard. The system will cost about $10,000.

+Newport, Ore.—A contract to construct a 1,000,000-gal. reservoir here has been awarded to PAYNE & REED, Portland.

+Portland, Ore.—A contract to remove two submerged water mains here has been awarded to A. C. U. PERRY, Selling Bldg., Portland, at $61,130.

Turner, Ore.—The town has decided to install a municipal water system, estimated to cost $10,000.

Los Angeles, Calif.—The Aqueduct Board is planning to take over the private water companies doing business in the city. It is estimated that this will cost about $1,000,000. William Mulholland is Ch. Engr. of Bd.

+San Diego, Calif.—The contract to furnish c.-i. water pipe to the city has been awarded to the U. S. CAST IRON PIPE FOUNDRY CO., 71 Broadway, New York, N. Y., at $173,573. Noted Apr. 13.

+Tulare, Calif.—The contract to construct a steel tank and tower for the water system here has been awarded to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, at $9840. Bids were opened May 5. Noted Apr. 17.

Kentville, N. S.—The Town Council plans to expend $15,000 for extending the water system. J. Carroll is Town Clk.

Bowmanville, Ont.—The town is receiving bids for the installation of machinery in the new pumping plant. Specifications are on file at the office of Chipman & Power, Consult. Engrs., Mail Bldg., Toronto. John Lyle is Town Clk.

Dunnville, Ont.—Bids will be received by the Water Commission until May 31, for laying about 10,000 ft. of water mains, the materials to be supplied by the city. B. L. Edgecomb is Chn.

+London, Ont.—Contracts for furnishing water pipe were awarded by the Water Commissioners, May 1, as follows: CANADA FOUNDRY CO., Toronto, 6- to 12-in. pipe, $33.50 per ton, 4-in. pipe, $34.50 per ton, specials $70 per ton; H. A. DRURY, Montreal, Que., 4- to 12-in. pipe, $39.25 per ton, special, $64.25 per ton; CHARLES MILLAR & SON, Utica, N. Y., 6- to 12-in. pipe, $36 per ton, 4-in. pipe, $38 per ton, specials $75 per ton; GAFFTSHORE-THOMSON PIPE CO., pipe, $33 per ton; LONDON FOUNDRY CO., London, specials, $56 per ton. Noted Apr. 17.

Wallaceburg, Ont.—The City Council is having plans prepared for the installation of water and sewer systems estimated to cost $130,000. H. E. Johnson is City Clk.

SEWERS

Charleston, N. H.—(Official)—Bids for laying about 30,000 lin.ft. of 6- to 12-in. sewers, with 80 flush tanks, manholes and catch basins, were received by the Board of Selectmen, May 15, as follows: Ricci Bros., Rutland, Vt., $12,699; Lang & Little, Leominster, Mass., $18,902; Daniel O'Connell's Sons, Holyoke, Mass., $18,582; A. Williams & Co., Boston, Mass., $21,146; H. F. Cummings & Co., Ware, Mass., $15,416; H. Spinach, Waterbury, Conn., $17,768; Marcello Construction Co., Portsmouth, N. H., $18,686; John E. Palmer, Boston, Mass., $25,066; James H. Kerr, Rumford, Maine, $18,898; Fales F. Simson, Rockland, Maine, $14,937; Weed & Walch, Mechanicsville, N. Y., $22,095; P. Pattassors, Bellows Falls, Vt., $16,408; Joseph Socco, Portsmouth, N. H., $15,864; Petrosser Bros., Hartford, Conn., $14,820; F. P. William, Attleborough, Mass. $19,323; R. H. Howes Construction Co., New York, N. Y., $18,498; Way & Eilli, Springfield, Mass., $27,337. E. F. Davis, 78 Main St., Northampton, Mass., is Consult. Engr. Noted May 8.

Boston, Mass.—Bids will be received by the Directors of the Port of Boston until May 28, for laying pipes and drains, and repaving Northern Ave., South Boston. F. W. Hodgdon is Ch. Engr.

New Bedford, Mass.—The Sewer Committee has recommended to the City Council the construction of a sewer in Durfee St. Estimated cost, $19,500. George H. Nye is City Engr.

Winchendon, Mass.—The proposition to install a sewer system here has been under consideration for several years. Bonds for $100,000 were voted some time ago, and a Sewer Commission appointed, of which Harland W. McColley is Chn.

Bridgeport, Conn.—Bids will be received by the Board of Contract and Supply until May 23, for constructing sewers in Frank and Whittier Sts. Alfred H. Terry is City Engr.

+Cheshire, Conn.—The contract to construct a sewage disposal plant at the State Reformatory, bids for which were received at the office of A. B. Hill, Engr., New Haven, May 5, has been awarded to THOMAS LEONARD & CO., 504 Barrett St., New Britain,Conn ., at $12,228. Noted May 15.

+Hartford, Conn.—The contract to construct 3150 ft. tile and concrete sewer, 36-, 30-, 24- and 12-in., in Terry Road has been awarded to C. H. SLOCOMB & CO., Hartford, at $19,826. Other bidders were: F. B. & W. H. O'Neil, Hartford, Conn., $21,302; B. Silvester, Hartford, Conn., $21,444; A. Conti & Co., Hartford, Conn., $22,896; John Mamocchio, Hartford, Conn., $25,347.

New Haven, Conn.—Bids will be received by F. L. Ford, City Engr. until May 23, for constructing sewers in North Front, Norton, Read and Auburn Sts.

★Stamford, Conn.—(Official)—Bids will be received by the City Clerk until 8 p.m., May 26, for constructing sewers as follows: 4100 ft. of 10-in. pipe in 3-ft. lengths, 1900 ft. of 12-in. pipe in 3-ft. lengths, 130 pieces of 10x4-in. y's 2 ft. long, 80 pieces of 12x4-in. y's 2 ft. long, 22 manholes, one flush tank. C. D. Ryder is City Engr. Noted May 8.

+Waterbury, Conn.—(Official)—The contract to construct sewers in Beacon, North Beacon, Willow, Pine, Fleet, Rose and Fiske Sts., has been awarded to ANTONIO LAMBO, Waterbury, at $7540. Bids were opened Apr. 29. Noted Apr. 24.

West Hartford, Conn.—(Official)—The town will soon ask bids for about 17 miles of pipe sewers, three miles being 24- and 22-in. double strength tile, to be furnished by the contractor. Some of the sewer is 30 ft. deep in rock, and the total cost will approximate $150,000. The sewer commission consists of A. C. Sternberg, Jr., Chn., Dennis Ahern and Allen S. Griswold. Plans and specifications may be seen at the office of Ford, Buck & Sheldon, Inc., Consult. Engrs., 60 Prospect St., Hartford.

Dunkirk, N. Y.—John M. Hackitt, City Engr., has prepared plans for the construction of an intercepting sewer along the lake front from Bass St. to Battery Point. Estimated cost, $75,000.

Elmira, N. Y.—(Official)—Bids will be received by Otis H. Gardner, City Clk., until 11 a.m., May 29, for the construction of the Roe Creek trunk sewer. Plans and specifications are on file at the office of the City Engineer.

★Mount Morris, N. Y.—(Official)—Bids will be received by the Board of Village Trustees until noon, June 5, for constructing a sewer system, according to plans, maps, details and specifications on file at the office of the Village Clerk.

+Newburgh, N. Y.—A contract to lay a trunk sewer in Fullerton Ave. has been awarded by the Common Council, May 6, to the KELLAM & SHAFER CO., Schenectady, N. Y., at $15,466. The other bids were: John Stino, Poughkeepsie, $16,526; Java & Kehoe, Kingston, $17,085.

✚New York, N. Y.—(Borough The Bronx)—(Official)—The following contracts have been awarded by the President of the Borough, Municipal Bldg., Third Ave. and 177th St., for the construction of sewers in various streets, Pugsley Ave., from Westchester Ave. to MacGraw Ave., SALVATOR PURIFICATO, at $25,599; St. Raymond Ave., from Parker St. to Zerega Ave., KNIGHT & DI MICCO, $15,160; St. Lawrence Ave., from Tremont Ave. to Merrill St., CHARLES E. FARRELL, at $8075. Bids were received on May 14. Cyrus C. Miller is Pres. Noted May 8.

✚New York, N. Y.—(Borough of Richmond)—(Official)—The President of the Borough of Richmond, Borough Hall, St. George, S. I., has awarded a contract to JOSEPH JOINSON'S SONS, West New Brighton, N. Y., at $6044, for constructing temporary combined sewers in Charles St., from St. Marys Ave. to Chestnut Ave., in Smith St., from St. Marys Ave. to Wall St.; in Oak St., from St. Marys Ave. to Wall St.; in Wall St., between Reynolds St. and Charles St., and in Reynolds St., from Wall St. to a point about 400 ft. south of St. Marys Ave. Bids were received May 13. George Cromwell is Pres.

✚★Norwich, N. Y.—(Official)—The contract to construct sewers here, bids for which were received by the Sewer Commissioners, May 15, has been awarded to NASH, ROBINSON & GRIFFIN, Norwich, at $7837. Noted May 8.

Syracuse, N. Y.—The Common Council has approved the proposition to construct a storm water sewer system in the First and Second Wards. Estimated cost, $100,000. Henry C. Allen is City Engr.

Secaucus, N. J.—(Official)—Bids will be received by the Borough Council until 8 p.m., June 3, for constructing a sanitary sewer system. Adrian Post is Boro. Clk. Noted Mar. 20.

Trenton, N. J.—Bids will be received by the Board of City Commissioners until May 28, for the construction of sewers in various streets. Frank Thompson is City Clk.

✚North Charleroi, Penn.—A contract to construct sewers here has been awarded by the Borough Council to the DONORA CONSTRUCTION CO., Donora, Penn., at $8700.

Pittsburgh, Penn.—Bids will be received by the City Controller until 10 a.m., May 23, for constructing sewers in various streets.

West Chester, Penn.—Bids for laying sewers in the Goose Creek sewer system were received by the Borough Council, May 5, as follows: M. & T. E. Farrell, West Chester, $13,350; E. H. Oliver, Chester, $14,975. Noted May 1.

Newark, Del.—The Town Council has approved the plans and specifications prepared by T. Chalkley Hatton, Consult. Engr., Wilmington, Del., for a sewer system and sewage disposal plant.

Pulaski, Va.—(Official)—Bids will be received by the Mayor and Town Council until 3 p.m., June 17, for constructing a system of sewers. The contract includes about ten miles of 6- to 18-in. vitrified pipe sewer, with manholes and flush tanks. J. H. Ratcliffe is Chn. Sewerage Com.

Hamlet, N. C.—The town contemplates an expenditure of $15,000 for constructing sewers. W. E. Davis is Mayor.

✚Greenville, S. C.—According to press reports, a contract to construct four miles of sewers here has been awarded to SULLIVAN & LONG, Bessemer, Ala., at $18,000.

Royston, Ga.—The town contemplates the installation of a sewer system. An election has been called for June 10 to vote a bond issue of $10,000.

Jasper, Ala.—(Official)—Bids will be received by J. M. Phillips, Mayor, until 8 p.m., June 2, for constructing about 10,000 ft. of sewer laterals.

Louisville, Ky.—According to press reports, bids will be received by the Board of Public Works until May 27, for constructing the Preston and Shelby St. sewers. Estimated cost, $85,000. David R. Lyman is City Engr. Noted May 15.

Bedford, Ohio—Bids will be received by C. C. Lowe, Village Clk., until noon, May 22, for constructing a sewage disposal plant. Specifications may be obtained at the office of Wilbur J. Watson, Consult. Engr., Leader-News Bldg., Cleveland.

✚Bexley, Ohio—(Official)—Bids for constructing sanitary sewers here acording to plans prepared by A. Elliott Kimberly, Consult. Engr., Columbus, Ohio, were received May 13, as follows: Sieverling & Fairbairn, Springfield, Ohio, $46,013 with cement joints; $49,267 with asphaltic joints; F. R. Stone, Lima, Ohio, $47,553, $53,722; Wm. Jones, Carnegie, Penn., $51,913, $59, 446; S. T. Knight, Columbus, Ohio, $53,185, $55,283; Barnewolt Construction Co., Peoria, Ill., $53,525, $56,654; KOHBARGER & HOYLES, Marion, Ohio, $41,734, $43,256 (awarded contract). Noted May 1.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, May 28, for constructing main and lateral sewers and drains in various streets. M. J. Keefe is Secy.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Dir. Pub. Ser., until May 27, for laying sewers in various streets.

✚Delaware, Ohio—A contract to construct about 10,000 lin.ft. of sanitary sewers here has been awarded to TAYLOR & CHAMERS, Genoa, Ohio, at $6900. Bids were opened May 6.

✚Idlewood, Ohio—A contract to construct a system of storm sewers here has been awarded to SIEVERLING & FAIRBAIRN, Springfield, Ohio, at $39,423. Plans were prepared by the Pease Engineering Co., Marshall Bldg., Cleveland..

Newark, Ohio—(Official)—Bids will be received by James McCarthy, Dir. Pub. Ser., until noon, May 27, for constructing the 16th St. drainage sewer, the Buckingham St. sanitary and drainage sewer, and the Boyleston Ave. sanitary and drainage sewer.

Danville, Ind.—Bids will be received by the Board of Town Trustees until May 26, for constructing a sanitary sewer system. Estimated cost, $19,000.

Logansport, Ind.—Bids will be asked in June for constructing brick and pipe sewers here, estimated to cost $45,000. H. H. Thompson is City Engr. Noted May 8.

Flint, Mich. (Official) No bids were received, May 2, for constructing sanitary sewers in Baker St., Taylor St., Dort Ave. and Young St. The work will be done by the city. Noted Apr. 24.

★(Official)—Bids will be received by D. E. Newcomb, City Clk., until 2 p.m., June 3, for constructing approximately 33 miles of 8- to 66-in. sewers. Maps and profiles are on file, and plans and specifications may be obtained at the office of the City Engineer. Bids for this contract were received and rejected Apr. 26. Noted Apr. 13.

Oshkosh, Wis. Bids will be received by the Board of Public Works until May 24, for the construction of sewers in Joe and Fifth Sts.

Bangor, Wis.—(Official)—Bids for constructing about 10,000 lin.ft. of 10- to 24-in. sewers, with manholes and catch basins, were received by S. E. Weldon, Village Clk., May 12, as follows: A. J. Hewett, Milwaukee, Wis., $17,820; Frazer & Danforth, St. Paul, Minn., $17,800; Robert Nelson, Racine, Wis., $15,491; Kercher Bros., Hudson, Wis., $19,200; J. R. Holfeltz, Iron Mountain, Mich., $16,278; Gray Robinson Co., Manitowoc, Wis., $19,452.

Evansville, Wis.—Bids will be received by F. W. Gillman, City Clk., until May 22, for constructing about 8000 ft of storm and sanitary sewers. Bids were received on this contract May 6. Noted Apr. 24.

Park Falls, Wis.—(Official)—Bids will be received by J. F. Blanchard, City Clk., until 7:30 p.m., June 18, for laying 225 ft. of 6-in., 2283 ft. of 10-in., and 8840 ft. of 8-in. vitrified pipe sewers, 34 manholes, and 3 lampholes. W. G. Kirchoffer, Madison, Wis., is Consult. Engr. Noted Apr. 3.

Racine, Wis.—John W. Alvord, Sanitary Engr., Chicago, Ill., has made a proposition to the Common Council to prepare a report and plan relative to the sanitary conditions of Racine, with reference to the protection of the city's water supply, the disposal and purification of sewage wastes, and the protection of the waters of the river and harbor from objectionable conditions.

Tomah, Wis.—The town contemplates laying about 1½ miles of 8-in. tile sewer. William Koopman is Town Clk.

✚Carroll, Iowa—The contract to construct sewers here has been awarded to R. J. HAMILTON, Carroll, at $18,523. The other bids were: Midwest Engineering Co., Omaha, $24,219; Blackhawk Construction Co., Waterloo, $25,065; H. J. Cathroe & Co., Omaha, $21,825; J. C. Anderson, Marshalltown, $21,796; Briggs & Corey, Shenandoah, $21,696; Frazer & Danforth, St. Paul, Minn., $21,667; M. A. Camery, Harlan, $19,803. Noted Apr. 13.

Charlton, Iowa—(Official)—Bids will be received by G. J. Gittinger, City Clk., until 1 p.m., June 6, for constructing about 14,000 lin.ft. of 12- to 24-in. storm and sanitary sewers. F. W. Trost is City Engr. Noted Apr. 17.

✚Davenport, Iowa—The contract to construct a sanitary sewer system in the 13th Ward has been awarded to the DAN E. KEELER CONSTRUCTION CO., Davenport, at $67,757. The other bids were: Offerman Construction Co., Omaha, Neb., $78,400; E. R. Harding & Co., Racine, Wis., $88,290; Lytle Construction Co., Sioux City, $71,891; Independent Construction Co., Davenport, $83,704; Brogan & Pitz, Green Bay, Wis., $78,590; D. J. Ryan Construction Co., Davenport, $83,235; Ryder & Layton, Muscatine, $77,446. Noted May 15.

✚Waterloo, Iowa—A contract to construct sewers in Lafayette St. has been awarded to the BLACKHAWK CONSTRUCTION CO., Waterloo, at $6762.

Blackduck, Minn.—Bids will be received by D. D. Rolfe, Village Recdr., until 8:30 p.m., May 27, for constructing an Imhoff sewage tank.

Concordia, Kan.—A. E. Harper, Consult. Engr., Kansas City, Mo., has been retained by the city to prepare plans for the installation of a sewer system.

Dodge City, Kan.—Bids will be received by the City Commissioners until May 29, for constructing a sanitary sewer system, estimated to cost about $15,000. Plans were prepared by Fred Eckert, Consult. Engr., Larned, Kan. H. E. Bell is Mayor. Noted May 1.

Pittsburg, Kan.—The City Commission has authorized the City Clerk to advertise for bids for constructing a main storm sewer with laterals, on the South Side. Estimated cost, $16,000.

New Rockford, N. D.—The city has decided to install a sewer system, and will probably soon engage an engineer to prepare plans and superintend the work. Noted Dec. 12, under Water Supply—Irrigation.

✚California, Mo.—The contract to construct about four miles of lateral sewers here has been awarded to BEN INMAN, California, at $16,495. Bids were opened May 7. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Apr. 24.

St. Louis, Mo.—The date of receiving bids for Letting No. 10,897, sewers in Rock Creek Sewer District No. 2, is May 23, not May 28, as noted in our issue of May 15.

Webster Groves, Mo.—(Official)—Bids will be received on or about July 21, for constructing a sanitary sewer system in District No. 7. Estimated cost, $20,000. The contract will include the construction of vitrified clay pipe sewers, brick manholes and flush tanks and a sewage disposal plant. Plans were prepared by the Fuller-Coult Co., St. Louis, Mo. W. A. Fuller is City Engr.

Conway, Ark.—Bids are being received for the construction of a sewer system here, estimated to cost $45,000. G. H. Burr is Engr. Noted Apr. 17.

Watonga, Okla.—(Official)—At the special election held May 16, bonds for $35,000 for a sanitary sewer system and disposal plant were carired. Plans and specifications are being prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted May 8

✚San Diego, Calif.—The contract to construct sewers in Balnoa Park has been awarded to the ENGINEERING & CONTRACTING CORP., San Diego, at $37,933. Noted May 8.

GARBAGE

+Columbus, Ohio—The contract was awarded, May 14, to the GRISCOM-RUSSELL CO., Massillon, Ohio and 90 West St. New York, for the construction of an incinerator, at $14,000.

Columbus, Ohio—The city has decided to issue bonds for $7500 for the purchase of an additional building and equipment for the removal and disposal of garbage Henry Maetzel is City Engr.

Martins Ferry, Ohio—The city has decided to issue $7000 of bonds for the construction of a garbage crematory. William Rowlands is Council Clk.

+St. Louis, Mo.—The Board of Public Improvements, May 13, awarded the contract to the INDIANA REDUCTION CO., Indianapolis, Ind., for the disposal of the city's garbage, at 87c. per ton. The company will erect, a plant to cost about $200,000.

STREETS AND ROADS

Barre, Vt.—(Official)—Bids will be received until 7 p.m., May 27, by the Street Commissioners, for the construction of about 7000 sq.yd. of granite block paving on North Main St. George A. Reed is City Engineer.

Athol, Mass.—The following bids were received May 13, by the State Highway Commissioner, 15 Ashburton Place, Boston, for the construction of 8100 lin.ft. of macadam road: R. F. Hudson, Melrose, $44,499 and Hassam Paving Co., Worcester, $50,576. No contract was awarded; also the following bids at the same place and time were received for paving for the Athol Street Ry. Co.: Daniel O'Connell's Sons, Holyoke, $19,734, Hassam Paving Co., Worcester, $18,894 and R. F. Hudson, Melrose, $18,577. No awards were made. Noted Apr. 10.

Boston, Mass.—Bids will be received until May 26, by the Department of Public Works, for bituminous macadam pavement in Calumet Place, Roxbury, and artificial stone sidewalks on Armandine, Dudley and Nightingale Sts., Dorchester. L. K. Rourke is Comr.

+The contract for the construction of artificial stone sidewalks on Minot St., Dorchester District, was awarded to DAVID M. BIGGS & CO., at $5640. Other bids were: Jas. Doherty, $5954; W. A. Murtfeldt Co., $6110; Warren Bros. Co., $6196; Jere. J. Sullivan, $6137; Boston Paving Co., $7513.

+The contract for the construction of an asphalt macadam roadway on Haansbrough St., Dorchester District, was awarded to JAMES DOHERTY, at $4123. Other bids were: William J. Rafferty Co., $4223; Boston Paving Co., $4617; J. C. Coleman & Sons Co., $4845. Noted May 8.

Boston, Mass.—See item under Sewers.

Boston, Mass.—(Official)—All bids received by the State Highway Commission for 8100 lin.ft. of surfacing on Main and School Sts., Athol, and the construction of 10,000 lin.ft. highway in North Andover, were rejected. W. W. Woodward is Chn. of Road Comrs. Noted May 8.

Bids will be received by the Directors of the Post, 40 Central St., until noon, May 28, for paving in Northern Ave., D St., and on Pier 6, also building sewers, surface drains and water pipes on same streets, and paving outer part of the pier with vitrified brick on concrete base. Hugh Bancroft is Chn., Frank W. Hodgkins is Ch. Engr.

+Grafton, Mass.—The State Highway Commission has awarded a contract for the construction of 7800 lin.ft. of macadam roads to the HORNE-LOWE CONTRACTING CO., at $8277. The only other bidder was J. J. Martin, at $9952. A. W. Dean is Ch. Engr.

+North Andover, Mass.—The contract for the construction of 10,000 lin.ft. of road was awarded by the State Highway Commissioner to D. J. SHEEHAN, Lynn, Mass., at $15,528. Other bids were: Hassam Paving Co., Worcester, $18,392; Rowe Contracting Co., Boston, $19,935. J. A. Gaffey, Medford, $20,555; T. A. Moynahan, Hamilton, $20,820; W. P. Rae, Lawrence, $22,450; R. F. Hudson, Melrose, $22,483; A. Michellu, Reading, $24,599.

+Pittsfield, Mass.—It is reported that the State Highway Commissioner has awarded a contract fo rthe construction of 12,000 lin.ft. of macadam road to O. G. BENEDICT, at $21,730. Wm. D. Sohier is Chn. of the Com.

+Providence, R. I.—(Official)—The State Board of Public Roads has awarded contracts as follows: To AMOS D. BRIDGES' SONS, Hazardville, Conn., for construction of roads in Bristol and Warwick; to OSCAR W. RACKLE, Providence, for roads in Warren and Tiverton, and to WALTER CRESSY, Gloucester, Mass., for road construction in South Kingston, East Providence, Tiverton, Portsmouth and Middletown. John H. Edwards is Chn. of the Bd. Noted May 15.

Bids will be received until noon, May 28, by the State Board of Public Roads for resurfacing the following roads; 6660 lin.ft. in Thornton, 21,120 lin.ft. in Johnston, North Providence and Smithfield, 31,680 ft. in Smithfield and Gloucester. John H. Edwards is Chn.

+Hartford, Conn.—(Official)—Contracts were awarded by the Board of Contract and Supply to the EDWARD BALF CO., Hartford, at $44,926, for asphalt paving on various streets, and to F. B. & W. H. O'NEIL, Hartford, at $7562, for granite block paving. R. N. Clark is City Engr. Noted May 1 and May 15.

+Hartford, Conn.—The contract for the construction of 8027 lin.ft. of native macadam road on the Manchester-Coventry Turnpike, in the town of Coventry, has been awarded to the AHERN CONSTRUCTION CO., Willimantic, Conn., at $2.05 per lin.ft. for macadam, $1.25 per lin.ft. for rubble drain, $8 per cu.yd. for concrete walls, $6 for masonry walls, and $5 for dry rubble walls.

Hartford, Conn.—Bids will be received until 2 p.m., May 29, by the State Highway Commission for construction of state highways in the following towns: Middlebury, Monroe, Wallingford, Fairfield, Somers, Middlefield, Stafford, Prospect, Chester, Simsbury, Ellington, Old Eyme and Middltown. C. J. Bennett is Comr.

New Haven, Conn.—The city plans to pave parts of Chapel, Sollege and Sachem Sts. and Congress Ave. with wood blocks. Frederick L. Ford is Engr.-in-Charge.

Batavia, N. Y.—(Official)—Bids will be received until 8 p.m., May 26, by the Board of Trustees for brick paving on Liberty St., Thomas and Dellinger Aves. The work includes 11,200 sq.yd. of paving, concrete curbing, 10-, 12- and 15-in. storm sewers and catch basins. R. L. Fox is City Engr. Noted May 1.

Brooklyn, N. Y.—(Official) The following bids were received on May 14, by the President of the Borough of Brooklyn, Borough Hall, for paving Berry St., from North 14th St to North Fourth St., and from Grand St. to Division Ave., and for paving Lorimer St., from North St. to Nassau Ave.: Crawford Co., Brooklyn, $35,877; Borough Asphalt Co., $37,024. Alfred F. Steers is Pres.

Brooklyn, N. Y.—Bids will be received until 11 a.m., May 28, by the President of the Borough o, Brooklyn, Borough, Hall, for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway or Avenue L, from E. 34th. St. to Flatbush Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway or Maple St., from Nostrand Ave., to Canarsie Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway or Avenue N, from Coney Island Ave. to a line about 139 feet east of E. 15th St.; for regulating, paving and repaving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of 59th St., from 7th Ave. to Fort Hamilton Ave. Alfred F. Steers is Pres.

+Buffalo, N. Y.—The Department of Public Works has awarded a contract to CALDWELL, JOYCE & STRACK, at $11,392, for grading and curbing a portion of Center St.

+Mechanicsville, N. Y.—The Village Trustees have awarded a contract for paving various streets to WEED & WALSH, at $20,735. The only other bidder was H. M. Parker, Hudson, at $21,788.

New York, N. Y.—(Official)—The Board of Water Supply has rejected all bids received for surfacing with brick the highways around the Ashokan Reservoir under Contract No. 134. No time has been set for readvertising the work. Chas. Strauss is Pres. of the Bd. Noted Jan. 2 and Feb. 27.

(Official)—The following bids were received on May 15, by the Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., for paving, where required, with bituminous pavement, the west drive of Central Park, from 110th St. and Eighth Ave., southerly to 102nd St., and from the Webster Monument southerly to 59th St. and Fifth Ave.: Barber Asphalt Paving Co., 233 Broadway, $108,510; Dayton Hedges, 1451 Broadway, $90,450; Sicilian Asphalt Co., 41 Park Row, $94,750; Topeka Co., 147 Fourth Ave., $99,045; Uvalde Contracting Co., 1 Broadway, $111,115; Warner-Quinlan Asphalt Co., 79 Wall St., $93,680. Charles B. Stover is Comr.

+New York, N. Y.—(Borough The Bronx)—(Official) The following contracts have been awarded by the President of the Borough, Municipal Bldg., Third Ave., and 177th St., for paving in various streets: Bathgate Ave., from East 188th St. to Fordham Road, to the ASPHALT CONSTRUCTION CO., Madison Ave. and 137th St., at $6266; West 172d St., from Aqueduct Ave. to Jessup Ave., to DE MUNN WE PARLA, at $15,148; Van Nest Ave., from West Farms Road to Bear Swamp Road, to HARRIS & ROSE, at $36,308; Westchester Ave., from Southern Blvd. to Ward Ave., to ASPHALT CONSTRUCTION CO., at $82,546; Webber Ave., from East 178th St. to East 187th St., to ASPHALT CONSTRUCTION CO., at $55,762. Bids were received on May 14. Cyrus C. Miller is Pres.

(Borough The Bronx)—Bids will be received until 3 p.m., May 24 by the Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Manhattan, for constructing gutters on the City Island Road and extending the road at Bartow Station, in Pelham Bay Park, in the Borough of the Bronx. Charles B. Stover is Commr.

+Rochester, N. Y.—The Board of Contract and Supply has awarded the contract for resurfacing Portland Ave. with asphalt to WHITMORE, RAUBER & VICINUS, at $32,721. The low bidders for paving Maple St. with asphalt were the Flower City Contracting Co., and Julius Friedrich, at $7366. Edwin E. Fisher is City Engr.

+Blairstown, N. J.—The Board of County Freeholders has awarded a contract for the construction of a rock road between Blairstown and Hainesburg, about 4½ miles, to SALMON BROS., Netcong, N. J., at $54,753. Other bids received were: Salmon Bros. (gravel road), $49,278; Miller Engineering & Contracting Co., Philadelphia (gravel), $46,625 (rock), $49,994; J. T. Harrop & Co., Garfield, N. J. (rock), $56,805.

Elizabeth, N. J.—(Official) Bids will be received until 3 p.m., May 26, by the Committee on County Roads of the Board of Chosen Freeholders of Union County, for the improvement of St. George Ave., from Grand St. to Leesville, in the city of Rahway.

Bids will be received until 3 p.m., May 27, by the Union County Freeholders for improvement of the west section of Morris Ave., from Keeler St. to Milburn Ave., Springfield Township. Jacob L. Bauer is County Engr.

Bids will be received until 8 p.m., June 2, by the City Council for various improvements on Lafayette, Flora and Catherine Sts. and Clark Place. William P. Neafsey is St. Comr.

+Irvington, N. J.—The Town Council has awarded a contract for paving and curbing 19th Ave., to the NEWARK PAVING CO., at $8915.

Princeton, N. J.—The State Road Commissioner has ordered a survey of Witherspoon St., from the Princeton line to the Somerset County line, preparatory to building a new road. Edwin A. Stevens is Comr.

Rutherford, N. J.—(Official)—Bids will be received until 8 p.m., June 13, by the Borough Council for paving Station Sq. and Park Ave., from Station Sq. to Rutherford Ave., with vitrified paving block. The work consists of 25,800 sq.yd. for the Borough, and 12,400 sq.yd. for the street railway company. Frank A. Stedman is Boro. Clk.

Trenton, N. J.—The State Road Commissioner has approved the plans submitted by the Board of County Freeholders of Mercer County for the Hopewell, Mt. Rose and Rosedale Road, and the Yardville, Windsor and Newton Road. The cost of construction is estimated at $130,000.

+Ashland, Penn.—(Official)—The Street Committee of the Borough Council has awarded a contract to BANKS & KALBACH, Wildwood, N. J., at $2.24 per sq.yd. for approximately 6300 sq.yd. of paving with Paterson block on Oakland Road. The other bidders were: General Construction Co., Williamsport, Penn., $2.37; Herrick Construction Co., Wilkes-Barre, Penn., $2.39. J. William Ritz is Town Clk. Noted Apr. 24.

+Barnesboro, Penn.—The Borough Council has awarded the contract for 5½ blocks of street paving to POLO OBBARA, Barnesboro, at $11,563. The Bell-Bockel Co., Altoona, bid $13,177.

Harrisburg, Penn.—(Official)—Bids for the construction of three roads in Lancaster County, bituminous macadam construction, penetration method, were received by the State Highway Commission as follows: (a) Corrugated pipe culvert; (b) cast-iron pipe culvert: Manheim Township, 20,235 ft.: John B. Shreiner, Manheim, Penn., (a) $63,598; (b) $64,032; Duquesne Contracting Co., Pittsburgh, Penn., (a) $72,017; (b) $72,261; Ambler-Davis Co., Philadelphia, Penn., (a) $70,210; (b) $70,563. Warwick Township, 24,105 ft.: Duquesne Contracting Co., Pittsburgh, Penn., (a) $89,435; (b) $90,263; Ambler-Davis Co., Philadelphia, Penn., (a) $72,993; (b) $74,310; Daniel S. Bader, Philadelphia, Penn., (a) $84,896; (b) $87,417; Stucker Bros. Construction Co., Harrisburg, Penn., (a) $113,453; (b) $114,508; George C. Souder, Lancaster, Penn., $71,706; (b) $72,824. West Earl Township, 9951 ft.: Duquesne Contracting Co., Pittsburgh, Penn., (a) $36,770; (b) $36,983; Ambler-Davis Co., Philadelhia, Penn., (a) $30,728; (b) $31,043; Matthew J. Best, Philadelphia, Penn., (a) $26,401; (b) $26,697; George C. Souder, Lancaster, Penn., (a) $32,381; (b) $32,632; John B. Shreiner, Manheim, Penn., (a) $32,801; (b) $33,147. E. M. Bigelow is Comr. Noted Apr. 24.

St. Marys, Penn.—(Official)—Bids will be received until 2 p.m., May 24, by the Borough Council, for grading, paving and curbing various streets. About 11,000 sq.yd. of brick paving will be required. Chas. P. Harvey is Boro. Secy.

+South Brownsville, Penn.—(Official)—The Borough Council has awarded the contract for the improvement of Shady Ave. to CRAFT & GANS, Uniontown, Penn., at $8272. Other bidders were: James Nixon, $8373; J. G. McGuire & Co., $8895. L. G. Moslener is Boro. Engr. Noted May 8.

Uniontown, Penn.—(Official)—All bids received May 14, for the construction of a brick or asphaltic concrete road in German Township, Fayette County, were rejected, and new bids will be received until May 26. Willard O. White, First Natl. Bank Bldg., Uniontown, is Engr. Noted May 8.

+Uniontown, Penn.—The Commissioners of Fayette County have awarded a contract for paving 8200 lin.ft. of road in South Union Township with brick and telford to the UNIONTOWN CONSTRUCTION CO. at $16,536, the county to furnish the brick. Thomas H. Hudson is County Solicitor. Noted Apr. 24.

West Chester, Penn.—Bids will be received by the Supervisors of West Sadsbury Township until 6 p.m., May 26, for grading and macadamizing 11,285 lin.ft. of the Upper Valley Road from Atglen to Parkersburg, Chester County. Harry Chalfant, Lenover, Chester County, Penn., is Secy. of the Supervisors.

Wilmington, Del.—(Official)—Bids will be received until noon, May 27, by the State Highway Commissioner of New Castle County, for the constructon of a macadam road from Stanton to the Oak Tree Corner, about 0.6 mile in length. James Wilson is Comr.

Petersburg, Va.—An appropriation of $26,000 has been made by the city for paving portions of Brown, Perry and Hasell Sts. with wood block. R. H. Judd is City Engr.

+Stafford, Va.—(Official)—The contract for constructing five miles of the White Oak Road, and five miles of the River Road, Stafford, County, has been awarded to L. B. MANVILLE, Newport News, Va., at $20,000. G. B. Wallace, Fredericksburg, Va., is Commonwealth Attorney. Noted May 15.

Parkersburg, W. Va.—The voters recently authorized a bond issue of $200,000 for street and sewer improvements. The Mayor may be addressed.

Charleston, S. C.—(Official)—The low bidders on about 30,000 sq.yd. of street paving, bids received May 6, were as follows: Sheet asphalt, Louis Laneson, Norfolk, Va., asphaltic concrete, the Wood Construction Co., Chattanooga, Tenn., wood block, the Creosoted Wood Block Paving Co., New Orleans, La., and the Simons Magrant Co., Charleston. The contract has not yet been awarded. J. H. Dingle is City Engr. Noted Apr. 17.

+Jacksonville, Fla.—(Official)—Bids will be received until 3 p.m., June 12, by the Committee on Public Works of the Board of Bond Trustees for about 96,000 sq.yd. of pavement on various streets, divided as follows: Dolarway, 26,141 sq.yd.; asphaltic concrete, 32,508 sq.yd.; vitrified block on concrete base, 27,743 sq.yd.; vitrified block on sand base, 3758 sq.yd., granitoid, 4826 sq.yd.; asphalt block, 1190 sq.yd. Henry Gaillard is Chn. of Com. L. D. Smoot is Ch. Engr.

+Pensacola, Fla.—(Official)—The Board of Bond Trustees has awarded a contract to W. P. KENNEDY, Pensacola, at $31,392, for the construction of 22,000 sq.yd. of concrete pavement and 14,400 lin.ft. curb. Other bidders were: R. S. Blome Co., $36,680; Southern Paving Construction Co., $37,764; W. E. Taylor, $33,160. George Rommel, Jr., is Ch. Engr. Noted Apr. 24.

Montgomery, Ala.—Bids will be received until June 2 by the Board of Revenue of Montgomery County for graveling 5½ miles of the Snowdon-Chambers Road, five miles of the Line Creek Road and 1½ miles of the Naftel Road. Thos. W. Edwards is County Engr.

New Decatur, Ala.—(Official)—All bids received May 12 by the City Council for various street improvements were rejected, and the work will be re-advertised at a later date. A. M. Lund is City Engr. Henry Hartung is Clk. Noted May 1.

Mount Sterling, Ky.—Bids will be received until June 3 by the City Council for about 2440 sq.yd. of paving and 1575 lin.ft. of curb and gutter on North Maysville St. Bids will be accepted on vitrified block, asphalt, bitulithic or tarvia on concrete base. H. M. Ringo is City Clk.

Ashville, Ohio—(Official)—Bids will be received until noon, May 26, by the Village Council, for grading, curbing, paving with brick and otherwise improving Main St., from Scioto to Walnut Sts. About 5570 sq.yd. paving will be required. E. F. Schlegel is Village Clk.

Canton, Ohio—(Official)—Bids will be received until 10 a.m. May 26, by the Commissioners of Stark County, for the improvement of about 1½ miles of the Canton-Canal Dover Road by curbing and paving with brick. The estimated cost is from $83,667 to $94,764, according to curbing used. J. H. McConnell is Audr.

Cleveland, Ohio—(Official)—Bids will be received until 11 a.m., June 11, by the Board of Commissioners of Cuyahoga County, for improvement of the Aurora Road. Frank R. Lander is County Surv.

+Columbus, Ohio—(Official)—The State Highway Commissioner has awarded a contract to O. M. JUNK, Chillicothe, Ohio, at $7333, for improving the Lancaster Road, Franklin County, and a contract to KORAH E. KUNKLE, Dayton, Ohio, at $6347, for improving Section 2 of the Devalon Road, Fayette County. Other bidders were: E. C. Radebaugh, Logan, Ohio; P. Brewer, Chillicothe, Shumway & Shumway, Portsmouth, Ohio; Lunsford Bros., Pedro, Ohio. Noted May 1.

(Official)—Bids will be received until 2 p.m., May 29, by the State Highway Commissioner for grading and paving with concrete .84 miles of the Belmont National Road, Union Township, at an estimated cost of $11,011, or as an alternative bid, for paving with brick, at an estimated cost of $12,900; for grading and paving with waterbound macadam, one mile of the Piqua Urbana Road, Mad River Township, at an estimated cost of $7739; for grading and paving with waterbound macadam, one mile of the Willshire-Fort Recovery Road, Willshire Township, at an estimated cost of $4828. James R. Marker is Comr.

+Columbus, Ohio—The Commissioners of Franklin County have awarded a contract to THEODORE VOGELBERG at $31,086 for improving four miles of road in Madison Township, the J. M. SNAUFFER CONSTRUCTION CO. was awarded contracts as follows: $67,884 for improving eight miles of the Jackson Pike, at $20,820 for improving the Park Road, Sharon Township, at $7131 for the Atcheson Road, Clinton Township, and at $23,003 for improving the Livingston Ave. Road, Truro Township. Noted May 1.

+Dennison, Ohio—(Official)—The Village Council has awarded contracts to GEORGE J. BOCK & SON, Coshocton, Ohio, at $21,098 and $10,600 respectively for improving First St. and Miller Ave. Edward Stingel is City Engr. John A. Foust is Clk. Noted May 1.

Galion, Ohio—(Official)—Bids will be received until noon, May 26, by the City Council, for paving portions of Cherry and Jefferson Sts. and Paynes Ave., about 18,210 sq.yd. in all. Ed. O. Yochem is City Clk.

Lancaster, Ohio—Bids will be received until June 5 by the Director of Public Service for paving Locust St. with vitrified brick. R. F. Brown is Dir.

Painesville, Ohio—(Official)—Bids will be received until noon, May 24, by the Director of Public Service for paving on four streets. The work includes approximately 33,000 sq.yd. of brick pavement, and 18,350 lin.ft. of stone curb. F. N. Downer is City Engr. S. A. Haskell is Dir.

Steubenville, Ohio—The City Council has authorized the Director of Public Service to advertise for bids for improving portions of Smith, McDowell and Railroad Aves. George W. McLeish is Mayor. Hugh W. Patterson is Clk. of Council.

+Springfield, Ohio—The Board of Control has awarded the contract for paving South Limestone St., from Rice to Leffels Lane, a distance of about one mile, to EDWARD FRYAN, at $43,431. Trinidad lake asphalt with concrete curb and gutter will be used. Edward Schaefer is Dir. Pub. Ser.

Wyoming, Ohio—(Official)—Bids will be received until noon, June 14, by the Municipal Council, for improving portions of Poplar, Cooper, Crescent, Grove and Pendery Aves. George H. Eversman is Village Clk.

Indiana—(Official)—Bids for road improvement in Indiana will be received as follows:

June 3, at Bedford, by Commissioners of Lawrence County, for construction of gravel and macadam roads and streets in the county, 13 in all. Ezra W. Edwards is Audr.

June 3, at Kokomo, by Commissioners of Howard County, for construction of three gravel and stone roads in Center and Ervin Townships. E. B. Swift is Audr.

June 3, at Marion, by the Commissioners of Grant County, for construction of three roads in Center Township and one in Van Buren Township. E. H. Kimball is Audr.

June 4, at Columbia City, by the Commissioners of Whitley County, for a road in Smith Township. Chas. E. Kiser is Audr.

June 4, at Bloomington, by the Commissioners of Monroe County, for constructing gravel roads in Richland and Van Buren Townships. W. F. Kinser is Audr.

June 5, at Wabash, by the Commissioners of Wabash and Kosciusko Counties, for the construction of a road on the county line. Daniel Showalter is Audr. of Wabash County.

June 6, at Corydon, by the Commissioners of Harrison County, for the construction of roads in Spencer, Washington and Franklin Townships. J. L. O'Bannon is Audr.

June 6, at Mount Vernon, by the Commissioners of Posey County, for the construction of a road in Black Township. James R. Haines is Audr.

+Danville, Ind.—The Commissioners of Hendricks County have awarded a contract for a stone and gravel road, about five miles long, in Lincoln Township, to AARON M. LISBY, Coatesville, Ind., at $25,750. Lewis W. Borders is Audr. Noted Apr. 24.

+Fowler, Ind.—(Official)—The Commissioners of Benton County have awarded a contract to EVANS & VANATTA, Fowler, Ind., at $18,600, for the construction of a stone road on the line between Benton and Tippecanoe Counties. D. L. Heaton is County Surv. Noted May 8.

Goshen, Ind.—Bids will be received until June 2, by the Common Council, for paving portions of Madison, Clinton, Third, Washington, Jefferson, Monroe and Douglas Sts. Vitrified brick will probably be used, but bids will be accepted on any kind of standard material.

LaPorte, Ind.—(Official)—Bids will be received until 10 a.m., May 29, by the Commissioners of Laporte County, for the construction of seven gravel roads in the county. Fred A. Hausheer is Audr. Noted May 15.

✚Newport, Ind.—(Official)—The Commissioners of Vermillion County have awarded a contract to GEORGE R. CHAPMAN at $23,800 for the construction of a gravel road in Vermillion Township. Roy Slater is Audr. Noted Apr. 17.

✚Sullivan, Ind.—The Commissioners of Sullivan County have awarded road contracts as follows: Campbell Road, Hamilton Township, to MALADY C. LLOYD, at $10,370; Section 1 of the Hughes Road, Hamilton Township, to KEEGAN BROS., Brazil, Ind., at $9080, and Section 2 of the same road, to O. T. PIETY, at $5800.

✚Tipton, Ind.—(Official)—The Commissioners of Tipton County have awarded a contract to T. R. GUNN, Atlanta, Ind., at $4389 for the construction of a gravel road. T. McKinney & Bro. bid $4489. Jesse O. Bowlin is County Engr. B. H. Tranbarger is Deputy Audr. Noted May 1.

✚Iron Mountain, Mich.—The Board of County Road Commissioners of Dickinson County has awarded a contract to JOHN E. BLOMGREN at $11,050 for the construction of about six miles of the Randville-Felch Highway. Other bidders were: Gus Freedeen, $13,689; Martin King. $15,110 and Wahlstrom Bros., $15,900.

Edwardsville, Ill.—(Official)—Bids will be received until 2 p.m., June 2, by the State Highway Commission, at the Town Clerk's office, Edwardsville, for improving the Old Fair Grounds Road, for a distance of about 6000 ft., and for improving 7985 lin.ft. of the Edwardsville-Troy Road. Bids will be received on three types of construction as follows: (1) Concrete roadway with macadam shoulders; (2) brick roadway with macadam shoulders; (3) concrete roadway without macadam shoulders. Peter Dresch is Town Clk.

Elgin, Ill.—(Official)—Bids will be received until 10 a.m., May 28, by the Board of Local Improvements for 11,300 sq.yd. of asphaltic concrete pavement on Division St. Albert Fehrman is Pres., M. H. Brightman is Secy. of the Bd.

Iowa Falls, Iowa—(Official) The contract for the construction of about 20,129 sq.yd. of paving and 10,800 lin.ft. of curb has been awarded to the KAW PAVING CO., Topeka, Kan., at $29,268. Other bidders were: M. A. Camary, $32,282; Elzy & Carlson, $34,007; the Dearborn Construction Co., $30,337. S. B. Gardner is City Engr. Noted May 1.

✚Muscatine, Iowa—The City Council has awarded a contract to the FORD PAVING CO., Cedar Rapids, Iowa, at about $90,000, for paving various streets with bitulithic, and the KORNEMAN PAVING CO., Muscatine, secured the contract for paving several alleys. C. H. Young is City Engr. Noted May 8.

✚Hibbing, Minn.—The City Council has awarded contracts to COONS & BUTLER, Hibbing, for about 15,000 sq.yd. bitulithic paving at $2.48 per yd., and for 22,000 sq.yd. creosoted wood block paving at $2.33 per yd.

Minneapolis, Minn.—(Official)—Bids will be received until 11 a.m., June 2, by the Board of Commisiosners of Hennepin County for repairing and graveling part of Road 105 in the Town of Champlin. Al. P. Erickson is County Audr.

Eldorado, Kan.—The City Council has decided to pave about 20 blocks of streets in the business districts, and bids will be asked as soon as plans can be prepared.

✚Cape Girardeau, Mo.—The City Council has awarded a contract to JOHN ROUSE, at $10,981, for paving portions of Bellevue and Themis Sts. Other bidders were: T. Haas, $12,155, and Harmon Loeffel, $11,125.

St. Louis, Mo.—(Official)—Bids will be received until noon, May 27, by the Board of Public Improvements for reconstructing portions of Pine, O'Fallon and Mullanphy Sts. E. R. Kinsey is Secy.

Conway, Ark.—Paving District No. 1 has recently been formed, and will lay from 10,000 to 12,000 sq.yd. of brick or creosoted block pavement, for which the sum of $25,000 is available. G. H. Burr is Engr. W. M. Harrell is Comr.

Fort Smith, Ark.—The Board of Improvements will sell bonds for $530,000, for municipal improvements, of which $350,000 will be used for street paving. M. H. Reed is City Engr.

Bastrop, Tex.—(Official)—Bids will be received until noon, May 26, by the County Court of Bastrop County for constructing about 40 miles of graveled roads with bridges and culverts in Road District No. 1. Abney & Mitchell, Eagle Lake, Tex., are Engrs.-in-Charge. J. B. Price is County Judge.

✚Longview, Tex.—The City Council has awarded a contract for the improvement of various streets to ROACH, MANGAN & CO., Fort Worth, Tex., at approximately $75,000. There were three other bidders on the work.

✚Nacogdoches, Tex.—(Official)—The City Council has awarded the contract for 11,450 sq.yd. of creosoted wood block pavement and 3800 sq.yd. of vitrified block pavement to the MUNICIPAL PAVING CO., Dallas, Tex., at approximately $48,000. The Aetna Engineering Bureau, Chicago, Ill., is Engr.-in-Charge. J. R. McKinney is City Secy. Noted May 1.

Tulsa, Okla.—The City Commission is having plans prepared and will soon ask for bids for about 13 blocks of street paving on Independence and Haskell Aves., North Ninth and Golden Sts. T. C. Hughes is City Engr.

Phoenix, Ariz.—(Official)—All bids received May 10 by the Commissioners of Special Road Dist. No. 1, Maricopa County, for road construction, were rejected as excessive. Edwin M. Lamson is Clk. Noted May 8.

✚Ritzville, Wash.—(Official)—The contract for the construction of Permanent Highway No. 3, Adams County, was awarded to S. S. SCHULER, Ritzville, Wash. There were six other bidders. J. L. Cross is Audr. Adams County. Noted May 1.

Seattle, Wash.—T. Ryan & Co., Lowman Bldg., at $60,913, were low bidders for paving Grand Ave. Other bidders were Ferguson-Coit Co., $62,233, D. H. Traphagen, $62,741, McQuaid & Wood, $61,350.

✚The Board of Public Works has awarded a contract to the ELLIOTT CONSTRUCTION CO. at $31,403 for paving 11th Ave., West, with bitulithic pavement.

✚Tacoma, Wash.—(Official)—The Commissioner of Public Works has awarded a contract to JAS. WARTER, SR., at $35,312, for paving North Oakes St., from Sixth Ave. to North 21st St., with asphaltic concrete. A. T. Metzger is Ch. Clk to Comr. W. C. Raleigh is City Engr. Noted May 8.

✚Baker, Ore.—(Official)—The Board of City Commissioners has awarded a contract to J. C. WHITE, Baker, Ore., for graveling and grading on Washington St. Ira L. Hoffman is Acting City Engr. James Cunning is City Clk. Noted May 8.

✚Salem, Ore.—A contract for paving various streets has been awarded to the AMBROSE-BURDSELL CONSTRUCTION CO., at $19,483.

✚Springfield, Ore.—A contract has been awarded to the CLARK & HENRY CONSTRUCTION CO. at $1.30 per sq.yd. for paving 18 blocks on Fourth and Fifth Sts.

✚Alhambra, Calif.—(Official)—The City Trustees have awarded a contract to W. A. KEEP, 28 South Olive St, Alhambra, for improving San Mario Ave., from Adams to Fourth Sts., by grading, oiling, constructing curb, gutter and sidewalks. T. B. Downer is City Engr. O. M. Caulk is City Clk. Noted May 1.

✚Colton, Calif.—(Official)—The City Trustees have awarded a contract to the PAGNESSA CONSTRUCTION CO., 211 Story Bldg., Los Angeles, at $34,561, for about 1½ miles of asphalt and oiled macadam pavement. Other bidders were: Fairchild-Gilmore-Wilton Co., $38,362; Highway Construction Co., Redlands, Calif., $40,047; W. D. Bahan, San Bernardino, Calif., $38,791; Los Angeles Paving Co., $38,418; and the Johnson-Shea Co., Riverside, Calif., $44,790. Chas. H. Wondries is City Engr. Noted May 1.

✚Los Angeles, Calif.—A contract for the improvement of Crocker St., from Fourth to Ninth Sts., was awarded to FORD & STOUT, at $26,114, for about 1¼ miles. FORD & STOUT, at $8991 was awarded the contract for improving Olive St. from Pelos Verdes to Mesa Sts. Homer Hamlin is City Engr.

✚The Board of Trustees has awarded contracts for street improvements as follows: To the FAIRCHILD-GILMORE-WILTON CO., at $7900 and $5218, respectively, for paving Cleveland St., from College to Alpine Sts., and Ottawa St., from Figueroa to Georgia St., with asphalt; BARBER ASPHALT PAVING CO., at $10,366, for paving Hobart Blvd., from 29th to Jefferson St.

✚National City, Calif.—The City Trustees have awarded a contract to the BARBER ASPHALT PAVING CO., Los Angeles, at $51,196, for paving National Ave., from 13th to 18th Sts., with asphalt. H. A. Kuehnstead is City Engr. Noted Apr. 24.

San Fernando, Calif.—Clarence L. Robinson was low bidder at $43,000, for various street improvements. S. G. Chamberlain is City Engr. Noted May 1.

San Francisco, Calif.—Bids as follows were received by the directors of the Panama Pacific Exposition Co., for grading the site for the Municipal Auditorium, and for the construction of a pile roadway in Fulton Basin: Excavating for auditorium: E. M. Huie Co., $32,012; Foster Voght Co., $36,897; Selby Grading & Teaming Co., $36,800; Healy-Tibbits Construction Co., $46,543; Daniel O'Day, $50,000; Contra Costa Construction Co., $43,900; State Construction Co., $37,965. Improvement of Fulton Basin: J. Monk, $11,736; Thompson Bridge Co., $8742; Healy-Tibbitts Construction Co., $6920; Central California Construction Co., $16,000.

Santa Ana, Calif.—The Highway Commissioners of Orange County will ask bids about June 1, for the improvement of approximately 50 miles of county roads.

Santa Monica, Calif.—Bids will be received until 5 p.m., May 26, by the City Clerk for improving a portion of Fremont Ave. G. A. Murray, is City Slerk.

✚Yreka, Calif.—The Board of Trustees has awarded the contract for paving Miner St. to the CLARK & HENRY CONSTRUCTION CO. at $22,000.

London, Ont.—(Official)—Bids will be received until 5 p.m., May 29,by the members of No. 2 Committee, for the construction of about 6700 sq.yd. of asphalt pavement, and concrete curb and gutters. W. B. Bennett is Chn. of the Com. W. N. Ashplant is City Engr.

INDUSTRIAL WORKS

✚Boston, Mass.—The contract for the factory to be built at 118-134 Harrison Ave. for the Eclipse Mfg. Co. has been awarded to the NATIONAL FIRE PROOFING CO., 120 Franklin St. The structure will be of reinforced concrete, three stories, 70x199 ft. Estimated cost, $90,000. Monks & Johnson, 7 Water St. are Engrs.

✚Indian Orchard, Mass.—The contract for the construction of a one-story, 60x200 ft. addition to the factory of the Indian Orchard Co., has been awarded to the CASPER-RANGER CONSTRUCTION CO., Holyoke, Mass.

✚Rockland, Mass.—The contract for the construction of a three-story, 100x45 ft. addition to the plant of the Hurley Shoe Co., on Church St., has been awarded to the H. C. BRIGGS CONSTRUCTION CO., Brockton, Mass.

Springfield, Mass.—The construction of a four-story, 58x100 ft. laundry on Franklin St., is contemplated by Fred Wells. Estimated cost, $26,000.

✚Williamansett, Mass.—The contract for the erection of a factory for the C. F. Church Mfg. Co., at Williamansett, at Montgomery and Orange Sts. has been awarded to HONORE MARTINEAU, 1021 Dwight St., Holyoke, Mass. The structure will be 40x225 ft., one story.

+Bridgeport, Conn.—The contract for the foundation work for an addition to the plant of the Stemon Hard Rubber Co. has been awarded to the DOWLING & BOTTOMLEY CO., 1119 Broad St., Bridgeport. The building will be 50x175 ft. of reinforced concrete, one story, on which bids are now being received. The Fletcher Engineering Co., 1089 Broad St. is Arch.

South Norwalk, Conn.—Plans have been prepared and bids are being received by Charles R. K. Makepeace & Co., Providence, R. I., for the construction of a four-story, 200x90 ft., factory for Cluett, Peabody & Co. Noted May 15.

+Brooklyn, N. Y.—James A. McCafferty, North Ninth St. has awarded a contract to the WILLIAM P. GARRY CO., 306 Freeman St., for the construction of a four-story, brick, factory, 100x50 ft., on the north side of West Eighth St. P. Tillion & Sons., 381 Fulton St., are the Archs. The estimated cost is $20,000.

Buffalo, N. Y.—Plans will be prepared at once by the Erie R.R. Co. for a new elevator to replace the 700,000-bu. capacity wooden elevator at the Buffalo River and Ohio St., foot of Louisiana St., which was completely destroyed by fire, May 16. The new structure will be of reinforced concrete construction, with structural steel head-frame and modern grain elevating machinery and equipment, electrically operated, will be installed. The capacity of the new elevator will be about 1,000,000 bushels.

Buffalo, N. Y.—The Otis Elevator Co., has received a permit to build a foundry, of brick and steel, at 135 Sheridan St. The estimated cost is $140,000.

Gowanda, N. Y.—Arrangements are being completed for building a manufacturing plant at this place by the Salisbury Ball Bearing Mfg. Co., of which C. W. Salisbury, of the Salisbury Wheel & Mfg. Co., Jamestown, is Pres.

Bayonne, N. J.—The Horsley Laboratories Co., Ave. E, recently incorporated with a capital of $100,000, to manufacture films, will erect a two-story, brick and steel building to cost about $22,000. A building permit has been granted to the company for the work. William Horsley is Pres.

Camden, N. J.—Ronalds & Johnson are having plans prepared by Ballinger & Perrot, Archs., 1211 Arch St., Philadelphia, Penn., for a new four-story, reinforced-concrete and brick, factory, 70x20 ft.

Newark, N. J.—The Roberts Rubber Co., manufacturer of rubber goods, contemplates building a new four-story, brick, factory, 106x50 ft., at 51 Colden St. The estimated cost is $82,000.

Paterson, N. J.—Westeroff Bros. Napier Co., silk manufacturers, have secured an additional site in Paterson, upon which they contemplate the erection of a new factory. Preliminary drawings call for a structure to cost $65,000. Present labor conditions in that city will probably postpone immediate action on this plan.

Philadelphia, Penn.—The Haverford Cycle Co., 411 Market St. has purchased property at 827 and 820 Arch St. and at 824 and 826 Cherry St., and have commissioned Penchert & Wunder, Archs., 310 Chestnut St., to prepare plans for the construction of a four-story machine shop. M. M. Sladkin is Pres.

+Reading, Penn.—The Carpenter Steel Co. has awarded a contract to the FOSTER MILLER CO., Pittsburgh, Penn., for the erection of a one-story steel plant, 114x100 ft., of galvanized iron and steel, at the foot of Bern St. Basic open hearth furnaces will be installed. The estimated cost is $40,000.

Riverside, Penn.—Plans are being considered by the Carpenter Steel Works Co. for the erection of factory additions to its plant, estimated to cost $40,000.

Baltimore, Md.—The American Agricultural Chemical Co., Fidelity Bldg., is planning to rebuild its plant which was recently destroyed by fire. The estimated cost is $100,000.

Ashland, Ohio—The Elite Mfg. Co., Ashland, will erect a three-story factory of concrete.

Chillicothe, Ohio—The American Pad & Textile Co., Greenfield, Ohio, has purchased a site at Chillicothe to be used for industrial purposes. The management proposes to install a sewing factory as a branch plant.

Cincinnati, Ohio—The Ohio Knife Co., Cincinnati, has secured a permit, and will erect a concrete factory on Dreman St. and the Cincinnati Hamilton & Dayton Ry. to cost $50,000. Noted Mar. 13.

The plant of Swift & Co., at Cincinnati, will be enlarged. Plans will be prepared for the erection of a six-story building to replace the present three-story structure.

The Charles Boldt Co., glass manufacturer, Cincinnati, has taken out a permit to erect a three-story factory and warehouse at Davis Lane and Carter St. Estimated cost, $18,000.

+Cincinnati, Ohio—The contract has been awarded to D. MEINKIN ,2126 Westen Ave., Cincinnati, for the construction of a machine shop for the Cincinnati Foundry Co. The structure will be one and two stories, and will cost about $20,000.

The Standard Publishing Co., Cincinnati, is considering the erection of a building to cost about $30,000.

Cleveland, Ohio—G. F. Mitchell & Son, Cleveland, will soon ask for bids for the erection of a two-story factory addition, 62x150 ft.

+Cleveland, Ohio—The contract for the erection of a plant for the Leisy Brewing Co., on East 37th St., has been awarded to AUGUST HAASE.

The Rauch & Lang Co., Cleveland, carriage maker, has taken out a permit for the erection of a factory on West 26th St., to cost $40,000.

+Columbus, Ohio—The contract has been awarded to R. H. EVANS & CO., Columbus, for the erection of a six-story reinforced-concrete cold-storage building for the National Ice & Cold Storage Co. The estimated cost is $350,000.

Port Clinton, Ohio—The Matthews Boat Co., Port Clinton, will double the capacity of its plant at a cost of from $50,000 to $75,000

Portsmouth, Ohio—The Vulcan Box Toe Process Co., Portsmouth, has changed its name to the Vulcan Last Co. The capacity of the plant will be increased.

Springfield, Ohio—The Springfield Ry. Co., Springfield, is planning to construct two reinforced-concrete car barns, 128x400 ft., and a machine shop and paint and carpenter shop, about 71x150 ft., at Springfield.

Urbana, Ohio—The Howard Paper Co., Urbana, is considering the construction of a factory. The building will be two stories and basement, 110x400 ft.

Evansville, Ind.—The Bucyrus Co., Evansville, manufacturer of steam shovels, is having plans prepared for the erection of an addition, 226x525 ft.

+Hagerstown, Ind.—The contract has been awarded to WERKING & KEAGHY, Hagerstown, for the conatruction of a factory for the Teeter Motor Co. The cost is estimated at about $150,000.

Kokomo, Ind.—Plans are being prepared for the erection of a factory for the Worth Wire Co., Kokomo. It will be one story, 90x200 ft.

The Kokomo Steel & Wire Works, Kokomo, is having plans prepared for the erection of a billet mill to cost about $500,000.

Logansport, Ind.—H. Snider & Son, Chicago, Ill., will erect a broom factory at Logansport, to cost about $10,000.

Marion, Ind.—The United States Glove Co., will erect a three-story and basement addition to its factory at Marion.

New Castle, Ind.—Bids will be received soon by the Hoosier Mfg. Co., Newcastle, for the construction of a three-story factory, 90x238 ft.

+Peru, Ind.—The contract has been awarded to the CHURCHILL CONSTRUCTION CO., Cincinnati, Ohio, for rebuilding the railroad shops of the Chesapeake & Ohio R.R. Co. at Peru.

Detroit, Mich.—The Detroit Graphite Co., Detroit, will erect a five-story factory and warehouse on 12th St., between Jefferson Ave. and Fort St. Estimated cost, $30,000.

Grand Rapids, Mich.—The Royal Ice Machine Co., Grand Rapids, Mich., recently organized, will erect a plant for the manufacture of ice-making machinery. Joseph Rick, Grand Rapids, is interested.

Jackson, Mich.—The American Lady Corset Co., Detroit, Mich., is considering the erection of a factory at Jackson. The building will be two stories and basement, 132x132 ft.

Madison, Mich.—The Madison Plow Co., Madison, will erect a new factory and warehouse at its plant, which will double its present capacity.

Saginaw, Mich.—Plans are being prepared by Cowles & Mutscheller, Archs., Saginaw, for the construction of two additions to the plant of the U. S. Graphite Co., Saginaw. Estimated cost, about $10,000.

Chicago, Ill.—The W. J. Hughey & Son Co., Chicago, will erect a factory at Prairie Ave. and 33d St., for the manufacture of automobile trucks. Estimated cost, $100,000.

+Utica, Ill.—The contract has been awarded to the DECATUR BRIDGE CO., Decatur, Ill., for the construction of the new factory for the Valley Chemical Mfg. Co., Utica.

Beloit, Wis.—Plans for the new plant of the Berlin Machinery Works are being prepared by Perkins, Fellows & Hamilton, Archs., Chicago, Ill. It will be of pressed brick, stone and fire proof conatruction, partly one and partly two stories, measuring 294x275 ft.

La Crosse, Wis.—The Hans Motor Equipment Co., Las Crosse, is considering the erection of an addition, 200x120 ft.

+Manitowoc, Wis.—The contract has been awarded to GEORGENSON & SCHNEIDER, for the construction of the proposed factory for the Wisconsin Aluminum Foundry Co. Estimated cost, about $22,000.

Minneapolis, Minn.—The Northwestern Reed & Rattan Works, Minneapolis, will erect a four-story factory on Main St. and First Ave. The estimated cost is $50,000.

Swift, Minn.—The Swift Lumber Co., Swift, will rebuild its saw mill, which was recently destroyed by fire, causing a loss of $10,000.

Wichita, Kan.—The Atchison, Topeka & Santa Fé Ry. Co. plans to build a new 12-stall roundhouse and shop at Wichita. A site covering about 30 acres has been purchased.

St. Louis, Mo.—The Landis Machine Co., St. Louis, has completed plans for the construction of an addition to its plant. New equipment will be added, which will about double the capacity of the present plant.

Argenta, Ark.—The Gulf Compress Co., Argenta, will rebuild its plant, which was recently damaged by fire to the extent of $75,000.

Beaumont, Tex.—Forrest Moore will build a cooperage plant at Beaumont, to cost approximately $25,000.

Dallas, Tex.—The Southern Traction Co., Dallas, has purchased a site covering about 15 acres in Trinity Heights, for its railway shops. Plans are being prepared. The estimated cost is $100,000.

Houston, Tex.—The Western Shingle Creosoting Co., Texarkana, Tex., plans to build a plant at Houston, for creosoting shingles. The company has a capital of $600,000.

Oklahoma City, Okla.—The Klein Iron & Wire Co., Oklahoma City, will construct an addition to its plant, which will about double the present capacity.

Poteau, Okla.—E. L. Moore, Garner, Tex., will erect a cotton-seed oil mill at Poteau. The estimated cost is $30,000.

Denver, Colo.—The Roberts Alfalfa Mill Mfg. Co., Denver, will build a factory in Denver, for the manufacture of meal manufacturing machinery.

Chandler, Ariz.—The Chandler & Egytian Cotton Growers' Assn., recently incorporated with a capital of $25,000, will erect a large cotton gin at Chandler. L. B. Sorey is Pres

Bellingham, Wash.—H. J. Miller, Everett, Wash., will erect a lumber plant one mile east of Lake Padden, near Bellingham. The estimated cost is $20,000.

Grandview, Wash.—The Standard Oil Co., San Francisco, Calif., plans to erect a distributing plant at Grandview, estimated to cost $20,000.

Leavenworth, Wash.—The Washington Steel & Iron Co., Leavenworth, plans to double the capacity of its plant. E. H. Rothert is Gen. Mgr.

North Yakima, Wash.—Charles Peterson, F. H. Sweet and John C. Sawbridge, North Yakima, have filed articles of incorporation and will erect a plant for the manufacture of a pipe covering device.

Spokane, Wash.—The Cooler Mfg. Co., Spokane, will erect a plant at Spokane, for the manufacture of an iceless refrigerator. A. M. Davis, L. D. Anderson and C. H. Tuvey are the incorporators.

Stanwood, Wash.—The Pacific Coast Condensed Milk Co., Stanwood, plans to erect a plant for canning, sterilizing and shipping milk. M. E. Stuart is Local Supt.

Beggs, Calif.—W. M. Doty, H. S. Brink and George E. Harvey, Biggs, are planning to organize a company with a capital of $25,000, for the purpose of erecting a large rice milling plant at Biggs.

Long Beach, Calif.—The Panama Rubber Co., Long Beach, will erect a plant for the manufacture of automobile tires. The estimated cost is $500,000. W. D. Nawers is Pres.

San Francisco, Calif.—The American Can Co., San Francisco, has taken out a permit to erect a three-story can factory of brick, on 19th St. The estimated cost is $75,000.

Plessisville, Que.—The Plessisville Foundry, which was recently burned with a loss of $150,000, will be rebuilt and enlarged.

Barrie, Ont.—A three-story addition will be built by the Barrie Milling Co. to its mill on Collier St. Electric power equipment will be installed.

Lindsay, Ont.—Hood & Sons are having plans prepared for a new knitting factory to cost about $30,000. New machinery will be installed.

The Lindsay Machine & Tool Co., formerly located at Peterborough, will build a plant here, for the manufacture of special machinery.

Port Dalhousie, Ont.—The Port Dalhousie Canning Co. will erect a new factory, costing about $30,000. It will be three stories, of concrete construction.

St. Thomas, Ont.—The St. Thomas Brass Co., Wellington St. and First Ave., will immediately erect an addition to its plant. It will cost $25,000.

Stratford, Ont.—The Stratford Milling Co. will build a plant for the manufacture of flour mill machinery. It will cost approximately $60,000.

St. Johns, N. B.—McAvity & Sons plan the erection of a foundry at St. Johns. Lockwood, Greene & Co., 60 Federal St., Boston, Mass., are Archs.

FEDERAL GOVERNMENT WORK

Post Office—Bennington, Vt.—Bids were received as follows, May 15, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Bennington: (a) Limestone; (b) sandstone; (c) marble: William H. Fissell & Co., New York, (a) $62,679; (b) $69,323; (c) $73,529; C. M. Leach, Boston, Mass., (a) $63,983; (b) $67,-283; (c) $71,873; Conners Bros. Co., Lowell, Mass., (a) $65,-700; (b) $68,700; (c) $74,300; West Chester Engineering Co., New York, (a) $67,464; (b) $70,500; (c) $77,800; Interstate Construction Co., Saginaw, Mich., (a) $68,055; (b) $72,450; (c) $93,065; Daniel T. McCarthy, Philadelphia, Penn., (a) $69,223; (b) $72,684; (c) $79,553; Woodbury & Leighton, Boston, Mass., (a) $76,951; (c) $86,851.

Motor Boat Machinery—Boston, Mass.—Bids have been received as follows for 10 sets of propelling machinery for 35-ft. motor boats for the navy: Standard Motor Construction Co., $15,000; Reeves-Cuberly Co., $15,400; Automatic Machinery Co., $16,750; Charles J. Jager Co., $16,790; Murray & Tregurtha Co., $18,545; STERLING ENGINE CO., 154 State St., Boston, Mass., $19,920 (awarded contract); New York Yacht, Launch & Engine Co., $22,320.

Dredging—Boston, Mass.—Bids will be received until noon, June 14, by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston, for dredging in the Merrimac River.

Motor Trucks—New York, N. Y.—Bids will be received until 10 a.m., July 7, by Maj. M. Gray Zalinski, Corps Engrs., U. S. A., Army Bldg., 39 Whitehall St., New York, for furnishing from one to ten motor trucks.

Dredging—Trenton, N. J.—Bids will be received until noon, June 9, by Lieut.-Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Philadelphia, Penn., for dredging the channel of the Delaware River at Trenton.

Engines and Generators—Philadelphia, Penn.—Bids were received May 14 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for furnishing two new engines and generators in the U. S. post office and court house, Philadelphia, as follows: Ball Engine Co., Philadelphia, $14,497; Harrisburg Foundry & Machine Works, Harrisburg, Penn., $13,-550; A. L. Ide & Sons, Springfield, Ill., $15,110; the Griscom-Russell Co., 90 West St., New York, $12,995; Ridgway Dynamo & Engine Co., Ridgway, Penn., $11,790.

★**Drinking Water System**—Baltimore, Md.—Bids will be received until 3 p.m., June 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of a drinking system in the U. S. post office and court house at Baltimore.

★**Dredge**—Wilmington, Del.—(Official)—Bids will be received until 11 a.m., June 2, by Maj. R. R. Raymond, Corps Engrs., Wilmington, for the construction of the steel seagoing dredge, "Minquas."

Submarine Tender—Washington, D.C.—Bids were received as follows on May 19 by the Secretary of the Navy for the construction of Submarine Tender No. 2, the "Bushnell." Class 1, bidders' design, machinery with steam turbine reduction gear; (2) bidders' design, machinery of internal combustion type; (a) contractor to furnish and install machine tools and shop equipment; (b) government to furnish and install machine tools and shop equipment; Fore River Shipbuilding Co., Quincy, Mass., (1a) $942,000; (1b.) $930,000; 3250 tons, 14 knots, 21 months delivery; New London Ship & Engine Co., Groton, Conn., (2a) $987,000; (2b) $972,000; 3100 tons, 14 knots, 30 months delivery; Seattle Construction & Dry Dock Co., Seattle, Wash., (1a) $935,695; (1b.) $918,893; (2a) $933,010; (2b) $921,208; 3500 tons, 14 knots, 21 months delivery.

Gun Forgings—Washington, D. C.—Bids were received as follows May 14, by the Chief of Ordnance Department, Washington, for furnishing 34 sets of 4-in. nickel-steel gun forgings: Midvale Steel Co., Philadelphia, Penn., 42.5c. per lb.; Crucible Steel Co., Pittsburgh, Penn., for eight sets only, 41c. per lb.; Bethlehem Steel Co., South Bethlehem, Penn., 44.25c. per lb.

Quay Wall—Washington, D. C.—Bids will be received until 11 a.m., June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, for the construction of a section of new quay wall at the navy yard, Washington.

★**Water and Sewer System**—Front Royal, Va.—(Official)—Bids will be received until June 13 by Capt. W. W. Whiteside, Const. Q. M., U. S. A., Front Royal, for the construction of a water and sewer system.

Post Office—Monroe, N. C.—Bids were received as follows May 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Monroe, N. C. (a) Limestone; (b) sandstone. W. J. Brent Construction Co., Norfolk, Va., (a) $50,582; (b) $51,282. Daniel T. McCarthy, Philadelphia, Penn., (a) $53,-822; (b) $54,322. W. Waters, Llanerch, Penn., (a) $51,400; (b) $53,000. Newport Contracting & Engineering Co., Newport News, Va., (a) $53,470; (b) $54,470. C. M. Leach, Boston, Mass., (a) $52,383; (b) $56,000. Algernon Blair, Montgomery, Ala., (a) $54,748; (b) $56,500. W. J. Brent Co., Norfolk, Va., $49,000; (b) $54,000.

Dredging—Fort Screven, Ga.—Bids for dredging in the vicinity of the government wharf were received by the Constructing Quartermaster, U. S. A., Fort Screven, May 1, as follows: P. Sanford Ross, Jersey City, N. J., $12,450; J. C. Tilton, Savannah, Ga., $13,700; Home Dredging Co., Mobile, Ala., $15,000. It was recommended that if any of the bids should be considered the bid of the Home Dredging Co. be accepted, as the other two specify that work is to be accepted when widths and depths have been obtained, same to be determined by soundings made at stern of dredge as it passes over the work, which is not considered desirable, owing to the fact that silt and other deposits will be stirred up by dredge and forced in the channel already accepted.

Cement—Vicksburg, Miss.—Bids will be received until June 10 by Capt. Ernest Graves, Corps Engrs., U. S. A., Vicksburg, for furnishing and delivering about 8000 bbl. of American portland cement at Riverton, La.

Stone—Memphis, Tenn.—Bids were opened Apr. 26, by Maj. E. M. Markham, Corps Engrs., U. S. A., Memphis, for 25,000 cu.yd. of riprap stone. The bids follow: C. C. Huthmacher, Grand Tower, Ill., 97c. per cu.yd., or $9700 on 10,000 cu.yd. instead of 25,000 cu.yd. loaded on government barges opposite Grand Tower; W. E. Arnold, Cape Girardeau, Mo., 99c. per cu.yd., or $14,850 on 15,000 cu.yd. instead of 25,000 cu.yd. loaded on government barges 1½ miles above Neely's Landing, Mo.

Stone—Memphis, Tenn.—Bids were received as follows, Apr. 28, by Maj. E. M. Markham, Corps Engrs., U. S. A., Memphis, for riprap stone: (a) 35,000 tons f.o.b. at quarry, per ton; (b) unloading at Hopefield Bend, Ark., per ton; Cammack & Ward, Little Rock, Ark., (a) 80c.; (b) 30c.; total, $42,000; Miller Engineering Co., Little Rock, (a) 82c.; (b) 20c., $35,700; William S. Cayort, Morilton, Ark., (a) 74c.; (b) 24c.; $34,300; L. G. Martin & W. B. Wall, London, Ark., (a) 70c.; (b) 20c.; $31,500; R. S. Handford, Batesville, Ark., (a) 63c.; (b) 10c.; $25,550; Martin & Rye, Russellville, Ark., (a) 69c.; (b) 26c.; $33,250.

★**Channel Excavation**—Chicago, Ill.—Bids will be received until noon, June 19, by the Sanitary District of Chicago for the excavation of Sects. 7 and 8 of the Calumet Sag Channel. For details see advertisement under "Contracts To Be Let."

Post Office—South Chicago, Ill.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract to M. YEAGER & SON, Danville, Ill., at $132,702, for the construction of the post office at South Chicago.

★**Cement**—Milwaukee, Wis.—(Official)—Bids will be received until 3 p.m., June 16, by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Milwaukee, for furnishing 16,000 bbl. of portland cement for use at Sheboygan, Wis., and Milwaukee.

★**Breakwater and Pile Pier**—Sheboygan, Wis.—(Official)—Bids will be received until 3 p.m., June 16, by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Milwaukee, Wis., for the construction of a reinforced concrete caisson breakwater and pile pier, removing old pier, and dredging at Sheboygan.

★**Steel Hull**—St. Louis, Mo.—(Official)—Bids will be received until noon, June 18, by Maj. Clarke S. Smith, Corps Engrs., U. S. A., Secy., Mississippi River Comn., Liggett Bldg., St. Louis, for the construction and delivery of a steel hull for floating derrick.

★**Steel Derrick and Machinery**—St. Louis, Mo.—(Official)—Bids will be received by Maj. Clarke S. Smith, Corps Engrs., U. S. A., Secy., Mississippi River Comn., Liggett Bldg., St. Louis, until noon, June 18, for construction and delivery of steel derrick and machinery will be received here until 12 noon, standard time, June 18, 1913, and then publicly opened. Information on application.

Traveling Cranes—Bremerton, Wash.—Bids will be received until 11 a.m., June 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for electric traveling cranes for the general foundry at the navy yard, Puget Sound, Bremerton.

✚Roads and Walks—Fort Stevens, Ore.—The contract for the construction of roads and walks at Fort Stevens has been awarded to OLAF BOREN, Astoria, Ore., at $8230.

Lock Gates—Portland, Ore.—Bids will be received until 11 a.m., May 24, by Maj. J. J. Morrow, Corps Engrs., U. S. A., Portland, for constructing and erecting 11 pairs of metal lock gates for the Dalles-Celilo Canal.

Conduit and Wiring System—San Francisco, Calif.—Bids will be received until 3 p.m., June 9, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for a conduit and wiring system in the U. S. Marine Hospital at San Francisco.

Wireless Station—Panama—All bids received May 10 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction and equipment of the wireless station at San Pablo Site, Caimito, Canal Zone, have been rejected and supplementary bids are asked, to be opened by the bureau at 11 a.m., June 7. List of bidders noted May 15.

Steel Barges—Panama—Bids were received as follows, May 19, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Com., Washington, D. C., for furnishing six steel dump barges, under Circular 774; Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Penn., $68,250 each; total, $409,500; Ellicott Machine Corporation, Baltimore, Md., $77,279 each; $144,558 for two; Maryland Steel Co., Sparrow's Point, Md., $59,750 each; total, $358,500; Newport News Shipbuilding & Dry Dock Co., Newport News, Va., $54,400; total, $326,400; Seattle Construction & Dry Dock Co., Seattle, Wash., $75,000; total, $450,000; United States Steel Products Co., New York, $67,320, $66,050, $64,965, $66,230 each; totals, $403,920; $396,300; $389,790; $397,380.

Engineering Supplies—Panama—Bids were received as follows, May 17, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing the following engineering supplies: 1,644,750 lb. saltpeter dynamite, 45% nitroglycerine and 540,500 lb. saltpeter dynamite, 60% nitroglycerine. E. I. DuPont de Nemours Powder Co., 90 West St., New York, $249,761; Hercules Powder Co., Wilmington, Del., $250,581; Keystone National Powder Co., Emporium, Penn., $268,716; Trojan Powder Co., New York, $15,846 (part); 3,205,000 ft. B. M., long-leaf yellow pine or Douglas fir; Great Southern Lumber Co., Bogalusa, La., $88,365; J. K. Joice, Chicago, Ill., $100,000; Long Bell Lumber Co., Kansas City, Mo., $94,061; Rainwater Lumber Co., New Orleans, La., $87,592; Thomas E. Coale Lumber Co., Philadelphia, $95,540; C. Elias & Bros., Buffalo, N. Y., $105,070; George S. Fowler, Washington, $82,-511 (Douglas fir); D. L. Gillespie & Co., Pittsburgh, Penn., $83,257; W. R. Grace & Co., San Francisco, Calif., $72,753 (Douglas fir); Hicks-Hauptmann Lumber Co., San Francisco, $89,419; Payton Lumber Co., St. Louis, Mo., $89,193. The contract was awarded to W. R. GRACE & CO.

Oil—Panama—Bids were received as follows, May 13, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer Isthmian Canal Comn., Washington, D. C., for furnishing the annual supply of oils and grease for use on the Isthmus for a period of one year ending June 30, 1914: (a) 40,000 gal. valve oil; (b) 5000 gal. air compressor cylinder oil; (c) 25,000 gal. marine engine oil; (d) 30,000 gal. stationary engine oil; (e) 30,000 gal. locomotive engine oil; (f) 6000 gal. turbine engine oil; (g) 4000 gal. gas engine oil; (h) 30,000 gal. car oil; (i) 5000 lb. nonfluid grease (j) 50,000 lb. yellow grease; (k) 30,000 lb. black grease; (l) 5000 lb. cable oil or grease: American Oil Co., Jackson, Mich., $58,700; Galena-Signal Oil Co., 17 Battery Place, New York, $65,408; alternate bid, $49,132; High Grade Oil Refining Co., 68 Broad St., New York, $38,662; New York Lubricating Oil Co., 29 Broadway, New York, $36,365; Texas Co., 17 Battery Place, New York, $40,695; Vacuum Oil Co., 29 Broadway, New York, $44,905. The unit prices of the lowest bidder, New York Lubricating Oil Co., follow: (a) 25c.; (b) 20c.; (c) 22c.; (d) 17c.; (e) 15c.; (f) 18c.; (g) 20c.; (h) 13c.; (i) 4½c; (j) 6.7c.; (k) 2.7c.; (l) 4c.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids will be received until May 28, by the State Harbor and Land Commissioners, State House, for dredging in Saugus River, Lynn Harbor, Manchester Harbor and in South River, Salem. N. F. Williams is Ch. Engr.

Wharf—Boston, Mass.—The Board of Port Directors is considering the purchase of the wharf of the Eastern R.R. at East Boston to be used for railroad terminal purposes. It will cost $750,000 to put it in proper condition.

Mausoleum—Springfield, Mass., Chester W. Chapin, New York, is having plans prepared for a $50,000 mausoleum which is to be erected in the Springfield Cemetery.

Elimination of Grade Crossings—Taunton, Mass.—The Railroad Commission has approved plans for the abolition of grade crossings in Taunton. This work is on the Old Colony Division of the New ork, New Haven & Hartford R.R. and, according to an estimate of the company, it will cost $2,282,-000. A. K. Crowell is City Engr.

Subways—Providence, R. I.—The city is considering the extension of the proposed subway under Washington St., from Exchange Place to the junction of Washington and Winter Sts., after the latter street is extended to Washington St. O. F. Clapp is City Engr.

Fire Apparatus—Naugatuck, Conn.—At a recent town meeting an appropriation was made for the purchase of a triple-combination automobile pumping engine, hose and chemical machine, and an automobile for the use of the fire chief. A. B. Cross, 3 Barnum Courat is Warden, and Wilson F. Clarke, 25 Cherry Ct. is Fire Chief.

Fire Escapes—South Norwalk, Conn.—The equipment of all the schools in the city with fire escapes is planned by a special committee of which Wilfred Bodwell, 6 Seymour St. is Chn. The cost is estimated at $20,000.

Greenhouse—Brooklyn, N. Y.—(Official)—Bids will be received until 3 p.m., May 29, by the Department of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Manhattan, for all materials and labor required for the erection of the second part of greenhouses for the Brooklyn Botanic Garden of Washington Ave., opposite Crown and Montgomery Sts., and for the proposed grading and topsoiling in the Brooklyn Botanic Garden. Charles L. Stover is Comr.

✚Dock—Buffalo, N. Y.—The Pennsylvania R.R. Co. has let a contract to the GREAT LAKES DREDGE & DOCK Co., Buffalo, for construction of a dock, one-half mile in length on the Buffalo River at the foot of Hamburg St. opposite the plant of the Buffalo Union Furnace Co. The construction will be of heavy piles and timber, reinforced for the bearing of heavy load.

Recreation Pier—Buffalo, N. Y. The city is considering the construction of a recreation pier on Lake Erie between Hudson aand Connecticut Sts. Francis G. Ward is Comr. Pub. Wks.

Granite Headers—New York, N. Y.—(Official)—Bids will be received until noon, May 29, by the Dept. of Docks and Ferries, Pier A, North River, for furnishing and delivering granite headers, stretchers and coping stones. R. A. C. Smith is Comr.

Improving Playground—(Official)—New York, N. Y.—Bids will be received until 3 p.m., May 29, by the Department of Parks, Arsenal Bldg., Fifth Ave. and 64th St., for furnishing all the labor and materials required to improve the playground on the easterly side of Amsterdam Ave., between 151st and 152d Sts. Charles B. Stover is Pres.

✚Stable—Niagara Falls, N. Y.—The contract has been awarded to the WESTERN BUILDING CO., Fidelity Bldg., Buffalo, for the construction of a stable for the Lang Brewing Co. at about $14,000.

Subway—Rochester, N. Y.—The city is planning for the construction of a subway under the tracks of the New York Central & Hudson River R.R. and the Buffalo, Rochester & Pittsburgh Ry. E. E. Fisher is City Engr.

Elimination of Grade Crossings—Syracuse, N. Y.—Plans for the elimination of grade crosings of the Delaware, Lackawanna & Western R.R. in Syracuse are nearing completion. H. C. Allen is City Engr.

Piers—Jersey City, N. J.—The city has bought 50 acres of meadow lands at Droyer's Point, Newark Bay. The land will be reclaimed and piers will be constructed. Charles A. Van Keuren is City Engr.

★River Work—Trenton, N. J.—Bids were received May 8 for improving Shark River Inlet. The contract has been awarded to the BAY STATE DREDGING & CONTR. CO., 215 Montague St., Brooklyn, at $57,654.

Fish Hatchery—Erie, Penn.—Bids will be received until June 1, by J. W. Yard & Son, Archs., Erie, for the construction of a fish hatchery at Erie. The structure will be two stories, 60x80 ft. The cost has been estimated at about $25,000.

Docks—Philadelphia, Penn.—The bill which gives the city of Philadelphia the right of eminent domain over wharves and docks for harbor improvements, has passed the State Senate, and will go to the Governor after the House concurs in minor amendments. The passage of this bill, together with the $2,000,000 appropriation measure introduced in the Senate will provide for an immediate beginning of the so called Moyamensing Pier improvements.

Stable—Philadelphia, Penn.—R. E. White, Arch., Pennsylvania Bldg., Philadelphia, is receiving bids for the construction of a stable for the George B. Newton Coal Co. It will be two stories, 90x125 ft. Estimated cost, about $35,-000.

Dredging—Gastonia, N. C.—Dutchman's Creek Drainage Commission, Gastonia, has issued $15,000 of bonds for dredging Dutchman's and tributary creeks. T. L. Ware is Chn.

✚Drainage Canals—Florida — The contract has been awarded to the SOUTHERN DRAINAGE & CONSTRUCTION CO., Kinston, S. C., for the construction of about 48 miles of drainage canals in Florida.

Levee Work—Mississippi—The state of Mississippi is considering an appropriation of $1,000,000 for the construction of levees along the Mississippi River.

Pier—Gulfport, Miss.—The Gulfport & Western Ry. Co. is considering the construction of a pier at Gulfport to cost about $500,000.

Seawall—Mandeville, La.—Bids will be received until 7:30 p.m., June 20, by the Mayor and Town Council for the construction of a timber seawall, and for filling with earth the area between the seawall and the beach. Louis Menant is Secy.

Bulkhead—New Orleans, La.—The lowest bid received May 5 by the Board of Control of the New Basin Canal for constructing a creosoted pile bulkhead at the West End, was submitted by W. J. Comerford, at $18.25 per lin.ft.; or $14,000.

Ditch—Henderson, Ky.—Bids will be received until 2 p.m., May 26, by the Board of Drainage Commissioners of Henderson County, Henderson, for the construction of Double Dam and Swan Pond Ditch. The work will require 132,776 cu.yd. Peter Manion, Henderson, is Pres. Noted Apr. 24.

Straightening Channel—Louisville, Ky.—Bids will be asked soon by the Board of Public Works for straightening the channel of Beargrass Creek. The work involves also the construction of concrete walls and floors. Estimated cost, $300,000. D. R. Lyman is City Engr.

★Dikes—Akron, Ohio—(Official) Bids will be received until noon, May 28, by R. M. Fillmore, Dir. Pub. Ser., for the construction of the Cuyahoga River Dikes. The principal items included in this contract are as follows: Earth excavation, (surface) 142,500 cu.yd.; earth excavation (below 3 ft.),

7000 cu.yd.; rolled embankment, 118,500 cu.yd.; wooden sheet piling, 164,000 ft. b.m.; riprap, 6700 cu.yd.; selected gravel, 3500 cu.yd. Minor items include seeding, laying of pipe drains and 80 cu.yd. concrete. Plans and specifications may be seen at the office of the director or at the office of F. A. Barbour, 1120 Tremont Bldg., Boston, Mass.

Structural Steel—Alliance, Ohio—Bids will be received by the city until May 27 for the structural steel for the superstructure of the Fifth St. Subway.

Dock—Cleveland, Ohio—Plans have been prepared by the Detroit & Cleveland Navigation Co. and the C. & B. Navigation Co., Cleveland, for the construction of a dock to cost about $450,000.

Flood Protection—Dayton, Ohio—Arthur E. Morgan, Memphis, Tenn., has been retained by the Flood Prevention Committee to prepare preliminary plans for flood protection for Dayton. Noted May 8.

★✚**Creek Diversion**—Toledo, Ohio—Bids were opened Apr. 25 by J. R. Cowell, Dir. Pub. Ser., for the diversion of Swan Creek at St. Clair St. and the removal of and re-erecting of St. Clair St. Bridge over Swan Creek. The contract has been awarded to M. RABBIT & SON. The Nasby, Toledo, at $96,086.

Drain—Boonville, Ind.—The contract has been awarded to the NAPPANEE DRAINAGE CO., Nappanee, Ind., for the construction of Big Drain, at about $17,000.

Ditch work—Goshen, Ind.—Plans are being prepared for the construction of five miles of open ditch in Nappanee Township and five miles of open ditch in Shaeffer, Harrison and Concord Townships.

Ditch—Valparaiso, Ind.—Bids will be received until 10 a.m., May 24, by G. F. Stichfield, County Surv., Valparaiso, for the construction of Ludington Ditch. The work includes about 128,982 cu.yd. of floating dredge work and 12.2 miles of drain tile from 5 to 18 in.

Channel Work—Chicago, Ill.—Bids will be received until June 19 by John McGillon, Clk. Sanitary Dist. of Chicago, for excavating Sects. 6 and 7 as a whole or separately for each section of the Calumet Sag Channel.

Drainage System—Oreana, Ill.—Bids will be received until May 31, by the Commissioners of Drainage District No. 1, Oreana, at the office of Charles Shastid, Oreana, for furnishing the labor and material for the construction of a tile drainage system. Preston Hicks, Decatur, Ill., is Engr.

Ditch Construction—Pontiac, Ill.—Bids will be received by the Commissioners of Coon Creek Drainage District, Dekalb and Kane Counties, Pontiac, for constructing the West Branch Ditch, 398,074 cu.yd., and the Jap Branch Ditch, 46,985 cu.yd. W. M. Hay, Engr., Sycamore.

Ditch—Urbana, Ill.—Bids will be received until 1 p.m., May 21, by the County Commissioners, Urbana, Ill., for the construction of the main open ditch of Sangamon and Drummer Drainage District in Champaign and Ford Counties. The work will require about 381,373 cu.yd. of excavation. E. F. Helman, Paxton, Ill., is Engr.

✚**Ditch**—Wheeling, Ill.—HUTCHINSON & OAKFORD, Peoria, Ill., have been awarded the contract by Wheeling Drainage District No. 1 for constructing an open ditch requiring 80,000 cu.yd. of excavation and for laying 32,000 ft. of tile tile. The contract for the tile was let to the NATIONAL DRAIN TILE CO., Terre Haute, Ind.

Crane—Milwaukee, Wis.—The Milwaukee Western Fuel Co. will erect an all-steel derrick for handling coal; the crane to have a reach of 300 ft. Estimated cost, $100,000.

Dock—Milwaukee, Wis.—The Arthur Kuesel Co., Milwaukee, is considering the construction of a concrete dock at 20th and South Canal Sts. Estimated cost, about $1,000,000.

✚**Drain**—Algona, Iowa—Contracts for the construction of Drain 69, bids opened May 1, by B. E. Norton, County Audr., Algona, have been awarded as follows: Open work, HUNT & ANDERSON, Bancroft, Iowa, at 10.49c.; tile work, WELP CEMENT PRODUCTS CO., Bancroft, at $34,060.

Bulkhead and Flood Gates—Waverly, Iowa—(Official) Bids will be received by the City Council until May 26, for the construction of a bulkhead and flood gates at the west end of the present dam. Ralph B. Slippy, Waterloo, Iowa, is Engr. F. A. Lee is City Clk.

Dredging—Tower, Minn.—The County Commissioners will ask for bids for dredging the channel of two rivers connecting Vermillion Lake and Tower, so as to make them navigable. E. K. Coe is County Engr.

Fire Station—Concordia, Kan.—The City Clerk is asking for bids for the construction of a fire station to cost about $25,000.

Green Houses—Yankton, S. D.—The Gurney Seed & Nursery Co., Yankton, S. D., is considering the construction of two greenhouses, each 24x150 ft.

★✚**Levees**—Palmyra, Mo.—Bids were received Apr. 26 by Frank G. Bier, Secy., Marion County Drainage Dist., for constructing levees, involving about 450,000 cu.yd. of earth and excavating and filling about 7000 cu.yd. muck ditch; constructing canals and ditches, involving the excavation of about 100,000 cu.yd. earth. The contract has been awarded to R. H. & G. A. McWILLIAMS, Steger Bldg., Chicago, Ill.

Bath-House—St. Louis, Mo.—Plans are being prepared for the construction of a two-story bath-house to cost about $35,000. F. A. Hueser is City Arch.

Dredging Wharf—Port Arthur, Tex.—The Gulf Refining Co., Port Arthur, Tex., will dredge a 26-ft. canal from the turning basin to the refining plant and will build a half mile of concrete wharf.

★**Creosoted Piling**—Seattle, Wash.—Bids will be received until 2 p.m., June 15, by the Port of Seattle Commission, 843 Central Bldg., Seattle, for furnishing 65,000 lin.ft. of creosoted piling. The Port Commission is of the opinion that the magnitude of the contract is sufficient to justify the erection of an additional creosoting plant in this vicinity and it will entertain under the above and give most careful consideration to a proposal for the erection of such a plant upon its own properties, if desirable, and the furnishing therewith the above material. Further information will be furnished on application to C. E. Remsburg, Secy.

★✚**Snow Sheds, Etc.**—Seattle, Wash.—The Great Northern R.R. Co. will construct snowsheds near Scenic Washington, including 8900 ft. timber sheds; 4000 ft. combination sheds with concrete and rubble back wall with timber posts and roof; 1200 ft. double track tunnel. Contracts have been awarded as follows: GRANT SMITH & CO., for tunnels and all timber sheds; for combination shed, GUTHRIE, McDOUGALL & CO.

Drydock—Oakland, Calif.—The city is considering the construction of a municipal drydock. Perry F. Bdown is City Engr.

River Improvement—Sacramento, Calif.—The River Improvement Bill has passed the State Legislature. It provides for an appropriation of $200,000.

Drydock—Lauzon, Que.—(Official)—Bids will be received until 4 p.m., June 23, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a drydock at Lauzon.

Dry Dock—Quebec, Que.—The Department of Public Works, Ottawa, Ont., will soon ask for bids for a dry dock to be constructed at Quebec. It will be about 1100 ft. in length. R. C. Desrochers is Secy.

✚**Dredging**—Deseronto, Ont.—The contract for the dredging required at Deseronto has been awarded to R. WEDDELL & CO., Trenton, Ont., by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont.

Canal—Ottawa, Ont.—It is reported that the Department of Railways and Canals, Ottawa, will soon ask for bids for the construction of the Welland Canal. The work will be done in sections and the new end will be built first. The entire work will cost $50,000,000. L. K. Jones, Ottawa, is Secy.

✚**Causeway**—Ottawa, Ont.—The contract has been awarded to FALLON BROS., Cornwall, Ont., by the Department of Public Works for the construction of a causeway to replace the old Cataraqui Bridge, at $212,000.

✚**Lumber**—Ottawa, Ont.—Contracts have been awarded to the following for furnishing lumber for the Hudson Bay Ry.: ATLANTIC LUMBER CO., Kent Bldg., Toronto, Ont.; MUSGROVE LUMBER CO., Halifax, N. S.; LONG BELL LUMBER CO., Philadelphia, Penn. Estimated total cost, $130,000.

Dredging—Bathurst, N. B.—Bids will be received until May 22 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for all dredging required at Bathurst.

Extension to Breakwater—Kelly's Cove, N. S.—Bids will be received until May 28 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the breakwater at Kelly's Cove, N. S.

BUILDINGS

Burlington, Vt.—The Central Vermont R.R. will erect a station at the foot of Main St. The estimated cost is $180,000. J. M. Morrison is Ch. Engr., St. Albans, Vt.

✚**Boston, Mass.**—The contract for the administration building to be built on the Commonwealth Pier at South Boston, for the Directors of the Port was awarded to the TYSON, WEARE & MARSHALL CO., 6 Beacon St. at $60,000. It will be of steel and concrete, three stories. Henry F. Keyes, 35 Congress St., is Arch.

✚The contract for the construction of the library at East Boston has been awarded to the JOHN F. GRIFFIN CO. at $65,397. Other bidders were: Connors Bros. Co. $68,079; J. E. Locatelli Co., Inc., $71,193; McGahey & O'Connor, $73,075; Geo. A. Cahill, $73,713; Patrick Rick, $75,875; Whiton & Haynes Co., $78,300; Mack Bros., $80,565; Jos. Slotnik, $83,500; Hapgood, Frost Co., $86,786. Horace G. Wadlin is Librarian. Noted Apr. 24.

Plans have been prepared by Andrews, Jacques & Rantoul, Archs., State Mutual Life Bldg., Boston, Mass., for a 10-story building adjoining the State Mutual Building at 50 Congress St., Boston. The Congress St. Associates are the owners of the property. The estimated cost is $500,000.

Holyoke, Mass.—A high school gymnasium is to be erected on Pine and Beach Sts. It will be of brick, three stories, 104x109 ft. Wm. B. Reid, 280 High St., is Arch.

Wilfred Wheeler, Secy. State Bd. of Agriculture, contemplates erecting a four-story municipal market from Faneuil Hall to Atlantic Ave. The estimated cost is $5,000,000.

Leicester, Mass.—Bids will be received until May 29, by E. Carleton, of Cutting, Carleton & Cutting, 44 Front St., Worcester, Mass., for the construction of a brick grade school. The estimated cost is $40,000. Noted May 15.

Lynn, Mass.—The lowest bidders for the construction of a bank building at Willow St. and Central Ave., for the Security Trust Co., were Woodbury & Leighton, Boston, at $239,000. Other bidders were as follows: Strout Bros., Lynn, $267,000; J. T. Wilson, Nahant, $269,000; John H. Cunningham, Portland, Maine, $279,000.

Malden, Mass.—Plans have been filed by A. J. Carpenter, Jr., Arch., 38 Dunreath St., Boston, for the construction of a theater on the north side of Malden Square. The estimated cost is $40,000.

Marblehead, Mass.—Bids for building the new high school were opened May 14 and rejected, as the lowest bid was $110,000, while the appropriation is but $85,000. A special town meeting will be called to consider the matter.

Pittsfield, Mass.—McCormack & Joyce, owners of the Greystone combination business and apartment building in Pittsfield, will erect a four-story apartment house at 179 South St. The estimated cost is $100,000.

South Hadley, Mass.—The town at a meeting May 12, voted to build a combination town hall and school, to cost $70,000. The G. P. B. Alderman Co., of Holyoke, Mass., are Archs. Edgar R. Noel is a Selectman.

Springfield, Mass.—Plans have been prepared for the erection of a theater on Main St. for McCauley Bros., 185 Main St. It will be of brick, pressed brick front, bluestone trimmed, steel beams and girders, 52x70 ft. Bids are now being received. Bruno Wozny, 381 Main St., is Arch.

Springfield, Mass.—A large addition to the Springfield almshouse and city hospital on State St. is planned. An administration building, 38x46 ft., three stories, a power house 50x50 ft., and a reinf. reed-concrete coal pocket are designed. McClintock & Craig, 33 Lyman St., are Archs.

Taunton, Mass.—The City Council has appropriated $100,000 for the erection of a new 16-room school in the North end. Plans are being prepared. Wm. Fish is Mayor.

Worcester, Mass.—H. S. Demoorjian, Arch., State Mutual Bldg., is preparing plans for a five-story business block 27x75 ft., with a garage on the street floor, of brick construction, with concrete foundations, gravel roof, a steam-heating plant in basement. Chas. Sandberg, Owner.

Providence, R. I.—The Weedru Land Co., Elmwood Ave., Providence, R. I., is having plans prepared by Wm. R. Walker & Son, Custom House St., for a two-story building, 65x95 ft., of steel beam construction and concrete foundation, brick with copper trimmings and gravel roof, to be used as a service station for the Cadillac Motor Co. An elevator 22x10 ft., sprinkler system, electric lights and steam heat will be installed.

Spitz & Natherson, of the Empire Theater, have secured a site in the Olneyville District for erection of a new fireproof theater, to cost $125,000. It will be of brick, concrete and steel.

Hartford, Conn.—Bids will be received by Whiton & McMahon, Archs., 49 Pearl St., until 11 a.m., June 2, for the construction of a school for the Northeast School District on Westland St. Separate bids are asked for masonry work, carpenter work, plumbing, heating, ventilating and tile work.

Davis & Brooks, Archs., 49 Pearl St., have prepared plans for a $65,000 building for the Fourth Church Society. Bids are asked for construction.

Waterbury, Conn.—Bids will be received by the Board of Education until 5 p.m., June 4, for an addition to the Washington St. School. It will be of brick with granite trim, 72x80 ft., two stories and basement. Louis A. Walsh, 51 Leavenworth St., Waterbury, is Arch.

Winsted, Conn.—The Y. M. C. A. is planning the erection of a $75,000 association building.

The St. Joseph Roman Catholic Church Society will erect a new church, to cost $80,000. Plans are being prepared.

Albany, N. Y.—The New York Telephone Co., contemplates erecting a 10-story building at State and Park Sts. The estimated cost is $1,000,000 including the installation of switchboards and other equipment.

✚Charlotte, N. Y.—The contract for the construction of the Infants' Summer Hospital at Charlotte has been awarded to A. W. HOPEMAN & SONS.

New York, N. Y.—The plans for the new warehouse district, which is to be established as part of the plans which the New York Central & Hudson River R.R. has in connection with its West Side improvement, will provide for a virtual "city of warehouses." The warehouses, each ten stories high, with the basements transversed by numerous railroad tracks and switches, are to be 10 in number. Seven will be built in the section from 11th to 12th Aves., and from 30th to 37th Sts. The other three will be located from 30th to 33d Sts., and from 10th to 11th Aves. This area contains approximately 1,137,500 sq.ft. The plans have been approved by the Board of Estimate and Ira A. Place, Vice-Pres. of the railroad.

The McMorrow Engineering & Construction Co., 217 West 125th St., has purchased a site, 100x75 ft., on the north side of West 81st St., east of Columbus Ave. Neville & Bagge, Archs., 217 West 125th St., have been commissioned to prepare plans for the erections of a 12-story apartment house on the plot.

Bids will be received until 2 p.m., May 27, by the President of the Borough of Manhattan, at the office of the Commissioner of Public Works, 21 Park Row, for Item "A," for furnishing all the labor and materials required for the erection and completion of a public bath building and gymnasium, to be located at 407 to 413 W. 28th St. Item "B," for furnishing all the labor and materials required for the erection and completion of a public bath building and gymnasium, to be located at 407 to 413 W. 28th St., in accordance with specifications calling for ceramic-mosaic tile for swimming pool. Item "C," for furnishing all the labor and materials required for the erection and completion of a public bath building and gymnasium, to be located at 407 to 413 W. 28th St., Borough of Manhattan, in accordance with sundry specifications. George McAneny is Pres.

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a 12-story apartment house, 100x81 ft., on the north side of 86th St., east of Park Ave., for the State Construction Co., 39 West 32d St. The estimated cost is $300,000.

Schwartz & Gross, Archs., 347 Fifth Ave., have completed plans for the construction of a 12-story apartment house, 104x100 ft., at Lexington Ave. and 72d St., for the E. A. L. Realty Co., 505 Fifth Ave. The estimated cost is $250,000.

Plans have been completed by Neville & Bagge, Archs., 217 West 125th St., for the construction of a 12-story apartment house, at 37 West 81st St., for the McMorrow Engineering & Contracting Co., 217 West 125th St. The estimated cost is $300,000.

Plans have been filed by Neville & Bagge, Archs., 217 West 125th St., for the construction of a 10-story apartment house, 125x90 ft., at the northeast corner of Cathedral Parkway and Lenox Ave., for J. A. Sonntag, 2 Lenox Ave. The estimated cost is $500,000.

✚Olean, N. Y.—(Official)—The general contract for the construction of an addition to Public School, No. 2, at 11th and State Sts., has been awarded to E. J. BAILEY, Brocton, N. Y., at $29,998. Other bidders were as follows: B. U. Taylor Co., Olean, N. Y., $34,686; L. E. Corsett, Olean, N. Y., $35,494; D. W. Dean, Olean, N. Y., $35,142; Western Building Co., Inc., Buffalo, N. Y., $39,491; Tuna Mfg. Co., Bradford, Penn., $31,750. The contract for the installation of the heating and ventilating system for the new addition and also the old building has been awarded to LEWIS & KITCHEN, 508 Kerper Bldg., Chicago, Ill. Other bidders were: J. A. Langdon & Sons, House Bldg., Pittsburgh, Penn., at $10,632; American Warming & Ventilating Co., Elmira, N. Y., $9300. Noted May 8.

✚Rochester, N. Y.—The contract has been awarded to the GORSLINE & SWAN CONSTRUCTION CO., Rochester, for the construction of a three-story addition to the telephone exchange building, for the New York Telephone Co. Noted Apr. 24.

✚Schenectady, N. Y.—(Official)—The contract has been awarded to the AMSTERDAM BUILDING CO., 43 W. 27th St., for the construction of a gymnasium for Union College. George B. Post & Sons, are Archs., 341 Fifth Ave., New York. Noted May 8.

Syracuse, N. Y.—Taber & Baxter, Archs., Syracuse, have completed plans for the reconstruction of the Lincoln Lodge hall at Ash and Townsend Sts.

Bids will be received until July 1, by Chas. E. Colton, Arch., Kirk Bldg., for the construction of an 11-story hotel at East Genesee and North Clinton Sts., for the Clinton-Genesee Realty Co. The estimated cost is $500,000. Noted May 15.

✚Camden, N. J.—A contract has been awarded to METZGER & WELLS, Philadelphia, Penn., for the erection of a new armory for Battery E, at Ninth St. and Newton Ave., for which the State Legislature appropriated $98,500. The structure will be of brick and limestone, three-stories, about 206x200 ft.

Cranford, N. J.—Bids will be received about June 1, by D. C. Newman Collins, 29 Broadway, New York, for the construction of a three-story school on Lincoln Ave., for the Board of Education. The estimated cost is $45,000. Noted Apr. 24.

Medford, N. J.—The State Board of Education has notified the Medford Board of Education that the present school building does not meet the requirements of the law, and that a new school must be erected. The estimated cost is $40,000.

Newark, N. J.—L. Bamberger & Co., Newark, N. J., will erect an addition to their storage house to cost $42,500. It are Archs., 22 Clinton St. will be two-stories, of brick, 62x282 ft. Hughes & Backoff

John T. Rowland, Jr., Arch., 15 Exchange Place, Jersey City, is preparing plans for the construction of a building to take the place of the Bayley Hall preparatory school. The estimated cost is $70,000.

Orange, N. J.—Bids will be received by the Board of Education, until May 21, for the construction of an addition to the Park Ave. school. The estimated cost is $55,000.

Paterson, N. J.—An addition will be erected to Public School No. 7, West 26th St.; the School Board of Estimate has voted an appropriation for the acquirement of a site.

✚Red Bank, N. J.—The First National Bank has awarded a contract for the erection of a one-story bank building, 55 ft. high, at Broad and Wallace Sts., to the HEDDEN CONSTRUCTION CO., Newark, at about $100,000. The structure will be of white marble.

★Trenton, N. J.—(Official)—Bids will be received by E. I. Edwards, Comptroller, of the Treasury, State House, Trenton, until noon, June 3, for labor and materials necessary for the installation of steel furnishings in the State Library.

Weehawken, N. J.—Bids will be received until 8:30 p.m., May 28, by George Limouze, Secy., Bd. of Trustees of the North Hudson Hospital, Town Hall, Union, N. J., for erection of the additions and alterations to the Hospital on Park Ave., Weehawken. Percie A. Vivarttas, 110 Fourth St., Union, N. J., is Arch.

✚Altoona, Penn.—The contract for the construction of the four-story addition to the department store of William F. Gable & Co., at 11th Alley and 14th St., has been awarded to CLIFFORD D. HUGHES, Altoona, Penn.

✚Erie, Penn.—The contract has been awarded to CONSTABLE BROS. CO., Erie, Penn., for the construction of a three-story school at East Ave. and Sixth St., for the Board of Education. Noted Apr. 24.

Overbrook, Penn.—Plans are being prepared for the construction of a dormitory at the Theological Seminary of St. Charles Borromeo at Overbrook.

✚Philadelphia, Penn.—(Official)—It was erroneously noted in the issue of May 8 that Wells Bros. Co., New York, was awarded the contract for the laundry building, dining room and kitchen building at the Home for the Feeble Minded. The contract for this work has been awarded to SAX & ABBOTT, 1328 Chestnut St., Philadelphia. Noted May 8.

✚The contract for the construction of the Haddington branch of the Free Library of Philadelphia, at 65th St. and Girard Ave., has been awarded to JACOB MYERS & SON, Witherspoon Bldg.

✚The contract for the construction of the car house at 58th and Vine Sts., for the Philadelphia Rapid Transit Co., has been awarded to the UNIT CONSTRUCTION CO. The estimated cost is $200,000.

Pittsburgh, Penn.—Prack & Perrine, Archs., Keystone Bldg., are preparing plans for the construction of a building at Butler and 63rd Sts., for Hubbard & Co. The estimated cost is $75,000.

Pittsburgh Lodge No. 46, Loyal Order of Moose, will erect a home at Penn Ave. and Parkers Way. It will be a five-story structure, 80x120 ft. The estimated cost is $400,000.

Henry D. Whitfield, Arch., 160 Fifth Ave., New York, will prepare plans for the addition to the Carnegie Library, North Side, which will cost $150,000.

The Board of Education has chosen sites for three elementary schools and two high schools.

John McSorley will erect a 10-story apartment house, 160x180 ft., at Bayard and Melwood Sts. The estimated cost is $500,000.

Frederick, Md.—Bids will be received until May 24, by Dr. J. H. Apple, Pres., for the construction of an administration building and dormitory. The estimated cost is $80,000. John B. Hamme, is Arch., York, Penn.

+Hagerstown, Md.—The contract for the construction of the lodge building for the I. O. O. F. has been awarded to GEORGE B. McC. WOLF. Noted Mar. 6.

+Danville, Va.—The contract has been awarded to W. K. ANDERSON, Danville, for the construction of a tobacco storage warehouse for the Pemberton Penn Co. It will be 75x212 ft., three stories, mill construction. Pritchett, Heard & Cardwell are Archs.

Charleston, W. Va.—Mrs. A. Boriarsky, Charleston, W. Va., has authorized Weber, Werner & Adkins, Archs., of Cincinnati, Ohio, to erect a 4-story, 40x100-ft. office building. Plans are being prepared.

+Clarksburg, W. Va.—The contract has been awarded to JAMES CAIN, Elkins, W. Va., for the construction of the high school for the church of the Immaculate Conception. The estimated cost is $75,000.

+Raleigh, N. C.—The contract for the construction of an addition to the Bland Hotel has been awarded to N. UNDERWOOD, Durham, N. C.

Winston-Salem, N. C.—Bids will be received until June 6, by Dr. C. S. Lawrence, Vice-Chn. of the Hospital Comn., for the construction of a hospital at Winston-Salem. It will be of reinforced concrete and brick, four-stories, 100x70 ft. P. Thornton Marye, is Arch., Candler Bldg., Atlanta, Ga. Noted Mar. 6.

+Augusta, Ga.—The general contract has been awarded to the McKENZIE CONSTRUCTION CO., Augusta, for the construction of the Chronicle office building. The heating and plumbing contract was awarded to E. J. ERBEIDING, and electric work to the BRILL ELECTRIC CO., both of Augusta. Noted Apr. 24.

Birmingham, Ala.—The Hygeia Co., recently organized, will erect a 16- or 18-story building on Fourth Ave.

Harry Wheelock, Arch., Steiner Bldg., is receiving bids for the construction of additions and improvements to the Hillman Hospital.

+Quitman, Miss.—The contract has been awarded to HANCOCK & McARTHUR, Meridian, Miss., at $29,988, for the construction of the court house at Quitman, and the SOUTHERN STRUCTURAL STEEL WORKS, San Antonio, Tex., at $9885, for the construction of the jail.

+Homer, La.—The School Board has awarded a contract to T. E. Stevens, New Orleans, for the construction of the high school. The estimated cost is $50,000.

New Orleans, La.—At a meeting presided over by Archbishop Blenk, it was decided to restore the old St. Louis Cathedral, which has settled dangerously within a few months, at a cost estimated at $97,500. An executive committee of seven will have the matter in charge. George Denegre is Pres.

Pineville, La.—The Board of Administrators of the Louisiana Hospital for the Insane has rejected all bids for two additional buildings. Bids ranged from $90,000 to $100,000. New bids are asked and will be opened June 12. William Drago is Arch., 512 Audobon Bldg. Noted May 1.

Shreveport, La.—The Ancient Accepted Scottish Rite Masons will erect a temple at Shreveport. The estimated cost is $150,000. Alfred W. Cheesman, Shreveport, is interested.

Knoxville, Tenn.—Bids will be received until 8 p.m., May 27, by R. B. Gardner, Secy., School Bd., 179 Knox Ave., for alterations and additions to school buildings. E. V. Dennick is Arch., 1212 House Bldg.

Brooksville, Ky.—A. J. Bryan, of the Falls City Construction Co., Louisville, Ky., has been selected to prepare the plans for the Bracken County courthouse, Brooksville. The estimated cost is $47,000. Erroneously noted May 15, under Brookville, Ohio.

Fort Thomas, Ky.—The City will erect a two-story and basement high school, 121x154 ft. David Davies is Pres. Bd. of Education. The estimated cost is $50,000. Weber, Werner & Adkins, Mercantile Library Bldg., Cincinnati, Ohio, are Archs.

Cincinnati, Ohio—The Reif-Schoening Tanning Co., Price Hill road, Cincinnati, will erect a two-story, 50x120-ft. fireproof building, on Sixth St. and Price Hill road. Stegner, Hughes & Alves, Commercial-Tribune Bldg., are Archs.

+Stegner, Hughes & Alves, Archs., Cincinnati, have awarded the contract for iron to be used in the erection of the Lippencott Co's new building on Main St., Cincinnati, to the POTHOFF CONSTRUCTION CO., electrical work to the BEATTIS ELECTRICAL CO., and roofing and sheet-iron metal to the JACOB FREUND ROOFING CO., all of Cincinnati.

Cleveland, Ohio—Plans are being prepared by J. W. Chrisford, Arch., 1452 Highland Ave., for the construction of a three-story and basement Masonic temple at Andrews and Detroit Aves. The estimated cost is $60,000.

Columbus, Ohio—The H. Pirrung Estate, Columbus, has authorized G. R. Bassett, Arch., Central National Bank Bldg. to prepare plans for a four-story and basement warehouse and store, 75x140 ft. Cost $85,000.

The Columbus Lodge, B. P. O. E., has purchased a site on East Broad St. upon which will be erected a club house to cost about $100,000.

The Columbus Depot Co., organized about one year ago has taken steps to erect a large interurban depot in the square bounded by Rich, Town, Wall and Front Sts. for the use of a number of traction lines entering the city.

+Evansville, Ind.—The contract for the construction of the warehouse at Ninth and Sycamore Sts., for the Cook Brewing Co., has been awarded to KOCH & GRIESBACHER. The estimated cost is $150,000.

+Belvidere, Ill.—The contract for the construction of the almshouse for Boone County, has been awarded to SKOGLAND & WEDDERBERG, De Kalb, Ill., at $30,940. Noted May 1.

Chicago, Ill.—Plans have been completed by George S. Kingsley, Arch., 186 North La Salle St., for a 13-story and basement building to be erected at 105-09 North Dearborn St., for Max Brede, Vice-Pres. of Albert Pick & Co. The structure will be of steel and pressed brick, 56x80 ft. The estimated cost is $350,000. Noted Mar. 6.

Milwaukee, Wis.—A 10-story hotel is contemplated by Max Goldstine on Third St., north of Sycamore St. A similar structure was contemplated by N. Stone on this site, as noted previously, but the lease of Mr. Stone was held void by Circuit Court Judge Fritz, who held that a contract made between Mr. Goldstine and S. A. Tolman, Chicago, Ill., owner of the property, made a lease between these two parties, effective before the Stone lease was signed up. Cost of the new structure, $250,000.

The Building Committee of the Knights of Columbus has submitted plans for the new clubhouse to be erected at 15th St. and Grand Ave. It will be three stories, of brick and stone, and will cost $60,000. Bids will be asked for soon.

Milwaukee, Wis.—Bids will be received until May 28, for the carpenter work on the addition to the school at 20th and Brown Sts. Check for 30 per cent. Frank M. Harbach, Secy. of the school board. Van Ryn & De Gelleke are the school board Archs.

+Oshkosh, Wis.—The general contract has been awarded to ANTON NIELSEN, Neenah, Wis., for the construction of the four-story and basement addition to the hospital owned by the Alexian Brothers. Breilinaier & Son are Archs., 41 University Bldg., Milwaukee, Wis.

+Keewatin, Minn.—The contract for the construction of the high school at Keewatin, has been awarded to THOMSON & EGAN, Ashland, at $59,986. The heating and ventilating contract was awarded to W. K. ZUSQUITZ, Hill City, and the electrical work, to McCLELLAND & THAYER, Duluth, at $4165. Bray & Nystrom are Archs., Duluth, Minn.

+Mankato, Minn.—The general contract has been awarded to OTTO NEITGE, Mankato, for the construction of the three-story and basement addition to St. Josephs Hospital.

+Nashwauk, Minn.—The contract for the construction of the proposed wings to the school here has been awarded to THEODORE NAUFFTS, Duluth, at $42,264.

+Cassville, Mo.—The contract for the construction of the Barry County Courthouse has been awarded to HAMBLEY & HANSON, St. Louis, at $45,150. Robert McCaw of Rolla submitted a bid of $47,159.

Kansas City, Mo.—Bids will be received until June 1, by Root & Seimens, Archs., 1212 Scarritt Bldg., for the construction of a four-story steel and concrete building at 922 Main St., for O. H. Martin, Mgr. of the Bay State Land Co. The estimated cost is $85,000.

Little Rock, Ark.—Cass Gilbert, Arch., 11 East 44th St., New York, is preparing plans for the completion of the State Capitol. The estimated cost is $500,000. G. H. Wells is Assoc. Arch.

Magnolia, Ark.—Plans have been prepared by Will, Seibert & Co., Archs., Texarkana, Ark., for the construction of two dormitories for the State Agricultural School. The estimated cost is $45,000.

+Cameron, Tex.—The contract has been awarded to A. Z. Badgers, Mantague, Tex., for the construction of a three-story sanitarium, 60x160 ft. George Burnett, is Arch., 1702 Amicable Bldg., Waco, Tex.

+Corsicana, Tex.—The contract has been awarded to D. C. McCORD, for the construction of the dormitory, for the I. O. O. F. Widows & Orphans' Home. Lang & Witchell, are Archs., 1614 Southwestern Life Bldg., Dallas, Tex.

Galveston, Tex.—John Christesen & Co., automobile and motorcycle dealers, will erect a 12-story office building at Tremont and Church Sts. The estimated cost is $750,000.

Seattle, Wash.—The Port of Seattle Commission will shortly ask for bids for the erection of a five-story reinforced concrete warehouse, at the foot of Bell St., at a cost of about $100,000. Capt. A. D. Powell, Central Bldg., is Arch.

Tacoma, Wash.—The lowest bidder for the construction of the Lincoln High School was Olsen & Young, Seattle, at $296,429. Other bidders were: Pearson Construction Co., $298,895; MacRae Bros., $315,550; H. F. Allen, $315,779; O. L. Tuell, $319,643; J. E. Bonnell, Tacoma, $321,490; O. F. Larson, $324,383; Cornell Bros., $331,920; Ditlefson & Geering, $324,899; Erickson, Teeter & Hansen, $348,118; Hans Pedersen, $349,435; Sound Construction & Engineering Co., $354,214; Kiebertz, Smith & Rawntree, $367,000. Noted Apr. 24.

+Portland, Ore.—The contract has been awarded to the BOYAJOHN-ARNOLD CO., for the construction of a building at Oak and Park Sts., for the Balfour-Guthrie Co. Noted May 8.

+A contract has been awarded to BOYAJOHN & ARNOLD CO., for the concrete work to be used in the construction of an eight-story office building for the Title & Trust Co. McNaughton & Raymond, are Archs., 47 Concord Bldg., Portland.

+Los Angeles, Calif.—The general contract has been awarded to the GAVAGAN-McCUTCHEON Co., Union Oil Bldg., at $60,800 for the erection of a six-story and basement reinforced concrete store and loft building on Broadway between Eighth and Ninth Sts. for F. W. Braun. It will be 50x164 ft., and reinforced concrete frame, walls, floors and roof, glazed brick facing, terra cotta cornice. W. J. Saunders, International Bank Bldg., is Arch.

Train & Williams Archs., Exchange Bldg., have been commissioned to prepare plans for the new Masonic temple to be erected on Grandview St. between Ninth and 10th Sts., for the Westlake Lodge, F. & A. M. It will be a two-story and basement brick structure 40x95 ft. The building will have concrete foundation and basement, white glazed brick and terra cotta facing.

+Oakland, Calif.—The contract has been awarded to PERCY J. WALKER, for the construction of a 10-story building at Broadway and 17th St., for Miss Lucy Fay Thomson. The estimated cost is $200,000. Walter Reed is Arch., Oakland Bank and Savings Bldg.

+San Francisco, Calif.—The following contracts have been awarded by F. H. Meyer, Arch., Bankers Investment Bldg., in connection with the erection of a six-story apartment building on Sutter St., for W. F. Perkins: General contract, LARSEN & LARSEN, at $46,000; brick work, CHAS. H. HOCK, 180 Jessie St., $9800; electric wiring, the PACIFIC FIRE EXTINGUISHER CO., 507 Montgomery St. $3290; heating, JOHN G. SUTTON CO., 243 Mine St., $1540.

The Efficiency Society will hold its May dinner at the Aldine Club, 200 Fifth Ave., May 29. This meeting will be devoted to "Office Efficiency."

Dr. Melvil Dewey will talk on "Ofi's Motion Study."

Mr. Leon Ora Pisher, Third Vice-President of the Equitable Life Insurance Co., will talk on "Office Efficiency as it Affects the Employee."

Mr. Mason Britton, of the Hill Publishing Co., will talk on "The Practical Operation of an Efficient Office."

INDUSTRIAL NOTE

The Riter-Conley Co., Pittsburgh, has recently finished shipping 700 tons of structural steel for a new blast furnace the Maryland Steel Co. is building at Sparrows Point, Md. The company has also received a contract for the structural work for the addition to the Pennsylvania Co.'s machine shop at Conway.

CONTRACT PRICES

Canal—Babb, Mont.—Bids for constructing the St. Mary Canal, St. Mary storage unit, Milk River Project, were received by the Reclamation Service, Apr. 28, as follows: (A) Kilpatrick Bros. & Collins Contracting Co., Beatrice, Neb.; (B) Winston Bros. Co., Minneapolis, Minn.; (C) Cardston Construction Co., Cardston, Alta.:

SAINT MARY CANAL, MILK RIVER PROJECT, MONTANA

	A	B	C
267,000 cu.yd. excavation, Class 1	$0.50		
10,000 cu.yd. excavation, Class 2	0.64		
500 cu.yd. excavation, Class 3	1.00		
16,500 sta. cu.yd. overhaul	0.02		
Total, schedule 1			
496,500 cu.yd. excavation, Class 1	0.35		
100,000 cu.yd. excavation, Class 2	0.55		
10,000 cu.yd. excavation, Class 3	1.00		
1,170,000 sta. cu.yd. overhaul	0.02		
Total, schedule 3			
428,000 cu.yd. excavation, Class 1	0.35	$0.26	$0.22
5,000 cu.yd. excavation, Class 2	0.55	0.45	0.60
1,000 cu.yd. excavation, Class 3	1.00	1.00	1.25
281,000 sta. cu.yd. overhaul	0.02	0.02	0.02
Total, schedule 4	$159,170	$120,150	$104,030
Totals, individual bids	$512,575	$120,150	

Sewers—Bexley, Ohio—Bids for constructing a system of sanitary sewers here, according to plans prepared by A. Elliott Kimberly, Consult. Engr., Columbus, Ohio, were received by the city, May 1, as follows: (A) Sieverling & Fairbairn, Springfield, Ohio; (B) F. R. Stone, Lima, Ohio; (C) William Jones, Carnegie, Penn.; (D) S. T. Knight, Columbus, Ohio; (E) Barnewolt Construction Co., Peoria, Ill.; (F) KOHBARGER & HOYLES, Marion, Ohio (awarded contract):

SANITARY SEWERS, BEXLEY, OHIO

28,529 lin.ft. 8-in. sewer pipe, cement joints	$0.24	$0.28	$0.22	$0.30	$0.2925	$0.15
4824 lin.ft. 10-in. sewer pipe, cement joints	0.34	0.37	0.29	0.40	0.405	0.21
4313 lin.ft. 12-in. sewer pipe, cement joints	0.44	0.44	0.35	0.50	0.5075	0.33
3405 lin.ft. 15-in. sewer pipe, cement joints	0.65	0.61	0.51	0.70	0.765	0.40
876 lin.ft. 18-in. sewer pipe, cement joints	0.85	0.85	0.72	0.95	0.99	0.60
22,529 lin.ft. 8-in. sewer pipe, asphaltic joints	0.32	0.45	0.42	0.35	0.365	0.19
4824 lin.ft. 10-in. sewer pipe, asphaltic joints	0.47	0.52	0.49	0.45	0.4975	0.28
4313 lin.ft. 12-in. sewer pipe, asphaltic joints	0.52	0.60	0.55	0.60	0.65	0.34
1470 cu.yd. excavation and back fill, under 6 ft.	0.30	0.33	0.48	0.30	0.23	0.28
6314 cu.yd. excavation and back fill, from 6 to 8 ft	0.40	0.36	0.64	0.40	0.32	0.41
18,979 cu.yd. excavation and back fill, from 8 to 10 ft	0.60	0.58	0.72	0.60	0.65	0.52
12,154 cu.yd. excavation and back fill, from 10 to 12 ft	0.73	0.80	0.88	0.95	0.78	0.71
1790 cu.yd. excavation and back fill, from 12 to 14 ft	1.05	1.00	1.10	1.20	0.92	1.30
530 cu.yd. excavation and back fill, from 14 to 16 ft	1.40	1.40	1.26	1.65	1.44	1.80
800 cu.yd. excavation and back fill, from 16 to 18 ft	1.60	2.00	1.42	2.25	1.61	2.75
1 house connection, 6-in. cement joints, each	0.55	0.28	0.22	1.10	0.22	0.50
1 house connection, 6-in. asphaltic joints, each	0.83	0.45	0.32	1.20	0.38	0.55
923 Y-branches, 8x6-in.	1.00	1.00	1.00	1.20	1.55	0.90
102 Y-branches, 10-6-in.	1.40	1.15	1.50	1.70	2.00	1.10
87 Y-branches, 12x6-in.	1.80	1.50	2.00	2.00	2.38	1.40
12 Y-branches, 15x6-in.	2.75	2.00	3.00	3.35	2.66	1.75
1 concrete manhole, 8½ ft. and under	42.00	35.00	30.00	27.00	65.00	30.00
1 concrete manhole, over 8½ ft. and under 10 ft	42.00	38.00	35.00	30.00	77.00	37.00
63 concrete manholes, over 10 ft. and under 12 ft	42.00	41.00	45.00	34.00	90.00	44.00
1 concrete manhole, over 12 ft. and under 14 ft	42.00	44.00	50.00	38.00	101.00	48.00
1 concrete manhole, over 14 ft. and under 16 ft	42.00	47.00	55.00	40.00	119.00	60.00
1 concrete manhole, over 16 ft. and under 18½ ft	42.00	50.00	60.00	45.00	135.00	70.00
1 brick manhole, 8½ ft. and under	52.00	38.00	30.00	27.00	75.00	30.00
1 brick manhole, over 8½ ft. and under 10 ft	52.00	41.00	35.00	30.00	89.00	37.00
1 brick manhole, over 10 ft. and under 12 ft	52.00	44.00	45.00	34.00	104.00	44.00
1 brick manhole, over 12 ft. and under 14 ft	52.00	47.00	50.00	38.00	120.00	48.00
1 brick manhole, over 14 ft. and under 16 ft	52.00	50.00	55.00	40.00	137.00	60.00
1 brick manhole, over 16 ft. and under 18½ ft	52.00	53.00	60.00	45.00	155.00	70.00
3 concrete drop manholes	52.50	45.00	60.00	45.00	100.00	70.00
3 brick drop manholes	60.00	50.00	60.00	45.00	115.00	70.00
14 concrete single flushing manholes	55.00	48.00	75.00	60.00	50.00	70.00
16 brick single flushing manholes	63.00	54.00	75.00	60.00	57.00	70.00
2 concrete double flushing manholes	110.00	55.00	100.00	100.00	55.00	80.00
2 brick double flushing manholes	122.00	60.00	100.00	100.00	63.00	80.00
16 lampholes	10.00	9.00	10.00	10.00	15.00	10.00
1 deep house connection	5.00	2.00	10.00	2.50	2.20	9.00
3 tons 14-in. c.i. pipe	40.00	45.00	60.00	50.00	45.00	30.00
2.9 tons 18-in. c.i. pipe	45.00	45.00	60.00	50.00	50.00	30.00
Class A concrete, per cu.yd.	8.00	10.00	12.00	9.00	10.00	10.50
Class B concrete, per cu.yd.	7.00	10.00	10.00	7.50	8.00	9.00
Class C concrete, per cu.yd.	6.00	8.00	9.00	7.00	6.00	8.00
Rock excavation, per cu.yd.	6.00	4.50	5.00	5.50	5.00	3.00
M ft. b.m. timber in foundations	38.00	35.00	50.00	50.00	30.00	30.00
M ft. b.m. sheathing in trench	38.00	35.00	40.00	50.00	30.00	30.00
Common labor, per hour	0.30	0.30	0.25	0.26	0.35	0.22
Skilled labor, per hour	0.50	0.50	0.35	0.50	0.50	.225
Foreman, per hour	0.60	0.60	0.60	0.75	0.65	0.30
Teaming, per hour	0.60	0.65	0.60	0.55	0.65	0.45
6-in. tile underdrains	0.30	0.30	0.20	0.25	0.12	0.25
8-in. tile underdrains	0.35	0.33	0.25	0.30	0.18	0.40
10-in. tile underdrains	0.45	0.40	0.30	0.35	0.25	0.45
12-in. tile underdrains	0.68	0.50	0.35	0.40	0.31	0.50
Railway crossing, lump sum	400.00	100.00	200.00	250.00	500.00	100.00
Totals	$46,013	$47,559	$51,914	$53,185	$53,526	$41,735
Totals	$49,267	$53,722	$59,447	$55,284	$56,655	$43,257

Idle Railway Cars—The most substantial decrease in idle equipment made this year, was reported May 1. The decrease in the fortnight was 18,000 cars. A year ago, in the corresponding two weeks, the decrease was 4,000 cars. Unless business shows down more rapidly than now seems probable, a shortage should occur early in the summer.

The buying of new cars by the railways has been very light during the last three months. Reports of the growing crops have been uniformly satisfactory, and the fall traffic is likely to be large.

Following is a table showing the surpluses and shortages:

1913	Surplus	Shortage	Net Surp
May 1	53,977	14,178	39,799
April 15	70,715	13,217	57,498
April 1	68,792	10,804	57,988
Mar. 16	57,998	20,223	37,775
Mar. 1	58,529	27,148	31,381
Feb. 15	52,700	30,517	22,183
Feb. 1	62,045	24,785	37,260
Jan. 15	53,230	24,791	28,439
1912			
Dec. 31	50,659	33,601	17,058
Dec. 14	26,614	61,006	*34,392
Nov. 30	26,135	62,536	*36,401
Nov. 21	22,363	73,475	*51,112
Nov. 7	19,987	71,156	*51,169
Oct. 24	17,289	67,270	*49,981
Oct. 10	22,810	54,389	*31,579
Sept. 26	26,754	44,547	*17,793
Sept. 12	27,380	36,000	*8,620
Aug. 29	36,047	26,297	9,750
Aug. 15	58,623	14,722	43,901
Aug. 1	65,904	9,395	56,510
July 18	75,389	6,407	68,922
July 4	70,731	6,707	64,024
June 20	73,464	5,746	67,718
June 6	89,208	2,822	86,386
May 23	123,683	7,482	116,201
May 9	136,776	6,678	130,098
April 25	151,186	12,305	138,881
April 11	94,943	15,554	79,389
March 27	52,680	33,974	18,708
March 13	46,028	42,985	3,043
Feb. 28	44,984	37,142	7,843
Feb. 14	50,886	36,928	13,958
Jan. 31	55,592	23,011	32,581
Jan. 17	102,479	12,194	90,285
Jan. 2			135,938

*Net shortage.

CONTRACTS TO BE LET

Filters, Basins and Grading

Baltimore, Md.

Sealed proposals, endorsed, "Bids for construction of Filters, Basins and Grading, Lake Montebello, Water Department, Contract No. 11" addressed to the Board of Awards of Baltimore City, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 A. M. Wednesday, June 4th, 1913, for the construction of 32 Mechanical Filter tanks; 2 Coagulating Basins; 1 Mixing Basin; 2 earthen dams, and Appurtenances, as shown on plans on file in the office of the Water Engineer, City Hall, Baltimore, Md.

Plans and specifications can be obtained at the office of the Water Engineer, City Hall, Baltimore, Md., on or after May 12th, 1913. A charge of Twenty-five dollars ($25.00) will be made for each set of plans and specifications; this amount will be refunded upon the return of these plans and specifications before June 11th, 1913, in good condition. Specifications used in making a bid will be considered as returned. Blueprints will be furnished to prospective bidders at twenty-five cents (25c.) each, which amount will not be refunded.

A certified check of the bidder on a clearing house bank, made payable to the Mayor and City Council of Baltimore for the sum of Twenty thousand dollars ($20,000) will be required with each bid.

The extent of the work is as follows:—

Excavation (Approximate) 110,000 cu. yds.
Two Coagulating Basins, capacity each 8,500,000 gals.
One Mixing Chamber, capacity of 3,000,000 gallons.
32 Mechanical filter tanks, four million gals. daily capacity with complete equipment.
Filtered water basins with capacity of 2,500,000 gals.
Two earthen dams built from excavated materials.

This contract does not include the filter equipment, machinery, piping or valves.

The successful bidder will be required to give bond to comply with the City Charter respecting contracts.

The Board of Awards reserves the right to reject any or all bids.

EZRA B. WHITMAN,
Water Engineer.

Approved May 7th, 1913.
JAMES H. PRESTON,
President Board of Awards.

⁂

Paving, Sewers, etc.

Boston, Mass.

Sealed bids or proposals for paving a portion of Northern Avenue and the Commonwealth Pier No. 6 on the South Boston Flats and building in the same sewers, surface water drains and water pipes will be received by the Directors of the Port of Boston at their offices at 10 Central Street, Boston, Mass., until 12 o'clock noon, Wednesday, May 28, 1913.

The work to be done is the paving with granite blocks of Northern Avenue 100 feet wide for a length of about 1000 feet; also a section of D Street 50 feet wide and 250 feet long and a street on the pier 100 feet wide and about 1100 feet long; the building of sewers, surface water drains and water pipes in said streets and the paving with vitrified brick on a concrete base the outer edge of the pier 45 feet wide and about 2600 feet long.

All proposals must be made upon blank forms which may be obtained at the office of the Directors, where plans and specifications and other information relating to the work may be obtained. Each bidder will be required to give to the Directors satisfactory assurance of his competency, experience and responsibility. The right is reserved to reject any and all bids and to waive any defect or informality at the discretion of the Directors. Hugh Bancroft (Chairman), Joseph A. Conry, William F. Fitzgerald, William S. McNary, Francis T. Bowles, Directors of the Port of Boston. FRANK W. HODGDON, Chief Engineer.

May 14, 1913.

Trunk and Lateral Sewers

DEPARTMENT OF WORKS
City of Oswego, N. Y., May 8, 1913.

Sealed proposals for the construction of trunk and lateral sewers for the City of Oswego, will be received by the Department of Works, in the City Hall, up to two o'clock p.m. of the 4th day of June A. D. 1913, and immediately thereafter be publicly opened and read.

The work to be done consists of the construction of approximately 9700 feet of sanitary sewer, from 8 to 36 inches in diameter, and 5865 feet of vit. Tile and Reinforced Concrete storm sewer made in complete sections from 15 to 72 inches in diameter; and the work will be done under two contracts.

The proposals submitted for these contracts must be accompanied by a certified check upon a National Bank or Trust Company, and drawn to the order of the Chamberlain of the City of Oswego for the following amounts:— For "E," "F," and "G," Three Thousand Dollars; for "H," Two Thousand Five Hundred Dollars.

Specifications and printed forms of proposals can be obtained of the City Engineer, and a full set of plans can be obtained from him, for the sum of ten dollars ($10), such a sum to accompany the order, and be drawn to the order of the City Chamberlain of the City of Oswego, and such sum will be returned to the applicant upon the return of the set of plans to the City Engineer in good condition. Specifications and plans may also be seen in the office of the Engineering News.

The Department of Works reserves the right to reject any or all bids, as it may deem it for the public interest so to do. Also to waive any slight informality in the proposals. The lowest bid need not necessarily be accepted in preference to a higher one. If the bids for the East Oswego Creek storm sewer make the total cost of the work exceed the total money appropriated, then the Department of Works, reserves the right to omit the construction of a sufficient amount of the upper end of the storm sewer, so as to bring the total cost of the work within the appropriation.

JOHN SMITH,
Commissioner of Works.

CHARLES H. SNYDER,
City Engineer.

⁂

Sewer System

Pottstown, Pa.

Sealed proposals addressed to Frank Seasholtz, Chairman of Sewer Committee, will be received at the office of the Clerk of Council until 1:30 P. M. May 27th, for the construction of Section-A of a Complete System of Sanitary Sewers for Pottstown, Pa. Section-A will comprise 13.5 miles of sewers varying from 6" to 30" inclusive in diameter.

Proposals must be made upon printed blanks furnished for that purpose and accompanied by a certified check for Two Thousand Dollars, ($2000). All proposals will be opened and publicly read immediately following the closing of the receiving of bids. Plans may be seen and specifications obtained at the office of the Clerk of Council, or at the office of Charles E. Collins, Engineer, Drexel Building, Philadelphia. Blue Prints may also be obtained by prospective bidders from the Engineer by depositing a certified check for the sum of Fifteen Dollars ($15.00) which will be returned upon the receipt of the plans in good condition. The Sewer Committee reserves the right to reject any or all bids.

FRANK SEASHOLTZ,
Chairman Sewer Committee.

⁂

Steel Bridge

Jewel, Ga.

Proposals are asked for erection of steel bridge over the Ogeechee River, at Jewel, Ga., between Hancock and Warren Counties.

Apply to G. C. BELL, Chman. Hancock Co., Ga., Sparta, Ga., and G. R. MANER, Chman. Warren Co., Ga., Warrenton, Ga.

Engineering News

VOLUME 69 MAY 29, 1913 NUMBER 22

The Yardley Bridge across the Delaware River, Philadelphia & Reading Ry.

The Philadelphia & Reading Ry. Co. has just completed near Yardley, Penn., one of the largest two-track concrete railway bridges in existence. This bridge is located on the line of the New York division between New York and Philadelphia at the crossing of the Delaware River, and replaces an old wrought-iron deck truss bridge, which has been in use since 1876.

The old bridge consisted of two 60-ft. deck plate-girder spans and seven wrought-iron deck trusses, one 120 ft., one 170 ft., and five 200 ft. in span. It had trusses 26 ft. 8 in. in depth, and a rail elevation some 70 ft. above the river. This bridge was erected in 1875 and opened for service in May, 1876. It was built jointly by the North Pennsylvania R.R. Co. and the Delaware & Bound Brook R.R. Co., F. H. Saylor being chief engineer and the late D. McN. Stauffer, for many years Editor of Engineering News, resident engineer. The masonry was built by McGranus & Fitzpatrick, and J. H. Cofrode & Co. were the contractors for the iron work. It was strengthened in 1883 by the introduction of an additional middle truss, adding 50% to the strength of the trusses and 100% to the floor system.



Fig. 1. View Just before Completion of Philadelphia & Reading R.R. Bridge across Delaware River, at Yardley, Penn.
(Old iron truss bridge in background.)

Design

The new bridge parallels the old, with center lines 35 ft. apart, connection to the main-line tracks being made by easy curves about one thousand feet back from the abutment of the bridge. The new bridge has a total length between ends of abutments of 1445.5 ft. and is made up of 14 arches, 11 of which are 90 ft. 9 in. in clear span, and three 85 ft. 11 in. clear span. The structure is divided in two by a middle abutment pier 20 ft. in width, whereas the intermediate piers, which are stable only under balanced dead load, are 10 ft. in width. There is a rising grade to the eastward of 0.22 ft. every 100 ft. The bridge carries two tracks 13 ft. c. to c., and is 33 ft. wide from out to out of coping. The base of the rail is about the same elevation as the old bridge, that is, 70 ft. above low water in the river, and about 80 ft. above the bed rock.

This bed rock is found very close to the river bottom and was utilized in all piers and abutments for a foundation. As originally designed, the two end abutments were to rest on concrete piles, but as described hereafter this project was abandoned and the abutments were carried to rock.

The piers are solid plinths resting as before noted on bed rock, and having plans symmetrical about a longitudinal center line. Each pier is provided with a cutwater extension. The upstream noses of Piers 2 to 11 inclusive are protected by bent steel plates 18x½ in. thick, anchored to the pier by ¾-in. round bolts. The side and end faces of the piers have a batter of ½ in. to the foot. The lower section is capped by a coping course 11 ft. wide and 2 ft. thick, the top of coping being about 4 ft. below the springing line of the arch.

Below the arch spring the abutments are solid plinths similar in section to the piers and extending as the piers to solid rock. The side walls, which extend up as spandrels above the arch spring, have an overhang to the rear, which overhang carries the railing back from the main pedestal of the abutment. The earth fill tails down alongside of the abutment and is held by low toe walls.

The arch ribs are full-width reinforced-concrete rings, curved to a five-centered arch. They are reinforced with two lines of reinforcing rods, one at the intrados and the other at the extrados, each being of ¾-in. square twisted rods spaced 7 in. c. to c. These are tied together with transverse rods ½ in. square and spaced 3 ft. c. to c., but are not connected with rods in a vertical plane. The arch rib is peculiar in one respect, in that its actual thickness is greater than its showing thickness. As will be noted from the halftones and from the elevations of the arch in Fig. 2, the showing face of the arch rib is 3 ft. 6 in. deep at the crown, enlarging to a radial depth of about 7 ft. at the springing line. In reality, the arch rib is 3 ft. 6 in. deep at the crown, but enlarges at a much greater rate to a depth of about 13 ft. 6 in. at its juncture with the adjoining arch over the middle of the pier. The reinforcement, however, follows the real depth, not the showing depth, of the arch, as shown on Fig. 2.

In erecting the arch the showing face depth was built first and the extra depth placed after the arch centers were struck. It will be seen from Fig. 2 that the arch rib as first built to the showing thickness carries on its top a section equivalent to the difference between the showing depth and the real depth, and that this section is tied into the showing arch rib when it is completed by roughening steps left in the extrados of the showing arch. A view looking down on one of the showing arches is given in Fig. 4, showing the roughened surface preparatory to receiving the additional arch rib section. This additional section extends only to within 2 ft. 6 in. of the outer edges of the rib, this 2 ft. 6 in. space being filled with the vertical spandrel walls, which are thus on the showing faces continuous from the showing arch ribs to the coping of the railing. The spandrels are tied into the upper part of the rib with anchor bolts (Fig. 2).

These spandrel walls are of gravity section and solid throughout. They have between them a fill made up of one- and two-man-size stones, which are carried to the subgrade of the roadbed where the regular ballasted roadbed is laid.

The pilasters are carried up above the base of the rail about 5 ft. and extend behind the face lines of the arches, providing refuge bays at the track level, and together with the intermediate concrete posts and two lines of 4-in. galvanized iron pipe form the railing.

Expansion is provided in each arch by vertical construction joints in the spandrel walls, rising as shown in Fig. 2.

The waterproofing of the arches is composed of five layers of felt, protected by one layer of hard brick thoroughly mopped, applied to the tops of the arches between the spandrel walls and flashed up in the inner faces of the spandrels about 12 in., except directly over the pier where the flashing extends 4 ft. above the tops of the arches. All vertical expansion joints and horizontal construction joints are protected by a single layer of prepared burlap 12 in. wide thoroughly mopped with an asphalt compound. This burlap is carried under the coping in all expansion joints.

The drainage of the bridge is taken care of by means of an 8-in. cast-iron pipe, extending from the valleys over the piers to the soffit of the arch (Fig. 2). It was at one time intended to place track tanks just west of the bridge, but experience showed that track tanks which were in service near the approaches to the old bridge resulted in an excess of water splashed from the tanks onto the old bridge. At one time this splashing was so great in the winter that a dangerously heavy coating of ice formed on the old bridge members. Rather than subject the new bridge to the possible excess of water from the tanks and also from possible freezing in the fill, the railway com-

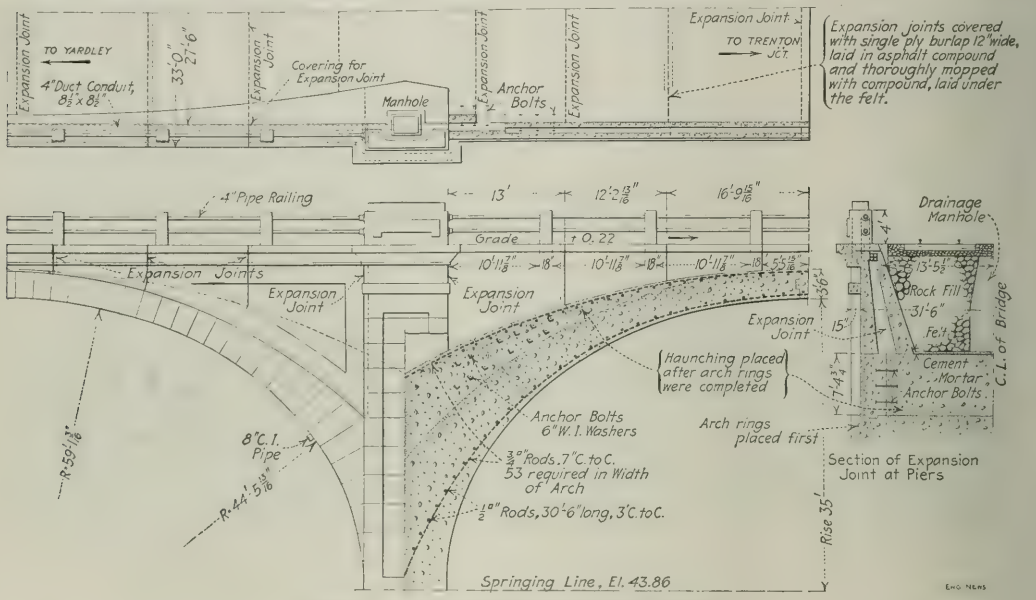


Fig. 2. Details of Arch of Yardley Bridge

pany has decided to move the present tanks, which are located just west of the old bridge on the embankment approaches, about a mile and three-quarters west and the work of constructing them is now in progress.

Embedded in each of the spandrel walls is a 4-way vitrified clay conduit with manholes placed at frequent intervals to carry the present and future lines of telephone and telegraph wire.

The forms of the bridge were made exceptionally smooth and tight, as noted below, so that no surface finish other than that formed by spading against these forms

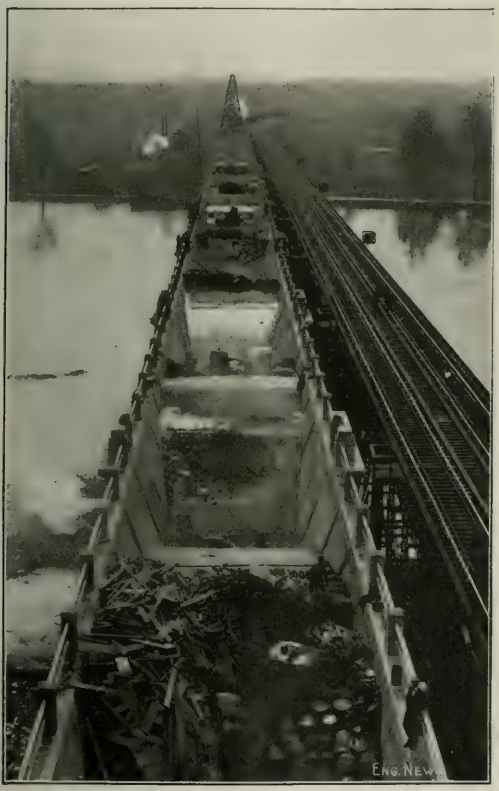


FIG. 3. VIEW LOOKING WEST ACROSS YARDLEY BRIDGE DURING CONSTRUCTION

was required. This has resulted in an extremely good surface texture.

LOADS AND STRESSES—The bridge was designed for the standard P. & R. Ry. loading for a 5500 lb. per lin. ft. of train preceded by two 2-8-0 locomotives and tenders, with 55,000 lb. on driver, 27,500 lb. on pilot and 44,000 on tender axles. The permissive maximum limit of compressive strength in the arch ring was 300 lb. per sq.in.

MATERIALS

The concrete used was of two classes. A 1:2:4 mixture was used in the first 4 ft. of the foundation. From this point to the springing line of the arches the mixture was 1:3:6 and the arches and spandrel walls were of 1:2:4. Embedded stones were allowed in the foundations and piers, but not in the arch rings or spandrel walls. One- to two-man-size stones were used for this purpose and procured from a local quarry for the New Jersey side of the bridge and imported stone on the Pennsylvania side. The quantity of stone used varied in different courses of the work, depending upon the convenience of the stone piles and the ability of the derricks to handle the concrete and place it in the forms as fast as it reached them from the mixer. As it was necessary to use the same derrick for both concrete and stone, the stone was placed when convenient, the concrete having the preference.

The coping was composed of a 1:3:6 mixture and the railing posts of a 1:2:4 granolithic mixture, the stones for the posts being of a ¼-in. trap rock cleaned of dust.

A standard portland cement tested by the railroad company in its laboratories at Reading, Penn., was used on all the work. The sand used in the concrete on the Pennsylvania side of the bridge was a well graded bar sand dredged from the Delaware River near Burlington, N. J. That used for the New Jersey was a bank sand from Birmingham, N. J. Freight rates governed the contractor in using the two different sands. While the



FIG. 4. VIEW OF ARCH RIB BEFORE THE HAUNCHING THICKNESS WAS ADDED
(Cableway tower passing through arch barrel)

specifications called for crushed rock to be used in all concrete, the contractor was allowed to use river pebbles for the Pennsylvania side of the structure, these being well graded in size from ¼ to 1¼ in. Crushed stone was used for the New Jersey side, ranging in size from 1¼ in. to a small percentage of dust, being the run of crusher.

The total quantity of concrete of all kinds in the bridge is 34,670 cu.yd., made up of the following materials: Cement, 42,363 bbl.; crushed stone and pebble, 37,172 tons; sand, 21,954 tons; embedded stone, 2558 tons; steel reinforcement, 262.5 tons.

The total area of surface to be waterproofed will amount to about 42,000 sq.ft. The stone spandrel filling will amount to about 7500 tons. There were used for construction purposes about 1,400,000 ft. b.m. of lumber,

800,000 ft. of which was required for the centering of the arches.

Construction

Plant—As a matter of convenience and particularly to promote the facility in procuring material, work was conducted from both sides of the river, duplicate plants being located on the New Jersey and on the Pennsylvania shores. Figs. 5-6 show at the left the plant as installed on the Pennsylvania shore up to the state line in the middle of the river, and the right the plant installed extending from the New Jersey side up to the same state line.

At the Pennsylvania half of the bridge the materials were shipped in over the Reading Ry. to a siding at the grade elevation of the main track and from there dumped through chutes over the embankment to the storage pile below (for the sand and stone) and to the warehouse (for the cement). This embankment being about 45 ft. high afforded unlimited capacity for the storage of material at practically no additional cost for rehandling. The cement house, which had a capacity of about 14 cars, had a narrow-gage track laid on the floor upon which a car containing a skip holding 50 bags could be operated to serve the mixer about 100 ft. distant. A derrick placed near-by controlled the sand and stone dumps as well as the cement from the storage house to the mixing plant, from which a narrow-gage track ran out to the bridge proper.

On the New Jersey side the mixing plant was located some seven or eight hundred feet back from the shore

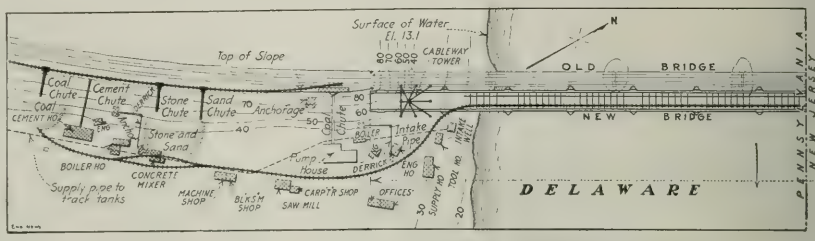


Fig. 5. Pennsylvania Side

Figs. 5-6. Plant Layout for Construction

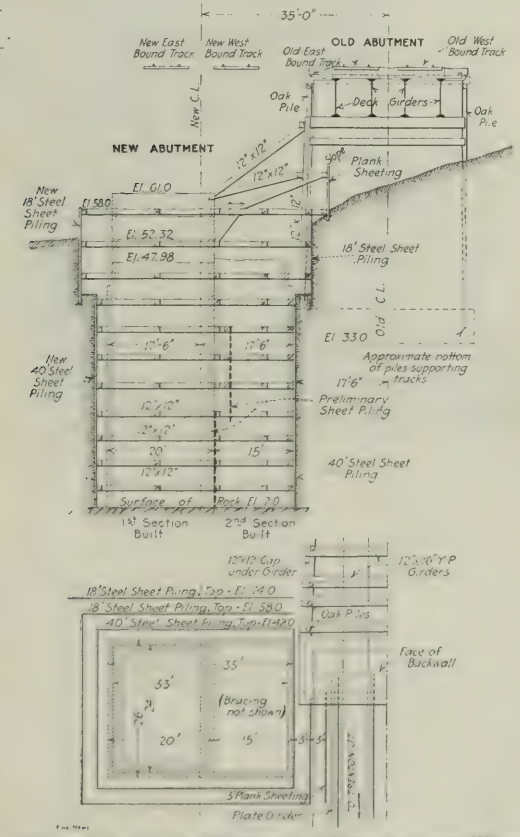


Fig. 7. Details of Method of Building the West Abutment

near a siding of the Reading road, which connected with the Belvidere division of the Pennsylvania R.R. Over this line all materials for the New Jersey half of the bridge were shipped. A derrick operating a clam-shell bucket unloaded the cars and delivered concrete materials either to the mixing bins or to the storage piles.

The mixing plants on both sides of the river were of similar construction, containing a batch mixer sufficiently elevated in timber framework to dump the mixture into cars or into buckets on flat cars. Above the mixer were provided the automatic measuring and storage bins.

On the Pennsylvania side of the river construction was carried on from a temporary pile trestle, built on the center line of the new bridge, reaching to the middle of the river at Peir 7. This trestle supported a 20-ft. gage track for the operation of a steel traveling crane, which was used in placing the coffer-dam, in excavating the pier foundations and in placing the concrete from the flat cars into the foundations or forms. At also supported a narrow-gage track used in transporting concrete, etc., by small locomotives from the mixing plant. On the New Jersey side construction was handled by a series of stiff-legged derricks, placed south of the bridge and midway of the piers so that each derrick served two piers. These were used in handling the excavation and the placing of materials in the piers. A temporary trestle carrying a narrow-gage track extended into the river to a point between Piers 8 and 9, and the track from it extended back to the mixing plant.

Work on the Pennsylvania side started in the middle of the River at Pier 7, which was completed to the springing line of the arch before work was started on Pier 6, after which it was necessary to abandon the river trestle between the completed piers. This work proceeded in similar fashion toward the Pennsylvania shore. At the same time work proceeded from Pier 8 east toward the Jersey shore, working on the temporary trestles and derricks there. While this preliminary work was going on a cableway on the center line of the new bridge was

being installed. The Pennsylvania tower for this cableway was located between the west abutment and Pier 1; the New Jersey tower between Pier 13 and the east abutment. It had a clear span of 1320 ft. between towers 125 ft. high. These towers were of long-leaf yellow pine, supported on concrete foundations. They were composed of eight 12x12-in. posts to a height of 78 ft. and four posts for the remainder of the distance to the top, all posts being braced by 3x12-in. sticks. A saddle at the top of three 12x14-in.x6-ft. oak timbers supported the cable. A total of about 28,000 b.m. of lumber was used in each of these towers. The main cable was 1¾ in. in

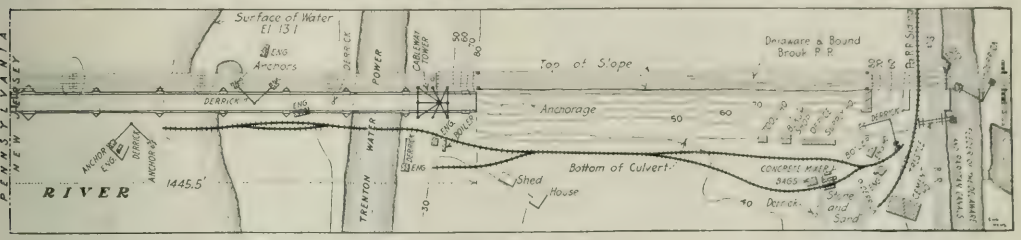


FIG. 6. NEW JERSEY SIDE OF P. & R. R.R. BRIDGE, YARDLEY, PENN.

diameter, made up of six strands of 19 wires each of plow steel with an ultimate stress of 112 tons. The cable was supported on an A-frame at the center pier, dividing it into two spans, each of which was operated by an engine at the respective ends of the cableway. The installation was made by the S. Flory Mfg. Co., of Bangor, Penn. This cableway was used for the remainder of the concrete work above the springing line of the arches and in placing the forms and centering.

In building the spandrel walls a movable sawmill installed by the contractor proved of great economy in resawing the heavy lumber required in the heavy part of the work into the smaller sizes for use in the pilasters and railings.

FOUNDATIONS—All of the piers were founded on bed rock, being placed in coffer-dams built of steel sheet piling driven with a steam hammer through a maximum of 6 ft. water (summer stage) and 8 ft. of heavy gravel, sand and boulders to the bedrock. Most of the unwatering of the coffer-dams was done with two 6-in. pumps. Some difficulty was experienced at first in lowering the water, but this was checked by placing burlap bags filled with earth against the outside of the piling. Long wire rods were used to puddle the gravel and silt along the outside of the joints. This assisted very materially in closing up any leaks through them. The excavated material was placed on the outside of the dams, which also aided in reducing the leakage. Although the piles in many instances penetrated the top stratum of the shale rock some 12 or 18 in., a great deal of water came into the dams at the bottom of the piling and interfered in the placing of the foundation concrete. The dams were about 24 in. wider than the neat foundation lines of the piers and this space was taken advantage of in leading the water around the outside of the concrete to the pumps at the end of the dam.

Enough of the steel piling, which was 12 in.-sections 18 ft. long, was purchased to cover five dams, or about 11,500 lin.ft. The first driving of five coffer-dams required 11,160 lin.ft.; the second driving of five dams required 10,980 lin.ft., and the third driving, 11,460 lin. ft., a total of 33,600 lin.ft. It will be seen that most of the piling was used three times. With the exception of a section of the dam at Pier 13, which was allowed to remain to protect the bank of the trestle water power canal, all the 18-ft. lengths of piling were recovered. The loss to the contractor by reason of the steel splitting open, or bending, or otherwise becoming damaged so as to be worthless for further use did not exceed 5% of the total, so that of the 63% pieces brought on the work, 600 were recovered and available for use on other work.

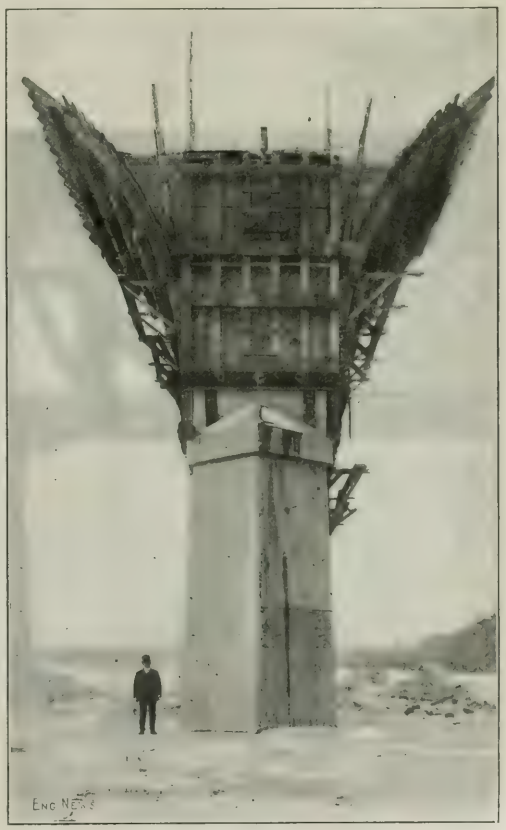


FIG. 8. VIEW OF ONE OF THE PIERS AND THE SO CALLED UMBRELLA

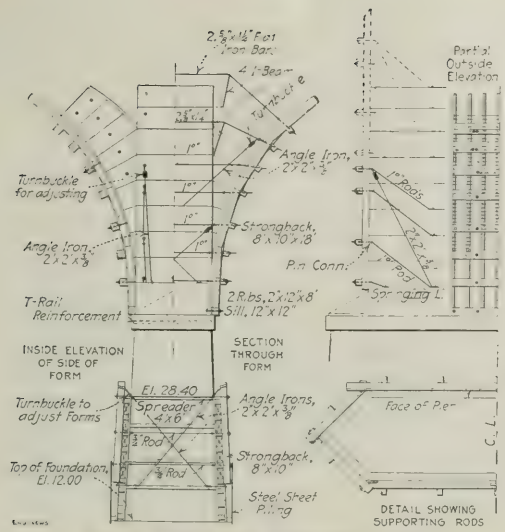


FIG. 9. DETAILS OF FORMS FOR PIERS

The abutments were originally designed to be built on concrete piles driven to rock. This construction was adopted on account of the proximity of the new abutments to those of the old, and the fact that the west abutment was founded about 30 ft. above the rock and the east abutment about 20 ft. The west abutment was first attempted. Here about 35 of the Chenoweth pattern piles were driven to the gravel, and in each case it was impossible to penetrate further. The piles were badly broken at the ends and several were broken and sheared off below the surface, so that it was deemed unwise to proceed with this construction, and arrangements were made to excavate to rock.

The method of building the abutment is shown in Fig. 7. Excavation to bedrock between steel sheet piles was first made for the southern half of the new abutment, which half was about 15 ft. south of the south face of the old abutment. This precaution was taken because the new abutment was so far below the old as to endanger the stability of the latter, if excavation were made close up to it. In order further to preserve the stability of the existing abutment carrying the main line railway, trestle bents were driven under the track just beyond the abutment (see Fig. 7).

The south half of the new abutment was carried to Elev. 61 (well above the springing line of the arch) and the old abutment then braced across to the new concrete, while the intervening half of the new abutment was built.

At the east abutment the excavation was carried down to the top of the 40-ft. sheet piling, shown in Fig. 7, without the use of a crib, the bank being sloped. The excavation was then carried to rock without the partition bulkhead.

There was a slight settlement of about 4 in. noted in one end of the old abutment, but nothing more serious resulted. A great deal of water was encountered in the excavation and much of it had to be raised about 42 ft. One 10-in. and one 6-in. centrifugal pump were used in unwatering the excavation.

METHOD OF LAYING UP ARCHES—As noted previously in this article, the piers were completed up to the springing line of the arches successively from the center toward each side of the river before any work was started on the arch ribs proper. These piers were carried up uniformly to the beginning of the arch curve in rectangular box form. Above that point the portions of the arches which were self-supported were erected as a balanced load, extending out on either side of the pier in the form shown in Fig. 8. This portion of the pier was known as the "umbrella."

When the piers were completed, arch centering was

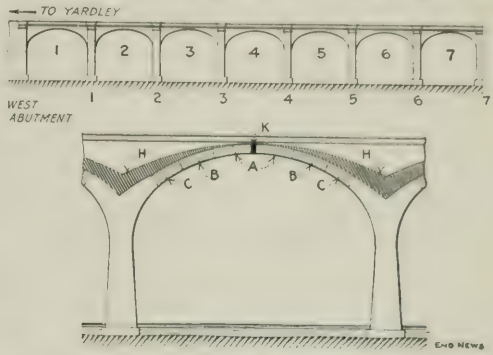


FIG. 10. VIEW OF TWO ARCHES UNDER CONSTRUCTION, SHOWING CENTERING

erected for the four arches nearest the center arch on the Pennsylvania side of the river, that is, Arches 1, 5, 6 and 7, and concreting proceeded from the center pier toward the Pennsylvania side in such fashion as to place a balanced loading on each of the centers successively. Fig. 12 and the accompanying table will show the method of laying up these arches, it being understood that new centering was provided for each successive arch with the exceptions noted below under "Forms and Centering." It will be noted from the drawing of the arch in Fig. 12 that the arch ribs were divided into five sections, each section extending for the whole width of the arch rib, and having a balancing section on the opposite side of the crown of the arch. They are section *A* near the crown, section *B* at the haunch, section *C* near the springing, section *K* the key at the crown, and section *H*, the



Fig. 11. Inside of One of Pier Forms



Date	No. of Block	Location on arch No. 7	6	5	4	3	2	1
6 15	1	A_7						
18	2		A_6					
20	3	C_7						
25	4			A_5				
25	5		C_6					
26	6	B_7						
28	7	K_7						
7/17	8				A_4			
18	9			C_5				
19	10		B_6					
19	11	H_7						
20	12		K_6					
20	13	H_7						
29	14					A_3		
30	15				C_4			
31	16			B_5				
31	17		H_6					
8 1	18			K_5				
8	19						A_2	
10	20					C_3		
12	21				B_4			
12	22				K_4			
15	23			H_5				
16	24							A_1
17	25						C_2	
19	26					B_3		
19	27					K_3		
20	28				H_4			
21	29							C_1
22	30						B_2	
22	31						K_2	
23	32					H_3		
24	33							B_1
27	34						H_2	
27	35							K_1
30	36							H_1

Fig. 12. Progress of Laying Concrete in Arches

final so called "haunching" addition, which brought the showing-depth thickness of the arch rib up to the full thickness. No centers were struck until at least three of the adjacent arches had been keyed.

The sections were laid up from the center of the bridge toward the end, so that no two sections on the same side of one arch would be laid on the same or successive days, and so that the progress of section laying on each dam would follow the order *A, B, C, K, H*. The order of laying is best understood from the accompanying tabular representation in Fig. 12. The "haunching" section *H* was not placed until the key section had received a hard set, and the centering was required to be maintained under a completed arch ring for at least 30 days. Two opposite sections amounted in contents to about a ten hours' run of the mixing plant. The joints of the sections, it will be noted, correspond with the expansion joint of the arches, as shown in Fig. 2. In order to prevent the bonding of one section with the other, and to form a cushion between them, corrugated asbestos boards were placed on the sides of each joint.

Forms and Centers— Especial care was taken to produce strong and economical forms. Those for the piers (as well as for all the rest of the bridge) were made of uniform standard sizes so that they could be used over and over again on the various piers. The section on the pier proper comprised two parts, one for the lower plinth and one for the umbrella form. Fig. 9 shows the details of these forms and Fig. 8 is a view of the umbrella forms in position.

The forms for the piers were made up in sections measuring about 12x16 ft. They were composed of 8x10-in. horizontal timbers, spaced about 2 ft. c. to c. as shown in the drawing, and provided with two thicknesses of 1x8-in. boards placed diagonally for the lagging. Upon the face of this lagging was tacked sheets of No. 22 galvanized sheet iron against which the concrete was spaded, as noted before. These forms were assembled on the shore, provided with special lifting rods so that they could be carried into the position with the derricks. They were held in position with ¾-in. rods and 4x6-in. timber spreaders across the pier. Attached to the ends of the rods were wrought-iron swivels,

receiving the square nuts of stub bolts which passed through the forms to outside vertical waling pieces. The stub bolts extended several inches into the concrete and were removed to release the form, leaving the bolt holes in the concrete to be closed with mortar. The forms were adjusted to line at the top by turnbuckles attached to 2x2x3/8-in. angle-iron cross-braces, which were anchored into the lower section of the concrete previously placed. After the concrete was placed in the section of forms as described above, the forms were removed, lifted up and attached to the angle iron as noted.

The umbrella forms were built in the same way after the same general design, altered to suit the peculiar shape. Details are shown in Fig. 9. In this drawing the method of attaching the cross-bracing iron bars to the anchor angle iron should be noted. Fig. 11 shows the interior of one of the pier forms before the placing of the concrete. The smoothness of the surface which is provided by the galvanized steel is particularly noticeable. All these forms were used over and over again with a very small percentage of failure and with a very large degree of economy. The upper parts of the pilasters, the spandrel walls and the arched-rib forms were all built after the same style as the ones noted above with the alterations to fit the particular cases.

The main centers, shown in Fig. 10, were made up of seven ribs, having a clear span of about 70 ft., supported at the ends on inclined timber bents resting on the coping of the piers, and suspended from the umbrella section by means of seven 1½-in. rods passing through the concrete to the back of the arch. The coping of the piers was reinforced with T-rails to take the thrust of the loaded centers, and in the middle the centers were supported by timber towers measuring 21x33 ft. at the base and founded upon 14 timber piles. Four sets of oak wedges were used under each rib, which were built in half sections for ease in erection. The centers for Arches 1 to 11 inclusive were all built new for the respective arches. In Arch 12, the ribs were all new except one, which was rebuilt from a 90-ft. 9-in. rib. In Arch 13, four ribs were new and three rebuilt, and in Arch 14 all seven ribs were rebuilt from other centers. All the forms and arch centers were of short-leaf yellow pine and were designed by the contractor.

In framing the centers they were given an additional height at the crown of about 1¾ in. above the plan height to allow for any compression in the centers and in anticipation of some settlement after they were struck. Levels were taken on the centers before and after completing the crown section (section *A*), on completion of the key (section *K*), and before and after striking the centers. The greatest deflection was at the time of completing the crown sections which ran from 0.05 to 0.13 ft. In the first centers that were built an attempt was made to obtain the additional height at the crown by manipulating the wedges, but this proved unsatisfactory. The remaining centers were then framed so as to give the required 1¾ in. additional height at the crown. Most of the arches deflected so as to be about ¼ in. below the plan elevation at crown at the striking centers, and four of the arches were ¼ in. higher.

Personnel

The construction work on the bridge was carried on under the direction of the Philadelphia & Reading Ry., of which William Hunter is chief engineer, the work being in direct charge of Edwin Chamberlain, assistant engineer, with H. L. Laning, assistant engineer on the ground. The contractor for the entire work was the Talbot Construction Co., of New York City, and their superintendent on the job was John E. Jones. Work was started on May 15, 1911, toward assembling the plant. On July 21, 1911, the first concrete was deposited. The bridge is now nearly completed, and is expected with the approaches to be ready for laying of rails about July 1. No date has yet been fixed for the opening to travel.

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Reclamation of Swamp Lands in North Carolina*

By Joseph Hyde Pratt†

In North Carolina the problem of reclamation of the swamp lands has been worked out more systematically than in any of the other South Atlantic states. There are approximately 4505 sq.mi. (in the eastern part of the state), a large proportion of which is susceptible to reclamation. Some of the swamp areas do not contain land well adapted to agricultural purposes, but vast areas would be capable of growing a variety of products, and these would not be far from railway transportation.

There are three distinct classes of swamp areas. The first is the great gum and cypress swamp which occurs in a long narrow belt ranging from ¼-mile to two miles in width, or in an extensive area several miles in diameter. Originally, these swamps were heavily timbered, but most of the timber has been removed or is under contract to be removed. This class of swamp land is especially adapted for agricultural purposes, when the excess water is removed, but it has little value for reforesting. The second class is open marsh, with very little timber and that of poor quality. The drainage has to be deeper and the soil is not as easily brought into a good state of cultivation as that of the first class. The third class is the higher land along the swamp areas, which it is now possible to cultivate, but which is constantly being drowned out by excessively rainy weather.

Long before the Civil War attempts were made to drain certain of the smaller swamp areas, but most of these were only partially successful, and attempts to drain on a large scale were failures. Three obstacles formerly stood in the way of the drainage of the swamp lands: 1, cost of clearing the land; 2, the cost of digging adequate canals and ditches; 3, lack of adequate laws that would permit the carrying out of the drainage proposition. All these obstacles have been removed, and it is possible to drain successfully any land that has sufficient agricultural value. The Drainage Act passed in 1909 and amended in 1911 makes it possible to carry out any drainage proposition, no matter how large or how many counties it may include. There are now 40 districts organized or in process of organization in eastern North Carolina.

After the main canals and laterals have been dug, the land is cleared by cutting the trees and underbrush; it is then burned over, leaving nothing but the large stumps. The stumps rot very quickly in this rich soil, so that no effort is made to remove them, except as they decay. The first year after the canals have been made, and land cleared, the land is planted with corn by means of a hand drill. There is no opportunity of plowing, so that the corn is planted by simply running the drill into the ground and dropping the seed. It is impossible to cultivate the crop while it is growing on account of the stumps. The fires, however, have destroyed all of the undergrowth and weeds, so that there is nothing to interfere with the growth of the corn. Land planted in this way has produced an average of 40 to 50 bushels of corn to the acre.

Another result of the drainage of the swamp lands is a general betterment of the health conditions of the section, and also the provision of good roads. In digging the drainage canals, if a little care is exercised and with but little increase in the cost, a good road can be made on the banks of the canals, from the earth thrown up

*Abstract of an address made at the National Drainage Congress at St. Louis Mo., April 10-12.

†State Geologist, Chapel Hill, N. C.

A Borough Surveyor and Master of Works for $389 a Year!

The "Royal Burgh" of Kirkcudbright, Scotland, recently advertised for a Surveyor and Master of Works, to devote his whole time to his position, and to be paid £80 or $389 a year. In accordance with British and Scotch practice, applicants for the position were sought by public advertisement. They were directed to file their applications with the town clerk by Apr. 5, 1913, together with copies of testimonials.

It might be thought that a place of only 2191 population (census of 1911), offering a salary of less than $400 a year, would not demand very much from its surveyor and master of works. On the contrary, much is demanded, as may be seen from the following "regulations," which we reprint from the London *Surveyor* for Apr. 4, 1913:

REGULATIONS FOR THE DUTIES OF THE SURVEYOR AND MASTER OF WORKS FOR THE BURGH OF KIRKCUDBRIGHT

The surveyor and master of works will be paid, to begin with, a salary of £80 a year, and for this salary he must devote the whole of his time to the duties of his office. The engagement will be for one year, and thereafter at one month's notice on either side, and his duties will be as follows, viz:

Slaughter-House Department

To visit the house every day that cattle are being killed, examine the carcasses, and see that any diseased meat is destroyed, and report such cases immediately to the veterinary inspector.

To collect the dues for the animals killed in the slaughter house, give the butchers receipts therefor, account for the dues to the chamberlain each week, and get the counterfoils of the receipts issued to the butchers initialed by the chamberlain.

Generally to see that the house is kept clean and in good order and repair, and that the regulations and by-laws are duly observed and enforced. To report to the town council every contravention of the regulations and by-laws without delay.

Water Department

To see that the water-works are kept in good order, and report any defects to the convener of the committee.

To report to the convener of the committee from time to time the quantity of water in store, the conditions of the reservoirs, springs and filter beds, and their tributaries.

To prepare estimates of cost of extensions and alterations of water mains.

To superintend all extensions, alterations and repairs of mains and hydrants.

To regularly inspect all pipes, taps and cisterns in houses once each quarter, and to enforce compliance with the regulations as to the supply of water to houses, etc.

To regularly scour the water mains, and thoroughly clean out all tanks and catchpits in October and February in each year, and to intimate to the convener of the Water Committee when this work is to be done.

To go around once every week all outside closets and see that they are kept clean and in good order, and report to the proprietor of the premises and the convener of the Public Health Committee when any of the closets require attention.

Sewerage Department

To prepare plans, specifications and estimates of the cost of extensions or alterations of main sewers.

To superintend all extensions, repairs or improvements of the sewerage system.

To see that alterations and connections with private drains are properly made and tested, and that all junctions are formed with fireclay collars.

To see that all private drains, soil pipes and sanitary appliances are kept in good order and repair, and intimate all defects to the respective proprietors or their factors and to the convener of the committee.

To carry out any special instructions which may be given him by the council or the convener of the Public Health Committee.

Roads Department

To call every morning before 9 o'clock on the convener of the Streets Committee for any instructions he may have to give, and attend promptly to these instructions.

To superintend the repair, cleansing and watering of streets and roads, and see that all the conduits for carrying the roof water below the foot pavements are kept clean.

To calculate the quantity of road metal required for the season, and measure the same when broken in heaps.

To prepare plans, specifications and estimates of cost of any proposed improvements.

To measure contract work, and give certificates for sums due to contractors.

To grant orders for opening the streets when required for connecting water, sewer or gas pipes, and see that the openings are properly filled up to the satisfaction of the committee.

To see that the burgh workmen and scavengers begin their work timeously in the morning, and go round and see that the work is properly performed.

Buildings (New and Old)

To examine plans of proposed new buildings, and alterations of existing buildings, and see that the statutory provisions are complied with; to inspect buildings during construction, and report to the council any case of contravention of the statutory regulations or of the warrant granted.

Generally

To see that all lands, houses, fences and grounds belonging to the burgh are kept in good order, the grass at St. Mary's Park and Moat Brae is properly and regularly cut, and the fences and seats kept in repair.

To prepare plans, specifications and estimates of cost of any new works, and superintend their execution, whether by contract or by day labor.

To check all accounts incurred in the various departments, and submit same to the Finance Committee; and generally to carry out the instructions of the various committees or conveners given either orally or in writing.

To have full control as to the engagement or dismissal of occasional workmen when employed at work ordered by the council or the convener of a committee, and to pay the wages of such workmen.

To report at once to the council or the Streets Committee any insubordination or disobedience to orders on the part of any of the workmen or scavengers.

To act as inspector under the Shops Act, 1911.

To carry out all the duties of a burgh surveyor, whether herein mentioned or not.

To undertake any other duties if required by the town council at such remuneration as may be determined.

To attend monthly meetings of Council and Finance Committee, and special meetings when required, and to give in a written report of the work that has been going on.

To report at once to the council when he becomes aware of any repairs being required on any of the burgh property.

To keep a daily register setting forth each day what he has been doing, and submit the register to each monthly meeting of council, or to any committee that may ask for production of it.

We call particular attention to the fact that the surveyor must see that the employees of the roads department "begin their work *timeously*"; that he must perform "all the duties of a burgh surveyor *whether herein mentioned or not*; and (a gleam of hope) that he may be called on to perform other duties, but "at such remuneration" as the Town Council may determine.

It is interesting to note that ("The Municipal Year Book") Kirkcudbright has been a royal burgh since 1455; owns three farms and some salmon fishings in the Dee; was one of the first Scottish burghs to introduce a gravity water-supply, and besides water-works also "owns the harbor, the gas-works and a cemetery."

In view of the multifarious duties and small salary of the surveyor it would seem quite proper to allow him a day off now and then to disport himself in the salmon fisheries and, as an inducement to continue in the municipal service all his life, free burial in the burgh cemetery.

Snow Surveys for Predicting Stream Flows

By J. Cecil Alter*

SYNOPSIS—The summer flow of Utah streams used for irrigation has been predicted for two seasons by measuring the actual snow depths and finding their water depth equivalents. The work has been carried on by the U. S. Weather Bureau and bids fair to be extended over wide areas for the use of all classes of water users dependent upon the runoff from snow-clad mountainous areas. The apparatus includes a measuring tube and spring balance scales, besides which use is made of a barometer for elevations and a thermometer for temperatures. The article describes the instruments and surveys, and tells of the practical use to which farmers and others may put the data.



The Snow Surveyor

The success of the mountain-snow survey scheme inaugurated two seasons ago in Utah by the U. S. Weather Bureau for the purpose of determining early in March the probable summer flow of irrigation streams has been fully demonstrated.

The plan was to go into the headwater regions of streams whose water is fully appropriated, toward the close of the snow-storing season, yet prior to the beginning of actual farming operations, and determine by hundreds of systematic depth, density and water-equivalent measurements of the snow, the amount of water stored which would subsequently flow to the service of the valley irrigators.

This being determined, a precipitation record at a representative place would show the amount of water added to the watershed after the completion of the survey; and a daily stream flow measurement at a flume, constructed above the highest water-using farm, would show the daily depletion of the supply indicated by the survey.

It was not intended to ascertain the actual acre-feet of snow-water stored on the watershed, and then charge and credit these values with the rain and snow added, and with the flow down the stream daily. On many smaller drainage systems this definite plan would be quite feasible, although in such a case an evaporation factor would need to be considered. As a matter of fact, in some erosion experiments being conducted by the U. S. Forest Service in coöperation with the U. S. Weather Bureau in the Mountains near Ephraim, Utah, this sort of survey was completed early in April, 1913, and will be repeated each season hereafter.

Instead of this precise plan, since the watershed chosen by the Weather Bureau for its original work was a medium-sized region, and perhaps typical of most of the Utah irrigation streams, the plan was to ascertain the average depth of the undrifted, lying-where-it-fell snow (Figs. 1 and 2) and its actual water contents, so that these values could be compared from year to year; and in this case stream-flow predictions would be stated in percentages of the flow in previous years instead of in actual acre-feet. The record of average weather conditions over the watershed, with the average stream gagings, would be additional factors for consideration in making the flow forecast.

And so, when the Weather Bureau snow surveyors completed the March, 1913, snow measurements, having made about 280 depth and density measurements in about 2500 acres of evenly laid snow on the upper reaches of Maple Creek, in the Wasatch Mts., near Springville, Utah, the confident assurance was issued in a printed report, and mailed to all users of Maple water, that "there is about 16% more irrigation water stored in these hills than at the same time last year." It was also found that the compactness, or density, of the snow was practically the same as it was last year, and that the ground beneath the snow contained no frost, as was the condition last year; so that if weather conditions from the completion of the survey to the close of the irrigation season average about the same as in 1912, "Maple Creek should supply about one-eighth more water this season than it did last year." And from a cursory examination of adjacent watersheds, the surveyors said it was quite probable that conditions in the Maple watershed were an index to conditions in near-by mountains.

The water prospects from this stream will remain one-eighth better than last year only as long as weather conditions subsequent to the measurement of snow remain similar. However, the effect of cooler, warmer, wetter, or drier weather will be more or less directly reflected in the stream gagings, so that from the weir measurements from week to week, compared with the flow measurements of corresponding dates last year, the water probabilities can at any time in the season be recomputed for the benefit of those farmers who may wish to know whether to divide the water freely between the alfalfa and the potatoes, or to give sparingly to the crop in greatest need.

In fact, there are a great many uses the farmer can make of this information. For instance, he may have insufficient water to mature his third crop of alfalfa, and rather than let the third crop go to pasture which he may not need, or plow it up for fall wheat, which he may not wish to do for many good reasons, he can probably turn the water shortage into an actual profit by letting the second hay crop go to seed.

He could not snatch such a success from imminent failure except by chance without an accurate, definitely stated knowledge of the amount of water available. Variations of the case are numerous, even complicated frequently, especially where the water has been so completely appropriated and utilized that only primary water-rights owners may expect plenty, the secondary rights, probably representing a majority of the acreage, suffering frequently through lack of water.

If these secondary users knew definitely, early in the spring (as the three hundred users of Maple water know this spring) that they may expect 16% more water than

*Observer, U. S. Weather Bureau, Salt Lake City, Utah.

they had last year, they could lay their entire summer plans with that important fact in view. They might not only secure outside range pasture, letting the alfalfa grow into three crops, and also increase the potato and beet acreage, but they might even include an additional strip of land under the water which seldom or never is operated as an irrigated tract, through scarcity of water.

The making of the survey consists in going up the bottoms of the cañon branches and back and forth along the sides or slopes of each gulley or drainway, making depth soundings every few rods with an alpenstock to keep in perfect touch with the varying depth of the snow, and every few hundred feet making an accurate depth and density measurement with specially made apparatus. (The accompanying halftones show the character of the country surveyed, the instruments employed, and how they are used.)

This apparatus consists of a sampling tube, made of galvanized iron, reinforced at the ends, with a light iron collar at the top, and a toothed cutting sleeve at the bottom. The tube is inserted perpendicular to the surface of the snow. It is about 3 in. in diameter and 50 in. long. With its contents, it is weighed on a spring balance scale, which is graduated to show the water equivalent, in inches deep, of the tube contents. Thus the scale reading is entered directly against the depth of snow value, which is read from the inch markings on the outside of the tube.

This apparatus was perfected by Prof. Chas. F. Marvin, in charge of the instrument division of the U. S. Weather Bureau, and so far it has met practically every demand made upon it. Naturally, the spring balance must have a rigid support, but this is provided by thrusting the alpenstock—the sounding staff—into the snow at an angle. The newer spring balances are made of aluminum and are thus easily carried.

A typical observation follows: Snow depth, 39.5 in.; water equivalent, 12.7 in.; barometer, 22.12 in.; thermometer, 19°.

Surprising as it may seem, the drawing up of the snow core, or sample, is a very easy matter in practically all cases, the only difficulty ever experienced being in very warm weather, while working in wet, slushy snow; but even under these circumstances the cutting sleeve, or a wad of earth gathered with the snow, offers sufficient obstruction to enable one to secure the snow sample by deft manipulation.

The opposite condition, of the snow freezing to the inner sides of the tube when air temperatures are below 20°, is a more formidable problem; yet even this difficulty was very readily overcome in temperatures as low as 10° or 15° by cleaning the tube with an oiled rag on the end of the alpenstock.

Where the snow depth was more than the capacity of the spring balances the sample was taken in two or more sections; where the depth was beyond the length of the tube the surface snow was dug away from one side of the tube and the complete sample then taken. Snow 7 ft. deep has been successfully sampled with a 50-in. tube with very little loss of time. As a rule this process is greatly preferred to carrying a longer, heavier snow tube over the mountains.

A thermometer reading was made at every sample-taking, together with a reading of an aneroid barometer and the time reading from a watch. These readings, in connection with continuous temperature and barometer readings at the base of the mountains, make it possible to calculate the altitude of every observation point.

An examination of the soil beneath the snow was made at every snow measurement to determine the amount of frost in the ground, because a continuous, well formed frost layer has a very important effect on the amount of water conserved naturally during the first thaws of spring; that is, during the spring runoff. Strangely enough, however, the ground in the mountains is almost never frozen beneath the snow. Where unfrozen, this information is readily gained by means of the snow sampling tube, as dirt samples are quite as easily secured as snow samples. Where there actually is a frost layer its thickness is ascertained by means of a small prospector's pick and a short driving bar.

Phenological observations were also made of the growth stages of the willow, quaking aspen and bush buds, as these are indications of the advance of the springtime, and the information is useful for comparison with other years, and for consideration by the farmers themselves.

During the work at Maple Creek this year soil temperatures beneath the snow were taken accurately, the value being 33° everywhere in the soft moist earth within 10 in. of the snow. The perpetual springs which burst forth through the snow at intervals along the cañons, showed temperatures of from 43° to 44° near the upper limit of all-winter flowing, and 48° near the valley at the outlet of the creek, varying apparently with the depth be-



FIGS. 1 AND 2. EVENLY COVERED SNOW-GATHERING GROUNDS IN UTAH

(In the foreground of Fig. 1, on the left, is a part of the watershed of Maple Creek; in the background are the Wahsatch Mts. Fig. 2, on the right, shows a heavy March layer of snow. Note the even distribution of the snow in the views. Under conditions shown here and in Fig. 3 snow measurements are comparable from year to year.)



FIG. 3. TRUDGING ALONG A GENTLE SNOW-COVERED SLOPE



FIG. 4. CLIMBING A 45° SLOPE ON SNOWSHOES



FIG. 5. THE HARDEST WORK OF THE SURVEY

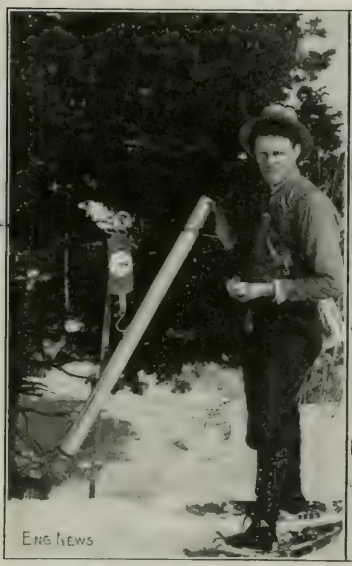


FIG. 6. SNOW-SURVEY APPARATUS



FIG. 7. SECURING SOIL SAMPLE IN SEARCH OF FROST



FIG. 8. A MEASUREMENT BEYOND DEPTH OF TUBE

FIGS. 3-8. MAKING A SNOW SURVEY IN UTAH

(The surveyor goes on snowshoes, provided with an alpenstock, a measuring tube graduated in inches, a spring balance graduated to show equivalent water depth in inches, a thermometer and an aneroid barometer. A density or water-depth determination is being made in Fig. 6. In Fig. 8 the snow was so deep that it had to be brushed to one side.)

neath the main mountain range that the water reaches before coming out again.

The snow on the Maple Creek watershed is about 5½ in. deeper than it was last year and shows little drifting except in the rougher portions of the watershed; and up to the close of the measurement period there had been only a few small snowslides even in these regions, thus indicating a firm condition of the under layers at that time. The streams were all comparatively low, being closed by frost and snow over the upper half of the watershed.

Practically the entire watershed carried a snow covering of a trace or more this year. It was also discovered that a comparatively small acreage carried as little as a trace or broken covering of snow. The density measurements, or determinations of the actual water contents of the snow by weighing, showed noticeable uniformity throughout the regions examined.

Owing largely to the impracticability of securing measurements of the snow that will be comparable from year to year in the rougher portions of the watershed and on the steeper slopes no systematic measurements were made

this spring in certain limited regions. It is, therefore believed that in the figures herewith presented of the snow layer over the smoother portions of the watershed, we have records that represent very closely a measure of the amount and the condition of the snow that will form a basis for fairly accurate comparisons with measurements in other years.

The comparisons made in the accompanying table may be considered direct, as the averages and values for identical regions have been computed for this purpose. In comparing the 1912 and 1913 figures with the previous values obtained in 1911, however, it will not be overlooked that these last-named figures were obtained two weeks later in the season.

So important has the snow-survey work been proven that a half-dozen irrigation companies, towns, and farming communities, have already begun the systematic measurement of the snow on their watersheds in the early spring. Many light, power and water companies sell their products on yearly contracts, which are made during the late winter and early spring. If an operating company finds that it has 10% more water in the hills than in a previous year, it can sign up and fulfill an increased number of contracts with safety; whereas, if the survey shows a shortage it can protect itself from loss by not entering into contracts for light, power, or water that it cannot fulfill.

That the work will ultimately extend into every part of the irrigation country seems assured, from the interest already being taken in it. The U. S. Weather Bureau plans to continue the work at Maple Creek, if practicable, for some years, to gain all the experience and information necessary for guiding others in the work, though it already appears from a close study of the Maple Creek records by individual branches that certain configurations of watershed, and certain smooth regions show striking similarity with the average records for the entire watershed; that is, certain limited regions are (natural law says they must be) true averages for the entire watershed; and if the experiences at Maple Creek prove ultimately that limited regions on a watershed may be selected for examination which will fairly represent the conditions over the entire watershed, the cost would not only be greatly reduced and thus render the scheme more practicable and profitable, but the snow-measurement period would be more nearly an instantaneous observation, as in theory it really should be.



FIG. 9. STOPPING THE SNOW SURVEY 20 MINUTES FOR LUNCH

Many of the snow surveyors at work in Utah and Idaho are using the Weather Bureau apparatus and methods.

COMPARATIVE SUMMARIES OF SNOW MEASUREMENTS MADE DURING THE PAST THREE SEASONS IN THE MAPLE CREEK WATERSHED, UTAH

Date	No. of measurements	Average depth of snow	Water in snow	Per cent. of density
Entire watershed				
1911 March, last half	195	35 4	10.8	31
1912 March, first half	260	42 2	10.2	24
1913 March, first half	281	47 8	11.8	25
Summary of Typical Branch Cañon				
1911 March 26, 27	65	38 7	13 4	35
1912 March 8, 9	91	45 6	11 5	25
1913 March 10, 11, 15	85	50 8	12 7	25

The government aims to supply the apparatus wherever possible, and it is only for lack of funds for this specific purpose that the Bureau does not actually perform the work on every watershed where a stream-flow forecast would be valuable.

Alfred H. Thiessen, in charge of the Salt Lake City office of the U. S. Weather Bureau, who also has charge of the snow survey work of the Bureau in Utah, plans to coöperate with every water company in the state with the end in view that the government shall supply all instruments, and possibly send experts to show the farmers and engineers how the work is done, and to publish and distribute from Salt Lake City all information obtained in this way. This would result in surveys being made in fifty instead of a half-dozen watersheds, and from this many actual measurements made simultaneously, estimates for intervening watersheds (not measured) could be made.

It has been proven that the cost should be comparatively small, as the labor in most cases could be supplied by men in the employ of the water companies who are not doing other work at this time of year. And where most of the company are farmers, the work may be done by volunteers, as has been done for two years already at Moroni, Utah. In this way, with the instruments furnished by the government, and the computing, publishing and distributing of the information being also done promptly by the Weather Bureau, there need be no actual expense to the water users for this work. And as has already been demonstrated, a week's work in the headwaters of a well used stream, by two snow measures, may be worth many thousands of dollars to the community at the foot of the mountains.

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Simple Locomotives with Three and Four Cylinders are in use on a number of English railways, and ten large four-cylinder simple engines of the 4:6:0 type have been built recently at the Crewe shops of the London & Northwestern Ry. for high-speed passenger service. They are fitted with Schmidt superheaters. The four valves are operated by two outside sets of Walschaerts valve gear. All the cylinders drive the first driving axle. The tender is mounted on six wheels and is fitted with a water scoop to take water from track tanks. The engine was built to the designs of Mr. Cooke, Locomotive Superintendent, and its main dimensions are as follows:

Driving wheels	6 ft. 9 in.
Truck wheels	3 ft. 3 in.
Wheelbase, driving	15 ft. 3 in.
Wheelbase, total	29 ft. 0 in.
Weight on drivers	59 tons
Weight on truck	19 tons
Weight of engine	78 tons
Weight of engine and tender	117 tons
Cylinders (4)	16x26 in.
Boiler, diameter	5 ft.
Boiler pressure	175 lb.
Tubes, No. 159; diameter	1⅞ in.
Tubes, length	14 ft.
Tubes, superheater; No. 24; diameter	5¼ in.
Heating surface; tubes	1161 sq.ft.
Heating surface; superheater tubes	486 sq.ft.
Heating surface; firebox	171 sq.ft.
Heating surface; total	1818 sq.ft.
Superheating surface	414 sq.ft.
Grate area	30½ sq.ft.
Water in tender tank	3000 imp. gal.
Coal in tender	7 tons

General Instructions to Inspectors of Street Paving

The Bureau of Highways of the Borough of Manhattan, New York City, of which H. W. Durham is Chief Engineer, has recently issued a small book of instructions to inspectors of street paving which contains a number of interesting and instructive points. Many, indeed, are general and are intended as guides to be used in conjunction with and as a supplement to regular contract forms and specifications. A brief abstract of some of these instructions is as follows:

THE INTENT OF INSTRUCTIONS

The object and intent of these instructions is to secure full compliance with the contract and specifications and the performance of first-class work by the contractor in such minor details as are not specifically mentioned, but implied, by the contract and specifications.

GENERAL INSTRUCTIONS

The inspector is to report to and be under the control and direction of the Chief Engineer and his authorized assistants.

The inspector is to read carefully and make himself familiar with the contract and specifications for the particular work to which he is detailed.

The inspector is to assume that the contract and its specifications are entered into by the contractor in good faith and with a full understanding of the requirements; and that the contractor may be and must be held to a strict compliance with the specifications, unless the inspector receives instructions to the contrary from his superior officers.

The inspector will be held strictly responsible for the enforcement of the contract and specifications so far as these relate to the quality of the materials used and the manner of doing the work.

In case the contractor, or his agents or employees, shall refuse or fail to comply with the contract or specifications, or to perform the work in accordance with the instructions from the assistant engineer in charge, or in a proper manner, the inspector is to direct the contractor to suspend the particular work at fault and to report the facts immediately to the assistant engineer; and the inspector is not to permit the work to proceed in disobedience of his requirements until instructions are received from the assistant engineer.

The inspector is to make out daily reports on the forms provided for the purpose, and also to keep in the notebook provided for each contract a detailed record of each day of the work, which must contain the following:

(1) The date of assignment to the contract and date of its actual commencement and completion.

(2) Detailed force account for each working day and amount of material used.

(3) Condition of weather each day.

(4) Delays, reasons for, and the period of duration.

(5) Railroad or other subsurface work being done within the limits of the contract whether by corporations or individuals, the date of beginning of such work and the date of completion.

(6) Condition of the sidewalks within the limit of the contract at the commencement of the work.

(7) Accidents: Date of accident, names of persons concerned and witnesses of any circumstances governing the case.

(8) Quantity of new and old curbstone set and location of same.

(9) Any neglect or refusal on the part of the contractor to comply with the contract specifications.

(10) Damages to persons or property by reason of any act or omission on the part of the contractor.

(11) Oral instructions or orders received from the engineer in charge of the work; and all other matters appertaining to the contract that might be worthy of record.

It is the duty of the inspector to familiarize himself with the local conditions affecting the contract to which he is assigned, in order that the work at all stages may be so carried on as to cause the least possible inconvenience to the property owners on the street, and to the general public using the street. The street must not be unnecessarily obstructed, and the contractor must provide temporary bridging or passageways at crossovers and wherever else necessary.

All materials as they are brought on the street must be piled compactly and neatly on planks or metal boards in the roadway, or upon the sidewalk, at such points as the inspector designates. The inspector must see that all loose material and excavated matter, such as broken curbstone, old paving blocks, old asphalt and earth, are removed from the site of the work as soon after being excavated as possible. All unused or waste material of every sort must be removed from the roadway and sidewalk of any completed portion of the street at the time it is opened to traffic.

The inspector must see that city monuments and benchmarks are preserved from injury by the contractor, and in case of any displacement or disturbance of such marks must notify the assistant engineer in charge.

The inspector is to examine the material as it is brought on the work and see that it conforms to the specifications before permitting it to be used. It will be part of the inspector's duty to notify the office of the city chemist at the different stages of construction in due time to take the necessary samples of the different materials in each block. Should the inspector at any time suspect that the material used is not in accordance with the specifications, samples must be taken by him, with a record of the location, and the office of the city chemist notified immediately.

PREPARATION OF THE SUB-FOUNDATION

Where earth excavation or embankment is necessary to bring the subgrade to proper grade, the important points to be looked after are:

(a) To bring the subgrade to the true and proper grade and contour required for the pavement.

(b) To properly consolidate the subgrade, so that it will furnish a firm support for the pavement and its foundation.

CURBING

In setting curbstone the important points to be looked after are:

(a) To see that the stones are set to the true grade and position.

(b) To see that the full space for concrete under and around the stone is provided.

(c) That the concrete used around the stone is of the specified quality.

(d) That the concrete is placed and compacted so as to fill all the space under and around the stone as specified.

(e) That no foreign material, either dirt or broken bits of flagging, be permitted to become mixed with the concrete.

The tendency of the workmen is usually to consider the above details as unimportant and to slight them.

MIXING THE CONCRETE

The contractor often desires to measure the sand and stone by wheelbarrow loads. In such cases the inspector will measure the capacity of the barrows used and determine the size and number of loads required for one batch of concrete, and thereafter insist that the loading conform to this standard size. As a check, the inspector should frequently keep account of the bags of cement and the barrow loads of sand and of stone used during, say, two hours, and measure the quantity of concrete made and determine from this data the ratio of the materials used. In any case the inspector must make return for the amount of material used during the day on his daily report by giving the exact quantities as counted by him both as to bags of cement and cubic yards of sand and stone used, and the quantities must not be estimated from calculations based on the amount of concrete laid.

When a concrete mixer is used the inspector must acquaint himself with the theory and principle of operation of that particular type of mixer and be able to detect any change in the proportions or uniformity of the mixture at any time.

When the mixer is of the automatic-feed type the inspector must test it at least once during each day's work, at times unexpected by the foreman, by feeding measured quantities of cement, sand and stone in the proportion of one, three and six into the respective hoppers. If the mixer is gaged properly and feeding freely the measured quantities of materials will be exhausted simultaneously. Should some cement be retained in the cement hopper after the sand and stone are exhausted, it is sufficient indication that the mixer is either improperly gaged or that the cement feed is clogged. Whatever the trouble, it must be corrected before the mixer is allowed to continue.

When the contractor employs a concrete mixer into which the materials are not loaded in batches, the inspector is not to depend for the securing of the proper proportions on the accuracy of the machine gaging or the proportion of shovelers used. The materials must be placed in properly proportioned piles, not containing more than 10 cu.yd. in the case of sand, broken stone or gravel, and the inspector must see that the machine exhausts all materials simultaneously. Should it be impossible to obtain these results, due to improper piling of

material, the inspector must require the use of measuring boxes for proportioning the charge for the mixer.

SHEET-ASPHALT PAVEMENT

The principal care of the inspector will be to see that the asphalt is not laid at too low a temperature. The minimum temperature permitted by the specifications is 250° F. While the main or interior mass of a wagon-load may be well above that temperature, the top and outer part of the load may be, particularly in cold weather, too cold to be safely used. Some of this colder portion may be sufficiently reheated by mixing it with the hotter material if properly handled in unloading; but any material that is so cold as to be lumpy when unloaded or, more particularly, when being raked out, should be discarded. This applies to both surface and binder mixtures. The best practical guide is the manner in which the mixture behaves in raking. It should always be so hot that it will, under the rake, break up into a uniform crumbling or powdery mass. If it does not do this it is too cold whatever its temperature may be.

PREPARATION OF STREET SURFACES—Before the binder is laid, all loose material, rubbish, street dirt and other matter foreign to the concrete surface shall be removed and the concrete surface swept, with street brooms if necessary, to properly clean it.

Neither binder nor surface mixture shall be laid upon wet surfaces. Before the spreading of the surface mixture on the binder, the latter must be cleaned of all foreign matter and swept if necessary. If the binder course already laid has become covered with mud from wagons or other travel, it must be swept clean. No loose fragments of binder material must remain on the surface. Any part of the binder course that may have become broken or loosened must be taken up and new material laid in its place with the same care as the original.

LAYING BINDER COURSE—Nearly the same care in raking and equally as careful rolling should be required as for the surface course. If the binder is not thoroughly compressed and becomes cold before the surface course is laid, it is likely in future hot weather to soften and yield under heavy travel, and thus start small depressions in the pavement.

LAYING THE SURFACE COURSE—The joints against a cold edge of previously laid surface must be cut back until solid, fully compressed material of full thickness is reached, and the raw edge completely but thinly painted with liquid bitumen. No masses or fragments of cold mixture must be allowed to remain on the surface of the binder in advance of the placing of the surface course to be covered up by the latter. Such cold masses will not be compressed by the roller but will later, under a hot sun and heavy travel, yield and start depressions in the pavement. The raking requires to be properly and skillfully done. The tines of the rake must penetrate to the binder, so that the raked material will be a uniform mass from top to bottom.

ROLLING—The inspector must insist upon the roller being placed upon the freshly raked surface just as soon as the material will bear it without being squeezed out or displaced laterally. The tendency is to keep the roller off too long, thus permitting the chilling of the surface and preventing its proper compression. The inspector must not take the contractor's word as to how soon the rolling may be begun, but should have trials made until he is able to judge for himself.

The rolling of the heavy roller should be very thorough; the roller should be kept at work constantly until the surface is too cold to be impressed. In operating the roller lengthwise of the street the rolling should begin at the gutters and work toward the center of the street whenever practicable. Cross rolling and diagonal rolling must be insisted upon wherever the width of the street will permit.

Asphalt surface must not be laid when rain or snow is falling or so long as the surfaces are wet. Surface mixture raked out and caught in a shower before it is well enough rolled to exclude water must be taken up and discarded.

The inspector is to measure and record each day the area of pavement laid and the quantity (number of batches) of surface mixture used, and note any lack of uniformity in the area laid per batch.

GRANITE BLOCK PAVING

The more important things for the inspector to look after are:

(a) The quality and shape of the blocks.
(b) The sand cushion.
(c) The setting of the blocks.
(d) The ramming of the surface.
(e) The filling of the joints.

THE BLOCKS—Assuming that the general quality of the granite has been approved, the inspector will need only to observe and reject blocks made from soft or weathered or otherwise defective stone. Any material divergence of the blocks from the correct form or from the sizes specified as permissible will be readily caught by the eye as they are brought to the street, and can be thrown out.

The proper dressing of the blocks is important, and should be watched carefully. While the inspector is not expected to examine each individual block, close observation of the blocks as they are handled and laid will enable him to detect and reject those that are materially defective in shape or dressing; or excessively wide joints will call attention to them as they are set.

SAND CUSHION—Screened sand must be used for the cushion bed. It should be moderately coarse and must be fairly clean and pure. The tendency with contractors is to use any dirty sand or sandy loam available on the street. Such material, especially if it becomes filled with water, will yield under the blocks and will not support them properly. The sand bed should not vary materially in thickness. It should be laid and graded not more than 50 nor less than 20 ft. in advance of the setting of the blocks.

SETTING THE BLOCKS—The blocks of uniform width and depth must be selected for each course, and each block must be laid upon a full bed of sand and "struck in" at the base so as to bring the stone in close contact with its neighbor in the preceding course and thus insure the closest possible joint.

The inspector must see that the joints in the line of traffic are close, and must see that the alignment of the courses is true. This is most important, as a crooked or wavy course lessens the chances of getting close joints, not only along that particular course, but also along the courses that are to follow. The inspector must see that all longitudinal joints are broken by a lap of at least 3 in.

The operation of ramming is not to be permitted to approach within 20 ft. of the paving. After ramming the surface of the pavement may look somewhat wavy and uneven. The inspector must see then that it is back-rammed. All blocks below the general plane of the surface must be raised and more sand placed thereunder, and the blocks rammed again to an even bearing.

Bond stones with their upper surface set exactly to the grade or contour of the paving before ramming must be set in lines across the street at intervals of not more than 6 ft. and with at least three such stones in each line on a 30-ft. roadway and five on a 60-ft. roadway. Care in setting these stones and in paving to the lines defined by them will prevent the completed surface of the pavement having the wavy appearance so often seen.

Whether sand or grit is used for partly filling the joints before the paving cement is poured, care must be exercised in placing the sand or grit in the joints. Dumping a wheelbarrow load on the surface and then sweeping the joints full is absolutely forbidden.

Sand and grit or gravel should be dried before being used and put into the joints to as nearly as possible a uniform height as called for in the particular class of granite pavement.

RAMMING THE SURFACE—This part of the work is likely to be slighted unless carefully watched. The important thing is to have each block equally and sufficiently rammed to bring it to a solid bearing on the sand, as well as to bring its top to the proper grade. The rammers will be disposed to touch lightly blocks or areas which, if thoroughly rammed, would be driven below the true surface of the pavement, and subsequent travel may force these down, making depressions in the surface. The inspector must give this item of the work special attention.

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Extensions to the Ontario Hydro-Electric Power Commission's electricity-supply systems are to be built, with an appropriation of $2,500,000, which has recently passed the Ontario Legislature. Some $400,000 is needed for extensions to the Niagara district, $250,000 for new offices in Toronto, $200,000 for extensions of the Windsor service, $250,000 for the St. Lawrence district, $250,000 for Clinton and Goderich, $100,000 for Newmarket and north of Toronto, and $75,000 for Carrington and Beaverton. Also $150,000 of the appropriation is for extensions of the Severn River lines (in Simcoe and Grey Counties and independent of the Niagara supply), and $20,000 for the Port Arthur (Kiministiquia River independent) lines. The Commission proposes to do its own construction.

Recent press abstracts of the report of the Commission to the Ontario Legislature gives the total capital expenditure to Oct. 1, 1913, as $4,579,829, of which $4,158,829 was in the Niagara system alone.

New Harbor and Waterfront Works at Toronto, Ont.

One of the most extensive harbor developments on the Great Lakes is about to be undertaken at Toronto, Ont., under the immediate jurisdiction of a recently created Board of Harbor Commissioners working with funds provided by the City government, the Board itself and the Dominion government. For a number of years there has been in existence at Toronto a Harbor Board, but this Board had very limited powers and had not made any extended effort toward the development of the port and warehouse district. In 1911 an Act was secured from the Dominion government, incorporating a new Board of Harbor Commissioners, in which was vested very wide powers for the management and development of the harbor of Toronto, and the improvement of the city's waterfront generally. This Board has been engaged in the study of the harbor problem since its creation, and, on Nov. 14, 1912, submitted to the City Council and the Dominion government, plans for a development of the harbor to extend over a period of eight years, from 1912 to 1920. This plan was approved by both the contracting parties, and work has now started thereon. In the accompanying figures, there are given plans of the harbor at present, and of the development suggested by the Commission's design.

The main harbor of the city of Toronto is formed by a natural island about a mile and a half away from and parallel to the north shore of Lake Ontario, which forms the water edge of the city. This island, shown in Fig. 1, has been used for numerous industrial plants and as a recreation park. It is pierced along its west shore by an artificially made channel between jetties, and along its south shore by a similar channel, the former known as the Western Channel, the latter as the Eastern Channel. At its eastern extremity, there has been built a breakwater, which separates the main harbor from a portion of the harbor known as Ashbridge Bay, which is, in effect, merely a marsh, at present of little value for commercial purposes, and a decided disfigurement to that end of the city. This Ashbridge Bay territory was all vested in the city of Toronto, and as a principal contribution toward the improvement work which the harbor commissioners were expected to undertake, the city deeded to the commissioners all the land owned by it along the water front, including particularly the Ashbridge Bay district of 1000 acres. In addition to this district, there was also the bay shore of the island, many properties along the front of the inner harbor, and all the water lots on the lake front from Bathurst St. to the Humber River. This property has been valued at $9,000,000, and from it is derived a revenue of $65,000, the greater portion of it at the time of transfer being in an undeveloped state.

The new plans of the commission involve the formation of a new commercial warehouse district, a new dock development, and a new park and boulevard system. The plans may briefly be divided into three parts; (1) the industrial development in the Ashbridge Bay district, and along a 17-acre area at the foot of Bathurst St.; (2) a commercial and dock development at both these points and along the central waterfront in the middle of the harbor proper; and (3) park and boulevard improvements along the 12 miles of outer waterfront from Woodbine Ave. along the outer bar, around the island to the Humber River at the extreme west of the city, with a protected waterway from the Humber on the west to Victoria Park on the east.

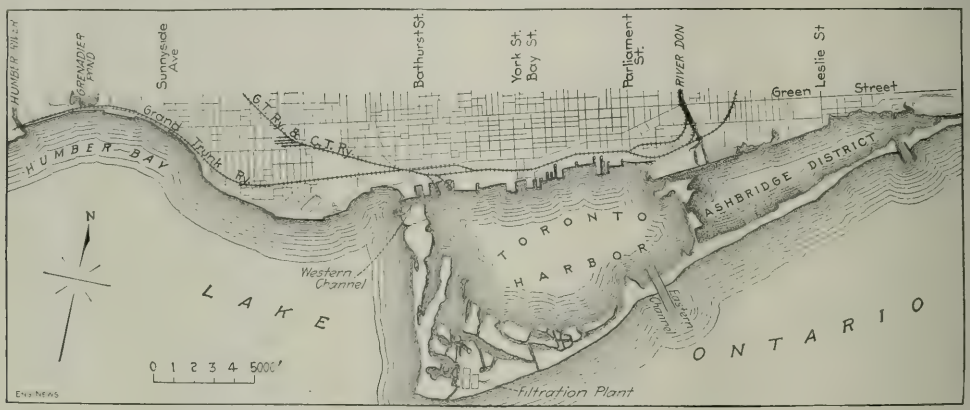


Fig. 1. Map of Waterfront at Toronto, Ont., as It Now Is

This entire project involves a total cost of $19,142,000, which is to be borne in the following amounts by the Dominion government, the city of Toronto and the harbor commissioners: City Council, $1,802,900; Dominion Government, $6,123,200; Harbor Commissioners, $11,215,900.

The engineer has estimated that the entire work can be carried to completion within eight years from the commencement of active operations. At least eighteen months was spent in a complete survey of the situation, which involved a hydrographic survey of the waterfront, and an involved study of the development. The resulting plans are outlined below.

Plans for Development

The harbor development is, for purposes of explanation, divided into three parts, as shown in Fig. 2. The Eastern Section includes all the district lying east of a line from Parliament St. to the eastern entrance to the

harbor, and extending east to the east city limits. The Central Section takes in the district between Parliament St. and Bathurst St., and includes the waterfront, the inner harbor, and the bay shore of the island. The Western Section deals with the property from Bathurst St. to the Humber River.

EASTERN SECTION.—The work projected for the Eastern Section includes all three classes of the development plan. The principal work will be the reclamation of the district known for many years as Ashbridge Bay, but which has been renamed, and will be in the future known as the Toronto Harbor Industrial District. Along the south face of this district there exists at the present time a low, narrow sandbar, which forms the north shore of Lake Ontario at this point. Many portions of this bar are frequently submerged during periods of high water. There is a constant shore erosion as a result of the heavy storms from the east which attack it. One of the most necessary portions of the work of carrying the harbor extension into the district is the protection of the shore. This will be done by means of a sea wall which will be constructed along the entire front, a distance of 4¼ miles, and an average distance of 700 ft. south from the present shore line. With this protection assured, the work of reclaiming the marsh lands will be commenced, and the two works will be carried on at the same time, the filling being placed in the portion of the district behind each section of the wall, as the wall construction proceeds.

The whole eastern Industrial District will then be filled by dredging from the lake, which will require one of the largest dredging operations ever attempted on the lakes. Bids were asked for this dredging, to be opened May 28, 1913, work to commence Aug. 1, 1913. Advertisement states that the commissioners have in preparation plans and specifications for the removal of approximately 35,000,000 cu.yd. of material by hydraulic dredging, and that borings indicate 70% of material to be sand and gravel, and 30% a mixture of sand, silt and clay, which has to be delivered from the source of supply to a point of discharge at a maximum distance of about 6000 ft., and an average length of delivery of about 4000 ft. The dredges required for the work must be capable of handling at least 600 cu.yd. per hour.

This filled in area will be divided into two parts. The industrial area proper will be north of a line drawn east and west, and 1000 ft. back from the sea wall. This line will be marked by a street 66 ft. in width, which will divide the industrial district from the second part of the district, that is, the park area, to the south. Immediately south of this street will be a tier of lots 100 ft. in depth, and extending for over three miles along the north face of the park area, which lots are intended to be reserved as locations for summer homes. In front of the cottage reservations will be a park district and bathing beach, situated on a lagoon. This lagoon will be crossed by numerous foot bridges, in order to give the public free access to the park land, boulevard driveway and promenade, which will be constructed immediately behind the sea wall. The sea wall itself will be broken at intervals of 2000 ft. by openings 40 ft. wide, with 8 ft. of head room, which will allow small craft ingress and egress. Ample provision has been made for the erection of public bath houses, and for location of aquatic clubs along the beach.

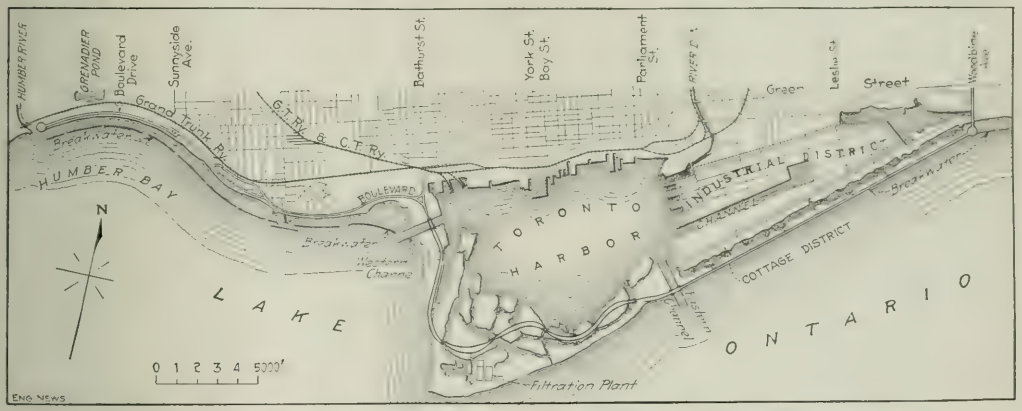


FIG. 2. MAP OF WATERFRONT AT TORONTO, ONT., AS PLANNED BY HARBOR COMMISSION

North of this roadway will lie the Industrial District, the development of which is so planned that when it is completed there will be 646 acres of land available for factory sites, 235 acres occupied by streets and railroad reservations, and 130 acres of waterways. The 30 miles of roadways will have a minimum width of 75 ft., and a maximum width of 175 ft. The district will be served by 30 miles of railway tracks, connecting with all three of the railroads which at present enter Toronto.

The railway layout has been so arranged that every alternate street will be free from tracks, and the siding service on the railroad reservations will be on a three-track system.

A ship channel will be constructed into the district for a distance of 6800 ft., terminating in a turning basin 1000 ft. square, and the sides of both the channel and turning basin will be so constructed as to form over 3½ miles of dockage accommodations. This channel will be 400 ft. wide, and the depth will be made to conform to the depth of the Welland Canal in order that any shipping which can enter Lake Ontario will be able to secure ample accommodations in Toronto Harbor.

The Welland Canal, it will be remembered, is being dug to a depth of 30 ft. over the miter sills of the locks.

The western, or bay face, of this Eastern Section, will be developed for dock purposes as the district grows, and will ultimately add two additional miles to the dock frontage of the area, as shown on the plan. One large dock is now being constructed, and will be equipped with modern freight sheds and a storage warehouse, and the first of a series of factory buildings will be erected back of the dock at an estimated cost of $409,000. The district has been so laid out that the area north of the ship channel will be reserved for light manufacturing plants. The area to the east of the turning basin will be the home of heavier plants, which do not require direct water access, while south of the channel will be located the heaviest class of manufacturing industries, which require a frontage direct on navigable water.

Central Section—In the central section, the work consists almost entirely of commercial and park developments, with one area covering 17 acres, at the foot of Bathurst St., suitable for industrial development The most urgent portion of the work is the encouragement of commerce by means of a proper wharfage service. This is now being provided at the east end of the harbor, by the new dock being constructed in the Eastern Section. Similarly, at the foot of Bathurst St., work is now being carried on, which will provide a dock with 20 ft. of water, behind which will be land suitable for light manufacturing plants, and also for the erection, by the commissioners, of a storage warehouse and a factory building, in which space will be rented to small manufacturing concerns. The sum of $409,000 will be expended by the commissioners in providing this warehouse and factory accommodation at this point. For the proper development of the central dockage facilities, the commission has planned to spend $1,785,000 in the construction of modern docks in the area from Bay St. to York St., with an adequate equipment of freight sheds and storage warehouses, but the details of this construction must be left until the question of the preparation of railway and highway grades has been definitely settled.

The other work planned for the Central Section consists of the reclamation of 352 acres of additional park lands on the island, a portion of which will serve as a location for the boulevard drive and the balance will include such portions of the island as are at present neither sightly nor useful. The driveway will be carried from the east across the Eastern Harbor Entrance by means of a roller-lift bridge, and will follow a winding course through the north portion of the island, crossing the lagoon by small bridges.

The Western Harbor Entrance, which is to be relocated, as shown in Figs. 1 and 2, will be crossed in the same manner, and on the large area of the land on the north and south of this entrance will be provided new park areas, and also a location for aquatic clubs, fronting on the western protected waterway.

Western Section—From Bathurst St. west to the Humber River, the treatment is almost entirely shore protection and park-reclamation work, the only provision for development of a commercial nature being in the district from Sunnyside Crossing to the Humber, where a tier of lots is being reserved as a location for refreshment privileges and other amusement features which are incidental to the development of a summer resort watering place. A breakwater will be constructed from a point 200 ft. west of the north pier of the Western Channel, to the mouth of the Humber River, and distant an average of 900 ft. south from the existing shore line. This breakwater is needed to prevent the destruction of the shore and the lake shore road, which suffer heavily from southeast and southwest storms. Inside this breakwater will be a protected waterway with an average width of 500 ft., reaching from the Humber to Bathurst St., and linking up with the island lagoon system and the new lagoon system planned for the Eastern Section, so as to form a complete protected waterway 14 miles in length across the entire city front.

The old Western Harbor Entrance will be filled up and the boulevard driveway, after crossing the new Western Entrance, will be carried north to this newly filled land, from there divided into two branches, one branch running straight north to connect with Bathurst St., and the other continuing the driveway along the lake front to the west. A recreation and passenger dock, 300 ft. long and double decked, will be constructed at the Exhibition Grounds.

From Sunnyside Crossing to the Humber, a distance of slightly over a mile, provision will be made for a four-track radial railway entrance to the city from the west, on an elevation equal to that occupied by the Grand Trunk R.R. tracks. From these radial tracks, connections can be later made, if desired, with any subway system from Sunnyside Crossing to the center of the city. This reservation will be 80 ft. wide. The southern limit will be an average of 30 ft. south of the present lake shore road. Between this crossing and the Humber River, provision is to be made for a new summer resort, with boulevard, driveway, bridle path, bath houses and amusement features.

Division of Cost

The City Council will construct the necessary highway bridge over the Don, to provide proper entrance to the Industrial District, and will build a retaining wall along the front of the Exhibition Grounds in the west, in order to separate the grounds from the boulevard, while the exhibition is in progress. They will follow up this initial work by undertaking the construction of necessary roadways, pavement and park features on the boulevard drive, including island bridges. The total cost of this portion of the work is estimated at $1,802,900.

The work allotted to the Dominion government is the construction of the ship channel and harbor expansion in the Industrial District, the necessary shore protection at the east end of the inner harbor, the construction of the breakwater from the Eastern Harbor Entrance to the east city limits, the construction of the breakwater from the Western Harbor Entrance to the Humber River, and the construction of the necessary lift bridges across the harbor entrances, and across the ship channel in the Industrial District. The cost of this work has been estimated at $6,123,200.

The balance of the work, which consists of the necessary dredging for reclamation purposes all across the entire front of the city, the filling of the Industrial District, construction of docks, freight sheds, warehouses, factory buildings, laying out of roadways and railway

reservations, construction of railroad facilities in the Industrial District, carrying out the development plan for the western summer resort section, is all to be under the charge of the Harbor Commission. The estimated cost is $11,215,900.

Personnel

The new Commission consists of five members, all serving without remuneration, each appointed to serve for three years. Three of these are appointees of the City Council, L. H. Clarke, T. L. Church and R. H. Smith. One is a direct representative of the Dominion government, F. S. Spence, and one, R. S. Gourlay, is the representative of the Board of Trade, appointed by the Dominion government on the nomination of that board. The chief engineer for the Commission is E. L. Cousins, and J. G. Sing is the consulting engineer.

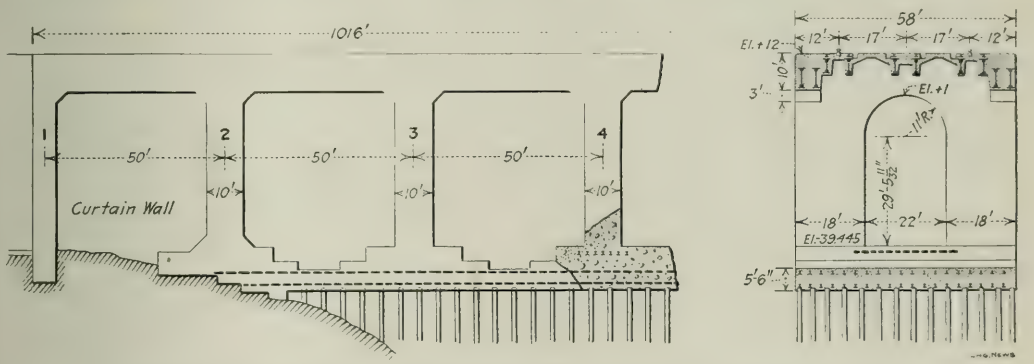
The Center Approach Wall for the Lower End of the Gatun Locks Panama Canal*

Because of the character of the foundation at the Gatun locks, the center approach wall on the sea side of the locks, which carries the tracks for the electric towing locomotives, will be constructed on an entirely different design from all the other lock and approach walls of the canal. The cellular form of reinforced-concrete wall used for the upper approaches at Gatun, Pedro Miguel and Miraflores was not used because of the possible effect of the salt water on the reinforcement. The gravity type of wall of U-section used for the lower center guide walls at Pedro Miguel and Miraflores, where they rest on rock foundation, is too heavy a construction for the mud foundation at Gatun, where, after excavation has been carried to a maximum depth of 50 ft. below sea level, the use of long piles is necessary to reach the underlying rock, which in places is 100 ft. below sea level.

To meet these conditions a steel, concrete-incased, causeway or viaduct, 1016 ft. long, from the line of the fender chains to the outer end, is being built on 20 concrete piers 50 ft. c. to c., which rest on a continuous reinforced-concrete slab supported on piles. The spans connecting the piers are carried by four steel plate-girders 6 ft. in depth and six plate-girders 4 ft. 6 in. in depth, arranged as shown in the accompanying illustration. The six spans nearest the locks are closed by 2-ft. curtain walls to prevent the water from surging from one approach channel to the other, between the piers, when one lock is discharging.

The original plans provided for piers resting on broad bases surmounting the piles. However, excavation revealed softness in the earth overlying the rock, which was not shown by the borings made at the time of determining the lock site, making it necessary to bind the piers together to protect them against transverse sliding. The foundation piles are driven on 4-ft. centers, longitudinally and transversely (on 3-ft. centers for the outermost 200 ft.) and are surmounted by a continuous slab of concrete which extends a foot below the top of the piles.

This base slab is 58 ft. wide with a level bottom. The top of the slab is a series of inverted stepped arches. The haunches between the successive inverted arches form the bases of the piers. At the lowest step of the inverted arches, the thickness of the base slab is 5 ft. 6 in.; at the springing line it is 10 ft. 6 in. Several of the arches were constructed with the soffit on a curve, but for the sake of speed in construction and consequent economy, as well as to afford a better bracing for the forms in the erection of the piers, the stepped arch was adopted. The lower part of each riser is on the circumference of a regular segment, of 42-ft. radius, so the strength of the arch is not diminished. Reinforcement in the base consists of 20 longitudinal rows of 70-lb. rails resting on a level with the tops of the piles and a similar row 3 ft. 6 in., c. to c., above.



Elevation and Section of Center Approach Wall, Gatun Locks, Panama Canal

Each pier, as shown, is an arched structure. The rectangular piers supporting the arch are 10x18 ft. in cross-section and the semicircular arch span between is 22 ft. The bottom of the arch opening is at an elevation—39.37 ft., and the top of the wall is 12 ft. above sea level.

The foundation was completed during the first week in April, appeared to be firm, and the erection of the superstructure is being pushed.

The completion of this foundation, assuring steady progress on the approach wall, has important bearing on the date of completion of the canal.

*Based on article in the "Canal Record" of Apr. 2 and Apr. 16.

Excavation for its site had been carried to 51 ft. below sea level when, on Jan. 25, a large slide from the east bank carried away tracks, overthrew machinery and covered the site with a layer of mud averaging 10 ft. thick.

In further developments the sliding threatened the work with delay. Any slides which may occur hereafter at this point will cause no interference. The placing of concrete will go on, and the sliding material will be removed by dredges after water is let in from the Atlantic entrance channel.

❖ ❖

Establishing Ex-Post-Facto Gage Heights

By C. F. Brown*

SYNOPSIS—Observed lake heights at the entrance of a river and also the volume discharged from the lake were employed in an alleged flood damage case to deduce river heights on a tributary of the lake at a point 15 miles above the lake. Subsequently, gage heights were available at the river station, so the deduced and the actual gage heights could be compared.

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The problem which confronted the writer of this article was that of the probable daily gage heights of a river for a series of years during which there had been no continuous observations at the point in question. The necessities arose through the construction of a bear-trap dam at the outlet of Cœur d'Alene Lake, Idaho, and the question as to the effect of the same on lands along the St. Joe River, a tributary of the lake, in the vicinity of St. Maries, a point 15 miles above the mouth of the river at Chatcolet, the head of the lake (see Fig. 1).

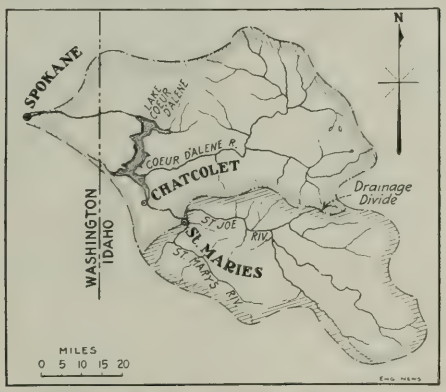


Fig. 1. Sketch Map of Lake Cœur d'Alene, Idaho, and Tributary Streams

It was admitted that the operation of the dam, the crest of which had a mean sea-level elevation of 2126.5, and which was to be raised only when the level of the lake receded to this elevation, would tend to retard the rate of lowering of the lake by making it a storage reservoir during the summer months. It was also conceded that lands adjoining the lake and along the river might be injured somewhat to Elev. 2128. The new dam had a discharge capacity 41% greater at the second highest flood stage than the old dam when open, decreasing somewhat as the flood height decreased, but at all times a discharge capacity greater than that of the old structure. The crest and bottom openings had elevations ranging from 2108.6 to 2116.5, as against a crest on the old dam of 2116.5.

It was claimed by the land interests that the raising of the dam during the summer months, beginning about July 1, tended to cause a piling up of the waters during the flood season and also during the time the bear traps were up; that is to say, that there were greater differences between the surface of the water in Cœur d'Alene Lake and the surface of the water in the St. Joe River at St. Maries, and consequently on the adjoining low lands, than there had been in years previous, and that the extent of injury to the river lands could not be shown from a comparison of the lake elevations and elevations of the lands in question. This assertion was not made by engineers, but by laymen, and constituted one of the claims for damages.

As shown by Fig. 2, the cross-section of the St. Joe River is unusually large and the gradient very low for all but extreme flood discharges. It was the opinion of the writer that because of this a direct relation could be established between elevations of the Lake and elevations of the river at St. Maries.

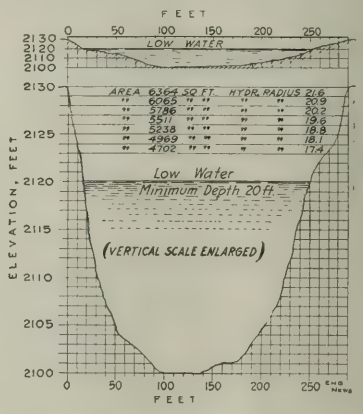


Fig. 2. Typical Cross-Section of St. Joe River, Idaho, St. Maries to Chatcolet

Hence the immediate object of this phase of the investigation was to show that the elevation of the water in the river at St. Maries was practically coincident with the lake levels at all seasons of the year excepting the periods of maximum runoff, and had been for many years previous to and since the construction of the dam, which in turn was evidence that the adjoining lands had not been injured by the construction and operation of the

*of Brown & Kleinschmidt, Civil and Consulting Engineers, Dooly Block, Salt Lake City, Utah.



Fig. 3. Valley of St. Joe River at St. Maries, Idaho; Looking Downstream

dam more than was shown by the curves of lake elevation.

The river valley lands have been built up by sediment from the river which has overflowed its banks annually. As a result the lands are found to have elevations from 2126 to 2128, with narrow banks along the river ranging from 200 to 500 ft. in width, and from 2 to 3 ft. higher than the average of the lands (see view, Fig. 3) and valley with St. Maries on the left, looking downstream.

Daily gage readings showing the fluctuations of the lake at Chatcolet had been kept by disinterested parties from Apr. 26, 1903. The dam was put into operation for the first time July 29, 1907. Referring to the diagram of gage heights of Cœur d'Alene Lake (Fig. 4) the effect on the lake elevations is shown by the two groups of curves between July 1 and Nov. 6, the lower group representing the years previous to, and the higher group those since the construction of the dam.

The runoff from this river system is influenced very largely by heavy snows in the mountains and the effect of the warm Chinook winds. The annual precipitation at St. Maries, on the lower edge of the basin, is 20 in., most of which falls in the form of snow. The elevation of the cachment basin varies from 2150 at St. Maries to altitudes upward of 7000 for the mountain crests. As usual in these latitudes, the precipitation varies directly as the altitudes, so that the precipitation of the mountains is probably 50 in. During the years 1891-6 the runoff from the total Spokane River Basin at Spokane, Wash., varied from 18.4 to 33.3 in., with 22.3 in. for the year 1909. Of this runoff over 50% occurs during the months of April, May and June, without taking into account the storage effect of the lake, and but for this a still higher runoff would be shown from the mountains during this period. These years are used for illustrative purposes, as the discharges are summarized in "Water-Supply Paper" No. 272, U. S. Geological Survey.

The basin is densely timbered, preventing the formation of extensive snow drifts and packs, and contributing to maximum discharges when the Chinook winds are accompanied by rain.

The river channel is peculiarly adapted to computations involving discharges and slope by reason of its very uniform section and bottom grade. The minimum depth is 20 ft. in low stages, with the surface elevation at 2120, and during the highest flood it reaches 35 ft., or an elevation of 2135 at St. Maries. At the low stage the width averages 250 ft., with 300 ft. between banks at an elevation of 2130. The river overflows its banks on the lower portions at Elev. 2128, but the average bank elevation is 2130. The banks have been eroded some by steamboats so that in places there are obstructions in the form of trees, willows, etc., along the sides.

A survey of the basic data on which the solution of the problem depended shows:

(1) Observed daily gage heights of Cœur d'Alene Lake, 1903-10.

(2) Observed daily discharges of the Spokane River at Spokane, showing discharges from Cœur. d'Alene Lake.

(3) Land surveys and topographic surveys of adjoining low lands, from which mean areas of the latter were determined.

From these data it was possible to arrive at the mean daily inflow into the Cœur d'Alene Lake drainage basin. The mean daily discharge of the St. Joe River was then determined by proportion from the total inflow as the ratio of the St. Joe drainage basin above St. Maries to the total drainage basin of the Spokane River at Spokane. These areas were obtained from the United States topographic maps. The uniformity of the cachment basin in all its essential features affecting runoff made such a relation as is described above sufficient for the degree of accuracy required.

In casting about for a formula of the flow of water in rivers from which the relation of the slope or hydraulic gradient to the discharge could be graphically expressed,

the Chezy formula with Kutter's coefficient naturally came first to mind. A simple inspection showed that our desired expression was a pure quadratic equation, but very unwieldy, especially with reference to the hydraulic radius, which precluded its use at all for the purpose at hand.

We next had recourse to the experimental formula of the form $V = C\, r^{.67}\, s^{.54}$, which in addition to being capable of solution by logarithms, has a more constant value of C for the same channel and different velocities.

In comparing the methods used in this solution, the reader is requested to withhold judgment as to mathematical accuracy and to keep in mind the accuracy required. The sufficiency of the computations will be shown later in comparison with actual gage readings made subsequently.

The method employed in arriving at the daily discharge of the river for the eight years will be described

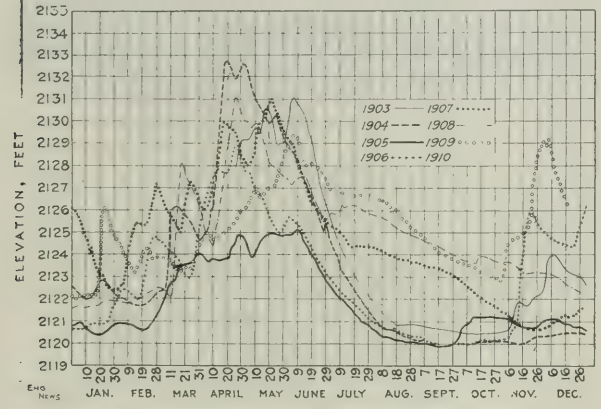


FIG. 4. GAGE HEIGHTS OF CŒUR D'ALENE LAKE, AT CHATCOLET, IDAHO, 1903-10

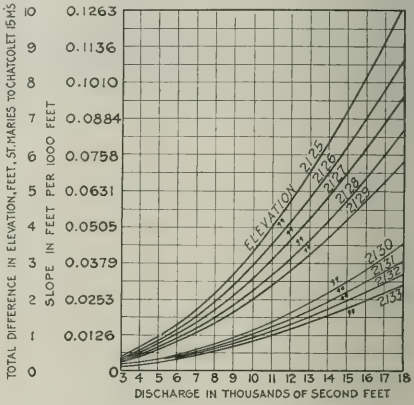


FIG. 5. SLOPE-DISCHARGE CURVES FOR ST. JOE RIVER, ST. MARIES TO CHATCOLET (Elevations at St. Maries.)

in some detail. The areas given below were used in the equations which follow:

Cœur d'Alene Lake Drainage Area, 3530 sq.mi.

St. Joe and St. Maries Rivers Drainage Area, 1690 sq.mi.

Area of Cœur d'Alene Lake, Rivers, etc., elevation under 2128, 27,448 acres.

Area of Cœur d'Alene Lake, Rivers, etc., elevation over 2128, 49,784 acres.

By proportion then,

$$\frac{\textit{St. Joe River discharge}}{\textit{Total inflow}} = \frac{1690}{3530}$$

or the St. Joe River Discharge = 0.478 Total Inflow.

To determine the total inflow two equations were necessary:

(1) For lake rising, with elevation under 2128.

Total Inflow = Spokane River Discharge + 13,724* × Daily Rise of lake in ft.

For lake rising, with lake elevation above 2128.

Total Inflow = Spokane River Discharge + 24,892* × Daily Rise of lake in ft.

(2) For lake falling, with lake elevation under 2128.

Total Inflow = Spokane River Discharge — 13,724* × Daily Fall of lake in ft.

For lake falling, with lake elevation above 2128.

Total Inflow = Spokane River Discharge — 24,892* × Daily Fall of lake in ft.

The Spokane River discharges were taken from curves of discharges at hand and the fluctuations of the lake from the curve of observed daily gage heights shown on Fig. 4. The several multiplications and divisions involved were made by a Brunsvega calculating machine and the slide rule.

Observations of velocity during maximum discharge showed that the water flowing out of the lake passed Spokane one day later on an average and that there was also one day's difference between St. Maries and the lake, the Spokane River being precipitous while the St. Joe is sluggish. Consequently in arriving at the discharge of the St. Joe River at St. Maries, the discharge of the Spokane River at Spokane two days following was used, while the discharge as indicated by the fluctuations of the lake was taken of one day following.

Knowing the mean daily discharge of the St. Joe River, the next step involved was that of preparing a set of curves from which the total difference in elevation between the lake and the river at St. Maries corresponding to the different discharges could be taken and added to the lake curves for the final curve of gage heights at St. Maries. Referring again to the formula

$$V = C r^{.67} s^{.54}, \text{ or } s = \sqrt[.54]{\frac{Q}{A\, C\, r^{.67}}}$$

it will be observed that a number of such curves will be necessary as the area of the waterway and consequently the hydraulic radius vary as the depth, which in turn is dependent upon the lake elevation. Accordingly, several sections were made of the river in different places, showing remarkable uniformity. One such section selected for use is shown in Fig. 2. It will be noted that the area and hydraulic radius for each foot of elevation from 2125 to 2133 are shown.

With these and observed slopes at nearly all stages of

*Area of the lake in acres divided by 2, reducing acre-feet to second-feet since 1 cu ft. per sec. or 1 sec.-ft equals 2 acre-ft. (nearly) in 24 hours.

elevation and discharge. S solutions of the formula

$$C = \frac{Q}{A\,r^{.67}s^{.54}}$$

another transposition of the exponential formula were made, giving values of C ranging from 59 to 70, an average value of 66 being taken when the river was within its banks. For elevations above 2130 when the river overflowed its banks C was found to have a value of 80.

The term $A\,C\,r^{.67}$ is a constant for each elevation and was calculated and designated as K_1, K_2, etc. The "Slope Discharge" curves were then made up by computing slopes for discharges of 3000, 6000, 9000, 12,000, 15,000 and 18,000 sec.-ft., passing through the channel at the different lake elevations from 2125 to 2133, and the points were platted in rectangular coördinates and the curves drawn as shown by Fig. 5.

Deriving the daily discharge of the St. Joe River at St. Maries by proportion from the observed discharge of the Spokane River at Spokane, and having the daily observed gage heights of Cœur d'Alene Lake, by use of the "Slope Discharge" curves (Fig. 5), the fall corresponding to any lake stage and derived discharge of the St. Joe River was obtained. The final curves (Fig. 6) were then made by adding these differences in elevation to the lake elevations for each day, making "Derived Daily Gage Heights" of the St. Joe River at St. Maries.

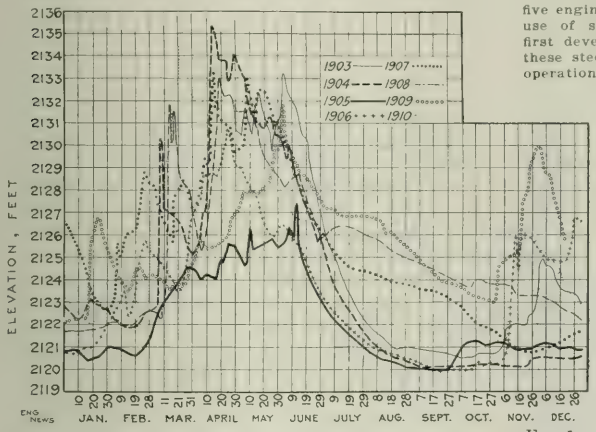


Fig. 6. Derived Gage Heights of St. Joe River at St. Maries, Idaho, 1903-10.

Daily observations of gage heights had been made at St. Maries for the year 1911 which afforded a means of comparing the derived gage heights with actual gage heights. For this purpose the gage readings for 1911 were derived as for previous years and platted on the same sheet, as were the actual gage heights for that year (see Fig. 7). The gage readings of the lake are also platted on this sheet to show the general relation of the two. As would be expected the peaks of the derived gage heights are slightly lower than the actual peaks. It must be agreed, however, that the results show a remarkable agreement, and one which justified the effort.

Coming now to the practical value of these derived curves, they show:

(1) That the only appreciable or significant differences between the elevations of the river at points near St. Maries and elevations of the lake occur during the flood period or during the months of April, May and June, sometimes beginning in March; and that during the remainder of the year and especially during the summer and fall months, the daily elevations of the river and lake are coincident.

(2) That the damages to the lands and crops on the lands at elevations higher than 2128 are the results of the late spring floods, separately and apart from the effect of the new dam.

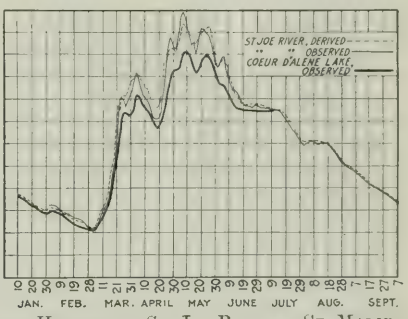


Fig. 7. Gage Heights of St. Joe River at St. Maries, Idaho, and of Cœur d'Alene Lake at Chatcolet, Idaho, January-September, 1911.

Five Blast-Furnace Blowing Engines, each with a capacity of 20,000 cu.ft. of free air per minute, operated by gas engines using blast-furnace gas, are to be built for the Maryland Steel Co. by the Bethlehem Steel Co., of South Bethlehem, Penn. The engines have double-acting gas cylinders in line with the blowing cylinders, and are similar in type to those now in operation in the Bethlehem Steel Co.'s own plant. The gas engines have cast-steel cylinders, 45 in. diameter and 60 in. stroke, which are the largest gas-engine cylinders ever cast in this country. The Bethlehem Co. is also building five engines of identical size for the Minnesota Steel Co. The use of steel castings for these very large cylinders was first developed by the Bethlehem Steel Co., and the first of these steel gas-engine cylinders has now been in successful operation for four years.

Sanitary Legislation in Indiana in 1913 has been summarized for this journal by Dr. J. N. Hurty, Secretary of the Indiana State Board of Health. The law of most interest to engineers was one which empowers the State Board of Health to order the installation of water filtration plants wherever the Board deems such a course necessary. The most important public health law passed in 1913, Dr. Hurty states, is a very comprehensive Housing measure. Among its features are prohibitions of inside rooms, or rooms without windows opening to the outer air. Another bill strengthens the old vital statistics law requiring the reporting of births, deaths, and contagious diseases. Dr. Hurty states that the bill makes the old law "almost perfect." A law of particular interest and with a somewhat facetious popular name, taken both from a part of its subject matter and from the introducer of the bill, is known as the "Rat Law." This bill was introduced by Senator Oscar Ratts, of Paoli. It authorizes health officers to enter upon any lands, buildings or vessels to ascertain whether or not they are infested with rats. Owners of buildings may be formally notified to clear their premises of rats and make premises rat-proof. The same law also provides for the teaching of anatomy, physiology and hygiene of the human system; the effects of alcohol and nicotine; the cause and course of consumption, and the dissemination of diseases by rats, flies and mosquitoes. Still another law authorizes cities of 20,000 inhabitants or more to raise funds for and to build public baths and swimming pools. The Lake Michigan Sanitary District Law, applicable to the counties bordering on Lake Michigan, creates a sanitary district, to be administered by five trustees appointed by the Governor. It is estimated that the contemplated sewerage and drainage work will cost $2,000,000.

Performance of a 450-HP. Boiler with Oil Fuel

By A. L. Menzin*

There was recently completed at the U. S. Navy Yard, Mare Island, Calif., a modern steam power plant to supersede old equipment for furnishing compressed air and electric power about the navy yard. The new equipment is housed in a handsome building of reinforced concrete and brick, and includes two 5000-cu.ft. steam-driven air compressors, two 500-kw. and one 1000-kw. turbo-generators, eight 450-hp. water-tube boilers equipped with superheaters, a complete oil-burning system, and the necessary auxiliaries.

In comparing the various bids received for furnishing and installing the boiler plant, the government made rational allowances for the differences between the respective guaranteed efficiencies and the lowest considered, by correcting the price named in each bid by an amount equal to the present worth of the corresponding saving in fuel—the total period of operation and the cost of fuel being assumed. The guaranteed performance was therefore an important factor in awarding the contract, in consequence of which the contractor was made liable to a proportional penalty should the actual performance be inferior to that guaranteed.

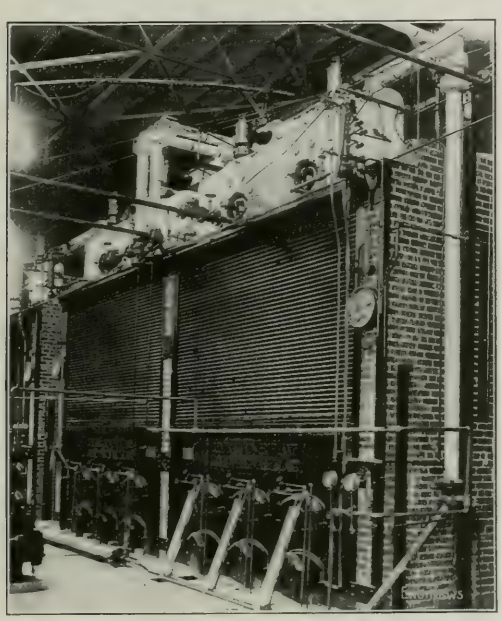


Fig. 1. Front of Oil-Fired Water-Tube Boiler at Mare Island Navy Yard, under Test

The efficiency at about rating guaranteed by the successful bidder, the Edge Moor Iron Co., of Edge Moor, Del., was 80%. Other important guarantees referred to moisture in the steam passing into the superheater, and to steam used by the oil burners for atomization. All guarantees were met in the first series of tests—the principal data and results of which are given below.

The tests were made under the direction of a board of naval officers consisting of Messrs. Fred Thompson, Civil Engineer, U. S. N. (chairman), A. H. Van Keuren, U. S. Naval Constructor; and Lieut. Harold Jones. Geo. A. McKay, Public Works Officer, under whose direction the plant was installed, coöperated with this board. The contractor was represented by the writer.

Owing to the pecuniary penalty involved, great care was taken to assure the reliability of all readings. The correctness of the testing apparatus was determined by suitable methods by, or in the presence of, representatives of both the government and the contractor. The water was weighed in all the tests. In the test for efficiency, the fuel oil was weighed; in other tests, in which the oil used was not involved, the oil was measured with a calibrated piston-type meter.

TEST AT ABOUT RATING

Date of trial	Oct. 11, 1912
Duration of trial	10 hr.
Dimensions and Proportions	
Name and type of boiler: Edge Moor water tube	
Number of drums in boiler	2
Number of tubes wide	17
Number of tubes high	14
Total number of 4-in. tubes 18 ft. long	231
Water heating surface, sq.ft.	4585
Name of superheater: Foster	
Superheating surface, sq.ft. (external surface of tubes only)	222
Name and type of oil burners: Owens inside mixer	
Number of burners to one boiler	3
Area of air spaces in furnace floor, approx., sq.in.	1140
Area of air spaces per horsepower of rating, approx., sq.in.	2.5
Average Pressures	
Barometer, in., Hg.	30.15
Steam pressure by gage, lb. per sq.in.	145.6
Pressure of oil to burners, lb. per sq.in.	47.5
Force of draft at damper, in. water	0.19
Force of draft in ash pit, in. water	0.15
Average Temperatures (F)	
Of external air	70°
Of air passing into ash pit	82°
Of steam	455.4°
Of feed water entering boiler	170.8°
Of escaping gases from boiler	421.0°
Of oil supplied to burners	127.1°
Fuel	
Kind of: California crude oil	
Specific gravity, oil freed from water, grit and other foreign matter	0.9504
Gravity, Baumé scale	17.30°
Percentage by weight of water in oil	1.42%
Percentage by weight of grit and other foreign matter in oil	0.034%
Calorific value of one pound of pure oil with water vapor due to hydrogen content uncondensed, B.t.u.	17,605
Calorific value with water vapor condensed (heat value as commonly given), B.t.u.	18,790
Quality of Steam	
Percentage of moisture in steam passing into superheater	0.06%
Superheat of steam passing out of superheater (F)	89.9°
Hourly Quantities and Rates	
Pure oil consumed, lb. per hr.	1,008.1
Water evaporated, lb. per hr., corrected for discharge through calorimeter	13,939.8
Equivalent evaporation, lb. per hr. from and at 212°	16,001.5
Equivalent evaporation per hr. from and at 212°, lb. per sq.ft. of water heating surface	3.49
Factor of evaporation	1.1479
Horsepower	
Horsepower developed	463.8
Rated horsepower (10 sq.ft. of water heating surface per horsepower)	458.5
Percentage of rating developed	101.2%
Economic Results	
Water apparently evaporated under actual conditions, lb. per lb. of oil as fired	13.77
Equivalent evaporation, from and at 212°, lb. per lb. of oil as fired	15.80
Equivalent evaporation, from and at 212°, lb. per lb. of pure oil	15.87
Equivalent evaporation, lb. per lb. of oil based on a standard calorific value of 18,500 B.t.u.	15.62
Efficiency	
Efficiency of boiler based on calorific value of oil with water vapor due to hydrogen content uncondensed	87.1%
Efficiency (as ordinarily given) based on calorific value of oil with water vapor condensed	81.6%
Smoke Observations and Gas Analysis	
Gases issuing from stack were just barely visible during entire test	
Minimum percentage of CO_2 at damper by Orsat apparatus	12.5%
Maximum percentage of CO_2 at damper	13.4%
Steam Required by Burners	
Steam used by burners to atomize 1 lb. of oil as fired	0.32 lb.
Percentage of steam generated used by oil burners for atomization	2.33%

*Testing Engineer, Edge Moor Iron Co., Edge Moor, Del.

For determining the steam used by the oil burners the orifice method was employed. The apparatus is shown at the right in Fig. 1. A hole made with a $\frac{3}{16}$-in. drill in a common pipe plug constituted the orifice. This was located in the flange union between gages. The apparatus was calibrated with tank and scales in the usual manner before the tests were run.

The government detailed men from its testing laboratory and engineering departments at Mare Island to observe and record all readings. The contractor also furnished two men for duty on the weighing platform so that all weights could be certified to by a representative of each party. The weighers and checkers were required to place their initials after each recorded weight as a precaution against errors. The weighing was done under the personal direction of W. A. Lynn, engineer in charge of the electrical laboratory at Mare Island. Temperatures, pressures, etc., were recorded by observers for the government and were occasionally checked by the contractor's engineer.

In the efficiency test, the weighing was conducted so that the weights of oil and water used during each hour could be determined. Pressures, temperatures, etc., were recorded every 15 minutes. The observers used specially prepared forms and by means of carbon paper recorded all readings in duplicate. Representatives of the respective parties interested were therefore able to compute the results of the tests independently from original records. After the computations were made the results were compared and checked.

All tests were made on one boiler selected by the government after the installation was completed and in operation. The blow-off piping and feed-water piping to boiler and superheater were disconnected from respective headers to avoid errors from leakage.

The factor of evaporation, equivalent evaporation and efficiencies given above are based on Marks and Davis' steam tables (1912 edition) and are slightly lower than the corresponding official results on account of the high specific heat of superheated steam specified in the contract. This was given as 0.65, which conforms to older practice.

The efficiency obtained in this test is remarkably good especially when it is considered that the firing was done by the regular government fireman who depended entirely on his eyesight for guidance in making the adjustments necessary for good combustion. He was cautioned about the firing probably not more than three or four times during the entire ten-hour run. The essentials for efficient performance, namely low temperature of outgoing gases and high percentage of CO_2 at damper, were present.

It will be noticed that two efficiencies of the boiler are given. These are in terms of the calorific values of the oil with water vapor due to the hydrogen content uncondensed and condensed as determined by the chemists. For commercial purposes it would seem to be more logical to consider the efficiency based on the first named calorific value, since the latent heat in the steam produced by the combustion of the hydrogen content is not commercially available for making steam. To utilize this latent heat would require a reduction of the temperature of the flue gases to 212° F. or less, which does not seem to be feasible even with economizers. When the fuel used is relatively low in hydrogen and the efficiency of the boiler is based on the "high" heat value, the boiler is unfairly favored by having a smaller amount of unavailable heat charged up to it. A comparison of boiler efficiencies based on the high heat value of the fuel is therefore not sufficient for determining the comparative performance of steam boilers.

It has been pointed out (Trans. Am. Soc. M. E., Vol. 33, p. 68) that there appears to be no exact relationship between the hydrogen content and the specific gravity of California oils, and that individual analysis is necessary. Very few data bearing on this point seem to have been published but, from those available, it would seem that there is a sufficient variation in hydrogen to warrant taking it into consideration when making guarantees, especially when a bonus or penalty is involved.

Besides the test for efficiency at rating, other tests of short duration were made to determine the characteristics of certain parts of the equipment at different rates of evaporation. The percentage of moisture in the steam passing into the superheater as determined by a throttling calorimeter was found to be 0.22% at 196% of rating as against 0.06% at 101.2% of rating. The performance of the superheater is shown in the following table:

Percentage of rating developed	61.4%	101.2%	196%
Superheat	92° F	90° F	118° F

The superheat produced by a given superheater de-

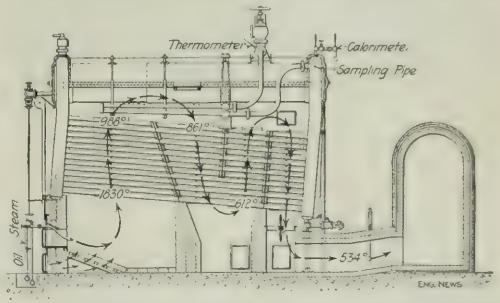


Fig. 2. Sectional Elevation of Oil-Fired Water-Tube Boiler at Mare Island Navy Yard

pends not only on the rate of evaporation but also on the character of combustion. With a given rate of evaporation too little or too much air will affect the average temperature of the gases passing through the superheater and the superheat will be affected accordingly.

The following table shows the steam used by the oil burners for atomization:

Horsepower developed by one burner	94	155	238	300
Pressure of oil, lb. per sq.in.	39	47.5	78	84
Temperature of oil, F °.	127	127	91	90
Efficiency of boiler	.....	81.6%		
Steam required for atomization, lb. per lb. of oil	*0.30	0.32	*0.20	*0.17
Percentage of steam generated used by burners for atomization	2.4%	2.33%	1.8%	1.5%

* Oil measured by meter and weight computed.

The steam used by an oil burner depends, of course, within limits, on the care taken by the fireman in adjusting the steam valve. This adjustment is not a delicate one, and if a fireman is careless he can use a great deal more steam than is required—which is not only a waste but which may also cause damage to the tubes by blowing the flame up against them. The inside mixer type of burner is somewhat proof against such carelessness as too much steam raises the pressure in the mixing chamber which cuts down the supply of oil and therefore the fire.

Fig. 2 shows the fall of temperature of the gases through the boiler when operated at about 196% of rating. Temperatures taken with the boiler operating at about rating would probably be of more interest but, unfortunately, a complete set of readings was not taken during this test. However, those taken permit of a comparison of the temperatures at certain points, which is given below:

	101.2%	196%
Percentage of rating developed		
Temperature between 1st and 2d rows of tubes over furnace, F.	1560°	1830°
Temperature at top of first pass	686°	988°
Temperature of gases passing out of boiler	421°	534°

The temperatures given above are the averages of several readings. All temperatures in the setting were taken with a Bristol electric pyrometer with bare thermo-couples set at approximately 30 in. from the inner face



FIG. 1. PLANK ROAD ACROSS THE DESERT NEAR BLYTHE, CALIF., FOR MOTOR TRUCK AND TEAM HAULAGE
(Ready for sand filling between wheel tracks.)

of the boiler wall. The thermo-couples were set by trial to give the highest temperatures, which corresponds to a setting where the cooling effect of radiation from the thermo-couple to the tubes is a minimum. All temperatures taken with the pyrometer are corrected for air temperature at the junction of the fire end with the extension piece. The temperature of the outgoing gases was taken with a mercury thermometer located as shown in the drawing. Temperatures near the damper taken with the pyrometer practically agreed with those indicated by the mercury thermometer.

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Grounding of Low-Potential Alternating-Current Circuits to prevent transmission of dangerous voltages to persons temporarily in contact with fixtures on the low-potential line, as noted in "Engineering News," Apr. 24, 1913, and May 9, 1912, is now made mandatory by a revised rule in the National Electric Code of the National Fire Protection Association, governing the insurance investigation of electrical installation. This is Rule 15, which now requires grounding of transformer-secondary and direct-current circuits provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts. It permits, but does not demand, the grounding of circuits where such potential exceeds 150 volts. For industrial private plants, not connected to a public distributing system and thoroughly insulated, grounding is not required. The rule recommends that the ground connection shall be placed on complete metallic underground piping systems, and urges water companies and water departments to allow the attaching of ground wires to their piping systems in full confidence that the integrity of the piping system will not in any way be affected.

This rule, like all others of the National Fire Protection Association, is not retroactive, and applies to work to be done after the new electrical code is printed and distributed, which is expected to be about June 1.

Improving Desert Roads for Motor-Truck Haulage

A motor-truck service for freight haulage between Blythe, Calif., and Blythe Junction, on the Atchison, Topeka & Santa Fé Ry., has been put in operation by the Santa Fé & Blythe Motor Transit Co., and in connection with this the company has done some road work of an unusual and interesting character. A large part of the distance is over a sandy desert, and it was necessary to form some kind of substantial roadbed to facilitate the handling of the trucks.

PLANK ROAD

For a distance of about three miles over the worst part of the route, with loose and shifting sand, a plank road



FIG. 2. COMPLETED PLANK ROAD, WITH FREIGHTER'S TEAM



FIG. 3. BUNDLES OF ARROW-WEED FOR FOUNDATION OF DESERT ROAD, BEING HAULED TO PLACE BY A MOTOR TRUCK

has been built, with satisfactory results. Railway ties for the sand filling, the short blocks being concealed by the planks.

The roadbed was graded with four-horse fresno or buck scrapers, and after the planks had been laid the scrapers were used to fill sand between and over the ties. The sand is very fine and soon fills all voids under the ties and planks, so as to form a solid roadbed. When the planks had been laid they were given a coating of crude oil, to prevent warping under the intense summer heat and to give a better traction surface for the rubber tires. The cost of this construction was about $1500 per mile. Fig. 2 shows the finished road, with a freighter's team.

In this connection we may note the use of a plank roadway several years ago as a connection between a rail-

way and a quarry in an Eastern state. The dirt road was almost impassable in the spring, when it was desired to begin hauling stone, and the cost of building a hard road was prohibitive. A plank road was decided upon as a temporary expedient. A double line of planks was laid on old railway ties, and although the construction was very rough and crude (giving trouble by the loosening and tilting of the ends of the planks) the hauling was made with comparative ease while the daily capacity of the haulage was greatly increased.

Brush and Straw Roads

On other parts of the route to Blythe a roadbed was formed by placing a layer of brush of arrow-weed and covering this with sand. These weeds grow in the bottom lands to a height of 4 to 6 ft., and about ½ in. diameter. They were cut by hand with an ax and piled in bundles, which were hauled by a Saurer motor truck to the stretch of road to be improved. This is shown in Fig. 3. The bundles of weed were placed with their ends meeting in the center of the roadway, allowing the bushy and heaviest part to lie in the wheel tracks. The weeds were then covered thickly with straw. Finally a crew of Mexican and Indian laborers threw on a covering of sand and dirt to hold the straw and weeds in place. This formed a very solid base when compacted by passage of wagons and motor trucks.

This construction was used on a few miles of bad road that was some 40 miles from the railway. It would have been too expensive to haul in lumber for a plank road, and it was more economical to use the materials at hand. This kind of road construction cost about $80 per mile where weeds and straw were plentiful. We may note that straw is used as a covering for sandy roads in northern Wisconsin and elsewhere.

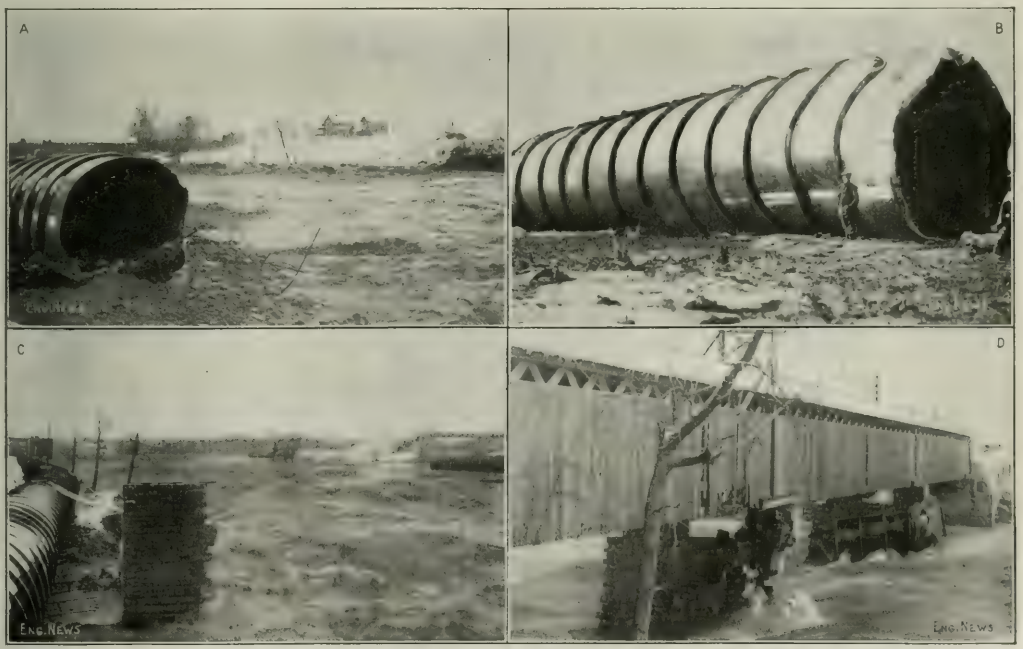
Freight Haulage

The distance between the town and the railway is about 50 miles. Freight teams required a week to make a round trip over the sandy road, and the charge for hauling was $20 per ton. There is now a regular service of Saurer trucks of 6½-tons capacity, each making a trip one way daily. The charge for hauling has been reduced to $7.50 per ton, with a much better service, and by agreement with the railway company, the latter makes through rates to Blythe (including the motor-truck service). For information we are indebted to W. H. Horrell, Phoenix, Ariz.

The End of the Balleville 14-Ft. Pipe

The 14-ft. penstock of the Balleville Hydroelectric Co., near Fremont, Ohio, whose collapse on Feb. 18 was noted in Engineering News of May 1, 1913, p. 909, was destroyed by the flood of Mar. 25, 1913. Herewith are four views showing the flood's work, sent us by L. H. Van Buskirk, Asst. Engr., Ohio State Board of Health.

The pipe was built last winter, and was finished in February, 1913. It was about 3000 ft. long. The pipe was 14 ft. in diameter, built of $\frac{5}{16}$-in. steel plates and stiffened at the ring joints, 7 ft. apart, with a 6x4-in. angle. It was supported by two lines of concrete pedestals, 6 ft. apart transversely and about 7 ft. apart longitudinally. Each 7-ft. length contained about 30 tons of water when full. The pipe collapsed at its first filling, the top buckling in and the sides bulging out.



The Balleville 14-Ft. Steel Pipe Destroyed by the Flood of Mar. 25, 1913.

An Engineer's Stage Journey through Arizona and Mexico in 1880

By C. L. Annan*

Thirty-two years ago New Mexico and Arizona were primitively wild. The Santa Fé Railroad had entered New Mexico on the north by a half-mile tunnel under Raton Pass and had penetrated to about the center of the Territory, following the old Santa Fé Trail south across the old Spanish land grants to Las Vegas. Thence winding westward in to the mountains, it steadily climbed the Pecos Valley to Glorieta Summit, dropping down to the other side and away to the Rio Grande. Construction trains were running down the river, and the grade was stretching rapidly to the south. West of the Rio Grande the country was terrorized by savages.

The ubiquitous Victorio, the most audacious Apache since the time of Cochise, dashed from point to point murdering, burning and mutilating, regardless of the cumbersome pursuit of the U. S. soldiery. If by chance, he was hard pressed, he slipped over the Mexican border and hid in the Sierra Madre Mountains awhile; but he might be expected to turn up at any time in the most improbable manner.

Things were beginning to take shape at Guaymas, the Pacific terminal of the Sonora Ry. to be, and a requisition for several engineers had been made on Chief Engineer Robinson of the Santa Fé. We started on the usual short notice. In due time we reached Albuquerque on the Rio Grande, where regular passenger service terminated and a hundred miles, more or less, must be undertaken on the construction trains of the extension southward.

By a lucky circumstance a parlor car for the accommodation of General Grant and his party, on their return from southern Mexico, was attached to the southbound material train with which we connected, so we occupied this coach as far as Bernalillo. Early in the afternoon the train pulled up at this pretty little station and the hungry travelers were not long in finding themselves at a well spread table in a near-by ranch house. As they strolled back toward the station the sky suddenly became overcast and heavy drops of rain began to fall. There was a general stampede for the shelter of the station house.

All at once I realized that I was elbowing General Grant, who stood just outside the door. The Ex-President was clad in a rusty Prince Albert and battered straw hat. He stood shoulder to shoulder with Indians, peons, vaqueros and what not, and with a closely burned cigar stump between the fingers of his right hand, unconcernedly watched the coming storm.

The rain ceased as suddenly as it came, which is a feature of the summer storms of this section. Directly after this copious shower, the patches of fallow ground in the vicinity were alive with myriads of minute toads, hopping in the sunlight.

A few miles farther south we reached the end of track in a waste of sand glittering in the burning sun. A short stage ride brought us to Socorro, a cluster of mud huts, where there was a large camp of engineers, our comrades of the last few years. Here we accepted warm greetings, and nonchalantly talked of old times and coming prospects. The evening reunion was a merry one and memorable to all who met again in after years.

At this village of Socorro we cut loose from the railroad and our stage journey began. Travel was heavy along the Rio Grande at that time and hotel accommodations at San Marcial, our first night's stop, were scanty. The late coming guests slept on the floor. A little after midnight a lively rattle of revolver shots roused the sleepers. Under such circumstances a bed on the floor had its advantages.

The next day the monotony of wheeling through sand was broken by the fording of the Rio Grande below Fort Craig. The road left the river at the ford and ran southward between two parallel mountain ranges for 85 miles. This waterless stretch, known as the Jornada del Muerto, was the dread of the old time freighters.

Finally emerging from the dry defile and striking the river once more, the sparse vegetation of the valley seemed luxuriant in comparison. Doña Ana, Las Cruces and Mesilla, sluggish Mexican settlements of considerable age, were passed.



Map Showing Route of Stage Journey through Arizona and Mexico in 1880

Our stage-driver was Aleck Le Beau, a jolly old fellow, stalwart and breezy, who by his thrilling tales kept our hair standing on end the day following the passage of the Jornada. Old Aleck was in fine spirits as he drove his team into the shallow water of the ford at Mesilla and splashing across the broad bottom pulled up at the little house on the west side to say goodby to his wife and younger children. His was one of the most trying stages, that from the big river to Fort Cummings, across the sun-blackened desert with its patches of greasewood and amole.

"Yes," he said, "I've seen a little of life in the last 66 years. I didn't miss much of interest in the late Mexican war when I kept pretty close to the heels of General Scott. And I've lived among the Indians for years. I saw a good deal of the Sioux as a youngster.

*M. Am. Soc. C. E., 2129 Scudder St., St. Paul, Minn.

The Sioux are pretty bad medicine, but of all the rascally reds I've ever met, the Apaches are the most poisonous. I've met lots of 'em and done 'em favors and in the natural order of things they should bear me no ill will. They know me well enough and have never molested me but I don't trust 'em. I'll show you a place a few miles on where I got a big scare on my last trip. I've a sort of feeling that they'll get me yet.* I never carry a gun. You don't see 'em till they have the drop. Victorio is sure a bad one. We'll strike Magdalena Cañon about noon, and there you'll see how these Apache devils do their work."

When we came to the Magdalena cañon we saw the remains of a Mexican wagon train. The carcasses of the oxen lay where they had fallen, alternating with the charred remnants of the wagons. From the rocks on the hillside had come the deadly fire early one morning and the massacre had been complete. Le Beau's recitals served to while away the hours of dread that weighted the spirits of the "tenderfeet" in spite of themselves.

On the arrival of the stage at Fort Cummings late in the evening nothing of the whereabouts of the Apaches could be learned. At about 10:30 p.m. Sam *El Diablo,* having succeeded to Le Beau's responsibilities, whipped up a fresh relay of horses in a drizzling rain and pointed for the entrance to Cook's Cañon. The way was rugged but Sam, like old Aleck, was cheery and voluble although in rather a constrained way, being somewhat hampered by the weight of his reputation. Some forty-odd indictments, some of them for murder, were hanging over him in Grant County. To drive a stage from Fort Cummings to Silver City was a fit assignment for an outlaw. It was regarded as rather the most undesirable billet on the run, and Doubtful (Cook's) Cañon was the particular stretch which made it dismal.† The night hours wore on, rain came intermittently and the moon dodged the flying clouds. The road was steep and heavy.

"Gentlemen, I shall ask you to walk with me over this rise," and his two passengers alighted. "This is a bad stretch of a worse cañon," said he. "It's what you might call a cemetery. They say there's about thirty under that rock pile, but that was old Cochise's work. Just beyond here is a somewhat fresher planting. You've probably heard how that flying devil Victorio scooped the Lyon party here last month, five of them. Well, gentlemen, climb up again."

Sam desired to be considered a good fellow in spite of the indictments. He was obliging and quiet in manner, and seemed to enjoy recounting the doings of the stage men, as Le Beau and others had done before him.

The story of Font Wins was a favorite one. Deserted by his military escort at the first fire of the ambushed Apaches and brought to a standstill by the loss of a horse at the same volley, he had coolly spiked his team while the bullets were flying and had carried his passengers to safety.

Fort Bayard looked good in the morning after the dismal night in the cañon. Silver City was a noonday revelation. One could hardly realize that this brisk little settlement, with houses of burned brick and painted wood, was a possibility in that region after the eternal brown of the mud shacks and walls and the dusty dress of everything for hundreds of miles to the east.

We decided to stay over a day, get into touch with civilization, and allow our hair to relax.

Stage passengers are generally a sociable lot. The night coach west carried a comfortable quota of five. About midnight I threw aside my blanket and climbed to the box.

Toward morning I went below again for a little nap and found a fellow passenger, a Chinaman, stretched out on the front seat in full-length slumber. The other three, in postures more or less cramped, were measuredly breathing in different keys. I couldn't find my blanket but curled up in the chill night air and soon joined the chorus.

Day was breaking when the coach pulled up at the relay station. The passengers uncrimped and stretched themselves. The Chinaman rolled out of my blanket, yawned while he folded it, then passed it over. "This your blanket"? He must have been a cook. Chinese cooks were persons of distinction in the Southwest at that time.

"This must be the run of the man who defied the road agents about a month ago," said I to the new driver, as we bowled along among the cactus toward Apache Pass an hour or so later. "I'm the man," said he, "and this is my first trip since the accident." "It must have been fairly lively for you for a few minutes," "Yes, but it was soon over. I had only three passengers: a Mexican who was sitting where you are now with a Winchester in the hollow of his arm and a belt full of cartridges; a cranky old prospector, snoozing inside, and a fussy woman.

"You see the road falls a little for some distance. When we got abreast of that bunch of cactus two fellows stepped into the road, and covered me with their guns.

"The woman saw the move and fetched a squawk to raise the dead. The team shied, and taking the bits in their teeth made a dash down the road.

"This was a great surprise to the roadmen but they gathered themselves together for a parting shot. I felt a twinge in the leg and caught the Mexican by the belt just as he was toppling off the box. All Hell couldn't stop the broncos while the rifles rattled and the woman shrieked. I had my hands full as we flew along, dragging the reins with my right and holding the Mexican's belt with my left. The top of his head was shot clean off.

"When we slowed up, my boot was full of blood and I just naturally keeled over. Have been in the hospital ever since. See those two holes in my boot leg? The bullet

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*The semi-monthly newspaper, published at Las Cruces, contained the following news item, a few weeks after this.

"One of the soldiers of the 16th Infantry stationed at the camp near Goodsite (16 miles east of Fort Cummings), from an eminence saw the hack coming up the road at about 4 p.m., and heard the shooting. He saw the hack turn back, and resolved to go to the place and see what was the matter. He found Le Beau, the driver, dead in the road at the place where the hack had turned, and following on he came to a point where he saw about ten Indians at the back going through the mail. He returned and reported, and the troops then went out and got the bodies of Le Beau and Roberts and returned and sent a courier to General Buell at Cummings. Madden's body was found next morning a few yards from the road."

The account then goes on to state how the Apaches were pursued in the customary way and how, as usual, they escaped into Mexico.—C. L. A.

†In October, 1881, more than a year later, a Tucson newspaper, while reporting a recent Apache ambuscade in this deadly cleft, commented as follows:

"The road from Apache Pass to the east passes through this narrow, rocky and tortuous defile for a distance of three miles or more, and in past years the Indians have made use of its peculiar advantages in their method of warfare to massacre travelers. It is estimated that the bones of no less than 150 victims of Indian cruelty lie scattered throughout this cañon. The scene is pregnant with tales of horror and bloodshed."

that caught me struck that lamp guard, split, swerved and went into my leg in two pieces."

This sort of recital was becoming rather a matter of course, and familiarity with the participants was beginning to dull the edge of prospective horrors. Dread of the Apache was on the wane. The acute stage had passed, and a dull resignation succeeded.

Away the old "mud wagon" rumbled, over Apache Pass, by Fort Bowie, through a little oasis at Dos Cabezas, and on to Benson, without accident of any kind to break the dusty monotony.

A night ride of sixty miles by rail, a day's respite in that old Mexican oven, Tucson, and the travelers then turned southward toward Guaymas, our destination, which lies about three hundred miles due south of Tucson. The road winds up and down the parched broken valleys of dry waterways. The sparse grass, coarse and dry, the clumps of stunted, thorny shrubs, the occasional giant cactus, everything visible in fact, bathed in the impalpable clay dust, rising on the lightest breeze, takes its dreary tint, and the whole expanse of the broken desert is a monotone in dead brown.

The proprietor of the stage line was a Mexican, although the coach was the standard old Concord "mud-wagon"—normal capacity, nine inside passengers; initial speed of fresh relay, 15 miles per hour; average speed less than four miles, night and day; motive power, mules and broncos, the mules quite as bronco as the horses, for all run at large. They were herded over an extensive range, and if the corral was empty on the arrival of the stage there was no relay.

The regular trip between Tucson and Hermosillo, about 76 consecutive hours of ordinary duty fitted the Mexican drivers for all contingencies. It took two men to drive a team of six; the *cochero* in chief held the reins almost without respite. His assistant ran alongside the weary team with a short whip or threw stones at the leaders from the box.

No special arrangements were made for the convenience of passengers in the way of eating and sleeping along the route. An occasional solitary habitation of adobe or driven sticks passed during the three days and three nights of continuous travel offered pot luck for the passengers as opportunity might offer. What little sleep was to be had, was in, on, or under the coach.

We were now in the land of *tortillas* and *frijoles*. Late in the day the stage pulls up in front of a hut. A frowsy woman kneels in the open before a fire of *mesquite* roots patting a dough ball. A crock of thick porridge of well-cooked *frijoles* simmers on the hot stones. The dough ball, expanded to nearly the size of a barrel head, but as thin as a wafer, is laid on a hot earthen platter and quickly cooked. Behold the *tortilla*. With a small piece torn from the edge of the tough edible, the *frijoles* are scooped as in a spoon. And the spoon is incidentally eaten with its contents. A sufficient remnant may serve as a napkin at the conclusion of the meal.

Another word as to *el cochero*. The monotony of the pull on the lines may be varied by the fall of a wheel horse in the mad rush of a fresh relay. The momentum may be checked in a hundred feet or so, and the tough animal may regain his feet for further service. The mending of the harness affords a little relaxation.

It is not at all surprising that after hours of strenuous attention the driver should succumb to drowsiness at times. Then the team may leave the road and stall the coach in a *mesquite* thicket. The sleeping passengers are aroused and politely requested to lend a hand at extricating the vehicle. The detached leaders become restive and make a dash for liberty, laying low their erstwhile persecutor of the short whip. Some hours are lost in their recovery, for the night is dark. *El cochero* does not repine.

Again a good road stretches away over the plain to the south, following a dry *arroyo* to the right. It is early morning, perhaps an hour before sunrise. He eases up on the reins. All about him are sleeping.

To relax is to sleep, the temptation is not to be resisted. When he comes to himself he is sprawling. The coach lies on its side in the bed of the *arroyo*. The startled inside passengers, much shaken, are trying to leave the wreck while the one who happened to have been sleeping on top lies insensible some fifteen feet away.

All this is apparently a matter of course to the Mexican jehu. He expresses neither surprise nor annoyance. He simply sets about putting things to rights. He directs the revival of the prostrate passenger and the righting of the coach, and is soon quietly on his way again.

Another day of heat and clouds of dust, another almost intolerable night and yet a few final hours in the broiling sun. The last relay is not forthcoming and most of the passengers walk the last few miles over the hot sands into Hermosillo for a bath and a square meal and a little sleep at full length. The luxurious cots are vacated at 3 a.m., and a dash is made at the last day's work under other auspices. Ninety miles in eighteen hours is the program.

The Guaymas welcome is a warm one. There is no cool evening breeze from the Gulf. A stifling heat prevails both day and night, month in and out. We fall in with some jolly companions, however, men earlier on the ground, some of them via the monthly steamer from San Francisco.

On completion of the road in 1882, the writer followed his chief to the other side of the Sierra Madre, but his traveling companion, Hugh T. Richards, remained, and a few years later became General Manager of the Sonora Ry.

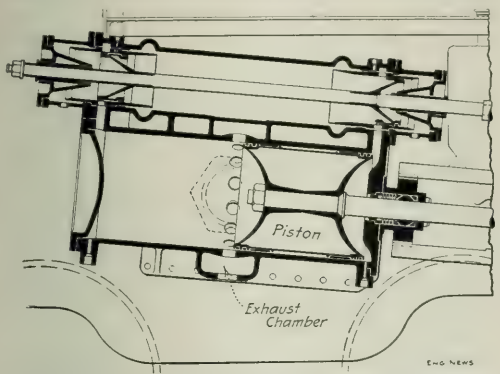
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Data on Earthquakes are very limited. This is due partly to a lack of any ordered study of the subject in the past and partly to the reluctance of certain communities to admit earthquake damage. In order to give more complete data in the future, the Seismological Society of America, with headquarters at Leland Stanford, Jr., University in California, are endeavoring to collect all data possible, not only for the future study of earthquakes but for the use of engineers who may wish information regarding the possible seismological conditions in any particular locality of the country.

In an article in the "Bulletin of the Seismological Society of America" for March, 1913, J. C. Branner, now President of Leland Stanford University, states that the society has received several requests from different engineers for information about the frequency and character of earthquakes in some particular district, and that it has always had to admit ignorance of the subject. He requests all who can to make what observations are possible regarding earthquake shocks and to send them with full data, whether such data be scientific or not, to the Seismological Society, so that they may start toward the building up of statistics on the subject. He further states that while this would seem to be the duty of some federal scientific bureau, so far it has not been possible to interest any particular bureau in the subject sufficiently to guarantee any accurate or complete record on the subject.

A Locomotive with the Stumpf Direct-Flow System of Steam Distribution

A locomotive with the Stumpf system of cylinders and valves for direct flow of steam has been built for the Northeastern Ry., England, and is an interesting novelty in locomotive design, although a few locomotives of this type are in use in other European countries. In the ordinary locomotive, steam entering at either end of the cylinder follows the piston in its stroke and then (as the piston makes its return strokes) the steam reverses its motion, the expanded and partly cooled steam being forced out at the same end of the cylinder and through the port which is to be used by the next inflow of hot steam. In the Stumpf system, the exhaust ports are at the middle of the cylinder so that this cooling effect is avoided. This arrangement necessitates the use of a long cylinder and a long drum-shaped piston, as shown in the



Locomotive Cylinder, Piston and Valve for Direct-Flow Steam Distribution (Stumpf System); Northeastern Ry., England

accompanying cut. This system is claimed to be a satisfactory substitute for superheating, and it is further claimed that its steam consumption is as low as that of a compound engine. The Northern Ry. locomotive, however, is equipped with a superheater.

In the Northeastern Ry. engine the cylinders are 20 in. diameter and 4 ft. 8 in. long, with a stroke of 26 in. The exhaust ports are a series of holes drilled round the cylinder walls and leading into an annular exhaust chamber. The piston fills approximately half of the cylinder volume. In fact, at the end of each stroke one or other of its edges is just clearing the ring of exhaust ports and allowing exhaust to take place. In this way each half of the cylinder volume has to deal with the steam from only one inlet port, and as the total area of the exhaust port is large the period of exhaust extends from a short time before the end of the stroke until a short time after. The bulk of the one stroke is thus occupied with the admission and expansion, and the bulk of the other with the compression of the steam. In general, the period of exhaust covers 10% of the stroke each way, so that admission and expansion occupy 90% of the stroke in one direction and compression 90% of the stroke in the other direction.

The pistons are hollow castings with spring rings at each end. The admission of steam is controlled by piston valves operated by Walschaerts valve gear. The valves have inside admission; their maximum travel is 6½ in. and their exhaust lap 1⅜ in. When the engine is running in full gear the valve ports provide an auxiliary exhaust; but when the engine is notched up, this auxiliary exhaust is closed and all the steam escapes by way of the central ring of ports.

The engine is of the 4:6:0 type, for fast freight service, with a total weight of 72 tons (54 tons on drivers). It was built to the designs of Mr. Raven, Chief Mechanical Engineer of the Northeastern Ry. Our information concerning it is taken from an article in *The Engineer*, of London.

Rules for the Protection of Electric-Service Employees; an Order of the New York Public Service Commission (First District)

Hearings were recently completed on the question of regulations to be prescribed as to all public-service corporations within the jurisdiction of the Public Service Commission for the First District of New York State (New York City) for the protection of employees from injury by high-tension electrical equipment or other dangerous conditions. As a result the following requirements have been fixed to apply on and after July 1, 1913:

(1) All high-tension switch compartments shall, so far as their construction will permit, be so inclosed as to make it impossible, except when necessarily opening the compartments, for employees to come in contact with electrically charged parts either from or above the floor level.

(2) All exposed high-tension cables in power or substations shall be inclosed by screens or otherwise protected.

(3) There shall be posted, in conspicuous places in all the power houses and substations, diagrams describing and showing the relative location of wires and cables (except lighting and signal wires) and the switches, etc., controlling them and all such wires, cables and connections shall be so tagged and numbered that they may be readily identified.

(4) All machines for the generation of current or connected with such generation shall be so protected by railings and gratings as to safeguard operators and others from coming in contact with moving or electrically charged parts.

(5) There shall be at least two operators on duty in rotary-transformer stations delivering current at 500 volts or higher when the same are in operation.

(6) All water-level glasses or gage-glasses on tanks, standpipes, or other storage receivers under pressure, shall be protected by screens to prevent injury in case of a bursting glass.

(7) Test cocks on water columns shall be fitted with extension rods or chains so as to be operative from the boiler-room floor level.

(8) All stop valves on steam boilers shall be of the automatic self-closing type.

(9) Outlets of all safety valves shall be vertical.

(10) All furnace doors on hand-fired boilers shall be fitted with latches or catches to prevent them from being blown open.

(11) All moving parts of stokers shall be so protected, wherever possible, as to prevent accidental contact with such moving parts.

(12) All large main cutout stop valves shall be provided with means whereby the same may be closed from the boiler or engine-room floor or other remote point.

(13) All large steam units shall be fitted with automatic self-closing valves.

(14) All high-speed engines shall be fitted with automatic safety stops.

(15) Elevator wells shall be properly and substantially inclosed, secured or guarded and shall be provided with proper traps and automatic doors in or at all elevator ways so as to furnish substantial covering when closed and to

open and close by action of the elevator when ascending or descending.

(16) All openings in floors shall be roped off or protected by railings when left unguarded, and, in addition, a red light shall be hung in the immediate vicinity when the location is unlighted or poorly lighted.

(17) All stairways shall be provided with safety treads, kept free from oil and water and be properly protected with hand-rails.

(18) Shafting running along or passing through floors shall be housed or screened or otherwise properly guarded.

(19) All belting shall be inclosed or otherwise protected wherever accidental contact is possible.

(20) Gear-case covers completely inclosing the gears shall be fitted to all machine tools and be kept in place while such tools are being used.

(21) Set screws and keys in exposed positions on moving machinery and shafting shall be countersunk or otherwise properly protected.

(22) Buzz saws and band saws shall be protected so as to prevent accidental contact with saw blades.

(23) Grinding and emery wheels shall be properly guarded and equipped with hoods and exhaust pipes to draw off finely powdered material.

(24) Guard glasses shall be provided for employees and used by them when engaged upon any work causing chips or fragments to fly, and wire screens of a portable or permanent type shall be set up on work benches or around employees engaged in chipping.

(25) A sufficient number of pails of clean, dry sand must be kept in all power stations, substations, auxiliary and switching stations.

(26) Power stations, substations, auxiliary and switching stations shall be provided with a sufficient number of chemical fire extinguishers of such a type that the contents cannot act as an electrical conductor. No other extinguishers shall be kept for use unless conspicuously labeled that they are not to be used until current has been shut off.

(27) All power stations, substations, auxiliary and switching stations and shops shall be provided with a first-aid or emergency kit.

(28) Provision shall be made whereby pulmotors will be available in case of accidents.

And it is further ordered that on or before June 1, 1913, said companies and said receivers adopt, promulgate and thereafter rigidly enforce rules and regulations to govern their employees in the handling of high-tension apparatus and in the handling of steam and mechanical apparatus in power stations, substations and shops.

NOTES FROM THE ENGINEERING SCHOOLS

UNIVERSITY OF ILLINOIS—The land grant made to this institution by the Federal government in 1862 requires military instruction to be given to all students, and an army officer is detailed to supervise the work. The old armory provides for a regiment of about 500 cadets, but in 1912 the cadet regiment of the University numbered 1525. The legislature of the state of Illinois has made an appropriation for a new armory, and this is now under construction. It will be 420x276 ft., with a drill hall having a clean floor space 394x200 ft., flanked on the longer sides by the company rooms, and having on these sides galleries, which will accommodate 3000 people. Above the galleries are two rifle ranges. The drill hall is spanned by steel arch trusses of the three-hinged type, spaced 26 ft. apart. In this great hall the entire regiment can be drilled. It will be used also as an assembly hall for commencement ceremonies, conventions, and other large gatherings.

UNIVERSITY OF CALIFORNIA—Among the graduate scholarships and scholarships announced by the University of California for the year 1913 and 1914 the following are noted as of interest to engineers:

(1) Ten University scholarships, yielding $400 each, available in any of the colleges of letters, sciences and engineering. (2) Two Flood scholarships in economics, yielding $400 each. (3) Two John W. Mackay, Jr., scholarships in electrical engineering, yielding $600 each. (4) Three Lick Observatory scholarships in astronomy, yielding $600 each. (5) One or two scholarships in physics under the Whiting fund, yielding $600 each. (6) One James M. Goewey scholarship in natural science, yielding $250. (7) One research scholarship in problems of city growth, yielding $1000.

Awards are made not upon basis of financial need, but solely for merit in scholarship and ability for research work.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY—A four-year course has been established in industrial physics as the outcome of demand felt for men trained for the investigation of physical problems that arise in the industries. The studies in physics embraced in this course require a less extended pursuit of pure and applied mathematics and more attention to applied physics in the lectures and laboratories. Applied optics, and heat and electrical measurements are greatly extended. Much time is devoted to the theory and practice of chemistry, to mechanical and electrical engineering subjects, electrochemistry, metallography, etc.; a large amount of equipment has been made available for precise measurements.

The aim will be to develop a man possessing such a knowledge of physical investigation and methods of attacking physical problems that he may deal intelligently with any questions of this nature that may arise in connection with various processes of the arts. The Institute is recommending this course for men only of unusual ability and especially those with manifest initiative. A full four-year course will be developed and those who desire to follow it must pursue the whole course for the scheduled time.

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Liquefied Chlorine Gas for Water Disinfection is now being used in several cities. It was first tested experimentally by the manufacturers of liquid chlorine at their Niagara Falls plant and later in the Mount Prospect Laboratory of the Department of Water Supply, New York City, by D. D. Jackson, chemist of the department, early in 1912. In July, 1912, it was used at the Belmont filter plant of the Philadelphia water-works. In November, 1912, it was put in use at Wilmington, Del., and at the Western New York Water Co.'s plant at Niagara Falls, N. Y., and since then it has been adopted at Somersworth, N. H. The chlorine gas is one of the products of the electrolytic decomposition of brine, caustic soda being the other. The gas is purified, liquefied by compression and refrigeration, and is placed in 8x60-in. steel cylinders for shipment. Each cylinder weigh about 85 lb. and contains from 100 to 110 lb. of liquid chlorine, under pressures ranging from 54 lb. at freezing to 125 lb. at 85° F. In utilizing the liquid chlorine it is discharged at the desired rate through control apparatus into an absorption tower where it combines with a spray of water which carries it into the water-supply for which treatment is desired. Liquid chlorine is made by the Electro-Bleaching Gas Co., of 25 Madison Ave., New York City, which has also developed a control apparatus. John A. Kienle, until recently chief engineer of the Water Department of Wilmington, Del., and under whose direction liquid chlorine was introduced in Wilmington, is now sanitary engineer of the company just named. The company has been engaged for the past seven years in manufacturing liquid chlorine for bleaching purposes and the chemical trade generally. It states that experience has demonstrated that for both bleaching purposes and for water-treatment chlorine in liquid form is much more efficient, unit for unit, than in the form of bleaching powder, or hypochlorite of lime, besides requiring less elaborate and expensive equipment for the application of the chemical and practically eliminating labor and power costs of operation.

EDITORIALS

Filter Killing in New York

The killing of the Croton water-filtration project by the Board of Estimate of New York City on May 22, after a four months' hold-up of the award of the contract for a 320,000,000-gal. mechanical filtration plant, sacrificed one more carefully wrought engineering project to the great game of American municipal politics. This particular killing comes in one of those pre-election fits of economy which so often follow the incurring of huge debts for municipal improvements made necessary by the rapid growth of American cities. The alleged ground for the killing is that filtration is not necessary. As we showed last week, it is late in the day to raise that point.

Aside from the need for filtration two serious aspects of this filter killing are: (1) The plans and specifications on which bids were based have cost the city a round $100,000 or so; (2) at the solicitation of the great city of New York numerous contractors throughout the country spent time and money to prepare and submit bids for the proposed filters, which a majority of the Board of Estimate finally decided were not needed at all. We suggest that hereafter contractors bidding on New York City work insist on the city putting up a certified check as a guarantee that the responsible authorities will not change their minds as to the need of the improvement on which bids are asked.

Finally, there is a human element involved in this unfortunate incident which deserves thought. Twenty to thirty engineers and draftsmen, including a number of the most experienced filtration engineers of the country, have wrought two of the best years of their lives into these plans and on their ultimate carrying out have based (especially the younger men) high hopes for their professional future. To these men it is a bitter experience to have their work stop with the blueprint stage. But it is the common lot of the engineer to see his best efforts sacrificed in the political game. As an engineer has just written to us in commenting on this matter: "Verily, the ways of politicians are beyond understanding"!

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The Philosophy of the Uni Flow Steam Engine

A brief description is given elsewhere in this issue of a new locomotive recently put in service on the Northeastern Railway of England, which has cylinders arranged for the Stumpf system of steam distribution. As steam engines of this type for various purposes are receiving much attention just now and their construction has been taken up by several American engine builders, an elementary explanation of the principles on which this type of engine operates, may be of interest to those who do not closely follow this branch of engineering work.

In the first place, to thresh over old straw, it is well to get clearly in mind just what is meant by the statement of authorities on steam engineering that one of the chief sources of loss in the development of power from steam is the heat loss inside the cylinder, due to the varying temperatures of the steam at different points of the stroke. We recall a statement published some years ago which made this heat loss far easier for the average engineer to comprehend than any abstract or mathematical statement possibly could. The statement was substantially as follows:

In the cylinder of an ordinary locomotive, using steam at 200 lb. boiler pressure, the temperature of the steam when it enters the cylinder will be about 388° F. When the steam inlet valve closes and expansion begins, the temperature of the steam runs rapidly down, and when the exhaust port opens, it instantly falls to 212 deg. During the whole of the exhaust stroke, the cylinder, the piston surface and the ports through which the steam flows, are exposed to this temperature of 212°. The difference between the temperature of the live steam as it enters the cylinder and the exhaust steam as it leaves, is 176°. This difference of temperature is as great as the difference between the hottest summer day in the Torrid Zone and the lowest temperature recorded in Arctic explorations.

Drop a piece of ice into boiling water, and note how rapidly it is cooled. The difference in temperature between the ice and the boiling water is substantially the same as that between the steam as it enters the locomotive cylinder and the same steam when it flows out of the exhaust.

The advantage of a compound or triple or quadruple expansion engine over the simple engine is that this temperature range is distributed through several cylinders, so that the flow of heat into the cylinder wall from the hot steam, and back again into the exhaust steam as it passes out, is very much less. This also explains, to a large degree, the superior economy of the four-valve engine over the plain slide-valve. By merely providing that the exhaust steam shall pass out through ports which are entirely separate from those through which the live steam enters, we make a large gain in economy.

In the Stumpf "Uni-Flow" engine, the exhaust ports are entirely separate from the inlet ports, and further, they are placed at the middle of the cylinder, while the inlet ports are at the ends. Thus the exhaust steam does not have to flow back to the end of the cylinder in order to escape.

In Europe, where fuel economy in locomotives receives far greater attention than in this country, locomotives have been built at various times equipped with separate admission and exhaust valves. The complications required in the valve motion, to secure variable cutoff and compression and reversing, have prevented such locomotives from ever coming into extensive use. By adapting the Stumpf system to locomotives, however, it would seem to be possible to make a valve motion which would not

be much more complicated than the valve motion now in use for driving piston and slide valves. The high compression, which is one feature of the Stumpf system, has its advantages for high-speed locomotive service, and if it is possible to keep the weight of the long piston down within reasonable limits, the new system may open a practicable means for effecting a material increase in locomotive fuel economy.

Publicity Work by Engineering Societies

An interesting letter appears in the correspondence columns of this issue regarding the results of the systematic efforts of the Cleveland Engineering Society to gain publicity for things of an engineering nature through the medium of the daily newspaper. Similar work is done by the Brooklyn Engineers' Club and probably by other local engineering societies. There is an opportunity for much good to be done the engineering profession by thus gaining a more appreciative consideration of the problems and achievements of engineers, and by giving engineers a larger share in the discussion of civic affairs.

If well done coöperation between the newspapers and the local engineering society will tend to increase the usefulness of both; but there is danger in indiscriminate enthusiasm for publicity at any cost, which an organization that wishes to maintain its standing as a *scientific* and *professional* society would do well to curb. Publicity, so called, may imperceptibly degenerate into mere notoriety. A good example of it is the kind of publicity that has been gained through magnificent schemes for changing the climate of the Northern Hemisphere and preventing floods in the Mississippi Valley.

Mere popularizing of engineering may not prove an unqualified blessing. Many able physicians and lawyers very decidedly disapprove of popularizing their professions; for there are people to whom a little knowledge is a dangerous possession. Reading articles in newspapers about home-made medicines and cure-alls seldom makes an average man competent as his own family doctor; and popular articles on law and legal advice never yet fitted a man to be his own lawyer. Since the theory and practice of engineering and the language of engineering are not less technical than are those of law and medicine, it may seriously be questioned how far the work of popularizing engineering ought to be carried. May not attempts to state complex engineering facts in terms of glittering generalities to attract the public eye ultimately react on the dignity of the engineering profession on which so much stress has been laid?

Particular emphasis should, therefore, be placed on the statement in Mr. Drayer's letter that articles are prepared by Publicity Committee of the Cleveland Engineering Society for the newspapers and are written in a *dignified manner*—more than that there should be no sacrifice of accuracy. The Cleveland society is to be congratulated that the articles inclosed with Mr. Drayer's letter are so prepared, and yet so written as to interest the public. If such articles are not prepared by members of an engineering society they should at least be passed upon by a committee before they are published, or many chance remarks may be picked up and featured in the headlines of a sensational newspaper, which will not reflect any credit on the society from thinking men.

Moreover, publicity, like spirituous liquors, is intoxicating. Many a professional man has found out to his chagrin that self-sought publicity may ultimately prove anything but desirable. The same may prove equally true of an engineering society. The members should not lose sight of the fact that they are and wish to be considered professional men, and that there is a gap between them and the general public which must be maintained if they wish to finally achieve the prestige which all this publicity work is intended to give. It may be much more necessary for the public to have a proper respect for the learnedness and the dignity of the engineering profession than that engineers should immediately come to their own in the share of glory to be distributed.

A Needed Reform in the Conduct of Engineering Competitions

In ENGINEERING NEWS of Jan. 30, 1913, and in each of the succeeding three issues, as well as in some other engineering and daily newspapers, there appeared the following advertisement:

Bridge and Viaduct Approaches

Richmond, Va., January 27th, 1913.

Competitive plans, specifications and approximate cost for the erection of a reinforced-concrete bridge and viaduct approaches on the site of the present Free Bridge over James River, from 9th and Byrd Streets to 7th and Semmes Streets will be received by the Administrative Board until April 15th, 1913, at 12:00 o'clock Noon.

For the first or accepted design a premium of $1,500.00 is offered.

For the second best design a premium of $500.00 is offered.

Information of location and profile and present grades of streets will be furnished by the City Engineer.

The Administrative Board reserves the right to reject any and all plans submitted.

ROBERT WHITTET, JR.,
Chairman, Administrative Board.

To such engineers as were sufficiently attracted by this notice to ask for further information there was sent a blueprint showing the location, plan and profiles of the proposed bridge and the following program of the competition:

OFFICE OF CITY ENGINEER.
Richmond, Va., March 4, 1913.

REQUIREMENTS OF THE ADMINISTRATIVE BOARD GOVERNING THOSE FILING DESIGNS AND PLANS FOR THE ERECTION OF A REINFORCED-CONCRETE BRIDGE OVER JAMES RIVER ON THE PRESENT FREE BRIDGE SITE AND ALSO REINFORCED-CONCRETE APPROACHES.

1. Plans, designs and specifications; also detail drawings sufficient to clearly explain and define the designs, and an approximate estimate of the cost of the structures must be submitted to the Administrative Board not later than April 15th, 1913. All designs submitted must be in black and white.

2. The bridge and approaches to be designed for reinforced concrete of such construction as to provide and care for safely the heaviest traffic loads for municipal service and for street cars at an estimated weight of 60 tons each. The bridge and viaduct to be not less than sixty (60) feet wide and the roadway to be not less than forty-four (44) feet (exclusive of sidewalks and including railing.) The bridge proper is to extend from shore to shore of James River and the viaducts to the termini to be as shown on the blue print furnished by the City Engineer. The character of the material to be used for paving roadbed and sidewalks is to be shown and also the kind and style of curbing and a detail of the railing. Poles for carrying wires for a double track electric railway and to be used also for the lighting of the bridge must also be shown and described. Space provision in the roadway or sidewalk must be shown for the installation of a

12 in. bell and spigot water main; a 20 in. bell and spigot gas main, and for a 4.5 sq.ft. area space for conduit ducts on each side of the bridge for high and low power wires. Provision must also be made for the lamps for lighting the bridge.

3. The bridge must be of such design as to vent readily the river flow of the highest recorded freshets. The plan showing the location and the profile showing approximately the surface of the rock bottom of James River; the present grades of the old bridge and streets; and a few sections showing the existing grades of said streets and the highest freshet water will be furnished by the City Engineer. All persons desiring to submit a design will be furnished with these conditions and blue prints, but are requested to return same to the City Engineer if they decide not to submit a design.

The awards to be paid for the accepted designs will be $1,500 for the first and $500 for the second best design.

The Administrative Board reserves the right to reject any and all designs or plans which may be submitted.

CHAS. E. BOLLING,
City Engineer.

As a result of the advertisement, 27 different designs were submitted to the Administrative Board of the City of Richmond by as many engineers or firms of engineers from all parts of the country, their headquarters running from Kansas City and Chicago in the West to Boston and New York in the East, and Nashville in the South, with a fair number of local competitors. In this list there were names of some of the best known concrete bridge designers in the United States, as well as many as yet unknown to fame or fortune. The plans submitted varied in quantity and nature from a full set of working drawings, accompanied by expensive architectural renderings of the proposed structure, to simple blueprints outlining only the salient features of the design.

The above notices were the only official ones which were publicly given to interested parties. Certain of the competitors, however, had learned (by personal inquiry and not from any general announcement) that the Board would consent to hear the plea of any competitor who might choose to present orally the virtues of his design. Such engineers to the number of nearly a dozen appeared before the Board and its advisor, a member of a local architectural and engineering firm, and for three days the Board heard their representations, apparently allowing each one as long a time as he considered necessary. After this rather laborious proceeding, the interest of the Board in the bridge matter was temporarily exhausted and no further consideration was given the matter for some time. On May 9 a representative of ENGINEERING NEWS was shown a great number of the designs submitted still safely reposing inside of the mail coverings in which they were sent. At that time it was stated by those in authority that the Board would probably finish up the inspection in two or three weeks, but no assurance was given of that fact. At any rate, at the time of this writing (May 27) the award has not been made.

Such in brief is the outline of one of the most flagrant examples of how not to conduct an engineering competition that has come to our notice. Because the injustice done by the Richmond authorities to the competing engineers is no less an injustice to the engineering profession in general, it seems to us that a full account of the case should be brought to the attention of the profession with a view to bringing about some reform in this matter of engineering competitions.

Most engineers believe that no useful purpose is served by holding competitions for engineering design. They believe that the multifold details that make up a completed structure cannot be explicitly set forth in any preliminary design, nor its suitability or superiority predicated from the engineer's first drawings. Notwithstanding this attitude by the profession at large, the fact remains that competitions for designs of engineering structures are occasionally held by authorities, generally by political bodies honestly seeking for the best design, to whom the professional objection seems selfish in the extreme.

Quite ignorant as to how to find engineers competent to prepare the plans for the structure desired, they assume that the city or county or state has a perfect right to endeavor to enlist the best available talent in a competition. Since such competitions are, therefore, unavoidable in certain cases, it should be the duty of the representative bodies of the profession to formulate a code of rules which could govern such competitions and to which members of the profession in good standing would conform.

Some time ago this was realized by those working in the architectural field and the American Institute of Architects formulated its well known code for the conduct of competitions. This code has been generally followed in large architectural competitions and has proved satisfactory. Whether its provisions would be suitable for engineering competition would require investigation, but the code could be profitably read by any committee of an engineering society which contemplates the drawing up of a similar code for engineers.

Any competition to select the proper design for an engineering structure should have certain strict fundamentals. Most of these fundamentals are absent in the Richmond competition. In the first place there should be a complete definition of the requirements of both the competition and the design, so that the competitors may start on a fair and even basis and so, also, that they may more readily meet the minds of the body holding the competition as to the structure desired. The program in the case of a bridge competition, for instance, should give full details as to how the competition is to be carried on. It should precisely stipulate the kind and extent of the drawings, should prescribe the date of the opening of the drawings and the latest date for the decision, should state whether the competitors are to be allowed to appear before the examining board and preferably should state whether or not the designer selected for first prize is to be given charge of the construction of the bridge either as supervising or as consulting engineer. It can readily be seen how few of these requirements are satisfied in the Richmond case.

The requirements of the design itself should be no less explicitly stated. First and foremost, the nature of the structure and its maximum allowable cost should be given. Any engineer knows that a bridge across a river at a given site may have a very wide range of cost. A competition which does not specify the nature and cost of the structure required will bring forth a variety of designs, one of which may meet the approval of the examining body, but it is not fair to those who do not happen to have the same mind in the matter as that body to leave those requirements as a matter of personal taste. Merely to state, as the Richmond authorities did, that a reinforced-concrete structure to carry certain loads is required is far from sufficient.

The definition of the requirements of both compe-

tition and design being satisfied, the next most important matter is that a competent examining body be provided. That body should preferably be a board of engineers who will act as a jury to report to the political body which has the matter in charge. If this is not feasible at least there should be a competent engineering advisor who will sit with that political body and whose advice in matters purely technical will be followed. Just why a body of elected officials, none of whom probably has any engineering or architectural experience, should be supposed to be able to decide which one of 27 designs is the proper one for some river crossing is beyond comprehension. In the Richmond case there was an engineer advisor, and one member of the Board who happened to be an engineer, but the deliberations of the Board being not open to public notice we have no way of knowing how far the advice of these gentlemen governed the final selection. At any rate, the engineer who acted as advisor is a young man of somewhat limited experience whose previous services would hardly qualify him as the final authority in the acceptance of a design of a bridge which is estimated to cost between $500,000 and $700,000. On account of certain local political conditions the city engineer had no connection with the competition beyond the preparation of the program given above.

Finally, any open competition for the design of an engineering structure should be conducted anonymously. As long as one competitor or a group of competitors are allowed to appear before the examining body to argue the merit of their own designs, there will always be a possibility of undue influence being used, to say nothing of the unfairness to other competitors who cannot or do not appear before that body. In the Richmond case there is no suspicion whatever thrown upon the integrity of the members of the Board or of any of the engineers who presented themselves to defend their design. There are occasions, however, when ignorance can do more harm than an evil intent.

These severe criticisms of the method of conducting the Richmond competition are made with full appreciation of the position of the Richmond Administrative Board. It deserves to be said in its behalf that there is no particular reason why that Board should not have done as it did inasmuch as there is no recognized professional method of carrying on such a competition.

It may be added also that the political conditions in Richmond are such that the Administrative Board is somewhat reluctant to proceed with the construction or even with the award of the prizes for the design of the bridge. In fact, it seems hardly likely, at present, that the bridge will be constructed for some time, which, incidentally, should have been noted in the invitation to competitors.

Notwithstanding the conditions of the competition, nearly thirty engineers submitted drawings and about a dozen of them spent the time and money to go to Richmond and explain their designs. The two engineers who receive the first and the second prizes will probably just about get back what they have spent on the work. All other engineers will have spent their time and money in vain, and what is even worse, will have labored under conditions which made a fair and intelligent award very doubtful. It is safe to say that the total amount expended by engineers on competition at Richmond will amount to $20,000. Of this amount the city of Richmond pays $2000 and the remaining $18,000 represents loss by engineers, sheer economic waste. Surely such competitions of engineering designs are a disastrous burden upon the profession.

We sincerely trust that some such organization as the American Society of Civil Engineers will look into this matter and appoint a competent committee to draw up some code to govern engineering competitions that will make them less disastrous to the participants.

In the absence of such a recognized code established by the profession itself, and recognized by it as authoratative, there is nothing to hinder any city or any corporation following the example of Richmond and by the offer of a few small prizes, putting engineers under a heavy burden of expense.

LETTERS TO THE EDITOR

Algae in the Water-Works Reservoir at Quincy, Ill., and Elsewhere

Sir:—I was much interested in the article with the foregoing title published in your issue of Apr. 24, 1913.

The organisms are described as "a mossy growth"—a growth about the size of a pin's head, "nearly globular and light green in color" (this is probably Volvox)—"a thin layer of green moss from which bubbles were rising to the surface"—"small patches of floating vegetable matter."

I wonder how engineers, confronted for years with these troublesome visitors, can be satisfied with such scanty knowledge and never feel the curiosity to know about these organisms. "As we do not have the necessary equipment for making the microscopic examination, no attempt was made to identify any organisms," says the engineer. A good pocket-lens and Whipple's book in the hands of an intelligent—and willing—foreman would do much. These can be had at small cost and even the willingness can be secured. And then, there is undoubtedly in Quincy, Ill., or neighborhood, a microscope and a man; the engineer himself must not necessarily be a trained naturalist, besides his many other qualifications; but he could apply to competent quarters for information. As to the practical side of such knowledge, the quantity of copper salt is to be regulated by the nature of the organism.

Ad. Kemna,
Antwerp Water-Works Co.
6 Rue Montebello, Antwerp, Belgium,
May 1, 1913.

The Early Agitation for a National Department of Public Works

Sir—In ENGINEERING NEWS of Apr. 24, just at hand, is an account of the proceedings of the Annual Convention of the National Drainage Congress at St. Louis. You give an extract of an address by Mr. Isham Randolph, in which he advocates a Federal Department of Public Works.

It may interest your readers to know that this same proposition was not only made some years ago during President Cleveland's administration, but was personally presented to him and to Congress by a group of engineers, who then realized fully the importance of what we called "A Rational Policy of Public Works."

We were unable to carry through what was then proposed, but two of our reforms were adopted—with no recognition of our efforts, however. One was the continuing contract system which supplied work once begun with the necessary funds for their completion. This matter I personally helped to get up with Senator Blanchard, of Louisiana, and he was in full accord with the idea and it was largely through his work and that of Mr. Clifton R. Breckenridge, Member of the House, that the matter was carried through. The other subject was the dividing of the whole country into grand divisions, each in charge of a Division Engineer. This has been done by the existing authorities.

The pamphlet and the bill presented to Congress at that time will show what it was attempted to accomplish. Mr. Lyman E. Cooley was the moving spirit in this project and the editor of the literary features and if the Department of Public Works should ever be created, he should have the credit of having originated the idea and urged it in season and out of season. Like many other reforms, we were not only abreast, but ahead of the times; but "all things come to him who waits" and *works*.

E. L. CORTHELL.

Berne, Switzerland, May 7, 1913.

Publicity Work of the Cleveland Engineering Society

Sir—Early in the fall of 1912 the Cleveland Engineering Society created a Publicity Committee to do certain things enumerated in a letter by the writer, published in ENGINEERING NEWS of Sept. 5, 1912. Since the efforts of almost a year can now be summed up, the results of the committee's work may be of interest to a goodly number of engineers desiring to improve the standing of the profession and to do civic good.

The first step was to obtain from the leading daily newspapers of the city their viewpoint by submitting "stories" of what transpired in the local engineering society written in a dignified manner and so as to be understood by the general public. At once it was evident that we could expect hearty coöperation from the newspapers. They soon came to recognize the value and authority of this service and welcomed contributions.

To date there have appeared in the local newspapers 695 in. or about 33 columns of engineering matter. This includes advance notices of meetings containing a picture of the speaker and descriptive matter telling how the subject would be treated; abstracts, sometimes with pictures, of the papers presented before the society; write-ups of inspection trips by the society to industries in and around Cleveland and two articles of an inspirational nature by leading engineers for the guidance of those about to choose a profession.

To illustrate the nature of the work there was a ½-page article in the magazine sections of the Cleveland *Plain Dealer*, Apr. 13 and 20, on "The Work of the Engineer," by A. J. Himes, President of the Cleveland Engineering Society, and an article in the same newspaper on "Mechanical Engineering," by Worcester R. Warner, Past-President of the society. There was also an article which appeared on May 4, reviewing a booklet by Chief Smoke Inspector Roberts, Past-President of the society.

It is worth stating that on account of limited time a review could be written for the one newspaper only, while the booklet itself was handed the other leading newspaper. The latter did its own reviewing and gave the book some 2 in. of formal publicity, but the former published the review in full as written by this committee and followed it with an editorial in the next issue on the benefits accruing from a lessening of the smoke nuisance.

The combined circulation of the two leading newspapers, the *Plain Dealer* and the *Leader*, is Sunday editions, about 240,000, week days about 190,000 copies. From these figures some idea may be gained as to the number of people reached.

Besides the publicity in the local field the committee has done some work in a wider field. The relation between effort and result has been about the same in either field. It would seem, from our short experience in Cleveland, if other engineering societies over the country would endeavor to get in touch with the public through the medium of the newspapers, both the engineering profession and the public would be gainers.

C. E. DRAYER.

Chairman, Publicity Committee, Cleveland Engineering Society.

1801 E. 93d St., Cleveland, Ohio, May 7, 1913.

[Comment on this letter and related topics may be found in our editorial columns.—ED.]

The Flood-Prevention Problem

Sir—Referring to your editorial on page 791, issue of Apr. 17, 1913, the officers and members of the National Drainage Congress appreciate your commendation to your readers of the admirable address delivered by Col. C. McD. Townsend at the National Drainage Congress in St. Louis, Apr. 10 to 12, and venture to express the hope that you will continue to aid us in our effort to educate the people of the United States to the knowledge that river control and flood prevention are not local questions, to be solved by local effort, independently and without regard to the problems of other sections.

It is a fact, though it seems almost incredible, that some prominent men of intelligence seem to believe that by means of reservoirs and reforestation an entire solution of this problem is offered, and it is equally as incredible that others urge that construction of levees and bank revetment on the lower reaches of the Mississippi is all that is necessary.

The National Drainage Congress insists that there is no one cure-all or universal panacea for this trouble. It is a disease which requires national diagnosis and harmonious treatment of all members. The plans of the Pittsburgh Flood Commission must be accepted as the best solution for the flood question at Pittsburgh, according to our present knowledge, and the plans of the Mississippi River Commission must be similarly accepted as the best solution now known of the flood question from Cape Girardeau to the mouth of the river; but neither of these plans help the flooded areas of Ohio and Indiana, the upper reaches of the Mississippi, or the Sacramento and San Joaquin Valleys of California.

The National Drainage Congress, though heartily in sympathy with these various independent projects and having the utmost admiration and belief in the men who have made these plans and are advancing them, does not indorse any project, no matter how tremendous and important. Following the example of the Rivers and Harbors Congress, we declare for a plan and not a project, and our plan is that Congress shall create a body which shall put in effect at the earliest possible moment such plans for coöperation with the several states and such other agencies as will meet the needs of the several localities of the United States; and we believe that the most effectual and direct means of accomplishing this coöperation and construction will be the establishment of a Department of Public Works, with a Secretary in charge, who shall be a member of the President's Cabinet.

As Isham Randolph says:

> The public works of the United States suffer because they are not concentrated under one responsible head. They are like orphans laid upon the doorsteps, to be cared for as best they may by sundry benevolent departments of the Government. These public works are national and correlated, and to secure the best results they should be grouped in one department under one responsible head, who can so organize all these activities as to make one coördinated, coöperative and efficient machine out of the now scattered parts.
>
> The day for commissions is gone by. We do not need to have a diagnosis of a catastrophe here and another there, each to be treated without reference to the other. What we need is a plan big enough to compass the land and so well considered that the work most needed can be first begun, and when it is finished it will be so much accomplished in the work of a great comprehensive project; and so will each successive component section of the plan be taken up in the order of its need, until the last section is reached, and the mighty work stands complete; a monument to the brains that planned and the energy and skill and well applied labor that accomplished all. Such a work as this is not for a decade or for a life-time, but to be carried forward long after its designers have been gathered to their fathers.

It is also the declaration of the National Drainage Congress that the government alone has power to so coördinate the interests of the government, the states, the corporations and the individuals as to successfully carry out such a comprehensive plan and to proportion the expense incidental thereto.

There are many state complications, such as the St. Francis Basin between Missouri and Arkansas, the Dismal Swamp between Virginia and North Carolina, and other instances beyond number which need government supervision; and we are thoroughly in accord with Col. Townsend in stating that this expense shall not be borne by the Government, but shall be equably divided among those who profit.

On the grounds of navigation, commerce and public health, a certain proportion of these benefits may be properly borne by the United States; where railroad rights-of-ways or corporation properties are protected or benefited they should pay in proportion to these benefits; and where primarily or incidentally swamp or overflowed lands are drained and protected, these lands should pay for such reclamation and protection; and where states, counties and other taxing bodies have their revenues increased, this should also be considered.

The government itself, with proper appeal, should be the one to decide absolutely and impartially, as is done by the Reclamation Service, as to when and where these improvements should be made, and again the government, with proper appeal, should be the one to apportion the benefits and damages among those affected.

The third insistence on our part is that it is not necessary for the government to hide behind the pretense of navigation and commerce in doing this work. Article I, Section 8 of the Constitution of the United States reads: "The congress shall have power to levy and collect taxes, duties, imports and excises, to pay the debts and provide for the common defense and general welfare of the United States." We believe that this term, common defense, includes defense from the internal enemies of the forces of Nature, which cause death and disease and loss of property, as well as defense against foreign foes of human kind, which cause no other disaster than these same ones of death and disease and loss of property.

This defense may be equally as well provided by our engineers as defense against human enemies is provided by the Army or Navy. Surely "general welfare" means the protection of the lives of our citizens, the protection of their health and their property, and the adding to our national domain of so many million acres, which, now unprotected and a menace to the general welfare, could be readily and profitably converted into agricultural lands, to lower the cost of living, and provide homes for hundreds of thousands now cooped in the great cities.

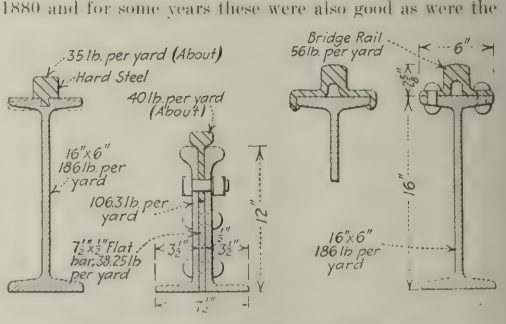
EDMUND T. PERKINS,
President, National Drainage Congress.
Chicago, Ill., May 1, 1913.

❖

Suggestions for Compound Rails from Australia

Sir—I have been for years, though in a desultory manner, thinking over the question of improved rails. This is driven home to us here in Australia in common with the rest of the world.

The best rails we ever had were 30-lb. rails laid in 1880, for about 35 miles on a branch line 200 miles north of here. Wherever I required good steel for any purpose these rails were used. We also got 41¼-lb. rails about 1880 and for some years these were also good as were the



SUGGESTIONS FOR COMPOUND RAILS

60-lb. rails bought about 1890; but since then there has been a great falling off in quality though the specification is the same, and the worst are 75-lb. rails laid two or three years ago.

Some years ago I made suggestions for compound rails, the head to be very hard and in short lengths and to be bolted or riveted to two channel irons set on edge. However, as ordinary rails were good enough for us with our light loads, I never went beyond talking to my assistants.

About six months ago, however, inspired by articles in your paper, I made several pencil sketches and gave



AN OVERSHOT WATERWHEEL ORIGINALLY BUILT IN 1650

them to Mr. N. G. Bell, our present Chief Engineer, who made drawings for me. These I now forward to you.

Both the pencil sketches and blueprints are intended more as suggestions than as actual proposals; and I merely send them as showing that people on this side of the Globe have similar ideas running through their minds to those of American engineers.

So far as I recall I never saw any drawings of compound rails till I saw the illustration of the rails for Chicago street railways in your issue of Jan. 23, 1913.

W. PAGAN.
M. Inst. C. E.

Brisbane, Queensland, Mar. 26, 1913.

[We reproduce herewith Mr. Pagan's sketches of girder rails with a separable wearing member of hard steel. As our readers who have studied this problem in detail are aware, many points must be kept in mind by the designer of a successful compound rail. Width of the head, conditions at joints, wear between the upper and lower parts, facility of bending for curves, stability against lateral stress, are a few that may be mentioned.

Perhaps the most interesting point in Mr. Pagan' letter, however, is his testimony that rail steel in Australia, purchased probably from British rail mills, is as unsatisfactory as that of which American engineers complain. With all the progress that has been made in alloy steels, heat treatment, inspection, chemical control of furnace mixtures and what not during the past 30 years, why is it that rail makers cannot produce as good quality steel rails as they did thirty years ago? Or is it a matter of will not instead of cannot?—EDITOR.]

A Really Old Overshot Waterwheel

Sir—The description of the old-time overshot waterwheel, in your issue of Mar. 20, recalls to my memory a much more venerable one. The accompanying photograph shows Gov. John Winthrop's mill, which was built by him under charter from King Charles II, in 1650. This grant was made by King Charles to endure "as long as trees grow and water runs."

The present wheel is exactly of the same design as the original wheel; but it wears out, of course, about every 20 years, and has been rebuilt many times, without change from the original design.

All the stonework is granite and the frame of the building is of hewed white oak. The wheel develops about 18 hp., is 18 ft. in diameter and about 6 ft. in width of buckets. The mill stands in a park on the outskirts of New London, Conn., and can be seen from the trolley cars which run between New London and Norwich.

I think this mill, built in 1650, is, without doubt, the oldest power station in existence on this continent. There are many references to this mill in the early records of the Connecticut Colony.

GEO. A. ORROK.

55 Duane St., New York., Apr. 17, 1913.

The Tests of the Norcross and "Mushroom" Flat Slabs

Sir—It seems to me that the tests on flat slabs by Dr. Henry T. Eddy, described in ENGINEERING NEWS, Mar. 27, 1913, p. 624, merit some comment.

The natural inference that one will make, on account of these tests being placed side by side, is that they are comparable as solutions in two ways of the same problem. It is pertinent, then, to lay the conditions of the tests side by side and compare first the conditions before the results are compared, to see if these are fair.

You mention editorially the absence of tensile reinforcement over the columns in the Norcross slab. There are other differences between this and the "mushroom" slab, and they are all unfavorable to the Norcross slab.

The Norcross slab was 16 ft. square and the columns were in a 12-ft. square. This leaves 2 ft. of an overhang in place of 2½ ft. as stated. The "mushroom" slab was 18 ft. square and the columns were in a 12-ft. square. This leaves 3 ft. of an overhang, 50% more than the other. This overhang is a very important feature. It balances load over the column and relieves bending moments between the columns.

The Norcross slab rested on steel plates laid on top of small gas-pipe posts. This is unheard-of construc-

tion. The "mushroom" slab was built integral with short heavy columns with large expanding heads, reinforced with steel. Each of these big columns would require a very considerable load to upset it, if severed from the slab. It would be difficult to balance much load on the gas-pipe arrangement without upsetting it.

Why were man-sized columns used to support this small "mushroom" slab? Why not columns merely strong enough to carry the vertical load? The column does not enter in the supposed analysis of the "mushroom" slab; it is supposed to carry only vertical load and not bending. These short, heavy columns would carry a large bending moment which has no relation to that which a high and heavily-loaded building column could carry.

Why were the first loads placed on the slab-balancing loads, that is, half on the overhang and half in the square between columns? The severe condition of loading is just as apt to be realized in a structure as any other.

EDWARD GODFREY.

Monongahela Bank Bldg., Pittsburgh, Penn.,
Apr. 3, 1913.

Sir—As you suggest in your editorial comment upon Dr. Eddy's article in the issue of Mar. 27, there is little of interest in the test of a slab such as Dr. Eddy calls the Norcross slab.

Why should the article be headed "A Comparative Test," etc., when the two slabs, viz., the Norcross and "mushroom," are not to be compared. Looking at the construction, it will be understood that the Norcross slab of nearly 12-ft. span, is not continuous, and is supported on 5½-in. columns around which the shearing stresses must be very large. The "mushroom" slab, on the other hand, has large and stiff column-heads, and 12x12-in. columns. It corresponds to a continuous beam, and the span between the points of inflection directly between the columns is probably not more than 6 ft.

The merits of the practical flat-slab system, as used in buildings, as for instance, the Akme system, the Corr-Bar system and the Cantilever Flat-Slab system are conceded, and are attained by proper attention to designing stiff column-heads, and providing proper reinforcement over the column. We know that the compressive stresses must be examined carefully, and that the maximum steel stresses are to be found over their column-heads. The merit of the Turner system does not need to be shown by knocking down a man of straw like this Norcross slab described by Dr. Eddy.

Fig. 8 in Dr. Eddy's article seems to show the maximum stresses to be over the column caps, yet Dr. Eddy's report of steel stress is for points in the center of the span where these stresses are not maximum.

What were the stresses near the column caps, both in compression and tension?

New York, Apr. 3, 1913.

X. Y. Z.

[The foregoing letters were submitted to Dr. Eddy, who has replied as follows.—ED.]

Sir—Referring to the two letters to be published in ENGINEERING NEWS, I have turned the matter over to C. A. P. Turner, and am submitting herewith a letter to be published, commenting upon these letters in preference to making any reply myself.

H. T. EDDY.

Milwaukee, Wis., Apr. 22, 1913.

Sir—Referring to the letters of Mr. Godfrey and another, criticizing the article of Dr. H. T. Eddy in "Engineering News," Mar. 27, 1913, in which he discusses a "Comparative Test of Two Flat Slabs," the present writer wishes to assume the entire responsibility for the design of the test slabs. Dr. Eddy was merely requested to discuss and elucidate the results obtained in course of the test. It will have to be acknowledged that he has done this with a completeness that leaves no doubt as to the nature of the constructions and their theoretical explanation.

The writer finds himself in complete and hearty agreement with Mr. Godfrey's impatient characterization of the Norcross test slab as an "unheard of construction" and a "man of straw." Such it is and nothing else, and the present writer would have assumed that everyone was of the same opinion also had not this Norcross patent been made the basis of a suit in equity in which the claim is made in pretended good faith that the Norcross construction with strips of hog-wire netting in the bottom of the slab for reinforcement is identical with and has the same merit as the Turner "mushroom" construction. The original specifications of the Norcross patent suggested the reinforcement to be made of hog-wire netting and the patent claims were allowed, as would appear from the file wrapper, on the ground that hog-wire netting was an improvement over rolled shapes or bars. It is of record that the claim of direct and diagonal strip reinforcement had been rejected in case of the prior Seeley patent. It was not then so absurd as it might at first appear to be to put a final quietus on the pretense that there might be some similarity between the two. The writer is pleased to know that this is so self-evident that even Mr. Godfrey thinks the effort to establish the incontestible truth of this position is trying to knock over a man of straw. He could ask no more emphatic indorsement of his contention.

Referring to the other letter, not signed, while it is true that the total stress that must be resisted by the reinforcement is undeniably greater in the "mushroom" system around the column than it is in any other part of the slab, it is also true that the intensity of the stress per unit of steel depends upon the cross-section of steel which resists that total stress. But on account of the massing of metal in the vicinity of the column the intensity of stress in the reinforcement here does not exceed that at other points. The 18-in. column used in the "Mushroom" test slab is the smallest size of concrete column we use in ordinary design.

This "Mushroom" test slab is quite similar to many bridge slabs that have been constructed with the same overhang at the edges, and with spans up to 50 ft. from center to center of columns.

C. A. P. TURNER.

Milwaukee, Wis.,
Apr. 22, 1913.

NOTES AND QUERIES

In the editorial on "Grouting Gravel in River Beds," in our issue of May 8, we intimated that the experiments described in that issue were made with a view to the possible use of this system for the foundations of the Cumberland River bridge of the Louisville & Nashville R.R., at Nashville, Tenn. We were misinformed as to this as solid limestone rock is found only 15 to 20 ft. below the surface at the bridge site, and all the piers are founded on rock, except one which is on concrete piles. The construction of this bridge was well advanced before the experiments were commenced, and they were made at that particular place merely to take advantage of the gravel bar and the existence of the contractor's equipment which could be used for the work.

A note concerning the biography of Edwin F. Wendt was inadvertently omitted from our article in the May 15 issue on "The Railway Valuation Board of the Interstate Commerce Commission." Mr. Wendt, as most of our readers will remember, was recently elected President of the American Railway Engineering Association, and a sketch of his life and work was published in our issue of Mar. 20, p. 591.

A Hydraulic Speed-Change Gear or Variable Speed Power Transmission*

The theoretical advantage of a hydraulic variable-speed power-transmission gear of the pump-and-engine type, a positive drive with infinite gradation in speed steps from a maximum in one direction to maximum reversed, has long been recognized. The number of inventors who have worked on such schemes testifies to the attractiveness of the idea, but the few completely successful devices evolved show that heavy mechanical difficulties have been encountered in perfecting design and construction.†

The gear shown in the accompanying figures has been in evolution at the hands of the present makers for some seven years. After two years' work, the first machine was sold to the government for elevating a 12-in.

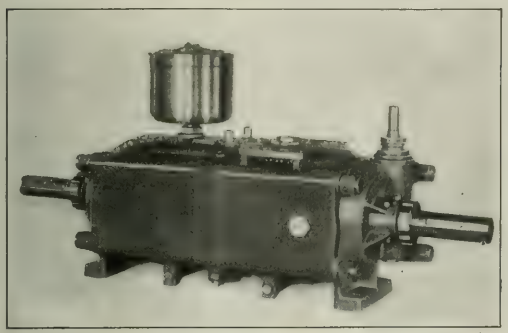


FIG. 1. THE WATERBURY HYDRAULIC SPEED-CHANGE GEAR ASSEMBLED

naval gun. This service was successful and was followed by other service until, it is claimed, somewhat more than 500 machines have been delivered for gun and turret control. The gear has been tried out also for motor cars, marine propulsion, drawbridges, cranes, hoists, machine tools, etc.

The complete transmission device is made up essentially of two parts, an oil pump designated by the makers as the "A-end" and an oil engine designated as the "B-end." The A-end may be driven by any source of power and is supposed to run at a constant speed in one direction. By a small control shaft on this end, the stroke of the pump pistons is changed to vary the delivery of oil to the engine. The B-end has a constant cylinder displacement per shaft revolution, so that speed of the driven shaft is determined by the rate at which oil is supplied to the B-end by the pump. No oil is bypassed and the leakage is very small between high and low-pressure spaces, averaging about $^{13}/_{100}\%$. There is practically no leakage from the gear as a whole, since the major part of the oil supply (that in the outer casing) is at atmospheric pressure only.

Fig. 1 gives an external view of the gear in its most compact form (called "type C" by the makers). In this type, the pump and engine mechanisms are combined into one working unit; the power enters the casing by the driving shaft which rotates at a constant speed, and comes out at the opposite end by the driven shaft, which rotates at any required speed and in either direction. The small vertical stud shown in the figure at the right (A-end) is the control shaft; the direction of rotation of the driven shaft is determined by the direction in which the control shaft is rotated from its zero position, while the speed of the driven shaft is determined by the angle through which the control shaft has been rotated. (When the pump and engine ends are further apart and connected only by piping, "type K" is the maker's designation.)

On top of the engine end is an oil expansion box communicating with the oil in the machine and vented to the air. The inclosing shell of the gear is filled with oil, although only a small portion of the oil is under pressure and active in transmitting power.

In Fig. 1 the pump and engine are directly united by a common valve plate which is located across the middle of the machine and through which the oil is circulated between the two ends. This valve plate may be made in almost any shape, permitting the placing of the two mechanisms at any angle or in any position with reference to each other. Each end may be provided with a separate valve plate and located in any desired position, the oil circulation being provided for by connecting pipes; there may be two or more engine ends remotely disposed to meet special requirements, as in motor vehicles.

In Fig. 2, the outer cases are removed, leaving the internal parts, the two shaft groups being separated a little from the valve plate, and the angle and tilting boxes being pulled away from the socket rings.

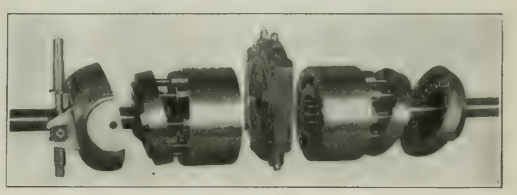


FIG. 2. VALVE PLATE, PISTON BARRELS, SOCKET RINGS, THRUST BLOCKS AND SHAFTS

THE VALVE PLATE—The valve plate stands in the middle of Fig. 2; it is also shown alone in Fig. 3. Passing through the plate about half way between its center and periphery are two semi-annular passages. These are for the circulation of the oil between the pump and engine cylinders. When the gear is transmitting power one of these passages is under positive pressure above atmospheric while the other is in suction. These two functions are changed according to the direction of rotation of the driven shaft. Connected with the passages are three pairs of valves: at the top are two small air needle valves used only for the escape of air from the passages and cylinders while being filled with oil; at the bottom are two ball-check valves used for replenishing any leakage that may take place from the high-pressure side to the low-pressure; at the bottom near the replenishing valves are two safety valves to provide relief should the gear be overloaded. There is also connected with each passage, near the top, a plugged hole for attaching gages in case it is desired to measure the oil pressure, or load carried. Near the top of the valve plate, and also in connection with all the valves, there

*From information furnished by the Waterbury Tool Co., New Britain, Conn.

†See "Engineering News," Feb. 18, 1909, and Oct. 31, 1912, for two hydraulic transmissions which seem to have been brought to a reasonable degree of practical utility.

are holes passing through the plate giving free circulation of the oil between the two ends of the gear within the inclosing cases, or shells. There are also bolt holes for securing the cases. In the center of the plate are roller bearings for the inner ends of the shafts.

Shaft Groups—The shaft groups of parts in the two ends are almost identical. A cylinder barrel is keyed to the inner end of each shaft, but slides freely along it. Each barrel has nine cylinders, parallel with the shaft and fitted with pistons provided with ball-ended connecting rods. The faces of the barrels in their revolution bear against the faces of the valve plate, and the cylinder ports in the barrel faces register with the semi-

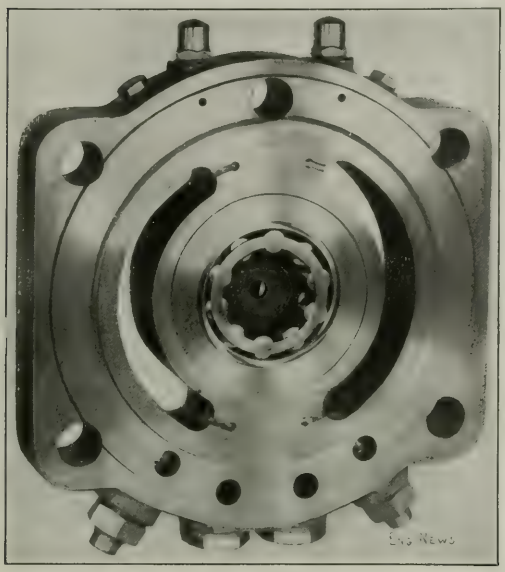


Fig. 3. Valve Plate Face of Waterbury Variable-Speed Transmission

annular passages except as they are passing over the separating lands at the top and bottom of the plate. The barrels are held lightly against the faces of the valve plate by spiral springs around the shafts, which are compressed between shoulders on the shaft and counterbored recesses in the barrels. These springs are intended only to hold the barrels in position under no load; when the gear is transmitting power, the barrels adjust themselves. By giving the port width and piston areas definite relations and by determining the proper contact surface on the valve plate, the oil-film pressure tending to separate the cylinder barrel from the valve plate and the internal pressure on the inner ends of the cylinders on each side of the ports are balanced; the oil film between the cylinder barrel and the valve plate is automatically regulated in thickness so that leakage is comparatively uniform, it being only about enough to provide general lubrication. A fiber disk between the inner ends of the two shafts divides the bearing chamber.

The piston connecting rods are formed with a ball on each end of each rod, one ball end being secured in a piston and the other in a socket in the socket ring. These rods have holes from end to end for the passage of oil under pressure for lubrication. The socket rings are connected by special universal joints with the shafts, so that while they revolve with the shafts, their planes of revolution may be at any angle to the shafts fixed by the setting of the roller-thrust bearings on which the socket rings bear in revolving. It is well known that, with the simple universal joint, there is a wide variation of angular velocity in the driven shaft with constant velocity of the driver. It is claimed that, by arranging a multiplicity of cylinders and manipulation of the spacing of the pistons, sufficient correction has been introduced for every commercial use.

The Tilting and Angle Boxes—In the engine end of the gear, the socket ring runs in what is called an angle box which is secured in the end of the case itself through which the shaft passes. It stands at a fixed angle of 20°, giving a constant reciprocation to the engine pistons. In the pump end, the box is hung on trunnions and may be adjusted to any desired angle while the gear is running by turning the threaded control shaft which carries a trunnion nut.

Bearings—The socket-ring bearings must carry a very heavy thrust load at high speed and a special alloy steel is used here. To prevent the endwise crowding of the rollers and consequent wearing of the outer ends of the rollers and retaining flanges, particularly at the main thrust bearings in the angle and tilting boxes, the conical rollers and corresponding track surfaces come to an apex some distance short of the axis of the shaft.

There is no side pressure transmitted by the connecting rods, the pistons, or the cylinder barrels, which remain practically parallel.

Operation—The pump shaft, which is connected to the source of power, is supposed to run at a constant speed and in one direction. If the tilting box stands in its neutral position, at right angles to the shaft, the pistons are carried around with the cylinder barrel but do not reciprocate. No oil is, therefore, taken from or delivered to the passages in the valve plate. If, however, the tilting box is inclined by turning the control shaft a little, the pistons reciprocate approximately to the extent of the sine of the angle of tilting multiplied by the diameter of the circle of centers of the sockets in the socket ring. Every cylinder during one-half of the shaft rotation is in communication with one of the passages in the valve plate and is then receiving oil, which it carries across the land and delivers into the other passage during the other half of the shaft rotation. The amount of oil transferred from one passage across to the other passage depends entirely upon the displacement of the pistons. The oil supply comes from half of the cylinders of the engine end. When oil is being forced into one of the passages (already full) the pistons in those engine cylinders in communication with this passage slide back from the valve plate; forcing back their respective sockets and turning the socket ring as a whole in its inclined plane in the angle box. The engine socket ring is always inclined 20° in its angle box so that the pistons always reciprocate to their full extent at every revolution of the driven shaft. While the pistons connected to the pressure passage of the valve plate are receding to make room before the incoming oil, the pistons facing the low-pressure passage are forced toward the valve plate delivering oil from their cylinders through the

PERFORMANCE DATA, DIMENSIONS, ETC., OF WATERBURY HYDRAULIC VARIABLE-SPEED POWER-TRANSMISSION GEARS

Size	5	10	20	35	150
Continuous Service					
Horsepower	12	20	30	50	150
R.p.m.	675	550	450	400	275
Intermittent Service					
Horsepower	15	25	45	70	200
R.p.m.	675	550	450	400	275
Inches length "Type C"	21	30	37	45	74
Lb. weight "Type C"	180	355	700	1230	5240
Lb. weight "Type K"	225	445	890	1500	6600

low-pressure passage into the suction cylinders of the pump barrel. Since the receiving capacity of the engine cylinders is constant and the delivery capacity of the pump cylinders is varied at will by turning the control shaft, the speed of the driven shaft is correspondingly varied. It will be seen that the only oil actively employed in transmitting power is that in the oil passages of the valve plate and in the cylinders. The inclosing outside cases merely serve as a retaining reservoir and are not subject to any pressure.

The oil pressure in the cylinders and valve-plate passages varies directly as the torque resistance which the driven shaft must overcome; the power output varies directly as the product of the oil pressure and the speed of rotation. The normal working oil pressure ranges usually between 300 and 500 lb. per sq.in., but it may rise to 1000 or even 2000 lb. to overcome an unusual resistance. In tests pressures as high as 4000 lb. per sq.in. have been attained.

EFFICIENCY—The great flexibility of such a device necessarily gives wide differences of efficiency. Under the best service conditions efficiencies are claimed ranging from 85% to 91%; under average working conditions these figures are reported to vary between 80% and 85%, while under small loads and low speeds of the driven shaft the efficiencies may drop to 50% or less. At a zero speed, the power efficiency must be zero, but the torque efficiency remains at 95%; torque efficiencies throughout the whole range remain between 90% and 96%.

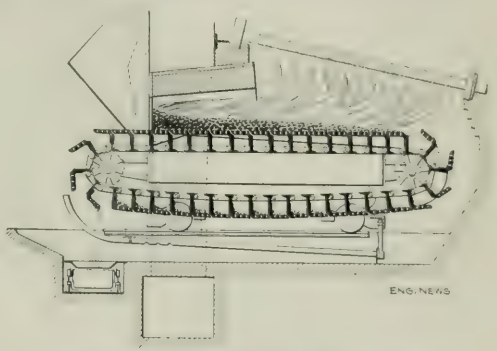
The horsepowers and speeds are as shown in the accompanying table. For regular continuous service the figures are all for pressures of 400 lb. per sq.in. and water cooling should be specified for this service. The figures for intermittent service are for 500 lb. per sq.in.; to meet excessive temporary loads the oil pressures may go to as high as 2000 lb. with proportional torques. Thus, a size-35 unit transmitting 70 hp. at full speed exerts a torque of 918 ft.-lb. with an oil pressure of 500 lb.; but even with the ordinary setting of the relief valves, a load can be started and accelerated with a torque of 1838 ft.-lb. and an oil pressure of 1000 lb. per sq.in. By setting the relief valve tight and running the oil pressure to 2000 lb. a torque of 3675 ft.-lb. can be exerted. For water cooling coils of small copper pipe are led through the outer casing and around the cylinder barrels as close as convenient.

The size numbers given are torque ratings at 100 lb. oil pressure and 63 in. radius, so that the torque exerted by any machine under assumed oil pressure is easily figured.

The design in the present form is the work of H. D. Williams and Reynold Janney, of New York City. Manufacture is in the hands of the Waterbury Tool Co., of Waterbury and New Britain, Conn.

A Chain-Grate Stoker Which Returns Its Ashes

At the new power station of the combined municipal system of Burslem, Fenton, Hanley, Longton, Stoke and Tunstall, in the Staffordshire pottery area of England, water-tube boilers have been equipped with a chain grate of new type, recently developed. This is shown in sectional elevation in the accompanying figure from London *Electrician*, Apr. 11, 1913. The device consists essentially of an endless chain of L-shape grate bars mounted (inverted) on chains, the links of which run over sprocket wheels driven from a countershaft. The tops of the grate bars, of course, are perforated and slotted for the passage of air through the fuel. This air supply enters from two rectangular conduits, one at each side of the stoker near the front end, opening into side-wall recesses of graduated height. This allows automatic variation of the quantity of air to the different parts of the fire; the back receiving the smallest quantity where the fire is thinnest. Conduits also supply air



A CHAIN-GRATE STOKER AND ASH CONVEYOR

to the front and back of the furnace through suitable control dampers. For the three boilers in this plant (each with a steaming capacity of 18,900 lb. per hr.) two fans are employed, each delivering 118 cu.ft. of air per minute.

As shown in the accompanying figure, the shape of the bars is such that when the chain passes over the rear sprocket the ashes left on top of one bar drop to the inside angle of the next forward bar, to be carried along and dumped out of that place when the bars are again separated at the front sprocket. In this way continuous removal of ashes is secured. These grates were made by the Underfeed Stoker Co., Coventry House, South Place, London, E. C., England.

Legislation on Automobiles and other Motor Vehicles in New Jersey, passed by the legislature of 1913, included a joint resolution for the appointment of commissioners to confer with other states on uniform automobile regulation; an increase in the number of automobile inspectors from 10 to 16 with a salary of $1350 each; permitting the state motor commissioner to issue a formula on Dec. 1 of each year for the computation of horsepower of automobiles; and giving to the state road commissioner and to county and municipal officials the power to control the moving of heavy road engines and other vehicles over thoroughfares and bridges with authority to give permits for such movement specifying conditions under which the movement may be made.

A Hollow Steel Slab Floor

In deciding on the floor construction to be used in a fireproof building, light weight and speed of erection are often vital factors. Both advantages are possessed in a marked degree by a material which has been on the market for five or six years, but is not well known and correspondingly has had rather limited use. It is a closely folded steel sheet, and may be regarded as a specialized form of trough flooring. It constitutes a hollow steel slab 2 in. thick weighing only 4½ to 5 lb. per sq.ft., yet capable of carrying ordinary and even heavy warehouse floor loadings on spans of 4 to 6 ft. The flooring is called "Cellular Metal" and is now made by the Edwards Manufacturing Co., Cincinnati, Ohio.

The view, Fig. 1, illustrates the method in which this "Cellular Metal" is applied. The job shown by the view was done two years ago and is chosen for illustration in preference to a more recent job because it illustrates work rather more difficult than a floor in an ordinary building. The auditorium floor shown is both sloping and dished. In this theater building both the auditorium and the mezzanine floors and the roof were made of "Cellular Metal." The particular construction used for the floors is given by a right-hand sketch in Fig. 2, showing 1½ in. of concrete laid over the steel, and wood flooring laid on the concrete by means of nailing strips and cinder filling; and plaster applied on the bottom of the "Cellular Metal" as ceiling finish. In the case of the auditorium floor the "Cellular Metal" was laid on the beams, but for the mezzanine it was laid on shelf angles riveted to the backs of channels used as floor joists, in order to keep the depth of floor down to a minimum. The roof construction used in this same building employed the plain "Cellular Metal" (i.e., without dovetail grooves in either face) as shown on the left in Fig. 2, and composition roofing was laid directly on the top surface of the steel, without any concrete.

The auditorium has its steel floorbeams spaced five to six feet apart, supported by brick piers, and the "Cellular Metal" flooring thus has spans of 5 to 6 ft. Its capacity is given as 150 lb. live-load. The weight of the floor, with the 1½-in. thickness of concrete on top, is given us by the manufacturers as about 25 lb. per sq. ft. of floor. For the total weight of floor there must be added to this the weight of plaster on the under side and the weight of sleepers, fill and wood flooring on top. The total weight, however, remains far enough below that of other forms of floor to make a material saving in strength of frame possible.

As this steel flooring is likely to prove convenient and desirable for various cases of temporary or permanent construction, we show in the sketch (Fig. 2), herewith, cross-sections of the three forms in which it is made. They are alike except for the dovetail grooving of top and bottom faces, which is provided for giving a key for plaster below or concrete on top. The "Cellular Metal" is made in widths of about 6 in. and in lengths up to 11½ ft. Sections side by side are joined by sliding together, as illustrated in the right-hand sketch in Fig. 2. How much fastening should be provided between the metal slab and the floor beams will depend on the de-



Fig. 1. Laying Hollow Steel Flooring in Auditorium of Harris Theater, Pittsburgh, Penn.

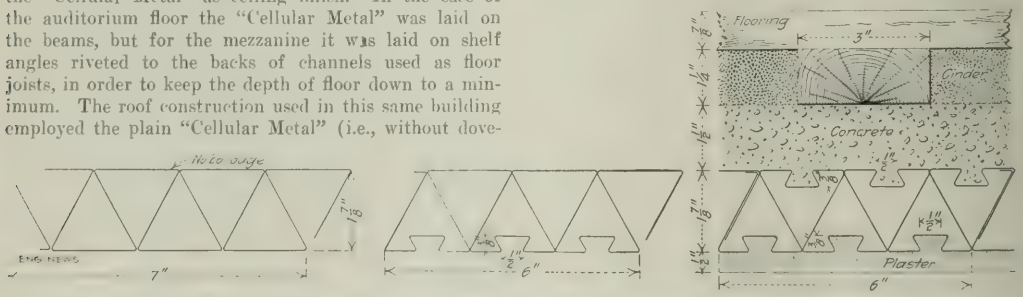


Fig. 2. Sections of Cellular Metal with and without Dovetail Grooves

(Section at right represents floor as laid in auditorium of Harris Theater, on spans 5 to 6 ft. The section without dovetails, at left, was used in the roof of the building, composition roofing being laid directly on the steel.)

signer's judgment; the manufacturers recommend fastening every third width by clips.

The material has been tested for load capacity, etc., As long ago as 1906 a floor constructed of "Cellular Metal" with 3 in. of concrete on top, the floor spanning 6 ft., was put through the regulation load-fire-and-water

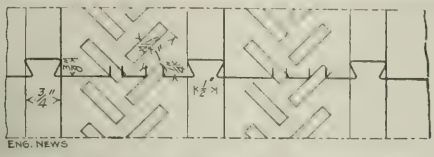


FIG. 3. "KEYRIDGE" METAL, USED IN PARTITIONS AND SUSPENDED CEILING OF HARRIS THEATER

test of the Bureau of Buildings, New York City, and passed the test, receiving approval for loadings of 150 lb. per sq.ft. on spans up to 6 ft. Tests were made two years ago by John W. Hill & Sons, consulting engineers of Cincinnati, Ohio, and as a result they recommended the table of safe loads given below.

SAFE LOADS FOR CELLULAR METAL FLOORS

Live-Load in Pounds per Square Foot, from tests by John W. Hill & Sons, Cincinnati, O.

Slab 3.06 in. thick, incl. Cellular Weight 20.63 lb. per sq.ft. Age 18 months Mix 1 : 4			Slab 4 in. thick incl. Cellular Weight 32.42 lb. per sq.ft. Age 18 months Mix 1 : 4		
Clear span, ft.	Safe load	Deflection, inch	Clear span, ft.	Safe load	Deflection, inch
3	1298	0.049	3	2333	0.039
4	728	0.087	4	1310	0.070
5	464	0.135	5	835	0.109
6	321	0.194	6	577	0.156
7	234	0.263	7	422	0.212
8	178	0.341	8	321	0.275
9	140	0.429	9	252	0.345
10	112	0.523	10	203	0.422
11	92	0.629	11	166	0.508

Note: The tests were on No. 24 gage Cellular Metal. The safe loads are one-quarter of the net breaking loads.

A companion material also used in the building shown by Fig. 1 is a special form of self-furring metal lath, or partition-framing material, made by the same manufacturers. This is sketched in Fig. 3. It is called "Keyridge." In the Harris Theater it was used for the ceiling under the roof trusses, in the reinforced-concrete balcony, and in various partitions in the building. A solid 2-in. partition of "Keyridge" plastered on both sides is said to require no studs. The ceiling metal was supported by hangers at 5-ft. spacing, without studs or furring channels.

This "Keyridge" is made in sheets 24 in. wide and in lengths up to 12 ft., of gages from 24 to 28. Used as reinforcement for concrete slabs it was tested by John W. Hill & Sons in slab thicknesses from 1⅞ to 4½ in. The 1⅞-in. slab gave a safe load (equal to one-quarter the net breaking load) of 98 lb. per sq.ft. on a 5-ft. span, and 21 lb. per sq.ft. on a 10-ft. span; the 4½-in. slab gave a safe load of 231 lb. per sq.ft. on a 5-ft. span and 49 lb. per sq.ft. on a 10-ft. span.

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The Grounding of Transformer Secondary Circuits has been ordered by the Public Utility Commission of the Province of Quebec in the cases of the Quebec Railway, Light & Power Co. and the Dorchester Electric Co. The Canadian Fire Underwriter's Association asked for this ruling, and recommended that the grounding be through the water mains of the city. The Commission, therefore, instructed the companies to approach the Quebec City Council to secure permission to comply with that recommendation.

Fatal Failure of Overloaded Wooden Floor at Long Beach, Cal.

Thirty-five persons were killed at Long Beach, near Los Angeles, Calif., by the failure of a wooden floor at noon, May 24, 1913. The floor was an approach from the upper deck of the city pier* to the second floor of the city auditorium, built some years ago. It led to the west entrance of the auditorium. A celebration was in progress, and a great crowd was about to enter the auditorium. Closed doors or some stoppage of the movement of people brought a dense crowd of people upon the approach, and the floor broke down. The crowd was dropped 13 ft. to the lower floor, and this in turn broke and dropped them five or six feet more to the sand beach (the tide was out). Injuries from the struggling people, and suffocation of those underneath, were the causes of death. Many were injured.

The following is an approximate (but not exact) statement of the structural facts. The approach was wholly of wooden construction. It had a 1-in. board floor on 2x12-in. wooden joists spaced 2 ft. apart. Two bays of these joists were carried on a transverse girder 18 ft. in span, whose section was 4x14 (two 2x14-in. sticks). The east bay of joists had a span of about 11 ft., and the west bay a span of about 14 ft., so that the girder carried a floor area of 18x12½ ft., or 225 sq.ft. The girder broke.

It is said that the ends of the girder had developed decay in the interior. The bearing of this question on the collapse will have to be determined by the official investigation. The manner in which the ends of the girder were supported is to be considered in connection therewith.

The ends of the girder were carried by 12x12-in. posts; the girder was mortised into the post 4 in. deep, so that it probably had a bearing of less than 4x4 in. at each end. There was also a kneebrace from post to girder: a stick about 3x6 in. or less, nailed to the face of the post and to the bottom face of the girder, with a reach of about 3 ft. The effect of the kneebraces in reducing the effective span of the girder is problematical, but this subject will doubtless be weighed by the investigating board.

On the face of the figures the girder was much the weakest part of the floor and was incapable of carrying a dense crowd. The full investigation of the design is likely to be important. An approximate estimate on the basis of the data noted indicates that a moderate crowd of 60 lb. per sq.ft. of floor would stress the girder to 2500-3000 lb. per sq.in., whereas working stresses range from 1000 to 1500 lb. per sq.in. This estimate is subject to correction of data from the official investigation.

The city promptly took charge of the care of the victims of the accident, and subsequently appointed an investigating board of architects and engineers. Pending full examination and report by this board accurate or complete data cannot be given.

The approach that failed was not part of the pier contract, but part of the building contract. Like the pier and the auditorium it was municipal property.

The accident is specially deplorable because most of the victims were women.

*For part of the pier history see Eng. News, 1910, II, 67, 185.

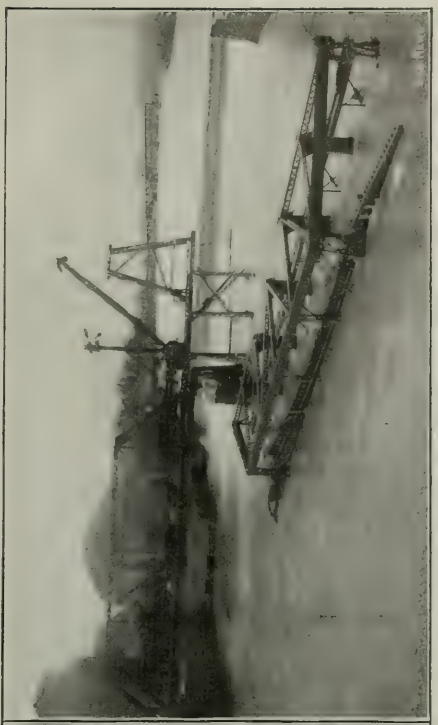


FIG. 3. TRESTLE BUILDING FOR RESTORING THE B. & O. CROSSING



FIG. 2. WRECKAGE OF EAST SPAN OF B. & O. BRIDGE AT ZANESVILLE, LYING UNDER ARCH OF Y-BRIDGE (Water is still high; but note dam and compare with Fig. 1.)

Rebuilding the Zanesville Bridge, Baltimore & Ohio R.R.*

Three railroad bridges went down in the flood at Zanesville. Some trains of all three roads have been running over the wooden structure which the Baltimore & Ohio built in less than eight days. The task looked impossible. The structure had to be placed in a swirling current, under the very edge of a fall, where soundings could not be made, where piles could not be driven. The river bottom was an unknown quantity.

On Sunday, Mar. 30, a little company, including Paul Didier (Prin. Asst. Engr.), G. A. Schmoll (Supt. M. P.) and G. F. Cunningham (Res. Engr.), arrived at CD tower, over two miles out of Zanesville. The tracks were impassable and they tramped into town by a five-mile route over the hills. The town was patrolled by soldiers, which made it hard at times for the railroad men to get around. They could scarcely get their reports to the telegraph office.

The water at the fall had risen during the flood to a height of 38 ft., or 16 ft. above the record of 1898. [See view Fig. 1. taken when the water had fallen somewhat below maximum stage. The surviving span of the B. & O. bridge shows at the extreme left, 80% submerged. In front of it is a ripple where water flows over the Y-bridge. The old bridge had withstood the pressure surprisingly well. In the drift that bore against the sides were three or four cars, parts of many houses and a great mass of undistinguishable wreckage. When the first span went down it was jammed through the low arch of the Y-bridge below. [See Fig. 2.] Two more spans followed.†

By the time Mr. Didier arrived, the water had gone down from 38 to 18.8 ft., with 12.5 ft. going over the dam at twelve to fourteen miles an hour.

"The bridge was gone when I got there," said Mr. Didier. "It looked like a funeral, and they expected me to act as undertaker."

Meanwhile D. A. Williams, the storekeeper, and W. H. Clifton, the lumber agent from Baltimore, were out on a great hunting trip for materials, and when it was time to begin the bridge the stuff was there.

Two cranes came, and W. M. Clark, Master Carpenter, organized a force of carpenters from Philadelphia, Baltimore and Pittsburgh, his own headquarters. On Friday, Apr. 4, a monkey-bent—two short beams with a piece over the top—was set upon a ledge of rock halfway down the bank, to prepare for beginning the work. By Saturday the water had fallen to 12 ft. on the gage and 6 ft. over the dam. It was decided to risk a bent in the river. On Sunday the first water-bent was placed. It dangled from the crane, dropped into the water and got its footing like a man on a pair of stilts. One end might strike a rock and the other a hole, in which case it was hauled up and sawed off till the top stood level. A rough john-boat or scow, of the width to be maintained between bents, was launched and held in place by ropes from shore. In each case the foot of the new bent was drawn against the outside of the boat and held there by ropes till it could be made fast to the structure. Stringers and bracing were fitted rapidly in place. The crew of carpenters always had timbers cut and ready before the bridgemen needed them.

As Mr. Didier said, "the water was both fierce and treacherous." Not a bent nor a tool was lost.

At the beginning the question of night work arose, but the risk was too great. The men appreciated the decision to do without it. Fourteen boxes of carbide had been furnished for light, but no torch was burned.

After the work was fairly under way a new bent was placed every two or three hours. The last of the 25 bents was set Apr. 11, five days from the beginning. Two plumb-posts were fitted into the middle of each bent. These also had to be dropped as far as they would go, marked, raised and cut the right length; then the top structure was quickly laid on. A temporary track had been used for the cranes. This was taken up and bridge ties and new rails were laid.

On Sunday, the thirteenth, Mr. Didier wired to General Superintendent U. B. Williams,

"After twelve o'clock noon, Monday, the fourteenth, you may resume traffic over bridge eleven. Maximum speed not to exceed four miles per hour until further advice."

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*Abstracted from an article by Robert J. Cole in the "Baltimore & Ohio Employees Magazine." Mr. Cole is editor of the magazine.

†Other information is to the effect that the two middle spans went out first, and the east span later. The east span is the one in Fig. 2, while Fig. 3 shows one of the middle spans lying in the river; the other lay in symmetrical position.—Ed. Engineering News.

As usual he was ahead of the schedule. Here is his own story of the last day:

"Monday morning I got out at daylight and examined every joint myself. At nine o'clock the little yard engine, 1171, ran across, making no impression. The big 2521 followed that; a slight sway could be observed on the bridge, but no variation of track. After we had run fifty-five empties and a coal train over, and I had done everything in my power to avoid accident—safety first you know—No. 14, a passenger train, went over at ten o'clock. This was two hours ahead of the time set."

Forty-four hours were consumed in doing the bent-work proper, all daylight work with only an hour and a half overtime.



FIG. 1. THE MUSKINGUM AT ZANESVILLE IN THE MARCH FLOOD

(Water had fallen a little below maximum. The ripple marks the Y-bridge. The west span of the B. & O. Ry. bridge is just beyond, nearly submerged, the east three spans already out.)



FIG. 4. THE B. & O. CROSSING RESTORED BY TRESTLE

(One of the carried-out spans at right, nearly as good as new.)

The Failure of the Sand Canon Inclined Pressure Tunnel, Los Angeles, Calif.

BY BURT A. HEINLY*

The dedication of the Los Angeles Aqueduct, which was to have been held on June 18 and 19, has been postponed to sometime early in October as a result of the failure of the Sand Cañon siphon, 150 miles north of Los Angeles. This siphon consists of 1900 ft. of pressure tunnel [in two parts] 9 ft. 2 in. in diameter, driven in hard granite on a 45° incline, connected by 890 ft. of 8½-ft. diameter $\frac{11}{16}$-in. shell steel pipe, the latter extending across the bottom of the cañon. The tunnel was lined with 12 in. of 1:2:4 concrete, poured from the top and was completed in November, 1912. It was under a maximum head of 455 ft.

The failure was due to the giving way of the pressure tunnel on the south side, 100 ft. from the top, with saturation and slippage of the whole side of the cañon wall.

The test of the inclined tunnel began on Saturday, May 24, with a flow of 17 cu.ft. per sec. This was increased to 42 sec.-ft. on Sunday, with the final breakage and the slide taking place twenty hours thereafter.

Some six weeks ago [early in April] the tunnel on the north side of the cañon was tested and showed a leakage 50 ft. beyond the end of the steel at the bottom. This was repaired by putting in 345 ft. of 66-in. diameter $\frac{3}{8}$-in. shell steel pipe and at this last test the north side incline showed tight. [We understand that this leak was in a stretch of level tunnel between the inclined tunnel and the original steel pipe.—ED.]

The entire siphon will be rebuilt with steel pipe, for which the order is placed, and should be ready for use in 90 days. The reconstruction is estimated to cost about $40,000.

Sand Cañon is the only pressure tunnel siphon on the aqueduct and was tried as an experiment in rock which was apparently admirable for the purpose. All other siphons have tested satisfactorily.

*636 South Hill St., Los Angeles, Calif.

Annual Meeting of the International Railway Fuel Association

The fifth annual convention was held at the Sherman Hotel, Chicago, on May 21 to 24, with a large attendance. The meeting extended over four days, as sessions were held only in the morning. The chair was taken by the president, H. T. Bentley, Assistant Superintendent of Motive Power, Chicago & Northwestern Ry.

At the opening meeting two addresses were made by representatives of the railways and the coal operators respectively. Mr. Quayle, Superintendent of Motive Power of the Chicago & Northwestern Ry., spoke of the necessity of economic use of fuel in order to save expense and insure efficient operation. Among other matters he instanced the advantages of superheaters on switch engines, not so much to save fuel as to save water, as the engines thus equipped can work for a greater length of time without having to interrupt their work by running to the water tank. Mr. Peabody, President of the Peabody Coal Co., discussed fuel contracts from the coal operator's point of view. He thought that in case of strikes of the miners the railway companies are influential in assisting the miners, as in order to avoid a shortage of fuel they at once demand that the operators shall furnish the maximum amount under their contracts. This results in the railway market absorbing coal which should go to outer markets at such times. In his opinion, the railways should maintain a stock supply sufficient for three or four months, thus avoiding difficulties in time of labor trouble and also using their cars for hauling coal at times when freight traffic is light. The saving in excess cost of coal purchased when high prices rule would more than compensate for the cost of plant and work for storing coal.

Mr. Peabody remarked also that at present only 60% of the coal is removed from a mine, 40% remaining in the pillars left to support the roof. He suggested that it would be cheaper to drive an entry to the extreme limit of the property and then work back, taking out the entire body of coal. In referring to this later, H. H. Stoek (Univ. of Ill.) remarked that this might be an extremely expensive method if it resulted in the surface settlement of valuable land, for which damage the coal operator would have to pay.

A paper on "Sub-Bituminous and Lignitic Coal as Locomotive Fuel," read by S. B. Flagg (U. S. Bureau of Mines), discussed the properties of these coals and described some of the front-end arrangements used to prevent the discharge of sparks from locomotives using such fuels. He stated that there is no doubt the subbituminous coals will be used in increasing quantity, but that there is little probability of marked increase in the use of true lignites. J. G. Crawford (C., B & Q. R.R.) referred to the necessity of special grates and tight ash-pans when burning lignite. The ash-pans must have plenty of air holes, but must be so made that sparks cannot be blown out by the wind. His road uses brick arches in connection with this fuel, although another speaker considered them inadvisable. Mr. Crawford also presented a committee report on a form of contract for the purchase of fuel. Several criticisms of this were made in the discussion.

A paper on "The Construction, Development and Operation of a Bituminous Coal Mine," by J. A. Garcia (Chicago), reviewed the methods of mining, the construction of shafts and tipples, and the screening and handling of coal for shipment. Steel tipples and several forms of wood and concrete lining for shafts were illustrated by drawings. A report on "Firing Practice" led to a protracted discusssion, the members realizing that the firemen (even when mechanical stokers are used) is a most important factor in the efficient and economical use of the fuel supplied. A report on "Scaling of Locomotive Boilers and Resultant Fuel Loss" consisted mainly of extracts from a government publication.

A committee report was presented on "The Modern Locomotive Coaling Station: Its Design, Construction, Operation and Maintenance." It pointed out the necessity of considering local conditions, and also such conditions as the use of mechanical stokers and large tenders. Further, it was recommended that coaling stations should be located at such distance from the terminal as the engines can traverse with one tender-load of coal. The bulk of the report consisted of a summary of a limited number of replies to a series of questions sent out in a circular letter. A subject of a rather different character from most of the papers and reports was "Self-Propelled Railway Passenger Cars." This was presented in a paper by S. F. Dodd and B. H. Arnold (General Electric Co.), which dealt mainly with cars of the gas-electric type. The cost of operation of several of these cars on the Frisco Lines was given as 16.61 to 17.36c. per motor train-mile. It appears, however, that gasoline cars with mechanical drive are much more numerous, but no figures of their operating cost were given.

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The Spring Meeting of the American Society of Mechanical Engineers

The American Society of Mechanical Engineers held its spring convention last week at Baltimore, Md., the first time that this Society has ever met in that city. The attendance at the meeting suffered somewhat on account of the near approach of the international meeting of the Society to be held in Leipzig, Germany, on June 21. Many of the Society members who are planning to go on the foreign tour, sailing from New York on June 10, were unable on that account to attend the Baltimore meeting. There were, however, about 300 members and guests registered at the Baltimore meeting. The chief responsibility for the entertainment of the visitors was undertaken by the Engineers' Club of Baltimore, and great pains were taken to provide the visitors with an attractive program of excursion to manufacturing plants and other objects of interest. At an informal reception in the Hotel Belvidere, on Tuesday evening, the visitors to the city were welcomed in an address by Mayor Preston, of Baltimore, to which response was made by Past-President Oberlin Smith. An interesting address was also made by Mendes Cohen, of Baltimore, who is, with two exceptions, the oldest living Past-President of the American Society of Civil Engineers. Mr. Cohen gave an interesting account of the prominence Baltimore took in the early days of the railway era in the development of transportation routes to the West. He referred also to the great work which the city has undertaken in the construction of a modern sewerage and sewage disposal system and the reconstruction of its pavements.

Code of Ethics—A professional session of the Society opened on Wednesday morning with a short business section. A report was presented at this session by the committee appointed to draft a code of ethics for adoption by the Society. The code which the committee drafted was presented at the December meeting in New York and was printed in the Society's *Journal* for January, 1913, and also in Engineering News of Jan. 2, 1913, p. 29. The committee had invited discussion and criticism of this proposed code and had considered the various criticisms which had been offered. As a result of these criticisms the committee submitted two proposed amendments in the code. The one of principal importance reads as follows:

> The engineer, in conformity to the practice in other professions, should not offer or execute a bond to guarantee the performance of his work. The client's reliance for the satisfactory execution of his work should be the professional reputation and experience of the engineer.

The committee further recommended that in order that the whole membership in the Society might have opportunity to express opinions as to the adoption of the proposed code instead of its being voted on merely by the members present at a meeting, that the proposed code should be printed in pamphlet form and sent out to each member of the Society accompanied by a ballot on which the member might indicate his approval or disapproval of the code, or of any clause thereof. Considerable discussion took place, generally devoted to the question as to whether a code of ethics was desirable at all. It was finally voted, however, to send out the proposed code for letter ballot by the members as recommended by the committee.

The Myriawatt—The special committee on the myriawatt as a standard of power also presented a further report which was discussed at some length. There appears to be confusion in the minds of members as to whether the new unit was to be merely ten kilowatts or whether it was to be chiefly used as a unit of heat transformed into power as in boiler practice.

Blast Furnace Gas Engines—In the preliminary program of the meeting a separate session had been arranged for the gas-power section on Wednesday morning. As the attendance of members of the gas-power section was too small to make advisable the holding of a separate meeting, the paper by Charles P. Sampson, of the Illinois Steel Works' Joliet plant, on the present operation of gas engines using blast furnace gas as fuel, was read in the main session. Mr. Sampson's paper was a useful compilation of practical experience in the running of blast furnace gas engines. Particular attention was devoted to the modern systems of removing the dust from blast furnace gas before using it in the engines. In the discussion on the paper it was shown that recent German practice has very much reduced the amount of power and of wash water required for cleaning blast-furnace gas.

Hydraulic Buffer—A paper describing a test of a hydraulic buffer was read by Carl Schwartz of the engineering staff of the New York Central R.R. In the equipment of the new Grand Central Terminal, in New York City, there have been imported from Europe some hydraulic buffers, designed to stop a train should it run into a terminal at too high speed. The piston of the hydraulic buffer described has a total travel of 11 ft. The specifications for the buffer required that it should be able to stop without damage a train weighing 1000 tons running against the buffer at a speed of 10 mi. per hr. The test described by the author indicates that the pressure set up in the hydraulic cylinder depends upon the velocity with which the train strikes the buffer and the distance that the plunger travels depends upon the weight of the train.

Mechanical Drawings—A brief paper, entitled "Shading in Mechanical Drawing," by Prof. W. Theo. Johnson, professor of mechanical drawing at the U. S. Naval Academy, reviewed the conflicting schemes for shading drawings and recommended a single rule as follows:

> Shade lines mark edges which separate fully illuminated surfaces from surfaces which are quite dark, but the light upon the object comes from a point almost perpendicular to the paper but inclined an infinitely small amount so that the projected direction of light is a 45° line as at present.

The discussion upon this paper was favorable to Prof. Johnson's rule.

Patent Law—The present condition of the patent law was reviewed in a paper by Edwin J. Prindle, of New York, with special reference to the decision in the Mimeograph case and the Bath Tub Trust case, and the threatened Congressional legislation as a result. Following Mr. Prindle's paper a resolution was passed for submission to the Council urging Congress to delay any legislation for amendment of the patent law until the whole subject had been investigated by a competent expert commission.

Automobile Trucks—A paper was presented, entitled "The Cost of Upkeep of Horse-Drawn Vehicles Against Electric Vehicles," by W. R. Metz, of Washington, D. C., superintendent of buildings of the Government Printing Office. The paper gave an array of figures as to the comparative cost of horse-drawn and electric vehicles which showed up with an enormous saving for the electric vehicles. It was pointed out in the discussion, however, that the figures given by the author charged only 2% interest on the investment in electric trucks and 10% depreciation, while the friendless horse was charged 6% interest and 20% depreciation with 15% depreciation on the horse-drawn vehicle and the harness.

High-Pressure Fire System—After the luncheon hour on Wednesday the members went to the City Hall Plaza where a special demonstration of the Baltimore high-pressure fire system had been arranged by the city authorities. Six high-pressure fire streams were sent into the air to an elevation variously estimated at 150 to 200 ft., deluging the pavements and the plaza with torrents of water and sending drenching showers of spray down on the heads of the crowd which witnessed the demonstration with every variation in the wind and in the direction of the nozzles. The high-pressure pumping station was next visited. There are now in service in the station three pumping engines with 4000 gal. per min. rated capacity at a piston speed of 300 ft. per min. The engines are of the crank and flywheel type with corliss valve gear. There was some criticism of the design which requires a boiler plant to be kept under steam day and night the year round for a service of only a few hours per year. It was explained, however, that to adopt electricity for driving the station as in the high-pressure pumps in New York City was deemed unreliable because Baltimore receives the bulk of its electric power from the McCall Ferry power plant on the Susquehanna River

40 miles away. Chances for breakdown on this service or on the auxiliary service of the power stations of the lighting and railway companies was felt to be such as to make the installation of steam advisable. From the pumping station the visitors were taken to a steamer and the remainder of the afternoon was spent in a tour of the harbor, inspecting the principal railway and shipping terminals along the water front. On Wednesday evening, Hon. O. P. Austin, Secretary of the National Geographic Society, entertained the members with an interesting lecture entitled "Around the World in Eighty Minutes," an apt illustration of the progress which has been made since Jules Verne's story.

FIRE PROTECTION—The second and concluding professional session of the Society was held on Thursday morning and was devoted to the subject of fire protection, which was felt to be particularly appropriate in view of Baltimore's unfortunate experience of nine years ago. A paper by James D. Scott, of Baltimore, gave a general description of the high-pressure system, which has many points of novelty and interest. F. M. Griswold, of New York City, reviewed the history of the long endeavor to secure a standard hose coupling and hydrant fitting so that the fire department of one city may aid another in case of necessity. For thirty years agitation for the adoption of a standard was practically fruitless. Recently, however, the efforts of the National Fire Protection Association have caused progress to be made so that there are now 73 cities or towns in which the new national standard has been put into service. There is hope, therefore, that the progress of change to the standard from this time on may be rapid.

Albert Blauvelt, of Chicago, discussed the problem of how conflagrations could be prevented from spreading. Mr. Blauvelt pointed out that the hot blast in front of a conflagration when once started prevents any fireman working in front of it. He discussed two plans for the stoppage of conflagrations; (1) their deflection by walls of buildings constructed of fireproof materials with wire glass windows, and (2) the absorption of the conflagration heat by buildings fully sprinkled. The paper gave some interesting data as to the values in congested districts of the principal cities, the cost of complete fire protection against conflagration and the gain which would be made by it.

Prof. Ira H. Woolson, of New York, under the title "Allowable Heights and Areas for Factory Buildings" reported the results of a circular letter of inquiry sent out to all the fire marshals and fire chiefs in the United States in cities of over 20,000 population. A digested summary of all the replies received indicated that for a brick and timber construction a building should not exceed three stories in height with an area of 6000 sq.ft. between firewalls in order that a fire department may cope with it. For such a building if sprinklered or if a fireproof construction and not sprinklered, the height may be increased to five stories and the area between firewalls to from 10,000 to 13,000 sq.ft. A building of fireproof construction fully sprinklered may be seven stories in height as a maximum, with 20,000 sq. ft. of area between firewalls. The chief lesson from Mr. Woolson's paper is that no matter what standards of construction or of fire protection are adopted there is a limit to the height and to the unbroken area to which buildings in cities should be allowed to be erected.

A brief paper by C. H. Smith described how main-belt drives in factories may be prevented from spreading fire from one floor to another by surrounding them with fire retarding partitions made of expanded metal plastered with cement mortar. Under the Associated Factory Mutual Fire Insurance Co., of Boston, with which Mr. Smith is connected, much of this work has been done with great additions to the safety of the factories.

The concluding paper on fire protection, by H. F. J. Porter, of New York, discussed the life hazard in crowded buildings due to inadequate exits. This attracted perhaps, the most interest of any paper of the session. Mr. Porter reviewed, in a graphic way, the great danger to the lives of employees and others in the crowded loft buildings and in the department stores and other structures where great areas are open to aid the spread of conflagration. Mr. Porter urged that in all such buildings at least one fire wall should extend from the basement to the roof, dividing the building into two separate parts. Safety openings through this wall provided with fireproof doors allow the employees from any floor to escape through them to the other side of the fireproof partition immediately a fire starts. This recommendation of Mr. Porter's paper was highly commended in the discussion.

JONES' FALLS COVERING—On Thursday afternoon the visitors were taken on a tour of inspection of the great concrete work which is being done in Baltimore in the covering of the stream which flows through the city known as Jones' Falls, a full description of which is shortly to appear in ENGINEERING NEWS. This trip ended at the pumping station, by which a large part of the city's sewage is forced through a long main to the sewage disposal plant at Back River. Trolley cars from the pumping station conveyed the visitors to the disposal plant. On Thursday evening a reception and dance was given in honor of the Society by the Engineers' Club of Baltimore. The concluding feature of the convention was an all-day excursion on Friday to Annapolis, the capital city of Maryland, and in colonial days a center of wealth, commerce and culture. The visitors met in the fine assembly chamber of the new State Capitol Building, where they were welcomed in an address by Governor Goldsborough of Maryland. Following the Governor's address, Admiral Hutchinson I. Cone, late Engineer-in-Chief of the Bureau of Steam Engineering, U. S. N., delivered an address describing the work of the U. S. Experimental Station at Annapolis. After luncheon at the ancient Carvel House the afternoon was spent in visiting the many points of interest in Annapolis and at the U. S. Naval Academy, visiting the naval vessels in the harbor and witnessing the flight in hydro-aeroplanes by officers and men of the aviation school. Several members of the Society, including its honored president, were treated to rides in an aeroplane and expressed their great delight with the novel experience.

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A Test Load for a Concrete Arch bridge is recently made in England by damming the ends of the roadway and pumping water into the area enclosed. "The Engineer," of London, gives the following account of the test:

A reinforced-concrete bridge comprising an arch of 57-ft. span and decking finished with solid parapets was recently tested under the load of 250 lb. per sq.ft., by building a clay wall at each end and filling the tank so formed with water supplied through a 2½-in. hose pipe. Water can be very easily applied and removed in tests of the kind, and in many cases could be pumped from the river crossed by the bridge to be tested.

A Landslide Wrecked a Train on the Sewell branch of the Chesapeake & Ohio R.R., near Hinton, W. Va., May 20. The train was composed of an engine, three freight cars and a caboose, in which a number of passengers were riding. The train was stalled by a previous slide due to a recent cloudburst, and while the train crew were engaged in clearing the track a second slide occurred which swept the entire train 300 ft. down the mountain side. Six persons were killed and several injured.

The U. S. Torpedo-Boat "Vesuvius" was Struck by Its Own Torpedo while engaged in maneuvers near Newport, R. I., on May 19. Something is reported to have gone wrong with the mechanism of a practice Whitehead torpedo, which caused the projectile to circle around and strike the ship in the stern. A 6-in. hole was knocked through the hull below the water line, but it was sufficiently patched to allow the ship to reach Newport under its own steam. The "Vesuvius" was formerly the famous dynamite cruiser which fired a dynamite-charged bomb by compressed air.

A Derailment on the South Side Elevated Ry., of Chicago, occurred May 24. A southbound train was passing the reverse-curve piece of track in Harrison St., by which the line makes two right-angle turns in getting from Wabash Ave. to the alley west of the avenue, when the front truck of the rear car left the rails. The body of the car projected partly over the structure, but the passengers were able to walk through to the next car. The train was stopped within a very short distance, and little damage was done, but South Side trains could not enter or leave the terminal loops for about half an hour.

The Blowing Out of a Breech Block on a 3-in. gun at Fort Moultrie, Charleston, S. C., caused the death of Capt. B. G. Hanna, U. S. A., and two enlisted men on May 22. The accident occurred about 10 o'clock at night, during night target practice. The type of gun used is known as a field mine gun and is designed to guard a portion of the mine field of the harbor from an enemy's small boats. The accident occurred with a charge of smokeless powder in a metallic container, and is said to have some of the characteristics of a flare-back, although exact nature of the breech failure has not been determined. Similar accidents occurred at Fortress Monroe on July 11, 1910, where the cause of the accident was found to be due to firing the gun before the breech mechanism had been locked, and at Indian Head, Md., Nov. 19, 1910, where the gun was prematurely fired due to the firing pin projecting in such a way that it was struck in closing the breech lock.

The New York City Filter Contract Hold-up, to which much space was devoted in our issue of May 22, was made permanent on the same day after the member of the Board of Estimate and Apportionment having the controlling vote announced that he had become convinced that filtration was unnecessary. This member (John P. Mitchell, president of the Board of Alderman), proposed that a new commission of engineers be appointed to consider other means than filtration for the improvement of the Croton water-supply, and suggested the following men for that purpose: Major Cassius E. Gillette, of Philadelphia; Allen Hazen, J. Waldo Smith and George W. Fuller, of New York City; and Harrison P. Eddy, of Boston. This proposition was not adopted. Mayor Gaynor then requested the Commissioner of Water Supply to withdraw his request for the approval of the filter contract award to the lowest bidder (the Keystone State Construction Co.). This having been done, Comptroller Prendergast introduced a resolution rescinding the authorization of bonds for the filtration project and other related work. The resolution was adopted by a unanimous vote.

PERSONALS

Mr. F. H. Hutchison, Electrical Engineer of the Chicago, Rock Island & Pacific Ry., at Chicago, Ill., has resigned.

Mr. Karl J. Barr has been appointed Acting County Surveyor of Edgar County, Ill., succeeding Mr. Carl W. Buckler.

Mr. Robert D. Hennen, of the Monongahela Valley Engineering Co., Morgantown, W. Va., has been appointed City Engineer of Morgantown.

Dr. Edward Thomson Fairchild, former State Superintendent of Schools of Kansas, was inaugurated President of the New Hampshire College of Agriculture and Mechanic Arts on May 21.

Mr. G. C. Cummin has resigned as City Engineer of Dayton, Ohio, to devote his whole time to flood prevention work. Mr. C. H. Kline, Engineer of the water department, has been appointed Acting City Engineer.

Mr. B. J. Denman, Assoc. Am. Inst. E. E., formerly Chief Engineer of the Electric Illuminating Co., of Detroit, Mich., has been appointed Assistant General Manager of the United Light & Railways Co., of Grand Rapids, Mich.

Mr. C. W. Sturtevant, M. Am. Soc. C. E., formerly Superintendent for James Stewart & Co., Baldwinsville, N. Y., is now General Superintendent for the New York State Dredging Corporation, 853 Powers Bldg., Rochester, N. Y.

Mr. J. R. Edwards has been appointed General Inspector of motor cars, reporting to the Engineer of Maintenance-of-way of the Lehigh Valley R.R. He will have general supervision of the maintenance and care of all motor cars.

Mr. M. H. Cahill, recently Superintendent of the Delaware, Lackawanna & Western R.R., at Buffalo, N. Y., has returned to the Baltimore & Ohio R.R. as Assistant Superintendent at Keyser, W. Va., succeeding Mr. J. M. Scott, promoted.

Mr. Burton Lowther, Assoc. M. Am. Soc. C. E., Constructing Engineer of the Water-Works Department, Kansas City, Mo., has been appointed Chief Engineer of Water-Works, succeeding Mr. C. N. Miller, Assoc. M. Am. Soc. C. E., resigned.

Mr. Morgan K. Barnum, General Superintendent of Motive Power of the Illinois Central R.R. and the Yazoo & Mississippi Valley R.R., Chicago, Ill., has resigned. He is succeeded by Mr. Robert W. Bell, Superintendent of Machinery, at Chicago, Ill.

Prof. W. H. Freedman, F. Am. Inst. E. E., head of the department of applied electricity at Pratt Institute, Brooklyn, N. Y., will return in September to the chair of electrical engineering at the University of Vermont, which he occupied until three years ago.

Prof. Sydney W. Ashe, Assoc. Am. Inst. E. E., recently engaged in educational work at the Harrison Lamp Works of the General Electric Co., Harrison, N. J., has been transferred to the Pittsfield works of the same company to engage in similar work.

Mr. J. A. Somerville, Superintendent of Transportation of the Missouri Pacific Ry. at St. Louis, Mo., has been promoted to be General Superintendent of Transportation, succeeding Mr. E. F. Kearney, elected Vice-President of the Texas & Pacific Ry., as noted in our issue of May 22.

Mr. B. F. Cresson, Jr., M. Am. Soc. C. E., who recently resigned as First Deputy Commissioner of the Department of Docks and Ferries, City of New York, has been appointed Engineer of the New Jersey Harbor Commission, with headquarters at 76 Montgomery St., Jersey City, N. J.

Dr. J. S. W. McCullough, Chief Health Officer of the Province of Ontario, Canada, is to be sent to Europe to investigate sewage- and garbage-disposal methods and the prevention of the pollution of water supplies. He will study sewage-disposal methods in Great Britain, France and Germany.

Mr. Richard L. Humphrey, M. Am. Soc. C. E., Consulting Engineer, of Philadelphia, Penn., has been awarded the medal of the Concrete Institute, of London, England, for the best paper read during the 1911-'12 session. Mr. Humphrey is President of the National Association of Cement Users. His paper was entitled "Fireproofing."

Mr. Bela Nagy, Industrial Engineer, formerly with the Davenport Foundry & Machine Co., Davenport, Iowa, the M. Rumely Co., Laporte, Ind., and other manufacturing concerns, has joined the staff of the Samuel Austin & Son Co., Designing and Constructing Engineers, Cleveland, Ohio. Mr. Nagy is a Hungarian and received his education in Vienna and Budapest. He came to this country in 1902.

Mr. Nathan C. Grover, Assoc. M. Am. Soc. C. E., formerly Chief Engineer of the Land Classification Board, United States Geological Survey, has been appointed Chief Hydrographer to succeed Mr. Marshall O. Leighton, M. Am. Soc. C. E., who was recently appointed a member of the Florida State Drainage Commission, as noted in our issue of May 15. Mr. Grover was some years ago Assistant Hydraulic Engineer of J. G. White & Co., New York City.

Mr. Warren C. Earle has been appointed Chief Engineer of the Railroad Commission of California to succeed Mr. R. A. Thompson, M. Am. Soc. C. E., resigned to become a member of the Railway Valuation Board of the Interstate Commerce Commission. Mr. Earle graduated from Northwestern University and has served in the engineering departments of the Northwestern Pacific Ry., the Wabash R.R. and the Chicago & Northwestern Ry.

Mr. Edward A. Crane, M. Am. Inst. Arch., of the firm of Rankin, Kellogg & Crane, Architects, Philadelphia, Penn., has been appointed City Architect of Philadelphia at a salary of $4000 per annum. Mr. Crane was appointed after a civil-

service examination and succeeds Mr. C. B. Zilenzieger, who was recently tried and acquitted for fraud in connection with city contracts. Mr. Crane was Chief of the engineering and drafting division in the office of the Supervising Architect, United States Treasury Department, from 1898 to 1903.

Mr. Archibald Currie, Assoc. M. Can. Soc. C. E., City Surveyor of Westmount, Que., has been made City Engineer of Ottawa, Ont., at a salary of $5000 per annum. Mr. Currie is a Scotchman and a graduate of Glasgow University. He has had experience in China on railway construction and in construction work in South Africa, where he was for a time with the engineering department of the city of Johannesburg. He also served in the city engineering departments of Glasgow and Belfast. Mr. Currie has been City Surveyor of Westmount for the past two years.

Mr. W. G. Comber, Resident Engineer, Pacific division, Panama Canal, has been placed in charge of all dredging operations in connection with the canal work in both the Atlantic and Pacific divisions, and of the dredging work to be very soon begun in the Central division. Mr. Comber is an Englishman who came to this country as a young man and began engineering work as an axman with one of the engineering parties of the Mississippi River Commission in 1883. Here he acquired a thorough knowledge and experience in surveying and in 1892 he was appointed Assistant Engineer in charge of a general survey of the Mississippi River. He began his work at Panama in the summer of 1905 when Mr. John F. Stevens was Chief Engineer, and was successively Resident Engineer at Cristobal, Division Engineer in charge of dredging at Balboa and Resident Engineer in charge of all dredging on the Pacific side.

Dr. David Starr Jordan has resigned as President of Leland Stanford, Jr., University, and will become Chancellor, a newly created office. Dr. Jordan is succeeded as President by Dr. John Casper Branner, M. Am. Inst. M. E., Professor of geology and Vice-President of the university since 1899. Dr. Branner graduated from Cornell University in 1874, and received a Ph.D. degree at Indiana University in 1885. For several years following the completion of his course at Cornell he was engaged in work in Brazil, first as Geologist of the Imperial Geological Commission, in mining work and later as Special Agent of the United States Department of Agriculture. Returning to this country in 1882 he became Topographic Geologist of the Geological Survey of Pennsylvania. From 1883 to 1885 he was Professor of geology at the Indiana University, and for seven years following was State Geologist of Arkansas. He went to Leland Stanford, Jr., University as Professor of geology in 1892.

OBITUARY

George D. Rosenthal, District Manager, of the General Electric Co., at St. Louis, Mo., died May 19 in New York City.

Francis M. Rites, M. Am. Soc. M. E., at one time Chief Engineer of the Westinghouse Machine Co., Pittsburgh, Penn., died at his home in Slaterville Springs, N. J., May 8. He was the inventor of the steam-engine governor which bears his name.

George Glover Crocker, Chairman of the Massachusetts Railroad Commission from 1887 to 1892, and Chairman of the Boston Transit Commission 1894 to 1899, died at his home in Cohasset, Mass., May 26. He was born in Boston, Mass., Dec. 15, 1843, and graduated from Harvard University in 1864. He was admitted to the bar in 1867 and since had practiced law in Boston. Besides the offices already referred to he was Chairman of the Joint Board on Metropolitan Improvements, 1909-'10. He was a member of the National Municipal League, the Massachusetts Civil Service Reform Association, the American Association for Labor Legislation and similar organizations.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St, New York City.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

OHIO ELECTRIC LIGHT ASSOCIATION.
June 15-18. Annual convention at Cedar Point, Ohio. Secy., D. L. Gaskill, Greenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 411, C. & N. W. Ter, Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

TRAIN DISPATCHERS ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy. Charles Warren Hunt, 220 W. 57th St., New York City.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.
June 20-21. Annual convention at Seattle, Wash. Secy., Jesse A. Jackson, City Hall, Seattle, Wash.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th. St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminister, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young, 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 17-19. Annual summer meeting at Buffalo, N. Y. Secy., E. A. Scott, 29 W. 39th St., New York City.

INTERNATIONAL GEOLOGICAL CONGRESS.
Aug. 7-14. Twelfth annual session at Toronto, Ont. General Secy., R. W. Brock, Director of Geological Survey of Canada, Ottawa, Ont.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 12-16. Annual convention at Chicago, Ill. Secy., W. O. Thompson, New York Central Car Shops, East Buffalo, N. Y.

Conference on the Weights and Measures of the United States—The eighth annual conference was held in Washington, D. C., May 14-17. Papers were read on the "Testing of Gas Meters," by M. H. Stillman, of the U. S. Bureau of Standards; "Testing of Water Meters," by W. F. Stutz, of the U. S. Bureau of Standards; "The Design of Scales," by A. Bousfield, Chief Engineer of the E. & T. Fairbanks Co.; and "Experiments on Scales and Weighing, and Technical Features of Scale Action and Construction," by C. A. Briggs, of the U. S. Bureau of Standards.

American Society of Testing Materials—The Nominating Committee has prepared the following ticket for the election of officers for the ensuing year, to be voted on at or before the first day of the annual meeting, Atlantic City, N. J., June 24-28, 1913:

President: A. N. Talbot, University of Illinois.
2d Vice-Pres: Richard Moldenke, Watchung, N. J.
New members of Executive Committee:
Wm. H. Bixby, John Brunner, F. H. Clark, Albert Sauveur.

The present 1st Vice-President, A. W. Gibbs (Pennsylvania R.R.), remains in office until 1914, as do the four 1914 members of the Executive Committee.

American Institute of Electrical Engineers—At the annual meeting of the Institute, held May 20, the Committee of Tellers reported the following officers elected by letter ballot: President, C. O. Mailloux, of New York; Vice-Presidents, H. H. Barnes, Jr., of New York, J. A. Lighthipe, of Los Angeles, Calif., C. E. Scribner, of New York; Managers, B. A. Behrend, of Boston, Mass., Peter Junkersfeld, of Chicago, Ill., H. A. Lardner, of San Francisco, Calif., and L. T. Robinson, of Schenectady, N. Y.; Treasurer, G. A. Hamilton, of New York. It was announced that, at the recent meeting of the Board of Directors, F. L. Hutchinson had been reappointed secretary.

The report of the Board of Directors made at this meeting showed a total membership of 7654, a gain of 195 during the year. The number is divided into five honorary members, 316 fellows, 847 members, 6486 associates. The cash receipts of the year were given as $112,982 and the total disbursements as $119,186. The total assets were placed at $683,036, while the liabilities, including mortgage on the joint societies building, current liabilities and special funds amount to $89,852.34.

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚Denotes contract awarded. The names of successful contractors are set in CAPITALS.

LEVEE WORK

In the next 30 to 50 days, bids will be received for levee construction along the Mississippi River between Cairo and the White River, to the extent of about $800,000 worth of work, to be performed in several contracts running from 6 to 18 months.

It is possible that work of similar character will be let during the season of 1914 and thereafter for a number of years, perhaps, to the extent of several millions of dollars per year.

The work consists of levee construction along the customary lines, and, although heretofore performed by teams, it is highly desirable that machine work, as well as team work, should be encouraged by reason of the largely increased quantities likely to be involved, and the fact that the work will probably be let in continuous stretches of many miles. Heretofore animal labor has necessarily been used almost exclusively, by reason of the noncontinuity of the work, involving excessive expense in moving machine equipment from place to place.

RAILWAYS

✚**Pennsylvania**—Philadelphia & Reading Ry.—This company has decided to construct a new low-grade freight line at Wayne Junction. Work upon the improvement will start at once, the contract having been awarded to C. P. BOWER, Reading, Penn. The new freight line will leave the Richmond Branch at a point between Germantown Branch crossing, of the Richmond Branch, and Clarissa St. Bridge, over Richmond Branch. It will practically parallel Clarissa St., dipping down and passing under Wayne Ave. and Germantown Ave. at Wayne Junction Station; then it will begin to rise, passing over 18th St. Belfield Ave., Broad St. and Old York Road, practically parallel to the Tabor Branch, and connecting with the Philadelphia & Newtown Connecting R.R., at a point close to the Tabor Branch, just beyond Logan Station. William Hunter, Philadelphia, is Ch. Engr.

Virginia—Atlantic Coast Line R.R.—See item under North Carolina.

West Virginia—West Virginia Development Co.—This company is considering the construction of a railroad from a connection with the Morgantown & Kingwood R.R., near Albright, for about 15 miles. The Kendall Lumber Co., Pittsburgh, Penn., is interested.

South Carolina—South Carolina & Western Ry.—This company is considering the construction of an extension from Florence to Poston, S. C. W. R. Bonsal, Hamlet, N. C., is Pres.

Seaboard Air Line Ry.—This company, it is reported, is considering the constructions of its line to Charleston, S. C. The line will be about 36 miles in length. W. D. Faucette, Portsmouth, Va., is Ch. Engr.

Florida—Surveys will soon begin, it is reported, for the construction of a railroad from Arcadia to Manatee, Fla., a distance of about 53 miles. J. G. Barkley, Tampa, Fla., is interested.

Alabama—Tidewater Securities Co.—This company has been organized for the purpose of constructing a railroad from Birmingham, Ala., to Gadsden, Ala., 60 miles, and from Birmingham to the Warrior River, 30 miles. J. M. Dewberry, Birmingham, is interested.

Mississippi—Corinth & Northwestern Ry.—This company has been organized and is applying for incorporation for the construction of a railroad from Corinth, Miss., to the Tennessee River. The office of the company will probably be located at Corinth.

✚**Louisiana**—Alexandria & Western Ry.—This company has awarded the contract to H. J. COX & CO., Iberia, La., for grading, bridging and track laying. It is expected to have the road completed and ready to operate by or before Aug. 1. This road extends from Alexandria, through the Bayou Rapids country, to a tract of timber owned by the Bayou Rapids Lumber Co., which is building a large sawmill. There is also a large tract of timber owned by the Garden City Lumber Co. and other concerns. The road will be fully equipped with passenger cars and freight cars to do business through that section.

Ohio—Lorain, Ashland & Southern R.R.—Incorporation papers for the consolidation of the Ashland & Western R.R. and the Lorain, Ashland & Southern R.R., under the name of the Lorain, Ashland & Southern R.R., with a capital stock of $1,800,000, have been filed in the office of the Secretary of State at Columbus. J. P. Ramsey, Wellington, Ohio, is Ch. Engr.

Michigan—Pere Marquette R.R.—This company will commence work at once on the construction of its proposed line between Pentwater and Ludington, Mich., a distance of about 18 miles. It is reported that the extension will cost about $1,000,000. A. L. Grandy, Detroit, Mich., is Ch. Engr.

South Dakota—Chicago, Milwaukee & St. Paul Ry.—This company, it is reported, is considering the construction of a branch line to Flandreau, S. D. C. F. Loweth, Chicago, Ill., is Ch. Engr.

South Dakota Central Ry.—This company is considering the construction of a line from Watertown, S. D., to Hankinson, N. D., a distance of about 125 miles. G. W. McArthur, Sioux City, S. D., is Gen. Mgr.

North Dakota—South Dakota Central Ry.—See item under South Dakota.

Missouri—St. Louis & San Francisco R.R.—This company has decided to improve its Clipton Branch, connecting Springfield with Kansas City. The road will be reballasted and laid with new 75-lb. steel. F. G. Jonah, St. Louis, Mo., is Ch. Engr.

Texas—International & Great Northern Ry.—This company has made application to the State Railroad Commission for permission to issue bonds for $780,000 for additions and betterments. It is stated that if the bonds are issued the proceeds will be used to improve the physical condition of the property, particularly that part between San Antonio and Laredo, Tex., 150 miles. O. H. Crittenden, Houston, Tex., is Ch. Engr.

Matador & Northern R.R.—This company has been organized for the purpose of constructing a railroad from a point on the Quanah, Acme & Pacific Ry. to Memphis, Tex., a distance of about 75 miles. It is announced that this first division will be constructed immediately and that it is planned to then extend the road north from Memphis to Canadian, a further distance of about 100 miles, where connection will be made with the Atchison, Topeka & Santa Fé Ry.

The construction of a railroad from Ennis, Tex., to a connection with the Texas & Brazos Valley Ry. at either Bardwell or Emhouse, Tex., is under consideration. E. M. Thomas, Ennis, Tex., is interested. The line will be about 50 miles in length.

Arizona—H. M. Daley and others, of Bisbee, Ariz., are considering the construction of an incline railroad up one of the mountains on the south side of Bisbee. It is estimated that about $100,000 will be spent.

Arizona—Chicago, Rock Island & Pacific Ry. and El Paso & Southwestern Ry.—These companies are considering the construction of an extension to their lines from Tucson, Ariz., via Phoenix, Ariz., Yuma, Imperial Valley and San Diego, Calif., to Los Angeles. Estimated cost, $40,000,000. J. L. Campbell, El Paso, Tex., is Engr. M. W., El Paso & Southwestern Ry., Western Division.

Oregon—Columbia & Nehalem River R.R.—This company will issue $875,000 of bonds for the construction of its proposed line from a point on the Columbia River, near Woods Landing, Ore., to the Nehalem River, a distance of 31 miles.

California—Southern Pacific Co.—This company will construct a five-mile cutoff from West San Jose, Calif., to the present coast line near the Oak Hill cemeteries. W. Hood, San Francisco, Calif., is Ch. Engr.

California—Atchison, Topeka & Santa Fé Ry.—This company contemplates building a branch road from Reedley, through the Kings River Cañon. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

ELECTRIC RAILWAYS

Lawrence, Mass.—The Bay State St. Ry. Co. is planning an expenditure of $88,000 for double-tracking portions of its line in Lawrence. David Bruce is Division Supt.

Oxford, Mass.—The Worcester Consolidated St. Ry. Co. is considering plans for the construction of an electric railway in Oxford. H. C. Page, Worcester, is Gen. Mgr.

Waterbury, Conn.—The Waterbury & Milldale Tramway Co. has completed surveys for the construction of its proposed electric railway from Waterbury to Milldale, about eight miles. Charles H. Clark, Milldale, is Pres. and W. G. Smith, Waterbury, is Ch. Engr.

Greece, N. Y.—The New York State Rys. Co. is considering plans for the construction of an electric railway in Greece. B. E. Wilson, Rochester, is Gen. Mgr.

Hornell, N. Y.—Plans are being prepared by the Hornell Traction Co. for the extension of its line through North Hornell. D. A. Proctor, Hornell, is Gen. Mgr. and Pur. Agt.

Jamestown, N. Y.—C. G. Mead, Jamestown, is interested in the construction of an electric railway from Hamburg to Jamestown. Surveys have been started at Hamburg.

Rome, N. Y.—The New York State Rys. Co. has been granted permission by the Public Service Commission to extend its lines in Rome. E. J. Cook, Rochester, is Gen. Mgr.

New Brighton, Penn.—Plans are being prepared by the Beaver Valley Traction Co. for the construction of about three miles of new track in New Brighton. W. H. Boyce, New Brighton, is Supt. and Mgr.

Oxford, Penn.—Surveys have been completed by the Oxford, Cochranville & Parkersburg Electric Ry. Co. for the proposed electric railway. N. R. Rambo, Oxford, is Ch. Engr.

Pottsville, Penn.—Plans are being prepared by the Pottsville-Shenandoah Ry. Co. for the construction of an electric railway to connect Pottsville, Shenandoah and Frackville.

Morgantown, W. Va.—The Morgantown Interurban Ry. Co. has completed surveys for the construction of its proposed

interurban line to connect Morgantown, W. Va., and Point Marion, Penn., about 10 miles. Noted Apr. 10.

Parkersburg, W. Va.—The Charleston, Parkersburg & Northern R.R. Co. has secured the right-of-way and is making preliminary arrangements for the construction of its proposed electric railway to connect Charleston and Parkersburg, about 47 miles. K. B. Stephanson, Parkersburg, is interested.

Andrews, N. C.—The Hiawassee Valley Ry. Co. is being organized for the purpose of constructing an electric railway to connect Andrews, Hayesville, N. C., and Hiawassee, Ga., about 35 miles. J. Q. Barker, Andrews, is interested.

Cross Anchor, S. C.—The construction of an electric railway to connect Cross Anchor and Spartanburg is contemplated by Daniel M. Miles and associates.

Waycross, Ga.—Preliminary arrangements are being made by the Waycross St. & Suburban Ry. Co. for the construction of its Gilchrist Park extension. A. B. Coryell, Waycross, is Gen. Supt. and Pur. Agt.

Venice, Fla.—The Charlotte Harbor & East Coast Electric Ry. Co. is considering plans for the construction of an electric railway from Venice to Charlotte Harbor, about 26 miles. W. J. Bowling, St. Louis, Mo., is Pres. and W. J. Epherson, Bronson, Fla., is Vice-Pres.

Shreveport, La.—The Shreveport Traction Co. has acquired the franchise and other holdings of the Shreveport Suburban Rys. Co. which operates an interurban electric line to Centenary College. The line will be improved and extended. W. A. Sullivan is Gen. Mgr.

Somerset, Ky.—The Kentucky Utilities Co. is considering plans for the extension of its electric railway from Somerset to Burnside, about seven miles.

Bellaire, Ohio—Plans are being prepared by the Wheeling Traction Co. for the extension of its electric railway from Bellaire to Neffs and its Bridgeport line to St. Clairsville. George O. Nagle, Wheeling, W. Va., is Gen. Mgr.

Cleveland, Ohio—Preliminary arrangements are being made by the Cleveland & Akron Short Line Ry. Co. for the construction of its proposed 26-mile electric railway to connect Cleveland, Akron and Barberton. W. E. Hawley, New England Bldg., Cleveland, is Ch. Engr.

Hammond, Ind.—The Union Ry. & Power Co. is making preliminary arrangements for the construction of an electric railway to connect Chicago, Hegewisch, West Hammond and Hammond. Arthur Jost, Royal Insurance Bldg., Chicago, Ill., is Pres.

Chicago, Ill.—The Chicago & Northern R.R. Co. has been incorporated to construct an interurban railway to connect Chicago, Lake Geneva, Palatine, Crystal Lakes and Richmond.

Freeport, Ill.—The Freeport Ry. & Light Co. has been granted a franchise to construct and operate an electric railway through Florence and Harlem. A. J. Goddard, Freeport, is Pres.

Rockford, Ill.—Plans are being considered by the Rockford City Traction Co. for double-tracking its line on State St. W. C. Sparks, Rockford, is Gen. Mgr. and Pur. Agt.

Davenport, Iowa—Surveys have been completed by the Davenport & Muscatine Ry. Co. for the extension of its street railway to North Muscatine. J. R. Lane, Davenport, is Vice-Pres.

Atchison, Kan.—The Doherty Operating Co., 60 Wall St., New York, N. Y., is interested in the construction of an interurban railway from Atchison, Kan., to St. Joseph, Mo.

Kansas City, Kan.—Preliminary arrangements are being made by the Kansas City, Kaw Valley & Western Ry. Co. for the construction of its proposed electric railway from Kansas City, Mo., to Lawrence, Kan., about 40 miles. J. D. Waters, Bonner Springs, Kan., is Pres. and O. K. Williamson is Ch. Engr. Noted May 15.

Topeka, Kan.—The Topeka Ry. Co. is preparing plans for the extension of its line in Topeka. A. M. Patton, Topeka, is Gen. Supt.

Devils Lake, N. D.—The Commercial Club is taking steps toward the construction of the proposed electric railway in Devils Lake and vicinity.

Stanberry, Mo.—The St. Joseph & Savannah Ry. Co. has been petitioned to consider the proposition to construct and operate an electric railway from Stanberry to Empire Prairie. J. H. Van Brunt, St. Joseph, is Gen. Mgr.

Pine Bluff, Ark.—The City Council has granted a franchise to the Pine Bluff & Sulphur Springs Interurban Ry. Co. to construct and operate an electric railway in Pine Bluff. This is part of a proposed line to connect Pine Bluff and Sulphur Springs, about eight miles. A. G. Russell, Pine Bluff, is Pres. Noted May 1.

Austin, Tex.—It is announced by A. B. Axtell, Ch. Engr., Guadalupe Traction Co., that the survey for the proposed interurban electric line which that company is to construct from Austin to San Antonio via Seguin and Lockhart has been finished from Austin to Lockhart and that the construction work will be started on this 30-mile division early in June. The distance from Austin to San Antonio via Lockhart and Seguin, according to preliminary surveys, is 92 miles. The company will also erect a large hydroelectric plant upon the Guadalupe River near Seguin. The power for operating the road will be obtained from this plant.

Wichita Falls, Tex.—The Wichita Falls Traction Co. is preparing to construct a two-mile extension to its line in Wichita Falls. T. E. T. Orth, Wichita Falls, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Astoria, Ore.—The Columbia & Nehalem River Ry. Co. will build a railroad 31 miles in length from Woods Landing on the Columbia River to the Nehalem River.

Portland, Ore.—Plans are being considered by the Portland, Eugene & Eastern Ry. Co., the electric subsidiary of the Southern Pacific Co., in Oregon, for the construction of 180 miles of new electric railway. At present the company has under construction lines from Canby to Molalla, 11.35 miles, and from Monroe to Eugene, 25.2 miles. Proposed lines are from Oswego to Hubbard, 21 miles of double track; Hubbard to Salem, 19.7 miles; Molalla to Silverton, 15.5 miles; Independence to McNary, 4.31 miles, and Albany to Wellsdale, 6.52 miles. J. P. O'Brien is Pres. and T. L. Billingsley is Gen. Supt.

Quebec, Que.—Plans are being prepared by the Quebec Ry., Light & Power Co. for the extension of its line to Limoilou, Que. H. G. Matthews, Quebec, is Gen. Mgr.

Ottawa, Ont.—The Ottawa & Morrisburg Electric Ry. Co. is planning to start work soon on the construction of its proposed electric railway to connect Ottawa, Morrisburg and Brockville, about 26 miles. J. G. Kilt, Citizens Bldg., Ottawa, is Pres. Noted Feb. 6.

Scarboro, Ont.—A franchise has been granted to the Toronto & Eastern Ry. Co. to construct and operate an electric railway in Scarboro.

Edmonton, Alta.—Preliminary arrangements are being made by the Edmonton, Stony Plain & Wabamun Ry. Co. for the construction of its proposed railway to connect Edmonton, Stony Plain and Wabamun, about 40 miles. E. S. McQuad, Edmonton, is interested.

Taber, Alta.—The Taber Transit Co. will soon be ready to award contracts for the construction of its proposed line to connect Taber, Retlaw and Bow City. V. O. Eastland, Calgary, Alta., is Ch. Engr.

LIGHT, HEAT AND POWER

Graniteville, Vt.—Plans are being prepared by the Consolidated Lighting Co. for the construction of a substation at Graniteville to furnish electricity in the vicinity. H. Larrabee, Montpelier, is Mgr., Pur. Agt. and Supt.

Brockton, Mass.—The Brockton Gas Light Co. is considering plans for the proposed improvements it will make to its gas plant.

Fall River, Mass.—The American Printing Co. will build a power plant in connection with its establishment.

Millbury, Mass.—The Powers Construction Co., Shelburne Falls, Mass., will build a tower line from the new transformer station of the Consolidated St. Ry., at Millbury, to Oxford, Mass.

Hartford, Conn.—See item under Buildings.

Albany, N. Y.—Press reports state that a bill has been signed appropriating $21,500 for the construction of a power plant in connection with the reconstruction of the Capitol.

***Binghamton, N. Y.**—Bids will be received by the State Hospital Commission at Albany, N. Y., until 3 p.m., June 4, for the reconstruction of the electric-light system at the Binghamton State Hospital, Binghamton. T. E. McGarr is Secy. of the Comn.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 2, by the Dept. of Education, Park Ave. and 59th St., Manhattan, for Item 1, installing, heating and ventilating apparatus. Item 2, installing temperature regulation, and Item 3, installing electric elevators in Bay Ridge High School, on the westerly side of 4th Ave., between 67th and Senator Sts., Borough of Brooklyn. C. B. T. Snyder is Supt.

Brooklyn, N. Y.—Bids will be received until 3 p.m., May 29, by the Dept. of Parks, Arsenal Bldg., Fifth Ave. and 64th St., Manhattan, for installing the steam-heating apparatus for the second part of greenhouses for the Brooklyn Botanic Garden, situated on Washington Ave., opopsite Crown and Montgomery Sts. Charles B. Stover is Comr.

New York, N. Y.—(Official)—Bids will be received until 11 a.m., June 10, by the Board of Water Supply, 165 Broadway, for Contract 93, for the construction of a complete telephone-transmission line, approximately 65 miles in length, along the Catskill Aqueduct, between Ashokan Reservoir, in Ulster County, and Croton Reservoir, in Westchester County, New York. The work includes a submarine crossing at the Hudson River. Charles B. Strauss is Pres.

New York, N. Y.—(Official)—Bids will be received by the President of the Borough of Manhattan, at the offices, Commissioner of Public Works, 21 Park Row, until 2 p.m., June 4, for furnishing all the labor and materials for furnishing and installing an electric elevator and all work incidental thereto in the County Court House, Chambers St., City Hall Park. George McAneny is Pres.

Nicetown, Penn.—Plans are being prepared for the construction of a power plant at Nicetown for the George W. Blabon Co. The structure will be one story, 85x79 ft., and will cost, $20,000.

Ocean City, Md.—Henry T. Moore, representing the Delmarvia Utilities Co., has applied to the Public Service Commission for permission to construct and operate an electric-light plant at Ocean City.

Spencer, N. C.—At a recent election, bonds for $50,000 were voted for the construction of an electric-light plant and water system. John T. Scott is Mayor.

Washington, N. C.—Bonds for $20,000 have been voted for the improvement of the municipal electric-light plant.

+Columbia, S. C.—(Official)—Bids were received by the Building Committee of the Board of Trustees of the University of South Carolina, May 15, for the installation of a central-heating plant at the institution, as follows: W. E. GUIMARIN & CO., Columbia, $14,322 (awarded contract); Peo Hardware & Supply Co., $14,850; Raleigh Iron Works, $16,735; B. MacKenzie, steam, $19,760; B. MacKenzie, hot water, $13,250; Evans-Almirall Co., hot water, $19,175. Noted May 8.

Jonesville, S. C.—The proposition to issue $22,000 of bonds for the construction of a municipal electric-light plant and water system is under consideration.

Buford, Ga.—The Georgia Ry. & Electric Co. is preparing plans for the reconstruction of its power plant at Buford, which was recently destroyed by fire. W. H. Smaw, Electric and Gas Bldg., Atlanta, is Pur. Agt.

Sarasota, Fla.—The installation of additional equipment in its plant is contemplated by the Sarasota Ice & Electric Co. R. E. Ludwig, Sarasota, is Secy. and Mgr.

Alleeville, Ala.—Plans are being prepared by the Alleeville Electric Co. for the construction of an electric-light and power plant at Alleeville. Estimated cost, $8000.

Rayne, La.—The proposition to expend $15,000 for the improvement of the municipal electric-light and water plant at Rayne is under consideration.

Cincinnati, Ohio—The Cincinnati Power Co., a new company, represented by Attorneys Henry Bently and Wm. B. Ment, of Cincinnati, has instructed Stegner, Hughes & Alves, Archs., to prepare plans for a series of independent power plants. The plan, it is understood, calls for the building of small plants in all sections of the city where necessary, and a campaign has been conducted to secure customers for power. The corporation has a capitalization of but $10,000.

Cleveland, Ohio—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, June 3, for furnishing a steam engine and generator for the Collinwood station of the municipal electric-light plant.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Dir. Pub. Ser., until June 10, for the installation of an ornamental lighting system on various streets.

Columbus, Ohio—Bids will be received by the Director of Public Service until June 10, for purchasing eight boilers, 18 ft. long, with 44 four-inch flues, and for eight boiler fronts, buckbars, safety valves and grate bars located at the old West Side Pumping Station on West Spring St.

Dayton, Ohio—The Dayton Gas Co. has been authorized by the State Public Service Commission to issue $100,000 bonds to repair immediately the property of the company that was damaged by the flood.

Norwalk, Ohio—Press reports are to the effect that the City Council has authorized the Director of Public Service to take the necessary steps for the construction of a municipal electric-light plant.

Steubenville, Ohio—The Chamber of Commerce is considering plans for the installation of an ornamental street-lighting system throughout Steubenville.

Huntington, Ind.—An election will soon be held to vote on the proposition to issue $75,000 in bonds for the installation of equipment in the municipal electric-light plant. H. L. Young is City Clk.

Wingate, Ind.—The proposition to install an electric-lighting system in Wingate is under consideration by the city authorities.

Elliott, Ill.—A franchise has been granted to the Central Illinois Utilities Co. to construct and operate an electric system in Elliott. J. C. Beker, Piper City, Ill., is Local Mgr.

Sheffield, Ill.—The property of the Sheffield Electric Light Co. has been purchased by the American Gas Co., of Philadelphia, Penn. Considerable improvements are planned by the new owners.

Sheboygan, Wis—The Common Council is agitating the construction of a municipal electric-lighting plant.

Cedar Rapids, Iowa—Tra G. Hedrick, Consult. Engr., Kansas City, Mo., in a report submitted to the City Council, recommended the construction of a power dam and plant to cost $200,000.

Clinton, Iowa—Plans are being prepared by the Clinton Gas & Electric Co. for the installation of additional equipment in its power plant. H. B. Dewell, Clinton, is Supt.

Dow City, Iowa—Preliminary arrangements are being made for the enlargement and installation of new equipment in the municipal electric-light plant. A. E. Loring is Engr.

Menlo, Iowa—Plans are being considered by George C. Buckley & Co., owners of the local electric-light plant, for the improvement and enlargement of the plant.

Monona, Iowa—The construction of an electric-light plant at Monona is contemplated by Wellman & Sons.

Montrose, Iowa—G. Vandyke is interested in the proposition to construct and operate an electric-light plant at Montrose.

Mount Ayr, Iowa—Plans are being considered by the Mount Ayr Light & Power Co. for the enlargement of its plant and the installation of additional equipment. R. M. Lewis is Mgr.

Waterloo, Iowa—Plans are being considered by the Citizens Gas & Electric Co. for an expenditure of $600,000 for the construction of a new plant and the improvement of its system. Austin Burt, Waterloo, is Mgr.

Madison, Minn.—Plans are being considered for the installation of additional equipment in the local electric-light plant. J. C. Bang is Supt.

Montevideo, Minn.—The Montevideo Electric Light & Power Co. contemplates the construction of a new power plant, to cost approximately $40,000. E. A. Aspnes, Montevideo, is Mgr.

Madison, Kan.—Bids will be received by the city until May 19 for the construction of a municipal electric-light and water plant. Rollings & Westover, Midland Bldg., Kansas City, Mo., are Consult. Engrs.

Tescott, Kan.—Rollins & Westover, Midland Bldg., Kansas City, Mo., have been retained as consulting engineers in connection with the proposed construction of a municipal electric-light system at Tescott. Estimated cost, $22,000.

Benedict, Neb.—The Town Council is considering plans for the reconstruction of the entire electric-light system. O. B. Canfield is Mgr. of the electric-light plant.

Sidney, Neb.—The City Council is considering the proposition to issue $22,000 of bonds for the construction of an electric-light and power plant.

Wisner, Neb.—Preliminary arrangements are being made for changing the municipal electric-lighting system from direct to alternating current. Paul Smith is Supt. Lighting Dept.

Hudson, S. D.—J. B. Bradley is interested in the organization of a company to construct and operate an electric-light plant at Hudson.

Kenmare, N. D.—Plans are being considered for the installation of an ornamental street-lighting system in the business district.

Maryville, Mo.—See item under Water Supply—Irrigation.

Waldron, Ark.—S. J. Hill and W. P. Harris contemplate the construction of an electric-light plant here.

Houston, Tex.—The Houston Gas Co. has obtained a franchise from the City Council for extending its gas mains along the Harrisburg Road and German St.

Peniel, Tex.—Plans are being prepared for the installation of an electric-lighting system in Peniel.

Tyrone, N. M.—Phelps-Dodge & Co., 99 John St., New York, N. Y., who own the Chemung copper mine here, will construct a large electric power plant for the purpose of providing power for operating the pumps of the mine and for running the cars through the tunnel that connects the Chemung with the Leopold mine.

Ingersoll, Okla.—At a recent election bonds for $5000 were voted for the purpose of constructing a transmission line from Cherokee to Ingersoll. B. F. Blue is Town Clk.

Valliant, Okla.—See item under Water Supply—Irrigation.

Twin Falls, Idaho—The Beaver River Light & Power Co. has obtained a franchise to enter Twin Falls, and it will spend $100,000 in the city for the work besides the transmission lines from its plant on the Malad River.

Gardnerville, Nev.—The Truckee River General Electric Co. has applied for a franchise to operate and maintain lines in Genoa, Nev., and vicinity.

Wells, Nev.—A hydro-electric plant will be erected on Trout Creek at once by John H. Crazier & Son to furnish light and power to Wells and vicinity.

Colville, Wash.—Preliminary arrangements are being made by the Stevens County Power & Light Co. for the construction of a transmission line from Colville to Chewelah. The company will erect substations at both places. Paul La Plant is in charge of the work.

Albany, Ore.—G. L. Rauch, Portland, and associates are considering the construction of a gas plant at Albany.

Baker, Ore.—The City Engineer is preparing plans for the construction of a municipal electric-light plant. Noted Mar. 13.

Fresno, Calif.—The San Joaquin Light & Power Co. will build a transmission line between Porterville and Formosa. The line will be a 60,000-volt transmission line.

Fresno, Calif.—The San Joaquin Light & Power Co. will install a 10,000-volt distributing line to supply the Barstow Colony with electric power for pumping and domestic purposes. The line will be about 10 miles long and will be built from a point near Rolinda to the San Joaquin River. Laterals will be built to the individual consumers along the line.

Sacramento, Calif.—The Southern Sierras Power Co. has been granted permission by the State Railroad Commission to erect distributing lines in Kern County. F. A. Worthley, Riverside, is Gen. Mgr.

†San Francisco, Calif.—The contract for the installation of electric-lighting fixtures in the 10-story office building to be erected on Bush St., for the Standard Oil Co., has been awarded to the H. W. JOHNS-MANVILLE CO., San Francisco, at $10,782.

Port Dover, Ont.—The proposition to construct a municipal electric-light plant, to cost $40,000, is under consideration.

Chignecto, N. S.—Plans are being considered by the Maritime Coal, Ry. & Power Co., Ltd., Montreal, Que., for the construction of an addition to its power plant at Chignecto.

Estevan, Sask.—Plans are being considered for the installation of additional equipment in the municipal electric-light plant.

Edmonton, Alta.—Plans are being prepared by A. J. Jeffers, City Arch., for the construction of a power plant, to cost $8000.

BRIDGES

Leominster, Mass.—Bids will soon be received by the city for the construction of the Whitney St. Bridge. Samuel H. Pitcher, Worcester, is Engr.-in-charge.

Amsterdam, N. Y.—(Official)—At a special election held on May 22, the citizens voted to issue $100,000 of bonds for the construction of a new bridge over the Mohawk River, connecting the city proper with the Fifth Ward. It was also voted to expend $10,000 to replace a temporary span bridge, which was washed out on Mar. 27. F. F. Crane is City Engr. Noted May 22.

New York, N. Y.—(Official)—The following bids were received, May 22, by the Department of Bridges, Municipal Bldg., for the improvement of the Brooklyn Plaza of the Manhattan Bridge: Northeastern Construction Co., 225 Fifth Ave., $596,400; Charles Meade & Co., 163 Broadway, $619,000; A. L. Guidone & Co., 131 East 22d St., $622,785; Snare & Priest, 233 Broadway, $648,780; John C. Rodgers & Son, 271 West 125th St., $644,000; Cooper & Evans, 220 Broadway, $648,248; Conners Bros. Co., 17 West 42d St., $649,000; Beaver Engineering & Contracting Co., 51 Chambers St., $663,660; Thomas T. Buckley Engineering Co., 103 Park Ave., $674,999; P. J. Carlin Construction Co., 1123 Broadway, $678,000; William P. Seaver, 322 Fifth Ave., $679,051; Rockland Granite Co., Rockland, Maine, $701,800; Oscar Daniels Co., Woolworth Bldg., $703,000; Dunbar Construction Co., 444 East 68th St., $712,000. Noted May 8.

†Camden, N. J.—The Board of County Freeholders has awarded contracts for the erection of two bridges over Newton Creek, Blackwood Turnpike, to the JOHN EVERWINE CONSTRUCTION CO., at $5592 and $4710, respectively. Bids were received May 12. Noted May 8.

Island Heights, N. J.—The borough authorities have ar-

proved plans for the construction of a new bridge across Barnegate Bay, between Island Heights and Seaside Heights.

Millville, N. J.—The Cumberland County Board of Chosen Freeholders is planning for the construction of a steel bridge over the Maurice River at Millville.

Jersey City, N. J.—See item under Streets and Roads.

Harrisburg, Penn.—Bids will be received until noon, June 5, by the State Superintendent of Public Grounds and Bldgs., Capitol, for the construction of a bridge over Mahoning Creek at Macks Fording, Armstrong County. Samuel B. Bambo is Supt.

Reading, Penn.—(Official)—Bids will be received until June 9, by the Commissioners of Berks County, for the construction of the Stumps Bridge, in Albany Township, and the Marion Bridge, in Marion Township. Each will have two spans, of steel and concrete. Charles Sandes is County Engr. Noted Jan. 16.

†Smithport, Penn.—(Official)—The Board of Commissioners of McKean County has awarded a contract to M. APPLEGATE & SON, Bradford, at $7000, for the removal of the present bridge, and the construction of a new 70-ft. span, reinforced-concrete arch bridge over Marion Creek. Bids were received on Mar. 28. G. A. Flink, Trust Bldg., Harrisburg, is Consult. Engr. Noted Mar. 13 and Apr. 10.

Towanda, Penn.—(Official)—Bids will be received until June 5, by the Board of County Commissioners, for the construction of two bridges across the Susquehanna River at Athens and Towanda. They will be of steel and concrete. David A. Feefe, Athens, is Engr.-in-charge.

West Chester, Penn.—Bids will be received until June 5, by the Board of County Commissioners, for the erection of the following bridges: A steel-girder bridge, with reinforced-concrete floor and stone substructure, London Britain township near Jones bridge; bids to be submitted by noon; steel-girder bridge, with reinforcel-concrete floor and stone substructure, East Brandywine township, near Bondsville; bids to be submitted by 1:30 p.m.; stone bridge with reinforced-concrete floor of standard I-beams, West Pikeland Township, near Upperman's store. Bid to be submitted by 2:30 p.m. John Parker is County Clk.

★Baltimore, Md.—(Official)—Bids for the construction of the Fallsway Viaduct above the foundation level were opened by the Board of Awards on May 21. The Claiborne-Johnson Co., Calvert Bldg., were low bidders at $191,000. The Elkins-Tufts Construction Co., 700 East Lexington St., were second at $195,000. Calvin W. Hendricks, 904 American Bldg., is Engr.-in-charge. Noted May 1.

Washington, D. C.—Bids were received as follows, May 26, by the Commissioners of the District of Columbia, for excavation and concrete arch masonry in connection with constructing bridges across Watts Branch in the vicinity of Deane Ave. and Grant St., N. E.: (a) excavation; (b) concrete arch masonry: Charles H. Tompkins, Washington, (a) 40c.; (b) $6; William F. Cush, Washington, (a) 80c.; (b) $5.5; Martin Dodge, Landover, Md., (a) 35c.; (b) $7.50; Warren F. Brenizer Co., Washington, (a) 50c.; (b) $9.

Morgantown, W. Va.—The Board of County Commissioners is now having surveys made for the location of the Cheat River bridge at Ices Ferry. Robert D. Hennen is County Engr.

†Mobile, Fla.—(Official)—The Board of Revenue of Mobile County has awarded a contract to J. L. HENDERSON, Birmingham, at $8199, for the construction of concrete bridges and culverts on Hall's Mill Road. The other bidders were: A. E. Perry, Mobile, $8175; Gaboury & Son, Jacksonville, $8339; McClain & Farragut, Mobile, $8584; Luten Bridge Co., Birmingham, $9086. Bids were received on May 19. Fay McClure is County Highway Engr. Noted May 15.

West Palm Beach, Fla.—Bids will be received until June 3, by the Commissioners of West Palm Beach County, for the construction of a bridge across Cypress Creek. George O. Butler is Clk.

Swords, Ga.—Bids will be received until June 9, by the Morgan County Commissioners of Roads and Avenues, at Madison, for the construction of a steel bridge across the Apalacher River, between Morgan and Green Counties, near Swords. The structure will be of steel, 452 ft. long, with a 100-ft. span. W. R. Rearden is Chn.

Quitman, Miss.—Bids will be received until noon, June 3, by the Chancery Clerk of Clarke County, for the building of a steel bridge across the Chickasahay River near Desoto, Miss.

Akron, Ohio—(Official)—Bids will be received until 11 a.m., June 20, by the Board of County Commissioners, for the construction of two new bridges. One will be of concrete, 754 ft. long and 184 ft. high. The other will be of steel, 780 ft. long and 188 ft high. C. L. Bown is County Clk. Noted May 1.

Cleveland, Ohio—Bids will be received until noon, June 4, by the Director of Public Service, City Hall, for the erection of structural-steel work for repairing the Praha and Columbus Road bridges. W. T. Springborn is Dir.

†Coshocton, Ohio The Board of County Commissioners has awarded a contract to the CENTRAL CONCRETE & CONSTRUCTION CO., Canton, at $19,900, for rebuilding the Warsaw bridge. Noted May 15.

Elyria, Ohio The City Engineer has been instructed by the City Council to prepare plans for the construction of a single-arch, concrete bridge, with a 30-ft. roadway, at Washington Ave. The estimated cost is $60,000. C. M. Theobald is City Engr.

Marietta, Ohio The City Council has decided to issue bonds to the amount of $120,000, for the replacing of the Putnam St. Bridge. Frank Gates is City Engr.

Mcconnellsville, Ohio (Official) All bids received on May 12, by the Board of County Commissioners, for the construction of the Stockport Bridge, have been rejected. New bids will be received until June 9. J. E. Patterson is County Audr.

New Baltimore, Ohio—The Board of County Commissioners, Cincinnati, has approved an estimate of $90,169 as the cost of a permanent bridge over the Great Miami River at New Baltimore. It will be 465 ft. long and have a 25-ft. roadway. The superstructure of the new bridge will cost $64,914, and the abutments $25,254. Albert Reinhardt is Clk.

Springfield, Ohio—Bids will be received until June 5, by the Board of County Commissioners, for the reconstruction and replacement of the following bridges: Red Bridge, No. 1423, over Mad River, on the township road leading from the Valley pile to the National pike at Rockway in Springfield Township; Kobelanz Bridge, No. 1016, over Mill Creek on the Dayton pike, in Springfield Township; Baker Bridge, No. 426, over Mad River, on the Tremont road in German Township; Baker Bridge, No. 452, over Mad River, on the Eagle City road in German Township.

Toledo, Ohio—Bids will be received until 10 a.m., June 6, by the Board of County Commissioners, for the construction of the substructure and superstructure of a bridge on Bancroft St., over Ten Mile Creek, Washington Township. Charles J. Sanzenbacher is County Audr.

Wabash, Ind.—(Official)—Bids will be received until 1 p.m., June 4, by the Commissioners of Wabash County, for the construction of a three-span reinforced-concrete arch bridge over the Mississinewa River, near Somerset. The structure will have a center span of 105 ft. and two end spans of 100 ft. each. A. W. Grosvenor, Bank Block, Fort Wayne, is Engr.-in-charge.

Manitowoc, Wis.—The Manitowoc County Board appropriated $27,000 for bridges to span various streams and creeks of the county. The cost is divided half way between the towns and the county at large. The 20 bridges will be distributed as follows: Gibson, one; Gibson and Mishicot, one; Centerville, one; Cooperstown, one; Two Rivers, two; Mishicot, one; Manitowoc, three; Manitowoc Rapids, one; Maple Grove and Rockland, two; Meeme, two.

Milwaukee, Wis.—The Board of County Commissioners has voted to have work started on the new concrete bridge across Root River, Port Washington Road. According to an estimate of W. M. Torgeson, state bridge engineer, submitted to the committees, it will cost $60,000. The new bridge is to be 285 ft. long and 60 ft. wide. The roadway will be 40 ft. in width. There will be four spans of 80 ft. each.

†Sheboygan, Wis.—The contracts for the New Jersey Ave. bridge have been awarded as follows: WISCONSIN DREDGE & DOCK CO., Sheboygan, substructure, $7300; PELLETT & McMULLEN, Manitowoc, superstructure, $10,900 for July completion and $10,700 for November. It will be constructed to be completed in July. It will be of reinforced concrete, with two end and one central pier; 220 ft. long, 32 ft. wide, with an 18-ft. roadway. C. N. Roby is City Engr. Noted May 1.

Council Bluffs, Iowa—Bids will be received until 2 p.m., June 5, by the County Auditor, for the construction of a 70-ft. pony-truss steel bridge, with a concrete floor. J. D. Hannan is Audr.

Eureka, Kan.—Bids will be received until June 3, by the Board of Commissioners of Greenwood County, for the construction of a concrete arch bridge over Honey Creek, in Fall River Township. Ira Whipple is County Clk.

Harper, Kan.—Bids will be received until noon, June 2, by the Board of Commissioners of Washington County, for the construction of six bridges in various parts of the county. R. P. Chevreaux is County Clk.

Fargo, N. D.—Bids will be received until noon, June 5, by the auditor of Cass County, for the construction of two county bridges. Addison Leach is County Audr.

Fort Worth, Tex.—Bids will be received until June 5, by the Board of Commissioners of Tarrant County, for the construction of a reinforced-concrete bridge over Johnson's Station branch on Dallas Road, near Arlington. J. A. Mulholland is County Audr.

Houston, Tex.—An election of taxpayers will be held July 1, to vote on the proposition of issuing $1,200,000 of bonds for the construction of new bridges and for paving additional streets. The amount of the bridge bonds will be $400,000, and of the street-paving bonds, $800,000. Frank L. Dormant is City Engr.

Lufkin, Tex.—(Official)—The Commissioners Courts of Angelina and Nacogdoches Counties have retained P. A. McCarthy, of the engineering firm of P. A. McCarthy & Sons, Consulting Engineers, Lufkin, to make surveys and soundings for bridge site over the Angelina River, in the vicinity of Spradley's ferry, and prepare plans and estimates. This is in line with the plans for a public highway between Lufkin and Nacogdoches. Preliminary surveys already made indicate that a span of 125 ft. will be required over the river channel, and about 2300 ft. of approaches on the Angelina County side.

Brigham City, Utah—The Board of County Commissioners has authorized the immediate construction of the following bridges: One over Mill Creek, just west of Honeyville; one over Beaver Dam Creek at Beaver Dam, one over the slough northwest of Brigham, one over Salt Creek, just north of the cement works, and one to span Box Elder Creek in Mantua. The bridges will have a 20-ft. driveway.

Salt Lake City, Utah—Bids will be received until 10 a.m., June 2, by the Board of County Commissioners, for the construction of either one or two reinforced-concrete bridges and one concrete arch. L. P. Palmer is County Clk.

Davenport, Wash.—Bids will be received until June 4, by the Board of County Commissioners, for the construction of four steel bridges as follows: One bow-string, truss-steel bridge, 60 ft. long and 18 ft. wide; one bow-string truss steel bridge, 100 ft. long and 18 ft. wide, both to be erected across Crab Creek, near Sprague; one bow-string, truss, steel bridge, 80 ft. long and 18 ft. wide, four miles south of Almira, and one 40-ft. steel bridge 18 ft. wide, 2½ miles west of Davenport. C. C. Lasle is County Clk.

†Ephrata, Wash. The EVERETT CONSTRUCTION CO., Everett, Wash., at $9,494, was recently awarded the contract for the construction of a bridge across Moses Lake. Other

bidders were: Nettleton, Bruce & Eschbach, $9575; American Pile Driving Co., $11,000; Security Bridge Co., $11,850; Central States Bridge Co., $12,237; O. H. Stratton, $12,148; C. C. Bulle, $13,150.

Seattle, Wash.—Arthur H. Dimock, City Engr., estimates the cost of the proposed bridge across the East Waterway, on Railroad Ave., at $612,000. The proposition is at present before the City Council for authorization.

Modesto, Calif.—(Official)—Bids will be received until 10 a.m., July 7, by the Board of County Supervisors, for the construction of an 800-ft. reinforced-concrete trestle, the removal of the present trestle and the construction of 400 ft. of temporary trestle. The structure will be of the girder type, 40 ft. center to center, and will require 2600 cu.yd. of concrete, 150 tons of steel and 240 concrete piles. It will cross the San Joaquin River. E. H. Annear is County Surv. Noted May 15.

WATER SUPPLY—IRRIGATION

Agawam, Mass.—The town has made an arrangement with the city of Springfield for a supply of water. The town will lay a system of pipe lines, estimated to cost $100,000. E. A. Kellogg, John Merrill and H. E. Dordurtha compose the committee in charge of the project. Noted May 22.

✚Boston, Mass.—(Official)—Bids for relaying water mains in Newbury, Marlborough and Fairfield Sts., were received by the Departfent of Public Service, May 16, as follows: JOHN T. SHEA, JR., $5138 (awarded contract); Thomas Burke, $5265; Anthony Baruffaldi, $5301; M. De Sisto & Co., $5771; R. Cartullo, $6344. Noted May 15.

✚The contract to furnish 30 tons of 12-in., 75 tons of 16-in., and 80 tons of 36-in. cast-iron flexible water pipe has been awarded by the Supply Department to the FLORENCE IRON WORKS at $36.70, $39.20 and $40.20 for the three sizes. Other bids were: U. S. Cast Iron Pipe & Foundry Co., $40, for all sizes; Warren Foundry & Machine Co., $52.50, for all sizes; Chas. H. Slattery is temporary Supt. of Dept.

Canton, Mass.—The city contemplates laying about 10,500 ft. of 6-in. c.-i. water pipe. Frederick Endicott is City Engr.

East Bridgewater, Mass.—Bids are being received by the Water Commissioners for the construction of one mile of 10-in. and two miles of 6-in. water mains.

Fall River, Mass.—Bids for furnishing a 6,000,000-gal. pumping engine were received by the Watuppa Water Board, Apr. 30, as follows: Platt Iron Works, Dayton, Ohio, $16,680 to $28,650; International Steam Pump Co., New York, $15,900 to $28,000; Allis-Chalmers Co., Milwaukee, Wis., $13,500; Nordberg Mfg. Co., Milwaukee, $16,000; Epping-Carpenter, Pittsburgh, $15,900; Power Equipment Co., Trenton, $12,583; R. D. Wood & Co., Philadelphia, $6698 to $7178. Noted Apr. 24.

✚North Attleboro, Mass.—(Official)—Bids for laying water mains in various streets were received by the city, May 12, as follows: (a) excavation and backfilling, per lin.ft.; (b) rock excavation, per cu.yd.; (c) excavation below grade; (d) rock excavation below grade: Antonio Magoviro, North Attleboro, (a) 35c.; (b) $4; (c) 50c.; (d) $4; James Lavezzo, (a) 29c.; (b) $3.50; (c) 54c.; (d) $4.25; Light, Heat & Power Corp., Boston, Mass., (a) 42c.; (b) $3.50; (c) 54c.; (d) $4; ROCCO GERMANE, North Attleboro, (a) 28c.; (b) $3.25; (c) 50c.; (d) $4 (awarded contract). Noted May 1.

★Hartford, Conn.—(Official)—Bids will be received by the Board of Water Commissioners until June 24, for constructing the Nepaug pipe line. The pipe line is about 7½ miles long, and is in the towns of Farmington, Avon and Burlington, Conn., distant 7 to 14 miles from Hartford. Separate bids will be received for 44-in. riveted steel, 42-in. lock-bar or welded steel and 42-in. c.-i. pipe for the main section of the line, but the award will be made for one kind of pipe only. The steel pipe, at two crossings of the Farmington River, will be increased to 46 in. in diameter and lined with mortar. The principal items of Contract 4 are: For Bid 1. The furnishing and laying 44-in. riveted steel pipe, ⅝-in. plate, 5400 lin.ft.; furnishing and laying 44-in. riveted steel pipe, ½-in. plate, 33,900 lin.ft. For Bid 2. Furnishing and laying 42-in. lock-bar or welded steel pipe, ½-in. plate, 39,300 lin.ft. For Bids 1 and 2. Furnishing and laying 46-in. steel pipe, ⅝-in. plate, at two crossings of the Farmington River, 550 lin.ft.; lining 46-in. steel pipe with mortar, 550 lin.ft. For Bids 3. Laying 42-in. c.-i. pipe, furnished by the Board, 39,850 lin.ft. For Bids 1, 2 and 3. Rock excavation, 4000 cu.yd.; concrete masonry for pipe casing and anchorages; for steel pipe, 700 cu.yd.; for c.-i. pipe, 100 cu.yd. Brick and concrete masonry for chambers, culverts, etc.; for steel pipe, 170 cu.yd.; for c.-i. pipe, 100 cu.yd.; special work at two crossings of the Farmington River; special work at two railroad crossings. Caleb Mills Saville is Ch. Engr. and F. D. Berry is Secy. Bd. of Water Comrs.

Thompsonville, Conn.—According to press reports, the Thompsonville Water Co. contemplates the construction of a dam 20 ft. high, on the Crombie property. The dam will create a reservoir with a capacity of 76,000,000 gal. H. R. Cooper is Supt.

Frankfort, N. Y.—It has been proposed to lay about 4400 ft. of water main along Moyer Creek, at an estimated cost of $12,000.

New York, N. Y.—See item under Light, Heat and Power.

Olean, N. Y.—(Official)—Bids will be received by the Board of Water Commissioners until 8 p.m., June 3, for constructing watermains in various streets, according to specifications on file at the office of the Board.

Upper Jay, N. Y.—Bids will be received by the Upper Jay Water District until 2 p.m., June 1, for constructing a water system, according to plans on file at the office of Ralph O. Beede, Chn. of Bd. Byron E. McLeod is Engr.

Roaring Spring, Penn.—(Official)—Bids will be received by the Borough Council until 8 p.m., May 30, for constructing a concrete reservoir and laying an 8-in. pipe line. J. L. Henry, Holidaysburg, Penn., is Consult. Engr. James M. Smith is Chn. Water Com.

✚Cumberland, Md.—The contract to lay a 30-in. watermain from the Fort Hill Reservoir to South Mechanic St., has been awarded to the THOMAS S. KEAN CO., Cumberland, at $15,500. Noted May 22.

Raleigh, N. C.—The value of the plant of the Wake Water Co. has been fixed at $250,000, and it will be taken over by the city by June 1. Gilbert C. White, Consult. Engr., Charlotte, N. C., was one of the appraisers. Noted Apr. 3.

Columbia, S. C.—The city will vote June 3 on annexing Shandon. If the vote is affirmitive, water and sewer systems estimated to cost $30,000 will be installed. W. H. Gibbes is Mayor.

Walterboro, S. C.—J. Newton Johnson, Consult. Engr., Florence, S. C., has been retained to superintend the rebuilding of the water system and the installation of a sewer system here.

Royston, Ga.—The J. B. McCrary Co., Atlanta, Ga., has prepared plans for water and sewer systems here, estimated to cost $30,000. Bids will probably be asked about July 1. C. B. Wellborn is Mayor. Noted May 8.

Thomson, Ga.—The Board of Trade is ready to grant a franchise to install water and sewer systems here. B. A. Neal is Pres.

✚Newberry, Fla.—According to press reports, the contract to install a water system and electric-light plant here has been awarded to the J. B. McCRARY Co., Atlanta, Ga., at $26,500.

Hattiesburg, Miss.—The city contemplates extending its water system to serve the Mississippi Normal College.

Rayne, La.—The town contemplates an expenditure of $15,000 for improving the water system and electric light plant.

Vivian, La.—(Official)—E. W. Gantt, Consult. Engr., Sam Houston Life Bldg., Dallas, Tex., has prepared plans for a water system here, estimated to cost $36,000.

✚Elizabethtown, Ky.—A contract to construct a reservoir for the water system here has been awarded to MURPHY BROS., Bowling Green, Ky.

Paducah, Ky.—The General Council is considering a proposition to install a pumping station for the water system. Estimated cost, $10,000. L. A. Washington is City Engr.

Rockport, Ky.—The Rockport Coal Co. contemplates the installation of a water system to include a tank of 25,000 gal. capacity, on a 20-ft. tower, and four miles of 2- to 6-in. pipe, with fittings and fire plugs. H. L. Tucker is Pres. and Mgr.

Akron, Ohio—(Official)—Bids will be received by R. M. Pillmore, Dir. Pub. Ser., until noon, June 5, for constructing a 48-in. steel pipe line from the proposed Cuyahoga River Dam to the proposed purification plant near Earlville. The line will be approximately 2240 ft. long, and alternative bids will be received on 48-in. lock-bar steel pipe, and 51-in. riveted steel pipe. Plans and specifications are on file at the office of the Director, and at the office of F. A. Barbour, Consult. Engr., Boston.

Bucyrus, Ohio—Bonds for $180,000 have been voted for the installation of a municipal water system.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 4, for furnishing and erecting a vertical triple-expansion crank-and-flywheel pumping engine for the high-service system at the Western Hills pumping station. The engine is to have a capacity of 7,000,000 gal. per day.

Cleveland, Ohio—(Official)—Bids will be received by W. J. Springborn, Dir. Pub. Ser., until noon, June 5, for an iron conduit.

Geneva, Ohio—(Official)—Bids will be received by the Board of Public Affairs until noon, June 6, for constructing a reinforced concrete dam 825 ft. long and 8 ft. high. Plans are on file at the office of Burgess & Long, Consult. Engrs., Columbus, Ohio.

Ironton, Ohio—It is proposed to install a filtration plant for the water system here, and an engineer will probably soon be employed to prepare the plans. H. M. Paul is Clk. of Council.

Kenmore, Ohio—Bids will be asked about July 1 for constructing a water system here, estimated to cost $100,000. Plans are being prepared by the Central Engineering Bureau, 53 West Jackson Blvd., Chicago, Ill. E. J. Shook is City Clk.

New Philadelphia, Ohio—Bids are being received by H. P. Frib, Dir. Pub. Ser., for the construction of a sewage-disposal plant estimated to cost $40,000.

Logansport, Ind.—(Official)—Bids for constructing a filtration plant for the water system were received by the Board of Public Works, May 20, as follows: Materne Mfg. Co., St. Louis, $57,751; New York Continental Jewell Filtration Co., New York, $95,750; Roberts Filter Mfg. Co., Darby, Penn., $59,364. The bids are under consideration. William Pickett is City Engr. Noted May 8.

Big Rapids, Mich.—The city is receiving bids for laying about 14,500 ft. of 4- to 12-in. c.-i. water mains. Gardner S. Williams, Ann Arbor, Mich., is Consult. Engr.

Cambridge, Ill.—According to press reports, bids will be received by the Village Clerk until May 29, for constructing an artesian well and a pumping plant, according to plans prepared by Arthur M. Morgan, Consult. Engr., Chicago.

Stockton, Ill.—The Village Board contemplates the construction of a 500,000-gal. water reservoir and a complete sewer system.

Fond du Lac, Wis.—The Water Department has ordered the extension of watermains as follows: In Park Ave., from Sixth St. to Dutch Gap, 8-in.; Marquette St., from Merrill to Sibley St., connecting with the large feed mains, 14-in.; Rees st., from Main to Marquette St., 14-in.; and 11th St., from Park Ave. to Ellis St., 8-in. W. H. Masson is Supt.

Prairie du Sac, Wis.—Mead & Seastone, Consul. Engrs., Madison, Wis., have prepared plans for the construction of a municipal water system here to include a 50,000-gal. elevated tank, 16,800 ft. of 8- and 6-in. c.-i. pipe, 26 hydrants and two triplex pumps. Estimated cost, $30,000. Noted Jan. 9.

+Turtle Lake, Wis.—(Official)—The contract to construct a tower and tank, and to lay water mains for the water system here has been awarded to W. D. LOVELL, Minneapolis, Minn., at $7550. Bids were opened by the village, May 20. A. T. Thompson, Colfax, Wis., is Consult. Engr. Noted May 8.

Fort Madison, Iowa—Wynkoop Kiersted, Consult. Engr., Kansas City, Mo., has submitted the following report to the City Council, relative to the installation of a water system here: Distributing system, hydrants, valves, distributing reservoir, $127,899; gang well, single lift, water-supply plant with steam equipment, $45,384; individual well, double-lift water plant, electrically operated, $22,747.

Morgan, Minn.—Bids will be received by the Village Clerk until May 29, for constructing a water system here, according to plans prepared by W. D. Lovell, Consult. Engr., Minneapolis, Minn.

Taylors Falls, Minn.—Bids will be received by W. H. Robertson, Village Clk., until 3 p.m., June 2, for constructing a water system. Plans are on file at the office of the Village Clerk and at the office of L. P. Wolff, Consult. Engr., Germania Life Bldg., St. Paul, Minn.

Madison, Kan.—(Official)—Bids will be received at the office of the City Clerk until 7:30 p.m., May 29, for constructing an electric-light plant and a water system. Plans and specifications are on file at the office of the City Clerk, or may be obtained from Rollins & Westover, Consult. Engrs., Midland Bldg., Kansas City, Mo. J. T. Braddock is Mayor. Noted May 1.

Hildreth, Neb.—According to press reports, bids will be received by Willis Neff, City Clk., until June 2, for constructing a water system and electric-light plant. Estimated cost, $10,000. Charles F. Sturtevant, Holdrege, Neb., is Engr.

Omaha, Neb.—According to press reports, bids will soon be asked for the construction of three reservoirs for the water system. The reservoirs will have a total capacity of 25,000,000 gal., and are estimated to cost $350,000. Watson Townsend is City Engr.

Peru, Neb.—Bids will be received by F. N. Martin, Village Clk., until May 29, for constructing a water system, estimated to cost $18,900. C. F. Sturtevant, Holdrege, Neb., is Consult. Engr. Noted Feb. 20.

Belfield, N. D.—It is proposed to install a water system here at an estimated cost of $10,000.

Helena, Mont.—Bids for furnishing 6-in. c.-i. water pipe were received by the City Council, May 5, as follows: American Cast Iron Pipe Co., Kansas City, $37.20; Massillon Iron & Steel Co., Chicago, $37.55; U. S. Cast Iron Pipe & Foundry Co., Chicago, $37.50; James Clow & Son, Chicago, $38.20; R. D. Wood & Co., Philadelphia, $46.55; A. M. Holter Co., Helena, $38.55.

Valier, Mont.—(Official)—H. J. Saunders, Consult. Engr., Valier, Mont., has been retained by the City Council to prepare an estimate and report on various sources of water supply. The cost of the system to be installed will probably be about $60,000.

+Kennett, Mo.—The contract to construct a water system here has been awarded to by the City Council to the KATZ CONSTRUCTION CO., Omaha, Neb., at $36,440. Plans for the system were prepared by Hiram Phillips, Liggett Bldg., St. Louis, Mo. Bids were opened Apr. 28. Noted Apr. 17. See also item under Sewers.

Maryville, Mo.—(Official)—Bids will be received by the Board of Public Works until noon, June 2, for furnishing the following equipment for the water system: One high-service, compound, condensing, duplex directing-acting pump of 1,000,000 gal. capacity; two low-service, horizontal split case, centrifugal pumps, direct connected to steam engine, 1000 gal. per min. capacity each. One boiler feed pump. Two pressure filters, 250,000 gal. capacity each. One 4-kw., 120-volt, d.-c. generator direct connected to steam engine. One 150-hp. open-feed water heater. Low concrete dam, gravity section. F. L. Flynt is Supt. of Construction, Water Dept. Hiram Phillips, St. Louis, Mo., is Consult. Engr.

Fayetteville, Ark.—Bids will be received by the City Council until May 31, for furnishing meters and meter boxes.

Walnut Ridge, Ark.—The Board of Town Commissioners is having plans prepared for the installation of a water system, and will ask bids for construction as soon as the plans have been completed. H. F. Graff is Pres.

Broken Bow, Okla.—(Official)—It is proposed to install a water system here, estimated to cost $30,000. J. E. Davis, Caddo, Okla., is Consult. Engr.

+Hinton, Okla.—(Official)—Bids for constructing a water system and electric-light plant here were received by the town May 19, as follows: T. C. Brooks & Son, Jackson, Mich., $27,000 100% A. TOLBERT, Ada, Okla., $25,917 (awarded contract); Tochterman, Kerby & Richards, Lawton, Okla., $27,-000 Electric Supply Co., El Reno, Okla., $28,656, Tulsa Electric & Construction Co., Tulsa, Okla., $30,290 N. S. Sherman Machine & Iron Works, Oklahoma City, $27,888; Connelley Construction Co., El Reno, Okla., $29,858. Plans were prepared by the Benham Engineering Co., Oklahoma City, Okla. Noted May 15.

Valiant, Okla.—(Official)—An election has been called to vote on a bond issue of $51,000 for the installation of a water system and electric-light plant here. E. W. Gantt, Sam Houston Life Bldg., Dallas, Tex., is Consult. Engr.

Agua Caliente, Ariz.—The New Johnson Irrigation Co. has finished the surveys for a reinforced-concrete dam across the Gila River near here and for the proposed system of irrigation canals and ditches. The dam will be 80 ft. high and will have a length of 1800 ft. About $1,500,000 will be invested in the project and approximately 100,000 acres of land will be irrigated. The incorporators of the company are J. L. Grant, Charles Ward and George A. Crowder, Phoenix, and E. K. Kassab, San Francisco.

Globe, Ariz.—The Gila River Water Co. plans to irrigate about 73,000 acres of land near Globe. R. W. Edson, Chicago, Ill., is Pres.

Puyallup, Wash.—The proposition to bond the city for $100,000 to rebuild the Salmon Springs water system was defeated at a recent election. Noted May 15.

Seattle, Wash.—According to press reports, bids will be received by the Board of Public Works until June 13, for constructing a concrete gravity dam at Cedar Lake. The dam will be 200 ft. high, 800 ft. long, 15 ft. wide at top and 20 ft. wide at bottom. The contract also includes the construction of a 1500-ft. tunnel, 11 ft. in diameter. Total cost, $1,000,000. A. H. Dimock is City Engr.

Arlington, Ore.—(Official)—Bids will be received by the city until June 3, for constructing an electric-light plant and overhead distributing system, also new pumping station and filtration plant. Estimated cost, $15,000. Louis C. Kelsey, Selling Bldg., Portland, Ore., is Consult. Engr. Noted May 15.

Ashland, Ore.—F. H. Walker, City Engr. has been instructed by the City Council to investigate and report on the most feasible plan for securing water supply for the city. A municipal system is under contemplation.

Pendleton, Ore.—According to press reports, the city will install a water system, to cost $200,000. The system will include 16½ miles of 18- to 24-in. concrete conduit pipe line, and two concrete reservoirs with a capacity of 1,000,000 gal. each. Frank C. Kelsey, Consult. Engr., Portland, is preparing plans. Noted May 8.

+Vale, Ore.—A contract has been awarded to WELLS BROS., Portland, Ore., for constructing the diversion dam and canal for the Malheur Irrigation Project.

Escondido, Calif.—The Board of City Trustees contemplates an expenditure of $100,000 for the installation of a municipal water system. Noted May 1.

Grass Valley, Calif.—A. L. Trowbridge, Field Engr. of the Pacific Gas & Electric Co., and F. M. Miller, Engr. for the Water Consumers' Association, are compiling plans and estimates for an irrigation system to supply water to 100,000 acres of land.

Los Angeles, Calif.—Bids will be received until 2 p.m., June 3, by the Department of Public Service for furnishing approximately 5611 tons of class B and class C standard bell and spigot c.-i. water pipe. James P. Vroman is Secy.

Loyalton, Calif.—The Mountain Development Co. will construct a reservoir and power plant near Sattley. The project will cost $180,000. The waters of Berry Creek will be diverted and the main reservoir constructed in Wild Bill Cañon. The principal dam will be 50 ft. high, 230 ft. long at the top and 60 ft. long at the bottom, 35 ft. thick at the bottom and 7 ft. at the top. The reservoir capacity will be 150 acre-feet. A smaller dam will also be built and two smaller auxiliary reservoirs.

Newport Beach, Calif.—The city contemplates laying an 8-in. water main from the pumping station to Balboa. Estimated cost, $25,000.

San Francisco, Calif.—M. M. O'Shaughnessy, City Engr., has prepared specifications for supplying the city with 2750 tons of c.-i. pipe to be used in sections of the city lacking a fresh-water supply. The cost of the material is estimated at $100,000, and the laying will cost $150,000.

+Tulare, Calif.—The contract to construct a water system here has been awarded to C. D. VINCENT, Oakland, at $37,-648. Noted May 22.

Galt, Ont.—The Water Commission contemplates an expenditure of $70,000 this year, for extending and improving the water system.

Ottawa, Ont.—(Official)—Bids will be received by R. C. Desroches, Secy. Dept. Pub. Wks., until 4 p.m., June 23, for the following work at the New Barracks, Long Branch, near Toronto, Ont.: (1) Water-works pipe laying; (2) sewer pipe lawing, (3) pump house, filter house and reservoir, (4) foundations for water tower, (5) steel water tower and supports, (6) waterlworks intake, pipe and well, (7) sewage pumping station, (8) sewage disposal works, (9) bridges or viaducts.

★Montreal, Que.—(Official)—Bids for enlarging the city aqueduct were received by the Board of Water Commissioners, May 16, as follows: Cook Construction Co., Ltd., Sudbury, Ont., $2,322,562; Quinlan & Robertson, Montreal, $2,-621,180; J. P. Mullarkey, Montreal, $2,750,952; Oscar Daniels Co., New York, $2,792,061; O'Brien & Doheny, Montreal, $2,-778,557; M. P. & J. T. Davis, Montreal, $3,260,866; Laurin & Leitch, Montreal, $3,268,265; Sir John Jackson, Ltd., Montreal, $4,225,593. Noted Apr. 24.

Edmonton, Alta.—The municipality of Edmonton will expend $3,140,000 for the construction of a permanent water system for the city. About $250,000 will be expended for filters and additional pumps at the present plant.

SEWERS

Biddeford, Maine—(Official)—Bids will be received by the city until 8 p.m., June 9, for constructing a trunk sewer, according to plans and specifications on file at the office of W. C. Bigelow, City Engr. The contract includes 1300 lin.ft. of 4x6-ft., 1650 lin.ft. of 3x5-ft. egg-shaped reinforced-concrete sewer, and 900 lin.ft. of 30-in. and 350 lin.ft. of 24-in. round reinforced-concrete sewer. Noted May 8.

Bellows Falls, Vt.—(Official)—Bids will be received by H. C. Bacon, Pres. Bd. of Trustees, until 8 p.m., June 10, for constructing sewers, according to plans and specifications on

file with E. A. W. Hammatt, Consult. Engr., 15 Water St., Newton Center, Mass., and at the office of the Board of Trustees. Noted Mar. 27.

Boston, Mass.—(Official)—Bids will be received by the Department of Public Works until June 19, for furnishing and erecting an automatic electric sewage-pumping plant in the station at Union Park and Albany Sts. L. K. Rourke is Comr. Pub. Wks.

✚The contract to construct sewers in Tesla, Burmah and other streets in the Hyde Park District has been awarded to JAMES H. FERGUSON, 22 Parkman St., Dorchester, at $7341. Bids were opened May 2. Noted May 15.

Boston, Mass.—Bids will be received by the Metropolitan Water and Sewerage Board, 1 Ashburton Pl., until 2:30 p.m., June 6, for constructing 600 ft. of 54-in. sewer in trench, $850 ft. of 48-in. sewer in trench, 180 ft. in tunnel, 560 ft. vitrified pipe drains, 60 cu.yd. portland brick masonry, 3900 cu.yd. concrete masonry in trench and 180 cu.yd. in tunnel, 10,000 ft. spencer piles in place. Henry H. Sprague is Chn. of Bd.

Brookline, Mass.—Bids will be received by the Board of Selectmen until 3:45 p.m., June 2, for constructing a sewer and surface drain in Clyde St. The contract include 900 ft. 32x40-in. concrete drain, 320 ft., 24x30-in. concrete drain and 200 ft. 18-in. pipe drain; in same trench will be laid 900 ft. 15-in. sewer pipe and 520 ft. 12-in. pipe. Edward A. M. Ettrick is Secy.

★✚**Fitchburg, Mass.**—(Official)—Bids for constructing a sewage disposal plant here were received by the Sewage Disposal Commissioners, May 15, as follows: (a) With Type A sprinkling filter floor; (b) with Type B sprinkling filter floor; (c) with Type C sprinkling filter floor; (d) with Type D sprinkling filter floor: R. H. NEWELL CO., Uxbridge, Mass., and N. S. BROCK, Boston, Mass., (a) $211,847, (b) $214,667, (c) $209,027 (awarded contract), (d) $214,667; Coleman Bros., Boston, Mass., (a) $240,323, (b) $240,232, (c) $237,503, (d) $237,973; International Construction Co., Boston, Mass., (a) $252,783, (b) $285,683, (c) $240,563, (c) $241,973; J. J. Prindiville, South Framingham, Mass., (a) $248,549, (b) $248,757, (c) $245,447, (d) $246,857; T. W. Sheridan & Sons Co., Newton, Mass., (a) $247,074, (b) $249,424, (c) $270,574, (d) $272,924. David A. Hartwell is Chief Engr. Noted May 1.

Pittsfield, Mass.—The Board of Public Works has awarded a contract to lay a sewer in Spring St., to E. B. ROBERTS, Boston, Mass., at $8300.

Worcester, Mass.—(Official)—The sewer improvements contemplated here will be done by day labor. The work is estimated to cost $25,000. F. A. McClure is City Engr. Noted May 19.

West Hartford, Conn.—(Official)—Bids will be received by the Sewer Commissioners until noon, June 6, for constructing about five miles of pipe sewers, according to plans on file at the office of Ford, Buck & Sheldon, Consult. Engrs., 60 Prospect St., Hartford. Noted May 22.

✚**Albany, N. Y.**—The contract to construct sewers in South Hawk and Chestnut Sts. has been awarded to JAMES S. CAMPION, Albany, at $6915. Noted May 15.

Batavia, N. Y.—Bids are being received for the construction of two miles of 10- to 20-in. storm sewers. Robert L. Fox is City Engr.

Brooklyn, N. Y.—(Official)—The following bids were received by the President of the Borough of Brooklyn, Borough Hall, May 21, for the construction of sewers in various streets: Hopkinson Ave., from Riverdale Ave. to Lott Ave., Murphy Bros., $4999; John C. Schrade, $5011; F. A. Felegrino Construction Co., $5001; Frank Merindino, $5260; A. B. Nichols, Inc., $5320; Culp Co., Inc., $5348; Joseph Jennings, $5380; Angelo Paino, $5439; James Glen, $6217; Tony Lapadula, $6515. Eighth Ave., from 62nd St. to 66th St., Eusebio Ghelardi, $8040; Albert F. Koch, Inc., $8068; Frank Merindino, Inc., $8496; F. A. Pellegrino Construction Co., $8671; Murphy Bros., $8134; Culp Co., Inc., $9007; Raphael Razzaro, $9066; Carmine Carrabura, $9635; Joseph Jennings, $9739. Livonia Ave., from Ames St. to Douglass St., Albert F. Koch, Inc., $10,020; Murphy Bros., $10,541; Eusebio Ghelardi, $10,571; Frank Merindino, Inc., $10,650; Angelo Paino, $10,775; Joseph Jennings, $10,891; James G. Gorman, $11,142; John C. Schrade, Inc., $11,271; A. B. Nichols, Inc., $11,469; Culp Co., Inc., $11,719; James Glen, $11,848. Alfred E. Steers is Pres. Noted May 15.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 4, by the President of the Borough of Brooklyn, Borough Hall, for furnishing all the labor and material required for constructing a sewer in E. 17th St. from Ave. M to Ave. N; for furnishing all the labor and material required for constructing a sewer in Erasmus St., between Rogers Ave. and Prospect St., and an outlet sewer in Erasmus St., between Prospect St. and Bedford Ave. Alfred E. Steers is Pres.

Buffalo, N. Y.—(Official)—Bids will be received by M. W. Simson, City Clk., until 8 p.m., June 9, for constructing sewers in Fillmore Ave., Cleveland Ave. and Edward St., according to specifications on file at the office of the City Clerk.

✚**Dunkirk, N. Y.**—A contract to construct sewers in Howard and Lucas Aves. has been awarded to P. GOGGIN, Fredonia, N. Y., at approximately $10,000.

Herkimer, N. Y.—The City Commission has retained Taney & Wood, Consult. Engrs., to prepare plans for a sewage-disposal plant. The plans will be completed by June 1, and submitted to the State Board of Health.

New York, N. Y.—(Borough The Bronx)—(Official)—Bids will be received until 10:30 a.m., June 4, by the President Boro. the Bronx, Municipal Bldg., Third Ave. and 177th St., for constructing a sewer and appurtenances in Montery Ave., between East 178th and East 179th Sts. Cyrus C. Miller is Pres.

★**Schenectady, N. Y.**—(Official)—Bids will be received by the Board of Contract and Supply until 2:30 p.m., June 11, for constructing a sanitary intercepting sewer from Nott St. to the site of the sewage disposal plant. The contract includes the following: Rectangular sewer, Type A, 8050 lin.ft.; rectangular sewer, Type B, 100 lin.ft.; manholes, 25; rock excavation, 300 cu.yd.; lumber for footings and sheathing, 45,000 B.M. Fred E. Johnson is Secy.

★(Official)—Bids will be received by the Board of Contract and Supply until 2:30 p.m., June 18, for constructing a sewage disposal plant. Fred E. Johnson is Secy., and W. Thomas Wooley, City Engr. Noted Oct. 31.

★**Watervliet, N. Y.**—(Official)—Bids will be received by the Storm Sewer Commission, 1555 Broadway, Watervliet, until 2 p.m., June 10, for completing an earth-filled dam and a concrete dam across Dry River, with overflow and outlet works, concrete and brick conduits and storm drains. The work will consist of approximately 65,000 cu.yd. of earth fill, concrete overflow and outlet works, concrete dam about 28 ft. high at spillway elevation, together with 6000 lin.ft. of concrete conduit, from 6 ft. to 8 ft. 6 in. diameter, and 1000 ft. of terra cotta sewer pipe. Plans and specifications are on file at the office of Solomon, Norcross & Keis, Consult. Engrs., Atlanta, Ga., and at the office of "Engineering News," 505 Pearl St., New York.

★**Newark, N. J.**—(Official)—Bids will be received by the Passaic Valley Sewerage Commission until 2 p.m., July 15, for constructing Section 1 of the Passaic Valley sewer to New York Bay, off Robbins Reef, N. J. The contract involves the following: Furnishing and placing, in trenches dredged below the bed of New York Bay, two lines of 96-in. reinforced-concrete pipes, 3000 lin.ft.; furnishing and placing, in trenches dredged below the bed of New York Bay, reinforced-concrete pipes, with horizontal and vertical branches, having diameters ranging from 24 to 96 in., 1500 lin.ft.; furnishing and placing riprap, of ½- to 3-ton stones, in trenches, for 24- to 96-in. reinforced-concrete pipes and branches, 30,000 tons; rock excavation, in dredged trenches, 100 cu.yd.

Paterson, N. J.—Bids will be received by the Board of Public Works until 4 p.m., June 3, for constructing sewers in various streets, according to plans prepared by the City Engineer. T. S. Standeven is Clk.

★**Plainfield, N. J.**—(Official)—Bids will be received by the Common Council until 8 p.m., June 16, for constructing sanitary sewers as follows: 6160 ft. 8-in. vitrified pipe sewer, 6 to 12 ft. deep; 1340 ft. 10-in. vitrified pipe sewer, 6 to 8 ft. deep; 400 ft. 8-in. cast-iron sewer, 6 to 10 ft. deep, 22 manholes, 4 flush tanks; branches, etc. James T. MacMurray is City Clk.

Reading, Penn.—(Official)—Bids will be received at the office of the City Clerk until 2 p.m., June 4, for constructing two concrete storm sewers, known as the West Elm St. Relief Sewer, and the North Sixth and Third St. Sewer and branches. Edmund B. Ulrich is City Engr.

Huntington, W. Va.—Bids will be received by the City Commissioners until June 12, for constructing trunk and lateral sewers in Seventh St. and several alleys. A. B. Maupin is City Engr. Noted May 15.

Parkersburg, W. Va.—See item under Streets and Roads.

Hamlet, N. C.—(Official)—Bids are being received here for the purchase of $15,000 of sewer improvement bonds. L. R. Terry is City Clk. Noted May 22.

Cordele, Ga.—Bids will be received by the Bond Commission until May 29, for constructing about 9000 ft. of 8-in. sewers, with manholes and flush tanks. Arthur Pew, Temple Court Bldg., Atlanta, is Consult. Engr.

Jacksonville, Fla.—Twombley & Henney, Consult. Engrs., New York, are completing plans for a sewer system. The plans will probably be submitted to the Board of Public Works about June 1, and bids asked soon after that date.

✚**Louisville, Ky.**—(Official)—Three contracts for constructing sewers here have been awarded to L. R. FIGG & CO., Louisville, at $7654, $19,249 and $13,191, respectively. Noted May 15.

Bowling Green, Ohio—Bids will be received by the Director of Public Service until June 6, for the construction of Sewer District No. 4.

Canton, Ohio—The City Council has accepted the plans for a sewage disposal plant as prepared by F. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, and has selected the Moser tract as the site of the new plant. Noted Mar. 6.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 4, for constructing main and lateral sewers in Bishop St. and other streets.

Dayton, Ohio—Bids are being received by the City Council for repairing sewers damaged by the recent flood. The work is estimated to cost $20,000.

✚**Marysville, Ohio**—The City Council has awarded the contract for the installation of a sanitary sewer system to WILLIAM H. GRAHAM, Columbus, Ohio, at $59,932. The contract for the construction of a disposal plant was awarded to FRANK MILLIGAN, Bellefontaine, Ohio, and WILLIAM EPPS, Marysville, at $42,054. Bids were opened May 20. Noted May 15.

✚**Boonville, Ind.**—(Official)—The contract to construct a sewer system on the North Side has been awarded to the JULIUS KELLER CONSTRUCTION CO., Indianapolis, Ind., at $74,616. The other bids were: Stinchfield, Reichert & Sanders, $75,893; J. H. Cahill, $75,113; John L. Newman, $75,353; H. G. Roetzle & Co., $78,658. Bids were opened by William A. Schafer, City Clk., May 20. Noted May 15.

Geneva, Ind.—John T. Gillig, Deputy Surv., has completed plans and profiles for the construction of a sewer system for the town.

★✚**Knox, Ind.**—The contract to construct a sewer system here has been awarded to V. GRAZIANO, Knox, at $18,220. Bids were opened by the Town Clerk, May 8. Noted May 1.

✚**Hillsboro, Ill.**—(Official)—The contract to construct a sewer system in Sewer District No. 1 has been awarded to A. M. LANYON, Waukegan, Ill., at $35,540. Bids were opened May 16. Noted May 15.

Kinkaid, Ill.—According to press reports, bids will be received by the Pawnee Construction Co. at the office of Alvord & Burdick, Hartford Bldg., Chicago, until June 1 [illegible]

constructing about 4½ miles of sanitary sewers, 8- to 15-in. diameter, and about 60,000 cu.yd. of grading.

Stockton, Ill.—See item under Water Supply—Irrigation.

+Boscobel, Wis.—The contract to construct sewers here has been awarded to C. H. PHILLIPS, Madison, Wis., at $15,-219. W. G. Kirchoffer, Madison, Wis., is Consult. Engr.

Racine, Wis.—Plans for a sewage purification plant to be built for the county have been completed by W. S. Schield, Sanitary Engr., Chicago, Ill. The plant will take care of the sewage from the Racine County Insane Asylum and the Sunny Rest Sanitorium, and after leaving the filter beds the water will empty into a natural stream and finally pass into Lake Michigan. Cost, $15,000. Noted May 8.

West Allis, Wis.—The Board of Public Works has opened bids for storm sewers in parts of Summit, 63d, 64th, 65th and 71st Aves., Elm and Burnham Sts., and Cuppel Place. L. W. Schruth was lowest on the greater part of the work with the following: Section A, concrete sewer, $4.37 per lin.ft.; Section B, concrete sewer, $3.50 per lin.ft.; 24-in. clay pipe, $1.35; 18-in., 87c.; 15-in., 75c.; 12-in., 65c.; brick manholes, $32.50; concrete manholes, $32.50; wood box inlets, $5.50; concrete in place, $6.

Des Moines, Iowa—It is proposed to construct a sewer along the tracks of the Des Moines Union R.R. to Walnut Creek, to serve Walnut Junction. Estimated cost, $100,000.

Eldora, Iowa—(Official)—Bids will be received by L. J. Stout, City Clk., until June 9, for constructing two miles of 8- to 15-in. sewers, and one mile of 4-in. water mains. Estimated cost, $20,000. S. B. Gardner is City Clk.

+Duluth, Minn.—A contract to construct sewers in Billings Park has been awarded to S. A. RICHES, Duluth, at $22,706. The other bids were: Russell Construction Co., $27,500; Peterson & Holm, $24,892; Pastoret Construction Co., vitrified pipe, $23,989; part vitrified pipe and part clay blocks, $22,991.

Valley Falls, Kan.—Bids will probably soon be asked for installing a sewer system here, according to plans prepared by Worley & Black, Consult. Engrs., Reliance Bldg., Kansas City, Mo. Estimated cost, $60,000. Noted Mar. 20

Norfolk, Neb.—(Official)—Bids will be received by P. F. Stafford, City Clk., until 5 p.m., May 29, for constructing sanitary sewers in Districts 35 and 36. Plans and specifications may be obtained at teh office of the City Engineer.

Sioux Falls, S. D.—(Official)—Plans and specifications are on file at the office of S. B Howe, City Engr., for constructing sanitary sewers in various streets. George W. Burnside is Mayor.

+Minot, N. D.—(Official)—The contract to construct one mile of storm sewer here, for which bids were opened May 19, has been awarded to GEORGE W. KEMPER, Minot, at $16,800. E. J. Thomas is City Engr.

+Butte, Mont.—(Official)—The contract to construct a reinforced-concrete storm sewer in Second Gulch, has been awarded to the BUTTE CONSTRUCTION CO., Butte, at $6392. Bids were opened May 7. Noted May 1.

+Kennett, Mo.—The contract to construct a sewer system here has been awarded to the KATZ CONSTRUCTION CO., Omaha, Neb., at $35,204. Bids were opened Apr. 30. Noted Apr. 13. See also item under Water Supply—Irrigation.

Brinkley, Ark.—Bids will be received by the Board of Commissioners, District No. 1, until June 19, for constructing about seven miles of 8- to 12-in. pipe sewers, 42 manholes, 32 flush tanks and a sewage disposal plant. E. Chaney is Chn.

Conway, Ark.—According to press reports, bids will be received by the Commissioners of the Conway Sewer Improvement District until June 5, for constructing a sewer system estimated to cost $45,000. Noted May 22.

Hamilton, Tex.—Preparations are being made for constructing a municipal sewer system here.

Temple, Tex.—(Official)—Bids will be received by the City Council until 5 p.m., June 10, for the purchase of $75,000 sewer bonds. W. E. Dozier is City Engr. Noted May 8.

+Caddo, Okla.—(Official)—The contract to construct a sewer system here has been awarded to the J. S. TERRY CONSTRUCTION CO., Poteau, Okla., at $28,017. Bids were opened May 15. J. E. Davis is City Engr. Noted May 8.

Cotton, Idaho—Surveys have been made for a complete sewer system here, to comprise about 3½ miles of sewers, and a sewage disposal plant. Estimated cvost, $20,000.

Kellogg, Idaho—The City Council has called an election for June 16, to vote on a bond issue of $30,000, for a sewer system. Robert Sterling is City Engr. Noted Jan. 30.

Arlington, Wash.—Bids will be asked by the City Council in June or July for the installation of a sewer system according to plans prepared by J. W. Morris, Consult. Engr., Yeon Bldg., Portland, Ore. The system will include about 8000 ft. of 8- to 36-in. pipe sewers, and is estimated to cost $25,000. Noted May 15.

Colville, Wash—The City Council is considering a proposition to install sewers in the district east of Main St. Estimated cost, $30,000.

Garfield, Wash—Bids will probably soon be asked for the construction of a trunk sewer and a sewage disposal plant here. Estimated cost, $14,350. Noted May 8.

North Yakima, Wash.—An election has been called for July 8 to vote on a bond issue of $240,000, for the installation of a sewer system. N. A. Gilman is City Engr. Noted Mar. 20.

+Sumner, Wash.—(Official)—The contract to construct a trunk sewer in Local Improvement District No. 8 has been awarded to the WASHINGTON PAVING CO., Tacoma, Wash., at $11,054. The other bids were: Albert Mead and C. S. Waters, Puyallup, $11,123; E. M. More, Tacoma, $10,743; McKim, Cline & Addison, Puyallup, $11,375; P. M. Overstreet, Seattle, $12,665; Fiasco & Coluccio, Seattle, $10,728. Bids were opened May 7. Noted May 1.

Sumas, Wash.—The City Council will soon ask bids for the construction of sewers in the alleys between North Front and Cherry Sts., in Blocks 14 and 15, and in the Johnson Addition.

Portland, Ore.—The City Auditor has been authorized to advertise for bids for the construction of the Lambert Ave. district sewer system. Estimated cost, $90,000. Thomas M. Hurlburt is City Engr.

According to press reports, Thomas M. Hurlburt, City Engr., has completed plans for the construction of sewers in Rhine St. Estimated cost, $130,000.

Hermosa Beach, Calif.—The city contemplates an expenditure of $36,000, for the installation of a sewage disposal plant.

Sacramento, Calif.—According to press reports, the city contemplates an expenditure of $1,000,000 for sewer construction. M. J. Desmond is City Clk., and J. W. Gross, Ch. Deputy City Engr.

+San Diego, Calif.—A contract to construct about five miles of sewers in Brooklyn Heights and Pound Cañon has been awarded to the CALIFORNIA GLAZE PIPE CO., San Diego, at $14,741.

San José, Calif.—It is proposed to install an outfall sewer and a sewage disposal plant here, at an estimated cost of $54,000. H. B. Fisher is a member of the Sewer Com.

Stockton, Calif.—C. E. Grunsky, Consult. Engr., and W. G. Hunter, City Engr., have completed plans for the proposed new sewer system and a sewage disposal plant.

Bowmanville, Ont.—Bids will be received by John Lyle, Town Clk., until May 30, for the construction of a sewage disposal plant. Chipman & Powers, Toronto, are Consult. Engrs.

★+Hamilton, Ont.—The West End sewage disposal plant, for which bids were opened May 6, will be built by day labor, under the supervision of A. F. Macullum, City Engr. Estimated cost, $62,000. Noted May 1.

Welland, Ont.—(Official)—Bids will be received by C. M Webber, Town Clk., until noon, June 2, for constructing sewers in various streets. James Hughes is Chn. Sewerage Com.

Edmonds, B. C.—The City Council has instructed the City Engineer to prepare plans for a sewer system to include Edmonds, East Burnaby and North Burnaby.

Esquimalt, B. C.—The Municipal Council is examining topographical maps which have been prepared for the installation of a sewer system here, estimated to cost $500,000.

STREETS AND ROADS

+Athol, Mass.—(Official)—The contract for paving in Main and School Sts. has been awarded to HUDSON CONSTRUCTION CO., Melrose, Mass., at $44,490. Erroneously noted May 15 that all bids were rejected.

+Boston, Mass.—(Official)—The State Highway Commission has awarded contracts to SNOW & FARRINGTON, Wrentham, Mass., at $4985 for improving a road in Wrentham; to CORDNER & MONTAGUE, Springfield, Mass., at $4017 for a road in Wilbraham and to T. A. MOYNIHAN & CO., South Hamilton, Mass., at $3338 for a road in Wenham. Arthur W. Dean is Ch. Engr. Noted May 15.

+The contract for paving Sleeper St., South Boston, was awarded to JOHN E. QUINN at $9037. Other bids were: Boston Paving Co., $9376, Northern Construction Co., $9397; Peter W. Hill, $10,021. L. K. Rourke is Comr. Pub. Wks.

+The contract for the construction of a macadam roadway in Whitefield St., Dorchester, was awarded to the WM. J. LIFFERTY CO., at $4637. Other bids were: J. J. McCarthy Co., $4663; Jas. Doherty, $4886; Boston Paving Co., $5312.

+The contract for the construction of bitulithic pavement on Washington St., Brighton, was awarded to the WARREN BROS. CO., at $24,585. Its bid for asphalt was $24,768. Other bids were: Boston Paving Co., asphalt, $25,-221, bitulithic, $24,977; Jas. Doherty, $25,814 for asphalt, $25,-631 for bitulithic. Noted May 8.

Bids will be received until June 2, for asphalt, macadam and bitulithic pavements, in Spring St., City Proper, Dennis St., Roxbury, and Center, Cliftondale and South Sts. and Walnut Ave., West Roxbury.

Bids will be received until June 3, by the Transit Committee, for repaving 6000 sq.yd. with asphalt or bitulithic in Boylston St. E. E. Davis, 15 Beacon St., is Chief Engr..

(Official)—Bids will be received until noon, June 3, by the State Highway Commission for the construction of 7300 lin.ft. of road in the town of Sandwich. William D. Sohier is Comr.

Cambridge, Mass.—Bids will be received until 10 a.m., May 31, by the Commissioners of Middlesex County, for the construction of a road from Chelmsford to Westford. L. S. Gould is Chn. of Comrs.

+Chicopee, Mass.—(Official)—A contract was awarded to the UNITED STATES WOOD PRESERVING CO. at $8652 for paving the roadway of the Chicopee and West Springfield Bridge with wood block under 3-in. plank. John A. Houlihan is Clk. of the Highway Dept.

Woonsocket, R. I.—(Official)—Bids will be received until 4 p.m., June 4, by the Committee on Streets and Bridges, for paving Bermon St. with stone block on concrete foundation. Frank H. Mills is City Engr.

Hartford, Conn.—Bids will be received by the State Highway Commission until 2 p.m., May 29, for the construction of about 2775 lin.ft. macadam road in the town of Haddam. Plans and specifications may be seen at the residence of E. F. Arnold, First Selectman.

New Haven, Conn.—(Official)—All bids received for paving sections of Chapel, College and Sachem Sts. and Congress Ave. were rejected, and the work will be readvertised. F. L. Ford is City Engr. Noted May 22

★(Official)—Bids will be received until 11 a.m., June 2, by the City Engineer, for paving portions of Congress Ave., College, Sachem and Norton Sts. About 29,000 sq.yd. will be required, and bids on various standard material will be accepted.

Bids will be received until 11 a.m. June 9, by the City Engineer for paving portions of Atwater, Canner, Cold Spring, Dewitt, Elm, Mansfield, Orange and South Front Sts., Edgehill Road, Prospect Place and Edgewood, Greenwich and Winchester Aves. F. L. Ford is Engr.

✦Batavia, N. Y.—The Board of Aldermen has awarded a contract to LOUIS GRIPP, Buffalo, N. Y., at $19,930, for paving Summit St. with bessemer brick. George N. Southworth is City Clk. Noted May 1.

Brooklyn, N. Y.—(Official)—The following are the low bids received by the President of the Borough of Brooklyn, May 21, for paving various streets: For paving Beverly Road, from Nostrand Ave. to Rogers Ave., with asphalt, the Cranford Co., at $7595; for paving East 13th St., from Ave. J to Ave. K, with asphalt, the Cranford Co., at $5329; for paving Hendrix St., from New Lots Ave. to Vienna Ave., Freeman Hess Co., at $5332; for grading, curbing and sidewalking Lincoln Road, from Nostrand Ave. to a point about 500 ft. easterly, and on East New York Ave., from a point 500 ft. easterly of Nostrand Ave. to Utica Ave., Castle Bros., at $12,197. Alfred E. Steers is Pres.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 4, by the President of the Borough of Brooklyn, Borough Hall, for regulating and paving with preliminary asphalt pavement on a 5-in. concrete foundation the roadway of Ames St., from Sutter Ave. to Blake Ave.; for regulating, grading, curbing and laying sidewalks on Bay 36th St., from 86th St. to Cropsey Ave.; for regulating, grading, curbing and laying sidewalks on Chester St., from Riverdale Ave. to Hegeman Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of Douglass St., from Sutter Ave. to Blake Ave.; for regulating, grading, curbing and laying sidewalks on E. 14th St., from Ave. U to Ave. V; for regulating, grading, curbing and laying sidewalks on E. 35th St., from Linden Ave. to Church Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of Ave I, from Ocean Ave. to the Long Island R.R.; for regulating, grading, curbing and laying sidewalks on Ave. J, from E. 40th St. to Brooklyn Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation the roadway of Ave. I, from E. 40th St. to Brooklyn Ave.; for regulating and paving with preliminary asphalt pavement on a 6-in. concrete foundation the roadway of Ave. L, from E. 19th St. to Ocean Ave.; for regulating, grading, curbing and laying sidewalks on N. 15th St., from Banker St. to Nassau Ave.; for regulating and paving with preliminary asphalt pavement on a 4-in. concrete foundation, the roadway of Riverdale Ave., from Rockaway Ave. to Junius St.; for regulating and paving with permanent asphalt pavement on a 6-in. concrete foundation the roadway of Rockaway Ave., from Riverdale Ave. to Lott Ave.; for regulating, paving and repaving with permanent asphalt pavement on a 6-in. concrete foundation the roadway of W. 17th St., from Surf Ave. to Neptune Ave.; for regulating and paving with permanent grade 1 granite pavement on a 6-in. concrete foundation the roadway of W. 17th St., from Neptune Ave. to Coney Island Creek; for regulating and paving with permanent asphalt pavement on a 6-in. concrete foundation the roadway of 5th Ave., from 65th St. to Bay Ridge Ave.; for regulating and repaving with permanent grade 1 granite pavement on a 6-in. concrete foundation the roadway of 5th Ave., from 39th St. to 60th St. Alfred E. Steers is Pres.

Buffalo, N. Y.—(Official)—Bids are being received by the Commissioner of Public Works for paving Roma Ave. with brick at an estimated cost of $13,510, and for block stone paving on Hamburgh Turnpike at an estimated cost of $17,399. Francis G. Ward is Comr.

Hornell, N. Y.—The Board of Public Works has passed resolutions authorizing the paving of Hornell, Church, Collier, Jaynes and West Sts. Bids will soon be asked.

★Newburgh, N. Y.—(Official)—Bids will be received until 5 p.m., June 10, by the City Council, for paving two sections of Liberty St., the first section, from Broadway to South St., will require about 10,800 sq.yd. paving and 4750 lin.ft. curbing. The second section will require about 14,650 sq.yd., including the street railway, or 11,300 sq.yd. pavement without the street-railway tracks and 7130 lin.ft. curbing. William J. Blake, Jr., is City Engr. D. J. Coutant is City Clk.

New York, N. Y.—Bids will be received until 3 p.m., June 5, by the Dept. of Parks, Fifth Ave. and 64th St., for paving where required, with bituminous pavement, the west drive of Central Park, from 110th St. and Eighth Ave. southerly to 102d St., and from the Webster monumeut southerly to 59th St. and Fifth Ave. Charles B. Stover is Pres.

✦New York, N. Y.—(Official)—The President of the Borough of Manhattan has awarded the following contracts for paving in various streets: To the SICILIAN ASPHALT PAVING CO., for paving 43rd St., from Sixth to Eighth Aves., with asphalt, at $16,574; to the ASPHALT CONSTRUCTION CO., at $20,690, for paving 56th St. from Ave. A to Third Ave., with asphalt; for paving 64th St., from Ave. A to First Ave., and from Second Ave. to Third Ave., with asphalt ,at $13,893; to WILLIAM J. FITZGERALD, at $9166, for paving Barrow St., from Hudson St. to Washington St., with granite; for regulating, paving and curbing 215th St., from Park Terrace to Indian Road, to WILLIAM D. MENNA CONSTRUCTION CO., at $12,188; Freeman Hess Co. was low bidder at $17,351, for paving Broome St., from Broadway to West Broadway, with granite, and at $24,644, for paving Ave. A, from 54th to 57th Sts., with granite. Bids were received on May 20. George McAneny is Pres.

✦(Borough of Richmond)—(Official)—The President of the Borough of Richmond has awarded the following contracts from bids received on May 21: To CORNELIUS VANDERBILT, West New Brighton, S. I., N. Y., at $18,167, for repaving, with vitrified brick, the roadway of Jewett Ave., from the Boulevard to Richmond Turnpike; to JOSEPH JOHNSON'S SONS, West New Brighton, S. I., N. Y., at $12,657, for repaving, with granite block, the roadway of Richmond Terrace, from Bodine St. to the S. I. R. T. George Cromwell is Pres.

New York, N. Y.—(Borough The Bronx)—(Official)—Bids will be received until 10:30 a.m. June 4, by the President of the Borough of The Bronx, Municipal Bldg., Third Ave. and 177th St., for paving and repaving with sheet asphalt on a concrete foundation the roadway of Beck St., from Leggett Ave. to Longwood Ave.; repaving with sheet asphalt on a concrete foundation the roadway of Kelly St., from East 156th St. to Longwood Ave.; East 156th St., from Kelly St. to Beck St., and setting curb where necessary, together with all work incidental thereto. (Sheet asphalt pavement.) (Permanent pavement.) For repaving with sheet asphalt on a concrete foundation the roadway of Boston Road, from East 165th St. to Jefferson St.; East 169th St., from Boston Road to Franklin Ave. and setting curb where necessary, together with all work incidental thereto. (Sheet asphalt pavement.) For paving with bituminous concrete on a cement concrete foundation the roadway of Morris Ave., from East 166th St. to East 170th St.; adjusting curb where necessary, together with all work incidental thereto. (Preliminary pavement.) For repaving with redressed granite blocks on a concrete foundation the roadway of East 169th St., from Boston Road to Southern Boulevard, and setting curb where necessary, together with all work incidental thereto. For repaving with sheet asphalt on a concrete foundation the roadway of Boston Road, from Prospect Ave. to the Southern Boulevard, and setting curb where necessary, together with all work incidental thereto. For repaving with redressed granite blocks on a concrete foundation the roadway of East 166th St., from Cauldwell Ave. to Dawson St., and setting curb where necessary, together with all work incidental thereto. For repaving with granite blocks on a concrete foundation the roadway of Webster Ave., from Gun Hill Road to the north side of 233d St., and setting curb where necessary, together with all work incidental thereto. For repaving with redressed granite blocks on a concrete foundation the roadway of Tremont Ave., from Third Ave. to Boston Road, and setting curb where necessary, together with all work incidental thereto. For regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in Beach Ave., from Gleason Ave. to Walker Ave., together with all work incidental thereto. For regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in Storrow St., from Public Place at 177th St. and Westchester Ave. to Unionport Road, together with all work incidental thereto. For regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in Gray St., from Tremont Ave. to Unionport Road, together with all work incidental thereto. For regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in East 187th St., from Valentine Ave. to Marion Ave., and building steps and appurtenances where necessary, together with all work incidental thereto. Cyrus C. Miller is Pres.

★Poughkeepsie, N. Y.—(Official)—Bids will be received until 4:30 p.m., June 5, by the Board of Public Works for about 14,000 sq.yd. vitrified brick pavement, 5200 lin.ft. new bluestone curb, and 2000 lin.ft. curb reset. R. J. Shields is Clk. of the Bd.

★Sidney, N. Y.—(Official)—Bids will be received until 8 p.m., June 11, by the Village Council, for about 3620 sq.yd. brick pavement and 2420 lin.ft. concrete or stone curb. E. F. Musson, Norwich, N. Y., is Engr.-in-Charge. Wm. Thorp is Clk. Noted May 15.

Troy, N. Y.—(Official)—The Board of Contract and Supply received bids as follows, for repaving River St., from Ferry to Adams Sts.: Edward Walsh, $20,856, $23,424 and $23,266 respectively for vitrified brick, granite block and wood-block pavement; John H. Gleason, $23,653 for granite block, the Martin Murray Co., $23,984 for granite block, the Parker-Hassam Paving Co., $24,714 for granite block, the Union Paving Co., $16,520 for sheet asphalt. James M. Riley is Secy. of the Bd.

Hackensack, N. J.—(Official)—Bids will be received until 12:30 p.m., June 2, by the Road Committee of the Board of Chosen Freeholders of Bergen County for resurfacing the Franklin Turnpike between Ramsey and Mahwah. M. J. Ford is Chn. of Rd. Com.

Hoboken, N. J.—The Common Council has adopted resolutions providing for the improvement of the following streets, and for which the City Surveyor is preparing plans and specifications: Willow Ave., Clinton St., Grand St., Monroe St., Jefferson St. and Jackson St. James H. Londrigan is City Clk.

Jersey City, N. J.—The Board of Freeholders has authorized the issuance of $60,000 bonds for improving the Newark Plank Road, and $35,000 for work on the Bridge St. bridge over the Passaic River.

Madison, N. J.—The Common Council has rejected all bids recently received, and has instructed the Road Committee to advertise for new bids for macadamizing Loantaka Way, and a part of the Green Village Road.

★✦Merchantville, N. J.—(Official)—The Borough Council has awarded the contract for various street improvements to the KELLY & McFEELY CO., Camden, N. J., at $96,121. J. C. Remington, Jr., is City Engr. W. F. McAllister is Boro. Clk. Noted May 15.

✦Ridgefield Park, N. J.—(Official)—The Board of Village Commissioners has awarded a contract for improving a portion of Christie St. to A. W. GILL, Leonia, N. J., at approximately $12,000. The other bidders were: Alfred Price, Ridgefield Park, N. J., about $12,000, and the Clinton Contracting Co., West Hoboken, N. J., at approximately $15,000. R. Schweizer, Jr., is Village Engr. M. D. Starker is Clk. Noted May 8.

South Amboy, N. J.—(Official)—Bids will be received until 8:30 p.m., June 10, by the City Council for paving Stevens Ave. with vitrified brick from Bordentown Ave. to Main St. Richard M. Mack is City Clerk.

Trenton, N. J.—The County Engineer has completed plans and specifications for the proposed new Windsor-Newton

Road, and has submitted same to the Board of County Freeholders for approval, and authority to call for bids. The road will be about seven miles long, extending to the Burlington County line. The estimated cost is about $50,000.

The Board of City Commissioners has instructed the City Clerk to advertise for bids for paving the following streets: Asbury St. (bituminous concrete or vitrified block), Ashmore Ave. (bituminous concrete or sheet asphalt), Atterbury Ave. (bituminous concrete), Division St. (bituminous concrete or sheet asphalt), Evans Ave. (bituminous concrete), South Hermitage Ave. (bituminous concrete or sheet asphalt), Hill's Alley, Howell's Alley and Quarry St. (all monolithic concrete), Peace St. (vitrified block), Riverside Ave. (bituminous concrete) and Sherman Ave. (vitrified brick). A. Swan, Jr., is City Engr.

(Official)—Bids will be received until 2:30 p.m., June 4, by the City Commission for approximately 31,000 sq.yd. pavement of standard varieties in various streets and alleys. Frank Thompson is City Clk. Noted May 8.

☆**Allentown, Penn.**—(Official)—Bids will be received until 5 p.m., June 3, by the Mayor for paving various streets, contract to be awarded in two sections, one of about 27,250 sq.yd. and the other of 34,000 sq.yd. Bids will be accepted on any standard material. Chas. D. Weirbach is City Engr. Chas. W. Rinn is Mayor.

Cornopolis, Penn.—(Official)—The Borough Council has passed ordinances authorizing the paving of sections of Fleming and Main Sts., Fifth and Bridge Aves. Bids will asked for the work at once.

✚**Ellwood City, Penn.**—The Borough Council has awarded the contract for paving Fourth St. from Lawrence to Division Ave., to ALBERT DAHL at $11,235. There were four other bidders.

Meadville, Penn.—(Official)—Bids will be received about July 1 for paving, curbing and storm sewers on parts of 12 different streets. The estimated cost is $200,000. B. F. Miller, Jr., is City Engr. F. C. Kiebort is City Clk. Noted May 15.

✚**Uniontown, Penn.**—(Official)—The contract for the construction of a road in Redstone Township was awarded to JOHN AUSTIN, Brownsville, Penn., and for constructing a road in Luzern Township to HOBLETZEL & PRICE, Meyersdale, penn.

All bids for the construction of a road in Jefferson Township were rejected, and new bids will be received by the County Controller until noon, June 12. Bids will also be received at the same time for 7.5 miles of brick paving in German Township, and for construction of one mile of bituminous-mixture road in Redstone Township. Thomas H. Hudson is County Solicitor. Noted May 8.

Washington, Penn.—(Official)—Bids will be received until 11 a.m., June 9, by the County Controller, for improving sections of the following county roads: about 1.4 miles of the Finleyville-Thomas Road, 1.4 miles of the Cecil-Venice Road, one mile of the Hill Church Eighty-Four Road, 1.2 miles of the Pike Run Road Extension, 1.5 miles of the Canonsburg-Thomas Road, 1.5 miles of the Westland Road, one mile of the Claysville-Burnsville Road, two miles of the Beallsville-Fredericktown Road, about 600 lin.ft. of the West Alexander-Burnsville Road, and 2.2 miles of the Donora-Eldora Road.

Bids will be received until noon, June 9, by the County Controller for furnishing vitrified brick or block for paving the above named roads. John H. Moffitt is County Controller. Chaney & Armstrong are County Engrs.

✚**Wilkes-Barre, Penn.**—The Board of Commissioners of Luzerne County has awarded the contract for constructing Sect. 2 of the Freeland-Fairview Road to the FREELAND CONSTRUCTION CO., at $62,025.

Baltimore, Md.—Bids will be received until June 4 by the Board of Awards, for the improvement of various streets under Contracts Nos. 115 and 119. The first includes about 3200 sq.yd. bituminous concrete paving, and the second is for 2800 sq.yd. vitrified block. Eugene E. Grannan is Pres. St. Comrs.

✚A contract has been awarded by the Board of Awards to PENN-MAR CONSTRUCTION CO., 612 Union Trust Bldg., for contract 108, at $24,999; to the same company, Contract 111, $12,930; EASTERN PAVING CO., Contract 110, $13,192. Noted May 15.

Washington, D. C.—(Official)—Bids were received as follows, May 26, by the Commissioners of the District of Columbia, for laying asphalt pavements, etc., in the District for the fiscal year ending June 30, 1914: (a) Eastern Paving Co., Philadelphia, Penn.; (b) Cranford Paving Co., Washington, D. C.; (c) Washington Asphalt Block & Paving Co., Washington, D. C. Laying asphalt pavement, 2½-in. surface, 2-in. binder before compression, 6-in. concrete base: (1) Pitch lake asphalt, (b) $1.77; (2) any asphalt conforming to specifications, (a) $1.76; (b) $1.69; vitrified brick, 6-in. concrete base, (a) $1.36; (b) $1.37; bituminous concrete paving, 6-in. concrete base, (a) $1.66; (b) $1.64; bituminous concrete paving, broken stone base, (a) 97c.; (b) 97c.; 2-in. asphalt block pavement, 6-in. concrete base, (c) $1.79. C. H. Rudolph is a Comr. Noted May 15.

Chestertown, Md.—Bids will be received until June 3 by the Commissioners of Kent County for building about 4.14 miles of state highway between Betterton and Still Pond. Plans and specifications on file at office of State Roads Commission, 534 North Howard St., Baltimore. Charles D. Woods, Chestertown, is Pres. of Comrs.

Huntington, W. Va.—Bids will be received until June 12, by the Board of Commissioners, for paving portions of Main and 16th St. and various alleys with vitrified brick. L. A. Pollock is Comr. of Sts. A. E. Maupin is City Engr.

Parkersburg, W. Va.—(Official) Bids will be received on or about July 1 by the City Council for paving streets and sewer construction at an estimated cost of $200,000. B. F. Stewart, Jr., is City Engr. Noted May 22.

✚**Montgomery, Ala.**—(Official)—The Board of Revenue of Montgomery County has awarded a contract to J. F. GIDDENS, Kent, Ala., for improving about six miles of the Banner-Grady Road. T. H. Edwards is County Engr. Noted May 1.

Meridian, Miss.—Bids will be received until June 3, by the Good Roads Commission, Dist. No. 1, Lauderdale County, for the construction of various county roads, about 37.22 miles in all. Bids will be accepted for either sand-clay and gravel or novaculite surfacing. C. C. Dunn is Chn. of Com.

Winona, Miss.—Bids will be received until June 2, by the Road Commissioners of Montgomery County, for constructing about 70 miles of sand-clay roads. Henry Hart is Chn. of Comrs.

New Orleans, La.—(Official)—Bids will be received until noon, June 2, by the Highway Department of the Board of State Engineers for the construction of about 5.8 miles of gravel road, beginning about five miles from Shreveport, extending to Keithville, Caddo Parish. W. E. Atkinson is State Highway Engr.

✚**Bowling Green, Ky.**—(Official)—The Fiscal Court of Warren County has awarded contracts for the construction, repair and maintenance of county roads for a year to various local contractors, usually farmers living along the highways. The total cost will be from $15,000 to $20,000. M. H. Crump is Road Engr. Noted May 15.

Williamstown, Ky.—The citizens and county officers of Grant County are planning the reconstruction of the Lexington Pike, about 24 miles in length. The Fiscal Court at Williamstown will have charge of the matter.

✚**Akron, Ohio**—(Official)—The contracts for paving East Market St. were awarded to WILDER & DAVIDSON and E. M. SCHAEFFER & SON. Ira A. Priest is City Clk. Noted May 1 and 15.

✚**Ashtabula, Ohio**—(Official)—The contract for constructing about 23,653 sq.yd. of shale-block paving and 15,460 lin.ft. curbing on Lake St. has been awarded to T. P. FITZGERALD, 304 Main St., Ashtabula, Ohio. M. H. Turner is Dir. of Pub. Ser. Noted May 8.

Chillicothe, Ohio—(Official)—Bids will be received until noon, June 12, by the Director of Public Service for refilling with gravel portions of Sugar, Ewing and Hickory Sts. Edward L. Albright is Dir.

Cincinnati, Ohio—(Official)—Bids will be received until noon, June 4, by the Director of Public Service, for improving Martha St., from Kirby to Badgley Aves., and Elberon Ave., from State to Purcell Aves. V. T. Price is Dir. M. J. Keefe is Secy.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., June 6, by the State Highway Commissioner, for the following road improvements: Six miles of the Piqua-Urbana Extension No. 1 Road, to be graded and paved with waterbound macadam and concrete at an estimated cost of $7779; for grading and paving with brick 1.89 miles of the Athens-Logan Road at an estimated cost of $26,267; for grading and paving with waterbound macadam one mile of the Urbana-West Jefferson Road, estimated cost $8960; for grading and paving with waterbound macadam 2.4 miles of the Canton-Steubenville Road, Section 1, at an estimated cost of $31,-095; for grading and paving with concrete 1.10 miles of the Scotland Station Easterly Road at an estimated cost of $14,-124. James R. Marker is Comr.

Dayton, Ohio—The Director of Public Service will soon advertise for bids for repairing the city streets damaged in the recent flood. The work is estimated to cost $100,000, for which bonds have been issued. Charles H. Hoglen is Dir.

Delaware, Ohio—Bids will be received until June 9 by the Commissioners of Delaware County for grading, draining and macadamizing about 1.26 miles of the Infirmary Road. W. F. Whittier is County Surv.

Lorain, Ohio—(Official)—Bids will be received until noon, June 5, by the Director of Public Service, for grading, draining, curbing and paving Globe Ave., from East 28th to East 31st Sts., and East 30th St., from Vine to Pearl Aves., with asphalt or vitrified brick. L. B. Johnston is Clk. to Dir.

Springfield, Ohio—Bids will be received until June 6, by the Board of Commissioners of Clark County, for the following road improvements: 1587 lin.ft. of the National Pike, about 5½ miles of the Valley Pike, 300 ft. of the Snyder and Dorner Pike and about 1.7 miles of the St. Paris Pike.

Struthers, Ohio—(Official)—Bids will be received until noon, June 16, by the Village Clerk for paving portions of Bridge St. and Poland Ave. with brick. Ira Eisenbraun is Clk.

Indiana—(Official)—Bids for road improvements in Indiana will be received as follows:

June 3, at Decatur, by the Commissioners of Adams County, for constructing gravel roads in French and Root Townships. T. H. Baltzell is Audr.

June 3, at Paoli, by the Commissioners of Orange County, for the construction of road in Orangeville Township. Ed. A. Palmer is Audr.

June 3, at Vincennes, by the Commissioners of Knox County, for the construction of gravel roads in Vincennes Township. John T. Knox is Audr.

June 3, at Wabash, by the Commissioners of Wabash County, for the construction of two roads in Noble Township. D. Showalter is Audr.

June 3, at Lebanon, by the Commissioners of Boone County, for construction of a road. D. M. Clark is Audr.

June 4, at Columbus, by the Commissioners of Bartholemew County, for a road on the line between Clifty and Hawcreek Townships. Philip J. Sater is Audr.

June 4, at Lafayette, by the Commissioners of Tippecanoe County, for the construction of a road in Wabash, Sheffield, Fairfield and Washington Townships, and one on the line between Washington and Perry Townships. George W. Baxter is Audr.

June 5, at Paoli, by the Commissioners of Orange, Crawford and Washington Townships, for the construction of a road on the line between said counties. E. A. Palmer is Audr. of Orange County.

June 5, at Frankfort, by the Commissioners of Clifton County, for the construction of 11 gravel roads. Chas. F. Cromwell is Audr.

June 13, at Corydon, by the Commissioners of Harrison County, for the construction of a road in Harrison Township. J. L. O'Bannon is Audr.

June 16, at Brazil, by the Commissioners of Clay County, for the construction of two roads in Van Buren, one in Posey and Brazil Townships. Edgar A. Staggs is Audr.

June 26, at Winchester, by the Commissioners of Randolph County, for a road on line between Randolph and Wayne Counties. H. F. Wood is Audr.

+Anderson, Ind.—(Official)—The Commissioners of Madison County have awarded contracts for gravel road construction as follows: A. B. HUFFMAN, two roads, $4050; JOHN E. MASON, two roads, $3300; MADISON CONSTRUCTION CO., five roads, $12,550; WALKER & SON, two roads, $5615; F. W. CARR, one road, $7838; UNDERWOOD & KIRKPATRICK, one road, $6900; CHESTER ROGERS, one road, $6031. Joel B. Benefiel is Audr. Noted May 1.

+Bloomington, Ind.—(Official)—The contract for brick paving on Seventh St. was awarded to BLAIR & KERR, Bloomington, at $1.96 per sq.yd. Noted May 15.

Bids will be received until June 3 by the City Council for four blocks of paving on Sixth St. Ulysses S. Hanna is City Engr.

+Crawfordsville, Ind.—(Official)—The Commissioners of Montgomery County have awarded contracts for the construction of roads in Scott and Franklin Townships to GEORGE J. MILLER, Lebanon, Ind., at $26,800 and to V. B. NOWLING, Rockville, Ind., at $10,980. M. L. Nees is County Engr. B. B. Engle is Audr.

New Albany, Ind.—The Board of Public Works has plans for the reconstruction of North State, West Main and East Market Sts. Macadam will probably be used. Chas. W. Appleby is City Engr.

+Seymour, Ind.—The City Council has awarded a contract for the construction of 10 blocks of concrete paving to DE GOLYER & MASTERS, Seymour, at $15,000.

+Duquoin, Ill.—The Board of Public Improvements has awarded the contracts for paving in Districts No. 2 and 3 to REEB BROS., Belleville, Ill., at$49 ,265 and $38,230 respectively.

Ottawa, Ill.—(Official)—Bids will be received between June 10 and 15 by the Board of Local Improvements for the construction of brick pavement and combined curb and gutter in the South Ottawa District. The estimated cost is $142,427. George L. Farnsworth is City Engr. Noted May 8.

+Waukegan, Ill.—(Official)—The Board of Local Improvements has awarded the contract for 1905 sq.yd. brick paving on County and Hickory Sts. to JAMES COPE & SONS CO., Racine, Wis., at $7228. Other bidders were: Charles Payne, Waukegan, Ill., $7253; McCugo-Bullock Co., $7441. M. J. Douthitt is City Engr. Noted May 15.

Wausau, Wis.—(Official)—The following bids were received by the City Council for 11,000 sq.yd. paving on various streets: Christ Johnson, Oshkosh, Wis., at $2.12 per sq.yd. for brick or $2.63 for creosoted block; Justenson & Howart, Wausau, $2.33 per yd. for brick; the Shutte Construction Co., Manitowoc, Wis., $2.14 per yd. for brick. The contract will probably be awarded to Mr. Johnson. B. C. Gowen is City Engr. Noted Apr. 10.

+Belle Plaine, Iowa—(Official)—Bids as follows were received by the City Council, May 19, for paving streets of Division "A": (a) sand filler, (b) concrete filler: Des Moines Asphalt Paving Co., Des Moines, Iowa, (a) $18,212, (b) $18,884; M. Tschirgi & Sons, Cedar Rapids, Iowa, (a) $19,619, (b) $20,459; J. W. TURNER IMPROVEMENT CO., Des Moines, (a) $18,096, (b) $18,688 (awarded contract). Charles P. Chase Clinton, Iowa, is Engr.-in-Charge.

+Virginia, Minn.—(Official)—The Street and Alley Committee has awarded the contract for 6051 sq.yd. of 3½-in. block pavement to the LAWRENCE-McCANN CO., at $2.63 per sq.yd., and a contract for 11,824 sq.yd. bitulithic pavement to the GENERAL CONTRACTING CO., at $2.48. E. F. Johnson is City Engr. Noted May 8.

Missoula, Mont.—(Official)—Bids will be received until June 4, by the City Clerk, for grading and paving about nine blocks of street, 19,000 sq.yd. The estimated cost is $74,122. Fred E. Buck is City Engr. W. H. Smith is City Clk. Noted May 15.

+Jefferson City, Mo.—(Official)—The contract for improving Chestnut St., from High to Atchison St., has been awarded to JOSEPH POPE, 22 West Dunklin St., Jefferson City, at $24,000. Noted May 15.

(Official)—Bids will be received until June 2, by the City Council for improving West High St., from Brooks to Maine and Miller St., from Broadway to Walnut St., and other streets. P. C. Harding is City Engr. J. Frank Morris is City Clk.

+Denver, Colo.—The Board of Public Works has awarded a contract to BEACH & DECKER at $33,357 for completion of the boulevard system connecting Montclair, Cheesman and Washington Parks. A. L. Fellows is City Engr.

Aberdeen, Wash.—(Official)—The City Council will shortly pass an ordinance and ask bids for paving M St. from Heron to Fourth St. with asphalt at an estimated cost of $16,200. Louis D. Kelsey is City Engr. P. F. Clark is City Clk.

+Ellensburg, Wash.—The Board of County Commissioners has awarded to CHAS. ANDERSON, Ellensburg, the contract for paving 11,022 sq.yd. of permanent Highway No. 2, at $23,317 for brick pavement. Other bidders were: Barber Asphalt Paving Co., Warrenite, $20,000; Xura Case, $19,850; Cascade Construction Co., asphalt macadam $11,573, concrete $16,153, sheet asphalt $20,941, brick $25,247; Chas. Anderson, concrete $15,430, sheet asphalt $21,492. Charles T. Jordan is County Engr. Noted Apr. 24.

Monroe, Wash.—The City Council has ordered the improvement of Madison St. from Main to Powell Sts., by paving with 6-in. concrete, curb, gutter, etc. Bids will soon be asked. G. F. Cook is City Clk.

Mount Vernon, Wash.—Bids are being received by the County Engineer of Skagit County for the improvement of eight roads in the county. A. L. Strong is Engr.

Renton, Wash.—Bids will be received until June 10, by the City Council for improving Cedar St. by grading, graveling and constructing gutters. Grant Bates is City Clk.

Seattle, Wash. The Board of Public Works has rejected as excessive all bids received for paving Grand Ave. New bids will soon be asked. Noted May 22.

+Contracts have been awarded to HOLT & JEFFERY, at $186,477 and $87,526, respectively, for improving Shilshole and Ninth Aves. Arthur H. Dimock is City Engr.

+Shelton, Wash.—(Official)—The Commissioners of Mason County have awarded the contract for constructing one mile of Permanent Road No. 5 to JESSE T. MILLS, Tumwater, Wash., at $7100, and one to HARBER & CHONQUIST Bothell, Wash., for improving the Eberhardt Road. E. L. Robinson is Audr. Noted May 15.

+Los Angeles, Calif.—The Board of Supervisors of Los Angeles County has awarded a contract to GEORGE S. BENSON & SONS at $15,127 for improving approximately two miles of the Long Beach Maples Road. Other bidders were: Conner Contracting Co., $18,264; White & Gaskill, $18,533; Taylor & Berliner, $18,839; Ernest A. Simmons, $19,959; F. F. Prendergast, $21,063; W. A. Dontanville, $21,200; Rogers Bros. Co., $23,331. A. M. McPherron is Deputy Clk. Noted May 1.

+The City Trustees have awarded the following contracts for improving various streets: FAIRCHILD-GILMORE-WILTON CO. at $104,070; FORD & STOUT at $6873; W. F. HEWITT CO. at $7865.

H. H. Curtis at $19,500 was low bidder for improving New York Ave. from Lake to Santa Anita Ave., Improvement District No. 16. Other bidders were: Conner Construction Co. at $20,958 and A. S. Bent at $24,800. L. A. Bartlett, Pasadena, is Engr.-in-Charge. Noted May 8.

+San Diego, Calif.—The City Trustees have awarded a contract to the ENGINEERING & CONTRACTING CO. at $44,261 for improving El Cajon Ave. from Park Blvd. to the city limits. William M. Rumsey is City Engr.

+The JESSE KNIGHT CONSTRUCTION CO. has been awarded a contract for grading portions of Landis and Arizona Sts. at $19,358.

+San Fernando, Calif.—(Official)—The City Trustees have awarded the contract for various street improvements to CLARENCE L. ROBINSON, 626 Stimson Blk., Los Angeles, at $43,313. Other bidders were: Fairchild-Gilmore-Wilton Co., $49,731; Bent & Pennebaker, $43,603. H. C. Caldwell is City Clk. Noted May 1 and 22.

+San Francisco, Calif.—The Panama-Pacific International Exposition Co. has awarded a contract to the HEALY-TIBBITTS CONSTRUCTION CO., San Francisco, at $6920, for the construction of a pile roadway near Fulton Basin. Noted May 22.

+P. L. LOPEZ was awarded the contract at $4310 for improving First St., from McFarland to Alexandria Ave.

Ventura, Calif.—Bids will be received by the City Clerk until 5 p.m., June 2, for improving portions of West Main St., Ventura Ave., Meta St., Laurel St., Kalorama St., Poli, Oak and East Main Sts. Work consists of curbs and sidewalks. Edwin Frensee is City Clk.

+Kingston, Ont.—The Board of Works has awarded the contract for about 10,000 sq.yd. of paving to the WINDSOR ASPHALT BLOCK CO. at $2.75 per sq.yd. R. J. McClelland is City Engr.

Oshawa, Ont.—(Official)—Bids will be received until noon, June 7, by the Town Engineer for the construction of approximately 15,000 sq.yd. of concrete pavement. Frank Chappell is Town Engr.

St. Thomas, Ont.—(Official)—Bids will be received until 5 p.m., May 30, by the City Engineer for the construction of about 12,300 sq.yd. of concrete pavement and 9900 ft. concrete curb; also for 3300 sq.yd. brick pavement with 3000 lin.ft. curb and gutter. M. Ferguson is City Engr.

Sault Ste. Marie, Ont.—(Official)—Bids will be received until 7 p.m., June 2, by the City Clerk, for the construction of about 116,000 sq.ft. concrete sidewalks. W. W. Van Every is City Engr. C. J. Pim is City Clk.

Tilbury, Ont.—The City Council plans to pave Market Lane and Carlyle Ave. The material has not yet been selected. W. A. Hutton is Clk.

Vancouver, B. C.—(Official)—Bids will be received until 2 p.m., June 10, by the Board of Works, City Hall, for asphaltic concrete, vitrified brick and creosoted wood-block pavement on various streets at an estimated cost of $1,200,000. F. L. Fellows is City Engr. S. J. Montgomery is Secy. Bd. of Works. Noted May 8.

INDUSTRIAL WORKS

+Boston, Mass.—The contract for a factory addition to the plant on Sydney St., Dorchester, District, for the Ernest M. Skinner Co., was awarded to the A. VARNERIN CO., 101 Tremont St. The structure will be of brick, three stories, 50x130 ft. Harry A. Dresser, 28 Dickens St., is Arch.

South Framingham, Mass.—Brown, Durrell & Co., Boston, will build a knitting mill at South Framingham, of brick, 100x100 ft.

+Springfield, Mass.—A general contract has been awarded to D. W. MELLEN, Springfield, for a laundry at 61 Franklin St., for Frank U. Wells, of 17 Jefferson Ave. The structure will be four stories, 58x98 ft., of brick and concrete with brownstone trim. R. S. Higgins, 45 East Alvord St., Springfield, is Arch.

The Springfield Breweries Co. is having plans prepared by Samuel M. Green, Arch., for a bottling plant which will be four stories, 147x50 ft. Thos. J. Flanagan is Pres. and Mgr.

+Worcester, Mass.—The Building Finish Co., 51 Herman St., Worcester, has awarded a contract to the E. J. CROSS

CO., Worcester, for the erection of a $20,000 building for factory purposes.

✚The Haywood Boot & Shoe Co. has awarded contract to E. J. CROSS & CO., Worcester, for the construction of a five-story addition of brick, 49x93½ ft., also for an addition to present building of one story, 40x90 ft.

Block Island, R. I.—The American Oyster Co. is to build an artificial ice and freezing plant at Block Island, to cost $50,000. A. F. Zoller is Mgr.

Bristol, R. I.—The National India Rubber Co. is planning the erection of a building for the wire-standing machine department, to be of brick, one story, 260x160 ft.

Pawtucket, R. I.—The William H. Haskell Mfg. Co., Pawtucket, is preparing plans for a two-story brick addition to its present plants on Commerce St.

Bridgeport, Conn.—A site, 123x342 ft., on Holland Ave., has been purchased by the Belknap Mfg. Co., 149 Water St. The company is planning to erect a building, 50x320 ft., of brick, mill construction, three stories, as soon as possible.

Bristol, Conn.—The Bristol Mfg. Co., Bristol, Conn., is contemplating erecting a brick addition, three stories, 40x60 ft.

✚**Stamford, Conn.**—The H. WALES LINES CO., 134 State St., Meriden, Conn., has been awarded the contract for two buildings at the plant of the Yale & Towne Mfg. Co., on Pacific St. One will be 203x50 ft., six stories, of brick, on a steel frame, and the second, 296x245 ft., one and three stories, of steel and reinforced concrete. The cost is about $300,000. The buildings will be used for general manufacturing, pattern and core shops and brass-casting shop. Bids were received May 12. Noted Mar. 13 and May 8.

Torrington, Conn.—The Standard Co. will erect a three-story building at its Laurel St. plant, of brick, 42x144 ft.

Waterville, Conn.—Plans have been completed for a number of addtiions to the plant of the Berbeckes & Rowland Mfg. Co., on Thomaston Ave. One building will be an addition to the dip-room, 43x152 ft., of brick, mill construction, one story, with asphalt floor, and a second will be for a casting shop, of brick and steel, 43x122 ft., with an ell, 12x33 ft. This building will have steel truss roof, metal sash and a steel stack. Griggs & Hunt, 111 West Main St., Waterbury, Conn., are Archs.

Brooklyn, N. Y.—The Drake Baking Co., 1000 Wilbert Market, has filed plans for a $115,000 factory, to be erected on the east side of Clinton St., 125 ft. south of Park Ave. The structure will be five stories high, to be built of brick and concrete. It will occupy a plot of ground 80x125 ft. Dodge & Morrison, Archs., prepared the plans for the building.

Buffalo, N. Y.—Bids are being received by the U. S. Home Co. for a blacksmith shop, 40x225 ft., and a store house, 37x180 ft., one story, to be added to its plant at Tonawanda St. and the New York Central R.R.

Fulton, N. Y.—Taber & Baxter, Archs., Syracuse, have prepared plans and are receiving bids for a two-story factory and office building, 30x100 ft., to be erected by the Oswego Falls Pulp & Paper Co., First St. and Broadway. The estimated cost is $20,000.

Kingston, N. Y.—Myron S. Teller, Arch., 280 Wall St., is preparing plans for a two-story and basement factory, 50x130 ft., to be built by the Kingston Factory Corporation. The company has plans in progress for additional factory buildings.

Weirton, W. Va.—The Weirton Plate Structural & Construction Co., has incorporated with Alfred Thompkins, Pres.; C. B. Chaney, Secy.-Treas.., both of Pittsburgh, Penn., and will construct a plant to be of steel, brick and concrete buildings, main structure to be 200x400 ft., with railroad sidings, and portable cranes, to manufacture heavy furnaces, gas producers and tin-house stacks.

Florence, S. C.—(Official)—The Universal Plow Co. will build a new two-story brick building at Florence, for the manufacture of farm implements. Estimated cost, $15,000. W. J. Wilkins, Florence, is Arch.

Sumter, S. C.—The Sumter Stave Co., Sumter, recently incorporated, will erect a stave mill here to cost about $20,000.

Mansfield, La.—C. J. Brece, Mansfield, will establish a tin shop at that point, to cost approximately $12,000.

Chattanooga, Tenn.—A plant to cost $100,000 will be established at Chattanooga, Tenn., for the manufacture of the Ausman motor truck. The Manufacturers' Association, of Chattanooga, will furnish the capital.

Lexington, Ky.—The Louisville & Nashville R.R. Co. has acquired the necessary land for its repair shops at Lexington, and will proceed shortly with construction work. The general offices of the company are at Louisville.

Louisville, Ky.—The J. V. Pilcher Mfg. Co., Louisville, Ky., will build an addition to its metal-button factory. Fred Erhart is Arch. The plans for the building will be completed shortly.

Upton, Ky.—Edgar Keith, Buffalo, Ky., will erect a flour mill at Upton, to cost $10,000.

Cincinnati, Ohio—The Illinois Leather Co., Cincinnati, which recently acquired property on the east side of McLean Ave., between Liberty and Denman Sts., in the West End will erect a [illegible] of concrete.

The John Hoffman Packing Co., Cincinnati, have been given a permit to erect a new packing house at Clearwater St. and Storrs Alley. Estimated cost, $15,000.

It is reported that the United States Sheet & Culvert Co., Birmingham, Ala., will remove its plant to Cincinnati, and increase its output. J. H. and J. W. Dean are officers of the company.

Cleveland, Ohio. The Schauffler Realty Co., Cleveland, will erect a 12-story brick factory for the manufacture of picture frames and moldings. The cost is estimated at $100,000.

Cleveland, Ohio.—The city will erect a large repair shop on Croton Ave. to be used for repairing its fire-department apparatus, and all auto vehicles of the city.

The Cottage Creamery Co., Cleveland, has taken out a permit for the erection of a manufacturing addition to its plant on Woodland Ave. Estimated cost, about $10,000.

Columbus, Ohio—The Columbus Bolt Works, Columbus, has taken out a permit for the erection of an addition to its plant on Dennison Ave.

The J. W. Brown Mfg. Co., Columbus, has acquired a five-acre site on the Marion Road on which a modern plant will be erected.

✚**Hamilton, Ohio**—The contract has been awarded to SIMS & BENZING, Hamilton, for the construction of an addition to the foundry of the Hamilton Foundry & Machine Co., at $20,000. The structure will be 60x450 ft.

Norwood, Ohio—The Mendel-Drucker Trunk Co., Cincinnatio, Ohio, will add a $20,000 addition to its plant. It is located in Norwood, a suburb of Cincinnati.

Sandusky, Ohio—Application has been made to the Secretary of State by the Suspension Roller Bearing Co., Sandusky, for permission to increase its authorized capital from $250,000 to $300,000. The plant is to be enlarged accordingly.

Indianapolis, Ind.—The Swartz Electric Co., Indianapolis, will erect two factories of reinforced concrete and steel. Estimated cost, $10,000.

Kalamazoo, Mich.—George Hanselman, owner of the Hanselman Candy Co., which was damaged by fire with a loss of $75,000, will rebuild at once. The cost of the new building will be $100,000.

Chicago, Ill.—The Illinois Malleable Iron Co., Chicago, has secured a permit and will erect a foundry to cost $20,000.

The Chicago Steel Products Co., a recently organized company, has acquired a seven-acre site at Elgin Ave. and Canal Pl. The company will erect works on the site.

Chicago, Ill.—J. S. Giles & Sons, Chicago, manufacturers of tinware, have secured a permit and will erect a four-story factory to cost $50,000.

✚**Freeport, Ill.**—The contract has been awarded to the BLACKHAWK CONSTRUCTION CO., Freeport, for the erection of a one- and two-story factory for the Stover Mfg. Co., Freeport, at about $40,000. The building will be of brick.

Chilton, Wis.—The Calumet Brewing Co. will erect two new buildings this year. The first will be a brewery with modern improvements to replace the present plant.

Jefferson, Wis.—E. A. Woodruff, Jefferson, is considering the erection of an automobile factory in Jefferson.

✚**La Crosse, Wis.**—The contract has been awarded to HERMAN STEINER, La Crosse, for the erection of a factory for the Iroquois Button Co.

✚**Menasha, Wis.**—The contract for the erection of the new bottling works and office building for the Walter Brewing Co. has been awarded to ULRICH & HOWMANN, Neenah, Wis., at $12,612.

Milwaukee, Wis.—A brick, concrete and steel bakery, four-stories, 64x170 ft., will be erected for the M. Carpenter Baking Co., 518 Grand Ave., at Seventh St., between Sycamore and Clybourn Sts., Milwaukee.

Dubuque, Iowa—The Dubuque Boat & Boiler Co. is planning the construction of a plant to replace the one recently destroyed by fire. Estimated cost, $25,000. Noted May 6.

✚**Wichita, Kan.**—The contract for the construction of a two-story building for the Campbell Bread Co. has been awarded to the ELLIS CONSTRUCTION CO., Wichita.

✚**Omaha, Neb.**—The contract for the construction of a five-story plant for the Item Biscuit Co. has been awarded to the D. H. SCHENCK CONSTRUCTION CO., Little Rock, Ark.

Kansas City, Mo.—Preliminary arrangements are being made by the Burns-Bowe Pie Co., Cleveland, Ohio, for the construction of a factory at 22d and Mullanphy Sts., Kansas City. Estimated cost, $45,000.

St. Louis, Mo.—The Fulton Bag & Cotton Factory Co. will erect a new factory on Broadway and North Market Sts., St. Louis, to cost $300,000.

Plans are being considered by the Wagner-Stierlin Piano Mfg. Co., for the construction of a five-story, 75x100-ft. factory at 4816 Kossuth Ave.

Texas City, Tex.—The Pierce-Fordyce Oil Association will build a paraffin wax factory at its oil refinery here. It is reported that this company will also greatly enlarge its refining plant.

Shoshone, Idaho—The Oregon Short Line R.R. Co. is preparing plans for the reconstruction of its roundhouse at Shoshone, which was recently destroyed by fire at a loss of $50,000. Frank Gross, Shoshone, is Supt.

Tuscon, Ariz.—Plans are being considered by the Zogg-Gypsum Fireproofing Co., for the construction of a $10,000 factory at Tuscon, for the manufacture of building blocks.

Seattle, Wash.—Dr. Martin Damiurette and 12 other physicians have purchased a site on Cross Island and will erect a manufacturing plant, at a cost of $500,000, for making turtle serum.

Plans are being completed for a four-story reinforced-concrete building to be erected at Fairview and Republican Sts. by Hans Pederson, at an estimated cost of $50,000. The structure will be used as an overall factory.

Tacoma, Wash.—The Roman Meal Co. will erect a $25,000 plant for the manufacture of Roman meal.

Bolton, Ore.—The Portland, Eugene & Eastern Ry. Co. will build car shops, machine shops and a repair plant at Bolton, to cost approximately $1,000,000.

Portland, Ore.—The Northwestern Steel Co. has acquired a site at Portland and will erect a steel-fabricating plant, estimated to cost $250,000. The new plant will have a capacity of at least 2000 tons per month. W. H. Cullers is one of the officers of the company.

The Pacific Iron Works is planning the construction of

four new buildings in connection with its plant at Portland. The buildings include a steel structural shop, 600x60 ft., a foundry, 200x60 ft., machine shop, 60x20 ft., and a pattern shop, 50x100 ft.

Sutherlin, Ore.—The Fruit Growers' Association has secured a site for a fruit-preserving plant, at Sutherlin, to cost $30,000.

Biggs, Calif.—A rice mill is to be constructed in this city. W. M. Doty, H. S. Brink and George E. Harvey are interested.

Chico, Calif.—The Everfresh Products Co., Medford, Ore., will erect a plant at Chico, for drying fruits and vegetables. Estimated cost, $25,000. J. J. Berry, of Chico, is interested.

Los Angeles, Calif.—Simon Levi, Central Ave., Los Angeles, has taken out a permit to erect a fruit-canning plant on Sacramento St. The building will be 120x130 ft., and is estimated to cost $23,000.

Puente, Calif.—The La Puente Walnut Growers' Association are preparing plans for the erection of a large packing plant at Puente. Robert H. Neely and B. F. Masson are interested.

San Diego, Calif.—The Pacific Coast Beef & Provision Co. will soon begin the erection of a cold-storage plant at Eighth and K Sts., San Diego. The plant will be 75x100 ft., and will cost $20,000. W. E. Turner is Mgr. of the company.

FEDERAL GOVERNMENT WORK

Post Office—Camden, Maine—Bids will be received until 3 p.m., July 1, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. post office at Camden, Maine. The building is to be one story and basement, and has a ground area of approximately 4100 sq.ft.

Coaling Plant—Boston, Mass.—(Official)—The time for receiving bids for alterations to the coaling plant at the Boston Navy Yard has been extended to 11 a.m., June 14. Bids were to have been received until May 31 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C.

★**Dredging and Rock Excavation**—Buffalo, N. Y.—(Official)—Bids will be received until 11 a.m., June 21, by Col. J. G. Warren, Corps Engrs., U. S. A., Buffalo, for dredging in outer harbor and dredging and rock excavation in lake approach to North Entrance, Buffalo Harbor, N. Y.

Filtration Plant, Etc.—Fort Porter, N. Y.—Bids will be received until 10 a.m., June 14, by the Constructing Quartermaster, U. S. A., Fort Porter, for a filtration plant and remodeling the water-distributing system at Fort Porter.

Repairing Jetties and Dredging—New York, N. Y.—Bids will be received until noon, June 23, by Col. S. W. Roessler, Corps Engrs., U. S. A., Army Bldg., New York, for enlarging, extending and repairing two stone jetties and for dredging in the harbor at Mattituck (L. I.), N. Y.

★**Dredging**—New York, N. Y.—(Official)—Bids will be received until noon, June 28, by Col. W. T. Rossell, Corps Engrs., U. S. A., Army Bldg., New York, for dredging in Staten Island Sound, N. Y. and N. J.

✚**Coal Pockets**—Atlantic City, N. J.—The contract has been awarded by the Philadelphia & Reading Ry. Co. to F. A. HAVENS & CO., 645 North 19th St., Philadelphia, Penn., for the construction of coal pockets to cost about $15,000.

★**Elevator and Lift**—Jersey City, N. J.—(Official)—Bids will be received until 3 p.m., June 16, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for one electric elevator and lift in the U. S. post office at Jersey City.

★**Dredging**—Philadelphia, Penn.—(Official)—Bids will be received until noon, June 25, by Lieut.-Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Philadelphia, for dredging in the Delaware River, below Philadelphia.

Dredging—Philadelphia, Penn.—All bids received Apr. 26 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the navy yard, Philadelphia, have been rejected. The work will be readvertised.

★**Air-Compressor Plants**—Pittsburgh, Penn.—(Official)—Bids will be received until noon, June 18, by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., Pittsburgh, for furnishing and installing water-power driven air-compressor plants at Dams Nos. 7 and 9, Ohio River.

★**Power House**—Pittsburgh, Penn.—(Official)—Bids will be received until June 12 for the construction of a fireproof power house, etc., at Dams Nos. 7 and 9, Ohio River. This is a postponement from May 21. Bids will be received by Lieut-Col. Francis R. Shunk, Corps. Engrs., U. S. A., Pittsburgh.

Bulkhead and Wharf—Annapolis, Md.—(Official)—Bids will be received until 11 a.m., June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a timber bulkhead and wharf at the U. S. Naval Academy Rifle Range at Annapolis. Estimated cost, about $10,000.

Seawall—Annapolis, Md.—Bids will be received until 11 a.m., June 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a seawall at the engineering-experiment station at Annapolis. The amount available for the work is $50,000.

✚**Bridge**—Annapolis, Md.—SANFORD & BROOKS, Baltimore, Md., have been awarded the contract for the construction of a highway bridge over Dorsey Creek, U. S. Naval Academy, Annapolis; bids opened May 3 at $39,600. Bidders noted May 8.

Wire and Cable—Washington, D. C.—Bids will be received until June 7, by Maj. C. W. L. Clarke, Disbursing Officer, War Dept., Washington, for furnishing wire and cable.

Torpedo Boat Destroyers—Washington, D. C.—Bids will be received until noon, Aug. 4, by the Navy Dept., Washington, for the construction of six torpedo-boat destroyers, Nos. 57 to 62.

★**Engine and Generator, Etc.**—Washington, D. C.—(Official)—Bids will be received by the Secretary of the Interior, Washington, until 2 p.m., June 5, for furnishing all labor and materials required in installation of one 250-kw. engine and generator, install two of water tube boiler and mechanical stoker, and for relocating, extending and connecting switchboard in engine room, Old Post Office Bldg., Eighth and E Sts., N.W., Washington, in accordance with plans and specifications for the work, copies of which may be obtained on application to the Chief Clerk of the department. Award will be made of contract subject to appropriation by Congress to meet the expense of the work.

★**Electric Elevators.**—Washington, D. C.—(Official)—Bids will be received until 2 p.m., June 20, by the secretary of the Interior, Washington, for the installation of two electric passenger elevators in the Patent and old Interior Building, Seventh and F Sts. N. W., Washington, for installation of hoistways therefor, and for excavating, cutting, and brick and steel work for same, also for installation of switchboard and pent houses for elevator machinery, all in accordance with plans and specifications for the work, copies of which may be obtained on application to the chief clerk of the department. Award will be made of contracts subject to appropriation by Congress to meet the expense of the work. Lewis C. Laylin is Asst. Secy.

★**Bridge**—Washington, D. C.—Bids were received May 20, at the office of the Superintendent of the National Zoological Park, Washington, for the construction of a rough stone faced bridge across Rock Creek in the National Zoological Park under the direction of the Smithsonian Institution, Washington: (a) earth excavation; (b) rock excavation, (c) concrete excavation, (d) bridge, 324 sq. ft. between faces of arch; (e) for each additional foot of bridge. Hogs & Lockard: (a) $5c.; (b) $3.25; (c) $7.50; (d) $7923. (e) $113. Warkert: (a) $5c.; (b) $3.25; (c) $7.50; (d) $7923. (e) $113. Wardell & Bro.: (a) $1.50; (b) $4; (c) $3; (d) $7500; (e) $175. Frazier & Burchner, 1 Madison Ave., New York, N. Y.: (a) $1.10; (b) $3; (c) $2; (d) $10,397. (d) $250. Penn Bridge Co., (a) 50c.; (b) $2.50; (c) $2; (d) $8750. (e) $176. Baltimore Stone Works, (a) $1; (b) $3; (c) $4.15; (d) $11,495. (e) $302; Frank Perna, (a) $3; (b) $3; (c) $10; (d) $19,515; (e) $520; National Fireproofing Co., (a) 75c.; (b) $5; (c) $3; (d) $8819; (e) $400.

Post Office—Bedford City, Va.—Bids will be received until 3 p.m., June 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixture, and approaches) of the U. S. post office at Bedford City. The building will be two stories and basement, and has a ground area of 4240 sq.ft.

★**Dredging**—Norfolk, Va.—(Official)—Bids will be received until noon, June 7, by Lieut.-Col. E. Eveleth Winslow, Corps. Engrs., U. S. A., Norfolk, for dredging approaches to the harbor at Cape Charles City, Va.

★**Lumber**—Wilmington, N. C.—(Official)—Bids will be received until noon, June 18, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for furnishing and delivering about 688,690 ft. b.m. of lumber.

★**Dredging Plant**—Jacksonville, Fla.—(Official)—Bids will be received until June 23, by Maj. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for the use of hydraulic dredging plant for work in the Indian River, Fla.

★**Dredging**—Jacksonville, Fla.—(Official)—Bids will be received until June 24 by Maj. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for dredging in St. John's River, Fla., below Jacksonville.

★**Dredge**—Mobile, Ala.—(Official)—Bids will be received until 11 a.m., June 20, by Lieut.-Col. C. A. F. Flagler, Corps Engrs., U. S. A., Mobile, for the construction of the steel hydraulic dredge "Gulfport."

★**Lock Gates, Etc.**—Montgomery, Ala.—Bids will be received until noon, June 20, by Maj. Earl I. Brown, Corps Engrs., U. S. A., Montgomery, for lock gates, filling and emptying valves, gate maneuvering gear, etc.

★**Ice and Refrigerating Plants**—Memphis, Tenn.—(Official)—Bids will be received by Maj. E. M. Markham, Corps Engrs., U. S. A., at the office of the Mississippi River Commission, First and Second District, U. S. Engineer Office, Custom House, Memphis, for furnishing and delivering three ice and refrigerating plants.

Post Office—Springfield, Tenn.—Bids will be received until 3 p.m., July 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at Springfield, Tenn. The building is to be two stories and basement of non-fireproof construction, stone and brick facing, terra-cotta cornice. It will have a ground area of approximately 4130 sq.ft.

★**Dredging**—Detroit, Mich.—(Official)—Bids will be received by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, for dredging Clinton River, Mich.

Dredging—Sheboygan, Mich.—Bids for dredging Sheboygan Harbor, Mich., were received by Lieut.-Col. Mason M. Patrick, Corps Engrs., U. S. A., Detroit, Mich., May 10, as follows: Greiling Bros. Co., Green Bay, Wis., 14½c., Arthur H. Vogel, Milwaukee, Wis., 19.7c., Great Lakes Dredge & Dock Co., Chicago, Ill., 22c.

Dredging—Duluth, Minn.—Bids will be received until noon, June 13, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, Minn., for dredging Duluth-Superior Harbor.

Buildings and Additions—Pine Ridge, S. D.—Bids will be received until 2 p.m., June 18, by the Commissioner of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing materials and labor for the erection of a brick hospital addition to brick laundry, addition to brick mess hall and additions to two brick dormitories at the Pine Ridge Indian School, S. D.

Post Office—Brookfield, Mo.—Bids were received as follows, May 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Brookfield: (a) Limestone; (b) sandstone: Hiram Lloyd Bldg. & Construction Co., St. Louis, Mo., (a) $62,979; (b) same; Rogers & Kaiser, Chicago, Ill. (a) $60,990; (b) $61,290; George W. Stiles Construction Co., Chicago, (a) $69,856; (b) $70,000; R. S. Moore, Lafayette, Ind., (a) $63,192; (b) $63,685; Frank

H. Latimer & Co., Kansas City, Mo., (a) $66,982; M. Yeager & Son, Danville, Ill., (a) $62,497; (b) $63,120; Interstate Construction Co., Saginaw, Mich., (a) $63,899; (b) $65,300; W. D. Lovell, Minneapolis, Minn., (a) $64,000.

★Jetty Work—Dallas, Tex.—Bids will be received until noon, June 20, by Maj. T. H. Jackson, Corps. Engrs., U. S. A., Dallas, for jetty work at Sabine Pass, Tex.

Post Office—Hillsboro, Tex.—Bids will be received until 3 p.m., June 27, by Oscar Wenderoth, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures) of the U. S. post office at Hillsboro. The building will be one story, with a ground area of 4350 sq.ft.

Bulkhead—Port O'Connor, Tex.—(Official)—The following bids were received, May 20, by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, Tex., for the construction of a creosoted pile bulkhead at Port O'Connor: (a) constructing a creosoted timber bulkhead 1800 ft. in length; (b) furnishing and placing riprap, 30 tons: Blodgett Construction Co., Galveston, (a) $7.39 per ft.; $13,302; (b) $4.80 per ton; $138; total, $13,440.

★Sluice and Penstock Gates—Elephant Butte, N. M.—(Official)—Bids will be received until 2 p.m., June 25, by the U. S. Reclamation Service, Euephant Butte ,for furnishing sluice and penstock gates and accessories for Elephant Butte Dam, Rio Grande project, New Mexico-Texas. For particulars address the U. S. Reclamation Service, Elephant Butte; 307 Wright & Callender Bldg., Los Angeles, Calif., or Washington, D. C. F. H. Newell is Dir.

Sluice Gates—Boise, Idaho—(Official)—Bids will be received until 2 p.m., June 16, by the U. S. Reclamation Service, Boise, for furnishing sluice gates for the new Jackson Lake Dam, Snake River Storage Project, Idaho-Wyoming. For particulars, address U. S. Reclamation Service, Boise, or Washington, D. C.

Traveling Cranes—Bremerton, Wash.—Bids will be received until June 21 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for electric traveling cranes for the general foundry, navy yard, Puget Sound, Wash., per Specification 1977. Amount available, $19,000.

Stone—Portland, Ore.—Bids were received by Maj. J. F. McIndoe, Corps Engrs., U. S. A., Portland, May 15, for furnishing and delivering stone for jetty construction at the mouth of the Columbus River, Ore. and Wash. The contract will probably be awarded to the Columbia Contract Co., Portland, at $1.10 per ton. The amount of stone required is 400,000 tons.

Post Office—Grass Valley, Calif.—Bids will be received until 3 p.m., June 30, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at Grass Valley, Calif. The building is to be one story high with a mezzanine and basement and will have a ground area of 4900 sq.ft.

Oil Tank—Hawaii—Bids were received as follows, May 24, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the delivery of one steel fuel oil-storage tank at the naval station, Pearl Harbor, H. T.: Reeves Bros. Co., Alliance, Ohio, $25,780; Petroleum Iron Works Co., Sharon, Penn., $21,500; Treadwell Consruction Co., Midland, Penn., $20,250; Camden Iron Works, 400 Chestnut St., Philadelphia, Penn., $27,000; Riter-Conley Co., Pittsburgh, Penn., $22,100; Chicago Bridge & Iron Co., Chicago, Ill., $25,800.

✚Coal Towers—Hawaii—The contract for constructing coal towers at the U. S. naval station, Pearl Harbor, H. T., bids opened May 3, has been awarded to the C. W. HUNT CO., New York, at $70,500.

Floating Caissons and Equipment—Panama—Bids will be received by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., until 10:30 a.m., July 21, for two lock-entrance floating caissons and their equipment.

Electric Hoists—Panama—Bids will be received until June 10, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, for electric hoists, etc., under Circular No. 777.

Furnaces, Ovens, Paving Blocks—Panama—(Official)—Bids will be received until 2:30 p.m., May 29, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnaces and ovens for foundry, and for paving blocks.

Crematory, Etc.—Panama—(Official)—Bids will be received until 10:30 a.m., June 5, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for a two-retort crematory, switches, frogs, etc., under Circular No. 776.

MISCELLANEOUS

Fire Apparatus—Somerville, Mass.—The City Council is considering the purchase of $60,000 worth of new fire apparatus. Charles A. Burns is Mayor.

Canal Work—Albany, N. Y.—The Governor has approved the bills providing for $200,000 to repair damage done by floods to portions of the barge canal and for rebuilding damaged structures and works; and for $75,000 for reconstruction of embankments, relaying slope walls and repair of other damage done by recent floods to the state canals.

Creek Work—Buffalo, N. Y. The Aldermanic Committee on Sewers has voted to fill in Scajaquada Creek to abate floods along its banks, and have the city take it over as a street between Grider and Genesee Sts. Estimated cost, $75,000.

Hose Wagons—New York, N. Y.—(Official)—Bids will be received until 10:30 a.m., June 2, by the Fire Department, 157 East 67th St., for furnishing and delivering 10 motor-driven hose wagons. Joseph Johnson is Comr.

Station Home—New York, N. Y.—(Official)—Bids will be received until 10 a.m., June 2, by the Police Dept., 240 Center St., for furnishing all the labor and materials required in making and completing repairs at the 13th and 17th Precinct station houses in the Borough of Manhattan, 33d, 68th, 74th, 77th and 79th Precinct station houses in the Borough of the Bronx; 169th, 170th, 171st Precinct station houses in the Borough of Brooklyn. R. Waldo is Comr.

Subway—New York, N. Y.—(Official)—Bids will be received until June 24, by the Public Service Commission, 154 Nassau St., for the construction of Sect. No. 4 of the Broadway-Fourth Ave. rapid-transit railroad. This railroad will be operated by the New York Municipal Ry. Corp. (Brooklyn Rapid Transit Co.), under the Dual System contracts. The Broadway subway is now under construction from Trinity Place and Morris St. to a point in Broadway midway between Houston and Bleecker Sts. Sect. No. 4 extends from this point north under Broadway to a point 390 ft. north of the southerly line of 14th St. It will be a four-track subway, and the section includes a local station at Eighth St. and half of the express station at Union Eq. Working shafts will be located in Union Eq., one in Broadway at Waverly Place, and one in Bond St. just off Broadway. These locations are chosen to minimize the interference with traffic and general business during the construction of the subway. The contractors will bid for construction only, which will not include the laying of tracks, or the finish work in stations. Travis H. Whitney is Secy. Comn.

Ship Canal—Harrisburg, Penn.—The House has passed the bill providing for surveys and preliminary work on the Ohio River Ship Canal, to extend from Lake Erie to the Ohio River with an appropriation of $150,000. The state of Pennsylvania will unite with Ohio and West Virginia in this project.

✚Stable—Millvale, Penn.—The contract has been awarded to C. G. LABOR, Millvale, for the construction of a livery stable for E. J. Piper. Estimated cost, $10,000.

Wharf and Dock Improvements—Philadelphia, Penn.—An amendment to the constitution to permit Philadelphia to borrow $25,000,000 for wharf and dock improvements, exclusive of the other debt, has been introduced in the State Senate by Senator Vare. Under the proposed amendment, Philadelphia could borrow this amount of money, even though the limit of the present borrowing capacity, 7% of the real-estate assessment, had been reached.

Park Work—Philadelphia, Penn.—The Councils Finance Committee has approved an expenditure of $300,000 for necessary work in Fairmont Park.

Fish Hatchery—Pleasant Mount, Penn.—Bids will be received until 2 p.m., June 21, by N. R. Buller, Comr. of Fisheries, Dept. of Fisheries, Harrisburg, Penn., for the construction of a fish hatchery.

✚Stable—Danville, Va.—The contract has been awarded to W. K. ANDERSON, Danville, for the construction of a stable for W. E. Gardner. The cost is estimated at about $10,000.

Creek Work—Richmond, Va.—The city is considering the construction of concrete walls along Schokoe Creek and paving the bottom. The cost is estimated at $1,000,000. Charles E. Bolling is City Engr.

Stable—Richmond, Va.—E. A. Saunders, Richmond, is considering the construction of a stable. It will be 30x100 ft.

Steel Towers—Wheeling, W. Va.—Sargent & Lundy, Engrs., Chicago, Ill., are preparing plans for the Wheeling Electric Co., for the construction of a 165-ft. steel tower on the river bank at 41st St., for the support of a high-tension cable to cross the Ohio River, and a similar tower 135 ft. high on the Ohio side of the river.

✚Tunnels—Whitney, N. C.—The contract has been awarded to RINEHART & DENNIS CO., Charlottesville, Va., for two large tunnels at Whitney, to be constructed for the Southern Aluminum Co. These tunnels are 2000 ft. long, 40 ft. wide and 34 ft. high.

Drainage Work—Orlando, Fla.—Bids will be received until June 21, by the County Commissioners, Orlando, for the construction of the proposed drainage system for Black Hammock Drainage District. The work will require about 240,000 cu.yd. of excavation. B. M. Robinson, Orlando, is Clk.

Pier—Pensacola, Fla.—The Memphis & Pensacola R.R. Co. is considering the construction of railway piers of reinforced concrete. W. P. Dickinson, Chicago, Ill., is Pres.

★Lumber, Steel Wire, Stone, Etc.—Shreveport, La.—(Official)—Bids will be received until noon, June 12, by Doullut & Williams, American National Bank Bldg., Shreveport, for supplying the following material (to be used in making and sinking subaqueous mattresses for bank protection on the Red River in Caddo Parish, La.) in car-load lots, Shreveport: 3,500,000 ft. b.m. lumber in lengths of 12 ft. and up, 1x4 to 1x6 in. wire, at least 30% of which shall be not less than 16 ft. long. The lumber may be of any variety which will not break, split or warp before the mattress is sunk, and whose strength or usefulness is not impaired by the presence of large knots, shakes and other defects which would cause breakage in weaving; 95,000 lb. of No. 14 galvanized steel wire; 45,000,000 lb. of stone weighing not less than 140 lb. to the cubic foot. It shall be in pieces of not less than 20 lb. and not more than 100 lb. in weight. It shall be touch, strong and not subject to material deterioration when exposed to weather or submerged in water; 30,000 lb. of nails; 45,000 bbl. of portland (hydraulic) cement. The cement shall meet the standard requirements for portland cement adopted by the American Society of Civil Engineers; 8000 cu.yd. of sand. The sand shall be sharp and clean and free from clay, earth, trash or vegetable matter of any kind; 12,000 cu.yd. of crushed rock or gravel. In either case it shall be strong, clean and durable and shall have a specific gravity of not less than 140 lb. to the cubic foot (solid measurement). None of the stone shall pass through a sieve whose mesh is less than ¼ in., nor shall any stone fail to pass through a screen with 1 and ½ in. mesh.

✚Fire Station—Louisville, Ky.—The contract has been awarded to T. GREINER, Louisville, for the construction of a two-story and basement fire station to cost about $20,000.

Levee Repair—Dayton, Ohio—The County Commissioners, Dayton, have been granted authority to spend about $10,000 for repairing the Miami levee north of North Dayton near Idylwild. The work will start at once.

Levee—Hamilton, Ohio—W. W. Crawford, County Audr., of Butler County, Ohio, Hamilton, and L. A. Dillon, Surv., are planning to rebuild the Stout Levee at a cost of $25,000.

Levee System and Dredging—Hamilton, Ohio—F. E. Weaver, City Engr., and John W. Hill & Son, Consult. Engrs., 506 First National Bank Bldg., Cincinnati, have been selected and will soon start a survey for the levee system and river dredging for the city of Hamilton. C. M. Robertson is Clk., Dept. Pub. Ser. The work includes excavation, piling, diking and concrete work. Estimated cost, $500,000.

Dredging—Toledo, Ohio.—Bids will be received until 10 a.m., June 12, by Maj. C. S. Bromwell, Corps Engrs., U. S. A., Cleveland, Ohio, for dredging Toledo Harbor, Ohio.

Ditch—Brownstown, Ind.—Bids will be received until 2 p.m., May 29, by Samuel Carr, Supt. of Construction, Brownstown, for the construction of the Rider Ditch.

Comfort Station—South Bend, Ind.—Bids will be received by the Board of Commissioners of St. Joseph County, South Bend, until 11 a.m., June 23, for the construction of a public comfort station in the city of South Bend. Clarence Sedgwick is County Audr.

★**Team Work**—Wellington, Ohio (Official)—There are 400,000 cu.yd. of team work to let at Wellington, Ohio, suitable for scrapers, wagons or machines. Call or write MacArthur Bros. Co., 810 Fisher Bldg., Chicago, Ill., or Wellington, Ohio.

★**Levee Work**—Cairo, Ill.—(Official)—Bids will be received until 2 p.m., June 2, for constructing about 562,000 cu.yd. of earth-work enlargement on the Cairo Drainage District levees. The work will be let by Cairo Drainage District. Profiles, plans and specifications may be seen and blank forms obtained at the office of the Cairo Drainage District, 1808 Washington Ave., Cairo. In addition to the above, and being a part of the same system, the U. S. engineer office, at Cincinnati, Ohio, will later receive proposals for about 522,000 cu.yd. of earth-work enlargement. Information upon application to Lieut.-Col. H. Jervey, Corps Engrs., U. S. A.

★**Ditch and Levee Work**—Oquawka, Ill.—(Official)—Bids will be received at the office of the County Clerk, Oquawka, by the Commissioners of Henderson County Drainage District No. 1, and Henderson County Drainage District No. 2, until June 16, for ditch and levee work aggregating 2,449,000 cu.yd. Harmon Engineering Co., of Peoria, Ill., are the Engrs., and will furnish further information upon inquiry.

✚**Drainage Work**—Sycamore, Ill.—Bids were received, May 22, at Sycamore, as follows, for 480,000 yd. of excavation in Coon Creek Drainage District: G. A. McWILLIAMS, Chicago, Ill., all at 7.25c. per cu.yd. (awarded contract); Carter Bros., Danville, Ill., all at 7.5c. per cu.yd.; Wolcott Dredging Co., Wolcott, Ind., all at 7.4c. per cu.yd.; Thomas & Sweet, Royal Center, Ind., all at 9.25c. per cu.yd.; Henry P. Johnson, Sterling, Ill., all at 7.5c. per cu.yd.; Foohey Dredging Co., Ft. Wayne, Ind., all at 7c. per cu.yd.; Northern Construction Co., Elkhart, Ind., all at 7.95c. per cu.yd.; Horton & Moseley, Chicago, Ill., all at 7.75c. per cu.yd.; Dilley & Berdine Co., Hebron, Ind., all at 7.62c. per cu.yd.; Indiana Dredging Co., Royal Center, Ind., at 6c. per cu.yd. on 200,000 yd.; and 12c. per cu.yd. on 60,000 yd.

Drain—Watswka, Ill.—Bids will be received until June 9, by the Commissioners of Martinton Drainage District No. 3, for constructing about 15,000 ft. of tile drain.

✚**Drainage Work**—Randolph, Wis.—Bids were received May 14 by the Commissioners of Bluen Y Cae Drainage Dist., at the office of Royal E. Clark, Atty., Randolph, for drainage work, comprising 94,000 sq.yd. of marsh soil underlaid with clay and 5050 yd. mixed granite and lime rock. The contract has been awarded to A. J. BRACKEN, Chicago, Ill. C. E. Corning, Portage, is Engr.

Subway—Racine, Wis.—The State Railroad Commission has ordered the Chicago & Northwestern Ry. Co. to construct a subway under its tracks in this city. E. C. Carter, Chicago, Ill., is Ch. Engr.

✚**Drainage**—Oskaloosa, Iowa—The contract has been awarded to the OFFERMAN CONSTRUCTION CO., Omaha, Neb., for the construction of Drainage District No. 2 at $11,000. Bids were opened by the County Commissioners of Mahaska County, May 22.

✚**Drains**—Sibley, Iowa—Contracts for drains have been awarded by the county as follows: SIBLEY CEMENT CO., Sibley, 35,400 lin.ft. 6- to 18-in. tile, $10,175; SEDGLEY & PARRISH, Worthington, Minn., 8300 ft. 6- to 15-in. tile, $3275. L. A. Wilson, Sibley, is Engr.

Ditch—Crookston, Minn.—J. E. Bein, County Engr., Crookston, has estimated the cost of constructing ditch No. 87 at about $10,000.

Ditches—Crookston, Minn.—Bids will be received until 2 p.m., June 11, by the County Commissioners, Crookston, for the completion of Ditches Nos. 63 and 64.

Ditch—Blue Earth, Minn.—Bids will be received by the County Auditor, Blue Earth, until June 6 for the construction of Ditch 14.

Dock—Duluth, Minn.—The Lehigh Valley R.R. Co. is considering the improvement of its coal dock here, at a cost of about $250,000. E. B. Ashley, New York, is Ch. Engr.

✚**Drain Tile**—Battle Creek, Neb.—The contract has been awarded to J. W. TENBRINK, Tremont, Neb., for 40,000 ft. of drain tile.

Ditch—Kennett, Mo.—Bids will be received until 1 p.m., June 2, by V. V. Randol, Engr., Drainage Dist. No. 24, Kennett, for the construction of the main ditch of the district.

Levee—New Boston, Tex.—The County Commissioners of Bowie County, New Boston, have decided to issue bonds for $50,000 for the construction of a levee, north of Texarkana, Tex.

Dike—Denver, Colo.—Plans are being prepared by the City Engineer for the construction of a dike to protect from overflows of the Platte River that section of the city between 47th and 53rd Aves. and the river and Washington St.

Subway—Tucson, Ariz.—The City Council, May 4, ordered plans prepared for a subway under the railroad tracks from Congress and Tool Ave., to Ninth St. and Fourth Ave. J. M. Rutherauff is City Engr.

Dike—Kelso, Wash.—Fred Lang, City Engr., has estimated the cost of a dike for Kelso at about $20,000.

✚**Fire Apparatus**—Seattle, Wash.—The GORHAM FIRE APPARATUS CO., 82 West Marion St., Seattle, Wash., has let the contract for supplying two motor-driven hook-and-ladders and one aerial tower, for the Fire Department at $22,000.

Seawall—Seattle, Wash.—A. H. Dimock, City Engr., is preparing plans for the construction of a concrete seawall along Railroad Ave. from Pike to Bay Sts., to cost $300,000.

Waterfront Improvement—Seattle, Wash.—The Port Commission of Seattle will receive bids until June 4 for central waterfront improvement, as per plans on file in the office of the Commission, Central Bldg. Alternative bids upon designs of bidder are also asked for three elevator equipments.

★**Creosoted Piling**—Seattle, Wash.—(A Correction)—The amount of piling for which the Port of Seattle Commission is asking for bids until June 18, was erroneously given last week as 65,000 lin.ft. instead of 650,000 lin.ft. C. E. Remsburg is Secy.

Bay Improvement—Bay City, Ore.—The Port Commission approved the plans for the improvement of Tillamook Bay. Work will be started as soon as bonds for $407,000 have been disposed of.

✚**Dredging**—Marshfield, Ore.—The Port Commissioners of Coos Bay have awarded to the PUGET SOUND BRIDGE & DREDGING CO., Central Bldg., Seattle, Wash., a contract for dredging the bay from the Smith Mill to the bar, at 12c. per yd. The work when completed will cost $200,000. Other bidders were: Tacoma Dredging Co., Tacoma, Wash., Standard American Dredging Co., Los Angeles, Calif.

✚**Pier**—Longbeach, Calif.—The MERCEREAU BRIDGE & CONSTRUCTION CO., Pacific Electric Bldg., Los Angeles, has been awarded the contract for the construction of a unit of the pleasure pier at the foot of Golden and Wabash Aves. for Harry Berndollar and associates. It will be 500 ft. wide and 760 ft. long, with concrete piles and surface.

Harbor Improvements—Los Angeles, Calif.—The City Council has authorized an issue of $2,500,000 of bonds for harbor improvement. Homer Hamlin is City Engr.

Jetty—Newport Beach, Calif.—This city is considering an expenditure of $100,000 for the construction of a jetty at the entrance to Newport Bay.

Channel Work—Oakland, Calif.—The Oakland Chamber of Commerce and the U. S. government contemplate improving 27 miles of the East Bay shore, which includes Richmond, Albany, Berkeley, Emeryville, Oakland, Alameda and San Leandro. The plans contemplate an inshore channel connecting Richmond to the Key Route Mole and serving the Oakland and Key Route Basin, the Oakland Inner Harbor and San Leandro Bay.

Dredging—Sacramento, Calif.—The State Senate, May 3, voted an appropriation of $150,000 for dredging and improving the channels of the Sacramento, San Joaquin and Feather Rivers.

Tunnel—San Francisco, Calif.—The Cortland Ave. Improvement Association has filed plans for the proposed Folsom St. tunnel with the Board of Supervisors. The estimated cost is $800,000. M. M. O'Shaughnessy is City Engr.

Waterfront Improvement—San Francisco, Calif.—The Finn Bill to submit to the people in November, 1914, a proposition to vote $10,000,000 more in State bonds for the improvement of the San Francisco waterfront, has passed the Senate. The request for the bonds is based on the demand for great expansion of the waterfront to accommodate Panama Canal traffic. M. M. O'Shaughnessy is City Engr.

✚**Wharf**—Port Moody, B. C.—The British Columbia Electric Ry. Co. has awarded the contract to W. A. GILLEY, New Westminister, B. C., for the construction of a wharf at Port Moody. The work will require about 200,000 ft. of lumber and 300 piles.

Jetty—Steveston, B. C.—Bids will be received until 4 p.m., June 17, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the completion of the jetty at the mouth of the Fraser River, at Steveson, New Westminster, B. C.

Dredging—Collingwood, Ont.—Bids will be received until June 5 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for dredging at Collingwood.

Dredging—Ottawa, Ont.—Bids will be received until June 4 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for dredging at various places in the provinces of Ontario and New Brunswick.

Dredging—Ottawa, Ont.—Bids will be received until May 30 by R. C. Desrochers, Secy. Dept. Pub. Kks., Ottawa, Ont., for dredging.

Wharf—Montreal, Que.—The Harbor Commissioners of Montreal have prepared plans and specifications for the construction of a wharf at Pointe aux Trembles. The cost is estimated at $175,000.

BUILDINGS

Brockton, Mass.—Rev. Casimir Urbinowicz, of St. Rocco's Lithuanian Church, has announced that plans are being prepared for a $70,000 church for the Lithuanians in the Montello District.

✚**Brookline, Mass.**—The contract for the construction of the Edward Devotion School has been awarded to the A. VARNERIN CO., Walnut Ave., Boston, Mass. The estimated cost is $134,000. Noted May 8.

Duxbury, Mass.—The Powder Point School will rebuild the hall recently destroyed by fire. The estimated cost is $50,000.

Fitchburg, Mass.—Bids will soon be asked for the construction of a seven-story hotel for John Moran. It will be of brick, 75x80 ft. George P. B. Alderman & Bros., Holyoke, Mass., are Archs. Noted May 8.

Millbury, Mass.—Bids are being readvertised until June 7, by the Building Comm. of the High School, for the construction of the high school. The estimated cost is $50,000. Noted May 15.

Springfield, Mass.—Plans are being prepared by Ed. L. Tilton, Arch., 32 Broadway, New York, for the construction of a library on Memorial Sq. E. F. Leonard is Chn. of Liberty Comm.

Springfield, Mass.—Shattuck & Hussey, Archs., Chicago, Ill., are preparing plans for a Y. M. C. A. building at Springfield, Mass. It will be of brick and steel, 100x135 ft., seven or eight stories. H. A. Mosley, of the Strathmore Paper Co., is Chn. of the Bldg. Com.

✦Providence, R. I.—The contract for a five-story and basement warehouse, 100x200 ft., for the Harris Terminal Warehouse Co., has been awarded to the THOMAS F. CULLINAN CO., 48 Custom House St., Providence. The building will be of concrete and steel with brick veneer and limestone trimmings, fireproof. Murphy, Hindle & Wright, Providence, R. I., are Archs. Cost, estimated at $30,000.

✦Baltic, Conn.—A contract has been awarded to the FENTON-CHARNLEY CO., McGrory Bldg., Main St., Norwich, Conn., for a school to be erected for the Academy of the Holy Family. The building will be three stories and basement, of brick, with artificial stone trimmings, and will cost about $80,000. T. G. O'Connell, Boston, Mass., is Arch. Noted Apr. 7.

Bridgeport, Conn.—Philip Glasher, of Glasher Bros. Co., contemplates erecting a hotel on Golden Hill St. The estimated cost is $50,000.

✦Hartford, Conn.—Contracts for various kinds of work connected with the school building of the Washington District, bids for which were received, May 20, have been awarded as follows: General contract, to A. L. HILLS, Hartford, Conn., $38,800 and an alternate bid of $38,420; kindergarten building, to A. L. HILLS, $3625; heating, BARRETT & WALL, Hartford, Conn., $3198; $285 less if Guerney heaters are used. Other bidders were: General contract, Burgess Construction Co., $40,220; W. J. Simms, Hartford, $44,000, alternate, $43,684; Alexander Hepburn, $47,276, alternate, $43,684; F. B. & W. H. O'Neil, $45,560, alternate, $44,460; Malley & Crowley, $45,900, alternate, $44,800; Ahern & Welch, $41,650, alternate, $40,600; Adam Purves, $40,675, alternate, $40,295; E. W. Gustofson, $44,661; T. R. Fox & Son, $45,254, alternate, $44,874; F. D. Kent, $41,590, alternate, $41,140; W. E. Caulkins & Son, $45,270, alternate, $44,970; William McKone, Inc., $43,150, alternate, $42,650; R. A. McKone, $44,150, alternate, $43,100; kindergarten, Burgess Construction Co., $3180; W. J. Simms, $4225; Alexander Hepburn, $3228; F. B. & W. H. O'Neil, $3500; Malley & Crowley, $3600; Ahern & Welch, $3600; Adam Purves, $3620; E. W. Gustofson, $4544; T. R. Fox & Son, $3990; F. D. Kent, $4490; W. E. Caulkins & Son, $3650; William McKone, Inc., $3998; R. A. McKone, $3950; heating, Shaffer-Marsh Co., $4160; G. W. Cunningham, $4438; Libby & Blinn, $3767. Noted May 8.

Bids for the construction of an isolation hospital will be received by the Board of Contract & Supply, Joseph Buthe, Secy., until 11 a.m., June 3. A. Raymond Ellis is Arch., 36 Pearl St. Noted Apr. 17.

Davis & Brooks, Archs., 49 Pearl St., are preparing plans for the construction of a building for the Fourth Church Society. The estimated cost is $65,000. Noted May 22.

The State Senate, May 21, passed appropriations for state armories as follows: $175,000 for site and building at Waterbury; $125,000 for site at New Haven; $12,000 for site at Bristol; $60,000 for site and building at Middletown; $50,000 for site and building at Manchester; $35,000 for site and building at Hartford, for Cavalry Armory.

New Haven, Conn.—A site on Chestnut St. has been purchased by the New Haven City School District for a new 16-room school. Plans are being prepared by Brown & Von Beren, Chamber of Commerce Bldg., Church St., New Haven.

Willimantic, Conn.—An appropriation of $75,000 has been made for the construction of the Natchang Grammar School. George F. Taylor, 193 Church St., E. Frank Bugbee, 694 Main St., and Walter B. Knight, 112 Main St., are members of the Bldg. Com. Noted Mar. 27.

Brooklyn, N. Y.—(Official)—The following bids were received May 22, by the Department of Parks, Fifth Ave. and 64th St., Manhattan, for the construction of a comfort station in Prospect Park: (Item (a) and (b)). Joseph Balaban, 261 Broadway, Manhattan, $14,729 and $15,773; Peter Cleary, 722 St. Marks Ave., $13,900 and $15,400; B. Diamond, 12 Bergen St., $13,953 and $15,647; George F. Driscoll Co., 548 Union St., $14,998 and $15,892; William H. Egan, 147 East 125th St., $13,514 and $14,459; Hudgrove & McDermott, 406 Jackson Ave., Long Island City, $16,582 and $18,156; Thomas McKeown, Inc., 103 Park Ave., Manhattan, $14,223 and $15,300; Merrick Fireproofing Co., 1 Broadway, Manhattan, $12,700 and $13,996; William D. Moore, 2029 East 15th St., $15,221 and $17,100; Ralph C. Peckwith, 529 Hudson St., Manhattan, $13,344 and $14,696; Neptune B. Smith, 413 East 34th St., Manhattan, $15,316 and $16,993; Werner Bartels Co., 38 Park Row, Manhattan, $14,447 and $16,347. Charles B. Stover is Pres.

The Long Island Automobile Club, 920 Union St., contemplates the erection of a three-story reinforced-concrete club house and garage on Eastern Parkway, through to Lincoln Place. The estimated cost is $85,000.

Buffalo, N. Y.—Bids will be received until 11 a.m. June 4, by Francis G. Ward, Comr. Pub. Works, for the construction of an addition to the school at Bailey Ave. and Seventh St.

**✦The American Bridge Co., 30 Church St., New York, has been awarded the contract to furnish 33 tons of structural steel for the Manufacturers & Traders National Bank Building, at Buffalo. The NORTHERN STEEL CONSTRUCTION CO. will erect the building. Noted May 15.

✦Huntington, L. I.—The general contract has been awarded to the H. H. SMITH BUILDING CO., Second Ave., Bayshore, L. I., for the construction of the school building on Lowndes Ave., between Second and Third Sts., for the Board of Education. Adden & Parker are Archs., 12 Bosworth St., Boston, Mass. Noted Mar. 13.

Lackawanna, N. Y.—The Y. M. C. A. contemplates erecting a building on Lackawanna Ave. The estimated cost is $75,000. A. H. Whitford is Secy.

New York, N. Y.—Radway & Co., 47 Lafayette St., contemplates the erection of a 10-story loft building, 125x50 ft., at 208 Center St., running through to 140 Baxter St.

Samuel Sass, Arch., 32 Union Square, is preparing plans for the construction of a nine-story office building, 100x50 ft., at the northwest corner of Chrystie and Canal St., for Nathan Marcus. Robert E. Moss, 126 Liberty St., is the Steel Engineer. The estimated cost is $80,000.

Plans have been filed by T. Hastings, Arch., 225 Fifth Ave., for the construction of a six-story store, bachelor apartment and art gallery building, 100x25 ft., at the northeast corner of Fifth Ave. and 53rd St., for A. McA. Pple, 68 William St. The estimated cost is $70,000.

Plans have been completed by Wallis & Goodwillie, Archs., 346 Fourth Ave., for the construction of an eight-story apartment house, 80x85 ft., at 315 West 89th St., for the George Backer Construction Co., 33 West 42nd St. The estimated cost is $200,000.

Plans have been completed by George F. Pelham, Arch., 30 East 42nd St., for the construction of an eight-story apartment house, 108x85 ft., at 168 West 87th St., for the West Side Construction Co., 322 West 100th St. The estimated cost is $200,000.

Plans have been completed by Julius Harder, Arch., 120 West 32nd St., for the construction of a 12-story apartment house, 100x90 ft., at 410 Park Ave., for the Ogden Goelet Estate, 9 West 17th St. The estimated cost is $300,000.

Plans have been completed by J. S. Lubeskind, Arch., Pelham, N. Y., for the construction of a 12-story apartment house, 78x83 ft., at 140 West 79th St., for the Brixton Realty Co., 314 West 87th St. The estimated cost is $425,000.

Bids will shortly be received by George Keister, Arch., 12 West 31st St., for the construction of a 12-story loft and theater building at the northeast corner of Broadway and 37th St., for the Times Square Improvement Co. F. A. Burdett & Co., 16 East 33rd St., will be the Engrs.-in-charge. The estimated cost is $300,000.

Plans have been filed by H. O. Chapman, Arch., 334 Fifth Ave., for the construction of two six-story store and loft buildings, at the southwest corner of Fifth Ave. and 53rd St., for the Dreicer Realty Co., 560 Fifth Ave. The estimated cost is $130,000.

Plans have been filed by Schwartz & Gross, Archs., 343 Fifth Ave., for the completion of alterations to a three-story store and garage building at 1741 Broadway, for M. Froclish, Broadway and 56th St. The estimated cost is $40,000.

Plans have been completed by Harold L. Young, Arch., 1204 Broadway, for the construction of a six-story apartment house at the southwest corner of 161st St. and Fort Washington Ave., for the Friedman Construction So., 171 Broadway. The estimated cost is $300,000.

Plans have been completed by Gronenberg & Lenchtag, Archs., 303 Fifth Ave., for the construction of a six-story apartment house, at the northwest corner of 161st St. and Fort Washington Ave., for the Hilliard Construction Co., 2865 Broadway. The estimated cost is $225,000.

Syracuse, N. Y.—The lowest bidders for the construction of the Genesee School were as follows: General contract, and decoration, E. K. Penno, Rosenblum Bldg., Syracuse, $80,414; heating and ventilating, T. E. Gildea, $9807; wiring, A. L. Gough, $832. All bids will probably be rejected as excessive. Noted Apr. 10.

Syracuse, N. Y.—Governor Sulzer recently signed a bill appropriating $80,000 for a poultry building to be erected on the State Fair Grounds, Syracuse, N. Y. Bids will be asked for at once and the building will be erected for use this year.

Camden, N. J.—Following the approval of the State Board of the location of the new Camden County Tuberculosis Hospital at Ancora, the Board of Chosen Freeholders has authorized its Hospital Committee to have plans and specifications prepared for the proposed institution.

Jersey City, N. J.—The Central R.R. of New Jersey has filed plans for the erection of two one-story reinforced-concrete buildings at its terminal on Communipaw Ave., to cost $80,000 and $70,000, respectively.

Moorestown, N. J.—Arnold H. Moses, Arch., 136 South Fourth St., Philadelphia, Penn., is preparing plans for a 14-room brick and stone school building to be erected at Moorestown.

✦Newark, N. J.—The contract for the construction of the addition to the storage warehouse of Bamberger & Co. has been awarded to FRED KILGUS, Freylinghuysen Ave., Newark, at $43,500. Noted May 22.

South Orange, N. J.—Seton Hall College is having plans prepared by John T. Rowland, Jr., Arch., Jersey City, N. J., for a new building to take the place of the present Bayley Hall Preparatory School. The estimated cost is $70,000. Rt. Rev. James R. Mooney is Pres.

Collegeville, Penn.—Charles W. Bolton & Son, Archs., Witherspoon Bldg., have prepared plans for the construction of a dormitory and alterations at Ursinus College. The estimated cost is $50,000.

Conshohocken, Penn.—H. L. Reinhold, Arch., 1309 Walnut St., Philadelphia, is preparing plans for the construction of a high school for the School Board of Conshohocken. It will be two stories of brick. The estimated cost is $50,000.

✦Crafton, Penn.—(Official)—The contract for the construction of the high school at Crafton, has been awarded to

SCHUTZ SCHREINER & CLYDE CO., Pittsburgh, Penn., at $81,380. Other bidders were: Geo. Hogg Co., $92,137; H. L. Kreusle, $95,480; William Miller Sons Co., $98,649. Noted May 8.

Donora, Penn.—The Board of Education is receiving bids for the construction of a two-story brick and steel school on First St., to cost $80,000. C. C. Compton, Post Office Bldg., is Arch. Noted May 8.

Duquesne, Penn.—All bids received, May 22, for the construction of the high school, were rejected. Plans are being revised. Carlisle & Sharrer are Archs., 7119 Jenkins Arcade Bldg. Noted May 15.

Easton, Penn.—Plans have been completed by Peuchert & Wunder, Archs., Philadelphia, Penn., for the construction of a four-story fireproof mait-storage building, for Willibald Kuehler's Sons. It will be 38x79 ft.

Germantown (Philadelphia P. O.), **Penn.**—A new hospital is being planned, to be located at Lincoln Drive and Wissahickon Ave., which will be known as the Providence General Hospital. Dr. Mary Davis Ridgway is Vice-pres.

+Philadelphia, Penn.—The contract has been awarded to JAMES G. DOAK, 1420 Chestnut St., for the construction of a 10-story apartment house at Spruce and Watts Sts.

Frederick Webber, Arch., Morris Block, will erect an apartment house at 35th St. and Powelton Ave. It will be four stories of white marble, 75x179 ft. The estimated cost is $260,000.

Philadelphia, Penn.—Duhring, Okie & Zeigler, Archs., Bailey Block, are preparing plans for the construction of a four-story hotel for the Inasmuch Mission. The estimated cost is $50,000.

Pittsburgh, Penn.—Preliminary plans are being prepared by Thomas Hanna, Arch., Keenan Bldg., for a five-story brick and terra-cotta store and office building, at Fifth and Wylie Aves., for Col. T. J. Keenan, Keenan Bldg. Estimated cost, $40,000.

Jarvis Hunt, Arch., 53 West Jackson Blvd., Chicago, has preliminary plans in progress for a 12- or 15-story department store to be erected on Sixth St., between Liberty and Penn Aves., for the Rosenbaum Co. Estimated cost, about $1,00,000. It is believed the plans will be completed by Sept. 1. Noted Mar. 27.

+Charles Bickel, Arch., May Bldg., has awarded to D. T. RIFFLE, Keenan Bldg., the general contract for constructing a three-story brick and terra-cotta building at Fifth Ave. and Grant St., for K. Solomon, Smithfield and Diamond Sts. Estimated cost, $65,000.

(Official)—The Fort Pitt Hotel Co. will erect a hotel at Smithfield St. and Sixth Ave. It will be 165x110 ft. The estimated cost is $2,000,000. Janssen & Abbott, Renshaw Bldg., will probably be the Archs.

+Baltimore, Md.—The contract has been awarded to the COWEN BUILDING CO., 106 West Madison St., Baltimore, by the Western Maryland R.R. Co., H. R. Practt, Ch. Engr., Hillen Station, for the construction of an addition, remodeling present structure, construction of shed and concourse, redecorating, installing sanitary plumbing equipment, etc., to cost about $75,000. Emory & Nussear are Archs., Professional Bldg., Baltimore. Noted Mar. 27.

+Sabillasville, Md.—Contracts have been awarded by the Managers of the State Tuberculosis Sanitarium for the erection of the administration buildings and children's ward, as follows: General contract, to the COWEN BUILDING CO., 106 West Madison St., at $35,731; wiring, WILSON-MALTMAN ELECTRIC CO., 30 South Charles St., $1561; heating, RIGGS-DISTLER & STRINGER, 7 East German St., at $3968; Howard Sill, 11 East Pleasant St., Baltimore, is Arch. All the contractors are of Baltimore, except E. S. Mobley, who is of Frederick, Md.

Washington, D. C.—The Palais Royal is having plans prepared by George P. Hales, Arch., Bond Bldg., for the construction of a store building at 711 Eleventh St., N. W. The estimated cost is $175,000.

+Petersburg, Va.—The contract for the construction of the addition to the building of the British American Tobacco Co., has been awarded to J. W. DAVIS CO. at $100,000. It will be a five-story structure, of steel and reinforced concrete.

Madison, Fla.—Bids will be received until 10 a.m., June 16, by J. E. Hardee, Chn., Madison County Comrs., for the construction of a court house. The estimated cost is $50,000. Bishop & Greer are Archs., Sandler Bldg., Valdosta, Ga.

+Guin, Ala.—The contract for the construction of the school at Guin has been awarded to the L. DAVIS CONSTRUCTION CO., Montgomery, Ala.

Mobile, Ala.—Bids will be received until May 31, by Patrick Lyons, Comr. Bd. Pub. Wks., for the construction of the City Hospital. The estimated cost is $50,000.

+Woodville, Miss.—The Board of Trustees awarded the contract for the Agricultural High School to the BURKER CONSTRUCTION CO., Hattiesburg, Miss.

New Orleans, La.—Plans have been prepared by Churchhill & Labouisse, Archs., for the construction of the 13-story building for the Cotton Exchange. Marble will be used for the exterior.

+The Equitable Realty Co. has awarded a contract to JOHN MINOT, at $42,645, for the construction of a five-story brick building on Barrone St., for the Schaffer-O'Conner, Inc. Noted Mar. 27.

Albert G. Bear, Arch., 600 Audubon Bldg., has completed plans for an apartment house costing approximately $150,000, to be erected at Coliseum and Urania Sts., by Alex. Lichtenstein and associates.

Ashland, Ky.—The local lodge, B. P. O. E., is planning the erection of a club house to cost $50,000. It will be two stories, of brick and concrete.

+Akron, Ohio—The contract for the construction of 100 dwelling houses for the Akron Tire & Rubber Co., has been awarded to the WALLIS & CARLEY CO., Sharon, Penn., at $200,000.

Athens, Ohio—Bids will be received until noon, June 17, by I. M. Foster, Secy. Board of Trustees of the Ohio University for the construction of the Commercial building at the Ohio University at Athens. Frank L. Packard is Arch., Hayden Bldg., Columbus, Ohio.

+Bellaire, Ohio—F. L. Packard, Arch., New Hayden Bldg., Columbus, Ohio, awarded to C. D. KEYSER, the contract for constructing a three-story brick fire-proof hotel building for the city. Estimated cost, $41,510.

+Cleveland, Ohio—The contract has been awarded to HILLER BROS. CO., Youngstown, for the construction of a club house for the Republic Rubber Co.

+Columbus, Ohio—The contract has been awarded to the FERRO CONCRETE CONSTRUCTION CO., Cincinnati, for the construction of the three-story and basement laboratory building, on Oak St. near Grant Ave., for The Physical Co.

Gordon & Maddon, Archs., 200 Sibley Block, Rochester, N. Y., have completed plans for the construction of a church at Seymour and Main Sts., for the Holy Rosary Church. The estimated cost is $70,000.

William P. Gintner, Arch., Arcade Bldg., Akron, Ohio, has completed plans for the construction of a church for the St. Leo congregation. The estimated cost is $50,000.

+Marion, Ohio—The contract has been awarded to MOORE BROS., Columbus, for the erection of a $40,000 school building. Richards, McCarty & Bulford are Archs., Columbus.

New Knoxville, Ohio—Plans have been prepared by Edwin E. Pruitt, Arch., Y. M. C. A. Bldg., Columbus, for a school building.

Union Furnace, Ohio—Bids will be received by the Board of Education of Union Furnace, until June 14, for the erection of a two-story school building.

+New Castle, Ind.—Bids will be received until May 31, for the construction of the new Pennsylvania R.R. station at New Castle. The estimated cost is $40,000.

Detroit, Mich.—E. M. Statler, proprietor of the Hotel Statler, Cleveland, Ohio, will erect a hotel at Detroit. The estimated cost is $4,000,000.

Plans are being prepared by Albert Kahn, Arch., Trussed Concrete Bldg., and Ernest Wilby, Assoc. Arch., for the construction of a 12-story office building, at Adams Ave. and Park St., for the S. S. Kresge Co. The estimated cost is $300,000.

+Flint, Mich.—Bids will be received until June 10, by the Board of Trustees, Michigan School for the Deaf, for the construction of a building, to cost $150,000. Noted Mar. 13.

+Grand Rapids, Mich.—The Contract for the construction of the annex to the Keeler Bldg. has been awarded to HAUSER, OWENS & AMES, Grand Rapids, at $70,000.

+Hastings, Mich.—The contract for the construction of a two-story bank building, for the Hastings City Bank, has been awarded to DES HOGGSON BROS., 7 East 44th St., New York, N. Y.

+Marquette, Mich.—The contract for the construction of the warehouse for the Cudahy Packing Co. has been awarded to JOHN BECK, Ashland, Wis.

+Norway, Mich.—The general contract for the construction of the high school has been awarded to the WEINBERG CONSTRUCTION CO., Grand Rapids, Mich. John D. Chubb is Arch., 32 North Clark St., Chicago, Ill. The estimated cost is $100,000.

Chicago, Ill.—Plans are being prepared by Meyer H. Sturm, Arch., 116 South Michigan Ave., for the construction of a four-story, brick, reinforced-concrete and steel hospital for the Evanston Hospital Assn. The estimated cost is $75,000.

Chicago, Ill.—A modification has recently been made in the plan for the new Union Terminal at Canal St. between Jackson Blvd. and Adams St. This was made at the request of the Pennsylvania Ry. and sanctioned by the executive committee of the Chicago Association of Commerce. E. R. Graham, 80 East Jackson Blvd., a partner of the late Daniel H. Burnham, is advisory architect.

Chicago, Ill.—D. H. Burnham & Co., Archs., 80 East Jackson Blvd., have prepared plans for the construction of an 11-story bulding at Fifth Ave. and Quincy St., for E. F. Keebler & Co.

Charles G. Dawes, Pres. of the Central Trust Co., of Illinois, will erect a hotel in the downtown section of the city. The estimated cost is $100,000.

Fond du Lac, Wis.—The Board of Education is considering plans for a 10-room school house, to cost $50,000.

Madison, Wis.—The masonic lodges of this city are negotiating for the purchase of the Chapman Block, North Carroll and West Mifflin Sts., opposite the new state capitol. A seven-story structure, with stores on the first floor, offices on the next four, and lodge hall on the two top floors, is planned for the site. The estimated cost is $250,000.

Milwaukee, Wis.—The congregation of Temple Emanu-El contemplate erecting a Temple on Hackett Ave. between Park Place and Belleview Place. The estimated cost is $100,000.

Milwaukee, Wis.—Plans for the new Washington High School have been completed by Van Ryn & De Gelleke, Archs., Caswell Block. It will be three stories with high basement, red brick and stone trimmings, and will be erected at Wright St. and Sherman Blvd., at a cost of $450,00.

A theater, 125 ft. on Grand Ave. and 200 ft. deep, with a seating capacity of 3500 persons; and a hotel, 16 stories, with 750 rooms, 140 ft. on Grand Ave. and 200 ft. on 2nd St., are to be erected on the present Plankinton House site, by Chas. W. Somers, Cleveland, Ohio. Construction work is to be started July 1, and completed within a year. George W. Harvey is the local representative of Mr. Somers. The work will cost approximately $600.00.

Racine, Wis.—Bids will be received until June 5, for the erection of a school on De Koven Ave., between Center and Franklin Sts. Chandler & Parks, Racine, are Archs. Bids will be received for complete work except plumbing, heating and electric wiring. The estimated cost is $95,000. Joseph J. Moritz is Secy. of the School Bd.

+Davenport, Iowa—The contract for the construction of the three-story office building at Fifth Ave. and 16th St., for A. Sohrback, has been awarded to HENRY W. HORST, Rock Island, Ill., at $50,000.

Keokuk, Iowa—(Official)—It was erroneously noted in the issue of May 22, that the Chicago, Rock Island & Pacific Ry., was preparing plans for the construction of a freight depot and warehouse at Keokuk. The company announces that no such work is being contemplated. Noted May 15.

+Duluth, Minn.—The contract for the construction of the hotel at Ironton Ave. and Fourth St., for Peter Spina, has been awarded to CHARLES B. ROWLEY, Brainerd, Minn. It will be three stories and basement of brick, stone and iron 75x100 ft.

+Ironton, Minn.—The contract has been awarded to CHARLES B. ROWLEY, Brainerd, for the construction of the hotel for Peter Spina, at Ironton Ave. and Fourth St.

+Minneapolis, Minn.—The general contract for the construction of the armory for the University of Minnesota has been awarded to the J. & W. ELLIOT CO., 906 Lumber Exchange, Minneapolis. C. H. Johnstown, 715 Capital Bank Bldg., St. Paul, Minn., is Arch.

Kansas City, Mo.—The Kansas City Southern Ry. Co. will erect a 6-story reinforced-concrete building at 11th and Wyandotte Sts. The estimated cost is $200,000. W. M. Bosworth is Mech. Engr., Pittsburg, Kan.

St. Louis, Mo.—The Order of Railroad Telegraphers will erect a home building at 12th and Olive Sts. The estimated cost is $500,000.

+St. Louis, Mo.—The contract for the construction of the eight-story and basement building at 19th and Pine Sts., for the Century Electric Co., has been awarded to the JOHN HILL CONSTRUCTION CO. Albert B. Groves is Arch., North Fourth St., St. Louis.

St. Louis, Mo.—William Wedemeyer, Arch., 105 North Seventh St., is preparing plans for the construction of a theater at Broadway and Geyer Sts., for Eugene and Harry Freund, 1560 South Broadway. The estimated cost is $40,000.

Dallas, Tex.—H. A. Overbeck, Arch., Juanita Bldg., has prepared plans for the construction of an eight-story jail and Criminal Court building for Dallas County. The estimated cost is $400,000.

San Antonio, Tex.—The Coliseum League is arranging to erect a coliseum at San Antonio, to cost about $250,000. Harvey L. Page, Arch., 741 East Douston St., has prepared plans for the proposed structure.

Ogden, Utah—The Denver & Rio Grande R.R. will erect a passenger depot on 24th St. It will be of concrete and brick. The estimated cost is $100,000. A. B. Apperson is Gen. Supt., Salt Lake City, Utah.

Portland, Ore.—The Oregon Furniture Co. has approved plans for the construction of a four-story brick warehouse, to cost $100,000. C. H. Bristow is Arch., Portland, Ore.

Berkeley, Calif.—A gymnasium to cost $50,000 will be constructed at the California Institution for the Deaf and Blind. J. W. Woollett, of Sacramento, is State Arch.

Los Angeles, Calif.—Carl Kurtz will erect a five-story and basement reinforced-concrete store and loft building on Los Angeles St. between Seventh and Eighth Sts. John P. Krempel and W. E. Erkes, 415 Henne Bldg., are Archs.

H. E. Huntington has approved preliminary plans for the 12-story Class A office building to be erected at 12th and Main Sts. Myron Hunt, Arch., Hibernian Bldg., is preparing working plans. The basement and sub-basement and foundation will be constructed during the present year and will be used as a substation for the Pacific Light & Power Co. The building will be 172x120 ft., of steel.

+The contract has been awarded to the RICHARDS-NEUSTADT CONSTRUCTION CO., Wright & Callender Bldg., at about $225,000 for the erection of an eight-story and basement Class A reinforced-concrete store and loft building to be erected on Broadway for Isaacs Bros. Co., 725 South Broadway. The building will have a frontage of 120 ft. and a depth of 140 ft. It will have reinforced-concrete frame and inclosing walls.

Oakland, Calif.—F. D. Voorhes, Arch., Central Bank Bldg., is preparing plans for a seven-story and basement Class C store and loft building, to be erected for H. A. Powell, at 13th and Webster St. It will be 50x100 ft., estimated cost, $85,000. The exterior of the building will be of pressed brick.

+Oakland, Calif.—The contract has been awarded to DYER BROS., San Francisco, for the steel work on the municipal auditorium at $177,000. Noted May 8.

+Richmond, Calif.—The Elks Hall Association has awarded the contract for the erection of a club building at 10th St. and Macdonald Ave. to FLUTH & MORTON, at $60,000.

Riverside, Calif.—Riverside Lodge No. 643, B. P. O. E., will erect a lodge and club house, to cost about $80,000, on Market St. and Whittier Place. The building will be three stories. S. L. Pillar and Welmer P. Lamar are Archs., Crescent Bldg.

+San Francisco, Calif.—Bids for the construction of the Manufacturers Palace of the Panama-Pacific International Exposition were received as follows: Commary Peterson Co., $210,333; McLaren & Peterson, $217,000; J. Monk, $234,558; Strehlow, Freese & Co., $230,000; Lang & Bergstrom, $243,153; E. Rolandi, $239,000. Noted Apr. 24.

+The Board of Public Works has awarded the general contract for the construction of the academic building of the Polytechnic High School to NEWSOM, WOLD & KOHN at $219,752.

+Miller & Colmesnil, Archs., Lick Bldg., have awarded the general contract for the construction of the three-story and basement commercial building at Golden Gate Ave. and Market St. to MATTHIES & GRIFFITHS, at $70,000. The building will be erected for the Santa Christania Investment Co. It will be 155x154 ft., of brick and steel. The exterior will be faced with cement plaster and brick.

Bids for furnishing between 6000 and 7000 tons of steel to be used in the construction of the new City Hall will be opened June 11. The estimated cost of all the steel to be used will be $500,00.

Will D. Shea, Arch., 244 Kearny St., has completed plans for the Young Men's Institute building, which is to be erected on Oak St. It will be a four-story and basement Class A building. The estimated cost is $100,000.

Bids for the steel to be used in the construction of the auditorium to be erected by the Panama-Pacific International Exposition Co. will be opened by the Board of Directors, May 29. About 3500 tons will be required. The estimated cost is $200,000.

San Jose, Calif.—The Southern Pacific Co. will construct a railway station at San Jose. W. Hood, San Francisco, Calif., is Ch. Engr.

+Montreal, Que.—The contract for the construction of the Muerling Municipal Refuse, on Champ de Mars St., has been awarded to THEODULE LESSARD, at $116,000.

+Montreal, Que.—The contract has been awarded to NORCROSS BROS., Tremont Bldg., Boston, Mass., for the construction of the Drummond Bldg., at St. Catherine and Peel Sts.

Montreal, Que.—Bids will be received until 4 p.m., June 16, by R. C. Desrochers, Secy., Dept. of Public Works, Ottawa, Ont., for the construction of the Postal Station at Montreal. M. D. J. Spence is Arch., 46 Beaver Hall Hill, Montreal, Que.

Ottawa, Ont.—Bids will be received until 6 p.m., June 11, by R. C. Desrochers, Secy., Dept. of Pub. Wks., for the construction of an addition and alterations to Rideau Hall.

+Edmonton, Alta.—The contract for the construction of the chool at Edmonton, has been awarded to the REED-McDONALD-BREWSTER CO., at $147,300.

CIVIL SERVICE EXAMINATIONS

Albany, N. Y.—The State Civil Service Commission announces the following examinations June 14, applications for which must be executed and filed with Commission on or before June 6:

Junior Bridge Draftsman, salary, $901 to $1200. Minimum age, 20 years. Candidates must have had some experience in mechanical or structural drafting. Subjects of examination and relative weights: Questions on drafting-room practice, including calculation of weights, quantities and bevels, simple girders, joints, etc., and detailing and tracing bridge members, 8; experience and education, 2.

Bridge Designer, salary, $1501 to $2100. Candidates must have had at least five years' practical experience in drafting, designing and constructing structural steel and bridge work. Candidates who have graduated in civil engineering from a school maintaining a standard satisfactory to the Commission will be credited with one year of the required experience. Subjects of examination and relative weights: Questions on graphical and analytical determination of stresses, and the design of trusses and girders, foundations, bearings, etc., 6; experience, education and personal qualifications, 4. For part of the examination candidates may use tables and books of reference as desired. Open to nonresidents.

Junior Railway Engineer, Public Service Commission, First District. Salary, 901 to $1200 per annum. The duties are to inspect the power houses and equipment of subway, elevated and street railways, and of electric companies in New York City. Candidates must have had at least three years' training in a technical school of recognized standing and not less than one year's experience in electric railroad or electric-lighting work, or in the manufacturing or installation of electrical or mechanical apparatus. Subjects of examination and relative weights: Theoretical and practical questions relating to the construction and operation of power house and railway equipment, measurements, standards, and other pertinent subjects, 5; experience and personal qualifications, 3; education, 2. Open to nonresidents.

Railway Business for March—For the month of March the operating income per mile of line decreased 31.3% for the railways of the East, increased 6.6% for the railways of the South and increased 9.4% for the railways of the West as compared with March, 1912. The average for the railways of the entire country decreased 9.9%.

This operating income for the 222,086 miles of line summarized by the Bureau of Railway Economics from the reports of the railways to the Interstate Commerce Commission aggregated for the month $52,137,897, or $235 per mile of line, which is equivalent to $7.57 per mile of line per day. Operating income is that proportion of their receipts which remains available to the railways for rentals, interest on bonds, appropriations for betterments, improvements, new construction and for dividends.

The aggregate of the total operating revenues for the month was $241,048,818, an increase of $9,864,272 over March, 1912. The operating expenses were $178,234,167, or $14,104,236 more than for March, 1912. The net operating revenue was $62,814,651, or $4,239,964 less than for March, 1912. Taxes were $10,418,258, an increase of 7.7% per mile of line over March, 1912, leaving the operating income 9.9% less per mile of line as stated.

CONTRACT PRICES

+Paving—Belle Plaine, Iowa—Bids for paving, Division A, according to plans prepared by Charles P. Chase, Consult. Engr., Clinton, Iowa, were received by the city, May 19, as follows: (A) Des Moines Asphalt Paving Co., Des Moines; (B) M. Tschirgi & Sons, Cedar Rapids; (C) J. W. TURNER IMPROVEMENT CO., Des Moines (awarded contract, using cement filler). The item bids were:

PAVING, BELLE PLAINE, IOWA

	A	B	C
2650 cu.yd. excavation	$0.50	$0.60	$0.48
1050 lin.ft. curb and gutter	0.58	0.75	0.60
546 lb. cast iron	0.045	0.04	0.045
8400 sq.yd. concrete base		0.95	
8400 sq.yd. brick, with sand filler	1.935	1.10	1.925
Extra cement filler	0.08	0.10	0.07
Totals, sand filler	$18,213	$19,619	$18,097
Totals, cement filler	$18,885	$20,459	$18,689

CONTRACT PRICES

Aqueduct—Montreal, Que.—Bids for enlarging the city aqueduct were received, May 16, by the Board of Water Commissioners, George Young, Ch. Engr. The bids were: (A) Cook Construction Co., Ltd., Sudbury, Ont.; (B) Quinlan & Robertson, Montreal, (C) J. P. Mullarkey, Montreal; (D) Oscar Daniels Co., 15 Broad St., New York; (E) O'Brien & Doherty, Montreal; (F) M. P. & J. T. Davis, Montreal; (G) Lawson & Leitch, Montreal; (H) Sir John Jackson, Ltd., Montreal.

ENLARGING AQUEDUCT, MONTREAL, QUE.

	A	B	C	D	L	I	G	H
2,350,000 cu.yd. earth excavation, with boulevards	$0 28	$0 41	$0 38	$0 46	$0 40	$0 42	$0 50	$0 74
2,350,000 cu.yd. earth excavation, without boulevards	0 32	0 42	0 38	0 52	0 45	0 40	0 55	0 76
436,180 cu.yd. rock excavation, with boulevards	0 90	1 00	1 15	1 10	1 15	1 20	1 25	1 14
436,180 cu.yd. rock excavation, without boulevards	0 90	1 05	1 15	1 15	1 15	1 15	1 30	1 18
108,700 cu.yd. reinforced retaining walls	9 50	9 00	9 60	8 50	9 25	12 50	11 30	11 6
22,500 cu.yd. unreinforced retaining walls	7 00	6 75	7 25	7 00	7 25	10 65	8 50	11 74
60,000 lin.ft. wooden piles under walls	0 45	0 35	0 45	0 40	0 50	0 55	0 40	0 85
Dam, lump sum	7,000 00	13,500 00	25,000 00	48,000 00	20,000 00	24,200 00	10,000 00	24,000 00
700 cu.yd. culverts	10 00	20 00	30 00	13 00	11 00	15 00	20 00	21 80
25,000 sq.yd. lining in tail-race	1 35	1 50	2 50	2 50	1 00	3 00	2 50	1 00
3350 sq.yd. slope walls in forebay	2 00	1 50	4 00	1 75	3 00	2 50	2 00	1 00
Totals (a)	$2,322,562	$2,621,180	$2,750,952	$2,792,061	$2,778,557	$3,260,366	$3,208,263	$4,225,567
Totals (b)	$2,416,562	$2,666,489	$2,750,952	$2,954,870	$2,896,057	$3,191,557	$3,407,564	$4,290,010

Paving—Brooklyn, N. Y.—Bids for paving Flatbush Ave. extension from Fulton St. to Concord Ave., and repairing Johnson St., from Flatbush Ave. extension to Gold St., with granite block, were received, May 14, as follows: (A) John A. Guinan Contracting Co.; (B) Robertson Construction Co.; (C) Frank J. Gallagher; (D) Newman & Carey Co.; (E) Freeman & Hess Co., Inc.; (F) Norton & Gorman Contracting Co.; (G) Charles A. Myers.

PAVING, BROOKLYN, N. Y.

	A	B	C	D	E	F	G
25,230 sq.yd. pavement	$3 35	$3 98	$3 95	$3 63	$3 97	$3 50	$3 50
8035 sq.yd. pavement	3 35	3 98	3 95	3 63	3 47	3 50	3 50
20 sq.yd. stone pavement	50 00	60 00	60 00	50 00	1 00	95 00	70 00
4200 cu.yd. concrete	5 20	5 50	5 40	5 40	5 85	5 90	5 50
1107 cu.yd. concrete	5 20	5 50	5 10	5 40	5 85	5 90	5 50
240 lin.ft. new curb	1 15	1 10	1 15	1 10	1 00	1 10	1 25
30 lin.ft. old curb	75 00	70 00	60 00	50 00	50 00	80 00	70 00
320 lin.ft. granite heading stones	1 00	1 25	95 00	1 00	1 00	98 00	2 00
515 lin.ft. 8-in. granite curb	1 60	2 00	2 45	2 00	1 75	1 80	2 00
3840 cu.yd. earth excavation	1 00	98 00	1 20	1 00	60 00	98 00	1 29
Totals	$144,326	$167,073	$166,202	$154,888	$150,275	$153,049	$152,574

Widening Canal—Louisville, Ky.—Bids for widening the Louisville and Portland Canal were received by Maj. J. O. Oakes, Engineer's Office, Louisville, Mar. 26, as follows: (A) Henry Bickel Co., Louisville, Ky.; (B) J. H. Cahill, Louisville, Ky.; (C) Callahan Construction Co., Knoxville, Tenn.; (D) Mason & Hanger Co., Richmond, Ky.; (E) Asheville Construction Co., Asheville, N. C.:

WIDENING CANAL, LOUISVILLE, KY.

	A	B	C	D	E
770,000 cu.yd. common excavation	0 45	0 45	0 50	0 45	0 40
205,000 cu.yd. rock excavation	.90	.95	.90	1.10	1.12
550 lin.ft. drilling bolt holes	1.00	.25	.50	.80	.60
24 cu.yd. stone paving	3 00	10 00	7 00	7 00	4 50
400 cu.yd. reinforced concrete	20.00	7.00	10.00	12.00	11.00
16,951 cu.yd. plain concrete	5.00	5.50	6.50	5.75	7.40
434,000 sq.ft. channeling	.30	.30	.40	.40	.38
385 lin.ft. 24-in. c.i. culvert	8.00	5.00	4.00	8.00	7.00
24 lin.ft. 16-in. c.i. culvert	6.00	3.00	2.50	4.50	4.00
58,000 lb. reinforcing rods	.05	.05	.04	.04	.074
1536 lb. iron check posts	.10	.07	.10	.08	.09
12,200 cu.yd. macadam roadway	.75	1.25	1.00	1.00	1.809
Totals	$565,095	$673,033	$700,808	$713,107	$743,10

Sewer—Knox, Ind.—Bids for constructing the East District Sewer were received by the Town Clerk, May 8, as follows: (A) J. C. Poll; (B) T. J. Campbell; (C) William J. Eiler & Co.; (D) Tony Ross; (E) Lewis E. Barnes; (F) A. M. Lanyon; (G) Tom Joyce; (H) VITO GRAZIANO (awarded contract).

EAST DISTRICT SEWER, KNOX, IND.

	A	B	C	D	E	F	G	H
750 ft. 20-in. pipe	$1 90	$1 72	$1 72	$1 60	$1 40	$1 50	$2 98	$2 00
660 ft. 20-in. pipe	1 90	1 75	1 72	1 85	1 55	2 00	3 33	2 00
660 ft. 18-in. pipe	1 70	1 62	2 32	1 70	1 50	1 75	1 44	1 75
1010 ft. 15-in. pipe	1 25	1 53	2 17	1 50	1 20	1 25	0 97	1 50
350 ft. 12-in. pipe	1 00	0 85	0 82	0 75	0 65	0 70	0 84	1 00
1700 ft. 12-in. pipe	1 00	1 00	1 27	0 97	0 75	0 80	0 925	1 00
350 ft. 12-in. pipe	1 00	1 25	1 56	1 20	0 80	1 00	1 00	1 00
6650 ft. 8-in. pipe	0 85	0 72	0 69	0 60	0 65	0 60	0 44	0 50
8970 ft. 8-in. pipe	0 85	0 78	0 79	0 65	0 75	0 70	0 51	0 50
350 ft. 8-in. pipe	0 85	0 85	0 89	0 70	0 90	0 65	0 625	0 50
200 ft. 8-in. pipe	0 85	0 70	0 59	0 50	0 60	0 40	0 44	0 35
190 ft. 6-in. pipe	0 65	0 45	0 46	0 45	0 40	0 30	0 37	0 35
60 ft. 16-in. railroad crossing	3 00	3 45	6 75	2 916	2 25	1 50	3 00	3 50
30 ft. 20-in. railroad crossing	4 00	5 00	7 90	3 33	2 70	2 00	4 00	4 00
30 ft. 8-in. railroad crossing	2 00	2 50	4 30	3 33	1 80	1 00	2 00	3 00
10 cu.yd. outlet	75 00	375 00	250 00	300 00	200 00	200 00	450 00	200 00
57 manholes	25 00	38 00	35 00	35 00	30 00	31 00	25.00	25 00
2 manholes and catch basins	25 00	90 00	70.00	35 00	35 00	40 00	42.60	75 00
9 lampholes	5 00	6 00	7 50	12 00	5 00	7 00	15.00	6 00
4 catch basins	20 00	60 00	40 00	45 50	27 80	40 00	40.00	35 00
4 sewer inlets	15 00	16 00	17.50	5 00	5.00	10 00	20 00	5 00
Totals	$23,436	$23,313	$23,205	$20,691	$20,045	$19,986	$19,174	$18,221

Paving—Colton, Calif.—Bids for paving Eighth St. from H to Mill St., were received by the City, May 12, as follows: (A) Fairchild-Gilmore-Wilton Co., Los Angeles; (B) PAONESSA CONSTRUCTION CO., Story Bldg., Los Angeles (awarded contract); (C) Highway Construction Co., Redlands, Calif.; (D) W. D. Bahan, San Bernardino; (E) Los Angeles Paving Co., Los Angeles; (F) Johnson Shea Co., Riverside, Calif.

PAVING, COLTON, CALIF.

	A	B	C	D	E	F
108,420 sq.ft. asphalt pavement	$0 156	$0 155	$0.1525	$0 1675	$0 165	$0 17
162,350 sq.ft. oiled macadam pavement	0 095	0 0775	0.0975	0.083	0 083	0 125
20,400 sq.ft. cement concrete gutters	0.15	0.15	0 14	0.145	0 14	0.15
3640 sq.ft. cement-concrete entrances	0 15	0.14	0.14	0.14	0 14	0.15
560 sq.ft. oiled macadam entrances	0 095	0.08	0 105	0 085	0 083	0 15
815 lin.ft. 30x12-in., 12-gage corrugated-iron culverts	2 00	1 25	3 50	3 00	3 00	1.75
150 lin.ft. 30x6-in., 12-gage corrugated-iron culverts	1.90	1.25	3 50	2.75	2 75	1.75
196 lin.ft. reinforced-concrete culverts	2.30	1.80	4.50	4.00	4 00	3 50
Totals	$38,362	$34,561	$40,047	$38,791	$38,418	$44,790

CONTRACTS TO BE LET

Passaic Valley Sewerage Commissioners

NOTICE TO ENGINE BUILDERS

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the first day of July, nineteen hundred and thirteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for furnishing and erecting Pumping Plant for the Newark Bay Pumping Station in the City of Newark, New Jersey.

Particulars that may enable Contractors to judge of the character of the plant to be furnished are given below:

BIDS.

The Contractor's bid must be for furnishing and erecting complete and ready to operate three (3) Pumping Engines (or sets of Engines) directly connected with and so operate three (3) submerged centrifugal pumps, each capable of raising 100 million gallons of sewage per 24 hours to a maximum lift of 37 feet. Each pump and engine must also be capable of pumping at as low a rate as 50 million gallons per 24 hours against a lift of 20 feet, and at all rates between. The foregoing capacities must be demonstrated by suitable trials.

The Contractor's bid must also include vertical internally fired, fire-tube boilers, sufficient in number and size to easily operate the three (3) engines when pumping at their maximum rate against their maximum lift, together with three additional boilers of the size offered for duplication and the general steam uses of the Station; a fuel economizer; feed-water heaters; a traveling crane; piping; feed pumps; condensers, and all necessary fittings and appliances found in pumping stations of the best class.

The Engine and Boiler Houses and all foundations will be provided by the Commissioners and in readiness within two years from the date of the execution of the contract.

The plant must be set up, complete in every detail ready to run within two and one-half years from the date of the execution of the contract.

Drawings, form of contract and specifications, and blank for proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.

JOHN S. GIBSON, Clerk.

April 22, 1913.

❋

Paving

CITY ENGINEER'S OFFICE, NO. 17 CITY HALL.

New Haven, Conn., May 22, 1913.

Sealed proposals will be received at this office until 11 a.m., June 2, 1913, for paving Congress Avenue between Howard and Davenport Avenues; College Street between Chapel and Grove Streets; Sachem Street between Prospect St. and Winchester Avenue; and Norton Street between Chapel Street and Derby Avenue, with creosoted wood block; sheet asphalt, Sicilian Rock Asphalt; and brick. Total yardage about 29,000. The Commission reserves the right to award on the basis of any of the above pavements.

Blank forms of proposal, and any information concerning plans, specifications, bonds, etc., will be furnished upon application.

No proposal will be received after the time specified, and all proposals not on the blanks furnished or not properly filled out will be rejected.

The right to reject any or all bids is reserved.

By order of the Commission on Permanent Pavements.

F. L. FORD, City Engineer.

Trunk and Lateral Sewers

DEPARTMENT OF WORKS.

City of Oswego, N. Y., May 8, 1913.

Sealed proposals for the construction of trunk and lateral sewers for the City of Oswego, will be received by the Department of Works, in the City Hall, up to two o'clock p.m. of the 4th day of June A. D. 1913, and immediately thereafter be publicly opened and read.

The work to be done consists of the construction of approximately 9700 feet of sanitary sewer, from 8 to 36 inches in diameter, and 5865 feet of vit. Tile and Reinforced Concrete storm sewer made in complete sections from 15 to 72 inches in diameter; and the work will be done under two contracts.

The proposals submitted for these contracts must be accompanied by a certified check upon a National Bank or Trust Company, and drawn to the order of the Chamberlain of the City of Oswego for the following amounts:— For "E," "F," and "G," Three Thousand Dollars; for "H," Two Thousand Five Hundred Dollars.

Specifications and printed forms of proposals can be obtained of the City Engineer, and a full set of plans can be obtained from him, for the sum of ten dollars ($10), such a sum to accompany the order, and be drawn to the order of the City Chamberlain of the City of Oswego, and such sum will be returned to the applicant upon the return of the set of plans to the City Engineer in good condition. Specifications and plans may also be seen in the office of the Engineering News.

The Department of Works reserves the right to reject any or all bids, as it may deem it for the public interest so to do. Also to waive any slight informality in the proposals. The lowest bid need not necessarily be accepted in preference to a higher one. If the bids for the East Oswego Creek storm sewer make the total cost of the work exceed the total money appropriated, then the Department of Works, reserves the right to omit the construction of a sufficient amount of the upper end of the storm sewer, so as to bring the total cost of the work within the appropriation.

JOHN SMITH,
Commissioner of Works.

CHARLES H. SNYDER,
City Engineer.

❋

Improved Paving

CITY ENGINEER'S OFFICE, NO. 17, CITY HALL.

New Haven, Conn., May 23, 1913.

Sealed Proposals will be received at this office until 11 A. M. June 9th, 1913, for paving Atwater Street, from Grand Ave. to Lombard St.; Canner Street, from Whitney Ave. to Orange Street; Cold Spring St., from Whitney Ave. to Orange St.; Dewitt Street; Edgehill Road from St. Francis Avenue to the City Line; Edgewood Ave., from end of present pavement to Edgewood Ave. bridge over West River; Elm Street, from Kensington Street to Pendleton St.; Greenwich Ave.; Mansfield St., from Prospect Place to Woodland St.; Orange St., from end of present pavement to Cold Spring Street; Prospect Place, from Prospect St. to Mansfield St.; South Front St.; and Winchester Ave., from Division Street to Highland Street, with sheet asphalt, asphaltic concrete, asfalto, and Amiesite, on concrete and new macadam foundation.

Total yardage about 88,000.

Certified check required, about 5 per cent. of bid.

Blank forms of proposal, and any information concerning plans, specifications, bonds, etc., will be furnished upon application, after June 2nd, 1913.

No proposal will be received after the time specified, and all proposals not on the blanks furnished or not properly filled out will be rejected.

The right to reject any or all bids is reserved.

By order of the Commission on Permanent Pavements.

F. L. FORD, City Engineer.

Engineering News

VOLUME 69 JUNE 5, 1913

The Westchester Railway Lines and Structures

SYNOPSIS—This is the first of two articles on an electric suburban railroad built for heavy traffic. A few historical notes are given, preliminary to describing the line and station structures. An unusual collection of interesting station designs is presented. The electrical features, including catenary structures, power supply, rolling stock, and signaling system, are covered by the second article to follow.

The design and construction of the New York, Westchester & Boston Ry., a heavy high-speed suburban electric line running from White Plains and New Rochelle in Westchester Co. through the Borough of the Bronx to the edge of Manhattan, and which has now been in operation for several months, presents opportunity for studies of unusual interest. While the road has been in operation on a commercial scale for several months now, yet the station structures and line equipment have not that long been fully completed, and it is only comparatively recently that the project could be truly seen in final form.



Viaduct and Station of the New York, Westchester & Boston Ry. at Fifth Ave., Pelham, N. Y.

History

The old New York, Westchester & Boston Ry. dates back to 1872, when it was organized and started construction. It was in a receiver's hands from 1875 to 1904. The projected line is recorded as running from the Harlem River to Portchester and Mt. Vernon, with one branch from 177th St., Bronx, southeast to Throgg's Neck about four miles, and another branch from Mt. Vernon to Elmsford about eight miles. In 1904 the company obtained rights from the city of New York, and the state Railroad Commission, but was held up until 1909 by the courts for a certificate of necessity and convenience. In that year it purchased the franchise for New Rochelle held by the New York & Portchester R.R., which had been organized in 1901, with a projected line from the Harlem River to Mt. Vernon and Portchester and with a branch from 177th St. southeast to Classon's Point, which is about two miles west of the Throgg's Neck end of the branch of the older Westchester road.

A new company bearing the name of the New York, Westchester & Boston Ry. was organized in 1910 as a consolidation of the two roads above noted. The new road was authorized to abandon such portions of the route of the two earlier companies not necessary for a continuous line between Harlem River and Portchester with a branch southeast to Classon's Point and Throgg's Neck and one north to White Plains.

Since the reorganization, the work has been carried forward so that one branch has reached White Plains; the Portchester branch has reached New Rochelle, and if it is continued beyond here it probably will be on the main-line right-of-way of the New Haven road.

This line is distinctively a metropolitan feeder, but it has no large or important terminal such as distinguishes most of the important suburban railroads. It must send its passengers on to other systems before they can reach their destination, the heart of the city. It should be noted, however, that this is a feature similar to

the efforts of the Pennsylvania R.R. in diverting suburban traffic from its large and expensive station at 34th St. in New York City in order to distribute these commuters along the lines of the Hudson & Manhattan Co. operating a tunnel system between New Jersey and Manhattan.

The Westchester routes bisect a territory which has relied heretofore on two now-electrified steam roads—the New York Central & Hudson River and the New York, New Haven & Hartford. (It is to be regarded as a subsidiary of the latter through ownership, although the road maintains its own indivuality of operation.) However, the new road traverses an area wherein the residents for the most part would have to walk an uncomfortably long ways to the older roads' stations.

The southern terminus of the Westchester road is the Harlem River station of the New Haven road (Harlem branch) in the Borough of the Bronx about opposite 130th St., Manhattan. Here a shuttle service connects with the Second and Third Ave. elevated lines. Morning and night, a limited number of rush-hour express trains are started from and run into this terminus to eliminate the delay and inconvenience of two transfers. A connection for transfer of passengers will be made with the Bronx terminus of the Interborough subway system, which is now only two blocks away from the Westchester station at 180th St.

The new road makes use of the tracks of the New York, New Haven & Hartford R.R. (Harlem division) for a little over three miles from the Harlem River terminal. From there to Columbus Ave. in Mt. Vernon, about 6½ miles, the Westchester has a four-track line on its own right-of-way. Just beyond the Columbus Ave. station the line splits into two double-track roads—one running two miles northeast into New Rochelle and one a little over nine miles north to White Plains.

A project is under way to further extend the service beyond White Plains, however. The Westchester Northern R.R. has been organized and has obtained rights to build northeasterly to Lewisboro on the Connecticut line and to a junction with the New Haven road in Danbury. This makes an extension of about 30½ miles. A branch line is projected from the town of Pound Ridge, in Westchester County, northerly into Putnam County

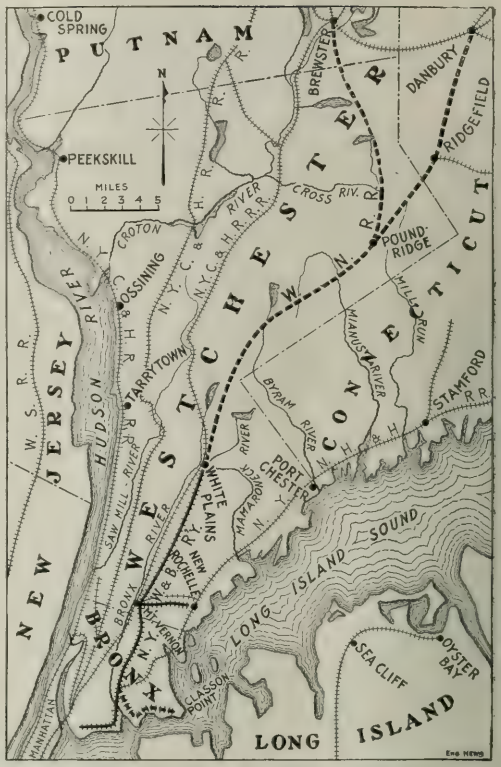


FIG. 2. MAP OF TERRITORY COVERED BY THE NEW YORK WESTCHESTER & BOSTON RY.



FIG. 3. THE WESTCHESTER STATION AT 180TH ST., BRONX, NEW YORK CITY



Fig. 4. The Westchester Terminal in White Plains, N. Y.

to a junction point with the New Haven road near the New York-Connecticut state line at Brewster, about 13 miles.

Service

The franchises of the New York, Westchester & Boston Ry. define the minimum number of trains and the hours of service, but in order better to attract passengers and develop new traffic those requirements have been exceeded. On the main line and on the easterly branch, stations are roughly a half mile apart, and are at twice that interval on the westerly branch. The train schedule shows 45 trains originating at White Plains on all days and 56 at New Rochelle. In general, an express from one branch always arrives at the Mt. Vernon junction station simultaneously with a local from the other branch, so that through or local passengers can transfer from one train to the other either to expedite their trip or to reach way stations as the case may be. This holds for both northbound and southbound trains, though there are a few more northbound ones per day than southbound. Sunday service is practically the same as on week days. Local trains at present are made up of only one car, and express trains are run in units of up to three cars, capacity being varied in this way rather than by a diminished schedule.

The fares are based on zone rates, there being eight 5c.-fare zones. Tickets are punched at a turnstile in front of the ticket office in each station as the passenger enters the train concourse or what corresponds in smaller stations; the punched tickets are deposited by the passenger before leaving the destination station. This arrangement removes all ticket collectors from the trains. The fare while being 5c. in one zone or between two, de-



Fig. 5. Street Viaduct of the Westchester Road at New Rochelle (North Ave.) Station





Figs. 6 and 7. Westchester Stations at Depressed-Highway Crossings

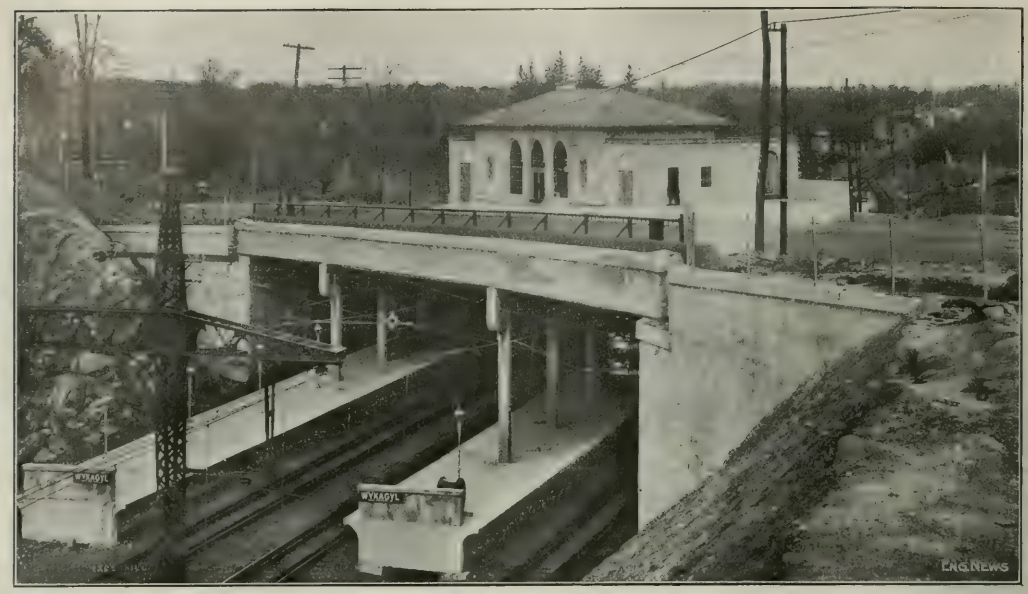


FIG. 8. STATION AT AN ELEVATED-HIGHWAY CROSSING

creases for long rides, for instance, being 25c. for the trip between White Plains and the Harlem River terminal. Commutation rates are also in force.

ROADBED

The designers of the new line could work without having to contend with steam-road traffic structures, grades, or alignments, so that this road is a pure type of electric, high-speed, high-tension, combined trunk and local line of large passenger capacity. The right-of-way follows, of course, the general contour of the country traversed, but minor topographical impediments have been cut through, bridged, or filled more boldly than is seen in interurban electric lines, or even in some steam roads. There are in all some seven miles of cuts varying up to 30 ft. in depth and averaging about 16 ft. The fills run up to a total length of 9 miles and vary in about the same way but with a smaller average height. Grades have been limited to 1%, except in two cases (1) the junction with the New Haven road (Harlem division) and (2) the White Plains terminal approach.

The line runs in typical subway construction for a stretch of 3940 ft. near Bronx and Pelham Parkway. Here the center columns are encased in a slab of concrete for 5 ft. above the track subgrade so as to form a derailment barrier. This casing is cut into about every 30 ft. to provide safety recesses for the track employees. The electrical equipment in spite of the high voltage has been made particularly simple and strong in this subway, as noted later.

In order to eliminate all grade crossings along the road, it has been necessary to carry a little over 10% of the line on 45 odd bridges and three viaducts, and to carry 22 highways over the track. The longest of the two viaducts is 2100 ft. and is at the 180th St. station in the Borough of the Bronx, and here the viaduct and station have been combined structurally and architecturally. A four-track viaduct with 116-ft. girders carries the road (four tracks) over the main line of the New Haven road in Mt. Vernon, just before the junction of the eastern and western branches.

The rails are of standard-section 90-lb. bessemer and are laid on creosoted pine ties with tie plates at curves,



FIG. 9. A REINFORCED-CONCRETE STATION WITH SPACE FOR STORES



FIG. 10. A SMALL-STATION ENTRANCE

bridges and stations; common spikes are used elsewhere. The ballast is crushed trap rock. The right-of-way is fenced in throughout, posts and fencing all double galvanized.

Stations

In designing the New York, Westchester & Boston Railway Stations between 180th St. and White Plains, the physical conditions at the various station sites differed so radically that it was found impracticable to adopt an absolute standard plan for all stations, and special study was accordingly given to each station site, no two of which were identical. As a result, the stations have been designed not only to meet the commercial requirements, but to give the appearance of a close sympathy with the natural conditions existing at each particular location.

In order to avoid the lack of unity of design, usually found in a railway-station improvement when viewed together with the adjacent supporting railway structures such as retaining walls and bridge abutments, the latter were woven into and made a part of the general station design, throughout the whole Westchester project, thus securing a simple, dignified appearance of buildings and settings all along the road. Notable examples are



Fig. 11. Interior of a Station on the New York, Westchester & Boston Ry.

seen in the concrete arch at Fifth Ave. and Third St., Pelham, and North Ave. bridge, New Rochelle (Figs. 1 and 5). The stations at East Lincoln Ave., and Kingsbridge Ave., Mt. Vernon (Figs. 6 and 7), also will show the advantages of this treatment.

In the planning of the stations proper, the chief consideration was given to the simplicity and directness of the layout with a view to the handling of passengers with the least inconvenience and at the lowest operating and maintenance cost. Wherever possible, surplus space was devoted to rental area, such as for stores, news stands, restaurants and similar purposes. The general offices of the road are accommodated at the 180th St. station (Fig. 3).

From the waiting-rooms, direct, safe and sheltered access is provided to each passenger platform by means of overhead bridges or by tunnels under the tracks, accordingly as the track is depressed or elevated. A system of separate exits has been worked out, so that direct access may be gained to the streets for passengers leaving the stations without in any way conflicting with the incoming traffic. Another feature is the sheltered platforms, which are equipped with ample and convenient seating capacity, in order that the passengers may await their trains at the platform level, as well as in the station buildings proper.

The type of the architecture is that of the Italian Renaissance, and the general exterior color scheme adopted consists of marble stucco applied to the walls. The station roofs and the copings of all inclosure walls are formed with a roof tile of a soft reddish-brown shade.

In the interior design of the stations (see Fig. 11), special attention was paid to securing a sanitary construction which could be easily maintained and kept clean, woodwork being entirely eliminated with the exception of the doors and seats. Steel window sash were used throughout. The walls throughout the main rooms are formed with a grayish marble "granite," highly polished, with ample relief in its border lines of soft verde antique marble. A capping consists of a continuous marble band forming a Greek fret design, makes a most consistent and appropriate finish to the wall surface decorations. In all the toilet rooms a new style of sanitary facing composed of opal-glass brick with rounded corners and coves at the floor line, is used. All hardware and metal finish is simple in design and of solid cast bronze.

These structures were designed by A. Fellheimer, of Stem & Fellheimer, associate architects, New York City, to whom we are indebted for the photographs and notes. Construction work of the Westchester road is under E. J. Langford, chief engineer; P. W. J. Smith is superintendent of operation and F. Zogbaum, engineer of maintenance.

❋

A Sanitary District for Northern Indiana may be created to take care of the questions of sewage disposal and the prevention of pollution of Lake Michigan in this rapidly developing territory. The Indiana legislature has passed an enabling act for the creation of such districts, based on the organization of the Sanitary District of Chicago. It is intended specially to apply to Lake County, which is adjacent to the Illinois-Indiana state line, but as yet nothing has been done towards establishing the proposed district. The conditions of water pollution by sewage within this territory were noted in our issue of Jan. 21, 1909 (p. 78).

Interstate Bridge Purchase is to be undertaken by the states of Pennsylvania and New York, if a bill of the New York Legislature is successful.

The Delaware River is spanned by 11 bridges in that portion forming the boundary between New York and Pennsylvania. Ten of them are toll bridges owned by corporations (Port Jervis, Barryville, Lackawaxen, Narrowsburg, Skinner's Falls, Cochecton, Callicoon, Kellams, Lordville and Hancock); while a bridge at Pond Eddy was acquired some years ago by the town of Lumberland.

The matter of the acquisition of these bridges has been pending before the Legislatures of the two states for several years. The first step was taken by New York in 1905, when it authorized the superintendent of public works to make an investigation of the Delaware River bridges in conjunction with a Pennsylvania commission, and to report as to conditions found. The State of Pennsylvania did not give the necessary authority to any of its officials to represent it in such matter until 1910, and it was not until that year that the joint investigation was made. In 1911, report was made to the Legislature. The pending bill, evidently a result of the report made at that time, would create an interstate bridge commission, consisting of the state engineer, the state superintendent of public works, and a third member to be appointed by the governor, this commission to act jointly with similar officials designated by the state of Pennsylvania. The joint commission is to acquire the rights, franchises and properties of the Delaware River toll bridges, either by agreement with the owners or by condemnation proceedings under the power of eminent domain. When the bridges have been acquired, they shall be free to the public. The cost of the acquisition of the structures as well as their maintenance when acquired is to be borne jointly by the two states. The bill appropriates $175,000 from the New York treasury.

The proposed arrangement is less interesting by its magnitude than by constituting a project for interstate action.

Laws of Heat Transmission*

By Irving Langmuir†

Even in the simplest case of heat transmission, the phenomena involved usually prove to be quite complicated. It is, in most cases, nearly impossible to separate completely the effects of conduction, radiation and convection, and, therefore, if quantitative results are to be obtained, it becomes necessary to make an elaborate series of corrections, to eliminate the undesired factors.

Failure to appreciate the necessity of separating each of these factors has rendered the majority of all investigations on heat transmission previous to 1880 almost valueless. A very large number of results published even today on heat conductivity and surface emissivity are thoroughly unreliable from this cause.

It is surprising to what extent the old unreliable data maintain their place in present-day handbooks and textbooks. There is probably hardly a field in which so much care is needed in selecting proper sources for information, the whole literature being full of absolutely contradictory statements.

In the present paper the writer has attempted to present in as clear a manner as possible the fundamental laws of conduction, radiation and convection of heat, and to furnish some experimental data which seems to be of value.

CONDUCTION OF HEAT

The problem of the conduction of heat through solids was the first subject of mathematical and experimental study in the development of the theory of heat. Fourier and others developed the mathematical theory long before there was any reliable experimental data by which they could test their conclusions.

Fourier considered especially the problem of the rate of heating of a body capable of conducting heat. To solve this problem, he invented special mathematical methods which are now studied under the head of Fourier's Series. Because of the extreme complexity of this subject, mathematical analysis does not promise, for the present, to be of much value to the electrical engineer. We shall, therefore, limit ourselves to the simpler problem of the steady flow of heat which prevails after sufficient time has elapsed for the temperature through the apparatus to become constant.

For this case of steady heat flow through solids, the general law may be stated

$$W = \frac{A}{l} \mathbf{k} (T - T_0) \qquad (1)$$

where

W = Watts of heat flow;
A = Area of cross-section of path of heat flow;
l = Length of heat path;
k = Coefficient of heat-conductivity expressed in watts per cm. per deg.;
$T - T_0$ = Difference of temperatuse causing the heat flow.

HEAT CONDUCTIVITY OF SOLIDS—The heat conductivity **k**, of solid bodies varies greatly for different substances, ranging from 4.2 watts per cm. per C° for pure silver to 0.0016 for such substances as rubber. The conductivity of finely divided solids, fibrous materials, powders, etc., is very much less than that of homogeneous solids. The best heat insulators known, such as eider-down, have a conductivity as low as 0.00020 watts per cm. per C°.

In Table I the writer has collected together all of the reliable data he has, by careful search, been able to find on the conductivity of such materials as are of interest to the electrical engineer.

In this table it will be noted that the conductivities of various substances of any one type do not differ very greatly from one another; for example, the range of conductivities of organic materials used for electrical insulation is from about 0.0015 to 0.0040. The presence of air spaces in a body very much decreases the conductivity, as is seen for the extremely low conductivities of such materials as wool, cotton batting, etc. That this high thermal resistance is entirely due to the presence of gas is evident from the fact that these materials are relatively good conductors when placed in an atmosphere of hydrogen.

In the case of powdered or fibrous materials, the heat conductivity is practically independent of the true conductivity of the solid substance forming the grains or fibers encountered.

For example, finely divided metallic powders, such as zinc dust or tungsten reduced by hydrogen from finely divided oxide are extremely good heat insulators, although the material itself is a good heat conductor.

The conductivity of liquids is quite low, and is in most cases very insignificant compared with the amount of heat carried through the liquid by convection currents. The figures given above for liquids can be used only for liquids through which heat is being transmitted downward, or in the case where the liquid is held in the meshes of some fibrous material such as cloth.

TEMPERATURE COEFFICIENT OF HEAT CONDUCTIVITY—Pure metals, although they have a large temperature coefficient of electrical conductivity, have a thermal conductivity which is practically the same at all temperatures. Alloys have a conductivity which usually increases somewhat with the temperature, the temperature coefficient being never greater than about 0.1% per C°.

In the case of pure crystalline, nonmetallic substances, Eucken ("Ann. d Physik, Vol. 34, p. 185, 1911) has shown that the thermal conductivity varies approximately inversely proportional to the absolute temperature. In others words, the temperature coefficient of such substances is usually about —0.33% per C°.

The same investigator has also shown that with amorphous, nonmetallic substances, like glass, the conductivity increases slightly with increase of temperature, the temperature coefficient being about +0.15% per deg. C°. Such substances as paraffin, ebonite, etc., are found to have practically no temperature coefficient.

Tests made by C. P. Randolph have shown that for powdered or fibrous materials the temperature coefficient of heat

TABLE I. THERMAL CONDUCTIVITIES AND RESISTIVITIES OF VARIOUS MATERIALS

Materials	Temp., C°	Conductivity watts per cm. per C°	Resistivity	References
Metals				
Pure copper	18	3.84	0.260	2
Commercial copper	18	3.50	0.285	2
Pure iron	18	0.67	1.49	2
Steel (1% C)	18	0.45	2.22	2
Cast iron	100	0.40		
Transformer steel (% Si)	20–250°	0.32	3.12	1
Brass	20–250°	1.30	0.77	1
German silver (30% Ni)	20–250°	0.28	3.6	1
Constantin (60 Cu, 40 Ni)	18	0.29	3.5	2
Calorite (65 Ni, 15 Fe 13 Cr. 7 Mn).	20–250°	0.16	6.2	1
Mineral Substances				
Graphite		3.57	0.28	11
Marble		0.030	33	3
Slate		0.020	50	3
Glass		0.011	90	4
Quartz glass		0.015	67	10
Porcelain		0.010	100	5
Insulating Materials				
Shellac		0.0025	400	4
Para rubber		0.0016	620	3
Gutta percha		0.0020	500	3
Paraffin		0.0026	390	3
Ebonite		0.0018	550	4
Paper		0.0013	770	3
Asbestos paper		0.0025	400	3
Varnished cambric		0.0025	400	6
Rubber tape		0.0043	230	6
Fullerboard varnished		0.0014	710	7
Pure mica		0.0036	280	7
Linen tape varnished and baked		0.0015	670	7
Miscellaneous materials	Apparent density grams per cu.cm.			
Cotton batting, loose	0.21	0.0046	2200	1
Cotton batting, tightly packed	0.10	0.00030	3400	1
Pure woolen wadding, loose	0.015	0.00049	2040	1
Pure woolen wadding, packed slightly	0.054	0.00036	2800	1
Pure woolen wadding, tightly packed..	0.192	0.00023	4400	1
Eider down, very loose	0.0022	0.00045	2200	1
Eider down, slightly packed	0.077	0.00025	4100	1
Eider down, tightly packed	0.11	0.00019	5200	1
Soft white pine cross grain		0.0016	640	
Liquids				
Water 25° C		0.0057	176	4
Paraffin oil		0.0014	710	8
Glycerin 25° C		0.0024	410	4
Petroleum 23° C		0.0016	630	8
Gases				
Air at 20° C		0.000249	4010	9
Air at 100° C		0.000300	3330	9

References:—[1] C. P. Randolph, Research Lab., General Electric Co. (1912). [2] Jager & Diesselhorst, Wiss. *Abl. d Phys.* Techn. Reichsanstalt, 3260 (1900). [3] Lees, *Phil. Trans.* (A) 183, 481 (1892). [4] Lees, *Phil. Trans.* A 191, 399 (1898). [5] Lees and Chorlton, *Phil. Mag.* (5), 41, 495 (1896). [6] Technical Report No. 10940. General Electric Company, by C. P. Steinmetz (1910). Experiments carried out by J. L. R. Hayden. [7] Paper on Heat Paths in Electrical Machinery, Instit. of E. E. Nov. 1911 by H. D. Symons and M. Walker. [8] R. Weber, *Ann. Phys.*, 11. 1047 (1903). [9] Langmuir, *Phys. Rev.* 34, 406 (1912). [10] A. Eucken, *Ann. Phys.* 34, 185 (1911). [11] Koenigsberger and Weiss, *Ann. Phys.* 35, 1 (1911).

*From a paper presented at the midwinter convention of the American Institute of Electrical Engineers, New York, February 26-28, 1913. Copyrighted by permission.

†Research Laboratory, General Electric Co., Schenectady, N. Y.

conductivity is very large. For example, measurements of the heat conductivity of popped water glass at various temperatures up to 500° C. gave the results

Range of temperature	Heat conductivity Watts per cm. per C°
20—100	0.00030
100—200	0.00039
200—300	0.00057
300—400	0.00076
400—500	0.00133

This material had an apparent density of 0.026 and contained air cells of about 0.5 mm. average diameter. The large temperature coefficient is caused by radiation across the walls of the air cells, which is relatively large at high temperatures but almost negligible at room temperature. Below 100° C. the temperature coefficient for powdered and fibrous materials may be taken as +0.3% for materials with a coarse structure and proportionately less for finer structure.

In the case of gases, the mobility and the coefficient of thermal expansion are so great that convection becomes very large. It was thought for a long time that gases had no true conductivity. Maxwell, however, calculated the conductivity from the kinetic theory, and predicted that it would be independent of the pressure. His results have since been thoroughly verified. To avoid convection currents, it is only necessary to reduce the pressure of the gas to a value of several centimeters. At lower pressures the heat conductivity is found to be entirely independent of the pressure down to a pressure of 1 mm. When the pressure becomes much less than this, the free path of the molecules begins to become comparable with the length of the path along which the heat is conducted. At still lower pressures, the heat conductivity becomes proportional to the pressure. It is evident that the pressure at which the change from one of these laws to the other takes place is inversely proportional to the length of the path of heat flow. In the case, therefore, where we have the space subdivided by the presence of a fibrous material, we find that the heat conductivity does not remain constant down to such low pressures as 1 mm., but may even, with very finely divided materials, decrease with decreasing pressure, from atmospheric pressure down. This subject has been very fully treated by Smoluchowski ["Anz. Akad. Wiss. Krakau" (1910) A. 129-153].

In the case of the heat conduction of gases, we find there is a large temperature coefficient of heat conductivity. It has been thoroughly proven that Sutherland's formula

$$k = \frac{K c_v \sqrt{T}}{1 + \frac{C}{T}} \qquad (2)$$

very accurately represents the change in conductivity with the temperature. Here "K" is a constant, "c_v" is the specific heat of the gas at constant volume, and "C" is a constant equal to 124 for air.

In general, when "**k**" is a function of the temperature, we cannot use equation (1) to calculate the heat conduction through a given body. It can be shown, however, [Langmuir, "Phys. Rev.," Vol. 34, p. 406 (1912)], that if we substitute for the factor $\mathbf{k}\ (T - T_0)$ the integral $\int_{T_0}^{T} \mathbf{k}\ dT$ we are then able to calculate the heat conduction, no matter how much the heat conductivity may vary with the temperature. For such cases as these, the results can be calculated most easily by calculating or plotting the values of the integral $\int_{0}^{T} \mathbf{k}\ dT$. If we represent by ϕ the value of this integral, which we may call specific conduction, then the formula for heat conductivity becomes

$$W = \frac{A}{l}(\phi - \phi_0) \qquad (3)$$

CONDUCTION THROUGH BODIES OF VARIOUS SHAPES.

Equations (1) or (3) can be used only for the heat conduction between parallel planes. In other cases, "A" and "l" are both variables, and the proper mean values must be determined by special methods.

No matter what the shape of the body, the ratio $\frac{A}{l}$ has a definite value, if the surfaces of in-flow and out-flow of the heat are fixed. Let us call this quantity the "shape factor," and represent it by the letter "s." Our equation for heat conduction thus becomes

$$W = s(\phi - \phi_0) \qquad (4)$$

The value of the shape factor for bodies of various shapes may be of interest. The following cases are worthy of considering here:

Planes

$$s = \frac{A}{l}$$

Concentric cylinders of diameters "a" and "b."

$$s = \frac{2\pi}{\log_e \frac{b}{a}} \qquad (5)$$

Concentric spheres of diameters "a" and "b."

$$s = \frac{2\pi}{\frac{1}{a} - \frac{1}{b}} \qquad (6)$$

Concrete Rectangular Prisms or Parallelopipedons. For this case the following formula applies with great accuracy to the flow of heat where the thickness of the heat-conducting material between the two surfaces is constant and where the thickness of the layer is not more than 2½ times the smallest dimension of the prism, a condition nearly always fulfilled in practice. The formula is

$$s = \frac{A}{t + \frac{1}{2}\Sigma l + \frac{1}{2}\pi t} \qquad (7)$$

Here "t" is the thickness of the layer of conducting material, "Σl" is the sum of the length of the 12 edges of the inner prism, and "A" is the total surface of the inner prism.

RADIATION OF HEAT

Dulong and Petit (1817) gave an empirical formula for heat radiation which has been used very largely by engineers almost up to the present date.

The Stephan-Boltzman law, as applied to the radiation body" is proportional to the fourth power of the absolute temperature has been shown to be derivable from the second law of thermodynamics, and has withstood the tests of very careful experimental investigation. We may, therefore, look upon this law as being one of the exact laws of nature. It must be remembered, however, that it applies only to radiation from a so called "black body"; that is, a body which absorbs all heat rays which fall on it. Such a body can only be approximately realized, and any actual body must radiate less heat than an ideal black body at the same temperature.

The Stephan-Boltzman law, as applied to the radiation from any given body, may be written

$$W = 5.7\, e \left[\left(\frac{T}{1000}\right)^4 - \left(\frac{T_0}{1000}\right)^4\right] \qquad (8)$$

Here "**W**" is the energy in watts radiated per square centimeter of surface; "T" is the temperature of the hot body, and "T_0" the temperature of the surrounding space, "e" we may call the relative emissivity of the body; it is always a number less than unity and is a characteristic property of the radiating body.

The radiation constant, 5.7, is subject to some uncertainty at present. For several years, the commonly accepted value was 5.32, which was the result obtained by Kurlbaum ("Wied. Am.," 65, 746, 1898). Recently, however (1909), Féry obtained a value 6.3. Since then many investigators have redetermined this constant. Paschen and Gerlach ("Ann. d Physik," Vol. 38, p. 30, 1912) obtained the value 5.9. Shakespeare ("Proc. Roy. Soc.," Vol. 86A, p. 180,1911) obtained 5.67. Within the next year or so the correct value of this constant will undoubtedly be determined. For the present, it would seem almost certain that the value 5.32 is too low, and that the value 5.7 must be fairly close to the true value.

The radiation of heat differs from conduction and also convection in that it is a purely surface phenomenon. The amount of heat radiated is strictly proportional to the extent of the surface, and is independent of the presence of gas adjacent to the surface. From bodies that are not black, the heat radiated from cavities in the bodies has a greater intensity than that radiated from a flat surface, for the reason that from such a cavity there is not only the heat radiated from the bottom of the cavity, but also that reflected by the bottom surface from the walls of the cavity. The above equation for radiation, therefore, applies only for heat that comes directly from a surface, and not for that which has been reflected from the surface. In general, however, this factor is not a difficult one to take into account in the consideration of heat radiation.

The most difficult question involved is the determination of the relative emissivity "e." For clean polished surfaces of metals this quantity is small, ranging from 0.02 to 0.20. For nonmetallic substances it is usually very much larger than this, ranging from about 0.3 up to about 0.9. The following table gives the values of "e" calculated by the writer from measurements made by C. P. Randolph. (A detailed description of these measurements will be published in the "Trans." of the Am. Electrochem. Soc., Vol. 23, 1913.)

TABLE II. VALUES OF HEAT EMISSIVITY

Copper, oxidized by heating to a red heat	0.74
Copper, calorized; that is, surface impregnated with Al	0.27
Silver, pure, polished	0.03
Cast iron, fresh machined surface	0.25
Cast iron, oxidized by heating to red heat	0.65
Aluminum paint on cast iron	0.47
Gold enamel on cast iron	0.39
Monel metal, polished	0.40
Monel metal, oxidized	0.45

The relative emissivities from highly polished metal surfaces can be calculated from the reflectivity of the surface for heat rays, the emissivity and reflectivity being complementary to each other. That is the emissivity is equal to "1 — r" where "r" is the reflectivity. There is a considerable amount of data in the literature on the reflectivities of metals for heat rays. However, it has been shown by Hagen and Rubens ("Ann. d. Physik," Vol. 8, p. 1, 1902) that the relative emissivity may be calculated by the formula

$$1 - r = e = 0.365 \sqrt{\frac{\theta}{\lambda}} \qquad (9)$$

where θ is equal to the specific electrical resistivity in ohms centimeter units at the temperature of the metal and λ is equal to the wave length of the radiant energy in centimeters.

Recent investigations have shown that this formula is very accurate for wave lengths exceeding 0.005 mm. in length. The average wave length of the light corresponding to any given temperature is, according to Wien's radiation law, approximately $\frac{0.29}{T}$ cm. If we substitute this in the above equation, we obtain the value

$$e = 0.68 \sqrt{\theta T} \qquad (10)$$

This equation enables us to calculate the relative emissivity for any highly polished metal up to about 500 or 600° C. However, because of surface oxidation, the emissivity will nearly always be much larger than this except with such metals as silver, platinum and gold.

Organic substances, such as oils, varnishes, resinous materials, have a very high emissivity; that is, between 0.8 and 1. Although in the visible spectrum these bodies are transparent, they are practically black bodies as regards the long heat rays that are involved in the radiation from bodies at ordinary temperature. The same is true of glass, this being practically a black body with respect to heat rays.

TEMPERATURE COEFFICIENT OF RADIATION—For small differences of temperature, equation (8) may be written

$$W = 0.0228\, e \left(\frac{T_o}{1000}\right)^3 (T - T_o) \qquad (11)$$

We thus see that the amount of radiation between two bodies having a given difference of temperature, increases in proportion to the third power of absolute temperature. This means that the temperature coefficient of radiation between two bodies differing only slightly in temperature, is + 1.0% per C°. This is at least three times greater than the temperature coefficient of heat conduction through solids or even gases.

CONVECTION OF HEAT

The transmission of heat through liquids or gases takes place principally by means of currents set up in the fluid because of differences of density produced by the unequal heating. The amount of heat carried by convection depends on the velocity of the convection currents and also on the specific heat of the fluid. The currents are produced by the differences in density between the fluid in contact with a hot body and in contact with the cold body. We may say, in a general way, that the amount of heat carried by convection will be roughly proportional to the product of specific heat, density, and expansion coefficient, and will be approximately inversely proportional to the viscosity of the fluid.

From the very nature of convection, we would hardly expect it to obey such simple laws as those of radiation. It will depend upon the shape of the hot body, the distance between the hot body and the cold body, and upon each of the factors mentioned in the paragraph above.

There have been a great many investigations made of the laws of convection of heat, especially in gases. Dulong and Petit, in 1817, derived several empirical laws which were more or less verified over rather narrow ranges of temperature by Péclet (1860). These laws are today used in many engineering handbooks as best representing the knowledge of convection of heat. Within the last 30 years, however, much more valuable work has been done, and we now know that the formulas of Dulong and Petit are only rough approximations.

Lorenz ("Ann. d Physik," Vol. 13, p. 582, 1881) derived formulas for the convection of heat from vertical plane surfaces, making, however, certain rather arbitrary assumptions. He obtained the formula

$$W_c = 0.548 \sqrt[4]{\frac{c\, p\, k^3}{h\, \mu\, T}} \sqrt{p\, g\, T_o} \,(T_o - T_1)^{5/4} \qquad (12)$$

where W_c = heat convection per unit surface, c = specific heat of the gas at constant pressure, k = its thermal conductivity, h = its viscosity, T = its average temperature, p = its average density, g = gravitational constant, T_o = temperature of plane surface; T_1 = temperature of the gas at a great distance from the plate, H = height of the plate.

Putting in the data for air, at room temperature, 27° C. and standard atmospheric pressure, this equation reduces to

$$W_c = 0.000399\, H^{-\frac{1}{4}} (T_o - T_1)^{5/4} \qquad (13)$$

where "W_c" is expressed in watts per sq.cm., and "H" is in cm.

This equation agrees well (within 5%) with the results calculated by the writer from the experimental results of C. P. Randolph on the convection of heat from disks of metal 7½ in. in diameter. It is very probable, from the method of derivation of this equation, that the influence of the height of the plane on convection is not as great as indicated by the term "$H^{-\frac{1}{4}}$" in the equation.

The writer ("Phys. Rev.," Vol. 34, p. 401, 1012) showed that the free convection of heat from small wires consisted essentially of conduction through a film of gas of definite thickness. It was shown experimentally that the thickness of the firm is independent of the temperature from 100° C. up to the melting point of platinum. The thickness of this film depends on the diameter of the wire, but in such a way that it may be calculated with no other data than the diameter of the wire and the diameter which the gas film would have in the case of convection from a plane surface. To calculate the heat lost by convection from any wire, all that is required is to know the coefficient of heat conductivity of the gas and the thickness of this gas film for a plane surface, this latter being a constant quantity characteristic for a gas at any given temperature and pressure.

It was shown [Langmuir, "Proc.," Am. Inst. E. E., Vol. 31, 1011 (1912)] that the formulas derived from this film theory agreed excellently with the experimental data of Kennelly ("Trans.," A. I. E. E., Vol. 28, p. 363, 1909) on the convection of heat from small copper wires in air at various pressures and in air moving at different velocities.

In the following, the writer has attempted to give the principal laws for the convection of heat under the different conditions which influence it.

FREE CONVECTION—The film theory of convection makes it possible to calculate the convection from plane surfaces, from cylinders or wires of any diameter, and from spheres.

In the case of plane surfaces, the heat lost by convection is calculated simply by considering that there is a layer of air 4.3 mm. thick, adhering to the surface, and through which the heat has to be carried by conduction. It must, of course, be remembered, that in addition to this heat loss by convection, there is the heat lost by radiation.

This film theory fully explains the fact that for wires of very small diameter the heat lost by convection is nearly independent of the diameter. This follows from the shape factor (see equation 5) for concentric cylinders, since the logarithm of a number varies only slowly as the number increases.

The amount of convection from the surface differs only slightly whether the surface is placed vertically or horizontally. With a surface placed in the latter position, so that it is exposed to the air above it, the heat lost by convection is about 10% greater than when the surface is placed vertically. With the surface horizontal, but inverted so that it must lose its heat downward through the air, the heat lost by convection is naturally considerably less. For a 7½-in. (19 cm.) disk, placed in this position, the heat loss was actually found to be only 50% of the heat lost when the surface was placed vertically.

The amount of convection from a surface probably does not depend, to any great extent, on the nature of the surface. At least, as far as the writer knows, there is no trustworthy experimental evidence that the surface has any influence.

It is a surprising fact that between temperatures of 100° and 500° C., the convection calculated from the film theory as above outlined, gives nearly identical results with those calculated by Lorenz's formula (see equation 12). At temperatures above 500° C., both for convection from plane surfaces and from wires, the convection calculated from the film theory agrees better with the experimental facts than that calculated from Lorenz's formula. At temperatures much below 50° the two formulas begin to diverge quite widely. The film theory would indicate that the convection would fall off practically linearly as the temperature difference decreases; whereas, according to Lorenz's equation, the temperature would be proportional to the 5/4 power of the temperature difference. This would mean that for very slight differences of temperatures, for example, 5° or 10°, that Lorenz's equation would give very much lower results than would be obtained from the calculation from the film theory.

To decide which of these two theories would give the correct result for very small temperature differences, will require careful experimental investigation. Probably the bulk of the evidence at present is in favor of Lorenz's equation.

It should be pointed out that there is no theoretical reason known why the thickness of the film should remain constant, as the temperature of the wire or plane varies. This is simply an experimentally determined fact at temperatures above 100° C. It is quite possible that for very small temperature differences, the film thickness might become greater. In any case, however, the variation in the film thickness down to temperature differences as low as 30° would not be very important in most calculations of heat convection.

EFFECT OF PRESSURE ON FREE CONVECTION—The heat conductivity of gases is independent of the pressure. According to the film theory, therefore, the effect of pressure on the amount of heat convection would depend simply upon the effect of pressure on the film thickness which we will call "B." Theoretically, it would be very difficult to determine exactly what this effect would be. But it is certain that as the density of the gas decreases by the reduction of pressure, the thickness of the film "B" would increase; not necessarily inversely proportional to the pressure, however.

From Kennelly's data, the writer found that "B" varied inversely proportional to the 0.75 power of the pressure. From recent experiments with small wires in air, over a wide range of pressure, the writer finds that "B" varies nearly inversely proportional to the first power of the pressure. From small wires, however, the amount of heat convection depends only slightly upon the diameter of the film. In these experiments, therefore, it is very difficult to find accurately the law according to which the film thickness varies with the pressure. As the size of the wire decreases, the convection becomes less and less sensitive to pressure changes.

For the effect of pressure on the convection from plane surfaces, there is only very meager experimental data. Compan, in studying the convection from spheres 2 cm. in diameter, concludes that the convection varies with the 0.45 power of the pressure. According to Lorenz's equation, the amount of convection from plane surfaces would be proportional to the 0.5 power of the pressure. This would be equivalent to saying that "B" varies inversely proportional to the 0.5 power of the pressure.

To decide exactly how convection varies with pressure, we require further experimental work on plane surfaces in air at various prssures. Provisionally, it is probably safe to say that for the convection from plane surfaces or wires, the value of "B" is inversely proportional to the 0.5 power of the pressure.

EFFECT OF TEMPERATURE ON FREE CONVECTION—From experiments by the author on convection from platinum wires in air at various temperatures from —180° up to 700° C., it would appear that the film thickness for a plane surface is approximately proportional to the absolute temperature.

The temperature coefficient of heat convection for small wires will simply depend on the temperature coefficient of the heat conductivity of the air, since in this case the amount of heat convection depends so slightly on the film thickness. From Sutherland's equation (2) it may be shown that in the neighborhood of room temperature, the heat conductivity of air increases approximately proportional to the 0.76 power of the absolute temperature. This would mean that the temperature coefficient of heat conductivity at room temperature is +0.25% per C.°, and this would be the temperature coefficient of heat convection from the wire.

In other words, more energy would be required to maintain a wire at a given temperature elevation above its surroundings, the greater the temperature of the surroundings.

It is quite different with the convection of heat from plane surfaces. Here, the convection depends not only on the heat conductivity of the air, but also on the thickness of the film. Since the latter varies proportionally to the temperature, the amount of convection from plane surfaces will be proportional to

$$\frac{T^{0.76}}{T} = T^{-0.24}$$

In other words, the temperature coefficient of the heat convection will be —0.08% per C.° From plane surfaces the convection with a given temperature difference decreases slightly with increasing air temperature.

Lorenz's equation would lead to the temperature coefficient of —0.37% per C.°, for convection from plane surfaces.

FORCED CONVECTION—The effect of air currents on convection is very great, as is well known. However, the air currents that occur in an ordinary room, at some distance from the windows, have only very slight effect on the convection from wires and plane surfaces heated to several hundred degrees. By placing a few large screens around the body, very consistent results are obtained. With higher wind velocities, such as those obtained by placing an electric fan close to the body, the amount of convection, both from plane surfaces and from wires, increases about fourfold. Measurements with an anemometer showed the wind velocity in this case to be about 100 cm. per sec.

Kennelly has investigated the effect of wind velocity on convection from small wires, and has found that the amount of convection varies approximately in proportion to the square root of the velocity. For velocities from 200 to 1000 cm. per sec., he finds that the convection is proportional to the quantity

$$\sqrt{\frac{v + 25}{25}}$$

That is, the convection of any given wind velocity can be calculated from the velocity in quiet air by multiplying by the above factor.

It has been found that the film thickness, in the case of forced convection from plane surfaces, is very different from that found for small wires in wind of the same velocity. This fact renders the film theory almost useless in cases of forced convection.

The best single equation for the calculation of convection of wires is probably an equation calculated by Russell ["Phil. Mag.," 20, 591 (1901)] by the method first given by Boussinesq. This equation is

$$W = 8\sqrt{\frac{c\rho k v a}{2\pi}}(T_2 - T_1) \qquad (14)$$

where W = convection loss per unit of length from the cylinder, c = specific heat of the gas or liquid at constant pressure, ρ = density of the fluid, k = heat conductivity, v = velocity, a = diameter of the cylinder, $T_2 - T_1$ = difference of temperature between the cylinder and the fluid.

If, in this equation, instead of the coefficient 8 in front of the radical sign, we place 5 or 6, we find that the results agree well with Kennelly's experimental data. On the other hand, for large cylinders from 2 to 10 cm. in diameter, the formula gives good results with the coefficient between 7 and 8.

In the case of forced convection in air at room temperature, equation (14) reduces to

$$W = 0.000180\ C\sqrt{va}\ (T_2 - T_1) \text{ watts per cm.} \qquad (15)$$

where "C" is the number that varies from 5 to 8, according to the size of the wire as described above.

From equation (14) we can calculate that with a given difference of temperature and given wind velocity, the amount of convection would vary with $\sqrt{T^{-1} + 0.76}$. This would mean that forced convection under these conditions would have a temperature coefficient of —0.04% per C°; that is, with a given difference of temperature, the amount of convection would decrease slightly as the temperature of the air increases.

If the velocity of the air is produced by centrifugal force, the velocity of the air currents will probably decrease as the air temperature increases, since the density decreases and the viscosity increases. The effect of this would be to make the temperature coefficient numerically still greater.

If the convection currents are caused by flue action (for example, because of heat given to the air in long passages), this effect will be still more marked, so that the temperature coefficient will be strongly negative.

In problems on convection of heat, the flue action is often very important. For example, in studying the convection from a horizontal, plane disk, 7½ in. in diameter, we find that if we place a cylinder of asbestos paper about 10 in. in diameter and 6 in. high, around the disk, the convection is nearly doubled when the disk is at about 150°. At higher temperatures the effect of the cylinder becomes relatively much less. By observing the motion of smoke in the air above the heated disk, it is seen that the air descends along one side of the cylinder, moves across the disk, and rapidly rises along the other side of the cylinder. In general, with vertical surfaces of considerable height, any means of preventing horizontal air currents from flowing in toward the middle portion of the surface, will tend to increase the convection, since it causes the air to be drawn over the lower portion of the surface with very much increased velocity. However, if such flues as are made in this way are too long, the convection again tends to decrease, since the air that comes in contact with the upper part of the surface is already heated by flowing along the lower part of the surface, and is, therefore, capable of taking up very little more additional heat.

The whole subject of flue action in convection is as yet very little understood, and should be the subject of further careful experimental investigation.

CONVECTION IN LIQUIDS—The convection in liquids, in principle, at least, does not differ radically from that in gases. However, the velocity of the currents set up is very much less than in the case of gases, but because of the very great heat capacity of liquids per unit volume, as compared with

gases, the amount of heat carried by convection is usually much greater than with gases. The effect of the viscosity of the liquids is usually of much more importance than in the convection of gases.

The viscosity of liquids, as a rule, decreases very rapidly with increase in temperature, so that the temperature coefficient of free convection in oil is always positive and has a very large value, but differs greatly for different oils.

COMBINED RADIATION, CONVECTION AND CONDUCTION

The heat lost by surfaces is equal to the sum of the heat radiated and the heat carried by convection. It may be of interest to calculate the relative magnitude of these two effects under various conditions. For a surface only slightly above room temperature in air at 20° C., we may calculate the heat lost by convection by determining the amount of heat that would be conducted through a layer of air 4.3 mm. thickness. For 1° temperature difference the heat carried through such a film would be equal to the heat conductivity of the air, i.e., 0.00025, divided by the thickness of the film in centimeters. This gives 0.00059 watt per sq.cm. per C.° as the convection from a body in the neighborhood of room temperature. For a body at 100° C., taking a mean conductivity over this range as 0.000275, we find in a similar way the convection to be 0.00064 watt per sq.cm. per C.°.

From equation (11) the radiation from a black body only slightly above room temperature (20° C.) is 0.00057 watt per sq.cm. per C.°. From equation (8), considering the radiation from a black body at 100° C. in surrounding of 20°, we find the radiation to be 0.00086 watt per sq.cm. per C.°.

The total loss of heat from a surface will be simply equal to the sum of the convection and radiation. For most purposes, it is more convenient to deal with surface resistivities, rather than with surface conductivities. The resistivities are obtained by taking the reciprocal of the sum of the radiation and convection. In the following table are given the surface resistivities of plane surfaces, in three different positions, vertical, horizontal with exposed surface above, and horizontal with exposed surface below. In each case the resistivity at 20° and at 100° is given. Also, the resistivity for the case of a body which does not radiate any heat, and the resistivity for a body radiating as much as a black body. Any actual body will, of course, have a resistivity which lies between these two extremes.

TABLE III. SURFACE RESISTIVITIES OF PLANE SURFACES

Position	20° C.	100° C.
Vertical		
No radiation	1700	1560
Full radiation	860	670
Horizontal, exposed above		
No radiation	1540	1430
Full radiation	820	640
Horizontal, exposed below		
No radiation	3400	3100
Full radiation	1150	850

There are some cases where the radiation of heat does not play any part in the heat loss from surfaces. For example, in the interior of machines the circulation of air may carry away heat, yet no heat will be lost by radiation. In this case, the surface resistance will be independent of the nature of the surface and will be that given in the table above for a case of no radiation.

The effect of air circulation will always be to cut down the surface resistance, but even with relatively high wind velocities, this effect will never cut it down to less than about one-fifth of its value with no wind.

Another important case, where the effects of radiation and convection need to be separated, is in determining surface losses from a piece of apparatus in a room in which the walls are at a different temperature from the air. It is readily seen that if the average temperature of the walls of a room is 10° above the temperature of the air surrounding the piece of apparatus in the room, the apparatus will receive heat by radiation which it must give up by convection. Since at room temperature radiation and convection are about equally effective in removing the heat from a body which is a good radiator, it is evident that the machine will reach a temperature which is about half way between that of the air and that of the walls; that is, the temperature of the surface of the machine will be about 5° above that of the air surrounding it. Similarly, if the walls are colder than the air, the machine will have a temperature lower than the air. It will be readily appreciated that this effect is by no means negligible, since the walls of a room are often 10° warmer or colder than the air. For example, the roof may be heated by the sun's rays and the air in the whole upper part of the room may be very warm, whereas the air in the lower part of the room may be very much colder. Placing paper or cheesecloth screens around the machine will almost completely prevent this difference of temperature of the air and machine.

As we have seen, small bodies, such as wires, take up the temperature of the air very much more readily than large bodies, and, therefore, this effect of radiation from the walls will be negligible in the case of wires.

In calculations of the flow of heat through apparatus it is usually most convenient to determine the thermal resistance of the solid parts and simply add the surface resistance. If we then multiply the result by the number of watts of heat flow we obtain the total drop in temperature from the outside of the machine to the air surrounding it. Of course, in actual machines it will usually be very difficult to calculate the thermal resistance of the solid parts. In any case, however, a knowledge of the relative importance of the various factors will be a long step toward the solution of the problem.

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A New Air-Operated Dump Car

For extensive grading work on railway construction and improvement it has become very general practice to use large dump cars of the power-operated side-dump type, having a capacity of 15 to 30 cu.yd., and operated by compressed air from the train-brake system. Equipment of this kind is used largely by railways and contractors, and while its main purpose is to remove and dump excavated material it is employed also to carry ballast, cinders, material for concrete, etc. The use of power operation facilitates the work and reduces the labor cost.

A new car of this type (Fig. 1), which has been introduced recently, has some special features. It is of steel construction throughout, and its general design does not differ greatly from that of other similar cars. The underframe has a single center sill (composed of a pair of channels), which carries the bolsters and end sills and is

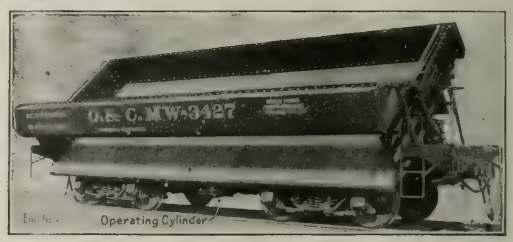


FIG. 1. SIDE-DUMP CAR OF 28-YD. CAPACITY, HAVING THE LOCKING AS WELL AS THE DUMPING MECHANISM OPERATED BY COMPRESSED AIR

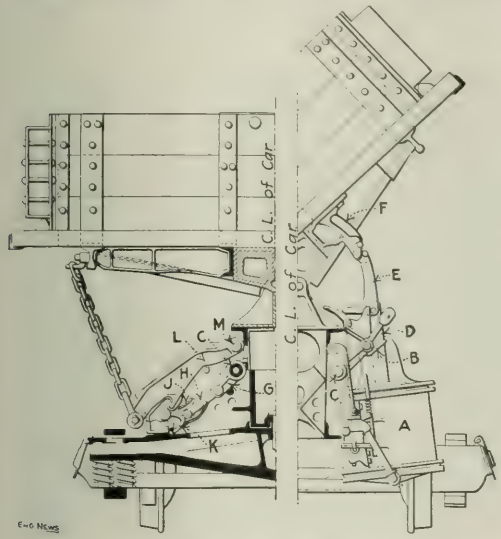
(Kilbourne & Jacobs Mfg. Co., Columbus, Ohio, builders)

mounted on a pair of diamond-frame trucks. Upon the sill are pedestals for the bearings which support the car body. The body has four sills of steel angles; each end is formed of three rows of steel channels, and the sides are of steel plate, while the floor is of wood. As is usual in such cars, the sides are not attached to the body, but are carried on hinged arms so arranged that as the body tilts the floor falls away from the side. With this arrangement the flow of material in dumping is unobstructed.

A distinctive feature of the car is in the method of applying the compressed-air power for operating. Cars of this type are operated in two different methods: (1) by a horizontal cylinder on each side (placed longitudinally or transversely), with cables led to the sides of the body; (2) by a vertical cylinder on each side, whose piston thrusts against the bottom of the body. It is this latter method which is employed in the new car. On each

side of the center sill, at the middle of its length, is a vertical cylinder which dumps the body and operates the locks holding it in normal position on the frame. The arrangement is shown in Fig. 2. When air from the car reservoir is admitted to the cylinder *A*, the stops *B B* are raised and operate the locking shaft *C*. The piston rod *D* rises also, and after the locks have been released, its lever connection *E* comes in contact with the lug or block *F*, on the bottom of the car body, and tilts the body. The cylinder on the other side then returns the body to its normal position. The movement of the body is under control, and it can be tilted slowly so as to avoid severe shocks, which is a desirable feature in such work as dumping from temporary trestles.

Another feature is the locking and unlocking of the body automatically by the pneumatic apparatus, as indicated above. In this way the work of uncoupling and coupling side chains on every car by hand at the dump-



Half Sectional Elevation at Locking Mechanism

Half Sectional Elevation at Operating Cylinder

FIG. 2. SECTIONAL ELEVATIONS OF DUMP CAR, SHOWING THE DUMPING AND LOCKING MECHANISM

ing point is eliminated. However, some makers who have locking systems prefer to use chains to secure the body to the underframe, as a measure of safety, since the accidental unlocking and dumping of a car in a train while running would be a serious matter and might cause derailment, although such an occurrence is improbable.

In the new cars, those of the larger size have the body locked near each corner (Fig. 2). The first part of the stroke of the operating cylinder causes rods to engage arms on the longitudinal shaft *C*, which carries at each end an arm *G*, to which the lock block *H* is attached. The rotation of the shaft draws back this lock in the curved guides *J*. This releases the locking knuckle *K*, which engages the hinged lever *L*, and with the tilting of the car body the chain is free to pull the lever clear of the knuckle as it swings on its pivot *M*. As the body comes to its normal position, the lever *L* is automatically engaged with the locking knuckle *K*. This is then held in place by the lock block *H* when returned to position by the rotation of the shaft as the piston completes its return stroke. It will be seen that these chains are permanently attached, and have not to be coupled and uncoupled like the safety chains noted above.

In the lighter cars, the corner locks are omitted, but near the middle of the car there are two transverse locking bands, semi-circular in form, which pass under the center sill and have their ends attached to opposite sides of the car body. Notches in the inner face of each band engage with locking dogs operated from the longitudinal shaft already mentioned.

In these new cars, therefore, the car body is unlocked, dumped, righted and relocked automatically by the use of air, and the complete operation occupies much less time than when chains on each car have to be uncoupled and coupled by hand. It is stated that one man on any car of a train can control the operation of all the cars, and can dump one car or all the cars, as may be required. The cars can be unlocked and dumped in about ten seconds, and righted and locked in the same time. The reservoir on the car is fed from the train-line of the brake system, and contains a supply of air sufficient to operate the car several times.

As to the performance of these cars, we are informed that a railway company using cars of 20-yd. normal capacity has in routine service handled 30 cu.yd. of cinders per car in a 10-car train, dumping the train on the high side of a curve (using 75 lb. pressure) and being ready to return in less than 20 sec. A railway contractor with a train of 20-yd. cars hauled 25 cu.yd. of stone per car, dumping the train from a 65-ft. trestle without causing injury to the trestle. On another piece of railway work a 10-car train averaging 280 cu.yd. of material is hauled an average of three miles at 35 m.p.h.; and is then dumped, righted and started back in a few seconds. In this way a comparatively small amount of equipment is required to serve steam shovels which are in continuous operation. A steel company has handled 1,500,000 cu.yd. of material with 18 cars in seven months, working 12 hours per day, or about 440 cu.yd. per car per day (190 days).

The cars are built to conform to the requirements of the Master Car Builders Association, so that they may be handled in regular road service. The large cars are of 20 cu.yd. capacity, level full, or 28 cu.yd. maximum load. They are 32 ft. long over couplers and weigh about 47,800 lb. A somewhat lighter car is of 16 yd. capacity (23 yd. maximum). These cars are built by the Kilbourne & Jacobs Mfg. Co., of Columbus, Ohio.

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The Tuolumne River Water Rights of the City of San Francisco were protected by Secretary of the Interior Lane shortly after coming into office by approving maps filed by the city of San Francisco. Secretary Lane has notified the various parties in interest that further than this he would let the Hetch Hetchy matter stand as left by ex-Secretary Fisher, who it will be remembered declined to grant a new permit to San Francisco, but instead insisted that the city should apply to Congress for the rights which it desired. Secretary Lane stated that he thought it would be unbecoming for him to grant a permit in face of the denial by Secretary Fisher, particularly since he (Mr. Lane) has been the original attorney for San Francisco in this very matter some 12 years ago. Secretary Lane said further, however, that he holds the same view now as when he represented the city, and that he would feel free to advise Congress to the effect that, in his opinion, the highest use to which the water of the Tuolumne River at the proposed reservoir site at Hetch Hetchy valley could be put would be to make it serve the purposes proposed by the city of San Francisco.

Construction Work in Madison Square Garden for an Automobile Exhibition

Madison Square Garden in New York City, has been for many years the place of holding those exhibitions requiring a large floor area, such as the Horse Show, the Dog Show, the Sportsmen's Exhibition and the various automobile shows. The building has been so long used that its seating capacity and decorations are much the worse for wear. These conditions, with the frequent need for providing additional floor space, have made it customary to decorate and furnish the auditorium especially for each show.

This work has to be done in the shortest possible time and methods have been developed for doing the work which are worthy of record. The accompanying photographs show the process of transformation of the auditorium, to prepare it for the Automobile Show of 1912. They have been furnished to us through the courtesy of M. L. Downs, Secretary of the National Automobile Show Committee at New York City, and W. W. Knowles, Consulting Architect for the New York Annual Automobile Show.

The method of overcoming the limitations of the Garden with respect to space available for exhibits was by building out temporary extensions to the balcony and gallery. The skeleton framework for these extensions was made of structural steel; the floors, railings, stairs, etc., were of wood. A feature which adds interest to the problem is the limited time available for the work. The Show opened at 8 p.m. Saturday and preparatory operations started at the Garden on the second Thursday preceding. The plan of the work is to first get all the steel erected and, as soon as this is finished, to start putting in the floors of the extensions. The decorations, consisting largely of burlap, bunting, and compo-board paneling, all fireproofed, are started as soon as the floor is in place.

In Fig. 1 are shown views of the work at various stages. The first view, taken Dec. 28, 1911, illustrates the condition of the main floor and balconies at the beginning of the job. In the second view, Dec. 30, the operations have progressed to a point where the structural-steel framework is nearly complete. The laying of the joists for the floor extensions is depicted in the third view, Jan. 1, 1912, and, in the next one, Jan. 2, these extensions are shown practically completed. The finished appearance, after the decorations are hung, is shown in the fifth view, Jan. 4. The last view, Jan. 6, shows the exhibits in place, preliminary to the opening of the show.

The total expense in preparing the auditorium for this exhibition was in the neighborhood of $80,000. The erection of the steel, about 200 tons, cost about $10,000. The floor extensions required 500 M ft. b.m. of lumber and cost $20,000. The expense of the decorations was $40,000, of which $7000 were paid for the big center canopy alone. The running expenses of the Show itself were about $10,000. The fact that much of the construction work was done on overtime, and that everything was sacrificed for speed, accounts for the high costs.

Several years ago the Automobile Show required only small extensions of the galleries and wood framing was used; but the city's building code requires the use of steel framework for the present larger extensions and increased girder spans. This work was done for the 1912 Show by the Grant & Ruhling Co., of New York City, on a contract basis, the steel being furnished by them. The first Automobile Show for which this system of structural steel extensions was used, was held several years ago and this company (under another name) supplied the steel and did the erecting. By marking the pieces and saving them from year to year, the expense of cutting and fitting has been reduced to a minimum and the erection process expedited. As a result of these economies, the same company has secured the contract for this steel framing each year. Their scheme of carrying out the erection is worth brief description.

The steel is brought to the Garden entrances on trucks. At 8 a.m. the doors are opened and the rush begins. The trucks are unloaded and the various pieces placed around the sides of the arena, as near as possible to where they are to go up. Two hoisting engines are rigged up in the center of the arena and hoisting blocks are swung from the roof trusses. Under the direction of a general foreman and four gang foremen, two gangs start from each end of the transverse axis of the Garden and work around the sides toward the ends of the longitudinal axis; 40 men are used in this work. This plan has been found to be the most economical, considering both time and cost. Working continuously day and night, it has been found possible to finish the steel erection in about 45 to 50 hrs.

As shown in Fig. 2, the column footings consist of I-beam grillages, encased in concrete, which are sunk in the earth permanently, with their top faces slightly below the level of the main floor (some of the grillages are below the basement floor level). The main columns are 8-in. 32-lb Bethlehem I-beams. The longest girder span measures 38 ft. 2 in. and for this span and the others of nearly equal length 24-in. 100-lb. I-beams are used. The shorter longitudinal spans of 30 ft. or less are bridged with 24-in. 80-lb., and 20-in. 65-lb. I-beams. The inner and outer row of columns, spaced a maximum of 14 ft., are cross-braced by pairs of 5x3x½-in. angles. This steel framework is designed for a maximum combined live and dead load of 125 lb. per sq.ft.

Flooring

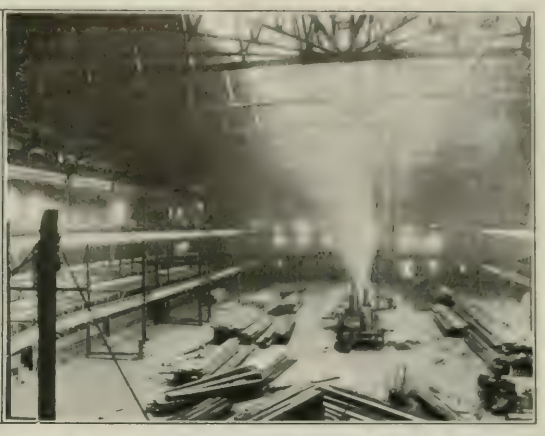
The floors, rails and other woodwork were put in by the Ellison Construction Co., of New York City. Immediately on the completion of the steel work a gang of 150 carpenters began work on the floors. Joists of 3x12-in. timber on 16-in. centers were first put in, extending from the passageway out to a point 9 ft. 4 in. beyond the outside girder, and on these a floor of 3-in. planking was laid. The time required for putting in the flooring and other woodwork was about two days, working, as with the steel erection, continuously day and night.

Decorations and Other Equipment

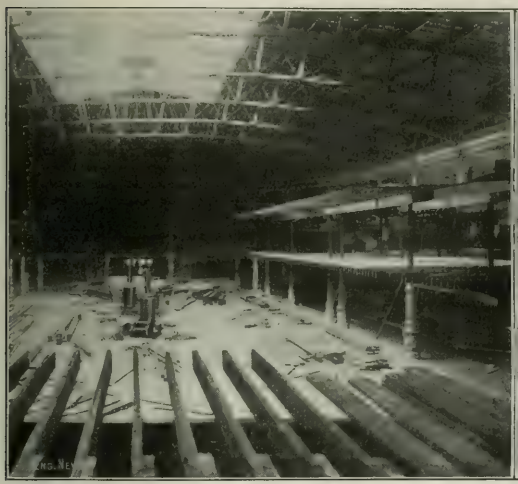
The decorations were designed for uniformity and convenience as well as appearance. The name placards were all of one style and the lettering the same on all. Exhibit spaces were marked by corner posts with illuminated signs all on the same pattern. Hollow cast-iron forms, harmonizing with the other decorations, were placed around the columns. A better idea of the decorative effects can be obtained from the last two views in Fig. 1, than can be given by mere description.



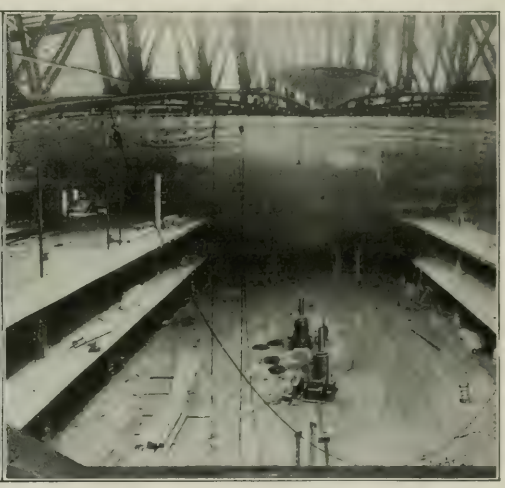
READY TO HOIST STEELWORK, THURSDAY, DEC. 28



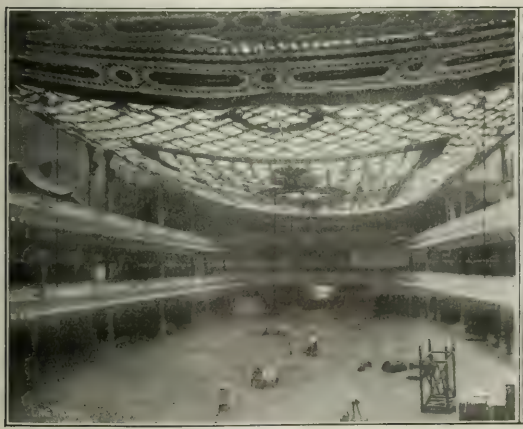
STEELWORK COMPLETED, SATURDAY, DEC. 30



FLOORING PARTIALLY DONE, MONDAY, JAN. 1



FLOORING NEAR COMPLETION, TUESDAY, JAN. 2



DECORATIONS NEAR COMPLETION, THURSDAY, JAN. 4



EXHIBITS IN PLACE, SATURDAY, JAN. 6

FIG. 1. STAGES IN CONSTRUCTION WORK, ANNUAL AUTOMOBILE SHOW, NEW YORK CITY

Two freight-elevators were erected (and later removed) by the A. B. See Co., of New York City, for temporary use only, in hoisting the exhibits up to the extensions and down again. These elevators each had a capacity of 8000 lb. and were each equipped with safety clutch and electric control. They were driven by 220-volt compound direct-current motors. The erection of the two elevators was carried on simultaneously; 12 men did the work in about 36 hours. Work on the elevators was started as soon as the steel frame was completed.

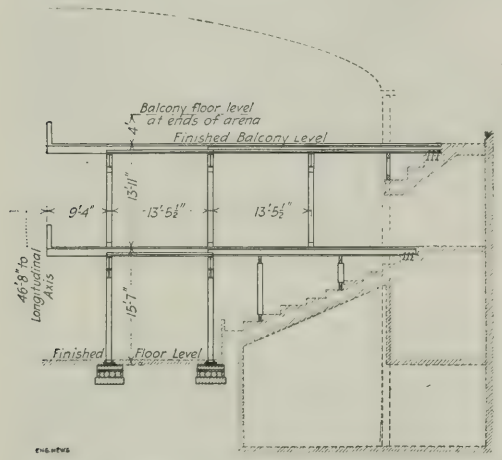


FIG. 2. TYPICAL SECTIONAL ELEVATION OF ONE SIDE OF MADISON SQUARE GARDEN SHOWING THE STEEL FRAMEWORK FOR EXTENSIONS

It is of interest to record that the work of stripping the Garden, after the Show, is compressed into a period of less than 24 hrs. There is more or less rapid action visible in the preparatory work, but the dismantling process represents the superlative, in the line of quick work.

Contracts Antedating the Establishment of Public-Utility regulation cannot stand in the face of the present powers of a commission under the constitution and the public utilities act, according to a decision of the Railroad Commission of California, now clothed with all usual powers for the regulation of public utilities of the state. The case is that of the city of Palo Alto against the Palo Alto Gas Co. A rate of $1.50 per 1000 cu.ft. of manufactured gas was complained of as being unreasonable. This gas, it appears, was purchased from the Pacific Gas & Electric Co. at a price equal to 50% of the gross income from its sale under a contract made in 1905 for a term of 10 years. The local gas company acts as distributor only. The gas is made 23 miles from the city and other communities along the line are served by the same pipe line. As a result of investigations and hearings, the commission found that the cost of manufacture, transmission and distribution, including 8% on the value of used and useful property, was $1.19 per 1000 cu.ft. In declaring the contract by which gas was purchased void, where in conflict with the findings of the commission, the report notes that, unless the action they take in this case is possible, any utility by entering into contract with third parties for the sale of its commodity would nullify the police powers of the state to supervise and regulate its public utilities.

In fixing the rate for this service the commission holds that it should be at least the average which is earned by other classes of business of the same degree of risk in that community. The commission announces that it must be liberal, lest too strict a policy should turn capital into other fields, while California needs development of its utilities. At the same time, it warns all that great care must be taken not to permit the inflation of property values especially with regard to "going concern."

Steel in Mine Construction*

By Carl Scholz†

Up to a comparatively short time ago, wood was used entirely for the construction of coal tipples, head frames and buildings on the surface; the only metal used was for the screens, which were of simple design and usually only provided for one separation. Wooden tipples are no longer built, except for very small country mines, and steel and concrete are used almost exclusively for the surface plants.

STEEL FOR COAL TIPPLES

The earlier steel tipples were imitations of the wooden structures, and were much too heavy. Usually 12-in. double channel columns, elaborately laced, were used to take the place of 12-in. square timbers, and this made the cost so high as to prevent extensive adoption of steel. With modern engineering, however, a properly designed steel tipple is no more expensive than a wooden tipple of equal strength, and has so many advantages that there can be no question of the advisability of the use of steel. The elimination of fire risk alone is of much importance. Steel tipples furnish the advantage of placing the supports some distance away from the shaft, and the A-frame type is extensively used. With a tipple of this design the wear of the shaft lining does not affect the structure, because the supports are some distance from the side of the shaft, and caving would not affect the supporting foundations. For fireproof shafts, the three-leg tipple can be used advantageously and at a minimum cost.

Within the last two years the writer developed two new mines, each of which will have a life of approximately ten years. One was a shaft mine and was equipped with a steel tower, with bolted connections, so that after extraction of the coal it can be taken down and removed to another location. The second mine was a slope, and a timber tipple was erected, since this is expected to be the last slope mine which the company will develop, and there would be no further use for the bents. But 13 months after this mine began operation the tipple was destroyed by fire, and the resultant losses would have paid for the steel construction even though it would have been wasted entirely after the extraction of the coal at this locality.

STEEL IN SHAFT LINING

Fireproofing of shafts is regarded as important for safety, and many state laws require such construction. In large and important mines a permanent shaft lining is desirable on account of the elimination of interference in operation due to repairs. Steel frames similar in design to wooden sets for two- and three-compartment shafts have been installed with steel sheeting as lagging. This construction, however, is very expensive. A modified design of a steel shaft lining has been designed by the author and installed at shaft No. 1 of the Consolidated Indiana Coal Co., Dallas, Iowa. In this design the principal members are placed vertically, instead of horizontally, as in the use of timber. Eight I-beams are used; four near the outside corners of the cages; two in the center of the cages, to which the buntings are fastened, and two on the sides, to which the outside guides are fastened; this makes a shaft of elliptical shape. The height of the I-beams ultimately forms the thickness of the concrete lining.

In sinking, the I-beams are fastened together on the outside at intervals of 5 ft., with curved angle irons bolted to the flanges, and thin lumber lagging is used to prevent the caving of material. When the bottom of the shaft is reached, the concrete is put in from the bottom to the top by clamping short form panels to the inside flanges of the I-beams. These inside forms are made from 3 to 5 ft. high. Ordinarily two sets are sufficient to allow of continuous concreting, and are used alternately. In the Dallas shaft this wall is 7 in. thick, and the outside lagging was left in place, with openings at intervals to permit the concrete to tie firmly into the rock surrounding the steel frame.

The advantage of this steel and concrete combination is that the steel can be put in with very little expense and without requiring skilled labor. Sections are bolted together with splice plates. Each section is made self-supporting by having a brace riveted to the outside of the I-beam, which rests in the rock or is supported by a shore or prop safely embedded in the shaft wall. By this means not much attention need be given to the plumbing of the shaft as it goes down, because the steel frames can be shifted to the proper position when the concrete is to be placed. The old method of putting in concrete shafts by the use of wooden forms is

*Abstract of a paper read at the Mining Conference, at the University of Illinois, Urbana, Ill., May 9, 10, 1913.

†President, Coal Valley Coal Co., Chicago.

complicated and requires much skilled labor and involves delay, because the forms must be very carefully set before the concrete is poured in order to have the required alignment for guides and buntings.

In the Dallas shaft the vertical I-beams were made in 15-ft. sections, and in soft material a blind ring (slightly larger than the completed shaft) was used to permit lagging down to the very bottom of the excavation. Whenever the proper depth was reached and a permanent steel frame was installed the temporary rings were removed and the lagging adjusted itself to the permanent bolts. The weight of material in this construction, including 45-lb. steel rails for guides and ¼-in. reinforcement rods 6 in. apart, is about 165 lb. per foot of shaft, and is less costly than the amount of lumber required for the same strength.

STEEL IN MINE WORKINGS

In the mine workings proper much steel is used for various purposes. With the increased weight of cars and motive power the important entries are now laid with 50- and 60-lb. steel rails, in stone ballast. Steel ties are becoming quite popular. At first thought the expense seems prohibitive, considering that a steel tie for 36-in. gage costs about 35c., against a wooden tie costing about 7c. or 8c. But the saving in wages and the reduced number of ties required makes the steel tie more economical under certain conditions. Where the mine bottom is hard, steel ties can be spaced from 4 to 6 ft. apart, enabling the base of the rail to rest on the floor and thus carry the load. The ties principally prevent the spreading of the track. The reduction in height required is of importance in low seams, and the ability to use steel ties over and over again with very little cost for recovery makes the steel ties economical.

Steel I-beams have been used for many years around shaft bottoms and on partings where wide entries have to be maintained. The use of specially made steel props and crossbars is of more recent adoption. Special H-beam sections have been made and found to be economical under certain conditions. The greater strength of steel results in the use of smaller sizes, which require less excavation for the same finished clearance, and the saving of wages in bolting these sets together, as compared with the costly preparation of timber, brings down the first high cost of the steel frames. The rapidly increasing cost of timber and the damaging effect of mine air, which results in dry rot, warrants the investigation of these frames in many localities.

Concrete in Mine Construction *

By A. F. Allard†

Within the last few years many important advances have been made at the modern coal plant in the use of concrete for buildings, shaft lining, walls and construction inside of the mine.

The growing scarcity and steadily increasing cost of large size timbers for inside mine construction makes concrete a welcome substitute, not only for new work, but for the renewal of wooden structures. The stability, permanence and fireproof qualities amply compensate for the increased first cost.

CONCRETE LINING FOR SHAFTS

The adaptability of concrete for this class of work is well recognized, judging by the large number of concrete shafts now being constructed. In fact, we have hoisting and ventilating shafts complete from top to bottom without a piece of timber; the lining walls, cross-buntons, and division wall of the air compartment are of concrete, while the guides and stairways are of steel. The method of sinking mine shafts through soft and water-bearing strata by means of the concrete caisson with a steel cutting edge or shoe has come into extensive use. By reason of its weight, penetration to great depth is possible, rapid progress is made in sinking, the flow of water met with is reduced, and a great saving in cost of labor and material is obtained by the omission of timber curbing.

The cost per vertical foot of a completed concrete-lined shaft is about 33% more than that of the wooden structure. This is the first cost only, for after a few years time the renewal of timbers would be necessary in the latter.

There are numerous designs for concrete shafts, including rectangular, circular, elliptical, and straight sides with circular end walls. The last is a very economical section, utilizing the end spaces for pipeways or stairways and reducing to a minimum the excavation and concrete outside. The circular end walls have great strength to resist the strata and water pressure, forming a continuous concrete arch from top to bottom. the side wall pressure are taken care of by the thickness of the concrete lining, dependent upon the nature and depth of strata penetrated. Generally a self-sustaining material, such as rock, slate or good shale, requires a wall 6 to 9 in. thick, which is sufficient for the anchorage of the buntons. A heavy fire-clay or wet-sand seam would require a much thicker wall.

In the Western iron and coal districts, a number of reinforced-concrete shafts have been sunk through quicksand in water-bearing ground by means of the pneumatic caisson or compressed-air system. This has proved effective in obtaining dry shaft walls and in making a water-tight joint when the concrete caisson reaches the bed rock. Air pressure is maintained until the concrete has set.

SHAFT BOTTOMS OF CONCRETE

The construction of shaft-bottom landings of plain and reinforced concrete includes the single- or double-track entry, providing storage room for loaded cars, space for empty-car lift back of the shaft, and room for empty-car storage track, together with the necessary chutes. For this work, I have used three different designs in concrete construction for supporting side walls and mine roof which have to bear excessive loads and sustain the crushing effect induced by the displacement of the roof strata.

The first is the rectangular section supporting I-beams on concrete side walls and covering with reinforced-concrete slabs, 3 to 4 in. thick. The depth of beam is usually 6 or 8 in. for single-track span and 12 to 18 in. for double-track, the size and weight of beams selected depending upon the nature and condition of the roof. I have placed the beams on 4-ft. centers, covered with slabs 2 ft. wide. The second design is the poured concrete arch with concrete side walls. The third design is the concrete-block arch, composed of plain concrete blocks previously molded in steel forms with joints cut on true radial lines. The blocks are laid up in the arch crown from each side wall, with cemented joints, and are supported on a light frame template until the key piece is placed, and one section of the ring is completed. Provision is made in molding to provide blocks of different lengths for breaking joints on the alternate courses. Blocks 6 in. thick for single and 8 in. for double-track spans and about 18 in. long make a convenient size for the men to handle. This method of arch construction is considerably cheaper than the solid poured section, for it eliminates the cost of expensive forms and time necessary for the transporting and placing of the wet mixture. The rectangular section is convenient at the back of the shaft where it is necessary to provide clearance room for empty-car lift and where going up into the roof with an arch of large span would prove expensive.

The poured arch section is generally adopted for a distance of 10 to 15 ft. on each side of the shaft, the work connecting into and supporting the shaft walls. The continuation of arch with concrete-block construction for the main landing and empty runarounds, makes an ideal and fireproof shaft bottom.

The Operation of the Chicago Elevated Railways as one complete system, with through routes and through trains, is being demanded by the city as a means of increasing the traffic capacity and relieving the very serious congestion of the terminal loop. The four original companies have been consolidated and are controlled by a single company with one set of officers, but they are still operated as distinct units. Separate fares are charged and there are no transfers, so that passengers having to use two of the connecting lines have to pay two fares. The trains of the four lines enter the terminal loop at different points, and each train passes entirely around the loop, leaving it at the same point at which it entered. The number of trains is so great during the busy hours, and the delays at the stations and junctions are so numerous, that the speed is extremely slow, thus cutting down the average speed between outlying stations and points on the loop. It has long been urged that the use of the loop as a universal terminal should be abandoned, through trains being run between the north and south sections of the city, while trains entering from each of the two west-side lines could pass around a portion of the loop and depart over the other line. A few structural changes would be necessary to change the present track connections, and as two of the lines run on the left-hand system their car equipment would require some changes to adapt it to right-hand running. The railway company, however, seems disinclined to make the changes in operation unless the city grants certain concessions.

*Abstract of a paper read at the Mining Conference held at the University of Illinois on May 10 in connection with the dedication of the Mining Laboratory.

†Chief Engineer, Bunsen Coal Co., Danville, Ill.

Direct-Lift Drawbridges without Cables

SYNOPSIS—The two articles following describe different designs for a new type of drawbridge in which the span is raised vertically but without the aid of cables either for the operating system or the counterweight system. The operation is by rack-and-pinion gearing, and the counterweights are carried by lever systems, attached to the lift span and pivoted over the towers. Some bridges of this type are already under construction, and the articles describe several modifications of the general design, adapted to meet varying conditions.

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Within the past few years the vertical-lift type of drawbridge has been regarded with some favor, and a number of bridges of this type (large and small) have

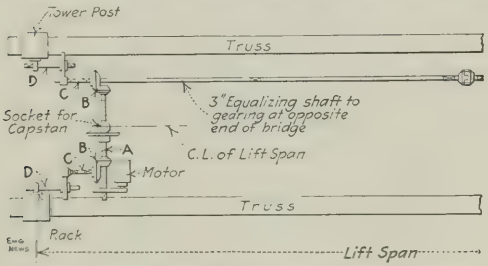


FIG. 1. OPERATING MACHINERY OF THE DIRECT-LIFT SPAN (STRAUSS SYSTEM) OF THE ARKANSAS RIVER BRIDGE, NEAR PINE BLUFF, ARK.

been built for both railway and highway purposes. Up to the present time all these bridges have been operated by cables and winding drums, the moving span being balanced by counterweights suspended from other cables. All these cables pass over sheaves on the top of high towers erected on the piers or abutments of the lift span, and between which the span moves. There are certain objections, however, urged against the cable system of operation, such as the possibility of breakage, the cost and trouble of renewing the cables, the adjustment for stretching, and the general care of the cables and sheaves. To avoid these objections, a direct-lift type of bridge has been designed, in which the operation is effected by pinions engaging with vertical racks on the tower posts, while the counterweights are carried by lever systems. Lift bridges of this type have been invented and patented by J. B. Strauss, engineer, of Chicago, and the Strauss Bascule Bridge Co. already has contracts for the design of some of these structures. The general type is capable of various modifications to meet special conditions.

Among the advantages claimed is the fact that the support of the lift span at points between its ends reduces the dead-load stresses and permits erecting the span in the open position when necessary without the use of falsework. This would avoid the trouble of building the span at a distance from the site and then floating it into position, or handling it in similar ways. In such case, the hanger points may be used as points of support from which the trusses are built out as cantilevers until they meet and are connected at the center.

OPERATING MACHINERY

The bridge is operated by spur pinions on the lift span which gear with vertical racks on the tower posts. The racks may be on the inside or outside face of the post, according to the detail requirements in each case. Fig. 1 shows the arrangement of the machinery on the Arkansas River bridge, the racks in this case being on the outer sides of the posts. The 25-hp. motor drives a cross-shaft *A*, on which are mounted three bevel gears. Two of these are bevel pinions, *B, B*, driving short individual countershafts *C, C*. These carry spur pinions which drive the operating shafts *D, D*, on which latter are the rack pinions. The third bevel gear on the cross-shaft engages with the pinion of a vertical shaft (on the center line of the bridge) having a capstan head, for operating the bridge by hand. The motor and gears are in duplicate at each end of the bridge, and to insure uniform action two of the countershafts are connected by a longitudinal equalizing shaft. On this last is a motor-driven emergency brake, which will check the motion in case of any accident to the counterweight system.

In this bridge, the 245-ft. lift span will weigh about 500 tons, and can be raised or lowered by the machinery

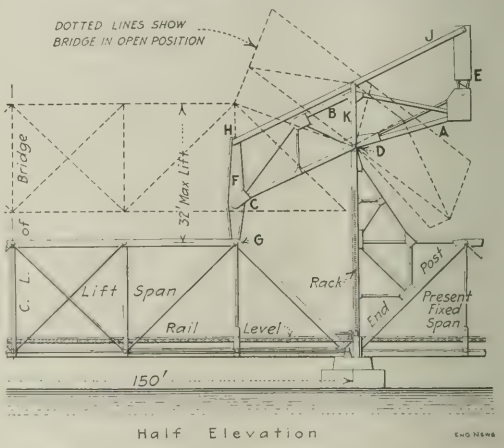


FIG. 2. COUNTERWEIGHT SYSTEM FOR DIRECT-LIFT DRAWBRIDGE (STRAUSS SYSTEM)

in about one minute, or by hand in about 50 minutes. The ratio of the gearing is as follows:

	No. of teeth	Pitch diam. in	Pitch	Width of face in.
Motor pinion	18	15 14	3½ d.p.	3½
Cross-shaft gear	126	36 00	3½ d.p.	3½
Cross-shaft bevel pinions	20	10 00	2 d.p.	4
Countershaft bevel gear	60	30 00	2 d.p.	4
Countershaft pinions	15	8 36	1¾ in.	3½
Operating shaft spur gear	52	29 00	1¾ in.	3½
Operating pinion	15	11 94	2½ in.	6½
Operating rack	240		2½ in.	3½
Bevel pinion on hand shaft	16	12 72	2½ in.	3½
Bevel gear on cross-shaft	24	19 08	2½ in.	3½

COUNTERWEIGHT SYSTEM

While the operation of the bridge by rack and pinion is extremely simple, the counterbalancing of the span in all positions is, at first sight, more involved. The ar-

rangement of the counterweight system is shown in Fig. 2. Upon the tower or bent, is carried a rocking counterweight truss ABC, supported by the trunnion pin D at the top of the tower. The rear end of the truss is attached to the lower part of the counterweight, E, while the forward end is attached to a vertical hanger F. The lower end of the hanger is attached to the bridge span at G, and its upper end is attached to a link H-J, whose rear end is attached to the upper part of the counterweight E. Part of the weight of the link is carried by a vertical strut K, pivoted to the link and to the trunnion pin of the truss at D.

Thus the counterweight, truss, hanger and link form a jointed frame, which is so proportioned as to meet the requirements for perfect balance as follows: (1) That for all positions of the lift span the sum of the moments of all the forces about point D (the trunnion at the head of the tower) must equal zero; (2) the moment of the counterweight about the point A (at the counterweight end of the rocking truss) must be equal and opposite to the combined moments of the lift span, hanger and link about the point C (at the bridge end of the rocking truss). With this system the bridge is balanced in all positions, and the main trunnion reaction on the post of the tower or bent is constant and always vertical.

This type of bridge lends itself especially to cases where a fixed span has to be converted to a draw span. These cases may arise from the development of navigation on a stream crossed by a fixed bridge, or by the shifting of the navigable channel from the original draw span to one of the fixed spans (as sometimes occurs).

Arkansas River Bridge

The second case (or the possible necessity of shifting the draw span from its original location to another span of the bridge) is represented by a combined railway and highway bridge over the Arkansas River near Pine Bluff, Ark. This bridge will carry a steam railway and electric railway (on one track), with two roadways and two sidewalks, outside of the trusses. It will have six through-truss spans of 245 ft. and an end span of 140 ft., besides long trestle approaches. As built, the first 245-ft. span will be a lift span on the Strauss system, with towers carried by the piers and the end panels of the adjacent spans. The lifted weight will be 500 tons. The maximum lift is 50 ft., giving a clear headway of about 60 ft. above high water.

Should the channel shift from its present location, the towers and the operating and counterweight mechanism can readily be moved to any one of the other spans. To provide for such a change, the towers are so made that they can be disconnected at the top chords and moved along these chords which would serve as a track. To facilitate this also, the counterweights are made in blocks of such size as to be handled by one man, so that they can be removed and replaced readily when it is necessary to shift the towers. That such a movement is not improbable is shown in an article on drawbridges by C. E. Smith, in our issue of Jan. 23, 1913. This referred to two other bridges over the Arkansas River in which provision is made for the shifting of the navigable channel, and the article referred also to the advantages of the vertical-lift type of drawbridge under such conditions. The Roemheld Construction Co., Chicago, has the contract for the Pine Bluff bridge.

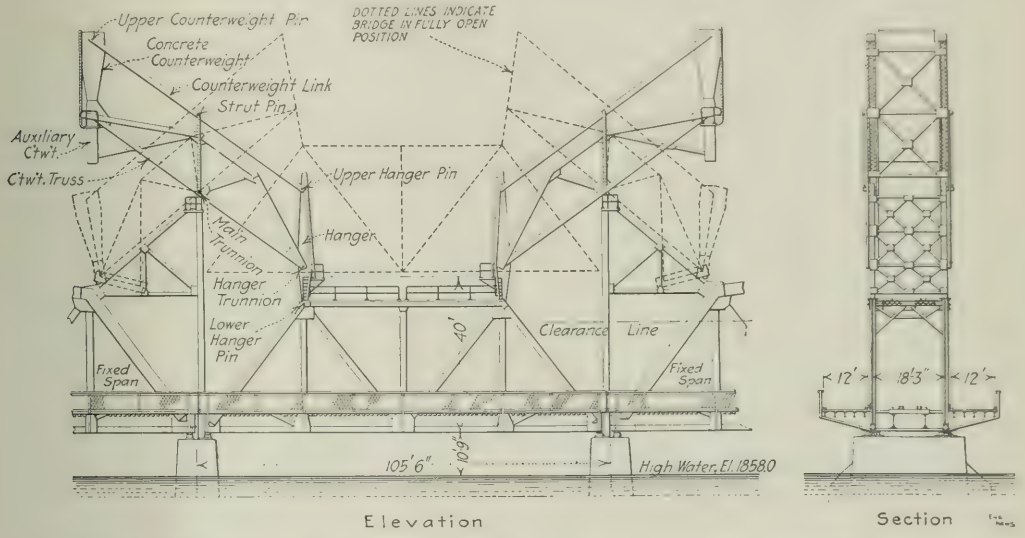


Fig. 3. Direct-Lift Span of Combined Railway and Highway Bridge over the Fraser River; Grand Trunk Pacific Ry.

(Strauss Bascule Bridge Co., Designer, Canadian Bridge Co., Contractor.)

Steilacoom Creek Bridge

This direct-lift bridge is to be built to carry the Northern Pacific Ry. over Steilacoom Creek, near Tacoma, Wash. It will be a double-track riveted pony-truss lift span of 96 ft., with trestle approaches. An un-

usual feature in this case is that the towers are connected by overhead struts, for the reason that they are carried only by the piers and cannot be braced from the trestle. The lift in this case is about 43 ft. 6 in., giving a clear headway of 50 ft. with the bridge raised. The lifted weight will be 155 tons. The American Bridge Co. has the contract for this bridge.

Fraser River Bridge

For the channel span of the combined railway and highway bridge to be built by the Grand Trunk Pacific Ry. over the Fraser River near Fort George, B. C., the Strauss direct-lift system has been adopted. This lift-span, shown in Fig. 3, will be a 100-ft. riveted through-truss span, with towers supported on the piers and adjacent fixed spans. It will carry a single track line and two 12-ft. roadways. The weight of this span will be about 200 tons. Its lift will be about 40 ft., giving a clear headway of 50 ft. when raised.

The Canadian Bridge Co. has the contract for the superstructure of this bridge. A duplicate of this structure will be built over the Nechako River for the same railway.

Proposed Modified Designs

Several designs have been prepared to adapt this type of bridge to meet special conditions. One of these provides for a much greater lift than those mentioned above, and is a design for a double-deck (street and elevated railway) bridge over the Chicago River at Lake St. The lift would be about 104 ft., giving a clear headway of 120 ft. with the bridge raised. This, together with the great weight to be carried, would necessitate heavier towers, and each of these is designed as a four-post braced tower on cylinder piers. The span would be 244 ft. c. to c. of piers (200-ft. channel) and the weight of lift span about 930 tons. Another design for this bridge provides for its operation from one tower only, the span length being 218 ft. and the lifting or hanger attachment being near the center of the span. This would weigh about 660 tons.

In another design, proposed for the 12th St. bridge over the Chicago River, the counterweight trusses form part of a suspension system, from which the live load is carried. The connections at the hangers would permit their movement without disengagement from the suspension truss. This design is said to be specially adapted for bridges of ornamental character.

In bridges with the floor high above water level, yet not sufficiently high for navigation, the counterweight system may be mounted beneath the level of the lift span. The same arrangement may be applied also for canal bridges, where space is limited and the lift is small. In this latter case, the counterweight system is arranged to be mounted in masonry pits below the ground, with the counterweight trusses placed at right angles to the line of the bridge. For such bridges, stairs may be erected on the abutments to provide for foot traffic while the span is raised.

Finally, for short plate-girder lift spans, a design has been made which dispenses with towers, each trunnion being mounted on a single post, braced from the pier. In this design, the hanger attachment is made at the bottom flange of the girders.

A Vertical-Lift Drawbridge without Cables

The vertical-lift type of drawbridge has received a considerable amount of attention within recent years, as noted in a preceding article, but while the existing bridges are operated by means of cables, we describe herewith the design of a vertical-lift bridge which is supported and operated without cables or chains. This type of bridge is said to be particularly adapted to and economical in cases where the height of travel or lift is not great, although it can be applied where the lift is as high as 150 ft. The design described below was developed by the Strobel Steel Construction Co., of Chicago, which controls patents covering the general design and specific details, and we are indebted to the engineers of the company for information, as well as for drawings showing different applications of the design. One bridge of this type is already under contract.

The principle of the design consists in suspending the lift span from pivoted and counterweighted lifting trusses which move on trunnions supported by towers at the end of the span. On the vertical posts of the towers are racks engaging with operating pinions on the lift span. This general type of construction is shown in Fig. 1, in which four-post towers support the lifting trusses *A-B*, having one end pivoted to the lift-span and the other end provided with a counterweight. In order to provide for the radial movement of the lever arm attached to the bridge, the trunnion-bearings *C* are fitted with rollers and have a horizontal travel on a track girder at the top of the tower, so that the point of attachment *B* will travel in a vertical path. With the bridge lowered, the trunnion of the lifting truss is at the forward end of its track. As the bridge rises the trunnion rolls backward, reaching the limit of its travel when the bridge is at mid-height; as the bridge continues to rise, the trunnion rolls forward again, reaching the limit of its travel when the bridge is lifted to its extreme position.

One end of the lift span is guided both longitudinally and laterally, while the opposite end is guided only laterally, thus providing for expansion of the span. The operating mechanism is mounted on the lift span, and has bevel-gear connections to a longitudinal shaft which carries the operation pinions.

In Fig. 2, this vertical-lift system is shown as adapted for cases where an existing fixed span must be converted into a movable span in order to provide for navigation and where the adjacent spans must not be loaded by the lifting apparatus, but the weight must be carried directly by the piers. This is effected by carrying the lifting truss *A-B* on a vertical bent *C*, on each pier, and braced to the adjacent span. In this case, however, no longitudinal movement of the trunnions is practicable and the trunnions are carried in fixed bearings at *D* on top of the posts. The necessary longitudinal travel to compensate for the radial movement of the lever arm is provided, therefore, at the point of attachment of the arm (or lifting truss) to the lift span. At this point an additional member *E* is built upon the bridge truss, and carries beneath it a track plate *F*, against which bears the roller *G* at the end of the lifting truss. The operation will be understood readily from the dotted lines, which show the curved path of the rollers and the vertical path of the bridge.

In the designs shown in Figs. 1 and 2, the lifting apparatus is provided at both ends of the bridge. A modified design in which the bridge is operated entirely from one end is shown in Fig. 3. In this design, also, the operating machinery is carried upon the tower instead of upon the bridge. In this case, the bridge in moving vertically has a longitudinal and horizontal movement, swinging in a vertical arc due to the radial movement of the arm of the lifting truss. This truss *A-B* has a fixed trunnion on the head of the tower at *C*, and a pin attachment to the lift span at *B*. To hold the span in a horizontal position while moving, the end of the bottom chord of the span is attached to the controlling strut *D-E*, the rear end of which is pivoted to the tower. Thus, as the lifting truss rises, the bridge is suspended from the pin *B* at the end of the top chord and supported longitudinally by the pin *D* at the end of the bottom chord.

The operating mechanism is different from that of the other designs. It is carried on the counterweighted or tail end of the lifting truss, at *A*, and serves as a part of the counterweight instead of adding to the weight to be lifted. The pinion engages with a rack on a vertical operating strut *F*, which is pivoted to the rear post of the tower. As the bridge rises, the pinion rides downward on the rack, the strut swinging outward to accommodate the curved path of travel of the pinion, as shown.

An alternative arrangement proposed is to put the trunnion bearing of the lifting truss at *E* and to attach this truss to the bottom chord of the lift span, while the controlling strut would be pivoted to the head of the tower and the top chord of the lift span. In other words, the positions of the lifting truss and controlling strut in Fig. 3 would be reversed. A second alternative is to replace the controlling strut by a second lifting truss, which would be somewhat similar to the arrangement employed for the Frederick Bridge at Dresden, Germany.

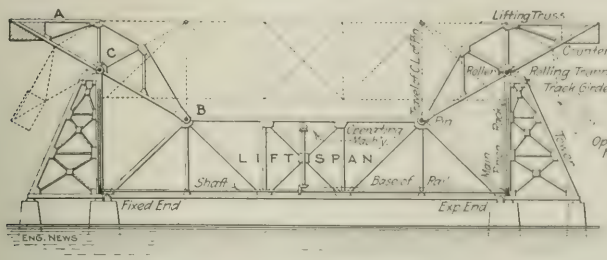


FIG. 1. DESIGN OF VERTICAL-LIFT DRAWBRIDGE WITHOUT CABLES

(Strobel Steel Construction Co., Chicago.)

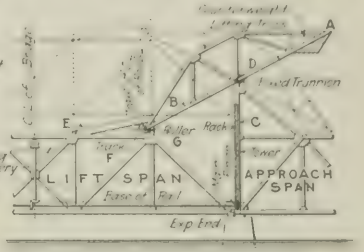


FIG. 2. VERTICAL-LIFT ARRANGEMENT (STROBEL SYSTEM) AS ADAPTED FOR CONVERTING A FIXED-SPAN TO A DRAW-SPAN

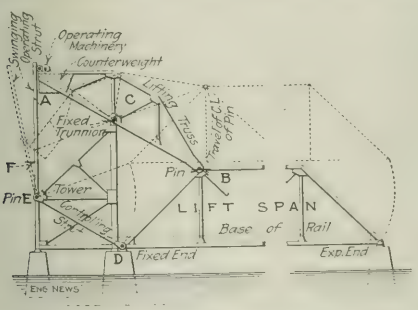


FIG. 3. VERTICAL-LIFT ARRANGEMENT FOR OPERATING A BRIDGE FROM ONE END (STROBEL SYSTEM)

A LONGITUDINAL-MOVEMENT DRAWBRIDGE

The temporary removal of a fixed span (to provide for infrequent navigation) by a derrick car which raises the bridge and runs it back longitudinally, is familiar to engineers, and was noted in our issue of Jan. 23, 1913. It is not generally known that designs were made some time ago for the regular operation of a drawspan in this way, the part of the derrick car being taken by counterweighted lifting trusses carried by trunnion bearings on a tower traveling on tracks outside of the line of the bridge girders. By rocking the trusses on their trunnions the bridge would be raised clear of the abutments, and the towers would then be run back sufficiently to carry the bridge clear of the opening. This design was invented and patented by Mr. Strobel, and is worth mention here, although the design has not been carried into practice.

The West Virginia Public-Utility Law which goes into effect soon provides for four commissioners, each with an eight-year term of service and a salary of $6000. The commission is given jurisdiction over the usual common carriers, over gas and electric companies, telegraph and telephone companies, and over municipalities furnishing gas or electricity. The jurisdiction is specifically extended over car companies, toll bridges and ferries, hydroelectric generating and transmitting companies, water companies, and persons, associations, corporations, or agencies employed in the several businesses noted. The commission also has to perform duties in connection with any workmen's compensation law which may be established. It has the usual power over rates and service, except that it cannot reduce any rates within ten years after the completion of a road or plant below a point which would prevent the owning corporation from making a net earning of 8% on the cost of construction and equipment. The commission is instructed to collect full and complete data on the value of all property owned and controlled by these corporations once a year, and to furnish this information to the Board of Public Works for tax assessments. The new law lays a new tax on public-service corporations by a special license fee proportioned to the value of the corporation's property. This tax is to be distributed so that its aggregate will produce a revenue of $60,000 a year for the support of the commission.

Origin and Theory of the Pitot Tube

By A. E. Guy*

The essay of Mr. John Airey, "Notes on the Pitot Tube," which appeared in Engineering News, Apr. 17, 1913, suggests several points worth examining into at this time, because the value of the Pitot tube is now well recognized and the instrument is consequently much in favor. These points may be enumerated as follows:

A—Authorities on hydraulics are at variance as to the kind of tube the French engineer, Pitot, did *use*, discover, or *invent*. All are unanimous in stating that he brought forth a single tube bent at the lower end; many state that the bent end of the tube was in the form of a funnel.

B—Did Pitot establish a theory for his instrument?

C—Should the theory be based on the consideration that the column of water in the tube is sustained by the impact of a jet of water of cross-sectional area equal to that of the pipe, in which case $h = K\frac{v^2}{g}$ (K being a coefficient to be determined by experiment)?

D—For perfect flow conditions the velocity head is undoubtedly $h = \frac{v^2}{2g}$; then what is the theory which could logically conduce to this result without resorting to imaginary and, therefore, unexplainable action between the streams coming into contact with the tube?

E—Is the theory offered by Mr. Airey logical and therefore acceptable?

1. As to *A* and *B*. The first point involves a difficulty of but minor importance, viz., that of translating into English the original description of the tube as presented to the Royal Academy of Sciences of Paris by Pitot himself, under date of Nov. 12, 1732. The description is printed *in extenso* in the "Memoirs of the Academy," along with an engraving showing the complete instrument, that is, the two tubes mounted on a piece of hard wood of triangular cross-section, each side of the section being about 1½ in. long; showing also the tubes separate, that is, one straight and one bent at the end, and a sliding gaging scale, on one edge of which are engraved the division lines for measuring the head proper, while on the other edge are corresponding division lines for reading at once the velocity. A photographic reproduction of the original engraving is given here in Fig. 1.

Pitot begins his paper by bemoaning the fact that practically the only method before used for measuring the velocity of streams in rivers and canals was productive of doubtful results. He analyzes briefly that method, consisting in measuring the velocity of a floating object, and then discloses the details of a novel apparatus which he has had constructed and with which he made some very successful tests. He also reports a discovery of the first magnitude made by use of the new device, viz., that the velocity of a stream is not the same at the surface as at some point below, and furthermore, that the velocity decreases as the depth increases, which was contrary to the opinion accepted from the Italian engineers, then recognized as the most advanced in Europe as regards knowledge of the motion of flowing streams. They held that in a river the velocity of the molecules is proportional to the mass situated vertically above them, and consequently that the velocity increased with the depth.

Pitot placed the straight tube with the lower opening near the flat base of the wood support; and the other tube had its bent branch engaged into a groove at the base of the support, the extremity of the branch reaching close to the thin edge of the triangular cross-section, and in line with the opening of the straight tube. In order to facilitate the reading of the instrument the back of the tubes, close to the support, was coated carefully with white-lead paint.

For measurements corresponding to a given depth the sliding scale was adjusted so that the zero mark corresponded to the depth, then the instrument being immersed up to that mark the water rose in the bent tube to a height which could be read on one side of the scale and corresponding to which the velocity was read on the other side of the scale. On page 370 the description reads:

> The force impressed by the velocity is always equal to the weight of a prism of water, the cross-sectional area of which would be the same as that of the surface impinged upon and whose height would be the same as that from which the water would have had to fall in order to acquire that velocity. Hence the water should ascend in the tube of my machine, through the force of the current, precisely to the height from which it should have dropped to form that current.

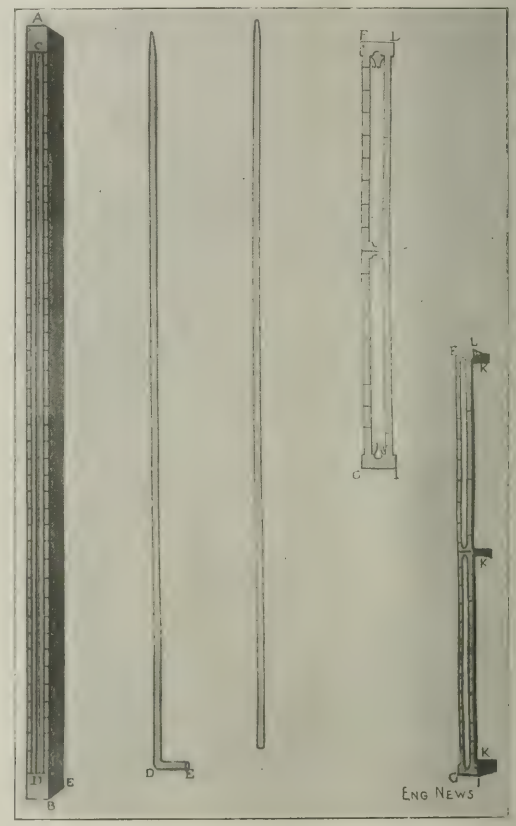


Fig. 1. Pitot's Original Illustration of the Pitot Tube

(Photographed from plate illustrating his paper, in Memoirs of the Royal Academy of Sciences, 1732.)

*Chief Engineer, Wilson Snyder Centrifugal Pump Co., 2 Ross St., Pittsburgh, Penn.

That is all the theory disclosed by Pitot. He arrived at it through very simple reasoning, thus: A head of water produces a certain velocity (this was well known then, having been fully demonstrated); conversely, says he, a given velocity should produce the head indicated by theory. On page 371 of the Memoirs he states:

> The principle of this instrument is so simple and so natural that as soon as I conceived the idea I ran at once to the river to make a preliminary test with one simple glass tube, and the result responded perfectly to my expectations. After this first trial I could not imagine that a thing so simple and at the same time so useful had escaped the attention of so many skilled men who had written and worked upon the subject of the flow of water. I have since searched exhaustively through all the treatises on Hydraulics which I have been able to find, in order to discover whether anyone had disclosed it before, and to make sure that consequently my conception is novel.
>
> At the precise time when I made the first test in the river I also conceived the application of my idea to the measure of the speed of vessels; indeed, the feasibility of this important application is too obvious to fail presenting itself at once, and before sending my Memoir to the academy I have meditated at length upon the means to render practical the applications for sea service, and to avoid all the irregularities that might develop, either from the different motions of the vessel or of the waves.

He then proceeds to describe what thus far he considers the best method, which consists in locating two tubes through the hull at some distance below the water line; one of these tubes having its opening flush or parallel with the axis of the vessel; the other having a bend directed toward the bow, "*with a flaring opening, as in my machine.*" These tubes extend conveniently inside the vessel, where they are each connected to a glass tube. With the vessel at rest the height of water is the same in both tubes, but with the vessel in motion there is a great difference between the two heights, and the difference is precisely, according to Pitot, the head corresponding to the speed of the vessel.

Thus far it is clear that the instrument invented by Pitot consisted of a combination of two tubes, one straight and one bent; as shown by the engraving accompanying his Memoir the opening at the bent end was not funnel-shaped, but it may have been slightly flared to conform with the supposed requirements of boat service; the theory advanced by Pitot was axiomatic, hence assumed to be so obviously correct as to require no further demonstration.

In *Encyclopedia Britannica,* section on Hydromechanics, Vol. XII, p. 507, Prof. Unwin says of the Pitot tube:

> A very old instrument for measuring velocities, invented or used by Pitot, consisted simply of a vertical glass tube with a right-angle bend, placed so that its mouth was normal to the direction of flow. . . . Pitot extended the mouth of the tube so as to form a funnel or bell mouth. In that case he found by experiment $h = 1.5 \frac{v^2}{2g}$.

There can be no question that Pitot did not merely use, but invented the instrument. As a brief digression, we might observe in this case the clear difference between invention and discovery. Thus, Pitot conceived a new theory, thought out means in which to embody it for practical use, and having further conceived the idea of the bent tube, he hastily made such a tube and ran to the nearest spot to experiment with it. This spot was between the piers of a bridge on the river Seine at Paris. He finds the velocity of the current corresponding to the head measured on his tube, realizes that his idea is correct, and with the addition of a straight tube, completes the invention. With the perfected instrument plunged at different depths at the same spot in the river, he then discovers that the velocity of the current decreases with the depth of the river.

As to Prof. Unwin's statement regarding the value of h, we may refer to the "Treatise on Hydraulics" by d'Aubuisson (Paris, 1834); on p. 144, the last paragraph, translated, reads as follows:

> This height measures well enough the sum of the pressures exerted upon the orifice of the tube, but the pressure exerted upon a body immersed in water is dependent upon the form of the body, as will be shown later. Furthermore, the pressure of the various streams composing the striking mass goes on diminishing from the center to the circumference in such a way that one single stream, the central one, for example, must be isolated, and besides, the form of the tube must be experimented with. Chevalier Dubuat, author of the foregoing observations, found that by shaping the orifice as a funnel, the opening of which is closed by a plate having a small hole at its center, two-thirds only of the elevation of the fluid in the tube represented the height due to the velocity, and that consequently $v = \sqrt{2g \cdot \frac{2}{3}h}$, h being the height of the water in the tube above the surface of the current.

From this we get $h = 1.5 \frac{v^2}{2g}$, but we see now that this result was obtained by another hydraulician, the well known Chevalier Dubuat, and obtained by means of a modification of the Pitot apparatus.

It seems that after Pitot had disclosed his invention, many investigators used the bent tube only, thinking the straight tube unnecessary. Furthermore, having no exact means for controlling their measurements, and the indications of the tube being at times in discordance with those of the float method, it came to be that the tube fell into disfavor with the investigators. Some, like Dubuat, attempted to modify the form of the orifice. And so it came to be regarded as a rather interesting instrument, but one that could not be relied upon without very exacting calibration, and even that had but a limited field of application.

In 1856 Darcy published his great work, "The Water Works of the City of Dijon," in which he described among the gages be used a novel form of the Pitot tube, which became known thenceforward as the Darcy tube. Even that is variously described by recent writers as being like Fig. 2, Fig. 3, or Fig. 4. Prof. Rateau (*Annales des Mines,* March, 1898) in a most remarkable paper on "Experiments and Theories on the Pitot Tube and the Woltman Mill," is himself led into error, evidently through the memoir of C. Ritter (*Annales des Ponts et Chaussées,* No. 54, 1885), which he quotes, for he states: "The tube was proposed by Pitot, Geometer and Engineer, in 1732, to gage the river streams; this instrument was perfected by Darcy, who added to it, in 1856, the straight tube to indicate the static pressure."

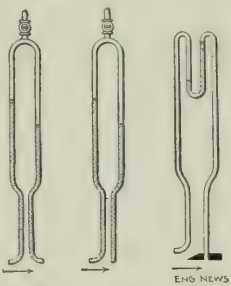


Fig. 2. Fig. 3. Fig. 4.

According to some, the trouble with the original Pitot tube had been with the flaring opening of the bent tube, and according to others, the double-tube instrument became really perfect only when the straight tube was provided with a thin guide-plate flush with the plane of the opening, as shown in Fig. 4.

2. As to *C.* Dubuat observed that plates moving with a given velocity in a large body of still water encountered less resistance than when immersed in a mass of water moving at the given velocity. This fact, ascertained through repeated observation, became known as the paradox of Dubuat, and it naturally gave rise to numberless discussions. The question is settled now, thanks to

the efforts of distinguished engineers, such as Bazin, Boussinesq, and particularly Prof. Rateau, who, in the paper before referred to, recounted the most conclusive experiments that perhaps could be devised to clear the subject. We know now that the variation of resistance observed by Dubuat was caused by the uneven velocity throughout the moving mass of water.

In the case of Mr. Airey, he had no difficulty in finding the coefficient of correction "K" in the formula $h = K\frac{v^2}{2g}$ because he made the tests with the different forms of Pitot tube by moving each tube at a constant velocity through a considerable mass of water in a state of rest. It would have been very difficult, if not impossible, to produce a moving stream of sufficient size to approximate the relative proportions of the instrument to the mass of water dealt with per unit of time and furthermore to impart throughout such a mass the required uniform velocity. Had Mr. Airey experimented with an ordinary stream, or with a pipe of large size, his results would have proven quite different. It was such considerations as these that prompted investigators to disregard Pitot's axiomatic theory and to try to explain the performance of the tube by the theory of impact, which gave $h = K'\frac{v^2}{g}$, where K' is an appropriate experimental coefficient. But most investigators, like Mr. Airey, knowing that $h = \frac{v^2}{2g}$ for perfect conditions, have sought to establish some kind of theory that would suit the answer to the problem set before them.

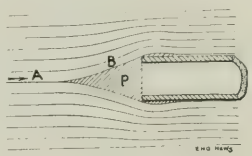


FIG. 5.

(Reproduced from Fig. 2 of Mr. Airey's article, Apr. 17, 1913, p. 782.)

With but a little stretching of the imagination it is easy to prove that the theory of impact suits the Pitot tube, provided the same assumption is used which Mr. Airey so conveniently provided to suit his own theory. Mr. Airey assumes that a cone of "dead" water is formed in front of the opening of the tube and that this cone, Fig. 5, co-axial with the tube, acts as a wedge to divide the current, the stream lines of which adjust themselves around the cone and re-form finally past the bend of the tube. Now the impact theory was first applied upon the supposition that a jet of water of cross-sectional area equal to that of the tube impinged upon the plane of the opening and was deviated at right angle to the direction of the jet, whence $h = \frac{v^2}{g}$, and the necessity of a corrective coefficient to agree with observed fact. Assuming now that a cone of "dead" water is maintained ahead of the opening, and applying the formula applicable to this case, as given by Weisbach, "Mechanics of Engineering," p. 1010, viz., $P = (1 - \cos\alpha)\frac{Q}{g}Q\gamma$ where P is the total impact pressure in lb.; Q is the quantity of water flowing per second; $\alpha = \frac{1}{2}$ the apex angle of the cone, and γ is the specific gravity of water. Let ω be the cross-sectional area of tube, and h be the velocity head, then $P = h\omega\gamma$, and $Q = \omega v$, whence we obtain by simplification $h = (1 - \cos\alpha)\frac{v^2}{g}$. The apex angle which would make $(1 - \cos\alpha) = \frac{1}{2}$ is evidently $60° \times 2 = 120°$, since $\cos 60° = 0.5$.

It is thus seen that with a little complaisance the impact theory can be made to agree with the facts very nicely. The 120° angle is certainly not out of reason, and after going so far we might as well agree that the generatrix of the cone could be a sinusoid, in which case the impact formula would still apply in a general manner, the main point being to determine the exact shape of the generatrix.

3. As to D. It is logical to assume that the mouth of the tube is capped with a body of "dead" water forming a sort of wedge, by means of which the current is deviated. The streams follow in lines of least resistance from the apex of the wedge to the end of the tube bend. The great difficulty is to ascertain the contour of the wedge; if we may judge from the photographs of projectiles in transit we may safely assume that the cap, instead of being like a sharp-pointed cone, is most probably a paraboloid, its size depending, of course, upon the velocity of the stream relative to the tube. One thing is certain, the tube has to displace a volume of water equal to the product of the cross-sectional area of the tube by the velocity of the current; but, as usually that cross-section is very small, as compared to that of the flowing mass, it is probable that the disturbance caused by the tube is local, that is, it affects only the region immediately surrounding it, the water flowing therethrough with increased velocity.

It has been assumed that the cap is composed of "dead" water; that should be understood to mean that the water thus located does not flow with the streams surrounding it, but not that it is in a quiescent state, for it is probably a most tumultuous mass of whirls. We have thus to deal with three uncertainties, viz., the existence of the cap, its shape and its composition. It seems probable that with proper means of investigation these points can be cleared, but, until they are, it is perhaps idle to seek to establish a purely mathematical theory of the Pitot tube.

It seems likely that at the apex of the cap of "dead" water there is an impact effect, while along the generatrix there is a deviating effect. Whatever form the generatrix of the cap may have, the problem requires the study of the transformation of the stream from A to B, Fig. 5. At A the cross-section may be assumed as $\perp w = \perp h \times \perp b$, but while the area $\perp w$ may be kept constant, the width $\perp b$ will go on increasing from the apex to the base, while the height $\perp h$ will correspondingly decrease. Such changes may be accompanied by changes of pressure and velocity. So much for one elementary stream. But the next stream is also affected by the changes in the first, and, being differently located, its deformation is somewhat different from that of the first; then all the other streams extending from the generatrix of the cone to what might be termed the normal or unaffected streams must be deformed to some extent. The pressure exerted at the given point B on the generatrix of the cone must then be the resultant of all the elementary forces effecting the deviation of all the streams

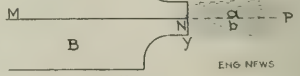


FIG. 6.

cut by a normal to the generatrix at the point B. These considerations prove that the subject is fit only for the mathematician well posted on the theory of molecular mechanics.

4. As to E. Mr. Airey attempts to solve a mystery by means of another mystery, but of a lesser order than the first, and that is hardly compatible with expectations. To quote him, p. 782: "Assuming that smooth motion exists, i.e., no discontinuity of flows occurs, or, more definitely, the velocity of any streamline cannot be more than infinitesimally different from the velocity of a streamline infinitesimally distant from it, then it follows that the boundary of "dead" water must be a streamline of infinitesimal motion." He then proceeds to consider two points A and B of the same streamline, Fig. 5 (Fig. 2 of Mr. Airey's paper), and writes the Bernouilli equation thus:

$$\text{Point } A \qquad\qquad \text{Point } B$$

$$\frac{v_A^2}{2g} + h_1 + atmos.\ press. = \frac{v_B^2}{2g} + \frac{p}{w} + atmos.\ press.$$

v_A, v_B = Velocity at A and B respectively;
h_1 = Depth of point A below the surface;
p = Pressure in *dead* water, constant in a horizontal plane;
W = Specific gravity of water.

Then if h is the height of water in the tube above surface level and a is the cross-sectional area of pipe: $pa = (h_1 + h)Wa$. Now, since v_A is the velocity of the stream and v_B is infinitely small, therefore negligible, $\frac{v_A^2}{2g} + h_1 = \frac{p}{w} = h_1 + h$ and finally $h = \frac{v^2}{2g}$.

Instead of assuming a conical cap of dead water, it would be just as fair to assume the cap as made of metal and composed of two parts, one conical connected to another of cylindrical form, which would fit exactly the bore of the tube like a frictionless piston. In both cases the body of "dead" water and the metal cone are assumed to be solid; then what becomes of the stream considered, which had a high velocity v_A at point A just before engaging the cone and then, midway up the cone, at point B, found its velocity v_B so small as to be negligible? According to Mr. Airey's premises, the current would be practically stopped along the generatrix of the cone and, as the difference in velocity between adjacent streamlines would be infinitesimal, it would require a goodly number of streams, piled up one against the other, to reach a sufficient distance from the generatrix where to find again the normal velocity of the current as observed at point A. This means that the cone would be practically surrounded by space where high pressure would obtain, which is totally disproved by numberless actual tests made with juxtaposed static and velocity pressure tubes, such as are used to measure the flow of liquids and of gases. It would appear as if Mr. Airey strained a point, and that consequently the theory he advanced is not acceptable.

5. Mr. Airey states, p. 783: (c) The greater the disturbance to streamline motion, the greater the discrepancy between the experimental head and $\frac{v^2}{2g}$, h always being less than $\frac{v^2}{2g}$. This is totally disproved by the experiments Prof. Rateau made and described in the paper referred to. He used a large box AB, Fig. 6, divided longitudinally by a thin partition Mn, and he caused to be maintained in each compartment so formed a uniform pressure by means of a fan blower. Means were provided to vary at will each pressure, so as to obtain any desired difference of pressure between the two compartments, and consequently different velocities of the issuing streams a and b. With a Pitot tube placed in either of the currents, close to the mouth xy of the nozzle, the height of the column of water observed was precisely equal to that read on a pressure tube attached to the corresponding compartment. But when the Pitot tube was made to oscillate by means of an ingenious pendulum device, such that the tube remained in one current as long as in the other, the time of oscillation being adjustable at will, it was found that the reading of the tube was greater than would be produced in the high pressure, or high-velocity current. Mr. Rateau shows that the coefficient (K) in the formula $h = K\frac{v^2}{2g}$ where V is the true mean velocity, may vary from 1 to 1.15, when the ratio of velocities does not exceed 2, but that with further increase of this ratio the coefficient increases rapidly, until it reaches the ultimate value 2. He concludes that the Pitot tube is an instrument which measures, not the mean velocity of a stream, but rather, the mean of the square of the velocities, that is, the mean momentum of a stream.

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An Improved Quartz-Tube Mercury-Vapor Arc Lamp has been designed for American uses by the General Electric Co. under the direction of E. Weintraub, of Lynn, Mass. This presents several features of departure from the German type described in "Engineering News," Dec. 5, 1907. Previously there had been difficulty in sealing the metal electrodes into the quartz tube on account of the difference of expansion and on this account ground joints had been resorted to. Now rolled tungsten is used, reducing the difference in coefficient of expansion somewhat but yet not enough to produce a satisfactory terminal; the improvement has been completed, however, by the development of a glass which adheres to the tungsten and has the same coefficient of expansion as it, and graduates into the pure quartz of the tube. This is a somewhat cheaper terminal than that previously used and allows tripling the current density in it.

The older lamp had both electrodes of mercury; with the mercury anode an extra amount of vapor had to be condensed at the cathode chamber and this required some adequate means of heat dissipation. Sufficient vapor comes from the mercury cathode alone and with the anode of solid material the construction of the lamp is simplified by removing the need of special heat dissipators. By certain precautions, tungsten becomes available for use as a solid anode.

The standard tube unit at present developed is for 4-amp. lamps with 80 volts across the tube. This is somewhat over 5 in. long with a luminous length of 3½ in. For use on 110 volts, direct current, the following figures are reported: watts consumed by the lamp, including mechanism, 440; mean spherical candlepower, 630; watts per mean spherical candlepower, 0.7. A 220-volt direct-current multiple-service lamp has been made with a 9-in. tube, 7 in. luminous length, and with 170 volts across the arc with 4 amp. Such a lamp would require 880 watts across the lamp and mechanism, would have a mean spherical candlepower of 1600 and show 0.55 watt per mean spherical candlepower. A lamp has been developed for alternating-current circuits and this has three electrodes disposed after the fashion of the mercury-vapor rectifier. The efficiency of such an arrangement is somewhat higher than the direct-current lamp (including the mechanism), on account of a smaller loss in the lamp transformer than in the resistance of the direct-current type. (See "Eng. News," Sept. 12, 1907.)

The quartz-tube lamp can be arranged for series circuits and the efficiency rises here with the elimination of the resistance used to steady the current. A 700-watt lamp on a series circuit would show a specific power consumption of 0.35 watt per mean spherical candlepower.

Sewage Treatment Works for Fitchburg, Mass.

By Frank A. Marston*

SYNOPSIS—Sewage-treatment works, consisting of Imhoff tanks, sludge beds, sprinkling filters and secondary or final settling tanks are about to be built for Fitchburg, Mass., under a contract awarded in May, 1913. Special features of this plant are rectangular Imhoff tanks, built side by side with dividing walls, cement-plaster partitions forming troughs and gas vents, and the use of structural-steel frames to support the reinforced-concrete walls of the tanks and also the partitions just mentioned; the installation of the air lift for removing sludge from the Imhoff tanks; the approval by the Massachusetts State Board of Health of sprinkling filters, the first plant of the kind to be thus approved; the construction of sprinkling filters 10 ft. in depth; the building of a 2-in. cement plastered curtain wall between the natural ground and the stone filling of the sprinkling filters.

The City of Fitchburg is located in the north central part of the State of Massachusetts on the North Branch of the Nashua River. In 1910 the city had a population of 37,826. A large number of manufacturing industries are located here on account of the excellent water power afforded by the numerous storage reservoirs along the river. The city is fairly well served by a system of sewers designed on the combined plan, which empty into the river at various points along its course. During the last two years, an intercepting sewer has been under construction, and at the present time is nearly completed, varying in size from 48 to 30 in. in diameter. The intercepting sewer will divert the sewage from the river and convey it to the trunk sewer through which it will flow to the sewage-treatment works. For a distance of 5500 ft. above the sewage-treatment works, the trunk sewer is in the form of an inverted siphon, constructed of 30-in. cast-iron pipe, at the upper end of which a chamber has been constructed with an overflow direct to the Nashua River, and a 36-in. stub for the future construction of an additional inverted siphon to be built when the normal quantity of sewage exceeds the capacity of the present siphon. Before the sewage enters the inverted siphon, it will pass through a grit chamber and coarse screen, where the gravel and sand will be removed and large objects, which might cause obstruction to the inverted siphon, will be retained. This grit chamber has been constructed in the sewer department yard where it will be readily accessible for inspection and cleaning.

In making studies for the future, the rate of growth of the city of Fitchburg was compared with that of other cities of a similar size and after taking into account all the various conditions an increase of 15% in population each five years was assumed to be the probable rate of growth to be expected. On this basis, the population to be expected in 1925 will be 57,400 and in 1940, 87,200.

The intercepting sewer was designed to provide for a maximum rate of sewage flow from the residential districts of 150 gal. per capita per day; a maximum ground water leakage of 1960 gal. per acre per day, approximately equivalent to 74,000 gal. per day per mile of sewers; and an allowance for industrial wastes of 8000 gal. per day per acre of industrial or mercantile districts. The ultimate maximum rate of flow to be provided for by the intercepting sewer, on the above basis, will be 39,000,000 gal. per day, which, based on the population to be expected in the year 1940, will be at the rate of 450 gal. per capita per day. No special allowance was made for storm water as it is the intention at some time to separate the storm water and sewage. In the meantime, storm water will be admitted up to the full capacity of the intercepting and trunk sewers, the amount being controlled by automatic sewer regulators with overflows to the river. The quantity to be carried by the trunk sewer in times of storm will be regulated by the overflow weir in the siphon chamber.

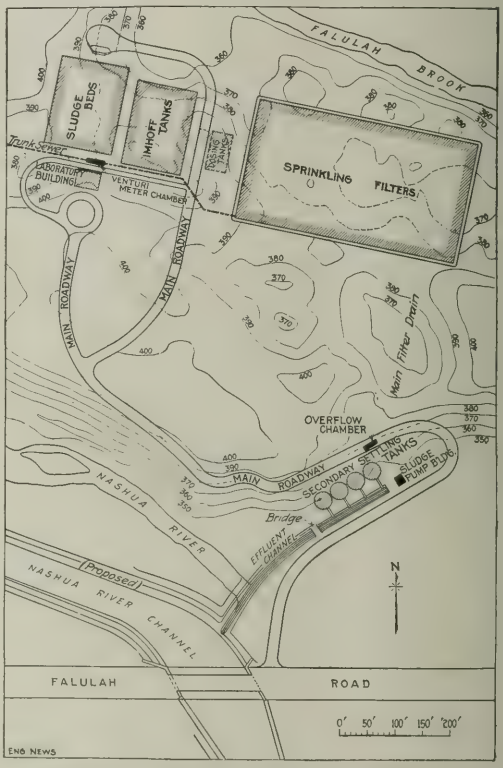


Fig. 1. General Layout of Sewage Works, Fitchburg, Mass.

In 1910, the normal water consumption was approximately 100 gal. per capita per day, and from careful studies and sewage measurements, it was determined that the normal quantity of sewage to be expected would be about the same. The design of the sewage-treatment works was based, accordingly, on a normal quantity of sewage of 100 gal. per capita per day. Certain portions of the plant, such as conduits and pipe lines, were designed to carry the maximum capacity of the trunk sewer;

*Assistant Engineer with Metcalf & Eddy, Consulting Civil Engineers, 14 Beacon St., Boston, Mass.

the tanks and sludge beds were designed to provide for the sewage of 55,000 persons; and the sprinkling filters for the sewage of 10,000 persons. When the sewage-treatment works are completed it is expected that the normal sewage flow will be about 1,000,000 gal. per day with a maximum rate of flow of 140% of the normal and a minimum rate of flow of 70% of the normal. The area would have to be made on account of the rapid growth of the city. From the studies made it seemed probable that a satisfactory effluent could be obtained from sprinkling filters followed by secondary sedimentation, at less cost.

The plant, as designed, consists essentially of Imhoff settling tanks with sludge beds, sprinkling filters and

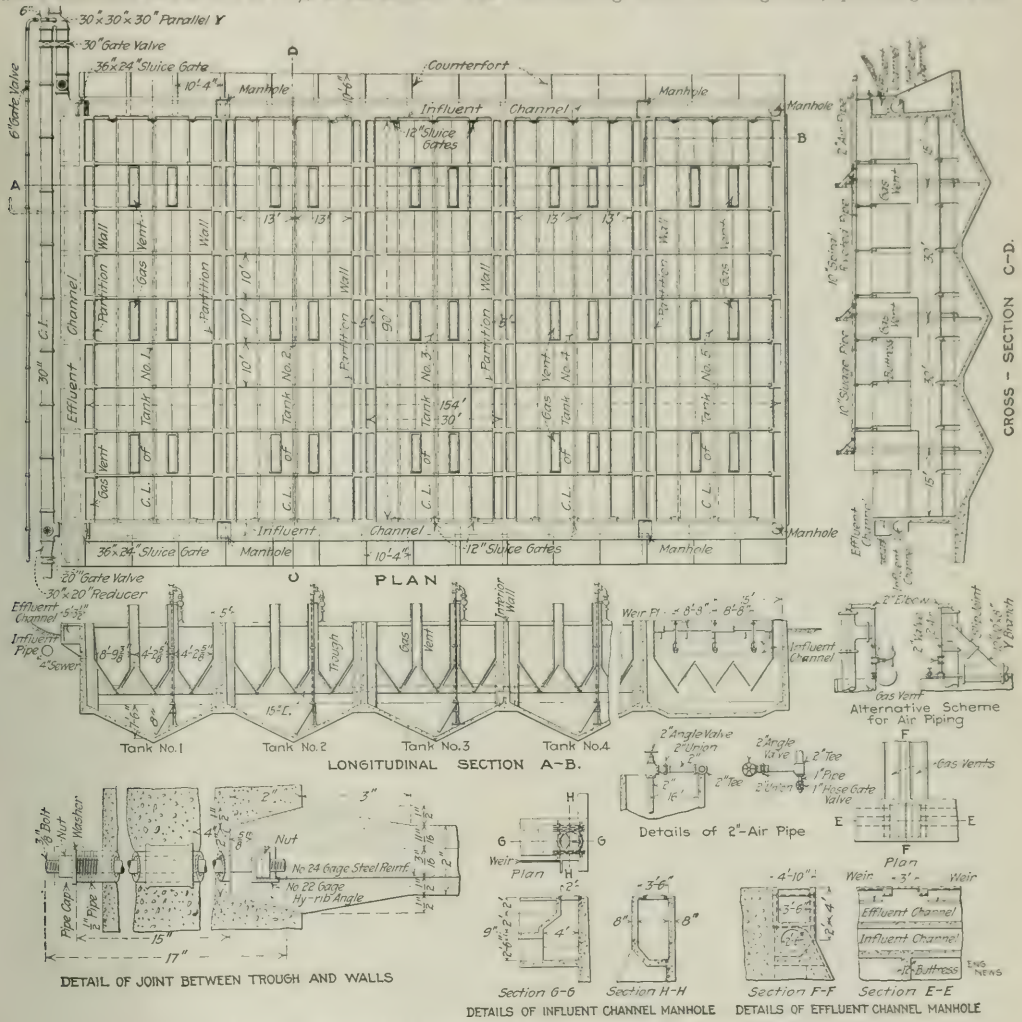


FIG. 2. DETAILS OF IMHOFF TANKS, FITCHBURG SEWAGE WORKS

maximum storm-water flow to be delivered at the sewage-treatment works will be approximately 12,000,000 gal. per day.

SEWAGE-TREATMENT WORKS

Although it was recognized that in all probability no better effluent could be obtained than that produced by intermittent sand filters properly constructed and operated, it was deemed inadvisable to construct this type of plant, owing, principally, to the large area required for present needs and the fact that frequent additions to this secondary settling tanks (see Fig. 1 for general layout). The tract of land selected for the sewage-treatment works lies partly in the southeasterly portion of the city of Fitchburg and largely in that portion of the town of Lunenburg adjoining. It is about 800 ft. from the nearest dwellings, and the prevailing wind is in the direction away from the city. The chief disadvantage of the location is the large quantity of earth excavation required in order to build the works at a suitable elevation to avoid pumping the sewage.

The use of sprinkling filters in Massachusetts in the

past has been limited to small experimental beds operated at the several experiment stations. The approval by the Massachusetts State Board of Health of this type of plant for Fitchburg marks an advance in the history of sewage treatment in the state, although, in this case, the approval provides for the possible use of intermittent sand filters operated at a high rate to further treat the sprinkling-filter effluent if it should prove necessary.

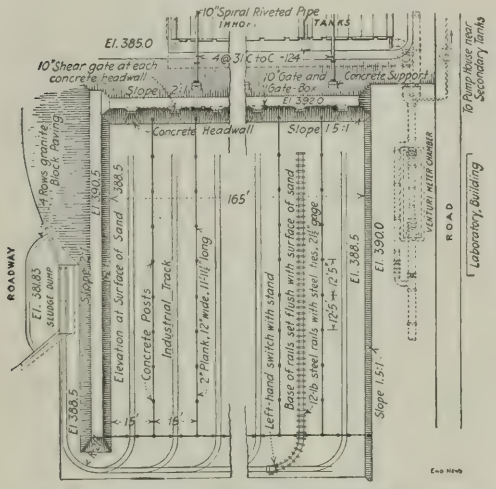


Fig. 3. Sludge Beds, Fitchburg Sewage Works

Measuring Apparatus—The quantity of sewage delivered at the works will be measured by a 30-in. by 15-in. Venturi meter with 12-in. float chambers and 7-in. copper floats, operating a type-M Register-Indicator-Recorder, furnished by the Builders Iron Foundry, of Providence, R. I. The meter will be equipped with vent cleaners and hand-hole openings on both the upstream and throat pressure chambers, and will be set in a concrete chamber below the surface of the ground. The recording instrument will be located near-by in the office on the second floor of the laboratory building.

Imhoff Tanks—Five Imhoff tanks (Fig. 2), each approximately 90 ft. long and 30 ft. wide, were designed to provide for three hours' storage for 125% of the normal flow of sewage (100 gal. per capita per day), for a population of 55,000 people. The tanks are rectangular in shape with a vertical wall 18 ft. 5 in. in depth, below which the bottoms of the tanks are constructed in the form of inverted pyramids, 7 ft. 6 in. deep, three pyramids to each tank, making a maximum depth of 25 ft. 11 in. below the top. Each tank is divided into two compartments, the upper one for sedimentation and the lower one for sludge storage, by means of cement-plaster partition walls, forming three troughs running longitudinally through the tanks. At the bottom of each trough is a slot 6 in. wide through which the solids will settle into the sludge compartment below. The sludge compartment was designed to retain sludge for a period of 6 months, on the basis of 0.007 cu.ft. of sludge being produced per capita per day. Six central gas vents, 24 in. wide by 9 ft. long, and side gas vents, 24 in. wide, continuous along the side walls of each tank, are provided.

The sewage will be delivered to the Imhoff tanks through 30-in. concrete conduits built in the end walls of the tanks from which the sewage will pass into each tank through three 12-in. openings controlled by sluice gates. Provision has been made for reversing the direction of flow into the tanks in order to make the sludge deposit more uniform. The effuent will flow over weirs, running practically for the full width of the tanks, into concrete conduits built in the end walls above the influent conduits. It is estimated that the maximum velocity of the sewage entering the tanks will not be greater than 2 ft. per sec., and when the rate of sewage flow exceeds the normal by 125%, amounting to 6,875,000 gal. per day, the horizontal velocity of flow through the tanks will be approximately 25 ft. per hour.

The tank walls will be constructed of reinforced concrete supported by structural-steel frames, which not only provide the main support for the exterior walls, but also for the thin partition walls between the sedimentation compartments and the sludge compartments. These thin partition walls will be constructed of three-coat cement plaster on rib-metal reinforcing lath, securely fastened to the structural-steel frames. There are eight frames to each tank, spaced 10 ft. c. to c. A special form of joint, shown as a part of Fig. 2, was designed to anchor the rib-metal reinforcing lath to the tank walls during construction, and at the same time allow for the expansion and contraction of the completed work. In building the end walls of the tanks, pieces of wrought-iron pipe will be set in the forms through which bolts will be placed to anchor the rib-metal reinforcing lath to the wall, and a groove will be left in the concrete wall

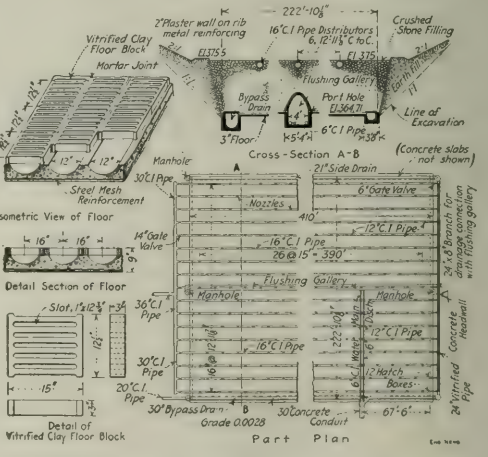


Fig. 4. Sprinkling Filters, Fitchburg Sewage Works

along the line of the joint and later filled with cement plaster to form a gas cutoff between the sedimentation and sludge compartments. After the thin partition walls have been completed, the bolts will be removed, thereby releasing the anchor on the rib-metal lath and allowing the thin partitions to expand and contract more freely.

Sludge Bed and Air Lift—Owing to the topography of the land on which the sewage-treatment works will be built, it was found desirable to construct the sludge beds

at a higher elevation than the Imhoff tanks, thereby making it necessary to pump the sludge. The usual forms of pumping machinery are not suitable on account of the breaking up of the sludge and the resulting loss in gas content, which would be disastrous to the rapid drying qualities for which Imhoff sludge is noted, and on this account use was made of the "air lift" principle. An 8-in. cast-iron pipe will be erected in the center of each pyramidal hopper extending from the bottom of the hopper to the top of the tank (Fig. 2). A 2-in. air pipe will deliver compressed air at a point in the 8-in. pipe about 17 ft. below the normal water line. This compressed air will rise in piston-like masses, carrying with it quantities of sludge. The initial lift will be about 8½ ft. from the normal water line to the top of the vertical pipes, from which the sludge will flow by gravity to the sludge beds through 10-in. riveted steel pipes, into a 10-in. cast-iron header on which are located the sludge outlets controlled by 10-in. shear gates.

The sludge-drying area (Fig. 3) was divided into eleven beds each 15 ft. wide and 111 ft. long, separated by small partitions constructed of 2-in. creosoted planks 12 in. wide, set on edge in concrete posts, spaced about 12 ft. c. to c. Each bed will be served by a narrow-gage track laid along the center line with the ties flush with the surface of the sand. The total area of the sludge-drying beds is approximately 18,300 sq.ft., being based on three persons per square foot of area for a population of 55,000 people. The sludge will be run onto the beds to a depth of about 8 in., but the partitions are 12 in. high. No underdrains will be constructed at the present time owing to the excellent drainage qualities of the soil, although it is intended to construct underdrains, if, in the future, they should be found necessary. After the sludge has dried sufficiently, it will be shoveled into small tip cars, which will be hauled to the northerly side of the sludge beds where the sludge will be dumped from the top of a concrete retaining wall directly into wagons driven alongside the wall at a lower elevation. It is planned to dispose of the dry sludge by filling low land belonging to the city.

Sprinkling Filters—The sewage after leaving the Imhoff tanks will flow alternately into one or the other of two dosing tanks of approximately 36,000 gal. capacity each where it will be stored until automatically discharged through 30-in. cast-iron siphons into the main distributors of the sprinkling filters.

The area of sprinkling filters required was based on the assumption that one acre of stone 10 ft. deep will care for the sewage from 20,000 persons. The beds now under construction will have an area of 2.07 acres at the floor level. The area is rectangular in shape (Fig. 4), 405 ft. long by 222 ft. 10 in. wide at the floor level and 5 ft. longer in each direction at the top. The crushed stone, a local granite, from 1 in. to 2 in. in size, will have a depth of from 10 ft. to 10 ft. 6 in. above the false-floor system. The surface area of the filters was increased to allow for the overlap from the adjacent row of nozzles.

The sewage will be conveyed to the filters through 36-in. and 30-in. cast-iron main distributors, from which 17 lateral distributors, 16 in. and 12 in. in diameter, will run the full length of the beds. These cast-iron distributors will be set in the stone just below the surface and the nozzles will be fastened directly to the distributors, thereby climating long riser pipes. The nozzles are located at the apices of equilateral triangles 15 ft. on a side. At the lower end of each lateral distributor there will be a 6-in. blowoff with an outlet to the low area on the east side of the sprinkling filters, which will act as a small sand filter for the sewage blown out of the distribution system or for the sewage drained from any portion of the distribution system which may be cut out for repairs or during cold weather to prevent freezing. Hatch boxes will be located at each end of each lateral distributor, as well as in the center where the size changes from 16 to 12 in. in diameter. By these means the distribution system can be readily cleaned or examined at any time and the filters can be operated in 17 units.

The crushed stone will rest on a false-floor system of the type shown in Fig. 4. The concrete floor will be formed into a series of channels or corrugations, spaced

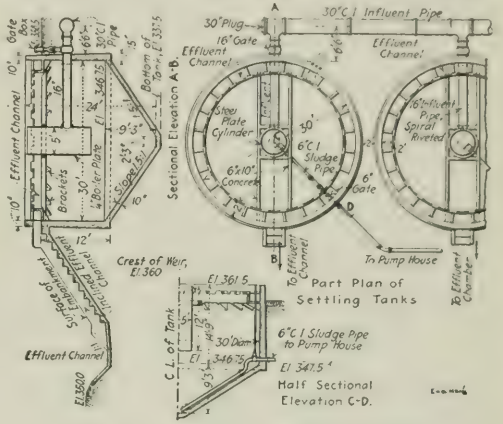


Fig. 5. Secondary Settling Tanks, Fitchburg Sewage Works

16 in. c. to c., and laid on a slope of 1 in 222, draining from the center line of the filters in either direction toward the outer edges. The concrete channels are covered by vitrified clay blocks, slotted to obtain a large amount of drainage area. The upper ends of the channels extend into a flushing gallery, 6 ft. high by 4 ft. wide, at a distance of 2 ft. 6 in. above the floor of the gallery, thereby making it possible to examine each of the floor drains and also flush or clean them in case solid matter should be deposited therein. A cast-iron water main with hose outlets will be laid in the gallery for convenience in flushing.

The sprinkling filters are almost entirely constructed in excavation with the surface of the filters below the natural ground level. The floor channels drain into U-shaped concrete underdrains (built along the edge of the filters on the north and south sides), covered with concrete slabs, and which lead to a main collector drain through which the effluent flows from the sprinkling filters to the settling tanks. Manholes are located so as to provide access to the underdrains as well as to furnish ventilation. No retaining wall will be built around the outside edges of the filters but a thin partition wall, constructed of cement plaster on rib-metal lath, will be built to separate the crushed stone from the earth fill-

ing. This partition wall was not designed to carry any unbalanced pressure as it was intended that the earth backing and the crushed-stone filling should be placed simultaneously and thereby avoid injury to the wall.

The filter effluent conduit will be constructed of reinforced concrete, 30 in. in internal diameter for a portion of the distance and the remainder will be constructed of 30-in. cast-iron pipe. At the lower end of the conduit, near the secondary settling tanks, a small overflow chamber will be constructed containing a weir 25 ft. long built at such an elevation as to make it impossible for anyone, either willfully or through carelessness, to shut the influent gates in the secondary tanks and back the sewage up into the sprinkling filters or to block the outlets of the secondary tanks and cause them to overflow.

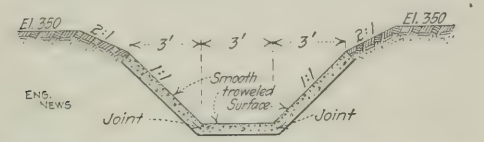


FIG. 6. CROSS-SECTION OF FINAL EFFLUENT OUTLET, FITCHBURG SEWAGE WORKS

The overflow chamber also includes a means for bypassing the filter effluent around the tanks.

SECONDARY SETTLING TANKS—The secondary settling tanks, four in number (Fig. 5), constructed of reinforced concrete, are cylindrical in shape with conical hopper bottoms. The tanks are 30 ft. in internal diameter, 14 ft. 9 in. deep in the cylindrical portion and 9 ft. 3 in. deep in the conical bottom, making a total depth of 24 ft. The tanks were designed on the basis of a sedimentation period of one hour for 125% of the normal daily flow of sewage from a population of 55,000 persons. The sewage will enter each tank from the 30-in. cast-iron filter effluent conduit through a 16-in. spiral-riveted steel pipe to a cylindrical pipe 5 ft. in diameter, constructed of ¼-in. steel boiler plate, 12 ft. long, set vertically with the top 1 ft. 2 in. above the flow line of the tank, which will cause the inflowing sewage to pass downward and underneath the lower edge.

It also serves to retain floating matters and prevent them from passing out with the effluent. The sewage will flow vertically upward through the tanks with an average velocity of approximately 15 ft. per hr. The effluent channel is located around the circumference on the inside of each tank and contains 24 weirs 2 ft. long, over which the effluent will flow into the effluent channel, thence down a flight of concrete steps to the main effluent channel and finally to the Nashua River.

The secondary settling tanks will be cleaned frequently by pumping out the entire contents of a tank, including sludge and water, with a 5-in. motor-driven, centrifugal pump, located in a small building near the tanks, and forcing it through a 6-in. cast-iron force main up into the influent conduit to the Imhoff tanks, in which the sludge will be deposited and allowed to decompose, together with the sludge from the crude sewage. This method of operation avoids the necessity of building separate sludge beds for the secondary settling tank sludge, which are usually troublesome because the sludge dries slowly and is apt to give off disagreeable odor, due to the large number of worms which it contains. When mixed with the crude sewage sludge in the Imhoff tanks, the secondary tank sludge will go through the "rotting out" process, the worms will be decomposed and the resulting sludge will be free from nauseating odors and will dry out much more readily.

FINAL EFFLUENT CHANNEL—The main effluent channel from the secondary settling tanks to the Nashua River is trapezoidal in section, 3 ft. in depth, with a bottom width of 3 ft., and sides built on a slope of 1 to 1 (Fig. 6). Both the sides and bottom will be paved with concrete.

In addition to the work already described, a considerable amount of excavation will be involved in improving and straightening the Nashua River channel, and in the construction of about one-half mile of macadam road to various portions of the sewage-treatment works.

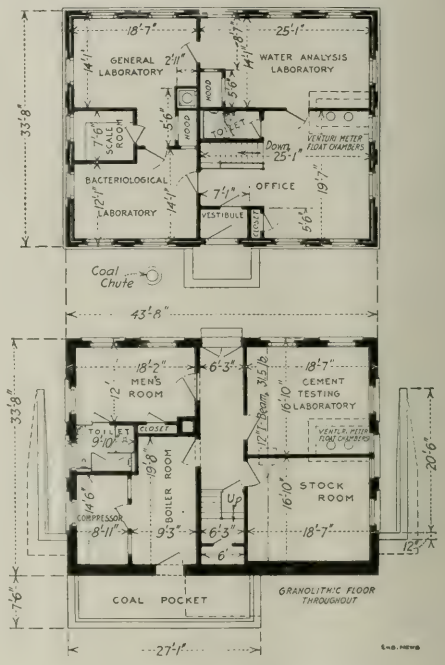


FIG. 7. FLOOR PLANS OF LABORATORY, FITCHBURG SEWAGE WORKS

LABORATORY—The laboratory building will be a two-story structure, 33 ft. 8 in. by 43 ft. 8 in. in plan, of grey, rough-cut brick, with a red tile roof and limestone trimmings. Complete equipment will be installed for general chemical, water analysis, bacteriological and cement-testing laboratories (see Fig. 7 for floor plans). The air compressor for furnishing compressed air to be used in pumping the sludge in the Imhoff tanks will also be installed in this building.

The sludge-pump building, 14 ft. by 17 ft. in plan, will be of a similar type of construction, one story high.

The project is under the general direction of the Sewage Disposal Commission, a board of three men appointed by the Mayor, and created by an act of the Massachusetts

Legislature in 1910. This board, of which Arthur H. Lowe is chairman, has under its charge not only the construction of the intercepting sewer and sewage-treatment works, but also the maintenance of the sewerage system together with the making of sewer extensions and house connections. David A. Hartwell is chief engineer and Harrison P. Eddy is consulting engineer. The plans and specifications for the sewage-treatment works were prepared in conjunction with Mr. Hartwell at the office of Metcalf & Eddy, consulting civil engineers, Boston, Mass. Proposals for the construction work were received May 15, and the contract has been awarded to the lowest bidders, R. H. Newell Co., and N. S. Brock, of Uxbridge, Mass. The contract will amount to approximately $215,000.

A Grouting Process for Preventing Slides on the Panama Canal*

By Geo. S. Rice†

In the Culebra Cut on the Panama Canal serious difficulties are being experienced from slides, and the Isthmian Canal Commission's report for 1912 contains an interesting description of the geological formation and the cause of slides, by the geologist, Mr. McDonald‡

The writer has reached the conclusion that the slides may continue to be a serious matter. Therefore it will be advisable to give consideration to any methods which will tend to prevent slides. A process used in shaft sinking and tunnel work suggests a method of erecting an underground retaining wall which (though not feasible for ground actually moving) will perhaps prevent the formation of a slide by taking care of the unbalanced pressures due to deep excavation.

CEMENTATION PROCESS FOR SINKING SHAFTS

While the method of filling cavities and rock crevices behind tunnel lining with cement grout has long been employed, a special application called the cementation process has been highly developed in France for sinking through porous and creviced water-bearing strata. Briefly, it consists of drilling a series of holes surrounding the shaft location through the porous strata to the more or less impervious coal measures, and pumping in cement grout under high pressure. The pumping may be either continuous, as the drilling proceeds, or (as in later undertakings was found to be better) in stages at intervals alternating with drilling every 16 ft. By this method a cylinder of cemented material is constructed within which the shaft can be sunk. In the earlier undertakings four drill holes were used, but for later shaft sinkings six holes were employed in a circle of 24 ft. diameter.

To prevent leakage to the surface of the injected grouting, a pit is first dug for each bore-hole through the loose earth and concrete placed tightly about a 12-in. standpipe, the top of which is capped. The cap has a stuffing-box, through which passes a grouting pipe that can be pushed to near the bottom of the hole. The pipe is connected with the pump, and the latter with the cement mixer. Before injection of cement begins, clear water is pumped through.

It has been found necessary to use only the finest ground cement, and employ pressures as high as 750 lb. per sq.in. to insure the thorough permeation of the cement into the small crevices and bedding planes of the strata. The cleaning out of all mud coating on the bore-hole is also found necessary. To this end it is the practice to drill the hole below the standpipe, about 7 in. diameter, and then ream to 10 in.

The water-bearing strata consist of marls or fissured chalks which are sometimes argillaceous. They are soft enough to be bored with an auger drill turned by power. The process has been so successful that it is supplanting the freezing system for sinking through highly water-bearing strata in northern France and Belgium.

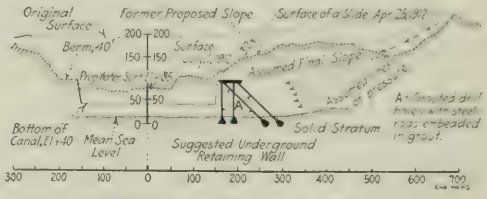
CONSTRUCTING UNDERGROUND RETAINING WALLS

The success achieved with the above process appears to offer possibilities in solidifying the slopes of unstable strata, at least sufficiently to prevent movement from occurring. The holes filled with concrete reinforced with iron bars would serve as deep-seated massive piles. Why not extend this principle and drill inclined holes to solid strata and insert in them heavy reinforcing bars which, when surrounded with cement, would act as diagonals or tension members?

A further development was to "spring" the holes at the bottom by shooting with dynamite. This would open up crevices, permitting a more extensive cementation and would provide an enlargement which would furnish anchorage for the tie bars. The upper end of the tie bar is to be held by a concrete capping. Thus the combination of vertical concrete posts and inclined metal ties reaching deep enough to reach solid strata), with the ground cemented between, would furnish a triangular dam, or retaining wall, which should have great strength against lateral pressure.

The nearer the holes, the more thorough would be the cementation. The only limit would be that of cost. The system, if applied extensively, would be costly. But it would only be considered where the cost of repairing damage to an engineering work by an extensive landslide would be vastly greater.

In proposing the scheme for checking, or rather prevent-



Proposed Method of Preventing Slides on the Panama Canal

ing, slides, the writer has had three main thoughts in mind: 1, as far as possible there should be drainage; 2, there should be a subdivision of the slopes from which the slides are liable to come; 3, there should be formed an underground dam, to prevent the foot of a slope from moving, and also to keep the water of the canal from circulating through the material. It is very much more destructive to the somewhat soluble walls to have water constantly entering and leaving the crevices through wave action, than if the ground water is merely held quiescent.

The scheme is as follows, and is shown by the accompanying cut:

1. To drill a series of holes along lines parallel with the axis of the canal, these holes to be both vertical and inclined, and go deep enough to reach firm strata below the level of the bottom of the canal. The depth of the holes might need to be 100 ft. or over 150 ft.

2. Cement grout to be forced into these holes under pressures of 750 to 1000 lb. per sq.in., so that the cement will penetrate all the fissures, making the mass impervious to water, and also binding the rock together.

3. Steel rods, 3 in. diameter or more, to be grouted into the holes.

4. Before the steel bars have been placed, dynamite is to be fired in the bottom of each hole to make an enlarged space in the firm stratum which the holes should reach. These will provide anchorage at the bottom. The rods will thus act as reinforcement to the cemented zone; and the rods in the inclined holes will serve as tension members of the wall. The latter rods will therefore be made much heavier than the others. The rods are to have nuts and washers or to be upset at each end. The upper ends are to be fastened in a concrete capping over the top of the "dam."

In applying this method it must be done before the ground begins to move. It cannot be applied to ground that is actually moving. Moreover, the wall must go sufficiently deep to get into solid strata. But there is nothing except cost to prevent such an underground dam from going as deep as seems desirable, or to make the holes as large or the tie rods as heavy as desired. It would be desirable to try the method beyond the present slide areas in order to determine the obstacles and necessities of the case. The work could be pushed from either edge into the slide area. Intermediate ground walls could be constructed further up the slopes, so as to lessen the weight and also to prevent water which might enter above from working down into the larger mass below. Accompanying these dams, underground horizontal drifts might in some cases be put into the slopes to drain the ground.

*Abstract of a paper read before the Western Society of Engineers, Chicago, May 12, 1913.

†Chief Mining Engineer, U. S. Bureau of Mines, Pittsburgh, Penn.

‡"Engineering News," Oct. 3 and Nov. 28, 1912.

The Timber-Treating Plant of the Baltimore & Ohio R.R.*

The Baltimore & Ohio R.R. has recently completed and put into operation, at Green Springs, W. Va., one of the most complete and modern timber-treating plants in America. It covers 60 acres and is situated close to large areas of timber land along the south branch valley of the Potomac River. The requirements of the B. & O. system approximate 2,500,000 ties annually for renewals, and a large proportion of these ties, with other timber for railroad use, will be treated in the new plant.

Practically all of the ties treated at the plant to date are oak, the number being approximately 200,000. The standard tie in use on the Baltimore and Ohio is 7x8 in. and 8½ ft. long, containing 4 cu.ft. Ties are unloaded and cribbed in piles of seven and one, and are handled by piecework. It is the intention to air-season all ties. However, if they are not received in quantities sufficient to properly air-season, the plant is designed to give a preliminary steaming and vacuum treatment before the injection of preservatives.

The location of the timber-treating plant is believed to be admirably suited for all purposes, being near large timber areas. Green Spring is at the junction of the Romney branch with the main line of the B. & O. This branch, which extends 16 miles to Romney, W. Va., with the Hampshire Southern R.R., extending 38 miles farther to Petersburg, taps a timber tract of several thousand acres, much of it being virgin forest. The outlet for all timber adjacent to the lines mentioned is by way of Green Spring, and it is merely a question of stopping the timber in transit to have it seasoned and treated.

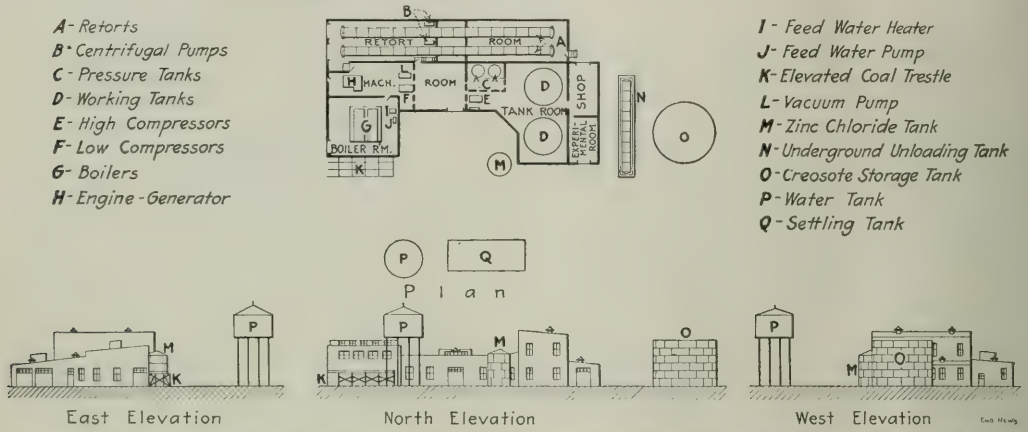
The accompanying figure shows the plan and elevation of the works. In addition an experimental plant, consisting of a complete physical and chemical laboratory, is situated adjacent to the main building. Here is a cylinder 30 in. in diameter, 9½ ft. long, to hold three or four ties. There are also two working or pressure tanks, an underground drain tank, pressure pumps and electric centrifugal pump. Any process can be studied and pressure can be supplied as high as 300 lb. The chemical laboratory adjoins the physical laboratory, for creosote distillations, zinc-chloride analyses, etc.

The office building is of concrete and is fireproof. The same is true of the other buildings in the plant, except small hose and engine houses of wood, located some distance from the other structures. A fire-protection system has been installed and a fire department will be organized from among the employees. A 6-in. water main has been laid the entire length of the tie yard and every 300 ft. there is a hydrant. The hose house is near the office and is equipped with a reel of 300 ft. of hose. Water pressure for fire emergency is maintained by a high 50,000-gal. tank kept filled at all times.

There are two treating cylinders, or retorts as commonly called, 7 ft. in diameter and 132 ft. long, made of ¾-in. steel for a working pressure of 175 lb. per sq.in. Each of the retorts rests on nine concrete piers and is securely anchored to the center pier. On the remaining eight piers, the retort rests on cast-steel saddles, with nests of steel rollers between the saddles and an iron plate imbedded in the concrete, each nest having three rollers 2 in. in diameter, 10 in. long.

At each end of the retort is a door which swings on steel rollers and can be opened and closed easily by one man, notwithstanding a weight of 6400 lb. The door consists of a steel frame with flanged-steel dished head 1 in. thick. The retorts are equipped with heating coils and also with perforated pipes, used to obtain a more perfect distribution of steam when green timber is being artificially seasoned as well as for the circulating device of the Card process.

The main building is of steel-frame construction with corrugated iron sides and concrete roof. The floors of the building are of cement and there is a concrete basement so constructed that should any of the preservative be spilled it can be recovered. In the basement is a concrete sump equipped with an electric signal warning the engineer in charge when the sump is filled. The sump is emptied by means of an ejector, the liquid passing into a settling tank about 50 ft. from the building.



Plan and Elevations of the Baltimore & Ohio R.R. Timber-Treating Plant at Green Spring, W. Va.

*From information furnished by F. J. Angier, superintendent of timber preservation, B. & O. R.R., Green Spring, W. Va.

The settling tank is also of concrete 20 ft. wide, 50 ft. long and approximately 10 ft. deep. The tank has four compartments and after the drainings from the plant enter the first section the liquid is forced to travel through each of the others in a circuitous path to the last. By this time any creosote carried from the plant falls to the bottom, because of its greater specific gravity, and enters a well in the bottom of the last compartment of the settling tank. Here an electric bilge pump forces it to an underground tank.

The boiler room, 30x40 ft., is situated adjacent to the main building, and contains two horizontal return-tube boilers of 150 hp. each, built for 125 lb. working pressure. Space is provided in the room for a third boiler to be installed when the requirements justify an enlargement. A boiler-feed heater, injector, and feed-water pump complete the equipment in the boiler room.

The oil storage tank is 40 ft. in diameter by 30 ft. high, having a total capacity of 280,000 gal. There is also a storage tank 15 ft. in diameter by 20 ft. high, for concentrated solution of zinc-chloride, with 25,000 gal. capacity. The oil-storage tank has 500 sq.ft. of heating coils in four sections. An angle stem thermometer is placed in the side of this tank (the oil being kept at a constant temperature of about 120° F.).

Near the storage tank is an underground unloading tank, 6 ft. in diameter by 60 ft. long. The tank is inclosed in a concrete pit, which will prevent waste of the creosote in the event that leakage occurs. The tank will withstand an air pressure of 50 lb. per sq.in. and creosote is forced from this tank into the storage or working tanks by air also. The working tanks and pressure tanks are all located inside the building, so that they can economically be warmed and the temperature of the working solution retained at 190°.

The working tanks are 24 ft. in diameter by 20 ft. high, each having a capacity of about 68,000 gal. They rest on concrete foundations 6 ft. above the floor line, and are equipped with three sets of cast-iron radiators with a total heating surface of 441 sq.ft. Each tank is also equipped with air coils for agitating a mixed solution of creosote and zinc chloride. Air is admitted at 100 lb. pressure and distributed in such manner as to completely mix the solution in from two to five minutes. The tanks are also equipped with mercury gages which show the true reading in cubic feet and gallons, regardless of the temperature. Each tank has a regulator to govern the steam supply and to maintain the required temperature.

The pressure tanks are 8 ft. in diameter and 14 ft. high, made of 7/8-in. steel for a working pressure of 175 lb. They are in reality a combination of pressure, measuring and drain tanks, and are located in such a way that they are readily filled while the treating cylinders are being loaded preparatory to treating a charge of timber. Compressed air can be applied through the top of these pressure tanks to force the preservative out through a bottom pipe leading to the retorts. Pressure is maintained until the required absorption is obtained in the timber, after which the valve is closed and any remaining preservative can be returned to the working tank by means of the compressed air already in the pressure tank. There is also a sufficient amount of compressed air in this tank to force all of the solution in the treating cylinder back to the working tank. The tanks are equipped with mercury indicators which show the amount of solution going into the timber.

They are also used as drain tanks to catch and measure the solution taken from the timber during the vacuum and draining process. The bottoms of the pressure tanks are only slightly lower than the treating cylinders; and though all of the drainings from the charge would not flow into the pressure tank by gravity, this is easily and quickly accomplished by admitting atmospheric pressure to the treating cylinder while the pressure tank maintains a vacuum. This combination of pressure-measuring-drain tank is unique with the plant at Green Spring. It was worked out by the writer, assisted by Card and McArdle, who were the draftsmen on pipe plans. It eliminated entirely the dirty and expensive pressure pumps commonly in use in timber-treating plants.

Recording gages and recording thermometers are connected to the treating cylinders. This places the superintendent in complete touch with the treatment in all of its details, the charts indicating the temperature, pressure and vacuum recorded for every moment the plant is in operation.

The plant is heated throughout by steam, a vacuum system being used, all condensation being returned to the boiler-feed heater and thence to the boilers. A 50-kw. generator furnishes the light for the plant and the yard, there being three arc and about 50 incandescent lamps. The electric plant also furnishes current to operate two 10-hp. 8-in. centrifugal pumps and a 1-hp. bilge pump. The centrifugals are used to circulate a mixture of creosote and zinc-chloride in the retorts while using the Card process. The bilge pump is in the settling tank and is used to pump creosote, that may have settled out from the drainings, into the underground unloading tank.

There are 130 tie cars used to deliver the ties to and from the treating cylinders. All storage-yard tracks have three rails, the outside pair being of standard gage and the inside rail fixing a 30-in. gage for the tram cars. In loading for treatment the ties are classified as hard and soft woods and as No. 1 and No. 2. For this work the men are paid at a rate per tram instead of per tie as is the case of unloading and cribbing for seasoning. Thus it makes no difference whether there are 30 or 40 ties on a tram, the cubical contents are practically the same and the amount paid is the same.



The Pension System of the Pennsylvania R.R. has just completed its thirteenth year of operation. It will be remembered that establishment of this system was one of the early acts of A. J. Cassatt, on becoming president of the road in 1899. By it, each employee is obliged to retire, on a pension, at the age of 70, and an employee may be retired, at the age of 65, in case of physical disability. The stipend allowed amounts to 1% of the average salary, or wage, for the ten years previous to retirement, multiplied by the number of years in the service of the company. No man may enter the employ of the road after attaining the age of 45, so that anyone retiring at 70 receives at least 25% of his average annual salary for the previous ten years. This allowance is given without any obligation to the railroad and the only stipulation is that a pensioner may not re-enter the service, under any condition.

Compilation of records shows that in the 13 years, 7152 men have received $8,368,786 from the various companies. Of these men, 3345 have died, leaving 3807 on the present rolls. Of these 2843 are on the lines east of Pittsburgh and 964 on lines west. At the close of 1912, 296 of the pensioners on lines east of Pittsburgh were over 80 years and nine were over 90.

Grouting the Arches of an Old Stone Viaduct

The Paris-Bordeaux line of the Paris & Orleans Ry. crosses the valley of the Dordogne River, near Libourne, by a masonry viaduct having 100 arches of 33-ft. span. This was built in 1846-50, and during its early years longitudinal cracks appeared in the intrados of the arches, but these did not appear to be of importance until a few years ago, when they began to extend under the influence of heavier engines and rolling stock and faster trains. The most serious cracks were close to the center line of the structure. In 1900, about 100 of these cracks were noted, some of them 16 to 20 ft. long and 0.6 to 0.8 in. wide. Some repairs had been made by replacing defective stones, pointing the joints and packing the cracks with cement, but in 1909 a general system of repair was undertaken.

Three arches at a time were supported on centering and the top of the arch uncovered. The concrete covering over the masonry was not disintegrated but showed a number of longitudinal cracks which allowed water to leak through to the arch masonry. Cracks were found in the extrados of the arches, some of which penetrated (more or less obliquely) the entire thickness and connected with the cracks on the intrados. The cause seemed to be the soft character of the stone used, the edges being cracked and crushed under the influence of vibration, especially where joints were not properly filled. This action resulted in causing considerable voids in the masonry. It was necessary, therefore, to fill the voids and thoroughly bond the masonry into a solid mass, and the method adopted was to force in cement grout under pressure. As the concrete covering was mainly intact, the grouting was done from the lower side or intrados. In this way it was not necessary to interfere with the traffic, which averaged 85 trains daily.

At first a machine was used that had been employed in grouting the lining of the approach tunnels at the Orsay railway station, in Paris. This had a lower reservoir for the grout, and an upper chamber in which air was compressed by a hand-pump. This was not satisfactory. The pressure was not sufficient to force the grout into the voids, and the grout frequently set in the pipes, causing continual delay and trouble. On the advice of Mr. Suquet, Engineer of the Metropolitan Railway, of Paris, a pressure pump was used, so that the operating piston did not come in contact with the grout, but worked in pure water, transmitting pressure through a diaphragm to the grout in an adjacent chamber. The pump was driven by a gasoline engine of 1¼ hp., the whole outfit being mounted on a truck.

The working force consisted of five men; two masons and three to attend to the grouting. The masons first cleaned out the fissures, and closed them with plaster, inserting at selected points pieces of old ½-in. lead gas pipe as nozzles. The plaster was allowed to set for two days before the grouting gang did its work. The foreman supervised the work and attended to the engine. One man prepared the grout and kept it stirred. The other man handled the injection hose, which he fitted to the lead nozzles mentioned above. This man wore a mask and goggles to protect his face and eyes from the jets of grout which spouted out when the voids had been filled. In a little while, however, he became expert at determining from the pressure in the hose the probable period of injection, and shut off the flow by a valve so that there were no overflow jets. This method was very successful and gave no trouble. The only precaution necessary was to pump water through the hose occasionally in order to prevent clogging.

Each arch had at least 20 injection nozzles, and some had as many as 100. The minimum amount of cement per arch was 110 to 220 lb., for 32 arches; the maximum was in four arches which required 1540 lb. each. The average was 475 lb. per arch. The total cost was $880; this included the cement, plaster, lead and wages. Test holes drilled into the work showed that the voids had been thoroughly filled and the stones bonded together. The old cracks have not extended, and the slipping or displacement of the stones (due to their wear) has ceased.

This work was commenced in 1909 and finished in 1911. Our information respecting it is taken from an article in the February number of the *Revue Generale des Chemins de Fer*, by Mr. Adam, Engineer of Maintenance-of-way of the Paris & Orleans Ry.

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The Idaho Public-Utilities Law recently approved by the governor is patterned after other state legislation which has proved effective in the regulation of public-service corporations. There are to be three commissioners appointed by the governor for overlapping terms of six years each at salaries of $4000. The commission appoints its own secretary and is empowered to employ engineers, accountants, inspectors, etc. The attorney-general of the state is the counsellor of the commission in actions at law. The usual scope of definition is given to the term "public utilities" and it also includes specifically wharfingers, warehousemen, and distributing companies which serve the public only indirectly. Companies constructing irrigation works are specifically excepted. The law provides that all charges by a public utility, or several jointly, must be just and reasonable without preference or discrimination and that the service must be reasonable, adequate and efficient, promoting the safety, health, comfort and convenience of patrons, employees and the public generally. The commission has ample power for making investigations, inspecting property, holding hearings, examining books and records, compelling the attendance of witnesses, regulating service, fixing rates, and enforcing its orders.

The commissioners and their employees are enjoined from divulging information received from a public utility, except such as is open to public inspection or made public by order of the commission, and disobedience of this provision is made a felony.

Thirty days' notice to the commission is required before rates may be changed and the change may not be upward without their permission. It is provided that the act shall not prevent sliding scales nor the adjustment of rates in relation to dividends under the approval of the commission. Telephone and telegraph companies are instructed to handle proffered business without delay or discrimination whether the business is from companies with whose lines physical connections may have been ordered by the commission.

Street-railway, gas, electric-supply, telephone and water corporations may construct or extend their plants hereafter only by first securing a certificate of public convenience and necessity from the commission. Exception is made, however, in territory in any city or town heretofore lawfully occupied or contiguous territory not already served. Power-generating companies, moreover, may enlarge their plants without permission or develop new plants and market the output. None of the specified classes of utilities may exercise any right or privilege or obtain a franchise without first obtaining a certificate of necessity.

Provision is made for rehearings on any order of the commission and for appeal to district and state supreme courts. The penalties for disobedience of the orders of the commission are fixed at not exceeding $2000 for each offense, each day of continuing violation being considered a separate offense. Each individual offender, either as individual or an agent of a company, is liable to a fine not exceeding $1000 or to a jail sentence not exceeding one year for violation of commission orders.

EDITORIALS

Wanted: Machinery for Levee Building

The levees along the lower Mississippi River from Cairo to the Gulf contain nearly 250,000,000 cu.yd. of earth, a greater volume than the total excavation on the construction of the Panama Canal. Practically all this work on the Mississippi levees has been done by either hand power or horse power. The negro pushing a wheelbarrow and a team of mules pulling a drag scraper represent the motive power and tools by which almost all this enormous volume of earth has been moved.

At the present time the probability seems strong that a great addition will be made to the Mississippi levees during the next four or five years. The floods of 1912 and 1913, following in such close succession, have aroused the people of the valley to the realization that the present levee system, while it has for a long term of years, from 1897 to 1912, kept practically all the flood waters off the lands of the delta, is not secure enough and high enough to guard against the years of exceptional flood. It is probable, therefore, that during the next five years many millions of cubic yards of earth will be added to the Mississippi levee line; and there seems to be an opportunity here for the manufacturers who have developed new forms of excavating apparatus and earth-handling machinery and for the contractors familiar with the use of such machines to prove the value of these devices.

We are not by any means urging here the oft-repeated foolishness that the discarded plant on the Panama Canal work should be brought up and utilized for the work along the Mississippi. Every engineer familiar with the conditions knows that the rock-excavating plants used in digging the Culebra Cut would be wholly useless in the conditions prevailing in the Mississippi Valley.

There have been developed, however, a number of new types of earth-moving machinery during the past few years, such as the cable drag scraper, which might possibly prove adapted to the work of Mississippi levee construction. We feel confident that the engineers responsible for this work will gladly coöperate with makers and users of machines which promise to reduce the cost of levee construction and thereby increase the amount of material which can be placed in the levees with the funds available.

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A Regular Semi-Monthly Meeting of the American Society of Civil Engineers outside of New York

The American Society of Civil Engineers has just announced a somewhat radical innovation in the matter of holding its regular meetings. Hitherto the Society has always had an annual meeting in January in New York City and an annual convention in June at some place that might reasonably answer to the name "summer resort," or at least could boast of a climate that would allow pleasurable outdoor activities in June. In addition to these two general meetings, regular semi-monthly meetings have been held in the Society House in New York City, at which meetings the papers which appear in the regular monthly *Proceedings* are read and discussed.

It is now announced that on Oct. 15, 1913, the regular semi-monthly meeting scheduled for that date will be held at New Orleans, La., and not in New York. Full details of the method of carrying on this meeting are not as yet available, but a society announcement gives the following explanation of the reason for holding the meeting outside New York City.

> It has been realized for some time that, with only one annual convention during each year, it is almost impossible to hold meetings which will be accessible to the rapidly growing membership, and there are some localities in which it is perhaps not desirable to hold a summer convention. It is hoped that by this plan one or more additional society meetings can be held each year and that these will serve to bring the somewhat widely scattered membership into closer touch with the Society and its work.

This experiment is, of course, a result of the feeling common among the membership of all the large national societies that the home members, or those living in the immediate vicinity of the home office, receive more than their share of the benefits of the association. In other large national societies a solution of the difficulty has been attempted by the establishment of local branches, but in the American Society of Civil Engineers the local branch idea has not been favored although several of such branches are in operation. The New Orleans meeting and those subsequent thereto, if any are held, will be watched with interest by the other societies that have the same problem to solve.

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Should an Engineer Make Himself Financially Responsible for His Estimates?

At the recent Baltimore meeting of the American Society of Mechanical Engineers, the committee appointed to present a code of ethics for adoption by the Society offered an additional clause to be inserted in the proposed code which has been before the Society for some months, and was published in ENGINEERING NEWS of Jan. 2, 1913. The proposed new clause reads as follows:

> The engineer, in conformity to the practice in other professions, should not offer or execute a bond to guarantee the performance of his work. The client's reliance for the satisfactory execution of his work should be the professional reputation and experience of the engineer.

In recommending the adoption of this clause as a part of the proposed code of ethics, the committee was aware that cases are not uncommon where engineers of good reputation do offer to guarantee their work. It may be well to explain, therefore, the reason which seemed to the committee conclusive why the engineer should not make such guarantees.

It may be said at once that the question as to the

propriety or impropriety of such practice on the part of engineers turns at once on the basic question whether engineering is a profession or whether it is a commercial business or trade. It may be said frankly that where engineering is carried on as a commercial business, in other words where an engineer is engaged in business as a contractor or a manufacturer or a dealer he must be expected to conform to ordinary trade customs and it is entirely proper that he should give guarantees and bonds for the performance of what he undertakes to do. Where, on the other hand, the engineer is engaged in working in a professional capacity, where as an advisor or designer he is in charge of engineering work, it is contrary to the interests of his profession, himself and his clients that he should be called upon to give financial guarantees for his work.

To illustrate what is happening, we may best depict the situation by reporting an actual case that recently came under our notice. The authorities of an important city desiring to build a large bridge, secured designs from a number of leading bridge designers under an offer of prizes for such designs with the understanding that the engineer receiving the first prize should be placed in charge of the construction. Each competitor submitted with his design an estimate of the cost of construction. One of the competitors later offered to give a bond that the cost of the completed structure should not exceed the estimate he had given, and on the strength of this guarantee he was awarded the first prize.

It can readily be understood that such guarantees are very attractive to the average city council. These men are inclined very naturally to say that the engineer who is willing to back his estimate with a financial guarantee shows thereby his confidence in his work and his reliability. Strong prejudice is created at once in favor of such a competitor as compared with another man who follows the professional standard and declares that his reputation and standing must be the reliance of his clients.

Let us, however, follow out the situation a little further, and see where it lands us. The average charge for engineering work on the part of the designing engineer for a bridge costing, say, half a million dollars, would seldom exceed 6% of the cost of the structure. The engineering work performed by the contractor in connection with shop drawings, designs, manufacture, erection, etc., is, of course, not included in this. Out of this 6% of the structure's cost, the engineer in responsible charge of such a work will probably expend in actual money at least 4% upon the work of making surveys, soundings, borings, preparation of design, drawings and estimate, inspection of the material and of the work of erection until the final completion. This leaves the engineer with a maximum profit upon the work for which he bears the responsibility, of 2% of its cost at most; and the average margin of profit will be much less than this, we believe. But the risk of loss involved in a financial guarantee that the estimated cost of the structure shall not be exceeded would represent almost invariably a risk of much more than 2%.

The situation revolves itself then into this: Since in any engineering work there is always a fair chance that the final cost will overrun the estimate by as much as 10%, no matter how carefully and conscientiously the original estimates are made, the engineer who gives such a financial guarantee and who is financially responsible runs the risk that he may have to lose not only the profit on this particular piece of work but all he could make as profit on five to ten other pieces of work of similar size. Every engineer knows perfectly well that the earnings of engineers, even the men who are leaders in the profession, are insufficient to enable them to assume any such financial risk. To do so would be simply a game of heads I win, tails you lose. If the engineer were placed in the position of the contractor where he could keep for himself as profit the whole amount by which the cost of the work fell *below* his original estimate there might then be some reason in making him pay for the extent to which the cost exceeded his estimate.

Again, however, we need to get back and consider what the engineer's estimate is, or rather what it ought to be. If it were common for engineers to guarantee their estimates by a bond, every engineer would make his estimates as large as possible, thus making himself secure against loss. It would be manifestly unwise, however, to place any such premium upon exaggeration by engineers. When a man asks his professional engineering adviser what his estimate is of the cost of a piece of work it is his right to be informed, as nearly as that engineer's ability and experience will enable him to give it, what the cost is going to be as nearly as possible. To have an estimate exaggerated in order that the engineer may gain a reputation for saving money in executing the work is contrary to the client's interest.

Since the engineer has not the financial ability to guarantee the accuracy of his estimate and make the guarantee good, there will result, should such a system of guarantee come into general use, the transfer of engineering work from the independent professional engineer, working with his own brains and with assistants on whose special knowledge and ability he can rely, to the large engineering corporation, relying on its profits from taking engineering contracts and doing the engineering work as an incidental. There are surely already influences enough and tendencies enough toward the elimination of the professional engineer and the performance of free engineering work by contractors without giving the movement further encouragement.

It should be said, however, that it is not in general the responsible, reliable and experienced engineer, by any means, who offers to guarantee his estimate. When a city council is selecting an engineer to prepare plans for a system of water-supply or sewerage or what not, it is generally the competitor of little or no professional standing and reputation and with little or no financial responsibility who is foremost with the offer to guarantee that his work can be performed inside his estimate. It is manifest that financial guarantees from a man who has nothing with which to make his guarantee good mean nothing in reality; yet this sort of talk from a man who can bluff well will often have a strong influence with a city council.

It should not be thought, however, that the subject we are discussing relates merely to the financial guarantee of the accuracy of an engineer's estimate. The question is as broad as the whole range of engineering work and it may be well to say that the clause proposed by the Code of Ethics Committee of the Mechanical Engineers is in conformity to the uniform rulings of the courts and the well known position of the engineer in law.

If an engineer of experience and standing, conscientiously and to the best of his ability carries out a piece of work, let us say for example builds a reservoir to hold water, and it afterwards fails from some cause or other, the law does not hold the engineer financially responsible for the failure of his work, nor can he be held criminally responsible, unless it can be shown that he has been negligent in some respect involving real culpability.

The engineer who undertakes work which he is competent to do and who executes it with care and thoroughness it not held by the law to be the guarantor of that work any more than the law holds the doctor the guarantor of the life of his patient, or the lawyer the guarantor of the soundness of his opinion. Of course either the doctor or the lawyer is responsible to his clients in damages, if through gross neglect and incompetence he fails to do those things which ordinary professional practice would demand and the client suffers loss. A similar rule applies to the engineer.

It need hardly be said in this place that ENGINEERING NEWS, in making the above argument, is not by any means urging that engineers should be released from any responsibility properly belonging to them. Our proposition is that their responsibility should be for their work as professional men; and that no engineer should attempt to assume a financial responsibility that the law does not expect him to take and which his financial condition forbids him from doing if he is to continue solvent.

Can Engineers Be Trusted to Arbitrate Fairly and Intelligently between the Public Interests and the Property Interests?

Senator Robert M. LaFollette, of Wisconsin, is said to have taken the chief responsibility in the drafting of the Railroad Valuation law. In the journal which he publishes, *LaFollette's Weekly*, for May 10, there appeared a leading article headed in large type "An Economist Is Needed." The article, which is signed by Senator LaFollette himself, says that the railroad valuation work should be placed in charge of an economist and not an engineer. We quote as follows:

> The Interstate Commerce Commission faces today the gravest responsibility of its life. By its work in valuing the property of the railroads the Commission will be judged by the American people now and hereafter. It has already announced the appointment of a staff of civil engineers as the first step in forming its organization. Engineers are indispensable, as are accountants and other experts, but it is not believed that engineers will be placed in charge of the work. That is a mistake which has been made too often to excuse repeating.
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> The value of the physical properties is very important and it is essential that the engineers should submit their findings on these factors; but even with these elements, a critical study of construction, repair, maintenance and depreciation accounts may be more illuminating than the engineers' appraisals and in every case will constitute an indispensable check on the work of the engineers. Hence it will be necessary to add to the staff a corps of experts familiar with railroad accounting.
>
> Besides, complex financial operations will present themselves, requiring the most thorough and searching examination. All of these elements, classes of values and all financial operations must be correlated, weighed and interpreted with relation to each other and as a whole. For these reasons the entire work must be under the control of an economist and not of the engineers whose work is to be checked.
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> The valuations of railway property by many, if not all, of the states have been made from the engineering rather than from the economic viewpoint. This has in every case given the railroads the advantage. The engineers who have made valuations of railway property have been primarily trained in the employment of private interests. Their practical experience in that service and in valuing public utilities for purchase and consolidation has always been from the viewpoint of the PROFIT WHICH PRIVATE INTERESTS COULD SECURE FROM THE PUBLIC. The economist by his very training deals with the whole problem from the public's standpoint, that is the standpoint of the JUST RELATION BETWEEN PRIVATE INTEREST AND PUBLIC INTEREST. For every reason, therefore, it is vital to the scientific integrity of this great economic investigation that it should be under the general direction and control of the ablest economist to be found in the country.

Senator LaFollette is unquestionably correct in his statement that questions of economics are deeply involved in the task of railroad valuation. He is right in stating that these economic questions are even more fundamental than the valuation of the physical properties; but he is, in our opinion, fundamentally and absolutely wrong in his statement that engineers are less trustworthy to maintain a fair and equitable relation between the public and the corporations than are the economists.

It is true that there are in the engineering profession, particularly in the branches having to do with the operation of public utilities, many prominent men who by long service with the corporations have acquired a strong bias on that side. It would be easy to name a number of prominent mechanical and electrical engineers particularly who are definitely committed to this side of the question. The attitude of these men, however, does not by any means commit the profession as a whole to any partisan view of the question.

Speaking from a wide acquaintance with engineers in different branches of the profession, we believe there is no class or profession, not excepting the teachers of economics in the colleges, who have a broader and fairer understanding of the economic questions in connection with the valuation of public utilities than have engineers.

As a matter of fact, the work of valuation has been going on, not merely for railways, but for various other public utilities for nearly a quarter of a century; and almost the whole of this work has been done by engineers and has received general public approval.

One in search of sound discussions of the economic and legal principles underlying such valuation will find more such discussion in the proceedings of engineering societies and in the reports rendered by engineers than anywhere else.

On behalf of the engineering profession, therefore, we think it important that a strenuous protest should be made against Senator LaFollette's charge that the engineers who have conducted valuation work in the past have made their valuations "from the viewpoint of the profit which private interests could secure from the public."

To make such a charge, without a scintilla of evidence in its support, falls little short of a libel on the engineering profession. Senator LaFollette ought to know that the engineer, by the very conditions of his employment, is trained from his earliest experience to occupy an impartial position. Every engineering inspector must endeavor to fairly adjudicate between the contractor and the party for whom the work is being performed. The same thing applies all the way up the line. There are hundreds of millions of dollars worth of work in progress in the United States today, the performance of which depends upon the impartial adjudication of the engi-

neer in charge as between the contractor and the employer.

There are unquestionably grave economic questions to be settled in connection with the railroad valuation work, and expert opinions on these questions by leaders of economic thought are highly desirable. These questions, however, are not by any means new. They have been studied for years by engineers who have been engaged in valuation work and studied with just as full recognition of the interests of the public as is given by Senator LaFollette himself.

The Senator's charge that the work which the engineering profession has already done in valuation of public utilities has been done as the tools of the corporations—for that is the real purport of what he says—has no foundation in fact. On the contrary, we believe, from a wide personal acquaintance with engineers, that, while in their professional work their aim is to effect that evenhanded and impartial justice which Senator LaFollette professes to desire, in the great majority of cases their personal sympathies are with the public interests rather than the property interests.

It happens that within the past few days there has come to us a letter written by an American engineer (a member of the American Society of Civil Engineers) holding a responsible position under a South American Government. The letter was written to a personal friend and not for publication, and we omit, therefore, from the extracts given below all mention of names and places.

The picture which the letter presents of an American engineer, standing up almost single-handed and alone, in defense of the people's rights against conscienceless exploiters is one which we particularly commend to Senator La Follette. Perhaps there are few engineers with such nerve and backbone to stand out in the face of heavy odds; but there are many, we believe, who will cordially coincide with the economic opinions which the writer of the letter expresses.

I have been charged with a responsibility during the last year, which, however much I may exaggerate it in practical effect, is quite important enough to demand from me the most disinterested and unselfish thinking that I am constituted to produce.

A large number of foreign and native corporations, syndicates and individuals, among them several from the United States, have asked for important concessions of land and water, in accordance with the time-worn policy of Latin-American countries to develop their resources by granting them to private persons and associations.

It has devolved upon me to examine these petitions, and the reasoning I have been able to do upon the matter has led me to render an adverse report in all cases. The premises from which I have started in all cases, and the conclusions which I have reached, are at complete variance with the common beliefs and practices here, and I am unable to discover more than one or two persons in this country, of any influence or social or political prestige, who would agree with me with that degree of sincerity that promises constructive action in the face of intrenched interests.

Out of a total population of 4,000,000 people in this country the governing classes constitute probably less than 10%, and the active agents in legislation, administration and, politics a much smaller percentage. I do not believe that there is a member of the Senate who is not a wealthy land owner; and the constitution of the House of Deputies is such that it is dominated by the same class. Large numbers of the Deputies are simply pawns in the hands of a few shrewd politicians.

The result has been that for years one law after another has been passed in which, under the pretext of developing the country and promoting agriculture, special privileges have been accorded the owners of the large rural estates, or have been granted to the would-be promoter who seems always sycophanting about a weak government. As a result, out of about 1,500,000 acres of arable land on the coast, capable of and requiring irrigation, one-half is under erratic cultivation and irrigation, and of that one-half, as much as 50% is owned and operated in large tracts by a few people. The other half is barren and unproductive, but is owned under "concession," so that there are actually no Government lands.

A law, the first draft of which was made by me, but which was so mutilated by the politicians before it got through Congress as to be absolutely unrecognizable, kept enough of its original form to provide that the Government can expropriate land privately owned, unimproved and susceptible of inclusion within the limits of an irrigation project. But a completing phrase, restricting the price to be paid for such lands and providing for its valuation by an impartial commission, was stricken out, so that we may have succeeded only in giving the politicians another weapon.

Another thing that the brave legislators added to the bill was a clause which gave the Government the power to guarantee the interest upon all or any money invested by private individuals in an irrigation enterprise. The introduction of this clause seems to be absolutely pernicious. In an ideally constituted society of absolutely truthful and honest men, who were, furthermore, experts in business management, such a principle might be safe, but it would, in such a society, become unnecessary from all points of view. If a business is a good and safe one, proven to be feasible by competent investigation, it needs no guarantee. If it is not so and has not been properly investigated, it should in no case be guaranteed by the Government.

I believe that if a Government or any other association of people guarantees interest on funds, they should be their own funds, raised by assessment upon their own resources and managed by them or their own duly appointed representatives; and I believe that as a principle of practical business as well as of abstract administrative science this is true, and that the Government guarantee of the interest upon private capital invested for private gain, upon the supposition that the indirect benefits to the Government in the shape of additional exports and greater population justifies the guarantee, rests upon a fallacy plainly proved by hundreds of analogies in many countries.

The law does not provide that the lands shall be disposed of at a fair price to colonists, nor does it prescribe any form of organization or management to be adopted by the companies enjoying the guarantee. It does provide that the guarantee shall not be granted unless the investigation and design of the projects involved shall have been executed or revised by the Government's Technical Service, and approved by the Government. But if the lands are to form, after the construction of the works for irrigation, a private estate, this clause simply makes the Government's Irrigation Service an employee of private interests.

There are still two means of escape from the ill effect of the law, supposing my reasoning as to fundamentals is correct. An older law, not repealed by the new one referred to, implies in its general purport, that expropriation can in general not take place, unless public utility is proven. The Government can hold, therefore, that unless lands are destined for the use of a community of independent and free landholders, through, for instance the sale of the improved lands at an equitable price and in relatively small holdings to insure freedom from monopoly, the solicitation for a concession under the new law is not justified.

Also, the new law authorizes the Government to issue approximately ten million U. S. Dollars worth of bonds and apply the proceeds to the construction of irrigation works. In pursuance of the policy logically implied by this part of the law, the Government could retire from concession or grant, all lands susceptible of irrigation pending a report of its engineers.

In my treatment of applications for the benefits of the law I am proceeding upon the first of these supposedly possible courses at present, and have succeeded in getting 75,000 acres of land retired from concession pending the decision of the Government relative to its development in accordance with designs and estimates already prepared.

The principle I believe to be fundamental in the whole matter is this. The prosperity of all classes, as opposed to the intense prosperity of a few and the ill estate of the many, depends upon the possession, or the ability and opportunity to possess, by the masses of the peon class, agricultural land in tracts small enough to be workable under intensive cultivation, and large enough to provide a living income.

The correctness of this principle is proven to anyone who will observe in this country, the contrast in physique, intelligence, energy and industry and domestic habits, between the peon who has lived all his life on a big sugar estate and worked for a wage and a glass of rum in the mornings, and the man of the same social origin who has acquired a right in some of the ancient rural communities left intact from

the time of the Incas or before, where he possesses a parcel of land and its produce for his own use.

You will see from the above that the irrigation problem in this country is as much a social problem as a strictly engineering one, and this is probably a corollary to the more general statement that the carrying out of engineering works constantly involves the solution of social problems. I think at any rate I have said enough to show that the conditions here connected with the work I am trying to do are somewhat complex, and that they require unbiased treatment.

So far, I have spoken only of the legislative manipulations of the landed classes. There is another element in the problems that are coming up which I think will interest you as an American and as an engineer. That is, the attitude of the so called "Diplomatice Service" in support of any proposition that purports to be American, and is introduced with a letter from Senator Doe, or some other U. S. Congressman. Recently, Mr. R., a member of a Chicago firm, proposed to this Government a scheme that is in brief as follows:

The Government was to issue two million pounds in gold bonds with guaranteed interest and principal, and sell these to Mr. R. at 87½% of their par value, and was to pay to Mr. R. 15% of the cost of constructing the irrigation works paid for out of the proceeds of the said bonds. It was to pay also to Mr. R. $35 U. S. Currency, for each acre colonized by him, and to allow him to colonize at the rate of one man to each 150 acres, and to give Mr. R. the exclusive power and authority to construct and operate all railroads, telephone and telegraph lines, moles, wharves and docks, to manufacture all structural materials, cement and brick, to build all houses, to establish all ice and cold-storage plants, etc., within the territory irrigated, for a period of fifty years.

The clause relating to colonization provided that the colonist himself need not appear in person, but might authorize a representative to select his land and that this written authority and the payment of one pound per hectare, should be proof of colonization and oblige the Government to pay the 18 pounds per hectare referred to in the contract. Also in the clause relating to construction, Mr. R. was to be given plans and engineering data, and receive a fair profit, 15%, but without assuming the responsibilities of a contractor in any sense.

I have had to advise unfavorably upon this proposition, but the U. S. Minister here has done all he could to get the Government here to accept it, and has gone so far as to say to the Government that if the proposition were accepted it would be a guarantee that there would be no more trouble with this country's hereditary foe.

It seems to be the attitude of these gentlemen that I ought to support any rascally scheme that they get up to "do" these people simply because they and I are Americans. I cannot see the patriotic side of this proposition.

I am strongly opposed to these legislators who are bartering away the resources and the moral vitality of their country, but I see no essential difference in their acts and the aims of these gentlemen who want to get everything for nothing and monopolize all the public utilities that can ever exist within the territory to be irrigated or improved.

It is not a question of race or color, or nationality, but a question of right and wrong. It may be true that this country is not competent to govern itself, but are foreign monopolies competent or likely to govern it for the benefit of the greatest number? If so, the best proof they can offer is a fair and equitable proposition in which they show a decent restraint from playing the hog and the despot.

I do not believe that the Government, however incompetent, could do much worse than the foreign corporations here have done, especially the English and American corporations. Foreign-operated railroads charge an average freight rate of 10c. per ton-mile, U. S. Currency. Foreign-operated mines pay no royalty, provide no protection to native workers, send the copper and the dividends out of the country, and flood the country with a swaggering retinue that are doing more in South America to alienate good will from us than any other element.

One hears from the average man who has traveled in these countries that the Government is corrupt. It is not so corrupt as it is inefficient. The corruption arises largely from the abuses that are easy to the clever manipulator in an inefficient organization.

What is to be the future of this country is a puzzle. So far politics has engaged all the President's time, and that of his cabinet. If foreign capital will not come into the country on a basis that permits a rural population to live in better condition than that of the laborers upon a large plantation whose products are sent to Europe and North America, then I do not believe that foreign capital should get in.

If the Government cannot now float its bonds so as to build and operate its own irrigation works, let it wait until it can.

The country is not suffering, there is no immigration of poor Europeans, or any other kind of immigration, there is no crowded population. Why should public works be built today at any cost to the country, depriving the nation of its resources, when by waiting a few years, land values will rise and interest rates fall to the point where capital will have to strike a different attitude.

In the meantime, we will have the advantage of added education, increased legislative and administrative intelligence and efficiency, and a larger understanding of what the national resources are capable of producing if properly managed. The importance of this point of view to the nation will be appreciated when it is understood that there are only a million and a half acres of arable land on the coast, the part of the country that must for many years sustain the center of population and culture of the nation; and if this goes today into the hands of monopolies, there will be no democratic future for the country.

LETTERS TO THE EDITOR

The Problem of Protecting the Younger Members of the Engineering Profession

Sir—I have been reading with interest the letters in ENGINEERING NEWS in regard to licensing engineers as a protection to the profession. In that connection I am taking the liberty of calling your attention to a point which I think is of vital interest to myself and many other young and relatively inexperienced engineers.

The following advertisement is taken from the "Situations Wanted" column of the Washington *Post*:

CIVIL engineer—Employment by all-round field man: $1.50 day.

You will note that the gentleman desiring employment dignifies himself with the title of "Civil Engineer," yet he values his services at only $1.50 per day. I frequently note similar advertisements in the newspapers.

A few years ago I was honored by having the degree of Civil Engineer, conferred upon me by a recognized engineering school, and since then I have had a varied line of experience in field and office in the East, North and West. I am at present employed by the government in the capacity of an engineer.

But I cannot as yet really call myself an engineer in the light that the recognized men in the profession are called engineers. I feel that at least 12 to 15 years of experience are required before one may attain that distinction. Yet this man boldly subscribes himself "Civil Engineer." He may be all he claims, but in that event there is something wrong somewhere if his services as a Civil Engineer are worth only $1.50 per day.

I graduated from college without money, friends or "pull" to help me secure any kind of a job and everything I got was by my own nerve. And during my four or five years of experience, the hardest thing I have en-

countered in getting work is the competition with the fellow who has served as utility man on a party for two or three seasons, who calls himself an engineer, and will work for half of what I feel that I am worth as I gain experience. Until the last year I have been forced to start work in the spring at less than half the pay I was getting when I was laid off when work stopped the fall before. And pardon my apparent conceit when I say that I carried some recommendations from previous employers of which I am proud.

I know several others of practically my age and experience who have had no "pull" and who have encountered the same difficulty, so that I feel our trouble is not all due to lack of ability and poor address.

I do not feel competent myself to suggest any possible remedies for the conditions noted above; so in the interest of my fellow "youngsters" in the profession, I am taking the liberty of asking you to suggest the subject to the prominent men in the profession that they may consider us younger men when considering protection for the engineering profession in general.

ROBT. TRULLINGER.

Washington, D. C., May 20, 1913.

The Grouted Foundation at the Lahontan Dam

Sir—In your issue of May 8, 1913, p. 969, I note your editorial comment concerning the grouting of the Lahontan Dam of the Truckee-Carson Project of the U. S. Reclamation Service, an article covering this work written by D. W. Cole having appeared in your issue of Apr. 3, 1913, p. 647. In your comments you state that the estimated saving of the grouting process over that of an excavated and concrete-filled trench is but $3300.

The above amount, by reference to the article, will be seen to represent only the saving between the cost of the grouted cutoff and the estimated cost of excavating and filling with concrete a trench to the same depth and does not take into account the loss and expense incident to the delay in program which the excavating and filling of the trench might involve.

The writer, because of previous experience in pressure grouting, was connected with the work under a temporary assignment and it was his understanding at the time, as also is inferred by Mr. Cole, that it was the question of time more than anything else which led the U. S. Reclamation Service engineers to the adopting of the grouting program. Had the excavation of the trench delayed the completing of the dam by as much as a year, as I understand was feared, the consequent maintenance of the work, depreciation of plant, and delay in supplying water to the project would have made an indirect difference in favor of the grouting aggregating many thousands of dollars. In this saving of time lies a great advantage in favor of pressure grouting, which, as at Lahontan, may be done through casings while the river flows uninterrupted on its course.

You also speak of a double line of holes being put down to a depth of 30 to 70 ft. If Mr. Cole's article be looked up it will be found that while two rows of casings were put down those of but one row, with the exception of some four or five holes put down for proving purposes, were drilled through, so that in effect the work was accomplished with but a single line of holes on 3-ft. spacing.

I think no one will take issue with you that as between a concrete-filled trench and a grouted cutoff the former is to be preferred when costing but $3300 or 33% more than the latter. Certainly such, were there no other consideration, would be the judgment of the very able engineers directing the work of the Reclamation Service. The repair of the cutoff of a high earth dam, such as the Lahontan, is a very serious matter. With a masonry dam the water can be drawn off, if need be, and a supplementary cutoff put down, and grouting or other treatment resorted to. This is not so much the earth dam, as some—even in recent years—have learned, if not to their own sorrow at least to the sorrow of those putting up the money. The Lahontan Dam has a 30-ft. concrete cutoff and the grouting was an added insurance warranted by the earth type of structure and by the fact of the location in the somewhat peculiar "sink" region.

H. A. RANDS.

Oregon City, Ore., May 19, 1913.

A Joint Railway Organization for the Inspection of Structural Steel and Steel Rails

Sir—In your issue of May 15, you publish a communication from Albert W. Buel, calling attention to the minority report of the Committee on Iron and Steel Structures of the American Railway Engineering Association. The idea there suggested of forming an inspection organization supported by a number of railway companies, united on a mutual interest basis, is not new. Morgan T. Jones has been spreading this plan among railway engineers and executive officers for several years. In June, 1907, a letter by him was read before the American Society for Testing Materials with a view to opening up this subject and laying the matter before engineers generally. It appeared then that such a suggestion would have been regarded as too radical.

The campaign was continued by Mr. Jones, in personal interviews; and in 1912 a comprehensive scheme of organization was worked out and the matter was laid before the American Railway Association, the executive committee of which was "of the opinion that the subject is not one which can be considered by the American Railway Association."

In March, 1913, a pamphlet relating to railway material inspection was published by Mr. Jones, setting forth the proposal that the railways get together and operate an inspection department under one head. A means of financing the organization was suggested and the scope of its more important activities outlined. It was very gratifying to him to find the recommendation, even of a minority of the Committee on Iron and Steel Structures, to be so thoroughly in harmony with his own efforts in behalf of higher efficiency in the field of inspection (and consequently manufacture) of railway materials.

The undersigned, while heartily indorsing this movement, wishes to take issue with Mr. Buel on several points. It is not fair to hope that a "trust of inspection bureaus" could show better results. In all lines of industry it is the competition of growing organizations,

headed by capable and conscientious men, which keeps the overgrown combinations from becoming utterly worthless from the standpoint of efficiency in any other line than that of the concentration of wealth for the proprietors. As long as inspection is conducted as a money making enterprise, competition will be of advantage to the purchasers employing this service. A trust would eliminate the stimulus to efficient inspection, and would not concentrate the power necessary to bring about some needed radical reforms in manufacture. This power can be concentrated only by uniting the buying power of many purchasers and backing a common representative, which representative they control. In other words, these purchasers (the railways) should unite to maintain an inspection bureau on a coöperative basis.

It is implied in the minority report that men with training as draftsmen and computers make better inspectors than men having training in the more responsible positions in the shop. The experience of the writer leads to quite the opposite opinion. The technical man is constantly raising questions in regard to design and character of details which have been settled by competent men before they reach him. Not until he has had several months' experience, under good coaching, does he know what he is in the shop for. The practical man, working under an experienced engineer, makes a far better inspector. Company inspection is usually less efficient than bureau inspection because the companies usually draw on their drafting force for inspectors. By uniting to maintain a company bureau with a properly constituted force of inspectors who are specialists, the advantages claimed for each system could be combined and better inspection at a lower cost would result.

It may be true in the case of some inspection bureaus that the time of the head men is fully taken up by business management and soliciting. This feature would be overcome by the organization proposed. The clientele of the bureau would be established and limited by the "stockholders list" and the entire energies of the officers could then be devoted to securing efficient inspection. It is said that, with two or three notable exceptions, one looks almost in vain for the name of a bridge engineer in the bureau organization. The writer is pleased to learn that the organization which he serves as manager is in a small class of "notable exceptions."

Mill inspection can be greatly strengthened through an organization having the united backing of a large percentage of the railways. Many of the errors in method which have been introduced gradually into the process of manufacturing rails, in order to increase tonnage output, could have been snubbed in their inception had such a bureau existed ten years ago. The problem now is to compel a restoration of correct methods, and this can be done only by united effort which will make reform a business necessity.

This brings us face to face with another issue of this movement, the production of better rails. The minority report of the committee above referred to has lightly dismissed this feature as something to be considered later on, and in taking this stand this committee has failed to see and improve its opportunity. Purchasers who are now served by inspection bureaus of the better class, are securing bridge material which is quite satisfactory both as to quality of steel and workmanship, and 18 years of specializing in this field of construction have brought to the writer's attention ample evidence in support of the above statement. Railway accidents due to the failure of steel structures are few.

This cannot be said of steel rails. During six months, beginning with October, 1911, and ending with March, 1912, there were 277 accidents due to broken rails, in which 22 people were killed and 768 injured. Volumes of statistics can be cited pointing to a very urgent need for better rails. Any proposal for the saving of life and limb and public and private wealth is not a matter to be lightly referred to as a future possibility. It demands immediate and serious consideration.

The railway companies by subscribing to the organization of a bureau of inspection and giving it their united support, will be in a position to bring about many such needed reforms in manufacture of railway materials. The result would be cheaper and at the same time better inspection. This would unquestionably result in better material and more harmonious relations between purchaser and manufacturer, which is sadly needed.

P. E. Stevens,
Mgr., Morgan T. Jones & Co.

Monadnock Block, Chicago, May 21, 1913.

The New York Water Filtration Controversy

Sir—Your last number devotes much space to what you call "The remarkable hold-up of the New York water filtration project," in which you state that it "has no apparent engineering justification" and cite me as one of the opposition. Permit me, therefore, to state the reasons for my views and to call your attention to some points not yet clearly brought out.

Beyond doubt, as you indicate, the people of New York are justly entitled to water that shall be "disease-germ-free, clear, colorless, tasteless and odorless." The city government is certainly bound to do its best to deliver water free from typhoid infection.

The typhoid rate of New York is very low and is getting lower. A reasonable allowance for cases caused by bad milk, uncooked vegetables, travelers and "Typhoid Marys," leaves only a very small percentage as possibly caused by the water-supply. In Washington, excellent filters caused no apparent change in typhoid.

On the other hand, the city appears to have been quite negligent in protecting the supply against contamination. Railroad trestles directly over the reservoir with no catch-pans under them, bridges without similar pans, house sewers and stable drainage going directly into the tributary streams (for which small cesspools could be easily substituted) and a very small police to enforce such sanitary regulations as exist, are among the things neglected. This neglect is far more than enough to account for the little typhoid that could possibly be attributed to Croton water.

Filtration is the standard way of making a safe water. It is not the only way, and the proposed mechanical filtration may not be the best way. For example, the United States Military Academy at West Point is supplied with an exceedingly high-grade water from surface streams, with a settling reservoir but no filtration. Filtration takes a very bad water and makes it so good that the difference is startling, but it is by no means perfec-

tion. It does not remove all the bacteria, possibly not all the dangerous ones, and mechanical filters are subject to errors in judgment. If neglected, they give dangerous water.

As opposed to the possible benefits of the proposed mechanical filtration, is the undoubted fact that the use of coagulants converts the temporary hardness, which is not a serious matter in the water, into permanent hardness, which is. Such hardness makes boiler scale, and boiler scale makes a tremendous increase in the quantity of coal required to make steam, and when one considers the number of boiler plants in the city, there being a pretty lusty boiler to every big building, the matter seems no trivial one. It is proposed to remedy this by putting the water through a softening process. This is expensive and has seldom, if ever, been applied to a supply as big as the Croton.

Practically all the reports on the improvement of Croton water are based upon the water *as it is* and not *as it will be* or easily *can be made* by the time the filters could be built. Apparently, the enforcement of the minor matters outlined above would leave Croton water objectionable only in the matter of color, taste and odor, all due to an excess of vegetable matter in the water. This seems to be almost entirely due to shoal places within the reservoirs. The marine vegetation on these shoals is killed when the water falls and bares the shoals to the sun. The land vegetation, which grows when the shoals are bare, is killed when they are again flooded. A comparatively modest amount of dredging and the building of a few dry, stone retaining walls, should go far toward remedying this at a comparatively small expense. The use of a trifling amount of sulphate of copper in the reservoir would destroy all the algae, to which a large part of the objectionable features are due.

This same excess of vegetable matter appears to interfere with the use of hypochlorite, which at other places, in very minute quantities, has proved more effective against typhoid than any known filter appears to be. Another difficulty in this behalf is stated to be the great variation in the quality of the water, a rainfall of two inches making a very bad effluent. It seems to be overlooked that this condition can be easily remedied when the new water is received from the Catskills, which will be long before the filtration plant could be made ready. Reservoirs filled from the Catskill supply can readily be drawn upon for a short time after excessive rains to give the Croton a chance for the bad water to be wasted or to be properly settled. Sedimentation is a most excellent way to get a pure, clear and wholesome water.

After the above precautions have been taken, a little aëration at a negligible expense would probably remove entirely the objectionable tastes and odors. In addition, cleaning out the city pipes and city reservoirs, necessary in any case, would doubtless add materially to the improvement. Practically all these things are recommended by those who advocate filtration, *after* the filters are built. As there are no immediate dangers in Croton water, why not try them first?

Engineers advocating filtration say that no water from the Catskills can be spared to help out the Croton; that the Catskill water is entirely for Brooklyn, Queens and Richmond boroughs, to save pumping costs; and that not even an occasional reservoirful can be spared to help out the Croton supply for Manhattan and the Bronx after excessive rains, and yet at least one of these engineers, a few years ago, recommended the award of the Ashokan Reservoir contract in the Catskill supply to MacArthur Bros. & Co. at a price over $2,500,000 above the lowest bid, that of John Pierce, on the ground that the lowest bidder would probably be slow with the contract and that haste was necessary on account of dangers of a water famine in Manhattan and the Bronx because the Croton supply was getting short. This apparently excessive zeal for building water-works together with the reasons given above, certainly justify the Board of Estimate in making haste slowly.

To my mind, a far more important reason exists in the specifications upon which bids were obtained. Fairness and economy in public contracts are as vital to a city's welfare as pure water. The specifications concerned are quite commendable with a few exceptions, but at least one of these is exceedingly important.

The most difficult matter in which to insure fair competition and economy lies in obtaining patented articles. In filtration plants of the type proposed, a few patented appliances have been found in some cases desirable, although I believe a practically perfect plant can be built without any of them. They consist of a few simple strainers, some devices for regulating water level and a few for convenience in operation. The commission of engineers which was favorable to filtration stated that the royalties on filtration patents thus far have been small and that all the more important patents will expire within a year or so after the earliest date at which the Jerome Park filters can be completed.

Yet, we find in these specifications that the small patented articles, instead of being entirely avoided or obtained under competition covering them alone, were lumped in the whole plant, and the inherent difficulties in their purchase was made to contaminate the competition of the entire plant and, quite probably, to entirely dominate it. This is wrong in principle and fully justifies the adverse vote of the Board of Estimate.

Alternative bids, too, are always objectionable, and pave the way for juggling contracts into the hands of favorites. In these specifications, there were six alternative ways of bidding, based on six different systems of operation, and these, in turn, hinged upon the objectionable patent features.

While it is stated in the specifications that any one of the six systems will "be satisfactory," there is nothing to prevent the award of the contract to a favorite on the ground of his system being more satisfactory than the others. Had the specifications said that the different systems would be equally satisfactory, the case would not have been so bad.

As it was, the importance of the patents was magnified in the specifications by the requirement of a large bond, $150,000, required for six years to protect the city against suits for infringement. This put a club worth pretty nearly $150,000 into the hands of whatever bidder could succeed in tying up all or most of the patents, but as if this were not enough, while the very large bond, $1,000,000, was given in the printed specifications as a bond simply for the faithful performance of the work, it was, I am reliably assured, in the specifications actually issued to bidders, altered to make it to also

cover the patents for a year after the contract was completed.

The normal difference in bids between the lowest and the next lowest for a contract of this size and character should be less than $100,000, and the above arrangement may fairly be considered as enough to put the contract into favored hands.

Any contractor who had previously used these patented appliances, would have a distinct advantage, and it is to be noted that the McNichol concern, which was the lowest bidder, had previously built a large set of similar filters in Philadelphia, in which they were awarded the contract under precisely similar alternative bids, which award was made as a matter of legitimate jugglery, there being only one way out of six possible that the McNichol could be figured the lowest bid.

It is to be noted here that the City of Baltimore has recently opened bids under specifications on all fours with the one under consideration, and that the McNichol concern was again the lowest bidder, but the bids have been rejected, and in the readvertisement, the patented articles are to be bought separately.

In this behalf, it is to be noted that the Jerome Park specifications call for bids carefully itemized in painstaking detail until it comes to the operating mechanism involving patents, for which a lump sum bid amounting to upwards of a million dollars is called for. All this mechanism is merely standard piping, easily itemized, and yet the patent virus is made to contaminate this big item, and then, the whole filter construction is tacked on to it. There would be equal justification in adding in the paving of a few dozen city blocks in the vicinity.

It has been argued all along the line that the impressive list of bidders cures all possible defects in the specifications and bidding. I beg to differ from this view. In the Cumberland Sound improvement contract, some years ago, amounting to $2,350,000, there was a nice array of three bidders with bids very close to each other, and yet the work could have been done for less than one-fifth of the lowest bid.

It is to be noted that the array in the Jerome Park Filter bids is one of competent bidders and that there are not many large contingencies in the construction itself; also that while the bids generally range quite uniformly in differences, McNichol's, the lowest, is over a half a million dollars below his nearest competitor. This indicates his concern had some big advantages somewhere.

Another point, the six alternative bids are based upon washing the filters with or without the use of air and using or not using "negative head." For any particular plant, these items have a more or less important engineering bearing. Only one system is the best. The city engineers should have determined in advance which one was best and obtained bids on that alone.

Some of the specifications are so severe as to be practically impossible of execution. The clay called for as specified literally could probably not be found in nature. This criticism may appear captious, but yet a contractor in Philadelphia who was the lowest bidder for a reservoir at about $500,000, the McNichol concern being next, at about $1,250,000, was ruined and practically driven to his death by the literal enforcement of almost precisely the same specification.

Note further, the fact that the moral blight under which the city government of Philadelphia has withered for years is entirely due to the domination of contractor bosses, compared to which blight the blight of typhoid is a bagatelle, and you have a final reason for the wisdom of the Board in postponing the letting of the contract till both the Croton watershed and the specifications can be "cleaned up."

CASSIUS E. GILLETTE.

Land Title Building, Philadelphia, Penn.
May 26, 1913.

[There follows a reply to Major Gillette's letter, from I. M. de Varona, chief engineer of the Department of Water Supply, New York City. We might add that portions of Major Gillette's letter, and particularly the last paragraph, suggest that his experiences at Savannah on government work and at Philadelphia on municipal water-supply and filtration seem to have filled his mind with the notion that all contractors and public officials are rascals, and that engineers as a class are not much better; and that in his zeal to kill what he regarded as another "job" he has overlooked some of the fundamental principles of water-supply and filtration and of engineering ethics as well.—ED.]

Sir—I return herewith copy of letter from Major Gillette, in regard to the filtration of the Croton water, which you forwarded to me.

This subject was so fully discussed in your issue of May 22, 1913, that further encroachment on your valuable space, with the statements of Major Gillette or comment on them, seems to me hardly warranted. I will, therefore, treat the matter as briefly as possible.

The alleged neglect in protecting the water-supply from contamination is Major Gillette's opinion, but not a fact.

That Major Gillette evidently is not familiar with our plans for mechanical filtration, is shown by his offhand criticisms. The amount of permanent hardness in the Croton water is negligible and will so continue after the use of coagulants. It is not true that the Department proposes to put the water through a softening process, because it is not necessary. The method of reducing the carbonic acid would also somewhat reduce the hardness, but that is not its purpose.

Major Gillette speaks very glibly of the easy manner in which the Croton water can be sufficiently improved by the adoption of such minor treatment as a "comparatively modest amount of dredging," the building of a few "retaining walls," the use of "a trifling amount of sulphate of copper" and "a little aëration at a negligible expense." This is a trivial and airy method of dealing with an important matter with which the writer is evidently unfamiliar. He reveals lack of knowledge of the conditions in the watershed, and his wholesale characterization of the expense involved in these various processes as trifling, betrays also lack of study. The various measures to which he alludes are not new. They have been considered by this Department and it may safely be asserted that the aggregate expense involved in carrying them into execution would be far from negligible and by no means compensated by the probable improvement in the water. Still less could they be accepted as an adequate substitute for filtration by any experts.

In the letter under consideration it is assumed that the Catskill supply can be used to replace that from the Croton when the latter is unsatisfactory. Major Gillette would be much embarrassed in proving this proposition, which is certainly not in accordance with the opinion of the engineers who have studied this matter and are conversant therewith.

As to what Major Gillette thinks he could have done to improve the specifications, it may be fair to remind him that, if we are correctly informed, in a proposed contract for the Queens Lane Contingent of the Torresdale Filters, which we are told was prepared under his direction, he was able to obtain only one bid and that bid was rejected, as we understand, because it was considered too high.

Referring to the alternative ways of bidding, Major Gillette alleges that there was nothing to prevent the award of the contract "to a favorite on the ground of his system being more satisfactory than the others," and adds that if it had been stated that all the systems would be equally satisfactory, the case would not have been so bad. This is certainly ridiculous. The specifications clearly say that any of the six types of filters designated "will satisfactorily do the work required for the filtration of the water and bidders may, therefore, bid upon all these types or any one of them," and under the city charter the lowest bid had to be accepted and we so recommended.

Major Gillette's intimation that the numerous bids received from responsible contractors did not indicate that the prices submitted represented the fair cost of the work, is simply a further indication of his characteristic disposition to criticize on general principles. Four of the bids were below the engineer's estimate and said estimate had been indorsed by all engineers who examined it. The further statement that "the normal difference in bids for a contract of this size should be less than $100,000," will be condemned as absurd by engineers having experience in the construction of large works. We challenge Major Gillette to show us a record of work of this character and to this atmount ($5,000,000), for which half a dozen bids have been received, in which the difference did not exceed $100,000.

It is not true, as Major Gillette asserts, when referring to our filters, that a certain firm "had previously built a large set of similar filters in Philadelphia in which they were awarded the contract under precisely similar alternative bids, which award was made as a matter of legitimate jugglery." Our alternative bids *are not precisely similar to those prescribed in Philadelphia.* In fact they radically differ. In our case there cannot be any jugglery, legitimate or illegimate.

As to the criticism of the specifications for clay: They are practically the same as have been used on all important work of this nature anywhere in this country, and no other criticism except that of Major Gillette has hitherto been made of them, although we, of course, admit that an arbitrary interpretation on the part of the engineer would prove damaging to the contractor. That, however, would be the case with any other item or any other contract.

Major Gillette further risks the following statements:

> The importance of the patents was magnified in the specifications by the requirement of a large bond, $150,000 required for six years to protect the city against suits for infringement. This put a club worth pretty nearly $150,000 in the hands of whatever bidder could succeed in tying up all patents, but as if this were not enough while the very large bond, $1,000,000, for the faithful execution of the contract was in the printed specifications as a bond for the faithful performance of the work, it was, I am assured, in the specifications actually issued to bidders altered to make it to cover the patents for a year after the contract was completed.

The above statements conclusively show, in our opinion, that Major Gillette does not know what he is talking about. The cost of the $150,000 bond would be 1% per annum, or $9000 in the aggregate for the life of the bond (6 years). This is far from "a club worth nearly $150,000."

In all contracts of this Department and we believe in those of all the other departments of the City of New York, the security bond guarantees not only faithful performance of the work but also indemnity from losses due to patent claims. Furthermore, in all contracts of this Department for work of this kind the contractor is responsible for repairs due to defective work for materials for one year after the completion of the work, so that in this instance we simply followed the usual practice of this Department and the provisions of the contract in regard to protection from patent claims up to one year after completion of the work were the same as in all other contracts. The contract and specifications were printed and bound together and copies thereof were furnished to prospective bidders. No other specifications were forwarded to anyone.

Referring to the patent question, the specifications are thus criticized:

> We find in these specifications that the small patented articles instead of being entirely avoided or obtained under competition covering them alone, were lumped in with the whole plant, and the inherent difficulties in their purchase was made to contaminate the competition of the entire plant and, quite probably, to dominate it. This is wrong in principle and fully justifies the adverse vote of the Board of Estimate.

In works of this character, it is customary to group the various articles in filter equipment in one item, for convenience and simplicity in handling the work. The question is one of judgment in each case. In the present one it was considered for the best interests of the city to so frame the specifications as to secure not only competition, but satisfactory bidders, and the results obtained from the bids submitted conclusively show that they accomplished their intended purpose.

The imputation that the patented articles were lumped in order to "contaminate competition, * * * * and, quite probably, to entirely dominate it," is, therefore, unwarranted by the facts, and against the evidence.

There is no question that in any city a combination of dishonest municipal officers and dishonest engineers can practically ruin a contractor under almost any specifications that can be written, and it seems to have fitted Major Gillette's purpose to assume that such conditions exist in our midst. From *his* hypothesis we confidently appeal to our citizens and to our records, and from *his* criticisms, to the judgment, fairness and decision of the engineering profession.

I. M. de Varona,
Chief Engineer Department Water Supply.
New York City, May 31, 1913.

Sir—In view of the editorial comment in your issue of May 22 regarding the plan for mechanical filtration of Croton water, we respectfully call your attention to the following facts:

As you know, the Board of Estimate and Apportionment of New York City voted unanimously (on the same day that the issue containing your editorial was published) to rescind the authorization of corporate stock for this filtration project. It appears, therefore, that the city officials with whom the responsibility rested of passing upon the question were unanimous in accepting the view urged by the Citizens Union, the Bureau of Municipal Research and other civic and taxpayers' organizations that the expenditure for filtration was not justified.

The decision rested largely with President John Purroy Mitchel, of the Board of Aldermen. Mr. Mitchel invited into conference the water commissioner and the engineers upon whose advice he [Mr. Mitchel] had acted as well as the Citizens Union and the engineers by whom it had been advised. The water commissioner was present at this conference with the following engineers: Allen Hazen, J. Waldo Smith, George W. Fuller, Nicholas S. Hill, Jr., Merrit H. Smith and George A. Johnson. The Citizens Union was present and represented by the following engineers: Major Cassius E. Gillette, of Philadelphia, R Walter Cruezbaur, Alexander Potter and Charles W. Parmelee, of New York City. John H. Frazee, an assistant engineer of the finance department, who as a member of the board of consulting experts appointed by the Board of Estimate and Apportionment had presented a minority report against the filtration project, was also present.

President Mitchel limited the discussion entirely to the question of whether filtration was necessary. He particularly desired to have answered the following question: "Is it possible by use of hypochlorite of lime to remove bacteria from the water so as to make it a safe water?" The engineers representing the Citizens Union answered this question in the affirmative and submitted many data showing the successful use of hypochlorite of lime in other cities. Engineers representing the water department stated that chlorination treatment was insufficient and unsatisfactory and would not sufficiently purify the water. Their answers were substantially the same as George A. Johnson's statement contained in the article printed in your issue of May 22, as follows: "All other means, such as forestation, sanitary patrolling, sedimentation, sterilization of the partially clarified water as it leaves the reservoirs, are insufficient and unsatisfactory and filtration is required."

The next day after this conference we submitted to Mr. Mitchel copies of sworn testimony given a few years ago by Messrs. George W. Fuller and George A. Johnson in the case of the Mayor and Aldermen of Jersey City against the Jersey City Water Supply Co., in which the question at issue was whether or not it was necessary to filter the Jersey City water-supply. Messrs. Fuller and Johnson appeared as witnesses for the water company, which contended that filtration was not necessary.

The Jersey City water-supply comes from a watershed consisting of 121 sq.mi. The Croton watershed contains 360 sq.mi. The population of the New Jersey watershed was, at the time of the trial of the action mentioned above, 25,000, the same as the present population of the Croton watershed.

Mr. Fuller testified as follows on the question of the chlorination treatment:

> I think that this process produces a safe water and one which in its efficiency as a process compares very favorably, indeed most satisfactorily, in fact, with the best filter plants as regards both construction and operation of those filter plants. In other words it meets the plan which is represented by the best practice in the art of water purification. I am speaking, of course, now with regard to the removal of objectionable bacteria; that is the very point at which the process is aimed. . . . .

Mr. Johnson testified as follows on the question of the chlorination treatment:

> Q. What is the quality of this water, after this treatment, as to safety and potability, in your opinion? A. I think it is perfectly safe for all domestic and industrial uses.
>
> Q. Is this method, in your opinion, reliable? A. Yes, sir.
>
> Q. Is it safe? A. Thoroughly.
>
> Q. Is it uniformly effective in its action? A. Yes, sir, always.
>
> Q. In your opinion is this method suitable, or otherwise, to be applied to Jersey City water-supply, for the purpose of rendering it safe and potable at Jersey City? A. I think it is in all ways thoroughly suitable and safe.
>
> Q. Is this method, in your judgment, a practical method for continuous use, to keep this water pure? A. Yes, sir, it is.

In view of the diametrically opposite statements made by these engineers on the question of the treatment of these two water-supplies, Mr. Mitchel could not very well have taken any other attitude or made any other report to the Board of Estimate and Apportionment on this subject than he did.

J. O. Hammitt, Secretary,
Citizens Union of the City of New York.
41 Park Row, New York City, May 26, 1913.

[The second paragraph in the foregoing letter does not accord with our understanding of the significance of the action of the Board of Estimate on May 22. Mr. Mitchel held the balance of power and thus became a sort of umpire in a factional controversy in the Board of Estimate. When he announced his decision against filtration, the project was killed. The subsequent unanimous action by the Board of Estimate amounted to an agreement to bury the dead, or in other words to rescind the resolution authorizing bonds for a project which had been killed after a long struggle.

The balance of the letter, and particularly the last sentence, indicates that Mr. Mitchel decided against filtration because the engineers brought in by the Citizens' Union asserted that hypochlorite disinfection was an equally good safeguard against dangerous bacteria, and that he threw overboard the contrary opinion of a half-dozen engineers because two of them (who speak for themselves below), in the famous Jersey City water case, had testified that reliance could be placed upon hypochlorite to make Rockaway River water safe. We believe Mr. Mitchel is too shrewd and experienced a lawyer to have been much influenced by the excerpt from the testimony cited above, dissociated from the opposing evidence in the same case and from the underlying causes of the Jersey City litigation. We give him credit for having based his decision on what appealed to him to be broader grounds.

Had Mr. Mitchel decided against filtration two years ago, instead of joining, as he then did, in marshaling the evidence for it and in recommending it, the city would have saved the $100,000 or so which it has spent on plans for filters. The readily available evidence for and against filtration has changed so little in two years that a decision for it two years ago and against it now is a virtual confession of lack of proper investigation at the earlier date. Of course Mr. Mitchel does not stand alone

in this confession, which, with the consequences of the negligence, is a sorry piece of business in these days of municipal research, reform and efficiency.—ED.]

Sir—I have read the foregoing letter of Mr. Hammitt and particularly the citation of my views as to the removal of objectionable bacteria from the Jersey City water-supply by the hypochlorite treatment. Those views were stated early in 1909, some five months after this treatment was first regularly applied to a public water-supply.

With the premises the same, my conclusions remain unchanged. But in the Jersey City case there was no attempt made by me to assume that the hypochlorite treatment was a substitute for filtration, which process received no direct consideration in that lawsuit. I stated views as follows:

Q. What in your judgment is the propriety, or, is it in your judgment a proper method to adopt at the Boonton dam for the rendering of this water pure and wholesome for use at Jersey City?

A. I think it is, assuming in my answer that it is the objectionable bacteria which it is the purpose to remove. I might add a word more, that is, that that qualification was intended to refer to the fact that this is not a substitute for filtration; it is not a process to remove mud or the coloring matter which we call vegetable stain, such as comes from decomposed leaves in swamps.

During the past four years a vast fund of experience has been accumulated as to chlorination. Among other things it has been found that some waters are far less suitable in a raw condition for an advantageous application of hypochlorite than was indicated by the early data at Jersey City. The Croton supply is one of those waters in which at times it is difficult to destroy objectionable bacteria by the hypochlorite treatment, without using quantities of the chemical such as to give to the treated water objectionable tastes and odors. This has been testified to at length by D. D. Jackson, Laboratory Division, Department of Water Supply, as well as by Ernst Lederle, Commissioner of Health, New York City. It was explained by me at the conference in Mr. Mitchel's office on May 20, 1913.

To those interested in ascertaining the truth as to the fallibility of the hypochlorite treatment, reference is made to the Croton analyses published in ENGINEERING NEWS of Feb. 27, 1913. The strongest statement of all was that made by Mr. Johnson in Mr. Mitchel's office on May 20, 1913, as to his recent investigation of the shortcomings of this process at Jersey City. A conclusion drawn in 1913 as to the hypochlorite treatment for the Croton supply, based on Jersey City evidence of 1909, is not justifiable.

Another erroneous conclusion drawn by Mr. Mitchel, in his statement at the Board of Estimate meeting on May 22, was that the color and turbidity of the Croton water would be removed by aëration to the extent of 50 to 75%. The Water Department and its expert advisers stated the facts of no removal on May 20, but here also Mr. Mitchel seems to have been guided by those who were not correctly informed as to the facts.

GEORGE W. FULLER.

170 Broadway, New York City, June 2, 1913.

Sir—My attention has been called to a letter addressed to you under date of May 26, by J. O. Hammitt, Secretary Citizens Union, in which certain statements are made with reference to my advocacy on the witness stand of the hypochlorite treatment of the water-supply of Jersey City.

In the Jersey City case the question of filtration of the supply was not the point at issue, the physical character of the water being considered satisfactory. The main question was whether or not the hypochlorite treatment would destroy such objectionable bacteria as the water might at times contain. My testimony, which Mr. Hammitt refers to, was given in the early part of 1909, or less than six months after the hypochlorite process was first applied on a practical scale in this country.

The views expressed by me on the witness stand at that time were based on the facts then available as to the efficiency of the process. Subsequent studies disclosed limitations of the process which were entirely unthought of in 1909, and these limitations have been repeatedly set forth by me in various publications and on the witness stand since that time. In an address made before the Annual Convention of the American Public Health Association, held in Milwaukee in September, 1910, I presented in considerable detail all of the evidence available at that time on the efficiency of this process, and paid particular attention to its limitations, closing my address with the following remarks:

LIMITATIONS OF THE PROCESS

In making a complete analysis of the practicability of this process, it is necessary to recognize the fact that it is not possible by the use of this germicide to overcome certain disadvantages, such as the following, which do not appear in connection with certain styles of water treatment:

(1) Inability to remove or destroy all of the spore-forming bacteria not considered to be pathogenic to man, at least not those common to water.

(2) Inability to remove bacteria which are embedded in particles of suspended matter.

(3) Inability to remove turbidity.

(4) Inability to remove appreciable amounts of color or dissolved vegetable stain.

(5) Inability appreciably to remove organic matter.

(6) Inability to remove swamp tastes or odors.

(7) Inability to remove creosote tastes or odors coming from the cleaning of stills used in the destructive distillation of wood.

(8) Inability to soften water; as a matter of fact, the addition of hypochlorite of lime usually results in a slight increase in the hardness of the water—although this is not ordinarily measurable—notwithstanding the fact that the commercial product usually contains a little free quicklime which reduces slightly the carbonic acid in the water.

(9) Difficulties encountered in applying this process, except with the greatest care, to waters which contain substantial quantities of reducing agents or compounds capable of oxidation, such as nitrites and unoxidized iron.

The foregoing statements set forth the advantages and shortcomings of this process which, like other things that are new, is likely to be, and in some cases is, considered a cure-all for all water ills, no doubt with disappointing results in some cases.

The application of hypochlorite to water, while comparatively simple, should always be carried out with much care and fidelity by a competent analyst; otherwise, if the dose is not adjusted so as to meet satisfactorily all local conditions, there is liable to be alternately an overdose of the chemical insufficient to sterilize, or an overdose which will result in objectionable tastes and odors readily noticeable to the consumers, and due to the bleach itself.

The use of hypochlorites cannot be considered in the light of a substitute for filtration. Where waters are uniformly satisfactory in appearance, but open to suspicion as regards their content in bacteria, the use of the hypochlorite process alone in many cases may prove sufficient. Where waters are unsatisfactory in physical appearance and are also polluted and require filtration, the combined use of filters and the hypochlorite process is called for. As an adjunct to filtration processes it has a distinct field of applicability, as above stated, for at a moderate cost it is feasible to obtain a water which is practically above suspicion; and, further-

more, there is brought about a substantial economy in the first cost of the filtration plant. This is made possible by the use of higher rates of filtration than are ordinarily used, and the required filter area may therefore be reduced. It also effects a substantial economy in the cost of operation.

It is not true, therefore, as Mr. Hammitt would have it appear, that I have suddenly taken a new position with reference to the hypochlorite treatment. As fast as I secured new information referring to the limitations of the process I promptly made it public, and the statements made by me at the hearing in President Mitchel's office were precisely those I have been setting forth publicly for at least three years. Those who have heard my remarks can by reference to the above quoted article, satisfy themselves that I expressed no views contrary to those I have held for several years.

In testimony given by me last March, in the case of the People of the State of New York vs. Passaic Valley Sewerage Commissioners, I made it very plain that while in 1909 the hypochlorite treatment gave every promise of complete success in the sterilization of the Jersey City water-supply, subsequent studies made by me for the Board of Street & Water Commissioners of Jersey City have shown that owing to the steadily increasing pollution of the supply it has become necessary to materially increase the dose of germicide. Furthermore, I expressed the conviction that the day is not far distant when the hypochlorite treatment will have to be abandoned there, for the reason that to kill the objectionable germs such large doses of the chemical will be required as to impart offensive and utterly inadmissable taste and odor to the water.

In conclusion I take this opportunity to state that I stand absolutely on what I said at the hearing in President Mitchel's office, and again assert that sterilization of the Croton water-supply is not to be considered in the light of a substitute for filtration in any sense except that an uncertain proportion of the pathogenic germs will be destroyed by its use. It is not a complete treatment, and the Croton supply can never be considered satisfactory until it is filtered.

All of the facts above set forth must have been in the possession of Mr. Hammitt when he wrote his letter to you, and to support his own imperfect claims he has used only such information as I possessed over four years ago, and has not seen fit to give any consideration to the various articles on the hypochlorite treatment I have published since that time.

GEO. A. JOHNSON.

150 Nassau St., New York City, June 2, 1913.

NOTES AND QUERIES

Azimuth by Direct Solar Observation—A correspondent in Vermillion, S. D., J. Maughs Brown, calls our attention to an error in the formula for determining the error in azimuth due to a one minute error in latitude, which occurs twice in the article on "Azimuth by Direct Solar Observation," by Louis Ross, in our issue of Mar. 6, pp. 455 and 456. The formula given as $\frac{dZ}{dL} = \sec L \cos t$ should read $\frac{dZ}{dL} = \sec L \cot t$. The table given below the formula is correctly computed. Our correspondent also suggests that the diagram shown in Fig. 6, p. 455, for finding the approximate time could very nicely be supplemented by a diagram for the equation of time placed directly underneath.

In noting the establishment of the Mellon Institute of Industrial Research and School of Specific Industries at the University of Pittsburgh, in our issue of Apr. 17, 1913, p. 7[illegible], we gave credit to Henry Hornbostel, of Pittsburgh, as the architect of the Institute building. We are informed that the statement from the University on which this note was based was in error in that the architect is J. H. Gloss, of Pittsburgh, and that Mr. Hornbostel's connection is only in a consulting capacity as the architect of the existing university buildings.

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Oiling Grade Crossings so as to prevent a dust nuisance is being regularly practiced on the Delaware, Lackawanna & Western R.R. Two equipments are in use in different parts of the line, each consisting of an oil car provided with compressed-air tanks and special nozzles for spraying the oil. These cars are drawn along the line, and the crossings are oiled in succession by a crew that goes with the car, so that each crossing is oiled about twice each year. It has been found that this procedure is successful in keeping down the dust to such an extent that there is no offense from that source to passengers, particularly to those on rear-end observation cars, where before the oiling the nuisance had been great.

A Photometric Laboratory on Wheels has been equipped by Hollis Godfrey, in charge of the Philadelphia Bureau of Gas under Morris L. Cooke, Director of Public Works. Trouble had been experienced in keeping the candlepower of street lamps up to the contract figure, and, as the contractors objected to photometric tests with small portable apparatus, standard laboratory equipment was mounted on a covered motor truck to be carried about the city and used to study the lamps burning in place, but with apparatus and under conditions prevailing in a good laboratory. So far only the gasoline lamps have been reported on; in four months, the penalties for outages and insufficient candlepower on these 19,000 lamps amounted to $41,036. The Gas Bureau has jurisdiction also over 14,000 electric and 24,000 gas lamps, and it is expected that these will be studied in their turn.

The Danger from Electric Shock in directing a stream of water on a high-tension electric line is discussed by F. C. Caldwell, Professor of Electrical Engineering at the Ohio State University, in the "Sibley Journal of Engineering" (Cornell University undergraduate publication). Measurements of resistance of a stream of water between the hose nozzle and a 12-ft. piece of No. 6 copper wire were made. Voltage was obtained from a 250,000-volt 50-kw. transformer, with the middle point connected by a low reading ammeter to earth and one terminal connected to the wire. Variation of frequency between 45 and 60 cycles with 20,000 volts showed no appreciable reactance of the stream and resistance was then calculated from current and voltage readings.

Increase of water pressure gave increased resistance of stream. This increase was slight for 6- to 10-ft. lengths of streams, but was marked for 15 ft.; the higher pressures gave a less solid stream, especially at greater distances from the nozzle. With a 1⅛-in. nozzle for 5000 and 30,000 volts the resistance gradually increased up to a critical length, which was about 17 ft. for a 1⅛-in. nozzle and 20 ft. for a 1½-in. Beyond this point the resistance rose suddenly and approached infinity. The critical point was where the stream ceased to be continuous and broke up into a mass of separate water drops. With a stream length of 15 ft. on a 50,000 volt wire, a resistance of about 20,000 ohms water path would be obtained and a current of about 0.25 amp. This would give the holder of the nozzle a severe shock and might be dangerous. With a stream length of 20 ft. for a 1⅛-in. nozzle, or 25 ft. for a 1½-in. nozzle the resistance would be 800,000 ohms or more, which would give but 0.06 amp. or less. This might be painful but practically not dangerous. The resistance of the body, being only a few thousand ohms, has been neglected in that statement. It is believed that such high-tension circuits when near buildings would be more than 25 ft. from the ground, so that there is little fear of injury to firemen from this source.

The fact that a nozzle is grounded through the stream of water in the hose was studied, but not found to keep the voltage so near that of the earth that danger to the nozzle holder was eliminated. Resistance of the path from nozzle to ground, through the water in the hose when the latter was thoroughly insulated, was found to be about 150,000 ohms per 100 ft., which could not be depended upon to shunt much of the current around a man holding the nozzle.

A similar study of dangers from playing streams on trolley wires was studied by the Pennsylvania R.R., as noted in "Engineering News," Nov. 19, 1908, p. 569. The results were in general agreement with the foregoing.

The Failure of the Sand Canyon Pressure-Tunnel Siphon of the Los Angeles Aqueduct

By Burt A. Heinly*

In Engineering News of May 29, announcement was made of the failure of the Sand Cañon siphon of the Los Angeles Aqueduct and the postponement until some time in October of the dedication of the project which was to have taken place June 19-20.

The failure of the work which in this instance was *pressure tunnel* and which in no way should be associated with the inverted steel siphons of the Aqueduct which supply, the failure, while causing some expense and creating disappointment at the postponement of the dedication, creates no difficulties that will prove onerous.

The breakage was due to a form of construction which, while recommended wherever ledge rock occurred at sites of siphon crossings, was adopted only at Sand Cañon, where the rock was sounder than at any other point on the Aqueduct.

The siphon as built has a total length of 2788 ft., consisting of 639 ft. of pressure tunnel 9 ft. 2 in. in diameter down the north side of the cañon on an incline of 45°, 597 ft. of horizontal pressure tunnel of the same diameter with 10 ft. of transition connecting to 890 ft. of steel pipe 8 ft. 6 in. in diameter of $\frac{11}{16}$-in. steel, then



Fig. 1. General View of Site of Sand Cañon Tunnel Siphon, Los Angeles, Calif.; Looking East

(The white line shows the original survey location of the siphon. After construction changes were made, which slightly modified the figures printed on the view, as may be seen by reference to the profile, Fig. 2. A comparison of this view with Fig. 3 will show the change made in the aspect of the south side of the cañon by the slide that followed the failure of the siphon.)

have been tested and found satisfactory, makes necessary the building of a new siphon entirely of steel across the cañon. The replacement of the damaged section involves an expenditure of approximately $40,000, or about one-sixth of one per cent. of the cost of the whole Aqueduct work, and a delay of ninety days.

The break occurred on the morning of May 19 at a point 100 miles below the Aqueduct intake and 150 miles north of the city. The interruption of flow is therefore 32 miles below the Haiwee Reservoir so that the filling of that impounding basin with a capacity of 63,800 acre-feet, which was begun Feb. 9, continues without hindrance. Moreover, as the city trunk line from the outlet of the Aqueduct to the city's distribution system is just entering upon construction, and as the city will be able to tide over the summer with its present water-

30 ft. of horizontal pressure tunnel (including 10 ft. of transition) of 9 ft. 2 in. diameter connecting with a pressure tunnel of the same diameter, 632 ft. in length and at a 45° incline up the south wall of the cañon. Where the steel pipe crosses the surface bed of the cañon it rests on concrete piers and at this point is 455 ft. below the hydraulic grade of the Aqueduct.

The construction was in massive granite apparently sound and of great hardness and durability, as is shown by the fact that where on an average the tunnels of the Aqueduct required from 25 to 30 lb. of 80% gelatin powder to the foot for breaking, on these pressure tunnels an average of 40 lb. was required. At the transitions there is 81 ft. of cover on the north side and 160 ft. on the south side, while the minimum depth of cover on the tunnels was 70 ft., with 170 ft. as the maximum.

The concrete lining averages 12 in. in thickness and

*636 South Hill St., Los Angeles, Calif.

is of 1:2:4 mix. On the horizontal tunneling, the concrete was grouted under 200 lb. pressure while on the inclined tunnels it was poured from the top.

The tunnel work was completed before July, 1912. The concreting was begun in August and was completed in October. Fabrication of the steel was completed in

The Department of Public Service had steel arriving for the construction of the City Trunk Line and, with certain modifications at local foundries, within 48 hours had started to its destination the material necessary for repairs. This consisted of 345 ft. of 66-in. diameter, 3/8-in. pipe, which was placed as shown in Fig. 2.



FIG. 2. PLAN, PROFILE AND SECTIONS OF SAND CAÑON TUNNEL SIPHON, LOS ANGELES AQUEDUCT. SHOWING LOCATION OF FAILURE, OF SLIDE AND OF NEW STEEL SIPHON

(All distances and stations refer to bottom of pipe. Sub Grade, "S. G.," is taken as finished line of concrete in bottom of invert and the bottom of the pipe. The hydraulic properties are: Diameter of pipe, 8½ ft.; area, 56.745 ft.; perimeter, 26.704 ft.; hydraulic radius, 2.125 ft.; "C" in Chezy's formula, 90; hydraulic slope, 0.00334; capacity, 430 sec.-ft.; velocity, 7.58 ft. per sec.)

November but testing of the whole structure was delayed until a sufficient supply of water could be obtained by the operation of the Aqueduct.

On May 13, 1913, this testing was undertaken. Quickly following the turning in of the water, the pressure tunnel on the north side, 50 ft. from the end of the steel, showed weakness with a blowout following, and the siphon was drained.

On May 16, the final testing of the siphon was undertaken by turning in 17 sec.-ft. In passing, reference to the north side may be dismissed by stating that with the exception of a small and unimportant leak it showed sound. The south side, however, within fifteen minutes after the water had reached hydraulic grade, began to show signs of failure about 125 ft. from the top. The three 16-in. Rensselaer blowoff gates at the lowest point



FIG. 3. BASE OF SLIDE AT SAND CAÑON PRESSURE SIPHON, LOS ANGELES AQUEDUCT

(From photograph taken at 9 a.m., Monday, May 19, following failure of South Pressure Tunnel. The line drawn across the view gives an idea of the yardage that slid, or washed into the bottom of the cañon; see also Fig. 2.)

in the siphon were immediately opened and the siphon drained.

Investigation showed that from a point about 125 ft. from the top to 150 ft. of the bottom of the incline, the concrete gave evidences of ultimate failure of the structure.

With the determination to test it to either the full flow of the Aqueduct or to destruction, on Sunday night the gates of the Haiwee Reservoir were opened to admit a flow of 42 sec.-ft. This flow had reached and filled the siphon by 6 a.m., Monday. Between that hour and 7 a.m., the displacement of the whole side of the cañon wall took place with the rupture of the tunnel for several hundred feet. The bulk of the water burst forth and with the accompanying movement of the saturated covering of the tunnel, a very large quantity of débris was carried to the floor of the cañon, as is shown in Figs. 2 and 3.

An examination of the tunnel showed checks and openings in the concrete ranging from the thickness of a knife blade to 3 in. and extending from within 125 ft. of the top to within 150 ft. of the bottom.

The examination disclosed no faulty construction. It should be noted that this was force account work in which there was no object in shirking or in the use of faulty materials. Indeed, on the contrary, because of some doubt expressed by the chief engineer at the outset as to the feasibility of pressure-tunnel construction, the work was carried on with more than usual care by the field construction force, with a very liberal use of cement. The quality of materials and the character of the workmanship is, therefore, not open to question by Aqueduct heads.

The plans for reconstruction call for the rebuilding of a new siphon entirely of steel from 100 ft. to 150 ft. west of the present pressure tunnel, as shown in Fig. 2. Within 72 hours after the break, plans for the new siphon had been prepared, bids received by telegraph and the contract awarded to the Riter-Conley Manufacturing Co. for 463 tons of steel plate, rolled, punched and sheared in accordance with the standards of Aqueduct siphon construction, delivery to be completed at Leetsvale, Penn., within 35 days. The 890 ft. of 8½-ft. pipe held taut and true through the bombardment of huge boulders that accompanied the break and it will be only necessary to move it to its new location. The siphon as now designed will consist of 1662 ft. of ¼- to ⅝-in. plate, 10 ft. in diameter, tapering to 8½ ft., with triple-riveted longitudinal joints and single-riveted circumferential joints.

The full construction equipment remains on the ground and with the exception of some changes in location of the hoists is ready for service. It is planned that the new work shall be completed within the next ninety days, and the expectation is that the whole system will be placed in operation shortly after that time.

No date has been definitely set for the dedication of the work but invitations will be mailed by the Celebration Committee to engineers throughout the country, government and state officials within two or three weeks or as soon as the dates are definitely determined.

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The Time for Completing the Cape Cod Canal has been extended to June 7, 1915, by an order of the Massachusetts Harbor and Land and Railroad Commissions, issued on Apr. 25.

United States Cement Statistics for 1912

Cement production in the United States for 1912 has been reported by E. F. Burchard, the U. S. Geological Survey expert, as follows:

PRODUCTION

The total quantity of portland, natural and puzzolan cements produced in the United States in 1912 was 83,351,191 bbl., valued at $67,461,513, compared with 79,547,958 bbl., valued at $66,705,136, in 1911. This represents an increase in quantity of 3,803,233 bbl., or 4.78%, and in value of $756,377, or 1.13%.

The distribution of the total production among the three main classes of cement in 1912 is as follows: portland, 82,438,096 bbl., valued at $67,016,928; natural, 821,231 bbl. valued at $367,222; puzzolan, 91,864 bbl., valued at $77,363.

The total production of portland cement in the United States in 1912, was 82,438,096 bbl., valued at $67,016,928, compared with 78,528,637 bbl., valued at $66,248,817, in 1911. The output for 1912 represents an increase in quantity of 3,909,459 bbl., or nearly 4.98%, and in value of $768,111, or 1.13%.

The shipments of portland cement from the mills in the United States in 1912 are 85,012,556 bbl., valued at $69,109,800, compared with 75,547,829 bbl., valued at $63,762,638, shipped in 1911. The shipments therefore represent an increase in quantity of 9,464,727 bbl., or 12.52%, and in value of $5,347,162, or 8.38%. The average price per barrel in 1912, according to these figures, was a trifle less than 81.3c., compared with 84.4c. in 1911. This represents the value of cement in bulk at the mills, including labor and costs of packing, but not the value of the sacks or barrels. The average price per barrel for the country is about 13.9c. higher than the average price received for portland cement in the Lehigh district, where it was sold at the cheapest rate, and is near the average price received in the Iowa-Missouri district, but it falls 54.5c. below the average price received on the Pacific coast, where portland cement brought the highest figure during the year.

STOCKS ON HAND

Reports were received from nearly all the mills in the United States that shipped any portland cement in 1912, giving stocks of finished cement on hand Dec. 31, 1912. For the very few mills which did not report this information an estimate, believed to be very close, has been made. The apparent stock on hand at the end of 1912 amounted to 7,811,329 bbl., compared with 10,385,789 bbl. on hand at the close of 1911, according to reports and revised estimates, thus indicating a reduction in stock of more than 2,500,000 bbl. during 1912.

IMPORTS OF FOREIGN CEMENT

The imports and exports of cement are reported to the Survey by the Bureau of Foreign and Domestic Commerce. The statements include all hydraulic cements, also the weights of sacks or barrels. Portland cement probably makes up at least 95% of the total in each year.

The imports of hydraulic cement in 1912 were approximately 68,503 bbl., valued at $93,558, or about $1.37 a barrel, compared with 164,670 bbl., valued at $242,722, or $1.47 a barrel, in 1911. This decrease in the quantity of cement imported was to be expected in view of the large excess domestic stocks that were marketed at low prices during the year.

EXPORTS

The United States has a comparatively small export trade in cement. In 1912 the quantity exported was only 4,215,532 bbl., most of which was portland cement, valued at $6,160,341, or approximately $1.46 a barrel, compared with 3,135,409 bbl., valued at $4,632,215, or about $1.477 a barrel, in 1911. The quantity exported in 1912 was slightly more than 5% of the total production of hydraulic cements in 1912. The exports in 1910, 1911 and 1912 have shown increases of 135, 27 and 26% respectively, over those of the preceding year.

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Cable Street Railways are still in use in the city of Edinburgh, Scotland. It is probable that this is the only city in the world where the cable system for ordinary street railway traffic, which was so extensively introduced twenty-five years ago, still remains in active service. It is recognized in Edinburgh, however, that extensions to the present cable system are not advisable. In view of the demand for new lines to suburbs, the City Council of Edinburgh has appointed a committee to visit a number of English cities and examine various types of street railways. It should be understood that the Edinburgh street railways are owned and operated by the city.

A Lower Court Decision on a Concrete Dam Patent

The following decision has been rendered by Justice Holt in the United States District Court, Southern District of New York, in the case of the Ambursen Hydraulic Construction Co., complainant, against the Hydraulic Properties Co., defendant. The Ambursen Hydraulic Construction Co. has taken an appeal from this decision of the lower court.

HOLT, J.:

This is a suit to enjoin the alleged infringement of a reissued patent, No. 12,246, granted July 26, 1904, to Nils Frederick Ambursen, for certain improvements in dams. Claims 2 and 3 of the patent are relied on. They are as follows:

2. A dam comprising a base, an inclined concrete flooring overhanging the base, a plurality of spaced buttresses interposed between the base and flooring, and metallic reinforcing members embedded in the flooring and extending lengthwise thereof and across the buttresses.

3. A dam comprising a base, spaced buttresses rising therefrom, and a relatively thin inclined concrete flooring supported by and overhanging the buttresses and base, said flooring having metallic reinforcing members extending lengthwise of the flooring and across the buttresses.

There is nothing novel in either of these claims except the use of concrete in the construction of the flooring. Before the use of concrete dams were made of timber, iron or steel, or of solid masonry. The complainant's concrete dam is substantially a reproduction in concrete of an old and familiar style of timber dam. The flooring is supported by buttresses with spaces between. The solid masonry dam had become, before the introduction of the concrete dam, the standard form of dam for the retention of large reservoirs of water.

The complainant's concrete dam is claimed to have, and I am satisfied from the evidence that it has, various points of superiority over the solid masonry dam. The cost is low. The material is plastic. It forms a solid mass without joints. But that is a feature of all concrete construction. The great development of the use of concrete in recent years has made it a valuable building material for many purposes. Its use alone, or reinforced by iron or steel rods or wires, was well known in other forms of construction when the first concrete dam was built. It was natural that it should have been tried late in dam building because of the great danger arising from any insecurity in a dam; but it seems to me that it was certain, in the development of the use of concrete, to be ultimately used in dam building.

The description and drawing in the original and reissued patent shows a dam with a curved flooring, and great stress is laid, in the descriptions and claims, on the importance of the curved flooring as causing the lines of pressure, perpendicular to the face of the flooring, to lie wholly within the limits of the base of the buttresses. No such dam has been built. All that have been built have a straight flooring. It is claimed that the patent applies to dams with a straight flooring, and, if it were valid in other respects, I think it would apply to them. The patent also describes and claims a method of fastening the buttresses to the base. But no claim is made in this case that the defendant threatens infringement of the curved flooring or of the method of fastening the buttresses described and claimed in the patent.

The claim is that under this patent the complainant has a monopoly of dams made of concrete after an old style of wooden dams. The general rule is, of course, that the substitution of one material for another is not invention. Undoubtedly the complainant's forms of concrete dam has many advantages; but they seem to me to result simply from the natural qualities of concrete, and not from any newly discovered qualities. The use of concrete for dams has the usual advantages that it has for houses and bridges, and for many other forms of construction. But that does not make its first adoption for a particular use patentable. If this patent is valid the first maker of a concrete house or bridge or sidewalk was entitled to a patent for the thing made.

The bill is dismissed, with costs.

May 27, 1913.



A Reduction in Express Rates in Wisconsin averaging 20% has been ordered by the Railroad Commission of that state.

Forest Trees Around the Water-Works Reservoir of Hornell, N. Y., will be planted by the Board of Public Works of that city in coöperation with the College of Forestry, of Syracuse University. It is stated that about 30,000 trees will be planted.

NOTES FROM THE ENGINEERING SCHOOLS

COLUMBIA UNIVERSITY—The sum of $20,000 has been placed at the disposal of the department of electro-mechanics by an anonymous contributor. This has been used for equipment to carry on research work in the joint field of physics and electrical engineering, under the direction of M. I. Pupin. The department occupies the basement of the Philosophy Building. Here several rooms are fitted up, well lighted and furnished at present as work rooms for research students. There are the office of the director, two large laboratories and two smaller rooms, a machine shop, a lecture room and a photographic dark room. Each laboratory has a switchboard panel from which 110 or 220 direct current and 60-cycle alternating current can be drawn. In addition there are now in service several small motor-generator sets mounted so as to be moved easily from room to room. Currents may be obtained of any frequency from a few cycles up to 200,000 per second. There is a large equipment of oscillographs, galvanometers, hot-wire indicating instruments and miscellaneous electrical instruments.

RENSSELAER POLYTECHNIC INSTITUTE—The Board of Trustees has decided to offer a Master's degree in science and engineering for one year's graduate work, and also the degrees of Doctor of Science and Doctor of Engineering for three years' graduate work, of which at least two years must be in residence at the Institute. The courses leading to these degrees are for college graduates whose previous courses fit them for the proposed work. Both laboratory research and theoretical study are to be required.

A four-year course in chemical engineering (leading to the degree chemical engineer) has been established. The first two years are similar to those of the older engineering courses, while the last two years contain more chemistry and particularly more industrial chemistry than the other courses.



A Survey of the Proposed Delaware River Drive from Trenton to Cape May, N. J., following so far as possible the Delaware River, was authorized by the New Jersey Legislature of 1913, and an appropriation of $15,000 was made for the purpose.

Enlarged Powers Granted to the Municipalities of New Jersey by the legislature of 1913 included the following: City planning commissions may be appointed by cities of the second class (first-class cities already have that power), to be composed of not more than nine members who are to have a yearly appropriation of $5000 for their work; cities may build public docks; cities may hold annual exhibits of the work accomplished by their different city departments; local boards of health were given the same power as the State Board of Health in the regulation of foods.

Plans for a Freight Terminal for the Pennsylvania R.R. Co., at Baltimore, were outlined by President Rea, on May 29. The company proposes to erect a large freight terminal there and will give the city 30 ft. of its Calvert St. property, one block in length, for the purpose of widening that street in order to provide access to the proposed freight houses. In return it expects the city to deed to it adjacent sections of the following streets: Centre, Monument, Madison, Read, Davis, Halliday, Franklin, Bell and Courtland Alleys. It is intimated by the "Baltimore Sun," of May 30, that future freight-terminal developments by the Pennsylvania in Baltimore will aggregate $10,000,000; but the present plan involves only the erection of the one on Calvert St. for which property to the value of approximately $1,000,000 has already been acquired.

An Explosion in the Engine Room of the destroyer "Stewart" during a speed test on May 23, 28 miles off San Diego, Calif., resulted in the death of two men and the serious injury of a third.

Some Dynamite Accidentally Exploded on May 22, killing four men and seriously injuring a fifth, who were employed in construction work on the Southern Pacific Ry., at Iceland, near Truckee, Calif. It is stated that the explosion resulted from the accidental setting off of a box of caps which ignited the dynamite.

A Locomotive Jumped the Track and plunged 18 ft. to the bed of a coal pier of the Pennsylvania R.R., at Baltimore, Md., on May 26, killing the fireman. The locomotive and the tender turned over in the fall from the trestle but none of the empty coal cars which it was drawing left the track. It is thought that a defective flange on one of the wheels of the locomotive caused the accident.

The Collapse of an Unused Coal Hoist of the old Frederick Teves Coal Co., near the foot of North First St., Brooklyn, N. Y., on May 29, caused the injury of five men. The structure was undergoing demolition by a wrecking company at the time of the accident.

Fifty Tons of White Lead Crashed Through Four Floors of the five-story building of the American Ice Co., at Philadelphia, May 24. The upper floors of the building were used by the Lawrence McFadden Co., a paint and varnish concern. The falling lead tore down the water and gas pipes and five of the rescuers were overcome by the escaping gas. The section of the street on which the building fronts has been closed.

A Premature Dynamite Explosion killed three men and seriously injured three others who were employed by the Dominion Construction Co. The gang was clearing the way for the construction of a spur line from the Canadian Pacific Ry. to the Lehigh Cement Co., near Bellville, Ont., Canada. It is stated that the accident was the result of the rapid progress of the charging, the dynamite being placed in the holes before they were allowed to cool after being drilled.

The New Union Station at Chicago is a subject of controversy as to its proposed location. As planned, it is to occupy practically its present site, west of the river, but covering a much larger area and extending from the river west to Clinton St., and from Jackson Boulevard north to Adams St. It will be a double-end terminal, with two railways entering from the north and two from the south, and would have 11 tracks for the former and 15 for the latter. The tracks would be 12 ft. below the street level at Clinton St., owing to the slope of the ground west from the river. Some interests, however, are advertising a location farther south, near 12th St., either as part of one immense railway station, or as one of a group of terminal stations, the latter plan being that advocated by F. A. Delano, President of the Wabash R.R. The matter is now being considered by a committee of the City Council, and public hearings have been held to get the views of railway authorities, civic and commercial associations and other interests.

The Government Department of Public Works suggested by Ishom Randolph and advocated at the recnet convention of the National Drainage Congress, was referred to substantially as follows in the resolutions adopted at that covention, to be presented to the President and to Congress:

We believe it to be a proper function of the Government of the United States, under the welfare clause of the Constitution, to take adequate measures to control the flood waters of our country, and so to conserve them as to protect the life, health and property of our citizens. This is a governmental duty equally as imperative as that of protecting our citizens from the attack of a foreign foe.

We petition the immediate consideration of adequate provisions for flood control, for the regulation and control of stream flow, and for the reclamation of swamp and overflow lands and arid lands. We believe the most effectual and direct means will be the establishment of a Department of Public Works, with a Secretary in charge thereof, who shall be a member of the President's cabinet.

We further believe that the wide scope of the problem of flood-water control, affecting practically all the states of the Union, can best be conducted under the immediate supervision of the President of the United States.

Geologic Folio and Atlases at Low Cost may be had from the U. S. Geological Survey at Washington, D. C., as a result of the recent fire at headquarters ("Engineering News," May 22, 1913, p. 1098). The following announcement has been made:

The entire basement in which the geologic folios were stored was filled with dense smoke and many of the folios were burned, others scorched and all more or less damaged by water. With the approval of Secretary Lane the Director announces that he will sell the entire remaining stock of some 150,000 folios, four-fifths of which are probably as near perfect as goods usually offered for sale, at the nominal price of 5c. each. The regular retail price of the standard folios is 25c., but a few unusually large folios have been sold for 50c. and the regular price of the "field edition" of the later folios, a more convenient form for use in the field, is 50c. All these are now to be had at 5c. each, but no wholesale rate applies to this fire sale.

Now is the time for students, engineers, and the public generally to order geologic folios to complete their files or to become acquainted with this Government publication, the 188 numbers of which fully describe the geology of some 175,000 sq.mi. of the United States. The stock includes probably 50,000 to 100,000 copies on which the real damage is practically negligible. Application should be made to the Director, U. S. Geological Survey, Washington, D. C., and remittance made by money order or in coin. Lists will be sent on application.

PERSONALS

Mr. Frank W. Buffum, of Louisiana, has been appointed State Highway Commissioner of Missouri at a salary of $3000 per annum.

Mr. Joseph E. Davies, a lawyer of Madison, Wis., has been appointed Commissioner of Corporations, United States Department of Commerce.

Mr. James D. Beaver, formerly Assistant Trainmaster, has been promoted to be Assistant Superintendent of the Pittsburgh, Shawmut & Northern R.R., at St. Marys, Penn.

Mr. James H. Sturdevant, Assoc. M. Am. Soc. C. E., Deputy Superintendent of Highways, New York State, was married on May 31, to Miss Mary P. Holmes, of Summit, N. J.

Mr. A. H. Wheatley, Assistant to the President of the Alaska Northern Ry., has resigned, and the duties of his office will be assumed by Mr. A. W. Swanitz, Chief Engineer.

Mr. H. A. Mentz has been appointed Engineer in charge of the newly opened branch office of the Solomon-Norcross Co., Consulting Engineers, in the Randolph Bldg., Memphis, Tenn.

Mr. Charles Hansel, M. Am. Soc. C. E., Consulting Engineer, of 43 Wall St., New York City, has resigned as Chief Engineer of the Cincinnati Union Depot & Terminal Co., Cincinnati, Ohio.

Mr. R. H. Dwyer, former Division Superintendent of the Missouri Pacific Ry., at Pueblo, Colo., has been appointed Superintendent of Construction of the Tela R.R., with office at Tela, Honduras.

Mr. W. S. Burnett has been appointed District Engineer in charge of construction on the Cleveland-Indianapolis and Cincinnati-Sandusky divisions of the Cleveland, Cincinnati, Chicago & St. Louis Ry., with headquarters at Middletown, Ohio.

Mr. A. M. Turner, Assoc. M. Am. Soc. C. E., formerly Resident Engineer of the Cleveland, Cincinnati, Chicago & St. Louis Ry., at Beach Grove, Ind., has been promoted to be District Engineer in charge of construction on the Chicago, St. Louis, Cairo and Michigan divisions.

Mr. P. J. Carter, who resigned as Office Engineer of the Gulf, Colorado & Santa Fé Ry., at Galveston, Tex., to engage in post-graduate work at the University of Wisconcin, has recently been appointed Office Engineer of the Western Lines of the Atchison, Topeka & Santa Fé Ry., at Amarillo, Tex.

Mr. Frank Beckwith, M. Am. Soc. C. E., Office Engineer of the Chicago, Burlington & Quincy R.R., Chicago, Ill., is reported to have been selected as Chief Engineer of a division of the new Chinese National Rys., about to be constructed. Mr. Beckwith is a graduate of the University of Illinois and has been in railway work in China before.

Mr. Walter W. Curtis, M. Am. Soc. C. E., Consulting Engineer, Chicago, Ill., has discontinued his Chicago office to take charge as President, of the Curtis Coal Mining Co., Colorado Springs, Colo. He will continue, however, to devote a portion of his time to private engineering practice, with headquarters at 1015 North Nevada Ave., Colorado Springs.

Mr. V. D. Simar has resigned as Chief Engineer of the Duluth, South Shore & Atlantic Ry., which position he has held since 1910. Mr. Simar's engineering experience began in 1870 as a chainman with a location partly on the Chicago, Milwaukee & St. Paul Ry. He was Locating Engineer for many miles of various railways west of the Mississippi River.

Mr. Frank W. Pfleging, formerly Signal Supervisor of the Kansas division of the Union Pacific R.R., Kansas City, Mo., has been promoted to be Signal Engineer, with headquarters at Omaha, Neb., succeeding the late J. C. Young. Mr. Pfleging graduated from Rose Polytechnic Institute in 1901, and has since been with the signal department of the Union Pacific R.R.

Mr. E. C. Carter, M. Am. Soc. C. E., Chief Engineer of the Chicago & Northwestern Ry., has been relieved of the active duties of his office in order that he may devote his whole time to special duties in connection with a physical valuation of the railway's property. Mr. W. H. Finley, M. Am. Soc. C. E., Assistant Chief Engineer, will be Acting Chief Engineer.

Mr. George C. Diehl, M. Am. Soc. C. E., County Engineer of Erie County, at Buffalo, N. Y., has been appointed the third member of the advisory board of engineers to make a thorough investigation of the highway problems of New York State. The other members of the board are Messrs. Harold Parker, M. Am. Soc. C. E., and W. D. Washington, as noted in our issue of May 22.

Mr. Henry Welles Durham, M. Am. Soc. C. E., Chief Engineer of Highways, Borough of Manhattan, New York City, has been appointed by Mayor Gaynor to represent the City of New York as delegate to the International Road Congress to be held in London, England, this month. Mr. Durham has also been delegated to make a study of paving and street maintenance in European cities.

Mr. Frank T. Townsend, Assoc. M. Am. Soc. C. E., recently Assistant Engineer, New York State Highway Department, has been appointed Assistant Engineer of the Inspection Department of the Dunn Wire-Cut-Lug Brick Co., Conneaut, Ohio. Mr. Townsend is a graduate of Rensselaer Polytechnic Institute, class of 1904, and has been with the New York State Highway Department for the past five years.

Messrs. Edwin Thacher and William Mueser, M's. Am. Soc. C. E., announce that they have dissolved the partnership hitherto conducted under the firm name of the Concrete-Steel Engineering Co., 21 Park Row, New York City. Mr. Mueser will continue the business under the former copartnership name, and Mr. Thacher will engage in private practice as a consulting engineer with offices at the same address.

Mr. C. G. Elliott, M. Am. Soc. C. E., has resigned as Chief of Drainage Investigations, United States Department of Agriculture, and will devote his time to private practice. Mr. Elliott has for some time been Chief Drainage Engineer of the John L. Roper Lumber Co., and will continue in this position as well as carry on his consulting work. His office is in the McLachlen Bldg., 10th & G Sts., Washington, D. C.

Mr. F. H. Newell, M. Am. Soc. C. E., Director of the United States Reclamation Service, will hereafter be known as Chairman of the newly created Reclamation Commission, under the reorganization of the Reclamation Service. The commission will consist of five members. Mr. George Barton French will have charge of operation and maintenance; Mr. A. P. Davis, M. Am. Soc. C. E., will be Chief Engineer, as at present, and Judge Will R. King, of Oregon, will be Chief Counsel. Another member of the Commission is to be selected by Secretary of the Interior Lane.

Mr. A. Merritt Taylor has been appointed Director of the new Department of City Transit, Philadelphia, Penn., at a salary of $10,000 per annum. Mr. Taylor has held the office of Transit Commissioner under the Department of Public Works since June of last year, but in this capacity had served, at his own request, without compensation except for personal expenses entailed by his work as Commissioner. He was formerly President of the Philadelphia & West Chester Traction Co. If the present plans for improved transit facilities are carried out it is stated that the new department will require the services of 150 engineering employees.

Mr. E. R. Lewis, Assistant to the General Manager of the Duluth, South Shore & Atlantic Ry., has been appointed Chief Engineer, succeeding Mr. V. D. Simar, resigned, as noted elsewhere. Mr. Lewis was born in Raritan, N. J., in 1869. He graduated from Iowa State University in 1890, and received a C.E. degree there in 1896. His engineering experience began in 1885 as an axman on construction of the Missouri Pacific Ry. He was promoted through various positions in the engineering department until 1896, when he resigned to enter the service of the Mississippi River Commission as Division Engineer on levee construction. The following year he resigned this position and went to South Africa as Locating Engineer for the Cape Government Rys., Cape Colony. Mr. Lewis returned to the United States in 1901 as Engineer in charge of construction of the White River R.R. in Arkansas, later becoming Division Engineer on location and construction of the Fort Smith & Western Ry. in Oklahoma. In 1903 and '04 he was again in South Africa as Locating Engineer for the Cape Colony railways. In 1905-'06 he was Assistant Engineer of the Keweenaw Central R.R., at Hancock, Mich., and then Division Engineer of the Michigan Central R.R. Since June, 1912, he has been Assistant to the General Manager of the Duluth, South Shore & Atlantic Ry

OBITUARY

Mosher A. Sutherland, former City Engineer of Passaic, N. J., died May 16. He was born near Geneva, N. Y., and served in the navy during the Civil War.

Louis Hill, a member of the firm, the E. S. Hill Construction Co., railroad contractors, St. Paul, Minn., was killed by a locomotive on some construction work near Great Falls, Mont., on May 22.

Frank H. Myers, formerly Superintendent of the Chicago, Milwaukee & St. Paul Ry., died at his home in Minneapolis, Minn., on Apr. 8 from apoplexy. He was born in 1876 and began railway work at the age of 15, as a telegraph operator.

Archibald Guthrie, head of the firm of A. Guthrie & Co., railroad contractors, of St. Paul, Minn., died, May 15, in Chicago, Ill. He was 69 years old and had been engaged in railway work since 1866, when he began as a laborer in a tracklaying gang on the St. Paul & Pacific R.R. Later he was clerk, brakeman, conductor, purchasing agent and Assistant Superintendent of the St. Paul, Minneapolis & Manitoba Ry. He was a consulting engineer when he became associatd with Foley Bros., railroad contractors. In 1897 he began business for himself under the firm name of A. Guthrie & Co., and also as a member of the firm of Guthrie, McDougall & Co., railroad contractors, of Portland, Ore.

Albert F. Holden, mine manager and owner, died at his home in Cleveland, Ohio, May 8, aged 46 years He graduated from Harvard University in 1888 and took special courses in engineering subjects at the Massachusetts Institute of Technology. Following his school work he went to Utah, where his father had extensive mining interests. Of these properties he was Manager for several years. In 1898-'99 he became associated with Messrs. Clark, Coolidge and Cole, of Boston, Mass., in the organization of the United States Mining Co., which became the nucleus of the present United States Smelting, Refining & Mining Co. He was also extensively interested in Alaska mines. He was owner of the Cleveland "Plain Dealer" and at one time part owner of the Boston "Traveler."

William McMurtrie, a prominent chemist, died at his home in New York City, May 24. He was born at Belvidere, N. J., Mar. 10, 1851, and graduated from Lafayette College in 1871, receiving a Ph.D degree there in 1874. For several years he was connected with the United States Department of Agriculture, and for six years, 1882-'88, he was Professor of chemistry at the University of Illinois. Later he was Consulting Chemist and Second Vice-President of the Royal Baking Powder Co., New York City, and Consulting Professor of chemistry at the Brooklyn Polytechnic Institute. He was a Past-President of the American Chemical Society, a Fellow of the American Association for the Advancement of Science, and a member of other societies and clubs in this country and Europe.

Henry Schlacks, former Superintendent of Machinery of the Denver & Rio Grande R.R., died in Chicago, Ill., May 16, aged 73 years. He was a native of Germany and came to this country as a young man. In 1855 he entered the service of the Illinois Central R.R. as a machinist apprentice. He served in the mechanical departments of various railways in the Central West until 1893, when he was appointed Superintendent of Machinery of the Denver & Rio Grande R.R. Mr. Schlacks leaves several prominent sons, Charles H., Vice-President of the Western Pacific Ry.; Henry J., an architect of Chicago; Joseph T., Vice-President of the McCord Manufacturing Co., of Detroit, Mich.; William J., of McCord & Co., of Chicago; Edward L., in the coal business in Nebraska, and Robert J., a manufacturers' agent in Denver, Colo.

Horace T. Herrick, M. Am. Soc. C. E., Superintendent of the Iowa division of the works of the Mississippi River Power Co., at Keokuk, Iowa, came to an untimely death through contact with electric wires of the Keokuk Electric Co., about 7 o'clock on the evening of May 26. Mr. Herrick was 33 years of age, a graduate of Purdue University and an engineer of great promise. He began work with Hugh L. Cooper, M. Am. Soc. C. E., Consulting Engineer, New York City, about eight years ago, in the drafting office, and since that time had made very rapid progress and developed rare professional and personal qualities, causing his death to be mourned by all of those who knew him. Mr. Herrick's experience involved important work on the McCall Ferry (Penn.) dam, and extensive reconnaissance work in the South and West and in Japan; for the past three years he has been employed on the works of the Mississippi River Power Co. The exact manner

of his death is somewhat in doubt. Transmission line poles of the Keokuk Electric Co. had fallen to the ground and part of the wires had encountered a launch belonging to the Mississippi River Power Co. Mr. Herrick was endeavoring to rescue the launch when a wire carrying 2200 volts came in contact with his hand.—[Contributed by Hugh L. Cooper.]

Henry M. Flagler, famous among railroad men as the builder of the Florida East Coast Ry., died May 20, at his home at West Palm Beach, Fla., at the age of 83 years. He was Chairman of the Board of Directors of the railway at the time of his death and to his financial strength and perseverance is due its recent completion, comprising some of the most remarkable railway construction in the world. Mr. Flagler accumulated a large fortune in the Standard Oil Co. operations, but the last years of his life were devoted almost exclusively to developing the east coast of Florida. Here he built the famous hotels at St. Augustine, Palm Beach, Miami, and other resorts now popular wintering places. His greatest achievement was the construction of the Florida East Coast Ry., which follows the eastern edge of the Everglades for many miles and extends for miles across the sea to Key West. In this railway and its equipment, Mr. Flagler invested nearly $40,000,000. Mr. Flagler began his business career when 14 years old. He became acquainted with John D. Rockefeller in the early days of the petroleum industry and became a member of the firm of Rockefeller, Andrews & Flagler, the germ of the Standard Oil Co. and its many subsidiaries. John D. Rockefeller has written of Mr. Flagler: "He was always on the active side of every question and to his wonderful energy is due much of the rapid progress of the Standard Oil Co. in the early days."

Prof. Francis T. Havard, of the mining and metallurgy department of the College of Engineering, University of Wisconsin, died at his home in Madison, Wis., recently. He was 35 years old and a native of Australia. He attended universities in Australia and Germany. At one time he was in charge of mining interests in South America, and later in Montana. He went to the University of Wisconsin in 1909.

ENGINEERING SOCIETIES

COMING MEETINGS

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 2-6. Annual convention at Chicago, Ill. Secy., T. C. Martin, 29 W. 39th St., New York City.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

OHIO ELECTRIC LIGHT ASSOCIATION.
June 15-18. Annual convention at Cedar Point, Ohio. Secy., D. L. Gaskill, Greenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 411, C. & N. W. Ter. Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Coglony Bldg., Chicago, Ill.

TRAIN DISPATCHERS' ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.
June 20-21. Annual convention at Seattle, Wash. Secy., Jesse A. Jackson, City Hall, Seattle, Wash.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

AMERICAN WATER WORKS ASSOCIATION
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESS.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 17-19. Annual summer meeting at Buffalo, N. Y. Secy., E. A. Scott, 29 W. 39th St., New York City.

INTERNATIONAL GEOLOGICAL CONGRESS.
Aug. 7-14. Twelfth annual session at Toronto, Ont. General Secy., R. W. Brock, Director of Geological Survey of Canada, Ottawa, Ont.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 12-16. Annual convention at Chicago, Ill. Secy., W. O. Thompson, New York Central Car Shops, East Buffalo, N. Y.

National Assembly of Civil Service Officials—The annual convention will be held in New York City, June 12-14.

Air Brake Association—At the annual convention held in St. Louis, Mo., May 8, W. J. Hatch, of Montreal, Que., was re-elected President. The Secretary is Otto Best, of the Nathan Manufacturing Co., of New York City.

Canadian Railway Club—The annual election of officers was held on May 13. The new officers are: President, R. W. Burnett, Master Car Builder, Canadian Pacific Ry.; Secretary, James Powell, Chief Draftsman, Grand Trunk Ry., and Treasurer, W. H. Stewart, Assistant Superintendent of the Canadian Pacific Ry.

International Railway Fuel Association—At the annual meeting held in Chicago on May 21 to 24 (and reported in our issue of May 29), officers were elected as follows: President, Robert Collett, Superintendent of Locomotive Fuel Service, St. L. & S. F. Ry., Springfield, Mo.; Secretary, C. G. Hall, Fuel Agent, C. & E. Ill. Ry., Chicago. The next meeting will be held at Chicago in 1914.

American Institute of Chemical Engineers—The sixth semi-annual meeting will be held at the Engineers' Club in Boston, Mass., June 25-28. Papers will be presented on "The Power Plant," by Perry Barker, of Arthur D. Little, Inc.; "Relation of the Manufacturer to the Patent System," by Dr. W. M. Grosvenor; "Depreciation and Obsolescence," by R. K. Meade; "Legal Control of Dangers to Health in Factories," by Dr. C. F. McKenna; "Some Peculiar Functions of the Retained Expert," by Dr. W. M. Grosvenor, and other papers.

Pacific Northwest Society of Engineers—The annual convention of the society will be held in Seattle, Wash., June 20-21. There will be a discussion of the proposal for consolidating the Societies of the Pacific Northwest. The proposed code of ethics of the Oregon Society of Engineers will also come up for discussion and possible adoption. Papers will be read on the Lake Washington Canal locks and on Cedar River dam of the Seattle water-supply, and these works will be inspected. The secretary is Jesse A. Jackson, City Hall, Seattle, Wash.

International Engineering Congress in 1915—The plans for the organization of the congress to be held in connection with the Panama-Pacific Exposition in 1915, have been perfected. The names of the members of the permanent committee on management were noted in our issue of Mar. 20. This committee has effected a permanent organization, with Prof. Wm. F. Durand as Chairman, and W. A. Cattell as Secretary-Treasurer, and has established executive offices in the Foxcroft Building, 68 Post St., San Francisco. The ten members of the committee, consisting of the presidents and secretaries of the five national societies, will constitute a Committee on Participation, through whom all invitations to participate in the Congress will be issued to governments, engineering societies, and individuals. The personnel of this committee is as follows: Chas. F. Rand, Chairman; Chas. Warren Hunt, Secretary; D. H. Cox, W. F. M. Goss, F. L. Hutchinson, Ralph Davenport Mershon, Calvin W. Rice, Bradley Stoughton, Geo. F. Swain, Robt. M. Thompson.

The actual management of the congress and the work of securing and publishing papers will be in charge of the members of the Committee resident in San Francisco. The work of the resident members has been assigned to different subcommittees, and Chairman Durand has made the following appointments: Executive Committee, W F Durand, Chairman, Ex-officio; W. A. Cattell, Secretary, Ex-officio; E. H. Benjamin, W. G. Dodd, A. M. Hunt; Finance Committee, W. G. Dodd, Chairman, Newton Cleaveland, R. S. Moore; Papers Committee, A. M. Hunt, Chairman, A. L. Adams, H F. Bain, G. W. Dickie, W. R. Eckart, C. D. Marx, C. R. Weymouth; Publicity Committee, W. A. Cattell, Chairman, C. Derleth, Jr., W. S. Noyes, T. W. Ransom; Local Affairs Committee, E. H. Benjamin, chairman, J. G. De Remer, H. P. Frear.

PRICES OF ENGINEERING MATERIALS

PRICE CHANGES AND THE BUSINESS OUTLOOK

Revision of prices this month has, in most cases, been toward lower levels. This is particularly true in the iron and steel market, where there has been a general scaling down of prices for the last five months, but perhaps more severe in the last four weeks. In pig iron, the reduction amounted to approximately $1 a ton. While this has not affected the finished steel market much for the present, it has resulted in a doing away with the premiums for prompt delivery which have been current for so long a time. Coupled with this, however, is an insis ent request for shipments, and comparatively little new business.

The absence of business from the railroads has been responsible for the slowing down in the steel market. Car building, particularly, has been much less active, there being about half as many car orders placed as during the corresponding month of last year. One extremely large order for motive power, however, was by the New York Central and subsidiary lines, amounting to 179 locomotives.

Labor conditions have been more unsettled than at any time in several years. The record of strikes during the month is an extremely long one, and there seemed to be unusual persistence. A few, however, have been settled. In most cases the striking employees are those receiving the lowest wages, and not the skilled workers.

Business conditions are more satisfactory than they were six weeks ago, although the weakness then noted is just now coming to the surface. Men of affairs are recognizing that much of the work which was contemplated this year in the way of improvements to factories, extensions of facilities, additions to railways and the like, must be postponed, and knowing this, they will use of existing facilities.

General business, while not as large as it was three months ago, is much more satisfactory than in the corresponding month last year, and is being done at a better margin of profit.

All reports regarding crop outlook are satisfactory, and, although it is too early to make any careful estimates, the season so far bids fair for the harvest of another satisfactory crop.

Financial conditions are responsible for the delaying of a great many engineering projects which were expected to be completed this year. The recent sale of 4½% city bonds in New York was only slightly above par, and the failure of issue in numerous other localities impressed upon the minds of city administrators that improvements must be curtailed until a fresh supply of capital is saved. The surest check to municipal and state extravagance is, perhaps, in high interest rates for new capital.

The failure of a large railway system, and the appointment of receivers for the protection of bondholders was a feature during the latter part of the month, but this was the result of indiscreet financiering, to say the least, and unwise extensions and enlargements which have characterized so many large enterprises. It is more and more clear that the troubles of the financial community in the flotation of new issues has been largely brought about by the resale of securities long held by European interests. These have to be absorbed by the American market, and the process of absorption is one which only takes place through a marking down of quotations.

Several notable pieces of contract work have been let during the month, including a five-mile tunnel on the Canadian Pacific in connection with an important grade revision, some extremely heavy work on the Baltimore & Ohio, and announcement is made that a progressive program of levee building will be carried on by United States engineers in the lower Mississippi. Road building in Texas is much more active than ever before, but in New York, there is a decided slumping off. In fact, no large contracts have been let this year, and the same is true of Connecticut and Pennsylvania, as road-improvement work has been held up until later in the season. In New York City, contracts for the new subway are not being advertised as rapidly as hoped for, and the $9,000,000 Jerome Park filtration plant has been indefinitely postponed.

LABOR

Contractors do not require as many laborers as last year. This is particularly applicable to workers who have heretofore been content to live in camps, for road work in New York has not started, and most of the contracts let last fall have been rushed throughout the winter. Neither is there as much road work going on in Connecticut or Pennsylvania as last year. In New York City, building is far less active, the aqueduct work did not require as many laborers, nor is there much more work on the subway than a year ago. In consequence, it is fairly easy to secure laborers for outside work.

An epidemic of strikes such as has rarely been seen has spread all over the country. The strike in Paterson, N. J., which has been fostered by the Industrial Workers of the World and has been creating turmoil there for two months, has subsided; and many of the workers have returned to their shops. In Syracuse, there was a serious strike of laborers; on the Long Island R.R. a large part of the maintenance-of-way force was out for a fortnight; a street railway strike in Cincinnati was attended by considerable violence, while the barbers in Brooklyn were out for a fortnight. The clerks on the New York, New Haven & Hartford Ry. have organized in a demand for higher wages, and 8000 men in the building trades are out in Cincinnati. In Philadelphia, dock handlers are out, machinists in Baltimore are striking for eight hours a day at $2.25, and in Halifax, Nova Scotia, there is a strike of street-car workers. Some small strikes have occurred among the aqueduct workers, and on the large estates in Westchester County, N. Y. In Newark, N. J., there was a small strike among the laborers.

Coupled with this is a report by Judge Gary of the U. S. Steel Corporation that laborers in the steel works were never so loyal, and so well satisfied with their wages. In fact, there have been rumors of a strike in one plant among the workers, who wished to labor seven days in the week, and receive proportionately higher wages. In Logansport, Ind., a similar strike occurred. The men have been getting $7 a day, but working only four days a week, and they wished either steadier work at lower wages, or more pay for the same work. The scarcity of coal miners is noted in practically all coal districts.

CEMENT, LIME AND BRICK

Portland Cement—Conditions in New York show little change compared with last month, the general opinion being that orders so far have been a disappointment. On the other hand, it is pointed out that stocks of cement at the mills are much smaller than they were a year ago, and, in consequence, it is not likely that there will be any large surplus late in the year. The experience of some manufacturers of cement who have started to buy from other manufacturers in large quantities, indicate that conditions are not as bad as they are painted. Construction work in New York is less active, but outside of New York, there is considerably more activity, and for each dollar of construction work this year, more cement is used than was the case two or three years ago. The growth is slow, but it is steady. In New York, quotations are unchanged at $1.58 per bbl. This is equivalent to a price of 98c. per bbl. in bulk at the mill, with an allowance of 10c. per bag by manufacturers for each bag returned, but dealers only allow 9c. per bag.

A special letter from a mill in the Lehigh Valley district makes the following comment: "Production in the Lehigh Valley has been unusually heavy so far this year, and there is a good stock on hand, so that any further advance in price by summer is not anticipated. On the other hand, labor conditions in the mill are not all that could be desired, and should there be any trouble, or inability to secure sufficient laborers, there may be a shortage of cement in the fall."

From the Missouri district, comments are as follows: "A shortage of cement in this territory is unlikely, for seven plants in the State of Kansas are shut down, and should all of them be running, there would be 40% over capacity. At the same time, there is likely to be a shortage of railroad cars in the fall, which will have considerable influence on the situation. It would not be surprising if quotations should advance from 10 to 15c. per bbl. within the next thirty or sixty days. The present quotation is $1.15 per bbl. in bulk at the mill, but because of unequal freight rates the price at some mills is nearer $1."

From the South and East, the report is to the effect that there is little likelihood of there being a shortage or a decided increase in the consumption, and quotations are steady at 90c. to $1 per bbl. in bulk at the mills. In Texas, no shortage is anticipated, but an advance is expected, and a decided increase in consumption over a period of years. The quotation there is $1.20 per bbl. in bulk at the mill. In the Oklahoma district, a shortage of cars is more likely than a shortage of cement, but it is expected that there will be an increase in the demand next year. The average price there is $1.05 per bbl. in bulk at the mill. In Michigan, no shortage is anticipated, nor is any advance expected, but it is believed that there will be an increase in consumption the next few years. The price ranges from 95c. to $1 per bbl. in bulk at the mill.

Los Angeles, Calif., reports a price of $1.25 per bbl. in bulk at its mill.

In Chicago there is an excellent business with prices from $1.05@1.10 in bulk.

In Boston, Portland cement in wood is $1.72, less 40c. for bags returned. In paper, the quotation is $1.42. In Pittsburgh, the price is $1.58, less 10c. for bags returned.

The figures of the U. S. Geological Survey have recently been issued, showing that the total production of cement in 1912 was 83,351,000 bbls., valued at $67,000,000, compared with 79,540,000 bbl. in 1911, valued at $66,000,000. In other words, the increase in the quantity was 4.78%, while the increased value was 1.13%.

Natural Cement—Business is fairly active, and prices are unchanged at 95c. per bbl. in New York, and $1.10@1.15 in Boston.

Lime—The market is steady and without change from last month as follows: State common, 200 lb. net, 97c. per bbl.; the former brand Rockland-Rockport, special, 300 lb., has been succeeded by the brand "300 Star," $1.37; finishing 300 lb., $1.55, an advance of 15c.; finishing 200 lb., $1.10, an advance of 8c.; 350 lb., $1.72, an advance of 10c.

Plaster Blocks—Prices are without change, and the market is fairly active, quotations being as follows:

	Weight, per sq.ft., lb.	Price, per sq.ft., cents
2-in.	7	6
3-in.	8½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13½ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

Plaster boards, ⅝ in. thick, are 16c. per sq.yd.

Brick—The market in New York is not especially active, but, on the other hand, there is no large over-supply of brick, and the same condition prevails at the yards. In spite of the

prospect of a dull season at the Hudson River brick yards this year, it is noticeable that laborers are difficult to secure, and even then are unwilling to work. Under normal labor conditions, there would likely be a large surplus of brick on the market, but, due to the fact that there is so much unrest, it will not be at all surprising if there should be a slight scramble for brick later in the year. Prices are somewhat firmer at $7 to $7.50 per thousand in New York.

STONE

Blue Stone—Business is normal and the orders being received, are generally for scattering lots, and do not portend any exceptional trade during the season. Prices are steady. Quotations in New York are at 19@20c. for flagging 3 in. thick delivered alongside of dock or f.o.b. cars, New York. Sewer bottom, 5 ft. square and 3 in. thick, are sold at 25c. per sq.ft. for large quantities. Curbing, 5x16 in., is 45c.; 5x20 in., 50c.; 6x16 in., 55c.; 6x24 in., 70c., f.o.b. New York. These prices are per lin.ft.

Promiscuous shapes of building and foundations stone sell at 70@75c. per cu.ft.

Granite—The falling off in the demand for granite in the vicinity of New York has been much greater than formerly and comparatively few buildings now use any large quantity of granite. At the same time, owing to the renewed demand for granite in other forms, the price is steady at 40 to 50 cents per cubic foot.

Limestone—There is less inquiry for limestone and several of the stone yards are shut down. Prices continue steady and unchanged at 80 cents to $1 per cu.ft. for limestone in the rough delivered alongside of dock. Dressed stone in New York is quoted at $1.40 to $1.60.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—There is not as much business as there was a year ago this time, and all shippers of crushed stone in the New York market are disappointed. Then, too, there is far less demand for road work than was formerly the case, new highway construction being held up in New York and in adjacent states. Subway work promises to open in the fall but comparatively little stone will be used on this work. There are a good many large orders in the market which are somewhat below the existing quotation. These are being specified on only sparingly.

Dealers are able to make shipments promptly at about the following quotations: 85 to 95c. per cu.yd. for 1½-in. stone; 90c. to $1 for ¾-in stone, and the same price for screening. These quotations are for full cargo lots delivered at the principal docks in Manhattan or Brooklyn, and, often when there is shallow water or an unfavorable dock, the quotations are somewhat higher.

Sand—Business did not open as was expected; in fact it is considerably less active, but prices are maintained for the reason that there would be no advantage in reducing quotations and protection is given to old contracts some of which were made at slightly lower figures. Price in full cargo lots delivered alongside of dock is 50c. per cu.yd.

Gravel—Quite a little material is required on subway work, but most of the large excavation work for foundations where gravel is required, has been finished and the demand is far less active than last year. Dealers in this class of material expect an improvement in business later in the year. In the meantime quotations are maintained at 85 to 90c. per cu.yd. delivered alongside of dock in full cargo lots of 500 cu.yd.

IRON AND STEEL

Pig Iron—Markets have been weak throughout the month, with prices continually lower and consumers making almost no purchases for future delivery. Practically all of the larger melters of iron have enough material on hand to supply their needs until the first of July, and with each succeeding price named lower than the preceding one there is no incentive to buy for the future. Production seems to be running ahead of consumption, and the figures compiled from authoritative sources show a production of approximately 2,800,000 tons for the month of April. In May the output was probably reduced somewhat, but not by a large amount. It is believed that a buying movement in iron will commence some time in June, and perhaps at a lower level of prices, but it is scarcely to be expected that present quotations will be very much further reduced. It is well to note that prices of iron have declined from $2 to $3 per ton, compared with the high figures recorded in December. Quotations for lots of 500 tons and over from the points named are as follows: Cincinnati, Southern Foundry No. 2, $14.75@15.25, a decline of 50c.; Southern Foundry No. 4, $14.25@14.75, a decline of 50c., following one of $1 a month ago; Northern Foundry No. 2, $16.25@$16.75, a decline of 50c. and No. 2 is $16@16.50, a decline of 25c. In New York, Northern Foundry No. 2 sells at $16.75@16.75, a decline of 50c.; Northern Foundry No. 2X, $16.75@17.25. In Chicago, No. 2 Northern Foundry is $16@16.75, a decline of 75c. and No. 2 Foundry is $15.50@16. In Pittsburgh, bessemer iron is $17.50, a decline of 10c. and basic, $15.90, a decline of nearly $1. These prices include the freight rate from the valley to Pittsburgh. In Birmingham, still lower quotations have been made, and some furnaces in that district have sold at $11.50@12.

Steel Rails—The demand for rails has fallen off to a marked degree. Even the traction companies, which had given indications of buying goodly quantities, have refused to come into the market. As far as steam railroads are concerned, there has been very little new business. There has been some business but of a miscellaneous character, amounting to very little in the aggregate. Neither has any export business developed. Even the demand for light rails, which have been sustaining the market for some time, has not been in evidence this month.

Prices are unchanged on a basis of $28 for standard sections of bessemer rails, and $30 for openhearth rails. Girder rails in 20-ft. lengths are $36.40 per gross ton, and 60-ft. lengths $38.40 per gross ton, f.o.b. New York. Other quotations f.o.b. Pittsburgh are as follows: Standard sections, 16 and 20 lb., $1.20; 12 and 14 lb., $1.25; 8 to 10 lb., $1.10. In New York, relaying rails are held at $22@22.50, and Chicago standard-section relaying rails are held at $21.

Track Supplies—Business is not nearly as active as a month ago, and railroads are not urging deliveries as they were. There seems to be a general slowing down of repair work on railways, as well as new construction work. The contracts for new railway work which have been let in the last few weeks have been insignificant, compared with recent years, and new railway projects are comparatively few, which indicates that there may be much less of this work in the near future.

Quotations are as follows: Spikes in large lots to railroads in Pittsburgh, $1.80; small contracts, $1.90@2. In Chicago, $1.95@2.05. Track bolts with square nuts in Chicago are $2.30@2.40, and angle bars, $1.50. These quotations are per 100 lb. The Lake Shore recently placed an order for 1100 tons of tie plates, probably the largest ever booked. Quotations are steady at $33@35 per net ton. The extras on railroad and boat spikes are as follows:

Railroad spikes	Cents
3, 3½, 4, 4½ and 5x½	Extra .10
2½, 4 and 4x⅝	Extra .20
3, 3½, 4 and 4½x⅝	Extra .30
2½x¾	Extra .40
2½, 3 and 3½x¾	Extra .60
2x⅞	Extra .80

Structural Materials—Business has been exceedingly quiet, there being little new building in New York, although hope is held out that the new Equitable structure will be started this summer. There is an endeavor on every hand to close up existing contracts, and because the financial interests in New York have refused to advance funds for many types of structures it will be several months before building activity in that part of the country starts anew. In other parts of the United States conditions are somewhat similar. Bridge material is in light demand, the railways are unable to finance their requirements and building is inactive, the buying of cars being about half what it was a year ago.

Quotations are easier, especially for future delivery. The premiums are disappearing. Future shipments of angles and beams are 1.45c. Pittsburgh, and prompt deliveries can be had at 1.50c., which is a reduction in the premium of $3 to $4 per ton. Other quotations are as follows: I-beams over 15-in., H-beams over 14-in., angles over 6-in., $1.55; deck beams and bulb angles, $1.75. The following extras are named for cutting the specified length. Under 3-ft., 25c. per hundred pounds. Under 2-ft. and more than 1-ft., 50c. per hundred pounds. Less than 1 ft., $1.55 per hundred pounds. No charge is made for cutting special lengths 3 ft. and over. The base price for beams and angles, Chicago delivery, is 1.63@1.68c.; jobbers' stock in that center is $2.05.

Cast-Iron Pipe—In the Middle West there seems to be a fair degree of activity, but in the East numerous complaints are made that pipe is a drug on the market. The city of San Diego, Calif., has awarded a contract for 5000 tons to the U. S. Cast Iron Pipe & Foundry Co.; Evansville, Ind., 1100 tons, and 4000 tons will be required in Cincinnati, Ohio. In the East the only order of importance is 600 tons of 36-in. pipe for Newark, N. J. Quotations are as follows per ton of 2000 lb.:

Chicago, 4-in., $28.50; 6- to 12-in., $26.50; 16-in. and larger, $25.50.

Birmingham, Ala., 4-in. is $22.50; 6-in., $21.50.

New York, N. Y., 6-in. is $23@24.

Gas pipe is $1 per ton higher in all markets in standard sizes.

Pipe—While discounts are sometimes shaded, particularly for the larger sizes of pipe, there has been no out-and-out cutting, and on the whole prices are fairly well maintained. New business is not in large volume, being far below shipments, and few inquiries have been recently entered. One company in the Pittsburgh district is in the market for 30 to 40 miles of pipe 8 to 12 in., but aside from this there is practically no business. Discounts and net prices, as stated, are unchanged as follows:

	Black	Galvanized
¾- to 2-in. steel butt welded	79½%	71%
2½- to 6-in. steel lap welded	78½%	70%
7- to 12-in. steel lap welded	75½%	65%

At these discounts the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
¾-in.	2.35	3.35	5-in.	31.80	44.50
1-in.	3.50	4.90	6-in.	41.50	58.50
1¼-in.	4.73	6.57	7-in.	58.00	83.50
1½-in.	5.56	8.00	8-in.	61.00	87.50
2½-in.	12.60	17.50	10-in.	1.00	$1.44
3-in.	16.50	23.10	11-in.	1.14	1.62
4-in.	23.30	32.80	12-in.	1.24	1.81

Piling, Sheet Steel—The volume of business taken this month was insignificant, compared with that of the preceding one. No larger orders of any consequence have been booked, save those mentioned in the report of May 1. Prices are firm at 1.60c. Pittsburgh, and stocks are sufficient for any demand that is likely to arise.

Rivets—Manufacturers are not troubled in making deliveries, but they would like to have more business on their books. Quotations are fairly steady at 2.20c. for structural rivets, and 2.30c. for cone-head boiler rivets. These prices are for large lots f.o.b. Pittsburgh.

Castings, Gray Iron—Business is less active, particularly in rough castings for general building work, and these are held at 1.75@2.25c. per lb. Castings for footings, manhole covers and outside work, are 1.65@1.90c. per lb. Castings for heavy machinery and lock gates where the material is large and the order desirable can be had at 2.25c. Intricate castings commandd 3@6c. per lb., depending on the size of the order and the shape of the pattern.

Sheets—Business is fairly satisfactory, and some of the rumors which have been spread throughout the steel trade regarding the drastic cutting of prices are absolutely without foundation. The American Sheet & Tin Plate Co. had nearly half of its Vandergrift mills idle for lack of steel during the month, but as a general rule, this company is operating to about 70% of capacity. Shipments are much better, and deliveries are made six to eight weeks after specifications are received. Some of the mills which were getting substantial premiums two months ago are now cutting prices. Quotations are unchanged from last month, and are as follows f.o.b. Pittsburgh and Chicago in cents per pound:

Nos.	Carload lots, Pittsburgh Black	Carload lots, Pittsburgh Galv.	Small lots, Chicago Black	Small lots, Chicago Galv.
10 and 11	2.00	2.50		
12	2.00	2.60	2.70	3.35
13 and 14	2.05	2.60	2.75	3.35
15 and 16	2.10	2.75	2.85	3.45
17 to 21	2.15	2.90	2.90	3.60
22 and 24	2.20	3.05	2.95	3.75
25 and 26	2.25	3.20	3.00	3.90
27	2.30	3.35	3.05	4.05
28	2.35	3.50	3.10	4.20
30	2.50	3.80	3.50	4.60

Corrugated Roofing—The net extras on roofing above the price of flat sheets are as follows: Corrugating, 2-in., 2½-in., 3-in., 5-in., 5c. per 100 lb.; single V-crimped, without sticks, 5c. per lb.; corrugating, 1½-in., 10c. per 100 lb.; painting roofing, 5c. per 100 lb. for 12 to 18 gage; 10c. per 100 lb. for 19 to 24 gage, and 15c. per 100 lb. for 25 to 28 gage.

Plates—All manufacturers are catching up with the orders on their books with astonishing rapidity, and new orders are not coming in in any large volume. Likewise orders for cars are still below normal, although about 3000 were purchased in the last week. One of the largest equipment orders that has been on the books in a long time was from the New York Central for 179 locomotives. Some activity is observed in the line of shipbuilding work; otherwise the situation is extremely quiet.

The premiums have not diminished much in the last month, although there is little demand, but prompt shipments are quoted at 1.50c. Pittsburgh, and future deliveries at 1.45c. in New York prompt shipments are 1.76c., and future delivery, 1.61c.

Old Materials—The markets have been quiet and prices have declined steadily throughout the month, with the lowest figures reached in the last few days. Consumers are not only refusing to buy more, but are requesting that shipments on purchases already made be deferred. Mills are badly congested with raw material. In New York quotations per gross ton are as follows:

Heavy-melting steel scrap	$9.50@10.00
No. 1 railroad wrought	12.25@12.75
Pipes and flues	9.50@10.00
Cast borings	6.00@ 6.50
Machinery cast, broken up	11.00@11.50
Stove plate	8.75@ 9.25
Malleable castings	10.00@10.50
Wrought turnings	6.00@ 6.50
No. 1 yard wrought, long	11.25@11.75
No. 1 yard wrought, short	10.25@10.75

In Chicago the market is very dull with only some desultory trading between dealers and an occasional order from a customer. The railways continue to offer scrap freely and appear willing to accept current prices. Quotations in Chicago are as follows:

	Per gross ton
Heavy-melting steel scrap	$10.75@11.25
	Per net ton
No. 1 railroad wrought	$11.00@11.50
No. 2 railroad wrought	10.50@11.00
No. 1 cast scrap	11.50@12.00
Pipes and flues	8.25@ 8.75
Agricultural malleable	10.50@11.00
Railroad malleable	11.75@12.25

In Pittsburgh, markets are just as lifeless as they have been for the last month or so, but prices continue to decline. Heavy-melting steel scrap is now 75c. a ton below the price of last month, and more than $2 per ton under the high figures reached in December. The sharpest decline was in old car wheels, which dropped $1.50 per ton. Quotations in the Pittsburgh market are per gross ton as follows:

Heavy-melting steel scrap	$13.40@13.75
Rerolling rails	15.00@15.25
No. 1 cast scrap	13.75@14.00
Old car wheels	9.00@ 9.25
Machine-shop turnings	7.55@ 8.00
Stove plate	9.50@ 9.75

Wire Rope—Prices are without change. The discount to the larger trade is 42½ and 5% from list, for galvanized, and 50 and 5% for bright.

The net prices of wire rope are as follows:

Diameter in.	Price per ft. Cast steel	Crucible steel	Plow steel
2½	$1.05	$1.24	$1.46
2¼	.85	1.05	1.22
2	.57	.65	.76
1¾	.55	.59	.64
1½	.32	.39	.45
1¼	.23	.28	.32
1	.15	.18	.21
¾	.10	.11	.13
⅝	.07	.09	.10
½	.06	.07	.07

Steel Shapes—Stocks in jobbers' hands are well assorted and buying is good. Many consumers are buying small lots for immediate needs from these interests in preference to placing large orders at existing prices. Quotations are as follows:

Refined iron:	Per lb.
1 to 1⅞ in., round and square	2.10c.
1½ to 4 in. x ⅜ to 1 in.	2.10c.
1½ to 4 in. x ¼ in. to ⅛ in.	2.30c.
Norway bars	3.60c.
Soft steel:	
¾ to 3 in., round and square	2.05c.
1 to 6 in. x ⅜ to 1 in.	2.05c.
1 to 6 in. x ¼ and ⅛ in.	2.20c.
Rods—⅝ and ½ in.	2.15c.
Bands—1½ to 6x⅛ in. to No. 8	2.35c.
Beams and channels—3 to 15 in.	2.15c.
Angles:	
3 in. x ¼ in. and larger	2.15c.
3 in. x ⅜ in. and ⅛ in.	2.55c.
1½ to 2½ in. x ⅛ in.	2.30c.
1½ to 2½ in. x ⅛ in. and thicker	2.20c.
1 to 1¼ in. x ⅛ in.	2.30c.
1 to 1¼ x ⅛ in.	2.35c.
Tees:	
1½ to 2½ x ¼ in.	2.25c.
1½ to 2½ x ⅛ in.	2.35c.
3 in. and larger	2.25c.

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

⅜ in.	$7.50
¼ in.	4.95
⅜ in.	3.95
½ in.	3.40
⅝ in.	3.20
½ and ⅝ in.	3.00
⅝ and ¾ in.	2.90
¾ and ⅞ in.	2.80
⅞ and 1 in.	2.70
1 to 1¼ in.	2.60
Extras for BB	
⅜ in.	1.50
¼ in.	1.50
⅜ and larger	1.25
Extras for triple B (BBB)	
⅜ and ¼ in.	2c.
⅜ and larger	1.75c.

Freight Rates—The freight rates on finished-steel products, from the Pittsburgh District, including plates, structural shapes, merchant steel and iron bars, pipe fittings, plain and galvanized wire, nails, rivets, spikes and bolts (in kegs), black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandaigua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 50, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter in in.	Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete: Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	16	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.10	74.22
10	14	66.42	71.08	98.15
11	14	71.20	76.57	102.24
12	14	83.75	89.15	118.30
13	14	89.67	96.55	127.98
14	14	99.14	105.51	138.85
15	14	108.05	114.89	151.92
16	14	117.53	124.82	166.58
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	301.32	314.89	395.37
30	10	324.81	399.15	430.64

*Made in both lighter and heavier gages at corresponding differences in price.

Lag Screws—The net price of lag screws has been advanced. Quotations per 100 lb. f.o.b. Pittsburgh are as follows:

Length in.	Diameter in inches: ½ in.	¾ in.	1 in.
3½	$1.14	$2.24	$4.50
4	1.21	2.36	4.76
4½	1.20	2.50	5.02
5	1.35	2.57	5.28
6	1.50	2.92	5.80
7	1.69	3.20	6.32
8	1.78	3.48	6.84
9	1.93	3.76	7.36
10	1.97	4.04	7.88
11	2.21	4.32	8.40
12	2.36	4.69	8.92

Switch Points—The following prices are named f.o.b. mill, for switch points in lots of ten or more pairs: for 60-lb. rail, 10-ft. points, $16.25; 15-ft. points, $17.50. for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25; for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points, $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Nails—Business has not been as active as last month, although specifications received by the mills have been fairly satisfactory. Stocks in jobbers' hands are ample for current needs, and retailers likewise seem to be well supplied. There seems to be a slowing down in the demand.

Quotations are without change as follows: Wire nails in large lots, $1.80 Pittsburgh. In Chicago, carload lots to retailers are $2.03; less than carload lots, $2.08. In New York wire nails from store are $2.10 and cut nails are $1.75 to $1.80 in Pittsburgh and $2.10 in New York. All of these quotations are per keg of 100 lb.

Coke—A fair degree of activity has been observed in the last fortnight and one large steel company closed for a fair supply for the last half of the year at $2.25 per net ton at oven. Prices for prompt delivery are firm at $2.15 to $2.25, and the latter quotation seems to be the standard one for the last half delivery. For 72-hr. foundry coke quotations are steady at $3 to $3.20 per net ton at oven and several contracts have been made for last half delivery at $3.20. The output of coke in the upper and lower Connellsville region is running at the rate of about 410,000 tons weekly.

Wire—The demand is very quiet and specifications against old contracts are coming in slowly. This is not at all satisfactory and it would not be at all surprising if a sharp cut would be made in quotations shortly, if the volume of business does not improve.

Quotations are without change as follows: Plain barbed wire in large lots in Pittsburgh is $1.80; galvanized $2.30; annealed fence wire in carload lots, $1.60; galvanized $2. In Chicago annealed fence wire is $1.78 and galvanized $2.18. Barbed wire in that market is $1.98 and galvanized, $2.38. All of these quotations are per 100 lb.

REINFORCING MATERIALS

Bars, Concrete Reinforcing—The expected heavy demand did not materialize. There has been a fair amount of buying and specifications on old contracts have been liberal, but the market lacks snap and the advantage is distinctly with the buyer.

The base price in Pittsburgh is 1.50c. for mill shipments. Other quotations are as follows in cents per pound:

	Mill shipments f.o.b. Pittsburgh	From warehouse Pittsburgh	From warehouse New York
¾-in. and larger.....	1.50	1.95	2.25
⅝-in.	1.55	2.05	2.30
½-in.	1.60	2.15	2.35
⅜-in.	1.70	2.25	2.45
¼-in.	2.00	2.50	2.75

Bars from stock, Pittsburgh, are usually cut to the required length, without extra charge.

Triangular Mesh—Manufacturers of this reinforcing material make shipments from warehouse promptly, but direct shipments from the mill are subject to a delay of approximately two weeks. Stocks are fair, the demand is seasonably large but not record breaking, and prices f.o.b. Pittsburgh continue steady and unchanged from last month as follows:

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material—Carload lots	Plain material—Less than car lots and over 10,000 sq.ft.	Galvanized—Carload lots	Galvanized—Less than car lots and over 10,000 sq.ft.
*4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 150, 300 and 600 ft

METALS

Copper—A good demand from both domestic and foreign consumers during the first half of May put sellers of copper in a strong position. Electrolytic copper was advanced to 15.87½c. delivered 30 days, and later to 16c. cash by the leading interests. Although resale lots and some offerings by first hands sold at around 15.50c. cash, New York during the last half of the month in the main, the higher quotations were maintained up to the close. Heavy exports were a feature of the industry in May. The total shipments to Europe according to Custom House returns is close to the largest on record, being in excess of 55,000,000 lb. Notwithstanding the enormous aggregate of metal shipped abroad since Jan. 1, foreign stocks have continued to decline, according to the statistics published there. Deliveries in May were 61,000 tons, or 3640 tons greater than supplies.

Domestic stocks declined 28,700,000 lb. during April and the known movements of copper since May 1 indicate a further decrease. Combined shipments into home consumption and for exports in April amounted to 164,053,564 lb. and production was 135,333,402 lb., making stock as of May 1, 75,549,108 lb.

Tin—Although the London pig-tin market covered a range of over £19 on large daily transactions, the business was chiefly speculative, and denoted little change in consumptive demand abroad. In the local trades business was the smallest of any month this year, domestic consumers apparently anticipating a let up in the demand for their products. During the last week of May the foreign market suffered a decline of about £10 and local prices about 2c. per lb. At the lower level there is more interest manifested by consumers. As stocks have been reduced to a low point it is probable that advantage will be taken of the decline to replenish them. Spot and June tin was offered at 47c. in the local market and in London spot closed at £212-10 and futures at £209-5, on June 2. The prices compare with 50c. and £232 for spot metal at the beginning of May.

Deliveries into domestic consumption in May amounted to 3350 tons and arrivals were 3022 tons.

Lead—The American Smelting & Refining Co. revised the price of shipment lead to 4.35c. early in May and the general selling trade followed with equivalent reductions. A fair demand prevailed for the metal and prices were maintained at that level up to the close of the month.

Spelter—Successive cuts in quotations by all sellers of spelter failed to attract business. At the end of May offerings were made at 5.35c. in New York compared with 5.55c. at the beginning.

Miscellaneous Metals—Small lots of metals and metal produced are sold at the following quotation:

	Per lb.
Bismuth	$2.25
Brass tubes, iron-pipe sizes:	
½-in.	.23
¾- to 3-in.	.22
3½-in.	.23
4-in.	.23
Brass rods	.18¼
Brass sheets	.18½
Solder, half and half guaranteed	.32
Zinc sheets	.10¼
Manganese bronze rods	.18¾
Manganese bronze in crucible form	.16¾

Old Metals—The market is steady and prices are slightly easier. Dealers, in New York, buy small lots at the following price:

	Cents
Copper, heavy and crucible	14.25
Copper, heavy and wire	13.73
Coper, light and bottoms	12.50
Brass heavy	8.75
Brass, light	7.50
Heavy machine composition	13.50
Composition turnings	11.00
Lead, heavy	4.00
Lead, tea	3.75
Zinc scrap	4.50

MILL SUPPLIES

Belting—The market is much less active than last month but quotations are well maintained.

Discounts on leather belting are as follows: Extra heavy, 50 to 50 and 5%; heavy, 50 and 10 and 5 to 60%; medium, 60 and 10 to 60 and 10 and 5%; light, 60 and 10 and 10 to 70%; Standard, 70 to 70 and 10%.

Discounts on rubber belting are likewise without change, the best grades being held at 40 and 10 to 50%; Standard 50 and 10 to 60% and competitive grades are 60 and 10 and 10% to 70%. The following net prices per foot of rubber belting are computed at the above discounts:

The net prices per foot of rubber belting figured at the above discounts are as follows:

RUBBER BELTING, NET PRICE PER FOOT

Width, inches	2-ply	4-ply	6-ply	8-ply
3	$0 16	$0 22	$0 33	....
4	0 21	0 30	0 45	....
5	0 26	0 41	0 55	....
6	0 30	0 51	0 65	$0 87
7	0 36	0 55	0 75	1 01
8	0 40	0 57	0 87	1 15
9	0 46	0 64	0 96	1 30
10	0 51	0 72	1 01	1 44
12	0 60	0 86	1 30	1 70
14	0 72	1 01	1 53	2 01
16	0 83	1 17	1 76	2 35
18	0 93	1 34	2 00	2 65
20	1 04	1 49	2 25	2 98
22	1 17	1 67	2 50	3 33
24	1 30	1 85	2 76	3 70
26	1 42	2 01	3 06	4 08
28	1 58	2 22	3 33	4 45
30	1 69	2 40	3 60	4 80
34	1 94	2 79	4 16	5 54
38	2 22	3 15	4 70	6 30
42	2 46	3 50	5 30	7 00
46	2 75	3 88	5 80	7 72
50	3 02	4 25	6 40	8 50
56	3 40	4 80	7 20	9 60
60	3 67	5 20	7 80	10 40

Shafting—The largest order received in a long time was from the makers of the Ford automobile, amounting to 4000 tons.

Discounts are unchanged at 58% from list in carload lots and 53% from list in less than carload lots. Business is fair.

The following net prices per foot are based on the discount of 53%:

Diameter in inches	Cents per foot	Diameter in inches	Cents per foot
¾	4 25	2¼	31 50
1	6 85		
1¼	10 80	2½	39 30
1½	14 05	2¾	48 00
1¾		3	56 50
2	25 00	3½	84 00

LUMBER

The market is quiet with little demand. Prices on the whole may be said to be steady, though some grades have declined during the month. The cause of this present state cannot be laid to any one thing, but is just the result of general conditions throughout the country.

Spruce—Fair business is noted, with prices steady. Yard quotations in New York are as follows:

2x10-in. }
3x10-in. } 12 to 16 ft..... $35
4x10-in. }
2x12-in. }
3x12-in. } 12 to 16 ft..... $37
4x12-in. }

For 18 and 20 ft., $37; for all lengths over add 50c. for every additional foot.

Flooring—Flooring is in good demand.

Quarter-sawed oak flooring, A1, is $88 per M. Selected white-oak or red-oak flooring is $55 per M., and common flooring, red or white, is $30 per M.

Maple flooring, ⅛x2¼-in., is $55 for clear; $50 for No. 1, and $28 for factory. Long-leaf yellow-pine flooring, ⅛x2½-in. face, is $60@65 for A heart rift; $50@55 for sap rift; $36 for No. 1 flat; $32 for No. 2, and $30 for No. 3.

Hemlock—Trade is not up to the usual mark, but prices are quoted firm.

Price per M., f.o.b. cars, New York:

	Length			
	10 ft.	12 ft.	14 ft.	16 ft.
2x4-in.	$27	$25	$25	$27

Long Leaf Yellow Pine—Pine of all grades is in very good demand with prices above normal. The opening of heavy outside construction work during the coming months is expected to call for large quantities.

Prices per Thousand Feet in Yard, New York.

	Length			
	20 ft. base	21 to 25 ft.	26 to 30 ft.	31 to 35 ft.
2in. thick and under by 8 in. wide and under	$36	$36	$36	$38
10 in. wide by 10 in. thick and under	42	42	42	45
12 in. wide by 12 in. thick and under	42	42	43	45
14 in. wide by 14 in. thick and under	47.50	48	50	50
16 in. wide by 16 in. thick and under	50	52	54	60

Shingles—There is almost no business now being booked, and all grades are exceptionally quiet. Why this is so, no one can fully say, but the cause is being laid mainly to uncertain weather conditions which prevailed all during May, and general business conditions. The outlook is that business must pick up and that the summer months will have a stimulating effect on the market, though no advance of prices is expected for some time. Quotations are steady at the following: Cypress shingles, New York: 7x24-in., rived and shaved, $23.5@24 per M.; 21-in., promiscuous widths, rived and shaved, $8 4-in. basis; 6x20-in., sawed $12 per M.; 6x18-in., sawed, $8.50 per M.; 5x18-in., sawed, $7.50 per M.

Piling—Conditions are unchanged with a firm market. In New York, the price of oak piling is 22@25c. per lin.ft. Oak piles 14 in. in diameter, 2 ft. from butt with a 6-in. top, and 40 to 45 ft. long, are held at $10.50@11.50; 50 ft. long, 25c. per lin.ft. Pine piles, 25 ft. long, 12 in. in diameter, 2 ft. from butt, with a 7-in. top, held at 17c. per lin.ft., while those 25 ft. long are 16c. In general, pine piles can be had at 16@17c.; oak piles, 55 to 60 ft., are quoted at 23c. per lin.ft.

Cross Ties—The market is firm but quiet. This is the closed season of the year and no orders of any consequence will be received until the fall. Shippers are busy filling the heavy contracts which accumulated last winter and ties are now being delivered in great quantities. Prices are steady with no change expected. The following quotations are now being given by G. S. Baxter & Co., 15 William St., New York, for all orders:

	Cents each
7x9 in. by 8 ft. 6 in.	88
6x9 in. by 8 ft. nominal	83
6x8 in. by 8 ft.	78

OILS AND PAINTS

Avenarius Carbolineum—This is sold in barrel lots at 80c. per gal, f.o.b. New York. In half barrels, 25 and 14 gals., at 85c. per bbl. New York.

Linseed Oil—Business shows more activity and prices are steady. There has been an absence of violent fluctuation during the last few months which has given buyers much confidence in the market. Quotations are firm at 48@49c. for city raw. In Chicago the price is 45@46c. per gal. These quotations are for 5 bbl. lots.

Paints—A much better demand exists than last year. Prices are steady in New York as follows: White lead in oil in 100-, 200- and 500-lb. kegs is 7¼ to 7½c. per lb.; in 25- and 50-lb. kegs, 7¾c. per lb. Red lead and litharge in 100-lb kegs is 7@7½c. per lb.

Hydrex preservative paint is 75c. per gal. in bbl. lots, New York City.

Colors in oil are quoted at the following prices per lb.: Lamp black, 12@14c.; Chinese blue, 36@46c.; Prussian blue, 32@36c.; Van Dyke brown, 11@14c.; Chrome green, 12@16c.; raw or burnt Sienna, 12@15c.; raw or burnt Umber, 11@14c.

Petroleum Products—Strenuous efforts are made by producers in all the existing oil fields to increase the production and to extend operations. These operations have not been especially successful.

Quotations for crude oil at the wells are firm but unchanged from last month as follows: Pennsylvania Second Sand and Tiona, $2.50; Mercer black, New Castle and Corning, $2; Illinois, $1.30; Kansas and Oklahoma, 88c.

Prices from tank-wagon delivery in New York are as follows: Auto naptha and stove gasoline, 21c. per gal.; kerosene, 9c. per gal.

Spirits Turpentine—Considerable instability has been manifest in the Southern markets and many rumors have been current that the market is demoralized. These have been denounced in no uncertain terms, but the fact remains that quotations are lower. Jobbers' prices in New York are 40@40½c. and in Savannah, 35@35½c. per gal.

CLAY PRODUCTS

Sewer Pipe—Prices have sharply advanced. This is due to an exceptional demand which continued all winter and now is large. The heavy call upon the factories during the winter exhausted this supply, and now the condition has arisen that, though it is impossible to fill all the winter orders, the spring orders are pouring in for greater quantities than has ever before been experienced. Discounts applying to the eastern lists, delivered in New York, are as follows: 3- to 24-in. inclusive, 60%; 27- to 30-in., 61%, and for 33- to 36-in., 56%. At those discounts the net prices per foot are as follows:

SEWER PIPE PER FOOT DELIVERED NEW YORK

3-in.	$0.0775	20-in.	$0.6975
4-in.	0.0775	21-in.	0.93
5-in.	0.124	22-in.	0.93
6-in.	0.124	24-in.	1.0075
8-in.	0.1705	27-in.	1.755
10-in.	0.248	30-in.	2.145
12-in.	0.31	33-in.	2.75
15-in.	0.4185	36-in.	3.08
18-in.	0.589		

Flue Linings—The demand is heavy and prices are quoted with a higher tendency. The discount from list, delivered New York, in carload lots, is 75%.

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x 8½-in.	14	$0.075	12x16-in.	45	$0.25
4½x13 -in.	20	0.1125	13x18-in.	57	0.30
6 x12 -in.	22	0.125	14x16-in.	60	0.2725
7 x 7 -in.	15	0.875	16x16-in.	65	0.40
8½x 8½-in.	18	0.1125	16x20-in.	80	0.50
8½x13 -in.	28	0.1625	18x18-in.	75	0.50
8½x18 -in.	45	0.92225			

Hollow Tile—Prices are firm with a steady market. Quotations, f.o.b. Perth Amboy, N. J., are as follows:

	Price per block		
Size	Hollow wall tile	Size	Interior partition block
4x12x12-in.	$0.06	2x12x12-in.	$0.048
6x12x12-in.	0.084	3x12x12-in.	0.048
8x12x12-in.	0.102	4x12x12-in.	0.052
10x12x12-in.	0.12	6x12x12-in.	0.072
12x12x12-in.	0.15	8x12x12-in.	0.096

Roofing Tile—Prices are steady. The best grade of promenade roofing tile in flat blocks for high-grade roofs is sold at $25 per M. for run of kiln and $35 per M. for selected. A cheaper form of tile with a smooth surface may be had at about $12, but it is not suitable for roof gardens. These prices are f.o.b. New York.

Roofing tile, unglazed, of the French and Spanish type, plain, is sold at $9 per 100 sq.ft. of roof surface, f.o.b., New York. Glass tiles are sold at 60c. each.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; 4c. per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x40 in. It varies in thickness from ⅛ to ½ in., and in weight from 2 to 27 lb. per sheet. The net price in 100-lb. lots is 5c. per lb.

Transite, asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in standard sheets, 36x48 in., 42x48 in. and 42x96 in. The prices, f.o.b. factory, Nashua, N. H., are as follows:

Thickness	Weight, pounds	Price
⅛-in.	1	$0.08
3/16-in.	1½	0.12
¼-in.	2	0.16
5/16-in.	2½	0.20
⅜-in.	3	0.28
7/16-in.	3½	0.28
½-in.	4	0.32
9/16-in.	4½	0.36
⅝-in.	5	0.40
¾-in.	6	0.44
⅞-in.	7	0.48
1-in.	8	0.52
1¼-in.	10	0.56
1½-in.	12	0.64
1¾-in.	16	0.72
2-in.	16	0.80

CONSTRUCTION NEWS

★Denotes an item regarding work advertised in Engineering News. ✚Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

Rhode Island—Southern New England Ry.—The contract between this company and the O'Brien Construction Co. has been canceled by agreement. A settlement has been reached, and the company will remove its entire plant from the right-of-way as soon as possible. Inability to finance the undertaking, it is reported, is given by John S. Murdock, Vice-Pres. of the railway, as the cause of discontinuing the work.

Connecticut—Westchester & Northern R.R.—(New York Central Lines)—This company has been authorized by the State Legislature to construct and operate its proposed line from White Plains, N. Y., to Danbury, Conn. The company has a charter in New York and did not apply for a Connecticut charter, but for the right to build and operate. G. W. Kittredge, New York, is Ch. Engr.

New York—Geneva, Seneca Falls & Auburn R.R.—This company, organized to take over the properties of the Geneva & Auburn Ry. Co., has been incorporated with a capital of $450,000. The road runs from Geneva to Cayuga Lake Park, passing through Waterloo and Seneca Falls, N. Y. The office of the company will be located at Seneca Falls.

New Jersey—New Jersey & Pennsylvania R.R. and Morristown & Erie R.R.—It is planned to use these companies to form a connection between the Erie R.R. and the Central R.R. of New Jersey. The former road extends from Whitehouse to Watnong, at Morristown. The latter extends from Essex Fells terminus of the Erie R.R. to Morristown. The plans call for the expenditure of about $2,500,000.

Pennsylvania—Philadelphia & Reading Ry.—This company, it is reported, has approved plans for improvements which will involve an expenditure of several million dollars, including the construction of the elevated extension from 16th St., Philadelphia, to Manayunk and a new line to Royersford for third track. W. Hunter, Philadelphia, is Ch. Engr.

Florida—Bradentown, Manatee & Arcadia R.R.—This company is considering the construction of a line, it is reported, from Bradentown, Fla., southeast via Manatee to Arcadia, about 55 miles. Construction work will be started soon. A. W. Jones, Augusta, Ga., is interested. Noted May 29.

Miami & South Florida R.R.—This company has applied for a charter for the construction of a line from Palm Beach, Fla., south via Miami, and Homestead to Detroit, about 100 miles. The company will have a capital of $500,000. H. C. Roome, Miami, Fla., is Pres.

Tampa & Gulf Coast Ry.—This company has sold $750,000 of bonds for the extension of its proposed line to St. Petersburg and other points. Construction work will begin at once.

Alabama—Pensacola, New Orleans & Mobile R.R.—This company has decided to spend $350,000 for extensions and improvements to its line. Henry McLaughlin is Pres., Pensacola, Fla.

Louisiana—Louisiana Sawmill Co.—This company, it is reported, has awarded contracts for the construction of a standard-gage lumber railroad 12 miles long to connect its mill at Glenmora, La., with timber holdings.

Mississippi—Corinth & Northwestern Ry.—This company has been granted a charter for the construction of its proposed line from Corinth, Miss., northeast to the Tennessee River at or near Hamburg, Tenn., about 18 miles. Clopton Thomas is interested. Noted May 29.

Kentucky—Long Fork R.R.—It is reported that the Baltimore & Ohio R.R. Co. has secured the charter of this company, which owns a right-of-way for a railroad on the left fork of Beaver Creek, which, when constructed, will develop about 100,000 acres of coal lands owned by the Elkhorn Fuel Co., and from 6000 to 8000 acres owned by the Milwaukee Coal & Gas Co. F. L. Stuart, Baltimore, Md., is Ch. Engr. B. & O. R.R.

Ohio—Detroit, Toledo & Ironton R.R.—This company has sold its Southern Ohio Division to Daniel B. Murray and Herman J. Schumacher, New York, for $1,550,000.

Wisconsin—Chicago, Milwaukee & St. Paul Ry.—This company, it is reported, will start work, June 15, on the elevation of its tracks from Kinnickinnic Ave. to Fowler St. It is estimated that the work will cost in all about $20,000,000. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Minneapolis, Merrill & Marinette Ry.—This company has filed incorporation papers for the construction of a railroad from Antigo, Wis., to Prentice Junction, a distance of about 75 miles. Capital, $400,000. The incorporators are: J. N. Cotter, John O'Day, L. N. Anson, A. B. Nelson, A. H. Wright, George T. Harding, Herman Meyer, E. S. King, F. W. Kubasta, William F. Peterman, and Christ Solum, all of Merrill, Wis.

✚**Kansas**—Anthony & Northern Ry.—This company has awarded the contract to MERNATHY & DAVIS, for work on its line from Pratt to Iuka, Kan., a distance of about five miles. G. L. Hutchinson, Kan., is Ch. Engr.

Arkansas—Fort Smith, Subiaco & Eastern Ry.—This company is considering the construction of an extension of its line from Scranton in an easterly direction to Dardanelle, Ark., a distance of about 25 miles.

De Queen & Eastern R.R.—This company is considering the construction of an extension from Dierks to Daisy, Ark., about eight miles, to connect with the Prescott & Northwestern R.R. Hans Dierks, Kansas City, Mo., is Pres.

Texas—Temple, Northwestern & Gulf Ry.—This company has been incorporated with a capital of $100,000 for the construction of a line from Temple, Bell County, in a northwesterly direction, through the counties of Bell, Hamilton, Coryell, Comanche and Erath to the city of Dublin, Tex., a distance of about 100 miles. The principal office of the company will be at Temple. The following are the incorporators: John H. Thompson, Houston; James F. Sadler, Jr., Houston; A. S. Vandevoort, Houston; J. R. Thompson, Houston; R. O. Faires, Houston; W. F. McGreger, Temple; J. H. McGregor, Temple, and William A. Vinson, Houston. It is expected that the new company will take over the property and assets of the present Temple & Northwestern Ry., a portion of the road having already been built, and extend it to the destination fixed in the charter of the Temple, Northwestern & Gulf Ry.

Oklahoma—Muskogee & Missouri Pacific Connecting R.R.—This company is having surveys made for the construction of its proposed line. C. N. Haskell, Muskogee, Okla., is Pres.

Colorado—Montezuma, San Juan & Southern R.R.—This company has been organized for the purpose of constructing a new railroad from near Dolores, Colo., to Wheatland, N. M. The company will have a capital of $4,000,000.

New Mexico—Montezuma, San Juan & Southern R.R.—See item under Colorado.

✚**New Mexico**—El Paso, Southwestern Ry.—This company has awarded the contract for the construction of its proposed line from Whitewater to Tyrone, N. M., to CHADWICK & DEYO, Tucson, Ariz.

Washington—Spokane & British Columbia Ry.—This company is having surveys made for the construction of its proposed new line. E. C. Clark, Spokane, Wash., is interested.

Ontario—Toronto, Hamilton & Buffalo Ry.—This company has received bids for 16½ miles of track work between Welland, Ont., and Smithville. R. L. Latham, Hamilton, Ont., is Ch. Engr.

Manitoba—Brule Lake R.R.—This company is making surveys and work will begin soon on the construction of a railroad from a point on the Grand Trunk Pacific Ry., east of Brule Lake at Mile 996 west of Winnipeg, Man., north six miles to the property of the North Alberta Coal Co. James McEvoy is Ch. Engr., Toronto, Ont.

✚**British Columbia**—Canadian Pacific Ry.—This company has awarded to the GRANT-SMITH-McDONALD CO., contracts for double-track work as follows: Revelstoke to Taft, Westmore to Kamloops and Kamloops to Tranquille, about 55 miles. Bids were opened May 10, by F. F. Busteed, Engr. Grade Revision, Kamloops, B. C.

British Columbia—Atlin Ry.—This company has applied for a charter for the construction of a line from a point on the southern end of Atlin Lake, B. C., or near Atlin, southerly to a point on the Taku River at the international boundary, and from a point on that line easterly to the southern end of Teslin Lake. Smith & Johnston, Ottawa, Ont., are interested.

ELECTRIC RAILWAYS

Norwich, Conn.—The Short Line Electric Ry. Co. is planning to start work soon on the construction of an extension of its line to Old Saybrook.

Hornell, N. Y.—Preliminary arrangements are being made by the Hornell Traction Co. for the extension of its line to the Country Club. D. A. Proctor, Hornell, is Gen. Mgr. and Pur. Agt.

Lockport, N. Y.—The International Ry. Co. is considering plans for double-tracking its line from Lockport to North Tonawanda, about 12 miles. T. W. Wilson, Buffalo, is Gen. Mgr.

Middleport, N. Y.—The Buffalo, Lockport & Rochester Ry. Co. is contemplating double-tracking its line from Lockport to Middleport. J. H. Cain, Rochester, is Gen Supt.

Seneca Falls, N. Y.—The extension of its line to Auburn is under consideration by the Geneva & Auburn Ry . Co.

Philadelphia, Penn.—The Philadelphia Rapid Transit Co. contemplates the extension of several of its lines in Philadelphia. M. F. Ryan, 820 Dauphin St., Philadelphia, is Supt.

Covington, Ga.—Plans are being considered by the Covington & Oxford St. Ry. Co. for the electrification of its three miles horse-car line to Emory College. R. C. Guinn, Covington, is Gen. Mgr.

Jackson, Ga.—Plans are being considered by C. S. Maddox and associates for the construction of an electric railway in Jackson.

Birmingham, Ala.—The Birmingham & Chattanooga Ry. Co. has completed surveys and will soon start work on the construction of its proposed electric railway to connect Birmingham, Ala., and Chattanooga, Tenn., about 147 miles. W. W. Shortridge, Birmingham, is Secy.

Norwood, Ala.—The Council has granted a franchise to J. C. Beatty to construct and operate an electric railway in Norwood.

Somerset, Ky.—Preliminary arrangements are being made by the United Water, Light & Traction Co. for the construction of a six-mile extension from Somerset to Burnside. Noted Mar. 27.

Beverly, Ohio—The Parkersburg, Marietta & Interurban Ry. Co. has started surveys for the construction of its proposed extension from Beverly to McConnellsville, about 15 miles. H. H. Archer, Parkersburg, W. Va., is Gen. Mgr. and Pur. Agt.

Fremont, Ohio—The Fostoria & Fremont Electric Ry. Co. contemplates the extension of its line from Fremont to Port Clinton. J. D. McDonnell, Fostoria, is Gen Mgr.

Galesburg ,Ill.—The Peoria, Canton & Galesburg Ry. Co. has applied to the City Council for a franchise to construct and operate an electric railway in Galesburg.

Paxton, Ill.—The Kankakee & Urbana Traction Co. has completed surveys for the extension of its line from Rantoul to Paxton, about 10 miles. C. J. Hays, Urbana, is Ch. Engr.

Peoria, Ill.—The Peoria, Galesburg & Western Ry. Co. has been incorporated to construct and operate an electric railway from Peoria to Galesburg. The incorporators are William T. Irwin, Clifford Ireland, John W. McDowell, Willian M. Allen and George J. Jobst, all of Peoria.

Bettendorf, Iowa—Plans are being prepared by the Tri-City Ry. Co. for the construction of an electric railway on State St., in Bettendorf. J. G. Huntoon, Davenport, is Vice-Pres. and Gen. Mgr.

Iowa City, Iowa—The Eastern Ry. Co. has completed preliminary surveys for the construction of an electric arilway to connect Iowa City and Muscatine. J. D. Wardle, Cedar Rapids, is Ch. Engr.

Alexandria, Minn.—The Electric Short Line Ry. Co. is considering plans for the extension of its line from Alexandria to Glenwood.

Duluth, Minn.—Plans are being prepared by the Interstate Traction Co. for the improvement and extension of its electric railway in Duluth. Charles B. Dunn, Dluuth, is Gen. Mgr. and Pur. Agt.

Arkansas City, Kan.—Preliminary arrangements are being made by the Interstate Traction Co. for the construction of an interurban railway to connect Arka. sas City, Kan., and Enid, Okla. S. K. Titus, Arkansas City, is Ch. Engr.

Atchison, Kan.—A company is being organized at Atchison for the purpose of constructing an electric railway to connect Atchison, Hiawatha, Efffingham, Kennekuk, Willis and Banker.

Topeka, Kan.—Plans are being considered by the Topeka Ry. Co. for an expenditure of $45,000 for the extension of its West 10th St. line to Gage Park. A. M. Patton, Topeka, is Gen. Supt.

Lincoln, Neb.—A franchise has been granted to the Lincoln Traction Co. for the extension of its 10th St. line in Lincoln. F. H. Brooks, Lincoln, is Gen. Supt. and Pur. Agt.

Devil's Lake, N. D.—The Devil's Lake & Chautauqua Electric Ry. Co. has been incorporated to construct and operate an electric railway from Devil's Lake to Chatauqua. The incorporators are W. E. Hocking, W. H. Horton and C. A. Stotair, all of Devil's Lake.

Little Rock, Ark.—The City Council has granted a franchise for a period of 50 years to the Little Rock, Pine Bluff & Eastern Traction Co. to construct and operate an electric railway in Little Rock.

El Paso, Tex.—Plans are being prepared by the El Paso Electric Ry. Co. for the extension of its lines in El Paso. H. S. Potter, El Paso, is Gen. Supt.

Portland, Ore.—The Portland Ry., Light & Power Co. is preparing to lay two miles of new track in the Woodstock District. F. W. Hild, Portland, is Gen. Mgr.

The Sumpter Valley Ry. is preparing to lay 6½ miles of new rail on its line where needed. Guy L. Anderson is Gen. Mgr.

Fresno, Calif.—The Fresno Traction Co. is considering plans for the construction of an electric railway from Biola to Muscatel, about nine miles. F. W. Webster is Gen. Mgr.

Los Angeles, Calif.—Preliminary arrangements are being made by the Pacific Electric Ry. Co. for the extension of its Hollywood line in Los Angeles. J. McMillan, Los Angeles, is Gen. Mgr.

Modesto, Calif.—The Tidewater & Southern Ry. Co. will receive bids soon for an extension of the line to Turlock, a distance of about 10 miles. J. H. Wallace, Stockton, is Ch. Engr.

San Jose, Calif.—The Peninsular Ry. Co. has applied for permission to extend its lines in San Jose. F. E. Chapin, San Jose, is Gen. Mgr. and Pur. Agt.

Berlin, Ont.—The Berlin & Waterloo St. Ry. Co. has been petitioned to double-track its line from Wellington St. to the Waterloo boundary line. V. S. McIntyre, Berlin, is Supt.

Winnipeg, Man.—Plans are being considered by the Winnipeg Electric Ry. Co. for the construction of about 14 miles of new track. Wilfred Phillips, Winnipeg, is Gen. Mgr. and Ch. Engr.

Burnbay, B. C.—Plans are being considered by the British Columbia Electric Ry. Co. for the extension of its line to Port Moody, about six miles, and for the extension of its Vancouver line to Burnaby. R. H. Sperling, Vancouver, is Gen. Mgr.

LIGHT, HEAT AND POWER

Cambridge, Mass.—Plans are being considered by the Cambridge Gas, Electric Light & Power Co. for the improvement of its power plant and the construction of an 18 mile transmission line. G. Lobo is Secy.

Medford, Mass.—Bids will be received at the office of the Mayor until June 9 for the installation of electric apparatus in the annex to the High School. Chas. S. Taylor is Mayor. Richard D. Kimball Co., 6 Beacon St., Boston, is Engr.

✚Worcester, Mass.—The Worcester Gas Light Co. has awarded the contract for the improvement of its gas plant to the RITER-CONLEY CO., Pittsburgh, Penn., at $216,270.

Kingston, R. I.—Bids will be received by the State Board of Control and Supply, Room 18 State House, Providence, until 10 a.m., June 19, for making additions to the power plant at Rhode Island State College at Kingston. William A. Schofield is Chn.

Waterbury, Conn.—The Waterbury Farrell Foundry & Machine Co. will build a power plant in connection with its establishment.

Rochester, N. Y.—The Rochester Ry. & Light Co. contemplates the construction of a new power station on the river flats in Rochester.

✚Chatham, N. J.—The Common Council has awarded the following contracts for additions to the municipal electric-light and water plant on bids recently received: One 100-kw. turbo-generator unit, $4612; one 75-kw., 2300-volt, three-phase generator and exciter, $1328, and one switchboard complete, $1766 (total for three items, $7336) to the FORT WAYNE ELECTRIC WORKS; one 500,000-gal., motor-driven pump, $1245, and one 150-hp. condenser, $723 (total for two items $1968); to the MAXISTEE IRON WORKING CO.; radial brick chimney, $1493, to the HEINE CO., New York; industrial railway, complete with charging car and scales, $325, to ERNEST WEINER CO. Contract for building alterations to the plant, awarded to STULL & PHILHOWER, Madison, N. J., at $1790. Noted May 8.

Trenton, N. J.—The Board of Freeholders has granted the New Jersey Northern Gas Co. permission to lay new gas mains on county roads between Pennington and Hopewell. The Board has also granted the Public Service Gas Co. permission to lay a new line on Lawrenceville Road.

Erie, Penn.—Plans are being considered by the City Council for substituting electricity for gas in the present street-lighting system.

✚Philadelphia, Penn.—The contract for the construction of a power plant at North American and Somerset Sts., for the E. F. Hougleton Co., has been awardede to HEWITT & RICE, Philadelphia, at $6000.

✚Yardley, Penn.—The Philadelphia & Reading Ry. Co. has awarded a contract to FRED A. HAVENS & CO., for the erection of a new power house and pump house here.

Brunswick, Md.—The construction of a power station and distributing system in Brunswick is contemplated by the Harper's Ferry Electric Light & Power Co.

Broadwater, Va.—Press reports state that the proposition to issue $25,000 of bonds for the construction of a municipal electric-light plant, is under consideration.

Clifton Forge, Va.—The Virginia-Western Power Co. has been incorporated with W. G. Mathews, Pres., and proposes to take control of the Virginia-Western Electric Co., Rockbridge Power Corporation, Covington Light & Power Co., and Buena Vista Light & Power Co., and has ordered $150,000 bond issue for additional improvements and the erection of a hydro-electric plant.

Grundy, Va.—E. E. Smith is interested in the organization of a company for the purpose of constructing an electric-light plant at Grundy.

✚Lockhart, S. C.—The contract for the construction of a dam, 1500 ft. long and 14 ft. high, across the Broad River for the Lockhart Power Co., has been awarded to WILLARD BOGGS & CO., Spartanburg, at $150,000.

Jefferson, Ga.—See item under Water Supply—Irrigation.

Birmingham, Ala.—The Kelley Co. is considering plans for the construction of an electric power plant to furnish electricity for its proposed railway. Estimated cost, $250,000. W. E. Kelley is Mgr.

Monterey, Tenn.—Preliminary arrangements are being made by the Monterey Fruit & Vegetable Association for the construction of an electric-light plant to cost $10,000. G. N. Welch and J. T. Price are interested.

Middlesboro, Ky.—The Board of Trade has taken up the project of building a central power plant in that vicinity for the service of coal mines and other industries, and is negotiating with the Stone & Webster Engineering Corporation, Boston, Mass., for the construction of the plant.

Rockport, Ky.—The Rockport Coal Co. has been granted a franchise to construct and operate an electric-light plant and water system in Rockport. H. L. Tucker is Pres. and Mgr.

Cincinnati, Ohio—See item under Buildings.

Cleveland, Ohio—The construction of a municipal heating plant, to cost $10,000, is under consideration. W. J. Springborn is Dir. Pub. Ser.

Tell City, Ind.—The contract for the installation of an electric-light system in Tell City has been awarded to the KOLLKER ELECTRIC CO., Evansville, Ind., at about $5000.

✚Columbus, Ohio—The contract for the installation of an electric-light plant in the Neill House has been awarded to the McKEEVER ELECTRIC CO., at $40,000.

Sandusky, Ohio—At an election to be held July 1 the proposition to issue $200,000 of bonds for the construction of a municipal electric-light plant will be submitted to the voters.

✚Centerville, Ind.—The contract for the construction of an electric-light plant has been awarded to the RICHMOND ELECTRIC CO., Richmond, at about $6000.

Adrian, Mich.—Plans are being considered by the Town Council for the installation of additional equipment in the municipal electric-light plant. T. W. Newell is Supt.

Detroit, Mich.—Bids will be received by the city until June 10 for the installation of additional equipment in the municipal electric-light plant. Frank H. Misterky is Supt.

✚Kalamazoo, Mich.—According to press reports, the contract for the construction of a municipal power and electric-light plant has been awarded to the CODDINGTON ENGINEERING CO., Milwaukee, Wis., at $29,100.

Onsted, Mich.—The installation of an electric-lyight system is under consideration. W. F. Morrill is interested.

Ovid, Mich.—At a recent election the citizens voted to issue $6000 of bonds for the improvement of the municipal electric-light plant.

St. Johns, Mich.—Plans are being prepared for the construction of a new gas plant at St. Johns.

Chicago, Ill.—Press reports state that the Finance Committee of the City Council has voted to authorize an expenditure of $4,000,000, for the extension of the ornamental street-lighting system.

Elgin, Ill.—Plans are being considered for the installation of an ornamental lighting system on South State St. W. Plummer and R. H. Howard are interested.

Hoopeston, Ill.—The City Council is considering the proposition to take over the lower plant of the Hoopeston Gas & Electric Co. It is understood that improvements will be made to the plant.

Richmond, Ill.—The Public Service Co. of Northern Illinois has been granted a franchise to construct and operate an electric-light system in Richmond. George H. Lukes, Chicago, is Gen. Supt.

Superior, Wis.—The Superior Water, Light & Power Co. is considering plans for the improvement of its plant and system. W. H. Winslow, Superior, is Vice-Pres. and Gen. Mgr.

Audubon, Iowa—The Audubon County Electric Co. contemplates the extension of its transmission line and the installation of additional equipment in its power plant. R. E. Wieland is Mgr.

Cedar Falls, Iowa—Plans are being prepared by Clark H. Streeter, City Engr., for the construction of the proposed municipal electric-light plant.

Decorah, Iowa—Plans are being prepared by the Interstate Power Co. for the construction of a central-power plant. G. W. Welch is Elec. Engr.

Lawler, Iowa—The installation of an electric-light system in Lawler is under consideration.

Sigourney, Iowa—Plans are being prepared by the Sigourney Electric Light, Heat & Power Co. for the improvement of its power plant. R. L. Van Meter, Sigourney, is Mgr. and Supt.

Sioux City, Iowa—The Sioux City Service Co. contemplates an expenditure of $100,000 for the improvement of its power plant at Second and Water Sts. E. L. Kirk, Sioux City, is Mgr.

Spencer, Iowa—Extensive improvements to the municipal electric-light plant are under consideration.

Duluth, Minn.—Plans are being considered by the Great Northern Power Co. for an expenditure of $300,000, for the installation of additional equipment in its power plant.

Starbuck, Minn.—The Town Council contemplates the installation of additional equipment in the municipal electric-light plant. A. H. Dreyer is Supt. Electric-light Dept.

Atkinson, Neb.—Plans are being considered by J. Skredla & Sons, owners of the local electric-light plant, for the installation of additional equipment.

Fairbury, Neb.—The installation of a street-lighting and power system is under consideration. G. D. Meyers is Supt. of the municipal electric-light plant.

Silver Creek, Neb.—Bonds for $16,000 have been voted for the construction of an electric-light plant and water system. D. F. Davis is Village Clk.

Wilber, Neb.—Bonds for $12,000 for the reconstruction of the electric-light system were voted at a recent election.

Washington, Mo.—Plans are being considered by the Mississippi River Power Distributing Co., for the extension of a transmission line from Washington to St. Louis.

Atkins, Ark.—L. L. Evans and W. H. Jones are interested in the organization of a company for the purpose of constructing an electric-light plant at Atkins.

Batesville, Ark.—Plans are being considered by the Commissioners of the Water and Electric Plant, for the construction of a new power plant. W. H. Walkup is Supt.

Floresville, Tex.—Preliminary arrangements are being made by the H. B. Harmon and O. A. Sims, of Beeville, Tex., for the construction of a $15,000 electric-light plant at Floresville. Noted May 8.

Franklin, Tex.—The City Commission is considering the plans for the purchase of the local electric-light and water-works plants. If the transaction is consummated bonds will be issued for enlarging and otherwise improving the property.

Petrolia, Tex.—The Lone Star Gas Co. will construct a natural-gas pipe line from Petrolia to Burkburnett and Electra, thence northwest along the Fort Worth and Denver City R.R. to Amarillo. Natural gas distributing systems will be laid in a number of towns reached by the main pipe line. More than 300 miles of pipe will be laid.

Seguin, Tex.—(Official)—The Guadalupe Water Power Co., incorporated under Texas laws, contemplates the erection of five or six reinforced-concrete dams across the Guadalupe River in the vicinity of Seguin, for the purpose of generating electricity, which will be used as a motive power in a system of interurban Railways, which will develop a highly productive farming section of Texas. The Interurban Co. will be formed in a short time, and it will have no connection with the Guadalupe Water Power Co. The work is being carried on by H. E. W. Brown, of Orange, W. B. Dunlap, of Beaumont, and J. H. Abbott, of Seguin.

✦Hilston, Okla.—The contract for the construction of an electric-light plant and water system has been awarded to DON A. TOLBERT, Ada, Okla. Noted May 15.

Colorado Springs, Colo.—A company composed of several business men has been organized to construct an electric-light plant to furnish electricity for their business establishments. Estimated cost, $5000. The Dobinson Drug Co. is interested.

Enumclaw, Wash.—The Enumclaw Water & Light Co. has been granted a franchise by the City Council to construct an electric-light plant.

✦Olympia, Wash.—The contract for the installation of an underground steam-heating system for H. Forshay, has been awarded to the AMERICAN DISTRICT STEAM CO., at $50,000.

Astoria, Ore.—Preliminary plans are being prepared by the City Engineer for the installation of a municipal electric-light plant.

✦Antioch, Calif.—The Great Western Power Co. has awarded the contract to the REARDON-CRIST CONSTRUCTION CO., for the construction of substation at Antioch, at $10,773.

Marysville, Calif.—The Oro Electric Corporation and the Great Western Power Co. have been granted franchises to construct and maintain power distributing systems within the city limits.

✦Pasadena, Calif.—(Official)—Bids were received by Herman Dyer, City Clk., May 13, for furnishing one water tube boiler and a 100-ft. stack, 40-in. in diameter, as follows: CHARLES C. MOORE & CO., $8805 (awarded contract); United Iron Works, $8095; Union Iron Works, $8200. Noted May 8.

✦San Francisco, Calif.—The contract for the installation of an electric-light system at Fort Mason has been awarded to the NEWBERRY-BENDHEIM ELECTRIC CO., of this city, at $15,700.

San Francisco, Calif.—The Pacific Gas & Electric Co. has applied to the State Railroad Commission for permission to erect three new power plants on the extension of the Bear River in Placer County and to erect a transmission line from the Bear River power sites to Nicolaus. It is estimated that this construction will develop 35,000 hp., and will cost $1,396,000. John A. Britton, San Francisco, is Vice-Pres. and Gen. Mgr.

Taft, Calif.—The city is contemplating installing a municipal gas plant.

Berlin, Ont.—The Dominion Tire Co. is planning to install a $50,000 power plant in connection with its new establishment.

Toronto, Ont.—Bids will be received by Adam Beck, Chn. Hydro-Electric Power Commission, Continental Life Bldg., Toronto, until June 16 for the construction of a dam and power plant at Wasdell's Falls, on the Severn River. W. W. Pope is Secy.

Winnipeg, Man.—Bids will be received by the Board of Control until June 5 for the construction of an addition to the power station. M. Peterson is Secy. of the Bd.

BRIDGES

✦Bangor, Maine—(Official—Bids will be received until 7 p.m., June 10, by the Street Engineers, at the office of the City Engineer, for the construction of two approach spans of the superstructure of the steel highway bridge over the Penobscot River, between Bangor and Brewer. The length of the spans will be 102 ft. and 61 ft. from center to center of end bearings. Frank E. Prossey is City Engr.

Manchester, N. H.—The Common Council has passed a resolution appropriating $100,000 for the construction of a bridge across the Piscataquog River at Kelley St. Samuel J. Lord is City Engr. Noted Mar. 6.

Boston, Mass.—Bids will be received until June 12, by the Department of Public Works, for the widening of the Pleasant St. bridge. L. K. Rourke is Comr.

Framingham, Mass.—(Official)—The Town Council has appropriated $12,000 to be used for the construction of a bridge. G. G. Van Valkenburgh is Town Engr.

New Brunswick, N. J.—Bids will be received until 2.30 p.m., June 16, by the Board of Chosen Freeholders, for the construction of a concrete bridge over Heards Brook, on the Woodbridge-Metuchen Road. Alvin B. Fox, Perth Amboy, is County Engr.

Reading, Penn.—Bids will be received until 10 a.m., June 11, by the County Controller, for the construction of a reinforced-concrete arch and girder bridge, across the Tulpehocken Creek, in Marion Township. D. K. Hoch is County Controller.

✦Denton, Md.—(Official)—The Board of Commissioners of Caroline County has awarded a contract to the SCHERZER ROLLING LIFT BRIDGE CO., Chicago, Ill., at $10,500, for the construction of a lift bridge over the Choptank River, on the Denton-Willow Road. H. Waldorf is County Engr. Noted May 8.

✦Washington, D. C.—The Commissioners of the District of Columbia have awarded a contract to CHARLES H. TOMPKINS, Washington, D. C., for the excavation and concrete-arch masonry in connection with constructing bridges across Watts Branch in the neighborhood of Deane Ave. and Grant St., N. E., at a cost of 40c. per cu.yd. for excavation and $6 per cu.yd. for concrete arch masonry.

A contract has also been awarded by the Superintendent of the Zoological Park for the construction of a reinforced-concrete bridge over Rock Creek to WARREN F. BRENIZER CO., Washington, D. C., at $10,287. Noted May 29.

Covington, Va.—(Official)—Bids will be received until noon, June 7, by the Circuit Court of Alleghany County, for the construction of two concrete and steel bridges. Both will be built over Dunlap Creek, one 140 ft. long and the other 50 ft. long. The Childrey-Sunday Co., Richmond, are Engrs.-in-charge.

New Castle, Va.—(Official)—Bids will be received until noon, June 9, by the Circuit Court of Craig County, for the construction of three concrete bridges, of one span each. One will be built over Meadow Creek, one over Sinking Creek and one over Barbours Creek. The Childrey-Sunday Co., Richmond, are Engrs.-in-charge.

✦Portsmouth, Va.—Bids will be received until noon, July 1, by the Street Committee, for the following bridge construction: One reinforced-concrete bridge to be known as the "Gosport Bridge," on First St., about 65 ft. wide and 21 ft. span; two reinforced-concrete culverts, one at north end of Dinwiddie St., about 105 ft. long and about 4 ft. diameter and the other at south end of Dinwiddie St., about 310 ft. long and about 4 ft. diameter. V. O. Cassell, Jr., is City Engr.

Edgefield, S. C.—Bids will be received until 11 a.m., June 7, by the Board of County Commissioners, for the construction of one steel span bridge, 125 ft. long, with a roadway of 12 ft. A. A. Edmunds is County Superv.

✦Lexington, Ky.—The Louisville & Nashville R.R. has awarded a contract to the CENTRAL CONSTRUCTION CO., Lexington, for the construction of a reinforced concrete via-

duct, at Lexington. The estimated cost is $63,000. Noted Mar. 6.

Pikeville, Ky.—The Fiscal Court of Pike County, at Pikeville, has announced that a bridge will be built over the Tug River at the mouth of Pikes Creek.

Richmond, Ky.—Bids will be received until June 28, by the Madison County Fiscal Court, for the construction of three bridges. One will be built at Berea, over Busby Fork Creek, one at Red House over Otter Creek, and one at Silver Creek Station, of three spans, 45 ft. each. W. R. Shackleford is County Judge.

Watson, Ky.—Bids will be received until June 18, by the Fiscal Court, at Columbia, for the erection of a steel bridge over the Green River, at Watson.

Ashtabula, Ohio—Bids will be received until 1 p.m., June 23, by the Board of County Commissioners, for the following bridge work: Construction of the superstructure for the Callender Bridge, at Callenders Grove, over the Grand River; construction of the substructure for the Callendar Bridge; the construction of one abutment and one retaining wall for a bridge at Geneva, over the Grand River. A. V. Hillyer is Clk.

✚Chillicothe, Ohio—(Official)—The Board of County Commissioners has awarded a contract to the CAPITOL CONSTRUCTION CO., Columbus, at $7450, for the construction of a bridge to be known as the Barnhart Bridge, in Green Township. Bids were received May 26. G. M. Anderson is County Audr.

Cincinnati, Ohio—The construction of a viaduct extending from Elberon Ave. and German St. to a point above Baymiller St., is being urged upon the city authorities by residents of Price Hill, who have appointed a committee of which Hiram Rulison is chairman, to take up the proposition with the proper authorities.

Cleveland, Ohio—Bids will be received until noon, June 10, by the Director of Public Service, City Hall, for the erection of the structural-steel work for the lower West Third St. bridge. W. J. Springborn is Dir. Pub. Ser.

Cleveland, Ohio—Bids will be received until 11 a.m., June 28, by the Board of County Commissioners, for the construction of a concrete arch bridge, over Chippewa Creek, in Brecksville Township. Frank B. Lauder is County Surv.

Cleveland, Ohio—Bids will be received until 11 a.m., July 2, by the Board of Commissioners of Cuyahoga County, for the construction of a concrete bridge, on the Albion Road, in Strongsville Township. John F. Goldenbogen is Clk.

Elyria, Ohio—(Official)—Bids will be received until 1 p.m., June 10, by the Board of County Commissioners, for the construction of the superstructure of the East River St. Bridge, in Elyria Township. T. L. Gibson is County Surv.

Lebanon, Ohio—Bids will be received until June 23, by the Board of Commissioners of Warren County, for the construction of a single-span, high-truss steel bridge, 300 ft. long. T. C. Fatterson is County Audr.

✚Newark, Ohio—The Board of County Commissioners has awarded a contract to the ILLINOIS BRIDGE CO., at $26,-270, for the construction of the Second St. bridge over the river in the city of Newark. It will have a span of 198 ft. Bids were received on May 24.

Zanesville, Ohio—Bids will be received until 11 a.m., June 17, by the Board of Commissioners of Muskingum County, for the reconstruction and rebuilding of the superstructure of the Duncan Falls bridge across the Muskingum River at Duncan Falls. H. H. Kennedy is Clk.

Richmond, Ind.—Bids will be received until 11 a.m., June 7, by the Board of Commissioners of Wayne County, for the construction of a concrete arch, with a span of 90 ft., at Wassons Ford. C. S. Bowman is Audr.

Manitowac, Wis.—The City Council has approved the report of the Bridge Committee for the construction of a bascule bridge to replace the present structure at Eighth St. The estimated cost of the new bridge is $50,000. L. K. Pitz is City Engr.

✚Milwaukee, Wis.—(Official)—The City Council has awarded a contract to the J. E. HATHAWAY CO., Milwaukee, at $5900, for replacing the stone abutments on the west end of the Chestnut St. Bridge, over the Milwaukee River. J. C. Pinney is Supt. of Bridges. Noted May 15.

Superior, Wis.—The Northwestern Fuel Co. will build a coal handling bridge at its docks in Superior. The structure will be 710 ft. long with a clear span of 551 ft. The estimated cost is $300,000.

Newton, Kan.—Plans have been practically completed for the construction of a $12,000 reinforced-concrete bridge over Sand Creek on the main street of Newton. The city, county and Arkansas Valley Interurban Co. will build the structure jointly. The plans were drawn by W. S. Gearhart, State Highway Engr. The bridge will be 140 ft. long and 45 ft. wide, with two spans of 70 ft. each, carrying a wagon bridge, the interurban tracks and footbridge on either side.

✚St. Louis, Mo.—(Official)—The Board of Public Improvements has awarded a contract to JOHN B. TURNER, Pierce Bldg., at $18,882, for the construction of two reinforced-concrete bridges over the tracks of the Missouri Pacific Ry., one at Arsenal St. and one at Columbia Ave. Bids were received May 23. William T. Findlay is Secy. Noted May 15.

✚Murfreesboro, Ark.—The Memphis, Dallas & Gulf R.R. has awarded a contract to the BLODGETT CONSTRUCTION CO., Kansas City, Mo., at $35,000, for the construction of a steel bridge, 612 ft. long, across the Owachita River.

Moscow, Idaho—Bids will be received until 2 p.m., June 10, by the Board of Commissioners of Latah County, for the construction of two steel bridges, one across Bear Creek, near Kendrick, and one across the Palouse River, near Palouse, Wash. Homer E. Estes is Clk.

★Salmon, Idaho—Bids will be received until July 15, by the Commissioners of Lemhi County, for renewing all the timber members in two combination Pratt truss bridges across the Salmon River, at Salmon. Fred Crandall is County Surv.

Everett, Wash.—The following bids have been received by the Board of County Commissioners for the construction of a bridge over the Ebey Slough: International Bridge Co., Seattle, ordinary construction, $30,568; Bascule type, $30,921; Everett Construction Co., $38,605 and $42,173; American Pile Driving Co., $39,220 and $40,709.

Grants Pass, Ore.—The County Court will receive bids for the construction of a bridge over the Illinois River on the Crescent City road, of either steel or ordinary construction.

Portland, Ore.—The following bids have been received by the City Council for the construction of a reinforced-concrete bridge over Sullivan's Gulch, at East 16th St.: Pearson Construction Co., Chamber of Commerce Bldg., Portland, $92,405; Graff Construction Co., Seattle, $101,513; Giebisch & Joplin, Portland, $96,754; International Contract Co., Seattle, $94,261; Consolidated Contract Co., Portland, $94,261; Hans Pedersen, Seattle, $99,704; Portland Bridge & Construction Co., Portland, $95,590. Thomas M. Hurlburt is City Engr. Noted May 15.

Portland, Ore.—The Sumpter Valley Ry. will construct four steel bridges on concrete abutments across the Powder River, during the summer months. Guy L. Anderson is Gen. Mgr.

Needles, Calif.—The Board of County Supervisors, at San Bernardino, contemplates the erection of a bridge across the Colorado River, 450 yd. south of the Atchison, Topeka & Santa Fé Ry. bridge. Shirley Bright is County Surv.

Redding, Calif.—The Board of City Trustees has adopted a resolution instructing the City Clerk to advertise for building a concrete bridge and a steel bridge with a concrete floor across the Sacramento River at Reid's Ferry. It is estimated that the bridge will cost between $50,000 to $60,000.

★Toronto, Ont.—Those desiring to submit bids on reinforced-concrete construction for Bloor St. Viaduct, are notified that they may prepare and submit, without any expense whatsoever to the city, their own plans and specifications. These will be received at the same time as those for the steel design. H. C. Hocken is Chn. Bd. of Control.

Lytton, B. C.—The Provincial Government of British Columbia has awarded a contract to the GRAFF CONSTRUCTION CO., Seattle, Wash., at $80,000, for the construction of a concrete arch bridge across the Thompson River at Lytton. Bids were received May 7. Noted Apr. 17.

WATER SUPPLY—IRRIGATION

★Agawam, Mass.—(Official)—Bids will be received by the Board of Water Commissioners until 2 p.m., June 12, for furnishing 900 tons of 8- and 6-in. c.-i. pipe and specials. Specifications are on file at the office of James L. Tighe, Engr., 189 High St., Holyoke, Mass. E. A. Kellogg is Chn.

Easthampton, Mass.—(Official)—The town contemplates laying one mile of 6- and 8-in. water pipe. Estimated cost, $5000. W. C. Tannatt, Jr., is Town Engr.

Framingham, Mass.—(Official)—The town contemplates an expenditure of $30,000 for extending the water system. Frank E. Hemenway is Town Clk.

Brooklyn, N. Y.—Bids will be received until 2 p.m., June 13, by the Department of Water Supply, Gas and Electricity, 13 Park Row, Manhattan, for furnishing, delivering and laying watermains and appurtenances in Flatbush Avenue extension. Henry S. Thompson is Comr.

Buffalo, N. Y.—Bids will be received by Francis G. Ward, Comr. Pub. Wks., until 11 a.m., June 10, for furnishing c.-i. pipe and specials, brass corporation cocks and plugs, hydrants, and valves.

✚Mechanicsville, N. Y.—(Official)—A contract to lay about two miles of water mains in the yards of the Boston & Maine R.R. Co., in Mechanicsville, has been awarded to the H. P. CUMMINGS CONSTRUCTION CO., Ware, Mass.

New York, N. Y.—(Official)—The construction of the proposed Jerome Park filtration plant, for which bids were received Jan. 23, has been indefinitely postponed. Noted Jan. 30.

✚Port Washington, (L. I.) N. Y.—(Official)—The Goodwin-Gallagher Sand & Gravel Co. has awarded a contract to H. K. CORBIN, 170 Broadway, New York, to lay 1000 ft. of 12-in. water main at its plant in Port Washington, L. I.

Tonawanda, N. Y.—It is proposed to connect the water systems of Tonawanda and North Tonawanda, to assure proper fire protection.

✚✚Atlantic City, N. J.—The contract to haul and lay about 6000 ft. of 48-in. c.-i. water pipe, furnish and drive 70,-000 lin.ft. of piles, and construct about 750 cu.yd. of reinforced caps and incidentals, has been awarded to W. F. FRITZ, East Orange, N. J., at $55,360. Bids were opened May 15. Noted May 8.

Bayonne, N. J.—Bids will be asked about June 15, for about 5000 ft. of 8-in. c.-i. water pipe. William P. Lee is City Clk.

✚Borganza, Penn.—(Official)—The contract to construct a dam has been awarded by the Board of Managers of the Pennsylvania Training School, May 20, to the CONCRETE CONSTRUCTION CO., Century Bldg., Pittsburgh, Penn. Plans were prepared by R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio. Noted May 15.

Rockville, Md.—According to press reports, the Commissioners of Montgomery County will install water and sewer systems estimated to cost $20,000.

✚Washington, D. C.—The contract to furnish and deliver 10,000 ¾-in. water meters has been awarded by the District Commissioners to the PITTSBURGH METER CO., Pittsburgh, Penn. Bids were opened May 1, and the contract awarded May 24. Noted Apr. 17.

Appalachia, Va.—According to press reports, the Clear Creek Water Co. will install a water system here estimated to cost $25,000. The water will be piped from springs in the mountains 300 ft. above the city. Frank Schefold, New Albany, Ind., is Engr.

Clarksville, Va.—According to press reports, the city contemplates enlarging its filtration plant. Estimated cost, $40,-000.

★Front Royal, Va.—(Official)—Bids will be received at the office of the Mayor until 2 p.m., June 21, for the construction of a gravity mechanical filtration plant of 1,000,000 gal. daily capacity. Plans and specifications may be obtained from Edwin V. Dunstan, Consult. Engr., Southern Bldg., Washington, D. C. W. W. Pettitt is Chn. Water Com.

Pulaski, Va.—The Norfolk & Western Ry. Co. will build a 100,000-gal. water tank at Pulaski. C. S. Churchill, Roanoke, Va., is Ch. Engr.

Scottsville, Va.—Plans are being prepared for completing the water system here. Estimated cost, $6000.

Cherryville, N. C.—Bids will be received by J. B. Houser, Mayor, until July 1, for constructing a water system here, estimated to cost $25,000. The contract includes: 20x32-ft. brick pumping station, electric pumps, 500,000-gal. brick reservoir, 100,000-gal. steel tank, 100-ft. tower, five miles of pipe, hydrants, valves, boxes, wells, etc. Plans were prepared by J. Newton Johnson, Consult. Engr., Florence, S. C. Noted May 15.

Jefferson, Ga.—The town contemplates the installation of water and sewer systems and an electric-light plant. Sydney J. Nix is Councilman.

Hattiesburg, Miss.—The city has decided to lay about 2½ miles of water pipe, estimated to cost $7000. The work will probably be done by day labor. J. H. Putnam is City Engr. Noted May 13.

Richton, Miss.—An election has been called for June 10, to vote on a bond issue of $10,000 for installing a water system. Noted May 15.

Johnson City, Tenn.—The city will lay one mile of water pipe from the reservoir to the Soldiers' Home. Estimated cost, $7000.

Tiptonville, Tenn.—Bids will be asked about July 1, for constructing water and a water system here, estimated to cost $20,000. Fred Callahan is Mayor. Noted May 8.

†Cincinnati, Ohio—(Official)—The contract to furnish pipe during the year 1913 has been awarded to the U. S. CAST IRON PIPE & FOUNDRY CO., at $53,110; the contract to lay pipe has been awarded to THOMAS J. SCULLY, 416 Mill St., Cincinnati, Ohio, at $37,535. Bids were opened May 19. J. A. Hiller is Supt. Distribution.

Pleasant City, Ohio—(Official)—Bids will be received by M. F. Devine, Village Clk., until noon, June 13, for constructing a water system estimated to cost $15,000. The contract involves about 3665 ft. of 8-in., 8000 ft. of 6-in., 800 ft. of 4-in. pipe, a concrete reservoir, pumps, engines, hydrants, gates and valves. H. L. Maddock, Newark, Ohio, is Consult. Engr. Noted Mar. 20.

West Terre Haute, Ind.—Bids will be received by the West Terre Haute Water Co. until June 16, for constructing a water system. W. R. Paige, Rose Dispensary Bldg., Terre Haute, is Consult. Engr. Noted Feb. 6.

Saline, Mich.—Bids will be received by Homer Fish, Village Clk., until June 18, for constructing a water system.

†Bloomington, Ill.—(Official)—The contract to construct water mains here has been awarded to P. F. McDONALD, Bloomington, at $31,139. The other bids were: T. H. Iglehart, Chicago, $31,564; Porter McCulley Construction Co., Mackinan, Ill., $31,752; Frank Sullivan, Bloomington, $33,731; C. C. Bowman, Bloomington, $35,280. Bids were opened by the Board of Local Improvements, May 22. Elmer Folsom is City Engr. Noted May 15.

Chicago, Ill.—According to press reports, bids will be received by L. E. McGann, Comr. Pub. Wks., until June 6, for furnishing and installing at the Jefferson Park pumping station, an electrical motor-driven centrifugal pump, of 3,000,000 gal. daily capacity.

†Rock Island, Ill.—A contract to lay water mains in Ninth Ave. has been awarded to P. F. TRENKENSCHUH, Rock Island, at $14,000.

†Maple Lake, Minn.—Contracts for installing a water system here have been awarded as follows: Tower and tank, to the MINNEAPOLIS STEEL & BRIDGE CO., Minneapolis, Minn.; sinking well, to F. J. KOPP, Minneapolis; furnishing and laying pipe, to W. D. LOVELL, Maple Lake. Total cost, $12,000. Bids were opened May 12. Noted May 1.

Wabash, Minn.—According to press reports, the Village Council contemplates the installation of water and sewer systems estimated to cost about $35,000.

Norfolk, Neb.—Bids will be received by P. F. Stafford, City Clk., until 5 p.m., June 16, for extending the water system here, according to plans and specifications on file at the office of the City Engineer. Estimated cost, $10,000.

Mayville, N. D.—(Official)—Bids will be received by C. O. Vanon, City Audr., until 10 a.m., June 18, for equipping an electric-light plant and constructing an addition to the water system. Plans were prepared by the Oscar Claussen Engineering Co., St. Paul, Minn.

Hannibal, Mo.—According to press reports, an election has been called for July 1, to vote on a bond issue of $285,000 for purchasing the private water system. C. T. Hays is Mayor. Noted May 1.

Corpus Christi, Tex.—In order to provide an ample supply of water for the city two new reservoirs are being constructed. An additional pumping plant will be established six miles west of the city on the municipal pipe line which brings the water into town from the Nueces River reservoir, 18 miles distant. The City Council is working on the plans for a larger and permanent water plant which will be located on either the Nueces River or at Tule Lae. Noted May 1.

Fort Worth, Tex.—The Water Commissioner has recommended the construction of a 36-in. water main from the Holly plant to North St. Estimated cost, $33,500.

Hillsboro, Tex.—The city contemplates the installation of water and sewer systems. Estimated cost $25,000.

Kaufman, Tex.—The City Council will install additional equipment in the water plant.

†Cushing, Okla.—A contract to lay about 7½ miles of cast water mains and 2½ miles of sewers has been awarded to the STOKES CONSTRUCTION CO., Oklahoma City, Okla.

Durant, Okla.—(Official)—The Benham Engineering Co., Oklahoma City, Okla., has been retained by the city to prepare plans for the proposed extensions to the water and sewer systems for which bonds for $50,000 were recently voted. W. P. Danford is City Engr. Noted May 27.

Lawton, Okla.—(Official)—The three miles of 10-in. pipe line contemplated to connect Fort Sill with the city pipe line will be laid under the supervision of the Constructing Quartermaster at Fort Sill. Noted May 15.

Salt Lake City, Utah—The City Commission has appropriated $16,000 for constructing a dam at Lake Phoebe, and for preliminary work on the Twin Lakes Dam. W. H. Korns is Comr. W.-Wks.

Prescott, Ariz.—The Arizona Land & Irrigation Co. will soon begin the construction of a system of irrigation near here. The water storage reservoir will be located on Willow Creek.

Amity, Ore.—(Official)—The water system to be installed here will cost about $19,000. Plans are being prepared by Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland, Ore. Noted May 15.

Cañon City, Ore.—Preliminary work for an irrigation project is under way near Cañon City. Michael Spears, former County Surveyor, is Engr.-in-Charge. The plans contemplate the construction of a dam 150 ft. high across Cañon Creek, above Cañon City. Enough water can be stored in this reservoir to supply 20,000 acres of bench land. The estimated cost is $400,000. It is proposed to bond the property benefited for the amount to carry on the work.

Salem, Ore.—Plans calling for the reclamation of 20,000 acres of land in the Teel Irrigation District in Umatilla County have been filed with the state engineer Lewis by W. B. Hinkle, Engr. for the project. It is proposed to build a 20-mile canal, one mile of which will pass through a tunnel and to construct a 90-foot dam. The cost of the project is estimated at $1,000,000, and as soon as possible an election will be held on a bond issue to finance the project.

Salem, Ore.—The Santiam Water Co. has been formed with a capital of $300,000 for the purpose of providing water to Salem and other near by cities from the Little North Fork of the Santiam River. W. E. Pierce, Boise, Idaho, is interested.

Vale, Ore.—D. M. Brogan, promoter of the Bully Creek Irrigation Project, announces that work of digging a ditch from the Malheur River to Lamberson Reserve will be started during the summer.

Centralia, Wash.—It is proposed to purchase the private water system for $140,000 and lay a 20-in. wood stave pipe line 16 miles long, at an estimated cost of $175,000. Stanley Macomber is City Engr. Noted May 8.

Brawley, Calif.—Water Co. No. 8 is arranging to construct a syphon or flume across New River, about four miles south of Brawley.

Daly City, Calif.—A bond election will be held June 21 when the proposition of issuing bonds to the extent of $100,000 for a municipal water system will be voted upon.

†Los Angeles, Calif.—(Official)—The contract to construct a water-distributing system in the townsite of Montrose has been awarded to the LOS ANGELES MFG. CO., Los Angeles, at approximately $100,000. Bids were opened by F. C. Finkle, Consult. Engr., May 20. Noted Apr. 24.

Montague, Calif.—The Big Springs Water Co. has been formed to bring water for irrigation purposes from Big Springs, Shasta County, to land near Montague. George W. Peltier, Sacramento is interested.

Agincourt, Ont.—See item under Buildings.

SEWERS

Boston, Mass.—Bids will be received by the Department of Public Works until June 6, for constructing sewers in Bowdoin, Bowniesidc and Crossman Sts., Dorchester, in Howard, Sussex and Tremont Sts., Roxbury, and in Alberta and Walworth Sts., West Roxbury. L. K. Rourke is Comr.

Boston, Mass.—The following bids were received May 28 by the Directors of the Port of Boston, for paving, laying sewer and water-pipes, etc., in Northern Ave., South Boston: Northern Construction Co., $104,597, Lawler Bros., $110,890, Per W. Hill, $111,793; Coleman Bros., $113,136; Simpson Bros. Corp., $113,856; James Doherty, $113,283; John J. Cashman, $125,745; John E. Quinn, $127,989; H. P. Converse & Co., $128,368; Ryan & Keon, $130,259; Boston Paving Co., $135,120; Hugh Naun Contracting Co., $149,276; Wm. H. Keyes, $155,010; I. W. Hodgdon, 40 Central St. is Ch. Engr. Noted May 22.

Boston, Mass.—L. K. Rourke, Comr. Pub. Wks., has requested an appropriation of about $700,000 for sewer construction and the mayor has recommended an immediate appropriation of $400,000. G. S. Dorr is Ch. Engr. Sewer Dept.

Easthampton, Mass.—(Official)—The town contemplates an expenditure of $17,000 for constructing sewer outlets and laterals. W. C. Tannatt, Jr., is Town Engr.

Fall River, Mass.—The Committee on Sewers of the Board of Aldermen has made an appropriation of $6000 for the construction of sewers.

Framingham, Mass.—(Official)—The town contemplates extensions to its sewer system estimated to cost $30,000. Frank E. Hennessey is Town Clk.

Holyoke, Mass.—(Official)—The Board of Public Works contemplates an expenditure of $20,000 for the construction of vitrified pipe sewers. O. Ferry is Asst. Clk.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 11, by the President of the Borough of Brooklyn, Borough Hall, for furnishing all the labor and materials required for constructing a sewer in New Utrecht Ave., west side, from a point about 80 ft. north or 63d St. to 66th St., and in 63d St., from New Utrecht Ave. to 14th Ave. Alfred E. Steers is Pres.

Buffalo, N. Y.—Bids will be received by the Board of Public Works until 11 a.m., June 7, for constructing sewers in portions of Skillen St. and Dewey Ave. Francis G. Ward is Comr.

Buffalo, N. Y.—The City Council has ordered the construction of 18-, 15-, 12- and 10-in. tile sewers in Henrietta and Beatrice Aves., and a 10-in. tile sewer in Hill St.

✚New York, N. Y.—(Borough of Queens)—(Official)—The President of the Borough of Queens, Jackson Ave. and Fifth St., Long Island City, has awarded a contract to CLANCY & VAN ALST, at $19,442, for the construction of a sanitary sewer in Redfern Ave., from McNeill Ave. to Leland Place. Bids were received on May 21. Maurice F. Connolly is Pres.

Rochester, N. Y.—The Acres Community Club has voted to employ an engineer to prepare plans for the installation of a sewer system to serve the tract. The system will probably have an outlet into Allen's Creek and Irondequoit Bay.

✚✚Ridgewood, N. J.—(Official)—The contract to alter and improve the sewage disposal plant of the village has been awarded to JAMES V. MEOLA, Paterson, N. J., at $8245. The other bids were: John E. Foley, $9110; F. R. Long, $11,480. Bids were opened May 20. Noted May 6.

Westfield, N. J.—(Official)—Bids will be received by the Town Council until 8 p.m., June 16, for constructing sewers as follows: 300 lin.ft. of 8-in., 420 lin.ft. of 12-in., 2950 lin.ft. of 15-in., 4340 lin.ft. of 18-in., 136 lin.ft. of 16-in., and 420 lin.ft. of 18-in. c.-i. pipe sewer ;40 manholes; branches and minor appurtenances. Charles Clark is Town Clk.

✚Danville, Penn.—The contract to construct a sewer system here has been awarded to PERRY M. KINSEY, Frankfort, Ind., at $19,285.

✚West Chester, Penn.—The contract to construct the Goose Creek Sewer from Market and Franklin Sts. to Linden, has been awarded to M. & T. E. FARRELL, West Chester, at $13,500. Bids were opened May 5. Noted May 22.

★Baltimore, Md.—(Official)—Bids for sewer construction have been received by the Board of Awards, as follows. ★Sanitary Contract 110, Sanitary District 16 B. Bids for all sewers in open trench: Middleton-Thompson Co., Baltimore, $125,201; Ryan & Reilly, Union Trust Bldg., $132,780; McCarthy & O'Herron, 1518 Malster Ave., $141,184; Whiting Turner Construction Co., Baltimore, $155,847; Gallegher, Boyle & Bryan, 147 W. Montgomery St., $158,502. Bids for all sewers under railway tracks in tunnel: McCarthy & O'Herron, 1518 Malster Ave., $146,833; Middleton-Thompson Co., Baltimore, $147,470; Whiting-Turner Construction Co., Baltimore, $163,464; Ryan & Reilly, Union Trust Bldg., $170,770; Gallagher, Boyle & Bryan, 147 W. Montgomery St., $183,897. Bids were opened Apr. 16. Noted Apr. 3.

Storm-water Contract 27: Ryan & Reilly, Union Trust Bldg., $29,025; Middleton-Thompson Co., Continental Bldg., $30,329. McCarthy & O'Herron, 1518 Malster Ave., $30,985; W. H. Thompson Construction Co., Calvert & Reed Sts., $32,928. Bids were opened Apr. 29. Noted May 1.

★Sanitary Contract 109, miscellaneous lateral sewers No. 4: W. H. Thompson Construction Co., Calvert & Reed Sts., $17,006; Middleton-Thompson Co., Continental Bldg., $19,080; Gallagher, Boyle & Bryan, 147 W. Montgomery St., $19,564; Whiting-Turner Construction Co., Sexton Bldg., $22,768. Bids were opened May 7. Noted May 1.

✚✚Sanitary Contract 111, Sanitary District 16 A: MIDDLETON-THOMPSON CO., $157,503. Tunnel construction to be used for all sewers where alternative prices were asked. (Reported awarded contract.) Whiting-Turner Construction Co., $164,826. (Trench construction to be used for all sewers where alternative prices were asked.) Ryan & Reilly, $168,875. (Tunnel construction to be used for all sewers where alternative prices were asked, except open trench construction in Baltimore St., from Nutaw to Paca Sts., and in Charles St., from Lonbard to Pratt Sts.) McCarthy & O'Herron, $186,865. (Trench construction to be used for all sewers where alternative pricos were asked.) Bids were opened May 14. Noted May 1.

✚✚Sanitary Contract 114, Section 8 of the High Level Interceptor: C. B. CLARK & CO., 1507 W. Lombard St., $100,152 (reported awarded contract); Whiting-Turner Const. Co., Sexton Bldg., $107,963; Ryan & Reilly, Union Trust Bldg., $110,104. Bids were opened May 21. Noted May 8.

✚✚Sanitary Contract 115: CAROZZA, LEVOZZA & CAROZZA, 132 Delphin St., $23,870 (reported awarded contract); Timothy, Bresnan & Sons, 2018 W. North Ave., $24,718; William McCarthy & O'Herron, 1513 Malster Ave., $27,209; W. H. Thompson Construction Co., Calvert & Read Sts., $25,956; Gallagher, Boyle & Bryan, 147 Montgomery St., $250,105. Bids were opened May 21. Noted May 8. Calvin W. Hendrick is Ch. Engr. Sewerage Comn.

Rockville, Md.—According to press reports, the Commissioners of Montgomery County contemplate the installation of sewer and water systems estimated to cost $20,000.

Bluefield, W. Va.—(Official)—Bids will be received by the Board of Affairs until June 13, for constructing about 6500 ft. of 15-in. sanitary sewer. Plans and specifications are on file at the office of the City Engineer. J. T. Akers is Audr. Noted Apr. 13.

Weldon, N. C.—W. C. Riddick, Consult. Engr., Raleigh, N. C., is preparing plans for sewer and water systems here, estimated to cost $40,000.

Walterboro, S. C.—According to press reports, bids will be received by the City until July 1, for constructing a sewer system estimated to cost $12,000. Plans were prepared by J. Newton Johnson, Consult. Engr., Florence, S. C.

Jefferson, Ga.—See item under Water Supply-Irrigation.

★New Orleans, La.—(Official)—Bids will be received by the Sewerage and Water Board until noon, July 28, for constructing an extension to the drainage pumping station, including suction and discharge basins, which contract is designated 55 D. Plans and specifications may be obtained at the office of the Board. George G. Earl is Gen. Supt.

✚Ruston, La.—The contracts to construct a complete sewer system here have been awarded as follows: Laying sewers, etc., to ISAAC C. MISHLER, Chattanooga, Tenn., at $25,748; furnishing pipe, to the TEXARKANA PIPE CO., Texarkana, Tex., at $10,916. Bids were opened May 15. Noted Apr. 24.

Shreveport, La.—The city will probably soon ask bids for constructing storm sewers estimated to cost $20,000. George Wilson is City Engr.

✚Louisville, Ky.—The contract to construct sewers in Shelby St. from Burnett Ave. to the city limits, and in Preston St. from Rawlings St. to the city limits, has been awarded to J. H. CAHILL, Louisville, Ky., at $90,641. Bids were opened May 27. Noted May 22.

Canal Dover, Ohio—The City Council has decided to install a sewage disposal plant. The plant will be erected about one mile south of the city, between the river and canal, and will cost about $60,000.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 9, for constructing main and lateral sewers and drains, with appurtenances, in various streets. Plans and specifications may be obtained at the office of the Chief Engineer of the Department.

Columbus, Ohio—(Official)—Bids will be received by S. A. Kinnear, Dir. Pub. Ser., until noon, June 10, for constructing the southern relief sewer. Plans and specifications may be obtained from the Chief Engineer of the Department.

Gibsonburg, Ohio—Bids will be received by the Village Clerk until noon, June 9, for constructing a storm sewer.

Greenfield, Ohio—Bids will be received by E. M. Connor, Village Clk., until noon, June 16, for constructing sanitary sewers.

Massillon, Ohio—H. M. Yost has prepared plans for the construction of storm sewers in Green, Jarvis and Wooster Sts., and an intercepting sewer in South St. Estimated cost, $16,000.

Norwalk, Ohio—Bids will be received by A. W. Carpenter, Dir. Pub. Ser., until noon, June 6, for constructing 700 ft. of 24-in., tile sewer in Whittlesy St., 1300 ft. of 15 to 20-in. tile tile sewer in West Elm St., and 1700 ft. of 24x30-in. and 36-in. sewer in East Elm St. Estimated cost, $50,000. John Laylin is City Engr.

Port Clinton, Ohio—(Official)—Bids will be received by the Village Council until noon, June 30, for constructing sewers in various streets. J. A. Singler is Clk.

Grand Rapids, Mich.—The lowest bid received by the Board of Public Works for constructing a sewer in Fulton St., and other streets, was submitted by C. E. Williams, Grand Rapids, at $11,157.

Highland Park, Mich.—The Village Council has taken preliminary steps for installing a sewer system estimated to cost $373,000. The plan provides for the construction of a sewer in Hamilton Blvd., a trunk line sewer in Oakland Ave., an intercepting sewer and sewage disposal plant.

Marshall, Mich.—(Official)—The Smith & Boulay Co., The Nasby, Toledo, Ohio, have prepared plans for the construction of storm water sewers here, estimated to cost $17,000. Bids will probably be asked about June 20.

Port Huron, Mich.—(Official)—The lowest bid received by the city for constructing a storm sewer to drain the section between 15th and 24th Sts., was submitted by John Deloyea, Port Huron, at $10,900. Bids were opened May 26. E. R. Whitmore is City Engr. Noted Apr. 24.

Chicago, Ill.—Bids will be received by the Board of Local Improvements until June 6, for constructing sewers in Addison, Byron, East 84th Sts., and other streets. E. J. Glackin is Secy.

Bangor, Wis.—Bids will be received by S. B. Weldon, Village Clk., until 2 p.m., June 7, for constructing about 13,000 lin.ft. of sewers.

Jackson, Wis.—Bids will be received by the Committee on Sewers until 7:30 p.m., June 10, for constructing sewers. Plans are on file at the office of the Village Clerk.

Kenosha, Wis.—The City Engineer has prepared plans for building a trunk sewer for the north and northeast sides. Preliminary plans adopted by the Common Council provide for a 36-in. sewer from Racine Ave. and North St. west to North Pleasant St. and south on North Pleasant St. to the intercepting creek. From this point the sewer will be kept open for carrying away storm water. A. O'Head is Mayor. A bond issue for paying a portion of the sewer will be issued, amounting to $35,000.

✚Belmond, Iowa—(Official)—The contract to construct about 14,000 ft. of 6- and 8-in. vitrified sewers here has been awarded to M. McELLIGOTT, Evanston, Ill., at $9200. The other bids were Hake & Bailey, $9500; E. F. Beaty, $10,500. Bids were opened May 20. Noted May 15.

Council Bluffs, Iowa—Wyncoop Kiersted, Consult. Engr., Kansas City, Mo., has prepared tentative plans for a sewer system in the west end.

Idebolt, Iowa—E. E. Carlson, Consult. Engr., Battle Creek, Mich., is preparing plans for a sewer system here, estimated to cost $17,000.

New Ulm, Minn.—Bids will be received by Albert J. Meyer, City Clk., until 5 p.m., June 9, for constructing sewers in various streets.

Ortonville, Minn.—Bids will be received by C. J. Stark, City Clk., until 8 p.m., June 16, for constructing a sanitary sewer system and sewage-disposal plant.

✚Burlingame, Kan.—A contract to construct six miles of sewers and a sewage-disposal plant here has been awarded to the TONKAWA CONSTRUCTION CO., Tonkawa, Okla., at $26,000. A. J. Smith, Emporia, Kan., is Consult. Engr.

Houston, Tex.—Bids will be received by Dan C. Smith, Jr., City Secy., until June 16, for constructing storm sewers as follows: 1000 lin.ft. of 42-in., 1780 ft. of 84-in., 1340 ft. of 102-in., 4520 ft. of 108-in. sewer, 23 manholes, 92 catchbasins and 2300 lin.ft. of 15-in. catchbasin connections. Specifications may be obtained at the office of the City Engineer.

✚Pecos, Tex.—(Official)—The contract to construct approximately 10 miles of sanitary sewers and sewer laterals, has been awarded to A. T. MULLER, Dallas, Tex. Bids were opened May 26. Noted May 8.

Waco, Tex.—Bids will probably soon be asked for the construction of a sewer system in Cameron Park. Estimated cost, $25,000. J. H. Mackey is Mayor.

✚Cushing, Okla.—A contract to lay 3½ miles of vitrified pipe sewers has been awarded to the STOKES CONSTRUCTION CO., Oklahoma City, Okla.

Globe, Ariz.—The City Council and the Board of Health are considering a proposition to install a new sewer system here to cost about $150,000.

Calgary, Alta.—The City Commissioners plan to install a trunk sewer system here to cost about $525,000. J. M. Miller is Clk.

GARBAGE

Springfield, Mass.—The City Council has voted to build a new garbage incinerator at North End to cost $10,400. John A. Dennison, is Mayor.

✚New York, N. Y.—(Borough of Queens)—(Official)—The President of the Borough of Queens, Borough Hall, Jackson Ave. and Fifth St., Long Island City, has awarded a contract to the NEW YORK SANITARY VITILIZATION CO., 30 Burling Slip, New York, at $8500, for the final disposition of garbage in the Fifth Ward, the Boro. of Queens, during the months of June, July, August and September, 1913. Bids were received May 21. Maurice E. Connolly is Pres.

White Plains, N. Y.—The village will install a garbage incinerator to cost about $30,000. Joseph B. Rider, South Norwalk, Conn., is Consult, Engr.

Pittsburgh, Penn.—It is reported that plans prepared by Irwin & Witherow, Engrs., Keystone Bldg., for a refuse utilization plant at Tusten and Brady Sts., for the American Reduction Co., have been approved by the Building Inspector. The building will be of brick and reinforced concrete, four stories, 52x203 ft. Estimated cost, $55,000.

✚Washington, Penn.—The City Council, May 19, awarded the contract to W. K. HERBERT, Washington, for the construction of a 20-ton garbage incinerator, at $10,500.

Clarksburg, W. Va.—The city is considering the erection of a garbage crematory.

Miami, Fla.—The citizens have voted in favor of issuing $25,000 of bonds for the installation of garbage incinerators.

Chicago, Ill.—Bids will be received by the city until 11 a.m., June 5, at Room 406, City Hall, for furnishing and providing all tools, appliances, material, labor and facilities to properly design; deliver material and equipment; prepare site; construct dock, retaining walls, roadways, foundations, buildings, switch tracks, machinery, appurtenances and auxiliaries, and completed a garbage-reduction plant and operate same for a period of five years on Lots 51 and 53 of the Sanitary District of Chicago. Specifications, contract and bond are on file and obtainable in the office of the Department of Public Works, Room 406, City Hall.

STREETS AND ROADS

✚Barre, Vt.—(Official)—The Street Commissioners have awarded the contract for about 7000 sq.yd. paving on North Main St. to the J. W. GORE CO., Boston Journal Bldg., Boston, Mass., at $21,907. There were eight other bidders. George A. Reed is City Engr. Noted May 22.

Boston, Mass.—Bids will be received until June 9 by the Department of Public Works for the construction of wood block and asphalt macadam pavement on Marion, Vernon and Ruggles Sts., Roxbury, and Orient Ave., East Boston. L. K. Rourke is Comr.

Boston, Mass.—(Official)—Bids for the improvement of Northern Ave. and Pier 6 have been received as follows by the Directors of the Port of Boston: W. B. Keyes & Co., $115,010; Hugh Bawn Construction Co., $149,275; Boston Paving Co., $135,119; Ryan & Keon, $130,259; H. P. Converse Co., $128,367; John E. Quinn, $127,939; John Cashman & Sons Co., $125,745; James Doherty, $119,289; Simpson Bros., $113,356; Coleman Bros., $113,135; Peter W. Hill, $111,792; Lawler Bros., $110,960; Northern Construction Co., $104,597. Hugh Bancroft is Chn of Dirs. Noted May 22.

Bids will be received by the State Highway Commission, 15 Ashburton Place, Boston, until noon, June 10, for building about 4000 ft. state highway in West Boylston. Wm. D. Sohier is Chn.

The Department of Public Works will have plans prepared immediately for paving the square at the junction of Brookline and Commonwealth Aves., Beacon and Deerfield Sts., with wood block, at an estimated cost of $75,000. L. K. Rourke is Comr.

Easthampton, Mass.—(Official)—The town contemplates the construction of one-half mile of macadam pavement. Estimated cost, $5000. W. C. Tannett, Jr., is Town Engr.

Holyoke, Mass.—(Official) The Board of Public Works plans to improve various streets at an estimated cost of $100,000. Bids will be accepted on wood block, asphaltic or bituminous concrete. O. C. Ferry is Asst. Clk.

Hartford, Conn.—Bids for the construction of state road work were received by the State Highway Commissioner, May 29, as follows: Town of Middlefield, 7322 lin.ft. macadam-telford construction on the Middlefield-Durham Road: Frank Arrigoni & Bro., Middletown, Conn., macadam, $2.09 per lin.ft.; telford, $3.25 per lin.ft.; cobble gutters, $1 per sq.yd.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd; dry walls, $6 per cu.yd; flush coat hot asphalt, 15c. per sq.yd.; treating oil Barber oil 12c per sq.yd. A. Brazos & Sons, Middletown, Conn., $2.28, $2.08, 90c, 8x, $7.50, $6, 25c, 15c.; town of Prospect, 3751 lin.ft. graded construction on the Union City Road: Joseph Mascetti, Torrington, Conn., grading, $1.00 per lin.ft.; telford, $2.40 per lin.ft.; rubble drain, $1.25 per lin.ft.; cobble gutters, 75c. per sq.yd.; concrete walls, $7 per cu.yd.; masonry walls, $6 per cu.yd.; dry walls, $5 per cu.yd. Louis Longhi & Bro., Torrington, Conn., $1.52, $2.62, $1.30, $1.20, $1.0, $8, $6, A. De Ambrosia, Hartford, Conn., $1.34, $2.29, $1.50, 75c, $12, $8, $4, Goodman & Trumbull, Litchfield, Conn., $1.40, $2.10, $1.25, 70c, 99, $6, $5, P. N. Beard, Shelton, Conn., $1.44, $2.19, $1.20, 50c, $7, $6, $5, town of Stafford, 5530 lin.ft. bituminous macadam construction on the West Stafford Road: A. D. Bridge's Sons Co., Hazardville, Conn., $1.73 per sq.yd. for macadam, $2.12 for telford, $1 per lin.ft. for rubble drain, 60c. per sq.yd. for cobble gutters, $10 per cu.yd. for concrete walls; $7 for masonry walls; $5 for dry walls; B. Silvestri & Co., Hartford, Conn., $1.64, $2.15, $1, 60c.; $7.50; $6; $5; town of Haddam, about 2775 lin.ft. macadam-telford construction on the Higganum Station Road: F. Arrigoni & Bro., Middletown, Conn., $1.94 per lin.ft. for macadam; $3.25 for telford; $1.25 per lin.ft. for rubble drain, $10 per cu.yd. for concrete walls; $8 for masonry walls; $6 for dry walls; 15c. per sq.yd. for hot flush coat asphalt; 8c. per sq.yd. for asphalt oil; A. Brazos & Sons, Middletown, Conn., $2.15; $3; $1.50; $8; $8; $7; 28c.; 18c.; town of Simsbury, 8593 lin.ft. macadam construction on the Tariffville Road; Goodman & Trumbull, Litchfield, Conn., macadam, $2.17 per lin.ft.; telford, $3.17 per ft.; rubble drain, $1.25 per ft.; concrete walls, $8 per cu.yd.; masonry walls, $6 per cu.yd.; dry walls, $4.50 per cu.yd.; hot flush coat asphalt, 13c. per sq.yd.; Trinidad oil, 9c. per sq.yd.; A. J. Ketchin & Son, Simsbury, Conn., $1.81; $2.60; 75c.; $7; $4.25; 13c.; 8½c.; L. Longhi & Bro., Torrington, Conn., $2.60; $3.25; $1.25; $10; $8; $6; Pierson Engineering & Construction Co., Bristol, Conn., $2.23; $3.20; $1.00; $8; $6; $5; 12c.; 7c.; Joseph Mascetti, Torrington, Conn., $1.79; $2.79; $1.25; $7; $6; $5; 12c.; 9c.; A. Brazos & Sons, Middletown, Conn., $2.55; $3.45; $1.40; $8.50; $7.50; $6; 25c.; 20c.; R. G. Miller, Bloomfield, Conn., $2.17; $1.50; $2; $7; $6; $5; 20c.; 15c.; Olmsed & Olmsted, East Hartford, Conn., $2.07; $3.10; $1.25; $7.50; $7.50; $7; 20c.; 8c.; town of Middletown, $544 lin.ft. concrete or bituminous concrete construction on the Hartford-Saybrook Tpk.: A. Brazos & Sons, Middletown, Conn., $2.15 per sq.yd. for concrete; $1.40 per lin.ft. for rubble drain; $8 per cu.yd. for concrete walls; $7.50 for masonry walls; $6 for dry walls; Connecticut Hassam Pavement Co., New Haven, Conn., $1.80 per sq.yd. for Hassamite; 30c. per lin.ft. for rubble drain; $3.50 per cu.yd. for concrete and masonry walls; $3 for dry walls; F. Arrigoni & Bro., Middletown, Conn., $1.93 per sq.yd. for concrete, $1.43 for Hassamite; $1.25 for rubble drain; $10 for concrete walls; $8 for masonry walls; $6 for dry rubble walls; town of Somers, 6100 lin.ft. native stone construction on the Ellington Road: R. G. Miller, Bloomfield, Conn., $2.35 for macadam; 75c. per lin.ft. extra for telford; $1.25 for rubble drain, $1 per sq.yd. for cobble gutters; $7 per cu.yd. for concrete walls; $4 for masonry walls; $3 for dry walls; 20c. per sq.yd. for hot flush coat asphalt; 15c. per sq.yd. for Barber oil; A. D. Bridge's Sons Co., Hazardville, Conn., $1.93; $2.53; $1; 50c.; $10; $7; $5; 15c.; 9c.; town of Ellington, 7810 lin.ft. gravel construction on the Somers Road: R. G. Miller, Bloomfield, Conn., gravel, $1.70 per lin.ft.; telford $2.65 per lin.ft.; rubble drain, $1.25 per lin.ft.; cobble gutters, $1 per sq.yd.; concrete walls, $7 per cu.yd.; masonry walls, $4 per cu.yd.; dry walls, $3 per cu.yd.; Vito Construction Co., Thompson, Conn., $1.64; $2.64; $1.24; 75c.; $10; $8; $5; A. Brazos & Sons, Middletown, Conn., $2.15; $3.10; $1.40; 90c.; $8; $7.50; $6.50; Franklin Construction Co., $1.68; $2.70; 95c.; 75c.; $8; $6; $5; Goodman &Trumbull, Litchfield, Conn., $1.80; $2.70; $1.25; 80c.; $8; $5.50; $4; town of Chester, 6759 lin.ft. macadam construction on the Chester Road: F. Arrigoni & Bro., Middletown, Conn., macadam, $1.93 per lin.ft.; telford, $4.05 per lin.ft.; rubble drain, $1.25 per lin.ft.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd.; dry walls, $6 per cu.yd.; hot flush coat asphalt, 15c. per sq.yd.; Barber oil, 12c. per sq.yd.; A. Brazos & Sons, Middletown, Conn., $2.89; $3.75; $1.20; $8; $7.50; $6; 25c.; 15c.; Sperry Engineering Co., New Haven, Conn., $3.80; $4.80; $1; $8; $6; $5; $20c.; 15c.; Goodman & Trumbull, Litchfield, Conn., $3.32, $4.56, $1.25; $8; $6; $5; 13c.; 9c.; town of Fairfield, 4272 lin.ft. amiesite or bituminous macadam construction on the Easton Turnpike: C. T. Eastburn Co., Meriden, ..Conn., $1.85 per sq.yd. for amiesite over stone base; $2.75 per sq.yd. over telford base; $1.50 per lin.ft. for concrete curb; $1 per lin.ft. for gutter drain; 40c. per lin.ft. for rubble drain; $12 per cu.yd. for concrete walls; $12 for masonry walls; $8 for dry rubble walls; F. Pierce, Jr., Co., Bridgeport, Conn., $1.95 per sq.yd. for amiesite over stone base; $2.80 for amiesite over telford base; $1.43 per sq.yd. for bituminous macadam; $2.30 per sq.yd. for bituminous macadam over telford base; 75c. per lin.ft. for concrete curb; 40c. per lin.ft. for gutter drain; $1 per lin.ft. for rubble drain; $10 per cu.yd. for concrete walls; $8 for masonry walls; $6 for rubble walls; Sperry Engineering Co., New Haven, Conn., $1.50 per sq.yd. for amiesite over stone base; $2.80 for amiesite over concrete base; $1 per lin.ft. for concrete curb; 50c. per lin.ft. for gutter drain; $1 per lin.ft. for rubble drain; $8.50 per cu.yd. for concrete walls; $6 for masonry walls; $4 for rubble walls; town of Middlebury, 2800 lin.ft. gravel construction on the Woodbury Road: Ahern Construction Co., Inc., Williamantic, Conn., gravel, $2.70 per lin.ft.; telford, $3.50 per lin.ft.; rubble drain, $1.25 per lin.ft.; concrete walls, $6 per cu.yd.; rubble walls, $5 per cu.yd.; L. Longhi & Bro., Torrington, Conn., $3.19; $4.39; $1.25; $10; $8; $6; John de Michiel & Bro., Torrington, Conn., $2.35; $3.35; $1.25; $7; $6; $5; Bennett N. Beard, Shelton, Conn., $2.10; $3; $1.25; $7; $6.50; $6; Peter Suzio, New Britain, Conn., $3; $3.85; $1; $8; $6; $5.50; town of Monroe, $6225 lin.ft. native stone macadam construction on the Bridgeport Turnpike, John de Michiel & Bro., Torrington, Conn., macadam, $2.09 per lin.ft.; telford, $3.09 per lin.ft.; rubble drain, $1.25 per lin.ft.; cobble gutters, 90c. per sq.yd. concrete walls; $7 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $5 per cu.yd.; hot flush coat asphalt, 10½c. per sq.yd.; Barber oil, 9c. per sq.yd.; Peter Suzio, New Britain, Conn., $2.10; $2.95; $1.25; 75c.; H. D. Pierce, Jr. Co., Bridgeport, Conn., $2.40; $3.30; $1; $70c.; $10; $8, $6; 20c.; 15c.; Bennett N. Beard, Shelton, Conn., $1.98; $2.68; $1; 50c.; $10; $6; $5; 30c.; 30c.; Goodman & Trumbull, Litchfield, Conn., $2.49; $3.49; $1.25; 60c.; $9; $5; $4.50; town of Old Lyme, 5586 lin.ft. native stone macadam or trap rock macadam construction on the Neck Road, Framingham Construction Co., South Framingham, Mass., native macadam, $1.83 per lin.ft.; telford, $2.68 per lin.ft.; trap rock macadam, $1.83 per lin.ft.; telford, $2.65 per lin.ft.; rubble drain, $1.25 per lin.ft.; concrete walls, $8 per cu.yd.; masonry walls, $6 per cu.yd.; rubble walls, $4.50 per cu.yd.; hot flush coat asphalt, 19c. per sq.yd.; Trinidad oil 16c. per sq.yd.; F. Arrigoni & Bro., Middletown, Conn., $2.50; $3.80; $2.70; $4; $1.25; $10; $8; $6; 15c.; 12c.; Sperry Engineering Co., New Haven, Conn., $3.15; $4.15; $3.15; $4.15; $1; $8; $6; $5; 20c.; 15c.; town of Wallingford, 6650 lin.ft. bituminous macadam, bituminous concrete, warrenite, amiesite or hassamite pavement on North and South Colony Sts.: Warren Brothers Co., Boston, Mass., bituminous concrete over concrete base, $1.87 per sq.yd.; warrenite over concrete base, $1.93 per sq.yd.; bituminous concrete surface, $1.30 per sq.yd.; 2-in. warrenite surface, $1.25 per sq.yd.; excavation for sub-grade, 60c. per cu.yd.; Charles

T. Eastburn Co., Meriden, Conn., amiesite surface over crushed stone base, $1.43 per sq.yd.; $1.10 per sq.yd. for 2-in. amiesite surface, excavation, 65c. per cu.yd.; Connecticut Hassam Paving Co., New Haven, Conn., hassamite, $1.50 per sq.yd.; bituminous macadam, $1.38 per sq.yd.; hassam surface over hassam concrete base, $1.40 per sq.yd., excavation, 50c. per cu.yd.; Edward Tracy, Derby, Conn., bituminous macadam, $1.44 per sq.yd.; 3-in. bituminous macadam surface, 95c. per sq.yd.; excavation, 60c. per cu.yd. Chas. J. Bennett is Comr. Noted May 22.

Brooklyn, N. Y.—(Official)—The following bids were received May 29, by the Department of Parks, the Arsenal, Fifth Ave. and 64th St., Boro. Manhattan, for grading and top soiling in the Brooklyn Botanic Garden: Joseph Balaban, 261 Broadway, Manhattan, $29,955; John Connor, 1762 Rogers Ave., $24,615; M. F. Hickey, Seventh St., $33,738; Norton & Gorman Contracting Co., 303 Douglass St., $33,820. Charles B. Stover is Pres.

✦New York, N. Y.—(Borough of Queens)—(Official)—The President of the Borough of Queens, Fifth St. and Jackson Ave., Long Island City, has awarded the following contracts, from bids received on May 21, for the paving of various streets: Riker Ave., from Woodside Ave. to Kelley Ave., to the FREEMAN-HESS CO., at $11,994; on Webster Ave., and on Wilson Ave., to the HASTINGS PAVING CO., at $71,120 and $16,856, respectively; Wilbur Ave., from William St. to Academy St., to the BARBER ASPHALT PAVING CO., at $10,399; Jackson Ave., from Woodside Ave. to Trans Meadow Road, U. S. WOOD PRESERVING CO., at $62,565; Harold Ave., from Thompson Ave. to Skillman Ave., to DANIEL DONOVAN, at $9856. Maurice E. Connolly is Pres.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 3 p.m., June 12, by the Department of Parks, Fifth Ave. and 64th St., Manhattan, for constructing automobile roads in Forest Park, Boro. of Queens. Charles B. Stover is Comr.

New York, N. Y.—(Official)—Bids will be received until 2 p.m., June 9, by the President of the Borough of Manhattan, at the office of the Commissioner of Public Works, 1 Park Row, for regulating and repaving with special granite block pavement on a concrete foundation the roadway of Elm St., from north side of Reade St. to south side of Worth St. For regulating and repaving with special granite block pavement on a concrete foundatin the roadway of Washington St., from south side of Little West 12th St. to south side 14th St. For regulating and repaving with special granite block pavement on a concrete foundation the roadway of Washington St., from west side Greenwich St. to east side West St. For regulating and repaving with special granite block pavement on a concrete foundation the roadway of Hudson St., from north side 12th St. to south side 14th St. For regulating and repaving with special granite block pavement on a concrete foundation the roadway of Second Ave., from north side 60th St. to north side 74th St. For regulating and repaving with wood block pavement on a concrete foundation the roadway of Water St., from north side Old Slip to north side Wall St. For regulating and repaving with wood block pavement on a concrete foundation the roadway of Bridge St., from west side Broad St. to east side of Whitehall St. For regulating and repaving with wood block pavement on a concrete foundation the roadway of 59th St., from west side Broadway to east side Fifth Ave. For regulating and repaving with wood block pavement on a concrete foundation the roadway of 17th St., from west side Broadway to east side Fifth Ave. For regulating and repaving with wood block pavement between curb and rails and special granite block pavement in and between tracks on a concrete foundation the roadway of Amsterdam Ave., from north side 60th St. to south side 62d St., and from south side 68th St. to south side Broadway. For regulating and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation, the roadway of Ann St., from west side of Nassau St. to east side of Park Row. For regulating and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation, the roadway of Beaver St., from west side of Pearl St. to east side of Hanover St., including Pearl St. south of Beaver St. to Wall St.; Wall St., from west side of Water St. to west side of Pearl St., and Hanover St., from west side of Pearl St. to south side of Exchange Place. For regulating and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation, the roadways of Nassau St. from north side of Wall St. to north side of Pine St., and from north side of Liberty St. to south side of Maiden Lane. For widening the roadway and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation from curb to rail and with special granite block pavement in and between tracks, the roadway of 14th St., from west side Eighth Ave. to east side Ninth Ave. For regulating and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation, the roadway of 35th St., from west side of First Ave. to east side of Third Ave. For regulating and repaving with sheet asphalt, heavy traffic mixture, with portland cement filler, with close binder on a concrete foundation, the roadway of 4th St., from west side of First Ave. to east side of Second Ave. For regulating, grading, curbing, flagging, guttering, etc., Park Terrace west from 218th St. to a point 100 ft. south of 215th St. For regulating, grading, curbing, flagging, etc., 176th St., from Broadway to Fort Washington Ave. George McAneny is Pres.

✦Niagara Falls, N. Y.—The Board of Public Works has awarded the contract for bitulithic pavement on 11th and 14th Sts. to WARREN BROS., at $2.49 per sq.yd. The McKINNEY & McGUIRE CO. was awarded the contracts for paving Chilton and Elmwood Aves with asphalt block, at $4406 and $6040, respectively. F. S. Parkhurst, Jr., is City Engr.

Olean, N. Y.—(Official)—Bids will be received until 8 p.m., June 11, by the Commissioners of Public Works, for paving Reed St., from North Union to North First St. H. E. Buntz is City Engr. George H. Luther is Comr

✦Troy, N. Y.—The contract for paving River St., from Ferry to Adams St. with granite block was awarded by the Board of Contract and Supply to the PARKER-HASSAM CO., at $24,714. James M. Riley is Secy. Noted May 29.

✦Newark, N. J.—The Board of Works has awarded contracts for street paving to the STANDARD BITULITHIC CO., Newark, as follows: Rose Terrace, $16,531; Dewey St., $15,666; Schaik St., $6808; Jefferson St., $5983. M. R. Sherrerd is City Engr.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., June 16, by the Board of Chosen Freeholders of Middlesex County for macadamizing Woodbridge Ave., from Roosevelt to Woodbridge, Alvin B. Fox, 137 Smith St., Perth Amboy, N. J., is County Engr. Peter H. S. Hendricks is Dir. Bd. of Freeholders.

✦Passaic, N. J.—The Common Council has awarded a contract for paving Temple Place to JOHN T. HARROP, Garfield, N. J., at $10,354. Colin R. Wise is City Engr.

The Common Council has passed an ordinance authorizing the paving of Autumn St., from Myrtle to Hain Ave.

★Trenton, N. J.—(Official)—Bids will be received until noon, June 17, by the State House Commission, for about 11,000 cu.yd. grading on the State House grounds. E. J. Edwards is Secy. of the Comn.

Woodbridge, N. J.—The Township Committee has instructed its engineer to survey the Crows Mill Road, Woodbridge, and make estimates of cost for macadamizing the same.

✦Hastings, Penn.—The Borough Council has awarded a contract for seven blocks of vitrified brick pavement to JOHN CERESA & T. R. WHITE, Ebensburg, Penn., at $23,000. C. S. Hoyt is Boro. Clk. Noted May 15.

✦St. Marys, Penn.—(Official)—The Borough Council has awarded the contract for about 11,000 sq.yd. brick paving to R. M. SUTTON, Franklin, Penn., at $31,703. Other bidders were: J. D. Kuhn, Greensburg, Penn., $34,832; Elder & Hasson, Ebensburg, Penn., $31,962; M. Applegate, Son & Co., Bradford, Penn., $31,454. The latter bid was for gravel base, specifications called for broken stone. B. Wallis, Johnsonburg, Penn., is Boro. Engr. C. P. Harvey is Boro. Secy. Noted May 22.

Scranton, Penn.—(Official)—Due to legal complications, no contracts can be awarded for the completion of three sections of an unfinished macadam highway in the county. Charles P. Savage is County Controller. Noted May 1.

✦Uniontown, Penn.—(Official)—The Commissioners of Fayette County have awarded a contract for the construction of a road in German Township to JOHN T. HOOVER, Uniontown, at $15,000. Willard O. White is County Engr. Noted May 22.

✦Wilmington, Del.—(Official)—The Commissioners of New Castle County have awarded the contract for the construction of a macadam road from Stanton to Oak Tree to THOS. R. CLARINGBOLD, Newark, Del., at $4995. Other bidders were: John F. O'Neal, Mount Cuba, Del., $5384; Stewart & Donohue, Wilmington, $5991; John A. Clark, Wilmington, $5780; E. E. Crumlish, Wilmington, $6740; Juniata Paving Co., Philadelphia, Penn., $6155; Alfred McDowell, Marshalton, Del., $5956. James Wilson is County Engr. and Highway Comr. Noted May 22.

Baltimore, Md.—Bids will be received until June 12 by the State Road Commission, 534 N. Howard St., Baltimore, Md., for the construction of seven sections of state highway, aggregating 16.5+ miles, and one bridge, as follows: One section along the Reisterstown Road, one mile grading, under contract Bc8; one section along the Frederick Road, about 1.69 miles, vitrified brick, under contract Bc3; one reinforced-concrete arch bridge across Gwynns Falls, under Contract No. Bc3Br.; one section along the York Road, 5.60 miles reinforced-concrete macadam, under contract No. B21; all in Baltimore County. Carroll County, one section 1.60 miles resurfacing macadam, contract No. C1-10; in Frederick County one section of resurfacing macadam, under Contract No. F13, 2.50 miles; Montgomery County, 1.25 miles of macadam or concrete, under Contract M10; Talbot County, one section, 2.94 miles concrete or macadam, under contract No. 01-12. Wm. L. Marcy is Secy.

Washington, D. C.—(Official)—Bids will be received until 2 p.m., June 12, by the Commissioners of the District of Columbia, for the construction of concrete sidewalks in the district. C. H. Rudolph is a Comr.

Cumberland, Va.—Bids will be received until June 14, by the County Court for the construction of soil roads in Cumberland County, Whitneville and Thomas Chapel Road, 1.3 miles; Farmville, 1.6 miles Cumberland Court House toward Farmville, 1.6 miles; Cumberland Court House and Centerville, 1.5 miles; Farmville toward Jamestown, 1 mile; plans and specifications obtainable at the office of P. St. J. Wilson, State Highway Commissioner, Richmond, Va., and at the office of the Clerk of the County Court, Cumberland, Va.

Norfolk, Va.—Bids will be received until June 9, by the Board of Control, for paving and regulating Bank St. from Main St. to City Hall Ave. The approximate quantities follow: 500 lin.ft. of new curbing, 200 lin.ft. of old curb, culled and reset, 1550 sq.yd. of wood block paving, and 100 cu.yd. of extra concrete under tracks; plans and specifications at the office of W. T. Brooks, City Engr.

Huntington, W. Va.—(Official)—All bids for paving 1½ miles of the Huntington-Hamlin Pike with brick were rejected by the County Court of Cabell County, and no time has been set for readvertising the work. F. F. McCullough is County Clk. Noted May 15.

Tampa, Fla.—Bids will be received until June 17 by the Board of Public Works, for the construction of 18,330 sq.yd.

brick pavement on various streets, including grading and curbing. The estimated cost is $29,328. F. F. Warren is City Engr.

New Decatur, Ala.—(Official)—Bids will be received until 8 p.m., June 10, by the City Council for curb, gutter and pavement on about four miles of city streets. About 85,000 sq.yd. bituminous concrete pavement will be required. Alfred M. Lund is City Engr. Noted May 1 and 22.

+New Iberia, La.—(Official)—The City Council has awarded the contract for the construction of about 12 miles of concrete sidewalks to the KENNETH GRANITOID CO., New Iberia, at approximately $50,000. Edwin P. Robb is City Engr. Noted Apr. 17.

+New Orleans, La.—(Official)—The State Highway Department has awarded the contract for the construction of about 14 miles of highway in East Baton Rouge Parish to the GEORGE W. GARIG CONSTRUCTION CO., Baton Rouge, La., at $52,090. Other bidders were: Body & Bradshaw, $56,980; United States Coal Gravel & Sand Co., $80,175; Jones & Wood, $57,190; C. C. Sandoz is Secy. Highway Dept. Noted May 8.

Shreveport, La.—The City Council will soon advertise for bids for the construction of gravel streets at an estimated cost of $60,000. George R. Wilson is City Engr.

+Ashville, Ohio—(Official)—The Village Council has awarded the contract for improving Main St., from Scioto to Walnut St., to GRAHAM & KNEUR, Columbus, Ohio, at $20,160. E. B. Pfleuger, Circleville, Ohio, is Engr. E. F. Schlegel is Village Clk. Noted May 22.

Cincinnati, Ohio—(Official)—Bids will be received until noon, June 10, by the Director of Public Service, for grading and paving with asphalt the west approach to the Gilbert Ave. Viaduct at Eighth St. and Broadway. Bids will be received until noon, June 11, by the Director of Public Service for paving with granite block the east approaches of the Gilbert Ave. Viaduct at Gilbert Ave. and East Court St. V. T. Price is Dir. M. J. Keefe is Secy.

Bids will be received until noon, June 27, by the Board of Hamilton County Commissioners for restoring the east approach of the Harrison Ave. Bridge over the Great Miami River, Miamitown, Colerain Township. Stanley Struble is Pres. of Comrs.

Circleville, Ohio—The Village Council has awarded the contract for paving Main St. to YOUNT & JACKSON, Dayton, Ohio, at approximately $52,000.

Columbus, Ohio—(Official)—No bids were received May 23, by the State Highway Commissioner for paving 1.86 miles of the Newark-New Lexington Road at an estimated cost of $18,726. Noted May 15.

Columbus, Ohio—Bids will be received until June 13 by the State Highway Commissioner, for road improvements as follows: For grading and paving with brick 1.07 miles of the Doylestown-Barberton Road, Chippewa Township, Wayne County, at an estimated cost of $16,156; for grading and paving with brick 2.51 miles of the Ashland-New London Road, Ruggles Township, Ashland County, at an estimated cost of $36,000; for grading and paving with waterbound macadam Section 2 of the McArthur-Hamden Road, Clinton Township, Vinton County, at an estimated cost of $14,987; for grading and paving with waterbound macadam 4.37 miles of the Mansfield-Lexington Road, Madison, Washington and Troy Townships at an estimated cost of $33,120; for grading and paving with waterbound macadam 1.38 miles of the Zanesville-New Lexington Road, Harrison Township, Perry County, at an estimated cost of $12,639; for grading and paving with bituminous macadam 1.12 miles of the Central Ave. Extension Road, Richfield Township, Lucas County, at an estimated cost of $12,817. James Marker is Comr.

+(Official)—Contracts as follow have been awarded by the State Highway Commissioner from bids received May 29: To the WILSON ENGINEERING & CONTRACTING CO., Xenia, Ohio, at $7545, for paving one mile of the Piqua-Urbana Road with waterbound macadam; to E. W. RYAN, Maumee, Ohio, at $14,500, for paving 2.5 miles of the Bryan-Napoleon Road with waterbound macadam; to the ERIE STONE CO., Van Wert, Ohio, at $4828, for macadamizing one mile of the Willshire-Fort Recovery Road; to E. W. TURNER, Logan, Ohio, at $12,800, for paving with brick 0.84 mile of the Belmont National Road. No bids were received for paving one mile of the Steubenville-Cambridge Road with brick at an estimated cost of $16,858, and none for paving 1.21 miles of the Port Clinton Road with concrete at an estimated cost of $16,540. Noted May 22 and 29.

Galion, Ohio—(Official)—The City Council has rejected all bids received May 26, for 18,210 sq.yd. of paving on Cherry and Jefferson Sts. and Paynes Ave. E. C. Yochem is City Clk. Noted May 22

Geneva, Ohio—(Official)—Bids will be received until noon, June 10, by the Village Council for grading, draining, curbing and paving North Broadway and East Main Sts. Cumings & Downer, Painesville, Ohio, are Engrs. in Charge. W. E. Morgan is Village Clk.

Lockland, Ohio—(Official)—Bids will be received until noon, June 23 by the Village Council for grading, draining, curbing and paving William St., from Wyoming Ave. to Lock St., with vitrified brick on concrete foundation. Frank Reed is Village Clk.

+Middlefield, Ohio—The Village Board has awarded a contract for street paving to the SCHILLING CONSTRUCTION CO., Youngstown, Ohio, at $32 230

New Philadelphia, Ohio—The Commissioners of Tuscarawas County have awarded a contract to WISE, SMITH & KRABILL, Canton, Ohio, at approximately $100,000, for paving four miles of the Canal Dover Road.

+Sunbury, Ohio—A contract has been awarded by the Village Council to LAMBERT BROS & WIRT Delaware, Ohio, at $23,000 for 10,600 sq.yd. paving on eight streets.

Washington C. H., Ohio—Bids will be received until June 7, by the Director of Public Service, for curb, gutter and concrete sidewalks on North Main St. C. E. Mark is Dir.

+Rensselaer, Ind.—(Official)—The Commissioners of Jasper County have awarded contracts to the CROWN POINT CONSTRUCTION CO., Crown Point, Ind., at $18,095 and $15,325 respectively for constructing 5½ miles of the Halstead Road and 4½ miles of the Yeoman Road. J. P. Hammond is Audr. Noted May 15.

Ithaca, Mich.—(Official)—Bids will be asked in about a month for 16,000 sq.yd. street pavement, to be of brick, concrete or asphaltic concrete construction. The Smith & Boulay Co., Toledo, Ohio, is Engr.-in-Charge.

Marshall, Mich.—(Official)—Bids will be received in about a month for paving on various streets, estimated to cost about $32,000. The Smith & Boulay Co., Toledo, Ohio, is Engr.-in-Charge.

Pontiac, Mich.—The City Engineer has prepared plans for paving various streets at an estimated cost of $88,858. Bids will be asked some time this year. William J. Fisher is City Engr.

St. Louis, Mich.—(Official)—Bids will be asked about July 1 for the construction of 16,000 sq.yd. of paving on various streets. The Smith & Boulay Co., 322 the Nasby, Toledo, Ohio, is Engr.-in-Charge.

+Burnham, Ill.—(Official)—Bids for asphalt macadam pavement on various streets were received as follows by the Board of Local Improvements: NEDJB & GREENWALD, $1.33⅓ per sq.yd. (contract awarded); Calumet Coal Co., $1.33⅓; Downey & Portz, $1.36; Ahlborn Construction Co., $1.35 per sq.yd. The successful bidders were low on curb and other incidentals. W. H. Smith is Village Clk.

Freeport, Ill.—The City Council has passed an ordinance authorizing the construction of brick pavement on portions of seven streets, at an estimated cost of $28,407. Charles Hepner is City Engr.

Quincy, Ill.—The Board of Local Improvements has authorized the City Council to ask bids for paving North Fifth St. from Hampshire to Vermont St., and Jersey St. from 18th to 20th St. George L. Fransworth is City Engr.

Racine, Wis.—(Official)—Bids will be received until 10 a.m., June 14, by the Board of Public Works, for paving Boyd Ave., from Washington Ave. to 17th St. The approximate quantities are 4550 sq.yd. paving and 2400 lin.ft. of curb and gutter. P. H. Connolly is City Engr.

Davenport, Iowa—The City Council has authorized paving sections of five streets with asphalt or brick at an estimated total cost of $72,400. Hugo Moeller is City Clk.

Greenfield, Iowa—(Official)—Bids will be received until 2:30 p.m., June 10, by the Town Council, for the construction of about 11,500 sq.yd. concrete pavement with concrete curb. M. G. McCreight is Town Clk. The Iowa Engineering Co., Clinton, Iowa, is Engr.-in-Charge.

Knoxville, Iowa—The City Council has passed an ordinance for 10 blocks of concrete paving on Montgomery St., and about 14 blocks on various other streets.

+Duluth, Minn.—The City Commission has awarded the contract for paving Grand Ave. with concrete to S. A. RICHES at $40,594. C. S. Palmer is City Clk.

Stuntz (Hibbing post-office), **Minn.**—Bids will be received until 8:30 p.m., June 16, by the Town Clerk, for constructing the Hughes Road and the Herman Road. Victor J. Benoe, Hibbing, Minn., is Town Clk.

+Bastrop, Tex.—(Official)—The County Court of Bastrop County has awarded the contract for constructing about 40 miles of gravel roads to RAY McDONALD, Austin, Tex., at $62,800. J. B. Price is County Judge. Noted May 22.

Marietta, Okla.—(Official)—Bids will be received until 7:30 p.m., June 11, by the City Council, for the construction of approximately 26,000 sq.yd. of asphaltic concrete pavement. The Benham Engineering Co., Oklahoma City, Okla., is Engr.-in-Charge. Noted May 1.

+Salt Lake City, Utah—The contract for Sidewalk Extension No. 159 has been awarded by the City Commission to P. J. MORAN at $80,005. Noble Warrum is City Recdr.

Montesano, Wash.—Bids will be received until 1:30 p.m., June 16, by the Commissioners of Chehalis County, for improving a section of the Thomas Lund Road. R. G. Trask is County Audr.

+Seattle, Wash.—(Official)—The Board of Public Works has awarded the contract for improving Leary Ave. to W. F. MANNEY & CO., at $31,904. Holt & Jeffrey bid $36,248. W. H. Tiedeman is Asst. City Engr. Noted May 8.

Spokane, Wash.—The City Engineer has completed plans for grading, curbing and sidewalks on 41st Ave., from Scott St., to Grand Blvd.; also for grading, curbing and paving Stevens St., from Second to Fourth. Estimated cost, $12,500. Plans are also completed for grading, curbing, draining and sidewalks on Hatch St., from 41st to 43d St. Morton McCartney is City Engr.

+The Commissioners of Spokane County have awarded the contract for constructing 6.35 miles of the Waikiki Road (gravel macadam) to JOHN F. COSTELLO at $56,650. Other bidders were: Spokane Asphalt & Paving Co., $65,848; Mitchell Bros., $66,268; Naylor & Norlin, $68,990; F. A. Empey, $99,400. The County Engineer's estimate was approximately $64,500.

Springfield, Mass.—The Nayasset Club will make alterations and additions to its club house. The estimated cost is $40,000. Col. J. K. Dexter is Pres.

+Tacoma, Wash.—(Official)—The Commissioner of Public Works has awarded contracts to GEORGE P. WRIGHT at $26,700, for paving Yakima Ave. with asphalt, and at $26,700, for paving L St. with asphaltic concrete. Owen Wood is Comr. Noted May 15.

Uniontown, Wash.—The Town Council has instructed the Town Clerk to advertise for bids for paving various streets at an estimated cost of $18,000.

Vancouver, Wash.—The Lindsay-Kibbe Co., Portland, Ore., at $25,470, for bitucrete and $24,124, for concrete, were low bidders for paving 15th St. Other bidders were: Lotter & Force, Dolarway, $26,667; 6-in. monolithic, $23,820; 6-in. concrete, $27,206; Star Sand Co., Portland, 6-in. concrete, $25,792; gravel bitulithic, $27,812; Henry Howard, light bitulithic, $28,679; Elwood Wilds, Portland, gravel bitulithic, Class "A," $28,594; 6-in. gravel concrete, $22,131; 6-in. Dolarway, $23,747; Montague O'Reilly Co., Portland, asphalt, $31,654; asphaltic concrete, $27,614.

Milwaukee, Ore.—Front St. is to be improved its entire length by a hard surface pavement at an estimated cost of $40,000. The Council has approved the estimates of the City Engineer.

✦Portland, Ore.—Street paving contracts have been awarded by the Street Committee of the City Council as follows: Wisteria and other streets, gravel bitulithic paving, the WARREN CONSTRUCTION CO., at $41,157. East 57th St., from Tremont to Sandy Blvd., gravel bitulithic, the WARREN CONSTRUCTION CO. at $12,649; Miller Ave., from East Seventh to East 16th Sts., concrete, the LINDEN, KIHLE CONSTRUCTION CO., at $15,619; East 37th St., from Hancock to Rossmere, concrete, to OREGON INDEPENDENT PAVING CO., at $8418. East Lincoln and other streets, bitulithic redress, the PACIFIC BRIDGE CO., $61,903. Bids for the paving of East Clay and other streets were rejected as property owners could not agree on the kind of pavement.

Bakersfield, Calif.—Bids will be received until June 28, by the City Trustees, for paving Chester Ave., from Fourth to 15th St., with asphaltic concrete, with concrete curb and gutter. H. F. Murdock is City Clk.

✦Corona, Calif.—The City Trustees have awarded the contract for constructing oil macadam pavement on East Sixth St., to the HIGHWAY CONSTRUCTION CO., Redlands, Calif., at $13,237. C. Gully is City Engr.

The contract for paving 1¾ miles of Seventh St. was awarded to GEORGE WEIGAND, Lamanda Park, at $18,248; C. F. EASLEY, Alhambra, Calif., at $16,045, received the contract for oiled macadam pavement on Howard St.

Los Angeles, Calif.—Gillette, Montgomery & Tracy, of Los Angeles, were low bidders at $101,997 for the construction of 11¼ miles of state highway between Calabasas and the west county line. Other bidders were: Bent & Pennebaker, $106,-665; W. U. Atkinson, $116,271; Harry C. Mayer, $119,368; Leigh Garnsey, $129,678; John D. Marsh, $141,065. Noted May 15.

✦Los Angeles, Calif.—M. W. McCOMBS, 516 Bryson Bldg., was awarded the contract at $49,000, for constructing sidewalks, curbs and gutters in Road District No. 18, Lamanda Park. Noted May 8.

H. H. CURTIS, 212 N. Sichel St., was awarded the contract at $19,500, for constructing oil macadam pavement in Road District No. 16. Noted May 8 and 22.

✦Sacramento, Calif.—The State Highway Commission has awarded a contract to LEIGH GARNSEY, at $51,869, for the construction of about 7½ miles of state highway in Ventura County, from the southern boundary to Newberry Park. Austin B. Fletcher is State Engr. Noted May 15.

Barrie, Ont.—(Official)—Bids will be received until noon, June 9, by the Town Council, for the construction of approximately 15,600 sq.yd. concrete pavement, and 10,000 lin.ft. concrete curb. K. S. MacDonnell is Town Engr.

Berlin, Ont.—(Official)—Bids will be received until 5 p.m., June 12, by the City Council, for constructing approximately 8400 sq.yd. asphalt or bitulithic pavement, 6400 sq.yd. vitrified brick paving for car tracks and 6800 lin.ft. curb and gutter. A. H. Millar is City Clk. Herbert Johnston is City Engr.

Stratford, Ont.—The City Council will soon ask bids for constructing about 10,397 lin.ft. concrete sidewalks at an estimated cost of $5500. A. B. Manson is City Engr.

Wingham, Ont.—(Official)—Bids will be received until 4 p.m., June 10, by the Town Council, for storm sewers, curbing and concrete pavement on Josephine St. John F. Groves is Town Clk. T. Harry Jones, Brantford, Ont., is Engr.

Moose Jaw, Sask.—(Official)—Bids will be recived until noon, June 6, by the City Commissioners, for the construction of approximately 17,000 sq.yd. of pavement, 332,000 sq.ft. concrete sidewalk and 55,400 lin.ft. combined curb and gutter. James Pascoe is Comr.

Amherst, N. S.—The City Council plans the construction of street paving and sidewalks at an estimated cost of $85,000. W. F. Donkin is City Clk.

INDUSTRIAL WORKS

Adams, Mass.—Plans are being prepared by the Renfrew Mfg. Co., for extensive improvements to its plant.

✦Chicopee Falls, Mass.—The contract for the construction of a factory, 90x240 ft., four stories, for the Fiske Rubber Co., has been awarded to FRED T. LEY & CO., INC., Springfield, Mass.

Northville, Mass.—Plans are being prepared for the construction of a factory in Northville. Estimated cost, $20,000.

Springfield, Mass.—Plans are being prepared by Samuel M. Green & Co. for a bottling plant on Liberty St., for the Springfield Breweries Co. It will be of brick, with stone trim, 50x147 ft., four stories.

Plans have been completed on which estimates are being prepared for a factory on Birnie Ave. for Frank H. Page, 60 Hampden St. It will be of brick, mill construction, 60x90 ft., three stories. Samuel M. Greene & Co. are Archs.

Estimates are being received on plans prepared by H. L. Sprague for a factory at the plant of the Kibbe Bros. Co., 37 Harrison Ave. The structure will be 56x77 ft., with an ell 10x16 ft., both six stories and basement, and a second ell 28x50 ft., one story and basement, all of brick, mill construction.

✦Taunton, Mass.—The contract for the construction of a silk mill on Washington St., for the Old Colony Investment Trust Co., has been awarded to L. M. WITHERELL & SONS, Taunton, at $15,000.

Templeton, Mass.—Plans are being considered by the Otter River Board Co. for the reconstruction of its plant, which was recently destroyed by fire.

Buffalo, N. Y.—The Lumen Bearing Co. is having plans prepared for a new brass foundry to replace buildings recently destroyed by fire. William H. Barr is Gen. Mgr.

The Larkin Co., soap manufacturer, has filed plans for an eight-story reinforced-concrete factory to be added to its plant at Carroll and Van Rensselaer Sts. The estimated cost is $400,000.

Carthage, N. Y.—The Carthage Machine Co. is having plans prepared for an addition to its machine shop. It will be two stories, 50x60 ft. A. E. Waudwell, Mgr.

✦North Tonawanda, N. Y.—MORRIS & ALLAN, Builders' Exchange, Buffalo, have received the contract for the construction of a three-story brick factory building, 60x140 ft., to be erected at Payne Ave. and the Erie R.R. by the Fahnestock Co., of Philadelphia, manufacturer of chocolate and confectionery. The estimated cost is $35,000.

Rochester, N. Y.—Plans have been filed for a one-story addition, 46x150 ft., to be made to the factory of the Rochester Can Co., on Hague St.

Norfolk, Va.—The Chesapeake Knitting Mills Corp. will erect a factory 200x80 ft., to be used for the manufacture of paper boxes. Cost, $10,000.

Suffolk, Va.—The Maxwell Hosiery Mills Co. has increased its capital from $10,000 to $20,000, and will erect a new plant on a site recently purchased.

Salisbury, N. C.—The Salisbury Mint Cola Co. has bought a site and is preparing to build a two-story factory.

Leesville, La.—The Vernon Iron Works Co. will build a new iron and steel foundry, to cost $25,000.

New Orleans, La.—The Sears Milling Co. has taken over the rights to manufacture Stafolife, a cattle feed, and is capitalized at $200,000. The concern will construct a plant.

The Southport Mill Co. will rebuild its plant at New Orleans, recently destroyed by fire, at a loss of $125,000. The concern manufactures meal and patent cake from cotton seed. Charles Monsted is Pres. and A. D. Geoghagan, Gen. Mgr.

Chattanooga, Tenn.—The Southern Aseptic Cotton Co. has increased its capital from $25,000 to $50,000, and will erect an addition to its plant to be used in the manufacture of aseptic cotton.

Chattanooga, Tenn.—A plant to cost $100,000 will be established at Chattanooga, for the manufacture of the Ausman motor truck. The Manufacturers' Association, of Chattanooga, will furnish the capital.

Louisville, Ky.—The Mengel Box Co. has purchased a city block adjoining its wooden-box factory in Louisville, and will erect an addition.

The Art Brass & Plating Works has announced plans for the manufacture of a patent reversible gasoline iron, and will enlarge its plant for the purpose of manufacturing the device. Carl Rindt, 448 South Fifth St., is Pres.

The Kosmos Portland Cement Co. is considering plans for enlarging its plant. The mills are located at Kosmosdale, a suburb. The offices are in the Paul Jones Bldg., Louisville.

Paducah, Ky.—The Nashville, Chattanooga & St. Louis R.R. Co., which has a small repair shop at Paducah, is planning to enlarge its facilities there in anticipation of the construction of a new bridge over the Ohio River, near that point. The general offices of the company are in Nashville, Tenn.

Akron, Ohio—The Akron Reflector Co., Akron, is arranging to erect a glass factory on the grounds of the old aluminum plant.

Akron, Ohio—The Firestone Tire & Rubber Co., Akron, will erect an addition to its factory at Akron. It will be of brick, 72x138 ft.

Cleveland, Ohio—The American Steel & Wire Co., Cleveland, will erect two additions to its plants in Cleveland, one between the Cuyahoga River and Baltimore & Ohio R.R., and the other at its Jones Ave. plant.

W. A. Kerber Co., Cleveland, will erect a packing plant on the west bank of the river, costing $100,000.

Columbus, Ohio—Howard & Merriam, Archs., Columbus, are preparing plans for the erection of a two-story factory for the Columbus Varnish Co., Columbus. Estimated cost, $10,000.

Columbus, Ohio—Plans have been completed by Stribling & Lum, Archs., Columbus, for the construction of a new plant for the John W. Brown Mfg. Co., Columbus.

The N. A. Curtis Mfg. Co., Columbus, has been organized with a capital of $15,000, for the manufacture of show cases, carpet sweepers and woodenware. A plant will be erected at Columbus. M. E. Swanson, Columbus, is interested.

Findlay, Ohio—The Allen Motor Car Co., Findlay, recently organized, has increased its capital to $500,000, and is contemplating the erection of a large addition to its plant.

Lima, Ohio—Bids will be received until noon, June 16, by the Board of Commissioners for the erection of the Lima State Hospital for erecting and equipping a machine shop at the proposed hospital. Frank L. Packard, Columbus, Ohio, is Arch.

Lima, Ohio—The Cincinnati, Hamilton & Dayton Ry. Co. is having plans prepared for the erection of additions to its shops at Lima, Ohio. Incorrectly noted last week as Chicago, Hamilton & Dayton Ry.

✦New Straitsville, Ohio—The contract has been awarded to the PORTSMOUTH ENGINE CO., Portsmouth, Ohio, through Hossman, general contractor, for furnishing castings and machine work for new stoves and furnace repairs for the Bessie Ferro Silicon Co., New Straitsville.

Toledo, Ohio—The Ohio Electric Automobile Co., Toledo, is planning to double its capacity. The new building to be erected which will cost approximately $100,000, will adjoin the present four-story brick factory.

Zanesville, Ohio—The Townsend Brick & Contracting Co., Zanesville, will erect an addition to its plant. Estimated cost, $50,000.

✦East Chicago, Ind.—(Official)—The Baldwin Locomotive Works, Philadelphia, Penn., has awarded the contract to the H. A. STRAUSS CO., Stock Exchange Bldg., Chicago, for the heavy construction work, including all labor and material, on the plant at East Chicago.

Detroit, Mich.—The Caddilac Motor Car Co., Detroit, has secured a permit for the erection of its proposed addition, to cost about $40,000.

The Detroit Graphite Co., Detroit, has secured a permit for the erection of a five-story brick and steel plant at 12th St., near Fort St., Detroit. Estimated cost, about $30,000. Noted May 22.

Jackson, Mich.—The Automatic Car Coupler Co., Jackson, is considering the erection of a factory at Jackson.

Chicago, Ill.—The Edmunds Mfg. Co., Chicago, will erect an addition to its plant to cost about $10,000.

Brillion, Wis.—The Brillion Iron Works, Brillion, manufacturers of gasoline engines, will erect a large addition to the plant, which will double its present capacity.

Waukesha, Wis.—The Universal Furniture Co., Chicago, Ill., will erect a plant at Waukesha, 60x350 ft. Work will start as soon as possible.

Des Moines, Iowa—The Herring Motor Car Co. contemplates the construction of a $10,000 plant at Ninth and Murphy Sts.

Hampton, Iowa—The Swen Wire Stretcher Co. is planning to establish a factory in this city.

Topeka, Kan.—Bids will soon be received by the State Text Book Commission for the construction of an addition to its printing plant. The work includes the erection of two buildings, one three stories, 50x150 ft., and the other three stories, 23x75 ft. Estimated cost $70,000.

Kenmare, N. D.—The Ohnstedt Mfg. Co., will build a foundry at Kenmare.

Joplin, Mo.—The Wilhoit Refining Co. will build a new oil refinery to cost $50,000, at Joplin.

Bryan Bros. & Co., will build a sludge mill at Joplin, to cost approximately $15,000.

Kansas City Mo.—Plans are being considered by Montgomery Ward & Co., for the construction of a new plant at Kansas City. Estimated cost $1,000,000. W. P. Thorne is Pres.

+St. Louis, Mo.—The contract for the construction of a three-story, 55x63 ft. addition to the George Kilgen & Sons, plant, has been awarded to C. LUND, 810 Olive St., St. Louis.

Fort Smith, Ark.—The Fort Smith Iron & Steel Co., has been incorporated with capital stock of $85,000 and will build a foundry to cost $25,000.

The Pendell Folding Screen Co., Inc., will establish a screen factory at Fort Smith, to manufacture a newly patented folding screen. Estimated cost $30,000.

Everett, Wash.—W. B. Wefesnet & Co., of Keosaqua, Iowa, contemplates building a factory for the manufacture of power boats in this city. The Everett Motor Boat Club is interested in the project.

Fontana, Calif.—C. C. Moore will erect a $25,000 plant for the manufacture of olive oil and by-products in Fontana.

Los Angeles, Calif.—The Commercial Engine Co. will erect two factory buildings at Ninth St. and Santa Fé Ave.

Los Angeles, Calif.—The Union Packing & Provision Co. will erect a packing plant in Vernon to cost $150,000. J. N. Porter, 239 South Hill St., Los Angeles, is Pres.

Richmond, Calif.—The Empire Mfg. Co., Spokane, Wash., is considering the construction of a branch factory for the manufacture of pumps and refrigerators at Richmond.

Van Nuys, Calif.—The Murray M. Harris Co., 700 Sichel St., Los Angeles, has purchased a site on Sherman Way from Sixth to A St. and will erect a modern plant 200x300 ft. It will be of reinforced concrete construction, faced with white glazed brick. A. S. Heineman, San Fernando Bldg., Los Angeles, is Arch.

Sherbrooke, Que.—A new company is negotiating for the purchase of a site for the erection of a car-wheel foundry. P. McCullough is interested.

Agincourt, Ont.—See item under Buildings.

Berlin, Ont.—The Dominion Tire Co. has decided to erect additional buildings, to cost $50,000.

Brampton, Ont.—The Massey-Harris Co., Toronto, Ont., has purchased a site at Brampton, and is having plans prepared for a factory to manufacture gasoline engines.

Brantford, Ont.—The Brantford Machine & Foundries, Ltd., recently incorporated to manufacture machine tools, is completing plans for a machine shop, of 10,000 sq.ft. floor space and a foundry, to be built at once.

Brantford, Ont.—The Duff Mfg. Co., Pittsburgh, Penn., manufacturer of ball-bearing screw jacks, is having plans prepared for a machine shop and assembling plant at Brantford.

Bridgeburg, Ont.—The Monarch Belt Co., Ebenezer, N. Y., plans to establish a factory at Bridgeburg.

Ford City, Ont.—The Tate Electrics, Ltd., will erect a new automobile factory in Ford City.

+Hamilton, Ont.—A contract has been awarded to the HAMILTON BRIDGE WORKS Co., for the iron and steel work for the addition to the plant of the Gartshore-Thomas Pipe & Foundry Co., on Stuart St.

Hamilton, Ont.—The Ontario Pipe Line Co. will establish a plant costing $1,500,000 in Hamilton. Ovens will be installed to produce 5,000,000 ft. of gas and 1008 tons of coke daily.

Ingersoll, Ont.—The Standish Mfg. Co., 11 College St., Toronto, Ont., considers erecting a factory, costing $20,000, at Ingersoll.

Toronto, Ont.—The Metallic Roofing Co. has plans for an addition to its present plant.

The Clark Mattress Co. has purchased a site and will erect a new factory on Clifford St. J. Clark, 370 Richmond West, is Mgr.

Toronto, Ont.—The Parolin Co. of Canadma has been incorporated to manufacture and deal in machinery and special appliances. Francis H. Stewart, Wilbert Willis and Howard Anderson, Toronto, are incorporators. The capital stock of the company is $50,000.

The Eastern Rubber Co. has plans for a three-story and basement factory, 72x200 ft., an office building 72x146 ft., and a boiler house 60x60 ft., all of brick, steel and concrete construction. G. Morton Wolfe, Ellicott Sq. Bldg., Buffalo, N. Y., is Arch.

J. M. Loose & Sons, manufacturers of piano actions and kindred products, have purchased a site, 250x134 ft., and will erect a new factory.

Welland, Ont.—The John Deere Plow Co., Dain, Ont., plans to erect a new factory at Welland, for the manufacture of all kinds of farm implements.

Saskatoon, Sask.—The Metal Shingle & Siding Co. plans the erection of a plant, costing $250,000. Noted Sept. 19, 1912.

Taber, Alta.—The Canada West Coal Co. will establish a plant at Taber, having a daily capacity of 100,000 pressed brick. The estimated cost is $100,000.

Vancouver, B. C.—A laundry, to cost $125,000, will be erected at Quebec St. and Sixth Ave. It will be three stories, of reinforced-concrete. Equipment costing $50,000 will be installed. G. B. Kaufman, 615 Hastings St., West, is Arch.

Newcastle, N. B.—The Canadian Gear Works, Ltd., will make additions and alterations to the present plant, and will manufacture wagon gears and bodies. The improvements include a planing mill.

FEDERAL GOVERNMENT WORK

Dredging—Portland, Maine.—Bids were received, May 29, as follows by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Portland Harbor: (a) Inner harbor, 216,000 cu.yd.: (b) anchorage, 1,142,600 cu.yd.; (c) back cove, entrance, 55,200 cu.yd.: P. Sanford Ross, Inc., Jersey City, N. J., (a) 27½c.; (b) 16.2c.; (c) 27½c.; J. S. Packard Dredging Co., Providence, R. I., (a) 30c. (b) 15c.; (c) 20c.; Jeremiah P. O'Riorden, Charlestown, Mass., (a) 27½c. (b) 17¼c.; (c) 28c.; Coastwise Dredging Co., Norfolk, Va., (a) 24c.; (b) 24.6c.; (c) 20c.; Morris & Cummings Dredging Co., New York, (a) 10.6c.; (b) 10.6c.; (c) 10.6c.; Eugene Breymann, Boston, Mass., (a) 25c.; (b) 9.5c.; (c) 25c.; John A. Seely, New York, (a) 16½c. (b) 16½c.; (c) 16½c.

Post Office—New Bedford, Mass.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., July 10, for the construction of the U. S. post office at New Bedford. The building is to be one story and basement, approximately 21,730 sq.ft. ground area.

Mechanical Equipment—New Bedford, Mass.—(Official)—Bids will be received until 3 p.m., June 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the mechanical equipment of the U. S. post office at New Bedford.

+Dredging—New York, N. Y.—(Official)—Bids will be received until noon, July 5, by Col. W. T. Rossell, Corps Engrs., U. S. A., Army Bldg., 39 Whitehall St., New York, for dredging in the Hackensack River, N. J.

Paving—New York, N. Y.—Bids were received as follows, May 31, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for paving in the navy yard, New York: Richard Lamb, 136 Liberty St., New York, $14,279; Franklin Contracting Co., 1 Hudson St., New York, $15,803; F. N. Lewis, 411 Manhattan Ave., New York, $13,970; Joseph Balaban Co., 261 Broadway, New York, $12,920.

Dredging—Philadelphia, Penn.—The dredging to be done in the Delaware River under bids to be opened June 25, will be divided into three sections: Section A will require 1,575,000 cu.yd.; Section B, 2,540,000 cu.yd.; and Section C, 2,730,000 cu.yd. Bids will be opened by Lieut.-Col. J. H. Kuhn, Corps Engrs., U. S. A., Philadelphia.

+Gun Forgings—Washington, D. C.—The contract for furnishing 34 sets of 4-in. nickel-steel gun forgings, bids opened May 14, has been awarded as follows: To the CRUCIBLE STEEL CO., Pittsburgh, Penn., for eight sets, and to the MIDVALE STEEL CO., Philadelphia, Penn., for 26 sets.

Boilers—Washington, D. C.—Bids were received as follows, May 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of two new high-pressure boilers, etc., at the Bureau of Engraving and Printing (new building), Washington, D. C.: W. G. Cornell & Co., Washington, $45,900; John W. Danforth Co., Buffalo, N. Y., $47,994; Crook-Krees & Co., Catonsville, Md., $52,200; Thompson-Starrett Co., New York, $49,303; S. Faith & Co., Philadelphia, Penn., $52,487; Evans-Almirall Co., New York, $52,113.

+Dredging—Norfolk, Va.—The contract has been awarded to the MARYLAND DREDGING & CONTRACTING CO., Baltimore, Md., for dredging Thimble Shoal, about 450,000 cu.yd., at 17.3c. per cu.yd. Bids were opened by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk. List of bidders noted May 15.

Post Office—Greenville, N. C.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., July 11, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches) of the U. S. post office at Greenville.

Lumber—Wilmington, N. C.—Bids will be received until noon, June 18, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for furnishing and delivering about 688,690 ft. b.m. of long-leaf yellow-pine lumber for construction of a dam in the Cape Fear River, at Kings Bluff, N. C.

Dredging—Wilmington, N. C.—Bids will be opened about Aug. 1 for dredging at the following localities: Scuppernong River, N. C.; estimated cost, $2500; Neuse River, N. C., $7500; Inland Waterway from Pamlico Sound to Beaufort Inlet, $6500; harbor at Beaufort, N. C., $6000; harbor at Morehead

City, N. C., $2000. New River, N. C., $6000. C. F. River at and below Wilmington, ocean bar and river channels, $150,000. Shallotte River, $8500. Maj. H. W. Stickle, Corps Engrs. U. S. A., Wilmington, is in charge.

Post Office—Winston-Salem, N. C.—Bids were received as follows, June 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Winston-Salem. (a) Limestone; (b) sandstone: William H. Maxwell, Auburn, Ind., (a) $186,687; Conners Bros. Co., Lowell, Mass., (a) $198,948; Wise Granite Co., Richmond, Va., (a) $191,300; (b) $202,000. C. M. Leach, Boston, Mass., (a) $206,563; (b) $212,773. Colin Gerlach, Frostburg, Md., (a) $197,750; (b) $204,000; J. P. Cullen Construction Co., Janesville, Wis., (a) $221,350; Herman Lloyd Building & Construction Co., St. Louis, Mo., (a) $197,488; William H. Fissell, New York, (a) $187,837; (b) $194,960; John G. Unkefer & Co., Minerva, Ohio, (a) $182,210; (b) $187,210; J. E. & A. L. Pennock, Philadelphia, Penn., (a) $185,400; (b) $193,200; Melton Construction Co., Washington, D. C., (a) $199,400; Wells Construction Co., Philadelphia, (a) $187,000; (b) $191,000; Boyle-Robertson Construction Co., Washington, D. C., (a) $169,981 (b) $175,981.

Dredging—Jacksonville, Fla.—Bids will be received until noon, June 27, by Maj. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for dredging in the channel between the St. Johns River and Cumberland Sound, Fla.

Levee Work—Vicksburg, Miss.—(Official)—Bids will be received until 11 a.m., June 14, by the Mississippi River Commission, Third District, U. S. Engineer Office, Vicksburg, for the construction of about 580,000 cu.yd. of earthwork to close Skipwitch crevasse. The work will include the following: Section (1) station 2661+85 to station 2678, 140,000 cu.yd.; (2) station 2678 to station 2694, 110,000 cu.yd.; (3) station 2694 to 2700, 110,000 cu.yd. (4) station 2711 to station 2731, 110,000 cu.yd.; (5) station 2731 to station 2750+85, 110,000 cu.yd. The work is to be completed on or before Nov. 30. Section 1 of this levee will have an 8-ft. crown, a 3 to 2 front slope, and 3 to 1 and 10 to 1 back slopes. The other sections will have an 8-ft. crown, a 3 to 1 front slope, and 3 to 1, 10 to 1 and 5 to 1 back slopes. In addition, all of the work will have a light topping of the gross grade of the standard section, 1½ ft. high with 2-ft. crown and 2 to 1 slopes. Contractors will be required to first construct each section of the levee to a height sufficient to keep out any further rise of the river this year. The work can best be reached by local boats leaving Vicksburg on Mondays and Thursdays and Greenville, Wednesdays and Fridays, or by rail to Lake Providence, La., thence by launch to the work, which is about 16 miles up the river. The local boats land opposite the work, which is about 3000 ft. from the landing. Bidders are requested to apply for proposal blanks at once.

Levee Work—New Orleans, La.—Bids will be received by the State Board of Engineers, New Orleans, for closing Van Cluse crevasse. The work will require about 225,000 cu.yd. of earth.

Earthwork—New Orleans, La.—Bids will be received until 11 a.m., June 8, by Capt. C. O. Sherrill, Corps Engrs., U. S. A., New Orleans, for about 615,000 cu.yd. of earthwork in the Lower Tensas Levee District.

★✦Dredging Canal—New Orleans, La.—Bids were received until 11 a.m., May 26, by Maj. Edward H. Schulz, Corps Engrs., U. S. A., New Orleans, for dredging a canal between Calcasieu River and Sabine River, La. It is reported that the contract has been awarded to the BOWERS SOUTHERN DREDGING CO., Galveston, Tex., at 6.6c. per cu.yd. It is estimated that 1,500,000 cu.yd. will be removed.

Post Office—Morristown, Tenn.—Bids were received as follows, May 29, for the construction of a post-office at Morristown: (a) Marble; (b) limestone: R. S. Moore, Lafayette, Ind., (a) $93,286, (b) $72,779; Hiram Lloyd Building & Construction Co., St. Louis, (a) $94,648; (b) $69,800; Daniel T. McCarthy, Philadelphia, Penn., (a) $97,350; (b) $69,850; George Becking, Chattanooga, Tenn., (a) $94,591; (b) $72,421; Algernon Blair, Montgomery, Ala., (a) $89,900; (b) $77,500; Westchester Engineering Co., New York, (a) $91,284; (b) $81,952; R. P. Farnsworth, Owensboro, Ky., (b) $74,854.

Dredging—Duluth, Minn.—Bids were received by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, May 29, for dredging at Grand Marais, Mich.: (a) per cu.yd.; (b) totals: Great Lakes Dredge & Dock Co., Chicago, Ill., (a) 17c.; (b) $10,200; Northern Dredge & Dock Co., Duluth, (a) 18½c.; (b) $11,100; Zenith Dredge Co., Duluth, (a) 25c. (b) $15,000.

Dredging—Duluth, Minn.—The dredging to be done in Duluth Superior Harbor, bids to be opened June 13, will require the removal of 925,000 cu.yd. Bids will be opened by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth.

Building—White Earth, Minn.—The following bids were received by the Commissioner of Indian Affairs, Washington, D. C., May 26, for the erection of a brick dormitory and brick mess hall, and installation of an acetylene-lighting system, and the erection of a laundry building at the White Earth Indian School, Minn.: W. D. Lovell, Minneapolis, Minn., brick dining hall, $12,200; brick dormitory, No. 101, $31,000; brick laundry, No. 33, $7500; frame laundry, No. 45, $6250; extension of acetylene-gas lighting system, $200; Schulind & Co., Alexander, Minn., brick dining hall, $11,819; brick dormitory, No. 101 $31,926; brick laundry, No. 33, $7227; frame laundry, No. 45, $6099; extension to acetylene-gas lighting system, $218.

Sheet Piling, Etc.—Plattsmouth, Neb.—(Official)—Bids will be received until 2 p.m., June 18, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for wood sheet piling and approach work at the U. S. post office at Plattsmouth.

✦Canal—Newell, S. D.—Bids have been received at the office of the Reclamation Service at Newell, for the construction of the extension of the North canal and lateral system for the Belle Fourche Project, S. D. Seven bids were received. On Schedule 1 the bid of Abram S. Perry, of Vale, S. D., was the lowest, at $10,460. On Schedule 2 the bid of Omer Merrill, of Newell, S. D., was lowest, at $11,809. On Schedule 3 the bid of Townsend & Parish, Minatare, Neb., was lowest, at $4346. This bid, however, was submitted on condition that Schedules 1 and 2, or all three schedules must be awarded them. They were not the lowest on either Schedules 1 or 2, and the difference in price of these two schedules more than offsets the difference between their bid and the next lowest bid on Schedule 3, the second lowest bid on this schedule being that of Gardner & Chambers, Newell, S. D., at $4600. The engineers have recommended the award of Schedules 1 and 2 to the lowest bidders and of Schedule 3 to the second lowest bidder as above indicated. The total price under these proposals will be $26,869, as against $27,916 bid by Townsend & Parish, for all three schedules. The amounts of the bids recommended for acceptance are less than the estimated cost of the work as fixed by the engineers. The Secretary of the Interior has authorized the Reclamation Service to accept the proposal of ABRAM S. PERRY, of Vale, S. D., for Schedule 2; and of GARDNER & CHAMBERS, of Newell, S. D., for Schedule 3.

✦Tile Drains—Billings, Mont.—The Secretary of the Interior has authorized the Director of the Reclamation Service to award the contract to E. LINDSTROM, Billings, for the construction of about 41,000 ft. of tile drains in connection with the Huntley Irrigation Project, Mont. The contract price is $38,521.

Custom House—St. Louis, Mo.—Bids will be received until 3 p.m., June 16, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the remodeling of the U. S. custom house at St. Louis.

Post Office—Searcy, Ark.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., July 8, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the U. S. post office at Searcy. The building will be one story and basement, with ground area of approximately 3800 sq.ft.

★Lock Valves, Etc.—Galveston, Tex.—(Official)—Bids will be received until noon, June 27, by Lieut.-Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, for constructing lock valves and operating gear, etc.

Post Office—Marlin, Tex.—Bids were received as follows by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., May 27, for the construction of a post-office at Marlin: Daniel T. McCarthy, Philadelphia, Penn. (sole bidder), limestone, $53,632; sandstone, $55,362.

Post Office—Pocatello, Idaho—Bids were received as follows, May 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Pocatello: (a) Limestone; (b) sandstone: Palmberg & Matteson, Astoria, Ore., (a) $97,200; (b) $97,200; George A. Whitmeyer, Ogden, Utah, (a) no bid; (b) $116,662; Hiram Lloyd Building & Construction Co. (a) $109,254; (b) $112,254; Campbell Building Co., Salt Lake City, Utah, (a) $101,024; (b) $99,524; William H. Maxwell, Auburn, Ind., (a) $106,627; (b) no bid; Whitway Lea Construction Co., Boise, Idaho, (a) $93,300, (b) $94,455. W. D. Lovell, Minneapolis, Minn., (a) $99,900; (b) no bid.

Dock—Bremerton, Wash.—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., is considering the construction of another dock at the navy yard, Puget Sound, Bremerton, Wash.

★Vault Protection System—San Francisco, Calif.—(Official)—Bids will be received until 3 p.m., June 20, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for an electric vault protection system in the U. S. Subtreasury (old) building at San Francisco.

Cranes—Panama—Bids will be received until 10:30 a.m., July 14, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for the concrete-handling cranes to be used in the construction of the Pacific Locks.

Dredging—Hawaii—Bids will be received until 11 a.m., July 1, by Maj. W. P. Woten, Corps Engrs., U. S. A., Honolulu, H. T., for dredging in Kahului, Hilo and Honolulu Harbors, H. T.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids will be received until 11 a.m., June 11, by the State Board of Harbor and Land Commissioners, Boston, for dredging a channel in Ouset Bay and at Woods Hole, Mass., about 32,500 cu.yd. and 6000 cu.yd respectively.

Dredging—Boston, Mass.—The following bids have been received by the State Harbor and Land Commissioners for dredging in Lynn Harbor, Mass.: J. P. O'Riordan, 20⅞c. per cu.yd. and $11 for boulders; Eastern Dredging Co., 24.9c. and $8; Bay State Dredging Co., 25c. and $5; Chas. M. Cole, 26c. and $10.

Dredging—Boston, Mass.—Bids were received by the State Harbor and Land Commission, Boston, for dredging South River, Mass.: Eastern Dredging Co., Boston, 35c. and $8; Bay State Dredging Co., 39½c. and $5. F. Williams is Ch. Engr.

Harbor Development—Boston, Mass.—The Harbor Development Bill, providing for an appropriation of $5,000,000 for the improvement of harbors in the state of Massachusetts, was passed by the State Legislature, May 24.

Stable—Boston, Mass.—The Hiram C. Whittington Estate will erect a brick stable to replace the one recently burned. It will be two stories. Estimated cost, $50,000. C. A. & F. N. Russell, 50½ Warren St., Boston, are Archs.

✦Bath House—Worcester, Mass.—The contract has been awarded to ERNEST WHITEHEAD, for the erection of the woman's bath house, at Lake Quinsagimond at $11,474

★**Tunnels and Retaining Walls**—New Haven, Conn.—(Official)—Bids will be received until noon, June 12, by the Yale Committee of Twenty-One, Inc., 11 Crown St., New Haven, for the earthwork, and constructing the tunnels and retaining walls for the Football amphitheater in Yale Field. The estimate of quantities, by which the bids will be tested, is as follows: 40,000 cu.yd. of loam removed and deposited in piles; 170,000 cu.yd. of earth deposited in oval embankment; 60,000 cu.yd. of earth deposited on meadows or other low ground; 10,000 cu.yd. of concrete; 15,000 bbl. of portland cement; 650,000 lb. of steel for reinforcement; 80 piles; 780 ft. b.m. creosoted timber; 1080 lin.ft. of 18-in. vitrified pipe sewer; 290 lin.ft. of 12-in. vitrified pipe sewer; 1700 lin.ft. of 10-in. vitrified pipe sewer; 2000 lin.ft. of 8-in. vitrified pipe sewer; 1000 lin.ft. of 6-in. vitrified pipe drain; 60 c.-i. drain inlets; 5 manholes; 1800 lin.ft. of 4-in. c.-i. water pipe; 6 hose connections with pipe, valve, gate box, etc., complete; 53,000 sq.ft. of 4-ply waterproofing; 80,000 sq.ft. of concrete surface coated with coal tar pitch. The above quantities are to be considered as only approximate, and are merely given as a basis for testing the bids. David Taggett is Secy.

Comfort Station—Waterbury, Conn.—Plans are being prepared by Robert A. Cairns, City Engr., 9 Leavenworth St., for a comfort station, to be erected near the center of the city. The cost will probably be from $10,000 to $15,000.

Dredging, Channel Work—Albany, N. Y.—The Governor has signed the following bills: For repairing the west pier at the foot of Owasco Lake and dredging Owasco Outlet; estimated cost, $20,400; for removing the island in the Chemung River at Corning and improving the river channel, $25,000; for repairing and reconstructing dikes and repairing the banks of the Chemung River in Elmira; $30,000; for deepening the channel of Ellicott Creek from the Erie Canal to the city line of Tonawanda; $80,000; for improving Bergholtz and Cayuga Creeks and Little River in the town of Niagara, Niagara County, to prevent the flooding of State Route 18, known as the Buffalo-Niagara Falls Boulevard. D. W. Peck is State Supt. Pub. Wks.

Stable—Brown Station, N. Y.—Bids will be received soon by J. Breuchard, Brown Station, for the construction of a stable to cost about $10,000.

Canal Terminal—Port Henry, N. Y.—Bids will be asked soon by Duncan W. Peck, State Supt. of Public Works, Albany, N. Y., for the construction of Barge Canal Terminal No. 25, to be located at Port Henry.

✚**Fire Station**—Potsdam, N. Y.—The contract has been awarded by the city to BROWN & FITZGERALD, Watertown, N. Y., for the construction of a fire-engine house, at $18,150.

Pier—Rochester, N. Y.—The only bid received by the Board of Contract and Supply, May 21, for the construction of a pier at Durand-Eastman Park, was that of the T. A. Gillespie Co., 30 Church St., New York, at $8000.

Harbor Improvement Bonds—Jersey City, N. J.—Bids will be received until 3 p.m. June 6, by the Board of Finance for $191,000 of gold harbor improvement bonds. Richard J. Woodhead is Clk. of Bd.

★**Retaining Wall**—Trenton, N. J.—(Official)—Bids will be received until noon, June 17, by E. I. Edwards, Controller and Secy. State House Comm., Trenton, for the construction of 100 ft. of concrete retaining wall on lands of the state in the rear of the State Capitol at Trenton.

Bath-Houses—Philadelphia, Penn.—The city is considering the reconstruction of several bath-houses at an estimated cost of $20,000.

Piers—Philadelphia, Penn.—Bids will be asked in about one month by the city for the construction of the two piers to be located between Reed and Fitzwater Sts. Plans and specifications are nearing completion.

✚**Stable**—Philadelphia, Penn.—The George B. Newton Co., 1527 Chestnut St., Philadelphia, has awarded the contract to A. Wilhelmhalm, 1626 Palmer St., Philadelphia, for the construction of a stable to accommodate 50 horses.

✚**Concrete Piling**—Pittsburgh, Penn.—(Official)—The contract has been awarded to the TRANSFELD CONSTRUCTION CO., House Bldg., Cincinnati, for the concrete piling for the Farmers' Market, to be located on Duquesne Way, between Sixth and Seventh Sts. Simplex concrete piles will be used.

Fire Station—Southampton, Penn.—The Southampton Fire Co. is receiving bids for the construction of a fire station. [illegible] cost $15,000.

✚**Pier Work**—Newport News, Va.—The contract has been awarded by the Chesapeake & Ohio Ry. Co., F. J. Cabell, Ch. Engr., Richmond, Va., to the RICHMOND STRUCTURAL STEEL CO., Richmond, for the extension of 150 ft. at inshore end of pier No. 5. The contract for covering unroofed portion of Pier No. 5 and putting elevated track into second story of Pier No. 4, has been awarded to the Virginia Bridge Co., Newport News.

✚**Tunnel Lining**—Elkins, W. Va.—The contract has been awarded to the PIEDMONT CONSTRUCTION CO., Charlottesville, Va., by the Coal & Coke Ry. Co. for lining about 1800 lin.ft. of tunnels. R. H. Pembroke, Elkins, W. Va., is Ch. Engr.

Stable—Wheeling, W. Va.—The Kalbitzer Packing Co., Wheeling, is having plans prepared for the construction of a [illegible] cost $15,000.

Levees—[illegible] The St. Francis Levee Board [illegible] which call for the [illegible] to be built at Pecan Point, up [illegible] Memphis. The [illegible] of the Hill Road, with [illegible] on the book. The cost of [illegible] of the [illegible] authorized by the Legislature will be [illegible] cent.

Levee Repair—[illegible] noon, June 27, by the County Commissioners, Cincinnati, for [illegible] Bridge over the Little Miami River, about [illegible]

Retaining Walls—Dayton, Ohio—Bids will be received until June 4 by the County Commissioners for constructing concrete retaining walls along the north side of Wolf Creek, Harrison Township.

Fire Apparatus—Greenville, Ohio—Bids will be received until noon, June 26, by the Director of Public Safety, for furnishing fire apparatus to cost about $10,000. H. B. Hole is Clk.

Fire Station—Lorain, Ohio—The city is considering the construction of a fire station. The cost has been estimated at $10,000.

River Work—Massillon, Ohio—H. M. Yost, City Engr., is preparing plans for concreting the banks and bottom of the Sippo River. Estimated cost, about $35,000.

✚**Drain**—Jefferson, Ind.—Contracts for the construction of Tile Drain No. 84 of Greene County, Jefferson, have been awarded as follows: Tile to ARTHUR McHOSE, Boone, Iowa, at $14,430; and REDFIELD BRICK & TILE WORKS, Redfield, Iowa, at $2385. Bids were opened May 19.

Stable—Peoria, Ill.—The National Implement & Vehicle Show is receiving bids for the erection of a stable to cost about $25,000. W. O. Ireland, Peoria, is Secy.

✚**Ditch**—Urbana, Ill.—The contract for constructing the main open ditch of Sangamon and Drummer Drainage District, Champaign and Ford Counties, about 381,373 cu.yd. has been awarded to N. C. McGINNIS & CO., Bement, at 5.98c. Bids were opened May 21.

Stable—Milwaukee, Wis.—Leiser & Holst, Germania Bldg., Milwaukee, are receiving bids for the construction of a stable. The building will be two stories, 50x140 ft.

Breakwater—Milwaukee, Wis.—The Park Board will have soundings made for building a breakwater along the lake shore, from Iron St. to Russell St. The sum of $42,000 is available. A. C. Clasis is Park Comr.

✚**Breakwater**—Milwaukee, Wis.—The C. H. STARKE DREDGE & DOCK CO., Milwaukee, Wis., has been awarded the contract at $17,874 for constructing a 200-ft. extension to the timber breakwater at the Kinickinnic River inlet. Bids were opened May 19 by the city.

✚**Earthwork**—Council Bluffs, Iowa—The Park Board has awarded the contract to E. A. WICKHAM & CO., Council Bluffs, for about 40,000 cu.yd. of earthwork.

✚**Drain**—Des Moines, Iowa—J. C. ANDERSON, of Marshalltown, Iowa, has been awarded the contract for eight miles of 10- to 22-in. tile drain in Crocker and Lincoln Townships at $19,451. H. Frase is County Audr.

Fire Apparatus—Des Moines, Iowa—Bids will be received soon by the city for furnishing six auto combination hose-and-chemical trucks, three auto-service trucks, and three auto-pumping engines; also for 3000 lin.ft. of three-ply hose. F. Carrs is City Engr.

Park Work—Des Moines, Iowa—Plans are being prepared by E. L. Masqueray, Landscape Arch., Oppenheim Bldg., St. Paul, Minn., and F. Carrs, City Engr., for improvements to the capitol grounds. The cost of the proposed work has been estimated at $2,000,000.

✚**Ditch**—Sioux City, Iowa—The contract for constructing the Little Sioux Ditch has been awarded by the County Supervisors to the CANAL CONSTRUCTION CO., Chicago, Ill., at 10½c. per cu.yd. for main ditch, and 15c. per cu.yd. for laterals; total, about $55,000.

Ditch—Fremont, Neb.—Bids will be received until 2 p.m., June 9, by John O'Connor, County Clk., Fremont, for the construction of a ditch and drain. Plans and specifications are on file at Fremont.

Ditches, Etc.—Marshall, Mo.—Bids will be received until 5 p.m., June 11, by the Saline County Court, Marshall, for the construction of ditches, levees, and for making other improvements in Gilham Lake Drainage District No. 1. Josephine Durrett is County Clk.

✚**Ditch**—Poplar Bluffs, Mo.—The contract has been awarded to the BELL HUDSON CONSTRUCTION CO., 189 West Madison St., Chicago, Ill., for the construction of a ditch at about $12,000. The contract was awarded by the County Commissioners of Butler County.

Wharves, Slips, Etc.—Houston, Tex.—The City Commission is considering the construction of wharves, slips, coaling stations and other improvements on the Houston Ship Channel. Frank L. Dormant is City Engr.

★**Pier**—Nueces, Tex.—The contract has been awarded to HARRY MINER, Neuces, for the construction of the proposed pier for the Neuces Hotel Co. Estimated cost, $100,000.

Mausoleum—Bakersfield, Calif.—The National Mausoleum Co., F. B. Davis, Hopkins Bldg., representative, will erect a $100,000 mausoleum in Union Cemetery, Bakersfield. The construction will be of marble, bronze, concrete and tile.

Railroad Ties—Los Angeles, Calif.—Bids will be received until June 6 by the Board of Public Works of Los Angeles, for furnishing 16,000 railroad ties for the railroad at Wilmington Harbor, and until June 23 for steel rails for the same.

✚**Elevators**—Los Angeles, Calif.—The LLEWELLYN IRON WORKS, Los Angeles, has awarded a contract at $20,000, for furnishing and installing the elevators for the nine-story and basement Class A steel frame store and loft building, to be erected at Fifth St. and Broadway, for the Metropolitan Fireproof Bldg. Co. Parkinson & Bergstrom, Security Bldg., are Archs.

Shed—Los Angeles, Calif.—The Harbor Advisory Board has approved preliminary plans for the large steel transit shed to be erected on Municipal Dock No. 1, Los Angeles Harbor. It will be 100 ft. wide and 1800 ft. long. Homer Hamilton is City Engr.

✚**Cement**—Sacramento, Calif.—The Advisory Board of the California State Department of Engineering has let a contract for furnishing 1,000,000 bbl. of cement to the OLD MISSION PORTLAND CEMENT CO., San Francisco, Calif. The cement will be used in the construction of the State Highway System.

BUILDINGS

Berlin, N. H.—A. Y. M. C. A. building will be erected at Berlin, to cost $85,000. Shattuck & Hussey, 19 South La Salle St., Chicago, Ill., are Arch. Noted Mar. 27.

+Boston, Mass.—The Massachusetts Society for the Prevention of Cruelty to Animals has awarded the contract for the erection of an animal hospital and office building to the J. M. & J. C. BUCKLEY CO., 67 Harrison St., Worcester, Mass. This building will be of brick and stone, fireproof, and will cost about $300,000. Putnam & Cox, Boston, Mass., are Archs.

Brookline, Mass.—Bids will be received about July 1 by Fred A. Short, Arch., 165 Milk St., Boston, Mass., for the construction of an apartment house at Westbourne Terrace. It will be four stories, of brick and stone, 42x350 ft. The estimated cost is $150,000.

Everett, Mass.—The city is planning the erection of a city hall on Broadway. Christopher Harrison is City Engr.

Hingham, Mass.—The Nantasket Steamboat Co. contemplates the erection of wharf buildings at Crow Point. Fred L. Lane, Rowes Wharf, Boston, Mass., is Supt.

Holyoke, Mass.—Bids will soon be asked by Wm. B. Reld, Arch., 280 High St., for the construction of the High School gymnasium building to be erected at Pine and Beach Sts. It will be three stories, 104x109 ft. Noted May 22.

Methuen, Mass.—Bids will soon be asked for the construction of a school on Ashford St. It will be two stories, of brick. The estimated cost is $40,000. Edward A. Bower is Chn. of Com. J. E. Allen is Arch., 283 Essex St., Lawrence, Mass.

+Millis, Mass.—The contract for the construction of the high school has been awarded to ERNEST T. WILSON, Natick, Mass. It will be of brick, two stories, 34x82 ft. Cooper & Bailey are Archs., 89 Franklin St., Boston, Mass.

Pittsfield, Mass.—H. S. Blaisdell will erect a business block on North St., and has awarded the contract for the masonry and brick work to JAMES C. HALL, and the woodwork, to HENRY LE BRODE.

New York, N. Y.—C. C. Haight, Arch., 452 Fifth Ave., has prepared plans for the construction of an eight-story loft building, 30x60 ft., at the northwest corner of Canal and Sullivan Sts., for the Trinity Corporation, 187 Fulton St. The estimated cost is $40,000.

Plans have been filed by Goldwin, Starrett & Van Vleck, Archs., 45 East 17th St., for the construction of an eight-story office building, 85x39 ft., at Lexington Ave. and 40th St., for Hoggson Bros., 7 East 44th St. The estimated cost is $100,000.

Plans have been filed by Howell & Stokes, Archs., 100 William St., for alterations to a 10-story hotel at 252 West 76th St., for the Haynes Co., 100 William St. The estimated cost is $95,000.

Plans have been filed by A. C. Jackson, Arch., 340 Fifth Ave., for the construction of a five-story dwelling, 65x28 ft., on the east side of Park Ave., north of 73d St., for A. Ryle, 75 East 56th St. The estimated cost is $90,000.

Plans have been filed by A. Morton Gray, Arch., 1402 Broadway, for the construction of a six-story loft building, 82x25 ft., on 45th St., east of Fifth Ave., for C. B. Squire, 321 Park Ave. The cost is $50,000.

Plans have been filed by Shampan & Shampan, Archs., 772 Broadway, Brooklyn, for the construction of a one-story brick theater, 139x81 ft., at Elmore Place and Crotona Parkway, for the Crotona Parkway Amusement Co., 20 Nassau St.

Niagara Falls, N. Y.—Jenss Bros., Falls St., have had plans prepared by Simon Larke, Arch., 608 Elmwood Ave., for a four-story and basement store building, 100x135 ft. It will be of brick, terra cotta, fireproof construction. Cost, $80,000. Bids are being received

Rochester, N. Y.—Rees & Ade, Archs., 541 Granite Bldg., are preparing plans for a 2-story Public Market Building, 140x188 ft., to be erected at Chestnut, Court and George Sts., by the Storandt & Sweeney Co., Triangle Bldg. The estimated cost is $125,000.

+The general contract for the construction of the six-story and basement storage warehouse, 92x60 ft., on Central Ave., for J. A. Schantz, has been awarded to FRED H. RAPP, 3 Circle St. P. W. Dyer is Arch., Cutler Bldg.

Syracuse, N. Y.—Russell & King, Archs., Snow Bldg., have drawn plans for a three-story commercial building, 50x150 ft., to be built on South Salina St. by the Basse Sprague Co., 312 South Salina St. It will be of brick and steel construction. The estimated cost is $65,000.

+Baltimore, Md.—The contract has been awarded to JOHN J. McIVER, for the construction of school building No. 83, at Lakewood, and Philadelphia, Aves. Haskel & Bares are Archs., 301 North Charles St. Cost, 103,977. Noted May 15.

+Frederick, Md.—The contract has been awarded to J. L. MENOUGH & SONS, York, Penn., for the construction of the Women's College. J. B. Hamme, York, Penn., is Arch. It will be of brick and terra cotta construction, two and four stories, concrete foundations, fireproof. Cost, 118,700. Noted May 22.

+Washington, D. C.—The contract for the superstructure of the 12-story Real Estate Trust Co.'s building at 14th and H. Sts., has been awarded to JOHN NOLAN, Washington, D. C. Milburn, Heister & Co. are Archs., Washington, D. C. Noted Apr. 17.

+Washington, D. C.—The contract for the construction of a home for Aged and Indigent Masons, has been awarded to ARTHUR M. POYNTON, 715 14th St., N. W., at $42,000. Kendall & Smith are Archs., Southern Bldg., Washington.

Petersburg, Va.—Plans have been completed for the erection of a five-story apartment house of fireproof pressed brick, terra cotta and copper. Cost, $100,000. A. T. Shepherd and Charles K. Bryant, are Archs., Richmond, Va.

Birmingham, Ala.—The Malone McConnell Real Estate Co. will erect a five-story hotel, 75x100 ft., at Second Ave. and 22nd St. The estimated cost is $75,000.

Hattiesburg, Miss.—The Mississippi Woman's College will erect a $50,000 building during the summer.

New Orleans, La.—The Standard Oil Co., of Louisiana, will erect a two-story warehouse and storage depot. It will be of brick and steel, to cost $45,000.

New Orleans, La.—Plans have been prepared by Albert G. Bear, Arch., 600 Audubon Bldg., for the construction of a six-story apartment house at Colliseum and Urania Sts., for Alex Lichtentag. It will be of brick, stone and terra cotta construction. The estimated cost is $150,000.

+Memphis, Tenn.—The contract for the construction of the terminal for the Illinois Central R.R. has been awarded to the JAMES ALEXANDER CONSTRUCTION CO., Memphis, Tenn., at $500,000. Noted Mar. 27.

+The contract for the construction of the warehouse at 74 West Iowa Ave., for the J. R. Watkins Medicine Co., has been awarded to the HAGLEN STAHR CO. The estimated cost is $100,000.

Youngstown, Ohio—Bids were received for the erection of the new city hall at Youngstown, as follows: Heller Bros., $218,830; Fred Holoch, $224,029; Andrews Bros., $246,575. On a straight sandstone front and side elevation with brick and stone side and rear, Heller Bros. bid $243,076, and for limestone, $236,026. Holloch's bid on straight sandstone was $247,322; brick and sandstone, $236,677, and brick and limestone, $234,648. Stadler Bros. bid on two styles, straight sandstone, $253,442, and brick and sandstone, $242,702. Andrews Bros. only bid on the 10 first chapters, or a bare building of brick and stone.

Chicago, Ill.—Bids will be received about July 1, by Meyer H. Sturm, Arch., 116 South Michigan Ave., for the construction of a four-story brick hospital for the Evanston Hospital Assn. Noted May 29.

Waukesha, Wis.—The Board of Public Works has been authorized to receive bids for the proposed city hospital. Plans for a brick structure, to cost $75,000.

Des Moines, Iowa—(Official)—The City contemplates improvements to various municipal buildings. The estimated cost is $1,600,000.

Lincoln, Neb.—Bids were received for the construction of the State Fair building as follows: Rasmussen & Kyhl, Omaha, $128,255; Goulé & Son, Omaha, $133,500; Buck & Wind, $126,890; Assenmacher & Co., Lincoln, $128,233; Trenton Building Co., Seward, $96,000.

+Louisiana, Mo.—The contract for the construction of the high school has been awarded to RALPH STEWART, Louisiana, at $42,000.

+St. Louis, Mo.—(Official)—The contract for the construction of the first section of the jail, has been awarded to the KELLERMAN CONTRACTING CO., Roe Bldg., St. Louis, at $183,000. Noted May 15.

+Dallas, Tex.—The contract for the construction of the interurban railway station at Dallas for the Union Terminal Co., has been awarded to the STONE & WEBSTER ENGINEERING CO., Boston, Mass. Noted May 20.

+Palestine, Tex.—The contract for the construction of the court house has been awarded to M. P. KELLEY, Gainesville, Tex., at$148,438. C. H. Page & Bros. are Archs., Austin, Tex. Noted May 8.

Waco, Tex.—The Praetorians, a fraternal insurance association, which has its headquarters at Dallas, has adopted plans for the erection of an eight-story brick and steel office building here.

+Phoenix, Ariz.—Streitz, Cook & Smart, Archs., Monihon Bldg., are preparing plans for a three-story concrete warehouse to be erected for the Arizona Eastern Ry. Co. Phoenix. It will have hollow tile partitions, cement and pine floors, heating plant, and will cost $60,000. The contract has been let to the ARIZONA CONCRETE CONSTRUCTION CO.

+Norman F. Marsh, Arch., Broadway Central Bldg., has completed plans for a grammar school, to be erected at Phoenix, Ariz. It will be a two-story and basement structure, 280x120 ft., and will cost $120,000.

Fullerton, Calif.—The Board of School Trustees will receive bids until June 7, for the erection of the brick school at Fullerton. It will be a one-story and basement structure of classic style. It will be T-shaped, extreme dimensions, 180x200 ft. It will have concrete foundation and basement brick walls plastered on the exterior and composition roofing. The cost will be about $50,000. Tuttle & Hopkins, Delta Bldg., Los Angeles, are Archs.

Los Angeles, Calif.—The Union Stock Yards Co. will erect an office building, to cost $75,000, on San Antonio St. in Vernon. Alfred W. Rea, 720 Black Bldg., Los Angeles, is Arch.

Oakland, Calif.—The following bids were opened by the Board of Education for the construction of the Durant School, on West St., at 29th St. Plans for the building were prepared by J. J. Donovan, Arch.: O. B. Ackerman & Son, $110,387; Thurston & Co., $104,965; Van Sant-Houghton Co., $101,593; Amweg & Co., $99,500; Christensen Bros., $104,566; Mathews & Griffith, $105,837.

San Diego, Calif.—Bids will be received until June 14, at the office of Thomas O'Hallaran, 511 American National Bank Bldg., for the erection of the California State Building on the exposition grounds in Balboa Park.

+San Francisco, Calif.—W. H. Weeks, Arch., 75 Post St., awarded the contract to CHAS. O. SMITH, 940 California St., for the construction of a seven-story concrete and steel lodging house on Ellis St., for Chas. C. Judson Co. Cost, $50,000.

Agincourt, Ont.—(Official)—The contract has been awarded to JOHN S. METCALF CO., Ltd., 54 St. Francis Xavier St., Montreal, Que., for the construction of all the buildings along the new line of the C. L. O. & W. Ry., about 180 miles in length, extending from the present main line at Glen Tay, Ont., near Smith's Falls, to the main line at Agincourt, not far from Toronto. The contract includes seven brick stations, 12 wooden stations, nine 40,000-gal. water tanks, a 12-stall engine house, with turntable, machine shop, coaling plant, ashpit and sand house; nine freight sheds, an ice house, seven station residences, 25 tool houses and miscellaneous buildings.

CONTRACTS TO BE LET

Paving

OFFICE OF PAVING COMMISSION
Baltimore, Maryland.

SEPARATE SEALED PROPOSALS, addressed to the Board of Awards, care of the City Register, will be received by him at his office in the City Hall until 11.00 A. M. Wednesday, June 18th, 1913, to grade, curb and pave with granite block and vitrified block, all on a concrete base, the streets listed in the following contracts:

VITRIFIED BLOCK CONTRACT NO. 58

	from	to
Fairmount avenue,	Central avenue	Broadway
Watson street,	High street	Central Ave.
Granby street,	Exeter street	Central Ave.
Low street,	Front street	East street
Forrest street,	Fayette street	Lexington St.
Customhouse Av.,	Lombard street	Water street
Hargrove alley,	Saratoga St.	Pleasant St.

Vitrified Block—14,400 sq. yds.
Certified Check—$1,000.00

VITRIFIED BLOCK CONTRACT NO. 59

	from	to
McMechen street,	Park avenue	North avenue
Sherman Place,	Lanvale street	North avenue

Vitrified Block—5,050 sq.yds.
Certified Check—$400.00

GRANITE BLOCK CONTRACT NO. 60

	from	to
Ridgely street,	Stockholm St.	Fremont avenue
President street,	Fawn street	Pratt street.

Granite Block—11,660 sq. yds.
Certified Check—$1,200.00

GRAN. BLK. OR HASSAM GRAN. BLK. & VIT. BLK. CONT. 61

	from	to
Fayette street,	Gay street	Central avenue
Exeter street,	Fawn street	Pratt street
Exeter street,	Low street	Gay street.

Gran. Blk. or Hassam Gran. Blk.—9,540 sq. yds.
Vitrified Block—1,500 " "
Certified Check—$1,000.00

The figures above represent the approximate quantities of the principal items appearing in the contract.

Specifications and proposal sheets can be obtained upon application to the office of the Paving Commission, City Hall. A deposit of $5.00 will be required for a specification covering each contract. This will not be refunded unless a bid is filed.

Plans and profiles are on file for the information of bidders in the office of H. KENT McCAY, Chief Engineer.

The Board of Awards reserves the right to reject any and all bids. A certified check of the bidder on a clearing house bank, drawn to the order of the Mayor and City Council of Baltimore to the amount as recited above, must accompany each bid.

The successful bidder will be required to furnish bond and to comply with the City Charter respecting contracts.

By order of the Paving Commission

R. KEITH COMPTON, Chairman
J. MYERS HEDIAN, Secretary

⁂

Filtration Plant

Front Royal, Va.

Sealed proposals will be received at the office of the Mayor of Front Royal, Virginia, until 2 p.m., June 21, and then and there publicly read for the construction of a gravity mechanical filtration plant having a capacity of one million gallons per day.

A certified check for 10 per cent of the bid must accompany each proposal.

Prospective bidders should apply to the Engineer, Edwin V. Dunstan, 204 Southern Building, Washington, D. C., for plans, specifications and blanks, enclosing $10 deposit for their return in satisfactory condition.

The Town reserves the right to reject any or all proposals.

W. W. PETTETT
Chairman, Water Committee.

Paving

INVITATIONS FOR PROPOSALS FOR BITULITHIC OR ASPHALT OR OTHER FORMS OF BITUMINOUS OR ASPHALTIC PAVEMENT.

City of Holyoke, Mass.

The Board of Public Works of Holyoke, Mass., will receive at its office, Room 2, City Hall, Holyoke, Mass., until 2 o'clock in the afternoon of Friday, June 20, 1913, sealed bids for laying approximately twenty eight thousand (28,000) square yards of bituminous or asphalt or other form of pavement, but not brick, wooden block or Belgian block pavement; the yardage being divided approximately as follows, viz:—

Contract A. Four thousand eight hundred (4,800) sq.yds.;
Contract B. Two thousand one hundred (2,100) sq.yds.;
Contract C. Twenty one thousand one hundred (21,100) square yards, the Board reserving the right to award the contracts separately or as a whole;

and for furnishing f.o.b. cars Holyoke, Mass., a sufficient quantity of wooden blocks to lay approximately fifteen hundred (1500) square yards of pavement, the entire work to be performed in accordance with specifications to be prepared and submitted by the bidder under and in conformity with information and specifications issued by the Board. As soon as may be after the above time and at the above place the bids so received will be publicly opened and read. Proposals must be accompanied by a certified bank check in the sum of Five Hundred Dollars ($500.00) or by lawful money in the same sum. Bids to be addressed to the Chairman, marked "Proposals for Paving." The Board reserves the right to reject any or all bids or to accept any bid that in its opinion may be for the best interests of the City of Holyoke.

OSCAR C. FERRY, Asst. Clerk.

Holyoke, Mass., May 29, 1913.

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Spillway and Waste Gates

Ann Arbor, Michigan, May 31, 1913.

Sealed proposals will be received at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Michigan, until 5:00 P.M. Monday, June 16, 1913, for the construction of a reinforced concrete spillway and waste gates, for the Argo Plant of the Eastern Michigan Edison Company, Ann Arbor, Michigan.

The approximate quantities of the principal items are:

1400 Cu. Yds. Excavation
2600 Sq. Ft. Sheet Piling
750 Cu. Yds. Concrete
19 Tons Reinforcing steel
22 Tons Structural steel and Mechanism

Plans and Specifications may be seen at the office of the undersigned, or may be obtained upon the deposit of a certified check for $10.00, $8.00 of which will be refunded upon the return of the Plans and Specifications.

The right is reserved by the Company to reject any or all proposals, and to accept such proposal as may appear to the best advantage of the Company.

GARDINER S. WILLIAMS,
Consulting Engineer,
Ann Arbor, Michigan.

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Grading

OFFICE OF COMPTROLLER OF THE STATE OF NEW JERSEY
State House, Trenton, N. J.

Sealed proposals for about eleven thousand cubic yards of grading on lands of the State of New Jersey in the rear of the State Capitol, Trenton, N. J., will be received at this office until twelve o'clock noon, June 17th, 1913, and then publicly opened.

Plans and specifications on application to

E. I. EDWARDS,
Comptroller & Secretary State House Commission.

Engineering News

VOLUME 69 JUNE 12, 1913 NUMBER 24

A Wooden Trestle Bridge Carried on Timber Beams

A remarkably unusual use of timber is represented by the bridge shown in the view herewith, a timber bridge on the Baker River & Shuksan R.R. across the Baker River, Wash., about 1½ miles above its mouth. The railway track here is about 180 ft. above the river. The bridge spans the gorge at about half the height to the track, by a combination of cantilever trusswork and 80-ft. beams, which, however, apparently acts as an arch; and on this bridge is erected a two-story trestle. Both upper and lower structures are built of round timber.

The lower half, or base bridge, has a total length of 160 ft. The length of the central span or beam portion is about 80 ft. Bents of round logs were framed and set on suitably prepared abutments or footings near the bottom of the cañon, leaning at an angle outward from the vertical. At their tops they engage horizontal timbers running out from the bank. These bents were framed of 24-in. fir logs. The beams of the central span are 18-in. logs; they take the thrust of the inclined bents, and with them form an arch. The trestle resting on this lower bridge is of more ordinary proportions and construction.



TRESTLE ON BEAM OR ARCH SPAN OF ROUND TIMBERS; BAKER RIVER & SHUKSAN R.R. CROSSING OVER BAKER RIVER, WASH.

In constructing this bridge, track was first laid on the railway grade to the bank of the river on the west side and bridge material was handled to the site over the track. All timbers used for the bridge were cut and framed in the woods close by, loaded directly onto log-

ging trucks and hauled to the site. Here they were lifted and set by a cableway spanning across the gorge on the center line of the bridge; this was operated by a hoisting engine at the east approach. The inclined bents of the lower part of the bridge were first set, being held in place temporarily by cables drawn across the river. The anchor timbers were next set in place. Then the 48-in. logs were laid to span the central opening, being dapped and bolted to the cantilevers.

This bridge was built as a temporary structure. When the time comes to replace it, it is to be used as falsework for the permanent bridge.

It is stated that the erection of the timberwork complete required only four weeks time after the foundations were ready. The erection was managed by J. MacBurney, who is given great credit for the efficient handling of the work.

The above data are from E. P. Lucas, General Manager of the Baker River & Shuksan R. R. (Concrete, Wash.), and A. S. Downey, Chief Engineer (Seattle).

Best Road Surfaces for Different Kinds of Traffic*

Experience in Massachusetts and elsewhere has shown conclusively that large numbers of swiftly moving automobiles cannot successfully be carried over a water-bound macadam road or over a gravel road. Such a road becomes raveled very rapidly, rutted and disintegrated. Traffic studies in Massachusetts indicate that from 50 to 100 automobiles a day make the use of some dust layer or binder necessary.

With the present motor-vehicle traffic it is necessary, where a road has heavy team traffic as well, to adopt in construction or resurfacing some form of bituminous mixture for at least the upper 2 or 3 in. of the road surface.

MOTOR-VEHICLE TRAFFIC ONLY—Some oiled gravel roads are satisfactory and very economical, if they are constantly and properly maintained, even where there are large numbers of swiftly moving automobiles a day, at least, in the summer months, but where there are not many heavily loaded wagons. Some of these roads have 500 automobiles or more a day, and yet they are cheaply built and cheaply maintained. Roads built of sand and asphaltic oil also stand up well under heavy motor-vehicle traffic, but these roads have very little heavy teaming on them. Heavy wagons and many heavy motor trucks rut such roads quickly and soon wear them out.

MAINTENANCE COSTS—When the motor vehicle appeared in fair numbers upon the roads Massachusetts had 600 to 700 miles of state highways (now, in 1912, over 900), and they were mostly water-bound macadam, with some few miles of gravel road.

These highways had been built from 1 to 14 years previously, very few miles had been resurfaced, and the Highway Commission had only $100 a mile a year to spend for maintenance and resurfacing, and not that much except for the last few years. The maintenance of these old roads was our problem in 1905, and has been ever since.

Automobile travel has increased 40% and the total traffic 14% a year, and these roads must be maintained, or the state's money, borrowed on long-time bonds, would be lost and wasted; the good roads would be gone, but the bonds would still remain to be paid.

The state doubled its appropriation for maintenance in 1908, giving the Highway Commission $200,000 a year instead of $100,000. The motor-vehicle fee was also increased, and the right to use the net fees for the maintenance of roads was obtained. These two sources of revenue for the last three years have provided about $500,000 a year, for maintenance; an average of $450 a mile a year, and we are at least holding our own.

BITUMINOUS BINDERS AND DUST LAYERS FOR OLD ROADS—Many miles of old roads have been saved by spreading a coat of asphaltic oil, light or heavy, or tar over them. Today some asphaltic binder or dust layer has been used on over 80% of our state highways. The only roads on which it has not been used are those located in the country districts where there is very light traffic.

This year (1912) we have used nearly 2,000,000 gal. of bituminous material in construction or maintenance. Over 800 of the 930 miles of our state highways have received some form of bituminous treatment. We have resurfaced as many miles of road every year as we could; using, where the traffic was heavy, a bituminous macadam on the top 3 in.

EFFECT OF TRAFFIC ON BITUMINOUS SURFACES—Massachusetts has four division engineers, on its highway work. They were asked the same questions relating to different tars, oils, asphalts, etc., and for their opinions of the relative merits or demerits of each.

The answers were all different. One had used tar on the surface successfully, another had not. One liked tar for penetration or mixing; another preferred an asphaltic compound. The same was true of the use of various asphaltic oils as a blanket coat, or as a dust-layer. One preferred a heavy cold oil, another a heavier hot oil. There was, however, if the traffic and other conditions in each case were carefully studied, a real agreement in all essentials.

WHERE HEAVY OILS FAIL—We have a good many miles of old macadam road which have been saved and maintained by ½ gal. of hot asphaltic oil spread upon each square yard of surface and properly covered with sand and pea stone or gravel. Many of these roads have worn three years, and in their fourth year are still in good condition. A few miles have worn four years and are now on their fifth year. The patching has cost but little, from 1 to 3c. per sq.yd. a year.

These roads often have very heavy automobile travel, possibly over 1000 cars a day. They often have large numbers of teams daily. One has over 500 teams and 1000 automobiles, and a heavy blanket oil surface has worn reasonably well for three years, and will for a fourth year except in a few places. This same road also has an average of 55 motor trucks a day.

Near two traffic taking stations, where the teaming was heavy, for one-quarter of a mile in each place (out of four miles), the blanket oil failed. It crumbled, went into mud, developed holes and was disappearing. We have replaced the top 3 in. with an asphaltic bituminous macadam.

HEAVY HORSE-DRAWN WAGONS CAUSE FAILURE—The traffic study shows that it is not the number of wagons, but heavy wagons—two or more horses and heavy loads on narrow tires—that cause the failure. The failure of roads treated with heavy oil has occurred on a few miles of road at certain places where it was clear that heavy horse-drawn wagons were responsible.

In two instances it was 50 to 75 ice-wagons a day, together with other wagons, carrying 3 tons or more each on 2½ to 3-in. tires which did the damage. In a month the oil surface began to crumble and break up on the side of the road on which the loaded teams traveled. The surface lasted three months on the other side of the road where these wagons came back empty. This same road, treated with the same oil, is still in good condition beyond the ice-houses. In one case for 3 miles, in the other for 15 or 16 miles, the oil surface is three years old and still needs only patching. Light cold oil has been substituted as a dust-layer and has proved reasonably satisfactory, though the stone of course is wearing out, and a bituminous macadam would probably prove economical.

In 1909 the Gloucester road, which had been covered with a hot oil blanket, was rutting and wearing out rapidly. A coal team was passing to some hotels three or four times a day during the summer (carrying 6 or 7 tons of coal on narrow tires). When a motor truck was substituted for the coal team the surface of the road, which had been oiled, was again in good condition. It has worn three years and now needs only patching.

HOT OIL BLANKET SURFACE—A hot oil blanket surface, made of a good asphaltic oil, will be economical and will carry large numbers of automobiles at high speeds (over 1000 a day in summer) for several years, will carry large numbers of light wagons (500 a day), and quite a number of motor trucks (50 or so a day), but will be destroyed by a large number of heavy wagons, especially those with narrow tires. Fifty or more such vehicles daily, farm wagons, wood wagons, etc., will rapidly destroy the road surface. A surface coat of a good quality of tar will last satisfactorily under a large amount of automobile travel, but usually it has to be renewed more often than a good quality of oil.

In all cases it is assumed that holes and depressions will be filled before tar or oil is used, that the bituminous material is evenly distributed and is sufficiently covered and kept so that it will not be picked up on tires, and that all holes that develop are patched at once as soon as they appear.

*Condensed from a paper on "Traffic Census of Roads in Massachusetts" by Alex D. Sedgwick, Chairman of the Massachusetts Highway Commission, at the convention of the American Road Builders' Association, Dec. 5, 1912.

Constant repairs, at a cost of 1 to 2c. a sq.yd. a year will save an expenditure of from 10c. to $1 a sq.yd. for the resurfacing of these bituminous surfaces if they are allowed to go to pieces; and they will do it in a year or two at the most, if not cared for properly.

When these surface treatments fail, as they will where the traffic is extremely heavy (heavy in weight of vehicles, not numbers of vehicles) then some more permanent form of construction must be selected and the road reconstructed as soon as possible. It will prove to be true economy in the end, and the end is not far off.

Light cold oils, water-gas tar, etc., used as dust-layers help to prevent the raveling of roads. These materials may be economical and work satisfactorily for small wagon traffic (30 to 50 a day) and medium automobile traffic (50 to 100 a day), provided the road is not one where high speeds are usual.

They may also help to preserve the road from the effect of automobile traffic where the team traffic is too heavy, or the loads are carried on such narrow tires that a hot oil blanket surface will not wear satisfactorily, until money becomes available to resurface the top 3 in. with some form of bituminous macadam.

CONCLUSIONS SUMMARIZED—The accompanying table shows as nearly as possible the results observed after four years of experience with bituminous materials, comparing these results with the traffic going over the road in 1909 and again in 1912.

It is fully realized that more experience will undoubtedly cause changes or modifications in some of the present opinions.

TABLE SHOWING KINDS OF ROAD SURFACING BEST ADAPTED TO DIFFERENT CLASSES OF TRAFFIC FOR A STANDARD ROAD 15 FT. IN WIDTH, WITH A 3-FT. GRAVEL SHOULDER ON EACH SIDE

	Average Daily Traffic			
	Light wagons	Heavy wagons one horse	Heavy wagons 2 or more horses	Automobiles a day
A good gravel road will wear reasonably well and be economical with	50 to 75	25 to 30	10 to 12	100 to 150
Needs to be oiled with				over 150
Oiled gravel fairly good either hot or heavy cold oil ½ gal. coating (cold oil must be used yearly)	75 to 100	30 to 50	20	500 to 700
Water-bound macadam will stand with	100 to 150	175 to 200	60 to 80 Perhaps more	Not over 75 at high speed
Dust-layer will prove serviceable on such macadam with				50 to 100
Macadam will then stand (but the stone wears, of course), with				300 to 500
Water-bound macadam with hot oil blanket coat will be economical with	250 to 300	75 to 100	25 to 30	Up to 1400 and more with fewer teams
Will stand at least	50 motor trucks		probably more	
But will crumble and perhaps fail with over		100 on narrow tires (loaded farm wagons, ice and wood wagons, etc.)	50	
Water-bound macadam with a good surface coating of tar will stand with	30 to 50	25 to 30	10 to 15	1800

The quality of gravel or other material and the speed of motor vehicles in particular localities are important factors and account for the above minimum and maximum variations.

It has not yet been satisfactorily determined when the weight of traffic makes it more economical to use a bituminous macadam, either tar or asphaltic products by penetration with a sealing coat of tar or asphalt, or by the mixing method, but it is believed that some such method would be economical and desirable where the team traffic is so heavy (75 to 100 heavy wagons on narrow tires with two or more horses), that a heavy, hot oil blanket surface will not carry the traffic but fails within the year.

We have several such bituminous macadam roads which have stood for three or four years very well indeed, but time alone will determine the ultimate economy. In surfacing with a 3-in. bituminous macadam top the extra cost for such top has varied from 30 to 60c. a sq.yd. depending on material and methods used.

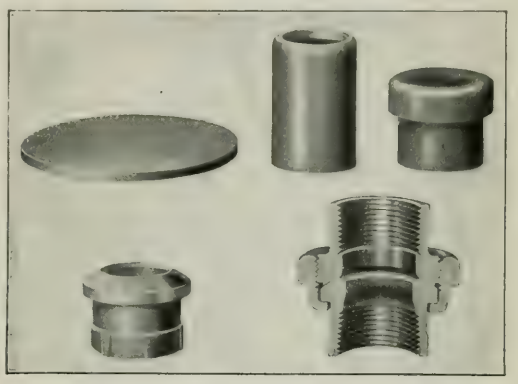
❖

A State Insurance Fund for State Buildings in New Jersey was established by the legislature of 1913. The fund will eventually amount to $1,000,000, and as a beginning $50,000 has been appropriated for the purpose.

A Pressed-Steel Union Pipe Coupling

The accompanying figures show part of the process of making a pipe union which possesses radical features of novelty. This coupling is made of cold-pressed steel throughout, except for a soft-brass ring seat which is inserted in the female end.

This type of union has been designated with the idea of securing some physical advantages with decreased cost of production. Many union couplings, on account of lack of uniformity in the castings, have to be replaced in service—especially on high-pressure lines. Such unseen defects can hardly exist in a pressed fitting, since the production in itself is a test of the uniformity and quality of metal. By using the same material found in steel pipe, the expansion of the union under heat, is the



SECTION OF A PRESSED-STEEL PIPE UNION COUPLING AND FOUR STAGES IN FORMATION OF MALE END

same as the expansion of the joined pipes which very greatly reduces the tendency to stretch and to leak on contraction.

First, from steel strips are cut flat disks which are then pressed into deep cups with the bottoms punched out. One end of a cylinder thus formed is rolled back on itself and pressed into final shape with a finished seat (male end) or a head ready for threading (female end). The lower end is then upset to form a head and the part is complete except for setting the ring insert in the female end. This is drawn from soft brass and annealed after drawing. After threading, the steel parts are galvanized by the sherardizing process in which the articles are heated with zinc dust in a revolving drum.

The successive drawing operations noted are performed by a series of punch presses, ranging in weight up to 100 tons and driven by motors of 5 to 150 hp. The manufacturers are the Mark Manufacturing Co., of Chicago, Ill.

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The Returns from Farm Animals on Irrigated Lands has been reported on by F. W. Hanna, of the U. S. Reclamation Service, and copies of the report have been sent out by F. H. Newell, director of the Service (Washington, D. C.), for the purpose of eliciting discussion. The subject is considered important to irrigation engineers because the permanent success of an irrigation project depends largely upon maintaining the fertility of the soil, toward which farm animals contribute in no small degree.

The Westchester Railway Electric Traction

SYNOPSIS—In a preceding article the lines and the stations of the New York, Westchester and Boston Ry. were pictured. The study of this interesting road is here continued with an outline of the electric-traction system including the overhead construction, the scheme of power distribution, the rolling stock and the switches and signals.

Overhead Construction

As the Westchester line is controlled by the New Haven road, it was only to have been expected that the 11,000-volt, single-phase system would be used. In fact the design and construction of the overhead structure were directly given over to the New Haven's electrical engineering department. Therefore, this work represents the latest development of the single-phase system, of which the New Haven has the largest example to be found yet. The new work shows, of course, many and great changes from the early New Haven installation (described in Engineering News, Sept. 5, 1907), the overhead contact system being very much simpler and more open, while continuity of service seems to have been increased, and first cost, maintenance expense, and general line troubles to have been reduced.

The supporting bridges for the overhead wires, of which a typical one for tangent stretches of track is shown in Fig. 1, are placed 300 ft. apart ordinarily. The design shown is a standard. For curves the spacing is reduced variously to a minimum of 200 ft., and heavier bridges are employed to care for the bending moments introduced in the legs by the pull-off of the suspended wires. There is one design for use on tangent, another for curves up to 4°. Where curves are sharper than 4°, a sufficient number of lattice-steel pull-



Fig. 1. Overhead Bridge for Tangent-Track Catenary Lines



Fig. 2. Catenary Bridges at Track Curves

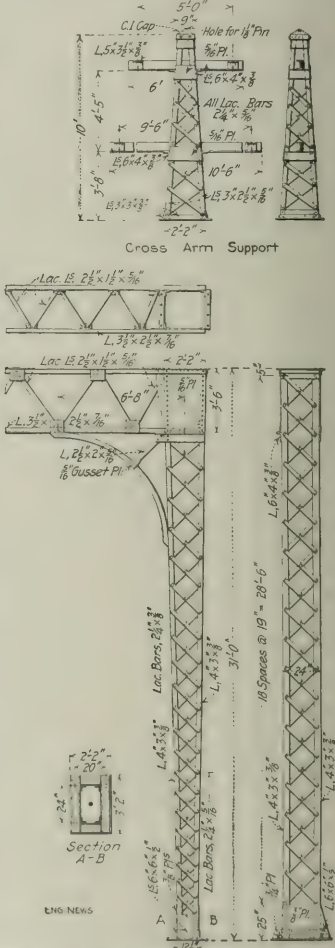


Fig. 3. Details of Tangent-Track Catenary Bridge

off poles are placed between the bridges to carry the extra side pull and to bring the conductor over the track center without awkward lengths of the catenary hangers.

In a few cases of station platforms, it is necessary to place the bridge columns between the outer and inner tracks to prevent extreme length of bridge girder, etc. In these cases, the outer catenaries are supported from cantilever ends of the girder as shown in Fig. 4.

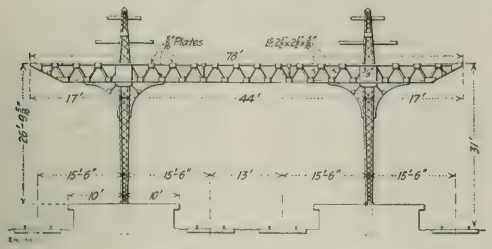


FIG. 4. CATENARY BRIDGE WITH CANTILEVER ENDS

On the four-track section, the main messenger cables (7/8-in. galvanized-steel strand) are fastened to saddles on top of the bridge girders. This cable is adjusted for a constant tension and variable sag. It carries none of the main-line current, being in contact with the bridges which are well grounded. Moreover, this construction gives a grounded overhead cage covering the contact conductors and protecting them from lightning.

In some cases the foundations for the bridges brought peculiar problems, as where the roadway was on a fill of considerable depth and it was desired to proceed with the foundations for the overhead construction before the fill could be allowed to settle. Where the height of the fill was considerable, a built-up arrangement of thick concrete slabs was used.

It was expected that in this way any disalignment of the foundation due to settlements could be compensated for by wedging up certain of the blocks of each foundation, and filling in with grout. Reinforced-concrete foundations were used to meet special conditions such as spanning station platforms, etc.

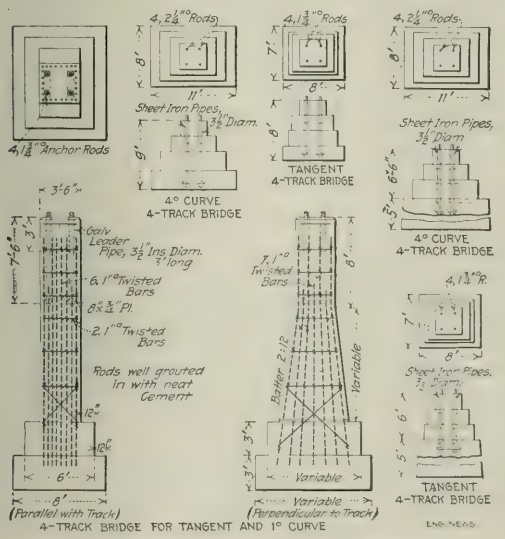


FIG. 5. A FEW CATENARY-BRIDGE FOUNDATIONS

The main catenary cable on normal spans carries a 3-in. I-beam at points 75 ft. out from each bridge (and therefore 150 ft. apart) spanning all four tracks (or both tracks on the White Plains branch). From these cross beams the intermediate catenary cable (5/8-in. galvanized-steel strand) is suspended by 110,000-volt-test porcelain insulators and this wire in turn holds up a No. 0000 grooved copper conductor with hangers 10 ft. apart, the length of the hanger rod being adjusted to make the copper wire parallel to the grade or to conform to such contour as is desired. Below the copper wire is a steel contact wire to take the wear of the locomotive-pantograph shoes. The wire is maintained parallel to the copper and 1¾ in. from it by spacing clips, also placed 10 ft. apart but midway between the catenary hangers to secure maximum flexibility.

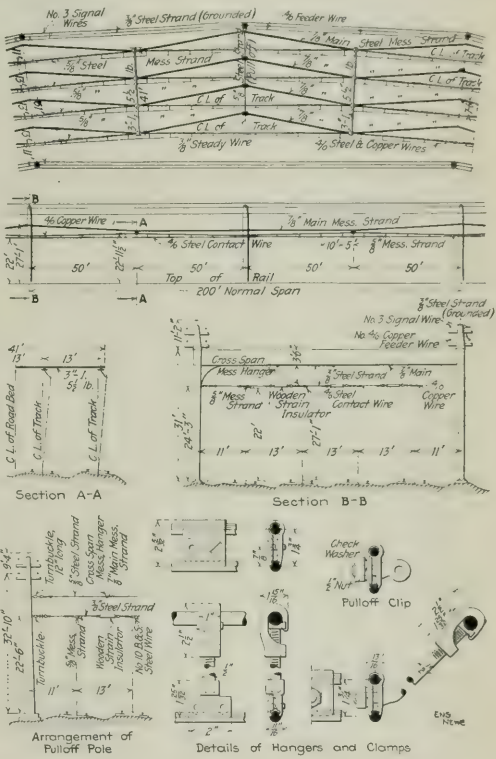


FIG. 6. NEW HAVEN 11,000-VOLT CATENARY CONSTRUCTION FOR CURVES

Where the sag varies, due to shortening up of the normal 300-ft. span, a T-section steel triangle is interposed between the main messenger cable and the crossbar, as seen in Fig. 2, to bring the crossbar to normal elevation. The same construction is found on some low bridge approaches and for the same reason.

The overhead wires have a novel appearance at curves

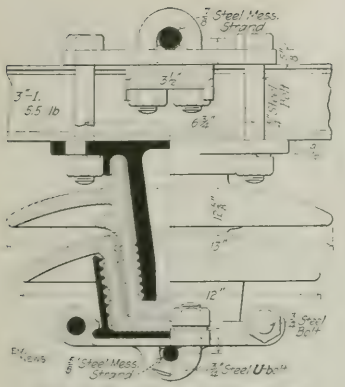


FIG. 7. DETAILS OF CATENARY INSULATOR



FIG. 8. LOW-BRIDGE CONSTRUCTION ON THE WESTCHESTER ROAD

due to the catenary hangers serving as both supports and pull-offs, and therefore being inclined to the vertical (28° for 1° curve, 48° for 2°, 58° for 3°, 63° for 4°). The proper length for these inclined rods in final position has been calculated for various curves. The catenary strand is installed with proper sag and the contact and copper wires are drawn up along the track to proper tension before the hangers are installed, when these lower wires have approximately the proper distance above the rails. The necessary flexibility is secured for easy underrunning of the locomotive pantograph by the inclined position of the hanger rod, there being a slight rotation about the secondary catenary cable support as the pantograph presses upward.

There are several low bridges on account of the grade eliminations. As shown in Figs. 8 and 9, the main cate-

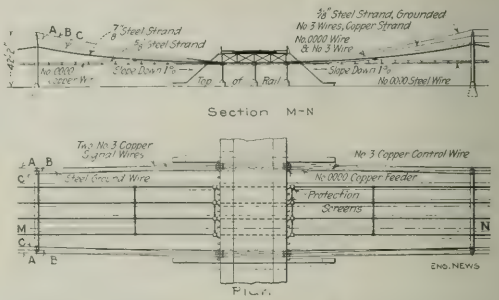


FIG. 9. PLAN AND ELEVATION OF LOW-BRIDGE CONSTRUCTION

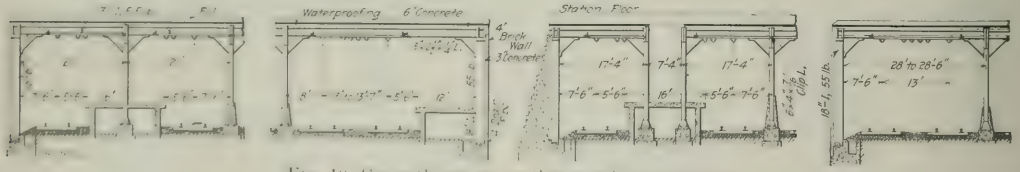


FIG. 10. CROSS-SECTIONS OF SUBWAY CONSTRUCTION

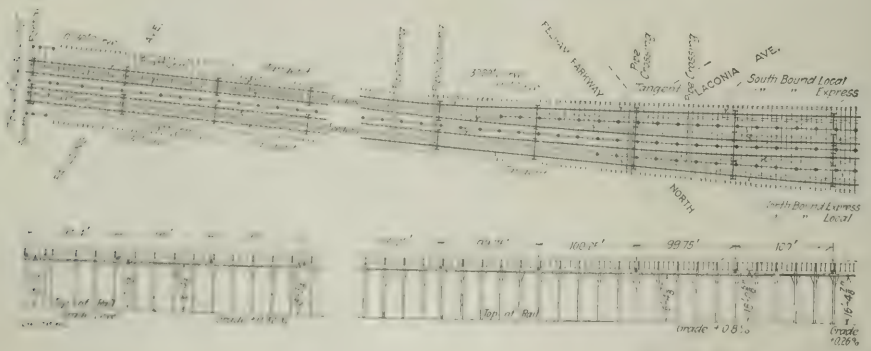


FIG. 11. PLAN AND ELEVATION OF

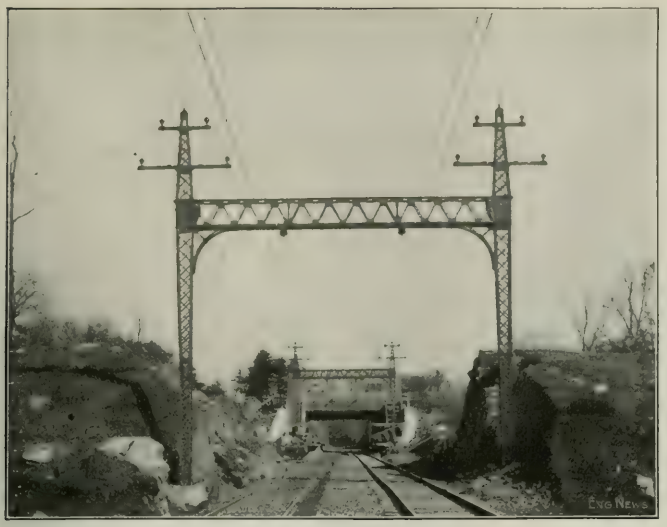


FIG. 12. SINGLE CATENARY ON TWO-TRACK LINE

nary cable is fastened to both end girders of the highway bridge; the copper and contact wires are supported in their usual way, but at two points only, and these outside the bridge.

A subway section of 3940 ft. has already been noted. The overhead construction is very simple here. The main catenary cables terminate at each portal, being securely anchored to the end girders. The standard form of insulator is attached to steelwork on the roof beams (which have a clear height of 18 ft. 5/8 in. above rails) and support the track catenary 16 ft. 4 7/8 in. clear above the rails. The copper and steel running wires are suspended from the messenger by standard hanger rods, and the usual spacing clips, as shown in Figs. 10 and 11. In the middle of the subway section is the Pelham Parkway station. The construction here is shown in Fig. 10.

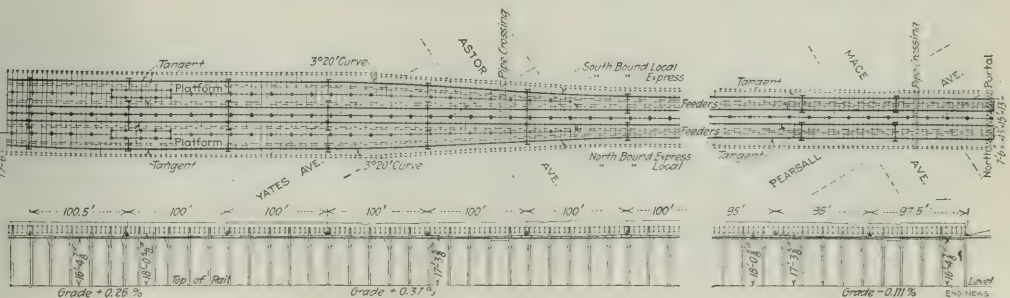
A further simplification of the overhead construction was tried out on the New Rochelle branch (the double form already described was continued on the White Plains line, so that comparison should be later available). The intermediate catenary is omitted and a single cable (fastened to the under side of the bridge trusses) supports the copper conductor directly with the steel contact wire below the latter as before. The catenary cable has to be insulated from the bridges, in this construction, instead of being directly fastened thereto.

POWER SUPPLY AND DISTRIBUTION

Power (25 cycles, 11,000 volts, single phase) is taken from the plant of the New York, New Haven & Hartford R.R. at Cos Cob (which supplies the New York-terminal electric-traction zone of that road, and is equipped with three-phase generators carrying



FIG. 13. JUNCTION OF TWO TWO-TRACK AND ONE FOUR-TRACK LINES



BRONX SUBWAY, N. Y., W. & B. RY.

elevator-motor and rotary converter loads on the three phases). A circuit diagram for the Westchester and New Haven combined system is shown in Fig. 14. Connection to the New Haven line is made at New Rochelle, Mt. Vernon and West Farms. The railway line is split into electrical sections between certain anchor bridges approximately 3 miles apart and the running conductors in these sections are connected together and to the feeder line through circuit-breakers as shown. The circuit-breakers, however, do not act directly on local overload, but are tripped from a control wire P_1, Fig. 14, which is energized by an overload relay at the Cos Cob station. The main overload relays here are so connected that the first action is to throw resistance into the main outgoing railway-phase feeder to limit the maximum short-circuit current and not to interrupt all traffic by every rush of energy.

As a circuit-breaker is allowed to open only by combined action of two relay coils, one carrying short-circuit current of the railway section in trouble, the other carrying control current from the power station, then only the circuit-breakers for the faulty conductor or section are thrown, and only after resistance has been inserted in the power-house circuit to reduce the short-circuit current to safe value for the breaker to open. The circuit-breakers, however, can be tripped from the signal towers in case of necessity for repairs or emergency action. In the circuit diagram (Fig. 14) one transformer is shown as connected to the automatic control wires, and having its secondary led to indeterminate circuits. It should be understood, however, that this secondary supplies all of the control coils on several circuit-breakers of that bridge. The same thing applies to the transformers for signal lamps and for the power for signal movements.

At present the main power distribution is at 11,000 volts, but soon this will be raised to 22,000 volts with 11,000 volts still on the contact wires. This is done by making the track-catenary connection to the feeders through an auto-transformer connected between the feeder and track circuit. The various stations are lighted from special transformers, the primaries of which are carried on the regulated railway phase of the power station, being connected between rails and the power-feeder wire A_1, Fig. 14. Where power for elevator or compressor motors, etc., is needed it is obtained (three-phase) from the feeders (F_1 and F'_1, Fig. 14) and rails.

Rolling Stock

No locomotives are used for passenger service on this line; there is, however, one electric switch engine for pushing the motor cars into the inspection and repair shop, and for other odd jobs. For convenience in making line repairs, when voltage is off the system, a gasoline-electric work car is provided.

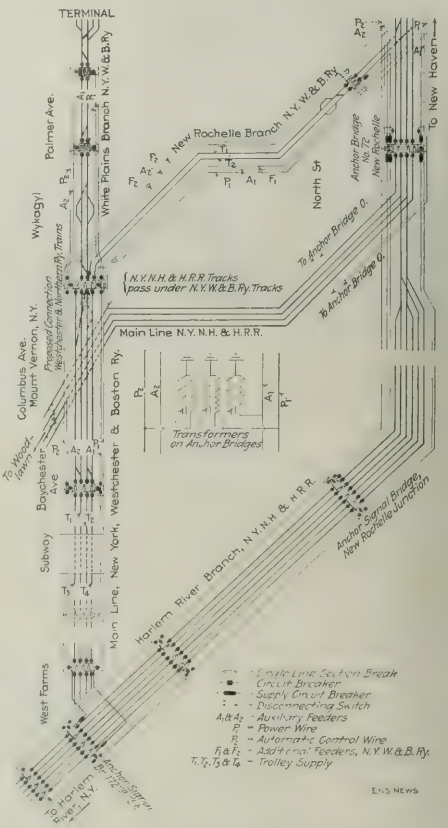


Fig. 14. Power-Supply Circuit Diagram of the New York, Westchester & Boston Ry.



Fig. 15. Steel Car of the Westchester Road

The 30 passenger cars in service are all motor cars, each with a full complement of 11,000-volt apparatus on board. The bodies are 61 ft. 4 in. long, 9 ft. 8 in. wide, and 13 ft. 4 in. high; the length over buffers is 72 ft. $3\frac{1}{4}$ in. Each ordinary car seats 78 passengers and weighs 120,000 lb. fully equipped. There are two 54-ft. combination cars with a 16-ft. compartment at one end for baggage.

The car-body design shows features of novelty and interest. It is virtually a development of the side-truss scheme worked out by the firm of L. B. Stillwell for the Hudson & Manhattan R.R. ("Hudson Tubes") tunnel equipment. The entire car sides of the latter are load-carrying members built up in truss form from rolled structural shapes. In the Westchester cars side trusses are built up from single-panel pressed-steel units in which the greater number of riveted joints are eliminated to give equal, or greater, and enduring rigidity with less



FIG. 16. INTERIOR OF WESTCHESTER CAR FRAME

weight. As shown in Figs. 16 and 17 the units are pressed with deep flanges from $\frac{1}{4}$-in. steel sheets and each comprises at once the outside plate of a post, the letter board and the diagonal braces below the windows. The units are riveted to a plate at the top, to the side sills at the bottom, and up the center to pressed channel shapes completing the posts which are 5 ft. $5\frac{5}{8}$ in. apart. The window sills are formed by a light continuous double channel (UU) with a light channel intermediate post to the side sill.

By carrying the vertical load largely on the car sides, the center sills, needed to transmit buffing stresses directly from buffer to buffer, are practically undeflected and can be made light. They are held in alignment as columns under buffing compressions with the panels formed by cross and side sills (see Fig. 16). The roof framework is of pressed steel carlines riveted to the deck sills, which are carried on the bent-in ends of the side posts. In this way the designers place a structural cage about the passengers, which should furnish maximum protection against collision stresses.

The sides are sheathed with $\frac{1}{16}$-in. steel sheets, but these are not held in place by the frame rivets and carry no load stress. This construction presents some advantages by promoting ease of repair to damaged cars. It also appears that steel cars, which have the sheathing held merely as a curtain, are quieter than those where these sheets have to carry load, for which action various explanations are offered.

It is expected that this design will soon be employed by steam roads in metropolitan districts. One of the advantages of this type of car for suburban steam-railway service is its easy conversion to motor-car service



FIG. 17. PRESSED-STEEL UNITS FOR CAR-SIDE FRAME

under electric traction, as the shallow center sills not only do not interfere with use of large motors on the trucks, but also permit arranging the motive-power control equipment under the floor for maximum accessibility. This type of car is confidently expected by the designers to develop a useful life of such length as to bring it within a period when electric traction, according to the expectation of its leading exponents, would become an economic necessity for the suburban service out of large centers.

The motive-power equipment of the Westchester car involves the addition of about 25,000 lb. of apparatus per car. Equipped as a steam-road coach the Westchester design of car would weigh about 85,000 lb. and seat 88 passengers.

The Westchester car bodies carry the motive-power control equipment in three general lines along the center and side sills, so that the workmen in the inspection pit, can pass freely around all apparatus. (In the West-

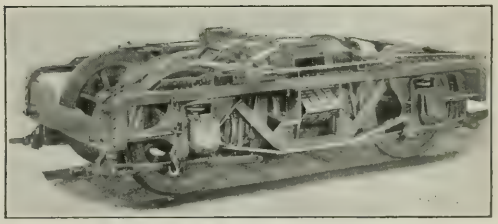


FIG. 18. MOTOR TRUCK, SHOWING CLASP BRAKE

chester inspection and repair shop, the pit tracks are carried on concrete piers to complete the accessibility. To facilitate inspection and cleaning, there are galleries in this shop at floor and deck levels. Three crews may work on a car at once.)

The cars have roof ventilating systems and electric heaters with thermostatic control. Special attention was given to heat insulation of the car exterior to prevent excessive loss of heat in cold weather. This is secured by use of a proprietary-insulation lining.

There are end and center side doors with pneumatic openers and electric control. While the station platforms of the Westchester line and the floors of these cars are on the same level, yet a flight of three steps has been built in each end vestibule, as the cars operate for some

distance over the Harlem branch of the New Haven road where low platforms are in use. These steps are covered with a trap door which is down at all the Westchester stations. The vestibules have the familiar Pullman end diaphragms to give a so called "solid train."

The car draft gear and buffing device are of standard steam-road type and have a capacity of 175,000 lb. The two motors are mounted on one truck, leaving the other an idler or trailer, for which smaller wheels and simplified construction are employed. The truck frame is made up of steel channels, angles, plates, and pressed shapes, with a few steel castings such as the journal pedestals and gussets.

On account of the high speeds and quick stops, a departure from the usual railway brake arrangements is seen. On the motor truck each wheel has two brake shoes after the style of the so called "clasp" brake. This was needed to reduce to a safe figure the energy dissipated at a single brake shoe. On the trailing trucks the ordinary type of brake rigging is employed. Separate cylinders work the brakes on each truck though a single control valve serves for both.

The entire system, including the air equipment, had to be designed for the peculiar demands of the proposed installation. In effect the standard form of electro-pneumatic control (see ENGINEERING NEWS, Feb. 29, 1912) was applied and adapted to the valve mechanism and auxiliary equipment developed for the heaviest steam-road equipment. It will be recalled that in this system the service and emergency applications are made truly simultaneous on all cars by electric control, although the old pneumatic control (serial) is still effective in case of failure of the electrical equipment. A 50-lb. service application of air is made from 70-lb. brake pressure. In emergencies the full reservoir pressure of 90 lb. is applied.

There is no auxiliary reservoir, however, and the old "triple valve" is replaced by a "control valve" serving the same purposes in somewhat simpler manner.

The arrangement of the brake rigging is diagrammatically shown in Fig. 19. All pulls are at right angles to lever members. The hand-brake rod and chain runs to a drum on a shaft carrying also a second (half-size) drum with a chain connected to an extension of the cylinder lever.

The motors are a single-phase series commutator type with a one-hour rating of 175 hp. (under forced ventilation), or 115 hp. continuous. The weight is in part directly on the truck axles, and partly supported through a nose suspension from a short three-leaf spring pocketed in the truck transom. Case-hardened solid gears were used for the most part, but on trial of a few flexible (spring bearing) gears favorable results were secured. In starting with the solid type, the pulsating torque of the single-phase motors produces considerable vibration throughout the car, but these vibrations are absorbed by the flexible gears.

On each platform is a small master controller with three running positions and three accelerating steps (for inserting resistance in the motor circuit). Acceleration of the trains at faster than a predetermined rate is prevented by an automatic-current limit switch which retards the successive step movements in the unit-switch group until the current for each step drops to proper value. The control also includes an overspeed switch which works the unit-switch group to reduce speed whenever a predetermined rate of 57 miles per hour is passed. This regulation is not effected directly, but the switch has (1) a current coil in series with one motor, and (2) a voltage coil connected across the armature of the motor. The two coils act differentially. When the combined effort of the current and voltage coils of the relay corresponding to a certain armature speed exceeds a definite value, then the unit-switch group will be manipulated to reduce the speed. The contactors of the multiple-unit group are thrown by compressed air from the brake system, but are released by current from a 32-volt storage battery floating on the direct-current circuit of a small motor-generator. A no-voltage relay opens the control circuit of the unit switches when line voltage comes off, in case the master controller is not changed before line voltage is restored, then the current-limit switch controls the succession of steps in the unit-switch groups and the rate of acceleration.

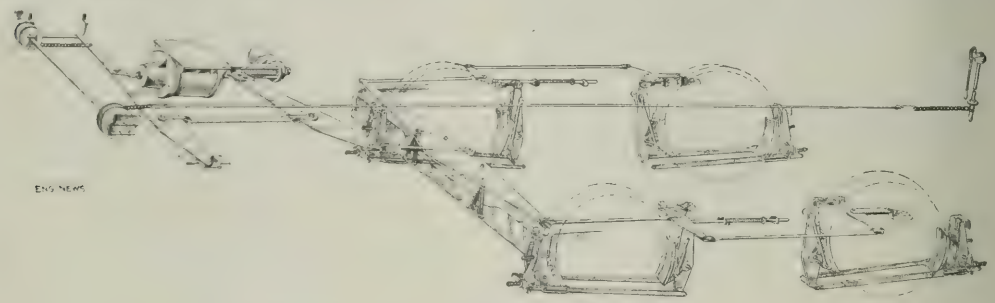


FIG. 19. DIAGRAMMATIC ARRANGEMENT OF WESTCHESTER CLASP BRAKE

SWITCHING AND SIGNALING EQUIPMENT

Automatic signals are used, the lines being divided up into sections about 1000 ft. long each, insulated from each other to permit the rails to be used for the signaling circuit. Both rails are used for propulsion and signal currents, as in the ordinary system. Novel features were introduced into this case by the use of 25-cycle propulsion current.

Sixty-cycle, single-phase current flows into the rails at the center of each block (Fig. 20). The power required per block for this service is some 0.1 kw. and the

current flowing through the track relay is about 1 amp. (at 3 volts); when a car or engine enters upon a block, its wheels in bridging the rails short circuit the track relays. These relays normally hold closed a circuit keeping the signal arms locked in "clear" position.

The insulating joints in both rails, at the end of each block, are bridged by impedance bonds which are installed in pairs as seen in Fig. 20. The arrangement shown is such that the full inductive impedance opposes the flow of the signaling current from one rail to the other and only a negligible amount passes. The bond as usual comprises a heavy coil wound about an iron core. The windings are of copper strap having a capacity of 200 amp. The bonds are immersed in transformer oil held in cast-iron cases which are set between the ties so as to be level with the top of the track ballast. Each pair of bonds is connected together at the center of the coils so that the railway propulsion current enters from both running rails and sets up opposing magnetic fields which neutralize each other, provided the current is equally distributed in the rails.. As the rail joints are staggered, one leg of the bond has to be extended (in buried wooden conduit) half a length to the nearest joint in the opposite rail.

A single track-supply transformer could be placed at one end of the block with a relay at the other, but wheels standing long at the feeding end would cause an unnecessary waste of power. Also, the voltage between rails at the relay end of the block might be so low that entering train wheels would not sufficiently short circuit the relay to hold the signal circuit at "danger." By center feeding with end relays, the 2000 ft. of rail interposed reduces the flow satisfactorily; there is small chance of wheels standing long in the middle of a block; and short circuiting of the rails is more certain.

The track relay is actuated solely by combination of signal and railway-propulsion currents; it is a vane type acting much like an induction wattmeter. There is an H-shape core with a double aluminum vane, moving in the air gaps between the arms, and pivoted so that it may oscillate through an angle of about 45°. The vane trunnions carry an arm which makes or breaks the desired connections. Copper bonds, acting as "shading" coils, inclose half of each pole-face area; on account of the alternating magnetic fields, induced currents are set up in them and the induced currents tend to hold the flux in the shaded part of the face. As a result, the relative intensity of flux is continually shifting between shaded and unshaded parts; this gives the effect of of progressively shifting field which would draw the vane arms after it. On one pair of arms, the pole faces are enlarged and a copper band encircles the pole, in addition to the half-pole-face band, and cuts down the flux of this arm below that in the undamped arms. The pull set up by signal current (60 cycles) alone is actually less here than that at the other end; if signal current alone passed through the relay, the leg of the aluminum vane between the small pole faces would be raised up. The choking is less effective on 25 cycles than on 60 cycles so that with propulsion current (25 cycles) flowing the difference between the pull on the vane in the two gaps would be less; the enlarged pole faces produce a greater effective pull than the smaller ones, so that the other side of the vane is pulled up when railway current alone is passing. When the relay is in normal operation, with signal current flowing through it, it will stand also from 9 to 12 amp. of railway propulsion current superimposed before it will change (sending signals to "danger"). This condition would arise only from a broken rail or open bond, in the track, when setting adverse signals is highly desirable. Beyond the relay there is less novelty seen in the signal equipment, except perhaps in the use of suspended center-pivoted two-position semaphore arms instead of the more familiar supported or mast type.

Where one signal has both home- and distant-indication arms a single motor moves either, in response to the proper impulses of the respective relays, as shown in Fig. 20. This design of semaphore has been widely used by the makers and is therefore but briefly described here.

Each semaphore has, in its base frame, one motor and an intermediate arrangement of apparatus to control the

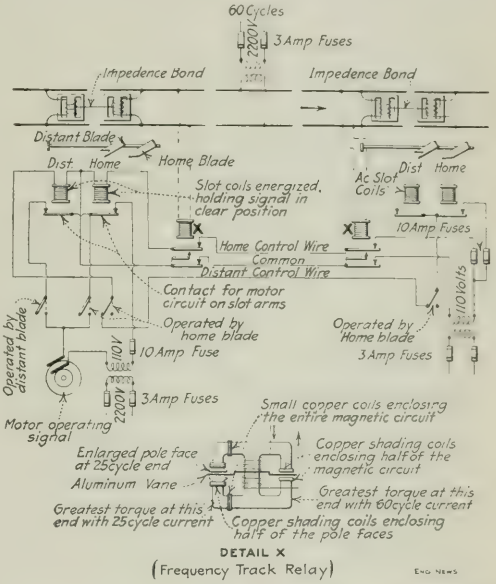


Fig. 20. Diagram of Track and Signal Circuit, New York, Westchester & Boston Ry.

position of the signal arm (which apparatus, in the development of the art of signaling, has universally come to be called the "slot mechanism" or "slot"). The motor drives a shaft carrying two endless chains, each carrying a pair of trunnions. The chains travel always in the same direction whenever the motor turns. The chain trunnion for either arm lifts a forked locked-toggle arm (the "slot arm") and through this a push rod which brings the semaphore arms to clear position. The slot arm is caught in this position by a hook latch; when the signal-current is withdrawn, the electromagnetic lock of the slot-arm toggle fails, the arm collapses and drops off from the latch hook, then the push rod and counterweight drop, bringing the arm to danger position.

The motors are a simple single-phase induction type starting automatically from any position and making a complete signal movement in four seconds.

As perhaps most of the signals on the Westchester line are suspended from the overhead bridges the above arrangement has to be changed—the long rod then reaching down from the slot instead of up to move the semaphore arm. In the subway section already noted the mast-type is used deprived of its arm and gives only the lamp indications.

The following cycle of operations begins after a train has passed out of a block (Fig. 20). Current flows through the relay to close the home-slot circuit and the slot magnet, acting as a relay, also closes the signal-motor circuit. The motor then raises the semaphore arm to clear position when the slot arm is latched there and the motor circuit opened automatically. The distant blade remains at "caution" until the train leaves the block ahead, when the home blade for that block then (in clearing) closes the distant slot circuit of the first signal so that the slot magnet (acting as a relay) starts the motor again to raise the distant arm. When this arm is raised and latched, the motor circuit is interrupted. It is seen that now both arms of the first signal mentioned are held clear by current through the track relays and slot magnets; when a train enters the block, both semaphore arms go to danger by loss of current through the track relays.

There are a few dwarf signals which are used for slow-speed train movement of reverse (from normal direction) traffic. These are a solenoid type, operated by direct current at 110 volts and controlled by an alternating-current relay (which replaces the slot magnets on the signals described).

Power for the signal and track circuits described is obtained from the main feeders which are carried along the right-of-way. A three-phase induction motor drives a 45-kw. single-phase generator to get the desired 60 cycles, to remove the peak of loads and to provide service when voltage may be off the signal-current feeders. A 70-hp. direct-current motor is connected to the same shaft and floats on a 400-amp.-hr. storage battery. When the three-phase power on the induction motor is interrupted the direct-current machine acts as a motor drawing energy from the storage battery. When three-phase current is uninterrupted, the conditions are reversed and the battery is recharged.

All-electric (direct-current) interlocking is used for the operation of the main-line track switches, there being seven interlocking plants. The most troublesome point in the train dispatching and routing is for the crossovers at the junction of the White Plains and New Rochelle branches in Mt. Vernon. It will be recalled from the previous article that the time tables are made up with the junction station here as a starting point, a local on one line meeting there with an express from the other but having to wait for the latter to clear the crossover and then to catch up with it on a parallel track.

At [illegible] once a route has been indicated to an approach it [illegible] cleared for an interval of 1½ min., except in emergency when the switch release can be thrown so that the lever man can change the route, but reaching of the train is necessary and requires an explanation to the signal engineer. Switches are unlocked as soon as a train enters.

Above each interlocking machine is a track model of the section governed by the machine, and for two blocks beyond the first home signal. Lamps indicate how then when the various signals may be cleared and when the switch locks are released, so that there is ample warning of routes which may be set up for approaching trains. The smaller of the interlocking plants do not have a man constantly in attendance and are arranged automatically to pass through trains.

In the interlocking equipment, only four wires run between the machine lever and the track switch (besides the direct-current supply mains). The track switches are motor driven (through a friction clutch and reduction gearing) with a horizontal drum operating the points. The motor armatures are connected permanently across the direct-current supply mains with current-limiting resistance and move the switches when current is sent through the field, the movement being controlled by direction of the field current. This is rather too heavy current to handle directly from the interlocking towers so an intermediate controller is set on a concrete foundation beside the switch (inclosed in a weatherproof case). This is itself a small motor with the armature permanently on the supply line and two field wires running to the machine lever. There are additional contacts on the controller to cause both ends of a crossover to move simultaneously. Two wires noted run from an indicating circuit to the indicator and lever lock on the machine. In the circuit controlled by the signal lever is a safety relay which can be energized only when the position of switch and lever correspond. Continuous current for operating switches and interlockings is furnished at each signal house by a small motor-generator set floating on a storage battery and receiving power from the signal feeders.

A very complete telephone system interconnects dispatchers, signal houses, and stations. The several circuits are assigned to various services and so connected that all important points can plug into at least two of them. The most important points can plug into any one of five different circuits, so that delays from broken wires are made remote.

One wire connects all signal houses on the four-track line and the New Rochelle branch. A second line connects all the interlocking towers on the four-track section and the White Plains branch. These two wires are for train control and may be handled together by one dispatcher, or separately by two dispatchers. A general-service wire connects all stations on the four-track section and the New Rochelle branch, and a second one connects all stations on the White Plains branch and the express stations of the four-track section. There is a wire for distance work between such points as signal houses, express stations, and terminals. There is also a local-service line between all the signal boxes by which the signalmen can intercommunicate without using a train wire. Finally there are duplicate wires all over the road to be substituted quickly for defective lines.

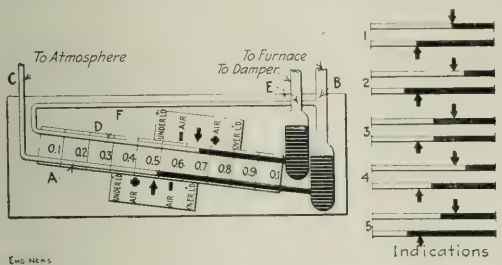
Inductive effects have not been serious. In addition to having the cables underground the lead sheaths are frequently grounded. There are static dischargers at each station and if all this proves insufficient, one pair of wires has been left to be connected to special transformers on the power lines to introduce differential currents in each cable opposing the disturbing impulses.

Construction is under E. J. Langford as chief engineer. Operation is directed by P. W. J. Smith, superintendent of operation; F. Zogbaum is engineer of maintenance.

The overhead construction work was under the supervision of E. H. McHenry, vice-president, and W. S. Murray, electrical engineer of the New York, New Haven & Hartford R.R., with P. J. Kearny, engineer in charge for the N. Y., W. & B. Ry. The rolling stock and shops were designed by the firm of L. B. Stillwell as consulting engineers.

A Boiler-Efficiency Indicator

One of the difficulties in insuring efficiency and economy of operation in large boiler plants is that of maintaining full boiler efficiency. Failure in this respect may result in excessive fuel consumption, a high degree of smoke, and irregular steam pressure. To maintain this efficiency it is necessary to keep the fireman informed as to the varying conditions, so that he may regulate his firing accordingly. While CO_2 recorders and steam-flow meters are valuable adjuncts for the operating engineer, they are expensive instruments and are not easily understood by the fireman. A device now being introduced indicates the conditions at each furnace in a graphic manner, for the guidance of the fireman. This device, shown in the cut, fulfills the purposes of the CO_2 recorder,



ENG NEWS

A Boiler-Efficiency Meter

Characteristic Indications

1. Normal operation of boiler.
2. Too much air, fuel bed too thin, or holes in fire.
3. Too little air, fuel bed too thick, or fire choked with slag.
4. Boiler running with overload.
5. Boiler running with underload.

the steam-flow meter and the draft gage. It may be fitted with an autographic recording attachment.

The operation is based upon the relation of draft conditions to the efficiency of the boiler. The CO_2 content of the products of combustion is a good indication of the efficiency of combustion, but it gives no indication of the capacity developed by the boiler. The draft conditions, however, afford a direct indication of both efficiency and capacity. When a boiler is working at its normal capacity, a decrease in the normal draft resistance at the grate (due to a thin fire or to holes in the fire) will result in an increase in the drop of draft pressure through the boiler, and a consequent reduction in efficiency due to the excess supply of air. On the other hand, an increase in the normal resistance at the grate (due to heavy firing or failure to clean the grates) will result in a decrease in the drop of draft pressure through the boiler, and a consequent reduction in the capacity or rate of steaming. It results also in loss of furnace efficiency due to imperfect combustion.

The device mentioned above shows two things simultaneously in relation to the above conditions: (1) the draft or air pressure in the furnace; (2) the drop in draft pressure through the boiler, or between the furnace and the damper in the smoke flue. It consists essentially of a pair of draft gages, the indicating portion being a pair of inclined tubes in which the movements of a body of oil (colored for convenience) show the variations in draft. The construction is shown in the accompanying cut, and this part of the device is mounted in a convenient position in the boiler room.

The lower gage tube A has a $\frac{1}{8}$-in. pipe connection B to the interior of the furnace, just above the fire level, while the pipe C, from its upper end, is open to the atmosphere. Thus the gage A gives a direct reading of the draft or air pressure in the furnace, and shows variations in pressure due to heavy, light or dirty fire. The upper gage tube D is in a closed loop; its lower end is connected to a pipe E leading to a point just inside the damper at the smoke flue or uptake. Its upper end is connected by a pipe F with the furnace tube B of the other gage. Thus the gage D is influenced by the pressure at the furnace and at the damper, and becomes a differential gage showing the drop in draft pressure between these points. A high reading on this gage indicates an excessive drop, meaning an excess of air, while a low reading indicates too low a drop, which results from an insufficient supply of air. The relations of the two gages indicate the causes of the defective conditions, some of which are indicated on the cut.

The gages are adjusted for each boiler. While the boiler is operating under normal conditions as to steam pressure, load and fire, the two lettered plates are shifted to bring the arrows at the positions indicated by the colored fluids in the tubes. They are then secured in position. In firing, the aim is to maintain the colored fluids in line with the respective arrows. This device is being introduced by W. A. Bloneck & Co., Fisher Building, Chicago, and is already in use in the boiler rooms of large office buildings and power stations, while it is being used also by the U. S. Navy Department.

Traffic Through the American and Canadian Canals at Sault Ste. Marie for the 1912 season is recorded as follows: The total freight traffic of both the American and Canadian Canals was 72,472,676 tons for the season of 1912, an increase of 36% over 1911. All items of freight show an increase when compared with the season of 1911, except coal, salt, copper and building stone. The total number of passengers was 66,877, a decrease of 13,074, and the passages through both canals numbered 22,778, a gain of 22% over 1911. Traffic through the American canal was 45% of the total freight, 55% of the total net registered tonnage, and 44% of the total number of passengers carried. Through the Canadian canal traffic was 55% of the total freight, 45% of the total registered tonnage, and 56% of the passengers carried.

The Area and Mileage of Street Paving of various classes in the city of Philadelphia is given as follows in the annual report of the Bureau of Highways, of which Wm. H. Connell is Chief:

Character	Sq. yards	Miles
Granite block	6,653,532	352.99
Asphalt (sheet)	6,959,656	472.35
Asphalt (block)	72,532	7.49
Vitrified brick	2,376,224	163.63
Cobble	162,775	14.02
Rubble	93,182	6.69
Slag block	78,071	8.13
Cement and granolithic	54,242	11.03
Wood block	121,505	4.06
Totals	16,571,719	1,040.39
Bituminous macadam roads	312,104	29.01
Waterbound macadam roads	3,035,429	261.31
Total macadam roads	3,347,533	290.32
Grand total (improved pavements and macadam roads)	19,919,252	1,330.71
Earth roads	.....	179.08

Waterman Avenue Culvert, over River des Pères, St. Louis, Mo.

By Charles W. Martin*

The River des Pères, a natural drainage outlet for a large portion of the area of the City of St. Louis, as well as a part of St. Louis County, crosses a number of streets in the western portion of the city. The rapid growth of this section of the city has necessitated the construction of a sanitary sewer below the creek-bed level and there is now need of a storm-water sewer of sufficient capacity to care for the runoff of the drainage area. Preliminary to this sewer construction and as a step toward the betterment of traffic conditions in this district two

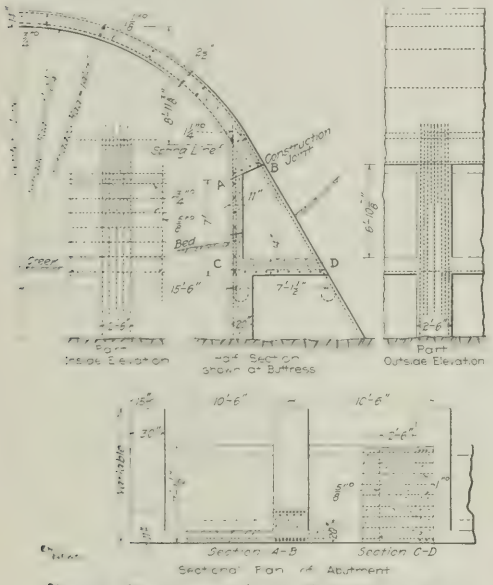


Fig. 1. Details of Arch Culvert across River Des Pères, Waterman Ave., St. Louis, Mo.

culverts have been constructed by the City, one at Waterman Ave. and one at Kingsbury Ave. Both culverts are in general, of the same design and it is intended that they may later become units of the proposed storm-water sewer. A description of the design and construction features of the Waterman Ave. culvert is given below.

The structure (Fig. 1) consists essentially of a reinforced-concrete arch, 76 ft. in length, with rubble masonry end and wing walls, retaining the roadway embankment. The arch span is 31 ft. and subtends a circular arc of 120°. The thickness of concrete at the crown and spring line is 14 and 17 in. respectively. The tranverse reinforcement for the intrados and extrados of the arch barrel consists of a system of 1-in. and 1¼-in. round rods spaced, in general, at 8 in. centers. Near the spring line the intrados bars is further reinforced with a system of 1-in. bars, making the spacing of bars in that region 4-in. centers. This reinforcement extends 2½ ft. below the spring line into a trapezoidal-sectioned skewback which is cast as an integral part of the arch and designed to act somewhat in the nature of a beam in transferring the arch-ring thrust and moment into the buttresses of the abutments. Each skewback is reinforced longitudinally with four 1⅛-in. bars which together with a system of ¾-in. bars, spaced from 4 to 4½-ft. centers, in each face of the arch constitute the longitudinal reinforcement of the arch barrel.

The buttresses are the primary structural elements of the abutments. They are 30 in. wide, spaced 10 ft. 6 in. centers and extend to bedrock, which is at a depth of 8½ ft. below the creek bed or about 17 ft. below the spring line of the arch barrel. The face plane of the buttresses is vertical while the back is made tangential to the extrados of the arch at the spring line. The front and back faces of the buttresses are reinforced with 1¼-in. bars. All of these bars extend upward from 30 to 40 in. above the longitudinal construction joint between the abutments and the arch-barrel skewback. Horizontal diaphragms 14 in. thick extend between buttresses at about the elevation of the creek bed. Above and below the horizontal diaphragms 11- and 20-in. face walls divide the abutment structure into a system of cells.

The horizontal diaphragms are reinforced, in the bottom face, by a system of 1-in. longitudinal bars with ⅝-in. bars transversely. They are designed to assist, by transferring the weight of their superimposed embankment to the buttresses, in limiting the range of application of the force resultants to the mid one-third of the rock-bearing area of the buttresses.

The end and wing walls are of rubble masonry, roughly coursed, with concrete copings (Fig. 2). The height of end walls is two feet above the arch crown. They were designed to retain, at a 1 on 1½ slope, an embankment of 5½-ft. height over the arch crown and 46-ft. width. Adjacent to the abutments the end walls extend to the elevation of the horizontal diaphragm but are stepped



Fig. 2. View of Waterman Ave. Culvert
[Railing and street surface yet to be placed]

up the creek embankments. The wing walls are built to retain the run-around embankment slope from the end walls and were carried to a depth of four feet below the creek bed. It is intended to protect them with rip-rap.

The backs of the arch barrel and walls were painted with asphalt. Weep holes, 3 in. in diameter, through the face-wall concrete at each bay of the cellular abutments provide outlets for seepage. At these points clay backfilling was rammed to such slope and stones piled as to facilitate drainage.

*Street Department, St. Louis, Mo.—[Editor's Note.]

In addition to the backfill loading, the arch structure was designed for a live load of 100 lb. per sq.ft. of roadway surface, which together with the influence of distortions in the structure resulting from a considered nominal change of temperature of 20° F., either way, in the arch-ring concrete, develop figured maximum stresses of 800 lb. compression per sq.in. in the concrete and 8000 lb. tension per sq.in. in the steel reinforcement. These maximum stresses obtain at the junction of the arch barrel and buttresses. In the horizontal diaphragms and face walls, however, simple beam action was assumed and the unit stress in the steel figured at 18,000 lb. per sq.in.

The construction features are not of special interest. Excavation was, in general, executed by hand. The concrete was machine mixed at a plant situated at the top of the creek bank and was conveyed to the abutment forms through chutes and to the arch forms in end-dump hand carts. The arch-barrel forms consisted of a 2-in. dressed and matched longitudinal sheathing supported by trusses of 30-ft. span spaced at 4-ft. centers transversely which, in turn, were supported by posts extending to rock. These posts, in place, were also used as studding for the abutment face wall forms. Forms for the extrados of the arch were constructed in "two-man" sized units and placed as the arch-barrel concrete progressed.

The material and proportions, by volume used in the concrete mixture were: One part "city tested" portland cement; two parts sand and four parts washed gravel graded in size from ½ to 1½ in. Tests indicated an average percentage of voids in the gravel of 41%. Plain, round bars rerolled from rail steel were used for all reinforcement.

The abutments were constructed as single units up to the skewback bearing. The arch barrel was poured in three sections. For each section the concrete was brought up simultaneously from each side and completed in one continuous run of the mixer.

The quantities and unit prices bid by the contractor for constructing the reinforced-concrete abutments and arch barrel and the masonry end and wing walls are as follows:

Item	Quantity	Unit price
Excavation	15,100 cu.ft.	$0.07
Concrete	11,300 cu.ft.	$0.34
Rubble masonry	8,050 cu.ft.	$0.20
Steel reinforcement	65,800 lb.	$0.0325

This makes the cost per lineal foot of culvert, without the masonry walls, approximately $93 and the total cost of the structure complete, save the embankment and surface improvements, approximately $8650.

Clay from excavations for neighboring buildings and ashes, hauled by the city, were used as backfilling. The maintenance of the dump only is chargable to the improvement and for that 3500 cu.yd. of filling required amounted to approximately $750.

During the construction the weather was unusually favorable and it is believed that the contractor made a fair profit on this culvert. Regarding the Kingsbury Ave. culvert, which was later also constructed under the one contract, the same can not be said.

The tributary drainage area of River des Pères, above these culverts, is approximately 10,500 acres, most of which lies in undeveloped districts. Its flood carrying capacity was put to test by a rainfall of 3.6 in. on Mar. 25 last, which had been preceded by rainfalls of 0.73 and 0.68 in. on the 23d and 24th respectively. The maximum rates of fall in inches per hour were, for a 10-min. and 1-hr. period, respectively 1.44 and 0.68. At Waterman Ave. the flood water level rose to a point a few inches above the sping line of the culvert arch barrel. While the intensity of this storm was not more than, say, 60% of a probable maximum, it was as intense as storms to be expected with any frequence.

L. R. Bowen, is Bridge Engineer for the City. Heman Construction Co. was the contractor. The writer designed the structures and had charge, in the field, of the construction at Waterman Ave. L. B. Vella was in charge, in the field, at Kingsbury Ave.

A Draftsman's Details

By A. T. N

Oh what a life
The draftsman leads,
In this old world today;
He draws his plans,
He draws his breath,
He draws also his pay.
His weary hours
Are long-drawn out,
While waiting for a "raise";
His wrinkled brow
Is drawn down more,
No increase meets his gaze.
He fills his pen,
Then draws a line,
And mutters "Things ain't square,
I think I'll chuck
This bloomin' job
For one with more fresh air.
I glue my nose
Down to my board
The bloomin' live-long day;
The bloomin' boss
Is standing near,
To see I earn my pay!
The boss, he thinks
I ought to know
All things from A to Z,
And still be glad
To work for him
At what he now pays me.
This drafting life
Is 'on the Fritz,'
It surely makes me 'sore!!'"
He "beats it" home
But in the morn'
He comes right back for more.

A Liquid Rheostat for large alternating-current motors has recently been developed by the Westinghouse Electric & Manufacturing Co., to supply the demand brought by the use of large slip-ring motors driving mine hoists, winding gears, rolling mills, etc. Such a rheostat provides an infinite number of speed steps between limits and permits smooth acceleration. This particular design comprises two compartments, an upper tank for immersing the electrodes and a lower storage reservoir. The small motor-driven pump maintains a steady stream of liquid, usually an alkaline solution, from the lower reservoir into the upper tank, the latter discharging its contents back into the former over a weir, which takes the form of a tube that can be raised or lowered through the floor of the electrode tank. By raising or lowering the weir the height of liquid in the electrode tank is varied and resistance between electrodes changed as desired. The operating lever of the rheostat controls both the weir and a master switch, which opens and closes the primary circuit of the motor. A valve in the intake pipe of the electrode tanks regulates the rate at which the liquid can be pumped in, so that no matter how quickly the operating arm is thrown over the liquid can rise in the tank only at a definite rate, thus fixing the rate of acceleration. Cooling coils for circulation of water, are introduced in the lower reservoir to prevent overheating and rapid evaporation. The capacities so far designed are from 400 to 1500 hp. of controlled motor.

The Morena Rock-Fill Dam, California

SYNOPSIS—The Morena rock-fill dam extends 150 ft. above the natural bed of Cottonwood Creek and has a concrete toe wall on the upstream side which goes down 112 ft. below the stream bed. The whole structure, including a 3-ft. concrete coping-wall, is 265 ft. high. The rock in the upstream portion of the dam proper was laid by hand and by derrick, and was faced with rubble masonry in cement for watertightness, except that for the lower 30 ft. the same end was achieved by an extension upwards of the 112-ft. concrete wall already mentioned. Above this concrete toe wall reinforced-concrete slabs extend 12 ft. or to Elev. 42 above the stream bed. The upper portion of the wet slope is also protected by a layer of reinforced concrete. The dam is 505 ft. long on top, 300 ft. thick or wide at the base and 16 ft. wide at the top. It contains 500,000 cu.yd. of material and cost $1,100,000 including a circular concrete tower 155.5 ft. high, with outlets at various levels.

☼

The Morena Dam is one of four (a fifth is projected) built by the Southern California Mountain Water Co. to supply San Diego and Coronado with water for municipal purposes. Eventually water will also be furnished for irrigation. The first dam (the Lower Otay) was begun in 1887. The Morena Dam was put under construction in 1896 but work was suspended in 1898 as stated further on.*

We have received from M. M. O'Shaughnessy, chief engineer of the Southern California Mountain Water Co. for a number of years (now city engineer of San Francisco), a set of blueprints and a number of fine photographs of the Morena Dam, which we reproduce herewith. The text of this article is based upon or quoted from a paper by Mr. O'Shaughnessy entitled "Construction of the Morena Rock-Fill Dam, San Diego County, California," presented at the meeting of the American Society of Civil Engineers, Dec. 20, 1911, and reprinted from the Transactions of that Society, Vol, LXXV, pp. 27 *et. seq.* (1912). In closing (by letter) the discussion on his paper Mr. O'Shaughnessy gave some additional information, parts of which we incorporate, in brackets, in their natural position in Mr. O'Shaughnessy's original paper.

Before taking up Mr. O'Shaughnessy's description of the Morena Dam a few facts regarding the larger works of which they form a part may be given.

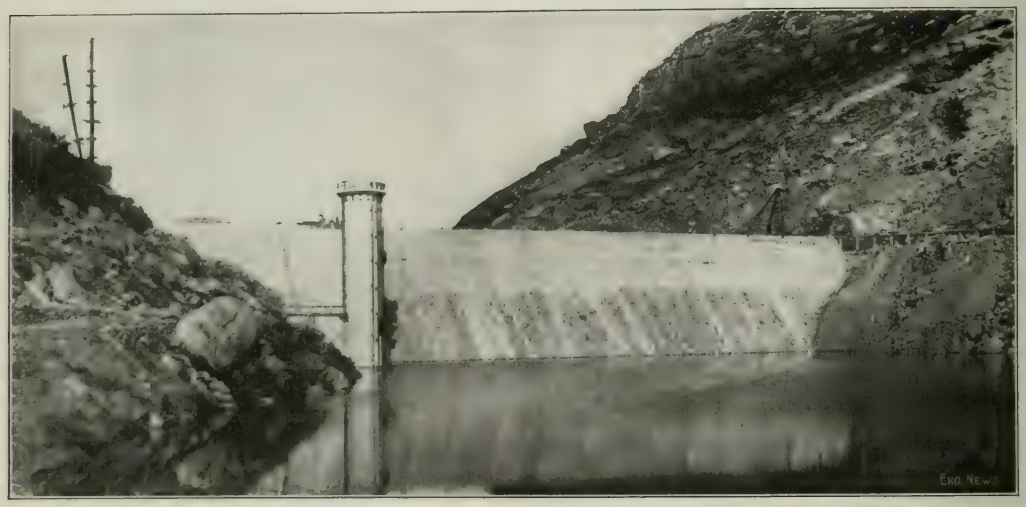


FIG. 1. GENERAL VIEW OF MORENA ROCK-FILL DAM, SAN DIEGO COUNTY, CALIF., LOOKING NORTHWEST

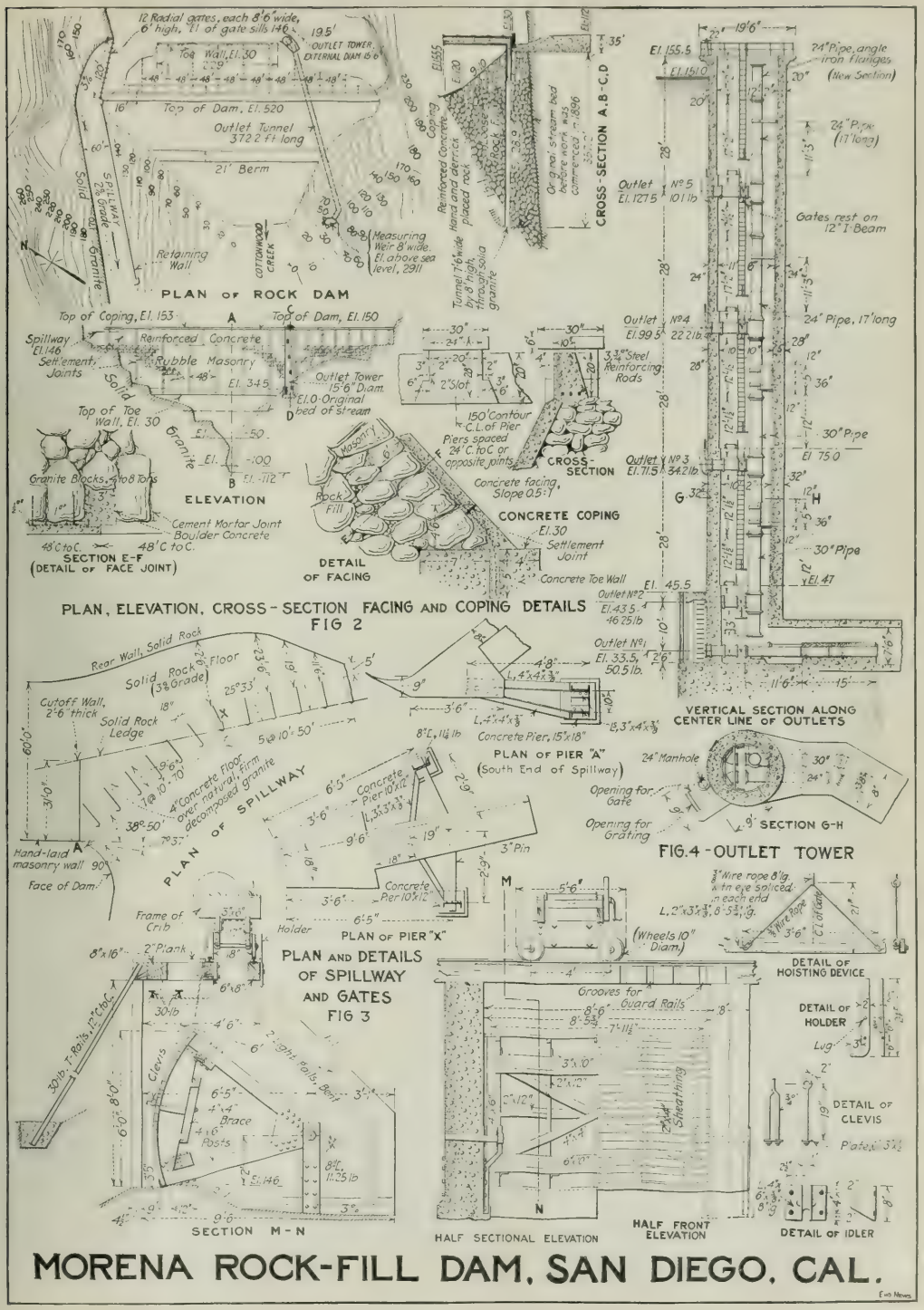
In the vicinity of San Diego storage capacity must be provided sufficient to supply water for from 5 to 7 successive dry years. The company already named derives its supply from storage works on Otay Creek and the Cottonwood River, with tributary drainage areas of "350 sq. miles of clean mountain watershed covered with wild brush."

The Cottonwood drainage area alone has an area of 250 sq. miles, ranging in altitude from 1500 to 6000 ft. and averaging about 3600. Rainfall records were not begun in this drainage area until 1906. At the Barrett dam-site (Elev. 1700) the rainfall has ranged from 29.94 in. in 1906 to 11.28 in. in 1910, while at the Morena Dam (Elev. 3300 ft.) the figures for the same years were 34.73 and 13.94 in. The runoff from the 250 miles of drainage area above the Barrett dam-site was 19.5 billion gallons in 1906 and 5.5 in 1910 (only 4.23 in 1908).

On the Sweetwater catchment area, to the north, the

*For detailed descriptions of the works of this company see "The Fire Drive and Wood Stave Conduit of the Southern California Mountain Water Co." a large fully illustrated staff article published in the issue of Apr. 7, 1904; also the two illustrated articles by M. M. O'Shaughnessy, published in our columns, one dealing with the Pelton Conduit, Nov. 26, 1903; the other describing a big blast at the Morena Dam, Dec. 30, 1909.

The company's contract with San Diego (August, 1906) calls for a supply of 7,766,000 gal. of water per day, at 4c per 1000 gal.


12 Radial gates, each 8'6" wide, 6' high, 21' of gate sills 146'
19.5' OUTLET TOWER. EXTERNAL DIAM. 6'6"
Toe Wall, El. 30
Top of Dam, El. 520
Outlet Tunnel 3722 ft long
21' Berm
SPILLWAY 2% Grade
Solid Granite
Retaining Wall
COTTONWOOD CREEK
Measuring Weir 8' wide, El. above sea level, 2911
PLAN OF ROCK DAM
Reinforced Concrete Coping
Hand derrick stone placed rock
Tunnel 7'6" wide by 8' high, through solid granite
Or original stream bed before work was commenced in 1896
CROSS-SECTION A.B-C.D
El. 155.5
El. 151.0
24" Pipe, angle iron flanges (New Section)
24" Pipe (17' long)
Outlet El. 127.5 No. 5 101 lb
Gates rest on 12" I Beam
24" Pipe, 17' long
Outlet El. 99.5 No. 4 222 lb
30" Pipe
El. 75.0
Outlet El. 71.5 No. 3 342 lb
30" Pipe
El. 47
Outlet No. 2 El. 43.5 1625 lb
Outlet No. 1 El. 33.5, 505 lb.
Top of Coping, El. 153
Top of Dam, El. 150
Spillway El. 146
Settlement Joints
Reinforced Concrete
Rubble Masonry
Solid Granite
Outlet Tower 15'6" Diam.
C.I.O. Original bed of Stream
Top of Toe Wall, El. 30
El. 345
El. -50
El. -100
El. -112
Granite Blocks, 3108 Tons
ELEVATION
Cement Mortar Joint Boulder Concrete
48' C to C.
SECTION E-F (DETAIL OF FACE JOINT)
3.3" Steel Reinforcing Rods
150° Contour C.L. of Pier
Piers spaced 24' C. to C. of opposite joints
CROSS-SECTION
Masonry
Rock Fill
DETAIL OF FACING
CONCRETE COPING
El. 30
Settlement Joint
Concrete Toe Wall
Concrete facing, Slope 0.5:1
El. 45.5
PLAN, ELEVATION, CROSS-SECTION FACING AND COPING DETAILS
FIG 2
Rear Wall, Solid Rock
Solid Rock (3/8 Grade)
Floor
Cutoff Wall, 2'6" thick
Solid Rock Ledge
4" Concrete Floor over natural, firm decomposed granite
PLAN OF SPILLWAY
Hand-laid masonry wall 90°
Face of Dam
Concrete Pier 10'x12'
8"I, 11.4 lb
Concrete Pier, 15'x18"
L, 4"x4"x3/8"
L, 3"x4"x3/8"
VERTICAL SECTION ALONG CENTER LINE OF OUTLETS
PLAN OF PIER "A" (South End of Spillway)
24" Manhole
Opening for Gate
Opening for Grating
SECTION G-H
FIG. 4 - OUTLET TOWER
Concrete Pier 10'x12'
L, 3"x3"x3/8"
3" Pin
PLAN OF PIER "X"
Frame of Crib
Holder
3/4" Wire rope 8'lg. with eye spliced in each end
L, 2"x3"x3/8", 8'-5 1/2"lg.
3/4" Wire Rope
C.I. of Gate
(Wheels 10" Diam.)
DETAIL OF HOISTING DEVICE
PLAN AND DETAILS OF SPILLWAY AND GATES
FIG 3
8"x16"
2" Plank
30 lb. T Rails, 12" C to C.
Clevis
Brace
Posts
2 light Rails, Bent
8"I, 11.25 lb
SECTION M-N
Grooves for Guard Rails
Solid Sheathing
HALF SECTIONAL ELEVATION
HALF FRONT ELEVATION
DETAIL OF HOLDER
Lug
DETAIL OF CLEVIS
Plates, 3/4"
DETAIL OF IDLER
MORENA ROCK-FILL DAM, SAN DIEGO, CAL.
Eng News

records for the 24 years 1887-8 to 1910-11 showed a rainfall of from 4.86 in. in 1901-2 to 16.19 in. in 1894-5. During four years (1899-00 and 1901-2 to 1903-4, inclusive) there was no runoff here.

At San Diego, the mean precipitation for the period 1850 to 1896 was 9.86 in., ranging from 3.02 in. in 1863 to 27.59 in. in 1884. On the Cottonwood drainage area, Mr. O'Shaughnessy states, a precipitation from 10 to 20 in. and sometimes 30 to 35 in. higher than at San Diego may be expected.

To fill the reservoir formed by the Morena Dam "to the 150-ft. contour," Mr. O'Shaughnessy states, "will require 47,970 acre-ft., or 2,084,000,000 cu.ft., which would be supplied by an average rainfall of 3.6 in. from the watershed. Under favorable conditions, this depth of runoff would be expected from an annual rainfall of 24 in., and, at times, may be the product of only 15 in. precipitation, depending largely on the distribution of the storms, and the frequency with which they succeed each other."

The four dams of the Southern California Mountain Water Co. already built and the Barrett Dam (projected) have the following characteristics:

Name	Type	Height, ft.	Outlet altitude, ft.	Area flooded, acres	Capacity, billion gal.
Lower Otay	Rock-fill*	150	400	869	13.00
Upper Otay	Arched concrete	77	521	164	1.09
Cloudburst Heights	Earth, and steel plate	34	385	17	0.09
Barrett	Not designed	150	1506	936	15.00
Morena	Rock-fill	265	2912	1370	15.00

We will now proceed to quote from Mr. O'Shaughnessy's paper, as follows:

The Morena Dam is 10 miles east of the Barrett Dam site, and on one of the streams which unite just above Barrett at an altitude of 3100 ft. above sea level. It is 35 miles in an air line southeast from San Diego, and about 7 miles north of the Mexican boundary line. The dam is a rock-fill structure [see Figs. 1, 5, 6 and 7 for views and Figs. 2 to 4 for details] facing a narrow cañon and lying between massive granite cliffs which tower 100 ft. high on the brink of a precipitous fall or cataract where the Cottonwood stream takes a plunge of 1000 ft. within a distance of two miles. This dam forms one of a series of five to be constructed by the company.

The Morena cañon is filled throughout with enormous boulders, and, at the site of the dam, a narrow fissure eroded by the stream was found to be 112 ft. below the stream bed at that point. A wall of rubble concrete, 36 ft. thick at the bottom and 12 ft. thick 30 ft. above the steam bed, was the first construction work done in 1896, when the project of building this dam was launched.

At that time it was intended to build the water face on a slope of 1¼ to 1 [and "to put on a water-tight face of asphalt-concrete"] and the downstream slope 1½ to 1; the top width was to be 20 ft. It was also intended to pave the water slope of the rock-fill with an asphalt concrete, which was thought to be durable and impervious. Work was suspended in April, 1898, however, after the toe wall, up to the 30-ft. contour, had been completed and about 120,000 cu.yd. of rock fill had been placed, out of a total of 306,000 cu.yd. required to complete the dam to the prescribed cross-section.

On resuming construction, on May 6, 1909, it was decided to change the upper slope, from the top of the completed toe wall up to the 120-ft. contour, to 9 horizontal to 10 vertical, and make it, from the 120-ft. contour to the top of the dam—150 ft.—½ horizontal to 1 vertical. It was decided to alter the character of the work by placing large masonry blocks of roughly dressed granite, from 6 to 10 tons in weight, selected from the rock piles, on the upstream face of the dam, and have them well bedded and set in cement mortar composed of 1 part cement to 2½ parts sand, and behind this masonry skin, about 7 ft. thick, to place all the stone, by hand and derrick, for a width of 50 ft. back from the face, in order to provide consistent support for the skin. [During construction intricacies [sic] were employed on the face of the hand and derrick-placed rock "to break off the sharp edges of flat stones, and chink in the cavities with broken rock."]

*Steel plate diaphragm 1 in. thick protected by concrete.

The top of the dam is 16 ft. wide, and is crowned with a 3-ft. concrete coping to provide for wave wash. The back slope is 1½ horizontal to 1 vertical, with a berm of 21 ft. at the 100-ft. contour to provide for future extensions in raising the dam. This berm was practically created by the alteration of the face slopes, which originally contemplated a flatter water slope.

In the original work, done 12 years ago without proper continuous technical supervision, there was a little recklessness in the disposition of the materials in the dam, and it was necessary, when the work was resumed in 1909, after a thorough examination, to tear out a large part of the old fill behind the toe wall, remove all loam or other objectionable material, and rebuild with a clean, well placed rock-fill.

At one time, after seeing the nature of the old construction, the writer was almost committed to the idea of letting the old mass stand and, as the additional rock was being placed, hydraulicking a granite surface soil from the adjoining hills into the interstices as the dam was being raised. After a thorough discussion of the matter, however, with many brother engineers, and especially with George L. Dillman, M. Am. Soc. C. E., who seemed to have a clearer conception than any one interviewed as to the requirements of a rock-fill dam*, the present method of procedure was decided on: that is, to construct a water-tight skin for the face of the dam and keep the rock fill absolutely clear of any soil or silt, and thus provide free drainage for any possible leaks which might occur in the future, without impairing the integrity of the mass by washing out sand or other solvent materials.

To obviate further any serious cracking of the skin which might be caused by settlement, grooves, 3 ft. square, and 48 ft. c. to c., were placed in the masonry, and into these concrete has been poured and brought to an absolutely smooth surface, the general average plane of which projects 3 in. beyond the general face of the masonry.

In the future it is proposed to place reinforced-concrete slabs, averaging 1 ft. in thickness, on the face of the masonry and attached to it by ¾-in. iron rods, 4 ft. c. to c. These slabs will be joined with ¾-in. water-tight settlement joints, poured with a sand asphalt along the center line of, and resting on, the concrete grooves previously mentioned. A slot 1 ft. wide and 5 ft. deep was left in the old toe wall [see detail, in Fig. 2] into which the reinforced-concrete facing has already been nested and constructed up to the 42-ft. contour, or 12 ft. above the old toe wall. The zero of the dam levels, as shown by the drawings, is the surface of the original stream bed before work was begun.

This toe wall had a leakage of 57,800 gal. per day in 1898, after it was built, with a head of water up to the 30-ft. contour. It will be noticed from Table I that the present leakage, under a head of 65 ft., is only 33,604 gal. per day. [With this head, 23 ft. of the masonry without concrete facing was under water pressure. The diminution in leakage with the increase in head is attributed to the compression of mud and silt in front of the old toe wall of rubble concrete, built in 1897-8. Mr. O'Shaughnessy states that "in all the recent German masonry dams a layer of clay and soil is deposited on the water face of the masonry."] This is now measured at a bedrock outcrop in the cañon below the dam and about 1000 ft. from it.

TABLE I.—LEAKAGE OF MORENA RESERVOIR [1911]

Date	Depth of water, in feet	Leakage, in gallons per 24 hours.
Jan. 13	42	29,727
March 6	48	97,226
March 11	52	120,596
March 14	55	104,152
April 5	60.37	70,448
April 19	62.3	51,053
April 25	63	46,529
May 1	63.5	51,053
May 12	64.25	46,529
May 11	64.37	51,053
May 22	64.78	37,481
June 5	65.33	33,604

As the freight rates from San Diego to Morena—a distance of about 60 miles by wagon road, with maximum grades of 16% to be overcome—run up to about 1c. per lb., it has been imperative to reduce to a minimum the quantities of materials necessary to make a first-class job, on account of the excessive cost of hauling to the dam site.

The cañon walls at the dam site are all of clean, hard granite, singularly free from fissures and seams, and the width between them is only 80 ft. at the stream bed and 520 ft. at the 150-ft. contour—the level of the top of the present completed dam. It has been necessary to add about 186,000 cu.yd. of rock to the original 120,000 cu.yd., in order to complete the dam to the prescribed cross-section.

*See Mr. Dillman's discussion of this paper, printed separately directly after this article.—Ed.

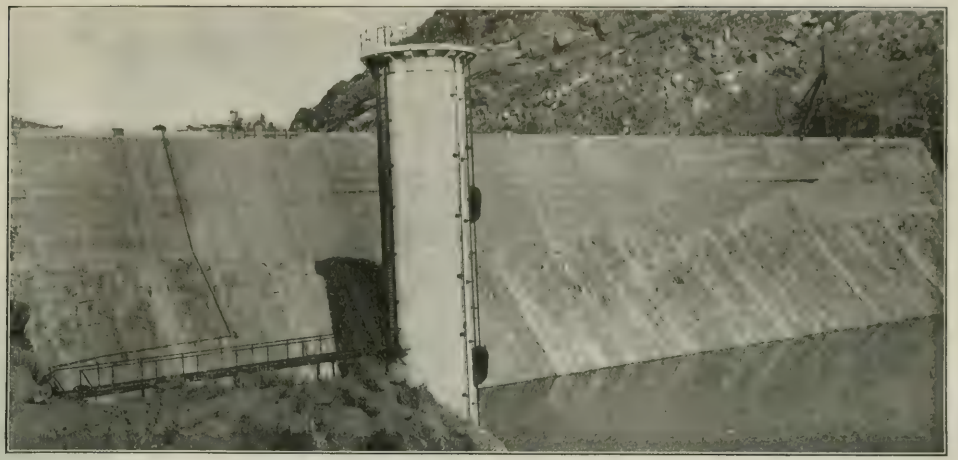


FIG. 5. UPSTREAM FACE, LOOKING WEST

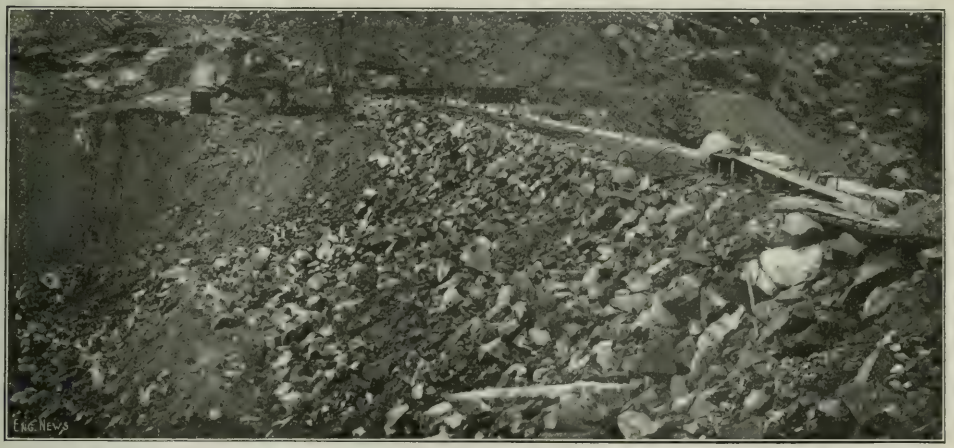


FIG. 6. DOWNSTREAM FACE, SHOWING LOOSE ROCK



FIG. 7. SPILLWAY AND PART OF DAM, LOOKING DOWNSTREAM

FIGS. 5-7. VIEWS OF MORENA ROCK-FILL DAM, SAN DIEGO COUNTY, CALIF.

Cableways—Construction operations were prosecuted with two Lidgerwood cableways, which were operated from towers about 300 ft. above the stream bed. The fixed cable was 2½ in. in diameter and 1350 ft. long, covering the lower slope of the dam. The other cable was mounted on movable trucks, which had a movement of 170 ft. on tracks at right angles to the axis of the dam, and was able to cover the whole of its water slope; this cable was 2¼ in. in diameter and 1100 ft. long. Each cable was able to handle readily loads up to 10 and 12 tons. All the large rock was chained, and was either picked up by the cable directly or delivered to it by feeding derricks, and transferred by the cable to the fill; the smaller rock was carried in 6x8-ft. skips, each having a capacity of 2 cu.yd. It was possible to move the track trolley cable into a new position in about 2 hours, which made a very convenient arrangement for moving the stone from the quarries directly into the dam work, where it was re-handled by derricks for the face masonry and back-filling.

Signaling Apparatus—In order to control the rapid operation of cables and the exact delivery of rock at certain points of the dam, and to communicate directions to the operating engineers, who were unable to see the work, a new system of signaling was devised. The system of bells used in the old days was abandoned, and an annunciator consisting of a box having ten compartments, each 8x8 in. in size, was placed within view of the engineer. The front of each compartment was closed by a pane of frosted glass and on these the following signals were painted: "HOIST," "LOWER," "GO OUT," "COME IN," "FAST," "SLOW," "STOP," and three spare spaces were left for special signals. At the back of each compartment were mounted two Edison keyless wall sockets with 16-cp., 110-volt lamps. The lamps were wired with a common return wire and an individual wire for the other terminal of each lamp, making 11 wires in all. These wires were of No. 14 copper, covered and cabled, and the outside was protected by jute braid. Each flexible cable was 650 ft. long, and could readily be moved to any favorable position on the south or operating end of the dam. At the signaling end of the cable, ten switches were mounted and normally held open by a spring requiring the pressure of the operator's fingers to close it. The switches were mounted on an insulated base in such a way that the leads were brought into them without coming into contact with the wooden framework. A 1¼-kw., 125-volt, direct-current, compound-wound generator was used, operating at a speed of 1650 r.p.m. The generator was driven by one C. H. Dutton, 5-hp. vertical steam engine, at a speed of 300 r.p.m. The engine was supplied with steam tapped from one of the boilers of the big Lidgerwood engines. By this system, a man, with the switch-signal board, moved around the dam to the most effective points for observing the control and placing of rock as the work progressed, without interfering with guy wires and absolutely preventing accidents, for, in 2½ years of operation, not a man was injured because of any confused signals.

Blasting Rock—In the construction work of 1896 and 1898, large blasts of powder were used indiscriminately in the adjoining hills to break up the solid granite for handling. Powder was used somewhat generously, as at that time the Company obtained it at the very low contract price of 5c. per lb. As the price of Judson powder was raised to 8c. in 1909, and other high-grade powders proportionately, a very careful study of the whole formation surrounding the dam was made before deciding to break rock for the new work. The whole formation in the nearby hills, from which the material for the dam was taken, is a solid granite, and as the cableways were fortunately placed at such a high elevation, 300 ft. above the dam site, a splendid opportunity presented itself for making a mass shot with a large charge of powder without endangering in any way the formation supporting the dam. [See "Eng. News," Dec. 30, 1909, for a full illustrated description of this big blast, written by Mr. O'Shaughnessy. A total of 16,225 kegs of powder and dynamite was placed in a tunnel drift and exploded at one shot, loosening 180,000 tons of rock at a total net cost of $7661, or an average of 4.2c. per ton. Ed.]

The loading of the charge was supervised by J. S. Maloney, Resident Engineer, and Messrs. A. H. Crane and H. F. Smith, agents for the Hercules Powder Co.

On May 20, 1909, the blast was exploded electrically and the result was most satisfactory, as it displaced about 180,000 tons of rock at the modest price stated. The greater part of the [illegible] was broken into pieces of from 20 to 30 tons in weight. The vast mass of [illegible] of the powder exploded [illegible] the [illegible] to do any effective work [illegible].

Spillway—The spillway will [illegible] ft. and will consist of a [illegible] on a 3% grade with an inclined entrance [illegible] out of the granite mountain side. The excavation for the dam was planned so that the materials from the spillway excavation were not wasted, but were put into the structure. The entrance to the spillway will be controlled by twelve radial gates, 8½ ft. wide and 6 ft. high, operated by a crab which runs on a track above the gates [Fig. 3.]

The heaviest floods, measured on the Cottonwood lower down at Barrett, from 250 sq.mi. of water-shed, have been about 7000 sec.-ft., and, as the Morena Reservoir has a capacity of 15,000,000,000 gal., for a water shed of 136 sq.mi., the writer feels secure in the safety of the spillway provisions.]

Outlet Tower—Through the solid bedrock on the south side of the dam at the 30-ft. contour, a tunnel, 387 ft. long, 8 ft. wide, and 7½ ft. high, through which the

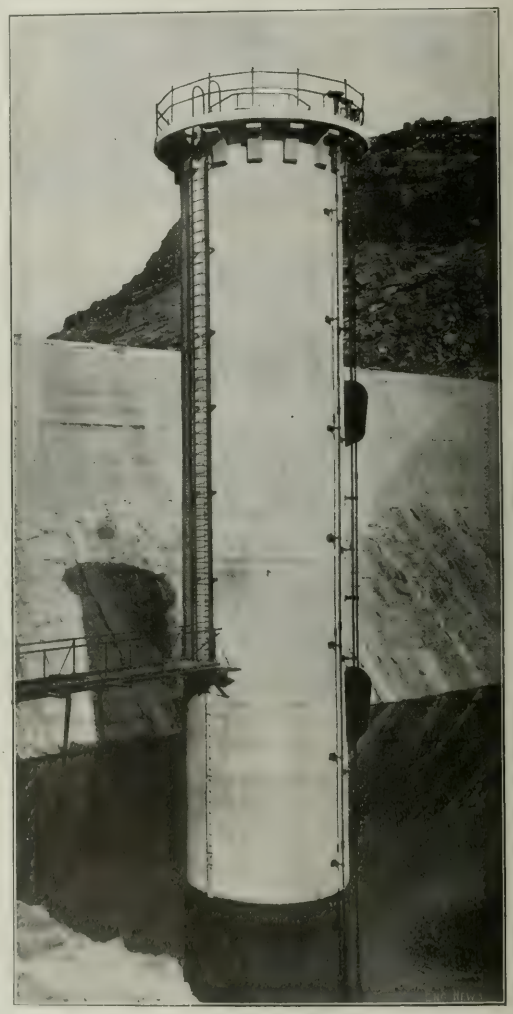


FIG. 8. VIEW OF OUTLET TOWER, MORENA DAM

water from the reservoir is drawn off. This is done through a reinforced concrete tower [Figs. 4 and 8] 15½ ft. in external diameter, with walls varying in thickness from 36 to 20 in. At the top of this tower, at an elevation of 155½ ft., there is an operating deck of reinforced concrete from which the outer gates are regulated. These gates are of the Coffin Valve Co.'s sluice type with vertical stems controlled by [illegible] set into the concrete. Around each gate there is

a screen to keep trash and drift from entering the 24-in. circular cast-iron pipes passing through the walls of the tower and connecting with a 30-in. vertical down-pipe which discharges into the tunnel. These outlets are 28 ft. apart vertically, so that the water may be drawn off under a light head from any of these levels. Between each opening and the down-pipe there is a curved, removable, bolted, flanged casting to enable the gates to be easily removed, if it is ever found necessary. Each is attached to Crane gates which are operated from platforms inside the tower at the different levels, and are used for emergency purposes only.

The admission of water through the outer sluice-valves relieves the leaf-valves from any chattering effect developed by the spouting water which discharges into the down-pipe and flows freely through the tunnel. There is also an independent 24-in. cast-iron pipe which will be used for washing out the sediment which, in the future, may accumulate near the base of the outlet tower. This pipe passes through the foundation of the tower and is connected with the tunnel. The inner 75 ft. of the tunnel—in solid granite—is lined with concrete; it is connected with the base of the tower, and incloses the pipes which discharge at the floor of the tunnel, so that every precaution has been taken to obtain, at a moderate expense, as simple and safe an outlet as possible. From the outer end of the tunnel the water will be permitted to flow at present along the natural grade of Cottonwood Creek until it is picked up above the Barrett Dam site by the Dulzura Conduit.

The work has been done by day's labor under the supervision of J. S. Molony, acting as resident engineer and general superintendent, with R. Wueste and R. P. McIntosh as assistants. About 95 men have been constantly employed since the blast explosion of Aug. 30, 1909, and the work has been peculiarly free from accidents, owing to the careful and conscientious supervision exercised by the men in charge.

The face masonry and back-filling have been expensive, the average cost of the whole work having been $2.50 per cu.yd., but the actual placing of the rock in the dam from the quarries has not cost more than $1 per cu.yd. The whole plant had to be rehabilitated on resuming work in 1909, which, of course, has added slightly to the unit costs, though labor conditions at present in that part of California have made work cost about 30% in excess of prices twelve years ago.

The writer has acted as chief engineer and consulting engineer of the project, and has not been restrained in any way by the president of the company, Mr. Spreckels, who practically owns the entire water system, from modifying the plan of operations or type of construction to suit conditions as the work progressed.

[The writer believes a reading of the paper and discussion will have developed the following conclusions:

(1) That a masonry dam, with a wagon-hauling cost of 1c. per lb., or $4 per bbl. for cement, would have been more expensive than the present structure.

(2) That freedom from uplift pressure is a desirable feature in favor of the rock fill type.

(3) That the great "Hydraulic Principle" of one impervious surface next to the water pressure, as elucidated by Mr. Dillman, is the object to be obtained by engineers in dam construction.

(4) That rock can be excavated economically by mass shots at higher levels above a dam without endangering the site formation, provided the strata are located so that the effects of the explosion will not open seams in the vicinity.

(5) That the circular outlet tower of the type designed is the most economical that can be constructed.]

The Great Hydraulic Principle: Or How to Make Engineering Structures Hold Water*

By George L. Dillman†

As Mr. O'Shaughnessy has given the writer some credit in the paper,‡ it may not be amiss to enlarge on the great "Hydraulic Principle." This principle applies to practically all hydraulic construction. It has been persistently ignored by many alleged experts, always to the detriment, and often to the destruction, of the works. Where intelligently applied, the result has been safety and economy. Just why it has not been announced by the great writers on hydraulics and taught as a fundamental principle in engineering schools has never been apparent to the writer.

Briefly stated, the principle is this: Construct one impervious surface, and build the rest of the structure to support that surface. If this surface should not be watertight, make it as nearly so as possible, in order that seepage or leakage will not be allowed to accumulate pressure against some other surface, or do other damage in getting away.

In the case of masonry or concrete dams, the particular part to make tight is the upstream face. If this is tight and supported, the result will be a dam; otherwise, a failure. This support is: (1) solid masonry or concrete, the result being the so called uniform-sectioned type; or, (2) buttresses of masonry or concrete, resulting in the multiple-arch dam—safer and more economical; or (3) a mass of loose rock, as in the present case, resulting in a stable structure.

In (1), special care must be taken that the upstream face is the least pervious surface, because, making any other surface tighter would tend toward weakness. Carried to the limit, making the downstream surface of ordinary types the most nearly watertight would insure failure. In (2), the multiple-arch or buttressed-wall type, no special care need be taken. Seepage will find its way out through the arches. In (3), or the present case, the loose rock fill takes care of the seepage if only ordinary care is taken in clearing the foundation for it.

The particular method of supporting the impervious (or most nearly impervious) surface is generally a matter of dollars and cents. That the author [in the case of the Morena rock-fill dam, with its impervious upstream face.—Ed.] has chosen the best one must be conceded, when the price of cement is considered. In other words, the loose rock wall undoubtedly costs less than any other support. To have placed any fine material in the loose rock would have been a mistake, not necessarily fatal, but an added expense, possibly resulting in failure. It costs money, does no good, and may be harmful; yet it has been done recently in California.

In the case of earth dams, with special cores of puddled clay, masonry or steel, earth on the upstream face acts in one of two ways. It may be impervious, making the core unnecessary, or it may be merely a support to the impervious core. This earth generally needs riprapping or paving, in order to resist wave action. In the case of puddle, it is necessary to prevent the puddle from drying out. In the case of masonry or steel, it seems to be unnecessary, as masonry or concrete could be built on a batter which would obviate the need for support. As steel is not a permanent construction material, its life would depend on its coating, which itself might require some protection; but the downstream material should be pervious. All possible seepage through the core should get away without eroding the material or producing pressure.

In the case of timber dams, the structure that stands is a face of planking connected with sheet-piling, as tight as the builder can make, supported by cribs, bents, loose rock, or something else, but always following the "Hydraulic Principle." Tightening it in more than one place is expensive and often fatal.

Other structures may well be mentioned here. A retaining wall should always have drains through it to prevent it from becoming a hydraulic structure. A steel tank or steel pipe should always be calked on the inside, as the outside calking only forms a small lip for tightness and soon rusts off or is forced open, whereas the inside calking has the necessary support. In a reinforced-concrete reservoir, the concrete forms the impervious surface, the steel its support. The location of the reinforcement and its initial tension are matters of moment. If the reinforcement is put in without initial tension, the concrete must give before the strength of the reinforcement is developed—this is the most common cause of leaky structures. Other cases of application cannot fail to occur to readers. The application of the principle cannot help but be efficient and economical.

*From a written discussion of a paper by M. M. O'Shaughnessy, on the "Construction of the Morena Rock-Fill Dam, San Diego County, Calif." The paper begins on p. 27 and this discussion appears on pp. 51 and 52 of the "Transactions" of the American Society of Civil Engineers, Vol. LXXV (1912).

†Nevada National Bank Building, San Francisco, Calif.

‡See foregoing acknowledgement.

Turkey Buzzards as Scavengers have long been looked upon, like the gulls of our northern seaports, as valuable aids in the sanitation of tropical and subtropical cities. It now appears from a news dispatch in the New Orleans "Picayune" that they are falling into disrepute. The Louisiana State Live Stock Sanitary Board has begun a war on the turkey buzzard and induced the State Conservation Commission to declare the buzzard a transmitter of disease, and to order its extermination. The attorney general of the state has given his opinion that the law does not protect the buzzard, since it has become destructive of public and private property.

Concrete Foundation for Tracks at Street Crossings

At the recent annual meeting of the American Railway Engineering Association there was some discussion as to the construction of tracks across paved streets, more particularly with regard to the foundation. Mr. Campbell, Engineer of Maintenance-of-Way of the El Paso & Southwestern Ry. System, referred to the use of a concrete foundation as used at El Paso, Tex., and which is specified by city ordinance. In the discussion he stated that the city requires this concrete construction and that the railway has found it very desirable, if not absolutely necessary, to have such a foundation in order to keep the track in surface, so that it will not require frequent attention. We have since received from Mr. Campbell a drawing of this construction, which is shown in the accompanying cuts.

It will be seen from Fig. 1 that a bed of concrete, 10 ft. wide and 12 in. deep under the ties, extends the full length between property lines at the street crossing. The concrete is also filled between and over the ties, to form

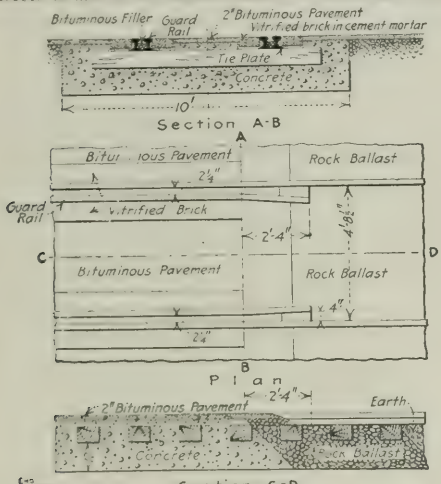


Fig. 1. Track Construction with Concrete Foundation at Street Crossings; El Paso, Tex. (El Paso & Southwestern Ry.)

the base for a 2-in. bituminous pavement. Beyond the ends of this concrete bed there is stone ballast beneath and between the ties. Parallel with each track rail is a guard rail of the same size, having its inner flange cut off so that the rail can be placed to leave a 2¼-in. flangeway. At the ends (beyond the property lines) this guard rail flares out for 2 ft. 4 in. to an end spacing of 4 in., where there is placed a filler block. The two rails rest on flat steel tie-plates ½x8 in., 13 in. long, having one spike hole on the outside of each rail and two spike holes between the rails. Between the rails is a bituminous filler, the top of which is 2 in. below the top of the rail. The filling is not shaped to fill the space under the rail heads, although in many cases this is considered desirable, in order to prevent the calks of horseshoes from getting caught under the rail heads.

In regard to the paving, it will be seen that while a 2-in. bituminous paving is used between and outside the rails, a triple row of paving bricks is laid adjacent to each rail. The bricks are bedded in cement mortar, which partly fills the joints, while the upper part of the joint is filled with a bituminous composition. This is shown in the section, Fig. 2. The use of the brick was found to be necessary, as the bituminous pavement would not stand up against the vibration of the rails. The paving between the rails is laid ⅜-in. below the rail heads.

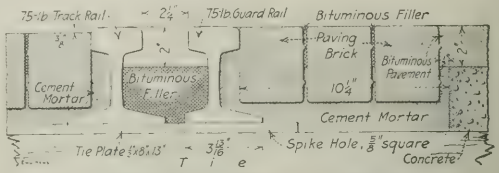


Fig. 2. Details of Paving of Steam-Railway Track at Street Intersections

The concrete base is used for the reason that it has not been found practicable to maintain proper line and surface on track carried across the streets on stone ballast. The construction is not found to be too rigid, and is the most satisfactory arrangement that has been tried on this road.

❖

The Mechanical Properties of Wood grown in the United States are given in tabular form in Circular 213 of the U. S. Forest Service, issued Mar. 24, 1913, and available at 5c. per copy, by application to the Superintendent of Documents, Government Printing Office, Washington, D. C. The table gives the results of tests on 49 species of American wood, tested in green condition in the form of small clear pieces. The number of test pieces from each tree varied from 40 to 120, and the total number of tests represented in the table is about 25,000. The test material was cut from typical trees, selected by members of the Forest Service and records were made of the conditions of growth. The table gives the kind of tree, the locality where it was grown, the number of trees from which the pieces were taken, description of the nature of the wood, and results of bending tests, both static and impact, compression parallel and compression perpendicular to the grain, hardness, shear parallel to the grain, cleavage or splitting, and tension at right angles to the grain.

Overflow from an Inverted Sewer Siphon, at Ames, Iowa, combined with bottom land being flooded at times with the overflow of a storm sewer, gave rise, some weeks ago, to the story that suits had been brought on account of nuisance from the local sewage-treatment works. Through the kind services of Prof. A. Marston, of Iowa State College, we have received the following statement from J. Q. Wickham, city engineer of Ames:

It is true that there have been some suits filed against the City of Ames, objecting to trouble arising in part from the overflow of the 8-in. inverted siphon of Sewer District No. 1, but largely from the storm water overflowing the bottom land near the plant at the same time.

The 8-in. siphon has now considerable growth on the inside, thus reducing its capacity to such a extent that in the spring, when the sewers take some ground water, it cannot carry all the sewage of the district, and, therefore, at such times overflows and causes some trouble at the foot of the hill on Duff Ave.

The original plan of the 8-in. siphon was so arranged that when the rate of flow had reached a certain amount it was to be supplemented by a 12-in. cast-iron pipe. The city authorities have been warned in my yearly reports of the past three years that the time was now at hand when something should be done, but, owing to a lack of funds, they have not been able to comply with the requirements, until recently. I will say, however, that before the pending suits had been filed steps had been taken by the sewer committee of Ames to enlarge the inverted siphon and also to take care of the storm water as well, and there was not the shadow of a reason for any suits. Material has already been ordered for the siphon, and the plans for stom-water sewer to extend to Squaw Creek, one-half mile south of the sewage-disposal plant, are now completed.

I would like to have it distinctly understood that the suits were not brought on account of the operation of the plant itself, as no cause for such complaint can be shown, as the plant has been working perfectly, even though it has been required to carry more than 100% overload through its filters.

General Method for Drawing Influence Lines for Stress in Simple Trusses

By Malverd A. Howe*

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An influence line for the bending moments at the center of moments for any member of a truss on two supports for vertical loads can be constructed by a method which is perfectly general in its application. The truss may be of any shape, and the loads may be applied to either the upper- or lower-chord joints.

A section is passed through the truss, in usual manner, cutting the member whose influence line is to be drawn. This section must evidently also cut a stringer in the panel containing the cut loaded chord. Let:

d = the horizontal projection of the length of the stringer which is cut by the section. This stringer will be called the *cut stringer*.

b = the horizontal distance from the left support of the truss to the left end of the cut stringer.

s = the horizontal distance from the left support of the truss to the center of moments.

h = the vertical distance, at the left end of the cut stringer, between the two chord members which are cut by the section.

h' = the vertical distance between the same chords at the *right* end of the cut stringer.

General Rule

To draw the influence line, proceed as follows:

(I) Through any point A (refer to Fig. 1; all other figures are lettered correspondingly) in a vertical line passing through the center of moments, draw a horizontal line cutting the vertical line through the left support of the truss at C and the vertical line through the right support at B.

(II) From C, at *any convenient scale*, lay off vertically downward the distance $CD = AC \div s$, and connect D and B by a right line.

(III) Through A and D draw a right line and prolong it until it cuts the vertical line drawn through the left end of the cut stringer at E.

(IV) Draw a vertical line through the right end of the cut stringer, intersecting the line CB at F, and connect E and F by a right line.

(V) The polygon $DEFBD$ contains the influence line sought; the ordinates between line $DEFB$ and line DB are the respective moments for unit loads on the truss vertically above them, i.e., the lines $ef = z_1$, $rc = z_2$, $gk = z_3$, are proportional to the stresses produced by loads of 1 lb, at W_1, W_2, W_3, respectively. The ordinates are measured at the scale used in laying off the distance $CD = s$.

Although the method outlined here applies to any of the figures accompanying this article, yet for greater clearness several forms of the trusses shown will be considered in detail.

Trusses with Simple Paneling

Web Members in Simple Trusses *having one or both Chords Inclined*—Figs. 1a and 2 show trusses having one set of web members vertical, and Fig. 1*b* a truss where both sets are inclined. In Figs. 1*a* and 2 the construction of the influence line $DEFB$ is identical.

To prove the construction correct, let the angles made with AB by the lines AE, EF and DB be respectively O_1, O_2 and O_3, and let the distance from the left support of the truss to the unit load be, in general, represented by a. While the load W_1 is to the left of the cut stringer, or to the left of the vertical through E, the moment is:

$$M_s = \frac{W_1 (l - a)}{l} s \qquad W_1 (s + a) = W_1 (l - a) \frac{s}{l} - W_1 (s + a) \frac{1}{1}$$

or,

$$M_s = W_1 (l - a) \tan O_2 - W_1 (s + a) \tan O_1 = W_1(pr - fp) = W_1(- ef)$$

If the load, W_2 (or W_2'), is on the cut stringer, or between the vertical lines passing through E and F, the moment is,

$$M_s = \frac{W_2 (l - a)}{l} s - W_2 \frac{b + d - a}{d} (s + b) = W_2 (l - a) \frac{s}{l} - W_2 (b + d - a) \frac{s + b}{d}$$

or,

$$M_s = W_2(l - a) \tan O_2 - W_2 (b + d - a) \tan O_2 = W_2(qr - eq)$$

$= W_2(- cr)$ when the load is to the left of the vertical through G,

$= W_2(+ cr)$ when the load is to the right of the vertical through G.

When the load is beyond the cut stringer, or on the right of the vertical through F, the moment is

$$M_s = \frac{W_3 (l - a)}{l} s = W_3 (l - a) \frac{s}{l}$$

$$= W_3 (l - a) \tan O_2 = W_3 (+ gk)$$

Maximum Load-Position—For uniform loads, the influence diagram $DEGFB$ at once indicates the portions of the span which are to be loaded to produce maximum moments (and hence maximum stresses).

The criterion for giving the position of wheel-loads producing the maximum moment is readily found from the influence diagram. For cases which usually occur in practice, the portion of the span on the left of the cut stringer may be considered as unloaded. Let z_2, z_2' and z_3, be the ordinates of the influence diagram directly below the wheel-loads W_2, W'_2 and W_3. The moment is,

$$M_s = W_2 z_2 + W'_2 z'_2 + W_3 z_3$$

If the loads move towards the left a distance δx, and no additional load comes on the span from the right and no load moves off the left end of the *cut stringer*, the moment becomes,

$$M'_s = - W_2 (z_2 - \delta x \tan O_2 + \delta x \tan O_2) + W'_2(z'_2 + \delta x \tan O_2 - \delta x \tan O_2) + W_3(z_3 + \delta x \tan O_2)$$

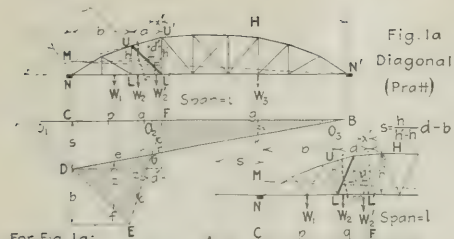
The difference between these moments is:

$$M'_s - M_s = \delta M_s = - W_2 \delta x (- \tan O_2 + \tan O_2) + W'_2 \delta x (\tan O_2 - \tan O_2) + W_3 \delta x (\tan O_2)$$

Dividing through by δx and placing $\frac{\delta M_s}{\delta x} = 0$ to find the point of maximum,

$$\frac{\delta M_s}{\delta x} = - W_2 \left(- \frac{s}{l} + \frac{s + b}{d} \right) + W'_2 \left(\frac{s}{l} - \frac{s + b}{d} \right) + W_3 \frac{s}{l} = 0$$

*Director of the Departments of Architecture and Civil Engineering, Rose Polytechnic Institute, Terre Haute, Ind.



For Fig. 1a:

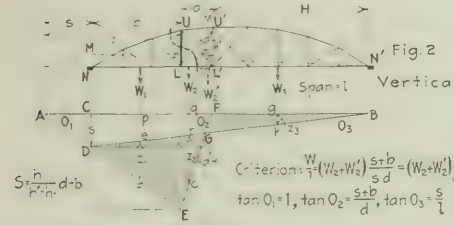
Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s-a}{sa}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

For Fig 1b:

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s-a}{a}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s-a}{a},\ \tan O_3=\frac{s}{l}$

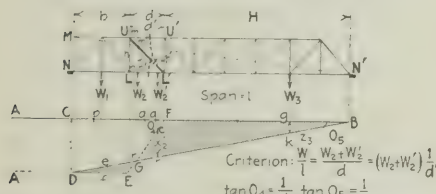


$S=\frac{h}{h'-h}d-b$

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s+b}{sd}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

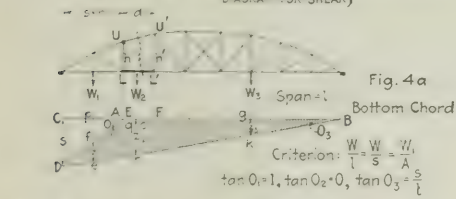
FIGS. 1 & 2 - WEBS OF CURVED-CHORD TRUSS



Criterion: $\frac{W}{l}=\frac{W_2+W_2'}{d}=(W_2+W_2')\frac{1}{d}$,

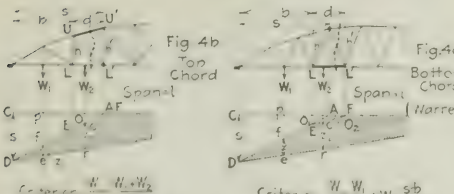
$\tan O_4=\frac{1}{d},\ \tan O_5=\frac{1}{l}$

FIG. 3 - WEB OF PARALLEL-CHORD TRUSS (INFLUENCE DIAGRAM FOR SHEAR)



Criterion: $\frac{W}{l}=\frac{W}{s}=\frac{W_1}{A}$,

$\tan O_1=1,\ \tan O_2=0,\ \tan O_3=\frac{s}{l}$



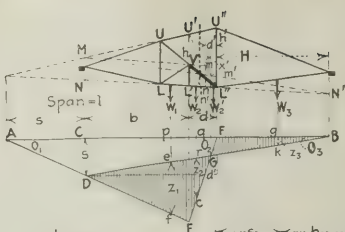
Criterion: $\frac{W}{l}=\frac{W_1}{s}+W_2\frac{s+b}{sd}$

If $s+b=d$, $\frac{W}{l}=\frac{W_1+W_2}{s}$

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

FIG. 4 - CHORDS OF CURVED-CHORD TRUSS

INFLUENCE LINES FOR WEBS OF TRUSSES WITH SIMPLE PANELS



$S=\frac{h}{h'-h}d-b$

For Fig. 5a:

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s}{s}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

For Fig. 5b:

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s+b}{sd}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

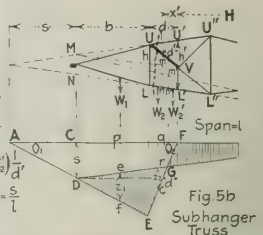
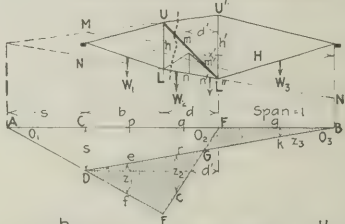


FIG. 5 - DOUBLE HALF OF DIAGONAL



$S=\frac{h}{h'-h}d-b$

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s+b}{sd}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

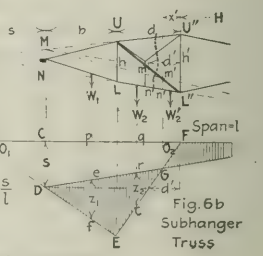
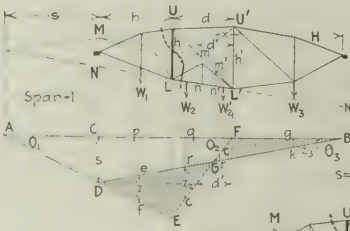


FIG. 6 - SINGLE HALF OF DIAGONAL



$S=\frac{h}{h'-h}d-b$

Criterion: $\frac{W}{l}=(W_2+W_2')\frac{s+b}{sd}=(W_2+W_2')\frac{1}{d}$,

$\tan O_1=1,\ \tan O_2=\frac{s+b}{d},\ \tan O_3=\frac{s}{l}$

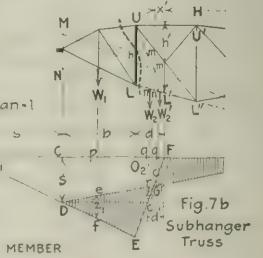


FIG. 7 - VERTICAL MEMBER

INFLUENCE LINES FOR WEBS OF TRUSSES WITH SUBDIVIDED PANELS

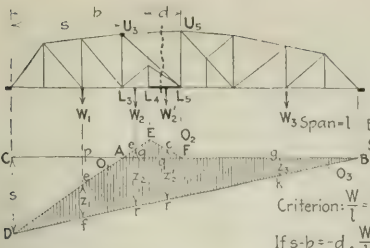


Fig. 8 Bottom Chord, Substrut Truss

Criterion: $\frac{W}{l} = \frac{W_1+W_2}{s} + W_2' \frac{s-b}{sd}$

If $s-b=-d$, $\frac{W}{l} = \frac{W_1+W_2-W_2'}{s}$

$\tan O_1 = 1$, $\tan O_2 = \frac{s-b}{d}$, $\tan O_3 = \frac{s}{l}$

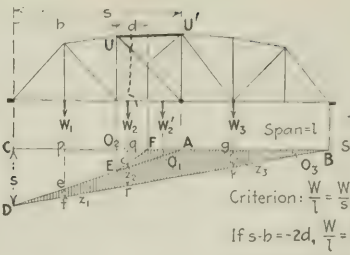


Fig. 9 Top Chord Subhanger Truss

Criterion: $\frac{W}{l} = \frac{W_1}{s} + W_2 \frac{s-b}{sd}$

If $s-b=-2d$, $\frac{W}{l} = \frac{W_1+2W_2}{s}$

$\tan O_1 = 1$, $\tan O_2 = \frac{s-b}{d}$, $\tan O_3 = \frac{s}{l}$

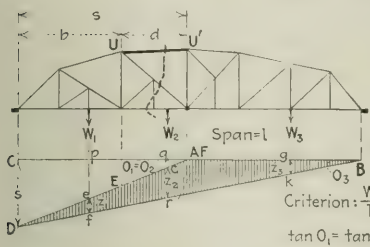


Fig. 10 Top Chord Substrut Truss

Criterion: $\frac{W}{l} = (W_1+W_2)\frac{1}{s}$

$\tan O_1 = \tan O_2 = 1$, $\tan O_3 = \frac{s}{l}$

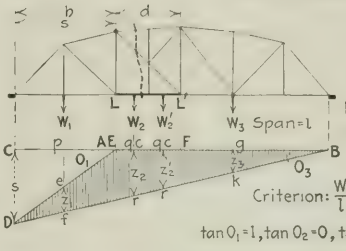


Fig. 11 Bottom Chord Subhanger Truss

Criterion: $\frac{W}{l} = \frac{W_1}{s}$

$\tan O_1 = 1$, $\tan O_2 = 0$, $\tan O_3 = \frac{s}{l}$

CHORDS OF TRUSSES WITH SUBDIVIDED PANELS

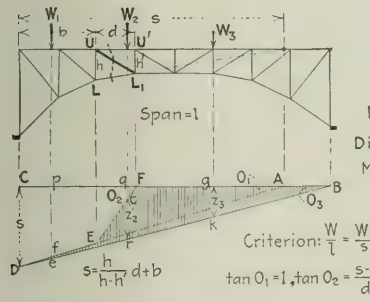


Fig. 12 Diagonal Member

Criterion: $\frac{W}{l} = \frac{W_1}{s} + W_2 \frac{s-b}{s}$

$\tan O_1 = 1$, $\tan O_2 = \frac{s-b}{d}$, $\tan O_3 = \frac{s}{l}$

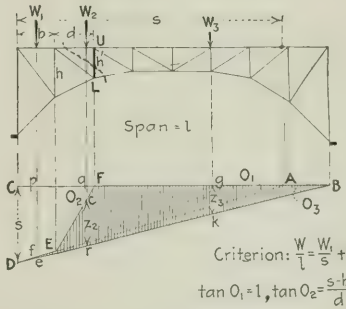


Fig. 13 Vertical Member

Criterion: $\frac{W}{l} = \frac{W_1}{s} + W_2 \frac{s-b}{sd}$

$\tan O_1 = 1$, $\tan O_2 = \frac{s-b}{d}$, $\tan O_3 = \frac{s}{l}$

WEBS OF TRUSSES WHERE CENTER OF MOMENT LIES BETWEEN SUPPORTS

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hence, if $W = W_2 + W'_2 + W_3$, the total load on the span,

$$\frac{W}{l} = (W_2 + W'_2)\frac{s+b}{sd} = \frac{W_2 + W'_2}{d'}$$

Where

$$\frac{1}{d'} = \frac{s+b}{sd} \text{ or } d' = \frac{d}{s+b}s - \frac{s}{\tan O_2}$$

The value of d' is found graphically from the influence diagram by drawing a line through D parallel to CB until it cuts the line EF, then d' is the distance indicated in the figures. This value may also be found graphically without drawing the influence line by simply drawing in the truss diagram the line Mm parallel to the cut bottom chord LL' and prolonging it until it cuts a diagonal line drawn from the intersection of the cut top chord and a vertical through the left end of the cut stringer to the intersection of the cut bottom chord and the vertical through the right end of the cut stringer. This point is indicated by the letter m in the figures. The horizontal distance of this point m from the vertical through the right end of the cut stringer is the value of d'. This is easily shown as follows: From Figs. 1, 2 and 3,

$$mn : h :: d' : d, \text{ or } d' = \frac{d}{h} mn = MN$$

$$MN : s :: h : s+b, \text{ or } MN = \frac{s}{s+b}h$$

Therefore,

$$d' = \frac{s}{s+b}d = \frac{d}{s+b}s$$

the value given above.

NEUTRAL POINT—The position of a load which produces no stress in the web member is indicated by the point G in the influence diagrams; for, a load in the truss immediately above G produces no stress in the web member since the ordinate of the influence diagram is zero. The point m' shown in the truss diagram is immediately above G. This point is located by the intersection of

the line MN' and the diagonal drawn as explained in determining d'. Let x' be the horizontal distance from m' to the vertical through the right end of the cut stringer, and $H + x'$ the horiontal distance of m' from the vertical through the right support of the truss. Then, in Figs. 1 and 2.

$$m'n' : h :: x' : d, \text{ or } m'n' = \frac{h}{d}x' = MN(H - x')\frac{1}{l}$$

$$MN : s :: h : s + b, \text{ or } MN = \frac{s}{s+b}h$$

hence

$$m'n' = \frac{H + x'}{l} \times \frac{s}{s+b}h = \frac{h}{d}x';$$

or

$$(H + x')\frac{s}{l} = \frac{s+b}{d}x'$$

which becomes

$$(H + x')\ tan\ O_2 = x'\ tan\ O_3.$$

The ordinate above the point G in the influence diagram satisfies this equality, and therefore G and m' are in the same vertical line.

Web Members in Simple Trusses *Having Parallel Chords*—The case shown in Fig. 3 presents an apparent exception to the general rule for drawing the influence line *DEFB*. The center of moments for any web member is at infinity. Taking N as the reference point, $s = \infty$. For a load on the left of the vertical through E, the moment is

$$M_s = W_1\frac{l-a}{l}s - W_1(s+a) = W_1\frac{l-a}{l}\infty - W_1(\infty + a)$$

Dividing both members of this equation by ∞

$$\frac{M_s}{\infty} = W_1\frac{l-a}{l} - W_1\left(1 + \frac{a}{\infty}\right) = W_1\frac{l-a}{l} - W_1$$

But $W_1\frac{l-a}{l} - W_1$ is the expression for vertical shear on the right of the load, and, consequently, practically at the load.

If CD is laid off equal to $s \div \infty = 1$, the ordinates of the influence diagram represent vertical shears instead of moments. DE drawn through A which is an infinite distance from the left support, will be sensibly parallel to ACB. It appears that the shear influence diagram is constructed in precisely the manner outlined for the moment influence diagram when CD is made equal to unity. For a load on the left of the vertical through E, the vertical shear is

$$S = W_1\frac{l-a}{l} - W_1 = W_1(1 - a)\frac{1}{l} - W_1(1)$$

or,

$$S = W_1(1 - a)\ tan\ O_2 - W_1(1) = W_1(pe - pf) - W_1(-cf)$$

In a similar manner it is shown that the ordinates immediately below W_2, W'_2 and W_3 represent the vertical shears produced by unit loads at these points.

The criterion for maximum shear is identical with that given above for maximum moments. Without writing out all the equations, it is evident from Fig. 4 that

$$\frac{\partial S}{\partial x} = -W_1(-tan\ O_1 + tan\ O_1) + W'_2(-tan\ O_1 + tan\ O_2) + W_3 tan\ O_2 = 0;$$

or,

$$W_2\left(-\frac{1}{l} + \frac{1}{d}\right) + W'_2\left(-\frac{1}{d} + \frac{1}{l}\right) + W_3\frac{1}{l} = 0$$

Therefore,

$$\frac{W}{l} = (W_2 + W'_2)\frac{1}{d} - (W_2 + W'_2)\frac{1}{d'}$$

The points m and m' and the value of $d' = d$ are found in the manner explained for Figs. 1, 2 and 3.

Chord Members in Simple Trusses—Fig. 4 shows the manner in which the influence diagrams for chord-stress moments are drawn, according to the general directions.

The criterion for wheel-loads for trusses having one set of web members vertical is found as follows, referring to Fig. 4a:

$$M_s - M'_s = \partial M_s = W_1\partial x\ (tan\ O_2 - tan\ O_1) + W_2\partial x(tan\ O_2) + W_3\partial x(tan\ O_3)$$

or,

$$\frac{\partial M_s}{\partial x} = W_1\left(\frac{s}{l} - \frac{s}{s}\right) + W_2\frac{s}{l} + W_3\frac{s}{l} = 0$$

Therefore,

$$\frac{W}{l} = \frac{W_1}{s}$$

In Fig. 4*b*,

$$\frac{W}{l} = \frac{W_1 + W_2}{s}$$

In both cases the criterion is the same; that is, the average load on the span equals the average load on the left of the center of moments.

If both sets of web members are inclined, as shown in Fig. 4*c*, the construction of the influence diagram remains unchanged as to method, but the resulting diagram is different in form from those shown in Figs. 4a and 4b, and the criterion for maximum moments produced by wheel-loads is different. From Fig. 4*c*,

$$\frac{\partial M_s}{\partial x} = W_1(-tan\ O_1 + tan\ O_2) + W_2(-tan\ O_2 + tan\ O_2) + W_3\ tan\ O_3 = 0.$$

or,

$$W_1\left(-\frac{s}{s} + \frac{s}{l}\right) + W_2\left(-\frac{s-b}{d} + \frac{s}{l}\right) + W_3\frac{s}{l} = 0$$

Hence

$$\frac{W}{l} = \frac{W_1}{s} + W_2\frac{s-b}{sd}$$

When

$$s - b = \tfrac{1}{2}d, \quad \frac{W}{l} = \frac{W_1 + \frac{1}{2}W_2}{s}$$

Trusses with Subdivided Panels

Web Members—The usual type of truss with subdivided panels has one set of web members vertical. The trusses here considered in detail have inclined chords.

Fig. 5a shows the moment influence diagram for the lower half of the diagonal UL'', in a truss with sub-struts. Since the portion VL'' is a member of the main truss and of the auxiliary truss LVL'', the length of the cut stringer is the horizontal projection of the distance LL''. All of the demonstrations given for Fig. 1 apply to this case. For a truss whose panel subdivision employs sub-hangers

the construction is similar, for the *upper* half of the diagonal; see Fig. 5b.

Fig. 6a shows the influence diagram for the upper portion of the diagonal UL'. This is a member of the principal truss only and hence the horizontal projection of LL' is the length of the cut stringer. The construction of the influence diagram and the demonstrations remain unchanged. In the sub-hanger truss, the *lower* half of the diagonal is subject to the same considerations and construction, as in Fig. 6b.

Fig. 7a considers the vertical UL. This member is in no way influenced by the auxiliary truss, which may be considered merely as a trussed stringer, and therefore the cut stringer is the same as in Fig. 6a. It follows that all constructions and demonstrations remain unchanged. In the sub-hanger truss the same post is subject to the influence of the auxiliary truss, and the length of the subpanel determines the length of the cut stringer as in Fig. 7b.

If the chords are parallel, the diagrams shown in Figs. 5 to 7 will take the form shown in Fig. 3, where CD is unity and the ordinates represent the vertical shear.

Chord Members—The two cases shown in Figs. 8 and 9, and 10 and 11, are sufficient to indicate the application of the general method.

In Fig. 8 the bottom-chord member L_4L_5 forms a portion of the main truss and of the auxiliary truss. The length of cut stringer is L_4L_5, and the influence line is drawn according to the general method. The same reasoning applies to the top chord in Fig. 9.

The diagrams for the unsubdivided chord are shown in Figs. 10 and 11 for lower and upper auxiliary truss respectively. They require no further explanation.

Web Members in Simple Trusses Where the Center of Moments Is between the Supports

The trusses shown in Figs. 12 and 13 have inclined bottom-chord members approaching the top chord at the center of the span. This makes the center of moments for some of the web members fall between the supports, as shown. The influence diagrams follow the general law, and indicate that the trusses are to be loaded from end to end for maximum moments. The criterions for wheel-loads are the same as found for Fig. 9. The influence diagrams for the chord members will be of the form shown in Fig. 4a.

A little study of the above explanations shows that, after the center of moments has been located and the length of the cut stringer determined, the construction of the moment or shear influence diagram is a mechanical process following general rules. When the diagram has been constructed as directed, the moments or shears for unit load on any point can at once be scaled, using the scale used in laying off the distance CD. No special calculations are required as is usually stated in textbooks which consider this form of diagram. This particular form of influence diagram forms a part of the influence diagrams for cantilever trusses and two- and three-hinged arches, making the construction of influence diagrams for such structures exceedingly simple.

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An Experimental Roadway is being built in the suburbs of Philadelphia on the direct through road to New York, which carries a heavy automobile traffic. The road is known as the Byberry & Bensalem turnpike. The test roadway is nearly 3½ miles long, and is being laid with 26 different kinds of pavement.

Suggested Code of Ethics of the Oregon Society of Engineers

I. Engineers should be men of sterling honesty and moral integrity. Their success and the standing of the profession depend upon their thoroughness, industry, business talent and upright character. They cannot honorably enter into such competition as that which may exist among business men.

II. They should encourage sound engineering learning, by training in scientific schools, by individual study and reading thereafter, and by actual work.

III. Their clients have a right to expect that the portion of business entrusted to them will receive careful investigation and intelligent treatment. Any information which the engineer has derived from such investigation, and which is peculiar to that business, is to be considered confidential.

IV. In their professional relations, engineers should be governed by strict honor and courtesy. Their conduct toward each other should be such that it will secure mutual confidence and good will.

They should not seek to divert to themselves the work of clients of other engineers.

It is the privilege of a client to transfer his work from one engineer to another; but before the change is made there should be a complete understanding between the engineer in charge and the engineer to whom the work is transferred, to avoid offense.

Communications are to be carried on between responsible heads, and not by unauthorized subordinates.

One engineer should not attempt to secure the services of an assistant or employee of another engineer, without first gaining the permission of such principal.

No assistant or engineer's employee should contract his services to another engineer without first consulting his principal.

An engineer should not hinder the advancement of an assistant, but should give him any aid and encouragement possible.

Criticism of another's work is to be broad and unprejudiced. The whole profession is affected by the success or failure of any member.

The relations between principals and their assistants should be those of frank and mutual helpfulness.

V. Engineers should be willing to assume their proper share of public work, and to render all assistance possible for the general good of the community.

VI. An engineer should not attempt work with which he is unfamiliar or inexperienced. In cases of doubt, consultations should be held with other engineers having broader experiences.

One engineer should not use language that will impair confidence in another engineer.

VII. Fees are to be based on local conditions, and to represent the customary values. One engineer should not seek to undercut others.

VIII. As far as possible, engineers should not be interested in any business that will prejudice their opinions as applied to their work.

They should not receive commissions for materials entering into work of which they have charge.

They should avoid any unprofessional advertising or appearance of commercialism, but should give other engineers the advantage of the record of publication, wherever desirable, of any unusual or interesting feature of their practice.

IX. Their attitude toward contractors should be one of helpfulness and tactfulness, combined with firm and just criticism.

X. An intimate relation should exist between the various branches of engineering.

A committee is to be appointed to try and pass upon a broach of conduct of any of the members. If serious enough, the case then to be handed to the Executive Board, whose decision will be final. Upon a three-fourths vote of the Executive Board, a quorum being present, a member may, after such trial, be expelled from the Society.

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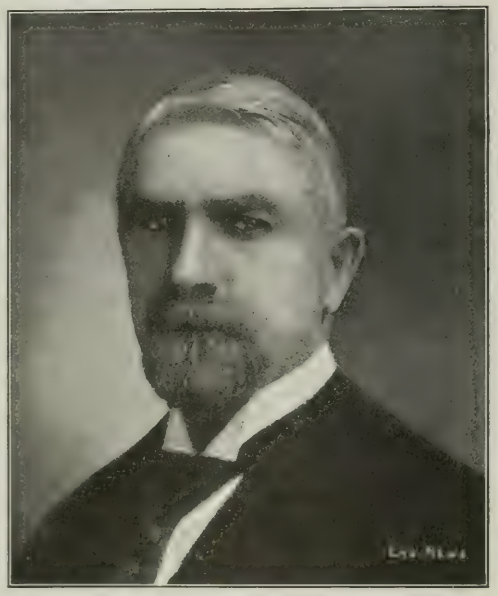
Street Accidents in London, England, cost the lives of 538 persons and injuries to 16,651 more in the year 1912, according to statistics issued by the British Home Office. The greatest number of fatal accidents from any one class of street traffic was 182 deaths caused by motor omnibuses; electric cars caused 37 deaths; motor vehicles, 171; horse-drawn vehicles, 143, and horse-drawn omnibuses, 5. More than half the nonfatal accidents were due to motor omnibuses and other motor vehicles.

Expensive 11-Mile Cutoff To Be Built by the Baltimore & Ohio Railroad*

A 17-mile double-track section of the Baltimore & Ohio R.R. main line in West Virginia is being enlarged to four-track by building a double-track low-grade cutoff 11 miles long, at a cost of about $6,000,000. It extends from Orleans Road to Little Cacapon, W. Va., and goes under the name of Magnolia Cutoff. With its completion the railway will have four tracks and three tracks for the entire 78 miles from Cumberland to Martinsburg, W. Va.

The present two tracks between the termini of the cutoff will be used for westbound traffic, and the cutoff will carry eastbound traffic. Thus the heavier traffic will get the benefit of the low-grade line.

The location of the cutoff is as follows: Beginning at the easterly end, it diverges to the southerly side of the present three-track line beyond Orleans Road, rises on an 0.1% compensated grade 1500 ft. to a crossing of the present tracks, and continues on the same grade through the ridge at Doe Gulley. The present Doe Gully tunnel will be converted into a four-track open cut, with some change in location, and a lowering of the summit level by 10 ft. Thence the new line runs along the hillside above the present tracks to a point east of Hansrote; here it diverges to the left and passes through the ridge just east of Magnolia. It then crosses over the present tracks and over the Potomac River at Magnolia in Maryland, pierces the ridge on the west side of the river and again crosses the river and the present tracks at Kessler's Curve, returning into West Virginia. Then follows hillside location above the existing tracks to a point just west of Paw Paw, where the location again turns to the left and goes through a short tunnel south of the present Paw Paw tunnel. All the old and new lines will be combined in a new four-track line somewhat above the present roadbed, above the highest known stage of the Potomac. At Little Cacapon the existing four-track line is reached.



HORACE GREELEY BURT

The cutoff saves 5.8 miles of distance and 887° curvature in eastbound traffic, and avoids a grade at Hansrote which now requires pusher engines for eastbound trains. It will have four tunnels (the longest about 3000 ft.) and two bridges over the Potomac River.

The construction is to be first-class. Retaining-walls will hold the foot of the slope along the river, and the slopes above the track will be terraced to guard against slides or falling rock. The line will have automatic signals, and at four points interlocking plants (Great Cacapon, Doe Gully, Magnolia and Little Cacapon).

Construction is in charge of F. L. Stuart, Chief Engineer of the Baltimore & Ohio R.R. It will be carried on in eight sections, which have been let as follows: Sections 2, 3 and 4 to H. S. Kerbaugh, Inc., New York; 5 and 7 to Bennett & Talbot, Greensburg, Penn.; 6 and part of 8 to Smith, McCormick & Co., Easton, Penn.; part of 1 to Kefauver & McLaran (the other part not yet let); part of 8 to Jas. F. McCabe.

The cutoff work includes several revisions of the location of the present tracks, as at Doe Gully and at Paw Paw.

*From data given by J. Hampton Rowe, Engineer Maintenance of Way, Baltimore & Ohio R.R. Co., Baltimore, Md.

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Horace Greeley Burt

Horace Greeley Burt, whose death was noted in our issue of May 22, was one of the many prominent railway engineers whose experience included both the engineering and operating departments of railway service.

His railway career began when he was 19, for in March, 1868, he became a rodman on the surveys and construction of the St. Louis, Vandalia & Terre Haute R.R. From December, 1869, he was engaged on railway location and construction work in Kansas until he entered the University of Michigan in the winter of 1870. After graduating (1873) he went with the Milwaukee & Northern R.R. for a few months, and then entered the engineering department of the Chicago & Northern Ry., where he remained for nine years and rose to be Chief Engineer. He then entered the operating department and from 1882 to 1888 was Division Superintendent; then he became General Manager of the Fremont, Elkhorn & Missouri Valley R.R., until July, 1896, and of the Chicago, St. Paul, Minneapolis & Omaha Ry., until 1898. Both of these roads are part of the Northwestern System, and in 1898 he became Third Vice-President of the Chicago & Northwestern Ry., in charge of traffic.

In January, 1898, he was made President of the Union Pacific Ry., and held this position until 1904. During his term of office very extensive reconstruction and improvement works were carried out over the entire line. He then took up private practice as a consulting engineer, and opened an office in Chicago in 1905.

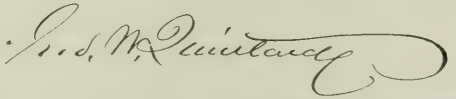
The Chicago Association of Commerce in 1911 organized a Committtee on Electrification of Railway Terminals, for the purpose of investigating the problem of applying electric traction to the vast and intricate rail-

way terminal system of Chicago, and also the problem of smoke abatement. Mr. Burt was appointed Chief Engineer of this committee, at the suggestion of Dr. W. F. M. Goss, of Purdue University (who was a member of the committee), on account of his qualifications both as an engineer and an administrator. This appointment was made in April, 1911, and Mr. Burt was in active charge of the work of the committee until the time of his death.

George William Quintard*

George William Quintard, whose death, at the age of 91 years, was briefly noted in our issue of Apr. 10, was prominently identified with the iron and steel shipbuilding industry of America almost from its very inception. Mr. Quintard was born in Stamford, Conn., Apr. 22, 1822, and came from a family of French descent, which had been prominent residents of that town for several generations. Isaac Quintard, the father of George W., was a merchant of Stamford.





After attending the public schools until he reached the age of 15, Mr. Quintard went to New York, where he found employment as clerk in a prominent grocery house. Mr. Quintard saved his earnings, and after five or six years of labor in a subordinate position was able to embark in business on his own account.

On Feb. 15, 1844, he married Frances J., a daughter of the late Charles Morgan, founder of the Morgan Line of steamers, and this circumstance eventually gave another direction to his career. He had already shown himself to be a capable man of business, and in 1847, at the age of 25, he gave up his mercantile pursuits to enter a new field of enterprise in which his energetic father-in-law had already made a reputation.

Mr. Quintard identified himself at that time with T. F. Secor & Co., owners of the Morgan Iron Works, on the East River, New York City. This establishment was engaged in the manufacture and repair of engines for steamboats and ocean steamships, and he found here a congenial field for the exercise of his abilities. In 1850 he became one of the proprietors, and in partnership with Charles Morgan, remained in active management until 1867.

At these works Mr. Quintard built a large number of what were considered, in those days, ponderous engines for coasting, lake and river steamers, mainly of the walking-beam type, also engines for ships of war, for both American and foreign governments. During the Civil War these shops were of great service to the government authorities who employed them to construct the engines of the following naval vessels: the "Onondaga," "Wachusett," "Seminole," "Muscoota," "Chenango," "Ticonderoga," "Ammonoosuc," "Katahdin," "Ascutney," "Idaho," "Tioga" and the "Kineo."

During his connection with the Morgan Iron Works, Mr. Quintard also built the engines for many famous steamers, a few of which were the following: the "Golden Rule," "Manhattan," "Albemarle," "City of Hartford," "De Soto," "Hatteras," "Peiko" (China), "Yang See" (China), "Fah Hee" (China), "Granite State," "San Francisco," "Robert Fulton," "New Brunswick," "Continental," "Villa Clara," "Cosmopolitan," "Commonwealth," and the Lake steamers, "Southern Michigan," "Western Metropolis," "Northern Indiana" and the "Crescent City."

In 1867, Mr. Quintard sold the Morgan Iron Works to John Roach, the noted shipbuilder, in order to devote his attention to the New York & Charleston Steamship Co., of which he was President and part proprietor.

In 1869 he established the Quintard Iron Works at the foot of 12th St. and the East River, New York City, which was only a few blocks above the Morgan Iron Works. At the Quintard Iron Works, he resumed the construction of marine engines and machinery, and in a short time developed the plant into an extensive establishment, in which were constructed some of the engines for the more modern Navy and merchant marine.

About 1890, Mr. Quintard retired from the active management of these works, and during the latter part of his life his time was occupied in the management of corporations in which he had investments, and into the direction of which he had been invited, owing to his financial ability and upright character.

He had been a director in the Manhattan Life Insurance Co., the Butchers' & Drovers' Bank, the New England & Nova Scotia Steamship Co., the Eleventh Ward Bank, the New York, Lake Erie & Western R.R., the Pennsylvania Coal Co., the Atlantic Mutual Insurance Co., the

*Data furnished by George Quintard Palmer, President of the Alberger Condenser Co., New York City.

State Trust Co., the Union Ferry Co., and the Leather Manufacturers' National Bank.

It fell to the lot of Mr. Quintard to become one of the assignees of his old friend, John Roach, whose fortune had been impaired by the hostile action, since repented of, by the Navy Department under William C. Whitney, at the time Mr. Roach was constructing the first ships of the new Navy. Mr. Quintard with his colleagues was able to extricate the affairs of Mr. Roach from difficulties, reopen the Morgan Iron Works and the shipbuilding establishment on the Delaware River, both of which had been closed, and place them once more on a prosperous footing.

Mr. Quintard served his fellow citizens in the positions of Emigration Commissioner and Park Commissioner, but declined all other tenders of public office.

A few years ago he resigned from most of his business connections and clubs, and the latter part of his life was spent between his farm in the country, and his town residence.

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Burning Low-Grade Fuels on Locomotives*

By Samuel B. Flagg†

The dividing line between lignitic and sub-bituminous coals and also between sub-bituminous and bituminous coals cannot be sharply drawn. In general, however, lignitic coals are characterized by a high moisture and high volatile matter content, a fairly low percentage of ash, and a low heat value. They are of a brownish color, have a woody appearance as regards their structure, and give up their moisture and disintegrate rapidly upon exposure to the atmosphere.

The lower grades of sub-bituminous coal differ from the lignites mainly in appearance. The better grades, however, have a much lower moisture content and higher heat value; in fact, the heat values of some of them are considerably higher than those of many of the bituminous coals. Even these high grade sub-bituminous fuels, however, have the same tendency to disintegrate upon exposure to the air and to heat in a furnace. Another characteristic feature of both the lignitic and sub-bituminous coals is their liability to heat in the pile or bunker and to take fire spontaneously. One point in favor of the sub-bituminous coals is the freedom from clinker troubles.

It has been estimated that of the coal easily accessible and still remaining in the coal fields of the United States 33% is represented by the lignitic and sub-bituminous deposits. There seems to be no question that these coals will be used in increasing quantities. There is doubtless much to learn relative to the proportion of grate area to heating surface that will give best results with different coals. Some of the roads are using this sub-bituminous fuel on the same engines that at other times burn bituminous coal. The probability of a marked increase in the use of the true lignites in the near future is not great.

SPARK-ARRESTER DEVICES

In some sections the greatest problem connected with the use of sub-bituminous fuels has been the preventing of spark troubles. Because of the high drafts necessary and the absence of any coking properties of the fuels, large quantities of sparks are carried out of the firebox. These must be caught by some arrangement of screens, or so delayed in passing out that they are cooled down to a temperature at which they will do no harm, or they must be broken up into particles of such small size that they will be dead before reaching the ground. The first attempts to solve this problem were made with different sizes and arrangements of screens and usually included two screens for the gases to pass through. It was usually found however that one of the screens clogged and prevented the free steaming of the engine.

By using a single screen properly set, most of the clogging trouble can be done away with. Screens set horizontally will, with some forms of stacks, remain clear longer and give less trouble than if set on an incline; and small-mesh netting of small wire is more satisfactory than that made of large wire.

A front-end arrangement designed to reduce in size the sparks or cinders, and also delay their delivery from the stack, is shown in Fig. 1 (American Locomotive Co.). A number of locomotives have been equipped with this device and have been in service for two to four years. It is stated that the sparks are reduced to such small size that they give no trouble.

The sparks upon leaving the front end of the flues strike the baffle plate A and are deflected downward. In front of the baffle plate is a table plate with an adjustable end B, under which the sparks and gases pass. Deflector plates attached to the boiler front and to the top and bottom of the smoke arch, and a flat plate attached to the front end door, again deflect the gases and solid particles, after which they pass through a netting C, of 4x4-in. mesh, which surrounds the vanes, D. These vanes are separate castings attached to the bottom end of a bell-shaped casting suspended from the base of the stack and set with about a 2-in. opening between them. In passing between the vanes the particles are further pulverized and by the time they leave the stack are harmless.

Another front-end arrangement for sub-bituminous coal burners is shown in Fig. 2, and has been used principally in locomotives burning coal from the Roundup district, Montana (C., M. & St. P. Ry.). The sparks do not pass through any screens or netting, the success of the device depending rather upon the delayed delivery of the solid particles, thus allowing them time to cool down. A roughened plate of ¼-in. steel A, is attached to the regular baffle plate at the front flue sheet. This, together with the table plate B fastened to a flange on the upper end of the exhaust pipe,

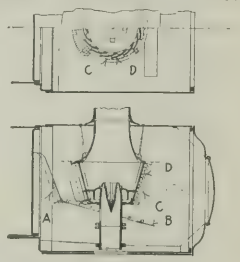


Fig. 1. American Locomotive Co.

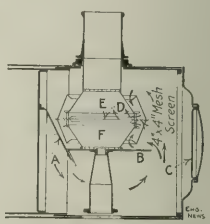


Fig. 2. Chicago, Milwaukee & St. Paul Ry.

Spark-Arresting Devices for Locomotives Burning Lignite

deflects the sparks and gases, causing them to pass to the front of the smoke-box. A liner plate C, attached to the front-end door serves as another deflecting plate.

The paths of the sparks and gases are indicated by the arrows. The top and bottom sides of the plate D, midway between the two petticoat pipes E and F, are faced with 4x4-in. mesh No. 8 netting, shaped as shown. Sparks in passing between the housing surrounding the petticoat pipes and entering the latter strike these screens and are broken up into smaller particles before being discharged.

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The Promotion of Traction-Engine competition has been undertaken by the American Society of Agricultural Engineers, which is now ready to furnish, during the year, technical assistance in the management of competitions of traction engines for general purposes. At the last annual meeting of the Society it was voted that a special committee should hold itself ready to assist, on request, in the technical management of such competitions during the coming season. This committee has been appointed and will discuss, with managers of fairs, expositions and apparatus shows, the technical aspects of such questions as where competition had best be held and what land, buildings, equipment and funds are necessary. Preparation of rules and regulations for the contest and supervision of testing and judging will be undertaken by the Society, but it will not undertake to record entries and make local arrangements. Inquiries should be made of the secretary of the Society, I. S. Dickerson, Urbana, Ill.

*From a paper to be read before the annual convention of the International Railway Fuel Association, at Chicago, May 21-24, 1913.

†U. S. Bureau of Mines, Pittsburgh, Pa.

EDITORIALS

The complacency with which some of us have assumed that America led the world in development of electric lighting, among other things, is rudely shattered by a recent editorial in a British contemporary* which tells us how crude our systems must be and how much more satisfactory are the systems over seas. It is of no avail that we consider the supply networks in our large cities on which voltage has not been off for years, or the sizzling potentials of our long transmission lines, our staggering production of lamps and machinery. All such considerations fail, for our systems have been convicted on the evidence of one of our own number. It seems that there has fallen into the hands of this contemporary a copy of an American technical journal published to further the interests of a group who feel that the large central station cannot compete in economy and satisfaction with a moderate-sized isolated plant. Possibly our transatlantic friends suffered a peculiar lapse and swallowed all the statements which they read without the proverbial and much needed grain of salt. Anyhow, bearing in mind the recognized tendency to concentrate the generation of electrical energy, our British cousin breaks out in a strain of pardonable pride, thus:

> We gather from the columns of this contemporary that central-station service, presumably in America, has not reached the same standard of reliability as now prevails throughout the length and breadth of the British Isles. . . .
>
> Presumably, both steam and hydraulic stations have been subject to somewhat serious interruptions, if we may take the word of our contemporary, and this fact has thrown discredit upon public electricity supply, while at the same time enhancing the claims which can be put forward on behalf of isolated plant. . . . .
>
> Whether or not it is a matter of temperament or natural ability, or even an indigenous aptitude for carrying out good work, we seem to have been able to establish a thoroughly reliable public electricity service, and one which we presume our American friends would like to possess. We do not say this in any boasting spirit. The result is doubtless due to that peculiarly British trait of thoroughness which evidently only comes of long experience.

We have heard that fine lawns, such as are found on a few estates in England, are to be secured only by centuries of continued rolling, but when it comes to building power plants we have cherished an idea that our experience dated back as far as anybody's.

The First Large Freight Yard to Be Operated by Electricity

One of the most difficult problems in connection with railway electrification is the electric operation of switching yards for freight service. Where the third-rail system of operation is employed, it will be conceded, probably, that operation of a freight yard by electric power is out of the question. The work of yard men is dangerous enough at the present time; and if we were to add to present dangers the necessity of keeping clear of a labyrinth of highly charged third rails, extending all over the labyrinth of tracks, it may well be expected that the result in casualties would shortly result in a public outcry and consequent legislation compelling the abandonment of the system. All this is aside from difficulties in connection with the interruption of the third rail in passing switches, which would always leave chances of a train coming to a standstill when the locomotive was not in touch with its current supply.

With the high-tension overhead system of electric distribution, however, such as is now in use on the New York, New Haven & Hartford R.R. from New York to New Haven, it becomes possible to equip a freight yard for electric operation by suspending a network of electric conductors overhead. This has now been done for the New Haven Ry. at its Harlem River freight terminal in the northern part of New York City. This terminal covers an area of 200 or 300 acres and its tracks have a total extent of 86 miles.

The steel towers which support the overhead network are spaced about 300 ft. apart longitudinally. Cables from the tops of these towers span 8 to 10 tracks and support at each track a single line of 7/8-in. steel cable. This cable carries a copper conductor and below it is the steel conductor wire against which the pantograph on the electric locomotive makes contact. Steel deflectors are used at the switches to give a smooth and continuous contact with the pantograph. The standard position of the contact wire is 22½ ft. above the top of the rail which gives a clearance of about 2 ft. over the head of the average brakeman standing on top of the cars. While this is rather closer to a high-tension electric conductor than is exactly pleasant, it is stated that among the 500 men employed in the yards since electric operation began, no casualties from electric shock have resulted. At present there are seven electric switching locomotives working in the yards and as many steam locomotives. It is expected that within six months additional electric locomotives will be put in service so that the entire yard will be operated by electricity.

Figures as to the cost of equipment of the yard for electric operation are not yet made public. We believe, however, in view of the past experience of the New Haven road with electric operation, that railway men in general will scrutinize very closely the operation of the Harlem yard before deciding to accept such a system for use elsewhere. It will, of course, be admitted that the elimination of smoke and escaping steam and the noise of the exhaust of switching locomotives is a great gain to the adjacent territory. It is stated that appartment houses are being erected in the district near the Harlem yards which has hitherto been considered unavailable for residence purposes. On the financial side, however, the case for electric operation is far from clear; and the financial side is one which no railway is overlooking in these days. Attention may well be directed not alone to the first cost of equipping a yard with the great labyrinth of towers, cables and contact wires, but to the cost of maintenance and depreciation of this overhead network. The probability seems strong that the life of this overhead network, exposed as it is to all the cor-

*London "Electrician," May 16, 1913.

rosive influences of the weather and accessible for repair and maintenance in the way of painting, etc., only with much expense and risk, will be a comparatively short term of years. This means, of course, that a high percentage must be assumed for depreciation in figuring total cost.

There seems to be no question also that a very much higher standard of track maintenance will have to be kept up with electric operation in order to keep the return track circuits in good condition. Railways have been accustomed to economize by using second-hand rails in yard track and expending very little work on track maintenance on long sidings over which no movements at high speed occur. Electric operation will mean that more money and probably a good deal more money will have to be spent on yard-track maintenance.

Reverting again to the question of danger, it is said that the overhead network is arranged in independent section. By throwing a switch, the current supply can be cut off from any unit section so that repairs to the overhead network can be made with safety. This is, of course, a necessary feature and will give no trouble if the repairs to be carried out involve something which can be done in a short time. If and when, however, repairs become necessary which will involve a day or several days to accomplish, the interruption to the business of a crowded yard might be a very serious matter. It will be worth investigation also as to whether the electric operating results in greater damage to cars and to lading than the operation with steam locomotives. With steam or compressed air it is easy to graduate the applied force. With electric power, however, the general tendency is to start up with a jerk.

Besides the large Harlem yard, the New Haven has also electrified its freight yards at New Rochelle, Mount Vernon, Woodlawn and Stamford and intends to transform its other freight yards all the way to New Haven. The results of its experience, financial and otherwise, in this new departure will be watched with critical interest by railway officials the country over.

Municipal Participation in Railway-Terminal Projects at Chicago

The railway-terminal problem in Chicago has entered a new phase of development, which seems to promise the review of present and future plans by an independent body which will consider them from the point of view of the city as well as that of the railways. This is a very desirable step in view of the importance of proper relations between the location and arrangement of railway terminals, the systematic development of municipal improvements, and the convenience of the traveling public.

This situation has developed as the result of an application to the city for the necessary authority to rebuild the present Union Station at approximately the existing location but on a much larger site, which proposed reconstruction includes also a revision of the adjacent freight terminals. This station is owned by the Pennsylvania R.R. Co. and is used by four railways. It lies on the west bank of the Chicago River and (including the station yard) extends from Jackson Boulevard to Madison St. (a distance of three blocks). When the railway company's plans for reconstruction were submitted to the city authorities, with request for an ordinance for certain closing and changing of streets, opposition was at once evident, and there has been a growing agitation against the approval of these plans. The opposition comes from various sources, some interested and others disinterested. Among the main points are that the design does not give sufficient consideration to the municipal aspect of the work, that the new plan would perpetuate the present undesirable feature of a line of railway property blocking the westward growth of the business portion of the city, and that it would perpetuate the present unsystematic arrangement of terminals and passenger stations.

As might be expected, the opposition is not united as to the proper action to be taken. One group of opponents declares that the new station should be located at 12th st., about a mile further south, in order to conform with certain plans for the city's development, to group all the railway-terminal stations, and to eliminate the present restriction to the city's growth. Another group considers that no such individual station should be built, but that all passenger and freight terminals should be combined in one vast station, in the neighborhood of 12th St.

At various public meetings, the discussion of the plan now proposed by the Pennsylvania R.R. has been taken up mainly by those interested either in the railways, in the various private or individual terminal projects, or in plans for the city's future improvement. From this presentation of these diverse interested views there has arisen the suggestion that no railway-terminal project should be approved by the city until it has been considered by a competent and disinterested commission that will consider it in its general relation to the city and the public. This is a very reasonable position, and it is to be hoped that such a method will be carried into effect, for however good the present plan of the railway company may be in itself, the fact remains that it has been prepared entirely in the interests of the railway company, and without regard to the railway situation as a whole.

The Board of Direction of the Western Society of Engineers has passed a resolution recommending that before the city grants an ordinance to any railway for changes in any of the present terminals (passenger or freight) a commission should be appointed, having special knowledge of the problems involved, to assist the city council in arriving at a proper decision. The Chicago Architects Business Association has passed a somewhat similar resolution, but recommending further that the commission should be composed of eminent engineers and architects who have no financial interest in or connection with any railway system.

The present railway-terminal system of Chicago is unsystematic in the extreme, and one of its worst features is that a great area of land in the heart of the city (which should be of high value) is occupied by freight tracks and freight sheds. The property cannot be developed, its undesirable character or occupation tends to lower the value of adjacent property, and by separating the central part of the city plan from its outlying districts it seriously hampers the proper growth and extension of the business district. Each railway has its own yards, sheds and other facilities, and there is no

attempt to harmonize or coördinate these facilities to promote the efficiency of the Chicago railways freight service as a whole. Some previous discussions of this matter will be found in our issues of May 9, 1912, and Feb. 27, 1913.

At the present time there are six passenger terminal stations in Chicago. Two of these are of modern construction, and the reconstruction of three others is under consideration. Each of the various plans for the several stations has been prepared entirely with a view to the requirements and ideas of the railways concerned in its use. The relation of each station to the municipal aspect of the matter has been practically ignored, as has been the question of relation to other terminal stations and railway systems. When the plans have been completed by the railways and their representatives, the city is simply asked to pass the necessary ordinances (for closing streets, etc.) and to issue the necessary construction permits. In addition to the railway plans for different stations, plans have been proposed by private parties at various times for the establishment of either one vast station for the use of all the railways, or else a group of adjacent stations each to be used by a certain group of railways. While these private plans present certain desirable and advantageous features, and include usually some consideration of the municipal side of the matter, they represent individual ideas only, and are likely to be open to objection from both the municipal and the railway sides of the question.

The city is by no means free from blame in the present situation. It has not attempted to impose its views or to make any representations in regard to plans which were known to be in preparation by the railways, although the advantages of coöperation should have been evident to the city authorities. And in the present case, it was only when the completed plans were submitted by the railway and objections were made to them by various parties, that the city authorities took any steps to consider the matter. The city has been delinquent also in failing to secure the provision of convenient local transportation routes serving the existing six stations. Between some of these stations there are no street-car routes whatever, although the city exercises control over the street-railway companies and could have long ago required the construction and operation of street-car lines on such routes.

This situation is paralleled in the Pennsylvania station in New York City, which, although projected in its present form nine years ago and opened for service nearly three years ago, is still in a peculiarly isolated zone, as far as rapid transit is concerned. That it is situated on a new subway line authorized only this year to be in operation possibly by 1917 is a measure of the time lost by lack of coöperation and municipal initiative.

In view of the importance of the relations between the railways and the public, and between the railway and municipal facilities, it seems very desirable that the problems affecting the new Union Station at Chicago should be carefully considered by some disinterested and expert authority before any plan is finally authorized. Such a commission would receive and weigh the various arguments presented, and should be able to arrive at some conclusion which would equitably adjust the matter with due regard to the city, the public and the railways.

What Is the Matter with Irrigation?

As those of our readers familiar with the conditions of engineering work in the far West are only too well aware, irrigation enterprises are, comparatively speaking, at a standstill. This is not because of lack of opportunity. There are still plenty of places where, by the construction of reservoirs that could store the spring floods, land which is now worthless desert could be converted into fertile and profitable fields.

But when the enthusiast who sees the possibilities of such a situation goes to a banking house in the East and asks it to finance the work, he is met with a reception compared to which a journey of polar exploration would be tropical. It will not do to blame the banker for this, because he knows by experience that irrigation bonds are today practically unsalable. Not a few banking houses have suffered in purse and in reputation because of the irrigation enterprises which they have financed in the past. It is worth while asking, therefore, why irrigation is unprofitable. It is true that many irrigation projects have been run by irresponsible men who have sought merely to sell stocks and bonds with little care whether the purchasers ever received any return or not. This, however, is only a part of the explanation why irrigation securities are shunned by investors. Wild-cat mining stocks innumerable have been sold in all parts of the country; but a valuable mine or valuable mining stock is not thereby rendered impossible of sale.

The trouble with irrigation enterprises is that even when they have been honestly and intelligently financed and managed, the final result has usually been either a loss to the investors or a return too small on the whole to pay for the risk and trouble. There are, of course, a few notable exceptions to this general rule. We are speaking in a large way now, and dealing not with particular enterprises but with the general run of well managed irrigation projects under private enterprise.

It is important to inquire the reason why there has been such general disappointment in the final outcome of irrigation work. According to information from reliable sources, the reasons why irrigation projects have so generally failed may be stated about as follows: There are enormous areas of arid land in the West which in their original state can produce nothing, but which with irrigation water properly applied can produce such crops that the lands will be worth $100 to $200 per acre, and in exceptional cases even more. The cost of building dams, storage reservoirs and canals to bring the water to such lands may be taken as averaging in the neighborhood of $50 per acre. As the final value of the land will be two or three times what it will cost to bring the water to it, there is apparently a very large margin of profit.

If it were possible for the irrigation financier to apply the water to the land, and then sell it all off to solvent purchasers at $100 per acre or more, his prospective large profit would be realized. There is, however, one essential element in irrigation development which many shrewd capitalists who have undertaken irrigation work in the past twenty years have overlooked, and that element is the character of the purchasers of the irrigated lands.

There are no doubt several millions of people resident in towns and cities who would be very glad to try the experiment of settling on an irrigated farm and enjoying all

the delights so picturesquely set forth by the glowing prospectus writers, but a very small percentage of these people have the ready money to buy an irrigated farm at $100 an acre, and an equally small percentage would know how to profitably work such a farm if they had it.

The present situation is that the supply of irrigated land offered for sale has far outrun the supply of intelligent farmers who desire and are able to purchase such lands, live upon, and work them. In British India the irrigation works undertaken by the Government have been uniformly successful and have invariably returned a handsome margin of profit on the cost of the work; but British India is swarming with peasants who ask nothing better than the privilege of living upon and working land which yields them a bare subsistence. There is the greatest possible contrast between the irrigator of British India and the Americans in the far West whom promoters of irrigation projects desire to place on the land.

A very large proportion of land buyers in the West have made money by land speculation. If the manager of an irrigation project can persuade land speculators to buy up lands at $100 an acre on the ground that they are likely to be worth $150 to $250 in the course of two or three years, he is a lucky fellow. In fact, we are informed that where irrigation enterprises have turned out profitably to their promoters and investors, it has generally been because those in charge were shrewd enough to sell out at a sure profit rather than hold onto the land and wait for a rise.

We should not be understood, however, as stating that there are no substantial intelligent farmers living on irrigated land in the West. On the contrary, there are a very great number of them; but it requires large inducements to persuade enough of these men to move into a new country to fill up at once a large irrigation project.

The development of an irrigation project is similar in many respects to the development of a tract of suburban land. Many an investor has learned by dear experience that it is impossible to quickly build up a suburban tract of large size and sell all the land at a large profit to *bona fide* home builders.

On the face of things there seems to be an enormous profit between the cost of a large tract bought by the acre and the price of the same land when cut up into building lots and sold to home buyers; but if the development is to come naturally, it will be found that instead of selling off all the lots in two or three years, it may be a matter of ten or twenty years or more before even two-thirds of the lots can be sold to home seekers. During all this time, interest on the investment is piling up and so are assessments for various street improvements, and the profit of the suburban land developer not infrequently turns out to be a minus quantity.

Conditions very similar operate to cut down the profits of an irrigation enterprise. In the first place if the works for water storage and distribution are of magnitude, two or three years of more may be required for their construction and during all this time interest charges are accumulating. The rate of interest on irrigation securities when they can be floated at all is seldom less than 6%; and when commissions to the bankers, etc., are deducted, the actual rate of interest paid is often 7% or more.

With the works completed, the next problim is to put the land under irrigation. Of the buyers of the land, only a small percentage are able to pay for their lands in cash. Even those who have capital have to expend it in buildings, in farm machinery, in the purchase of stock and in preparing the land for irrigation. A considerable part of the settlers will prove failures through shiftlessness, intemperance, ignorance, etc. Meanwhile the whole irrigation plant must be operated and maintained at heavy annual expense. Thus it has very often resulted, even with an irrigation enterprise honestly built and financed, that for two or three years after its completion it was a case of a good deal of money going out and little coming in. A graphic picture of the course of events on many irrigation projects is given in the following, furnished to us by an engineer thoroughly posted in irrigation development:

> An irrigation system depends for its success upon hundreds of individual farmers who cannot be controlled and organized as are laborers employed in the factory. Each farmer must learn individually, sometimes through years of experience and frequent failure, how to successfully subdue and cultivate the ground.
>
> The lands may be sold immediately after the system is built as the result of attractive advertising; but relatively few of the persons who obtained farms will be experienced farmers. Thousands of acres may be provided with water, but at the end of the first year, it will be found that a very small percentage has actually been properly leveled and prepared for cultivation of crops. Many of the farmers have made mistakes and comparatively few can show much return for their work.
>
> The next year a little larger area is in cultivation and so on. Then there comes a good year with abundant crops, which glut the market so that the farmer gets small return. So it goes, with ups and downs, year after year. On the whole there is progress, but in the meantime, the farmers have not been able to keep up their payments. Interest has been defaulted; the bondholders have been forced to take the property, reorganize and start over again, the first investors usually losing all they have put in.

Nor are these the only difficulties which the promoter and manager of an irrigation enterprise must face. A good many engineers are of the opinion that it is easier to tackle all the engineering problems in building an irrigation works than it is to solve the human problem of managing the works after they are completed and keeping peace and harmony between the various water users.

Where an irrigation plant is permanently operated by a private corporation, there is apt to grow up antagonism of the water users toward the company. Such antagonism toward corporations operating public utilities is a notable feature everywhere; but nowhere is it more injurious and dangerous to public welfare than in the case of irrigation companies. The welfare and very existence of the whole community is dependent on the supply of water available for irrigation. The whole community is endangered if the company which administers this supply becomes bankrupt so that it cannot properly maintain and operate its plant.

Because of this very general antagonism between the farmers and the corporation which controls the supply of water to their lands, the plan of having the farmers themselves own and manage the irrigation works on which they depend has been generally favored and is probably, on the whole, the best plan of control. Nevertheless, these water users' associations also have their troubles. Personal jealousies and feuds and local politics too often result in incompetent men being placed in control of the works; maintenance may be neglected and

favoritism in the distribution of water may lead to litigation and loss.

Turning now to the reclamation of arid land by the Federal government, through the U. S. Reclamation Service, it will be apparent that while this work is free from the financial difficulties that hamper work carried on under private enterprise, it has the same sort of difficulties to contend with with respect to securing the settlement on the reclaimed lands of the right sort of successful farmers.

The Reclamation engineers have made good by building works on the various projects which are on the whole admitted, even by their critics, to be well designed and well executed. The financial returns from the sale of the reclaimed lands to settlers, however, have fallen far below the amounts which would have been received by this time if the original plan had been successfully carried out.

The reasons why the settlers have in many cases failed to pay the installments on their lands as they became due are substantially the same as those which have caused disaster to many private irrigation companies, as related above. The government, however, is even more handicapped in the disposal of its land than is the irrigation corporation. Lands under a government Reclamation project must be sold, under the law, to whoever applies for them at a price fixed to cover the actual cost of supplying water. The sum is payable in yearly installments and no cash down is required. Under these conditions a large portion of the purchasers of lands on Reclamation projects have been land speculators rather than *bona fide* settlers and farmers. They have exercised their right to purchase under the law on the chance that they might dispose of their right to the land to someone else at a profit before payments became due.

According to our information, a large portion of the land to which water is supplied on the Federal Reclamation projects is not under cultivation because those who hold title to it have not actually settled upon it and gone to farming. Another large proportion of settlers who are living upon the land lack the capital or the ability to successfully work their holdings. The result in either case is that payment of the annual installments to the Government is not made when they come due. Further, many settlers of this class even when able to pay have refrained from payment in the hope that Congress might pass legislation which would give them further time for payment. The example of such land owners, of course, has its influence on the other class of settlers who are successfully working their lands. They, too, delay payments in the hope that something will result to their advantage.

Notwithstanding these drawbacks, there are many settlers who have paid the installments on their lands as they came due and a large amount has already returned to the treasury from the completed irrigation works and is available, according to the original plan, for investment in new works. If it once becomes definitely known that Congress will not alter the terms of payment originally fixed, there will doubtless be great acceleration in the payment for water rights on the Federal works.

It is of interest to contrast the difficulties above set forth with the sale and settlement of irrigated lands in the United States and the methods which are being pursued by the Canadian Pacific Ry. Co. in placing settlers upon its lands in the Canadian Northwest. The far-sighted managers of the Canadian Pacific know that the prosperity of the great network of railway lines in the fertile new empire now being created in western Canada depends upon the character of the people who are brought to settle upon the tributary lands. The company received by land grant from the Dominion enormous areas of land, much of which it has held up to the present time instead of selling it at the nominal prices at which all public lands were held throughout the West twenty-five or more years ago.

To make many of these tracts located in the arid regions cultivable, the railway company has engaged in irrigation work on a large scale; but instead of selling these lands to whoever may come, the railway company has adopted the policy of carefully selecting its settlers and future patrons. Agents of the company travel through eastern Canada and the eastern United States and select in country towns young farmers who have a good reputation for honesty, energy and success in farming. After thoroughly investigating such men, the company makes them a liberal offer to move to lands in the Canadian Northwest. We understand that to such men the entire capital necessary to make a start is furnished. The company erects farm buildings, breaks up the land and puts in a first crop so that the farmer from Ontario or New England when he moves to his new home and goes to farming has the great advantage of a complete going farm plant without undergoing for years the struggles and hardships of the pioneer life. He pays for his farm and home and stock year by year as he earns profits.

By thus carefully selecting its settlers, the company insures not only financial success for them and for itself, but good social conditions in the new towns and communities it is creating. The emigrant moving to the territory knows that his life and property will be safe in his far-away new home.

Of course it takes a very large amount of capital to finance land development in this way, but the capital is invested in a manner which makes the return upon it practically secure.

It is of interest also to refer to the progress in irrigation which is being made in British India. A recent Indian bluebook gives the statistics of this development as follows:

In British India the government has built and now operates some 59,000 miles of main and branch irrigation canals. These supply water to over 48,500,000 acres of cultivable land. The net earnings of the Government last year from the irrigation works which are classed as "productive" (in distinction from protective works such as levees, etc.), is given as 8.81% on the total capital outlay, which up to the present time is in the neighborhood of $175,000,000. This total outlay, however, includes works which are still under construction and not yet completed, so that they are not yet yielding revenue. If the completed works alone are taken, the average earnings last year on the capital invested were 10.27 per cent.

Additional irrigation works are under examination by the Indian government, designed to furnish water to nearly 30,000,000 acres of land additional, at a total capital outlay of about $200,000,000, on which the estimated annual earnings are over 7 per cent.

The tendency is, of course, to blame the engineer for

the disappointing financial results of recent irrigation enterprise in the United States. The above review, however, should convince any intelligent person that it is not necessary to assume any defective work by the engineers responsible for the design and construction of American irrigation works to account for the slough in which irrigation finance has landed.

There is no reason to believe that the reservoirs and canals built by the U. S. Reclamation Service or by the reputable irrigation companies are not the equal of similar works in Canada or in India. In Canada, however, as shown above, it has been deemed as necessary to invest capital in establishing desirable settlers upon the land as to build the works necessary to supply it with water. In British India the irrigation engineer has the advantage of very low-priced labor; and a swarming population is ready to utilize every foot of irrigated land as fast as the water can be supplied to it.

It is needless to say that we cannot and would not if we could, duplicate in this country the conditions of overpopulation and pressure for subsistence that aid the irrigation engineer in British India to show such large financial returns from his enterprise.

What we should do is to recognize in either private or Government irrigation work that the sale of land to *bona fide* successful farmers is as necessary to the financial success of irrigation work as the storage and distribution of the water itself, and that properly directed expenditure to that end should be considered a necessary part of the cost of irrigation work.

LETTERS TO THE EDITOR

Flange Width in T-Beams on Tile and Concrete

Sir—Answering the inquiry as to the proper flange width to be assumed for tile and concrete T-beams, made by Ernest McCullough in ENGINEERING NEWS, May 22, 1913, p. 1078, information will be found on p. 110 of the *Proceedings* of the 29th Convention of the Indiana Engineering Society, 1909, where the writer presented tests of hollow-tile reinforced-concrete floor sections.

Table I, reproduced herewith, shows the shear values

RELATIVE STRENGTH IN SHEAR OF HOLLOW TILE REINFORCED-CONCRETE BEAMS

Series	No.	Reinforcement	Max. shear (Lb per sq in.)	Ratio	Failure
A	(1)	Plain	295	53	Shear
	(2)	Bent rods	430	77	Shear
	(3)	Bent rods and stirrups	560	100	Shear
B	(1)	Plain	269	74	Shear
	(2)	Bent rods	303	84	Shear
	(3)	Bent rods and stirrups	360	100	Shear
C	(1A)	Plain with tile	232	100	Shear
	(2A)	Plain with tile	194		Shear
	(1B)	Plain without tile	144	66	Shear
	(2B)	Plain without tile	145		Shear

obtained. The beams comprised one rib with one-half a tile on each side and 2½ in. of concrete on top. The tile varied from 6 to 12 in. in depth. The full data of the tests will be found on p. 110 in the article cited.

W. K. HATT.

Purdue University, Lafayette, Ind.
May 26, 1913.

The Richmond, Va., Bridge Competition

Sir—I wish to express my approval of your criticism in ENGINEERING NEWS of May 29, 1913, p. 1131, of the manner in which the competitive plans for the proposed bridge and viaduct approaches for Richmond, Va., has been conducted.

Seeing notice that competitive plans would be received until Apr. 15, I wrote to the City Engineer in the early part of February for information and profile of location. I received within a few days blueprint of profile and requirements of the Administrative Board governing the filing of designs and plans. I immediately went to work on a design, giving considerable thought to whether it would be best to submit a design with the cost of construction as low as possible, or something ornamental.

After I had plans worked out and almost ready to submit I had occasion to talk with a prominent engineer who had entered such competitions before and he gave such good reasons for not entering the competition I dropped the matter without further work.

I believe a code, possibly similar to the one formulated by the American Institute of Architects, would be of much good if it is necessary to have competitive designs. I am somewhat doubtful of any real good being derived from such designs, or at least I cannot see where it justifies so large an expenditure. If it costs the engineering profession 4% of the estimated cost of a structure to get up competitive designs and it only receives 0.4% compensation, who pays the difference? If it is advantageous to have competitive designs on one structure, why not on all?

JOHN R. BAYLIS.

Birmingham, Ala., May 31, 1913.

One Way to Buy Professional Service

Sir—Congratulations are extended the Engineering profession on the possession of a friend, who offers to its members an opportunity set forth in the following recent advertisement:

COMPETENT SURVEYOR during June (may be college professor, including assistants from graduating class), to survey and plot a tract of 250 acres into building sites, in exchange for board of family and assistants, at first-class summer inn on mountain; 2000 ft. elevation; 100 miles from New York City; charming summer colony. P. O. 911, Eng. News.

There are some in the ranks, who will be presumptuous enough to think that even an inferior surveyor is worth more than his board, even though it be on a mountain top.

CONSTANT READER.

Bradford, Penn., May 26, 1913.

[That is one way to look at it. Another way is to figure

out what the board bill would be per month for a family of nine children at prevailing summer hotel prices. And who knows what unattached heiresses there may be as attractions for the graduates in that "charming summer colony"!—Ed.]

Technically Trained Judges to Decide Patent Cases

Sir—I note an excellent article in your issue of May 8 (p. 958), by Mr. Gilbert H. Montague, entitled, "Some Radical Reforms in the Conduct of Patent Litigation." The present writer, however, believes the real root of the inefficiency of our courts on technical questions has not been brought out in the discussion.

Our Federal judges are men of the highest character and acumen. Their absolute fairness, integrity and honesty is not open to a shadow of suspicion. Modern progress, however, is based, not on the general learning of any particular class of men, but rather on special knowledge fitting a certain class of men to perform with marvelous efficiency and rapidity some special service for the community. The training required to achieve this is the result of lifelong study and practice in this special field.

Let us consider the fitness of the ordinary Federal judge to try highly complicated causes: He is not an expert mathematician, nor is he familiar with mechanical principles, to say nothing of purely technical matters. He would probably be equally unable to appreciate the difference between a staging jack, a mover's jack, a hydraulic jack and a ratchet jack. In other words, the judge, a master in logic and learned in law, is inefficient in his grasp of technical matters because he has not been trained in this line.

In this connection I may quote the remarkable decision rendered in the Circuit Court of the United States for the Eastern District of Texas, Beaumont. Equity case No. 152, and Equity case No. 153, Horace G. Johnston, et al, vs. Southern Wells Works Co. et al:

> The Court: In each of these cases I render judgment for the defendants. I entertain very grave doubt about what ought to be done in the matter, but I must decide the cases at this term of the Court. They involve some questions about machinery, and I have felt inefficient in the matter. I am sorry that I did not know before I tried the cases that I could summon a jury of skilled mechanics, the law providing for not more than seven and not less than five to decide the issues of fact, but I did not know of this provision of the law until the cases were argued and counsel had left, and I did not discover until they were gone and the trial over that I could avail myself of that source of light. There was nothing then left to be done except to take the briefs and come to the best understanding I could.

Why should we not have specialization along judicial lines? Why should we not have a class of judges who are trained experts to decide technical questions, which in order to decide intelligently require special training along special lines? Indeed, is not our judicial system as far behind the present state of progress in this particular as were the Dark Ages when decision by combat was prescribed or permitted?

Let us consider the *modus operandi* of the trial of an ordinary case of patent litigation, whether under the new rules or the old rules. The case involves special questions of a technical nature. In order to present it properly to the judge, the attorney must, with experts, lay the foundation in his testimony for the production of a brief which will be so comprehensive as to be in fact a treatise covering all of the elementary fundamental principles of mechanics, trade terms, and methods of operation that are involved in the point at issue. This means, frequently, that a case which could be ready for argument with six hours' work, before a judge who is a trained technical expert, will require three to four months' hard work on the part of the attorney, with testimony to the extent of three to four thousand pages, before these points can be properly brought out and the judge given even an imperfect and flimsy substitute for the solid technical training which he should have had in order to fit him to render a fairly intelligent judgment on the case in hand.

Such a condition of affairs is very lucrative to the legal profession, for at the rate of $50 per day to an attorney for preparing an inferior substitute for the technical training of an honest, painstaking judge, he is able to charge his client from five to ten thousand dollars in well earned fees, thus rendering litigation even of the simplest matter, an enormous burden upon the poor but meritorious inventor.

Is it not also a most flagrant and unwarranted imposition upon honest, painstaking, conscientious men, such as the judges of our Federal Courts, to require them to assume the burden of attempting to master the rudiments of the technique, in one case of textile machinery, in another of strains and stresses, in a third of hydraulics, in a fourth of the mechanics of flight, in the fifth of the chemistry of dye stuffs, etc.? It is time that some steps were taken toward reform in the organization of the judiciary to which patent litigation is intrusted.

This suggestion is not made as a carping critic, merely to find fault with the remarkably good work performed by the judges, but from the standpoint of fair play to the judges themselves and with the hope of reducing the cost of such litigation by placing it in charge of such judges as are fitted for their task by technical training, and do not have to be specially educated for each and every case they try, by the slow, tedious, wasteful process of having the attorney get up a digested summary of the principles involved and set forth, the entire literature of each art to which the case under litigation belongs.

It is too much to expect that our Federal judges shall be competent to decide questions involving all the arts, all the sciences and all the trades of the twentieth century. It leads to bad decisions. Why should not a wealthy government like ours employ experts to decide such cases, as has been done and is done by other countries inferior to ours in technical achievement?

These are questions which it seems to me are of vital interest to the engineering profession as a whole, and the free and energetic expression of opinion by the civil engineer, the mechanical engineer, the electrical engineer, the chemist, the metallurgist, and the manufacturer alike, is all that is required in order to bring about a much-needed reform.

We have been accustomed since our boyhood days to see Justice represented as a blindfolded figure holding the scales. Under the new rules, would not our technical justice be equally well represented without the bandage? For with judges who know nothing of machinery set to decide patent causes involving machinery and required to decide these cases expeditiously, or "while you

wait," with judges knowing nothing of chemistry required to decide chemical questions offhand, is not justice blind enough without any bandage over her eyes? Under present conditions would not Justice be better represented by the elusive goddess Fortuna, with the folds of her garments draping a wheel of fortune, a royal flush or a dice and box.

C. A. P. Turner.

Phoenix Building, Minneapolis, May 15, 1913.

NOTES FROM THE ENGINEERING SCHOOLS

University of Michigan—The first annual exhibit of the Engineering Department was given in the buildings of the department May 15 and 16. This exhibit was prepared entirely by students, with suggestions in some cases by members of the faculty. Work done in the departments of civil, electrical, mechanical and chemical engineering and also in forestry and architecture was displayed. The laboratories of the department were kept open with machinery running and experiments of general and popular interest were performed. Many attractive models were prepared which illustrated various engineering problems. The exhibit was widely advertised and it attracted many people from the city and state, the total attendance for the two days exceeding 10,000. The exhibit was generally pronounced a success, and those in charge believe that it gave the people of the state a clearer understanding of the work being done in the engineering department.

One of the most interesting features was a model irrigation and power development, shown in the accompanying figure, as made by students in hydraulic engineering. The model was made of earth on a wood frame 8x12 ft.; there was a difference of 4 ft. in elevation between highest and lowest points. Water was supplied through a $^3/_4$-in. hose and carried off by a small drain at the lower end.

Johns Hopkins University—The establishment of a Department of Engineering has been made possible by appropriations of the state of Maryland (special funds for buildings and equipment, and continuing annual sums for maintenance). Postgraduate and undergraduate courses in civil, mechanical and electrical engineering have been arranged, professors have been appointed and plans for buildings and equipment are under way. Up to this time there has been no such distinct department though courses in physics, applied electricity, chemistry, bacteriology and public hygiene, economic geology geological surveying, etc., have always been maintained to present recent advances in science and their industrial applications.



A Model Irrigation and Power-Development Project

A, mountain; B, crater lake; C, canon; D, supply canal; E, reservoir; F, arch dam; G, penstocks; H, roads; I, power house; J, river; K, main distributing canal; L, flume; M, power-transmission line; N, check irrigation; O, lateral ditches; P, furrow irrigation; Q, village; R, flood irrigation.

The undergraduate courses are to be of four years' duration and will combine the usual fundamental and cultural subjects with professional studies. English, mathematics, physics, French or German, and mechanical drawing will occupy most of the first year and, with chemistry, will run through the second year. During the last two years the more specialized studies will be supplemented by political economy, philosophy, advanced chemistry and mathematics, biology, etc. In addition to the familiar methods of instruction, it is planned to

make more prominent the study of existing engineering works.

Those who wish to enter these courses must first present evidence of a satisfactory knowledge of mathematics, English, history, French or German, Latin or physics, chemistry or biology, or mechanical drawing. Entrance examinations are required in addition. Each applicant is expected also to furnish a certificate showing completion of a standard high-school course. Applicants who satisfy the regular requirements for admission to undergraduate academic courses of the University will be admitted to the engineering courses.

Under the conditions of the legislative act making possible this departure, one or more scholarships, carrying exemption from tuition and fees, are apportioned to the several counties of the state in proportion to the number of legislative delegates therein. There also are scholarships for each legislative district of Baltimore. Six scholarships "at large" have been established. One scholarship for each such county and legislative district also carries $200 for board and lodging. These scholarships are to be awarded only to those "whose means are such that they are unable to procure a technical education" otherwise.

Electric-Traction Plans of the Norfolk & Western Ry.

The substitution of electric traction for steam on the Bluefield-Vivian (W. Va.) section of the Norfolk & Western Ry., as announced in ENGINEERING NEWS, May 8, 1913, has been further explained by the road's consulting engineers, Gibbs and Hill, of New York City.

The electrified section constitutes practically a separate gathering division for the coal traffic from the Pocahontas region and comprises about thirty route miles or about eighty-five track miles; the division is double-tracked throughout except in the Elkhorn Tunnel, which is single-tracked and with a large amount of third or passing siding track and branches into the coal workings. The grades on the line are heavy, being from 1.5 to 2% eastbound to and through the summit tunnel, a distance of about ten miles, thence the grade falls for about a mile and then rises again at the ruling rate of about 0.4% for approximately 12 miles to the east end of the division at Bluefield. The heavy coal business originates west of the summit and is in large part hauled eastward over the grades above noted. The coal trains originating on the division are filled out generally to a weight of 3250 tons from the various workings along the line and hauled over the grades at a speed of about 7.5 mi. per hr. by three Mallet engines, one at the head end of the train and two pushing. The Mallet engine equipment is used locally on the division in question and under electric operation these engines will be displaced by electric engines, allowing the Mallets to be used on the other regular divisions of the road.

At present the electric service will not touch merchandise freight or passenger traffic, being confined to "tonnage trains" originating on the electrified section. These will be operated by electric head engines and pushers at a speed of about 13 mi. per hr. on the heaviest grade. The number of trains handled up the grade will be about 20 per day, comprising a daily tonnage of 65,000, but the design of electrical equipment will be such that this tonnage can be progressively increased in the future as the occasion requires.

An overhead electrical conductor will be used to convey current to the trains, the local conditions precluding the use of a third rail alongside the tracks. The traction current has not yet been decided upon and plans and estimates are being made for the use of either alternating- or direct-current locomotives according to which design proves most adaptable to the service and cheapest in first and operating costs. Electric power will be generated in a steam power house to be erected by the company at Bluestone, which is on the line of the railway about one-third the way from Bluefield to Vivian; this power house will have an installed capacity at present of 24,000 kw. All work is to be completed for service in the summer of 1914.

The local conditions are considered especially favorable for electric haulage, the traffic is dense and of heavy train units operating at fairly uniform intervals over a section of the main line which is practically a separate engine division at present and can be electrically worked in the same way without increasing the cost of engine service on the other sections of the line. Electric power can be generated at an unusually low cost since excellent coal is obtainable at the point of origin; other conditions, conducive to high economy with electric traction, are (1) a train service such that a minimum of electrical equipment can perform the haulage in practically continuous service, (2) fewer engine crews per train than with steam, and (3) the higher speed of operation over the division which will be nearly double that possible with present steam equipment. Delays due to taking water, coal, etc., in steam operation will also be eliminated and the reliability of locomotive operation will be increased under certain conditions of weather. These conditions result in reduced operating cost and allow a large increase in capacity of the line at times of congestion and in the future; this is especially important even at the present time in the Elkhorn Tunnel, which is single track and in which, because of ventilating conditions, steam locomotives limit the speed.

Annual Convention of the National Electric Light Association

The 36th convention was held at the Medinah Temple, Chicago, June 3 to 6, and as usual there were both general and section meetings, the latter including the technical and hydro-electric, commercial and accounting sections. In this way as many as three meetings were held simultaneously. To provide for this, a large tent had been erected at the rear of the building to accommodate some of the section meetings. A fairly large exhibit of electrical apparatus was arranged in the basement. While the attendance was large, many of the meetings were of comparatively small interest owing to the lack of discussion. It is true that the list of papers did not include much of special novelty or importance, but it seemed surprising that so many engineers and others connected with the electrical industry could remain silent and inert, allowing papers and reports to pass in succession without a word of comment or criticism or any expression of personal experience or opinion. The president's address foreshadowed some changes in the management of the conventions for the future, as they are likely to become unwieldy under present arrangements.

At the opening meeting an address of welcome on behalf of the city was made by L. E. McGann, Commissioner of Public Works. The presidential address by Frank M. Tait (Dayton, O.) reviewed some of the work of the Association, and suggested that plans be considered for increasing its revenue. He suggested also that the technical and the hydro-electric and power-transmission sections should be combined and developed as an auxiliary section or association, presumably in much the same way as the auxiliary associations of the American Electric Railway Association. In regard to the losses suffered by electric-light and power companies during the recent floods, he thought it would be of interest to see what attitude will be taken by public service commissions as to the financial requirements of companies which have to practically rebuild their plants. The income from ordinary rates is not sufficient to provide for such great expenditures, and he thought the companies should be allowed to charge these expenses to capital account. This address was referred to a committee to consider its suggestions.

The report of the Committee on Organization showed a present membership of 12,442. The report of the Secretary (T. C. Martin) showed that the annual expenditures include about $50,000 for publication and $20,000 for convention expenses, leaving only about $30,000 for headquarters expenses and general work. Among its various publications the association has issued no less than 85,000 copies of its pamphlet on "Resuscitation from Shock," besides which large editions have been issued by individual companies. The Pennsylvania R.R., for instance, printed 20,000 copies for distribution among its employees. Mr. Martin presented also (by title) his annual report as chairman of the Committee on Progress, reviewing the developments in various lines of electrical work during the past year. This was in two parts, one being general and the other relating particularly to technical developments. The report of the Insurance Expert (W. H. Blood) stated that reductions in insurance rates are progressing, owing in part to the improved record from the lighting companies in regard to fire losses, while the insurance companies are making fewer claims for "faulty wiring" as the cause of fires.

A paper by Paul Lupke (Trenton, N. J.) is a regular feature of the conventions, and this year his paper, entitled "Anticipation," dealt with the education and training of beginners for and in the electrical industry. A brief report as to the work of conducting the "Question Box" department was read by S. A. Sewall, Assistant Secretary. All the above matters were disposed of at the first session.

The election of officers was held at the closing session; and under an amendment to the constitution this provided for four vice-presidents instead of two. The President is Joseph B. McCall, President of the Philadelphia Electric Co.; and T. C. Martin (New York) was reëlected Secretary.

Lamps

The striking feature in the incandescent-lamp industry, as shown by the report of the Committee on Lamps, presented by Frank W. Smith (Boston), is the rapid decline of the carbon lamp and the rapid increase of the tungsten lamp. Of the total number of lamps sold in 1912, the tungsten, gem and carbon lamps represented 39.94, 33.59 and 25.47% respectively, with tantalum for the remaining 1%. In 1907, the figures were 0.10% for tungsten, 5.88% for gem, 93.27% for carbon and 0.75% for tantalum. As compared with 1911, the carbon lamp had declined 50% in one year. Norman Macbeth (N. Y. City) remarked that the tungsten lamps are usually of higher candlepower than the carbon lamps, so that if the comparison was on the basis of light output (instead of number) the tungsten lamps would represent probably 60 to 75% of the total.

A paper on "New Developments in Incandescent Lamps," by J. E. Randall (Cleveland), stated that the most striking development is the use of wire filament wound in a helical coil, which allows a great length of filament to be put into small compass without appreciable leakage between adjacent turns. This makes it possible to construct lamps to focus closely, as for street-car and automobile headlights, etc. Another improvement is the use of certain chemicals in the lamp bulb to prevent the formation of the black deposit which so generally reduces the effective life of lamps having large filaments.

A paper on "The Flame Carbon Arc Lamp," by W. A. Darrah (Pittsburgh), dealt mainly with the design and construction details, including the regulation to insure a steady light. In a paper on "The Relation of the Incandescent Lamp to Lighting Service," by M. D. Cooper and R. E. Campbell (Cleveland), attention was called to the voltage drop in the consumer's house or plant, resulting in unsatisfactory service, which is usually attributed to the central station company, although really the company is not responsible. The average interior drop is about two volts. The remedy is in proper voltage selection of incandescent lamps and electric heating and cooking appliances. In the discussion it was pointed out that architects should be more fully informed as to the conditions of proper wiring installations.

Electrical Measurements and Meters

The brief report of the Committee on Measurements was presented by Dr. Steinmetz, in the absence of Dr. Kennelly, chairman of the committee. It predicted the abandonment of the "horsepower" as an uncertain unit, and referred to the proposed adoption of the myriawatt as a unit of power. While this is not in itself preferable to the kilowatt as such a unit, it has the advantage of being a self-explanatory decimal multiple of the watt (10,000), while it happens to be very nearly the same as the "boiler horsepower." The British proposal to adopt the term "Kelvin" in place of "kilowatt-hour" was deprecated, since it is not a self-explanatory term, while the term "watt-hour" would still have to be retained as the unit.

The Committee on Meters submitted a lengthy report dealing with meters and metering. Question has been raised as to the accuracy of watt-hour meters in measuring rapidly fluctuating loads, such as flashing signs and welding machines, but the committee considers that there is no inaccuracy of the meter under such conditions. Three forms of demand meters were described, but Mr. Parker (Rochester, N. Y.) considered that more attention should have been given to this type of instrument, owing to its importance at this time and to the limitations of existing devices. F. C. Vaughen (Schenectady) agreed with this position, but explained the difficulties which the manufacturer encounters in producing an improved design.

Electrical Apparatus

The Committee on Electrical Apparatus reviewed a number of developments in apparatus for central-station work, and called attention to the tendency to higher speeds and larger units in rotative apparatus. Turbo-generators are now made as large as 25,000 kw. and with speeds running from 3600 r.p.m. for 5000 kw. units to 1500 r.p.m. for 20,000 kw. units, while in rotary converters the commutator speed for 60-cycle machines has been made higher than 5000 ft. per min. as compared with 3000 to 4000 ft. in 25-cycle machines. There is a tendency to use direct-coupled exciters on waterwheel generators, and even on turbo-generator units. This may be found desirable from economy and simplicity, but where only few generating units are installed other sources for reserve excitation are preferable. Progress has been made in the development of 60-cycle rotaries in sizes of 1000 kw. and over for use in large direct-current lighting systems. Attention is called also to a new

form of motor converter for the conversion of alternating to direct current, which is in general use abroad.

A paper on "Switchboard Instruments," by Paul MacGahan (Pittsburgh) dealt with alternating-current and direct-current indicating instruments, and one by E. G. Reed (Pittsburgh) dealt with "Development in Distributing Transformers." The recent improvements have been in the materials and methods of winding and insulating the coils, but further improvements are more likely to relate to the magnetic circuit than to the current-carrying circuit. The report of the Committee on Grounding Secondaries stated that the rules as revised provide that grounding is required in secondary circuits up to 150 volts and is optional for circuits of higher voltage. It was stated also that connecting secondary alternating-current systems to water pipes does not tend to cause electrolysis. A paper by A. S. Hibbard (New York) dealt with the use of telephone communication between the central station and various exchanges and other points as a means of adapting the facilities of the plant to the varying conditions of load. It described in detail the systems employed by the electric generating companies of New York and Chicago.

Lightning Arresters

The Committee on Electrical Apparatus referred to the material improvements in electrolytic arresters. Disconnecting switches are recommended for use with arresters of this type, and a combined fuse and disconnecting switch now being designed will be a material improvement over present apparatus. A short paper on "The Conditions of Lightning Protection" by E. E. F. Creighton (Schenectady, N. Y.), reviewed some of the different types of arresters and the difficulties encountered in affording protection. The conditions are much worse on the lines than at stations, and while transmission lines are inadequately protected, the development of apparatus for protection on the lines is not progressing as it should. A paper on "Developments in Protective Apparatus," by J. N. Mahoney (Pittsburgh) dealt with improvements in oil circuit-breakers, carbon circuit-breakers and lightning arresters which have been brought about by the high voltages, large capacities and great lengths of lines now becoming common. Arresters of the electrolytic type are now available up to 165,000 volts, which is the highest voltage adopted commercially.

Transmission and Line Construction

A paper on "Transmission Line Construction" by R. D. Coombs (New York), related mainly to pole and tower supports. It deprecated the tendency to make poles and towers of excessive strength to provide for carrying a large proportion of broken wires, when the attachments of these wires would not stand any considerable part of such a load. A paper by A. O. Austin (New York) discussed factors affecting reliability in the suspension type of insulator now so largely employed, while another by H. H. Rudd (Pittsburgh), discussed the design of transformers for transmission lines and suggested the standardizing of certain features. Dr. Steinmetz compared the direct-current and polyphase systems of transmission and indicated the marked superiority of the alternating current.

The report of the Committee on Underground Construction dealt with high-tension transmission cables and their installation. This was accompanied by specifications for cables. The report of the Committee on Distributing Lines pointed out that voltages as high as 100,000 or 150,000 are being used for transmission and that a number of distributing systems in rural districts operate at voltages as high as 22,000; this last is about the limit (except in the case of large consumers) owing to the high transformer cost. In the congested business centers of large cities direct-current can sometimes be used to advantage.

The report of the Joint Committee on Overhead Line Construction (which represents also the American Institute of Electrical Engineers, the American Electric Railway Association, the Association of Railway Telegraph Superintendents, and the American Railway Engineering Association) presented specifications for overhead crossings of electric-light and power lines. It suggested that specifications should be prepared for the construction of constant-potential lines of over 5000 volts, which are constructed parallel with or close to telephone and telegraph lines. A paper on "Poles and Pole Preservation," by R. A. Griffin (Chicago) referred to the increasing consumption of poles and recommended (1) the conservation of the forests; (2) the more economical use of the present supply of timber, and (3) the preservation treatment of poles. The open-tank system of treatment is effective if the oil is heated and then cooled (or the poles transferred to a tank of cold oil) so that the partial vacuum thus caused will assist in the penetration. This penetration will be much greater than by simply dipping or brushing the poles. The proportion of poles treated by the closed-retort system is relatively small.

Applications of Electricity

The papers and reports were by no means limited to the question of lighting, and one group of subjects related to the development of central-station business in supplying current for power for various purposes. A paper by E. P. Dillon (Pittsburgh) suggested the desirability of city and interurban electric railways as customers for central stations, and instanced the conditions in Chicago, Cleveland, New York and other cities. The electric vehicle was suggested by E. E. Witherby (Chicago), as a great opportunity, and it was shown that some electric companies act as local agents for manufacturers of these vehicles. The application of central-station current for lighting and power in coal mines was outlined by W. A. Thomas (Pittsburgh).

The report of the Committee on Steam Heating discussed the matter of isolated plants in large cities, furnishing both heat and light, as compared with plants furnishing heat only and taking lighting current from central stations. It was stated that in one case in Chicago it has been found economical to dispense with the dynamos and use the boiler plant simply for heating. The report of the Committee on Refrigeration suggested the advantages of developing central-station current for the operation of refrigerating and ice-making plants.

Another possible and promising line of business development is electric distribution from central-station plants to small towns (less than 5000), this including the absorption of existing local (and often unprofitable) plants. This was discussed in a paper by J. E. Kearns (Schenectady, N. Y.). As a further extension of this

idea, several reports dealt with the development of the use of electricity in rural districts and on the farm. The former includes such industrial work as the operation of excavators, gravel washing and screening plants, quarries, clay-working industries, pumping plants, etc.

Machinery

The report of the Committee on Prime Movers reviewed the developments in water, steam and gas operated machinery. As to the first, it mentioned sundry improved auxiliary devices, and recommended investigation of the subject of continuous measurement of stream flow and wheel consumption in plants under operation. As to the second, it referred particularly to the Ferranti high-superheat steam turbine, the principle of which is to maintain the steam in a perfectly gaseous state through the turbine. The steam is re-superheated between the first and second stages, and then passed through a regenerator between the exhaust and the condenser, so that the excess heat is reclaimed. A machine of 5000 hp. has been built. As to gas power, the report states that there has been no important development. The gas turbine has not been made a success as yet, and there has been noticeable decrease in the use of engines operating on illuminating gas. One of the devices mentioned by the committee was a new form of thrust bearing, used on the hydraulic turbines of the hydro-electric plants at Keokuk, Iowa., and McCall's Ferry, Penn., and in the steam turbines of the U. S. collier "Neptune." This device was described in a paper by Albert Kingsbury (Pittsburgh) the inventor.

The report of the Committee on Operation of Water Power Systems was of a general character, outlining the operating features in relation to the generating plant and the electrical apparatus under normal and emergency conditions. It was stated that practically no hydro-electric development with the capacity of the apparatus above the rated capacity at minimum stream-flow is attempted without the provision of a steam-power station on the system. This may serve (1) as an auxiliary station during low-water periods; (2) as a reserve in case of interruptions; (3) as a regulating station to take care of variations in the load when the hydro-electric plant is running at constant output.

Miscellaneous

The report of the Public Policy Committee, presented by Samuel Insull (Chicago) stated that the tendency of the industry is toward a regulated monopoly, as against destructive competition. As to employees, adequate compensation for their work and proper care of their welfare tend to economy and to favorable public opinion. A renewal of a former tendency to municipal ownership and operation of public utilities is considered imminent, and it was suggested that members should see that the local papers are supplied with publications relating to the companies' side of the question. A paper by E. H. Thomas (Seattle) on "The Failure of Conservation" was a general and somewhat wild attack on the government's policy of protection and conservation of national resources in the interests of the nation and the public, instead of allowing these resources to be exploited for private gain to the detriment of the public. A talk on "Resuscitation from Electric Shock," by W. C. L. Eglin (Philadelphia) threw some doubt upon the value of the pulmotor, and spoke more favorably of the Meltzer mechanical method of artificial respiration. Following this was a lecture by J. B. Douglas (Philadelphia) on "Accident Prevention in Public Utilities"; this related to the protection of such danger points as moving machinery, high-tension apparatus, etc., and to the general policy of safeguarding life and limb in industrial enterprises.

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The Piling for a Bridge was Driven Through the Cab of the Locomotive of the Pennsylvania R.R. Co., which went through a flood-weakened Big Four bridge at West Liberty, Ohio, on Mar. 25. A coffer-dam had been constructed and pumps installed when a diver found that the piling driven for a temporary bridge had pinned down the locomotive.

Six-Hundred Pounds of Dynamite Exploded in the machine packing house of the Giant Powder Co., at Giant, Calif., on May 30, killing four men and annihilating the building, leaving only an excavation 7 ft. deep to mark the site. The cause of the explosion is unknown. The last accident of a similar nature occurring at this plant was in 1907, when the nitroglycerin mixing-house was blown up.

Two Missouri Pacific Passenger Trains Collided on May 27, near Brant, Mo., killing four trainmen and injuring nine others and six passengers. The "St. Louis Times" states that the accident was caused by conflicting orders concerning the point where the trains, Nos. 11 and 12, should meet, and a mistake of the block signal man in permitting the two trains on the same block. The train dispatcher, who issued the orders, accepts all responsibility for the wreck.

The Tunis Mono-Rail Railway, which has been in operation for three years past in Pelham Park, in the northern part of New York City, is soon to be rebuilt as a regular standard-gage trolley line. It is claimed that the road has been successful mechanically, but it connects at the southern end with an ordinary trolley railway, necessitating a change of cars for a short ride. The Tunis monorail line installed last winter in the underground tunnel connecting the Capitol at Washington with the Senate office building, is also to be abandoned. The reason for the abandonment is the noise made by the car wheels rolling on the rail, augmented by the echo from the tunnel walls.

PERSONALS

Dr. Alexander MacAlister has resigned as President of Drexel Institute, Philadelphia, Penn.

Mr. Elson Hale, formerly City Engineer of Pine Bluff, Ark., has been appointed City Engineer of Little Rock, Ark.

Mr. R. T. Martin, formerly Assistant City Engineer of Tampa, Fla., has been appointed City Engineer, succeeding Mr. F. T. Warren, resigned.

Mr. E. A. Clark, M. Am. Soc. C. E., is Chief Engineer of the Engineering Construction Co., recently organized, with offices at 106 North La Salle St., Chicago, Ill.

Mr. J. Edgar Johnson, formerly Eastern Representative at New York City of the P. & M. Co., Chicago, Ill., has been appointed Division Engineer of the Pere Marquette R.R., at Saginaw, Mich.

Prof. V. I. Smart, of the department of railway engineering, McGill University, Montreal, Que., has resigned to accept the position of General Manager of the General Railway Signal Co. of Canada.

Mr. Peter P. Smith, a lawyer of Brooklyn, N. Y., has been appointed a Special Deputy Attorney of New York State to prosecute contractors for alleged fraud in connection with recent state-highway work.

Col. William Crawford Gorgas, Assistant Surgeon General, U. S. A., Chief Sanitary Officer of the Panama Canal Zone, was awarded the honorary degree of Doctor of Science at Columbia University on June 4.

Mr. F. G. Glover has been appointed Electrical Engineer of the Chicago, Rock Island & Pacific Ry., with headquarters at Chicago, Ill., succeeding Mr. F. E. Hutchinson, resigned, as noted in our issue of May 29.

Mr. R. B. Elsworth, formerly Assistant Signal Engineer of the New York Central & Hudson River R.R., at Albany, N. Y., has been promoted to be Engineer of Maintenance of Signals, succeeding Mr. J. M. FitzGerald.

Mr. Reginald J. S. Pigott, Jun. Am. Soc. M. E., has resigned as Assistant Professor of steam engineering, Columbia University, New York City, to accept a position with the Interborough Rapid Transit Co., New York City.

Mr. F. D. Batchellor, formerly Assistant to the General Superintendent of the Baltimore & Ohio Southwestern R.R., has been appointed Assistant Superintendent of the Cincinnati, Hamilton & Dayton Ry., at Dayton, Ohio.

Mr. E. D. Sabine, Resident Engineer of the Grand Central Terminal, New York Central & Hudson River R.R., New York City, has been promoted to be Terminal Engineer, succeeding Mr. W. L. Morse, M. Am. Soc. C. E., resigned, as noted elsewhere.

Mr. F. H. Judd, formerly Assistant Engineer of Buildings, New York Central & Hudson River R.R., New York City, has been promoted to be Resident Engineer, Grand Central Terminal, succeeding Mr. E. D. Sabine, promoted as noted elsewhere.

Mr. John I. Miller has been appointed Superintendent of Public Works of Ohio at a salary of $4000 per annum. Mr. Miller was nominated by ex-Governor Harmon, but the confirmation of his appointment was held up during the winter by Governor Cox, who has now reappointed him.

Mr. George B. Preston, M. Am. Soc. C. E., formerly Engineer, Westinghouse, Church, Kerr & Co., New York City, has been appointed Assistant Professor of steam engineering, Columbia University, succeeding Mr. Reginald J. S. Pigott, resigned, as noted elsewhere.

Mr. R. E. Hore, M. Am. Inst. M. E., Geologist of the Michigan Geological Survey and Instructor at the Michigan College of Mines, has been appointed Editor of the "Canadian Mining Journal," with headquarters at Toronto, Ont. Mr. Hore is a graduate of the University of Toronto.

Mr. Gustav Rasmus, Consulting Mechanical Engineer, of New York City, has retired from engineering practice to become associated with Messrs. Lawrence I. Gallagher and William F. Nickel, formerly Patent Examiners, U. S. Patent Office, as Patent Attorneys, 2 Rector St., New York City.

Mr. E. G. Chenoweth, former Assistant Superintendent of the car department, has been appointed Mechanical Engineer of the Chicago, Rock Island & Pacific Ry., in charge of car design, succeeding to a part of the duties of Mr. C. A. Seley, Mechanical Engineer, resigned, as noted in our issue of Apr. 17.

Mr. Charles Yoder, formerly Assistant Engineer of the Lake Shore & Michigan Southern Ry., at Cleveland, Ohio, has been promoted to be Assistant Engineer of Track of the Lake Shore & Michigan Southern Ry., and the Dunkirk, Allegheny Valley & Pittsburgh R.R. His headquarters will remain at Cleveland.

Mr. E. W. Scheer, formerly Assistant to the General Superintendent of the Baltimore & Ohio Southwestern R.R., has been appointed Superintendent of the Illinois division, at Flora, Ill., succeeding Mr. F. B. Mitchell, appointed Superintendent of the Toledo division of the Cincinnati, Hamilton & Dayton Ry., at Dayton, Ohio.

Mr. W. L. Morse, M. Am. Soc. C. E., Terminal Engineer, New York Central & Hudson River R.R., in charge of the Grand Central Terminal reconstruction, New York City, has been appointed Chief Engineer of the Jacksonville Terminal Co., a new organization of the railways entering Jacksonville, Fla., for the purpose of constructing a union terminal.

Mr. August E. Christhilf, formerly Chief Engineer of the commissioners for opening streets, of Baltimore, Md., has been appointed Assistant Superintendent of Public Works, of Atlanta, Ga., at a salary of $3000 per annum. After leaving his position with the city of Baltimore, Mr. Christhilf was Chief Engineer of the F. E. Schneider Paving Co., of that city.

Mr. G. S. Goodwin, recently Assistant Mechanical Engineer of the Chicago, Rock Island & Pacific Ry., at Silvis, Ill., has been promoted to be Mechanical Engineer in charge of locomotive design, succeeding to a part of the duties of Mr. C. A. Seley, Mechanical Engineer, resigned, as noted in our issue of Apr. 17. Mr. Goodwin's headquarters will be in Chicago, Ill.

Mr. L. Jutton, formerly General Inspector of Bridges of the Chicago & Northwestern Ry., at Chicago, Ill., has been promoted to be Division Engineer, with headquarters at Madison, Wis. Mr. Jutton graduated from the University of Illinois in 1902. He entered the bridge department of the Chicago & Northwestern Ry. in the fall of 1903 as a structural draftsman.

Mr. J. E. Willoughby, M. Am. Soc. C. E., has resigned as Chief Engineer of the Caribbean Construction Co. and the Compagnie Nationale des Chemins de Fer d'Haiti, at St. Marc, Haiti, to become Assistant Chief Engineer of the Atlantic Coast Line R.R., at Wilmington, N. C. Until about a year ago he was Engineer of Construction of the Louisville & Nashville R.R.

Prof. J. P. Jackson, F. Am. Inst. E. E., Dean of the school of engineering, Pennsylvania State College, has been appointed Commissioner of the newly created Department of Labor and Industry of Pennsylvania. The new department will take over the duties and powers of the present Department of Factory Inspection. There will be three bureaus under the new department—inspection, statistics and arbitration.

Prof. W. K. Hatt, M. Am. Soc. C. E., head of the school of civil engineering at Purdue University, has been appointed Chairman of a commission of engineers to make a design for a new bridge over the Wabash River at Lafayette, Ind., replacing one washed out by the recent floods. The new bridge is estimated to cost $250,000. The other members of the commission are: Mr. Everett Vawter, a civil engineer of Lafayette, and Prof. Albert Smith, of Purdue University.

Mr. John A. Ferguson, formerly Assistant Engineer of reinforced-concrete construction, Bureau of Construction, Department of Public Works, Pittsburgh, Penn., in charge of the design of and specifications for reinforced-concrete bridges, has been transferred to the Bureau of Building Inspection, Department of Public Safety, as Engineer in charge of the inspection of the engineering features of buildings and their acceptance or rejection by the bureau.

Mr. C. H. Baker, formerly Chief Engineer of the Hoosac Tunnel power station of the Boston & Maine R.R., and the Berkshire Street Ry., has been appointed Mechanical Engineer of the Public Service Electric Co., Newark, N. J. Mr. Baker graduated from Lawrence Scientific School, Harvard University, in 1902, and has served on the engineering staffs of Westinghouse, Church, Kerr & Co., the Brooklyn Rapid Transit Co., and as Assistant Chief Engineer of the Cos Cob power plant of the electric division of the New York, New Haven & Hartford R.R.

Mr. Robert G. Dieck, M. Am. Soc. C. E., Consulting Engineer, of Portland, Ore., was elected a Commissioner of Portland, for a term of four years, commencing July 1, at the recent municipal election under the new commission plan charter. Mr. Dieck was born in Philadelphia, Penn., Dec. 24, 1875. He was educated in the public schools of Philadelphia and at the University of Pennsylvania, where he graduated in civil engineering in 1896. For three years he was employed with the Board of Highway Supervisors of Philadelphia upon highway and underground improvements. After a year in the engineering department of the Bureau of Filtration of Philadelphia, Mr. Dieck accepted an appointment under the United States Bureau of Insular Affairs as Provincial Supervisor, Philippine Islands. In 1902, he was appointed Superintendent of Water Supply and Sewers of Manila, P. I., where he was in charge of the design and construction of a storm-water drainage system, an improved distribution system for water, and other important work. In 1905 he was appointed City Engineer of Manila in charge of all municipal improvements. In conjunction with the Director of Health of the Philippine Islands, Dr. Victor G. Heiser, he drew the new building and sanitary codes for the city. He was also one of the five members of the Municipal Board of Manila, which consisted of the Mayor and four members with much the same powers as are given to the Commissioners of Portland under the new charter. Since 1907, Mr. Dieck has been in private practice as a consulting civil engineer at Portland. In 1910 and '11 he served as Chairman of a committee of three to draft a new plumbing code for the city.

OBITUARY

William F. Brusher, one of the founders of the Standard Gas Engine Co., of San Francisco and Oakland, Calif., died at his home in Oakland, May 24. He is survived by a widow and five children.

George L. Hall, President of the National Railways Material Co., and Secretary of the Knickerbocker Valve Co., died at the Presbyterian Hospital, New York City, June 1. He graduated from Princeton University in 1889 and for many years was a practicing civil engineer.

George B. Francis, M. Am. Soc. C. E., Consulting Engineer, New York City, died June 9, at his home in New York, of hemorrhage of the brain. He was also a member of the Canadian Society of Civil Engineers, and the Institution of Civil Engineers of Great Britain. A biographical sketch will appear in a later issue.

Curtis H. Peters, Mechanical Engineer for Winston & Co., General Contractors, was killed on June 9, when his motor car was run into and wrecked by an express train on the Ulster & Delaware R.R. at Browns Station, N. Y. Mr. Peters was on an inspection tour of the Catskill Aqueduct and Ashokan Reservoir work, for which Winston & Co. have large contracts.

John Kingsbury Dean, a mechanical engineer and salesman of the Dean Bros. Steam Pump Works, Indianapolis, Ind., died at his home in Indianapolis, June 1, aged 44 years He leaves four brothers, Charles G. Dean, of Milwaukee, Wis., Stuart Dean, Superintendent of the Dean Bros. Steam Pump Works, Douglas Dean, of Chicago, Ill., and Ward Hunt Dean, of Indianapolis.

Hartwell Bishop, a civil engineer of San Francisco, Calif., and son of Joseph Bucklin Bishop, Secretary of the Isthmian Canal Commission, died June 4, at the Peter Bent Brigham Hospital, Boston, Mass. He was 33 years old and a graduate of Harvard University, class of 1903. Subsequently he took a post-graduate course in civil engineering at Columbia University and was for a time in tunnel work in New York City. He went to San Francisco after the earthquake, and for seven years was employed by the United Railroads of San Francisco on construction work. He had recently come East on a vacation. Mr. Bishop is survived by his parents, a brother Farnham Bishop, a sister, and a widow to whom he had been married but a year and a half.

Joseph Lewis Stephenson, a pioneer civil engineer of Salt Lake City, Utah, died at his home in that city May 31. He was born in Uppersville, Va., Apr. 13, 1834, and graduated from the Virginia Military Institute in 1854. During the Civil War he served four years in the Confederate Army. At the close of the war he resumed his occupation as a civil engineer and served with the engineering staffs of several pioneer Western railways ending his railway experience with the Denver & Rio Grande and the Rio Grande Western. In the early '80's he took up irrigation work in Idaho and superintended the construction of many miles of ditches and the building of several dams. He was also engaged at one time in municipal work in Denver, Colo. For the past 17 years he had held a position in the office of the Surveyor-General of Utah.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.
June 11-13. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, Old Colony Bldg., Chicago, Ill.

OHIO ELECTRIC LIGHT ASSOCIATION.
June 15-18. Annual convention at Cedar Point, Ohio. Secy., D. L. Gaskill, Greenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.
June 16. Semi-annual meeting at Atlantic City, N. J. Secy., Jos. A. Andreucetti, Room 411, C. & N. W. Ter. Sta., Chicago, Ill.

MASTER CAR BUILDERS' ASSOCIATION.
June 16-18. Annual convention at Atlantic City, N. J. Secy., J. W. Taylor, 390 Old Coolony Bldg., Chicago, Ill.

TRAIN DISPATCHERS' ASSOCIATION OF AMERICA.
June 17-19. Annual meeting at Los Angeles, Calif. Secy., John F. Mackie, 7122 Stewart Ave., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.
June 20-21. Annual convention at Seattle, Wash. Secy., Jesse A. Jackson, City Hall, Seattle, Wash.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESSES.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young, 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 17-19. Annual summer meeting at Buffalo, N. Y. Secy., E. A. Scott, 29 W. 39th St., New York City.

INTERNATIONAL GEOLOGICAL CONGRESS.
Aug. 7-14. Twelfth annual session at Toronto, Ont. General Secy., R. W. Brock, Director of Geological Survey of Canada, Ottawa, Ont.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 12-16. Annual convention at Chicago, Ill. Secy., W. O. Thompson, New York Central Car Shops, East Buffalo, N. Y.

Iron and Steel Institute—The autumn meeting will be held in Brussels, Sept. 1-4.

American Road Congress—The annual meeting will be held in Detroit, Sept. 29-Oct. 5.

American Road Builders' Association—The annual convention will be held in Philadelphia, Dec. 9-12, at the First Regiment Armory.

Western Railway Club—At the meeting held in Chicago on May 27 officers were elected as follows: President, Henry LaRue (C., R. I. & P. Ry.), Chicago; Vice-Presidents, W. B. Hall (Union Railway Equipment Co.) and E. W. Pratt (C. & N. W. Ry.). The Secretary is J. W. Taylor, Old Colony Building, Chicago.

International Railway Fuel Association—At the Chicago convention on May 24, the following officers were elected for the ensuing year: President, Robert Collett, of Springfield, Ill.; Vice-Presidents, A. C. Buell, of Omaha, Neb., and D. R. Sebastian, of Chicago, Ill.; Secretary-Treasurer, C. Y. Hall, of Chicago, Ill.

Natural Gas Association of America—At the annual convention held in Cleveland, Ohio, May 22, the following officers were elected for the ensuing year: President, E. L. Brundrett, of Kansas City, Mo.; Vice-President, F. L. Chase, of Columbus, Ohio; Secretary-Treasurer, T. C. Jones, of Delaware, Ohio. The next convention will be held in St. Louis, Mo., in May, 1914.

American Society of Civil Engineers—For the 45th annual convention to be held in Ottawa, Can., June 17-20, the following program has been announced: June 17, at 3 p.m., there will be a reception by the Premier, the Right Honorable R. L. Borden, and the Mayor of Ottawa, at the Chateau Laurier. At 9 p.m. the president and officers of the society will hold an informal reception at the Chateau Laurier. On June 18, at 10 a.m., the first session will be called to order, and the president will deliver the annual address, after which the business meeting will convene. In the afternoon the members and guests are invited to attend a garden party at the residence of T. C. Keefer, Past President, Am. Soc. C. E.; and in the evening there will be a lecture on Canadian Engineering subjects at the Chateau Laurier. The program for the morning of June 19 will be announced at the business meeting. In the afternoon there will be a motor drive through the city. The tea, which was to have been given at the residence of Sir Sanford Flemming, will be omitted. In the evening the Ottawa branch of the Canadian Society of Civil Engineers will tender a reception at the Chateau Laurier.

American Institute of Electrical Engineers—The thirtieth annual convention will be held in Cooperstown, N. Y., June 23-27. The following papers have been announced:

(1) "A Suggestion for the Engineering Profession," by William McClellan; (2) "Test of an Artificial Aërial Telephone Line at a Frequency of 750 Cycles per Second," A. E. Kennelly and F. W. Liebenknecht; (3) "The Adaptation of Automatic Methods to Long-Distance Telephone Toll Switching," H. M. Friendly and A. E. Burns; (4) "Electrolytic Corrosion of Iron in Soils," Burton McCollum and K. H. Logan; (5) "The National Association of Corporation Schools," F. C. Henderschott; (6) "Vocational Education in Philadelphia and Vicinity," A. J. Rowland; (7) "Vocational Training in the Far West," Robert Sibley; (8) "The Pennsylvania Railroad Company Apprentice Schools," John Price Jackson and J. W. L. Hale; (9) "Suggested Specifications for Testing High-Tension Insulators," J. A. Sandford, Jr., and F. W. Peek, Jr.; (10) "Constant Voltage Transmission," H. B. Dwight; (11) "Theory of the Non-Elastic and Elastic Catenary as Applied to Transmission Lines," C. A. Pierce, F. J. Adams and G. Gilchrist; (12) "The Behavior of Synchronous Motors during Starting," F. D. Newbury; (13) "Commutating Pole Saturation in Direct-Current Machines," H. E. Stokes; (14) "The Industrial Use of Synchronous Motors on Central Station Lines," J. C. Parker; (15) "Electrical Requirements of Certain Machines in the Rubber Industry," C. A. Kelsey; (16) "Standardization of Method for Determining and Comparing Power Costs in Steam Plants," H. G. Stott and W. S. Gorsuch; (17) "Automatic Substations," H. R. Summerhayes; (18) "Converting Substations for Basements and Sub-Basements," B. G. Jamieson; (19) "Operation of Frequency Changers," N. E. Funk; (20) "The Electric Strength of Air," J. B. Whitehead and T. T. Fitch; (21) "The Positive and the Negative Corona," W. W. Strong; (22) "Law of Corona and the Dielectric Strength of Air," F. W. Peek, Jr.; (23) "An Oscillographic Study of Corona," Edwin Bennett.

ENGINEERING LITERATURE

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REVIEWS AND NOTES

Paving Specifications and Construction

Reviewed by EDWIN A. FISHER*

SPECIFICATIONS FOR STREET ROADWAY PAVEMENTS, With Instruction on Street Paving Work—By S. Whinery, M. Am. Soc. C. E. Second edition, enlarged and entirely reset. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. x + 116; illustrated. $1, net.

ASPHALT CONSTRUCTION FOR PAVEMENTS AND HIGHWAYS—A Pocket-Book for Engineers, Contractors and Inspectors. By Clifford Richardson, M. Am. Soc. C. E. New York and London: McGraw-Hill Book Co. Leather; 4x7 in.; pp. ix + 155. $2, net.

The standardizing of paving specifications is receiving more general attention than ever before. The value of co-operation by municipalities is also being more appreciated. The reviewer agrees with Mr. Whinery that, notwithstanding the activity of the various societies in presenting standards in pavement specifications [since the first edition of this work appeared.—Ed.] there is still room for individual effort; and the reviewer would add, especially by one so thoroughly equipped as the author by long and successful experience as chief engineer and manager of a large paving company, whose careful, painstaking work the reviewer remembers with much pleasure. The author also has had a large experience as consulting engineer for a number of the larger cities in the country. His careful use of language makes the work of great value to the engineer as a model of clear and concise expression.

Besides revising his earlier specifications for various types of pavements (reviewed by the present writer in these pages on Aug. 15, 1907) the author has added specifications "for two comparatively new kinds of roadway pavement that have merited attention, and for concrete sidewalk and concrete combined curb and gutter." He has also added some twenty-five pages of "Instructions to Inspectors," both general and relating specifically to the various types of construction covered by his specifications.

In his introductory pages the author treats of the subject of contracts and contractors with the extreme candor and fairness expected by one of his training and experience. He deserves special commendation for his very clear and definite statements regarding the responsibility of the contractor, the engineer and the municipality.

While the reviewer agrees with the author in his statement (page 11) that it is both unwise and illegal to provide that the decisions of the engineer shall in all cases be final and conclusive, he is of the opinion that the engineer can and should act in an absolutely impartial manner, regardless of the fact that his salary is paid by the municipality. The reviewer commends the Introduction as a whole, and if the book contained nothing else, its publication would be fully justified.

Section 23, on incidental work at the contractor's expense, is in the interest of a clear understanding of what is required. Section 24, relating to extra work for which the contractor is entitled to payment, is excellent, although in the reviewer's practice it is amplified as follows:

In case the engineer deems it impracticable to estimate said extra work, as aforesaid, the contractor shall present an itemized account of the labor and material used in said work, which account must be verified by the inspector on the work; and said contractor shall be paid the actual cost, together with 15% of his payroll additional for supervision and use of tools. Claims for extra work must be presented to the engineer on or before the tenth day of the month following in which said extra work was done.

The guaranty clause, Section 25, is especially clear and fair, both to the municipality and the contractor.

The reviewer agrees with the author now, as he did in 1907 in a review of an earlier edition of this work, that the practice of laying pavement surfaces, particularly those of asphalt, upon a foundation of old stone blocks reset with the joints unfilled with mortar, is all wrong and should never be resorted to. It is a source of satisfaction that in the reviewer's experience he has never been obliged to use this form of construction.

The reviewer also agrees with the note on page 24, to the effect that old stone block and cobble-stone pavements that have become solidified in place by long travel, make a good foundation for asphalt or other pavements, provided they can be utilized without taking up or disturbing the old pavement. The objection to this method of construction is the fact that such pavements cannot be as well repaired in case of cuts, as those with a concrete foundation.

The author is right in holding that the proportions of cement, sand and broken stone should be left blank in a general specification. He believes it is undesirable to have different specifications used by the same contractor on the same job.

In view of the increasing weight of motor trucks the reviewer believes that in no case should a concrete foundation be laid less than 6 in. in thickness; and in important thoroughfares this thickness should probably be increased to at least 9 in.

The reviewer agrees with the author in his specifications for 5¼-in. depth for granite blocks. He believes that there is no good reason for making blocks deeper than this on any street. He also believes that the extra cost of dressing blocks so that the joints will not exceed ⅜ in. is fully justified.

With reference to filling joints, the reviewer has never seen the necessity of laying blocks near the curbstone parallel with the curbs. He believes that it is best to have as few breaks in the pavement as possible, and would lay the blocks continuous from curb to curb. He also never has seen the necessity of expansion joints across the street.

The reviewer does not agree with the author in his specifications for brick pavements. He thinks it is extremely desirable that the size of brick be standard, and fully agrees with the specifications of the American Society of Municipal Improvements and the Association for Standardizing Paving Specifications in providing for a standard size. He also believes that the average loss in the new rattler should not be made as low as 18%. The new rattler is between 4 and 5 points more severe than the old.

The reviewer disagrees emphatically with Section 90, with reference to the longitudinal gutter course, and to filling the six contiguous courses running across the street in a length of 50 ft. with bituminous cement while the remainder of the pavement is filled with cement grout. In his experience he has become satisfied that the cross expansion joints are not required, and that expansion joints at the curb should be made by one joint at the curb and not by a number of joints in courses of brick, laid parallel with the curb.

The specifications relative to paving where railway tracks exist should be amplified. A pavement foundation under the rail of the same depth as that under the remaining part of the pavement is entirely insufficient for the heavy cars now in use by the street surface railways. The reviewer's experience is that the concrete for a distance of about 18 in. outside the outside rails should be not less than 12 in. in thickness.

*City Engineer, Rochester, N. Y.

The specifications for asphalt pavement reflects the experience and study of the author in the branch of the work in which he is especially well qualified.

The specifications for combined curb and gutter are excellent, and the reviewer agrees with the author in the note on page 84 relative to hydraulic-concrete sidewalks, that while the specifications conform to the common practice in laying sidewalk in two courses, such construction is neither necessary nor desirable. In view of the opinion of the author, it is the intention of the reviewer in his practice to change his specifications to correspond to this opinion.

The section on regrading (page 88) is excellent, and one that has not generally been considered. The instructions to inspectors on street-paving work, with such changes as may be necessary to adapt them to the conditions in the different municipalities, are in every way commendable.

The book is a very valuable contribution to the literature upon the proper construction of pavements and will have much influence in standardizing, so far as local conditions permit, the specifications for this kind of work.

Mr. Richardson, in his handbook on "Asphalt Construction for Pavements and Highways," very properly emphasizes the necessity of careful attention to details in the construction of a successful asphalt pavement. He also cautions the engineer against following literally so called standard specifications which are only of general application. This action is timely, and applies as well to other kinds of work as to asphalt pavements. The author has probably had a larger experience in the construction of asphalt pavements and in a critical observation of pavements of which he has known the exact details of the material entering into them and the workmanship than any other person.

The author first deals with broken stone, the foundation and the intermediate course, which last is made to include a general review of asphaltic pavement and binders as well as asphaltic-concrete bearing surfaces. He next takes up the mineral aggregate, the filler or dust, native bitumens, fluxes and asphaltic cements. None of these chapters is long, the whole nine just outlined aggregating about fifty pages. As much space is then devoted to the single chapter on "Surface Mixtures," and again as much to the last seven chapters, which treat of maintenance and repairs, the plant, work on the street, advice to engineers, contractors and inspectors, the laboratory, examinations of materials and instructions for taking various samples for examination.

Touching now upon a few points of the book, it may be mentioned, first of all, that the description of the proper quality of broken stone is concise and definite. Although the author's advocacy of a comparatively smooth surface for the concrete foundation for sheet asphalt is at variance with the usual current practice, yet the reasons given for a relatively smooth surface for a comparatively smooth surface are sound. It would seem, however, that if the concrete were somewhat rough the pavement would not be as likely to roll as if it were made as smooth as possible.

The instructions relative to binder (pages 16-22) are very clear and specific. The author devotes, very properly, a large amount of space (Chapter 5) to the grading of the sand. From the experience of the reviewer, the failures in asphalt pavements have resulted more from the use of improper sand than from any other cause.

On page 45 it is stated that the handbook is confined to the use alone of the Trinidad and Bermudez asphalts, and that many of the directions can be applied to the use of other materials. It is to be regretted that the author has not given more detailed instructions relative to the use of such other asphalts as are now in general use.

The instructions to the inspector, with the illustrations given on pages 74-77 inclusive, are valuable in making quick tests of the mixture upon the street. The advice to engineers, contractors and inspectors, and the suggestions to citizens, in Chapter 14, are worthy of very careful consideration.

The book as a whole is of great practical value, especially to the engineer in charge of a laboratory for use in connection with the inspection of asphalt pavements.



CITY OF BRIDGEPORT, CONN.—A Study of the Organization and Procedure of Each Permanent Board, Commission, Committee and Office (except those connected with Courts, Education and Elections)—Report of Peter White, Resident Partner, at Chicago, of Haskins & Sells, C. P. A., New York City. Paper, 7x10 in., pp. 112.

Similar studies of the organization duties and methods of the various city departments might profitably be made in every city of the country where such studies have not been undertaken—which means the vast majority of them. This study is particularly valuable because of its running comment on the general functions of the various departments and because of its "constructive suggestions" at the end of each departmental study. The various recommendations are briefly summarized in the opening pages of the report, which adds materially to its value. The study as a whole was made under the direction of a Committee on Audit, created late in 1911 to "provide a uniform system of audit and account" for all branches of the city government. It is interesting to note that the city engineer receives the highest salary ($4000) of any official of Bridgeport, and that quite recently the resignation of the director of public works and superintendent of streets were, by arrangement, put in his hands. He is, however, subject in some respects to the orders of the Commission on new paving and sewer work.

A British Book on Structural Engineering

Reviewed by LEWIS J. JOHNSON*

THEORY OF STRUCTURES—By Arthur Morley, M. I. Mech. E.; Professor of Mechanical Engineering, University College, Nottingham. New York, London, Bombay and Calcutta: Longmans, Green & Co. Cloth; 5x9 in.; pp. xi + 574; 4 plates; 319 text figures. $2.50, net.

This work begins with the rudiments of resistance of materials and considerably more than half its space is devoted to that introductory topic. The topics therein treated are the usual ones of simple tension, compression, shear and bending, with applications to strength and stiffness of beams and columns. The last part of the book treats of the theory of frames (simple as well as indeterminate), stresses from fixed and variously placed loads, design of details of plate girder and truss bridges, theory of suspension bridges, metal arches, stability of earthwork and masonry.

Much of the introductory matter has been taken, as the author states in the preface, from his earlier work, "Strength of Materials" (Reviewed in "Eng. News," Aug. 12, 1909, p. 12, Eng. Lit. Sup.) "without great modification." The topics which appeared in "Strength of Materials" which do not reappear in "Theory of Structures" include little else than torsion, flat plates, and descriptions of testing apparatus and methods. "Theory of Structures" may, therefore, be regarded as a revised and enlarged edition of the former work, the revisions and extensions being directed solely to meet the needs of designers of roofs and bridges.

Like its predecessor, this book makes, on the whole, a distinctly favorable impression. One could wish, however, for an even clearer lining out of the great fundamental principles of statics, and assumptions of resistance of materials. The style is still conventionally didactic enough to obscure to an unnecessary extent the inferential nature of many of the statements. For example, Rankine's "Theory of Earth Pressure" is stated without making clear that it rests on something more substantial than a great name. A few lines would have made it clear why so wise a man as Rankine fathered it—to the advantage of the reader's comprehension of engineering science and his intelligent respect for Rankine.

Even in this later work Morley has not supplanted the ellipses of stress and inertia with the vastly simpler and more instructive circle of stress, suggested long since by Kulmann, and the Müller-Breslau or Mohr-Land circles of inertia. He repeats, in his cuts of columns with various end conditions, the absurdity too common in textbooks of not showing the full set of external forces in action, thus encouraging a thoughtless student with an over developed faith in authors to assume that cases do after all arise in which a body may be in equilibrium under the action of two noncoincident forces.

The treatment of structural connections and design is so thoroughly British as to be of little but suggestive value to the American student. Its phraseology in using "railbearers" for stringers, and its transformation of a weight estimate of 15,545 perfectly good pounds into an alleged equivalent of "6 t. 18c. 3q. 5 lb." are harmonious with its use of T's and small flats as main members of riveted trusswork as something that would not flourish on this side of the Atlantic. We have not checked the metamorphosis through which the 15545 was put! We may well rest content with being learned enough to be aware that t., c., and q. stand for 2240, 112 and 28 lb. units respectively!

It is a pleasure to commend in this, as in "Strength of Materials," the abundance of fully worked out numerical problems, besides an abundance of well selected problems for practice.

In a word, the work may be characterized as containing little that is new, but nevertheless an excellent treatise on

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*Professor of Civil Engineering, Harvard University, Cambridge, Mass.

the mathematical or theoretical aspects of structural design. When it comes to practical design, however, the American student should turn to any of several excellent modern American works for his book treatment of that subject.

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The Steel-Rail Problem

Reviewed by M. L. BYERS*

STEEL RAILS: THEIR HISTORY, PROPERTIES, STRENGTH AND MANUFACTURE, With Notes on the Principles of Rolling Stock and Track Design—By William H. Sellew, Principal Assistant Engineer, Michigan Central R.R. New York: D. Van Nostrand Co. London: Constable & Co., Ltd. Cloth; 7x10 in.; pp. xvii + 559; 361 illustrations; 33 folding plates. $12.50, net.

Of late years attention has been drawn with considerable frequency to railroad accidents caused by rail failures. The author states:

> The rails of heavier section manufactured within the last few years are not giving the services they should be expected to. The fault may lie in improper methods of manufacture or in the design of the rail itself which, while suitable for the conditions existing 19 years ago, may be unfitted for the heavy wheel loads of today.

The present work, the author states, is essentially a compilation in which he has endeavored to systematize knowledge in existence on the subject and present in concise, yet clear form, the most important features of the problem.

The opening chapter devotes 70 pages to the history of the development of the rail section. The various sections in use in the past, together with the principal sections in present use in the United States and elsewhere, are fully illustrated.

The second chapter contains 69 pages on the speed and weight of modern locomotives, fast and unusual train runs, effect of counterbalance, track irregularity, rocking of the engine, flat spots in the wheels, etc. Illustrations, and the principal characteristics, of the principal types of present-day locomotives and cars are given.

The next 103 pages are devoted to the supports of the rail. Many types of steel and concrete ties are illustrated in and out of the track. Service tests are reported. Information as to the forest regions of the United States, geographic distribution of the total lumber production, the strength of various woods in their natural state and after being subjected to various treatments, railroad plantations for tie timber, size and spacing adopted for wooden ties are given. Tie-plates and screw spikes are illustrated and considerable data as to their use, especially abroad, are given. Discussions of the action of the tie, ballast and subgrade under load are summarized, and the form of the apparatus for measuring track depression illustrated.

Chapter IV (77 pages) summarizes the data bearing on the stresses in the rail and the methods which have been used in endeavoring to ascertain them. The relation between wheel load and areas of contact between the wheel and rail is stated. There is a table showing the dimensions, weights and costs of different systems of track superstructure on wooden ties. The character and causes of tire wear are illustrated and discussions abstracted. The cause and effect of flow of metal in the rail head are touched upon; the reciprocating machine for testing such flow is illustrated, and the results of tests are given. There is a description of instruments for observing the effect of train movement on track structure, and data and diagrams resulting from their use are given.

In Chapter V. (56 pages) discussions on the strength of the rail, the influence of stress and strain, repeated stresses, low temperature, etc., are taken up. The drop-testing machine for testing rails is shown by specifications and illustrations, and the results of such tests are given. The sclerоscope and Amsler-Laffon instruments for measuring hardness of metal are illustrated and the principles upon which they act are explained. The Pennsylvania Steel Co.'s rotary machine for testing rail wear is illustrated.

The following chapter (137 pages) is devoted to an illustration of the processes involved in the manufacture of rails from the loading of the ore at the mines to the finishing of the product at the mill, including illustrations of modern ore docks, ore vessels, loading and unloading machines, blast furnaces of various kinds, openhearth furnaces, converters, electric furnaces, etc. The chemical composition of early and recent rails is compared. The effect of variation in different ingredients, alloys, etc., is shown by numerous tables and diagrams. Discussion of the relative desirability and availability of different processes of steel manufacture is abstracted; illustrations of the defects found in different types of ingots are given, and discussion of the causes reviewed. Data in regard to American and foreign rolling mill practice are given, and there is an abstract of discussions of the effect of variations.

The final chapter of 38 pages compares the principal rail specifications of today, of which several are given in their entirety.

The Appendix illustrates a complete set of the forms recommended by the American Railway Engineering Association for use in connection with the reporting and studying of rail failures.

The book contains a large amount of information of general interest to those concerned with railway affairs, but which is hardly of material importance in connection with the study of the problem of securing, at reasonable cost, a rail entirely fitted to present-day requirements. On the other hand, owing to the magnitude of the field, it has been impossible to cover the subject fully in any of its branches, the data given showing the general trend and the sources of the information available to those desiring to make a fuller investigation. For the purpose of affording the would-be student of steel-rail problems a general view of the entire field and guide posts to point the way to more detailed study, the book should be of very material value. It represents a large amount of painstaking investigation.

*Special Agent, Delaware & Hudson Co., 32 Nassau St., New York City.

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A Treatise on the Engineering Design of Artificial Lighting

LIGHT, PHOTOMETRY AND ILLUMINATION—A Thoroughly Revised Edition of "Electrical Illuminating Engineering." By William Edward Barrows, Jr., B. S., E. E.; Professor of Electrical Engineering, University of Maine. New York and London: McGraw-Hill Book Co. Cloth; 6¼ x 9½ in.; pp. ix + 335; 192 text figures; numerous tables. $3, net.

In reviewing the earlier volume, on which the present work is based ("Eng. News," Feb. 18, 1909), we noted that a wide range of useful data had been presented in every accessible and convenient form, but that the scope of the work had not been made large enough so that the book would be of the greatest possible service to students and engineers. The author had included much matter of greatest interest only to illumination experts and physicists, to the exclusion of much that was really fundamental in the design of good everyday lighting installations. That situation seems to have been changed in the revision which has produced the new volume. Much of the material of more remote application has been abandoned and there is an interweaving of the simple ideas which fix hygienic and artistic lighting effects. There is still a great wealth of experimental data and a sufficient pursuit of theoretical discussions to suit the most avidious in that way. The time in any engineering course which can be allotted to the study of illumination problems is so small that only a part of this book becomes immediately suitable for undergraduate courses, but there is material to indicate lines of future study for the men who take up illumination work in after life.

Comparing this book to some of the others available on the same general subject it is seen that it is perhaps the most comprehensive of any now available (if we except two volumes of Johns Hopkins lectures), as it pursues the computations and theoretical discussions further than the rather more general works like Bell's "Art of Illumination," or the descriptive and somewhat pictorial work by Cravath and Lansingh, "Practical Illumination."

At the outset the author discusses the physics of what we call light. He fixes the place of light in radiation phenomena and discusses the properties known as reflection, refraction, color value, color component, etc. The constitution and reproduction of daylight is one topic taken up in particular.

After this is a chapter entitled "Luminous Equivalent of Radiation" which deals largely with physiological factors. This will be found especially interesting to beginners and of lasting usefulness to anyone who does not continuously work in the field of illuminating engineering.

So far about 15% of the volume is covered; about 33%, following, discusses photometric-laboratory apparatus and practice, starting with the primary standards of light sources and setting forth their peculiarities, advantages and drawbacks, going into the use of intermediate standards for comparative use, and later presenting the principles of photometry, with a description of the various pieces of laboratory apparatus which are better known through proved utility.

The remaining half of the book is concerned with the design of illumination installations—that is, not the architectural or mechanical features of fixtures, or the energy supply, but rather the apportionment of illumination values on surfaces to be lighted, the location and size of light-pro-

ducing units and the redistribution of flux at various angles by reflecting and refracting shades, etc. This half of the book has some less-digested and more-debatable parts than the preceding half, probably on account of the existance of conflicting ideas among illuminating experts. For instance, the author quotes Messrs. Sweet and Doane who, from an investigation of visual efficiency as affected by reflection from walls, claim it is desirable for efficiency that walls should be as dark as is consistent without being gloomy and depressing wherever close application to work in hand is to be maintained. However, it is pretty generally admitted that there is another effect entering in which seems not to have been discussed in this book. No one can apply his eyes to work in hand so persistently that it is not necessary occasionally to relieve these organs by glancing off to areas of less illumination or different color, and fatigue is usually induced if the contrast between the work and the walls is very great, although a moderate difference is advisable.

Similarly, the discussion of principles of street lighting is a presentation of the views of A. J. Sweet, who is an exponent of the idea of uniformity in pavement-illumination values, and the complete elimination of glare. There are, however, engineers of repute who hold that the function of street lighting is satisfied if freedom of collision and safety from personal molestation is secured. To this end they utilize some of the glare which would be so completely eliminated by the others. The glare then used is that specular reflection which assists in silhouetting bodies against a lighter background underneath or near the light sources as they may be variously disposed along the street.

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Water Powers, Their Development and Utilization

Reviewed by EMIL KUICHLING*

DIE WASSERKRAEFTE, IHR AUSBAU UND IHRE WIRTSCHAFTLICHE AUSNUTZUNG—Ein technisch-wirtschaftliches Lehr- und Handbuch. By Adolf Ludin, Preisgekrönt von der Kgl. Akademie des Bauwesens in Berlin. Parts I and II. Berlin: Julius Springer. Cloth; 8x11 in.; pp. xvi + 763 and 637, respectively; 1087 text illustrations and folding plates. 60 Marks.

This elaborate work on the development and utilization of water powers received in its original abbreviated form the prize offered in 1909 by the Royal Academy of Engineering (Bauwesen), of Berlin, for the best treatise on the subject, and was subsequently enlarged to its present size by the author in collaboration with several other experienced engineers. A brief introduction by Dr. Ing. Hermann Keller, Member of said academy, sets forth the great economical importance of water powers and the purpose of the academy to secure a good description of those recent power developments which might serve as models for future similar enterprises in the hilly and flat regions of Germany. He also states that in the preparation of the manuscripts entering into competition for the prize of 3000 marks, attention was to be given particularly to the economical value of each plant with reference to local conditions, and the successful author was afterward to be assisted financially in completing his work by a thorough personal examination of such plants in Germany and other European countries. On receiving this prize, Mr. Ludin made a tour in 1909 and 1910 through Germany, Austria, Switzerland, northern Italy and France, and inspected critically a large number of water-power plants. The results of all these supplementary observations, and the further studies made from the literature of the subject at home and abroad, were then submitted to the academy in the form presented in the two volumes mentioned. The introduction closes with the fervent hope that this treatise may prove useful and instructive to all who are interested in the practical development and economical utilization of water-power.

The work is divided into three main parts. Part I describes in 200 pages the modern methods of utilizing water powers, and the natural, technical and economical considerations underlying their development. Costs of the construction and operation of numerous large steam-power plants for producing and distributing electrical energy are given to serve as a basis of comparison with those of similar water-power plants, and following these data the principles of the economical utilization of water-power are set forth in full detail. A very interesting chapter is the one devoted to the computation of the most economical magnitude of a contemplated hydraulic power development, with consideration of auxiliary steam power, water storage and association with other plants in the vicinity.

Part II embraces 563 pages, in which good descriptions are given of the plants at Rheinfelden, Beznau, Tuilière, Schweinfurt, Blankenstein, Dörverden, Celle, Mülthal, Steinbusch and fifteen other localities in Germany, France and Switzerland. These plants involved the construction of dams and storage reservoirs of various magnitude, and the accompanying illustrations show many interesting details of location and construction. The costs and results of operation are also given along with many instructive maps, diagrams and load curves.

Part III deals with the engineering details of water-power development, and embraces the construction of fixed and movable dams, intakes, head-works, fish-ways, high dams for large reservoirs, spillways, outlets, screens, canals in earth and rock, tunnel conduits, pipes of various material, erect and inverted siphons, aqueduct bridges, gates and valves for controlling the flow of the water, air-chambers, sediment chambers, pressure regulators and devices for arresting floating driftwood and ice This portion of the second volume embraces 500 pages, and the remaining 109 pages are devoted to the design and construction of power houses, screening racks, outlets, transmission-line supports, valuable statistical data, and some details of spillways and dams. To the construction and theoretical design of turbines relatively little space is given, as the author refers for such information to various special treatises on that subject, but this omission is amply compensated by many critical descriptions and illustrations of turbines in place.

The second volume closes with an excellent index and an abbreviated list of the technical literature on water-power consulted by the author, and it is gratifying to find that this list embraces most of our American engineering publications and journals. The subjects dealt with by the author are numerous and important, and the temptation to refer at greater length to his treatment of some of them is strong, but as space therefor is not now available, it must suffice to say that Mr. Ludin's work has been very well done, and that it deserves to occupy a prominent place in the library of every hydraulic engineer.

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THE CONCRETE HOUSE AND ITS CONSTRUCTION—By Maurice M. Sloan. Philadelphia: Association of American Portland Cement Manufacturers. (Secretary, Percy H. Wilson, Land Title Building.) Cloth; 6x9 in.; pp. 224; illustrated. $1.

The concrete dwelling house is a comparative novelty and, like all novelties, subject to considerable suspicion on the part of those who might or should use it. It is largely to allay that suspicion and to encourage the prospective home builder to use concrete that the Association of American Portland Cement Manufacturers has published this very attractive book.

In one regard it is most successful. We know of no other similar work that gives so fully or clearly the many small but necessary details of fittings and connections of concrete house construction, details that in many ways are quite different from those required in the larger types of concrete construction. It provides, too, very satisfactory chapters on structural design and construction, containing the required information in simplest terms but sufficiently complete. While the author is evidently not quite clear whether he is addressing the builder or the owner, and so confuses the very different instruction the two should have, it is nevertheless the fact that he has succeeded in his intention "to make clear the advantages of concrete in the construction of dwellings."

In some other respects, however, the author has not been so fortunate. It is quite probable that the average prospective builder has no doubt about the many structural and fireproof qualities of concrete construction. What he is worried about—and his worry is based on the experience of many—is the appearance and cost of a concrete house. It is a well known fact that the average concrete house is not good to look upon and is very expensive. It would appear to be the duty of the author of such a book as this to try to allay this feeling of distrust by the illustration and description of some of the occasional houses where a happy combination of architect and builder has produced a good looking concrete house which costs little more than houses of the older and less durable type. It is perhaps a matter of taste, but it seems to us that Mr. Sloan could have been more happy in his selections of examples of the architectural possibilities of concrete. With the exception of a very few, the houses illustrated are lacking in the something that makes the passer-by wish he had built his house that way. The author has not quite succeeded in steering a straight course between the gingerbread of over ornamentation and the "futurist" style that "would have concrete frankly stand for what it is"—including hair cracks and form marks.

*Consulting Engineer, 52 Broadway, New York City.

As to cost, the author states that "the prevailing notion that the cost of a concrete house is far in excess of other materials is absolutely wrong," but the reader looks in vain for figures bearing out this statement.

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A Notable British Survey of Municipal Ownership

PRINCIPLES AND METHODS OF MUNICIPAL TRADING—By Douglas Knoop, Lecturer on Economics in the University of Sheffield; Late Langton Fellow of the University of Manchester. London: Macmillan & Co., Ltd. Cloth; 6x9 in.; pp. xvii+409; $3.25 (10s.), net.

Mr. Knoop's book differs materially from the many others on the same general subject in that it deals with the principles and methods, as well as with the advantages and disadvantages, of municipal trading—or ownership. As befits a book which has grown from a successful effort to win the Warburton Essay Prize (1906) at the University of Manchester, the book is judicial rather than partisan in character. Here and there the author states what is and what is not a fit subject for municipal ownership and he is continually bringing out weak points in British municipal trading enterprises—which enterprises are more varied and more common than with us.

The scope, development and extent of municipal trading are first dealt with. Questions of management and financial aspects are then taken up. This leads naturally to a consideration of "Selling Policies," which is followed by "The Labor Policy." The author next sets forth "The Results of Municipal Trading," and then presents a 20-page "Summary and Conclusion." Appendixes consist of a brief bibliography and tramway and other municipal ownership statistics.

The specific data, which are extensive, are drawn from Great Britain and Germany, chiefly the former. There are a few meager references to the United States. A better aquaintance with conditions in this country, especially as regards state control, might have broadened the author's opinion as to the best ways of meeting some of the British problems which he discusses; but we do not offer this as a serious criticism.

The chapter on "Results" was apparently a disappointment to the author himself, because of lack of the right sort of statistical data, lack of uniformity in such statistics as are available, failure to distinguish properly between capital and operating expenditures and other weaknesses or inaccuracies in accounting practice. The author deserves credit for making the best out of deficient material and for his ingenuity in weighing financial results from different viewpoints. He is also entitled to commendation for recognizing the consideration which should be given to local conditions in such a study; for instance, in taking into account whether the local policy is to supply a given service at low rates and make up deficiencies from "the rates" (general taxation) or to make a profit to be applied "in relief of rates." Either of these policies may be wrong, according to one's viewpoint, but the author rightly urges that it is the wrong policy rather than the result which follows that should be condemned.

The final conclusion of the author, as expressed in the very last words of his book, is that after many years of study, but subject to change when more and better data are available, "municipal trading in itself is undesirable, but that nevertheless a certain amount of it may be justified, owing to the fact that in certain industries private enterprise may give even less satisfactory results than municipal enterprise." Elsewhere in the chapter of "Summary and Conclusion" we find the following more explicit statement of what industries may better serve the people under public rather than private ownership:

> These industries are such as have a strong tendency to become local monopolies, which is generally true of tramways, water, gas and electricity supply undertakings. . . . There can be no general rule on the subject, each individual case must be considered on its own merits.

It will be seen that, in the author's opinion, the much debated question of municipal ownership is one of expediency, and that in general he considers it expedient for cities and towns to own and operate monopolistic or noncompetitive undertakings, while, "with one or two small exceptions, the management of competitive undertakings by municipalities is strongly to be deprecated." These exceptions include "a small amount of experimental housebuilding, where such is necessary to form a basis for new and better building regulations, or for town-planning schemes, and the provision of savings banks where suitable facilities for the safe keeping of small sums of money are not provided by the central government or by private undertakings of high-class standing."

Before dismissing the book we wish to revert again to the benefit which the author and his book might have derived from a fuller consideration of American practice. He makes it clear that the British central authorities lay down the conditions under which municipal trading or ownership may be entered upon, but he does not cite as worthy of consideration and possible adoption the practice of some American states (of course, not the Federal government) in controlling the character of the "trading" service, the rates charged and the division of the burden among private consumers and the general public, or city as a whole. It is true that outside Wisconsin as a state and the sanitary aspects of public water-supply, this control is confined chiefly to private companies (which we call public service or public utility corporatons); but state regulation has of late years weakened some of the strongest of the earlier arguments for municipal ownership of monopolistic or non-competitive services.

The author and his readers might also have profited from a consideration of the American theory and practice, already mentioned casually, of dividing the cost of the various "trading" services between the private consumer and the city as a whole. This eliminates all those questions as to "subsidies from the rates" (taxes) and "contributions to the relief of the rates," which together occupy considerable space in Mr. Knoop's book. We do not mean to convey the idea that every city in the United States, or even a large percentage of them, makes a clear-cut division of this sort; but the principle seems to have gained more recognition here than in England, and where it is not observed it is more through poor accounting than deliberate intention.

Finally, we take pleasure in commending Mr. Knoop's book as being on the whole the broadest in general scope and the most impartial in treatment of any of the many books on municipal trading or ownership which have yet appeared in the English language. Its value, as we have already indicated, would be increased if its geographical scope were broadened—not so much in the way of statistics as in general principles and practice. Limited as the book is chiefly to Great Britain it would probably gain in forcefulness, as it certainly would in readability, if a considerable reduction were made in the amount of statistical data and analysis with which the book abounds. To some, however, these features will be strong points in favor of the book.

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TESTS OF REINFORCED-CONCRETE BUILDINGS UNDER LOAD—By Arthur N. Talbot and Willis A. Slater. Bulletin 64. Urbana, Ill.: University of Illinois. Paper; 6x9 in.; pp. 104; illustrated.

The testing under load of the floor systems of reinforced-concrete buildings, by measuring the elastic deformation of the steel and concrete members, was first tried in the Fall of 1910 by members of the Engineering Experiment Station of the University of Illinois. Since that time, nearly a dozen full-sized test panels have been experimented upon in the same fashion, all under the general supervision of members of the same experiment station. In past issues of "Engineering News" rather lengthy abstracts of these tests have appeared, notably in the issue of Apr. 18, 1912, p. 718. Some of the engineering societies, also, have published in their proceedings abstracts of one or more of the tests, but there has not appeared, until the above noted bulletin, any full account of the experiments.

This bulletin is devoted particularly to a description of three of these tests and to a lengthy and complete description of the technique of the testing. The method of testing is so different from the ordinary load tests that a knowledge of the technique is quite necessary if one is to attempt similar tests. On this account, the bulletin is of more interest to one who is contemplating making such tests than to the engineer who wishes to get some enlightenment on the performance of certain types of reinforced-concrete structures, but a close reading of the data presented will be of undoubted usefulness to the latter.

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THE PURIFICATION OF PUBLIC WATER-SUPPLIES—By George A. Johnson. Water Supply Paper 315. Washington, D. C.: United States Geological Survey. Paper; 6x9 in.; pp. 84; illustrated.

The characteristics of water-supplies from various sources are outlined, some typhoid statistics in relation to water-supply given, slow sand and mechanical filtration described and the cost of each given for a number of plants, besides which hypochlorite and water softening treatment are taken up. A few well chosen illustrations, mostly halftones, are presented. The author states that delay in publication (manuscript submitted in July, 1911), has rendered some of the text "behind the most approved practice of today," but, as he truly says, only "in some relatively unimportant respects." The

paper will be of value for city officials and others wishing a simple statement of the principles and practice of filtration, for whom it was specifically designed. Engineers will also welcome it as a concise review of the subject, written by an authority on water treatment.

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A Notable Book on Electrical Machine Design

Reviewed by COMFORT A. ADAMS*

ELECTRICAL MACHINE DESIGN—The Design and Specification of Direct and Alternating Current Machinery. By Alexander Gray, Assistant Professor of Electrical Engineering McGill University, Montreal, Can. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii+528; 317 text illustrations. $4, net.

The work of the engineer whether it be concerned with the design of a dynamo, of a power plant, or of a bridge, consists in the application of scientific principles to the attainment of certain practical ends which usually involve economic or commercial considerations. In most cases the phenomena involved are so complex, and the number of variables so great, that an exact scientific solution of the problem is impossible. Hence the resort to empirical short cuts. In the early days of dynamo design these short cuts involved the neglect of many factors either considered of negligable importance or wholly overlooked, and one of the chief assets of the designer was the mass of empirical information and data gathered in the course of his work. It was during these comparatively early days (not many years ago) that one of the authorities on the subject made the much quoted statement that Dynamo Design is an art rather than a science.

But the modern designing engineer must take quite a different attitude toward his work if he is to excel. Many of the computations now regularly made by the higher-grade designers would have been ridiculed ten years ago as "academic," and "useless refinements." The rational is rapidly displacing the empirical, and Professor Gray's is the first comprehensive book, printed in English, which is at all satisfying to those who want to know the reason why, and at the same time eminently practical.

The first impression one gets in glancing through the book is the immense amount of ground covered in the 511 pages of text. Not only is the variety of machines treated considerable, including Direct-Current Machines, Synchronous Generators and Motors, Polyphase Induction Motors, and Transformers, but each type is considered in an unusually exhaustive fashion. For example, under D.-C. Machines there are the following chapters: Magnetic Induction; Armature Winding; Construction of Machines; Insulation; The Magnetic Circuit; Armature Reaction; Design of Magnetic Circuit; Commutation, Efficiency and Losses; Heating; Procedure in Armature Designs; Motor Design and Ratings; Limitations in Design; Interpoles; and Specifications. Under Induction Motors are considered such practical topics as "Noise and Deadpoints," in addition to the subjects ordinarily treated. Under Insulation, the potential gradient is treated in a rational practical manner, and under Heating, the temperature gradient in copper and in insulating materials is subjected to computation. These subjects are usually noticeable by their absence.

It is thus not strange that there are some places where compactness is carried too far, although the reviewer was continually surprised at the skill displayed in getting reasonably satisfactory explanations and demonstrations into small compass. It is to be regretted that more references were not given for the benefit of those desiring a more thorough understanding of the subject.

There is so much to commend and the book is so full of interesting considerations commonly overlooked that it is only possible to point out what seems to the writer to be the most distinguishing characteristic, namely, the relatively rational order of procedure and the use of computations rather than empirical data. It gives the student a feeling of confidence to realize that he is not wholly dependent upon canned information as to "precedent" and "good practice."

There are several omissions and apparent inaccuracies, but these are for the most part of minor importance. Some of the more prominent follow.

No mention is made of interpole leakage, of its magnitude or of its importance, and no intimation is given as to the desirability of an inductive shunt for the adjustment of the interpole excittion.

In computing the tooth-tip reactance of Alternators (page 223) the flux per ampere inch in each belt is charged in proportion to the r.m.s. value of the current during the corresponding portion of the cycle, whereas since the reactance volts is the final end of the calculation, it is $\frac{di}{dt}$ and its r.m.s. value that are significant.

On page 358 no reason is given for multiplying the Carter coefficients for stator and rotor together rather than averaging them.

On page 389 it is stated that the number of (wound) rotor and stator slots per phase per pole must each be a whole number. The only requirement of "balance" is that the total number of slots in (wound) rotor or stator shall be a multiple of the number of phases. There are in fact certain advantages arising from a fractional number of slots per phase per pole, the only disadvantage being the greater chance for mistake in the original connecting up the coils.

In general there is too much concrete information in proportion to the explanations, and the limitations given for the various constants are too narrow in many cases. The design of a standard type of machine is made too easy from the standpoint of a text for students (whether in or out of college). It is not sufficient to supply the opportunity to think; the average student will not think unless considerable pressure is brought to bear, and the chief value of college instruction in dynamo design is to cultivate the habit of thinking, of demanding the reason why.

It is to be regretted that the metric system was not used in at least an auxiliary capacity.

The book seems to be such a distinct step in advance of the otherwise available literature in English on this subject that the reviewer does not wish to lay undue stress on minor details. The illustrations are for the most part clear and to the point, and the typography is excellent.

*Professor of Electrical Engineering, Harvard University, Cambridge, Mass.

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SYNDICALISM, INDUSTRIAL UNIONISM AND SOCIALISM—By John Spargo. New York: B. W. Huebsch. Cloth; 5x8 in.; pp. 241. $1.25, net.

An analysis of Syndicalism by a socialist who believes in bringing about the socialistic state through education and order rather than anarchy, and who also believes that treachery to those without the ranks will later be followed by treachery between factions within could hardly fail to be interesting, especially when written by John Spargo. The author deals with the origin, history and philosophy of syndicalism and with its accompaniment of sabotage or economic injury to the capitalists by one means or another. The Relation of Syndicalism to Socialism is discussed—naturally to the advantage of the latter. The book is well worth reading, especially by all who are likely to have to meet labor problems.

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STEEL; ITS SELECTION, ANNEALING, HARDENING AND TEMPERING—By E. R. Markham. Fourth edition, fully illustrated. New York: Norman W. Henley Publishing Co. Cloth; 5x8 in.; pp. 367; 168 text illustrations. $2.50, net.

Earlier editions of this book, under the title "American Steel Worker," were favorably reviewed in our issues of June 18, 1903, and Nov. 15, 1906. There is known, of course, to have been a great progress in development of special steels for automobile construction and the author has taken opportunity to include a little matter on the new products. He complains, however, of the secrecy which manufacturers throw around their complicated alloys. The book is avowedly only a text on practical manipulation.

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Studies of "County Government," by a number of writers and from many viewpoints, fill 275 pages of the May "Annals of the American Academy of Political and Social Science" (Philadelphia; $1 a number). The subject is one which deserves serious consideration, since public attention is fixed, for the most part, on the cities and towns or else on the states and the nation, leaving the counties almost out of consideration except by the politicians and their coworkers. The symposium just noted might well have included separate papers on county public works and their administration. The general plan of the symposium was outlined by H. S. Gilbertson, of the National Short Ballot Organization, New York City, and the symposium was under the editorial direction of Prof. Clyde L. King, of the University of Pennsylvania, Philadelphia.

Pumping Machinery

Reviewed by NICHOLAS S. HILL, JR.*

MODERN PUMPING AND HYDRAULIC MACHINERY, as Applied to All Purposes, with Explanation of the Theoretical Principles Involved, Construction, Working and Relative Advantages—Being a Practical Handbook for Engineers, Designers and Others. By Edward Butler, M. Inst. M. E., author of "Carburettors, Vaporisers and Distributing Valves," "Evolution of the Internal Combustion Engine," etc. Philadelphia, Penn.: J. B. Lippincott Co. London: Charles Griffin & Co., Ltd. Cloth; 6x9 in.; pp. xvi + 473; 345 illustrations. $5.50, net.

The author of this English publication says the book is intended to be useful to "practical engineers, designers, and others engaged either in the construction or application of pumping and hydraulic machinery." This is certainly a wide field of usefulness and one difficult to treat comprehensively in a volume of even 460 pages. It must be said that much has been accomplished. The character of the book is principally descriptive. It is illustrated with an abundance of well chosen cuts and the subject is presented in a very readable manner. The products of English and Continental builders form the greater number of subjects described, but this does not detract greatly from its value to the American reader. Many principal types of American machines find their proper place in the treatment, the whole work being a very comprehensive and analytical review of the present state of the art of building and operating hydraulic machinery.

It is doubtful if the designer will find that quantitative information which is helpful in his work in more than a small amount except in certain chapters. Dimensions of parts which have been found in practice to be correct, or formula derived therefrom are a most useful part of any book on design, but such information is very meager in this volume. The designer, and many others, should, however, profit by the mass of information relating to features of design and conditions of operation of all classes of hydraulic machinery which are in successful use today. Historical matter is presented in a very few pages.

Nineteen chapters are devoted to a discussion of all the more common forms of steam-driven pumps, direct-acting pumps directly driven by gas engines, air-lift and air-displacement pumps, deep-well pumps, ejectors, fire-engine pumps, rotary pumps, centrifugal pumps and other special forms of pumps. Besides a consideration of about all the known forms of pumps in common use, there are chapters on boring appliances for wells, appliances for raising petroleum from deep wells, gas-displacement pumps, hydraulic transmitters, waterwheels, hydraulic turbines and pipe-line phenomena. It is quite evident that it is impossible to give in 460 pages more than general information about all of these subjects. A remarkable amount of information is, however, crowded into the space, and a careful reader may absorb a large fund of general information on all of these subjects and a considerable amount of specific information on some of them. The advantageous and peculiar features of all classes of pumps and other hydraulic machinery are well and comprehensively stated.

Performances, expected and attained, and the adaptability for various purposes is woven into the descriptive matter and also discussed separately in an interesting manner and a large amount of such important matter is to be found.

The work will undoubtedly prove a valuable addition to the literature of the subject, especially as a source of information relating to types and service and to a certain extent as furnishing information on which to base design.

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CASSELL'S REINFORCED CONCRETE—A Complete Treatise on the Practice and Theory of Modern Construction in Concrete Steel. Edited by Bernard E. Jones, Editor of "Building World" and Albert Lakeman, M. C. I. Honors Medalist in Building Construction. London and New York: Cassell & Co., Ltd. Cloth; 8x11 in.; pp. xx+398; 171 illustrations and 500 diagrams and working drawings. $5, net.

As a rule, collaboration in a book of this sort is not very successful because the various authors are apt to overlap, and not infrequently to contradict each other. In this particular case, however, the editing has been quite carefully done and the separation of the subject matter into distinct fields has resulted in a clear-cut treatment, with the additional advantage of having a specialist in charge of each branch. The chief contributors and the different subjects treated are as follows: Frank C. Gatehouse, portland cement; Thomas Potter, concrete; A. B. Searle, concrete, cement, waterproofing, etc.; E. L. Rhead, steel; Albert Lakeman, theory; V. F. Hyde, erection forms; F. P. Barker, forms; G. E. Hardy, architectural treatment; A. F. Jennings, paving; W. H. Brown, estimating; and B. E. Jones, editor-in-chief, introduction, history, example, etc.

The book is distinctly British in that it lays especial emphasis on the matter of estimating, which is the special province of the "quantity surveyor" in Great Britain, and upon the differences in the various systems which control the concrete industry in that country. Aside from these localisms, and a peculiar kind of notation, the book would serve admirably for American use. It is simple in its treatment and quite comprehensive, particularly in the description of various kinds of machinery used in concrete construction. It is illustrated very extensively with photographs which are of considerable interest and with line drawings of structures, which, as usual in English books on concrete, are quite valueless on account of their lack of detail.

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THE SOCIAL CENTER—Edited by Edward J. Ward, Adviser in Civic and Social Center Development, University of Wisconsin. [National Municipal League Series.] New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. x + 359. $1.50, net.

The main thesis of this book is that every public school house should be not only a polling place, but also a meeting place for all citizens, old and young. The author says that members of city, state and national legislatures deliberate before they vote and have fit meeting places for their deliberations, but that the members of the great electorate (who are rapidly becoming direct legislators as well) have no common meeting place for discussions of public questions, free from domination by some political party or religious sect or other division of the great body politic. Indeed, they rarely have fit voting places, even. He would place polling places in public school buildings, and also provide there suitable halls for meetings of both adults and youth, as well as branches of public libraries. The meetings held in these school buildings would have to do with all phases of citizenship, recreation and education. A civic and social secretary would be provided for each building. Examples of social center work in a number of cities are given. The book is an extension of the general principles set forth in "The Wider Use of the School Plant," noted in our issue of June 15, 1911.

The economic waste due to the general restriction of the use of school buildings to a few daylight hours for 180 days in the year, while at the same time providing still other public buildings, many of which are used far less of the time, is a subject which should have been given wide attention long before this. In addition, there are other and perhaps even stronger reasons for making the school house the civic and social center of each neighborhood. These reasons are set forth at length—often at unnecessary length—in the book before us, which deserves a wide circulation.

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MORTALITY STATISTICS FOR 1911—General Death Rates, Specific and Standardized Death Rates, Infant and Child Mortality, and Causes of Death. Bulletin 112. Washington, D. C.: Bureau of the Census. Paper; 9x12 in.; pp. 142.

It is a pleasure to note that 63.1% of the estimated mid-year population of the United States were embraced in the death-registration area. The total population involved is placed at 59,275,977 and the death rate from all causes was 14.2 per 1000. This is the lowest death rate for the registration area ever yet recorded and is a notable decline from the 17.8 rate of 1900—though it should be noted that the registration area has been materially extended since 1900. The typhoid death rate per 100,000 was 21 per 100,000 in 1911, as compared with 25.6 for the five years 1906-10 and 32 for 1901-6.

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INSPECTION OF EUROPEAN PORTS—By Joseph A. Conry. Boston, Mass.: Directors of the Port of Boston. Paper; 6x9 in.; pp. 28.

Concise notes on 16 European ports are here presented in readable form, followed by a few paragraphs of "conclusions" applied to Boston. The ports inspected were London, Bristol, Cardiff, Grimsby (England's latest port) Hull, Newcastle Leith, Glasgow, Belfast, Dublin, Liverpool, Manchester, Antwerp, Rotterdam, Bremen and Hamburg.

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Articles and notes on City Planning form a considerable part of the contents of the "Journal of the American Institute of Architects" (The Octagon, Washington, D. C.; 50c. per number) for June. The opening article is "A City-Planning Program," by F. L. Olmsted, and address at the recent City Planning Congress at Chicago, Ill.

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A new edition of "Defunct Municipal Lighting Plants" has been issued as a 55-page pamphlet (The Municipal Ownership

*Consulting Engineer, 100 William St., New York City.

Publishing Co., New York City; 25c.). It consists of from a few lines to a couple of pages or more regarding a considerable number of electric-lighting plants reported as having been sold or leased to private companies or else shut down. The allegations of fact and expressions of opinion are designed to prove that municipal ownership is universally and inevitably a miserable failure.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

ABSTRACT OF THE THIRTEENTH CENSUS OF THE UNITED STATES, Taken in 1910, with Supplement for New York. Washington, D. C.: Bureau of the Census Cloth; 9x12 in.; pp. 795; illustrated.

AMERICAN WOOD PRESERVERS' ASSOCIATION—Proceedings of Ninth Annual Meeting, Jan. 21-23, 1913. Baltimore, Md.; Secretary, F. J. Angier, Mt. Royal Station. Paper; 5x8 in.; pp. 478; illustrated.

CHICAGO CIVIL SERVICE COMMISSION—Analysis of Employment and Departmental Organization Charts, March, 1913; and Outline Report of Work of the Efficiency Division, 1909-1912. Chicago, Ill.: R. A. Widdowson, Secretary. Paper; 7x10 in.; pp. 99.

COMPUTATIONS FOR MARINE ENGINES—By C. H. Peabody, Professor of Naval Architecture and Marine Engineering, Massachusetts Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. v+209; 51 text figures. $2.50, net.

THE DESIGN AND CONSTRUCTION OF STEAM TURBINES—A Manual for the Engineer. By Harold Medway Martin, author of "Statically Indeterminate Structures and the Method of Least Work." London, England: "Engineering." New York: Longmans, Green & Co. Cloth; 8x11 in.; pp. viii+372; 523 illustrations, including 24 folding plates. $8.50, net.

THE DEVONIAN AND MISSISSIPPIAN FORMATIONS OF NORTHEASTERN OHIO—By Prof. Charles S. Prosser. Columbus, Ohio: Geological Survey of Ohio. Bulletin 15. Cloth; 6x9 in.; pp ix+574; illustrated.

DIE ELEKTRISCHEN STADTSCHNELLBAHNEN DER VEREINIGTEN STAATEN VON NORDAMERIKA; Anlage, Bau und Betrieb der Stadtbahnen in New York, Boston, Philadelphia und Chicago. By F. Musil. [Sonderandruck aus dem Organ für die "Fortschritte des Eisenbahnwesens," 1913.] Wiesbaden, Germany: C. W. Kreidel. Paper; 9x12 in.; pp. 50; 37 text illustrations and 6 folding plates. 3.60 Marks.

AN ELEMENTARY TREATISE ON CALCULUS—A Text-Book for Colleges and Technical Schools. By William S. Franklin, Barry MacNutt and Rollin L. Charles, of Lehigh University. South Bethlehem, Penn.: The Authors. Cloth; 6x8 in.; pp. ix+291. $2.

FOREST PARK RESERVATION COMMISSION OF NEW JERSEY—Eighth Annual Report for Year Ended Oct. 31, 1912. Trenton, N. J.: Alfred Gaskill, Secretary. Paper; 6x9 in.; pp. 81, illustrated.

GAS ANALYSIS—By L. M. Dennis, Professor of Inorganic Chemistry, Cornell University. New York: The MacMillan Co. Cloth; 5x8 in.; pp. xvi+434; 110 text illustrations. $2.10, net.

GEOLOGICAL SURVEY OF NEW JERSEY—Annual Administrative Report of State Geologist Henry B. Kümmel (Trenton, N. J.) for 1912, including a Second Report on Shark River Inlet by C. C. Vermeule, Consulting Engineer, and a List of New Bench Marks. Cardboard; 6x9 in.; pp. 103.

ILLINOIS COAL MINING INVESTIGATIONS—Preliminary Report on Organization and Method of Investigations. Urbana, Ill.: "Coal Mining Investigations," University of Illinois. Paper; 6x9 in.; pp. 71; illustrated.

ILLINOIS HIGHWAY COMMISSION—Fourth Report, for Years 1910, 1911 and 1912. Springfield, Ill.: A. N. Johnson, State Engineer. Paper; 6x9 in.; pp. 345; illustrated.

ILLINOIS STATE MINING BOARD—Annual Coal Report for Year Ended June 30, 1912. Springfield, Ill.: Martin Bolt, Chief Clerk. Cloth; 6x9 in.; pp. xvi+423.

ILLINOIS WATER SUPPLY ASSOCIATION—Proceedings of Fifth Meeting, Mar. 11-12, 1913. Urbana, Ill.: Secretary, Edward Bartow, University of Illinois. Cloth, 6x9 in., pp. 277; illustrated.

LAKE SUPERIOR IRON ORE ANNUAL FOR 1913—Official Figures on Shipments by Mines, Ranges and Ports together with Complete Statistics Bearing on the Lake Superior Ore Movement since 1844; Ore Prices, Receipts at Lower Lake Docks. Cleveland, Ohio: Penton Publishing Co. Leather or cloth; 6x9 in.; pp. 71; illustrated. Leather, $2; cloth, $1.

LEHRBUCH DES HOCHBAUES—Edited by Esselborn. In Two Parts. Vol. 1, Steinkonstruktionen und Grundbau. Holzkonstruktionen. Eisenkonstruktionen. Eisenbetonkonstruktionen. Veranschlagen. Baufuhrung. Beleuchtungs- Heizungs- und Andre Anlagen. By E. Beutinger, B. Kossmann, G. Ruth, H. Steinberger, R. Weder. Paper; 8x11 in.; pp. xxiii+897; 2500 text figures. 36 Marks.

MINERAL INDUSTRIES AND GEOLOGY OF VERMONT—Report of State Geologist George H. Perkins (University of Vermont, Burlington, Vt.) for 1911-1912. Cloth; 6x9 in.; pp. 269; illustrated.

THE MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK—Proceedings for 1912. New York: The Municipal Engineers, 29 W. 39th St. Cloth; 6x9 in.; pp. 362; illustrated.

THE MODERN WARSHIP—By Edward L. Attwood, M. Inst. N. A., Royal Corps of Naval Constructors. [Being one of the Cambridge Manuals of Science and Literature.] Cambridge, England: The University Press. New York: G. P. Putnam's Sons. Linen; 5x7 in.; pp. vii+146; illustrated. 40c. net.

NEW YORK STATE DEPARTMENT OF LABOR (Albany, N. Y.)—Annual Report of Commissioner of Labor for Year Ended Sept. 30, 1912; Annual Reports of Bureaus of Factory Inspection, Mercantile Inspection, Mediation and Arbitration for Year Ended Sept. 30, 1911, Vol. I; Annual Report of Bureau of Labor Statistics for Year Ended Sept. 30, 1911, Vol. III, Part II. Cloth; 6x9 in.; pp. 383, 641 and 601, respectively.

ORE DEPOSITS OF THE HELENA MINING REGION, MONTANA—By Adolph Knopf. Washington, D. C.: United States Geological Survey. Paper; 6x9 in.; pp. 143; illustrated.

PORTLAND CEMENT MATERIALS AND INDUSTRY IN THE UNITED STATES—By Edwin C. Eckel. Washington, D. C.: United States Geological Survey. Paper; 6x9 in.; pp. 401; illustrated.

PRINCIPLES OF IRRIGATION ENGINEERING: Arid Lands, Water Supply, Storage Works, Dams, Canals, Water Rights and Products—By Frederick Haynes Newell, Director, and Daniel William Murphy, Engineer in Charge of Drainage, United States Reclamation Service. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiii+293; 53 illustrations. $3, net.

PROPOSED REGULATIONS FOR THE DRILLING OF GAS AND OIL WELLS—By O. P. Hood and A. G. Heggem. Washington, D. C.: Bureau of Mines. Paper; 6x9; illustrated.

PROVINCE OF ONTARIO HYDRO-ELECTRIC POWER COMMISSION—Fifth Annual Report for Year Ended Oct. 31, 1912. Toronto: W. W. Pope, Secretary. Paper; 6x9 in.; pp. 255, illustrated.

PUBLIC SERVICE COMMISSION, FIRST DISTRICT, STATE OF NEW YORK—Report for Year Ended Dec. 31, 1911. Vol. II, Statistics of Transportation Companies for the Year Ended June 30, 1911. Compiled by George P. Watkins, Assistant Chief Statistician. New York: Bureau of Statistics and Accounts. Cloth; 6x9 in.; pp. 771.

"ROSE TECHNIC" AUTHOR AND SUBJECT INDEX, 1891 to 1912. Terre Haute, Ind.: Rose Polytechnic Institute. Paper; 8x11 in.; pp. 30.

SOLUTION OF RAILROAD PROBLEMS BY THE SLIDE RULE—By E. R. Cary, M. Am. Soc. C. E., Professor of Railroad Engineering and Geodesy, Rensselaer Polytechnic Institute. New York: D. Van Nostrand Co. Cloth; 4x6 in.; pp. ix+136; 43 text figures. $1. net.

STATISTICAL ABSTRACT OF THE UNITED STATES—Thirty-fifth Number, 1912. Washington, D. C.: Bureau of Foreign and Domestic Commerce. Cloth; 6x9 in.; pp. 836.

STEEL DESIGNING—Being "Structural Engineering," Book III. By Edward Godfrey, M. Am. Soc. C. E., Structural Engineer, Robert W. Hunt & Co.; author of "Steel and Reinforced Concrete in Buildings," "Some Mooted Questions in Reinforced Concrete Design," etc. Pittsburgh, Penn.: The Author, Monongahela Building. Leather; 4x7 in.; pp. 492; numerous text figures and drawings. $2.50.

ST. LOUIS BUREAU FOR REVISION OF ACCOUNTS AND METHODS—Report of Apr. 15, 1913. St. Louis, Mo.: B. J. Taussig, Comptroller. Paper; 9x12 in.; pp. 26; illustrated.

TESTIMONY AND REPORT ON THE LIVINGSTONE CHANNEL [DETROIT RIVER]—Washington, D. C.: International Joint Commission of the United States and Canada. Two Pamphlets. Paper; 6x9 in.; pp. 225 and 18, respectively.

TRADE UNIONISM, UNEMPLOYMENT, WAGES, PRICES AND COST OF LIVING IN AUSTRALIA, 1891-1912. [Labor and Industrial Branch Report No. 2.] Melbourne, Australia: Commonwealth Bureau of Census and Statistics. Paper; 6x9 in.; pp. 77.

UNITED STATES GEOLOGICAL SURVEY—Complete lists, to date, of serial publications (topographic maps excepted) of the Survey. Washington, D. C.: George Otis Smith, Director. Paper; 6x9 in.; pp. 124.

WISCONSIN RAILROAD COMMISSION—Opinions and Decisions, Vol. VII, June 15 to Sept. 23, 1911. Vol. VIII, Sept. 27, 1911, to Mar. 12, 1912. Compiled by J. M. Winterbotham, Secretary. Madison, Wis. Cloth; 6x9 in.; pp. xvii+887 and xxiii+863.

CONSTRUCTION NEWS

★ Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS

RAILWAYS

New York—New York Central Lines.—A. T. Hardin, Vice-Pres. New York Central Lines, in his application to the Public Service Commission for permission to build the proposed "short connection" between the lines of the Boston & Albany R.R. and the West Shore R.R., a short distance south of Albany, has stated the approximate cost of the total work, including Hudson River bridge, to be $10,000,000. The Public Service Commission has approved the undertaking. The plans call for improved yard facilities on both the east and west shores of the Hudson River and a $3,000,000 bridge.

New York—Delaware & Hudson Co.—For the purpose of completing construction under way and providing for further additions to the company's property, this company was authorized by the Public Service Commission to issue $2,000,000 of bonds. G. H. Burgess, Albany, is Ch. Engr.

✚**Pennsylvania**—Chartiers Southern R.R.—Subcontracts for the masonry work and tunnel work necessary in the construction of this company's line have been awarded to the following: FOGLE BROS., Toronto, Ont.; H. J. ZEVELY, Morgantown, W. Va.; W. J. TORRINGTON & CO., Philadelphia; N. C. HUNTER & CO., Washington, Penn.; for tunnel work. PATTON & RICHARDSON, Newport News, Va. The general contract includes 1,500,000 cu.yd. earth and rock excavation, 1300 lin.ft. earth and rock tunnel, 40 concrete bridges and 40,000 cu.yd. concrete masonry. Brocklehurst & Potter Co., Providence, R. I., are the general contractors. Noted May 15.

Maryland—Pennsylvania R.R.—This company plans to do the following work in the city of Baltimore: Construct a four-track line from Union Station to Calvert Station, where there are now two tracks; construct a freight yard four blocks long and two blocks wide, including the site of Calvert Station, to contain additional tracks. This is in connection with plans which involve the expenditure of about $10,000,000 in and near Baltimore. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

✚**West Virginia**—Virginian Ry.—This company has awarded the contract to W. W. BOXLEY & CO., Roanoke, Va., for the construction of a two-track tunnel and revision of alignment through Jennys Gap between Lester and Slab Fork, Raleigh County, W. Va.

North Carolina—The construction of a railroad from Rockingham, N. C., to Cheraw, S. C., is being planned. It will be about 25 miles long. William Gillispie, Cheraw, is interested.

South Carolina—See item under North Carolina.

Georgia—Savannah & Southern Ry.—This company has awarded the contract for its proposed extension from Norden to Lanier, Ga. S. Starr, Letford, Ga., is Gen. Mgr.

Mississippi—Gulfport & Western Ry.—The city of Gulfport, it is reported, has voted to issue $150,000 of bonds to aid this company to construct its line from Gulfport to Covington, La., 62 miles. W. H. Hardy is Pres., George P. Hewes, Treas., and J. D. Hardy, Secy. Work will begin within 60 days. Noted May 22.

Louisiana—Southern Pacific Co.—See item under California.

✚**Illinois**—Macoupin County Extension Ry.—This company has awarded the contract to the WINSTON BROS. CO., Minneapolis, Minn., for the construction of a coal road eight miles in length, from Benld, Ill., in a southwesterly direction in Macoupin County. The contract requires 200,000 cu.yd. of excavation. Noted May 22.

Illinois—Chicago & Western Indiana R.R.—This company is preparing to start work on the elevation of its tracks in the city of Chicago, Ill., between 71st St. and 83d St. E. H. Lee, Chicago, Ill., is Ch. Engr.

Minnesota—Grand Marais & Northwestern R.R.—This company plans to award contracts for its proposed line about Oct. 1. The route is from Grand Marais, Minn., west to a connection with the Duluth & Northern Minnesota R.R., about 50 miles. Arthur Mitchell, Duluth, Minn., is Pres. Noted May 22.

Arkansas—De Queen & Eastern Ry.—This company is considering the construction of a 25-mile line from De Queen, Ark., to Broken Bow, Okla., to connect with the Texas, Oklahoma & Eastern Ry. E. S. Byington, Broken Bow, Okla., is Ch. Engr.

Oklahoma—De Queen & Eastern Ry.—See item under Arkansas.

Texas—Surveys are being made for the construction of the proposed railroad between Gig Springs, Tex., and Tucumcari, N. M. J. J. Fry is interested.

Texas—Southern Pacific Co.—See item under California.

Colorado—Denver & Salt Lake R.R.—This company, May 20, filed with the Secretary of State a notice of an increase of capital stock from $10,000,000 to $35,000,000.

Nevada—Southern Pacific Co.—This company, it is reported, is considering the construction of a line from Coaldale to Tonopah, Nev. From that point the line will connect with the Nevada & California R.R. W. Hood, San Francisco, Calif., is Ch. Engr.

Washington—Chicago, Milwaukee & St. Paul Ry.—This company is considering the construction of a line from Neppel, the new townsite on Moses Lake in southeastern Douglas County, north through the grain country south of the Colville Indian Reservation, to Foster Creek, and thence along the creek to Bridgeport on the Columbia River and west to Bellingham, Wash. C. F. Loweth, Chicago, Ill., is Ch. Engr.

✚**Washington**—Southern Pacific Co.—This company has awarded a contract to P. NELSON & CO., Oakdale, Calif., for the construction of two double-track tunnels near Colfax, Wash., one 1300 ft. long and the other 400 ft. long. The CHADWICK & SYKES CONSTRUCTION CO. has been awarded the contract for the grading work for the double track to be laid between the long tunnel and Colfax, Wash., a distance of three miles.

✚**Oregon**—The contract, it is reported, has been awarded to OLSON BROS., Seaside, for constructing a logging line in Clatsop County, Ore., from near Gearhart Park, east to the Lewis and Clark River. Work will start at once. M. J. Kinney is interested.

Minkler Southern Ry.—This company has been incorporated with a capital of $200,000, for the purpose of constructing a line from Minkler, Fresno County, to Exeter, Tulare County. The line will be about 41 miles in length. The office of the company will probably be at Minkler.

California—Southern Pacific Co.—This company applied to the State Railroad Commission, June 5, for permission to issue $30,000,000 of bonds for improvements, including construction work, on its entire system in Louisiana, Texas and California. W. Hood, San Francisco, Calif., is Ch. Engr.

The Pacific Coast Borax Co., Oakland, Calif., is having surveys made for the construction of a line from the Lilas Mine on the Tonopah & Tidewater R.R. to its borax deposits in Death Valley, Calif.

Nova Scotia—Halifax Harbor Terminals Ry.—(Official) Bids will be received until noon, June 21, by L. K. Jones, Asst. Deputy and Secy. Dept. Rys. and Canals, Ottawa, Ont., for grading this railway from Rockingham to the Halifax Ocean Terminals. The line is a double-track road.

Ontario—Canadian Northern Ry.—This company has filed with the city of Toronto, Ont., revised plans for a western entrance into the city, which will call for the construction of a four-mile line, and include the construction of a 2360-ft. tunnel, 30 ft. wide and about 25 ft. deep, from a point south of Davenport Rd., east of St. Clarens Ave., to a point east of Talbot Ave. The tunnel will be built for two tracks with a center wall running through its entire length. The tracks will be depressed to the west and bridges erected over the streets. The Humber River will be crossed on a high level bridge.

Manitoba—Canadian Northwestern Ry.—The bill authorizing this company to incorporate for the construction of a line from Winnipeg, Man., to Manitou and then through the southern portion of Manitoba and Saskatchewan to Lethbridge, Alta., has been approved by the Canadian Parliament. L. K. Jones, Ottawa, Ont., is Secy. Dept. Rys. and Canals. W. C. Montague, Beaulieu, Que., is interested.

Alberta—Canadian Northwestern Ry.—See item under Manitoba.

Saskatchewan—Canadian Northwestern Ry.—See item under Manitoba.

ELECTRIC RAILWAYS

Biddeford, Maine—Plans are being considered by the Biddeford & Saco R.R. Co. for double-tracking its line on Main St. in Biddeford. C. M. Durell, Biddeford, is Supt.

Brockton, Mass.—Plans are being prepared by the Bay State St. Ry. Co. for the extension of its line on several streets in Brockton. J. T. Conway, Brockton, is Gen. Supt.

Lenox, Mass.—The construction of an electric railway in Lenox is contemplated by the Berkshire St. Ry. Co. C. Q. Richmond, Pittsfield, is Gen. Mgr.

Springfield, Mass.—A franchise has been granted to the Springfield St. Ry. Co. for the construction of an electric railway on certain streets in Springfield. E. J. Dickson, Springfield, is Mgr.

Riverhead, (L. I.) N. Y.—W. S. Davis, Hartford, Conn., is interested in a project which is under consideration, to construct an electric railway from Riverhead to Orient Point, about 30 miles.

Syracuse, N. Y.—The New York State Rys. Co. has been granted permission to double-track its line in East Syracuse. H. M. Butler, Rochester, is Pur. Agt.

Asbury Park, N. J.—Charles Leland, Asbury Park, is interested in the construction of a trolley line to connect Asbury Park and Freehold.

Morristown, N. J.—The Morris R.R. Co. has increased its capital stock from $30,000 to $250,000 to provide for the construction of its proposed electric line between Morristown and Madison. The line will be used by the Morris County Traction Co., with which the former company is affiliated.

✚**Trenton, N. J.**—The Trenton & Mercer County Traction Co. has awarded a contract to the NEWTON PAVING CO. for rebuilding its line on North Broad St., from State to Perry Sts., to include rebuilt roadbed, replacement of present ties with creosoted ties imbedded in a crushed stone and concrete foundation, and new 103-lb. rails in place of the present 70-lb. sections.

Honesdale, Penn.—The Wayne County St. Ry. Co. has been incorporated to construct an interurban railway from Honesdale, to Hawley. Martin B. Allen and Edmund B. Hardenbergh are interested.

Martinsburg, W. Va.—The Shenandoah Traction Co. is making preliminary arrangements for the construction of a proposed electric railway to connect Martinsburg, W. Va. and Williamsport, Md. Dudley D. Britt, Clarkesburg, W. Va., is Ch. Engr. Noted Apr. 3.

Charleston, S. C.—Preliminary arrangements are being made by the Charleston & Summerville Interurban Ry. Co. for the construction of its proposed electric railway to connect Charleston and Summerville, about 22 miles. J. L. David is Pres.

Clarkston, Ga.—The Georgia Ry. & Power Co. has been granted a franchise to construct and operate an electric railway through Clarkston. This is part of the proposed line to connect Atlanta and Stony Mountain. G. W. Brine, Electric and Gas Bldg., Atlanta, is Gen. Ggr.

Birmingham, Ala.—Plans are being prepared by the Birmingham Ry., Light & Power Co. for the extension of its line to Lewisburg. U. H. Harris, Birmingham, is Supt. Ry. Dept.

Clarksville, Tenn.—Plans are being considered by the Clarksville Ry. & Light Co. for the extension of its line in Clarksville. A. C. Murray, Clarksville, is Pres. and Gen. Mgr.

Johnson City, Tenn.—Preliminary arrangements are being made by the Johnson City & Elizabethton Ry. Co. for the construction of its proposed electric railway to connect Johnson City, Milligan College, Oak Grove, Gap Creek and Elizabethton, about 13 miles. J. C. Burchfield is Pres.

Memphis, Tenn.—Plans are being prepared by the Memphis St. Ry. Co. for the extension of its line in Memphis. E. W. Food, Memphis, is Gen. Supt.

✚Chardon, Ohio—The contract for the engineering work on the proposed electric railway to connect Chardon, Ohio, Jefferson, Ohio, and Meadville, Penn., about 50 miles, has been awarded to the PEASE ENGINEERING CO., Cleveland, Ohio.

Cincinnati, Ohio—The Cincinnati Traction Co. has been granted a franchise to construct and operate an extension of the Avondale street railway on Hunt St. in Cincinnati. Dana Stevens, Cincinnati, is Gen. Mgr.

Columbus, Ohio—The Columbus, Kenton & Toledo Traction Co. has started surveys on its proposed line from Columbus to Findlay. C. T. Wisewell, Kenton, Ohio, is Gen. Mgr. and Ch. Engr. Noted May 23, 1912.

Toledo, Ohio—Plans are being considered by the Fort Wayne & Northwestern Electric Ry. Co. for the extension of its line to Toledo. C. J. Munton, Kendallville, is Gen. Supt.

Frankfort, Mich.—Eugene Zimmerman is interested in the construction of an electric railway from Frankfort to Honor.

Bradford, Ill.—The Central Illinois Interurban Ry. Co. has started surveys on its proposed electric railway to connect Kewanee, Osceola, Bradford and Henry, about 40 miles. John R. Fate, Peoria, is interested.

Taylorville, Ill.—A franchise has been granted to the Decatur, Sullivan & Mattoon Transit Co. to construct and operate an electric railway in Taylorville.

Merrill, Wis.—The Minneapolis, Merrill & Marinette Ry. Co. has been incorporated to construct and operate an interurban railway from Merrill to Antigo and from Merrill to Prentice Junction, about 75 miles in all.

✚Moberly, Mo.—The Moberly, Huntsville, & Randolph Springs Ry. Co. has awarded the contract for grading its proposed line from Randolph Springs to Moberly, about 12 miles, to the JENNINGS CONSTRUCTION CO., at $13,080. Bids were received by C. H. Damern, Pres., May 29. Noted May 15.

Salt Lake City, Utah—A franchise has been granted to the Salt Lake & Ogden Electric Ry Co. for the construction of an electric railway on certain streets in Salt Lake City. Park Kenner, Salt Lake City, is Pur. Agt.

Tacoma, Wash.—Bonds for $87,000 have been voted for the construction of a municipal electric-railway on South 11th St. Noted Mar. 6.

Portland, Ore.—The City Council has granted a franchise to the Errol Heights Ry. Co. to construct and operate an electric railway on certain streets in Portland.

San Diego, Calif.—Plans are being prepared by the San Diego Electric Ry. Co. for the extension of its line to the Fort Rosecrans Military Reservations. B. M. Warner, San Diego, is Gen. Supt.

✚Ottawa, Ont.—The Ottawa & Morrisburg Electric Ry. Co. has awarded a contract to the RELIANCE CONSTRUCTION CO., Chicago, Ill., for the construction of its proposed line from Ottawa to Morrisburg.

Medicine Hat, Alta.—The Montreal Engineering Co. has been granted a franchise to construct and operate an electric railway in Medicine Hat.

LIGHT, HEAT AND POWER

Boston, Mass.—Plans have been prepared for the installation of an ornamental street-lighting system on Huntington Ave.

✚Olneyville, R. I.—The contract for the construction of the addition to the power plant of the Narragansett Electric Lighting Co. has been awarded to FAMIGLIETTI BROS. CO., 166 Broadway, Providence, R. I.

Brooklyn, N. Y.—(Official)—The following bids were received June 2, by the Department of Education, 500 Park Ave., Boro Manhattan, for installing the heating and ventilating apparatus in the Boys' Evening High School, William J. Oliver: $79,985, Raisbeck Heating Co.; $85,500, E. Butzler Co.; $85,582, Blake & Williams; $87,944, P. J. McKinnon, $79,000, C. B. J. Snyder is Supt.

Seneca Falls, N. Y.—Preliminary arrangements are being made for a two-mile extension of the ornamental street-lighting system in Seneca Falls. R. C. Smith is Supt.

Troy, N. Y.—The City Engineer is preparing plans for the extension of the ornamental street-lighting system.

✚Camden, N. J.—The city has awarded a contract to EDWARD FAY & SON, Philadelphia, Penn., for the construction of a municipal power house to be located on Federal St. at Coopers Creek, to be 80x80 ft., three stories, and to cost $100,000.

✚Chatham, N. J.—We are advised that the contract for the erection of a brick chimney at the municipal electric-light plant at Chatham, has been awarded to the MANISTEE IRON WORKS CO., Manistee, Mich., and not the Maxistee Iron Working Co., as erroneously noted in the issue of June 5.

Jersey City, N. J.—The Public Service Electric Co. will build an addition to its Marion power station, on Duffield St., to cost about $10,000.

Philadelphia, Penn.—Plans are being prepared by John G. Brown for the construction of a power plant at Ninth St. and Allegheny Ave., for the Electric Storage Battery Co.

Williamsburg, Penn.—Plans are being prepared by the Penn Central Light & Power Co. for the construction of a new power plant at Williamsburg to have a capacity of 30,000-hp. Warren Partridge, Clearfield, is Gen. Mgr.

Cambridge, Md.—Plans are being considered by the Cambridge Gas, Electric Light & Power Co. for the installation of new equipment in its power plant. G. Lobo is Secy.

Washington, D. C.—Walter C. Allen, District Elecn., is preparing plans for the installation of an ornamental lighting system on Pennsylvania Ave., from the Peace Monument to the Treasury Bldg. Estimated cost, $7000.

Eastville, Va.—Stanley Scott and associates are interested in a project to construct and operate an electric-light and ice plant at Eastville.

Norfolk, Va.—The Virginia Ry. & Power Co. will expend $100,000 during the present year for the remodeling of its gas plant, and converting it from a water-gas plant to a coal-gas plant, with 1,000,000 cu.ft. per day, and with additional purifiers and other accessories. The company is also making preparations for the expenditure of $2,000,000 additional for improvements during the year 1914.

Richmond, Va.—The City Council has appropriated $38,000 for the installation of an ornamental street-lighting system.

Jacksonville, Fla.—Plans are being considered by the Southern Utilities Co. for the improvement of its various power plants. H. C. Adams, Jacksonville, is Gen. Mgr.

Louisville, Ky.—See item under Buildings.

Coshocton, Ohio—Plans are being prepared by the Coshocton Light & Heating Co. for the extension of its transmission line and the installation of new equipment in its power plant. C. H. Howell is Supt.

Lancaster, Ohio—The proposition to issue $125,000 of bonds for the construction of a municipal electric-light plant will be submitted to the voters at an election to be held soon.

Lebanon, Ohio—The $25,000 bond issue for a water-gas plant at Lebanon, was passed, and the Reliance Engineering Co., of Cincinnati, Ohio, will prepare plans. It will have a capacity of 750,000 cu.ft. The city also intends to extend the gas mains and install larger pipes throughout the city.

Steubenville, Ohio—The Chamber of Commerce is considering the installation of an ornamental street-lighting system.

✚Toledo, Ohio—The contract for the construction of a power plant for the Lucas County Infirmary and Hospital for Tuberculosis has been awarded to JOHN PIOCH, Toledo, at $10,500. Bids were received May 19. Noted May 8.

★Ann Arbor, Mich.—Bids will be received by Gardner S. Williams, Consult. Engr., until 5 p.m., June 16, for the construction of a reinforced-concrete spillway and waste gates for the Argo plant of the Eastern Michigan Edison Co. Noted Apr. 10.

Whitehall, Mich.—Plans are being considered by the Frugale Power Co. for the construction of an electric-power plant at Whitehall, to cost from $15,000 to $20,000. Frank H. Speese is Engr-in-Charge.

Lewistown, Ill.—Plans are being considered by the Lewistown Electric Co. for the installation of additional equipment in its power plant. C. W. King is Gen. Mgr.

Sterling, Ill.—The installation of an ornamental street-lighting system in Sterling and Rock Falls, is being considered by a joint committee from both cities.

Hollandale, Wis—Herman Azzaline, Sr., has prepared plans for the installation of an electric-light plant in Hollandale.

Superior, Wis.—See item under Buildings.

Belmont, Iowa—The construction of an electric-light plant at Belmont is being considered by W. T. McVasky & Co.

Holstein, Iowa—The construction of an electric-light plant at Holstein is contemplated by the Holstein Service Co. W. F. Hutton is Secy.

Maxwell, Iowa—Plans are being considered by W. A. Curtis, for the construction of an electric-light plant at Maxwell.

Mediapolis, Iowa—The Mediapolis Electric Co. has been granted a franchise to construct and operate an electric-light plant at Mediapolis.

Russell, Iowa—At a recent election it was voted to install a municipal electric-light plant.

✚Sioux City, Iowa—(Official)—The contract for placing concrete piles for the foundation of a power plant at Sioux City, for Armour & Co. has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York, N. Y.

Duluth, Minn.—See item under Buildings.

St. Paul, Minn.—According to press reports, the St. Paul Gas Co. is preparing plans for the construction of a new gas plant to cost $1,500,000. Paul Doty is Gen. Mgr.

Warroad, Minn.—At a recent election bonds for $30,000 were voted for the construction of an electric-light plant and water system.

Arcadia, Kan.—Bids will soon be received by the city for the construction of a municipal electric-light plant. Estimated cost, $8500. E. T. Archer & Co., New England Bldg., Kansas City, Mo., are Consult. Engrs.

Chanute, Kan.—An expenditure of $12,000 is planned for the improvement of the municipal electric-light plant. J. N. Johnson is Comr. of Pub. Utilities.

Herington, Kan.—The proposition to issue bonds for $50,000 for the construction of an electric-light plant and waterworks system in Herington is under consideration. Plans are being prepared by the Benham Engineering Co., Oklahoma City, Okla.

Jetmore, Kan.—The citizens of Jetmore are considering the proposition to issue $10,000 of bonds for the construction of an electric-light plant and water system. Noted Mar. 27.

Wautoma, Kan.—Charles T. Dahlke has been granted a franchise to install and operate an electric-light system in Wautoma. A transmission line will be erected from Neshkora, about nine miles.

North Platte, Neb.—The city is considering plans for the installation of an ornamental street-lighting system. Charles McNamara is City Engr.

Hudson, S. D.—The Hudson Electric Co. is preparing plans for the construction of an electric-light plant at Hudson. J. D. Bradley, Hudson, is Pres.

Kenmare, N. D.—(Official)—The Kenmare Light & Power Co. will soon receive bids for the installation of an ornamental street-lighting system. P. M. Cole is interested. Noted May 29.

Mayville, N. D.—Bids will be received by C. O. Vangen, City Audr., until 10 a.m., June 18, for the construction of an electric-light plant. Plans and specifications are on file at the office of the Claussen Engineering Co., Commercial Bldg., St. Paul, Minn.

Portageville, Mo.—The Portageville Mfg. Co. contemplates the construction of an electric-light plant in connection with its establishment.

Morrillton, Ark.—Plans are being considered by the Morrillton Light & Power Co. for the reconstruction of its power plant, which was recently destroyed by fire. William L. Moose is Pres.

Galveston, Tex.—Bids will be received by John D. Kelley, City Clk., until June 12, for furnishing material for the proposed ornamental street-lighting system.

Fort Worth, Tex.—The Fort Worth Power & Light Co. will double the capacity of its electric-light and power plant here. Included in the equipment to be installed are eight new boilers with a total of 4000 hp.

Franklin, Tex.—The city contemplates purchasing the power and water plants of the Franklin Water & Light Co. It is understood that improvements will be made to the property if the deal is consummated.

Newkirk, Okla.—Plans are being considered for the installation of an ornamental street-lighting system. J. H. Fox is Supt.

Valliant, Okla.—An election will soon be held at which the proposition to issue $51,000 of bonds for the construction of an electric-light plant and water system, will be submitted to the voters. E. W. Gantt, Sam Houston Life Bldg., Dallas, Tex., is Consult. Engr.

Clayton, N. M.—Plans are being considered for the installation of a new street-lighting system. E. E. Kirtley is Supt. of the electric-light plant.

Ashton, Idaho—Plans are being considered by the Ashton & St. Anthony Power Co., Ltd., for the construction of an electric-light plant near Ashton. Estimated cost, $200,000. N. N. Holm is Pres.

Salt Lake City, Utah—W. Lackner has made application for permission to utilize Cleve Creek for generating electric power. If his application is approved, he will erect a power house at the mouth of Cleve Creek Cañon and construct a conduit 5000 ft. long, with a 450-ft. head to convey the waters of the stream to it.

Flagstaff, Ariz.—The Flagstaff Electric Light Co. is planning the construction of a new power plant in Flagstaff. G. T. Herrington is Gen. Mgr.

Eatonville, Wash.—Preliminary arrangements are being made for the construction of a municipal electric-light plant at Eatonville. Plans have been prepared by Evans & Dickson, Tacoma. Noted May 22.

Hollister, Calif.—Elmer Sherman, Mgr. of the Coast Counties, Gas & Electric Co. is considering the extension of the company's power line from the present limits on the Tresto Pinos Road to the Macomber ranch near Paicines.

Jackson, Calif.—The installaion of a street-lighting system in Jackson is under consideration.

+Pasadena, Calif.—The contract for the installation of an ornamental lighting system on Los Robles Ave. has been awarded to B. F. KIERULFF, JR., Los Angeles, at $22,130.

Hull, Que.—The Hull Power Co. will expend $1,250,000 for the construction of a new power house and equipment.

Windsor Mills, Que.—The Canada Paper Co. has purchased a site on the St. Francis River and will erect a $300,000 power dam and plant for supplying its mills.

BRIDGES

Augusta, Maine—Press reports state that the Maine Central R.R. contemplates the erection of a steel bridge over the Kennebec River at Augusta. The estimated cost is $350,000. T. L. Dunn, Portland, is Ch. Engr.

Falmouth, Maine—Bids will be received until 2 p.m., June 14, by the Board of Selectmen, for the construction of a reinforced-concrete arch bridge of the open-spandrel type. It will have a span of 160 ft.

Harpswell, Maine—Bids will be received until 2 p.m., June 18, by the Board of Selectmen, for the construction of the substructure and the superstructure for a bridge between Orris Island and Bailey's Island. George B. Merrill, Portland, is Engr.-in-charge.

East Jaffrey, N. H.—The citizens have voted to build 10 new bridges. Four of these will be of concrete and four of granite.

Boston, Mass.—The Mayor has instructed the Department of Public Works to advertise for bids for the construction of a temporary drawbridge to replace the present Chelsea south bridge, after the department had informed the Mayor that the Chelsea north bridge was practically completed. It is estimated that the new structure will cost in the vicinity of $90,000. L. K. Rourke is Comr. Pub. Wks.

+Yarmouth, Mass.—(Official)—The Commissioners of Barnstable County at Barnstable, have awarded a contract to the TAYLOR & CROSBY CO., Centerville, at $16,889, for the construction of a reinforced-concrete girder bridge, between Yarmouth and Dennis. Bids were received May 11. F. C Wales, Tremont Bldg., Boston, is Engr. Noted May 1.

+Granville, N. Y.—The Town Council has awarded a contract to CLARK & WELLS, Hudson Falls, at $5943, for the construction of a concrete arch bridge at Main St.

Herkimer, N. Y.—The Town Board is considering the erection of a bridge over West Canada Creek. The estimated cost is $65,000.

Jay, N. Y.—The citizens at a special election held recently, voted to issue bonds for $7000 for the construction of a bridge over the Ausable River and to rebuild a bridge between Jay and upper Jay.

+New York, N. Y.—(Official)—The Department of Bridges, Municipal Bldg., has awarded a contract to the NORTHEASTERN CONSTRUCTION CO., 225 Fifth Ave., at $596,000, for the improvement of the Brooklyn plaza of the Manhattan bridge. Bids were received May 22. Arthur J. O'Keefe is Comr. Noted May 29.

Rochester, N. Y.—The following bids were received May 26 by the Board of Supervisors of Monroe County, for the construction of the Ballantyne Bridge over the Genesee River; Lupfer & Cormick, $42,435; Seneca Engineering Co., $45,000; Barrally & Ingersoll, $46,000; Frank M. Skene, $46,700; Owego Bridge Co., $47,600. It will be a steel truss bridge, with a concrete floor, and a span of 216 ft. Noted May 15.

+Baltimore, Md.—The Board of Awards has awarded a contract to the STEWART-JONES CO., Rock Hill, S. C., and the CLAIBORNE-JOHNSTON CO., Calvert Bldg., Baltimore, at their joint bid of $190,693, for the construction of the Fallsway Viaduct above the foundation level. Bids were received May 21. Calvin W. Hendricks, 904 American Bldg., is Engr.-in-Charge. Noted May 29.

King William, Va.—(Official)—Bids will be received until noon, June 23, by the Board of County Supervisors, for the construction of a concrete and steel bridge, over the Pamunkey River, between Hanover and King William. It will have three spans, one 119 ft. one 37 ft. and one 29 ft. The Childrey-Sunday Co., Richmond, are Engrs.-in-charge.

Tazewell, Va.—(Official)—Bids will be received until noon, June 20, by the Board of County Supervisors, for the construction of a steel and concrete bridge over the Church River, near Richlands. There will be two spans, one 119 ft. long and the other 37 ft. long. The Childrey-Sunday Co., Richmond, are Engrs.-in-charge.

Yorktown, Va.—(Official)—Bids will be received until noon, June 19, by the Board of County Supervisors, for the construction of two concrete and steel bridges. One will be built over Harrod's Hill Creek and one over Smith Creek. The Childrey-Sunday Co., Richmond, are Engrs.-in-Charge.

+Lewisburg, W. Va.—(Official)—The County Court has awarded a contract to the LUTEN BRIDGE CO., York, Penn., at $4844, for the construction of a bridge across Second Creek at the Clarence Dickson Ford. It will have two 60-ft. reinforced-concrete archs. Bids were received on June 3. John E. Douglas is County Rd. Engr. Noted May 8.

Lebanon, Tenn.—Bids will be received until July 7, by Walter H. Drane, City Engr., for the construction of a reinforced-concrete girder bridge across Town Creek on West Main St. The structure will have two spans and will be 65 ft. wide.

+Memphis, Tenn.—(Official)—The UNION BRIDGE & IRON CO., Sharp Bldg., Kansas City, Mo., has been awarded the contract by the Chicago, Rock Island & Pacific Ry., for the construction of the substructure of a bridge over the Mississippi River at Memphis. The work consists of sinking five pneumatic piers, several smaller piers for the approaches, and all shore protection. The cost of the substructure will be about $1,250,000. The finished bridge will be about 6000 ft. long, and is located 200 ft. above the Frisco R.R. Bridge at Memphis. The estimated cost of the entire structure is $4,000,000. Ralph Modjeski, Chicago, Ill., is Engr.-in-charge. Noted Aug. 29.

Burnside, Ky.—The Burnside Bridge Co. will erect a steel drawbridge over the south fork of the Cumberland River at Burnside, as soon as plans are approved by the War Department.

Akron, Ohio—Bids will be received until noon, June 27, by the Board of Commissioners of Summit County, for the construction of the following: Two reinforced-concrete arch bridges over the Little Cuyahoga River, on East North St., in Akron; the substructure for the Hopkins bridge over Yellow Creek, west of Ghent; the substructure of the bridge across the channel in Coventry Township. C. L. Bown is County Clk.

+Ashland, Ohio—(Official)—The Director of Public Service has awarded a contract to SEYMOUR SCOTT, Ashland, at $4855, for the construction of the concrete abutments for the Holbrook St. bridge. Bids were received June 5. Fred Edwards is Dir. Noted May 22.

Elyria, Ohio—(Official)—Bids will be received until 1 p.m., June 30, by the Board of Commissioners of Lorain County, for the construction of the following bridges: Freeman Bridge, estimated cost $5909 for the superstructure, $11,950 for stone and $9737 for concrete; West View bridge, $5296. T. L. Gibson is County Engr.

Mansfield, Ohio—Bids will be received until noon, June 30, by the Board of Commissioners of Richland County, for the construction of the following bridges: Lexington bridge substructure. Troy Township; Newville bridge substructure, Worthington Township; Newville bridge superstructure, Worthington Township; Alexander bridge substructure, Monroe Township; Alexander bridge superstructure, Monroe Township; Darling bridge substructure, Monroe Township; Darling bridge superstructure, Monroe Township; Culler bridge superstructure, Monroe Township; Ice House bridge substructure, Monroe Township; Beemiller bridge superstructure erection and repair, Worthington Township.

Mt. Vernon, Ohio—The Commissioners of Knox County have decided to build eight bridges in the county, to replace those washed away by the March floods. It will be necessary to issue bonds to the amount of $200,000.

Warren, Ohio—The Board of Commissioners of Trumbull County has decided to erect a bridge over the Mahoning River at Hartford, Warren Township. W. R. Harrington is County Clk.

✚Youngstown, Ohio—The Board of County Commissioners has awarded a contract to the WYMER-HARRIS CONSTRUCTION CO., Youngstown, at $6480, for the construction of a steel bridge, 180 ft. long, on the South Center Road, in Youngstown Township. I. M. Hogg is County Audr. Noted May 22.

Bids will be received until 11 a.m., June 25, by the Board of County Commissioners, for the construction of a reinforced-concrete bridge on the town-line road, between Youngstown and Cortsville Townships. I. M. Hogg is County Audr.

Wabash, Ind.—(Official)—No bids were received June 4, by the Board of Commissioners of Wabash County, for the construction of a three-span reinforced concrete bridge over the Mississinewa River near Somerset, as contractors were unable to undertake the construction under the appropriation. The Board will probably later on increase the appropriation and the work will be readvertised. The structure will have a center span of 105 ft. and two end spans of 100 ft. each. A. W. Grosvenor, Bank Block, Fort Wayne, is Engr.-in-charge. Noted May 29.

Chicago, Ill.—Bids will be received soon by the city for a temporary rolling drawbridge over the Chicago River at Madison St., as a preliminary to the construction of the new permanent bridge. It will have a 71-ft. st.-t. truss span, with its rear end mounted on car-tracks running on a trestle, the bridge having a longitudinal movement in a horizontal line. The approaches will be pile trestles. The temporary bridge will be for foot traffic only. A. J. Hammond is Engr. of Bridges and Harbor. Noted Apr. 24.

Ottawa, Ill.—(Official)—Bids will be received until 1 p.m., June 18, by the Board of County Commissioners, for the construction of a reinforced concrete bridge in Serena Township. It will be of steel and concrete and will have two clear spans of 50 ft. each.

Ottawa, Ill.—(Official)—Bids will be received until 2 p.m., June 23, by the Board of County Commissioners for the construction of the Big Vermillion Bridge, in La Salle Township. The structure will have a steel channel span, 224 ft. long and reinforced concrete approaches.

Merrimac, Wis.—The State Senate, at Madison, has passed a bill appropriating $50,000 for a free wagon bridge across the Wisconsin River, at Merrimac.

Oshkosh, Wis.—The Wisconsin Bridge & Iron Co., Milwaukee, has taken over the contract for the superstructure of the new West Algoma St. bridge. The contract was originally awarded to the Joliet Bridge & Iron Co., of Joliet, Ill., but the company asked to be released after the death of its president. The request was refused and the National Security Co., of New York, who furnished the guarantee, arranged with the Wisconsin company to take over the contract. It calls for an expenditure of $86,440. The Wisconsin Bridge and Iron Co. bid $90,700 at the time bids were opened for the work. Noted Feb. 6.

Hutchinson, Kan.—Bids will be received until 3 p.m., June 12, by the Board of City Commissioners, for the construction of a concrete bridge on First Ave. West, and of a bridge on Ave. B East. G. L. McLane is City Engr.

Ulm, Mont.—(Official)—All bids received June 2 by the County Clerk of Cascade County, for the construction of a three-span steel bridge over the Missouri River at Ulm, have been rejected. The work will be readvertised. Lee Dennis is County Clk. Noted May 15.

Newport, Ark.—Bids will be received until June 30, by the Board of Improvements, for the construction of a reinforced-concrete bridge, 42 ft. wide and 200 ft. long. W. J. Parks, Citizens Bank Bldg., Pine Bluff, Ark., is Engr.-in-Charge.

Montesano, Wash.—All bids submitted to the Board of County Commissioners, for the construction of bridges over the Wynoochee and Black Rivers have been rejected, as the call for bids was not in proper form. F. W. Moore, of Portland, Ore., has been employed to prepare new plans on which bids will be received soon.

Mt. Vernon, Wash.—The County Commissioners are contemplating the construction of a steel bridge over the Skagit River at Fir. A. L. Strong, County Engr., has been instructed to make an investigation and prepare estimates.

McMinnville, Ore.—The Board of Commissioners of Yam Hill County have authorized the construction of a 120-ft. steel span bridge across the Yam Hill River, at Carlton. Jones & Flagg, Consult. Engrs., McMinnville, are preparing plans upon which bids will be received soon.

✚Naples, Calif. Mayberry & Parker, Consult. Engrs., Pacific Electric Bldg., Los Angeles, have awarded a contract to the PUTNAM STONE CO., Chamber of Commerce Bldg., Pasadena, at $20 621 for the construction of four reinforced concrete bridges at Naples.

New Westminister, B. C.—The city is planning to construct a new reinforced concrete bridge across the Brunette River. The estimated cost is $6500.

WATER SUPPLY—IRRIGATION

Belfast, Maine—(Official)—Bids will be received by the Belfast Water Co. until June 26, for constructing a dam and a water purification plant of 1,000,000 gal. capacity. Estimated cost, $20,000. William Wheeler and Robert Spurr Weston, 14 Beacon St., Boston, are Assoc. Engrs.

★Agawam, Mass.—(Official)—Bids will be received by the Board of Water Commissioners until 2 p.m., June 24, for furnishing 100 or more fire hydrants. E. A. Kellogg is Chn.

★Bids will be received by the Board of Water Commissioners until 2 p.m., June 24, for furnishing 36,000 lb. desilverized soft pig lead for calking water pipe under heavy pressure. James L. Tighe, 189 High St., Holyoke, Mass., is Consult. Engr.

Billerica, Mass.—Bids will be received by the Water Commissioners until June 18 for furnishing and laying about four miles of 6- and 8-in. water mains with necessary valves and hydrants. Sydney A. Bull is Chn. E. Worthington is Engr.

★Chester, Mass.—(Official)—Bids will be received by the Board of Water Commissioners until 2 p.m., June 27, for furnishing and laying 4000 ft. of 6-in. and 11,500 ft. of 4-in. c.-i. water pipe. Plans and specifications are on file at the office of James L. Tighe, Consult. Engr., 189 High St., Holyoke, Mass.

Springfield, Mass.—The Water Board has placed an order for 1300 tons of 24-in. water pipe costing $28,000 to be laid in State St. and Berkshire Ave. Cost of construction, about $40,000. It was also voted to install 12-in. extension in Orange and Ormonds Sts. and St. James and Commonwealth Aves. F. H. Clark is Supt. of Engineering.

★Hartford, Conn.—(Official)—Bids for constructing the Nepaug Pipe Line will be received by the Water Commissioners until June 16. The contract includes: Furnishing and laying 39,300 ft. of 44-in. steel pipe, or 42-in. c.-i. pipe, 4000 cu.yd. rock excavation, and 1070 cu.yd. brick and concrete masonry. F. D. Berry is Secy. of Bd. and Caleb Mills Saville, Ch. Engr. Noted incorrectly, May 29.

Boonville, N. Y.—W. G. Stone, Consult. Engr., Mann Bldg., Utica, N. Y., is preparing plans for enlarging the municipal water system at Boonville. George O. Bridgeman is Supt. W.-Wks.

✚Honeoye Falls, N. Y.—The contract to construct a water system here has been awarded to BERT WARREN, Honeoye Falls. The contract includes about 5½ miles of mains, a pumping station and elevated tank. Noted Apr. 24.

Lockport, N. Y.—The Common Council has authorized the Water Commissioners to advertise for bids for laying two water mains in Willow and other streets leading to Vine St. and North Transit, Caledonia, and Gooding Sts., and to the Cascade Pulp Mill.

Milltown, N. J.—The Borough Council has decided to arrange for a special election to vote on a bond issue of $45,000 for installing municipal water and sewer systems.

✚Greenville, Penn.—(Official)—The contract to construct force mains from the reservoir to the city has been awarded to E. KEE, JR., Uniontown, Penn. The work is under the supervision of Chester & Fleming, Hydraulic Engrs., Pittsburgh, Penn. The construction of a new reservoir will be begun at an early date.

Homestead, Penn.—The Borough Council has authorized the expenditure of $23,000 for improving the water system. The water is obtained from artesian wells, and it is proposed to put these wells and the pumping machinery in better condition. H. C. Trautman is Boro. Engr. Noted Apr. 3.

Pittsburgh, Penn.—(Official)—The Director of Public Works has been authorized to advertise for bids for furnishing and installing a connection to the 60-in. Montrose rising main for the Aspinwall pumping station. Estimated cost, $14,000.

✚Roaring Spring, Penn.—(Official)—The contract to construct a concrete reservoir and lay an 8-in. pipe line here has been awarded to the STANDARD CONTRACTING CO., Altoona, Penn., at $7559. The other bids were: Ira J. Reichter, New Kensington, Penn., $7962; C. R. Simpson, Huntington, Penn., $8331; A. Vipond, $8807; Poezel & Co., $9171; H. R. Clark Co., $9390. Bids were opened May 30. J. Luden Henry, Hollidaysburg, Penn., is Consult. Engr. Noted May 29.

Clayton, Del.—(Official)—Herbert W. Hatton, Consult. Engr., Equitable Bldg., Wilmington, has completed plans for water and sewer systems and a sewage disposal plant at Clayton. Estimated cost, $20,000. An election will probably soon be called to vote on a bond issue.

Milton, Del.—(Official)—Bids will be received by the Town Council until 8 p.m., June 18, for constructing a water system, the supply to be obtained from two artesian wells. The contract includes: Two triplex pumps, two gasoline engines, 100,000-gal. water tower, 2300 ft. of 2-in. g.-i. pipe, 8500 ft. of 4-in., 5900 ft. of 6-in., 1200 ft. of 8-in. c.-i. pipe, pumping station and two wells. Plans were prepared by Charles E. Collins, Consult. Engr., Drexel Bldg., Philadelphia. Noted May 15.

★Baltimore, Md.—(Official)—Bids will be received by the Board of Awards until 11 a.m., June 18, for Water Contracts No. 12, No. 13 and No. 14. Plans and specifications may be obtained at the office of Ezra B. Whitman, Water Engr. James H. Preston is Pres., Bd. of Awards. For particulars, see advertisements in this issue.

★✚Baltimore, Md.—(Official)—Bids for Contract 11, filters, basin and grading, were received by the Board of Awards, June 1, as follows: STEWART-JONES CO., and CLAIBORNE-JOHNSTON & CO., Calvert Bldg., $396,896; (awarded contract) Henry Smith & Sons Co., 111 Hanover St., Baltimore, $405,014; C. W. Lane & Co., Inc., Atlanta, Ga., and Lane Bros. Co., Baltimore, $419,232; Elkan-Tuft Construction Co., 702 East Lexington St., $410,482; Albert H. Prange, 1250 Lake Drive, Grand Rapids, Mich., $426,835; Hassan Paving Co., 390 Main St., Worcester, Mass., $438,946; Nicola Build-

ing Co., Pittsburgh, Penn., $460,117; Oscar Daniels Co., Woolworth Bldg., New York, $199,135; Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, $507,252; Ryan & Reilly, Union Trust Bldg., Baltimore, $531,141. Ezra B. Whitman is Water Engr. Noted May 15.

Elm City, N. C.—Bonds for $10,000 have been voted and are now on sale for improvements to the water and sewer systems. Clarence Winsted is Clk., Bd. of Aldermen.

★**Goldsboro, N. C.**—(Official) Bids will be received by the Mayor and Board of Aldermen until 3 p.m. July 1, for constructing a pumping station and filter plant. The contract involves the construction of a brick pumping and filter building, with 1,500,000-gal. mechanical filter, resetting old pumps, and laying about 6000 ft. of 12-in. force main. Plans and specifications are on file at the office of the Mayor, and at the office of Gilbert C. White, Consult. Engr., Charlotte, N. C. Noted May 8.

Raleigh, N. C.—The city plans to make several improvements to the water system recently purchased from the Wake Water Co. The improvements include: Impounding reservoir on the land of the Central Hospital, capacity 200,000,000 gal., $20,000; duplicate gravity intake pipe, $7500; 16-in. force main from the pumping station to the city, $20,000; new 3,500,000-gal. pump and repairs to the old pump, $12,500; new boiler and stack at pumping station, $2650. Noted May 29.

Rocky Mount, N. C.—The city contemplates an expenditure of $135,000 for improvements to the water and sewer systems and the electric-light plant, and for paving several streets. W. L. Parrott is Mayor.

Lancaster, S. C.—Tentative plans are being considered for improvements and extensions to the water system, estimated to cost $12,000. An election will probably soon be called to vote on a bond issue.

Albany, Ga.—An election has been called for July 24 to vote on a bond issue of $12,000 for extending the water system. H. A. Tarver is Mayor, and R. J. Edgerly, City Engr. Noted Apr. 24.

Passagrille, Fla.—Bonds for $5000 have been voted for the installation of a water system here. Noted May 15.

Sanford, Fla.—The Sanford Waterworks Co. is preparing to make improvements to its water plant here, which will cost about $40,000. The supply is now obtained from a lake several miles from Sanford, but when the proposed improvements are completed, the water will be taken from artesian sulphur wells. A system for aërating the sulphur water will be installed, two pumps added to the present equipment, and a new standpipe constructed.

Bastrop, La.—Plans have been prepared for improving the water system here. It is proposed to install new pumps and boilers at the pumping plant, and to build a 50,000-gal. tank on an 80-ft. tower. J. K. Skipworth is Mayor.

✚**Corbin, Ky.**—(Official)—The contract to construct a municipal well-water system here has been awarded to the AMERICAN LIGHT & WATER CO., Chicago, Ill., at $26,794. The other bids were: R. Jeager, Rich Hill, Mo., $27,000; Oliver Bros., Knoxville, Tenn., $30,000. Plans for the system were prepared by the Southern States Engineering Co., First National Bank Bldg., Chicago. Thomas F. Young is City Clk. Bids were opened May 27. Noted May 22.

Flemingsburg, Ky.—The Town Council contemplates the installation of a water system. H. A. Hackley is Town Clk.

★✚**Lexington, Ky.**—(Official)—The contract to construct a reservoir dam for the Lexington Hydraulic & Mfg. Co. has been awarded to the MASON HANGER CO., Lexington, at $49,044. The other bids were: Central Construction Co., Lexington, $54,157; J. H. Cahill Co., Louisville, $56,448; Corey Reed Co., Lexington, $58,787. Bids were opened June 2. Noted May 22.

★**Akron, Ohio**—(Official)—Bids will be received by R. M. Pillmore, Dir. Pub. Ser., until noon, June 24, for constructing a 48-in. steel pipe line from the proposed Cuyahoga River dam to the proposed purification plant near Earlville. Alternate bids will be received on 48-in. lock-bar steel pipe, and 51-in. riveted steel pipe. The distance is 2240 ft. F. A. Barbour, Boston, Mass., is Consult. Engr. Noted May 29.

Cincinnati, Ohio—(Official)—The bids received May 30, for relining the Eden Park Reservoir, have been rejected. New bids will probably be asked the latter part of the month. B. L. Baldwin is Gen. Supt., Dept. Pub. Ser. Noted May 22.

Bids will be received by W. T. Price, Dir. Pub. Ser., until noon, June 19, for relining the west basin of the Eden Park Reservoir. Estimated cost, $120,000.

✚The Board of Public Service has awarded the contract for the 7,000,000-gal. pump for the Western Hill Pumping Station to the HOLLY MFG. CO., at $72,771. The other bidders were: Bethlehem Steel Co., $87,750; W. Todd Co., $76,160; Allis-Chalmers Mfg. Co., $86,350. Bids were opened June 4. Noted May 29.

Euclid, Ohio—Bids will be received by F. H. Shoaff, Village Clk., until June 30, for laying 10-in. watermains in Chardon Road, Perry St., Superior and Roseland Aves.

✚**Granville, Ohio**—The contract to construct a water system here has been awarded to LEE & McGAW, Granville, at approximately $5000.

Painesville, Ohio—(Official)—Bids will be received by S. A. Haskell, Dir. Pub. Ser., until noon, June 21, for constructing a water-works intake and crib, which is Contract 1 of the proposed improvements. The contract involves the construction of a wooden ballasted crib to be located about 1500 ft. from the shore of Lake Erie, and furnishing and laying a 24-in. steel or c.-i. pipe from the well on shore to the crib. Plans and specifications are on file at the office of the Director of Public Service, and at the office of R. Winthrop Pratt, Hippodrome Bldg., Cleveland, Consult. Engr. Noted May 8.

✚**Springfield, Ohio**—A contract to furnish an engine for the pumping station has been awarded by the Board of Control, to the LAIDLAW-DUNN-GORDON CO., Cincinnati, at $5495.

West Park, Ohio—(Official)—Bids will be received by Fred Feuchter, Clk., Bd. of Trustees until noon, June 21, for laying water-mains in Belmont St., Elmwood St. and a part of Triskett Road, according to plans on file at the office of the William H. Evers Engineering Co., The Arcade, Cleveland, Ohio.

Portland, Ind.—O. O. Clayton, City Engr., is preparing plans for laying 4-in. watermains in various streets. Estimated cost, $5000.

Ahmeek, Mich.—The Village Council contemplates the installation of a water system, estimated to cost $9000. The supply will be obtained from a spring on the property of the Ahmeek Mining Co.

Miles, Mich.—(Official)—Bids will be received by the Board of Public Works until 8 p.m., June 18, for laying watermains, according to plans and specifications on file at the office of Barron Wetherby, City Clk.

Olivet, Mich.—Plans have been prepared and submitted to the Village Council, for a water system, estimated to cost $14,000. An election will probably soon be called to vote on a bond issue.

✚**St. Louis, Mich.**—The contract to construct a water system here has been awarded to the TRAVERSE CITY IRON WORKS, Traverse City, Mich., at $6000. Plans were prepared by Smith & Boulay, Consult. Engrs., The Nasby, Toledo, Ohio. Noted May 8.

Saline, Mich.—(Official)—Bids will be received by Homer Fish, Village Clk., until 6 p.m., June 18, for constructing a water system. Estimated cost, $30,000. Plans were prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio. Noted June 5.

Elgin, Ill.—(Official)—Bids will be received by William F. Sylla, City Clk., until 2 p.m., June 14, for constructing a steel tower and tank of 500,000 gal. capacity, with appurtenances, on the west side of the Fox River. Specifications are on file at the office of the City Clerk.

East St. Louis, Ill.—The City Water Co. will make improvements to its water system, estimated to cost $1,000,000. The enlargement of the plant will allow the company to supply Granite City, Venice and Madison, Ill. These towns were previously supplied by a plant at Granite City. Charles M. Horner is Supt.

Lostant, Ill.—Edward Byrne, Consult. Engr., La Salle, Ill., has been retained by the town to prepare plans for a water system. Estimated cost, $12,000.

Utica, Ill.—Bids will probably soon be asked for constructing a water system here, estimated to cost $16,000. Edward Byrne, La Salle, Ill., is Consult. Engr.

Waukegan, Ill.—(Official)—Plans are being prepared for the construction of a subintake into the harbor for emergency work. The pipe line will be from 600 to 1000 ft. long, composed of c.-i. pipe. Estimated cost, $6000. Bids will probably soon be asked. M. J. Douthitt is City Engr.

✚**Cherokee, Iowa**—(Official)—The contract to extend the water system here has been awarded to the BLACK HAWK CONSTRUCTION CO., Waterloo, Iowa, at $9122. The other bids were: Fraser & Danforth, Duluth, Minn., $9360; Elkhorn Construction Co., $9437; Swanson & Belsworth, $9341. Bids were opened May 22. William Shordow is City Clk. Noted May 22.

Morrison, Iowa—The Des Moines Bridge & Iron Co., Des Moines, Iowa, has completed plans for the construction of a water system here. The City Council will probably soon ask bids for construction.

Minneota, Minn.—Bids will be received by S. B. Erickson, Village Recdr., until June 16, for extending the water system.

Morgan, Minn.—(Official)—The contract to construct a water system here has been awarded to W. D. LOVELL, Minneapolis, Minn., at approximately $12,200. Bids were opened May 29. Noted May 29.

✚**Taylors Falls, Minn.**—(Official)—The contract to construct a water system here has been awarded to the PASTORET-LAWRENCE CO., Duluth, Minn., at $6588. The bids received for the construction of a reservoir have been rejected, and the contract will be readvertised. W. H. Robinson is Village Clk. Noted May 29.

Argonia, Kan.—Rollins & Westover, Consult. Engrs., Midland Bldg., Kansas City Mo., have prepared plans for a water system and electric-light plant here. Estimated cost, $25,000.

Herington, Kan.—(Official)—The city will call another special election in the near future to vote bonds for waterworks and electric-light extensions, the principal object being to obtain a new and reliable source of water supply. The Benham Engineering Co., Oklahoma City, Oklahoma, have been retained as consulting engineers to investigate, make examinations, draw plans and specifications and supervise the work of construction. The probable cost will be approximately $50,000. Noted May 8.

✚**Madison, Kan.**—(Official)—The contract to construct a water system and electric-light plant here has been awarded to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, at $30,000. The other bids were: Commercial Construction Co., Kansas City, Mo., $30,535; T. C. Brooks & Sons Co., Jackson, Mich., $30,628; Katz Construction Co., Omaha, Neb., $31,392; Sherman Machinery Co., Oklahoma City, Okla., $30,700; A. J. Foster & Co., Joplin, Mo., $30,617; Everett & Brent, Hutchinson, $34,350; Alamo Engine & Supply Co., Omaha, Neb., $31,700. Bids were opened by Chester E. Fellay, City Clk., May 29. Rollins & Westover, Midland Bldg., Kansas City, Mo., are Consult. Engrs. Noted May 29.

✚**Scott, Kan.**—The contract to construct a water system and electric-light plant here has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $33,967. Bids were opened May 27. Noted May 1.

✚**Peru, Neb.**—(Official)—The contract to construct a water system here has been awarded to the INTER-MOUNTAIN BRIDGE & CONSTRUCTION CO., Tecumseh, Neb., at $18,785.

The other bids were: Nebraska Construction Co., Lincoln, $18,800; Briggs & Co., Shenandoah, Iowa, $18,960; Des Moines Bridge & Iron Co., Des Moines, Iowa, $19,955; T. C. Brooks & Sons, Jackson, Mich., $18,825; Commercial Construction Co., Kansas City, Mo., $22,015. Bids were opened May 20. C. F. Sturtevant, Holdrege, Neb., is Consult. Engr. Noted May 29.

Carter, S. D.—(Official)—The contract to construct a water system here has been awarded to W. D. LOVELL, Minneapolis, Minn., at $9900. The other bids were: G. S. Townsend, Dallas, Tex., $10,685; W. E. Orr, Winner, S. D., $10,150; Chicago Bridge & Iron Works, $10,250. Bids were opened May 27. Noted May 22.

Twin Bridges, Mont.—The town has voted to install a water system, estimated to cost $17,000. H. S. Green, Spokane, Wash., is Consult. Engr. Noted Mar. 13.

St. Louis Mo.—(Official)—Bids will be received by the Board of Public Improvements until noon, June 20, for constructing the intake tower, tunnel and screen chamber at the Chain of Rocks pumping station. Estimated cost, $500,000. The contract includes constructing the superstructure of the intake tower, 2700 ft. of 8-ft. tunnel through the limestone superstructure of the screen chamber, gates, valves, etc. Edward E. Wall is Water Comr. Noted May 22

Pine Bluff, Ark.—An ordinance has been passed requiring the Pine Bluff Water Co. to extend its water mains in various streets. W. A. Lee is City Clk.

Coleman, Tex.—The City Council has under consideration the construction of a water storage reservoir near here to augment the municipal water supply.

Denton, Tex.—The city will install an additional pump for the water plant, which will have a daily capacity of 600,000 gal.

Eagle Pass, Tex.—The Indio Cattle Co. will construct an electric irrigation pumping plant upon its property near here. The International Electric Co. will build a power transmission line from its central station here down the valley of the Rio Grande to the property of the Indio Cattle Co. and supply power for this and other irrigation pumping plants in that section.

Franklin, Tex.—See item under Light, Heat and Power.

Henderson, Tex.—Preparations are being made for the construction of a municipal water plant and distributing system here.

Spur, Tex.—This city has issued $25,000 of bonds for constructing a water plant and distributing system.

Madill, Okla.—Tentative plans have been prepared for improvements to the municipal water system. Estimated cost, $7000.

Watonga, Okla.—Bonds for $35,000 have been voted for the installation of a water system here, according to plans prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted May 8.

Blanche, Idaho—The Bay Lake & Reservoir Co. was recently incorporated with a capital stock of $50,000, to build and operate an irrigation system here. The incorporators are M. Ogge, E. Curt, Ira Bray, C. H. Ogge and G. Amos, all of Blanche.

Brewster, Wash.—The Directors of the Brewster Irrigation Project recently authorized a bond issue of $1,250,000 to be used in the construction of an irrigation system. A call for bids for construction will be issued at once.

Kittitas, Wash.—The Clark Estate, Ellensburg, Wash., will pipe the waters of Warm Springs to this city, a distance of three miles. The estimated cost of the work approximates $20,000.

Seattle, Wash.—Bids for constructing watermains in North 82nd St., were received by the Board of Public Works, May 23, as follows: Dickens & Rightmire, $26,400; T. Ryan, Lowman Bldg., $26,322; Jahn Construction Co., $27,869; Krogh & Jessen, $26,516; Washington Construction Co., $27,336; Graff Construction Co., $29,106; Ferguson-Coit Co., $26,478.

Toppenish, Wash.—The Chief Engineer of the Indian Service, Washington, D. C., has approved the plans for the Satus Irrigation Project, which entails the expenditure of $500,000. The work includes the construction of a dam, reservoir and ditches.

Amity, Ore.—Plans for the construction of a 240,000-gal. water reservoir here have been submitted to the City Council for approval and definite action.

★Burlingame, Calif.—(Official)—Bids will be received by the Board of Trustees until 8 p.m., June 30, for constructing a distributing water system, according to plans and specifications on file at the office of the City Clerk. The following pipe will be required: 3700 ft. of 8-in., 27,300 ft. of 6-in., 68,800 ft. of 4-in. bell and spigot, Class B; 35,900 ft. of 3-in. and 54,800 ft. of 2-in. full weight galvanized pipe. Shipmen, Denny & Rhame, Holbrook Bldg., San Francisco., are Consult. Engrs.

✚Los Angeles, Calif.—(Official)—The contract to furnish about 3611 tons of Class B and Class C standard bell and spigot cast iron pipe has been awarded to U. S. CAST IRON PIPE & FOUNDRY CO., Monadnock Block, San Francisco, at $31.52 per ton, delivered. Bids were opened June 3. Noted May 29.

✚Oxnard, Calif.—(Official)—Contracts for constructing a water system here have been awarded as follows: Pipe lines, etc., to C. B. VINCENT, Oakland, Cal., at $60,117; pumping plant to H. N. TEWEY Co., Los Angeles, at $23,709. Olmsted & Gillelen, Wright & Callender Bldg., Los Angeles, are Consult. Engrs. Noted May 15.

Roseville, Calif.—The city contemplates a bond issue of $35,000 for purchasing and improving the plant of the Roseville Water Co.

San Francisco, Calif.—The Spring Valley Water Co. has ordered the construction of the Calaveras dam, which will cost about $3,000,000.

Santa Monica, Calif.—The City Engineer is preparing plans for a municipal water distributing system estimated to cost $95,000.

Kentville, N. C.—J. Carroll, Engr, is preparing plans for extending the water system. Estimated cost, $20,000.

SEWERS

✚Boston, Mass.—(Official)—A contract to construct sewers, for which bids were received by the Metropolitan Water and Sewerage Board June 6, has been awarded to the NORTHERN CONSTRUCTION CO., 89 West Cedar St., Boston, Mass., at $104,597. The other bidders were: Lawler Bros., $110,890; P. W. Hill, $111,792; Coleman Bros., $113,135; Simpson Bros., $113,856; James Doherty, $118,288. The contract includes: 600 ft. of 54-in. sewer in trench, 3550 ft. of 48-in. sewer in trench, 180 ft. in tunnel, 560 ft. vitrified pipe drains, 50 cu.yd. portland brick masonry, 3900 cu.yd. concrete masonry in trench and 180 cu.yd. in tunnel, 10,000 ft. Spencer piles in place. F. W. Hodgdon is Ch. Engr. Noted May 29.

✚The contract to construct sewers in the Pinehurst District, Hyde Park, has been awarded by the Department of Public Works, to PETER W. HILL, Boston, at $35,620. The other bids were: George M. Bryne Co., $36,436; Michele de Sisto & Co., $37,484; James H. Ferguson, $39,522; Anthony Cefale, $40,364; George J. Regan, $41,211; W. L. Dolan, $43,197; M. Russo & Son, $43,910; Falvey & Kelly, $50,184. L. K. Rourke is Comr.

Louis K. Rourke, Comr. Pub. Wks., has recommended an expenditure of approximately $730,000 for the construction of sewers. The sewer work summarized as essential is as follows: Maywoods Brook conduit, etc., $50,000; Dorchester Brook sewer, from Massachusetts Ave. to Clifton St., $40,000; Dorchester Brook sewer, from Brook Ave. to Brookford St., $50,000; Davenport Brook, $132,000; Mattapan Brook, $21,000; Readville District, Rugby District, and the district in vicinity of Thompson St., near Stony Brook Reservation, Hyde Park, $34,000; Easterly branch, Shepard Brook, Brighton, $153,000; Rosalindale Brook conduit, $53,500. Temple St. Outlet, West Roxbury, $80,000; Dent St. Brook, West Roxbury, $67,500; Charles, Friend, Kingston, Merrimac, Oswego, Portland and Sudbury Sts., rebuilding, $39,650.

Bids will be received by the Department of Public Works until June 13, for constructing pipe sewers and drains in Seaver St., Roxbury District, and in Adams and Wildwood Sts., Dorchester District. L. K. Rourke is Comr.

Malden, Mass.—Bids will probably soon be asked for sewer construction, estimated to cost $12,000. H. W. Estey is City Engr.

New Bedford, Mass.—(Official)—The City Council has decided to lay the sewer in Durgee St. by day labor. Estimated cost, $19,500. George H. Nye is City Engr. Noted May 22.

★Pittsfield, Mass.—(Official)—Bids will be received by the Board of Public Works until 7:30 p.m., June 20, for constructing the Pleasant Park sewer and the Newall St. sewer. Plans and specifications may be obtained on application to A. B. Farnham, Engr., of Bd. Noted May 15.

Springfield, Mass.—It is proposed to construct a sewer system in the Fairview Section. Edward Wright, Jr., of the State Board of Health, is investigating the project.

✚Bridgeport, Conn.—The contract to construct sewers in Frank and Whittier Sts. has been awarded to the PIERCE MFG. CO., Bridgeport. Bids were opened by the Board of Contract and Supply, May 23.

✚New Haven, Conn.—(Official)—The contract to construct a sewer in North Front St. has been awarded to DWYER & MAHONEY, New Haven, Conn., at $15,956. The other bids were: Thomas F. Maher, $18,371; Lawrence O'Brien, $21,953. Bids were opened May 23. Noted May 22.

★✚Stamford, Conn.—A contract for the extension of the sewer in Seaside Ave. has been awarded to PELLEGRINO BROS., New York, at $74,000. Noted May 22.

Ballston, Spa, N. Y.—The Board of Trustees has directed the Village Engineer to prepare plans and specifications for the construction of a sanitary sewer in High St., from Beach St. to Blood St.

Brooklyn, N. Y.—(Official)—Bids will be received until 10 a.m., June 18, by the President of the Borough of Brooklyn, Borough Hall, for constructing sewers in portions of the following streets: Cranberry Lane; 69th St.; 70th St.; Eighth Ave.; sewer basin on Fifth Ave.; on 67th St.; on Maple St.; on 45th St.; on 60th St. Alfred E. Steers is Pres.

Brooklyn, N. Y.—(Official)—The following bids were received on June 4, by the President of the Borough of Brooklyn, Borough Hall, for the construction of a sewer in East 17th St., from Ave. M to Ave. N: Joseph Jennings, $6133; B. Pecone & Co., $6133; Frank Merendino, $6409; Culp Co. Inc., $6574; James J. Gorman, $6674; A. B. Nichols Inc., $6745; John C. Schrade, $68.22; Murphy Bros., $7373; Arthur Nosworthy, $7392. Alfred E. Steers is Pres. Noted May 20.

✚Elmira, N. Y.—(Official)—The contract to construct the Roe Creek trunk sewer has been awarded to CONNORS & GALLAVAN, Elmira, N. Y., at $6598. The other bids were: Holleran Bros., Elmira, $7510; E. W. Walsh, Elmira, $8692; Murray & Ford, Elmira, $8427; John C. Costello, Elmira, $11,647. Bids were opened May 29, and the contract awarded June 2. Noted May 22.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., June 16, by Maurice E. Connelly, Pres. Boro. of Queens, for constructing sewers and appurtenances in Elton St., Forest Ave., Putnam Ave. and other streets.

Northport, (L. I.) N. Y.—(Official)—Vrooman & Perry, Consult. Engrs., Gloversville, N. Y., are preparing plans for the construction of 22 miles of sewers and a sewage disposal plant for the village.

Oswego, N. Y.—(Official)—Bids for sanitary sewers, Contracts E, F, and G, and storm sewers, Contract H, were received by the Department of Public Works, June 4, as follows: R. M. Barnett, Oswego, N. Y., E, F and G, $45,349; H, $73,200. James Fennell, Oswego, N. Y., E, F and G, $39,660;

John Young, Syracuse, N. Y., H, $73,710; Samuel Bonn, Syracuse, N. Y., E. F and G, $43,584; Leary & Morrison, Fairport, N. Y., E, F and G, $44,299; H, $79,581; Pratt, Reed & Philips, Massena, N. Y., E, F and G, $53,212. Charles H. Snyder is City Engr. Noted May 15.

Scarsdale, N. Y.—The town has authorized the sale of $180,000 of bonds, for the construction of a trunk sewer. The system will connect at one end with the system of White Plains to provide an outlet for the Lynton Place sewer. The sewer in Scarsdale will empty into the Bronx Valley Sewer at a point below the Hartsdale Station of the Harlem R.R.

Watertown, N. Y.—The State Conservation Commission has approved the plans prepared by E. W. Sayles, City Engr., for the construction of sewer in Arlington St. Estimated cost, $12,000.

Jersey City, N. J.—(Official)—Bids will be received by the Board of Chosen Freeholders until 3 p.m., June 12, for constructing sewers according to specifications on file with Walter O'Mara, Clk. of Bd.

Milltown, N. J.—See item under Water Supply-Irrigation.

Princeton, N. J.—The Common Council has passed ordinances authorizing the construction of sewers in John, Witherspoon, McClain, Lytle and Clay Sts., and in Princeton Township to Lehigh Ave.

Trenton, N. J.—The Board of City Commissioners has passed an ordinance authorizing the construction of sewers in Commonwealth Ave., Morris Ave., Bert Ave., Columbus Ave., Revere Ave., and Emmett Ave. Frank Thompson is City Clk.

Erie, Penn.—An ordinance has been passed providing for the construction of a storm water sewer system on the west side, to protect the section drained by Cascade Creek. Estimated cost, $10,000.

Pottstown, Penn.—Bids for constructing Section A of the proposed new sanitary sewer system were received by the Sewer Committee, May 27, as follows: Cantell Construction Co., Philadelphia, $142,307; Atlantic Construction Co., Philadelphia, $131,965; Willauer & Co., Pottstown, $128,358; Martin & Miller, Passaic, N. J., $127,789. Noted May 8.

Wilkinsburg, Penn.—According to press reports, it is proposed to construct a sewage disposal plant here estimated to cost $125,000.

★Newark, Del.—(Official)—Bids will be received by the Sewer Commission until noon, June 18, for constructing a sewage disposal plant and about 25,594 ft. of terra cotta pipe sewers from 8- to 12-in. diameter, with the necessary manholes, lampholes and flush tanks. Specifications and blank forms may be obtained at the office of T. Chalkley Hatton, Ch. Engr., Wilmington, Del. Samuel J. Wright is Chn. Sewer Comn. Noted May 22.

Lancaster, S. C.—An election will probably soon be called to vote on a bond issue of $45,000, for the construction of a sewer system.

✚Cordele, Ga.—(Official)—The contract to construct about 9000 ft. of 8-in. sewers, with manholes and flush tanks, has been awarded to FRANK MOORE & CO., Savannah, Ga. Bids were opened May 29. Arthur Pew, Temple Court Bldg., Atlanta, is Consult. Engr. Noted May 29.

Jackson, Ga.—Tentative plans have been prepared for a sewer system here. An election will probably soon be called to vote on a bond issue of $20,000 to finance the improvement. W. E. Watkins is Mayor.

Jacksonville, Fla.—(Official)—L. D. Smoot, Ch. Engr. of the Board of Trustees for the Waterworks and Improvement Bonds, advises us that plans for the proposed improvement of the sewer system are not being prepared by Twombley & Henney, Consult. Engrs., New York, as noted May 29. Plans for all construction work are prepared at the office of the Chief Engineer.

★✚Laurel, Miss.—(Official)—The contract to construct a system of sanitary sewers here has been awarded to DOBBS & WETMORE, Meridian, Miss., at $25,432. The other bids were: F. H. Fleming & Co., Mobile, $32,594; S. A. Gamis, Laurel, $29,973; Healy Construction Co., Meridian, Miss., $26,484; Finnell Contracting Co., Tuscaloosa, $25,931; Sullivan, Long & Hagerty, Bessemer, Ala., $25,041; Hampton Reynolds, New Orleans, $36,521. Bids were opened by D. A. Scarborough, City Clk., June 5. Noted May 15.

New Iberia, La.—The Sewerage Commission is examining various plans that have been submitted for the construction of a sewer system, estimated to cost about $75,000. J. S. Power is Mayor. Noted Feb. 20.

Lafayette, La.—The City Council is having plans prepared for a sewer system estimated to cost $100,000. C. D. Bourdeaux is Chn. Sewerage Comn. Noted Mar. 13.

Danville, Ky.—Bids will be received by the city until June 14, for constructing sewers as follows: 430 ft. 39-in., 575 ft. 36-in., 450 ft. 30-in., 450 ft. 27-in., 104 ft. 24-in., 1885 ft. 8-in. vitrified sewer pipe; inlets, manholes, and flush tanks, and alterations and additions to the sewage disposal plant. Plans and specifications are on file at the office of the W. S. Shields Co., Hartford Bldg., Chicago, Ill. J. M. Wallace is Mayor. Noted Mar. 6.

Louisville, Ky.—The lowest bid received for the construction of sewers in Shelby and Preston Sts., was submitted by J. H. Cahill, at $90,041. Bids were opened May 27. An official table of the bids received will be published in an early issue of "Engineering News." Noted May 22.

✚Bowling Green, Ohio—(Official)—The contract to construct sewers in District No. 4 has been awarded to CARL D. FINCH, Bowling Green, at $7268. The only other bid received was that of Taylor, Muldoon & Chambers, at $7746. Bids were opened June 6. Noted May 29.

Lima, Ohio—See item under Miscellaneous: River Improvement.

Martins Ferry, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, June 24, for constructing sewers in North Eighth St., and other streets. William Rowland is Clk.

Niles, Ohio—(Official)—Bids will be received by the Board of Control until noon, June 12, for constructing sanitary sewers in Walnut, Pratt and Langley Sts., Pine Alley and East Park Ave. J. E. Tregaskis is Clk.

Piqua, Ohio—(Official)—Bids will be received by A. W. Burton, Dir. Pub. Ser., until noon, June 17, for constructing sanitary sewers in Spring St., Caldwell St., Gill St., River St., and Broadway. Plans and specifications are on file at the office of the Director.

★Shelby, Ohio—No bids have been received by Bert Fix, Village Clk., for extending and altering the municipal sewage treatment plant. The estimate of $12,000 for this work, is said to be too low, and this is quoted as the reason that no bids were received, May 29. A. Elliott Kimberly, 8 East St. Louis St., Columbus, Ohio, is Consult. Engr. Noted May 8.

Zanesville, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, June 16, for constructing sewers in Wheeling Ave., and other streets. A. J. Voll is Clk.

✚Danville, Ind.—(Official)—The contract to construct a sanitary sewer system here has been awarded to PERRY McKINSEY, Frankfort, Ind., at $19,000. Bids were opened by the Board of Town Trustees, May 26. Noted May 22.

Hobart, Ind.—(Official) V. Graziano & Co. want to sublet part or all of a contract for four miles of 8- to 20-in. sewer, to be laid about 72 miles from Chicago.

Marion, Ind.—According to press reports, bids are being received by C. L. Anderson, Mayor, for constructing a sewer system estimated to cost $60,000. R. L. Adams is City Engr.

Portland, Ind.—O. O. Clayton, City Engr., is preparing plans for sewer construction estimated to cost $8000.

Grand Rapids, Mich.—The city has been enjoined from emptying sewage into the Grand River. It will be necessary to reconstruct all the sewer outlets, and a part of the system, also to build two septic tanks. L. Stevens is City Engr.

Joliet, Ill.—The Board of Local Improvements contemplates the construction of a sewer system in the Second Ward, estimated to cost $25,250. Preliminary plans for the system have been submitted by C. D. O'Callahan, City Engr.

Rockford, Ill.—Edwin Main, City Engr., is preparing plans for the construction of sewers in the southern section of the city. Estimated cost, $20,000.

Salem, Ill.—J. S. Spiker, Consult. Engr., Vincennes, Ind., has prepared plans for the construction of a sewer system here.

Beloit, Wis.—Bids for constructing sewers in Districts B and C have been received by the city, as follows: R. Nelson, Racine, $6868; J. Kaminski, Watertown, $7290; P. Johnson, Racine, $8690, McGavock Bros., Beloit, $9853.

Oshkosh, Wis.—Bids were received by the Board of Public Works, May 24, for the construction of sewers in Joe and Fifth Sts.: Joe St., August Strey, 10-in. pipe, 52c. per lin.ft.; 12-in., 57c.; 6x10 Y branches, 50c.; 6x12 Y branches, 55c.; grade manholes, $0; drop manholes, $45; 24-in. vitrified catchbasins, $37; 27-in. vitrified catch basins, $40; R. E. Mierswa & Son, 10-in., 72c.; 12-in., 76c.; 6x10 Y branches $2.02; 6x12 Y branches, $2.14; grade manholes, $28; Fifth St., August Strey, 15-in. pipe, $73c.; 18-in., 82c.; 6x15 Y branches, 75c.; 6x18 Y branches, 85c.; grade manholes, $30; drop manholes, $36; 24-in. vitrified catchbasins, $37; 27-in. vitrified catchbasins, $40. Noted May 22.

✚Charlton, Iowa—(Official)—The contract to construct storm and sanitary sewers here has been awarded to H. J. CATHROE & CO., Omaha, Neb., at $16,049. The other bids were: C. W. Ramsey, Excelsior Springs, Mo., $19,810; Lytle Construction Co., Sioux City, Iowa, $20,675; Brogan & Pitz, Green Bay, Wis., $18,698; Briggs & Cory, Shenandoah, Iowa, $19,044. Bids were opened by G. J. Gisinger, City Clk., June 6. F. W. Trost is City Engr. Noted May 22.

✚Thief River Falls, Minn.—Contracts to construct two systems of sewers have been awarded by the City Council, as follows: Contract 1, FRASER & DANFORTH, St. Paul, at $14,433; Contract 2, to T. E. WEBSTER, St. Paul, at $21,879.

Halstead, Kan.—(Official)—Albert C. Moore, Consult. Engr., Joplin, Mo., has been retained by the city to prepare plans and supervise the construction of a sanitary sewer system. Estimated cost, $40,000. Bids will be asked in about four weeks.

Ralston, Neb.—(Official)—Bids will be received by the Board of Village Trustees until 10 a.m., June 17, for constructing a sewer system, according to plans on file at the office of the Towl Engineering Co., City National Bank Bldg., Omaha, Neb. C. M. Skinner is Chn. Village Bd.

Dickenson, N. D.—(Official)—Bids will be received by the City Council until 3 p.m., June 17, for laying 8173 ft. of 8-, 10- and 15-in. sewer pipe, 5136 ft. of c.-i. water pipe, and installing ten hydrants, seven gate valves, five lampholes, one flush tank and 20 manholes. Plans and specifications are on file at the office of R. C. Hill, City Audr.

✚Anaconda, Mont.—According to press reports, a contract to construct the Second Gulch sewer system has been awarded to the BUTTE CONSTRUCTION CO., Butte, Mont., at approximately $10,000.

✚St. Louis, Mo.—According to press reports, the contract to construct sewers in Rock Creek Sewer District No. 2 has been awarded to WILLIAM F. RILEY, St. Louis, at $144,284. Bids were opened May 23. Noted May 22.

Trenton, Mo.—The City Engineer has prepared tentative plans and estimates for the construction of sewers in Sewer District No. 9. Estimated cost, $20,000.

✚Conway, Ark.—(Official)—The contract to construct a sewer system here has been awarded to JOSEPH McCOPPIN, Little Rock, at $35,125. The other bids were: J. E. Davis, Caddo, Okla., $42,600; F. S. Smedley, Muskogee, Okla., $42,453; Nick Peay, Little Rock, 038,457; Koch & Kost, Joplin, Mo., $42,512; C. E. Hall, Clinton, Mo., $36,591; Bash & Gray, Joplin, Mo., $43,116; Hunter & Hunter, Oklicitz, Tex., $39,054; Dalton & Campbell, Dallas, $38,138; J. O. Severns, Oklahoma City, Okla., $42,120. Williams, Haye & Payne, Fort Smith, Ark., $42,119. Bids were opened June 5. Noted May 29.

San Antonio, Tex.—Clinton Brown, Mayor, has recommended a bond issue of $750,000 for constructing sanitary sewers, and $300,000 for storm sewers.

Texarkana, Tex.—The City Council has called an election for June 30, to vote on a bond issue of $60,000 for extending and improving the sewer system.

Henryetta, Okla.—(Official)—Bids will be received by the city until 8 p.m., June 25, for constructing a system of main sanitary sewers, according to plans prepared by the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla. Noted Apr. 10.

Denver, Colo.—(Official)—The Board of Public Works has published a notice to property owners, of the proposed construction of 20 miles of 8-in. to 8-ft. storm sewers and appurtenances in North Denver. Estimated cost, $425,000. If the proposed improvement is not protested, the Board will probably call for bids soon after July 5, when the notice expires. W. D. Salter is First Asst. Engr. Noted May 15.

Globe, Ariz.—The City Engineer has submitted a report to the City Council estimating the cost of the proposed new sewer system at $149,639. Noted June 5.

Albany, Ore.—The City Council has accepted plans and specifications prepared for the construction of sewers in Geary, Oak, Railroad and Baker Sts. Bids will probably soon be asked.

Los Angeles, Calif.—The lowest bid received by the Board of Public Works for the construction of the San Pedro storm sewer system, was submitted by S. M. Kerns, Los Angeles, at $74,231. The bids were rejected. Homer Hamlin is City Engr. Noted May 15.

Pasadena, Calif.—The Board of Trustees is considering plans for the construction of a sewer system designed to serve the entire southern portion of the city. Estimated cost, $208,000. J. S. Van Ornum is City Engr.

Calgary, Alta.—George Craig, Consult. Engr., is preparing plans for the construction of a trunk sewer estimated to cost $530,000. Bids will soon be asked. Noted June 5.

Regina, Sask.—Plans are being prepared for the construction of 1040 ft. of 12- and 9-in. steel pipe for the sewer system. Estimated cost, $15,000. A. W. Pool is Clk.

★†Toronto, Ont.—(Official)—Contracts for Sections 1 and 2 of the Toronto Midway Outlet, have been awarded to JENNINGS & ROSS, Toronto, at $69,950 and $51,000, respectively. The contract for West Toronto Outlet, Division 2, has been awarded to the ORPEN CO., LTD., Toronto, at $118,900. Bids were opened May 27. Noted May 15.

GARBAGE

†Parkersburg, W. Va.—The contract has been awarded by the city to J. K. HINEY, Parkersburg, for the removal of garbage of the entire city, at $4000. The contract covers a period of one year.

†Chicago, Ill.—The time for receiving bids for the construction of the garbage reduction plant and for the disposal of garbage has been extended to noon, June 25. Bids were to have been received June 5. Noted June 5.

STREETS AND ROADS

Boston, Mass.—Bids will be received until June 17, by the State Highway Commission, for the construction of 2400 lin.ft. of road in Revere. A. W. Dean is Ch. Engr.

Bids will be received until June 16, by the Department of Public Works, for wood block pavement in Pleasant St. and Warren Ave., City Proper, and in Marion, Ruggles and Vernon Sts., Roxbury; for vitrified brick pavement in Bowdoin and Hancock Sts., Dorchester, and for artificial stone sidewalks in Hollander, Rosedale and Withington Sts. and Dorchester Ave., Dorchester.

†The contract for paving Cliftondale St., West Roxbury, with asphalt macadam was awarded to THOMAS F. MINTON, at $7147. L. K. Rourke is Comr.

†Cambridge, Mass.—(Official)—The Commissioners of Middlesex County have awarded the contract for constructing two miles of gravel road between Chelmsford and Westford to ANTONIO PALLOTTO, Lowell, Mass., at $5768. Other bidders were: Thomas Bruno, $7569; W. H. Whittaker, $5889; H. Michelini, $6246; H. W. Tarbell, $6810. F. H. Kendall is County Engr. Noted May 29.

★Holyoke, Mass.—(Official)—Bids will be received until 2 p.m., June 20, by the Board of Public Works, for the construction of about 28,000 sq.yd. of bituminous or asphalt pavement. Oscar C. Ferry is Asst. Clk.

†Sandwich, Mass.—The contract for the construction of 7900 lin.ft. of state road was awarded to the LANE QUARRY CO., at $9602. Other bids were: H. L. Thomas, Middleboro, $10,755; Antony Williams & Co., $11,052. Noted May 29.

†Hartford, Conn.—Contracts for state road work, bids for which were received May 29, have been awarded by the State Highway Commissioner as follows: Town of Stafford, 5530 lin.ft. bituminous macadam construction on the West Stafford Road, to B. SILVESTRI & CO., Hartford, Conn., bituminous macadam, $1.64 per sq.yd.; telford, $2.15 per sq.yd.; rubble drain, $1 per lin.ft.; cobble gutters, 60c. per sq.yd.; concrete walls, $7.50 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $5 per cu.yd. Town of Middlebury, 7416 feet of macadam construction on the Hartford-Saybrook Turnpike, to FRANK ARTHUR & BRO., Middletown, Conn., concrete road, $1.63 per sq.yd.; rubble drain, $1.25 per lin.ft.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd.; dry rubble walls, $6 per cu.yd. Town of Wallingford, 6650 lin.ft. Hassamite construction on the South and South Colony Road to the CONNECTICUT HASSAM PAVEMENT CO., New Haven, Conn., Hassamite, $1.56 per sq.yd.; Hassamite pavement over a Hassamite concrete base, $1.40 per sq.yd. extra excavation, 50c. per cu.yd. Town of Somers, 6400 lin.ft. native stone macadam construction on the Ellington Road, to A. D. BRIDGES' SONS CO., Hazardville, Conn., macadam, $1.93 per lin.ft.; telford, $2.50 per lin.ft.; rubble drain, $1 per lin.ft.; cobble gutters, 50c. per sq.yd.; concrete walls, $10 per cu.yd.; masonry walls, $7 per cu.yd.; dry rubble walls, $5 per cu.yd.; hot flush coat asphalt, 15c. per sq.yd.; flush coat Barber oil, 9c. per sq.yd. Town of Ellington, 7810 lin.ft. gravel construction on the Somers Road, to A. VITO CONSTRUCTION CO., Thompson, Conn., gravel, $1.64 per lin.ft.; telford, $2.64 per lin.ft.; rubble drain, $1.24 per lin.ft.; cobble gutters, 75c. per sq.yd.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd.; dry rubble walls, $5 per cu.yd. Town of Old Lyme, 5556 lin.ft. macadam construction on the Neck Road to the FRAMINGHAM CONSTRUCTION CO., South Framingham, Mass., 2525 lin.ft.; macadam, $1.99 per ft.; 3061 lin.ft. macadam, $1.64 per ft.; telford, $2.69 per ft.; rubble drain, $1.25 per ft..; concrete walls, $8 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $4.50 per cu.yd.; hot flush coat asphalt, 19c. per sq.yd.; Trinidad oil, 16c. per sq.yd. Town of Prospect, 8771 lin.ft. graded construction on the Waterbury-Bethany Road, to JOSEPH MOSCETTI, Torrington, Conn., grading. $1.09 per lin.ft.; telford, $2.09 per lin.ft.; rubble drain, $1.25 per lin.ft.; cobble gutters, 75c. per sq.yd.; concrete walls, $7 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $5 per cu.yd. Noted May 22 and May 29.

★New Haven, Conn.—(Official)—Bids will be received until 2 p.m., June 16, (instead of June 2, as previously noted) for paving various streets. Group A includes about 29,000 sq.yd. pavment; Group B, about 43,500 sq.yd.; Group C., 43,000 sq.yd. and Group D. 7800 sq.yd. F. L. Ford is City Engr.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 18, by the President of the Borough of Brooklyn, Borough Hall, for paving portions of the following streets: Ames St.; East Fourth St.; East 13th St.; East 19th St.; Eldert Lane; Montgomery St.; Union St.; Williams Ave.; 45th St.; 46th St.; 47th St.; 58th St.; 70th St.; 74th St. Alfred E. Steers is Pres.

Brooklyn, N. Y.—(Official)—The following are the low bids received June 4, by the President of the Borough of Brooklyn, Borough Hall, for paving in various streets: Bay 35th St., from 86th St. to Cropsey Ave., B. Turecamo, $19,352; Ave. I, from Ocean Ave. to the Long Island R.R., Cranford Co., $6168; Ave. J, from East 40th St. to Brooklyn Ave., Cranford Co., $9373; Riverdale Ave., from Rockaway Ave. to Timins St., Barber Asphalt Paving Co., $15,160; Rockaway Ave., from Riverdale Ave. to Lott Ave., Barber Asphalt Paving Co., $6444; West 17th St., from Surf Ave. to Neptune Ave., Uvalde Contracting Co., $9720; West 17th St., from Neptune Ave. to Coney Island Creek, Patrick J. Hickey, $10,492; Fifth Ave., from 65th St. to Bay Ridge Ave., Alcatraz Asphalt Co., $9414; 82nd St., from 18th Ave. to 20th Ave., Uvalde Contracting Co., $9165; Fifth Ave., from 39th St. to 60th St., Freeman-Hess Co., $74,345. Alfred E. Steers is Pres.

Buffalo, N. Y.—(Official)—The following low bids were received by the Commissioner of Public Works for paving Roma Ave. and Hamburg Turnpike: Roma Ave., brick, the Erie Contracting Co., at $13,500; asphalt, the German Rock Asphalt & Cement Co., $17,200; Hamburg Turnpike, the Erie Contracting Co., at $17,399 for block stone, asphalt, the German Rock Asphalt & Cement Co., $16,930. No contracts have been awarded. W. J. Troup is Asst. City Engr. Noted May 29.

New York, N. Y.—(Boro. The Bronx)—(Official)—The following are the low bids received, June 4, by the President of the Borough of the Bronx, Municipal Bldg., Third Ave. and 177th St., for paving portion of various streets: Beck St., Asphalt Paving Co., $13,176; Boston Rd., Barber Asphalt Paving Co., $41,807; Morris Ave., Asphalt Construction Co., $13,227; Boston Road, Uvalde Contracting Co., $25,274; 156th St., Asphalt Construction Co., $19,425; Webster Ave., Cunningham Contracting Co., $155,321; Tremont Ave., Burnside Co., $67,812; 169th St., Asphalt Construction Co., $20,883; Beach St., Del Balso Contracting Co., $27,465; Starrow St., Nicholas Mastroginni, $13,947; Gray St., Pheon Contracting Co., $14,988; 18th St., George Cravierro, $8207. Cyrus C. Miller is Pres.

(Borough of Queens)—(Official)—Bids will be received until 2 p.m., June 18, by the President of the Borough of Queens, Borough Hall, Fifth St. and Jackson Ave., Long Island City, for paving portions of the following streets: 17th St.; Camelia St.; Beebe Ave.; William St.; Sea Girt Ave.; Shell Road; Van Devinter Ave.; Madison St.; Fairview Ave.; Charles Place; Hill St.; West Ave.; Seventh St.; Seneca Ave. Maurice E. Connolly is Pres.

(Official)—The following bids were received May 29, by the Department of Parks, the Arsenal, Fifth Ave. and 64th St., for improving the play grounds on the easterly side of Amsterdam Ave., between 151st St. and 152d St.: Dunbar Contracting Co., 444 East 68th St., $10,523; Joseph Balston Co., 261 Broadway, $10,937. Charles B. Stover is Pres.

(Official)—The following bids were received June 5, by the Department of Parks, The Arsenal, Fifth Ave. and 64th St., for paving, with bituminous pavement, the west drive of Central Park, from 110th St. and Eighth Ave. southerly to 102d St., and from the Webster Monument southerly to 59th St. and Fifth Ave.: Asphalt Construction Co. 208 Broadway, $79,496; Barber Asphalt Paving Co., 233 Broadway, $108,510; Dayton Hedges Co., 1451 Broadway, $30,450; Sicilian Asphalt Paving Co., 41 Park Row, $83,215; Uvalde Contracting Co., 1 Broadway, $103,240; Warner Quinlan Asphalt Co., 79 Wall St., $92,450. Charles B. Stover is Pres.

Olean, N. Y.—(Official)—Bids will be received until 6:30 p.m., June 21, by the Commissioners of Public Works for paving sections of Eighth and North Clinton Sts. and Laurel Ave. with vitrified block. H. E. Buntz is City Engr. Geo. H. Luther is Comr.

Solvay, N. Y.—(Official)—Bids will be received until 5 p.m., June 23, by the Village Clerk for paving Milton Ave. E. M. Hall is Clk.

✚Hackensack, N. J.—The Board of Chosen Freeholders of Bergen County has awarded the contract for resurfacing Franklin Turnpike between Ramsey and Mahwah to GEORGE M. BREWSTER at $29,368. Other bidders were: Ernest Abrahams, $30,046 and E. C. Humphrey, $30,157. M. J. Ford is Chn. of Rd. Comm. Noted May 29.

✚The Board of Chosen Freeholders has awarded the contract for improving 2.87 miles of the Market St. Road, Saddle River Township, to GEORGE M. BREWSTER, at $72,015. The contract for improving 2.3 miles of the Wyckoff Road, first section, was awarded to the UNION BUILDING & CONSTRUCTION CO., Passaic, N. J., at $21,124.

✚Irvington, N. J.—The Town Council has awarded contracts to JOHN DORER, Stuyvesant Ave., Irvington, for paving Elmwood Ave., at $16,435, and Webster St. from Elmwood Ave. to Tiffany Place, at $3504. The contracts call for 10-in. telford pavement, and concrete curb and gutter.

✚Long Branch, N. J.—The City Commissioners have awarded a contract for paving a portion of Second Ave. to the METROPOLITAN BRICK CO. at $2.48 per sq.yd.

✚Madison, N. J.—(Official)—The Common Council has awarded a contract for repairing macadam pavements to FRED S. SMITH, Morristown, N. J., at between $5000 and $6000. No bids for new road construction will be asked for the present. S. Y. Willits is City Clk.

✚New Brunswick, N. J.—The Common Council has awarded a contract for paving parts of Morris, Neilson, Harvey and Redmond Sts. to THOS. H. RIDDLE, at $26,784; CONRAD SEBOLT, at $14,148, was awarded the contract for paving Welton and John Sts. John J. Curran is St. Comr. Noted May 8.

Newton, N. J.—The State Highway Commission is planning for the early improvement of the Newton-Stanhope Road, which is to be taken over as a part of the State Highway System. The road will be widened to conform with state requirements. Harvey Snook, County Engr., has been instructed to commence the necessary surveys.

Perth Amboy, N. J.—The Common Council has passed ordinances authorizing the paving of Oak St., from Smith St. to New Brunswick Ave., and Mechanic St., from Washington St. to Buckingham Ave. with 2-in. asphalt blocks. Wilbur La Roe is City Clk.

Ridgefield Park, N. J.—(Official)—Bids will be received until 9 p.m., June 17, by the Village Commissioners, for the improvement of Hazelton Road. Miller D. Starker is Village Clk.

✚Trenton, N. J.—(Official)—The City Commission has awarded contracts for paving various streets and alleys, about $1,000 sq.yd., to CHAS. A. REID & CO., 231 Highland Ave., Trenton, N. J., at $12,977; the NEWTON PAVING CO. at $33,341, and the McGOVERN CONTRACTING CO., at $12,142. Frank Thompson is City Clk. Noted May 29.

★Washington, N. J.—(Official)—Bids will be received until 11 a.m., June 24, by the Board of Chosen Freeholders of Warren County, for repairing and improving the Morris Turnpike between Port Colden and Phillipsburg. J. R. Thatcher is Dir. Bd. of Freeholders. F. W. Salmon, Netcong, N. J., is County Engr.

✚Altoona, Penn.—The Board of Public Works has awarded a contract for paving the approaches to the new Seventh St. Bridge to the BELL-ECKEL STONE CO., at **$11,582.** The Woodman Lumber Co. bid $11,853.

Derry, Penn.—(Official)—Bids will be received until 8 p.m., June 16, by the Borough Council, for the improvement of Fourth Ave. The approximate quantities are: 4600 cu.yd. excavation; 6960 sq.yd. vitrified block paving, 2000 lin.ft. combined curb and water table, and 480 lin.ft. stone backing curb. J. M. Nicholson is Boro. Clk.

✚Philadelphia, Penn.—The Department of Public Works has awarded contracts to the EASTERN PAVING CO., at $40,000 for resurfacing 13 streets with asphalt, and at $27,000 for paving 11 streets with asphalt. M. L. Cooke is Dir.

✚St. Clair, Penn.—The Borough Council has awarded a contract to the OTT BROS. CO. at $11,971 for grading, curbing and paving a portion of Ormsby Ave. There were four other bidders.

Laurel, Del.—(Official)—The taxpayers will vote in about a week upon a bond issue of $30,000 for street improvements. If carried, bids will be asked at once for street work, estimated to cost $60,000. Herbert W. Hatton, 506 Equitable Bldg., Wilmington, Del., is Engr. in Charge.

✚Baltimore, Md.—The Board of Awards has awarded a contract for vitrified brick pavement on various streets, under Contract No. 53, to PATRICK F. REDDINGTON at $85,959. Eugene E. Grannan is Pres. St. Comrs.

★Baltimore, Md.—(Official)—Bids will be received until 11 a.m., June 18, by the Board of Awards, for vitrified block paving on various streets under Contracts No. 58 and 59; and for granite block pavement under Contracts No. 60 and 61. R. Keith Compton is Chn.

Bids will be received until June 18 by the Board of Awards, for about 9520 sq.yd. bituminous concrete pavement under Contract No. 121. Eugene E. Grannan is Pres. of St. Comrs.

✚The Board of Awards has awarded Contract No. 118 to FRECH & ALLEN, Westminster, Md., at $68,200. The work includes 20,400 sq.yd. sheet asphalt paving and 60,000 sq.yd. grading.

Chestertown, Md.—(Official)—The Commissioners of Kent County received two bids for the construction of 4.14 miles of state road between Betterton and Still Pond, and both bids were rejected. Chas. D. Woods is Pres. of Comrs. Noted May 29.

★Pocomoke, Md.—(Official)—Bids will be received until 8 p.m., June 26, by the Street Improvement Commission, for the construction of 30,000 sp.yd. brick, asphalt, concrete or bituminous concrete paving, 1500 sq.yd. granolithic pavement and 29,000 ft. concrete curb. E. James Tull is Chn. of Com.

Richmond, Va.—(Official)—Bids will be received until 11 a.m., June 13, by the State Highway Commission for the construction of 2.2 miles of macadam on the Broad St. Road from the Brookland District line to Monument Heights Ave., Henrico County. P. St. John Wilson is Comr.

Centerville, Ala.—(Official)—Bids will be received until 1 p.m., June 21, by the Commissioners Court of Bibb County, for improving a part of the Elliston and Centerville Road. Estimated cost, $1000. W. S. Keller is State Highways Engr.

Greenville, Ala.—(Official)—Bids will be received until 1 p.m., June 25, by the Commissioners Court of Butler County, for grading and surfacing a portion of the Milner Mill Road, near Georgiana, Ala., at a cost of $10,000. W. S. Keller is State Highway Engr.

Montgomery, Ala.—(Official)—Bids will be received until noon, June 23, by the Board of Revenue of Montgomery County for grading and graveling the following roads: Three miles of the Macon County Road, 4½ miles of the Sprague Junction Road and 2½ miles of the Fannin's Mill Road. T. H. Edwards is Engr.

✚Montgomery, Ala.—(Official)—The Board of Revenue of Montgomery County has awarded the contract for improving 5½ miles of the Snowdon-Chambers Road, five miles of the Line Creek Road and 1½ miles of the Naftel Road to F. F. McCULLOUGH, Montgomery, Ala. There were five other bidders. Noted May 22.

★New Decatur, Ala.—(Official)—Bids will be received until 8 p.m., June 16 (instead of June 10, as previously noted), by the Mayor and City Clerk, for about $5,000 sq.ft. asphaltic concrete pavement and 17,000 lin.ft. concrete curb and gutter. Henry Hartung is Clk. Noted June 5.

✚Winona, Miss.—(Official)—The Road Commissioners of Montgomery County have awarded the contract for the construction of 70 miles of sand-clay roads to BEADLES & MORRISON BROS., Winona, Miss., at $40,000. Henry Hart is Chn. Comrs. Noted May 29.

✚New Orleans, La.—(Official)—The City Council has awarded the contract for paving Magazine St. from Exposition Blvd. to Audubon Park to ADAMS & STEWART, Birmingham, Ala., at $6669. Thos. L. Willis is Asst. City Engr. Noted May 15.

✚Knoxville, Tenn.—The City Commissioners have awarded contracts for paving Forest Ave. from Fourth to Ninth St. and Third Ave. from Caswell to Wells St. to the MURRAY CONSTRUCTION CO., Knoxville, at $18,433 and $9445 respectively. D. G. Leahy is Recdr. Noted May 15.

✚Canton, Ohio—The Commissioners of Stark County have awarded the contract for paving seven miles of the Canton-Cairo Road to WISE, SMITH & KRABILL at $115,507. The contract for paving four miles of the Alliance-Marlboro Road was awarded to HAINES & MILLER, Akron, Ohio, at $77,646. J. H. McConnell is Audr.

Cleveland, Ohio—(Official)—Bids will be received until noon, June 13, by the Director of Public Service for grading, draining, curbing and paving with brick portions of Perkins Ave., West 48th Place and West 49th Place, and for resurfacing with asphaltic concrete a part of Lake Ave. W. J. Springborn is Dir.

Columbus, Ohio—(Official)—Bids will be received by the State Highway Commissioner until 2 p.m., June 13, for grading and paving with waterbound macadam two miles of the Kenton-Findlay Road, Sects. 1 and 2, at an estimated cost of $1788, and $5064 respectively. James R. Marker is Comr.

✚Columbus, Ohio—The State Highway Commissioner awarded the contract for paving 1.89 miles of the Athens-Logan Road, Athens County, with brick to WILSON & BOWERS, Athens, Ohio, at $25,200. Davidson & Cunod, Athens, bid $25,600. The contract for paving one mile of the Urbana-West Jefferson Road was awarded to SAMUEL W. WRIGHTSEL, Logan, Ohio, at $8960. Noted May 29.

✚Lancaster, Ohio—(Official)—The contract for paving Locust St. with vitrified brick has been awarded to BOWER & WILSON, Athens, Ohio, at $7300. R. F. Brown is Dir. of Pub. Serv. Noted May 22.

✚Lima, Ohio—(Official)—The Director of Public Service has awarded the contract for 4028 sq.yd. of brick pavement on Jameson Ave. to J. BLODGETT, Lima, Ohio, at $8303. Other bidders were: Summers & Hardin, $9100; H. S. Enck, $9131; and Murray & Jamieson, $8335. G. A. Crayton is City Engr. Noted May 1

Lorain, Ohio—Bids will be received until June 30 by the Board of Commissioners of Lorain County for grading and paving a portion of the Kipton-Wakeman Road.

New Philadelphia, Ohio—(Official)—Bids will be received until noon, June 12, by the Director of Public Service for improving West Fair St. by grading, curbing and paving with brick, asphalt or asphaltic concrete. H. P. Fribley is Dir. T. L. Auginbaugh is Clk.

✚Uhrichsville, Ohio—(Official)—The Trustees of Mill Township have awarded a contract to HENDERSON BROS., Coshocton, Ohio, at $31,984 for improving two miles of the Park Valley Road. Paul R. Murray is Engr. H. O. Snyder is Township Clk. Noted May 1.

Warren, Ohio—(Official)—Bids will be received until noon, June 19, by the Director of Public Service, for paving sections of Mercer, North Pine, Belmont and Adams Sts. with vitrified block, asphalt block or creosoted wood block, about 15,531 sq.yd. in all. Chas. L. Craig is Dir. Wm. E. Dilley is City Audr.

✚Wooster, Ohio—(Official)—The Director of Public Service has awarded contracts to the MIDLAND CONSTRUCTION CO., Lima, Ohio, for brick pavements as follows: Pittsburgh Ave., $25,474; College Ave. Extension, $5141; Nold Ave., West end, $5647; Nold Ave., East end, $6104; Derr Ave., $2123; West Liberty St. Road, $9172; South Walnut St., $10,178. T. P. Brown is City Engr. Fred Haller is Dir. of Pub. Ser.

Youngstown, Ohio—(Official)—Bids will be received until noon, June 16, by the Trustees of Poland Township, Mahoning County, for paving with brick a portion of Section 1 of the Poland-Struthers Road. W. J. Maurice, Lowellville, Ohio, is Township Clk. George M. Montgomery, 816 Wilson Ave., Youngstown, is Engr.

+Indiana—(Official)—Contracts for road improvements in Indiana have been awarded as follows:

At Greensburg, by Commissioners of Decatur County to REED & THOMSON, Greensburg, Ind., at $12,548. Linton W. Sands is Audr.

At Williamsport, by Commissioners of Warren County to J. W. THOMAS, Delphi, Ind., at $11,890. Other bidders were: Mahoney Bros., $12,228 and W. J. McGuire, $12,170. D. H. Moffitt is Audr.

At Jeffersonville, by Commissioners of Clark County to MAGGERT & PEACOCK at $23,580. George W. Stoner is Audr. At Kentland, by Commissioners of Newton County, to ALVA E. HARRIMAN at $6795. S. R. Sizelove is Audr.

No bids were received by the Commissioners of St. Joseph County for the construction of a road in Lincoln Township. Clarence Sedgwick is Audr. Noted May 15.

+(Official)—Contracts for road improvements in Indiana have been awarded as follows:

By the Commissioners of Pulaski County for a road in Harrison Township to O. L. MARKLE, Winamac, Ind., at $8898. Noted May 15.

By the Commissioners of Adams County to JULIUS HAUGH and HOMER FAUST, at $6962 and $7165 respectively for roads in Root and French Townships. Noted May 29.

By the Commissioners of Boone County to WM. McCARTHY, at $56,000 for constructing a county road. Noted May 29.

By the Commissioners of Orange County, for a road in Orangeville Township to CHAS. H. TROWBRIDGE, West Baden, Ind., at $4050, and for a road in Orange, Washington and Crawford Townships to JOHN DAVIS, Hardinsburg, Ind., at $8050. Noted May 29.

The Commissioners of Tippecanoe County have awarded road contracts to local contractors at a total cost of $23,381. George W. Baxter is Audr. Noted May 29.

Indiana—(Official)—Bids for road improvements in Indiana will be received as follows:

July 7, at Jeffersonville, by Commissioners of Clark County, for the construction of roads in Jeffersonville and Charlestown Townships. George W. Stoner is Audr.

July 9, at Peru, by Commissioners of Miami County, for the construction of a road in Deer Creek Township. Frank K. McElheny is Audr.

June 18, at Paoli, by Town Board, for improving the Public Square. Arthur McCart is Town Clk.

June 27, at Noblesville, by Commissioners of Hamilton County, for the construction of four roads. George Griffin is Audr.

June 30, at Rushville, by the Commissioners of Rush County, for roads in Walker and Union Townships. Allen R. Holden is Audr.

July 7, at Vevay, by the Commissioners of Switzerland County, for a road in Pleasant Township. John W. Smith is Audr.

July 8, at Monticello, by the Commissioners of White County, for the construction of roads in Honey Creek, West Point, Prairie and Round Grove Townships. A. G. Fisher is Audr.

July 8, at Wabash, by the Commissioners of Wabash County, for constructing a gravel road in Chester Township. D. Showalter is Audr.

July 8, at Vincennes, by Commissioners of Knox County, for constructing gravel roads in Winder, Johnson, Harrison, Busseron, Vigo and Vincennes Townships. J. T. Scott is Audr.

July 8, at Brazil, by the Commissioners of Clay County, for construction of a road in Brazil Township. Edgar A. Staggs is Audr.

July 14, at South Bend, by the Commissioners of St. Joseph County, for a road in Lincoln Township. Clarence Sedgwick is Audr.

Fort Wayne, Ind.—The Board of Public Work has had plans prepared and adopted resolutions for paving 18 streets. Bids will be asked during the summer. Frank M. Randall is City Engr.

+Laporte, Ind.—(Official)—The Commissioners of La Porte County have awarded contracts for road improvements in the county as follows: T. W. F. SMITH & Co. at $7000, to ACKERMAN & Co. at $52,380, $9200 and $7500, to WILLIAM H. HARRIS at $34,590 and to WILLIAM B. HUTCHINSON at $6235 and $12,443. Fred A. Hausheer is Audr. Noted May 22.

+Monticello, Ind.—(Official)—The Commissioners of White County have awarded a contract for the improvement of roads in Princeton and Jackson Townships to Z. W. DRITT, Logansport, Ind., at $4368. A. G. Fisher is Audr. Noted May 15.

+Flint, Mich.—(Official)—The Common Council has awarded contracts for brick and sheet asphalt pavement on various streets, about 37,000 sq.yd., in all, to ALBERT PRANGE, Grand Rapids, Mich., and the CLEVELAND TRINIDAD PAVING CO. D. E. Newcombe is City Clk. Noted May 1.

★Sturgis, Mich.—(Official)—Bids will be received until 7 p.m., June 30, by the City Council, for the construction of approximately 5000 sq.yd. brick pavement and 1500 lin.ft. combined curb and gutter. Chas. W. Coye is City Clk.

+Elgin, Ill.—(Official)—The Board of Local Improvements has awarded the contract for 11,300 sq.yd. of asphaltic concrete pavement on Division St. to the WESTERN IMPROVEMENT CO., Racine, Wis., at $22,690. Other bidders were: Logan & Glertz, Elgin, Ill., $25,075. H. G. Goeltz, Chicago, $26,097, McCarthy Improvement Co., Davenport, Iowa, $25,869. M. H. Brightman is City Engr. Noted May 22.

Jamaica, Ill.—(Official)—Bids will be received until 10 a.m., June 23, by the Highway Commissioners, for the improvement of about 12 miles of road in Jamaica Township. Earl Trisler is Clerk.

+Rock Island, Ill.—The Board of Local Improvement has awarded the contract for paving 25th St. from Ninth to 18th Ave. with brick to the TRI-CITY CONSTRUCTION CO. at $2.05 per sq.yd. Wallace Trichler is City Engr. Noted Jan. 9.

Marinette, Wis.—Bids will be received until June 17, by the Board of Public Works, for brick and macadam pavement and concrete curb and gutter. A. H. Holquist is Chn. Board of Public Works. A. L. Hillis is City Engr.

Council Bluffs, Iowa—(Official)—Bids will be received until 5 p.m., June 16, by the City Council, for 7098 sq.yd. of vitrified brick pavement on Ninth and Tenth Aves. and Ave. E. Charles J. Duff is City Clk.

Keokuk, Iowa—The City Council has passed a resolution for the paving of Fifth St. from Blondeau to Orleans St. with concrete. J. F. Winters is City Engr.

Minneapolis, Minn.—(Official)—Bids will be received until 11 a.m., June 16, by the Board of Commissioners of Hennepin County for improving Road No. 7, Town of Minnetrista, Road No. 10, Town of Corcoran, and Road No. 12, Town of Champlin. A. P. Erickson is County Audr.

The Board of Aldermen has voted to pave Snelling Ave., from University to Grand Ave., with creosoted wood block, and bids will be called for at once. F. W. Cappelen is City Engr.

+Norfolk, Neb.—The City Council has awarded the contract for 47,000 sq.yd. street paving with natural lake asphalt to the FORD PAVING CO., Omaha, Neb., at $88,330. The Council will advertise at once for bids for paving three additional blocks on West Norfolk Ave. and South Seventh St. P. F. Stafford is City Clk. H. H. Tracey is City Engr. Noted May 1.

Poplar Bluff, Mo.—(Official)—Bids will be received until 7:30 p.m., June 30, by the City Clerk for street improvements, estimated to cost $88,093. The work includes 36,201 sq.yd. brick pavement, 18,996 ft. curb and gutter, headers, sewer pipe, etc. Edward C. Thomas is City Engr.

+St. Louis, Mo.—(Official)—The Board of Public Improvements has awarded the following contracts from bids received May 27: To the RUECKING CONSTRUCTION CO. at $19,899 for repaving Pine St. from 12th to 19th St. with wood block; to WM. H. REDEMEYER at $20,082 for repaving O'Fallon St. with brick from Seventh to 14th St.; to JOHN McMAHON at $18,200 and $22,969 respectively for repaving Mullanphy St. from Broadway to 12th St., and From 12th to Hogan St. with brick. Charles M. Talbert is St. Comr. Noted May 22.

Okmulgee, Okla.—(Official)—Bids will be received until 7:30 p.m., June 30, by the City Commission, for paving District No. 4, containing 33,000 sq.yd. bituminous concrete pavement, and District No. 5, containing 6000 sq.yd. James G. Lyons is Comr. of Pub. Wks.

+Tulsa, Okla.—(Official)—The City Commission has awarded the contract for about 13 blocks of paving to the PARKER WASHINGTON CO., 4500 Duncan St., St. Louis, Mo., at $1.63 per sq.yd. The Cleveland Trinidad Paving Co. bid $1.98. T. C. Hughes is City Engr. Noted May 22.

★Pocatello, Idaho—(Official)—Bids will be received until June 16 by the City Council for the construction of 20,000 sq.yd. bitumen pavement. The city also wishes to buy street cleaning equipment. W. A. Sams is City Engr.

+Everett, Wash.—N. W. BALL, Wenatchee, Wash., at $25,330, was awarded a contract by the Snohomish County Commissioners for improving one mile of highway between Stanwood and the Great Northern Station. Brick on a concrete base will be used.

+Seattle, Wash.—The Board of Public Works has awarded contracts to T. RYAN & CO., at $42,954, for paving Grand Ave., and at $26,322, for laying water mains on North 82d and connecting streets. The contract for paving Fifth Ave. was awarded to RUSSEL & GALLAGHER, at $7568. A. H. Dimock is City Engr.

The Board of Public Works has awarded a contract to P. J. McHUGH PAVING & CONSTRUCTION CO., at $8393, for paving Third Ave., North, and Mercer St. Other bidders were: Elliott Construction Co., $8595; McQuaid & Moore, $8772. F. A. HADLEY, INC., 713 Fairview Ave., at $14,163, was awarded the contract for grading Avalon Way. HOLT & JEFFREY, Hinckley Bldg., were awarded the contract for grading 24th Ave. South, at $69,142. Other bidders were: Henry Brice, $74,336; Andrew Peterson, $74,948.

The BARBER ASPHALT PAVING CO., at $141,177, has been awarded the contract by Board of County Commissioners for paving six miles of North Trunk Road, from the northern city limits to the Snohomish County line. Brick will be used on two miles of the road and warrenite for the remainder, both on 5-in. concrete base. E. A. WILLIAMS & CO., at $85,289, were awarded a contract for paving three miles of roadway between Lake Forest Park and Bethell. Brick blocks, on 5-in. concrete base, will be used.

Bids for grading Eighth Ave., Northwest, were received as follows: Sloane Bros., $39,104; Henry Brice, $40,865; J. H. Cullum, $41,728.

+The Commissioners of King County have awarded a contract to J. W. JOHNSON, at $84,450 for paving three miles of the Pacific Highway with brick, south of Kent to the Pierce County line. Max Wardall is County Clk.

Tolt, Wash.—H. C. Malott, Seattle, was low bidder at $18,495, for concrete paving on Tolt Ave. and Commercial St.

+Fort Stevens, Ore.—The contract for the construction of roads and walks has been awarded to OLAF BOREN, Astoria, Ore., at $8229.

+Ontario, Calif.—(Official) — The City Trustees have awarded the contract for improving various streets to E. A. SIMMONS, Ontario. There were six other bidders. B. B. Munn is City Engr. Noted May 8.

Richmond, Calif.—The City Council has passed an ordinance authorizing the paving of 11 miles of streets, making 19 miles to be improved during the summer.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., June 23, by the State Highway Commission for the following road construction: About 6½ miles in San Bernardino County, between the westerly and southerly boundaries through Ontario; about 6½ miles in San Luis Obispo County between San Luis Obispo and Santa Margarita; 12 miles in Santa Barbara County from Los Alamos to Bicknell Station; 7½ miles in Santa Clara County between Morgan Hill

and Gilroy; about two miles in San Mateo County between Cypress Lawn Cemetery and South San Francisco, and about five miles of road in El Dorado County between Shingle Springs and El Dorado. Austin B. Fletcher is State Highway Engr. Wilson R. Ellis is Secy.

✚GILLETTE, MONTGOMERY & TRACY were awarded the contract at $101,997 for constructing approximately 11¼ miles of State Highway in Los Angeles County, between Calabasas and the west county line. Noted June 5.

INDUSTRIAL WORKS

Boston, Mass.—A $1,000,000 cold-storage plant will be erected on the new fish pier at South Boston. Plans have been completed by Sterrett & Brunner, 156 State St. The building will be of steel and concrete, 220x252 ft., eight stories. William J. O'Brien is interested.

✚**Dorchester, Mass.**—The contract for the construction of an organ factory on Sidney St. has been awarded to the A. VARNERIN CO., 101 Tremont St., Boston, at $39,000. The building will be four stories, 115x57 ft.

Farmingham, Mass.—The Kuerney Heater Mfg. Co., 188 Franklin St., Boston, will build a moulding room and foundry, 50x600 ft.

✚**Springfield, Mass.**—The contract for constructing a factory for the Bay State Candy Co., 286 Chestnut St., has been awarded to OSTIGAY & RIVEST, 98 Forest Park Ave. It will be 41x90 ft., two stories, of brick, and will be located on Franklin St. Bruno Wozny is Arch.

✚**Worcester, Mass.**—The contract for the construction of a manufacturing plant on Neponset St., for Malcolm K. Smith, has been awarded to E. J. CROSS & CO., Worcester, at $18,000.

The Norton Wheel Co. is having plans prepared by Frost & Chamberlain, Archs., Slater Bldg., for a fire-brick plant of brick and steel, fireproof, two stories, 128x138 ft.

Bristol, Conn.—Plans have been prepared by C. R. Makepeace & Co., Providence, R. I., for the construction of a two-story, 50x90 ft. addition to the plant of the Bristol Mfg. Co. Noted May 29.

Buffalo, N. Y.—The Clark-Banks Foundry Co., Inc., recently organized, will build and equip a foundry at Niagara and Sloan St. S. L. Clark and G. I. Banks are the directors, 1418 Niagara St.

The United States Rubber Reclaiming Co. has had plans prepared and will erect a factory in Buffalo.

George J. Metzger, Arch., West Huron St., has prepared plans for a two-story addition to the factory of the Automatic Transportation Co., at Main St. and the Erie R.R.

Kingston, N. Y.—The Ulster County Cleaning & Dyeing Co. has had plans prepared by G. W. Betz, Arch., who is receiving bids for a one-story factory, 81x35 ft., with a one-story ell, 28x53 ft.

Lockport, N. Y.—The Niagara Canning Co. will erect a one-story canning factory of steel and concrete, on lower Market St., East Lockport. E. P. Marvin, Jr., and Frank P. Silvernail are managing directors.

✚**Niagara Falls, N. Y.**—A contract has been awarded to SNYDER & GILLETT, for a 40x80-ft., two-story addition to the plant of the International Acheson Graphite Co., at Buffalo Ave. and Portage Rd.

Syracuse, N. Y.—The Clark Textile Co. is receiving bids for an additional mill, 172x32 ft., of fireproof construction.

✚**Canton, Ohio**—The contract has been awarded to MELBOURNE BROS., Canton, for the erection of the proposed factory addition to the Gordon Rubber Works. The cost has been estimated at $25,000.

Chillicothe, Ohio—The American Pad & Textile Co., Cincinnati, is having plans prepared for the erection of an addition to its plant at Chillicothe.

Cincinnati, Ohio—The Tenacity Mfg. Co., maker of loose-leaf devices, will more than double their present plant. The addition will be built on the south side of Clark St., near Reading Rd. and will be 30x150 ft., two stories, fireproof. Contracts will be let soon.

The American Tank & Pump Co., Cincinnati, is contemplating the erection of a manufacturing plant in Cincinnati. A. C. Davis and P. E. Studebaker, of Cincinnati, are interested.

Cleveland, Ohio—The National Quality Lamp Co., Cleveland, will appropriate $17,000 for additions to its plant.

C. B. Morgan, 2510-12 Church Ave., Cleveland, will erect a printing building. Cost, $10,000.

Columbus, Ohio—C. W. Bellows, Arch., Columbus, is preparing plans for the construction of an addition to the plant of the E. M. Hulse Co. The building will be six stories, 73x150 ft.

Dayton, Ohio—The Lewis W. Keyser Co., Dayton, will rebuild its factory recently destroyed by fire. The new building will be erected on the old site.

Dayton, Ohio—Ritchie, Wertz Co., 33 East Greenwood Ave., Dayton, have authorized F. J. Hughes & Co., Archs., 417 United Brethern Bldg. Annex, to prepare plans for a four-story and basement factory and power building, 60x160 ft. Estimated cost, $50,000.

Norwood, Ohio—The Globe-Wernicke Co., Cincinnati, manufacturer of office furniture, filing cabinets, etc., will build an addition to its plant at Norwood, Ohio. It will be five stories, 385x75 ft. Harry Hake, Provident Bank Bldg., Cincinnati, is Arch.

Portsmouth, Ohio—F. Smith, Arch., Dayton, has been retained by the Excelsior Shoe Co., Portsmouth, to prepare plans for the erection of its proposed addition. The building will be six stories, fireproof.

Portsmouth, Ohio—The United States Metal & Corrugated Culvert Co., Birmingham, Ala., has acquired a site and will erect a factory at Portsmouth.

Reading, Ohio—Dr. W. S. Burkhardt, Cincinnati, Ohio, is interested in the construction of a factory to be located at Reading, a suburb of Cincinnati.

Tiffin, Ohio—The Grey & White Co., Tiffin, is receiving bids for the construction of a cold-storage plant. It will be three stories and basement, 57x97 ft. Estimated cost, $25,000.

The Page Ohio-Michigan Dairy Co. will erect a new plant on Wade St.

Warren, Ohio—The Trumbull Steel Co., Warren, has had plans prepared for the erection of two additions to its plant.

Columbia City, Ind.—C. V. Vance, Fort Wayne, Ind., will erect a canning plant at Columbia City, Ind. It will be two stories, 40x70 ft., of cement block.

✚**Columbus, Ind.**—The Lincoln Chair Co., Columbus, has awarded the contract to HEGE & CO., Columbus, for the erection of its proposed factory. The cost has been estimated at about $20,000.

Edinburg, Ind.—The W. G. Thompson Veneer Co., Edinburg, is considering the construction of a sawmill. The capital of the company is $35,000.

Indianapolis, Ind.—The Swartz Electric Co., Indianapolis, has completed arrangements for the erection of two factory additions to its plant. Estimated cost, $10,000. Noted May 29.

Detroit, Mich.—The Goodspeed Detroit Mfg. Co., Ltd., Detroit, recently incorporated, will erect a factory in Detroit, and engage in the manufacture of automobile engine parts. The plant will cost about $20,000.

Detroit, Mich.—The Clipper Belt Lacer Co., Detroit, will erect an addition to its plant. The improvement will double its capacity.

Detroit, Mich.—The Fisher Body Co., Detroit, has increased its capital from $50,000 to $1,600,000, and will erect an addition to its plant. The company manufactures automobile bodies.

Detroit, Mich.—A large machine and truck shop will be erected at Labelle Ave. and the Terminal R.R. by the Detroit Union Rys., costing about $115,000.

Chicago, Ill.—A $100,000 plant will be erected by Swift & Co., Chicago, on the north side of Wayne St., between Main and Union Sts. W. H. Horton, Chicago, is Arch.

Milwaukee, Wis.—The recently organized Mutual Brewing Co. has acquired a site at 35th and National Aves. for the site of its $1,000,000 brewery. The company is an organization composed of retail liquor dealers, with offices at 230 Grand Ave. Edward G. Hundt is secy. The company proposes to manufacture its own products.

Sheboygan, Wis.—The Frost Veneer Seating Co., Sheboygan, will receive bids soon for the erection of an addition to its factory, 90x250 ft.

Cedar Rapids, Iowa—The Western Implement & Motor Co., Davenport, Iowa, recently organized, will establish a factory at Cedar Rapids, to cost about $60,000.

Invergrove, Minn.—The Rock Island Co. will build a roundhouse and repair shops at Invergrove. Estimated cost, $150,000.

Minneapolis, Minn.—Press reports state that the Prest-O-Lite Co. has purchased a site near Minneapolis, for the construction of its proposed $150,000 factory.

Dallas, Tex.—The Ford Motor Co. will erect an automobile assembling plant here. It has adopted plans for a five-story reinforced-concrete and brick building.

Fort Worth, Tex.—W. J. Hefley and associates will construct a cotton-seed oil mill here at a cost of about $90,000. The plant will be equipped with ten presses and have a daily capacity of 100 tons. The mill building will be 60x150 ft.

Lewisville, Tex.—W. P. Davis and associates will erect a cotton-seed oil mill here at a cost of about $75,000.

San Antonio, Tex.—The Rio Grande Wax Co. is preparing to erect a wax refinery here and will construct another factory at some point in western Texas. The proposed refinery will have a daily capacity of 10 tons of wax which is made from the wild candelilla weed. Ralph H. Hugo, of San Antonio, is interested.

Texarkana, Tex.—The Purified Gasoline & Oil Co. will construct a plant here for the manufacture of gasoline. It will have a daily capacity of about 50,000 gal. S. Hardin is Pres., J. W. Miller, Vice-Pres., and J. O. Battle, Secy. and Treas.

Lamar, Colo.—Preliminary arrangements are being made by the Helvetia Condensed Milk Co. for the construction of its factory at Lamar. Estimated cost, $200,000.

Everett, Wash.—The Weyerhaeuser Lumber Co., Tacoma, Wash., will erect a lumber mill in Everett with a daily capacity of 200,000 ft. George S. Long is Mgr.

Seattle, Wash.—The Puget Sound Cement & Lime Co., recently incorporated with a capital stock of $3,500,000, is planning the erection of a cement plant at Seattle, estimated to cost $1,200,000. The incorporators are Hans Pederson, Alex Polson, C. P. Bissitt and George W. Allen.

A site for a coke, steel and iron plant, to cost about $5,000,000, has been secured near Seattle by Henry M. Dawes, of Chicago, Ill., Chas. G. Dawes, of Chicago, and R. C. Dawes, Vice-Pres. of the Seattle Lighting Co.

Spokane, Wash.—The Inland Casket Co., 2320 Carlisle Ave., will erect a three-story brick factory, to cost from $15,000 to $20,000. Work will begin shortly. Ballard Plannery, Kuhn Bldg., is Arch.

Medford, Ore.—The Rogue River Fruit & Produce Association will build a cold- and dry-storage plant, to cost about $40,000.

Los Angeles, Calif.—The California Woolen Mills Co., Los Angeles Investment Bldg., has made arrangements with the Dutro-Wren Construction Co., Longbeach, for the erection of its factory buildings in the Inner Harbor tract. Alfred W. Rea and C. E. Garstang, Black Bldg., have prepared preliminary plans and expect to start working drawings at once. The buildings will be of reinforced concrete and brick. The plant and machinery will cost $200,000.

San Francisco, Calif.—The Workman Packing Co. will construct a three-story factory, to cost approximately $50,000, on Harrison St., between Fourth and Fifth Sts.

Stockton, Calif.—The San Joaquin Valley Refining Co. has been incorporated and will build a refinery in Stockton. The refinery will have a capacity of 1000 bbl. per day. The com-

pany will manufacture gasoline, distillate and other products. John S. Willis, of San Francisco, and F. P. Faulkner, of Sacramento, are interested.

The American Gasoline Co. will erect a refinery and distributing plant at a cost of about $50,000. A site for the plant has been secured.

Vernon, Calif.—The Union Packing & Provision Co., Los Angeles, has been incorporated with a capital of $250,000. The company has purchased a 12-acre site at Vernon, near Los Angeles, and will erect a large packing plant, to cost approximately $150,000. J. N. Porter is Pres.

Wilmington, Calif.—The W. H. Hoegee Co., Los Angeles, Calif., will erect a four-story concrete factory at Front and Canal Sts., for the manufacture of sporting goods.

FEDERAL GOVERNMENT WORK

Post Office—Bangor, Maine—(Official)—Bids will be received until 3 p.m., July 7, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, (except mechanical equipment and approaches) of the U. S. post office at Bangor. The building will be three stories and basement, with a ground area of approximately 15,600 sq.ft.

Dredging—Portland, Maine—(Official)—Bids were received as follows, June 7, by the Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in the Kennebec River, Maine: Bay State Dredging Co., Ltd., Boston, Mass., 28.25c. per cu.yd.; Eastern Dredging Co., Boston, 26.8c.; Jeremiah P. O'Riorden, Charlestown, Mass., 30c.; Charles M. Cole, Fall River, Mass., 27.25c.

Dredging—Portland, Maine—(Official)—Bids were received as follows, June 7, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Carvers Harbor, Maine: Bay State Dredging Co., Ltd., Boston, 24.3c.; Eastern Dredging Co., Boston, 24.3c.; Jeremiah P. O'Riorden, Charlestown, Mass., 26c.; Charles M. Cole, Fall River, Mass., 22.9c.

Dredging—Portland, Maine—(Official)—Bids were received as follows, June 7, by Lieut.-Col. W. E. Craighill, Corps Engrs., U. S. A., Portland, for dredging in Medomak River, Maine: Bay State Dredging Co., Boston, 32.9c.; Eastern Dredging Co., Boston, 34.3c.

Wharves—Newport, R. I.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., June 28, for the construction of wharves and fender wharf at the naval torpedo station at Newport.

Breakwater—New London, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, until 2 p.m., June 23, for repairing the inner arm of the breakwater at the mouth of the Housatonic River, Conn.

★**Dredging**—New London, Conn.—(Official)—Bids were received as follows, May 31, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, for dredging in the Mystic River, Conn.: (a) Per cu.yd. for an estimated yardage of 34,000 cu.yd.; (b) totals: Atlantic Dredging Co., 81 New St., New York, (a) 27.6c.; (b) $9384; Charles M. Cole, Fall River, Mass., (a) 24.9c.; (b) $8466; (recommended for acceptance); The T. A. Scott Co., New London, (a) 28.25c.; (b) $9605.

★**Concrete Platforms**—New York, N. Y.—(Official)—Bids will be received until noon, June 19, by Col. S. W. Roessler, Corps Engrs., U. S. A., Army Bldg., New York, for the installation of concrete platforms for mortar and 10-in. gun in the projected armory of the Eighth Coast Artillery District, New York.

★**Dredging**—New York, N. Y.—(Official)—Bids will be received until noon, July 7, by Col. S. W. Roessler, Corps Engrs., U. S. A., Army Bldg., New York, for dredging in Bay Ridge and Red Hook Channels, New York Harbor, N. Y.

Dredging, Etc.—New York, N. Y.—All bids received by Col. W. M. Black, Corps Engrs., U. S. A., Army Bldg., New York, May 13, for dredging and rock removal in Port Chester Harbor and East Chester Creek, have been rejected as excessive.

Removing Dock—New York, N. Y.—Bids will be received until 11 a.m., June 28, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the removal of the cob dock at the navy yard, New York.

★**Dredging**—Ogdensburg, N. Y.—(Official)—Bids will be received until 11 a.m., July 3, by Col J. G. Warren, Corps Engrs., U. S. A., for dredging at Ogdensburg Harbor, N. Y.

Post Office—Corry, Penn.—(Official)—Bids will be received until 3 p.m., July 16, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including mechanical equipment, interior lighting fixture, and approaches) of the U. S. post office at Corry. The building will have two stories and basement, with a ground area of approximately 5400 sq.ft.

★**Elevators**—Philadelphia, Penn.—(Official)—Bids will be received until 3 p.m., June 17, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of two electric passengers in the U. S. post office at Philadelphia.

★**Valve Jacks, Etc.**—Pittsburgh, Penn.—(Official)—Bids will be received until noon, July 9, by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., Pittsburgh, for the furnishing and delivering river-wall valve jacks, lock gates, engines and gate-operating gearing for dams Nos. 7 and 9, Ohio River.

★**Power House**—Pittsburgh, Penn.—The time of opening bids for a fireproof power house at Dams Nos. 7 and 9, Ohio River, has been extended to June 12. Bids were to have been opened May 21 by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., Pittsburgh. Noted May 29.

Removing Wreck—Baltimore, Md.—The bid of the Merritt & Chapman Derrick & Wrecking Co., New York, for removal of wreck of steamship Alum Chine has been recommended for acceptance. Bids were opened May 27. The bid was $16,838.

★**Hydraulic Lift**—Washington, D. C.—(Official)—Bids will be received until 3 p.m., June 30, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for installing an hydraulic lift at the U. S. Treasury Building, Washington.

★**Air Compressors**—Washington Barracks, D. C.—(Official)—Bids will be received until 2 p.m., July 11, by Maj. W. J. Barden, Corps Engrs., U. S. A., Washington Barracks, Washington, D. C., for furnishing three motor-driven, two-stage air compressors.

Projectiles—Washington, D. C.—Bids have been received as follows by the Chief of Ordnance, U. S. A., Washington, for furnishing 200 12-in. mortar shell, 1046 lb., Model 1907, and 300 6-in. c.-i. shell, Model 1908: Tredgar Co., Richmond, Va., 12-in., $28 each; 6-in., $8; Bethlehem Steel Co., South Bethlehem, Penn., 12-in., $55.49; 6-in., $22; Midvale Steel Co., Philadelphia, Penn., 12-in., $60; 6-in., $20.

Gun Forgings—Washington, D. C.—Bids were received as follows, June 6, by the Bureau of Ordnance, Navy Dept., Washington, D. C., for furnishing two, four or six sets of 12-in., 50-caliber gun forgings: Bethlehem Steel Co., South Bethlehem, Penn., and Midvale Steel Co., Philadelphia, each bid 34½c. per lb.

✚**Willows**—New Orleans, La.—Bids will be received until a.m., June 26, by Maj. W. H. Schulz, Corps Engrs., U. S. A., New Orleans, for furnishing about 26,000 cords of willows at South and Southwest Passes, Mississippi River.

Rock—New Orleans, La.—Bids will be received by Capt. C. O. Sherrill, Corps Engrs., U. S. A., New Orleans, Mississippi River Comn., Fourth District, until 11 a.m., June 17, for furnishing and delivering 77,500 tons of rock along the Mississippi River, between Greenville, Miss., and New Orleans.

Stone—New Orleans, La.—(Official)—Bids were received as follows, May 8, by Maj. Edward H. Schulz, Corps Engrs., U. S. A., New Orleans, for furnishing 8000 cu.yd. of stone for South and Southwest Passes, Mississippi River: (a) Per cu.yd.; (b) totals: OSCAR F. BARRETT, Cincinnati, Ohio, (a) $3.38; (b) $27,940 (awarded contract); John Riess, New Orleans, (a) $3.54; (b) $28,320.

★**Levee Work**—Memphis, Tenn.—(Official)—Bids will be received until 11 a.m., June 29, by Maj. E. M. Markham, Corps. Engrs., U. S. A., Mississippi River Comn., First and Second District, Memphis, for about 1,900,000 cu.yd. of levee work in the first and second districts.

★**Ice and Refrigerating Plants**—Memphis, Tenn.—(Official)—Bids will be received until noon, June 23, by Maj. E. M. Markham, Corps. Engr., U. S. A., Mississippi River Comn., First and Second Districts, Memphis, for furnishing and delivering three ice and refrigerating plants, complete. Noted May 29.

Dredging Plants—Cincinnati, Ohio—Bids will be received by Lieut.-Col. H. Jervey, Corps Engrs., U. S. A., Cincinnati, until 2 p.m., July 8, for the hire of five dredging plants. These will consist of one dredge, one towboat and two dump scows.

Breakwater—Conneaut, Ohio—Bids will be received until June 26 by Maj. Chas S. Bromwell, Corps Engrs., U. S. A., Cleveland, Ohio, for breakwater construction at Conneaut Harbor.

Building—Fort Benjamin Harrison, Ind.—Bids will be received until 11 a.m., June 17, by the Department Quartermasters, U. S. A., Federal Bldg., Chicago, Ill., for the construction of an isolation hospital at Fort Benjamin Harrison.

Dock—Chicago, Ill.—Bids will be received until 10 a.m., June 28, by Lieut.-Col. George A. Zinn., Corps Engrs., U. S. A., Chicago, for the construction of a timber-concrete dock in the north branch turning basin, Chicago River.

Dredging—Chicago, Ill.—Bids were received as follows, May 27, by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Chicago, for dredging in the Chicago River, about 118,000 cu.yd.: (a) Disposal eight miles from shore; (b) disposal behind bulkheads: Great Lakes Dredge & Dock Co., Chicago, (a) 14.75c.; total, $17,405; (b) 14.75c.; $17,405. Fitz Simons & Connell Dredge & Dock Co., Chicago, (a) $20,060; (b) 17c.; $20,060; Byrne Bros. Dredging & Engineering Co., Chicago, (a) 30c.; $35,400; (b) 28c.; $33,040. The bid of the Great Lakes Dredge & Dock Co. has been recommended for acceptance.

✚**Engines and Generators**—Chicago, Ill.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for furnishing and installing engines and generators in the Chicago post office to the HARRISBURG FOUNDRY & MACHINE WORKS, Harrisburg, Penn., at $42,000.

Timber—Chicago, Ill.—Bids will be received until July 2 by Lieut. Col. G. A. Zinn, Corps Engrs., U. S. A., Chicago, for furnishing fir timber, f.o.b. at mills.

Superstructures of Breakwaters—Chicago, Ill. — Bids will be received until July 2 by Lieut. Col. G. A. Zinn, Corps Engrs., U. S. A., Chicago, for rebuilding with timber, superstructures over the easterly and southerly breakwaters at Chicago Harbor, Ill.

Vault-Protection System—Peoria, Ill.—Bids will be received until 3 p.m., June 20, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for an electric vault-protection system in the U. S. post office at Peoria.

✚**Dredging**—Milwaukee, Wis.—The contract has been awarded to the ARTHUR VOGEL DREDGING CO., Milwaukee, Wis., at 22c. per cu.yd., for dredging in Waukegan and Kenosha Harbors, Wis. About 20,000 cu.yd. will be removed at Waukegan and 18,000 cu.yd. at Kenosha.

★**Dredging**—Duluth, Minn.—(Official)—Bids were received as follows, June 3, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, for dredging in Portage River Harbor: Great Lakes Dredge & Dock Co., Chicago, Ill., 9½c. (recommended for acceptance); Zenith Dredge Co., Duluth, 14c.; Northern Dredge & Dock Co., Duluth, 11½c.

★**Dredging**—Duluth, Minn.—(Official)—Bids were received as follows, June 3, by Capt. E. D Peek, Corps Engrs., U. S. A., Duluth, for dredging in Superior Entry, Duluth-Superior Harbor: (a) 52,500 cu.yd. in entrance channel (b) 208,000 cu.yd. in entrance channel, (c) 8000 cu.yd. in stilling basin, (d) 600 cu.yd. exceeding 1 cu.yd. boulders; (e) totals: Great Lakes Dredge & Dock Co., Chicago, Ill.; and Duluth, Minn., (a) 9¾c.; (b) 9¾c., (c) 9¾c., (d) $1.50, (e) $36,929. Zenith Dredge Co., Duluth, (a) 26c.; (b) 26c.; (c) 18c.; (d) $2.35; (e) $70,345; Northern Dredge & Dock Co., Duluth, (a) 12½c.; (b) 14½c.; (c) 14½c.; (d) $1; (e) $38,382; Duluth-Superior Dredging Co., Duluth, (a) 10c.; (b) 10c.; (c) 10c.; (d) $1; (e) $27,350. The bid of the Great Lakes Dredge & Dock Co. has been recommended for acceptance.

Rock and Stone—Duluth, Minn.—Bids will be received by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, until noon, June 30, for furnishing and placing rock on the breakwater at Ashland, Wis., and for furnishing and placing rubble stone foundation for breakwater extension at Marquette, Mich.

Mechanical Equipment—Minneapolis, Minn.—Bids will be received until 3 p.m., July 15, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the mechanical equipment of the U. S. post office at Minneapolis.

Post Office—Poplar Bluff, Mo.—(Official)—Bids will be received until 3 p.m., July 15, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including mechanical equipment, interior lighting fixtures and approaches) of a one-story and basement stone-faced building of 5300 sq.ft. ground area, nonfireproof (except the first floor), for the U. S. post office at Poplar Bluff.

★**Sluice and Penstock Gates**—Elephant Butte, N. M.—(Official)—Specifications are on file at the office of "Engineering News," 505 Pearl St., New York, for sluice and penstock gates and accessories for Elephant Butte Dam, Rio Grande Project, New Mexico, Tex. Bids will be received until June 25, by the U. S. Reclamation Service, Elephant Butte.

Harbor—San Jose, Calif.—Col. Thomas H. Rees, Corps Engrs., U. S. A., Oakland, Calif., has been instructed to make surveys for the construction of the proposed harbor at San Jose. The project contemplates dredging of a channel 300 ft. wide and 18 ft. deep, for a distance of 2½ miles. The town has agreed to erect wharves and warehouses.

Cranes—Panama—Specifications are on file at the office of "Engineering News," 505 Pearl St., New York, for concrete-handling cranes to be used in the construction of the Pacific Locks of the Panama Canal. Bids will be received until 10:30 a.m., July 14, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn.

Lumber—Panama—Bids will be received until June 16 by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing lumber under Circular 778-C.

Oil Tank—Hawaii—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded a contract for furnishing an oil tank at the naval station, Pearl Harbor, H. T., to the TREADWELL CONSTRUCTION CO., Midland, Penn., at $20,250.

MISCELLANEOUS

Fire Station—Buffalo, N. Y.—The city of Buffalo will build a two-story and basement firehouse, 44x56 ft., at Elmwood Ave. and Great Arrow St., from plans by Howard L. Beck, Arch., Municipal Bldg. Francis G. Ward, Commissioner of Public Works, is receiving bids.

Dredging—Hornell, N. Y.—The Governor has signed the bill appropriating $50,000 for dredging and straightening the Canisteo River from Hornell to Addison. Duncan W. Peck is State Supt. Pub. Wks.

Hose Wagons—New York, N. Y.—(Official)—The only bid received June 2 by the Fire Department, 157 East 67th St., for furnishing 10 motor-driven hose wagons, was that of the International Motor Co., 1764 Broadway, at $42,500. Joseph Johnson is Comr.

✚**Pumping Engines**—New York, N. Y.—(Official)—The Fire Department, 157 East 67th St., has awarded a contract to the NOTT FIRE ENGINE CO., Minneapolis, Minn., at $13,000, for furnishing two gasoline-propelled pumping engines. Bids were received on June 2. Joseph Johnson is Comr.

Tractors—New York, N. Y.—(Official)—The lowest bid received by the Fire Department, 157 East 67th St., on June 2, for furnishing 10 two-wheel gasoline-driven tractors, attached to fire engines, was that of the Robinson Fire Apparatus Mfg. Co., St. Louis, Mo., at $31,500. Joseph Johnson is Comr.

Trap Rock and Oil—New York, N. Y.—(Borough The Bronx)—Bids will be received until 10.30 a.m., June 18, by the President of the Borough The Bronx, Municipal Bldg., Third Ave. and 177th St., for furnishing and delivering 150,000 gal. of asphalt road oil, and for furnishing and delivering broken trap rock stone and screenings. Cyrus C. Miller is Pres.

Vessels—New York, N. Y.—Bids are being received by the Hamburg-American Line for the construction of six steamships, to cost about $12,000,000. The vessels will carry passengers and freight, and will ply from New York and Philadelphia to San Francisco and Puget Sound ports. The contract calls for the construction of from four to six steamships, to be of 11,000 tons displacement. The vessels are to have accommodations for 250 cabin passengers, and are to be 490 ft. long.

★**Chimney**—Ossining, N. Y.—(Official)—Bids will be received until noon, June 25, by John S. Kennedy, Agt. and Warden, Sing Sing Prison, Ossining, for the construction of a chimney. Drawings and specifications may be consulted and blank forms of proposal obtained at Sing Sing Prison, Ossining. Complete sets of plans and specifications will be furnished to prospective bidders upon reasonable notice to and at the discretion of John S. Kennedy, Agt. and Warden, Sing Sing Prison, Ossining.

✚**Pier**—Rochester, N. Y.—The contract has been awarded by the Board of Contract and Supply to the T. A. GILLESPIE CO., 50 Church St., New York, for a pier on Lake Ontario, at $9995. Noted June 6.

City Yard—Paterson, N. J.—The city is considering establishing a new city yard. The cost has been estimated at $40,000.

✚**Dam**—Harrisburg, Penn.—(Official)—Bids will be received by the Board of Public Works, 222 Market st., until 2.30 p.m., July 1, for furnishing all materials and performing all labor for the construction of a reinforced-concrete dam across the Susquehanna River, about 3000 ft. long and about 5 ft. high, consisting of a series of piers and slabs. The quantities involved are approximately 1150 cu.yd. of concrete, 110 tons of steel reinforcement, and 1000 cu.yd. of stone filling. Specifications, plans and blank form of proposal can be obtained at the office of the Board of Public Works and from James H. Fuertes, Consult. Engr., 140 Nassau St., New York, upon making a deposit of $25. This deposit will be given back to the bidder upon the return of the plans and specifications in good order. Edwin C. Thompson is Secy.

★**Protective Wall**—Harrisburg, Penn.—(Official)—Bids will be received at the office of the Board of Public Works, 222 Market St., until 2:30 p.m., June 27, for furnishing all materials and performing all labor for the construction of a protective wall and appurtenances, along the Susquehanna River in the city of Harrisburg. The work will consist of about 13,500 lin.ft. of stepped reinforced-concrete retaining wall and appurtenances. The quantities involved are approximately 12,000 cu.yd. of concrete, 600 tons of steel reinforcement and 45,000 cu.yd. of excavation and fill. Specifications, plans and blank form of proposal can be obtained at the office of the Board of Public Works, and from James H. Fuertes, Consult. Engr., 140 Nassau St., New York, upon making a deposit of $25. This deposit will be given back to the bidder upon the return of the plans and specifications in good order.

Drain—Concord, N. C.—The contract for constructing the Big Cold Water Creek drain in Cabarrus County has been awarded to M. P. MOORE, Statesville, N. C., at $15,000, for dredging, and $1.50 per cu.yd. for stone.

Drainage Work—Tallahassee, Fla.—The house of the State Legislature has passed the bill, authorizing the issue of $6,000,000 of bonds for drainage work.

✚**Levee Work**—Greenville, Miss.—Bids will be received by the Board of Mississippi Levee Commissioners, Greenville, until noon, June 17, for the construction of about 2,300,000 cu.yd. of enlargement of old levees, and new levee construction. This work is all team work, with wagons or wheeled scrapers. W. J. Shackelford is Ch. Engr.

Pipe Line—Shreveport, La.—Arrangements are being made by the Standard Oil Co. for the construction of a second pipe line from the Caddo oil fields, near Shreveport to its refinery at Baton Rouge, La., at an estimated cost of $750,000. C. W. Clark is Gen. Mgr. at Shreveport.

✚**Ditch**—Defiance, Ohio—The contract has been awarded to D. G. WATSON, Defiance, by the County Commissioners, for the construction of the North Gordon Creek Ditch, at $13,974.

River Improvement—Lima, Ohio—(Official)—Preliminary surveys will be made soon by the W. J. Sherman Co., Consult. Engr., Toledo, Ohio, for the proposed improvements to be made to the Ottawa River. The survey will probably cover a distance of about eight miles. Plans for a disposal plant will be included in the report of the engineer. The plant will probably be erected at once because of a ruling of the State Board of Health, which prohibits the further use of the river as waste place.

Fire Station—Marion, Ohio—Plans have been completed for the construction of a fire station for the city.

Levee—Broad Ripple, Ind.—The Town Trustees, it is reported, have voted to construct a levee from the east line of the Union Traction Co.'s right-of-way to the Monon R.R., thence east to the Westfield gravel road on what is known as Kirk St., a distance of about half a mile. Estimated cost, about $15,000.

✚**Drainage Work**—Assumption, Ill.—The contract has been awarded to CAZLETT & SON, Assumption, for work in Drainage District No. 5, bids opened May 24 by R. W. Johnson, Assumption. The contract includes 2970 ft. 24-in., 1820 ft. 14-in., 1800 ft. 12-in., 820 ft. 10-in., and 1820 ft. 8-in. tile. Noted May 15.

✚★**Levee Work**—Cairo, Ill.—(Official)—Bids were received June 2, for constructing about 562,000 cu.yd. of earth work enlargement on the Cairo Drainage District levees. The contract has been awarded to the WALSH CONSTRUCTION CO., Davenport, Iowa, at $286,770.

Ditch—Sandwich, Ill.—Bids will be received until June 12 by the Drainage Commissioners of Northville, Sandwich and Little Rock Townships Special Drainage District, for excavating about 18,000 yd. open ditch and laying about 12,000 ft. drain tile, from 8 to 30-in., and constructing 12 manholes and a bulkhead. S. M. Henderson is County Clk.

Ditch and Tile—Urbana, Ill.—Bids will be received until June 16, by Webber & Roth, Urbana, for the construction of drainage work in Union Drainage District, Arden and Stanford Townships, near the village of Royal, five miles north of St. Joseph or Glover. The work consists of 200 ft. of open ditch, two concrete bulkheads containing 12 cu.yd. each, and furnishing and laying the following tile: North Branch, 3000 ft. of 30-in., 3000 ft. of 27-in., 1800 ft. of 24-in., 1800 ft. of 22-in., 1000 ft. of 20-in., 1000 ft. of 18-in., 1200 ft. of 16-in., and 26 ft. of cast-iron pining 16-in. inside diameter under the Chicago & Eastern Illinois R.R. tracks; South Branch, 4200 ft. of 22-in., 3800 ft. of 20-in., 1550 ft. of 18-in., maximum depth 3½ to 4 ft. Bids may be submitted on well-burned clay tile or well-made concrete tile. Estimated cost clay tile work and hauling, $17,000. G. F. Fisher, Danville, Ill., is Engr.

Ditch—Alden, Iowa—The contract will be awarded soon by the village for the construction of Drainage Ditch No. 39. Estimated cost, $96,000.

Drainage District—Clear Lake, Iowa—The county is considering the construction of Drainage District No. 18.

Ditch—Eldora, Iowa—All bids have been rejected by the County Supervisors, Eldora, for the construction of the Lamm Ditch.

Tunnel—Iowa City, Iowa—Bids will be received by the State Board of Education, Iowa City, for the construction of a tunnel for the State University. It will be 2000 ft. in length.

Ditch Tile—Litchfield, Minn.—Bids will be received until 1 p.m., June 21, by the County Audr., Litchfield, for tiling Ditch No. 35. A. O. Palmquist is County Audr.

+Coaling Stations—Hulbert, Ark.—(Official)—The contract has been awarded to the ROBERTS & SCHAEFFER CO., McCormick Bldg., Chicago, Ill., by the Rock Island Co., Chicago, for the construction of a fireproof counter-balanced bucket (Holman type) coaling station at Hulbert, at about $15,500.

Shipyard—Beaumont, Tex.—The Chamber of Commerce of Beaumont is interested in the construction of a shipyard at Beaumont for the construction of small vessels.

Tunnel—Dallas, Tex.—The city is considering the construction of a tunnel beneath the race track at the Fair Grounds. The cost has been estimated at about $27,000.

New Towns—Midland, Tex.—The O. W. Kerr Co., Minneapolis, Minn., which recently purchased the Nelson Morris ranch of 223,000 acres near Midland, is preparing to establish towns upon the property and develop the land by means of irrigation.

Tunnel—Denver, Colo.—The citizens have voted to authorize a tunnel commission to plan for a bond issue, to be submitted at another election. The proposed tunnel will commence east of Tolland, 35 miles from Denver, and will be 6.4 miles in length. Construction will cost from $4,000,000 to $4,500,000. E. Fleming is Chn., Chamber of Commerce Tunnel Comn.

+Coaling Stations—Salida, Colo.—(Official)—The Denver & Rio Grande Ry. Co., Denver, Colo., has awarded the contract to the ROBERTS & SCHAEFFER CO., McCormick Bldg., Chicago, Ill., for constructing two counter-balanced bucket (Holman type) locomotive coaling stations at Salida and Minturn, Colo., at about $22,500.

Electric Block System—Everett, Wash.—The Great Northern Ry. Co. has prepared plans for the expenditure of $90,000, which will be used in extending the electric staff block system. The system is the same as the one in operation between Everett and Seattle, and will be extended from Pacific Ave., Everett, to Everett Junction, from the Junction to Drawbridge No. 10, thence to Marysville, and on to Bellingham, Wash.

Jetties—Puyallup, Wash.—The County Commissioners, Puyallup, will ask for bids soon for the construction of two jetties along the banks of the Stuck and Puyallup Rivers.

+Grandstand—Seattle, Wash.—The contract has been awarded to A. F. DEVEREAUX, Seattle, for the construction of the Potlatch grandstand. The structure will seat about 15,000.

+Harbor Work—Seattle, Wash.—Contracts have been awarded by the Port of Seattle Commission, Central Bldg., for harbor works as follows: To HARRINGTON PETERS CO., Oriental Block, at $97,200, for constructing warehouse, etc., at the East Waterway Improvement, and at $18,507 for warehouse, etc., at Salmon Bay Improvement; to HANS PEDERSON, Madison Block, at $242,944, for substructure work on Smith's Cove Improvement; to the PUGET SOUND BRIDGE & DREDGING CO., Central Bldg., at $252,308, for dredging and excavation at the Smith's Cove Improvement; to the SEATTLE SWITCH & FROG CO., Lowman Bldg., at $22,168 and $6,792.40, for rails and appurtenances at the Smith's Cove and Central Waterfront Improvements.

Dock Bonds—Portland, Ore.—The Commissioner of Public Docks has withdrawn the advertisement calling for bids for the purchase of Series B, dock bonds for $1,250,000.

Bell Tower—Berkeley, Calif.—Bids will be received until 10 a.m., June 19, by the Controller of the University of California, Berkeley, for the excavation and concrete structural steel and steel erection, granite work, marble work, elevator and ornamental metal work for the Sather campanile, on the grounds of the University of California, Berkeley.

Dredging—Los Angeles, Calif.—James R. Garretson, 200 I. W. Hellman Bldg., has filed application with the U. S. Engineer, Central Bldg., Los Angeles, for permission to dredge False Bay, San Diego, and reclaim tidelands more than one mile in extent.

Shed—Los Angeles, Calif.—The Alta Planing Mill Co., 830 McGary St., has submitted the lowest bid at $55,829, for the erection complete of Municipal Freight Shed No. 1 on Pier A, at $55,829.

+Boilers—San Francisco, Calif.—The contract has been awarded to the PACIFIC FIRE EXTINGUISHER CO., for the installation of boilers in the Relief Home, at $12,863.

Tunnels—San Francisco, Calif.—The Board of Public Works is arranging to have plans and specifications prepared for the construction of the Twin Peaks tunnels. M. M. O'Shaughnessy is City Engr.

+Cement—Santa Ana, Calif.—The County Board of Supervisors has awarded a contract to the RIVERSIDE PORTLAND CEMENT CO., Riverside and Los Angeles, Calif., for furnishing 100,000 bbl. of portland cement at $1.35 per bbl.

Pier Work—Santa Monica, Calif.—D. G. Turnbull has purchased the old Bristol pier, and will remodel it and erect several amusement buildings and a café. About $60,000 will be expended.

Canal—Ottawa, Ont.—Bids will be received by L. K. Jones, Secy. Dept. Rys and Canals, Ottawa, until 4 p.m. July 17, for the construction of Sect. 1 of the Welland Canal. Plans, specifications and form of contract to be entered into can be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Engineer-in-Charge, St. Catharines, Ont. Noted May 22.

+Wireless Stations—Ottawa, Ont.—The contract has been awarded to the MARCONI CO. OF CANADA, by the Department of Railways and Canals, Ottawa, for the erection of two wireless stations at the terminals of the proposed Hudson Bay Ry., at Port Nelson, B. C., the northern terminal, and at Le Pas Man., the connecting point of the new line with the government railway system.

Dredging—Port Arthur, Ont.—Bids will be received until June 13, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the dredging required at Port Arthur.

★Dredging—Toronto, Ont.—According to press reports, the contract for dredging the harbor will be awarded by the city to the Canadian Stewart Co., Montreal, Que. About 30,000,000 cu.yd. of material will be removed. C. H. Rust is City Engr.

Car Shed—Toronto, Ont.—The Toronto St. Ry. Co., Toronto, has had plans prepared for the construction of a car shed, to cost about $36,000. H. G. Salisbury, 10 Adelaide St., Toronto, is Arch.

Subway—Welland, Ont.—The city is completing arrangements for the construction of the proposed subway under the tracks of the Michigan Central Ry. tracks in Welland. Estimated cost, $20,000.

Breakwater Extension—Ogilvies, N. S.—Bids will be received until June 13, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the breakwater at Ogilvies.

Pier—Malbaie, Que.—Bids will be received until 4 p.m., June 24, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a pier at Malbaie, Gaspe County, Que.

BUILDINGS

Amherst, Mass.—Plans are being prepared by Lionel Moses, Arch., 156 Fifth Ave., New York, for the construction of a hotel at Amherst College.

Boston, Mass.—The United Society of Christian Endeavor will erect a headquarters building on Mt. Vernon St., as a memorial to its founder, Rev. F. E. Clark. Wm. Shaw, Tremont Temple, is Secy.

+Brookline, Mass.—The contract for the construction of the 36-apartment building to be erected on Westbourne Terrace, for L. E. Baldwin, 6 Beacon St., Boston, has been awarded to J. H. MURPHY & CO. Cost, $160,000. Fred A. Short, Boston, is Arch. Noted June 5.

Everett, Mass.—(Official)—It was erroneously noted in the issue of June 5, that the city was planning the erection of a city hall. No such work is contemplated this year.

+Pittsfield, Mass.—The contract for the construction of the freight house for the Boston & Albany R.R. has been awarded to WILLIAM M. BALLARD, Oneida, N. Y.

Springfield, Mass.—The City Hospital will be enlarged, at a cost of $750,000. It will be of brick, four stories. Kirkham & Parlett are Archs., 25 Harrison Ave., Springfield.

Westfield, Mass.—Davis & Brooks, Archs., 49 Pearl St., Hartford, Conn., are preparing plans for the construction of a school. The estimated cost is $75,000. Noted Apr. 24.

+Woronoco, Mass.—The contract for the construction of 15 dwellings for the Strathmore Paper Co. has been awarded to the CASPER RANGER CONSTRUCTION CO., Appleton, St., Holyoke, Mass.

Bridgeport, Conn.—Bids will soon be asked for the construction of several buildings for the General Hospital. An addition to the main building a nurses' home, a ward building, a laundry and a power plant will be erected, all of brick and steel. E. F. Stevens, 9 Park St., Boston, Mass., is Arch.

Plans have been drawn for a business block to be erected at Broad and John Sts. for Nathl. W. Bishop. It will be five stories, 70x80 ft., of brick and steel. E. G. Southey, 983 Broad St., is Arch.

Hartford, Conn.—A set of several buildings for the Hartford School of Religious Pedagogy, and the Kennedy School of Missions will be built. The sum of $1,000,000 is now being raised for that purpose.

Hartford, Conn.—Bids for the construction of the isolation hospital for the city were received by the Board of Contract & Supply as follows: General contract, Thomas Malcolm, Hartford, Conn., $58,735; Louis F. M. Miller, Meriden, Conn., $64,622; F. D. Kent, Hartford, Conn., $54,740; T. R. Fox & Son, Hartford, Conn., $62,890; W. E. Caulkins, Hartford, Conn., $69,999; Adam Purves, Hartford, Conn., $63,458. Electrical work: Baldwin-Stewart Electric Co., Hartford, Conn., $2778; E. S. Francis, Hartford, Conn., $3336. Heating, Libby & Blinn, Hartford, Conn., $7800; Barrett & Wael, Hartford, Conn., $8850; G. W. Cunningham & Co., Hartford, Conn., $9469; James T. Murray, Hartford, Conn., $7660. Painting: Charles Fail, Hartford, Conn., $7265; Carl W. Jainsen, Hartford, Conn., $5920. Plumbing: Hanlon & Murphy, Hartford, Conn., $10,290; Edward Mohl, Hartford, Conn., $13,666. Marble tile: White & Clark, Hartford, Conn., $1215. Noted May 29.

The contract for the new Fourth Church Society church has been awarded to W. E. CAULKINS & SON, Hartford, Conn., at $71,000. Noted May 22.

+Hartford, Conn.—The Sisson Drug Co. has awarded the contract for a four-story warehouse at the rear of its Main St. store to SMITH & DESCHAMPS, Hartford. The building will be 90x40 ft., and of mill construction.

Manchester, Conn.—Bids will be received by A. L. Brown, Chn. Eighth School District, until 2 p.m., June 12, for the construction of a school building. Plans at the offices of the J. T. Robertson Co., Manchester, Conn., and W. P. Crabtree, Arch., New Britain, Conn.

Torrington, Conn.—The Torrington High School was recently destroyed by fire. A bond issue of $250,000 for the construction of a new building has been approved by the State Legislature. A town meeting will be held June 6, to vote on the appropriation. Charles H. Alvord, 115 Litchfield St., is Chn. Bd. of Education.

Willimantic, Conn.—Plans are being prepared by Dudley St. Clair Donnelly, 98 State St., New London, Conn., for the construction of the Natchang Grammer School. Noted May 29.

Windsor, Conn.—Bids will be received until June 17, by Murphy & Dana, Archs., 331 Madison Ave., New York, for the construction of school buildings at Loomis Institute, Windsor, Conn. The buildings include a refectory, 150x45 ft.;

two dormitories, each 40x100 ft.; a power house, gymnasium, and residence for the Head Master. Each of the buildings will be of brick, with artificial stone trimmings.

Albany, N. Y.—The Fuller & Robinson Co., Archs., Albany, have prepared plans for the construction of an administration building, for the Albany Medical College. Dr. A. Vanderveer is in charge.

Brooklyn, N. Y.—(Official)—The following were low bidders on bids received by the Department of Parks, Fifth Ave. and 64th St., Manhattan, for the erection of the second part of the greenhouse for the Brooklyn Botanic Garden, on Washington Ave., opposite Crown and Montgomery Sts.: Joseph Balaban, 261 Broadway, Manhattan, $26,898; Concord Construction Co., 476 Court Ave., $27,985. Bids were received on May 29. Charles B. Stover is Pres.

Brooklyn, N. Y.—Plans have been filed by A. W. Ross and W. W. Rasmussen, Archs., 1133 Broadway, Manhattan, for the construction of a four-story, brick hospital building, 296x225 ft., at the northwest corner of St. Marks and Rochester Aves., for St. Mary's Hospital. The estimated cost is $200,000.

+Buffalo, N. Y.—The contract for standard Raymond concrete piles for the foundation of the Gayety Theater has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York. Noted Apr. 24.

Buffalo, N. Y.—Bids will be received until 11 a.m., June 18, by Francis G. Ward, Comr. Pub. Wks., for the construction of a school on Sears St., near Broadway. Noted Apr. 10.

+Buffalo, N. Y.—The general contract has been awarded to GEORGE SCHAAF, 547 East Utica St., for a two-story warehouse and office building, 80x150 ft., to be erected by the Buffalo Weaving & Belting Co., 215 Chandler St. G. Morton Wolfe is Arch., Ellicott Sq. Cost, $45,000.

+The general contract for the construction of the theater to be erected at 745 Genesee St., for Martin Plenthner, has been awarded to the BISON CONSTRUCTION CO., Builders' Exchange. William A. Kidd is Arch., Chamber of Commerce.

Bethune, Bethune & Fuchs, Archs., Franklin St., are preparing plans for a theater, 42x116 ft., to be erected at Rhode Island St. and West Ave., by John J. Mahar, 250 Main St. The estimated cost is $70,000.

Bernhard & Vonwinkle, 1592 Genesee St., will build a brick fireproof building, 65x131½ ft., at Genesee and Danuble Sts., to be used as a theater. The estimated cost is $40,000.

+Castleton, (S. I.) N. Y.—The contract for the construction of the stone dining hall, kitchen and service building on Manor Road, for the City of New York, Department of Public Charities, has been awarded to FRYMIER & HANNA CO., 25 West 42nd St., New York.

+Elmira, N. Y.—The contract for the construction of the four-story building for N. J. Thompson & Co., at State and Market Sts., has been awarded to the WILLIAM R. COMPTON REALTY & BUILDING CO.

Glens Falls, N. Y.—Barnard & Wildner, Archs., 46 Lawton St., New Rochelle, N. Y., are preparing plans for the construction of a hotel on the site of the Ruliff. The estimated cost is $150,000. Hon. A. B. Colvin is interested.

Ithaca, N. Y.—Plans have been prepared by Day & Klauder, Archs., 923 Chestnut St., Philadelphia, for the construction of a dormitory, for Cornell University. The estimated cost is $150,000.

Jamestown, N. Y.—Jamestown Lodge, B. P. O. E., contemplates the erection of a four-story brick and steel lodge and office building, 50x120 ft. The estimated cost is $100,000.

Lockport, N. Y.—The New York Central Lines will erect freight terminals at Lockport. The estimated cost is $100,000. S. J. Kearns, is Supt., Rochester, N. Y.

New York, N. Y.—Bids will be received unil 3 p.m., June 19, by the Department of Parks, The Arsenal, Fifth Ave. and 64th St., for the erection of a playground building in John Jay Park, at the foot of East 76th St. Charles B. Stover is Comr.

Plans have been filed by George F. Pelham, Arch., 30 East 42nd St., for the construction of a 16-story loft and store building, 84x50 ft., on the south side of 25th St., east of Sixth Ave., for the Rexton Realty Co., 37 Liberty St. The estimated cost is $150,000.

Plans have been filed by O. Codman, Arch., 340 Madison Ave., for the construction of a six-story dwelling on the north side of 89th St., east of Fifth Ave., for A. M. Huntington, 1083 Fifth Ave. The estimated cost is $90,000.

+B. Altman & Co., have awarded a contract to MARK EIDLITZ & SON, 489 Fifth Ave., for the erection of a 12-story addition to its department store at Fifth Ave. and 34th St. The new section will cover the entire block front on Madison Ave., from 34th to 35th Sts. and will add to the length of the present building 95 ft. on 35th St., and 145 ft. on 34th St. On the Madison Ave. front the building will be 12 and possibly 16 stories high. Trowbridge & Livingston, 527 Fifth Ave., are the Archs. The estimated cost is $2,500,000.

Bids will soon be received by the McMorrow Engineering & Construction Co., 271 West 125th St., for the construction of a 12-story apartment house, 92x75 ft., on the north side of 81st St., east of Columbus Ave. Neville & Bagge, 215 West 125th St., are the Archs. The estimated cost is $450,000.

Bids will be received until 2 p.m., June 19, by the President of the Borough of Manhattan, at the offices of the Commissioners of Public Works, 21 Park Row, for furnishing all of the labor and materials required for the erection and completion of a public comfort station to be located at 129th Street and Third Avenue and for furnishing all of the labor and materials required for the erection and completion of a public comfort station and band stand in Abingdon Square. George McAneny is Pres.

Plans have been prepared by Harold L. Young, Arch., 1204 Broadway, for the construction of a six-story apartment house, on the entire block bounded by St. Nicholas and Edgecombe Aves., 137th and 138th Sts., for the Yale Realty Co., 5 Beekman St. The estimated cost is $400,000.

Plans have been completed by George F. Pelham, Arch., 30 East 42nd St., for the construction of a 10-story apartment house at Riverside Drive and 150th St., for the Be Glad Construction Co., 319 West 92nd St. The estimated cost is $450,000.

Plans have been filed by C. B. Meyerd, Archs., 1 Union Sq., West, for the construction of a six-story apartment house, 100x86 ft., on the northside of 141st St., east of Riverside Drive, for the B. V. Construction Co., 979 East 163rd St. The estimated cost is $120,000

Plans have been filed by Schwartz & Gross, Archs., 347 Fifth Ave., for the construction of a 12-story apartment house, 166x102 ft., at Riverside Drive and 141st St., for Newmark & Davis, 3740 Broadway. The estimated cost is $500,000

(Boro. The Bronx)—Plans have been filed by F. A. Schmitt, Arch., 604 Cortlandt Ave., for the construction of a two-story brick school, 75x69 ft., on the north side of 144th St., east of Willis Ave., for the Roman Catholic Church of St. Pius, 420 East 145th St. The estimated cost is $60,000.

+(Boro. of Queens)—(Official—The Department of Education, 500 Park Ave., Manhattan, has awarded a contract to PETER CLEARY, at $159,000, for the construction of Public School 14, Boro. of Queens. Bids were received June 2.

+Syracuse, N. Y.—(Official))—The contract for the construction of the three-story building on South Salina St., for the Besse Sprague Co., has been awarded to DAWSON BROS., Union Bldg., Syracuse, N. Y., at $65,000. Noted June 5.

Syracuse, N. Y.—Bids will be received until June 17, by the State Fair Commission, Syracuse, for the construction of a poultry building on the State Fair Grounds. James A. Randell, Is Arch., 704 S. A. & K. Bldg., Syracuse, N. Y. Noted May 29.

Bayonne, N. J.—Louis E. Jellade, Arch., 37 Liberty St., New York, is preparing plans for the construction of a Y. M. C. A., building. J. Herman Mahnken is Chn. of the Bldg. Com. Noted May 8.

+Belleville, N. J.—The Town Council has awarded a contract for the erection of a new town hall to the GEORGE A. SHEDDON CO., New York, at $65,605. Other bidders were: J. Westlecraft & Son, Belleville, $68,886; Oscawanna Building Co., New York, $69,770; Michael Staub, Mamaroneck, N. Y., $71,041.

Flemington, N. J.—J. N. Pierson & Son, Archs., Perth Amboy, are preparing plans for a two-story brick high school to be erected here.

+Jersey City, N. J.—The contract for the fireproofing, cement work and waterproofing for St. Peters club at Warren and Grand Sts., has been awarded to the COMMONWEALTH ROOFING CO., Grove and 19th Sts., Jersey City, N. J. Noted May 15.

Lyndhurst, N. J.—The Union Township Committee is planning for the erection of a new town hall at Lyndhurst to cost about $45,000. A special election to vote on the proposition has been called.

Newark, N. J.—Newark Lodge, Loyal Order of Moose, will erect a club house, at 237 Plant St. The estimated cost is $41,000.

Newark, N. J.—The Board of Education, Newark, contemplates the erection of an addition to the public school in Oliver St. E. F. Guilbert is School Arch., City Hall. The estimated cost is $50,000.

New Brunswick, N. J.—The Board of Chosen Freeholders has adopted resolutions for the erection of a county jail to replace the present structure, and has authorized the preparation of plans.

+Orange, N. J.—The Board of Education has awarded a contract for the erection of a six-room addition to the Park Ave. School, and for necessary alterations in the existing building, to CORNELIUS KEVITT, INC., Glen Ridge, N. J., at $42,655. The contract calls for the completion of the work by Nov. 15. Noted May 22.

+Beatty, Penn.—The contract has been awarded by the Benedictine Fathers for the construction of a building for St. Vincent's Arch Abbey, to THOMAS REILLY, 1616 Thompson, at $175,000.

+Butler, Penn.—(Official)—The contract for the construction of the Y. M. C. A. building at Butler, has been awarded to GEORGE SCHENCK & CO., Butler, Penn., at $90,000. Noted May 15.

+Erie, Penn.—The contract has been awarded to CONSTABLE BROS., Erie, Penn., at $40,000, for the construction of the First Methodist Church edifice.

+Hershey, Penn.—The contract for the construction of the two-story school on Granada Ave. between Cocoa and Ceylon Sts., has been awarded to the TITZEL CONSTRUCTION CO., Lancaster, Penn., at $70,000.

Johnstown, Penn.—Bids will be received until 5 p.m., June 24, by Charles H. Meyer, Secy., 603 Swank Bldg., for the construction of an addition to the Roxbury School, Eighth Ward. J. Emmet Lucas is Arch., 141 Fairfield Ave.

Monessen, Penn.—J. M. Beall, Arch., Savings & Trust Bldg., has prepared plans for a two-story brick school to be erected by the Board of Education. Bids will be received about June 15.

Philadelphia, Penn.—Bids are being received by Horace Trumbauer, Arch., Land Title Block, for the 18-story addition to the Ritz-Carlton Hotel, at Broad and Walnut Sts., to be 60x138 ft.

+The contract has been awarded to C. WHITE & BRO., Philadelphia, for the construction of one-story brick church, 42x85 ft., at 57th and Summer Sts., for St. Mathew's African United Methodist Protestant Church, to cost $110,000.

+Philadelphia, Penn.—The contract has been awarded to IRWIN & LEIGHTON, 126 North 12th St., for alterations and

additions to the office building at 10 South Broad St., for the Arcade Real Estate Co., Arcade Bldg. The Furness Evans Co., Provident Bldg., are Archs. Noted May 8.

+The contract for the construction of the seven-story office building at Sixth and Walnut Sts., for the Penn Mutual Life Insurance Co., 925 Chestnut St., has been awarded to DOYLE & CO., 1519 Sansom St. Noted May 1.

Philadelphia, Penn.—Bids will be received about June 15, by Walter Smedley, Arch., Stephan Girard Bldg., for the construction of a brick addition to the West Philadelphia Hospital, at 41st and Preston Sts.

Pittsburgh, Penn.—Bids will be received until 9 a.m., June 12, by the Board of Trustees of the Pennsylvania State College, Edward Erle Sparks, Secy., for the construction of the Horticultural Building on the campus of the Pennsylvania State College. Edward Hazlehurst, is Arch., 1433 Chestnut St.

Pittsburgh, Penn.—A site has been selected on the South Hills by the officials of the Board of Education for the erection of a new school. The structure will be located on Ruth, Harwood, Eureka and Senaca Sts. No architect has been selected. The building will cost $250,000.

+The contract for the concrete piling to be used in the construction of the Farmers' Market, in Duquesne Way, has been awarded to the CRANFORD CONSTRUCTION CO., Pittsburgh, Penn. Simplex concrete piles will be used.

+**Baltimore, Md.**—The contract has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York, for placing standard concrete piles for the foundation of a warehouse for the S. J. Van Lill Co., Baltimore, Md.

+The contract for the steel work for Gilman Hall, at Johns Hopkins University, has been awarded to DIETRICH BROS., Pleasant and Davis Sts., Baltimore, Md. Noted Apr. 17.

+**Cumberland, Md.**—The contract has been awarded to WRIGHT-RICHARDSON, Cumberland, for the construction of the tuberculosis hospital for the Allegheny County Sanitarium. George Sansbury is Arch., Citizens National Bank. It will be 136 ft. long, and central portion 36x18 ft., with wings 50x8 ft., of mill construction.

+**Charleston, W. Va.**—The contract has been awarded to the J. C. JONES & CO., at $100,000, for the construction of the six-story warehouse for the Hubbard Grocery Co. Noted May 15.

Wheeling, W. Va.—The National Bank of West Virginia will build a banking house of brick, granite and terra cotta. Plans are being prepared by Edward Bates, Schmulbach Bldg. The building will be 47x66 ft.

+**Tampa, Fla.**—The contract for the construction of the two-story office building for the Tampa Electric Co. has been awarded to MILLER & HYER, at $40,000. F. J. Kennard is Arch., Tampa.

De Ridder, La.—W. L. Stevens, Arch., Liverpool & London Globe Annex, New Orleans, La., is preparing plans for the construction of a court house and jail, for Beauregard Parish. The estimated cost is $175,000.

+**Covington, Ky.**—The contract for the construction of the church for St. Augustine's congregation, has been awarded to JOSEPH WILBERS, at $60,000. D. Davis is Arch., Fosdick Bldg., Cincinnati, Ohio.

Cleveland, Ohio—The East End Market House Co., is having plans prepared by Knox & Elliot, Archs., 1248 Rockefeller Bldg., for the construction of a market house and cold storage building extending from East 105th to East 101st Sts. The estimated cost is $200,000.

Cleveland, Ohio—Bids are being received by the Forest City Engineering Co., Superior Bldg., for the construction of a six-story and basement, 160x175 ft., steel and concrete, fireproof, warehouse, on Lakeside Ave. and 22nd St., for the H. C. Christy Co. The estimated cost is $175,000.

Columbus, Ohio—F. L. Packard, Arch., New Hayden Bldg., Columbus, has completed plans and will ask for bids for the construction of schools at Hamilton, New Philadelphia, Troy, Marysville, and Millersburg. The estimated cost of the work is $600,000.

Hamilton, Ohio—The Board of Education of Hamilton will advertise for bids at once on the High School. It will be three stories and basement, 166x222 ft. Cost, $300,000. F. L. Packard, New Hayden Bldg., Columbus, Ohio, is Arch. Associate Arch., Fred G. Mueller, 704 Rentschler Bldg., Hamilton. Noted May 1.

Sandusky, Ohio—Bids will be received until 2 p.m., July 2, by the Ohio Board of Administration, Hartmann Bldg., Columbus, Ohio, for remodeling an addition to the Domestic Building at the Ohio Soldiers' and Sailors' Home, Sandusky. W. E. Haswell is Secy.

+**Tiffin, Ohio**—The contract for the construction of the Masonic Temple at Tiffin, has been awarded to the BRIGHT CONSTRUCTION CO., Toledo, Ohio.

+**Youngstown, Ohio**—The contract for the construction of the city hall has been awarded to HELLER BROS., Youngstown, Ohio, at $218,830. Noted June 5.

+**Logansport, Ind.**—The general contract for the construction of the high school has been awarded to BAINES BROS., Logansport.

+**Flint, Mich.**—The general contract for the construction of the temple for the B. P. O. E. has been awarded to H. V. SNYDER & SONS, Battle Creek, Mich., at $50,000. Noted Mar. 13.

+**Muskegon, Mich.**—The contract for the construction of the lodge building for Muskegon Lodge, B. P. O. E. has been awarded to the H. SILENSERGER CO., Chicago, Ill., at $65,000.

Ashley, Ill.—Bids will be received until noon, June 14, by the Board of Education for the construction of a brick high school at Ashley. Fred Brown is Acting Secy., Ashley.

Oshkosh, Wis.—Plans for the home office building to be erected by the Federal Reserve Association call for a brick 54 ft., four story brick structure with stone trimmings. Henry Ashley, 75 Main St., Arch. C. M. Robinson is Supreme Secy. Cost, $50,000. Noted May 8.

+**Superior, Wis.**—The general contract for the construction of the Carpenter School, has been awarded to A. DAUPLAISE, at $43,225. The heating and ventilating contracts were let to the AMERICAN HEATING CO., at $12,625; and electric wiring, NEIL & CO., at $1241.

+**Dubuque, Iowa**—The general contract has been awarded to ULRICH WILLY, 2595 Jackson St., for the construction of a three-story, brick, 110x60 ft., gymnasium, for the Dubuque German College and Seminary.

+**Duluth, Minn.**—The contract for the construction of the R. E. Denfield Industrial School, has been awarded to the CHIPPEWA FALLS CONSTRUCTION CO., Chippewa Falls, Wis., at $135,178. The heating and ventilating contracts were let to the AMERICAN HEATING CO., at $33,700; and the electric wiring to RICHARDSON ELECTRIC CO., at $7150.

St. Cloud, Minn.—Bids will be received until 4 p.m., June 17, by C. L. Atwood, Dir. of the State Normal School, St. Cloud, Minn., for remodeling and repairing the main building and old buildings at the State Normal School.

+**Grand Island, Neb.**—The contract for the construction of the four-story and brick Y. M. C. A. building has been awarded to C. D. RICHEY, Hastings, Neb. Other bidders were: Henry H. Falldorf, Grand Island; William C. Tothman; Harvey E. Wood, Aurora; George C. Pesha, College View, Neb., C. E. Goodhand, Ord, Neb. Noted May 15.

Jefferson City, Mo.—H. H. Hohenschild & Harry E. Clymer, Archs., Navarre Bldg., are preparing plans for the construction of a cell building at the Missouri penitentiary. The estimated cost is $350,000.

Poplar Bluff, Mo.—The contract for the construction of the two-story high school at Poplar Bluff, has been awarded to the McCARTHY LUMBER & CONSTRUCTION CO., Farmington, Mo., at $45,622. Other bidders were: J. W. Linton, $53,000; G. Hartman Contracting Co., $52,000; Mississippi Construction Co., $52,600; C. W. Tetwiler, $48,730. Noted May 8.

St. Louis, Mo.—Kennerly & Stiegmeyer, Archs., are preparing plans for the construction of a 14-story hippodrome and hotel at Seventh and Market Sts., for Frank Talbot. The estimated cost is $1,000,000.

Dallas, Tex.—Bids will be received about July 25, by George Team, County Audr., for the construction of an eight-story jail and Criminal Court building for Dallas County. The estimated cost is $400,000. Noted May 29.

Seattle, Wash.—Plans are being prepared by James H. Schack, Arch., Dorons Block, for a six-story apartment house to be erected by Bogue Brown on Sixth Ave., near Pine St. at an estimated cost of $325,000.

Salem, Ore.—The State Board of Control will receive bids until June 19, for the completion of unfinished portions of the State Supreme Court and Library Building. Plans may be obtained from W. C. Knighton, Arch., Capitol Bldg. R. B. Goodwin is Clk. Bd. of Control.

Berkeley, Calif.—Bids will be received at the office of the Comptroller, University of California, until June 19, for erection of the Sather campanile on the University grounds. The estimated cost is $200,000.

Los Angeles, Calif.—The Huntington Park Union High School District will erect a two-story and part basement brick school to cost about $80,000. It will be 119x225 ft. George W. Eldredge, 521 Los Angeles Investment Bldg., Los Angeles, is Arch.

San Diego, Calif.—Bristow & Lyman, Archs., Timkin Bldg., have prepared preliminary plans for a 14-story office building to be erected at Fifth and B Sts., for Homer Peters, Jr., and associates. It will be of steel frame and brick construction, 75x100 ft., with terra cotta exterior.

+The contract for the structural-steel and iron work for the six-story Sefton Hotel on F St., between Sixth and Seventh Sts., has been awarded to the BAKER IRON WORKS, Los Angeles, Calif. W. S. Bebbard, Grant Bldg., is Arch. The estimated cost is $250,000.

San Francisco, Calif.—The Hobart Estate Co. is having plans completed by Willis Polk & Co., Arch., Mer. Ex. Bldg., for a 20-story office building on Market St., near Montgomery. Estimated cost, about $1,500,000.

San Francisco, Calif.—The following bids for furnishing and erecting the structural steel and iron work of the Exposition Auditorium were received by the Committee on Buildings and Grounds: J. G. Williams Construction Co., on Proposal C receiving f.o.b. San Francisco, unloading, storing, hauling, erecting, etc., the steel and iron, $53,500. Smith Rice Co., Proposal C, $59,500. United States Steel Products Co., Proposal B for furnishing, fabricating and delivering f.o.b. San Francisco, $217,238; for furnishing, fabricating and delivering Eastern terminal, $164,835. California Construction Co., Proposal A for furnishing, fabricating, erecting, riveting all steel and cast iron, $314,060; Proposal B for furnishing, fabricating and delivering, San Francisco, $257,940; for furnishing, fabricating and delivering Eastern terminal, $204,940; Proposal C for receiving, f.o.b. San Francisco, unloading, storing, hauling and erecting the steel and cast iron, $59,120. Blume Construction Co., for receiving, f.o.b. San Francisco, unloading, storing, hauling and erecting, $39,900. Noted May 29.

Greenwood, B. C.—Bids will be received until June 16, by R. C. Desrochers, Secy., Pub Wks. Dept., Ottawa, Ont., for the construction of a public building. Plans, specifications, etc., at offices of Wm. Henderson, Resident Arch., Victoria, B. C.

+**Swift Current, Sask.**—A contract has been awarded to the HEALEY CONSTRUCTION CO., Toronto, Ont., for the construction of the J. F. Booker Hotel at Cheadle St. and First Ave. East. The estimated cost is $200,000.

Colon, Panama—R. L. McKearney, Gruenwald Hotel New Orleans, La., has been appointed architect for a 350-room hotel at Colon, Isthmus of Panama, which will be built by New York interests at a cost of $400,000. It will be of reinforced concrete.

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The Completion of the Los Angeles Aqueduct

By Burt A. Heinly*

Next November the City of Los Angeles expects to formally dedicate to public use its new water-works system by which the municipality is to draw upon the streams of the Sierra Nevada Mountains, 250 miles distant, for a supplementary domestic supply. The occasion will be one of more than ordinary note for doubtless no ancient or modern city of its size has undertaken and carried to successful completion a project of such monumental magnitude. Likewise, also, no American city has such possibilities of economic and financial returns to its citizens from a municipal enterprise as has Los Angeles in the Los Angeles Aqueduct if its affairs are managed with judgment and business acumen. The dedicatory exercises with the several days of attendant celebration, aside from the completion of the enterprise, are to be made worthy of note by the attendance of various government officials and of the governors of many of the Western States together with their staffs.



Fig. 1. The Headwaters of the Los Angeles Aqueduct

(A part of the main range of the Sierras. Mt. Whitney, Elev. 14,502, the highest peak in the United States, appears in the background, near the extreme left.)

Because of the articles that have appeared in this and other publications on various phases of the undertaking and in view of the fact that other articles will appear from time to time on the same subject now that the Aqueduct, *per se*, is completed, the writer believes that a brief description of the works with some reference to the historical details and a concrete explanation of the plans of operation and the future economic importance of the task will be of more than common interest to the engineering profession.

Any general description of the work, however brief, must take up the three following phases—all of them unusual and each, depending upon the viewpoint of the reader, of first importance:

(1) The project stands as one of the most extensive water-works systems in existence, built under most adverse conditions of climate and topography.

(1) With the exception of 9 miles of construction, the commissary department and the hospital and medical divisions, which were under contract, the enterprise has been accomplished under the direct control and supervision of the city. The undertaking has been completed in larger detail and at something under the $24,500,000 voted for the purpose and the time of estimated construction has not been exceeded. To advocates of municipal construction of public works an interesting field of investigation is here opened.

(3) While primarily a water-works system, the Los Angeles Aqueduct provides for the irrigation for a long term of years of 135,000 acres of land with surplus water and for the development of a maximum of 120,000 hp. of electrical energy, so that to the municipal economist this phase of the undertaking would stand first.

Before entering upon an outline description of the engineering work, the writer desires to present certain facts that are not apparently well understood even in his own city.

The Aqueduct, *per se*, has a total length of 234.7 miles, but the outlet of the Aqueduct is 24 miles northwest of

*City Water Department, 636 South Hill St., Los Angeles, Calif.

the city. To procure the Sierra supply it is necessary for Los Angeles to carry the water from the outlet of the Aqueduct across the San Fernando Valley by 13 miles of 72- to 62-in. steel inverted siphon, through the crest of the Santa Monica Mountains by a tunnel 3781 ft. long, down Franklin Cañon and take it into the distributing mains on the western edge of the city. While the Aqueduct is all but completed and is to be formally dedicated, it is hardly possible that Los Angeles can draw upon the new supply before the summer of 1914 as the construction of the trunk line is just now being undertaken. The explanation of the division of the work is two-fold: What was of vital importance in 1907 when construction was undertaken was that the total bond issue of $24,500,000 exhausted the limit of the city's legal indebtedness. Moreover, geographically, the Aqueduct ends in the two reservoir sites on the rim of the San Fernando Valley and it was decided that the districts desiring surplus water for irrigation should build their pipe lines at their own expense and that the city should build its supply main out of the general revenues of its Water Department. This, as well as the fact that approxi-





FIGS. 2 AND 3. WIER AND HEADGATES, OWENS RIVER DIVERSION TO LOS ANGELES AQUEDUCT

(In the lower view the headgates were being opened on Feb. 9, 1913, when the first 60 miles of the Aqueduct and the Haiwee Reservoir were placed in operation.)



Fig. 1. Dipper Dredge Excavating Canal Section in Owens Valley, Los Angeles Aqueduct

mately 10 miles are classed as power construction, will explain the many discrepancies as to the length of the system.

Again: The Owens River supply is supplementary to that of the present one, amounting to 40,000,000 gal. per day from the Los Angeles River. The water from present sources is pure and good and there is no reason why in a country where water for all purposes is at such a premium that the city should in any way surrender its riparian rights in the stream which date back to the founding of the pueblo in 1781. Also, there will be no changes of moment in either the present pumpage or gravity distribution systems. The only improvements needed are those which have already been accomplished during the past five years. These consist mainly, as they apply to the new source, of laying extra large mains toward the sea in the southwest part of the city where the growth of population is most rapid, and extending large-size connecting mains at right angles and across the city to the eastward.

The Los Angeles Aqueduct, or the Owens River project as it is often popularly denominated, was conceived in 1904 and came as a result of the dwindling sources of the city's supply from the surface and sub-flow of the Los Angeles River. The Owens River, with its tributary streams draining the eastern face of the Sierra Nevada Range (the roofshed of the United States) for a distance of 120 miles, was found to be the only available source of adequate supply. In the valley of this stream, the city's Board of Water Commissioners, out of the funds of the Water Department, secretly began in the early part of 1905 to take options on lands and appurtenant water rights. July 1, 1905, these negotiations had reached a point where speculators could not impose upon the municipality and the plans of the board with a report on the negotiations in the valley were made public. In September of the same year, the people voted $1,500,000 to take up the options and carry on the preliminary engineering investigations. By the fall of 1906, the plans and estimates had been completed under the direction of William Mulholland, the city's Water Superintendent, and his chief assistant, J. B. Lippincott. In December of that year, after several months of study and field inspection, a consulting board of engineers composed of Messrs. John R. Freeman, Frederick P. Stearns and James D. Schuyler (now dead) gave the project their approval practically as it was outlined. In June of 1907 the people voted $23,000,000, the amount of Mr. Mulholland's estimate, to undertake the work, it being understood that power development must be made from future bond issues for that purpose.

A classification of the work as it has been carried out, includes the construction noted in the table at the top of the next column.

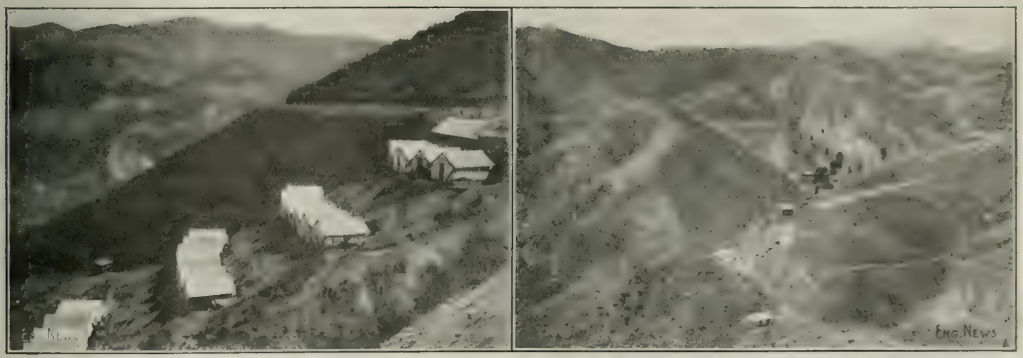


Fig. 5. Camp in the Santa Susana Range

Fig. 6. Camp on the Jawbone Division

(These views give some idea of the mountainous country through which much of the Los Angeles Aqueduct was built. Of 23 miles in the Jawbone division, 20.5 miles were tunnel construction.)

Classification	Length in miles
Tunnel	42 69
Power tunnel	9 23
Open unlined canal	21 14
Open lined canal	39 56
Concrete-covered conduit	97 72
Haiwee by-pass	1 95
Siphons (steel and concrete)	12 06
Flumes	0 17
Power penstock	9 44
Other power construction	0 30
Reservoirs	8 50
Total length of aqueduct	233 76

Of the foregoing, 51,000 ft., exclusive of penstocks, is classed as power construction with a *pro rata* of cost defrayed from the power bonds issue of $3,500,000 for the reason that it was necessary to adapt the designs of the Aqueduct to meet the needs of power development. This is particularly true of a stretch of seven miles leading from the outlet of the Elizabeth tunnel (47 miles from Los Angeles). At this point, the original design of lined canal of a capacity of 800 sec.-ft. This canal, 21.14 miles in length, is unlined for the reason that a considerable quantity of the underground flow of the valley is taken up. At the northern toe of the Alabama Foot Hills, not far from the mouth of the Valley, the Aqueduct assumes the form of an open concrete-lined ditch, 39.56 miles in length and with a capacity of 900 sec.-ft. This ditch empties into the Haiwee Reservoir and is of a capacity of more than double that of the rated delivery of the Aqueduct in order to take care of the flood flow of the Owens River and tributary streams which it is the duty of the Haiwee Reservoir to impound, clarify and sterilize. This basin, with a capacity of 63,800 acre-feet, acts as the balance for the whole system. This first part of the system was placed in operation Feb. 9, 1913, with the most satisfactory results.

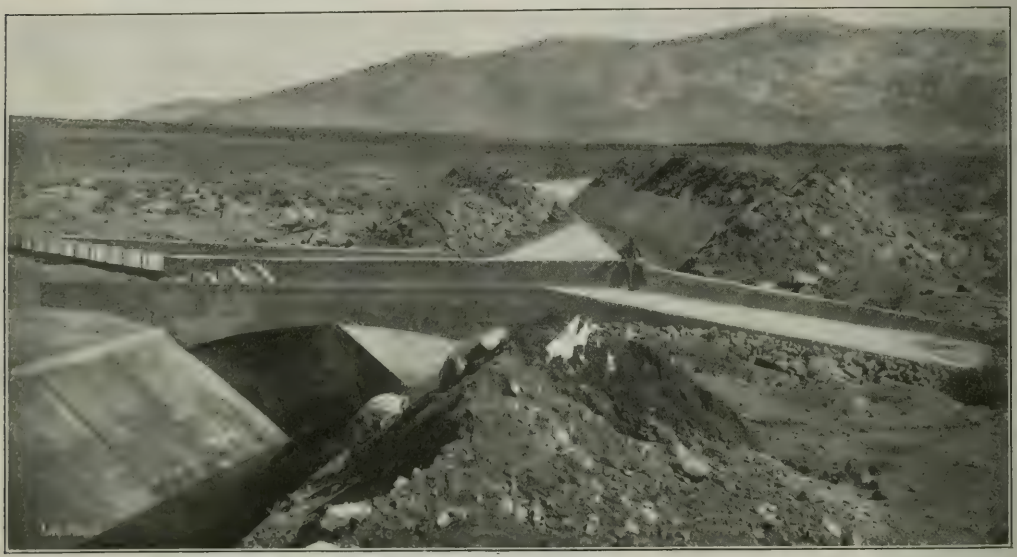


Fig. 7. Concrete-Lined Open Section of the Los Angeles Aqueduct in the Heart of the Mojave Desert

the Aqueduct as a water-works provided for the use of the natural channel of the San Francisquito Cañon for a distance of 7 miles, the water being caught up at the cañon's outlet, thence carried by means of tunnels, siphons and small stretches of conduit through the heart of the Santa Susana Mountain range and into the San Fernando reservoirs at the Aqueduct outlet. The change to meet power requirements makes it necessary to carry the Aqueduct along the rim of the cañon. As money from the sale of power bonds was not available until 1911, work on the power section was not undertaken until July of that year. About 1000 ft. of tunnel with some tunnel lining still remains to be accomplished on this stretch and temporarily, at least, the floor of the cañon must be used. This will in no way affect the operation of the Aqueduct as a water-works project.

The intake of the system at an elevation of 3812 ft. above sea level, is situated 11 miles north of the town of Independence, Inyo County, Calif., where the whole normal flow of the Owens River is diverted into an un-

From the Haiwee Reservoir south to the Fairmont Reservoir, a stretch made up of 137 miles of tunnels, conduits, and siphons, the rated capacity is 431 sec.-ft. The Fairmont Reservoir, situated at the northern edge of the Sierra Madre Range, is designed solely as a power regulating reservoir and has a capacity of 7620 acre-feet. From here the water passes beneath the Coast Range by means of 40,617 ft. of pressure tunnel of 1000 sec.-ft. capacity to provide for peak loads of power generation, to emerge on the south side of the range, and, emptying into a surge chamber, from there plunges down 941 ft. upon the power wheels of hydro-electric plant No. 1.

This plant, with a maximum capacity of 69,370 hp., is now under construction. The three units being installed will have a maximum capacity of 37,500 hp. and it is expected that the plant can be completed by late fall. From here the water will be carried 7 miles along the rim of San Francisquito cañon, in this distance to be shot down 512 ft. for the development of 14,100 hp., whenever the market will justify the installation of the neces-



FIG. 8. A TYPICAL STRETCH OF FLAT-COVER AQUEDUCT; THROUGH ROSE VALLEY

sary machinery. After leaving the tail race of this proposed power plant the water flows into an equalizing basin called the Dry Cañon Reservoir, which has a capacity of 1325 acre-feet. From here, the Aqueduct as stated above, and of a capacity of 420 sec.-ft., takes its course through the rugged Santa Susanas to its outlet on the edge of the Fernando Valley, at which point its elevation is 1461 ft. above sea level. The elevation of the city's business district is approximately 276 ft. above sea level.

Here at the present time a cascade and water race is being constructed with two miles of conduits and two short tunnels carrying the water into the City Trunk Line and the Lower Fernando Reservoir, both of which are now under construction. The completed plan calls for a power drop of 291 ft., with a possible development of 10,000 hp. between the Aqueduct Outlet and the Upper Fernando Reservoir. This is a contemplated impounding basin of 15,940 acre-feet, with a surface elevation at 1275 ft., situated between the Outlet and the Lower Fernando Reservoir, which has a surface elevation of 1135 ft. above sea level and a capacity of 25,000 acre-feet. From the Intake to the Outlet it will be seen that the Aqueduct is a gravity system.

The plans of distribution with the building of at least two additional reservoirs are not in a stage to permit of even prophecy. However, the reader will visualize the whole system by seeing the Aqueduct as an arm, the San Fernando reservoirs as the palm of the hand and the trunk lines leading off therefrom as the fingers.

The carrying capacity of the Aqueduct is rated at 20,000 miner's inches (of southern California) or 259,200,000 gal. in 24 hours. Allowance of 1600 miner's inches was made for seepage, evaporation and other losses. Tests of nearly 100 miles of the Aqueduct made up to May, 1913, show that this provision for loss is more



FIGS. 9 AND 10. CONSTRUCTION OF COVERED CONDUIT, WITH RIBS, ACROSS THE MOJAVE DESERT

than ample and the system should be capable of delivering a quantity something in excess of the 20,000 miner's inches.

As to the quality: The purity of the water and its freedom from present or future contamination is unquestioned both because of its source and the fact that the 3000 miles of the Owens River drainage basin are so rugged as to remove any fear of pollution through growth of population in the valley. The supply will be made up about half and half of the waters of the Owens River and streams debouching from their mountain cañons directly into the Aqueduct. An analysis of the mineral content of Owens River and Black Rock Spring, the latter being a fair sample of the quality of the 34 streams, is herewith given:

	In grains per U. S. gallon	
	Black Rock Spring	Owens River at Aqueduct Intake
Sodium chloride	0 92	3.05
Sodium sulphate	1 97	4 47
Sodium carbonate	1 64	1 57
Calcium carbonate	3 42	7 71
Magnesium carbonate	0 64	1 26
Iron and alumina	0 23	0 36
Silica	0.16	0 54
Total solids per U. S. gallon	8 98 grains	22.96 grains

(Samples taken Apr. 19, 1912, submitted Apr. 23; reported Apr. 30, 1912. Analyses by Prof. Laird J. Stabler.)

The average mineral content of the new supply will, therefore, be about 15 to 17 grains per U. S. gallon. This as compared with most Eastern waters will show excessively high. With Western waters, however, the showing is very favorable. The mineral content of the present supply of the city is 31 grains per U. S. gallon. At this point and as a general answer to the many

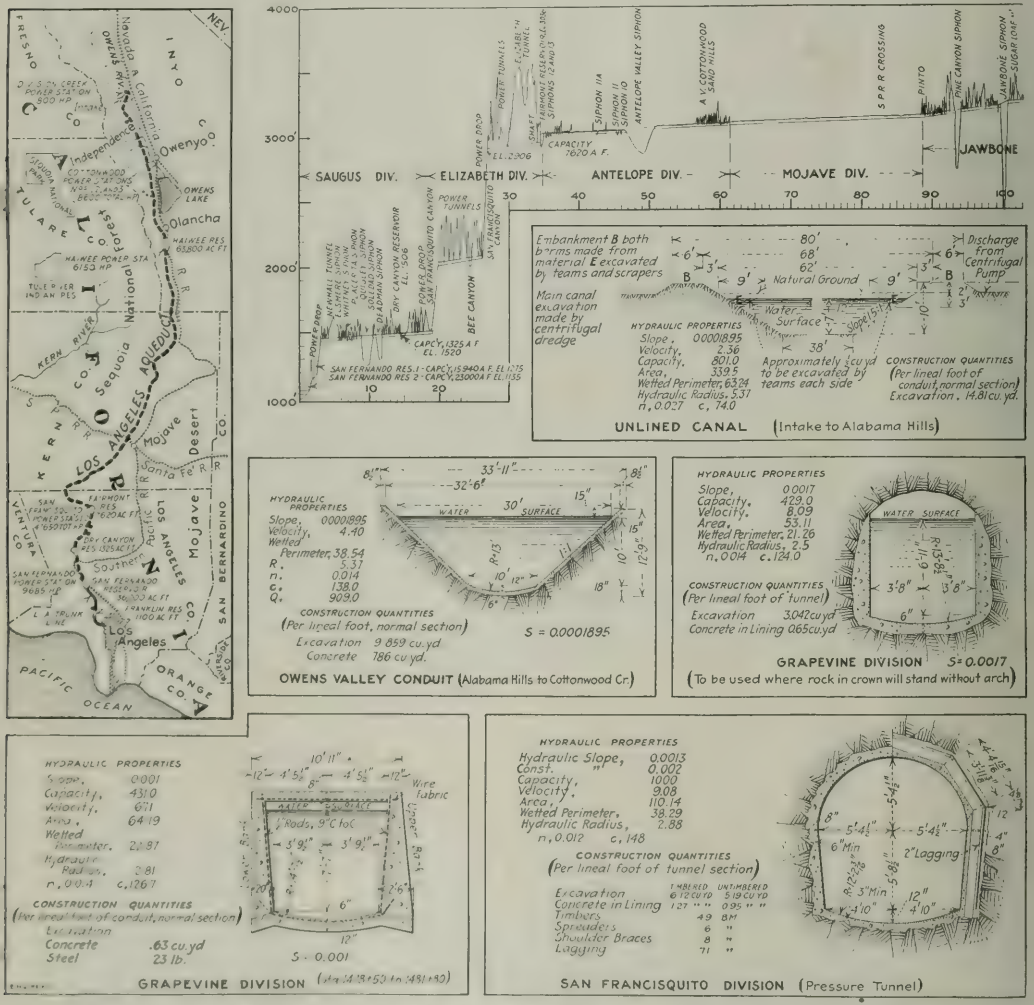


FIG. 11. MAP AND PROFILE OF LOS ANGELES AQUEDUCT, WITH TYPICAL CROSS-SECTIONS SHOWING OPEN CHANNEL AND TYPICAL SECTIONS OF CHANNELS AND

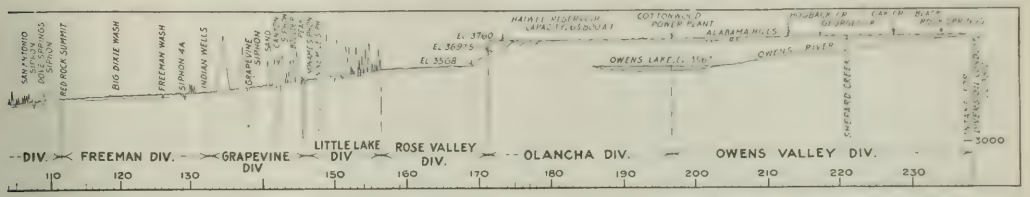
inquiries which the department has received, it may be well to state regarding the possible deterioration of the steel siphons that the water is of a character to cause a minimum corrosion of the material. The siphons are raised on concrete piers, are laid in a region of remarkably dry atmospheric conditions and have been coated inside and out with a heavy asphaltum liberally diluted with gas-works coal tar. In an extensive use of steel pipe of this character, extending over a period of 30 years, it has been Mr. Mulholland's experience that pipes

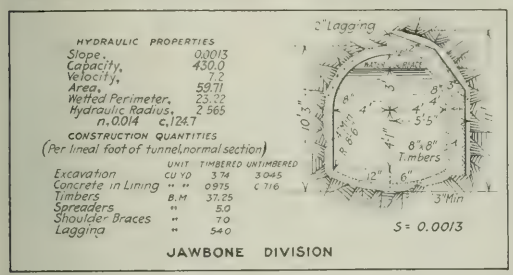
mer of 1908, is noteworthy, as will be seen by the following tabulation of the progress by years:

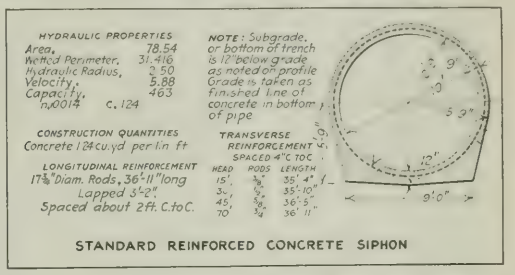
	Miles
Excavation completed to July 1, 1909	36.82
Excavation completed July 1, 1909 to July 1, 1910	66.36
Excavation completed July 1, 1910 to July 1, 1911	43.18
Excavation completed July 1, 1911 to July 1, 1912	18.28
Excavation completed July 1, 1912 to May 1, 1913	29.57
Excavation remaining uncompleted (project entirely	0.25

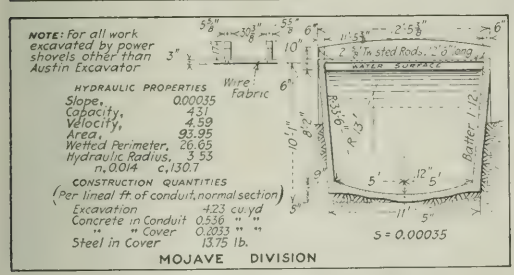
In the above siphon work is classed as excavation

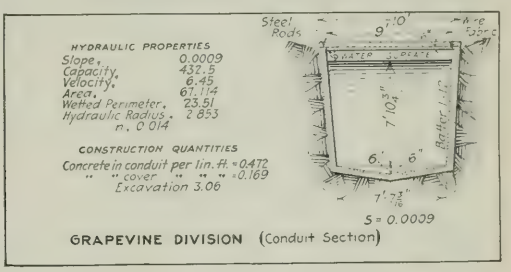
In concluding the brief description of the engineering features, the writer would draw attention to the difficult conditions under which the work was inaugu-

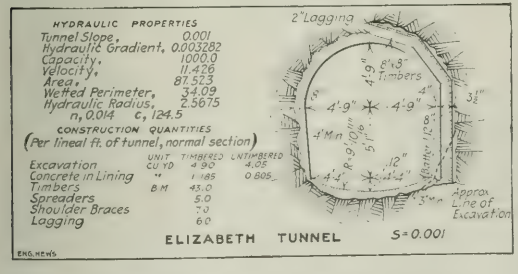












UNLINED DITCH, OPEN LINED CHANNEL, COVERED REINFORCED-CONCRETE SIPHONS

in the air with water constantly flowing through them show no appreciable deterioration in that period under our California conditions.

The rate at which the excavation of the Aqueduct has been carried on, following its beginning in the late summer of 1908, is noteworthy, as will be seen by the following tabulation of the progress by years:

rated and carried on. From June of 1907, when the $23,000,000 bond issue was voted, to October of 1908 was required simply for preliminary construction, in which nearly 20% of the total amount voted was expended. The operations have been in or on the edge of a desert, originally far from human habitation and at first without methods of communication, transportation or even water-supply. The fact that the construction includes *52 miles of tunnels*, ranging from a few hundred feet up to five miles in length, tells briefly of the rugged, mountainous topography which was encountered for much of the way. To the foregoing must be added the difficulty of procuring labor in sufficient quantity, and once having obtained it to hold its employment under the adverse climatic conditions of the Mojave Desert.

To advocates of municipal ownership, the work is of particular interest from the fact that it is of itself a municipal project which in turn has involved many other fields of somewhat unusual municipal endeavor. These, in brief, may be summarized as follows:

Leasing and farming of as much of the land as is tillable of the 100,000 acres of property purchased in the Owens Valley to procure and protect the purity of the water-supply, these operations being carried on under the direction of the city's farm superintendent.

The inauguration of an extensive plan of forestation for commercial purposes on lands in the Owens Valley not suited to crops.

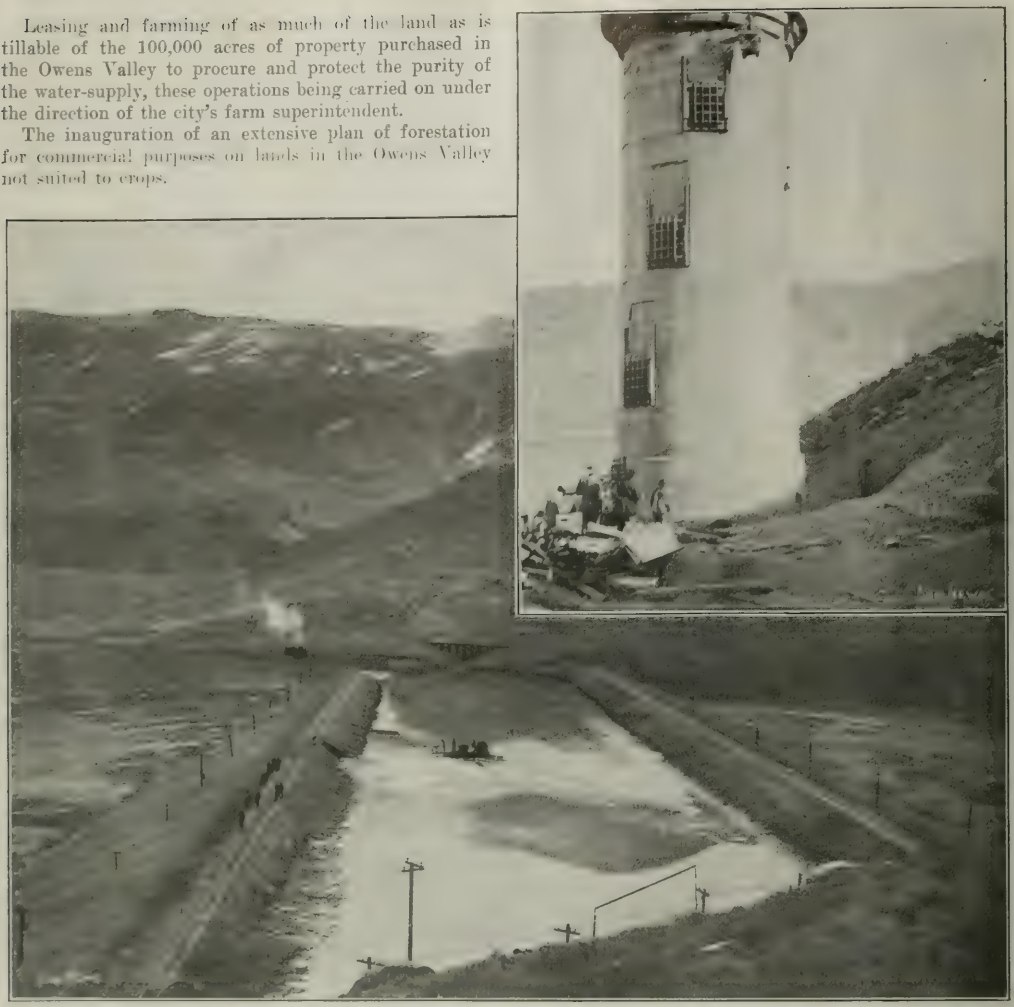


FIG. 12. BUILDING THE LOWER DAM OF THE HAIWEE RESERVOIR BY THE SLUICING PROCESS

FIG. 13. GATE TOWER OF THE HAIWEE RESERVOIR

The position of the city as a corporate producer of electric power to supply communities without its own limits. This was brought about by the city's having surplus current from its two hydroelectric construction power plants in the Owens Valley and the sale of electric energy to the towns of Independence and Lone Pine for lighting and power purposes.

The ownership and operation of a municipal telephone line with 220 miles of main line and 240 miles of branches, switchboards, complete operating and maintenance force.

The manufacture of standard Portland and tufa cement (the latter being an innovation in the cement industry of this country) by the erection of one Portland mill and three tufa regrinding mills at an outlay of more than $900,000.

Last, but not least, the construction of the entire work with all side issues as a municipal proposition in which nearly all classes of day labor were practically taken into partnership with the city and paid a bonus whenever the progress was in excess of a stated average. The one exception to the above and exclusive of the commissary and medical departments was the construction of 9 miles of comparatively easy conduit and tunnel building let by contract at the opening of operations for the purpose of being able to arrive at a just comparison of economy between private and public construction. Based on the records of the cost-keeping department, the comparison shows that if the Aqueduct had been built under private contract it would have cost close to $40,000,000. Much salvage, including the Monolith cement mill, which is subject to purchase by Los Angeles County at a cost



FIG. 14. MUNICIPAL CEMENT MILL AT MONOLITH, CALIFORNIA

(Much of the cement used on the Los Angeles Aqueduct was made by this mill. Its capacity was 1000 bbl. per day and its cost, with the tufa grinding mills shown in the other view, was about $900,000.)

FIG. 15. TUFA REGRINDING MILL, LOS ANGELES MUNICIPAL CEMENT PLANT

(The tufa quarry and mountain shown in the background.)

of $550,000, remains to be disposed of, so that no statement can be given of the total actual cost, but it is safe to say that the project has been completed well within the total appropriation of $24,500,000, of which $1,500,000 has been expended for land and water rights.

Concerning the last phase of the subject, that of commercial utility, this journal has recently printed (March 13, 1913) an extensive article on the distribution and sale of surplus waters, and power development is not at a point where the comments as to possible sales will go farther than estimates. Where these are based upon conservatism they are of value and for this reason the writer presents a statement of the ultimate revenue capacity as prepared some months ago by J. B. Lippincott, assistant chief engineer of the Los Angeles Aqueduct Bureau.

In explanation of his rates on water it should be stated that the present rate for city domestic use is 9⅔c. per 1000 gal. and that for the sale of surplus water he figured on the original plan of water distribution



FIGS. 16 AND 17. ELIZABETH TUNNEL, LOS ANGELES AQUEDUCT

(The tunnel extends for five miles beneath the Sierra Madre Range. Each view is taken at a point three miles from the portal. The speck of light in Fig. 17 is the portal.)



FIG. 18. SOLEDAD SIPHON, LOS ANGELES AQUEDUCT, LOOKING SOUTH

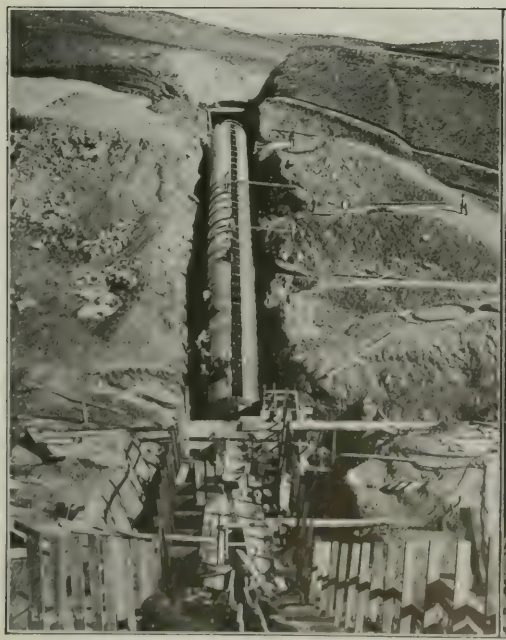


FIG. 19. WHITNEY REINFORCED-CONCRETE SIPHON

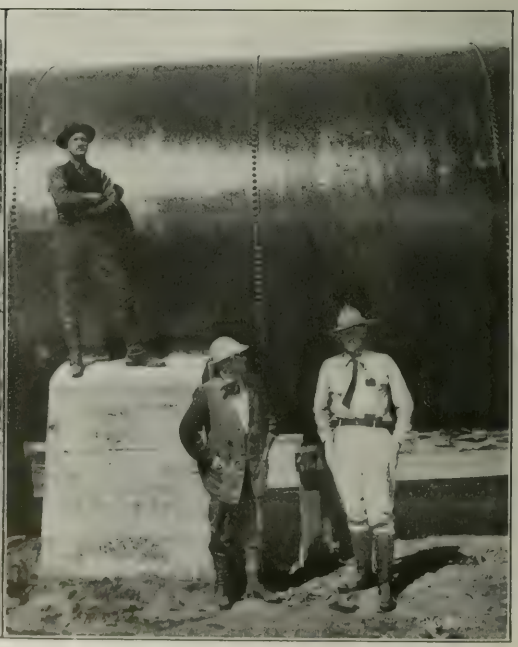
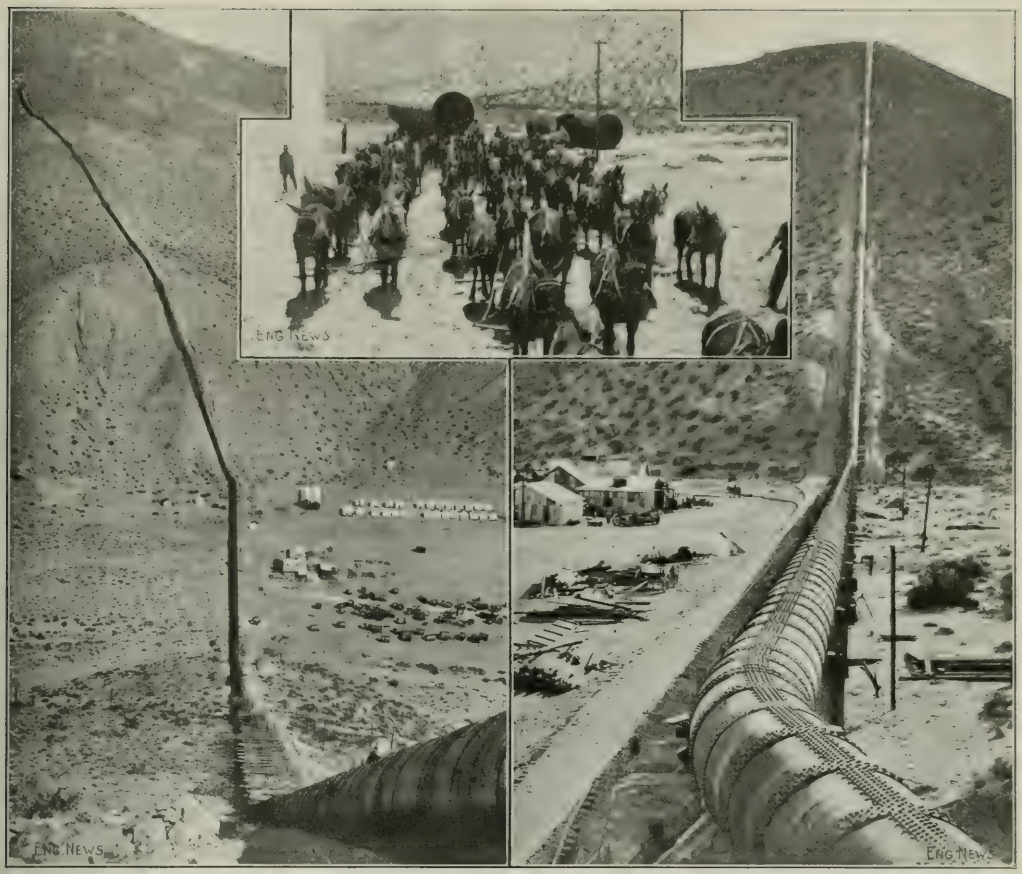


FIG. 20. DEADMAN STEEL SIPHON



FIGS. 21, 22 AND 23. JAWBONE SIPHON, LOS ANGELES AQUEDUCT, LOOKING SOUTH AND LOOKING NORTH; ALSO 50-MULE TEAM HAULING PIPE SEVEN MILES FOR SIPHON

(The siphon ranges from 7½ to 10 ft. in diameter and the steel plates are from ¼ to 1⅛ in. thick. The siphon is 8000 ft. long and its highest point is 850 ft. above the cañon bottom.)

in that all lines employed to distribute surplus water for irrigation should be constructed at the cost of the districts served. Moreover, he assumed the rate for irrigation as being $10 per acre per annum, whereas the City Council recently set the official rate at 2c. per in. per hour or $23.36 per acre per annum, the city to build the main trunk lines. Under this arrangement, nearly 2000 miner's inches of water were contracted for, on lands lying to the northeast of the municipality.

Mr. Lippincott, after estimating the whole cost of the Aqueduct and water properties at $24,500,000, assigns an estimate of cost of $7,000,000 to utilize all available drops on the Aqueduct for the production of 48,000 kw. of continuous power, with main power lines to the city of Los Angeles but without distribution, as per the estimates of the Board of Electrical Engineers. This would give $31,500,000 as the total cost of the Aqueduct as a water and power enterprise.

135,000 acres irrigated at $10 per acre, net	$1,350,000
30,000 acres irrigated with return water at $10 per acre	300,000
26,000,000 gal. per day of water sold from the Aqueduct for domestic purposes at a net profit of 5 c. per 1,000 gal	475,000
48,000 kw. of continuous power *wholesaled* in city @ 0 6c. per kw.-hr, based on present condition of oil market	2,300,000
Total ultimate annual revenue	$4,425,000

Capitallized at 5% this is $88,500,000.

The revenues he estimates as shown in the accompanying table.

Also it will be seen from the foregoing that the revenues from water should tend to constantly increase until they had reached that point where all the surplus water once disposed of for irrigation is being taken for domestic uses at a very much higher rate.

Also, in the case of power development the figures are for wholesale delivery, and the city, if it is determined to build its distribution system, could expect a corresponding increase in net revenues from the additional labor and expense. On the whole, then, Mr. Lippincott's estimates are on the safe side of conservatism.

In conclusion, two economic and sociological phases of this great project which seem to have been entirely overlooked in all that has been written on the subject are these: In undertaking the construction of the Aqueduct, the city has established its future which as it pertained to

a water-supply and so additional population was in a precarious condition up to 1905. Realty values have been fixed firmly or advanced and a sound tone given to commercial enterprises. The writer believes that the enterprise, in the foregoing described way, has already paid for itself.

The sociological aspect is this: The responsibility of so great an undertaking at such a high cost in taxation to a city numbering less than 350,000 people in 1905, centered municipal attention upon the work, kept politics out, gave no time or opportunity for petty party or sectional strife, taught the community what could be done and gave it confidence in itself. One of the reasons

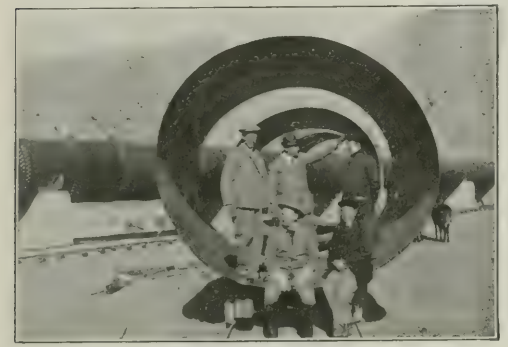


FIG. 24.—A 10-FT. SECTION OF THE ANTELOPE STEEL SIPHON, LOS ANGELES AQUEDUCT

for the defeat of several recent proposed bond issues for municipal enterprises is directly due to the fact that many voters, while believing in municipal ownership, feared that the city was becoming overconfident of its present ability.

In the construction of the Aqueduct, William Mulholland, superintendent of the city's water distribution system for more than a quarter of a century, has served as designer and constructor, with J. B. Lippincott as his chief assistant engineer, Roderick MacKay as mechanical constructor and E. F. Scattergood as chief electrical engineer.

☼

The Lighting of the Panama-Pacific Exposition buildings and grounds at San Francisco in 1915 is being designed on what are believed to be new lines for such work. Heretofore exposition lighting has been largely by outlining the prominent architectural features of buildings and grounds by strings of incandescent lamps. That has been abandoned in this case for the general scheme of projecting various colored streams of light upon the external surfaces. The use of colored light will be prominent, especially tones involving the reds, blues, oranges, and vermilion. High towers of the buildings will be set with large cut-glass jewels to reflect the light projected upon the building; many of these jewels will be spring mounted to increase their scintillation. All through the grounds, walks and roadways, there will be flaming-arc lamps with special heavy diffusing globes to keep the intrinsic brilliancy low. The open courts will be lighted also by large fountains with inner structures built up of dense glass and housing a multitude of arc lamps. There will be utilization of the day flags and bunting at night in the scheme to flood the structures with light. A floating battery of searchlights will play on the sea mists, which are met with in this locality, or upon artificial clouds of steam produced in clear weather, or upon a multitude of small balloons, etc., which may be sent up to get variety. The whole project of illumination design is under the direction of W. D'A. Ryan, of the General Electric Co., Schenectady, N. Y.

A Traveling Filter-Sand Agitator at South Bethlehem Pa.

The water-purification plant of the Bethlehem City Water Co., at South Bethlehem, Penn., was built in 1904 and is of the slow sand filtration type invented and installed by P. A. Maignen.* The water is obtained from the Lehigh River. The pumping station is on the river bank, but the reservoirs and filtration plant are located some distance away at an elevation of 265 ft. above the river.

From the upper raw-water reservoir the water runs by gravity to the filter house through a 20-in. main. The normal capacity of the filter plant is 4,000,000 gal. per day. The plant consists of six units of scrubbers, in concrete tanks 16 ft. wide, 38 ft. long and 6 ft. deep; and six units of slow sand-filtration beds 16 ft. wide, 152 ft. long and 6 ft. deep. Water enters the bottom of the scrubber beds through 8-in. valves and flows over a dwarf dividing wall to the slow sand filters. After filtering through the sand, the water flows out through effluent pipes at the bottom into the filtered-water reservoir, alongside and 20 ft. below the raw-water reservoir.

The scrubbers consist of a 9-in. layer of 3-in. pebble stones, and a 9-in. layer of coke; above there is a 24-in. space filled with 4 rows of slates, placed at a slight angle upwardly, each row slanting in a contrary direction to the next; the space between the slates is filled with coke of "nut" size. Over the slate is an 18-in. layer of sponge held down by cedar slats. The final sand filters consist of 18 in. of gravel and 24 in. of sand. The water filters through under a head of about 2 ft.

When the plant was first built, a special sand-washing device was constructed, consisting of a portable platform and an elevated washing trough. The sand was scraped off the surface of the beds, loaded on the platform and rolled to the washer by men walking on the division walls of the tanks. The washer consisted of four bucket-elevators on a suitable framework, and was operated by an electric motor. The dirty sand was shoveled into a hopper and carried to the elevated trough by a conveyor. At the trough the sand was thrown from the conveyor into the water; it was then dipped out and allowed to fall back into the trough successively by two other bucket-conveyors. The fourth conveyor raised the cleaned sand and carried it to a chute, from which it was distributed to the filter beds. The wash water entered from the far end of the trough and flowed out at the near end where the dirty sand entered. The flow of the wash water was so regulated as not to carry away much of the fine sand.

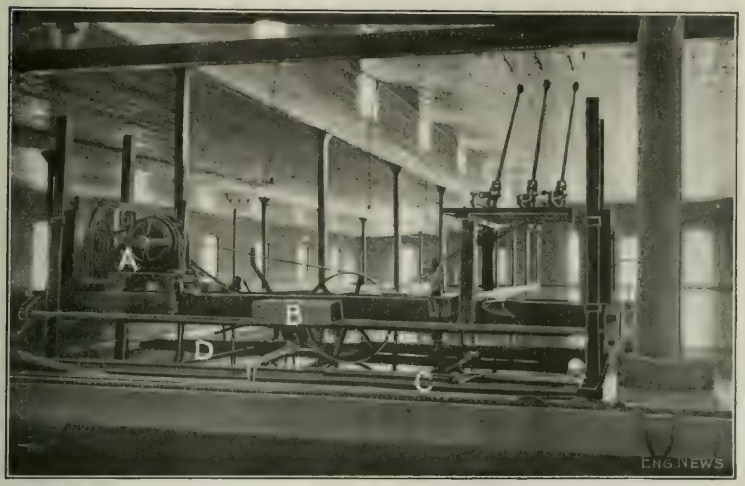
This machine proved cumbersome in practice, and the sand-washing process required a filter bed to be thrown out of service for practically a whole day. As the filtered-water reservoir holds but slightly more than enough water for 24 hours' consumption of the present population, either an enlargement of the filter plant or a more expeditious method of sand washing was imperative. Under these circumstances the superintendent of the water-works, H. M. Ueberoth, designed and built the washing machine shown in the accompanying illustration, with which a filter bed may be thoroughly washed in about 2 hours.

This machine accomplishes its purpose without lifting

*Described by P. A. Maignen in "Proceedings," American Water-Works Association, 1905.

the sand from the filter bed, by plowing up the upper 6 in. of sand by means of a heavy wire-toothed rake and two steel plow points about 8 in. long, while the actual washing is being done by water pumped from the filtered-water reservoir and forced back through the effluent pipes, up through the filter beds from the bottom, and out through wash water standpipes at the upper end of the beds nearest the scrubbers. For pumping the water back from the filtered-water reservoir a special electrically driven pump was installed at the lower end of the filter house.

The plowing apparatus is merely a framework of heavy timbers mounted on four flanged car wheels, which travel on a bar-iron track fastened to the inner edge of the filter tanks. The car is driven at a speed of 3 or 4 miles



ELECTRICALLY PROPELLED SAND AGITATOR FOR USE IN WASHING FILTER BEDS, SOUTH BETHLEHEM, PENN.

an hour by a 10-hp. electric motor *A*, belted to a pulley wheel, to the shaft of which are attached the bevel gears *B*. The current for operating the motor is provided by three overhead trolley wires. Three wires and trolley poles are used so as to furnish a return circuit and to make it unnecessary to reverse the poles at the end of the run.

Two rakes are provided, one on both front and rear of the car. Each rake is hung from a heavy plank (*C* and *D*), which is raised and lowered from the surface of the sand by two vertical screws and crank levers. The rake itself resembles an ordinary farmer's hay rake, made of stout wire prongs, bent to an arc, about an inch between centers. The two plow blades are detachable and may be fastened at any point of the rake frame by iron brackets. They trail behind the rake at a distance of about 2 ft. Of course, the rear rake and plows only are in use while the machine is in operation. The whole apparatus is transferred from one bed to another by a small overhead crane.

This sand-washing device is home-made and designed to meet the peculiar conditions at the South Bethlehem plant. It has been in use over a year and has proved both efficient and economical, and is doubtless adaptable to use elsewhere. It is not patented.

The First American Locomobile

For nearly twenty years the self-contained and economical steam power plant known as the "locomobile" has been largely built in continental Europe. The outfit is generally arranged as follows: A compound engine is mounted upon its own boiler so that its cylinders are in the smoke box and the steam passes from a superheater directly to the high-pressure cylinder and from thence through a reheater directly to the low-pressure cylinder without any loss of heat from exposed piping. These locomobiles attain a fuel economy in small plants of 100 to 500 hp., equal to that of a large power station with high-class equipment. Furthermore, they are extremely compact, occupying very small space; and the cost of construction is cut down by the elimination of all steam piping and its accessories.

Notwithstanding the long and successful use of locomobiles on the continent of Europe, they have been little imitated in England and wholly ignored in the United States. Now, however, the first American manufacturer to produce this type of power plant, the Buckeye Engine Co., of Salem, Ohio, has undertaken the manufacture of these machines and their design is described by Mr. F. R. Low in a recent issue of *Power*.

The engine is mounted upon the boiler, superheater and reheater. Everything has been designed with a view to accessibility. The boiler is internally fired; and although it has a grate surface of only 9 sq.ft. and a heating surface of about 370 sq.ft., the unit has developed 200 i.hp. The furnace and tubes are removable for cleaning and inspection as in the German locomobile.

The gases after passing through the boiler tubes impinge upon the superheater and then the reheater, after which they escape. The space above the heaters is not shut off and the gasses are free to rise around the cylinders and thus tend to maintain in them as high a temperature as possible. Thus, instead of a steam jacket there is a hot gas jacket.

The course of the steam is from the dome into the far end of the heater, returning in a direction counter to the gas flow, passing into the high-pressure cylinder. From thence it passes through the reheater and into the low-pressure cylinder, whence it is discharged through the feed-water heater to the condenser.

In a recent test the engine developed an indicated horsepower on less than 9.75 lb. of steam per hour. The coal per indicated horsepower-hour varied from 2 lb. at 75 hp. to 1.5 lb. at 200 hp. With efficient loading, i.e., from about 60 to 100% of full load, the unit delivers a kilowatt for about 2.5 lb. of coal per hour, and an indicated horsepower-hour for about 1.5 lb. condensing and 2 lb. noncondensing.

Blended or Sand-Cements; Results of the Study and Experience of the U. S. Reclamation Service*

By Rapier R. Coghlan†

The term "blended cement" will be applied in this article to those hydraulic cements made by intimately blending in a tube mill, or other suitable blending machine, portland cement and certain varieties of natural rocks. It will exclude blast-furnace slags and natural cements. The manufacture and use of blended cements is of economic importance if suitable precautions are taken at the start, and its more general and widespread use will depend upon its ability to get engineers to look with favor upon it. Should it succeed, the people of the western deserts and mountains are assured of a cheaper and at the same time a reliable cement.

Sand-cement made by blending portland cement and quartz sand has been used to a limited extent in the United States.‡ Its use was discontinued, however, because of the decreased cost of portland cement making its production unprofitable. Concrete structures in which it was used do not appear to have suffered because of the substitution. That the cement was as strong as the portland cement which was used in its manufacture was probably due to the fact that at that time the standard of fineness for portland cement was much lower than at present, and for this reason a greater amount of inert clinker was rendered active by the fine grinding necessary to produce the sand-cement. As will be pointed out later, quartz sand is not a suitable material for the production of a high-grade sand-cement.

Some rocks, mostly of volcanic origin, have more or less silica existing in what is known to chemists, and nowadays to most engineers, as soluble or colloidal silica. This colloidal silica acts as a weak acid and has the power to neutralize bases. Portland cement is a complex mixture of various silicates and aluminates of lime with lesser amounts of secondary minerals. The process of setting may be described as follows, although it must be admitted that the knowledge of the subject is still very incomplete. In setting, portland cement undergoes a decomposition, reacting with water to form more stable compounds, and at the same time liberating hydrated lime. As the reaction takes place in a concentrated solution, the hydrated lime thus set free crystallizes throughout the mass, serving to bind it together more firmly. As portland cement is readily hydrolized if too much water is present, it is not possible to study the reaction in dilute solution, but the fact is established that hydrated lime is always liberated by the reaction.

Hydrated lime is a well known base, and it seems probable that if some substance with acid properties and from which an insoluble compound would be formed was present in the portland cement at the time it was undergoing the change caused by the addition of water, the hydrated lime thus set free would unite with this substance. Here then, is the basis upon which sand-cements or blended cements are formed. Rocks containing active or colloidal silica are blended with portland cement to furnish the necessary neutralizing compound and the result is a sand-cement.

Chemical analysis reveals the fact that several of the igneous and intrusive rocks have colloidal silica in varying amounts. It is also present in sandstones, the cementing material of which is deposited silicic acid. For obvious reasons limestones and dolomites are not sources of soluble silica, nor is quartz found to yield much even after prolonged fine grinding. In the light of our present knowledge it is also probable that the alumina in the aforementioned rocks reacts to some extent as a colloid and enters into the combination with the hydrated lime, acting as an acid and yielding an insoluble compound. This is a point which has not been definitely determined and is not here stated as a fact. Furthermore, the alkali oxides which are always present in igneous rocks play an important part in the reactions involved in the setting and hardening of sand-cements.

A glance at Table I below shows the wide range of materials that have been tested and found to yield satisfactory blended cements. The materials represented by Analyses 3, 4, 6, 7, 8 and 9, are being used at the present time for the production of such cements by the Los Angeles Aqueduct engineers and the U. S. Reclamation Service. Analysis 10 represents a pure quartz which after prolonged grinding, so that all of it passed the 200-mesh screen, yielded only 1.64% soluble silica. It will be noted that the soluble or colloidal silica has no definite relation to the composition of the rock, more probably being dependent upon the phenomena accompanying the formation of the rock. The lava flow from which the material for Analysis 2 was taken, shows clearly the action of steam during its ejectment, while the material for Analysis 1 was from a flow which had come to the surface more quietly.

The colloidal silica in materials like these makes them valuable for sand-cement manufacture. It is unquestionably true that more of the silica of the blending material is rendered active by the fine grinding necessary to produce an intimate mixture of the portland cement and sand material, thus furnishing more acidity to neutralize the basicity of the hydrated lime.

Before accepting as true any statement regarding the reaction between hydrated lime and colloidal silica, we should first ascertain if there be any substantial proof of the same. We have historical record that similar cements were made by the early Romans, but old records are apt to become musty and confused. A modern determination and one that could be applied by anyone desiring to do so would be more satisfactory.

TABLE I CHEMICAL ANALYSES OF ROCKS FOUND SUITABLE FOR MAKING BLENDED CEMENT

	1	2	3	4	5	6	7	8	9	10
SiO_2	44.72	48.08	74.88	74.64	75.66	72.32	50.96	80.52	82.40	99.60
Fe_2O_3	14.30	16.06	1.14	1.14	2.12	2.01	6.57	2.00	1.40	
Al_2O_3	19.26	15.39	13.60	13.42	11.76	13.85	18.37	10.02	10.00	0.31
CaO	8.30	7.78	0.90	0.80	2.30	1.20	10.20	0.80	0.80	
MgO	7.48	6.64	0.37	0.39	1.78	0.39	0.45	0.71	0.61	
K_2O	2.30	1.60	3.89	3.86	None	N.D.	3.92	3.85	1.31	
Na_2O	2.00	3.20	3.35	3.38	None	N.D.	.....	.....	0.86	
SO_3	None	None	None	None	None	0.31	None	None	None	
H_2O CO_2	1.64	1.89	0.88	1.66	5.42	3.78	7.26	2.10	1.90	
Colloidal (Soluble) Silica	12.57	19.60	2.41	2.37	14.60	4.01	12.98	7.18	6.42	1.64

Analysis No. 1 Basalt from near Elephant Butte, N. M.
Analysis No. 2 Basalt from near Elephant Butte, N. M.
Analysis No. 3. Granite from near Boise, Idaho.
Analysis No. 4. Granite from near Boise, Idaho.
Analysis No. 5. Tufa from near Elephant Butte, N. M.
Analysis No. 6. Tufa from Los Angeles Aqueduct.
Analysis No. 7. Basaltic tufa from Lahontan, Nevada.
Analysis No. 8 and No. 9. Sandstones from Elephant Butte, N. M.
Analysis No. 10. Quartz "90%" passing 200-mesh sieve.

*See "Engineering News" May 20, 1913, p. 962, "Sand-Cement as Used by the U. S. Reclamation Service."

†Manufacturing Cement Chemist U. S. Reclamation Service, Elephant Butte, N. M.

‡See "Engineering News," Feb. 15, 1912, p. 305, Apr. 30, 1896, p. 252.

Dr. Michaelis has shown that such a combination does take place between hydrated lime and puzzolanic materials, and that the mixtures are capable of developing considerable strength, even when immersed in water, the solvent action of which on hydrated lime is well known.

The writer has tested this reaction for himself with most of the materials with which he has been experimenting for sand-cements. The routine method employed in the laboratory has been to mix one part by weight of hydrated lime with one part by weight of the material whose activity is to be tested. In many cases these proportions are not correct, sometimes giving too much lime and sometimes not enough. The blend is then ground to a fineness of 90% passing the 200-mesh sieve. This combination is then made into briquettes with standard testing sand in the proportions of 1 : 3 by weight. After setting or hardening the briquettes are placed in water until the test period is due. Sometimes the action is weak at seven days and occasionally briquettes fall to pieces during the immersion period; but, in general, the materials which have given the best results in sand-cements have developed strength at 28 days and continue to gain.

These tests have generally shown that the materials which develop the most activity with hydrated lime are those containing the oxides of sodium and potassium in an available form. The ready solubility of the oxides of the alkali metals present in igneous rocks, eruptive and intrusive, can be shown by shaking some of the rock powder in water to which a few drops of alcoholic solution of phenol-phthalein have been added. The solution immediately assumes a pink color, which increases in depth as the solution of the alkalies proceeds. Puzzolanic action, the action between colloidal silica and hydrated lime, seems dependent upon the presence of the alkali oxides which probably act as catalyzers in the following manner:

Sodium oxide will be taken as an example. The sodium oxide combines with water to form the hydroxide. The hydroxide reacts with silica to form sodium silicate, or water glass, which is soluble. The water glass then combines with hydrated lime to yield insoluble silicate of lime, setting free the sodium hydroxide, which continues to render more silica active for the combination with the lime. In this manner, a small amount of sodium oxide, which is in the nascent state, seems capable of rendering a much larger amount of silica active.

$$Na_2O + H_2O = 2\ NaOH \qquad (1)$$

$$2\ NaOH + SiO_2 \quad Na_2SiO_3 + H_2O \qquad (2)$$

$$Na_2SiO_3 + Ca(OH)_2 = 2\ NaOH + CaSiO_3 \qquad (3)$$

This action has been tested by the writer in the case of a sandstone, which contained alkali oxides, that were not in the available form, being combined with SO_4 and Cl. This sandstone would not develop puzzolanic action when mixed with hydrated lime. Upon adding a small percentage of sodium silicate to the water used in mixing the mortar, puzzolanic action was developed and the briquettes continued to increase in strength.

A study of the analyses of Italian puzzolans shows that they contain a considerable percentage of sodium and potassium oxides. According to the foregoing, puzzolanic mixtures should continue to increase in strength until the maximum amount of silica had combined with the lime. An essential feature of such a combination is the necessity for keeping the mixtures moist during the early period of hardening.

It will be seen from the foregoing that in sand-cement we should have a maximum amount of lime combined with silica. Therefore the blending of any of these colloidal silica-bearing rocks with portland cement should have a tendency to produce a stronger and more durable cement for use in concrete work. The presence of the alkalies within the cement itself should act as an anti-alkali to the alkaline salts present in water. The reduction in the amount of lime existing in the set cement as hydroxide is in itself beneficial as it lessens the danger of disintegration from the action of alkaline waters. Another factor contributing to the combination between the hydrated lime and silica is the fact that the hydrated lime set free from the portland cement is in the nascent state and therefore more active and ready to combine with whatever is present. Danger of disruption of concrete in which sand-cement is used, by oxidation of the sulphides so commonly present in artificial puzzolans is not to be feared, as there is at the most but a slight amount of sulphur in any form present in the rocks which are suitable for the manufacture of sand-cement.

There is no foundation for the statement that the strength of blended cements is due to the finer grinding of the portland cement which they contain, and to the filling of the voids in the portland cement with the blending material. Portland cement of a fineness of 80% passing the 200-mesh sieve, having a specific gravity of 3.140, showed the following void tests: Settled and tamped voids, 40%; slightly settled, 47%; loose, 51.5%. The same cement made into sand-cement with granite gave the following void tests: Settled and tamped voids, 45%; loose, 60%. The voids in blended or sand-cement are the same or greater than the voids in the portland cement from which it is made, which is in accordance with the laws of voids, that the finer and more nearly uniform in size particles become, the greater may be the percentage of voids expected. A considerable reduction in volume takes place when blended cements are mixed with water, on account of the air being forced out of the cement and a rearrangement of the particles taking place.

Manufacture of Sand-Cement

We now come to the question of the manufacture of sand-cement, and must, therefore, know under what conditions we can obtain the best grade of sand-cement possible from the materials at hand.

The tendency of most eruptive rocks is to undergo alteration to clay or claylike substances under the action of meteoric agencies. This condition is easily recognized by chemical, microscopical and other physical inspection. The most important test, after satisfying one's self that the material is but slightly altered from its original condition, is to determine the colloidal silica content. Rocks which show no colloidal silica present should be abandoned as they cannot be relied upon to produce a good quality of sand-cement. These things being satisfactorily settled, the experimenter or manufacturer is ready to undertake the production of the desired product.

The proportion in which to blend the rock with the portland cement is dependent upon the strength desired in the concrete in which the product is to be used. With rocks rich in colloidal silica, the portland cement

may be very low, while with other rocks it may be necessary to maintain the proportion at one to one. The results of the physical tests of the product will govern the user in the amount of portland cement to be blended with the rock, and he should be the one to dictate to the manufacturer what these proportions shall be in his particular case.

Rocks which have been found suitable for sand-cement, and which are fruitful sources of colloidal silica, vary in specific gravity from 2 to 3.05. Generally speaking, one barrel of portland cement blended with an equivalent volume of any of the materials will yield on grinding slightly more than two barrels of sand-cement. The usual method followed in the manufacturing process is to prepare the rock by passing it through a ball mill or other pulverizer, which reduces it to a fineness of 100% passing the 20-mesh sieve. Finer material than this does not seem to blend well with the portland cement in the tube mills. It would even be better to take cement clinker and prepare it with a ball mill, rather than use the finely ground cement.

The question arises as to whether the materials should be blended by weight or by volume. As an illustration, take the case of granite which is to be blended with portland cement.

Voids in the pulverized granite = 42%.
Specific gravity of the granite = 2.630.
Weight per cu.ft. at mixing hopper = $2.630 \times 62.5 \times 0.58 = 95.5$ lb.
Voids in Portland cement = 51.5%.
Specific gravity of cement = 3.140.
Weight per cu.ft. at mixing hopper = $3.140 \times 62.5 \times 0.485 = 95.4$ lb.

As the materials have the same weight per cubic foot in the loose condition in which they arrive at the mixing machine, it is obviously immaterial whether the blending be done by weight or by volume. The machinery for measuring by volume being very simple, that method is employed in this particular instance. The proportions in the blend are checked by specific gravity and weight tests.

Basalt ground under the same conditions as the granite gave the following analysis:

Voids in basalt = 42%.
Specific gravity of basalt = 3.050.
Weight per cu.ft. at mixing hopper = $3.050 \times 62.5 \times 0.58 = 110.8$ lb.
Weight of cement at mixing hopper = 95.4 lb.

In this instance it would be best to proportion by weight as the greater weight per cubic foot of the basalt would cause an excess of basalt and might overcrowd the cement.

The assumption is made in the two preceding cases that it is desired to mix half and half. With materials of low specific gravity, like some of the tufas, which run as low as 2.20, it is best to proportion by volume as, the weight method will give too large a bulk of material for the cement to cover. This would be governed, however, by the activity of the material in question, as material that is rich in colloidal silica, can be made into an excellent grade of sand-cement with a much smaller proportion of portland cement than would be required with material that showed only a small amount of this valuable compound.

Since one barrel of portland cement blended with an equivalent volume of any one of the materials mentioned, will yield a little more than two barrels of high-grade sand-cement, it is apparent that the cost of a barrel of sand-cement thus made, should be about two thirds of the cost of a barrel of straight portland cement. The economic value of this cannot be overestimated in remote places where large quantities of cement are being used. A regrinding and blending plant for the manufacture of sand-cement at the rate of 1000 bbl. per day can be erected and ready to operate for about $45,000. Such a plant will require about 400 hp. to operate it. Labor will depend upon the wages current in the locality in which the plant is operating.

The Rio Grande Project of the U. S. Reclamation Service, located at Elephant Butte, N. M., will require about 520,000 bbl. of cement in the next three years. This cement will be used in the erection of the Elephant Butte Dam,* which is to store water for the irrigation of lands lying along the Rio Grande in New Mexico, Texas and old Mexico. It is proposed to use sand-cement in the construction of this dam. A sand-cement plant, in which portland cement will be blended with 50% by volume of sandstone has been erected at a cost of approximately $48,000. Power is furnished by a steam power plant at about 1¾c. per kw.-hr. Labor runs from $1.50 per day for Mexican laborers to $4 per day for skilled laborers. The cost sheet for the manufacture of the sand-cement will show

0.5 bbl. of Portland cement @ $2.50	$1.250
Sandstone	0.035
Plant charge	0.092
Labor	0.068
Supplies	0.055
Power	0.184
Cost of 1 bbl. of sand cement	$1.684
Net saving per barrel by using sand cement	$0.816

From the results of tests of the blends of this sandstone with lesser amounts of portland cement, it is probable that the percentage of portland cement may be carried as low as 40%. The U. S. Reclamation Service has studied sand-cements for over six years and the determination to try it out in such structures as the Elephant Butte and Arrowrock Dams, was reached after mature deliberation. Completely equipped testing laboratories have been installed at Arrowrock, Idaho and Elephant Butte, N. M. Sand-cement is tested even more rigidly than portland cement. Aside from the usual routine tests that are employed in testing portland cement, compression tests are made daily of the concrete being placed in the dams, and it is hoped that the building of these structures will furnish very complete data regarding sand-cement in actual use. It has been claimed by some that sand-cement concrete is more impervious to water than ordinary portland-cement concrete, this has not been substantiated by results actually obtained, but it is true that it is just as impervious as portland-cement concrete when used in the same proportions and under the same conditions. There is no valid reason why it should be more impervious than portland-cement concrete, but every reason why it should resist the action of alkaline waters much better.

The practice in the U. S. Reclamation Service laboratories when making experimental sand-cements has been to grind the blends so that just 90% of the product will pass the 200-mesh sieve, it being considered impracticable to carry the fineness greater than this. All experiments were designed to duplicate as nearly as possible the conditions that would be met in the actual manufacturing process on a commercial scale. For this reason the results of tensile tests given in Table II may not be as high as the results reported by others who have experimented on sand-cement mixtures. The cements thus

*"Engineering News," Jan. 16, 1913, p. 118.

made were tested only in the shape of briquettes, using the standard proportions of 1:3 with standard testing sand. The blends were tested for fineness, setting time, specific gravity and soundness. Two-inch cubes of the standard mortar were tested for compression. The normal consistency test showed that excepting the cements in which tufa was used this property was nearly the same as with the portland cement employed in making the blend. The setting time was changed but little, excepting in certain mixtures where the material was not very active.

TABLE II. TENSILE STRENGTH (LB. PER SQ.IN.) OF SAND-CEMENTS WITH DIFFERENT PROPORTIONS OF GROUND ROCK

Nature of rock	Per cent. of rock	7 day	28 day	3 mon.	6 mon	1 year
Basalt	35	230	365	385	480	190
Basalt	40	180	330	395	125	460
Basalt	45	195	315	395	445	475
Basalt	50	185	300	385	425	415
Basalt	55	150	280	340	380	385
Basalt	60	130	215	370	390	400
Basalt	70	95	240	285	330	350
Basalt	80	60	165	195	235	332
Tufa	50	225	380	515	530	585
Tufa	60	140	255	460	522	535
Tufa	70	150	230	405	420	452
Sandstone	40	225	380	405	420	445
Sandstone	50	240	310	360	380	385
Sandstone	60	125	245	290	340	350
Portland cement	0	245	460	500	395	300
Portland cement	0	235	355	385	385	390

The same brand of portland cement was used in all of the tests shown in Table II and in many of the characteristics of the sand-cements are quite similar to those of the parent cement. In order to test the assertion that the finer grinding of the portland cement was responsible for the strength of sand-cements, some of this brand, which was normal in every respect, developing the strength shown by the test headed "portland cement," was ground so that 90% of it passed the 200-mesh sieve, with the results, when tested, shown by the first test headed "portland cement." This test, which was duplicated a number of times with the same result, indicates that when used by itself, this particular brand should not be ground as fine as 90% through the 200-mesh sieve, but gives much better results at its normal fineness of about 80% passing this sieve. Whether this is true of all portland cements ground to an abnormal fineness is now being tested and the results will be published if they bear out the foregoing.

A few compressive tests of mortars in which sand-cement has been used (Table III) will serve to show that it is equally efficient when used in compression. The mortars tested were of 1:3 mix with standard testing sand.

TABLE III. COMPRESSION STRENGTH (LB. PER SQ.IN.) OF SOME 1:3 SAND-CEMENT MORTARS

Nature of rock	Per cent. of rock	7 day	28 day	3 mon.	6 mon.
Sandstone	50	2167	3437	3750	4063
Sandstone	50	1500	3312	2500	4000
Sandstone	50	1000	2315	2750	3500
Sandstone	60	800	1390	1439	1875

The purpose of this article is not to quote a mass of data regarding the strength of experimental mixtures. The real proof of a cement is what it can do when made into concrete where the ratio of cement to inert material is quite small. If it can hold together nine parts or more of sand and gravel and develop great strength under these conditions, and continue to hold that strength, it can then be called a good cement. The small laboratory tests are no criterion of what may be expected in actual construction work. Within a few months tests of concrete being made from sand-cement and placed in the Arrowrock and Elephant Butte Dams will be available for publication. It is not thought worth while at this time to publish results so far obtained as they do not yet reach the three-month period. It is sufficient to state that the sand-cement as actually manufactured is quite superior to any that was made in the laboratory and that the concrete is developing greater strength than the laboratory tests indicated, being amply strong for the great stresses that are to be put upon it.

Sand-cement has as its recommendations that it is cheaper than portland cement and develops as good strength. It is less liable to be acted upon by alkaline waters, is always sound and on account of its greater fineness gives a better appearance to concrete in which it is used.

But few instances have been noted in which sand-cement has shown any deterioration with time. Its increase in strength is gradual but steady. No retarder, such as plaster of paris, is necessary to control the set, as the puzzolanic action, which is much slower than the ordinary setting of portland cement, can be depended upon to act in this capacity.

It is to be hoped that the portland-cement manufacturers will interest themselves in this product and that if it proves its worth its manufacture may become more widespread. Cheaper cement would mean more cement sold, more cement houses and cement work done in the cities and country.

Municipal Ownership and Operation of street railways in Detroit was approved at a municipal election on Apr. 7 together with proposals to increase the bonded indebtedness of the city and to place city employees under civil service rules. Completion of this municipal project is held up by court actions.

There is to be a board of three street railway commissioners to serve without salary and to be subject to removal at the will of the mayor. The board may purchase, lease or condemn all or any part of existing street-railway properties in the city and may operate for a distance of 10 miles from the city limit. To provide funds the Common Council is empowered to issue bonds to the amount of 2% of the assessed value of real and personal properties in the city on request of the street-railway board. Additional bonds may be secured by the properties and revenues of the street-railway system. The rate of fare to be charged is specified as sufficient to pay (1) operating and maintenance expenses, including paving and sprinkling between tracks, (2) taxes on physical property of the entire system as though privately owned, (3) fixed charges, (4) a sufficient per cent. to provide a sinking fund to pay the principal of the mortgage bonds and other per cents to provide a sinking fund to pay the principal of the general bonds.

Cracks in a Brass Switch-Rod—An investigation of cracks which a 1¼-in. brass switch-rod developed during service is reported in the "A. E. G. Journal" of May, 1913. Some of its essential parts are, in substance:

The brass rod in addition to a longitudinal crack showed a number of transverse cracks. It could be seen that the parts of the rod bounded by the cross cracks had expanded. This observation gave rise to the assumption that the outer skin of the brass rod had tried to expand, this expansion having been prevented by the inner core, so that strains were set up which would finally lead to cracks under external stress. The chemical analysis of the rod gave the following results: Cu, 58.48%; Zn, 40.26%; Pb, 1.23%; Fe, 0.03%. Experience with similar qualities of brass containing considerably more lead than the rod in question had shown that the lead did not give rise to cracks. Microscopic samples were taken from different points of the rod and etched, with the result that the inner structure of the rod was found to differ appreciably from the structure of the outer layers, the interior being coarser. It was concluded that the cracks were not due to faulty composition but to stresses in the material caused by cold drawing. The recommendation is made that cracking of drawn-brass rods may be avoided in practice by heating the material after each drawing, and by minimizing the reduction per pass. Limiting the heating to 300° C. is recommended.

Electric Power for Quarries, Gravel Plants and Contract Work*

Stone Quarries

Stone quarries form a most desirable load for central-station service. They are usually located not far from some small town; or, rather, a small town will usually spring up adjacent to a stone quarry of any considerable size. In all except the very largest quarries, the load is strictly a summer load, the quarry shutting down as soon as the ground is frozen. The machines to be driven are of a nature extremely adaptable to motor drive, and the industry presents no absolute demands for steam in the process of manufacture.

A requisite of prime importance in quarry practice is the flexibility of the source of power with motor drive. The frequently changing heads to which drainage pumps are subjected, the continual shifting in location of such pumps, the changing lengths and grades of hauls and inclines, the remodeling and extension of compressed-air pipe lines, the varying grades of stone encountered, and numerous other contingencies, make it often necessary to call upon the overload capacities of motors and machines.

In the quarry proper the main operations consist of drilling, blasting, hauling and (where there is seepage of water into the quarry) pumping.

DRILLING—The drilling of the rock preparatory to blasting in various quarries is done by four general types of drills: (1) Compressed-air tripod drills, making a 2- to 3-in. hole; (2) well drills making a 4- to 6-in. hole; (3) electric-air "pulsator" tripod drills for the same class of work as the compressed-air tripod drill; and (4) hand drills for placing "pot shots" to break large-size stones.

A compressed-air tripod drill requires about 150 cu.ft. of air at 90 lb. pressure at the drill for best operation. An electric-air "pulsator" drill has a small, specially constructed air-compressor as part of its equipment. The air-compressor is driven by a 7.5-hp. motor, the motor being started and stopped as the drill is operated or shut down. With both compresed-air and "pulsator" tripod drills the maximum efficient depth of hole is about 22 ft. and numerous changes in drill size are required as the hole deepens. The electric-air drill has a drilling capacity 25% greater than a similar compressed-air drill and the power consumption of the electric-air drill is less than 25% that required by the compressed-air drill.

The electric-air drill has not yet been very generally adopted in quarry practice because it is necessary to have the small motor-driven compressor located within 9 ft. of the drill proper, and quarrymen are not fully educated to the advantages to be obtained by the use of the electric-air outfit.

Well-type drills are used in quarries where the working face is 40 to 100 ft. high. A series of 5- to 6-in. holes are drilled the full depth of face and 25,000 to 50,000 yd. of rock loosened at one blast. Well drills are equipped with 10- or 15-hp. variable-speed motors and have become very popular; their use not only improves quarrying conditions, but reduces the cost of power, labor and dynamite for drilling and blasting.

There will be needed around each quarry from two to six hand drills for drilling small holes for "pot shots." These drills require about 50 cu.ft. of air each and one or more of them will be in pretty steady use.

HAULAGE—The manner in which rock cars are transported from quarry to crusher plant depends upon local conditions. If the quarry is deep, a system, of inclines and drum hoists is employed; electric tramways are in use at numerous quarries and have been successful on grades as great as 6%. There are two general types of motor-driven hoists for this work; one type uses a motor which runs continuously and the hoisting drums are controlled by friction clutches and band brakes; the other type has a variable-speed motor, direct-geared to the drum and the motor is started, stopped or reversed as desired. Either type of hoist is controlled by a man placed at the top of the incline, and the cars are usually self-dumping.

CRUSHERS—The gyratory crusher is the most popular, roll crushers are used to some extent, and jaw crushers are used considerably in plants having a capacity of less than 250 tons per day. Rolls and disk crushers are used to a great extent for crushing smaller sizes of rock. From discharge openings at the base of the main crusher the rock drops into an elevator which raises it to a rotary sizing screen.

A combination of individual and group drive will be found most advantageous in crusher plants and the use of 440-volt motors will generally prove best. Crushers should be driven by slip-ring motors. If a crusher is shut down when it is full of rock it is often a troublesome job to clear it of all rock before starting up again. This is especially true if the crusher is driven by a squirrel-cage motor. If a slip-ring motor is used and the crusher belt is backed up a few feet by hand, the motor will often be able to start the crusher without its being necessary to clean out the rock. Dust-proof bearings should be used on all stone plant motors and it will usually pay to install all wiring in conduit. The use of slip-ring motors is to be recommended for air-compressor drive on account of the heavy starting load.

PUMPING—On account of there being at times considerable grit in the water pumped, the use of centrifugal pumps is usually best on this service. The use of the direct-connected centrifugal pump makes a pumping unit easy to move from point to point. The use of automatically controlled, slip-ring motors will be found to work out most satisfactorily for this service.

Sand and Gravel Plants

Plants having power-driven machines vary in size from one requiring 10 hp. to drive a short belt conveyor and dry screen, to plants requiring 300 or 400 hp. The power demand is more steady during time of operation than either stone quarries or brick plants, and as no steam is required (except in special cases for manufacturing purposes) central-station energy can be used to great advantage. The sand and gravel season closes as soon as the ground is frozen and plants shut down at dark, so that the load is strictly "off peak." Some attempt has been made to do dry screening in winter but with small success.

Motor drive and central-station service have been thoroughly tried out in this industry. The flexibility of motor drive is of great value here. Putting individual motors on distant pumps and outlying belts dispenses with the operating troubles from long steam lines and long rope drives. On account of pumps being often of considerable size and located several hundred feet from the screening plant, the use of 440-volt motors will in general be found desirable.

Plants getting sand from river or lake bottoms by means of "sand-sucker" pumps, make equally desirable load for the central station. In plants of any considerable size (400 cu.yd. and over) the sand and gravel are loaded from the bank into small cars by a steam or electric shovel. Central stations should be cautious in recommending the use of or of taking on electric shovels in this class of work, as their load is of a very fluctuating nature and may cause considerable disturbance on transmission lines. The local lines to such shovels are also of a very temporary nature and are subject to short circuits.

The shovel often works several hundred or even thousand feet from the main gravel plant, and the cars loaded by the shovel are hauled to and over the hopper at the loading end of the main conveyor belt by means of a small steam locomotive, electric locomotive or stationary car puller. The motors on such car pullers, or hoists, vary between 15 and 75 hp., depending on the size of cars, length of run, speed of cars and rise of incline.

From the hopper the sand and gravel are usually carried to the top of the screening and crushing plant by a long endless belt-conveyor.

Excavating Plants

In districts where irrigation or drainage projects require the digging of large canals there is another source of revenue from rural business. Contractors on this class of work are usually in a hurry and want equipment which will be subject to the least delay required by repairs.

Where the ground is not too hard and dirt taken out of the canal is to be deposited along the bank, the drag-line excavator has been found to be a highly efficient machine. We have stated above that care should be exercised in taking on electric-shovel loads because of their extreme fluctuations. This criticism does not hold for excavators of the drag-line type or having clam-shell buckets, which dig down into their load. The drag-line type of excavator has not these severe fluctuations and is a highly desirable load for a cross-country transmission line.

In this type of machine the large drag-line motor usually runs continuously and the lines are controlled by means of friction clutches on the winding drums; the motor which turns the excavator to swing the boom running when it is desired to swing. The friction clutches require considerable pressure and are operated by compressed-air, requiring a small motor-driven compressor. Current is carried into the

*From the report of The Committee on Electricity in Rural Districts, presented at the annual meeting of the National Electric Light Association, at Chicago, June 3-6.

excavator cab through collector rings, some 6 ft. diameter, under the cab floor and surrounding the king-pin.

Two electric drag-line excavators are to dig an eight-mile section of a canal, which will require about three years. Each excavator has a 112-hp., 440-volt motor on the drag line, 50-hp. motor for turning and 5-hp. for driving the air compressor. Besides these there are on the job about 100 hp. on drainage pumps and 10 hp. driving the machine shop, making a total of about 450 hp. The contractors have under consideration a complete electrical cooking equipment for the camp boarding house.

The central station furnishing power for this project extended its 33,000-volt transmission line about 4½ miles to the middle of the canal section, where a substation was installed stepping down to 2300 volts. Two 2300-volt, 3-phase feeders are taken out of the substation and the pole lines are extended each way as the excavators move forward. The 2300-volt feeders terminate on poles on specially built wagons for transformers stepping down from 2300 volts to 440 volts. From the transformer wagons about 150 ft. of 440-volt cables, lying on the ground, carry the current to the excavator collector rings.

Lighting current in the excavator cabs is obtained by transformers located in the cabs, stepping down from 440 to 110 volts. There are three 100-kw. transformers in the 33,000-volt substation and three 50-kw. transformers are put on each transformer wagon. Other transformers stepping down from 2300 to 440 and 110 volts are scattered around the job as desired by the contractor.

The contractor guaranteed the central-station company enough income to warrant the 33,000-volt line extension (besides this there was incidental farm business along the way). He erected a sheet-iron building for the 33,000-volt transformers and made his own line extensions at 2300 volts. The company furnishes all transformers and the current is measured at 2300 volts.

This installation has not been in operation long enough to furnish any accurate data on the cost per cu.yd., but during April, 1913, the power consumption was 48,480 kw.hr., the maximum demand on a 30-minute basis 156 kw. and the power bill $929.09.

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Sanitary Precautions to Protect the Watershed of a City Water-Supply During the Construction of an Electric Railway*

The following regulations were prepared by the Board of Water Commissioners of Springfield, Mass., as a part of the contract by which the Berkshire Street Ry. acquires a right-of-way through the watershed of the Little River water supply. These regulations have been approved by the Massachusetts State Board of Health, subject to amendment after further examination.

SECTION 1. The Berkshire Street Ry. Co., its contractors and employees, shall prevent nuisances in and about all camps and works; shall protect water courses, reservoirs, and all sources of water supply from pollution, contamination, or interference, and safeguard the public health as may be directed from time to time by the constituted authorities of the State and City. Said Company shall summarily dismiss, or cause to be dismissed, and not again engage except with the written consent of the engineer, any employee who violates this section.

SECTION 2. The Board of Water Commissioners of the City of Springfield shall have the right, in order to determine whether the requirements as to sanitary matters are being complied with, to enter and inspect any camp or building or any part of the works, and to cause any employee to be examined physically or medically or treated; also to inspect the drinking water and food supplied to the employees. The sanitary precautions, the care of the employees, the camps and all territory occupied by the Company or its contractors, shall at all times be satisfactory to the engineer or other authorized representative of the Water Department. Said Company shall promptly and fully, and in every particular, comply with all orders and regulations in regard to these matters, including all sanitary and medical rules and regulations which may have been or may be promulgated from time to time. And to this end and to properly preserve the peace, the Board of Water Commissioners shall have the right of access to the camps and quarters of the Company or its contractors.

SECTION 3. No camps shall be located on the watershed of the City of Springfield, if suitable sites are existent off the watershed which could be made available for such camps, but camps placed outside the watershed shall not be located on the watershed of any other water supply. Any camp located on the watershed can only be so located after its approval by the engineer of the Board of Water Commissioners of the City of Springfield, the camps shall, if ordered, be inclosed by barbed wire or other approved fences not less than 10 ft. high, with not more than two entrances. Each camp and grounds surrounding it in all directions shall be thoroughly illuminated by high power acceptable lights. This illumination shall be maintained from sundown to sunrise every night during the occupation of the camp, unless otherwise ordered. Employees shall, so far as practicable, be required to remain within camp when not at work.

SECTION 4. Buildings for the sanitary necessities of all persons employed on the work, beginning with the first men employed to build camps or for other preliminary operations, shall be constructed and maintained by the Company, or its representatives, in the number, manner, and places ordered. All persons connected with the works shall be obliged to use these conveniences under penalty of discharge. Unless otherwise directed, the sanitaries shall be provided with water-tight removable receptacles of suitable capacity. These receptacles, if used, shall not be allowed to overflow, but shall be removed without spilling, at required intervals, their contents at once treated as directed, and then promptly taken to a designated place outside the watershed, and there disposed of as ordered. In case camps are located on the watershed, incinerators of satisfactory design shall be provided, which shall satisfactorily consume all night soil and other camp refuse. Said Company shall provide a sufficient number of acceptable attendants to keep all sanitaries in satisfactory condition and compel employees to use them.

SECTION 5. Said Company shall retain the services of acceptable qualified medical practitioners, to the number ordered, who shall have the care of the employees of the Company or its contractors, shall inspect their dwellings, the stables, and the sanitaries as often as required, and shall supply medical attendance and medicines to the employees whenever needed. Whenever practicable, an employee having a communicable disease shall be removed, when and as directed, to a hospital outside the watershed. The medical supervision of the Company over its employees shall extend to the physical and medical examination of all applicants for employment, in order to prevent persons having communicable diseases from becoming connected with the work, and the Company or its contractors shall employ only persons shown by such examination to be free from communicable diseases. Whenever, in the opinion of the engineer, it is necessary for the protection of the public health or the health of the employees, the Company shall remove or cause to be removed any employee from the work to a hospital, or shall remove permanently from the work or any camp any employee whose presence is believed to endanger the health of other persons.

SECTION 6. Once each week, or more frequently if required, the Company shall give the engineer, in such detail as may be prescribed from time to time, a written report signed by the physician in regular attendance, setting forth clearly the health conditions of the camp or camps and of the employees.

SECTION 7. The water furnished by the Company shall include a sufficient supply of drinking water of acceptable quality for all its employees, to be obtained from approved sources. If any water supply for domestic uses should become contaminated, the Company shall promptly provide a new supply from an approved source and abandon the contaminated supply, or shall provide works for purifying the contaminated water when and as ordered.

SECTION 8. All wash water from kitchens, laundries, and other places, and all drainage from stables, shall be conveyed by satisfactory means to places directed, where such drainage shall be treated by the means ordered so as to yield an acceptably innocuous effluent.

SECTION 9. Drainage from camps and shelters and from other places yielding water unfit for direct discharge into a reservoir or tributary thereof shall be conducted in tight drains or other approved conveyors to filters, septic tanks, or other disposal plants of approved construction, at places designated, and treated as directed to produce an acceptable effluent. Such effluent shall be discharged only in the manner and at the place or places directed. All arrangements for drainage shall be sufficient to provide for all rain water falling within the camp, so that there will be no overflow from camps which shall at any time reach the water course of the watershed without purification.

SECTION 10. Garbage, both liquid and solid, shall be promptly and satisfactorily removed from the buildings and immediately placed in approved tight receptacles of sufficient capacity for about one day's ordinary production. At least once in every twenty-four hours all such garbage shall be incinerated or otherwise thoroughly and satisfactorily disposed of in an approved manner.

SECTION 11. Shelters and other conveniences for the workmen within the watershed shall be provided with sanitaries for the use of all workmen, and other sanitaries shall also be provided near all points of work. The use of these must be insisted on under penalty of discharge, and sufficient inspectors must be provided to see that sufficient sanitaries are provided and that all workmen use them at all times on the watershed. All night soil thus collected shall be in tight receptacles, and shall be disposed of at times and in manners heretofore provided or specified by the engineer of the Water Department.

SECTION 12. The Company shall build such disposal plants, sewers, drains, and other structures, and shall do such other work, not herein particularly specified, as may be ordered for carrying out the intent of these regulations.

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A Commission to Study the Administrative Procedure of Municipalities and to make recommendations on the subject was authorized by the New Jersey State Legislature of 1913.

*From the Annual Report of the Water Commissioners of Springfield, Mass., 1912.

Stream Flow Gagings under Anchor Ice Conditions

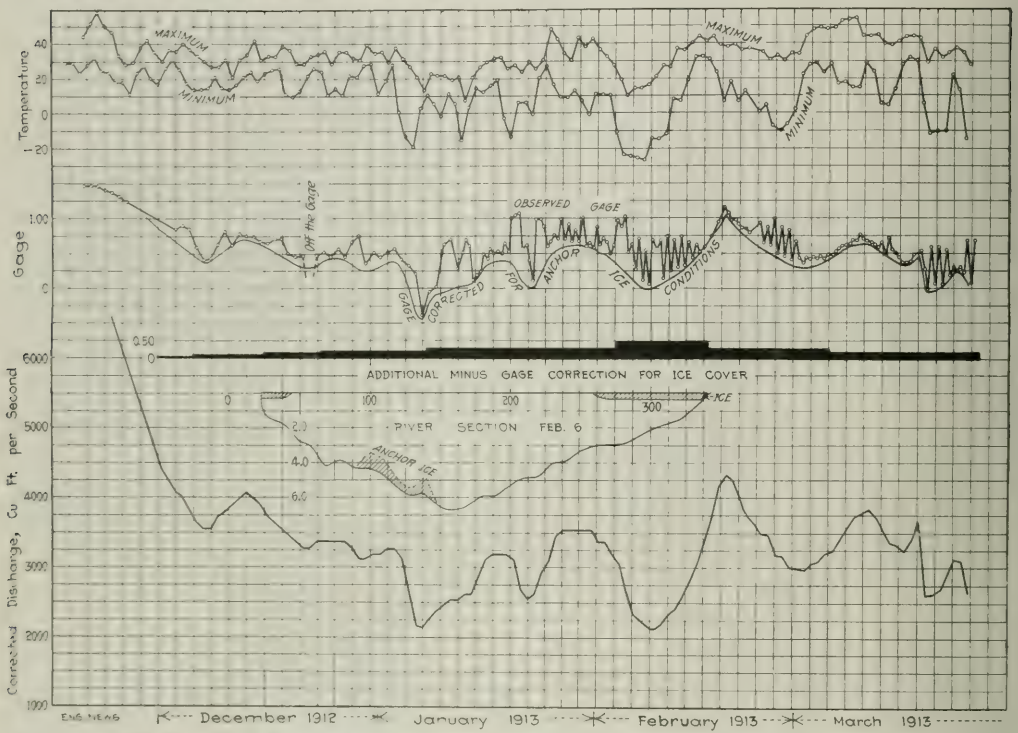
By Chester Wason Smith*

As it is often highly desirable to determine correctly the minimum flow of a stream, and as on many streams the minimum flow occurs in winter when measurements are, or may be, largely affected by ice conditions, it is thought that the measurements herein described may be of some interest.†

The stream illustrated is a northern stream, the winter flow of which fluctuates with the temperature, and it has a watershed of about 10,500 sq.mi. above the point of measurement.

Previous figures as to the flow had been based upon daily gage heights and a fairly well determined open-water rating curve, together with a general but rather casual consideration of temperatures. There were some indications that the minimum flow might be less than had been supposed; so beginning Jan. 12, the gage was observed twice daily, and from Feb. 3 to Apr. 1 an experienced hydrographer was kept at the station making daily current meter measurements and such other observations as might assist in a determination of the true flow.

The meter measurements were made from a boat running on a cable stretched across the river. About a thousand feet below the station was a riffle or rapids in the river, also another about 1½ miles above the station. The gage was at the station, though another one was later established on the riffle below.



Stream Flow Gagings in Winter, Showing Effect of Temperature and Anchor-Ice

Above the upper riffle was slack water, with the river entirely frozen over for about ten miles. The river is straight for some distance above and below the station, has a gravel bed with few boulders, and is shown in section on the accompanying diagram.

The diagram shows the daily maximum and minimum temperatures, the daily (and after Jan. 12 the a.m. and p.m.) observed gage readings. The derivation of the corrected gage height and finally estimated discharge curves will be explained.

That the flow was dependent on the temperature and fluctuated with it was to have been expected, but the very sensitive and immediate agreement is interesting to follow. Beginning with the cold weather Nov. 20 to Dec. 1, when the smaller tributaries froze up, the flow

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*Hydraulic Engineer with Westinghouse, Church Kerr & Co., 30 Wall St., New York City.

†Earlier articles on the winter measurement of stream flow, but dealing generally with under-ice flows, have appeared in our columns as follows:

"Records of Flow at Current Meter Gaging Stations Where the Streams are Subject to Ice." By E. H. Tillinghast. May 11, 1905.

"Determination of Stream Flow During the Frozen Season." By C. Robert Adams. Feb. 2, 1911.

"Gaging Minnesota Streams in Winter." By W. G. Hoyt. Sept. 12, 1912, p. 469.

"Methods of Estimating Stream Flow When Streams are Frozen." By W. G. Hoyt. Apr. 10, 1913.

A monograph on "Determination of Stream Flow During the Frozen Season," by H. K. Barrows and Robert E. Horton, was published in 1907 by the U. S. Geological Survey as Water Supply Paper No. 187.

is alternately checked and released precisely as the temperature varies, and leads to the conjecture that previous winter flows could be analyzed almost from a study of temperature conditions alone. A suspicion that the true flow of such a stream could not fluctuate as rapidly as the gage heights led to the taking of gage readings twice daily, when the fluctuations at once showed up more violent still.

The fluctuations were caused by anchor and slush ice lodging on the head of the riffle below and acting as a dam to back up the water until the pressure became enough to dislodge it, when, of course, the level of the water fell until it represented the normal flow of the river, or until ice again began to lodge. Anchor ice also formed or collected at times on the river bottom at the gaging station and had something of the same effect on the water elevation.

In general it seemed to be that the anchor ice formed and lodged during the night and went out during the day, though of course this procedure was modified by temperature conditions, and seemingly to some extent also by whether it was a sunny or a cloudy day. Depending on the temperature, anchor ice would form in varying quantities, also floating slush or cakes would assist in forming the jam; undoubtedly, the two daily readings did not catch all of the maximum and minimum fluctuations of the gage.

The effective gage height was assumed as a line drawn practically through the daily minimum readings, to which was applied a further correction, as shown on the chart, to allow for the more stable condition of surface solid ice with consequent reduction of section and increase of friction. The amount of this final correction was a matter of the judgment of the hydrographer, and varied with the extent and thickness of the surface ice.

The final gage heights thus obtained were considered as indicating a flow equal to the same heights on the open-water rating curve; which curve, not having been previously determined for such low flows, was extended downward parallel to the general trend of the best discharge measurements under ice conditions.

It will be seen at once that not only the gage height, but any measured discharge, might vary widely from the true normal 24-hour flow of the river; disregarding for the moment the effect of the surface solid ice. For instance, assume that the actual flow on a certain day (as on Feb. 1, see diagram) was 3360 sec.-ft. and that the control point at the head of the riffle below was free from anchor or floating ice, then the gage would read 0.50 and a meter measurement would show that relation between gage height and discharge.

Second, assume the same flow (3360 sec.-ft.) but that anchor and floating ice was collecting on the control point so that the gage climbed up to 1.00, then a meter measurement taken during the period while the gage was going say from 0.70 to 1.00 would show that for average gage of 0.85 the quantity of water actually passing the gaging station would be 3360 sec.-ft. *minus* the amount being *put into storage* by raising the 1½ miles of river, between the station and the riffle upstream, from 0.70 to 1.

Again assume, with the actual flow still 3360 sec.-ft., that at the stage of 1.00 the jam is pushed out and another meter measurement is taken while the river is falling from 1.00 to 0.70, then the actual quantity passing the gaging station would be 3360 sec.-ft. *plus* the same above mentioned amount passing *out from storage*.

Under such conditions a river becomes a series of alternately forming and disappearing reservoirs, which might (depending on the duration of the pulsation) adversely affect a project which had storage only for its daily peak.

It will be readily seen that it was necessary to carefully watch the gage and differentiate between the fluctuations caused by collections of ice on the control, and those caused by a period of milder weather with consequent increase in actual flow; also that for practical purposes any measurement at time of fictitious gage height should be eliminated.

Under the conditions obtaining along the river above the gaging station it did not seem probable that anchor and floating ice could act to reduce the gage height *below* the true normal; in other words, the fluctuations were all upon one side of the truth. This was because the water emerging from under ten miles of surface ice, carried no anchor ice and none formed in the short distance to the first riffle. Coming down over the first riffle, and in its passage by the gaging station to the second riffle, the water got enough colder so that anchor ice formed. If the ten miles of river above the upper riffle had not been protected by ice cover, anchor ice would undoubtedly have formed and created similar jams on the upper riffle, with longer periods between fluctuations owing to the much larger storage for same change in height. In this case the gage in the pool below would have shown fluctuations considerably below the normal, as to a certain extent the pool would have drained down while water was being stored above.

Anchor ice may accumulate somewhat on the rough river bed along a riffle, enough to have some effect on a gage placed on the riffle, but a jam proper would not form because, owing to the relatively steep grade and swift current, the water would almost momentarily back up enough to push the jam along. The real jams would form at the head of the riffle. A gage on the riffle, while not subject to such wide fluctuations as one in the pool, still might not be any better indication of the true actual flow; for while subject perhaps to but slight fictitious raises, it might be depressed considerably below the normal from a jam above. Then the jam might form upon only a portion of the width of the river; it might form upon either side or in the middle and while backing up water in the pool, divert the water actually passing, to one side or the other for some distance below.

In fact it would be quite possible to observe all manner of apparent inconsistencies in the simultaneous readings of several gages placed within quite short distances of each other.

In making a determination of the winter flow of such a stream it is necessary to carefully study conditions for some distance up and down stream from the gaging station. Select a gaging station that will not be affected by jams of anchor or floating ice, or if that is impossible, aim to get one such that the fictitious fluctuations may be readily recognized both in direction and amount. Depending on the character of the stream and the station it might be highly desirable that a recording gage be established so as to show all the fluctuations.

A New Design for Water-Works Intake Cribs

By W. D. Barber*

SYNOPSIS—The water-supply intakes at cities taking their supply from the Great Lakes are troubled more or less by ice and floating impurities, the handling of which adds to the cost of operation. The article given herewith outlines the features of the design of the present intake cribs, and the difficulties encountered in maintaining a uniform supply of good water from them. It describes also a new design of crib, combined with submerged intakes, which has been proposed for use in connection with the two new water intakes for the city of Chicago.

A number of towns and cities on the Great Lakes are using these immense reservoirs as the source of their water supply. The method employed to obtain this water is to run pipes or tunnels out to deep water and admit the water through ports in cribs or sunken intakes, but many difficulties are encountered in the operation of such cribs. The purpose of this article is to outline the construction of intakes of this kind and to describe a new design of crib which it is thought will eliminate the present difficulties. The aim is to reduce the cost of construction and operation, and to secure an abundant supply of pure water. The largest and most important cities that take their water-supply in this way are Chicago, Cleveland, Buffalo, Toronto, Milwaukee, Gary and Erie. Of these cities Chicago has spent by far the greatest amount of money along this line, and has built six of the eight large cribs now in use. Cleveland and Buffalo have the others. The characteristics of all these are shown in the accompanying table.† The other cities mentioned take their supply from submerged intakes or some modified form of these.

Present Design of Lake Intake Cribs

The crib is practically a hollow cylindrical or polygonal structure sunk to a firm foundation in the bed of the lake and rising above the water surface. Horizontal ports in the walls admit water to the central space or well, in the center of which is a vertical intake pipe or cylinder forming an extension of the shaft from the tunnel which carries the water to the city. In the sides of this pipe are intake or controlling gates, but in one case the top of this pipe is below water level. The typical construction is shown in Fig. 1, which represents the Carter H. Harrison crib.

The eight large cribs vary in capacity (based on an average velocity of flow in the supply tunnels of 3 ft. per sec.) from 54,000,000 to 300,000,000 gal. per 24 hours. The smallest is the Lake View crib, and the largest is the Edward F. Dunne crib (1911), both at Chicago. These cribs are placed 6500 to 22,000 ft. from shore, in water 26 to 50 ft. deep. The ports are rectangular, ranging from 4x4 to 6x8 ft. in size, and placed 6 to 25 ft. below the surface. Anchor ice forms at certain periods in the crib ports, and in the gates around the intake shaft, at the center of the crib. At certain periods also fish are quite troublesome and screens have been placed over the shaft gates to exclude fish and dirt.

At Chicago, long, hard storms from the east and northeast disturb the water along the shore and the muddy water is carried by the undertow to points beyond the cribs, thus placing them within the zone of muddy water,

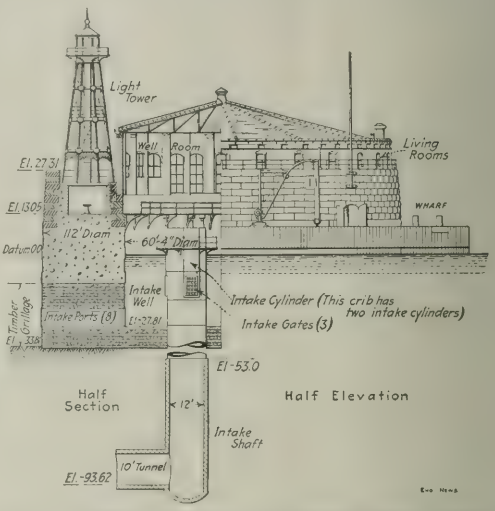


Fig. 1. Typical Example of Water-Works Intake Crib; the Carter H. Harrison Crib at Chicago
(This crib has two intake cylinders.)

causing at such periods the whole water-supply of the city to become more or less objectionable for use. Other sources of pollution are from sewage and the dumping of refuse from scows in the path of currents that carry these impurities by the cribs so that they may be drawn into the ports.

The general shape of the present cribs is either circular or polygonal in plan. They are usually built of timber cribbing for 15 to 30 ft. from the bottom, and extended to the crib floor (some 13 ft. above the lake surface) by means of steel shells or timber walls with the intervening space filled with stone or concrete. The Buffalo crib is built of steel shells from the bottom up. In size, they vary from about 65 to 114 ft. outside diameter, while the diameter of the interior (or the intake well) varies from 30 to 70 ft. The wall of the crib is 18 to 30 ft. thick, and in the best cribs is composed of concrete filling between the inner and outer steel shells.

Defects of Present Crib Design

The defective features of cribs of the present type may be listed as follows:

* Assistant Engineer, Bureau of Engineering, Department of Public Works, Chicago.

† The various water-intake cribs and tunnels on the Great Lakes have been described fully in "Engineering News," and we refer the following references for the information of our readers.—Editor.

"The Chicago Intake Tunnels and Cribs"; Oct. 18 and Nov. 8, 1900.

"The C. H. Harrison Crib and Intake Tunnel (Chicago)"; Aug. 24, 1905.

"The Southwest Intake Tunnel (Chicago)"; Nov. 14, 1907, and June 17, 1909.

"The Intake Tunnel and Crib at Cleveland, Ohio"; Aug. 11, 1910.

"The Intake and Crib at Buffalo, N. Y."; Feb. 9, 1911.

WATER-WORKS INTAKE CRIBS ON THE GREAT LAKES

	Chicago					Cleveland	Buffalo
1. Name of crib	Lake View	C. H. Harrison	Two-Mile	Four-Mile	Hyde Park	E. F. Dunne	...	...
2. Location	Montrose Ave	North Ave.	Division St.	Harrison St.	68th St.	59th St.		
3. Distance from shore	10,000 ft.	14,000 ft.	10,000 ft.	20,500 ft.	10,500 ft.	11,300 ft.	4 miles	Porter Ave.
4. Depth of water	20 ft.	24 ft.	23 ft.	23 ft.	23 ft.	23 ft.	45 ft.	6500 ft. 30 ft
5. Crib, shape	24-sided	Circular	5-sided	Circular	6-sided	24-sided	Circular	Circular
6. Crib, diameter	72 ft. 6 in.	112 ft.	58-ft. sides	114 ft.	84 ft. 6 in.	112 ft.	100 ft.	110 ft.
7. Intake well, shape	6-sided	Circular	5-sided	Circular	6-sided	Circular	100 ft.	Circular
8. Intake well, diameter	21 ft. 6 in.	60 ft. 4 in.	22-ft. sides	70 ft.	30 ft. 6 in.	60 ft.	50 ft.	70 ft.
9. Thickness of side	25 ft. 6 in.	26 ft. 0 in.	25 ft.	27 ft.	27 ft.	26 ft.	25 ft.	20 ft.
10. Ports in crib	(4) 4x4 ft.	(6) 5.583 6 ft.	(3) 3x4 ft.	(6) 5.583 ft.	(6) 5.583 .5 ft.	(8) 7x7 ft.	(12) 7x10 in.	(12) 10x10 in.
11. Area of ports	72 sq.ft.	180 sq.ft.	60 sq.ft.	150 sq.ft.	115.5 sq.ft.	392 sq.ft.	6 at 18.5x6 ft. at 24 ft. from bottom	432 sq.ft.
12. Bottom of port below water	22 ft.	26 .5 ft.	30, 19 & 8 ft.	30 ft.	30 ft.	25 3 ft.		14 ft
13. Gates in intake cylinder	(3) 4x4 ft.	(3) 6x4 ft.	{ A (2) 4 .583 6 ft. B (3) 4 .584 5 ft. C (3) 4 .584 5 ft.	(3) 4x4 ft.	(3) 4x5 ft.	(12), 6 each shaft	Intake open*	(6) 7x6 ft.
14. Area of gates, sq ft	48 sq.ft.	81 sq.ft.	84 75+60 75	60 75 sq.ft.	60 sq.ft.	590 sq.ft. 3 each shaft 197 ft	95 sq.ft	120 sq.ft.
15. Gates, depth below water	22 ft.	20 ft.	A, 32 ft.; B, 18 ft.; C, 15 ft.	11 ft.	6 ft.	3 each shaft 11 ft	...	11 ft.
16. Intake shaft, diameter	10 ft.	11 ft.	A, 8 ft.; B, 8 ft.; C, 10 ft.	10 ft.	9 ft.	(2) 12 ft. 3 in	11 ft.	13 ft.
17. Intake tunnel, invert below water level	63.3 ft.	93 .5 ft.	A, 62 ft.; B, 61 ft.; C 63 ft.	96 .5 ft.	64 ft.	153 ft.	110 ft.	50 7 ft
18. Intake tunnel, diameter	6 ft.	10 ft.	A, 5; B & C, 7	8 ft. (forking to two 6 ft.)	7 ft.	Horseshoe; 14 ft., equiv.	9 ft.	12x13, vert. sides, segment roof
19. Intake tunnel, area of section	28 .27 sq.ft.	78 .54 sq.ft.	58 11+38 48	50 .27 sq.ft.	38 .48 sq.ft.	154 sq.ft.	63 .6 sq.ft.	128 .06 sq.ft
20. Flow capacity of tunnel at 2 ft per sec., mil gal per 24 hr	39 .6	101 .8	3 tunnels, 123 .2	63 .1	49 .8	200	82 .4	165 .75
21. Date of crib completed	1896	1898-99	1867 (enlarged 1885)	1894-95	Rebuilt 1896	1904-1911	1903	1908-10
22. Cost of crib and superstructure	$107,200	$235,000	$117,500	$178,000	$137,500	$425,000	...	...
23. Ratio of area of crib ports to shaft gates	1 : 0 666	1 : 0 45	1 : 1 45	1 : 0 40	1 : 0 52	1 : 1	1 : 0 183	1 : 0 277
25. Ratio of area of crib ports to tunnel	1 : 0 426	1 : 0 43	1 : 0 986	1 : 0 393	1 : 0 333	1 : 0 398	1 : 0 123	1 : 0 265

*The top of intake cylinder is open at 21 ft. below water.

(1) The only means of controlling the water flow is by the gates on the intake pipe or shaft at the center of the well.

(2) The form of the crib ports permits the bulk of the water to be drawn directly from the surface of the lake, the draft being in the form of an inverted cone.

(3) Ice, dirt, fish, etc., may be drawn through the crib ports into the intake wall.

(4) The crib is an obstruction to floating ice, and during storms the ice is piled up on the windward side from 10 to 25 ft. above the surface and down to the bottom of the lake. This causes more or less obstruction to water entering the ports on the windward side. Fig. 2 shows an ice jam at the Two-Mile crib.

(5) All screens and other devices for keeping impurities from entering the supply tunnels are located in the well, just outside the gates of the intake shaft. There is no means of shutting off the flow of water into the well while cleaning the screens, and loose material removed from them usually falls back into the well.

(6) The intake well and well room in the center of the crib, from 60 to 90 ft. in diameter, with galleries, platforms, etc., is unnecessarily large. It greatly increases the cost of construction and operation, while adding nothing to the efficiency of the crib.

FIG. 2. AN ICE JAM AT THE TWO-MILE INTAKE CRIB; CHICAGO

(7) Owing to the defects in design, the operating force may vary from the normal force of one crib keeper and two assistants to some 25 to 30 men in winter, including enginemen and other mechanics.

RELATION OF WAVE ACTION TO PURITY OF WATER

Quality of the water being the first aim, the crib must be located in a pure-water zone and the supply taken from a depth where storm and surface conditions do not disturb the water drawn into the ports. The wave motion extends very little below a depth equal to the height of the wave, and this wave motion is mainly vertical. A wave moving toward the shore over water that is gradually getting shallow, when the depth equals the height of the wave, alters its shape, becomes more abrupt, and changes from an undulation to a wave of translation, thus causing the surface water to approach the shore. There is a resultant undertow or lower current back to deep water. The deeper the water the slower and more diffused becomes the current of the undertow. This undertow extends beyond the wave of translation. This is caused by the rise in the surface due to the wind.

From borings and soundings taken in Lake Michigan,

it is found that the sand covering the lake bottom extends to where the water is 22 to 24 ft. deep. This indicates that beyond this limit the undertow is too slow to carry heavy particles. From this point to a depth of 40 to 50 ft. simply a muddy condition of the water may prevail. It is safe to assume that the effect of wave action ceases at a depth of 25 to 30 ft., and the undertow or lower outward current at a depth of 40 to 45 ft. By placing the intake crib at this latter depth, with ports 10 or 15 ft. from the bottom and spread out so as to draw water from a large area, a supply of pure water would be practically assured.

Anchor Ice at Intakes

When the temperature of the water is at freezing point and the atmosphere is below freezing, the conditions are favorable for the formation of anchor ice. Even under these conditions ice is not formed readily in large bodies of water, where the surface is disturbed or kept in constant motion, unless the water first comes in contact with some substance whose temperature may readily be reduced to a point below freezing. When initial ice crystals have been formed under this condition, however, the ice formation becomes more or less rapid, depending upon the relative temperatures of the air and water. Where this water is in motion it will flow for long distances without any appreciable loss in its latent heat. The formation of ice also becomes more difficult of formation as the depth becomes greater.

If this cold water comes in contact with iron, stone, or other substances that may be reduced to a temperature below 32°, and the substance will permit of the adherence of ice to it, the troublesome anchor ice immediately begins to form. The velocity of the water will affect the rapidity of this ice formation, although the crib keepers say it has very little effect. A slow velocity where the water is flowing downward and the pressure increasing rapidly has a great tendency to result in forming anchor ice under the contact conditions noted.

Anchor ice will form in ports or intakes at times quite rapidly, even though the metal or substance to which this ice adheres is at great distances below the surface. This is evidenced at all deep ports and sunken intakes subjected to extremes of heat and cold. In a submerged orifice, when the water completely surrounds and covers the opening, the tendency is to draw the bulk of the water directly from the surface. This explains, in a measure, why anchor ice forms more rapidly as the velocity increases in the ports of existing cribs. The surface water or blanket covering to the deep water is being used as a supply, instead of the deep water of a denser volume. A simple experiment illustrating this is to watch the emptying of a wash basin or bath tub through a hole in the bottom. The circular motion, the column of air, and the suction directly over the opening, are quite evident.

The ice forms most rapidly and is most troublesome at about 1 to 6 a.m., when the temperature of the air is at its lowest point, but it may form quite rapidly during a cloudy day when the air is colder than the water. A blanket of ice on the surface of the water is a full protection against anchor ice. At one time, tugs were kept at work at the Chicago cribs to keep ice from forming in the ports, but this practice has been abandoned and better results are now obtained by allowing the surface ice to remain undisturbed.

In the cold weather of February and March the theory that the velocity of water in ports and the depth of port below the surface were the main checks to the formation of anchor ice, was given a rude shock, when at the Chicago crib having the largest and deepest ports (the Edward F. Dunne crib), these ports and the gates to the intake shafts were clogged to such an extent that the water in the crib well was lowered from 2 to 3 ft. when the pumps were drawing only 53,000,000 gal. per 24 hr. Had the pumping stations required the full capacity of 300,000,000 gal., it might have been practically impossible to keep the ports and even the intake shafts clear of ice. Taking this 53,000,000 gal. per 24 hr. and a zone extending 25 ft. beyond the ports as the source of supply, the water in this zone would be completely changed 22 times in 24 hr. in the 32 ft. of water at this place, or about 125 times if pumping full capacity. The temperature of the surface water thus drawn into the ports would give results practically the same as though the ports were near the surface. These conditions indicate that inlets should be not only deeply submerged, but also spread out over a large area of lake bottom, with special checks to prevent drawing in surface water.

New Intake Cribs and Tunnels at Chicago

The city of Chicago is preparing to build two new intake cribs about three miles from shore, one opposite 35th St. and the other opposite Wilson Ave., in water 38 ft. and 34 ft. deep. The intake tunnels will have a flow capacity of 400,000,000 and 300,000,000 gal., respectively, the former having a cross-sectional area equivalent to a diameter of 16.2 ft., with a shaft of the same diameter rising to the intake well of the crib. The velocity of flow in the tunnel to give this capacity is 3 ft. per sec.

At the 35th St. crib, we have 38 ft. of water in the lake with a medium hard clay bottom from 40 to 60 ft. below. The site is in water deep enough to place the intakes below the effect of wave action, but it is well within the zone of the undertow or muddy water during certain portions of the year. This crib will be some 16,000 ft. from shore, but it would have to be located from 8 to 10 miles out to secure the depth of 60 ft. necessary to eliminate this periodical condition, and the turbidity of the water may have no influence upon its quality. The size of a supply tunnel to furnish 400,000,000 gal. in 24 hr. at a velocity of 3 ft. per sec. will be equivalent to a circular tunnel of 16.2 ft. diameter. This tunnel will have to carry 53,330,000 cu.ft. of water per 24 hr. In water 38 ft. deep this will make a block of water 1340 ft. in diameter (deducting the 100 ft. crib diameter).

Considering that in the present design of crib and port no provision is made for keeping surface water from entering the well of crib (all water being drawn from the outside crib wall on a radius of from 50 to 57 ft.), it is easy to see why anchor ice will at certain times be a source of great annoyance, even though the velocity is only a foot or less per second in the total area of each port. If the body of water required to supply a crib as now constructed were considered to draw into ports from a reservoir extending 25 ft. beyond the port entrance, the water would have to be removed some 20 to 30 times per 24 hr. even though the flow was uniform from the sur-

face to the bottom of the lake. As the surface water furnishes the bulk of the supply, the rapidity of change is very much greater.

Operating Conditions at the Chicago Intake Cribs

The general particulars of the intake cribs are given in the accompanying table. The regular force for each of the Chicago cribs consists of a keeper at $1200 and two assistant keepers at $1000 each. As the 68th St. and Dunne cribs are connected, however, one force operates both of these. In winter, there are also from two to a dozen laborers to assist in clearing the ice; these are paid $2.50 per day and board (estimated at $1 each). The Two-Mile crib has three enginemen in winter, but the enginemen at the Lake View crib have been dispensed with by using a low-pressure steam system (10 lb.) which requires one-third less coal. The cost of operation (for 1911) given in the table, includes salaries, meals, supplies and repairs. The ice and water conditions at these cribs are as follows:

Lake View Crib: Anchor ice forms in the ports of the crib and in ports of the intake-shaft cylinder. When the current is slow, the ice does not form. The water is pure, but is roiled by storms.

Harrison Crib: Anchor ice forms in the intake-shaft cylinders, but not in the crib ports. During long-continued storms the water becomes roiled. There is no floating matter, as the prevailing winds carry it away.

Two-Mile Crib: The anchor ice has already formed at this crib in great quantities, and has required at times 30 or 35 men to keep the ports and intake gates free. A compressed-air system has been installed for blowing out the ice, and this has reduced the extra force. The air tank is 2x10 ft., carrying 60-lb. pressure, and a 4-in. pipe with 1¼-in. nozzle is thrust down into the center of the port. The ice dislodged flows into the well and is removed with wire dippers. The shaft intake ports and gates are then cleared in the same way. These have to be watched continuously.

Four-Mile Crib: This is further from shore and in deeper water than any of the other cribs. Anchor ice forms at times at the gates of the intake-shaft cylinder, due to increased velocity. The water gets roiled during long storms. A bill passed by Congress permits the dumping of scows some four miles west of the crib, and the wind brings the floating and semi-floating refuse to the crib, where it enters the ports and clogs the screens. During some storms the screens have to be cleaned about every half hour. This material includes paper, straw, horse manure, etc.

68th St. Crib: Anchor ice forms here when it does not at the adjacent Dunne crib, owing to the extra velocity of water in the ports of the former. The water is roiled during long storms.

Dunne Crib: Anchor ice causes trouble here at times. The water conditions are the same as at the 68th St. crib.

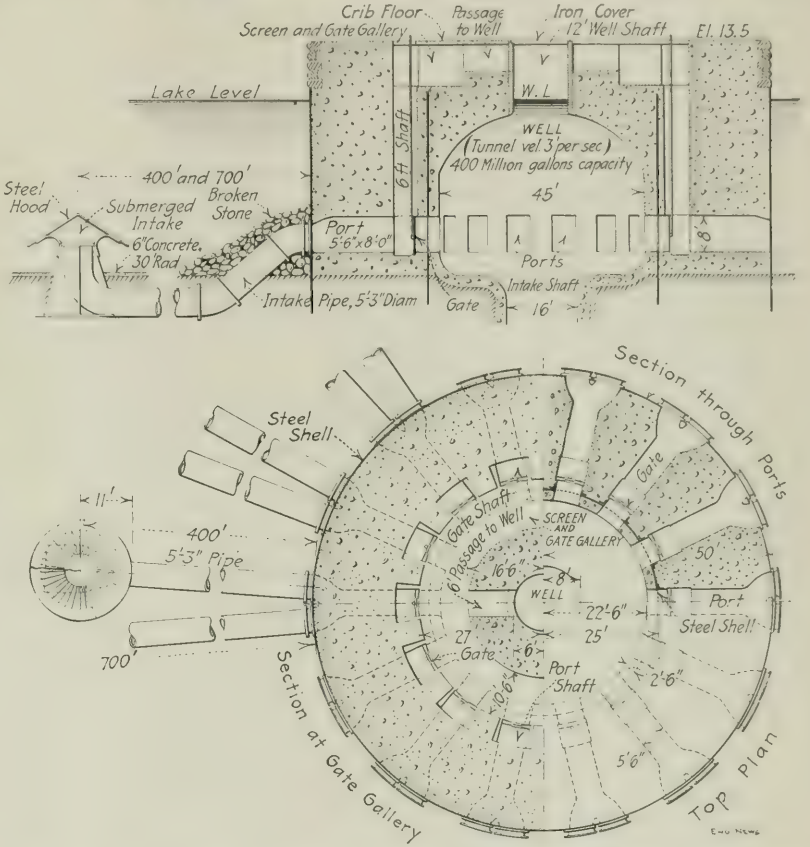


Fig. 3. Proposed Design of Crib for the New Water-Works Intakes at Chicago
(W. D. Barber, Assistant Engineer, Department of Public Works, Chicago; designer.)

Proposed New Design of Intake Crib

The drawing in Fig. 3 shows a new type of crib which has been designed to overcome the difficulties and objections to the ordinary type, and which represents the pre-

liminary design for the proposed three-mile crib off 35th St. This crib would be 100 ft. in diameter, with a 45-ft. well, and a 12-ft. shaft from the top of the well to the crib floor, while the intake shaft opening into the bottom of the well would be 16.2 ft. in diameter. The ports and the opening into the intake shaft have been designed to give a smooth and even flow of water to the tunnel, with a minimum of obstruction or interference to flow.

Its distinctive features are the following: (1) The use of radial intake pipes with submerged intakes 400 to 700 ft. from the crib, so as to increase the area of supply and thus reduce the suction effect; and also draw all the water from near the bottom of the lake. (2) The shape of the intake well, and the covering in of the well so as to reduce the amount of waste space in the crib surface. (3) The direct communication of the well with the intake shaft, thus eliminating the usual intake which forms an extension of the shaft rising into the well and fitted with gates. (4) The provision of gates and screens in the intake ports, and the use of a shaft to allow of raising the gates and screens above the surface for cleaning or repair, and to avoid having such work done in the well.

It is of interest to note that the Harrison crib (of the old type), with a diameter of 112 ft., provides a flow capacity of 152,000,000 gal. daily, with a velocity of 3 ft. per sec. The proposed crib, 100 ft. diameter, would provide a capacity of 400,000,000 gal., and the velocity in the intake ports would be only 1 ft. per sec., so that several ports could be closed (for repair, etc.) without reducing the capacity of the intake.

The points regarded as desirable in the designing of an intake crib are as follows:

(1) To locate the crib in water 50 to 60 ft. deep, where the supply may be drawn from sunken intakes placed below the influence of surface disturbances and the effects of undertow caused by storm conditions. The intakes to be protected against direct entrance of water from the surface.

(2) To design the ports with shafts for gates, screens and devices for cleaning and other work necessary, and to have these parts outside of the well area.

(3) To so design the intake shaft, well, and port entrances as to eliminate sudden changes in velocity and direction of flow, cross-currents, contractions, etc., that may affect the regular and uniform flow into the intake tunnel.

(4) With the changed design of the well, port construction and cleaning conditions, the superstructure may be changed to greatly reduce cost of construction and operation.

(5) To spread the intake area so that the water within this area will be changed very slowly, say once in 24 hours.

(6) To place the submerged intakes 400 to 700 ft. from crib and pipe the water to the port entrances. They would be beyond the limits of ice jams caused by the crib as an obstruction to floating ice.

It is proposed to form this crib of steel shells 100 ft. and 50 ft. in diameter, with the annular space between them divided by radial partitions into 14 water-tight compartments. The steel bottom would be placed above the lower edges, which would form a cutting edge to be pressed 5 to 8 ft. into the clay bottom of the lake. This steel structure would be built on shore. An intake port is provided in each compartment. On the outside of the outer shell are flanges for fastening the ports to pipes that lead to sunken intakes placed 400 to 700 ft. from the crib. On the inner shell of each compartment are steel frames and fittings for sluice gate for each port, with guides, etc., for gates and screens. These parts may all be built before the steel crib is towed out to its location.

When the crib is in position, the water-tight compartments will be permitted to fill with water in an even uniform manner so that the crib will settle gently into place. A flanged pipe pierces the bottom of each compartment so that when the cutting edge rests firmly on the clay bottom the water may be pumped from under the compartment, thus forcing the cutting edges into the clay and drawing the whole structure into its final position. The tops of the steel shells will then be 3 to 4 feet above the lake surface.

When this preliminary work has been done the water-tight compartments will be pumped out (one at a time). The ports, gates, screens, gate-shaft and other parts may then be built in place. Instead of filling the whole compartment or pocket with concrete, it would be more economical and just as serviceable to place about 4 ft. of concrete next each shell and around ports and gate shaft, and then fill the intervening space with broken stone, clay and sand (thoroughly puddled and tamped) up to the floor of the crib some 13.6 ft. above lake level.

When the pockets have been finished up to the floor of the screen and gate gallery, the space inside the inner steel shell may be pumped out, and the connection made to the intake shaft. This would be fitted above with fish-screen and sluice-gate gallery. Adjacent to the cleaning gallery would be an incinerating plant to dispose of material from the screens, as well as the garbage and refuse on the crib.

When the crib has been finished ready for the superstructure, the blank flanges may be removed from the thimbles at the intake ports and flanged couplings fitted for the intake pipes. It will be noticed that each port through the wall of the crib connects with two 63-in. pipes, thus doubling the number of sunken intakes as compared with port entrances. The number of these pipes and intakes might again be doubled, thus making the intake area more uniformly distributed in drawing its water supply to the crib.

This would permit the deep water in the lake within the area of the intakes to adjust itself slowly to this loss of water and disturb the surface as little and as slowly as possible. Extensive experiments would be needed to determine to just what extent this subdividing could be carried on to advantage as to cost and the elimination of difficulties caused by anchor ice. The intake pipes beyond the outer wall of the crib are to be laid in a trench excavated in the bottom of the lake. Around the crib for a distance of 50 to 75 ft. would be placed sufficient broken stone to protect these intake pipes from ice jams and other disturbances, the pipes entering the crib being entirely covered with this broken stone.

The outer end of each intake pipe would be turned up vertical and fitted with a steel hood to protect the inflow, as shown. The bars fastening the hood to the pipe would be of polished brass or some metal to which ice will not adhere. The lower side of the hood would

be lined with zinc or brass for the same reason. The hood is to be 22 ft. diameter and this distributes the area of inflow of each of the 28 intakes to a large area of lake bottom. Around each of the intakes concrete is to be deposited (by means of a tremie or chute) to a thickness of about 6 in. for a radius of 30 ft. The lower edge of hood would be about 30 in. above the concrete.

Heavy materials dropped from the surface would simply fall on the hood and roll away to one side. Lighter materials stand very slight chance of being carried under the hood by the inflow current. To prevent the formation of anchor ice in the hood and intake (in the event of such disturbance as to cause water to be drawn from near the surface), there would be a 2-in. pipe led along the intaake pipe for gravity flow from a hot-water tank on the crib to the hood. For any intake thus choked, the intake gate would be closed and hot water allowed to flow to the hood.

Buoys would be placed around the crib to warn vessels from anchoring within the area occupied by the intakes. In regard to the submerged intakes, it may be noted that practically all such intakes now in use have no protection or means of preventing the surface water from flowing directly into the intake. And all sunken intakes as now built are troubled at times with the formation of anchor ice.

The intake well being partly covered by the floor of the crib, the well room in the superstructure would be only about 20 or 24 ft. square, leaving only sufficient space to operate a hoist or crane for use in making repairs on the well, shaft or tunnel. This would extend up through the two-story superstructure, and above it would be the light tower. With this design, the building necessary for housing the operating force, well room, store rooms, etc., would occupy only half the space now usually devoted to this purpose, and half the surface area of the crib might be utilized as a garden for the use and pleasure of those living on the crib.

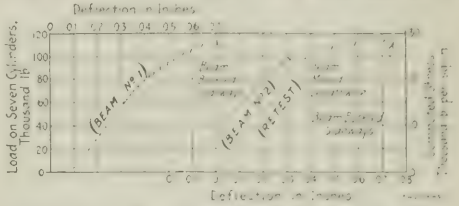
The elimination of trouble from anchor ice at the crib means that one crib keeper and his two assistants could handle the work throughout the year, instead of having to hire a much larger force during the winter. The staff is needed to place lights and meet other government requirements, and also attend to the cleaning of screens and other work. The cost of this 400,000,000 gal. intake crib would be practically the same as that of the Edward F. Dunne crib (300,000,000 gal.), as the submerged intakes and outside piping would about balance the difference in cost of the crib proper.

The author has been in the employ of the city for some 17 years and has had charge of the construction of several of the intake tunnels. He realizes that little investigation has been made along the line eliminating the numerous defects and difficulties encountered at the present cribs, but has sought to devise a new and better structure for the purpose.

❖

Through Train Service between New York City and points in eastern New Hampshire and Maine and the North Station in Boston will be inaugurated on June 23, through the completion of the new Hampden R.R., extending from Springfield, Mass., to Bondsville, 16 miles. Through trains over the New Haven system will connect with the Boston & Maine system at Bondsville, so that passengers from New York City and farther South can travel to Maine and New Hampshire summer-resort points without change of cars. The distance from New York to the North Station in Boston by this route will be 234 miles, as compared with 232 miles by the Shore line.

Bending Tests of Two I-Beams were made recently by the Iron City Testing Laboratory, Pittsburgh, for Hindman-Henderson Co., of the same city. A uniform-load testing machine was used, having seven hydraulic plungers applying equal loads at the eighth-points. The I-beam section was somewhat unusual, being 20 in. deep and weighing 59 lb. per lin.ft. (nominally.) Deflections were measured at all stages of loading, and autographic curves of deflection taken. These show complete straightness up to an extreme-fiber stress of 31,000 lb. At 49,000 to 51,000 lb., the two beams (which had deflected laterally throughout the tests) failed by jumping out of the machine sideways. The curves (see cut) in-



AUTOGRAPHIC LOAD-DEFLECTION CURVES FOR TWO 20-IN. BETHLEHEM I-BEAMS, SHOWING HIGH FLEXURAL ELASTIC LIMIT

dicate, however, that this failure point was close to the normal ultimate. The deflections of the two beams differed slightly, which result is attributed to differences in manufacture. Moduli of elasticity of 28,000,000 and 25,000,000, for the two beams respectively, are reported. The following table of weights and properties of the section, and their departures from nominal values, may be of interest:

	Nominal	Beam 1	Beam 2	Mean Departure
Depth, in.	20	19.54	19.64	2% low
Weight, lb. per ft.	59	54.3	54.3	8% low
Flange width, in.	8.0	8.1	8.1	1% high
Web thickness, in.	0.375	0.389	0.389	3% high
Area, sq.in.	17.36	15.79	15.91	9% low
Moment of Inertia, in.⁴	1172.2	1023	1011	13½ low

The tests show that I-beams may have perfectly elastic and normal character practically up to the tensile elastic-limit value of the metal, in spite of the existence of irregularities, internal stresses, etc., evidenced by irregular or inconsistent deflections. The test thus tends to set at rest some of the doubts raised by the tests of Prof. E. Marburg ("Engineering News," Aug. 12, 1909, p. 168) when very low values of elastic limit were found in bending tests of I-beams. However, published tests of I-beams are too few in number to allow of very positive conclusions.

A Temporary Rolling Drawbridge of the retractile type, moving in a horizontal line across the river, is to be built over the Chicago River at Madison St. to accommodate foot traffic during the removal of the present swing bridge and the construction of the new bascule bridge. A pile trestle south of the present bridge will extend from the west bank to the line of the old center pier, and the rolling draw will form the east connection, providing a 70-ft. opening for navigation.

The construction will be very similar to that of the Milwaukee River drawbridge described in our issue of Jan. 30, 1913. The drawspan will have steel trusses 70 ft. long, with a walk 11 ft. wide between them, and one end of the span will be mounted on a pair of car trucks traveling on two standard-gage tracks on a trestle parallel with the present east approach to the bridge. The city owns a large yard south of the approach which is used to store material for the Bridge Department, and this yard provides a convenient site for the trestle carrying the tracks on which the draw will run. The span will be balanced by a counterweight on the short arm, behind the trucks. The operating mechanism will consist of a hoisting engine and cable connected to the trucks, and it is expected that the bridge can be operated in about one minute.

The plans for this temporary drawbridge have been prepared under the direction of Alonzo J. Hammond, Engineer of Bridges and Harbor. The removal of the present bridge has been ordered by the War Department in furtherance of its policy for the improvement of the Chicago River channel by taking out all center piers and similar obstructions.

❖

Instruction in Methods for the Prevention of Accidents must be given by the teachers of the public schools of New Jersey, 30 minutes during each month hereafter, according to a bill passed by the legislature of 1913.

Bank Strengthening on the New York Barge Canal

Rather extensive work in driving sheet-piling in canal embankment has been begun on the western division of the New York State Barge Canal.

Contract 112—A contract covering the driving of about 145,000 lin. ft. of steel sheet-piling (12 in. wide) was let recently to John Young, of Syracuse, N. Y., which applies to the original canal contracts 60 (near Spencerport) and 66 (between Gasport and Lockport). The sheeting will be driven in a single line, extending along some 5100 ft. of canal bank that is higher than ordinary or is of such character as to be thought to call for precaution against seepage and washout. Piles 16 to 24 ft. long will be driven. The Chesley Construction Co., Buffalo, is doing the work under subcontract.

Alteration Contracts—A similar piece of work done as an alteration of an existing contract (contract 77) is being constructed by the T. A. Gillespie Co., at Palmyra, where about 6000 ft. of canal bank are to be strengthened by a line of 6-in. wooden sheeting 18 ft. long. A similar alteration is being carried out by H. S. Kerbaugh Inc., on contract 63, involving the reinforcement of 7600 lin.ft. of bank between Fairport and Bushnell's Basin by steel sheeting 16 to 24 ft. long. Similarly about 5000 ft. of bank on contract 61 at Brockport (contractors, Cleveland & Sons) are to be reinforced with steel sheeting 12 to 20 ft. long. The work here is being done on subcontract by the Horton Construction Co., of Buffalo.

The total of the sheet-pile reinforcing on the Barge Canal work covers nearly 24,000 lin.ft. of canal bank and involves a cost in the neighborhood of $400,000.

The sketch (Fig. 1) herewith illustrates the general arrangement of the steel sheeting. It applies to the conditions as found on contract 61 at Brockport, on contract 63 near Bushnell's Basin, and on the special piling contract 112. Here the new barge canal occupies the same alignment as the Erie Canal. On contract 61 the widening (from Erie width to Barge Canal width) was mainly on the side shown, while on contract 112 and contract 63 the widening was done on the opposite side and the sheeting therefore is driven mainly in old bank. In two of the contracts (61 and 112) the bank is being built somewhat higher than the old bank, as the water-level of the canal will be raised about 2½ ft. to secure the increased canal depth; on contract 63 the water-level remains about the same and the canal is dredged for the extra depth.

The intention throughout is to carry the sheeting to or below the canal bottom, and into the original ground surface or the embankment of the old canal.

Fig. 2 shows the conditions existing on contract 77 just east of Palmyra. Here the Barge Canal departs from the Erie Canal and occupies the straightened align-

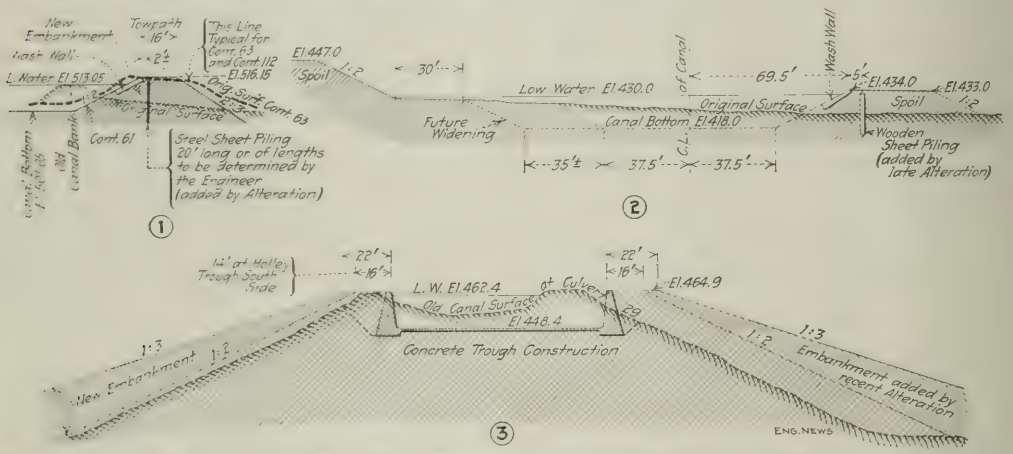


Fig. 1. Sketch Section of New York Barge Canal Bank Showing Relation of Steel Sheet-Piling to Original Construction

Fig. 2. Typical Section on Contract 77, Showing Wooden Sheet-Piling Now Being Driven

Fig. 3. Concrete Trough Sections, and Embankment Widening (Irondequoit, Holley, and Culvert 29)

The sketch (Fig. 1) herewith illustrates the general arrangement of the steel sheeting. It applies to the conditions as found on contract 61 at Brockport, on contract 63 near Bushnell's Basin, and on the special piling

ment of the old channel of Canargua Creek, crossing and recrossing at many points. There was not enough material in the original excavation to complete the north bank to the full intended cross-section, and this had the result that during the March, 1913, flood the partially completed bank was washed out at one of the places where the canal alignment crosses the creek channel, the fill here being, of course, higher than shown in Fig. 2. The wooden piling is being driven to give additional security against another scouring-out of the bank. The banks will, however, be filled out to full section later when additional spoil is available. The channel in this section is now open for use as part of the Erie Canal, connecting with the old Erie at Macedon on the west and at East Newark on the east.

Vertical Side-Walls Instead of Paved Slopes—At a section in high embankment at a creek crossing (culvert 29 at Bushnell's Basin) the canal prism was originally planned to be secured against seepage of water by revetting the side slopes and the floor with concrete.

Since then, however, experience has been had with concrete trough construction having vertical side-walls, and the section at culvert 29 has been changed to one with concrete trough.

STRENGTHENING OF EMBANKMENTS.—Several high embankments at culvert crossings are being strengthened by flattening of the side slopes and widening the embankment on top. This is true at Irondequoit, at culvert 29 and at Holley. The sketch Fig. 3 illustrates the change. The usual widening is from 14- or 16-ft. top width to 22-ft. width and the side slopes are being flattened from 1 on 2 to 1 on 3. At the two last-mentioned points the culverts will be extended to suit the increased width of embankment. The three points above-mentioned are the locations of the three concrete troughs built in connection with the barge canal.

The break at the Irondequoit Creek crossing, reported in our issue of Sept. 19, 1912, is now being cared for by a timber flume, built last September. It will ultimately be spanned with a concrete aqueduct in place of a new culvert with a new embankment.

SPECIFICATIONS AND COST OF SHEETING.—The bank reinforcement by driving steel sheeting is being done under the following special specifications:

SPECIAL SPECIFICATIONS

Upon points in which these special specifications conflict with the general specifications, the provisions of the special specifications shall prevail, and those of the general specifications in conflict therewith shall be void and of no effect.

The work under this contract shall be completed by May 10, 1913, and all equipment and materials removed from the towpath by May 15, 1913. In case the work is not progressed at such a rate as will insure its completion as above specified, the state will exercise its rights under clause 11 of the contract.

Twelve-Inch Steel Sheet-Piling shall be composed of medium steel of a quality acceptable to the engineer and shall be subjected to surface inspection. It shall be of some standard type which has been satisfactorily used in other works and the least thickness of metal shall be three-eighths of an inch except on tapering edges. The heads of the piles when driven shall not project above, or more than 6 in. below the elevations shown for them on the plans. Piling shall be furnished in lengths to fit the locations and shall be of such dimensions as will give a distance of not less than 12¾ in. from center to center of piles, measured along the line of the piling. It shall be driven so that the top will be as nearly as possible at the elevations shown on the plans. All piles which project above this elevation shall be sawed off.

The contract price per linear foot of pile for **12-in. steel sheet-piling** shall include the cost of all labor and materials necessary to furnish, drive and cut off the piling as herein specified or shown on the plans. The cost of all excavation and backfilling necessary to place the piling shall be included in the contract price for **12-in. steel sheet-piling.**

The following are the contract prices for the steel sheet-pile work:

Contract 112, steel sheeting 16 to 24 ft. long, 83c. per lin.ft. of 12-in. pile driven.

Alteration of Contract 63, steel sheeting 16 to 24 ft. long, 90c. per lin.ft. of 12-in. pile driven.

Alteration of Contract 61, steel sheeting 12 to 20 ft. long, 90c. per lin.ft. of 12-in. pile driven.

The work is under direction of E. J. Govern, Division Engineer, Western Division, Rochester, N. Y.

The work above described is progressing and will soon be completed. No particular difficulty has been encountered, but in driving the long 24-ft. steel sheeting through very hard embankments some shattering of the web at the top has been experienced.

The use of sheeting is not new in the Barge Canal work. Sheeting in banks has been driven both under original construction contracts and where the necessity for such additional protection developed—under alterations of original contracts. The present work, however, is new in being the reinforcing of old (Erie) canal banks at places where they are practically unaltered in the Barge Canal work. The use of steel sheeting is also largely new, as most of the canal sheeting that has been put in was wooden sheeting.

A Water-Works Company Which Advertises

Gas and electric-lighting companies make free use of advertisements in the local press to extend their business but water companies do comparatively little of this kind of advertising. A notable exception is the Terre Haute Water Works Co., of Terre Haute, Ind. A recent example of the advertising done by the company just named, and one which has particular interest just now in view of the recent floods (see notes from Dow R. Gwinn, p. 742 of our issue of Apr. 10, 1913) is reproduced herewith.

16 THE SATURDAY SPECTATOR April 26, 1913

"THE PUBLIC BE PLEASED"

It is our desire to furnish the best possible service to our patrons, and with that idea in mind we are keeping in touch with the best thought in Water Works design and construction. We want to make the Terre Haute plant as near perfect as it can be made. As we learn by study, observation and experience, we make improvements to our plant so that we can have better service. Two of our officials have been in the water business over thirty years, and several of our men have been with the company for more than a score of years.

We have a good plant, and, what is of equal importance, a trained force of men that can be relied upon.

It was said that the water supply in 10 cities of Indiana was out of service during the recent flood. We maintained the usual pressure, but not the usual standard of purity. At the end of three days, we were again furnishing the high grade of water which has been so satisfactory to our patrons. The results will be interesting to some, so we give the record, since the settling basin pump was started, as made by our Bacteriologist.

Efficiency of Filtering and Purification Process

Date	Pct. of Efficiency	B Coli
March 29	99 9	None
March 30	99 8	None
March 31	99 4	None
April 1	99 6	None
April 2	99 1	None
April 3	99 2	None
April 4	99 8	None
April 5	99 1	None
April 6	99 2	None
April 7	94 6	None
April 8	97 2	None
April 9	97 5	None
	Average 99 0	

Water purification is only one of our hobbies, and we believe our customers appreciate what we try to do. As a result of the purifying process, the bacteriological tests show the water delivered through the mains during 1912, averaged 98.4 reduction of bacteria, something a little nearer perfection than we poor mortals attain personally.

We have a feeling, however, that we should make such changes and improvements in our plant that will enable us to not only furnish plenty of water during floods, but *water of the unusual standard.* We will fall short of our ideals if we fail in doing so.

And we want to tell our friends and patrons that we are even now making minor improvements and are planning more extensive ones, with the hope of being in a position to avoid a repetition of the recent experience. The flood was unprecedented, and we may not have another like it in the next 100 years, but we want to be prepared for an even greater flood.

By the way, good water service is a good advertisement for a city, and with us good service is a duty and an obligation.

TERRE HAUTE WATER WORKS CO.

AN EXAMPLE OF WATER COMPANY ADVERTISING

The Machinery Building at the Panama-Pacific International Exposition will have nearly eight acres of floor space. In addition there will be an auxiliary structure to be known as the Gas and Fuels Building. Electrical machinery will be located in the main building, which will be served by adequate crane facilities. Power will be available in the form of alternating and direct current, gas and water in this building, while steam and compressed air will be provided in a section adjacent to the Gas and Fuels Building.

Filling a Tunnel Cave-in by the Hydraulic Method

By Donald F. McLeod*

In locating the new 24-in. Potters Falls pipe line of the water-works system of the city of Ithaca, N. Y., it was found convenient to avoid a sliding clay deposit on a steep bank by tunneling behind the deposit. The tunnel, shown in plan in Fig. 1, is 470 ft. long. Its cross-section (Fig. 2) is nearly oval, and is 6 ft. high by 5 ft. in greatest width. The lining is of reinforced-concrete 6 in.

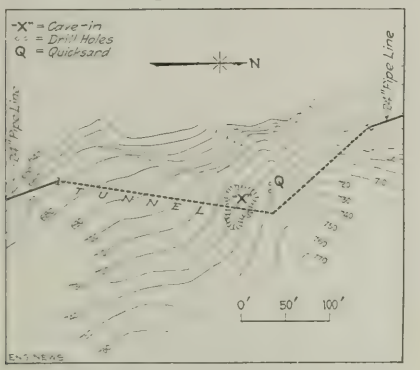


Fig. 1. Plan of the Tunnel on the Potters Falls Pipe Line, Ithaca, N. Y.; Showing Location of Quicksand Deposit

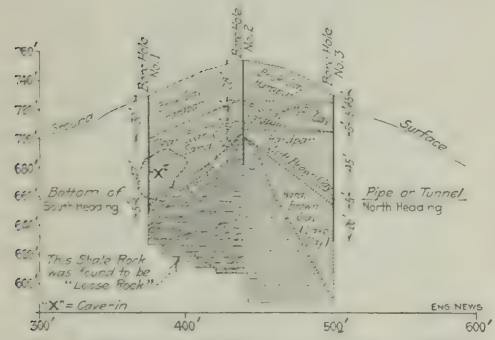


Fig. 3. Section of Material on Line of Tunnel as Indicated by Test Borings

thick. The greatest depth of cover is 100 ft. Preliminary borings showed that the material consisted of glacial clay, hardpan, gravel and sand. The lining was designed to resist a pressure equivalent to a head of 40 ft. of water, but before the tunnel was completed the lining was put to a test not contemplated by the designer.

Although the preliminary borings showed a deposit of sand over 40 ft. deep (Fig. 3), the contractor (who had little faith in the record of the borings) made no preparations for encountering this deposit. When the north heading struck it, about a foot from its indicated position on the profile of the borings, there was no timber casing in the heading and no provision for bulkheading. The result was that the sand, which was full of water, rushed out and filled the heading for a distance of about 40 ft.

Instead of working on the south heading and giving the sandy deposit a chance to drain out through the north heading, work was continued on the latter. The heading had just been cleaned out, up to the face, when another outrush of sand occurred, similar to the first. The work was then completed from the south heading, the workmen being protected by a timber casing, inside of which the concrete lining was built. The cavity left by

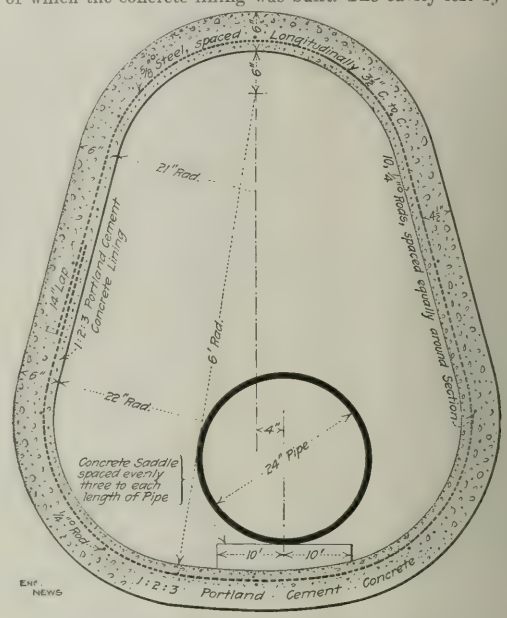


Fig. 2. Cross-Section of Tunnel for Pipe Line

the outrushes of sand was irregular in form and had a maximum height of over 30 ft. above the tunnel.

After the tunnel lining had been completed through the cavity, and the concrete had been allowed to set for several weeks, the cavity was back-filled by sluicing wet sand from the surface, in the following manner: A point was located on the surface of the ground as nearly as possible over the highest part of the cavity, and a hole drilled through, using an ordinary 5-in. well drilling outfit. The bore hole, which was about 60 ft. deep to the top of the cavity, was cased in the ordinary manner.

There was a large deposit of very fine, silty sand within a distance of about a thousand feet, and this sand was hauled in dump wagons to the bore hole. Tank wagons were used to haul water from a small stream. A wooden box, of the form used for mixing concrete, was set up, and in this the sand and water were mixed with hoes to about the consistency of wet concrete, so that the mixture would flow down a wooden trough into the bore hole. When the cavity was nearly full, care was taken not to let the muddy filling material rise in the casing above the top of the cavity, for fear of putting extra pressure on the tunnel casing.

No difficulty was met with, and the cavity was com-

*City Engineer, Ithaca, N. Y.

pletely filled. The amount of sand deposited, as estimated by the number of wagon loads brought on the work, was 142 cu.yd. The capacity of the cavity, as estimated from cross-sections made by a survey party, was 148 cu.yd. The concrete casing of the tunnel stood the strain without any damage. The backfilling was completed May 10, 1912. An inspection made in January, 1913, showed all the tunnel lining to be in good condition.

The location of the Potters Falls pipe line was made by the writer, as was also the design of the tunnel.

Cutting a 20-in. Water-Main Connection into a 20-in. Tee

An interesting piping problem was recently solved by the use of a pipe-tapping machine at water-works of the Bethlehem City Water Co., South Bethlehem, Penn. The population of the city has increased quite rapidly since the filters were constructed in 1904, and the plant is now taxed to very nearly its full capacity.† The filtered-water reservoir holds only about enough water for 24 hours' consumption, and should any accident or some other reason make it necessary to draw off the water from the reservoir, the city would be left without a supply of filtered water.

The full lines on the accompanying sketch plan show the piping layout at the water-purification plant. Both upper and lower reservoirs are surrounded by concrete walls, and in the narrow space between is a riprapped embankment, leaving a space only about 5 or 6 ft. wide at the tee-connections where the pipes could be made accessible without entailing large expense and difficult work.

For obvious reasons it was desired to make a direct

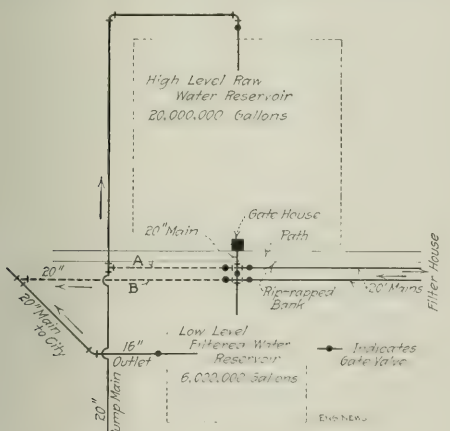


FIG. 1. SKETCH PLAN OF PIPING, BETHLEHEM CITY WATER CO. PLANT, SOUTH BETHLEHEM, PENN.

connection between the filter plant and the 20-in. main supplying the city, so that filtered water could be passed into the main without going through the storage reservoir. It was also desired to connect the incoming pump main direct to the filters to provide for any emergency which would necessitate the emptying of the raw-water reservoir.

From the peculiar location of the plant on top of a hill, and the difficulties imposed by the original layout, these connections could not be made except by crosses in place of the tees in the constricted passageway between the two reservoirs, or by the redesign of the entire piping system. Moreover, to dig into the retaining walls, take out the necessary sections of pipe to remove the tee-connections and replace them with cross-connections would have meant shutting off the entire water-supply of a city of 30,000 inhabitants for at least a day, with the possibility of an accident making the time much longer.

The problem was finally solved by cutting 20-in. openings into the backs of the two tee-connections, and mak-

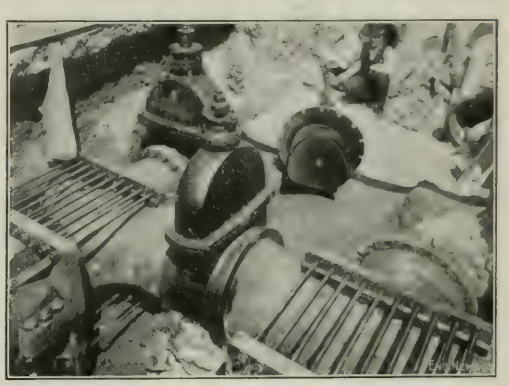


FIG. 2. VIEW OF PIPE-TAPPING MACHINE CUTTER WITH ONE 20-IN. CONNECTION COMPLETED

ing a regular 20-in. pipe connection. The work was done by the Water-Works Equipment Co. of New York City, by means of its pipe-tapping machine.

This machine has been used extensively for tapping straight pipe in diameters up to 48 in., and under almost any pressure met with in city water-works systems. The operation of tapping a straight pipe, using an inclosing sleeve, tee-connection and gate valve, is familiar to water-works engineers, and has been fully described in past issues of ENGINEERING NEWS,* but up to this time the company named had not been called upon to make a full diameter cut on the back of a tee-connection.

Fig. 2 shows the left-hand connection completed and the collar and half-sleeve in place for making the right-hand connection. The only difference in the method regularly employed was the necessity of a specially designed sleeve connection which is shown in the view. The steel collar is made of a two-piece casting bolted together and is joined to a special half-sleeve, made like the ordinary sleeve connection, except that it goes but halfway around the pipe. The collar bears against the bell of the old tee-connection and is joined to the half-sleeve by twenty 1-in. steel rod bolts, 10 above and 10 below. These castings once in place, the procedure is identical with the now common practice of pipe tapping.

†A brief description of the Maignen slow sand filtration plant at South Bethlehem, may be found on page 1284 of this issue, in an article describing a "Traveling Filter-Sand Agitator."

*A description of a power-operated pipe-tapping machine and the procedure in making a 30-in. connection with a 30-in. main at Trenton, N. J., may be found in our issue of Apr. 12, 1906, p. 412.

Further Data on the Long Beach Pier Floor Collapse

The pier floor collapse at Long Beach, Calif., which on May 24, 1913, caused the death of 38 persons (three more having died since the report in ENGINEERING NEWS, May 29, 1913, p. 1145), has been investigated by a committee of experts appointed by the local authorities. From their report and from additional information that has come to us, it is evident that the structure was deplorably weak, not only for the extraordinary crowd that was on it at the time of failure, but for any ordinary load.

The measurements of the panel which fell, given in our previous article, were practically correct. With a few changes noted in a later measurement, the design was as follows:



FIG. 1. EDGE OF THE BREAK IN FLOOR OF LONG BEACH PIER

A floor of 1-in. rough plank with a 7/8-in. tongue-and-groove topping, rested on 2x12-in. joists, 24 in. c. to c. and poorly bridged, which in turn rested on a girder made up of two 2x14-in. sticks, 18 ft. 6 in. c. to c. of 12-in. posts. The girder framed into a mortised bearing in the posts, 4 in. deep, giving a 4x4-in. bearing there, and was additionally supported by 3x4-in. knee braces, 36 in. long from face of post to the end of bearing on bottom of beam. The joists on either side of the girder spanned 11 ft. 3 in. and 15 ft. c. to c. of girders. The vertical distance between floors was 13 ft. and the lower floor, which collapsed under the impact of the falling upper floor, was 7 ft. from the sand beneath.

With the aid of the accompanying view and the above data, the following abstract of the report of the examining experts will readily be understood:

The building does not at all agree with the plans and specifications furnished us. There were evidently many items omitted and changed from what the contract called for, but certain portions of the building are stronger than specified. The entire construction leads your committee to believe that the stresses and strains were never properly computed.

It appears that the main members had a safety factor of approximately two, whereas good engineering practice requires a safety factor of six.

However, the connections had even a smaller safety factor than two. In other words, girders which are 4x14 in. should have been 13x14 in. and floor joists resting on these girders should have been 2x14 in. and not 2x12 in.

The cause of the failure was the breaking of a 4x14-in. girder at its support on a post in the center of the wrecked section. This girder had entirely decayed for some inches outside of its seat on the post, and all its load was being carried by a 3x4-in. angle brace, which was imperfectly connected.

There was a 2x14 in. scab or splice 24 in. long, tying this girder to the adjoining girder, but this scab had no bearing on the post, and so was affording no assistance in carrying the load. However, this scab effectually concealed from detection by a casual examination the rottenness of the girder which failed.

It would have been a simple matter to have detected this decay, if proper minute inspection had been made by one familiar with such work.

The excessive decay of this girder was doubtless caused from the fact that the floor above had no drainage and, as we understand, after each rain, water stood for quite a time over this portion, slowly percolating into the joints. The top of the post shows a marked degree of decay.

The weakness of the existing knee-bracing, and the total absence of adequate bracing at right angles to girders, contributed to the failure of the remaining portion.

As the direct cause of this accident is so apparent it seems unnecessary to seek for contributory cause.

Had the lower floor been properly constructed it would have withstood the impact of the falling load, but the girders of this floor had such poor support the wonder is that it held under ordinary usage. Had the lower floor remained intact, we believe the accident would have been far less serious.

No minute inspection of other portions of the building or approaches was made, but enough was noted to justify your committee in recommending that the building be condemned.

ALBERT C. MARTIN.
W. H. AUSTIN.
CHARLES E. RICHARDS.

Fig. 1 is a view of the break, showing at the top the doors to the auditorium, outside which the crowd was massed. The isolated 12x12-in. post in the left foreground supported the girder which failed. The mortise which received the girder can be seen on the far side of the post, and a dark spot to be noted on the side of the post is where the knee brace was nailed.

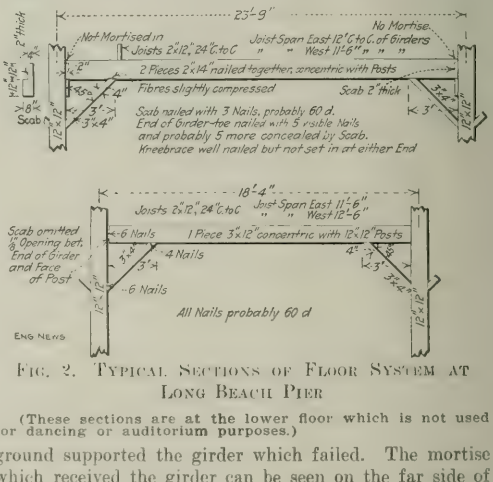


FIG. 2. TYPICAL SECTIONS OF FLOOR SYSTEM AT LONG BEACH PIER

(These sections are at the lower floor which is not used for dancing or auditorium purposes.)

In Fig. 2 are given two sections at the lower floor, which is not used for dancing or auditorium purposes. They are shown here to give some idea of the general design of the structure.

⁂

An Improvement in Granite-Block Paving has been adopted in Philadelphia in the repaving of Broad St. between Cumberland and Silver Sts. The street was laid with granite-block paving of the old type with large blocks and wide joints. The old pavement was removed and the old blocks were cut in half and relaid with the cut end uppermost and the joints between the blocks were grouted with portland-cement mortar. The pavement obtained in this way has a much smoother surface than the pavement originally laid and the cost of the work was a little less than half the cost of laying a new granite-block pavement.

EDITORIALS

The Los Angeles Aqueduct: An Appreciation

The Los Angeles Aqueduct, to which a large part of our present issue is devoted, will long serve as a remarkable example of municipal enterprise and engineering ability. Boldly conceived to meet a far-seeing vision of municipal growth, boldly yet carefully designed to overcome unusual obstacles at a necessary minimum of cost, skillfully and conscientiously constructed amidst the manifold difficulties of the desert and the mountains in a hot, rainless region, and completed within the estimates of cost in record time, the Aqueduct will serve as a worthy memorial to its Chief Engineer, William Mulholland, and his able staff of assistants.

Mr. Heinly's article, with its numerous halftone views, its maps, profiles and cross-sections of the Aqueduct, does all that could be done in eleven pages of our space to picture the work as a whole and in its main details. No adequate conception of the magnitude, variety and difficulties of the Aqueduct construction can be gained, however, without traversing its whole length of 235 miles, from the intake opposite the high Sierras, across the sun-scorched deserts, along and over equally sun-scorched mountains and for scores of miles through the very mountains themselves, on down to the great terminal power plants and reservoirs.

When the writer of this note went the length of the Aqueduct somewhat less than a year ago, he found, as he expected to find, but as he had only inadequately anticipated, that the engineering conception and execution of the work was on a grand scale and painstaking and skillful in detail. What he was not prepared for was the whole-hearted way in which tunnel-drivers, pipe men, concrete gangs and all labor of high and low degree entered into their work. The spirit of these men and of their foremen and superintendents was the highest possible testimony to the devotedness and ability of the whole engineering staff, from the Chief Engineer and his able lieutenants down to the instrument men and rodmen.

We take all the more pleasure in making this brief note of appreciation, because of the abortive attacks which were made upon the character of the Aqueduct construction work a year or so ago. One of these was an attack by a local political faction, which, though unpleasant, was a common enough incident in connection with municipal work. The other attack was of a far different and more unusual character. It was an attempt to discredit the cement made in the municipal works, which entered largely into the construction of the Aqueduct, and with it to discredit the very integrity of the Aqueduct itself. This attack on the cement was all the more deplorable because it was made, if not indeed conceived, by engineers, in the interests of private cement manufacturers. It is a pleasure to note, however, that engineers throughout the West generally condemned both these attacks; and that engineers of both West and East, scores of whom have visited the work in question, unite in admiration and praise of the Los Angeles Aqueduct and its creators.

Engineers Wanted for the Work of Railway Valuation

When the Railway Valuation bill passed Congress, we called attention to the fact that it called for a greater amount of engineering work than any task ever undertaken. Recently we announced the appointment of the Board of five engineers which is to have general charge of this huge work. On June 12, the United States Civil Service Commission sent out announcements of the positions and salaries in the various grades of the engineering staff and invitations for applications from candidates for the positions.

The list of positions to be filled and the rated salary for each is as follows:

	Salary per annum
Senior Structural Engineer	$1800 to $4800
Senior Mechanical Engineer	1800 to 4800
Senior Railway Signal Engineer	1800 to 4800
Senior Electrical Engineer	1800 to 4800
Senior Civil Engineer	1800 to 4800
Senior Architect	1800 to 4800
Senior Inspector of Motive Power	1800 to 3600
Senior Inspector of Car Equipment	1800 to 3600
Architect	1080 to 1500
Inspector of Motive Power	1200 to 1500
Civil Engineer	720 to 1500
Inspector of Car Equipment	1200 to 1500
Electrical Engineer	1080 to 1500
Railway Signal Engineer	1080 to 1500
Mechanical Engineer	1080 to 1500
Structural Engineer	1080 to 1500

Necessary expenses when absent from headquarters in the discharge of official duties will be allowed.

Appointments to all these positions will be principally for duty in the field; but some candidates will be assigned to the general office force at Washington.

Applicants for positions commanding a salary of $1800 per year or over, in other words for the Senior grade, are not required to appear at any place for examinations but will be rated upon the evidence adduced as to their general and technical education and training and their practical experience and fitness. For the lower grades examinations are to be held on July 23 at all the places throughout the United States where such examinations are usually held, a list of which can be obtained from the U. S. Civil Service Commission at Washington upon application to any of its local offices.

For the Senior grade, two classes of eligibles will in general be established, one rated at salaries of $3000 per year and upward, the other at $1800 to $2700 per year. Applicants should state the grade for which they desire to be examined, but they will be admitted to the examination only for the grade or grades for which are shown by their statements of training and experience to be probably fitted.

In general, for the Senior rating, applicants should be 30 to 60 years of age for the higher grade and 25 to 50 years of age for the lower grade. There is some variation in these requirements for the different positions.

In general, also, for the Senior rating, graduation from a technical school and at least five years' practical experience, or if not a graduate at least ten years' practical experience is requisite. Engineers desiring to make application for any of the above named positions should make application at once for a copy of the announcement of the examination for the position they desire, and also for a copy of Form 2039. Applications may be addressed either to the United States Civil Service Commission, Washington, D. C.; the secretary of the Board of Examiners, post office, Boston, Mass.; Philadelphia, Penn.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; customhouse, New York, N. Y.; New Orleans, La.; Honolulu, Hawaii; old customhouse, St. Louis, Mo.; or to the chairman of the Porto Rican Civil Service Commission, San Juan, P. R.

The Ultimate Power to Regulate Railway Rates

The decision of the Supreme Court of the United States in the Minnesota Rate cases has been generally referred to in the press as endangering the value of railroad investments. It is true that the Court's decision is adverse to the contention of the railroads. Careful reading of the decision, however, reveals nothing radical in the principles enunciated by the Court.

The State of Minnesota, like a number of other States of the Union, has enacted laws fixing maximum rates for freight and passenger service on railway traffic within the State's borders. Such State regulation of railway rates has been practiced to a greater or less extent ever since the early days of the railway era in the United States. The passage of the Interstate Commerce Law in 1887, while it for the first time put in force the power of Congress to regulate interstate traffic on railways, did not interfere with the rights of the several States to regulate railway traffic within their own borders.

It is said, however, that a State, by its regulation of traffic within its own territory may control commerce passing over State lines. For example, Duluth, Minn., and Superior, Wis., are at about the same distance from the twin cities of St. Paul and Minneapolis. If now the Minnesota maximum rate law fixes a very low rate from Duluth, that city will have its commerce benefited at the expense of its rival city just across the State line in Wisconsin.

Instances without limit might be multiplied where the State's power may thus be exerted to affect interstate traffic. Where such cases occur, however, the Supreme Court says in its opinion just handed down that the authority of Congress is supreme when and where it chooses to exercise it. In fact Congress has already empowered the Interstate Commerce Commission to correct such interferences with interstate traffic.

To put it plainly, the attorneys for the railways appear to have blundered in appealing directly to the Federal Court for relief in the Minnesota rate cases instead of to the Interstate Commerce Commission. While the Supreme Court has not yet made its decision on the question whether the Interstate Commerce Commission has already authority under present Federal law to act in such cases, its comment that the Interstate Commerce Commission had not been called upon to act in the case is at least suggestive.

There is a strong tendency at the present time among railway men and financiers to look toward Federal regulation of railway affairs as a desirable result. That all public utilities are and ought to be subject to government regulation, is now well nigh universally admitted; and the possible conflicts between State and Federal regulation are well recognized. On the other hand, so long as State regulation confines itself to matters that solely affect local conditions within the State's limits and lets alone the matters that properly belong to the Federal jurisdiction as affecting interstate traffic, there is much to be said for continuing the dual control.

Furthermore, to quote a hackneyed saying, "it is a condition and not a theory that confronts us." With the present political complexion of Congress, there is small chance of the passage of any legislation which would wipe out entirely State authority over public utilities and substitute sole Federal control in its place. Nor is it at all certain that such a change would be a wise one. The division of responsibility between State and Federal authority, while it has its disadvantages, has also its marked advantages. In Great Britain, long experience has made plain the many objections to making the National Parliament the sole legislative authority over local as well as national matters. The reaction against this concentration of authority has become so strong that home rule for Ireland may yet be followed by home rule for Scotland, and there may be an even further delegation of local government matters to different localities within the Kingdom.

What is needed in the United States is a greater assumption of authority by the States over matters which they now neglect, and it is a serious mistake for the States to meddle with matters which should properly come under Federal control.

The Renaissance of Sand-Cement

The so called blended or sand-cements which are the subject of an article on another page of this issue by Rapier R. Coghlan, of the U. S. Reclamation Service, are not new, as any standard work on portland cement will show. In 1893 a patent was issued to T. L. Smidth, of the Danish firm of T. L. Smidth & Co., for a sand-cement which was made by grinding intimately together portland cement and sand or silica rock. Factories were built in various parts of the United States and a considerable quantity of the product used in various structures which, so far as we know, are standing today in good condition. Its use at that time died out because of the increasing production of true portland cement, which began to be made so cheaply that its price competition drove the blended cement out of the market.

Apparently its absence from the field of structural engineering continued until the last five or six years when the remoteness of several of the large structural developments in the Far West, notably those connected with the U. S. Reclamation Service, led the engineers to look into the subject with a view of producing a cement materially less in cost than the true portland cement which had to be carried so far that its cost was very high. As our readers well know, the experi-

ments and studies of the engineers of the Reclamation Service have led them to the adoption of a blended sand-cement on several of the large dams which are now under construction. Mr. Coghlan's article is a résumé of the studies which brought about this decision.

A distinction should be made between the old understanding of what this sand-cement is and how it acts and the present theory advanced by the engineers of the Reclamation Service. The early sand-cements were supposed to reach their strength and soundness, equivalent to the strength and soundness of a normal portland cement, because of the finer grinding which the regrinding of cement with sand brought about. The older books were not quite clear as to just why this finer grinding should make a normal cement out of a mixture of cement and sand, but they ascribed the fineness to a sort of ball mill action which took place when the sand and cement were ground together. The later idea, advanced by Mr. Coghlan, is that the rock or sand which is ground up contains a certain quantity of soluble silica, which combines with the freed lime of the setting portland cement to form a hard calcium silicate exactly in the same fashion as the assumed action in puzzolanic or tufa cement takes place. This is in complete distinction to the older theory which called a sand-cement a cement made by mixing a portland cement with an *inert* substance.

It is not for engineers to dabble in the intricacies of physical chemistry, particularly in those higher realms where the cement chemist roams. Suffice it to say that the latest investigators in cement chemistry claim that fine grinding will cause better cement by subdividing the hard cementitious particles and making them more reactive to water. Under this reasoning it is probable that some such action takes place as a result of the final grinding of the sand-cement, however much additional cementing power is added by the combination of the soluble silica. This is not successfully contradicted by Mr. Coghlan who merely shows that the finely ground sand or rock does not tend to fill up the voids in the cement. In fact, he admits that the particles are of finer grain in the blended cement, which is precisely the contention of the advocate of the fine-grinding theory.

While these theories are of academic interest to engineers, any experiments to show the effectiveness of the blended cement are of practical interest to them, and it is to be hoped that the Reclamation Service will continue in its study and that the Bureau of Standards will also take up a similar investigation.

The cement manufacturers have not taken kindly to the proposed improved cement, doubtless because of the fear that its use will result in a falling off in the demand for the true portland cement. On the face of it this would appear to be possible, for, using Mr. Coghlan's figures for plant and operation cost, it should be possible to produce a blended cement for $1.13 per barrel, where the portland cement which forms one-half of its volume costs $1.40 a barrel, a saving of 20%. On the other hand, the manufacturer of the blend requires machinery not available for the small user, so that no pronounced effect on portland cement production need be anticipated until the desirability of the compound becomes so evident that it will lead to its manufacture for commercial purposes, at which time the cement companies themselves will be the best equipped for entry into the business and participation in its profits.

It has not been proved as yet that blended cement is in every way as desirable as the true portland. On the other hand, the invidious term "adulterated cement" which some of the cement interests so freely use would sound better if there had been presented any tests which show the sand-cement to be inferior to the true portland. The engineering profession is not so enamored of the words "portland cement," or of the chemical and physical makeup of the product that bears that name, that it would not accept a substitute if that substitute produced a satisfactory concrete at a 20% saving in cost.

Maximum Load Assumptions for Ordinary Floors

It is an unfortunate fact that the design of the floor framing for ordinary wooden structures is, as a rule, left to the sole discretion of the carpenter builder. For the usual conditions of load, this is probably safe enough practice; but that it is extremely unsafe where the loading is beyond that of the ordinary dwelling house is very often demonstrated. The latest instance is the fatal pier failure at Long Beach, Calif., which was noted in these columns some weeks ago and is more fully described in this issue. In this particular case, the error was doubly reprehensible in that the floor was on a public pier and immediately in front of an auditorium door, where naturally a large crowd could be expected; whereas the floor to carry this crowd was hardly stronger than that which would ordinarily be used in a dwelling house.

In most cases, however, the trouble lies not so much in the design of the floor, but in the estimate of the load which that floor might reasonably be expected to carry. In fact, experience shows that it is not safe to assume any but a maximum load—that is, the largest load that a crowd can total—for any floor where people can congregate. For loadings of warehouses or similar structures the normal load of goods will, of course, be in excess of any load that people could produce.

Within the past two weeks, there has been an example of an unexpected maximum load which will bear description.

On Saturday, June 7, an international tennis match was held in New York City at the West Side Tennis Club, which consists of a great number of tennis courts and a small clubhouse designed only for the locker rooms and baths of the members and possibly for the simplest kind of entertainment. Immediately alongside the clubhouse, which is the only building or shelter on the entire grounds, there had been built a temporary three-sided grandstand, all but surrounding the court where the match was to take place, and capable of seating about 5000 people.

On the afternoon in question these stands were practically filled with people watching an engrossing match, so engrossing, in fact, that hardly fifty of the five thousand persons present left their seats until the threatening drops of a long imminent rainstorm turned into a torrential downpour, driving everyone to the nearest cover, which, as has been noted, was the little clubhouse. Soon all the floors and porches of this small building were packed to suffocation with hundreds of very wet people and the adjoining lawns filled with those anxious for admittance.

No one seemed particularly concerned for the strength of the floor until an ominous cracking under one of the porches drove the crowd thereon to the wetter but more stable turf outside. Fortunately, the movement was so rapid and escape so easy that the overstrained floor did no more than crack; but throughout the remainder of the storm the crowding in the building and the porches was decidedly less.

The point of this example is not that the porch was poorly designed for the load which it ordinarily carried—for we know nothing of the design of the floor—but that the clubhouse is ideally located for the assumption of a low maximum floor load. The porch in question is isolated, with an outlook upon an approach walk where little of interest might reasonably be expected to take place. A few hundred people ordinarily are present at the grounds or in the building, and at times of large tournaments, perhaps a thousand. But to have a sudden and terrific rainstorm come up when 5000 people—by far the largest crowd the grounds ever held—were forced to seek shelter in or around the building, was a coincidence which probably will never again occur; and it is a decidedly fortunate thing that it remained only a coincidence and not, as well it might, a terrible disaster. Had one of the three or four loaded floors collapsed under the unexpected crowd, there surely would have resulted nearly, if not fully, as many fatalities as occurred at Long Beach.

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The Stamford Collision on the New Haven Railroad

The fatal rear collision on the New Haven R.R. at Stamford, Conn., on the afternoon of Thursday, June 12, is attracting wide attention, not only by reason of the casualties (which were surprisingly few considering the serious nature of the accident) but because of the circumstances under which the collision occurred.

In the first place the accident happened on the New Haven R.R., which, rightly or wrongly, is in very bad repute with the general public at the present time by reason of other fatal accidents on the road within the past three years, as well as because of its general conduct, financial and otherwise.

In the second place this collision occurred under the block system and under circumstances which leave no room for doubt as to the primary responsibility of the engine driver. It will be recalled that the two other very serious recent disasters on the New Haven road were likewise due to disobedience of block signals by the engine runners, although in the previous cases these signals required a slackening of speed for a crossover switch.

Briefly summarized, the circumstances of the Stamford collision were these: The first section of the westbound Boston express had stopped at Stamford to exchange its steam locomotive for an electric locomotive. Instead of getting away with four or five minutes delay as usual, it was held for some eighteen minutes so that the second section following overtook it. The standing section was protected by a home signal in the rear set at danger and a distant signal set at caution. The standing train, moreover, was perfectly visible to the engineer of the approaching train, the track being straight for a long distance and it being broad daylight. Nevertheless, the engineer of the second section ran past the danger signal and struck the rear of the standing train at a speed variously estimated at 12 to 20 miles per hour. The rear car of the standing train was a wooden Pullman parlor car in front of which were steel coaches. The locomotive telescoped the parlor car for nearly two-thirds its length, killing six persons and seriously injuring about twenty others.

It is, of course, to be expected that an engine runner who has caused a fatal accident under such circumstances will make the best defense he can for himself on the witness stand. The story of the engine runner, Dougherty, is briefly as follows: Both he and the fireman identified the distant signal at caution when they were a train length back of it and he then closed the throttle and let the train drift toward the home signal. We quote further from his testimony as reported in the New York *Times* as follows:

> It was straight track ahead. I could see the other train apparently right under the home-signal tower. I gave her the air and saw she was not taking it. After going maybe a car length I gave her the air stronger. The air didn't take hold. When I was 200 ft. away from the home signal I gave her the emergency. That put on the full force. I saw there was going to be a collision because she would not stop. I grabbed the sand-valve string and the whistle.
>
> After one long blast, I let go of the sand valve and held to the whistle still, waving my other arm out of the cab window to two trainmen I could see in the rear of the first section. I was praying they'd move out. I was trying to warn them. The two men saw a collision was coming and stepped aside from the track.
>
> That was all I could do. My train broke in two. I tried to reverse the engine, but my back wouldn't stand for it. I got the lever three notches up, but I failed then.

According to Dougherty's previous testimony, on the previous Tuesday, at South Norwalk, he had applied the emergency air brake on account of a child coming onto the track ahead and instead of stopping the train in two or three car lengths at the speed it was running, it ran to the lower end of the station platform before stopping. He also ran past the station at Bridgeport and had to back up two or three car lengths after the train stopped. After that he used greater caution and applied the air earlier than usual. He also wrote in the work book at Stamford "brakes no good; won't hold."

Later testimony by other engineers who had run the same train with the same locomotive on previous days was that its brakes had operated all right. Tests of the brake equipment are to be made as part of the official investigation.

The best comment of all on Dougherty's claim that the air brakes would not hold is the fact that his train broke in two after the emergency application of the brake was made before the collision occurred at Stamford. This is proof which cannot be gainsaid that there was no stoppage in the train pipes and that the air brakes on the cars at least were in good working order. It is also, however, circumstantial evidence that the air brakes on the locomotive itself may not have had adequate holding power. If, as Dougherty testified, there had been previous trouble with failure of the brakes to hold sufficiently, the cause is probably to be sought in improper adjustment or maintenance of the air brakes on the locomotive driving wheels.

It will be of interest to inquire also whether the locomotive had brakes on the leading truck and what was the condition of the brake on the tender. As those of our readers familiar with railway matters will recall, the ap-

plication of brakes to locomotive truck wheels was first introduced some twenty years or more ago as the result of a serious collision where official investigation showed that additional braking power on the locomotive might have prevented a bad disaster.

It should be clearly understood, of course, that these circumstances in nowise lessen the primary responsibility of Dougherty for the collision. He had been making station stops with the same train throughout the length of the run and he had a long distance in which to bring his train to a stop before reaching the home signal and striking the train standing beyond. If his train did not check its speed properly, as he testifies, when the service application of the brakes was made, he should then and there have applied the emergency instead of waiting until he was close upon the home signal. That his train would have stopped had he done this, far back of where the collision occurred, is proved beyond question by the fact that the brakes went on with such force as to break the train in two.

Nevertheless the lesson of the disaster that great care should be exercised in keeping in good order the air brakes on locomotives, especially those in fast passenger service, and in seeing to it that every wheel on the locomotive has its full braking power exerted is one that deserves emphasis. It is well known that locomotive brake equipment requires more attention to keep it in order than the brakes on car equipment. But such attention is too important to safe operation to be in any way neglected.

A feature of Dougherty's testimony which has made a great impression upon the general public is his statement that he attempted to reverse the engine previous to the collision but had not sufficient strength to do so because of having strained his back in handling the reverse lever a week previous. It would be well if this public testimony should lead to the general use of a power reverse gear on modern locomotives. Such gear is already considerably used on some especially heavy types of engines and its use ought to be universal, as has heretofore been pointed out in these columns. In fact the failure to apply power to the reversing gear of heavy locomotives is an example of the lethargy that has prevailed far too largely in steam-locomotive design and construction in this country and which has made our American locomotive-engineering practice lag very far behind that of the more progressive European locomotive designers and builders.

It should be said, however, that use of the reverse lever to stop a train is only justifiable as a last resort. If the air brakes on Dougherty's locomotive in the Stamford wreck were not holding properly after the emergency brake went on, throwing over the reverse lever and opening the throttle might have helped to check the speed. If the locomotive driver brakes *were* holding, however, reversing the engine would only have made matters worse. In general, the instructions to engine runners properly equipped with driver brakes should be to rely on the brakes for stopping the train and not to use the reverse lever.

LETTERS TO THE EDITOR

Licensing Surveyors in Canada

Sir—In view of the discussions which have taken place recently in your columns concerning the bill before the New York Legislature proposing to license engineers, it may be of interest to some of your readers to know something of the status of engineers in Canada.

A sharp line is drawn here between the Land Surveyor and all who practice other branches of engineering. All over the Dominion, those who wish to survey land in any manner which will affect the title to the lands surveyed, must hold a commission as Land Surveyor. If the survey is of Dominion lands, he must be a Dominion Land Surveyor. If the survey is intended to be of record in a Land Titles Office under provincial jurisdiction, he must hold a commission as Provincial Land Surveyor for the province in question.

In Manitoba, Saskatchewan and Alberta, the Torrens title is universal and to a lesser extent in the eastern provinces. Since in this system the government guarantees the title to be good, it is reasonable to expect the government to regulate the manner of survey and inquire into the character of the surveyor.

To acquire a commission as Dominion Land Surveyor, any person may take a preliminary examination covering Euclid, Algebra, Plane and Spherical Trigonometry, Mensuration, Spelling and Orthography. Graduates from recognized colleges or universities in engineering branches may take a limited examination. These examinations are fair tests, though severe to one not fresh from college.

The ordinary applicant must then serve three years' apprenticeship, and the graduate one year's apprenticeship, concluded by a final examination in the same subjects and in addition Astronomy, the Land Titles Act and Manual of Survey.

Surveyors holding a Dominion Land Surveyor's commission may obtain a provincial commission, at least in the three provinces mentioned, by writing an additional examination on the Land Titles Act of the province.

In addition to these precautions, the provincial governments maintain surveyors and staffs who check all plans of subdivisions, and who require all plans submitted to conform to the law and practice; and a public works' surveyor who passes on the feasibility of streets.

Men who wish to practice other branches of the engineering profession are in no way restricted, although (at least in Alberta and Saskatchewan) plans of water-works and sewerage are referred to the provincial sanitary engineer; irrigation, water-power and water-supply plans must be referred to the Commissioner of Irrigation (Dominion). In most cities, also, a city building inspector passes upon building plans. In this province (Al-

berta) no one may practice as an architect but a member of the Alberta Architects' Association.

This provision is by no means rigidly adhered to, the limitation seeming to prohibit a man calling himself Architect without this qualification. In many cases plans are drawn by builders and others who style themselves building inspectors. It is interesting to note that the only serious building failure in recent years during a very active period of building in Calgary, was a building in course of erection for which no architect had made plans, the plans having been prepared cheaply by a carpenter who could use a ruling pen.

F. K. Beach.

222a 8th Ave., W., Calgary, Alberta, Can.

[At least two of the Canadian provinces have laws regulating the practice of civil engineering. They are Manitoba and Quebec. Under these laws no one is entitled to call himself a civil engineer, or to practice civil engineering unless he is a member of the Canadian Society of Civil Engineers. The Manitoba law went into effect in 1896 and the Quebec law in 1899.—Ed.]

Cost of Horse-Drawn Vehicles versus Electric Vehicles

Sir—In Engineering News of May 29, 1913, p. 1149, you state in an article covering the spring meeting of the American Society of Mechanical Engineers that, in the paper read on "Cost of Upkeep of Horse-Drawn Vehicles vs. Electric Vehicles," "the figures given by the author charge only 2% interest on the investment in electric trucks and 10% depreciation, while the friendless horse was charged 6% interest and 20% depreciation."

I am inclosing herewith a copy of the paper and beg to invite your attention to p. 580, table No. 1, in which is given the experience of the Naval Gun Factory at Washington. In this table interest on investment is figured at 2%.

On p. 581, table No. 2, is given the experience of a commercial house in Washington, and this firm charged 6% on their horse-drawn equipment for interest, 20% depreciation for the horse and 15% depreciation for the vehicle and harness. The same company, however, charged 6% for their electric vehicles.

On p. 585, table No. 8, is given the cost per year of the horse-drawn vehicle at the Government Printing Office, and if you will examine this table, you will find that the interest on the investment is given as 2%, depreciation of the wagon 10%, depreciation of the horse 20% and of the harness 15%.

On p. 589, table No. 12, giving the cost of operating an electric truck, you will find interest on investment at 2% and depreciation at 10%.

The object of the above figures is to show that where I made comparisons for electric-driven trucks over horse-drawn trucks, I charged the same interest on investment in the figures given by commercial establishments—namely, 6%, and in the figures given for Government Departments I charged 2% interest on investment against both the horse-drawn and the electric-driven. This was done because the Government borrows money at 2% whereas commercial houses have to pay from 5 to 6%.

The statement given in the Engineering News, as mentioned above, is therefore incorrect, and the author of this statement evidently confused the figures given for commercial houses against the figures given for Government Departments.

Referring to the depreciation charges, I think it is a well known fact that a horse is not much good for heavy trucking service after five years of use, and the horse-drawn wagon is not much good after ten years of use, so that the 20% depreciation on the horse, 10% on the wagon and 15% on the harness represent average figures. The depreciation on electrics is, of course, not yet well understood, but there are plenty of electric vehicles in use at the present time which were purchased 10 years ago, or more, so that the 10% depreciation for this class of vehicle is on the safe side.

W. R. Metz,
Superintendent of Buildings, Gov. Printing Office.
Washington, D. C., June 9, 1913.

[Our correspondent seems to have missed the main point of our criticism. If the relative economy of two different machines is to be compared the comparison should be made *on the same basis* for both. The fact that the firm using one machine may have better credit than the firm using the other, so that it could borrow money at a lower rate of interest has nothing to do with the case. Incidentally we very much doubt that the U. S. Government can at the present time borrow money at 2% interest or anything like it.—Ed.]

A Concrete Slab under a Railway Track on a Side-Hill Embankment

Sir—Some of your readers may be interested to learn the result of the work done at Oil City, Penn., in placing reinforced-concrete slabs under a street railroad track, located on the edge of a steep slope. This construction was described in the Engineering News, issue of Feb. 6, 1913, p. 242. It was then said that a year or more might elapse before anything would happen which would demonstrate the success or failure of the method, which was largely an experiment. The demonstration came sooner than was expected.

Before the concrete was two months old, an unusual rainfall, almost continuous for about a week, loosened the soil on the slope so that there was a considerable slide, and the structural strength of the slabs, girders and columns was brought into play, probably for the first time. It may be recalled from the former article that the concrete was laid directly on the ground, which being then firm and hard, not only supported the concrete during constructive work but also while it was hardening. The unusually low initial cost of the work was possible on account of this constructive feature.

If the concrete had not been put in just when it was, the slide would have been far more extensive, the trolley road would have been put out of business for perhaps two months, and the cost of restoring the roadbed and putting in a permanent construction would have been far greater than the actual cost of the work as done last fall. The preliminary estimate for the cost of a stone (or concrete) retaining wall, with the costly system of sheet piling which would have been necessary, was between $4000 and $5000. The preliminary estimate for

the concrete-slab construction was $1150. The actual cost was about $980.

The complete success of the method and its comparatively insignificant cost have induced the management to put in similar construction in two other places where incipient failure of the slope has already begun.

WALTER LORING WEBB,
Harrison Bldg., Philadelphia, Penn.
June 4, 1913.

The Fulfillment of a Prophecy

Sir—In ENGINEERING NEWS of Dec. 19, 1912, p. 1156, you published a communication from me relative to the possible instability of a concrete bridge then nearing completion in an Indiana city. The bridge consisted of two arch spans of 87 and 107 ft. each, supported upon old stone abutments and pier of a former wooden bridge.

It seemed an extremely doubtful matter as to whether or not the structure could remain standing when centers were struck and earth fill added. It is only fair to state that it did remain standing and with no apparent evidence of weakness, although a theoretical analysis showed the design to be extremely dangerous. But it was never subjected to any severe loading test.



RUINS OF A CONCRETE BRIDGE WRECKED BY FLOOD, BROOKVILLE, IND.

(Details of design appeared in "Engineering News," Dec. 19, 1912, p. 1156.)

On Mar. 25, 1913, however, the Easter flood accomplished its destruction. Whether or not the piers or abutments were undermined cannot be definitely determined. A view of the collapsed bridge is shown herewith. It is located in Brookville, Indiana.

DANIEL B. LUTEN.

Indianapolis, May 31, 1913.

Use of Wood Poles in the United States in 1911, by steam and electric railroads, electric-light and power companies, telegraph and telephone companies, are presented for the coming bulletin of the U. S. Census Bureau. The total purchase amounted to 3,418,000, of which 70.3% were purchased by the telephone and telegraph companies, 23% by electric railroads and electric-light and power companies, and 6.7% by steam roads. The total number shows a decrease of 452,700, compared with 1910, and 320,700 compared with 1909, but it exceeds the totals for 1908 and 1907 by 168,900 and 134,800, respectively. The decrease was confined to telegraph and telephone companies and steam railroads. Over 90% were of cedar, chestnut, oak, pine and cypress, standing in that order of relative importance.

Annual Convention of the American Railway Master Mechanics Association

The 46th annual convention was held at Atlantic City, N. J., June 11 to 13, with the usual large and enthusiastic attendance. The meetings were held in the assembly room on Young's Pier, and the exhibits (occupying more space than ever) were arranged upon this pier, except that some cars and other large exhibits were placed upon a railway siding. The program was arranged upon a definite schedule, allowing a specified time to each subject. But the proceedings ran behind the schedule from the very start. However, on the third day, the meeting made good time, and cleared off the entire program without undue haste, and would have finished on time but for the delay incident to balloting for officers.

There was only one session each day (9:30 to 1:30), but in future it may be necessary to have at least one afternoon or evening session to enable the various matters to be given proper consideration. With a three-day convention it should be an easy matter to arrange four or five sessions, and still have plenty of time for the exhibits and the social features of the convention.

The meeting on June 11 was opened with prayer by Rev. N. W. Caldwell. The annual address was then read by the President, D. F. Crawford (Pennsylvania Lines). The report of the Secretary, Jos. W. Taylor, showed a membership of 1074, and that of the Treasurer, Angus Sinclair, showed a bank balance of $1369. The secretary reported also that the endowment fund for four scholarships at the Stevens Institute of Technology is insufficient, and that a committee has been appointed to consider means for maintaining the scholarships. It has been the custom to elect members of long standing to the position of honorary member, but it is felt that this rather detracts from the real purpose of this grade of membership. The Executive Committee therefore proposes a change in the constitution, creating the additional grade of life member. To this may be elected members of 10 years standing who, through age or other cause, may cease to be engaged in railway service.

PRESIDENT'S ADDRESS

The address by Mr. Crawford was far from being of a formal or perfunctory character, but touched briefly and interestingly upon a number of points of particular interest to the railways at this time. In the first place there is much proposed legislation which will affect the railways and which relates to such diverse matters as wages, train crews, headlights, freight rates, safety appliances, and regulations in regard to operation. As the various laws are proposed by the Federal and different State governments there is likely to result a rather chaotic condition of railway regulation, unless something can be done to promote some degree of uniformity.

Smoke prevention is another important matter, and the successful handling of this may do much to check the growing demand for electrification of terminal lines. In view of the increasing immigration and the capacity of many of the foreigners for becoming good workmen in railway service, he suggested the desirability of railway officers studying foreign languages so that they can handle these men without the aid of interpreters. Three

particular subjects were suggested by Mr. Crawford as desirable for investigation by the Association, with a view of effecting uniformity: (1) Train resistance; (2) tonnage rating; (3) statistics of operating costs. As to the first, he showed that in 1900 ENGINEERING NEWS published a chart of 21 diverse formulas, since which time the number has increased materially, with the result of confusing the situation still more. A resolution was passed later recommending that the association take up the investigation of train resistance and train tonnage.

He pointed out also that this year there is no report on the long proposed consolidation of the Master Mechanics and Master Car Builders associations, and it is apparent after several years' consideration that the majority of the members are opposed to this suggestion. Nevertheless, a closer working arrangement is desirable, which may be brought about by holding the conventions of the two associations during one week, and with a joint session on one day. It is desirable also that the Master Mechanics Association should keep in closer touch with the work of the Air Brake, the Railway Fuel and the Testing Materials associations. He expressed the opinion also that the Master Mechanics Association should give more attention to the larger problems affecting railway equipment and operation.

MECHANICAL STOKERS

The report of the Committee on Mechanical Stokers showed very clearly that the practical and economic advantages of such a device have become generally recognized, and that the stoker has reached the commercial stage of development. In fact the report dealt entirely with this side of the question, and did not discuss matters of design or construction, except to state that the stokers are of two classes: The "scattering" (which in a measure imitates the action of hand firing) and the "underfeed." Several makes of stokers were mentioned, most of which have gone out of use, but two are in use in large and increasing numbers: (1) The Crawford "underfeed" stoker, of which 159 are in service and 140 ordered, or 299 in all; (2) the Street "scattering" stoker, with 189 in service and 173 ordered, or 362 in all. The Crawford Stokers are all (except two) on the Pennsylvania System, while the Street stoker is in use on a number of roads.

As to efficiency, the average mileage per stoker failure has been 11,679 miles on the Norfolk & Western R.R. and 4474 miles on the Chesapeake & Ohio R.R. There is still some uncertainty as to a saving in fuel, but a saving of 5% is considered logical from the fact that there is a better fire, the door is kept closed, and the combustion is more complete. There is another possibility of economy in the fact that coals of lower heat value (and lower price) can be used to advantage with mechanical stokers. In starting, steam can be raised quickly and probably with advantage as compared with hand firing, while at terminals the fire can be cleaned or knocked out in much less time than on a hand-fired engine. It is general experience that stoker-fired engines can haul heavier train loads than those fired by hand, and as the former can fire a larger amount of fuel and still retain uniformity in the firing, a higher boiler power is reasonably sure. It must be borne in mind, however, that intelligent care is required to insure efficient operation of the stoker and that the device must constitute an item for locomotive repairs.

The discussion related mainly to the efficiency of the mechanical stoker as proved by actual service experience, and to the advantages which it offers in regard to increased efficiency and economy of railway operation due to the ability to increase train loads. Mr. Crawford stated that it was the desire to increase this load that led the Pennsylvania Lines to take up the matter. The use of the stoker will also permit the use of engines with larger cylinders and greater power than those now in service. A number of engines now being built for the Pennsylvania Lines have cylinders of 2 in. greater diameter than similar hand-fired engines, while some existing engines to which stokers have been applied are having the cylinders bored out to increase the diameter as much as the thickness of the metal will permit. Thus locomotives can be built of greater power than could be operated with hand firing. Mr. Gaines (Cen. R.R. of Georgia) stated that only a few years ago the train tonnage on his road was controlled by the ability of the firemen to deliver coal, but with the introduction of the superheater the fuel economy has been increased to such an extent that the firemen can handle even larger engines than before. He thought there was no doubt of the increased use of stokers on large engines.

Mr. Street (American Stoker Co.) stated that for a comparison of fuel economy it is absolutely necessary to show the coal per mile per hour. He believes that the firemen have come to recognize the mechanical stoker as the "fireman's friend." Mr. Cook (Pennsylvania Lines) has found that at first the performance of stoker engines is good, but then it declines for a while as the men lose interest in the device; but later on, as they get more familiar with its use and its advantages the performance improves materially. Mr. Sinclair pointed out that the stoker will not do its work alone; it needs to be handled carefully and by an intelligent fireman if the best results are to be obtained. An engineer representing the Roumanian Government Railways said that efficiency with hand firing on large locomotives requires good coal and good firemen. As neither of these are available in his country the mechanical stoker is being introduced and promises to give very satisfactory results. We may call attention to the fact that while Mr. Crawford referred to the use of larger cylinders on mechanically fired locomotives, Prof. Benjamin referred to a similar possibility on superheater engines.

LOCOMOTIVES WITH SUPERHEATERS

The committee on this subject made a very brief report of progress, although when continued in 1912 it expected to make a full report on the comparative economy and maintenance cost of locomotives using superheated steam and saturated steam. The increase (if any) in maintenance cost is thought to be negligible. The number of superheater locomotives in the United States and Canada is now 8822, an increase of over 100% since the time of the committee's former report. The engines have been uniformly satisfactory. Troubles with packing and valves, due to the high temperature of the steam, have not developed seriously, and have been overcome by the use of good material in the parts concerned. The cylinders, cylinder bushing, valves and valve bushings must be of a close-grained iron rather harder than is required

when using saturated steam, and the iron should be low in phosphorus and silicon.

The Pennsylvania R.R. is conducting a series of tests of two pairs of engines of the 4:4:2, the 4:6:2 and the 2:8:0 classes, one of each pair using saturated steam and the other having a Schmidt superheater. A voluminous report on these tests of the 4:4:2 engines was presented by Mr. Young (Engineer of Tests, P. R.R.). These showed that an increase of 32% in dynamometer horsepower and 23 to 46% in economy may be expected by the use of superheating. The application of the superheater to a passenger engine will permit an increase of 30% in tonnage rating where starting heavy trains and running at low speeds do not constitute factors in the loading. Where these factors have to be considered, there need be no reduction in the loading of the superheater engine as compared with one using saturated steam.

In close relation to the two reports voted above was a paper read by C. H. Benjamin (Purdue University) on "Tests of Superheater Locomotives." This related to a continuation of tests reported upon in 1911, using the same locomotive but now equipped with a superheater. The important feature of these tests was in regard to the increase in power due to the superheater when the engine is burning the same amount of coal as when it operated on saturated steam. The tests indicated the following: (1) the increase in power due to superheating when burning the same amount of coal (110 to 130 lb. per sq. ft. of grate per hour) varies from 22.6 to 13.0%; (2) for any steam pressure, the percentage of increase in power decreases as the coal consumption increases; (3) for any coal consumption, the increase in power increases as the pressure increases.

Another point was in regard to cylinder diameter. With a coal consumption of 120 lb. per sq.ft. of grate per hour, the increase in power with superheated steam is about 20%. But if the cylinder diameter were made 18¾ in. instead of 16 in. (as with saturated steam) the cutoff with superheated steam could be at a more efficient point, and the increase in power would be raised to about 25% (at 160 to 200 lb. pressure).

In the discussion, Mr. Young (Pennsylvania R.R.) pointed out that very similar results have been arrived at in the Purdue and Pennsylvania tests, carried out independently. He suggested also that conclusions as to increase in cylinder volume should be based on tests with a higher range of speeds than those of the Purdue engine. To increase the volume in large cylinders of maximum available diameter, the stroke may be lengthened slightly, but this must be considered very carefully in relation to possible slipping of wheels with the cylinders of increased stroke. Prof. Benjamin suggested that somewhat similar results in efficiency may be attained by reducing the pressure slightly instead of increasing the cylinder volume.

Firebox Repairs and Boiler Washing

The report of the Committee on Design, Construction and Inspection of Locomotive Boilers related largely to the use of oxyacetylene and electric welding in firebox repair work. It is becoming general practice to weld tubes to the firebox tube sheet, and it is probable that under this method the tubes can be run without removal for more than three years, which is the limit imposed by the new government regulations. For tube welding, the electric process is considered the better and cheaper. Other repairs include the welding of cracks in plates and mud-rings, and the welding of patches in plates. The committee pointed out that each process has a field of its own. It recommended the use of electric welders for roundhouse repairs, while both electric and oxyacetylene welders can be used at the shops, as the latter may be kept busy cutting out and applying new plates.

The committee recommended the washing out of boilers with hot water, and discussed the boiler water conditions as related to water softening, boiler compounds and blowoff cocks. As to flexible staybolts, these are used generally in certain locations only, but some roads are using them throughout the entire firebox, and the committee recommended further experiments in this direction. It suggested also that there should be some slack in these bolts, as if all are screwed tight there will be excessive internal stresses in the firebox. In the discussion, Mr. Pratt (Chicago & Northwestern Ry.) stated that if flexible staybolts are used throughout, there must be some method for taking up slack in the front crown bolts, and this is provided in some special forms of flexible bolts.

The discussion related largely to the use of welders in repair work, indicating that this is a very general and increasing practice, and that as a rule the results are satisfactory. It was generally admitted also that each of the two types mentioned has its particular field of application. Specially satisfactory results have attended the welding of tubes to the tube plate (firebox plate only), and in many cases tube troubles have been eliminated in this way. Mr. Pratt (C. & N. W. Ry.) referred to the government regulation noted above, and to the desirability of getting longer service than three years out of the large superheater tubes when welded into place. He suggested that the purpose of the law is to insure thorough internal inspection of the boiler, and as inspectors admit that the large tubes do not interfere with this, it may be possible to arrange to continue these tubes in service for more than three years.

The old question of the pitting of tubes came up. Mr. Gaines thought this due to the use of steel tubes. He has had this trouble, but eliminated it by abandoning steel tubes. Mr. Bentley, however, has this trouble with both steel and iron tubes on the Chicago & Northwestern Ry.

Three-Cylinder Locomotives

This paper by J. Snowden Bell gave a review of American and foreign three-cylinder simple and compound locomotives, but related especially to simple engines, in which the balancing and the more uniform distribution of the power are characteristic features. The three-cylinder simple locomotive dates back to 1846, when a design was patented by Robert Stephenson and William Howe, but the first locomotives of this type actually built were American engines, built at the shops of the Philadelphia, Wilmington & Baltimore R.R. in 1847. In 1880, and again in 1892 and 1894, some three-cylinder engines for the Erie & Wyoming Valley R.R. were built to the designs of John B. Smith. In 1909, a three-cylinder engine of the 4:4:2 class was built at the shops of the Philadelphia & Reading R.R., to the designs of H. D. Taylor, then Superintendent of Motive Power. Two similar engines and a 4:6:0 engine of the same type were built in 1911 and 1912. No details of performance of these mod-

ern engines were given in the paper, as the railway does not wish to make this information public until there has been greater experience with the engines.

It may be noted that several railways in England and on the Continent are using three-cylinder simple engines (while some also have four-cylinder simple engines). Mr. Bell pointed out that the most important advantage is the substantially uniform turning moment. This gives more rapid acceleration in starting, increased steadiness in running, and reduced destructive action on rails and bridges, together with greater tractive power and utilization of a lower factor of adhesion than a two-cylinder engine. While this involves the use of a crank axle, there is now little objection to such an axle, and in any case an axle with a single crank should be less objectionable than the double-crank axles used on four-cylinder locomotives.

Smoke Prevention

The prevention of smoke from locomotives in and near cities is becoming a more insistent problem for the railways, both in regard to the smoke itself as a nuisance and in regard to the present or prospective relation of this nuisance to the question of electrification. The report, however, did not discuss the problem, but referred to two methods of abating or reducing the smoke nuisance. The first of these is the washing of smoke at roundhouses, and it was stated that several railways are experimenting with a device for this purpose. Presumably this is the device used at the Chicago roundhouse of the Lake Shore & Michigan Southern Ry., which was described and illustrated recently in Engineering News.

The second method is the use of steam jets in the firebox. This has been the subject of extended tests made at the Altoona testing-plant of the Pennsylvania R.R. for a committee of the General Managers Association of Chicago, working in conjunction with the smoke-abatement committee of the Chicago Association of Commerce.

The results of the tests indicate two things: (1) if 4 to 6 lb. of air per lb. of coal fired is delivered over the fire by steam-jet tubes the emission of smoke will be reduced to a very small amount; (2) while the brick arch is a benefit, particularly while the engine is running, the steam-jet combustion tube is of value either with or without the brick arch. The injection of steam and air in combination is more effective than steam or air alone. This method is believed to result in actual economy in fuel consumption, especially in the conditions under which switching engines are operated. The jet tubes should be at least 2 in. diameter, placed in the back or side plates of the firebox and with a $\frac{3}{16}$-in. steam nozzle in each tube. A brief review of the history of this device shows that it was applied as early as 1838. It has been used at various times and has formed the basis of some patented devices for improving combustion.

In the discussion, Mr. Sinclair referred to the early use of steam jets in Great Britain, and to the extremely wasteful methods of firing employed on and permitted by American railways for many years. In fact, one of the troubles at the present time is that the railway officers do not enforce the rules against firing with excessive smoke. As to the steam jet, it is one of the most efficient and economical of smoke-reduction or complete-combustion appliances, and is the basis of numerous patented devices. But to be successful it must be kept in proper condition and handled by a careful fireman. One member stated that several railways at Chicago have equipped a number of locomotives with steam jets, following the lines suggested by the above report on the Pennsylvania R.R. tests, and have had excellent results.

Locomotive Headlights

This subject gave rise to the most animated and protracted discussion of the entire convention. The very brief report of the Committee on Minimum Requirements for Headlights, stated that the functions of a headlight are as follows: (1) to warn employees and the public of the approach of a train; (2) to designate the head of a train; (3) to permit the enginemen to observe wayside objects, such as whistle posts, etc. These requirements can be met by an oil headlight, or a light of the same power as the present oil lamp. The committee proposed a series of tests so that a conclusive report may be made next year. As to high-power headlights, the committee stated that tests confirm the conclusion that they are a decided source of danger on roads with multiple tracks and automatic signals.

Mr. MacBain (Lake Shore & Michigan Southern Ry.) urged very strongly that the convention should take action and state what is the minimum requirement, as such action could be presented to legislative bodies now considering the headlight question. Other speakers thought it might safely be left for a year, so as not to take hasty action, but suggested that the committee should hasten its work and report by next January. Mr. MacBain referred to the Ohio law which provides that the light must enable objects to be seen at a distance of 450 ft. He stated that a 16-in. reflector 9 in. deep with a 25 cp. oil lamp will enable objects to be seen at 350 ft. Legislators are apt to claim that the light should enable the engineman to see a man on the track at such a distance as to stop the train before reaching him, but Mr. Sinclair pointed out that this is requiring the railway to protect people who are violating the law. One member took the position that as high-power lights are unsafe, the association should determine the maximum power of light which it is safe to put on a locomotive.

Mr. Fowler (Midland Ry. of England) rather derided the American headlight, but this merely indicated his unfamiliarity with conditions in this country. A resolution calling for immediate action was lost, but it was decided that while the committee should proceed with its proposed tests it should arrange to have its report distributed by January, or six months in advance of the next meeting.

Maintenance of Electric Railway Equipment

This paper by C. H. Quereau (New York Central R.R.) was of a rather unusual but specially interesting character in that it sought to remove some of the mystery which, to the steam motive-power man (and many another man) seems to surround electricity and electrical work. He explained simply and briefly the meaning of certain fundamental electrical terms. He showed also that from 75 to 90% of the problems of maintenance of electrical equipment can be worked out successfully by a good mechanic who has very limited electrical knowledge but has had experience in the motive-power department of steam roads. He cited several cases of this kind. Of course, some knowledge of electricity is essential, but

this is of an elementary character and practical rather than theoretical. With these conditions understood, men in the mechanical department will have less fear of losing their positions as a result of the increase in electric traction on steam roads.

An electric locomotive is more complicated than the steam locomotive, in number of adjustable or working parts, but the parts are lighter and more easily handled and owing to the ease of replacing parts the engine never needs to go to the shop for a general overhauling. It may readily be seen that there is no particular mystery or danger in the electric locomotive when the records for 1912 (after five years' service) show a cost of less than 4c. per mile and an average of 48,271 miles per train detention due to electrical apparatus, and a record of 249,423 miles without such a detention. We shall print an abstract of this paper later, as of interest to both the old and the young engineer who is not familiar with electrical work, and is apt to regard it with some distrust.

In the discussion, Mr. Keiser stated that on the New York electrified division of the Pennsylvania R.R. the maintenance of locomotives and multiple-unit cars is under a "steam" foreman of 20 years' experience in roundhouse and shop practice. Further, the enginemen on these locomotives become sufficiently familiar with the equuipment in six months' experience to be able to make light repairs on the road. Mr. Bickford (New York Central) said that enginemen find little trouble in learning how to run electric locomotives. But as each type of locomotive has its peculiar features and certain weak points, it is desirable that the men should be particularly familiar with the type of apparatus or the engines they are running, so as to avoid trouble in the handling of high-speed traffic. Mr. Wildin explained that the New York, New Haven & Hartford R.R. has two electric branches which form parts of steam-operated divisions and are under the care of the regular master mechanics. The electrified division at New York has been until recently in charge of an electrical official, but now it is under an assistant mechanical superintendent trained on steam lines, while all the repair work which corresponds to roundhouse work is under a master mechanic of steam experience.

Miscellaneous

Cast-Steel Frames—The Committee on Cast-Steel Locomotive Frames submitted a revised form of the present specifications, which was adopted as "recommended practice," without discussion. While steel with 0.25 to 0.28% carbon is still used, experience indicates that steel of 0.37 to 0.40% carbon is better, and the new specifications require that high-carbon steel frames shall have not less than 0.37% carbon and a reduction in area of not less than 25%. The tensile strength of the material is specified as 70,000 lb., while the old specifications called for not less than 55,000 lb. and in many existing specifications the range is from 60,000 to 80,000 lb. Although vanadium steel is extensively used for frames, the committee did not consider it advisable to submit standard specifications for this class of steel.

Main and Side Rods—The Committee on Main and Side Rods presented its specifications as previously submitted in 1911, and these were adopted as recommended practice. Mr. Gaines (Cen. R.R. of Ga.) referred to the general impression that in American practice the rods are very much heavier than in English practice, even for engines of approximately similar power, but he thought that in engines of comparable dimensions there is not now very much difference. Mr. Fowler (Midland Ry., England) considered that American rods are much the heavier, even for approximately similar engines, but he stated that in English practice the rods are given a special heat treatment to improve the quality of the steel.

Tires and Wheels—The Committee on Steel Tires re-submitted its specifications as presented last year, and these will now go to letter ballot. There was no discussion, but a recommendation to make this a standing committee was referred to the executive committee. The The Committee on Engine and Tender Wheels submitted specifications and gages for steel wheels, and recommended the adoption of the M. C. B. specifications for cast-iron wheels as adopted in 1912. It has done nothing to prepare designs for cast-iron wheels for tenders of 70 tons capacity, as no action has been taken as yet upon the question of increased thickness of flange and its relation to frog and guard-rail clearance. The committee's recommendations will be submitted to letter ballot.

Boiler Tubes—The Committee on Specifications for Materials submitted specifications for steel boiler tubes, agreeing closely with those of the American Society for Testing Materials. The carbon content, however, is given as 0.08 to 0.18% (instead of being "not over 0.15%") and large superheater and arch tubes are included as well as 2½-in. boiler tubes. The hydraulic pressure test is specified as 1000 lb. for the latter, and 800 lb. for tubes of 5 in. diameter and over. These specifications will go to letter ballot.

Special Grades of Steel—The Committee on Alloy Steels and Heat-Treated Steel presented an interesting report showing the varied and increasing use of such special grades of steel. We shall give an abstract of this later. The discussion showed, however, that there has been some considerable trouble due to defective metal. Mr. Young, Engineer of Tests of the Pennsylvania R.R., stated that close inspection and test is essential to securing good material. Otherwise, the heat-treated steel may be inferior to the carbon steel. Further, the heat treatment will make poor steel worse, but will improve good steel.

Standards—The Committee on Revision of Standards suggested a number of minor changes, but showed that a comparatively few members take enough interest to consider the standards or even to vote upon them when submitted to letter ballot. The committee suggested that a larger vote be required for the adoption of standards, and a resolution was passed that no standard would be adopted until it has been listed as a "recommended practice" for at least a year. The only other discussion was on the committee's suggestion that the present specifications for wrought-iron axles should be eliminated, since such axles are undesirable. The committee's recommendations will be submitted to letter ballot.

Officers

The election of officers resulted as follows: President, D. R. MacBain, Superintendent of Motive Power, Lake Shore & Michigan Southern Ry., Cleveland, Ohio; Vice-

Presidents, F. F. Gaines (Central R.R. of Georgia), E. W. Pratt (Chicago & Northwestern Ry.), and Wm. Schlafge (Erie R.R.); Treasurer, Angus Sinclair, New York. The Secretary is Joseph W. Taylor, of Chicago.

The Tunnel Accident at Fifty-sixth St. and Lexington Ave. New York City

The cave-in of three to four hundred tons of rock, which took place in the subway excavation at Fifty-sixth St. and Lexington Ave., at 6:10 p.m. on June 14, was caused by seams in the solid rock. Two of these seams running diagonally on each side and above the roof of the express tunnel, met at about 11 ft. above this roof, extending longitudinally on both sides about 30 ft., and forming what is commonly known as a bell. The seams parted, either as the result of a blast or from the dead weight of the rock, and the cohesion between them was insufficient to bear the mass which slid and fell into the excavation for the express tunnel. Ten workmen were killed and three injured.

The rock which fell formed the roof of what was destined to be the express tunnel, being situated beneath the tracks for the local tunnel. From the cave-in, the excavation extended about 70 ft. north and 140 ft. south.

The shoring was of the heaviest timber used for such a purpose, all being of 12x12-in. yellow pine. Longitudinal beams, or wallplates, rested on either a rock shelf or upon posts. From these wallplates, arch beams were placed every 4 ft., thus allowing only 3 ft. of rock between the beams.

The mass broke into large pieces, the maximum being about 15 ft. square and 8 ft. thick. In falling it carried away about 8 cross timbers. The wallplates remained in position.

At the informal hearing before Public Service Commissioners McCall and George V. S. Williams, on June 16, at 3 p.m., Mr. Alfred Craven, Chief Engineer of the Commission, Mr. Robert Ridgway, Engineer of Subway Construction, Public Service Commission and Mr. Bayly Hipkins, Chief Engineer of the Bradley Contracting Co., which is doing the work of subway excavation, all stated that the shoring was of sufficient strength to carry any normal load; and that no timber would have sufficed under such excessive load conditions. The danger could not be foreseen for the rock formation, Manhattan schist, was good. The rock within the confines of the seams was of too great bulk to give forth any false vibrations from the usual method of sounding. The accident is, apparently, one of the dangers always present in tunneling work which it is impossible wholly to guard against.

Flood Protection Measures are now being considered by several of the large cities which suffered from the unprecedented floods a few weeks ago. The city of Columbus, Ohio, has appointed John W Alvord, of Chicago, as consulting engineer to prepare plans and report on flood protection. The city of Dayton, Ohio has appointed a board of consulting engineers to consider the Miami Valley drainage and the flood protection of the city. This board is composed of John W Alvord, of Chicago, Daniel W Mead of Madison, Wis., and S. M. Woodward, Professor of Hydraulics at The University of Iowa. The board will consider alternative plans for the Miami Valley Work which have been prepared by Mr. Morgan, of Dayton.

Steam Jets for Smokeless Combustion on Locomotives*

These tests were made to determine the merits and proper application of steam-jet combustion tubes in a locomotive firebox for abating smoke, both with and without a brick arch, the special purpose being the development of a specification applicable to locomotives operating in Chicago.

In brief, the results show that if from 4 to 6 lb. of air per pound of coal fired is delivered over the fire by steam-jet tubes, the emission of smoke will be reduced to a very low amount, and that while the brick arch is a benefit (particularly while the locomotive is running), the steam-jet combustion tube is of value either with or without a brick arch.

The locomotive was equipped with a brick arch consisting of six rows of bricks supported on two 3-in. tubes, with a 5-in. gap between the flue sheet and the front of the arch.

There were eight steam-jet combustion tubes along each side of the firebox, six above the fire door on the back head, and four below the fire door. The tubes consisted of pieces of 2-in. boiler tube, approximately 6 in. long, inserted in place of stay-bolts. Each tube was provided with a $\frac{3}{8}$-in. steam nozzle connected to a ½-in. steam line. Separate valves controlled the steam admission to each set of tubes.

CONCLUSIONS

SMOKE—The steam-jet combustion tube has a decided value in reducing smoke under the widely varied conditions of these tests. The air injected by the tube was found to be the greatest factor in reducing smoke, although a small amount of steam seems essential in smoke reduction.

When using steam jets, injecting air into the firebox, it was apparent that a greater reduction in smoke was accomplished by their use with improper firing as compared with careful firing.

The firebox temperature was found to be higher when the arch was in service as compared with the plain firebox, although the data do not consistently show that a reduction in smoke follows increased firebox temperature.

The brick arch showed a considerable reduction of smoke when running, due presumably to higher firebox temperatures, and better mixing of the gases of combustion. In the standing tests, the brick arch showed little, if any, benefit in the way of smoke reduction when the proper mixture of air and steam is supplied.

The steam-jet tubes seem to give the best results in preventing smoke when located so that the injected air and steam meet the flame as high as possible above the fuel bed. If the arch is used, the best results seem to be obtained when the air passes underneath the arch as high as possible above the fuel bed.

The arch gives better results in smoke prevention if it fits tight against the flue sheet. A tight arch, however, has the practical disadvantage of collecting deposits of sparks and eventually closing the lower flues.†

An efficient design of smoke-box blower is an important factor in smoke abatement. Air openings in the fire door are of slight assistance, as they are capable of supplying only about 10% of the air necessary above the fire and a very small percentage of the total air for complete combustion.

The best results were obtained when from 4 to 6 lb. of air per pound of coal fired was injected by the steam tubes from the back head above the fire door. The total amount of air, including that which was introduced above the fire, should be not less than 13 lb. per pound of coal for good smoke prevention.

The tests indicate that the best results can be obtained when the least amount of steam is injected with the greatest amount of air.

ECONOMY—The use of the steam-jet tubes results in considerable economy, and in the efficiency tests an increase in evaporation was obtained.

SPARKS—The steam-jet tubes apparently reduce the weight of sparks discharged from the stack, but the data were not of a character to firmly establish this point.

*From a report of tests made by the Pennsylvania R.R. at Altoona for a committee of the Railway General Managers Association of Chicago, which is working in conjunction with the smoke abatement committee of the Chicago Association of Commerce. This report was submitted at the annual convention of the Railway Master Mechanics Association by the Committee on Smoke Prevention.

†As to this, one speaker in the discussion, stated that he puts a spark hopper between the brick arch and the tube plate. In this way he gets the advantage of a tight arch and avoids trouble from the accumulation of sparks and dirt against the tubes.—Ed.

BLOWER VALVE—There is a necessity for a quick-acting, easily operated valve capable of giving reasonable graduations in pressure.

STEAM NOZZLES—It was found that the steam nozzles were being worn by the steam and this accounts for the inability of the steam lines to supply as great a pressure to the jets as desired in some of the later tests. The nozzles were made of brass. They should be made of steel and, if necessary, hardened.

The $\frac{1}{4}$-in. steam nozzle seems to be the desirable size to use in a 2-in. tube.

There is noise incident to the use of the steam-jet tubes in the most efficient arrangement. If the tubes are located in the cab, they should be covered with a cast-iron box provided with a cast-iron air intake from a point outside the cab, the air intake being provided with a muffler.

NOTES FROM THE ENGINEERING SCHOOLS

MICHIGAN COLLEGE OF MINES—A series of extension lectures through the larger towns of the lower Michigan peninsula has been undertaken. The lectures will be given by Prof. E. D. Grant and the subject will be "Copper Mining in Michigan." They will be illustrated by lantern slides and by specimens of copper-bearing minerals.

CARNEGIE INSTITUTE OF TECHNOLOGY—A pamphlet has been published by the Institute, entitled "Suggestions Concerning the Choice of a Course in Engineering." The pamphlet is intended to give the students in the preparatory classes some elementary knowledge of what the work of an engineer is and what classes of work engineers taking up different specialties will be called upon to perform. Following the introductory pages, devoted to an explanation as to what in general the work of the engineer consists of, a separate section is devoted to each of the special courses, such as chemical engineering, civil engineering, commercial engineering, mechanical engineering, etc.

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A Broken Axle on a Big Four freight train, near Stockwell, Ind., on June 1, caused the demolition of twelve cars. Two tramps were killed and five more injured.

A Boiler Explosion on the steam barge "E. M. Peck," of Duluth, on June 11, in Racine harbor, caused the death of four men, the injury of two, while two others are missing.

An Unseaworthy Ferryboat, crossing the river Tcheptsa, in Russia, toward the town of Glazov sank on June 5. Fifty persons were drowned.

Five Tons of Fireworks Exploded on June 11, in a flour mill at Deerfield, Mass. The damage, due to the wrecked buildings in the vicinity, is estimated at $40,000, according to press dispatches.

The Destruction, by Fire, of the Groveland Bridge, which carries the only trolley line from Haverhill to Groveland and West Newbury, Mass., on June 3, caused the cutting off of communication between the latter towns and Haverhill. The fire was presumably caused by the electric wires on the bridge, which was an old structure.

A Broken Truck on the Tender of the leading engine of a freight train on the Clinchfield Division of the Norfolk & Western R.R., near Cleveland, Ohio, on June 8, caused the two locomotives which were drawing the train to plunge down a steep embankment. The leading engine crashed into a house, situated at the foot. Its two occupants were scalded to death by the escaping steam from the locomotive. The engineer and the fireman of this locomotive were killed.

A Big Four Engine Sideswiped Two Box Cars in the railroad yards near Norwood, Ind., on June 6. The engineer was killed by escaping steam from broken steam pipes. The General Manager of the Big Four lines stated that the accident resulted from the yard switching crew backing a string of box cars onto a siding too short to contain all the cars.

The New York State Hydro-Electric System, which was proposed in connection with a plant at Vischer's Ferry on the Mohawk River, near Albany, has been temporarily killed off by Governor Sulzer's veto of a bill appropriating $600,000 for commencing the work. The veto was not made on the grounds that a state hydro-electric system was inadvisable, but that the bill was defective and the project to develop power at this point was open to criticism. The governor's memorandum shows that, in his opinion, a better situation would be at Long Sault, on the St. Lawrence River, where a much greater amount of power can be developed and where the river shows greater uniformity of flow throughout the year. He proposes also, to appoint a commission of experts and disinterested citizens to investigate the Vischer's Ferry, Long Sault, Niagara, Genesee, and other possible water-power developments to determine what course is best for the state. He expects to have the report ready for the consideration of the next legislature.

A New Water-Supply for Winnipeg, Manitoba, from Shoal Lake, the western part of the Lake of the Woods, is to be reported on by Rudolph Hering and James S. Fuertes, of New York City, and F. P. Stearns, of Boston, who have already spent some time on the ground. In 1897, when the population of Winnipeg was 40,000, Mr. Hering recommended a ground water-supply for the city, which has been developed to a capacity of some 9,000,000 Imp. gal. per day and is now being extended to 20,000,000 Imp. gal. capacity. This water has the great hardness of 150 to 170 parts per million of temporary hardness and double that amount of permanent hardness. In 1907, the city appointed a board of consulting engineers to report on a larger and softer supply. The board, which consisted of James H. Fuertes, R. S. Lea, J. E. Schwitzer and Geo. C. Whipple, recommended a filtered supply from the Winnipeg River, but no action to that end has ever been taken. The population of Winnipeg is now estimated to be some 200,000, or five times what it was fifteen years ago.

Increased Activity in Shipbuilding—Returns received by the Bureau of Navigation of the Department of Commerce indicate that the current fiscal year will show an output of American shipyards greater than for any of the past four years, and equal to the average annual output for any series of active years of construction. For the nine months ended Mar. 31 the merchant vessels built in the United States and officially numbered by the Department comprised 1114 of 260,265 gross tons, compared with 1051 of 151,341 gross tons for the corresponding nine months a year ago. As the spring and early summer are generally the season of greatest progress, the output for the year will probably reach 400,000 tons. Steel steamers built aggregate 151,507 tons, compared with 75,507 tons for the corresponding nine months a year ago. Shipbuilding on the the Great Lakes shows little change, but the total output on the Atlantic seaboard has increased from 64,522 tons to 161,061 tons. Wood sailing vessels show a decrease and form only a small fraction—11,971 tons—of the total for the United States.

The New Test-Weight Car Equipment ordered by the Bureau of Standards, Washington, D. C., for the testing of railroad scales differs radically in principle from any in use. Instead of the wheels, brakes and other movable parts of the car constituting part of the standard weight, as is the usual practice, a series of 10,000-lb. weights and a truck for moving them on the scales, will be carried in a specially designed car provided with a power crane, etc., for handling the weights. This allows the weights to be standardized and transported to any point with a reasonable assurance that they will remain constant. Under the present method, with the running gear included in the weight of the test car, it is necessary to verify this weight at frequent intervals.

The complaints of shippers against the railroads to the effect that the latter are charging excessive weights has been called to the attention of the Bureau, which expects to begin, soon after July 1, an inspection of the railroad scales, starting with those of the Eastern lines. This is a new departure as the railroads have always operated their own scales entirely free from federal inspection.

Lock-Gate Accident on Welland Canal—A rather unusual accident happened on the Welland Canal about 5 o'clock Sunday morning, June 8, when all four gates of Lock 1, at Port Dalhousie, were carried out and traffic through the canal was interrupted for about 36 hours.

The steamer "Lloyd S. Porter," of the Interlake Line, upbound, had just finished laying up two barges and was proceeding to tie up along the east approach wall about 200 yd. below the lock, to await the preparation of the lock to receive her. In the meantime, the steamer "Neepawah," also upbound, was about midway in the level between Locks 1 and 2. The upper gates were still open and the water in the lock at the level of the upper reach. The engineer of the "Porter"

misunderstanding the captain's signal to reverse, gave her speed ahead. When she was about 50 ft. from the lower gates, the engines were finally reversed, too late. She struck the west gate a blow sufficient to unmiter the gates. The lift at this lock is 14 ft. and the rush of water tore the two lower gates from their anchorages and they became firmly wedged, one above the other, between the lock walls. The sudden rush of water from the reach above also carried out the upper gates down through the lock and over the two lower gates into the harbor below. The captain of the "Neepawah," which was approaching Lock 2, became aware of what had happened, and, giving his vessel full speed ahead, succeeded in making Lock 2 before the water had lowered enough to ground his boat or for the current to carry her back toward Lock 1.

The reaches between Locks 1 and 2 of both the old and new canals are connected, and, had it not been for the very large pondage thus afforded, the "Neepawah" would have been unable to get safely in Lock 2 and the accident would have been much more serious.

The pondage above Lock 1 is so great that it took fully 12 hr. for the water above Lock 1 to get down to Lake Ontario level. This also delayed the commencement of making repairs and the resuming of traffic after the repairs had been made.

Four spare gates were put in and navigation resumed about 6 o'clock Monday evening, June 9. The damage is estimated at about $6000. The "Porter" received very small injury, her rudder being slightly damaged.—From information furnished by W. H. Sullivan, Superintending Engineer, Welland Canal, St. Catharines, Ont.

PERSONALS

Mr. J. T. Morrison, formerly Traffic Manager of the Pullman R.R., Chicago, Ill., has been elected Vice-President.

Mr. W. A. Royce, a graduate of the Michigan State College of Mines, has been appointed City Engineer of Traverse City, Mich.

Mr. W. F. Devine, of Erie, Penn., has been appointed Superintendent of Motor Cars, Chicago, Peoria & St. Louis R.R., Springfield, Ill.

Mr. W. S. Hawkins, of Jefferson City, Mo., has been appointed State Highway Engineer of Missouri, at a salary of $2000 per annum.

Mr. W. A. Durham has resigned as Assistant General Manager of the Missouri, Kansas & Texas Ry., St. Louis, Mo., and the office has been abolished.

Mr. Willis E. Morse, General Manager of the Denver, Northwestern & Pacific Ry., has been elected Vice-President and General Manager.

Mr. Theodore O. Sechrest has been appointed General Mechanical Inspector of the Louisville & Nashville R.R., with headquarters at Louisville, Ky.

Mr. Paul Schultze, M. Am. Soc. C. E., formerly City Engineer of Troy, N. Y., has been appointed Deputy Commissioner of Highways of New York State.

Mr. Dan D. Schrenck, Treasurer of the Toledo & Indiana R.R., Toledo, Ohio, has been elected President, succeeding his father, the late S. C. Schrenck.

Mr. F. W. Mellor, formerly of Warren & Wetmore, Architects, New York City, has been appointed Architect of the New York, New Haven & Hartford R.R.

Prof. F. A. Laws, M. Am. Inst. E. E., Associate Professor of Electrical Engineering at the Massachusetts Institute of Technology, has been promoted to be Professor.

Mr. L. E. Moore, Assoc. M. Am. Soc. C. E., has been promoted from Assistant Professor to be Associate Professor of civil engineering at the Massachusetts Institute of Technology.

Mr. Frank P. Barclay, former Master Mechanic of the Illinois Central R.R., at McComb, Miss., has been promoted to be Superintendent of Motive Power of the lines south of the Ohio River.

Mr. R. S. de Mitkiewicz, formerly connected with the truck department of the Peerless Motor Car Co., has joined the staff of the truck department of the American Locomotive Co., New York City.

Mr. Joseph H. Nash, former Superintendent of the Burnside Shops, Illinois Central R.R., Chicago, Ill., has been promoted to be Superintendent of Motive Power of the lines north of the Ohio River.

Mr. George B. Preston, M. Am. Soc. M. E., recently appointed Assistant Professor of steam engineering at Columbia University, retains his connection with Westinghouse, Church, Kerr & Co., until July 1.

Mr. George R. Sinnickson, Assoc. M. Am. Soc. C. E., formerly Division Engineer of the Pennsylvania R.R., at Williamsport, Penn., has been promoted to be Superintendent of the Schuylkill division.

Mr. A. N. Doud has resigned his position with the Acme Equipment & Engineering Co., of Cleveland, Ohio, to enter practice for himself under the firm name of the A. N. Doud Engineering Co., Cleveland.

Mr. J. J. Rhodes, formerly Division Engineer of the Pennsylvania R.R., at Altoona, Penn., has been appointed Superintendent of the Central division of the Philadelphia, Baltimore & Washington R.R.

Mr. G. O. Huckett, former Road Foreman of engines of the Chicago, Burlington & Quincy R.R., at Wymore, Neb., has been promoted to be Master Mechanic at Sterling, Ohio, succeeding Mr. H. M. Barr, resigned.

Dr. D. E. Thomson, President of the Mexican Northern Power Co., and a prominent financier of Toronto, Ont., has been elected President of the Porto Rico Ry., which is controlled by Canadian capitalists.

Mr. C. I. Leiper, formerly Division Engineer of the Philadelphia, Baltimore & Washington R.R., at Jersey City, N. J., has been promoted to be Principal Assistant Engineer with headquarters at Wilmington, Del.

Mr. J. W. Howard, formerly Instructor, has been promoted to be Assistant Professor of topographical engineering at the Massachusetts Institute of Technology. Mr. Howard graduated from the Institute in 1903.

Mr. Samuel Barnes, recently with the Cape Girardeau-Jackson Interurban Ry., Cape Girardeau, Mo., has been appointed Superintendent of the Jersey Central Traction Co., with headquarters at Keyport, N. J.

Mr. Alexander Robertson, former President of the Western Maryland Ry., has been appointed Assistant to the President of the Missouri Pacific Ry. system, with headquarters at St. Louis, Mo., succeeding Mr. Finlay J. Shepard.

Mr. H. L. Watson, Jun. Am. So. M. E., formerly Sales Engineer of the Allis-Chalmers Co., of Milwaukee, Wis., at Boston, Mass., has been appointed Sales Manager of the De Laval Steam Turbine Co., Trenton, N. J.

Mr. G. E. Russell has been promoted from Assistant Professor to be Associate Professor of civil engineering at the Massachusetts Institute of Technology. Prof. Russell graduated from the Institute in the class of 1900.

Mr. R. J. Knight, formerly Assistant Roadmaster of the Colorado & Southern Ry., at Trinidad, Colo., has been appointed Roadmaster of the Northern Pacific Ry., at Staples, Minn., succeeding Mr. Philip McGuire, retired.

Mr. J. M. Scott, former Supervisor of Transportation of the Baltimore & Ohio R.R., and more recently Assistant Superintendent at Keyser, W. Va., has been promoted to be Superintendent of the Monongah division at Grafton, W. Va.

Mr. William Lynch, formerly Trainmaster of the Texas & Pacific Ry., at Bunkie, La., has been promoted to be Superintendent of the Rio Grande division, at Big Spring, Tex., succeeding Mr. A. G. Whittington, resigned, as noted elsewhere.

Mr. G. S. Strout, Asoc. M. Am. Soc. C. E., formerly Assistant Engineer of the State Railroad Commission of California, has been appointed Assistant Engineer for John S. Eastwood, Consulting Hydraulic Engineer, of San Francisco, Calif.

Mr. Newman Erb, of New York City, President of the Ann Arbor R.R., the Minneapolis & St. Louis R.R., the Pere Marquette R.R., and the Tennessee, Alabama & Georgia R.R., has been elected President of the Denver, Northwestern & Pacific Ry.

Mr. A. G. Whittington has resigned as Superintendent of the Rio Grande division of the Texas & Pacific Ry., at Big Spring, Tex., to become Superintendent of the San Antonio division of the International & Great Northern Ry., at San Antonio, Tex.

Prof. George F. Swain, President of the American Society of Civil Engineers, and Professor of Civil Engineering at Harvard University, has been chosen Chairman of the Boston Rapid Transit Commission, of which he has been a member since 1894.

Mr. Alfred E. Roche, Deputy City Engineer of Troy, N. Y., has been promoted to be City Engineer, succeeding Mr. Paul Schultze, M. Am. Soc. C. E., resigned as noted elsewhere. He

is succeeded as Deputy City Engineer by Mr. John C. Watts, at present Assistant City Engineer.

Mr. George C. Koons, formerly Engineer of the Cumberland Valley R.R., at Chambersburg, Penn., has been appointed Assistant Engineer of maintenance-of-way of the Pennsylvania R.R. in charge of bridges and structures, with headquarters at Philadelphia, Penn.

Mr. John Duder, Assoc. M. Am. Soc. C. E., Principal Assistant City Engineer of Salt Lake City, Utah, has resigned to become Chief Engineer for the A. A. Clark Co., Contractors, of Salt Lake City. Mr. Duder has served in the city engineering department for many years.

Mr. Earle B. Phelps, Assoc. Am. Soc. C. E., Consulting Sanitary Engineer, of New York City, and Assistant Professor of research in chemical biology at the Massachusetts Institute of Technology, has been promoted to be Associate Professor of research in chemical biology.

Mr. James Mapes Dodge, Past-President of the American Society of Mechanical Engineers, Chairman of the Board of Directors of the Link-Belt Co., Philadelphia, Penn., was awarded the honorary degree of Doctor of Engineering by Stevens Institute of Technology at the recent commencement.

Mr. Philip Carroll, Assistant General Superintendent of the Southern district of the Missouri Pacific Ry. System, has been appointed Superintendent of the Missouri division, with headquarters at Poplar Bluff, Mo., succeeding Mr. J. Cannon, who has been transferred to the Eastern division at Sedalia, Mo.

Mr. J. H. Kimball, M. Am. Soc. C. E., Designing Engineer for the Commissioners of Sewerage, Louisville, Ky., has resigned to become associated with Stonestreet & Ford, Consulting Engineers, of Louisville, Ky. Mr. Kimball graduated in sanitary engineering at the Massachusetts Institute of Technology in 1894.

Mr. S. G. Porter, M. Am. Soc. C. E., for the past six years Chief Engineer of the Arkansas Valley Sugar Beet & Irrigated Land Co., Holly, Colo., has resigned to accept the position of Inspection Engineer on the staff of the Commissioner of Irrigation, Department of the Interior, Canada, with headquarters at Calgary, Alta.

Prof. Henry M. Howe, M. Am. Inst. M. E., Senior Professor of metallurgy at Columbia University, will retire from active work at the end of the present term, June 30, with the title of Professor Emeritus. Prof. Howe graduated from Harvard University in 1869 and from the Massachusetts Institute of Technology in 1871. He has been Professor of metallurgy at Columbia since 1897.

Mr. A. B. Clark, formerly Principal Assistant Engineer of the Philadelphia, Baltimore & Washington R.R., at Wilmington, Del., has been promoted to be Assistant Engineer of maintenance-of-way of the Pennsylvania R.R. in charge of roadway and track, with headquarters at Philadelphia, Penn. Mr. Clark graduated from Lafayette College in 1891 and entered the service of the Pennsylvania R.R. as a rodman.

Mr. James C. Harding, M. Am. Soc. C. E., has resigned from the firm of George W. Fuller, M. Am. Soc. C. E., Consulting Hydraulic Engineer and Sanitary Expert, New York City, to open an office of his own at 170 Broadway, New York City, for practice in hydraulic and sanitary engineering. Mr. Harding has been a member of the firm of George W. Fuller for the past two years, and has had 21 years' experience in engineering work.

Mr. J. W. Knightlinger, formerly Assistant Superintendent of the Sacramento division of the Southern Pacific Ry., has been appointed Superintendent of Morgan's Louisiana & Texas R.R. & Steamship Co., and the Louisiana & Western R.R., at New Orleans, La. Recently Mr. Knightlinger has been Assistant Superintendent of these lines. He began railway work in 1894 as a messenger with the Chicago, Milwaukee & St. Paul Ry., at Mason City, Iowa.

Mr. Carl F. Pilat, a member of the firm of Hinchman & Pilat, Landscape Architects, New York City, has been appointed Landscape Architect of the Department of Parks of the Boroughs of Manhattan and Richmond, New York City, at a salary of $4000 per annum, succeeding Mr. Charles D. Lay, resigned. Mr. Pilat is a graduate of Cornell University, class of 1900, and has been associated with Mr. Frederick B. Hinchman for the past 13 years.

Mr. J. B. Carothers, recently Special Engineer on the staff of the Chief Engineer of the Baltimore & Ohio R.R., has been appointed Assistant to the General Superintendent, with headquarters at Cincinnati, Ohio. Mr. Carothers has had many years' experience in both the engineering and operating departments. He has been Division Engineer, Division Superintendent, and at one time was Chief Engineer of Maintenance-of-Way of the Baltimore & Ohio Southwestern R.R.

Mr. Edward Chambers, formerly Assistant Freight Traffic Manager of the Atchison, Topeka & Santa Fé Ry., Coast Lines, at San Francisco, Calif., has been elected Vice-President of the Atchison, Topeka & Santa Fé Ry., in charge of traffic, with headquarters at Chicago, Ill. Mr. Chambers began his railway experience as a freight handler at Pueblo, Colo., with the Atchison, Topeka & Santa Fé Ry. in 1878. He has passed through practically every grade in the freight-traffic department.

Col. B. W. Dunn, of New York City, Chief Inspector of the Bureau of Explosives and Combustibles of the American Railway Association, has been elected a member of the council of the Underwriters' Laboratories, Chicago, Ill. The work carried on by Col. Dunn is similar in many respects to that undertaken by some departments of the Underwriters' Laboratories, and the addition of Col. Dunn to the council is expected to aid the establishment of uniformity in fire prevention engineering practice.

Mr. H. E. Stitt, for the past 10 years in blast-furnace work for the Jones & Laughlin Steel Co., the Elyria Iron & Steel Co., and the Carnegie Steel Co., of Pittsburgh, Penn., has been appointed Associate Designing Engineer of the Samuel Austin & Son Co., of Cleveland, Ohio. Recently Mr. Stitt was Resident Engineer and Construction Superintendent for A. G. McKee, M. Am. Soc. M. E., Consulting Engineer, of Cleveland. Mr. Stitt was also Assistant Engineer for the late Anton Burchard, Consulting Engineer of Cleveland.

Mr. Howard C. Phillips, Assoc. M. Am. Soc. C. E., Valuation Engineer of the Atchison, Topeka & Santa Fé Ry. System, Chicago, Ill., has been elected Alumni Trustee of Princeton University. Mr. Phillips graduated from Princeton in 1890 and has been a prominent member of various alumni associations, being at one time President of the Association of Southern California. The Princeton Engineering Association, composed of the graduates from technical courses, has long sought to place an engineering graduate on the Board of Trustees, and the election of Mr. Phillips was accomplished by a large majority of the alumni vote.

Mr. P. H. Morrissey, former Grand Master of the Brotherhood of Railroad Trainmen, has been appointed Assistant to the Vice-President in charge of operation of the Chicago, Burlington & Quincy R.R. Mr. Morrissey was born at Bloomington, Ill., Sept. 11, 1862. He entered the railway service with the Chicago & Alton R.R. in 1879, and served successively as a passenger brakeman, freight brakeman and freight conductor. In 1890 he was elected Vice-Grand Master of the Brotherhood of Railroad Trainmen, and in 1895 Grand Master. In this office he was prominent in the amicable settlement of several labor disputes and served on a number of arbitration boards.

Mr. C. M. Larson, Assoc. M. Am. Soc. C. E., Assistant Chief Engineer of the Wisconsin State Board of Assessment and the Railroad Commission of Wisconsin, has been chosen to succeed Prof. W. D. Pence, M. Am. Soc. C. E., as Chief Engineer. Prof. Pence was recently appointed one of the five engineers in charge of the Interstate Commerce Commission's valuation of the railroads of the United States, as noted in our issue of May 15, 1913. Mr. Larson is a native of Wisconsin and a graduate of the University of Washington. He has been connected with the State Board of Assessment since 1903, with the exception of a year's work in railway construction in Mexico.

Prof. F. O. Marvin, M. Am. Soc. C. E., Dean and Professor of civil engineering at the University of Kansas, has resigned after 38 years association with the University. Prof. Marvin has felt obliged to give up his active duties because of ill health, but in recognition of his long and faithful service the Board of Administration has elected him Advisory Dean, and his connection with the University will not be severed. Prof. Marvin has been Dean of the College of Engineering since 1891. He is succeeded as Dean by Prof. P. F. Walker, M. Am. Soc. M. E., Professor of Mechanical Engineering. Prof. Walker is a graduate of the University of Maine, class of 1896, and of Cornell University.

Mr. Charles B. Buerger, Assoc. M. Am. Soc. C. E., recently Assistant Engineer, Department of Gas, Water Supply and Electricity, City of New York, and for the past two years Senior Assistant Engineer in the filtration division of the department, has joined the firm of George W. Fuller, M. Am. Soc. C. E., Consulting Hydraulic Engineer and Sanitary Expert, New York City. Mr. Buerger entered the service of the Bureau of Filtration, Philadelphia, Penn., in 1906, as a mechanical engineer, and was engaged upon the design, construction and testing of pumping stations and equipment. Later he was engaged on the design of the preliminary filters at Torresdale and Belmont, and of the filter plant at Queen Lane.

Mr. C. A. Preston, formerly Division Superintendent of the Pennsylvania R.R. at Altoona, Penn., has been appointed Valuation Engineer, with headquarters at Philadelphia, Penn. Mr. Preston graduated from the Polytechnic College at Philadelphia in 1872. He entered the service of the Cattaraugus Ry. the same year as rodman. After five years' experience in railway location he joined the ill-fated Collin's expedition to build the Madeira & Mamoré Ry. in Brazil, in 1878. After his return to this country he entered the service of the Pennsylvania R.R. on surveys on the West Pennsylvania division. From 1880-'82 he was Principal Assistant Engineer of the Mexican National Ry. In April, 1882, he returned to the Pennsylvania R.R. as Assistant Supervisor at York, Penn. He was subsequently promoted to be Supervisor, Assistant Engineer, Principal Assistant Engineer and Superintendent.

Mr. Joseph T. Richards, M. Am. Soc. C. E., formerly Chief Engineer of maintenance-of-way of the Pennsylvania R.R., has been appointed Consulting Engineer of maintenance-of-way. Mr. Richards is 68 years old and has been in engineering work since 1869, when he entered the service of the Pennsylvania R.R. as a rodman on the construction work for the shops at Altoona, Penn. He was engaged in various engineering positions in railway and construction work in Pennsylvania until 1876, when he was appointed Assistant Engineer of maintenance-of-way; and from 1877 to 1883 he was Principal Assistant Engineer of maintenance-of-way of the New Jersey division of the Pennsylvania R.R. Later he was Assistant to the Chief Engineer and Assistant Chief Engineer. He was appointed Engineer of maintenance-of-way in 1893 and 10 years later was promoted to be Chief Engineer of maintenance-of-way.

OBITUARY

Henry F. Rice, a former General Superintendent of the Chicago, Rock Island & Pacific Ry, died at his home in Des Moines, Iowa, June 7.

John Jacobs, for many years a civil engineer employed by the Illinois Central R.R., died at his home in Chicago, Ill., June 6. He was 87 years old.

Everett H. Woodruff, President of the firm of John T. Woodruff & Sons, Contractors, of Flushing, N. Y., was among those killed in the collision on the New York, New Haven & Hartford R.R., on June 12, at Stamford, Conn.

Eugene McCarthy, a member of the firm of McCarthy Bros., General Contractors of Cincinnati, Ohio, was killed in Hyde Park, Cincinnati, by a switch engine on the tracks of the Norfolk & Western Ry., on June 2. He was 61 years old.

James Gaston Kirkpatrick, a civil and hydraulic engineer of Jackson, Miss., died June 6. He was a graduate of the University of Mississippi and a brother of Mr. Walter G. Kirkpatrick, M. Am. Soc. C. E., City Engineer of Birmingham, Ala.

William Dixon Collingwood, formerly one of the leading building contractors of Columbus, Ohio, died recently at the age of 65 years. For many years he was associated with George Donaldson under the firm name of Donaldson & Collingwood.

William Simpson, one of the best known building contractors of Canada, died in Toronto, Ont., June 4, aged 69 years. He was born in Scotland and came to Canada in 1867. For a number of years he lived in Winnipeg, Man., and was contractor for several prominent buildings there.

Francis E. Ward, former General Manager of the Chicago, Burlington & Quincy R.R., died at Chicago, Ill., June 6. He was born July 29, 1867, in Montreal, Que. His railway work began in 1881 as an apprentice clerk and stenographer in the mechanical department of the Grand Trunk Ry. He was General Superintendent of the Montana Central Ry. in 1898, and following its absorption by the Great Northern he was General Superintendent of the latter railway. Later he was General Manager of the Great Northern Ry., resigning this position in 1907 to accept the same office with the Chicago, Burlington & Quincy R.R. Since his resignation as General Manager he had done special work on the staff of the President of the company.

Joseph G. Cutler, Roadmaster of the Northern Pacific Ry., at Walla Walla, Wash., died May 29. He was born in Cambridge, Mass., 55 years ago, and graduated from Lawrence Scientific School, Harvard University. His engineering experience began in 1881 as a rodman on the New York, West Shore & Buffalo R.R. Later he served in the engineering departments of the Canadian Pacific Ry., the Boston, Hoosac Tunnel & Western R.R. and the Burlington & Missouri River R.R. In 1888 he went to Washington State where he became Resident Engineer and later Chief Engineer of the Washington & Columbia River R.R. When the Northern Pacific Ry. acquired control he was made Assistant Superintendent, and subsequently Roadmaster of the Pasco-Walla Walla branch of the latter road.

Charles Henry Cramp, former President of William Cramp & Sons, famous shipbuilders, of Philadelphia, Penn., died June 6. Mr. Cramp was 85 years old on May 9 last, and had been in feeble health for a long time. Charles H. Cramp, a son of William Cramp, founder of the firm, was born in Philadelphia, in 1828. He received his education in the public schools; he graduated from the Central High School, and entered the shops of his father's plant as a common workman. In 1857 he was taken into the partnership. On the death of William Cramp, the father, in 1879, Charles Henry became the head of the firm, which had been incorporated seven years previously as the William Cramp & Sons Ship & Engine Building Co., which has constructed many of the best known American war vessels as well as many war vessels for the Russian, Japanese and other foreign navies.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.
June 20-21. Annual convention at Seattle, Wash. Secy., Jesse A. Jackson, City Hall, Seattle, Wash.

AMERICAN INSTITUTE OF ELECTRICAL ENGINERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESSES.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminister, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young 220 King St. West. Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 17-19. Annual summer meeting at Buffalo, N. Y. Secy., E. A. Scott, 29 W. 39th St., New York City.

INTERNATIONAL GEOLOGICAL CONGRESS.
Aug. 7-14. Twelfth annual session at Toronto, Ont. General Secy., R. W. Brock, Director of Geological Survey of Canada, Ottawa, Ont.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 12-16. Annual convention at Chicago, Ill. Secy., W. O. Thompson, New York Central Car Shops, East Buffalo, N. Y.

International Association of Fire Engineers—The 41st annual convention will be held in New York City on Sept. 1-6.

National Society for the Promotion of Industrial Education—The seventh annual convention will be held in Grand Rapids, Mich., Oct. 19-25.

The Baltimore Engineers' Club—At a recent meeting, the following officers were elected for the ensuing year: President, J. H. Milburn; Secretary, H. C. Williar, Jr.

Society for the Promotion of Engineering Education—The annual convention will be held in Minneapolis on June 24-26. The work of the first day is of a general character. At 8 p.m. there will be a joint session with the American Waterworks Association. The program for the second day is divided into two sections: the first is essentially of an engineering educational nature; the second will include a number of papers by highway engineers and will be presided over by Prof. A. H. Blanchard, who will also present a paper entitled "Highway Engineering, An Essential of Civil Engineering Curricula." Other papers will be read by C. H. Davis, Harold Parker and Prevost Hubbard.

CONSTRUCTION NEWS

★ Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

✚**New York**—Delaware, Lackawanna & Western R.R. This company has awarded the contract to C. U. REYNOLDS, New York, for the construction of seven miles of second-track work on its line from Jamesville to Syracuse. The cost of the work has been estimated at about $1,000,000. G. J. Ray, Hoboken, N. J., is Ch. Engr.

Long Island R.R.—To eliminate grade crossings on the Long Island R.R. chiefly in Queens Borough, the Public Service Commission is about to petition the Legislature at its forthcoming special session for an appropriation of $1,000,000, which constitutes the state's one-quarter share of the total cost of the work. Under the railroad law one-half the expense must be borne by the railroad company, one-fourth by the city and one-fourth by the State. At the regular legislative session $350,000 was appropriated, but that amount was among the items vetoed by the Governor.

✚**Virginia**—Virginia-Carolina R.R. This company has awarded the contract to the CALLAHAN CONSTRUCTION CO., Empire Bldg., Knoxville, Tenn., for the construction of its proposed extension of 40 miles. P. W. Early, Abingdon, Va., is Ch. Engr. Noted May 22.

West Virginia—Buckhannon & Northern R.R.—It is reported that the Pittsburgh & Lake Erie R.R. (New York Central Lines) will finance the construction of the seven-mile extension of this company to Fairmont, W. Va. S. D. Brady, Fairmont, is Ch. Engr. Noted May 1.

North Carolina—Statesville Airline R.R.—The Iredell County Board of Supervisors has ordered the issuance of the Statesville Air Line Railroad Co. bonds voted to the capital stock of the company by townships in the county as follows: Turnersburg, $35,000; Eagle Mills, $20,000; Union Grove $10,000.

Louisiana—Mansfield Ry. & Transportation Co.—This company, operating a line from Mansfield, La., to the Sabine River, will extend its line to Neighborton, about 10 or 12 miles, to take care of the business created by the opening up of a new oil field in De Soto Parish. The line is owned by the Frost-Johnson Lumber Co., Shreveport, La.

Tennessee—Mingo Valley R.R.—This company has been incorporated for the purpose of constructing a railroad in Tennessee. M. H. Taylor, Erie, Penn., is interested.

Ohio—Toledo, Ann Arbor & Jackson R.R.—This company has applied to the Public Service Commission to issue $390,000 of stock and $850,000 of bonds.

Indiana—Chicago & Wabash Valley R.R.—This company has been bought by Chicago capitalists. The company now operates a line from Crown Point to McCoysburg, Ind., and the new owners are considering the construction of a line to connect with the Elgin, Joliet & Eastern Ry. R. P. Ingalls, Chicago, Ill., is interested.

Illinois—Illinois Central R.R.—This company is planning to begin work about July 1 on the construction of its proposed second-track through Willow Ridge, Cairo, Ill. The cost has been estimated at $780,000. It will include the reduction of grade and the construction of 2½ miles of double-track. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

✚**Illinois**—Chicago, Burlington & Quincy Ry.—This company, it is reported, has awarded the contract to YALE & REAGAN, Chicago, Ill., for grading work on a three-mile double-track low-grade line between Kewanee and Galva, Ill. About 400,000 cu.yd. of earth will be moved.

Montana—Butte-Boise-Winnemucca R.R.—This company has been incorporated in Idaho with a capital of $40,000,000, it is reported, for the purpose of constructing a line of railroad from a point nine miles east of Anaconda, Mont., south to a connection with the Gilmore & Pittsburgh R.R. at Armstead, Mont., using that line to Salmon City, Idaho, thence southwest via Challis, to Boise City, thence through Oregon to Winnemucca, Nev., where a connection will be made with the Western Pacific Ry. about 650 miles. L. O. Leonard, Boise City, is interested.

Missouri—Chicago & Alton R.R.—This company will lay 35 miles of 80-lb. steel rails on its Fulton Branch.

Arkansas—Fort Smith, Subiaco & Eastern R.R.—This company is preparing to commence construction on its proposed line to Dardanelle, Ark. At that point a connection will be made with the Chicago & Rock Island Ry. H. Stroup, Paris, Ark., is Pres. Noted June 5.

Texas—Galveston, Houston & Henderson R.R.—This company will lay 12 miles of new track on Galveston Island. The sum of $135,000 has been appropriated for the work. J. H. Hill, Galveston, Tex., is Vice-Pres. and Gen. Mgr.

✚**Texas**—Artesian Belt R.R.—This railway, which was constructed by the late Dr. C. F. Simmons, St. Louis, Mo., is being extended from Christine to Crowther, 17 miles. Contract for this extension was recently let to the McMULLEN CONSTRUCTION CO. When completed to Crowther the road will have a length of 60 miles. Its northern terminus is Macdona on the Southern Pacific Co. near San Antonio, Tex. The road is now owned by S. A. Hopkins, Boston, Mass., and associates. The same interests are largely interested in the oil field at Crowther and one purpose of the extension of the line is to provide a transportation outlet for the product of the wells. J. P. Jackson, Macdona, Tex., is Ch. Engr.

Texas Short Line—This company, it is reported, is considering the construction of an extension in a southerly direction from Grand Saline to Canton, Athens, Houston and Galveston, Tex., and north from Grand Saline to Sulphur Springs and Paris or from Grand Saline to McAlester, Okla. T. B. Meeks, Grand Saline, Tex., is Pres. and Gen. Mgr.

Temple, Northwestern & Gulf Ry.—It is reported that this company has completed surveys and secured the necessary capital for the construction of its proposed line from Temple to Dublin, Tex., a distance of about 100 miles. W. E. Dozier, Temple, Tex., is Ch. Engr. Noted June 5.

Oklahoma—Cushing R.R.—This company has been incorporated for the purpose of constructing a 12-mile railroad from Cushing, Okla. The incorporators are C. R. Perry, P. Arbon, Tulsa, Okla., and R. C. Jones, Cushing, Okla.

Colorado—Georgetown & Grays Peak Ry.—This company has been incorporated for the purpose of acquiring and extending the Argentine Central Ry. The line, now constructed from Silver Plume to the summit of Mount McClellan in Clear Creek County, will be operated and improved.

New Mexico—Santa Rosa, Palma & Albuquerque R.R.—This company has been incorporated for the purpose of constructing a railroad between Albuquerque and Santa Rosa, 125 miles, through Bernalillo, Torrance and Guadalupe Counties. It will connect at Santa Rosa with the El Paso & Southwestern Ry.

Idaho—Latour Creek R.R.—This company has been incorporated for the purpose of constructing a railroad in Kootenai County. It will be about nine miles in length. Capital, $75,000. The line will connect with the Oregon-Washington R.R. & Navigation Co. H. V. Moore, Pullman, Wash., is interested.

Idaho—Western Pacific Ry.—See item under California.

Nevada—San Pedro, Los Angeles & Salt Lake R.R.—This company has applied to the State Railroad Commission for authority to issue $1,119,000 of bonds for various improvements, including the construction of a branch from Moapa, Nev., to St. Thomas, Nev. E. G. Tilton, Los Angeles, Calif., is Ch. Engr.

Southern Pacific Co.—This company will spend about $2,000,000 for double-tracking a portion of its lines in the state of Nevada. W. Hood, San Francisco, Calif., is Ch. Engr.

Washington—Puget Sound & Williamsport Harbor Ry. (Chicago, Milwaukee & St. Paul System)—This company is having surveys made for the construction of its proposed line east from Raymond, Wash. C. A. Goodnow, Railway Exchange Bldg., Chicago, Ill., is Pres.

Elk Creek & Grays Harbor R.R.—This company has been incorporated with a capital of $50,000, for the purpose of constructing a railroad from Doty to Cosmopolis, on the Grays Harbor line of the Oregon-Washington R.R. & Navigation Co. E. L. Mesereau, Doty, Wash., is interested.

California—Watsonville Transportation Co.—This company, which owns and operates a railway, has been bought, it is reported, by Milwaukee capitalists. Work will start soon on the construction of an extension from Watsonville to San Juan Bautiste, Calif.

Southern Pacific Co.—The State Railroad Commission has granted permission to this company to issue $30,000,000 of bonds for various improvements to its lines. W. Hood, San Francisco, Calif., is Ch. Engr. Noted June 12.

Western Pacific Ry.—This company is considering the construction of an extension to its line to San José, Twin Falls, Idaho, and Boise City, Idaho. T. J. Wyche, San Francisco, Calif., is Ch. Engr.

Alaska—A bill has been submitted to the Territories Committee of the U. S. Senate providing for an issue of $40,000,000 of bonds for the construction of a government railway in the territory of Alaska.

ELECTRIC RAILWAYS

Bangor, Maine—The Bangor Ry. & Electric Co. contemplates extensions of its line to northern Maine Junction in the town of Hermon, and an extension from Hampden to Winterport and possibly to Franklin, also an extension of the Brewer Division to Orrington. C. H. Johnson, Bangor, is Supt. Rys.

Portland, Maine—The City Council has granted a franchise to the Cumberland County Power & Light Co. to construct and operate an electric railway on certain streets in Portland. Henry B. Ivers, Portland, is Gen. Mgr.

Boston, Mass.—The Bay State St. Ry. Co. is considering plans for the extension of its Highland Circuit line to connect with its line in Lynn. R. S. Goff, Boston, is Vice-Pres. and Pur. Agt.

Worcester, Mass.—The Worcester Consolidated St. Ry. Co. contemplates the extension of its line from Southbridge to Brimfield. H. C. Page, Worcester, is Gen. Mgr.

Hornell, N. Y.—The Chamber of Commerce of Hornell is considering plans for the construction of an electric railway from Hornell to Rochester. Jay Stevens is Secy.

Gloversville, N. Y.—The Fonda, Johnstown & Gloversville R.R. Co. is considering plans for the extension of its electric railway to the Fifth Ward in Amsterdam. W. H. Collins, Gloversville, is Gen. Mgr.

Syracuse, N. Y.—According to press reports the Cortland & Ithaca Traction Co. which is now constructing a trolley line from Ithaca to Cortland, intends to extend the line to Syracuse.

Altoona, Penn.—Plans are being considered by the Logan Valley Ry. Co. for the construction of an electric railway on the new boulevard in Altoona. S. S. Crane is Gen. Mgr.

East Berlin, Penn.—The East Berlin & York Electric Ry. Co. is considering plans for three different routes for its proposed electric railway to connect East Berlin and York. William R. Smith, York, is Engr.

Kensington, Md.—The Sandy Springs Ry. Co. is making preliminary arrangements for the one-mile extension of its line in Kensington. R. H. Phillips, Sandy Springs, is Secy. and Pur. Agt.

Huntington, W. Va.—The Ohio Electric Ry. Co. is considering plans for the extension of its line to Ritter Park and for double-tracking its lines on Third and Fourth Aves. W. W. Magoon, Huntington, is Gen. Mgr.

Waynesville, N. C.—Alden Howell and John P. Swift are interested in the construction of an electric railway to connect Waynesville, Canton, Clyde, Bellwood and Woodrow.

Albany, Ga.—The Albany Transit Co. is making preliminary arrangements for the extension of its Madison St. line for about one mile in Albany. Noted Mar. 20.

Atlanta, Ga.—The Georgia Ry. & Power Co. is considering plans for double-tracking its Ivy St. line in Atlanta. W. H. Smaw, Electric & Gas Bldg., Atlanta, is Pur. Agt.

New Orleans, La.—The Orleans-Kenner Electric Ry. Co. is making preliminary arrangements for the construction of its proposed electric railway from New Orleans to Kenner and Hanson City. A. Smith Bowman, New Orleans, is interested.

Memphis, Tenn.—The Memphis St. Ry. Co. is preparing to extend its Lane Ave. line to Evergreen St. E. W. Ford, Memphis, is Gen. Supt.

Bowling Green, Ky.—The Kentucky Southwestern R.R., Light & Power Co., City National Bank Bldg., Paducah, Ky., is taking approximate estimates on an electric railway and two power houses, from Bowling Green to Grayson Springs, Ky., a distance of 45 miles. W. A. Calhoune is Ch. Engr.

Owensboro, Ky.—Plans are being prepared by the Owensboro City Ry. Co. for the extension of its line on Breckenridge St. G. R. Millican, Owensboro, is Supt. and Pur Agt.

Browntown, Mich.—The Council has granted a franchise to the Arthur Greenway Co., Detroit, to construct an electric railway through Browntown. This is part of a proposed line to connect Rockwood, Flat Rock, Dundee, Browntown and Adrian.

Chicago, Ill.—Plans are being considered by the Northern Elevated R.R. Co. for the extension of its line to Wilmette. E. C. Noe, Chicago, is Gen. Mgr.

Kankakee, Ill.—Preliminary arrangements are being made by the Danville, Crescent & Kankakee Traction Co. for the construction of its proposed electric railway from Kankakee to Cissna Park, about 40 miles. E. E. Meyer, Crescent City, is Pres.

Springfield, Ill.—The Springfield & Central Illinois Ry. Co. has been incorporated to construct and operate an electric railway from Springfield to connect with the Terre Haute, Springfield & St. Louis Ry. The incorporators are George W. White, Alfred L. Lynch, N. E. McMillan, William Larberg and C. P. Johnson.

Milwaukee, Wis.—The Milwaukee Electric Ry. & Light Co. is considering plans for the construction of an electric railway on State St. and Howell Ave. R. B. Stearns, Milwaukee, is Vice-Pres.

Lancaster, Wis.—Thomas McDonald, Lancaster, is interested in the construction of an electric railway from Lancaster to Stockton, about 65 miles.

Keokuk, Iowa—The Keokuk & Columbus Junction Transit Co. has completed surveys on its proposed electric railway to connect Columbus Junction, Keokuk, West Point, New London, Winfield and Donnellson, about 89 miles. T. A. Craig, Keokuk, is Secy.

Minneapolis, Minn.—E. G. Potter, Minneapolis, is interested in the construction of an electric railway from Minneapolis to St. Cloud, Minn.

Humboldt, Kan.—The City Council has granted a franchise to the Union Traction Co. to construct and operate an electric railway in Humboldt. D. H. Siggins, Coffeyville, is Pres. and Gen. Mgr.

Little Rock, Ark.—Plans are being prepared by the Little Rock Ry. & Electric Ry. Co. for the construction of its proposed Biddle St. car line. C. J. Griffith, Little Rock, is Gen. Mgr. and Pur. Agt.

Temple, Tex.—The Southwestern Traction Co. is making a survey for the proposed extensions of its interurban electric lines that are to run south from here to Austin via Granger and Taylor and north to Waco, Tex. The present line of the company connects Belton and Temple.

Cushing, Okla.—The Cushing R.R. Co. has been incorporated to construct and operate an electric railway from Cushing to Drumwright, about 12 miles. The incorporators are C. R. Perry and Paul Arbon, Tulsa, and T. J. Hughes, J. H. Tuttle and R. C. Jones, Cushing.

Nowata, Okla.—The Kansas-Oklahoma Traction Co. is making preliminary surveys for the construction of its proposed electric railway from Winfield to Perry. Clyde A. King, Coffeyville, Kan., is Interested.

Forest Grove, Ore.—The Oregon Electric Ry. Co. proposes to construct an extension of the electric railway from Forest Grove to Cherry Grove. C. A. Coolidge, Portland, is Gen. Mgr.

Corona, Calif.—A franchise has been granted to the Pacific Electric Ry. Co. for the construction of an electric railway in Corona. J. McMillan, Los Angeles, is Gen. Mgr.

Fresno, Calif.—The Fresno Traction Co. will build a new line to the San Joaquin River, a distance of about 10 miles. F. W. Webster, Fresno, is Gen. Mgr.

Glendale, Calif.—The board of Trustees is considering plans for the construction of an electric railway in Glendale.

Los Angeles, Calif.—Lewis Ginger, of Glendale, Calif., has applied for a franchise to construct a scenic railway along the mountain ridges of Griffith Park, with Hollywood, 1747 ft. high, as its apex.

Riverside, Calif.—The construction of about five miles of new track in Riverside is contemplated by the Pacific Electric Ry. Co. J. McMillan, Los Angeles, is Gen. Mgr.

Brandon, Man.—An appropriation of $150,000 has been made for the construction of a municipal street railway in Brandon. R. E. Speakman is City Engr.

LIGHT, HEAT AND POWER

Boston, Mass.—Plans are being prepared by Sterrett & Brunner, 156 State St., for the construction of a power plant to generate 2000 hp., to be erected on the fish pier at South Boston. William J. O'Brien is interested.

+Springfield, Mass.—The contract for the construction of a heating plant in connection with the Almshouse, at Springfield, has been awarded to the CASPER-RANGER CONSTRUCTION CO., Holyoke, Mass., at about $16,000.

+Worcester, Mass.—The contract for a transformer substation to be built on Southbridge St. for the Worcester Electric Light Co. has been awarded to the WESTINGHOUSE CHURCH KERR CO., 10 Bridge St. New York, N. Y.

+Brooklyn, N. Y.—(Official)—The Department of Education, 500 Park Ave., Manhattan, has awarded a contract to PHILIP & PAUL, at $7531, for making alterations and repairs to the heating and ventilating apparatus in Public School 31, Brooklyn. Bids were received on June 9.

+(Official)—The Department of Education, 500 Park Ave., Manhattan, has awarded a contract to WILLIAM J. OLVANY, 177 Christopher St., Manhattan, at $8252, for making alterations and repairs to the heating and ventilating apparatus in Public School No. 1, Brooklyn. Bids were received on June 9.

New York, N. Y.—(Official)—Bids will be received until 10:30 a.m., June 23, by the Fire Department, 157 East 67th St., for the installation of the steam heating apparatus, in a new central office of the firm-alarm telegraph system, on Transverse Road, Central Park. Joseph Johnson is Comr.

+New York, N. Y.—(Official)—Bids were received June 11 by the Board of Water Supply for Contract 93, installing a portion of the Catskill Aqueduct telephone system, as follows: NEW YORK TELEPHONE CO., 15 Dey St., New York City, $41,617, (awarded contract); Carpenter & Lindsay, Paterson, N. J., $46,549; Lord Electric Co., 105 W. 40th St., New York City, $51,379; Watson-Flagg Engineering Co., 27 Thames St., New York City, $53,104; Young & Hyde, Inc., Produce Exchange Bldg., New York City, $53,862; Perry J. Fitzgerald, 48 Howard St., Albany, N. Y., $58,543; Henry E. Fox Construction Co., 81 E. 125th St., New York, $64,656; W. L. Bull, Jr., Inc., 135 Front St., New York, $71,077. Noted May 29.

(Official)—Bids will be received until 2 p.m., June 24, by the President of the Borough of Manhattan, at the office of the Commissioners of Public Works, 21 Park Row, for item "A," for furnishing all the labor and materials required for repairs to the power plant, excepting covering on piping, tanks, etc., in the public bath building located at 342-348 East 54th St., Borough of Manhattan, and for item "B," furnishing all the labor and materials required for repairs to the power plant, including covering on piping, tanks, etc., in the public bath building, located at 342-348 East 54th St., Borough of Manhattan. George McAneny is Pres.

Syracuse, N. Y.—A power house 58x36 ft. four stories will be erected by Onondaga County at the Onondaga County Home, Onondaga Hill. Frank X. Woon is Pub. Agt., Onondaga County, Syracuse.

Burlington, N. J.—The Public Service Corporation is negotiating for property on the Delaware River, near Burlington, and plans for the erection of an electric power station to furnish energy for light, power and railway service for this vicinity. The proposed station is to later supplant the company's plants at Burlington, Bordentown and Cinnaminson.

+Chatham, N. J.—We are advised that the contract for the erection of a chimney at the municipal electric-light plant has been awarded to the HEINE CHIMNEY CO., 30 Church St., New York, and not to the Manistee Iron Works (who were awarded the contract for pumps), as noted in the issue of June 12.

Farmingdale, N. J.—The Board of Public Utility Commissioners has granted the Farmingdale Lighting Co. permission to install and operate a system on the road between Farmingdale and Freehold.

Newark, N. J.—The Board of Public Utility Commissioners has granted the Public Service Gas Co. permission to issue $750,000 of capital stock, to be used for improvement and extensions to its plants and system. Henry D. Whitcomb is Gen. Mgr.

Yardville, N. J.—Charles A. Comp has acquired the Yardville electric-lighting plant, and flour and feed-milling plant operated in connection, formerly the property of Augustus Wolf, Chambersburg, Penn. The new owner plans for extensive improvements and additions in both properties, and contemplates the erection of water-works near the power station, for general local service.

Blairsville, Penn.—Plans are being considered by the Town Council for the construction of an electric-light plant.

Philadelphia, Penn.—The Philadelphia Rapid Transit Co. has prepared plans for the construction of a power plant at 13th and Mifflin Sts. Estimated cost, $30,000. W. L. Mahe is Pur. Agt.

Bluestone Junction, W. Va.—The Norfolk & Western Ry. Co. is having plans prepared for the erection of a steam-power electric plant of about 32,000 hp. at Bluestone Junction.

High Point, N. C.—The city contemplates the extension of its transmission lines and the installation of additional equipment for its electric-light system. H. C. Bulla is Mgr.

Rocky Mount, N. C.—Bonds for $12,000 have been voted for the installation of additional equipment in the municipal electric-light plant. A. S. Lyon is Mgr. and Ch. Engr. of the plant. Noted Feb. 15.

Rock Hill, S. C.—Plans are being considered by the Southern Power Co. for the construction of a substation at Rock Hill. W. R. Cornell, Charlott, N. C., is Pur. Agt.

La Grange, Ga.—Bids will be received by J. D. Edmundson, Mayor, until July 8 for the installation of a municipal gas plant. James N. Hazlehurst, Candler Bldg., Atlanta, is Consult. Engr.

Bastrop, La.—The enlargement and improvement of the municipal electric-light plant and water system is under consideration. J. K. Skipworth is Mayor.

Anna, Ohio—Plans are being considered by the Managers of the Electric Light Board for the installation of additional equipment in the municipal electric-light plant. T. S. Price is Clk. of the Bd.

Gallon, Ohio—Bids will be received by the Director of Public Service until noon, June 24, for the construction of an addition to the municipal electric-light plant. E. C. Yochem is Clk.

Norwalk, Ohio—The Cleveland, Southwestern & Columbus Ry. Co. will expend $20,000 for improving its plant if granted a new franchise. C. G. Taylor is Supt.

Plymouth, Ohio—Bids will be received by the Board of Trustees of Public Affairs until June 26, for the installation of additional equipment in the municipal electric-light plant. J. S. Smith is Clk. of the Bd.

Warren, Ohio—The Trumbull Public Service Co. contemplates an expenditure of $40,000 for improvements to its plant.

Bluffton, Ind.—The citizens are considering the proposition to issue $20,000 of bonds for the improvement and installation of new equipment in the municipal electric-light plant.

Waynetown, Ind.—(Official)—An election will be held June 27, to vote on the proposition to construct and operate an electric-light system in Waynetown. E. H. Edwards is Town Clk. Noted May 8.

Grand Rapids, Mich.—The construction of a substation at Wealthy St. and Indiana Ave. is contemplated by the Grand Rapids-Muskegon Power Co. Estimated cost, $18,000. A. F. Walker, Grand Rapids, is Supt.

Chicago, Ill.—The installation of a power plant to cost $246,000, at the new county hospital on Lincoln St., has been recommended to the County Board.

Chicago, Ill.—The American Car & Foundry Co. will build a one-story power plant in connection with its plant at South Wood and Pauling Sts. Estimated cost, $5400.

Elgin, Ill.—The installation of a municipal electric-light plant is under consideration. Chapman, Inc., Chicago, Ill., is Consult. Engr.

Homer, Ill.—Preliminary arrangements are being made by V. S. Thompson, owner of the local electric-light plant for the construction of a new plant in the western part of the town.

Manito, Ill.—Plans are being considered by the Village Board for the construction of an electric-light plant at Manito.

Mason City, Ill.—The Commercial Club is interested in the installation of an ornamental street-lighting system.

+Milwaukee, Wis.—The contract for furnishing 63 ornamental lighting standards for the Grand Ave. Viaduct has been awarded to the WISCONSIN IRON & WIRE WORKS. Plans have been prepared by Vaughn & Meyer. Estimated cost, $8750.

New Richmond, Wis.—The Commercial Club and Council is agitating the installation of an ornamental street-lighting system.

Davenport, Iowa—Permission has been granted to the Peoples Light Co. to construct a gas holder at Davenport to cost $60,000.

Ossian, Iowa—The construction of an electric-light plant at Ossian is contemplated by Harry Bullard.

+Preston, Iowa—The City Council has awarded the contract to the J. J. MAHLER ELECTRICAL CO., for the installation of an electric-light system in Preston.

Shellsburg, Iowa—Plans are being considered by the Council for the installation of an electric-light system.

Minneapolis, Minn.—Plans are being considered by the Twin City Rapid Transit Co. for the installation of additional equipment in its power station at the Twin City line. J. J. Canfield, Minneapolis, is Gen. Supt.

Roseau, Minn.—Bids will be received by P. H. Buran, Clk., until June 20, for the construction of an electric-light plant and water system at Roseau. Plans have been prepared by Leonard Peterson, Thief River Falls.

+Augusta, Kan.—The contract for the construction of a municipal electric-light plant has been awarded to S. J. SAFFORD & SON, Wichita. Noted Apr. 24.

+Madison, Kan.—(Official)—The contract for the construction of an electric-light plant and water system has been awarded to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, at $30,000. Bids were received May 29, by Chester E. Fellay, City Clk. Rollins & Westover, Kansas City, Mo., are Consult. Engrs. Noted May 29.

Wichita, Kan.—Preliminary arrangements are being made for the installation of an ornamental lighting system on West Douglas Ave. Estimated cost, $20,000. Bert C. Wells is City Engr.

Sidney, Neb.—At a recent election it was voted to issue $22,000 in bonds for the construction of an electric-light and power plant. Noted May 29.

Big Stone, S. D.—The installation of a municipal electric-light system is under consideration. William Lauster is City Audr.

Cogswell, N. D.—Plans are being considered by the Cogswell Electric Light & Power Co. for the installation of additional equipment in its plant.

Grand Forks, N. D.—The installation of additional equipment in the municipal electric-light plant is contemplated by the managers of the plant. H. Juneau is Ch. Engr.

Lakota, N. D.—The Lakota Light & Power Co. will increase the capacity of its plant by installing new equipment. James P. Larson is Mgr.

St. Thomas, N. D.—Bids will be received by S. E. Peterson, City Audr. until June 21, for the construction of a municipal electric-light plant. H. G. Lykken, Grand Forks, is Consult. Engr. Noted May 22.

Heber Springs, Ark.—U. S. Bratton, of the Arkansas Public Service Co., Little Rock, is negotiating for a water-power site on the Little Red River, near Heber Springs, and is planning the erection of a hydro-electric plant to develop 3000 hp.

Rockport, Tex.—The Rockport Electric Light Co. has sold its electric-light and power plant to G. E. Fussell, Eagle Lake, Tex. The plant will be remodeled and enlarged.

Sanderson, Tex.—The construction of an electric-light plant at Sanderson is contemplated by E. McGinley. Estimated cost $10,000.

Whitesboro, Tex.—At a recent election it was voted to install a municipal electric-light plant.

Cleveland, Okla.—The construction of a new electric-light plant is under consideration by the City Council.

Casa Grande, Ariz.—The Casa Grande Valley Water Users' Association contemplates the construction of a 500-hp. plant in the Casa Grande Valley.

Phoenix, Ariz.—The following bids were received by the Salt River Water Users' Association for the construction of a power house for the Cross Cut canal power plant: Arizona Engineering & Construction Co. (Bowen & Shumway), $34,000; E. W. Keithline, $37,055; Marlin & Gillas, $37,374; Los Angeles Planing Mill Co., $39,854. The structure will be 85x140 ft., two stories and will be of reinforced concrete. Bids were received June 5. Noted May 15.

Williams, Ariz.—The Williams Water & Electric Co. contemplates purchasing two 25-cycle 440-volt generators, and one 60-cycle 2200-volt generator.

Spokane, Wash.—The Okanogan Valley Power & Light Co. has been organized and has taken over the power plant of Nixon-Kimmel Co. near Pateros, the Big Bend Light & Power Co. and the Grangeville Light & Power Co. These systems will be combined and improvements made. The officers of the new concern are: Eugene Enloe, Pres.; S. E. Gates, Vice-Pres., and W. C. Sivyer, Secy.-Treas.

Portland, Ore.—The Northwestern Electric Co. has been granted a franchise to construct and operate a central heating plant in the Pittock Block. Estimated cost $300,000.

Alhambra, Calif.—O. M. Caulk, City Clk., will receive bids until 9 a.m., June 21, for furnishing ornamental concrete lamp posts, together with necessary equipment, wiring and appurtenances for lighting Granada Ave. between Alhambra and Mission Roads.

Fresno, Calif.—The San Joaquin Light & Power Co. will spend $2,000,000 during the next six months to increase its steam and generating capacities 24,000 hp., and to build 1000 miles more of distributing lines to supply a number of small towns. A. G. Wishon, Fresno, is Gen. Mgr.

Piedmont, Calif.—The installation of a municipal electric light plant is being considered by the City Council.

Brockville, Ont.—Bids are being received by the Light and Power Department for the installation of a ornamental lighting system on Main St., one mile in length.

Melita, Man.—A franchise has been granted to R. E. Denny to construct and operate an electric-light plant in Melita.

Russel, Man.—The construction of a municipal electric-light plant to cost $18,000 is being considered.

Prince Albert, Sask.—Plans are being prepared for the construction of a new steam generating station at Prince Albert. C. O. Davidson is City Clk.

Saskatoon, Sask.—An expenditure of $15,000 is planned for the extension of the electric-light and power system Andrew Leslie is City Clk.

BRIDGES

+Bangor, Maine—(Official)—The City Council has awarded a contract to the CANTON BRIDGE CO., Attleboro, Mass., at $15,417, for the construction of two approach spans of the superstructure of the steel highway bridge over the Penobscot River, between Bangor and Brewer. The length of the spans will be 102 ft. and 61 ft. from center to center of end bearings. Bids were received June 10. Frank F. Prossey is City Engr. Noted June 5.

Manchester, N. H.—The Mayor has approved the bill passed by the Common Council appropriating $100,000, for the construction of a bridge across the Piscataquog River at Kelley St. Samuel J. Lord is City Engr. Noted June 5.

Amsterdam, N. Y.—(Official)—The Common Council has retained the Concrete Steel Engineering Co., Park Row Bldg., New York, N. Y., to design and prepare the plans for a new concrete bridge over the Mohawk River. This will replace the steel bridge recently destroyed by the spring freshets. F. E. Crane is City Engr.

Glens Falls, N. Y.—(Official)—The Concrete Steel Engineering Co., Park Row Bldg., New York, N. Y., has been retained as consulting engineer to design a concrete bridge over the Hudson River at Glens Falls. Howard M. West is City Engr.

York, N. Y.—At a recent town meeting the citizens voted to appropriate $11,200 for the purpose of constructing jointly with the town of Geneseo a new highway bridge across the Genesee River, between the towns of York and Geneseo.

New Brunswick, N. J.—Bids will be received until 2:30 p.m., June 23, by the Board of Chosen Freeholders, for the rebuilding of three wooden bridges over the Manalapan Brook, in Monroe Township. Peter H. S. Hendricks is Comr.

✦Toms River, N. J.—(Official)—Arthur C. King, Engr.-in-Charge, Toms River, has awarded a contract to EDWARD FAY & SON, 1821 Ranstead St., Philadelphia, Penn., at $95,-000, for the construction of a road bridge across Barnegat Bay, from Island Heights to Sea Side Park. The structure will consist of 7212 ft. of timber trestle and 3150 ft. of earth fill, bulkheaded. Bids were received on May 17. Noted May 1.

Butler, Penn.—Bids will be received by the Board of County Commissioners until July 2, for the construction of a joint county bridge between Butler and Armstrong Counties, over Bear Creek. The superstructure will be a steel trusis.

Frenchville, Penn.—(Official)—Bids will be received until June 21, by the Supervisors of Girard and Covington Townships, for the rebuilding of a reinforced-concrete bridge on the existing abutments, at Frenchville. E. W. Hess, Clearfield, is Engr.-in-Charge.

Harrisburg, Penn.—The following bids were received on June 5, by the State Superintendent of Public Grounds and Buildings, Capitol, for the construction of a bridge over Mahoning Creek at Macks Fording, Armstrong County: J. A. Lord, Hastings, $11,995; G. W. Ensign, Camp Hill, $15,253; Nelson Merydith Co., Chambersburg, $16,932; Ferro Concrete Co., Harrisburg, $18,795, and E. M. Wichert Co., Pittsburgh, $21,886. Samuel B. Bambo is Supt. Noted May 29.

Morristown, Penn.—Bids will be received until 11 a.m., July 2, by the Board of Commissioners of Montgomery County, for the construction of a reinforced-concrete bridge over the west branch of Stony Creek, West Point, and for the repairing of Crow Creek Bridge, near Bridgeport. John N. Jacobs is County Controller.

✦Reading, Penn.—(Official)—The County Controller has awarded a contract to the FERRO CONCRETE CONSTRUCTION CO., Harrisburg, at $6566, for the construction of a reinforced-concrete arch and girder bridge across the Tulpehocken Creek, in Marion Township. Bids were received June 11. D. K. Hoch is County Controller. Noted June 5.

York, Penn.—Bids will be received until June 24, by the Board of County Commissioners, Court House, for the construction of eight concrete and three stone bridges.

✦Covington, Va.—(Official)—The Circuit Court of Alleghany County has awarded a contract to the ROANOKE BRIDGE CO., Roanoke, at $8375, for the construction of two concrete and steel bridges. Both will be built over Dunlap Creek, one 140 ft. long and the other 50 ft. long. Bids were received June 7. The Childrey-Sunday Co., Richmond, are Engrs.-in-Charge. Noted June 5.

Macon, Ga.—Bids will be received until June 24, by the City Council, for repairs on the Spring St. bridge. J. J. Gaillard is City Engr.

Greenup, Ky.—Bids will soon be received by the Fiscal Court for the construction of a bridge over North Fork.

Lexington, Ky.—Bids will soon be received by the Fiscal Court at Lexington, for the construction of a steel or concrete bridge over Elkhorn Creek. Plans are by L. Terrell, State Road Engr., Frankfort.

Owensboro, Ky.—The Fiscal Court of Daviess County has had plans prepared for the construction of seven bridges, with concrete piers and steel superstructures.

Paducah, Ky.—The County Fiscal Court has had plans prepared for the construction of a three-span bridge each 100 ft. clear, with a reinforced-concrete floor and abutments.

Cincinnati, Ohio—The Board of Commissioners of Hamilton County in joint session with the Board of Commissioners of Dearborn County, Ind., recently approved the plans prepared for an interstate bridge over the Whitewater River, at Harrison. The estimated cost is $76,000.

Cincinnati, Ohio—Bids will be received until noon, July 11, by the Board of Commissioners of Hamilton County, for the following work: A wrought-iron truss bridge on Elliot St., in Springfield Township; a bridge over Mill Creek, near the Fair Grounds, Springfield Township; a bridge over the mouth of the Blue Rock Creek, on Blue Rock Pike, Colerain Township; for culvert work on the Union Cemetery Road. Albert Reinhardt is Clk.

Cleveland, Ohio—Bids will be received until 11 a.m., July 9, by the Board of Commissioners of Cuyahoga County, for the construction of a concrete arch, over Chippewa Creek, Brecksville Township. Leann F. Gaudenbergen is Clk.

Fort Ancient, Ohio—The County Commissioners of Warren County will erect a single span high truss bridge at Lebanon, with 16-ft. roadway, with creosoted plank and block floor and repairing and raising old abutment with concrete, over the Little Miami River at Ft. Ancient, at an estimated cost of $12,000. T. C. Patterson is County Auds.

Marietta, Ohio—Bids will be received until July 5, by the Board of Commissioners of Washington County, for furnishing all materials and building a bridge across the Muskingum River, at Beverly.

✦Zanesville, Ohio—The Board of County Commissioners has awarded a contract to C. W. LANE, Newark, at $2,000, for the construction of the Gassport Bridge. Bids were received on June 7.

Lafayette, Ind.—Plans for a bridge to be built across the Wabash River at the foot of Main St. were submitted to the Board of County Commissioners by Will on E. Hall, Albert Smith and Everett E. Voyles, Municipal engineers. The cost is estimated at $75,000 for the concrete and $25,000 for the steel. The new bridge would be 200 ft. longer than the old bridge, and it is planned to make it 40 ft. wide, exclusive of the walks.

Noblesville, Ind.—Bids will be received until 11 a.m., June 21, by the Board of Commissioners of Hamilton County for the construction of a bridge over the Great Eel at the White River near Perkinsville. Charles Gerkel is County Auds.

Mascoutah, Ill.—Bids will be received until 10 a.m., June 27, by the Town Clerk, at the Town Hall, for the construction of three reinforced concrete bridges in Mascoutah Township, St. Clair County. Charles Stock is Town Clk.

Janesville, Wis.—Charles E. Moore, County Highway Comr., has awarded contracts for a concrete bridge in the town of Harmony and one in the town of Spring Valley to E. L. BOYLES, Beloit, Wis. The first bids were rejected. Both bridges receive state and county highway aid. Cost, $3000. The common council has decided to erect two new concrete bridges, one over Spring Brook on South Main St., and another over the Rock River at Milwaukee St. The Spring Brook bridge will be three-span, 72 ft. long and 26 ft. wide. The Milwaukee St. Bridge was recently damaged by fire, and will be replaced by a concrete structure. Plans are now in the hands of the State Commission for approval. Bids will be asked soon.

Merrimac, Wis.—(Official)—The State Legislature at Madison, has passed a bill providing for the construction of a bridge across the Wisconsin River, at Merrimac. The structure will be of steel, reinforced-concrete floor, with a lift or draw span of a 70-ft. clear opening. The total length will be approximately 2000 ft. The estimated cost is $93,000. M. W. Torkelson, Madison, is State Bridge Engr. Noted June 12.

North Fond du Lac, Wis.—The Village Board has authorized the construction of a concrete bridge at Center St. to replace the present wooden structure.

Guthrie, Okla.—The Board of Commissioners of Logan County has ordered that a bridge be built across the Cimarron River, north of Division St. The new structure will be built of concrete and steel.

✦Everett, Wash.—The Board of County Commissioners has awarded a contract to the INTERNATIONAL BRIDGE CO., Central Bldg., Seattle, at $30,586, for the construction of a bridge over the Ebby Slough. Noted June 5.

Visalia, Calif.—A steel bridge, estimated to cost $180,000, will be constructed across the St. Johns River, near Visalia, by the Minkler Southern Ry.

Lytton, B. C.—(Official)—We have been advised by resident engineers that the contracts have been let by the provincial government for the construction of a steel highway bridge, with concrete substructure, across the Thompson River at Lytton. This bridge carries the main highway from Hope to Lytton on toward Lillooet and the north. It consists of one steel 250-ft. truss span, 35 ft. deep, resting on concrete, piers 70 ft. above low water, together with two 70-ft. plate girder spans and one 50-ft. plate girder span, carried on steel bents and concrete abutment. There is some 200 ft. of trestle approach, with a similar length of grading. The level of the new bridge will be 40 ft. higher than the present structure and will greatly improve the grading at this crossing. The steel will be fabricated by the Canadian Bridge Co., while the Graff Construction Co., Seattle, Wash., will construct the substructure and carry out the erection. The bridge was designed by E. A. Stone, M. Can. Soc. C. E., M. Inst. C. E., consulting engineer of Vancouver, B. C. This work was noted June 5.

Victoria, B. C.—The City Council has authorized the city Engineer to prepare plans for a concrete and steel bascule bridge, with a span of 200 ft., at Johnson St. Noted May 1.

WATER SUPPLY—IRRIGATION

Boston, Mass.—(Official)—Bids will be received by the Supply Department until June 24, for furnishing 410 hydrants for the high-pressure fire service. Charles H. Slattery is Temporary Supt.

Bids will be received by L. K. Rourke, Comr. Pub. Wks., until June 20, for furnishing and delivering five sluice gates and compressed air rams at Moon Island; and for assembling 100 Boston post hydrants, 200 6-in. valves, and 100 12-in. valves.

Cohasset, Mass.—(Official)—The Cohasset Water Co. plans to build a deferrization plant, capacity 1,000,000 gal., at the Beechwood pumping station, Cohasset. The plant will consist of an aerator, trickler, subsiding basin, three mechanical filters and appurtenances. Estimated cost $14,000. The plans and specifications are on file at the office of R. S. Weston, Consult. Engr., 14 Beacon St., Boston.

✦Springfield, Mass.—The Water Board has awarded contracts for furnishing water pipe to its U. S. CAST IRON PIPE & FOUNDRY CO. Philadelphia, Penn., as follows: 500 ton 12-in. at $23.60 per ton; 100 ton 10-in. at $23.60 per ton 70 to 4-in. at $25.60 per ton; special sizes 48 24-in. at $52.50 per ton.

Glens Falls, N. Y.—Howard M. West, Water Supt., has been authorized by the Water Commission to reinforce the spillway walls of the concrete dam of the Keenan Reservoir.

New York, N. Y.—(Official)—Bids will be received until 2 p.m., June 23, by the Commissioner of Water Supply, Gas & Electricity, 21 Park Row, for furnishing, delivering and laying water mains and appurtenances in Grand Boulevard and concourse, Borough of the Bronx. Henry S. Thompson is Comr.

✦Pleasantville, N. Y.—(Official)—Bids will be received by the Board of Village Trustees until 8 p.m., June 24, for completing the construction of a circular mass concrete reservoir of 500,000 gal. capacity, designated as Contract 1; also for completing the pipe line leading to the reservoirs, designated as Contract 2. Plans and specifications are on file at the office of the Village Clerk, and at the office of the Lippincott Engineering Co., 30 East 42d St., New York.

Gloucester City, N. J.—The P. A. Stewart Co. is planning to install a system of water mains on its tract of land at Charter Oak Farm. The company has made application to obtain a water supply from the city.

Haledon, N. J.—The Borough Council has called a special election for the purpose of voting bonds for $10,000 for extensions to the water system.

Rockaway, N. J.—The Water Committee of the Borough Council, acting upon instructions from the State Board of Health, is planning to make improvements and extensions to its water system. The work is estimated to cost about $20,000. Noted May 22.

Yardville, N. J.—See item under Light, Heat and Power.

Allentown, Penn. (Official)—In connection with the improving of the water system, Johnson & Phillips, Consult. Engrs., 150 Nassau St., New York, N. Y., have been retained to design the apparatus for the application of the hypochlorite line of the disinfectant supply. Charles D. Wierbach is City Engr. Noted Apr. 10.

Barnesboro, Penn.—The Borough Council has passed an ordinance authorizing a special election to vote on a bond issue of $35,000, for the construction of a municipal water plant.

Evansville, Penn.—(Official)—Bids will be received by A. Lotz, Secy. Boro. Council, until 8 p.m., June 20, for the construction of a brick and concrete reservoir of 200,000 gal. capacity. Plans may be obtained at the office of the McBride Surveying & Engineering Co., 331 Fourth Ave., Pittsburgh.

+Homestead, Penn.—Contracts for improving the water system have been awarded by the Borough Council as follows: E. M. WICKES, Pittsburgh, extension of the intake pipe, $7735; H. R. HEINICKE, New York, erection of smokestack 110 ft. high, $1720; BABCOCK & WILSON, Pittsburgh, two 250-hp. boilers, $7656; PITT CONSTRUCTION CO., Pittsburgh, erection of bichloride plant for purifying the water, $375. Noted June 12.

Loretto, Penn.—(Official)—Bids are being received by G. Etzel, Mgr., for improvements to the property of C. M. Schwab. The contract includes: Stone walled dam, with overflow, the dam to be 25 ft. high and 200 ft. long, mounted with an iron fence; grading surrounding hillsides; constructing 1800 ft. of iron fence; constructing two reservoirs, each 60 ft. in diameter and 12 ft. deep.

Washington, D. C.—Bids will be received by the District Commissioners until June 19, for furnishing and delivering 1359 tons of c.-i. water pipe, and 156 tons of c.-i. water pipe specials. Cuno H. Rudolph is Chn.

Ashland, Va.—The city contemplates purchasing the holdings of the Ashland Gas, Sewerage & Water Co. F .W. Scarborough, Consult. Engr., has appraised the system at $32,000, and estimated the cost of installing a municipal system at $39,000.

Shadyside, Va.—The village contemplates the installation of a water system, the water to be piped from Moundsville, which is just across the river.

Lancaster, S. C.—The city contemplates an expenditure of $12,000, for improving and extending the water system.

Mooresville, N. C.—An election has been called for July 8, to vote on a bond issue of $20,000, for extending the water system.

Washington, N. C.—Gilbert C. White, Consult. Engr., Charlotte, N. C., is preparing plans for the construction of water and sewer systems and an electric-light plant here. Bonds for $130,000 were recently voted for this work. Noted Apr. 17.

Lagrange, Ga.—Bids will be received by J. D. Edmundson, Mayor, and the City Council, until 5 p.m., July 8, for constructing a municipal water system and gas plant. Plans were prepared by James Nesbit Hazlehurst, Consult. Engr., Candler Bldg., Atlanta. Estimated cost, $190,000. Noted Apr. 24.

Rome, Ga.—The city contemplates an expenditure of $35,000 for installing new pumps at the city pumping station. Noted Mar. 27.

Thomaston, Ga.—Bonds for $15,000 have been voted for improving the water and sewer systems. Plans for the proposed improvements are being prepared by the J. B. McCrary Co., Third National Bank Bldg., Atlanta. Noted May 15.

Jackson, Miss.—Bonds for $100,000 were voted, June 7, for constructing a filtration plant and reservoir, and laying a 36-in. supply main. B. H. Klyce is City Engr. Noted May 1.

Pass Christian, Miss.—The City Council is receiving bids for laying a 4-in. water main in Front St., from Market St. to Davis St.

Pontotoc, Miss.—The Pontotoc Electric Light & Power Co. contemplates the installation of a water system, to include mains, pumps, boilers and an elevated steel tank of 100,000 gal. capacity.

Monroe, La.—Tentative plans have been prepared for improvements and extensions to the water system, estimated to cost $75,000.

+Lenoir City, Tenn.—The contract to install a water system here has been awarded to the J. E. McCRARY CO., Third National Bank Bldg., Atlanta, Ga. Estimated cost, $40,000.

Nashville, Tenn.—The proposition to issue $2,500,000 of bonds for constructing a reservoir was defeated at the election, June 5. The city will now proceed with its original plan of repairing the reservoir damaged last year. Estimated cost, $200,000. George W. Stainback is Chn. Bd. Pub. Wks. Noted Apr. 24.

Akron, Ohio—(Official)—The city is about to begin the construction of a reservoir dam on the Cuyahoga River for water supply. The dimensions of the dam will be, 18 ft. high and 530 ft. long, of which about one-half is reinforced concrete spillway, and the other half earth embankment. The dam is of hollow reinforced concrete with a floor, designed by F. A. Barbour, Consult. Engr., Boston, and carried out by the Ambursen Hydraulic Construction Co. under his supervision. Noted May 29.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 20, for furnishing and delivering c.-i. specials for the water distribution system.

Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 24, for furnishing and delivering valves for the water distribution system.

Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 24, for laying c.-i. pipe, specials and valves, from the main pumping station on Eastern Ave., to the intersection of Madison and Grandlin Roads.

Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 27, for furnishing and delivering c.-i. pipe and specials for the 42-in. main in Madison Rd., from Grandin Rd. to Cinnamon St. Plans and specifications are on file at the office of the General Superintendent of the Water-Works Department.

+Geneva, Ohio—(Official)—The contract to construct a reinforced-concrete dam, 325 ft. long and 8 ft. high, has been awarded to E. T. HEWETT, Jefferson, Ohio, at $14,900. Bids were opened by the Board of Public Affairs, June 6. Noted May 29.

Glendale, Ohio—(Official)—Bids will be received by the Board of Trustees of Public Affairs until noon, July 2, for the following work: Raising water tank, placing pot bottom in water tank, placing portland cement concrete air compressor, and electric motor, and constructing a steel water tower and tank. J. H. Freemeyer, Jr., is Clk. of Bd.

Lima, Ohio—(Official)—Bids will soon be asked for laying about 14,830 lin.ft. of 20-in. c.-i. water main, the pipe to be furnished by the city. J. R. Morris is Dir. Pub. Ser.

Norwood, Ohio—A bond issue of $100,000 is proposed, for installing a new softening system in connection with the water-works; also a new boiler, pump, engine, dynamos, etc. W. M. Fridman, Mayor.

Painesville, Ohio—(Official)—Bids will be received by S. A. Haskell, Dir. Pub. Ser., until noon, July 8, for constructing a water purification works of 3,000,000 gal capacity, and a pumping system, this being Contract 2 of the proposed improvements to the water system. Plans and specifications are on file at the office of the Director, and at the office of R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland. Noted June 12 and May 8.

Decatur, Ind.—Bids will be received by the City Council until July 1, for constructing a reinforced-concrete reservoir of 230,000 gal. capacity. Plans are on file with H. M. Devoss, City Clk., and J. T. Gillig, Engr.

+Big Rapids, Mich.—The contract to extend the water system has been awarded to the MARKLE CEMENT CO., Muskegon. The contract involves laying about 15,000 ft. of 4- to 12-in. c.-i. mains. Gardner S. Williams, Ann Arbor, Mich., is Consult. Engr. Noted May 29.

Chicago, Ill.—The city has purchased a tract of land in Mayfair, as a site for the proposed new pumping plant, which is estimated to cost $250,000. L. E. McGann is Comr. Pub. Wks.

+Quincy, Ill.—(Official)—The Citizens' Water Co. has awarded a contract to the NEW YORK CONTINENTAL JEWELL FILTRATION CO., 15 Broad St., New York, at $99,484, to build a water purification plant, consisting of baffle chambers, sedimentation basins, and a 6,000,000-gal. filtration plant and clear well.

Carson, Iowa—The City Council has been authorized to install a water system estimated to cost $15,000.

Winfield, Iowa—The City Council contemplates the installation of a water system, estimated to cost $12,500.

Deerwood, Minn.—The Oscar Claussen Engineering Co., St. Paul, Minn., is preparing plans for the construction of a 50,000-gal. tower and tank, and other improvements to the water system.

Minneapolis, Minn.—Bids will be received by the City Purchasing Agent until June 19, for furnishing and installing centrifugal pumps and motors, with the necessary auxiliary equipment to operate each unit automatically.

Roseau, Minn.—Bids will be received by P. H. Buran, Village Clk., until June 20, for constructing a water system and electric-light plant, according to plans prepared by Leonard Peterson, Consult. Engr., Thief River Falls, Minn.

Highland, Kan.—It is proposed to install a water system here, at an estimated cost of $16,000. The system will include a 90-ft. water tower and a 50,000-gal. tank.

+Hildreth, Neb.—(Official)—The contract to construct a water system here has been awarded to the ALAMO ENGINE & SUPPLY CO., Omaha, Neb., at $5836. Bids were opened June 2. Noted May 29.

+Cut Bank, Mont.—The contract to construct a water system and electric-light plant here has been awarded to the TWO MIRACLE CONCRETE CORP., Kansas City, Mo., at $41,000. The other bids were: Haggard Construction Co., Fargo, N. D., $75,000; J. V. Lovell Co., Minneapolis, Minn., $51,000. Noted Apr. 17.

+Maryville, Mo.—(Official)—Contracts for constructing a water system here have been awarded by the Board of Public Works, as follows: Pumps, motors and generators, to the MERKLE-HINES MACHINERY CO., Kansas City, Mo., at $5200; two separate filters, to the PITTSBURGH FILTER CO., Pitsburgh, Penn., at $3998; repairs to tower, to the CHICAGO BRIDGE & IRON WORKS, Chicago, Ill., $7000. Bids were opened June 2. Noted May 29.

Owensville, Mo.—(Official)—Bonds for $12,000 have been voted for installing a water system here. J. P. Davis, Windsor, Mo., is Consult. Engr.

Bay City, Tex.—Land owners in the Peyton Creek Irrigation District have voted favorable on the proposition of issuing $125,000 of bonds to take over the Lake Austin reservoir, canals and pumping plant, and to enlarge that irrigation system.

Belton, Tex.—The City Council has called an election for July 2 to vote on a bond issue of $24,000 for improving and extending the water system.

Crystal City, Tex.—Bonds have been voted here for the purchase of the local water plant and for extensions to the distributing system.

Pecos, Tex.—The California - Texas Investment Co. has purchased a tract of 10,000 acres of land near here and will develop water and construct a system of irrigation for the purpose of reclaiming the land. The company is composed of Charles Fowler, Frank F. Fowler and Henry S. Judson, all of Los Angeles, Calif.

Spur, Tex.—Preliminary plans for the proposed water system here have been completed and approved by the City Commission. Estimated cost, $25,000. Noted June 12.

Waxahachie, Tex.—The City Council has ordered an election of taxpayers to be held July 7 to vote on the proposition of issuing $22,000 of water improvement bonds and $10,000 of permanent street improvement bonds.

Olympia, Wash.—An election will probably soon be called to vote on a bond issue of $150,000, for the construction of a municipal water system.

Eugene, Ore.—Bids will probably soon be asked for constructing three reservoirs, and several miles of 10- and 12-in. water mains. Bonds for $100,000 have been sold to finance these improvements. Noted May 1.

★**Burlington, Calif.**—(Official)—The date of receiving bids for the proposed water system here has been extended from June 30 to July 21. Noted June 12.

Sacramento, Calif.—R. L. Stone, Pres. of the Sacramento Valley Land & Water Co., has offered to supply Sacramento with 45,000,000 gal. of mountain water daily, for $3,950,000, or an alternate proposition affecting the water rights only, for $300,000. The company's supply is obtained in Napa and Lake Counties from the watershed of Putah Creek. The proposed dam will be 150 ft. high, and the reservoir will cost $665,000.

San Francisco, Calif.—The Midland Counties Irrigation Co. has been incorporated by W. F. Boardman, S. C. Ashill, Robert M. Harding, W. Nunlist, J. J. Webb, W. A. Simmons and W. C. Crittenden, and will take water from the Sacramento River at a point north of Red Bluff, Calif., and convey it to the Gooch lands and other tracts near Red Bluff.

San Rafael, Calif.—The Martin Municipal Water District is planning to build a reservoir in Liberty Gulch, Alpine Valley, to gather and store water from the Bolinas and Tamalpais water sheds and to build a distributing system, which will include the southern end of Marin County. The plan includes the purchase of about 5300 acres of land and tunnel and conduit rights of way from the Shafter-Howard Estate. The dam will be 125 ft. high, and will impound about 6,000,000,000 gal. of water. The daily supply is estimated at 15,000,000 gal. Estimated cost, $2,882,000.

Tulare, Calif.—Bids will be received by E. Oakford, City Clerk, until July 7, for constructing a new pumping plant at O St., between Tulare and Kern Sts., and installing two 750-gal. per min. pumps for domestic service, driven by two 60-hp. motors and two 750-gal. per min. pumps for fire service, run by two 40-hp. motors.

✚**Ventura, Calif.**—A contract has been awarded to WADDELL & WAGNER, 318 East 17th St., Los Angeles, at $11,000, for constructing a 1,000,000-gal. reservoir and distributing system of cement pipe on Tapo Ranch, Ventura County. F. G. Dessery, Central Bldg., is Engr.

Orilla, Ont.—The City Engineer is preparing plans for reconstructing the water system. Estimated cost, $50,000.

SEWERS

Waterville, Maine—The lowest bid received, June 2, for constructing about 600 ft. of 66-in. trunk sewer, was submitted by James H. Kerr, at $6037 for concrete, and $5152 for vitrified segment block. Noted Apr. 17.

Manchester, N. H.—Surveys are being made under the supervision of the Board of Public Works, for a sewer in Amoskeag. Estimated cost, $18,000.

✚**Boston, Mass.**—A contract to construct sewers in Bowdoin and Bourneside Sts., Dorchester District, has been awarded to ANTONY BARUFFALDI, at $5537. Bids were received June 6. Noted June 5.

✚**Milton, Mass.**—A contract to construct about 4600 ft. of pipe sewers has been awarded to LOUIS BALBONI, Roslindale, Boston, Mass., at $6113. Bids were opened May 23.

West Hartford, Conn.—Bids were received by the Board of Sewer Commissioners for the sewer system, June 6, as follows: (a) Section 1: (b) Section 2; (c) Section 3; (d) Section 4: Henry Spinach, Waterbury, Conn., (a) concrete, $41,672; cast iron, $39,622; (b) $46,572; (c) $60,899; (d) sanitary, $33,810; stone, $9840; total, $43,650; Piersen Engineering & Construction Co., Hartford, Conn., (a) concrete, $43,471; cast iron, $45,645; (b) $41,596; (c) $51,196; (d) sanitary, $47,008; storm, $10,782; total, $57,790; B. Silvestri Co., Hartford, Conn., (a) concrete, $45,518; cast iron, $49,578; (b) $43,055; Petrossi Co., Hartford, Conn., (a) cast iron, $52,772; Falvey & Kelley, Dorchester, Mass., (a) concrete, $63,634; cast iron, $63,184; (b) $46,015; (c) $62,026; F. B. & W. H. O'Neil, Hartford, Conn., (b) $41,567; (c) $48,933; sanitary, $36,027; storm, $11,810; total, $47,837; C. H. Slocomb & Co., Hartford, Conn., (b) $42,640; Angelo Conti & Co., Hartford, Conn., (b) $43,982; (c) $44,248; (d) sanitary, $33,524; storm, $10,101; total, $43,625; D. F. Crowley, Hartford, Conn., (b) $45,355; Di Marco Co. Hartford, Conn., (b) $53,435; (d) sanitary, $33,730; storm, $8632; total, $42,362; Petrossi Bros., Hartford, Conn., (d) sanitary, $49,010; storm, $9703; total, $58,713. Noted May 29.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 25, by the President of the Borough of Brooklyn, Borough Hall, for furnishing all the labor and material required for constructing sewers in Coney Island Ave., both sides from the sewer summit between Ave. N and Ave. O to Ave. O, and outlet sewers in Ave. O, from Coney Island Ave. to Kings Highway, and in Kings Highway, from Ave. O to Ave. N. Alfred E. Steers is Pres.

Yonkers, N. Y.—(Official)—Bids will be received by the Bronx Valley Sewer Commission, White Plains, for constructing a sewage settling, reducing and screening plant at the intersection of the Bronx Valley Sewer with Tibbet's Brook, in the city of Yonkers. Frank F. Hoak is Chn.

Belleville, N. J.—Frank Shepherd, Town Engr., has prepared plans for a sanitary sewer system here. Bids will probably soon be asked.

Hammonton, N. J.—Bids will be received by the Board of Sewerage until June 30, for constructing about 11 miles of pipe sewers and a sewage disposal plant. Samuel Anderson is Sec'y.

✚**Perth Amboy, N. J.**—The Common Council has awarded a contract to LIDDLE & PERRIELLO, Perth Amboy, for the construction of a 15-in. sewer line in Brookland Pl., at $1.21 per lin.ft., and $24 for each m.hole.

Blairsville, Penn.—(Official)—Bids will be received by the Town Council until 8 p.m. June 24, for constructing 10,000 ft. of 6-in. house connections, 12,000 ft. of 8-in. house connections, 25 manholes, brick or concrete, with standard iron cover, 18 lampholes of 8-in. pipe, t.c., with standard iron cover, and about 500 8x6-in. Y reducers. Hugh R. Wiley is Secy. Edward J. O'Brien, Latrobe, is Engr.

Fernwood, Penn.—The Commissioners of Upper Darby Township are planning to install a sewer system to serve Fernwood, Drexel Hill and Highland Park. Estimated cost, $35,000.

★**Newark, Del.**—(Official)—The date of receiving bids for the construction of the proposed sewer system and sewage disposal plant has been extended to noon, June 25. Samuel J. Wright is Chn. Sewer Comn. T. Chalkley Hatton, Wilmington, Del., is Consult. Engr. Noted June 12.

Roanoke, Va.—Bids will be received by W. L. Craft, City Clk., until noon, June 27, for constructing sewers in various streets. Plans and specifications may be obtained at the office of F. L. Gibboney, City Engr.

Parkersburg, W. Va.—B. F. Stewart, Jr., City Engr., is preparing plans for the construction of several sanitary sewers. Estimated cost, $25,000.

Bessemer City, N. C.—It is proposed to install a sewer system here, to cost about $25,000. R. F. Coble is Mayor.

Cherryville, N. C.—J. Newton Johnston, Consult. Engr., Florence, S. C., is preparing plans and specifications for the installation of a sewer system here.

Dunn, N. C.—Gilbert C. White, Consult. Engr., Charlotte, N. C., has been retained to prepare plans and specifications fort a sewer system, using Black River as an outlet.

Mooresville, N. C.—An election has been called by the Town Commissioners for July 8, to vote on a bond issue of $30,000, for constructing sewers.

Washington, N. C.—See item under Water Supply—Irrigation.

Jackson, Ga.—An election has been called for July 8 to vote on a bond issue of $23,000 for constructing sewers. W. E. Watkins is Mayor. Noted June 12.

✚✚**Birmingham, Ala.**—Contracts have been awarded as follows for the construction of a sewer to start at Ave. E and 13th St., and empty into the old Elyton Canal near Smith's Park: Sections 1, 2 and 3, to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, at $70,940, $26,945, and $70,152, respectively; Section 4, to A. C. BROOKS & CO., Birmingham, at $24,750. Bids were opened June 3. Noted May 15.

Lafayette, La.—C. A. Reis, Consult. Engr., Shreveport, La., has been retained to prepare plans for a sewer system here, estimated to cost $100,000. Noted June 12.

Greenville, Tenn.—Bonds for $40,000 have been voted for extending and improving the sewer system.

✚**Louisville, Ky.**—The contract to construct sewers in Shelby and Preston Sts. has been awarded to J. H. CAHILL, Louisville, at $90,041. Bids were opened May 27. Noted June 12.

Paris, Ky.—The City Council is considering the construction of sewers covering the entire eastern portion of the city. J. T. Hinton is Mayor.

Bedford, Ohio—The lowest bid received by C. C. Lowe, Village Clk., for the construction of a sewage disposal plant was submitted by W. H. Ralston, Mount Vernon, at $6200. Bids were opened May 22. Noted May 22.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 27, for constructing main and lateral sewers in various streets. Plans and specifications may be obtained at the office of the Chief Engineer of the Department.

✚**Columbus, Ohio**—(Official)—The contract to construct the southern relief sewer has been awarded to the J. B. SHEETS CO., Pittsburgh, Penn., at $189,000. Bids were opened June 10. Noted June 5.

Galion, Ohio—(Official)—Bids will be received by E. C. Yochem, City Clk., until noon, June 24, for constructing sanitary sewers in Cherry St., Jefferson St., Payne Ave., and the Tenth District. A. O. Theobald is City Engr.

Mansfield, Ohio—(Official)—Bids will be received by the Board of Control until noon, June 24, for constructing storm water sewers in various streets, according to plans and specifications on file at the office of the City Engineer. E. A. Bleeker is Dir. Pub. Ser.

Mount Vernon, Ohio—The City Council has decided to install a sewage disposal plant. Estimated cost, $40,000.

Geneva, Ind.—(Official)—Bids will be received by the Board of Trustees until 9 a.m., July 9, for constructing 7218 ft. of 10- to 36-in. pipe sewers, 30 manholes, and a concrete head wall. Plans and specifications may be obtained from W. A. Wells, Town Clk. John T. Gillig, Decatur, Ind., is Consult. Engr. Noted May 29.

Mount Vernon, Ind.—John E. Anderson, Engr., is preparing plans for the construction of a 48-in. sewer, estimated to cost $15,000. J. T. Schulheis is City Clk.

Rockport, Ind.—Bids will be received by the Common Council until June 27, for constructing joint storm and sanitary sewers in portions of Walnut, Main, Elm and various other streets. Charles E. Sarneal is City Clk.

Grosse Pointe Park, Mich.—Bonds for $150,000 were voted, June 4, for the construction of a sewer in Jefferson Ave. Louis N. Hiss-ndegen is Village Pres. Noted Apr. 24.

✚**Pontiac, Mich.**—A contract to construct sewers in various streets has been awarded by the City Commission to the GRAY-ROBINSON CONSTRUCTION CO., Manitowoc, Wis., at $18,387.

Farmington, Ill.—Charles H. Dunn, Consult. Engr., Peoria, Ill., is preparing plans and specifications for the installation of a sewer system here.

✚**Herrin, Ill.**—The contract to construct a sewer system and sewage disposal plant here has been awarded to the FOULKES CONTRACTING CO., Terre Haute, Ind., at approximately $50,000. R. L. Adams is City Engr.

✦Kinkaid, Ill.—(Official)—The contract to construct about 4½ miles of sanitary sewers, 8- to 15-in. diameter, and about 60,000 cu.yd. of grading, has been awarded to JOHN BROGAN, Green Bay, Wis., at $21,150, for sewers, and $24,000 for grading. Bids were received, June 2, by the Pawnee Construction Co., at the office of Alvord & Burdick, Consult. Engrs., Hartford Bldg., Chicago. Noted May 29.

✦Bangor, Wis.—(Official)—The contract to construct about 13,000 lin.ft. of sewers here has been awarded to L. W. SCHRUTH, Milwaukee, Wis., at $14,119. The other bids were: N. F. Palen, Sparta, Wis., $14,759; Robert Nelson, Racine, Wis., $14,904; Thill-Manning-Whalen Co., Lax, Wis., $14,880; C. W. Noble, Lax, Wis., $14460; Chas. Millard Sparta, Wis., $13,902. Bids were opened June 7, by S. B. Weldon, Village Clk. Noted June 5.

Racine, Wis.—J. W. Alvord, Consult. Engr., Chicago, Ill., has been retained by the city to prepare plans for the proposed sewage disposal plant.

✦Superior, Wis.—A contract for the lateral sewers to be laid in the district south of the Normal School has been awarded by the Board of Public Works to the RUSSELL CONSTRUCTION CO., Superior, at $5000.

✦Eldorado, Iowa—(Official)—The contract to construct two miles of 8- to 15-in. sewers, and one mile of 4-in. water mains has been awarded to the DEARBORN CONSTRUCTION CO., Waterloo, Iowa, at $18,975. The other bids were: H. J. Cathrowe Co., Omaha, Neb., $20,479; M. Tschirgi & Sons, sewer only, $18,240; Des Moines Bridge & Iron Co., water only, $2238; Black Hawk Construction Co., water only, $1955; S. W. Ansel, water only, $2026. L. J. Stout is City Clk. Noted May 29.

Sac City, Iowa—(Official)—Bids will be received until 8 p.m., June 23, for the construction of sewers in various streets. W. F. Weary, is City Clk.

✦New Ulm, Minn.—(Official)—The contract to construct sewers in various streets here has been awarded to LARS OVERN, St. Peter, Minn., at $6570. The other bids were: Chas. Emmrich, New Ulm, $8208; H. Coalsaet, Marshall, Minn., $7414; B. Keogh, St. Peter, Minn., $7400. Bids were opened June 9. F. D. Minimum is City Engr. Noted June 5.

Thief River Falls, Minn.—Bids will be received by W. H. Quist, City Clk., until June 27, for constructing sewers in Districts No. 3 and No. 4. The contract involves the construction of about 18,000 lin.ft. of 8- to 29-in. pipe.

Kinsley, Kan.—Bids will be received by M. A. Wilson, City Clk., until June 23, for constructing a sanitary sewer system, according to plans prepared by Burns & McDonnell, Consult. Engrs., Scarritt Bldg., Kansas City, Mo.

Howard, S. D.—Bids will be received about June 30 for constructing a sewer system and sewage disposal plant here, according to plans prepared by Bruce & Standevin, Consult. Engrs., Omaha, Neb. Estimated cost, $23,000. Noted May 8.

✦St. Louis, Mo.—(Official)—The contract to construct sewers in Rock Creek Sewer District No. 2, Letting No. 10,897, has been awarded to WILLIAM F. RILEY, St. Louis, at $144,285. The other bids were: Fruin-Colnon Construction Co., St. Louis, $177817; John T. McMahon, St. Louis, $157,037; Thos T. Hogan, St. Louis, $148,656. Bids were opened May 23. Noted May 22.

Bids will be received by the Board of Public Improvements until noon June 24, for Letting No. 10,904, the Glaise Creek Joint District Sewer. The contract involves the following: 1945 ft. of 16x11 ft. 7 in.; 379 ft. of 15 ft. 6 in. x 11 ft. 2½ in.; 300 ft. of 12x8 ft. 6¾ in.; 15 ft. of increaser from 12x8 ft. 6¾ in. to 16x11 ft. 7 in.; 20 ft. of junction chamber, as per plan, with creek inlets, manholes, and all other appurtenances. William T. Findly is Secy.

Ogden, Utah—Bids will be received by H. J. Craven, City Engr., until 10 a.m., June 24, for constructing sewers in District No. 116.

Salt Lake City, Utah—(Official)—Bids will be received by Noble Warrum, City Recdr., until 10 a.m., June 19, for constructing pipe sewers, according to plans on file at the office of the City Engineer.

Colville, Wash.—The City Council has passed an ordinance providing for the construction of a trunk sewer and a subtrunk sewer, with branches. Plans and specifications have been approved and are on file with the City Clerk.

Sumas, Wash.—The City Council has passed a resolution of intention for the construction of a sewer and drainage system. J. L. Mitchell is City Clk.

Biggs, Calif.—Charles E. Sloan, Consult. Engr., Nevada Bank Bldg., San Francisco, is preparing plans for the construction of a sewer system here.

The Pas, Sask.—Bids will be received by H. H. Elliott, Secy.-Treas., until 6 p.m., July 1, for furnishing and laying sewer pipe. Murphy & Underwood, Saskatoon, Sask., are Consult. Engrs.

Saskatoon, Sask.—Bids will be received by George T. Clark, City Engr., until June 20, for constructing 3400 lin.ft. of 36-in. and 2478 ft. of 30-in. concrete sewer.

Vancouver, B. C.—The Board of Public Works has recommended the laying of 30-in. pipe sewers through Kitsilano Park, also a 27-in. sewer in Arbutus St., and 14-in. in Yorke St. The improvement will cost approximately $10,000.

STREETS AND ROADS

Boston, Mass.—The following bids were received by the State Highway Commission for constructing 4000 lin.ft. of macadam road in West Boylston: (a) Trap rock; (b) local stone: New England Construction Co., Worcester, (a) $13,100; (b) $13,100; Horne & Lowe Construction Co., Worcester, (a) $13,162; (b) $13,802; Way & Cellillo, Springfield, Mass., (a) $13,267; (b) $13,187. All bids were rejected. W. D. Sohier is Chn. Noted June 5.

✦The contract for the construction of an asphalt macadam roadway in Orient Ave., East Boston, has been awarded to JAMES DOHERTY at $20,505. Other bids were: Howe Contracting Co., $20,614; William J. Rafferty Co., $21,876; Coleman Bros., $22,173.

Bids will be received until June 23, by the Department of Public Works, for paving Providence St., City Proper, and for sidewalks in Pope's Hill and Walnut Sts., Dorchester. L. K Rourke is Comr.

Bids will be received until June 24 by the State Highway Commission, for constructing 7300 lin.ft. of road in Townsend. Arthur W. Dean is Highway Engr.

Pittsfield, Mass.—Bids will be received until 7:30 p.m. June 20, by the Board of Public Works, for the construction of about 4000 sq.yd. of blockstone pavement on Columbus Ave. L. B. Cummings is Secy.

✦Hartford, Conn.—Contracts for the improvement of State roads, bids for which were received May 29, have been awarded as follows:

Town of Monroe, 6225 lin.ft. of gravel construction on the Bridgeport-Monroe Turnpike to BENNETT N. BEARD CO., Shelton, Conn., gravel, $1.50 per lin.ft.; telford, $2.20 per lin.ft.; rubble drain, $1 per lin.ft.; cobble gutters, 60c. per sq.yd.; concrete walls, $10 per cu.yd.; masonry walls, $6 per cu.yd.; dry rubble walls, $5 per cu.yd. Town of Fairfield, 4272 lin.ft.; bituminous macadam construction on the Easton Turnpike to the B. D. PIERCE, JR., CO., Bridgeport, Conn., bituminous macadam, $1.43 per sq.yd.; macadam over telford, $2.30 per sq.yd.; rubble drain, $1 per lin.ft.; concrete walls, $10 per cu.yd.; masonry walls, $8 per cu.yd.; dry rubble walls, $6 per cu.yd. Chas. J. Bennett is Highway Comr. Noted May 29.

✦Albany, N. Y.—The Board of Contract and Supply has awarded contracts for the improvement of New Scotland Ave. and repaving Broadway with asphalt from Columbia St. to Livingston Ave. to the NORTH HUDSON CONTRACTING CO., Troy, N. Y., at $104,937 and $36,032 respectively. The contract for paving a portion of Alden Ave. with brick was awarded to B. F. MULDERRY at $9727. Isadore Wachsman is Secy. of the Bd.

Brooklyn, N. Y.—(Official)—Bids will be received until 11 a.m., June 25, by the President of the Borough of Brooklyn, Borough Hall, for paving portions of Belmont Ave., Sutter Ave., Blake Ave., Dumont Ave., Carroll St., Irving Ave., St. Johns Place, Ave. L and Ave. D. Alfred E. Steers is Pres.

✦Hornell, N. Y.—The Board of Public Works has awarded contracts for street paving as follows: For paving Church St. to the GREENFIELD CONSTRUCTION CO. at $5632; to WITT & BLADES at $4039 for paving Collier St., $7506 for Jane St., $3334 for West St. and $5681 for Hornell St. Noted May 29.

✦Lockport, N. Y.—The Common Council has awarded the contract for paving Lock St. with brick to C. N. STAINTHORPE & CO., Lockport, N. Y., at $21,485. Other bidders were: C. B. Whitmore Co., $22,725; H. P. Burgard Co., Buffalo, $27,833; S. V. R. Malcom & Son, Buffalo, $23,778. Julius F. Frehsee is City Engr.

★Newburgh, N. Y.—(Official)—The time for receiving bids for paving Liberty St. from Broadway to North St. has been extended to June 24, instead of June 10, as previously noted. D. J. Coutant is City Clk. Noted May 29.

✦New York, N. Y.—(Official)—The following contracts for paving on various streets have been awarded by the President of the Borough of Manhattan from bids received June 9: 14th St., from Eighth Ave. to Ninth Ave., with sheet asphalt and special granite, to the SICILIAN ASPHALT PAVING CO., at $20,392; 35th St., from First Ave. to Third Ave., with sheet asphalt, to the UVALDE CONTRACTING CO., at $13,365; to WILLIAM J. FITZGERALD, at $6377, for Water St., from Old Slip to Wall St., with wood block; at $8241, for 16th St., from Broadway to Fifth Ave., with wood block; at $8328, for 17th St., from Broadway to Fifth Ave., with wood block; at $31,618, for Amsterdam Ave., from 60th St. to 62nd St., and from 68th St. to Broadway; to JOSEPH GALLICK, at $12,522, for regulating, grading, curbing and paving Park Terrace West, from 215th St. to 218th St. George McAneny is Pres.

New York, N. Y.—(Borough The Bronx)—Bids will be received until 10.30 a.m., June 25, by the President of the Borough The Bronx, Municipal Bldg., Third Ave. and 177th St., for paving portions of various streets. Cyrus C. Miller is Pres.

(Borough of Queens)—(Official)—Bids will be received until 11 a.m., June 25, by the President of the Borough of Queens, Borough Hall, Jackson Ave. and Fifth St., Long Island City, for paving portions of various streets. Maurice E. Connolly is Pres.

(Borough of Queens)—(Official)—The following bids were received, June 12, by the Park Board, Fifth Ave. and 64th St., Boro. Manhattan, for constructing automobile roads in Forest Park, Boro. of Queens: Joseph Balaban & Co., 281 Broadway, Manhattan, $49,740; Evergreen Construction Co., 244 Jackson Ave., Long Island City, $36,509; McBride & Catlan Contracting Co., 2904 Valentine Ave., Bronx, $51,522; Thomas O'Connor, 103 Cedar St., Manhattan, $39,666; Pheon Contracting Co. 99 East 160th St., Manhattan, $40,171; Thomas J. Sullivan, 401 West 34th St., Manhattan, $40,877; William Young, 448 West 36th St., Manhattan, $62,598. Charles B. Stover is Pres.

✦Olean, N. Y.—(Official)—The Commissioners of Public Works have awarded the contracts for paving Reed St. and South First St. to T. E. RIGGATE and D. D. DUGAN respectively. Bids will be received until June 21 for paving portions of five streets. F. M. Stowell is City Clk. Noted June 5 and 12.

Poughkeepsie N. Y.—(Official)—The following were the bids received, June 5, by the Board of Public Works, for 14,000 sq.yd. brick pavement: (a) Metropolitan block; (b) Olean block; (c) Mack block: P. W. Mulderry, (a) $39,721; (b) $38,461; (c) $40,421; S. Beskin, Fishkill, N. Y., (a) $38,900; (b) $37,640; (c) $39,690; Bridgeport Construction Co., Poughkeepsie, N. Y., (a) $40,762; (b) $38,242; (c) $40,762. The contract will be awarded June 19. R. J. Shields is Clk. of the Bd. E. W. Sylvester is Supt. Noted May 29.

✦Sidney, N. Y.—(Official)—Bids for paving Bridge St. with brick, concrete curb and gutter were received by the Board of Trustees as follows: Valley Construction Co., Sidney, N. Y., $12,091, INGALLS STONE CO., Oneonta, N. Y., $10,479 (awarded contract); Strobel & Field, Herkimer, N. Y., $11,140; Dana W. Robbins, Cobleskill, N. Y., $11,772; Nash, Robinson & Griffin, Norwich, N. Y., $11,111. E. F. Musson, Norwich, N. Y., is Engr.-in-Charge. Noted May 29.

Bloomfield, N. J.—Bids will be received until July 7 by the Town Council for about 2750 sq.yd. bitulithic pavement on Dodd St. Raymond F. Davis is Town Clk.

Harrison, N. J.—The Common Council has passed an ordinance providing for the paving of Hamilton St., from Davis to Franklin Ave., with bitulithic block, on a concrete foundation.

Hoboken, N. J.—The Common Council has instructed its engineer, James Wittemore, to prepare plans and specifications for the improvement of Washington St. Asphalt block, granite block, bitulithic block, or wood block, on a 6-in. base, will be used.

Hoboken, N. J. (Official) Bids will be received until 4 p.m. June 25 by the City Council, for repaving and improving pavement of Willow Ave., Grand, Clinton, Monroe, Jefferson and Jackson Sts. James H. Londrigan is City Clk. Noted May 22

Rahway, N. J.—Alvin B. Fox, Perth Amboy, County Engr., for the State Highway Comn., will soon commence surveys for the proposed state highway road from Rahway to New Brunswick.

Trenton, N. J.—The Board of Commissioners has approved of ordinances providing for the paving of the following streets: Lamberton St., from Ferry to Cass St. (bituminous concrete); Grand St., from Cass to Liberty St. (vitrified brick or bituminous concrete); and repaving South Broad St. with vitrified brick. A. Swan, Jr., is City Engr.

Blairsville, Penn. (Official) Bids will be received until 8 p.m., June 24, by the Borough Council, for about 22,600 cu.yd. of excavation, 47,000 lin.ft. concrete curb and 50,600 sq.yd. paving, of brick or other approved material. Hugh R. Wiley is Secy. Edward J. O'Brien, Latrobe, Penn., is Engr.

Crafton, Penn.—(Official) Bids will be received until 5 p.m., July 1, by the Borough Council for paving parts of McMunn Ave. and Bloomer St. F. J. Huffman is Boro. Clk. James S. Haring is Boro. Engr.

Grove City, Penn.—(Official)—Bids will be received until 7 p.m., June 24, by the Borough Council for improving Madison St. and Woodland Ave. Bids will be accepted for brick, asphaltic concrete or asphaltic macadam pavement. The approximate quantities are 3000 cu.yd. excavation, 8500 sq.yd. paving and 6500 lin.ft. curbing. L. L. McKay is Boro. Secy.

✚Mount Carmel, Penn.—The Borough Council has awarded the contract for paving and curbing 15 blocks of street in the business district to the OTTO PAVING & CONSTRUCTION CO., Lancaster, Penn., at $80,000. Vitrified block on a concrete base will be used.

✚New Castle, Penn.—The Borough Council has awarded a contract to JOHN B. THORSON, at $18,871, for paving portions of Wallace Ave., Beavers and Reis Sts. M. E. MILLER, at $10,782, was awarded the contract for paving Winter Ave. and Apple Alley.

✚Pittsburgh, Penn.—The Mayor and City Council have awarded the contract for repaving a portion of Fifth Ave. with blockstone to BOOTH & FLINN, LTD., at $11,800. Wm. A. Magee is Mayor. Noted May 15.

Pittston, Penn.—(Official)—Bids will be received until 7:30 p.m., June 24, by the City Council, for improving portions of Market, Elizabeth, John, Vine, Front and South Main Sts. Thomas F. English is City Clk.

✚Cumberland, Md.—The City Council has awarded contracts for improving various streets to the MODERN CONCRETE CONSTRUCTION CO., at $9094, and to FREDERICK PERRY, at $4101. James P. Gaffney is City Engr.

Savannah, Ga.—The City Council has decided to pave portions of Barnard, York, Hull, Perry, Harris and Taylor Sts. with creosoted wood block or asphalt block pavement. About 17,000 sq.yd. will be required. Bids will be received until June 25. E. R. Conant is Ch. Engr.

Alabama—(Official)—Bids will be received as follows for the construction of roads in Alabama:

June 24, at Linden, Ala., by the Commmissioners' Court of Marengo County for grading draining and surfacing about four miles of road. Amount available $7000. W. A. Hall is Clk.

June 27, at Birmingham, Ala., by the Board of Revenue of Jefferson County for macadamizing part of the old Stouts Road, at a cost of $4000.

July 1, at Anniston, Ala., by the Commissioners' Court of Calhoun County for macadamizing about 1½ miles of the Piedmont & Jacksonville Road. Estimated cost, $4000.

July 3, at Columbia, Ala., by the Board of Revenue of Shelby County, for grading and draining part of the Alabaska and Saginaw Road. Estimated cost, $4000. W. S. Keller is State Highway Engr.

Grenada, Miss. (Official) Bids will be received until July 8, by the City Council for the construction of 14,000 sq.yd. vitrified brick, wood block, concrete or bitulithic pavement and 10,000 lin.ft. concrete curb. L. B. James is City Recdr.

✚Meridian, Miss. (Official)—The Good Roads Commission of Lowndes County, has awarded a contract for constructing county roads to J. OTTO KITTEL, Nashville, Tenn., at $104,000. The total cost of rural roads to be constructed will aggregate $175,000. W. P. Moore is Ch. Engr. C. C. Dunn is Clk. of the Com. Noted May 29.

✚New Orleans, La.—(Official)—The State Highway Department has awarded a contract for the construction of about 55 miles of gravel roads in Caddo Parish to the HEALY CONSTRUCTION CO., Meridian, Miss., at $32,962. Other bidders were: Eagle Construction Co., $51,803; W. B. Kenard, A. G. Hammet & J. B. Marston, $34,365; Neel & Ritchie, $36,176; Boyd & Bordelon, $38,501. W. E. Atkinson is State Highways Engr. Noted May 29.

✚Mount Sterling, Ky.—(Official)—The City Council has awarded the contract for about 9400 sq.yd. asphalt base paving and 4575 lin.ft. curb and gutter at $2.25 per sq.yd. and 70c. per ft. respectively. Other bidders were: The Central Construction Co., Lexington, Ky., and E. C. Milner & Co., Louisville, Ky. J. W. Bosley is City Engr. H. M. Ringo is City Clk. Noted May 22.

Amherst, Ohio—(Official)—Bids will be received until noon, July 5, by the Village Council for grading, draining curbing and paving portions of Main, Church, Elyria, Tenney, West Railroad, North Railroad, South Railroad and West Sts. C. W. Courtney, 1150 Leader-News Bldg., Cleveland, is Engr.-in-Charge. H. J. Miller is Clk.

Ashland, Ohio—Bids will be received until noon, June 21, by the Director of Public Service for paving East Washington and West Main Sts. with Metropolitan brick on concrete foundation, concrete curb and gutter. Fred Edwards is Dir.

Canton, Ohio—(Official)—Bids will be received until 10 a.m., June 25, by the Board of Commissioners of Stark County for paving with brick and otherwise improving 2.15 miles of the Fairmount Home Road Extension. The estimated cost is from $40,794 to $45,904, according to curbing used. J. H. McConnell is County Audr.

✚Chillicothe, Ohio—(Official)—The contract for grading and filling with gravel portions of various streets was awarded to PINKNEY BREWER, Chillicothe, at 47c. per cu.yd. for Hickory St., and 42c. for Ewing and Fourth Sts. Henry M. Redd is City Engr. Edward L. Albright is Dir. of Pub. Ser. Noted May 29.

✚Cincinnati, Ohio—(Official)—The County Commissioners have awarded the contract for improving the Mill Road, Springfield, Township, to O. D. CURRY, 2525 Ashland Ave., Cincinnati, at $22,693. Clinton Cowan is County Engr. Noted May 15.

Cleveland, Ohio—(Official)—The low bidder for improving the Aurora Road was the ENTERPRISE PAVING & CONSTRUCTION CO., Cleveland, Ohio. Frank R. Lander is County Surv. Noted May 22.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., June 27, by the State Highway Commissioner for the following road construction: Grading and paving with brick, 1.07 miles of the Doylestown-Barberton Road, Chippewa Township at an estimated cost of $16,156; grading and paving with bituminous macadam 1.39 miles of the Millersburg-Berlin Road at an estimated cost of $17,462; grading and paving with waterbound slag macadam 2.34 miles of the Pittsfield-Wellington Road at an estimated cost of $17,176; grading and paving with waterbound macadam 3.3 miles of the Wilmington-Xenia Road at an estimated cost of $20,639; grading and paving with concrete 1.09 miles of the Port Clinton Road at an estimated cost of $16,569; grading and paving with concrete 2.6 miles of the Oberlin-Norwalk Road at an estimated cost of $31,595; grading and paving with waterbound macadam, one mile of the Urbana-Sidney Road at an estimated cost of $8658; grading and paving with concrete 0.41 mile of the Kalida-Lima Road at an estimated cost of $5422; grading and paving with waterbound macadam, 1.38 miles of the Zanesville-New Lexington Road at an estimated cost of $12,639; grading and paving with brick for medium traffic, one mile of the Chester Road, Chester Township. James R. Marker is Comr.

Bids will be received until 2 p.m., June 20, for the construction of the following roads: Grading and paving with waterbound macadam 1.26 miles of the Steubenville-Cambridge Road at an estimated cost of $9005; grading and paving with brick for heavy traffic,0.66 miles of the Wadsworth-Wooster Road at an estimated cost of $10,110; grading and paving with brick for heavy traffic, 1.14 miles of the Zanesville-Dresden Road at an estimated cost of $21,053.

✚(Official)—Contracts for road improvements have been awarded as follows: To the WILSON ENGINEERING & CONTRACTING CO., Xenia, Ohio, at $7398 for paving part of the Piqua Urbana Extension No. 1 Road; to LUNSFORD BROS., Pedro, Ohio, at $6000 and $7994 respectively for improving parts of the Kenton-Forest and Kenton-Mount Victory Roads.

✚The following contracts were awarded from bids received on June 13: Lexington-Mansfield, water-bound macadam, 4.37 miles, to T. A. GRUBER Caledonia, Ohio, $32,256; Ashland-New London, brick, 2.51 miles, LEE, GRIGGS & ANDERSON, Millersburg, Ohio, $36,000; McArthur-Hamden, water-bound macadam, 2.78 miles, ROUSH & WOOLUM, $14,899; Central Ave. Extension, Toledo, 1½ miles, bituminous macadam, W. M. GRAY, Bowling Green, $12,300; Kenton-Findlay, two miles, waterbound macadam. W. G. MUSTARD, Ada, Ohio, $6845.

✚Delaware, Ohio—(Official)—The Commissioners of Delaware County have awarded the contract for improving 1.26 miles of the Infirmary Road to V. T. BARTON, Condit, Ohio, at $7100. S. C. Kissner & Sons bid $7170. W. F. Whittier is County Engr. Noted May 29.

Euclid, Ohio—(Official)—Bids will be received until noon, June 30, by the Village Council for improving Church St. from Euclid Ave. to the tracks of the New York, Chicago and St. Louis R.R. by grading, draining and paving with brick. Fred H. Schoaff is Village Clk. The F. A. Pease Engineering Co., Cleveland, Ohio, is Engr.-in-Charge.

Lancaster, Ohio—Bids for paving Sixth Ave. from Forest Rose Ave. to East St., about 25,800 sq.yd., were received by the Board of Control as follows: J. R. Glover, Lancaster, $40,445; C. F. Justus, Lancaster, $36,795; Rosser & Harper, Bremen, $42,744; Bowers & Wilson, Athens, $33,059. R. F. Brown is Dir. of Pub. Serv.

Lorain, Ohio (Official)—Bids will be received until 10 a.m., June 27, by the Commissioners of Lorain County for improving approximately 9 miles of the Penfield Ave. Road, Sheffield Township, by paving with concrete, waterbound macadam or macadam with a bituminous binder. T. L. Gibson is Surv.

Sebring, Ohio—(Official)—Bids will be received until noon, June 28, by the Trustees of Smith Township, for paving about 3½ miles of the Johnson Road with limestone or slag macadam. The contract will be let in two sections, the first of 1½ miles and the second two miles. J. F. Lamborn is a Trustee.

+Springfield, Ohio— The Board of Control has awarded contracts for paving portions of McCreight Ave., Jefferson and Washington Sts., to McHUGH BROS. at $11,426. Edward Schaefer is Dir. of Pub. Ser.

Toledo, Ohio— Bids for paving Summit and Cherry Sts. were received as follows by the Board of Control: Summit St.: Asphalt Block Paving Co., asphalt block, $36,656. The Andrews Asphalt Paving Co., Trinidad asphalt, $33,571, bitulithic, $35,-360. H. P. Streicher, sheet asphalt, $31,880. Harris & Tansey, wood block, $46,319. The Garrigan Bros. Co., sheet asphalt, $46,088, wood block, $41,316; Warren Bros. Co., Boston, bitulithic, $35,265; M. F. O'Sullivan, wood block, $50,179; The Russell & Jennison Co., wood block, $43,122; A. A. Reilly, wood block, $43,424. Cherry St.: Asphalt Block Paving Co., $39,529; the Garrigan Bros. Co., wood block, $57,128; sheet asphalt, $54,898; bitulithic, $44,985.50. Andrews Asphalt Paving Co., asphalt, $33,958.50; the Russell & Jennison Co., wood block, $52,930, sheet asphalt, $33,450; Warren Bros., bitulithic, $40,-499; H. P. Streicher, wood block, $55,024; sheet asphalt, $29,-744; bituminous concrete, $31,344. T. R. Cowell is Dir. of Pub. Serv.

+Toledo, Ohio—The Director of Public Service has awarded the following contracts for street improvements: GARRIGAN BROS. CO., at $11,317, for paving Summit St. with creosoted wood block; H. P. STREICHER, at $29,744, for paving Cherry St. with asphalt over the present stone pavement; ALBERT GRYZBOWSKI, at $4141, for vitrified brick pavement on Central Ave. T. R. Cowell is Dir.

Washington C. H., Ohio—(Official) Bids will be received until noon, June 28, by the Director of Public Service for the construction of concrete sidewalks eight ft. wide on North St. from Court to Paint St. C. E. Mark is Dir.

+Bedford, Ind.—(Official) The Commissioners of Lawrence County have awarded contracts for the construction of 13 county roads to five local contractors at a total cost of $24,381. Ezra W. Edwards is Audr. Noted May 22.

+Columbia City, Ind.—(Official)—The Commissioners of Whitley County have awarded a contract for the construction of a road in Smith Township to W. W. HATCH & SON, Goshen, Ind., at $15,290. Chas. E. Kiser is Audr. Noted May 22.

+Corydon, Ind.—(Official)—The Commissioners of Harrison County have awarded a contract to KENNEDY & MEURER, New Middletown, Ind., at $7797 for the construction of roads in Spencer, Washington and Franklin Townships. J. L. O'Bannon is Audr. Noted May 22.

+Crawfordsville, Ind.—(Official)—The Commissioners of Montgomery County have awarded contracts for road construction to LAWRENCE JENKINS, Frankfort, Ind., at $4075 and to F. B. WARREN, Crawfordsville, Ind., at $9372. Bennett B. Engle is Audr. Noted May 15.

+Frankfort, Ind.—(Official)—The Commissioners of Clifton County have awarded contracts for county road construction as follows: FRANKFORT CONSTRUCTION CO., two roads, W. D. KELLY, one road, NEEF & SEAMAN, four roads, LEE & KELLER, one road, MAXWELL & KELLY, Michigantown, Ind., three roads. Chas. F. Cromwell is Audr. Noted May 29.

+Mount Vernon, Ind.—(Official)—The Commissioners of Posey County have awarded the contract for constructing a road in Black Township to the MOUNT VERNON CONSTRUCTION CO. at $6393. J. R. Haines is Audr. Noted May 22.

+Bloomington, Ill.—The Board of Local Improvements has awarded a contract to I. D. LAIN at approximately $57,000 for brick pavement on Clay and Vale Sts. and Mercer Ave. The only other bidder was Meyer & Thomas, East St. Louis, Ill.

The City Engineer has prepared plans for paving East Washington St. with brick from Main St. to the Illinois Central R.R. tracks. The estimated cost is $31,005. Elmer Folsom is City Engr.

Paris, Ill.—(Official)—Bids will be received until 2 p.m., June 30, by the Town Board of Highway Commissioners for the improvement of the Clinton Road. The approximate quantities are: 2165 cu.yd. excavation, 9028 lin.ft. concrete curb and 6086 sq.yd. brick pavement. Chas. Sullivan is a Highway Comr.

Portage, Wis.—(Official)—Bids will be received until noon, June 30, by the City Council for construction granite macadam pavement on portions of De Witt, Oneida, Cass and Wisconsin Sts., about 23,642 sq.yd. in all. Walter E. Washburn is City Clk.

+Burlington, Iowa—(Official)—The City Council has awarded the contract for paving Denmark and River Sts. to YOUNG & BRUSCHER at $1.17 per sq.yd. H. G. Vollmer is City Engr.

+Greenfield, Iowa—(Official)—The Town Council has awarded the contract for constructing about 11,500 sq.yd. of concrete pavement to J. S. McLAUGHLIN & SONS, Red Oak, Iowa, at $18,000. Other bidders were: D. W. Wright, Bedford, Iowa, and the Des Moines Engineering & Construction Co. M. G. McCreight is Town Clk. Noted June 5.

Pittsburg, Kan.—(Official)—The Board of City Commissioners has passed resolutions for the improvement of Fifth and Chestnut Sts., Forest and Park Aves. Bids will soon be asked. O. T. Jones is City Clk.

St. Joseph, Mo.—The Board of Public Works has ordered that bids be asked for paving and grading various streets and alleys. Concrete or asphaltic concrete will be used for the pavement. Joel E. Gates is City Clk.

+Argenta, Ark.—The Commissioners of Street Improvement Districts Nos. 15 and 16 have awarded a contract for various street improvements to R. MOBLEY, Little Rock, Ark., at from $145,000 to $160,000, according to the class of pavement, which has not yet been selected. Chas. Cobb and John Farmer are Chn. of Comrs.

Telluride, Colo.—(Official)—Bids will be received until June 23, by the Board of Commissioners of San Miguel County, for improving a portion of the Norwood Hill Road, State Primary Road No. 44. Plans and specifications are on file with the Clerk and Recorder, Telluride, and with the State Highway Commissioner, Denver. Robert E. Hogan, Telluride, is Clk.

Coeur d'Alene, Idaho— The City Council is considering grading, constructing sidewalks and curb in Fort Grounds Addition. The estimated cost is $30,000.

+Centralia, Wash.— ALLRED & JAMES, at $11,865, were awarded contract by the City Council for paving Maple St. Other bidders were: American Contracting Co., $12,895; Kensel Construction Co., Tacoma, Wash., $12,080.

+Montesano, Wash.— The Commissioners of Chehalis County have awarded a contract for the construction of the Gravel Road to the SPOKANE PAVING & CONSTRUCTION CO., at $36,927. This bid does not include graveling. The County Commissioners have passed a resolution for the construction of two roads between Aberdeen and this city. The sum of $34,000 has been appropriated for the work.

+Mount Vernon, Wash.—(Official)—The Commissioners of Skagit County have awarded contracts for the improvement of eight county roads to various local contractors at a total cost of $10,731. A. L. Strong is County Engr. Noted May 29.

+Puyallup, Wash.—The City Council has awarded the contract for paving Fifth Ave. and Fifth St. to McKIM & ADDISON, Tacoma, Wash., at $17,456. Bitucrete surface on a concrete base will be used.

Spokane, Wash.— The Commissioner of Public Works has recommended that the contract for paving Mission Ave. be awarded to Mitchell Bros., at $39,764, or C. M. Paine, at $42,-495, for Spokane bituminous No. 2. D. C. Coates is Comr.

+Tacoma, Wash.— The Commissioner of Public Works has awarded the contract for paving North Sixth St. from K St. to Ainsworth Ave., to JOSEPH WARTER, SR., 631 North Fife St. The bid for asphalt concrete pavement was $16,000. Other bidders were: Chas. G. Schaefer, $18,146; Anderson & Lilljbeck, $16,970; Geo. P. Wright, $16,670; Keasel Construction Co., $17,-000; McHugh Contracting Co., $18,293. Owen Woods is Comr.

Uniontown, Wash.—(Official)—Bids will be received until 8 p.m., July 5, by the City Clerk for about 20,000 sq.yd. paving and 2550 lin.ft. curbing. The estimated cost is from $18,-000 to $22,000. About 12 varieties of pavement are under consideration. E. V. Edwards is City Engr. P. W. Busch is Clk. Noted June 5.

Salem, Ore.—The City Council has decided to pave portions of 18th St. and Fairmount Ave. Bids will be asked soon. Chas. F. Elgin is City Recdr.

Bakersfield, Calif.—The County Supervisors of Kern County contemplate constructing 221.5 miles of paved roads and 92 miles of graded roads with concrete culverts. There will be a bond issue of $2,500,000 for this purpose.

+Los Angeles, Calif—The City Trustees have awarded the contract for improving Eighth St. from Main to Central Ave. to the FAIRCHILD - GILMORE - WILTON CO., Los Angeles, at $57,276. The BARBER ASPHALT PAVING CO. was awarded contracts for paving 54th and Coronado Sts. at $5556 and $6103 respectively. Homer Hamlin is City Engr.

Sacramento, Calif.—(Official)—Bids will be received until 2 p.m., June 30, instead of June 23, as previously noted, by the State Highway Commission, for the construction of six sections of state highway. Wilson R. Ellis is Secy. Noted June 2.

Santa Ana, Calif.—Bids will be received by the Board of Supervisors of Orange County, until 2 p.m., June 24, for the construction of a little more than five miles of road between Santa Ana and Huntington Beach. The construction will be concrete base with oiled surface. The county will furnish cement, rock, sand and oil. Bids will be received until 2 p.m., June 24, for the construction of three miles of county road on Orangethorpe Ave., south of Fullerton, concrete base with oiled surface. Noted May 22.

+Santa Monica, Calif.—THE IRA HODSON CO. was awarded the contract, at $140,000, for improving Fremont Ave. G. A. Murray is City Clk. Noted May 22.

Vernon, Calif.—This city will soon call for bids for paving a number of streets with asphalt. Bonds for $95,000 will be sold for this work. T. J. Furlong is City Clk., and Joseph A. Hurley, 600 Thorne Bldg., Los Angeles, is City Engr.

+Wilmington, Calif.—The City Trustees have awarded a contract to the STANDARD AMERICAN DREDGING CO., at $18,399, for grading E St.

+London, Ont.—(Official)—The Committee on Streets has awarded the contract for about 6700 sq.yd. asphalt pavement to FOLEY & GLEESON, Ottawa, Ont., at $16,300. W. W. Ashplant is City Engr. Noted May 22.

Merritton, Ont.—The City Council is considering laying sidewalks on various streets at an estimated cost of $20,000. Richard Clark is Clk.

+Oshawa, Ont.—(Official)—The Town Council has awarded the contract for approximately 15,000 sq.yd. of concrete pavement to J. W. McCUTCHEON and H. B. McCONNELL, Oshawa, Ont., at $1.12 per sq.yd. for paving and 35c. per lin.ft. for curbing. There were six other bids, ranging from $1.15 to $1.37 per sq.yd. Frank Chappell is City Engr. Noted May 22.

+Stratford, Ont.—(Official)—The contracts for the construction of 10,397 lin.ft. of concrete sidewalks, 4½ ft. wide, have been awarded to the City as contractor. Bids were received on June 9. A. B. Manson is City Engr. Noted June 5.

INDUSTRIAL WORKS

Fairfield, Maine—The Keyes Pulp Fibre Co. will build a factory addition 90x228 ft., 10 stories, of brick. W. L. Keyes is Pres.

Tilton, N. H.—The A. W. Carter Woolen Mill will build a three-story addition to the present plant.

+Boston, Mass.—The Arthur C. Harvey Co., 26-28 Stillings St., has awarded the contract for the erection of a new building of mill construction to J. M. & J. C. BUCKLEY, Worcester, Mass. The building will be 65x121 ft. of steel, so constructed that it may later be raised to six stories. Moton D. Stafford, Boston, is Arch. in charge of the work.

Cambridge, Mass.—William Crane has purchased 11,000 sq.ft. of land at Maine & Heywood Sts. Cambridge, and will erect a four-story brick factory.

+Springfield, Mass.—The Kibbe Co. has awarded a contract for a $40,000 factory building to A. E. STEPHENS CO. It will be six stories 77x55 ft., with an ell 28x50 ft.

+The Berger Machine Co., 168 Bernie Ave., has awarded a contract to FRED T. LEY & CO., Inc., Springfield, for the construction of a three-story, 92x60-ft. addition to its plant. Estimated cost, $20,000.

+Bristol, R. I.—The Cranston Woolen Co. has awarded the contract for the construction of a three-story, 120x68 ft. addition to its plant to A. C. J. LARNED & CO., Providence, R. I.

Hartford, Conn.—The Whitney Mfg. Co. will erect a four-story addition to its plant.

Batavia, N. Y.—Bids are being received by the Batavia & New York Woodworking Co., for the construction of a one- and two-story addition to its plant. The structure will be 722x108 ft. Plans were prepared by H. W. Homelius & Sons, Archs.

Buffalo, N. Y.—The American Bronze Co., 1450 Niagara St., is having plans prepared for the construction of a foundry to be erected at Authur St. and the Erie R.R.

+Corning, N. Y.—The Corning Glass Works has awarded a contract to the TRUSSED CONCRETE STEEL CO., Detroit, Mich., for the construction of a five-story addition, 120 x100 ft.

+Elmira, N. Y.—The Morrow Mfg. Co. has awarded a contract to the W. R. COMPTON CO., Lake St., for the construction of a heat treatment building, 250x100 ft., one story high, to be added to its automobile plant.

Greece, N. Y.—The New York State Rys. Co., Rochester, is having plans prepared for the erection and equipment of a car-barn on Charlotte Blvd., in Greece, a suburb of Rochester. The estimated cost is $200,000. D. P. Falconer, Rochester, is Engr.-in-Charge.

+Hornell, N. Y.—The E. H. Nelson Bottling Works has awarded a contract to J. F. KEENAN, for the construction of a two-story and basement bottling plant, 125x36 ft.

Rochester, N. Y.—The Rochester Bronze & Aluminum Co., 77 West Water St., has had plans prepared by Gilbert E. Chump, Arch., for the construction of a one-story foundry, 87x60 ft.

+Sherrill, N. Y.—The Oneida Community, manufacturers of silverware, has awarded a contract to the GRIFFITH-PIERCE CO., Utica, for the construction of a new factory. The structure will be three stories, 239x158x57 ft., of reinforced concrete. The estimated cost is $120,000. William P. Field, Prudential Bldg., Newark, N. J., is Engr.-in-Charge.

+Troy, N. Y.—A. E. Bonesteel has awarded a contract to MARTIN & CO., Troy, for the construction of a new factory, three stories, 120x40 ft., on River St.

Akron, Ohio—The Star Drilling Machine Co., Akron, Ohio, has taken out a permit for the construction of a factory, to cost about $30,000.

Alliance, Ohio—The Gibson Motor Car Co., Alliance, plans to construct a factory, 35x250 ft.

+Cincinnati, Ohio—The contract has been awarded to the FERRO CONCRETE CONSTRUCTION CO., Harrisburg, Penn., for the construction of a seven-story printing plant for the Standard Printing Co. The building will be 75x75 ft.

+Cleveland, Ohio—The Otis Steel Co., Cleveland, has awarded contracts as follows for the construction of its proposed plant in the upper Cuyahoga Valley: To the AMERICAN BRIDGE CO., Pittsburgh, Penn., for 2500 tons of structural steel work to be used largely in the construction of the finishing mills; to the MORGAN ENGINEERING CO., Alliance, Ohio, for the construction of a 72-in. plate mill; to the WILLIAM TODD CO., Youngstown, Ohio, for the construction of three jobbing mills. The company plans an ultimate expenditure of from $10,000,000 to $13,000,000.

Cleveland, Ohio—The Cleveland Electric Co., Cleveland, is considering the erection of an addition to cost about $12,000.

Columbus, Ohio—O. C. Darst, Arch., Columbus, has prepared plans for the erection of a six-story reinforced-concrete factory for the Hanna Paint Co. Bids are being received.

+Columbus, Ohio—The contract has been awarded to NICHOL & CARR, Columbus, for the erection of the plant for the John W. Brown Mfg. Co., at about $100,000.

+Elyria, Ohio—The contract has been awarded to KAISER BROS., Elyria, for the construction of the proposed plant of the U. S. Automatic Co. at $10,500.

Lorain, Ohio—The Baltimore & Ohio R.R. Co. has decided to enlarge its shops at Lorain, instead of rebuilding its shops at Zanesville, which were destroyed by the floods of several months ago.

Norwood, Ohio—The Safe Cabinet Co. will erect a three-story factory, 96x96 ft.

+Portsmouth, Ohio—The contract has been awarded to F. H. SMITH, Dayton, Ohio, for the construction of the proposed six-story factory for the Excelsior Shoe factory, Portsmouth.

Tiffin, Ohio—Contracts will be awarded soon by Gray & White Co., Tiffin, for the erection of their proposed cold storage and packing plant. It will be four stories, 60x100 ft.

Toledo, Ohio—Bids will be asked soon by the Toledo-Owens Glass Sand Co., Toledo, for the construction of its proposed plant. It will have a crushing capacity of 2000 tons daily. The company was incorporated recently with a capital of $100,000.

Indianapolis, Ind.—The Universal Stenotype Co., Owensboro, Ky., will remove its plant to Indianapolis. The factory will be enlarged. R. M. Bowen is Vice-Pres. and Gen. Mgr.

Indianapolis, Ind.—The Sanitary Milk Products Co., Indianapolis, is having plans prepared for the construction of a dairy. The building will be two stories, 49x98 ft., of brick. Rubush & Hunter, American Central Life Bldg., Indianapolis, are Archs.

Muncie, Ind.—Goodrich Bros. Hay & Grain Co., Winchester, Ind., have had tentative plans prepared for the construction of a grain elevator with a capacity of 100,000 bu.

Kalamazoo, Mich.—The Handelman Carriage Co., Kalamazoo, Mich., will rebuild its factory recently destroyed by fire. The cost has been estimated at $100,000.

Chicago, Ill.—The Pullman Couch Co., Chicago, has received a permit for the construction of a one-story factory. Estimated cost, $12,000.

Chicago, Ill.—The West Coast Co., Chicago, have secured a permit and will erect a factory on West 76th St. The cost has been estimated at about $70,000.

+Chicago, Ill.—(Official)—The contract has been awarded to the R. S. BLOME CO., City Hall Square Bldg., Chicago, for the construction of the cold-storage plant for the Independent Packing Co. to be erected at 41st St. and Emerald Ave. Estimated cost, $250,000.

North Chicago, Ill.—The Cyclone Fence Co., North Chicago, will soon award contracts for the construction of its proposed factory addition. It will be 160x130 ft. and will cost about $20,000.

Antigo, Wis.—The Holland Flexible Auto Wheel Co., Antigo, will erect a factory for the manufacture of automobile wheels. This company was incorporated with a capital of about $100,000. J. K. McKenna, Antigo, is interested.

Beloit, Wis.—The Berlin Machine Works, Beloit, will erect an addition to its factory. It will be 275x294 ft.

Milwaukee, Wis.—A permit has been granted to Jacob Wellauer for the construction of a factory. It will be five stories and basement, 60x120 ft., of brick, concrete, fireproof. The Standard Bedding Co., will occupy the building. The cost has been estimated at $58,000. R. Messmer & Bro., Majestic Bldg., are Archs.

The Mutual Brewing Co., Milwaukee, has purchased a site on which to erect its proposed plant.

St. Paul, Minn.—Preliminary arrangements are being made by Swift & Co. for the construction of a cold-storage plant at Fifth St. and Brodway. Estimated cost, $40,000.

Virginia, Minn.—Plans are being considered by the Virginia & Rainy Lake Co., for an expenditure of $25,000, for the improvement and enlargement of its lumber plant.

Joplin, Mo.—The Aronoga Circle Mining Co. will erect a compressor and sludge mill at Joplin, to cost about $12,000.

The Reo Mining Co. contemplates the erection of a concentrating mill at Joplin, to cost $50,000.

The Powhattan Lead & Zinc Co. will erect a plant at Joplin to cost about $50,000.

The Wilhoit Refining Co. will build an oil refinery, at Joplin, to cost approximately $40,000.

St. Louis, Mo.—The Fulton Bag & Cotton Mills Co. has had plans completed for the erection of a $300,000 manufacturing plant. Noted May 29.

Fort Smith, Ark.—The Fort Smith Iron & Steel Co. will establish a foundry at Fort Smith, to cost $30,000.

Dallas, Tex.—Preliminary arrangements are being made by the Stanard-Tilton Co. for the construction of a $50,000 flour mill.

Houston, Tex.—Plans are being prepared by the Dallas Fireworks Co. for the construction of a $10,000 plant at South Houston. William A. Suce, Dallas, is Pres.

Marshall, Tex.—The Marshall Brick Co. has increased its capital stock from $20,000 to $40,000, and will make enlargements and improvements to its plant.

Rogers, Tex.—The Farmers' Cotton Oil Mill Co. will build a $50,000 cotton-oil mill at Rogers. Thomas C. Webb, Mart, Tex., is Mgr.

Muskogee, Okla.—The Missouri, Oklahoma & Gulf Ry. will build shops at Muskogee. The plans include a large machine shop and a boiler plant. About $200,000 will be expended. J. W. Hoffman, Muskogee, is Gen. Supt.

Everett, Wash.—The Summer Iron Works Co., whose plant was recently destroyed by fire, will erect a new plant, to cost about $100,000.

+Port Angeles, Wash.—The Puget Sound Mills & Timber Co. has awarded the contract for the construction of its $1,000,000 lumber plant to the UNION MACHINERY & SUPPLY CO., Seattle.

Seattle, Wash.—John Graham, Architect, Lyons Bldg., has completed plans for the five-story and basement, $400,000 factory, to be built in this city by the Ford Motor Co. Bids for construction are being received. The building will be of reinforced concrete.

Stockton, Calif.—The San Joaquin Valley Refining Co. is planning to erect an oil refinery to cost $75,000. F. P. Faulkner, Sacramento, is interested.

Tulare, Calif.—The Tulare Grain & Milling Co. will rebuild its plant destroyed by fire. Estimated cost, $25,000.

Montreal, Que.—The General Fire Extinguisher Co., 175 McCord St., is having plans prepared for a new factory, 127x300 ft., of concrete construction. Robert Findlay, 10 Phillips Place, is Arch.

The Robert Mitchell Co., Belair St., has plans for a new iron foundry, 108x180 ft., to be built of brick.

Elmira, Ont.—The Elmira Furniture Co. is having plans prepared for a new three-story factory, of brick, 50x150 ft. C. Knechtel is Arch.

+Peterborough, Ont.—The contract for the steel work on the new steel sash factory of Henry Hope & Sons has been awarded to the HAMILTON BRIDGE CO., Hamilton, Ont.

Stratford, Ont.—The Wood Mosaic Co., New Albany, Ind., has secured a site and is having plans prepared for a branch factory, costing $100,000 which it will erect at Stratford. G. Lapping is Mgr.

St. John, N. B.—The Oil Motor & Mfg. Co. is having plans prepared for a new brick factory. F. Nell Brodie, Princess St., is Arch. M. L. G. Vincent, 128 Charlotte St., St. John, is Mgr. of the company.

FEDERAL GOVERNMENT WORK

Building—Boston, Mass.—(Official)—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the reconstruction of Building No. 24 at the Boston Navy Yard: Penn Bridge Co., Washington, D. C., $64,843; C. M. Leach, Boston, Mass., $61873; Darling-Slade Construction Co., Newport, R. I., $77,000; Simpson Bros. Corporation, Boston, Mass., $72,355; Guernsey-O'Meara Co., Philadelphia, Penn., $72,680; Conners Bros. Co., Lowell, Mass., $86,600; Marr Bros. & Stuart Co., Boston, Mass., $72,434; Whitton & Haynes Co., 35 Federal St., Boston, Mass., $76,600.

Coaling Tower—Boston, Mass.—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for coaling tower, alterations and improvements to coaling plant at the navy yard, Boston, Mass.: Robbins Conveying Belt Co., New York, Item (1), $128,900; (2) $85,600; Mead-Morrison Mfg. Co., Boston, (1) $65,000; (2) $48.527; Guarantee Construction Co., New York, (1) $98,400; C. W. Hunt Co., Inc., New York, (1) $119,340.

Rock Excavation—Boston, Mass.—Bids were received as follows, by Col. Frederic V. Abbott, Corps Engrs., U. S. A., Boston, for rock excavation in the Mystic River, Mass.: Great Lakes Dredge & Dock Co., Boston, $28.70 per cu.yd.; Eastern Dredging Co., Boston, $17.80; Johnston & Virden, Lewes, Del., $22.50.

Dredging—New London, Conn.—(Official)—Bids were received as follows, May 31, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, for dredging in the Mystic River, Conn.: Atlantic Dredging Co., 81 New St., New York, 27.6c.; total, $9384; Charles M. Cole, Fall River, Mass., 24.9c.; $8466; The T. A. Scott Co., Inc., New London, Conn., 28.25c.; $9605.

Dredging—Greenwich, Conn.—(Official)—Bids will be received until June 30, by Maj. G. P. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging in Greenwich Harbor, Conn.

Watermain—West Point, N. Y.—(Official)—Bids will be received until July 14, by Capt. G. A. Youngblood, Corps Engrs., U. S. A., West Point, for laying a branch watermain 20 in. in diameter and 260 ft. in length, and for constructing a small masonry intake dam across Queensboro Brook, 2¾ miles from Fort Montgomery, Orange County, N. Y. This work is of the nature of an extension to the water-supply of the U. S. Military Academy at West Point. Capt. C. A. Youngberg, Corps Engrs., U. S. A., is Engr.-in-Charge, with W. L. Webb, C. E., as assistant.

Dredging—Trenton, N. J.—Bids were received as follows, June 9, by Lieut.-Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Philadelphia, Penn., for dredging in the Delaware River from Lailor St. to the upper railroad bridge, Trenton, about 4500 lin.ft.: Atlantic, Gulf & Pacific Co., Park Row Bldg., New York, 69.5c. per cu.yd.; total, $312,750; John A. Seely, 30 Church St., New York, 80c.; $360,000. The contract requires the dredging, removal and disposition of about 450,000 cu.yd. of materials.

Stone—Philadelphia, Penn.—(Official) — Bids will be received until noon, July 14, by Lieut.-Col. Joseph E. Kuhn, Corps Engrs., U. S. A., 815 Witherspoon Bldg., Philadelphia, for furnishing and placing about 15,000 tons of riprap stone in dike and revetment at Beedy Island, Delaware River, about 40 miles below Philadelphia.

Electric Capstans—Philadelphia, Penn.—(Official)—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing three electric capstans at the Philadelphia Navy Yard: Hyde Windlass Co., Bath, Maine, (2) $8150; American Engineering Co., Philadelphia, (1) $8625; (2) $8325.

Water System—Baltimore, Md.—Bids were received as follows, June 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for a drinking-water system to be installed in the U. S. post office, Baltimore: Mayer Ice Machinery & Engine Co., Jersey City, N. J., $6500; Chattard & Norris, Baltimore, $5290.

Motor Vehicles—Washington, D. C.—Bids will be received until 2 p.m., June 20, by the Post Office Department, Washington, for 20 or more four-wheeled and 20 or more three-wheeled- motor-driven vehicles for use in the postal service as they may be ordered during the remainder of the fiscal year ending June 30.

Boilers—Washington, D. C.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the installation of two high-pressure water-tube boilers in the new building of the Bureau of Engraving & Printing, Washington, to the W. G. CORNELL CO., Southern Bldg., Washington, D. C., at $45,900. List of bidders noted June 5.

Oils—Washington, D. C.—Bids will be received until 3 p.m., June 27, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for supplying to the various public buildings under control of the Treasury Department, lubricating oils during the fiscal year ending June 30, 1914, in accordance with the specification, copies of which may be had at Washington, at the discretion of the Supervising Architect.

Waterfront Improvement—Washington, D. C.—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for waterfront improvement at the navy yard, Washington: Sanford & Brooks, Baltimore, Md., $14,300; Clark & Winston Co., Washington, $11,987.

Dredging—Norfolk, Va. — (Official) — Bids were received as follows, June 7, by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, for dredging the approaches to the harbor at Cape Charles City, Va.: Coastwise Dredging Co., Norfolk, 20.46c. per cu.yd. scow measurement; total, $20,150; Norfolk Dredging Co., Norfolk, 21.2c.; $21,200. About 100,000 cu.yd. will be dredged.

Post Office—Hickory, N. C.—Bids were received as follows, June 11, for the construction of a post office at Hickory: (a) limestone; (b) sandstone: C. M. Leach, Boston, Mass., (a) $59,873; (b) $62,000. J. L. Crouse, Greensboro, N. C., (a) $61,616; (b) $63,616; Daniel T. McCarthy, (a) $62,811; (b) $64,811; Algernon Blair, Montgomery, Ala., (a) $63,500, (b) $66,000. Worrell & Waters, Blanch, Penn., (a) $65,000, (b) $66,800. George W. Stiles Construction Co., Chicago, Ill., (a) $58,274; (b) $63,200; Olin Gerlach, Frostburg, Md., (a) $76,900, (b) $78,500. W. J. Brent Construction Co., Norfolk, Va., (a) $61,044; Melton Construction Co., Washington, D. C., (a) $60,900.

Post Office—Cartersville, Ga.—(Official)—Bids will be received until 3 p.m., July 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, and approaches), of the U. S. post office at Cartersville. The building is one story and basement and has a ground area of approximately 4400 sq.ft.; stone, stucco, and terra-cotta facing, tile roof. Drawings and specifications may be obtained from the custodian of site at Cartersville, or at the discretion of the Supervising Architect.

Cement—Vicksburg, Miss.—Bids were received June 10 by Capt. Ernest Graves, Corps Engrs., U. S. A., Vicksburg, for furnishing and delivering about 8000 bbl. of American portland cement at Riverton, La.: (a) Brand; (b) per bbl. in sacks; (c) deduction for empty sacks returned; (d) totals: F. R. Bissell, Trustee for bondholders the Iola Portland Cement Co., 815 Commerce Bldg., Kansas City, Mo., (a) Iola; (b) $2.24; (c) 9½c.; (d) $14,850; the Kansas Cement & Material Co., Waldheim Bldg., Kansas City, Mo., (a) Sunflower; (b) $2.32; (c) 10c.; (d) $15,360; the Atlas Portland Cement Co., Chicago, Ill., (a) Atlas; (b) $2.34 and 2.40; (c) not stated; Perry Grain & Cement Co., Vicksburg, Miss., (a), Coosa; (b) $2.40; (c) 10c.; (d) $16,000; the Atlas Portland Cement Co., 30 Broad St., New York, (a) Atlas; (b) $2.40; (c) 10c.; (d) $16,000.

Lumber—New Orleans, La.—Bids will be received until June 20, by Capt. C. O. Sherill, Corps Engrs., U. S. A., Mississippi River Comn., Fourth Dist., New Orleans, for furnishing about 2,520,500 ft. b.m. rough pine lumber for mattress construction.

Stone—Marquette, Mich.—Bids will be received until June 30, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, Minn., for furnishing and placing rubble foundation for breakwater extension at Marquette Harbor, Mich.

+Post Office—Petoskey, Mich.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of the post office at Petoskey, to RICHARD COLLINS, Alpena, Mich., at $57,468.

Rock—Ashland, Wis.—Bids will be received until June 30, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, Minn., for furnishing and placing rock on the breakwater at Ashland.

Dredging—Duluth, Minn.—Bids were received June 13, by Capt. E. D. Peek, Corps Engrs., U. S. A., Duluth, for dredging Duluth-Superior Harbor: (a) 925,000 cu.yd.; (b) totals: Northern Dredge & Dock Co., Duluth, (a) 8½c. per cu.yd., scow measurement; (b) $78,625; Duluth-Superior Dredging Co., Duluth, (a) 79c.; (b) $73,075 (recommended for acceptance); Great Lakes Dredge & Dock Co., Chicago, Ill., (a) 9c.; (b) $83,250; Byrne Bros. Dredging & Engineering Co., Chicago, (a) 15½c.; (b) $143,375; Zenith Dredge Co., Duluth, (a) 8½c.; (b) $78,625.

Post Office—Brookfield, Mo.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract for the construction of a post office at Brookfield, to ROGERS & KAISER, Chicago, Ill., at $60,890. Noted May 29.

+Rock-Crushing Plant—Fort McDowell, Calif.—The following contracts have been awarded by Capt. J. Longstreet, Q.M., U. S. A., Angel Island, for installing a rock-crushing plant at Fort McDowell: ALLIS-CHALMERS CO., San Francisco, transformers and motors, $1389; PACIFIC STATES ELECTRIC CO., San Francisco, wattmeter, wire, conduit, etc., $195; ORENSTEIN-ARTHUR KOPPEL CO., San Francisco, railway supplies, $699; DAVIS-ROGERS CO., San Francisco, bunkers and machinery, $11,929.

+Locomotives and Cranes—Panama—Contracts have been awarded by the Isthmian Canal Comn., as follows: GENERAL ELECTRIC CO., Schenectady, N. Y., for towing locomotives for all locks, at $13,270 each; CLEVELAND CRANE & ENGINEERING CO., Wickliff, Ohio, electric traveling cranes, $25,700.

Coaling Plants—Panama—Bids were received as follows, June 14, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for the construction and equipment of a coaling plant at Cristobal and one at Balboa, Canal Zone: Item (1) four unloading towers, Cristobal; (2) two, Balboa; (3) six, Cristobal and Balboa; (4) two duplex stocking and reclaiming bridges, for Cristobal; (5) two single bridges, Balboa; (6) items (4) and (5) combined; (7) four reloaders, Cristobal; (8) two reloaders, Balboa; (9) Items (7) and (8) combined; (10) one conveying and power station, Cristobal; (11) same for Balboa; (12) Items (10) and (11) combined; (13) one complete installation for Cristobal plant, Items (1), (4), (7) and 10 combined; (14), one complete installation for Balboa plant, Items (2), (5), (8) and (11) combined; (15) two complete installations, one for Cristobal, and one for Balboa, Items (13) and (14) combined; David Duncan, 17 Battery Place, New York, informal, no bond, (1) $794,500; (2) $397,250; (3) $1,191,750; (4) $463,760; (5) $231,480; (6) $696,500; (7) $630,410; (8) $301,700; (9) $905,100; (10) $320,000; (11) $210,000; (12) $430,000; (13) $2,212,660; (14) $1,140,830; (15) $3,262,490; eight to 18 months; Hunt Construction Co., New York, formal: (1) $326,532; (2) $169,490; (3) $485,735; (4) $710,933; (5) $452,462; (6) $1,152,640; (7) $638,893; (8) $327,936; (9) $949,052; (10) $490,442; (11) $438,493; (12) $900,251; (13) $2,111,813; (14) $1,361,285; (15) $3,350,497; seven to 18 months; Augustus Smith, Bayonne, N. J., formal: (1) $414,551; (2) $208,755; (3) $623,326;

(4) $425,968; (5) $318,127. (6) $731,240; (7) $186,302; (8) $1,185; (9) $273,715; (10) $266,685; (11) $280,280, alternate; $279,015. (12) $576,154, alternate, $558,913; (13) $1,413,689; (14) $501,375; (15) $2,200,000, alternate, $1,972,899; six to 14 months; W. L. Ball, Inc., 125 Front St., New York, informal, (1) $463,000; (2) $231,500. (3) $694,500. (4) $548,000; no bond; (5) $400,250; (6) $254,250. (7) $266,500; six $196,250; (8) $574,750. (10) $916,250. (11) $750,000. (12) $1,666,250. (13) $2,313,750; (14) $1,581,000. (15) $2,850,000; eight to 22 months; Wellman-Seaver-Morgan Co., Cleveland, Ohio, with bond, but Wellman-Seaver-Morgan Co. (Cleveland, Ohio, with bond, but Wellman-Seaver-Morgan Co., Cleveland, Ohio, with bond, but bid on their own specifications as follows, (a) cristobal; (b) Balboa; (c) both plants: Six grab bucket bridges, (a) $500,000; (b) $834,000. (c) $822,750 extra bridges, $75,500; eight transfer cars, (a) $66,000, (b) $12,000; (c) $186,000; extra cars, $8000; one 150-ton capacity wharf hanker, (a) $87,500; (b) $85,500; (c) $156,000; four 50-ton capacity track scales, (a) $13,200, (b) $7,120, (c) $20,200, third rail system, (a) $18,000, (b) $14,000; (c) $27,500; five generator units with feeders from substations to cranes, including lighting system; (a) $87,750, (b) $85,500; (c) $146,250; total, without wharf bunker, (a) $685,760; (b) $457,130; (c) $1,124,800, total, with wharf bunker, (a) $773,260, (b) $545,630, (c) $1,130,800; eight to 18 months.

+Radio-Station—Panama—Bids were received as follows, June 7, by the Bureau of Yards and Docks, Navy Dept, Washington, D. C., for the construction of three steel towers for the wireless station at Caimito, Canal Zone: (a) on foundations furnished by the government; (b) on foundations furnished by the contractor: Penn Bridge Co., Washington, D. C., (a) $112,350; (b) $126,200. United States Steel Products Co., New York, (a) $141,000, Des Moines Bridge & Iron Co., Pittsburgh, Penn., (a) $129,595; (b) $150,349. Federal Telegraph Co., San Francisco, Calif., (a) $149,000; (b) $191,000. The wireless equipment has been awarded to the FEDERAL TELEGRAPH CO., at $50,512.

Steel Towers—Porto Rico—(Official)—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of two 200-ft. steel towers at the naval station, San Juan, P. R.: (a) Work complete; (b) towers; (c) foundations: Henry Monk, Guantanamo, Cuba, (a) $24,900; (b) $18,740; (c) $5500, Des Moines Bridge & Iron Co., Pittsburgh, Penn., (a) $17,715; (b) $13,447; P. J. Carlin Construction Co., 1123 Broadway, New York, (a) $17,275, Chicago Bridge & Iron Co., Chicago, Ill., (a) $19,140; Snare & Triest Co., 233 Broadway, New York (a) $16,911; (b) $13,920; (c) $3690; Baltimore Cooperage Co., Baltimore, Md., (a) $19,890; (b) $16,994; (c) $2688.

Buildings—Guantanamo, Cuba—Bids were received as follows, June 14, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of quarters and a storehouse at the Radio Station, Guantanamo: Henry Monk, Guantanamo, Cuba (sole bidder), quarters, $6890; storehouse, $3090; total, $9980.

MISCELLANEOUS

Dredging—Boston, Mass.—Bids were received as follows, June 11, by the State Harbor and Land Commissioners for dredging Ouset Bay: John R. Burke, Wollaston, 28⅝c. per cu.yd. and $10 for boulders; Eastern Dredging Co., 29.2c. and $8; J. F. Packard Dredging Co., Providence, R. I., 29.9c. and $9; also for dredging at Woods Hole: J. R. Packard Dredging Co., $1.12 and $15. and John R. Burke, $1.24 and $15. Wm. F. Williams is Chief Engr.

Pier Work—Portland, Maine—The Grand Trunk Ry., is considering lengthening the present piers at Portland and the construction of new piers and sheds. H. B. Stewart, Montreal, Que., is Struct. Engr.

Motor Fire Apparatus—Boston, Mass.—Charles H. Cole, Fire Comr., has recommended to Mayor Fitzgerald the appropriation of $300,000 for the substitution of motor fire apparatus for all horse-drawn machines. The sum of $150,000 is required at once.

Pier—Boston, Mass.—The Directors of the Port of Boston are considering the construction of a pier at East Boston, similar to the Commonwealth Pier now being erected in South Boston.

Retaining Wall—Boston, Mass.—Bids will be received until June 24 by the Park and Recreation Department, for the construction of a retaining wall, etc., at Tyler St. Playground. D. H. Sullivan, 33 Beacon St., is Chn.

Motor Fire Apparatus—Waterbury, Conn.—The State Legislature has granted permission for the city of Waterbury to issue $75,000 of bonds for the motorizing of the fire department. Samuel C. Snagg, Ch. Engr. has recommended to the Board of Public Works that the following pieces of apparatus be purchased immediately: Two tractors, one for ladder truck and one for steamer; one 85-ft. aerial ladder truck, four combination chemical-and-hose wagons and one instruction automobile. The total cost is estimated at $44,500.

Dike—Binghamton, N. Y.—The taxpayers, June 6, voted to issue $70,000 of bonds to remove the island north of the Erie R.R. Bridge, and use the earth to construct a dike along the river bank from McDonald Ave. to the Cutler Ice houses.

Jetties—Atlantic City, N. J.—The Longport City Commission is considering an appropriation of $20,000 for the construction of jetties and bulkheads to protect the entire lower section of Absecon Island on which Atlantic City and Longport are built.

Retaining Wall—New Brunswick, N. J.—Bids will be received until 2:30 p.m., June 30, by the Board of Chosen Freeholders, New Brunswick, for the construction of a concrete retaining wall and pipe railing along the South Amboy-Matawan Road at Cheesequake. P. H. Hendrickson is Eng.

Harbor Improvement—Philadelphia, Penn.—The State Senate, June 4, passed a bill appropriating $1,000,000 for harbor improvements at Philadelphia.

Pier—Baltimore, Md.—Plans and specifications have been prepared for the construction of a pier, 54x800 ft. for the Baltimore & Ohio R.R. at Locust Point. M. A. Long, Baltimore, is Asst. to Ch. Engr.

Drainage Bonds—Raleigh, N. C.—Bonds for $500,000 have been sold, the proceeds to be used for carrying on the work of draining Mattamusket Lake, Hyde, County. J. P. Kerr, Raleigh, is interested.

Artificial Lake—Salunda, N. C.—The Pittsburgh Development Co., Pittsburgh, Penn., is considering the construction of an artificial lake near Green River Cove and develope the surrounding property.

Subway—Alliance, Ohio—Bids were received May 27, by the city for the structural steel necessary in the construction of the Fifth St. Subway, about 400,000 lb.: Mount Vernon Bridge Co., $2.65 per 100 lb.; King Bridge Co., $2.90; Fort Pitt Bridge Co., $2.67; McClintock Marshall Construction Co., $2.80; Capital Construction Co., $2.95. Noted May 22.

Engine House—Carthage, Ohio—Plans have been submitted to the city for the construction of an engine house to cost about $15,000.

Comfort Station—Cincinnati, Ohio—Bids will be received until noon, Jan. 27, by the Director of Public Service, for the construction of a public comfort station at the southwest corner of McMillan St. and Sedalia Alley. V. T. Price is Dir.

Bath-house Work—Cleveland, Ohio—Bids will be received until noon, June 24, by W. H. Kirby, Secy. to the Dir. of Pub. Serv., for alterations and additions to the Clark Ave. bath-house.

Fence—Columbus, Ohio—Bids will be received until July 9 by the Ohio State Board of Agriculture, Columbus, for furnishing material and erecting a fence around the race track and part of the ground enclosure fencing at the Ohio State Fair grounds, Columbus. Dawson & Holbrook, 44 East Broad St., Columbus, are Archs.

Fire Station—Marion, Ohio—Bids will be received until June 21 by M. A. Mickley, Dir. Pub. Ser., for the construction of a fire station. Estimated cost, $85,000. Marriott, Allen & Hall, Hayden Bldg., Columbus Ohio, are Archs. Noted June 12.

Fire Apparatus—Martins Ferry, Ohio—The city is considering the purchase of a fire engine to cost about $10,000.

Stadium—Warsaw, Ind.—The Dunkards are considering the construction of a stadium at Winona Lake, to cost $100,000. D. M. Carver, Troutwood, Ohio, is Moderator.

Drainage—Jackson, Mich.—The city has appropriated $10,000 for the drainage of Shields Lake.

Street Signs—Chicago, Ill.—The city has decided to place street signs at places where they are at present needed. Ray Palmer, City Elecn., is in charge of the work.

Drainage Work—Jerseyville, Ill.—The Commissioners of the Nutwood Drainage and Levee District west of Jerseyville, have submitted a new plan for an improvement of the district. Estimated cost, $54,000. The levee is to be raised to the high-water mark of 1844, and an extension and improvement of the ditches is to be made.

Stable—Milwaukee, Wis.—R. Fox, Milwaukee, will soon award the contract for the erection of a livery stable to cost about $40,000. Leiser & Holst, Germania Bldg., Milwaukee, are Archs.

+Dredging—Racine, Wis.—The contract has been awarded by the city to GREILING BROS., Green Bay, Wis., for dredging about 25,000 cu.yd. at 18c. per cu.yd.

Ditch—Buffalo, Minn.—Bids will be received until June 27, by John A. Berg, County Audr., Buffalo, for the construction of Judicial Ditch No. 19.

Ditches—St. James, Minn.—(Official)—Bids will be received until 2 p.m., June 28, by the County Audr., St. James, for the construction of Judicial Ditch No. 7. The cost is estimated at $40,721.

Levee Work—Folsom, Neb.—Farmers in the vicinity of Folsom have joined with the Chicago, Burlington & Quincy Ry. in the construction of levees along the Missouri River. The work will cost about $25,000.

+Ditch—Fremont, Neb.—(Official)—The contract has been awarded to MATZIN BROS., Hooper, Wis., by the county for the construction of Scott Ditch, at 8.9c. per cu.yd.

Coal Dock—Mandan, N. D.—Plans have been completed for the construction of the proposed coal dock for the Northern Pacific Ry., Co., at Mandan.

Drainage—Elsberry, Mo.—The Commissioners of Elsberry County, Elsberry, are considering issuing $325,000 of bonds for the construction of a drainage system in the county.

Ditches, Etc.—Marshall, Mo.—(Official)—Bids were received June 11, by the Saline County Court, Marshall, for the construction of ditches, levees, and for making other improvements in Gilham Lake Drainage District No. 1. All bids opened were rejected as excessive. Josephine Durrett is County Clk.

Levee—England, Ark.—Bids will be received until July 7, by the Directors of Plum Bayou Levee District, England, for constructing about 6000 ft. of new levee, approximately 100,000 cu.yd. Dickinson & Watson are Engrs., State Bank Bldg., Little Rock, Ark.

Levee—Marion, Ark.—Bids will be received until July 1, by the St. Francis Levee Board, Marion, for 5,000,000 cu.yd. of levee work. B. G. Covington is Ch. Engr., Randolph Bldg., Memphis, Tenn.

Dredge Work—Newport, Ark.—Bids will be received until July 7 by Phillips, Hillhouse & Boyce, Newport, for constructing 33 miles of dredge work, a small amount of scraper work, two small levees and 12 bridges for Cow Lake Drainage District, Jackson County, Ark. G. R. Hays is Secy.

Drainage District—Pocohontas, Ark.—Bids will be received until 1 p.m., June 30, by L. R. Pickett, Secy., Little Running Water Drainage District, Pocohontas, for the construction of a drainage ditch requiring the removal of about 400,000 cu.yd. of material.

Wharves and Docks—Corpus Christi, Tex.—The State Railroad Commission, Austin, Tex., has approved the application of the city of Corpus Christi to purchase land on Harbor Island for a site for municipal wharves and docks.

+Electric Elevators—Galveston, Tex.—The contract has been awarded to the OTIS ELEVATOR CO., Chicago, Ill., for the installation of two electric elevators in the new general office building at present under construction in Galveston by the Gulf, Colorado & Santa Fe Ry., at $15,000.

Fire Stations—San Antonio, Tex.—The city is considering the construction of fire stations to cost about $50,000.

Dikes and Drainage—Everett, Wash.—The County Commissioners of Snohomish County, Everett, have retained C. N. Reitz & H. D. Hansel, Consult. Engrs., Seattle, Wash., to prepare plans for reclaiming Ebey Island. Dikes are to be constructed and about 14 miles of swamp land will be drained. The proposed improvement will cost approximately $200,000.

Seawall and Fill—Seattle, Wash.—Preliminary plans have been prepared for a seawall and fill on Railroad Ave., Seattle, to cost $300,000. A. H. Dimock is City Engr. Noted May 29.

Mausoleums—Seattle, Wash.—The Northwest Mausoleum Co., White Bldg., Seattle, proposes building a $100,000 mausoleum in Everett, Wash., work of construction to begin the latter part of July. The structure will be built of reinforced concrete with dressed stone or tile exterior. The same company will also build a $40,000 mausoleum, of reinforced concrete, faced with dressed stone in Hoquiam, Wash. Work on the latter will begin by July 1. W. K. Steele, is Engr. and W. Marbury Somervell, White Bldg., Arch., will prepare all plans.

Subway—Spokane, Wash.—The Spokane Portland & Seattle Ry. Co., A. M. Lupfer, Ch. Engr., has filed plans for a concrete subway and fill to be built in Brick Yard Gulch in the vicinity of 23rd and 24th Aves., Spokane. Estimated cost, $25,000.

Drainage—Tacoma, Wash.—The County Commissioners of Pierce County, Tacoma, are considering the drainage of about 4898 acres of land in the Hylebos District.

+Tunnels—Oregon—The Southern Pacific Co., W. Hood, Ch. Engr., has awarded the contract for the construction of tunnels No. 3 and 6, to PORTER BROS., Portland, Ore. The tunnels will be located between the Siuslaw and the Umpqua Rivers, on the line of the Willamette Pacific Ry.

+Riprap—Los Angeles, Calif.—The contract has been awarded to the RUSSELL-GREENE-FOELL CO., Los Angeles, for 4700 tons of riprap for the Water St. wharf, at $2.20 per ton. Total, $10,340.

Earthwork—Los Angeles, Calif.—The city will ask for bids soon for cutting down a portion of Knob Hill and for razing Timms Point, San Pedro. The Harbor Commission has estimated the cost of the work at about $120,000.

Steel Rails—Los Angeles, Calif.—Bids will be received until June 23, by the Board of Public Works, for furnishing 750 tons of steel rails with necessary fastenings. H. B. Ferris is Secy.

Tunnel—San Francisco, Calif.—M. M. O'Shaughnessy, City Engr., has estimated the cost of constructing the proposed Fillmore St. tunnel at about $3,000,000.

+Fire Stations—San Francisco, Calif.—The contract has been awarded to H. CHASE, San Francisco, by the Directors of the Panama Pacific Exposition Co., San Francisco, for the construction of three fire stations at $37,781.

BUILDINGS

Boston, Mass.—The Roxbury Latin School will erect a school on Seaver St., fronting Franklin Park. The estimated cost is $125,000. Wm. H. Slocum, 55 Kilby St., is Treas. of School. R. Clifston Sturgis, 120 Boylston St., is Arch.

+The contract for the construction of the Wilton Theater at Tremont St. and Dix Pl. has been awarded to the HAYNES CONSTRUCTION CO., 178 Devonshire St. Chas. H. Blackall, 20 Beacon St., is Arch.

A six-story mercantile building will be built at Washington St. and Dix Place for the Washburn Realty Co. by the R. H. Gardner Estate. The estimated cost is $125,000. Alfred C. Turner, 683 Atlantic Ave., is Arch.

+The contract for building the new $500,000 addition to the State Mutual Building has been awarded to NORCROSS BROS., Worcester, Mass. Andrews, Jacques & Rantoul, Boston, are Archs. Noted May 22.

+Brookline, Mass.—The contract for the construction of the school on Harvard Ave. has been awarded to the A. VARNERIN CO., 101 Tremont St., Boston, Mass., at $102,300. Noted May 8.

Fitchburg, Mass.—A three-story brick block, 102x130 ft., will be built at Fairmont and Daniels Sts., for N. M. Des Chenes. It will be of brick and wood.

Holyoke, Mass.—Bids will soon be asked for the construction of the building for the Knights of Columbus, at Suffolk and Chestnut Sts. It will be 75x122 ft., three stories, of brick and limestone. Oscar Beauchemin is Arch., 380 High St.

Lowell, Mass.—A car barn will be erected on Middlesex St., for the Bay State St. Ry. Co., 5 Merrimack St. It will be 145x288 ft., of brick, one story, to cost $100,000.

The Oblate Fathers will erect a church on Merrimack St. It will be of brick and stone. The estimated cost is $150,000. Henry L. Rourke, 22 Hildreth Bldg., is Arch.

+Millbury, Mass.—The contract for the construction of the school for the town has been awarded to the UNITED FIREPROOFING CO., 1125 Broadway, New York. It will be of brick, two stories, 62x112 ft. The estimated cost is $50,000. John T. Simpson is Arch., Newark, N. J. F. W. Moore is Chn. of the Comn. Noted May 1.

Worcester, Mass.—Bids will soon be asked for the construction of the Lovell St. school. The estimated cost is $50,000. George C. Halcott is Supt. of Pub. Bldgs. Noted May 1.

+Central Falls, R. I.—Contracts for erection of the new court house and police station have been awarded as follows: General construction, HUMES CONSTRUCTION CO., Providence, R. I.; heating and ventilating, SAMUEL JACKSON CO., Pawtucket, R. I.; plumbing and gas fixtures, O. W. WILMARTH & CO., Central Falls, R. I.; electric lighting, New England Machine & Electric Co., Pawtucket, R. I. Total cost, $60,000.

+Hartford, Conn.—(Official)—Contracts for the construction of the isolation hospital have been awarded as follows: General contract, F. D. KENT, at $54,740; plumbing, HANLON & MURPHY, $10,290; heating, JAMES T. MURRAY, $7660; electrical work, BALDWIN STEWART ELECTRICAL CO., $2778. Noted June 12.

Torrington, Conn.—The town has authorized its Board of Selectmen, George E. Cook, Pres., to obtain specifications for the erection of a new high school, to cost approximately $175,000.

+Albany, N. Y.—The general contract for the construction of the Central Y. M. C. A. building, has been awarded to the A. E. SEEFIANS CO., 25 East 26th St., New York, at $72,300. Noted Mar. 20.

+Albany, N. Y.—Bids for cleaning, pointing and waterproofing the exterior stone work and central court and two western courts of the State Capitol Building, will be received until 4 p.m., July 7, by the Trustees of Public Buildings, Capitol, Albany. Lewis F. Pilcher is State Arch.

Buffalo, N. Y.—The city of Buffalo, H. P. Emerson Supt. Education, will erect a school building, three stories and basement, at Saratoga and Ontario Sts. Howard L. Beck, Municipal Bldg., is Arch. The estimated cost is $90,000.

Lansing, Bly & Lyman, Archs., Prudential Bldg., are receiving bids for the construction of a two-story and basement school, 60x124 ft., on St. Paul St., by the Notre Dame De Lourdes Church. The estimated cost is $50,000. Rev. Martin Philips is Pastor.

Emerson C. Dell, Arch., 99 Harvard Block, has completed plans for a four-story and basement store and loft building, 93x100 ft., of steel and brick, to be erected at 1170 Main St., by Waldemar J. Schultze, 208 Anderson Place, who is taking bids.

The Thayer Syndicate, of Toronto, Walter F. Mullen Agt., 48 Niagara St., will erect a store and office building, two stories and basement, 60x150 ft., of steel, brick and terra cotta at Main and West Utica Sts. Robert Wallace, Arch., Builders' Exchange, is receiving bids.

+Elmira, N. Y.—The contract for the construction of the addition to St. Joseph's Hospital, has been awarded to JOHN CUNNINGHAM. The building will be two stories and basement, 85x84 ft.

Ithaca, N. Y.—A two-story and basement fraternity house will be erected by the Delta Chi Fraternity. W. W. Taylor is Chn. of Bldg. Com. The estimated cost is $75,000. Gibb & Waltz are Archs., Trust Co. Bldg., Ithaca, N. Y.

Gibb & Waltz, Archs., Trust Co. Bldg., are preparing plans for a four-story department store addition, 65x117 ft., to be erection by Rothschild Bros., at State and Tioga Sts. The estimated cost is $75,000.

Jamestown, N. Y.—Peterson & Wood will erect a two-story theater, 75x120 ft. The estimated cost is $45,000. Freeburg & Fidier are Archs., Fenton Bldg.

Manchester, N. Y.—The Lehigh Valley R.R. Co. is receiving bids for the construction of a transfer staion to be erected at Manchester. The estimated cost is $150,000. A. L. Roberts is Mech. Engr., South Bethlehem, Penn.

New York, N. Y.—Bids will be received until 10:30 a.m., June 23, by the Fire Department, 157 East 67th St., for erecting and completing a new central office for the bureau of Fire Alarm Telegraph, to be located on the south side of Transverse Road, No. 2, Central Park, about 1300 ft. from the intersection of Fifth Ave. and 79th St., Boro. Manhattan. Joseph Johnson is Comr.

Bids are now being received by Maginnis & Walsh, Archs., 100 Boylston St., Boston, Mass., for the construction of a parochial school to be erected in 84th and 85th Sts., between Park and Madison Aves., Manhattan, for the Church of St. Ignatius Loyola. It will be a five-story structure, 193x125 ft. The estimated cost is $500,000.

The Rexton Realty Co., 37 Liberty St., has had plans prepared by George F. Pelham, Arch., 30 East 42nd St., for the construction of a 16-story loft and store building, 80x54 ft., at 34 West 25th St. The estimated cost is $150,000.

+Archer M. Huntington, 1083 Fifth Ave., has awarded a contract to ROBINSON & WETTER, 1360 Broadway, for the construction of a six-story, stone residence, at 3 East 89th St. Ogden Codman, 340 Madison Ave., is the Arch. The estimated cost is $90,000.

Plans have been filed by E. Flagg, Arch., 109 Broad St., for the construction of a four-story private dwelling, 82x25 ft., at Park Ave. and 32nd St., for L. G. Morris, 80 Broadway. The estimated cost is $50,000.

Plans have been filed by C. P. H. Gilbert, Arch., 1123 Broadway, for the construction of a three-story bank building, 96x28 ft., on the west side of Broadway, north of 25th St., for the Lincoln Trust Co. The estimated cost is $70,000.

The Aetna Amusement Co., Long Acre Bldg., Broadway and 42nd St., has leased the property at the southwest corner of 107th St. and Broadway. The company contemplates the erection of a theater and office building on the site to cost about $160,000.

The West 82nd St. Realty Co., of 353 West End Ave., has commissioned Schwartz & Gross, Archs., 347 Fifth Ave., to prepare plans for the construction of a 12-story apartment house at West End Ave. and 96th St. It will be 100x125 ft.

(Borough the Bronx)—The 144th St. and Seventh Ave. Co., 1884 Seventh Ave., is having plans prepared by Gronenberg & Leuchtag, Archs., 303 Fifth Ave., for the construction of a five-story apartment house, 95x93 ft., on the west side of Prospect Ave., north of 167th St. The estimated cost is $150,000.

(Boro. the Bronx)—Plans have been filed by A. F. A. Schmitt, Arch., 604 Courtlandt Ave., for the construction of a two-story brick school, 75x69 ft., on the north side of 144th St., east of Willis Ave., for the R. C. Church of St. Pius. The estimated cost is $60,000.

(Boro. of Queens)—Bids will be received by the Department of Education, Park Ave. and 59th St., Manhattan, for the construction of New Public School 96, on the northwest corner of Rockaway Road and Lincoln Park, South Ozone Park, Boro. of Queens. C. B. J. Snyder is Supt.

Niagara Falls, N. Y.—(Official)—Bids will be received until June 28, by Simon Larke, Arch., 608 Elmwood Ave., for the construction of Jenns Bros. department store. The estimated cost is $75,000. Noted June 5.

Edgewater, N. J.—Bids will be received until 8 p.m., July 7, by the Board of Education, of Edgewater, for the construction of a school. Ernest Sibley is Arch., Palisade, N. J.

Hoboken, N. J.—The Board of Education has approved plans for the erection of Public School No. 1, and will soon ask for bids.

Jersey City, N. J.—The Board of Education has approved plans for Public School No. 24 on Virginia Ave., to contain about 42 class rooms, an auditorium, and manual-training department. John T. Rowland, Jr., 98 Sip Ave., is Arch. Bids will soon be asked.

Newark, N. J.—The West Side Trust Co. has filed plans for the erection of a one-story bank building, about 86x90 ft., on Springfield Ave. and High St. The structure will be of brick and terra cotta, with marble or limestone face, and is estimated to cost $75,000. Crow, Lewis & Wickenhoefer, 200 Fifth Ave., New York, are Archs.

Orange, N. J.—The Progressive Investment Co., Orange, will erect a theater 70x196 ft. The estimated cost is $50,000. Hyman Rosenshin is Arch., Newark, N. J.

The Board of Education is receiving bids for the construction of the school to be erected at Main and Cleveland Sts. The estimated cost is $100,000.

Plainfield, N. J.—Edward A. Wurth, Newark, N. J., Arch., is preparing plans for a store and loft building, 50x110 ft., to be erected at Plainfield for Roth & Co.

Beechview, Penn.—St. Catherine's Church will erect a school at Baltimore St. and Belasco Ave. The estimated cost is $60,000.

✚Monessen, Penn.—The contract for the construction of the B. P. O. E. lodge building, has been awarded to the MOTZ LUMBER CO., Monessen, at $50,000. Noted Mar. 6.

Olyphant, Penn.—Bids will be received until 4 p.m., June 24, by P. J. McGinty, Pres. Bd. of Education, Olyphant, for the construction of an annex to the high school. E. H. Davis is Arch., Connell Bldg., Scranton, Penn.

Philadelphia, Penn.—William F. Deakyne has purchased a site at 213 South Broad St., upon which will be erected a clubhouse for the members of the masonic order. The building will be 12 stories, 49x100 ft. The estimated cost is $350,000.

Plans have been filed by Metzger & Wells for the construction of an apartment house at 18th and Walnut Sts., for McIlvain & Co. The estimated cost is $250,000.

Pittsburgh, Penn.—Bids will soon be asked by James H. Gelsey, Mellen National Bank Bldg., for the construction of the Mellen Institute of Industrial Research. The estimated cost is $150,000. Noted Apr. 10.

✚Pottsville, Penn.—The contract for the construction of the office building for the Pennsylvania R.R. Co., at Pottsville, has been awarded to the READING CONSTRUCTION CO., Reading, Penn., at $250,000.

Sharon, Penn.—E. E. Clepper, Arch., 316 East State St., Sharon, Penn., has prepared plans for the construction of an arcade building at Porter and North Water Sts.

✚Valencia, Penn.—McClure & Spahr, Archs., Keystone Bldg., Pittsburgh, have awarded the contract for constructing a one- and three-story brick fireproof home for convalescents for the Kingsley House Association, to J. CHARLES WILSON, 541 Fourth Ave., Pittsburgh, to cost $95,000.

Cumberland, Md.—Bernard Thumel, Arch., Cumberland, is preparing plans for the construction of a hotel, at Baltimore and Canal Sts., for Joseph H. Reinhart, Baltimore St. The building will be six stories of concrete, brick and steel. The estimated cost is $300,000.

Salisbury, Md.—The New York, Philadelphia & Norfolk R.R. will erect a terminal station at the junction. The estimated cost is $50,000. R. V. Massey is Supt., Cape Charles City, Va.

Norfolk, Va.—Rossell Edward Mitchell, Arch., Dickson Bldg., has completed plans for an industrial building, to be erected at Plume and Randolph Sts., for the Syndicate Realty Corporation. The estimated cost is $62,000.

✚Petersburg, Va.—The contract for the construction of the Y. M. C. A. building has been awarded to the HARRISON CONSTRUCTION CO., Petersburg, at $77,190. Noted May 1.

Roanoke, Va.—Bids will be received until noon, June 28, by F. L. Gibboney, City Engr., Roanoke, for the construction of the city hall. The estimated cost is $250,000.

Charleston, W. Va.—Weber, Werner & Adkins, Archs., 414 Walnut St., are preparing plans for a 12-story brick, steel and terra cotta bank and office building at Kanawha and Capitol Sts., for the Kanawha National Bank. The estimated cost is $100,000.

Wayne, W. Va.—Bids will be received until July 10, by John G. Lambert, County Comr., for the construction of an infirmary building for Wayne County. J. R. Kieske is Arch., Ceredo, W. Va.

Durham, N. C.—Plans are being prepared by Milburn Heister & Co., Union National Bank Bldg., Washington, D. C., for the construction of a lodge building for the B. P. O. E. The estimated cost is $40,000.

Goldsboro, N. C.—Millburn, Heister & Co., Archs., Union Bank Bldg., Washington, D. C., are preparing plans for the construction of a court house for the Wayne County Commissioners. The estimated cost is $100,000.

Louisburg, N. C.—The Board of Commissioners of Franklin County selected Millburn, Heister & Co., Washington, D. C., to prepare plans for the court house. The estimated cost is $50,000. Plans will be ready about Jan. 1.

Ocala, Fla.—The Board of Public Instruction of Marion County will expend $50,000, for the construction of a school. Mark & Sheffield are Archs., Jacksonville, Fla.

Birmingham, Ala.—The Earl Estate will erect a five-story building at 1018 First Ave. It will be 50x110 ft., of reinforced concrete and terra cotta. The estimated cost is $50,000.

✚Cullman, Ala.—The contract for the construction of the Sacred Heart Catholic Church, has been awarded to P. J. CLARKE [illegible] N. W. Washington, D. C., at $85,[illegible]

Mobile, Ala.—Joseph Stone, Arch., 201 Pollock Bldg., has prepared plans for the construction of a theater on the site of the old Mobile Theater. The estimated cost is $60,000.

Meridian, Miss.—The Ancient Accepted Scottish Rite Masons will erect a cathedral at 23d Ave. and 11th St. The estimated cost is $85,000. H. M. Threefoot is Pres.

Homer, La.—Bids will be received until June 30, by the City Clk., for the construction of a two-story and basement brick school. The Stevens & Nelson Co. are Archs., London & Globe Annex, New Orleans, La.

✚Johnson City, Tenn.—The contract for the construction of the school at Johnson City has been awarded to CURTIS BROS., Johnson City. Bauman Bros. are Archs., Knoxville, Tenn.

✚Memphis, Tenn.—The contract for the steel work to be used in the construction of the station for the Illinois Central R.R. has been awarded to the VIRGINIA BRIDGE & IRON WORKS, Roanoke, Va. Noted June 5.

Covington, Ky.—St. John's Roman Catholic Church, Covington, contemplate erecting a 2½-story church and school building, at a cost of $50,000.

Louisville, Ky.—The Inter-Southern Life Insurance Co., of Louisville, which has arranged to take over the lease of the Southern National Life of Louisville on a site at Fourth and Market Sts., has announced that a 10-story office building costing $150,000, will be erected there. James R. Duffin is Pres.

Louisville, Ky.—Plans are being prepared by Brinton B. B. Davis, Arch., Inter-Southern Bldg., Louisville, for the construction of an institution for aged women, at Louisville, to be known as Parr's Rest. A steam-heating plant will also be installed.

Bowling Green, Ohio—Howard & Merriam, Archs., Columbus, Ohio, are preparing plans for the construction of a dormitory at the Bowling Green Normal College. The estimated cost is $85,000.

Cincinnati, Ohio—The Proctor & Gamble Co., of Cincinnati, will receive bids on its new office building at Eighth & Race Sts., Cincinnati. Elzner & Anderson, Archs., Ingalls Bldg.

Contracts have been awarded for the 12-story Gwynn Building, to be erected at Sixth & Main Sts., Cincinnati, as follows: WM. MILLER & SONS, rough carpentry work; 444 exterior metal doors and windows to the ENGLISH METAL PRODUCTS CO., of New York. Ernest Flagg is Arch.

Lima, Ohio—Swift & Co. are receiving bids for a warehouse to be erected on East Wayne St., between Union and Main Sts. Plans were prepared by W. H. Horton, Arch., Chicago, Ill.

Lisbon, Ohio—C. & M. Metsch, Archs., East Liverpool, Ohio, are preparing plans for enlarging the court house.

✚Mt. Vernon, Ohio—The contract for the construction of the county jail has been awarded to R. E. & W. S. ANDERSON, Mt. Vernon, Ohio, and the iron work to the VAN DORN IRON WORKS, Cleveland.

✚Indianapolis, Ind.—The contract for the construction of the Third Christian Church, at Broadway and 17th St., has been awarded to WILLIAM P. JUNGCLAUS & CO., Indianapolis, at $85,000.

Detroit, Mich.—Bids will be received until noon, June 24, by Chas. A. Gadd, Secy., Bd. of Education, 50 Broadway, for the construction of the school at Caniff and Oakland Aves.

Racine, Wis.—Bids for erecting the school in the college district have been received by the Board of Education. Lowest bidders on general contract were as follows: Louis Hansen, $74,900; J. C. Jensen, $76,700; Martin Sorrenson, $83,450; James Court, $85,000; Christ Hansen, $85,400; heating and plumbing: Harry Morris, $7999; C. Beecher, $8000; Smollen & Schoenleben, $8191; M. Gleason, $8345, O. C. Davis, $8435; Wiring-Wisconsin Electric Construction Co., $1372; D. Elmer Roberts, $1588. All bids were referred to the Committee on Finance, Buildings and Grounds.

Duluth, Minn.—The United States Steel Corporation at Duluth will erect apartment houses, estimated to cost $1,000,000. George L. Reis, is Vice-Pres.

Kansas City, Mo.—Montgomery Ward & Co. will erect a building at St. John and Belmont Aves. The estimated cost is $1,250,000. J. W. McKecknie is Arch., 1019 Gloyd Bldg., Kansas City.

Freeport, Tex.—The Houston & Brazos Valley Terminal Co., which is a subsidiary of the Missouri, Kansas & Texas Ry. Co., has been organized with its principal office at Freeport, for the purpose of constructing an extensive system of railway terminals at Freeport and Velasco near the mouth of the Brazos River. The company has a capital of $300,000. The board of directors is composed of C. E. Scha, who is also president of the Missouri, Kansas & Texas Ry.; W. A. Webb, Dallas, Gen. Mgr. of the Texas lines of that company; Felix Jackson and James A. Baker, Houston, and F. R. Cobb, Freeport.

Denver, Colo.—Plans are being prepared by Manning & Frewen, Archs., Majestic Bldg., for the construction of a hotel at 1492 Broadway, for the Meni Investment Co.

Manning & Frewen, Archs., Majestic Bldg., are preparing plans for the construction of a theater on Curtis St., for the Western Vaudeville Manager's Association. The estimated cost is $165,000.

Phoenix, Ariz.—Bids will be received until July 6 by the Trustees of the Phoenix School District for the erection of a two-story and basement brick grammar school. About $125,000 is available.

Albuquerque, N. M.—A high school, to cost $100,000, will be erected at Central Ave. and Broadway. Trost & Trost, Albuquerque, are Archs.

Tacoma, Wash.—Heath & Gove, Archs., National Realty Bldg., have prepared plans for the construction of a hotel at Tacoma, to be known as the Hotel Winthrop. The estimated cost is $600,000.

+Portland, Ore.—The contract for the erection of the eight-story Pittock Building has been awarded to the BRAYTON ENGINEERING CO. at $700,000. Doyle & Peterson are Archs

Berkeley, Calif.—A. W. Cornelius, Arch., Merchants' National Bank Bldg., is preparing plans for a theater to be erected for Williamson & Mason, on Shattuck Ave., Berkeley. It will be of reinforced concrete, 60x75 ft. Estimated cost, $100,000.

+Los Angeles, Calif.—The following contracts have been awarded by Parkinson & Bergstrom, Archs., Security Bldg., in connection with the construction of the 12-story Class A office building for the Metropolitan Fire Proof Building Co., at Fifth St. and Broadway. General contract, P. C. ENGSTROM CO., Fifth and Seaton Sts., $272,216; elevators, LLEWELLYN IRON WORKS, $20,275; marble and tile work, B. V. COLLINS, 945 South Los Angeles St., $23,000; structural steel, BAKER IRON WORKS, $77.60 per ton.

Riverside, Calif.—The Riverside Lodge, B. P. O. E., will erect a lodge building at Market St. and Whittier Place, Riverside, to cost about $55,000. Barnett, Haynes & Barnett, 717 Wright & Callender Bldg., Los Angeles, are Archs.

San Francisco, Calif.—The Building and Grounds Committee of the Panama-Pacific International Exposition Co. opened bids, May 27, for the construction of the Transportation Building. Bids on the general construction were as follows: (a) Exposition company to furnish lumber, and (b) contractor to furnish lumber: Lange & Bergstrom, (a) $252,085; (b) $358,518; Streshlow, Freeze & Peterson, (a) $261,000; (b) $363,500; J. Monk, (a) $279,975; Commary-Peterson Co., (a) $296,500; F. Rolandi, (a) $308,900; (b) $430,000.

The following bids were opened by the Board of Public Works for the general construction of the Edison School: Heckenroth & Schell, $49,580; Monson Bros., $42,677; Newsum, Wold & Kohn, $44,820; Carnahan & Mulford, $46,589, McSheehy Bros., $49,942; Thomas Miller, $46,674; F. H. Born, $59,837.

San Francisco, Calif.—(Official)—Bids will be received until July 1, by W. D. Shea, Arch., 244 Kearney St., for the construction of the Young Men's Institute, on Oak St. The estimated cost is $200,000. Noted May 29.

EXAMINATIONS

Engineers Wanted for Railway Valuation

The United States Civil Service Commission announces that examinations will be held, July 21 to 23 in cases where necessary, for the purpose of filling positions in the Interstate Commerce Commission, under the act providing for the valuation of the property of carriers. The general conditions to eligibility, examination, place of application, and other information applying to all positions are as follows:

Appointments will be principally for duty in the field, but some will be made for duty in Washington, D. C. In general, two grades of eligibles will be established, the salary in the higher grades ranging from $3000 to $4800 per year, and the lower grade $1800 to $2700. Examinations are open only to men who are citizens of, or owe allegiance to the United States.

Those desiring further information should apply for Form 2039 to the U. S. Civil Service Commission, Washington, D. C.; or to the secretary of the Board of Examiners, post office, Boston, Mass.; Philadelphia, Penn.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; or St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; customhouse, New York, N. Y., New Orleans, La.; Honolulu, Hawaii; old customhouse, St. Louis, Mo.; or to the chairman of the Porto Rican Civil Service Commission. No application will be accepted unless properly executed and filed with the Civil Service Commission at Washington, in complete form, prior to the hour of closing business on July 21, 1913. The positions to be filled are as follows:

SENIOR STRUCTURAL ENGINEER. Two grades. Grade 1. Age between 30 and 60 years; salary $3000 to $4800; required, graduates in engineering from a reputable technical school, at least five years' actual responsible practice in structural engineering work, subsequent to graduation. If not a graduate, not less than 10 years' actual responsible practical experience. Grade 2. Age between 25 and 50 years; salary $1800 to $2700; must have had three years' experience in structural work, subsequent to graduation, and if not graduates, not less than 10 years' experience.

STRUCTURAL ENGINEER. Age between 23 and 40; salary $1080 to $1500; examination on practical theory and construction of steel, concrete, masonry, 60 points, education, training, experience and fitness, 40 points.

SENIOR CIVIL ENGINEER. Two grades. Grade 1. Age between 30 and 60; salary $3000 to $4800; requirements, graduation in civil engineering, reputable technical school, at least five years' actual responsible experience in connection with railway civil engineering or equivalent professional work subsequent to graduation. If not graduates, not less than ten years' actual responsible practical experience. Grade 2. Age limit between 25 and 50 years; salary $1800 to $2700; three years' experience subsequent to graduation; not less than eight years' experience without graduation.

CIVIL ENGINEER. Two grades. Grade 1. Age between 23 and 40; salary $1200 to $1500; requirements, five years' actual experience in engineering, of which not less than two years must have been in railroad work or its equivalent. A technical school training will be considered to cover not more than three years of these five. Grade 2. Salary $720 to $1080; age limit between 20 and 35; requirements, two years' practical experience and three years in a technical school of civil engineers. Examination will be on the following subjects: Theoretical and practical questions in civil engineering, 60 points; education, training, fitness and experience, 40 points.

SENIOR INSPECTOR OF CAR EQUIPMENT. One grade. Age between 25 and 60 years; salary $1800 to $3600; applicants will be rated upon evidence of their general technical education, training, practical experience and fitness. Must show they have had at least five years' experience as master mechanic, master car builder, general car foreman, or in similar service, and that they have, within two years next preceding the date of their application, been in active service in such capacity.

INSPECTOR OF CAR EQUIPMENT. One grade. Age between 25 and 60 years; salary $1200 to $1500; examination will be on the following subjects: Mathematics, including pure and applied mechanics; practical engineering with special reference to the equipment of locomotives and railway cars, the construction and testing of brake shoes, brake beams, and the air-brake system, 60 points; education, training, experience and fitness, 40 points. Requirements, three years' actual experience in the employ of a railway in the department of equipment, or with a company manufacturing railway car equipment, is required. Graduation in mechanical engineering from a technical school of recognized standing will be accepted in lieu of two of these three years.

SENIOR ELECTRICAL ENGINEER. Two grades. Grade 1. Age between 30 and 55 years; salary, $3000 to $4800. No examination required. Must be graduate in electrical engineering from a reputable technical school, and have at least five years' actual responsible practical experience in electrical engineering work subsequent to graduation, or if not graduate, not less than ten years' actual responsible practical experience in the above line of work. Grade 2. Age between 25 and 45 years; salary $1800 to $2700; must have had three years' experience as in grade 1, subsequent to graduation; if not graduate, not less than eight years' experience.

ELECTRICAL ENGINEER. Age between 23 and 40 years; salary $1080 to $1500. Will be examined in the following subjects: Practical questions on electricity and electrical engineering, pure and applied mathematics, etc., 60 points; education, training, experience and fitness, 40 points. Three years' experience in electrical engineering work required, but graduation from a technical school of electrical engineering will be accepted as equivalent to two years.

SENIOR INSPECTOR OF MOTIVE POWER. Age between 25 and 60 years; salary $1800 to $3600. Applicants will be rated upon the evidence adduced as to their general education and training. They must have had at least five years' experience as master mechanic, road foreman of engines, roundhouse foreman, locomotive shop foreman or engineman, and must show that they have, within two years next preceding the date of their application, been in active service in any such capacity or in the capacity of inspector of locomotive equipment under the Government of the United States.

INSPECTOR OR MOTIVE POWER. Age between 25 and 60 years; salary $1200 to $1500. Competitors will be examined in the following subjects: Mathematics, including pure and applied mechanics, practical questions upon the theory and design of steam engines, boilers, and furnaces with special references to railway locomotives, and the classification and testing of fuels (coals and crude oils) used in connection with them, etc., 60 points; education, training, experience and fitness, 40 points. Applicants must have not less than three years' experience in the motive-power department of a railroad, and graduation in mechanical engineering from a technical school of recognized standing will be accepted in lieu of two years.

SENIOR ELECTRICAL ENGINEER. Two grades. Grade 1. Age 30 to 50; salary from $3000 to $4800. No examinations required. Applicants for positions must be graduates in mechanical engineering or electrical engineering from a recognized technical school, and have had five years' practical experience in electrical engineering work subsequent to graduation; or, if not graduates, they must have had not less than 10 years' actual responsible practical experience in the same capacity. Grade 2. Age between 25 and 50 years; salary $1800 to $2700. Must have had three years' experience as per grade 1, subsequent to graduation; or, if not graduate, not less than eight years' such experience.

RAILWAY SIGNAL ENGINEER. Age between 23 and 40 years; salary $1080 to $1500. Applicants will be examined in the following subjects: Mathematics, including pure and applied mechanics; practical questions relating to block signals and interlocking systems, including the interlocking systems, including the electrical equipment which is a part of such special railway apparatus, 60 points; education, training, experience and fitness, 40 points. Three years' experience in the employ of a railway in the block-signaling or interlocking-system department, or with a company engaged in the manufacture of this special feature of railway equipment is required for admission. Graduation in mechanical engineering or electrical engineering will be accepted in lieu of two years of this experience.

SENIOR MECHANICAL ENGINEER. Two grades. Grade 1. Age limit between 30 and 60 years; salary $3000 to $4800; requires graduation in mechanical engineering from a reputable technical school; five years' actual responsible practical experience in mechanical engineering work subsequent to graduation; or, if not graduates, not less than ten years' actual responsible, practical experience. Grade 2. Age limit between 25 and 50 years; salary $1800 to $2700; not less than three years' experience as per grade 1, or if not graduates, not less than eight years' experience.

MECHANICAL ENGINEER. Age limit between 23 and 40 years; salary $1080 to $1500. Examined in the following subjects: Mathematics, including pure and applied mechanics; practical questions relating to steam engines, boilers and the mechanical apparatus used in the equipment of power plants, the classification and testing of fuels, etc., 60 points; education, training, experience and fitness, 40 points. Three years' practical experience in mechanical engineering required for admission. Graduation in mechanical engineering from a technical school accepted in lieu of two years of these three.

SENIOR ARCHITECT. Two grades. Grade 1. Age limit between 30 and 60 years; salary $3000 to $4800. Requirements, graduation in architecture from a reputable technical school, and at least five years' actual responsible, practical experience in architectural work, subsequent to graduation; or, if not graduates, they have had not less than ten years' actual responsible, practical experience. Grade 2. Age limit between 25 and 50 years; salary $1800 to $2700. Requirements, three years' experience, as for grade 1, subsequent to graduation; or, if not graduates, not less than eight years such experience.

ARCHITECT. Age limit between 23 and 40 years; salary $1080 to $1500. Competitors will be examined in the following subjects: Theory and practice of railway architecture and construction, 60 points; education, training and fitness, 40 points. Applicants must have had not less than four years' experience in architecture. Technical school training will be considered equivalent to not more than three years of these four. Those having had experience in railway work will be given a higher rating in the second subject.

CONTRACT PRICES

+Sewage Disposal Plant—Fitchburg, Mass.—Bids for constructing a sewage disposal plant were received by the Sewage Disposal Commissioners, May 15, as follows. (A) R. H. NEWELL CO. and N. S. BROCK, Uxbridge, Mass. (awarded contract); (B) Coleman Bros., Boston, Mass.; (C) International Construction Co., Boston, Mass.; (D) J. J. Prendeville Co., South Framingham, Mass.; (E) T. Stuart & Son Co., Newton, Mass.

SEWAGE-DISPOSAL PLANT, FITCHBURG, MASS.

	A	B	C	D	E
1090 cu.yd. earth excavation and refill for sewers, conduits and pipe lines in trench	$0 60	$0.75	$2 20	$1.00	$0.70
1450 cu.yd. earth excavation for laboratory building, Venturi meter chamber, etc	0 60	0.80	2 20	0 58	0.50
840 cu.yd. earth excavation for timber tanks	0 42	0.60	0 35	0.35	0.35
48 cu.yd. earth excavation for operating tanks, sewage tests, etc	0 29	0.50	0 28	0.38	0.35
90 cu.yd. earth excavation for screenhouse, settling basins, dosing tanks, sludge-pump building	0 85	1.00	0 75	1.35	1.25
1500 cu.yd. earth excavation for different classes	0 47	1 00	0 50	0 33	0.60
600 cu.yd. earth excavation for Nashua River conduit	0 42	0 75	1 00	0 48	0.65
1000 cu.yd. earth excavation for brick masonry or pipe sewer	1.00	2.00	1 00	0.55	1.00
2450 lin.ft. constructing main roadway	2 75	3 50	3 80	2.80	4.00
450 lin.ft. constructing branch roadway	0.70	1.50	1.25	1.25	1.00
100 cu.yd. grout, including brick masonry or pipe lines	1.00	1.00	1 60	0 65	0.75
1000 cu.yd. dressing earth surfaces with teams and plows	0.60	0.75	2 50	1.00	1.25
1000 sq.yd. furnishing and placing sods on embankment	0 30	0.40	0 40	0 30	0 50
25 cu.yd. rock excavation	2 00	3 00	3.50	1.90	2 00
2750 cu.yd. Class A concrete masonry in timber tanks	11.50	13 00	14.00	7.80	14.00
500 cu.yd. Class A concrete masonry in operating filters	11.00	12 00	15 00	11.65	12.50
50 cu.yd. Class A concrete masonry in trickling filters, in main filter drain	10 00	12.00	10 00	25.00	18.00
124 Class A concrete masonry roof	2.50	2.00	2.75	3.00	4.00
11 Class A concrete masonry headwalls	15 00	20 00	25.00	16.00	30.00
5 cu.yd. concrete piers in gatehouse	12 00	20 00	14.00	20.00	20.00
125 cu.yd. additional Class A concrete masonry	15 00	9.00	14 00	17.00	14.00
50 cu.yd. Class B concrete masonry where ordered	6 00	8.00	7.00	7.50	10.00
4200 sq.yd. partition walls, vents and troughs in Imhoff tanks	1.75	1.40	2 50	2.45	2.35
1400 sq.yd. outside partition walls in sprinkling filters	1.80	1.50	2.75	2.40	2.25
Concreting steel frames of Imhoff tanks, lump sum	1200 00	400 00	175.00	908.00	1250.00
50 cu.yd. Class A concrete masonry protection for flood channel	1.50	1.50	2.00	2.00	1 50
200 cu.yd. Class A concrete masonry in Nashua River conduit	2 00	2.00	2.25	4.25	2 00
70 sq.yd. slate partition in gutters, where ordered	1 00	1.00	0 50	1.75	1 00
57 cu.yd. brick masonry laid in portland-cement mortar	18 00	18.00	17 00	16.50	17.50
158,000 lb. twisted steel reinforcing bars	0.04	0.03	0.04	0.03	0.04
122,000 lb. structural steel work in Imhoff tanks	0 045	0.05	0 045	0 04½	0.05½
15,000 lb. structural steel work in dosing tanks, etc	0 045	0.05	0.12	0 04½	0.05½
Freight	60%	65%	63 1/3%	45%	60%
100 lin.ft. 4-in. vitrified pipe, furnished	0.10	0 08¾	0 09+	0 13+	0 10
100 lin.ft. 6-in. vitrified pipe, furnished	0.16	0.14	0.146	0.22	0.16
100 lin.ft. 8-in. vitrified pipe, furnished	0.22	0 19¼	0.20+	0.30+	0.22
100 lin.ft. 10-in. vitrified pipe, furnished	0.32	0.28	0.29+	0.44	0.32
100 lin.ft. 12-in. vitrified pipe, furnished	0 40	0.35	0.36+	0.55	0.40
100 lin.ft. 15-in. vitrified pipe, furnished	0.54	0 47¼	0.49+	0.74+	0 54
100 lin.ft. 18-in. vitrified pipe, furnished	0.76	0 66½	0.69+	1.04+	0.76
100 lin.ft. 20-in. vitrified pipe, furnished	0 90	0 78¾	0.82+	1.23+	0.90
100 lin.ft. 24-in. vitrified pipe, furnished	1.30	1.13¾	1.18+	1.78+	1.30
100 lin.ft. 4-in. vitrified pipe, laid	0.08	0.15	0.06	0.08	0.15
100 lin.ft. 6-in. vitrified pipe, laid	0.10	0.16	0.07	0.08	0.15
100 lin.ft. 8-in. vitrified pipe, laid	0.12	0.20	0.10	0.08	0.15
100 lin.ft. 10-in. vitrified pipe, laid	0.16	0 23	0.15	0.08	0.25
100 lin.ft. 12-in. vitrified pipe, laid	0.18	0 30	0.18	0.11	0 25
100 lin.ft. 15-in. vitrified pipe, laid	0 22	0.40	0.25	0.12	0.25
100 lin.ft. 18-in. vitrified pipe, laid	0 28	0.45	0 30	0.13	0 40
100 lin.ft. 20-in. vitrified pipe, laid	0 30	0.50	0.30	0.15	0.40
100 lin.ft. 24-in. vitrified pipe, laid	0 35	0.60	0.40	0.18	0.40
50 lin.ft. 4-in. c.i. pipe, laid	0 13	0.15	0.09	0.30	0.15
2280 lin.ft. 6-in. c.i. pipe, laid	0.18	0.16	0.10	0.30	0.20
150 lin.ft. 8-in. c.i. pipe, laid	0 23	0 25	0.40	0.55	0.30
70 lin.ft. 12-in. c.i. pipe, laid	0 35	0.30	0.18	0.55	0 35
3890 lin.ft. 16-in. c.i. pipe, laid	0 45	0 45	0 38	0.75	0.50
300 lin.ft. 20-in. c.i. pipe, laid	0.65	0 60	0.60	1.10	0.75
830 lin.ft. 30-in. c.i. pipe, laid	0.80	0.80	0.85	1.50	1.20
110 lin.ft. 36-in. c.i. pipe, laid	1.10	1.00	1.50	2.00	1.50
160 cast-iron nozzles furnished by Commission	1 50	0.50	1 50	2.00	0.75
Hardware	5 00	7.00	5 00	10 00	10.00
32,700 cu.yd. laying broken stone in sprinkling filters	1 65	2 25	1 95	2.60	2.10
1000 lin.ft. wooden rail fence	0 35	0 40	0 35	0 30	0.45
Setting gates, specials, castings and other metal in masonry, lump sum	900 00	600 00	600.00	1710 00	2000.00
Inspection	11,500 00	14,000.00	12,000.00	12,819.00	15,500.00
Sludge-pump building, lump sum	1200 00	2000 00	1700.00	1733 00	2250.00
Centrifugal pump unit	1000 00	1000 00	225 00	2000 00	1500 00
9400 sq.yd. floor system for sprinkling filters, type A	2 90	2 60	4.00	3 73	3.00
9400 sq.yd. floor system for sprinkling filters, type B	3 20	2 60	7.50	3.75	3.25
9400 sq.yd. floor system for sprinkling filters, type C	2 60	2.30	2.70	3.40	5.50
9400 sq.yd. floor system for sprinkling filters, type D	3 20	2 35	2.85	3.55	5.75
Totals, with type A floor system	$211,847	$240,323	$252,783	$248,549	$247,074
Totals, with type B floor system	214,667	240,323	285,683	248,737	249,424
Totals, with type C floor system	+299,027	237,503	240,563	245,447	270,574
Totals, with type D floor system	214,667	237,973	241,973	246,857	272,924

Type A. This type provides for steel-mesh reinforcement embedded in Class A concrete masonry. Vitrified tile to be furnished by the contractor is to be laid in the cement.

Type B. This type is to be constructed entirely of reinforced concrete. The slotted concrete blocks are to be cast separately from the floor, and constructed of portland-cement mortar mixed in the proportions of 1 part of cement to 3 parts of sand.

Types C and D—These two types are of a similar character. The floor is to be of vitrified clay blocks laid in Class A concrete masonry.

+ Denotes contract awarded.

+Water System—Hinton, Okla. Bids for constructing a water system and electric-light plant according to plans prepared by the Henderson Engineering Co., Oklahoma City, were received by the Town Council, May 19, as follows: (A) T. C. Brooks & Son, Jackson, Mich.; (B) DON A. TOLBERT, Ada, Okla. (awarded contract); (C) Tochterman, Kerby & Richards, Lawton, Okla.; (D) Electric Supply Co., El Reno, Okla.; (E) Tulsa Electric & Construction Co., Tulsa, Okla.; (F) N. S. Sherman Machine & Iron Works, Oklahoma City; (G) Connolly Construction Co., El Reno.

WATER AND ELECTRIC LIGHT SYSTEMS, HINTON, OKLA.

	A	B	C	D	E	F	G
1-in. c.i. pipe, Class B, per lin.ft.		$0 20	$0 15		$0 15	$0 17	
5665 lin.ft. 2-in., Class B, c.i. pipe	0 22	0 25	0 21	0 293	0.22	0 242	0 22
14,604 lin.ft. 4-in., Class B, c.i. pipe	0 46	0 55	0 48	0 487	0 48	0 50	0 49
1	0 62	0 70	0 70	0 633	0 70	0 67	0 66
2	0 95	0 95	0 735	0 95	0 92	0 80	
24	24 75	30 00	27 00	31 90	31 00	25 00	27 25
27	10 00	12 00	11 50	15 95	12.00	13 00	10 55
9	12 00	17 00	14 50	18 70	15.00	16 25	14 75
1	20 00	25 00	21 00	27 50	22 00	20 00	20 80
1		2 50	2 00	1 30	1 75	2 75	2 20
10	7 00	8 50	7 50	7 75	5 00	8 00	7 60
Concrete, per cu.yd.	7 00	12 00	10 00	9 50	10.00	9 00	8 00
Total	$ [illegible]	$25,017	$27,000	$28,696	$30,330	$27,885	$29,858

Filters—Baltimore, Md.—Bids for Contract 11, filters, basins and grading, were opened by the Board of Awards, June 4. Ezra B. Whitman is Water Engr. The bids were: (A) STEWART-JONES CO. and CLARKSON-JOHNSTON & CO., Calvert Bldg., Baltimore (awarded contract); (B) Henry Smith & Sons Co., 111 Hanover St., Baltimore; (C) C. W. Lane & Co., Inc., Atlanta, Ga., and Lane Bros. Co., Baltimore; (D) Elkan-Tuft Construction Co., 702 East Lexington St., Baltimore; (E) Albert H. Prange, 1250 Lake Drive, Grand Rapids, Mich.; (F) Hassan Paving Co., 390 Main St., Worcester, Mass.; (G) Nicola Building Co., Pittsburgh, Penn.; (H) Oscar Daniels Co., Woolworth Bldg., New York; (I) Keystone State Construction Co., Pennsylvania Bldg., Philadelphia, Penn.; (J) Evans & Reilly, Union Trust Bldg., Baltimore; (K) average of bids.

FILTERS, BALTIMORE, MD.

	A	B	C	D	E	F	G	H	I	J	K
12 acres clearing and grubbing	$200 00	$150 00	$300 00	$75 00	$100 00	$100 00	$96 00	$[illegible] 00	$200 00	$500 00	$134 10
110,000 cu.yd. earth excavation	0 38	0 29	0 70	0 53	0 47	0 50	0 45	0 60	0 74	0 72	0 56
700 cu.yd. rock excavation	5 00	2 92	2 50	2 00	1 50	3 00	3 60	2 00	4 00	4 00	3 05
69,200 cu.yd. earth embankment	0 21	0 17	0 20	0 15	0 30	0 30	0 29	0 29	0 26	0 35	0 24
37,800 cu.yd. rolled embankment	0 35	0 32	0 30	0 23	0 30	0 50	0 48	0 25	0 40	0 45	0 35
230 sq.yd. rubble paving	3 00	0 70	1 50	2 00	1 00	2 00	1 20	1 00	2 00	1 50	1 59
6 acres seeding	80 00	75 00	150 00	25 00	50 00	60 00	60 00	55 00	100 00	50 00	70 50
254 cu.yd. concrete, class A	24 00	22 00	23 90	30 00	22 00	30 00	28 85	25 00	29 00	35 00	26 97½
3680 cu.yd. concrete, class B	9 20	11 00	13 20	12 80	11 00	11 00	11 05	11 75	12 80	13 50	11 73⅝
5339 cu.yd. concrete, class C	9 00	7 95	6 55	9 90	9 00	8 25	6 60	11 75	10 70	10 70	9 04
15,576 cu.yd. concrete, class D	9 70	10 95	9 00	10 00	10 00	11 00	12 85	11 75	11 10	12 00	10 84½
3883 sq.yd. special surfacing of concrete	0 35	0 35	0 45	0 30	0 40	0 40	0 33	0 30	0 70	0 50	0 40¼
1,856,000 lb. steel reinforcement	0 03½	0 03⅝	0 03	0 03½	0 04	0 03	0 02½	0 04½	0 04	0 04½	0 03⅝
53,000 lb. miscellaneous steel	0 05	0 10	0 06½	0 05½	0 04	0 05	0 07½	0 09	0 10	0 08	0 07 17/32
35,500 lb. iron castings	0 06	0 07	0 04½	0 04½	0 04	0 05	0 06½	0 06	0 07	0 06	0 05 61/64
50 lin.ft. 24-in. terra cotta drains	2 50	2 50	2 20	2 00	1 50	2 00	3 20	2 50	2 00	2 00	2 24
290 lin.ft. 10-in. terra cotta drains	0 96	0 80	0 65	1 50	0 75	1 00	1 25	0 90	1 00	0 60	0 94 3/16
200 lin.ft. 6-in. terra cotta drains	0 72	0 35	0 40	1 00	0 50	0 50	1 00	0 70	1 00	0 45	0 66 7/16
200 lin.ft. 4-in. terra cotta drains	0 60	0 30	0 30	0 80	0 40	0 50	0 90	0 50	1 00	0 40	0 57
Wooden baffles, lump sum	1680 00	2449 00	3175 00	2500 00	3000 00	3000 00	2629 00	3000 00	2800 00	3000 00	2923 30
Ash elevator, lump sum	480 00	200 00	312 00	270 00	300 00	250 00	317 00	300 00	200 00	325 00	295 40
Fence, lump sum	440 00	100 00	150 00	175 00	200 00	225 00	255 00	100 00	500 00	100 00	224 50
Stairs and railings, lump sum	1920 00	1500 00	1680 00	1500 00	1500 00	1800 00	1536 00	600 00	2400 00	1500 00	1593 60
Hatchways, lump sum	1008 00	700 00	708 00	865 00	600 00	850 00	1440 00	1000 00	900 00	750 00	882 10
Sump valves, lump sum	540 00	425 00	751 00	210 00	500 00	750 00	616 00	600 00	800 00	300 00	549 25
200 tons special castings, set	12 00	20 00	30 00	15 00	10 00	25 00	24 00	20 00	32 00	15 00	20 30
Small piping, lump sum	2400 00	680 00	2260 00	325 00	400 00	800 00	2565 00	300 00	2800 00	500 00	1303 00
5 72x72-in. sluice gates, set	100 00	50 00	100 00	64 00	60 00	50 00	216 00	85 00	300 00	100 00	112 50
2 60x72-in. sluice gates, set	102 00	40 00	75 00	61 00	55 00	50 00	180 00	75 00	300 00	100 00	103 80
2 60x60-in. sluice gates, set	82 00	30 00	60 00	49 00	50 00	50 00	150 00	65 00	250 00	100 00	88 60
10 54x54-in. sluice gates, set	77 00	25 00	55 00	44 00	45 00	40 00	121 00	65 00	240 00	75 00	78 70
10 48x48-in. sluice gates, set	62 00	20 00	50 00	24 00	40 00	35 00	96 00	65 00	200 00	75 00	66 70
4 36x48-in. sluice gates, set	57 00	18 00	45 00	18 00	35 00	30 00	72 00	50 00	150 00	75 00	55 00
4 30x36-in. sluice gates, set	47 00	15 00	40 00	15 00	30 00	25 00	45 00	50 00	120 00	65 00	45 20
5 24x24-in. sluice gates, set	27 00	13 50	35 00	14 00	25 00	20 00	24 00	35 00	100 00	35 00	32 85
8 18-in. circular sluice gates, set	22 00	10 00	30 00	7 00	20 00	10 00	10 60	35 00	50 00	25 00	21 96
Totals	$396,896	$405,014	$419,392	$419,482	$426,835	$438,946	$460,118	$499,435	$507,252	$531,141	$450,451

Paving—Boston, Mass.—Bids for paving, draining, regulating and laying water pipe near Commonwealth Pier 6 were received by the Directors of the Port of Boston, May 28, as follows: (A) Northern Construction Co.; (B) Lawler Bros.; (C) Peter W. Hill; (D) Coleman Bros.; (E) Simpson Bros.; (F) James Doherty; (G) John Cashman & Sons Co.; (H) John E. Quinn; (I) H. P. Converse & Co.; (J) Ryan & Keon; (K) Boston Paving Co.; (L) Hugh Nawn Construction Co.; (M) W. H. Keyes & Co. The item bids were as follows:

PAVING, BOSTON, MASS.

	A	B	C	D	E	F	G	H	I	J	K	L	M
2625 lin.ft. 10-in. vitrified pipe sewers	$1 32	$2 70	$2 40	$1 70	$1 90	$3 10	$3 90	$3 00	$2 41	$2 75	$4 00	$3 80	$2 08
1950 lin.ft. 12-in. vitrified pipe sewers	1 45	3 08	2 50	2 25	2 35	3 15	6 56	3 10	3 52	3 25	4 31	4 00	3 28
400 lin.ft. 15-in. vitrified pipe sewers	2 00	4 00	2 85	4 00	3 66	4 15	7 36	3 25	4 45	5 00	5 00	5 00	4 19
45 vitrified-pipe Y-branches	1 75	3 50	2 00	5 00	1 60	3 25	2 40	7 00	8 10	1 75	6 75	5 50	8 90
25 catch basins	90 75	300 00	80 00	120 00	100 00	125 00	124 90	150 00	175 00	75 00	195 00	150 00	100 00
19 manholes	80 00	100 00	60 00	110 00	77 00	100 00	119 65	150 00	150 00	75 00	150 00	125 00	95 00
1070 lin.ft. 12-in. c.i. water pipe	1 75	2 00	1 75	1 85	1 80	2 00	1 62	3 00	3 24	2 50	2 10	3 50	3 53
350 lin.ft. 4-in. c.i. water pipe	1 14	1 50	1 60	1 30	1 45	1 50	1 21	2 75	2 44	2 00	1 45	2 50	3 05
7 hydrants	52 80	75 00	80 00	65 00	77 00	70 00	85 00	60 00	66 00	150 00	75 00	70 00	60 00
8 gate valves	32 00	50 00	60 00	30 00	42 00	35 00	80 00	45 00	44 00	75 00	33 00	50 00	50 00
21,460 sq.yd. granite-block paving, gravel base	2 43	2 65	2 55	2 55	2 68	2 51	2 38	2 78	2 65	2 95	2 95	3 35	2 83
12,000 sq.yd. vitrified-brick paving, concrete base	*2 61 †2 65	1 50	2 55	2 65	2 53	2 69	2 69	2 80	2 50	2 95	*2 59 †2 69	3 00	2 93
1900 sq.yd. brick sidewalks, gravel base	1 00	1 25	1 10	1 00	1 08	1 09	0 98	1 00	1 10	1 05	1 40	1 25	1 19
2200 lin.ft. straight edgestones	1 00	1 40	1 00	1 05	0 99	0 97	1 06	1 16	1 18	1 00	1 04	1 35	1 10
60 lin.ft. curved edgestones	1 45	1 75	1 20	1 50	1 50	1 33	1 40	1 60	1 73	1 50	1 45	1 75	1 50
1130 lin.ft. wooden curbs	0 35	0 60	0 50	0 50	0 44	0 41	0 48	0 50	5 61	0 40	0 33	0 75	0 55
5 M ft. lumber	43 00	65 00	40 00	70 00	55 00	53 00	45 00	60 00	77 00	50 00	45 00	50 00	50 00
54 ring bolts	12 00	10 50	10 00	12 00	13 75	13 00	11 00	5 00	10 00	10 00	15 00	20 00	12 00
Totals	*$104,597 †$105,105	$110,890	$111,793	$113,136	$113,856	$118,289	$125,745	$127,989	$128,368	$130,259	*$135,119 †$136,390	$149,276	$129,710

* Waldo Bros. or Tuna Valley Block. † Bessemer or Allegheny block.

Sewers—Kinkaid, Ill.—Bids for constructing about 4½ miles of sanitary sewers and grading 60,000 cu.yd. were received by the Pawnee Construction Co., June 2, at the office of Alvord & Burdick, Consult. Engrs., Hartford Bldg., Chicago. The bids were: (A) G. E. Stryslin & Co., Litchfield, Ill.; (B) Barrewott Construction Co., Peoria; (C) Cleary Bros., Chicago; (D) Carmin Roberts, Chicago; (E) John Brogan, Taylorville; (F) Marquette Construction Co., Chicago; (G) M. C. Conners & Co., Chicago; (H) Healy & Finnerty, Chicago; (I) Kaminski Co., Watertown, Wis.; (J) Arthur Birt, Decatur, Ill.; (K) Driscoll & O'Brien, Decatur; (L) William Heggie, Joliet:

SEWERS AND GRADING, KINKAID, ILL.

	A	B	C	D	E	F	G	H	I	J	K	L
11,322 lin.ft. 8-in. sewer	$0 39	$0 75	$0 82	$0 64	$0 57	$0 67	$0 63	$0 60	$0 47	$0 585	$0 348	$0 48
54 manholes	30 00	42 00	30 00	28 00	35 00	35 00	32 00	75 00	27 00	30 00	22 18	29 00
3622 lin.ft. 8-in. sewer	0 69	1 82	1 20	1 25	0 70	0 79	1 39	1 95	0 93	1 435	1 337	1 00
18 manholes	35 00	60 00	30 00	40 00	50 00	43 00	37 00	35 00	47 00	40 00	31 00	29 00
1402 lin.ft. 12-in. sewer	0 48	0 97	1 00	0 75	0 74	0 78	0 65	0 76	0 77	0 72	0 431	0 62
9 manholes	30 00	42 00	30 00	28 00	40 00	35 00	32 00	25 00	25 00	30 00	21 20	29 00
3706 lin.ft. 12-in. sewer	0 75	1 65	1 20	2 20	0 90	0 94	1 53	2 15	1 27	1 82	1 128	0 95
22 manholes	35 00	60 00	30 00	40 00	50 00	43 00	37 00	35 00	47 00	40 00	30 58	29 00
434 lin.ft. 15-in. sewer, cut 11.4 ft	0 84	1 55	1 40	1 00	0 95	1 10	1 52	2 15	1 35	1 91	1 102	1 25
3 manholes	35 00	60 00	30 00	40 00	40 00	43 00	35 00	35 00	47 00	50 00	28 41	29 00
541 lin.ft. 15-in. sewer cut 9.7 ft	0 79	1 55	1 40	1 00	0 83	0 92	0 99	1 95	1 00	1 31	0 837	1 30
4 manholes	35 00	49 00	30 00	40 00	40 00	43 00	35 00	33 00	35 00	30 00	26 10	29 50
1530 lin.ft. 15-in. sewer, cut 6.7 ft	0 60	1 10	1 40	0 90	0 83	0 86	0 79	0 99	0 83	0 91	0 678	1 10
8 manholes	30 00	42 00	30 00	30 00	40 00	35 00	32 00	25 00	25 00	30 00	21 90	29 00
1 special overflow manhole	35 00	12 00	50 00	75 00	70 00	65 00	65 00	40 00	50 00	45 00	120 00	60 00
1 bulkhead	10 00	20 00	50 00	20 00	15 00	70 00	20 00	25 00	25 00	16 00	15 00	15 00
14 flush tanks	60 00	60 00	70 00	110 00	73 00	80 00	90 00	65 00	65 00	65 00	61 20	70 00
Totals for sewers	$16,737	$32,490	$27,610	$28,849	$21,450	$22,983	$26,495	$30,779	$21,902	$27,446	$19,435	$21,443
60,000 cu.yd. grading		0 50	0 32		0 35	0 41	0 28	0 40				
25,000 cu.yd. overhaul		0 04	0 02		0 01	0 015	0 015	0 02				
Totals for grading		$42,000	$25,200		$24,000	$29,100	$21,300	$30,000				
Grand totals		$74,490	$52,810		$45,450	$52,083	$47,794	$60,779				

Canal—Grand Junction, Colo.—Bids for constructing the Canyon Division Canal, Grand Valley Project, were opened by the U. S. Reclamation Service, June 2. The bids were as follows: (A) Reynolds, Ely Construction Co., Springfield, Utah; (B) W. O. & S. B. Morrison, Denver, Colo.; (C) Killpatrick Bros., Beatrice, Neb.; (D) John J. Lumsden & Co., Grand Junction, Colo.; (E) Hewitt & Felch, Oakdale, Calif. The item bids were:

CANYON DIVISION CANAL, COLORADO

	A	B	C	D	E
60,500 cu.yd. excavation, class 1	$0.18	$0.18½	$0.25	$0.37	
1500 cu.yd. excavation, class 2	0.48	0.55	0.45	0.65	
1000 cu.yd. excavation, class 3	0.98	0.98	0.90	1.00	
950,000 cu.yd. overhaul	0 10½	0.016	0.01¼	0.02	
1500 cu.yd. riprap	2.25	3.90	3.50	6.00	
Totals, schedule 1	$35,615	$39,597	$43,700	$63,460	
54,500 cu.yd. excavation, class 1	0.18	0.18 9/16	0.25	0.37	
1000 cu.yd. excavation, class 2	0.48	0.58	0.45	0.65	
1000 cu.yd. excavation, class 3	0.98	1.10	0.90	1.00	
140,000 cu.yd. overhaul	0 01½	0.018	0.01¼	0.02	
200 cu.yd. riprap	2.25	4.00	3.50	6.00	
Totals, schedule 2	$14,108	$15,648	$18,045	$26,205	
41,000 cu.yd. excavation, class 1	0.18	0.18 9/16	0.25	0.37	
500 cu.yd. excavation, class 2	0.48	0.58	0.45	0.65	
500 cu.yd. excavation, class 3	0.98	1.15	0.90	1.00	
213,000 cu.yd. overhaul	0 01½	0.016	0.01¼	0.02	
Totals, schedule 3A	$11,305	$12,022	$14,120	$20,255	
41,000 cu.yd. excavation, class 1	0.18	0.18 9/16	0.25	0.37	
500 cu.yd. excavation, class 2	0.48	0.58	0.45	0.65	
500 cu.yd. excavation, class 3	0.98	1.15	0.90	1.00	
1000 cu.yd. overhaul	0 01½	0.016	0.01¼	0.02	
21,000 cu.yd. material loaded into cars	0 10	0.11	0.25	0.35	
Totals, schedule 3B	$10,225	$10,940	$16,190	$23,365	
137,000 cu.yd. excavation, class 1	0 18	0.18 9/16	0.25	0.37	$0.28
3000 cu.yd. excavation, class 2	0 48	0.53	0.45	0.65	0.45
2400 cu.yd. excavation, class 3	0 98	1.15	0.90	1.00	1.00
825,000 cu.yd. overhaul	0 01½	0.015	0.01¼	0.02	0.02
100 cu.yd. riprap	2 25	4.25	3.50	6.00	3.50
Totals, schedule 4	$41,052	$42,692	$50,485	$72,140	$58,960
27,000 cu.yd. excavation, class 1	0.18	0 18½	0.25	0 37	0.26
3000 cu.yd. excavation, class 2	0 48	0.55	0.45	0.65	0.45
600 cu.yd. excavation, class 3	0 98	1.10	0.90	1.00	1.00
25,000 cu.yd. overhaul	0 01½	0.018	0.01¼	0.02	0.02
100 cu.yd. riprap	2.25	4.00	3.50	6.00	3.50
Totals, schedule 5	$7481	$8155	$9365	$13,640	$9820
Grand totals	$109,568	$118,115	$155,715	$195,700	

Sewers—Boston, Mass.—Bids for Section 68, Contract 104, of the New Mystic Sewer, North Metropolitan System, Winchester, were received by the Metropolitan Water and Sewerage Board, June 6, as follows: (A) Coleman Bros., Boston; (B) Michael Russo & Son, 240 Milk St., Boston; (C) Long & Little, Leominster, Mass.; (D) A. G. Tomasello, 69 Gibson St., Dorchester; (E) G. M. Bryne Co., 166 Devonshire St., Boston.

SECTION 68, CONTRACT 104, NEW MYSTIC SEWER, BOSTON, MASS.

	A	B	C	D	E
600 lin.ft. earth excavation and refilling in trench for 54-in. sewer	$13.00	$12.00	$9.00	$8.00	$7.50
3850 lin.ft. earth excavation and refilling in trench for 48-in. sewer	10.50	12.00	9.00	7.50	6.50
180 lin.ft. earth or rock excavation and refilling in tunnel for 48-in. sewer	25.00	22.00	16.00	17.00	15.00
560 lin.ft. earth excavation and refilling in trench for vitrified pipe drains	2.00	2.60	1.53	1.47	1.75
60 cu.yd. brick masonry (portland) in manholes and special structures	17.00	17.00	17.00	20.00	16.00
3960 cu.yd. concrete masonry (portland) in trench and special structures	18.00	9.00	9.50	8.50	7.50
180 cu.yd. concrete masonry (portland) in tunnel	11.00	12.00	14.00	13.00	9.00
10,000 lin.ft. spruce piles in place	0.40	0.30	0.90	0.35	0.25
Totals	$131,045	$100,096	$93,377	$77,748	$67,535

Sewers—Atlanta, Ga.—Bids for constructing lateral sewers, Groups 6 and 7, were opened by the city, June 12. R. M. Clayton is Chief of Construction. The bidders were: (A) Dysard Construction Co.; (B) J. R. Cothran; (C) B. T. MEEKS (awarded both contracts); (D) L. R. Brine; (E) Cement Stone & Tile Co.; (F) Case & Cothran:

SEWERS, GROUP 6, ATLANTA, GA.

	A	B	C	D	E
80 M brick	$16.50	$16.00	$14.00	$16.50	$15.00
10 cu.yd. rubble masonry	4.75	4.00	3.00	5.00	6.00
10 cu.ft. cut stone	1.00	1.00	1.75	1.00	2.00
15 sq.ft. cut flagging	0.75	0.75	0.80	1.00	1.00
1500 ft. bm. lumber	18.00	17.00	15.00	17.50	18.00
13,000 cu.yd. excavation and back filling 10 ft.	0.60	0.60	0.48	0.57	0.60
2500 cu.yd. excavation and back filling 15 ft.	0.75	0.75	0.60	0.70	0.80
600 cu.yd. excavation and back filling 20 ft.	1.10	1.00	0.80	0.87	0.95
200 cu.yd. excavation and back filling 25 ft.	1.30	1.20	1.00	1.25	1.10
200 cu.yd. solid rock excavation	3.50	3.00	2.50	3.00	4.00
800 cu.yd. semi-decomposed rock excavation	0.80	1.00	0.75	0.65	1.15
10 cu.yd. plain concrete	5.00	4.50	4.50	6.00	5.00
10,000 ft. 6 and 8-in. vitrified pipe laid	0.05	0.05	0.03	0.03	0.05
2500 ft. 10 and 12-in. vitrified pipe laid	0.06	0.06	0.03$	0.04	0.06
1000 ft. 15 and 18-in. vitrified pipe laid	0.07	0.07	0.05	0.06	0.07
100 ft. 20 and 22-in. vitrified pipe laid	0.09	0.10	0.06	0.08	0.10
1000 ft. 24-in. vitrified pipe laid	0.12	0.12	0.08	0.12	0.12
10 cu.yd. broken stone	2.00	3.00	2.50	3.00	3.00
Totals	$15,661	$15,598	$12,143	$15,913	$15,954

SEWERS, GROUP 7, ATLANTA, GA.

	A	F	C	D	E
100 M brick	$16.00	$17.00	$14.00	$16.50	$15.00
10 cu.yd. rubble masonry	4.00	5.00	3.00	5.00	6.00
10 cu.ft. cut stone	1.00	1.00	1.75	1.00	2.00
15 sq.ft. cut flagging	0.75	0.75	0.80	1.00	1.00
2 M ft. bm. lumber	16.00	17.00	15.00	17.50	18.00
15,000 cu.yd. excavation back filling 10 ft.	0.60	0.60	0.48	0.57	0.60
3000 cu.yd. excavation back filling 15 ft.	0.75	0.75	0.60	0.70	0.80
800 cu.yd. excavation and back filling 20 ft.	1.00	1.00	0.82	0.87	0.95
200 cu.yd. excavation and back filling 25 ft.	1.25	1.20	1.00	1.25	1.10
200 cu.ft. solid rock excavation	3.00	3.00	2.50	3.00	4.00
1000 cu.yd. semi-decomposed rock excavation	0.75	1.00	0.75	0.65	1.15
10 cu.yd. plain concrete	5.00	4.50	4.50	6.00	5.00
41,000 ft. 6 and 8-in. vitrified pipe laid	0.05	0.05	0.03¾	0.03	0.05
3000 ft. 10 and 12-in. vitrified pipe laid	0 05	0.06	0.03$	0.04	0.06
1000 ft. 15 and 18-in. vitrified pipe laid	0 06	0.07	0 05	0.06	0 07
100 ft. 20 and 22-in. vitrified pipe laid	0 08	0.10	0 06	0.08	0.10
1000 ft. 24-in. vitrified pipe laid	0.10	0.12	0 08	0.12	0.12
10 cu.yd. broken stone	2 00	3.00	2.50	3.00	3.00
Totals	$17,691	$18,092	$14,064	$16,126	$18,363

Paving—Greenfield, Iowa.—Bids for paving according to plans of Charles E. Chase Consult. Engr. Chester, Iowa were received here to see holloway, city I. a. McLeod $141,192 & Stokes, Red rock, Iowa (awarded contract), also Des Moines Engineering & Contracting Co., Des Moines, Iowa, (C) D. W. Wright, Redford, Iowa.

PAVING, GREENFIELD, IOWA

3000 cu.yd. excavation	$0.35	$0.40	$0.395
8500 lin.ft. new cement concrete curbs	0.31	0.335	0.2875
11,300 sq.yd. plain concrete pavement	1.34	1.3675	1.35
11,300 sq.yd. reinforced concrete pavement	....	....	1.35
Totals, plain concrete	$18,889	$19,567	$18,941
Totals, reinforced concrete	....	....	21,201

Sewers—Louisville, Ky.—Bids for constructing sewers in Shelby and Preston Sts. were received by the Board of Public Works, May 27. David R. Lyman is City Engr. The bids were as follows: (A) J. H. Cahill Somerville, Ky.; (B) Henry Bickel Co., 443 Garden St., Louisville; (C) Guild & Co.; (D) James Duff Construction Co.; (E) James Ferry & Sons, 2111 Madison Ave., Baltimore. The item bids on this contract were as follows:

SEWERS, LOUISVILLE, KY.

	A	B	C	D	E
1100 cu.yd. earth excavation	$1 00	$1 25	$2 00	$1 50	$2 00
1100 cu.yd. gravel refill	2 00	1 50	2 00	2 00	2 50
20 cu.yd. class A concrete masonry	10 00	8 00	7 00	20 00	12 00
40 cu.yd. class B concrete masonry	7 00	5 00	6 50	12 00	11 00
175 concrete manholes		5.00		4 00	6 00
175 brick manholes	6 00		5 00		
50 lin.ft. 6-in. sewer	0 90	1 50	0 60	2 00	1 00
750 lin.ft. 18-in. sewer	3 75	3 60	2 63	3 10	3 85
483 lin.ft. 24-in. sewer	4 50	4 20	3 72	3 90	5 30
50 lin.ft. 15-in. catch basin leads	3 00	3 35	2 40	2 00	2 00
2209 lin.ft. 6-in. underdrain	0 20	0 30	0 50	0 50	0 35
2200 lin.ft. 10-in. underdrain	0 35	0 75	0 60	0 60	0 45
10 lin.ft. 18-in. drop inlets	3 25	7 50	5 00	3 00	5 00
50 18x6-in. Y's	3 00	1 50	1 15	4 00	3 00
4 18x15-in. Y's	4 50	6 00	2 67	6 00	6 00
32 24x6-in. Y's	7 00	3 50	3 50	7 50	4 00
4 24x15-in. Y's	15 00	8 00	7 03	10 00	10 00
1 18-in. bend	3 00	3 00	5 00	3 00	3 00
Reduction stub, lump sum	97 20	330 00	659.13	760 00	760 00
Junction chamber, lump sum	1000 00	600 00	1015 33	1200 00	1100 00
54-in. creek inlet, lump sum	1367 00	640 00	1243.28	750 00	1350 00
39-in. creek inlet, lump sum	896 50	460.00	662 80	800 00	740 00
42- and 27-in. creek inlet, lump sum	1323.25	1315 00	1650 73	750 00	1780 00
48-in. creek inlet, lump sum	1365.25	730 00	929 80	1175 00	1240 00
39-in. creek inlet, lump sum	1082 00	615 00	822.80	850 00	1000 00
24-in. creek inlet, lump sum	459 00	465 00	480.80	275 00	600 00
30-in. creek inlet, lump sum	30.00	40 00	67.00	50 00	100 00
Totals, contract A	$19,228 70	$17,167	$18,903	$19,407	$22,302
428 lin.ft. 30-in. sewer	5 81	5.00	6.47		6 85
579 lin.ft. 42-in. sewer	10 65	7.60	8.79		10 00
534 lin.ft. 54-in. sewer	12 63	8.30	11 54		12 50
70 lin.ft. 54-in. sewer, vitrified brick lining	13 75	12.25	13 04	15.00	18 00
333 lin.ft. 78-in. sewer, vitrified brick lining	18 80	20 00	17.67	27 70	24 00
2550 lin.ft. 84-in. sewer, vitrified brick lining	18 50	20 00	19 22	27 70	24 80
70 lin.ft. 84-in. sewer, vitrified brick lining	20 00	23 50	22 72	31 70	37 50
60 lin.ft. 78-in. sewer, vitrified brick lining	20 00	23 10	20 73	31 70	33 00
308 6-in. slants	0 50	1 25	0 50	0.75	0 60
32 15-in. slants	3 25	10 35	1 70	2 00	3 00
2 18-in. slants	4 00	11 50	4 00	4 00	5 00
1 24-in. slants	12 00	20 00	6 50	8.00	8 50
Totals, contract B	$72,673	$73,287	$72,885		$92,793
428 lin.ft. 30-in. sewer	5 66	5 00	4 82		6.75
579 lin.ft. 42-in. sewer	9 45	7 60	7 19		10 15
604 lin.ft. 54-in. sewer	10 77	8 30	10.49		13 25
308 6-in. slants	0 50	1 25	0 50		0 60
32 15-in. slants	3 25	10 35	1 70		3 00
2 18-in. slants	4 00	11 50	4 00		8.50
1 24-in. slant	12 00	20 00	6.50		
Totals, contract C	$14,677	$12,313	$12,784		$17,078
428 lin.ft. 30-in. sewer		5.00	4 87	4 90	7 00
579 lin.ft. 42-in. sewer		7 60	7 63	7 00	10 55
604 lin.ft. 54-in. sewer		8.30	10 49	9 00	13.75
29 30x6-in. Y's		1.50	1 00	1 50	1.00
4 30x15-in. Y's		12 00	1 35	3 00	2 50
38 42x6-in. Y's		1 75	1 00	1 50	1 50
4 42x15-in. Y's		12 50	1.35	3 00	3 00
40 54x6-in. Y's		2.00	1 00	1 50	2 00
2 54x15-in. Y's		13.50	1 35	3.00	3 50
Totals, contract D		$11,869	$12,959	$11,777	$18,604
428 lin.ft. 30-in. sewer			8.15		
579 lin.ft. 42-in. sewer			10 20		
604 lin.ft. 54-in. sewer			13 04		
393 lin.ft. 78-in. sewer			20 73		
2620 lin.ft. 84-in. sewer			22 72		
308-6-in. slants			0 50		
32 15-in. slants			1 70		
2 18-in. slants			4 00		
1 24-in. slants			6 50		
Totals, contract E			$85,163		

Dam—Plattsburg, N. Y.—Bids for constructing the West Brook storage dam, were received by the city, May 4, as follows: (A) J. J. Fitzpatrick & Sons, Plattsburg; (B) Cunningham-Woodward Co., Glens Falls; (C) Gifford Construction Co., Jamaica; (D) George Cooke, Plattsburg; (E) Charles R. Lewis, Ilion:

STORAGE DAM, PLATTSBURG, N. Y.

	A	B	C	D	E
100 cu yd. mucking	$0 41	$0.75	$0.90	$0.70	$1.00
30,000 cu.yd. embankment	0 39	0 70	0 65	0.50	0.60
1500 cu.yd. excavation	1.80	3 00	2 00	0.70	3.00
10 M ft. B.M. sheet piling	48.00	70.00	30.00	30 00	30.00
4800 cu.yd. concrete	6.90	7 95	6.50	6 50	7.50
15,000 lb. steel	0.05	0 06	0.05	0.05	0.05
2800 sq.yd. slab concrete	1.45	1 60	1 80	1.25	1.60
350 sq.yd. cobble drain	0.20	1 50	0 75	0.70	1.00
160 lin.ft. 24-in. c.-i. pipe	4 00	4 00	5 00	4.00	4.00
144 lin.ft. 16-in. c.-i. pipe	3 50	2 75	5 00	2.50	3.00
60 lin.ft. pipe rail	0 90	0 80	1 50	2 00	1.50
Screens, flush boards, valves, etc., lump sum	475.00	502 00	500 00	310.00	525.00
Totals	$59,994	$71,876	$62,152	$53,545	$66,169

CATALOG NOTICES

The C. O. Bartlett & Snow Co., Cleveland, O. Catalog No. 33. The universal crane and excavator. Illustrated, 16 pages, 6x9 inches.

Bausch & Lomb Optical Co., Rochester, N. Y. Catalog. Engineering instruments. Illustrated, 156 pages, 6½x10 inches.

The Producers' Supply Co., Franklin, Penn. Folder. Gas engine. Illustrated.

Harrison Safety Boiler Works, Philadelphia, Penn. Booklet. "Evolution of the Cochrane Multiport Valve." Illustrated, 52 pages, 3x6 inches.

Haynes Automobile Co., Kokomo, Ind. Pamphlet. Automobiles. Illustrated, 16 pages, 5½x9 inches.

The C. D. Butchart Co., Denver, Colo. Bulletin No. 11. Northwestern headgates and headgate lifts. Illustrated, 46 pages, 6x9 inches.

Americal Steel & Wire Co., Chicago, Ill. Booklet. "Triangle Mesh Wire Reinforced Concrete Pavements and Roadways." Illustrated, 102 pages, 6x9½ inches.

The United States Asphalt Refining Co., 90 West St., New Cork. Booklet. Aztec asphalt. Illustrated, 26 pages, 6x8½ inches. Booklet. Aztec liquid asphalt for oiling roads. Illustrated, 16 pages, 6x8½ inches.

Buffalo Forge Co., Buffalo, N. Y. Catalog No. 256. Buffalo exhaust fans, with practical data on blow-pipe systems. Illustrated, 64 pages, 6x9 inches.

The Gardner Governor Co., Quincy, Ill. Circular G-R 2. Gardner-Rix vertical air compressors. Illustrated, 16 pages, 6x9 inches.

The Weber Chimney Co., McCormick Building, Chicago, Ill. Catalog. Reinforced-concrete chimneys. Illustrated, 48 pages, 5x9 inches.

Mesta Machine Co., Pittsburgh, Penn. Bulletin H. Blowing engines. Illustrated, 8 pages, 6x9 inches.

The Improved Equimpent Co., 60 Wall St., New York. Bulletin No. 6. Silica retorts and settings for gas benches. Illustrated, 24 pages, 6x9 inches.

Link-Belt Co., Philadelphia, Penn. Book No. 120. Peck carrier. Illustrated, 112 pages, 6x9 inches.

CONTRACTS TO BE LET

Viaduct Substructure

Columbus, Ohio.

SEALED PROPOSALS for furnishing the labor and material for constructing the masonry approaches to and substructure of a viaduct over the tracks of the Baltimore & Ohio, the P., C., C. & St. L. and the C., C. C. & St. L. Railways, on North Fourth Street, in the City of Columbus, Ohio, addressed to Mr. S. A. Kinnear, Director of Public Service of the City of Columbus, State of Ohio, will be received until 12 o'clock noon (standard time) of July 2, 1913, in accordance with the plans and specifications on file in the office of said Director of Public Service, in the custody of the Chief Engineer, City Hall, and from whom copies may be obtained.

All bids will be compared on the basis of the Engineer's estimate of the quantities of work to be done, as follows:

CONTRACT No. 2

Item No. 1.	Excavation	7,000	cu. yds.
Item No. 2.	Embankment	4,000	cu. yds.
Item No. 3.	Concrete, Class A (Parapet Wall)	1,800	lin. ft.
Item No. 4.	Concrete, Class B (Piers)	1,450	cu. yds.
Item No. 5.	Concrete, Class C (Footings)	5,100	cu. yds.
Item No. 6.	Masonry, Class A (Coping)	1,800	lin. ft.
Item No. 7.	Masonry, Class B (Concrete) (with Sandstone Facing)	4,450	cu. yds.
Item No. 8.	Limestone Wheel Course	160	lin. ft.
Item No. 9.	Twisted Steel Rods	32,000	lbs.
Item No. 10.	Expanded Metal	8,800	sq. ft.

The quantities are approximate, being given only as a uniform basis for comparison of bids, and the City of Columbus reserves the right to increase or decrease the amount of any class or portion of the work as may be deemed necessary.

In the proposal shall be stated separately the price bid for the labor, and the price bid for the material (mandatory under the law), and also the total.

The bidder shall submit samples of the sandstone which they propose to use in the construction of the work and at least one face of each sample shall be smoothly dressed.

The Director of Public Service reserves the right to reject any or all bids.

S. A. KINNEAR, Director.

Attest: PAUL B. KEMPER, Clerk.

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The Sanitary District of Chicago

ALTERATIONS, ADDITIONS AND ELECTRICAL EQUIPMENT FOR THE R. A. WALLER SUB-STATION ON WENTWORTH AVENUE NEAR W. 64th STREET.

TO CONTRACTORS.

Sealed proposals for alterations, additions and electrical equipment for the R. A. Waller substation will be received by the Clerk of The Sanitary District of Chicago at the office of the said Sanitary District, Room 700, 900 South Michigan Avenue, Chicago, Illinois, until 12:00 M., noon, standard time on June 26th, 1913, and will be publicly opened by the Board of Trustees of said Sanitary District at a meeting to be held on that day or at the first meeting thereafter.

The work for which tenders are invited consists of the following divisions:

DIVISION A—For alterations and additions in the substation building, and for furnishing and installing electrical equipment.

DIVISION B—For installing plumbing and sewerage work.

All bids must be made upon blank forms of proposal furnished by the said Sanitary District, and shall be made in accordance with all the terms and conditions set forth in "Requirements for Bidding and Instructions to Bidders," attached thereto.

The specifications, containing blank form of proposal, and the drawings may be obtained upon application at the office of the said Sanitary District.

The Board of Trustees of said Sanitary District reserves the right to reject any or all bids.

THE SANITARY DISTRICT OF CHICAGO.

THOMAS A. SMYTH,

President of Its Board of Trustees.

Attest:

JOHN McGILLEN, Clerk.

Proposals Invited

THE SANITARY DISTRICT OF CHICAGO
56TH AVENUE AND 52ND AVENUE
SEWER OUTLET AND APPURTENANCES.

TO CONTRACTORS

Sealed proposals endorsed, "PROPOSALS FOR SEWER OUTLET, SOUTH 56TH AVENUE AND SOUTH 52ND AVENUE," will be received by the Clerk of the Sanitary District of Chicago at the office of said District, 700-900 South Michigan Ave., Chicago, Illinois, until 12 M. standard time on Thursday, June 26, 1913, and will be publicly opened by the Board of Trustees of said District at a meeting to be held that day or at the first meeting thereafter.

The work for which said tenders are invited includes the construction of a concrete sewer outlet from existing sewers on South 56th and South 52nd Avenues with a common outfall at the main channel of the Sanitary District of Chicago. The contract includes an outfall at the main channel and two crossings of the Ogden Ditch. The work is largely concrete and excavation.

The work is located along the line of West 39th Street, extended, and along the line of South 52nd Avenue, extended, and is partly in the town of Cicero and partly in the township of Stickney, County of Cook, State of Illinois.

The work covered includes excavation, concrete, reinforcing steel, miscellaneous items covering sewer pipe connections, iron castings, structural steel, outlet and outfall. A certified check for Five Thousand Dollars ($5,000.00) is required as a deposit with the bid.

All bids must be made upon blank forms of proposal furnished by the Sanitary District, and shall be made in accordance with and to conform to the terms and conditions set forth in "Requirements for Bidding and Instructions to Bidders," attached thereto.

Specifications, forms of proposal and plans may be obtained upon deposit of Five Dollars ($5.00) at the office of the said District, which sum so deposited will be refunded if said plans and specifications are returned on or before July 10, 1913.

The Board of Trustees reserves the right to reject any or all bids.

THE SANITARY DISTRICT OF CHICAGO.

By THOS. A. SMYTH,

President of its Board of Trustees.

Attest:

JOHN McGILLEN, Clerk.

Chicago, June 10th, 1913.

❖

Notice to Contractors

Sealed proposals for cleaning, pointing and waterproofing the exterior stone work and central court and two western courts of the State Capitol Building at Albany will be received by the Trustees of Public Buildings, Capitol, Albany, N. Y., until 4 o'clock P.M., on Monday, July 7th, 1913, when they will be opened and read publicly. Proposals shall be accompanied by a certified check in the sum of five per cent. of the amount of bid, and the contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent. of the amount of contract within thirty days after official notice of award of contract and in accordance with the terms of Specification No. 1699. The right is reserved to reject any or all bids.

The work will not necessarily be let to the lowest bidder, as consideration will be given to the references of each contractor, to successful operations performed by him and to his reliability and responsibility as a contractor.

Specifications may be consulted and blank forms of proposal obtained at the office of the State Architect, Capitol, Albany, N. Y.

LEWIS F. PILCHER,

State Architect.

Dated Albany, N. Y., June 9, 1913.

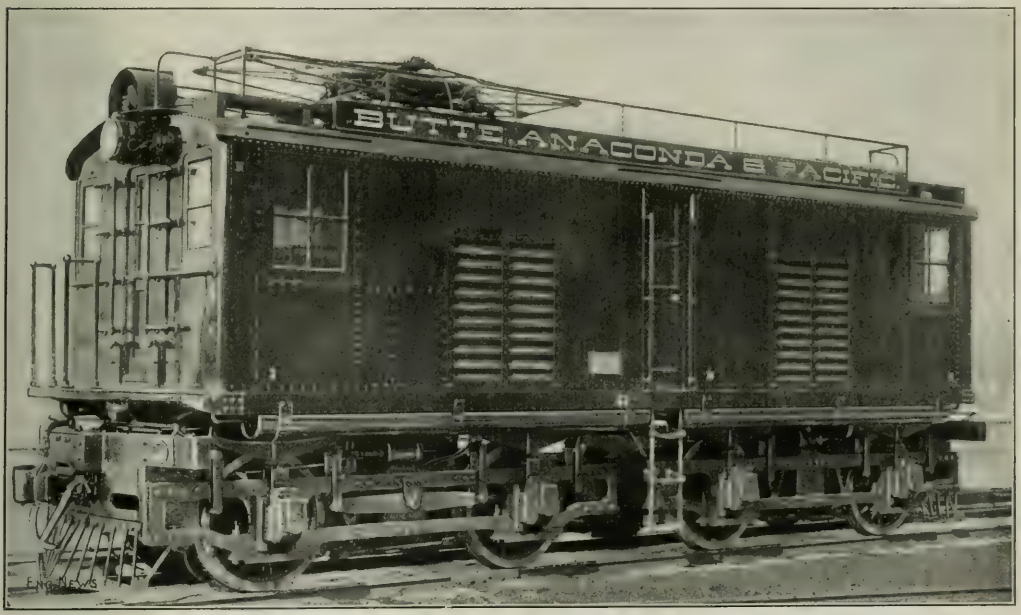
Engineering News

VOLUME 69 JUNE 26, 1913 NUMBER 26

A 2400-Volt Direct-Current Locomotive; Butte, Anaconda & Pacific Railway

The proposed substitution of electric traction for steam on the Butte, Anaconda & Pacific Ry. was described in ENGINEERING NEWS, Aug. 15, 1912. It will be recalled that this is a standard-gage mining road, having a single-track main line about 30 miles long, besides some 84 miles of sidings, yards and smelter tracks. trains will be hauled, however, by two coupled units. A passenger train will consist of one hauling unit and three coaches.

The locomotives are an articulated double-truck type (0:4:4:0) with all the weight on the drivers. A box cab, containing an engineman's compartment in each end and a central compartment for the control apparatus, etc., is carried on the truck frames by hollow center pins in the center transoms. It extends practically the entire length of the locomotive, being 36 ft. long, with its end platforms.



2400-VOLT DIRECT-CURRENT FREIGHT LOCOMOTIVE; BUTTE, ANACONDA & PACIFIC RY.

The maximum grade against load is 0.3%, with 1% against the returning empties. The heaviest train has been 50 loaded ore cars (3400 tons).

Interest has centered largely in the proposal to use direct-current at 2400 volts, supplied to the locomotives from overhead catenary-supported trolley wires. The passenger cars are to be lighted from a 600-volt train line and heated from a 2400-volt line, jumper cables connecting cars and locomotives.

One of the locomotives for this road is shown in the accompanying figure. The initial equipment comprises 15 freight locomotives and two passenger units of nearly the same design. Single units, such as shown, will be used for making up trains and for car spotting. Freight

The trucks are built up of heavy steel castings. The side frames are a truss pattern with heavy top and bottom members and pedestal tie bars. They are connected by cast end frames and a cast center transom. The entire weight is carried on semielliptic springs with different equalization on each truck. As may be seen in the accompanying figure, the forward truck on each side has a single equalizer bar for the two side springs. On the rear truck only the two forward springs, on opposite sides of the truck, are equalized. Friction draft gear, mounted on the end frames, transmits hauling and buffing stresses to the truck frames and a knuckle joint transmits stress from one frame to the other, there being no buffing or hauling stresses carried by the cab.

There is one motor geared to each axle, with a solid pinion on each end of the armature shaft, meshing with gears on the wheel hubs. The reduction is 4.84 for freight units and 3.2 for passenger. Two units will haul a 5400-ton ore train at 15 mi. per hr. on the ruling grade, or at 21 mi. per hr. on level tangents. The maximum speed of a passenger train will be 45 mi. per hr. on level tangent track.

The motors are a commutating-pole (interpole) type, wound for 1200 volts and insulated for 2400. The motor casing is inclosed and provided with forced ventilation; air is supplied from a blower in the cab, being led along a duct sealed in the cab underframe, down the hollow center pins to the truck transoms and out to the motors.

The continuous capacity of each motor under forced ventilation is for 190 amp. on 1200 volts, and 225 amp. on 1200 volts for the one hour rating. For the double-unit 160-ton locomotive this is equivalent to a continuously sustained output of 2440 hp.; the one-hour equivalent is 2900 hp.

The cab underframe consists of two 12-in. longitudinal steel channels on either side of the center and two 6x6-in. steel angles along the outer edges. The central channels are inclosed and form a distributing air duct for forced ventilation.

The engineman's compartment, at either end of the cab, contains the seat, controller, air-brake valves, bell and whistle ropes, ammeter, air gages, sanders and other control apparatus that should be within immediate reach. These compartments are electrically heated.

In the central section is grouped the control apparatus. The contactors, reverser and rheostats are mounted in two banks running lengthwise of the compartment and are arranged with ample space between them to afford convenient access for cleaning, inspection and repair. All parts and circuits carrying 2400 volts are thoroughly protected from accidental contact. A dynamotor is employed to furnish 600 volts for the operation of contactors, lights and air compressor.

The control equipment on the locomotives is the well known multiple-unit type with which the main current is handled by special isolated switches (contactors) actuated by light currents from a master controller. There are the usual arrangements of series and series-parallel groups but no full parallel as the motors are a 1200-volt type. There are ten controller steps of the series grouping, with diminishing resistance, and nine in the series-parallel. Transition from series to series-parallel is secured without opening the motor circuits, and the acceleration can be kept smooth and close to the slipping point of the drivers. There are hand switches for cutting out either pair of motors, the locomotive then operating with one pair.

The contactors are similar to those employed in ordinary service, the variations providing for proper insulation at the higher voltage. There is a main hand switch, that can be opened under heavy currents, and three smaller 2400-volt switches, one for heaters and one for the dynamotor. In all these the switch blade is connected to a grounded-iron hand lever by a wood rod. There is also one main-circuit fuse and two motor-circuit fuses—all of a boxed copper-ribbon type placed as near as possible to the overhead collector. Auxiliary fuses protect the heater and dynamotor circuits. All have magnetic blowouts to insure proper rupture of the arc.

Current is collected by an overhead trolley on a pantograph frame. The pantograph is pneumatically operated and can be put into service from either end compartment by a hand valve. Each passenger locomotive has two collectors but each freight unit only one. A 2400-volt insulated bus line connected direct to the pantographs is run along the roof center of the cab. The bus lines are connected by couplers between the two units of the freight locomotive, so that current is obtained from both collectors or from a single collector. Collectors and bus lines are guarded by railings.

The locomotives are equipped with arc headlights. The cab illumination is provided by ten incandescent lamps arranged in two circuits, one lamp being placed in each end compartment and the rest in the center. A 600-volt bus line is provided on the passenger locomotives for lighting and a 2400-volt bus line for heating the passenger coaches.

The air brakes are the combined straight and automatic type. The motor-driven air compressor is a two-stage affair, with a piston displacement of 100 cu.ft. per minute, pumping against a tank pressure of 135 lb. per sq.in. Air is taken from the interior of the central compartment through a screen; in passing from the low- to the high-pressure cylinder the air is led through cooling pipes on the roof of the cab. This reduces the temperature and condenses the moisture burden before entering the high-pressure cylinder. From the latter it is delivered into four reservoirs, each 12x164 in., located under the floor of the cab and connected in series.

Pneumatic sanders are used and the valves are arranged for sanding the track in front of the leading wheels when running in either direction. The necessary bells are fitted with automatic ringers, and the whistles are air-operated. All wiring is drawn through conduit.

The principal data and dimensions applying to the locomotives are the following:

Length inside of knuckles	37 ft. 4 in.
Length over cab	31 ft.
Height over cab	12 ft. 10 in.
Height with trolley down	15 ft. 6 in.
Width over all	10 ft.
Total wheel base	26 ft.
Rigid wheel base	8 ft. 8 in.
Total weight	160,000 lb.
Weight per axle	40,000 lb.
Wheels, steel tired	46 in.
Journals	6x13 in
Gears, forged rims, freight locomotives	87 teeth
Gears, forged rims, passenger locomotives	80 teeth
Pinions, forged, freight locomotives	18 teeth
Pinions, forged, passenger locomotives	25 teeth
Tractive effort at 30% coefficient	48,000 lb.
Tractive effort at one hour rating	30,000 lb.
Tractive effort at continuous rating	25,000 lb.

An Act to Abate Smoke at Albany, N. Y., was passed by the Legislature of 1913. The act declares to be a nuisance any stack, chimney or furnace within the city of Albany, or within two miles from that city, not being used for a private dwelling, which sends forth smoke in such quantities and of such a density as to be capable of causing injury to the health of residents or to public or private property. Exemptions are made for brief periods while starting or cleaning fires. Smoke of greater density than is indicated by No. 3 on the Ringelman smoke chart issued by the U. S. Bureau of Mines, will be sufficient evidence of "density capable of causing injury to health or property of residents of the city, but proof of injury may be made by other means also. Violation of the act is declared to be a misdemeanor. The act is enforceable by the city of Albany, through its corporation council and is to take effect July 1, 1913. In approving the bill on May 31, 1913, Governor Sulzer attacked a memorandum to the effect that the mayor and council returned the bill to him without action on the ground of not having jurisdiction. He added that in his belief the "proper enforcement" of the act "will rid the city of Albany of an intolerable nuisance."

Steel Ties on Foreign Railways

The extensive use of steel ties in some countries of Europe and in other foreign countries has been advanced as an argument in favor of their more extensive use in this country. On the other hand, it has been stated that none of the foreign ties now in use are strong enough for track carrying the heavy trains and heavy driving-axle loads (50,000 to 60,000 lb.) of American trunk line railways. The steel ties now in use on foreign railways are almost exclusively of the inverted-trough type. They are manufactured extensively in England and Germany, for while none are used in England, they are exported in large quantities to India and the colonies. The ties are usually quite shallow, about 3½ in. deep, the Swiss tie described below being a typical example. The only steel tie used extensively in this country is of I-beam section (like the Severac tie used in Europe many years

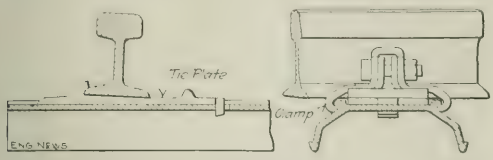


FIG. 1. STEEL TIE OF THE HAARMANN TYPE (1911 DESIGN); PRUSSIAN STATE RAILWAYS

ago); for heavy traffic lines it is usually 5½ in. deep, 4½ in. wide on top, 8 in. wide on the bottom, and weighing 170 to 180 lb. for a length of 8½ ft.

Attention may be called to the fact that in India cast-iron ties are used very extensively, and orders for such ties are placed frequently with English makers. Each tie consists of a pair of bowls or pots connected by a transverse tie bar (ENGINEERING NEWS, Aug. 17, 1911). While cast iron would not be considered a suitable material for track construction in this country, it must be remembered that for 30 or 40 years English foundrymen have been improving the material to secure a metal specially adapted to this purpose, much in the same way as American foundrymen have developed a cast iron suitable for the severe conditions of car-wheel service.

We have made inquiry recently as to the present status of the steel tie in Europe, and present below some information in regard to this.

GERMANY—Very little definite information has been obtained, but it is generally known that many of the state railways use steel ties extensively in main-track construction. In 1892, there were 8025 miles of track laid with steel ties, or 20% of the total railway mileage. It is stated that in 1911, the Prussian State Railways purchased 160,000 tons of these ties. The heaviest driving-axle loads are given as 40,000 lb. The heaviest ties in use are of the Haarmann type (1911 design) weighing 141 lb. each, with a length of 8.85 ft. These are shown in Fig. 1. The tie is of the trough section, reinforced by a rib on each of the lower edges, and having ribs along the top surface to form a shallow channel. In this channel rest long tie-plates, having a lug on the outer end to fit over the rail base, while the inner end has a locking lug which engages with a hole in the tie.

The rail fastening is peculiar, and requires no bolt-holes in the tie. A spring clamp is hooked over the edges of the top ribs of the tie, and its middle portion is bent to form a vertical U-shaped stem. A horizontal bolt through this stem draws the edges of the clamps tightly under the ribs. The tie is the latest development of the type invented and manufactured by Dr. Haarmann, of the Georgs-Marien Steel Works, Osnabruck, Germany.

SWITZERLAND—On the Swiss Federal Railways, the use of steel ties has been increasing steadily for several years, and the percentage of track laid with steel ties has increased from 55.4% in 1902 to 64.9% in 1911. The heaviest ties weigh 159.5 lb., and are shown in Fig. 2. At the end of 1911 there were about 90,400 tons of these heavy ties in service (or 1,247,000 ties); these were spaced about 2286 per mile, on a total length of about 546 miles (exclusive of ties of lighter weight). Of the above total, about 889,900 ties (or 64,520 tons) were used on the construction of new lines during the five years 1904-08.

It will be seen that the ties are of the familiar trough section, 9.6 in. wide on the bottom, 5.2 in. on top, and with a depth of only 3.56 in. The length is 8.85 ft. The

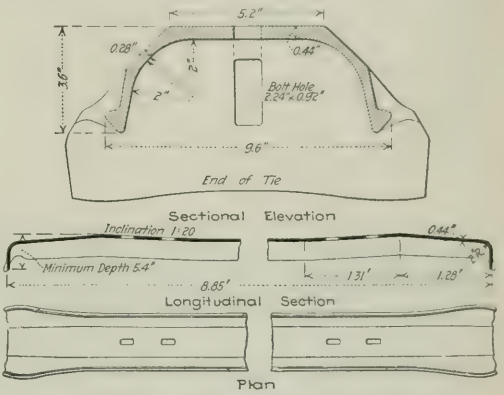


FIG. 2. STEEL TIE OF THE SWISS GOVERNMENT RAILWAYS (STANDARD DESIGN)

rails are fastened by bolted clamps, the bolts having T-heads inside the tie. The heaviest locomotives operated on lines laid with these heavy steel ties weigh 118 tons, with a maximum driving-axle load of 16.3 tons. For the above information we are indebted to Mr. von Steiger, Chief Engineer of Maintenance-of-Way. We may note that in 1894 41% of the track of all railways in Switzerland was laid with steel ties, the percentages on different roads ranging from 18% to 60%.

NETHERLANDS—It is rather surprising to learn that the Netherlands State Railways Co., which formerly used steel ties extensively, has now abandoned them. All have been removed from main tracks, and there remain only a small proportion relaid in sidings, according to a statement by Mr. Beunke, Chief Engineer of Way and Works. However, it is reported that this was due to the fact that the company simply operates the State Railways under lease, and therefore did not feel warranted in making heavy expenditures for steel ties to effect an eventual economy in maintenance which would not benefit the company if the lines should be taken over by the state. In 1894, there were about 320

miles of railway in Holland which were laid with steel ties. The ties were mainly of the type invented and introduced by the late Mr. Post while Chief Engineer of Maintenance-of-Way. These were of the trough pattern, but of unsymmetrical section, being narrow and deep at the middle and wider but shallower at the rail seats.

BELGIUM—Mr. Braet, Engineer in Chief of Maintenance-of-Way, of the Belgian State Railways, informs us that the use of steel ties has been abandoned by these railways. At one time steel ties were used extensively in Belgium, and in 1894 there were about 176 miles of track laid with steel ties. But some two years earlier reports had been made by engineers of the State Railways showing that the results were unsatisfactory as to cost of maintenance-of-way and as to behavior under high-speed traffic.

Most of the ties were similar to the Post type mentioned above, but weighing as much as 165 lb. in the heavier designs. The heaviest locomotives now in service weigh 173 tons, with a maximum driving-axle load of 22 tons.

Artificial Controls for Stream Gaging Stations

BY C. ROBERT ADAMS*

SYNOPSIS—An innovation in gaging stations for determining the flow of small streams in rough beds has been made by the hydrographic engineers of the U. S. Geological Survey as a part of its precise stream gaging work in the White Mountains of New Hampshire. Small barriers of concrete, or of rubble leveled off with cement-mortar, have been built to provide stable channel conditions. Three different types of these artificial barriers are described and rating curves for each type and for a stream having a natural control are given.

In the course of its investigations to determine the effects of deforestation upon stream flow in the White Mountains of New Hampshire, the Water Resources Branch of the U. S. Geological Survey was confronted with the problem of procuring precise determinations of stream flow over an indefinite unbroken period of time on small rough mountain streams. The desirability of eliminating all possible sources of error led to the establishment of several concrete controls on these streams at situations where the natural controls gave evidences of instability or where other conditions were unfavorable.[1]



FIG. 1. COVERT BROOK CONTROL DURING CONSTRUCTION



FIG. 2. GIBB'S BROOK CONTROL AND GAGE HOUSE

FIGS. 1 AND 2. CONCRETE CONTROLS FOR PRECISE STREAM GAGINGS

The Survey's method of determining the discharge of streams by rating curves whereby a certain gage height represents a certain accompanying discharge, is too well known to require further explanation here, except for a brief reference to those physical causes which operate to render the relation between gage height and discharge a constant one. On streams with shifting channels it is well known that this relation is gradually changing, and its application to estimates of discharge must be attended with numerous determinations of the discharge at various gage heights. In general, water surface elevation at any gage location is determined by two factors, namely, the control conditions and the surface slope of the water.

Controls are channel obstructions, such as dams, waterfalls, rapids, jams, and the like, which require that the water surface shall be at a certain elevation to produce sufficient head to discharge the flow past the obstruction. Progressing upstream, the water surface increases in elevation an amount sufficient to furnish the requisite head to overcome the friction originating in the wetted perimeters of the channel. The relative importance of these two factors in producing a final gage height depends upon local conditions. As an almost universal rule, it has been found desirable, when stream gaging stations are being selected, to locate the river gage at a location close to and above a well defined and permanent control. In this way irregularities of gage height due to other causes than varying discharge, such as channel storage, are largely eliminated and the resulting dis-

*Assistant Engineer, U. S. Geological Survey, Washington, D. C.

[1] A more lengthy paper on this general subject, with theoretical discussions here omitted, was presented by the present writer at a recent conference of engineers of the U. S. Geological Survey.

charge curve or rating table becomes most nearly fixed and unchanging.

In the White Mountains but little difficulty was encountered in finding well defined controls, but in the majority of cases danger of erosion existed, banks were low or unstable, or no suitable section was at hand for current meter measurements. The advantage of installing concrete controls was apparent not only in overcoming these uncertainties, but also through enabling greater precision of rating and the use of this standard rating for frozen as well as open-water periods.



FIG. 3. CONCRETE CONTROL ON BURNT BROOK

(The log bridge is above the control, at the current meter section of the stream, at a carefully graded location. The small building contains the recording gage.)

Altogether seven controls were constructed, following three different types. The first type is that used for Gibbs Brook and Covert Brook (Figs. 1 and 2), consisting of a channel 5 ft. long, approximately level longitudinally, and with its surface composed of a cylindrical surface bounded by tangent planes. The dimensions of these controls are shown on the view (Fig. 1) depicting the Covert Brook control during construction. This control was built of rubble masonry with cement mortar and cement finish. The control at Gibbs Brook (Fig. 2) was of concrete throughout, with a masonry wingwall. Fig. 1 shows the gage well in the control, while the Fig. 2 includes the house containing the recording gage.

The second type of control was used at Burnt Brook, Shoal Pond Brook and Anderson Brook. These controls were virtually concrete dams, having a level crest length of 30 ft. and a thickness of 2 ft. The abutments were vertical, of a thickness equal to that of the crest, that is to say 2 ft., and extended 5 ft. in elevation above the crest. From that point they extended horizontally either into the natural bank of the stream or into a well compacted earth fill. Extending down from the crest the upstream faces of the controls were vertical; the downstream faces were vertical for 2 ft. and then extended forward with a slope of 1 to 2. The foundations were either ledge or gravel filled with large boulders. The exception to these specifications is in the case of Shoal Pond Brook where the abutments, instead of having a thickness of 2 ft., were extended upstream for several feet to hold the earth fill which was extended from the somewhat distant terraces. The crests of these controls were practically level in the cases of Shoal Pond Brook and Burnt Brook. At Anderson Brook the control had a notch constructed at one side about 8 ft. long and about one-half foot lower than the remainder of the crest. Fig. 3 shows the control at Burnt Brook.

The controls at Flume Brook (Figs. 4 and 5) and Lost River were of the third type and consisted of low dams of rubble masonry set with cement mortar. They were made approximately level, extending to large boulders in the banks as abutments. Their foundations were placed down in the river bed on well compacted material or ledge, and they were built up from a base of approximately 3 ft. to a thickness of something over 1 ft. at the crest. Their construction was done rapidly and without adherence to geometric design. Lines were placed across the channel indicating the upstream and downstream edges of the control crest; and the rubble masonry was carried up to them, finishing with a smooth layer of cement mortar. The water in both cases was diverted through the river bank at one end, coffering of sand bags being used for the area containing the control. Leakage through the coffering was handled with a single diaphragm pump operated by hand.



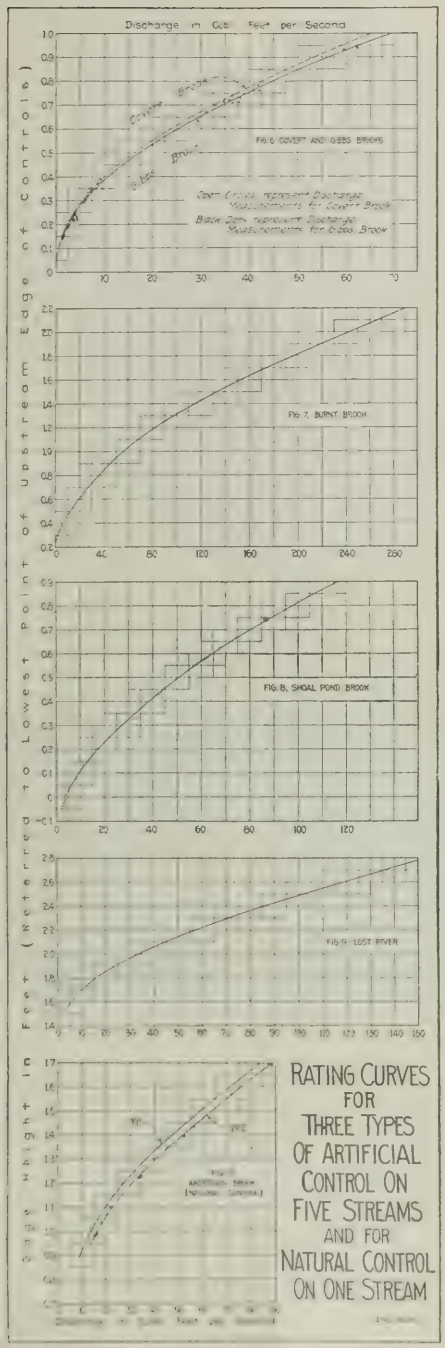
FIG. 4. STREAM BEFORE CONSTRUCTION



FIG. 5. AFTER CONSTRUCTION

FIGS. 4 AND 5. FLUME BROOK CONTROL

As already suggested, these controls were constructed to fill a varied purpose, principally to insure a permanent relation between gage height and discharge, to provide suitable means for measuring discharge, and to facilitate winter estimates during the frozen period. How the first two of these purposes have been served is illustrated by the accompanying rating curves. Fig. 6 shows the curves for Covert Brook and Gibbs Brook stations with attendant measurements of flow. As would be expected, the curves very nearly coincide in position. The increased



discharge at Gibbs Brook is supposed to be produced by a slight downward slope through the control, amounting to 0.06-ft. in 5 ft. At Covert Brook the downward slope amounts to but 0.01-ft. in 5 ft. Apparently there was but little difference in velocity of approach in either case, although such velocity of approach became considerable at higher stages than are represented on the diagram.

Figs. 7 and 8 show ratings for Burnt Brook and Shoal Pond Brook with controls of the second type.

Fig. 9 shows the rating curve for the Lost River station, which was of the third type. This curve is based on ten current meter measurements made by six different observers.

Fig. 10 shows the rating for a natural control. It is for a secondary gaging station on Anderson Brook with a natural control of compacted gravel. Erosion at the control, approximately 0.04-ft. in average depth, has caused a shift in the curve for 1912, moving it to the right of that for 1911. Such a small erosion is seen to be of consequence in affecting precision of results on these streams. A similar effect was noted on Zealand and Ammonoosuc Rivers in the White Mountains. During the fall of 1911 one curve for rating was determined for these two streams. In the early medium stages of the following spring this curve did not apply but the control had apparently lowered, affecting the curves by approximately 0.05-ft. in elevation, which would be equivalent to a scouring action on the control of that amount. After high water had passed, and during the month of June, both rating curves shifted back to their positions for 1911, which would be equivalent to a silt accumulation on the controls equal to that previously removed by the high water. The action may be explained by supposing that during high water material is transported down the channel. The controls are cleared of their finer deposits and the rating curve is correspondingly changed. During low stages the material in suspension brought from above gradually precipitates and tends to refill the controls, again changing the rating curves.

The result is that for streams like Ammonoosuc and Zealand Rivers the rating curve after high water will be permanently in one position, but at low stages it will be anywhere on a fan-shaped extension, dependent upon the conditions of silt accumulation at the control.

Emphasis should be placed upon the quality of the measuring equipment accompanying these controls. For measuring the small discharges occurring at Gibbs Brook and Covert Brook during periods of low water an equipment was installed consisting of a hinged spout leading to a water tight box, 5x5x5 ft. inside measurement. Determinations of discharge were made by raising the spout and allowing water to enter the box for a certain number of seconds. Then the spout was lowered and the quantity of the water in the box measured. The spouts were either operated by hand or by a lever operated over a pair of lightly constructed shear legs. Difficulties in preventing leakage were met but were successfully overcome. The agreement of individual determination of discharge by this method is well exemplified in the rating curves. For the larger streams metering sections were graded, usually with the bottom of the gaging section about 1 ft. below the crest of the control.

The diagrams illustrate both the permanency of the ratings at these stations and the quality of the metering. As for the use of controls during the winter, their value

is at once evident. Ice accumulations occur on the controls only in very cold weather, and may then be removed with an ice chisel without damage to the control. When cleared of ice, the open-water rating curve may be applied to the observed gage height. On streams with natural controls this has not been possible, but ice forming on them has of necessity been left to accumulate, causing backwater at the gage and rendering the open-water rating of no value. At such times it has been necessary to make a complete current meter measurement to determine the discharge, whereas with the concrete controls it was only necessary to observe a gage height.

The accompanying view (Fig. 11) of the Lost River control, taken on Jan. 16, 1912, illustrates a peculiar characteristic noted at these controls when left undisturbed in winter. Field notes taken at the time of the photograph are added to explain this feature:

On Jan. 8, 1912, a visit was made to Lost River, Jackman, Pike and Moosilauke gaging stations and photographs taken of conditions. Each station was found entirely covered with snow and ice. A small opening was observable at the Lost River control and another at the upper end of the cleared section at Jackman Brook. Otherwise the streams were entirely covered.



FIG. 11. LOST RIVER CONTROL IN WINTER

From Jan. 8 to 16, 1912, the weather was extremely cold generally, warming up somewhat on Jan. 10 and 16. On the former date the maximum temperature at North Woodstock reached 33°. Other than that it was always below freezing temperature.

On Jan. 16, 1912, a trip was made to Lost River and Jackman Brook. Jackman Brook was found entirely frozen and snow covered, even including the small place formerly open. Yet on Lost River the ice had melted at the sides above the control, leaving long lanes of open water 3 or 4 ft. wide. In the center of the stream was a long slab of floating ice averaging about 6 in. in thickness. Photographs were taken of the conditions. The staff gage was read and was found to be 1.62 at 11 a.m. The control was entirely out of sight under snow and ice.

In the afternoon the control was cleared of ice and snow. It was found that the water had worn itself a channel under the ice and was flowing over the entire length of the control and without any backwater effect. Yet above the water was an ice layer 4 in. or more thick surmounted by about 2 ft. of snow. After clearing the control entirely the staff gage read 1.62 at 3 10 p.m. the same as in the morning.

The building of these concrete controls for river gaging stations was an innovation with the U. S. Geological Survey. For that reason no attempt was made to construct all alike, but differences were looked upon with favor in order to indicate from experience which type gave greatest satisfaction. The results show that the particular type must be designed for particular needs. The value of having standard ratings for certain types is, however, well recognized. Under such circumstances estimates of flow could commence immediately with the installation of the station without the necessity of waiting for sufficient ranges of stage to occur to permit the determination of the station rating.

In conclusion the advantages of artificial controls may be enumerated as follows: (1) Fewer current meter measurements are required for the initial rating. (2) The initial rating is of increased accuracy. (3) The rating curve is permanent and not subject to change from erosion or sedimentation. (4) Temporary inaccuracies due to backwater or channel storage are obviated. (5) Winter estimates of flow can be made with precision comparable with those of the summer. (6) The period of doubtful accuracy occurring during the early winter freeze-up is eliminated. (7) Any derangement of conditions at the gaging station is at once observable by inspection. (8) Greater latitude of station location is possible.

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The Bureau of Municipal Research of Milwaukee, Wis., was created in September, 1912, to take the place of the former Bureau of Efficiency and Economy, recreated during the recent Socialist administration, and which the present administration claimed had no legal status. The new Bureau is headed by a director at a salary of $3000 a year, who is assisted by an assistant at $1800 a year. The director is charged with the duty, under the direction of the comptroller, of devising accounting systems for the various city departments, and of auditing city accounts. It is also the duty of the director, in this case under the direction of the mayor, "to apply tests of efficiency of departments and persons in the service of the city; to gather and tabulate all available statistics of municipal governmental activities that in his judgment or in the judgment of the mayor may be of service or benefit to the city, whether such governmental activities apply to the city or not," and he shall make monthly reports to the Mayor, showing the result of the work of the Bureau and an annual report to the common council.

Locomotive Terminal Facilities in large cities usually include extensive coaling and coal-storage plant. A report on "Modern Coaling Stations" presented at the recent annual meeting of the International Railway Fuel Association, in Chicago, suggested the advisability of keeping such plants away from city terminals. We quote below this portion of the report:

Modern coaling stations should not be located at the large centers of population wherever this can be accomplished without too great expense. It is believed that it will always prove economical to locate coaling stations away from terminals a distance equal to that which can be covered by one locomotive tank supply, and that no engines, except possibly one or two fast passenger engines, be coaled at the larger terminals.

This conclusion is reached after carefully considering the delay and cost due to stopping passenger trains for coaling purposes, and also after giving due consideration to the desirability of having all of the motive-power activities of a division consolidated under one general supervision. Like all other rules, this one has its exceptions. It would not be economical to so locate a coaling station where the fuel was being delivered at the terminal in question, as it would mean dead haul of loads and empties for double the distance between the terminal and the coaling station.

Additional factors for careful consideraton are: (1) grade conditions, (2) density and directions of traffic, (3) junction points, and (4) location of supply. The most elastic temporary or emergency coaling plant that can be established is the locomotive crane. This is particularly so where property values are excessively high, and where it is desired to store an emergency supply on the ground from time to time. In fact, there are some who advocate this method of handling locomotive fuel at all points and under all conditions.

Repair of an Old Brick Tunnel Lining

During the last few years a double-track railway tunnel near Hönebach, Germany, on the line from Weissenfels to Bebra, whose brick lining had become dangerously out of repair, was put into good condition at a cost of $225,000. As the tunnel is almost exactly 1 km. long, the cost of the work amounts to about $360,000 per mile. The date of original construction is 1845-1848; the age of the structure makes the repair work particularly interesting. It is described in "Zeitschrift für Bauwesen,"

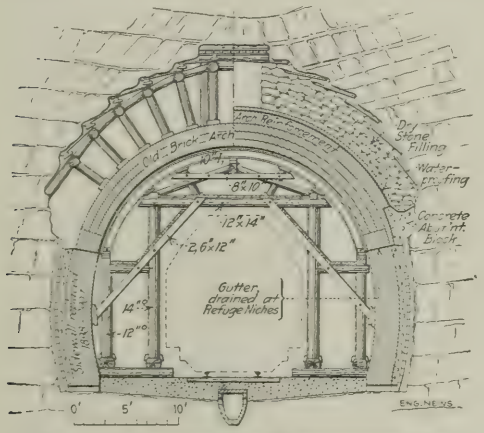


FIG. 1. REINFORCING AND WATERPROOFING THE DOUBLE-TRACK HÖNEBACH TUNNEL, GERMANY

No. 1, 1913, by R. Loewel and E. v. Willmann, who were in charge of the work.

The tunnel was originally built under the direction of Belgian engineers. The Belgian method was used with advance of the bottom heading from the portal and five intermediate shafts. The lining was brick, in three to four rings not bonded together, laid up in a lime-sand mortar with a small addition of powdered brick, except that the key section of the arch was laid in cement mortar.

The ground overlying the tunnel is wet, and the lining leaked considerably from the beginning. The inflow of water and the resulting leaching of the mortar and disintegration of the brick, together with ice troubles in winter, led to many and long-continued attempts at repairing, including patching the brickwork, grout injection into the brickwork and into the stone backing, etc.

More thoroughgoing reconstruction became necessary, and it was begun in 1898 with rebuilding of the side-walls below the springing of the arch; a 28-in. limestone wall backed with 8 in. of concrete was substituted for the old side-walls. This had to be done in short sections, so as not to interrupt traffic, and on this account it took nine years, being completed in 1907. Repair or replacement of the arch could then be undertaken.

Removal of the old arch and construction of a new roof would have blocked the tunnel (or at least restricted it to single-track operation) for several years. It was believed that the old lining was good enough to warrant repair, and that this need not interfere with double-track operation; while the condition of the arch was threatening, yet an examination indicated that little more than the inner ring required renewal. It was expected that suitable repair operations would be much cheaper than reconstruction, could be done in less time, and would not interfere with use of the tunnel. As matters turned out, the repair involved more difficulties than were anticipated.

The method of repair decided upon was to drive a 5x6-ft. heading over the top of the arch for the full length of the tunnel, and then, proceeding in alternate sections 10 ft. long, open out laterally on top of the arch ring down to the spring line, repair all damaged or disintegrated spots and add a reinforcing layer to the arch, apply waterproofing, and complete the work by filling the void above the waterproofing with dry-packed stones. It was felt that this method would give sure results as compared with very doubtful results in case of grout injection. The adopted plan included repair of the inner ring or rings of the lining after the exterior was repaired and made safe by the process described.

The work was carried out under this plan by contract. The crown heading was driven between August, 1908, and October, 1909, without incident. The operations of widening out, repairing and waterproofing were begun near the middle of the tunnel and carried back toward the ends, work being in progress on a length of about 100 ft.

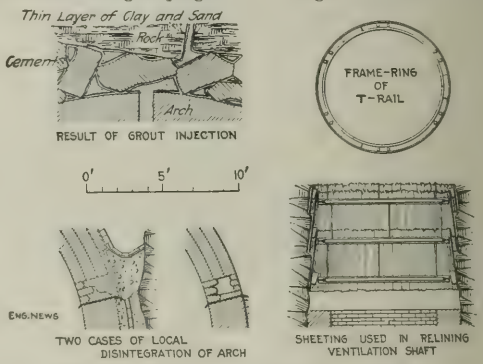


FIG. 2. HÖNEBACH TUNNEL REPAIR

of tunnel at any given time. Alternate 10-ft. sections were widened out, the drifts timbered, and the reinforcement and waterproofing done. The intermediate section between two successive drifts was excavated after these two drifts were again closed, and at the same time the corresponding part of the crown heading was treated. Under this working plan a rate of advance of about 4 ft. per day at each end of the tunnel was achieved.

Some trouble developed at an early stage of this work from settlement of the overlying rock and squeezing of the timbering in the heading on account of the impossibility of doing the dry packing so thoroughly as to make it take its share of the load immediately. Much crushing of the crown bars and posts was noted, and in one case a post was punched through the arch masonry, which at this point was 30 in. thick but was in poor condition. Also, due to slight lateral yielding of the skewbacks of the arch, cracks developed in the crown,

within a month after the widening-out was begun. This effect was traced to the fact that when the restraint of the arch by the overlying rock was removed by means of the excavation for waterproofing, the arch distorted slightly. The difficulty was remedied (at first only in one section but subsequently throughout the work) by forming a concrete abutment and gutter behind the skewback of the arch on either side of the tunnel. This was necessary not only to support the arch thrust but also to take care of the drainage back of the arch, as it was apparent that the drain courses back of the sidewalls were not taking care of this drainage, and continued to allow water to leak into the tunnel even after complete waterproofing of the arch above the springing line.

The most serious difficulty was encountered a few months later, when the work was threatened by the incipient failure of the lining of one of the ventilating shafts (originally a construction shaft). The foot of this lining failed by crushing and telescoping, and there were signs that the arch masonry below and around it was also practically at failure. Operation of trains through the tunnel would have been discontinued at once except for the importance of the line, but single-track operation was immediately instituted (the operating track being shifted to the middle line) and heavy bents of centering were set to support the arch. It was then necessary to reconstruct the shaft lining and its connection to the arch, a difficult piece of work which had to be done under the protection of complete sheeting held by frame rings made of old rails. In renewing the shaft masonry great care was used to obtain tight contact between the lining and sound rock, after cleaning out all soft rock and loam, in order to avoid the likelihood of water draining down between masonry and rock and accumulating over the arch under pressure.

Repair of the inner face of the arch was started only after all the waterproofing and backfilling was completed. This was done under a contract which provided that wherever the inner ring of the brickwork was structurally sound it was to be coated with a cement-mortar facing, and wherever it showed deterioration the brickwork was to be removed and replaced to the depth of disintegration, and also coated with cement-mortar facing.

In some earlier repair work in this tunnel a cement-mortar facing had been applied by placing the mortar directly on the centering and laying the arch repair masonry upon this mortar bed, so that when centers were struck the mortar remained adherent to the brickwork. This facing proved to be very durable and to give effective protection to the arch. The same method of placing was therefore adopted for all parts of the later work where brick-work had to be renewed.

In applying the cement facing to that part of the brickwork which was still in good condition, it was found necessary to finish it to a smooth surface. Early parts of the work put on with a rough surface soon developed white spots and efflorescences, which upon examination proved to be centers of disintegration. Chemical analyses indicated that the effect of the locomotive gases was responsible for this disintegration. The trouble did not appear where facing was floated smooth instead of being left with a rough surface. In those parts of the facing which were put on simultaneous with replacement of some of the brickwork, the facing mortar was laid up on the centers with the brickwork, as already described, and in this case the cement attained a sufficient set before striking centers to be no longer affected by the gases.

In the course of the waterproofing of the back of the arch there was opportunity to examine the efficacy of some earlier grout injection work, which had been undertaken in the attempt to reduce or abolish the leakage of water through the arch. It was found that all loose stone was coated with a fine layer of clay and sand, and the grout which was forced into this mass had only filled the interstices without making tight contact with the individual pieces of the stone packing. The result was that the water again soon leached out passages and channels in the mass and in a short time no effect of the grout injection remained. The condition of the grouted work is illustrated by one of the sketches in Fig. 2 herewith.

The total cost of the repairs described above included: Roadbed, track and signal work to the amount of M. 50,000; Brick, cement, stones, waterproofing, and other material, M. 200,000; Contract labor, M. 650,000. The total cost was M. 900,000, or approximately $225,000.

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A Cableway Up Mt. Blanc is to be built for passenger service under direction of Prof. von Salis, son-in-law of the late Mr. Guyer-Zeller, of Zurich, the projector of the Jungfrau Ry. This cableway is to be built in four sections. The first section has a rise of 653 m. in a horizontal distance of about 2 km. The cables are carried on 27 steel towers 10 m. to 25 m. high. The minimum gradient is 15% and the maximum is 85%. The second section makes a vertical rise of 743 m., terminating at the Glacier des Bossons. This section has an average gradient of 63%. The third section, about 1 km. long, terminates at the Premiere Arete and has a mean gradient of 67%. The fourth section, terminating at the Col du Midi has a total rise of 760 m., or a maximum grade of 60%. The cars to run on the line each carry 20 passengers. The two supporting cables on each section are parallel and about 4 m. apart. One car rises while the other descends, an endless hauling cable controlling their movement. The steel carrying and hauling cables are 64 mm. and 32 mm. in diameter respectively. The two lowest sections are expected to be completed by 1914.

Engineering work in Philadelphia municipal affairs seems to have been of little account during the era of political management of the city's affairs, but the Blankenburg administration has instituted a number of reforms which promise to give a proper prominence to the engineer.

The Bureau of Highways and Street Cleaning of the Philadelphia Department of Public Works, has the responsibility for the maintenance of all roads and streets within the city limits, including over 1000 miles of paved streets and nearly 300 miles of macadam road, as well as 180 miles of earth roads. The Bureau also has charge of all repaving and street reconstruction, of the construction of parks and boulevards, of street cleaning, and the collection of ashes and garbage over the entire city and of the maintenance of all the city's sewers and of all the city bridges, aggregating an investment of over $21,000,000.

Although practically all this is engineering work, Mayor Blankenburg's administration when it took charge of affairs, found that out of the 266 persons engaged in the administrative work of the Bureau, outside of laborers, foremen, etc., only one was ranked as an engineer, and he was receiving the munificent salary of $1500 per annum. This lone civil engineer was assistant to a man without engineering education or experience.

In the reorganization of the Bureau under its present Chief, Wm. H. Connell, the work which the Bureau carries on has been placed in charge of an engineering force, made up of 15 assistant engineers, 17 engineering inspectors and 80 ordinary inspectors, nine-tenths of whom are also engineers. Temporary inspectors are also employed at $100 per month during the construction season. A scale of salaries and positions has been established, under which there are four grades of inspectors at $1200 to $1500 per year and five grades of assistant engineers at $1500 to $4000 per year. In the future it is planned to fill these positions, when vacancies occur, chiefly by promotion from the lower grades after the examination of candidates by the Civil Service Commission.

New Shops of the Canadian Pacific Railway near Calgary, Alberta, Canada

The Canadian Pacific Railway has recently put in operation near Calgary, Alberta, Canada, a large shop plant of more than ordinary interest by reason of its size, its modern design and the speed with which it was constructed. Its location is at Ogden, 4½ mi. from Calgary, which is 2250 mi. from Montreal. Its distance from those sections of the continent where the greater part of the construction materials, machinery and equipment were produced, constituted the first and one of the most important problems. A second important problem arose on account of the construction season being extremely short owing to the high latitude, frost remaining in the ground until about Apr. 1 and returning with snow as early as Oct. 1. A third very important problem was the comparative scarcity of labor in the Canadian Northwest, this condition being greatly aggravated during the late summer months when harvesting begins and all labor markets are practically drained of men.

Plans had, therefore, to be drawn, materials ordered, deliveries made and a complete field force organized so that the shops could be closed in between Apr. 1 and Dec. 1 and sufficiently heated so that inside work could be continued after the cold weather had set in.

Description of Shops

The erecting shop which is 778x75 ft., is served by two traveling electric cranes carried on two levels. A 120-ton crane furnished with two 60-ton trolleys is carried on the upper level and is used for transferring and wheeling and unwheeling locomotives. One of the trolleys on this crane is equipped with a 10-ton auxiliary hoist for handling light material at a high hoisting speed. Another 10-ton traveling electric crane operates at high speed and serves the entire area of the erecting shop, for handling material in that shop and transferring it to the blacksmith shop and machine shop. The machine shop and the boiler shop are located in adjacent bays on either side of the erecting shop.

Provision is made on the crane columns in the erecting shop for attaching portable jib cranes for use in dismantling and erecting material on the front ends of locomotives. These cranes are placed where desired by means of the overhead traveling electric cranes.

The machine shop for heavy machine tools is located parallel with and adjacent to the erecting shop. It is 60-ft. 9 in. wide and the same length as the erecting shop. A high-speed traveling crane of 10-ton capacity covers the entire area of this shop. Material can be brought into the shop through a door provided in the end of the building, the material being brought up to the end of the machine shop by the electric yard crane which travels across the end and outside of the locomotive shop.

Space for the lighter machine tools is provided in a shop having the same dimensions, parallel with and alongside of the heavy machine shop. Provision has been made for a foreman's office elevated above the floor and having a liberal glass surface in the walls so as to give the best possible view of the shop.

The blacksmith shop is located alongside of and parallel with the erecting shop on the opposite side from the machine shop.

The space for the boiler shop is provided in a two-bay building, alongside of and parallel with the erecting shop at the end of the blacksmith shop, 352 ft. long and the same width as the latter shop.

The riveting tower is located between two of the roof trusses in the end of the boiler shop, with a 25-ton crane for serving the hydraulic riveter.

An entrance track is provided through the outside wall of the boiler shop on which boilers or other equipment going to this department can be delivered on cars under the traveling crane, for unloading, or may be loaded out for shipment in the same way.

The heating throughout is done by the indirect-fan system. For distributing the heated air, underground concrete and tile ducts are used.

The general illumination consists of Cooper-Hewitt lamps with circuit and plug boxes for extension loop cords. Provisions have also been made for incandescent lighting circuits for individual lighting at machine tools where required, and for outlet boxes for connecting extension lamp cords to provide lighting for the interior of the locomotive boilers on the erecting floor.

A suitable system of piping is provided for distributing live steam, compressed air, fuel oil and also water for fire protection, drinking and hydraulic pressure.

Outlets for compressed air are provided in duplicate in the sides of each of the engine pits to supply compressed air for operating pneumatic tools.

In the main locomotive shop the electrical feeders from the power company's transmission lines are carried in underground ducts, bringing the current at the voltage delivered by the power company, viz., 2200 volts, to a substation located adjacent to and immediately outside of the low machine bay, the transformers for stepping down to 440 volts being located in this substation. Here also are located two direct-current motor generators. The switchboard for controlling the power and lighting circuits in the machine shop and for the tender shop and foundry is also located in this substation. As far as possible distributing feeders are carried in conduit beneath the shop floor, thereby minimizing the amount of exposed wiring in the shops.

The building containing all of the above departments of the locomotive shop is constructed with a structural-steel frame carried on concrete foundations. The exterior walls up to the window-sill line are of concrete and above the window sills are of hollow-tile, plastered.

With the exception of the blacksmith shop and a portion of the boiler shop the floor throughout is constructed with a 1½-in. asphalt mastic wearing surface which is underlaid with a rough concrete slab about 6 in. thick. In the blacksmith shop and a portion of the boiler shop the floor is of cinders.

The roof sheathing is constructed of 2x4's, surfaced on one side and one edge and spiked together on edge, thus affording good fire-resistance qualities and materially reducing the heat losses. The roof water-proofing is four-ply tarred felt, pitch and gravel, with copper flashing.

The tender and wheel shop is constructed with a structural-steel frame and with steel roof trusses; otherwise the general construction of the building is similar to that described for the main locomotive shop. It is an L-shaped structure 263x80 ft. with an L 180x80 ft., and affords space for making repairs to locomotive

tenders, steam-shovels and other maintenance-of-way equipment.

Space for the pattern shop and pattern storage is provided in a separate building located adjacent to the foundry, a fire wall separating the pattern shop from the pattern storage. The general construction of the building is the same as that of the other buildings—the roof of slow-burning mill construction. The structure is 162x31 ft. and is heated by the direct system and lighted with keyless-socket marine type incandescent lamps. A sprinkler system is provided for fire protection.

The gray-iron foundry building is 203x80 ft., constructed with two bays. The frame is of structural steel carried on concrete footings. The general construction is the same as that described for the other building except that the floor is of the usual clay type used in foundries and the roof over the cupola room is of corrugated asbestos. Heating is by the indirect-fan system with underground tile and concrete hot-air ducts. For general illumination flaming arcs are used in the high bay and in the low bay, with outlet boxes for extension lamp cords.

The storehouse and office building is 252½x60 ft. The walls are constructed of hollow-tile blocks on concrete foundations which are carried up so as to bring the floor of the storeroom to the car-door height.

For storing and distributing oil a separate building is provided convenient to, but located far enough away from, the storehouse and other buildings to eliminate the fire risk. It is constructed with tile walls (plastered on the exterior) on concrete foundations, with a concrete basement at one end for the tanks which contain the oil for local distribution. The roof is of reinforced-concrete slabs, as is also the floor of the pump room over the basement. That part of the building used for storing oil in barrels has a cinder floor. The pump room is partitioned off with a brick wall carried up to make a fire wall.

The oilhouse basement is heated by the direct system to the temperature necessary to render the oil fluid during extreme cold weather; the direct system being also used to heat the rest of the building. The lighting of the building is with keyless-socket marine type incandescent lamps. There is fire protection in the form of sprinklers.

The coach repair and paint shop, of which a photograph is shown, is 362x146 ft. and has fifteen tracks on 24-ft. centers. It is constructed with hollow-tile carried on concrete foundations. Heavy timber posts support the roof, which is of slow-burning mill construction. Otherwise, the construction is the same as that described for the main shop building.

Heating is by the indirect fan system and the lighting is by incandescent lamps. Compressed air, steam and water service and automatic sprinklers are provided.

The freight-car repair shop, 303x231 ft., is supplied with compressed-air and steam and water service piping, heated with the indirect fan system and lighted by 100-watt tungsten lamps.

Two eight-inch wells equipped with electrically operated pumps have been put down, for obtaining water for shop purposes. To supplement this supply and to provide a main source of supply for fire protection, the city of Calgary has brought down into the shop site to a point midway the length of the main shop building on the west side a ten-inch cast-iron water main. The shop service and fire lines are connected into this main and into a steel tank of 125,000 gallons capacity, which is erected on a 70-ft. steel tower, principally for use in connection with automatic sprinklers in the various buildings where these are installed.

Progress of the Work

The location of the shops, as previously stated, is about 1½ miles east of Calgary, practically on the open prairie and before beginning construction, arrangements had to be made to house and board on the shop property a considerable labor force. To this end, frame bunk-houses were erected with two tiers of bunks on each side of the building, eight bunks long, each house having a capacity of 32 men. Stoves were placed in the center aisle and benches along the sides of the lower tier of bunks. With the approach of summer, and as the labor forces were increased, some of the men were housed in standard 12x14-ft. wall tents which accommodated four men each. A large mess room with kitchen and storeroom space was



Coach-Repair Shop; Canadian Pacific Railway Near Calgary, Alberta, Canada

fitted up with a capacity for feeding about 400 men at one time.

As there were no accommodations near the shops for men with families, the Railway Company put into temporary service a train to carry the men back and forth from Calgary, and several hundred men went back and forth on this train each day. This arrangement helped the situation considerably, especially as the season advanced and all kinds of labor became more difficult to obtain. A standing order was placed through several labor agencies in Calgary to send men daily to the job. As the work neared completion the bunk houses and mess house were turned over to the Railway to take care of their own men who were at that time living in cars on the property. This, of course, released the cars and permitted their use at other points.

The work was designed and built in its entirety by Westinghouse, Church, Kerr & Co., consulting and constructing engineers, of Montreal and New York, working under the direction of Mr. J. G. Sullivan, Chief Engineer of the Western Lines of the Canadian Pacific Railway, and Mr. N. E. Brooks, Division Engineer.

The progress schedule below will show the prosecution of the work but it should again be pointed out that it was not possible to break ground until Apr. 1, 1912, and by Mar. 17, 1913, the locomotive shop was in full operation. When the magnitude of the work is considered as also its distance from the larger centers, it will be appreciated that a record for prompt performance has been established.

The progress of the work was as follows:

	Commenced 1912	Completed 1913	Duration of job in months
Locomotive shop	Apr. 15	Mar. 15	11
Tender shop	Apr. 15	Mar. 15	11
Coach shop	Apr. 15	Mar. 15	11
Power house	May 15	Jan. 15	8
Storehouse and offices	June 15	*Dec. 15 *(1912)	6
Freight car shop	Apr. 30	Mar. 31	11½
Foundry	July 15	Mar. 31	8
Planing mill	Apr. 30	Feb. 28	10
Pattern shop and storage	July 31	Jan. 31	6

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Modern Steel-Tipple Design*

By John A. Garcia†

Steel structures have been built in the Illinois and Indiana coal fields only during the past ten or fifteen years and have not been generally adopted in either of these states, except that fireproof structures are now required by law in Illinois. At the same time there has been a steady progress in the West toward more substantial construction and toward mines designed for greater safety and longer life. This fact, together with the demand for better preparation of the product in addition to the more recent requirement of timber structure of sufficient rigidity to prevent the vibration of the screens from affecting the scales and seriously damaging the main structure.

The first steel tipple followed almost exactly the lines of the accepted wooden structure. At least six steel columns were placed on or adjacent to the curbing, the screens were carried on an independent structure, and the batter braces were connected as formerly. The whole structure was interwoven with a network of light angle bracing. The actual working stresses in the tower, when first calculated, were found to be surprisingly small and the required sections extremely light. But the first designers did not realize that steel is a very elastic material, and that a structure of sufficient theoretical strength, which could be built for a cost approximating a well constructed wooden tipple, would lack entirely the rigidity necessary for satisfactory operations

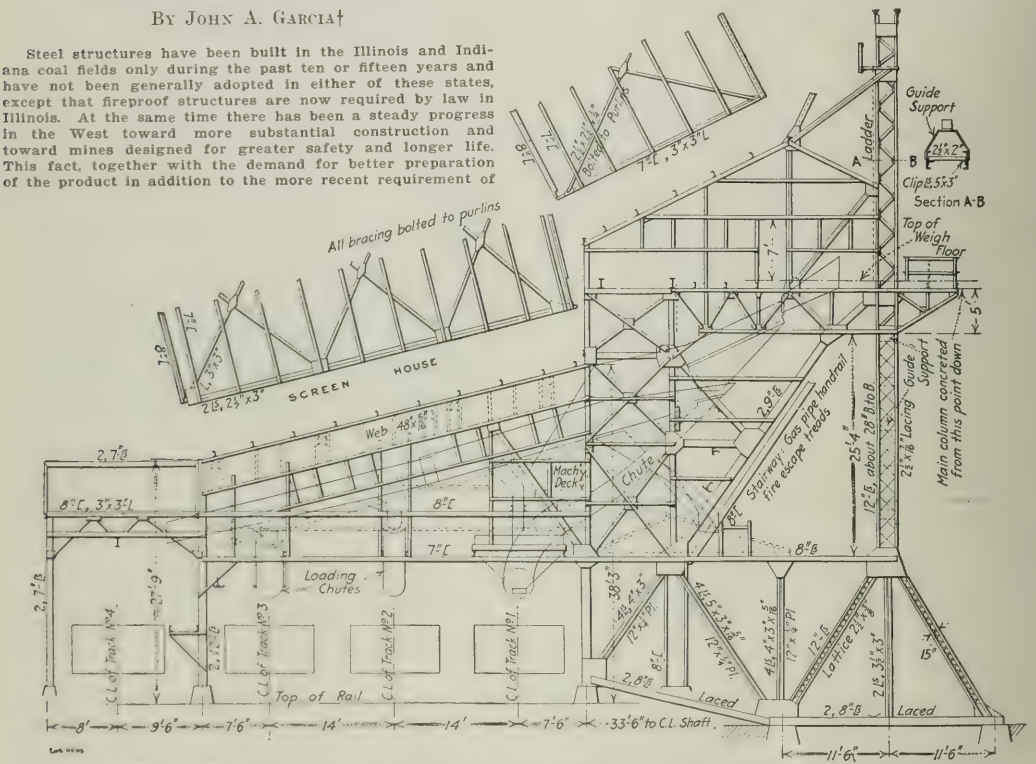


Fig. 1. New Type of Steel Tipple and Screen House; West Kentucky Coal Co.
(John A. Garcia, Chicago; Inventor; Allen & Garcia, Chicago, Engineers.)

law, has led to a very interesting development of this line of engineering.

The keystone of a mining installation is the shaft and tipple. In the old days the shaft was put down in the cheapest possible manner; small, cramped and timber lined. The tipple was placed immediately on the curbing or just outside of it. The tipple usually consisted of six heavy vertical timbers placed at the corners of the two hoisting compartments, braced laterally by batter braces and carrying the sheave wheel on cross timbers at the top. A heavy timber brace was then framed between the sheave deck and the engine foundations. The weighhouse was supported by similar bents placed between the tracks and the screens were hung or supported underneath and covered by a loading shed. When shaker screens began to come into use it was found necessary to support them on an independent interior structure, as it proved very difficult to produce and maintain a

*Abstract of a paper read at the Mining Conference at the University of Illinois, May 8, 10, 1913.

†Allen & Garcia Co., Engineers, McCormick Building, Chicago.

under the shock of hoisting and dumping and the constant vibration of the screens.

It is not surprising, therefore, that the first steel structures were distinctly less rigid and satisfactory than their wooden predecessors. They had one advantage in that they were fireproof. The freedom from shrinkage and rotting was offset by the rusting of the metal and the extreme liability of the light members to damage from accident. Any damage to the shaft, any settlement around it, or fire in the curbing had almost as destructive an effect on the tipple as if it had been built of wood, and coal operators began to wonder whether even the small increased cost of steel was worth while.

The first step toward the construction of a steel tipple distinctly superior to wood was the A-frame design, in which the legs of the tower are carried onto firm ground well away from the shaft. Another improvement introduced about the same time, consisted of spanning the tracks with a clear span and carrying the screens on a bridge, so as to avoid the inconvenience and danger of columns located between the tracks. The first A-frame tipples, so far as the writer knows,

were designed by Andrews Allen in 1899; and the first bridge for carrying the screens, by George S. Rice, at about the same time. Since that time it has become almost the universal practice of designers (even when the old six-column towers are employed) to carry the foundations well away from the shaft; and the clear span over the tracks, while not generally adopted, has been coming more and more into favor.

The A-frame tipple, while a distinct improvement over previous construction and greatly superior to the wooden structure in strength, permanence and rigidity, had some serious drawbacks. The guides had to be carried inside of a widely spreading tower by means of substantial horizontal frames; and these frames, even if of sufficient strength, were particularly liable to damage and corrosion and, when really built for permanence, added greatly to the cost of the structure. In this respect the old form of six-column tower, when the footings are carried a sufficient distance outside the shaft, still has an advantage over the A-frame type, although

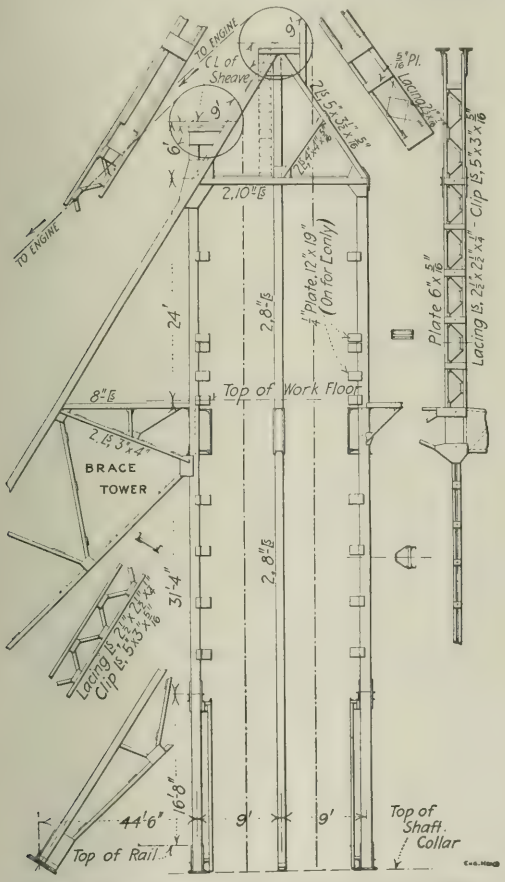


FIG. 2. FRONT ELEVATION OF STEEL TIPPLE, WITH BRACE TOWER ON ENGINE-HOUSE SIDE

this advantage is neutralized by the greater complexity and the indeterminate character of the structure.

In all these designs the independent screen structure was a uniform feature. The effect of the vibration of the screens was so little understood and so inadequately analyzed that none of the designers appeared to be brave enough to break away from the prevailing practice and design a structure that should be stiff and strong enough in all its parts and with the unavoidable vibration so localized that no damage could come to the structure or inconvenience to the operation of the scales.

In the meantime there came a development in the direction of concrete shafts. This construction not only removes the danger of fire, but makes the shaft curbing (in most cases) the best and most substantial as well as the least expensive foundation on which to place the tower. Thus the principal advantage of the A-frame structure was removed.

About two years ago, the Allen & Garcia Co. took up the problem of building a tipple over a concrete shaft and decided to place the main column members directly on the curbing. We were unwilling to revert to the six-column design, on account of its complications and ambiguity of stress, and finally a system of construction was evolved (and protected by patents*) which seemed to us to be a distinct improvement over any previous construction. Instead of putting columns at the corners of the shaft, two main columns are placed in the middle of the curbing at each end of the shaft just back of the guides, the guides themselves being carried directly by, or bracketed from these columns. The center guides are also carried by a vertical column directly between them, this column being hung from the main structure, so as not to rest on the buntings, and being bracketed at several points so as to have ample lateral and longitudinal stiffness. When adapted to an end hoist tower, the sheaves are carried directly on an A-frame of the same width as the column, the forward leg of which is carried down to the ground in a line outside of the resultant of the cable stress. All columns are made of such width as will insure sufficient lateral rigidity when unsupported throughout their length, and to carry the journal bearings of the sheaves. The main structure carrying the weighhouse and screens, is built over the tracks at right angles to the hoisting frame and designed to give the greatest possible rigidity to the tower and to carry the shock of dumping directly to the ground. This construction is shown in Figs. 1 and 2, which represent the steel tipple for the West Kentucky Coal Co., at Sturgis, Ky.

With this tower of extreme rigidity, it is an easy matter to design a screen structure so stiff that the vibration of the screens will have little or no effect upon it and the screens can then be hung on properly journaled, rigid hangers, so as to operate with only a fraction of the friction and wear incident to roller bearings. The eccentrics or other operating mechanism for the screens may then be supported on cross members, so that any vibration arising from them will be entirely absorbed before being communicated to the main structure.

The advantages of this construction are many. In the first place, the main tower is composed of three very heavy and substantial members which can be encased in concrete so as to protect them entirely against accident or corrosion. Second, the weight and cost of the main tower, in spite of its great strength and rigidity, are scarcely half that of a properly designed A-frame tower. Third, the shaft is left entirely clear at the bottom of the tower, so that the rails and other material can be easily loaded on the cages. Fourth, the foundations are cheapened and cut down in number and a screening structure of sufficient stiffness can be built and rigidly connected to the main structure. Fifth, the guides are attached directly to the tower columns and form a stiff rigid slide for the cages from shaft to dumping point; all at a less cost than the former style of construction.

In working out the details of this new type of structure it became necessary to make a careful analysis of the action and operation of the screens. The first requirement is to design the screens so that they will be as nearly balanced as possible under the varying conditions of load. This can usually be accomplished by making the upper section of the screen, which received the coal directly from the weighpan, somewhat shorter and lighter than the lower section. In studying the forces acting upon the screen through the driving rods, it became evident that it was possible to devise a much better operating mechanism than the time-honored eccentric. The eccentric, while a very convenient device, is inefficient and troublesome for transmitting power. The friction on the eccentric strap is great, causing frequent heating, and the diameter is so large that perfect lubrication becomes difficult. We substituted a bell-crank device, operated by driving rods from two large flywheels which perfectly balance the two sides of the screen. In this way the power factor is made so constant that the motor or engine can be directly connected to this shaft and as the whole mechanism is self contained, the resulting vibration is very small. The driving rods have brass journal bearings of ample size, arranged for thorough lubrication, and the ratio of lever arms is such that the forces are reduced to 25% before reaching the driving rods and the flywheels.

The next step was to adapt the "A & G" tipple construc-

*Patented July 16, 1912.

tion to a timber-lined shaft and this has proved to be unexpectedly easy. It is only necessary to carry the two main colums on law "A Frames," or even on steel beams, to any desired distance from the shaft curbing. Next comes the adaptation.

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Modern Methods in the Manufacture of Portland Cement

By H. K. G. Bamber*

[The following description of some of the late developments in cement manufacture is a part of an address delivered by Mr. Bamber before the Vancouver branch of the Canadian Society of Civil Engineers, May 26, 1913. The plant which is taken as the example is a new one nearing completion at Bamberton, on Saanich Inlet, Vancouver Island.—Ed. Engineering News.]

The manufacture of portland cement has its origin in Great Britain, where suitable materials are found in the greatest abundance. The advancement of chemical science, however, has enabled materials of different characteristics found in various parts of the world to be brought into use, and the author himself has been engaged in British Columbia on the construction of a cement plant at Bamberton on the Saanich Inlet, Vancouver Island, for the Associated Cement Co., (Canada) Ltd., a company formed by the Associated Portland Cement Manufacturers (1900) Ltd., of England, to operate upon a practically pure limestone, and a clay shale of very uniform composition. Particular reference will be made to the special additional processes which have been introduced in the new plant on Saanich Inlet, in order to insure the absolute uniformity of quality, the absence of which in the product of many plants has been the cause of much anxiety and trouble to the constructional engineer.

There are many factors which help to produce various unsatisfactory results, but perhaps the feature of most importance in the experience of the engineer, and the one in which uniformity is most desirable, is that of setting time. The difficulties of the engineer are great, if during the construction of some important work he is suddenly confronted by a change in the characteristics of the materials he is using, to counteract which might necessitate a reconsideration of his methods of construction, and it should be the aim of all cement manufacturers to supply as uniform a material as possible; so regulating the various properties of their product to suit the climatic and other conditions existing, which latter have a most important bearing on the setting time of all cement, which as a chemical product is rapidly affected by changes in atmospheric conditions. The difficulties which confront the cement manufacturer, who having produced an article, the very first quality of which is subject to variation in many of its characteristics due to such atmospheric changes, is not fully realized, or understood, and it frequently happens when some difficulty arises in connection with construction, due to such causes, the quality of the cement is unjustly impugned. Long experience has taught the prudent manufacturer how to produce cement which is least affected by such changes, and the methods adopted will be shortly described.

The manufacture of portland cement necessitates three distinct and separate operations—the first process is mechanical, and includes the assembling, proportioning, amalgamating, and grinding the raw materials—the second chemical, during which the material prepared by the first process is calcined at a high temperature, bringing about chemical combination of the various ingredients—the third and final process being partly mechanical and partly chemical, in which the clinker resulting from the calcining operation, together with a small percentage of retarder, is reduced to a fine powder. During the latter operation the cement is submitted to a partial process of hydration by means of steam, at a temperature ranging between 220 and 300 F., and after subsequent cooling the cement is ready for immediate use.

PROCESS 1—It is essential that the raw materials selected are of such physical character as to be easy of reduction, and such chemical composition that the resulting mixture contains the necessary ingredients in proper ratio one to the other. If so constituted, and thus available for the purpose, the proportions of the mixture are kept constant by means of continuous chemical supervision, the permissible limits of variation in the composition of the raw mixture being very narrow.

This preliminary part of the manufacture may be conducted by one of three methods depending upon the physical condition of the raw material to be operated upon.

Where the materials are soft, as in the case of chalk, clay and marls, such as are found in England, the wet process is usually adopted, which consists of reducing the materials together to a pulp, or slurry, containing about 40% water. This is easily accomplished in open wash mills, or pug mills, requiring but small expenditure of power.

When one or both of the materials are of a hard or crystalline character, and in some cases with the soft materials already referred to, the dry process is adopted, which consists of evaporating the water from the raw materials as quarried, and grinding them in a dry state to a fine powder, by means of suitable machinery.

The third process, which is suitable for both soft and refractory materials, has been adopted for the works at Bamberton, Saanich Inlet, and consists of a semi-wet process, in which the drying of the raw materials is avoided—the materials being reduced to a thick slurry in mills suitable also for the dry process, but with a small percentage of water, producing a more uniform and reliable product than is possible with the dry process.

In any of the processes it is essential to reduce the raw material to such fineness that at least 95% will pass through a sieve having 32,400 openings per square inch, more particularly where the materials have not been partially mixed by nature.

A great improvement in the quality of the cement is produced by the introduction, at this stage of the manufacture, of such storage capacity and machinery that large quantities of this prepared slurry can be kept in reserve, and continuously mixed, thus correcting any irregularities that may have occurred in the composition of the material during the first mixing and grinding operations. By this means a product of absolutely correct and uniform composition is presented to the kiln for calcination, and it will be readily understood that, although the cement industry as a whole has not until recently thought it necessary to provide such intermediate storage of prepared raw material, how important it is, before the material is submitted to an expensive chemical process of calcination, in which the desired results are so adversely affected by any irregularity, either in the material, or the temperature at which the operation is conducted, that this correcting process should be installed. It is not possible to get perfect chemical combination of the lime with the silicates and aluminates of the clay or shale unless the materials have been reduced to a very fine state of subdivision, and have been thoroughly amalgamated.

PROCESS 2—The calcining or clinkering is carried out in rotary kilns, which with modern practice are increasing in size, now averaging from 150 to 200 ft. in length, and from 7 to 10 ft. in diameter, being set at an angle to the horizontal of ½ in. to the foot. The raw material is fed into the upper end of the revolving kiln, while the fuel for raising the temperature within the kiln is introduced at the lower end, the raw material passing successively through the three operations of drying, calcining, and clinkering, on its passage down the kiln, the clinker leaving the kiln at red heat. This heat is removed by passing it through rotary coolers, and is used for heating the air for combustion passing into the kiln.

The cool clinker is now ready for the final grinding operation, but before being submitted to this the clinker is stored and mixed under cover in large bulk, so that again any small irregularities of the calcining operations are spread over the product of several days, and thus tend toward uniformity of the finished product.

PROCESS 3—After cooling and mixing, the clinker, which is material of hard and refractory character, is reduced to a fine powder with the aid of very powerful crushing and grinding machinery, details of which will be explained with the aid of lantern slides. The importance of very fine grinding was not realized until recent years, but its value will be understood when it is known that it is only the impalpable powder of the cement which has any cementitious properties—the coarser particles present being of no more value than their equivalent bulk of sand or crushed rock. It is common practice at the present time to so reduce the clinker that 85% will pass through a sieve having 32,400 openings per square inch, but at the new works at Bamberton, machinery has been installed to enable the cement to be so ground that 95% will pass through this sieve if required. This extra fineness materially increases the cost of production, but adds considerably to the cementitious value of the material. Using this fine-ground cement a much richer and

*Cement Expert, Ingress House, Greenhithe, Kent, England.

stronger concrete is obtained, by reason of the larger quantity of cementitious material present in the very finely ground cement, or on the other hand economies in cost of construction can be obtained by reason of the larger amount of aggregate which such fine-ground cement will carry, to produce equal results.

During the process of grinding provision is made for the regulation of the setting time of the cement. Cement clinker ground without any such provision is always very quick setting. The method adopted at the Bamberton works is similar to that now almost universally employed in England, and consists of injecting steam into the tube mills during the final process of grinding together with the addition of a much reduced proportion of gypsum, which is used as a retarder. The effect of this process is to hydrate and thus remove the expansive properties of any loosely combined lime compounds which have resulted from any slight defects which have passed the earlier processes uncorrected, and thus produce a cement which is safe to use immediately after manufacture, even if taken hot from the mill, and by means of this process the setting time of cement can be regulated to suit all requirements.

The difficulty often experienced by engineers, however, in using hot cement is being provided against by the introduction, at the Bamberton works, of a separate cooling plant, through which all cement as it leaves the grinding mill is passed. This special plant extracts the heat from the cement, reducing it to atmospheric temperature before storage. This is a very important addition to the methods of modern manufacture, and, although used largely in English plants, is being introduced for the first time into Canada, or indeed on the American continent, at the plant now being installed. After the cement has been submitted to the process described, it is stored, and mixed in large bulk at atmospheric temperature, before being placed on the market.

The works at Bamberton are now just commencing manufacturing operations, and will be producing full output of 2000 bbl. per day before the end of June.

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Classification of Water Consumption in Milwaukee, Wis.*

The average daily consumption of water in Milwaukee, Wis., in 1912, was 47,556,000 gal. The maximum daily consumption has reached figures nearly twice that average.

The present supply comes from a brick-lined intake tunnel, 7½ ft. in diam., which extends to a crib 3146 ft. from the shore of Lake Michigan. From the crib two cast-iron pipes, each 60 in. in diam., extend 5000 ft. farther into the lake, where the depth of water over the intake is 60 ft. The capacity of the tunnel, with a drop of 4 ft. in the pump wells, is 75,000,000 gal. in 24 hours, and with a drop of 8 ft. in the pump wells, 95,000,000 gal. The practical limit of the present waterworks has, therefore, been reached and the construction of a new intake tunnel was recently begun. The new intake will consist of a 4000 ft. brick tunnel, 12 ft. in diameter, extending to a crib in 40 ft. of water. From the crib four lines of 72-in. cast-iron pipe will extend to a point 6000 ft. from shore in 60 ft. of water. The contract was let on Apr. 29, of this year.

In connection with the construction of the new works the city engineer has compiled some interesting statistics on the amount and character of the city's water consumption, which are given in the accompanying tables.

The metered water rate in Milwaukee is 11gc. per 100 cu.ft., or 6c. per 1000 gal., for water furnished within the city, and 6c. per 100 cu.ft., or 8c. per 1000 gal., for water furnished beyond the city limits. This rate applies to all consumers regardless of quantity consumed. There were 57,657 services metered on Jan. 1, 1913, and 700 services unmetered, but these were to have been metered by May 1, 1913.

The water department has found no flat-rate assessment plan which has proven fair and equitable and has decided in the future to meter the services of all consumers great and small. The department has found, by experience, as has been found everywhere else, that wilful waste ceases as soon as the consumer discovers that others no longer pay for his wastefulness.

Table I gives the classification of metered consumers for the year 1912. One hundred of the largest consumers paid $402,563, or nearly 50% of the entire revenue of the water department during 1912.

TABLE I CLASSIFICATION OF WATER CONSUMERS
MILWAUKEE, WIS.

1,185	less than $0.50 per year	2.10%
6,347	between $0.50 and $1.00 per year	11.00%
15,182	between $1.00 and $2.00 per year	26.33%
10,656	between $2.00 and $3.00 per year	18.48%
7,157	between $3.00 and $4.00 per year	12.41%
4,899	between $4.00 and $5.00 per year	8.50%
8,017	between $5.00 and $10.00 per year	13.90%
2,228	between $10.00 and $20.00 per year	3.86%
598	between $20.00 and $30.00 per year	1.00%
271	between $30.00 and $40.00 per year	0.47%
167	between $40.00 and $50.00 per year	0.29%
376	between $50.00 and $100.00 per year	0.65%
428	between $100.00 and $500.00 per year	0.75%
66	between $500.00 and $1000.00 per year	0.11%
80	between $1000.00 and over	0.14%
57,657		100.00%

Table II gives the comparative statement of water consumption, pumped, metered and unaccounted for in 1912. The cost per 1000 gal. based on the total pumpage and ordinary expenditures was 1.6c., and based on the amount for which the city received revenue, 2.15c.; the actual cost per 1000 gal., including sinking fund charges, depreciation, taxes, and 4% interest on net invested capital was 5.773c. The revenue per 1000 gal. based on the total pumpage was 4.676c., and based on the 74.73% of the total for which the city actually received payment, was 6.257c. per 1000 gal.

The largest consumer on the water registrar's list is the Chicago, Milwaukee & St. Paul Ry. Co., whose shops are just outside the city limits. The water bill for these shops in one year amounted to $70,000. The shops employ 6000 men.

The per capita consumption in 1912 was 113.2 gal. per day, but eliminating the 100 largest consumers the daily per capita consumption was only 75 gal.

*From the recent annual report of the Milwaukee Water Works.

TABLE II COMPARATIVE STATEMENT OF WATER CONSUMPTION 1912

1	2 Minicipal: buildings, parks, sprinkling, fire extinguishing	3 Industrial: power and manufacturing	4 Commercial: dwellings and stores	5 Slippage of pumps	6 Under-registration of meters	7 "Unaccounted for"	8 Total gal.	9 Per cent	10 Revenue per mil-gal
Metered	432,460,200	6,270,402,130	4,734,356,770	.	.	.....	11,437,219,100	65.71	.....
Estimated flat rate	1,145,703,526	63,896,250	360,664,000	.	.	.....	1,570,263,776	9.02	.....
Under registration of meters	.....	.....	.....	.....	522,168,287	.....	522,168,287	3.00	.....
Slippage of pumps	.....	.....	.....	870,280,479	.....	.....	870,280,479	5.00	.....
"Unaccounted for"	.....	.....	.....	.....	.....	3,005,677,938	3,005,677,938	17.27	.....
Total water consumption	1,578,163,726	6,334,298,380	5,095,020,770	870,280,479	522,168,287	3,005,677,938	17,405,609,580	100.00	$46.76
Per cent of total pumpage	9.06	36.40	29.27	5	3	17.27	.....	100.00	.....
Daily consumption per capita, gal.	10.26	41.20	33.14	5.66	3.39	19.55	113.2	.	.

George Blinn Francis

The sudden death of George B. Francis on the night of June 9, from a hemorrhage of the brain, was noted in our issue of June 12. For nearly a year past Mr. Francis had been in ill health so that he had been obliged to relinquish his professional work. His death, while still in the prime of life, will be felt as a severe loss by his many friends in the engineering profession.

George Blinn Francis was born at West Hartford, Conn., Jan. 31, 1857. He was a lineal descendant of some of the very earliest settlers in the Connecticut Valley. After attending the public schools of his native town and the Hartford High School, from which he was graduated at the age of 17 years, he went to Providence, R. I., where he took a minor position in the engineering department of the Providence city water-works.



Geo. B. Francis

He remained there several years until in the early '80's, the construction of the West Shore R.R. opened a chance for employment to many young engineers who afterward won distinction in the profession.

During the railway construction boom of 1880 to 1887, Mr. Francis was one of the army of engineers who were roaming from the Atlantic to the Pacific wherever new railways were being surveyed and built. During this time he was connected successively with the West Shore R.R., the Oregon-Washington R.R. & Navigation Co., the Northern Pacific Terminal Co., in Oregon, the Eads Tehuantepec Ship Railway, of New York City, which was proposed by the late James B. Eads to transfer ships across the Isthmus of Tehuantepec in Mexico, the New York, Ontario & Western Ry., in New Jersey, the West Shore R.R., in New York, the Portland Construction Co., at Portland, Ore., the Northern Pacific Ry., in Washington, the South Pennsylvania R. R., in Pennsylvania, the New Jersey Junction Ry., in New Jersey, and the New York Central & Hudson River R.R., in New York. During the early part of this period, on Apr. 11, 1882, he was married to Miss Florence Louise Green, of Providence.

On May 1, 1887, he returned to his old home at Providence, where he had been appointed Principal Assistant Engineer of the New York, Providence & Boston R.R., now the Shore Line of the New York, New Haven & Hartford R.R. This position he resigned in 1892 to become Resident Engineer of the New York, Providence & Boston & Old Colony R.R. Terminal Co., having direct charge of the design and construction of the Providence railroad terminals. By his conspicuous success at Providence a larger field for his engineering talents was soon opened, and in 1896 he was appointed Resident Engineer and Acting Chief Engineer of the Boston Terminal Co. on the construction of the famous South Terminal passenger station in Boston, Mass., one of the first of the great passenger terminal stations in the United States. The Providence and Boston terminals are fitting monuments of Mr. Francis' engineering skill.

On the completion of the Boston terminal in 1900, Mr. Francis again returned to Providence, this time as Chief Engineer of the Providence street railway system. In June, 1902, he resigned this position and removed to New York City where he became the head of the civil engineering staff of Westinghouse, Church, Kerr & Co., and as such he had charge of much important work in connection with the Pennsylvania Terminal in New York City. He also served as Chief Engineer and Consulting Engineer on many other large projects undertaken by Westinghouse, Church, Kerr & Co., in Rhode Island, Massachusetts, New York, New Jersey, Pennsylvania, Virginia, Michigan, Missouri and Georgia. During the few years he had also done a great variety of work, as consulting engineer, especially in Providence, where his previous work was well known and appreciated.

It is natural that a man of so active a temperament should have availed himself of every opportunity to meet and know his brother members of the engineering profession, and thus we find him not only a member but a very active member of the American Society of Civil Engineers, the Canadian Society of Civil Engineers, the Institution of Civil Engineers of Great Britain and a Past-President of the Boston Society of Civil Engineers. The breadth and scope of his activities not only as a member of the American Society of Civil Engineers but as a practicing civil engineer may in a small measure be gained from a mere mention of the subjects of the papers and discussions which he contributed to the *Transactions* of that society: Bridge Substructure and Concrete Work; "Electric Railways in the Ohio Valley between Steubenville, Ohio, and Vanport, Penn."; Electrification of the Suburban Zone, New York Central & Hudson River R.R.; Overloaded Bridges; Panama Canal; Sinking Bridge Piers; Substructure of Marsh River Bridge; "The New York Tunnel Extension of the Pennsylvania R.R.; Certain Engineering Structures of the New York

Terminal Area"; "The Scranton Tunnel of the Lackawanna & Wyoming Valley R.R.", for which he received the Thomas Fitch Rowland Prize in 1906; "The South Terminal Station, Boston, Mass."; Uniform Practice in Pile-Driving.

Mr. Francis was also prominent in the Masonic Fraternity and was a Past-Master of his home lodge in Providence.

He is survived by a widow and one son, George B. Francis, Jr. The interment was at his birthplace in West Hartford, Conn.

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Federal Report on Carey Act Irrigation Projects

A third and final report on the "History and Present Condition of the Carey Act Projects" was made to the Secretary of the Interior on Feb. 15, 1913 (Senate Document 1097, 62d Congress, 3d Session) by a committee created during the previous year. The committee consisted of F. R. Dudley, of the General Land Office; F. W. Hanna, of the Reclamation Service; and Herman Stabler, of the Geological Survey. The report consists of a general introduction, a review of operations under the Act by states and a general summary and conclusions. The latter is here reprinted, as follows:

The extent of Carey Act operations in the various states, and the technical reclamation of lands as evidenced by the granting of patents, is shown by the following table, taken from the report of the Commissioner of the General Land Office for 1912:

The table shows the Carey Act has been productive of irrigation progress in that nearly 474,000 acres of land have had waer supplies made available to them. Of this area over 62% is in Idaho, over 22% in Wyoming, nearly 11% in Oregon, and the remainder, a little over 5%, in Montana In the other states practically no reclamation has so far resulted. In addition to the reclaimed lands for which patent has issued there are over 200,000 acres of lands included in pending applications for patent. No information is available to show what proportion of the land technically reclaimed has actually been irrigated. If, however, it be assumed that at the date of the report from which the above table was taken water was available for 680,000 acres of Carey Act lands, and that 50% of these were actually irrigated, it would follow that the total area irrigated under the Carey Act in 1912 was about 340,000 acres.

It is well known that the Carey Act projects include large areas of private lands as well as segregated lands. No detailed information as to the areas of such private lands is available, but it seems likely from fragmentary data that the Carey Act projects as a whole have made water available for an area of 1,200,000 acres, of which possibly 600,000 acres were irrigated. These estimates are, of course, of doubtful accuracy. It seems fairly certain, however, that water has been made available for about 20 per cent. of all the lands that have been segregated to the several states, and thousands of acres of additional lands are being brought under water every year. With all the undesirable features of its history, therefore, it must be concluded that much actual development has been accomplished. That more actual reclamation has not been accomplished and that severe and well merited criticism of operations under the act has arisen is due chiefly to the following causes:

(a) The inactivity during the early stages of the act, due largely to a lack of appreciation of its possibilities on the part of the states and to a lack of interest on the part of capital, as a result of loss experienced by promoters of private irrigation projects.

(b) The segregation of land for long periods of time at the requests of promoters, either without funds for financing the project or without intention to invest their own funds in the undertakings, resulting in long delays without accomplishing results.

(c) The underestimation of costs of irrigation works, resulting in bankruptcy of the construction companies or long delays in getting additional funds for completing the developments.

(d) Careless and inefficient state supervision of Carey Act matter in general and in particular of the construction of the irrigation works, resulting in nonacceptance of the works and in legal proceedings.

(e) Prior to establishing the practice of Federal investigation of the water-supply for the segregation before approving the segregation, the segregation of lands with inadequate and incompetent knowledge of the water-supply for them resulting in insufficient water-supply for properly irrigating the land.

(f) Improper methods of disposing of the lands under the segregations, permitting them to pass into the hands of local and nonresident speculators, who either have unloaded their holdings onto the actual farmers with heavy burdens, or who are renting their holdings to such farmers, or who are keeping their lands out of cultivation.

(g) Failure to appreciate the long time required to settle and develop the arid lands and reduce them to a profitably productive state and to adjust payments of water rights thereto.

(h) Failure to appreciate distances to produce markets and the time required to develop local markets and local stock consumption of crops.

(i) Dishonesty of state officials in the administration of Carey Act matters in collusion with dishonest construction work by the contractor on projects under development.

(j) Application for segregation of large areas of land when irrigation securities could be readily sold, accompanied by failure to finance the projects promptly, subsequent financing being made difficult or impossible by unfavorable market conditions for such securities.

The chief obstacle in the way of Carey Act projects at present is a general lack of confidence on account of past failures, resulting in inability to secure financial backing. When a market for Carey Act bonds is found, it is generally at a price to the developing company of 80 to 85, thus making the cost of money to the company at the rate of 7% or more on the basis of a 6%, and in addition requiring the redemption payment for the bond to be from 20 to 25% greater than the original proceeds. The cost of colonization, which is a surprisingly large item in undertakings of this character; the cost of administration during a period of 20 years more or less, from the beginning of construction until the last deferred payments have been made by settlers; the cost for interest for the period of investigation and construction and until the interest on settlers' notes is sufficient to offset the bond interest; and a profit, even though small, for the developing company and the people who have taken the risks of the development increase the cost of the land to the settler, under even the best projects of this character, to an amount in the neighborhood of twice the actual construction cost.

It is evidently not possible under any scheme of financing and development to remove all of these items of cost from irrigated land. Under the Government projects of the Reclamation Service the items of interest and profit have been eliminated, but the costs of colonization and administration remain, in addition to the actual cost of construction. It has been suggested that the same items could be reduced under the Carey Act by the states lending their credit to the projects and supervising their development in such manner as to assure successful development under reasonable conditions.

OPERATIONS UNDER THE CAREY ACT, BY STATES

(State desert-land segregation under section 4 of the act of Aug. 18, 1894 28 Stat., 372-422), and the acts amendatory thereof, commonly known as the Carey Act, with the action taken thereon from the passage of the act to June 30, 1912.)

State	Applied for	Segregated	Rejected or relinquished	Patented	Reconveyed	Time to reclaim extended
	Acres	Acres	Acres	Acres	Acres	Acres
Colorado	373,503 56	272,197 98	46,221 77			
Idaho	3,106,994 17	1,290,541 63	877,609 93	295,995 68		51,178 46
Montana	554,432 63	200,597 06	374,206 74	25,653 03	10,104 03	62,604 95
Nevada	163,789 05	36,808 59	47,229 35			
New Mexico	10,164 68	7,564 68	2,600 00			
Oregon	736,163 60	338,617 19	229,647 12	51,583 13	6,014 49	
Utah	435,170 02	136,820 63	267,980 83			
Washington	155,649 39		155,649 39			
Wyoming	1,765,079 48	999,083 61	300,400 66	100,787 67	3,977 23	17,397 53
Total	7,301,036 58	3,291,231 37	2,300,545 79	473,999 51	20,095 75	131,180 94

FIELD AND OFFICE

A Special Problem in Reverse Curves

By Wm. C. Crosby*

An interesting problem in reverse curves presented itself recently for solution and various handbooks on railroad curve problems were duly consulted in order to find some ready formula applicable to the case in hand; but to no purpose. It became necessary to "get into" the problem, with the resulting consequence of making a discovery useful in its application to the solution of the problem at hand as well as important in its general adaptability to all reverse-curve problems.

The Problem—Referring to Fig. 1, the points A and B were fixed points on the tangents, and the reverse

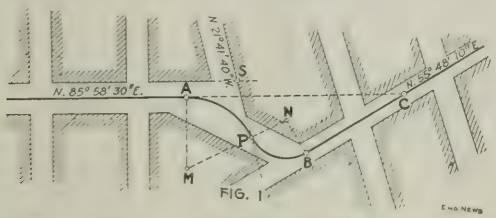
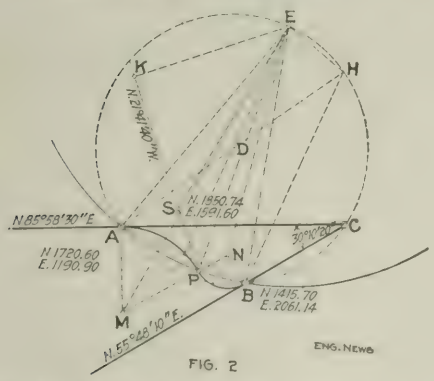


Fig. 1. Special Reverse-Curve Problem: Tangent Points A and B Fixed, and Reverse Curvature to Occur on Line S P



curves AP and PB were to connect the tangents, but with the specific condition that the point P of reverse curvature must lie on the prolongation of the street line SP as shown.

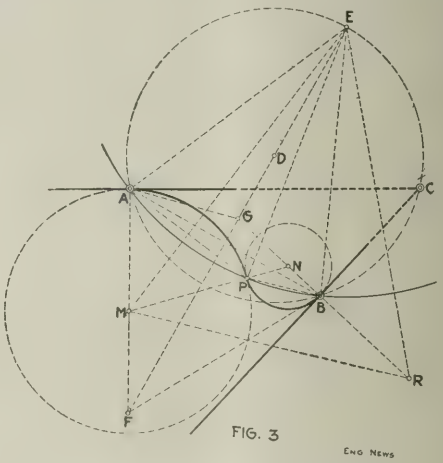
Since it was not permitted to disturb the position of either A or B and since the true position of P was not known excepting that it was a point somewhere on a fixed line, it became necessary to determine the locus of all the various points of reverse curvature for any pair of conjugate reversing arcs tangent at A and B, and within the limits of the fixed tangents. Having determined this locus, its intersection with the fixed line SP determines the true position of P, after which the radii MP, NP could then be computed as well as any other matter which might be necessary.

Fig. 2 is a skeleton sketch of the conditions presented in the given problem, having the corresponding points marked the same as in Fig. 1. The dotted auxiliary lines used in the computation are also shown.

Solution—The arc APB shown in a solid line is the locus of all points of reverse curvature possible between A and B and is obtained thus:

Draw a circle passing through the three given points A, B and C; the center of this circle is D. Join A with B, which is a chord in the circle just drawn. Through the center D, draw a diameter perpendicular to the chord AB and cutting the circumference at E; then E is the center of a circular arc through A and B, which arc is the desired locus. Its intersection P with the given line SP is the point of reverse curvature sought in the specific problem.

The required values can be calculated on the basis of the geometrical construction. Choosing one of the two tangent points A or B as an origin and arbitrarily assigning a bearing to the tangent will often facilitate the computation, for by so doing and deriving coördinates for the different points much purely trigonometrical work as well as the study of the geometrical interdependence of the given points and those to be found will be avoided.



This last remark may appear superfluous to the technical man; but it carries with it a hint for the benefit of those who have had but little practice, or lack in training, and are sometimes obliged to perform calculations which frequently cause them no little annoyance and waste of valuable time.

Demonstration—In order to prove that the geometric

*Assistant Engineer, Department of Docks and Ferries, New York City.

construction of the circular arc APB, whose center is E, as shown in Fig. 2, makes this arc the locus for all points of reverse curvature to any pair of circular conjugate arcs tangent to each other and to the given tangents at the fixed points, refer to Fig. 3 and proceed as follows:

The centers of two conjugate circles tangent to the given tangents at A and B are denoted by M and N. Prolong NB to R, making $BR = PM$; then triangle MNR is isosceles, having $MN = RN$. Since A and B are points on the same circumference $AECB$, therefore $\angle EAC = \angle EBC$, each being measured by half the arc EC; adding to each of these equal angles the equal angles MAC and RBC (right angles) makes $\angle MAE = \angle RBE$; therefore, $\triangle MAE = \triangle RBE$, having the sides EA, AM and the included angle MAE of the one, respectively equal to the sides EB, BR and the included angle RBE of the other. Hence $ME = RE$, and triangle MER is isosceles, with $\angle EMR = \angle ERM$. Taking away from each of these equal angles the equal angles NMR and NRM leaves $\angle EMP = \angle ERB$. But $\angle ERB = \angle EMA$; therefore, $\angle EMP = \angle EMA$.

Now in the triangles MAE, MPE, the side ME is common, $MA = MP$ and $\angle EMA = \angle EMP$; hence, these triangles are equal; therefore, $PE = AE = BE$. Hence the point P is on the arc of the locus circle which passes through A and B. But P, by construction, is the point of reverse curve of the conjugate arcs AP, PB, and is a point on the line MN joining the centers of these arcs; therefore, the point of reverse curve is at the intersection of MN with the locus circle passing through A and B and whose center is E.

For any other position of M, P and N a similar demonstration will show that P must lie at the intersection of MN with the same arc APB. Hence APB is the required locus, which was to be proved.

Remarks—As P approaches B for a limit, the radius MA increases while the radius NB decreases, and the chord AP approaches the chord AB for a limit. The limiting maximum value for the radius MA will be FA, while the radius NB of the conjugate arc will be zero. Conversely, as P approaches A for a limit, the limiting maximum value for the radius NB will be GB, while the radius MA of the conjugate arc becomes zero. These limiting maximum values in all cases may be at once determined, as at G and F, by drawing BG and AF perpendicular to BC and AC respectively and intersecting both by a diameter through D perpendicular to AB as shown.

If, as often happens, the tangents are parallel to each other, then the point of intersection C will be infinitely removed from A and B, and likewise the radius EA will be infinite in length; the locus then becomes equivalent to the chord AB.

Application—The foregoing method will enable one radius to be readily obtained when the other is given; the position of the point of reverse curve can also be determined. Or, it is possible to obtain both radii, having given the special case where the point of reverse curve must lie somewhere on a fixed line passing between the given tangent points, as happens in the problem presented and illustrated by Fig. 1.

Note—The point E must always be taken on the same side of the chord AB with C. It is possible, where ACB is obtuse, for D and E to lie on opposite sides of AB; then with $AC = CB$, E and C would coincide.

In concluding, it may be remarked that the conditions given in the problem worked out, present a case of the most complicated kind, and the necessity for determining the locus is apparent. All problems involving reverse curves, however, are readily worked out by using the locus, particularly those in which the radii of the reverse arcs are unequal and where the tangents are not parallel. In the graphical investigation of a tentative study wherein certain conditions are to prevail, the plotting of the locus or of several loci will often save a great amount of time and trial calculation.

A Cracked I-Beam

The subjoined view of an 18-in. I-beam shows a bad case of brittleness and internal stress. The beam was in a commercial lot of bridge steel, and was not handled with unusual violence. The circumstances are set forth in the following letter:

This beam had been ordered from one of the mills to be used as a floorbeam in a highway bridge. It was taken into the shop one cold winter morning (about 10 below zero) and placed on skids resting on the flange in the same position as shown in the picture. There was some ice on the flange, at the right-hand end in the picture, and one of the men took a sledgehammer and struck it on the top flange near the end to break off the ice. The result can be seen in the picture. The crack started at the end, about the middle of the web depth, and continued to within a foot of the other end, where it stopped. The crack spread at the end where it started to about 10 in.



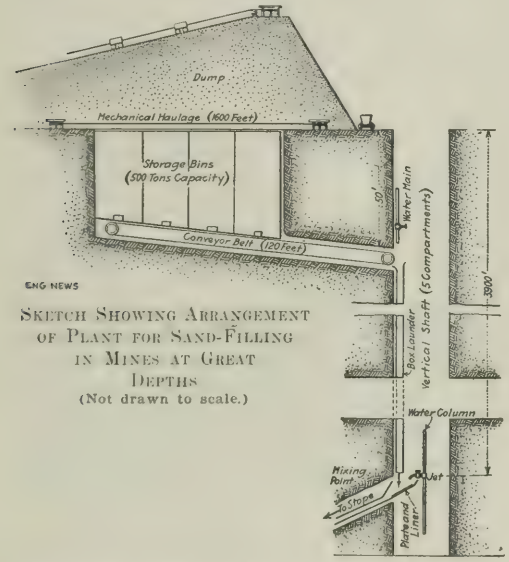
The mill took the beam back and replaced it with another. The incident happened two or three years ago, but I would be interested in getting a satisfactory explanation of the cracking.

Cases of cracking of rolled shapes, under circumstances indicating brittle material and internal stresses, have occurred before, though they are rather infrequent. We are not acquainted with any study of structural steel to get at the causes of such behavior. Ingot defects—blowholes, unsoundness, segregation of hardening impurities—affect structural steel in somewhat the same way as rail steel. In rolling, the flow of the metal under the rolls tends to set up internal stresses of various kinds, and the result will depend on temperature of rolling, degree of reduction in the final passes, etc. Much more information on the subject than is now available would be of interest to engineers.

A System of Sand-Filling for Deep Mine Shafts

A method of supplying dry sand to a shaft for filling purposes has been devised by Mr. Girdler-Brown, General Manager of the Cinderella Consolidated Mine, in the Transvaal, South Africa, and is described in a paper read at a meeting of the Institution of Mining and Metallurgy, London, England, Oct. 17, 1912, by R. E. Sawyer, under whose direction the plant was installed and successfully operated. An abstract of Mr. Sawyer's paper is as follows:

The method described renders the operation of sand filling at great depths, where, of course, it is most needed, a matter of comparative simplicity. In first cost it compares favorably with any other method, no de-watering cones or neutralization process being necessary, and it shows to the greatest advantage when employed in shafts of great depth and in circumstances where continuous filling is not necessary, as interruptions are almost certain to occur from time



SKETCH SHOWING ARRANGEMENT OF PLANT FOR SAND-FILLING IN MINES AT GREAT DEPTHS
(Not drawn to scale.)

to time in wet weather, due to an excess of moisture in the sand.

The sand used should not contain more than from 5% to 6% of moisture, and should have been exposed to the sun and air for at least two days before use; it will then be practically free from cyanide and neutral in character. Sand in this condition may be found at the foot of any working dump during fairly dry weather. Sand taken direct from the cyanide tanks was tried, but even after it had been treated with potassium permanganate, considerable quantities of cyanogen were evolved when the sand became mixed with ordinary acid mine water. This action was, however, entirely obviated by exposing the sand to the sun and air, as already mentioned.

The plant was originally laid out with a view to adopting the usual practice in sand filling of running the sand down the shaft already mixed with water, but this idea was found to be impracticable, owing to the excessive wear of the pipes caused by the great depth through which the mixed sand fell, and the cost of pumping entailed.

When the column first installed was worn out, it was decided to replace this by a square wooden box conduit down which the sand should fall unmixed with water. This conduit measured 12x11 in. in cross-section, inside measurement, and its cost was approximately 60c. per running foot. Observation doors were cut at distances of about 100 ft.

The piping and conduit from the surface bins were replaced by a belt which conveyed the sand to the top of the box conduit. It was found that sand containing no more than 4% of moisture would run freely from the bins to the belt without handling. On arriving at the head of the box conduit, the sand falls down the box on to a steeply inclined iron plate on which a stream of water is made to play. The plate, by the way, should be provided with a liner of the hardest white cast iron to counteract the excessive wear at that point.

On being mixed, the sand and water flow into a steeply inclined conduit where they undergo further mixture before being conveyed by means of pipes or other conduits to the part of the mine requiring filling. The effective capacity of the plant is controlled by the quantity of water available, as it is found that the delivery of the sand through the vertical box is practically without limit.

From time to time trouble was caused by the sand containing too great a percentage of moisture. This caused it to adhere to the sides of the conduit in gradually increasing quantities until at last the flow was seriously impeded. Under such circumstances, the remedy was to sluice out the box with water from the surface until the adhering sand was washed away.

In this connection, experiments were conducted with a view to determining the maximum percentage of moisture which would allow of the sand being run down "dry." The following were the results obtained:

From 0 to 5% of moisture allowed the sand to fall freely, leaving the sides of the box clear and dry.

From 5 to 7% of moisture did not affect the fall, provided that the sides of the box were themselves dry.

From 7 to 9% of moisture caused the sand gradually to begin adhering to the sides of the conduit, where it accumulated slowly.

From 9% upward of moisture caused a rapid accumulation of sand along the sides of the conduit.

These results were largely influenced, it was found, by the proportion of slime contained in the sand.

The liability of the sand to choke the conduit under certain atmospheric conditions renders it essential to have an efficient bell-signaling service between the mining point and the surface bins, as the supply of sand should be regulated in proportion to the quantity of water available for service. Thus, if the sand is supplied too quickly, it has a tendency to pile up at the bottom of the box conduit and choke it, as the water is not in that case sufficient to sluice it away. On the other hand, if the sand appears to be coming down slowly, it may be that a certain proportion is sticking to the sides of the conduit, on account of there being too great a percentage of moisture. When this is found to be the case, sluicing must be resorted to as mentioned previously, and must be repeated from time to time as the occasion warrants.

Jets of compressed air were introduced with a view to increasing the velocity of the falling stream, and thus preventing the adhesion of the sand. The box conduit was furthermore connected with the intake of a ventilating fan near the bottom, and to a blower at the top, the idea being to dry the sides of the box, and thus prevent the sand from sticking. These devices undoubtedly permitted the use of damper sand than could otherwise have been employed, but they were practically of no avail when the sand contained more than 10% of moisture, and were consequently abandoned after prolonged trials.

There is actually a saving in the quantity of water requiring to be pumped out of the mine when the sand-filling plant is in operation. The sand in the stope probably retains at least 10% of moisture. The sand as sent down contains on an average 3%, and it is calculated that in the course of a good day's run, the water saved from the necessity of being pumped 4000 ft. to the surface will amount to something like 8000 gal.

The labor required to operate the plant is small. A learner in charge of three boys will look after the belt and surface bins, and the underground part, including the mixing point and the stope to be filled, is in charge of a timberman. The sand is brought from the dump to the surface bins by means of mechanical haulage, the actual shoveling and tipping necessary being done by unskilled labor. Taking an average of 400 tons per shift, the cost was 5.2c. per ton.

Five Blast-Furnace Blowing Engines, each with a capacity of 20,000 cu.ft. of free air per minute, operated by gas engines using blast-furnace gas, are to be built for the Maryland Steel Co. by the Bethlehem Steel Co., of South Bethlehem, Penn. The engines have double-acting gas cylinders in line with the blowing cylinders and are similar in type to those now in operation in the Bethlehem Steel Co.'s own plant. The gas engines have cast-steel cylinders, which are said to be larger than those of any gas engines ever built in this country.

THE GILMORE AND PITTSBURGH RAILROAD COMPANY, LTD.

Estimate of Cost of ... Extension ... To ... Section ...
Office of Engineer.... Armstead, Montana ... 191 ... Estimate No. ..

	Unit	Quantity	Price	Subtotal	Total	Cost when completed: Subtotal	Cost when completed: Total	Remarks
1. Engineering—5% of items 2-31 inclusive								
2. Right-of-way and station grounds	Acre							
3. Real estate	Acre							
4. Grading								
a. Clearing	Acre							
b. Grubbing	Square rod							
c. Common excavation	Cu.yd.							
d. Loose-rock excavation	Cu.yd.							
e. Solid-rock excavation	Cu.yd.							
f. Overhaul beyond ... feet	Cu.yd.							
g. Piles	Lin.ft.							
h. Timber in bulkheads, cribs, etc.	M ft. b.m.							
j. Riprap	Cu.yd.							
k. Concrete masonry	Cu.yd.							
l.								
m.								
n.								
5. Tunnels								
a. Excavation	Cu.yd.							
b. Masonry lining	Cu.yd.							
c. Timber lining	M ft. b.m.							
d.								
6. Bridges, trestles and culverts								
a. Piles	Lin.ft.							
b. Timber in frame trestles and decks of pile trestles	M ft. b.m.							
c. Foundation excavation	Cu.yd.							
d. Concrete masonry	Cu.yd.							
e. Bridge steel	Lb.							
f. Steel guard rails including splice bars, spikes, etc.	Ton (2240 lb.)							
g. Cast-iron pipe	Lb.							
h. Timber in culverts	M ft. b.m.							
i.								
k.								
7. Ties								
a. Cross ties—1st class	Each							
b. Cross ties—2d class	Each							
c. Bridge ties	Each							
d. Switch ties	M ft. b.m.							
8. Rails, lb. per yd.	Ton (2240 lb.)							
9. Frogs and switches								
a. No. .. turnouts	Each							
b. No. .. turnouts	Each							
c. No. .. turnouts	Each							
d.								
e.								
10. Track fastenings								
a. Spikes—300 in 200-lb. keg	Lb.							
b. Tie plates	Each							
c. Splice bars (centered) and bolts	Pair							
d. Nut locks	Lb.							
e. Rail braces	Each							
f. Guard rails on curves and in tunnels	Ton (2240 lb.)							
g. Bumping posts	Each							
h.								
j.								
k.								
11. Ballast	Cu.yd.							
12. Track laying and surfacing	Mile							
13. Roadway tools								
14. Fencing right-of-way								
a. Wire fence, feet panels	Rod							
b. Cattle guards	Each							
c.								
d.								
15. Crossings and signs								
a. Excavation	Cu.yd.							
b. Timber in grade crossings	M ft. b.m.							
c. Foundation excavation	Cu.yd.							
d. Masonry in overhead bridges	Cu.yd.							
e. Timber in overhead bridges	M ft. b.m.							
f. Steel in overhead bridges	Lb.							
g. Track signs	Each							
h. Crossing gates	Each							
j.								
17. Telegraph and telephone lines								
18. Station buildings and fixtures								
a. Type, complete with fixtures	Each							
b. Type, complete with fixtures	Each							
c. Type, complete with fixtures	Each							
d. Car-body type	Each							
19. General office buildings and fixtures								
20. Shops, engine houses and turntables								
a. Shops	Each							
b. Engine houses, stalls	Each							
c. Turntables, length	Each							
d.								
21. Shop machinery and tools								
22. Water stations								
a.	Each							
b.	Each							
23. Fuel stations								
a.	Each							
b.	Each							
31. Miscellaneous structures								
a.								
b.								
c.								
32. Transportation of men and material								
33. Rent of equipment								
34. Repairs of equipment								
35. Earnings and operating expenses during construction								
35½. Injuries to persons								
43. Law expenses								
44. Stationery and printing								
45. Insurance								
46. Taxes								
47. Interest and commissions								
48. Other expenditures								
10% added for unforseen contingencies								
Total								

Compiled by.....Checked by.....Approved by..... Engineer

An Estimate of Cost Form for Railroad Construction

By C. O. Diffenderfer*

Construction work on the Gilmore & Pittsburgh R.R., between Armstead, Mont., and Salmon and Gilmore, Idaho, 120 miles, was started in the spring of 1909 and finished in the fall of 1910; and the accounting department began their accounts in conformance with the Interstate Commerce Commission's instructions embodied in their pamphlet entitled "Classification of Expenditures for Road and Equipment as Prescribed by the Interstate Commerce Commission in accordance with Section 20 of the Act to Regulate Commerce," effective July 1, 1907, and a supplement effective July 1, 1908.

The engineering departments made out the preliminary estimate of the cost in the usual manner by collecting all materials of a kind under one head, and when the work was completed there was considerable clerical work done in transferring items in order to compare the preliminary estimate of cost and the actual cost when completed, as shown on the auditor's books.

Last spring an estimate of cost form was devised which would aid in comparing the engineering department's preliminary estimate of cost and accounting department's record of cost of any extension when completed, and also, when the figures of the actual cost of the work were inserted in their respective places, would form a record for future reference in the engineer's office.

The general scheme of the accounts is as follows: (1) Road, items 1-36; (2) Equipment, items 37-42; (3) General Expenditures, items 43-48.

The following items have been omitted, however, either as being outside the pale of the construction department or as not being used in the construction of the Gilmore & Pittsburgh R.R.: (16) Interlocking and Other Signal Apparatus; (24) Grain Elevators; (25) Storage Warehouses; (26) Dock and Wharf Property; (27) Electric-Light Plants; (28) Electric Power Plants: (29) Electric Power Transmission; (30) Gas Producing Plants; (36) Cost of Road Purchased; and all the Equipment items, 37 to 42.

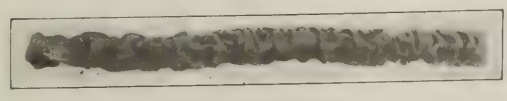
The locating engineer supplies all data from items 4 to 15 and the remainder are supplied in the chief engineer's office.

An additional value is in compiling the prospective cost in a uniform manner, and reducing oversights and omissions to a minimum.

*Engineer, Gilmore & Pittsburgh R.R., Armstead, Mont.

A Remarkable Upsetting Job on a Length of Steel Well Casing

The National Tube Co. reports that a customer sent them a description and the photograph here reproduced of a joint of $5\frac{3}{16}$-in. steel casing. The photograph repro-



NOT A WOOD BORER

duced herewith is neither a view of a diseased large intestine nor a picture of the Teredo Navalis. It is a piece of steel well casing which has been subjected to end compression by a nitroglycerin explosion and thus upset to less than half its original length.

According to information furnished by the National Tube Co., one of its customers sent on this exhibit to show the remarkable ductility of steel pipe.

The length of well casing formed part of a liner which was placed in a 3000-ft. well near Gore, Ohio. Although the well had been completed and shot it was decided to repeat the shot and to that end 150 quarts of nitroglycerin were lowered. The liner was then removed but upon inspection it was discovered that one joint was still in the hole. The shot was then fired with the hope that it would incidentally throw out the joint, but the latter lodged 1500 ft. from the top and it was several days before a belt socket could be put over it and the joint thus brought to the surface. The joint, which was originally 18 ft. in length, was compressed to about 8 ft. The photograph suggests the severe stresses to which the material was subjected, and also its remarkable toughness.

Reinforcing an Old Railway Viaduct*

BY W. T. CURTIS†

In 1888, the Chicago & West Michigan Ry. (since absorbed by the Pere Marquette R.R.) built a wrought-iron single-track viaduct across the Manistee River, about 100 miles north of Grand Rapids, Mich. This viaduct is 1170 ft. long, consisting in the main of 14 tower spans 75 ft. high and 30 ft. long, 45-ft. intermediate spans, and one 150-ft. river span. The 30-ft. and 45-ft. spans were simple deck-plate girders 8 ft. apart. The river span consisted of deck trusses spaced 14 ft.

The original structure was designed for a loading about equal to Cooper's E-25. The rolling equipment became heavier, and in later years the bridge was somewhat overloaded. In 1911 it was decided to adopt still heavier loading (E-50), and it was necessary either to replace the structure with a new one, or to reinforce it. The latter method was elected as being the more economical.

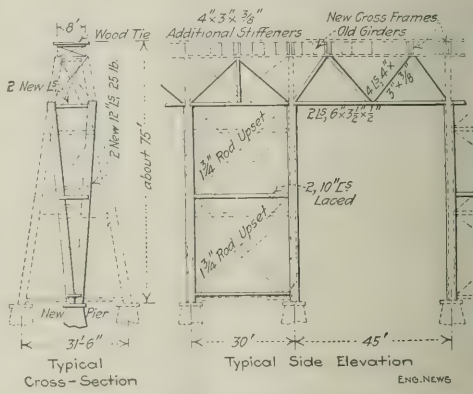
Mr. Deimling, Chief Engineer of the Pere Marquette R.R., asked for competitive propositions for both cost and design on the reinforcement, submitting (by way of suggestion) a solution which had been used some years ago on the Mill Creek trestle. This consisted in adding a new line of deck-plate girders on the center line of track, these girders being supported on new independent posts at the center of each bent.

Some tenders were offered on this scheme of reinforcement but were discarded partly on account of greater cost but chiefly on account of uncertainty of distribution of load among the three girders. The 8 ft. spacing of the old girders made the wood ties so short and stiff as to cause a marked degree of undeterminates of the distribution of the load among three girders. A further objection was the rocking or tipping effect over the new center girder as a fulcrum under imperfectly adjusted or worn ties, the shortness of the ties magnifying this difficulty. Still another objection was the fact that the erection would seriously interfere with traffic during a long period of time.

Another scheme considered was to reinforce each of the legs of the bents by adding another member parallel to it, surmounted with an additional new track girder placed closely along the side of the old girders, making a total of four girders. This was discarded as being prohibitively expensive and somewhat unsightly.

The scheme finally adopted was proposed by the Wisconsin Bridge & Iron Co., being original with the writer, and is shown in the accompanying cut, in which the dotted lines show the old or original structure and the full lines show the new members. This plan was adopted for its economy, its lesser degree of indefiniteness of distribution of loads, its far greater general stiffness, its minimum interference with traffic during construction, and incidentally on account of its having a less patched-up appearance than either of the other schemes.

The governing or fundamental idea of the adopted scheme was to convert the old deck-plate girders into deep lattice trusses, of which the old girders would constitute the top chords. This was done by adding a bottom chord about 12 ft. below the girders and introducing a Warren web system between the two chords thus formed. The old deck girders are stiff enough to resist the bending action of the load,



REINFORCEMENT OF AN OLD VIADUCT ON THE PERE MARQUETTE R.R.

(The dotted lines show the old structure, and the full lines show the reinforcement and reconstruction.)

and to deliver these local loads to the panel points of the newly formed truss. In calculation, for safety, the old girders were figured both as single spans between new panel points, and as continuous girders, the worst result being used in all cases. Additional stiffeners were added and cross frames installed.

To carry the excess load from these trusses to the ground, two new columns are added to each bent, starting at the bottom chord of the new trusses and running on an incline down to a new concrete pier built at the center of each old bent. The two new columns thus form a V and make the remodeled bent consist of two A-frames, as shown in the typical cross-section.

This construction has the desired effect of virtually lessening the height of the trestle towers by about 12 ft., for the load is now delivered into the towers at the bottom chord of the newly formed trusses. Furthermore, this system braces the structure longitudinally by virtue of the depth of the new trusses, while the new A-frame form of the bents stiffens the structure transversely. The scheme has the further advantage of being capable of field construction with practically no interference with traffic, as the old girders were not disturbed, except for the drilling of holes, etc., in them. In this manner we preserved for the main length of the viaduct the original two-point bearing for the ties.

At the river span, a new deck truss 150 ft. long was placed midway between the old trusses. The distance between the old trusses is 14 ft., being thus sufficient to give longer and consequently more limber ties, permitting of more definite proportioning of loads as delivered from the

*Abstract of a paper read before the Western Society of Engineers, at Chicago June 9.

†Contracting Engineer, Wisconsin Bridge & Iron Works, Detroit, Mich.

ties into the two old and the one new truss, and also minimizing the tipping effect of the ties. The load from the new center truss is carried to the ground by a new independent vertical column at each end bent.

The towers supporting the river span, and the three short spans of the north approach to the river span, were originally built with the deck girders spaced 14 ft., as in the river span trusses, and we therefore reinforced this small portion of the viaduct by the introduction of a new girder midway between the two old ones, in line with the new river truss and, like the latter, supported by a single new independent straight column at the middle of each of the old bents.

A difficulty which presented itself was the difference in deflection between the old shallow river trusses and the new deeper one. This difference was found to be so small that it could be taken care of by making the hangers from the old to the new trusses heavier than was theoretically required. This made the hangers act as equalizers, so that if one truss should commence to be overstrained it would deflect enough more to deliver the load to the other truss before any actual harm would be done to the former. In this way, the load in any possibly overstrained member would still be so much below the elastic limit load that set deformation was out of the question.

It was found that the percentage of overstrain necessary to demand equalization was very low, and that while perhaps this solution of the distribution of the loads would not be considered as desirable in new designing, it served as a safe and satisfactory solution of the problem. The expansion of this new river truss was taken care of by a link construction.

The structure being narrow and high, the matter of thoroughly bracing it was nearly as important as the direct loading feature, and while the general form of reinforcement provided for a marked general stiffening of the main run of the viaduct, additional bracing was added entirely independent of the old bracing system, which was allowed to remain intact

Much trouble was experienced in finding suitable connections of the new wind-bracing rods to the old bents which were not converted into the double A-frame form, on account of the old bracing being pin connected. Whenever possible, a connection was made which did not make necessary the removal of the old pins, but this was impossible in some cases. For longitudinal bracing, the newly formed side trusses formed sufficient bracing down to the tops of the V-shaped columns, and the tractive forces are carried from this point to the ground by an entirely new system of bracing in the longitudinal plane of the legs of these new columns.

Extra care was exercised in all the details to allow for inconsistencies in the old construction. This was done by providing numerous shims and doing a great deal of field drilling that would otherwise not have been necessary. The entire job abounded in painstaking work in order that the new member would fit the old parts to which it should connect, and at the same time clear the old parts with which it was desired not to interfere.

ERECTION

The erection of the steel work was somewhat unusual, and while at first appearing somewhat formidable, is worked out satisfactorily and with reasonable economy, barring delays due to foundation trouble.

The old work was mostly field bolted, which made the occasional temporary removing of old members less expensive. The field drilling and riveting was an expensive item, as there were about 7000 holes to drill, 2500 old ¾-in. rivets to knock out and ream the old holes to ⅞ in., and about 28,700 rivets to drive.

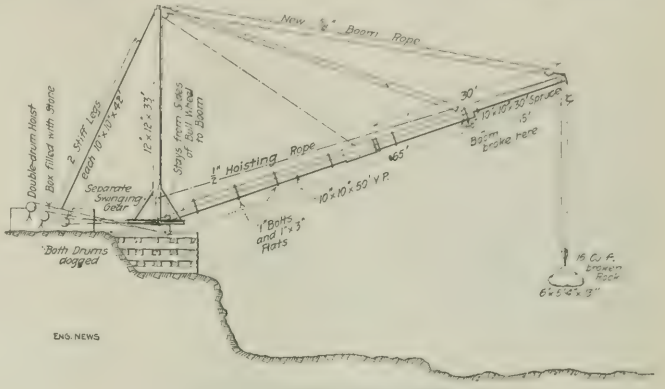
The new steel was handled by a derrick car at the beginning of the work, but this method did not prove entirely satisfactory, and a locomotive crane gave better results.

The river span was erected with very little falsework. The new steel columns were first erected at the ends of this span. Then the top chord was raised and suspended from the old structure with steamboat ratchets, the turnbuckles being placed so as not to interfere with traffic. All new top chord bracing was then placed, this being connected to the old trusses, and all bottom chord bracing removed. The balance of the new truss was then placed with falsework consisting of but a single wood post at either end, and the truss was kept suspended and controlled with 24 turnbuckles until completely riveted.

A Derrick of Which the Boom Broke

A recent derrick accident, in which the boom of the derrick broke and killed some workmen below, has led to discussion of right and wrong ways of rigging a derrick. We show a sketch of this derrick so as to put the matter before our readers and give them an opportunity to discuss the subject.

A stiff-leg derrick used in rock excavation, with a spliced boom 65 ft. long, was rigged with a five-part topping lift taking on to the end of the boom and two



DERRICK WHOSE BOOM BROKE

intermediate points as shown in the sketch. While hoisting a load of 16 cu.ft. of broken rock, the boom broke near the end of the main stick. This also happened to be the point where the middle sheave of the boom falls was attached.

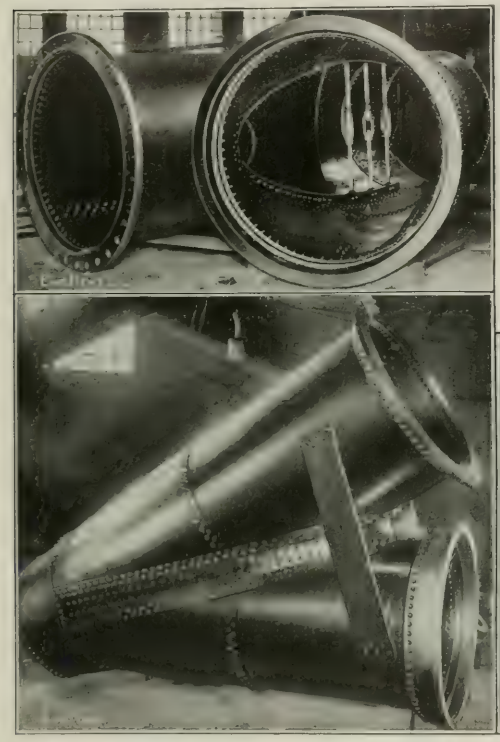
The contractor who used this derrick has all his derricks rigged in this same way, and so far as he knows the style of rigging is satisfactory. In the absence of any books on the subject of derricks and their rigging, information is desired from engineers and contractors familiar with the subject. Attaching the becket line of the boom falls to the boom below its top is little practiced today. The idea that the boom is strengthened by counterbalancing part of its weight is fallacious, as the varying pull of the line introduces changing and unknown bending stresses in the boom.

The Largest Manganese Steel Castings to date were recently made, so claims the Edgar Allen American Manganese Steel Co., for the Bethlehem Steel Co. The castings are two 52-in. reversing blooming-mill pinions, weighing 23,600 lb. each.

The Effect of Inert Dust on explosions of gas is again considered in the third report of the Explosions in Mines Committee, appointed by the British Home Office. It will be recalled that Sir Frederick Abel, from experiments made some 30 years ago, held that the addition of calcined magnesia, or other incombustible dust, to a noninflammable mixture of gas and air, brought about a general inflammation immediately on contact with flame or after a few seconds. The committee has carefully repeated the experiments on which these findings were based, but eliminating certain arrangements which produced elements of uncertainty (such as the use of an injector for drawing in the dust-laden gaseous mixture). They find that the presence of noncombustible dust in weak gaseous mixtures does not render them more explosive than before, and that, to the contrary, the dust, being heat-absorbing material, renders the mixtures distinctly less explosive. The use of such dust, therefore, (as on shelf barriers to check the propagation of explosion and flame), seems to have its last lingering objection removed.

Large Riveted Steel Special Water-Pipe Joints

As a part of the 60-in. diameter riveted steel pipe for the North Side Reservoir, Pittsburgh, Penn., the two types of specials illustrated herewith have recently been installed. Five 60-in. diameter Y's and one 60x48x60-in. offset T were required and it was the original intention of the city to have them made of cast iron, about 1½ in. thick and properly reinforced. The James McNeil & Bros. Co., of Pittsburgh, however, proposed to make them of plate steel, and after consideration of their submitted designs the city accepted their proposition. Accordingly five Y's of the type shown in Figs. 1-2 and



Figs. 1-2. Riveted-Steel 60-In. Special for Pittsburgh, Penn., Reservoir

one T, shown in Fig. 3, were built. The cost was lower than for the cast-iron specials originally considered.

The Y's were made of ⅝-in. soft open-hearth flange steel plates. The two branches of each Y were united by a ¾-in. flanged plate, double riveted to the branches. Riveted on the inside of this mantle plate were two heavy angle irons with a baffle plate and three ¾-in. bronze bolts with turnbuckles between. One branch of the Y's had a rolled-steel flange for connection to the valve, while the other branch had a cast-steel bell end for a lead joint connection.

The 60x48x60-in. T was made of ⅝-in. soft open-hearth flange steel plates and was constructed as a 60-in. elbow with a 48-in. outlet. This 48-in. outlet was riveted to the elbow eccentrically, that is, the bottom of the 48-in. outlet was level with the bottom of the 60-in. elbow.

The shipping weight of the Y's was 14,000 lb. each and of the T 11,000 lb., one-third of the estimated weight of the cast-iron specials. All of the specials were tested at 100 lb. per sq.in. internal pressure.

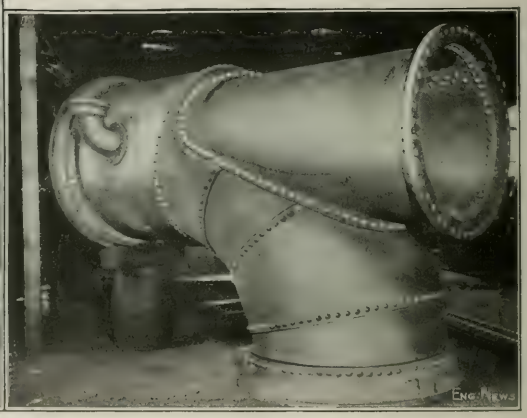


Fig. 3. Offset T Special, 60x48x60 In.

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Surveying Lots with Curved Boundaries

Several of our correspondents disagree with the methods and results of the survey of the lot layouts described in our issue of Apr. 24, 1913, p. 846, by J. H. Anderson, of Rock Island, Ill. As this is a problem which all land surveyors are sure to meet sooner or later, and as the methods described by Mr. Anderson are evidently not better than other methods, we give below some ideas on the subject from engineers who have had experience in similar work.

Sir—J. H. Anderson, in his article, seems in some cases to have contented himself with approximations in his computations where the determination of exact results by slightly different methods would have been equally easy. It also appears that he has not taken advantage of numerous chances to easily check his computations.

In the article the following statement appears:

In laying out work of this character it is not possible to run in the curves by the ordinary methods used in railway work; viz., defining the degree of curve as the angle subtended at the center by a 100-ft. chord. Chords should be computed so that the distance shown is the exact distance along the curve. In other words, the degree of curve should be defined as the angle subtended at the center by a 100-ft. arc.

Mr. Anderson, himself, apparently contradicts the latter part of this statement when he uses 1146.28 ft. for the center-line radius of the 5° curve at the south end of Forest Road; 1146.28 ft. is the radius of a curve which has a chord of 100 ft. subtending a central angle of 5°. Using Mr. Anderson's definition of a 5° curve the radius would be 1145.92 ft., which is the radius of a curve having a central angle of 5° subtended by an arc of 100 ft.

While this difference would not greatly affect ordinary arcs with so flat curves as this one, for very large central angles, or for curves of short radius, the error introduced would be of appreciable magnitude. For curves sharper than 13°, which in such a layout are often used, the error would be greater than 0.20 ft. per 100-ft. arc.

If the center-lines of the streets are run in by the regular methods used in railroad work the tables in Searles' or similar handbooks can be used without introducing any error; and the computation of frontages and chords for setting the

lot corners on the property line will not, thereby, be in any way complicated, but will, on the other hand, be simplified, since the radii of the property line curves are obtained by direct addition or subtraction of the half width of the streets to the center-line radii as taken from the tables.

Mr. Anderson uses the formula C = 2R sin ½ Δ for the computation of chords and uses R as defined by a 100-ft. chord, where to be consistent with his previous statement he should use an R as defined by a 100-ft. arc.

Mr. Anderson's method of finding the length and bearing of the line between two points whose coördinates are known is unnecessarily laborious. The bearing is found by use of the formula $\tan Z = \frac{D_2 - D_1}{L_2 - L_1}$, where Z is the bearing angle. This Mr. Anderson has done. The length l can then be found by use of either the formulas $l = \frac{L_2 - L_1}{\cos Z}$ or, $l = \frac{D_2 - D_1}{\sin Z}$, which involves less work than by the use of the formula $l = \sqrt{(D_2 - D_1)^2 + (L_2 - L_1)^2}$ which he uses.

The problem illustrated by Fig. 1 is a special case of a general type. If the lot lines were not due east and west and north and south, i.e., parallel to the coördinate axes, the solution given would be applicable. A solution of the general case is here given:

Coördinates a		0.0	439.35
Log dif. lat	2.4213607	— 263.85	
Log cos 77° 02′ 15″	9.3508307		
Log 1176.28	3.0705107		
Log sin 77° 02′ 15″	9.9887894		
Log dif. dep	3.0593001		+ 1146.30
Coördinates m = A		— 263.85	1585.65
Coördinates A — 263.85	1585.65		
Coördinates C 65.00	0.00		
	328.85	1585.65	
Log 1585.65	3.2002073	Log 1585.65	3.2002073
Log 328.85	2.5169978	Log sin 78° 17′ 00″	9.9908553
Log tan Z	0.6832095	Log AC	3.2093520
Z	78° 17′ 00″	AC	1619.39
Sin B = b sin C / c		a = b sin A / sin B	
Log 1619.39	3.2093520	Log 1619.39	3.2093520
Log sin 11° 43′	9.3076503	Log sin 4° 31′ 04″	— 8.8963521
Log b sin C	2.5170023	Log b sin A	2.1057041
Log 1176.28	3.0705107	Log sin 16° 14′ 04″	9.4464916
Log sin B	9.4464916	Log a	2.6592125
B	16° 14′ 04″	a	456.27
Coördinates A		— 263.85	1585.65
Log dif. lat	2.5169988	+ 328.55	
Log cos 73° 45′ 56″	9.4464881		
Log 1176.28	3.0705107		
Log sin 73° 45′ 56″	9.9823281		
Log dif. dep	3.0528388		— 1129.38
Coördinates B		65.00	456.27
Log. dif. lat	0.0000000	0.00	
Log cos 90°	— ∞		
Log 456.27	2.6592125		
Log sin 90°	10.0000000		
Log dif. dep	2.6592125		— 456.27
Coördinates C	(Check)	65.00	0.00

This solution includes a complete check of the computations involved and shows errors in Mr. Anderson's coördinates of the point m, the bearing of the radial line mb, the central angle bma, the coördinates of the point b and the length of the north lot line. For this special case Mr. Anderson's solution is simpler than the one here given, but should have been checked by computing the coördinates of b from m, knowing the length and bearing.

Checking the problem of Mr. Anderson's Fig. 2 (p. 847) by the method used in checking the general problem given above shows an error in the coördinates of the point a.

It is, of course, impossible to solve the problem illustrated by Mr. Anderson's Fig. 6 (p. 848), since more conditions have been assigned than can be fulfilled by one simple circular curve. A solution of the triangle abc, which gives cp′ equal to 6.77 and cp equal to 6.97, proves this statement.

H. C. STEVENS,
W. W. SMITH,
With Blair & Drane,
Civil and Landscape Engineers.

Charlotte, N. C.
Apr. 26, 1913.

Sir—Concerning the description of the "Field Work and Computations for Laying Out Subdivisions on Curved Street Lines," by J. H. Anderson, in your issue of Apr. 24, it would be interesting to know how so many curves came to be in the layout, and what steps were taken to insure their accurate relocation in the future when the lots have become occupied by more or less contentious owners.

Apparently the ground is rugged and the streets were located closely to the contours, but could not more tangents and fewer curves have been used? Is not some consideration due future owners of the lots and to other surveyors who are perhaps not quite as fond of logarithms as Mr. Anderson is?

The fieldwork of locating all these curves and lots was not described, but it is presumed that the governing points of the curves were referenced to permanent subsurface monuments.

Judging from the size of the lots and the ruggedness of the ground, the lots are not very high in price, and many of them will in all probability be staked out by poorly paid surveyors who will not be as careful with their fieldwork as Mr. Anderson was with his figures; and as the section becomes more and more built up, trouble between contentious land owners will be relieved only by their willingness to compromise. Let us hope the surveyor on the job will have a saving sense of humor.

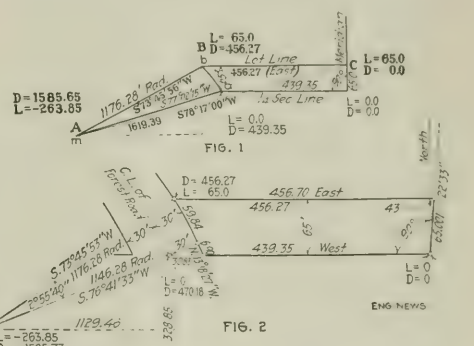
WALTER H. DUNLAP.

Roanoke, Va., Apr. 25, 1913.

Mr. Albert Compton Lyman, of Vancouver, B. C., sends us Fig. 2, giving the results of his computation, which do not agree with the results given by Mr. Anderson in our issue of Apr. 24.

Proof of these letters was submitted to Mr. Anderson and we have received the following reply:

Sir—My critics are correct when they state that I have used a radius for the 5° curve based on the railroad definition of degree of curve. I have done likewise for the 7° and the



4° curve which makes up the rest of Forest Road. This was done only on this street because the error introduced was negligible.

The error in the coördinates of point b is 0.07 ft., which can be neglected. In the light of these facts the statement that "degree of curve should be defined as the angle subtended at the center by a 100-ft. arc" is perhaps a little broad, but it is desirable in work of this kind, in fact it is absolutely necessary on sharp curves, to so define and use it.

I also find that the bearing of line in b in Fig. 1 is in error. The bearing should be S 73° 45′ 56″ W as given by my critic, and as will be found by using the coördinates of b and m in Fig. 1. The error was probably made in tracing.

My critics also give the length of the north lot line of Lot 180 as 456.27 ft., while my length is 456.59 ft.; 456.59 ft. is the length to the section line which is not the meridian; 456.27 ft. is the length to the meridian line and is not the length of the north lot line.

In regard to the method of finding the length of a line between two points whose coördinates are known, I do not know that finding l from $\sqrt{(D_2 - D_1)^2 + (L_2 - L_1)^2}$ is so much more laborious than finding it from $\frac{L_2 - L_1}{\cos Z}$, particularly as the latter method involves the looking up of an additional trigonometric function with its consequent chance for error and trouble in interpolating. Also, in using the latter method, any error in finding the bearing of the line will be introduced into the length, therefore the former is the more accurate.

Mr. Dunlap wants to know how so many curves got into the layout, and why more tangents were not used. Every effort was made to keep the streets as straight as possible without, at the same time, causing an excessive amount of excavation. Even as it is the cut and fill was very heavy in places. The curves are all referenced to permanent monuments and the lot corners marked by 1-in. gas pipe, in no case shorter than 2 ft.

Mr. Dunlap jumps at the conclusion that the lots are low priced and not very desirable. On the contrary they form a part of the most exclusive residence district in the city. The 70 acres described in this layout are the last of a tract of about 400 acres, all of which has been laid out on the above plan. The streets are all graded and paved; sidewalks, sewer, water and gas mains laid; and the lots are graded and sodded before being placed on the market. The residences are all of them of the highest class, several of them costing $100,000. The entire district is covered with fine old oak trees and the lots were laid out so as to give to each its proportionate share of these. Also, in laying out the streets, consideration was given the trees so as not to destroy any more than necessary.

Mr. Dunlap is extremely worried over the trouble to the future "contentious" landowner and the "poorly paid surveyor." The first layout in this addition was made ten years ago and no trouble has been experienced in relocating these lots. A large scale map showing every deflection angle, chord distance, and all the bearings and distances is filed with the city engineer. I assumed that future surveyors were able to turn off an angle and run out a line whose bearing is given.

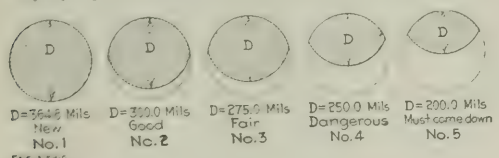
Mr. Dunlap concludes with the hope that the future "surveyor on the job will have a saving sense of humor." I am happy to state that the present surveyors on the job possess that quality and are therefore able to appreciate Mr. Dunlap's letter.

J. H. ANDERSON.

1025 Fourteenth St.,
Rock Island, Ill., June 9, 1913.

NOTES

Renewal Point of Copper Trolley Wire—The accompanying diagram, showing the practice of one of the large city railway companies of the country on the classification of trolley wires in place, as to their wear and renewal, is printed in the "O. B. Bulletin" (house organ of the Ohio Brass Co., Mansfield, O.) May, 1913. It is this operating company's practice to keep a monthly record sheet of the



wire breaks and every fall and spring an engineer takes micrometer measurements of the trolley wires in sections where the worst breaks occur. These measurements are taken 300 or 400 ft. apart, the results plotted and compared with the accompanying diagram.

Where wire is found in condition No. 3, it is found that the expected life is six months under heavy service. Wire which comes into the class of No. 4 is considered dangerous and is renewed as soon as possible. If found in condition No. 5 anywhere, it is renewed without delay.

Motor Trucks for Contractors—As an example of the economy introduced by motor trucks in transportation connected with engineering enterprises is the case of the Bridgeport Hydraulic Co., engaged in the construction of a large dam seven miles outside of Bridgeport, Conn.

Horse-drawn trucks were first considered as a means of transporting the materials to the dam, but on investigation it was found that in order to employ horses, the roads would have to be made over and, in one place, a hill cut down, with corresponding expense.

In addition, the estimates on the cost of hauling showed about 35c. per ton-mile (one team and driver, 2-ton load, one trip of seven miles each way per day) as compared with 14c. per ton-mile by motor trucks (four trips per day at 89c. per ton, 5 tons per trip of seven miles). Motor trucks were selected and the wisdom of the selection was manifest when the figures after over six months' operation showed the cost to average about 10c. per ton-mile, or 4c. cheaper than the estimate.

These trucks have never faltered in spite of the severe road conditions encountered. They have since been equipped with power mechanism for rolling onto the cars a pipe 18 in diameter by 13 ft long, weighing 5 tons. Four trips per day are made to the dam, one pipe being carried each time, or four pipes per day moved. To do this same work, four teams of six horses each, with additional horses to assist on the hills, would be required. A trailer has been designed to carry an additional pipe on each trip.

In addition to the economy gained, the condition of the roads traveled by only one motor truck with broad tires, making four trips per day, is far better than it would be with four teams with narrow-tired wagons which cut into the road bed, especially in bad weather.—[From a paper on the "Economics of Motor Trucking," by Clinton Brettell, Truck Sales Department, Locomobile Co. of America, Bridgeport, Conn., in the "Quarterly" of the School of Mines, Columbia University.]

Effect of too Much Water in Mixing Concrete—The tests described in the article with the above heading in "Engineering News," May 22, 1913, p. 1063, has been commented on by E. J. Griesenaur, Cement Tester, C. M. & St. P. Ry., as follows:

The following paragraph in the article is not quite clear: "All material was dry before mixing and water was added in percentages from 20% to 42%, according to the following method: As a minimum, enough water was taken to moisten the stone and sand and then there was added 20% (of the amount of cement by weight) water."

It is not clear to me whether the percentages of water of 20% to 42½% is the amount of water added to the mixture after moistening the aggregate, or whether the water required to moisten the aggregate is included in the percentages given of from 20% to 42½% inclusive. If the former, then, it seems, the percentage required for that (to moisten the aggregate) should be given. If the latter, then it seems to me the statement as given in the paragraph quoted conflicts.

I would appreciate enlightenment in this matter in order to use the method, if possible, in conducting some tests along that line.

I might add that we have made a number of tests of different pit sands in the past couple of years, comparing the normal consistency mortar with a soft mushy consistency in tensile strength and the results obtained invariably showed the soft mushy consistency mortar briquettes to be much weaker than the normal consistency mortar briquettes.

C. J. Robison, who made the tests noted above, has replied as follows regarding our correspondent's query:

The amount of water which stone will absorb depends upon the stone and temperature. Connecticut trap rock was used and the temperature of the room was about 60°. Therefore, I did not think that the percentage of water absorbed by stone or sand was a constant quantity and, therefore the same per cent. of absorption would apply to all parts of the country under different conditions.

To make matters clearer, I will state that water was added in the following manner. By experiment I found that 2.1% of water (2.1% of the amount of stone by weight) was absorbed by stone, and that 10% water (10% of the amount of sand by weight) was absorbed by sand; and then added 20% water (20% of the amount of cement by weight, etc.)

The matter of determining the amount of water absorbed by stone and sand would take very little time, and it would be best for these tests to be made before starting work. However, one would be on the safe side if they assumed 2% water (2% of the amount of stone by weight) was absorbed by stone and that 10% water (10% of the amount of sand by weight) was absorbed by sand.

Bolted Field Connections for Bridges, as compared with riveted connections, are noted in a paper on the strengthening of an old railway viaduct, read before the Western Society of Engineers by W. T. Curtis. The viaduct was built in 1888 on a road now forming a part of the Pere Marquette R.R., with tower spans of 30 ft., intermediate spans of 45 ft., and a 150-ft. desk truss river span. The old structure was field-bolted (with the exception of the buck and lateral bracing between the girders), but this was not discovered until the field work of reconstruction or reinforcement had been commenced. The replacing of all old field bolts with new rivets was considered.

Careful investigation, however, showed the old structure to be in perfect alignment, with none of the bolts loose in the slightest degree, although the structure had seen years of service and had been somewhat overloaded in its later years. It was decided, therefore, not to go to the extra expense of replacing the bolts with rivets. On the other hand, many of the buck and lateral connections which had been riveted originally, were found to be in bad shape on account of loose rivets, the vibration of passing trains having caused the parts to wear deeply into some of the rivets.

While it was realized that the points which had been riveted in the old structure were points subject to more severe service than the points which had been bolted, the investigation satisfied those who participated in it that bolts are in reality much better than they are generally considered in ordinary practice. Mr. Curtis stated that other observations made under similar circumstances have supported this conclusion.

An Engineer's Field Suit—Specially designed duck clothing for hunters and fishermen has been in the market for many years, and has in some degree answered the purpose of the surveyor and field engineer. The firm of Bird, Jones &

Kenyon, of Utica, N. Y., has now designed a complete suit to meet the particular needs of engineers. The coat is shown in the accompanying illustration. This clothing is made in "Duxbak," which is waterproofed, and "Kamp-It," which is not waterproofed. The advantages of the various pockets



A Coat Specially Designed to Meet the Needs of the Engineer

are apparent to the experienced surveyor. Inside pockets are provided for pipes, tobacco, etc., on both sides of the coat, and on the right side is a small inside pocket designed for matches.

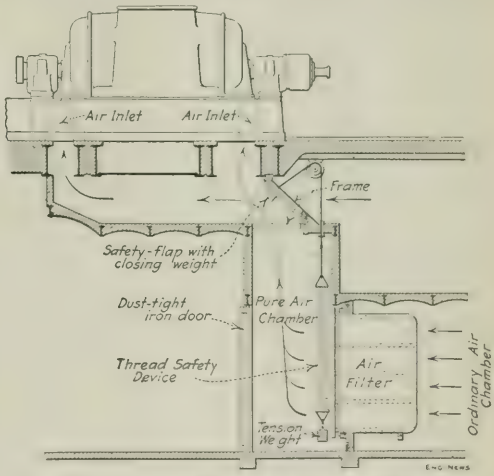
Accurate Method of Leveling with a Wye Level—The Borough of Queens, New York City, is one of those sometimes referred to as a "rural borough," because it contains much open land. A year or two ago this borough entered upon a comprehensive scheme for rapid improvements, and a preliminary was the organization of a topographical bureau, to obtain surveys as rapidly as possible on which to base the proposed improvements. An important part of this work, of course, was the establishment of a network of benchmarks. Equipments of precise levels were not available; and, moreover, speed and accuracy were prime requisites. An accurate method, which was found to have many advantages, was devised and used under the direction of H. K. Endemann, Assistant Engineer, and then acting Chief Engineer of the Topographical Bureau. This method consists of employing two rodmen, using ordinary target rods, reading to thousandths of a foot, and an ordinary wye level, chosen from several for its good qualities. The procedure was to set up at uniform distances of approximately 225 ft. from each rod, iron pins being used always for turning points, and have two independent target settings made on each turning point. These were read by each rodman and recorded in his book, and the mean was recorded by the levelman. The levelman then picked up his instrument and made another setup at the same point, and repeated the operation on the same turning points, recording his results in a separate field-book. Thus in reality two distinct level lines were obtained simultaneously and a double check on each rod reading was obtained. The limit of allowable error was 0.02 K (K = the distance in miles), and Mr. Endemann stated in a recent discussion before the Municipal Engineers of the City of New York that several hundred miles of levels were run much within this limit. The city is at present engaged in establishing a series of precise level benchmarks to which all the borough benchmarks will soon be referred.

Oxyacetylene Cutting Torches have been put to good use in cutting up old locomotive boilers. The rapidity with which iron and steel plate can be cut with this instrument has made its use a great economy.

Wrought steel in mud fireboxes is worth $6.65 per ton compared with $10.75 per ton when cut into sheets that can be put under the shears, according to information furnished by the Oxweld Acetylene Co., of Chicago. It is stated that in general the cost of cutting up discarded boilers with oxygen and acetylene varies from 20 to 50% less than by hand tools—depending upon the thickness of the material and the amount of rust or scale adhering, together with local conditions under which the work has to be done.

It is reported that two 20-ton steel fire boxes were cut up for the shears in 12 hr. at a time cost of $1.22 with more than 300 lin.ft. of cut made through ⅞-in. plate. Another case is cited where the cut totaled 210 lin.in. through ½-in. plate, 9 in. through 3-in. plate, and 172 in. through ⅜-in. plate. This work was done in 53 min. at 8c. per lin.ft., average. It was estimated that two men would have done the work by ordinary hand tools in one week, whereas only 1½ days were required for the oxyacetylene torch. On another piece of work 78 ft. of ½-in. plate was cut in 2½ hr., and one piece 18 ft. long was cut in 13 min. The cost of cutting was 5.44c. per ft. Cutting of a certain three-ton boiler averaged $2 per ton and was done in 1½ hr., with a total length of cut 60 ft. 4 in. A 14-ton boiler was cut at the rate of $1.23 per ton in nine hours and with 111 ft. 8 in. of cut at the rate of 14.9c. per ft. A five-ton steel car frame was cut up in 2½ hr. at an average cost of $2 per ton.

Protection of Air-Cooled Electric Generators—It is reported by H. Treitel in the Allgemeine Elektricitäts Gesellschaft "Journal" for February, 1913, that frequent fires in the dry-air filters of German turbine-generator cooling systems, have led to the design of apparatus to interrupt the air supply quickly. The fundamental principle consists of the



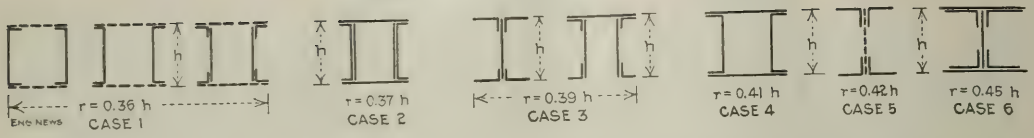
Fire Protection in Turbine Generator Cooling System

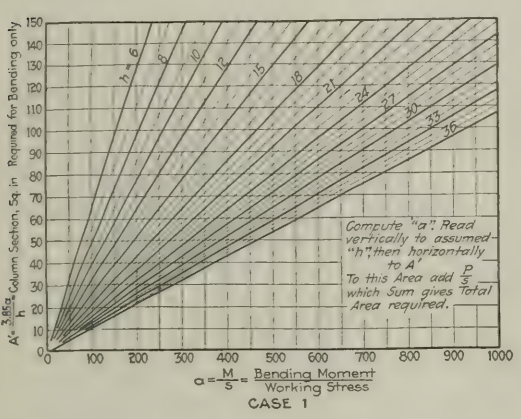
release in the air passage of some closing device, as a result of either temperature rise or spread of combustion. One such is shown in the accompanying figure. A counterweight, suspended by cotton threads, holds open a flap door; when the threads burn through, the door drops shut against the filtered-air supply and opens a passage to the machine-room cellar. Optical or acoustic signals give warning of the movement of the door.

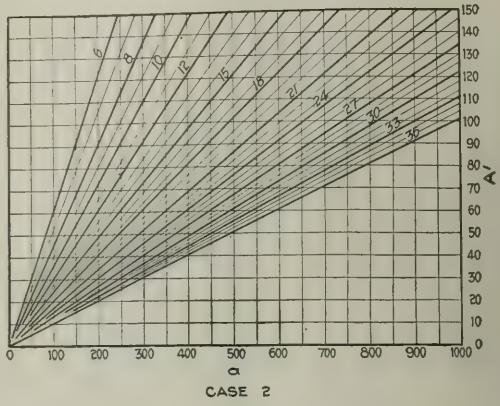
Weight of Crushed Trap Rock—The following figures are given by F. R. Upton, Newark, N. J., on the weight of crushed trap rock of various sizes, the measurements being made at the quarry of the Bound Brook Crushed Stone Co., in carload lots:

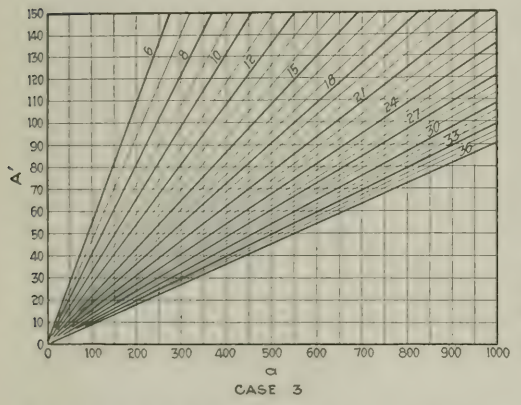
Size	Lb. per cu.yd.	Lb. per cu.ft.
⅛-in. dust	2585	96
¾-in.	2370	88
1-in.*	2401	89
1¼-in.*	2537	94
1½-in.	2433	90

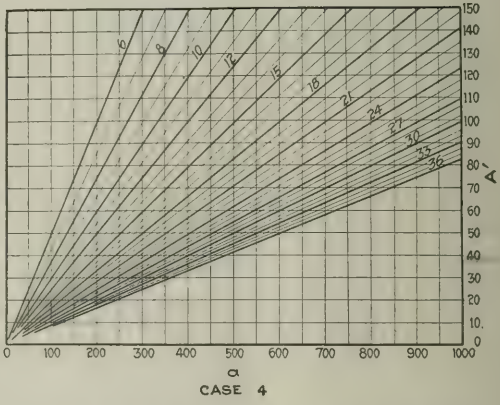
*Average of two cars.

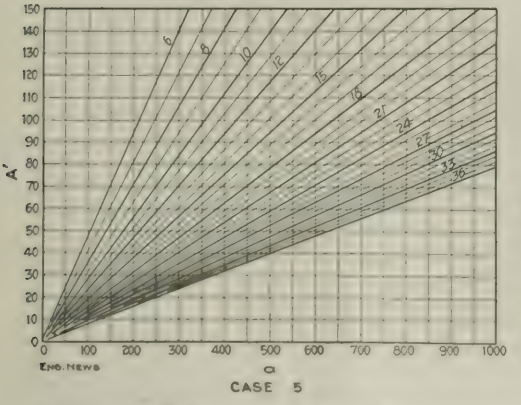


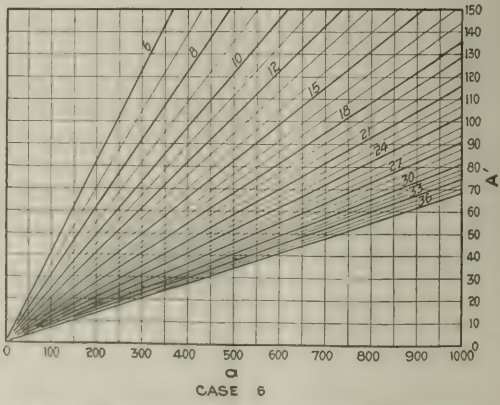












DIAGRAMS TO BE USED IN DESIGNING COLUMNS, SUBJECT TO BOTH TRANSVERSE AND LONGITUDINAL LOADING

(Devised by G. Paaswell.)

A Direct Method of Designing Columns

By George Paaswell*

The design of a column subject to a transverse as well as longitudinal loading, involving as it does functions of the correct section (section modulus), is necessarily a matter of trial. Usually the functions of several sections must be calculated before the correct one is obtained.

The customary method of designing such a column is to use the formula

$$s = \frac{P}{A} + \frac{Mh}{2I}$$

where

s = stress allowed in compression;
P = direct load;
M = bending moment;
A = total area of required section;
h = depth out to out of column;
I = moment of inertia of column.

Since $I = Ar^2$, where r = radius of gyration, the formula may be written

$$s = \frac{P}{A} + \frac{Mh}{2Ar^2}$$

In a previous issue of Engineering News* relations

*May 23, 1912, p. 991.

between the radius of gyration and the depth out to out of various sections were given. If we put then $r = ch$, where c = a constant as determined by the method noted the formula becomes

$$s = \frac{P}{A} + \frac{M}{2c^2hA}$$

Solving for area of section,

$$A = \frac{P}{s} + \frac{M}{2c^2hs}$$

The section modulus required for the bending load only is $\frac{M}{s}$. Calling this a, the formula becomes,

$$A = \frac{P}{s} + \frac{a}{2c^2h}$$

Applying this general formula to the several cases shown in the accompanying figure we get

For Case 1. $r = 0.36h$ $\quad A = \frac{P}{s} + \frac{3.85\,a}{h}$

For Case 2. $r = 0.37h$ $\quad A = \frac{P}{s} + \frac{3.65\,a}{h}$

For Case 3. $r = 0.39h$ $\quad A = \frac{P}{s} + \frac{3.28\,a}{h}$

For Case 4. $r = 0.41h$ $\quad A = \frac{P}{s} + \frac{2.96\,a}{h}$

For Case 5. $r = 0.42h$ $\quad A = \frac{P}{s} + \frac{2.83\,a}{h}$

For Case 6. $r = 0.45h$ $\quad A = \frac{P}{s} + \frac{2.46\,a}{h}$

Curves are shown herewith for several types of columns, the areas required for various values of a and h for bending alone being shown at the left as A'. To these areas should be added the area required from the direct load alone, i.e., $\frac{P}{s}$.

In most cases h of the column is fixed or assumed. In cases where it is not, a glance at the curves will show an economic depth to be used (taking all items involved into consideration).

Since generally heavy sections are involved, the maximum stresses allowable from the column formulas of various specifications can be used.

Where light sections are used and the allowable stress is less than the maximum the allowable stress may be obtained directly (presupposing the value of h has been adopted) by substituting in the specified formula for stress the value of h.

Thus if $r = 0.4h$ and the New York Building Code is specified

$$s = 15{,}200 - 125\frac{L}{h}$$

Since girders are customarily designed by area, although theoretically we must design by moment of inertia, it is justifiable to design the columns by area also.

*Public Service Commission, First District, New York, 154 Nassau St., New York City.

Filing and Indexing System for Boston Harbor Development Work

Frank H. Jones*

The novel feature of the filing system adopted by the engineering department of the Directors of the Port of Boston, Mass., which makes it especially applicable to the use of public service commissions, designing and construction engineering firms, is the relative speed and accuracy with which it permits of a physical valuation or report of the actual work accomplished, as set apart from the more general data collected in the course of engineering and administration.

The decimal system is used as a basis and the field of the work is first divided into the following topic divisions:

0. General
1. Rivers
2. Harbors
3. Dry Docks
4. Piers
5. Land
6. Grain Elevators
7. Railroads
8. Viaducts and Bridges
9. Highways
10. Warehouses
11. Power Plants

With an increase in the scope of the work other topic numbers may readily be added with no interference whatever with matter already filed.

It will be noted in the following specimen topics that when a numerical subdivision is once assigned it carries a definite, tangible idea throughout the entire system. For instance, the subdivision .02 occurs under 3, as the file number which is assigned to all the progress reports in connection with a contract for the construction of a dry dock. The same subdivision having identically the same meaning occurs under 4 in connection with pier contracts and again under 6, 8, 10, and 11. This process of standardizing the meaning of the subdivisions is carried out all the way through the topics.

The subdivisions of 1, Rivers and 2, Harbors are practically the same. The considerations outlined under 3, Dry Docks, 4, Piers, 6, Grain Elevators, 10, Warehouses, 11, Power Plants, and all minor construction topics and subtopics are treated in much the same manner throughout, showing the facility with which the system is comprehended by even the most inexperienced user.

*2817 Washington St., Roxbury, Mass.

The filing of the data is done under two general classifications, "Contract" and "Miscellaneous," both of which are divided and subdivided as far as necessary by means of the decimal system outlined under the various topics considered.

The filing under classification "Contract" is by contract numbers which are consecutively assigned as soon as possible after a proposition becomes the basis of a contract, and the data under one contract number are placed in the file in alphabetical order. The filing under classification "Miscellaneous" is by alphabetical arrangement of locations and subjects.

The same index is used for both filing classifications of data and is arranged alphabetically to include both locations and subjects. Contract data are grouped under their proper alphabetical location and distinguished by a guide card stating the subject of the contract; and the group has as many decimal divisions as are necessary for quick reference. Miscellaneous data, either of location or subject, are grouped under the proper alphabetical location or subject and distinguished by the proper topic number.

The primary aim in working out this system was to group, as far as possible, all interrelated subjects and only set apart, under as few heads as consistent with ready reference, all considerations which could be definitely bounded in scope. The word "general" has been construed in every case in its broadest sense, and the word "miscellaneous," long abused by file clerks, has been done away with almost entirely except in reference to a class of data distinctly separate from contract or actual improvement work under the jurisdiction of the department.

The method of divisioning is explained more in detail as follows: 0. General, pertains to office and engineering administration; 2. Harbors, treats of all harbor improvements, contract data as well as proposed work and miscellaneous data; 4. Piers, contains all data concerning the construction of a pier.

It should be especially noted throughout the divisioning that the manner in which the topics are treated allows of future expansion without altering the present scheme.

The more important topics and their subdivisions are outlined as follows:

0 ORGANIZATION AND ADMINISTRATION OF THE ENGINEERING DEPARTMENT
.1 LEGAL CONSIDERATIONS
.11 Opinions of Counsel
.12 Contracts
.13 Contractors
.131 List of Bidders
.14 Permits, Agreements, Franchises, Patents
.15 Damages (Personal and other—not real estate, for which see LAND 5.)
0.2 EMPLOYEES
.21 Titles
.22 Time and Expense Reports
.221 Weekly
.222 Monthly
.23 Addresses, Credentials.
.24 Accidents
.25 Salaries, Increase, decrease, promotion
.26 Absence, Vacations
0.3 OFFICE ADMINISTRATION
.31 Rental, Leases, etc.
.32 Regulations, Instructions, Office Practice (sizes of drawings, computations, symbols, titles, etc.)
.33 Accounts
0.4 FILING AND INDEXING
0.5 SUPPLIES AND EQUIPMENT
.501 Field Outfits
.502 Requisitions
.507 Orders
.51 Furniture and Office Equipment
.52 Stationery and Blank Forms
.53 Engineering and Drafting Supplies and Instruments
0.6 REPORTS, PUBLICATIONS, ADVERTISING
.61 Catalogs
.62 Periodical and Other Reports
.63 Periodical Publications
.64 Advertising
.65 Printing
.651 Process Printing
.652 Photographs
0.7 DESIGNING STANDARDS
0.8 SPECIFICATIONS

2. HARBORS

2.0 GENERAL
.01 Charts, Maps, Surveys
.011 Studies, Schemes, Considerations for Proposed Developments
.02 Tide water displacements
2.1 DREDGING
.11 Preliminary to Contract
(General Plan, location, borings, soundings, diagrams and other information necessary for a clear interpretation of all existing conditions on the site at the time of contract.)
.111 Studies
(Studies of preliminary and working considerations for the contract.)
.12 Progress, Completion, Maintenance
(Progress data, diagrams, overdepth estimates and reports showing conditions after improvement.)
.13 Plant, Force, Material
(Temporary Structures, force, material, and testing data.)
2.2 BREAKWATERS, DIKES, EMBANKMENTS
(Subdivisions same as under 2.1)
2.3 RECLAMATION OF LAND
(Subdivisions same as under 2.1)
2.4 AIDS TO NAVIGATION
(Subdivisions same as under 2.1)
2.5 CHANNELS AND ANCHORAGE BASINS
(Subdivisions same as under 2.1)
2.6 ISLANDS

4. PIERS

4.0 GENERAL
.01 Preliminary to Contract
(General plan and location, borings and soundings, diagrams and other information necessary for a clear interpretation of the existing conditions on the site at the time of contract.)
.011 Studies
(Schemes of preliminary and working considerations.)
.02 Progress, Completion, Maintenance
(Progress, and data relating to the conditions upon completion and future maintenance.)
.03 Plant, Force, Material
(Temporary structures, force, material and testing data.)
.04 Railroad Connections and Construction
4.1 SUBSTRUCTURE
.11 Dredging, Excavation, Filling, Surfacing, Grading, Highway Connections.
.12 Retaining Walls, Sea Walls, Piles and Pile Work
.13 Platform
4.2 SUPERSTRUCTURE
.21 Foundations, Floor Plans, Elevations, Sections and Details.
.22 Structural Steel
4.3 UNDERGROUND PIPING, PLUMBING, WATER SUPPLY, DRAINAGE, SEWAGE, HEATING AND VENTILATING, PRESSURE SYSTEMS
4.4 ELECTRICAL, POWER AND LIGHTING
.41 Distribution
.42 Appliances
4.5 MECHANICAL

The subjects 7. Railroads and 9. Streets are topics to which the Board has frequent reference, though at present no jurisdiction over such construction or designing work; and their filing treatment is very simple, the first division (9.1) being left for contract considerations should they ever exist while 9.0 constitutes the general file with the subdivision 9.01 as "Characteristics of existing streets" (such as sewers, lines, drainage, etc.), and the subdivision 9.011 as "Studies for proposed alterations and extensions."

The following extracts from the special instructions for filing plans and drawings show the manner in which data relating to a specific topic are automatically drawn together and made ready for instant reference as a whole or in part:

All plans, drawings, studies, etc., shall be accessioned (consecutively numbered, as the means of referring to them) when a title and all filing information have been determined. When the drawing is completed it is given its proper file number.

Contract plans, not exceeding folder size, shall be located in folders numbered and arranged according to the contract numbers and their subdivisions. When two or more folders are required for the plans of any decimal division the limiting accession numbers shall be indicated on the cover of each folder.

Miscellaneous plans not exceeding folder size shall be located in folders (1) alphabetically and (2) decimally arranged.

Contract or miscellaneous plans exceeding, or under, folder size shall be rolled and their location plainly marked in all the entries.

EDITORIALS

What is a Proper Safe Unit Stress for Timber?

An interesting review of the unit stresses fixed by the building ordinances of various cities for yellow-pine timber used in buildings was recently made by Mr. A. D. North, a Chicago engineer, in a paper before the Yellow Pine Manufacturers Association. The results of Mr. North's inquiry may be briefly summarized as follows: A maximum stress of 1200 lb. per sq.in. on the extreme fiber of wooden beams is allowed by the cities of Atlanta, Cincinnati, Columbus, Detroit, Washington, Louisville, Memphis, New York, Pittsburgh, Richmond and St. Paul. Their total population is in the neighborhood of 7,500,000. The cities of Chicago, Birmingham and Trenton, with a total population of 2,400,000, allow 1300 lb. fiber stress. Lowell, Mass., allows 1400 lb. fiber stress. Boston, New Orleans and Newark allow 1500 lb. fiber stress. Paterson, Philadelphia and Minneapolis allow 1600 lb. fiber stress. A fiber stress of 1800 lb. is allowed in Buffalo, Baltimore, Chester, Evansville, Cleveland, New Haven, St. Louis and Toledo, their combined population being 2,640,000.

Mr. North urges that if an extreme fiber stress of 1800 lb. per sq.in. is safe in the cities last named, then the cities first named are requiring by law to use 50% more material in the construction of wooden buildings than is necessary for safety. That is to say, if a certain load is carried safely by a 2x10 floor joist in Buffalo, or Baltimore or St. Louis, the same load would require a 3x10 floor joist in the cities of New York, Pittsburgh, St. Paul, Detroit, etc.

Mr. North declares that the use of the low fiber stress of 1200 lb. for yellow pine in building codes is at the present day due either to ignorance or to the activities of special interests. He admits that such stresses were recommended in a model building code issued by the National Board of Fire Underwriters years ago, but he states that that code is now being revised. He urges, furthermore, that the interests which have favored the use of fireproof materials in buildings have been active in opposing any increase in the allowable stresses in structural timbers.

Without taking any position in support of Mr. North's claim that timber stresses are too low in many cities, it certainly is an interesting question what justification there is for a fiber stress of 1200 lb. on the one hand or of 1800 lb. on the other. If the Baltimore building law is safe, then the New York law does require a wasteful use of the material. On the other hand, if the New York law represents the maximum stress which should be permitted upon timber, then the Baltimore ordinance endangers public safety. Evidently, both extremes cannot be right.

Mr. North urges that a factor of safety of 6 or more for timber is unreasonably high and subjects those who use timber for building purposes to an unfair and burdensome tax. One remark which may probably be made in connection with this is that if every structure could be planned and supervised by a competent engineer, then higher factors of safety might reasonably be used on many timber structures. A building law, however, must be made to fit the worst timber which passes the average commercial inspection. As is well known, much of the timber accepted in the present-day market is full of knots and other defects which reduce the maximum strength of many pieces considerably below the average strength which prevailed in the sound and clear timber which was ordinarily obtainable in the market twenty-five years ago.

Reasonable economy in building construction is highly desirable and timber construction in proper places ought by no means to be handicapped by excessive factors of safety. On the other hand, the public safety should not be sacrificed in any city building ordinance. There is not one case in ten thousand where those whose lives are at risk in a city building have or can have any knowledge of the strength of the structures in which they live and work.

Advertising Franchises in New York City

A generation ago, when public franchises were a subject for barter and sale between boards of aldermen and promoters, some excellent reformers succeeded in inserting into the laws of several states a provision that public advertisement of a franchise must be made for a certain period before it could be granted. Some of the present-day results of this law, which were never foreseen by those who framed it, have been pointed out in a recent report by the Bureau of Franchises of New York City, of which Mr. Harry P. Nichols is chief.

The idea of the framers of the law, of course, was that a franchise was such a valuable thing that the cost of advertising its grant in local newspapers would be a mere bagatelle for the parties desiring to obtain the franchise. The framers of the law, however, did not foresee that where there would be one franchise granted of such value as that for the street railway on Broadway or the construction of underground conduits for electric wires over a large section of the city, there would be fifty franchises to be granted for minor public utilities, the value of which to the holders would be comparatively trifling.

In the report above referred to it appears that the necessary cost of the advertising in connection with grants of franchises to street surface railways in the Borough of Manhattan, New York City, is from $2500 to $4000. A railway on Staten Island obtained franchises for four short sections of track and the cost of publication alone amounted to nearly $4 per foot of track laid. In several other cases cited the cost of the the advertising has been as great as the revenue which the city would receive from the franchise for a long term

of years. In still another case where a concern had run some wires in a street, it was found that the concern was barely earning its operating expenses and that if it were required to go through the legal procedure necessary to obtain a franchise, it would be driven out of business.

Mr. Nichols recognizes the importance of the enforced publicity which the present law secures, but urges that modification should be made so as to reduce the cost of advertising under the present system.

We suggest that it would be well to go even further and inquire what useful purpose is served by a large proportion of the so called "legal advertising" other than to furnish a source of revenue to various political newspapers. Of course, there is a certain amount of this advertising which is of public interest and importance. Much of it, however, is published simply because the law requires it and gives no such useful and valuable publicity as the law requiring it originally contemplated.

A Recommended Excursion

Engineering structures as a rule do not receive much attention in print until after their completion, which is good practice, since it insures the gathering together in one place of all the information regarding the structure in question. It is unfortunate, sometimes, because it often happens that many engineers do not know of certain operations until after they are completed, and the methods which might have been of interest are then not open to observation. On this account we would like to call attention as prominently as possible to the construction now going on at the Tunkhannock Creek Viaduct, on the Summit Cutoff of the Deleware, Lackawanna & Western R.R., west of Scranton, Penn.

This viaduct, a general description of which appeared in ENGINEERING NEWS, June 21, 1912, p. 1110, will be, when completed, the largest concrete structure ever built. It has a total length of 2230 ft. and is made of two 100- and ten 180-ft. arch spans, carrying a double-track railway about 240 ft. above the level of the creek. The massive piers, 40x46 ft. in plan, rise up out of the valley to this enormous height and reach down 95 ft. below the ground surface to a footing on bed rock. Undoubtedly they are the largest monolithic shafts ever built.

During the coming summer this work will be at its height. Construction of the piers has been going on all winter and some of them have already reached the skewback elevation. The steel-arch centers, on which the long arches will be built, will be put in place within the next few months, while at the same time pier construction for some of the shorter piers will be going on. Many construction features are of interest, particularly a tower cableway with a central tower higher than any ever before built, and a material storage plant remarkably compact in arrangement.

This bridge is located at Nicholson, Penn., about three-quarters of an hour north of Scranton on the main line of the Lackawanna R.R. It is easily reached on that road from Hoboken in the south, and from Buffalo, Elmira or Binghamton in the north. We know of no excursion in the eastern part of the country which would better repay an engineer than a visit to the site of this bridge and to the somewhat smaller but similar Martin's Creek viaduct about [illegible] further east.

A Supreme Court Ruling on Government Ownership of the Water Power of Navigable Streams

"Ownership of a private stream wholly upon the lands of an individual is conceivable; but that the running water in a great navigable stream is capable of private ownership is inconceivable."

The above quotation is not an excerpt from some address on censervation. It is taken from the opinion of the Supreme Court of the United States in the case of the Chandler-Dunbar Water Power Co. At Sault Ste. Marie, Mich., the United States is building a new lock for navigation and has caused to be removed the water-power plant which the Chandler-Dunbar Co. had built. The lower courts awarded the company damages to the amount of $550,000 as the value of its water power taken by the Government. The Supreme Court threw out this award and in a most sweeping opinion declared that the United States has the ultimate authority over the beds of all navigable streams and may exercise that authority without interference from or compensation to the owners of the lands fronting on the stream. The following quotation gives some idea of the broad character of the Supreme Court's ruling:

> This title of the owner of fast land upon the shore of a navigable river to the bed of the river is at best a qualified one. It is a title which inheres in the ownership of the shore and, unless reserved or excluded by implication, passes with it as a shadow follows a substance, although capable of distinct ownership.
>
> It is subordinate to the public right of navigation, and however helpful in protecting the owner against the acts of third parties, is of no avail against the exercise of the great and absolute power of Congress over the improvement of navigable rivers. If, on the judgment of Congress, the use of the bottom of the river is proper for the purpose of placing therein structures in aid of navigation, it is not thereby taking private property for a public use, for the owner's title was in its very nature subject to that use in the interest of public navigation. If its judgment be that structures placed in the river and upon such submerged land are an obstruction or hindrance to the proper use of the river for purposes of navigation, it may require their removal and forbid the use of the bed of the river by the owner in any way which in its judgment is injurious to the dominant right of navigation. So, also it may permit the construction and maintenance of tunnels under or bridges over the river, and may require the removal of every such structure placed there with or without its license, the element of contract out of the way, which it shall require to be removed or altered as an obstruction to navigation.

Not only may the Federal Government improve rivers for navigation without compensating the riparian owners because of their technical title to the bed of the stream but it may develop and lease water powers on navigable rivers and the riparian owners of adjoining lands have no claim on the value of such powers. The Court says:

> The 12th section of the act of 1909 declares that the conservation of the flow of the river is
> "primarily for the benefit of navigation and incidentally for the purpose of having the water power developed, either for the direct use of the United States or by lease . . . . through the Secretary of War."
>
> If the primary purpose is legitimate, we can see no sound objection to leasing any excess of power over the needs of the Government. The practice is not unusual in respect to similar public works constructed by State governments.
>
> It is, at best, not clear how the Chandler-Dunbar Co. can be heard to object to the selling of any excess of water power which may result from the construction of such controlling or remedial works as shall be found advisable for the improvement of navigation, inasmuch as it had no property right in the river which had been "taken." It has, therefore, no interest whether the Government permit the excess of power to go to waste or make it the means of producing some return upon the great expenditure.

Social Problems and the Engineer

We hope that every young engineer among our readers will take the time to carefully read the presidential address of Prof. George F. Swain, President of the American Society of Civil Engineers, delivered at the Ottawa convention last week and printed on another page of this issue. It is faint praise to say that Prof. Swain's address is worthy of the highest traditions of the engineering profession. The traditions of the profession too often are that the engineer should stick closely to his special work in technical and scientific matters.

As our readers know, ENGINEERING NEWS has for many years contended earnestly that engineers were as much responsible for the solution of social problems and the development of good citizenship and good government as any class of men in the community. Prof. Swain's address, in fact, breaks loose from all traditions and discusses those broad fundamental questions of sociology, of government, of education, of industry, on which in the last analysis the continuity of our civilization depends. The sole criticism that can be made of President Swain's address is that it dealt with themes too deep and profound to receive proper attention at a summer holiday meeting of an engineering society. The answer to this is that undoubtedly President Swain was looking beyond, to the larger audience which he might justly hope to reach, in view of the prominence of the occasion and the official character of his utterances.

Available space permits us to publish only a condensed abstract of his address, which by no means does it full justice. We strongly advise our readers not to content themselves with reading the abstract which we present, but to take pains to obtain the full text of the address when printed and made available to the profession by the Society, as it undoubtedly will be.

We shall attempt no discussion here of the important questions raised by Prof. Swain. We will only remark that he gave forceful expression in a masterly manner to the ideas that are in the minds of thousands of earnest thinking men. There can be no doubt at all that if the engineering profession would fulfill its opportunity for public leadership it must give earnest study and consideration to the great problems to which Prof. Swain has called attention.

⁂

Air Brakes and the Stamford Collision

Not in a long time have there been tests of air brakes so full of interest as those which were made last week at Stamford, Conn., with the locomotive and cars of the second section of the Boston express which collided with the section ahead on the afternoon of Thursday, June 12. Orders had been given that the brake equipment of the locomotive and cars be in no way interfered with and on June 17 the train was run to the place where the collision occurred and stops were made with it, over the same stretch of track, the brakes being applied in different ways.

According to the figures of these tests published in the *New York Times,* for test No. 1 a train speed of 64½ miles an hour was obtained when emergency application of the brakes was made. The train was stopped after running 2097 ft. For the second test a full service application of the brakes was made with a reduction of pressure in the train pipe of 30 lb. The brakes were applied when the train was running 60 miles an hour and the train was stopped in 1994 ft. In the third test an emergency application was made at a speed of 57½ miles an hour and the train was stopped in 1617 ft. In the fourth test an emergency application was again made at a speed of 60½ miles an hour and the train was stopped in 2525 ft. In the fifth test, with the train running 59½ miles an hour, a service application of 15 lb. was made followed shortly after by a further reduction of 15 lb. more. The train was stopped in 47 sec. after running 2586 ft. In the sixth test the train was stopped from a speed of 57 miles an hour, in 50 sec. time, having run 2138 ft.

In the seventh test the conditions were reproduced under which Engineer Doherty testified that he applied the brakes on the day of the collision. His testimony was that he made a service application with 10 lb. reduction when he saw the distant signal at caution, 5 lb. more after running 200 ft. and then applied the emergency. In this test the train ran 2296 ft. before stopping, which carried it 375 ft. further than the point where the rear of the second section was located on the day of the fatal collision.

Our account of the accident last week, made up from such newspaper reports as were then available, stated that according to Doherty's testimony he applied the emergency when only 200 ft. from the rear of the section ahead. The above account would indicate that the brakes were applied very much farther back. In a still later statement, made by the Coroner on opening the session of the inquest on June 20, it is declared that Doherty shut the throttle of his locomotive when 3300 ft. east of the distant signal, that he made a service application of the air brake with 15 lb. reduction when 1200 ft. from the distant signal and an additional service application with 10 lb. reduction when 300 ft. east of the distant signal, and that when he was 500 ft. past the distant signal and 1300 ft. from the home signal he applied the emergency.

There is, of course, nothing but Doherty's testimony to show that he applied the brakes as above stated; and the tests above reported are strong evidence that had he applied the brake at these points the train would have been stopped in time.

We suggested last week that the break-in-two of the colliding train when the emergency application was made at the time of the collision indicated that the brakes on the locomotive might not be holding properly. However, according to the testimony of P. J. Langdon, chief air-brake inspector of the Lackawanna R.R., the brake equipment on the locomotive was all in first-rate condition with the exception of the air-brake pump governor which had become clogged with dirt and required cleaning. Mr. Langdon also testified, however, that on testing the air-brake equipment on the cars he found that the brake on one of the Pullman cars of the train required a 20-lb. reduction in train-pipe pressure to operate. Under these conditions the brakes on this car would not be set at all in ordinary service application and would only be applied by the emergency.

It is of interest to record, however, that when a test was made with the trial train to determine the relative stopping power of the locomotive and the cars, the locomotive being cut loose from the train when the brake

was applied, the result was that the locomotive ran a long distance ahead of the cars before it was stopped. The published explanation is that a pin dropped out of the air-brake gear on the locomotive and rendered the brakes inoperative. It is rather extraordinary that a brake gear on an express locomotive only recently put in service should be in such a condition that an accident of that sort should be possible. One is led to question whether any such thing really happened and whether the real fact was not that the braking power on the heavy locomotive was actually inadequate to exert anything like the stopping power of the brakes on the train.

The time and expense devoted to the investigation of this collision will be well repaid without doubt in the stimulus that it will give to better maintenance of air brakes wherever the news of this investigation extends. It is altogether probable that if an expert investigation were made, there would be found features to be criticized in the air-brake practice of probably half the railway companies of the country.

The air brake is in fact a marvel of mechanical ingenuity in that notwithstanding its exceedingly complicated construction it operates with marvelous reliability over long periods of time with comparatively very little attention. When, however, some such accident occurs as this at Stamford, it serves to call public attention to the fact that the hard-working and comparatively unknown air-brake inspector, engaged in his ceaseless round of oiling and cleaning cylinders and triple valves is rendering a service on whose faithful and conscientious performance the safety of the traveling public depends.

The United States Supreme Court on Principles of Railway Valuation

In the recent decision of the United States Supreme Court on the Minnesota rate cases, some important principles are laid down with respect to railway valuation and its relation to railway rates, which are of especial interest at this time when the valuation of all the railways of the United States is about to be undertaken under the direction of the Interstate Commerce Commission.

In the Minnesota rate cases, several railway companies appealed to the Federal courts on the ground that the rates put in force by the State authorities were so low as to be confiscatory, or in other words to deprive the owners of railway property of their possessions without due process of law. In order to determine whether or not the rates fixed by the State reduced the net return to the owners of the railway below a fair rate of income from their investment, it became necessary first of all to find what was the fair value of the property. The lower Federal courts had already made an estimate of the value of the property, based largely upon the valuation made by the State of Minnesota. Quoting from one of its previous decisions, the Supreme Court says:

> In order to ascertain the fair value of the property, the original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stocks, the present as compared with the original cost of construction, the probable earning capacity under particular rates prescribed by statute and the sum required to meet operating expenses are all matters for consideration and are to be given such weight as may be just and right in each case.

The lower Federal courts, however, in the present case declared that the value of bonds and stocks issued by a company was a wholly unreliable basis for determining the value of the property as a basis for rate making. The Supreme Court approves this viewpoint. In the lower courts, also, much evidence was produced to show the actual cost of construction and equipment of the entire railroad system from its origin down to Apr. 30, 1908. These figures, however, could be definitely shown only by the corporate books and records, and in the early history of the original company, these are somewhat obscure and uncertain and by reason of lapse of time could not be verified by other proof. The lower courts, therefore, held that it was impossible to fix reasonable rates upon the original investment made by the railway as a basis. They took, therefore, as their basis for fixing a reasonable rate, "the cost of reproduction new." On this basis the lower courts found the value for the entire Northern Pacific R.R. system to be $452,666,000, which is considerably in excess of the total outstanding bond and stock issues of the company.

The Supreme Court, however, proceeds to discuss the method by which this valuation or "cost of reproduction new" was arrived at. It appears that in estimating the value of the real estate owned by the company and used for the right-of-way of its railways and for city terminals, etc., that the appraisers took, not the market value of the property alone, but "the value of the property for railway purposes." In other words, the appraisers made a valuation of the right-of-way owned by the company outside of city limits on the basis of the fair market value per acre compared with contiguous lands alongside and multiplied that sum by three. This procedure was defended upon the ground that in condemnation proceedings the company would be obliged to pay somewhat more than the fair market value and would have to bear the expense of the proceedings as well. They would have to pay also consequential damages by reason of removal of buildings and other results of the use of the property for railway purposes. It was also argued, however, that because this land was owned in an entire strip it possessed "a peculiar value for railway purposes" and this seems to have been an important element in making up the valuation. The Supreme Court dismisses this theory of railroad valuation as absolutely unjustified. The Court says:

> The evidence demonstrates that the appraisements of the St. Paul and Minneapolis property were in substance appraisals of what was considered to be the peculiar value of the railroad right-of-way. The railway right-of-way was conceived to be a property sui generis, a large body of land in a continuous ownership representing one of the highest uses of property and possessing an exceptional value. . . .
>
> We hold that it was error to base the estimates of value of the right-of-way, yards and terminals upon the so called "railway value" of the property. The company would certainly have no ground for complaint if it were allowed a value for these lands equal to a fair average market value of similar land in the vicinity without additions by the use of multipliers or otherwise to cover hypothetical outlays. We also think it was error to add to the amount taken as the present value of the lands the further sums, calculated on that value, embraced in the items of engineering, superintendence, legal expense, contingencies and interest during construction.

The Supreme Court further attacks the valuation accepted by the lower courts on the ground that no deduction was made for depreciation. The lower courts defended their omission to make any allowance for depreci-

ation on the ground that depreciation was more than offset by appreciation, that the roadbed was constantly increasing in value, that it becomes solidified, embankments and slopes become settled and stable and that a large part of the depreciation is taken care of by constant repairs, renewals and replacements. The Supreme Court holds that such a rough-and-ready treatment of the matter of depreciation cannot be approved. It says:

> When an estimated value is made on the basis of reproduction new, the extent of existing depreciation should be shown and deducted.

We believe these rulings of the Supreme Court are of great importance in connection with the work of railway valuation now being undertaken. It should be understood that in the Railway Valuation Act, Congress has not fixed any standard whatever on which railway rates may be based. It has simply ordered that an appraisal be made and it has required that both the original cost of the road according to the available records and the cost of its reproduction new shall be determined, together with allowances for depreciation.

In view of the above quoted Supreme Court decision, however, it is clear that the Federal Constitution protects the holders of railway investments from capricious legislation by Congress as well as by the States, tending to confiscate the value of their property. Not only would any attempt to determine the present valuation of a public utility property on the basis of original investment break down of its own weight, but the Supreme Court is now on record as disapproving of this as a sound basis for reasonable rates. The basis of valuation to which the court has now given its approval is "the cost of reproduction new." In many cases the lands and other property owned by the railway have increased in value so that they are now worth ten or twenty times what they originally cost. That is an increment of value which belongs to the owners of the railway just as much as a similar increment in value belongs to any other owners of real estate.

On the other hand, however, rails, rolling stock, buildings, bridges and other property which were bought or constructed many years ago and which have deteriorated in value are to be appraised, not at what they originally cost, but at what they are worth at the present time. Thus far, at least, the recent Supreme Court decision appears to lay a sound foundation for the work of the staff of valuation engineers.

LETTERS TO THE EDITOR

Careful Tamping an Important Factor in Levee Building

Sir—Your editorial in a recent issue entitled, "Wanted: Machinery for Levee Building," makes mention of the possibility of using the cable drag scraper in the construction of river levees. This appears to be about the only machinery equipment now extant having sufficient working radius for the heaviest work, though many sections of the Mississippi system, especially in the lower valley, have been constructed by self-propelling drag-line machines equipped with rather unusually long booms. It is doubtful, however, if we should take it for granted that the day of the drag scraper and mule is entirely past, for this method of levee building has certain advantages over the faster but not always cheaper machinery method.

In April, 1911, the writer witnessed a short but plucky fight against what looked to be a certain crevasse at the Myrtle Grove plantation. The river was not excessively high at that time, but a long continued gale, blowing in line with one of the longest reaches of the lower river had caused the waves to batter down the timber revetment at the angle at Myrtle Grove, and the wash soon cut away the narrow banquette and the front slope of the levee. In spite of the fact that a large force of men was working under most efficient leadership, it was not until the waves had cut entirely through the crown of the levee that the water was checked by the solid material which formed the back slope.

Col. Wilkinson, President of the Myrtle Grove Plantation Co. was in personal charge of the work and stated that the original levee at this point was built by mules and scrapers and was later increased in height and thickness by a dredge which was operated along the banquette. In spite of the severe storm, it was easy to see the line of demarkation between the material that had been compacted by the teams and that which had been placed without this tamping. As the waves cut into the front of the levee, there was usually a break at the junction of the two pieces of work.

There was nothing to indicate, however, that the later work had been done carelessly or with inferior material. In fact, there was no choice of material, nothing but the deposits on the banquette being available. While the force of the waves would undoubtedly have cut through the more solid material had it not been protected as quickly as possible, it is certain that no possible effort on the part of the local forces could have prevented a crevasse if the entire levee section had been as friable as that in the front.

Quite similar conditions existed at the Poydras break of this year. The entire front and crown of the levee was destroyed and a considerable current was running over the top of the remaining portion when the local plantation forces and the construction gang of the Phillips Land Co. saved the situation. The section of this levee was made up the same as that at Myrtle Grove. The portion destroyed would have gone out regardless of whether it was solid material, as the break was evidently due to undercutting; but if the material in the rear portion of the levee had not been well packed, it would not have withstood the erosion of the considerable flow that passed over the top for some time before it could be stopped. This break occurred at the time when the river was nearly at its maximum height and if it had not been

stopped, the loss would undoubtedly have been tremendous.

The levee which is built by machinery or by wheelbarrows is sufficient under favorable conditions if properly constructed; but it will not stand up against unusual currents as will the levee that is built by the team and scraper method. It would probably be impossible to get together team outfits that could handle the material that should be placed in the Mississippi River levees in the next few years; but it is probable that the advantages of more substantial levees would justify an extra expense in special instances where conditions are favorable for team work or where exposure to erosion is specially severe.

A. M. Shaw.

New Orleans, La., June 10, 1913.

[The advantage of thorough compacting of a levee embankment is well set forth by our correspondent. We may point out, however, that material placed by cars or drag scrapers may be compacted by rolling with grooved rollers as is commonly done in earth dam construction.—Ed.]

Machinery for Levee Building

Sir—Referring to the editorial in your issue of June 5, "Wanted—Machinery for Levee Building," the statement that practically all the levees on the Mississippi River have been built by either hand power or horse power is misleading. At the present time there are engaged in levee building on the Mississippi, a large number of most efficient earth-handling machines such as drag-line scrapers, orange-peel excavators, gasoline-driven loaders, etc.

Articles frequently appear in the public press urging the use on levee building of the plant now engaged in the construction of the Panama Canal, on the assumption that with these machines levees could be built for a much lower cost than that at which they are now being built with present appliances. That this impression is erroneous, the following figures will, I think, show.

The Fourth District, Mississippi River Commission, New Orleans, purchased in 1908 a McMyler Levee Building machine with 74-ft. boom operating a 2-yd. bucket in certain classes of material, and in others a 2½-yd. bucket. Since the purchase of this machine it has constructed 709,255 yards of earthwork at a cost of $83,068, or about 11.712c. per cu.yd., including all charges for repairs, maintenance, operation, depreciation, interest, superintendence and proportional share of office expenses. During this same period the average cost of work done by contract under this office, considering the contract price only without other overhead expenses, has been 21.66c. per cu.yd.

From the above figures it will be seen that any other machinery proposed for levee building work, either that at Panama or elsewhere must be of a very efficient type in order to compete successfully with the machinery now in use under this office. The general public imagines that the levees can be built most economically with steam shovels such as are used at Panama; but a steam shovel can only be used in levee building when operated in connection with cars, engines and railroad tracks; and inasmuch as the earth to be moved is in nearly all cases taken from the immediate front of the levee to be built, the impracticability of the steam shovel is evident. There are certain cases, however, in which steam shovels and railroad equipment can be used to advantage, notably in the closure of crevasses where material must be hauled for considerable distances.

What is most urgently needed for levee building along the Mississippi River, especially above Old River where the specifications require a very wide, flat pit and where the levees are so large of section that drag-line and orange-peel machines are not adapted to the work, is some form of machine capable of excavating material and conveying it two or three hundred feet at one operation.

For and in the absence of C. O. Sherrill, Captain of Engineers, U. S. A

J. D. Schmidt, Chief Clerk.

New Orleans, La., June 17, 1913.

Concerning Advertising by Engineering Schools

Sir—I received a few days ago a bulletin from Harvard University describing the courses of study in sanitary engineering. It is fine reading and makes older engineers envious of the young men who can attend such schools and receive the benefit of the instruction there given. On page 16 appears the following:

> The sanitary specialist needs extensive laboratory experience and practice in research, while the engineer needs to work with his surveying instrument, his drafting board and the other tools of his profession. The demand for young sanitary engineers is continuous and increasing. There is little doubt but that men who enter this field will find useful service and a competent livelihood.

Your attention is called to the second and third sentences in the above paragraph. Is it necessary for an institution of such high standing and so well known to advertise in this way to attract students? Can the statements made be substantiated? It is well known that the demand for *young* men trained in engineering schools is fairly good, no matter what specialty they took in school. So is the demand for *young* stenographers and bookkeepers. The reasons are the same in all cases, the fact being that in all work of a clerical, or semi-clerical nature, the beginner is nearly always assured of temporary employment at least.

My observation has been that as a specialty to pursue in school, sanitary, and municipal engineering generally, can hardly be so well recommended as structural engineering. The majority of engineers in private practice in Chicago are engaged in structural work and some of them employ a considerable office staff. The few engineers who specialize in sanitary and municipal work do not employ so many men and the work is more fluctuating. I know that the average pay is better in the offices of structural engineers.

Young men come into my office almost every day seeking employment and they represent first-class schools in all parts of the country, but especially schools in the vicinity of Boston and New York. Those most dissatisfied with conditions of employment and pay are the young men who took highly specialized courses, especially in sanitary work. In large cities positions are gained through civil service examinations and in smaller municipalities the city engineer and his staff are the prey of politics. It is not dignified for a university like Harvard to make statements calculated to attract young men toward a certain line of study with assurances as to their

earning power. It should be sufficient to establish a first-class course of study and let it be known. To make statements to the effect that a demand exists for men in any line of work smacks of the methods of business colleges.

ERNEST MCCULLOUGH.

Chicago, Mar. 20, 1913.

NOTES AND QUERIES

F. H. J., Roxbury, Mass., writes:

I should like to ascertain from the experience of other engineers expressed through your valuable columns if the process of grouting the bed of an artificial pond having a sand and gravel bottom was ever successfully practiced as a method of preventing excessive leaching of the water through the bottom, and if accomplished what were the methods used and the approximate cost?

The proposition in question is the prevention of excessive leaching in a shallow reservoir situated on a gravelly plateau which is to be used for storage of water for irrigation. The area of the reservoir is to be four to five acres.

Annual Convention of the Master Car Builders Association

The 47th annual convention was held at Atlantic City, N. J., June 16 to 18, closely following that of the Master Mechanics Association (reported in our issue of June 19), and with an attendance comprising very many of those who were present at the former convention. The meetings were held in the assembly room on Young's Pier, and on this pier was the extensive exhibit of railway equipment, material and appliances which is such a striking feature of these allied conventions.

At the opening session on June 16, the annual address was delivered by the President, C. E. Fuller (Union Pacific Ry.). This dealt largely with matters relating to car interchange and matters touched upon in the various committee reports. He urged caution in making recommendations for improvements in car construction and car service. While such improvements are important and in the main necessary, the association should carefully consider whether they may unduly increase the cost of car operation and maintenance. The report of the Secretary, Joseph W. Taylor (Chicago) showed that the total membership is 879, and that the total number of cars represented is 2,713,650.

Car Couplers and Draft Gear

The car coupler is again in a stage of development, owing to the variations and special features which have been introduced in the too numerous designs, though all of the designs conform to the standard contours of coupling parts. The number and variety of couplers are causing increasing trouble, but as these special features are covered by patents, there are difficulties in arriving at a uniform standard design. The Committee on Coupler and Draft Equipment was instructed last year to proceed with the design of an M. C. B. standard coupler, working in conjunction with the manufacturers and using as few as possible of the patents now in force. The committee's report consisted mainly of descriptions of an extended series of tests and a review of the proceedings of several meetings held by the committee jointly with representatives of the manufacturers. The conclusions arrived at are that the present coupler is of inadequate strength, and that the required increase in strength will necessitate increasing the weight of the coupler 30 to 40%.

The committee made an exhibit of designs of couplers embodying the specifications agreed upon by the railway representatives and the manufacturers, the latter having designed the working parts according to their ideas to meet the specifications. From these designs couplers will be selected for service test to determine the strength, the efficiency of operation and the best contour lines, with a view to harmonizing the designs and eliminating details that prove unsatisfactory. It is recommended that until these service tests are made and certain couplers selected for trial, the railways should not apply other new or experimental types of freight couplers.

It was stated that the committee will probably be able to present a design for a standard coupler at the 1914 convention.

Cars and Car-Dumping Machines

The increasing use of car dumping or unloading machines (by which the car is tilted in a cradle), for handling coal and ore, etc., has developed special features of damage to cars handled in this way. A committee appointed to investigate the matter stated that the machines are of two types: (1) the floor carrying the track is shifted transversely to bring the car against the side of the cradle; (2) the side of the cradle is moved inward to come in contact with the car. In the first case, the damage occurs when the car is tilted, as it has not a proper bearing, and such parts as hand-holds, ladders, staples and door-operating mechanism are damaged by coming in contact with the cradle. In the second case, damage is done by hydraulic clamps crushing in the sides and bending down the top of the car, while parts of the floor framing outside the rails are likely to strike the column bolts of the trucks.

To prevent such damage, the cradle (in either class of machine) should be faced with 10-in. timbers, spaced far enough apart to allow any loose material to fall through, and cut away at certain points so as to clear projecting appliances on the side of the car and afford a full support to the car when the cradle is tilted. On machines of the second class, care must be taken also to provide against the present excessive pressures. Railways should see that these remedies are applied to car dumpers at steel works, etc. In designing new cars, consideration should be given to the possibility of their use on car-dumping machines. Other machines and appliances used in loading and unloading cars will be considered in a later report.

In the discussion, several speakers referred to their experience with cars damaged in this way. In the discussion on car trucks, also, it was stated that the tilting of cars in these machines disturbs the bearing so that the waste in the journal boxes is likely to get into the bearings and cause the cars to develop hot-boxes.

Steel Freight Cars

A rather surprising matter brought out by the Committee on Car Construction was the lack of strength in some new steel cars. This was substantiated by several speakers who recorded their experience with such cars, many of which sustain damage in ordinary road and yard service. Under a rule relating to car repairs it is as-

sumed that an all-steel car or a car with steel underframe is strong enough not to be damaged in fair usage, and consequently the handling road is made responsible for the cost of repairs. But it appears that in some recent designs the center-sill section has been so reduced (to save weight and first cost) that the cars are no stronger than (if as strong as) the wooden cars. Yet under the above rule, the owner is protected against repair expenses, which is manifestly unfair.

The committee recommended that existing steel or steel-underframe cars that do not meet the following requirements should be classed with wood cars and subject to the same rules of repairs: (1) cross-sectional area of center sills should be not less than 16 sq.in.; (2) ratio of stress to end strain not less than 0.09; (3) the length of center or draft sill members, or part of member between braces, to be not more than 20 times the depth of the member, measured in the direction in which buckling might take place. For new cars, greater strength should be required, in view of the developments in heavier locomotives, rougher handling of cars, etc. For such cars, the sill area should be not less than 24 sq.in., the ratio of stress to end strain not more than 0.06, and the unbraced length as above.

The discussion showed a general opinion that it is time for the Association to take definite action in this matter and specify certain minimum requirements. The committee's recommendations will be submitted to letter ballot.

Box Cars

The report of the Committee on Car Construction stated that an investigation of repairs to box cars indicates that wood ends without reinforcement are not strong enough for present conditions. Metal ends and metal reinforcement have been found satisfactory. The committee recommended that the ends should be reinforced with steel plates and cross braces on wood cars, and with braces on steel-underframe cars. New cars should have steel ends, and such ends should be applied also to cars with wood superstructure requiring complete renewal of ends.

End doors in box cars are causing trouble from the difficulty and danger of sealing them and inspecting the seals. Some roads are now omitting them from new cars, and nailing them up on the old cars. They are only required on roads handling long lumber in comparatively short cars, and will become obsolete with the advent of the 40-ft. box car. If used, they should be made to lock automatically when closed, with a lock accessible only from the inside, thus avoiding the necessity of seal records. Seal appliances should be accessible from the ground or from the end ladder.

One member pointed out that in ventilated cars for fruit and vegetables end doors are required at top and bottom for ventilation. And as these doors have to be open for part of the trip and closed for the rest of the trip (to regulate the ventilation according to the change of climate) they cannot be made to lock automatically on the inside. Mr. Hennessey (C. M. & St. P. Ry.) referred to the end doors of automobile cars, which form practically the entire end of the car. The committee saw no reason why these should not lock automatically on the inside when closed, in which case seals would be required only on the side doors. However, it was decided that the committee had been considering lumber more especially in regard to end doors.

The Committee on Inspection of Box Cars referred to the necessity of inspecting cars before loading them, with special classes of freight, to avoid claims for damage to freight due to leaky roofs, dirty floors, projecting rails, etc. The practice of several roads in this respect was described. Several members thought this a matter for the operating department, and it was decided to refer it to the American Railway Association, which originally requested its consideration.

Tank Cars and Refrigerator Cars

This committee report related to special designs of cars for carrying special fluids, such as liquified chlorine gas, liquified petroleum gas, bisulphide of carbon, sulphuric acid, and ammonia solutions. It presented also some minor changes in the present specifications for tank cars. As to the tests of these cars and their safety valves, the committee recommends that a certified record of the tests should be filed with the U. S. Bureau of Explosives, owing to the importance of such records in case of lawsuits relating to damages. The report was approved, and it was decided to see if the plan of piling records of tests would meet the approval of the Bureau of Explosives.

The question of preventing damage from brine droppings from refrigerator cars has been a problem for both the engineering and the mechanical departments of railways. The private car companies have agreed to equip these cars with tanks to retain the brine, instead of allowing it to drip upon the track. At the special meeting to consider the rules of interchange, representatives of these companies protested that the M. C. B. Association has not allowed time enough for making the necessary changes. The working out of the details has been left to the companies, and they have tested different devices, many of which have proved unsatisfactory. In addition, the changes involve considerable expense. They asked that the date for having all cars equipped be extended from Sept. 1, 1914, to Sept. 1, 1916, but it was decided to extend it only to 1915.

Freight Cars of Light Capacity

A matter submitted for topical discussion was the advisability of withdrawing from interchange service all cars of 40,000 and 50,000 lb. capacity, and restricting their use to their owning lines. This developed a very brisk discussion with opinions about equally divided. Mr. Hennessey (C., M. & St. P. Ry.) and Mr. Schroyer (C. & N. W. Ry.) objected strongly to the proposition, claiming that many of the light-capacity cars are as strong as, if not stronger than, many of the larger modern cars of high capacity. Also, that railways are bringing these cars up to the requirements of modern train and yard service, and that it would be a very serious matter to require roads having many such cars to withdraw them from interchange service.

On the other hand, Mr. Crawford (Pennsylvania Lines), Mr. Barnum (B. & O. R.R.) and Mr. MacBain (L. S. & M. S. Ry.) thought that in general the light-capacity cars mixed with high-capacity cars are a menace to the safety of trains, and that it is very poor economy to try and put these old cars in condition to meet modern operating requirements. Mr. Gaines (C. of Ga. R. R.) said that when his road receives a car of less than

60,000 lb. capacity it transfers the load to another car, believing this to be more economical than to handle the light car.

Another member approved of the idea, but thought it outside the province of the Association, and that the matter should be taken up with the higher officials, or referred to the American Railway Association for its opinion in the matter. Mr. MacBain (L. S. & M. S. Ry.) remarked that while his road aims to keep its own equipment in good condition, 47% of the cars on its lines are "foreign" cars, and some 80% of the draft-gear failures occur in these foreign cars. Other speakers referred to similar experiences. It was voted to appoint a committee to make inquiry as to the number of light-capacity cars on individual railways, with a view to submitting to the American Railway Association the proposal to prohibit the use of these cars in interchange traffic after 1914.

Trucks, Wheels and Axles

The Committee on Car Trucks presented a report of progress as to the design of cast-steel truck frames and bolsters for cars of 80,000 to 140,000 lb. capacity, and expects to be able to submit a design for the bolster next year. It is making tests also of arch-bar frames. Another committee has to deal with specifications for cast-steel frames and bolsters, but has not been able to make its proposed tests. It was suggested that the two committees should work together. It has been claimed that under emergency applications of the quick-acting brake, there have been cases of axle failures and a tendency of the journal to roll out under the edge of the bearings. To avoid this trouble on passenger cars, the brakeshoe may be lowered or clasp brakes may be used, but the latter are too expensive for tenders or freight cars. It was suggested that it might be desirable to remedy the trouble by altering the depth of the journal bearing.

The Committee on Car Wheels submitted additions to the specifications (adopted last year) for wrought-steel wheels, and these will be submitted to letter ballot, except that the proposed limits for segregation will be omitted. The specifications provide for openhearth steel, and for chemical composition as follows:

	Acid Steel	Basic Steel
Carbon	0.60 to 0.80	0.65 to 0.85
Manganese	0.55 to 0.80	0.55 to 0.80
Silicon	0.15 to 0.35	0.10 to 0.30
Phos. and sulphur (each)	max. 0.05	max. 0.05

The discussion brought up the question of shape of wheel tread, and Mr. Garstang (C., C., C. & St. L. Ry.) referred to a suggestion of P. H. Dudley (New York Central Lines) that the present taper of 1 in 20 be changed to 1 in 38, to prevent carrying an excessive proportion of the load on the inner side of the rail head. He referred also to the request of the makers of cast-iron wheels that in wheels for high-capacity cars they should be allowed to increase the thickness of the flange by 1/8 in. (the metal to be added on the back of the flange). The objection to this is the probable interference of the thicker flange (when the wheel tread is worn) with the flangeway of frogs, switches, guard rails and crossings. The present prescribed width of flangeway is 1¾ in., and a motion was carried to request the American Railway Association to consider increasing this to 1⅞ in. to accommodate the thicker wheel flanges. This is a matter in which the maintenance-of-way department should be consulted before any definite decision is made, although the discussion included no reference to this side of the question.

As to the taper of the tread of the wheel, it appears from the discussion that wheels of different taper are being tried (with diverse results) while at least two roads have tried cylindrical treads. On the Lake Shore & Michigan Southern Ry. the results were unsatisfactory, while on the Chicago, Milwaukee & St. Paul Ry. they were satisfactory. The plan was abandoned, however, on this latter road, the standard form of wheel tread being adopted for the sake of uniformity.

Air-Brake Equipment

The report of the Committee on Brake Shoes and Brake Beams, presented by Prof. Benjamin (Purdue University), recommended further tests on the shoes tested in 1910, in order to furnish data for high-pressure specifications, these tests to be made at a speed of 65 m.p.h. and at pressures of 9000 to 12,000 lb. It also recommended: (1) a standard spacing of 60 in. (instead of 60¼ in.) for brake-beam heads, as the latter allows the brake-beam to shift; (2) the consideration of a specification for a brake-beam for passenger cars. It was decided that the brake-shoe tests should be continued as suggested, and that the two recommendations should be approved, although there was some objection to the first. The report presented in an appendix the results of the brake-shoe tests made at the laboratory of the American Brake-Shoe & Foundry Co., by the New York Central R.R.

The discussion developed the fact that a proposed recommendation as to the brake heads involves certain patents, and this question will be considered by the Executive Committee before sending out the recommendation for ballot.

The Committee on Air-Brake Hose submitted specifications and recommended the discontinuance of both the labels now used. The calendar label, which is intended to show the dates of application and renewal, is seldom used; the label indicating that the hose is M. C. B. standard involves unnecessary expense. A single label of new pattern was recommended, but quite a different label was proposed by the Committee on Train Brake and Signal Equipment. This latter was withdrawn, however, and the questions of adopting the new specifications for hose, the new label, and a specification for gaskets, will be submitted to letter ballot.

This latter committee presented other recommendations as follows: (1) all freight cars weighing 37,000 to 58,000 lb. to have 10-in. brake cylinders, the braking power to be 60% of the light weight of car (based on 50 lb. per sq.in. cylinder pressure), and a total leverage ratio of 9 to 1 not to be exceeded with the above cylinder and pressure; (2) a standard triple valve for all freight cars is desirable, and the K-1 and K-2 are recommended for 8-in. and 10-in. equipments; (3) on account of the increased weight and length of passenger trains, no brake pipes less than 1-in. diameter should be used, and new equipment should have 1¼-in. pipe; (4) the ends of the brake pipe should be supported by swinging clamps and hangers, so that there will be no trouble from hose parting while a train is passing through crossovers or sharp curves; (5) galvanized pipes and fittings should be used on coal and refrigerator cars to prevent corrosion by acids and brine.

Mr. Schroyer (Chicago & Northwestern Ry.) objected to the limitation of the present 8-in. brake cylinders to cars of less than 37,000 lb. weight, as imposing undue expense for new material and the scrapping of material which is still good. This view was not supported, however, and it seemed to be the general opinion that modern trains and train service demand the use of the 10-in. cylinder. The report was accepted, except as to its recommendation of a label for brake hose (noted above).

Car Heating and Lighting

The Committee on Train Pipe and Connections for Steam Heat presented specifications for steam-heat hose and couplings. Last year its specifications for hose were rejected. For the coupler it preferred the medium to the large size, as there is so little difference in the openings that it does not affect the passage of steam through the train line. The Committee on Train Lighting submitted the following: (1) designs for car axles for the application of pulleys from which dynamos are driven; (2) general design for axle-dynamo suspension, providing a minimum clearance of 6 in. above the rail and 3½ in. from any mechanism attached to the car body; (3) a standard design for battery boxes on cars.

Car Interchange

The rules affecting the handling and repair of cars (railway and private) in interchange between various railways are of great importance as affecting the facility of through traffic. As noted already, a special session was devoted to the consideration of proposed revisions in the rules of interchange, such as are presented annually. The meeting was a very protracted and animated one. The discussion was mainly in regard to the relation of the revised rules to private or non-railway cars, the representatives of which claimed that they would be affected adversely. After extended discussion, however, the revisions were adopted practically as suggested by the committee.

The abuse of the repair card and the billing of the railways of excessive repair costs were discussed, and while some speakers thought that such trouble existed (due perhaps to the repair-men not having full knowledge of the cost of repairs), others thought that such controversies simply waste time. There is no question of dishonesty, and if railways will build cars well and see that they keep them in proper repair they need not fear excessive bills. The Committee on Prices for Labor and Material submitted certain changes in the prices allowed for repair work, and these were adopted, with the exception of certain allowances for depreciation.

Miscellaneous

The Committee on Revision of Specifications submitted suggestions for securing uniformity in style of the various specifications, on the line of the standard adopted by the American Society for Testing Materials. Supplementing this, it submitted a number of the present specifications revised as to style and wording. The committee recommended also that the specifications for wrought-iron axles be discontinued, as material of this kind is no longer purchased in large quantities. There was some objection to this, as when the same suggestion was made at the Master Mechanics convention, but the matter will go to letter ballot. The Committee on Revision of Standards presented a number of minor changes. The Committee on Safety Appliances made a brief report as to the work of the railways in meeting the requirements of the new law, and was instructed to inquire as to the possibility of getting an extension of time for the application of certain appliances. The Committee on Rules for Loading Long Material submitted some changes in the rules, including the loading of such flexible material as long steel plates extending over three cars (flats or gondolas). Its rules related also to the loading of machinery and automobiles.

Officers

The election of officers resulted as follows: President, M. K. Barnum, General Mechanical Engineer, Baltimore & Ohio R.R.; Vice-Presidents, D. F. Crawford, Pennsylvania Lines; D. R. MacBain, Lake Shore & Michigan Southern Ry.; and R. W. Burnett, Canadian Pacific Ry.; Treasurer, J. S. Lentz, Lehigh Valley R.R. The Secretary is Joseph W. Taylor, Chicago.

Annual Convention of the American Society of Civil Engineers

The annual convention of the American Society of Civil Engineers was held at the Chateau Laurier at Ottawa, Canada, June 17 to 20. The attendance was fair, but not large. The features of the convention were the presidential address, a discussion of proposed amendments to the Constitution of the Society, illustrated addresses on Canadian Engineering and various receptions and rides about the city, the whole followed by a trip to Montreal on June 20, and an inspection of the Montreal Harbor. The Ottawa members of the Canadian Society of Civil Engineers entertained at lunch and gave an evening reception. A garden party was given by Past-President Thos. C. Keefer and a tea by Mr. and Mrs. Collingwood Schreiber.

The address of the President, George F. Swain, of Harvard University, was a scholarly, but virile consideration of some of the leading social tendencies and problems of the present day, and of the duties of the engineering profession toward them and suggestions as to the part the Society might and should take in correcting evil tendencies and solving social problems. An abstract of the address appears elsewhere in this issue.

The subjects of the addresses on Canadian Engineering work, all illustrated by lantern slides, were: "Canadian Water Transportation," by C. R. Coutlee, Engineer-in-charge of the Upper Ottawa Storage branch of the Public Works Department; "Railway Transportation," by R. F. Uniacke, chief bridge engineer of the Transcontinental Railway; "Water Powers of Canada," by J. B. Challies, Superintendent of Water Power, Interior Department; and the Toronto Harbor and Park Improvements, by Mr. Molliter, of the Toronto Harbor Commission.

Proposed Constitutional Amendments

Two groups of amendments to the Constitution came automatically before the convention, for amendment or for reference to a committee before the amendments go to letter ballot. The first group related to the status of the Secretary; the second, proposed to increase the

number of geographical districts from 7 to 13 and to prescribe that in addition to five past-presidents the nominating committee (now appointed by the Board of Direction) be elected, one from each of the 13 proposed districts. The first group of amendments would alter Articles V and VI and the second group Article VII of the Constitution. The amendments, however, were taken up in reverse order, thus reserving a consideration of the status of the Secretary to the last place.

No amendments were made to the amendment designed to increase the number of districts from 7 to 13, so that amendment, we understand, will go to letter ballot. The proposition to elect the nominating committee by districts led to the random discussion and parliamentary tangle, which generally occurs when a constitutional amendment comes before a meeting of the Society.

On motion of Allen Hazen the tangle was finally referred to a committee of five, to be appointed by the chair, and to report at the January business meeting.

This group of amendments, having been disposed of in two batches, the other group, altering the status of the Secretary, was taken up. At this juncture the Secretary read a letter of protest against both groups of amendments. This protest, which was distributed in printed form, was signed by 762 members, of whom 64 were now or had once been members of the Board of Direction. Of the whole 762 protestants, 358 are in the resident district (New York and vicinity) and 404 are nonresidents, "widely distributed."

On motion of Past-President, John A. Bensel, this group of amendments was also referred to the committee already provided for.

We reprint the letter of protest in full, but without the signatures:

To the Business Meeting of the Annual Convention, American Society of Civil Engineers:

Under date of Apr. 30, 1913, several proposed amendments to the Constitution of the Society were sent in regular course to the members. They consist of two groups, one of which changes the status of the Secretary by removing him as a member of the Board of Direction, and adds other details as to the method by which he shall be elected; the other changes and fixes the details of the procedure for electing members of the Nominating Committee, and incorporates these details in the Constitution, taking them out of the hands of the Board of Direction, and the final action away from the annual meeting.

The undersigned believe the adoption of these amendments inimical to the best interests of the Society for the following reasons:

1. No amendment to the Constitution should be adopted, or even proposed, unless there is some necessity for it.

2. The first group, if adopted, will lessen the importance of the office of Secretary. If it is intended that the Secretary shall be only a clerk, why should he be required to be a Corporate Member of the Society?

Under the requirements of the Constitution, which the proposed amendment does not change, the Secretary is the Executive Officer of the Society, and, as such, must represent it as other scientific, governmental and secular organizations are represented. He is required also to be a correspondent, a librarian, a house and office manager, an editor, a publisher, an accounting officer, and the everyday representative of the Society. His duties must be performed with care and thoroughness, and he must have executive capacity and good business judgment, as well as literary ability and familiarity with the broad field of Engineering.

3. As long as these are the requirements of the position it is evident that the Secretary should continue to be a member of the Board of Direction, as he has been since the organization of the Society.

Prior to 1895 the Secretary was elected by the membership. This method proving unsatisfactory a change was made, and, beginning with that year, the Secretary has been elected by the Board of Direction. The present Secretary was the first elected under this rule, and has since been re-elected annually. This continuity of service has been of great value to the Society as is evidenced by the annual reports of the board during this period. As the board is entrusted with the management of the affairs of the Society, and is largely dependent on the efficiency of the Secretary, there can be no question but that the present method of election is based on sound business considerations. The approval of the Board of the conduct of the business of the Society at the present time is evidenced by a report of the present Finance Committee published in the April, 1913, number of "Proceedings."

The other group of amendments proposes to incorporate in the Constitution a fixed method of election of members of the nominating committee.

1. By the present method, suggestions received from the various geographical districts are presented to the annual meeting, and that meeting appoints the committee. The details of securing these suggestions are in the hands of the Board of Direction. It is now proposed that instead of receiving suggestions, ballots be issued, said ballots to be canvassed by the Board of Direction, and the result reported to the annual meeting.

2. In the past it is believed that the suggestions received have not in many cases reflected the sentiments of a majority of the members in each district, and that under the proposed amendment it may happen that a very few members in a district may thus name a member of the nominating committee.

3. There have also been some indications in recent years of the use of log-rolling methods in the selection of members of this committee, and the power now reserved to the Society in annual meeting may be useful to correct this growing evil.

4. It is poor policy to put details of this kind into the Constitution, and the present procedure should be considered as under trial, and the Board of Direction should be left free to improve it as need arises.

We therefore recommend to the membership that these amendments, which, under the Constitution, must be issued for letter-ballot, be defeated.

The only particularly significant point in the amendments affecting the Secretary which have not been brought out here are that under the proposed amendment the salaries of the Secretary and Treasurer would be fixed by ballot by a majority of the whole Board of Direction, whereas now the Constitution merely provides that the salaries shall be "determined by the Board of Direction." [It appears that when the salary of the Secretary was last increased (recently, from $10,000 to $12,000 a year) that the vote of the Board was actually taken by letter ballot (15 to 14), although not required by the Constitution.]

Other Business

The report of the Board of Direction covered a number of interesting points. The Board recommended that hereafter the author of each paper to be presented to the Society shall submit with the paper a digest of its contents and a summary of conclusions. Every author of a paper is urged to present his paper in person, or else to give 30 days' notice that he will not do so, and in that event to choose someone to read the paper for him. Authors are also urged to suggest persons to discuss their papers. A grouping of papers by subjects is suggested. Hereafter lantern slides will be made at the expense of the Society.

Acting on recommendations submitted to it, the Board of Direction voted on June 4 to appoint committees, of five each, on Uniform Water Laws and on Floods, and against creating a committee on Ideal Building Codes for American Cities.

The Board has under consideration the appointment of a Committee on Rails, to act jointly with the American Railway Engineering Association.

The business meeting referred to the Board of Direction a communication asking whether the Society

should approve or disapprove propositions for the regulation of engineers and for other schemes designed to improve the status of the engineer.

The Secretary announced that Col. Geo. W. Goethals has agreed to accept the presidency of the International Engineering Conference, to be held at San Francisco, in 1915. The Secretary also announced that the canvass for suggestions for the next summer convention of the Society had shown Chicago to stand first on the list *with a grand total of 43 votes.*

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Some Tendencies and Problems of the Present Day and the Relation of the Engineer Thereto*

BY GEORGE FILLMORE SWAIN†

We are living in a most remarkable age, an age different from any that has preceded it in the history of the world, and one in which changes are taking place with marvelous rapidity. As a profession, we are largely responsible for the present conditions, and as such we should do our part in solving such problems as exist, and in helping to direct aright the tendencies of the day. We have a duty to ourselves, to our profession, to society, and to our successors, and we must perform it.

We have been often reminded of the fact that in one sense engineering is the oldest of the professions, since engineering constructions of some form are necessary even in the rudest communities. But in another, and perhaps a truer sense, it is the youngest of the professions.

Civilization, as we know it today, then, seems to me to be due mainly to the engineer, or applied scientist, using the term in its widest sense. Of course, a great ethical advance has also been made, of which any student of history must be fully conscious. But when we consider that moral principles were known and recognized by the ancients, in as perfect a form as that in which they can be stated today, without producing much of any widespread ethical progress or any advance in civilization for many centuries, we must, I think, conclude that it is the dissemination of intelligence, the facilities for transportation, the development of machinery, which have made the whole world kin, and thus have been the chief elements in promoting the universal brotherhood of man and the practical recognition of human rights, and so have been the main agents in the progress of civilization.

The political and social evolution in the past has up to a comparatively recent period, not involved any diminution of the incentive to individual effort, nor to any great extent the attempt to deprive the individual of the fruits of his industry and ability. Of late years, however, with growing political power in the hands of the less intelligent classes, symptoms of a change have shown themselves. The spectacle of isolated instances of great wealth acquired unfairly or too rapidly, and of rewards out of proportion to service, instead of being looked upon as necessary phenomena, seeing that men are human, and that no human affairs can ever be perfect, has led to a widespread spirit of envy and discontent, and sometimes to a desire to deprive men of the results of their honest toil.

It is to some unfavorable phenomena incident to this movement that I wish to call your attention today, believing that if they continue, disaster may result, in which case, as always, the suffering will mainly come upon those least able to bear it.

1. In the first place, let me refer to the tendency to consider men equal, or to what I may term a false democratic ideal.

What I conceive to be the true democratic ideal is this: that all men are equal before the law, so that neither differences in wealth, race, social position, nor talent shall confer any advantage or impose any disadvantage in the impartial administration of justice; that while ability may be admired, every man who is honest, industrious, sober and faithful, and who does his work in the world as well as he can and with due regard to the rights of others, is deserving of equal respect and regard, whether he occupy the humblest or the most exalted position; that success depends upon the spirit with which one's natural endowments are utilized and the degree to which they are developed, and not upon those endowments themselves, so that the humblest laborer on the street may be making as great a success of his life as the most gifted; that there should be kindliness and a spirit of brotherhood between all men and neither envy of those more capable, who receive greater rewards, nor contempt of those less gifted, who do the menial work of the world; and that neither race, poverty, nor inferior social position should prevent the possibility that a man, by hard work, integrity, and conscientiousness should be able to reach, by some available ladder, a position commensurate with his abilities. A man should be judged by what he is, not by what he has, whether he is black or white, or who his grandmother was. He should have the opportunity to get such education as best fits his natural qualifications. Rich and poor should be judged by the same standard—inherent worth. But though respect should be equal, rewards should not be, but should be in proportion to the value of the service, and governed by the law of supply and demand; nor are great rewards necessary for happiness.

Unfortunately, a democratic government, especially with universal suffrage, instead of tending to the realization of this ideal, tends in some respects directly away from it, and leads not seldom to the grossest perversions of it. The equality of man, which the framers of the Declaration of Independence held to be self-evident, instead of being interpreted as above, is held to mean that men are inherently equal in all respects.

It is self-evident that instead of being equal, men are very unequal. There is perhaps more difference between the most intelligent and the least intelligent voter than there is between the latter and an intelligent animal. It is held that all, being equal, should have equal opportunity. But why should there be equality of opportunity for unequal individuals? Inequality of opportunity for unequal men is a nearer approach to true equality than equal opportunity for unequal men. Why, for instance, should all men have opportunity for a college education, when only a few can profit by it, and the great majority should work with their hands, not with their heads? Not every man who is able to pass successfully through a college course is able to use it when he has finished, and many a good mechanic has by its means been spoiled to make a poor and discontented clerk or lawyer.

One of the conditions of individual progress is the willingness to recognize and admire superiority, and without envy to rejoice in its success. The idea of the equality of man limits this recognition, and so hampers individual progress, and therefore collective progress. In college, there is little in class associations to stimulate a man to excel. If he does, he is termed a "grind" and is looked down upon. If all men are equal, he has no right to exhibit any superiority to his fellows. The same is true among the so called laboring classes. No man must do any more work, or do it any better, than another. Individual excellence and initiative are discouraged. Indeed, individual freedom is not seldom infringed upon, and a man is not allowed, at times, to work at wages satisfactory to himself, when he desires to do so—a strange result of freedom, and in reality as great an outrage as any that can be quoted from the mediaeval annals of despotism. With growing discontent, many minds turn to socialism, that impracticable Utopia which, as President Butler has well said, "would wreck the world's efficiency for the purpose of redistributing the world's discontent."

The idea of the equality of man, instead of allowing the best men to govern and fitting the man to the proper vocation, leads to the placing of unfit men in power, the control of large masses of men by demagogues, the judging of men by the number of votes they can control; and thus it leads to the withdrawal of many of the best men from active participation in public affairs, because they see how little influence they can exert, and that the only reward of one who unselfishly serves the public is likely to be criticism and contumely. It also discourages loyal and faithful service, and makes difficult the maintenance of proper relations between employer and employee.

What the ultimate result will be, cannot be foretold. The political doctrine of the equality of man is still on trial. Yet, as regards the United States, where that doctrine has its present expression, Lincoln long ago observed that if it fails, it will not be on account of interference from without, but it will be by suicide. It behooves us, therefore, if we can, to see to it that our institutions shall not fail by suicide.

Nevertheless, it is a somewhat striking fact that several of the most philosophical and learned historians have distrusted the ultimate success of our institutions. Froude, Macaulay and Lecky all express the gravest doubt of the permanence of our form of government

*Condensed from the annual address before the American Society of Civil Engineers, Ottawa, Canada, June 18, 1913. The portions of the address consisting of "applications" to engineering, the engineer and the American Society of Civil Engineers are given nearly in full, but the review of "Tendencies" is necessarily abbreviated under each of the subheads.

†President, American Society of Civil Engineers; Professor of Civil Engineering, Harvard University, Cambridge, Mass.

Unfortunately, it is a vain hope that there will ever be an absence, or even a dearth, of demagogues to stir up this spirit of unworthy discontent, but we should do all in our power to counteract it. Unfortunately, much of it is due to the unwise use of wealth by those who possess it, who think that money can buy everything, and is the end and aim of existence and who, instead of being governed by a feeling of the brotherhood of man, and the spirit of respect for true worth even in the humblest occupations, assume an attitude of superiority, or even of insolence, toward those less fortunate than themselves.

2. The Tendency to Disregard Authority. Out of the tendency to look upon all men as equal, spring some other tendencies to which I will refer. One of them is to disregard authority, and to consider that one man's opinion is as good as that of any other. We see this tendency about us every day; it leads to intellectual arrogance, dogmatism and lawlessness.

Every man has presented to him, almost daily, questions which he is not competent to decide for himself, either because he has not had the necessary time, training or experience, or because he is incapable of judging.

In these days when literature is so superabundant, it is most important to choose our advisers wisely, to know whom to trust, to discern wisdom, to select the proper books to read, to choose the best authorities to whom we shall listen, and, when we have so chosen, to consider attentively the message they bring, and to distinguish advice that springs from self-interest from that which is disinterested. There is a great temptation to form hasty and immature judgments on slight authority; and the habit, once formed, may be difficult to eradicate.

The disregard of authority is peculiarly observable in the younger generation. It is not confined to the uneducated, but is even more observable in many whose self-esteem has been increased by a course in college. Finding that men disagree on almost every subject, and that even those in position of authority do not hold the same opinion, it is easy to conclude that one man's opinion is as good as another's.

It seems to me that if intelligent men differ on any subject, it must be due to one or more of the following causes:

1. One or the other is not in possession of all the facts or principles involved.

2. One or the other may use facts or principles which are incorrect.

3. One or the other may reason incorrectly.

4. One or the other may see the facts out of proportion, attributing too great importance to some and too little to others.

5. One or the other may illustrate the natural stubborness or imperviousness of the human mind.

It is not always clearly recognized that facts cannot always be compared directly, because they cannot be expressed except in incommensurable terms. For instance, if we ask which is the greater, six feet or two meters, there will be no disagreement in the answer; but if we ask which is the more important, 10 feet or $5, or which is more important, truthfulness or beef steak, the reply is not entirely obvious. These are not fanciful illustrations. We are continually obliged to make comparisons between things which have to do with our physical well-being and those which have to do with our moral or spiritual well-being. They are incommensurable, yet they must be compared and an opinion formed from the comparison. In planning a railroad station, for instance, a certain design requires the passengers to walk a certain number of feet, while another design costs more but requires less walking. Here is a comparison which must be made between feet and dollars. In such a case, some will endeavor to express the comparison in commensurable terms. They will compute, perhaps, the value of the shoe leather that would be saved in a year if all the passengers using the station have to walk the given distance less, and compare it with the interest on the additional expenditure. Similarly, the expenditure of millions of dollars is asked for electrification, the advantage urged being the saving of a certain number of minutes each day for each passenger and because the aggregate saving of time in a year, valued at the average annual wage of an individual, amounts to a sum greater than the interest on the cost. Such comparisons are generally made by those who find their judgment unable to deal with the subject in any other way, who cannot compare except by measuring or weighing, as they have been trained or accustomed to do. Yet such persons do not realize that the comparisons they make may be entirely deceptive. Although more rapid transit may render a journey quicker, it does not follow that the time is saved. It may be usefully employed in reading, or in conversation, or in sleep, or in meditation. An additional fifteen minutes spent in going from one's house to one's office, is not necessarily lost; it may be utilized like any other fifteen minutes in the day. Even if spent solely in meditation, it would be most beneficial, for, as Arnold Bennett says, the great defect of the age is the absence of meditation. In such arguments as that for electrification, the mistake is also made of not considering whether the individuals who would make the saving claimed would be the same individuals who would bear the increased cost.

3. The Disregard of Experience—One of the most serious tendencies of the present day, particularly in the United States, a tendency which, like the disregard of authority, seems to result from that to regard men as equal, is the disregard for experience. It is a tendency fraught with great possibilities for evil, which must be recognized by every serious thinker.

In any occupation, except those which have to do with the study of purely abstract relations, which, as above explained, may be arrived at correctly in the seclusion of the study, it is almost self-evident that experience is of great value. In any occupations having to do with pure and applied science, and particularly in those having to do with man and his relations to society—that is to say in politics, economics and government, as well as in engineering—experience is a necessary qualification for arriving at correct judgments. A person having a power of perception of mathematical relations may become a profound mathematician at an early age; indeed, the perception of mathematical truths is essentially a subjective faculty, and may be most correct and powerful when the mind is removed from the objective state. Some mathematical prodigies have reached their greatest power when mere boys, and have lost it with increasing age and contact with the objective world. But, in business affairs, no amount of reading of books or of closet meditation can take the place of actual experience. But, if all men are equal, then the boy's opinion is as good as the man's, and experience is a mere useless drag.

It seems to be an inherent tendency of our form of government to disregard the value of experience; any man is considered good for any job; all he has to do is to get the votes, by one means or another. Men who have made little or no study of government, and who have had no experience in it, are considered capable of judging of and administering laws and of occupying any elective or appointive position. The butcher, the baker, the candlestick maker, are all eligible for the state legislature, for congress, for the senate, for the mayoralty or the presidency. This condition necessarily results in gross inefficiency and waste, not always through evil intent, but perhaps more often through stubbornness, ignorance, conceit or the unwillingness or inability to select and take good advice. Not until our legislators and our administrators of public affairs are chosen from men trained and experienced, and who have ascended from the bottom step by step, will efficiency, economy and wisdom be attained in our government. Whether this time will ever be reached may well be doubted. We are much less advanced in this respect than some of the countries in Europe, where the expert is more recognized and has a higher standing, and where knowledge, and particularly experience, are valued higher than here.

In these days, when higher education is a fad, there is an increasing tendency, in my opinion very pernicious, to regard book knowledge as the equivalent of experience. We are more and more inclined to regard those as able to speak with authority, whose knowledge is derived simply from books, who perhaps have spent their lives in a professorial chair, with no actual experience in the subjects they teach or write about.

Of course, it must not be supposed that experience is everything. In some cases, experience only confirms a man in rule-of-thumb practice, works him deeper and deeper into a rut, and destroys his power of vision. Probably all of us have seen instances of men, whose long experience in doing a particular thing in a particular way has only destroyed their power to see that there is another and a better way, and whose only reason for doing that thing in that way is that they have always done it in that way. Such men, however, would never, under any circumstances, be leaders. They are the soldiers in the ranks, whose only function should be to obey orders. It not infrequently happens, in the administration of some business affair, that a new man with a fresh mind, without experience in that line, but with a power of selecting good advisers, of grasping a new situation quickly, of seeing all the elements involved and of judging them correctly, will arrive at a truer decision than another man of less grasp and judgment, though experienced in the matter in question. This, however, is no argument against experience, but simply illustrates that experience must be combined with grasp and judgment; for the new man, before he becomes really proficient, must either gain his experience, or must be able to select his advisers well and to rely on them.

4. **The Tendency to Relax Discipline**—Another of the demoralizing tendencies of the equality of man is that which has led in recent years, it seems to me, to the gradual but steady relaxation of discipline. It will probably be denied by few that for the proper training and full development of the human being, discipline is necessary. Life itself is little more than discipline; it is not for pleasure; it is for work, accomplishment, development; without discipline there will be no proper development. He who is born with a golden spoon in his mouth and whose life is a continual round of pleasure, is likely to go out of the world less developed than when he entered it. "The beginning of wisdom," says Solomon, "is the desire of discipline." Work, which is itself an end, and rather to be sought than what it brings, consists largely in doing things which in themselves are uninteresting and perhaps distasteful, and we must accustom and train ourselves to be able to do this kind of work cheerfully and well. This ability will be attained only through discipline. Moreover, the man who attains a position of responsibility must be able to direct and command the work of others, and no one can command wisely until he has first learned how to obey. For this too, discipline is necessary. Yet the tendency of recent years seems to me to have been toward a steady relaxation of the discipline imposed by law and custom upon the growing individual.

A tendency to relax discipline is strikingly shown where its necessity is obvious, namely, in our educational system. Formerly the boy was put through a rigid course of prescribed study, some of it interesting and some uninteresting to him; but all of it, presumably, if the course was properly prepared by a capable faculty, necessary for the end in view. The modern tendency has been to substitute what he chooses to do or likes to do. The result has been, and is, that many young men come out of our colleges with minds and faculties practically wild and undisciplined, without willingness to do as they are told, and without the faculty of concentrating their attention on unpleasant but necessary tasks. But if all men are equal, why should the teacher have the power to impose unpleasant tasks upon the pupil!

5. Another of the tendencies very marked at the present time, is the spirit of innovation, which seems to pervade all things: whatever is, is wrong: the social custom must be changed in order to keep up with the time. This spirit is particularly observable among the young and the immature, especially if it has been preceded or accompanied by a lack of discipline in early training. It is an instance of what Ferrero terms "that youthful spirit of innovation which is in all ages the main source both of perversion and of progress." Many of our young men "all aflame with an enthusiasm unquenched as yet by any continuous contact with affairs," set out to reform the world, not so much because it needs reform, as because they wish to justify their existence. This spirit of innovation is at all times a spirit to be expected and reckoned with. Every generation as it comes along will endeavor to change the condition in which it finds itself, and will designate that change with the name of progress even though it be perversion. Oh! Progress! what crimes are committed in thy name. Even if a social condition were perfect and ideal a new generation would endeavor to change it. Youth desires change; often because it knows no better. Age becomes conservative because it knows by experience the dangers of haste or unwise change. The spirit of equality accelerates this tendency.

This spirit of innovation which pervades all things seems to be largely a result of scientific progress; the rapid advances made in inventions of all kinds, the improvements in the arts and manufacturers, have resulted in a complete revolution of the methods in many branches of industry within a comparatively few years. Men now living were born before there were any railroads, and almost all of us can remember the time when the applications of electricity were just beginning. An industrial plant but a few years old may be out of date and unable to compete with newer and more economical installations. We are accustomed in engineering matters to see things completely remodeled within a short time.

This familiarity with industrial change and the recognition of its benefits has naturally led to the idea that everything must be reconstructed, or it is old-fashioned and out of date, even though it be a thing in which there have been no new discoveries, warranting any change whatever, music, painting, dancing, education, everything. A fad must be completely reorganized. This willingness and desire for change affords the opportunity for unscrupulous mediocrity and for ambitious and unscrupulous failure to foist upon the public, which eagerly accepts it, forms of change which discerning men must characterize as gross, ridiculous and demoralizing. The result, in many cases, is a deterioration pitiable to behold. Let anyone compare for instance the modern painting, dancing and music, with that in vogue fifty or one hundred years ago, and he will find abundant proof of this. In politics and goverment too, the same tendency, the same recklessness, the same demoralization, are equally observable.

6. Advancing civilization and increase of wealth inevitably lead to increased luxury and extravagance; and, with our advancing civilization, this tendency is not wanting. If the experience of the past is of any value, however, it is a serious sympton of degeneration. The sudden accession of great wealth, particularly to those who are incompetent to use it wisely, engenders luxury and ostentation, and a contempt for those less fortunate; thus stimulating, to a certain extent, an attempt of the latter, particularly if endowed with the ballot, to recoup themselves and gain what they conceive to be their rights at the expense of wealth, by various forms of unjust taxation and other well known expedients. If it is our duty to preach the gospel of content and the inequality of man, it is equally our duty to preach the proper use of wealth, and the proper attitude of the wealthy toward those less fortunate; and while believing that individual initiative should be stimulated to the utmost, and allowed to enjoy the fruits of its success, it may, nevertheless, fairly be questioned whether some of the rewards under present conditions are not too large, and whether men would not exert themselves as well for the prospect of a more reasonable recompense as for the prospect of unreasonable and excessive riches. But again history repeats itself, and things move in circles. Peace causes prosperity, prosperity gives rise to wealth, wealth gives rise to luxury and extravagance, luxury and extravagance are the source of contention, contention results in war or social revolution, these result in poverty, poverty results in peace, and so the circle is completed.

7. The last tendency to which I will call attention, is what seems to me the distinct tendency, under present conditions, and in fact, under conditions which have existed in increasing degree as civilization has advanced, toward the deterioration of the race. The law of evolution in all species of animals and plants, the law which we ourselves recognize and follow in breeding and cultivating them, is for the survival of the fittest, the gradual elimination of the weak and unfit. This is distinctly the law of progress. In the case of man, however, there is added an element which does not exist with the lower animals or with plants, namely, the element of human reason. Under the domination of this element, has not the tendency steadily been, with the growth of altruistic ideas and the prevalence of philanthropic institutions, toward the survival of the unfit?

This problem is one of the most serious that confronts us today. I have no time, even had I the knowledge, to discuss it in detail; I will content myself with merely mentioning it. It may seem wrong to believe that all have not equal right to survive, yet it seems to me that the interests of society as a whole must lead us to the conclusion that serious evil, and perhaps ultimate ruin, await us unless some means can be devised for solving this problem and in some manner regulating the perpetuation of our species. If humanitarianism leads to race degeneration, it cannot be the way of progress intended by an all-wise Creator, and we should try to see in what way we are misapplying it.

APPLICATION TO ENGINEERING PROBLEMS

And now you may very likely have asked what has all this to do with engineering, or with the engineering profession; what is the appropriateness of a discussion of social conditions before a society of engineers? My answer is that the engineer is primarily a member of the social body; that its problems are his problems; and that he cannot avoid the responsibility of taking a share in their solution. The problem of the 20th century, it seems to me, will be preëminently, a social problem, and upon its solution will depend the happiness of mankind for years to come. Moreover, this social problem is largely, as I have shown, the outcome of the work of the engineer who, as the advance agent of civilization, has been the main factor in creating the conditions which give birth to this problem.

It will be evident, therefore, that I differ from one of my predecessors who, in his annual address, intimated that social problems were out of the province of the engineer and that he should not meddle with them. On the other hand, I maintain that it is his duty to exert himself in their solution. Moreover, I consider this duty the more necessary because I believe the engineer to be well fitted—possibly better fitted than any one else to solve these problems wisely. Let me briefly give you my reasons for this opinion.

The engineer is by training a scientific man. If this education is what I conceive it should be, and what it will be more and more in the future, it will consist of a training in mathematics, logic, science and in the technical branches of his profession, together with a sufficient amount of study of the humanities—history, economics, language, literature—

to give him a clear view of the relations of things. He will be preëminently by training a scientific man, but with a power of understanding and handling social questions.

Again, the engineer is a business man, for engineering is business and business is engineering; he deals with men, he has to do with financial affairs, he learns the characteristics of human nature, and his training, therefore, tends to teach him tact, moderation and conservatism.

Of course, any sweeping eulogy or disparagement of any class of men cannot be truthfully made. Engineers will differ on questions of opinion, as other men will. There are dishonest, untruthful, unreliable engineers, as there are men of this type in every class.

Nevertheless, on the whole, if there is anything in training and experience, may we not believe that engineers, as a class, have the training, temper, and experience which will best enable men to judge sanely and solve wisely the social problems which confront us?

What then, may the engineer do to aid in the solution of the social problems of the 20th Century?

In the first place, he should consider it his duty not to retire into the technical recesses of his professional work and content himself with being the servant of other men, but should actively exert himself and take the initiative in the great problems of the day. He will find that these problems in their details are largely of an engineering character.

What, for instance, is involved in the problem of administering the affairs of a great city? Do they not involve, in the main, the preservation of the health, safety, property and order of the community? and are they not, therefore, predominantly of an engineering character? Financial and legal questions of great importance are, of course, involved, but why should the engineering problems be considered secondary to these? Engineers can employ financiers and lawyers, as well as be employed by the latter. I see no reason why the position of mayor of a city could not be filled at least as satisfactorily by an engineer with proper breadth of view, training and experience, as by a man of any other profession. Yet I doubt if the mayor of any city in the United States is or has been an engineer.

The same holds true of other administrative positions. The management of our great corporations involves problems largely of an engineering nature, and high administrative positions in these concerns are being more and more given to engineers. Even such a position as that of president of a republic is not one which the engineer should necessarily consider himself excluded from. Why is he not as well qualified to fill it as a soldier, a lawyer, or a college professor, provided his training and experience, judgment and breadth of view warrant. Two of our greatest presidents, Washington and Lincoln, while not engineers, did have some little practice in what was then termed engineering, and one president of the French Republic has been a professional government engineer.

There is perhaps a tendency today toward better recognizing the qualifications of the engineer in the administration of municipalities and larger political units. The position of commissioner of public works in a city is perhaps the most important municipal position next to that of mayor. Formerly, this position was monopolized in most cities by men who were mere politicians. Now-a-days, it is quite common to appoint engineers to such posts. In Boston, Philadelphia, Cincinnati, and very likely other cities, these positions are now held by trained and educated engineers, and this recognition I consider significant and deserved.

Engineers, however, will not and should not be recognized in this way unless they show their interest in public questions, unless they inform themselves about them, unless they study the economic and social, as well as the engineering problems involved, and unless they assert themselves before the public. This I trust they will do more and more as years go by. "The fault, dear Brutus, is not in our stars, but in ourselves, that we are underlings."

In education too, where, as I view it, the tendencies I have referred to are plainly evident, we may as a profession exert a good influence. I have often expressed the opinion that an engineering education is the best possible education for any vocation, because it combines, or should combine in the best proportions, the study of abstract relations with that of natural science and of the humanities. These, combined with training and experience in the profession itself, should make the engineer as well educated as any class of men. He should be sane and sensible, not likely to be carried away by fallacious, economic theories; conservative, and yet safely progressive.

Engineers should, I think, exert more influence than they do in education, by actively interesting themselves in it, serving on school committees, and insisting on the maintenance of rigorous discipline and the scientific method. Above all, they should aid in maintaining the standard of engineering education, and prevent it from succumbing to the prevailing tendency to relaxation of discipline. The best students do not really seek such relaxation, and schools which make students work hard and which insist on a high standard of accomplishment, will attract strong men.

Let us make the engineering schools the place of refuge for those who are disgusted with the relaxation of discipline which prevails so largely elsewhere.

APPLICATIONS TO THE AMERICAN SOCIETY OF CIVIL ENGINEERS

Finally, let us inquire what this Society, representing the engineering profession, may do in the directions which have been suggested. We have been criticised in the past as being inactive, as taking no part as a Society in large public questions. I must frankly confess that the criticism has seemed to me in some measure deserved. Our Society is large, rich, influential, but we have been too content to sit down in dignified ease, taking little or no initiative, and allowing other younger societies to outstrip us in actual work performed and in real influence exercised. We have had some committees which have been done good work in unifying practice in relation to technical matters. In these respects, however, we have been far surpassed by two or three of the newer societies, whose committees after long and conscientious labor, have exercised far greater influence than we have in the solution of even professional problems.

It is true that this is largely due to the fact that those Societies are more specialized than ours, that they are composed of men all engaged in one line of work, who could coöperate and lay down the results of experiment, experience and opinion more easily than we could. This Society, however, is the American Society of Civil Engineers, it includes engineers in all branches; there is no reason why the engineers in the different branches should not associate themselves together in sections, or why we could not do more committee work along the various engineering lines than we have done in the past.

I believe, therefore, that we should favor the establishment of branches of the Society in various parts of the country, and of student branches in the several technical schools; and that we should urge our committees to activity, supply them with funds, and perhaps pay the mileage of members who attend meetings. The Society is rich, and it is not a philanthropic institution. If members give their time to committee work, I see no reason why they should be expected to give money, and the expense of attending many meetings may not seldom be considerable.

Moreover, we have been very loath to take any steps in formulating answers to questions which are largely matters of opinion; and we have done, thus far, little or nothing to influence public opinion in regard to questions of the day. I believe that we could and should go much further in these directions; that we should step forward, take the initiative and become a moving force in the community. Let me make some more definite suggestions.

In the first place, I believe we should have a standing Committee of Public Relations, its province being to keep track of all public affairs involving engineering questions directly or indirectly, in all the states in the Union, and to take such action as may be deemed desirable to insure a wise treatment of such questions. This committee might perhaps consist of President and Secretary of the Society ex officio, of a certain number of members of the Board of Direction to be appointed each year by the President, and of a certain number of members of the Society not members of the Board of Direction, to be nominated by the Board of Direction. These outside members might be in considerable number, perhaps one or more from each state or group of states so that the committee could keep in touch with public affairs affecting the profession in all parts of the Union.

Further, our Committee on Engineering Education should, in my opinion, be enlarged, supplied with funds, and encouraged to active and exhaustive work. If we could lay down the principles which we believe should govern in engineering education, the general curriculum which should be adopted, the proportion of the humanities which should be included, and similar matters, we might, I believe, do much good and, while still leaving ample room for individual initiative and divergencies in practice in different institutions, render effective aid to those teachers who are striving to resist some prevailing tendencies.

In the next place, I believe it will be wise to have more committees of the Society, dealing with specific problems, than we have had in the past. You have before you at this meeting, I am glad to state, a report from the Board of Di-

rection stating that, as provided in the Constitution, it has voted to appoint two special committees to deal respectively with the regulation of streams and with uniform water legislation. I believe that still other committees could be appointed to advantage. We have no reason to be afraid of having too many committees. We should, rather, be sure that we lose no opportunity to exercise legitimate influence on public opinion or to aid in the solution of large problems. We might well, I believe, have a standing committee on conservation, another perhaps on corporation legislation, another on the history of American engineering. Let us give our earnest attention to this matter and let us not hesitate to suggest any and every means that may occur to us to promote the welfare of the Society, of the profession, and of the public. The Board of Direction will be always ready, I am sure, to act promptly with such members of the Society who can show a proper field for all legitimate action.

Reviewing, then, the points which I have brought to your attention, I have endeavored to show that the problem of the times is preëminently a social problem. I have outlined some of the tendencies of the day, as they appear to me, I have given the reasons for my belief that it is the duty of engineers to aid in the solution of these problems and that by training and experience they are well qualified to do so. If my tone has appeared to indicate a pessimistic attitude toward the tendencies of the day, I fear I must plead guilty in some degree to the imputation; whether wisely or not, as the years have gone by, I have grown more conservative and I find myself having little sympathy with many of the tendencies which I seem to see about me. I believe that this age will be looked upon by future generations, not as an age of progress, but more distinctly as an age of deterioration, an age of fads, frivolities, fancies and follies; of much reading and little thought; an age of impulse rather than an age of reason. But after all, it is only an epoch in the history of man. It will pass away, and others will solve the problems that we leave to them. May we do our part, as members of one of the greatest professions, to help direct the tendencies of the day in such manner that our successors may look back upon us with approval and not with blame, and that we may aid in forwarding the true progress of mankind.

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A Four-Story Concrete Building Collapsed, on June 13, while under construction at Vancouver, B. C.

A Northbound Lake Shore Passenger Train Struck a work train head-on, a mile north of Kalamazoo, on June 18. Twelve persons were injured. The cause of the accident is laid to a misunderstanding of orders.

Two Surface Cars Collided on June 22, in Brooklyn, N. Y. A Fifth Ave. car, going east on Court St., was struck by a Crosstown car. It is claimed that the accident was caused by the nonperformance of the brakes on the latter car. Seven persons are known to have been injured.

A Man Was Boiled to Death while cleaning one of the boilers of the cruiser "Birmingham," lying in the Philadelphia Navy Yard, June 14. The man was about to leave the boiler when the steam was suddenly turned on with such force that he was unable to escape. Commandant Grant has ordered an inquiry into the matter.

A Rear-End Crash on the Creve Cœur Lake line of the United Railways, in St. Louis County, Mo., on June 15, resulted in the injury of 22 persons. The accident is claimed to have been caused by a defective air brake on the colliding car. The motor reversed alright, but the momentum of the car was too great to prevent the collision.

A Defective Derailing Switch, installed near the Harlem River drawbridge, at 133d St., New York City, derailed the rear car of the southbound Croton local, on the New York Central R.R., on June 20. The switch was placed at this point to save any train from plunging into the river should the drawbridge be open. In this case the bridge was closed and the signals indicated this condition. The fact that the local was proceeding at only about six miles per hour prevented a more serious accident.

A New Mississippi River Bridge, at Memphis, Tenn., is to be begun soon according to reports. It is stated that the bridge which is to be built and used jointly by the Chicago, Rock Island & Pacific, Missouri Pacific and St. Louis Southwestern railways, is to be named the "J. T. Harahan Bridge" after the late president of the Illinois Central R.R. who before his death has projected a bridge at this place to supplement the famous Memphis Bridge built about 30 years ago by the late George S. Morison.

The South Guard Pier of the Concrete & Bridge across the Hudson River, at Troy, N. Y. slid into the river without warning at 3 a.m., June 7, 1913. This pier, with its companion pier on the north side of the bridge, was located just beyond the center pier of the swing span of the bridge and was used only to guard that pier and not as a rest for the opened swing span. It was of masonry construction resting on a wooden crib, with no pile footing. No particular attention had been paid to these guard piers as they carried none of the load of the bridge. It is supposed that the Spring flood this year undermined the wooden crib and wrecked the foundation. The pier was built in 1872 and 1873.

The sinking masonry did some damage to cross-river cables at this point and caused some trouble with the local trolley system.

Faulty Design of the Timbering Caused the Tunnel Accident which took place in the subway excavation at Fifty-Sixth St. and Lexington Ave., New York City, on June 14, according to the verdict of the coroner's jury (rendered on June 20).

The jury said:

We find that the said accident was due to the faulty design of the timbering. We further find that in view of the extraordinary width of the said tunnel in proportion to the rise of the arch an error in judgment was made by the engineers of both the Public Service Commission and the Bradley Contracting Co. in using the form of centering adopted, which form of centering has shown itself to be unsafe for tunnels of this nature and width.

We recommend the use in future of some other system.

The experts on the jury were Frank E. Conover, a builder, of 34 West 33d St.; Reginald Pelham Bolton, engineer, of 55 Liberty St.; Ernest Flagg, architect, of 109 Broad St.; Charles Sooysmith, consulting engineer, of 71 Broadway; E. Marshall, consulting engineer, of 115 Broadway, and Charles H. Gillespie, architect, of 1123 Broadway.

In this accident (described in our issue of June 19) a cave-in of three to four hundred tons of rock, crushed to death ten workmen and injured three.

Four Bridges Burned In One Week—On June 9, the wooden truss bridge, resting on cast-iron columns, over the tracks of the New York & Long Branch R.R., at Middletown, N. J., was burned, apparently the result of a spark from a locomotive. Traffic on the railroad was tied up for three hours, and the highway was closed for repairs.

On the same date the floor of the $2,000,000 North Kansas City steel bridge caught fire from some unknown cause. The structure carried the tracks of the Kansas City, Clay Co. & Excelsior Springs trolley line and a highway; and travel was stalled. The wooden flooring and ties were creosoted, and burned so fiercely that the rails were bent and many of the steel beams buckled.

The floor of the two-track deck-girder bridge of the Delaware, Lackawanna & Western R.R., which spans the Passaic River at Little Falls, N. J., was burned on June 15. The ties were impregnated with creosote and 600 of them were destroyed and the rails distorted.

The old, four-track, wooden trestle over Newark Bay, between Bayonne and Waverly, N. J., used jointly by the Pennsylvania and the Lehigh Valley railroads, was destroyed for a distance of about 3500 ft. out from the Bayonne shore, on June 15. Thirty-two cars, loaded with farm produce, were lost. The ties of the two Lehigh Valley R.R. tracks only were creosoted.

The Richmond, Va., Bridge Competition, which was referred to in an editorial in "Engineering News," May 29, 1913, p. 1134, has been turned over to a commission of engineers for final decision. As was noted in the editorial referred to, this competition was advertised in February to be opened Apr. 15. The competition, in our opinion, was subject to many criticisms, not the least of which was the long delay in the examination of the plans and the award of the prize. It now appears that the Administrative Board defends their delay by claiming that a number of the competing engineers asked for a hearing and requested that the time appointed for such hearing be from 30 to 60 days from the date of opening of plans. At any rate, on June 18, the Board passed the following motion:

WHEREAS no other engineers offering designs for the bridge have expressed a desire to appear before the Board to explain their plans and the Board having given all full opportunity having delayed the award as long as can reasonably be expected, all plans having been opened in the presence of the Board and viewed with the explanation and aid of two engineers.

THEREFORE, be it resolved that all plans and designs for the bridge, specifications and letter filed therewith are hereby referred to the City Engineer, J. A. Johnson, H. P. Beck and Carlton McCarthy with authority to associate such others as they may desire to report to the Board the names of the successful competitors in their judgment for the prizes offered by the Board in accord with the City Engineer's advertisement.

The Hamburg-American Steamship "Imperator," the largest vessel afloat, arrived in New York on Wednesday, June 18,

at the end of her maiden voyage across the Atlantic. The "Imperator" has a length of 919 ft. overall, with 98-ft. beam and is a vessel of 50,000 tons register. She is propelled by four screw propellers of about 16 ft. diameted, driven at 185 r.p.m. by compound steam turbines with a capacity of 62,000 hp. She is intended to make the trip from Hamburg to New York in six days at an average speed of 22½ knots. Her three huge funnels are each 32 ft. in length by 18 ft. in width and their tops are about 150 ft. above the water level. In the hull construction of the "Imperator," there is an entire inner hull extending above the water line. Her athwartship bulkheads divide the hull into 17 watertight compartments and have been carried up to the level of the second deck, high above the water line.

PERSONALS

Mr. George T. Bacon has been appointed General Manager of the Owego Bridge Co., Owego, N. Y.

Mr. D. McD. Campbell, Assoc. M. Can. Soc. C. E., has resigned as City Engineer of Sydney, N. S., to engage in private practice.

Mr. Jesse Taylor, of Jamestown, Ohio, has been appointed General Secretary of the National Highways Association, Washington, D. C.

Mr. D. T. Easby, formerly Supervisor of the Pennsylvania R.R., at Newport, Penn., has been promoted to be Division Engineer at Oil City, Penn.

Mr. C. E. Zortman, formerly Supervisor of the Pennsylvania R.R., at Pittsburgh, Penn., has been promoted to be Division Engineer at Pittsburgh.

Mr. T. H. Booz, Jr., until recently County Engineer of Floyd County, Ga., is now City Engineer and Superintendent of Public Works of Rome, Ga.

Mr. Andrew Rinker, for many years City Engineer of Minneapolis, Minn., has opened an office in the Plymouth Bldg., Minneapolis, for private practice as a consulting municipal engineer.

Mr. Frank W. McKinney, Assoc. M. Am. Soc. C. E., Assistant Engineer of the Baltimore Sewerage Commission, has been appointed Chief Engineer of the Commission for Opening Streets, Baltimore.

Mr. C. E. Brinser, recently Division Engineer of the New York, Philadelphia & Norfolk R.R., Cape Charles, Va., has been appointed Division Engineer of the West Jersey & Sea Shore R.R., at Camden, N. J.

Mr. Maurice H. Thatcher has resigned as a member of the Isthmian Canal Commission and head of the Department of Civil Administration, Canal Zone, Panama. He was appointed in 1910 by President Taft.

Mr. C. A. Coffin, Assoc. Am. Inst. E. E., has resigned as President of the General Electric Co., Schenectady, N. Y., and has been elected Chairman of the Board of Directors, with office at 30 Church St., New York City.

Mr. Wm. Alexander Duff, Assoc. M. Can. Soc. C. E., has resigned his position with the Commissioners of the Transcontinental Ry. of Canada, to become Engineer of Bridges of the Intercolonial Ry. at Moncton, N. B.

Mr. Thomas B. Kennedy, recently Assistant to the Chief Engineer, has been appointed Chief Engineer of the Cumberland Valley R.R., succeeding Mr. George C. Koons, transferred as noted in our issue of last week.

Mr. F. H. Morris, for the past 10 years Assistant Engineer with the Massachusetts State Highway Commission, has been appointed Senior Highway Engineer of the United States Office of Public Roads, Washington, D. C.

Mr. T. J. Skillman, recently Supervisor of the Pennsylvania R.R., at New York City, has been promoted to be Division Engineer of the New York, Philadelphia & Norfolk R.R., at Cape Charles, Va., succeeding Mr. C. E. Brinser, transferred, as noted elsewhere.

Mr. Francis K. Newcomer, son of Lieut.-Col. Henry C. Newcomer, Corps of Engineers, U. S. A., has just graduated from the United States Military Academy at West Point, at the head of his class. Lieut.-Col. Newcomer graduated at the head of his class in 1886.

Mr. Robert T. Frazier, a patent lawyer and for several years employed in the United States Patent Office, Washington, D. C., has been appointed Assistant Commissioner of Patents. He is a native of Tennessee and a graduate of the United States Naval Academy at Annapolis.

Mr. J. G. Seyfried, formerly Structural Engineer of the Grand Trunk Ry., at Montreal, Que., has been appointed Engineer of the bridge department of the Canada Foundry Co., Ltd. Mr. Seyfried will make his headquarters at the Toronto plant, where he will also serve as Assistant to the Manager, Mr. J. L. Brower, M. Can. Soc. C. E.

Col. George Washington Goethals, M. Am. Soc. C. E., Chairman of the Isthmian Canal Commission, and Chief Engineer of the Panama Canal, was awarded the honorary degree of LL. D. by the University of Pennsylvania on June 18. Col. Goethals has previously received honorary degrees from Columbia University, Yale University and Harvard University.

Mr. Thomas Ewing, Jr., a patent lawyer and member of the firm of Ewing & Ewing, New York City, has been appointed Commissioner of Patents, Washington, D. C. Mr. Ewing is a native of Kansas and has received degrees from the University of Wooster, Ohio, Columbia University and Georgetown University. For two years, 1888-1890, he was an Assistant Examiner in the United States Patent Office.

Mr. Samuel R. Lewis, Past-President of the American Society of Heating and Ventilating Engineers, of the firm of Lewis & Kitchen, Chicago, Ill., and Kansas City, Mo., has been appointed Consulting Engineer of the National Incinerator Co., New York City, which company has taken over the incinerator business of Lewis & Kitchen. The heating and ventilating business of the firm of Lewis & Kitchen will continue without change.

Mr. H. M. Waite, City Engineer of Cincinnati, Ohio, is reported to be in search of an engineer to take charge of surveys and plans for converting the old Miami & Erie Canal into a subway and boulevard. According to the Cincinnati "Times-Star," of June 13, Mr. Waite has recently been in New York City for the purpose of interviewing engineers who have had experience on the New York subways.

Mr. F. N. Huddleson, of the city engineering department of Salt Lake City, Utah, has been promoted to be Principal Assistant Engineer, succeeding Mr. John Duder, Assoc. M. Am. Soc. C. E., resigned, as noted in our columns of last week. Mr. Huddleson graduated in mechanical engineering from Ohio State University in 1902, and for some years previous to his employment with the city engineering department of Salt Lake City, he was with the engineering staff of the San Pedro, Los Angeles & Salt Lake R.R.

Mr. F. I. Cabell, Chief Engineer of the Chesapeake & Ohio Ry., has been appointed Chairman of the Valuation Committee of the railway, consisting of Messrs. J. P. Nelson, Real Estate Agent, and E. M. Thomas, Accountant. This committee will be relieved of all other duties and will devote its whole time to valuation work. The duties of Chief Engineer will be temporarily performed by Mr. W. F. Steffens, Assoc. M. Am. Soc. C. E., Assistant Chief Engineer, and formerly Engineer of Structures of the Boston & Albany R.R., at Boston, Mass.

Mr. George P. Johnson, recently Receiver for the Detroit, Toledo & Ironton Ry., Detroit, Mich., and former General Superintendent of the Western division of the Norfolk & Western Ry., has been appointed General Manager of the Chesapeake & Ohio Ry., with office at Richmond, Va. Mr. Johnson began railway work in 1890 as a clerk with the Chicago, Burlington & Quincy R.R. He first entered the service of the Norfolk & Western Ry. in 1898 as General Yardmaster at Kenova, W. Va., having come from a similar position with the Lake Shore & Michigan Southern Ry. at Toledo, Ohio.

Mr. Delos F. Wilcox will sever his connection with the Public Service Commission for the First District, New York State, on July 1, to engage in private practice as a consulting franchise and public utility expert, with offices at 93 Nassau St., New York City. Mr. Wilcox is a graduate of the University of Michigan and of Columbia University. He has been Chief of the Bureau of Franchises of the Public Service Commission since 1907. He will specialize in making franchise surveys, formulation of franchise policies, drafting or criticism of public utility legislation and franchise sections of city charters, the negotiation of franchise settlements, etc., for cities or other public bodies and for civic and business organizations devoted to the public welfare.

Mr. Henry R. Towne, Past-President, Am. Soc. M. E., President of the Yale & Towne Manufacturing Co., of Stamford, Conn., has resigned as President of the Merchants Association of New York City, after more than five years' service. Mr. Towne began his work for the Association, which was "created to foster the trade and welfare of New York," in 1900, as a member of the Engineering Sub-Committee of the Ramapo Committee, through whose work the Association defeated the Ramapo water-supply project. One result of this work was the establishment of the present Board of Water Supply under whose management the new Catskill water-supply has been developed. Mr. Towne was elected President

of the Association in 1908, and has been reëlected successively every year since.

Mr. E. Wilbur Rice, Jr., M. Am. Inst. E. E., formerly Vice-President, has been elected President of the General Electric Co., Schenectady, N. Y., succeeding Mr. C. A. Coffin, resigned as noted elsewhere. Mr. Rice was born at La Crosse, Wis., May 6, 1862; his father is Mr. Edwin Wilbur Rice, famous editor and writer on religious subjects, of Philadelphia, Penn. Mr. E. W. Rice, Jr., was educated in the public schools of Philadelphia, and the Central High School, where he graduated in 1880. He was Superintendent of the Thomson-Houston Electric Co., now the Lynn, Mass., plant of the General Electric Co., from 1883 to 1888, and Technical Director from 1888 to 1894. Upon the formation of the General Electric Co., he was elected Vice-President, which office he has held ever since. Mr. Rice is a Chevalier of the Légion d'Honneur, of France, and a member of the Institution of Civil Engineers and of the Institution of Electrical Engineers of Great Britain.

OBITUARY

Frederic Danforth, M. Am. Soc. C. E., Consulting Engineer, and Chief Engineer of the Eastern Maine R.R., of Gardiner, Maine, died at his summer home at Squirrel Island, June 6. He was born in 1848 and graduated from the Thayer School of Civil Engineering, Dartmouth College, in 1870.

C. S. Williamson, of Mason, Ohio, a civil engineer in charge of a survey party under the Mississippi River Commission, was drowned on June 22, together with eight of his party, when the launch in which they were at work was struck by a squall and capsized. Among those drowned was J. W. McConnell, who graduated in civil engineering at Cornell University in this year's class. Five of the party were saved.

Edwin S. Cramp, M. Am. Soc. M. E., grandson of William Cramp, who founded the firm of Wm. Cramp & Sons, Shipbuilders, of Philadelphia, Penn., died at his home in New York City, June 20. He was connected with the shipbuilding works for many years, and at the time the Cramp interests were sold, in 1907, he was Vice-President of the William Cramp & Sons Shipbuilding Co. It is said to have been due to his ability as a marine engineer that his company was able to obtain $500,000 in bonuses in 1894, for exceeding the speed requirements in contracts for United States war vessels. He was a son of Charles H. Cramp, who died on May 9, last, at the age of 85 years. Edwin S. Cramp was a member of the Society of Naval Architects and Marine Engineers, and was a Vice-President of the American Society of Mechanical Engineers, in 1896-'98.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 17-20. Annual convention at Ottawa, Ont. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.
June 20-21. Annual convention at Seattle, Wash. Secy., Jesse A. Jackson, City Hall, Seattle, Wash.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 23-26. Annual convention at Cooperstown, N. Y. Secy., F. L. Hutchinson, 33 W. 39th St., New York City.

AMERICAN WATER-WORKS ASSOCIATION.
June 23-28. Annual meeting at Minneapolis, Minn. Secy., J. M. Diven, Troy, N. Y.

PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESSES.
June 23-28. Congress at London, England. Secy., W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminister, London, S. W.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
June 24-26. Annual meeting at Minneapolis, Minn. Secy., H. H. Norris, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 24-28. Annual convention at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

CANADIAN ELECTRICAL ASSOCIATION.
June 25-27. Annual convention at Toronto, Ont. Secy., T. S. Young 220 King St. West, Toronto, Ont.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
June 25-28. Semi-annual meeting at Boston, Mass. Secy., J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

OHIO ELECTRIC LIGHT ASSOCIATION.
July 15-18. Annual convention at Cedar Point, Ohio. Secy., D. L. Gaskill, Greenville, Ohio.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 17-19. Annual summer meeting at Buffalo, N. Y. Secy., E. A. Scott, 29 W. 39th St., New York City.

INTERNATIONAL GEOLOGICAL CONGRESS.
Aug. 7-14. Twelfth annual session at Toronto, Ont. General Secy., R. W. Brock, Director of Geological Survey of Canada, Ottawa, Ont.

THE TRAVELING ENGINEERS' ASSOCIATION.
Aug. 12-16. Annual convention at Chicago, Ill. Secy., W. O. Thompson, New York Central Car Shops, East Buffalo, N. Y.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Sept. 1-6. Annual convention at New York City. Secy., Jas. McFall, Roanoke, Va.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 10-12. Annual convention at Philadelphia, Penn. Secy., Willard Kent, Narragansett Pier, R. I.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Sept. 9-13. Annual meeting at Colorado Springs, Colo. Secy., S. M. Guma, 755 Boyleston St., Boston.

Colorado Association of Members of the American Society of Civil Engineers—At the annual meeting, on June 14, the following officers were elected for the ensuing year: President, G. N. Houston; Secretary-Treasurer, R. W. Toll, 700 Tramway Building, Denver, Colo.

American Society of Mechanical Engineers—What is doubtless the largest and most notable delegation of American engineers that has ever visited Europe in a body, sailed from New York on June 10, on the steamship "Victoria Luise," of the Hamburg-American Line, to attend the international meeting of the American Society of Mechanical Engineers with the Verein Deutscher Ingenieure (the German Society of Engineers), which is without exception the largest by far of any engineering society in the world. The plans and preparations for this notable international meeting have been reported from time to time in the columns of "Engineering News." For nearly a year past a special committee of the American Society has been making the detailed arrangements for the trip, and on the other hand the officers and committees of the German Society of Engineers has been making most elaborate preparations for the entertainment of the visitors. The party sailing on the "Victoria Luise" numbered nearly 250. Additional members who are now abroad joining the party at Hamburg or Leipsic will bring up the number to practically the limit of 300 set by the terms of the invitation, that being as large a party as could be comfortably accommodated in the tour through Germany in the hotels of the various cities to be visited.

The "Victoria Luise" arrived at Hamburg, on June 19. A cable dispatch from Secretary Rice reports that the party was favored with exceptionally fine weather all the way across the Atlantic and that a varied program of entertainment during the voyage was carried through successfully. After two days' sight seeing in Hamburg, the party traveled by special train to Leipsic where the international meeting with the Verein Deutscher Ingenieure was held on Monday and Tuesday. Papers by President W. F. M. Goss, on "Engineering Development and Human Progress," and by James M. Dodge, of Philadelphia, on "Industrial Management" were presented. King Frederick Augustus, of Saxony, was among those present at the international meeting. Announcement was made at the meeting that the German Society had voted to confer the Grashoff Memorial Gold Medal on George Westinghouse, who is a Past-President of the American Society of Mechanical Engineers.

Among the prominent members of the Society who are included in the party which is now in Germany, are Past-Presidents Col. E. D. Meier, John R. Freeman, Worcester R. Warner and Jesse M. Smith; Vice-President James Hartness, Managers Henry Hess and H. M. Leland. From the head office of the Society in New York are Calvin W. Rice, Secretary, and Lester G. French, editor. The technical press is represented by F. E. Schmitt, of "Engineering News," Fred R. Low, of "Power," L. C. Alford, of the "American Machinist," William Kent and Robert Thurston Kent, of "Industrial Engineering." Among the prominent engineering educators are L. P. Breckenridge, of Yale, Arthur M. Greene, Jr., of Rensselaer, Chas. R. Richards, of Cooper Union, and L. S. Marks, of Harvard. The list of other well known men in the party includes Geo. M. Bond, of Hartford, Geo. M. Brill, of Chicago, S. H. Bunnell, of New York, J. S. Detrick, of Baltimore, Wm. A. Doble, of San Francisco, E. R. Fellows, of Springfield, Vt., Geo. H. Frost, of Plainfield, N. J., H. L. Gantt, of New York, Philetus W. Gates, of Chicago, Frank B. Gilbreth, of Providence, R. I., Morris Knowles, of Pittsburgh, Alfred E. Kornfeld, of New York, Wm. Lodge, of Cincinnati, Chas. A. Mead, of Upper Montclair, N. J., Mansfield Merriman, of New York, Samuel L. Moore, of Elizabeth, N. J., H. G. Reist, of Schenectady, Newell Sanders, of Chattanooga, and Walter Wood, of Philadelphia.

CONSTRUCTION NEWS

★ Denotes an item regarding work advertised in Engineering News. ✚ Denotes contract awarded. The names of successful contractors are set in CAPITALS.

RAILWAYS

New York—Boston & Albany R.R.—This company, June 14, made application to the Public Service Commission to issue $2,015,000 of bonds for the improvement of its line. F. B. Freeman, Boston, is Ch. Engr.

New York—Dansville & Mount Morris R.R.—This company is considering the construction of its line south so that almost direct communication between Rochester, Hornell and adjacent territory will be established. L. R. Doty, Geneseo, N. Y., is interested. C. C. Hoge, New York, N. Y., is Pres.

Maryland—Rock Castle R.R.—This company has had a survey made for the construction of its proposed line, about 28 miles. J. C. Pence, Westernport, Md., is Const. Engr.

Virginia—Virginia-Carolina R.R.—(Official) — The Callahan Construction Co., Empire Bldg., Knoxville, Tenn., recently awarded contract by this company for 40 miles of its proposed line will soon start work, which comprises considerable cart and car work; also some team work. Contractors desiring to communicate with the company can write to Knoxville, Tenn., and arrangements will be made for them to meet the superintendent at the branch office at Abingdon, Va., who will show them over the work. The entire 40 miles is now ready for construction and work will be let at once. For prices and further particulars, write or wire Callahan Construction Co., Empire Bldg., Knoxville, Tenn. Noted June 19 and May 22.

North Carolina—Hiawasee Valley Ry.—This company will award contracts for grading on its road about July 15. It is proposed to construct a line from Andrews, N. C., on the Southern Ry. via Marble, Peach Tree and Hayesville to Hiawasse, Ga. W. C. Sanderlin is Ch. Engr., Andrews, N. C. Noted May 15.

Mississippi—Ferguson & Palmer Co.—This company, with offices at Paducah, Ky., will build a railroad into timberlands near Houlka, Miss., preparatory to erecting a sawmill. Earl Palmer is in charge.

Mississippi—New Orleans, Mobile & Chicago R.R.—This company is planning to commence work soon on its extension from Beaumont, Miss., into New Orleans. A. F. Church, Laurel, Miss., is Supt.

Louisiana—New Orleans, Mobile & Chicago R.R.—See item under Mississippi.

Tennessee—Yazoo & Mississippi Valley R.R.—(Illinois Central R.R.)—This company is planning to improve its yards at Noconnah, Tenn., at a cost of $600,000. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Kentucky—Baltimore & Ohio—This company is planning to construct a line along and parallel to the Beaver Creek Branch of the Chesapeake & Ohio R.R. It will be 25 miles long. F. L. Stuart, Baltimore, is Ch. Engr. Noted June 5.

Ohio—Chesapeake & Ohio R.R.—This company has been authorized by the Public Service Commission to issue $377,000 of stock and $380,000 of bonds for the betterment of its lines in the state of Ohio. F. J. Cabell, Richmond, Va., is Ch. Engr.

Kansas—The construction of a railroad from Scott City, Kan., to Fort Dodge, Kan., is under consideration. F. L. Yantis, Scott City, is interested.

Kansas—Kansas City, Kaw Valley & Western R.R.—This company will award contracts for grading about July 1 for its proposed line from Kansas City via Muncie, Kan., Edwardsville, Bonners Springs, Lanape, Loring and Linwood to Lawrence, Kan. There will be a steel bridge about 1000 ft. long across the Kaw River. O. W. Williamson is Ch. Engr., Bonners Springs, Kan.

Kansas—Hutchinson & Northern Ry.—The Public Utilities Commission, June 13, issued a charter to this company. It is proposed to construct a railroad from Hutchinson, Kan., to Fairbury, Neb.

Nebraska—Hutchinson & Northern Ry.—See item under Kansas.

✚**Montana**—Great Northern Ry.—This company has awarded the contract to the WIDELL CO., Mankato, Minn., for the construction of tunnels and bridges in Montana.

Arkansas—The Kentarkark Land & Lumber Co.—This company with offices in the Inter-Southern Bldg., Louisville, Ky., will let a contract soon for the construction of a 10-mile railroad into its timber property in Arkansas.

Texas—Temple, Northwestern & Gulf Ry.—This company will do its own work on its proposed line from Temple to Dublin, Tex. W. E. Dozier, Temple, is Ch. Engr. Noted June 5.

Texas—San Antonio, Uvalde & Gulf R.R.—This company has increased its capital stock from $280,000 to $315,000 for the purpose of raising the necessary money to provide for extensions to its line. The offices of the company will be located at San Antonio, Tex. A. R. Ponder, San Antonio, is Gen. Mgr.

Colorado—Colorado & Northern Ry.—This company is preparing to start work on the construction of its proposed line from Hayden to Cadoma.

New Mexico—El Paso & Southwestern Ry.—See item under Arizona.

New Mexico—The Phelps-Dodge Co. will construct a 15-mile railroad from Tyrone, N. M., to Whitewater, N. M.

Idaho—Chicago, Milwaukee & St. Paul Ry.—This company has sold $999,500 of bonds for the construction of a connection in Idaho and Washington, between the Puget Sound & Willapa Harbor Ry. and its main line. It will be about 30 miles in length. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Utah—Bingham & Garfield Ry.—This company has filed an amendment to its articles of incorporation increasing the capital stock from $2,500,000 to $6,000,000. H. C. Goodrich, Salt Lake City, Utah, is Ch. Engr.

Arizona—San Diego & Arizona Ry.—This company, it is reported, will complete construction of its line to Yuma, Ariz. The sum of $1,000,000 will be spent within a year for the above work. E. J. Kallright, San Francisco, Calif., is Engr. and Acting Supt.

Arizona—El Paso & Southwestern System—The State Corporation Commission of Arizona, June 18, granted permission to this company to consolidate the six companies comprising the system which controls 458 miles of road in Arizona and 440 miles in New Mexico. It is reported that this is preliminary to executing a plan to issue bonds for the extension of the line from Tucson to Phoenix, Ariz. F. B. King, Tucson, Ariz., is Supt.

Washington—Great Northern Ry.—This company will award contracts at once for the construction of its proposed 40-mile line to complete its line to Vancouver, B. C. The work will be carried on from Cold Water summit, to which point the company is now constructing its line. The western end will be at Hope, B. C. A. H. Hogeland, St. Paul, Minn., is Ch. Engr.

Washington—Chicago, Milwaukee & St. Paul Ry.—See item under Idaho.

California—Atchison, Topeka & Santa Fé Ry.—This company has completed surveys, it is reported, for the construction of a direct line from Los Angeles to the Imperial Valley, with a branch to San Diego. The company plans an extension of the Perris branch from Temecula by way of San Luis Rey Valley and Warner's hot springs through the San Felipe Valley to El Centro, Calif. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

Alaska—The Senate Committee on Territories, June 16, ordered a favorable report on a bill appropriating $40,000,000 for the construction, equipment and operation of a railroad in Alaska and giving the President full authority to do the work as he sees fit. The funds are to be raised through the sale of bonds and three-fourths of the gross proceeds of sales from the public domain is to provide a sinking fund for their redemption. Noted June 19.

Canada—Alberta & Great Waterways Ry.—The Canadian Pacific Ry. Co. it is reported, is negotiating for the purchase of this company's line.

ELECTRIC RAILWAYS

North Adams, Mass.—Plans are being prepared by the Berkshire St. Ry. Co. for the improvement of its line from North Adams to Williamstown. C. Q. Richmond, Pittsfield, is Gen. Mgr.

Stafford Springs, Conn.—Preliminary steps are being taken by the Stafford Springs & Monson St. Ry. Co. for the construction of its proposed line from Stafford Springs to the Massachusetts state line. Frederick Faulkner, M. D. O'Connell and Robert H. Fisk, all of Stafford Springs, are interested. Noted Dec. 26, 1912.

Falconer, N. Y.—Surveys have been started for the proposed electric railway to connect Falconer and Buffalo, via Ellington, Clear Creek, Leon, South Dayton, Wesley, Persio, Gowanda and Hamburg, about 55 miles in all. C. D. Meade is interested.

Fredonia, N. Y.—J. Herbert Digby, Dunkirk, N. Y. is interested in the construction of an electric railway from Fredonia to South Dayton.

Rochester, N. Y.—The Rochester & Suburban Ry. Co. contemplates double-tracking and extending its lines in Rochester. E. J. Cook, Rochester, is Gen. Mgr.

Avonmore, Penn.—The West Penn Traction Co. is making preliminary arrangements for the construction of an extension of its Avonmore, Salina & Apollo St. line in Avonmore. W. E. Moore, Pittsburgh, is Gen. Mgr.

Charlottesville, Va.—Surveys are being made for the construction of an electric railway from Charlottesville to Alberene, about 12 miles.

Richmond, Va.—The Virginia Ry. & Power Co. contemplates the extension of its Broad St. line to Roseneath Road. C. B. Buchana, Richmond, is Gen. Mgr.

McMechen, W. Va.—Plans are being prepared by the Wheeling Traction Co. for the extension of its double-track lines in McMechen. George O. Nagle, Wheeling, is Gen. Mgr.

Parkersburg, W. Va.—The Parkersburg, Marietta & Interurban Ry. Co. is considering plans for the extension of its line to McConnellsville, Ohio. H. H. Archer, Parkersburg, is Gen. Mgr. and Pur. Agt.

Augusta, Ga.—The City Council has granted a franchise to the Augusta-Aiken Ry. & Electric Co. to construct and operate an electric railway on Craig St. E. C. Deal, Augusta, is Gen. Mgr.

St. Augustine, Fla.—The Jacksonville & St. Augustine Public Service Corporation has started surveys for the construction of its proposed electric railway to connect St. Augustine and Jacksonville, about 55 miles. Thomas R. Osmond is Gen. Mgr. Noted Feb. 20.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. has applied for a franchise for the extension of its East Lake line to 87th St. and ultimately to Roebuck Springs. G. H. Harris, Birmingham, is Supt. Ry. Dept.

Nashville, Tenn.—The Nashville Ry. & Light Co. is considering plans for the extension of its line from Nashville to Rock City. H. A. Davis, Nashville, is Supt. Ry. Dept.

Lancaster, Ky.—The construction of an electric railway to connect Lancaster and Richmond is under consideration.

Middletown, Ohio—Preliminary arrangements are being made by the Middletown, Reading & Cincinnati Interurban Ry. Co. for the construction of its proposed electric railway to connect Norwood, Reading, Sharonville, West Chester, Monroe, Middletown and Dayton. George T. Atler is interested.

+Youngstown, Ohio—The Poland St. Ry. Co. has awarded the contract for grading its proposed line from Youngstown to Poland to KANE & SMITH, Youngstown. Noted Feb. 6 and May 1.

Muskegon, Mich.—The Muskegon-Ludington & Manistee Electric Ry. Co. has been incorporated to construct and operate an electric railway from Muskegon to Ludington and Manistee. The incorporators are Thomas Jacobs, Walter Heiston, Henry R. Baldwin and Sidney M. Well, Chicago, Ill., and Charles F. Williams, Washington.

Plans have been prepared by the Muskegon-Casnovia Land & Development Co. for the construction of its proposed electric railway to connect Muskegon, Kant City and Casnovia, about 27 miles. James L. Smith, Muskegon, is Secy. Noted May 1.

Benton, Ill.—According to press reports a company is being organized at Benton for the purpose of constructing an electric railway from Benton to Christopher, Herrin and Johnson City, about 30 miles. D. F. Darnell, Decatur, is interested.

Springfield, Ill.—Plans are being prepared by the Capitol City Park & Amusement Co. for the construction of an electric railway in Zoo Park.

Topeka, Kan.—Plans are being considered by the Topeka Ry. Co. for the extension of its line to Gage Park. A. M. Patton, Topeka, is Gen. Supt.

Corpus Christi, Tex.—The Corpus Christi St. & Interurban Ry. Co. contemplates the construction of two miles of new track. F. C. Headley, Corpus Christi, is Supt.

Dothan, Tex.—Hugh G. Smith, Dothan, is interested in a project to construct an electric railway on West Main St. and through Houston Heights.

Albuquerque, N. M.—E. J. Hall, Albuquerque, is interested in the construction of an electric railway to connect Albuquerque, Bernalillo, Sila, Santa Anna, Alameda, Los Linas and Belen.

Fallon, Nev.—Grading has been started by the Fallon Electric R.R. Co. for the construction of its proposed electric railway to connect Fallon, Stillwater and Harrigan South. C. A. Hascall is Pres. and H. Latten is Ch. Engr.

Raymond, Wash.—The Willapa Harbor Ry. Co. is preparing plans for the construction of an electric railway from Raymond to Menlo. R. L. Fisher Raymond, is Mgr. and Pur. Agt.

Exeter, Calif.—Plans are being considered by the Visalia Electric R.R. Co. for the extension of its line in Exeter. F. W. Webster, Fresno, is Gen. Mgr.

Fresno, Calif.—The Fresno Traction Co. has completed surveys and is making preliminary arrangements for the construction of its proposed electric line to connect Fresno and the San Joaquin River, about 10 miles. F. W. Webster, Fresno, is Gen. Mgr. Noted June 19.

+Los Angeles, Calif.—The Pacific Electric Ry. Co. has awarded the contract for grading its proposed electric line to Upland, to GRANT BROS., Security Bldg., Los Angeles.

Los Angeles, Calif.—Plans are being prepared by the Los Angeles Ry. Co. for the construction of an electric railway on Hill St. in Los Angeles. C. A. Henderson, Los Angeles, is Gen. Mgr. and Pur. Agt.

Sacramento, Calif.—The Northern Electric Ry. Co. will construct a line from this city to Vallejo, a distance of 60 miles. A 10-mile branch from Suisun to Vacaville will also be constructed, this to be extended later to Woodland. A. D. Schindler, San Francisco, is Pur. Agt. and Gen. Mgr.

Berlin, Ont.—Plans are being prepared by the Berlin & Waterloo St. Ry. Co. for double-tracking its line from Wellington St. to the Waterloo lines. T. R. Cumming, Welland, is Ch. Engr.

Dunnville, Ont.—The Council has granted a franchise to the Dunnville, Wellandport & Beamsville Electric Ry. Co. to construct and operate an electric railway in Dunnville.

Niagara Falls, Ont. Preliminary arrangements are being made by the Niagara Falls, Welland & Lake Erie Ry. Co. for the construction of a one-mile branch on North Main St. to Welland. C. J. Laughlin, Jr., Welland, is Vice-Pres. and Gen. Mgr.

York, Ont.—The construction of an electric railway in York is planned by the Forest Hill Electric Ry. Co.

North Vancouver, B. C.—The Lynn Valley Scenic Ry. Co. is considering plans for the construction of an electric railway through Lynn Valley to Lynn Valley Park. J. P. Crawford is interested.

Victoria, B. C.—The Vancouver Island Hydro-electric & Tramway Co. is making preliminary arrangements for the construction of its proposed electric railway at Ladysmith, Vancouver Island. Montague Yates, Victoria, is interested.

LIGHT, HEAT AND POWER

+Greenfield, Mass.—The Greenfield Electric Light & Power Co. has awarded contract to the S. MORGAN SMITH CO., for the installation of three water wheels at its Gardner Falls station.

Binghamton, N. Y.—Bids will be received by the Board of Contract and Supply until July 2 for the construction of a municipal electric-light plant on Noyes Island. Douglas Sprague, 39 Cortlandt St., New York, is Consult. Engr. Noted Sept. 19.

Hudson, N. Y.—See item under Buildings.

New York, N. Y.—Bids will be received until June 26 by Patrick A. Whitney, Comr. of Correction, for furnishing materials and installing complete electric-lighting plant equipment in the Seventh District Prison, W. 53d St., Manhattan. Bids will be received until June 30 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in new School 53, Boro. The Bronx.

Schenevus, N. Y.—Plans are being prepared by the Great Bear Light & Power Co. for the construction of a transmission line from East Worcester to Schenevus. W. F. Shupe, Worcester, N. Y., is Mgr. and Supt.

Syracuse, N. Y.—The Syracuse Lighting Co. will expend $100,000 in improving its plant. J. C. DeLong, Syracuse, is Gen. Mgr.

Camden, N. J.—The lowest bid received by the Municipal Electric Light Committee, June 16, for the construction of a municipal lighting plant was that of the Atlantic Construction & Supply Co., Atlantic City, at $413,000, if wires are not laid underground, and $479,300 if they are. Noted Apr. 17.

+West New York, N. J.—The West Shore R.R. has awarded a contract to GEORGE ALLEN & SON, 1245 Park Ave., New York, N. Y., for rebuilding of the boiler and economizer settings at the Weehawken power station.

Leighton, Penn.—Plans are being prepared by the Parryville Gas Co. for the construction of a gas plant and system in Leighton.

Williamsburg, Penn.—Plans and specifications have been completed for the construction of a one-story brick and steel power plant to be 150x180 ft., at Williamsburg, for the Pennsylvania Central Light & Power Co., of Altoona. Bids are being received by Day & Zimmerson, Archs., Philadelphia. Noted June 12.

Chattanooga, Tenn.—The Chattanooga & Tennessee Power Co. will erect an auxiliary plant to develop 25,000 hp. W. E. Boileau, Chattanooga, is Gen. Mgr.

Lexington, Ky.—Press reports state that the Transylvania University contemplates the installation of a $50,000 electric-lighting and heating plant in connection with the institution. R. H. Crossfield is Pres.

Cincinnati, Ohio—See item under Buildings.

Ripley, Ohio—The city contemplates the purchase and improvement of the gas and electric plant of the Ripley Gas Light & Coke Co.

Bluffton, Ind.—The city has been granted permission by the Public Utility Commission to issue $20,000 of bonds for the improvement of the municipal electric-light plant. Noted June 19.

+Fort Wayne, Ind.—The Fort Wayne & Northern Indiana Traction Co. has awarded the contract for the construction of an addition to its Spy Run power plant to the ADAMS CONSTRUCTION CO., Chicago, Ill., at $25,000.

Rockford, Ill.—Bids will be received by the city until June 26 for the installation of an ornamental lighting system. E. A. Wetergren is City Clk.

+De Pere, Wis.—The contract for the new lighting system to be installed here has been awarded to the DE PERE ELECTRIC LIGHT & POWER CO.

Neshkoro, Wis.—The Neshkoro Light & Power Co. is making preliminary arrangements for the construction of an electric-light and power plant at Neshkoro. C. T. Dahlke is Engr.-in-Charge.

Early, Iowa—The proposition to issue $7000 of bonds for the construction of a municipal electric-light plant is under consideration.

East Peru, Iowa—The Peru Electric Light & Power Co. has been granted a franchise to construct and operate an electric-light plant and system at East Peru. F. A. Herweke is Supt.

Lyons, Iowa—The Commercial Club is considering plans for the installation of an ornamental street-lighting system.

Monona, Iowa—A franchise has been granted by the City Council to Wellman & Son to construct and operate an electric-light plant at Monona. Noted May 29.

+Anoka, Minn.—The State Board of Control has awarded the contract for alterations and additions to the power plant at the Anoka Asylum for the Insane, including boiler stokers, pumping machinery and piping, to J. P. ADAMSON & CO., St. Paul, at $23,678.

Detroit, Minn.—Bids will be received by the city until July 7 for the installation of an ornamental lighting system on Washington and Pioneer Sts. E. J. Bestick is City Clk.

Ellsworth, Minn.—At a recent election the citizens voted to issue $8000 of bonds for the construction of a municipal electric-light plant.

Lake Park, Minn.—The proposition to issue bonds for $10,000 for the construction of an electric-light plant is under consideration. Ira Shannack is Clk.

Onamia, Minn.—The citizens are considering the proposition to issue bonds for the construction of a municipal electric-light plant.

Windom, Minn.—An election will soon be held at which the proposition to issue $15,000 of bonds for the improvement of the municipal electric-light plant and water system, will be submitted to the voters.

Wood Lake, Minn.—The Council is considering plans for the construction of an electric-light plant at Wood Lake.

Wilber, Neb.—Preliminary arrangements are being made and bids will soon be received for the construction of a municipal electric-light plant. O. C. Martz, Lincoln, Neb., is Consult. Engr. Noted June 5.

Frankfort, S. D.—Preliminary arrangements are being made and bids will soon be received for the installation of an electric-light system at Frankfort.

Belfield, N. D.—Press reports state that the construction of an electric-light plant at Belfield is under consideration.

Mott, N. D.—Plans are being considered by S. Stewart for the installation of an electric-light plant in connection with his establishment at Mott.

Waldron, Ark.—S. J. Hill and W. P. Harris are planning for the construction of an electric-light plant at Waldron. Noted May 29.

Denison, Tex.—According to press reports the Texas Power & Light Co. contemplates the construction of a new power plant on the Red River, near Denison. Estimated cost, $750,000. W. B. Head is Vice-Pres.

Waelder, Tex.—Preliminary steps are being taken for the construction of an electric-light plant and ice factory at Waelder.

Westboro, Tex.—Plans are being considered by the city for the construction of a municipal electric-light plant. J. C. Jones is City Secy.

Santa Fé, N. M.—It is reported that a syndicate of Chicago, Ill., men has taken over the projected White Rock Cañon hydro-electric project which was being promoted by Charles M. Lang, Salt Lake City, Utah, and associates. It is planned to build a dam across the White Rock Cañon and construct a large hydro-electric plant. A system of power transmission lines will also be built, running to Albuquerque, Santa Fé, Las Vegas and several other places.

Downey, Idaho—The Utah Light & Power Co. has been granted a franchise to construct and operate an electric-light plant and system at Downey.

Park City, Utah—Louis A. Jeffs is contemplating the construction of an electric-light plant in Park City.

Colville, Wash.—The Stevens County Power & Light Co. is making preliminary arrangements for the construction of a substation at Colville and one at the United Copper Mine near Chewelah. H. R. Williams, Colville, is Vice-Pres. and Gen. Mgr.

Warden, Wash.—Preliminary arrangements are being made by the Washington Water Power Co. for the extension of its transmission lines into Hartline.

✦Arlington, Ore.—(Official)—Bids were received by the city, June 3, for constructing an electric-light plant and pumping station as follows: (a) power house; (b) engines, generator, etc.; (c) filter; (d) electrical distribution system; E. O. Hall, Hood River, (a) $1793; (d) $1810; R. R. Popplelton, Portland; (d) $2550; H. W. LANG, Arlington; (a) $1750, (awarded contract); NePage, McKenney & Co., Seattle, Wash.; (a) $1650; (b) $5368; (d) $1339; Dennis & Christensen, Portland; (a) $1650; (b) $5195; (d) $1475; CALIFORNIA JEWELL FILTER CO., San Francisco, Calif.; (c) $2506 (awarded contract); FAIRBANKS, MORSE & CO., Portland, (b) $5125; (d) $1375, (awarded both contracts). Louis C. Kelsey, Portland, is Consult. Engr. Noted Aug. 8, 1912.

✦Long Beach, Calif.—The contract for the installation of an additional unit at the steam power plant of the Southern California Edison Co., has been awarded to the F. O. ENGSTROM CO., Fifth and Seaton Sts., Los Angeles, at about $1,000,000.

Porterville, Calif.—The Mount Whitney Power Co. has prepared plans for the construction of a substation at Fourth St. and Putnam Ave., Porterville.

Reedley, Calif.—A. A. Weber and R. W. Wilson, of the Alta District Gas Co. have applied for a gas franchise and will erect a plant at once if it is granted.

San Diego, Calif.—The San Diego Gas & Electric Co. plans to spend $459,000 for extensions. C. C. May, San Diego, is Pur. Agt.

✦San Francisco, Calif.—The City Electric Co. has awarded a contract at $7742 to BLUXOME & CO., for the erection of a reinforced-concrete substation on Post St., near Polk St. W. A. Clark is Engr.

✦Venice, Calif.—The contract for the installation of an ornamental street-lighting system in the canal district has been awarded to the SOUTHERN CALIFORNIA ELECTRIC CO., at $17,738.

Visalia, Calif.—The Mt. Whitney Light & Power Co. is preparing plans for the Tuolumne Light & Power Co. project. A reservoir will be constructed on the Tuolumne River and a power plant will be erected below Groveland. The project will cost about $2,000,000.

Point Rouge, Que.—Plans are being prepared for the installation of additional equipment in the local electric-light plant. Charles A. Julien is owner.

Kamloops, B. C.—J. J. Carment Engr. is preparing plans for a new $260,000 hydro-electric plant to be located on the Barriere River near Kamloops.

Summerland, B. C.—The installation of additional equipment in the municipal electric-light plant is under consideration.

BRIDGES

Glens Falls, N. Y.—(Official—Plans are in preparation but a special election must be held regarding the construction of the proposed concrete bridge across the Hudson River. Howard M. West is City Engr. Noted June 19.

✦Dover Furnace, N. Y.—The New York Central & Hudson River R.R. Co. has awarded the contract to E. H. BROWN, Hempstead, N. Y., for the reconstruction and relocation of Bridge H-108 at Dover Furnace.

Herkimer, N. Y.—(Official)—The citizens have voted against the construction of the proposed bridge over West Canada Creek to cost $65,000. B. R. Haile is Town Clk. Noted June 12.

✦Rochester, N. Y.—The contract has been awarded to the JOBSON-GIFFORD CO., 30 East 42d St., for the erection, including the painting, of the steel superstructures for Bridges 701, Hudson Ave., 702, Chatham St., 703, Joseph Ave., and 705, Clinton St., for the New York Central & Hudson River R.R. at Rochester.

Watertown, N. Y.—The taxpayers, June 11, voted against the construction of the proposed three bridges.

✦New York, N. Y.—The contract has been awarded to the THEO. SMITH & SON CO., foot of Essex St., Jersey City, N. J., by the New York Central & Hudson River R.R. Co. for the manufacture and delivery of rail seat and lock and rerailing device for Bridge No. 127, Hudson Division, and joint bars and machinery for Bridge No. 8, River Division.

Clarion, Penn.—Bids will be received by the Board No. 1 of Road Supervisors of Beaver Township, Clarion County, until July 1, for a concrete arch, or an iron bridge, 65-ft. span, capacity 25 tons, with concrete abutments, at Beaver Furnace on Deer Creek. G. E. Coulter is Secy.

Indiana, Penn.—Bids will be received by the Commissioners of Indiana County, until July 7, for a reinforced-concrete bridge across Crooked Creek, Rayne Township, Indiana County.

✦Harrisburgh, Penn.—The contract has been awarded by the state to the JAMES O. LORD CO., Hastings, Penn., for the construction of a bridge over Mahoning Creek at Mack's Fording, Armstrong County, at $11,995. List of bidders noted June 19.

Mercer, Penn.—Bids will be received until July 7 by the County Commissioners of Mercer County, Mercer, for stone or concrete abutments for various bridges.

✦Uniontown, Penn.—Bids will be received by the Controller of Fayette County and by the Controller of Washington County, until noon, July 9, at the Office of the Commissioners of Fayette County, Uniontown, for the construction of piers, foundations, etc., necessary in the building of a steel bridge, viaduct and approaches, over the Monongahela River, between South Brownsville and West Brownsville. Plans, specifications and other information on file in the offices of the Controllers and the Commissioners of Fayette County and Washington County, where they may be seen by all parties interested. The same can be obtained from George Porter, Engr. for Fayette County, Uniontown, Chaney & Armstrong, Engrs. for Washington County, Penn., or Hermann Laub, Consult. Engr., Pittsburgh, upon application from a bona fide bidder accompanied by a deposit of $20, which will be returned after the contract is made.

Washington, Penn.—Bids will be received until July 7 by John H. Moffit, County Controller, Washington, for the purchase of $100,000 of Washington County Brownsville bridge bonds.

Crowley, La.—The Police Jury of Acadia Parish has authorized the erection of a 1500-ft. bridge over Bayou Que de Tortue on the public road from Crowley to Gueydan. Work on the bridge will be rushed, as it is to be completed in time to permit wagons to cross when hauling of the rice crop commences in the early fall.

✦Baltimore, Md.—The contract has been awarded by the Board of Awards, to the STEWART-JONES CO., Rock Hill, S. C., and CLAIBORNE, JOHNSON & CO., 901 Calvert Bldg., Baltimore, for the masonry work in connection with bridge No. 2 to be built over Gunpowder River near Lock Raven, 900 ft. long, under the supervision of the Water Board, at $26,235.

✦The contract has been awarded by the State Road Commissioners Garrett Bldg., Baltimore, to ELKAN-TUFT CONSTRUCTION CO., Lexington and Jones Falls, Baltimore, for the construction of a concrete bridge spanning Gwynn's Falls, and Western Maryland Ry. at Frederick Ave., at $54,000 for the bridge and $14,696 for wings, to be constructed after plans prepared by the Commissioners Engineers.

Memphis, Tenn.—The name of the company receiving the contract for the construction of the substructure of the bridge across the Mississippi River at Memphis was erroneously noted June 12 as the Union Bridge & Iron Co. instead of the Union Bridge & Construction Co. The officers of the company are in the Sharp Bldg., Kansas City, Mo.

Chillicothe, Ohio—(Official) — Plans have been prepared and are being considered for the construction of the new Main St. bridge. The plans call for five additional spans of 150 ft. each. The bridge which now spans the river, will be raised about four ft. The entire structure complete will cost about $100,000. G. M. Anderson is County Engr. Noted May 22.

Colerain, Ohio—Bids will be received by the Board of Commissioners of Hamilton County until noon, June 27, for the repair of the approach to the bridge on Harrison Ave., over the Great Miami River at Colerain. Albert Reinhardt is Clk. of Bd.

✦Dresden, Ohio—The County Commissioners have awarded the contract for the construction of a bridge at Dresden to E. M. SCULLY, at $32,300.

Kings Mills, Ohio—The Board of County Commissioners of Warren County, Lebanon, contemplate the construction of a two-span high-truss steel bridge over the Little Miami River at Kings Mills.

Lagrange, Ohio—Bids will be received by the Board of Commissioners of Lorain County until 1 p.m., June 30, for the construction of the superstructure of the Freeman Bridge No. 5, near Lagrange. F. L. Ellenberger is Clk. of Bd.

Marietta, Ohio—The City Council has authorized a bond issue of $120,000 for the purpose of rebuilding the Putnam St. bridge.

New Baltimore, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County until noon, June 27 for the construction of the superstructure of the

new bridge over the Great Miami River at New Baltimore. Albert Reinhardt is Clk. of the Bd.

✦Springfield, Ohio—(Official)—The Board of County Commissioners of Hamilton County, Cincinnati, has awarded the contract for the alterations to the lift bridge over the Miami River and Erie Canal at Section Ave., Springfield, to O. D. CURRY, 2525 Ashland Ave., Cincinnati, at $21,000. Bids were received June 13. Noted May 22.

Bids will be received by the Board of County Commissioners of Hamilton County until noon, July 11 for the construction of a concrete culvert on German Road in Springfield. Albert Reinhardt is Clk. of the Bd.

Sycamore, Ohio—Bids will be received by the Board of Commissioners of Hamilton County, Cincinnati, until noon, July 18, for the construction of the superstructure of the bridge at Clark and Davis St., over the East Fork of Millcreek. Albert Reinhardt is Clk. of Bd.

Troy, Ohio—Bids will be received by the Commissioners of Miami County until 2 p.m., July 15, for substructures and steel superstructures of the following bridges: Bridge over Still water River at West Milton; bridge over Stillwater River on Troy and West Milton Pike; bridge over Stillwater River at Sugar Grove; bridge over Ludlow Creek at Ludlow Falls; bridge over Greenville Creek one mile west of Covington; bridge over Miami River on Lockington Pike; repair of bridge over Miami River at North Main St., Piqua; bridge over Stillwater River at Bridge St., Covington.

Venice, Ohio—Bids will be received by the Board of County Commissioners of Hamilton County, Cincinnati, until noon, June 27, for the construction of the west approach to the highway bridge over the Great Miami River near Venice. Albert Reinhardt is Clk. of Bd.

✦Ottawa, Ill.—(Official)—The contract for the construction of a reinforced concrete bridge in Serena Township has been awarded to GEORGE E. QUINLAN, 1321 East 53rd St., Chicago, Ill., at $3712. Noted June 12.

Wilmington, Ill.—The County Board has authorized the construction of a $60,000 bridge. Nicholas Engles is County Superv.

Madison, Wis.—The Assembly has approved of a bill appropriating $50,000 to assist the residents of Sauk and Columbia counties to build a bridge over the Merrimac river.

Carson, Iowa—The Board of Supervisors will erect a 120-ft. span bridge across the Nishnabotna River. The estimated cost is $5000.

✦Hutchinson, Kan.—(Official)—The contract for the construction of a concrete bridge at First Ave., West, and another at Ave. B. East, has been awarded to the ST. JOSEPH CONSTRUCTION CO., Hutchinson, Kan., at $14,700. Noted June 12.

Newton, Kan.—(Official)—Bids will be received until July 1, by Miss Adella Martin, City Clk., for the construction of a concrete bridge on Main St. The estimated cost is $12,000. W. S. Gearhart, is State Highway Engr. Noted June 5.

Great Falls, Mont.—(Official)—Bids will be received until June 26, by Lee Dennis, County Clk., Cascade County, at Great Falls, Mont., for the construction of a bridge over the Missouri River at Elm. The estimated cost is $40,000. Noted June 12.

✦McAlester, Okla.—(Official)—The contract for the construction of three bridges for Pittsburg County has been awarded to the MISSOURI BRIDGE & IRON CO., St. Louis, Mo., at $8148. W. S. O'Neal is County Clk. Noted May 22.

✦Idaho City, Idaho—The contract has been awarded to the MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, Kan., for the construction of two steel highway bridges and reinforced concrete retaining wall at the North fork of the Payette River. The first bridge will cost approximately $5000. Bidders for the other bridge were as follows: Missouri Valley Bridge & Iron Co., $9214; Minnesota Steel & Machinery Co., $12,797; Colorado Bridge & Construction Co., $11,521; James J. Burke & Co., Salt Lake City, $15,000; J. H. Forbes & Co., Caldwell, Idaho, $10,341; Security Bridge Co., Minneapolis, $11,998.

✦Moscow, Idaho—(Official)—The contract for the construction of two steel bridges for Latah County, has been awarded to the SECURITY BRIDGE CO., Minneapolis, Minn., at $7385. Noted June 5.

Salmon, Idaho—Bids will be received by the County Commissioners of Lemhi County, Idaho, until July 15, for renewing timber members in two combination Pratt truss-bridges.

✦Republic, Wash.—The contract for the construction of a bridge across the San Poil River at Cache Creek has been awarded to H. H. STRATTON, 2325 Sinto Ave., Spokane.

Seattle, Wash.—The lowest bidder for the construction of 20th Ave. N. E., bridge was J. R. Wood, 621 Valley St. at $41,-628. Other bidders were as follows: Nettleton-Bruce-Sachback, $41,726; Graff Construction Co., $43,737; International Contract Co., $44,733; Russell & Gallagher, $47,497, and Harrington-Peters Co., $49,223. It is probable that J. R. Wood will be awarded contract.

✦Independence, Ore. The County Court has awarded the contract for the construction of a concrete bridge to PURCELL & GALLAGHER, Portland, Ore.

Portland, Ore.—(Official)—All bids received for the construction of a reinforced concrete bridge over Sullivan Gulch, have been rejected and the project will be discontinued. Thomas M. Hurlburt is City Engr. Noted June 5.

Los Angeles, Calif.—Bids will be received by the Board of Supervisors until 2 p.m., June 30, for the construction of four trestle bridges over the Laguna Wash on University Ave., Hubbard Ave., Sunol Drive and First St., in the Alhambra and Fruitland Road Districts.

Redding, Calif.—Plans have been accepted by the City Trustees for a reinforced concrete bridge to be built across the Sacramento River. The bridge will be twenty one ft. wide, and 800 ft. long. The piers will rise sixteen ft. above the highwater mark. The estimated cost is $15,000. Noted June 5.

San Jose, Calif.—Wm. Radtke, of Gillory, was the lowest bidder for the construction of a concrete bridge near San Jose. Other bidders were as follows: John W. Williams, San Jose, $12,000; M. E. Kilcourse, San Jose, $11,432; T. K. Beard, Modesto, $10,856; State Construction Co., San Francisco, $12,-289; A. W. Beggers, S. F., $13,937; R. O. Summers, San José, $14,845. The engineer's estimate was $11,200. Plans were also ordered for two new bridges to cost about $25,000 and $8000. Irving L. Ryder, Engr., San Jose, Calif.

Ventura, Calif.—Bids will be received until 2 p.m., July 8, by the County supervisors for the construction of seven reinforced concrete bridges and culverts in the Conejo Valley.

WATER SUPPLY—IRRIGATION

Portland, Maine—According to press reports, the Trustees of the Water District contemplate the installation of a plant to treat the water taken from Sebago Lake with a solution of hypochlorite. J. M. Caird is Engr.

✦Brownington, Vt.—According to press reports, the Orleans Water Works Co., Orleans, Vt., has awarded a contract to the H. P. CUMMINGS CO., Ware, Mass., for laying 24,000 ft. of 6-, 8- and 10-in. c.-i. water pipe, and constructing a concrete dam, intake and gate house at the outlet of Willoughby Lake. Dudley & Sawyer, Manchester, N. H., are Consult. Engrs.

★Agawam, Mass.—(Official)—Bids will be received by the Board of Water Commissioners until 2 p.m., July 2, for hauling and laying 90,000 ft. of 4-, 6- and 8-in. c.-i. pipe. Plans and specifications are on file at the office of James L. Tighe, Consult. Engr., 189 High St., Holyoke, Mass. E. A. Kellogg is Chn.

East Longmeadow, Mass.—Bids will be received by the Board of Selectmen until 2 p.m., July 8, for furnishing and laying about 10,500 ft. of 78-in. and 15,600 ft. 6-in. c.-i. water pipe with necessary hydrants, and gates. Plans and specifications are on file at the office of Durbee, White & Towne, Engrs., Springfield, Mass. T. C. Burton is Chn, of Selectmen.

✦Fall River, Mass.—The Water Board has awarded the contract for setting boilers and making alterations and additions to the boiler house at the pumping station to WILLIAM A. BORDEN at $10,500.

Foxboro, Mass.—The Board of Water Commissioners contemplates laying about 14,000 ft. of 8- and 6-in. pipe from Foxboro to Foxdale. Estimated cost, $15,000. W. R. Lewis is Secy.

Worcester, Mass.—The City Council Committee on Water has ordered installation of water pipe in various streets as follows: 2250 ft. 2-in., 1100 ft. 8-in., 5650 ft. 12-in., 1100 ft. of 16-in. Cost, about $22,000 George W. Batchelder Water Com.

Brooklyn, N. Y.—Bids for laying water mains in various streets were received by Henry S. Thompson, Comr., Water Supply, Gas and Electricity, June 13, as follows: Robert Carter Co., Brooklyn, $19,002; Beaver Engineering & Contracting Co., 51 Chambers St., $20,964; Tam Corp., 11 East 125th St., N. Y. City, $20,709; Carragno & Dragonetti, 1178 Clay Ave., $18,733; Murphy Bros., Brooklyn, $20,844; J. O'Leary, 245 East 202d St., $20,939; L. D. Gregory, 212 West 138th St., $18,883; McBride & Callan, 670 Eighth Ave., $19,568; Hanover Contracting Co., 215 West 125th St., $20,471.

★Lockport, N. Y.—(Official)—Bids will be received by Schuyler Beattie, City Clk., until 7:30 p.m., July 9, for constructing a 12-in. watermain in Willow St., Beattie Ave., High St., Hyde Park, Mulberry St., Pound St. and Walnut St., according to plans and specifications on file in the office of the City Clerk. Noted June 12.

Paterson, N. J.—The Mayor and City Council have approved an election for voting on a bond issue of $10,000, to be used for extending the water system. H. J. Harder is City Engr.

✦Danville, Penn.—(Official)—The contract to construct a settling basin, furnish and install new pumping machinery, and make connections with the pumping station of the city water system, has been awarded to the PITT CONSTRUCTION CO., Pittsburgh, Penn. Bids were opened by the Board of Water Commissioners, May 20. Chester & Fleming, Pittsburgh, are Consult. Engrs. Noted May 8.

Morganza, Penn.—(Official)—R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio, has been retained to supervise the construction of a water-works dam for the Pennsylvania Training School at Morganza. William F. Penn is Supt. of School.

Shippensburg, Penn.—The borough contemplates an expenditure of $50,000 for enlarging its water system.

Ashland, Va.—(Official)—The proposition to purchase the holdings of the Ashland Gas, Sewerage & Water Co. was voted down at the recent election. Noted June 19.

✦Norfolk, Va.—According to press reports, a contract to furnish water meters during the year, has been awarded by the Board of Control, to the NATIONAL METER CO., Norfolk, at approximately $20,000.

Richmond, Va.—Preliminary plans and estimates have been prepared for laying a 12-in. watermain in Broad St., to supply water to the Fulton Hill District. E. E. Davis is Supt. W.-Wks.

Vinton, Va.—The project to install a municipal water system here has been favorably acted upon, and bonds for $25,000 have been voted for the purpose. Noted Feb. 6.

Barboursville, W. Va.—The proposition to install a municipal water system here will come up for a vote July 9. Tentative plans and estimates place the cost of a system at $12,500.

Parkersburg, W. Va.—Plans have been prepared for laying an 8-in. watermain across the Little Kanawha River, to serve the South Side. Estimated cost, $8000. B. F. Stewart, Jr., is City Engr.

Winston-Salem, N. C.—The Water Committee has been authorized to purchase a 2,000,000-gal. pump, and construct a clear-water basin at the Salem pumping station. Estimated cost, $12,000.

Columbia, S. C.—The city voted, June 3, to annex three suburbs, and will proceed immediately to extend the water and sewer systems to those localities. Estimated cost, $100,000. W. H. Gibbes is Mayor. Noted May 29.

Mount Pleasant, S. C.—It is proposed to install a water system here, estimated to cost $20,000. Tentative plans provide for a 100,000-gal. standpipe and an artesian well, with the necessary pipe lines and hydrants.

Alachua, Fla.—The J. E. McCrary Co., Third National Bank Bldg., Atlanta, Ga., has prepared plans for a water system and electric-light plant here. Estimated cost, $24,000.

Thomasville, Ala.—Edgar B. Kay, Consult. Engr., Tuscaloosa, Ala., has prepared plans and specifications for the installation of water and sewer systems here. An election has been called for July 21 to vote on a bond issue of $25,000.

Paducah, Ky.—L. A. Washington, City Engr., has submitted to the City Council plans for the establishment of a new pumping station, the equipment for which will cost $9000. The pumps will be electrically operated. Noted May 29.

Winchester, Ky.—The Winchester Water Co. contemplates the installation of additional pumps for pumping the water from the Kentucky River to the town.

★**Akron, Ohio**—(Official)—The following bids were received by the Water Committee, June 5, for its construction of 2240 cu.ft. of 51-in. steel pipe from the reservoir to the pumping station: East Jersey Pipe Co., for lock-bar pipe, $101,100; Carroll-Porter Co., Pittsburgh, Penn., lock bar, $95,054, riveted, $97,290; for 30- and 48-in. concrete drain work in connection with the water system the following bids were received: Payne-Gillen Co., Akron, $55,250; Amalu Construction Co., Cleveland, Ohio, $52,205; W. H. Tunt, Akron, $34,336; All bids were rejected as being excessive and the work will be readvertised later in the season. Frank A. Barbour, Tremont Bldg., Boston, is Consult. Engr. Noted May 29 and June 12.

✚**Akron, Ohio**—According to press reports, a contract to furnish and install a 10,000,000-gal. reciprocating pump in the city pumping station, has been awarded to the WILLIAM TOD CO., Youngstown, Ohio, at $78,000. Noted May 15.

Cincinnati, Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, July 1, for laying c.-i. water pipe, special castings and valves in Madison Road. Plans and specifications may be obtained at the office of the General Superintendent of the Water-Works Department.

Cortland, Ohio—An election has been called for July 19, to vote on a bond issue of $20,700, for constructing a water system. L. Hutton is Mayor.

Glouster, Ohio—(Official)—Bids will be received by the Board of Public Affairs until noon, June 28, for constructing a receiving basin for the municipal water system. J. L. Davis is Clk.

Lima, Ohio—(Official)—Bids will be received by J. R. Morris, Dir. Pub. Ser., until July 3, for laying 14,830 ft. of 20-in. bell and spigot c.-i. water main. The pipe will be furnished by the city. G. A. Crayton is City Engr. Noted June 19.

New Lexington, Ohio—At an election held June 16, bonds for $50,000 were voted for purchasing the water system of the Lexington Water Co. Noted May 1.

✚**Plensant City, Ohio**—(Official)—The contract to construct a water system here has been awarded to F. R. STONE, Lima, Ohio, at $14,350. Bids were opened by M. F. Devine, Village Clk., June 13. H. L. Maddock, Newark, Ohio, is Consult. Engr. Noted June 5.

Rocky River, Ohio—(Official)—Bids will be received by Frank Mitchell, Village Clk., until noon, July 22, for installing a water system.

Youngstown, Ohio—Bids will be received by the Director of Public Service until July 1, for furnishing and laying a 30- and 36-in. water main across the Mahoning River. W. H. McMillin is Clk.

Zanesville, Ohio—Bids will be received by A. J. Voll, Clk., Bd. Pub. Ser., until July 2, for furnishing 1000 ft. of 20-in. c.-i. water pipe, specials and water gates.

West Terre Haute, Ind.—(Official)—No bids were received, June 16, for constructing the proposed water system. The contract will probably be readvertised. W. R. Paige, Rose Dispensary Bldg., Terre Haute, is Consult. Engr. Noted June 5.

Bay City, Mich.—E. L. Dunbar, Supt. W.-Wks., is receiving bids for a 5,000,000-gal. high-duty pump, to be installed at the West Side pumping station.

✚**Niles, Mich.**—Official)—The contract to lay water mains in various streets here has been awarded to E. H. POWER, Niles, at 75c. per ft. Bids were opened June 18. Noted June 12.

Altamont, Ill.—Bids will be received by the City Clerk until 7:30 p.m., June 27, for constructing a 40,000-gal. steel tank on a 100-ft. steel tower and about 2500 ft. of 4- and 8-in. c.-i. pipe, with the necessary castings, hydrants, valves and boxes. Plans were prepared by the Fuller-Coult Co., Chemical Bldg., St. Louis, Mo. F. Schumacher is Mayor. Noted Apr. 3.

✚**Cambridge, Ill.**—The contract to construct an artesian well and pumping plant here has been awarded to the J. P. MILLER WELL CO., Chicago, at $2.95 per ft. for the well. Bids were opened May 29.

Atlantic, Iowa—According to press reports, bids will be received by T. E. Nichols, City Clk., until June 30, for drilling, casing and connecting six 6-in. wells.

Deerwood, Minn.—(Official)—Bids will be received by J. O. Hage, Village Clk., until 11 a.m., June 28, for constructing a complete water system, according to plans prepared by the Oscar Claussen Engineering Co., St. Paul, Minn. Noted June 19.

Lake City, Minn.—(Official)—Bids will be received by the City Council until 8 p.m., July 1, for extending the water distributing system, and constructing a 500,000-gal. reinforced concrete reservoir. The contract involves furnishing and laying about 12,000 ft. of 4-, 6- and 12-in. c.-i. or wood stave pipe, with 5 tons of specials. Plans and specifications are on file at the office of L. P. Wolff, Consult. Engr., Germania Life Bldg., St. Paul, Minn.

✚**Norfolk, Neb.**—(Official)—The contract to extend the water system here has been awarded to the GENUNG HEATING & CONSTRUCTION CO., Norfolk, at $9100. Bids were opened June 16, by P. F. Stafford, City Clk. Noted June 5.

Omaha, Neb.—R. B. Howell, Water Comr., contemplates the installation of new boilers, a smokestack and coal storage basin. Estimated cost, $80,000.

✚**Ralston, Neb.**—The contract to lay the mains for the proposed new water system here has been awarded to the ALAMO SUPPLY CO., Omaha, Neb., at $19,493. Noted May 15.

Mayville, N. D.—(Official)—Bids will be received by T. O. Vangen, City Audr., until 10 a.m., July 15, for equipping an electric-light plant and constructing an addition to the water system. Plans and specifications are on file with the Oscar Claussen Engineering Co., St. Paul, Minn. Bids on this contract were received and rejected June 18. Noted June 5.

New Rockford, N. D.—F. S. Crabbe, Consult. Engr., Fargo, N. D., has been retained by the City Council to prepare plans for the installation of a water system here.

Choteau, Mont.—According to press reports, Swearingen & McCulloh, Consult. Engrs., Great Falls, Mont., are preparing plans for the installation of a water system here.

Hannibal, Mo.—The City Council has approved the plans of the Hannibal Water Co. for laying 16- and 12-in. water mains in various streets. W. H. Louse is City Clk. Noted June 5.

Hopkins, Mo.—An election will probably soon be called to vote on the installation of a water system. Estimated cost $12,000.

Monroe City, Mo.—(Official)—Bids will be received by George W. Tompkins, City Clk., until 1 p.m., July 8, for constructing a water system estimated to cost $68,000, and a sewer system estimated to cost $10,000. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Consult. Engrs. Noted Apr. 24.

Walnut Ridge, Ark.—R. C. Huston & Co., Memphis, Tenn., have been retained to prepare plans for the proposed water system here. B. F. Graff is Pres., Bd. Town Comrs. Noted May 29.

Coleman, Tex.—M. L. Minter Engr., has made a survey for a reservoir on Indian Creek. The dam will be 40 ft. high and have a capacity of 336,000,000 gal. Noted June 12.

Houston, Tex.—The City Council has taken preliminary action to call an election to vote on a bond issue of $100,000 for the installation of water mains and fire plugs. This work is contemplated to afford better fire protection.

Port Arthur, Tex.—The Port Arthur Rice & Irrigation Co. is installing additional machinery at its pumping plant near here and making other improvements at a cost of about $40,000. It will add about 8000 acres of land to its irrigated tract.

Bingham, Utah—Bonds for $15,000 were voted recently for installing a water system. Bids for construction will probably soon be asked.

Castle Dale, Utah—According to press reports, it is proposed to install a water system here, estimated to cost $14,000. Bonds have been voted.

Endicott, Wash.—C. H. Green & Co., Consult. Engrs., Paulsen Bldg., Spokane, Wash., are preparing plans for a water system here. Bonds for $12,000 were recently voted for this purpose.

✚**Hillyard, Wash.**—The contract to construct a water system here has been awarded to the JAMES KENNEDY CONSTRUCTION CO., Portland, Ore., at $18,153 for District 1, $10,275 for District 2, and $2545 for District 3.

✚**Puyallup, Wash.**—Contracts were awarded recently, as follows: Furnishing c.-i. pipe, to CRANE & CO., Tacoma, Wash., at $7580; laying pipe, to McKIM, KLINE & ADDISON, Seattle, at $9920.

Seattle, Wash.—(Official)—Bids for constructing a gravity dam at Cedar Lake were received by the Board of Public Works, June 13, as follows: Hans Pederson, $866,578; Nettleton-Bruce-Eschbach Co., $687,110; P. E. McHugh, $976,071; Graff Construction Co., $778,882. A. H. Dimock is City Engr. A list of the item bids on this contract will be published in the Contract Prices columns of this or some other early issue. Noted May 29.

Amity, Ore.—Louis C. Kelsey, Consult. Engr., Selling Bldg., Portland, Ore., has been retained to prepare plans and specifications for the proposed water system here. Estimated cost, $25,000. Noted June 12.

Echo, Ore.—(Official)—June 14, the Teel Irrigation District voted bonds in the amount of $1,200,000 for the construction of necessary works to supply water for irrigation purposes. The District comprises 20,000 acres of land. The main features of construction will be a tunnel 12,341 ft. long; a storage reservoir dam 105 ft. high, 650 ft. long on top and 200 ft. on the bottom; a main canal 19 miles long including five miles of flume, and 54 miles of ditching for distributing system, with all structures connected built of concrete. W. B. Hinkle is Engr. in chief, and J. Frank Spinning. Noted June 5, under Salem, Ore.

★**Burlingame, Calif.**—(Official)—The date of receiving bids for the proposed water system here has been extended from June 30 to July 21. Noted incorrectly June 19.

Dinuba, Calif.—It is proposed to construct an auxiliary pumping plant for the municipal water-works. The plant will cost about $5000.

Lakeview, Calif.—The Nuevo Land Co. will soon award a contract for the construction of a cement pipe and irrigation system at Lakeview to cost $30,000. F. W. Sdalder and J. W. Chase, Riverside, are directors.

Sacramento, Calif.—The City Clerk has been authorized to advertise for bids for furnishing a 450-hp. turbine pumping engine for the Water Department.

Sanger, Calif.—The town contemplates the installation of municipal water and sewer systems.

Santa Barbara, Calif.—The city contemplates voting bonds in the sum of $120,000 for the construction of the Gibraltar Reservoir.

Suisun, Calif.—The Solano Irrigated Farms, Inc., has had plans completed for the erection of a filtration and sterilization plant in Solano County to supply water to Suisun and other towns, the water to be taken from the Sacramento River. The plant will have a capacity of 200,000 gal. per min. Patrick Calhoun, is Pres.

✚Victoria, B. C.—(Official)—Bids will be received by C. H. Rust, Water Comr., until noon, July 15, for furnishing and laying about 27½ miles of reinforced concrete pipe and appurtenances on the line of the Sooke Water Supply gravity conduit, according to specifications on file at the Sooke Water Supply Office, 1414 Douglas St., Victoria. Wynn Meredith is Consult. Engr.

Galt, Ont.—The Town Council has been authorized to expend $70,000 for the construction of a water system.

St. Rose, Que.—Bids will be received by J. A. Joly. Secy.-Treas., until July 7, for constructing a water tank, a sewer purification system, a water system, a filtration system and power house, and for furnishing the necessary pumps and other equipment. Plans and specifications are on file at the office of the Secretary-Treasurer, and at the office of Ouimet & Lesage, Consult. Engrs., 76 St. Gabriel St., Montreal.

Winnipeg, Man.—Bids will be received by M. Peterson, Chn. Bd. of Control until July 2, for furnishing and installing two horizontal two-stage turbine pumps, direct coupled to a slow constant speed induction motor, switching gear and starter panel.

SEWERS

✚Biddeford, Maine—The contract to construct a trunk sewer here has been awarded to OTTO NELSON CO., 149 Exchange St., Bangor, Maine, at $47,524. The other bids were: Conner Bros., Lowell, Mass., $66,796; F. B. Williams Co., South Attleboro, Mass., $50,818; Joseph Sacco Co., Portsmouth, N. H., $47,823; M. A. Small & Son, Saco, Maine, $49,743; Falicy & Kelly, Dorchester, Mass., $56,214; F. A. Rumery Co., Portland, $64,118; John Gulliver, Portland, $75,294; C. A. Prest, Topsham, $57,359. Bids were opened June 9. Noted May 29.

★Portland, Maine—(Official)—Bids will be received by Elon Bradbury, Comr. Pub. Wks., until noon, July 14, for constructing Section 2 of the East Side intercepting sewer, and Sections 1 and 2 of the Fall Brook branch of the East Side intercepting system. Specifications and proposal blanks may be obtained from the Commissioner. Noted Oct. 17.

✚Bellows Falls, Vt.—(Official)—The contract to construct sewers here has been awarded to BALDASARO & ROBINSON, Bellows Falls, at $13,678. Bids were opened by H. C. Bacon, Pres. Bd. of Trustees, June 10. Noted May 29.

Fitchburg, Mass.—(Official)—Bids will be received by the Sewage Disposal Commission until June 30, for furnishing c.-i. pipe, special castings, gate valves and sluice gates for the sewage disposal works. Harrison P. Eddy, of Metcalf & Eddy, 14 Beacon St., Boston, is Consult. Engr. David A. Hartwell is Ch. Engr. Bids will be asked soon for furnishing a small centrifugal pump and air compressor.

Framingham, Mass.—(Official)—Specifications are being prepared for the proposed sewer extensions. Estimated cost, $30,000. F. W. Meserve is Chn. Sewer Com. Noted June 5.

★✚Pittsfield, Mass.—The Board of Public Works received bids June 21, on Newell St. drain construction as follows: C. E. TRUMBULL CO., Boston, Mass., $17,875 (awarded contract); James D. Kelly, Dorchester, Mass., $18,320; F. T. Ley Co., Springfield, Mass., $19,256.

Bids on Pleasure Park drain were: E. P. ROBERTS CO., Pittsfield, Mass., $22,066 (awarded contract); C. E. Trumbull Co., Boston, Mass. $26,625; Y. T. Ley Co., Springfield, Mass., $27,052; H. W. Golden & Son, Troy, N. Y., $31,154. Noted June 12.

★Bronxville, N. Y.—(Official)—Bids will be received by the Board of Village Trustees until 8 p.m., July 8, for extending the sewer system, according to plans prepared by George H. Rogers, Village Engr., and now on file at the office of Frank Dinsmore, Village Clk.

Goshen, N. Y.—According to press reports, Clyde Potts, Consult. Engr., New York, has prepared preliminary plans for the installation of a sewer system and sewage disposal plant here. Estimated cost, $50,000 to $80,000.

★Schenectady, N. Y.—(Official)—Bids will be received by the Board of Contract and Supply until 2:30 p.m.; July 2, for furnishing and supervising the installation of sewage pumping machinery and appurtenances. W. Thomas Wooley is City Engr.

★Bids will be received at the same time for the construction of a sewage pumping station and force main, and for the installation of pumping machinery and appurtenances in North Ferry St. Thomas Wooley is City Engr.

★Schenectady, N. Y.—(Official)—Bids will be received by the Board of Contract and Supply until 2:30 p.m., July 9, for constructing a 42-in. intercepting sewer from Nott St. along Front St., to North Ferry St. and a 36-in. sanitary intercepting sewer from the proposed sewage pumping station over private lands and Washington Ave. to near Fuller St. Thomas Wooley is City Engr., and Fred E. Johnson is Secy. Bd. of Contract and Supply. Noted Oct 31.

Watertown, N. Y.—(Official)—At a special election held June 11, the proposition to construct a sewer in Arlington St. was defeated. E. W. Sayles is City Engr. Noted June 12.

★Newark, N. J.—(Official)—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., July 29, for the following contracts: Section 6, southerly portion, main intercepting sewer in the city of Newark; Section 6, central portion, main intercepting sewer in the city of Newark; Section 6, northly portion, main intercepting sewer in the city of Newark; Section 19, Acquackanonk-Garfield-Passaic Branch intercepting sewer, Borough of Garfield. John S. Gibson is Clk. For particulars, see "Contracts to be Let."

Paterson, N. J.—(Official)—Bids will be received by the Board of Public Works until July 1, for constructing about 5200 ft. of 6- to 24-in. storm water sewer in Main St. H. J. Harder is City Engr.

Plainfield, N. J.—(Official)—Bids for constructing sanitary sewers here were received by the Common Council, June 16, as follows: Mobus Bros., North Plainfield, $9767; Michael Garafano, Summit, N. J., $7283; Alfonso Colucci, Plainfield, $8420; New York Sewage Disposal Co., New York, $11,770; Burke & Bonham, Plainfield, $8476; T. Foster Callahan, Elizabeth, N. J., $8913; C. A. Peterson, Plainfield, $8281. Noted May 29.

✚Secaucus, N. J.—According to press reports, the contract to construct a sanitary sewer system for the Clarendon Section has been awarded to CHARLES O'NEILL, Secaucus, at $24,900. Bids were opened June 3. Noted May 22.

Centerville, Penn.—(Official)—R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, Ohio, has been retained to prepare plans for a sewage treatment plant for Point View, at Mine No. 5 of the Vesta Coal Co., near Centerville. The plant will be of sufficient capacity to serve a population of 5000.

Duquesne, Penn.—(Official)—Bids will be received by the Sewer Committee until noon, July 5, for constructing a sewer in South First St., Third Ward. L. W. Francis is Chn

Philadelphia, Penn.—According to press reports, George S. Webster, Ch. Bureau of Surveys, has prepared plans for a sewage disposal system estimated to cost $25,000,000.

Richmond, Va.—The Administrative Board has forwarded a request to the Common Council asking an appropriation of $27,000 for the construction of the Southside Sewer. Charles E. Bolling is City Engr.

Roanoke, Va.—Bids will be received by W. L. Craft, City Clk., until noon, June 27, for constructing sewers in various streets. F. L. Gibboney is City Engr.

Winton, Va.—At a recent election, bonds for $17,000 were voted for constructing a sewer system.

Charlotte, N. C.—The Executive Board plans to expend $30,000 for the construction of sewers in the suburbs of the city. Bids will probably soon be asked on this work. Joseph Firth is City Engr.

★Dunn, N. C.—(Official)—Bids will be received by the Mayor and Board of Commissioners until July 8, for constructing about six miles of 8- to 24-in. pipe sewers. Plans and specifications are on file at the office of M. L. Wade, Mayor, or may be obtained from Gilbert C. White, Consult. Engr., Charlotte, N. C. Noted June 19.

✚Atlanta, Ga.—(Official)—Bids for constructing lateral sewers, Groups 6 and 7, were received by the city, June 12, as follows: Group 6: Dysard Construction Co., $15,661; J. R. Cothran, $15,598; B. T. MEEKS, $12,143 (awarded contract); L. R. Brine, $13,943; Cement Stone & Tile Co., $15,954; Group 7: Dysard Construction Co., $17,691; Case & Cothran, $18,092; B. T. MEEKS, $14,064 (awarded contract); L. R. Brine, $16,126; Cement Stone & Tile Co., $18,363. For item bids see under Contract Prices, June 19.

★✚Birmingham, Ala.—(Official)—Bids for constructing an extension to the South Side trunk sewer, with laterals, were received by Walter J. Kirkpatrick, City Engr., June 3, as follows: Section 1, SOUTHERN ASPHALT & CONSTRUCTION CO., $70,940 (awarded contract); Sullivan, Long & Haggerty, $73,039; J. W. Gurley & Co., $74,705; Thomas Worthington, $75,825; Dunn & Lallande Bros., $82,596; Section 2, SOUTHERN ASPHALT & CONSTRUCTION CO., $26,945; Sullivan, Long & Haggerty, $31,276; J. W. Gurley & Co., $31,759; Dunn & Lallande Bros., $32,131; Thomas Worthington, $34,027. F. H. Peterson, $37,433; Section 3, SOUTHERN ASPHALT & CONSTRUCTION CO., $70,052 (awarded contract); Thomas Worthington, $77,982; Sullivan, Long & Haggerty, $82,944; J. W. Gurley & Co., $87,188; Dunn & Lallande Bros., $104,052; Section 4, A. C. BROOKS & CO., $27,844 (awarded contract); Southern Asphalt & Construction Co., $28,689; Sullivan, Long & Haggerty, $33,212; J. W. Gurley & Co., $34,533; F. H. Patterson, $41,021; Dunn & Lallande Bros., $44,612.

Thomasville, Ala.—See item under Water Supply—Irrigation.

New Orleans, La.—(Official)—Bids will be received by F. S. Shields, Secy., Sewerage and Water Bd., until noon, July 23, for the following: Contract 53 D, underground conduit from Sewerage Station A to the Mississippi River; Contract 55D, extension to drainage pumping station No. 1, including all foundations, suction and discharge basins; Contract 56D, sluice gates for drainage pumping station No. 1; Contract 57D, traveling crane for drainage pumpnig station No. 1. Noted June 5.

Danville, Ky.—(Official)—The contract to construct sewers in various streets has been awarded to the DILLEHAN BRICK CO., Danville, at $11,625. Bidders were opened by the city, June 14. Noted June 12.

Bexley, Ohio—Bids will be received by George E. Fry, Village Clk., until July 1, for constructing a municipal sewage treatment plant, according to plans prepared by A. Elliott Kimberly, Consult. Engr., 8 East Long St., Columbus. Noted May 1.

Cambridge, Ohio—According to press reports, bids will be received about July 15, for the construction of a sewage disposal plant, according to plans prepared by Karl M. Cosgrove, Consult. Engr., Cambridge, Ohio. J. A. Leyshon is Dir. Pub. Ser.

Cambridge, Ohio—(Official)—Bids will be received by the Directors of Public Service until noon, July 8, for constructing 7500 ft. of 8-in. vitrified sewer, and 6000 ft. of 5-in. house drains. Karl M. Cosgrove is City Engr.

✚Canton, Ohio—A contract to construct storm sewers in McDonald, Harrisburg and Oaklawn Aves., has been awarded to LOGAN D. BURD, Canton, at $7600.

Cincinnati, Ohio—General plans have been prepared and submitted to the Director of Public Service, for the Duck Creek Interceptor. Estimated cost, $300,000. This will be the first work on the proposed new sewer system, which is estimated to cost $3,000,000.

Cincinnati Ohio—(Official)—Bids will be received by V. T. Price, Dir. Pub. Ser., until noon, June 27, for constructing main and lateral sewers and drains in various streets.

Cleveland, Ohio—(Official)—R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, has been retained by the Cincinnati, Painesville & Eastern R.R. Co., Willoughby, Ohio, to prepare plans for a sewage treatment plant at Willoughbeach Park, a result owned by the railroad on the Clarke near Cleveland.

Euclid, Ohio—(Official)—Bids will be received by Fred H. Shoaff, Village Clk., until noon, July 14, for constructing sewers in various streets, according to plans on file with the Clerk, and at the office of the F. A. Pease Engineering Co., Marshall Bldg., Cleveland.

✚**Greenfield, Ohio**—(Official)—The contract to construct sanitary sewers here has been awarded to the CHILLICOTHE CONSTRUCTION CO., Chillicothe, Ohio, at $4685. Bids were opened June 16, by E. M. Connor, Village Clk. Noted June 5.

Mount Vernon, Ohio—(Official)—R. Winthrop Pratt, Consult. Engr., Hippodrome Bldg., Cleveland, has been retained by the city of Mount Vernon to determine the degree of treatment necessary in connection with the construction of the proposed additional sewerage and an intercepting sewer to carry all of the sewage of the city into the Kokosing River. Noted June 19.

✚**Niles, Ohio**—(Official)—The contract to construct sanitary sewers in Walnut, Pratt and Langley Sts., Pine Alley and East Park Ave. has been awarded to FRANK MANNELLO, Pittsburgh, Penn., at $4964. Bids were opened June 12, by the Board of Control. Noted June 12.

Pemberville, Ohio—The Smith & Boulay Co., The Nasby, Toledo, Ohio, is preparing plans for the construction of a storm water sewer system here.

Youngstown, Ohio—The lowest bids received by the city for constructing the Brier Hill District Sewer were as follows: Section 1, Harris & Kinson, $6,817; Section 2, Charles Harris, $28,483 for brick; Dioro & Serafino, $29,897 for segment block.

Zanesville, Ohio—(Official)—All bids received June 16, for constructing sewers in Wheeling Ave. and other streets were rejected. The contract will be readvertised. A. J. Voll is Clk., Dept. Pub. Ser. Noted June 12.

Marion, Ind.—Bids will be received by the Board of Public Works until June 27, for constructing the West Marion combined storm and sanitary sewer. Estimated cost, $32,000. F. R. Heck is Clk. Noted June 12.

✚**Flint, Mich.**—The contract to construct approximately 33 miles of sewers here has been awarded to ALBERT H. PRANGE, Grand Rapids, Mich., at $374,212. The only other bid received was that of William Moran & Co., Joliet, Ill., at $384,362. Bids were opened by D. E. Newcomb, City Clk., June 3. Noted May 22.

Saline, Mich.—(Official)—Bids for constructing sewers here, according to plans prepared by the W. J. Sherman Co., The Nasby, Toledo, Ohio, were received by the city, June 11, as follows: Emanuel L. Schneider, Ann Arbor, Mich., $19,552; Edwards & Whaley, Milan, Mich., $18,214; VANDERWEEK BROS., Grand Rapids, Mich., $17,517 (awarded contract); Weoge & Tyler, Coldwater, Mich., $18,434.

✚**Chicago, Ill.**—(Official)—Bids will be received by John McGillen, Clk., Sanitary District of Chicago, unti noon, June 26, for constructing a sewer outlet at South 52d Ave., and for making alterations and additions, and installing electrical equipment at the R. A. Waller substation. Thomas A. Smyth is Pres. of Bd. For particulars, see under "Contracts to Be Let."

✚**Evansville, Wis.**—The contract to construct about $8000 ft. of storm and sanitary sewers here has been awarded to CHARLES E. HUGHES, Rockford, Ill., at $7889. Bids were opened May 22. Noted May 22.

Horicon, Wis.—According to press reports, plans are being prepared for the construction of six miles of sewers here. Estimated cost, $30,000.

✚**Jackson, Wis.**—(Official)—The contract to construct sewers in various streets here has been awarded to FRED SCHULTZ, Jr., West Bend, Wis., at $5060. Bids were opened June 10. Noted June 5.

Janesville, Wis.—(Official)—Bids will be received by the Board of Public Works until 2 p.m., July 8, for constructing sewers in Sewerage Districts 3, 14 and 15.

✚**Marinette, Wis.**—A contract to extend the main sewer here has been awarded to JOHN STRIFFLER, Streator, Ill., at $25,520.

Marshfield, Wis.—W. G. Kirchoffer, Consult. Engr., Madison Wis., has been retained to prepare plans for improving the sewage disposal plant. Estimated cost, $10,000.

Sheboygan, Wis.—Bids will be received by the Board of Public Works until June 27, for constructing 15-in. pipe sewers in Superior Ave. and other streets.

Davenport, Iowa—The Board of Local Improvements has recommended the construction of sewers and water mains in the third section to Brook's Grove, and in the Glenwood Addition.

Woodbine, Iowa—A special election has been called for July 7 to vote on a bond issue of $20,000 for sewer construction.

Ortonville, Minn.—(Official)—Bids for constructing a sanitary sewer system and sewage disposal plant here were received by C. J. Stark, City Clk., June 16, as follows: Fraser & Danforth, Hackney Bldg., St. Paul, Minn., $11,485; Hagerty Construction Co., $11,980; W. D. Lovell, $13,300; Tanner Bros., $12,020. Noted June 5.

Concordia, Kan.—G. L. McLane, City Engr., has prepared preliminary plans for extending the sewer system to the Arkansas River, and for building a pumping station on the land of the State Reformatory.

✚**Ralston, Neb.**—(Official)—The contract to construct a sewer system here, according to plans prepared by the Towl Engineering Co., Omaha, has been awarded to the OFFERMAN CONSTRUCTION CO., Omaha, at $8000. Bids were opened June 17. Noted June 12.

Mitchell, S. D.—(Official)—Bids will be received by N. H. Jensen, City Audr., until 8 p.m., July 7, for constructing lateral sewers in various streets.

Platte, S. D.—Bids will be received by F. P. Swan, City Audr., until July 7, for laying sewers in portions of Pennsylvania Ave. and other streets.

Helena, Mont.—It is proposed to construct a storm sewer in Beattie St., from Second St., to Broadway and along Broadway to Davis St. Estimated cost, $12,000. William Jordan, Jr., is City Engr.

Carthage, Mo.—The City Engineer has been authorized to prepare plans for a main sewer to serve the south and west sides. Estimated cost, $20,000.

✚**Brinkley, Ark.**—(Official)—The contract to construct about seven miles of 8- to 12-in. pipe sewers and a sewage disposal plant here has been awarded to A. B. DOWELL, Carbondale, Ill., at $23,900. Bids were opened June 19. Noted May 29.

Houston, Tex.—Bids will probably soon be asked for constructing a storm sewer along German and Milby Sts., in the Second Ward. Estimated cost, $150,000. Dan C. Smith, Jr., is City Secy.

Polytechnic, Tex.—Bids will be received by W. H. Brown, City Secy., until June 26, for constructing a sewer system here, according to plans prepared by Nagel & Peterson, Consult. Engrs., Muskogee, Okla. The contract involves the construction of 17,000 ft. of sewers. Noted Jan. 2.

Port Angeles, Wash.—The City Engineer has completed plans for the construction of a trunk sewer in Lincoln St., estimated to cost $61,633. Bids will probably soon be asked on this contract.

Los Angeles, Calif.—McLean & Walsh were low bidders at $13,000, for the construction of a sewer in Nevin Ave., from 32d to Palomares St. Other bidders were: M. N. Pekich and J. S. Ukropina $17,300; M. R. Fulmis, $18,040; Peter Grbovach, $19,995; R. N. Niccevich, $17,300; John Radich, $16,500; J. J. Veselich, $13,750; W. F. Eggert, $16,996; John Sutalo, $13,800; J. C. Wnkcjevich, $21,731; B. M. Sherer, $18,587.

San Francisco, Calif.—The Secretary to the Board of Public Works has been instructed to advertise for bids for laying sewage discharge pipes in Commercial St., from the Embarcadero to Sansome St., and in Fulton St., from 26th to 49th Ave.

St. Rose Que.—See item under Water Supply—Irrigation.

Merriton, Ont.—Plans have been completed for the construction of seven miles of sewers here. Estimated cost, $35,000. Richard Clark is City Clk.

GARBAGE

✚**Springfield, Mass.**—The contract has been awarded to E. T. DAVIS & SON, 157 Lebanon St., Springfield, for the construction of the West Side incinerator, estimated to cost $8000.

San Antonio, Tex.—The city is considering the installation of garbage incinerators to cost about $50,000.

STREETS AND ROADS

Boston, Mass.—Bids will be received until June 30, by the Department of Public Works, for the construction of bituminous macadam roadway in Emmons St., East Boston. L. K. Rourke is Comr.

✚The contract for the construction of bitulithic pavement in Centre and South Sts., West Roxbury District, was awarded to WARREN BROS. CO., at $39,699. Other bids were: Boston Paving Co., $41,869; Michael Meehan, $43,106.

Fitchburg, Mass.—The City Council has decided to pave Circle St. at an estimated cost of $8700. F. C. Davis is City Engr.

★**Bridgeport, Conn.**—(Official)—Bids will be received until 8 p.m., July 8 by the Paving and Sewer Commission, for about 17,300 sq.yd. paving on Park Ave. and John St. Bids will be accepted on any form of permanent pavement. Bernard Keating is Secy.

✚**Hartford, Conn.**—A contract has been awarded by State Highway Commissioner C. J. Bennett to the CHARLES T. EASTBURN CO., Meriden, Conn., for the reconstruction with amiesite of Elm St., Putnam, Conn., a distance of about 1400 lin.ft.

✚**New Haven, Conn.**—The contract for paving Greenwich and Edgewood Aves. with bituminous macadam has been awarded by the Board of Public Works to G. W. BLAKESLEE & SONS, 58 Waverly St., New Haven, at $33,000, and for paving Elm St. with sheet asphalt, to the UNION PAVING CO., Schenectady, N. Y., at $40,000.

★✚**New Haven, Conn.**—(Official)—The contracts for paving the streets in "Group A," about 29,000 sq.yd. of creosoted wood block, and those in "Group B," 43,500 sq.yd., bituminous macadam pavement, were awarded to the HASSAM PAVING CO., New Haven, Conn., and the ROBERT E. DALEY CONSTRUCTION CO., New Haven, respectively. F. L. Ford is City Engr. Noted May 29 and June 12.

✚**Albany, N. Y.**—The Board of Contract and Supply has awarded the contract for the improvement of Whitehall St. to P. W. MULDERRY at $13,073 and a contract for improving a section of Myrtle Ave. to ROBERT DUMARY at $4104.

★**Cohoes N. Y.**—(Official)—Bids will be received until 8 p.m., July 1, by the Common Council, for approximately 5445 sq.yd. vitrified brick pavement on Ridge Ave. John F. Mahony is City Clk.

Mechanicsville, N. Y.—Bids will be received until 7:30 p.m., July 2, by the Village Council for grading, curbing and paving with vitrified block parts of First and Clall Aves., Canal, Leonard and Warsaw Sts. The approximate quantities are;

4200 cu.yd. excavation, 11,800 sq.yd. paving and $750 lin.ft. new curb, old curb reset, etc. Archie W. Smith is Village Clk.

North Tonawanda, N. Y.—The Board of Public Works has directed the City Engineer to prepare plans for repaving Webster St. with brick, at an estimated cost of $16,000. Bids will be asked for at once. A. P. Smith is City Engr.

+Troy, N. Y.—The Board of Contract and Supply has awarded the contract for paving Fifth Ave., from First to 25th Sts., with bitulithic, to WARREN BROS. PAVING CO. James M. Riley is Secy.

Elizabeth, N. J.—Bids will be received until July 1, by the City Council, for improving Court, South Seventh, East Grand, Christine and Anna Sts. About 15,260 sq.yd. brick pavement, 3270 sq.yd. trap rock pavement and 5680 lin.ft. curb will be required. Wm. P. Neabsey is Street Comr.

★Marlton, N. J.—(Official)—Bids will be received until 3 p.m., July 2, by the Township Committee of Evesham Township for the construction of about 1.74 miles of gravel road, beginning at Maple Ave. and Main St., Marlton, to Moorestown Road, Evesboro. Heister Clymer is Township Clk. George Albert Haines, Medford, N. J., is Engr.

Newark, N. J.—(Official)—Bids will be received until 10 a.m., July 10, by the Committee on Roads of the Board of Chosen Freeholders of Essex County, for paving Bloomfield Ave with granite block between the city line of Newark and the borough line of Glen Ridge, the contract to be let in two sections, Section 1 from Newark to Belleville, Section 2, beginning at Station 4+50 and ending at the dividing line between Bloomfield and Glen Ridge. Seymour P. Gilbert is Chn. of Road Com. Frederic A. Reimer is County Engr.

Paterson, N. J.—(Official—Bids will be received until 4 p.m., July 1, by the Board of Public Works, for resurfacing Main St. with about 10,500 sq.yd. of wood or asphalt blocks. H. J. Harder is City Engr.

+Trenton, N. J.—(Official)—The State House Commission has awarded the contract for 11,000 cu.yd. of grading on the State House grounds to CHARLES A. REED & CO., Trenton, N. J. E. I. Edwards is Controller. Noted June 5.

Westfield, N. J.—(Official)—Bids will be received until 8 p.m., July 7, by the Town Council, for improving East Broad St. from Chestnut St. to Springfield Ave. The approximate quantities are: 16,991 cu.yd. excavation, 11,294 sq.yd. bituminous concrete pavement, 630 sy.yd. macadam pavement, 56 sq.yd. stone block gutter, and 2052 sq.yd. cobble stone gutter. Charles Clark is Town Clk.

Brookville, Penn.—(Official)—Bids will be received until noon, July 2, by the Town Council for grading, curbing and paving portions of West Main, Water, and Pine Sts. and Weinker Way with brick, about 3630 sq.yd. Bids will also be received for relaying the paving on East Main St. Arthur B. Stewart is Clk. of Council.

Cornopolis, Penn.—(Official)—Bids will be received until 7:30 p.m., June 30, by the Borough Council for grading, curbing and paving Fifth Ave., from Chestnut to Montour St., Fleming St. from State to Highland Ave., and Main St. from McIntyre to Highland Ave. Ernest C. Harper is Boro. Secy.

Franklin, Penn.—(Official)—Bids will be received until 7:30 p.m., June 27, by the City Council for repaving Liberty St. from Moffet's Alley to 15th St., and for curbing and paving 12th St. from Elk St. to Otter St. Philip Engelskirger is Controller.

Nottingham, Penn.—(Official)—Bids will be received until 6 p.m., July 15, by the Board of Supervisors of West Nottingham Township, for macadamizing about 1.75 miles of the Christine Road from Nottingham Church and the Village of Glen Roy. John A. Kimble, Nottingham, is Secy.

Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., July 11, by the Controller of Allegheny County, for the following road improvements: 2.8 miles of the Wildwood Road in McCandless and Hampton Townships, 1.51 miles of the Curry Hollow Extension Road, Jefferson and Baldwin Townships, 1.05 miles of the Natrona and Brackenridge Road, Harrison Township. John S. Gillespie is Road Comr. R. J. Cunningham is County Controller.

Reading, Penn.—The Mayor has signed ordinances providing for five blocks of brick paving and one of concrete paving on various streets. Bids will soon be asked. Edmond Ulrich is City Engr.

Swissvale, Penn.—(Official)—Bids will be received until 8 p.m., July 3, by the City Council, for grading Milligan Ave. from Westmoreland Ave. to Locust St. E. M. Watt is Supt. Pub. Wks.

Uniontown, Penn.—(Official—Bids will be received until 2 p.m., June 30, by the Road Supervisors of Jefferson Township, Fayette County, for the construction of about two miles of macadam Tarvia covered road in two sections of about 8500 ft. and 1700 ft. respectively. W. H. Binns is Secy.

+Uniontown, Penn.—(Official)—Bids for the construction of a road in Jefferson Township were received by the County Controller as follows: F. J. FOYE, $31,956 (awarded contract) V. De Giorna, $31,933; McLaughlin Construction Co., $33,813; Donora Construction Co., $34,773; J. G. McGuire, $36,809. Thomas H. Hudson is County Solicitor. Noted May 29.

+Washington, Penn.—The Commissioners and Controller of Washington County have awarded the Following contracts for road construction: 1.1 miles of the Finleyville-Thomas Road to the COLLINS-GORDON Contracting Co., Pittsburgh, at $18,396; 1.4 miles of the Cecil-Venice Road to OFFUTT KUHN, Greensburg, Penn., at $17,961, one mile of the Hill Church Eighty-Four Road to JOHN L. ELDER, Bloesburg, Penn., at $11,229, 1.2 miles of the Pike Run Road Extension to the DONORA CONSTRUCTION CO., at $23,382; 1.5 miles of the Canonsburg-Thomas Road to JAMES HOLLORAN, Canonsburg, at $19,438; 1.5 miles of the Westland Road to SAMUEL GAMBLE, Carnegie, Penn., at $18,579; one mile of the Claysville-Manifold Road to REED, LIGGETT & BRITT Co., Washington, Penn., at $11,255, two miles of the Bealesville Fredericktown Road to HASTINGS & PIPER, Charleroi, Penn., at $25,500, 600 ft. of the West Alexander-Burnsville Road to the COLLINS-GORDON CONSTRUCTION CO.; 1.2 miles of the Donora-Eldora Road to DONORA CONSTRUCTION CO, and one mile of the same road to HASTINGS & PIPER. The contracts for furnishing the brick for paving the above roads were awarded to the MACK MFG. CO. and the PENNSYLVANIA CLAY CO., at prices ranging from $17.50 to $21.50 per M. John H. Moffitt is County Controller. Noted May 29.

Dover, Del.—(Official)—Bids will be received until July 1 by the Levy Court of Kent County for the construction of about 1.45 miles of waterbound macadam road. Caleb S. Kenney is Rd. Engr.

+Baltimore, Md.—The State Road Commissioners have awarded a contract to H. K. FAUST, 4106 Belle Ave., Baltimore, at $103,079, for the improvement of Frederick Ave., from Bentalau St. to Vale Ave., and a contract to P. J. FLANIGAN & SONS 120 East Lexington St., Baltimore, at $32,521, for grading the Reistertown Road from Ruskin Ave. and Pimlico Gate to Druid Hill Park. Wm. L. Marcy is Secy. of the Comm.

A contract has been awarded to the BALTIMORE ASPHALT BLOCK & TILING CO., 231 Courtland St., Baltimore, for street paving Contract No. 120 of Annex Commission, calling for bituminous concrete on Cedar and Carwell Aves., and 36th, 34th and Dulin Sts., at $26,498.

Salisbury, Md.—Bids will be received until July 8 by the Highway Commission, of Wicomico County, at Salisbury, for the construction of section of State-aid highway on the Spring Hill Church Road, between Hebron and Spring Hill Church, a distance of 1.27 miles; plans and specifications on file at the office of State Roads Commission, 534 N. Howard St., Baltimore, Md., and at the office of the County Commissioners, at Salisbury.

Towson, Md.—Bids will be received until July 10 by the Highway Commissioners of Baltimore County, for the construction of 1.39 miles of the Warren Road and 0.76 mile of the Charles St. Ave. extension between Chesapeake Ave. and Joppa Road. E. Stanton Bosley is Secy.

Marion, Va.—(Official)—Bids will be received until July 7 by the Board of Supervisors of Smyth County for the construction of about 20 miles of macadam road in Marion District, divided into four sections, and for 27 miles macadam road and 30 miles grading in St. Clair District. Plans and specifications are on file at the Clerk's office, Marion, and with P. St. John Wilson, State Highway Comr., Richmond.

Vinton, Va.—A bond issue of $8000 has been voted by the town for the improvement of streets and sidewalks.

New Cumberland, W. Va.—(Official—Bids will be received until noon, July 5, by the County Court of Hancock County, for paving 2.6 miles of the County Road from the Brooke County line at Holliday's Cove to Ave. A, Weirton. James A. Bowers, Weirton, W. Va., is Engr.

Graham, N. C.—The town has voted to issue $50,000 of bonds for paving streets and constructing sidewalks.

St. Augustine, Fla.—The Commissioners of St. Johns County have been authorized by the Governor to issue $70,000 to be used for the construction of permanent roads. Tentative plans have been prepared for paving three miles of John Anderson Blvd., and to hard surface several other roads; also to complete the road from St. Augustine to Hastings by way of Elkton.

Titusville, Fla.—(Official)—Bids will be received until 2 p.m., July 7, by the Board of Commissioners of Brevard County for improving about 3.25 miles of the Indian River and Orlando Highway from Mims to Six Mile Branch. J. F. Mitchell is Clk. L. R. Paxton is County Engr.

+Selma, Ala.—(Official)—The City Council has awarded the contract for paving Dallas Ave. to the MONTGOMERY COURT CO., at $25,311. Bids were received on June 12. W. S. Knapp is Asst. City Engr.

Clarksdale, Miss.—(Official)—Bids will be received until July 8, by the Mayor and City Commissioners for asphaltic concrete paving on portions of Second and Third Sts., Issaquena, Yazoo and Delta Aves. About 26,000 sq.yd. will be required. W. S. Bobo is City Engr. M. W. Purnell is City Clk.

+New Orleans, La.—(Official)—The contract for improving Fern St., from Commercial to Mobile Sts., was awarded by the City Council to the BARBER ASPHALT PAVING CO., at $41,643, of which $33,288 was for paving only. Thomas L. Willis is Asst. City Engr.

Newport, Ky.—Bids will be received until noon, July 7, by the City Commissioners for paving York St., from Eighth to Ninth St., with creosoted wood block or granite block.

Winchester, Ky.—Bids will be received until 8 p.m., July 4, by the City Council, for the construction of about 15,000 sq.yd. brick pavement. S. B. Tracy is City Clk.

Cambridge, Ohio.—(Official)—Bids will be received by the Director of Public Service until noon, July 10, for constructing 11,000 sq.yd. of vitrified block pavement. Karl M. Cosgrove is City Engr.

Cleveland Heights, Ohio—(Official)—Bids will be received until noon, July 8, by the Village Council, for grading Yellowstone Rd. from Mayfield to Noble Rd. H. H. Canfield is Village Clk.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., July 3 by the State Highway Commissioner for grading and paving with waterbound macadam, bituminous surface, 1.86 miles of the Newark-New Lexington Road at an estimated cost of $18,726; for grading and paving with waterbound macadam, 2.4 miles of the Canton-Steubenville Road at an estimated cost of $31,096. James R .Marker is Comr.

Bids will be received until 2 p.m., July 3 for grading and paving with concrete, 1.10 miles of the Scotland Station Easterly Road at an estimated cost of $15,453; for grading and paving with concrete 2.64 miles of the Akron-Youngstown Road at an estimated cost of $34,991.

+The Board of Control has awarded contracts for street improvements as follows: Sullivan Ave., from Central to Hague Ave., (asphalt) ANDREWS PAVING CO., $113,875;

Long St. from Winner to Woodland Ave., (asphalt) A. G. PUGH, $20,176; Monroe Ave. from Broad to Oak St., $3156; Monroe Ave. from Oak St. to Bryden Rd., $6092 and Parkwood Ave. from Clifton to Mt. Vernon Ave., $8721. The following contracts were awarded for brick paving; East Ave. from Oakley to Maynard Ave., M. T. HALEY, $5638; 11th St. from the first alley north of Broad to Long St., S. T. KNIGHT, $5098, Factory St., from Buttles to First Ave., B. F. PATTERSON, $6849; Lechner Ave. from Neil to Harrison Ave., B. F. PATTERSON, $5839; Oakley Ave. from Palmetto to Sullivan, FOLEY BROS., $19,797; Schiller St. from High to Parsons, $25,967; Sheldon Ave. from Parsons to Kinc, S. T. KNIGHT, $15,479, Second Ave. from High to Sixth St., B. F. PATTERSON, $15,158; Sixth St. from Fifth to 11th Ave., S. T. KNIGHT, $17,230, Welch Ave., Parsons to Anne St., W. H. GRAHAM, $5303, Markison Ave., High St. to Parsons Ave., ANDREWS PAVING Co., $29,764; Lechner Ave. from Doren to Sullivant Ave. FOLEY BROS., $10,814.

Dayton, Ohio—Bids will be received until July 2 by the Director of Public Service for paving various streets and alleys, also for resurfacing various streets and replacing curb, gutter and concrete sidewalks. R. P. Sebold is Dir. Chas. J. Gross is Secy.

Euclid, Ohio—(Official—Bids will be received until noon, July 14, by the Village Council for grading, draining and paving with brick parts of Lampson Drive, Cromwell, Colonial, Quenton and Mannering Roads. Fred H. Schoaff is Village Clk.

Greenwich, Ohio—Bids will be received until noon, July 14, by the Village Council, for about 5700 sq.yd. brick or bituminous macadam pavement on various streets. F. H. Daniels is Village Clk.

Junction City, Ohio—Bids will be received until June 28, by the Village Clerk for improving portions of Main and Logan Sts.

+Lowellville, Ohio—(Official)—The Trustees of Poland Township have awarded the contract for paving a portion of Section 1 of the Poland-Struthers Road with brick to CHAS. HARRIS, Youngstown, Ohio, at $9000. W. J. Maurice, Lowellville, is Township Clk. Noted June 12.

Rocky River, Ohio—(Official)—Bids will be received until noon, July 22, by the Village Council, for the construction of concrete sidewalks on North Ridge Road. Frank Mitchell is Village Clk.

+Wyoming, Ohio—(Official)—The Village Council has awarded the contract for improving various streets to the ANDREWS ASPHALT PAVING CO., Hamilton, Ohio, at 46c. per lin.ft. Other bidders were: Elliott Bros., 48c., Wm. Barber, 54c., and J. McJoint, 51c. George Eversman is Clk. Noted May 22.

Indiana—(Official)—Bids will be received for road improvements in Indiana as follows:

July 1, at Fort Wayne, by the Commissioners of Allen County for the construction of two roads. Calvin H. Brown is Audr.

July 3, at Bluffton, by the Commissioners of Wells County for the construction of five stone roads. L. A. Williamson is Audr. July 7, at Franklin, by the Commissioners of Johnson County, for the construction of a road in Hensley and Union Township. H. L. Knox is Audr.

July 7, at Kentland, by the Commissioners of Newton County for the construction of roads in Iroquois and Jefferson Townships. S. R. Sizelove is Audr.

July 7, at Shoals, by the Commissioners of Martin County for building a road in Perry Township. Lorenzo D. Haga is Audr.

July 7, at Vernon, by the Commissioners of Jennings County for the construction of roads in Geneva and Lovett Townships. G. H. Bernhardt is Audr.

July 7, at Rushville, by the Commissioners of Rush County for improving the Louden Road, Walker Township. Allen R. Holden is Audr.

July 7, at Scottsburg, by the Commissioners of Scott County for the construction of roads in Lexington, Johnson, Jennings and Vienna Townships. Robert Blunt is Audr.

July 7, at Greenfield, by the Commissioners of Hancock County for the construction of a road in Sugar Creek Township. Lawrence Wood is Audr.

July 7, at Fowler, by the Commissioners of Benton County for the construction of a crushed limestone road in Center Township. Warren Mankey is Audr.

July 7, at English, by the Commissioners of Crawford County for the construction of a road in Union township. Jos. B. Enlow is Audr.

July 7, at Mount Vernon, by the Commissioners of Posey County for the construction of three gravel roads. Jos R. Haines is Audr.

July 7, at Rensselaer, by the Commissioners of Jasper County for the construction of roads in Gillam and Kankakee Townships. J. P. Hammond is Audr.

July 8, at Rockville, by the Commissioners of Parke County for the construction of seven gravel roads. James E. Elder is Audr.

July 8, at Marion, by the Commissioners of Grant County for the construction of five roads in Center Township and one in Washington Township. E. H. Kimball is Audr.

July 8, at Logansport, by the Commissioners of Cass County for the construction of a road in Eel Township. J. E. Wallace is Audr.

July 8, at Corydon, by the Commissioners of Wabash County for the construction of a road in Pleasant Township. D. Showalter is Audr.

July 8, at Martinsville, by the Commissioners of Morgan County for the construction of a brick road in Washington Township. J. S. Whitaker is Audr.

July 8, at Plymouth, by the Commissioners of Marshall County for the construction of roads in Bourbon Township. C. F. McCoy is Audr.

July 8, at Princeton, by the Commissioners of Gibson County for the construction of roads in Barton and Montgomery Townships. William T. Roberts is Audr.

July 8, at Kokomo, by the Commissioners of Howard County for the construction of gravel roads in Ervin, Taylor and Honey Creek Townships. E. B. Swift is Audr.

July 8, at Rockville, by the Commissioners of Pike County for the construction of five highways. John D Gray is Audr.

July 8, at Valparaiso, by the Commissioners of Porter County for the construction of a road in Washington Township. C. A. Blachly is Audr.

July 9, at Crown Point, by the Commissioners of Lake County for constructing six gravel roads. Chas. A. Johnson is Audr.

July 9, at Bloomington, by the Commissioners of Monroe County for the construction of roads in Richland and Van Buren Townships. W. F. Kinser is Audr.

July 9, at Columbus, by the Commissioners of Bartholomew County for the construction of roads in Columbus, Hancock and Clifty Townships. Philip Sater is Audr.

July 10, at Crown Point, by the Commissioners of Lake County for the construction of two roads in Calumet Township. Chas. A. Johnson is Audr.

July 11, at Corydon, by the Commissioners or Harrison County for the construction of a road in Heth township. J. L. O'Bannon is Audr.

Bremen, Ind.—(Official)—Bids will be received until 6 p.m., June 26, by the Board of Town Trustees for paving portions of Center and Plymouth Sts. with brick, asphalt, concrete bitumen, or bitulithic pavement. The approximate quantity required is 14,206 sq.yd. T. Frank Knoblock is Town Clk.

+Corydon, Ind.—(Official)—The Commissioners of Harrison County have awarded a contract to QUEBBLEMAN & PILLARS at $4449 for the construction of a road in Harrison Township. There were no other bids. J. L. O'Bannon is Audr. Noted May 29.

Indianapolis, Ind.—The Republic Construction Co. was low bidder at $2.75 per sq.yd., for 6980 sq.yd. creosoted wood block pavement on 32d St. Chas. A. Schrader is Pres. Bd. of Pub. Wks.

+Detroit, Mich.—The Department of Public Works has awarded contracts for 16,231 sq.yd. paving on five streets to J. A. MERCER at $41,552. J. J. Haarer is Comr.

East St. Louis, Ill.—The Board of Local Improvements has decided to repave Broadway, Collinsville and Missouri Aves., and Front St., and has instructed the City Engineer to prepare plans. The approximate cost will be $100,000. E. F. Harper is City Engr.

Elgin, Ill.—(Official)—Bids will be received until 10 a.m., June 30, by the Board of Local Improvements for paving parts of Milwaukee St. and Riverside Ave. with brick, about 5493 sq.yd. Albert Fehrman is Pres. William F. Sylla is City Clk.

Freeport, Ill.—The City Council has passed ordinances for about 125,000 sq.yd. pavement on various streets to be completed this summer and bids will soon be asked. The approximate cost is $250,000. Chas. Hepner is City Engr.

Peoria, Ill.—The Board of Local Improvements has ordered the advertisement of bids for paving Cedar St. from Warner Ave. to Brotherson St. The City Engineer has been instructed to prepare plans and estimates for paving Richmond Ave. from Knoxville Ave. to North St. L. C. Jeffries is City Engr.

Madison, Wis.—The Board of Public Works contemplates paving East Main St. and West Washington Ave. with asphalt. E. E. Parker is City Engr.

+Milwaukee, Wis.—The Department of Public Works has awarded the contract for paving Reed St. from Washington St. to National Ave. with granite block to JOHN WEIHER at $15,170, and for macadamizing Auer Ave. to J. H. DONAHUE at $8005. F. G. Simmons is Comr.

Bloomfield, Iowa—Bids will be received until July 24, by the City Council for about 5000 sq.yd. paving and 3500 lin. ft. curb. Bids will be accepted for brick, concrete or asphaltic concrete pavement. A. B. Welch is City Clk.

Eagle Grove, Iowa—(Official)—Bids will be received until 7:30 p.m., June 30, by the City Clerk for the construction of about 32,168 sq.yd. of brick block, portland cement concrete, asphaltic concrete or bitulithic pavement, and 2722 lin. ft. combined curb and gutter. C. H. Currie, Webster City, Iowa, is Engr.-in-Charge.

Hamburg, Iowa—It is reported that bids will be received about July 15 by the City Council for about 38,000 sq.yd. pavement, various standard materials and 12,000 lin.ft. curb and gutter. H. Grevenkamp is City Engr.

Shenandoah, Iowa—The City Council has passed ordinances authorizing the construction of 15 blocks of asphalt pavement, and bids will soon be asked.

Butte, Mont.—Bids will be received until July 1 by the City Council, for about 5000 sq.yd. bitulithic paving. W. A. Willis is City Clk. Paul A. Gow is City Engr.

Kansas City, Mo.—Bids will be received until June 30 by the Commissioners of Jackson County for grading and draining about 4.66 miles of the Stayton Road.

Conway, Ark.—(Official)—Bids will be received until 3 p.m., July 2, by Street Improvement District No. 1 for the construction of approximately 12,000 sq.yd. of paving, 3500 lin.ft. curb and gutter and 700 ft. of storm sewer. G. H. Burr is Engr. W. M. Harrell is Secy. Noted May 22.

+Belton, Tex.—The Board of Commissioners of Bell County has awarded the contract for the construction of roads in Precinct No. 1 to the WITT, FOUNTAIN SHAW ENGINEERING CO., Dallas, Tex., at approximately $150,000. There were 13 other bidders.

+Greenville, Tex.—The City Council has awarded the contract for paving various streets with asphaltic concrete to LEVY & LEVY, Muskogee, Okla. A. L. Donaldson is City Engr.

Denver, Colo.—The State Highway Commissioner has announced that $1,000,000 will be spent for the construction of state roads during 1913, and it is estimated that the various counties will spend $1,250,000 additional on county highways.

+Phoenix, Ariz.—The Commissioners of Special Road District No. 1 have awarded the contract for the construction of the Central Ave. Blvd. to the ARIZONA ASPHALT PAVING CO. at $32,000. Bitulithic on a concrete base will be used. E. M. Lamson is Clk. Noted May 8 and May 22.

+Monroe, Wash.—The City Council has awarded a contract for 3961 lin.ft. of paving to H. C. MALOTT, 6526 17th St., N. E., Seattle, at $19,300. G. F. Cook is City Clk. Noted May 29.

+Renton, Wash.—(Official)—The contract for the improvement of Cedar St. was awarded by the City Council to GEORGE A. BANDERETT, Renton, at $5873. C. R. Campbell bill $5945. Grant Bates is City Clk. Noted May 29.

+Spokane, Wash.—The City Council has awarded the contract for paving Mission Ave. to MITCHELL BROS., Exchange Bank Bldg., Spokane, at $39,764, using Spokane Bituminous No. 2. Noted June 19.

The City Engineer has completed plans for paving 13th Ave. from Ferris Court to Grand Blvd., about 29,000 sq.yd. Bids will soon be asked. D. C. Coates is Comr. of Pub. Wks.

Glendale, Calif.—The City Trustees plan to pave Broadway from Glendale to Central Ave., a distance of almost one mile. Asphalt will be used, with concrete curb and gutter.

+Inglewood, Calif.—The contract for the construction of macadam pavement, concrete curb, gutters and sidewalks on Spruce St. was awarded to S. G. CUMMINGS, 1302 North 22nd St., at $13,955.

Los Angeles, Calif.—The City Trustees have awarded the contract for the improvement of Chesterfield Sq., bounded by Slauson and Western Aves., Arlington and 51st Sts., to FORD & STOUT, at approximately $87,000. The work includes 700,000 sq.ft. asphalt paving on concrete base.

Pomona, Calif.—A special election will shortly be held to vote on an issue of $75,000 of bonds, the proceeds to be used for street improvements. C. E. Bayley is City Engr.

+San Diego, Calif.—The City Trustees have awarded the contract for grading Robinson Ave. from Tenth to Florida St. to the C. L. HYDE CONSTRUCTION CO., at $10,061. Wm. M. Rumsey is City Engr.

San Francisco, Calif.—The Board of Public Works has requested the Board of Supervisors to appropriate $40,419 for paving Bay St. from the Embarcadero to Leavenworth St. The Board of Public Works is also planning to pave First St. from Market to Mission St., with vitrified brick. M. M. O'Shaugnessy is City Engr. k.

San Rafael, Calif.—This city contemplates spending $100,000 for street improvements, $25,000 for a street repairing plant, $25,000 for an incinerator, and $40,000 for dredging the San Rafael Canal.

+Venice, Calif.—THE METROPOLITAN CONTRACTING CO., 155 Wilson Building, Los Angeles, was awarded the contract at $10,132, for improving Washington Blvd.

Ventura, Calif.—Bids will be received until July 9 by the Board of Supervisors of Ventura County for paving the Montalvo Bridge with 3½-in. asphalt macadam. The bridge is 1824 ft. long and 19½ ft. wide. J. B. McClosky is County Clk.

Montreal, Que.—The Board of Control has recommended that the City Council pass an ordinance for paving and otherwise improving the Champ de Mars at an estimated cost of $35,400.

+Berlin, Ont.—(Official)—The City Council has awarded the contract for various street improvements to the WARREN BITUMINOUS PAVING CO., 103 Bay St., Toronto, Ont., at $51,628. H. Johnston is City Engr. A. H. Millar is Clk. Noted June 5.

Merriton, Ont.—(Official)—Bids will be received until July 10 by the Town Clerk for constructing concrete sidewalks on various streets at an estimated cost of $20,000. R. Clark is Town Clk. F. N. Rutherford is Engr. Noted June 19.

Ottawa, Ont.—The City Council plans street improvements in the near future at an estimated cost of $15,000. F. C. Askwith is City Engr.

+Calgary, Alta.—The City Council has awarded the contract for 50,000 sq.yd. asphaltic concrete paving to the CROWN PAVING & CONSTRUCTION CO., at prices ranging from $2.45 to $2.75 per sq.yd., and 65c. per ft. for curb and gutter.

Red Deer, Alta.—The taxpayers have passed bylaws authorizing the expenditure of $10,000 for sidewalk construction and $8000 for other street improvements.

FEDERAL GOVERNMENT WORK

Mechanical Equipment—Bangor, Maine.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., July 31, for the mechanical equipment, except lighting fixtures, elevator and lift, at the U. S. post office at Bangor.

Dredging—Boston, Mass.—(Official)—Bids were received, June 14, by Col. Frederic V. Abbot, Corps Engrs., U. S. A., Boston for dredging in the Merrimac River: (a) below Rocks Bridge; (b) above Rocks Bridge and at Currents Shoal: Bay State Dredging Co., Boston, (a) 1.95 per cu.yd.; (b) 86c.; Commonwealth Dredging Co., Boston, (a) 2.29, (b) 71c.

Building—Bingham, Mass.—Bids will be received until 11 a.m., July 12, by the Bureau of Yards and Docks Navy Dept., Washington, D. C., for the construction of a magazine for smokeless powder at the naval magazine at Bingham. The sum of $16,000 is available for the work.

Heating Plant—Newport, R. I.—Bids will be received until 11 a.m., July 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the erection of a building for the heating plant at the Naval Hospital Reservation, Newport.

★Dredging—New Haven, Conn.—(Official)—Bids will be received until 2 p.m., July 25, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., for dredging in New Haven Harbor.

Dredging—New London, Conn.—Bids will be received by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., New London, Conn., until July 5, for dredging in Housatonic River, Conn.

★Dredging—New York, N. Y.—(Official)—Bids will be received by Col. Frederic V. Abbott, Corps Engrs., U. S. A., Army Bldg., New York, until noon, July 19, for dredging in the Raritan River, N. J.

Dredging—Philadelphia, Penn.—Bids will be received until 11 a.m., July 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the Philadelphia Navy Yard.

★Dredging—Wilmington, Del.—(Official)—Bids will be received until 11 a.m., July 27, by May R. R. Raymond, Corps Engrs., U. S. A., Wilmington, for dredging the harbor at Wilmington.

Seawall—Annapolis, Md.—(Official)—Bids were received as follows, June 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a reinforced-concrete seawall at the Naval Experiment Station, Annapolis: Item (1), work complete, using cylindrical shells, type (A), (B) or (C); Item (2), net price for omission of each bay of 6 ft., using cylindrical shells, type (A), (B) or (C); Item (3), net price per pile in place for another piles if present piles cannot be used; Item (4), amount to be deducted under Item (1), if each shell in 234 ft. of the south wall is made 8 ft. long instead of 6 ft., types (A), (B) or (C). Twohig & Easterly, Norfolk, Va., (1A), $56,571; (1B), $51,547; (1C) $51,460; (2A) $370; (2BC) $330; (3) $64; (4A) $1840; (4BC) $1532. Interstate Construction Co., 1170 Broadway, New York, (1A) $58,500; (1BC) $54,800; (2A) $440; (2BC) $410; (3) $16; (4A) $2480; (4BC) $1320. Riverside Contracting Co., 39 Cortlandt St., New York, (1ABC) $66,600; (2ABC) $480; (3) $25; (4ABC) $1200. Sanford & Brooks, 24 Commerce St., Baltimore, Md., (1A) $41,700; (1BC) $48,200; (2A) $300; (2BC) $350; (3) $15; (4A) $1700; (4BC) $2300. Amount available, $50,000.

★Repairs to Mechanical Equipment—Washington, D. C.—(Official)—Bids will be received until 3 p.m., July 21, by Oscar Wenderoth, Supervising Arch., Treasury Dept., Washington, for repairs to the mechanical equipment of the U. S. Treasury and the Butler Building, Washington.

Shell—Washington, D. C.—The following bids were received June 13 by the Chief of Ordance, Washington, for furnishing projectiles: Item (1) 100 14-in. A. P. shell, Model 1909; (2) 600 12-in. D. P. shell, Model 1908, weight 1046 lb.; (3) 700 12-in. D. P. mortar shell, Model 1911. Washington Steel & Ordnance Co., Washington, D. C., (1) $524 each; (2) $320 each; (3) $230 each. American & British Mfg. Co., Bridgeport, Conn.: (2) for 200 only, $335 each; (3) for 300 only, $221 each. Midvale Steel Co., Philadelphia, Penn., (1) $620 each; (2) $408 each; (3) $298 each. Watertown Arsenal, Watertown, Mass., (2) $250 each; (3) $175 each. Bethlehem Steel Co., South Bethlehem, Penn., (1) for 100, $565 each; (2) $312 each; (3) $246 each.

+Coal Barges—Washington, D. C.—The U. S. Government has awarded the contract for the construction of 10 coal barges to WILLIAM CRAMP & SONS SHIP & ENGINE BLDG. CO., Beach and Ball Sts., Philadelphia, Penn., at $185,000.

★Ash Conveyor—Washington, D. C.—(Official)—Bids will be received until 2 p.m., June 30, by the Department of the Interior, Washington, for the furnishing all labor and material required in the erection and completion of an ash conveyor for the central heating plant, Freedman's Hospital, Washington, in accordance with drawings and specifications for the work, copies of which may be obtained on application to the Chief Clerk of the Department. Award will be made of contract subject to appropriation by Congress to meet the expense of the work.

+Forgings—Washington, D. C.—The contracts for furnishing six sets of 12-in. 50-calibre steel gun forgings for the Navy Ordnance Department, bids opened June 4, has been awarded to the MIDVALE STEEL CO., Philadelphia, Penn., at 34.5c. per lb. for four sets; and to the BETHLEHEM STEEL CO., South Bethlehem, Penn., 34.5c. per lb. for two sets.

★Lock and Dam—Wheeling, W. Va.—(Official)—Bids will be received until 11 a.m., July 23, by Maj. F. W. Altstaetter, Corps Engrs., U. S. A., Wheeling, for the construction of Lock and Dam No. 16, Ohio River.

Boiler, Etc.—Asheville, N. C.—(Official)—Bids will be received until noon, June 27, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D .C., for a new heating boiler, breeching, stack, etc., in the post office and court house, Asheville, N. C., in accordance with the specifications copies of which may be obtained at this office, at the discretion of the Supervising Architect.

Buildings—Cherokee, N. C.—Bids will be received until 2 p.m., July 11, by the Commissioner of Indian Affairs, Dept. of the Interior, Washington, D. C., for the construction of frame quarters and a brick laundry at the Cherokee Indian School, Cherokee.

Concrete Wharves—Charleston, S. C.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., July 31, for constructing concrete wharves at the Charleston Navy Yard. Estimated cost, $290,000.

★Dredging—Jacksonville, Fla.—(Official)—Bids will be received until noon, July 21, by Maj. J. R. Slattery, Corps Engrs., U. S. A., Jacksonville, for dredging and rock removal at Trout Creek Cut in St. Johns River, Fla.

★Dredging—Mobile, Ala.—(Official)—Bids will be received until 11 a.m., July 25, by Lieut.-Col. C. A. F. Flager, Corps Engrs., U. S. A., Mobile, for dredging in the harbor of Mobile.

Post Office—Cynthiana, Ky.—(Official)—Bids were received as follows, June 17, by Oscar Wenderoth, Superv. Arch., Treas-

ury Dept., Washington, D. C., for the construction of a post office at Cynthiana: (a) Limestone; (b) sandstone: M. Yeager & Son, Danville, Ill., (a) $60,565; (b) $61,565; George W. Stiles Construction Co., Chicago, Ill., (a) $56,678; (b) $61,600; O. P. Raymond Lumber & Construction Co., Cynthiana, (a) $74,860.

Post Office—Du Quoin, Ill.—(Official)—Bids were received as follows, June 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Du Quoin: (a) Limestone; (b) sandstone: August Ohm, Terre Haute, Ind., (a) $68,500; George W. Stiles Construction Co., Chicago, Ill., (a) $61,468; (b) $68,500; R. S. Moore, Lafayette, Ind., (a) $61,791; (b) $66,116; James Corse, Racine, Wis., (a) $61,000; (b) $64,000; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $66,215; (b) $68,215.

Post-Office—Rochelle, Ill.—(Official)—Bids were received as follows, June 17, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Rochelle: (a) limestone; (b) sandstone: James Corse, Racine, Wis., (a) $52,220; (b) $54,495; Alexander & Dinnie, Rockford, Ill., (a) $56,485; (b) $58,235; Barnes Bros., Logansport, Ind., (a) $54,000; (b) $55,900; Shegland & Widberg, De Kalb, Ill., (a) $73,992; (b) $74,342; George W. Stiles Construction Co., Chicago, Ill., (a) $52,995; (b) $55,600; W. J. McAlpine, Dixon, Ill., (a) $54,104; (b) $54,960; Israel Doan's Sons Co., Aurora, Ill., (a) $73,627; (b) $76,267; Hart Bros., Rockford, Ill., (a) $60,702; (b) $60,702.

Cement—Milwaukee, Wis.—(Official)—Bids were received June 16, by Lieut.-Col. George A. Zinn., Corps Engrs., U. S. A., Milwaukee, for 10,000 bbl. of cement (portland) for use at Sheboygan and Milwaukee, (a) 8000 bbl. at Sheboygan; (b) 8000 bbl. at Milwaukee; (c) credit for return of bags; (d) totals: Lehigh Portland Cement Co., Chicago, Ill., (Lehigh Brand), (a) $1.98; (b) $1.80; (c) 10c.; (d) $30,240; Alpha Portland Cement Co., Easton, Penn. (Alpha Brand), (a) $1.80; (b) $1.69; (c) 10c.; (d) $27,920; Atlas Portland Cement Co., New York City (Atlas Brand) (a) $1.82; (b) $1.80; (c) 10c.; (d) $28,960; Universal Portland Cement Co., Chicago, Ill. (Universal Brand) (a) $1.80; (b) $1.71; (c) 10c.; (d) $28,080; Western Lime & Cement Co., Milwaukee, Wis. (Huron Brand), (a) $1.80; (b) $1.69; (c) 10c.; (d) $27,920; Lake Shore Stone Co., Milwaukee, Wis. (Chicago AA Brand), (b) $1.77; (c) 10c.; (d) $14,160.

★Breakwater and Pile Pier—Sheboygan, Wis.—(Official)—Bids were received June 16, by Lieut.-Col. George A. Zinn, Corps Engrs., U. S. A., Milwaukee, Wis., for the construction of a reinforced concrete caisson breakwater and pile pier, removing old pier, and dredging at Sheboygan. The bids follow: Robert Love & Co., Muskegon, Mich., $223,465; Greiling Bros. Co., Green Bay, Wis., $162,970; Wisconsin Dredge & Dock Co., Sheboygan, Wis., $187,951; Muskegon Dock & Dredging Co., Muskegon, $177,365; Edward Eugene Gillen, Racine, Wis., $201,648; Great Lakes Dredge & Dock Co., Chicago, Ill., $204,054.

Repairs to Post Office—Sioux City, Iowa—Bids were received as follows, June 23, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for miscellaneous repairs to the post-office at Sioux City: William F. Hammel, Sioux City, $12,895; Dubel & Anderson, Sioux City, $13,187.

Post Office—Moorhead, Minn.—Bids were received as follows, June 23, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Moorhead: (a) limestone; (b) sandstone: George W. Stiles Construction Co., Chicago, Ill., (a) $51,705; (b) $52,530; J. W. Miller, St. Paul, Minn., (a) $49,958; James Corse, Recine, Wis., (a) $49,967; (b) $50,400; American Construction Co., Milwaukee, Wis., (a) $49,800; (b) $50,360.

✚Buildings—White Earth, Minn.—The contract has been awarded to SCHULIND & CO., Alexandria, Minn., for the construction of the dormitory, mess hall, lighting system and laundry at the White Earth Indian School, White Earth, at $42,600. Bids were opened May 26. List of bidders noted June 5.

Sheet Piling—Plattsmouth, Neb.—G. J. S. Collins, Omaha, Neb., submitted a bid of $12,343, June 18, for wood sheet piling and approach at the post office at Plattsmouth. Bids were opened June 16 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C.

✚Building—Wahpeton, N. D.—The contract has been awarded to R. K. HOFSES, Aberdeen, S. D., by the Commissioner of Indian Affairs, Washington, D. C., for the construction of a brick hospital at the Wahpeton Indian School.

Sluice and Penstock Gates—Elephant Butte, Mont.—(Official)—Bids will be received until 2 p.m., July 10, by the U. S. Reclamation Service, Elephant Butte, for furnishing sluice and penstock gates and accessories for Elephant Butte Dam, Rio Grande Project, New Mexico-Texas. This is an extension of date from June 25.

Post-Office Extension—St. Louis, Mo.—(Official)—Bids were received as follows, June 16, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of an extension to the post-office at St. Louis, Mo. Mississippi Valley Construction Co., St. Louis, $74,994; Hiram Lloyd Building & Construction Co., St. Louis, $72,317; Daniel Evans Construction Co., St. Louis, $70,900.

Jetty Work—Dallas, Tex.—Bids will be received by Maj. T. H. Jackson, Corps Engrs., U. S. A., Dallas, until noon, July 16, for jetty work at Sabine Pass, Tex.

★Pumping Plant, Etc.—Oklahoma City, Okla.—(Official)—Bids will be received until 3 p.m., July 25, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for a pumping plant and a cooled drinking water supply system in the U. S. post office at Oklahoma City.

✚Reclamation—Palisade, Colo.—The Secretary of the Interior has awarded contract to the REYNOLDS ELY CONSTRUCTION CO., Springsville, Utah, for the excavation of the Cañon Division Main Canal, Grand Valley Irrigation Project, Colo. The division is five miles in length and its construction involves the excavation of 365,000 cu.yd. of material. The contract price is $109,565, subject to a possible reduction to $108,488 if a certain alternative is accepted, the choice of alternative methods depending upon the execution of a pending contract between the United States and the Rio Grande Junction R.R. Co. The canal is located between two and seven miles northeast of Palisade, Colo.

✚Boilers, Generators, Etc.—Fort Bayard, N. M.—(Official)—Bids will be received until 10 a.m., July 9, for the sale of the following: Two Kewanee, return-tubular, 100-hp. boilers; two fifty kw. D. C. General Electric Co.'s engines and generators; switchboard complete for two generators; one 7½-ton York ice machine; one two-ton Shule ice machine, 99 50-lb. ice cans and two steam pumps 14x12x9 in. Information furnished on application to Lieut. C. E. Holmberg, Q. M., U. S. A., Fort Bayard.

Jetty Work, Aberdeen, Wash.—The U. S. government is considering extending the jetty at the bar one mile further out in order to insure a deeper channel.

Air Compressor—Bremerton, Wash.—Bids will be received until 11 a.m., July 12, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing one air compressor with at least 5300 cu.ft. of free air per min., complete with accessories, at the navy yard, Puget Sound, Bremerton. Estimated cost, $35,000.

Electric Traveling Cranes—Bremerton, Wash.—(Official)—Bids were received as follows, June 21, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the installation of electric traveling cranes at the Navy Yard, Puget Sound: Item (1), one 20-ton four-motor with five-ton auxiliary, one five-ton one-motor, one 3½-ton, three-motor traveling bridge cranes and one five-ton three-motor traveling wall crane; Item (2), deduction for omission of five-ton one-motor cranes; (Item (4), addition for one additional five-ton one-motor hand-traversing bridge crane; Cyclops Iron Works, 837 Folsom St., San Francisco, Calif., (1) $18,400; (2) $1900; (3) $4400; (4) $1900; Pawling & Harnischfeger, 38th & National Ave., Milwaukee, Wis., (1) $16,825; (2) $2725; (3) $3950; (4) $2675. Amount available, $10,000.

Dredging and Removing Rocks—Vallejo, Calif.—Bids will be received until 11 a.m., July 26, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging the channel and basin in Mare Island Strait, and removing rocks at Vallejo.

Electric Lamps, Motor Boats, Etc.—Panama—Bids will be received until 10:30 a.m., July 9, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Chicago, Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing electric lamps, motor boats, switch stands, tie plates, etc.

✚Floating Caissons and Equipment—Panama—(Official)—Bids will be received until 10:30 a.m., July 21, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for two lock entrance caissons and the equipment, under Circular No. 778.

✚Steel Barges—Panama—The contract has been awarded by the Isthmian Canal Commission, Washington, D. C., to the MARYLAND STEEL CO., Sparrow's Point, Md., for six steel dump barges under Circular 774, at $358,500. Bids were opened May 19. List of bidders noted May 22.

MISCELLANEOUS

Dam—Waterville, Maine—The Lockwood Co., whose cotton mills are located on the falls of the Kennebec River, in Waterville, has decided to proceed with the construction of the new dam for which plans recently were completed. It will be 885 ft. long, of reinforced concrete, taking the place of a wooden structure.

✚Dredging—Boston, Mass.—The State Board of Harbor and Land Commissioners, Boston, has awarded the following contracts, bids opened May 23: Saugus River, dredging, to the BAY STATE DREDGING CO., LTD., 247 Atlantic Ave., Boston; Lynn Harbor, dredging, to J. P. O'RIORDEN, 6 City Sq., Charlestown, Mass.; Manchester Harbor, widening channel and dredging anchorage basin, to the EASTERN DREDGING CO., 247 Atlantic Ave., Boston; South River, Salem, dredging, to EASTERN DREDGING CO.

✚Walls and Grading—Boston, Mass.—The contract has been awarded to the J. C. COLEMAN & SONS CO., by the Park and Recreation Department for grading and constructing walls at the Mount Ida Playground, at $20,555.

Fire Station—Holyoke, Mass.—Plans are being prepared, and bids will be asked about July 20, for the construction of the central fire station on Maple St. It will be 82x90 ft., four stories, of brick and limestone. Oscar Beauchemin is Arch.

Buildings—Ipswich Beach, Mass.—(Official)—Bids will be received after June 26 by J. F. Le Baron, Engr. and Proprietor, Common Point, Essex, Mass., for the construction of a small two-story reinforced concrete cottage, garage, stable, boat-house and wharf on Ipswich Beach.

✚Swimming Pool—Northampton, Mass.—The contract has been awarded to J. L. MATHER, Northampton, for the construction of the swimming pool and for other improvements for the Y. M. C. A., at $25,000.

Harbor Work—Plymouth, Mass.—Governor Foss has sent to the State Legislature a special message calling for an appropriation of $83,500 for improvements at Plymouth Harbor, which sum must be appropriated by the state to secure an equal sum for the same purpose appropriated by U. S. Government.

Elimination of Grade Crossing—Torrington, Conn.—The borough authorities and the New York, New Haven & Hartford R.R. Co. are planning the elimination of a grade crossing on North Elm St. The cost is estimated at about $80,000. Edward Gagel is Ch. Engr. N. Y., N. H. & H. R.R., New Haven, Conn.

★Clock System—Albany, N. Y.—(Official)—Bids will be received until 4 p.m., July 21, by the Trustees of Public Buildings, Albany, for a central energy clock system for the State Education Building. Lewis F. Pilcher is State Arch.

★Shaft Sinking—New York, N. Y.—(Official)—Contractors wishing to bid on sinking an inclined shaft (60 degrees) 8x20 about 1000 ft. deep, granite rock, eastern location, may communicate with P. 1089. Engineering News, New York.

Subway—New York, N. Y.—Bids were opened June 24 for Section 4 of the Broadway-Fourth Ave. Subway to be operated by the Municipal Ry. Corp. (E. R. T.), extending from a point about midway between Houston and Bleecker St. to a point in Broadway 390 ft. north of 14th St. The unofficial totals are as follows: Dock Contractor Co. (Hoboken), 2 Rector St., New York City, $2,578,000; Oscar Daniels Co., Woolworth Bldg., New York City, $2,650,000; Degnon Contracting Co., 60 Wall St., New York City, $2,735,000; Underpinning & Foundation Co., 290 Broadway, New York City, $2,745,000; Mason & Hanger Co., Van Cortlandt Park, New York City, $2,758,000; E. E. Smith Contracting Co., 101 Park Ave., New York City, $2,759,000; Holbrook, Cabot & Rollins Corporation, 331 Madison Ave., New York City, $2,841,000; Cranford Co., 100 Montague St., Brooklyn, N. Y., $2,861,000; Godwin Construction Co., 251 Fourth Ave., New York City, $3,015,000; Booth & Flynn (Pittsburgh), 3785 Broadway, New York City, $3,136,000; J. F. Cogan Co., contractors, Woolworth Bldg., New York City, $3,310,000.

Subways—Philadelphia, Penn.—The lower house of the State Legislature has passed the bill authorizing the city to build subways for leasing purposes, and gives the Council control over the leases and contracts. Under its provision work must start within 18 months.

Engine House—Pittsburgh, Penn.—John P. Brennen, Arch., City Hall, North Side, is preparing plans for an engine house on Webster Ave., to cost $60,000. The building will be of brick, two stories, and fireproof.

Retaining Wall—Verona, Penn.—Bids will be received until noon, June 26, by Frank, Lloyd & Stophlet, Archs., 1100 House Bldg., Pittsburgh, Penn., for the construction of a retaining wall at Verona.

Fire Hose—Washington, D. C.—Bids will be received until 2 p.m., June 27, by the Commissioners of the District of Columbia, Washington, for furnishing and delivering 15,000 ft. of 2½-in. fire hose.

✚Canal—Norfolk, Va.—The contract has been awarded to the Brett Engineering Co., Wilson, N. C., by Parksville Drainage District No. 1, for the construction of about 10 miles of drainage canals. The work will require the excavation of about 262,000 cu.yd. Bids were received June 11.

Levees—New Orleans, La.—Contracts for levee bids opened June 9 have been awarded as follows: For the Vaucluse Levee, Lots 1 and 2, to FRANCIS T. CONSTANT, Alexandria, at 34c. per cu.yd.; totals, $58,820 and $57,120, respectively; for the Ingefield Levee, Lots 2, 3 and 4, to B. T. CLARK & CO., Natchez, Miss., at 29½c. and 29.16c. per cu.yd.; totals, $38,199, $38,054 and $37,762, respectively.

Wall and Fill—Cincinnati, Ohio—Bids will be received by the County Commissioners until noon, July 11, for the construction of a concrete wall and fill on Hillside Ave. at Rapid Run, Delhi Township. Albert Reinhardt is Clk.

Elimination of Grade Crossings—Cincinnati, Ohio—The city is considering the elimination of grade crossings on the Cncinnati, Hamilton & Dayton Ry.

Ditch—Anderson, Ind.—Bids will be received until July 5 by the County Surveyor, Anderson, for constructing the George Hertzel Ditch, 10,880 lin.ft. 20-, 22- and 24-in. drain tile and the removal of 38,451 cu.yd. of earth.

✚Ditch—Brownstown, Ind.—F. C. MORGAN, Vincennes, Ind., has been awarded the contract at 8.1c. per cu.yd., for constructing the Rider Ditch and branches, bids opened May 29 at Brownstown by S. Carr, Engr.-Supt.

Drydock—Evansville, Ind.—Thomas Crozier, Evansville, is organizing a company for the purpose of constructing a drydock here.

Removal of Bypass—Chicago, Ill.—(Official)—Bids were received as follows, June 19, by the Sanitary District of Chicago for the removal of the bypass at and north of Jackson St.: Great Lakes Dredge & Dock Co., Chicago, $17,900 and $18,900; Byrne Bros. Dredging & Engineering Co., Chicago, $31,323 and $34,711.

Channel Work—Chicago, Ill.—(Official)—Bids were received as follows by the Sanitary District of Chicago, June 19, for the excavation and construction of Contract Sections 7 and 8 of the Calumet Sag Channel: (a) Section 7; (b) Section 8; (c) Sections 7 and 8: Green & Sons Co., Chicago, (c) $1,065,039; Bryne Bros. Dredging & Engineering Co., Chicago, (a) $529,150; (b) $1,550,197; (c) $1,071,672; Great Lakes Dredge & Dock Co., Chicago, (c) $1,296,551; T. W. Keys, La Salle, Ill., (a) $766,150; (b) $781,330; (c) 1,547,480.

Dredging—Milwaukee, Wis.—A. F. Bues was the only bidder for dredging the navigable streams of Milwaukee at 14c. per cu.yd. The city will spend about $30,000 for dredging this year.

Coal Trestle—Two Harbors, Wis.—Plans have been completed for the construction of a coal trestle for the city. Bids will be received soon for a wood or a steel superstructure with concrete base.

Drain Work—Fort Dodge, Iowa—Bids will be received until 10 a.m., June 28, by J. L. Hanrahan, County Audr., Fort Dodge, for the construction of the branches known as Sects. 8, 9, 16, 17, 18, 19, 20, 21 and 22 of Drain 96. Estimated cost, including labor, $38,143.

✚Ditch—Blue Earth, Minn.—Contracts for constructing Ditch 14 have been awarded as follows: Open work, to MELGREW & BOYCE, Dubuque, Iowa, at $6500; Clear Lake, Iowa, $59,500. Robt. L. Miller, of Blue Earth, is Engr.

Ditch Work—Crookston, Minn.—No bids were received June 11, by H. J. Welte, County Audr., Crookston, for finishing Ditches 63 and 64.

Ditch—Crookston, Minn.—The Commissioners of Polk County are considering the construction of a ditch. H. J. Welte is County Audr.

Sprinkler System—Minneapolis, Minn.—Bids will be received until June 28 at the office of the Controller of the University of Minnesota, for installing sprinkler systems in four buildings at the University.

✚Ditch—Warren, Minn.—The contract has been awarded to SMALL & McMAHON, Aitkin, Minn., for the construction of Ditch No. 28, at $26,000. The work will require the excavation of about 220,214 cu.yd.

Telephone System—Mitchell, S. D.—On June 10 the proposition to issue $60,000 of bonds for a municipal telephone system was carried.

✚Ditch and Levee Work—Elsberry, Mo.—Bids will be received at the office of James G. Welch, Secy., Elsberry, by the Commissioners of the Elsberry Drainage District, until 11 a.m., July 8, for ditch and levee work aggregating 920,000 cu.yd. The Harman Engineering Co., Peoria, Ill., Engr. and will furnish further information upon inquiry.

Drainage Work—Houston, Tex.—The property owners of Drainage District No. 7 have voted to issue $140,000 of bonds for drainage improvements.

Comfort Stations—Salt Lake City, Utah—The city will erect two public comfort stations. Estimated cost, about $10,000. Bids will be asked soon.

Dock—Portland, Ore.—Plans are nearing completion for the construction of the West Side dock. Bids will be asked soon. G. B. Hegardt is Ch. Engr. Dock Comn.

Wharf—Oakland, Calif.—The Southern Pacific Co. is planning for the construction of new wharves at Oakland. W. Hood, San Francisco, Calif., is Ch. Engr.

Levees—Sacramento, Calif.—Bids will be received about July 15 by the City Engineer for the construction of levees along the Sacramento River. Estimated cost, $900,000.

Subway—Bridgeburg, Ont.—Surveys are being made for the construction of the proposed subway at the Thompson grade crossing. Estimated cost, $50,000. The cost will be born by the Railway Commission, the Grand Trunk Ry., the Michigan Central R.R. and the township of Bertie.

✚Lock Gates—Ottawa, Ont.—(Official)—The contract has been awarded to ROGER MILLER & SON, Toronto, Ont., for lock gates for the Ontario-Rice Lake Division of the Trent Canal. Bids were opened by R. C. Desrochers, Secy. Dept. Pub. Wks.

Wharf Extension—Sea Gull, Ont.—Bids will be received until July 14 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the wharf at Sea Gull, St. Joseph's Island, District of Algoma, Ont.

✚✚Dredging—Toronto, Ont.—The contract has been awarded by the Port Commission of Toronto to the CANADIAN STEWART CO., Montreal, Que., for dredging about 30,000,000 cu.yd. in the harbor. Noted June 12.

Harbor Work—Toronto, Ont.—The Department of Public Works, Ottawa, Ont., has voted in favor of aiding the Toronto Harbor Commission in its harbor improvement work to the extent of $500,000. R. C. Desrochers is Secy., Ottawa.

Harbor Work—Whitby, Ont.—The Canadian Government is planning to enlarge the harbor at Whitby, Ont., at a cost of about $20,000. R. C. Desrochers, Ottawa, Ont., is Secy. Dept. Pub. Wks.

Observatory—Victoria, B. C.—Bids will be receivd until July 2 by R. C. Dsrochrs, Scy. Dpt. Pub. Wks., Otawa, On., for h consrucion of an obsrvaory at Gonzales Heights, Victoria.

✚Lock System—Victoria, B. C.—The Canadian Government has awarded the contract to the ELEVATORS SUPPLY & EQUIPMENT Co., for the installation of a patent lock system in the new jail, at $25,000.

Jetty—Steveston, B. C.—Bids will be received until July 2 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for completing the jetty at Steveston, at the mouth of the Fraser River, New Westminister. This is an extension from June 17.

Breakwater—Parker's Cove, N. S.—Bids will be received until June 30, by R. C. Resrochers, Secy. Dept Pub. Wks., Ottawa, Ont., for constructing a breakwater at Parker's Cove.

Wharf—White's Bluff, N. B.—Bids will be received until July 9 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a wharf at White's Bluff.

Car Ferry Terminal—Carleton, P. E. I.—Bids will be received until Juyl 2 by the Department of Railways and Canals, Ottawa, Ont., for donstrulting a car ferry terminal at Carleton Point, P. E. I. This is a readvertisement as the contract recently awarded was abandoned.

BUILDINGS

Durham, N. H.—James H. Richie, Arch., 8 Beacon St., Boston, Mass., is preparing plans for the construction of the engineering building for the New Hampshire State College. The estimated cost is $80,000.

✚Athol, Mass.—The contract for building a block on Main St. for L. S. Starrett has been awarded to L. B. TAYLOR. It will be 88x106 ft., three stories, of brick and limestone. Funk & Wilcox, 15 Beacon St., Boston, are Archs.

✚Boston, Mass.—The contract for the construction of the 10-story building for Houghton & Dutton at Tremont and Beacon Sts., has been awarded to the GEO. W. HARVEY CO., 201 Devonshire St.

Boston, Mass.—The City Council, June 13, decided to negotiate a loan of $298,000, for new buildings, changes and additions at City Hospital and $22,000 (additional) for municipal building in Ward 7. M. J. Fish is Supt. of Pub. Bldg. Plans are ready for bids for the $150,000 station for the Boston & Maine R.R. to be erected at Clinton. R. C. Reamer, Boston, Mass., is Arch.

Fall River, Mass.—A five-story steel frame addition to the Notre Dame Parish Home will be erected. It will be 50x135 ft. Louis G. Destremp is Arch., 56 North Main St.

Holyoke, Mass.—Bids will be received until June 27, for the high school gymnasium to be built at Pine and Beach Sts. W. E. Reid is Arch., 280 High St. Noted June 5.

Marblehead, Mass.—Vroom Bros., Lynn, Mass., It is reported, have filed a petition in the Essex Superior Court asking an injunction to restrain the town of Marblehead from awarding contract to build the new high school to McGahey & Connor, Boston, Mass., who bid $79,000. Vroom Bros. bid $78,529. Noted May 22.

✦Methuen, Mass.—The contract for the construction of the school on Ashford St. has been awarded to E. A. PEABODY & SON, Bay State Bldg. It will be two stories, of brick, with boiler house included.

North Adams, Mass.—Plans are being prepared for a three-story high school. Bids will be asked about Aug. 1. E. C. & G. C. Gardner are Archs.

Springfield, Mass.—A five-story office building is being planned at Stearns Park, for Frank L. Dunlap, 274 Main St. It will be 60x100 ft., of brick E. C. & G. C. Gardner are Archs., 33 Lyman St.

Springfield, Mass.—Wood Williams, Williams Dental and Surgical depot, has purchased the Stearns Park Hotel property for $100,000 and will erect upon the site a five-story business block, 100x60 ft.

✦Providence, R. I.— The contract for building an apartment house on Whitmarsh St., for Manuel F. Williams has been awarded to JOHN McLEOD, 511 Hope St. It will be 65x200 ft., three stories, of brick and terra cotta. Frank W. Woods, 212 Union St., is Arch.

✦The contract for the construction of the gymnasium for St. George's School has been awarded to WILLIAM WILLIAMS, 86 Weybosset St., Providence. It will be 45x128 ft., of brick and steel, 2½ stories.

✦Hartford, Conn.—Contracts for the construction of the addition to the Northeast School District buildings have been awarded as follows: Masonry, A. L. HILLS, Hartford, Conn., carpentry; ALEXANDER HEPBURN, Hartford, Conn., steel; BERLIN CONSTRUCTION CO., Berlin, Conn., tile and marble work; WHITE & CLARK, Hartford, Conn.

✦New Britain, Conn.—The contract for the storage building to be erected on Elm St. for Landers, Prary & Clark, has been awarded to the TORRINGTON BUILDING CO. It will be of brick, 42x260 ft., two stories, of mill construction. Unkelbach & Perry are Archs., 162 Main St.

Brooklyn, N. Y.—Plans have been filed for the construction of the telephone building at Lorimer St., and Boerum Place, for the New York & New Jersey Telephone Co. The estimated cost is $100,000.

✦Buffalo, N. Y.—The general contract for the construction of the eight-story department store to be erected at Washington and North Division Sts., for Wilson & Smith, 515 Mutual Life Bldg., has been awarded to JAMES N. BYERS.

✦Hudson, N. Y.—The following contracts have been awarded by the State Architect at the N. Y. State Training School for Girls at Hudson. Construction of cottages 13 and 14, and conduits, to the BARRIGAN CONTRACTING CO., of Little Falls, $44,700. Plumbing work of cottages 13 and 14 to P. C. DOHERTY, of Poughkeepsie, $4378. Installation of the hot water and circulating piping in the new main conduit to THOMAS A. O'MALLEY, of Albany, $586; electric work of cottages 13 and 14 to T. FREDERICK JACKSON, INC., New York City, $5087. Construction of the new school building to D. W. DEAN, of Olean, $53,713. Heating of the school building to J. J. HRAN & CO., of Troy, at $4390. Electric work for the new school building to PETER KEELER BUILDING CO., at $2420. For the heating work, conduits, including the pressure reducing valves, to the W. B. ARMSTRONG CO., of Albany, $5630. Also heating work at $3947. Noted May 15.

✦Malone, N. Y.—The contract for the construction of the hotel at Malone for Flannigan Bros. has been awarded to F. A. CASWELL, Watertown, N. Y.

Ithaca, N. Y.—(Official)—Bids will be received about July 10, by Gibb & Waltz, Archs., Trust Co. Bldg., Ithaca, N. Y., for the construction of a fraternity house for the Delta Chi Fraternity. The estimated cost is $40,000. Noted June 19.

(Official)—Bids will be received about June 30, by Gibb & Waltz, Archs., Trust Co. Bldg., Ithaca, for the construction of the department store for Rothschild Bros. The estimated cost is $75,000.

✦New York, N. Y.—The contract for driving the steel pile foundation for the 12-story apartment hotel to be erected at Park Ave. and 77th St., has been awarded to the UNDERPINNING & FOUNDATION CO., 290 Broadway, New York. Noted May 15.

Plans have been filed for the construction of a six-story hospital at Edgecomb Ave., between 163rd and 164th Sts., for St. Lawrence Hospital. The estimated cost is $500,000.

Plans have been filed by V. Hugo Koehler, Arch., 489 Fifth Ave., for the construction of an office and store building at Broadway and 107th St., for the Aetna Amusement Corporation. The estimated cost is $100,000.

Plans have been filed by Wallis & Goodwillie, Archs., 346 Fourth Ave., for the construction of a 12-story loft building at 33d St. and Madison Ave., for the East 33d St. Ry. Co. The estimated cost is $400,000.

Plans have been filed by Wallis & Goodwillie, Archs., 346 Fourth Ave., for the construction of an eight-story apartment house, 50x85 ft., at 124 West 55th St., for the George Barker Construction Co. The estimated cost is $140,000.

✦Niagara Falls, N. Y.—The general contract for the construction of the Alumni Building at Niagara University, has been awarded to JOHN LENNON & SONS, 1328 South Ave., Niagara Falls, N. Y. Noted Apr. 10.

✦Potsdam, N. Y.—A contract has been awarded to L. B. CLEVELAND, by the New York Central & Hudson River R.R. Co. for the proposed passenger station at Potsdam.

★Schenectady, N. Y.—Bids will be received until 2:30 p.m., July 23, by the Fred E. Johnson, Secy., Board of Contract & Supply, City Hall, for the construction, including plumbing and gas fitting, heating and ventilating and electrical work of the three schools for the Second, Ninth and Tenth Wards, Schenectady, N. Y. W. Thomas Wooley is Arch., 447 Franklin St.

✦Sherrill, N. Y.—The fireproofing contract in connection with new building being erected by the Oneida Community Co. at Sherrill, has been sublet to the ROEBLING CONSTRUCTION CO., Erie County Bank Building, Buffalo, N. Y.

✦The contract for steel work, amounting to about 600 tons, for the building to be erected at Sherrill, by the Oneida Community Co., Ltd., has been sublet to the AMERICAN BRIDGE CO., 30 Church St., New York.

Syracuse, N. Y.—The lowest bidder for the construction of the poultry building at the State Fair Grounds was the Peter Keeler Building Co., Albany, N. Y., at $76,350, and Burns Bros., Syracuse, at $3313, for plumbing work. Noted May 29.

✦Newark, N. J.—Contracts for the completion of the Cathedral of the Sacred Heart, have been awarded to E. M. WARREN, of Newark, and the WEBB GRANITE & CONSTRUCTION CO., Worcester, Mass. The total of the two contracts is $1,000,000.

✦The contract for furnishing between 1300 and 1400 tons of structural steel for the Military Plaza Hotel, has been awarded to the HEDDEN IRON CO., 1 Madison Ave., New York.

Greensburg, Penn.—Paul A. Bartholomew, Arch., will prepare plans for a 2½-story brick school at Pittsburgh and Maple Sts. to cost $40,000.

Millvale, Penn.—J. T. Comes, Arch., 1005 Fifth Ave., Pittsburgh, has completed plans for a two-story brick and stone fireproof church and parsonage for St. Anthony's Congregation, North Ave. The estimated cost is $125,000.

✦Hazleton, Penn.—The contract for the construction of the industrial building, school house, refrigerating house, and a barn at the Luzerne County Home and School for Boys, has been awarded to W. H. SHEPHERD & SONS, Wilkes-Barre, Penn., at $40,500. Other bidders follow: Herman Mailander, Wilkes-Barre, $46,930; S. Y. Frederick & Son, Hazleton, $47,600; H. L. Campbell, Hazleton, $48,000; James M. Boyle, Freeland, $52,420; J. M. Leach, Jr., Wilkes-Barre, $41,470; W. H. Shepherd & Sons, Wilker-Barre, $40,500.

New Castle, Penn.—Bids will be received about July 1, by Frank Foulk, Arch., Pearson Block, for the construction of a club house for the B. P. O. E. It will be three stories and basement, 75x90 ft., of brick and stone. The estimated cost is $50,000. Noted May 8.

New Eagle, Penn.—Bids will be received until 7 p.m., June 27, by William Pickering, Chn. of Com. on Pub. Property, New Eagle, Penn., for the construction of a brick municipal building.

Philadelphia, Penn.—Bids are being received by Hewitt, Granger & Paist, Archs., for the construction of the Jewish Maternity Hospital, at 532 Spruce St. It will be four stories, 46x97 ft. The estimated cost is $40,000.

The Board of Education will expend $200,000 for repairs to various school buildings.

Pittsburgh, Penn.—John T. Comes, Arch., 1005 Fifth Ave., has prepared plans for the construction of a church on North Ave., for St. Anthony's congregation. The estimated cost is $125,000.

Plans are being prepared for the construction of the freight house at North Canal and Anderson Sts., for the Pennsylvania R.R. It will be four stories, of brick. The estimated cost is $337,000.

Pittsburgh, Penn.—Ellsworth Dean, Arch., Fitzsimmons Bldg., Fourth Ave., is preparing plans for remodeling the Bakewell building, Grant and Diamond Sts. A three-story addition 22x90 ft., will be built. It will have stone foundations, tile floors and partitions, composition roofing, etc.

Pittsburgh Hospital, Sisters of Charity, will build an additional wing to the building in Frankstown Ave., to cost $200,000. The architects have not yet been selected.

✦Sunbury, Penn.—The contract for remodeling and rebuilding the Northumberland County court house has been awarded to the SHAMOKIN LUMBER & MFG. CO., Shamokin, at $60,400.

Georgetown, Del.—Brinckloe & Canning, Archs., Wilmington, are preparing plans for remodeling and enlarging the Sussex County court house.

Baltimore, Md.—J. Appleton Wilson, Arch., 800 Law Bldg., is preparing plans for the construction of the Pratt Library on West North Ave.

Petersburg, Va.—(Official)—Bids will be received until noon, June 30, by A. T. Shepherd & Charles K. Bryant, Archs., Richmond, Va., for the construction of the Sycamore apartments, at Petersburg. The estimated cost is $75,000. Noted June 5.

Richmond, Va.—The Virginia Building Corporation will erect a 22-story office building at 11th and Main Sts. The estimated cost is $400,000. H. L. Denoon is Pres.

✦Raleigh, N. C.—The North Carolina State Fair awarded the contract for the construction of the buildings at the State Fair to W. B. BARROW, Raleigh, N. C.

✦Winston Salem, N. C.—The contract for the construction of the hospital at Winston Salem, has been awarded to J. A. JONES, Charlotte, N. C., at $90,000. Noted May 22.

✦Augusta, Ga.—The contract for the construction of the hotel to be erected at City Park, for the Lawrence Hotel Co., has been awarded to C. W. REQUARTH CO., 1210 Commercial Bldg., Charlotte, N. C. The estimated cost is $250,000. Bellomby & Whaley, are Archs., Augusta, Ga.

✦Savannah, Ga.—The contract for the construction of the Masonic Temple, has been awarded to E. MORGAN, Savannah, Ga. The estimated cost is $200,000.

Laurel, Miss.—The Y. M. C. A. will erect a new home at a cost of $50,000.

✦New Orleans, La.—The contract for the alterations to the Y. M. C. A., building has been awarded to H. F. HINRICHS, New Orleans, La.

Grayson Springs, Ky.—J. G. Gallagher, Louisville, Ky., is interested in the organization of the Grayson Springs Hotel Co., which will establish a $250,000 hotel and summer resort at Grayson Springs, Ky.

Cincinnati, Ohio—The Jacob Vossler Co., manufacturer of cheese, etc., will build a four-story warehouse on Court St. between Central Ave. and John St. It will be heavy mill construction 22x100 ft. Anton Reig, is Arch. 2554 Vine St.

✦The general contract has been awarded to GRIFFITH & SONS CO., Cincinnati for the $350,000 addition and alteration to the John Shillito Co. store at Seventh & Race Sts. Six new elevators will be installed.

The Provident Savings Bank & Trust Co., Cincinnati, Ohio, has acquired a site adjoining its present building, and is considering the erection of a 12-story addition.

J. Stacey Hill, owner of the Hotel Gibson, Cincinnati, Ohio, who has been building a four-story addition, has announced that this will be increased to 12 stories. G. W. Drach, Arch., will receive bids at once.

The Union Savings Bank & Trust Co., Cincinnati, has had plans prepared for the erection of an 18-story addition.

✦Cleveland, Ohio—The contract for the construction of the department store building, at Prospect Ave. and Ontario St., for May Bros., has been awarded to the BLACK CONSTRUCTION CO., St. Louis, Mo. Noted Apr. 3.

Columbus, Ohio—Bids will be asked at once for the construction of a $175,000 school to be erected by the Board of Education on Studer Ave.

✦Columbus, Ohio—The contract for the construction of the eight-story department store to be erected on High St., for Z. P. White, has been awarded to C. F. HANSBERGER, Columbus, Ohio.

Hamilton, Ohio—Bids will be received until June 27, by F. L. Packard, Arch., New Hayden Bldg., Columbus, Ohio, for the construction of a school at Hamilton. Noted Jun✦ 12.

Chicago, Ill.—Patterson & Davidson, Archs., 53 West Jackson Blvd., have prepared plans for the construction of a 16-story building at Madison and Franklin Sts., to be known as the Shoe & Leather Exchange. The estimated cost is $1,800,000.

The Central Forwarding Co. will erect a warehouse at Iron and 36th Sts. and the River. It will be five stories, 100x250 ft. The estimated cost is $200,000.

...Evanston, Ill.—Bids will be received about July 10, by Meyer J. Strum, Arch., 116 South Michigan Ave., Chicago, Ill., for the construction of the Evanston Hospital. The estimated cost is $125,000. Noted June 5.

Hartford, Wis.—Plans have been prepared for a two-story and basement school by R. Messmer & Bros., Archs., 1004 Majestic Bldg., Milwaukee. C. L. Friday is Clerk. Cost, $40,000.

Madison, Wis.—J. N. Cady, Arch., is planning a large store building to be erected for Alexander Kornhauser. The estimated cost is $50,000.

West Allis, Wis.—Bids were received as follows, for the erection of an addition to the Lincoln School. General construction work received only one bid, from A. Tady, at $24,222; plumbing, Polacneck & Johnson, $6875; Neis-Freund Co., $6500; Wauwatosa Hardware Co., $6750; heating, Downey Heating & Supply Co., $8400; electric wiring, Wisconsin Equipment Co., $630. No recommendations were made. Chandler & Park are Archs., Racine, Wis.

✦Des Moines, Iowa—The contract for the construction of the addition to the Park Ave. School has been awarded to BENSON & MARXER, at $38,094, and the contract for plumbing, heating and lighting to PRAY & CUMERFORD, at $9916. Proudfoot, Bird & Rawson are Archs., 625 Flynn Block.

St. Paul, Minn.—Granger & Frost, Archs., 806 The Temple, are preparing plans for the construction of a 20-story office building at Fourth and Jackson Sts., for James J. Hill. Noted Apr. 24.

Winona, Minn.—Bids were received as follows, for the construction of the county jail: A. C. Thomas, St. Paul, $49,496; John Lohse, Winona, $49,651; Seidlitz & Werner, Winona, $54,100; H. W. Jackson, St. Paul, $49,700.

Joplin, Mo.—Shattuck & Hussey, 19 South La Salle, St., Chicago, Ill., are preparing plans for the construction of a Y. M. C. A. building, at Joplin. The estimated cost is $125,000.

✦St. Louis, Mo.—The contract for the construction of the church at Grand Ave. and Emily St., has been awarded to JOHN COSTELLO & SON, 251 St. Louis Ave., at $62,300.

Plans have been prepared by Herman Lee Meader, Arch., 178 Fifth Ave., New York, for the construction of a hotel at 12th and Olive Sts. It will be 10 stories, of brick and steel. Henry Blodgett, Third National Bank Bldg., is interested.

✦The contract for the construction of the hospital addition on Delmar Ave., for St. Luke's Hospital, has been awarded to the W. M. SUTHERLAND BUILDING & CONSTRUCTION CO., St. Louis. The estimated cost is $150,000.

Abilene, Tex.—Plans have been approved by the County Commissioners for the construction of Taylor County court house. George Burnett is Arch., Waco, Tex.

Corpus Christi, Tex.—An election of taxpayers of Nueces County will be held July 4, to vote on the proposition of issuing $250,000 in bonds for the erection of a new county court-house and jail, and $500,000 of bonds for constructing 200 miles of good roads.

✦Dallas, Tex.—The contract for the construction of the four-story and basement build'ng at Elm and Griffin Sts., for the Huey & Philip Hardware Co., has been awarded to the ALEX WATSON CONSTRUCTION CO., Dallas.

Denver, Colo.—The Denver Union Stock Yards will erect an exhibition building, at Denver. It will be three stories, 60x100 ft. The estimated cost is $75,000.

Phoenix, Ariz.—Bids will be received July 15, by the Trustees of Phoenix School District for the construction of a two-story and basement brick grammar school. Norman F. Marsh, Broadway Central Bldg., Los Angeles, is Arch. It will be 280x120 ft., with pressed brick exterior, slate and composition roof, hollow tile and metal lath partitions, cement and tile floors.

Wenatchee, Wash.—The Wenatchee Growers' Exchange will build a $40,000 warehouse at Yakima and Wenatchee Aves. Bebb & Mendel are Archs., Denno Bldg., Seattle, Wash.

Los Angeles, Calif.—(Official)—Bids will be received until noon, July 15, by George W. Eldredge, Arch., 521 Los Angeles Investment Bldg., for the construction of the Huntington Park Union High School. The estimated cost is $100,000. Noted June 12.

The Alta Planing Mill Co., 830 McGary St., was the lowest bidder at $499,885 for the erection of a group of nine buildings at Vermont and Willowbrook Aves., for the Los Angeles State Normal School. Other bidders were as follows: Southwestern Construction Co., $504,000; Lewis A. Hicks Co., $531,000; Los Angeles Planing Mill Co., $533,500; and C. J. Kubach Co., $537,900. Allison & Allison are Archs., Hibernian Bldg.

San Diego, Calif.—The Wurster Construction Co., Spreckels Bldg., San Diego, was the lowest bidder at $272,000, for the construction of the California State building at the San Diego Exposition. Other bidders were: F. O. Engstrum Co., $284,000; Klein & O'Brein, $289,412. B. G. Goodhue is Arch. Noted June 5.

San Francisco, Calif.—The lowest bidder for furnishing the structural steel to be used in the construction of the city hall, was the United Steel Products Co., at $476,283. Other bidders were: Phoenix Iron Co., $545,000; Union Iron Works, $571,000; Pacific Rolling Mills, $532,000; Dyer Bros., $585,099. Noted May 29.

✦The following contracts have been awarded by the Directors of the Panama Pacific Exposition Co., in connection with the construction of the buildings on the fair grounds: Plumbing contract, for Transportation Building, to JOHN G. SUTTON CO., at $17,384; pile foundation contracts for Mines Building and Varied Industries Building, to HEALY TIBBITTS CO., 8 Main St., at $28,426; erection of the Manufacturers Building, to McLERAN & PETERSON, Sharon Bldg., at $210,326.

San Francisco, Calif.—The San Francisco Medical Society will erect a 13-story and basement office building at Northeast Post and Powell Sts. to cost about $1,250,000. Ward & Blome, 310 Sansome St., are Archs.

✦San José, Calif.—The general contract for the construction of the Hester School has been awarded to ROBINSON & PLACE, Okland, Calif., at $60,950. The heating contract was let to the PACIFIC HEATING & BLOWER CO., San Francisco, at $5200.

✦The Board of Public Works has awarded the contract for the erection of the Edison School at 22d and Church Sts., to MONSON BROS., at $42,677. Noted June 19.

✦Montreal, Que.—The contract for the construction of the 10-story office building at Beaver Hall Hill, for the Guarantee Co., of North America, has been awarded to the GEORGE A. FULLER CO., 369 St. Catherine St., West.

INDUSTRIAL WORKS

Fairfield, Maine—The Keyes Pulp & Fibre Co., W. L. Keyes, Pres., is having plans prepared for an addition to its plant, which will be 90x228 ft., two stories, of brick.

Springfield, Vt.—The John T. Slack Co., Springfield, Vt., will build a one-story brick addition to its carding department, 228x47 ft.

Boston, Mass.—William Crane, Boston, has purchased a site on Heywood St., and will erect a four-story factory building.

Gardner, Mass.—Frank M. Flavor will build a three-story brick factory, 40x100 ft., to manufacture building material and inside finish.

Bridgeport, Conn.—Plans are being prepared for the proposed addition to the plant of the Frisbie Pie Co., on Kossuth St. It will be 50x100 ft., of brick and wood, three stories, mill construction. Leonard Asheim is Arch.

The Belknap Mfg. Co. has purchased a site on Holland St. for a three-story brick factory, 50x320 ft.

Naugatuck, Conn.—The United States Rubber Co. will erect a two-story brick and steel manufacturing addition to its reclaiming plant, to cost $75,000.

New Britain, Conn.—Plans have been prepared for an addition to the factory of Landers, Tracy & Clark, and bids will be received at once for a building about 30x70 ft., two stories, of brick, mill construction. Unkelbach & Perry, 162 Main St., New Britain, are Archs.

Torrington, Conn.—The Progressive Mfg. Co. will erect a two-story brick factory, 30x152 ft., to its plant at this city.

Waterbury, Conn.—Plans are being prepared for a factory building to be erected on North Elm St., for the General Mfg. Co. It will be 28x77 ft., two stories and basement, of Brick.

Buchanan, N. Y.—Edwin A. & H. Lansing, Quick Archs., have prepared plans for a factory one and two stories, 696x1920 ft., to be built by the Standard Oil Cloth Co. 320 Broadway, New York City, at an estimated cost of $600,000.

Buffalo, N. Y.—The McCue Co., manufacturers of automobile axles, forgings and gears, will build an extensive addition to its machine shop and drop forge plant at Elmwood Ave., Grats St., and the New York Central R.R. C. T. McCue is Pres. and Gen. Mgr.

Victor H. Canahan & Co., West and Forest Aves., is having plans prepared by Emerson C. Dell, Arch., for a 2-story and basement factory 45x98 ft., to be built at once. It will be of brick-mill construction.

✦The Aluminum Castings Co., Rogers C. Adams, Mgr. will build an addition to its Elmwood plant, Elmwood Ave. and the Erie R.R. The general contract has been let to the LACKAWANNA BRIDGE CO. for the steel work.

A four-story and basement addition 60x100 ft. is to be made to the meat products packing plant of the Danahy Packing Co. on Metcalfe St.

The Dobel Mfg. & Plating Co., has been incorporated and will erect and equip a plant for plating and polishing.

Fredonia, N. Y.—The Cudahy Packing Co. will erect a factory at Fredonia, N. Y., 112x192 ft. of steel and concrete construction.

Gloversville, N. Y.—The Normandie Silk Mills, Inc., has been incorporated and will equip mills for the manufacture of silk fabrics. Thos. H. Hubbard, George B. and Clinton V. Rowland, Gloversville, are the incorporators.

Oneonta, N. Y.—A three-story and basement flour mill 80x92 ft., is to be erected by the Elmore Milling Co. Orlo Epps is Arch., Main St., Oneonta.

Port Chester, N. Y.—The Smith-Angevine Co. plans to build a factory on Purdy Ave., for the manufacture of soap and other products, from hides. Estimated cost, $20,000.

Rochester, N. Y.—The New York State Rys. Co., Rochester, N. Y., is having plans prepared for the erection and equipment of a car barn on Charlotte Blvd., in Greece, a suburb of Rochester. The estimated cost is $200,000. D. P. Falconer, Rochester, is Engr.-in-Charge.

Howard B. Nurse, Arch., Cutler Bldg. has completed plans and is taking bids for a 1-story factory, of brick and steel to be erected on Elm St. by the Probst Realty Co. for the Varsity Candy Co., lessee who will install machinery for the manufacture of candy.

Syracuse, N. Y.—Bids are being received for a two-story factory, 78x134 ft., to be erected by A. H. Durston.

Utica, N. Y.—A factory building 54x118 ft. 2 stories for which plans have been completed will be built on Broad St. by J. A. Birsching manufacturer of textile machinery.

✚The West End Brewing Co. has let contracts for a 55x90-ft. addition to its brewing plant. The structural iron work contract has been let to the UTICA STEAM ENGINE & BOILER WORKS.

Camden, N. J.—The Victor Talking Machine Co. Camden, N. J., will erect a large addition.

Elizabeth, N. J.—The Waclark Wire Co. has secured a permit and will erect an addition to its plant, to cost $20,000.

Mount Wolf, Penn.—The American Wire Fabric Co. has completed plans for doubling the capacity of its plant at Mount Wolf. The plans provide for an extension, 200x80 ft., a new tower, 42x36 ft., and a new engine house.

Philadelphia, Penn.—The Central Machine Co. is having plans prepared for the construction of a three-story machine shop at Seventh and Franklin Sts., Peuckert & Wunder are Archs.

A permit has been granted to James Stewart & Co., for the construction of a drier machinery house, at Girard Point, Philadelphia. It will be three stories, 33x62 ft., to cost $60,000.

The General Engineering Co., Philadelphia, Penn., has been granted a permit for the erection of a factory 67x157 ft. at Front & Kenilworth Sts. to cost $13,000.

Pittsburgh, Penn.—The Standard Underground Cable Co., Pittsburgh, Penn., has plans for a factory and office building 50x21 ft.

Baltimore, Md.—The Martin Wagner Co., and the American Can Co., whose plants were recently destroyed by fire, has announced that it will rebuild at once.

Suffolk, Va.—The Parker Buggy Co. has announced plans for the reconstruction of its plant, which was destroyed by fire recently.

Parkersburg, W. Va.—The General Porcelain Co., East Liverpool, Ohio, will erect a new plant, 500x300 ft., at Parkersburg, for the manufacture of electrical porcelain. Cost, $400,000.

Wheeling, W. Va.—The Wheeling Steel Casting Co., Wheeling, has been reorganized and plans to enlarge its plant in North Warwood. Charles H. Dowler is Gen. Mgr.

Charlotte, N. C.—The cotton-yarn mill of George A. Howell, at Charlotte, which was recently destroyed by fire, will be rebuilt. Estimated cost, $30,000.

Gastonia, N. C.—The Cocker Machine & Foundry Co. is being organized at Gastonia, and contemplates the construction of two buildings, each about 40x100 ft. The concern plans to manufacture textile machinery, and conduct a general repair and job foundry business. George B. Cocker is Pres.

Georgetown, S. C.—The Atlantic Coast Lumber Corp. plans to build a concrete and steel mill with a daily capacity of 750,000 ft. of lumber, at Georgetown, to replace that recently burned.

Brunswick, Ga.—The Yaryan Naval Stores Co. plans to build a paper mill at Brunswick, estimated to cost $500,000. M. Perry is mgr.

Birmingham, Ala.—The Steel Cities' Chemical Co. contemplates the construction of an addition to its plant at Birmingham. Estimated cost, $100,000. Culpepper Exum is Pres.

Pansy, Ala.—The Rocky Creek Lumber Co., whose plant was recently destroyed by fire, will rebuild at once at a cost of $50,000.

Beulah, Tenn.—W. W. Bennett, Detroit, Mich., automobile manufacturer, has purchased a site at Beulah, near Nashville, and will establish a new plant.

Knoxville, Tenn.—The Sanford-Day Iron Works are having plans prepared for the construction of a foundry, 66x256 ft., of iron, on a brick foundation.

The Knoxville Tinware Co. contemplates the construction of a plant in the Nobles addition.

The Sanford-Day Iron Works, Knoxvile, is having plans prepared for the erection of a foundry, 66x256 ft., to increase the output of cars.

Memphis, Tenn.—The Yazoo & Mississippi Valley R.R. Co. has had plans prepared for two roundhouses, repair shops, and several changes in its yards at Nonconnah, Memphis.

Memphis, Tenn.—R. J. Darnell, Inc., suffered $100,000 loss in the destruction of its double sawmill and veneer plant by fire. Plans for reconstruction have already been approved.

Louisville, Ky.—The Louisville Gas & Electric Co., which was recently formed, has announced plans for the erection of a garage and stables and blacksmith shop. George H. Harries is Pres.

Paris, Ky.—The Kentucky Distilleries & Warehouse Co., with general offices in Louisville, has announced plans for the enlargement of the Lewis Hunter distillery, near Paris, and will purchase equipment this summer. J. A. Wathen may be addressed at the Louisville office.

Somerset, Ky.—The Cincinnati, New Orleans & Texas Pacific Ry. Co. will erect additions to its railroad shops at Somerset. About $160,000 will be expended.

IND WKS.

Cincinnati, Ohio—An eight-story, 44x100-ft. cold-storage plant is being planned and will be erected for the Bender, Striebig & Co., at 218-20 Wright St., Cincinnati.

The Hoffner Bros. Co., tanner, Hopple St. and the Canal, Cincinnati, will build a five-story addition to the plant, 166x80 ft., of brick, mill construction. Phillip Pfeiffer, Arch., will receive bids.

Cleveland, Ohio—The Pfaffman Egg Noodle Co., Cleveland, is having plans prepared for the erection of its proposed factory. It will be three stories, 65x110 ft. The cost has been estimated at $35,000.

Columbus, Ohio—The Columbus Dental Mfg. Co., Columbus, is having plans prepared for the construction of its proposed factory. It will be two stories, and will cost about $15,000.

Columbus, Ohio—A permit has been issued to the Hayden-Corbett Chain Co., Columbus, for the erection of an addition to cost about $10,000.

✚**Lorain, Ohio**—The United States Automatic Co., Lorain, has awarded the contract to KASER BROS., Elyria, Ohio, for the construction of an addition to its plant, at $10,380.

✚**Mount Gilead, Ohio**—The contract has been awarded to the HUGHES-KEENAN CO., Mansfield, Ohio, for the construction of the erecting shop for the Hayden Hydraulic Press Mfg. Co., Mount Gilead.

Niles, Ohio—The Niles Home Baking Co., Niles, is receiving bids for the construction of its proposed bakery, one story, 56x100 ft.

The Deforest Sheet & Tin Plate Co., Niles, will erect several additions to its plant.

Painesville, Ohio—The plant of the Unionville Milling Co., Painesville, owner by J. Morgan, has been destroyed by fire, entailing a loss of $12,000. The main building was 50 ft. high and 30x30 ft., with an addition 18x46 ft. The other building was 30x30 ft. Mr. Morgan contemplates the reconstruction of the plant, with the structure fireproof throughout.

Sidney, Ohio—The Olympic Candy Kitchen, Sidney, will erect a candy factory.

Silica, Ohio—The Toledo-Owens Glass Sand Co., Toledo, Ohio, is planning to erect a plant at Silica to cost $150,000. M. J. Owens is Pres.

Youngstown, Ohio—The Columbiana Rubber Co., Columbiana, has voted to increase its capital stock from $100,000 to $500,000. A large part of the increase will be used for buildings and equipping the plant.

Auburn, Ind.—The Auburn Automobile Co., Auburn, contemplates the erection of a factory, two stories and basement, 60x250 ft.

✚**Indianapolis, Ind.**—The Cole Motor Car Co., Indianapolis, has awarded the contract to the BEDFORD STONE & CONSTRUCTION CO., Bedford, Ind., for the construction of its proposed addition, at $175,000. Noted Feb. 20.

The Independent Envelope Co., Indianapolis, will receive bids soon for the erection of its proposed factory, two stories and basement, 80x160 ft.

Muncie, Ind.—Goodrich Bros. Hay & Grain Co., Muncie, Ind., is having plans prepared for the construction of a grain elevator. The capacity will be 100,000 bu.

Detroit, Mich.—Stahl & Kinsey, Archs., Detroit, have completed plans for the erection of a three-story and basement factory 71x120 ft., for the Bowering Soap Co., on Salliotte Rd., Detroit. W. J. Kengeli is Pres.

Chicago, Ill.—M. L. Chapin, Chicago, plans to erect a two-story brick garage, 100x125 ft., at a cost of $25,000.

The Cram-Richtsteig Metal Frame Action Co., Chicago, is receiving bids for the erection of its proposed factory one and two stories, 65x200 ft.

The Chicago Foundry Co., Chicago, is receiving bids for the erection of its proposed foundry; 100x155 ft.

✚**Jackson, Mich.**—The contract has been awarded to the Hauser-Owen-Ames Construction Co., Grand Rapids, Mich., for the construction of the factory for the American Lady Corset Co. Estimated cost, about $70,000.

Appleton, Wis.—Herman J. Schlegel, Appleton, Wis., manufacturer of furnaces and electric washing machinery, will soon let the contract for the erection of a new machine shop and foundry. The plant will also include a pattern shop.

✚**Fond du Lac, Wis.**—The HUTTER CONSTRUCTION CO. has been awarded the general contract for the erection of a two-story brick and concrete glading and painting building for the Moore & Galloway Lumber Co. It will be 36x42 ft. in connection with a mill construction warehouse, 36x250 ft.

Waukesha, Wis.—The International Steel Construction Co., Waukesha, has filed an amendment to its articles of incorporation which increases its capital stock from $10,000 to $50,000.

Amarillo, Tex.—The Rock Island R. R. Co. will make several improvements and will erect car-repair shops at Amarillo, which will cost about $80,000.

Cleburne, Tex.—The Gulf, Colorado & Santa Fé R.R. will make improvements and additions to its shops here at a cost of $123,000. The work will soon be started.

Dallas, Tex.—The Planters Oil Co., Dallas, was recently organized with capital $150,000, and will establish a cotton-seen oil mill.

The owners of the Dundee Woolen Mills will build a six-story and basement addition to their plant.

Mexia, Tex.—John R. Rollins, of St. Louis, Mo., and associates are preparing to construct a plant here for the manufacture of terra cotta. More than $100,000 will be invested in the enterprise, it is stated.

Rosenberg, Tex.—Arrangements are being made to construct a brick and tile factory here at a cost of about $100,000. I. M. Staunton is interested.

Wichita Falls, Tex.—E. C. Holt and associates will soon begin the construction here of a cotton mill that is to cost $500,000.

Mesa, Ariz.—A. H. Parker and associates contemplate erecting four small ore-reduction mills near here. Each mill will be of 25 tons capacity and will cost about $25,000.

Seattle, Wash.—The Ford Motor Co., Detroit, Mich., has completed plans and specifications for the construction of an assembling plant to be erected at Seattle, Wash., at an estimated cost of $400,000.

Los Angeles, Calif.—The San Pedro, Los Angeles & Salt Lake City R.R. Co. is planning to spend about $140,000, on enlarging and improving its repair shops.

Morris & Co., Kansas City, Mo., packers, will erect a three-story and basement building on Sixth St. between Mill and Mateo Sts. It will be either reinforced concrete or steel frame.

✚The Webster Showcase & Fixture Co. has awarded a contract to the F. O. EGGSTROM CO., Fifth and Seaton Sts., Los Angeles, at $20,000, for the construction of a three-story factory at 431 Colyton St. The building will be of brick and concrete, 49x158 ft. John J. Cornwell is Arch.

✚**Martinez, Calif.**—The Associated Oil Co. has awarded a contract to REEVES BROS., of Alliance, Ohio, whereby the capacity of the plant at Avon, now under construction, will be doubled. Four tanks with a capacity of 10,000 barrels each and eight additional stills will be constructed.

Richmond, Calif.—The National Mfg. Co., of San Francisco, will erect a three-story plant building to manufacture brass fitting and ornamental brass work of all kinds.

Montreal, Que.—The Riordan Pulp & Paper Co., Montreal, is having plans prepared for a new mill to be erected in Northern Ontario, having an annual capacity of 30,000 tons.

M. J. Butler, 222 Victoria Square, Montreal, is manager of a new company, which has purchased a mile of waterfront along the St. Lawrence, and is having plans prepared for a new $1,000,000 steel forging plant.

Sorel, Que.—The Sorel Iron Works will soon begin the construction of an addition to its foundry to cost $10,000.

Ottawa, Ont.—Bids will be received by the Brown Lithographing Co. for the erection of a new factory on Wellington St., to cost $20,000. It will be of brick construction, with a concrete foundation.

Peterborough, Ont.—Plans are being prepared for the new Canadian factory of the Vermont Marble Co., Proctor, Vt. The building will be one story, 64x212 ft., wood construction, concrete foundation, felt and gravel roof. It will cost $20,000.

Stratford, Ont.—Farquharson & Gifford, manufacturers of upholsterers' supplies, have had plans prepared for a new factory to cost $15,000. J. S. Russell, 21 Downie St., is Arch.

Davidson, Sask.—The Heathfield, Hammond & Thomas Co. plans to erect a new brick-making plant. New equipment will be required.

EXAMINATION

Laboratory Aid and Engineer—Washington, D. C.—The United States Civil Service Commission announces an examination for laboratory aid and engineer, for men only, on July 2. From the register of eligibles resulting from this examination, certification will be made to fill a vacancy at a salary ranging from $800 to $900 a year, in the forest products laboratory at Madison, Wis., and vacancies as they may occur in positions requiring similar qualifications. The duties of laboratory aid and engineer consist, in general, of the operation and care of the mechanical appliances used in the laboratories. Applicants for this examination should be of good physique, as they may be required to handle heavy timbers and to do general work in pipe fitting and setting up and modification of machinery. Competitors will be examined in the following subjects, which will have the relative weights indicated: 1. Arithmetic (simple tests in addition, subtraction, multiplication, and division of whole numbers and United States money), 10. 2. Operation and care of boilers, motors, shafting, etc. (including a general knowledge of the processes involved in the manufacture of wood pulp) 30. 3. Training, experience, and fitness, 60. Practical experience and familiarity with the use and care of machinery and tools, such as steam boilers, pumps, saws, electric motors, etc., is prerequisite for consideration for this position. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination Form 1312.

Mechanician and Laboratory Assistant—Washington, D. C.—The United States Civil Service Commission announces an examination for mechanician and laboratory assistant, for men only, on July 2 and 3. From the register of eligibles resulting from this examination certification will be made to fill a vacancy at a salary ranging from $1000 to $1400 a year, in the Bureau of Mines, San Francisco, Calif., and vacancies as they may occur in positions requiring similar qualifications. The duties of the person appointed to this position will consist in the design construction and repair of scientific instruments and apparatus used in the chemical, physical, and metallurgical laboratories of the bureau, together with assistance in the work of investigation and testing in these laboratories and in the field work. Two days will be required for this examination. Competitors will be examined in the following subjects, which will have the relative weights indicated: 1. Practical questions, 30; 2. General physics and chemistry, 20; 3. Mechanical drawing, 20; 4. Education, training, experience, and fitness, 30. Applicants should have had training in physics, general analytical and physical chemistry, and mechanical drawing, together with adequate actual experience in the making and repair of instruments of precision. A knowledge of glass blowing is an advantage, but is not insisted on at the outset. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination Form 1312. Applicants must have reached their 21st but not their 40th birthday on the date of the examination.

INDUSTRIAL NOTE

The Riter-Conley Mfg. Co., Pittsburgh, Penn., has received a rush order for 1600 ft. of 10-in. pipe, ranging from one-quarter to five-eighths inch in thickness, for a new siphon for the Los Angeles Aqueduct.

The Firm of C. G. Young, Bankers Trust Bldg., New York, has been engaged to make examinations and reports on certain important Public Utilities in Central America. H. A. Beldon, one of the firm's engineers, who will make the local studies, sailed from New York on May 17 and will probably be away for some time. This firm has had a wide experience in all Latin American countries as well as other parts of the world.

The Laclede Steel Co., St. Louis, Mo., manufacturer of rail carbon-steel bars for reinforcing work, also angles and agricultural shapes, announce the appointment of Theodore Geissmann & Co., Inc., 72 West Adams St., Chicago, Ill., as its authorized district sales agent in the Central West, for the distribution of its products.

The Dunn Wire Cut-Lug Brick Co. reports that in 1912, the total number of square yards of paving brick laid by manufacturers of wire cut-lug brick, who are licensed under the company's patents, and who are also members of the National Paving Brick Manufacturers Association, was equal to 53% of the total yardage of paving brick produced by all the manufacturers in the National Association. The company has also licensed several manufacturers of paving brick who are not members of the National Association.

Profits Derived by the city of Pasadena, Calif., from the operation of the municipal lighting plant from Mar. 29, 1912, to Mar. 29, 1913, totalled $63,365, according to a report made by expert accountants employed to audit the books. According to the report the profits shown are after bond interest and other charges, totaling $95,679, had been paid. The value of the plant is fixed at $580,745.

The Manufacturer's Supply Co., 2317 University Ave., S. E., has purchased from the Stone & Webster Engineering Corporation, its entire plant used on the $30,000,000 hydro-electric development for the Mississippi River Power Co., at Keokuk, Iowa. The equipment consists of everything in construction equipment and machinery, used in connection with this work. This company has shipped up to date from the work to the plant in Minneapolis, over one hundred carloads of the equipment, and the balance, about the same number of cars, will be released, and come forward to their plant after July 15, the date set for the operation of the power house and dam.

The Maryland Steel Co., Sparrows Point, Md., has awarded a contract to the Raymond Concrete Pile Co., New York and Chicago, for the design and construction of reinforced concrete stock bins for blast furnace "C" at its Sparrows Point plant.

The Colombian Ministry of Public Works has been authorized to proceed with the construction of a section of railway designed to connect the Southern Ry. with the Salto de Tequendama Ry. The line will be bidived into three sections, the Tequendama Station to the river Muña, thence to El "Charquito," and from the latter point to Salto de Tequendama.

The Rockwell Furnace Co.—The good will, drawings, patterns, patents, etc., of the Rockwell Furnace Co., New York, N. Y., have been purchased by the Quigley Furnace & Foundry Co., Springfield, Mass. The latter will continue the manufacture of the full line of Rockwell furnaces with the exception of the melting furnaces, portable heaters, rivet forges, etc., which will be built by the Monarch Engineering & Mfg. Co., Baltimore.

Statistics of the Iron Trade—The Bureau of Statistics of the American Iron and Steel Institute has received from the manufacturers statistics of the production of all kinds of steel ingots and castings in the United States in 1912.

The production of Bessemer steel ingots and castings in 1912 was 10,327,901 tons, against 7,947,854 tons in 1911, an increase of 2,380,047 tons, or over 29.9%. The production in 1912 was 1,947,929 tons less than in 1906, when the maximum production of 12,275,830 tons was reached. The year of next largest output was 1907. Of the total production in 1912 10,-260,913 tons were made by the standard Bessemer process, 33,553 tons by the Tropenas process, and 33,433 tons by other modifications of the standard Bessemer process.

The total production of open-hearth steel ingots and direct castings in 1912 amounted to 20,780,723 tons, against 15,-598,650 tons in 1911, an increase of 5,182,073 tons, or over 33.2%. In 1908 the production of open-hearth steel for the first time exceeded the production of Bessemer steel, the excess amounting to 2,719,974 tons. In 1912 the output of open-hearth steel exceeded the output of Bessemer steel by 10,452,822 tons, or over 101.2%. Of the total production of open-hearth steel in 1912 19,909,875 tons were ingots and 870,848 tons were castings, against 15,027,459 tons of ingots and 571,191 tons of castings in 1911.

It is estimated that about 573 883 tons of open-hearth stee. ingots and direct castings which were treated with ferro-vanadium, ferro-titanium, ferro-chrome, nickel, or other alloys are included in the total for 1912, as compared with about 296,065 tons in 1911. Of the total in 1912 about 493,-195 tons were ingots and about 80,685 tons were castings, while in 1911 about 255,333 tons were ingots and about 40,732 tons were castings.

In 1912 there were 19,641,502 tons of open-hearth steel made by the basic process and 1,139,221 tons by the acid

process, while in 1911 the production by the basic process amounted to 14,685,932 tons and by the acid process to 912,718 tons.

Included in the 19,641,502 tons of basic open-hearth steel ingots and castings produced in 1912 are 1,438,654 tons of duplex steel ingots and castings which were made from metal partly purified in Bessemer converters and finally purified in basic open-hearth steel furnaces. This steel was produced by seven works in four states as follows: Pennsylvania, four; Maryland, one; Alabama, one, and Illinois, one. Similar statistics for 1911 were not collected by the American Iron and Steel Association. No acid open-hearth steel was produced by the duplex process in 1912.

The production of crucible steel in 1912 amounted to 121,517 tons, against 97,653 tons in 1911, an increase of 23,864 tons, or over 24.4 per cent. The maximum production was reached in 1907, when 131,234 tons were made.

The production of steel by the electric process in 1912 amounted to 18,309 tons, as compared with 29,105 tons in 1911, a decrease of 10,796 tons. In 1910 the output was 52,141 tons, in 1909 it was 13,672 tons, and in 1908 it was 5,355 tons. In the latter year the production was included with that of open-hearth steel.

The production of all kinds of steel ingots and castings in 1912 amounted to 31,251,303 tons, against 23,676,106 tons in 1911, an increase of 7,575,197 tons, or almost 32%. The production of 1912 was much the largest in the country's history.

The total production of all kind of steel ingots in 1912, not including steel castings, amounted to 30,284,682 tons, against 23,029,479 tons in 1911, an increase of 7,255,203 tons, or over 31.5%. The production in 1912 was the largest in our history. The year of next largest production was 1910, when 25,154,087 tons were made.

Idle Railway Cars—A steady but gradual increase has been reported in the number of idle railway cars since the last report was printed in this paper. The number of idle cars now, however, is less than that at the corresponding date last year and also in 1911.

The following table has been computed from the figures of the American Railway Association:

1913	Surplus	Surplus	Net surplus
June 14	71,126	7,199	63,927
May 31	59,291	9,283	50,008
May 15	61,269	10,975	50,294
May 1	53,977	14,178	30,799
Apr. 15	70,715	13,217	57,498
Apr. 1	68,792	10,804	57,988
Mar. 15	57,998	20,223	37,775
Mar. 1	58,529	27,148	31,381
Feb. 15	52,709	30,517	22,193
Feb. 1	62,045	24,785	37,260
Jan. 15	53,230	24,791	28,439
1912			
Dec. 31	50,659	33,601	17,058
Dec. 14	26,614	61,006	*34,392
Nov. 30	26,135	62,536	*36,401
Nov. 21	22,363	73,475	*51,112
Nov. 7	19,987	71,156	*51,169
Oct. 24	17,289	57,270	*49,981
Oct. 10	22,810	34,389	*31,579
Sept. 26	26,754	44,547	*17,793
Sept. 12	27,380	36,000	*8,620
Aug. 29	36,047	26,279	9,750
Aug. 15	58,623	14,722	43,901
Aug. 1	65,304	9,395	56,510
July 18	75,389	6,467	68,922
July 4	70,731	6,707	64,024
June 20	73,464	5,746	67,718
June 6	89,208	2,822	86,386
May 22	123,683	7,482	116,201
May 9	136,776	6,678	130,098
Apr. 25	151,136	12,595	138,541
Apr. 11	94,943	15,554	79,389
Mar. 27	52,680	33,974	18,704
Mar. 13	46,028	42,985	3,043
Feb. 28	44,984	37,142	7,842
Feb. 14	50,886	36,928	13,953
Jan. 31	55,592	23,011	32,581
Jan. 17	102,479	12,194	90,258
Jan. 2	.....	.....	135,938

French Railway Operation—The working of the State railways, which include the old system of 1879, and the Ouest Ry. bought four years ago, is very expensive. The reporter of the Senate, though he tries to appear optimistic, has to admit that the increase of expenses has for the three years been continuous, both for the old and the new lines. He states that the financial results can only appear deceptive. He wishes to point out that the expenses in which the railway administration have been involved have been necessitated by the condition in which the old Ouest company left its line. But it has been shown, notably by M. Colson, a State Councilor, that the system, before being purchased, was minutely inspected by the Government engineers, and that it was out of the question that they should have allowed the company to neglect its upkeep. On Jan. 1, 1909, the State took possession of the line. In 1908, a year in which the expenditure was swelled by the costs of liquidation, the working receipts exceeded $219,500,000, while expenses were rather under $148,000,000, leaving a net profit of $71,000,000. During 1912 the receipts reached nearly $242,000,000, a figure which is certainly satisfactory; but working expenses rose to nearly $220,000,000, leaving a net profit of $22,000,000. Thus in four years of State working receipts have increased 10%, expenses 50%, and the net profit has declined 68%. During the same period the ratio of expenses has grown from 67% to 91%. Further, on the ld State system, where a company cannot be accused of having allowed the line to get into a bad condition, affairs have been much the same.

The Public Service Commission for the First District has come to an agreement with the Long Island R.R. Co. in regard to the easement rights for the St. Felix St. branch of the Fourth Ave. Subway, which passes under the Long Island R.R. station in Brooklyn. The Long Island Co. has withheld its consent to the construction of this subway pending this agreement. It has been agreed that the city will pay the railroad company $200,000 for the right to build the subway under the station, and that the patrons of the subway shall have free use of the stairways, etc., in the railroad station. All that remains to be done now to legalize this route is to get the consent of the Brooklyn Academy of Music. This branch leaves the Fourth Ave. Subway at Fulton St. and runs through St. Felix St. and Flatbush Ave. to a connection with the Brighton Beach Elevated R.R. at Malbone St. When completed it will be operated by the New York Municipal Ry. Corporation in accordance with the provisions of the dual-system contract. The agreement was reached in a conference, participated in by members of the Public Service Commission and officers of the Long Island R.R. and the New York Municipal Ry. Corporation. George McAneny, Boro. Pres., representing the Board of Estimate and Apportionment, also participated in the conference. The proposal to use the right of way of the Evergreen Branch of the Long Island R.R. instead of Wyckoff Ave. for the Eastern District elevated railroad was discussed, but no agreement was reached. This matter will be the subject of further conferences. The Commission for the First District will hold a hearing June 26 at 2:30 p.m., on the application of the New York Municipal Ry. Corporation for permission to issue $400,000 of its capital stock. The companw last January applied for permission to issue $1,000,000 in capital stock, and the Commission at that time authorized an issue of $100,000. The company now asks to issue $40,000 of the remaining $900,000 of such stock, for the purpose of providing working capital for the performance of the company's obligations under the dual-system subway contract.

William C. Jones, Ltd., Manchester, England, and 200 Summer St., Boston, Mass., announces the erection, in Boston, of a plant to demonstrate its patented method of manufacturing wiping-waste in rope form. The makers claim that the large capacity of the machine and the superior economy and convenience of the "Boa Waste" have been appreciated and taken advantage of, in Europe, for some time.

Value of Scrap—Junk dealers, during 1912, did an enormous business, the Geological Survey asserts in a statement issued this week. The value of "secondary metals," exclusive of gold, silver, platinum, iron and aluminum, recovered last year was $77,395,843, as compared with $52,585,390 in 1911, an increase of more than $25,000,000.

The survey's report does not set forth the quantity of old iron and steel remelted, neither does it include the precious metals. The quantity of aluminum scrap returned to the secondary smelters is increasing rapidly, says the survey, owing to the rise of the automobile, and it adds that the report next year probably will include "secondary aluminum."

The total amount of secondary copper recovered was 137,507 tons, assuming that the brass remelted had an average copper content of 70 per cent.; secondary lead recovered amounted to 67,168 tons; recovery of secondary zinc amounted to 81,543 tons; and secondary tin recoveries reached 15,401 tons. The quantity recovered as tin was 8333 tons and that in alloys and chemical compounds 7068 tons.

Civil Engineer Student—The U. S. Civil Service Commission announces an open competitive examination for civil-engineer student, for men only, on Aug. 6. From the register of eligibles resulting from this examination certification will be made to fill vacancies as they may occur in this position in the Office of Public Roads, Department of Agriculture, at a salary of $720 per annum, and vacancies as they may occur in positions requiring similar qualifications. An appointment as a result of this examination, and satisfactory service in the position, will afford young engineers an excellent opportunity to acquire experience in highway engineering. A part of the time will be devoted to laboratory and office work and the remainder to practical road building in different parts of the United States. The age is thus enabled to become familiar with thesephases of the work. As this work involves considerable travel throughout the United States, all traveling expenses, and subsistence not to exceed 30 days on any one assignment, will be paid by the department.

As insufficient eligibles were secured from the examination for this position held on Apr. 9, 1913, qualified persons are urged to enter this examination.

Competitors will be examined in the following subjects, which will have the relative weights indicated:

Mathematics and mechanics, pure and applied, 50 points; surveying, construction and material of construction, 50 points.

An educational training equivalent to that required for graduation in civil engineering from a recognized school or college is a prerequisite for consideration for this position.

CATALOG NOTICES

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog I. Brownhoist locomotive cranes. Illustrated, 72 pages, 6x9 inches.

Edgar Allen American Manganese Steel Co., McCormick Building, Chicago, Ill. Bulletin No. 61. "Stag" brand manganese steel castings for rolling mills and blast furnaces. Illustrated, 28 pages, 6x9 inches.

United States Blue Print Paper Co., 319-21 S. La Salle St., Chicago, Ill. Catalog. Drawing materials and surveying instruments. Illustrated, 400 pages, 4x6 inches.

Sprague Electric Works, 527-31 W. 34th St., New York. Catalog No. 521. Flexible steel-armored hose. Illustrated, 16 pages, 5½x7½ inches.

The Goulds Mfg. Co., Seneca Falls, N. Y. Pamphlet. Irrigation pumps. Illustrated, 32 pages. 6½x8 inches.

De Laval Steam Turbine Co., Trenton, N. J. Catalog C. Steam turbines, velocity-stage type. Illustrated, 108 pages, 6x9 inches.

Baldwin Locomotive Works, Philadelphia, Penn. Record No. 73. Recent Development of the Locomotive. Illustrated, 54 pages, 6x9 inches. Record No. 74. Gasoline locomotives. Illustrated, 24 pages, 6x9 inches.

CONTRACT PRICES

Harbor Improvement—Sheboygan, Wis.—Bids for building reinforced-concrete caisson breakwater and pile pier, removing old pier, and dredging at Sheboygan, were opened June 16, by Lt.-Col. George A. Zinn, Corps Engrs., Milwaukee. The bids were: (A) Robert Love & Co., Muskegon, Mich.; (B) Greiling Bros. Co., Green Bay, Wis.; (C) Wisconsin Dredging Co., Muskegon, Mich; (E) Edward Eugene Gillen, Dredging Co., Muskegon, Mich.; (E) Edward Eugene Gillen, Racine, Wis.; (F) Great Lakes Dredge & Dock Co., Chicago, Ill.:

HARBOR IMPROVEMENT, SHELBOYGAN, WIS.

	A	B	C	D	E	F
2947 cu.yd. concrete superstructure on caissons	$7.75	$7.50	$8.00	$6.50	$8.50	$8.50
1211 cu.yd. concrete superstructure on pile pier	7.75	8.50	11.00	6.50	8.75	9.50
3579 cu.yd. concrete filling in caissons	7.75	5.75	6.00	6.50	7.75	5.00
74 cu.yd. concrete slab walk	7.75	12.00	11.00	6.50	8.50	9.50
1135 foundation piles	16.80	17.50	16.50	15.00	19.90	20.00
14,000 lin.ft. furnishing and driving round piles in pile pier	0.35	0.34	0.40	0.33	0.37	0.40
1680 lin.ft. driving round piles in pile pier, piles furnished by U. S.	0 20	0.25	0.20	0.20	0 23	0.20
393.12 M. ft. B.M. making and driving sheet piles, timber furnished by U. S.	20 00	18 00	20 00	17.00	19.00	20.00
131.312 M. ft. B.M. framing timber furnished by U. S.	20 00	20 00	25.00	20.00	21.50	25.00
14,275 lb. wrought iron or steel drift bolts and wrought iron or wire spikes	0.04	0.05	0.05	0.05	0.05	0.05
31,453 lb. wrought iron or steel screw bolts and tie-rods	0.04	0.05	0.05	0.05	0.05	0.06
32,914 tons stone	1.65	1.45	1.50	1.55	1.70	2.10
1700 lin.ft. removing old pier	35.00	10.50	19.00	20.00	18.50	17.00
50,000 cu.yd. dredging	0 25	0.13	0.18	0.16	0.19	0.18
Totals	$223,465	$162,970	$187,951	$177,365	$201,648	$204,554

Sewers—Saline, Mich.—Bids for constructing sewers in various streets, according to plans prepared by the W. J. Sherman Co., Toledo, Ohio, were received, June 11, as follows: (A) Emanuel L. Schneider, Ann Arbor, Mich.; (B) Edwards & Whaley, Milan, Mich.; (C) Vanderweek Bros., Grand Rapids, Mich.; (D) Weage & Tyler, Coldwater, Mich.:

SEWERS, SALINE, MICH.

	A	B	C	D
6-in. sewer pipe laid	$0 21	$0.15	.....	.....
16,810 lin.ft. 8-in. sewer pipe laid	0.21	0.20	0.18	0.26
3590 lin.ft. 10-in. sewer pipe laid	0 30	0.29	0.27	0.37
1970 lin.ft. 12-in. sewer pipe laid	0.49	0.32	0.35	0.47
15-in. sewer pipe laid	0.74	0.45	.....	.....
4290 lin.ft. trenching under 6 ft.	0.38	0.29	0.27	0.27
9520 lin.ft. trenching 6 to 8 ft.	0.43	0.41	0.37	0.35
6810 lin.ft. trenching 8 to 10 ft.	0 60	0.57	0.57	0.51
1670 lin.ft. trenching 10 to 12 ft.	0.70	0.74	0.75	0.65
10 lin.ft. trenching 12 to 14 ft.	1.20	1.05	1.00	0.80
30 lin.ft. trenching 14 to 16 ft.	1 20	1.70	1.50	1.10
100 lin.ft. 4-in. farm tile laid	0.10	0.14	0.45	0.15
100 lin.ft. 6-in. farm tile laid	0.15	0.18	0.50	0.18
49 manholes	36.00	40.00	40.00	35.00
3 drop manholes	42.00	49.00	45.00	40.00
2 flush tanks	75.00	63.50	55.00	70.00
1.28 tons c.i. pipe	38.00	—50.00	30 00	30.00
100 lb. c.i. pipe specials	0.06	0.18	0.55	—
60 lin.ft. laying 8-in. c.i. pipe	1.50	.....	0.75	0.70
100 lin.ft. galvanized pipe connections	0.15	0.20	0.50	0.32
50 sq.yd. repaving brick	1.50	1.05	0.60	0.75
20 cu.yd. concrete	8.00	6.00	5.00	10.00
10 cu.yd. extra excavation	2.00	0.30	1.00	0.50
50 cu.yd. rock excavation	6.50	3.00	3.00	2.00
1 M. ft. b.m. new sheeting	40.00	18.00	28.00	25 00
1 M. ft. b.m. old sheeting	25.00	12.00	28.00	15.00
10 cu.yd. extra concrete	8.00	6.00	5.00	10.00
10 cu.yd extra gravel	2.50	1.50	1.50	3.00
10 cu.yd. extra broken stone	3.00	1.50	2.00	3.00
100 hours common labor	0.30	0.275	0.29	0.30
25 hours team labor	0.75	0.55	0.59	0.60
Totals	$19,552	$18,214	$17,517	$18,434

Dam—Seattle, Wash.—Bids were received by the Board of Public Works, June 13, for constructnig a concrete gravity dam at Cedar Lake. The dam will be 200 ft. high, 800 ft. long, 15 ft. wide at top, and 20 ft. wide at bottom. The contract also includes the construction of a 1500-ft. tunnel, 11 ft. in diameter. A. H. Dimock is City Engr. The bids were: (A) Hans Pederson, Alaska Bldg., Seattle; (B) Nettle-Bruce-Eschbach Co.; (C) P. E. McHugh, Tacoma, Wash.; (D) Graff Construction Co., Seattle:

CEDAR RIVER DAM, SEATTLE, WASH.

	A	B	C	D
108,000 cu.yd. cyclopean masonry concrete 1 to 7 in.	$5 25	$3.30	$5.40	$3.56
3500 cu.yd. back of dam concrete 1 to 6 in.	6 50	4.92	6.25	5.18
2200 cu.yd. tunnel lining concrete 1 to 6 in.	10 00	8 90	14.00	12.50
1600 cu.yd. valve wells concrete 1 to 8 in.	8.00	6.90	10.00	9.65
450 cu.yd. penstock valve pit	7 50	6.14	14.00	6.00
26,000 cu.yd. earth excavation	0.35	0.18	0.40	0.50
120,000 cu.yd. rock excavation	1.10	1.02	1.25	1.52
1550 lin.ft. tunnel excavation	14.75	21.60	30.00	15.00
32,000 lin.ft. drilling grout holes	0.75	1.68	1.50	1.50
2000 bbl. portland cement for grouting	2.50	2.52	2.30	2.40
320 cu.yd. grout	6.00	20.10	8.00	5.40
12,000 lin.ft. 4-in. grouting pipes	0.37	0.12	0.50	0.37
300 lin.ft. 2-in. galvanized steel pipe in tunnel lining	0.26	0.12	0.30	0.20
1000 lb. copper strips in contraction joints	0.45	0.60	0.35	0.40
1 venturi meter	3446.00	4800.00	4250.00	5500 00
6 sluice valves	750.00	960.00	485.00	764.00
3 66-in. gate valves	4100.00	5040.00	4165.00	6710.00
1 24-in. gate valves on bypass	250.00	360.00	325.00	300.00
3 floor stands for 12-in. bypass	10.00	90.00	35.00	50.00
3 sets sheaves for counterweights for 60-in. valves	16.00	150.00	10.00	30.00
183 lin.ft. 78-in. steel pipe	30.00	36.00	30.00	35.00
28,800 lb. 24-in. c.i. flanged pipe	0.09	0.12	0.10	0.04
4500 lb. c.i. counterweights	0.04	0.06	0.06	0.04
27 lin.ft. 2½-in. valve stems for 24-in. gate valve	2.00	6.00	4.00	3.00
265 lin.ft. 5-in. valve stems for sluice valves	9.00	10.80	9.00	8.00
1 penstock valve house	800.00	960.00	1000.00	1400 00
3 screens	150.00	240.00	110.00	110.00
1750 lin.ft. phospor bronze cord	0.10	0.30	0.25	0.25
1 steel gate	70.00	120.00	70.00	100 00
100,000 lb. special castings	0.05	0.072	0.06	0.07
Removal of flume and pipe line, lump sum	600.00	1920.00	10,000	2250.00
Totals	$866,578	$689,110	$976,071	$798,882

****Telephone System**—New York, N. Y.—Bids for constructing a portion of the telephone system for the Catskill Aqueduct, Contract 93, were received by the Board of Water Supply, June 10, as follows: (A) NEW YORK TELEPHONE CO., 15 Dey St., New York (awarded contract); (B) Carpenter & Lindsay, Paterson, N. J.; (C) Lord Electric Co., 105 West 40th St., New York; (D) Watson-Flagg Engineering Co., 27 Thames St., New York; (E) Young & Hyde, Inc., Produce Exchange Bldg., New York; (F) Perry J. Fitzgerald, 48 Howard St., Albany, N. Y.; (G) Henry E. Fox Construction Co., 81 East 125th St., New York; (H) W. L. Bull, Jr., Inc., 135 Front St., New York; (I) Average:

CATSKILL AQUEDUCT TELEPHONE SYSTEM, NEW YORK

	A	B	C	D	E	F	G	H	I
1575 30-ft. wooden poles	$10 00	$7.75	$9 84	$9 98	$7 50	$11 00	$11.228	$14.00	$10.16
1135-ft. wooden poles	12 00	10.75	11.70	13 00	8.50	14 00	14.014	15.00	12.37
21 40-ft. wooden poles	14.00	14.75	15.00	16 36	9.50	19.00	18.256	16.00	15.36
120 setting wooden poles in rock at additional price	5 00	7.25	14.50	34.10	3.00	8.00	17.71	15.00	13.07
63 steel poles	51.65	70 00	65.75	57.33	80.00	120.00	59.83	45.00	68.69
13 setting steel poles in rock at additional price	1 45	10.00	6.60	24 94	13.00	10 00	28.83	25.00	15 35
25 replacing existing wooden poles	12.75	10.00	14 50	9 98	8.00	15.00	16.87	15 00	12 76
50 moving existing wooden poles	11.00	6 00	8.00	5 37	2.50	10.00	11.24	5 00	7 39
125 wire guys	6.90	8 25	7.00	6 50	4.00	5 00	7 70	10 00	6 92
450 6-pin crossarms	1 38	2 35	2.50	1 72	2.20	1 50	2 54	1 25	1 93
1150 8-pin crossarms	1 58	2 53	3.00	1 98	2 50	1 80	2 97	1 55	2 24
550 10-pin crossarms	1 76	2 90	3.50	2 38	3.00	2 00	3 43	1 87	2 60
4950 insulators	0 026	0 0325	0 12	0 06	0.05	0 03	0.0863	0 04	0 056
575 brackets in aqueduct tunnels	5 26	10 00	8 50	6 50	7.00	10 00	8 55	4 60	7.55
5 aqueduct tunnel cable entrances	79 75	137 00	132.00	150 00	300.00	100 00	137 34	400 00	179.51
Cable entrance to tunnel at Breakneck Uptake chamber, lump sum	107 45	235 00	160 00	200 00	700 00	250 00	261 00	1300.00	401.68
35,000 lb. bare copper wire	0 27	0 225	0.21	0 26	0.24	0 22	0 319	0 50	0 275
Hudson River crossing, lump sum	2,528 [illegible]	[illegible] 4,474 06	3,900 65	3,616 06	7,500 00	9,000.00	6,610.00	5,600.00	5,271 07
2 station instrument sets, set	80 89	100 00	163 00	158 00	300 00	60 00	162 19	150 00	146.76
4 jack station sets, set	69 00	190 00	102.00	150 00	100.00	40.00	178.19	85 00	114.27
Private branch exchange switchboard and apparatuses, lump sum	287 62	275 00	340 00	350 00	450 00	250 00	342 61	390 00	335 65
5 underground railroad crossings	102 65	225 00	196 00	285 00	300 00	100 00	361.34	600 00	278 75
500 transpositions	0 70	0 65	1 80	1 00	1 00	1 00	4 76	5 00	1 99
Clearing and trimming of trees, lump sum	230 00	525 00	792 00	2,250.00	4,000.00	1,750.00	2,100.00	2,500.00	1,768 37
Totals	$41,617	$46,549	$51,379	$53,104	$53,862	$58,543	$64,656	$71,077	.....

✚**Channel**—Chicago, Ill.—Bids for constructing Sections 7 and 8 of the Calumet Sag Channel, were received by the Sanitary District of Chicago, June 19, as follows: (A) Green & Sons Co., Chicago; (B) Byrne Bros. Dredging & Engineering Co.; (C) Great Lakes Dredge & Dock Co.; (D) T. W. Keys:

CALUMET SAG CHANNEL, CHICAGO, ILL.

	A	B	C	D
Section 7				
1,150,000 cu.yd. glacial drift excavation		$0 1375		$0 62
10,000 cu.yd. solid rock excavation		0 90		3 00
1800 lin.ft. roadway construction		2 50		3 00
650 cu.yd. concrete		7 50		12 00
10,000 lb. reinforcing metal		0 065		0 045
Erecting Worth Road Bridge, lump sum		7000 00		9500 00
Totals, Section 7		$529,150		$766,150
Section 8				
1,200,000 cu.yd. glacial drift excavation		0 139		0 62
5000 cu.yd. solid rock excavation		0 90		3 00
1295 lin.ft. roadway construction		2 50		3 00
550 cu.yd. concrete		7 50		12 00
9000 lb. reinforcing metal		0 065		0 045
Erecting Pipes Road Bridge, lump sum		11,000 00		11,500 00
Totals, Section 8		$550,198		$781,334
Sections 7 and 8				
12,350,000 cu.yd. glacial drift excavation	0 425	0 135	0 515	0 62
15,000 cu.yd. solid rock excavation	1 90	0 90	2 80	3 00
3075 lin.ft. roadway construction	2 25	2 50	2 75	3 00
1200 cu.yd. concrete	10 00	7 50	14 00	12 00
19,000 lb. reinforcing metal	0 06	0 065	0 055	0 045
Erecting Worth Road Bridge, lump sum	7230 00	7000 00	7590 00	9500 00
Erecting Pipes Road Bridge, lump sum	10,500 00	11,000 00	10,500 00	11,500 00
Totals, Sections 7 and 8	$1,065,039	$1,071,673	$1,296,551	$1,547,480

✚**Paving—Painesville, Ohio**—Bids for paving Erie and State Sts. were received by the city, May 24. The bids were: (A) E. A. FRESHWATER & SONS, Chester, W. Va. (awarded both contracts at following bids: Erie St., using Bessemer Block with grout filler and concrete curb and gutter, $14,301; State St., using Metropolitan Block, with grout filler and stone curb, $31,705); (B) Ohio Engineering Co.; (C) Gould & Maybach; (D) Midland Construction Co., 10 South La Salle St., Chicago; (E) R. Deckard & Son:

PAVING ERIE ST., PAINESVILLE, OHIO.

	A	B	C	D	E
2260 cu.yd. grading	$0.40	$0.45	$0.50	$0.40	$0.40
8657 sq.yd. Bessemer block	1.20	1.25	1.34	1.54	1.48
8657 sq.yd. Metropolitan block	1.23	1.28	1.36	1.56	1.50
8657 sq.yd. Medal block	1.23	1.20	1.20	1.42	1.40
8657 sq.yd. Bula block	....	1.28	1.36	....	1.50
8657 sq.yd. Newburg block	....	....	1.20	....	....
4937 lin.ft. stone curb	0.51	0.52	0.50	0.52	0.48
4937 lin.ft. concrete curb and gutter	0.50	0.55	0.50	0.50	0.45
8657 sq.yd. additional for asphalt filler	0.24	0.15	0.60	0.19	....
8657 sq.yd. additional for tar filler	0.09	0.10	0.55	0.16	....
52 lin.ft. headers	0.50	0.40	0.30	0.40	0.30
10 inlet basins removed or rebuilt	10.00	15.00	15.00	15.00	3.00
50 ft. 10-in. inlet basin pipe	0.50	0 60	0.50	0.48	0.60
2 new manhole caps	10.00	12.00	12.00	15.00	10.00
9 manhole covers reset	2.00	2.00	2.00	4.00	3.00
1 F.H. cap reset	2.00	2.00	2.00	5.00	2.00
670 lin.ft. 6-in. house sewer	0.40	0.50	1.00	0.55	0.40
500 sq.ft. new side wall approach	0.12	0.10	0.13	0.10	0.10
300 sq.ft. old side wall relaid	0.07	0.05	0.05	0.10	0.05

PAVING STATE STREET, PAINESVILLE, OHIO.

	A	B	C	D
6200 cu.yd. grading	$0.40	$0 45	$0 50	$0 40
12,600 sq.yd. foundation	0.60	0 55	0 72	0 50
12,600 sq.yd. Bessemer block	1.12	1.25	1.42	1 47
12,600 sq.yd. Metropolitan block	1.15	1.28	1.44	1 49
12,600 sq.yd. Medal. block	1.15	1.20	1 28	1.35
12,600 sq.yd. Bula block	....	1.28	....	....
12,600 sq.yd. Newburg block	....	....	1 28	....
7610 lin.ft. stone curb set in concrete	0 61	0 65	0 75	0.59
7610 lin.ft. concrete curb and gutter	0.50	0 55	0 75	0.50
12,600 sq.yd. additional for asphalt filler	0 24	0 15	0 60	0 19
12,600 sq.yd. additional for tar filler	0 09	0 10	0 55	0 16
360 lin.ft. headers	0.50	0.40	0 30	0.40
4 inlet basin covers, reset	2 00	4.00	2 00	3 50
280 lin.ft. 8-in. pipe sewer	1 00	0 75	1 00	1 25
270 lin.ft. 12-in. pipe sewer	0 70	0 70	0 65	0 50
250 lin.ft. 18-in. pipe sewer	1 30	1 50	1 00	0 90
180 lin.ft. 10-in. inlet basin pipe	0 50	0 60	0 50	0 50
6 inlet basins	16.00	20.00	15 00	25.00
4 new manhole caps and covers	10 00	12.00	12 00	15.00
20 manhole covers reset	2 00	2 00	2 00	4.00
4 new F. H. caps	10.00	6.00	5 00	5.00
7 F. H. caps reset	2 00	2 00	2 00	2 00
700 lin.ft. 6-in. house sewers	0 40	0 50	1 00	0 55
300 sq.ft. new side wall approach	0 12	0 10	0 13	0 10
1000 sq.ft. old side wall relaid	0 07	0 05	0 05	0 10
5000 lin.ft. 3-in. tile under drains	0 06	0 05	0 10	0 06
4 new manholes 8 ft. deep	30.00	30.00	30.00	20 00
1 M. ft. b.m. sheeting	20.00	30.00	35 00	40 00
2700 sq.yd. reinforcement	0.15	0.17	1.12	0 25

CATALOG NOTICES

Union Iron Works, Hoboken, N. J. Catalog No. 20. Road builders' and roofers' equipment, pipe line supplies. Illustrated, 16 pages, 7x10 in.

Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 126. Compression riveters. Illustrated, 8 pages, 6x9 in. Bulletin No. 129. Hose, hose, couplings, hose clamp tools. Illustrated, 8 pages, 6x9 in.

The Consolidated Expanded Metal Co's., Braddock, Penn. Insert for loose leaf catalog. Highway bridges and culverts. Illustrated, 16 pages, 5½x7½ in.

Cling-Surface Co., 1032-48 Niagara St., Buffalo, N. Y. Bulletin. Cling-Surface treatment for ropes. Illustrated, 8 pages, 6x9½ in.

The Western Elaterite Roofing Co., Denver, Colo. Pamphlet. Specifications for laying Elaterite roofing. Illustrated, 4x9 in.

Ingersoll-Rand Co., 11 Brodway, New York. Form 3008. Class "PE-2" direct-connected electric driven air compressors. Illustrated, 40 pages, 6x9 in. Form No. 575. Instructions for installing and operating Class "PE" electric driven air compressors. Illustrated, 28 pages, 6x9 in.

General Electric Co., Schenectady, N. Y. Bulletin No. 4085. Battery-charging motor-generator sets for railway signaling. Illustrated, 16 pages, 8x10½ in. Bulletin No. A4086. Circuit breakers for railway service, Type MR. Illustrated, 2 pages, 8x10½ in.

Sprague Electric Co., 527-31 W. 34th St., New York. Catalog No. 327. Electric fans. Illustrated, 40 pages, 8x10½ in. Bulletin No. 115. Electrical equipment for buildings. Illustrated, 24 pages, 8x10½ in.

The Hydrex Felt & Engineering Co., 120 Liberty St., New York. Pamphlet. "Sound Transmission in Buildings—Its Prevention and the Use Therefor of Hygienic Materials." Illustrated, 24 pages, 6x9 inches.

The Heine Chimney Co., Chicago, Ill. Catalog. Interlocking radial brick chimneys. Illustrated, 32 pages, 4x9 inches.

The Bull Dog Dump Wagon Co., Boston Building, Kansas City, Mo. Pamphlet. Bull Dog dump wagon beds. Illustrated, 6x9 inches.

Spray Engineering Co., 201 Devonshire St., Boston, Mass. Bulletin No. 51. Air washers. Illustrated, 8 pages, 6x9 inches.

Stone & Webster Engineering Co., Booklet. Water Powers. Illustrated, 6x7½ inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Catalog No. 42. Boyer railway speed recorder. Illustrated, 20 pages, 6x9 inches.

Joseph Dixon Crucible Co., Jersey City, N. J. Booklet. Graphtie brushes. Illustrated, 16 pages, 3½x6 inches.

Edgar Allen American Manganese Steel Co., McCormick Building, Chicago, Ill. Bulletin No. 56. Gyratory and jaw crusher wearing parts. Illustrated, 28 pages, 6x9 inches.

J. F. Donahoo, Woodward Building, Birmingham, Ala. Pamphlet. International safety railway ties. Illustrated. 6x9 inches.

Ohio Road Machinery Co., Oberlin, Ohio. Catalog. Road making and contracting machinery. Illustrated, 16 pages, 6x9 inches.

The Blake & Knowles Steam Pump Works, 115 Broadway, New York. Catalog. Single direct-acting pumps. Illustrated, 84 pages, 6x9 inches.

The Bristol Co., Waterbury, Conn. Bulletin No. 143. Recording differential pressure gages and recording flowrate meters. Illustrated, 16 pages, 8x10½ inches. Bulletin No. 170. Patent electric furnaces for soldering coppers. Illustrated, 2 pages, 8x10½ inches. Bulletin No. 1300, Class III recording thermometers. Illustrated, 48 pages, 8x10½ inches.

Clayton Air Compressor Works, 115 Broadway, New York. Bulletin No. 210. Printed in Spanish. Air compressors. Illustrated, 32 pages, 6x9 inches.

Westinghouse, Church, Kerr & Co., 37 Wall St., New York. Book No. 5. Work Done. Railroad shop edition. Illustrated. 46 pages, 6x9 inches.

Continental Car & Equipment Co., Inc., Highland Park, Louisville, Ky. Catalog C. P. Dump cars. Illustrated. 80 pages, 6x9 inches.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 15. Spiroflo centrifugal condensers. Illustrated, 24 pages, 6x9 inches.

The Strauss Bascule Bridge Co., 104 S. Michigan Ave., Chicago, Ill. Bulletin No. 1. Lift bridges. Illustrated, 20 pages, 8x10½ inches.

CONTRACTS TO BE LET

Sewer System Extension

Bronxville, N. Y.

Sealed proposals will be received by the Board of Trustees of the Village of Bronxville, at the office of said Board of Trustees in the Village Hall, Bronxville, New York, until 8 P. M. on the 8th day of July, 1913, and opened immediately thereafter, for the construction of an extension to the sewer system of said Village of Bronxville, said extension being known as Tanglewylde Ave. and Park Ave. in said Village, according to the maps and plans prepared by Geo. H. Rogers, Village Engineer, which said maps and plans have been approved by the State Department of Health, a copy of which is now in the office of the Village Clerk, Village of Bronxville, New York.

Plans, profiles and specifications may be seen and blank proposals obtained from Geo. H. Rogers, at his office in Dusenbury Building, Depot Square, Tuckahoe, New York.

The person submitting a proposal shall submit therewith a certified check issued by a State or National Bank, in good standing, within the State of New York, for 10% of the amount of his bid or proposal, to the Village of Bronxville, without conditions, to be forfeited to the Village in case the person making such proposal shall refuse to enter into a contract in accordance therewith, as liquidated damages, and not as a penalty.

The Board of Trustees reserve the right to reject any or all proposals or bids.

Proposals must be addressed to Frank Dinsmore, Village Clerk, Bronxville, N. Y., and endorsed, "Sewer Construction Proposals."

Dated June 18th, 1913.

FRANK DINSMORE,
Clerk of the Village of Bronxville.

⁂

Bids for Paving

Cohoes, N. Y.

Notice is hereby given that at a regular meeting of the common council of the city of Cohoes, N. Y., to be held on the 1st day of July, 1913, at 8 o'clock p.m., sealed proposals will be received for the paving of Bridge avenue, as per specifications prepared by the city engineer and on file in the office of the city clerk, pavement to be of vitrified brick, distance to be paved about 1,400 feet long and 35 feet wide.

A bond in the sum of 50 per cent. of the contract cost of the work will be required for the faithful performance thereof.

All proposals must be accompanied by a certified check to the amount of 5 per cent. of bid.

The common council reserves the right to reject any or all bids.

JOHN F. MAHONY, City Clerk.

⁂

Notice to Building Contractors

Schenectady, N. Y.

Sealed proposals will be received by the Board of Contract and Supply, of the City of Schenectady, New York, At their office in the City Hall Annex until 2:30 P. M. Wednesday, July 23d, 1913, for the general construction, plumbing and gas fitting, heating and ventilating and electrical work for the proposed three new schools for the Second, Ninth and Tenth Wards, Schenectady, N. Y.

Plans may be seen and specifications and bidding blanks procured at the office of the City Engineer and Architect, Mr. W. Thomas Woodey, No. 117 Franklin Street, Schenectady, N. Y. Blue Print plans, to a limited number, may be procured by any person so desiring by depositing with the said Engineer and Architect the sum of $25.00.

BOARD OF CONTRACT & SUPPLY,
FRED E. JOHNSON Secretary.

Bridge

Wilmington, Del.

Sealed proposals for the construction of the Third Street Bridge crossing the Christiana River, Wilmington, Delaware, will be received by the President of the Levy Court, New Castle County, at the Levy Court Room in the Court House, Wilmington, Delaware, until twelve o'clock noon of the 15th day of July, 1913, at which time all bids received will be publicly opened and read.

The substructure of the proposed bridge will embrace two concrete piers and two reinforced concrete abutments, section of new bulkhead and some alterations in the existing water main. Concrete work will amount to about 2500 cu. yds.

The superstructure will be composed of a movable bridge with a clear channel span of 150 ft. and two riveted truss approach spans, total length of superstructure being 416 ft. between the back walls of the abutment.

Separate bids will be required for the sub and superstructures.

Plans and complete data are on file in the office of the County Engineer, James Wilson, Church Building, Wilmington, Delaware, and in the office of the Consulting Engineer, J. E. Greiner, Fidelity Building, Baltimore, Md.

Plans, specifications, forms for contracts and proposals will be furnished contractors by the Consulting Engineer upon receipt of a deposit of $10.00 for each set. These deposits will be returned to bidders upon the return of the plans, etc., in a clean, undamaged and unmarked condition within ten days after the time of opening the bids. No deposits will be returned to those who have not submitted proposals and any bidder failing to return these plans, etc., within the specified time shall forfeit his deposit to cover the cost to the Engineer of replacing the same.

A certified check or acceptable bond to the amount of $1000.00 will be required with each bid as a guarantee of good faith.

The Levy Court reserves the right to reject any or all bids.

B. F. GROVES,
President of the Levy Court.
SAMUEL L. BURRIS, Chairman,
A. B. HOLLINGSWIRTH,
CHARLES GOODING,
Bridge Committee of the Levy Court of
New Castle County, Wilmington, Delaware.

JAS. WILSON,
County Engineer.

⁂

Notice to Contractors

(Change of Date)

Sealed proposals for cleaning, pointing and waterproofing the exterior stone work and central court and two western courts of the State Capitol Building at Albany will be received by the Trustees of Public Buildings, Capitol, Albany, N. Y., until 4 o'clock P.M., on Monday, July 21st, 1913, when they will be opened and read publicly. Proposals shall be accompanied by a certified check in the sum of five per cent. of the amount of bid, and the contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent. of the amount of contract within thirty days after official notice of award of contract and in accordance with the terms of Specification No. 1699. The right is reserved to reject any or all bids.

The work will not necessarily be let to the lowest bidder, as consideration will be given to the references of each contractor, to successful operations performed by him and to his reliability and responsibility as a contractor.

Specifications may be consulted and blank forms of proposal obtained at the office of the State Architect, Capitol, Albany, N. Y.

LEWIS F. PILCHER,
State Architect.

Dated Albany, N. Y., June 9, 1913.

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